BANGLADESH PRIVATE SECTOR DEVELOPMENT SUPPORT PROJECT (PSDSP)

Economic Zones Development Assignment

Department for International Development, UK

Pre-Final Report – Kaliakoir Hi-Tech Park

Aug 2009

PRICEWATERHOUSECOOPERS | IIFC Bangladesh | Mahindra Consulting Engineers | DevConsultants

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LIST OF EXHIBITS

LIST OF ABBREVIATIONS

APO	:	Annual Plan of Operation
BASIS	:	Bangladesh Association of Software and Information Services
BCC	:	Bangladesh Computer Council
BCR	:	Benefit to Cost Ratio
BEPZA	:	Bangladesh Export Processing Zones Authority
BOD	:	Biochemical Oxygen Demand
BOI	:	Board of Investment
BUET	:	Bangladesh University of Engineering and Technology
BOQ	:	Bill of Quantities
CAGR	:	Compounded Annual Growth Rate
CNG	:	Compressed Natural Gas
CSF	:	Critical Success Factors
DfID	:	Department for International Development
DO	:	Dissolved Oxygen
DoE	:	Department of Environment
dB (A)	:	Decibel Unit
EA	:	Environmental Assessment
ECC	:	Environment Clearance Certificate
ECR	:	Environment Conservation Rule
EHS	:	Environmental, Health and Safety
EIA	:	Environmental Impact Assessment
EMS	:	Environmental Management System
EPC	:	Engineering, Procurement & Construction
ESIA	:	Environmental and Social Impact Assessment
ESC	:	Environment and Social Cell
ESMF	:	Environmental and Social Management Framework
ESMP	:	Environmental and Social Management Plan
ESO	:	Environmental and Safety Officer
FSI	:	Floor Space Index
FGDs	:	Focused Group Discussions
FABR	:	Fluidized Aerobic Bio Reactor
FTE	:	Full Time Equivalent

ICR	:	Implementation Completion Report
IDA	:	International Development Association
IECs	:	Important Environmental Components
IEE	:	Initial Environmental Examination
GDP	:	Gross Domestic Product
GVA	:	Gross Value Added
HTA	:	Hi – Tech Park Authority
ICT	:	Information & Communication Technology
KHTP	:	Kaliakoir Hi Tech Park
MLD	:	Million Liters per day
MoSICT	:	Ministry of Science and Information & Communication Technology
MTB	:	Multi –Tenated Building
MFL	:	Maximum Flood Level
NOx	:	Oxides of Nitrogen
PAP	:	Project Affected Person
PCU	:	Passenger Car Unit
PICOM	:	Private Infrastructure Committee
PSIG	:	Private Sector Investment Guidelines
RAP	:	Resettlement Action Plan
RSPM	:	Respiratory Suspended Particulate Matter
SPM	:	Suspended Particulate Matter
STP	:	Software Technology Park
T&T	:	Telegraph and Telephone Board
ToR	:	Terms of Reference
WB	:	The World Bank
WQS	:	Water Quality Standards

RESPONSE SHEET OF COMMENTS RECEIVED ON DRAFT FINAL REPORT

Financial, Market & Economic analysis related comments	Response
Standardize Benchmarking	Benchmarking has been standardized and presented in a single format as asked for (Section 5.2.3)
Phasing logic to be explained and triggers also	The phasing logic and the triggering of the next phase have been explained (Section 5.3.4.1)
Inclusion of intangibles like environment using shadow pricing in economic analysis	A separate section on evaluating the intangible benefits has been added (Section 8.4)
Inclusion of demonstration effect in Economic Analysis	Presented in Section 8.4
Capturing benefits due to forex in economic analysis	Presented in Section 8.4
Calculation of economic IRR	Economic IRR figures have been presented in Section 0
Capturing benefits of differential impact on marginalized groups	Presented in Section 8.4
Discussion of economic analysis with WB expert to be nominated	WB to nominate an expert
Presentation on discussions with Investors and Lenders	The details of the stakeholder consultations have been presented in Section 5.2.2
Roundtable with domestic lenders	A roundtable with lenders was held on 29th July, 2009. The key discussion points are presented in Section 12 (Annexure 1)
Detailed construction cashflows on debt and equity from stakeholders	Detailed construction cashflows as discussed have been presented in Section 9.4.1.1, Section 9.4.1.2 & Section 9.4.1.3
Include details of Interim report and PFR as relevant	Relevant details have been included all across the report

Technical design related comments	Response
Comments from BEPZA	
Landfill design standards from WB to be adhered to & GW monitoring wells to be indicated with the landfill	Section on landfill standards included in the report, drawing annexed to the report (Section 15)

Adequacy of design for climate change	Section 6.2.1
Show schematic locations of ground water monitoring wells on landfill design drawings.	Groundwater monitoring wells indicated on the solid waste mgmt/ landfill drawings
Waste segregation and corresponding treatment system recommended	Section on general methodology for waste segregation and corresponding treatment inserted in the report (Section 6.5.5)
Illustration of consideration of the peak factor for sewage network	Explicit table indicating the peak factor incorporation prepared and inserted in the report (Section 0)
Environmental clauses in the bid documents to be more stringent	Section 13
Comments from World Bank/IFC	
Landfill numbers to be rectified, since the amount of landfill material will not increase beyond a certain point	Solid waste addition to landfill number revised. Active life according to the same revised (Section 15)
Water Balance scheme to be added to the report	Annexed the water balance scheme (Section 18)
FABR is highly specific - more widely available technology should be included in the report	Write up on the alternate technology to the FABR has been included in the PFR, the corresponding design changes included (Section 0)
Borrow pit guidelines to be inserted in the reports	Section 17
Manpower required for O&M of environmental infrastructure	Table showing the manpower according to various components of the environmental infrastructure in Section 6.5.4
Extraction of environmental infrastructure related costs	Component wise break up of environmental infrastructure components included in the report (Section 6.6)
Process for obtaining approval from the Bangladesh Railways for construction of the RoB to be mentioned in line with the recommendation of an RoB included in KHTP report	Write up indicating the time line required for obtaining such approval from the BR to be included in the report (Section 6.3.3)
e-waste related recommendation to be clearer	Section on the e-waste treatment prepared and inserted in the report in the relevant section, building up on the recommendations given in the PFR (Section 6.5.3.1)

PPP related comments	Response
Highlight tenor issue	The tenor issue of short term loans has been highlighted in Section 7.3.4
Implementation roadmap	As discussed, a detailed implementation roadmap has been included as a separate section in Section 0
Risk allocation matrix for each PPP option	For each of the PPP options presented, we have included a risk allocation matrix under Section 9.4.1.1, Section 9.4.1.2 & 9.4.1.3
Third PPP option for KHTP	Apart from the two PPP options presented earlier in the DFR, another PPP option, where BCC would be responsible for upfront development and subsequently the project would be transferred to a private operator, has been detailed out in Section 9.4.1.3
Transaction docs outline for KHTP	Pending

1 EXECUTIVE SUMMARY

1.1 PROJECT BACKGROUND AND RATIONALE

The Bangladesh economy has been growing at a steady rate of around 5-6%. However, given the prevalent scenario in terms of poverty, Bangladesh needs to significantly increase growth rates to 7-8% to have a significant and sustained impact on the poverty rates. In order to achieve the target growth rates, Bangladesh needs to develop a competitive private sector that could help in strengthening the trade relations of the country with the global market.

Export Processing Zones (EPZs) have been set up in the country to promote exports and these have been relatively successful especially in sectors such as textiles. However the ***OVERALL IMPACT OF EPZS HAS BEEN LIMITED***. The spillover effects into the local economy are also felt to be limited. Further the EPZs have been developed solely by the public sector, whose resource limitations constrain further growth. In order to foster private sector development, the Government of Bangladesh requested the assistance of the Department for International Development, UK (DFID) and the World Bank (WB or the Bank) to set up the Private Sector Development Program (PSDSP).

The Bangladesh Economic Zones initiative is a part of the PSDSP. As part of the initiative, a draft ***ECONOMIC ZONES ORDINANCE WAS FORMULATED IN 2007-08*** which is now awaiting ratification by the Government. Further, DFID has appointed a consortium of PricewaterhouseCoopers Pvt. Ltd. (PwC), Infrastructure Investment Facilitation Centre (IIFC), Mahindra Consulting Engineers (MACE) and Development Consultants (Dev Con) - jointly referred to as the PwC Consortium or the Consultants – to carry out the feasibility for 4 identified sites to be developed as Economic Zones. The Kaliakoir Hi Tech Park (KHTP) is one of the 4 sites selected for the study, the details of which are as follows:

Location	Area (Acre)	Proposed Industries/Companies
Comilla	475*	Garments, Textiles, etc
Meghna	637	Multiproduct
Narsinghdi	500	Multiproduct
Kaliakoir	262	Knowledge-based industries

**Including approx. 50 acres land for Airstrip*

Exhibit 1 Proposed Zones Identified Under PSDSP

1.1.1 SCOPE OF WORK, PROGRESS AND COVERAGE

The broad scope of work of the PwC Consortium for each of the identified sites[1] is as follows:

- **Business Plans**
    - Market Assessment & Industry Analysis
    - Assessment of Land Acquisition issues
    - Economic & Financial Analysis

[1] Except for the Narsingdi site for which a curtailed scope has been agreed with DFID on account of time constraints

- Recommended PPP Options
- Proposed Institutional Arrangement

- **Engineering & Designs**
  - Basic Planning Study
  - Preliminary Design Study
  - Final Design
  - Preparation of Tender documents
- **Environmental and Social Assessment and Management Plans**
  - Environmental & Social Impact Assessment
  - Environmental & Social Sector Framework
  - Environmental Management Plan
  - Resettlement Action Plan
- **Investment, Management & Oversight Framework (IMOF)**
  - Investment Guidelines
  - Management Guidelines
  - Oversight Guidelines

The above scope was broadly divided into the following deliverables:

- ***INCEPTION REPORT*** detailing the approach and methodology and preliminary site visits
- ***INTERIM REPORT*** comprising the Market Assessment & Industry Analysis, Environmental & Social Impact Assessment and Baseline Analysis of operations at the existing Comilla EPZ
- ***PRE-FEASIBILITY REPORT*** comprising Basic Planning Study, Preliminary Design Study, Preliminary Financial Analysis and Environment and Social Management Framework
- Report on an ***INVESTMENT MANAGEMENT AND OVERSIGHT FRAMEWORK*** (IMOF)
- ***DRAFT FINAL REPORT*** comprising all items of scope not previously covered
- ***FINAL REPORT*** taking into account comments on the Draft Final Report
- Report on a ***PUBLIC INVESTMENT FACILITY*** (PIF) to be set up for funding the EZs

The ***team was mobilized on 8th June, 2008*** and has since been making continuous progress towards completion of the assignment. The following were the key milestones during project execution:

- ***18th June,2008*** - Inception Presentation
- ***2nd July, 2008***- Inception Report Submission
- ***26th August, 2008*** - Interim Findings Presentation of Phase 1
- ***15th September, 2008*** - Interim Report Phase 1 Submission
- ***4th December,2008*** - Discussion Presentation on Phase 1Pre-feasibility Report findings
- ***16th January,2009*** - Pre-feasibility Report of Phase 1
- ***28th January, 2009*** - Stakeholder Meeting with BCC
- ***APRIL, 2009*** – Draft Final Report Submission
- ***MAY, 2009*** – Draft Final Report Presentation
- ***JUNE, 2009*** – Discussion with World Bank Mission and other stakeholders

The present deliverable constitutes the Pre-Final Report for the KHTP at Kaliakoir.

1.1.2 COVERAGE OF THE REPORT

This report is the ***pre-final deliverable for the feasibility assessment of Kaliakoir***, one of the four zones mentioned in the Exhibit 1 above. The feasibility draws upon earlier deliverables including:

- The Inception Report outlining the methodology for the feasibility study
- The Interim Report covering Market and Demand Assessment
- The Pre-feasibility Report covering Master-planning, Infrastructure Planning and Financial Analysis
- Comments received on various deliverables, notably comments on the Interim Report received on 22nd November and comments on the Pre-feasibility Report received on 2nd March, 2009
- Discussion with World Bank and other stakeholders on the draft final report in May-June, 2009

1.2 INTRODUCTION TO KALIAKOIR HI TECH PARK (KHTP)

The Kaliakoir Hi-tech Park (KHTP), located ***40 Kms north of Dhaka***, is a long pending proposal of the Government of Bangladesh to set up an industrial zone catering to Hi-tech industries in Bangladesh. The KHTP covers a total land area of ***262 acres, all of which has been acquired.*** Substantial progress has been made in the last few years apart from completion of land acquisition - a boundary wall has been completed and certain preliminary expenditure on roads and administrative buildings has been incurred, making it ready for development. The location of Kaliakoir with respect to Dhaka, its suburbs and the Dhaka airport is shown in the exhibit below:

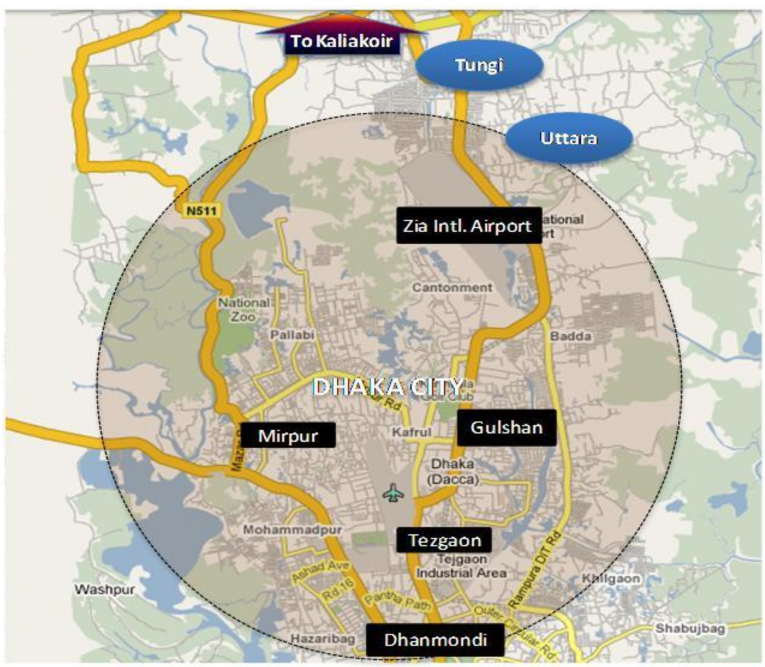

Exhibit 2 Kaliakoir Location Map

1.2.1 CONNECTIVITY

The KHTP site is about 40 Kms north of Dhaka and the ***commute time is about 1.5 hours***. It is also about 25-30 kms from the important northern suburb of Uttara and the Zia International Airport at Dhaka. The commute time from both these place is about 1 hour.

The site is directly ***connected by a railway line to Dhaka***. It has been earlier suggested that this be used to establish a high speed link to Dhaka and the Airport to enable an easy commute for employees residing in the city.

1.2.2 PROJECT PROGRESS

The ***project was first mooted in 2001*** and the Bangladesh University of Engineering and Technology (BUET), a premier engineering institute in Dhaka, was appointed to carry out a feasibility study. The project is being ***implemented by the Bangladesh Computer Council (BCC), an agency of the Ministry of Science and Information Technology*** (MoSICT). While initially the progress was slow, substantial progress has been achieved in the last couple of years - as noted above, land has been acquired and some boundary walls and administrative buildings have been set up and some preliminary roads have also been completed.

1.3 MARKET AND DEMAND ANALYSIS

1.3.1 THE ECONOMIC CONTEXT

The world economy has been reeling from the impact of the credit crisis which exploded in the last quarter of 2008. The crisis has ***severe consequences for foreign investments and exports***, both of which are crucial for the proposed KHTP.

Subsequent to the crisis, a sharp fall was witnessed in the GDP growth across regions in the world. Also, trade has fallen sharply owing to demand slowdown.

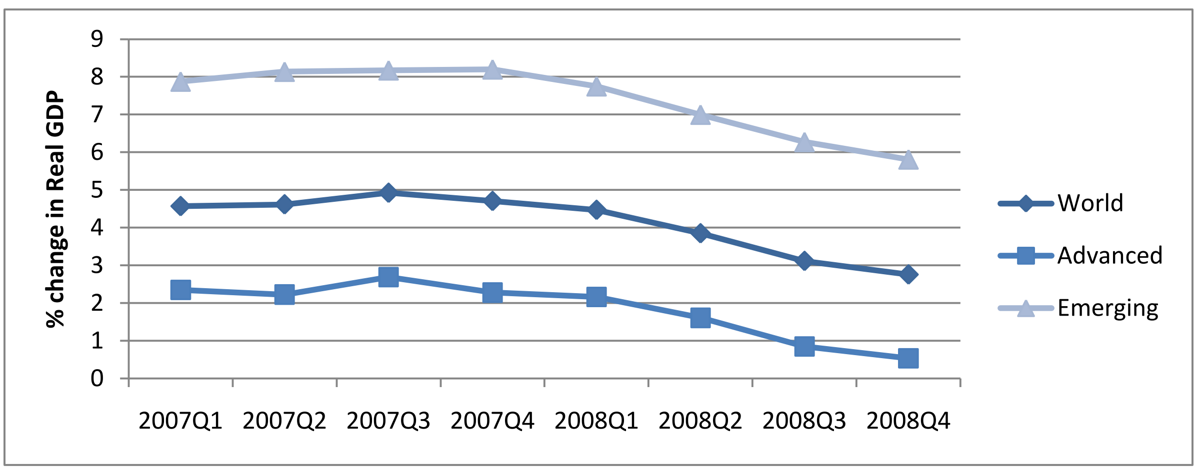

Exhibit 3 Real GDP growth in 2008 vis-à-vis 2007

In terms of future outlook, International Monetary Fund (IMF) projections state that a ***turnaround in GDP growth would only happen by 2010***. The world GDP is forecasted to grow by around 4.2% in real terms in the year 2010 which would be a 1.2% improvement over the corresponding 2009 figure.

While Bangladesh has been doing relatively well, registering growth rates of over 5.5 to 6% until 2007-08, the global economic crisis is expected to have a significant impact on certain sections of the economy. ***Exports, which have been growing at 15-20%, are likely to taper off***, as demand from its largely western customers, gets affected. ***Remittances are also expected to decrease*** on account of the economic downturn in the Middle East and the UK where most of the Bangladeshi migrants are employed.

It can be inferred that the impact of the global economic recession is expected to be significant for Bangladesh. This is also true of the ***Hi-tech sectors which are presently confronted by a number of issues in the sub-continent***.

However, ***on financial markets, the impact of the crisis is not expected to be very significant*** since the Bangladeshi credit markets are relatively insulated and foreign portfolio investors do not play a large part in the country.

In sum, it may be argued that while short-term effects of the crisis are already in evidence, ***the overall impact is likely to be less for Bangladesh.*** FDI, on the other hand, is expected to be somewhat impacted in the short to medium term. These implications have been appropriately factored into our demand estimation.

1.3.2 THE BANGLADESH ICT INDUSTRY

The following exhibit illustrates the possibilities available for development within the Hi-tech sector and our recommendations on the immediate priority areas based on specific Critical Success Factors (CSFs) for each industry segment and Bangladesh's strengths against these:

Industry / Sector		CSF	Bangladesh Capability	Rating
IT/ITeS	ITeS – Voice Services	Basic computer knowledge, English fluency	Accent neutralization costs	*****
	ITeS – Data Services	Basic computer knowledge	Large talent pool available	*****
	IT services – Basic outsourcing	Skilled workforce, Partnership with large software house, ability to scale up	Talent pool and islands of excellence	*****
	IT services – end to end consulting	Project Management skills, Scalability, vertical market knowledge	Potential to develop once industry scales up	*****
IT/ITeS	Software Products	Execution skills, branding, vertical market knowledge	Existing products, Vertical market skills in garments, banking etc;	*****
HARDWARE	Hardware Assembly	Skilled labour (Electronics), Low import barriers for components	Talent pool available, Evolving domestic market	*****

Industry / Sector		CSF	Bangladesh Capability	Rating
R&D	Hardware & Product Design	Developed Hardware and R&D capabilities, Logistics cost	Still at a nascent stage, lower R&D capabilities	*****
	Biotechnology – Agri Biotech	Local industry linkage, trained manpower, R&D capabilities	Nascent R&D Capabilities	*****
	R&D Services	Research base and capabilities. Strong university linkage	Nascent R&D Capabilities	*****

Exhibit 4 Critical Success Factors for IT Industries

The focus of the feasibility study is therefore on the sub-segments identified above, especially Information Technology (IT) and IT Enabled Services (ITES). These are referred to as the ICT or the technology industry.

The total ***size of the Bangladesh IT industry is about USD 113 Mn*** (including both hardware and software) as of 2007. The growth of the industry has been about 28% over the last 5 years but in the last 2 years, growth has increased to over 50%. The ***software services industry employed about 25,000 people*** in the country in 2007 – the growth rate of employees was about 15% over the preceding 6 years

A major proportion of the industry constitutes very small and small companies, which account for about 75% share of the market. The ***large and medium scale companies (employing over 50 people) on the other hand contribute a smaller share of 25%*** while accounting for a higher share of employment, at nearly 57%. Most of the exports, which account for around 9% of the total industry revenues, come from the larger companies. ***Only these larger companies may be immediate target tenants as far as the KHTP is concerned.***

The ***biggest export market is the US***. However, over the years, there has been a shift in focus, with other major destinations, especially the EU, South Asia and South East Asia, being targeted for exports.

1.3.2.1 INVESTOR PERCEPTIONS

Based on a dialogue with foreign and domestic investors, the following key findings emerged regarding their inclination, concerns and expectations with respect to investing in Bangladesh:

- The Bangladesh market is ***not top of mind*** either as a market or as an investment destination
- However several ***sub-continental firms said that they would be willing*** to investigate the possibility of setting up software development operations in the country. However MNC companies were less enthusiastic about the idea.
- ***Cost arbitrage, especially with regard to wage cost, was recognized as an opportunity*** by most sub-continental firms although MNC firms felt that this would gradually erode over time, as seen in countries like India. Bangladesh as a ***de-risking opportunity*** for technology majors, many of whom have a concentrated exposure to India, was also seen as an opportunity, notwithstanding concerns about Bangladesh itself.
- Other concerns included ***availability of qualified manpower***, the limited opportunities in the ***domestic market*** which often acts as the base for setting up outsourcing ventures and ***lack of familiarity*** with the market.

- Domestic players were generally positive about the KHTP, some mentioned ***concerns about the commute time***. Since many companies operate buses to and from the offices for employees, it was felt that this could substantially raise costs which would have to be offset by lower lease rentals.

1.3.2.2 THE OPPORTUNITY

Wage rates are very competitive, being ***3-4 times lower than in neighboring countries***. However while manpower and security concerns remain, it worth noting that countries having similar or higher level of constraints have much bigger technology industries. Pakistan, for example, employs over 100,000 employs in the technology sector as against 25,000 in Bangladesh. This is just one indication of the difference between the potential and actual industry size.

1.3.2.3 IMPACT OF DOWNTURN

While here appears to be a good potential for the development of the industry in the long term, there are some ***concerns in the short to medium term*** on account of the global recession and the consequent impact on the technology industry.

Worldwide technology products and related services sector spendings are estimated to have grown at 7.3 per cent to reach USD 1.7 trillion in 2007. It is estimated that in 2008, the worldwide IT market growth will be lower at about 5.5%.

However, when ***compared to the sharp decline in growth of other non-IT industries, the IT sector has been somewhat resilient***. The industry's sales have been growing steadily, albeit at a slower rate. But, the net incomes have been affected significantly.

1.3.3 METHODOLOGY FOR DEMAND PROJECTION

We have evaluated three scenarios based on probable future growth scenarios for IT/ITeS exports from Bangladesh. The following schematic indicates the methodology proposed for estimation of land demand for the KHTP

Exhibit 5 Land Demand Assessment Methodology for Bangladesh ICT Industry

It is important to note that the projection does not take into account any incremental impact on the technology sector, of the KHTP itself but addresses the quality space issues that the industry is confronted with today. It ***does not factor in shifting of existing units into the KHTP or substantial increase in foreign players establishing their presence in Bangladesh***, both of which are distinct possibilities.

The fundamental assumption driving the demand projection is the growth rate assumed for the industry. This was based on the following:

- A ***50% growth rate was actually witnessed in the last 2 years*** for the technology sector in Bangladesh and a growth rate of 25% was achieved over the last 10 years.
- ***Emerging locations in India***, most of which have social infrastructure at a comparable or less developed level than Dhaka, have achieved ***growth rates ranging between 25% and 70% in the last 5 years***. Kolkata, in West Bengal, which has similar cultural and socio-economic parameters, witnessed a 55% growth rate. Even interventions which are seen as unsuccessful, such as in Hubli, Karnataka, resulted in a growth rate of 35%
- ***Pakistan witnessed a growth rate of between 50% and 70% from 2003 to 2009*** and presently employs over a 100,000 professionals as against 25,000 in Bangladesh

- As pointed out, while the economic downturn will have a definite short term impact, it is expected to be relatively less severe in its implications for the technology sector.

Considering the above, and being very conservative on account of the downturn, in the base case, an ***average growth rate of 20% for industry turnover has been assumed***. This has been suitably moderated in the initial years to take into account, the impact of the downturn and also stabilized at 10% in the long term. Growth rates assumed in each of these scenarios are as shown in the table below:

Scenario	Revised ICT Industry Growth Rate
Scenario 1 (Base Case)	20%
Scenario 2 (Optimistic)	25%
Scenario 3 (Pessimistic)	15%

Exhibit 6 Probable Future Growth Rates for IT Sector in Bangladesh

Exhibit 7 provided below represents the estimated size of the Bangladesh' ICT industry under the three scenarios taken into consideration.

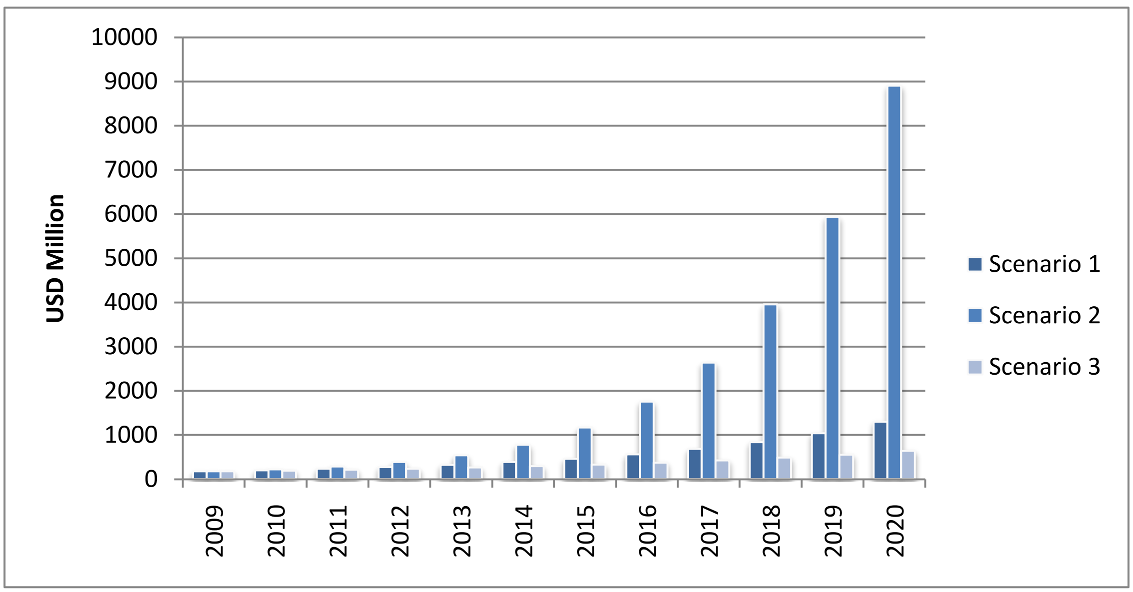

Exhibit 7 Estimated size of Bangladesh' ICT industry under various scenarios

1.3.3.1 ALLOCATION OF DEMAND TO KHTP

The projected space demand was allocated to the KHTP based on its ***competitive position vis-à-vis other competing developments*** in and around Dhaka. Kaliakoir Hi-tech Park would be the first-of-its-kind facility being proposed in Bangladesh for the ICT industry. Based on market studies, there is ***no other similar ICT facility being envisaged as of now***.

Currently, most of the players operate from their own facilities and many of them are in central Dhaka. ***Rentals charged for space within the park would be significantly cheaper*** than what companies presently incur for renting space outside. Coupling the benefits of ***superior infrastructure*** with lower prices is expected to contribute to demand for space at the Hi tech park.

Discussions with supporting agencies promoting the development and growth of Information and Communication Technology (ICT) industry in Bangladesh such as BASIS revealed that while there have been various plans to develop alternate IT/ITeS hubs in the suburbs of Dhaka, no concrete plans are expected to materialize in the near future. Consultations with stakeholders revealed that ***BASIS had proposed a handover of approximately 68 acres in Mohakali Industrial Estate*** for development of an Incubator/Software Technology Park. While Mohakhali has a location advantage over Kaliakoir, the following would redound to its advantage:

- ***Land acquisition has not yet been commenced*** and is expected to considerably delay the process whereas land is in complete possession at Kaliakoir
- ***Price of the land***, being in central Dhaka is expected to be very high as compared to Kaliakoir
- The area is ***considerably smaller*** and the benefits of spreading infrastructure costs would be accordingly smaller

Other alternatives for players in the technology sector include scattered facilities within Dhaka, as is the case presently. While the existing Software Technology Park (STP) at BSRS Bhaban charges very low lease rentals of USD 0.22 per square feet, ***no space is available at the facility at present. Outside the STP, commercial space is very expensive as compared to Kaliakoir.***

Many of the ***smaller companies are, however, operating from residential space*** which is considerably lower in terms of cost as compared to commercial buildings. Since these are typically smaller establishments with 25 or fewer employees, they would, in any case, not form a part of the focus tenants for the KHTP.

For the larger companies, it is expected that a substantial number would find the KHTP very attractive given the pricing of alternatives within Dhaka city. However, since location decision are often made by senior executives who reside in the heart of the city and are generally disinclined to increase their commute times, the process of shifting may be gradual although we believe that the quantum of the cost differential will eventually force many to move.

Taking into consideration the pros and cons discussed above as well as the proportion of the medium/large scale companies in the ICT industry in Bangladesh, we have assumed ***a gradually "ramped up" approach towards the market share of the Kaliakoir Tech Park. For the first 5 years, starting in the year 2011, the market share of the Kaliakoir Hi-tech Park has been assumed in the range of 33% - 50% of the incremental demand*** for space by technology companies in Dhaka. Post year 5, the market share for demand attracted by Kaliakoir Hi Tech Park has been kept at 50% of the incremental demand for ICT space.

It is important to emphasize here that a high speed rail link, as previously suggested using the existing railway line, would greatly boost the project prospects.

1.3.3.2 AREA OFF-TAKE

The total land available for development is 262.63 acres. Based on industry norms and site-specific constraints, around 98.9 acres would be developed as roads and open areas. Given a ***global Floor Space Index (FSI) of 2***, the remaining 163.7 acres translate into ***around 14.51 million sq ft of space***.

Keeping in mind the training and manpower enhancement requirements, some space has been reserved for institutions like university and training centers. After deducting area for other amenities (including their individual FSIs), a ***total space of 10.67 million sq ft is earmarked for commercial and residential***

use. 60% of this space (approximately 6.***38 million sq ft) would be used for commercial*** use while the remaining ***4.25 million sq ft would be for residential*** purposes. Further, of the 6.38 Mn Sqft of commercial space, only 1.91 Mn Sqft (30%) are assumed to be developed by the project SPV as built up space. The rest has been assumed to be leased as land to other developers who will build space. The off-take of the "industrial area" of the KHTP after factoring in the above is presented in the following exhibit.

As indicated the off-take of commercial space and serviced land for ICT companies (called the "industrial area" or "processing area") is completed in:

- 12 years in the base case
- 4 years in the optimistic case
- 32 years in the pessimistic case

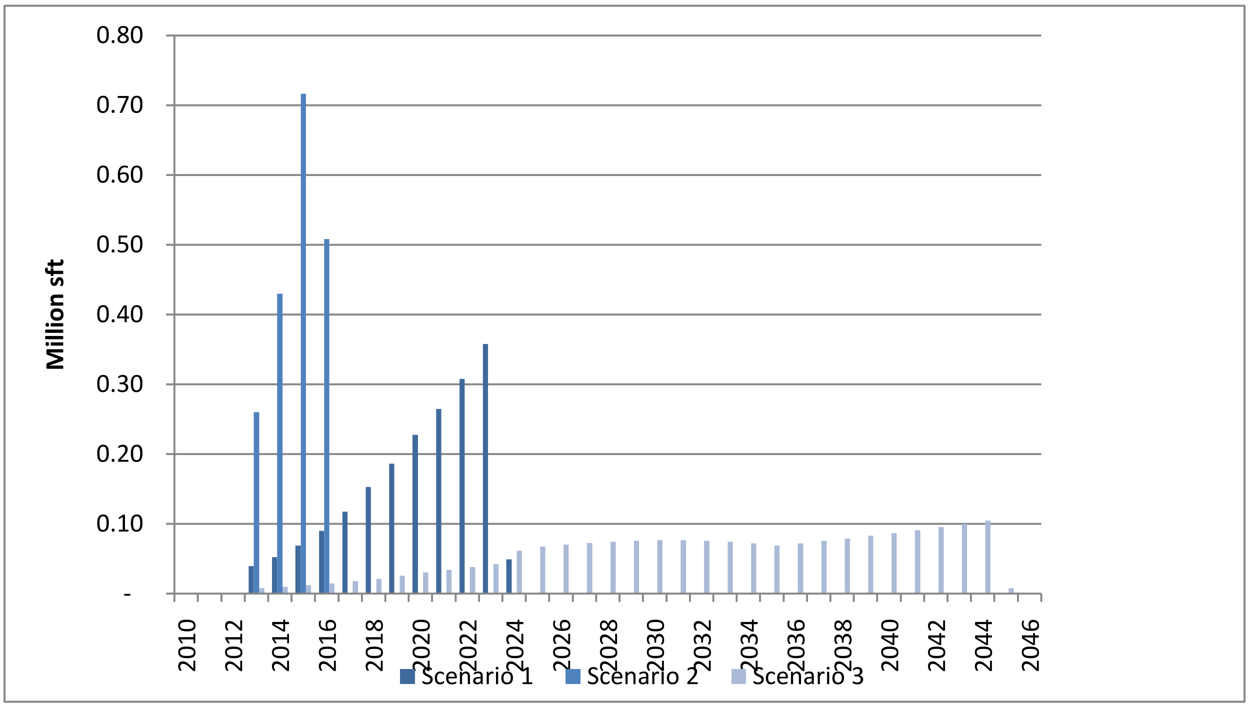

Exhibit 8 Offtake for the processing area under various scenarios

Residential off-take will be faster even with the conservative assumption that, on an average, only ***5-15% of employees actually stay within the park***. This is because of dependents as well as higher norms for space required per person in a residential development as compared to commercial space. The ***off-take of residential space would be 12 years in the base case***, 4 years in the optimistic case and 33 years in the pessimistic case.

The ***development of the KHTP is planned in 2 phases*** depending on the land off-take scenario. For the base case, the two phases would be completed by 2012 and 2019 respectively.

1.4 ENVIRONMENT AND SOCIAL MANAGEMENT PLAN

The ENVIRONMENT AND SOCIAL MANAGEMENT PLAN (ESMP) will help the Hi-Tech Park regulatory Authority address the adverse environmental and social impacts of the project, enhance overall benefits from the project, and introduce internationally recognized good environmental and social practices. The primary objectives of the ESMP are to:

- MAXIMIZE THE ECONOMIC, SOCIAL AND ENVIRONMENTAL BENEFITS of the proposed project
- FACILITATE THE IMPLEMENTATION OF THE MITIGATION MEASURES by providing details of each project impact, and proposing an implementation schedule;
- IDENTIFY MONITORING PARAMETERS to ensure that all proposed mitigation measures are completely and effectively implemented and to define a monitoring mechanism;
- DEFINE THE RESPONSIBILITIES of project proponents for the three phases i.e. design, construction and operation;
- Identify TRAINING REQUIREMENTS at various levels and provide a plan for implementation;
- Identify the RESOURCES REQUIRED to implement the ESMP and the corresponding financing arrangements; and
- Provide COST ESTIMATES for all proposed ESMP actions.

1.4.1 APPROACH

Impacts have been identified for all the stages of the project i.e. pre-construction, construction and operations phases. All the activities during various phases, that may lead to certain impacts were identified and considered for analysis. The significance of the impacts was evaluated based on the following:

- Basic understanding
- Past experience
- Impact assessment matrix

The impact assessment matrix, as defined in the Environmental and Social Management Framework (ESMF) was developed to quantify the impacts and understand their significance in detail. Impacts have been rated across five parameters:

- Scale of Impact (Rated on a scale from -3 to 3, with -3 being the most negative and 3 being the most positive).
- Probability (Rated on a scale from 0 to 4 with 0 being no probability and 4 being highly probable).
- Cumulative Impact (Rated on a scale from 1 to 3).
- Permanence (Rated on a scale from 1 to 3).
- Reversibility (Rated on a scale from 1 to 3).

Ratings have been assigned based on past experience of similar development projects and basic understanding of the processes.

Finally, an overall environmental score is calculated based on the above ratings, as described in the ESMF, to determine the significance of the impacts.

1.4.2 KEY IMPACTS

1.4.2.1 CONSTRUCTION STAGE IMPACTS

- Ownership of land has already been transferred to the BCC. Therefore, there are NO LAND ACQUISITION-RELATED IMPACTS.
- The affected household-heads informed the consultants that they will re-construct all housing structures and facilities on the own homestead area, 10 meters north of the park's boundary wall. THEREFORE, SINCE THE HOUSEHOLDS' LIVELIHOOD SYSTEM SHALL NOT BE AFFECTED, THE IMPACT IS MINOR.
- There are 138 fruits and 27 timber trees of various sizes and species belonging to the squatters that would be required to be cut. Squatter families shall be entitled for compensation for the same. Therefore, some MODERATE SHORT TERM IMPACT is envisaged.
- A 15 feet wide paved village approach road runs from the Dhaka-Kaliakoir main road towards surrounding villages. Approximately, 5000 villagers use this road. Development of the park will lead to closing of this road and hence all of the above users will be affected. THIS IS ANTICIPATED TO BE THE ONLY LONG TERM MAJOR IMPACT OF THE PROJECT.
- At the northern boundary, there is a 360 feet deep tube-well which supplies water for irrigation for over 50 acres of agricultural lands. Therefore, SHORT TERM MODERATE IMPACT IS ENVISAGED due to the loss of this asset.
- No utility relocation is required
- THE TOTAL REPLACEMENT COST OF ALL HOUSING AND RELATED STRUCTURES IS ESTIMATED AT 330,000 TAKA OR ABOUT USD 4700. LOSS OF TREES IS ADDITIONALLY ESTIMATED AT US 1050.
- It is recommended that all the earth material be brought from an authorized place. Assuming this is done NO MAJOR IMPACT IS EXPECTED to be associated with the disruption of the earth surface.
- Soil erosion and siltation of water bodies from clearing and grubbing, storage of filled material, excavation for construction structures etc. can have a negative impact on the flow regime and water quality of the Turag River and Kaliakoir Khal adjacent to the Hi-Tech Park construction site (1 km from Kaliakoir khal and 2 km from Turag River). However, these IMPACTS CAN BE CONTROLLED THROUGH GOOD CONSTRUCTION PRACTICES as suggested in the EIA report.
- During the construction phase, storm water runoff can carry large sediment loads which increase turbidity in the river waters. This CAN BE AN IRREVERSIBLE IMPACT, if not mitigated properly. During construction, oil and grease and hazardous material should be managed properly in designated areas, and disposed of appropriately. These are MINOR SHORT TERM, REVERSIBLE IMPACTS.
- The transportation and use of heavy equipment and trucks would be required during construction. Trucks would transport construction materials and heavy equipment. This has the potential to directly impact traffic flow and accident risk along village approach road and especially at the Dhaka - Kaliakoir main road. This can BE A SIGNIFICANT IMPACT IF NOT PROPERLY MITIGATED.

- MINOR NEGATIVE IMPACT ON THE AMBIENT AIR QUALITY WITHIN A FEW METERS FROM THE SOURCE AND WITHIN THE SITE would occur. However, appropriate mitigation measures, in the form of good construction practices, would still need to be followed in order to keep these impacts to a minimum.
- Construction activities would not have a significant impact on existing ambient noise levels, but the personnel operating the machines and the workers stationed close to the machines are prone to exposure of high levels of noise. This is, however, expected to be A SHORT TERM AND REVERSIBLE IMPACT.
- Average estimated requirement of water for various construction activities would be about 180 kl every day. NO CONSIDERABLE IMPACT ON THE WATER TABLE IS ENVISAGED due to the withdrawal.
- Wastewater generation during construction is assessed to about 80 L/P/D (Litres per capita per day), which can cause water pollution, if not treated. NO SIGNIFICANT IMPACT ON THE QUALITY OF WATER RESOURCES IS ANTICIPATED due to disposal of treated wastewater.
- The overall IMPACT OF WASTE DISPOSAL DURING CONSTRUCTION PHASE CAN BE SIGNIFICANT AND HENCE PROPER MITIGATION MEASURES WOULD BE REQUIRED.
- Temporary concentration of labour force inside the camps may create un-hygienic conditions, if not mitigated properly. This is considered to be a MINOR IMPACT.
- The construction site is moderately congested with traffic and in close proximity to areas used by the general public. During construction, there is AN INCREASED RISK TO PUBLIC SAFETY, due to the hazardous nature of such work.
- LOSS OF FAUNA WILL BE A MAJOR IMPACT WHICH CANNOT BE REVERSED.
- NO HISTORICAL OR CULTURAL MONUMENTS WILL BE AFFECTED/ LOST due to the construction of the project.
- The project shall generate SIGNIFICANT EMPLOYMENT OPPORTUNITIES DURING CONSTRUCTION, which can be provided to the local people, if found appropriate. The project would also generate SIGNIFICANT SHORT TERM BUSINESS OPPORTUNITIES

1.4.2.2 OPERATION STAGE IMPACTS

- The ambient air quality is WITHIN THE ACCEPTABLE LEVEL PRESCRIBED BY DEPARTMENT OF ENVIRONMENT AND WORLD BANK GUIDELINES. During operational phase, VEHICULAR EMISSIONS WILL BE THE MAJOR SOURCE OF AIR POLLUTION from the Hi-Tech Park. However, SINCE MOST HEAVY VEHICLES USE CNG, POLLUTION FROM VEHICULAR SOURCES IS EXPECTED TO BE MINIMAL.
- The industries within the site will be service industries and therefore very limited emissions are expected in relation to these activities.
- Noise during operation phase will be less than 55 dB (A) within a distance of 20 m from the source. Thus noise in the operation phase of the project would have moderate impact.

- The proposed internal road system of arterial, secondary and tertiary roads shall be connected to the Hi-Tech Park main access road. THESE WOULD HAVE A NEGATIVE IMPACT ON THE TRAFFIC MOVEMENT.
- Since the Hi-Tech Park would not discharge any contaminated liquid waste, which can deteriorate the water quality of the area, no SIGNIFICANT ADVERSE IMPACT IS ANTICIPATED ON SURFACE OR GROUND WATER RESOURCES.
- No negative impacts are predicted due to sewerage or solid waste during the operation phase since handling and disposal of solid wastes has been suitably designed in the detailed engineering study
- Proposed minimum finishing ground level is +10.50 m in order to prevent flood/water logging (MFL at the site is +9.18 m) within the Hi-Tech Park area during rainy season. Plinth level of all the buildings shall be above the maximum flood level.
- The development of the project area will not bring any changes in the land use pattern
- The Hi-Tech Park will be knowledge based industrial zone and thus shall not create employment opportunities for most local people as in case of other EPZs. However, a number of employees will be required in the tenant industries for administration and management purposes. Eligible local people would be able to avail these jobs.
- The project shall generate long term business opportunities for the business community. In addition, backward and forward linked industries/organizations would be established due to the development of the project.
- NONE OF THE PARAMETERS' ENVIRONMENTAL SCORE REACHES THE RANGE OF -72 TO -108 WHICH IS THE RANGE FOR MAJOR AND IRREVERSIBLE IMPACT. NO CUMULATIVE IMPACT IS EXPECTED to be created as there are no other industrial settlements in the nearby region

1.4.3 ESMP

The ESMP, emerging from the above, is based on 5 major principles:

- The POLLUTER PAYS for pollution and prevention of pollution.
- The DEPARTMENT OF ENVIRONMENT (DOE) IS TO PLAY A CENTRAL ROLE in the environmental and social safeguarding of the project - regulation, supervision and enforcement but with substantial support from the developer and external consultants in the beginning.
- Environmental and social safeguards to be INCORPORATED FROM THE INCEPTION of all activities.
- PRIVATE SECTOR DEVELOPMENT for execution and implementation of environmental and social safeguard related activities.
- All activities undertaken within the framework of the PSDSP or subsequent developments are to be REVIEWED FOR THEIR ENVIRONMENTAL AND SOCIAL IMPACTS, and, when required, they need to be included in effective Environmental and Social Management Plans aimed at off-setting, preventing, or mitigating any such negative impacts. Satisfying the environmental and social safeguard requirements is a condition for the proposed activities to be implemented.

1.4.3.1 MITIGATION MEASURES

To avoid and minimize the impacts resulting from the activities of the project, measures and management plans, which are essential to mitigate the impacts discussed above, have been proposed. These are based upon appropriate technological design, improvements or adjustments, and policy including good site operational practices etc. The overall strategy has the following sequence:

- Impact avoidance: Changing project location, design and construction methods to avoid impacts.
- Impact minimization: Where impacts cannot be avoided, implementing mitigation measures to reduce the impact to acceptable levels.
- Compensation: Arranging compensation where impacts cannot be avoided or sufficiently mitigated.
- Enhancement: Measures, which, at insignificant cost to the project, give appreciable social or developmental benefits.

The mitigation plan has been adopted to highlight the action procedures to avoid/minimize / control the resultant impacts arising out of the different project phases i.e. pre-construction, construction and operation. NO RESIDUAL IMPACT OF THE PROPOSED MITIGATION MEASURES IS ANTICIPATED. The Entitlement Policy packages for different categories will be based on the ESMF.

1.4.3.2 ENTITLEMENT PLAN

The project specific entitlement matrix is accordingly presented in Exhibit 9 below:

Type of Loss	Application	Entitlement Person	Compensation
Housing Structures and associate facilities	Entire structure affected OR where structures partially affected such that the remaining structure is unviable for continued use.	Squatter	All affected squatters will be entitled to: Compensation in cash at replacement cost for affected structure
Trees	Lost trees	Squatter	Compensation in cash calculated on the basis of type, age and productive value of affected trees.
Loss of public Infrastructure - existing village approach road	Construction of alternate village approach road	Kaliakoir Pourashava	Construction of an alternate road.
Community Asset- Deep Tube-well	Re-installation of Deep Tube-well	Representative of Users	Compensation in cash at replacement cost for affected Deep Tube-well

Exhibit 9 Entitlement Matrix

1.4.3.3 MONITORING PLAN

The prime objectives of monitoring are:

- To check whether mitigation and enhancement measures are actually being adopted, and are proving effective in practice.
- To provide a method whereby impacts which were subjected to uncertainty at the time of preparation of the ESMP, or which are unforeseen, can be identified and steps can be taken to adopt appropriate control measures.
- To provide information on the actual nature and extent of key impacts and the effectiveness of mitigation and enhancement measures used on the project
- To satisfy legal, safeguard and community obligations.

Monitoring has two components:

- COMPLIANCE MONITORING, which checks whether prescribed actions have been carried out, usually by visual observation and by the use of checklists.
- MONITORING OF EFFECTS, which records the beneficial and adverse consequences of activities on the biophysical and social environment. This is often done through repeated measurements of a set of objectively verifiable indicators.

1.4.3.3.1 PRE CONSTRUCTION STAGE MONITORING

Compliance monitoring during the pre-construction stage has three components:

- Checking that the project's design incorporates appropriate measures to avoid or minimize negative impacts.
- Incorporation of appropriate protective clauses in the contract documents that are to be followed by the contractors.
- Ensuring that acquisition of land and damages to properties are dealt with as per the Resettlement Action Plan (RAP) prepared for the park, and compensations are made accordingly.

1.4.3.3.2 CONSTRUCTION STAGE MONITORING

Compliance monitoring during the construction stage comprises:

- Contractors' compliance with environmental clauses in their day-to-day activities.
- Implementation of site clearance activities after completion of work.

Direct monitoring during the construction phase will involve the following activities:

- REVIEW OF CONTRACTOR'S PROPOSED DESIGNS and working methods including a review at construction commencement to ensure that the designs and working methods proposed by the contractors have taken account of the environmental constraints specified in the tender documents (geotechnical, ecological, social, safety etc).
- SITE- SPECIFIC REVIEW OF CONTRACTORS' TEMPORARY FACILITIES; involving the inspection of contractors' worksites and work camps to ensure that the contractor's arrangements regarding temporary facilities are satisfactory.

- REGULAR SITE INSPECTION during the construction period, involving scheduled and unannounced inspections to ensure that the stipulated procedures as defined in the ESMF and this ESMP are being followed by the contractor(s). This monitoring will require the completion of systematic observations of site activities using checklists to be developed by the Park regulatory authority or the supervising consultants.
- INSPECTION OF THE CERTIFICATE OF SITE CLEARANCE and restoration, to ensure that actual restoration has taken place, e.g., the temporary works have been adequately & appropriately disposed of etc.

The above monitoring system will be fully controlled by the appropriate implementing agency.

1.4.3.3.3 OPERATIONS STAGE MONITORING

Operations stage monitoring would involve the following:

- Periodic monitoring and checking of environmental parameters within the park.
- Timely resolution of labor related issues and proper functioning of grievance mechanism.
- Inspection of individual units to check whether the units follow the prescribed environmental and social norms or not.
- The rationale for the reporting system is based on accountability to ensure that the measures proposed as part of the Environmental & Social Management Plan get implemented in the project.

Annual third party environmental audits are proposed which need to be followed by suitable action plan to correct various issues identified during the audits.

1.4.4 INSTITUTIONAL ARRANGEMENTS

The ESMP implementation, organization structure is shown in **Error! Reference source not found.**the following exhibit.

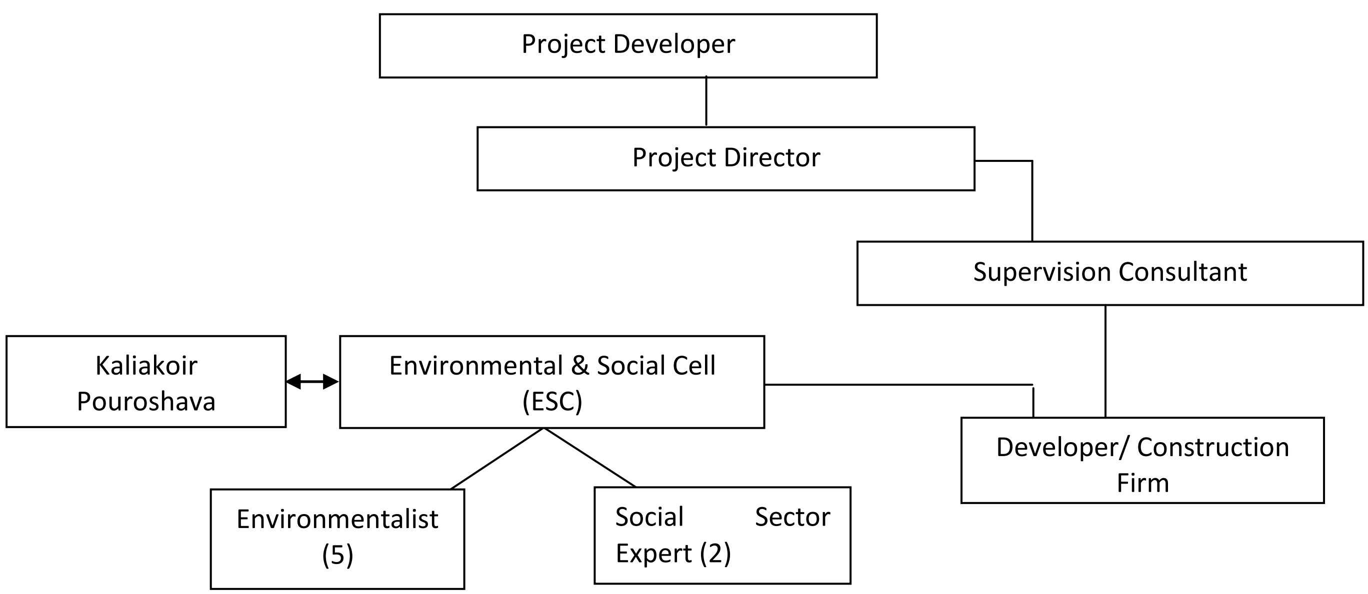

Exhibit 10 ESMP Implementation and Organizational Structure

The following key entities will be involved in the ESMP implementation:

- Project Director
- Environmental and Social Cell (ESC)
- The Supervision Consultant
- Developer/ Construction Firm (if appointed by the SPV for construction works only)
- Kaliakoir Pouroshava Authority

1.5 DETAILED ENGINEERING AND MASTER PLANNING

The final detailed engineering design phase of the project aims at developing norms/ schemes for the development of the project. These would in turn ensure that the factors/ implications considered in carrying out the environmental/ social studies are enforced. Inputs considered for the final design study include:

- Site features, constraints and physical parameters
- Market analysis and land off-take estimation
- Environmental and sustainability considerations
- Feedback from Stakeholders

Further to receipt of comments and feedback and the refining of assumptions related to the project components, a number of design changes took place. The following exhibit provides a brief snapshot of the design changes incorporated in the study, further to the basic planning and design study.

Project Component	Revision in Design Decision at Detailed Engineering Phase
On-site Infrastructure Development Phasing	Development of on-site infrastructure was designed to be phased as closely as possible based on the projected land off-take at the site
Site Access for Pedestrian Employees	Provision of pocket gates for pedestrian access was included in the master planning of the zone

Exhibit 11 Revision in Project Design Components at Detailed Engineering Stage

1.5.1 PROJECT PHASING

To optimize financial returns it is important to phase the development keeping in mind design and modular considerations such as:

- Focus Industries
- Projected land off-take
- Infrastructure Needs Assessment
- Economic Investment Modules
- Project cash flows

1.5.2 DISCUSSIONS WITH BCC

Subsequent to the basic planning study, the consultants held discussions with the BCC, the feedback from which is shown in the following exhibit.

Aspect	Feedback
Observed site area	It was agreed that, in the survey, parts of water bodies have added to the site area, and that the site area of 264 acres as surveyed by the consultants is therefore accurate
Land parcellation and allotment	Further to the zoning carried out in the basic planning study, it was agreed that the detailed engineering design would include land plot parcellation and industry wise allotment of the same
On-site roads	Rationale of including a green belt and sidewalks along with on-site roads was agreed to.
Constraint due to rail line	Rail over-bridge for seamless connectivity within the site zones was agreed to
Site zoning with respect to community access to on-site facilities	It was conveyed that access to on-site facilities should be shared with the surrounding communities.

Exhibit 12 Feedback from BCC on Basic Planning Study

1.5.3 SOCIO-ENVIRONMENTAL CONSIDERATIONS/ INPUTS TO DESIGN

In addition to the feedback on the engineering design from the concerned nodal agency, a number of socio-environmental aspects were considered while finalizing the engineering design. The following exhibit captures a snapshot of the corresponding parameters and their impact on the design aspects.

Parameter	Input	Design aspect
Social	Project impact on village approach road	Design of alternate village approach road through Kaliakoir Pourushava
	Access to institutional/ public facilities within the project area for local community	Zoning/ land parcellation within the project carried out in such a way that local communities can be granted access to such facilities without causing interference to the industrial area
	Sidewalks within the project area to be effectively utilized	Ample green buffer/ cover is designed for the sidewalks to cater to the corresponding requirement

Parameter	Input	Design aspect
Environmental	Ambient air quality and noise control	No diesel-fuelled generators are envisaged to be installed at the project site and ample greenery/ buffers are designed to counter the traffic related air quality impacts. Also, appropriate noise control/ mitigation measures are recommended to be enforced by the corresponding authorities.
	Water quality at the project site	The water treatment system has been designed considering the input water quality at the project. Also, the waste water treatment system has been recommended based on maximum water recycling and minimum discharge to surrounding environs.

Exhibit 13 Socio-environmental Considerations for Design of the Zone

1.5.4 LAND USE PLAN

The proposed land use plan for the KHTP is summarized in the following table:

Description	**Total Area**	
	Acres	%
Category A (Industrial Area)		
1. Industries		
MTB	16.10	6.13
IT/ITES Plots	35.33	13.45
Hardware	9.32	3.55
2.Customs,Security, Admin, entrance plaza	1.86	0.71
3.Warehouse	5.26	2.00
Total	**67.87**	**25.84**
Category B (Non-industrial Area)		
4. Entrance Plaza	0.70	0.27
5. Residential	38.51	14.66
6. Commercial & CBD	7.32	2.79
7. Institutions, Social Amenities, Sports & Recreation	41.66	15.86

Description	Total Area	
	Acres	%
8. Existing Admin Building	0.87	0.33
9. Training Centre	10.22	3.89
Total	**99.28**	**37.80**
Category C - Other Areas		
10. Utilities	14.10	5.37
11. Road	35.57	13.54
12. Greenery	45.81	17.44
GRAND TOTAL	**262.63**	**100.00**

Exhibit 14 Land Use Plan

1.5.5 PROJECT CAPITAL AND OPERATING COSTS

Based on the detailed design and assessment of various project components, a snapshot of the estimated project costs is captured in the following exhibit. A comparison with the costs estimated in the basic planning stage is also shown:

S No	Description	Basic Planning Stage Cost (USD Mn)	Detailed Design Stage Cost (USD Mn)
1	Road works including drain, culvert etc	6.80	7.02
2	Sewerage network including STP	1.62	2.29
3	Water supply including WTP	3.50	1.81
4	Electrical works including Transformer, street lighting	1.98	1.98
5	Buildings - Admin & Social amenities	2.20	2.19
6	Infrastructure for Sustainability covering green cover, water harvesting, energy saving and energy efficient devices, etc.	0.34	0.38
7	Boundary Wall	0.43	0.47
8	Land Development cost	5.67	5.67
	TOTAL	22.54	21.81

Exhibit 15 Snapshot of Estimated Project Costs

Project operating expenses have been assumed as percentage of the capital costs of various project components. The following exhibit captures these expenses, as percentages of the capital costs.

Project Component	Annual Operation Cost (% of capital cost)	Annual Repair/ Maintenance Cost (% of capital cost)
Road works including drain, culvert etc	2.00%	5.00%
Sewerage network including STP	4.00%	2.00%
Water supply including WTP	2.50%	2.00%
Electrical works including Transformer, street lighting	2.00%	5.00%
Buildings - Admin & Social amenities	0.00%	5.00%
Telecom network	2.00%	5.00%
Infrastructure for Sustainability covering green cover, water harvesting, energy saving and energy efficient devices, etc.	2.00%	2.00%

Exhibit 16 Project Operation, Maintenance and Repair Costs

1.5.6 DEVELOPMENT PHASING SCHEDULE

The following exhibit provides a brief snapshot of the proposed on-site infrastructure development phasing schedule.

Activity	Estimated Duration	Proposed Commencement	Proposed Finish
On-site Infrastructure Development - Phase I	**331 days**	**Jan 2012**	**Dec 2012**
Site Grading, Road works including drain culvert & Bridges	200 days	Jan 2012	Jul 2012
Site Grading	100 days	Jan 2012	Apr 2012
Road works including drain, culvert & Bridges	197 days	Jan 2012	Jul 2012
Water supply & sewerage Network	175 days	Jan 2012	Jun 2012
Water Supply Network including Distribution Network - Potable & Non potable	145 days	Jan 2012	May 2012
Sewerage Network including pumping stations	175 days	Jan 2012	Jun 2012
Water Treatment & sewerage Treatment Plant	280 days	Jan 2012	Nov 2012
Water Treatment Plant , ELSR,GLSR, PH,PSF,ACF, Chlorination O/H,External water supply source	280 days	Jan 2012	Nov 2012
Sewerage Treatment Plant & Solid waste Management	271 days	Jan 2012	Oct 2012
Electrical Work	60 days	Apr 2012	Jun 2012
Admin & Social amenities	301 days	Jan 2012	Nov 2012

Activity	Estimated Duration	Proposed Commencement	Proposed Finish
Boundary wall	145 days	Feb 2012	Jul 2012
Landscaping & Rain water harvesting etc	90 days	Apr 2012	Jul 2012
Vertical Development	321 days	Mar 2012	Feb 2013
On-site Infrastructure Development - Phase II	**307 days**	**Jan 2019**	**Mar 2020**
Site Grading, Road works including drain culvert & Bridges etc.	167 days	Jan 2019	Aug 2019
Site Grading	97 days	Jan 2019	May 2019
Road works including drain, culvert & Bridges	164 days	Jan 2019	Aug 2019
Package - Water supply & sewerage Network	202 days	Jan 2019	Oct 2019
Water Supply Network including Distribution Network - Potable & Non potable	112 days	Jan 2019	Jun 2019
Sewerage Network including pumping stations	202 days	Jan 2019	Oct 2019
Package - Water Treatment & sewerage Treatment Plant	277 days	Feb 2019	Mar 2020
Water Treatment Plant , Storage, Chlorination , External water supply sourcing	277 days	Feb 2019	Mar 2020
Sewerage Treatment Plant & Solid waste Management	277 days	Feb 2019	Mar 2020
Electrical Work	60 days	Jun 2019	Aug 2019
Landscaping & Rain water harvesting etc	90 days	Aug 2019	Dec 2019
Vertical Development	*321 days*	*Apr 2019*	*Jun 2020*

Exhibit 17 Proposed Infrastructure Development Phasing Schedule

1.6 FINANCIAL ANALYSIS

1.6.1 PRICING

Pricing is typically the variable that has maximum impact on the financial returns. The area around Kaliakoir is presently not very well developed so benchmarks from surrounding areas are generally not available for pricing. It has also been the experience in case of such large-scale infrastructure investments, that the development itself significantly influences the price trends of the entire surroundings.

The basis for pricing is essentially the prevailing rates for similar developments in and around Dhaka as well as discussions with industry players on willingness and ability to pay. The issue of pricing needs to be seen in the context of the demand analysis presented earlier. Thus the following issues would have an impact on pricing:

- ***Prices being paid by technology companies presently*** operating in and around Dhaka
- ***Willingness/ability to pay*** as indicated based on discussions with potential tenants
- ***Quality of infrastructure*** to be made available at the KHTP and the resultant clustering effects
- ***Commute time*** between Dhaka, the northern suburbs and the KHTP

As stated above, the development of the high speed rail link between Dhaka/Uttara/the Airport and the KHTP would dramatically impact the pricing scenario but the same has not been considered in this analysis.

Presently companies in the ICT sector operate from commercial areas within Dhaka such as Gulshan, Banani, Dhanmondi, Uttara. The smaller ones also operate from residential properties but these are not relevant for the KHTP analysis. Commercial rentals in various areas of Dhaka are given below.

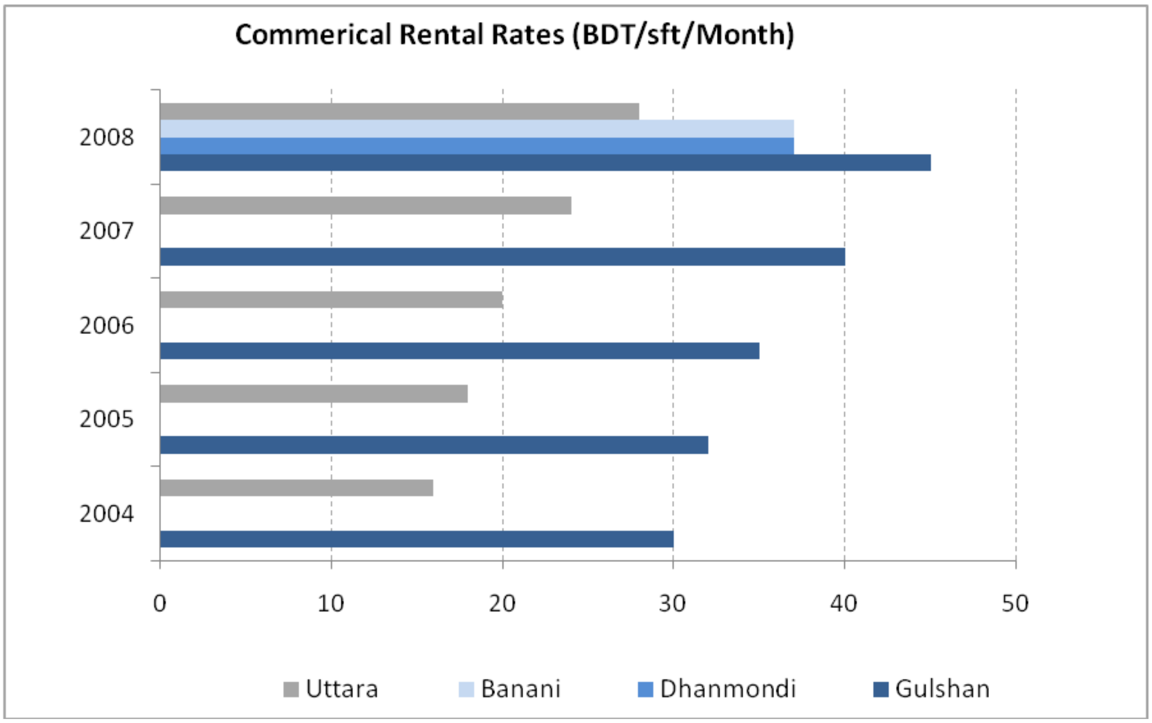

Exhibit 18 Commercial rental rates trend in various areas of the city

In the context of the KHTP development, ***the real estate scenario of Uttara is of considerable significance. As shown in Exhibit 2,*** Uttara is located south of the project, within an hour's commute, and is also the closest major residential/commercial area to the Park. It is also the biggest example of recent suburban development and is therefore an indicator of the pricing potential of KHTP.

Residential/commercial rates at Uttara are observed to be a function of the proximity to the airport. Sectors 3 and 4 which are closer to the airport have higher rates than the other sectors.

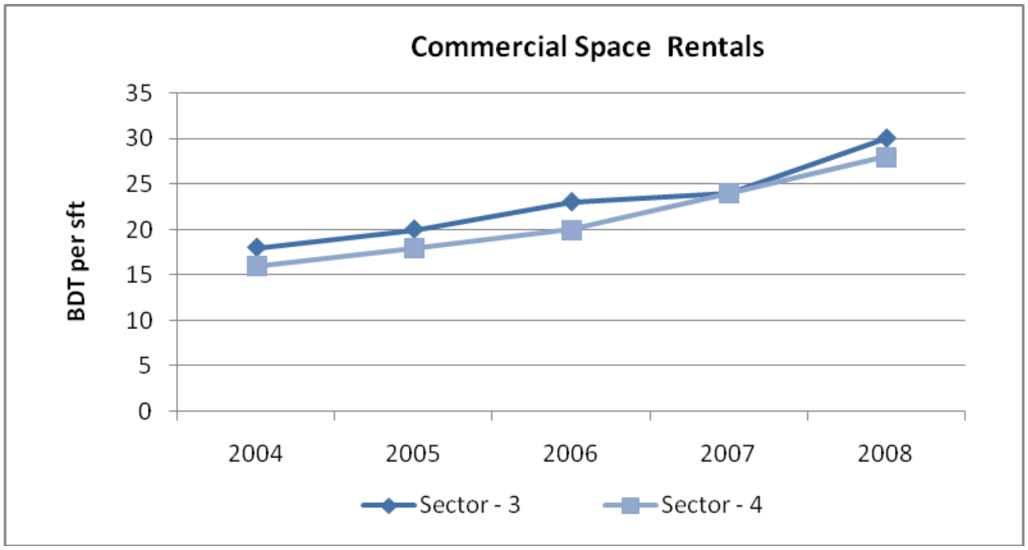

Exhibit 19 Rental Trends for Commercial Space in Uttara

1.6.2 PROJECTIONS FOR KALIAKOIR

In order to evaluate the relative positioning of Kaliakoir in relation to established hubs nearby, a comparison of Kaliakoir with Dhaka and Uttara was done. The results are summarized in the exhibit below.

Comparative Factors	Dhaka	Uttara	Kaliakoir
Connectivity	Excellent	Excellent	Moderate
Cost of living	High	Moderate	Low
Social Infrastructure	High quality	Good quality	Low quality
Commute time to the park for employees working in Kaliakoir	1 hr 30 min	45 mins -1 hr	10-15 min
Land prices per sft	USD 246	USD 116	USD 22
Commercial Rentals (sft/mth)	USD 0.65	0.44	USD 0.26 (est)
Space availability	Little or none	Adequate	Large land bank available

Exhibit 20 Comparative Location Analysis

Thus while the KHTP offers substantially lower costs, the main issue would be the commute time from Uttara and central Dhaka. However the ***commute times are within range of those prevailing in major technology hubs in the region*** such as Bangalore, Delhi etc. The cost advantage is expected to prompt more and more developments to move to the KHTP rather than operate in the costlier central suburbs as is presently the case.

1.6.2.1 PRICING ESTIMATE

Given the risk of the project, 3 scenarios have developed for pricing – base, pessimistic and optimistic – by changing assumptions on critical variables. The pricing scenarios for each component are discussed below:

1.6.2.1.1 COMMERCIAL - MTBS

It is felt that ***a 50% discount over the prices at Uttara would be a penetrative pricing level*** for the operations at KHTP. Thus a pricing level of USD 2.67 per square foot per year (PSFSPY) has been assumed in the base scenario. The assumptions in different scenarios are as follows:

- Base – 50% of price prevailing at Uttara
- Pessimistic – 40% of price prevailing at Uttara
- Optimistic – 60% of price prevailing at Uttara

1.6.2.1.2 RESIDENTIAL SPACE

It has been assumed that a ***10% premium over neighboring residential developments*** (notably the Shamsul Alamain development which is coming up in Kaliakoir) can be assumed given that these cater to middle-income groups and would not have the employment and social infrastructure benefits that would be available at the KHTP. Accordingly ***an average rate of about USD 24 per square feet for residential prices*** has been assumed. While this would technically be a long term lease collected upfront, it would be a sale for all practical purposes. This is further broken down depending on the category of development and the overall range is between USD 15 and USD 35 per square feet.

1.6.2.1.3 LAND

The total land area of components involving lease of land excluding roads, open areas, admin buildings and utilities would be close to 90 acres. The prevailing land rates in the region range from USD 22500 to 45000 per acre for undeveloped land. Given the strategic location of the KHTP, its road frontage and the prestige value of the project, it can be assumed that the land can be sold at the higher end of the range. ***The base case assumption is therefore USD 40,500 per acre***. In the pessimistic case, it has been assumed that it would be sold in the middle of the range (USD 33,500 per acre) and in the optimistic case, it has been assumed that it would be sold in the highest end of the range (USD 45,000 per acres).

In addition, a premium would need to be added for additional infrastructure that is being created on the land. On a discounted basis, this works out to about ***50% over the cost of undeveloped land***. After adding this premium, the lease rate has been worked out for each of the three cases taking a time period of 20 years and a discounting rate of 17.5% (which is an estimate of the developer's cost of equity). The lease rates per square metre accordingly work out to:

- Base – USD 2.74 per square metre
- Pessimistic – USD 2.28 per square metre
- Optimistic – USD 3.04 per square metre

1.6.2.1.4 PROJECTIONS

Projections for pricing have been estimated based on an actual statistical analysis of past prices at Uttara. ***Past 5 year trends were analyzed using variance analysis*** in which the lower 95% limit, the lower 75% limit and the CAGR were used respectively for the pessimistic, the base and the optimistic cases. They were further *converted into real dollar terms* for the purpose of analysis. Finally they were also "ramped up" to reflect the actual price build up observed in such developments and finally moderated. The results are presented below:

Commercial	Base	Pessimistic	Optimistic
Starting Rate	0.0%	0.00%	0.0%
Stabilized Rate	5.97%	3.71%	5.97%
Peak Rate	5.97%	3.71%	7.06%
Peak Achieved in (years)	10	10	10
Peak Period (years)	5	5	5

Exhibit 21 Growth rate assumptions for Commercial

Residential	Base	Pessimistic	Optimistic
Starting Rate	0%	0%	0%
Stabilized Rate	5.00%	5.00%	5.00%
Peak Rate	16.4%	5.04%	21.49%
Peak Achieved in (years)	10	10	10
Peak Period (years)	5	5	5

Exhibit 22 Growth rate assumptions for Residential

1.6.2.1.5 MAINTENANCE CHARGES

In addition ***maintenance charges have been assumed to be USD 126/acre/month***. This assumption is based on benchmarks of maintenance costs charged in prominent EPZs and SEZs operational in South Asia.

1.6.2.1.6 WATER AND SEWERAGE

Revenue from water supply and sewerage has been estimated at actual o***perating cost plus a 17.5% return on capital cost***.

1.6.3 GENERAL ASSUMPTIONS

The analysis is based in US Dollars and is in real terms. The ***project timeframe is assumed as 35 years*** with the starting year of construction being 2012 and the starting year of commercial operations being 2013. A residual value has also been calculated at the end of the period.

No tax break as been assumed for the project and a ***tax rate of 37.5% has been assumed***, based on prevailing norms. However a separate scenario has been developed for estimating the impact of tax breaks. Further ***lease tax has been factored in at 5%*** of the value of lease rentals.

The project has been assumed to be funded at a ***debt-equity ratio of 50:50.*** Other financing assumptions depend on the particular scenario under analysis. Broadly the following variations have been used:

- A pure market-based funding wherein the interest rate is 12% (in USD terms) and the term is 5 years with a moratorium of 1 year from commencement of construction
- The second funding option is the channeling of Donor funds to a private developer through the domestic financial system in an IPFF-like structure. The tenor assumed is 20 years with a 5 year

moratorium with market interest rates being applicable (although we understand the rates are actually a little below the market benchmarks, we have been conservative)

1.6.4 CAPITAL COST

Capital costs are based on the inputs from the detailed engineering study. The cost items are summarized below – this is further split into two phases which are projected to be operational in 2012 and 2019.

Cost Head	Cost (USD '000)
Road works including drain, culvert etc.	7,018
Sewerage network including STP	2,300
Electrical works including Transformer, street lighting	1,989
Buildings - Admin & Social amenities	2,199
Infrastructure for Sustainability covering green cover, water harvesting, energy saving and energy efficient devices, etc.	387
Boundary Wall	478
Land Development cost	5,670
MTBs	34,841
Total Cost	**54,882**

Exhibit 23 Capital costs for the project

1.6.5 OPERATING AND OTHER COSTS

The following recurring items of costs have been considered in the financial analysis

- Operating costs
- Repairs and Maintenance Costs
- Employee Costs

The first two items are based on percentage of capital costs as per the following assumptions:

Operations cost (yearly)	Basis	Proportion
Road works including drain, culvert etc	% of capital cost	2.00%
Sewerage network including STP	% of capital cost	4.00%
Electrical works including Transformer, street lighting	% of capital cost	2.00%
Buildings - Admin & Social amenities	% of capital cost	0.00%
Infrastructure for Sustainability covering green cover, water harvesting, energy saving and energy efficient devices, etc.	% of capital cost	2.00%

Exhibit 24 Operational cost assumptions

Repair & Maintenance cost (yearly)	Basis	Proportion
Road works including drain, culvert etc	% of capital cost	5.00%
Sewerage network including STP	% of capital cost	2.00%
Electrical works including Transformer, street lighting	% of capital cost	5.00%
Buildings - Admin & Social amenities	% of capital cost	5.00%
Infrastructure for Sustainability covering green cover, water harvesting, energy saving and energy efficient devices, etc.	% of capital cost	2.00%

Exhibit 25 Repair & Maintenance cost assumptions

The assumptions made with respect to employee costs are presented in the exhibit below.

Employee Level	Average Salary per Annum (USD/Employee)	Number of Staff Employed
Top management	27,800	3
Senior Management	20,800	2
Middle Management	13,000	5
Lower Level	3,900	6
Secretarial	2,100	5

Exhibit 26 Assumptions for employee expenses

In addition to capital and operating costs, we have also considered major maintenance costs for infrastructure like roads and asset replacement costs for utilities like electrical infrastructure, sewerage etc. The assumptions for these are as follows.

- For roads, the major maintenance in relaying is provided for every five years, with the ***cost of maintenance being 10%*** of the original capital cost
- The electrical infrastructure would need replacement every 20 years with an outflow of around 70% of the original capital cost.

1.6.6 BASE CASE RETURNS

Financial feasibility has first been examined for the Base Case assuming the following:

- Market-based financing
- IDA-enabled funding

The financial returns in each of the two funding options for the base case scenarios are presented in the table below.

Funding Option	Project IRR	Equity IRR	Avg DSCR
Market-based financing	20.0%	21.8%	0.3
IDA-enabled funding	20.5%	23.9%	3.8

Exhibit 27 Financial returns in base case scenario

From the above table it can be seen that while ***both options yield healthy financial returns***, the ***IDA-enabled funding is desirable from a debt servicing perspective***. The DSCR is at a comfortable level of 3.8 in this scenario whereas it is below acceptable levels with market funding. ***Clearly there is a role for donor agencies to play***, given this situation.

Further, in the table below we present the financial returns in the pessimistic and optimistic growth scenarios with the assumption that the IDA-enabled funding would be used for the development. The optimistic growth scenario would generate healthy returns with the equity IRR being 47.5%. The DSCR is also adequate. However, the ***pessimistic growth scenario generates sub-optimal returns*** with equity IRR of around 5.4%.

Industry Growth Scenario	Project IRR	Equity IRR	Avg DSCR
Optimistic	32.7%	47.5%	4.5
Pessimistic	6.6%	5.4%	0.6

Exhibit 28 Financial returns in optimistic & pessimistic scenarios

1.6.7 SENSITIVITY ANALYSIS

Sensitivity analysis was also undertaken to determine the impact of changes in capital costs, operating costs, the base case pricing levels and price growth, varying each factor by -20% to +20%. Here, the base case growth scenario has been used with IDA-enabled funding.

Below, we present the sensitivities of the returns to the capital cost and yearly operating costs. It can be seen that the ***returns are highly sensitive to the capital costs in Phase I***.

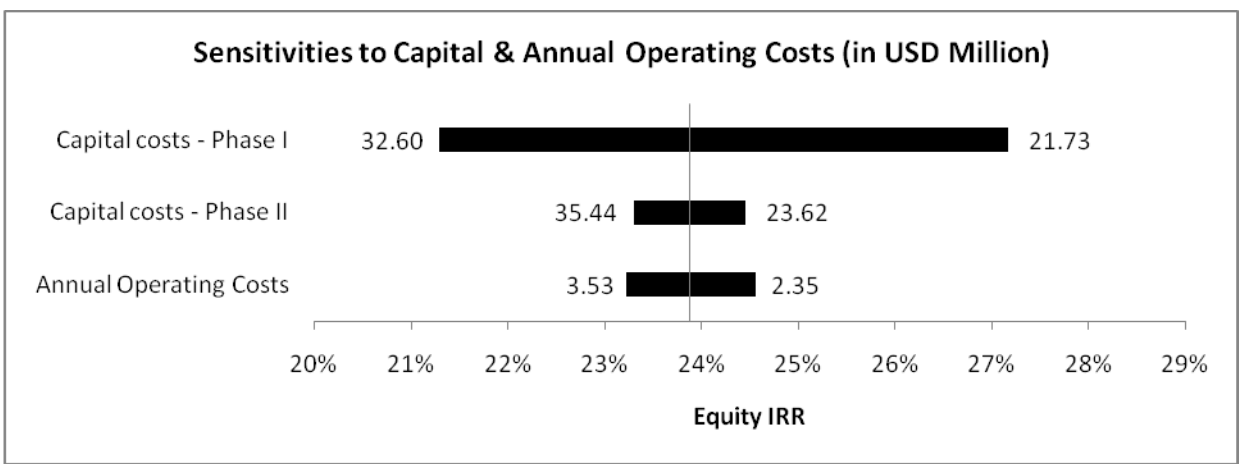

Exhibit 29 Sensitivities to Capital & Annual Operating Costs

Further, the sensitivities to the pricing levels and price growth were analyzed. The same are presented in the exhibit below.

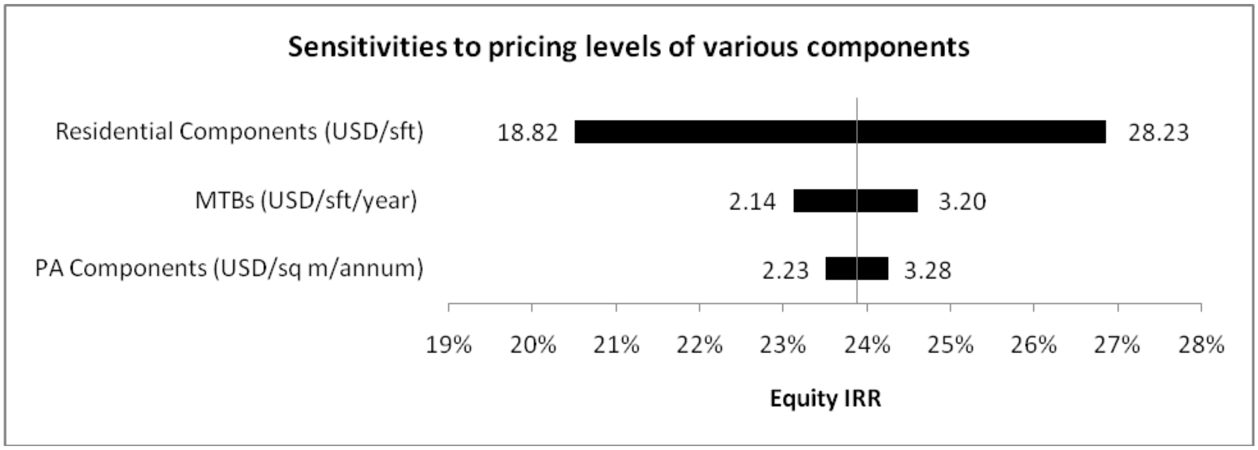

Exhibit 30 Sensitivities to pricing levels for various components

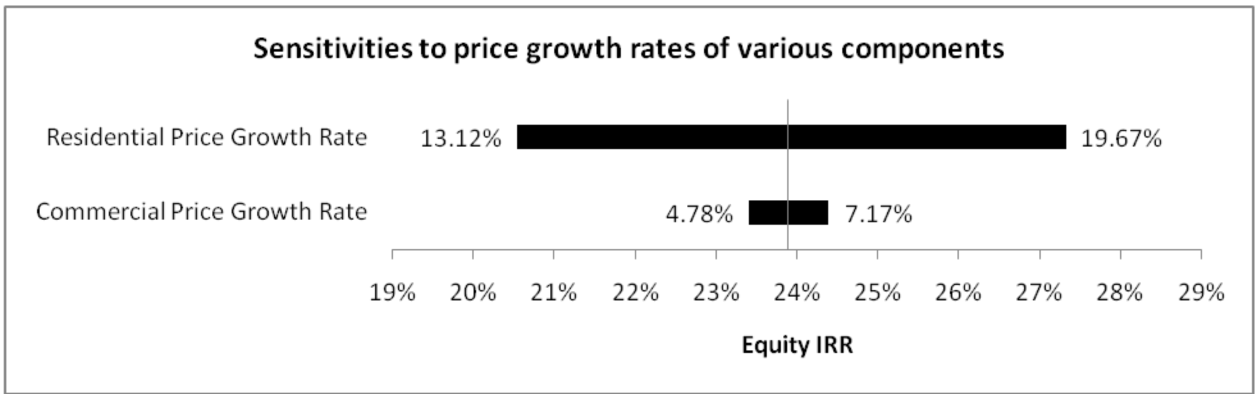

Exhibit 31 Sensitivities to pricing growth for various components

From the above exhibits it can be observed that the ***returns are highly sensitive to both the residential rates and residential pricing growth*** assumed.

1.6.8 BCC CASHFLOWS

The Hi Tech park development would involve the participation of BCC in development & financing of the project. BCC would hold a 26% share in the venture. Also, the private developer would be paying out yearly fixed lease payments for the entire area leased from BCC, depending on the hurdle rate for the return on the developer's equity.

In doing this analysis, the ***hurdle rate for equity IRR has been assumed to be 17.5%.*** That is to say, we have assumed that the lease rate based on a competitive tendering process would be set at a level that yields a 17.5% Equity IRR to the developer. This is based on our understanding of returns expectations (in real USD terms) of developers in the region.

In the table below, we present the lease rates that BCC is likely to realize from the private developer in the base case. This lease payment to BCC would cap the private developer returns to 17.5% as explained before. The lease rates have been assumed to increase by 5% annually. The lease rate plus the BCC's cash-flows as a 26% shareholder in the project were discounted and divided by the number of acres to estimate the value to BCC per acre of development. This is presented below:

Industry Growth Scenario	Base Lease rate (USD/Acre/Year)	Discounted Cashflows to BCC (USD/Acre)
Base Case	6,070	110,835

Exhibit 32 Lease payments to BCC for 17.5% return to private developer

BCC could realize around USD 110,835 per Acre in present value terms from the project in the base case scenario. While the realization in the optimistic scenario would be even higher, the same would be negative is the pessimistic scenario prevails.

1.6.9 IMPACT OF TAX EXEMPTIONS

After assessing the financial feasibility of the development in the three industry growth scenarios, we also analysed the impact of any tax breaks on the returns for the developer. The rates of tax exemption have been derived from the earlier draft of the EZ ordinance which grants a 10 year 100% tax holiday followed by 5 years of 50% tax payments.

The impact of these tax exemptions on the financial returns is presented in the exhibit below.

Industry Growth Scenario	Project IRR	Equity IRR	Avg DSCR
Base Case	22.9%	26.9%	4.5
Optimistic	41.6%	58.7%	5.7
Pessimistic	6.6%	5.4%	0.6

Exhibit 33 Impact of tax exemptions onto financial returns

It can be seen that the ***returns improve substantially*** with the tax exemptions available to the developer. In the base case the equity IRR increases from 24% to 27%. Similarly, in the optimistic case the equity IRR jumps to 59% from 48%. However, ***the pessimistic scenario is still unviable***.

1.6.10 KEY FINDINGS

From the financial feasibility analysis presented above, it can be inferred that the project is inherently feasible in the base case and optimistic case from the perspective of absolute financial returns in terms of project and equity IRR.

However, there would be *debt servicing concerns in the case the debt financing is availed from the domestic financial institutions*. This is reflected in the below par DSCR ratios as presented before. This is because of the fact that domestic financial institutions can arrange debt for a maximum tenure of 5 years (with one year moratorium). This limited tenure loan further results in a sort of temporal mismatch between the funding and subsequent commissioning of the asset and the corresponding revenue outflows from the asset.

This is the primary reason for the *improved debt service coverage in the scenarios where the funding mechanism has extended repayment tenure* of 15 years with 5 years moratorium. This 20 year debt tenure, although at market rates of 12%, significantly improves the DSCR to 3.8 from 0.3 and also positively impacts the equity IRR for the base case.

This extended tenure debt would need to be IDA supported and could be routed to the domestic financial system through a structure like the IPFF.

1.7 ECONOMIC ANLAYSIS

While financial returns from the project appear healthy, it is also important to look at the differential economic impact of the project.

International experience suggests that Economic Zones (EZs) are important economic drivers and can make significant contributions to local, regional and national economic development through job creation/retention and as regional gateways for generating value adding economic activities.

1.7.1 TYPES OF IMPACT

The following are the broad categories of economic impacts that need to be evaluated in the context of the KHTP:

- ***Employment Impacts***
  - Direct Employment Impacts
  - Indirect or Induced Employment Impacts
  - Spin-off Impacts
  - Wider Impacts
- ***Impacts on Economic Outputs***
  - Expenditure on the development of the Expansion itself;
  - Expenditure and staff employed by the EZ management; and
  - The expenditure and employment generated by tenant companies.

1.7.2 APPROACH TOWARDS ECONOMIC ANALYSIS

The ***economic analysis is founded on the concept of incremental Gross Value Added*** (GVA) which is in turn computed from norms of GVA per capita in the construction and technology industries (for the construction and operations stages respectively). This is multiplied with direct and induced employment in the construction and operations stages based on normative estimates of employment generation. These are moderated for additionality and displacement effects which take into account alternative employment means in a "no project situation" and the possibility of employment in companies outside the KHTP area. In sum, the incremental impact attributable to the KHTP development alone, was sought to be captured.

Incremental GVA as calculated above was discounted over the project life. Further incremental tax revenues from the project were calculated based on the Tax to GVA ratio. Only pessimistic estimates of GVA were considered since economic analysis is usually very subjective in nature. The results are presented below for the base, pessimistic and optimistic scenarios:

Item	Pessimistic	Base	Optimistic
Economic Output (GVA USD Mn)	20.2	117.1	578.1
Financial IRR	5%	24%	48%

Exhibit 34 Economic Returns and Impact

It can be seen from the above that there are ***significant economic returns from the project*** which further warrant intervention from the Government and donor agencies in implementing the project.

1.8 PROJECT STRUCTURING

Hi Tech park developments around the world often have a strong private sector accent although there are ***examples of government led development as well***. Given the expertise required to develop the project as well as the sensitivities surrounding land issues, it is important to analyze relevant issues to help identify a suitable structure for implementation of the project.

The following are the key elements in PPP Structuring that were identified:

- Government participation
    - 100% Government
    - 100% Private through PPP
    - Joint Venture between public and private sectors
- Choice of Implementing agency
- Role of Donor Agencies
    - IDA funding to Government agencies
    - Funding to private sector through market intermediaries or through agencies like the IFC
    - No direct lending
- Unbundled versus Bundled Structure
    - Bundling of EPC, O&M and Marketing contracts
    - Unbundling of above activities
- Component PPPs
    - Master developer for entire projects
    - Separate developers for discrete project components
- Selection of developer
    - Lease rental
    - Revenue Share
    - Equity premium in project SPV(in which shares are initially held by implementing agency)
- Mechanism of transfer of land
    - "Made available" to developer
    - Lease
    - Sale
- Duration of Concession

1.8.1 CONSIDERATIONS IN DEVELOPING A PPP STRUCTURE

The key considerations that went into designing the elements of the PPP structure in the context of the KHTP are as follows:

- Ease of Project Completion
- Government Capacity – Financial and technical
- Investor Interest and Risk
- Tax Implications
- Lender's Perspective
- Development Objectives
- Legal Issues

The final evaluation of the elements based on the above considerations is presented below:

	Options	Ease of Project Completion	Government Capacity	Investor Interest/ Risk	Tax Implications	Lender's Perspective	Development Objectives	Legal Issues	Final Evaluation
Government Shareholding	• 100% Government • JV • 100% private • Carving out separate projects	100% Government project would be easier to implement it would be faster, especially in prevalent market conditions. Also a minimum stake of 10-26% would be preferable from the government's point of view given sensitivities of the project	The Government agencies have almost no experience in projects of this kind – in addition it would impose a fairly large financial burden on the government. However the former can be mitigated by going for a combination of EPC, O&M and marketing contracts	Investor interest is uncertain in present market conditions. Also they would prefer at least a minimum of 51% if they do decide to participate	Transfer of land from BCC to private party/SPV may attract stamp duty	Lender's are positive about the project especially if led by Donor agencies but are more hesitant in case it is headed by Government agencies	PSDSP is predicated on private participation so a PPP structure would be better	Issue of sub-lease to a private developer (who would then have to further sub-lease it) would need to be investigated	PPP route would be the way to go except that present market conditions may make it difficult. Even if project is implemented through PPP, Government should hold a minimum stake
Who should be the implementing agency?	BCC or any other agency designated by MoSICT should be the implementing agency. No need for a new agency or any new regulation is anticipated, pending enactment of EZ act. Also, new SPV should be created to set up the project whether or not a PPP structure is envisaged								
What should be the implementati on route	Broadly the following routes are available – Development under the Private EPZ Act, Development under the proposed EZ Act or development through the PICOM route. The experiment with the Private EPZ Act has not been very successful judging from the Korean EPZ experience and the EZ Act is also unlikely to be passed too soon. Neither provides for tax breaks for developers. Therefore it is felt that the PICOM route would be the best option for the project.								
What would	• Direct IDA	While donor	Donor	Investor's	None	Lenders	Project is in	None	Funding

	Options	Ease of Project Completion	Government Capacity	Investor Interest/ Risk	Tax Implications	Lender's Perspective	Development Objectives	Legal Issues	Final Evaluation
be the role of donor agencies?	Lending • Participation through market in IPFF like structure • No Participation	funds would help mitigate project cash-flow constraints, they are not otherwise critical for the project	funding would certainly help meet the government's share of project investments	would face severe cash-flow mismatch unless loans supported by Donors are available		have said they would definitely get extra comfort from Donor financing	consonance with development objectives and the PSDSP program		support, preferably through IDA mechanism is critical for setting up the project
Component PPPs	• Component PPPs • Whole Project to 1 investor	Separate transactions could delay the process	Component PPPs would put the burden of core infrastructure on the Government thereby increasing capital commitments	Investors would typically prefer the entire project to smaller components. Especially less attractive components may not find takers	None	Lenders have expressed greater comfort with smaller component PPPs	A full-fledged PPP would be in greater consonance with PSDSP objectives as compared to component PPPs which would be of smaller total value	Component PPPs would not involve sub-leasing of land	In case a PPP structure is decided upon, it would be better to give it out as 1 project than individual components
How to select private party?	• Lease Rentals • Equity premium • Revenue Share	Revenue share is difficult to calculate and past experience suggests that this could lead to implementation delays	Government would need to have higher monitoring mechanism levels in case of revenue share	Would prefer revenue share as it reduces demand risk	None	Would prefer revenue share as it reduces risk	None	None	Lease rentals is suggested since it is less complicated to implement

	Options	Ease of Project Completion	Government Capacity	Investor Interest/ Risk	Tax Implications	Lender's Perspective	Development Objectives	Legal Issues	Final Evaluation
How should land be transferred?	• Only "made available" • Lease • Sale	Lenders would want some charge over the land so at least a long term lease would be required. A sale is not recommended as a time-bound contract is envisaged with the private developer							
What should be the concession period?	5 to 99 years	None	None	Investors would want a long enough period to ensure adequate return on capital with allowance for demand build up	None	Would generally prefer longer term contract and ensure that it is at least longer than the debt tenor	Very long contracts may reduce bargaining power of implementing agency	None	A 35 year lease is suggested keeping in mind the land off-take projections and debt tenor of 20 years

Exhibit 35 Analysis of PPP Options

1.8.2 EVALUATION OF OPTIONS

Development of the Kaliakoir Hi-Tech Park basically involves the following components, as per the concept master plan for the zone in Basic Planning and Design study:

- IT space and hi tech manufacturing area development
- Social Infrastructure development
- University and school

It is generally recommended that the development of the ***university and school be led by the government*** with the help of Donor funding and the land allocated for those facilities not be considered in the land to be developed through the PPP route.

1.8.2.1 OPTION 1 – GOVERNMENT LED

Under this option, BCC/MoSICT will be the executing agency with funding from GoB and WB. Exhibit 168 shows the unbundled transaction structure. The elements involved in this option are:

- *Ownership:* BCC/MoSICT will be the 100% owner and solely responsible for the development of the project.
- *Implementation*: Although BCC/MoSICT will be the 100% owner of the park, they are expected to involve private parties for construction, operations & management and marketing. But the overall responsibility will still be on BCC/MoSICT.
- *Land transfer*: The issue of land transfer will not be a concern in this case as the land will be continued to be owned by BCC.
- *Transaction Structure*: BCC/MoSICT will be in-charge of construction and operation inside the park and pay the various contractors directly. Payment to the EPC contractor will be a huge upfront expenditure on BCC/MoSICT's part.
- *Source of Finance*: Direct funding from GoB, WB and loans from other banks.
- *Selection Process*: Separate selection process for all three components will have to be executed by BCC/MoSICT.
- *Taxation:* All private sector parties entering into contract with BCC/MoSICT will be subjected to taxation. Stamp duty will not be an issue as no land transfer takes place.

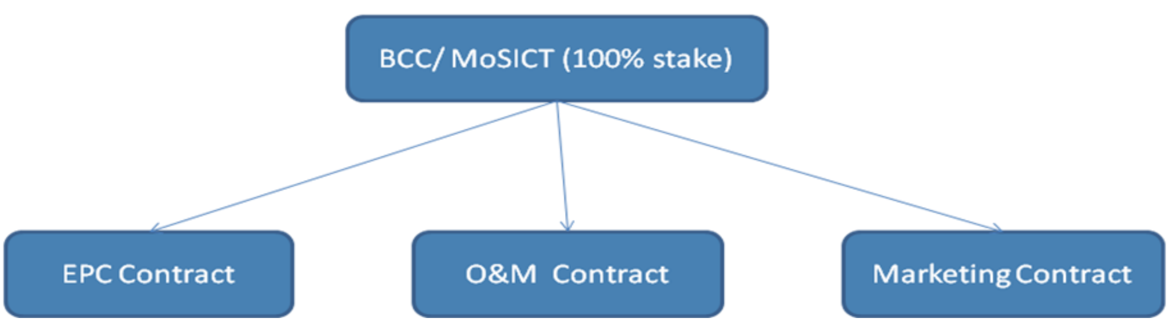

Exhibit 36 Unbundled Structure for Option 1A

1.8.2.2 OPTIONS 2 – PPP STRUCTURE

Under this option, it is recommended that the KHTP be developed through the PPP route involving approval from PICOM. The procedures for this option are clearly set out in the Private Sector Investment Guidelines (PSIG) of Bangladesh. ***The same process is being followed in other sectors, for example in the power sector***. Exhibit 170 gives a schematic of the PPP arrangement under this option.

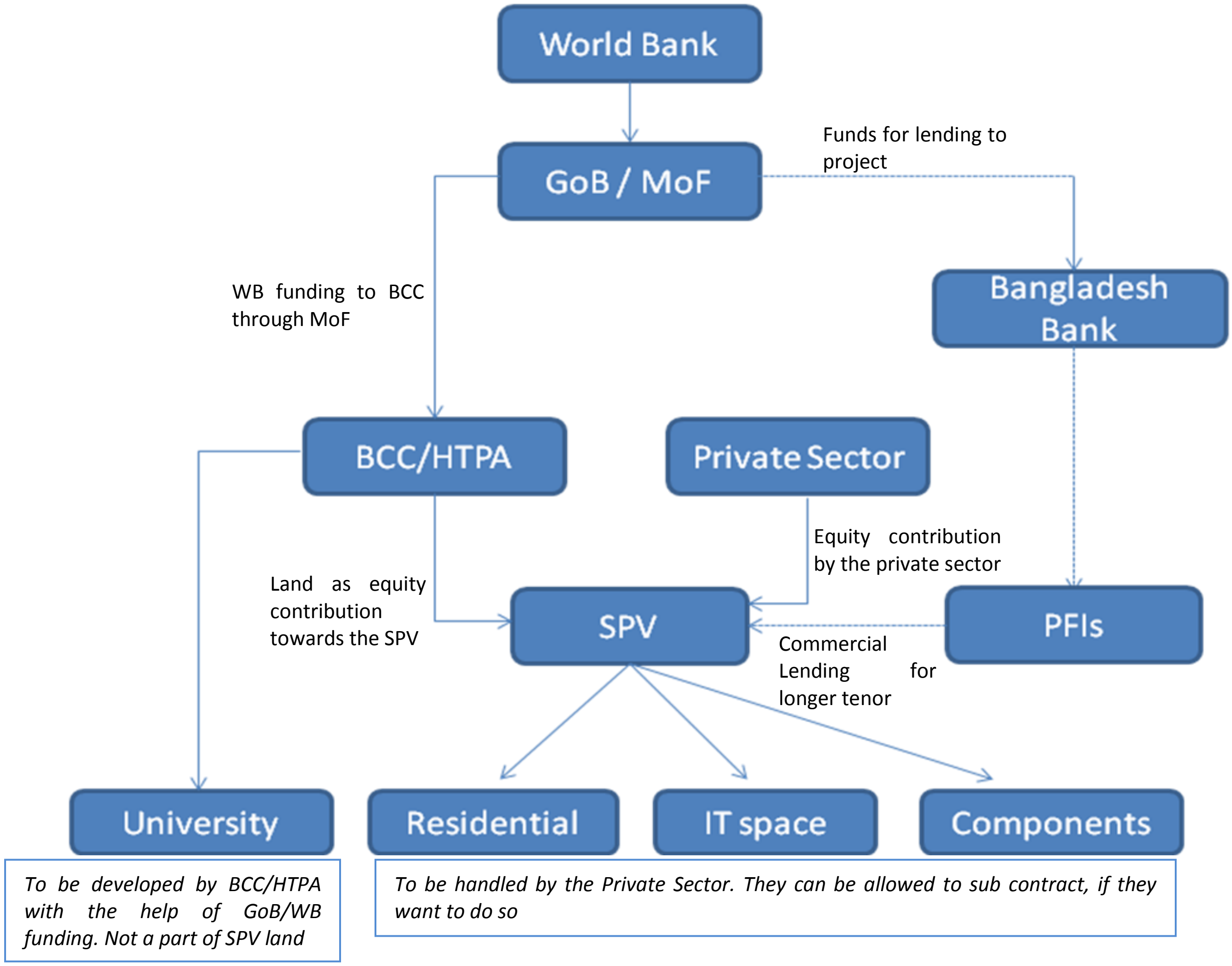

Exhibit 37 PPP Structure following PSIG Process

The following are the key features of this structure:

- It is recommended that ***74% stake in the SPV be given to the private sector***, while BCC hold the balance 26%.
- The participating agency from the government's side can be either BCC or any other agency of the MoSICT. Forming a new authority and formulating its mandate may involve a long time since it would require a new legislation. Therefore, it is ***recommended to develop the project through BCC*** which is already allowed to form companies for the promotion of the IT sector.
- Land will have to be transferred to the SPV by BCC on a long term lease. The concession agreement that would be signed between BCC and the private sector will have to include a clause allowing the SPV to sub-lease the land to the individual units.

- A ***tenure of 35 years*** is recommended as a period suitable for both the government as well as the private sector
- Financing of the project will be carried out in the following ways:
    - BCC contribution to equity in form of land
    - Donor agencies/GoB funding, in case additional equity is required from BCC's side
    - Donor agencies to channel funding to the project through market participants to mitigate tenor constraints in the local debt market
    - Financing from International Finance Corporation (IFC), which is the private sector funding arm of the World Bank and can also advance longer tenor loans at market rates
- The users of the Hi-Tech Park would be the IT companies engaged in software development and other IT/ITES services as well as hardware companies. As per the current benefits provided to the IT sector in the country, the exporters have been provided a tax holiday till 2013. Thus similar incentives to those which prevail in the EPZs and are proposed in the EZs will be available to users.
- ***A fixed land lease rate method*** has been deemed to be the simplest method to evaluate and monitor, and so is recommended as the financial criterion for the bid selection process. Bidding should be undertaken following PSIG specifications, a variation of the two stage-two envelope process.

1.8.2.3 OPTION 3 – GOVERNMENT LED UPFRONT DEVELOPMENT FOLLOWED BY TRANSITION TO A PRIVATE DEVELOPER

Under this option, BCC/MoSICT will be the executing agency responsible for the upfront development of infrastructure and utilities for the Park. This would be with funding from GoB and WB and would be in line with the final master plan. Subsequent to this upfront development, BCC/MoSICT would bring in a private developer for operating and maintaining the Park. The private developer would also be responsible for constructing and leasing the MTB space and other social infrastructure and amenities as required. The University would be developed by the BCC/MOSICT.

Following are the key features of this option:

- Initially BCC/MoSICT will be 100% owner and solely responsible for the upfront development of the Park. Subsequent to the upfront development, the area would be leased to a private developer who would be operating and maintaining the Park as well as building & leasing the MTB space and other social infrastructure and amenities. However, BCC/MoSICT would continue to own the Universities/schools setup within the Park.
- After upfront development, the developed area will have to be transferred to the private developer SPV by BCC on a long term lease.
- Payment to the EPC contractors for the various infrastructure/utilities would be a huge upfront expenditure on BCC/MoSICT's part. However, this would be recovered by leasing the developed area to the private party and collecting yearly leases for the full area from the private party.
- Tenure of 35 years is recommended as a period suitable for both the government as well as the private sector.

- For the proposed upfront development, BCC/MoSICT could obtain direct funding from GoB & WB and loans from local banks. The private developer SPV could be funded from the following sources
    - Equity contribution by the private sector
    - Financing from the local PFIs
    - Financing from IFC
    - Channeling of funds from World Bank through an IPFF like structure
- The current policy in the country does not provide any tax incentives to the developer as such. Therefore, in this case too, the developer will not get any tax incentives. However, it is strongly recommended that in order to compete with the countries in the nearby region, tax incentives be made applicable to the developer as well.
- The users of the Hi-Tech Park would be the IT companies engaged in software development and other IT/ITES services. As per the current benefits provided to the IT sector in the country, the exporters have been provided a tax holiday till 2013. Thus similar incentives as prevail in the EPZs and proposed in the EZs will be available to users.

The project structure is outlined below and the following sub-sections discuss the pros and cons of the options in terms of its impact on project aspects.

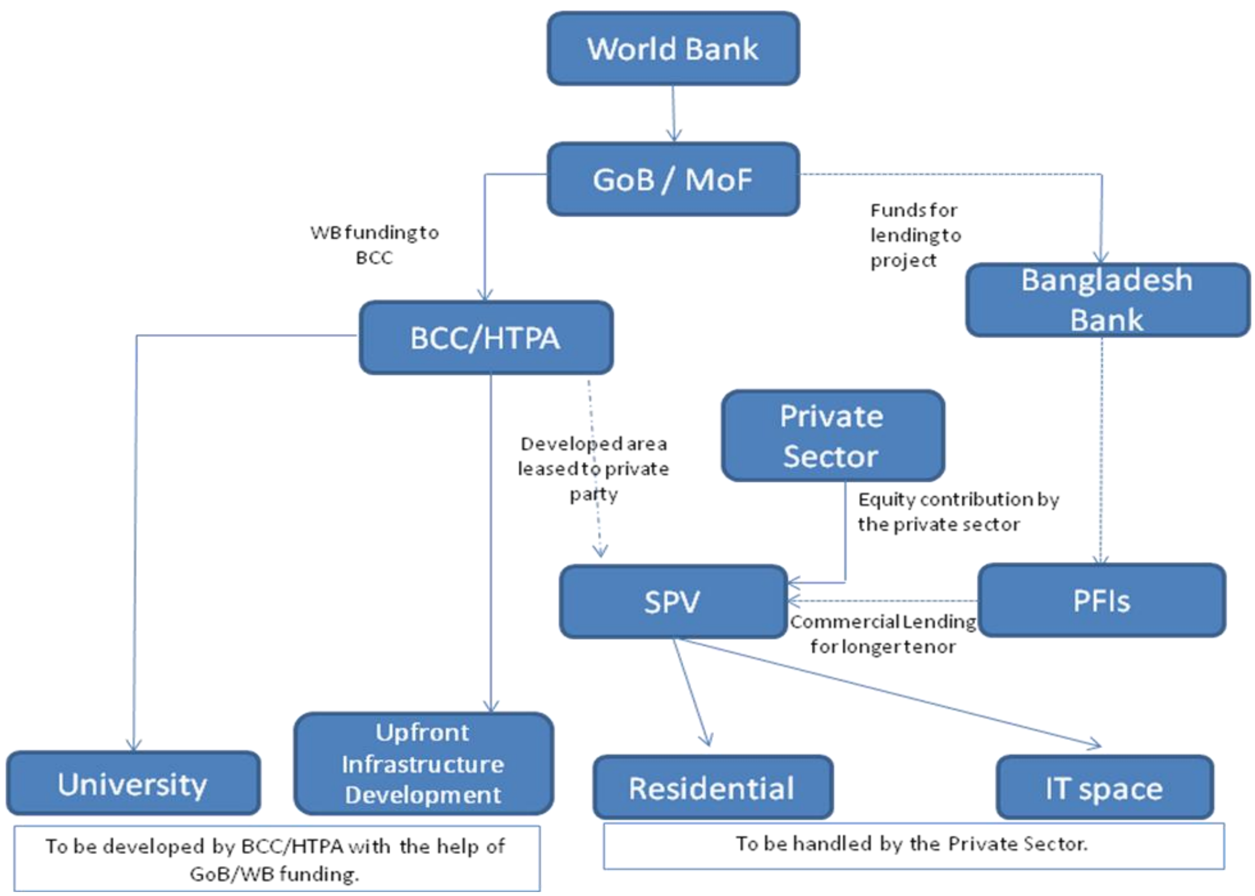

Exhibit 38 PPP Structure for Option 3

1.8.2.4 COMPARISON OF OPTIONS

The following exhibit gives a comparison of all the options discussed above.

Project Aspects	Option 1 (BCC Led)	Option 2 (PPP through PICOM)	Option 3 (PPP with BCC led upfront development)
Ease of Implementation	Neutral. Various transaction are required which may delay the process and complicate the structure but maybe the only option in the short term	Neutral – PPP development would be more efficient but investor interest maybe lukewarm in the short term (1-2 years)	Neutral – Initial government investment would provide great comfort to investors but government capacity may be strained initially
Government Capacity	Negative – Government would be stretched on both the financial and technical fronts	***POSITIVE – PRIVATE CAPITAL AND EXPERTISE WOULD BE VERY VALUABLE FOR THIS PROJECT.***	Neutral – Although private capital and expertise would be involved, some upfront development from BCC would be needed
Development Objective	Negative – Would not achieve private sector development objective – also government less development would be less efficient	***POSITIVE – PRIVATE PARTICIPATION AND EXPERTISE WOULD BE IN CONSONANCE WITH DEVELOPMENT OBJECTIVES.***	Neutral – Although private participation would be there, initial risk would be taken by the Government.
Investor Interest	Neutral – Investors may prefer an EPC/ O&M arrangement at this point in time but may want to look at development option in the medium term	Negative – Interest would be low at this point and lack of tax incentives would not help matters	***POSITIVE – OWING TO THE COMMITMENT SHOWN BY THE UPFRONT DEVELOPMENT BY THE GOVERNMENT, INVESTORS INTEREST WOULD SUBSTANTIALLY INCREASE***

Project Aspects	Option 1 (BCC Led)	Option 2 (PPP through PICOM)	Option 3 (PPP with BCC led upfront development)
Financial/Tax	***POSITIVE - TAX WOULD NOT BE MATERIAL SINCE ONLY GOVERNMENT AGENCIES WOULD PARTICIPTAE. TAX ON EPC/O&M CONTRACTS WOULD BE LESS THAN IN CASE OF A FULL-FLEDGED PRIVATE DEVELOPMENT OPTION. NO STAMP DUTY DUE TO ABSENCE OF LAND TRANSFER***	Negative - No benefits to developer. Can be improved by providing the same to the developer through PSIG. Stamp duty will be an issue	Negative – same as option 2
Lenders Perspective	Neutral – under the structure, bank lending is not envisaged	***POSITIVE – DOMESTIC LENDERS SEEM QUITE KEEN ON THE PROJECT ESPECIALLY IF WORLD BANK SUPPORT EXISTS AND GOOD PRIVATE PARTIES COME FORWARD TO INVEST***	***VERY POSITIVE – UPFRONT GOVERNMENT INVESTMENT WOULD PROVIDE EVEN GREATER LENDER COMFORT***
Legal Issues	***POSITIVE – NO LAND TRANSFER IS ENVISAGED AND PROCESS OF GETTING APPROVALS AND CLEARANCES WOULD BE SIMPLER***	Negative - Land transfer issue will be involved. Also, sub-leasing to tenants by the developer may be an issue	Negative – Same as Option 2
Donor Agencies Role/Objective	Negative - But one of the main objectives of PSDSP program i.e. involvement of the private sector, will not met. Also Government led process will be less efficient.	***POSITIVE – PRIVATE PARTICIPATION AND KNOW-HOW WOULD BE USEFUL IN MEETING PSDSP OBJECTIVES***	***POSITIVE – SAME AS OPTION 2***

Exhibit 39 Comparison of options for Project Structuring

An analysis of the issues suggests that the ***PPP route with a 26% government shareholding is the best possible option for the project***. However, the major issues with this structure are:

- The difficult ***economic circumstances***, especially in the real estate and IT sectors which may not be conducive for a PPP transaction at the present moment.
- ***Lack of tax breaks and stamp duty implications*** compare poorly against incentives available in neighboring countries, which also have a tested market as far as Hi tech Parks are concerned.

However we understand that the PICOM route provides for discretionary tax breaks for under-developed sectors.

Irrespective of the above, the project is still expected to evince adequate interest from Developers if marketed properly although the challenges in the business environment need to be recognized.

Keeping in mind the urgency of development at the site and the fundamental attractiveness of the project, it is advisable to attempt to develop the KHTP through option 2, failing which Options 3 and Option 1 may be considered as back-ups.

1.9 INSTITUTIONAL ARRANGEMENTS

The complex structure of the KHTP poses quite a few institutional questions that need to be addressed, whether or not the project is implemented through the PPP route. It would be worthwhile to begin with the need for institutional intervention in an EZ context. Drawings from the Terms of Reference, these can be summarized as follows:

- Implementation
- Investment
- Facilitation/Approvals and Clearances
- Regulation
- Operations and Management

1.9.1 INSTITUTIONAL OPTIONS

Fundamental to the institutional arrangements is the question of the implementation route. The following broad options have been discussed:

- The ***Private EPZ Route***
- The ***EZ Route***
- ***New legislation*** specific to the IT sector
- ***Existing PPP route*** but external to EZ/EPZ sector

The implications of each have been analyzed below:

- The ***Private EPZ route may not strictly apply*** since this would be a project with some government shareholding (i.e. e between 26 and 100%) as per the recommendations for project structuring above. Also the ***experiment with the Korean EPZ has seen substantial delays*** and cannot therefore be considered an appropriate implementation mechanism for this project. Also, crucial tax breaks for developers are not available under the scheme.
- The EZ route had considerable backing from the interim administration as well as the benefit of substantial time having been spent on thinking through the issues involved. However the pace has lost momentum since the new administration is grappling with a slew of new legislations which has inevitably caused the ***EZ legislation to get delayed. Also, the tax breaks that had been proposed earlier are believed to have been removed*** from the final version of the ordinance.
- A new legislation is being considered by the MoSCIT to create a "Hi Tech Park Authority" (HTPA) which would regulate and operate all industrial parks in the Hi Tech sectors. While this may obtain tax breaks for developers that are not presently available under any other regime, the

process of creating and enacting a new law, and setting up of a new organization would take a long time. While the merits of a separate HTA are beyond the Consultants' locus, the process would certainly take time which would have implications for the speed of development – for example, the ***EZ legislations is still awaiting final approval, 2 years after work on it first started***. It is therefore not recommended that the KHTP be held up until the formation of the Authority – means to incorporate the park within the HTA's purview, if and when the HTA becomes a reality may be specifically considered while constituting the Authority.

- Pending the passage of the EZ act, the possibility of using an existing PPP route was explored and it was found that the country has a fairly well thought out structure for evaluating and implementing PPP projects, namely the Private Infrastructure Committee (PICOM) route under which PPP projects from a wide range of infrastructure sectors can be implemented. This has been used primarily by the power sector but the guidelines specifically provide for industrial parks as well. It also allows for tax breaks to be granted on case-to-case basis for under-developed sectors.

While the ***PICOM route appears to be the simplest mechanism for implementing the project, if done on a PPP basis,*** the MOSCIT could go ahead with the usual ***DPP/ECNEC approval process in case it decides to implement the project on its own***. In this context, it is worth pondering about whether the PICOM route can substitute all of the special incentives and provisions provided for in the EZ route. The key issues in this context are as follows:

- Tax incentives for tenants
- Tax incentives for developers
- Approvals and clearances for tenants
- Approvals and clearances for developer

The issues are analyzed in the following table:

Issue	PICOM Route (PPP Structure)	ECNEC Route (100% Govt)	EZ Route
Tax Incentives for tenants	Would continue to be available as per benefits available to IT Companies and other exports (for hardware manufacturers) until 2013	Same as PICOM route	Benefits available to tenants – both exporters and domestic manufacturers – under EZ route
Tax Incentives for developers	Possible on a case to case basis for under-developed sectors	Not relevant since Government is the developer	Not available in current form of ordinance
Approvals for tenants	Would be obtained as per existing process which would not be affected in anyway	Same as for PICOM route	EZ route proposes a specific mechanism for clearance of approvals

Issue	PICOM Route (PPP Structure)	ECNEC Route (100% Govt)	EZ Route
Approvals for developers	Approval would come through the PICOM process which lays down a specific procedure for the same. MOSCIT could also play a facilitator's role in enabling the same	The process would be similar to that followed for any public sector project which would require preparation of a DPP and ECNEC clearance	The EZ act lays down the processes by which private developers may obtain approvals for setting up zones.

Exhibit 40 Analysis of Incentives Under Different Development Routes

Since the IT sector as well as Hardware manufacturers are anyway granted tax benefits under various provisions of existing legislations, ***not going through the EZ/Private EPZ route would not make any material difference to tenants***.

As far as developers are concerned, they presently do not get any tax breaks, even under the proposed EZ Act and therefore going through the ***PICOM route would not place them at any disadvantage***. Further, the PICOM route provides for case to case tax exemptions for PPP projects in under-developed sectors.

For approvals and clearances, tenants can continue to use the existing processes for setting up their units. These can be strengthened by the developing entity – whether public or private – which can facilitate the process of obtaining/renewing approvals.

There would be ***considerable technical demands on the MOSCIT/BCC*** in implementing the project. The following specific recommendations are made in this context:

- ***Creation of an SPV*** for implementation of the project – Irrespective of the route chosen, it is recommended that a separate SPV be created for development of the Park. The government's shareholding in this SPV can be routed through the BCC itself.
- Creation of a ***Project Monitoring Unit (PMU)*** within the BCC for implementation of the KHTP whether through the public or private sector routes.
- ***Appointment of a implementation support consultant*** to hand-hold BCC through the proposed transactions i.e. e:
    - Appointment of a Master Developer in case the PPP route is adopted
    - Appointment of EPC, Marketing and O&M Contractors in case the public sector route is adopted

1.9.1.1 PROJECT MONITORING UNIT (PMU)

As noted above, it is suggested that a PMU be created within BCC, with the help of an Implementation Support Consultant, to look into all aspects related to project related works, whether or not implemented through PPP. This would require some initial hand-holding to look into the following aspects:

- Supporting capacity building and re-organisation of the implementing agency to enable PPP transactions. There should be clarity on the indicators used to track progress made by the agency as well as the senior and middle level officers within the agency. A system to track should also be in place. This should include the following:

- A comprehensive Training and Development Plan
- A well laid out Recruitment and Compensation Strategy
- Process for creation of a Project Management Unit (PMU) within the implementing agency
- A broad level organization structure of PMU within the organizational context
- Operationalization of the PMU

- Support the implementing agency in operationalising the agenda for Public-private partnerships in the context of the various legislations governing EZs, EPZs and PPPs. This should result in establishment of a sound system for bringing about PPPs.
- Map the regulatory scenario for PPP development, especially interface with other department and implications of different EZ legislations such as BEPZA Act, Private EPZ Act, EZ Ordinance etc. The consultant would be responsible for documenting the details of the implementing mechanism, all clearances and approvals and suggest appropriate investment routes such as EZs/EPZs under different scenarios. Further the consultant needs to broadly review the key issues in the overall EZ/EPZ legislative scenario and make suitable recommendations to strengthen and streamline the overall EZ development process.
- Investor promotion including building a shelf of feasible projects (including component PPPs) for potential investment.
- Building capacity for escorting and facilitating clearances to investors. A system with clear responsibility for facilitating investment clearances should be implemented. A system for tracking of time taken for investment clearances will need to be put in place that also allows linkages with the GoB effort to track nation-wide investments into the sector.
- Development of model contract documents such as Request for Qualification, Request for Proposal, Concession Agreements.
- A Process Manual detailing the steps for initiation and management of PPP transactions for each identified category of projects.

1.9.1.2 ROLE OF PMU REGARDING TRANSACTIONS

The PMU, if required with the help of the Implementation Support Consultant, would manage the process of selecting the master developer or the EPC/O&M contractors as the case may be. This would involve the following:

1.9.1.2.1 PRE TRANSACTION STAGE

The PMU would be responsible for identifying an appropriate structure for the project. This would include the following activities:

- Review the existing feasibility reports and other relevant project information, and making suitable adjustments to reflect any subsequent events/changes
- Identify prospective investors and engage them in a dialogue to gauge their interest and obtain inputs on preferred project structure, key decision points, areas of concern etc.
- With the help of a Legal Consultant, review regulatory and legal issues
- Identify key areas of support from the Government including list of clearances and chart out a realistic timetable for the same

- Review and fine tune the proposed project structure based on the consultations with key stakeholders such as private developers, relevant government agencies, lenders and other financial investors
- Chalk out an appropriate transaction structure based on the identified constraints and the qualification/evaluation criteria, timeframes, documentation etc.
- Identify key project risks and prepare a mitigation plan to be incorporated into the project structure and project documents
- Prepare a Project Information Memorandum (PIM) capturing the highlights of the project, key information and relevant decision drivers
- Co-ordinating with a legal consultant to prepare key project documents which should include documents such as:
    - Request for Qualification
    - Request for Proposal
    - Concession Agreement
    - Lease Agreement
    - Shareholders Agreement
    - Government Support Agreement

1.9.1.2.2 TRANSACTION STAGE

In this stage, the PMU would be responsible management of the actual transaction process including:

- Drafting advertisements that will be issued in appropriate domestic and international media for inviting Expressions of Interest from private partners
- Facilitating the Marketing of the project to prospective investors which would include:
    - Providing inputs to a PR agency for preparation of relevant marketing material including CDs, brochures, information packs, AV material etc.
    - Conducting investor road shows and meets at select domestic and international venues
    - Interfacing with investors over telephone, electronic mail etc.
- Short-listing respondents expressing interest on the identified criteria and facilitating issue of project documents to short-listed investors
- Conducting a pre-bid meeting inviting short-listed investors to obtain inputs on project documents, transaction process etc.
- Issuing final project documents to investors based on discussions in the pre-bid meeting
- Prepare a spreadsheet based evaluation tool for evaluating the investors' proposal to obtain the scores as per the predetermined evaluation criteria
- Coordinating with a technical consultant to assess the technical merits of the proposals received from investors
- Preparing a bid evaluation report summarizing the ranking of the proposals received

1.9.1.2.3 POST TRANSACTION STAGE

This stage would commence after the technical and financial proposals have been evaluated and a preferred bidder has been identified. The activities during this stage would include:

- Identifying the key issues in the negotiations process and preparing an overall negotiation strategy including an "issues and positions" paper that would lay out suggested responses to key decision points.
- Preparing a financial model for evaluating the impact of alternative outcomes
- Working with the legal consultant in revision of project documents to reflect the changes post negotiations

- Coordinating with the legal consultant to assist the Implementing Agency in negotiating the project agreements with the preferred bidder.

1.10 CONCLUSIONS AND RECOMMENDATIONS

- Global Economy
    - The demand prospects for the KHTP appear good despite the ongoing economic crisis. However there may be short term negative impacts on account of the downturn in the crucial IT and Real Estate sectors.
- Bangladesh Hi tech Industry
    - Based on an assessment of the Hi-tech industries in Bangladesh it is recommended that the initial focus be on IT, ITeS and Hardware sectors.
    - The software services sector in Bangladesh employed about 25,000 people in 2007. The sector has been witnessing rapid growth over the last two years.
    - In terms of number of firms, small companies (less than 50 employees) are in the majority but the majority of employees work for larger companies. It is expected that only the larger companies would be potential tenants for the KHTP.
- Investor Interest
    - While investment into the Bangladesh Hi tech sector remains a challenging proposition for international firms, firms from the sub-continent indicated prima facie interest. Concerns included availability of manpower, lack of a well-developed domestic market and administrative issues like visa processing.
- Demand Projections
    - Based on experience of smaller growth centers in the region, as well as the experience of countries with similar socio-political characteristics such as Pakistan, a growth rate of 20% in the base case has been assumed.
    - However this is moderated to account for the impact of the downturn in the first few years. A total of three scenarios were developed with the pessimistic and optimistic scenarios built around growth rates of 15% and 25% respectively.
    - Demand for space from the Hi tech sector was “allocated” to the KHTP by assessing its competitiveness with respect to competing destinations.
    - At present there are no facilities comparable to the proposed KHTP in Bangladesh. The KHTP would be able to offer substantially better infrastructure at much lower prices but would involve longer commutes from city centre.
    - Based on the experience in urban areas in the sub-continent, it is expected that longer commutes to save real estate cost would become acceptable in Dhaka as well.
    - Considering the pricing advantage as well as the nature of firms in the Bangladesh Hi tech sector, it is estimated that 33% of incremental demand for space in Dhaka can be attracted by the KHTP. This is expected to go up to 50% over 5 years.
- Master-planning

- Of the 263 acres, after elimination of space for roads, open areas and utilities, about 163 acres are available for development. Using an FSI of 2, this translates to about 14 Mn Sq ft of space.
- After deducting social infrastructure components, about 10.67 Mn Sq ft of space would be required of which 60% would be commercial space for use by Hi tech sectors and balance for residential purposes.

- ESMP
  - No major irreversible impacts are expected from the project. Being largely focused on the service sector, levels on environmental are low compared to other industrial zones.
  - Institutional arrangements proposed include a supervision consultant for monitoring the project and an environment and social cell.
- Detailed Engineering
  - The major changes from the preliminary master plan include provision of pocket gates for pedestrian access and realignment of infrastructure phasing.
  - The total cost of the project (excluding MTBs) was estimated at USD 21.81 Mn. In the basic planning stage, the estimate was USD 22.54 Mn
- Pricing
  - Pricing has been based on a 50% discount over rates prevailing at Uttara for commercial buildings. This translates to a lease rate of USD 2.67 per square foot per annum in the base case
  - For residential development, a 10% premium has been assumed over residential developments in the area (which are mostly middle income in nature). This yields an average of USD 24 per sq ft as the sale price.
  - For serviced land, prevailing land prices have been taken with a mark-up of 50% to account for development expenses. This translates to a lease rate of USD 2.74 per acre per annum in the base case.
  - Price growth is based on statistical analysis of real estate in Uttara in the past 5 years and the lower 75% limit for commercial and residential prices have been taken for the base case. The real dollar growth rates implied by this are 5.97% and 16.4% respectively for commercial and residential respectively. However, to be on the conservative side a gradually ramped up growth scenario has been assumed.
- Financial Returns
  - Returns have been calculated over a 35 year period. The debt to equity ratio has been assumed at 50:50 and no tax breaks have been considered.
  - Returns are very healthy in the base case at over 20% project IRR but the DSCR is below acceptable limits on account of tenor limitations in the Bangladesh financial markets. However, if a donor enabled funding tenor of 20 years, with a moratorium of 5 years is assumed, the debt servicing constraints are mitigated.
  - The equity returns are unacceptable at 5% in the pessimistic case, which is a combination of pessimistic assumptions on several variables. However while returns are

sensitive to variables such as pricing, price growth capital cost etc., the project returns are resilient to negative variation of each variable, acting individually, by up to 20%.

  - BCC stands to gain substantially from the project in the base case by virtue of lease rentals as well as its equity share in the project (which would be a minimum of 26%). The discounted value of cash-flows to BCC in the base case would be about USD 118,000 per acre.
  - Tax breaks would make a very significant difference to project returns which would increase by 24% to 27% (equity IRR). However the pessimistic scenario would continue to have unacceptable returns even with tax breaks.
  - An economic analysis of the project reveals that there are substantial economic gains from the development of the project in terms of employment as well as Gross Value Added.

- Project structuring and Institutional Development
  - Considering the various factors involved in the structuring decision, it would be appropriate to develop the KHTP as a joint venture with 26% stake held by the BCC (or any other entity of the BCC).
  - Notwithstanding present challenges in the knowledge and construction sectors, given the fundamental attractiveness of the project and the urgency of development, an attempt should be made to develop the KHTP through PPP as suggested under Option 2. Government led development can be considered as a fall back option in case there in inadequate private sector interest.
  - It is suggested that the PPP transaction, if found suitable, be routed through the PICOM. For various reasons the EZ route and the Private EPZ route have been found unsuitable. While the Hi tech park authority is being formed in parallel, it can be provided the necessary flexibility to absorb the KHTP as and when it is formed.
  - Whether implemented through the PICOM route or directly by the BCC through the ECNEC route, it is suggested that adequate capacity be built in the BCC by creating a Project Monitoring Unit with the help of an Implementation Support Consultant.

2 BACKGROUND & COVERAGE

The Bangladesh economy has been growing at a steady rate of around 5-6%. However, given the prevalent scenario in terms of poverty, Bangladesh needs to significantly increase growth rates to 7-8% to have a significant and sustained impact on the poverty rates. In order to achieve the target growth rates, Bangladesh needs to develop a competitive private sector that could help in strengthening the trade relations of the country with the global market.

Export Processing Zones (EPZs) have been set up in the country to promote exports and these have been relatively successful especially in sectors such as textiles. This is largely attributable to availability of serviced land, infrastructure quality, logistics and connectivity. In addition there is also an authority controlling the sector in the form of BEPZA (Bangladesh Export Processing Zones Authority).

However the overall impact on EPZs has been limited in terms of cumulative impact. The spillover effects into the local economy are also felt to be limited. Further the EPZs have been developed solely by the Public Sector, whose resource limitations constrain further growth.

In order to tackle some of the above issues and based on a request from the Government of Bangladesh, the World Bank and the Department for International Development, U.K. (DfID) have set up a new investment operation called the Private Sector Development Support Project (PSDSP), to support the development of a few pilot projects incorporating the new Economic Zones (EZ) model. Accordingly, the following EZs have been identified for further assessment:

Location	Area (Acre)	Proposed Industries/Companies
Comilla	475*	Garments, Textiles, etc
Meghna	637	Multiproduct
Narsinghdi	500	Multiproduct
Kaliakoir	262	Knowledge-based industries

**Including approx. 50 acres land for Airstrip*

Exhibit 41 Proposed EPZ Identified for Development

The PwC – led consortium has been appointed as consultants (the consultants) for carrying out the feasibility studies for the above mentioned EZs. The team was mobilized on 8th June, 2008 and has since been making continuous progress towards completion of the assignment. The following were the key milestones during project execution:

- 18th June,2008 - Inception Presentation
- 2nd July, 2008- Inception Report Submission
- 26th August - Interim Findings Presentation of Phase 1
- 15th September - Interim Report Phase 1 Submission
- 4th December,2008 - Discussion Presentation on Phase 1Pre-feasibility Report findings
- 16th January,2009 - Pre-feasibility Report of Phase 1
- 28th January, 2009 - Stakeholder Meeting with BEPZA
- April, 2009 – Draft Final Report Submission
- May, 2009 – Draft Final Report Presentation
- June, 2009 – Discussion with World Bank Mission and other stakeholders

2.1 COVERAGE OF REPORT

This report is the final deliverable for assessment of Kaliakoir, one of the four zones mentioned in the Exhibit 1 above. The feasibility draws upon earlier deliverables including:

- The Inception Report outlining the methodology for the feasibility study
- The Interim Report covering Market and Demand Assessment
- The Pre-feasibility Report covering Master-planning, Infrastructure Planning and Financial Analysis
- Comments received on various deliverables, notable comments on the Interim Report received on 22nd November and comments on the Pre-feasibility Report received on 2nd March, 2009.
- Discussions with the World Bank and other stakeholders in May-June, 2009

2.1.1 ADDITIONAL AREAS COVERED

Apart from the analysis and findings presented in earlier reports, the following key aspects have been looked at in the present deliverable:

- Specific comments received on earlier reports
- Refinement of assumptions underlying technical and financial analysis through stakeholder consultations
- Environmental and Social Management Plan
- Economic Analysis
- PPP Structuring and Options

2.2 LAYOUT OF THE REPORT

The layout of the report is as follows:

- Chapter (3) provides an introduction to the site and industrial land in Bangladesh
- Chapter (4) details the scope of work and the analytical approach
- Chapter (5) summarizes the findings of the market and demand assessment study
- Chapter (6) provides details of the engineering and technical aspects of the study
- Chapter (6.1) presents the findings of the financial analysis
- Chapter (8) covers economic analysis
- Chapter (9) highlights PPP structuring options for development of the project
- Chapter (0) presents the key conclusions

3 INTRODUCTION TO KALIAKOIR HI TECH PARK (KHTP)

Kaliakoir Hi Tech Park (KHTP) is a long pending proposal of the Government of Bangladesh to set up an industrial zone catering to Hi-tech industries in Bangladesh. The KHTP sits is located the district of Gazipur, about 40 km north of Dhaka City. The measuring 262 acres as per the survey carried out by the Consultants, has been fully acquired and a boundary wall has been erected around the site. The location of KHTP within Bangladesh has been shown below:

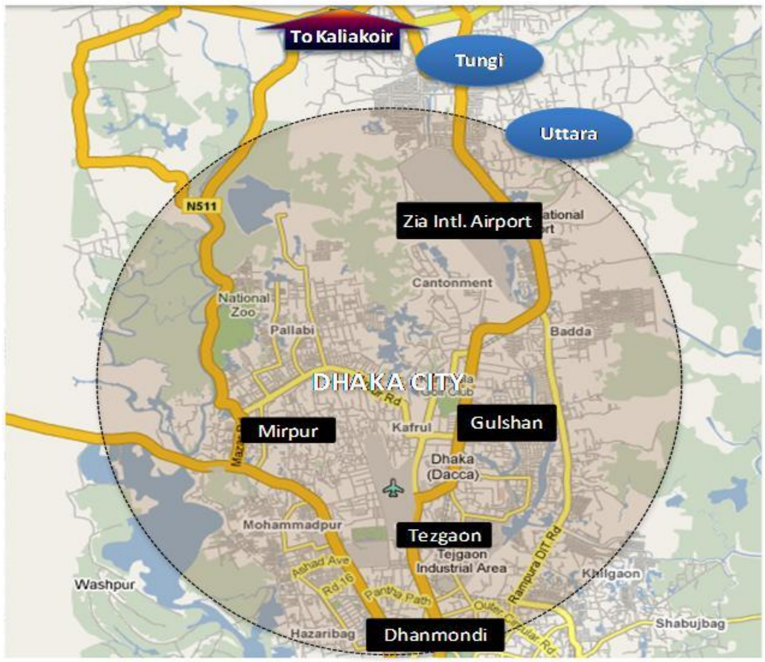

Exhibit 42 Kaliakoir Location Map

3.1 CONNECTIVITY

The site is located north of Dhaka off the Dhaka Tangail highway, further widening of which may be required when the KHTP is fully operational. The commute time to Dhaka is about one and a half hours by road.

The site of the KHTP is directly connective by a railway line to Dhaka. It has been earlier suggested that this be used to establish a high speed link to Dhaka and the Airport to enable an easy commute employees residing in the city. However this would be a separate project and may involve substantial capital outlays.

Kaliakoir Hi-Tech Park site is located about 25 km from Dhaka's international airport, which is the country's largest airport with good connectivity to destinations within Bangladesh as well as international destinations in South Asia, South East Asia, the Middle East and Western Europe.

Although a port is not critical given the nature of activities envisaged in the KHTP, it is located 350 km from Chittagong port, the country's largest port, which is approximately 5 hours by road.

3.2 PROGRESS TO DATE

The idea of setting up a Hi-Tech Park in Kaliakoir actually originated in as early as 2001 when Bangladesh University of Engineering and Technology (BUET) was given the responsibility to carry out the feasibility study for the project. Bangladesh Computer Council (BCC) was given the responsibility to look after the project and make initiatives to develop the project further. BUET prepared a report, based on which, the 1st phase of the project got underway. The 1st phase of the project included setting up an administrative building, widening of the access road, data transfer connectivity of the park and other basic infrastructure facilities.

The project is being implemented by the Bangladesh Computer Council, an agency of the Ministry of Science and Information Technology (MoSICT). A preliminary capital expenditure plan including boundary wall, some internal roads and administrative buildings have been approved and are in various stages of progress. The total expenditure on these investments is projected to be USD 2.7 Mn.

With the announcement of the PSDSP program, it was felt that it would be useful to include the KHTP under the larger EZ program.

4 SCOPE OF WORK AND APPROACH

4.1 SCOPE OF WORK

The consultant's scope of work covers feasibility studies of four EZs in Bangladesh. The activities under each feasibility study are as follows:

- **Business Plans**
  - Market Assessment & Industry Analysis
  - Assessment of Land Acquisition issues
  - Economic & Financial Analysis
  - Recommended PPP Options
  - Proposed Institutional Arrangement
- **Engineering & Designs**
  - Basic Planning Study
  - Preliminary Design Study
  - Final Design
  - Preparation of Tender documents
- **Environmental and Social Assessment and Management Plans**
  - Environmental & Social Impact Assessment
  - Environmental & Social Sector Framework
  - Environmental Management Plan
  - Resettlement Action Plan
- **Investment, Management & Oversight Framework (IMOF)**
  - Investment Guidelines
  - Management Guidelines
  - Oversight Guidelines

4.2 APPROACH

While our approach to each of the scope elements is further described in appropriate sections of the report, a brief summary of the same is provided below:

4.2.1 MARKET AND DEMAND ANALYSIS

As detailed out in the Terms of Reference, the objectives of the market assessment & industry analysis study are:

- Assess attractiveness of proposed EZs to potential investors vis-à-vis other sites both in Bangladesh and in "competitor" countries
- Analyze the expected demand for potential tenants to be located in the EZs
- Site-specific industry analysis for each identified industry segment

4.2.2 DEMAND ASSESSMENT FOR INDUSTRIAL LAND

The overall approach to be followed for the demand assessment study is presented in the exhibit below:

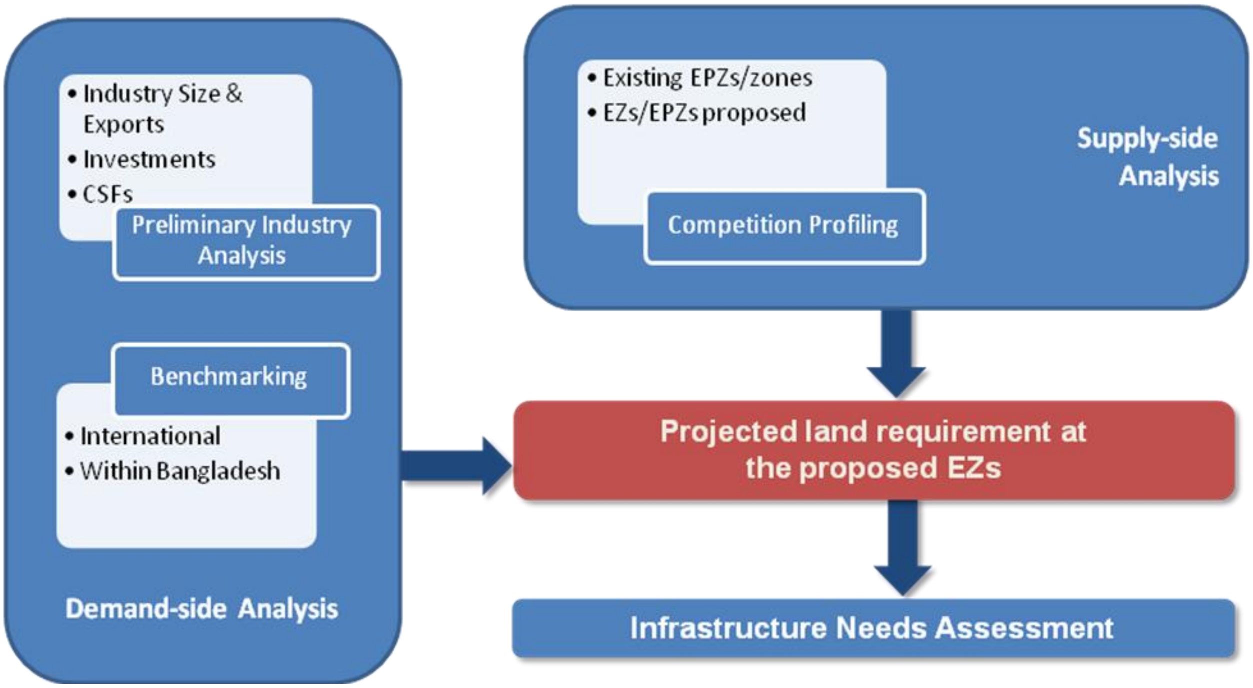

Exhibit 43 Demand Assessment Overall Approach

As illustrated, the approach includes an assessment of the relevant industry from the point of view of industry size, exports, investments and the "critical success factors" (or CSFs). Further it involves benchmarking the industry in Bangladesh with appropriate benchmarks which are worthy of emulation or are competitors.

This leads to a demand side analysis which results in the projection of investments in and exports from, Bangladesh for the industry under study. This in turn leads to a demand for industrial land using standard norms for land intensity of the industry.

The demand for land is analyzed in the context of the available supply of land – both existing and projected – and the competitiveness of the KHTP with respect to its key competitors within the country. Based on this, a "share" of demand is estimated for the KHTP which is then translated into a "land off-take" projection.

The investment demand is also used to estimate the infrastructure requirements and phasing which would be the basis for the master planning and detailed engineering of the proposed KHTP.

4.2.3 SUPPORT INFRASTRUCTURE AND PRICING

The demand assessment is supported by a pricing analysis covering the industrial, residential and commercial segments, to the extent relevant, for the site. The residential and other social components are estimated based on the requirements of the industrial component and the existing infrastructure within and around the site.

For each component, a suitable pricing band has been evolved based on discussions with stakeholders, competitive pressures and appropriate benchmarks.

4.2.4 ENGINEERING AND DESIGN

Engineering and Master Planning would be done in 4 phases as illustrated in Exhibit 7 below:

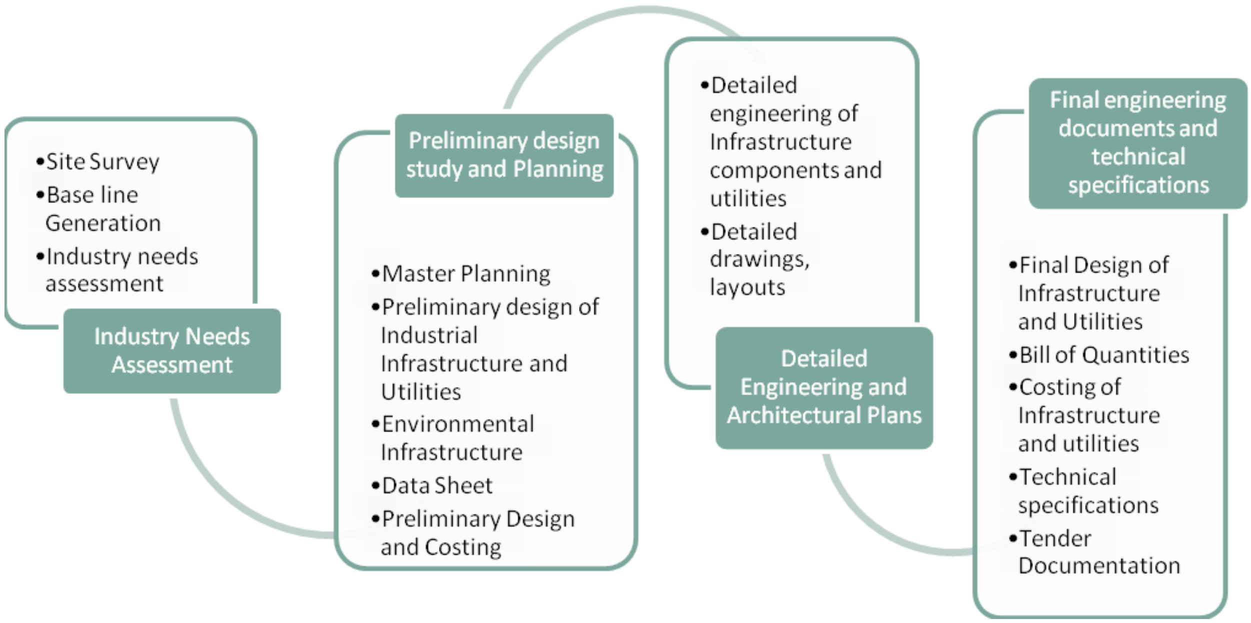

Exhibit 44 Engineering and Design Methodology

4.2.4.1 PHASE I: INDUSTRY NEEDS ASSESSMENT

This involves a full assessment of the existing infrastructure facilities, infrastructure gap assessment from operations, management and regulation from an engineering perspective based on which the infrastructure for the KHTP would be planned.

4.2.4.2 PHASE II: PRELIMINARY DESIGN STUDY AND PLANNING STUDY

Phase 2 involves review and validation of the work already conducted by the project sponsors and complementary planning surveys, if necessary, to determine the site profiles of the zones. Based on consultations with Government and stakeholders, this leads to the development of a Master Plan.

The basic planning study involves general planning considerations for the proposed project including geological, hydrological, and environmental issues, soil investigation, traffic flows, power and water requirements and other relevant topics which may constrain a standard industrial estate plan and provide the basis for the preliminary and final design.

The preliminary design is based on intimate consultation with, and finalized based on, the approval of project sponsors and other major stakeholders of the proposed projects, as determined in the context of the Business Plan activities. The preliminary design study shall comprise the following components

- Evaluation of optimal estates layouts and respective blocking out design including proposals for sitting of estate facilities base on comparison of design alternatives
- Determination of design criteria for all physical on-site and off-site infrastructure components;

- Preliminary design of all on-site and off-site infrastructure components necessary to support the operations of industrial parks; and
- The preliminary design shall incorporate the result and recommendation of the environmental and social impact assessment studies

The preliminary design study provides the layout of the KHTP in terms of ancillary infrastructure and shared facilities, environmental infrastructure for treatment of effluents and waste, access and service, roads, power, water/sewerage and connectivity, both on site and off site.

Technical parameters of site environmental infrastructure (separation and treatment of industrial effluents and sewage, storm water and drainage, solid / hazardous waste disposal, environmental quality monitoring and lab analysis) operational requirements etc is also included.

4.2.4.3 PHASE III: DETAILED ENGINEERING AND ARCHITECTURAL PLANS

After completing the preliminary designing and planning, detailed engineering designs and other architectural plans for each of the infrastructural components proposed are prepared. These designs form critical inputs for the subsequent tendering stage and consist of the following:

- Detailed plans for
  - Ground Improvements
  - Earthworks & Site Grading
  - Compound Wall & Fencing
- Designs & plans for the following ***Connectivity Infrastructure*** components
  - Transport Planning
  - Road-works
  - Footpaths & Pedestrian Walkways
  - Culverts
- Detailed designs for the following ***Infrastructural components***
  - Drainages
  - Water supply, treatment & distribution system
  - Sewerage/Sullage collection & treatment system
  - Power supply & distribution system
  - Solid waste management
  - Rain water harvesting
  - Greenery
  - Signage
  - Telecommunications
  - Amenities building

4.2.4.4 PHASE IV: FINAL ENGINEERING DOCUMENTS AND TECHNICAL SPECIFICATIONS

The final design is built on the planning and design studies to propose the overall architecture, in compliance with recommendations from the Environmental and Social Study. For the engineering and design component, this phase includes:

- Final detail design and engineering of all infrastructure components
- Cost Estimates on the basis of unit cost analysis and Bill of Quantities
- Final geological, hydrological and soils engineering investigations reports
- Schedule of Project Implementation consistent with phase development of industrial parks
- Recommendations for contract management and site supervision including Terms of Reference

4.2.5 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLANS

The Environmental and Social Impact Assessment (ESIA) study is an integral part of the overall feasibility and ensures that the proposed developments do not have any negative effects on the adjacent areas and that the concerns of the communities and main stakeholders are properly addressed. Exhibit 8 below details out the ESA framework proposed.

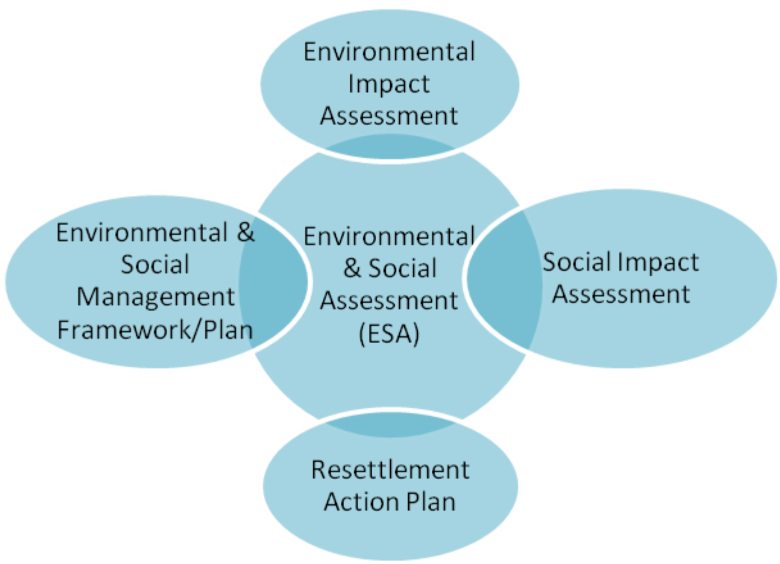

Exhibit 45 Environmental & Social Assessment Framework

4.2.5.1 ENVIRONMENTAL IMPACT ASSESSMENT

The scope for the Environment Impact Assessment is as follows:

- A general description of the proposed sub project and existing physical, environmental, biological and socio-economic conditions
- Consultation with public/stakeholders involving concerned people in identifying the environmental issues
- Identification and assessment of the potential impacts associated with road improvement activities within the study area on the natural and human environment

- Identification of the means of mitigating negative impacts and development of an Environmental Management Plan (EMP) including mitigation measures for negative impacts, measures for pollution control and environmental monitoring

For the EIA study, the methodology is as follows:

- Kick-Off meeting with RSRP team
- Collection and review of documents relevant to RSRP
- Site reconnaissance, field visit to site and neighborhood areas
- Interaction with Design Consultants
- Stakeholder Consultations
- Environmental Data Collection and Analysis
- Detailed Legislative Review
- Deskwork of identification, prediction and evaluation of significant/potential impacts
- Formulation of Environmental Management and Monitoring Plan

4.2.6 SOCIAL IMPACT ASSESSMENT

Social impact assessment covers the following aspects of the ESIA:

- Identifying the various stakeholders, and enumerate the Project Affected Families
- Identifying and assessing the likely social impacts of the project through a socioeconomic survey of the affected families
- Assist the project proponents in developing and documenting the Public Consultation, the entitlement package and the Resettlement Action Plan (RAP), Institutional and financial arrangements for implementation of the above plans

The overall activities of the SIA study include the following:

- Review of Project Design and Secondary Literature
- Visit to the Project Area
- Conduct Socioeconomic Survey (Household Interviews, Focus Group Discussion, In Depth Interviews)
- Impact Analysis
- Principles in Social Impact Assessment/Mitigation

THE ENVIRONMENT AND SOCIAL IMPACT ASSESSMENT (ESIA) REPORT FOR KHTP WAS SUBMITTED AS PART OF THE INTERIM REPORT.

4.2.7 ENVIRONMENT & SOCIAL MANAGEMENT FRAMEWORK (ESMF)

The ESMF, a part of the overall ESA, highlights the following:

- Establish methodologies for environmental and social impact assessment procedure within the PSDSP sub-project cycle

- Assess the potential environmental and social impacts of the PSDSP Subproject, whether positive or negative, and propose mitigation measures which will effectively address these impacts
- Communicate to the stakeholders the potential impact of different anticipated sub projects, and relevant mitigation measures and strategies
- Serve as a tool for project implementers at the PSDSP site to identify and mitigate potential environmental and social impacts during all stages of the subproject cycle thereby avoiding long term negative impacts
- Identify potential environmental policies, legal and institutional framework pertaining PSDSP
- Highlight National EIA guideline and procedures

THE DRAFT ESMF HAD BEEN SUBMITTED ALONG WITH THE PRE-FEASIBILITY REPORT. THE FINAL VERSION OF THE ESMF IS BEING SUBMITTED ALONG WITH THIS REPORT.

4.2.7.1 ENVIRONMENT & SOCIAL MANAGEMENT PLAN

The ESMP describes how the mitigation and other measures to enhance the benefits of environmental protection will be implemented. It explains how the measures will be managed, who will implement them, and when and where they will be implemented. The following elements are described in the ESMP:

- Potential environmental and social impacts resulting from project activities
- Proposed mitigation measures
- institutional responsibilities for implementation of the mitigation measures
- Monitoring indicators
- Institutional responsibilities for monitoring the implementation of the mitigation measures which includes monitoring of environmental impacts by local communities
- Cost estimates for these activities
- Time horizons for implementation of the ESMP

A SEPARATE REPORT ON ESMP IS BEING SUBMITTED ALONG WITH THIS REPORT.

4.2.8 FINANCIAL ANALYSIS

After estimating the likely area off-take, the infrastructure required, engineering inputs and inputs from the environmental and social assessment, the financial feasibility study has been carried out. This feasibility study provides further inputs to the project structuring exercise.

Estimation of demand and revenue potential forms a critical part of Financial Analysis of an EZ project. Demand and revenue have the following key determinants:

- Saleable land / built up area after accounting for infrastructure to be made available
- Absorption rate of the land or the number of years for the saleable land to get completely absorbed

- Pricing of rentals and leases to be charged to investors. This would obviously have an impact on the absorption rate. We will seek to assess a band which optimizes net returns

The starting point for the financial analysis would be the estimation of the saleable land, which would in turn depend on infrastructure requirements (based on inputs from the Industry Analysis module) and the area this would take up. The process for arriving at saleable land is illustrated in Exhibit 9 below.

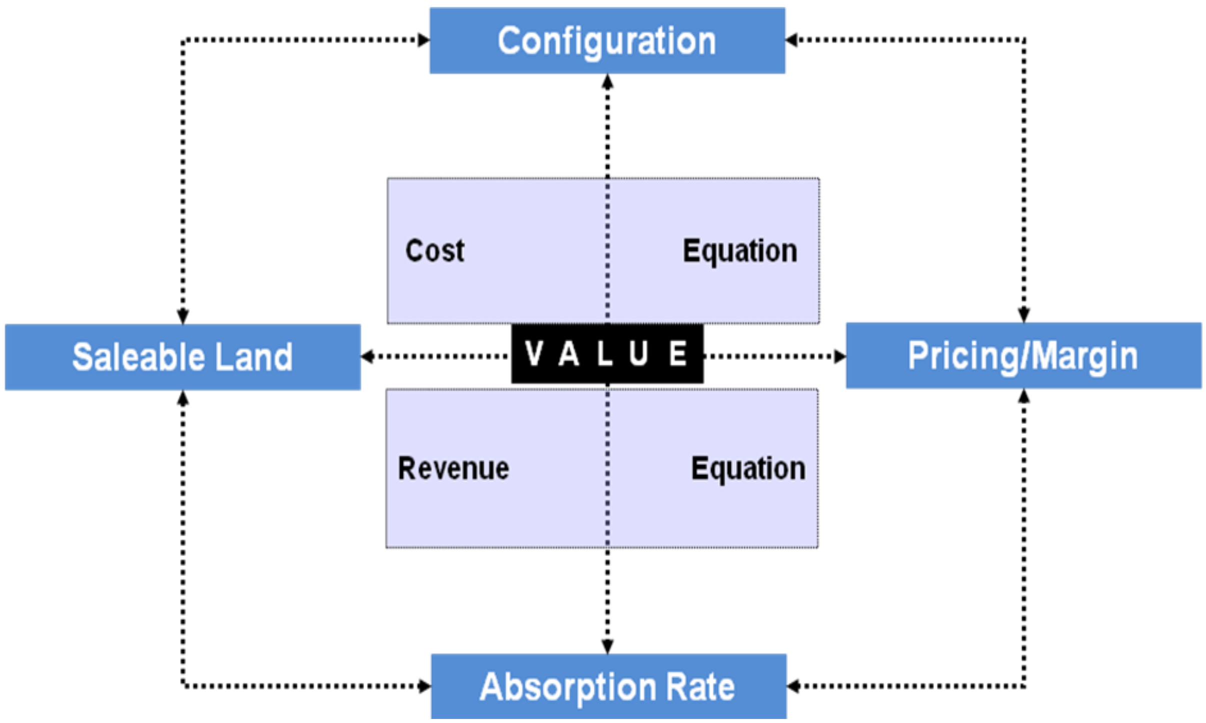

Exhibit 46 Value Creation at the proposed EZs

4.2.8.1 PRICING & REVENUE MODELS

The final task before estimation of project cash-flows is to project revenue. The land off-take module is mapped onto the projections for area off-take to project the income streams.

Our projection of realization for various components is based on suitable norms/benchmarks for components such as power, water etc. as well as the social infrastructure components proposed. Further suitable revenue structures have been devised for various components including lease of space/land, pricing of utilities etc.

4.2.8.2 FINANCIAL FEASIBILITY

The overall approach to be followed for the financial feasibility study is summarized in Exhibit 10 below:

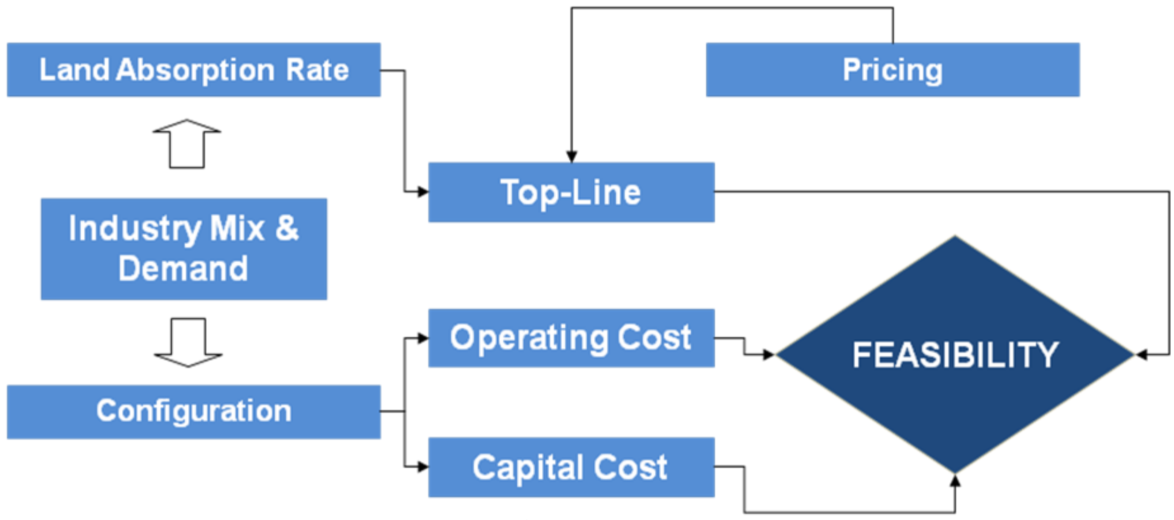

Exhibit 47 Financial Feasibility Framework

After estimating the cost and revenue streams from the individual EZ projects, the financials of the proposed EZs are calculated including profitability, cash-flows and returns. The following metrics are estimated based on the feasibility analysis:

- Net Present Value (NPV)
- Internal Rate of Return (IRR)
- Economic Rate of Return (ERR)
- Running IRR Graph
- Cash-break even and discounted break-even
- Payback period
- Financial Ratios
- Debt Service Coverage Ratio (DSCR)

The financial modeling provides a consolidated account of the financial viability of the project comprising the following:

- Assumption sheet – capturing key economic and financial inputs required for the financial model
- Project Cost
- Operation and maintenance costs
- Funding / financing plan – depending upon the preliminary implementation model
- Working Capital – projections of working capital requirement and the eligible bank borrowing for financing the same, and the gap to be met out of long-term sources
- Revenue estimates
- Income statement
- Balance sheet
- Cash flows statement
- Book Depreciation
- Tax Depreciation
- Key indicators – would present the key financial viability indicators at a consolidated place
- Scenarios / sensitivity sheet – allowing development and evaluation of scenarios and sensitivities for assessing project risks and their impact on financial viability indicators

Also, a sensitivity analysis that would help identify the key variables/parameters that could significantly affect the overall returns from the identified EZ projects. Some of the parameters that are analyzed for calculating sensitivity of returns can include:

- Lease rates (upfront/annual lease)
- Utilities charges
- Facility maintenance charges
- Project capital cost
    - Land development costs
    - Construction/facility development costs
    - Land acquisition costs
- O&M Costs
- Yearly inflation rates - Cost & Revenue-side impact
- Debt : Equity ratio

4.2.8.3 ECONOMIC ANALYSIS

Using inputs from the financial inputs, an economic analysis of the KHTP is done. This includes assessment of impact on GDP as well as employment. The employment potential can be further broken up into

- **Direct Employment** – The employees directly employed by the operating industrial units
- **Indirect Employment** – Employment created due to the spill-over effects of local industrialization and other needs

4.2.9 RISK IDENTIFICATION & ANALYSIS

The risk assessment of the project is based on inputs from the financial model and other frameworks. The risk analysis framework helps identify key project risks and recommend risk mitigation and allocation measures.

Some of the key project risks that have been included are:

- **Project location risk:** Risk that the proposed location of the EZ site may not be commercially attractive as a result of which facilities at the EZ may be under-utilized and affect the viability of the project.
- **Regulatory Risks:** Risk of regulation by the government on operation of such EZ e.g. regulation governing acquiring of land for the project, etc.
- **Political Risk:** Risk related to the stability of the political regime of the country, state or local authority.
- **Environmental Risk:** Risk to local environment due to pollution caused by direct or indirect operations at the proposed EZ.
- **Commercial risk:** Risk of demand for units not being equal to the supply at the EZ (i.e. land off-take at the EZ not matching expectations).
- **Construction risk:** Risk arising out of prolonged construction period resulting in cost overruns.
- **Financing risk:** Risk arising on account of failure to achieve financial closure.

- **Operating risk:** Risk arising on account of operators default in operating the facility.
- **Competition risk:** Risk arising on account development of a competing facility in proximity of the proposed EZ.

Considering the size of the proposed project, it is desirable that a sound strategy to assess, quantify and mitigate risks is put in place. A Risk Assessment Framework (RAF), shown in Exhibit 11 below, is used to allocate and mitigate such risks.

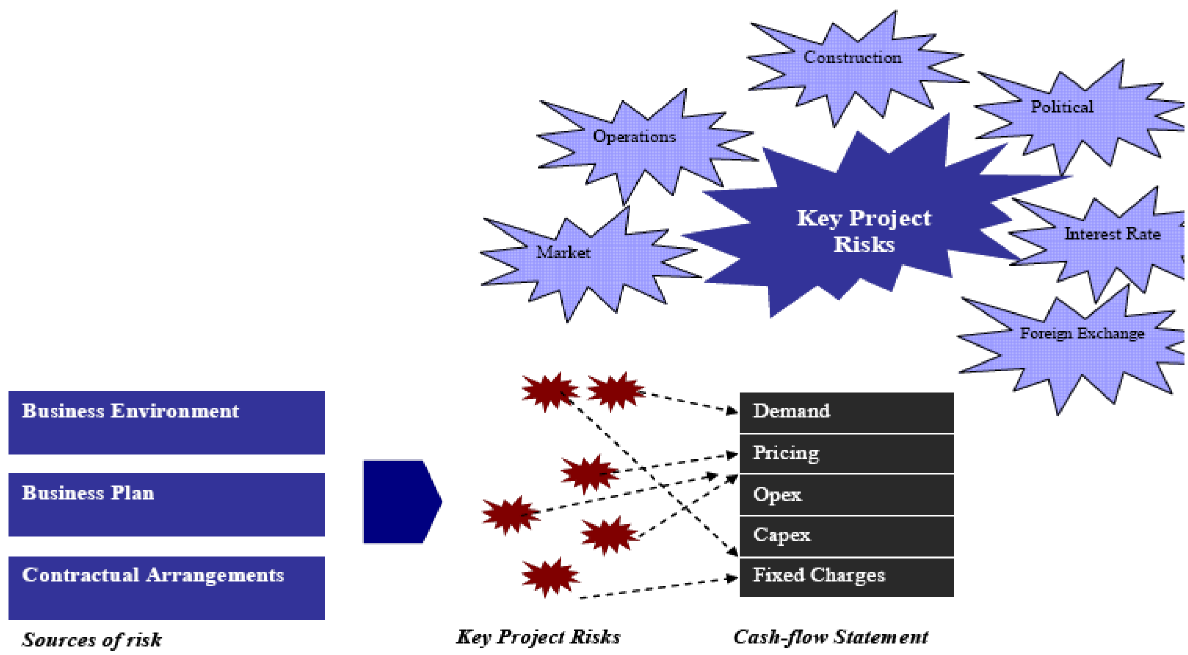

Exhibit 48 Risk Assessment Framework

The impact of risks on project returns is assessed by a sensitivity analysis to:

- Analyze and isolate risk elements and critical returns sensitivity factors
- Perform sensitivity analysis to individual risk items and gauge the probability of each
- Perform scenario analysis to assess the impact of combination of several risk elements from most pessimistic to most optimistic

Once the risks are identified and their impact understood an allocation strategy is formulated. The basis of the strategy is to allocate each risk to the party best equipped to control it.

4.2.10 PPP AND INSTITUTIONAL OPTIONS

It is understood that the proposed project as well as the overall PSDSP program envisages considerable private participation. Accordingly PPP structures and options have been devised for the project.

The project structure for the proposed EZs is evolved through a two-stage process as depicted below:

Exhibit 49 Two-stage process for Project Structuring

First, the structure neutral feasibility is established in terms of the financial returns, debt service, break-even etc. These aspects have already been covered in the preceding section on financial feasibility. Subsequently, the various project structuring options are analyzed on the basis of the following parameters:

- Financial Implication
- Implementing Issues
- Stakeholders Views
- Taxation Issues
- Legal and Regulatory Issues
- Relevant Case Histories

The PPP structuring process seeks answers to questions such as:

- Government Role and Stake
- Nature of private sector involvement
- Bundling options
- Nature of land transfer
- Reversion of assets
- Selection Process and Bidding Criteria
- Tenure of concession
- Project documentation
- Legal and institutional processes

4.2.11 INSTITUTIONAL FRAMEWORK

In order to propose the institutional frameworks for the proposed EZs the roles of Government and the private sector need to be reviewed with respect to the following functions:

- Regulation
- Ownership and development
- Operation and Management
- Compliance monitoring

In the illustration below, the various institutional interfaces and the strategy for each has been further detailed. The project imperatives (which involve government institutions) can be broken up into areas such as approvals, regulation, incentives etc.

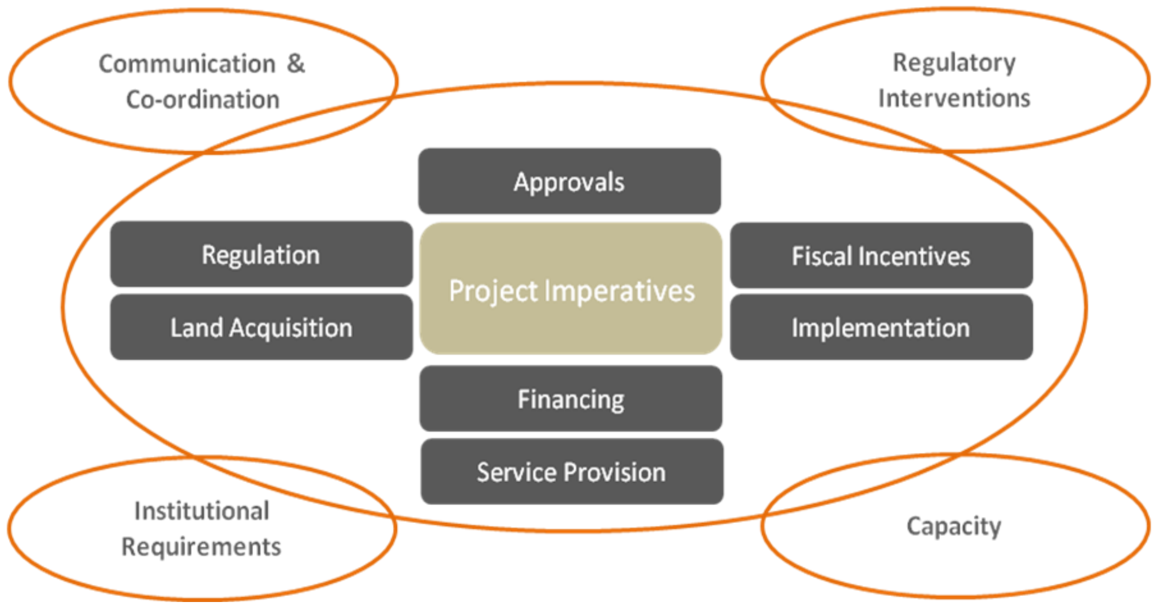

Exhibit 50 Institutional Mapping Framework

5 MARKET AND DEMAND ASSESSMENT

In this section we will summarize the findings of the market and demand assessment study, which were presented in the Interim Report. The analysis further reflects the changing economic climate, the results of which are w being felt across the globe.

The analysis largely focuses on the Hi tech sector which, which is the specific focus of the park.

5.1 ECONOMIC CLIMATE

The developments in the global and the Bangladeshi economy are significant in terms of the impact on the proposed KHTP. Accordingly, key economic trends and projections have been summarized in this section.

5.1.1 GLOBAL ECONOMIC CONTEXT

The world economy has been reeling from the impact of the credit crisis which exploded in the last quarter of 2008. The consequences of the crisis have severe consequences for foreign investments as well as exports both of which are crucial for the proposed KHTP.

This economic downturn was preceded by a boom period. The world GDP in the past five years grew at a rate of around 4.6% in real terms. This trend is further reflected in the exhibit below.

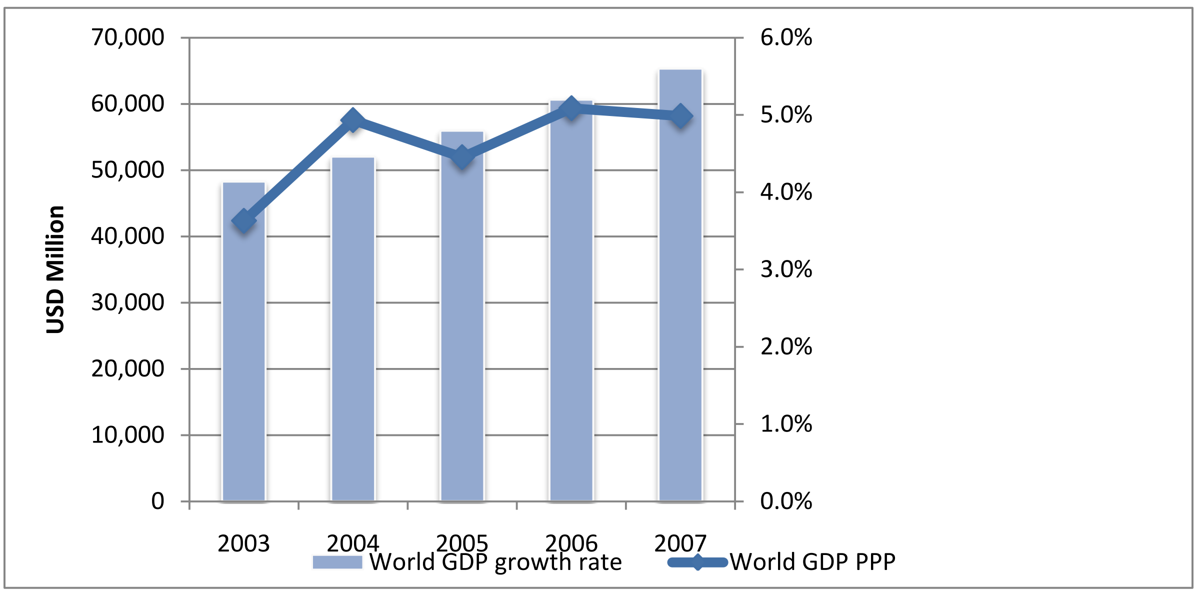

Exhibit 51 Global GDP Trends

Also, in terms of world trade, the same period witnessed a corresponding rise in world imports for all commodities. The CAGR of world import growth was around 16% in the last five years. The past trend in world imports is presented in the exhibit below.

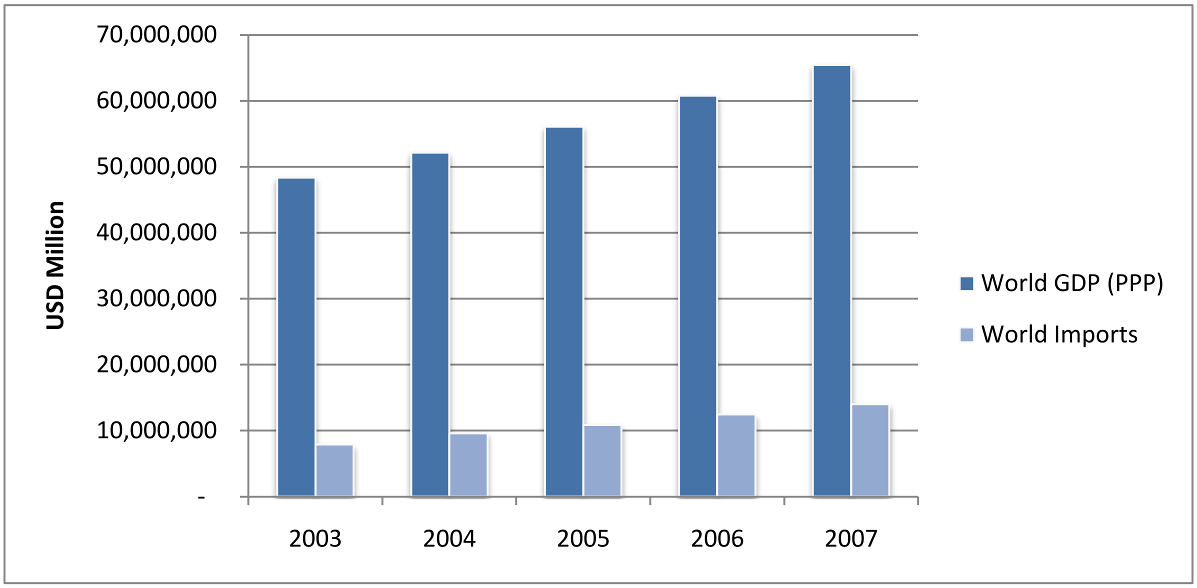

Exhibit 52 Past trends in Global imports

However, from the year 2008, the effects of the slowdown have been quite evident. This has been reflected in the sharp fall witnessed in the GDP growth across regions in the world. Also, the trade has fallen sharply owing to demand slowdown. This is presented in the exhibit below.

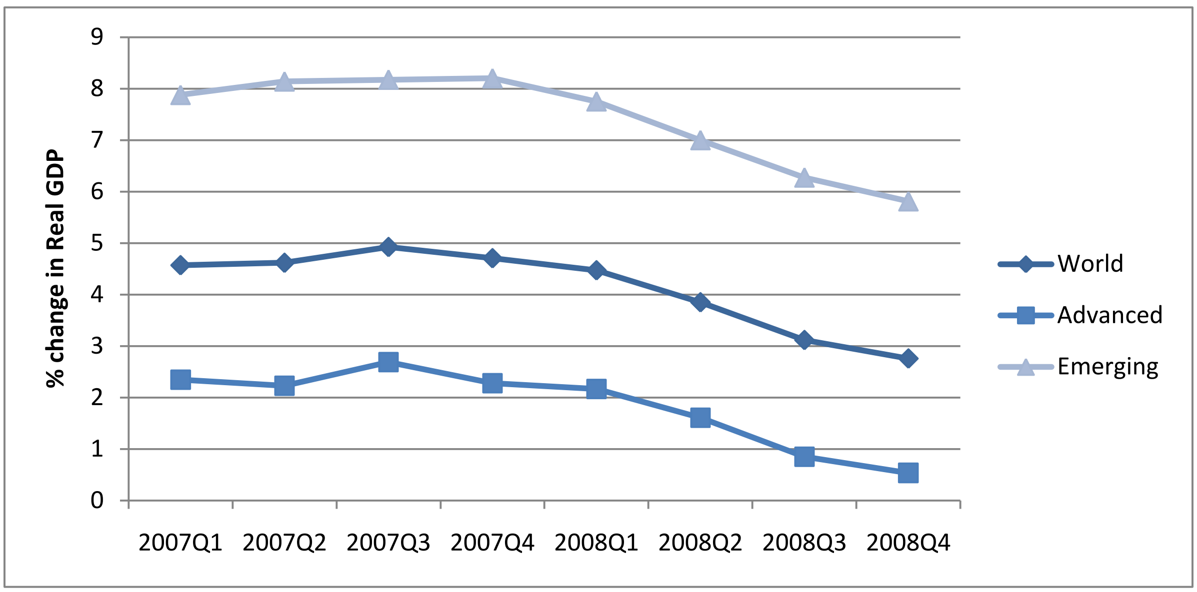

Exhibit 53 Real GDP growth in 2008 vis-à-vis 2007

It can be seen that the real GDP growth rate has fallen from 4.6% in the first quarter of 2007 to 2.8% in the last quarter of 2008. Also, the world trade has fallen considerable as reflected in the CPB[2] trade volume index shown below.

[2] The CPB Netherlands Bureau for Economic Policy Analysis (Dutch: Centraal Planbureau, Central Planning Bureau) is an independent Dutch government agency founded in 1945 that delivers economic analysis and forecasts.

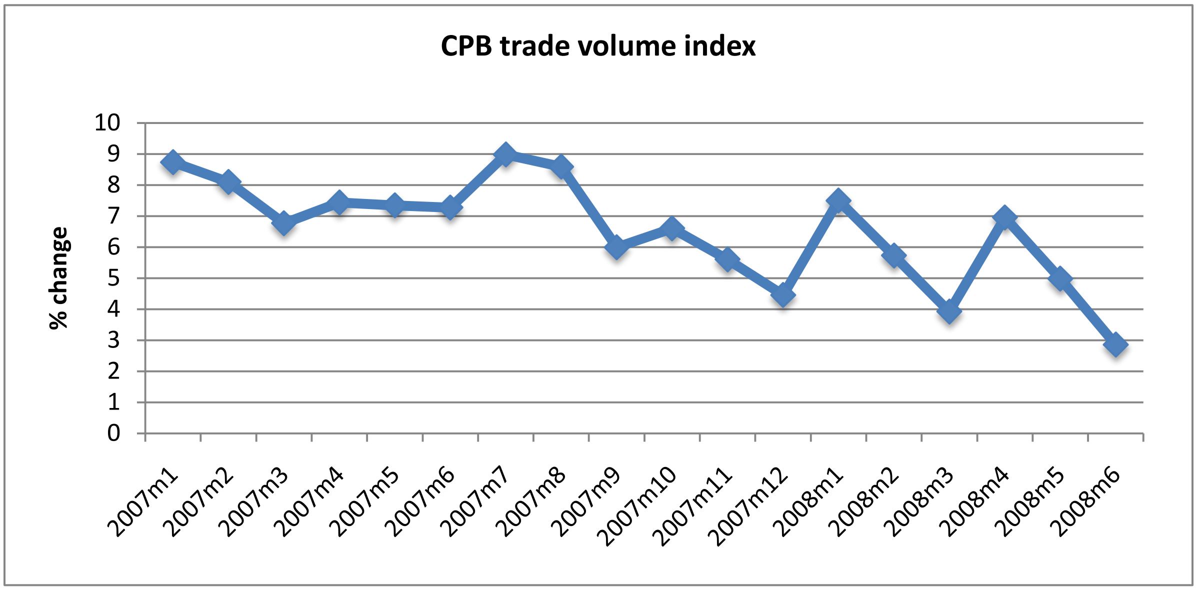

Exhibit 54 Decline in Global Trade in 2008

In terms of the future outlook, IMF projections state that the turnaround in GDP growth would only happen by the year 2010. The world GDP would grow by around 4.2% in real terms in the year 2010 which is 1.2% improvement over the corresponding 2009 figure. The future outlook in terms of real growth in world GDP is presented in the exhibit below.

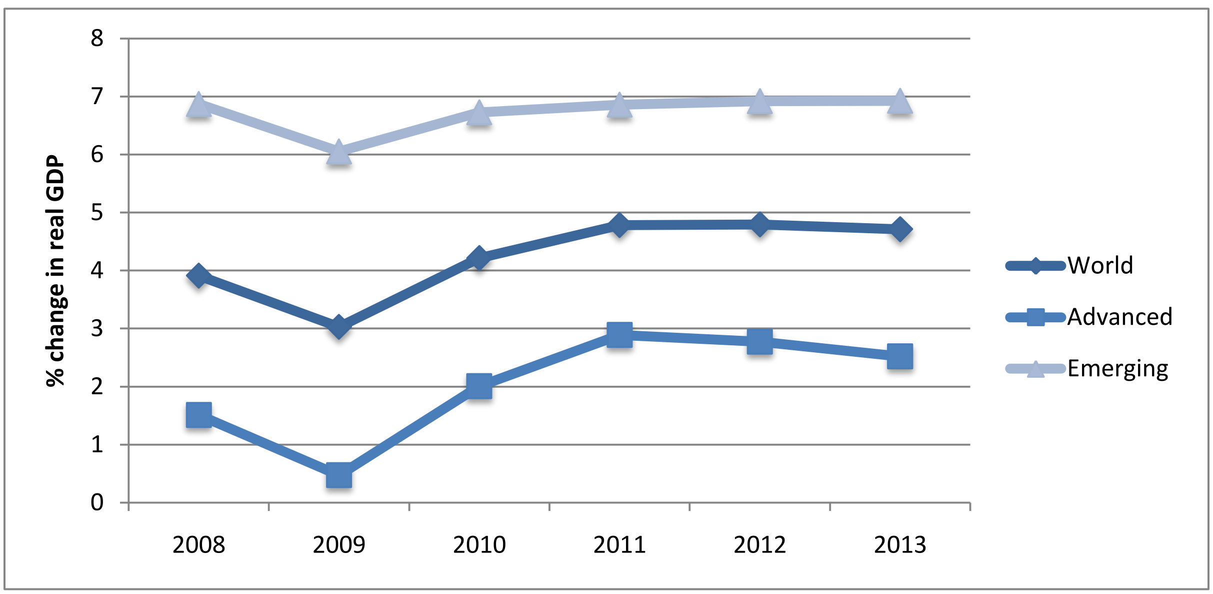

Exhibit 55 IMF projections on future GDP growth

5.1.2 BANGLADESH ECONOMIC CONTEXT

Over the past few years, the Bangladesh economy has exhibited stable economic performance, in spite of internal tensions and natural disasters. The graph below shows that the growth rates between 2002-03 and 2007 -08 has been consistently above 5%.

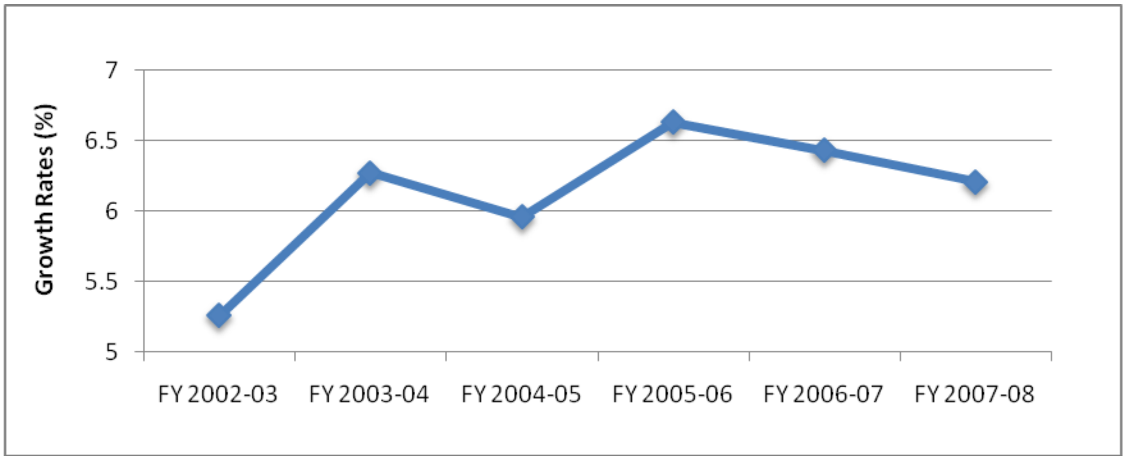

Exhibit 56 Trend in GDP growth of Bangladesh

Further the economy has diversified over the last few years with an increasing thrust on the services sector which now accounts for about 60% of the total GDP. The agricultural sector, however, continues to employ the majority of the population, highlighting the vulnerability of the agrarian workforce.

Since 1991, the country has shifted from import substitution to an outward looking i.e. export led development strategy. This has yielded particularly impressive results in some sectors such as textiles. The compounded annual growth rate (CAGR) of Bangladeshi exports was 17% between 2002-03 and 2007-08. The main destinations for Bangladeshi exports are the USA, the European Union and the Indian sub-continent.

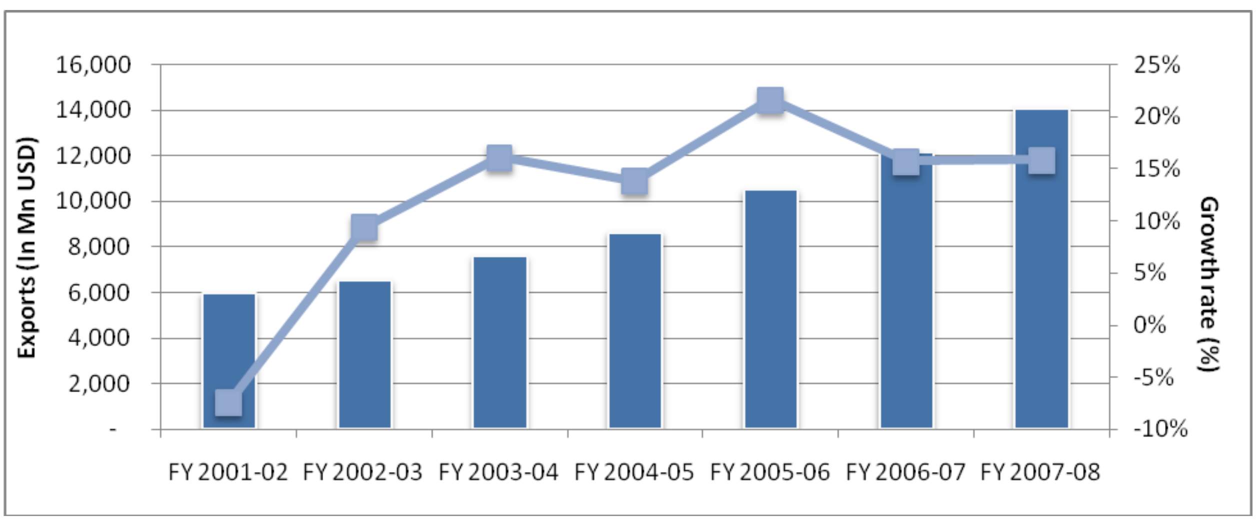

Exhibit 57 Trend in Exports in Bangladesh

Gross capital formation (GCF) has steadily grown as a percentage of the GDP from about 17% in the early 1990s to over 25% presently. Much of this is attributable to private investments whose share in the total has gone up from about 62% to over 67% in the same period. Foreign Direct Investment (FDI) has been among the contributors to the growth in private investments, having grown at a compounded annual growth rate (CAGR) of 13% between financial years 2004 and 2007. In absolute terms, the growth rate in FDI in 2007 over 2004 was nearly 45%. The total FDI inflows into Bangladesh were USD 666 in 2007-08.

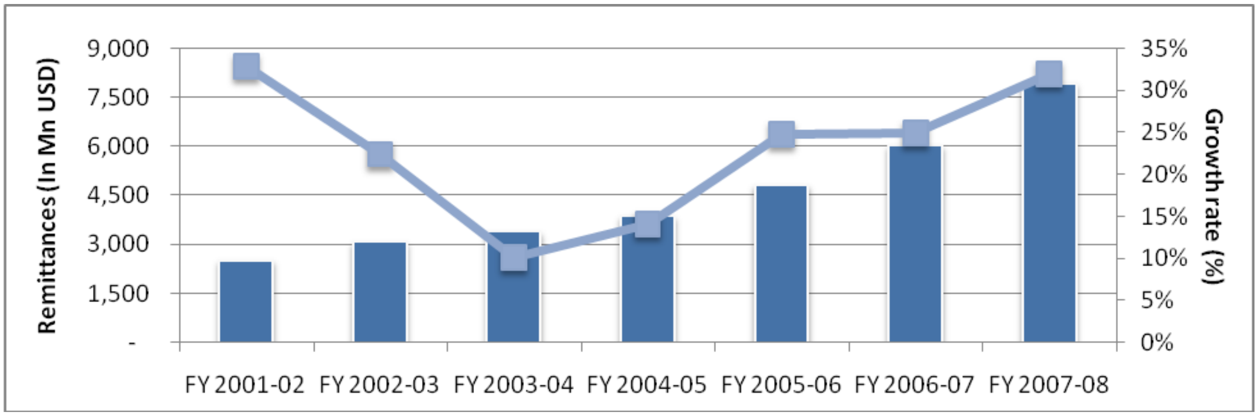

Exhibit 58 Trend of Remittances in Bangladesh

Another important contributor to the Bangladeshi economy has been remittances from its national employed in foreign countries, particularly in the Middle East. *Remittances were USD 7,915 Mn (thus being greater than FDI and over half of export earnings)* in financial year 2007-08 and have grown at a compounded annual growth rate of 24% over the last five years.

5.1.2.1 IMPACT OF ECONOMIC CRISIS ON THE ECONOMY

Bangladesh has exhibited consistent growth across the key economic parameters over the past few years, presenting a promising proposition for growth within the country. The growth in exports and remittances to Bangladesh as a percentage of GDP has been summarized below:

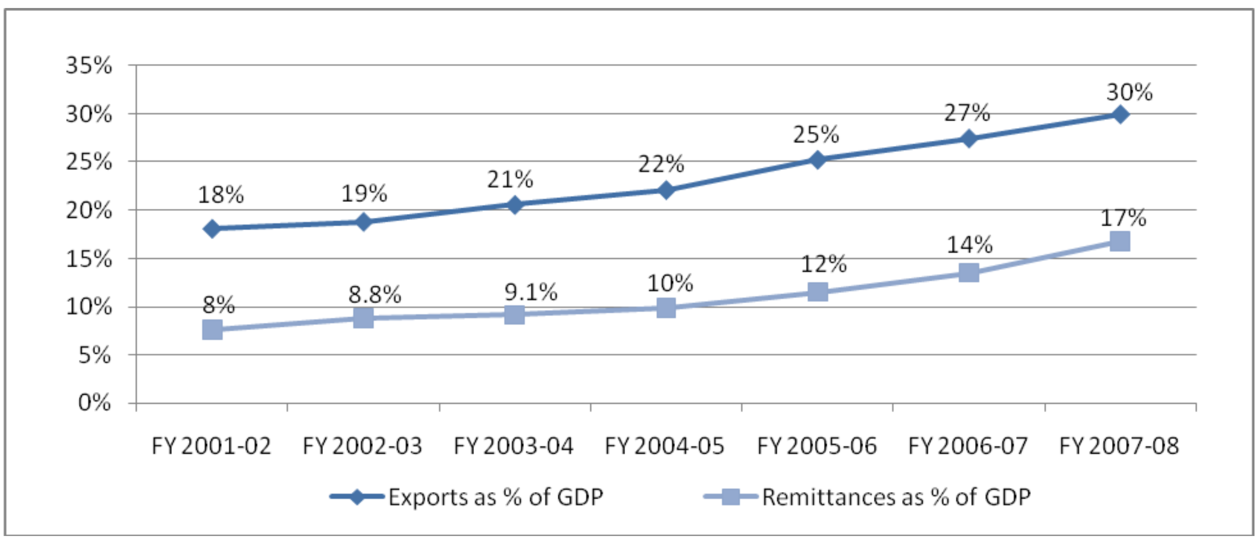

Exhibit 59 Performance in terms of exports and remittances

However, notwithstanding its creditable performance in the recent past, Bangladesh, like most economies in the world, is expected to be affected by economic crisis, particularly in foreign direct investments, exports and remittances.

An indication of the same is highlighted by the fact that there has been a massive domestic migration of Bangladeshi labor force from other countries of employment, especially South East Asia and the Middle East. Historically, these regions have been the employers of Bangladeshi emigrants and were driven by the boom in crude prices, which fuelled the real estate, construction and retailing industries.

However in light of the global meltdown, spending on construction and consumer goods sectors have witnessed a steep decline, especially in the Gulf and Southeast Asia, leading to slow down in manpower sourcing from Bangladesh. For instance, approx. 70,000 Bangladeshi workers in Malaysia are reported to have been denied work visas on account of domestic slowdown. Similarly, there have been reported cases of significant job losses in Middle East nations such as UAE and Dubai. The effect of this inward migration is expected to have a direct negative impact on the remittances flowing into Bangladesh going forward. Based on secondary estimates by Bangladesh Association of International Recruiting Agencies (BIRA), the remittances are expected to witness a fall by nearly 50% in 2009 compared to the previous year.

The exports sector too is expected to be negatively affected on account of slowing consumer spending in the 2 major export markets of Bangladesh, i.e. the US and the EU. Based on secondary sources, IMF has projected that income growth in Bangladesh's export markets would decline from 1.5 percent in 2008 to 0.5 percent in 2009 thus hampering growth in exports. Although demand for Bangladesh's exports is not very sensitive to income, export prices are expected to decline, thus bearing a significant impact on the export earnings even if export volumes remain largely unaffected. As per unpublished estimates from BGMEA, garment exports have witnessed a cumulative decline of nearly 18% since the onset of economic crisis in US and the EU. Based on stakeholder's consultations, the exports sector is expected to witnesses a further slowdown in export orders in the coming 6-8 months. A similar trend may be expected with respect to FDI inflows into Bangladesh.

While the level of economic slowdown expected in Bangladesh may not be quantifiable presently on account of lack of published data, it can nevertheless be inferred that the negative impact of global economic recession is expected to be severe for Bangladesh. This is also true of the IT sector which is which is faced with a number of issues in the sub-continent.

However, on the financial markets, the impact of the crisis is not expected to be very significant since its credit markets are relatively insulated and foreign portfolio investors do not play a large part in the country.

In sum, it may be argued that while short-term effects of the crisis are already in evidence, the overall impact is likely to be less for Bangladesh. FDI, on the other hand, is expected to be relatively affected in the short to medium term. These implications have been appropriately factored into our demand estimation.

5.2 BANGLADESH ICT INDUSTRY

The Bangladesh ICT industry was covered in detail in the Interim and Pre-feasibility Reports. Here we present an overview of the findings of earlier reports and some specific additional developments which have been factored in since, especially the impact of the slowdown on the ICT industry.

Earlier we had also short-listed the key target segments within the "Hi tech" industry sectors so that there could be greater focus in the planning and design of the KHTP. The following table illustrates the possibilities available for development and our recommendations on the immediate priority areas based on the specific Critical Success Factors (CSFs) for that industry and Bangladesh's strengths against these:

Industry / Sector		CSF	Bangladesh Capability	Rating
IT/ITeS	ITeS – Voice Services	Basic computer knowledge, English fluency	Accent neutralization costs	*****
	ITeS – Data Services	Basic computer knowledge	Large talent pool available	*****
	IT services – Basic outsourcing	Skilled workforce, Partnership with large software house, ability to scale up	Talent pool and islands of excellence	*****
	IT services – end to end consulting	Project Management skills, Scalability, vertical market knowledge	Potential to develop once industry scales up	*****
IT/ITeS	Software Products	Execution skills, branding, vertical market knowledge	Existing products, Vertical market skills in garments, banking etc;	*****
HARDWARE	Hardware Assembly	Skilled labour (Electronics), Low import barriers for components	Talent pool available, Evolving domestic market	*****
	Hardware & Product Design	Developed Hardware and R&D capabilities, Logistics cost	Still at a nascent stage, lower R&D capabilities	*****
R&D	Biotechnology – Agri Biotech	Local industry linkage, trained manpower, R&D capabilities	Nascent R&D Capabilities	*****
	R&D Services	Research base and capabilities. Strong university linkage	Nascent R&D Capabilities	*****

Exhibit 60 CSFs of various ICT segments

The focus of the feasibility study is therefore on the identified sub-segments above, especially information technology (IT) and IT Enabled Services (ITES). These are referred to as the ICT or the technology sector.

5.2.1 CHARACTERISTICS OF THE BANGLADESH ICT INDUSTRY

This sub-section presents certain key characteristics of the Bangladesh ICT industry which are relevant for our analysis. The Bangladesh IT industry is in its infancy – the total size of the industry was about USD 117 Mn as of 2007. Hardware accounts for another USD 183 Mn. The growth of the IT industry has been about 28% over the last 5 years but between 2005 and 2007, growth has spurted to over 50%.

The major driver for ITeS growth has been domestic demand, primarily from the following sectors:

- Large demand for IT automation in domestic industries – Telecom, BFS, Pharma & Textile
- E-governance initiatives implemented by local software companies

The internal demand for ITes has been further supplemented by the emerging demand for back end ITeS processes such as payroll management, accounting and web based development from the US and the European markets. Bangladesh has also forayed into engineering and marketing services for South Asian countries. However, this is limited to only few a small scale companies.

A survey conducted by the Bangladesh Association of Software and Information Services (BASIS) in 2007 highlights the composition of the IT/ITeS industry in Bangladesh with regard to market shares based on scale of the companies. The findings are as shown below:

Company Type	No of Companies	Employee Strength	% Share of Co.s	% of Share of Employees
Very Small Scale (<25 Employees)	30	404	36%	13%
Small Scale (25-50 Employees)	33	967	39%	30%
Medium Scale (50-100 Employees)	16	1,068	19%	33%
Large Scale (100 Employees)	5	753	6%	24%
Sample Size	84	3,192	100%	100%

Exhibit 61 BASIS Sample Survey (2007) of ICT Industry in Bangladesh

A major proportion of the industry constitutes the very small and small companies, accounting for an approximate 75% share of the market. The large and medium scale companies on the other hand contribute a smaller share of 25% while accounting for a higher share of employment at nearly 57%. It is worth keeping in mind that only the larger companies may be the immediate target tenants as far as the KHTP is concerned.

On the whole, while there has been a shift from traditional demand drivers to more contemporary segments, the traditional segments continue to drive a major part of the market demand, with the small – medium segment dominating the ICT industry in Bangladesh.

5.2.1.1 ICT EXPORTS

The Bangladesh ICT industry is essentially domestically focused with only about 10% of total revenues coming from exports. However has undergone a gradual shift in the market over the past few years. The country is presently exports to nearly 30 countries, with the bulk of the business being handled by about 100 local firms. A large part of the exports are handled by the mid to large scale IT companies, with majority of the smaller companies having an inward focus. On the whole, ICT exports from Bangladesh have witnessed promising performance levels, with the total ICT exports growing at a CAGR of around 28% for the last ten years. The following illustration indicates the growth of exports across various industry segments forming part of the ICT industry in Bangladesh.

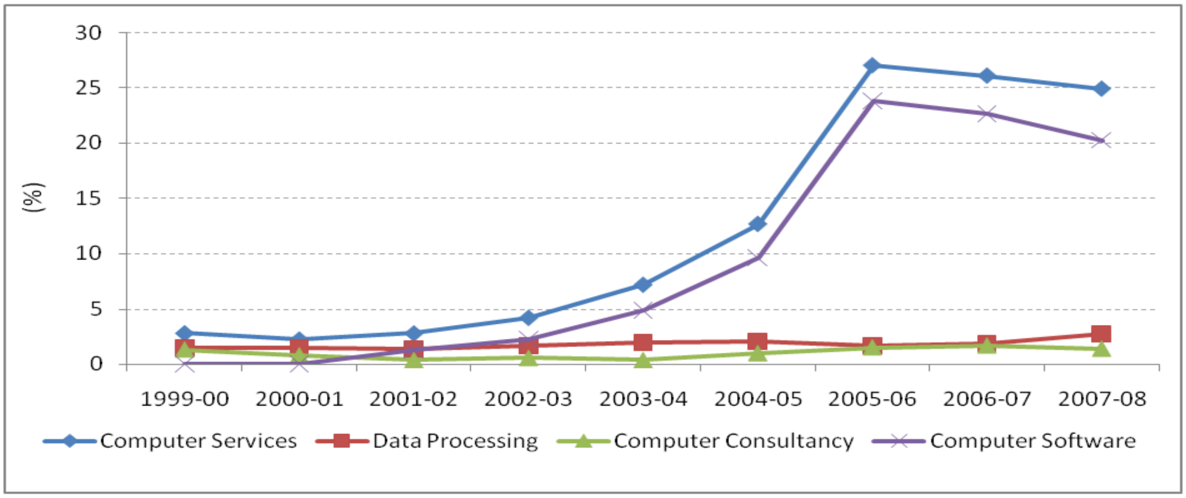

Exhibit 62 ICT Industry export growth rates

As observed, the rate of growth of computer services far exceeds the growth rates achieved by any other sector of the ICT industry in Bangladesh.

In the table below, we have provided a snapshot of the Bangladesh's export destinations. The biggest export market is the US. However over the years there has been a shift in focus, with other major destinations for exports being increasingly targeted. IT exports to the European Union and South Asia Pacific region represents this trend. It may be noted that a majority of the exports are presently undertaken by a small proportion of a few large firms.

Country	No. of Exporting Companies	Country	No. of Exporting Companies
USA	70+	Germany	8
Denmark	20+	Canada	6
UK	10+	Switzerland	5
Japan	10+	Norway	5
Australia	10+	South Africa	4
Middle East -(UAE, SA, Bah)	10+	Thailand	4
Finland	8	Sweden	3

Exhibit 63 Export map for Bangladesh ICT exports

5.2.1.2 IT/ITES EMPLOYMENT

The overall economic focus of Bangladesh has undergone a major shift over the last few years as growing importance is now being given to the services sector. The IT/ITeS industry has been one of the main segments fuelling the growth of services and related employment. The exhibit below provides an indication of the level of employment generation and the rate of growth of employment in IT/ITeS sector.

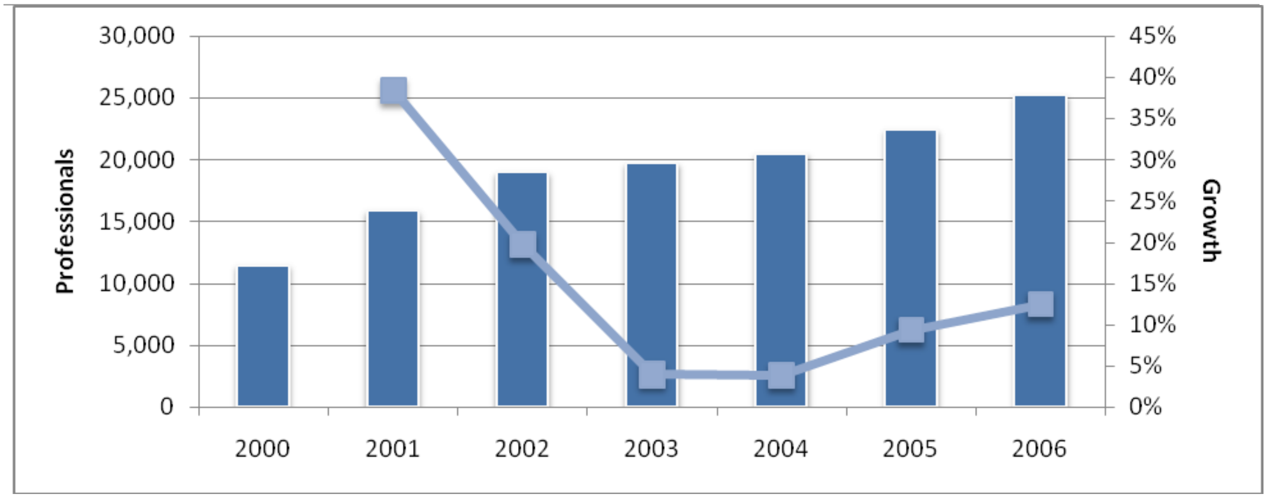

Exhibit 64 IT/ITeS employment in the Bangladesh ICT industry

The industry presently employs more 25,000 professionals as of 2007 and the level of employment has witnessed a Compounded Annual Growth Rate (CAGR) of approx. 10% between the years 2002 to 2006. Judging by the size of employment, it is evident that the industry is relatively very small compared to immediate competing countries like India. However, considering the potential for the industry, the country still faces a shortfall of skilled employees.

5.2.2 THE BANGLADESH ICT INDUSTRY – POTENTIAL EVALUATION

Bangladeshi companies are typically very small and none of the IT majors are present in the country in a big way. The country has not yet witnessed large IT Parks and Software Delivery Centres of the kind that have been witnessed in the region. The Consultants sought to find out the possibility of attracting investors and setting up such facilities. Therefore, the Consultants met with a number of IT/ITeS companies in the sub-continent as well as MNCs. Following is the list of stakeholders consulted.

- MNC IT Companies
  - IBM
  - Yahoo!
  - Microsoft
  - HP
- Indian IT Companies
  - Wipro
  - Infosys
  - Tata Consultancy Services (TCS)
- Bangladesh software & hardware assembly companies
  - Spinnovation Ltd
  - Leads Corporation
  - Business Automation
  - Decode Ltd
  - CIPROCO Computers Ltd.

The highlights of the stakeholder discussions are tabulated below:

ISSUE	RESPONSE
Awareness	• Bangladesh was not top of mind for most investors. This is quite unlike the textile and pharma sectors where external investors appeared to be aware of opportunities in Bangladesh.
Perception About Bangladesh	• Sub-continental companies including Indian IT majors were, prima facie, open to the idea of evaluating the opportunity but did not have information or specific plans. • MNCs were unequivocal in saying that Bangladesh is not likely to be a priority in the short to medium term
Opportunity	• Cost was clearly a major perceived advantage but the extent of the opportunity has not been communicated. However some companies, especially MNCs, said that since labour arbitrage disappears over time, this was not a factor in their location selection process. On the other hand, Indian companies seemed to feel that the cost arbitrage could help their margins in the medium term. • De-risking and diversification is a major concern among MNCs. Many feel that they are too concentrated in countries like India. However Bangladesh is not seen as an immediate alternative to India. • Among Indian IT companies, there is a specific direction towards globalizing their operations and exploring untested locations. Many are evaluating options in the Middle East, South East Asia and Eastern Europe. • There is also a tendency to move away from established locations like Bangalore and Hyderabad in India which have considerable real estate and manpower pressure in terms of both cost and availability
Risks	• Country risk was cited by the majority of IT companies as a potential concern in Bangladesh. They will probably keep an eye on developments before evaluating their options. • Another key concern was availability of talent. Some felt that this could offset any gains from wage cost arbitrage • Companies also expressed a preference for expanding into locations that have a fairly large domestic market. Bangladesh's limited market for IT services could be a roadblock in this context. • Lack of familiarity with the business environment was another concern among both Indian companies and MNCs. Many have limited or no operations in the country.

Exhibit 65 Overview of Stakeholder Interactions

In light of the above discussions, our aim was to establish the perceived strengths of Bangladesh as an IT destination and understand to what extent the weaknesses could be mitigated.

Our analyses were therefore focused on the following issues:

An analysis of salaries for employees in the IT sector indicates a huge gap between salaries in India and Bangladesh. SALARY LEVELS IN BANGLADESH ARE LESS THAN THOSE PREVALENT IN INDIA IN 1997 AND ARE BETWEEN 3-4 TIMES LOWER THAN THE CURRENT SALARIES IN INDIA across various employee categories. This is clearly an opportunity.

The question that immediately follows from the above is that of quality. The IT sector in Bangladesh is undoubtedly small which means that the talent pool is presently limited. However, in the Indian context, a large part of the workforce is actually trained internally. Often engineering graduates are recruited without any background in IT and put through an intensive in-house training program for 3-6 months. THUS THE KEY QUESTION IS, WHAT IS THE NUMBER OF ENGINEERING AND TECHNICAL GRADUATES THAT BANGLADESH PRODUCES ANNUALLY.

Between the major cities, Bangladesh produces more than 25,000 engineering and computer science graduates annually. This is far lower than the graduate pool at large IT centres such as Bangalore, Chennai and Pune in India. Considering that the industry is growing at 50%+ on a base of 25,000 employees, THE NUMBER OF ENGINEERING GRADUATES WOULD CERTAINLY SEEM TO BE A CONSTRAINT FOR THE IT SECTOR.

While acknowledging the seriousness of the perception of the political scenario, the issue needs to be studied in context. Considering the experience of countries with a comparable socio-economic profile, the problem would seem to more of communication. The experience of Pakistan as an IT destination demonstrates how a comparable economy is still far ahead of Bangladesh in the IT sector.

	BANGLADESH	PAKISTAN
GDP (USD Bn)	206.7	410
GDP Real Growth Rate	5.6	7.5%
Exports (USD Bn)	11.75	16.31
Internet Users	450,000	12 Mn
IT ITeS Exports (USD Mn)	26	162
IT ITeS Exports as a % of total Exports	0.22	1.00
IT ITeS Employment	20,000	110,000

Exhibit 66 Comparative Analysis of Pakistan & Bangladesh IT Industry

As the table demonstrates, even if one accounts for the fact that Pakistan's economy is twice as large as Bangladesh, there is still a huge difference in the relative sizes of their IT exports (5-6 times). The numbers would suggest that even after accounting for perceived political issues, the IT industry in Bangladesh is performing far below its potential.

5.2.2.1 EXPANSION PLANS OF LOCAL PLAYERS

As the above analysis shows, while there is plenty of potential in the Bangladesh technology sector, there are also significant constraints which need to be addressed. Pending this, it would continue to be the domestic industry which would drive the growth in this sector. Accordingly, we consulted the following to understand their perceptions about the proposed KHTP

- Bangladesh Computer Council (BCC)

- Bangladesh Association of Software & Information Services (BASIS)
- Ministry of Science and Information & Communication Technology (MoSICT)
- Prominent Bangladeshi Software & Hardware assembly companies

While they were generally positive about the KHTP, some mentioned concerns about the commute time. Since many companies operate buses to and from the offices for employees, it was felt that this could substantially raise costs which would have to be offset by lower lease rentals.

5.2.3 BENCHMARKING

For a clearer picture of the potential of the Hi-tech sector in Bangladesh it would be useful to look at comparable countries that have been relatively successful in developing competencies in the sector. Accordingly, in this section, we present the benchmarking analysis carried out with regard to ICT industries in competing countries like India, Pakistan, Vietnam and Sri Lanka.

	BANGLADESH	PAKISTAN	SRI LANKA	VIETNAM
GDP (2007 est.)	USD 206.7 billion	USD 410 billion	USD 81.29 billion	USD 221.4 billion
GDP Growth Rate	5.6%	6.3%	6.3%	8.5%
Literacy	43.1%	49.9%	90.7%	90.3%
Age Structure	0-14 years: 33.4% 15-64 years: 63.1%	0-14 years: 36.3% 15-64 years: 59.4%	0-14 years: 24.1% 15-64 years: 68%	0-14 years: 25.6% 15-64 years:68.6%
Median Age (years)	22.8	21.2	30.4	26.9
Exports	USD11.75 billion (2007 est.)	USD16.31 billion (2007 est.)	USD8.14 billion (2007 est.)	USD48.07 billion (2007 est.)
Internet Users	450,000 (2006)	12 Mn (2006)	428,000 (2006)	17.87 Mn (2007)
IT ITeS Exports (USD Mn)	26	162	98	70
IT ITeS Exports as a % of total Exports	0.2%	1%	1.2%	0.15%
IT ITeS Employment	20,000	110,000	30,000	25,000
Salary – Engineers (USD per month)	142 – 192	494	167-253	100-208
Salary – Managers (USD per month)	378 – 598	1146	309-767	390-736
Office Rent (USD	15-20	12-22	10	25-62

	BANGLADESH	PAKISTAN	SRI LANKA	VIETNAM
per sft, monthly)				
Housing Rent (USD per sft, monthly)	654 (Banani), 2182 (Gulshan)	1280-7200	1500	2100-3500
Corporate Income Tax (%)	40	35	15-35	28
Personal Income Tax Rate (Highest %)	25	0-25	5 -35 (7 slabs)	40

Exhibit 67 Macro-level benchmarking

Bangladesh and Vietnam have almost similar employment numbers. However, the Vietnam IT/ITeS industry has been an export-oriented one, whereas the Bangladesh ICT industry has been growing because of the domestic demand.

As part of the benchmarking exercise, we also compared the labour charges, rents and taxes prevalent at various major IT/ITeS destinations with those at Dhaka in Bangladesh. The findings of the same are reproduced below:

	DHAKA	DALIAN	HANOI/ HOCHI MINH	BANGALORE	KARACHI	COLOMBO	Trivandrum
Engineers *USD per month*	142 – 192	308-445	100-208	187-387	494	167-253	180-380
Managers *USD per month*	378 – 598	545-897	390-736	522-1020	1146	309-767	500-1000
Office Rent (USD Monthly per sq. m)	15-20	35	25-62	21-28	12-22	10	10
Housing Rent per Month (USD Monthly)	654 (Banani), 2182 (Gulshan)	3036	2100-3500	2048-3200	1280-7200	1500	1000-1200
Corporate Income Tax Rate *(%)*	40	25	28	30	35	15-35	30
Personal Income Tax Rate (Highest %)	25	45	40	30	0-25	5 -35 (7 slabs)	30

Exhibit 68 Location-level benchmarking

It can be inferred from the above exhibit that Dhaka scores highly in terms of the wages, office rental rates as well as cost of residential accommodation as compared to other leading IT destinations. Even as compared to the tier 2 cities in India, Dhaka has an advantage in terms of salary. Rental rates are higher although as compared to the tier 2 cities. Other destinations are slowly becoming more expensive and Bangladesh would do well to use this cost advantage to its benefit.

In the exhibit below, a comparative analysis of the power and water charges has been presented. It should be noted that uninterrupted power supply and 24X7 internet connectivity are a must for any IT/ITeS based industry to operate.

	DHAKA	DALIAN	HANOI	BANGALORE	KARACHI	COLOMBO
Electricity Charges						
Rate per 1 Kwh	0.02 - 0.08	0.1	0.09-0.1	0.1	0.06-0.11	0.15-0.2
Water Charges						
Rate per 1 cu. M	0.36	0.7	0.47	1.54	0.39	0.45
Gas Charges						
Rate per 1 cu. m	0.03-0.12	0.2	1.18	1.43/kg	4.63/Mn BTU	1.34/kg
Fuel Charges						
Gasoline (1 lit)	0.97	0.7	0.81	1.29	0.86	1.17
Diesel (1 lit)	0.58	0.77	0.64	0.9	0.52	0.74

Exhibit 69 Location-level benchmarking

It can be observed that Dhaka offering in terms of power charges is quite competitive as compared to the other competing destinations. However, availability of the same could be an issue that needs to be tackled effectively.

5.2.4 IMPACT OF DOWNTURN

While the above analysis indicates a good potential for the development of the industry in the long term, there are some concerns in the short to medium term on account of the global recession and the consequent impact on the technology industry.

Worldwide technology products and related services sector spends are estimated to have grown at 7.3 per cent to reach USD 1.7 trillion in 2007. It is estimated that in 2008, the worldwide IT market growth will have been lower at about 5.5%, mainly due to the economic slowdown in the US and elsewhere. The ongoing slowdown has significantly affected the IT industry in terms of the revenue growth rates, profit margins and investments into the sector.

We have presented below, the impact of the impending slowdown onto the US IT and technology exports. It can be seen that the export growth rate has declined from around 14-15% to 11% in the year 2008 and is expected to further go down in 2009.

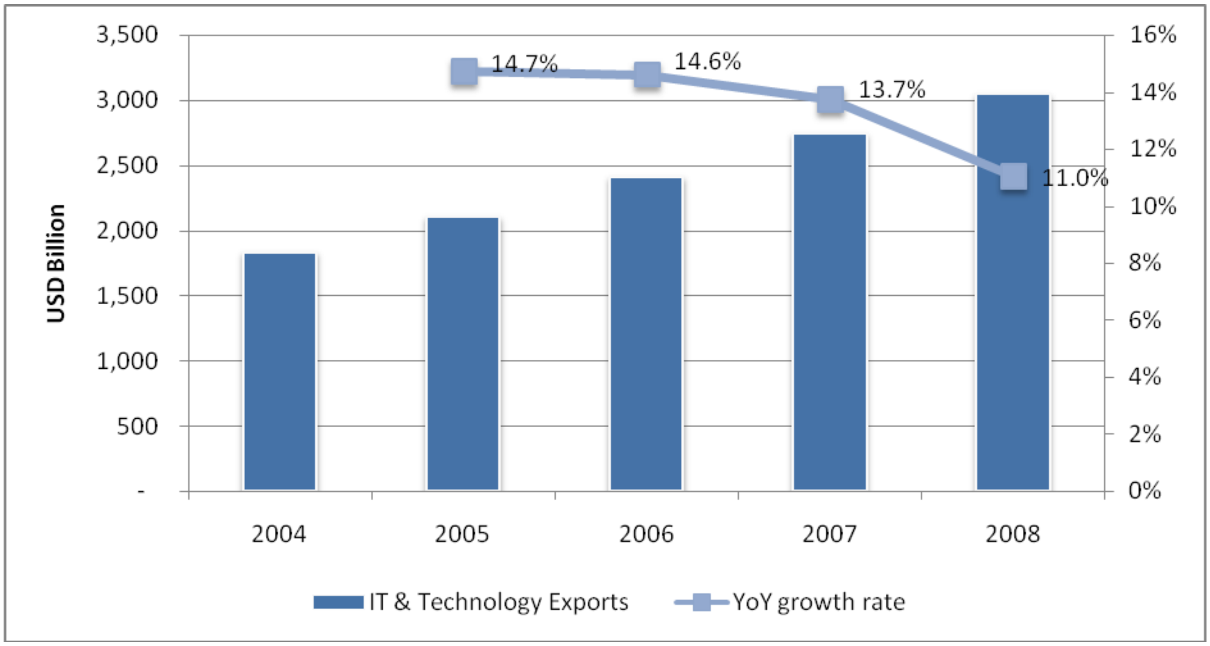

Exhibit 70 Decline in US IT exports

However, when compared to the sharp decline in growth of other non-IT industries, the IT sector has been somewhat resilient. The industry's sales have been growing steadily, albeit at a slower rate. But, the net incomes have been affected significantly.

Given technology's role in productivity, cost control and competitiveness, IT spending is still expected outpace GDP growth in rich countries as well as developing ones. Global spending on IT products and services is expected to grow only by 0.5% in 2009, but is expected to subsequently rebound in 2010. The greatest impact would be felt in global hardware markets, where overall spending growth would be –3.6% this year, led by a steep decline in outlays for servers, PCs, and printers/MFPs. In contrast, worldwide spending on software and IT services are each expected to grow by 3.4% in 2009.

5.3 DEMAND PROJECTIONS

Taking into consideration the prevalent recessionary global market situation, it is prudent to assume a conservative growth in business and employment levels in the Bangladesh IT industry going forward.

We have evaluated three scenarios based on probable future growth scenarios for IT/ITeS exports from Bangladesh. The following schematic indicates the methodology proposed for estimation of land demand for the KHTP

Exhibit 71 Land Demand Assessment Methodology for Bangladesh ICT Industry

As the first step, exports turnover in value terms has been estimated for Bangladesh technology industry under three distinct growth scenarios. The export turnover estimated under each scenario has then been converted into corresponding levels of employment generation, based on 'average turnover per employee' benchmarks of the industry. The employment numbers generated are further converted into land demand based on 'sft space per employee' benchmarks again based on industry norms. Subsequently, a proportion of the projected land demand is apportioned to the Kaliakoir Hi-Tech Park, taking into consideration, the share of competing locations within Bangladesh in the overall demand.

Projection of the growth rate is the first key assumption in the demand estimation scenario. The following were considered in making this projection:

- Actual growth rate observed in the recent past
- Growth rates achieved by emerging locations in neighboring economies with an established technology sector
- Growth rates achieved by comparable economies but which have a more developed technology sector
- Impact of the economic downturn.

The norms emerging from the above benchmarks were as follows:

- A 50% growth rate was actually witnessed in the last 2 years for the technology sector in Bangladesh and a growth rate of 25% was achieved over the last 10 years.
- Emerging locations in India, most of which have social infrastructure at a comparable or less developed level than Dhaka, have achieved growth rates ranging between 25% and 70% in the last 5 years. Kolkata, in West Bengal, which has similar cultural and socio-economic parameters, witnessed a 55% growth rate. Even interventions which are seen as unsuccessful, such as in Hubli, Karnataka, resulted in a growth rate of 35%
- Pakistan witnessed a growth rate of between 50% and 70% from 2003 to 2009 and presently employs over a 100,000 professionals as against 20,000 in Bangladesh
- As pointed out, while the economic downturn will have a definite short term impact, it is expected to be relatively less severe in its implications for the technology sector.

Considering the above, and being very conservative on account of the downturn, in the base case, an average growth rate of 20% for the industry turnover has been assumed. This has been suitably moderated in the initial years to take into account, the impact of the downturn and also stabilized at 10% in the long term. Growth rates assumed in each of these scenarios are as shown in the table below:

Scenario	Revised ICT Industry Growth Rate
Scenario 1 (Base Case)	20%
Scenario 2 (Optimistic)	25%
Scenario 3 (Pessimistic)	15%

Exhibit 72 Probable Future Growth Rates

Exhibit 73 provided below represents the estimated size of the Bangladesh' ICT industry under the three scenarios taken into consideration.

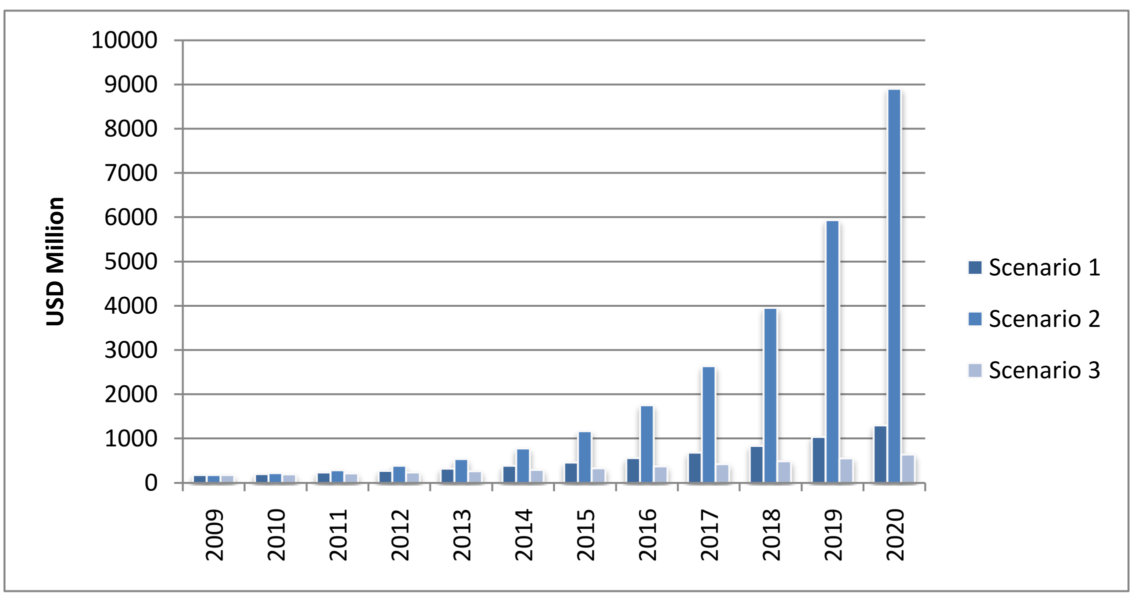

Exhibit 73 Estimated size of Bangladesh' ICT industry under various scenarios

Exhibit 73 represents the estimated employment from the ICT industry under the three scenarios based on average turnover per employee growth of 7.5% per annum in line with past trends.

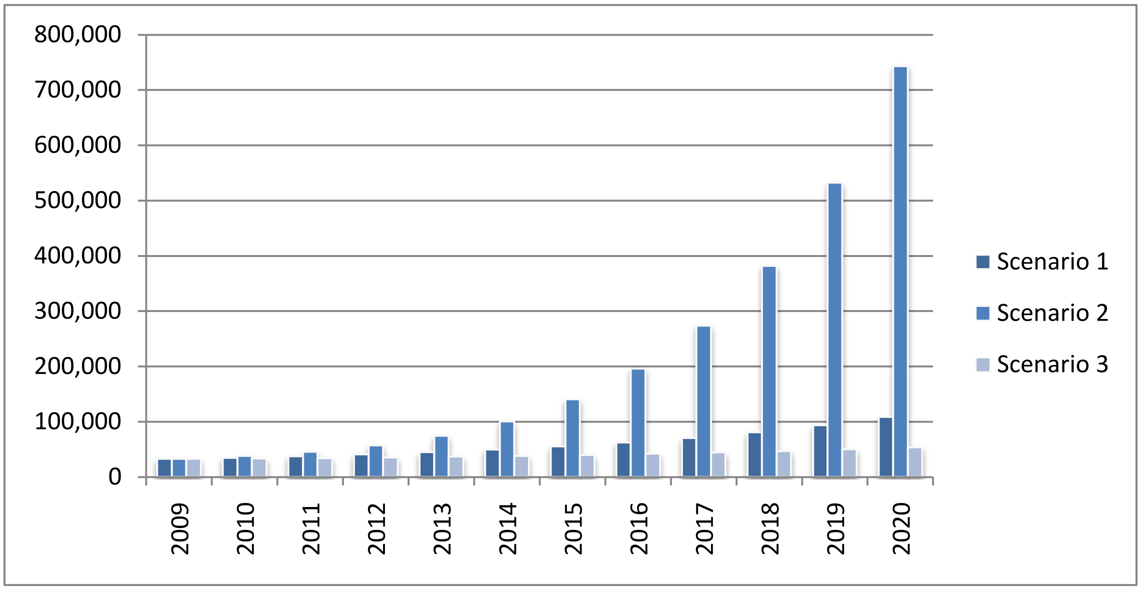

Exhibit 74 Projected Employment under various scenarios

Based on the industry growth estimated in base case scenario, the employment generation from Hi Tech Sector in Bangladesh is estimated to grow to about 108,000 employees by 2020.

Further, based on the average area requirement benchmark of 100 sft per person, the employment generated has been translated into area requirement in Million sft. The incremental area requirement on a year to year basis has been illustrated below.

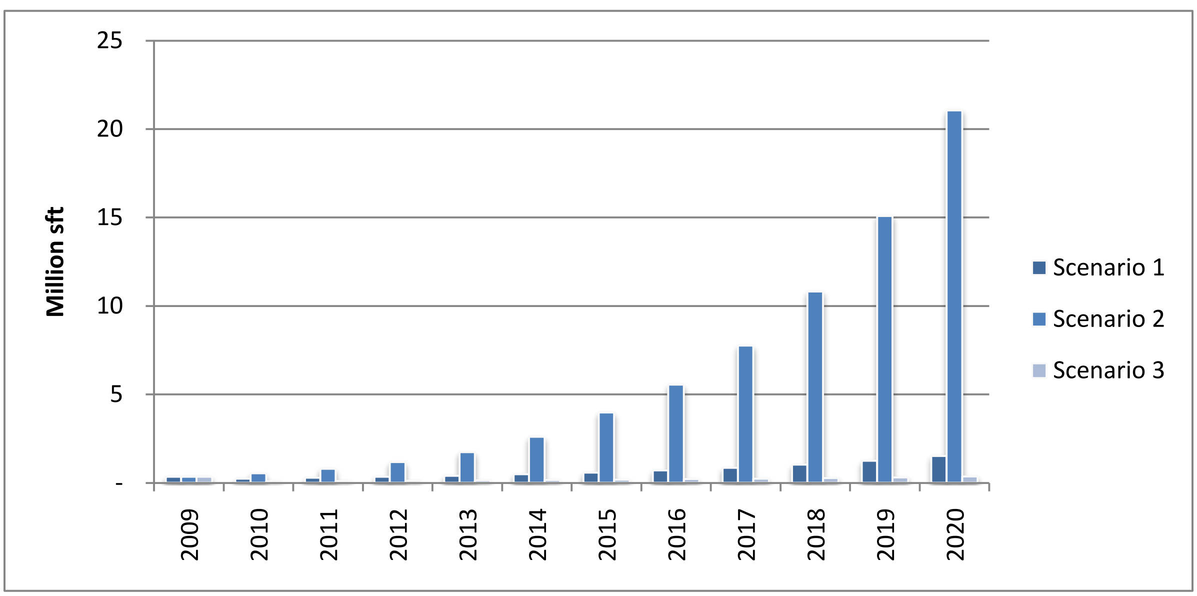

Exhibit 75 Incremental Space Requirement (in Mn sft)

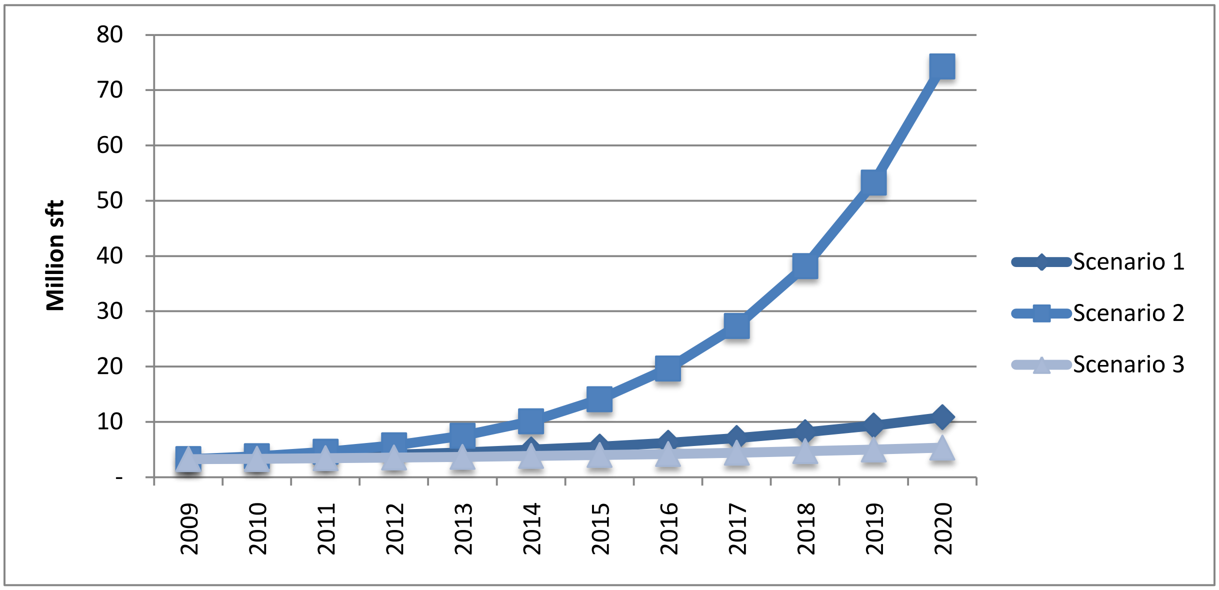

Exhibit 76 Cumulative additional space requirement for Bangladesh ICT industry

As indicated in Exhibit 76 Cumulative additional space requirement for Bangladesh ICT industry the cumulative additional space requirement under the base case scenario is expected to reach around 10 Million sq ft by the year 2020. As opposed to this, the cumulative additional demand for ICT space in Bangladesh is approximately 5 Million sq ft by the year 2020 under the pessimistic scenario and 74 Million sq ft under the optimistic scenario. It may be noted that the optimistic scenario, would depend on a number of enabling factors including support from the government, establishment of educational linkages as well as a positive response from foreign investors.

It has been assumed that some of the major constraints presently confronting the technology industry such as cost of infrastructure availability, industry-clustering and organization, availability of training & technical education institutions etc. would be mitigated through the Hi Tech park development. The present rate of growth of graduates in Bangladesh is around 7-8% which significantly lags the projected growth of employment in the industry, indicating thereby, the need for educational infrastructure to be bundled into the KHTP concept.

The development of the park is expected to bring about an improvement in the quality of education and trainability of the existing workforce through provision of supporting infrastructure, thereby acting as catalyst for manpower retention, thus driving the growth of revenues and the industry as a whole.

5.3.1 DEMAND ALLOCATION

After the assessment of demand from the industry under various growth scenarios, a proportion of the incremental (year on year) demand has been allocated to the Kaliakoir Hi-tech Park project. The factors taken into consideration in this process have been discussed below:

- Kaliakoir Hi-tech Park would be the first-of-its-kind facility being proposed in Bangladesh for the ICT industry. Based on market study, there is no other similar ICT facility being envisaged as of now, apart from the Kaliakoir Park.
- The availability of quality infrastructure within an organized dedicated industrial cluster is expected to act as a strong catalyst to channeling of future demand to the park.

- Currently, most of the players operate from their own facilities and many of them are in central Dhaka. Rentals charged for space within the park would be significantly cheaper than what companies presently incur for renting space outside. Coupling the benefits of superior infrastructure with lower prices is expected to contribute to demand for space at the Hi tech park
- Future demand for ICT space is expected to accrue to the park largely on account of new demand for space by existing domestic players. It does not factor in shifting of existing units into the KHTP or substantial increase in foreign players establishing their presence in Bangladesh, both of which are distinct possibilities which would further enhance the prospects of the Park.
- Relocation/migration of units can be considered as fair possibility on account of the following factors:
    - Costs involved with leasing of space would be significantly lesser compared to rentals paid for spaces occupied at present (Comparatives of prevailing rates have been presented in the later sections)
    - Units would have easy access to skilled manpower since a University and a training centre have been proposed within the Park
    - The park would act as a self-sufficient integrated development, where the industrial zone would be complemented by well-planned residential & recreational zones
    - Critical infrastructure in terms of Internet bandwidth, 24X7 power etc. could be centrally maintained and shared so as to reduce overall cost of operations thus assuring quality and continuity of operations

With respect to competing locations within Bangladesh, we understand that no similar projects are presently under consideration. Discussions with supporting agencies promoting the development and growth of ICT industry in Bangladesh such as BASIS revealed that while there have been various plans to develop alternate IT/ITeS hubs in the suburbs of Dhaka, no concrete plans are expected to materialize in the near future. Consultations with stakeholders revealed that BASIS had proposed a handover of approximately 68 acres in Mohakali Industrial Estate for development of an Incubator/Software Technology Park. However, the project has not been evaluated post the proposal stage and the proposal faces considerable land acquisition challenges. While Mohakhali has a location advantage of Kaliakoir, the following would redound to the advantage of the latter:

- Land acquisition has not yet been commenced and is expected to considerably delay the process whereas land is in complete possession at Kaliakoir
- Price of the land, being in central Dhaka is expected to be very high as compared to Kaliakoir
- The area is considerably smaller and the benefits of spreading infrastructure costs would be accordingly smaller

Other alternatives for players in the technology centre include scattered facilities within Dhaka, as is the case presently. While the existing Software Technology Park (STP) at BSRS Bhaban charges very low lease rentals of USD 0.22 per square feet, no space is available at the facility at present. Outside the STP, commercial space is very expensive as compared to Kaliakoir.

Typically most of the smaller establishments with 25 or fewer employees operate from within residential spaces and would, in any case, not form a part of the focus tenants for the KHTP. For the larger companies, it is expected that a substantial number would find the KHTP very attractive given the pricing of alternatives within Dhaka city. However, since location decision are often made by senior executives who reside in the heart of the city and are generally disinclined to increase their commute times, the process of shifting may be gradual although we believe that the quantum of the cost differential will eventually force many to move. Since a fairly well-developed suburb exists at Uttara which is closer to the KHTP (45 minutes) and since the KHTP would itself include very high quality housing, and in addition, prompt the development of surrounding areas, this issue is likely to get resolved in the long run. It may be noted here that a high speed rail link, as previously suggested using the existing railway line, would greatly boost the project prospects.

Taking into consideration the pros and cons discussed above as well as the proportion of the medium/large scale companies in the ICT industry in Bangladesh, we have assumed a gradually "ramped up" approach towards the market share of the Kaliakoir Tech Park. For the first 5 years, starting in the year 2011, the market share of the Kaliakoir Hi-tech Park has been assumed in the range 33% - 50% of the total demand for space by technology companies in Dhaka. Post year 5, the market share for demand attracted by Kaliakoir Hi Tech Park has been kept at 50% of the incremental demand for ICT space. This has been done in line with the observations made earlier with respect to the Park's competitive positioning.

The corresponding land off-take for the Processing Area is given in the chart below. In the base case, it takes a total of 12 years from the start of operations for space in the KHTP to be completely filled out. In the pessimistic and optimistic cases, the corresponding numbers of years are 33 and 4 respectively.

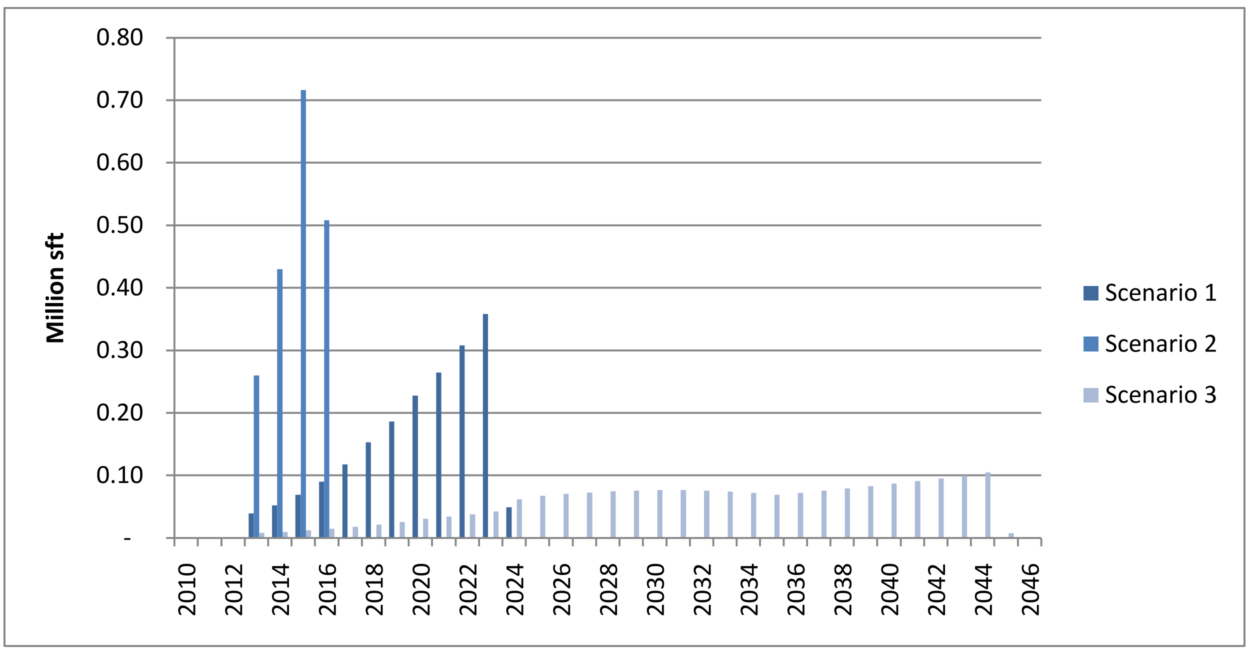

Exhibit 77 Offtake for the processing area under various scenarios

5.3.2 SUPPORT INFRASTRUCTURE FOR RESIDENCE

Social infrastructure components would be an essential feature of the KHTP for reasons discussed above. Of the total employment of about 63,000, the following assumptions have been made:

- 40% of the total park employees would be married with an average family size of 3

- 5% and 15% of married and single residents, respectively can be accommodated within the park premises although the actual demand is likely to be higher – some of this would be catered to by residential developments which are likely to mushroom in the surrounding area.
- Based on master planning discussed in the section below, a total of 4.25 Mn square feet can be dedicated for residential purposes. In the base case, this is expected to be absorbed in about 12 years with a lag of 2 years from the commencement of park operations

5.3.3 LAND USE AND MASTER PLAN

The total land area of the KHTP is about 262 acres. Of this roads & open areas and utilities would account for about 95 acres. The total space that can be created within the park would be 14.51 Mn square feet by applying a Floor Space Index (FSI) of 2 on the balance area (166 acres).

Of this land/space for a number of components have to be earmarked from a planning point of view, each of which would involve creation of a certain amount of built-up space, leaving the balance for residential and office space (which would essentially house ICT businesses). The following table presented these components and the corresponding built up space requirements.

Component	Area (In Acres)	Built-up Space (In Million sft)
Admin Building and Entrance Plaza	3.44	0.30
Logistics	5.26	0.16
School	7.16	0.31
University	25.6	1.12
Hospital	3.17	0.21
Training Centre	10.22	0.67
Recreation	5.73	0.17
Mall and Hotel	7.32	0.64
Hardware, logistics and admin	9.82	0.30

Exhibit 78 Component-wise area and built-up space requirement

As the table above indicates, the components above would take up a total space of about 3.87 Mn square feet, leaving a balance of about 10.63 Mn Sqft for development as office and residential spaces. This has been split in 60:40 ratio to yield:

- 6.38 Mn Sqft of office space
- 4.25 Mn Sqft of residential space

Of the 6.38 Mn sqft of office space, it is envisaged that the KHTP master developer would only construct 30% (or 1.91 million square feet) as Multi-tenanted Buildings (MTBs) and lease the rest as serviced land to other developers. This is a conservative assumption, since built up space would typically yield more than plain serviced land. The rationale for doing this would be to minimize off-take risk as well as capital commitment.

The residential space is further divided into dormitories (for single employees), high rise, mid rise and villas. The total built up area of and the percentage of single and married employees opting for each type of accommodation are given in the table below:

Type	Married	Single
Dormitory	0%	25%
High Rise	55%	65%
Mid Rise	35%	10%
Single Family Villas	10%	0%

Exhibit 79 Residential space breakup for single & married employees

The final land use plan for the KHTP is given below:

Component	Area (in Acres)	Area (In Mn sft)
Roads, Open Areas	81.38	-
Utilities	14.1	-
Admin Building and Entrance Plaza	3.44	0.30
Logistics	5.26	0.16
School	7.16	0.31
University	25.6	1.12
Hospital	3.17	0.21
Training Centre	10.22	0.67
Recreation	5.73	0.17
Mall and Hotel	7.32	0.64
Hardware, logistics and admin	9.82	0.30
PA	53.28	6.38
NPA/Residential	35.52	4.25

Exhibit 80 Land-use plan

5.3.4 AREA OFF-TAKE

The total space off-take for commercial and residential space is given in the chart below. While both MTBs and residential space take 12 years to get absorbed, the latter lags the former by two years. The first year of operations is assumed to be year 2013, after accounting for project development and construction time.

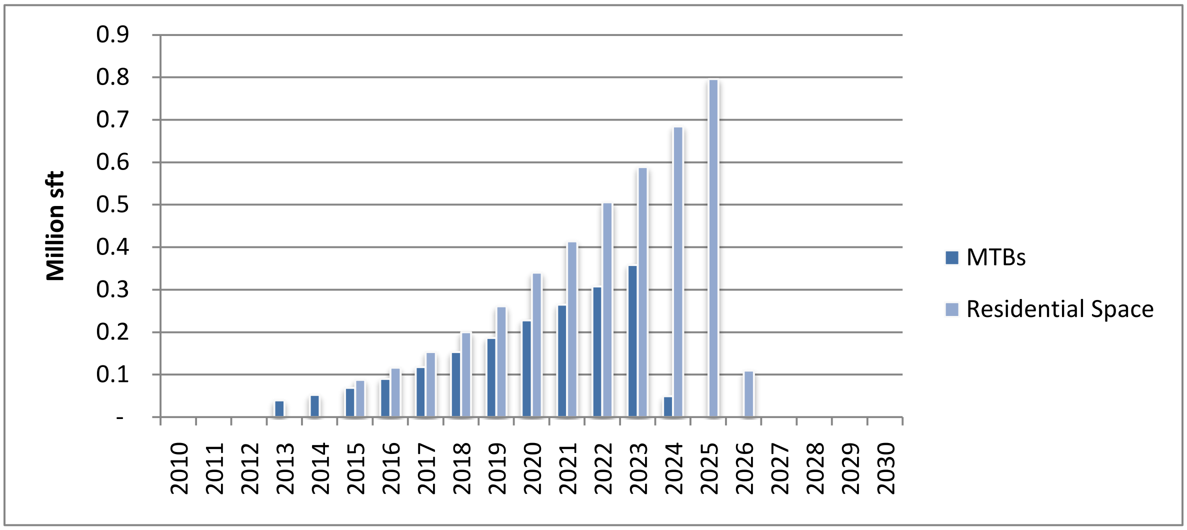

Exhibit 81 Offtake for MTBs and residential components in the base case

The absorption of various support components is given in the table below.

Component	Year of Absorption
Utilities	2012
Admin Building and Entrance Plaza	2012
Logistics	2013
School	2015
University	2015
Hospital	2015
Training Centre	2013
Recreation	2015
Mall and Hotel	2015

Exhibit 82 Absorption for support components

5.3.4.1 PHASING OF DEVELOPMENT

The Park is envisaged to be developed in phases. The phasing would enable the developing agency to suitably spread the development over the demand build up rather than developing the entire zone in one go. An added advantage would be that of utilising feedback from investors and users witnessed in the initial years so as to revise the phasing plan if necessary. This would imply phasing of developing the infrastructure and commissioning various utilities required. Given that the commercial operations are slated to start in the year 2013, the first phase construction would start in the year 2012. *The trigger for phase II would be activated when the zone occupancy reaches around 40%*. In the base case (scenario 1), this would happen in the year 2019. Therefore, in the base case, phase I development would start in the year 2012 and phase II development in the year 2019.

6 TECHNICAL PLANNING & DESIGN STUDY

6.1 INTRODUCTION

In the previous stages of this assignment, a basic planning and design study was conducted. The primary inputs to this were the site boundary & functional requirements of the facility being designed.

Subsequent to that, consultations with the BCC yielded further inputs to the design study. This was primarily to enhance the utility of the industrial zone being designed and also to incorporate views and insights from the BCC into the design of the zone.

Further, recommendations based on public consultations and environmental study, were also compiled in the form of the Resettlement Action Plan and the Environment and Social Management Plan.

Building on the basic design studies, the environmental and social recommendations as well as the insights from the BCC, the design of the zone was modified.

Based on the modified design, further detailing of the design in terms of the project components was carried out and a detailed engineering study was undertaken. The results of this detailed engineering design study are presented in this report.

6.1.1 OBJECTIVES OF THE DETAILED DESIGN

The following are the objectives sought to be achieved by the detailed engineering study:

- Detailing engineering plans (master plans & utility layouts)
- Overall master planning architecture for the zone being developed
- Incorporation of social and environmental components in the engineering design of the project
- Technical specifications and guidelines to be followed while developing the zone

The following section encompasses the considerations that formed part of the inputs to the design study at this stage of the assignment.

6.1.2 FINAL DESIGN CONSIDERATIONS

A snapshot of inputs considered for carrying out the final design of the zone is included in this sub-section.

6.1.2.1 SOCIAL AND ENVIRONMENTAL STUDY

- Construction of alternate village approach road through Kaliakoir *Pourashava*;
- Zoning of the Park components in such a way that access to institutional facilities can be granted to local communities surrounding the Park area as well;
- Green belt along the road network within the zone has been designed, in which various trees such as fruits, medicine etc can be included.

Further, the environmental quality standards envisaged to be adhered to by the on-site infrastructure, based on the environmental study are summarized in the following exhibit.

<table>
<tr><th>Parameter</th><th>Globally followed Standards/ Guidelines</th><th>Bangladesh Standards</th><th>Comment</th></tr>
<tr><td>Ambient Air Quality</td><td>
<table>
<tr><th>Parameter</th><th>WHO guidelines (µg/m3)</th></tr>
<tr><td>Sulphur Dioxide</td><td>20 (24 hr mean)</td></tr>
<tr><td>Nitrogen Oxides</td><td>40 (annual mean)</td></tr>
<tr><td>Suspended Particulate matter (SPM_{10})</td><td>50 (24 hr mean)</td></tr>
<tr><td>Suspended Particulate matter ($SPM_{2.5}$)</td><td>25 (24 hr mean)</td></tr>
<tr><td>Carbon Monoxide</td><td>-</td></tr>
<tr><td>Ozone</td><td>100</td></tr>
<tr><td>Lead</td><td>0.5</td></tr>
</table>
</td><td>
<table>
<tr><th>Parameter</th><th>BD guidelines (µg/m3)</th></tr>
<tr><td>Sulphur Dioxide</td><td>365 (24 hour)
80 (Annual)</td></tr>
<tr><td>Nitrogen Oxides</td><td>100 (Annual)</td></tr>
<tr><td>Suspended Particulate matter (SPM_{10})</td><td>150(24 hour)
50 (Annual)</td></tr>
<tr><td>Suspended Particulate matter ($SPM_{2.5}$)</td><td>65(24 hour)
15 (Annual)</td></tr>
<tr><td>Carbon Monoxide</td><td>1000 (8 hour)</td></tr>
<tr><td>Ozone</td><td>-</td></tr>
<tr><td>Lead</td><td>0.5</td></tr>
</table>
</td><td>No diesel generation sets are envisaged to be established at the project site. Further, air quality monitoring is envisaged to be carried out by respective agencies responsible for operation of captive power generation units & other air polluting components etc.</td></tr>
<tr><td>Ambient Noise Standards</td><td>
<table>
<tr><th>Location</th><th colspan="2">WB guidelines dB(A)</th></tr>
<tr><td></td><td>Day</td><td>Night</td></tr>
<tr><td>Silent</td><td>-</td><td>-</td></tr>
<tr><td>Residential</td><td>55</td><td>45</td></tr>
<tr><td>Commercial</td><td>70</td><td>70</td></tr>
<tr><td>Industrial</td><td>70</td><td>70</td></tr>
</table>
</td><td>
<table>
<tr><th>Location</th><th colspan="2">BD guidelines dB(A)</th></tr>
<tr><td></td><td>Day</td><td>Night</td></tr>
<tr><td>Silent</td><td>50</td><td>40</td></tr>
<tr><td>Residential</td><td>55</td><td>45</td></tr>
<tr><td>Commercial</td><td>70</td><td>60</td></tr>
<tr><td>Industrial</td><td>75</td><td>70</td></tr>
</table>
</td><td>No ambient noise polluting project components are envisaged as a part of the site infrastructure. The respective agencies responsible for such noise generation are envisaged to be monitored by the proposed environmental monitoring agency at the site</td></tr>
</table>

Parameter	Globally followed Standards/ Guidelines		Bangladesh Standards		Comment
	Parameter	WHO Guidelines (mg/l)	Parameter	BD Guidelines (mg/l)	
Potable Water Guidelines	pH	6.5-8.5	pH	6.5-8.5	The water treatment infrastructure at the site has been designed considering the applicable standards.
	TDS	500	TDS	1000	
	BOD	Nearly 0	BOD	0.2	
	Turbidity	5 NTU	Turbidity	10 NTU	
	Fluoride	1.5	Fluoride	1	
	Nitrite	0.91	Nitrite	<1	
	Sulphide	0	Sulphide	0	
	Ammonia	1.5	Ammonia	0.5	
	Chloride	250	Chloride	150-600	
	Iron	0.3	Iron	0.3-1	
	Phosphorus	-	Phosphorus	0	
	Arsenic	0	Arsenic	0.05	

Exhibit 83 Environmental Quality Standards Consideration for Engineering Design

6.1.2.2 FEEDBACK FROM THE BCC

The feedback provided by the BCC to the consultants based on the basic planning and design study has been provided as a snapshot in the following exhibit.

Aspect	Feedback
Observed site area	It was agreed that, in the survey, parts of water bodies have added to the site area, and that the site area of 264 acres as surveyed by the consultants is therefore accurate
Land parcellation and allotment	Further to the zoning carried out in the basic planning study, it was agreed that the detailed engineering design would include land plot parcellation and industry wise allotment of the same
On-site roads	Rationale of including a green belt and sidewalks along with the on-site roads was agreed to.
Constraint due to rail line	Rail over-bridge for seamless connectivity within the site zones was agreed to
Site zoning with respect to community access to on-site facilities	It was conveyed that access to on-site facilities should be shared with the surrounding communities.

Exhibit 84 Feedback from BCC on Basic Planning Study

6.1.2.3 IMPLICATIONS OF SITE SPECIFIC STUDIES

- A topographic study facilitated the estimation of the volume of cutting and filling required at the site. The net filling/ cutting volume of land required at the site, was estimated at the basic planning stage based inputs from the topographic study.
- The design of overall master-plan architecture of the park was prepared in compliance with the environmental & social study. For instance, provision of pocket gates for access to communities from surrounding villages was considered, based on public consultations. Further, an alternate village approach road was designed based on the feedback from the surrounding community.
- Inputs from the land off-take and market studies were considered to arrive at the zoning and land parcellation for the project site.

6.1.2.4 STANDARDS FOLLOWED

In addition to the environmental standards adhered to, the following exhibit captures a snapshot of the standards followed, in terms of the floor area ratio etc.

Description	Design Standard Criteria
FAR	Bangladesh National Building Code
Occupant Load	Bangladesh National Building Code
Setback	Bangladesh National Building Code

Description	Design Standard Criteria
Water supply	Bangladesh National Building Code for all areas except industrial area
Sewerage system	Bangladesh National Building Code
Sewerage system appurtenances	Bangladesh National Building Code
Storm water drain	Bangladesh National Building Code
Common area lighting	Bangladesh National Building Code
Road network	Bangladesh Standard schedule of rates

Exhibit 85 Standards Followed for the Design

The following sections further elaborate components involved in the design of the zone.

6.2 SITE DEVELOPMENT

Details of the site development are included in this section. Further to the basic planning study, the focus components are site development and the phasing of on-site infrastructure development.

Detailed workings for the Bill of Quantities (BoQ) and detailed design drawings have been included as an annexure to this report.

6.2.1 ADEQUACY OF DESIGN FOR CLIMATE CHANGE

The site grading and design along with the storm drain system has been proposed to cater to the possible impacts of global climate change, in terms of probability of flash floods and increased precipitation. This section elaborates the fact that the design proposed by the consultants takes into consideration the possible impacts of the climate change and has been prepared accordingly.

6.2.1.1 PRECIPITATION

The precipitation details indicated in the report on Climate Change Prediction Modelling Generation of PRECIS scenarios for Bangladesh (Validation and Parameterization) dated November 2008 are well within the limits of peak rain fall considered for the design of storm water drainage system. Hence the design takes care of the impact due to increase in precipitation. Some of charts and values are reproduced for easy reference.

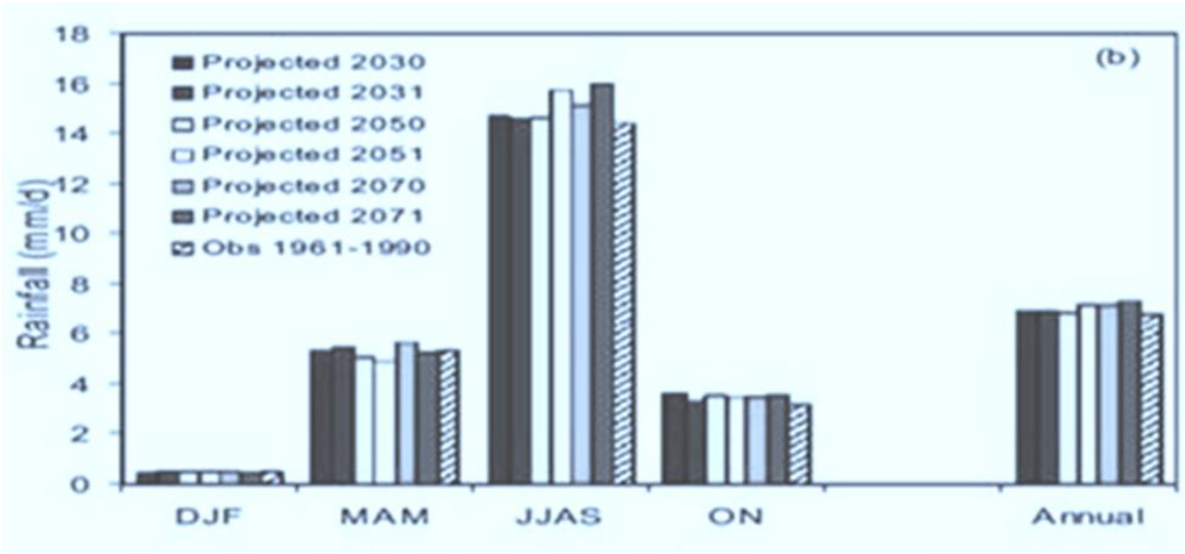

Fig. 17 (b). Seasonal and annual amount (mm/d) of projected rainfall.

Source: Report on Climate Change Prediction Modelling Generation of PRECIS scenarios for Bangladesh (Validation and Parameterization) dated November 2008- Climate Change Cell

PRECIS generated rainfall (mm/d) scenario in 2050.

	2050 m1	2050 m2	2050 m3	2050 m4	2050 m5	2050 m6	2050 m7	2050 m8	2050 m9	2050 m10	2050 m11	2050 m12
Barisal	0.11	0.66	0.67	0.54	2.97	22.10	9.88	10.53	10.02	1.20	0.20	0.05
Bhola	0.13	0.86	1.19	0.61	3.10	26.15	10.07	10.71	10.70	0.85	0.12	0.06
Bogra	0.06	0.39	0.96	1.04	9.83	18.28	13.95	12.35	10.20	0.68	0.06	0.10
Chandpu	0.08	0.68	1.01	0.63	2.78	20.16	7.29	9.08	10.10	1.07	0.10	0.05
ChittAP	0.36	1.24	1.95	2.11	6.34	24.99	3.51	6.18	4.48	0.33	0.18	0.31
Comilla	0.08	0.76	1.42	0.93	3.06	18.90	7.86	10.04	10.56	0.99	0.09	0.05
Coxbaza	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Dhaka	0.06	0.42	1.48	0.78	6.12	20.64	11.01	10.57	12.12	1.07	0.23	0.07
Dinajpu	0.06	0.34	0.55	1.39	8.45	17.78	15.93	11.86	10.83	0.63	0.00	0.04
Faridpu	0.06	0.32	0.94	0.63	4.15	17.73	11.00	8.93	8.80	0.83	0.18	0.07
Feni	0.16	1.12	1.92	1.21	5.00	22.92	7.55	10.33	9.25	1.06	0.15	0.08
Hatiya	0.26	1.35	1.74	1.41	4.11	27.89	4.89	7.63	9.18	0.35	0.04	0.09
Ishurd	0.06	0.18	0.76	0.45	5.30	15.92	13.33	8.88	6.68	0.60	0.10	0.16
Jessor	0.07	0.27	0.55	0.52	3.42	16.51	12.22	7.66	5.40	1.16	0.13	0.11
khepup	0.11	0.63	0.64	0.40	3.00	27.99	11.20	12.14	9.27	0.72	0.19	0.05
Khuln	0.08	0.32	0.41	0.52	2.78	16.72	12.37	8.31	5.28	1.33	0.16	0.12
Kutubdi	0.32	1.27	2.04	1.97	6.94	29.33	2.61	4.37	3.62	0.31	0.23	0.30
Mcourt	0.11	1.17	1.60	0.79	3.19	23.77	8.28	10.79	10.94	0.98	0.05	0.04
Madarip	0.08	0.58	0.91	0.63	2.92	19.48	8.96	9.48	10.68	1.24	0.20	0.06
Mongla	0.08	0.32	0.41	0.52	2.78	16.72	12.37	8.31	5.28	1.33	0.16	0.12
Mymensi	0.14	1.03	2.73	2.59	14.64	18.68	10.72	9.78	13.55	0.51	0.15	0.15
Patua	0.11	0.63	0.64	0.40	3.00	27.99	11.20	12.14	9.27	0.72	0.19	0.05
Rajshah	0.07	0.27	0.72	0.59	6.22	17.55	13.45	8.91	7.45	0.48	0.10	0.15
Rangam	0.29	0.87	1.78	1.35	6.13	20.63	5.58	6.14	5.80	0.99	0.02	0.04
Rangpu	0.04	0.52	0.84	1.63	10.10	16.38	16.59	11.25	12.24	0.43	0.01	0.03
Sandwi	0.31	1.75	2.68	2.72	5.84	27.15	5.24	7.98	6.97	0.28	0.15	0.09
Satkhir	0.07	0.22	0.36	0.49	2.73	16.58	13.71	8.15	4.65	1.28	0.09	0.15
Sitakun	0.14	0.88	1.57	1.28	4.82	19.15	7.50	9.97	10.99	1.44	0.17	0.08
Srimong	0.09	1.18	2.56	2.08	8.19	15.44	8.54	8.84	10.62	0.75	0.15	0.11
Syedp	0.06	0.34	0.55	1.39	8.45	17.78	15.93	11.86	10.83	0.63	0.00	0.04
Sylhet	1.28	4.60	12.43	15.59	28.45	17.26	15.53	12.40	14.43	1.20	0.68	0.22
Tangai	0.05	0.44	1.06	0.85	8.11	17.09	11.63	9.83	9.76	0.62	0.12	0.08
Teknaf	0.08	0.86	0.77	1.63	11.09	49.72	5.35	8.26	5.77	0.15	0.04	0.04
Country	0.16	0.84	1.57	1.57	6.45	21.90	9.94	9.33	8.78	0.80	0.14	0.10
Normal	**0.51**	**0.66**	**1.74**	**4.70**	**9.32**	**16.48**	**17.39**	**13.39**	**10.01**	**4.96**	**1.28**	**0.25**

Exhibit 86 Projected Rainfall Data, 2050

Source: Report on Climate Change Prediction Modelling Generation of PRECIS scenarios for Bangladesh (Validation and Parameterization) dated November 2008- Climate Change Cell

6.2.1.2 FLOODING

The study of flood details were conducted for seven districts namely Faridapur, Sirajganj, Sunamganj, Sathkira, Barisal, Gaibandha & Pabna. Out of the seven districts Sirajganj district is closer to Kaliakoir EPZ site. For other sites the details are not available / no impact due to climate change.

In the study area (Sirajganj) the raise in flood level in the year 2040 is estimated as 15.17m from 14.81 m as on 2004. Kaliakoir site is well far away from the study area and hence the impact will be much lower than the estimated in the study area. The site grading is considered 1.32m above the maximum flood level. Hence the design takes care of the impact due to increase in Flood level.

The following exhibit captures the study results carried out in this regard.

Jamuna river. It is also seen that increase of flood level is also very high in a normal flood event in the Ganges river, which is more than 50cm. Statistical analysis of historical time series of annual peak flow shows frequency of moderate flood has increased considerably from early eighties.

Table 6.2: Change of flood level and duration due to climate change (Moderate Flood)

Station	Duration of flood			Maximum Flood level			Maximum Flow		
	Flood Level (m PWD)	Flood Event		Flood Event		Depth increase in 2004	Flood Event		Flow increase in 2004
		2004	2040	2004	2040		2004	2040	
Bahadurabad	19.5 (Danger Level)	10 days	16 days	20.19 mPWD	20.56 mPWD	37 cm	85,921 m^3/s	99,036 m^3/s	13,115 m^3/s
	20	3 days	8 days						
Sirajganj	13.75 (Danger Level)	17 days	19 days	14.81 mPWD	15.17 mPWD	36 cm	86,500 m^3/s	99,800 m^3/s	13,300 m^3/s
	14.5	6 days	10 days						
	14.7	3 days	8 days						
	15	0 days	3 days						

Table 6.3: Change of flood level and duration due to climate change (Average Flood)

Station	Duration of flood			Maximum Flood level			Maximum Flow		
	Flood Level (m PWD)	Flood Event		Flood Event		Depth increase in 2005	Flood Event		Flow increase in 2005
		2005	2040	2005	2040		2005	2040	
Bahadurabad	19.5 (Danger Level)	0 days	5 days	19.34 mPWD	19.61 mPWD	27 cm	67,060 m^3/s	71,064 m^3/s	4,004 m^3/s
	19.28	3 days	14 days						
	19	15 days	26 days						
Hardinge Bridge	14.25 (Danger Level)	0 days	11 days	14.05 mPWD	14.68 mPWD	63 cm	44,278 m^3/s	54,234 m^3/s	9,956 m^3/s
	14	2 days	27 days						
	13.9	4 days	34 days						
	13.5	25 days	54 days						

Exhibit 87 Flooding Related Climate Change Projections

6.2.2 INFRASTRUCTURE DEVELOPMENT PHASING

Based on the market study/ land off-take component of the assignment, infrastructure development phasing was arrived at. The objective of attempting to club infrastructure phasing as closely as possible with the land off-take schedule was to optimize the investment grounded for on-site infrastructure development.

The following exhibit presents a snapshot of the methodology adopted to arrive at infrastructure development phasing.

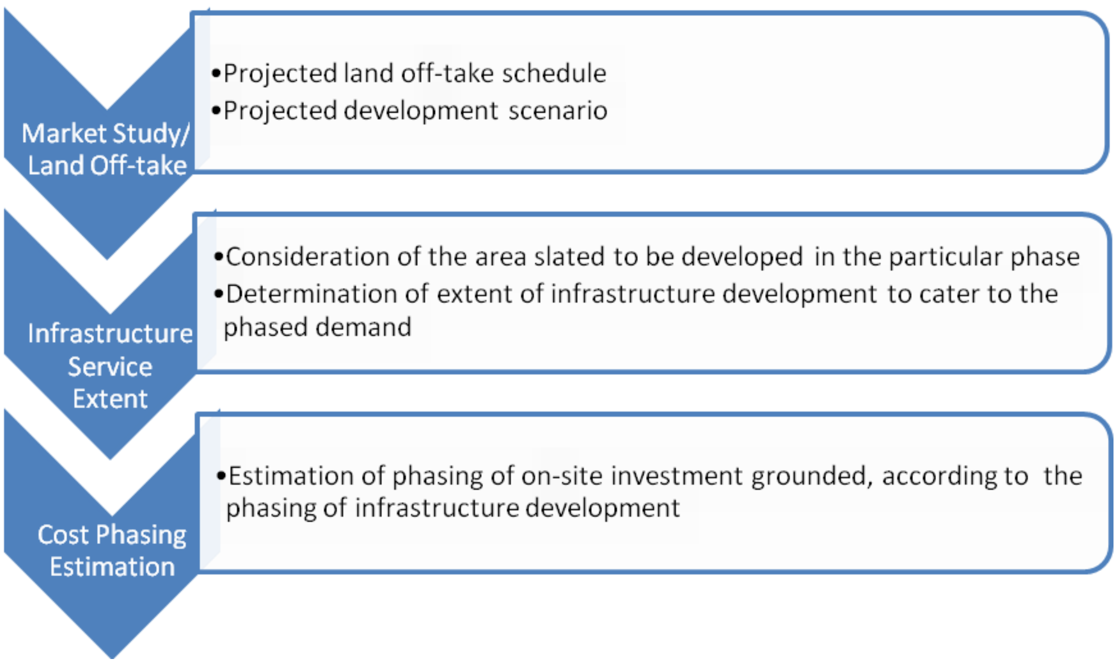

Exhibit 88 Infrastructure Phasing Methodology

Based on the above methodology, the infrastructure development schedule was prepared. The phasing schedule and the detailed drawings are annexed to this report, as mentioned.

6.2.2.1 SITE GRADING

As mentioned in the basic planning and design study, the proposed minimum finished ground level is +10.50 m in order to prevent flooding / water logging within the project area during rainy season. This is further to the maximum flood level being observed to be +9.18m at the site. Plinth level of all the buildings is recommended to be above the maximum flood level. The contour map was used to estimate the cutting and filling required at the site to achieve this. Based on the computations, the external earth required for filling is estimated to be about 1.201 million cubic m. Based on the above, detailed workings were carried out to arrive at the earthwork estimation and costing, and the same are included in the project costing, under site development head.

The guidelines to be adhered to while selecting the site for borrowing the landfill material, operating the facility and closing the same have been annexed to this report.

6.2.2.2 BOUNDARY WALL

The entire site has to be secured with fencing /compound wall. Boundary wall construction executed by the BCC has already neared completion. Due to provision of village approach road planned along the inside of the northeastern boundary of the northern side of the site, it is proposed to construct another compound wall along the northeastern boundary in order to meet the closed enclave requirement. Industrial fencing is envisaged between category A & B (the processing and non-processing areas respectively) as well.

As mentioned in the Basic Planning Study, the assumptions made for designing the boundary wall are as follows:

- Site boundary as confirmed by the BCC
- Requirements of the alternate village access road and the access points to the Park

Hollow block construction, with running foundation has been considered. The lengths of various sections of the same are as follows:

- Railway fencing: 1620 running m.
- Village road fencing: 3100 running m.
- Fencing between the site area categories A and B is 1600 running m in length.\

Railway fencing along the portion of the rail tracks crossing the site has been designed. This is in order to ensure safety, and also to ensure that the rail over-bridge is utilized for crossing the tracks.

6.3 ROADS

A detailed road design was prepared, drawing inputs from discussions held with BCC and the contour survey carried out at the site. The site specific road requirements were discussed with BCC, while the extent of cutting/ filling and details of road grading were based on the contour survey.

6.3.1 ON-SITE TRAFFIC MANAGEMENT

Based on the traffic flow estimation carried out for the project site, the road design was developed.

For ready reference, the following exhibit presents a snapshot of the traffic volume estimation carried out at the basic planning stage.

Description	Total Area		Estimated population	Total No. of Vehicles	Total PCUs / day
	Acres	%			
	Category A (Industrial Area)				
1. Industries					
MTB	16.10	6.13	14022	1977	1922
IT/ITES Plots	35.33	13.45	30769	3886	4009
Hardware	9.32	3.55	8117	1068	1127
2.Customs,Security, Admin, entrance plaza	1.86	0.71	270	39	37

Description	Total Area		Estimated population	Total No. of Vehicles	Total PCUs / day
	Acres	%			
3.Warehouse	5.26	2.00	916	263	584
Total	**67.87**	**25.84**	**54094**	**7233**	**7679**
Category B (Non-industrial Area)					
4. Entrance Plaza	0.70	0.27	203	25	28
5. Residential	38.51	14.66	16769	4046	3895
6. Commercial & CBD	7.32	2.79	6375	1370	1301
7. Institutions, Social Amenities, Sports & Recreation	41.66	15.86	6047	813	856
8. Existing Admin Building	0.87	0.33	126	11	13
9. Training Centre	10.22	3.89	1483	198	208
Total	**99.28**	**37.80**	**31003**	**6463**	**6301**
Other Areas					
10. Utilities	14.10	5.37	2456	294	316.5
11. Road	35.57	13.54	0		
12. Greenery	45.81	17.44	0		
GRAND TOTAL	**262.63**	**100.00**	**87553**	**13990**	**14295**

Exhibit 89 On-site Traffic Estimation – Methodology Snapshot

Further, in the detailed design phase, the following practical operational aspects of traffic management were considered:

- Avoidance of direct intersection of major on site roads, for added safety;
- Incorporation of adequate green buffer along the roads, to ensure effective usage of the sidewalks by the employees of the Park.

In addition to these, the signage scheme etc recommended in the previous design phase would remain unchanged.

6.3.2 FINAL ROAD DESIGN

Considering the Bangladesh schedule of rates, the design of roads carried out at the previous stage of the assignment was refined. A snapshot of the final design of the roads is shown in the following exhibit.

Layer	Composition Details
Wearing Course	Seal coat with 1 kg/ sqm. With 60/70 or 80/100 penetration grade, conforming to the requirement of the ASTM/AASHTO standards.
Binding Coat	A tack coat of 1.25 kg/ sqm. of 60/70 or 80/100 grade bitumen.
Asphaltic Base	Bituminous macadam 50 mm thick in 1 layer, laid with mechanical spreaders.
Binding Coat	A prime coat of 1.2 l/ sqm. of 60/70 or 80/100 grade bitumen.

Layer	Composition Details
Base Course	WBM 225 thick in 3 layers, consisting of 75 mm thick each.
Sub-base	Brick soling layer.

Exhibit 90 Road Design as per Bangladesh Schedule of Rates & International Standards

The road design in terms of the lane width is carried out based on the revised traffic volume estimates. The following exhibit presents a snapshot of the road categories designed further to the same.

Category	Road Width (m)	Carriageway Width (m)	No of lanes	Length (m)
Major Arterial Road	30.0	7.5 + 7.5	4 lanes (with 2.0m central divider)	2239
Primary Road	24.0	5.5 +5.5	Two lane	1425
Secondary Road	18.0	4.0 + 4. 0	Two lane	1912
Tertiary Road	12.0	3.0 + 3.0	Two lane	408
Village Approach Road	6.0	3.50	Single Lane	3046
			Total Road Length	**9030**

Exhibit 91 Revised Details of Road Categories

6.3.3 RAIL OVER-BRIDGE

A rail over-bridge has been recommended to be constructed to connect the two sections of the project site divided by the rail line passing through the site.

The consultants were informed by the Bangladesh Railways that the approval from the BR department for the RoB would be provided within 3 months of application. The application would need to be submitted to Chief Engineer (East), Bangladesh Railway (BR) along with the diagram and reason for constructing the RoB. The application is then to be sent to the Dhaka Divisional office where the DRM (Dhaka) shall undertake the site survey and submit a report with his recommendations and comments to the CE (East). Thereafter, the report is to be sent along with the application to the GIBR, who shall grant the approval.

6.3.4 STREET LIGHTING

Street lighting design has remained unchanged from the pre-feasibility stage of the assignment. The governing principle for the design has been provision of adequate light (minimum 20 Lux) on the road surface.

6.3.5 WALKWAYS & POCKET GATES

Based on the social impact assessment, it was observed that pocket gates to the village approach road running along the project boundary were necessary. Four such gates have been designed. The details with respect to the location of the gates are provided in the drawings, included as an annexure to this report.

As in the previous stage of the assignment, walkways with adequate green buffer have been designed, in order to ensure maximum utilization of the walkways by pedestrians.

6.3.6 BUFFER REQUIREMENTS

Buffer areas are areas between the roadside and the construction of the units in the plots. They consist of a green buffer and a physical buffer. The green buffer is meant for tree planting / turf and small ancillary structures. Within the physical buffer, driveways, car / lorry parks, and other ancillary structures can be developed. The buffer requirements vary depending on the width of the road along which the buffer is designed.

The exhibit below captures a snapshot of the buffer requirements designed for the Kaliakoir Hi-Tech Park.

Road Width (m)	Green Buffer (m)	Physical Buffer (m)	Total Buffer (m)
30	6	6	12
24	4	4	8
22	4	4	8
18	4	4	8
15	2	2	4

Exhibit 92 Buffer Requirement According to Road Categories

6.4 UTILITY INFRASTRUCTURE

The basic planning study included utility demand estimation, preliminary estimation of possible utility sources, and block estimates of the on-site utility network design parameters.

Based on the same, sizing of the utility networks was carried out. This facilitated the estimation distribution components for different sub-zone-wise utility requirements.

6.4.1 POWER SUPPLY

As mentioned in the basic planning study, the power demand of the project site was estimated based on international standards with respect to the built up area, relevant industry norms and the projected population at the project site.

Types of power supply infrastructure components to be established catering to different sub-zones at the project site were designed in detail.

Further, it was emphasized in meetings with various project stakeholders that a resilient and robust power distribution network was required, in order to prevent supply interruptions to the entire project area, due to individual network arm failures. This aspect has also been incorporated in the design of the power supply network.

As per the conclusion of the previous design phase, an over-head power distribution network for 11 kV line and an underground distribution network for 33 kV line have been considered for the design.

The detailed drawings of the network design have been included as annexure to this report.

6.4.2 WATER TREATMENT & SUPPLY

Ground water is envisaged as the primary source of water for the project operations. Based on the same, filtration of the water followed by chlorination is considered for treatment of water, as mentioned in the basic planning study. Further, a hydro-geological study was carried out in order to assess the potential of ground water sourcing at the project site, and also to identify and recommend ground water recharge mechanisms. The study report has been annexed herewith.

6.4.2.1 WATER SOURCING

For ready reference, water sourcing reference has been included in this sub-section. As mentioned before, ground water is envisaged as the source for the water supply at the site. However, adequate recharging & alternative sources of water including recycling are envisaged to be incorporated in the design of the systems to minimize the impact of the Park on the surroundings & ensure sustainability.

The following sub-sections detail the parameters of the water transmission & distribution network design.

6.4.2.2 STORAGE RESERVOIR SIZING

Based on the design criteria adopted which was in turn influenced by the demand estimation and the distribution requirements, detailed design of storage reservoirs (both ground level and elevated storage) was carried out. This included storage capacity detailing as well as the staging height determination for the overhead storage reservoirs.

The following exhibit presents a snapshot of the revised underground storage reservoir sizing (storage towards 24 hrs demand).

Description	Underground Storage Reservoir Capacity in cu.m.	
	Potable Water	Non Potable Water
Category A	1200	1600
Category B		
Northern side of railway track (residential)	1600	1400
Southern side of railway track (institutional area)	350	400

Exhibit 93 Storage Reservoir Size Estimation

6.4.2.3 WATER TRANSMISSION NETWORK DESIGN

For water transmission from the storage reservoir to the overhead tank, transmission network designs as well as pump details were worked out.

A snapshot of the methodology adopted for the design of this project component is presented in the following exhibit.

Design Stage	Design Parameter	Value (input for selection)
1	Water demand (MLD)	1.255
2	Average Discharge (m^3/hr)	54.56
3	Head provided including additional head & losses (m)	76
4	Pipe length required for providing the elevation	50
5	Diameter of the pipe required (mm)	150

Exhibit 94 Water Transmission System Design Parameter Selection

It may be noted that the diameter for the pipe was selected based on optimization of the cost involved in establishing a system. A snapshot of the comparative analyses of various system parameters is presented below. It may be noted here that the overall cost estimate used as the optimization parameter includes the total investment, including the costs of pumping machinery etc.

Sl. No	Internal diameter (mm)	Head due to friction & other losses (m)	Velocity (m/s)	Total head (m)	Power required for peak discharge (kW)	Approx. overall Cost USD'000	Optimum? (Y/N)
1	50	57.7	7.72	76.10	15.08	21.86	N
2	63	18.7	4.86	37.12	7.35	10.76	N
3	76	7.5	3.34	25.91	5.13	7.61	N
4	100	1.9	1.93	20.37	4.03	6.12	N
5	150	0.2	0.86	18.67	3.70	5.97	Y
6	200	0.06	0.48	18.47	3.66	6.53	N
7	250	0.02	0.31	18.42	3.65	7.19	N
8	300	0.009	0.21	18.41	3.64	7.70	N
9	350	0.004	0.16	18.40	3.64	9.26	N

Exhibit 95 Water Transmission System Parameter Selection

For other network parameter selection, a similar methodology has been followed. E.g. pipe diameters for various branches of the water distribution network were also selected based on the same methodology.

6.4.2.4 WATER DISTRIBUTION NETWORK DESIGN

Design of the water distribution network was carried out using WaterCAD® software. A representative snapshot of the analytical outputs is shown in the following exhibit.

Pipe length (m)	Inner Diameter (mm)	Base Flow (l/s)	Calculated Hydraulic Grade (m)	Pressure (m)	Sluice Valve		Air Valve		Scour Valve		Flow Meter	
					Qty	Size	Qty	Size	Qty	Size	Qty	Size
171.3	98.6	0.00	23.18	12.65								
124.66	66.8	3.69	20.74	10.21	1	100	1	40	1	100		
504.14	98.6	0.34	22.06	11.54								
139.29	98.6	0.54	21.24	10.72								
179.22	56.2	0.12	21.23	10.70	1	100	1	40	1	100		
24.69	98.6	0.94	21.10	10.57								
398.98	98.6	3.72	19.94	9.41	1	100	1	40	1	100		
145.69	56.2	0.67	20.87	10.35	1	100	1	40	1	100		
32	66.8	1.82	19.11	8.59								
105.16	66.8	2.19	20.59	10.06	1	100	1	40	1	100		
58.52	98.6	0.08	20.59	10.06	1	100					1	100

Exhibit 96 Snapshot of WaterCAD® Proceeding for Water Network Design

It may be noted here that the software utility used requires node coordinates of various pipe segments in the network, which have been input, based on the network design prepared. The columns in the exhibit above refer to various network parameters being designed. For instance, the pressure head reveals the hydraulic gradient at which water would be pumped through the pipes.

The design of the water distribution network has been carried out separately for industrial, residential and institutional areas, for potable and non-potable water supply. The network design drawings have been included as an annexure to this report.

It may be noted that all pipes have been designed considering HDPE (High Density Poly-ethylene) material, considering cost effectiveness, expeditiousness of establishment and the life of the pipes.

6.5 ENVIRONMENTAL INFRASTRUCTURE

Details of infrastructure components related to the environmental infrastructure of the site are included in this section.

6.5.1 STORM DRAINS

Based on the capacity requirements of the storm water drainage system (arrived at by studying the rainfall pattern at the project site), design of the sizing of the storm drain system was carried out. As in case of the basic design study, closed top RCC box storm drainage system has been designed.

A snapshot of the sizing methodology / calculation adopted for the design of storm drains is included in the following exhibit.

Pipe length (m)	Cumulative flow (m^3 /sec)	CULVERT?	Bottom width (m)	Up-stream ground level (m)	Down-stream ground level (m)	Total depth (m)	Up-stream invert level (m)	Down-stream invert level (m)
54.67	0.05		0.50	10.5	10.5	0.6	9.95	9.90
56.36	0.09		0.50	10.5	10.5	0.65	9.90	9.84
128.35	0.18		0.50	10.5	10.5	0.92	9.84	9.58
388.52	0.62		1.00	10.50	10.50	1.04	9.58	9.19
156.59	0.39		1.00	10.5	10.5	0.82	9.84	9.68
180.58	0.56		1.00	10.50	10.50	0.99	9.68	9.50
24.00	1.18	Yes	1.20	10.5	10.5	1.31	9.19	9.17
105.06	0.08		0.50	10.5	10.5	0.65	9.96	9.85
31.12	0.35		1.00	10.50	10.50	0.78	9.85	9.72
145.22	0.52		1.00	10.5	10.5	0.95	9.70	9.55
12.00	0.87	Yes	1.00	10.5	10.5	1.27	9.55	9.23

Exhibit 97 Snapshot of Drain Size Calculation

The columns of the exhibit above correspond to the different network parameters being designed. For instance, the total depth mentioned in the exhibit refers to the depth of water flow envisaged through the drain. Also, the pipe length parameter has been derived based on relevant network drawings which are annexed to the report.

Further, it may be noted here that a peak factor in terms of substantially higher design rainfall has been incorporated in the design of the storm drain system. The following exhibit captures a snapshot of the same aspect of design.

Culvert?	Rainfall max. per day (mm)	Rainfall Intensity MM/Hr (24hours)	Rainfall Intensity considered MM/Hr	Flow in Cum/Sec	Cumulative flow in Cum / Sec
	987.00	41.13	75.00	0.05	0.05
	987.00	41.13	75.00	0.04	0.09
	987.00	41.13	75.00	0.09	0.18
	987.00	41.13	75.00	0.43	0.62
	987.00	41.13	75.00	0.39	0.39
	987.00	41.13	75.00	0.17	0.56
YES	987.00	41.13	75.00	0.00	1.18
	987.00	41.13	75.00	0.08	0.08

Exhibit 98 Incorporation of Peak Factor in Storm Drain Design

6.5.2 SEWERAGE & SULLAGE TREATMENT

Based on the revised sewage volume estimation, the sizing of the sewerage and sullage treatment system proposed at the basic planning stage has been finalized.

It may be noted here that although in the basic planning stage, it has been emphasized that sewage and sullage is best treated separately for better recirculation of treated water, considering the sizing of the project being proposed, it would not be viable to separate the sewage and sullage treatment systems. Therefore, sewage and sullage are both designed to be treated with the same system.

The following exhibit presents a snapshot of the revised sewage & sullage (combined) volume estimation, along with the proposed treatment system sizing.

Park Zone	Estimated Sewage/ Sullage Generation (MLD)	Proposed Treatment System Sizing (modules x capacity)
Category A (Industrial/ processing area)	2.05	2 x 1.2 MLD
Category B (Residential etc/ non-processing area)	2.34	Institutional area: 2 x 0.3 MLD Residential area: 2 x 0.9 MLD
Utilities (roads etc)	0.17	Included in the corresponding category treatment system
Total	**4.56**	**4.8**

Exhibit 99 Revised Sewage/Sullage Volume Estimation & Treatment System Sizing

A snapshot of the calculations used for estimation of the sizing required for the sewage/ sullage system is presented in the following exhibit.

It may be noted here that both the FABR (fluidized aerobic bio reactor) and the ASP (activated sludge process) have been considered for the sewage and sullage treatment, and an option has been provided to choose any of the two treatment methods, based on the tendering process decision as well as availability of the technology. Further, the design of the STP also takes into consideration the fact that the operation of the plant would be prone to peak usage, and hence a peak factor of 2 has been incorporated in the design.

Sl.No	Design Details	STP 1	STP 2	STP 3	unit
1			**Bar Screen Chamber**		
	Normal Flow	0.63	1.73	2.08	MLD
	Normal flow	26.35	72.18	86.77	m3/hr
	Peak factor	2.00	2.00	2.00	multiplier
	Peak flow designed for	52.69	144.35	173.53	m3/hr
	No. of Screen Chambers	2	2	2	
	Detention Time	30	30	30	Sec
	Free Board	0.3	0.3	0.3	m
	Depth Assumed	1.5	1.5	1.5	m

Sl.No	Design Details	STP 1	STP 2	STP 3	unit
	Area of screen chamber	0.000	0.401	0.482	Sqm
	Length Assumed	0.4	0.65	0.7	m
	Width required	0.366	0.617	0.689	m
	Width recommended	0.4	0.6	0.7	m
	Recommended material of construction (MOC) of screen chamber	RCC with epoxy coating			
	Design Recommended	Provide2 No of 0.4 M length x0.4 m wide x1.8 m total depth	Provide2 No of 0.65 M length x0.6 m wide x1.8 m total depth	Provide2 No of 0.7 M length x0.7 m wide x1.8 m total depth	
2	**Collection sump**				
	No. of tanks	1	1	1	
	Retention time for normal flow	1.5	1.5	1.5	hrs
	Peak factor	2	2	2	
	Retention time considered	3	3	3	
	Volume	79.04	216.53	260.30	Cum
	Free Boad	0.30	0.30	0.3	m
	Liquid depth assumed	5	5	5.00	m
	Area of sump	15.81	38.11	52.05951461	Sqm
	Length Assumed	4.00	6.20	7.2	m
	Width required	3.95	6.15	7.230	m
	Width recommended	4.00	6.10	7.200	m
	Recommended material of construction of screen chamber	RCC with epoxy coating			
	Design Recommended	Provide1 No of 4 M length x4 m wide x5.3 m total depth	Provide1 No of 6.2 M length x6.1 m wide x5.3 m total depth	Provide1 No of 7.2 M length x7.2 m wide x5.3 m total depth	
3	**Fluidized Aerobic Biological Reactor**				
	Type	Attached growth system			
	Normal Flow	26.35	72.18	86.77	Cum/hr

Sl.No	Design Details	STP 1	STP 2	STP 3	unit
	No. of Reactors	4	4	4	Nos
	Hydraulic retention time	4	4	4	hrs
	Volume of each reactor	26.35	72.18	86.77	Cum
	Free Boad	0.5	0.5	0.5	m
	Liquid depth assumed	5.5	5.5	5.5	m
	Area of sump	4.79	13.12	15.78	Sqm
	Length Assumed	2.20	3.65	3.900	m
	Width required	2.177	3.600	4.045	m
	Width recommended	2.2	3.6	4.0	m
	Recommended material of construction of screen chamber	RCC with epoxy coating			
	Design Recommended	Provide4 No of 2.2 M length x2.2 m wide x6 m total depth	Provide 4 No of 3.645 M length x3.6 m wide x6 m total depth	Provide4 No of 3.9 M length x4 m wide x6 m total depth	
			OR		
3	Aeration tank				
	Type	Aerobic suspended growth system			
	Normal Flow	26.35	72.18	86.77	Cum/hr
	No. of aerators	4	4	4	Nos
	Hydraulic retention time	4	4	4	hrs
	Volume of each reactor	26.35	72.18	86.77	Cum
	Free Boad	0.50	0.50	0.50	m
	Liquid depth assumed	2.00	2.00	2.00	m
	Area of aerator	13.17	36.09	43.38	Sqm
	Length Assumed	5.10	8.50	9.40	m
	Width required	2.58	4.25	4.62	m
	Width recommended	2.60	4.30	4.70	m
	Recommended material of construction of screen	RCC with epoxy coating			

Sl.No	Design Details	STP 1	STP 2	STP 3	unit
	chamber				
	Design Recommended	Provide4 No of 5.1 M length x2.6 m wide x2.5 m total depth	Provide4 No of 8.5 M length x4.3 m wide x2.5 m total depth	Provide4 No of 9.4 M length x4.7 m wide x2.5 m total depth	
4			Clarifier		
	Normal Flow	26.35	72.18	86.77	Cum/hr
	No. of tanks	2	2	2	
	Hydraulic retention time	3	3	3	hours
	Volume	39.52	108.26	130.15	cum
	Free board	0.3	0.30	0.30	m
	Recommended MOC of clarifier	RCC with epoxy coating			
	Depth assumed	3.50	3.50	3.50	m
	Area required for clarifier	11.29	30.93	37.19	sqm
	Diameter of clarifier required	3.79	6.28	6.88	m
	Diameter of clarifier recommended	3.80	6.30	6.90	m
	Design Recommended	Provide2 No of 3.8 M dia x3.8 m total depth	Provide2 No of 6.3 M dia x3.8 m total depth	Provide2 No of 6.9 M dia x3.8 m total depth	

Exhibit 100 Sewage Treatment System Design – Methodology Snapshot with peak factor incorporation

The sewage collection network has also been designed to cater to the peak flows. The following exhibit presents a snapshot of the same.

Manhole reference		LENGTH	Flow	Cumulative flow	Peak factor multiplier	Peak flow	Proposed diameter
From	To	m	lit/sec	lit/sec		lit/sec	mm
31	31a	30	0.807	0.807	2.00	1.61	150
31a	31b	30		0.807	2.00	1.61	150
31b	31c	30		0.807	2.00	1.61	150
31c	31d	30		0.807	2.00	1.61	150
31d	31e	30		0.807	2.00	1.61	150
31e	31f	30		0.807	2.00	1.61	150

Manhole reference		LENGTH	Flow	Cumulative flow	Peak factor multiplier	Peak flow	Proposed diameter
From	To	m	lit/sec	lit/sec		lit/sec	mm
31f	32	25.96		0.807	2.00	1.61	150
32	32a	30	3.879	4.686	2.00	9.37	150
32a	32b	30		4.686	2.00	9.37	150

Exhibit 101 Peak Factor Incorporation in Sewage Collection System Design

The manhole references are based on the corresponding drawings included in the annex of this report.

6.5.3 SOLID WASTE MANAGEMENT SYSTEM

Preliminary estimation of projected solid waste volume generation was carried out at the basic planning & design phase. These estimates have been further refined, based on details available from detailed design of other project components.

Exhibit 102 recalls the methodology adopted for designing the solid waste management system at the site in the basic planning study. For bio-degradable waste, bio-composting has been recommended.

Non Bio Degradable Waste

From Commercial Area

From Industries / Units

From Street Sweeping, Garden / Landscaping, Construction debris

Recyclable Waste

Segregation according to material type like paper, steel, plastic etc

Storing in transfer stations

Disposing through PCB approved vendors for recycling

E - Waste

Industrial units responsible for collection & disposal

Source segregation by the individual units

Collection & transportation by PCB approved Recycler to be located

Street Sweeping & Construction Debris

Collected & used for land filling within the zone area to Secured Landfill

Non Recyclable Waste

Collection and disposing off to Secured Landfill

Exhibit 102 Solid Waste Management Methodology

It may be noted here that a separate area for secured land-fill has been designated on-site for solid waste management.

The following exhibit presents a snapshot of the methodology followed for the solid waste quantity estimation.

Mixed Garbage Estimation	
% To Windrow Platform Platform (A)	80.0
% of Waste to compost	23.6
% directly to landfill	5.0
% Rejection from Platform	17.4
% as Recyclable on (A)	15.0

No.	Year	(Tons)					
		SW collection	To windrow Platform	Reject from platform	Direct to landfill	Total Qty to Landfill per day	Landfill/year
1	2008	15.45	12.36	2.15	0.77	2.92	1,067
2	2009	15.91	12.73	2.22	0.80	3.01	1,099
3	2010	16.39	13.11	2.28	0.82	3.10	1,132

Exhibit 103 Solid Waste Quantity Estimation

A secured landfill for managing the solid waste generated on site has been designed. The methodology adopted for design of this landfill is as given in the following exhibit.

Total landfill area	1.80	Acres
	7,299.43	Sqm
Area provided for infrastructure	2,962.79	Sqm
Area for landfill	4,336.64	Sqm
Total volume of excavation	-	cum
Total volume of land filling	22,875.00	cum
Soil cover volume	2,287.50	cum
Balance volume	20,587.50	cum
Add for Compaction at 15%	*23,675.63*	cum

Exhibit 104 Landfill Size Estimation Methodology

Considering the above, the “active” design life is 14 years & 2 months, with 3 tons of landfill waste assumed to be generated per day in year 1. This is in line with the applicable World Bank standard that states the minimum life of a landfill shall be 10 years. Though it does not meet the regulation of 25 years of "active" life cycle, in the coming years the non bio degradable volume will come down due to implementation of source segregation at household level and greater segregation of bio degradable waste at segregation platform of compost facility. Further details like soil liner, drainage layer, composite layer, daily cover, intermediate cover, final cover, gas venting layer, leachate collection system, etc are annexed with this report.

Further, a snapshot of the general flow path of solid waste has been presented in the following exhibit.

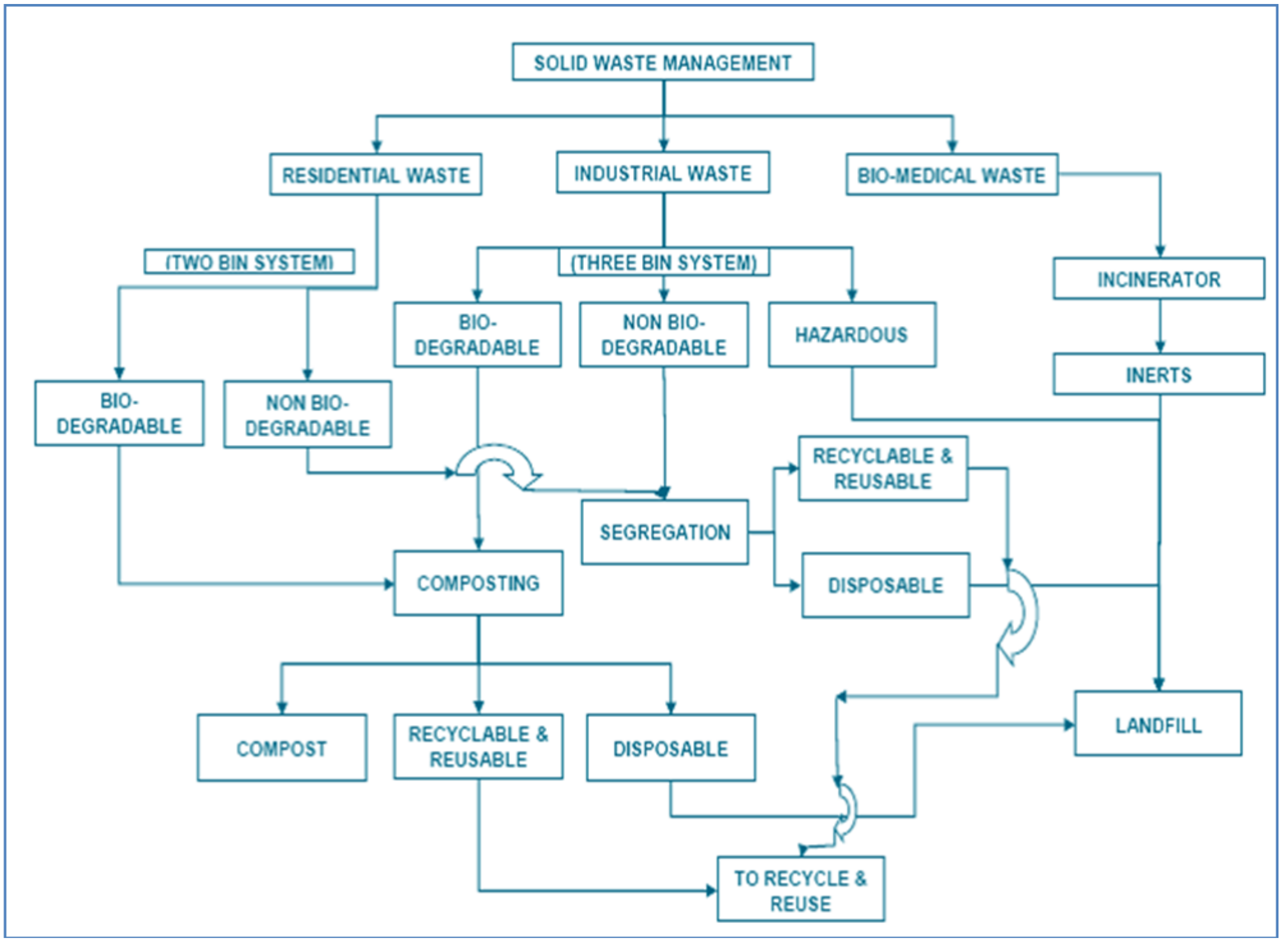

Exhibit 105 Solid Waste Flow Indication

The following exhibit presents a snapshot of the landfill design, with the ground water monitoring wells positioned.

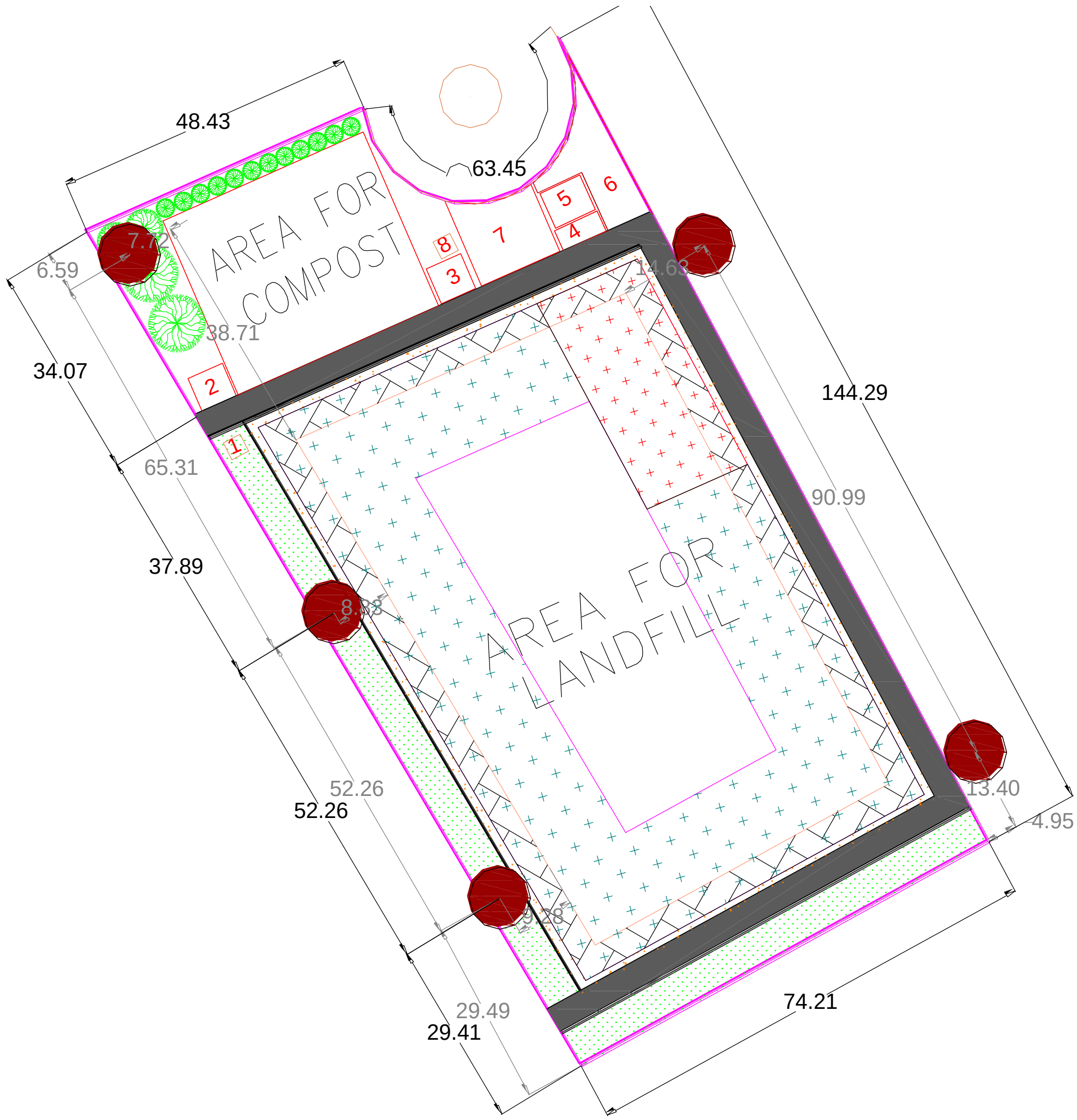

Exhibit 106 Landfill Layout with Ground Water Monitoring Wells

6.5.3.1 E-WASTE MANAGEMENT

In addition to disposal of e-waste from the Hi-Tech Park to DoE approved vendors for re-cycling, it is also recommended that the functional segment of the e-waste (working computers & other useful electronic equipment etc) be sent to schools, libraries and other public establishments outside the Park, which may need them.

Further, the types of e-waste, toxic constituents, handling methods have been presented in the Basic Planning Study report. There is currently no organised e-waste recycling facility in Bangladesh. The term e-waste is applied to all waste from or caused by electronics, which is often toxic waste. In order to manage e-waste, it is recommended that an investor unit would be setup with 2 TPD capacity for e-waste recycle processing plant in the hardware zone of the Kaliakoir Hi-Tech Park. The remnants from e-waste recycling process shall be disposed to engineered secured landfill within the Park. The liquid waste from e-waste recycling process will be treated by the e-waste recycling unit and the treated effluent will be disposed into the sewer line.

6.5.4 MANPOWER REQUIREMENTS FOR MANAGEMENT OF ENVIRONMENTAL INFRASTRUCTURE

The following exhibit captures a snapshot of the manpower required for management of the on-site environmental infrastructure proposed.

Sl.No	Designation	Time	Nos/shift	Project Component							
				STP 1	STP 2	STP 3	WDS / WTP			SWM	Total
1	Plant in Charge	G.Shift	1		1			1		1	3
2	Shift Operators	3 shifts	1	3	3	3	3	3	3	2	20
3	Relievers				2			2		1	5
4	Helpers	3shifts	1	3	3	3	3	3	3	3	21
5	Relievers				2			2		1	5
6	Mechanic	G shift	1	1	1	1	1	1	1	2	8
7	Electrician	G shift	1	1	1	1	1	1	1	1	7
8	Misc. labour for cleaning			2	2	2	1	1	1	10	19
9	Lab Chemist	G shift			1			1		1	3
10	Plumber							3			3
11	Reliever							2			2
12	Bill collectors							4			4
13	Tractor driver									4	4
14	Front end loader driver									4	4
15	SWM collection team									10	10
16	Watch & Ward			3	3	3	3	3	3	3	21
17	Watch & Ward - reliever				2			2		1	5
	Total				**47**			**53**		**44**	**144**

Exhibit 107Manpower Requirements for Management of Environmental Infrastructure

It may be noted here that the costs associated with the abovementioned task force have been considered in the O&M costs assumed for the environmental infrastructure component.

6.5.5 WASTE SEGREGATION AND TREATMENT

Different types of waste on-site have been proposed to be treated in appropriate different manners.

6.5.5.1 SEWAGE

Collection and treatment system dedicated to the sewage generated on the site has been proposed. The STP have been designed according to the sewage generation estimated.

6.5.5.2 SOLID WASTE

Source segregation for solid waste has been proposed. While the bio-medical waste produced by the on-site healthcare facilities has been proposed to be incinerated by the corresponding agencies, monitored according to the recommended parameters, rest of the solid waste is proposed to be segregated and treated either through composting or secure landfilling.

6.5.5.3 E-WASTE

E-waste treatment has been recommended to be carried out by dedicated investor unit established on an area of 1 acre in the hardware zone. Details of the same have been provided in the e-waste management related section of the solid waste management design proposed.

6.6 PROJECT COSTING

Project costing underwent further refinement, based on the final design. The following exhibit presents a snapshot of the refined project costing, with a comparative perspective to the project costs arrived at, at the basic planning & design stage.

Sl. No	Description	Basic Planning Stage Cost (USD in Mn.)	Detailed Design Stage Cost (USD in Mn.)
1	Road works including drain, culvert etc	6.80	7.02
2	Sewerage network including STP	1.62	2.30
3	Water supply including WTP	3.50	1.82
4	Electrical works including Transformer, street lighting	1.98	1.99
5	Buildings - Admin & Social amenities	2.20	2.19
6	Infrastructure for Sustainability covering green cover, water harvesting, energy saving and energy efficient devices, etc.	0.34	0.39
7	Boundary Wall	0.43	0.48
8	Land Development cost	5.67	5.67
	TOTAL	**22.54**	**21.86**
	Overall Project On-site Infrastructure Cost (USD '000 per Acre)		83

Exhibit 108 Project Costing Snapshot

Significant reduction in water treatment and distribution network has been observed, as a result of optimization and finalization of the design standards of the water related systems.

The following exhibit presents a snapshot of the capital costs associated with the environmental infrastructure on-site.

Project Component	USD'000
Sewerage network including STP	2299.9
Water supply including WTP	1814.7
Infrastructure for Sustainability covering green cover, water harvesting, energy saving and energy efficient devices, etc.	386.9
Total	**4501.5**

Exhibit 109 Environmental Infrastructure Cost Components

6.6.1 ON-SITE INFRASTRUCTURE COST PHASING

Based on the phasing of the infrastructure development on-site, the costs of the infrastructure components shall be phased as well. The phase-distributed project infrastructure component costs are as summarized in the following exhibit.

Sl. No	Project on-site infrastructure component	Phase 1		Phase 2	
		Grounded cost (USD'000)	% of total	Grounded cost (USD'000)	% of total
1	Road works including drain, culvert etc	2253	32%	4765	68%
2	Sewerage network including STP	1017	44%	1283	56%
3	Water supply including WTP	991	55%	824	45%
4	Electrical works including Transformer, street lighting	995	50%	995	50%
5	Buildings - Admin & Social amenities	2199	100%	0	0%
6	Infrastructure for Sustainability covering green cover, water harvesting, energy saving and energy efficient devices, etc.	155	40%	232	60%
7	Boundary Wall	478	100%	0	0%
8	Land Development cost	3402	60%	2268	40%
	TOTAL	**11490**	**53%**	**10367**	**47%**

Exhibit 110 Infrastructure Cost Phasing

6.6.2 OPERATING EXPENSES

Project operating expenses have been assumed as percentage of the capital costs of various project components. The following exhibit captures a snapshot of the assumed operating expenses, as percentages of the capital costs.

Project Component	Annual Operation Cost (% of capital cost)	Annual Repair/ Maintenance Cost (% of capital cost)
Road works including drain, culvert etc	2.00%	5.00%
Sewerage network including STP	4.00%	2.00%
Water supply including WTP	2.50%	2.00%
Electrical works including Transformer, street lighting	2.00%	5.00%
Buildings - Admin & Social amenities	0.00%	5.00%
Telecom network	2.00%	5.00%
Infrastructure for Sustainability covering green cover, water harvesting, energy saving and energy efficient devices, etc.	2.00%	2.00%

Exhibit 111 Project Operation, Maintenance and Repair Costs

The costs mentioned above are distributed over areas excluding that occupied by the utilities, to arrive at a unit cost. However, the tenants of the project are envisaged to be charged approx. USD 130 per acre per month towards the O&M expenses incurred by the zone developing entity.

6.7 PROJECT MANAGEMENT

6.7.1 PROJECT SCHEDULING

Success of project planning is achieved by adhering to the project schedule. A project schedule has therefore been recommended, in line with the project planning and design. Appropriate project scheduling would ensure timely completion of the project which in turn would be critical for enhancing project returns.

The recommended project schedule for infrastructure construction phasing has been included as an annexure.

The following exhibit provides a brief snapshot of the proposed on-site infrastructure development phasing schedule.

Activity	Estimated Duration	Proposed Commencement	Proposed Finish
On-site Infrastructure Development - Phase I	**331 days**	**Jan 2010**	**Dec 2010**
Site Grading, Road works including drain culvert & Bridges etc.	200 days	Jan 2010	Jul 2010

Activity	Estimated Duration	Proposed Commencement	Proposed Finish
Site Grading	100 days	Jan 2010	Apr 2010
Road works including drain, culvert & Bridges etc	197 days	Jan 2010	Jul 2010
Water supply & sewerage Network	175 days	Jan 2010	Jun 2010
Water Supply Network including Distribution Network - Potable & Non potable	145 days	Jan 2010	May 2010
Sewerage Network including pumping stations	175 days	Jan 2010	Jun 2010
Water Treatment & sewerage Treatment Plant	280 days	Jan 2010	Nov 2010
Water Treatment Plant , ELSR,GLSR, PH,PSF,ACF, Chlorination O/H, External water supply source	280 days	Jan 2010	Nov 2010
Sewerage Treatment Plant & Solid waste Management	271 days	Jan 2010	Oct 2010
Electrical Work	60 days	Apr 2010	Jun 2010
Admin & Social amenities	301 days	Jan 2010	Nov 2010
Boundary wall	145 days	Feb 2010	Jul 2010
Landscaping & Rain water harvesting etc	90 days	Apr 2010	Jul 2010
Vertical Development	321 days	Mar 2010	Feb 2011
On-site Infrastructure Development - Phase II	**307 days**	**Jan 2017**	**Mar 2018**
Site Grading, Road works including drain culvert & Bridges etc.	167 days	Jan 2017	Aug 2017
Site Grading	97 days	Jan 2017	May 2017
Road works including drain, culvert & Bridges etc	164 days	Jan 2017	Aug 2017
Package - Water supply & sewerage Network	202 days	Jan 2017	Oct 2017
Water Supply Network including Distribution Network - Potable & Non potable	112 days	Jan 2017	Jun 2017
Sewerage Network including pumping stations	202 days	Jan 2017	Oct 2017
Package - Water Treatment & sewerage Treatment Plant	277 days	Feb 2017	Mar 2018
Water Treatment Plant , Storage, Chlorination , External water supply sourcing	277 days	Feb 2017	Mar 2018
Sewerage Treatment Plant & Solid waste	277 days	Feb 2017	Mar 2018

Activity	Estimated Duration	Proposed Commencement	Proposed Finish
Management			
Electrical Work	60 days	Jun 2017	Aug 2017
Landscaping & Rain water harvesting etc	90 days	Aug 2017	Dec 2017
Vertical Development	*321 days*	*Apr 2017*	*Jun 2018*

Exhibit 112 Proposed Infrastructure Development Phasing Schedule

6.7.2 CONTRACT MANAGEMENT & SITE SUPERVISION

Recommendations for development of a contract management system for project implementation have been included as annexure to this report.

The key points covered in the contract management and site supervision norms include:

- Contract management:
    - Planning & scheduling systems and procedures
    - Cost management measures
    - Quality assurance systems and measures
- Site supervision norms
    - Guidelines for regular site monitoring & inspection
    - Recommendations for on-site safety measures
    - On-site issue handling

6.8 LIST OF ANNEXURES

The following form the annexure to this report, and have been appended to the report:

- Master plan;
- On-site road and utility network design drawings (power, water, sewage, storm drains & effluent treatment etc);
- Generic drawings for project specific components
- Recommended on-site infrastructure phasing schedule (both Gantt chart and indicative phasing in master plan drawing);
- Detailed bill of quantities for the on-site project components designed;
- Contract management and site supervision norms;
- Solid waste management system design;
- Hydro-geological survey study report.

7 FINANCIAL ANALYSIS

Since the Pre-feasibility report, the financial analysis has been refined based on inputs from demand projections as well as technical studies/detailed engineering. The revised results are presented in this section.

7.1 PRICING

The area around Kaliakoir is presently not very developed so benchmarks in surrounding areas are not available for pricing. It has also been the experience in such large-scale infrastructure investments, that they significantly influence the price trends of the entire surroundings. Case studies in support of this have been previously presented as part of the Pre Feasibility Report.

The basis for pricing is essentially the prevailing rates for similar developments in and around Dhaka as well as discussions with industry players on willingness and ability to pay. The issue of pricing needs to be seen in the context of the demand-supply analysis presented earlier. Thus the following issues would have an impact on pricing:

- Prices being paid by technology companies presently operating in and around Dhaka
- Willingness/ability to pay as indicated based on discussions with potential tenants
- Quality of infrastructure to be made available at the KHTP and the resultant clustering effects
- Commute time between Dhaka, the northern suburbs and the KHTP

It may be mentioned here that the development of the high speed rail link between Dhaka/Uttara and the KHTP would dramatically impact the pricing scenario but the same has not been considered in this analysis.

7.1.1 REAL ESTATE SCENARIO IN DHAKA AND SUBURBS

Since the project site is within commuting distance of Dhaka, the pricing needs to be seen in the context of the real estate scenario in Dhaka. This was analyzed by speaking with leading developers as well as secondary data analysis.

Dhaka, the capital city of Bangladesh, is one of the most densely populated cities of the world. Owing to high levels of sustained demand over the years, real estate prices in Dhaka have witnessed an upward trend and are presently at very high levels compared to any other location outside Dhaka. Some of the key activity clusters within the city for residential and commercial activity are listed below:

Residential Clusters	Commercial Clusters
Gulshan	Dhanmondi
Baridhara	Gulshan
Banani	Banani
Uttara	Uttara

Exhibit 113 Prominent Residential and Commercial Cluster in Dhaka

Most of the cluster mentioned above comprise of a mix of residential and commercial developments in the same location. As observed, there are no dedicated areas for ICT related commercial spaces (except the BASIS promoted BSRS Bhaban) with most of the IT/ITeS companies working out of small offices in residential areas. Development activity initiated by the private developers over the last few years has led to the emergence of quality commercial office spaces within prime pockets of the city. Being such, the rentals charged are high and beyond the reach of most small and medium segment ICT related companies. This is especially true of clusters such Banani, Dhanmondi and Gulshan which are perceived as prime residential and commercial hubs.

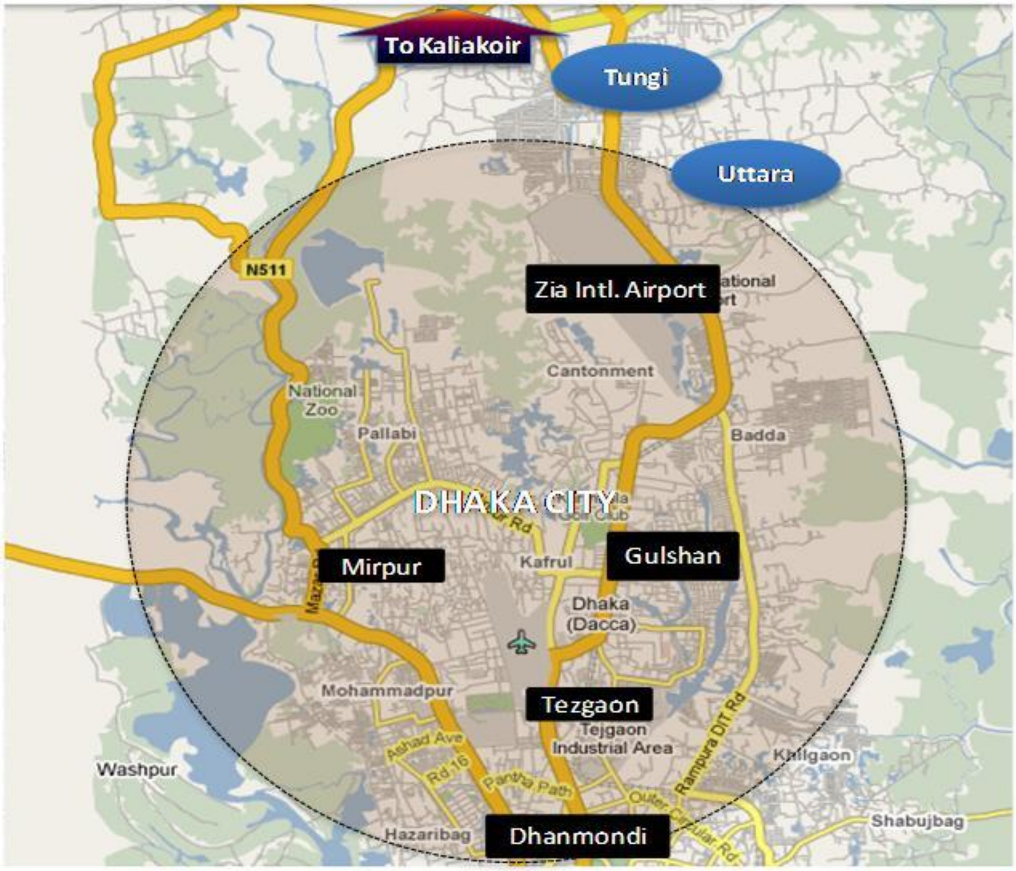

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Exhibit 114 Major Residential and Commercial Areas in Dhaka

Small scale units typically operate out of low grade commercial complexes and even residential units, therefore the availability of office space for such companies is not a major constraint. The flexible location decision choice set has led to a geographically fragmented industry with no standardization in rentals. As a result, the cost of commercial space varies significantly across clusters within Dhaka. Thus, there is an absence of centrally established IT/ITeS hubs in the Dhaka area, the only exception being the BASIS promoted BSRS Bhaban.

With most of the prime residential and commercial clusters within the city gradually witnessing saturation and developable land rapidly becoming a scarce commodity, there has been an emergence of satellite hubs such as Uttara which is now an upwardly mobile community including both residential and commercial developments. It may be noted that Uttara is north of Dhaka towards the Airport and Kaliakoir, whose historical development as well as prevalent prices provides a good insight into the pricing outlook for the KHTP.

7.1.1.1 PRICING AND TRENDS

Prevalent prices and historical trends of various areas in central and suburban Dhaka are presented below.

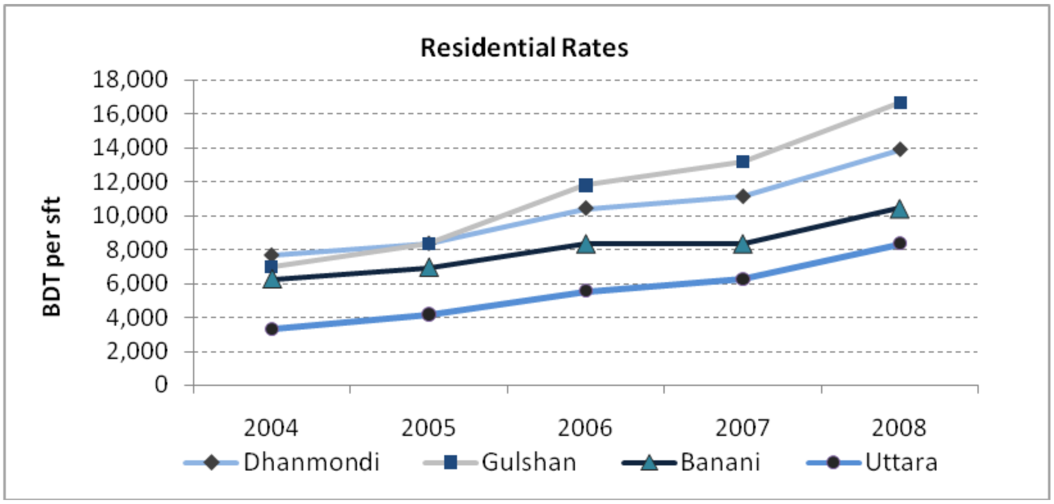

Exhibit 115 Trend of selling rates for residential purpose in various areas of city

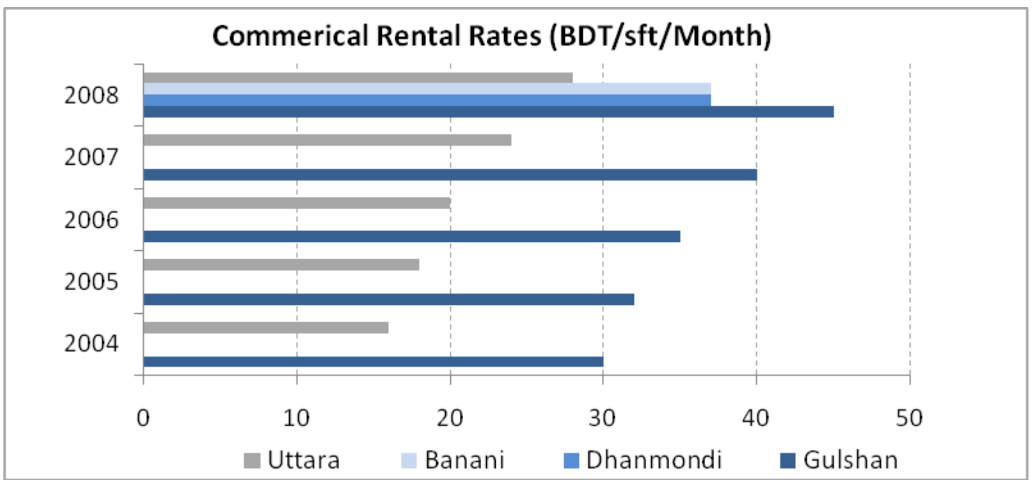

Exhibit 116 Commercial rental rates trend in various areas of the city

As presented above, there has been a marked increase in the real estate prices and rental levels across all major pockets within Dhaka. In comparison to real estate markets in comparable cities in the region, the level of appreciation in real estate prices within Dhaka has been high over the last 5 years. The Exhibit below gives details of the price growth of each cluster for the last five years.

Cluster/Area	Residential CAGR % (2004-08)	Commercial CAGR % (2004-08)
Gulshan	24%	11%
Banani	14%	12%
Dhanmondi	16%	12%
Uttara	26%	15%

Exhibit 117 CAGR for land prices and rental rates

It is important to note here that while most of the clusters within Dhaka indicated fairly encouraging levels of growth, the appreciation in Uttara was even higher. This is on account of cheaper land availability and saturating land supply within Dhaka and is line with global trends of price growth in suburban counter magnets of major cities. The relevance of Uttara's performance lies in the fact that it forms the nearest established residential and commercial hub in proximity to the Kaliakoir site and the movements in real estate prices in Uttara are indicative of the potential pricing power of the KHTP in the coming years. Nevertheless, a cautionary note is warranted on account of the fact that the last 5 years, real estate markets have been markedly frothy. With the advent of the economic downturn, realty trends throughout the South Asian region have been headed southwards.

7.1.1.2 UTTARA

As noted above, it is useful to look at the development of Uttara to get an understanding the pricing potential that exists for the KHTP.

Uttara is the fastest growing suburb of Dhaka and forms a peripheral location to Dhaka as an alternate residential and commercial hub. The region also lies in proximity to Kaliakoir, which is situated approximately 25-30 kms from Uttara.

The emergence of Uttara, which was first developed in the early 1980s, has been driven primarily by the ever increasing population pressure and unavailability of land in Dhaka. The development of the International Airport and the region's proximity to Dhaka has led to a rapid development of the district over the past few years. A map of the region is shown in the following exhibit.

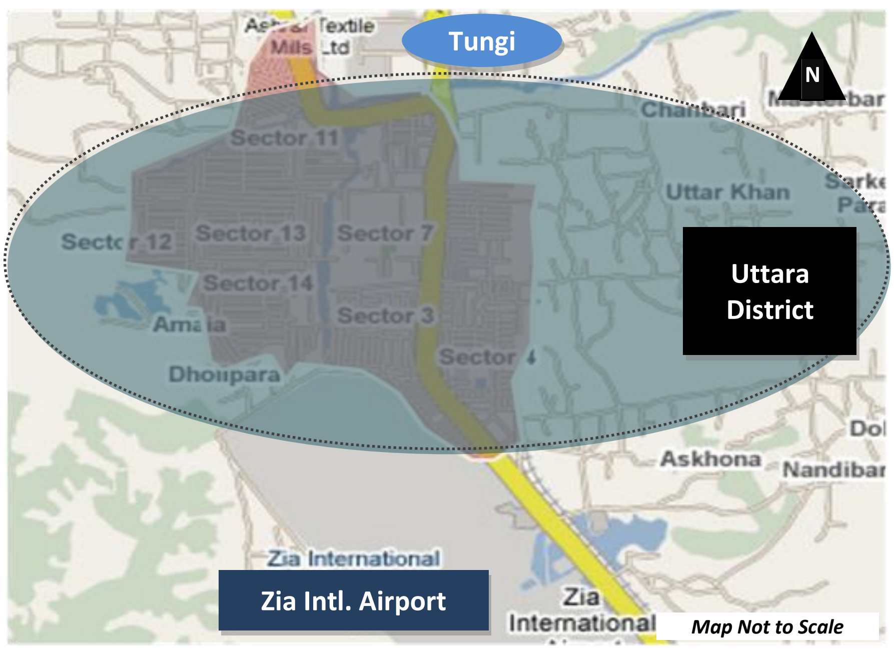

Exhibit 118 Location of Uttara

The Uttara district features a mix of both residential and commercial facilities. The development initiated by RAJUK was carried out in two phases of development, which can be further broken into development of individual sectors. Presently sectors 3, 4, 7 & 11 feature the majority of the organized development activity in the region. Owing to the success of the development of Uttara as a satellite township, a third phase of development has been announced and includes the development of additional sectors 15-18 as shown in the Exhibit 119.

Exhibit 119 Location for 3rd phase of Uttara Model Town Project

Until adequate social infrastructure is developed at Kaliakoir, Uttara would be the primary centre of residence of the working population of Kaliakoir Hi-Tech Park. With commute time of about 45 minutes, this would be in line with development of technology parks in leading hubs in the region such as Bangalore, Delhi and Chennai.

7.1.1.2.1 PRICE TRENDS AT UTTARA

Residential/commercial rates at Uttara are observed to be a function of the proximity to the airport. Sectors 3 and 4 which are closer to the airport have higher rates than the other sectors. Since these are also the sectors which were covered under the first two phase of Uttara Model Town Project, the sectors are the most developed ones.

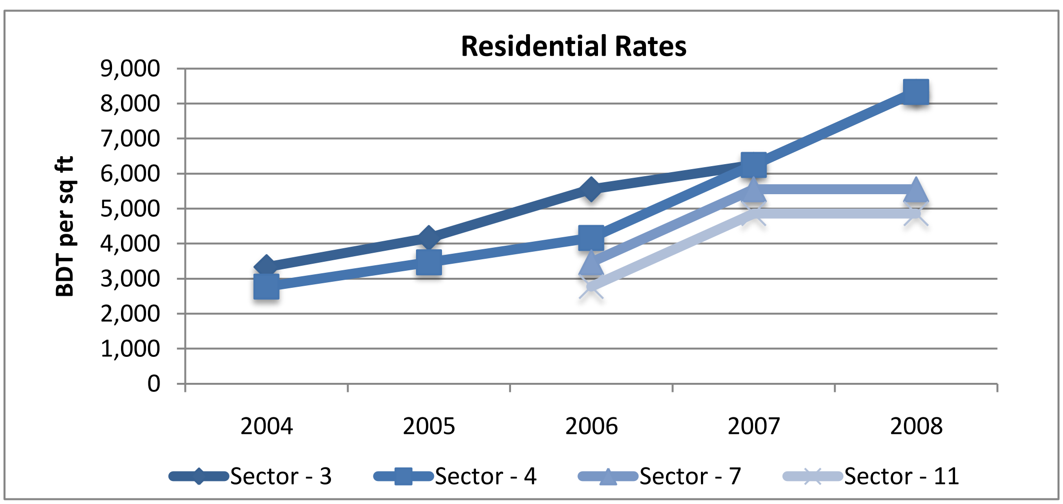

Exhibit 120 Trend of Residential selling rates in Uttara

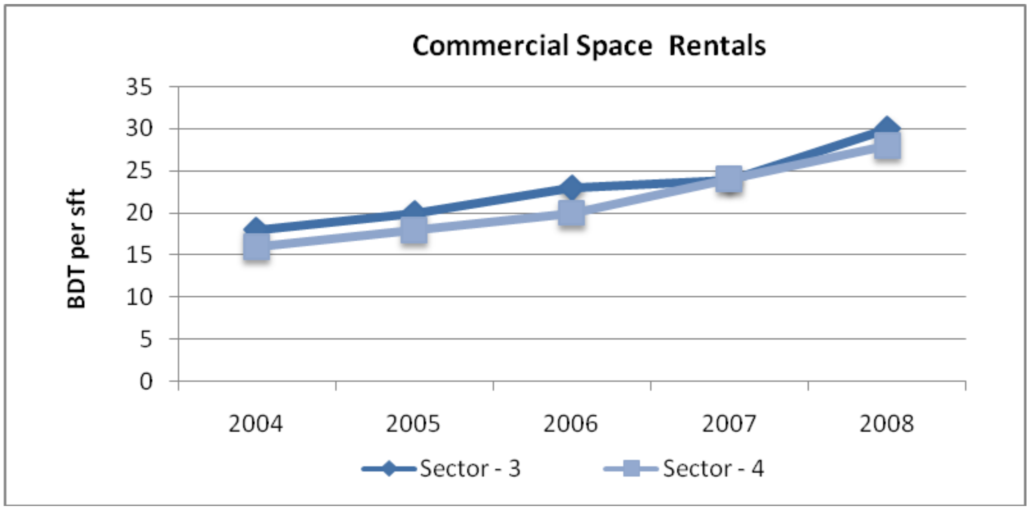

Exhibit 121 Rental Trends for Commercial Space

As can be seen from the exhibits, prices in sector 3 and 4 are the highest, primarily on account of their proximity to the airport. There is not much commercial development in Sectors 7 and 11.

7.1.2 PROJECTIONS FOR KALIAKOIR

The price projections for commercial and residential space in the KHTP have been analyzed in the context of the analysis of commercial and residential markets in Dhaka and Uttara as presented above. The results are presented in this sub-section.

Kaliakoir is a small Upzila (sub district) in the Gazipur district of Bangladesh with little or no commercial or residential activity at present. The population of the region is close to 15,000 people with farming being the major occupation. The following exhibit provides an overview of the connectivity and linkages of Kaliakoir region -

Road Connectivity	• National Highway (N-4) runs through the region. • Three way connectivity: from Gazipur, Dhaka and Mirzapur • 30 km from Uttara with a travel time of around 60 min and 40 km from Dhaka with a travel time of around 90 min
Rail Connectivity	• Railway line running through the Project site • Railway station is missing • Rail line is well connected to other parts of the country • Nearest major stations are Mirzapur and Tungi wherein Tungi forms the connecting point to Chittagong
Air Connectivity	• Around 30 km from the region with a travel time of around 75 min

Exhibit 122 Connectivity analysis of Kaliakoir

Given the direction of development of the city – which is generally towards the north, spreading towards the Uttara, airport and Tungi, regions, the KHTP can be looked at as part of the emergence of a suburban sprawl towards the north of the city and as a logical extension to Uttara with regard to development activity – the pricing scenarios have been evaluated, keeping this in mind.

As mentioned before, the level of real estate in the region is limited, with only a few small projects being undertaken in the region. One of the prominent projects is being carried out by Shamsul Alamain Real Estate Pvt. Ltd. (SARE), which is essentially a residential project. The project is nearing completion and features around 60 flats with varying flat sizes of between 1,000 and 1,200 sq. ft. A second phase of the project is planned by 2011 wherein the developer is envisaging construction of 120 more flats. With regards to pricing, the current selling price of the apartments is reported to be around USD 22 per sq.ft. Exhibit 123 lists the various facilities that are located within reasonable distance from the project site.

Industries	Social Infrastructure	Recreational Facilities
• An Ready Mix Concrete (RMC) plant on way to Uttara – 40 min from the park • Dhaka EPZ – 30 min from the park	• East West Medical college hospital in Abdullahpur	• Golf club in Savar • Sports complex in Kashimpur – 20 min from the park • Nandan water park near project site – 10 min from the park

Exhibit 123 Existing Vicinal Facilities

Exhibit 124 maps the Kaliakoir region and the activity centres highlighted above. As mentioned before, the region enjoys good connectivity to surrounding areas and main cities through its road and rail infrastructure.

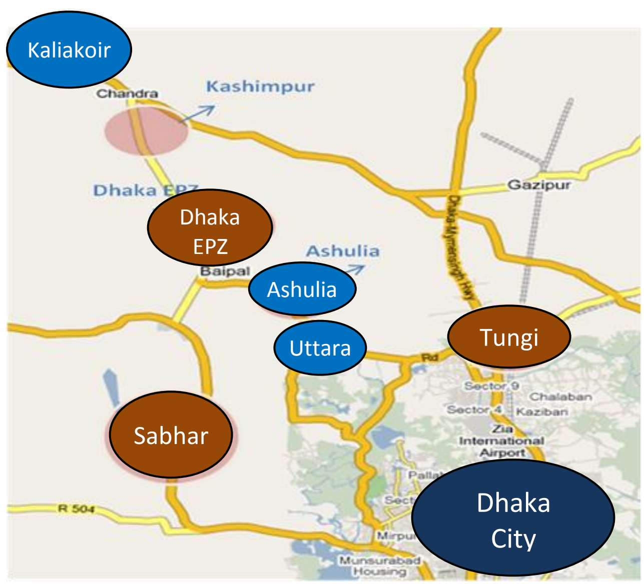

Exhibit 124 Kaliakoir and the nearby region

In order to evaluate the relative positioning of Kaliakoir in relation to nearby established hubs, a comparison of Kaliakoir with Dhaka and Uttara was done with regard to settlement options as highlighted by the exhibit below.

Comparative Factors	Dhaka	Uttara	Kaliakoir
Connectivity	Excellent	Excellent	Moderate
Cost of living	High	Moderate	Low
Social Infrastructure	High quality	Good quality	Low quality
Commute time to the park for employees working in Kaliakoir	1 hr 30 min	45 mins -1 hr	10-15 min
Land prices per sft	USD 246	USD 116	USD 22
Commercial Rentals (sft/mth)	USD 0.65	0.44	USD 0.26 (est)
Space availability	Little or none	Adequate	Large land bank available

Exhibit 125 Comparative Location Analysis

Thus while the KHTP offers substantially lower costs, the main issue would be the commute time from Uttara and central Dhaka. However the commute times are within range of those witnessed in other major technology hubs in the region such as Bangalore, Delhi etc. The cost advantage is expected to prompt more and more developments to move to the KHTP rather than operate in the costlier central suburbs as is presently the case.

7.1.2.1 PRICING ESTIMATE

Pricing for different components of the KHTP project are described in this section. In addition, the growth rate in real USD terms has also been estimated for the purpose of financial projections.

Given the risk associated with the project, it is also important to look at different scenarios and their impact on the viability of the project. Therefore, we have developed 3 scenarios – base, pessimistic and optimistic – by changing assumptions on critical variables. These assumptions are described where relevant in the following sub-sections.

7.1.2.2 COMMERCIAL SPACE/MTBS

The pricing for commercial space (MTBs) is based on the prevailing price in commercial pockets in Uttara, which is about USD 5.3 per square foot per year (PSFPY). Based on discussions with players in the sector as well as subjective estimates considering the additional commute time, better quality of facilities and experience at other developments in the sub-continent, it is felt that a 50% discount over the prices at Uttara would be a penetrative pricing level for the operations at KHTP. Thus a pricing level of USD 2.67 PSFSPY has been assumed in the base scenario. The assumptions in different scenarios are as follows:

- Base – 50% of price prevailing at Uttara
- Pessimistic – 40% of price prevailing at Uttara
- Optimistic – 60% of price prevailing at Uttara

7.1.2.3 RESIDENTIAL SPACE

The pricing for residential space is broadly based on the prevailing prices for residential developments in and around the project site, primarily the Shamsul Alamain development which is selling at USD 22 per square feet. It may be noted that the sale would be a long term lease but would be a sale for all practical purposes.

It has been assumed that a 10% premium over the above development can be assumed given that the Shamsul property caters to middle-income groups and would not have the employment and social infrastructure benefits that would be available at the KHTP. Accordingly an average rate of about USD 24 per square feet for residential prices has been assumed. This is further broken down depending on the category of development and the overall range is between USD 15 and USD 35 per square feet.

The pricing assumed is the same for all scenarios.

7.1.2.4 LAND

Other than commercial and office spaces, a substantial portion of the KHTP would be leased as developed land on which other developers would build various components including social infrastructure, the hardware park, logistics infrastructure etc. The total land area of such components excluding roads, open areas, admin buildings and utilities would be close to 90 acres.

The pricing of these components is based on the prevailing land rates in the region which ranges from USD 22500 to 45000 per acre. Given the strategic location of the KHTP, its road frontage and the prestige value of the project, it can be assumed that the land can be sold at the higher end of the range, The base case assumptions is therefore USD 40,500 per acre. In the pessimistic case, it has been assumed that it would be sold in the middle of the range (USD 33,500 per acre) and in the optimistic case, it has been assumed that it would be sold in the highest end of the range (USD 45,000 per acres).

In addition, a premium would need to be added for additional infrastructure that is being created on the land. On a discounted basis, this works out to about 50% over the cost of undeveloped land. After adding this premium, the lease rate has been worked out for each of the three cases taking a time period of 20 years and a discounting rate of 17.5% which is an estimate of the developer's cost of equity. The lease rates per square metre accordingly work out to:

- Base – USD 2.74 per square metre
- Pessimistic – USD 2.28 per square metre
- Optimistic – USD 3.04 per square metre

7.1.2.5 PRICE PROJECTIONS

Projections for pricing have been estimated based on an actual analysis of past prices at Uttara, since it is expected that after the saturation of Uttara and the setting up of the KHTP, the development in the Kaliakoir region will be an important sub-urban development comparable with that of Uttara.

As noted above, the commercial and residential prices at Uttara have grown at a CAGR of 14% and 28% respectively over the last five years. However it is important to look at the variation in these growth rates to find statistically robust growth rates that make some allowance for downside risk.

Accordingly confidence limits were established for the growth rates and the results were as follows:

- Commercial
    - 95% lower limit – 10.96%
    - 75% lower limit – 13.22%
    - CAGR – 14.3%

- Residential
    - 95% lower limit – 13.05%
    - 75% lower limit – 23.64%
    - CAGR – 28.74%

It was decided to take the 75% lower limit for the base case and the 95% lower limit for the pessimistic case. Thus, based on the data analyzed, there is a 75% probability that the growth rate would be higher than that assumed in the base case and a 95% probability that it would be higher than in the pessimistic case. For the optimistic case, the CAGR was taken as the basis of projecting rates.

Further it was necessary to convert these growth rates in real dollar terms. Average depreciation of the Taka against the USD in the period during which prices were evaluated was 4.25% and the US inflation rate was about 3%. Therefore the revised growth estimates for commercial and residential prices were as follows:

- Commercial
    - Base – 5.97%
    - Pessimistic – 3.71%
    - Optimistic – 7.06%
- Residential
    - Base – 16.4%
    - Pessimistic – 5.04%
    - Optimistic – 21.49%

The growth rates have been further moderated to take into account the current recession in the property markets as well as the expected "ramp up" time for the KHTP to realize its pricing potential. The following table summarizes the assumptions on this:

Commercial	Base	Pessimistic	Optimistic
Starting Rate	0.0%	0.00%	0.0%
Stabilized Rate	5.97%	3.71%	5.97%
Peak Rate	5.97%	3.71%	7.06%
Peak Achieved in (years)	10	10	10
Peak Period (years)	5	5	5

Exhibit 126 Growth rate assumptions for Commercial

Residential	Base	Pessimistic	Optimistic
Starting Rate	0%	0%	0%
Stabilized Rate	5.00%	5.00%	5.00%
Peak Rate	16.4%	5.04%	21.49%
Peak Achieved in (years)	10	10	10
Peak Period (years)	5	5	5

Exhibit 127 Growth rate assumptions for Residential

7.1.2.6 MAINTENANCE CHARGES

In addition maintenance charges have been assumed to be USD 126/acre/month. This assumption is based on typical benchmarks of maintenance costs charged in prominent EPZs and SEZs operational in South Asia. It has been assumed that the space for warehouse would also be yielding the same lease revenues as the industrial area

7.1.2.7 WATER AND SEWERAGE

Revenue from water supply and sewerage has been estimated at actual operating cost plus a 17.5% return on capital cost.

7.2 METHODOLOGY FOR FINANCIAL ASSESSMENT

The financial feasibility analysis is based on the following framework.

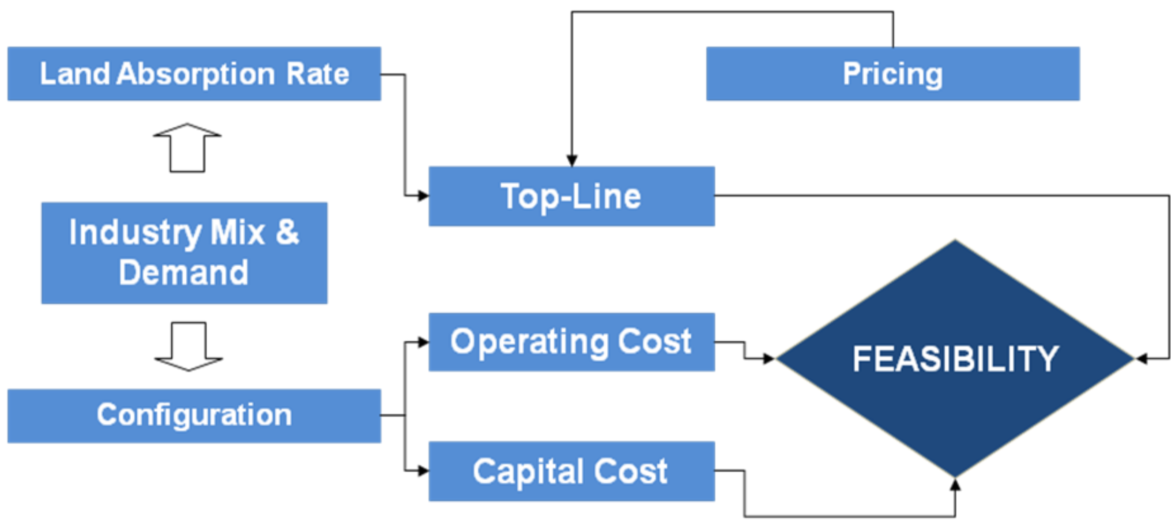

Exhibit 128 Financial Feasibility Analysis Framework

The revenue and cost streams would form the primary basis for assessing the financial viability of the project. Various categories for revenues would accrue to the developer as detailed below. Broadly these would include;

- Lease rentals from lease of services land to other developers who would set up commercial space
- Lease of built up commercial space in Multi Tenanted Buildings
- Lease (upfront) of residential built up space
- Lease of serviced land to developers of social infrastructure components
- Utility revenues to the extent relevant
- Maintenance charges

Further, the key costs have been segregated as

- **Capital costs:** One-time costs for developing enabling infrastructure and commissioning the essential utilities. These have been detailed out in the following sections of the report.

- **Operating costs:** Recurring costs that include day-to-day costs of the running operations at the zone as well as any repair & maintenance costs. These have been elaborated upon in the following sections of the report.
- **Asset replacement costs:** These represent the costs incurred on replacing the infrastructure/utilities like electrical infrastructure, sewerage system etc. These major replacements have been assumed to happen every 10 years.

Each element of the financial analysis is further explained below starting with the general assumptions.

7.2.1 GENERAL ASSUMPTIONS

The following general assumptions have been made throughout the analysis. The analysis is based in US Dollars and is in real terms. The project timeframe is assumed as 35 years with the starting year of construction being 2012 and the starting year of commercial operations being 2013. A residual value has also been calculated at the end of the period.

7.2.2 TAX ASSUMPTIONS

A tax rate of 37.5% has been assumed, based on prevailing norms. However a separate scenario has been developed for estimating the impact of tax breaks.

7.2.3 FINANCING ASSUMPTIONS

The project has been assumed to be funded at a debt-equity ratio of 50:50. Further assumptions depend on the particular scenario under analysis. Broadly the following variations have been used:

- A pure market-based funding wherein the interest rate is 12% (in USD terms) and the term is 5 years with a moratorium of 1 year from commencement of construction
- The second funding option is the channeling of Bank funds to a private developer through the domestic financial system in an IPFF-like structure. The tenor assumed is 20 years with a 5 year moratorium with market interest rates being applicable (although we understand the rates are actually a little below the market benchmarks, we have been conservative)

7.2.4 CAPITAL COSTS

Capital costs have been based on the inputs from the engineering study presented in the report. These have been further fine-tuned after detailed engineering and a number of sub-optimal components have been eliminated keeping in mind the need to keep costs down.

Further based on the demand estimation, a two-stage phasing has been done to defer capital expenditure and align it with expected demand. The two phases have been assumed to be commissioned by 2013 (1st phase) and 2020 (2nd phase) respectively. The commissioning is expected to start a year in advance and would be taking a year for development.

The details of the infrastructure related expenditures forming part of the capital costs have been highlighted in the table below:

Cost Head	Cost (USD '000)
Road works including drain, culvert etc.	7,018
Sewerage network including STP	2,300
Water supply including WTP	1,815
Electrical works including Transformer, street lighting	1,989
Buildings - Admin & Social amenities	2,199
Infrastructure for Sustainability covering green cover, water harvesting, energy saving and energy efficient devices, etc.	387
Boundary Wall	478
Land Development cost	5,670
MTBs	34,841
Total Cost	**56,697**

Exhibit 129 Capital costs for the project

As presented above, the total costs for the above mentioned components would be around USD 57 Million. It should be noted that provision of quality infrastructure has been the focus in modeling the infrastructure requirement for the Hi-tech Park. However, several iterations of the project design have been done to ensure that cost is optimized based on overall project considerations.

As mentioned before, the Park is envisaged to be developed in two phases, namely 2012 and 2019. The phasing of the capital costs according to the planned phases is presented in the exhibit below. In addition to the above hard costs, the following soft costs have also been considered:

- Project Development Costs at 5%
- Contingency Costs at 5%
- Applicable Interest During Construction

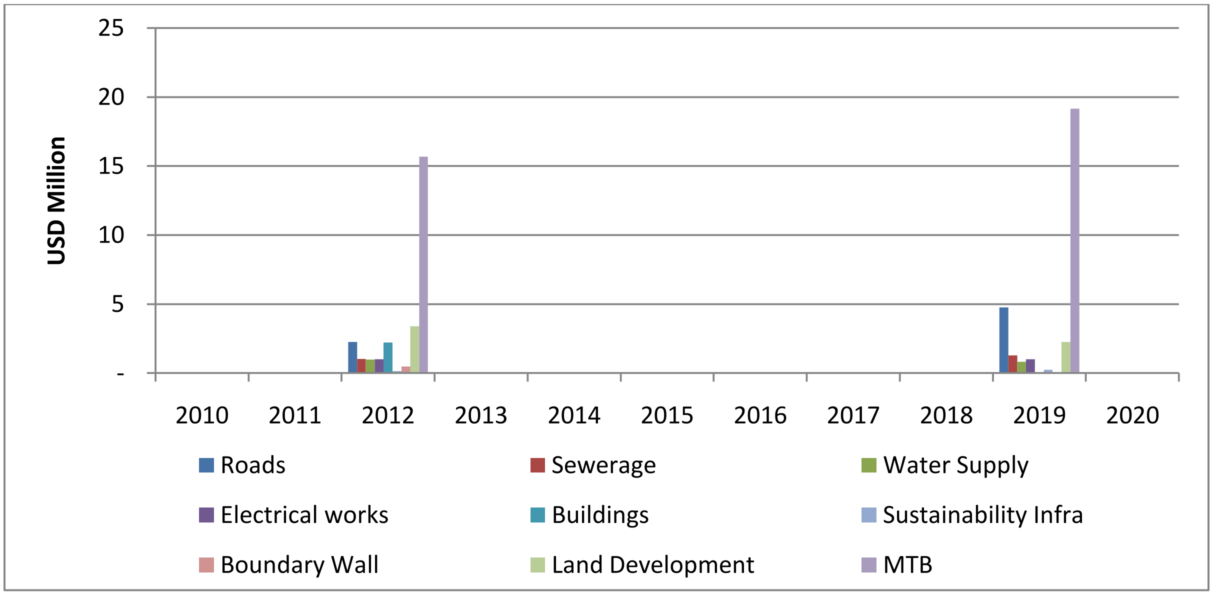

Exhibit 130 Phasing of Capital Costs

The project cost for the two phases is USD 27.2 Million and USD 29.5 Million respectively. It can be seen from the above exhibit that the MTBs, alone, account for around 60% of the total cost. The other substantial costs are that of land development and roads.

7.2.5 OPERATING COSTS

Operating costs and repairs and maintenance costs have been assumed as percentage of capital costs for various items as per the detailed engineering. These are summarized in the tables below.

Operations cost (yearly)	Basis	Proportion
Road works including drain, culvert etc	% of capital cost	2.00%
Sewerage network including STP	% of capital cost	4.00%
Electrical works including Transformer, street lighting	% of capital cost	2.00%
Buildings - Admin & Social amenities	% of capital cost	0.00%
Infrastructure for Sustainability covering green cover, water harvesting, energy saving and energy efficient devices, etc.	% of capital cost	2.00%

Exhibit 131 Operational cost assumptions

Repair & Maintenance cost (yearly)	Basis	Proportion
Road works including drain, culvert etc	% of capital cost	5.00%
Sewerage network including STP	% of capital cost	2.00%
Electrical works including Transformer, street lighting	% of capital cost	5.00%
Buildings - Admin & Social amenities	% of capital cost	5.00%

Repair & Maintenance cost (yearly)	Basis	Proportion
Infrastructure for Sustainability covering green cover, water harvesting, energy saving and energy efficient devices, etc.	% of capital cost	2.00%

Exhibit 132 Repair & Maintenance cost assumptions

The assumptions made with respect to employee costs are presented in the exhibit below.

Employee Level	Average Salary per Annum (USD/Employee)	Number of Staff Employed
Top management	27,800	3
Senior Management	20,800	2
Middle Management	13,000	5
Lower Level	3,900	6
Secretarial	2,100	5

Exhibit 133 Assumptions for employee expenses

The total operating costs, considering all the above mentioned components, is presented in the exhibit below. It can be seen that that the Repair & Maintenance costs are substantially higher in proportion to the other costs. Also, the costs are initially lower and increase in a stepped manner as result of the phased development of the Park.

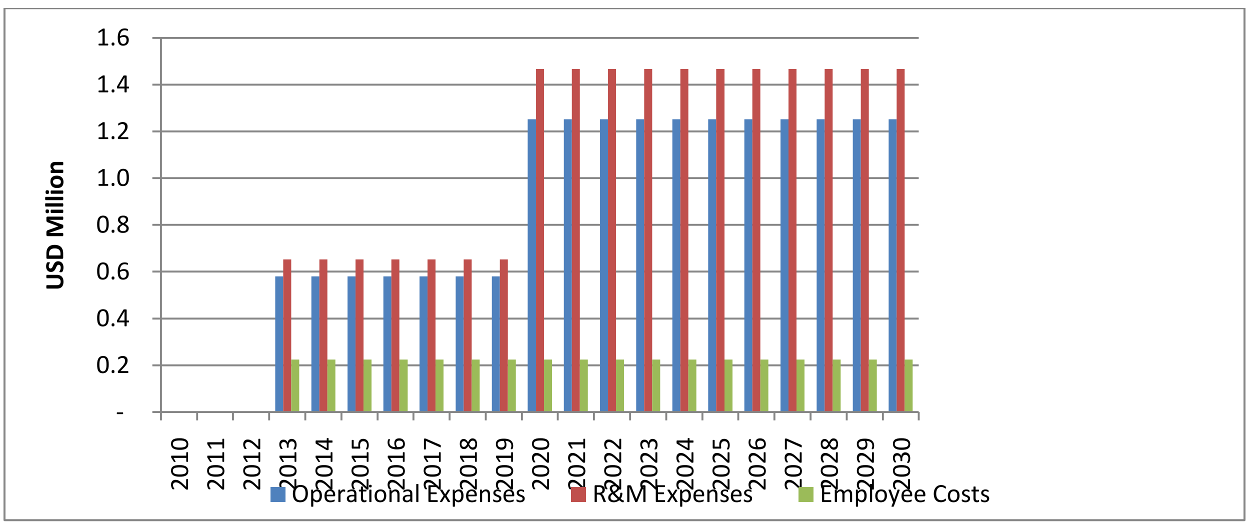

Exhibit 134 Operating costs

7.2.5.1 MAJOR MAINTENANCE AND ASSET REPLACEMENT COSTS

In addition to capital and operating costs, we have also considered the major maintenance costs for infrastructure like roads and asset replacement costs for utilities like electrical infrastructure, sewerage etc. The assumptions for these are as follows.

- For roads, the major maintenance in relaying is provided for every five years with the cost of maintenance being 10% of the original capital cost
- The electrical infrastructure would need replacement every 20 years with an outflow of around 70% of the original capital cost

In the exhibit below, we present a summary of these costs over the period 2012-2030.

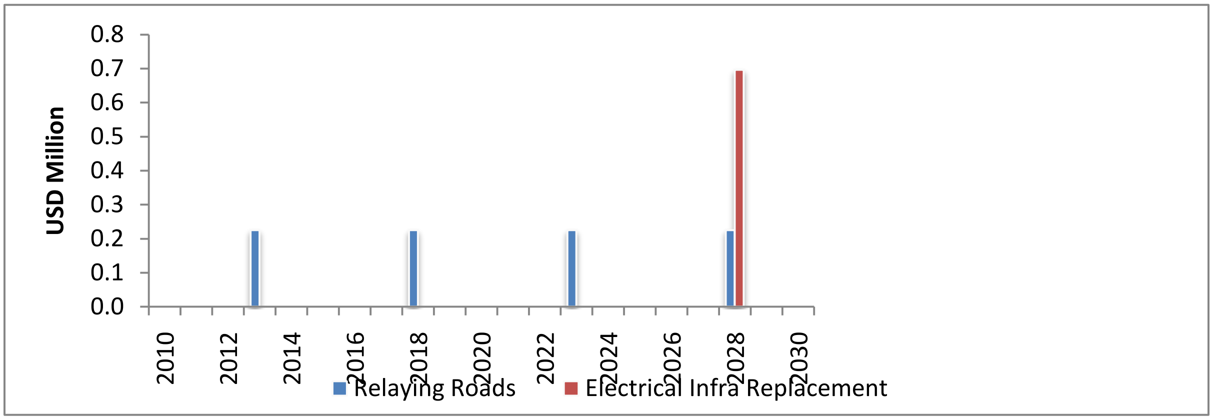

Exhibit 135 Major maintenance and asset replacement costs

7.3 FINANCIAL FEASIBILITY

Financial feasibility has first been examined for the Base Case assuming the following:

- Market-based financing
- IDA-enabled funding

The financing terms used for the above two funding options has already been detailed out in the previous sections. In the IDA-enabled funding, the Bank' funds would be channelized through the domestic financial system to the developer.

The financial returns in each of the two funding options for the base case scenarios are presented in the table below.

Funding Option	Project IRR	Equity IRR	Avg DSCR
Market-based financing	20.0%	21.8%	0.3
IDA-enabled funding	20.5%	23.9%	3.8

Exhibit 136 – Financial returns in base case scenario

From the above table it can be seen that the IDA-enabled funding is desirable from a debt servicing perspective. The DSCR is at a comfortable level of 3.8 in this funding scenario.

Further, in the table below we present the financial returns in the pessimistic and optimistic growth scenarios with the assumption that IDA-enabled funding would be used for the development. The optimistic growth scenario would generate healthy returns with the equity IRR being 47.5%. The DSCR is also adequate from the debt servicing perspective. However, the pessimistic growth scenario generates sub-optimal returns with equity IRR of around 5.4%.

Industry Growth Scenario	Project IRR	Equity IRR	Avg DSCR
Optimistic	32.7%	47.5%	4.5
Pessimistic	6.6%	5.4%	0.6

Exhibit 137 Financial returns in optimistic & pessimistic scenarios

7.3.1 SENSITIVITY ANALYSIS

Sensitivity analysis was also undertaken based on probable changes in capital costs, operating costs, the base case pricing levels and price growth, varying each by -20% to +20%. Here, the base case growth scenario has been used with IDA-enabled funding.

Firstly, we present the sensitivities of the returns to the capital and yearly operating costs. It can be seen that the returns are highly sensitive to the capital costs in Phase I. This is the phase where approximately 48% of the development is envisaged.

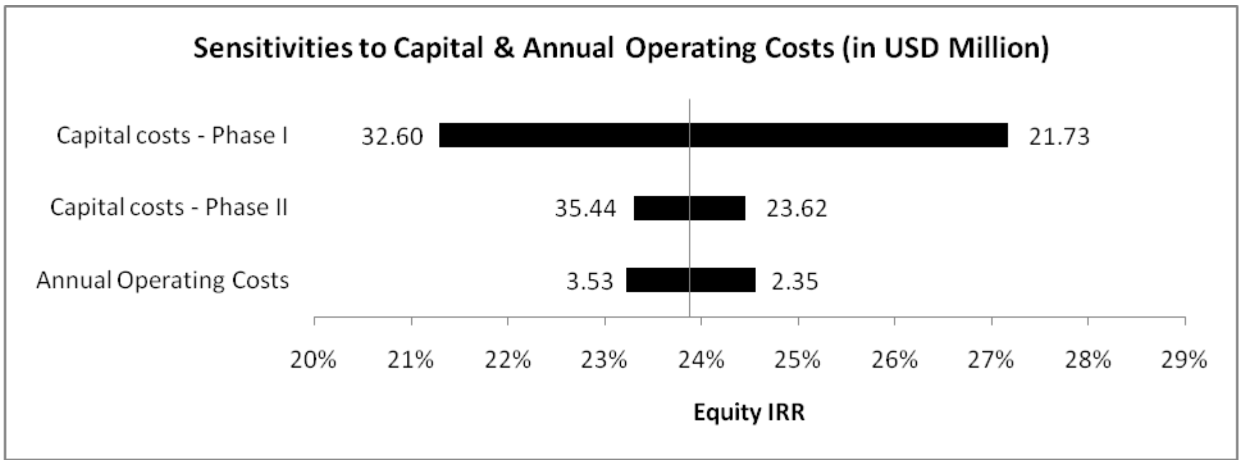

Exhibit 138 Sensitivities to Capital & Annual Operating Costs

Further, the sensitivities to the pricing levels and price growth were analysed. The same are presented in the exhibit below.

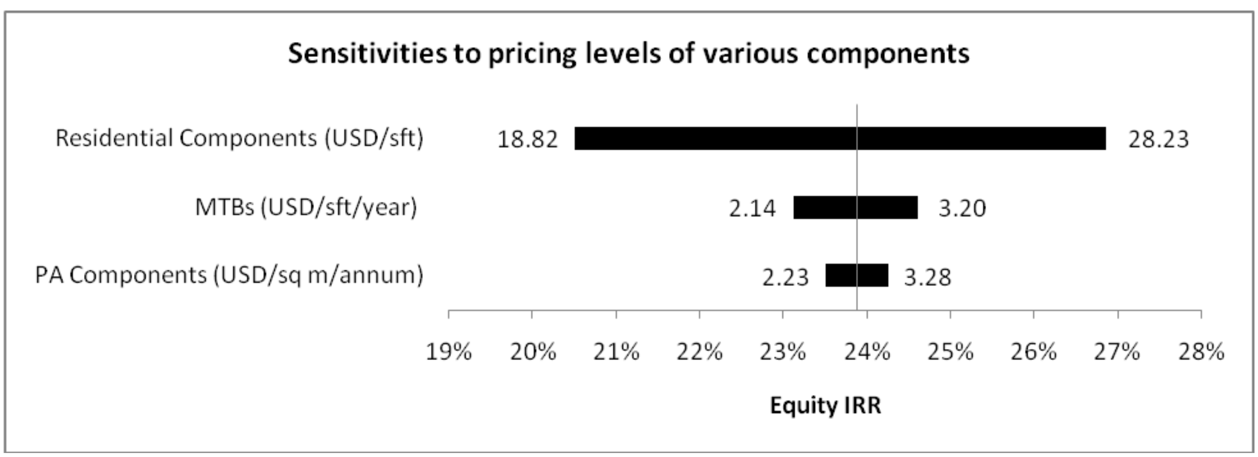

Exhibit 139 Sensitivities to pricing levels for various components

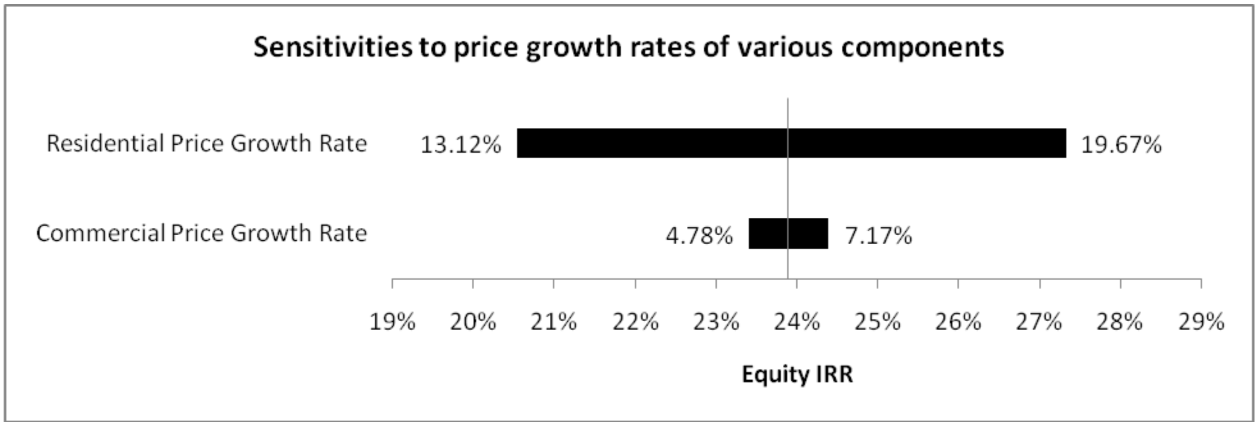

Exhibit 140 Sensitivities to pricing growth for various components

From the above exhibits it can be observed that the returns are highly sensitive to the residential rates and residential pricing growth assumed. It should be noted that the residential leases would be in the form of one-time upfront lease payment.

7.3.2 BCC CASHFLOWS

The Hi Tech park development would involve the participation of BCC in development & financing of the project. As detailed in Section 9 on project structuring, BCC would hold a 26% share in the venture. Also, the private developer would be sharing some part of revenues in the form of yearly fixed lease payments for the entire area leased from BCC.

In doing this analysis, the hurdle rate for equity IRR has been assumed to be 17.5%. That is to say, we have assumed that the lease rate based on a competitive tendering process would be set at a level that yields a 17.5% Equity IRR to the developer. This is based on the average Return on Net Worth figures (in real USD terms) for developers in the region.

In the table below, we present the lease rates that BCC would be likely to realize from the private developer in the base case. This lease payment to BCC would cap the private developer returns to 17.5% as explained before. Also, the discounted rate per acre has also been calculated. Here, the lease rates have been assumed to increase by 5% annually.

Industry Growth Scenario	Base Lease rate (USD/Acre/Year)	Discounted Cashflows to BCC (USD/Acre)
Base Case	6,070	110,835

Exhibit 141 Lease payments to BCC for 17.5% return to private developer

BCC could realize around USD 110,835 per Acre in present value terms from the project in the base case scenario. While the realization in the optimistic scenario would be even higher, the same would be negative if the pessimistic scenario prevails.

7.3.3 IMPACT OF TAX EXEMPTIONS

After assessing the financial feasibility of the development in the three industry growth scenarios, we also analysed the impact of any tax returns on the returns for the developer. The rates of tax exemption have been derived from the EZ ordinance. This translates into a 10 year 100% tax holiday followed by 5 years of 50% tax payments.

The impact of these tax exemptions onto the financial returns is presented in the exhibit below.

Industry Growth Scenario	Project IRR	Equity IRR	Avg DSCR
Base Case	22.9%	26.9%	4.5
Optimistic	41.6%	58.7%	5.7
Pessimistic	6.6%	5.4%	0.6

Exhibit 142 Impact of tax exemptions onto financial returns

It can be seen that the returns improve substantially with the tax exemptions available to the developer. In the base case the equity IRR increases from 24% to 27%. Similarly, in the optimistic case the equity IRR jumps to 59% from 48%. However, the pessimistic scenario is still unviable.

7.3.4 KEY FINDINGS

From the financial feasibility analysis presented above, it can be inferred that the project is inherently feasible in the base case and optimistic case from the perspective of absolute financial returns in terms of project and equity IRR.

However, there would be *debt servicing concerns in the case the debt financing is availed from the domestic financial institutions*. This is reflected in the below par DSCR ratios as presented before. This is because of the fact that domestic financial institutions can arrange debt for a maximum tenure of 5 years (with one year moratorium). This limited tenure loan further results in a sort of temporal mismatch between the funding and subsequent commissioning of the asset and the corresponding revenue outflows from the asset.

This is the primary reason for the *improved debt service coverage in the scenarios where the funding mechanism has extended repayment tenure* of 15 years with 5 years moratorium. This 20 year debt tenure, although at market rates of 12%, significantly improves the DSCR to 3.8 from 0.3 and also positively impacts the equity IRR for the base case.

This extended tenure debt would need to be IDA supported and could be routed to the domestic financial system through a structure like the IPFF.

7.4 RISK MANAGEMENT

Since risk management is extensively dependent on the project structure, this aspect is dealt with in the chapter on PPP Structuring.

8 ECONOMIC ANALYSIS

While financial returns from the project appear healthy, it is also important to look at the differential economic impact of the project, which is presented in this section.

8.1 ECONOMIC CONTRIBUTION OF EZS

International experience suggests that Economic Zones (EZs) are important economic drivers and can make significant contributions to local, regional and national economic development through job creation/retention and as regional gateways for generating value adding economic activities. These economic linkages need to be supported and strengthened, through for example developing chains of value added activities, better integration of the EZs into local supply chains, and developing economic clusters focused around the EZs. In Bangladesh total EPZ employment has grown from about 600 in 1983 when the first zone was set up in Chittagong to over 224,000 by 2008[3]. It may be noteworthy that even the total employment in the ICT industry has kept pace with overall economic growth, with present levels of employment in the ICT industry estimated at nearly 25,000 employees.

Therefore, the economic impact of the proposed Kaliakoir Hi-Tech Park (hence force referred to as the Hi-Tech Park or the EZ site) will manifest itself in a number of ways, and at a number of spatial levels. Our approach will focus on the employment and economic output generating impacts of the Kaliakoir EZ. Over and above this quantifiable economic impact is the role the Park plays in delivering wider economic development, which is readily recognised by a wide range of stakeholders.

The assessment of the economic contribution of the Kaliakoir Hi-Tech Park is required to provide evidence of the role of the Park as a key economic driver at local and national levels. This is important to demonstrate the rationale for the public sector (either the BOI, World Bank or IFC) to intervene through investment in supporting the development of the Park, and to illustrate the nature and scale of the economic benefits of this intervention. The economic case for the Kaliakoir EZ should be considered alongside the commercial and financial cases[4] as part of a holistic approach to determining the feasibility of the Kaliakoir Hi Tech Park in Bangladesh.

8.2 APPROACH

This section sets out our approach to assessing the economic impacts of developing the Comilla EPZ Expansion in Bangladesh through:

- Summarising the types of economic impacts that typically arise from projects of this nature, and
- Outlining the methodology that will be adopted to measure these economic impacts

The overall methodology adopted for assessment of economic impact from EPZ expansion is presented below:

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[3] *BEPZA website*

[4] *The financial viability of the project is distinct from that of economic viability. Whilst financial viability concerns the relationship between costs and revenues (receipts through land rentals), the economic viability of the project concerns the relationship between project costs and the economic benefits generated throughout Bangladesh. These benefits could include jobs and expenditure, productivity increases, taxation receipts and improvements to the overall image and perception of Bangladesh as an investment location.*

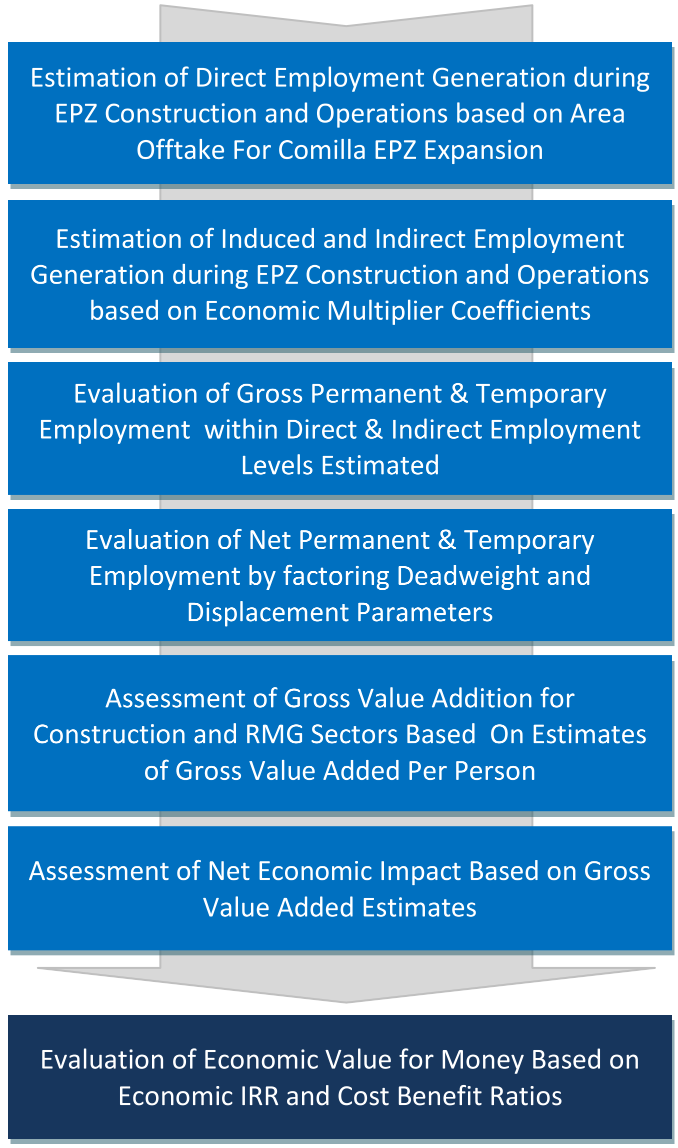


Exhibit 143 Economic Impact Assessment Methodology

Each of the steps highlighted in the methodology above have been elaborated in detail in the following sections.

8.3 DIFFERENT TYPES OF ECONOMIC IMPACT

Exhibit 144 Typical Economic Impact Generated Through EPZ Development below summarizes the type of economic impacts typically associated with development of such economic zones. In identifying the economic impact of the Hi Tech Park development, we have defined its geographical area of impact at the national level by considering the impact of such a zone in Bangladesh as a whole.

Figure 1 : Social and Economic Impact of Bangladesh Economic Zones

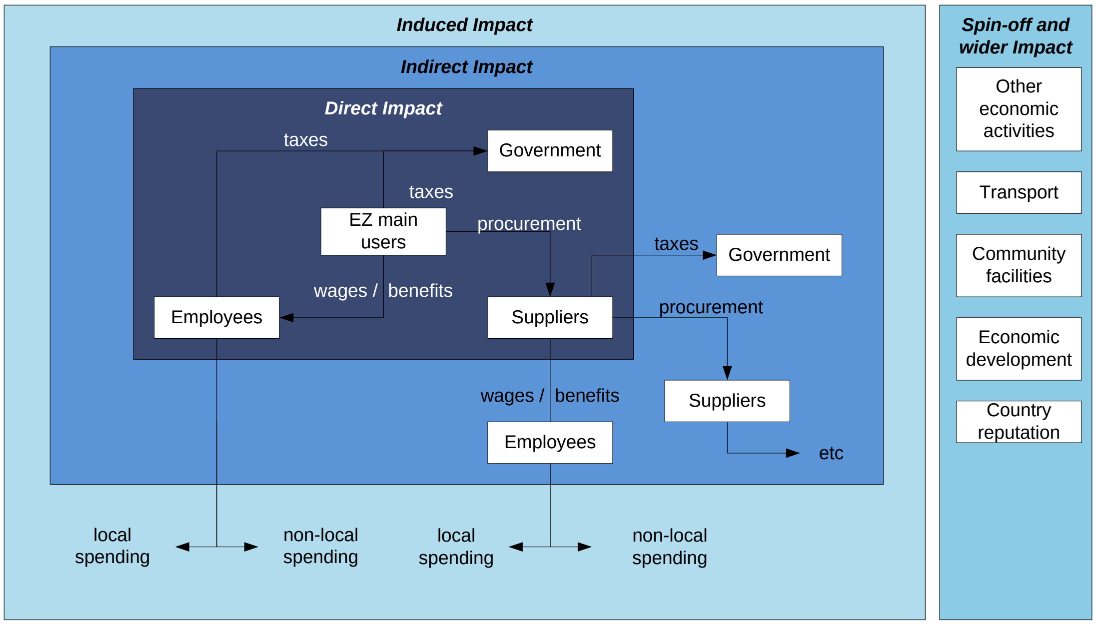


Exhibit 144 Typical Economic Impact Generated Through EPZ Development

In summary, we would expect the economic benefits arising from such developments to fall into two categories:

8.3.1 EMPLOYMENT IMPACTS

Impacts on levels of employment in Bangladesh will arise during both the construction and operational stages. For both stages the impacts would arise through several mechanisms:

- **Direct employment benefits**: construction and operating the park will create additional jobs in companies involved in construction of the park as well as through new businesses investing and operating in the zones;
- **Indirect and induced employment benefits**: the expenditure of these additional companies on goods, services and labor, will support additional economic activity throughout Bangladesh. In turn, this expenditure will support additional (indirect) jobs, and the salaries paid out to these workers will result in additional (induced) expenditure throughout the Bangladesh economy;
- **Spin-off impact** measures the employment associated with the spin-off activity located within or outside the EZ boundaries, which emanates are either customers of the Park's companies or directly benefiting for the image and perception impact arising from the development of the Hi Tech Park. The image and perception of Bangladesh is likely to be improved by the EZ development, which could in turn attract additional firms to locate in the country (i.e.: attract foreign direct investment). There is much evidence elsewhere of the image and perception of areas / countries as a place to do business following EZ developments;
- **Wider impacts** will take into account the fact that access to labor markets could change for local firms (e.g.: through related transport improvements). Improvements in access to more diverse or highly skilled labor markets (following investment in new training and educational facilities)

can increase levels of productivity amongst local firms, and create employment opportunities for those living in Bangladesh by promoting accessibility to new labor markets. Other wider impacts include synergies with strategic sites development, environmental benefits (e.g.: improving contaminated sites), assessment of economic development linkages through supplier linkages, business clusters, and support to wider economic development initiatives.

Assessment illustrates the methodology used to assess the employment impact of the proposed Hi Tech Park development on a national level. The quantity and quality of job creation potential is assessed, distinguishing between temporary and permanent employment opportunities, which will typically occur respectively during the construction and operational phases. The net employment impact will also incorporate analysis of indirect and induced employment effects as conditioned by 'leakage' within the economy. Multiplier coefficients used have been derived from survey evidence supported by relevant findings of previous impact reports, in the absence of availability of a relevant intra regional input/output model for Bangladesh.

Framework used to assess total employment impact

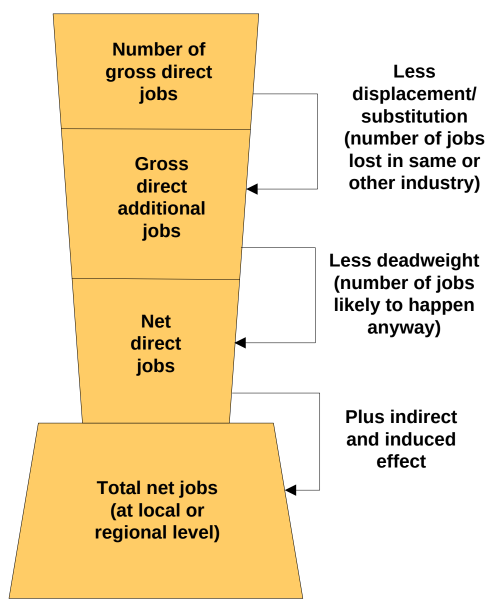


Exhibit 145 Framework for Employment Assessment

8.3.2 IMPACT ON ECONOMIC OUTPUT

Changes in the costs and productivity of businesses in Bangladesh will give rise to increases in Gross Domestic Product (GDP), which in turn result in employment growth. The development is likely to attract higher value added activities to Bangladesh which will raise GDP throughout the country. We also anticipate agglomeration benefits could arise from any acceleration of property development and economic development initiatives throughout the development of such dedicated infrastructure.

The economic contribution made to GDP arises from the profits and salaries generated in both the development and operational stages of the Park and will include the contribution made by:

- Expenditure on the development of the Hi Tech Park itself;
- Expenditure and staff employed by the Park's management; and
- The expenditure and employment generated by tenant ICT industry companies.

These activities will generate profits and salaries both directly (park's management itself generates profits and pays salaries that are invested and spent within the economy), and indirectly (tenant companies deliver profits and salaries that are spent within the Bangladesh economy). Additionally, and in turn, these tenant companies will purchase goods and services from other companies located outside of the Hi Tech Park, which in turn supports the *indirect* generation of profits and salaries in these companies. Finally, the spending of these other companies generates an additional effect (an *induced* contribution) throughout the Bangladesh economy.

8.4 OTHER INTANGIBLE BENEFITS

Other than the directly quantifiable economic impacts as detailed above, a number of other intangible benefits would also be realized through the EZ program and the Kaliakoir Hi-tech Park project in particular. These are detailed out in this section of the report.

8.4.1 MEASURING INTANGIBLE BENEFITS

There is now a recognised body of research that seeks to value in monetary terms a whole range of environmental and social impacts. These impacts are associated with either improvements in outcomes (e.g.: enhanced river water quality) or avoided costs (e.g.: avoided loss of biodiversity, avoided agricultural productivity losses, or avoided damage to property from flooding). The estimation of the monetary values of these impacts follows established methodology based on environmental and welfare economics techniques of "willingness to pay" and "willingness to accept" a change in outcomes.

In the context of the Bangladesh Economic Zones, a range of environmental and social impacts have been identified in qualitative terms. However, the conversion of these impacts into robust, monetary values would require a significant level of additional information in terms of the specific impact pathway (i.e.: mechanism of impact of the project on the environment), a quantification of the physical environmental impact, and the use of appropriate benefit transfer techniques to convert these physical impacts into monetary values. This level of analysis is beyond the scope of this economic impact assessment. Also it would be essential that the unit monetary values adopted are appropriate to Bangladesh given its socio-economic context and economic output levels.

However, it can be anticipated that the Economic Zones will in principle be associated with a range of environmental and social impacts that are potentially amenable to measurable quantification. For example, the EZs are anticipated to generate significant positive externalities in terms of attracting firms that will adhere to a higher level of compliance with environmental standards than is currently prevailing across Bangladesh. To the extent that these firms are businesses that have relocated from elsewhere in Bangladesh, this will represent avoided environmental costs (such as reduced water or air pollution) since these firms are now complying with higher levels of environmental standards. There will also be a positive externality associated with the impact of EZs in raising the general compliance with environmental standards across non EZ zones (expected to take place over time). A key potential area of quantification would be in terms of the climate change impact of the EZs, adopting the shadow price of carbon values now increasingly applied to CO_2 emissions reductions arising from public policy interventions.

8.4.2 POTENTIAL DEMONSTRATION EFFECTS OF THE EZS ON OTHER EPZS

The experience of the Chinese economic zones illustrates the potent demonstration effect Economic Zones can have. A World Bank review (1992) of the Chinese experience claims that the growth of non-state rural industry engaged in export processing can, in part, be attributed to the demonstration effect of the Economic Zones. As the industry is estimated to employ about 100 million people, the socio-economic impact goes much beyond what was originally expected by the zones.

It is important to point out that in addition to demonstrating a different way of operating a business, the Chinese zones demonstrated a different business model based on employing a higher level of women and paying higher wages. In most cases, the wages were double and more than comparable with wages prevailing outside the zones. Data from some companies showed that the wages were as high as three times the average outside the zones. The fact that this business model was successful sent out a strong message about the potential for including women in the work- force and that higher wages are not necessarily uncompetitive.

However, international experience also suggests that while the demonstration effect can be powerful and influence a whole sector, industry and national policies, this does not happen automatically. The experience of the economic zones needs to be monitored, well recorded and adequately communicated for them to have a successful demonstration effect. It is also important to ensure that such information is combined with, among others:

- High level political support and commitment;
- Inter- zone linkages; and
- Links to the relevant industries and business communities

It is a prerequisite that the EZ adopt international best practice and sustainable policies and processes (environmental and/ or social). Otherwise, there is a high- risk that the zones may demonstrate weaknesses of the model rather than their strengths.

8.4.3 FOREIGN EXCHANGE EFFECTS

The EZs are expected to attract foreign inward investment into Bangladesh, thereby raising the country's foreign exchange reserves and helping to reduce its current account deficit. Increased foreign exchange reserves can potentially assist the Bangladesh government to stabilise foreign exchange rates to provide a more favourable economic environment. The positive impact of enhanced reserves is demonstrated through the experience of emerging economies such as China and India, who have used their significant accrual of foreign exchange reserves to invest in overseas assets and bonds, thereby contributing to its efforts to achieve greater macroeconomic stability and improved economic competitiveness.

The example of Pakistan is also illustrative of the potential benefits of foreign direct investment. The economy of Pakistan is the 26th largest in the world in terms of purchasing power and 47th largest in absolute dollar terms. Pakistan's economy is founded upon its textiles, chemicals, food processing, and agricultural industries. The economy has suffered in the past from decades of internal political disputes, a fast growing population, and limited foreign investment. However, IMF approved government policies, bolstered by foreign investment and renewed access to global markets, have generated solid macro economic recovery over the last decade.

8.4.4 IMPACTS OF EZS ON MARGINALISED GROUPS

As the Economic Zones aim to encourage investors to use local labour, invest in training and adopt international best practice in hiring local people, the assumption is that this will lead to greater equity in accessing EZ jobs compared with currently existing ones.

The EZ structure allows for improved government and private sector monitoring of labour standards and hiring practices due to the scale of the operation. This is particularly important for small scale businesses which are typically difficult to monitor on a regular basis. Therefore, the EZs offer the opportunity for the monitoring of business activities on a concentrated basis which is more efficient as it results in economies of scale.

As the EZs will follow the relevant construction and labour standards regulations, it is expected that access to the EZ will increase the possibilities for people with disabilities to participate in new economic opportunities.

It is also expected that the greater security of income and opportunities that the concentration of jobs provides, and the fixed geographic location of such jobs, will benefit women and single parents significantly as it will provide for a more stable environment where accommodation, child care, savings and schooling can be planned.

The training and opportunities provided by the EZ will also benefit low skilled local residents, usually members of marginalised groups. It is expected that the EZ and the associated multiplier effect will benefit large sections of the local community regardless of their occupation, skill level and identity. The EZs are expected to create opportunities for employment, provision of services (within and outside the EZ), procurement and supply chain opportunities for small and medium businesses, and increased trading and consumption in the area.

Capturing such effects can be beneficial in unpacking the multiple socio- economic impacts of the EZs. This can be realised through the monitoring and evaluation system as well as through dedicated evaluation work.

The impacts on marginalised groups can be monitored and analysed in both quantitative and qualitative terms as follows:

- Quantification – e.g.: increased participation rates, increased economic output, reduced social welfare payments; etc can be very useful to monitor a number of future socio- economic impacts. It can be achieved by adapting the monitoring and evaluation system to record relevant data that will then allow appropriate analysis to be undertaken. The cost will be incremental but it will be in addition to everything envisioned so far.
- Qualitative- the impacts can be recorded regularly through stakeholder interviews and focus groups in the form of story- telling. This information can be very useful in helping to understand the reasons, multiple layers and diversity of impact often hidden behind quantitative trends.

8.5 DISTINGUISHING FEATURED OF HIGH TECH PARK DEVELOPMENT

The Hi Tech Park will be a revolutionary concept in terms of Economic Zone development in Bangladesh. The Pre Feasibility Study and Basic Planning and Design Study for Kaliakoir Hi-Tech Park presents the concept for the proposed EZ model and presents this concept in terms of both market demand and master planning vision. In summary the Kaliakoir Hi-Tech Park will be a new concept in Economic Zone development in Bangladesh. The masterplan is based on the broad objective of establishing a world class business environment targeted at high growth industrial sectors and new businesses.

It will offer a new commercial real estate product in Bangladesh that would create conducive environment for a lifestyle integrated industrial and business city. The Park will be supported by high quality infrastructure facilities and compliance with international standards in environmental and ethical operations. It will be largely focused on a business model that is attractive to internationally based investment from outside Bangladesh, but unlike the conventional ICT related developments, it will be focused on maximizing the economic linkages between the Park and the rest of the Bangladesh economy. Therefore, the development of the Kaliakoir Hi-Tech Park will deliver a step change in EZ development in Bangladesh through offering a new real estate product based on its location and high environmental quality assurance related factors.

The location characteristics of the Park underpins the uniqueness of the proposed project, offering the opportunity for a commercial development that is integrated with Bangladesh's existing, domestic high technology sector and support activities, new transport infrastructure with multi modal accessibility (e.g. rail link to Dhaka), a high quality green environment and potential for creating a new sustainable residential community in neighbouring areas. Investment in the Park will mean providing an environment that will be attractive to hi-tech occupiers through:

- Urban fringe mixed use location;
- Potential occupier profile – attraction of inward investment, growth and retention of existing activities;
- Size/scale (range of floor plates);
- Image and brand;
- Environment;
- High levels of accessibility (locally, regionally and nationally) to trade and labor markets;
- Delivery (speed);
- Cost; and
- Sustainability in terms of a balanced community

The successful development of this Park would provide a unique product offering, differentiated from Bangladesh's existing EPZs & ICT related developments, therefore contributing towards the overall economic performance and competitiveness of Bangladesh as a business and investment destination.

8.6 ANALYSIS OF ECONOMIC IMPACTS

In this section we outline the range of potential economic benefits that might be generated within Bangladesh as a result of the construction and operation of the proposed Hi Tech Park. We also consider the key assumptions upon which these ranges of economic impact are based. The key economic impacts assessed include the direct, indirect and induced employment impacts, the economic output impact, and the wider economic development impacts.

8.6.1 TEMPORARY EMPLOYMENT DURING CONSTRUCTION PHASE

Investment in the proposed Park will create a number of construction jobs. The nature of such employment is inherently short term and is a function of the scale and type of the construction expenditure.

The direct expenditure involved will lead to increased output generated in the Bangladesh economy. Detailed knowledge of the capital expenditure programme and the effects upon the economy are required in order to develop a precise relationship between the capital expenditure and net output generated. Given limitations of data availability and sufficiency relating to the Bangladesh economy (specifically sector-specific input/output tables), it has not been possible to identify the extent of any output benefits with accuracy. However, we note that:

- Average Gross Value Added (GVA) in Bangladesh (for all economic sectors, not just 'Construction', was USD 627 in 2007 (USD 644 per capita in 2009 prices)[5]; and
- Construction sector GVA per capita is reported as USD 3,559 (2007 values). Up-lifting this figure to 2009 values suggests that GVA could be as much as USD 3,660 per capita.

Gross Value Added Per Capita	USS 000's
GVA per capita (2007)(i)	3,559
GVA per capita (2009)(b),(ii)	3,660

Exhibit 146 GVA per capita, Bangladesh, Construction sector

Notes: (a) Figures shown represent average GVA for all sectors of the Bangladesh economy – in the absence of any construction sector-specific data
(b) Assumes annual GVA growth of 7 per cent per annum (nominal) between 2007 through 2009, adjusted by a GDP deflator of 5.6 per cent per annum, resulting in real growth of 1.4 per cent per annum.

Sources: (i) UN (2009), UN Statistics Division, 'Bangladesh – all available series'
(ii) World Bank (2008), 'World Bank Country Report: Bangladesh'

Using this data, we have applied average GVA value per worker to the total capital expenditure that is projected to arise in the course of development so as to project the likely employment impacts that could arise. This analysis is summarized below.

8.6.1.1 GROSS TEMPORARY EMPLOYMENT

The table below summarizes the estimated capital costs for the proposed development. The total gross capital investment is estimated to be nearly USD 56.6 million (expressed in undiscounted 2009 prices). Using the ratio of one person-year per USD 3,660, it is estimated that almost 14,072 gross person-years of employment could be created during the construction phase.

Convention in economic appraisals of this nature typically assumes that 10 person-years of employment can be taken as equivalent to one permanent full-time job created. On this basis, we project that this investment could support the creation or maintenance of almost 1,407 Full Time Equivalent (FTE) jobs.

Estimated capital cost (USD'000's, 2009 un-discounted prices)	Construction years – direct	Construction Gross Full Time Equivalent (FTE)
56,697 (a)	**14,072**(b)	**1,407** (c)

Exhibit 147 Estimated Gross Direct Temporary Employment

Notes: (a) Total capital costs to be expended incrementally between 2012 and 2019
(b) derived by dividing capital costs through projected GVA per capita in the construction sector

[5] *Assumes annual GVA growth of 7 per cent per annum (nominal) between 2007 through 2009, adjusted by a GDP deflator of 5.6 per cent per annum, resulting in real growth of 1.4 per cent per annum*

(USD3,660)
(c) Person years of employment are converted into FTE's using a ratio of person years : FTE's of 1:10, as per standard appraisal practice

8.6.1.2 NET TEMPORARY BENEFIT

8.6.1.2.1 DIRECT BENEFITS

The table below presents the net direct temporary economic impacts – in terms of full time equivalent jobs, and Gross Value Added. In doing so, it takes the gross direct impacts summarized in Exhibit 147 Estimated Gross Direct Temporary Employment above and considers the extent to which factors such as 'deadweight' and 'displacement' could in practice reduce the temporary benefits arising from the scheme. We summarize each of these terms below:

- ***Deadweight:*** this refers to the proportion of jobs created at the national level which would have happened anyway, irrespective of whether the proposed development went ahead. In practice, we suggest that the deadweight effect associated with the Park should be low, since the development concept seeks to establish a qualitatively different integrated ICT industry dedicated facility that is differentiated from other sites both in terms of the quality of infrastructure and ultimately, rental charges. As such, we have assumed that deadweight will be limited (10 per cent of temporary benefits are projected to be offset by deadweight) and;
- ***Displacement***: Given that there is no clear dependency between the Park and other development projects in Bangladesh, it is anticipated that the proposed development would have relatively little impact on the delay or outcome of other pending development projects. We have adopted a cautious approach to appraisal in this regard, and assumed that some 20 per cent of projected benefits would be delivered by construction activity that is displaced from elsewhere in Bangladesh. In practice, we would expect displacement to be lower

On this basis, Exhibit 148 Net direct temporary impacts (FTE jobs) below translates the projected gross temporary impacts into net impacts.

Impact	Gross Direct FTE Impact	Deadweight (%)	Displacement (%)	Direct net impact
Jobs (FTE)	1,407	90%	20%	912

Exhibit 148 Net direct temporary impacts (FTE jobs)

8.6.1.2.2 INDIRECT AND INDUCED BENEFITS

In addition to the direct impacts generated by the project itself there will be increased local employment arising from the *indirect* and *induced* effects of this construction activity. *Indirect* employment growth will arise locally through services and supplies to the construction process benefiting local suppliers of temporary buildings, materials and sub-contractors of subsidiary construction tasks. *Induced* benefits will also arise as construction workers, and those employed in providing services to the construction process, will spend some of their incomes locally, and this will generate further local employment. The rate at which indirect and induced employment is created in this way is established through the application of conventional employment multiplier techniques and the selection of an appropriate multiplier coefficient, based on leakage estimates (the proportion of expenditure and incomes 'leaking' outside of the Bangladesh economy). In the absence of any construction sector multipliers for use in Bangladesh, we have conducted a review of potentially relevant sources so as to derive a suitable value.

On this basis, Exhibit 149 Composite economic multiplier coefficients sets out a series of multipliers that could be applied to the direct temporary benefits discussed above. These multipliers represent '*composite*' coefficients – that is, they combine both the indirect and induced effects described above.[6]

Multiplier estimate	Basis
1.10	Output multiplier, Jebel Ali Free Zone, UAE(a)
1.11	Income multiplier, Jebel Ali Free Zone, UAE(a)
3.33	**Output multiplier, Bangladesh(b)**
2.80	Income multiplier, Bangladesh(b)
2.00	Output multiplier, free trade Zones, Mexico(c)
2.70	Income multiplier, free trade Zones, Puerto Rico(c)

Exhibit 149 Composite economic multiplier coefficients

Sources: *(a) PwC analysis*
(b) International Labour Organisation (2008), Remittances: Characteristics and Development Perspective
(c) Indian Council for Research on International Economic Relations (2007), 'Impact of Special Economic Zones on Employment, Poverty and Human Development', Working Paper No.194, May

Given the locally-specific nature of the ILO multipliers summarized above (they are specific to Bangladesh) we have applied an output multiplier of 3.33 to the direct benefits arising from the construction of the Zone (so as to model the resulting indirect and induced benefits)[7]. This implies that for every one direct job created in the construction phase, a further 2.33 jobs could be expected to be supported in the broader Bangladesh economy as a whole. On this basis, we project that:

- An additional 2,124 FTE jobs could be created in the wider Bangladesh economy during the construction phase of the project (2009 through 2012); and
- These additional jobs represent an increase in economic output (Gross Value Added) of some USD 1.37 million (expressed in undiscounted, 2009 prices)

Impact	Net Direct Impact	Multiplier coefficient	Indirect and induced impacts	Total impact
Jobs (FTE)	912	3.33	2,124	3,036
GVA (USD'000's) (a)	NA	3.33	1,370(b)	1,370

Exhibit 150 Net total temporary impacts (FTE and GVA), (2009 undiscounted prices)

Notes: *(a) Presented in undiscounted constant 2009 prices*
(b) The 2,124 additional jobs supported throughout the Bangladesh economy are valued (in terms of

[6] *A composite multiplier coefficient includes consideration of both the indirect and induced expenditure and income effects arising from an investment*.

[7] *We apply an Output multiplier since we are primarily concerned to model indirect and induced benefits in output terms (this being defined as the contribution to additional profits and salaries) in subsequent sectors of the economy that might be supported by the construction stage of the development*

prevailing economic output) at the average GVA per capita rate of USD 644 (representing average GVA across all sectors of the economy in 2009

8.6.2 PERMANENT ECONOMIC BENEFITS

The proposed expansion will generate a number of permanent employment opportunities. These employment opportunities will create economic benefits which can be measured in terms of jobs and economic output (Gross Value Added). Gross Value Added (GVA) comprises of the profits and salaries generated by economic activity.

We consider these economic benefits in two parts:

- *Firstly*, the gross economic benefits are considered (these being the absolute benefits that could theoretically be generated); and
- *Secondly*, we consider the extent to which these gross benefits would in practice be additional to the Bangladesh economy. As such, issues of deadweight and displacement are addressed. We also consider the wider (indirect and induced) economic benefits which could arise.

8.6.2.1 GROSS PERMANENT BENEFITS

The number of gross direct jobs has been estimated using the breakdown of the floor-space figures for the proposed Expansion (by use-class type) and adopting typical employment densities for different types of land uses, expressed in terms of square feet of floor-space per FTE. These have been derived separately (outside of the remit of this economic assessment) and are summarised below. On this basis, it is estimated that the proposed scheme would create almost 66,230 direct gross jobs when fully occupied (to capacity) by 2024.

Land use type	Total floor space (Acres)	Employment density (sq ft per worker)	Total Gross direct jobs (FTE)
ICT Industry	53.28	100	63,800
Hardware Park	9.82	100	2,400
Logistics	5.26	250	30
Total			**66,230**

Exhibit 151 Projected Job Creation

These jobs will support increased economic output throughout the Bangladesh economy. This output can be expressed in monetary terms by multiplying the Gross Value Added generated per FTE job by the number of jobs to be created. Whilst we note that average GVA per capita in Bangladesh is estimated to be USD 644[8] in 2009, there is no specific GVA data that relates specifically to the high-tech sector companies that are expected to operate from the Kaliakoir EPZ. As such, we conducted a survey of existing high-tech companies operating from Dhaka so as to derive a GVA per capita estimate. Exhibit 152 GVA per capita, ICT sector (Kaliakoir Hi Tech Park, 2009 undiscounted values) below summarizes the survey findings. In summary, we calculate that average GVA in the high-tech sector to be USD 5,746 per capita, reflecting the higher value-added nature of the sector relative to others in Bangladesh.

[8] *(2009), UN Statistics Division, 'Bangladesh – all available series', PwC analysis*

Number of employees working for companies surveyed(a)	Average salary per annum (BDT)(b)	Average profit per employee (BDT)	Inferred GVA per employee (BDT)	Inferred GVA per employee (USD)(c)
1,338	321,397	74,368	395,765	5,746

Exhibit 152 GVA per capita, ICT sector (Kaliakoir Hi Tech Park, 2009 undiscounted values)

Notes: (a) Derived from a survey of existing IT/ITeS companies operational in Bangladesh. n=15. Survey conducted in 2009
(b) Weighted average of salaries between management (BDT 660,000, n=206) and workers (BDT 252,000, n=1,132)
(c) BDT:USD conversion rate of 0.0145 is applied

On the basis that almost 66,230 employees will be working at the newly developed park by the year 2024, Exhibit 153 Projected direct GVA benefits, 2024 (2009 undiscounted values) below suggests that annual GVA benefits could be around USD 410.9 million per annum in 2024.

Total gross direct jobs (FTE)	GVA per employee (USD)	Total (USD millions)
66,230	5,746	386.2

Exhibit 153 Projected direct GVA benefits, 2024 (2009 undiscounted values)

However, not all of these permanent direct jobs represent new additional employment opportunities for the Bangladesh economy. The extent to which these jobs are genuinely 'additional' will depend on the degree of 'deadweight' and 'displacement' that is projected to arise. We consider these further below.

8.6.2.2 ADDITIONALITY OF PERMANENT BENEFITS

8.6.2.2.1 DIRECT PERMANENT BENEFITS

The extent to which benefits are additional will vary according to the nature of the investment, the type of firms attracted to the zone (in terms of whether the business originates from outside or within Bangladesh) and in terms of what businesses are being substituted from existing activities. As such, we have made adjustments to the gross permanent benefits summarized above to allow for both deadweight and displacement as follows:

- *Deadweight*: the extent to which public investment in the Kaliakoir EZ would act to deter or replace private sector investment in similar schemes elsewhere in the region, or indeed throughout Bangladesh as a whole. In practice, we suggest that the deadweight effect associated with the development should be low, since the facilities and economic activity promoted by the Kaliakoir EZ are unique in the Bangladesh context. Moreover, there is a market consensus that the development is regarded as an essential part of Bangladesh' aspirations to further develop the high tech sector, by fostering growth through the creation of leading-edge facilities. As such, we have assumed that deadweight will be minor (**10 per cent of temporary benefits are projected to be offset by deadweight)**;[9] and

[9] PwC analysis

- *Displacement*: the extent to which the projected benefits delivered by the project will be generated by existing companies locating from other sites in Bangladesh is known as 'displacement'. On the basis that the Kaliakoir EZ will represent a premium product for the high-tech sector (which is currently in a stage of relative infancy in Bangladesh), we have assumed that the displacement of economic activity will be relatively high (**we project that some 80 per cent of projected benefits would be delivered by activity that is relocated from elsewhere in Bangladesh**). We consider this to be a fairly realistic assumption, given the current profile of establishment avenues available to the High-Tech sector companies in Bangladesh and the market proposition that Kaliakoir will foster new indigenous growth in the sector, as well as attracting foreign investment.

On this basis, the table below translates the projected gross economic benefits arising from the expansion into net benefits (net of deadweight and displacement). The table summarises projected impacts for one year (2024) – this being the first year for which the development is considered to be fully populated.

Impact	Gross Direct Impact	Deadweight (%)	Displacement (%)	Direct net impact
Jobs (FTE)	66,230	10%	80%	11,921
GVA (USD'000 s)(a)	386.2	10%	80%	69.54 (b)

Exhibit 154 Net direct permanent impacts (FTE and GVA) (2024)(i)

Note: (a) Expressed in undiscounted 2009 constant prices
(b) Based on a GVA per capita figure of USD 5,832 in 2024 (2009 undiscounted prices), on the basis of real GVA growth per annum of 0.1% per annum. GVA per capita in 2009 (USD 5,746) is inflated on this basis to 2024(ii)
Sources :(i) PwC analysis
(ii) UN (2009), UN Statistics Division, 'Bangladesh – all available series' reports nominal GVA growth ('Other' sector) of 5.7% per annum and inflation (GDP deflator) of 5.6% per annum, resulting in real GVA growth of 0.1% per annum

8.6.2.2.2 INDIRECT AND INDUCED PERMANENT BENEFITS

In addition to the direct economic impacts summarized above, additional (indirect) benefits are expected to arise from secondary businesses who supply goods and services to on-site activities that in turn create further economic activity by purchasing additional supplies from other businesses located within Bangladesh. Additionally, an induced economic effect will also result from increased local consumer expenditure arising from the creation of additional personal income derived from the first (direct workers) and successive (indirect workers) rounds of spending.

These indirect and induced benefits are typically considered through the application of a multiplier coefficient that represents the additional economic benefits that arise over and above the projected direct impacts. We have considered a range of potential multiplier coefficients for use in this regard (as summarised in Exhibit 149 Composite economic multiplier coefficients above) and note in particular that the International Labour Organisation suggest a composite multiplier coefficient of 3.33[10] as being applicable for use in Bangladesh. This is however a general coefficient that applies to all economic activity, in all sectors of the economy.

[10] *International Labour Organisation (2008), Remittances: Characteristics and Development Perspective*

As a consequence (and in the absence of any published multiplier for the high-tech sector in Bangladesh), we conducted a survey of high-tech companies currently operating Dhaka to attempt to derive a suitable coefficient that reflected the nature of the high-tech sector in Bangladesh. However, given the relative infancy of this sector in Bangladesh and the comparatively small size (in terms of employees and turnover) of existing companies, most companies reported an uncharacteristic reliance on local (Bangladesh) goods and services[11]. Whilst we have no good reason to question the economic output (GVA) reported to us by these companies[12], we do not consider that the expenditure patterns reported by local companies are indicative of the nature and size of companies that would locate in the Kaliakoir EZ.

As such, and in the absence of any published sector-specific multipliers in Bangladesh, we have applied the ILO coefficient (3.33) so as to appraise the indirect and induced economic benefits that could be created. The section below applies this multiplier values to the net direct impacts summarized in Exhibit 154 Net direct permanent impacts (FTE and GVA) (2024)(i)above to derive the total (direct, indirect and induced) permanent economic contribution which could arise from the development.

8.6.2.3 SUMMARY OF NET PERMANENT BENEFITS

Exhibit 155 Projected Net permanent benefits (2024)below presents the permanent economic impacts estimated for the operational phase of the proposed development at the Bangladesh level. In doing so, it once again presents a snapshot of potential benefits in a given year (2024 – this being the year in which the development has been fully occupied and features total employment capacity).

Therefore, after taking all relevant aspects of additionality into account, it is projected that the proposed development will create in excess of 39,600 FTE jobs within the Bangladesh economy, equivalent to around USD 231.5 million of economic output in 2024.

Benefit	Direct gross benefits	Direct net benefits (net of Deadweight and Displacement)	Induced & indirect benefits	Total net benefits
FTE jobs	66,230	11,921	27,777	39,698
Output (GVA) (USD Millions)(a)	386.2	69.54	162.00	231.5

Exhibit 155 Projected Net permanent benefits (2024)

Note: (a) Expressed in undiscounted constant 2009 prices
Source: PwC analysis

[11] *Our experience is that larger high-tech organisations typically show a greater dependence on overseas factors of production and distribute profits in a global fashion, compared to the local (relatively small) companies currently operating in the Bangladesh high tech sector that we were able to interview in the course of this study. As such, the 'transferability' of our survey findings on economic leakage, to that of a fully occupied EPZ at Kaliakoir in 2019 is not considered to be sufficiently robust relative to the 'all sector' multiplier calculated by the ILO.*

[12] *It being broadly consistent with a trend towards higher value added employment, compared with a similar survey that we conducted of Ready Made Garment companies operating from the Comilla EPZ. It is however important to note that our surveys cannot be regarded as statistically significant (they simply offer a 'snapshot' of GVA). However, these limitations must be considered in the context of there being no other source for the GVA generated by 'high tech' companies in Bangladesh*

8.6.3 TOTAL ECONOMIC IMPACT

This section summarises the total economic impacts that are projected to arise from the development scheme. It does so in three steps:

- **The total net annual impacts** generated in the construction and operational stages of the project are summarized in terms of an *annual snapshot* of projected benefits (benefits arising in a single year - 2024);
- **The economic value for money of the project** is considered by relating the projected net economic benefits to the project costs over a longer appraisal timeframe (not simply one year); and
- **Sensitivity tests** are conducted to evaluate the extent to which the value for money associated with the project could change under particular circumstances

8.6.3.1 TOTAL NET ANNUAL IMPACT FOR YEAR 2024

Exhibit 156 Summary of total net economic benefits during construction and operation (2024) below summarizes the total projected economic impacts associated with the proposed development, during both the construction and operational phases, taking account of the direct and indirect / induced economic impacts.

Despite conservative assumptions (particularly those concerning displacement), the proposed development (once operational and fully occupied by 2024) has the potential to make a significant contribution to the Bangladesh economy. In summary, we project that:

- In total the scheme could create nearly 172,450 FTE additional jobs within the Bangladesh economy in 2024; and
- These jobs equate to some USD 986.5 million in additional economic output (GVA) that could be brought about by the scheme

Economic measure	Phase	Direct gross impacts	Direct net impacts	Induced & indirect impacts	Total net impacts
FTE jobs	Construction	1,407	912	2,124	3,036
	Operational	66,230	11,921	27,777	39,698
	Total	67,637	12,833	29,901	42,734
Economic output (GVA) (USD millions)(a)	Construction	N/A(b)	N/A(b)	1.37	1.37
	Operational	386.2	69.54	162.00	231.5
	Total	386.2	69.54	163.37	232.87

Exhibit 156 Summary of total net economic benefits during construction and operation (2024)

Notes: (a) Expressed in undiscounted constant 2009 prices

(b) Construction GVA is not expressed given that this is the required investment in the development itself

Source: PwC analysis

8.6.4 ECONOMIC VALUE FOR MONEY

This section considers the value for money that is likely to be achieved by the scheme by relating the projected economic output benefits to the project costs. In doing so, it aggregates all costs and output benefits over a period of time and discounts these back to a 2009 present value using a discount rate of 10% real. We understand that this discount rate represents the World Bank's in-country discount rate for *economic* appraisal of social and infrastructural projects in Bangladesh.[13]

Exhibit 157 Summary of Costs and Benefits, (in Present Value terms) below summarizes the present values of costs and benefits over time (discounted back to 2009). It also shows that when considered over a ten year period (to 2019), the project delivers a Benefit to Cost Ratio (BCR) of 40:1. However, when appraised over a longer period to 2060 (this period being consistent with that used to consider the *financial* viability of the project), the BCR increases to 150:1.

Appraisal period	Present value of costs (USD millions) (a)	Present value of net benefits (USD millions) (b)	Benefit Cost Ratio (b-a)	Economic IRR(ii) (%)
10 year appraisal period (2009-2019)(i)	31.8	117.1	4.0:1	64.5%
51 year appraisal (2009 - 2060)(i)	31.8	546.2	18.9:1	73.6%

Exhibit 157 Summary of Costs and Benefits, (in Present Value terms)

Note: (i) Discounted at 10.0% real to January 2009. Expressed in constant 2009 prices
(ii) The Economic Internal Rate of Return (IRR) is the discount rate required to return the present value of net benefits (benefits less costs) to zero. This is therefore the discount rate at which the project is expected to 'break even'.

8.6.4.1 SENSITIVITY ANALYSIS

We have conducted several sensitivities around the extent to which the projected benefits summarized in Exhibit 157 Summary of Costs and Benefits, (in Present Value terms) could change should different assumptions be used to underpin the analysis. The principal assumption (in terms of its relative impact on our findings) is that of the phasing of employment growth during the operational phase of the development. Exhibit 158 Projected employment growth, base case, optimistic and pessimistic scenario below summarises the profile of employment growth that has been applied to support the analysis presented in this paper (the 'base case'), but also shows a more optimistic as well as pessimistic profile of employment, where the uptake of floor-space is changes the level of employment growth achieved.

Year	Base case	Pessimistic scenario	Optimistic scenario
2012	0	0	0
2013	1,364	272	8,992

[13] *Discount rate drawn from: World Bank (2008), ' Implementation completion and results report (IDA-29950), Private sector Infrastructure Development Project, January 30th, Sustainable Development Sector, World Bank, Dhaka*

2014	3,173	610	23,856
2015	5,552	1,026	48,643
2016	8,666	1,532	66,230
2017	12,728	2,143	66,230
2018	18,014	2,879	66,230
2019	24,453	3,760	66,230
2020	32,330	4,813	66,230
2021	41,490	5,990	66,230
2022	52,141	7,302	66,230
2023	64,527	8,765	66,230
2024	**66,230**	**10,899**	**66,230**
2025	66,230	13,237	66,230
2026	66,230	15,670	66,230
2027	66,230	18,183	66,230
2028	66,230	20,760	66,230
2029	66,230	23,382	66,230
2030	66,230	26,027	66,230
2031	66,230	28,672	66,230
2032	66,230	31,292	66,230
2033	66,230	33,860	66,230
2034	66,230	36,349	66,230
2035	66,230	38,729	66,230
2036	66,230	41,224	66,230
2037	66,230	43,837	66,230
2038	66,230	46,575	66,230
2039	66,230	49,443	66,230
2040	66,230	52,447	66,230
2041	66,230	55,595	66,230
2042	66,230	58,893	66,230
2043	66,230	62,348	66,230
2044	66,230	65,967	66,230
2045	66,230	66,230	66,230

Exhibit 158 Projected employment growth, base case, optimistic and pessimistic scenario

Should the optimistic or pessimistic employment growth scenario arise in practice, Exhibit 159 Sensitivity analysis for costs and benefits (2009-2019) below shows the impact that this profile of higher and lower growth could have on the projected BCR of the scheme. On the basis of the optimistic, the scheme delivers a promising BCR of 31.2:1. In case of the pessimistic employment growth numbers, the scheme delivers an equitable BCR of 1.1:1.

Scenario	Present value of Costs (USD millions) (a)(i)	Present value of Net benefits (USD millions) (b)(i)	Benefit Cost Ratio (b-a)	Economic IRR (%)
Base Case	31.8	117.1	4.0:1	64.5%
Optimistic Scenario	31.8	578.0	20.1:1	232.9%
Pessimistic scenario	31.8	20.2	0.7:1	-

Exhibit 159 Sensitivity analysis for costs and benefits (2009-2019)

Note: (i) Discounted at 10.0% real to January 2009. Expressed in constant 2009 prices

8.6.5 SPIN OFF AND WIDER ECONOMIC BENEFITS

In addition to the significant employment that the proposed Park would generate, it is also important to examine the development's wider socio-economic impacts. These can be categorised as follows:

8.6.5.1 ECONOMIC DEVELOPMENT IMPACTS

It can be anticipated that the establishment of the Kaliakoir Hi Tech Park will generate a catalytic effect in terms of attracting, retaining and expanding the ICT industry in Bangladesh. This effect will be centred on a series of cross-cutting themes as follows:

- Role of Kaliakoir Hi-tech Park as a catalyst for economic growth and competitiveness in the country;
- Strengthening of the Dhaka - Kaliakoir corridor as a key economic driver for local and national prosperity.

In addition, the catalytic effects can be regarded as the magnetic effect the EZ has on a wide range of economic activities and include, for example, schools and other educational and health facilities provided for the children of the direct and indirect employees, firms drawn to the area because of the activity generated by the EZ and its users, and the economic development of the local areas..

8.6.5.2 QUALITY OF IMPROVEMENT

The proposed Park will create not only an increase in the quantity of employment opportunities in the Kaliakoir area but also substantially enhance the quality of jobs available. The new employment opportunities available will offer high quality, better paid jobs for local people. This will be important, for example, in helping to retain young people in the area many of whom currently are going overseas in search of these opportunities. An increase in the pool of available skilled workers will in turn increase the incentive for employers to relocate to the area.

9 PPP AND PROJECT STRUCTURING

Hi tech park developments around the world often have a strong private sector accent although there are examples of government led development as well. Given the expertise required to develop the project as well as the sensitivities surrounding land issues, it is important to exhaustively analyze relevant issues to identify a suitable structure for implementation of the project.

9.1 PUBLIC PRIVATE PARTNERSHIP

Public-Private Partnership (PPP) refers to deals where a government agency provides the right to a private party, to operate an asset or an infrastructure facility catering to multiple entities or common users. The three main needs that motivate governments to enter into PPPs for infrastructure are to:

- Attract private capital investment;
- Increase efficiency and use available resources more effectively; and
- Reform sector through a allocation of roles, incentives and accountability

PPPs can follow a variety of structures and contractual formats. However all PPPs incorporate three key characteristics:

- Contracts defining the roles and responsibilities of the parties;
- Sensible risk sharing among the public and private sector partners; and
- Financial rewards to the private party commensurate with the achievement of specified outputs.

A successful PPP is designed with careful attention to the context or the enabling environment within which the partnership will be implemented. The contractual elements of PPP must be tailored to accommodate the existing conditions and achieve the desired objective.

One of the key questions in case of the Comilla EPZ Expansion is whether and what type of a PPP Structure is optimal given the project development objectives.

9.1.1 PPP IMPLEMENTATION MODELS

The evolution of the various forms of PPP has emerged from the need of the public sector for investment greater than their capacities and, and willingness of the private sector to accept greater risks and obligations. The exhibit below highlights the different models of PPP according to the source of investment and the apportionment of risks and obligations.

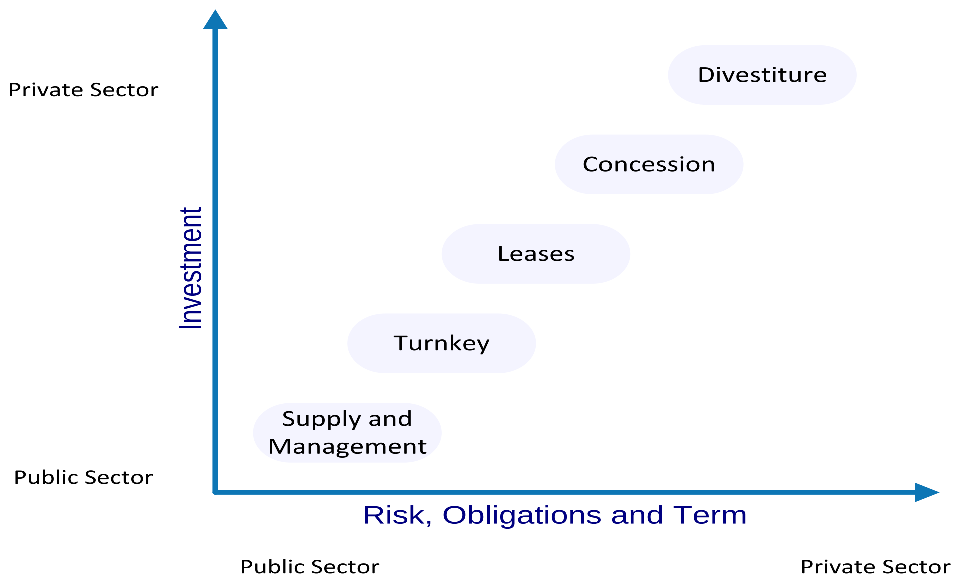


Exhibit 160 Investment & Risk Implications of PPP Models

9.1.2 EXAMPLES OF PPP

Relevant examples of PPP projects in the recent past include:

- Power sector in Bangladesh is mainly driven by PPP arrangement. There are numerous examples like Khulna power plant (Concession agreement), Haripur power plant (22 year concession agreement), IPP of 11 MW at Mohipal, Feni on BOO basis etc.
- There are examples of PPP projects in the country in other sectors as well like ports and telecommunications wherein private sector holds the major stake in the SPV.
- Some of the widely recognized PPP arrangements in case of IT parks, in the nearby regions, are: IT Park at Chak Shahzad - National Park Area Islamabad, Cyberjaya Flagship Zone (CFZ) in Malaysia, Techno Park in Dubai, UAE etc.

9.2 ELEMENTS OF PPP

In this section we discuss the elements affecting the structuring of the Kaliakoir Hi-Tech project.

9.2.1 TRANSACTION STRUCTURE

9.2.1.1 OWNERSHIP

There are three categories of project ownership, which have been illustrated in Exhibit 161. Under the first category, developing the project is a fully government initiative. Here the financing and commercial risks will remain with the public sector. This does not, however, preclude the private sector from having a role in the development of the project. Depending on whether or not certain expertise and capacities exist in the government sector, private participation could be bought in through Management and Service Contracts for the project.

At the other end of the spectrum, is developing the project wholly through the private sector. The government's role in such a project would become primarily that of regulator and facilitator if required. Project financing, project performance and commercial risks are transferred to a private project sponsor, usually selected through a competitive bidding procedure. In return for being awarded exclusive rights to developing the project, the private project developer would be required to pay the host government either in the form of a certain percentage of revenues, or a fixed amount per year as lease or royalty payments. The private developer may also need to pay fees to the government agency regulating and monitoring the project.

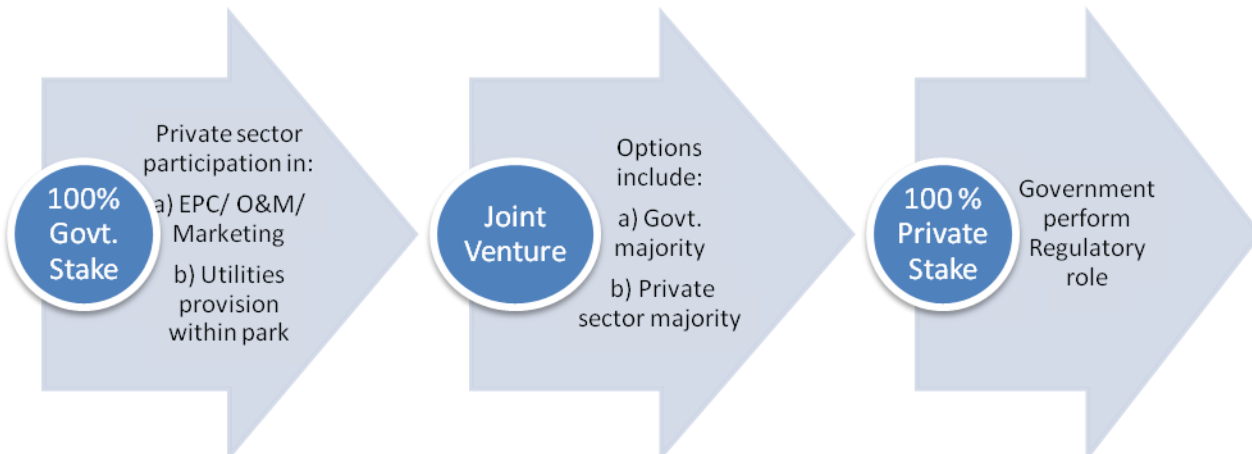


Exhibit 161 Broad Categories of Project Ownership

In between these two options is a joint venture between public and private sector. The joint venture is modeled in order to bring about the best efficiencies from each of the parties.

The decision on the portions in the ownership stake of the joint venture company will include:

- Extent of protection to the private sector from exposure to some of the more difficult risks that are best allocated to the public sector partner (generally under the umbrella of a multilateral guarantee or similar protection).
- Availability of financing resources within the country and the risk appetite of investors.
- Government policy on extent of foreign investment and objective of developing local entrepreneurship.

Other aspects such as legality issues and implementation problems, with certain structures, may also affect the rationale behind adopting a certain project ownership structure over another.

9.2.1.2 PROJECT IMPLEMENTATION

Following from the above, the project implementation could be undertaken by either public or private sector agencies in the following ways:

9.2.1.2.1 GOVERNMENT LED DEVELOPMENT

If the project is implemented by the Government either on its own or in a Joint Venture, it can either do so through an existing vehicle or create a new vehicle for the purpose.

Creating a new vehicle – a project specific SPV but with 100% government shareholding – would enable greater accountability and transparency as well as enable funds generated from the project to be retained for further development of the project.

9.2.1.2.1.1 UNBUNDLED PARK DEVELOPMENT

In this structure, the Government leads the development of the project but appoints separate private parties for carrying out specific aspects of project development – essentially construction, operations and marketing. The individual contracts associated with each of these elements, as well as salient features of the contracts have been described in the following exhibit:

Contract	Salient Features
Engineering, Procurement and Construction (EPC)	• Contractor is responsible for all design, engineering, procurement, construction, commissioning and testing activities. • Provides a guaranteed completion date. If not met, the EPC contractor is liable for delay liquidated damages, designed to compensate the project company for loss and damage suffered due to the late completion • Unlike a traditional construction contract, EPC contracts usually contain performance specifications, detailing the performance criteria the EPC contractor must meet, but not how they must be met • Contain performance guarantees backed by performance liquidated damages payable by the EPC contractor if project fails to meet the performance guarantees. The performance guarantees usually comprise a guaranteed production capacity, quality and efficiency
Operation and Maintenance (O&M)	• Activities included in an O&M contract for a park include provision of property management systems, complaint redressal management, as well as regular, preventive and break-down maintenance • Operating fees under the O&M contracts parallel the operating portion of the tariff under each service contract for variable and fixed costs of operation
Marketing	• Usually this type of contract would request for a market assessment study for the planned zone in order to analyze likely sectors and key players for the park and then create a strategy to best promote and publicize the park targeting these likely investors

Exhibit 162 Salient features of EPC, O&M and Marketing Contracts

The major benefit to unbundling is that parties with expertise in the specific area of the contract are brought into the project. However, there are quite a few drawbacks to unbundling these three areas of park development, which include:

- Awarding to different parties may result in an increase in the overall project cost;
- Greater transaction costs and timeframe associated with bidding and awarding to different parties;

- No single point of interface for the entire project – may lead to finger-pointing between EPC contractor and O&M service provider if park is unsuccessful

9.2.1.2.1.2 COMPONENT PPPS

A form of unbundled development, in case of Component PPPs, the public sector remains responsible for development and overall management of all zone activities. However the public sector may offer discrete components of EZs to the private sector. The users of these facilities would be the tenant industry investors in the zone.

In identifying which activities within a zone could be carved into a component PPP project; there are a number of criteria which need to be met. These include:

- Capable of being identified as a “discrete” project therefore able to be independently financed
- Meeting a certain minimum economic size - therefore services such as a restaurant need not be considered to be a component PPP
- Established and viable revenue model
- No legal/regulatory restriction on private participation

Component PPPs would be governed by their respective concession agreements. Private zone developers are also free to outsource the above components to other private organizations in a private-private partnership. Some of the major services which could be carved off as separate component PPPs in case of the KHTP are:

- IT space development (MTBs)
- Residential and commercial space development
- University and school development
- Power generation and/or distribution
- Telecommunication and Data transfer services
- Water supply (distribution and operation)
- Waste management

The basic revenue and cost model envisaged for implementation through component PPP is presented in the following exhibit.

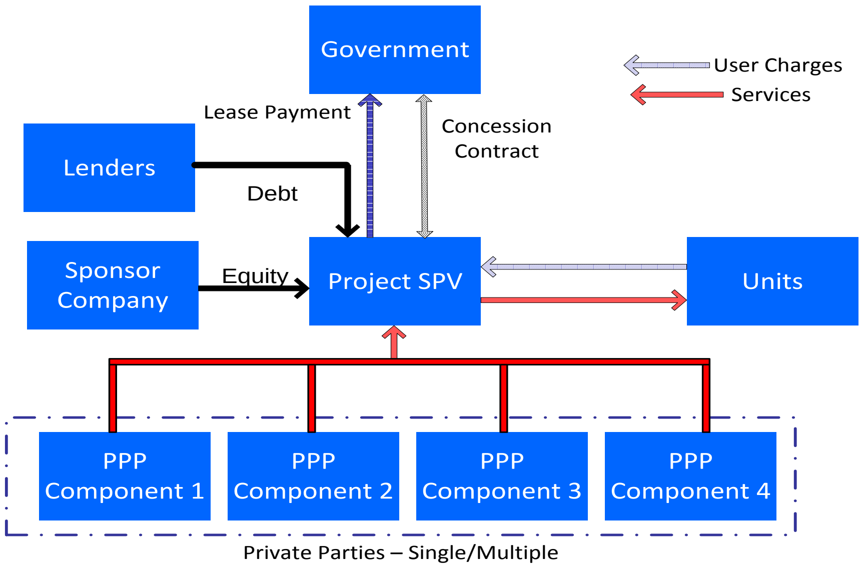


Exhibit 163 Component PPP Revenue Model

9.2.1.2.2 PRIVATE SECTOR-LED DEVELOPMENT

9.2.1.2.2.1 MASTER DEVELOPER

Implementing a project through a master developer would entail appointing a developer for the integrated development of the entire zone. The assets could be either jointly owned by the master developer and the Government, or owned solely by the master developer. The corresponding revenue model is depicted in the following exhibit.

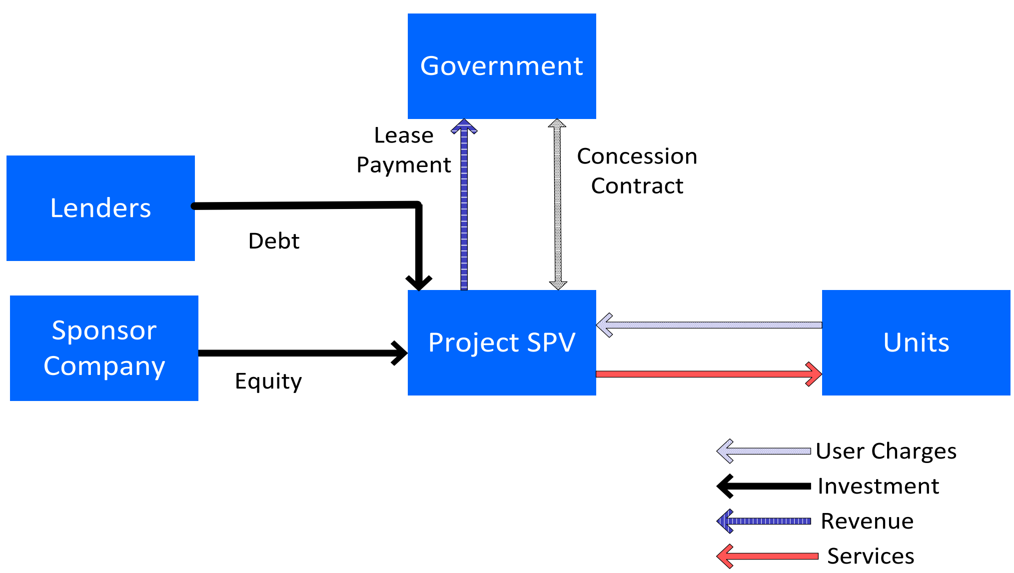


Exhibit 164 Master Developer Route of PPP Implementation

It may be noted here that the investments shown to be made by the tenant industries in the zone are towards setting up of their own industrial units and not for the purpose of investment in the ownership or the operation of the zone.

The key objectives achieved through this method of project implementation are:

- Higher zone development and operation efficiency achieved through integrated coordination which arises from a single management/ operating entity for all project components
- Lower transaction costs associated with obtaining a single developer, as opposed to many developers for the various aspects of the project

In case of Kaliakoir Hi-Tech Park, which is essentially a service industry based park, the utility services (components) would not be of such a large scale as in case of a manufacturing industry based park. The sizeable components would only be the development of IT space and residential space and based on the feedback from the consultations with various developers, it is recommended to have both the components bundled otherwise it would be difficult to get the developers interested in to the project. Also, in case of separating the IT and residential & commercial space, there is a huge risk of over development of the residential & commercial space with IT space developing at a rather slow pace. However this can be mitigated through appropriate contractual and project oversight mechanisms.

9.2.1.3 LAND TRANSFER

Land for the project has already been acquired by the Government. The method of transfer could be either through a sale of a lease. Considering the sensitivities of land issues in the country, it is recommended that the land be transferred on a long term lease for the duration of the contract.

9.2.1.4 CONCESSION PERIOD AND REVERSION OF ASSETS

The concession period refers to the period of time in which the rights to develop and operate a facility is given to the private sector. A number of considerations can be taken into account when deciding on how long the term should be. These include:

- Current land lease arrangements in the country
- Precedence from other PPP projects in the country and other countries in the region
- Best practices as deemed by multilateral donor agencies

Furthermore, when calculating the term for a concession, the expected period an investor could recover investment costs should be taken into account through analysis of the projects financial returns. After the expiry of the concession period, the question of reversion or transfer back of project assets needs to be addressed according to Private Sector Infrastructure Guidelines.

9.2.2 TAX AND DUTY IMPLICATIONS

This section aims to highlight some of the key aspects related to tax/ duty payments. As a background, the tax/ duty benefits applicable to units in the EPZs are reproduced here:

- Income tax exemption for ten years and 50% income tax rebate on export earnings after that period;
- Duty free import of raw materials, machinery, construction materials and other materials used in manufacturing process;
- Income tax exemption, subject to existing conditions on salaries of foreign technicians, for three years;
- Tax exemption on interest on foreign loans;
- Tax exemption on royalties, technical know-how and technical assistance fees;
- Tax exemption on profits on account of transfer of shares by foreign companies listed with the stock exchange.

However, in case of Kaliakoir, which would not be an EPZ, the above may not be available. However, it is our understanding that companies operating in the Information Technology sector as well as exporter in other sectors would have access to similar benefits. Nevertheless it is suggested that these be formalized through separate legal provisions.

9.2.2.1 TAX ON ZONE DEVELOPER

The Bangladesh Export Processing Zone Authority Act, 1980 exempts the industrial units operating in the EPZs from the Company Law of Bangladesh in addition to the Income Tax Law. The Private EPZ Act, 1996 also offers the same exemptions to units operating from private EPZs. However, similar exemptions for a zone developer are not provided in Bangladesh which is provided in other neighboring countries like India. Therefore, if possible, the PPP structuring should try to factor in these incentives for the developer as well.

This is possible through the PICOM route which has provisions for providing special incentives for the project in case of promoting a new sector in the country which is the case in KHTP.

9.2.2.2 STAMP DUTY ON TRANSFERRED LAND

Stamp duty needs to be paid in Bangladesh on the registration value of land, in case of sale or lease. From 2003, the reduced stamp duty is 5 percent on the registration value of the property. For transfer of EPZ land, a 50% exemption from stamp duty is offered to the units on their 30 year lease agreement with BEPZA. Therefore, in case of Hi-Tech Park, wherein transfer of land would be required from BCC to the SPV, same incentive should be made applicable.

9.2.3 SELECTION PROCESS

9.2.3.1 PROCUREMENT PROCEDURES

Bidding procedures can broadly be defined according to the following methods:

- ***SINGLE-STAGE: ONE-ENVELOPE*** - Bidders submit Bids in one envelope containing both the Financial and Technical Proposals.
- ***SINGLE-STAGE: TWO-ENVELOPE*** - two sealed envelopes are submitted simultaneously, one containing the Technical Proposal and the other the Financial Proposal. The Technical Proposal is opened and evaluated first. Bidders which meet a standard in their technical grading will then have their financial envelopes opened and graded. This effectively allows for the technical proposal to be evaluated without reference to price.
- ***TWO-STAGE: TWO-ENVELOPE*** – At the first stage, Bidders submit two sealed envelopes simultaneously, one containing the Technical Proposal and the other the Financial Proposal. The Technical proposal is opened as advised in the bidding document, and technical project configurations are then discussed between the parties, in order to come to bring bids to an acceptable standard acceptable to the Government. Bidders are then allowed to make amendments to their Technical Proposals and are invited, at the second stage, to submit Modified Bid Proposals consisting of Revised Technical Proposals and Supplementary Price Proposals based on the technical standard agreed.
- ***TWO-STAGE*** - Bidders first submit their technical proposals, in accordance with the specifications, but without prices. These are opened at the date specified in the bidding document and evaluated and discussed with the bidders. The Bidders are allowed to revise or adjust their Technical Proposals to meet the requirements of the Government. At the second stage, Bidders are invited to submit financial proposals and revised technical proposals in compliance with the acceptable technical standard. The revised technical proposals and financial proposals are opened in public at a date and time advised by the Purchaser.

The general procedure followed by PPP projects in Bangladesh has been as prescribed by the Private Sector Investment Guidelines (PSIG) of 2004. The steps prescribed by the PSIG are summarized as follows:

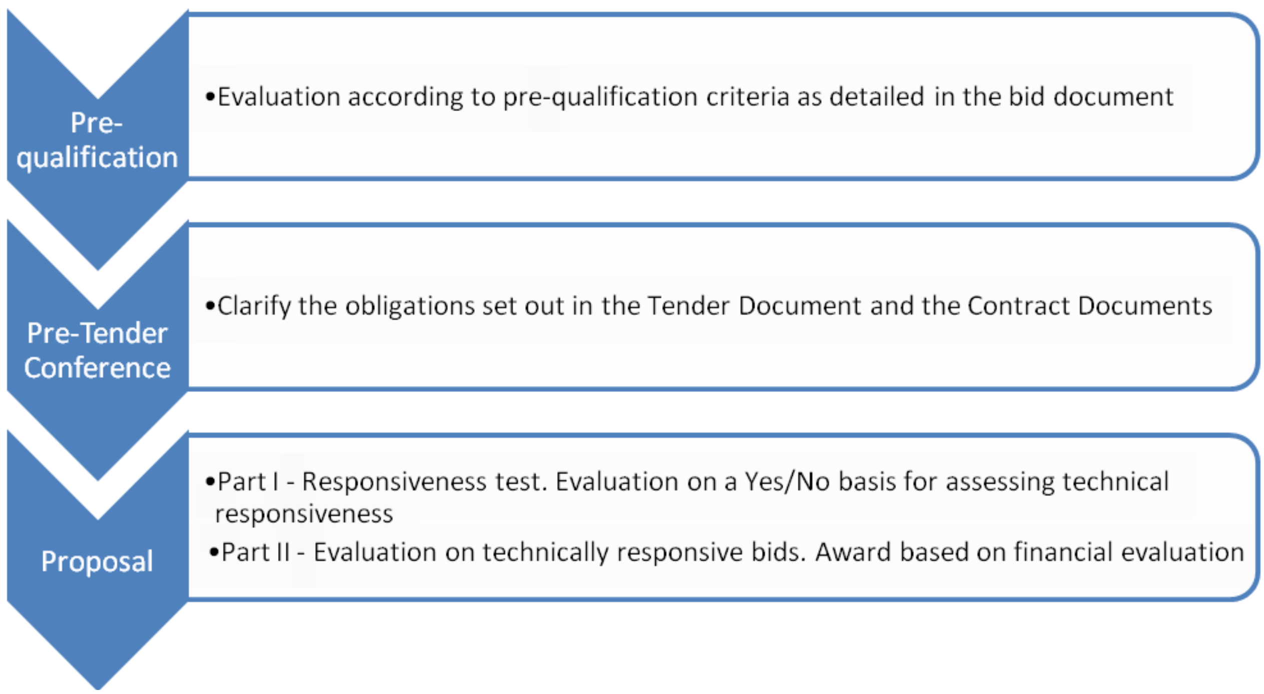


Exhibit 165 PSIG Tender process

9.2.3.2 GUARANTEES AND FEES

The PSIG recommends bidders provide a bid security along with their bids. The suggested bid security is given as being 1 to 3 percent of the total project cost as determined by the feasibility study, with a ceiling of USD 5 million. The validity period of the tender security is to be 30 days beyond the validity period of the tender, which itself should be at least 180 days from the deadline for submission of Tenders.

9.2.3.3 PRE QUALIFICATION CRITERIA

Under the PSIG, the Executing Agency is to prepare a pre-qualification document, which contains a brief project description, preliminary scope of work, evaluation criteria and the requirements of information, data, document and description from potential Investors for their appraisal to fulfill the evaluation criteria. When pre-qualifying bidders for an infrastructure project, the executing agency assesses the following aspects of the bid:

- Legal Status of potential investors
- Technical and Managerial Capacity
- Financial Capability
- Project Development Experience
    - Project development experience up to commercial operation
    - Similar project development experience

- Project Operating Experience
    - Similar type of project
    - Reliable operating experience of not less than 3 years or not more than 5 years
- Current Ownership in Investment
    - Similar type of project
    - Ownership will be calculated by multiplying the equity percentage with the capacity of the project

The executing agency is prescribed to provide at least 60 days from the date of first advertisement of the notice for pre-qualification, for preparation of qualification statements. Depending on the investment level and availability of expected Investors, an extension of 30 days may e provided.

9.2.3.4 SELECTION CRITERIA

Short listed bidders are then given at least 90 days, from the date of availability of tender documents, to prepare their bids. During this time, bidders may be given permission by the executing agency to visit the site in order to help prepare their bids. Additionally, the Executing Agency can hold a pre-tender conference in order to clarify the obligations set out in the tender document and the contract documents.

Tender evaluation is divided into two parts. Part I consists of a responsiveness test, undertaken on a Yes/No basis. The responsiveness test covers the areas of:

- Technical soundness of the proposal through examination of engineering designs and drawings, codes and standards etc
- The business plan of the investor including marketing strategy, financial projections, etc;
- Operational feasibility of the proposal through examination such as proposed organization including structure, safety standards etc
- Environmental standards such as identification of possible adverse impacts, mitigation plan, compliance of minimum quality and standards, identification of environment management plan, design of affluent treatment plan and types of equipment, compensation and resettlement action plan for project affected people, etc;
- Financing plan; and
- General conditions such as compliance of tender requirements, validity of bid security etc

Bids found to be technically responsive under Part I, are then assessed in terms of financial criteria. PSIG provides for a number of methods for the Government to base their assessment of the financial returns. These include evaluation in terms of:

- Lowest present value of tariff, tolls, fees or charges;
- Highest present value or percentage of revenue sharing (such as royalty);
- Lump-sum amount of cash to the Government for the right to carry out the project;
- Contract term where other financial conditions are fixed;
- Lowest present value of subsidy over the contract period where other financial conditions are fixed;

- Firm commitment for ongoing investment and/or capacity expansion, more connections etc.;
- Highest present value of lease payment or rent;

9.3 METHODOLOGY FOR PROJECT STRUCTURING

The key PPP elements identified in the above section impact the various factors related to the project completion and execution. Therefore, it is important to carefully study the impact of the elements on project aspects so that the final PPP structure has been tested against all possible scenarios and is the most optimal option.

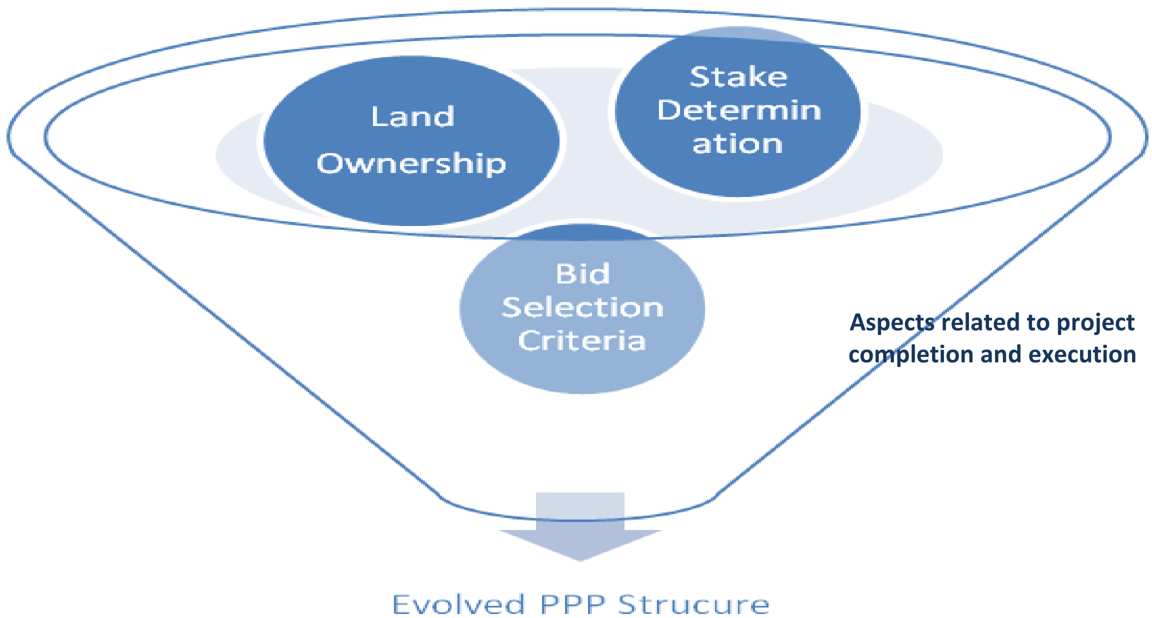


Exhibit 166 Project Structuring Methodology

9.3.1 EASE OF COMPLETION OF PROJECT

Completion of project and beginning of the operation phase is the one most challenging task which revolves around all the PPP elements like the parties involved, approvals and clearances, issue of land ownership etc. Each one of them can have a significant impact on the progress of the project. Therefore, it is necessary to understand the impact of all the PPP elements on the timely completion of the project.

Timely completion of the project development phase makes things easier in future and helps to keep the actual things in line with the planning done before the project development. This boosts the confidence of the lenders as well and also helps in attracting the investors as timely completion of the project reflects the management capacity and commitment of the developer.

9.3.2 GOVERNMENT CAPACITY

As the nomenclature, PPP, suggests that government is an integral part of this structure, it is important to check whether the participating government authority has the capacity to be involved in all the elements of the PPP. It is important to test the various elements on the grounds of governments' capacity so that proper training measures and modifications in the structure can be suggested otherwise. For e.g. if the representative government authority has not handled a project of one kind ever in the past, then it is better that the PPP arrangement is dominated by the private sector with the government assuming the regulatory and supporting role. In this way

9.3.3 INVESTOR INTEREST/RISK

This is perhaps the most important aspect that needs to be factored in while structuring the PPP arrangement. Therefore, all the necessary elements, identified above, must be tested on the ground of promoting investors interest in the project and optimizing the risks associated. For e.g. splitting the project into various components in case of a Hi-Tech Park, wherein the processing and non-processing zone off-take are closely interlinked, would deteriorate a developers' interest in the project. However, in case of a purely industrial park, project can be split into various components without actually hampering investors' interest.

9.3.4 PROJECT FINANCIALS AND TAX IMPLICATIONS

Financial performance of the project can also depend on the type of structure that has been drawn as the structure would determine the regulatory environment to which the project be subjected to. For e.g. if the structuring is done in such a way that the representative government organization is the owner of the project and that particular organization is free from certain taxations, then this could largely impact the financial performance of the project which in turn would facilitate in attracting the sub-investors, lenders etc. Another example can be that of pertaining to land sale or lease, wherein, if the land is obtained on a sale then the upfront payment can influence the financials of the project negatively, whereas lease would have a lesser impact.

9.3.5 LENDER'S PERSPECTIVE

Obtaining financing for the project is another critical aspect that directly affects all the phases of the project. To obtain the financing, the PPP arrangement and structuring needs to be carefully thought about so as to give the project a simple yet robust look which can install confidence in the lending agencies. Generally, security of land give the lenders a cushion, but in case where land is not owned by the developer, special arrangements needs to be factored in to the structure like government guarantee, right to the property etc. Similarly, other elements of PPP structuring need to be examined critically so as to maximize the attractiveness of the project for the lenders as this may help the developer in arranging the finance at lower interest rate.

9.3.6 DEVELOPMENT OBJECTIVES

Another aspect that the PPP structuring or the elements need to take into consideration is the governments' objective out of the project. Especially, in terms of ownership and the type of role government is looking to play. In case of government's inexperience in a certain sector, it would ideally like to give major stakes to the private sector while playing a regulatory role itself. In some cases, government may not have adequate funds or expertise in some areas of the project to develop the project on its own, so it would like to involve private participation to meet the financing and experience. But, in this case, it would be necessary to first establish whether government wants to be the majority stakeholder or the minority stakeholder because private sector generally does not feel comfortable playing the minor role in a PPP arrangement. So, in such a case, the structuring can be oriented towards a component PPP wherein only certain parts of the project are given out to the private sector.

9.3.7 LEGAL ISSUES

All the elements of PPP structuring need to be checked on legal grounds so as to ensure that there are no legal bottlenecks in the future which could possibly lead to long delays and modifications. In case of land transfer related issues, country laws need to be examined if the land can be transferred by sale or lease and the associated stamp duties. From organizational point of view, laws need to checked if the participating government authority is allowed to participate in a joint venture with a private sector or not. Other issues include: threshold limits as per companies act that will have a bearing on the stake determination, laws regarding the private sector participation etc.

9.4 PUTTING IT ALL TOGETHER

In the matrix below we have summed up the issues identified above and ties them into the elements of project discussed earlier in the report:

	Options	Ease of Project Completion	Government Capacity	Investor Interest/ Risk	Tax Implications	Lender's Perspective	Development Objectives	Legal Issues	Final Evaluation
Government Shareholding	• 100% Government • JV • 100% private • Carving out separate projects	100% Government project would be easier to implement it would be faster, especially in prevalent market conditions. Also a minimum stake of 10-26% would be preferable from the government's point of view given sensitivities of the project	The Government agencies have almost no experience in projects of this kind – in addition it would impose a fairly large financial burden on the government. However the former can be mitigated by going for a combination of EPC, O&M and marketing contracts	Investor interest is uncertain in present market conditions. Also they would prefer at least a minimum of 51% if they do decide to participate	Transfer of land from BCC to private party/SPV may attract stamp duty	Lender's are positive about the project especially if led by Donor agencies but are more hesitant in case it is headed by Government agencies	PSDSP is predicated on private participation so a PPP structure would be better	Issue or sub-lease of to a private developer (who would then have to further sub-lease it) would need to be investigates	PPP route would be the way to go except that present market conditions may make it difficult. Even if it implemented through PPP, Government should hold a minimum stake
Who should be the implementing agency?	BCC or any other agency designated by MoSICT should be the implementing agency. No need for a new agency or any new regulation is anticipated, pending enactment of EZ act. Also, new SPV should be created to set up the project whether or not a PPP structure is envisaged								
What should be the implementation route	Broadly the following routes are available – Development under the Private EPZ Act, Development under the proposed EZ Act or development through the PICOM route (explained further down this section). The experiment with the Private EPZ Act has not been very successful judging from the Korean EPZ experience and the EZ Act is also unlikely to be passed too soon. Neither provides for tax breaks for developers. Therefore it is felt that the PICOM route would be the best option for the project with the proposed Hi Tech Park Authority when created, taking over.								
What would	• Direct IDA	While donor	Donor	Investor's	None	Lenders	Project is in	None	Funding

	Options	Ease of Project Completion	Government Capacity	Investor Interest/ Risk	Tax Implications	Lender's Perspective	Development Objectives	Legal Issues	Final Evaluation
be the role of donor agencies?	Lending • Participation through market in IPFF like structure • No Participation	funds would help mitigate project cash-flow constraints, they are not otherwise critical for the project	funding would certainly help meet the government's share of project investments	would face severe cash-flow mismatch unless loans supported by Donors are available		have said they would definitely get extra comfort from Donor financing	consonance with development objectives and the PSDSP program		support, preferably through IDA mechanism is critical for setting up the project
<u>Applicable in case PPP Structure is opted for</u>									
Component PPPs	• Component PPPs • Whole Project to 1 investor	Separate transactions could delay the process	Component PPPs would put the burden of core infrastructure on the Government thereby increasing capital commitments	Investors would typically prefer the entire project to smaller components. Especially less attractive components may not find takers	None	Lenders have expressed greater comfort with smaller component PPPs	A full-fledged PPP would be in greater consonance with PSDSP objectives as compared to component PPPs which would be of smaller total value	Component PPPs would not involve sub-leasing of land	In case a PPP structure is decided upon, it would be better to give it out as 1 project than individual components
How to select private party?	• Lease Rentals • Equity premium • Revenue Share	Revenue share is difficult to calculate and past experience suggests that this could lead to implementation delays	Government would need to have higher monitoring mechanism levels in case of revenue share	Would prefer revenue share as it reduces demand risk	None	Would prefer revenue share as it reduces risk	None	None	Lease rentals is suggested since it is less complicated to implement

	Options	Ease of Project Completion	Government Capacity	Investor Interest/ Risk	Tax Implications	Lender's Perspective	Development Objectives	Legal Issues	Final Evaluation
How should land be transferred?	• Only "made available" • Lease • Sale	Lenders would want some charge over the land so at least a long term lease would be required. A sale is not recommended as a time-bound contract is envisaged with the private developer							
What should be the concession period?	5 to 99 years	None	None	Investors would want a long enough period to ensure adequate return on capital with allowance for demand build up	None	Would generally prefer longer term contract and ensure that it is at least longer than the debt tenor	Very long contracts may reduce bargaining power of implementing agency	None	A 35 year lease is suggested keeping in mind the land off-take projections and debt tenor of 20 years

Exhibit 167 Analysis of PPP Options

9.4.1 ANALYSIS OF OPTIONS

Development of the Kaliakoir Hi-Tech Park basically involves the following three components, as earmarked in the concept master plan for the zone in Basic Planning and Design study:

- IT space and hi tech manufacturing area development
- Social Infrastructure development
- University and school

It is generally recommended that the development of the university and school be led by government with the help of GoB/WB funding and the land allocated for those facilities be considered in the land to be developed through the PPP route.

This chapter deals with the possible basket of options for the development of the park and PPP arrangement for the Kaliakoir Hi-Tech Park project. Each option is discussed with respect to the PPP elements involved in that option. The pros and cons of each option, based on the analysis of the impact of elements on the project aspects, have also been detailed out in this section.

9.4.1.1 OPTION 1 – GOVERNMENT LED

Under this option, BCC/MoSICT will be the executing agency with funding from GoB and WB. Exhibit 168 shows the unbundled transaction structure. The elements involved in this option are:

- **Ownership:** BCC/MoSICT will be 100% owner and solely responsible for the development of the project.
- **Implementation:** Although BCC/MoSICT will be the 100% owner of the park, they may involve private parties for construction, operations & management and marketing works. But the overall responsibility will still be on BCC/MoSICT's part.
- **Land transfer:** The issue of land transfer will not be a concern in this case as the land will be continued to be owned by BCC.
- **Transaction Structure:** BCC/MoSICT will charge the operating units inside the park and pay the different contractors directly. Payment to the EPC contractor will be a huge upfront expenditure on BCC/MoSICT's part.
- **Source of Finance:** Direct funding from GoB & WB, loans from local banks.
- **Selection Process:** Separate selection process for all the three components will have to be executed by BCC/MoSICT.
- **Taxation:** All the private sector parties entering into contract with BCC/MoSICT will be subjected to taxation. Stamp duty will not be an issue here as no land transfer is taking place.

The impact of the above listed elements on various project aspects needs to be analyzed now to test the suitability of the option. The project structure is outlined below and the following sub-sections discuss the pros and cons of the options in terms of its impact on project aspects.

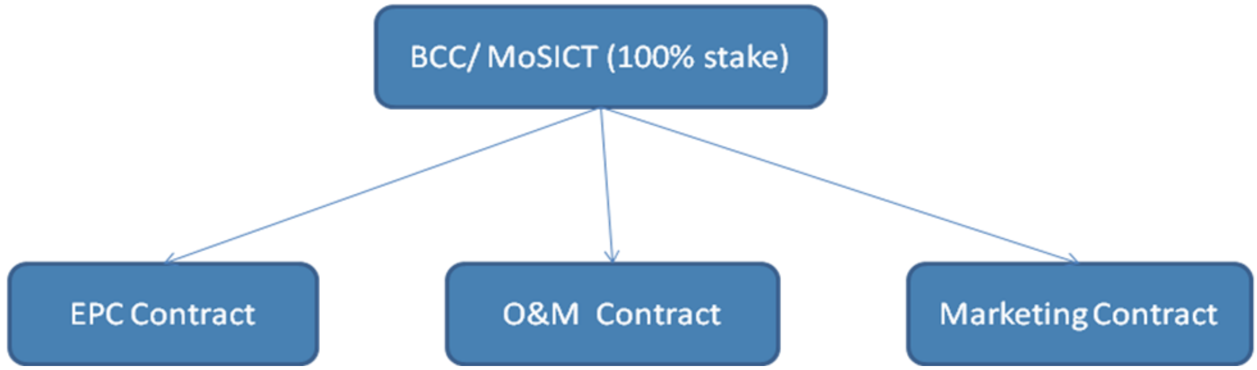


Exhibit 168 Unbundled Structure for Option 1A

For the above detailed unbundled structure for the BCC/Government led development of the Park, the following exhibit presents a schematic of the financing flows (debt and equity) during the development phase of the Park. The financing flows have been detailed out including sources of finance and corresponding terms.

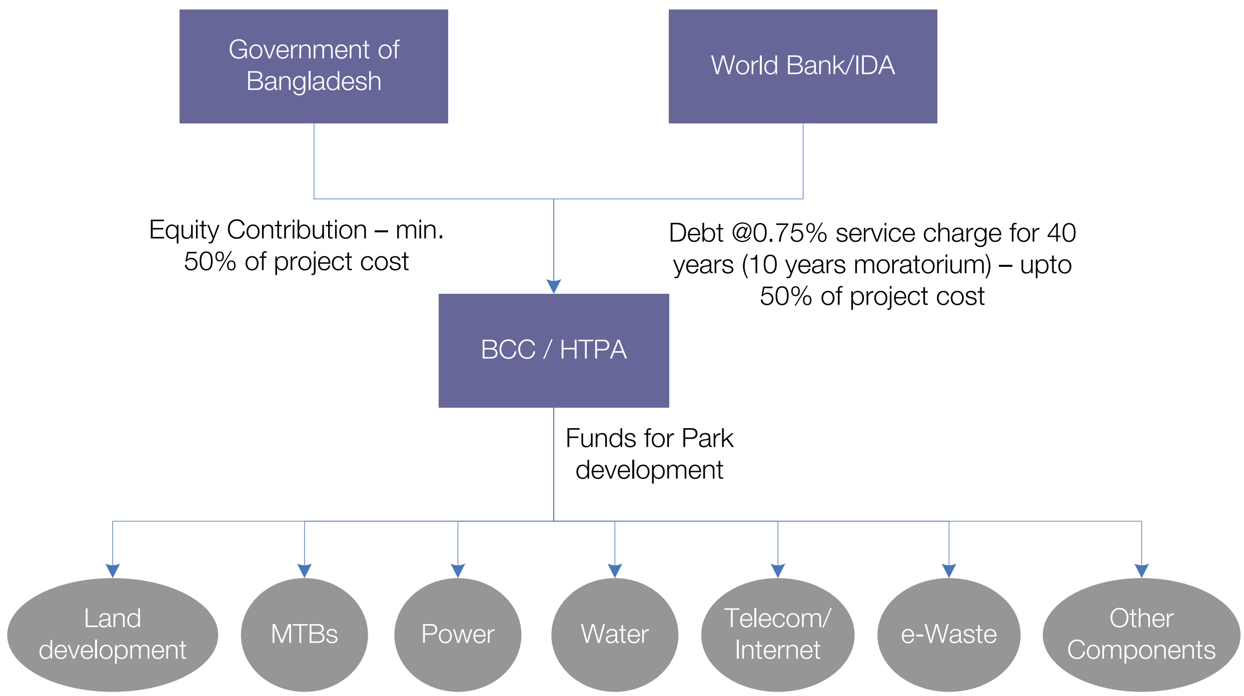


Exhibit 169 Detailed financing flows (debt and equity) during the Park development for the BCC led development

9.4.1.1.1 EVALUATION OF OPTION 1

The PPP option has been evaluated below, against the identified factors that impact project structure

9.4.1.1.1.1 EASE OF IMPLEMENTATION

On paper it would be easier to implement since it does not depend on private sector appetite. However, practically speaking, the Government will have to co-opt EPC, O&M and Marketing contractors (see below) and given the fact that neither BCC nor MoSICT has any past experience of handling any such project, implementation of the project may take a long time. Execution of separate bidding processes for three components will be another time taking process.

> *Overall Impact: Implementation may take very long time due to involvement of various bidding process*

9.4.1.1.1.2 GOVERNMENT CAPACITY

In this option, the capacity of government is the most important issue as BCC/MoSICT would be executing the project on its own. Given the fact that neither of the two parties has ever been involved in such a project, it may require extensive training which would require additional time. Also it would stretch the financial means of the Government.

> *Overall Impact: BCC does not have adequate capacity to handle the project, of such a large scale, effectively.*

9.4.1.1.1.3 INVESTOR INTEREST

Investor interest in the present economic environment is uncertain. From this point of view it may be left to the Government to fund this project, if the private sector does not evince adequate interest

9.4.1.1.1.4 LENDER'S PERSPECTIVE

Lenders would be more comfortable lending to "good" private parties than the Government. However in this case, the Donor agencies would be lending to the project, so this should not be an issue.

9.4.1.1.1.5 DEVELOPMENT OBJECTIVE

This option will best serve the government's objective of bringing about the IT development in the country with 100% control over the activities. But the other hand, the purpose of the PSDSP project, which is to encourage the involvement of the private sector in the country will get defeated. The Government's lack of familiarity with the sector could also lead to implementation delays.

9.4.1.1.1.6 LEGAL ISSUES

Since the land transfer is not involved in this case, legal issues are lesser in this case.

9.4.1.1.1.7 USER BENEFITS

The users of the Hi-Tech Park would be the IT companies engaged in software development and other IT/ITES services. As per the current benefits provided to the IT sector in the country, the exporters have been provided a tax holiday till 2013. Other than this, there is no act or law that lists out the benefits being provided to the IT exporting companies like BEPZA Act that lists out the benefits provided to the users inside the EPZ.

> *The benefits to the users inside the Hi-Tech Park are expected to remain the same as being offered to the IT exporters in the country unless a new policy or act is made for the Hi-Tech Park to provide additional incentives to the users so as to attract them to move to the park*

It is envisaged under this structure that the BCC/MOSCIT would not require need to create any new institutions for the development of the park, nor is there need for any additional legislations, as may be proposed. However for the sake of greater transparency, a separate SPV may be created with 100%

ownership of the BCC/MOSCIT which would then invest into the KHTP. To the extent required, one time approvals can be obtained through relevant government agencies.

While the proposed KHTP should adequately serve the needs of the industry for the short to medium term, a more permanent arrangement would ideally be dovetailed into the EZ regime that is presently under the consideration of the Government.

These issues are dwelt upon in greater detail under institutional issues later in this section.

9.4.1.2 OPTION 2 – PPP ROUTE WITH PICOM APPROVAL

Under this option, it is recommended that the KHTP be developed through the normal PPP route which involves approval from PICOM. The guidelines are clearly mentioned in the Private sector investment guidelines (PSIG) of the Government. The same process is being followed in other sectors, for example in the power sector throughout the country. Exhibit 170 gives a schematic of the PPP arrangement under this option.

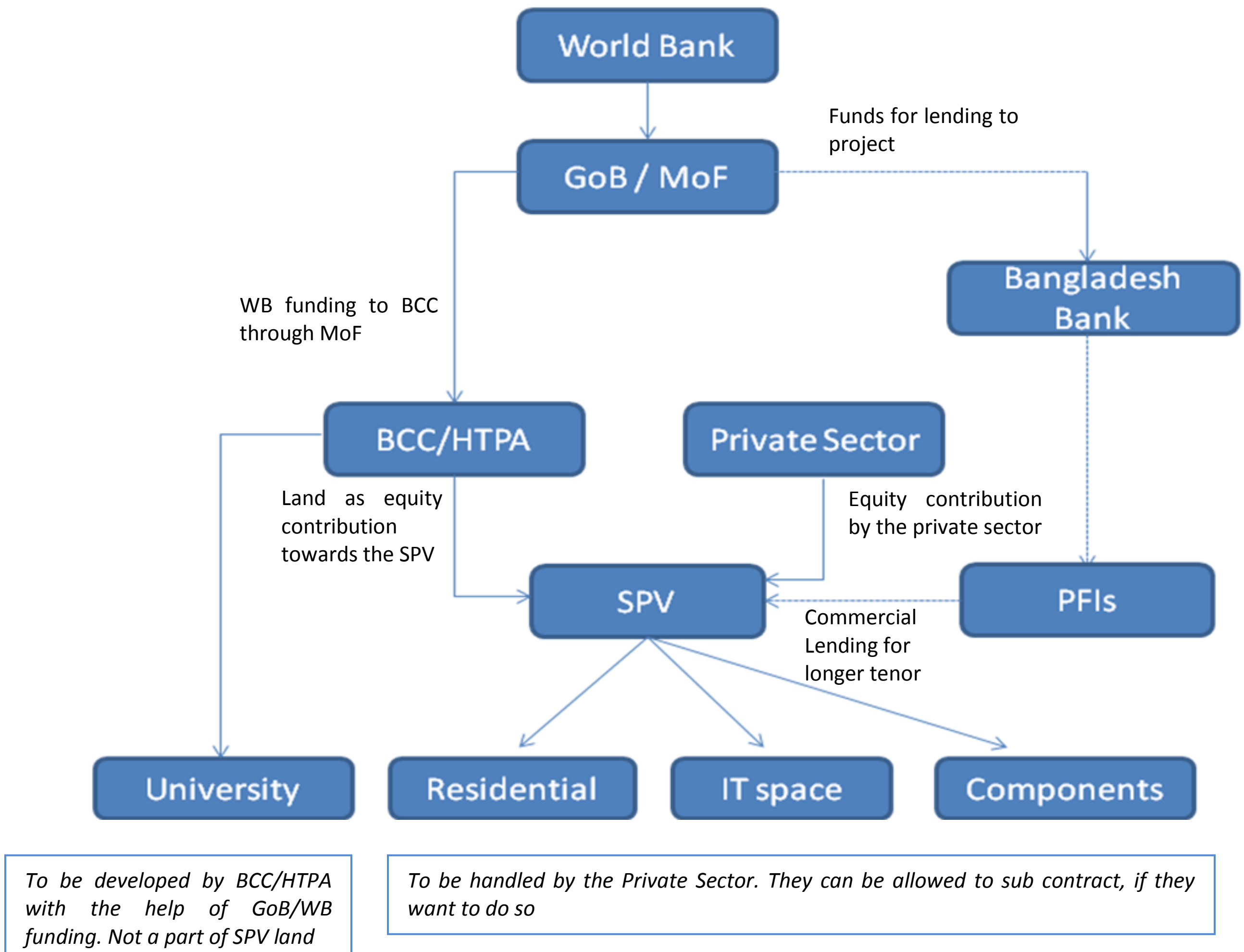


Exhibit 170 PPP Structure for Option 2

For the above PPP structure with a master developer option, we present the detailed financing flows (debt and equity) for the Park development phase. The details presented include the sources of financing, the corresponding terms & tenures and the extent of financing available.

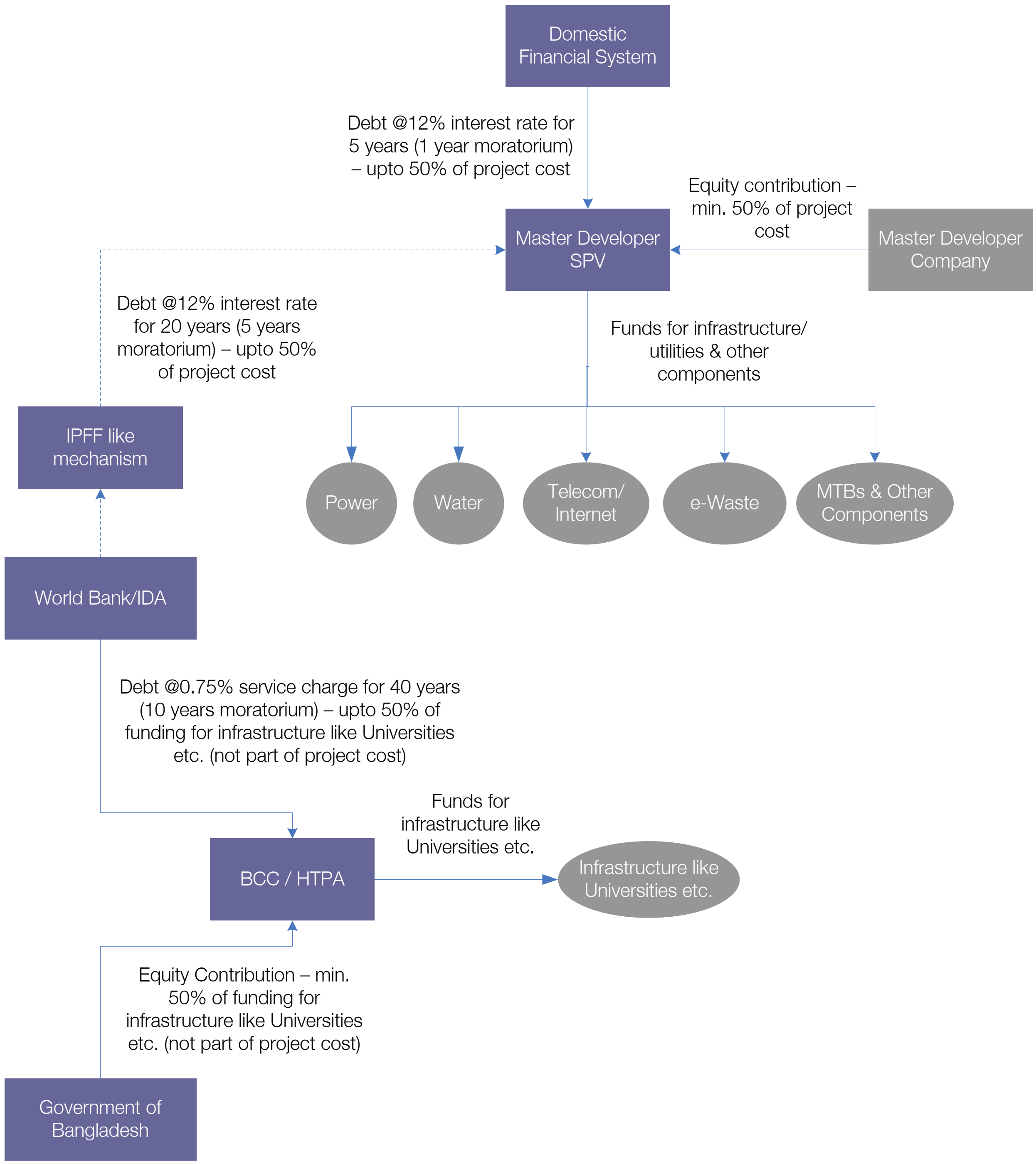


Exhibit 171 Detailed financing flows (debt and equity) during the Park development for the Private Developer led development

9.4.1.2.1 PPP ELEMENTS

The PPP elements involved in this option are as follows:

9.4.1.2.1.1 STAKE DETERMINATION IN SPV

It is recommended here, that a SPV would be formed by the participating private sector, selected through bidding process, and BCC. Based on our consultations with various private developers in Bangladesh and outside the country, it is recommended that 74% stake in the SPV be given to the private sector, while BCC holds the balance 26%. This is based on the threshold limit as per the Companies Act, which would give BCC representation rights in the board of SPV. BCC can contribute land as equity on its part and incase there is a shortage, it can acquire loan for the balance amount from WB/GoB. It is also advisable for BCC/HTPA take up some stake in the SPV. Based on consultations with the developers, it is found that the private sector prefers to be the majority stake owner and not governed by the government. On the other hand, a minority stake held by the Government would make it easier to the sell the project to the public.

9.4.1.2.1.2 PARTICIPATING AGENCY

The participating agency from the government's side can be either BCC or any other agency of the MOSICT. Forming a new authority and formulating its mandate may involve a long time since it would require a prior legislation. Therefore, it is recommended to develop the project through BCC which is already allowed to form companies for the promotion of the IT sector. The implications of the KHTP on the Authority and transfer modalities may be examined while this is done.

9.4.1.2.1.3 LAND TRANSFER

Land will have to be transferred to the SPV by BCC on a long term lease. The concession agreement that would be signed between BCC/HTPA and the private sector will have to include a clause allowing the SPV to sub-lease the land to the individual units. This will have to be investigated further.

9.4.1.2.1.4 TENOR OF CONCESSION

Tenor of the concession can be decided based on the following factors:

- Normal concession period for a PPP project in Bangladesh: 20-25 years
- Existing BEPZA norms in terms of leasing the land to the units: 33 years
- Timeframe in which the investor can be expected to recoup his investments

Based on the above considerations, tenure of 35 years is recommended as a period suitable for both the government as well as the private sector.

9.4.1.2.1.5 SOURCE OF FINANCE

Financing of the project will be carried out in the following ways:

- BCC contribution to equity in form of land
- WB/GoB funding, in case additional equity is required from BCC/HTPA's side
- Equity contribution by the private sector. Private sector involvement will increase the ability to raise finance for the project through various lenders and investor's contacts.

- Financing from the local PFIs – Funds provided by WB to PFIs and then PFIs providing loan at commercial lending rates but for longer tenor as the normal commercial loans in Bangladesh are given for a tenor of maximum 5 years.
- Financing from IFC, which is the private sector funding arm of the World Bank and can also advance longer tenor loans at market rates

9.4.1.2.1.6 DEVELOPER INCENTIVES

Current policy in the country does not provide any tax incentives to the developer as such. Therefore, in this case too, the developer will not get any tax incentives. However, it is strongly recommended that in order to compete with the countries in the nearby region, tax incentives be made applicable to the developer as well. PSIG has provisions for providing special incentives to projects which are meant to promote an under developed sector in the country, which is the case in this project.

9.4.1.2.1.7 BENEFITS

The users of the Hi-Tech Park would be the IT companies engaged in software development and other IT/ITES services. As per the current benefits provided to the IT sector in the country, the exporters have been provided a tax holiday till 2013. Thus similar incentives as prevail in the EPZs and proposed in the EZs will be available to users

> *Therefore, the benefits to the users inside the Hi-Tech Park are expected to remain the same as being offered to the IT exporters in the country*

9.4.1.2.1.8 SELECTION PROCESS

There are three methods which the Government could measure the financial returns from bidders on:

- Equity Premium – Amount that the bidder is willing to give to the Government as consideration for equity in the SPV
- Revenue Share – Fixed or variable percentage share of the gross revenue earned by the SPV
- Land Lease Rate

Examination of previous PPP infrastructure projects in Bangladesh does not show any precedents for using the equity premium method. Also, the Revenue Share method has created legal wrangles in past projects, as it is very complex to define the gross revenue of an SPV, especially in case of a complex operation like zone management. The Land Lease Rate method has been deemed to be the simplest method to evaluate and monitor, and so should be used as the sole financial criteria for the bid selection process.

Bidding should be undertaken following PSIG specifications, a variation of the two stage-two envelope process, as described in the succeeding sections. This ensures a more transparent process of bidder selection, though it may bring up additional capacity requirements for BCC.

9.4.1.2.2 EVALUATION OF OPTION 2

The PPP option has been evaluated below, against the identified factors that impact project structure

9.4.1.2.2.1 EASE OF IMPLEMENTATION

This option provides an easier and faster mode of implementation of the project as compared to other option discussed earlier because it practically obviates the need for three separate bidding processes to start the development work.

It will also be a faster mean because the PSIG guidelines are already in place and several power projects have been developed so far

However, under current market conditions, it may take a while before investors look for Greenfield investment opportunities in an untested market.

> *Overall Impact: Overall implementation time would be reduced due to reduction in the number of bidding process (as compared to Government led route since effectively 3 transactions will have to be run) and also involvement of a private sector would speed up the development phase. However investor interest at this point in time is a question mark.*

9.4.1.2.2.2 GOVERNMENT CAPACITY

Under this option, Government will play more of a regulatory role in this case, for which the existing bodies have the capacity. Assistance will, however, be required during the bidding process of selecting the developer.

> *Overall Impact: Positive, as BCC only assumes a regulatory role and can appoint consultants to carry out the bid selection process.*

9.4.1.2.2.3 INVESTOR INTEREST

As pointed out above, under present market conditions, investor interest may be low, However in the medium term, it is expected that this will change

> *Overall Impact: Negative in short term but positive in medium term.*

9.4.1.2.2.4 FINANCIAL AND TAX IMPACT

As there is no policy currently that provides tax benefits to the developers, the implication on the financials of project from the developer's perspective can be negative. Also, since the other competing neighboring countries in the region provide tax incentives to the developer, it may reduce the overall interest of the investors. Therefore, is it is strongly recommended that certain incentives to the developer be provided through special arrangement, provision for which does exist in the PSIG guidelines, for promoting under-developed sectors in the country. Also, the land transfer process would involve stamp duty, which would further impact the financials negatively. Currently EPZs are being provided a 50% rebate on the stamp duty, therefore same should be provided in this case as well.

> *Overall Impact: Negative, as the developer is not provided any tax incentive. Also, stamp duty on land transfer will be an issue.*

9.4.1.2.2.5 LENDER COMFORT

Due to major stake- holding by the private sector, overall comfort of the lenders will increase. The local lenders, through consultations, responded that they are generally more comfortable with lending to the private sector. Also, if the WB money is available to lend on commercial terms, but a longer tenor, the local lenders will feel more comfortable in participating. However, lenders may require certain guarantees from the private sector and the government.

> *Overall Impact: Positive, due to private sector control and WB involvement. However, certain guarantees may still be required.*

9.4.1.2.2.6 DEVELOPMENT OBJECTIVES

Overall, the objective of the government to bring about the development of the Hi-Tech Park will be met. Also, because of the lack of expertise of the government in developing a Hi-Tech Park, involvement of the private sector will help project objectives. Also, private sector involvement would bring precious capital which is a huge constraint for the government.

> *Overall Impact: Positive, with the government's main objective of developing the park and promoting the IT sector being met. It will be learning for them as well to build their capacity for future.*

9.4.1.2.2.7 LEGAL ISSUES

Legal issues involved will be higher in this option because of the land transfer process involved. Government will also have to ensure that sub-leasing of the land by the SPV to the users is permissible.

9.4.1.3 OPTION 3 – GOVERNMENT LED UPFRONT DEVELOPMENT FOLLOWED BY TRANSITION TO A PRIVATE DEVELOPER

Under this option, BCC/MoSICT will be the executing agency responsible for the upfront development of infrastructure and utilities for the Park. This would be with funding from GoB and WB and would be in line with the final master plan. Subsequent to this upfront development, BCC/MoSICT would bring in a private developer for operating and maintaining the Park. The private developer would also be responsible for constructing and leasing the MTB space and other social infrastructure and amenities as required. The University would be developed by the BCC/MOSICT.

9.4.1.3.1 PPP ELEMENTS

In this section we present the various PPP elements involved in Option 3 detailed above.

9.4.1.3.1.1 OWNERSHIP

Initially BCC/MoSICT will be 100% owner and solely responsible for the upfront development of the Park including land development, boundary wall, infrastructure/utilities etc. Subsequent to the upfront development, the area would be leased to a private developer who would be operating and maintaining the Park as well as building & leasing the MTB space. However, BCC/MoSICT would continue to own the Universities/schools setup within the Park.

9.4.1.3.1.2 IMPLEMENTATION

For the upfront development mentioned before, BCC/MoSICT will be the sole party responsible for the same. They may involve private parties for construction and development. After leasing the developed area to a private party, that party would be responsible for operating and maintaining the park. Also, the private party would be responsible for building MTBs, leasing them to tenants and maintaining them. However, BCC/MoSICT would be 100% responsible for setting up the Universities and schools.

9.4.1.3.1.3 LAND TRANSFER

After upfront development, the developed area will have to be transferred to the private developer SPV by BCC on a long term lease. The concession agreement that would be signed between BCC/HTPA and the private sector will have to include a clause allowing the SPV to sub-lease the land and built-up space to the individual units.

9.4.1.3.1.4 TRANSACTION STRUCTURE

Initially, for the upfront development, BCC/MoSICT will pay the different contractors directly. Payment to the EPC contractors for the various infrastructure/utilities would be a huge upfront expenditure on BCC/MoSICT's part. However, this would be recovered by leasing the developed area to the private party and collecting yearly leases for the full area from the private party.

9.4.1.3.1.5 TENURE OF CONCESSION

Based on the various considerations presented under Option 2 also, tenure of 35 years is recommended as a period suitable for both the government as well as the private sector.

9.4.1.3.1.6 SOURCES OF FINANCE

For the proposed upfront development, BCC/MoSICT could obtain direct funding from GoB & WB and loans from local banks. The private developer SPV could be funded from the various sources listed out in Option 2.

9.4.1.3.1.7 SELECTION PROCESS OF PRIVATE OPERATOR/DEVELOPER

Selection process of the private developer/operator would be similar to the one detailed out for Option 2.

9.4.1.3.1.8 BENEFITS

The benefits to the users of the Hi-Tech Park would be similar to those stated in our analysis of Option 2.

The impact of the above listed elements on various project aspects needs to be analyzed now to test the suitability of the option.

The project structure is outlined below and the following sub-sections discuss the pros and cons of the options in terms of its impact on project aspects.

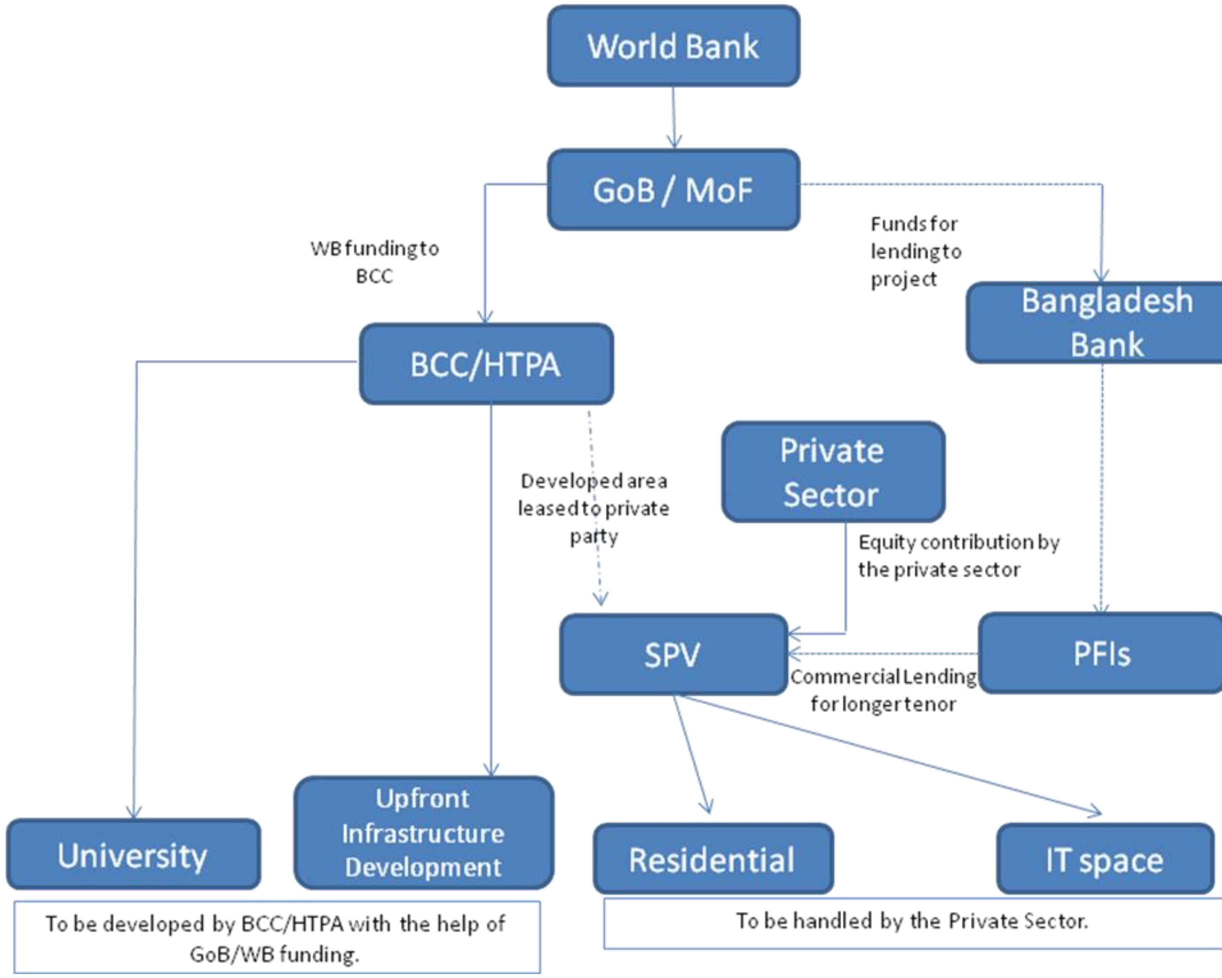


Exhibit 172 PPP Structure for Option 3

For the above detailed unbundled structure for the BCC/Government led development of the Park, the following exhibit presents a schematic of the financing flows for the debt and equity parts. The financing flows have been detailed out including sources of finance and corresponding terms.

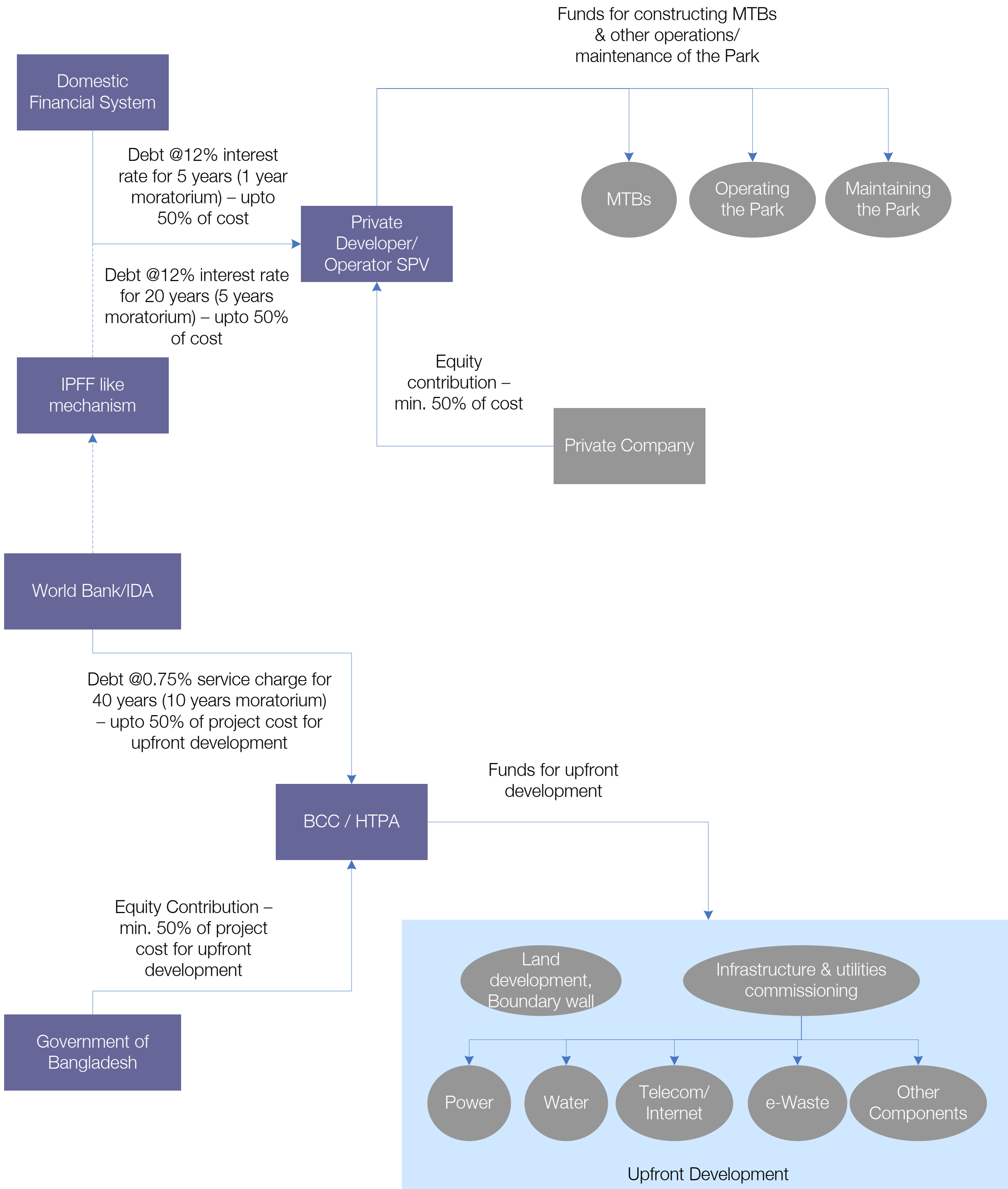


Exhibit 173 Detailed financing flows (debt and equity) for the BCC led upfront development followed by transition to a private player

9.4.1.3.2 EVALUATION OF OPTION 3

The PPP option has been evaluated below, against the identified factors that impact project structure.

9.4.1.3.2.1 EASE OF IMPLEMENTATION

This option provides a relatively easier and faster mode of implementation of the project as compared to other two options discussed earlier because the development work would start immediately and by the time the upfront development finishes, a private developer/operator would be appointed to start operating the Park.

However, under current market conditions, it may take a while before investors look for Greenfield investment opportunities in an untested market.

> *Overall Impact: Neutral - Initial government investment would provide great comfort to investors but government capacity may be strained initially.*

9.4.1.3.2.2 GOVERNMENT CAPACITY

Under this option, after leasing the developed area to a private developer/operator, the Government will play more of a regulatory role, for which the existing bodies have the capacity. Assistance will, however, be required during the bidding process of selecting the developer. Also, undertaking the upfront development would need some capacity building at various levels.

> *Overall Impact: Neutral - Although private capital and expertise would be involved, some upfront development from BCC would be needed.*

9.4.1.3.2.3 INVESTOR INTEREST

Investor's interest, in this scenario, would be positive. This would be because of the upfront commitment that would be shown by BCC.

> *Overall Impact: Positive – Owing to the commitment shown by the upfront development by the government, investors' interest would substantially increase.*

9.4.1.3.2.4 FINANCIAL AND TAX IMPACT

Same as that in Option 2.

9.4.1.3.2.5 LENDER COMFORT

The comfort to lenders would be very high under this PPP option as the upfront investment put in by the government for infrastructure development would help in increasing the confidence in the project. Also, the funding requirement needed would come down which would further lend comfort to the lenders.

> *Overall Impact: Very Positive – Upfront government investment would provide even greater lender comfort.*

9.4.1.3.2.6 DEVELOPMENT OBJECTIVES

Same as Option 2.

9.4.1.3.2.7 LEGAL ISSUES

Same as Option 2.

9.4.2 COMPARISON OF OPTIONS

Following exhibit gives a comparison of all the options discussed above.

Project Aspects	Option 1 (BCC Led)	Option 2 (PPP through PICOM)	Option 3 (PPP with BCC led upfront development)
Ease of Implementation	Neutral. Various transaction are required which may delay the process and complicate the structure but maybe the only option in the short term	Neutral – PPP development would be more efficient but investor interest maybe lukewarm in the short term (1-2 years)	Neutral – Initial government investment would provide great comfort to investors but government capacity may be strained initially
Government Capacity	Negative – Government would be stretched on both the financial and technical fronts	***POSITIVE – PRIVATE CAPITAL AND EXPERTISE WOULD BE VERY VALUABLE FOR THIS PROJECT.***	Neutral – Although private capital and expertise would be involved, some upfront development from BCC would be needed
Development Objective	Negative – Would not achieve private sector development objective – also government less development would be less efficient	***POSITIVE – PRIVATE PARTICIPATION AND EXPERTISE WOULD BE IN CONSONANCE WITH DEVELOPMENT OBJECTIVES.***	Neutral – Although private participation would be there, initial risk would be taken by the Government.
Investor Interest	Neutral – Investors may prefer an EPC/ O&M arrangement at this point in time but may want to look at development option in the medium term	Negative – Interest would be low at this point and lack of tax incentives would not help matters	***POSITIVE – OWING TO THE COMMITMENT SHOWN BY THE UPFRONT DEVELOPMENT BY THE GOVERNMENT, INVESTORS INTEREST WOULD SUBSTANTIALLY INCREASE***
Financial/Tax	***POSITIVE - TAX WOULD NOT BE MATERIAL SINCE ONLY GOVERNMENT AGENCIES WOULD PARTICIPTAE. TAX ON EPC/O&M CONTRACTS WOULD BE LESS THAN IN CASE OF A FULL-FLEDGED PRIVATE DEVELOPMENT OPTION. NO STAMP DUTY DUE TO ABSENCE OF LAND TRANSFER***	Negative - No benefits to developer. Can be improved by providing the same to the developer through PSIG. Stamp duty will be an issue	Negative – same as option 2

Project Aspects	Option 1 (BCC Led)	Option 2 (PPP through PICOM)	Option 3 (PPP with BCC led upfront development)
Lenders Perspective	Neutral – under the structure, bank lending is not envisaged	***POSITIVE – DOMESTIC LENDERS SEEM QUITE KEEN ON THE PROJECT ESPECIALLY IF WORLD BANK SUPPORT EXISTS AND GOOD PRIVATE PARTIES COME FORWARD TO INVEST***	***VERY POSITIVE – UPFRONT GOVERNMENT INVESTMENT WOULD PROVIDE EVEN GREATER LENDER COMFORT***
Legal Issues	***POSITIVE – NO LAND TRANSFER IS ENVISAGED AND PROCESS OF GETTING APPROVALS AND CLEARANCES WOULD BE SIMPLER***	Negative - Land transfer issue will be involved. Also, sub-leasing to tenants by the developer may be an issue	Negative – Same as Option 2

Exhibit 174 Comparison of Various Options for Park Development

An analysis of the issues suggests that the PPP route with a 26% government shareholding is the best possible option for the project. However, the major issues with this structure are:

- The difficult economic circumstances, especially in the real estate and IT sectors which may not be conducive for a PPP transaction at the present moment.
- Lack of tax breaks and stamp duty implications which compare poorly with incentives available in neighboring countries, which also have a tested market as far as Hi Parks are concerned. However we understand that the PICOM route provides for discretionary tax breaks for under-developed sectors.

The suggested way forward is a market testing exercise to understand the expectations and interest of the key target investors and wait until the market conditions are more conducive. We believe that the groundwork that needs to be done before the project is "transaction-ready" would anyway take some time.

However if the project is sought to be implemented immediately, option 1 with private support for EPC, O&M and Marketing may be considered.

9.5 RISK MANAGEMENT

An essential aspect of PPPs is the management of risks arising out of the project implementation and operation. The following exhibit presents a snapshot of the risks arising in businesses.

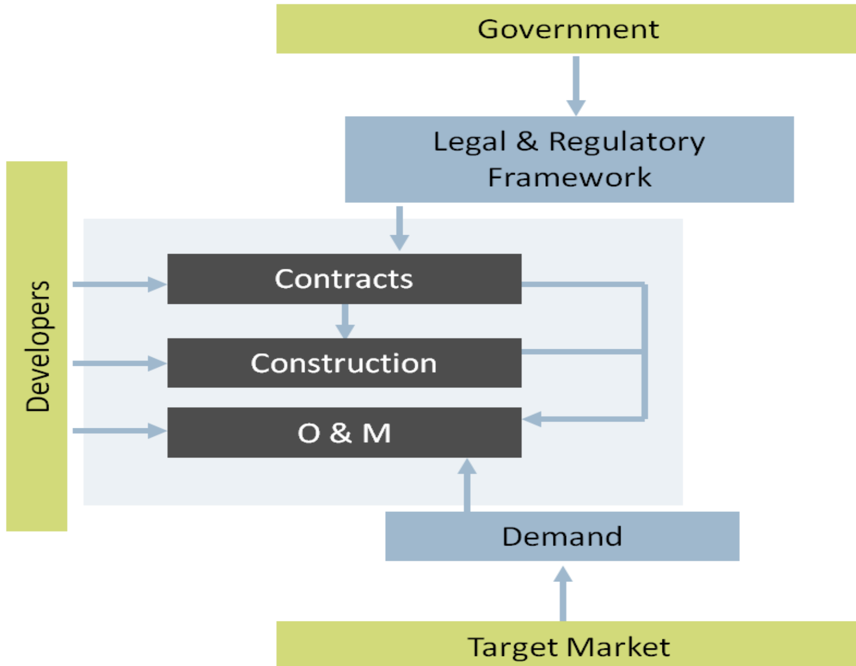


Exhibit 175 Sources of Risks to Businesses

The process of managing risks arising in the context of PPP projects is presented in the exhibit below.

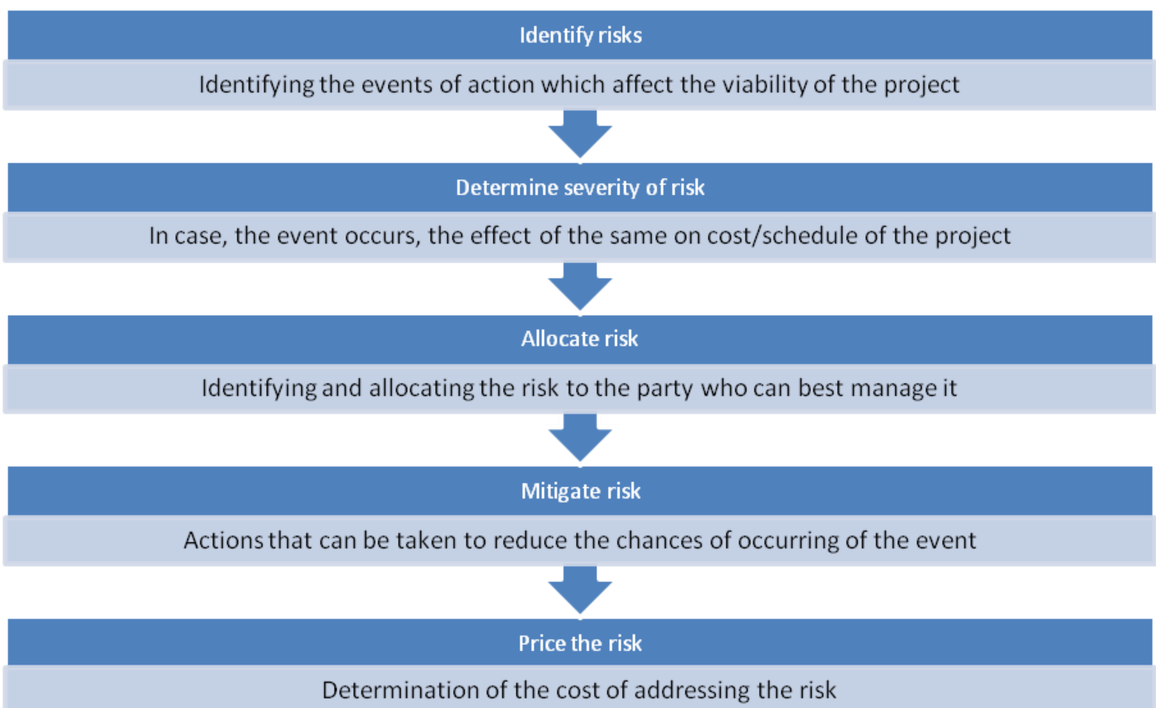


Exhibit 176 Risk Management Process in PPP Projects

The following exhibit depicts various risks involved in the context of PPP projects.

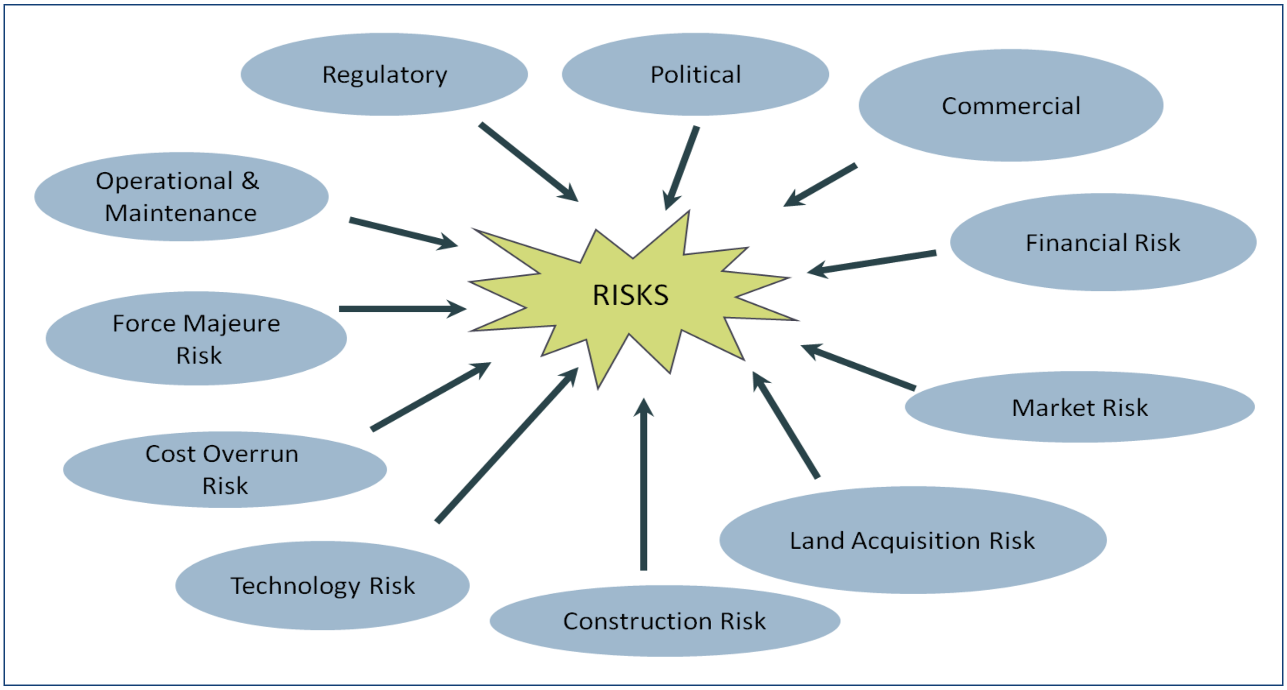


Exhibit 177 Risks to PPP Projects

9.5.1 RISK ALLOCATION

The various risk categories mentioned in the earlier sub-sections arise during different phases of the project. The following exhibit depicts some of the risks, the phase of project in which they arise, and the typical allocation of those risks.

It may be noted that the risk allocation and phasing shown here is only on a general and indicative level and the actual risk allocation arrangement for a project will be governed by project specific parameters.

Risk Categories	Phase of dominance	Allocation of risk
Land acquisition	Project Development	Public
Delays in project development	Project Development	Private party
- Design risk		
- Planning risk		
Project completion risk	Construction Period	Private party
Project cost risk/Cost over-runs	Construction Period	Private party
Technology risk	Construction/Operations Period	Private party
Regulatory & administrative risk	Operations Period	Public/Private party
Commercial risk	Operations Period	Private party
Operations & maintenance risk	Operations Period	Private party

Financial risk	Operations Period	Private party
- Interest rate risk		
- Foreign exchange exposure risk		
- Tax rate change risk		
- Inflation risk		
Termination risk	Operations Period	Private party
Insolvency and outside creditor risk	Throughout Project Cycle	Private party
Force Majeure	Throughout Project Cycle	Insured
Environmental risk	Construction/Operations Period	Public/Private party
Political & social risk	Throughout Project Cycle	Public
- Events of wars		
- Nationalization or revocation		
- Social risk		

Exhibit 178 Risk Phasing & Allocation

After identifying the key risks we present the risk allocation and mitigation plans for each of the above two mentioned development models in the subsequent sections.

9.5.1.1 RISK ALLOCATION UNDER OPTION 1 – BCC LED DEVELOPMENT

In the following exhibit, we present the risk allocation matrix for the BCC-led development model. Here, BCC would be solely responsible for developing and operating the zone. It may contract out this work to other private parties. The matrix outlines the key risks, likely affected parties and corresponding mitigation measures.

Risks	Bearer	Mitigation Mechanism	Residual Impact
Construction risk	BCC	EPC contract	Exclusion of cost and time
Operations risk	BCC	O&M contract	-
Demand risk	BCC	-	Direct impact on revenues and ,in turn, on debt servicing
Financing risk			
Interest rate	BCC	Fixed/floating terms	Partial impact on debt servicing
Exchange rate	BCC	Receipts in USD	-
Pricing risk	BCC	Upfront vs yearly lease payments	Partial impact on competitiveness of the zone

Risks	Bearer	Mitigation Mechanism	Residual Impact
Political risk	BCC	Political risk insurance	Residual impact on operations of the units, and the Park as a whole
Regulatory/ legal risk	BCC	-	Direct impact on operations of the units and the Park as a whole
Environmental risk	BCC	Compliance clauses	-
Commercial/payment risk	BCC	Fixed period lease agreements	Partial impact on revenues
Force Majeure risk	BCC	Insurance contracts	Park operations getting affected

Exhibit 179 Risk allocation matrix for the BCC-led model

9.5.1.2 RISK ALLOCATION UNDER OPTION 2 – MASTER DEVELOPER OPTION

In the exhibit below, we present the risk allocation matrix for the Master developer option. Here, the majority of the risk would have to borne and subsequently mitigated by the master developer chosen to develop the zone.

Risks	Bearer	Mitigation Mechanism	Residual Impact
Construction risk	Master developer	EPC contract	Exclusion of cost and time
Operations risk	Master developer	O&M contract	-
Demand risk	Master developer/ BCC	-	Direct impact on revenues and, in turn, on debt servicing. Also, residual impact on revenue/profit sharing with BCC
Financing risk			
Interest rate	Master developer	Fixed/floating terms	Partial impact on debt servicing
Exchange rate	Master developer	Receipts in USD	-
Pricing risk	Master developer	Upfront vs yearly lease payments	Partial impact on competitiveness of the Park
Political risk	BCC	Concession agreement	Park operations affected if the contract is terminated
Regulatory/ legal risk	BCC	Concession agreement	-
Environmental risk	Master developer	Compliance clauses	Residual impact on Park attractiveness

Risks	Bearer	Mitigation Mechanism	Residual Impact
Competition risk	Master developer	Exclusivity clauses	-
Force Majeure risk	Shared	Concession agreement	Park operations affected if the contract is terminated as a result of the force majeure lasting beyond a point

Exhibit 180 Risk allocation matrix for the master developer-led development model

1.1.1.1 RISK ALLOCATION UNDER OPTION 3 – BCC LED UPFRONT DEVELOPMENT FOLLOWED BY TRANSITION TO A PRIVATE DEVELOPER/OPERATOR

In the following exhibit, we present the risk allocation matrix for the BCC-led upfront development model where the park infrastructure would be developed upfront by BCC and subsequently a private developer/operator would be brought in. The matrix outlines the key risks, likely affected parties and corresponding mitigation measures.

Risks	Bearer	Mitigation Mechanism	Residual Impact
Construction risk during upfront development	BCC	EPC contract	Exclusion of cost and time
Construction risk of MTBs	Private Party	EPC contract	Exclusion of cost and time
Operations risk	Private Party	O&M contract	-
Demand risk	Private Party	-	Direct impact on revenues and, in turn, on debt servicing. Also, residual impact on revenue/ profit sharing with BCC
Financing risk			
Interest rate	BCC/ Private Party	Fixed/floating terms	Partial impact on debt servicing
Exchange rate	BCC/ Private Party	Receipts in USD	-
Pricing risk	Private Party	Upfront vs yearly lease payments	Partial impact on competitiveness of the Park and, in turn, on revenues and profits
Political risk	BCC	Political risk insurance	Residual impact on operations of the units, and the Park as a whole

Risks	Bearer	Mitigation Mechanism	Residual Impact
Regulatory/ legal risk	BCC	-	Direct impact on operations of the units and the Park as a whole
Commercial/payment risk	Private Party	Fixed period lease agreements	Partial impact on revenues
Force Majeure risk	BCC/ Private Party	Insurance contracts	Park operations getting affected

Exhibit 181 Risk allocation matrix for the BCC-led upfront development model

9.6 INSTITUTIONAL ISSUES

The complex structure of the KHTP poses quite a few institutional questions that need to be addressed, whether or not the project is implemented through the PPP route. It would be worthwhile to begin with the need for institutional intervention in an EZ context. Drawings from the Terms of Reference, these can be summarized as follows:

- Implementation
- Investment
- Facilitation/Approvals and Clearances
- Regulation
- Operations and Management

9.6.1 IMPLEMENTATION ROUTE

Fundamental to the institutional arrangements is the question of the implementation route. The following broad options have been discussed:

- The Private EPZ Route
- The EZ Route
- New Ordinance specific to the IT sector
- Existing ordinances for PPPs but external to EZ/EPZ sector

The implications of each have been analyzed below:

- Of the above, the Private EPZ route may not strictly apply since this would be a project with some government shareholding (i.e. e between 26 and 100%) as per the recommendations for project structuring above. Also the experiment with the Korean EPZ has seen substantial delays and cannot therefore be considered an appropriate implementation mechanism for this project. The PM's office is over-loaded with many inter-ministerial issues and the Executive Cell which is responsible for oversight of Private EPZs is not a separate institution and is constrained by under-staffing. Also, crucial tax breaks for developers are not available under the scheme.

- The EZ route had considerable backing from the interim administration as well as the benefit of substantial time having been spent on thinking through the issues involved. However the pace has lost momentum since the new administration is grappling with a slew of new legislations which will inevitably cause the EZ ordinance to get delayed. Also the tax breaks that had been proposed earlier are believed to have been removed from the final version of the ordinance.

- A new ordinance is being considered by the MOSCIT itself to create a "Hi tech authority" (HTA) which would regulate and operate all industrial parks in the Hi Tech sectors. While this may obtain the tax breaks for developers that are not presently available under any other regime, the process of a new ordinance, which would have to be created from scratch and setting up of a new organization would take up a long time. While the merits of a separate HTA are beyond the Consultants locus, the process would certainly take time which would have implications for the speed of development – for example, the EZ legislations is still awaiting final approval, 2 years after work on it first started. It is therefore recommended that the KHTP not be held up until the formation of the Authority – means to incorporate the park within the HTA's purview, if and when the HTA becomes a reality may be specifically considered while constituting the Authority.
- Pending the passage of the EZ ordinance, the possibility of using an existing generic PPP route was explored and it was found that the country has a fairly well thought out structure for evaluating and implementing PPP projects. This was found in the Private Infrastructure Committee (PICOM) route under which PPP projects from a wide range of infrastructure sectors can be implemented. This has been used primarily by the power sector but the guidelines specifically provide for industrial parks as well. It also allows for a case to case grant of tax breaks for under-developed sectors.

While the PICOM route appears to be the simplest mechanism for implementing the project, if done on a PPP basis, the MOSCIT could go ahead with the usual DPP/ECNEC approval process in case it decides to implement the project on its own. In this context, it is worth pondering about whether the PICOM route can substitute all of the special incentives and provisions provided for in the EZ route. The key issues in this context are as follows:

- Tax incentives for tenants
- Tax incentives for developers
- Approvals and clearances for tenants
- Approvals and clearances for developer

The issues are analyzed in the following table:

Issue	PICOM Route (PPP Structure)	ECNEC Route (100% Govt)	EZ Route
Tax Incentives for tenants	Would continue to be available as per benefits available to IT Companies and other exports (for hardware manufacturers) until 2013	Same as PICOM route	Benefits available to tenants – both exporters and domestic manufacturers – under EZ route
Tax Incentives for developers	Possible on a case to case basis for under-developed sectors	Not relevant since Government is the developer	Not available in current form of ordinance
Approvals for	Would be obtained as	Same as for PICOM route	EZ route proposes a

tenants	per existing process which would not be affected in anyway		specific mechanism for clearance of approvals
Approvals for developers	Approval would come through the PICOM process which lays down a specific procedure for the same. MOSCIT could also play a facilitator's role in enabling the same	The process would be similar to that followed for any public sector project which would require preparation of a DPP and ECNEC clearance	The EZ ordinance lays down the processes by which private developers may obtain approvals for setting up zones.

Exhibit 182 Key Issues

Thus in this instance, since the IT sector as well as Hardware manufacturers are anyway granted tax benefits under various provisions of existing legislations, not going through the EZ/Private EPZ route would not make any material difference to tenants. For the same reason, a new regulation/authority is not needed.

As far as developers are concerned, they presently do not get any tax breaks, even under the proposed EZ Act and therefore going through the PICOM route would not place them at any disadvantage. It is possible to envisage a new legislation specific to the IT sector which grants such an incentive but this is by no means definite. More certainly, this would delay the implementation process by at least 2-3 years going by the experience with similar legislations in the past. Finally, the PICOM route does provide case to case tax exemptions for PPP projects in under-developed sectors.

For approvals and clearances, tenants can continue to use the existing processes for setting up their units. These can be strengthened by the developing entity – whether public or private – which can facilitate the process of obtaining/renewing approvals.

The PICOM lays out a clear route for approvals and clearances required by the developer which are working quite well. If MOSCIT decides to implement the project 100% on its own, the ECNEC process is another well established route that can be followed.

It emerges from the above that between the ECNEC and PICOM processes, all of the areas that need to be addressed are covered. Creation of a new authority/legislation for the purpose is therefore not required and could significantly delay the project implementation timeframe.

9.6.2 INSTITUTIONAL IMPERATIVES FOR BCC

As noted above, whether the project is developed through the PPP route or the public sector route, there would be considerable technical demands on the MOSCIT/BCC in implementing the project. The following specific recommendations are made in this context:

- Creation of an SPV for implementation of the project – Irrespective of the route chosen, it is recommended that a spate SPV be chosen for development of the Park. The government's shareholding in this SPV can be routed through the BCC itself.
- Creation of a Project Monitoring Unit (PMU) within the BCC for implementation of the KHTP whether through the public or private sector routes.
- Appointment of a implementation support consultant to hand-hold it through the proposed transactions i.e. e:

- Appointment of a Master Developer in case the PPP route is adopted
- Appointment of EPC, Marketing and O&M Contractors in case the public sector route is adopted

The last two are explained in further details below.

9.6.2.1 PROJECT MONITORING UNIT (PMU)

As noted above, it is suggested that a PMU be created within BCC, with the help of an Implementation Support Consultant, to look into all aspects related to project related works, whether or not implemented through PPP. This would require some initial hand-holding to look into the following aspects:

- Supporting capacity building and re-organisation of the implementing agency to enable PPP transactions. There should be clarity on the indicators used to track progress made by the agency as well as the senior and middle level officers within the agency. A system to track should also be in place. This should include the following:
    - A comprehensive Training and Development Plan
    - A well laid out Recruitment and Compensation Strategy
    - Process for creation of a Project Management Unit (PMU) within the implementing agency
    - A broad level organization structure of PMU within the organizational context
    - Operationalization of the PMU
- Support the implementing agency in operationalising the agenda for Public-private partnerships in the context of the various legislations governing EZs, EPZs and PPPs. This should result in establishment of a sound system for bringing about PPPs.
- Map the regulatory scenario for PPP development, especially interface with other department and implications of different EZ legislations such as BEPZA Act, Private EPZ Act, EZ Ordinance etc. The consultant would be responsible for documenting the details of the implementing mechanism, all clearances and approvals and suggest appropriate investment routes such as EZs/EPZs under different scenarios. Further the consultant needs to broadly review the key issues in the overall EZ/EPZ legislative scenario and make suitable recommendations to strengthen and streamline the overall EZ development process.
- Investor promotion including building a shelf of feasible projects (including component PPPs) for potential investment.
- Building capacity for escorting and facilitating clearances to investors. A system with clear responsibility for facilitating investment clearances should be implemented. A system for tracking of time taken for investment clearances will need to be put in place that also allows linkages with the GoB effort to track nation-wide investments into the sector.
- Development of model contract documents such as Request for Qualification, Request for Proposal, Concession Agreements.
- A Process Manual detailing the steps for initiation and management of PPP transactions for each identified category of projects.

9.6.2.2 ROLE OF PMU REGARDING TRANSACTIONS

The PMU, if required with the help of the Implementation Support Consultant, would manage the process of selecting the master developer or the EPC/O&M contractors as the case may be. This would involve the following:

9.6.2.2.1 PRE TRANSACTION STAGE

The PMU would be responsible for identifying an appropriate structure for the project. This would include the following activities:

- Review the existing feasibility reports and other relevant project information, and making suitable adjustments to reflect any subsequent events/changes
- Identify prospective investors and engage them in a dialogue to gauge their interest and obtain inputs on preferred project structure, key decision points, areas of concern etc.
- With the help of a Legal Consultant, review regulatory and legal issues
- Identify key areas of support from the Government including list of clearances and chart out a realistic timetable for the same
- Review and fine tune the proposed project structure based on the consultations with key stakeholders such as private developers, relevant government agencies, lenders and other financial investors
- Chalk out an appropriate transaction structure based on the identified constraints and the qualification/evaluation criteria, timeframes, documentation etc.
- Identify key project risks and prepare a mitigation plan to be incorporated into the project structure and project documents
- Prepare a Project Information Memorandum (PIM) capturing the highlights of the project, key information and relevant decision drivers
- Co-ordinating with a legal consultant to prepare key project documents which should include documents such as:
    - Request for Qualification
    - Request for Proposal
    - Concession Agreement
    - Lease Agreement
    - Shareholders Agreement
    - Government Support Agreement

9.6.2.2.2 TRANSACTION STAGE

In this stage, the PMU would be responsible management of the actual transaction process including:

- Drafting advertisements that will be issued in appropriate domestic and international media for inviting Expressions of Interest from private partners
- Facilitating the Marketing of the project to prospective investors which would include:
    - Providing inputs to a PR agency for preparation of relevant marketing material including CDs, brochures, information packs, AV material etc.
    - Conducting investor road shows and meets at select domestic and international venues
    - Interfacing with investors over telephone, electronic mail etc.
- Short-listing respondents expressing interest on the identified criteria and facilitating issue of project documents to short-listed investors
- Conducting a pre-bid meeting inviting short-listed investors to obtain inputs on project documents, transaction process etc.

- Issuing final project documents to investors based on discussions in the pre-bid meeting
- Prepare a spreadsheet based evaluation tool for evaluating the investors' proposal to obtain the scores as per the predetermined evaluation criteria
- Coordinating with a technical consultant to assess the technical merits of the proposals received from investors
- Preparing a bid evaluation report summarizing the ranking of the proposals received

9.6.2.2.3 POST TRANSACTION STAGE

This stage would commence after the technical and financial proposals have been evaluated and a preferred bidder has been identified. The activities during this stage would include:

- Identifying the key issues in the negotiations process and preparing an overall negotiation strategy including an "issues and positions" paper that would lay out suggested responses to key decision points.
- Preparing a financial model for evaluating the impact of alternative outcomes
- Working with the legal consultant in revision of project documents to reflect the changes post negotiations
- Coordinating with the legal consultant to assist the Implementing Agency in negotiating the project agreements with the preferred bidder.

10 IMPLEMENTATION ROADMAP

After analyzing the proposed PPP options from the implementation and risk perspective, we now present the detailed implementation roadmap for the above presented PPP option involving a master developer. The implementation roadmap covers the various timelines for each of the planning and development related activities involved in the master developer PPP option. These would give an indicative timeline for taking the project forward through the PPP option discussed before.

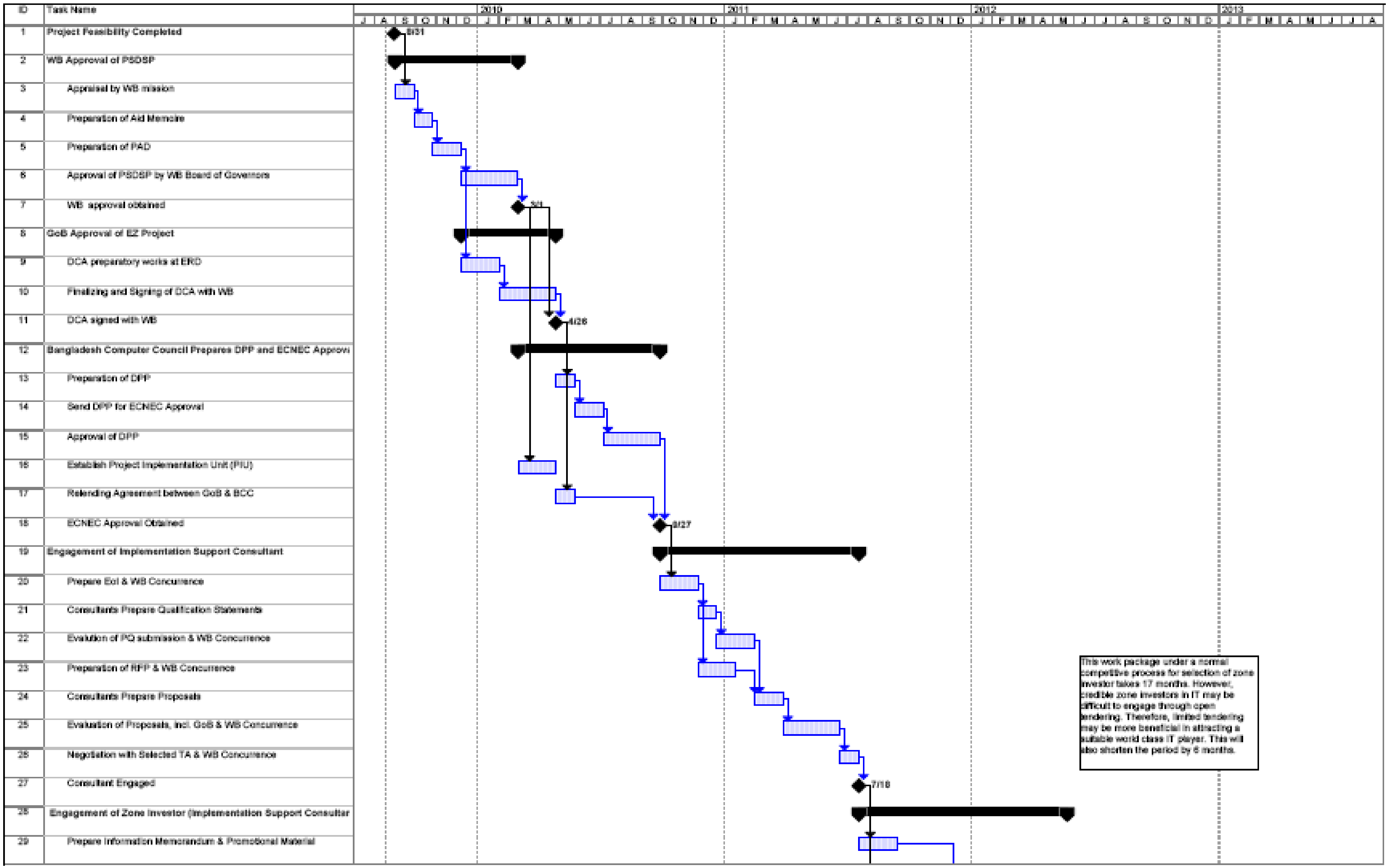
In the master developer option, the key activities along with the estimated time required to finish them are listed below.

Activity	Estimated Time
Project Feasibility Completed	**-**
WB Approval of PSDSP	**6.5 months**
Appraisal by WB mission	1 month
Preparation of Aid Memoire	1 month
Preparation of PAD	1.5 months
Approval of PSDSP by WB Board of Governors	3 months
WB approval obtained	-
GoB Approval of EZ Project	**5 months**
DCA preparatory works at ERD	2 months
Finalizing and Signing of DCA with WB	3 months
DCA signed with WB	-
Bangladesh Computer Council Prepares DPP and ECNEC Approval	**7.5 months**
Preparation of DPP	1 month
Send DPP for ECNEC Approval	1.5 months
Approval of DPP	3 months
Establish Project Implementation Unit (PIU)	2 months
Relending Agreement between GoB & BCC	1 month
ECNEC Approval Obtained	-
Engagement of Implementation Support Consultant	**10.5 months**
Prepare EoI & WB Concurrence	2 months
Consultants Prepare Qualification Statements	1 month
Evaluation of PQ submission & WB Concurrence	2 months
Preparation of RFP & WB Concurrence	2 months
Consultants Prepare Proposals	1.5 months
Evaluation of Proposals, incl. GoB & WB Concurrence	3 months
Negotiation with Selected TA & WB Concurrence	1 month
Implementation Support Consultant Engaged	-

Engagement of Zone Investor (Implementation Support Consultant)	**11 months**
Prepare Information Memorandum & Promotional Material	2 months
Prepare List of Potential, Renowned IT Players	2 months
Investment Promotion with the List of IT Players	3 months
Preparation of Commercial Framework (Proposed MTCs)	2 months
MTCC Decides on Major Terms and Conditions	1 month
Preparation of Tender Package & Concession Agreement	1 month
Approval of Bid package	1 month
Short Listed Bidders Prepare Tenders	2 months
Evaluate Investment Bids	1.5 months
Approval of the Selected Bidder	1 month
Prepare & Issue LOI to the Selected Bidder	0.5 months
Formation of SPV by Investor	1 month
Negotiate & Finalize Concession Agreement	1 month
Zone Investor Engaged	-
Financial Closure	**6 months**
Submit Loan Application to Lenders	1 month
Lenders Due Diligence	3 months
Preparation of Loan Documents	2 months
Financial Closure	-
Construction of EZ (IT Park Developer)	**12 months**
Preparation of Detailed Master Plan by IT Park Developer	1 month
Receive ECC from DOE	1 month
Engagement of Construction Contractor	1 month
Plot Demarcation as per Master Plan	1 month
Construction of Internal Roads (Continuing)	3 months
Development of onsite Utilities & Infrastructure	6 months
Construction of Residence & Social Infrastructure (Continuing)	8 months
Construction of MTB as per Master Plan (Continuing)	6 months
Initial Zone Promotion and Marketing for Plots	6 months
COD (Plots & MTB Land ready for Leasing)	-

Exhibit 183 Activities involved in developing the project through the master developer option

The above mentioned activities are further presented in the form of an implementation roadmap in the exhibit below.


ID
Task Name
2010
2011
2012
2013
J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A
1 Project Feasibility Completed
8/31
2 WB Approval of PSDSP
3 Appraisal by WB mission
4 Preparation of Aid Memoire
5 Preparation of PAD
6 Approval of PSDSP by WB Board of Governors
7 WB approval obtained
3/1
8 GoB Approval of EZ Project
9 DCA preparatory works at ERD
10 Finalizing and Signing of DCA with WB
11 DCA signed with WB
4/26
12 Bangladesh Computer Council Prepares DPP and ECNEC Approv
13 Preparation of DPP
14 Send DPP for ECNEC Approval
15 Approval of DPP
16 Establish Project Implementation Unit (PIU)
17 Relending Agreement between GoB & BCC
18 ECNEC Approval Obtained
8/27
19 Engagement of Implementation Support Consultant
20 Prepare EoI & WB Concurrence
21 Consultants Prepare Qualification Statements
22 Evalution of PQ submission & WB Concurrence
23 Preparation of RFP & WB Concurrence
24 Consultants Prepare Proposals
25 Evaluation of Proposals, incl. GoB & WB Concurrence
26 Negotiation with Selected TA & WB Concurrence
27 Consultant Engaged
7/18
28 Engagement of Zone Investor (Implementation Support Consultar
29 Prepare Information Memorandum & Promotional Material
This work package under a normal competitive process for selection of zone investor takes 17 months. However, credible zone investors in IT may be difficult to engage through open tendering. Therefore, limited tendering may be more beneficial in attracting a suitable world class IT player. This will also shorten the period by 6 months.

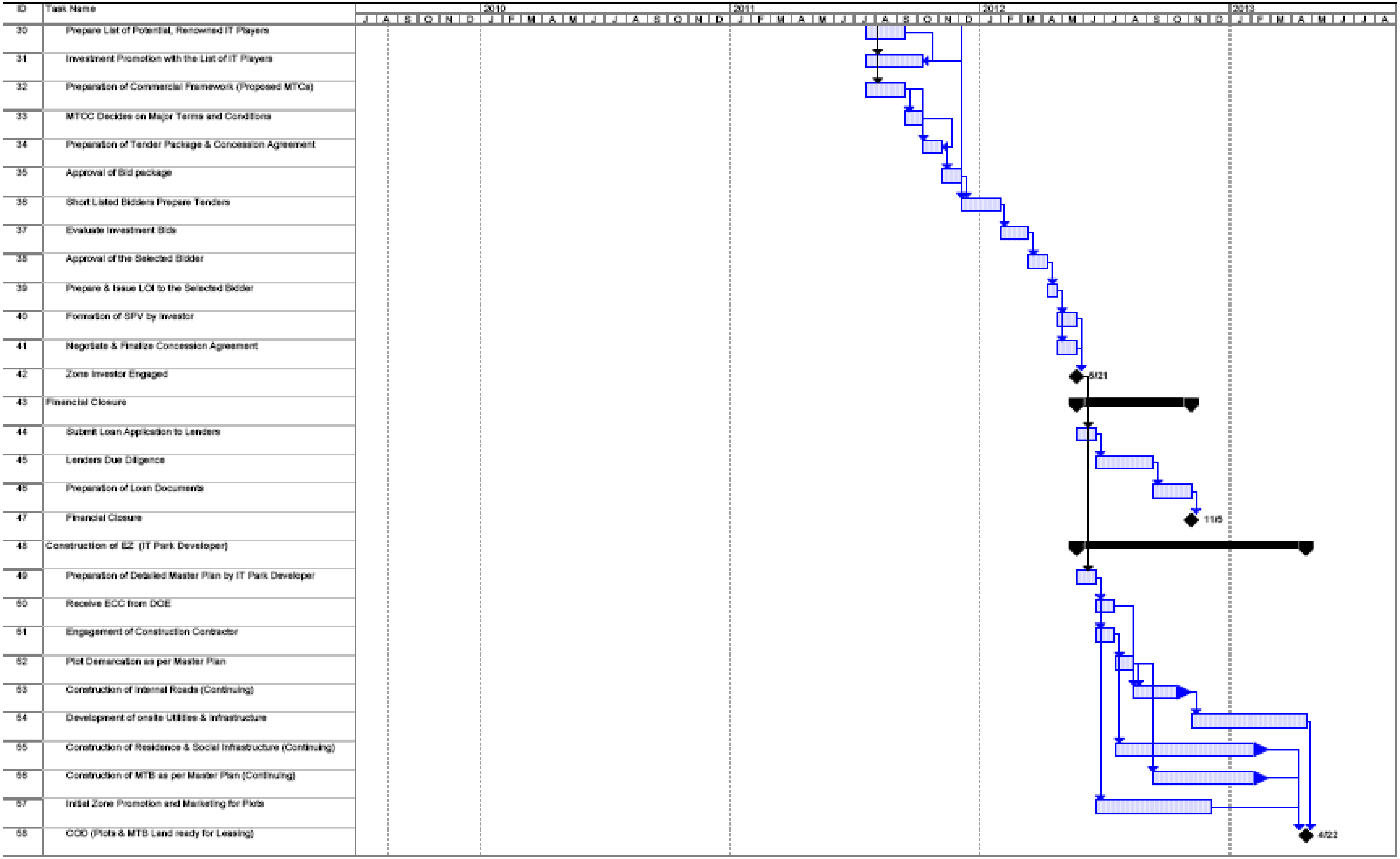


Exhibit 184 Implementation roadmap for the master developer-led PPP option

11 CONCLUSIONS AND RECOMMENDATIONS

- Global Economy
  - The demand prospects for the KHTP appear good despite the ongoing economic crisis. However there may be short term negative impacts on account of the downturn in the crucial IT and Real Estate sectors.
- Bangladesh Hi tech Industry
  - Based on an assessment of the Hi-tech industries in Bangladesh it is recommended that the initial focus be on IT, ITeS and Hardware sectors.
  - The software services sector in Bangladesh employed about 25,000 people in 2007. The sector has been witnessing rapid growth over the last two years.
  - In terms of number of firms, small companies (less than 50 employees) are in the majority but the majority of employees work for larger companies. It is expected that only the larger companies would be potential tenants for the KHTP.
- Investor Interest
  - While investment into the Bangladesh Hi tech sector remains a challenging proposition for international firms, firms from the sub-continent indicated prima facie interest. Concerns included availability of manpower, lack of a well-developed domestic market and administrative issues like visa processing.
- Demand Projections
  - Based on experience of smaller growth centers in the region, as well as the experience of countries with similar socio-political characteristics such as Pakistan, a growth rate of 20% in the base case has been assumed.
  - However this is moderated to account for the impact of the downturn in the first few years. A total of three scenarios were developed with the pessimistic and optimistic scenarios built around growth rates of 15% and 25% respectively.
  - Demand for space from the Hi tech sector was "allocated" to the KHTP by assessing its competitiveness with respect to competing destinations.
  - At present there are no facilities comparable to the proposed KHTP in Bangladesh. The KHTP would be able to offer substantially better infrastructure at much lower prices but would involve longer commutes from city centre.
  - Based on the experience in urban areas in the sub-continent, it is expected that longer commutes to save real estate cost would become acceptable in Dhaka as well.
  - Considering the pricing advantage as well as the nature of firms in the Bangladesh Hi tech sector, it is estimated that 33% of incremental demand for space in Dhaka can be attracted by the KHTP. This is expected to go up to 50% over 5 years.

- Master-planning
    - Of the 263 acres, after elimination of space for roads, open areas and utilities, about 163 acres are available for development. Using an FSI of 2, this translates to about 14 Mn Sq ft of space.
    - After deducting social infrastructure components, about 10.67 Mn Sq ft of space would be required of which 60% would be commercial space for use by Hi tech sectors and balance for residential purposes.
- ESMP
    - No major irreversible impacts are expected from the project. Being largely focused on the service sector, levels on environmental are low compared to other industrial zones.
    - Institutional arrangements proposed include a supervision consultant for monitoring the project and an environment and social cell.
- Detailed Engineering
    - The major changes from the preliminary master plan include provision of pocket gates for pedestrian access and realignment of infrastructure phasing.
    - The total cost of the project (excluding MTBs) was estimated at USD 21.81 Mn. In the basic planning stage, the estimate was USD 22.54 Mn
- Pricing
    - Pricing has been based on a 50% discount over rates prevailing at Uttara for commercial buildings. This translates to a lease rate of USD 2.67 per square foot per annum in the base case
    - For residential development, a 10% premium has been assumed over residential developments in the area (which are mostly middle income in nature). This yields an average of USD 24 per sq ft as the sale price.
    - For serviced land, prevailing land prices have been taken with a mark-up of 50% to account for development expenses. This translates to a lease rate of USD 2.74 per acre per annum in the base case.
    - Price growth is based on statistical analysis of real estate in Uttara in the past 5 years and the lower 75% limit for commercial and residential prices have been taken for the base case. The real dollar growth rates implied by this are 5.97% and 16.4% respectively for commercial and residential respectively. However, to be on the conservative side a gradually ramped up growth scenario has been assumed.
- Financial Returns
    - Returns have been calculated over a 35 year period. The debt to equity ratio has been assumed at 50:50 and no tax breaks have been considered.
    - Returns are very healthy in the base case at over 20% project IRR but the DSCR is below acceptable limits on account of tenor limitations in the Bangladesh financial markets. However, if a donor enabled funding tenor of 20 years, with a moratorium of 5 years is assumed, the debt servicing constraints are mitigated.

- The equity returns are unacceptable at 5% in the pessimistic case, which is a combination of pessimistic assumptions on several variables. However while returns are sensitive to variables such as pricing, price growth capital cost etc., the project returns are resilient to negative variation of each variable, acting individually, by upto 20%.
- BCC stands to gain substantially from the project in the base case by virtue of lease rentals as well as its equity share in the project (which would be a minimum of 26%). The discounted value of cash-flows to BCC in the base case would be about USD 118,000 per acre.
- Tax breaks would make a very significant difference to project returns which would increase by 24% to 27% (equity IRR). However the pessimistic scenario would continue to have unacceptable returns even with tax breaks.
- An economic analysis of the project reveals that there are substantial economic gains from the development of the project in terms of employment as well as Gross Value Added.

- Project structuring and Institutional Development
    - Considering the various factors involved in the structuring decision, it would be appropriate to develop the KHTP as a joint venture with 26% stake held by the BCC (or any other entity of the BCC).
    - Notwithstanding present challenges in the knowledge and construction sectors, given the fundamental attractiveness of the project and the urgency of development, an attempt should be made to develop the KHTP through PPP as suggested under Option 2. Government led development can be considered as a fall back option in case there in inadequate private sector interest.
    - It is suggested that the PPP transaction, if found suitable, be routed through the PICOM. For various reasons the EZ route and the Private EPZ route have been found unsuitable. While the Hi tech park authority is being formed in parallel, it can be provided the necessary flexibility to absorb the KHTP as and when it is formed.
    - Whether implemented through the PICOM route or directly by the BCC through the ECNEC route, it is suggested that adequate capacity be built in the BCC by creating a Project Monitoring Unit with the help of an Implementation Support Consultant.

12 ANNEXURE 1 – ASSESSMENT OF INVESTORS' INTEREST AND LENDERS' PERSPECTIVE

In order to assess the investors' interest and the lenders' perspective towards investing and financing the Comilla and Kaliakoir projects, a workshop was conducted on 29th July 2009. The participants for the same were selected in order to represent the key players in the banking and infrastructure development sector. In addition, there was representation from the donor agencies as well as the executing agencies for the two projects. The audience comprised of the following:

- Board of Investment (BoI)
- Executing agencies
  - Bangladesh EPZ Authority (BEPZA)
  - Bangladesh Computer Council (BCC)
- Donor agencies
  - World Bank
  - Department for International Development, UK (DfID)
- Lending institutions
  - Bangladesh Bank (managing the IPFF mechanism of lending)
  - Eastern Bank
  - Standard Chartered Bank
  - HSBC
- Industry Associations
  - Bangladesh Association for Software and Information Services (BASIS)
- Investors
  - Youngone group (KEPZ)
  - United group
  - Rupayan group

The workshop was an interactive one where the views and opinions of the investor and lending community were explored. The specific agenda for the workshop included discussions of the following aspects:

- Project securities and guarantees
- Promoter guarantee/undertaking
- Pre-conditions for sanction
- Experience with IPFF – issues and constraints
- Any option for tenor enhancement

- Difference in lending to an established textile industry project vis-à-vis a nascent Hi-tech industry project

The key findings of the interactions were as follows:

- The banking community was of the opinion that providing funding for around USD 30 million should not be an issue. However, it was emphasized that there must be enough clarity about the project in terms of the key components, development activities involved and timelines, stakeholders, mode of implementation, key risks and mitigation measures etc.
- Currently in Bangladesh, the lending norm is that the fund availing agency has to give corporate guarantees of some kind and there is a full recourse applicable. However, these could be relaxed to a certain extent depending on the project, its promoters and the agencies involved.
    - With regards to the specific projects, it was mentioned that as textile is an established industry, the requirement for guarantees could be relaxed. However, for the Kaliakoir Hi-tech Park project, owing to the nascent stage of the ICT industry, some sort of guarantee mechanism would be a pre-requisite for extending lending.
- In terms of risks, the banking community could look at taking on or sharing the market/demand and the financial risk.
- The tenure problem arising out of the asset-liability mismatch was also discussed in detail and it was acknowledged that projects like Comilla expansion and Kaliakoir Hi-tech Park would need longer tenures in the range of 15-20 years.
- In order circumvent the tenure problem, IPFF route was suggested and debated upon. Through various case studies in Bangladesh (specifically in the power sector) it was highlighted that the IPFF route has been very successful in terms of providing primary funds or refinancing the debt availed for the project. For these two projects also, IPFF funds could be availed.
- One of the key concerns raised by the foreign banking community with regards to the IPFF mechanism was the fact that only four banks are currently allowed to participate in the IPFF facility. If this could be expanded to involve other banks also then the quantum of fund available could increase manifold and thus a number of other sectors and projects would be able to avail these.
- Some of the foreign banks mentioned that they or their overseas peers could provide funds at a lower rate and with extended tenures to foreign investors. This could be achieved by eliminating the premium associated for country risk, and only accounting for the cost of funds and depreciation of taka. However, extending such lending to the local investors could be difficult.
- It was again emphasized that the funding from international donor agencies is critical, both in terms of lending directly to projects and through the IPFF route.
- With regards to the Kaliakoir Hi-tech Park project, BASIS asserted that there is a large demand for ICT office space and also space for hardware assembly industry that can be readily occupied, and hence ventures making such space available to the industry are highly demanded. Also, guaranteed round-the-clock supply of power and internet connection were expressed to be essential for establishment of ICT based industries, and it was mentioned that this would be one of the USPs of the KHTP project.

13 ANNEXURE 2 – ENVIRONMENTAL SPECIFICATIONS FOR BID DOCUMENTS

It is recommended that, bare minimum; the following clauses are incorporated in the bid document:

- The developer shall take all steps to protect the environment and avoid damage and nuisance arising because of his operations.
- The developer shall comply with all statutes and regulations concerning the execution of works as per the DoE and donor's environmental guidelines.
- The developer shall be responsible for familiarizing himself with all legislation relating to environmental protection that is relevant to his activities. Reference to global best practices and local environmental guidelines should be made.
- The developer shall be responsible for bearing the costs of cleaning up any environmental pollution resulting from his activities.
- In case of surface water pollution from developer's activities, the developer shall take adequate preventive measures for not doing so and in case pollution of surface water occurred the developer shall be liable to make the water to its original quality especially where the surface water has potential use. Costs including both for the tests and purification shall be borne by the developer.
- Where water abstraction from boreholes by the developer results in adverse effects on groundwater, which at the time of commencement of the contract was being used by the local people, the developer shall arrange supply of equivalent quantity of safe water to the users as before.
- The developer shall, at all times, maintain all sites under his control in clean and tidy condition and shall provide appropriate and adequate facilities for temporary dumping of all wastes before disposal.
- The developer shall be responsible for safe transportation and disposal of all wastes generated out of his activities in such a manner so that environmental pollution or hazards to health in any form is within prescribed limits. In the event of any third party being employed to dispose of wastes, the developer shall be considered to have discharged his responsibilities under this Clause from the time the wastes leave sites under his control, providing that he has exercised due diligence in ascertaining that the proposed transport and disposal arrangements such as to not cause pollution or health hazards.
- The developer shall not allow waste oils, lubricant or other petroleum derived wastes to be used as dust suppressants and that all reasonable precautions shall be taken to prevent accidental spillage of petroleum products, their contact with soil or discharge into water courses.
- The developer shall be responsible for the provision of adequate sanitary facilities for the construction workforce (including those employed under subcontracts) at all construction, office and camp sites. The developer shall not knowledgably allow discharge of any untreated sanitary wastes either to groundwater or surface water. Before mobilization of the construction workforce, the developer shall provide details of sanitary and drainage arrangements to the Engineer for approval. The detail should include maintenance and operation plants and generally be sufficient to allow the Engineer to assess whether the proposed facilities are adequate.

- All vehicles and plant operated by the developer (or his appointed contractors) shall be maintained according to the original manufacturers' specifications and manuals, with particular regard to the control of noise and/or smoke emissions. The construction supervision consultant shall have the right to require the developer to replace or rectify any vehicle or plant that he thinks emits excessive noise and/or smoke, within 48 hours of notice in writing.
- The developer shall make reasonable effort to reduce noise nuisance caused by construction activities, including location of crusher and ancillary plants in locations where the distance between those plants and residential areas is such that it results in attenuation of noise at existing residential areas.
- The developer shall take all reasonable measures to minimize dust-blow arising from any sites under his control by regular watering of any stockpile, bare soil, haul road, un-surfaced traffic area and any sources of fatigue dust, when conditions require dust suppression. If, in the opinion of the Engineer, the dust suppression measures are ineffective, the developer shall take further measures to minimize the dust blow nuisance as directed by the Engineer.
- In case of any traffic disruption is caused by the construction activities of the developer (or his appointed contractors), the developer shall be responsible to provide separate pathway to the full operational use by the vehicles. The facilities in this regard shall be such that either party is not disturbed.
- In case of any road damage by the developer (or his appointed contractors), the developer shall notify the engineer about it and at his own cost shall repair the road to its original condition.
- In case of any damage incurred in agriculture or surrounding homesteads outside of the acquired land either permanently or temporarily by the developer or his appointed contractor activities, the developer shall be responsible to pay compensation for that upon the appropriate monetary evaluation applicable to the local market at the time the damage occurs.
- Upon completion of construction, the developer shall remove equipment, surplus material, rubbish and temporary works of every kind the developer shall leave the site in clean condition to the satisfaction of the Engineer.

14 ANNEXURE 3 – HYDRO-GEOLOGICAL STUDY REPORT

14.1 OBJECTIVE OF THE STUDY

Rain is the main source of fresh water. Though Bangladesh gets a high amount of rainfall, with an annual average of about 2320 mm, it is not evenly spread across the year. Most of the time, even in a year of normal rainfall, many parts of the country faces water stress, while flooding is also common in rainy season.

The quantity of water that is recharged into ground water is much lesser than the water which goes as run off. As huge quantity of rainwater finds its way ultimately to sea especially, through canals and rivers, the only choice is to harvest and conserve this water through appropriate rainwater harvesting methods.

In light of the same, this study aims to:

- Study the hydro-geological parameters of the proposed project site
- Recommend measures to harvest rainwater for sustainable water sourcing to the project

14.2 SITE SPECIFIC PARAMETERS

The project area will be covered by buildings of varying dimensions, asphalt roads and a network of well designed storm water drains after development activities. Therefore, the quantity of runoff water generated on account of heavy rainfall is enormous which can be effectively utilized both for direct usage as well as recharge to ground water sources.

Moreover, the study site is located in an area which will require large quantity of water for processing and other applications. The over exploitation of ground water sources without adequate recharge activities is not considered advisable due to the uncertainties associated with monsoons and increasing demand of different types of industries in the proposed industrial area for water.

The overdraft of ground water beyond the safe yield, inadequate natural recharge and successive failure of monsoon may contribute to the rapid depletion of ground water table and reduce the yield from the water extraction structures.

14.2.1 REGIONAL WATER POTENTIAL

Many parts of Bangladesh are located within the floodplains of three rivers, the Ganges, the Brahmaputra and the Meghna, and their tributaries such as Teesta, Dharla, Dudhkumar, Surma and Kushiyara. The three major river systems drain to the Bay of Bengal through Bangladesh.

The project site falls in part of the Meghna River Basin. Peak discharges are in the order of 100,000 m^3 per sec in the Brahmaputra, 75,000 m^3 per sec in the Ganges, 20,000 m^3 per sec in the upper Meghna and 160,000 m^3 per sec in the lower Meghna.

Because of the great disparity between the monsoon floods and the low flow during the dry season, the manageable surface water resources are considered as equal to 80 % of the dependable flow in March. Surface water resources are used extensively for dry season irrigation.

The internal renewable surface water resources are estimated at 105 km^3 per year for Bangladesh. This includes 84 km^3 of surface water and about 21 km^3 of groundwater resources available within the country, although part of the groundwater comes from the infiltration of surface water with an external origin.

The analysis of the regional surface water potential gives an idea of the water resources potential in the study region also. The presence of surface and ground water potential is evaluated from the field studies in the month of February 2009. The scope, for developing ground water in the proposed site and harvesting rainwater for its storage in surface and supplement the ground water resources is considered to be very good.

In Bangladesh, the surface and ground water utilization structures consist of:

- Low Lift Pumps (LLPs): Power operated centrifugal pumps
- Shallow Tube Wells (STWs): Drawing water with a motorized suction mode pumping unit
- Deep Tube Wells (DTWs): Drawing water with a power operated force mode pumping unit
- Manually Operated Pumps (MOPs): Extracting water from a shallow tube well and
- Traditional systems

Because of its low-lying topography, about 22% of the area of the country is flooded each year. In view of flooding and soil salinity due to water logging condition, the water management requires proper water quality assessment also, which has been incorporated in the engineering design study, in terms of incorporating water and waste water treatment mechanisms.

14.2.1.1 HYDRO-GEOLOGY

The site terrain is observed to be a part of the sedimentary complex located in the Madhupur Tract which is flanked by Brahmaputra – Jamuna flood plain on the western side and Old Brahmaputra flood plain on the Eastern side. There are a few palaeo-channels (old river courses) with sand and silt.

The top soil (Dhaka Clay) is followed by alternating layers of clay associated with silt and sand. The water bearing formations are represented by medium to coarse grained sandy layers extending beyond depths of 250 m below the ground level.

14.2.1.2 GROUND WATER CONDITION

The ground water condition is mainly influenced by soil cover, which controls the local vertical rainfall recharge. The infiltrated water has to be stored in the interstitial spaces inside the sandy layer, which again depends on the primary porosity in sand. The thickness of the sand layer decides the total ground water storage while the open pore spaces controls the movement of water in the sub surface.

The ground water potential at a site is moderate to high depending on the thickness of granular zones encountered at depth. Ground water in the project site area occurs in shallow aquifers under unconfined to semi-confined conditions while confined condition prevails in deeper aquifers.

14.2.1.3 WELL INVENTORY STUDY

This section focuses on the inventory of the wells existing at the project site.

There are 3 shallow tube wells and 1 deep tub well located inside the premise at various locations. Out of the 3 shallow tube wells, the well located near admin building is fitted with a 1.5 HP pump and the other 2 wells are with hand pumps. The depth of the shallow wells varies from 40 m to 45 m below ground level. The wells are used for construction activities and domestic purposes at present including drinking purposes.

The shallow tube wells are located at:

- South of Entrance gate
- South West of Admin Building
- In between and 30 feet and 60 feet road on the South Eastern side of Admin building.

The deep tube well at the site is not in operation at present and it is reported that a 20 HP submersible pump will be installed shortly. The water drawn from this tube well will also be utilized to meet the demand for construction activities and drinking purposes.

In addition, there is a test tube well of 37 mm dia. and 155 m depth located close to the deep tube well. This well has been drilled to check the quality of ground water at deeper depths.

The quality of water drawn from the shallow wells is satisfactory. The TDS concentration is around 120 PPM to 200 PPM which is very much within the limits prescribed by WHO for potable water. The available reports indicate that the Arsenic concentration is within the allowable limit of 0.05 mg per litre. The salinity is reported to be 400 micro mhos per centimeter.

14.2.1.3.1 WATER LEVEL

There is not much fluctuation of water level at present due to limited extraction of ground water as per local enquiry. Continuous extraction of ground water for factory needs and inadequate recharge activities may lower the water table gradually.

14.2.1.3.2 PUMPING TEST

The details of a pumping test conducted at one of the shallow tube well of 33 m depth are captured in the following exhibit.

Location of the well	South West of Administrative Building
Depth of the well:	33 m (110 feet)
Static water Level:	11.1 m below ground level
Pump power	1.5 HP
Discharge	130 liters per minute
Draw down:	0. 5 m
Pumping Duration	50 minutes

Exhibit 185 Result of Pumping Test – Shallow Tube Well

The water level stabilized within 30 minutes of pumping start, and the decline in level was observed to be negligible beyond the observed drawdown. It is evident from the test that the shallow tube wells are capable of giving around 7800 liters per hour and 10 hours pumping will give around 78 m^3/day.

The semi-confined and confined nature of aquifers would result in impact of pumping on a larger area and the standard spacing norms of 350 m for shallow tube wells and 750 m for deep tube wells are recommended to avoid mutual interference. The yield would be low in summer and the sustainability of shallow tube wells would depend on the surface water influence.

14.2.1.4 GROUND WATER SOURCING FOR PROJECT

The deep tube wells, drilled to depths ranging from 160 m to 200 m can yield around 50,000 liters per hour and 10 hours pumping will give around 500 m^3/day. In order to get the total project requirement of 6450 m^3/day, about 13 deep tube wells with a spacing of 750 m distance would be required.

The shallow tube wells ranging in depths varying from 30 m to 40 m below ground level can yield around 7800 liters per hour and 60 to 70 m^3/day which indicates that about 80 shallow tube wells are required and the spacing requirement between two shallow tube wells will be 375 meters.

The ground water condition in and around the study site is studied in micro level by studying the clay, silt and sand layer disposition in depth and space. The ground water condition in this area is almost uniform in the entire study area. The well inventory study of the existing tube wells around the premise indicates that the ground water condition in the terrain is considered to be good.

14.2.2 ARTIFICIAL GROUND WATER RECHARGE

In light of the aspects of water sourcing and influence of the same on the project operations, artificial recharge of the ground water sources at the project site is envisaged. This section elaborates the methodology recommended for the same.

14.2.2.1 GEOPHYSICAL STUDIES

As far as artificial recharge is concerned, the main considerations are the availability of larger infiltration surface to get sufficient water to the aquifer through the intermediate zone. The recharge water flows through the aquifer, building a ground water mound and therefore it requires a sufficient permeable surface soil and suitable intermediate zone.

Technical information about piezometric zone, hydraulic conductivity, and geometry of the aquifers and location of the recharge structures are the essential parameters for proper design of site-specific artificial recharge structures.

Role of geophysics has been helpful in assessing the subsurface hydro geological conditions economically & adequately. It can model the stratification and spatial variability of hydraulic conductivity for the characterization of zone and area suitable for artificial recharge.

It is also observed that maintaining the natural flow of water in the rivers or artificially keeping water in valleys, riverbeds, ponds, lakes, etc. at similar scientifically appropriate locations will create the required hydrostatic head and provide conditions for ground water movement. This will also be very useful to recharge the unsaturated aquifers and thus stabilize the ground water, resulting in satisfactory yield of dug wells, tube wells, etc.

By various ground water studies, it has been scientifically estimated that ground water runs parallel to the topography and finds termination point in a drainage line such as rivers, lakes, etc., which cut across its movement path, and is considerably influenced by the volume of water stored in the water bodies.

The study site is covered by water bodies located on the Southeastern and Northwestern sides. The gradient of the study site is also towards the water bodies, which improves the recharge to ground water source in and around the study site.

14.2.2.2 WATER HARVESTING POTENTIAL

It is designed that the runoff water generated from the study site will be allowed to flow through a network of lined storm water drains.

14.2.2.2.1 ESTIMATION OF RUNOFF

As mentioned in the Basic Planning and Design Study, the runoff estimation is carried out as follows:

Annual Runoff = Catchment Area x Runoff Coefficient x Annual Rainfall in m

With the average rainfall being 3336 mm per annum[14] (3.336 m) and the runoff coefficient of the area being 0.6 (based on the surface characteristics etc), the quantity of the runoff water available from the project site is estimated to be:

= 275.68 (acres) x 4047 (conversion to m^2) x 0.6 (Runoff co-efficient) x 3.336 (Rainfall)

= 2,233,139 m^3 per annum

= 2.2 million m^3 per annum (approx.)

Based on the calculation and also the study of the site area, two storage-cum-percolation ponds (SCPs) are recommended. The locations of the ponds are elaborated in the succeeding sections of this report.

The following exhibits capture a snapshot of the water harvesting potential (WHP) at the SCPs.

Month	Rainfall (mm)	Co-Efficient (m)	Area of SCP 1 (m^2)	WHP (m^3)	Rounded WHP (m^3)
Jan	0.008	0.60	156908	753	750
Feb	0.003	0.60	156908	282	300
Mar	0.249	0.60	156908	23442	23000
Apr	0.107	0.60	156908	10073	10000
May	0.418	0.60	156908	39353	39000
Jun	0.290	0.60	156908	27302	27000
Jul	0.661	0.60	156908	62230	62000
Aug	0.405	0.60	156908	38129	38000
Sep	0.715	0.60	156908	67314	67000
Oct	0.467	0.60	156908	43966	44000
Nov	0.008	0.60	156908	753	750

[14] Source: Meteorological Department, Bangladesh

Dec	0.005	0.60	156908	471	500
Total				**314068**	**312300**

Exhibit 186 Monthly Water Harvesting Potential for SCP-1

Month	Rainfall	Co-Efficient (m)	Area of SCP 2 (m^2)	WHP (m^3)	Rounded WHP (m^3)
Jan	0.008	0.60	958770	4602	4600
Feb	0.003	0.60	958770	1726	1700
Mar	0.249	0.60	958770	143240	143000
Apr	0.107	0.60	958770	61553	61500
May	0.418	0.60	958770	240460	240500
Jun	0.290	0.60	958770	166826	166800
Jul	0.661	0.60	958770	380248	380200
Aug	0.405	0.60	958770	232981	233000
Sep	0.715	0.60	958770	411312	411000
Oct	0.467	0.60	958770	268647	268600
Nov	0.008	0.60	958770	4602	4600
Dec	0.005	0.60	958770	2876	2900
				1919073	**1918400**

Exhibit 187 Monthly Water Harvesting Potential for SCP-2

In order to enhance and ensure the sustainability of the project from the perspective of ground water drawal, artificial recharge of aquifers holding the ground water is proposed. The natural process of recharging the aquifers is accelerated through percolation of stored or flowing surface water, which otherwise does not percolate into the aquifers. Artificial recharge aims at augmenting the natural replenishment of ground water storage by some method of construction, spreading of water or by altering natural conditions.

The following sub-sections brief the concept of artificial recharge and capture its relevance in the project context.

14.2.2.3 NEED FOR ARTIFICIAL RECHARGE

Water flow below the land surface takes place with the process of infiltration. The soil is not completely saturated with water unless water supply is maintained for sufficiently long periods. If water is applied only intermittently, there may be no recharge during the first infiltration or even between two subsequent infiltrations. The percolation of water in the soil during the period between two instances of infiltration is referred to as redistribution.

The study site is occupied by clayey top soil and the potential aquifers are located at depths ranging from 40 m to 160 m below ground level (BGL). The association of silt along with the top soil is envisaged to hinder the natural percolation of rainwater and most of the rainwater may be wasted as runoff, if proper artificial recharge measures are not taken.

There is a good scope for designing rainwater-harvesting schemes for the study area where the runoff generated within the premise from the catchment areas may be collected and utilized for various applications after subjecting to treatment. Such treated rainwater can be stored in a recharge pond for injection into ground with a site specific recharge system.

Besides, impounding water on the surface and also charging the unconfined aquifers of the area shall raise the ground water table to a considerable extent benefiting sustainable yield of tube wells located also in the surrounding community. In other words, the project can also achieve the objective of conjunctive use of water and rendering the Corporate Social Responsibility (CSR) to the surrounding community in Kaliakoir.

The hydraulic effects generated by artificial recharge are basically of two types, *viz.* Piezometric effect in confined aquifers, and volumetric effect in unconfined aquifers. The following subsections capture a brief of these effects.

14.2.2.3.1 PIEZOMETRIC EFFECT

The Piezometric effect results in a rise of the Piezometric surface, the magnitude of which depends on the geologic and hydraulic boundaries of the aquifer being recharged and the type, location, yield and duration of the recharge mechanism. It is also related to the ratio of Transmissivity (T) of the aquifer and the replenishment coefficient (C), which is equal to the storage coefficient. The recharged water moves in a sliding effect, with a speed related to ground water flow.

14.2.2.3.2 VOLUMETRIC EFFECT

The volumetric effect is related to the specific yield, replenishment coefficient, Transmissivity and the geologic and hydraulic boundaries of the unconfined aquifer. These result in a spreading-out effect with a speed related to the ground water recharge flow.

14.2.2.4 FACTORS INFLUENCING ARTIFICIAL RECHARGE

The factors affecting the artificial recharge capacity are briefly covered in this section.

14.2.2.4.1 INFILTRATION CAPACITY

The rate of infiltration through a medium and also the infiltration volumes relate in a combined manner, to the infiltration capacity.

Infiltration capacity depends on many factors such as type of soil, moisture condition, organic matter, vegetative cover, season, air entrapment formation of surface seals etc. Vegetative cover certainly increases the rate of infiltration as compared to barren soil by preventing runoff and increasing the contact time between water and the soil. Large ponds with recharge shafts for artificial recharge of the deeper aquifer are ideal for the study site under reference.

14.2.2.4.2 HYDROLOGICAL CYCLE

A few significant parameters of the hydrological cycle influencing the ground water potential include rainfall, infiltration, seepage from lakes and other surface water bodies and vertical drainage of ground water. Influence of human activities like that of ground water withdrawal and artificial recharge produce considerable negative (declining) and positive (rising) effects, respectively on the ground water level.

14.2.2.4.3 RECHARGE & DISCHARGE ZONES

Areas on the site can be delineated into recharge and discharge zones depending on whether water is added to or withdrawn from the zone of saturation. In groundwater discharge areas, the water level increases with depth. The water rise in an aquifer represents the net response to the process of simultaneous drainage from and recharge to the aquifer. The water level rises when the ground water storage increases and declines when there is a decrease in storage.

14.2.3 RECOMMENDATIONS

One of the significant objectives of the rainwater harvesting exercise is to develop a dependable in-situ source of water based on scientific systems and techniques. A careful study of the rainfall pattern in the Dhaka and the surrounding area indicates that the study area receives adequate rainfall commencing from March and extending up to October. The rainfall of last 3 years shows an average annual rainfall of 3,336 mm and the rainfall recorded for the year 2007 was 4,313 mm.

14.2.3.1 PLANNING AND DESIGN APPROACH

The recommendations are planned and designed based on the concept of Aquifer Storage Recovery.

The fresh water percolates vertically through the unsaturated zone and after reaching the ground water table; it starts spreading in radial directions from the spreading basin of suitably designed structures to the recovery well and water extraction structures like dug wells and tube wells.

Sources for Conjunctive Use of Water – Structure Wise	
Storage cum Percolation Ponds (SCP-1 & SCP-2)	Runoff water
Recovery Well	Shallow aquifers
Deep Tube Wells	Deep seated aquifers

Exhibit 188 Structure-wise Sources of Water for Ground Water System

Based on the above, the following sections elaborate the selected locations and other details of the storage-cum-percolation ponds and the ground water recharge system associated with the same.

14.2.3.2 RECHARGE PONDS

The following exhibit captures the recommended parameters of the two SCPs envisaged at the site.

System Parameter	SCP – 1	SCP – 2
Location	Northwest of the study area	Southeastern side of the study area
Present Condition	At present, this water body, with an area extent of approximately 31,000 m^2 and a reported depth of 3 to 4 m can store approx. 60,000 to 90,000 m^3 of water	At present this water body, with an area extent of approximately 46,000 m2, is very shallow and undulated. It is reported that during monsoon part quantity of the runoff water generated on the northeastern side of the study area and northwestern side outside the study area enters into the water body. The Geophysical survey, interview with the senior members of the local community, the drainage pattern, top soil condition and other related studies indicate that water may be retained only during monsoon period and the water body get dried 3 to 4 weeks after the monsoon. It may be also appropriate to mention here that the subsurface formation is conducive to develop groundwater extraction as the water body and the surrounding area can be considered as hydro-geologically potential area for the construction of tube wells.
Catchment Area	A portion of the northwest corner of the study area and part quantity of the runoff water generated in the nearby villages on the eastern and western side (Reported names of the villages Peeretek and Lothpur). It is recommended to deepen and develop the pond as per the details elaborated in this exhibit.	

System Parameter	SCP – 1	SCP – 2
Dimensions of SCP	Available Surface Area : 31,000 m^2 Recommended Depth : 9 m Free Board : 1 m Width of the Berm : 1.5 m Storage capacity : 0.25 million m^3	Available Surface Area = 46,000 m2 Recommended Depth = 9 m Free Board = 1 m Width of the Berm = 1.5 m Storage capacity = 0.37 million m^3
Dimensions of the Bund around the SCP	Top width : 6m Bottom width : 8.5 m Height : 1.2 m	Top width – 6m Bottom width – 8.5 m Height – 1.2 m
Recommended Design	Rejuvenation of the existing water body as an SCP, as shown in Exhibit 190.	Rejuvenation of the Existing Pond as SCP 2, as shown in Exhibit 192.
Construction Recommendations	• Dewater and excavate the soil up to a depth of 9m below ground level and make use of the part quantity of the soil for making bunds around the pond, and also for landscaping purpose. • Provide suitable slope to the sidewalls of the pond in the ratio 1.5:1 (Horizontal: Vertical) to avoid soil erosion. • Level and consolidate the bottom and side walls of the pond. Remove all sharp edges and protrusions. • Provide necessary berm of width 1.5 m on all sides of the pond. ○ Option 1: Pitching of the side walls and the Berm with PCC slabs measuring 0.3 m x 0.45 m x 0.05 m ○ Option 2: As pitching with PCC slabs may be expensive, planting of the grass called Vetiver (Vetiveria zizanioides) is recommended on the berm and top and side walls of the bund.	
Water Treatment System - Fountain	Provide 1 fountain of suitable capacity which will not only aerate the stored water but will also enhance the beauty of the SCP.	
Water Treatment System – Imploder	Imploders are pumps, which not only aerate stored water but also remove oil particles and reduce BOD & COD thereby improving the quality of water to a considerable extent. Imploders suck the air from the atmosphere and produce bubbles. These bubbles are allowed to dissolve in the water to aerate the system continuously. Thus, the concentration of COD and BOD is brought down considerably. Oil particles, if any, will be removed and allowed to float on the surface. This floating oil can be removed later by gravity. It is therefore recommended to install 2 imploders of 3 HP capacity on the SCP – 1.	

System Parameter	SCP – 1	SCP – 2
Sources of Water	• The physiography of the surrounding area of the SCP-1 indicates that part quantity of the runoff water generated in the surrounding villages and part quantity of the northwest corner of the study area may enter into the SCP-1. • After rejuvenation of the pond, particularly deepening the pond to 9m depth, the storage capacity will increase to a considerable extent. At the same time, as the catchment area for this water body is limited, it is recommended to pump the water from SCP-2 as and when necessary.	• It is reported that during heavy monsoon period the overflow water from the present water body situated on the western side outside the boundary limit, can also enter into SCP-2. • As the catchment area for this water body is larger, compared to SCP-1, if necessary, the excess water from SCP-2 can be pumped to SCP-1.
Overflow arrangement	The present overflow arrangement may be rejuvenated to maintain the same drainage pattern.	It is noted that the overflow water from SCP-2 flows towards the southwest direction and passes through a culvert near the main road. This drainage pattern may be maintained even after rejuvenation of SCP-2.
Construction of Recovery Well	Construction of a Recovery well in a hydro-geologically favourable location / adjacent to the SCP may enable yield of silt free water regularly. A Recovery well with Steining wall consisting of porous blocks can facilitate good recovery of surface water and ground water, which can be utilized for daily applications. Dimensions of the recovery well: Dia. – 12 m Depth – 12 m (below ground level)	Construction of a recovery well is considered as an option for the SCP-2.

System Parameter	SCP – 1	SCP – 2

Recommended Construction Details for the Recovery Well	• Construct Steining Wall for the recovery well with random rubbles and porous blocks. The base of the Steining Wall will be provided with suitable RCC foundation. Two RCC belts shall also be provided to strengthen the structure.
	• "Weep holes" consisting of porous blocks may be provided at an interval of 0.5 m on the Steining Wall in vertical and horizontal directions up to the free board.
	• The parapet wall of the recovery well will be constructed above the base of the SCP to a height of 1.2 meters. The thickness of the wall will be 0.5 metre comprising 30% of random rubbles and 70% of porous blocks. Necessary plastering of the parapet wall will be carried out with appropriate concrete mix.
	• The well will be covered with suitable size weld mesh of mesh size not more than 1 sq. inch. The weld mesh will be fitted on steel frames of suitable sizes. Necessary manholes of 0.6 m x 0.6 m will also be provided in the mesh.
	• Necessary step arrangements will be provided for easy approach inside the well for maintenance purposes.
	• The porous blocks should be prepared using cement and gravel in the ratio cement: gravel::1:2. Sand should not be used as filler as the pores spaces will be blocked. The porous blocks shall be of the following specifications:
	  ○ Length of the Block : 250 mm
	  ○ Width of the Block : 150 mm
	  ○ Thickness of the block : 150 mm
	It is recommended to connect the Recovery well and SCP by specially designed filtering system.	

Exhibit 189 Recommended Groundwater Recharge System Parameters

Exhibit 190 Design Recommended for SCP – 1

Exhibit 191 Vetiver Grass

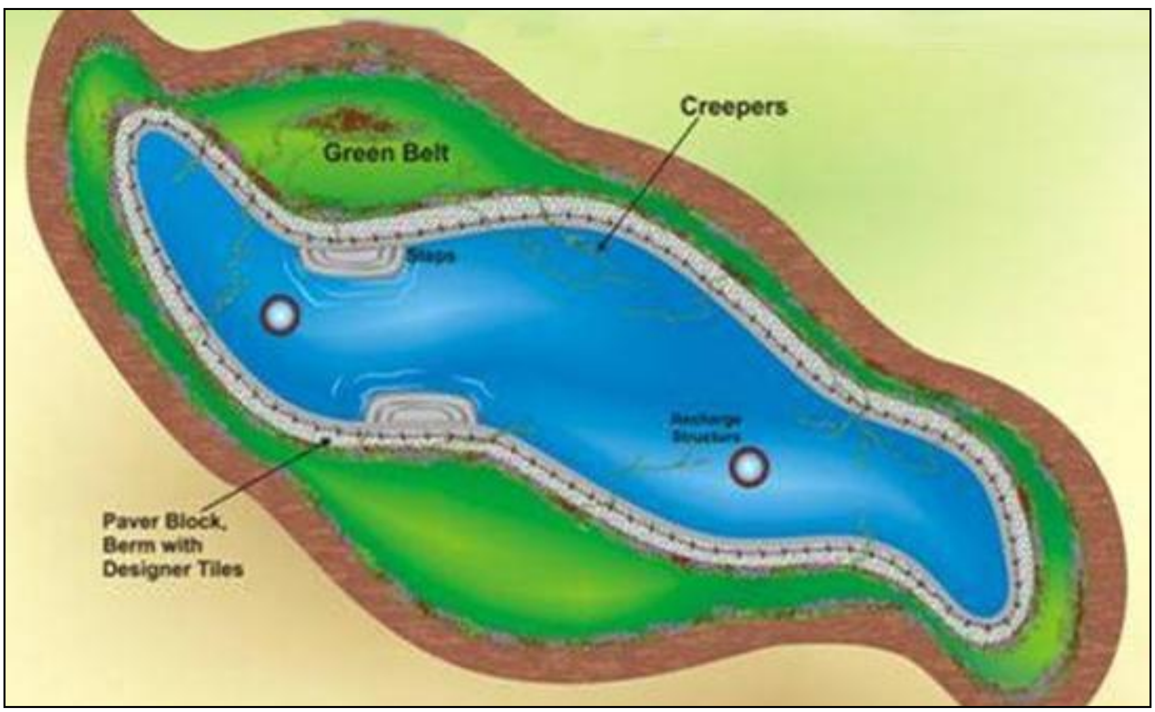


Exhibit 192 Design Recommended for SCP - 2

14.2.3.3 RECHARGE STRUCTURES FOR EXISTING AND PROPOSED TUBE WELLS

The hydro-geological study, the drainage pattern, rainfall details, the tube well inventory of the neighbourhood area, the pump test carried out at the site and also the discharge of tube wells of surrounding area indicate that shallow tube wells and deep tube wells can be drilled at favourable locations. Besides, it may be noted that there are already three shallow tube wells and one deep tube well at the study area. Needless to mention, site-specific and scientifically designed recharge structures need to be constructed for the existing tube wells and also the proposed tube wells. It is also advisable to introduce these recharge structures concurrently while drilling the proposed tube wells.

With a view to recharge the shallow and deep aquifer of the existing and proposed tube wells, an innovative recharge structure Surface Water Harvesting Structure (SWHS) as per the following exhibit is recommended.

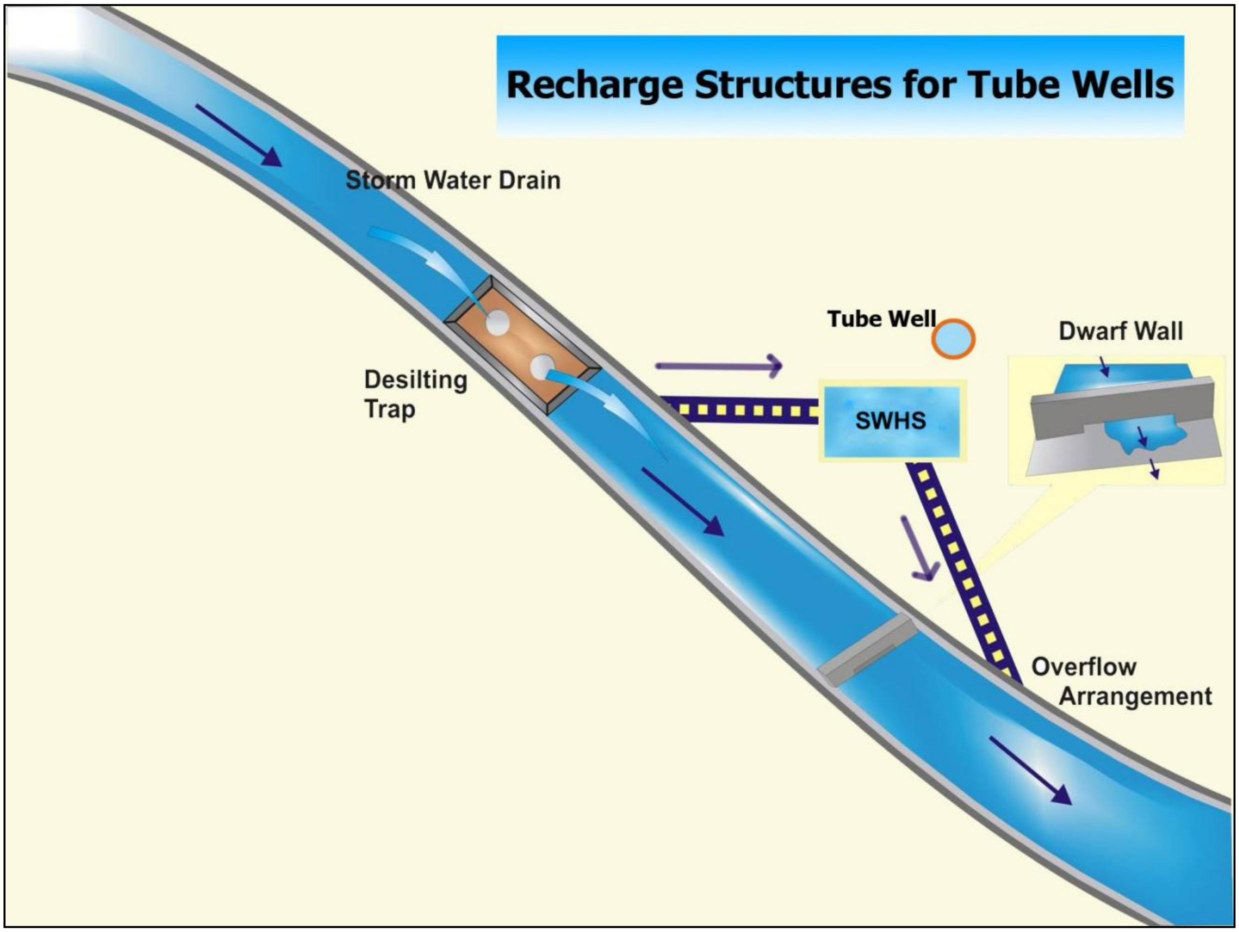


Exhibit 193 Recommended Surface Water Harvesting System for Tube Wells

This structure is especially suited for sedimentary formations with limited open areas. Besides, both surface water and roof water can be diverted to this unique structure for recharge. The recharge structure can hold not only adequate quantity of water but also facilitate water to infiltrate into shallow and deep aquifers. Salient advantages of the SWHS are envisaged to be:

- Appropriate for areas where impervious thick clay beds overlie the aquifer.
- Surface water is filtered through pebbles and sand media before percolation.
- Water stagnation in the low-lying areas can be checked.
- It does not require acquisition of large piece of land, like percolation tanks.

As far as possible, the structure can be located on the groundwater flow line itself. If it is not possible due to any reasons of unavoidable nature, it may be located as near as possible to the groundwater flow line.

The following sections briefly capture the salient features related to construction of the SWHS.

14.2.3.3.1 RECOMMENDED LOCATION & DIMENSIONAL PARAMETERS

The following exhibit presents a snapshot of the location and the dimensional details of the SWHS recommended.

Parameter	Recommendation
Location	2-5 m away from the tube wells
Dimensions of the SWHS	• Length : 8 m • Width : 5 m • Depth : 2.5 m • Slope of Sidewalls : 1:1 • Width of the Berm : 0.75 m
Dimensions of Recharge Well within the SWHS	• Diameter : 1.5 m • Depth : 3 m below base level of the structure • No. of Recharge wells : 2
Recharge Shafts within the Recharge Wells	In order to recharge water to the deeper aquifer layers, it is proposed to construct recharge shafts within the recharge wells proposed.

Exhibit 194 Recommendations for Location & Dimensional Details of SWHS

14.2.3.3.2 RECOMMENDED CONSTRUCTION PARAMETERS FOR SWHS COMPONENTS

The following exhibit presents the recommended construction parameters for the various SWHS components.

System Component	Recommended Design
Construction Details of SWHS	• Excavate the overburden soil and dispose the soil elsewhere. • Provide suitable slopes to the sidewalls of the pond in the ratio 1:1 (Horizontal: Vertical) to avoid collapse of top soil. • Level and consolidate the bottom and sidewalls of the pond. Remove all sharp edges and protrusions. • Provide necessary berm of width 1 m on all sides of the pond. • Construct a toe wall at the base of the sidewall of the pond to check the slipping of pre-cast slabs provided on the sidewalls. • Level the sidewalls of the pond, consolidate further and provide PCC mix of suitable thickness as a binder for fixing the pre-cast slabs. • Fix pre-cast PCC slabs of size 0.3 m x 0.45 m x 0.04 m and carryout pointing also, at the bottom and on the sidewalls. • Maintain water level for each row of pre-cast slabs for getting better aesthetic view. • Lay pre-cast slabs on top of the berm also. • Construct fencing all around the structure for safety reasons

System Component	Recommended Design
Construction Details of Recharge Well within the SWHS	• Construct the recharge chamber by brickwork of 230 mm thickness. • Cover the recharge well by RCC slab of thickness 75 mm. • Fill the recharge well with pebbles of different sizes in an ascending order and cover the top layer by a layer of coarse sand. • Provide periodical chlorination to the recharge well. • Provide necessary manhole for maintenance purposes.
Construction of Recharge Shafts inside the Recharge well	• Recharge shaft drilled in recharge well 1: ○ Diameter of the recharge shaft : 180 mm ○ Depth of recharge shaft : 50 m ○ Slots to be provided : In the sandy subsurface formation which can be assessed during the drilling operation of the tube well ○ Provide casing pipe of 150 mm diameter. ○ The annular space between the bore hole and the casing pipe may be filled with pebbles in an ascending order of diameter. ○ Provide suitable slots wherever fine to medium sand is encountered during drilling process. • Recharge Shaft drilled in recharge well 2: ○ Diameter of the recharge shaft : 180 mm ○ Depth of the shaft : 140 m ○ Slots to be provided : In the sandy subsurface formation which can be assessed during the drilling operation of the tube well ○ Provide casing pipe of 150 mm diameter. ○ The annular space between the bore hole and the casing pipe may be filled with pebbles in an ascending order of diameter. ○ Provide suitable slots wherever fine to medium sand is encountered during drilling process.

Exhibit 195 Recommended SWHS System Component Construction Parameters

14.2.3.3.3 WATER SOURCING FOR THE SWHS

The sources of water for the SWHS are envisaged to be:

- The runoff water from the storm water drain, water bodies like SCP-1 and SCP-2 by providing 150 mm diameter RCC/PVC pipe;
- Roof water from the nearby industrial sheds.

In addition, water is recommended to be channelized from the storm water drains into the SWHS for recharging the groundwater system. The recommendations related to the same are as follows:

- Construct a dwarf wall in the storm water drain on the downstream side of the SWHS.
- The dwarf wall may be up to 2/3rd height of the drain. The thickness of dwarf wall may be 9 inches and length of the wall is equal to the width of the base of the storm water drain.

- Provide 10 mm clearance on the base of the dwarf wall to flush off initial water, which may contain dust and silt particles.
- The level of the top of the dwarf wall should be less than the free board level of the SWHS (free board of SWHS is envisaged to be 0.6m BGL). This is an additional precaution to avoid flooding of the area near the tube well.
- The excess water, if any, will flow through the existing storm water drainage system.

14.2.3.4 RECHARGE STRUCTURES FOR THE STORM WATER DRAINS

It is advisable to design site-specific recharge structures for the storm water drains with a view to saturate the potential aquifer, particularly the shallow aquifer at the study site. It is reiterated here that the water table during pre-monsoon period is reported to be 13 to 14 m BGL, from which it can be inferred that a sizable quantity of rainwater can be made to percolate through the proposed rainwater harvesting structures.

The continuous impounding of rainwater in these site-specific artificial recharge structures will invariably improve the overall ground water status of the study site in terms of quality and quantity. The bed saturation characteristics of the sub-stratum will be improved which will facilitate easy infiltration of rain water into the underlying formations.

It is thus recommended to:

- Construct recharge chambers with in-well bores in the open area adjacent to the storm water drains.
- The in-well bores will gradually allow the water to percolate and reach the aquifer of the premise resulting in improved yield from the tube wells.
- The recharge structures may be constructed close to the existing and proposed tube wells identified by surveys.
- A few recharge structures may also be constructed on the recharge zones of the factory site that have been identified with conventional water divining methods.
- Divert the runoff water from the nearby storm water drain to the recharge structures through 150 mm diameter RCC pipes by resorting to the following:
    - Construct a dwarf wall along the path of storm water drain on the downstream side of the recharge structure.
    - The dwarf wall may be up to 2/3rd height of the drain. The thickness of dwarf wall may be 9 inches and length of the wall is equal to the width of the base of the storm water drain.
    - Provide 10 mm clearance on the base of the dwarf wall to flush off initial water, which may contain dust and silt particles.

To ensure removal of suspended particles (silt, dust etc.), it is recommended to:

- Provide a de-silting pit (silt trap) along the path of storm water drain especially on the upstream side of the dwarf wall. The depth of the pit may be 0.75 m from the existing base level of the storm water drain.
- The length of the de-silting pit may be 1m.

- Clear the accumulated silt from the pit periodically.
- Provide 2 of 2" diameter PVC pipes at the base of the de-silting pit to avoid stagnation of water, breeding of mosquitoes and contamination of water due to external sources.
- The de-silting trap will check the entry of free silt to a considerable extent.
- Provide necessary overflow arrangement from the recharge wells to divert the excess water to the storm water drain.
- Provide 150 mm diameter RCC pipes for overflow arrangement to avoid flooding of the area.

The following exhibit presents the recommended design dimensions of the recharge structures for the storm drains.

Design Parameter	Recharge Chamber close to Storm Drains	In-well Bore
Diameter & Depth	• Diameter of Chamber : 2 m • Depth of the Chamber : 3 m	• Diameter of the bore: 250 mm • Depth : 10 m • Provide casing pipe of 150 mm diameter.
Material of Construction	The chamber may be constructed by brickwork of 230 mm thickness. The chamber may be covered by two no.s of perforated RCC slabs of thickness 75 mm.	N/A
Other Recommendations	• Provide suitable gradient towards the outlet side on the base of the chambers to avoid water stagnation in the chamber. • Provide a plastic net inside the chamber on the mouth of the inlet pipe to screen the leaves and paper clippings, which may be drained into the chamber along with the roof water. • Necessary plastering and painting of the chamber may be carried out.	• The annular space between the bore hole and the casing pipe may be filled with pebbles in an ascending order. • Provide suitable slots wherever fine to medium sand is encountered during drilling process • The recharge well may be constructed at an interval of 50 m.

Exhibit 196 Recommended Design Parameters for Recharge Structures with Storm Water Drains

15 ANNEXURE 4 – SOLID WASTE MANAGEMENT SYSTEM

15.1 INTRODUCTION TO SOLID WASTE MANAGEMENT

The integrated management of municipal solid waste consists of a series of activities linked with the control of waste generation, segregation, storage, collection, hauling, sweeping, treatment and final disposal. These activities must be carried out in such a way as to harmonize with the best principles of public health, economy, engineering, and aesthetics and also to meet public expectations.

In the integrated approach to solid waste management, the main objective of treatment is to reduce the health risks and pollution potential of the waste. The treatment solution that best suits the local technical, economic, social, and environmental conditions should therefore be selected. Composting, vermiculture, and incineration are the most common solid waste treatment methods. The latter has a great impact on volume reduction.

15.1.1 SOLID WASTE MANAGEMENT AT THE KALIAKOIR HI-TECH PARK

It may be noted here that the composting component is envisaged as a part of the ISWM, also comprising sanitary landfill facility at the project site.

The ISWM facility is envisaged to cater to:

- Municipal solid waste (MSW) generated at the project site, by composting;
- Solid waste that cannot be recycled/ composted, by incineration/ land filling;
- Solid waste generated, by the incinerator facility;
- Reject from the composting facility, by land filling.

This document aims to elaborate the design methodology including that for composting for the solid waste treatment, and sanitary landfill within the site area. Recycling, including composting is the next preferred solid waste management option.

While lower on the hierarchy than source reduction and recycling combustion (with energy recovery) and land filling, there also are options to manage materials that cannot be reduced, reused, recycled, or composted. Combustion reduces the amount of non-recyclable materials that must be land filled and offers the benefit of energy recovery. Land filling is needed to manage certain types of non-reusable, non-recyclable materials, as well as the residues generated by composting and combustion. The following sections deal with the components of the system under reference.

15.2 CONSIDERATIONS FOR THE DESIGN OF THE SWM FACILITY

The integrated solid waste management system has been designed considering the following aspects:

- The waste incoming to the facility shall be maintained prior to further processing. To the extent possible, the waste storage area should be covered. If, such storage is done in an open area, it shall be provided with impermeable base with facility for collection of leachate and surface water run-off into lined drains leading to a leachate treatment and disposal facility;
- Necessary precautions shall be taken to minimize nuisance of odour, flies, rodents, bird menace and fire hazard;

- In case of breakdown or maintenance of plant, waste intake shall be stopped and arrangements be worked out for diversion of waste to the landfill site;
- Pre-process and post-process rejects shall be removed from the processing facility on a regular basis and shall not be allowed to pile at the site. Recyclables shall be routed through appropriate vendors. The non-recyclables shall be sent to well-designed landfill site(s);
- In case of the compost plant, the windrow area shall be provided with impermeable base. Such a base shall be made of concrete or of compacted clay, 50 cm thick, having permeability coefficient less than 10^{-7} cm/sec. The base shall be provided with 1 to 2 per cent slope and circled by lined drains for collection of leachate or surface runoff; and
- Ambient air quality monitoring shall be regularly carried out particularly for checking odour nuisance at down-wind direction on the boundary of the SW processing plant.

The following sub-sections elaborate a few more aspects considered while designing the SWM facility at the Park.

15.2.1 SITING

A number of factors influence locating the SWM facility. Some of the major factors in facility siting include:

- Optimum location to minimize hauling distances;
- Assurance of an adequate buffer between the facility and nearby establishments;
- Suitable site topography and soil characteristics;
- Sufficient contiguous land area for the volume and type of material to be processed.

Potentially suitable locations for composting facilities include areas adjacent to and in the buffer areas of existing or closed landfills, transfer stations, and in vicinity of wastewater treatment plants. Siting should be avoided for any type of solid waste facility, including composting facilities, within 20 km from an airport. This is to prevent birds, which could be attracted to the site by potential food sources, from interfering with airplanes.

A centrally located facility close to the source of the compost feedstock will maximize efficiency and convenience while reducing expenses associated with hauling these materials. Locating a site with an extensive natural buffer zone, planted with trees and shrubs, is an effective way to reduce the potential impacts that a new composting facility might have on the surrounding areas. If natural buffers do not exist, artificial buffer zones may need to be constructed.

15.2.2 ODOURS

An important consideration in the siting and design of the SWM facility is the potential for odors and for odour transport to the surroundings. In order to predict how these odors will be transported, information on meteorological conditions (e.g., wind speed and direction, temperature, and inversion conditions) in the vicinity of the site is utilized. This information is then used to conduct dispersion modeling to predict how odors could be transported into the community. The information and data are thus incorporated in the design of the facility in terms of locating the facility.

The succeeding sections of this report elaborate the design aspects of the composting facility as well as the sanitary landfill facility for the Park.

15.3 COMPOSTING

Composting is the process of decomposition of organic waste by the bacteriological action of the microorganisms contained in the waste. The result of this process is known as 'compost', a product similar to humus that acts as a soil conditioner and can have a commercial value. However, since the commercial value is usually lower than the production cost, this system could need to be subsidized or clubbed with other project components that generate adequate revenue.

Composting is recommended to be used as an integrated solid waste management to handle MSW (municipal solid waste), since no other single approach can meet the needs of all communities.

A hierarchy of management methods is considered while developing an integrated solid waste management plan. Source reduction is the preferred management option and can be defined as the design, manufacture, purchase, or use of materials or products (including packages) to reduce the amount and toxicity of the waste before it enters the MSW stream.

Consideration of a composting process should be a part of a comprehensive approach to solid waste management. Composting has emerged as an attractive and viable option for handling the MSW.

15.3.1 PLANNING BASES

The following sections brief the aspects that have been considered for the design of the solid waste management facility, in addition to the standards mentioned in the previous section.

15.3.1.1 OPERATIONAL ASPECTS

The operational aspects of the design include the chosen composting technology (e.g. turned windrows, aerated static piles, in-vessel systems, etc.); the equipment needed; proposed site design; and the pollution, nuisance, and odor control methods that will be employed. The design of the facility is carried out in consideration of these factors.

Proper sitting and design are the prerequisites to establishing safe and effective composting facilities.

15.3.1.2 TOPOGRAPHY

Some site clearing is normally necessary for composting facility development, but minimizing this work is desirable in order to reduce expenses and maintain trees on the perimeter of the site, which act as a buffer. The composting site is designed to be appropriately graded to avoid standing pools of water and runoff. To avoid erosion, the land slope at the SWM facility has been designed to be between 2 to 4 percent.

Further, the composting site should have a water source for properly controlling the moisture content of the composting process.

15.3.1.3 LAND AREA REQUIREMENTS

To operate efficiently, sufficient spaces for the preprocessing, processing, and post processing compost stages as well as to the surrounding buffer zone are required. Typically, the bulk of the site is occupied by the composting pad and the buffer zone. Administrative operations and equipment also need to be housed on site and should be planned for when determining land area requirements for the facility.

15.3.1.4 OTHER FACTORS AFFECTING SITING DECISIONS

The other factors that must be considered when siting a composting facility include:

- The existing infrastructure - The presence of existing utility hookups, storage space, and paved access roads could significantly reduce costs of site preparation.
- Zoning issues – The construction of composting facilities is permitted only on certain tracts of land within a community as dictated by local zoning laws.
- Site ownership - Potential sites could be owned by a public or private entity. Ownership will affect cost and control of the composting facility.
- Nearby land uses - Sites near schools or residential areas could provoke objections from citizens concerned about potential odor or noise.

15.3.2 PROCESS DESCRIPTION

The steps involved in the bio-composting site design/ development/ implementation process are as follows:

- Waste dumping site is leveled and brick paved or cemented for prevention of ground water contamination (partial shed is required in heavy rainfall locations).
- Waste is treated with bio-cultures, enzymes and herbal extracts for de-fouling and to induce accelerated bio conversion cycle.
- After treatment, waste is stacked in 50 to 100 meters long windrows of 3 to 5 m width and 2 to 3.0 m height.
- Within 48 hours temperature of heap reaches 65 to 70 deg. C due to exothermic heat generated by aerobic microorganisms. This kills pathogens and ensures proper fermentation.
- Required moisture of around 40% is maintained throughout the fermentation cycle.
- Aeration is done for rapid microbial multiplication through front-end loaders or compost turning machines or other means of aeration.
- As fermentation progresses, bio mass changes colour from light green, to dark brown humus like substance.
- Well decomposed bio mass is processed through mechanical separating, grading, sieving, and air classification machines.
- Fully matured and stabilized humus like organic fertilizer / soil enricher is recovered.
- Quality control is done for physical, chemical and biological parameters of the organic enriching agent.
- Finished product is packed in bags of appropriate sizes.
- Inorganic and non biodegradable products like plastic, metals, rubber, stones, and bricks are recovered for different uses.
- Remnants to the extent of 10 to 20% are disposed of to the sanitary landfill.
- The process is completed in 4 to 6 weeks.

15.3.3 PLANT LAYOUT & CAPACITY

The decision on the capacity for composting plant and landfill takes into consideration various factors like present garbage scenario, the change in the garbage segregation scenario due to implementation of International Standards, command area calculation, space availability and project economics and other pertinent parameters.

The composting plant will then be allowed to take only the biodegradable portion of the solid waste.

To ensure efficient and smooth operation of the facility, an optimum layout is planned for the processing facility with sufficient space requirements for the preprocessing, processing and post processing compost stages, with necessary infrastructure facilities with buffer zone. The plant layout is shown in the following exhibit.

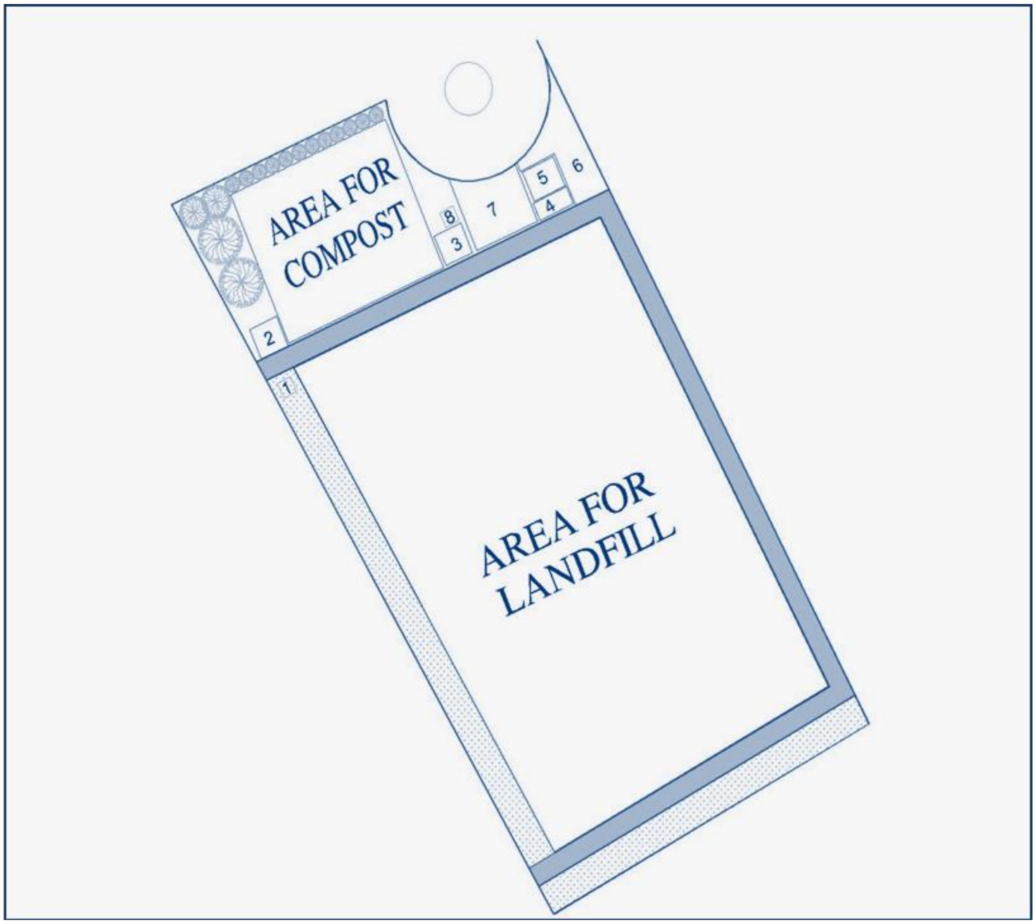


Exhibit 197 Composting & Landfill Area Layout

To ensure efficient and smooth operation of the facility, an optimum layout is planned for the processing facility with sufficient space requirements for the preprocessing, processing and post processing compost stages; with necessary infrastructure facilities and buffer zone. The allotted area for integrated solid waste management is 2.71 acres inclusive of landfill and other infrastructure facilities. To minimize the composting area, duration of cycle and to get a cleaner and healthy environment, it is recommended to make use of organic waste converter. The following section deals in detail with the organic waste converter.

15.3.3.1 ORGANIC WASTE CONVERTER

Organic Waste Converter (OWC) is specifically designed for composting the organic waste.

The segregated organic waste including food waste, garden waste, and bio sludge from different sources can be converted into dry, homogenized, odour free raw compost within 15 minutes using the OWC machine, and subsequently the raw compost can be cured over a period of 10/15 days, using rack and bin system with plastic crates and fogging system.

The following exhibit captures a snapshot of the process described above.

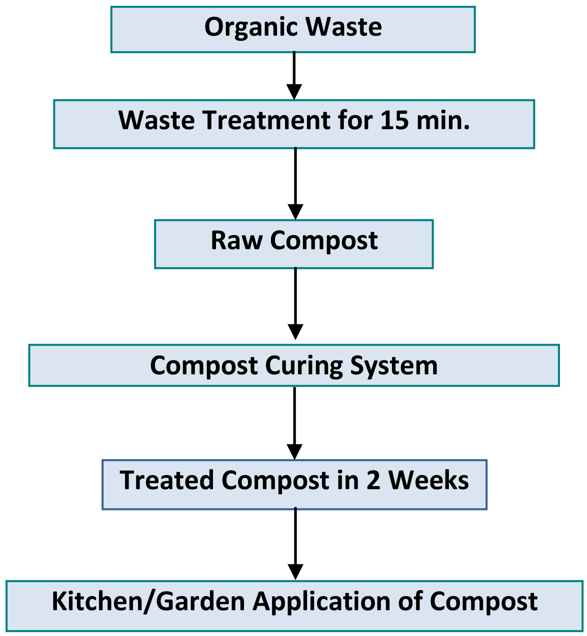


Exhibit 198 Organic Waste Treatment using Organic Waste Converter

The OWC module is designed to be suited for the capacity of 15MT mixed waste. It shall consist of:

- 3 Nos of composting machine
- 3 Nos of compost curing system
- 3 Nos of mechanical shredders

For the above module, a platform of size 35m X 30m is recommended for compost.

15.3.4 OTHER INFRASTRUCTURE FACILITIES

In addition to the components of the composting system described in the earlier section, a green buffer zone is planned all along the perimeter of the facility. An administrative office, workers' changing room and security cabin are also recommended in the plant layout. The facilities for water supply, electrical system, security, etc. are also planned. The combined layout of the composting as well as land filling facility has been depicted in Exhibit 197 included earlier.

15.4 INCINERATION OF BIO-MEDICAL WASTE

The bio-medical waste generated by the on-site healthcare facilities is recommended to be incinerated by incinerators with suitable capacity. Typical incineration of 100 kg/hr would be adequate to handle the bio-medical waste generated by the population quantum under reference for the Kaliakoir Hi-Tech Park.

The following exhibit captures a snapshot of the monitoring parameters related to the incinerator.

S.NO.	PARAMETER	RANGE / VALUES	UNITS
1	Total Suspended Particulates	20	mg/dscm
2	Sulphur Di-oxide (SO2)	30	ppmv (or 80% reduction)
3	Oxides of Nitrogen (Nox)	150	ppmv (24-hr Average)
4	Opacity	10	%
5	Hydrochloric Acid (HCl)	25	ppmv (or 95% reduction)
6	Dioxins and Furans	13	ng/dscm
7	Cadmium	0.01	mg/dscm
8	Carbon Monoxide(CO)	50-150	ppmv
9	Lead (Pb)	0.14	mg/dscm
10	Mercury (Hg)	0.05	mg/dscm (or 85% reduction)
11	Total Metals	n/a	
12	Hydrogen Flouride (HF)	n/a	

Exhibit 199 Incinerator Monitoring Parameters

15.5 LANDFILL – DISPOSAL OF SOLID WASTE

Sanitary landfill is a technique for the final disposal of solid waste in the ground that causes no harm to the environment during its operation or after its closure. This technique uses engineering principles to confine the waste to as small an area as possible, covering it daily with layers of earth and compacting it to reduce its volume. In addition, it anticipates the problems that could be caused by the liquids and gases produced by the decomposition of matter. The succeeding sections deal with the design aspects of landfill at the Kaliakoir Hi-Tech Park site.

15.5.1 STANDARDS FOR LANDFILLING

The standards considered while designing the landfill at the site include:

- Land filling shall be restricted to non-biodegradable, inert waste and other waste that is not suitable either for recycling or for biological processing. Land filling shall also be carried out for residues of waste processing facilities as well as pre-processing rejects form waste processing facilities. Land filling of mixed waste shall be avoided unless the same is found unsuitable for waste processing.

- The Landfill site shall be planned and designed with proper documentation of a phased construction plan as well as a closure plan.
- The Landfill sites shall be selected to make use of nearby waste processing facility. Otherwise, waste processing facility shall be planned as an integral part of landfill site.

The following exhibit presents a snapshot of a few applicable international standards and the compliance status of the design facility at the site.

International standards	Compliance with the standards
The landfill sites shall be selected to make use of nearby waste processing facility. Otherwise, waste processing facility shall be planned as an integral part of landfill site	Vermi-composting plant is recommended at the site.
The landfill site shall be away from habitation clusters, forest areas, water bodies, monuments, national parks, wetlands and places of important cultural, historical or religious interest.	The site is away from any authorized habitation, forest area, monuments, national parks, wetlands and places of important cultural, historical or religious interest.
Landfill site shall be away from airport including airbase.	No Airport is within 20 kms from the SLF site.

Exhibit 200 Compliance of SLF (Sanitary Land Fill) Site with International Standards

The following sub-sections present the process involved in planning and design of the sanitary landfill.

15.5.2 LANDFILL DESIGN & PLANNING ASPECTS

15.5.2.1 LANDFILL CAPACITY

The land area or, more importantly, the volume of space required is primarily dependent upon the quantity of the solid waste, the efficiency of compaction of the waste, the depth of the fill, and the desired life of the landfill. Data on the quantity and character of residential and commercial to be land filled are therefore necessary for estimating the space required. In estimating volume requirements, volume reduction of the solid waste due to compaction is also considered. The desired life of the landfill is another major factor in determining the total volume required.

The decision on the plant capacity for composting and landfill also takes into account various factors like the change in the garbage segregation scenario, command area calculation, the end produce, space availability and project economics and other such pertinent parameters.

The quantity to be handled in the mixed garbage scenario over a period of 25 years in the composting plant and in the landfill is depicted in the following exhibit.

Mixed Garbage with Compost Plant	
MSW yearly Increase	3.00%
% To Segregation Platform (A)	80.00%
% of Waste to Compost facility	23.61%
% directly to landfill	5.00%

% Rejection from Platform			17.40%	
% as Recyclable on (A)			15.00%	
Year	**Solid Waste Collection Tonnes/Day**	**To Segregation Platform Tonnes/day**	**To Landfill / Day In Tonnes**	**Landfill / Year In Tonnes**
1	3.71	2.97	0.70	257.15
2	4.48	3.58	0.85	310.72
3	5.41	4.33	1.03	375.01
4	6.49	5.19	1.23	450.01
5	7.73	6.18	1.47	535.73
6	9.27	7.42	1.76	642.87
7	10.82	8.65	2.05	750.02
8	12.36	9.89	2.35	857.17
9	13.91	11.12	2.64	964.31
10	15.45	12.36	2.94	1071.46
11	17.00	13.60	3.23	1178.60
12	18.54	14.83	3.52	1285.75
13	19.31	15.45	3.67	1339.32
14	19.31	15.45	3.67	1339.32
15	19.31	15.45	3.67	1339.32
16	19.31	15.45	3.67	1339.32
17	19.31	15.45	3.67	1339.32
18	19.31	15.45	3.67	1339.32
19	19.31	15.45	3.67	1339.32
20	19.31	15.45	3.67	1339.32
21	19.31	15.45	3.67	1339.32
22	19.31	15.45	3.67	1339.32
23	19.31	15.45	3.67	1339.32
24	19.31	15.45	3.67	1339.32
25	19.31	15.45	3.67	1339.32

Exhibit 201 Yearly Landfill Volume Estimation

The hazardous waste generation quantity, along with the other solid waste generation estimation is shown in the exhibit below.

Year	**Hazardous waste generation / Year (Tonnes)**	**Cumulative Hazardous waste (Cu.m) / Year**	**Cumulative Solid waste (Cu.m) / Year including the MSW**	**Total Cumulative Volume of waste (Cu.m)**
1	31.68	39.60	325.53	365.13
2	38.28	47.85	718.88	806.33
3	46.20	57.75	1193.61	1338.81
4	0.42	0.53	1763.29	1909.01
5	66.00	82.50	2441.47	2669.70
6	79.20	99.00	3255.30	3582.52
7	92.40	115.50	4204.76	4647.48

8	105.60	132.00	5289.86	5864.58
9	118.80	148.50	6510.59	7233.82
10	132.00	165.00	7866.97	8755.19
11	145.20	181.50	9358.98	10428.70
12	158.40	198.00	10986.63	12254.35
13	165.00	206.25	12682.10	14156.07
14	165.00	206.25	14377.56	16057.79
15	165.00	206.25	16073.03	17959.51
16	165.00	206.25	17768.50	19861.22
17	165.00	206.25	19463.97	21762.94
18	165.00	206.25	21159.43	23664.66
19	165.00	206.25	22854.90	25566.38
20	165.00	206.25	24550.37	27468.09
21	165.00	206.25	26245.83	29369.81
22	165.00	206.25	27941.30	31271.53
23	165.00	206.25	29636.77	33173.24
24	165.00	206.25	31332.24	35074.96
25	165.00	206.25	33027.70	36976.68

Exhibit 202 Hazardous Waste Incorporation in the Landfill

Hence, considering the ultimate garbage generation scenario, the waste volume and landfill life has been calculated. The landfill capacity is estimated as presented in the following exhibit. The site can handle 31200 m^3 of landfill material in the available area of 2.71 acres allotted for landfill operation.

Total landfill area	2.20	Acres
	8911.27	Sqm
Area for infrastructure & others	2086.16	Sqm
Area for landfill	6814.20	Sqm
Total volume of earth filling	13453.21	cum
Total volume of land filling	31927.67	cum
Soil cover volume	4789.15	cum
Balance volume	27138.52	cum
Add for Compaction at 15%	31209.30	cum

Exhibit 203 Landfill Capacity Estimation

15.5.2.2 DESIGN LIFE

The active life period for the present project is calculated as per Exhibit 204 for mixed garbage scenario with Inertization plant.

year	waste generation / day	Cumulative waste direct to landfill (Cu.m) / Yr	Cumulative rejects from windrow platform	Cumulative Hazardous waste (Cu.m) / Yr	Total Cumulative Rejects (Cu.M)

			(Cu.m)/ Yr		
1	3.71	56.39	269.14	39.60	365.13
2	4.48	124.53	594.34	87.45	806.33
3	5.41	206.77	986.84	145.20	1338.81
4	6.49	305.46	1457.83	145.73	1909.01
5	7.73	422.94	2018.53	228.23	2669.70
6	9.27	563.93	2691.37	327.23	3582.52
7	10.82	728.40	3476.36	442.73	4647.48
8	12.36	916.38	4373.48	574.73	5864.58
9	13.91	1127.85	5382.74	723.23	7233.82
10	15.45	1362.82	6504.15	888.23	8755.19
11	17.00	1621.28	7737.70	1069.73	10428.70
12	18.54	1903.25	9083.38	1267.73	12254.35
13	19.31	2196.96	10485.14	1473.98	14156.07
14	19.31	2490.67	11886.89	1680.23	16057.79
15	19.31	2784.38	13288.65	1886.48	17959.51
16	19.31	3078.09	14690.41	2092.73	19861.22
17	19.31	3371.80	16092.16	2298.98	21762.94
18	19.31	3665.51	17493.92	2505.23	23664.66
19	19.31	3959.22	18895.68	2711.48	25566.38
20	19.31	4252.93	20297.43	2917.73	27468.09
21	19.31	4546.65	21699.19	3123.98	29369.81
22	19.31	4840.36	23100.95	3330.23	31271.53
23	19.31	5134.07	24502.70	3536.48	33173.24
24	19.31	5427.78	25904.46	3742.73	35074.96
25	19.31	5721.49	27306.22	3948.98	36976.68

Exhibit 204 Active Life Period of the Landfill

Considering the above, the “active” design life of the proposed site is 21 years. This is also in line with the applicable World Bank Standards for the landfill. It is advised that additional area for landfill shall be looked for, for the disposal waste generated after 21 years. This can also be implemented in conjunction with the solid waste management aimed at serving the surrounding communities.

15.5.2.3 LANDFILL LAYOUT

The present facility is integrated with Inertization, and engineered landfill. The layout aspects have been discussed in composting chapter. The landfill site comprises the area in which the waste will be filled as well as additional area for support facilities. Within the area to be filled, work may proceed in phases with only a part of the area under active operation at a time. The following facilities have been designed for efficient operation of the landfill:

- Road – access and internal
- Equipment maintenance shed
- Weigh bridge
- Temporary waste storage
- Areas for stockpiling cover material and liner material
- Leachate Collection and Recovery System (LCRS)
- Landfill gas management facilities
- Leachate monitoring wells

Since the site is developed as an integrated plant, most of the facilities shall be developed as common for both composting unit and landfill unit. The common facilities which are considered are:

- Access road
- Security room
- Water supply system
- Transformer yard & control panel room

Due to the level difference in the topography and being an integrated SWM plant, the road layout, position of the amenities and location of area for stockpiling of cover material and liner material are positioned along the boundary to maximize the area utilization.

15.5.2.4 TYPE OF LANDFILL

Landfills can be developed in many different ways / sections depending on the topography of the site, waste volume and soil profile. The common forms of landfills are:

- Above ground landfills (area landfills)
- Below ground landfill (trench landfills)
- Slope landfills
- Valley landfills (canyon landfills) and
- A combination of the above.

Depending on the site condition and the depth of water table at the site, it may not be feasible to dig pits or trenches to bury the waste; and it can be deposited directly on the original ground, which should be raised several meters after the terrain has been made waterproof.

Considering the aforementioned aspects of the Hi-Tech Park site, area landfill is chosen for this site.

15.5.2.5 SOIL CHARACTERISTICS

Generally, the profile of the soil plays a major role in the selection of the landfill site because of the following considerations:

- Good quality excavated earth can be used as cover soil, which has a direct bearing on the project cost.
- Low permeability of soil (permeability 1×10^{-7} cm/sec) is recommended to reduce the leachate seepage.
- Stability of slopes.

15.5.2.6 PHASED OPERATION

The operation phasing methodology considers the following aspects:

- Site profile
- Daily input of garbage or daily cell area
- Active life period of the site
- Meteorology of the site

The term 'phase' describes a sub-area of the landfill. A 'phase' consists of cells, lifts, daily cover, intermediate cover, liner, and leachate collection facility, gas control facility and final cover over the sub-area.

Each phase is typically designed for a period of 12 to 18 months. Phases are filled from the base to the final/intermediate cover and capped before onset of monsoon leaving a temporary un-restored sloping face.

Excavation to a depth of 1.0 m below ground level (6.50 m) is proposed so as to facilitate the composite liner & geo-membrane liner system. Land filling shall be carried out to a height of 7m above ground level.

15.5.2.7 LEACHATE GENERATION

Leachate is generated on account of the infiltration of water into landfills (during precipitation) and its percolation through waste as well as by the compaction of the waste due to self-weight. Thus, leachate can be defined as a liquid that is produced when water or other liquid comes in contact with solid waste. Leachate is a contaminated liquid that contains a number of dissolved and suspended materials.

The volume of leachate in a sanitary landfill depends on the following factors:

- Rainfall in the landfill area
- Surface runoff and/or groundwater in-filtration
- Evapo-transpiration
- Original moisture content of the waste

- Degree of compaction
- Field capacity (capacity of the soil and the facility to retain moisture).

The volume of leachate depends on the rainfall also. This increases the quantity, either by direct precipitation on the waste deposited there or by increasing the amount of filtration through cracks in the terrain.

15.5.2.8 LINER SYSTEM

Leachate control within a landfill involves the following steps:

- prevention of migration of leachate from landfill sides and landfill base to the subsoil by a suitable liner system;
- drainage of leachate collected at the base of a landfill to the sides of the landfill and
- removal of the leachate from within the landfill.

A competent liner system is designed with low permeability and resistance to chemical attack, puncture and rupture. A liner system may comprise a combination of barrier materials such as natural clays, amended soils and flexible geo-membranes.

A composite liner comprises two barriers, made of different materials, placed in contact with each other to provide a beneficial combined effect of both the barriers. Usually a flexible geo-membrane is placed over a low-permeability clay or amended soil barrier.

As per the US Environment Protection Agency design criteria (document no.40 CFR 258.4) standard Type D design is:

- Upper component of 60 mil (1.5mm thick) HDPE (high density poly-ethylene) liner
- Lower component of minimum of 600mm thick compacted soil with a hydraulic conductivity of no more than 1 x 10^{-7} cm/sec.

Generally, compacted soil of 600 mm thickness is considered necessary to minimize the number of cracks or imperfections through the entire liner thickness that could allow leachate migration. But, in the leachate quantity calculation, we have considered the natural soil at site with hydraulic conductivity of 2.10 x 10^{-7} m/sec, 25 holes and a very conservative defect-hole diameter of 0.011m with poor contact and arrived at a leachate flow of 34.26 cu.m. per year.

The highest level of water table shall be at least two meter below the base of clay or amended soil barrier layer. The following composite liner system has been adopted

- Drainage layer of 15cm thick granular soil material of permeability value of 1 x 10^{-2} cm/sec.
- A 1.5mm thick HDPE liner
- A 900 mm thick compacted soil of permeability value 1.0 x 10^{-7} cm/sec amended with additives like Bentonite to reach the required permeability value.

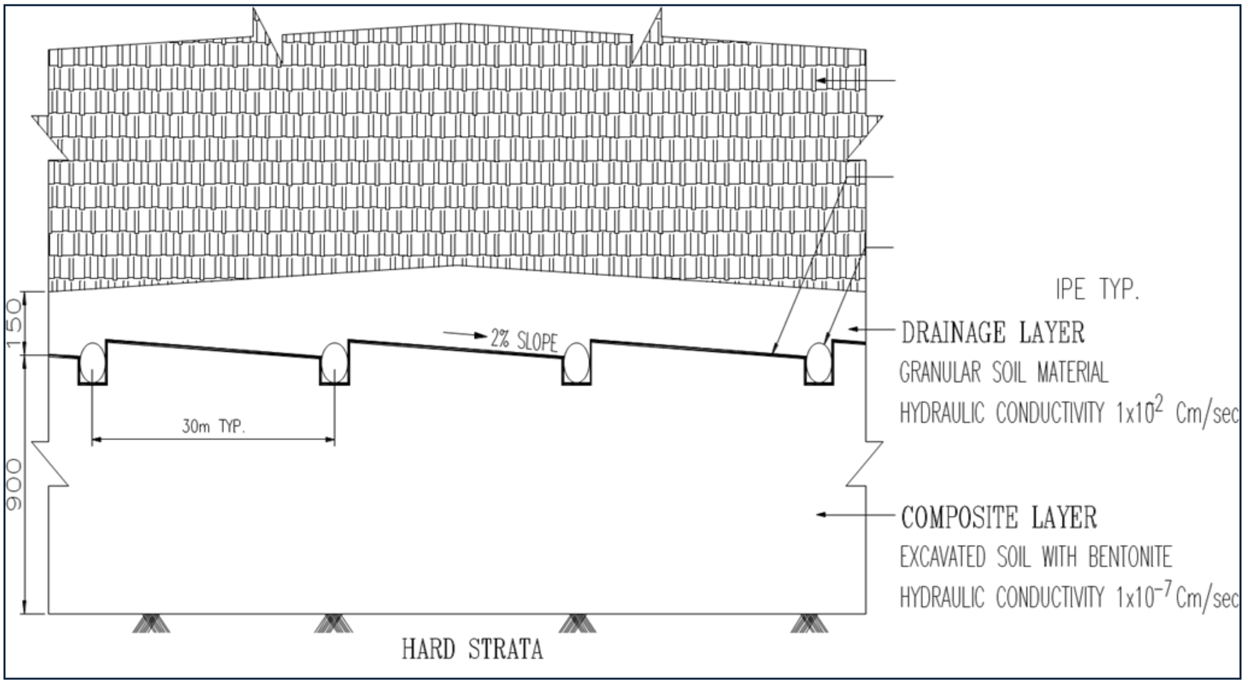


Exhibit 205 Landfill Liner Design

15.5.2.9 DAILY CELL COVER

The term cell is used to describe the volume of material placed in a landfill during one operating period, usually one day. A cell includes the solid waste deposited and the daily cover material surrounding it. The deposited solid waste shall be spread into thin layers and compacted to high density using sheep foot rollers and vibro-compactors. Daily cover usually consists of 15 to 30 cm of native soil that is applied to the working face of the landfill at the end of operating period each day. The purposes of daily cover are to control the blowing of waste materials; to prevent rats, flies and other disease vectors from entering or exiting the landfill; and to control the entry of water into the landfill during operation.

A daily cell cover of 15 cm thick of locally available compacted soil of permeability coefficient of 2.1 x 10^{-7} cm/sec is recommended.

15.5.2.10 LEACHATE COLLECTION AND REMOVAL SYSTEM (LCRS)

A leachate collection system comprises a drainage layer, a perforated pipe collector system, sump collection area and a removal system.

A leachate drainage layer of 15 cm thick of granular soil material of permeability value of 1x 10^{-2} cm/sec with a slope of 2% shall be provided above the geo-membrane liner. A system of perforated pipes and sumps are provided within the drainage layer. The pipe spacing is governed by the requirement that the leachate head should not be greater than the drainage layer thickness.

Leachate is removed from the landfill by:

- pumping from vertical wells or chimneys,
- pumping from side slope risers, or

- gravity drains through the base of a landfill in aboveground and sloped landfills.

Side slope risers are preferred to vertical wells to avoid down drag problems. In some landfills, the leachate is stored in a holding tank before being sent for treatment.

All components of the leachate collection system must have sufficient strength to support the weight of the overlying waste, cover system and post closure loadings as well as stresses from operating equipment. The component that is most vulnerable to compressive strength failure is the drainage layer piping. Leachate collection system piping can fail by excessive deflection, which may lead to buckling or collapse.

Perforated drainage pipes provide good long-term performance. These pipes have been shown to transmit fluids rapidly and have good service lives. The depth of the drainage layer around the pipe should be more than the diameter of the pipe. The pipe can be placed in trenches to provide the extra depth. In addition, the trench serves as a sump for leachate collection. Pipe can be susceptible to particulate and biological clogging similar to drainage layer material. Proper maintenance and design of pipe systems mitigate these effects and provide systems that function properly.

Design of perforated collection pipes considers the following factors.

- The required flow using known percolation impingement rates and pipe spacing
- Pipe size using required flow and maximum slope
- The structural strength of the pipe

Proper storm water drainage system has been designed to minimize the leachate generation and prevent pollution of surface water and to divert the storm water from entering the active cell of the landfill.

15.5.2.10.1 LEACHATE COLLECTION SUMP

The leachate collection sump is a temporary storage pond during the active life period of the landfill; hence, open excavation with composite geo-textile liner on bottom and sides is envisaged to be sufficient for this purpose. The following exhibit presents a snapshot of the international standards pertaining to the design of the leachate collection sump and the compliance measures taken as a part of the design of the facility for the project under reference.

International Standards	Compliance to the Standards
Prior to the commencement of rainy season, an intermediate cover of 45-65 cm thickness of soil shall be placed on the landfill with proper compaction and grading to prevent infiltration during monsoon.	An intermediate cover of 45cm thickness of compacted soil amended with additives like Bentonite to achieve permeability value of 1 x 10^{-7} cm/sec shall be provided at a slope of 2%
Proper drainage berms shall be constructed to divert the run-off away from the active cell of the landfill.	A storm water drain of bottom width of 0.50 m, top width of 1m and depth of 0.25m has been designed
Provisions for management of leachate collection and treatment shall be made	Extensive leachate collection pipeline network has been designed and the collected leachate shall be used in the composting yard

Exhibit 206 International Standards Compliance for Leachate Sump

15.5.2.10.2 LEACHATE TREATMENT AND MANAGEMENT SYSTEM

Leachate is created as rainfall lands on an uncapped landfill and percolates through the waste. The water dissolves and rinses down certain constituents within the waste and settles down to the bottom of the landfill. Mobilization of the landfill constituents is a function of their chemical solubility and the rate of water movement through the waste. pH greatly influences the chemical solubility of certain materials. The composition and quantity of leachate is subject to seasonal, and even daily, fluctuations, which significantly impact the design of leachate treatment plants.

The collected leachate shall be pumped to composting area to be sprayed on top of the windrows. In the bioconversion process taking place in the windrows, which is fully aerobic fermentation under controlled conditions, usually no leachate is generated. If some leachate is generated under exceptional circumstances, that shall be absorbed onto dry bio-fixed / bulking agent and re-mixed into the fermenting biomass.

However, if there is still surplus leachate, the same shall be channelized into a separate leachate collection tank. An area has been allotted for developing a leachate treatment plant, which can be constructed in due course of time depending upon the actual leachate generation rate and rainfall conditions.

15.5.2.11 LANDFILL GAS

Gas is a byproduct of waste when it degrades in a landfill, and the quality of gas generated depends on the type of waste in a landfill. Most of the gas that comes from landfills is methane. Some other gases that are generated are carbon dioxide, nitrogen and oxygen.

Landfills are capable of generating gas pressure that could lead to damage of the landfill cover. In order to keep the pressure of the gas low, the gas should be vented. If a high amount of gas makes its way through the landfill cover, the vegetation on top of the landfill could die. If the vegetation dies, the soil could erode from the final cover. Vegetation surrounding the landfill could also be affected.

The following sections describe the gas venting systems used in landfill facilities.

15.5.2.11.1 PASSIVE VENTING SYSTEM

A passive venting system is used when only minimal amount of gas is expected from a landfill. This type of venting is typically used for very small landfills and uses isolated gas vents (single pipes embedded in the landfill, allowing gas to flow freely from the waste to the atmosphere).

15.5.2.11.2 ACTIVE VENTING SYSTEM

An active venting system is used for landfills that generate a large amount of gas, or gas that would be of a noxious nature. A blower is used to move gas through pipes that are embedded in the landfill. The gas could be used for energy reuse purposes, burned on-site, or released into the atmosphere after being treated.

For controlled landfills with geo-textile liner in enhanced decomposition mode, as a norm, gas is produced at the rate of 2.24×10^{-3} standard cubic metres per wet kilogram of waste per year.

Considering the fact that major portion of the waste receivable at landfill site is non-biodegradable waste and inertized waste only, the gas generation rate will be negligible.

However, as per the requirement of International Standards, a gas vent layer with a thickness of 200 mm made of granular soil material with a permeability range of 1 x 10^{-2} cm/sec has been designed.

15.5.2.11.3 ACTIVE GAS VENTING CUM FLARING SYSTEM

Normally the gas collected in the gas vent layer shall be collected and vented through vent pipes of 150 mm diameter HDPE pipe taken up to gas relief layer. It is common practice to provide one vent pipe per 7500 standard cubic metres of gas per year and for Piplodi Village site 52 numbers of gas venting pipes shall be provided. On top of the final cover, the gas vent pipes shall be connected together through a network of GI pipes and taken to flaring unit. Flaring unit consists of collection chamber, blower and butane tank to ignite the LFG, control valves, sensors to automatically cut-off the butane flow and switch off the blower when LFG flow is stopped. One number of 50 cum/hr gas venting & flaring system shall be provided, which will be more than sufficient to take care of any eventuality.

15.5.2.12 FINAL COVER SYSTEM

A landfill cover is usually composed of several layers each with a specific function. The final cover system must enhance surface drainage, minimize infiltration, vegetation and control the release of the landfill gases. The specific cover configuration depends on the climatic conditions at the site. To ensure rapid removal of rainfall from the completed landfill and to avoid the formation of puddles, the final cover should have a slope of about 5 to 20 percent.

The following exhibit captures a snapshot of the applicable international standards for final cover design and the compliance status of the design.

International Standards	Compliance to the Standards
A final cover system shall be designed to minimize infiltration and erosion. The final cover shall meet the following specifications, namely: - • Barrier Soil Layer of 60cms thick compacted soil of permeability value of 1 x 10^{-7} cm/sec • On top of barrier soil, layer, there shall be a drainage layer of 15cm • On top of the drainage layer, there shall be a vegetative layer of 45cm to support natural plant growth and to minimize erosion	• Gas Venting Layer of 200mm thick granular soil material of permeability value of 1 x 10^{-2} cm/sec • Barrier Soil Layer of 600mm thick compacted soil amended with additives like Bentonite to achieve a permeability value of 1 x 10^{-7} cm/sec • Geo-membrane Layer of 1.5mm thick HDPE liner with hydraulic conductivity of 7 x 10^{-15} m/sec • Drainage Layer of 150mm thick granular soil material of permeability value of 1 x 10^{-2} cm/sec
A vegetative cover shall be provided over the completed site.	Vegetative Layer of 450m thick with compacted clay soil has been provided and the landfill operator shall plant of suitable variety which will have sustained growth like grass, shrubs etc.

Exhibit 207 Compliance to Standards with regards the Final Cover Design

Exhibit 208 presents a snapshot of the final cover system design involved. Further, it may be noted here that the storm water drainage system at the project site has been designed considering the location of the landfill and the associated aspects such as prevention of runoff from flowing from the landfill into the other areas of the project site. The following sub-section also recapitulates the supporting on-site infrastructure designed for the solid waste management system.

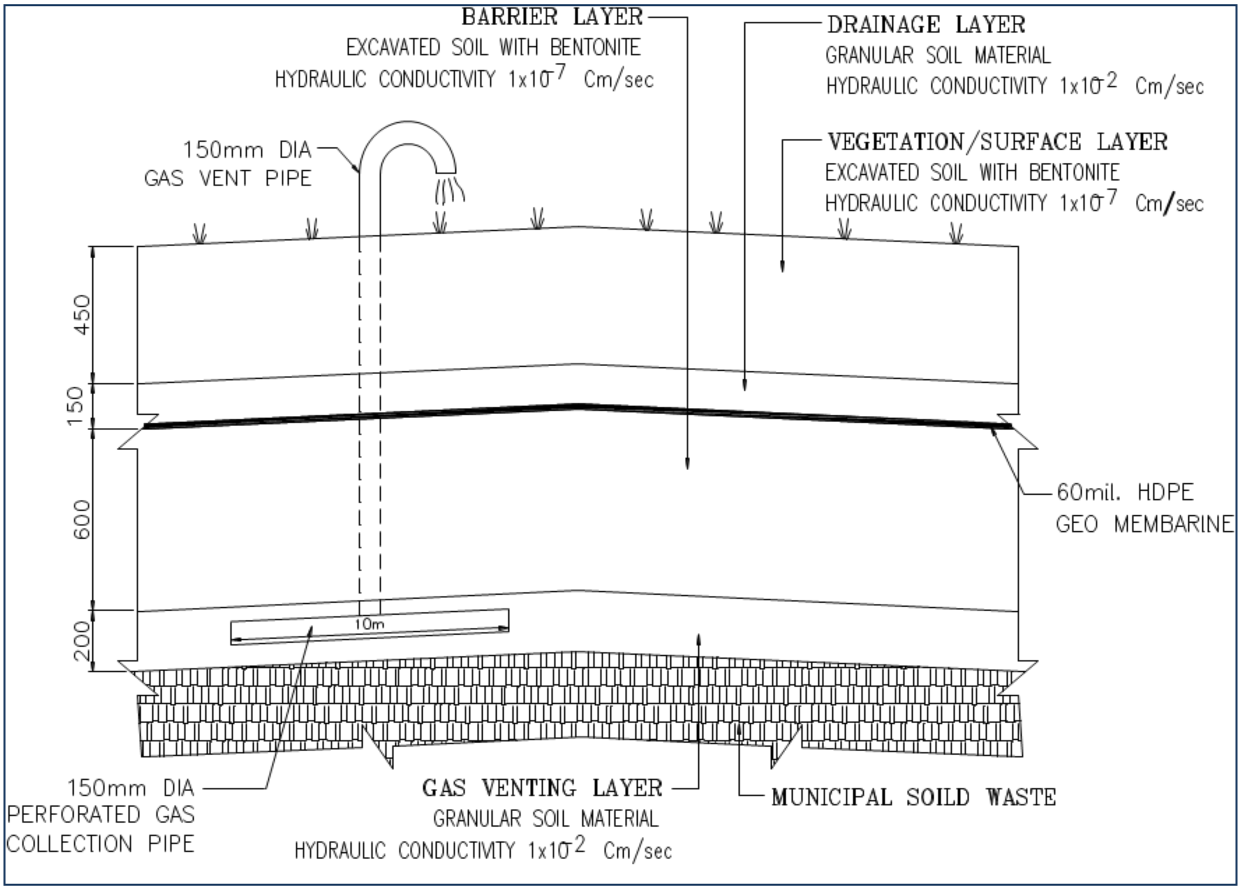


Exhibit 208 Final Cover System Design

15.5.2.13 SUPPORTING ON-SITE INFRASTRUCTURE

The Kaliakoir SWM facility is envisaged to be developed as an integrated plant, most of the infrastructure shall be common for both Vermi-composting plant and engineered sanitary landfill site. The following sub-sections capture the on-site supporting infrastructure facilities designed to support the SWM facility.

15.5.2.13.1 LEACHATE COLLECTION SUMP

One leachate collection sump capable of storing 105 cu.m. of liquid with a rainfall intensity of 75 mm/hour has been recommended. The size of the sump is 7m (L) x 4m (B) x 3m (H).

15.5.2.13.2 WATER SUPPLY

The requirement of water for landfill site is envisaged to be negligible. One water tank of 2500 lit capacity shall be provided at the facility site for use by the supporting personnel at the facility.

15.5.2.13.3 LIGHTING

On the active face of landfill, movable heavy duty focus lamps shall be provided depending on the operational requirement.

15.5.2.13.4 COVER MATERIAL STORAGE AREA

For stocking, cover material area of about 168 Sqm. is envisaged.

15.5.2.13.5 TEMPORARY HOLDING AREA

At times, the garbage received at site has to be stored temporarily before shifting it to daily cell area. For this purpose, a total area of approx. 30 Sqm. shall be provided.

15.5.2.13.6 COMPOUND WALL AND SECURITY

A security room of size 3m x 3m is recommended for the security purpose and the whole area is recommended to be bounded by compound wall.

15.5.2.13.7 BUFFER ZONE

A six meter wide green buffer zone has been recommended all around the SEM facility site.

The following exhibit captures a snapshot of compliance of the SWM facility design with the international standards.

International Standards	Compliance with the Standards
Approach and other internal roads for free movement of vehicles and other machinery shall exist at the landfill site	Proper internal roads have been designed to facilitate the movement of vehicles.
The landfill site shall provide inspection facility to monitor waste brought in for landfill, office facility for record keeping and shelter for keeping equipment and machinery including pollution monitoring equipment.	All the required facilities like inspection platform and pollution monitoring equipment have been provided
Provisions like weighbridge to measure quantity of waste brought at landfill site, fire protection equipment and other facilities as may be required shall be provided.	Weighbridge and other infrastructure facilities have been designed in the vermin-compost plant.
Landfill site shall be fenced or hedged and provided with proper gate to monitor incoming vehicles or other modes of transportation	The entire site has been designed to be protected by compound wall and gate with security
Utilities such as drinking water (preferably bathing facilities for workers) and lighting arrangements for easy landfill operations when carried out in night hours shall be provided.	Workers toilets, rest area, drinking water facilities are recommended in the composting site.
A buffer zone of no-development shall be maintained around landfill site and shall be incorporated in the Town Planning Department's land use plans	A green buffer of 6 m width has been recommended all around the site.

Exhibit 209 Compliance of SWM Facility Supporting Infrastructure with International Standards

15.6 MONITORING SYSTEM

The objective of the monitoring system is to find out whether a landfill is performing as designed; and to ensure that the landfill is conforming to the regulatory environmental standards.

Monitoring at a landfill site is carried out in four zones:

- On and within the landfill
- In the unsaturated subsurface zone (vadose zone[15]) beneath and around the landfill.
- In the ground water (saturated) zone beneath and around the landfill.
- In the atmosphere/local air above and around the landfill.

The parameters to be monitored regularly are:

- Leachate head within the landfill;
- Leachate and gas quality within the landfill;
- Long-term movements of the landfill cover;
- Quality of pore fluid and pore gas in the vadose zone;
- Quality of ground water in the saturated zones and
- Air quality above the landfill, at the gas control facilities, at buildings on or near the landfill and along any preferential migration paths.

The indicators of leachate quality and landfill gas quality must be decided after conducting a study relating to the type of the waste, the age of the waste, the composition of the leachate and gas likely to be generated and the geotechnical as well as hydro-geological features of the area.

The frequency of monitoring varies from site to site but it must be so fixed that it is capable of detecting unusual events and risks in the initial phases of their appearance so as to give time to diagnose and localise the cause and enable early steps to be taken for containment or remediation. Usually a monthly or a bi-monthly monitoring frequency is considered suitable during the operational phase of a landfill as well as for 3 to 4 years after closure; this frequency can be decreased to 2-3 times a year in later years, if all systems perform satisfactorily. The monitoring frequency may have to be increased if concentrations higher than expected are detected, if control systems are changed or if drainage systems become clogged / nonfunctional. The frequency of monitoring may also be increased during those periods in which gas generation or leachate generation is higher, such as during the monsoon periods.

The following instruments/equipment have been recommended for periodical monitoring

- Groundwater samplers for groundwater monitoring wells
- Leachate samplers for leachate monitoring within the landfill and at the leachate tank
- Vacuum lysimeters, filter tip samplers, free drainage samplers for leakage detection beneath landfill liners.
- Surface water samplers for collection of sample from sedimentation basin.

[15] vadose zone is defined as that zone from the ground surface to where the permanent groundwater is found

- Down-hole water quality sensors for measuring conductivity, pH, DO, temperature in leachate wells, groundwater wells and sedimentation basins.
- Landfill gas monitors (portable) for onsite monitoring of landfill gases.
- Active and passive air samplers for monitoring ambient air quality.

Further, the following exhibits present snapshots of the parameters to be monitored, for the landfill and the leachate generation.

S.No.	Parameter	Monitoring Frequency	Units
1	Visual Landfill Inspection	Daily	
2	Mass of Landfilled MSW	Daily	Tons
3	Mass of Landfilled construction & Demolition waste	Daily	Tons
4	Mass of Soil (Other than daily cover)	Daily	Tons
5	Type of Daily Cover	Daily	
6	Mass of Daily Cover	Daily	Tons
7	Landfill volume	Quarterly	m3
8	Settlement	Quarterly	m
9	Volume of Leachate	Daily	m3
10	Rainfall	Daily	mm
Leachate Monitoring Parameters			
11	Temperature	Monthly	°C
12	pH	Monthly	
13	Conductance	Monthly	µSm/cm
14	Total Dissolved Solids	Monthly	mg/L
15	Alkalinity	Monthly	mg/L (as CaCO3)
16	Chloride	Monthly	mg/L
17	Bromide	Monthly	mg/L
18	Floride	Monthly	mg/L
19	Sulfate	Monthly	mg/L
20	COD	Monthly	mg/L
21	BOD	Monthly	mg/L
22	Total Organic Carbon	Monthly	mg/L
23	Total Phosphorus	Monthly	mg/L
24	Ortho Phosphate	Monthly	mg/L
25	Ammonia	Monthly	mg/L
26	Nitrite	Monthly	mg/L
27	Nitrate	Monthly	mg/L
28	Volatile & Semi volatile Organic Compounds	Quarterly	µg/L

29	Volatile fatty acids	Quarterly	mg/L
30	Arsenic	Quarterly	mg/L
31	Barium	Quarterly	mg/L
32	Cadmium	Quarterly	mg/L
33	Calcium	Quarterly	mg/L
34	Copper	Quarterly	mg/L
35	Chromium	Quarterly	mg/L
36	Iron	Quarterly	mg/L
37	Lead	Quarterly	mg/L
38	Magnesium	Quarterly	mg/L
39	Mercury	Quarterly	µg/L
40	Potassium	Quarterly	mg/L
41	Sodium	Quarterly	mg/L
42	Selenium	Quarterly	mg/L
43	Silver	Quarterly	mg/L
44	Zinc	Quarterly	mg/L
Landfill Gas Monitoring Parameters			
45	Total Gas	Atleast once a Week	scfm
46	Carbon Dioxide	Weekly	%V/V
47	Oxygen	Weekly	%V/V
48	Methane	Weekly	%V/V
49	Carbon Monoxide	Weekly	%V/V

Exhibit 210 Landfill, Leachate & Landfill Gas monitoring parameters

15.6.1 CLOSURE AND POST-CLOSURE MAINTENANCE PLAN

The criteria for landfill closure focus on two central themes: (1) the need to establish low-maintenance cover systems and (2) the need to design a final cover that minimizes the infiltration of precipitation into the waste. Critical technical issues considered for design of the post closure plan are:

- Degree and rate of post-closure settlement and stresses imposed on soil liner components;
- Long-term durability and survivability of cover system;
- Long-term waste decomposition and management of landfill leachate and gases; and
- Environmental performance of the combined bottom liner and final cover system.

Once a landfill reaches its capacity, it must be managed to limit any potential adverse environmental effects. Closures involve capping the landfill with a excavated soil amended with additives like Bentonite to achieve a permeability value of 1×10^{-7} cm/sec to minimize moisture infiltration. The top vegetative layer shall be prepared with good excavated clay material to support vegetation. During post-closure, the level of methane production and leachate collection shall be monitored periodically by the landfill operator.

Post-Closure care usually involves periodical inspections of the landfill site to monitor land surface care, leachate collection, and methane control by way of flaring and to maintain flaring equipment. Monitoring is a post closure activity designed to detect any adverse environmental impacts.

Closures must occur in a manner that:

- Minimizes post closure releases of the leachate and explosive gases
- Minimizes the need for further maintenance
- Ensures protection of human health and the environment

Post closure requirements include:

- Maintenance of the final cover and containment system
- Leachate collection (when leachate collection exists)
- Ground water monitoring
- Gas flaring

Post closure care must continue for a minimum period of 15 years. Additional time periods may be added as necessary to protect human health and the environment.

Determination of the end-use of a landfill site is an essential part of the plan for landfill closure and post-closure maintenance. Some possible uses of closed landfill sites include parks, recreational areas, golf courses, vehicle parking areas and sometimes even commercial development.

A closure and post-closure plan for landfills involves the following components:

- Vegetative stabilization of the final landfill cover.
- Management of surface water run-off with an effective drainage system.
- Periodical inspection and maintenance of landfill cover and facilities.

15.6.2 ENVIRONMENTAL MONITORING SYSTEMS

Long term environmental monitoring is conducted at closed landfills to ensure that there is no release of contaminants from the landfill that may impact health or the surrounding environment. The monitoring required at completed landfills usually involves:

- Vadose zone monitoring for gases and liquids;
- Groundwater monitoring; and
- Air quality monitoring. The number of samples collected for analysis and the frequency of collection will usually depend on the regulations of the local air pollution and water pollution control agencies.

15.6.3 POST-CLOSURE CARE

Post-closure care requirements are focused on operating and maintaining of the following four components that shall prevent or monitor releases from the landfill unit:

- Cover system;
- Leachate collection system;
- Ground-water monitoring system; and
- Gas monitoring system.

The landfill operators shall comply with the following requirements for a minimum of 15 years period following closure of the landfill:

- When the final cover is installed, repairs and maintenance may be necessary to keep the cover in good working order. Maintenance may include inspection, testing, and cleaning of leachate collection and removal system pipes, repairs of final cover, and repairs of gas and ground water monitoring networks.
- Inspection should be made on a routine basis. A bimonthly schedule (six times a year) should be followed to check for routine inspections. Records of inspections detailing observations should be kept in a logbook so that statutory authorities can verify changes in the parameters. In addition, records should be kept detailing the changes in pose-closure care personnel to ensure that changing personnel will not affect post-closure care due to lack of knowledge of routine activities.
- Inspections should be conducted at bimonthly intervals and the condition of the facility should be recorded with notes, maps, and photographs. The inspector should take notice of eroded banks, patches of dead vegetation, animal burrows, subsidence, and cracks along the cover. The inspector also should note the condition of leachate collection and removal pipes & pumps, gas monitoring systems, and monitoring wells.
- Topographic surveys of the landfill unit(s) can be used to determine whether settlement has occurred. These should be repeated every few years until settlement behaviour is established. Depressions caused by settlement may lead to pending and should be filled with soil. Excessive settlement may warrant reconstructing or adding to portions of the infiltration layer. Damage caused by settlement such as tension cracks and tears in the synthetic membrane should be repaired.
- Large and small crevices may form along the cover where water has eroded the cover. This may lead to exposure of the synthetic geo-membrane and, in severe cases, depending on the cover system installed, exposure of the waste.
- Erosion may lead to increased infiltration of surface water into the landfill. Areas showing signs of erosion should be repaired.
- Certain types of vegetative cover (e.g. turf-type grasses) may require mowing at least two times a year. Mowing can aid in suppression of weed and brush growth, and can increase the vigour of certain grass species. Alternatively, certain cover types (e.g. native prairie grasses) require less frequent mowing (once every three years). Insecticides may be used to eliminate insect populations that are detrimental to vegetation. Insecticides should be carefully selected and applied with consideration for potential effects on surface water quality.
- Leachate collection and removal pipes may be flushed and pressure-cleaned on a regular schedule (annually) to reduce the accumulation of sediment and precipitation and to prevent biological fouling.

- Similarly, gas collection systems and gas flaring system should be inspected to ensure that they are working properly. Necessary periodical maintenance (monthly) for blower and topping up of butane tank will be required for gas flaring system. Vents should be checked to ensure they are not clogged by foreign matter such as debris.

16 ANNEXURE 5 – CONTRACT MANAGEMENT & SITE SUPERVISION NORMS

16.1 NEED FOR CONTRACT MANAGEMENT AND SITE SUPERVISION NORMS

The contract management and site supervision norms have been devised in order for efficient and compliant project development. While contract management norms concentrate on monitoring management issues and addressing them to effectively manage the project, site supervision norms facilitate to ensure implementation of the guidelines and design parameters on site.

16.2 CONTRACT MANAGEMENT

Management of the contract entered with the private player for development of the project is a key in achieving overall planning and development success for the project.

The following sub-sections brief focus points related to this contract management.

16.2.1 PRE-PLANNING MANAGEMENT

Pre-planning contract management is envisaged to focus on the following aspects, which are covered under the purview of the ongoing studies.

- Market demand assessment.
- Financial viability
- Permitting and approval requirements
- Statutory permissions / clearances / approvals necessary at various stages of project execution

16.2.2 PLANNING AND SCHEDULING SYSTEMS

Procedure for planning and scheduling systems are envisaged to encompass:

- project scope definition as covered under various components of this feasibility study;
- Value of the contract as indicated in the financial feasibility studies;
- work breakdown structure definition & time scheduling of works, as indicated in the project implementation schedule;
- Identification of optimum construction techniques to match available resources which needs to be discussed with the contractor awarded the contract and enforced subsequently;
- Preparation of an overall plan for control and monitoring of project, which has been included in the succeeding sections of this document – for site supervision;
- Estimation of required materials, equipment and manpower resources to carry out activities on which to base the project schedule, which has been included in the combined financial as well as the detailed planning and design study;
- Monitoring project schedule regularly and recommending remedial measures to maintain scheduled progress, which forms a part of the site supervision norm section of this document;

- Regular updates on the status of the project implementation need to be carried out in order to identify issues if any and address them to adhere to timely project completion schedule.

16.2.3 COST MANAGEMENT SYSTEMS AND PROCEDURES

Management of the costs incurred in implementation of the project and the related procedures are recommended to cover:

- Preparation of Bill of quantities, carried out in the detailed engineering study activity of the study;
- Escalation allowances, if any, based on the financial feasibility results;
- Financing /cash flow considerations in line with the prevailing project structure and the financing requirements;
- Comparison of budgeted and forecast costs as part of the project monitoring and site supervision norms included in the succeeding sections of this document;
- Estimation of change in costs as per the monitoring activities & the corresponding measures ; and
- Examination of contractors' claim submissions to ensure in-budget project costing.

16.2.4 QUALITY ASSURANCE AND INSPECTION SYSTEMS AND PROCEDURES

Quality assurance norms are devised in order to ensure the quality of on-ground work is in line with the intended quality:

- It is recommended that quality standards for the materials and procedures on-site are established and incorporated in the contract management system;
- Preparation and monitoring of a quality surveillance plan is recommended, in conjunction with review and audit of the material manufacturers' quality controls;
- It is recommended that detailed material and procedure inspection reports be prepared on a regular basis.

16.3 CONSTRUCTION MANAGEMENT – SITE SUPERVISION

16.3.1 NEED FOR SITE SUPERVISION NORMS

This set of norms provides information and guidelines for field work for project management work being administered by the PIA (project implementation agency). It is expected to serve as a guideline for the PIA's construction personnel working on this project.

The following sections deal with various aspects of the site supervision activity and the corresponding resource requirements.

16.3.2 ORGANIZATION

The administrative and field procedures for the project management activity are established by this document.

Staff organization and individual responsibilities are clearly identified, and the reporting mechanisms set up. In actual practice, however, one person may be assigned several roles (or vice versa) and the organization may require corresponding changes.

16.3.3 SITE SUPERVISION

The policy or objectives of PIA, when executing its responsibilities for supervising construction for a client, shall be to ensure general conformance to the following:

- The work is according to the contract documents;
- All contractors comply with all national, provincial and municipal regulations, whichever is the most stringent, dealing with fire, safety, health and environmental issues at the site;
- The budget and schedule parameters for the project are monitored and reported regularly;
- The quality of the completed work meets the required standards, codes and regulations, and the requirements of the contract documents;
- The business practices of all parties associated with the project follow recognized or prescribed standards.

It is recommended that during construction the project manager, along with his team shall carry out the following responsibilities:

- Supervise inspection of the works;
- Undertake regular review of the contractor's
  - progress and schedule
  - management and administration
  - quality assurance
  - safety measures on-site
- Recommend authorization of change orders/extra works/extra items on a day-to-day basis;
- Maintain a check on waste on-site etc.

In case of issues, the project manager shall assess them on a case to case basis and either make a decision or refer it to the sponsors for immediate review and response.

The following guidelines shall be adhered to by the site team.

16.3.3.1 LIMITING LIABILITY EXPOSURE

This section deals with limiting the exposure to various liabilities envisaged during project implementation phase. The following exhibit captures a number of liability exposures and recommended measures to mitigate them.

Liability Exposure	Recommended Mitigation Measure
Exposure to time/ cost overrun liability, due to the contractor's inability to maintain the work progress sufficient to achieve the proposed	Recommended to be mitigated by regular oversight of the work being carried out, and also constant feedback and interfacing with the project

Liability Exposure	Recommended Mitigation Measure
timeline.	sponsors through managerial personnel.
Contributory liability induced by construction supervision in terms of: • Collapse or sudden failures of structures • Liability for injury to the contractor's employees etc • Liability for cost overruns due to suggestions etc	The project management and supervision team engaged by the sponsors/ sponsors shall maintain professional conduct, and hold appropriate meetings etc for suggesting any changes in either the procedures or time lines to be followed by the contractor. Any review/ monitoring of the project implementation procedures shall be recorded. Further, safety standards of the contractor should not be judged/ reviewed by the site supervision team.
Force majeure conditions such as sudden weather changes	The project contract documents shall have provisions explicitly advising handling of such situations.
Sundry liability arising out of seeming incompetence of the site supervision team to assist project implementation.	The contractor and the site team should come to an agreement regarding the scope of work of the site supervision team.
Sundry liabilities arising out of interaction of the site supervision team with the contractor	Regular maintenance of records and milestone based checking of the contractor's work by the site supervision team is recommended as the measure to avoid such liabilities

Exhibit 211 Limiting Liability Exposure

16.3.3.2 CONSTRUCTION COMMENCEMENT

This section covers guidelines related to the initial stages of the project implementation. The PIA'S project manager shall be the principal contact with the contractor and shall be assigned the responsibility for ensuring that the contract administration is carried out appropriately.

After the awarding of a contract and when all parties have had a chance to review the contract documents, a pre-construction meeting shall be held. It shall be held prior to the commencement of any work on the contract by the contractor. The purpose of the meeting shall be to acquaint both the site supervision team and the contractor's staff with one another, to establish lines of communications, and define what the sponsor's requirements for the project will be.

As soon as practicable after the contract award, the project manager shall advise the contractor of the start-up meeting. The contractor's project manager, project coordinator, safety supervisor, a company officer, and other interested parties shall be present at this meeting for the purpose of discussing items of mutual interest concerning the start, operation and the completion of the contract work. The Start-up Meeting may in fact be covered by more than one meeting held either in the Consultant's office or at the construction site.

The contractor shall be furnished an advanced copy of the meeting agenda with a request that he be prepared to provide specific information with regard to the agenda items. The PIA's project manager shall preside over the meeting, calling upon appropriate representatives for applicable presentations. He or his designate will prepare a written summary of the meeting for distribution to all attendees.

Items for discussion at the meeting shall include, but not be limited to, the following:

- PIA's (and the sponsor's) and the contractor's authority and responsibilities (including those in the contract documents)
- Names, positions, addresses and telephone numbers (including home telephones for emergencies) of the contractor's, PIA's and sponsor's representatives.
- Hours and days of work
- Safety, accident prevention and emergency plans
- Obtained/ pending permits and licenses
- Early actions required of the contractor (including contract formalities)
- Correspondence and record-keeping requirements
- Subcontractor approval procedure
- Source and material approval procedures
- Progress schedule monitoring and reporting requirements
- Maintenance of traffic etc
- Details of construction activities for the duration of the project implementation
- Co-operation and co-ordination with utility providers
- Contractor & sponsor concerns

16.3.3.3 CONSTRUCTION SITE IDENTIFICATION

The construction site shall be clearly identified by a sign, conforming to the sponsor's specifications, which identifies the sponsor, the Engineer (PIA) and the contractor(s).

16.3.3.4 SITE SECURITY AND SAFETY

The PIA shall establish and maintain site security measures as necessary. All field offices shall be securely locked when unattended. Authorized office use outside normal working hours shall be regulated to maximize security.

The contract documents and primary correspondence shall be stored in a locked fireproof cabinet. Access to field office files shall be controlled and limited.

16.3.3.4.1 SAFETY POLICY AND PROCEDURES

The contractor shall be responsible for ensuring compliance with the laws, regulations, codes etc., which relate to the work, to the preservation of the public health, and to construction safety. The contractor shall be required to have workers trained in first aid procedures. The project manager shall obtain from the contractor the names of these workers, and shall ensure that they are properly identified.

When a project manager /PIA site supervision team is aware of a hazardous or illegal situation created by a contractor, action shall be taken as follows:

- If the violation is minor, the project manager shall instruct the contractor to correct the safety violation.
- If the violation is sufficiently serious, project manager will advise the sponsor to write to the contractor, in writing, to close down the operation and to take the necessary remedial action prior to resumption of the operation.
- In all cases, the particulars shall be recorded in written.
- At the start of field work, the project manager shall familiarize himself with the contractor's plans for actions to be taken in case of injury to personnel or damaged property.
- It shall be the responsibility of the project manager to ensure that all PIA's personnel in, or visiting, the field are safety-conscious and familiar with the safety norms.
- It is emphasized that all safety-related policies, regulations and guidelines apply equally to field employees and any visitors to the work site. Site representatives must ensure that visitors are informed of the requirements for protective equipment and ensure that they comply.

16.3.3.4.2 SAFETY EQUIPMENT

This section covers in brief the safety equipment requirement at the site.

- Construction staff working in the field shall be required to wear safety footwear. Construction field staff must wear safety boots with a metal box toe and a metal insole.
- Safety vests - Blaze orange, reflective fluorescent safety vests must be worn at all times when working within road right-of-way limits.
- Eye protection - The standard eye protection is goggles.
- Safety hats - The safety hat shall consist of a shell and suspension that will adequately protect the head against impact and from flying or falling small objects. Safety hats must be replaced if hats are dropped and/or cracks appear or there are signs of deterioration. Safety hats must not be painted as most paints will cause early deterioration and loss of protection.

16.3.3.4.3 ACCIDENT REPORTS

In the event of an injury to an employee, the representative of the sponsors on site shall submit to the PIA an accident investigation report, in the corresponding format as may be required by the sponsor/client.

When a serious accident or emergency situation occurs, the site representative shall ensure that the injured personnel receive immediate medical attention and assistance is, and then promptly report the emergency incident to the PIA'S project manager.

16.3.3.4.4 PERMITS

Many local urban bodies have by-laws governing the use of water from hydrants, cutting roadways, noise, notification to emergency organizations (fire, ambulance, and police) and hours of work. The site representative must ensure that the requirements of each are met (either by the sponsor's staff, or as a result of the preparation and design process, or by the contractor's staff as required).

Some permits may require inspection visits by the authorities' representative, or submission of periodic reports. The contractor shall be required to provide the site representative with copies of such reports, and advise him of any actions taken by the authorities' representatives.

16.3.3.4.5 VISITORS TO THE SITE

Casual visits to the construction site shall be discouraged due to safety considerations. The site representative shall extend all courtesies and co-operation to, and arrange for, an escort of all official visitors through the project. A clean supply of visitor hardhats (plus boots, rainwear and any necessary safety equipment) shall be maintained for use by visitors. In the event that visitors mention displeasure or irregularities with the conduct of the construction, a courteous interest must be displayed and assurance made that, as appropriate, corrective action will be taken.

The site representative shall maintain a Visitors' Register which shall list all visitors to the job site. All such visitors must wear the designated visitor hardhats and conform to site safety policies. Visitors may be required to sign a release of liability agreement before entering any hardhat area.

16.3.3.5 FIELD ADMINISTRATION

This section deals with the administrative aspects of the site supervision activity.

16.3.3.5.1 SCHEDULING

Soon after the contract award, the contractor shall submit a plan of work, resource requirements forecast, and cash flow projection, if required.

Within a reasonable time from the date of contract award, the contractor shall be required to submit a schedule as described in the general conditions. This schedule shall be submitted in a timely manner so that review of construction co-ordination requirements can be resolved; especially issues associated with utility relocation work and the other contractors on the project, if any.

The construction schedule shall be a detailed schedule defining and inter-relating all the activities to be performed by the contractor during the construction phase. It shall be divided into logical work areas. It will commence from the award of contract and continue through to completion of deficiencies.

The project manager shall review the contractor's schedule submittals for logical scheduling etc., add comments (if any), and forward to the project coordinator for review and approval as appropriate. The project manager shall retain a copy for reference.

During the progress of the job, the schedule shall be revised by the contractor whenever the effects of change orders or approved delays change the time of completion. If the contractor revises his sequence of operations, the project manager shall evaluate its effects on logic, milestones, claims, and completion. All changes to the overall schedule shall be approved by the project coordinator.

Updating of the contractor's schedule to show actual and proposed progress shall take place during the first week after the approval of the schedule, and monthly thereafter. This updating shall involve a monthly meeting between the contractor, the PIA'S project manager, PIA`S project coordinator, and sponsor of the project. At the meeting, the contractor shall present a narrative progress report and all changes to the contractor's schedule will be discussed. The schedule update shall include the scheduling of any changes incorporated into the work, and the impact of those changes on the overall project implementation scheme.

The project manager shall, in his review of the schedule, evaluate the availability of approved-for -construction drawings.

16.3.3.5.2 SCHEDULE DELAYS

The contractor shall have the freedom to select the sequence for performing work, unless there are special specification requirements. The project manager shall be thoroughly familiar with the current approved schedule so that accurate contractor reporting is maintained and schedule problems are recognized immediately.

Force majeure events may justify an extension of contract time if they delay activities on the critical path of the schedule. However, each instance shall be carefully documented and evaluated before such approval is granted.

In the event that portions of the work are likely to be delayed, the project manager shall immediately discuss the situation with the project coordinator.

In general, in order to qualify for an extension of time under the contract, the contractor, within 4 days from the beginning of any delay, shall state in writing the cause or causes of delay. Then, within 30 days after the end of the delay, the contractor shall formally request an extension of time in which he details the circumstances of the delay, the number of days actually delayed, measures taken to prevent re-occurrence or minimize the delay, etc.

The project manager shall prepare a short report including all facts pertinent to the delay. He shall consider whether or not the contractor took reasonable precautions to prevent or minimize the delay, and shall recommend the number of days to be allowed, if any. This report shall be forwarded to the PIA’S project coordinator for a decision as to the number of days to be allowed, if any.

If the project coordinator concurs with the site representative's recommendation that (subject to the sponsor's approval), a delay be allowed, a change order will be initiated specifying the number of days allowed and the new date for completion of the work or for specified portions of the work. If he does not concur with the recommendation, the contractor shall be notified by the project manager that his request for an extension of time has been denied, along with the reasons for such denial.

16.3.3.5.3 PROGRESS MEETINGS

Regular progress meetings shall be held to monitor the work progress and to resolve any problems that occurred.

These meetings shall be held on a regular basis and also when required of circumstances. Detailed minutes of the progress meeting shall be maintained and distributed to all the attendees.

Those attending the progress meeting shall include:

- PIA’S project coordinator and/or project manager;
- contractor's project manager and representatives (site superintendent);
- Others as required.

Items for discussion at the progress meeting are of a specific nature. The subjects for discussion would include the following:

- Review items outstanding from the previous meeting.
- The contractor shall review the work that has been carried out since the last meeting.
- Work schedule maintenance shall be discussed thoroughly, covering the following cases:

- Work on schedule - plans until the next site meeting & issues anticipated in the future
- Failure to maintain schedule:
  - Is it due to the contractor's lack of control? If so, can the contractor assure PIA'S that he can rearrange his work to catch up? If not, PIA'S shall point out the penalties involved and the serious action that can be taken against the contractor if his work schedule is not met.
  - Is it due to circumstances beyond the contractor's control? Causes for the delay in schedule shall be reviewed. In some cases the contractor can bring his work schedule up to date prior to the end of the contract. If he cannot, he may have to ask PIA's in writing for an `extension of time'.

- If there is the possibility of a claim, if so, it shall be reported.
- The project manager shall outline whether specifications are being met or not. If they are not, he shall specify measures to bring this item within specifications.
- Any other problems on the contract shall be dealt with, i.e., traffic control, utilities, property sponsors, safety concerns, etc.

16.3.3.5.4 PROGRESS REPORTING

The site representative shall complete a field report on a regular basis.

16.3.3.5.5 ANTICIPATION OF CLAIMS

Throughout the construction work, the project manager shall look out for situations which may give rise to contractor's claims at a later date. Any relevant situation shall be carefully documented on a regular basis.

16.3.3.5.6 CLARIFICATION INSTRUCTION

The PIA shall issue clarification instructions to clarify specific items in the contract documents and to give direction to the contractor concerning specific construction procedures. The instructions shall be issued in response to a request from the contractor for clarification. Clarification instructions are issued on the assumption that no extra cost is incurred while carrying out activities in line with the clarification instructions.

16.3.3.5.7 FIELD ORDER

The purpose of a field order is to authorize additional construction work of an emergency nature, when there is insufficient time to process a change of work order. The maximum commitment level shall be set by the project coordinator and must not be exceeded without his written approval.

The project manager shall:

- Identify the necessity for emergency work to be performed.
- Prepare a field order.
- Obtain authorization from the project coordinator for the work to proceed.
- Issue the field order, describing the work to be done.

- Process a note to the sponsor to issue a letter for additional / extra work.
- Verify quantities on the contractor's additional / extra work.

The contractor shall:

- Prepare and sign daily record of the labour, material and equipment used.
- Obtain the project manager's signature and provide him with a copy of deployment for man power, machinery & material utilized.
- Use signed forms as basis of rate analysis for work covered by extra item note.
- Report the rate analysis to the project manager, including:
  - The name of each tradesman or foreman and the hours worked.
  - The actual amount of materials used, including waste.
  - Material salvaged from the work (this shall be the property of the sponsor). The contractor shall not remove any such materials from the contract site without proper credit value being given to the sponsor.
  - The equipment utilization, stating length of time and hire rate. Care shall be taken that equipment is not claimed when it is not required or no longer in use.

16.3.3.5.8 EXTRA ITEM NOTIFICATION

The purpose of issuing an extra item notification is to identify extra items in the contract work to obtain a quotation of cost for approval before implementation.

An extra item notification is often initiated by the sponsor. Prior to this, the change shall be 'cost' by the project estimators. If appropriate, the extra item shall be 'negotiated' with the contractor.

16.3.3.5.9 PROGRESS MONITORING

For purposes of measurement for a progress payment, the project manager and the contractor shall mutually agree to a progress 'cut-off date' for which payment shall be made for all work satisfactorily completed to such date. The project manager shall make such calculations as are necessary to verify the contractor's invoices for partial payment and final payment. Where possible, the project manager's final estimate shall be used to substantiate the contractor's partial progress. Where field measures are required, the project manager shall ensure that he has adequate information to permit calculations of the appropriate quantities.

16.3.3.6 PAYMENTS AND VERIFICATION OF INVOICES

Aspects related to the payments to the contractor and verification of the invoices raised by the contractor are covered in this section.

16.3.3.6.1 GENERAL

The project manager shall maintain accurate records to substantiate the work done on a daily basis. These records shall be used for progress and final payment or for claims that may be processed against the contract at a later date. This daily progress of work shall be recorded in a daily progress report.

The information recorded and presented shall provide sufficient details to support the progress and final payments.

The project manager shall review the contractor's invoice, thoroughly comparing it with his own independent calculations of progress or other back-up material. If he finds discrepancies or mistakes in the invoice, he shall attempt to resolve the differences with the contractor. Where such resolution is not possible, the matter shall be referred to the project coordinator or a competent authority that shall make a final decision.

The invoice shall be transmitted to the project coordinator for his approval; after which it will be forwarded to the sponsor's office for processing. In the event that there are differences in the contractor's invoices, the supporting documentation must also be included.

16.3.3.6.2 COMPLETION CERTIFICATE

The purpose of issuing a Letter of completion certificate is to record the stage for purposes of triggering defect liability period, release of holdback and commencement of guarantees.

As a general guide, the project manager shall consider completion of work to be when:

- The contract work is capable of being properly and efficiently used for the purpose intended by the sponsor; or,
- The contract work is ready to be so used by` the sponsor; and
- It is proper for the contract guarantee periods to commence.

Thus, a letter of completion certificate may be requested and issued, notwithstanding outstanding deficiencies and other work which cannot be completed expeditiously for reasons beyond the control of the contractor.

Typically, the contract value of the outstanding work shall not exceed 1% (on a larger contract) to 3% (on a smaller contract).

The project manager shall ensure that all manuals, warranties, guarantees, and as-built drawings are received for safekeeping, prior to issue of a work completion certificate.

The project manger shall arrange for the formal project inspection, by

- the sponsor's representative,
- the project coordinator,
- The contractor's official representative.

The project manger shall be responsible for preparing the Inspection Report for completion of work which includes a list of all deficiencies (defective, faulty, or incomplete work). The project Manger shall establish, with the contractor, the value of all deficiencies listed and will set a date for their completion.

The work will not be considered as complete and taken over by the sponsor until all the temporary works constructed by controller are removed and work site cleaned to the satisfaction to the project manager.

16.3.3.6.3 DOCUMENTATION AND FINAL PAYMENT

Prior to the issuance of the final progress payment certification, and preferably prior to the issue of the Letter of completion certificate, the project manager or site representative will be responsible for making a final check to ensure that:

- The accounts between the sponsor and the contractor are in order. Items that must be considered are: original contract sum, additions and deductions included on change orders, cash allowances, and deductions for liquidated damages and/or back charges.
- All required contractor warranties and guarantees have been supplied.
- All certificates of inspection and acceptance of relocation, modification and new work performed have been obtained from utility companies, public agencies and others.
- All reproducible shop drawings, working drawings, test results or reports, catalogue cuts, suppliers' and manufacturers' data and other as-built information and operating manuals and parts lists have been submitted by the contractor.
- All issued revised contract drawings and specifications have been incorporated into the contract by issuance of change orders.
- There are no outstanding claims by utility companies or other agencies against the contractor or other agencies against the contractor for damages to existing third- party-owned facilities as a result of his construction performance.
- There are no outstanding claims by the contractor against the sponsor.

16.3.3.6.4 LETTER OF FINAL COMPLETION

When all the field work, deficiencies, inspections, and administrative paper work have been completed satisfactorily, the project manager shall arrange for the issue of the letter of final completion.

It shall be noted that once the certificate has been signed and issued by the 'project manager', the contract is terminated and the site engineer ceases to have authority and responsibility under the contract.

16.3.3.7 PROJECT HAND-OVER AND CLOSE-OUT

The closing phases of a construction project involve both field staff (site representatives) and office staff.

The Final Certificate is also to be filed in the project close-out file.

16.3.3.8 INSPECTION AND CONTROL

16.3.3.8.1 GENERAL RESPONSIBILITIES OF THE PIA

The inspection and control role of the PIA will generally be as follows:

- The inspection/ control team will visit the site at intervals appropriate to the progress of construction to familiarize with the progress and quality of the work and to determine in general if the work is proceeding in accordance with the contract documents.

- Based on the team's observations and their evaluation of the contractor's applications for payment, the team will determine the amounts owing to the contractor under the contract and will issue certificates for payment in such amounts.
- The team will have authority to reject work which in their opinion does not conform to the requirements of the contract documents. Whenever the team considers it necessary or advisable, the team will have authority to require special inspection or testing of work whether or not such work is then fabricated, installed or completed.
- The team will review and take appropriate action upon the contractor's submittals such as shop drawings, product data, and samples in accordance with the requirements of the contract documents.
- The team will conduct inspections to determine the dates of completion of work and total completion of work in accordance with the requirements of the contract. He will receive and review written warranties and related documents required by the contract and provided by the contractor and will forward such warranties and documents to the sponsor for his acceptance.

16.3.3.8.2 INSPECTION REPORT

The project manager (and all inspectors) shall carry an inspection diary which shall be written up at the actual location at which work is being inspected. From the diaries, daily reports shall be prepared and submitted daily to the project manager. At every point of inspection, the following information shall be recorded as appropriate:

- The time and date the inspection is carried out
- The tender item to which the work refers
- The precise location of the work and any inspection carried out
- Labour being used
- A description of materials being used
- Weather conditions
- Instructions issued to the contractor's staff and the remedial action or response (if any)
- Visits by testing personnel from outside inspection companies (if any)
- Quantities of daily completed work, as well as quantities of major materials installed/ delivered to the site.
- Verification of extra work claimed and performed
- Details of specific problems on site (accidents, utilities, safety, delays, weather)
- Records of quality assurance
- Any work in progress by 'others' which might affect the contract
- Manpower count by trade for each major operation. Supervisors by name.
- Specific equipment utilized and usage hours for each major operation. All idle or 'down time' of major equipment on job site.

- Record results or note occurrence of any quality tests or other tests performed by the material quality test consultant.

16.3.3.8.3 CONFORMITY OF WORK WITH CONTRACT

In the effort to ensure that the work proceeds in accordance with the contract documents, the project manager and/or inspectors shall be concerned with (but not limited to) the following items:

- The contractor's authority and responsibilities
- The names, positions, addresses and telephone numbers (including home telephones for emergencies) of the contractor's and sponsor's representatives.
- Hours of work
- Safety, accident prevention and emergency plans
- Permits and licenses
- Early actions required of contractor (including contract formalities)
- Correspondence and record-keeping requirements
- Subcontractor approval procedure
- Shop and working drawing processing procedures
- Source and material approval procedures
- Progress schedule requirements
- Maintenance of traffic
- Co-operation and co-ordination with utilities providers
- Progress and final payments to the contractor
- Change order, contractor proposals and claim procedure
- Disputes procedures
- Specific points pertaining to the contract, e.g. addendum special provisions and specifications. Any change in specifications requested by the contractor must be in writing, for approval by the sponsor
- Contractor concerns.

16.3.3.8.4 INSPECTION

The primary purpose of regular inspection of field work is to assure general conformance with contract requirements. Additionally, the inspection function must permit prompt and appropriate corrective action, shall unacceptable materials or workmanship be detected.

When the nature of field inspection work requires specialized knowledge, the project manager shall, through the project coordinator, arrange for the temporary assignment of inspectors, engineers or call for the assistance of the support consultants. Thus, special on-site inspection will be made by personnel experienced in judging compliance with plans and specifications under the direction of the project manager.

The project manager shall ensure that all work performed and all materials incorporated in the work are in general conformance with the contract documents. This requirement includes, but is not necessarily limited to, the following:

- checking contractor materials certification and samples
- inspecting delivered materials and equipment
- inspecting work in progress and in place
- Directing and supervising the sampling of construction materials for laboratory analysis.

When materials or workmanship do not comply with specifications, the project manager shall immediately notify the contractor of the unsatisfactory condition. Failure by the contractor to comply with verbal field instructions shall be reason for the project manager to notify the contractor in writing.

The project manager shall advise the project coordinator if he judges that items of material or equipment require inspection at a location remote from the site. The project coordinator will advise the project manager as to the inspection procedures to be implemented in each case.

16.3.3.8.5 THEORETICAL COMPUTATION OF MATERIAL QUANTITIES

Items such as concrete, excavation, etc. are measured and paid based on volume/ quantity. Therefore, the actual pay quantities shall be arithmetically based upon accurate dimensions determined from the working drawings or field survey. The computations shall be prepared in a conventional manner, using standard calculation sheets which are neat, legible, dated, signed and assigned a pay number and title. Reference shall be made to applicable contract and working drawings. Sketches shall be attached to supplement the calculations. All computations shall be independently checked before comparing with the contractor's calculations.

Final quantities shall be computed, if possible, before work commences on the item, thereby enabling realistic progress payments and thus preventing overpayment.

16.3.3.8.6 DIFFERING SITE CONDITIONS

The contractor shall immediately notify the project manager in writing, if he encounters what he believes to be:

- a subsurface or latent physical condition at the site differing materially from those indicated in the contract, or,
- Unknown physical conditions at the site, of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the contract.

The project manager shall:

- promptly investigate and document the undisturbed conditions,
- require the contractor to document fully and in advance all reasons to support his position for alleged differing site conditions before proceeding with processing of the request for determination,

In the case of concurrence with the contractor's position, the site representative will request the contractor's proposal for cost-time adjustment and notify the project manager, who will notify the sponsor. In the case of denial, the contractor shall be advised in writing that his request is denied. This letter must explain the basis of the denial. Immediate action shall be required to avoid delays.

16.3.3.8.7 SUBSTANTIAL AND TOTAL PERFORMANCE INSPECTIONS

The total performance inspection shall be planned ahead of time in order to effectively utilize the period for defects liability.

The following procedure is recommended, to achieve this.

- As the contract approaches completion, the contractor shall be reminded that he shall be preparing for final inspection by cleaning up the site, and completing the miscellaneous small bits and pieces of work that remain unfinished.
- Notice of 'approaching project completion' and the required final inspection shall be written and the arrangement noted in the site meeting minutes.
- A checklist of inspection items shall be prepared.
- In the event that there is a third party approval required, such as by a government agency in addition to the sponsor, a preliminary inspection (not formal) shall be held by the project manager and the third party to identify any concerns of the third party.
- When the contractor informs the project manager that he has finished all work and cleaned up, an informal final inspection shall be carried out. The contractor and project manager shall be represented by at the least a superintendent and a senior inspector.
- The contractor shall be provided with a copy of the resulting informal deficiency (if any) list. The contractor shall be asked to estimate the time to complete and thus set the date for the final inspection.
- The sponsor and third party, if any, shall be advised of final inspection date and time.
- Inspection participants shall be advised of the length of time required for the inspection.
- Final inspection shall be held to review work over entire project in detail.

  Note: it is prudent, where third party approval is required, to obtain progressive acceptance and approval in writing, as the work progresses.
- The contractor shall be formally advised of results of the final inspection; the deficiencies and the amount of hold back from the substantial completion payment.
- Copies of final inspection report shall be issued to the sponsor (and third party if any) stating items mentioned above.
- Issue of substantial completion payment shall be initiated.
- Correction of deficiencies shall be ensured; when deficiencies are reported corrected, re-inspection shall be carried out and total performance certificate shall be issued, along with starting the warranty period.
- Issue of total performance payment (upon receipt of statutory declarations) shall be initiated

16.3.3.9 UTILITY CO-ORDINATION

In the event there are contractor-utility agency difficulties in cooperation, progress or scheduling, the site representative shall effect prompt resolution of same to keep the work on schedule.

The affected utility agency may have a representative at the construction site to perform the following:

- Inspect the work performed by utility forces and their contractors
- Inspect work performed by the project contractor

Representatives of utilities and agencies shall be allowed to observe and inspect work applicable to their interests.

The site representative shall substantiate the progress and completion of all construction work performed and inspection services rendered by utility and agency forces.

Shall any live utility be interrupted, disturbed or in any way damaged during construction; the site representative shall immediately contact the affected utility representative.

16.3.3.10 ENVIRONMENTAL PROTECTION

The contract specifications may set certain limits for noise and vibration levels and spell out general pollution and dust control requirements. These requirements, as well as those covering discharge and disposal of construction materials and general cleanliness of the job site, shall be enforced. In order to evaluate the contractor's performance in this respect, particular attention shall be paid at all times to the general appearance and housekeeping of the job site. The contractor shall be notified immediately of any unacceptable condition.

17 ANNEXURE 6 – BORROW PIT SITING, OPERATION & CLOSURE GUIDELINES

This section includes the guidelines to be followed while selecting the site for borrow pit. Borrow pit is the source of earth filling for the project. The section also includes guidelines related to the operation and closure of the borrow pit.

17.1 PRIOR TO BORROW PIT OPERATION COMMENCEMENT

The factors to be considered before selecting the borrow pit are:

- The borrow pits should be selected in such a way that ensures minimal vegetation disturbance.
- The area of the pit should be surveyed and plotted on a map.
- Clear vegetation with the dozer blade raised above the soil surface in order to preserve vegetation rootstock.
- Strip the top 250mm of topsoil and conserve in piles not more than 2 metres in height.
- Spread cleared vegetation over the topsoil stockpiles. This helps to keep the topsoil seed bank viable.
- The pit should be designed to be self draining.
- The depths in borrow pits shall be regulated so that the sides will not be steeper than 5%, from the edge of the final section.
- Agricultural areas will not be used for borrowing of materials, unless requested by the landowner for making ponds or for lowering the land for making it irrigable.
- No borrow area will be opened without permission of the authority in charge of granting environmental approvals.
- Borrow pits will not be dug continuously in a stretch. The location, shape and size of the designated borrow areas will be as approved by the Authority referred above.
- The right to create borrow pits is generally negotiated between the contractor and individual landowners. Farmers often sell topsoil for fill materials on assumption that the topsoil will be replenished during the next flood. The contractor should preferably obtain earth from sites at proposed / potential fish ponds or alternatively they should minimize the loss of valuable agricultural land by removing a thin layer of soil from a wide area. If the fill materials are taken from farm topsoil or upper layer, the contractor should ascertain that the silt deposition is sufficient to rehabilitate the farmland within three years and the deposited soil is not at the expense of the fertility of adjacent properties.

17.2 REHABILITATION OF BORROW PITS

While rehabilitating borrow pits the following aspects need to be adhered to:

- The rehabilitation work would require the use of a Bulldozer. Also care has to be taken that the spacing between tines should be minimal so that it provides comprehensive ripping.
- In order to enable rip lines hold up after heavy rainfall, deep ripping is required instead of simple scarification.

- Ripping to be done along contour, not up and down slope which leads to enhanced erosion.
- Topsoil to be re-spread across borrow pit evenly.
- Minimize bowl effect within pit, i.e. attempt to reduce the depth of the pit as far as is practicable to minimize ponding. Surface ponding reduces the efficiency of re-vegetation, leading to bare patches or poor re-growth and potential erosion.
- Around the perimeter of the borrow pit, drag in undisturbed vegetation from up to 5m to break up edge-effect and promote seed distribution and mulching.
- All rubbish, equipment, etc, to be removed from the borrow pit.
- Clearly identify the borrow pits which have to be left open for future work.

17.3 RESPONSIBILITIES OF VARIOUS ENTITIES

17.3.1 ENVIRONMENTAL AUTHORITY

- Ensures that the rehabilitation of borrow pits is undertaken in an appropriate manner. Monitors the success of the rehabilitation.
- Inspects every borrow area location prior to approval.

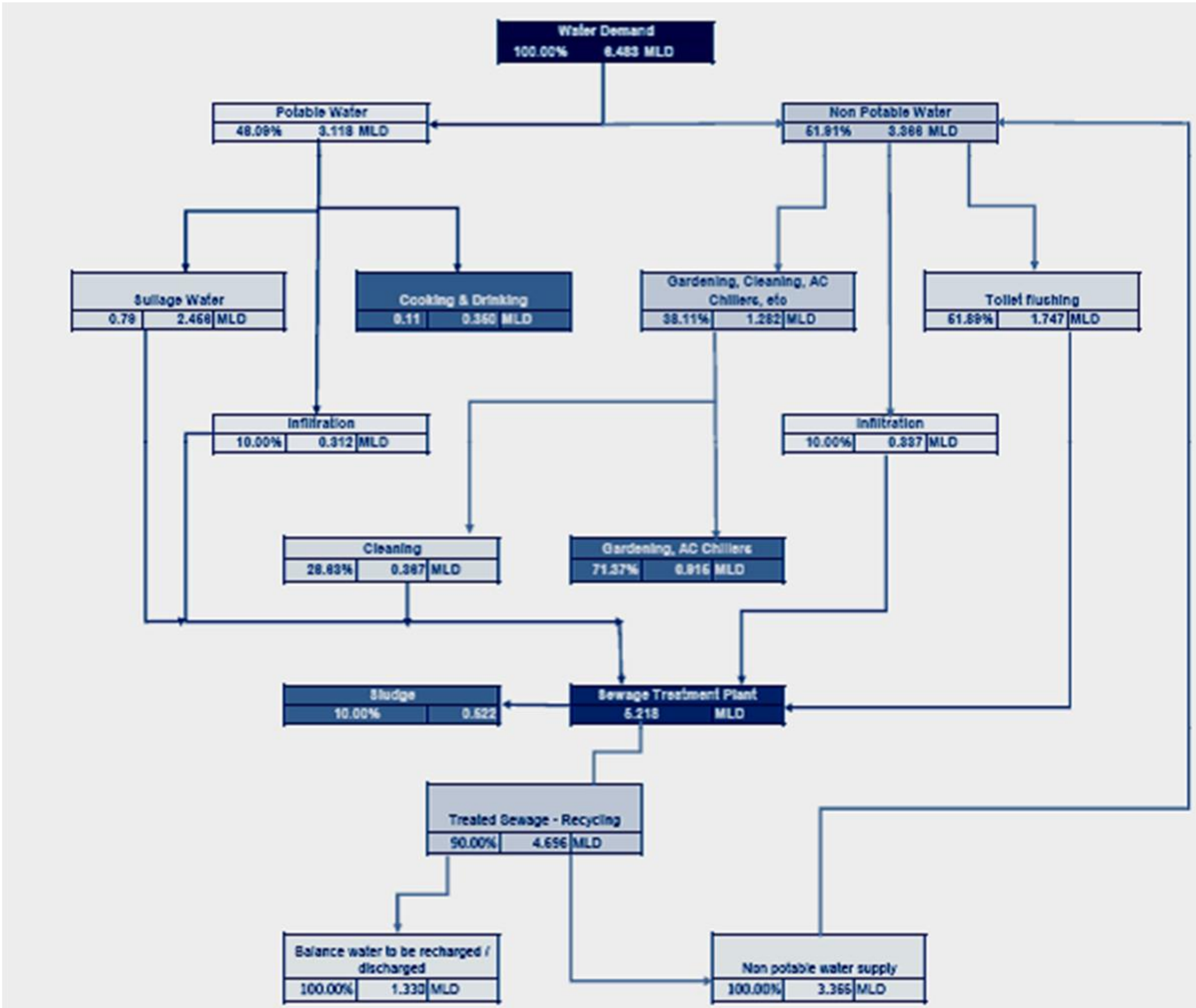
17.3.2 CONTRACTOR

- Arrangement for locating the source of supply of material for embankment and sub-grade as well as compliance to environmental requirements, as applicable, will be the sole responsibility of the contractor.
- The contractor will not use any of these locations for borrowing: within and up to 1000m either side of Reserve Forest/ Ecologically sensitive areas.
- Locations identified by the contractor shall be reported to the Authority in charge of granting the environmental approvals, as well as the corresponding authorities of the project implementing agency.
- Borrow pits shall be rectangular in shape with one side parallel to the centre line of the road and generally maintain the form of the land;
- No borrow pits shall be dug within 5 m of the toe of the final section of the road embankment,
- Borrow pits shall be dug continuously. Ridges of not less than 8m width shall be left at intervals not exceeding 300m and small drains should be cut through the ridges to facilitate drainage;
- To ensure efficient drainage, the bed level of the borrow pits shall, as far as possible, slope down progressively towards the nearest cross drain, if any, and shall not be lower than the bed of the cross-drain,
- When it becomes necessary to borrow earth from temporarily acquired cultivable lands, the depth of borrow pits shall not exceed 45 cm. The topsoil to a depth of 15 cm shall be stripped and stockpiled for later rehabilitation of the pit. Thereafter, soil may be dug out to a further depth not exceeding 30 cm and used in forming the embankment. Once the borrow pit is no longer required, the stockpiled top soil shall then be spread back on the land;

17.4 CONTROL MEASURES

- Construction vehicles and equipment will be maintained and refueled so that spillage does not contaminate the soil.
- Fuel storage and refueling sites will be kept away from drainage channels and important water bodies.
- Planning of haul roads should be carried out to avoid agricultural areas.
- The stockpiles will be covered with gunny bags or tarpaulin. It will be ensured by the contractor that the topsoil will not be trafficked either before stripping or when in stockpiles.
- Unutilized debris material shall be suitably disposed off by the contractor; either through filling up of borrow areas created for the project or at pre-designated dump locations, subject to the approval of the authority in charge of granting the environmental approvals.
- Recommended mitigation measures for rehabilitation and restoration of borrow areas are:
    - if used for agriculture, stockpiled topsoil should be returned to the borrow pit;
    - if used as a fish pond, the banks should be stabilized by compaction and any additional excavated material shall be disposed of in accordance with good operating practice;
    - for all other uses, stockpiled topsoil should be returned to the borrow pit and all worked areas stabilized through re-vegetation using local plants.
- Sediment shall be controlled at each site by ensuring that base of the borrow pit drains into a sediment trap prior to discharging from the site.

18 ANNEXURE 7 – WATER BALANCE SCHEME PROPOSED FOR THE KALIAKOIR HI-TECH PARK



19 RESPONSE SHEET OF COMMENTS RECEIVED ON DRAFT FINAL REPORT

Financial, Market & Economic analysis related comments	Response
Standardize Benchmarking	Section 5.2.3
Phasing logic to be explained and triggers also	Section 5.3.4.1
Inclusion of intangibles like environment using shadow pricing in economic analysis	Section 8.4
Inclusion of demonstration effect in Economic Analysis	Section 8.4
Capturing benefits due to forex in economic analysis	Section 8.4
Calculation of economic IRR	Section 0
Capturing benefits of differential impact on marginalized groups	Section 8.4
Discussion of eco analysis with WB expert to be nominated	Section 8.4
Presentation on discussions with Investors and Lenders	Section 5.2.2
Roundtable with domestic lenders	Section 12 (Annexure 1)
Detailed construction cashflows on debt and equity from stakeholders	Section 9.4.1.1, Section 9.4.1.2 & Section 9.4.1.3
Include details of Interim report and PFR as relevant	Details included across report

Technical design related comments	Response
Comments from BEPZA	
Landfill design standards from WB to be adhered to & GW monitoring wells to be indicated with the landfill	Section on landfill standards included in the report, drawing annexed to the report (Section 15)
Adequacy of design for climate change	Section 6.2.1
Show schematic locations of ground water monitoring wells on landfill design drawings.	Groundwater monitoring wells indicated on the solid waste mgmt/ landfill drawings
Waste segregation and corresponding treatment system recommended	Section on general methodology for waste segregation and corresponding treatment inserted in the report (Section 6.5.5)
Illustration of consideration of the peak factor for sewage network	Explicit table indicating the peak factor incorporation prepared and inserted in the report (Section 0)

Environmental clauses in the bid documents to be more stringent	Section 13
Comments from World Bank/IFC	
Landfill numbers to be rectified, since the amount of landfill material will not increase beyond a certain point	Solid waste addition to landfill number revised. Active life according to the same revised (Section 15).
Water Balance scheme to be added to the report	Annexed the water balance scheme (Section 18)
FABR is highly specific - more widely available technology should be included in the report	Write up on the alternate technology to the FABR has been included in the PFR, the corresponding design changes included (Section 0).
Borrow pit guidelines to be inserted in the reports	Section 17
Manpower required for O&M of environmental infrastructure	Table showing the manpower according to various components of the environmental infrastructure in Section 6.5.4.
Extraction of environmental infrastructure related costs	Component wise break up of environmental infrastructure components included in the report (Section 6.6).
Process for obtaining approval from the Bangladesh Railways for construction of the RoB to be mentioned in line with the recommendation of an RoB included in KHTP report	Write up indicating the time line required for obtaining such approval from the BR to be included in the report (Section 6.3.3).
e-waste related recommendation to be clearer	Section on the e-waste treatment prepared and inserted in the report in the relevant section, building up on the recommendations given in the PFR (Section 6.5.3.1).

PPP related comments	Response
Highlight tenor issue	Section 7.3.4
Implementation roadmap	Section 0
Risk allocation matrix for each PPP option	Section 9.4.1.1, Section 9.4.1.2 & 9.4.1.3
Third PPP option for KHTP	Section 9.4.1.3
Transaction docs outline for KHTP	Pending

20 LIST OF DATA SOURCES/REFERENCES

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- PSDSP : Gender Equality Study, CIDA (2006)
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- PwC internal database and research
- Rites Ltd., Environmental Impact Assessment – IT Park Phase –II, Delhi Metro Rail Corporation Ltd, February 2006
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- Special Economic Zones: Global Experience and Best Practices, FIAS (2004)
- Stakeholder Consultations with various industry associations and industries and financial institutions

DISCLAIMER

The primary purpose of this Draft Report and its contents is to present the key findings and recommendations on the feasibility of the proposed Kaliakoir Hi- Tech Park.

Our assessment and opinions are based on the facts and circumstances provided/collected during our meetings with the officials of BEPZA, BCC, DFID, the World Bank and research from sources in public domain held to be reliable. If any of these facts, assumptions or representations is not entirely complete or accurate, the conclusions drawn therein could undergo material change and the incompleteness or inaccuracy could cause us to change our opinions. The assertions and conclusions are based on the information available at the time of writing this report and PwC will not be responsible to rework any such assertion or conclusion if new or updated information is made available.

PwC disclaims all liability to any third party who may place reliance on this report and therefore does not assume responsibility for any loss or damage suffered by any such third party in reliance thereon.

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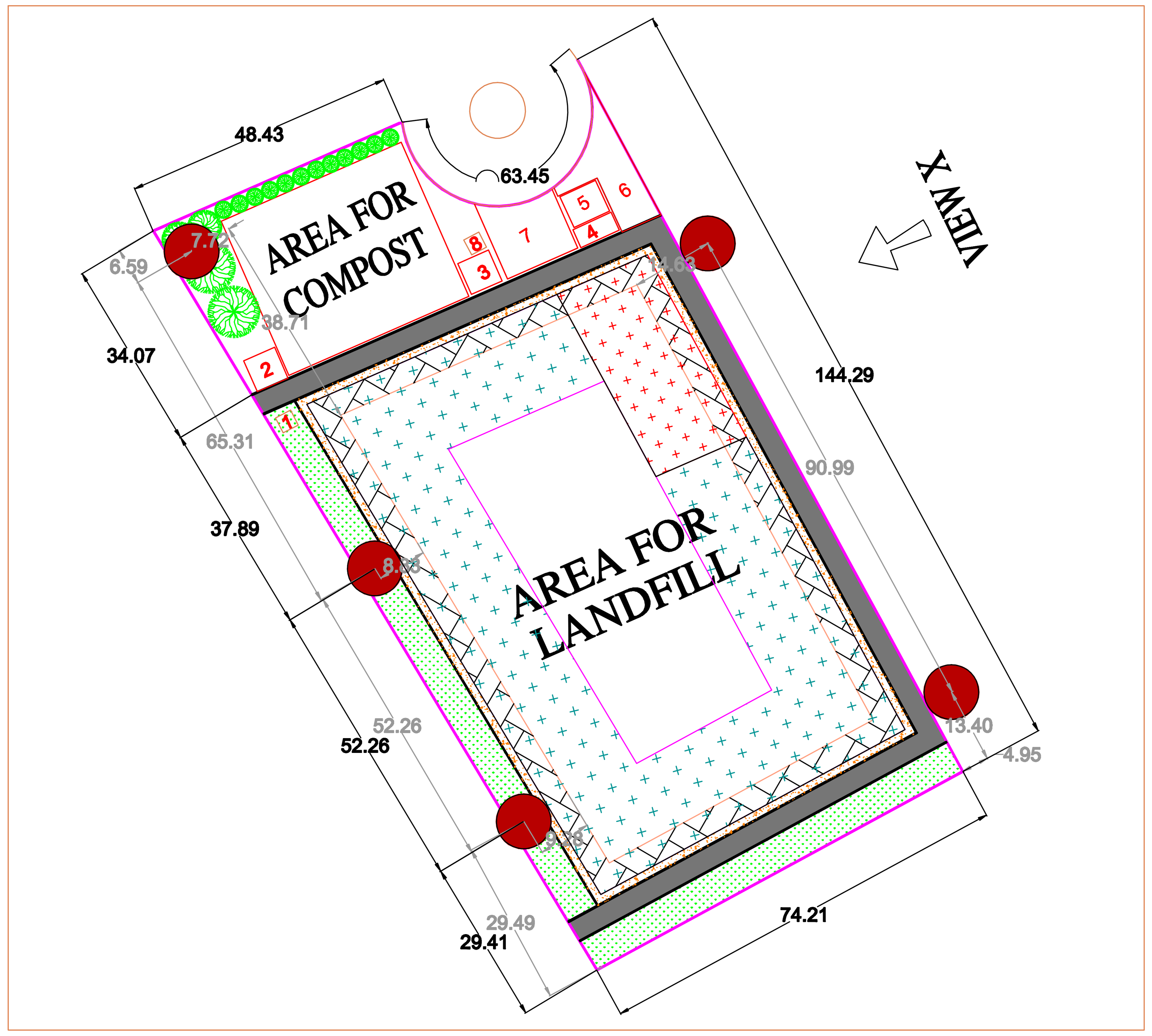
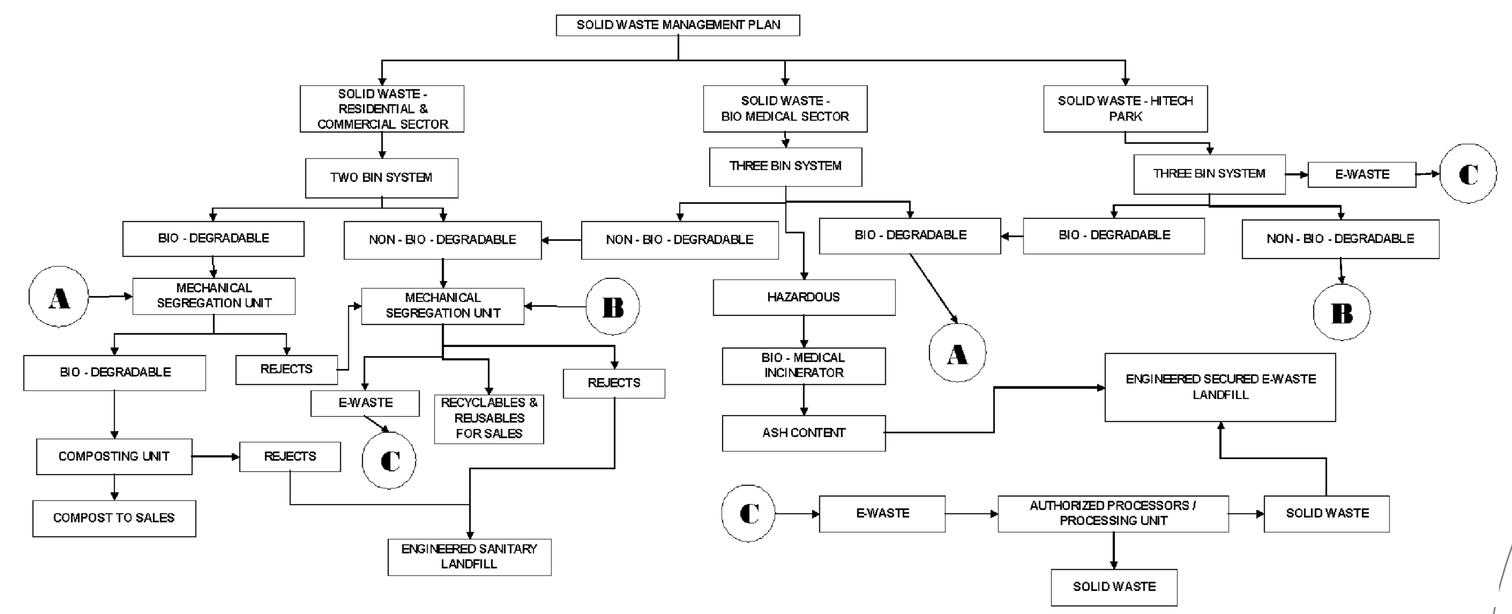
NOTES:-

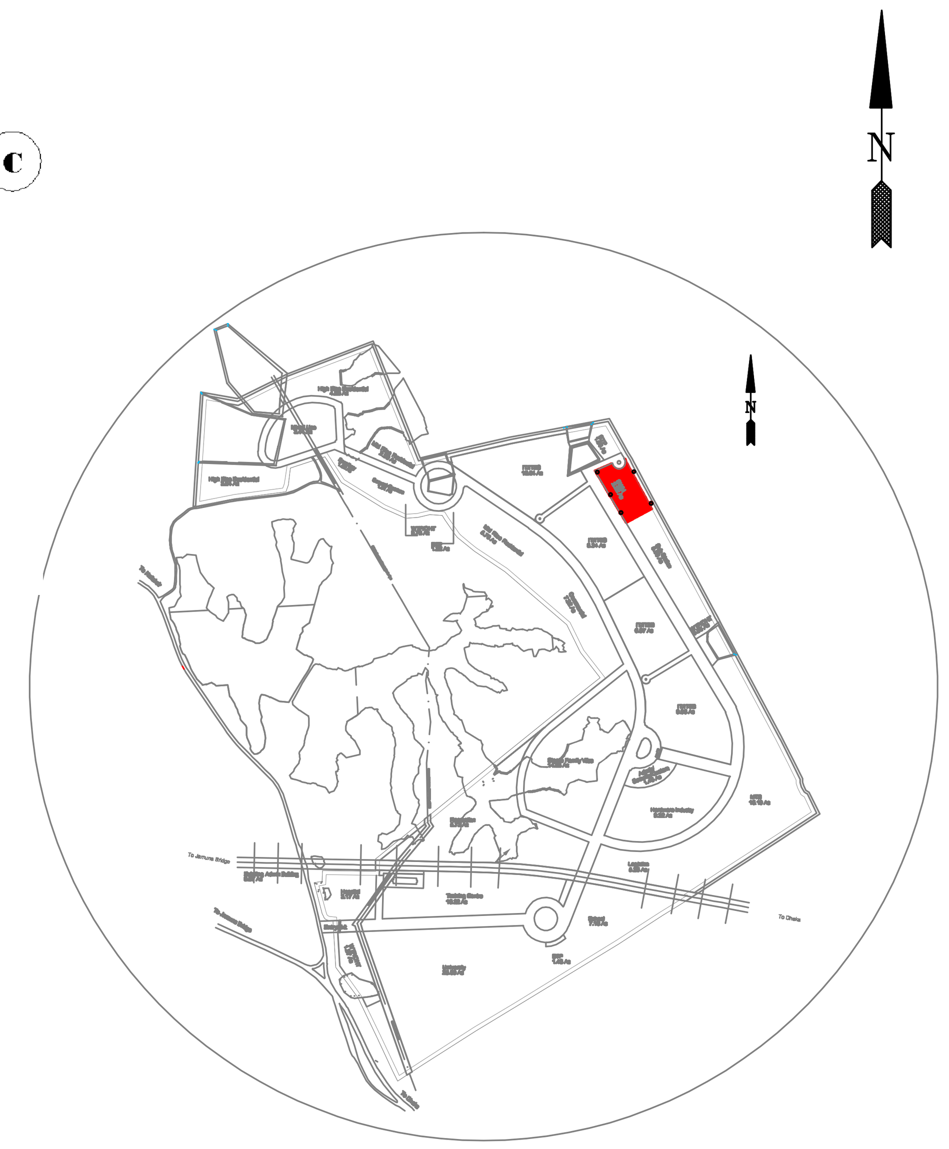
1) ALL DIMENSIONS ARE IN METRES

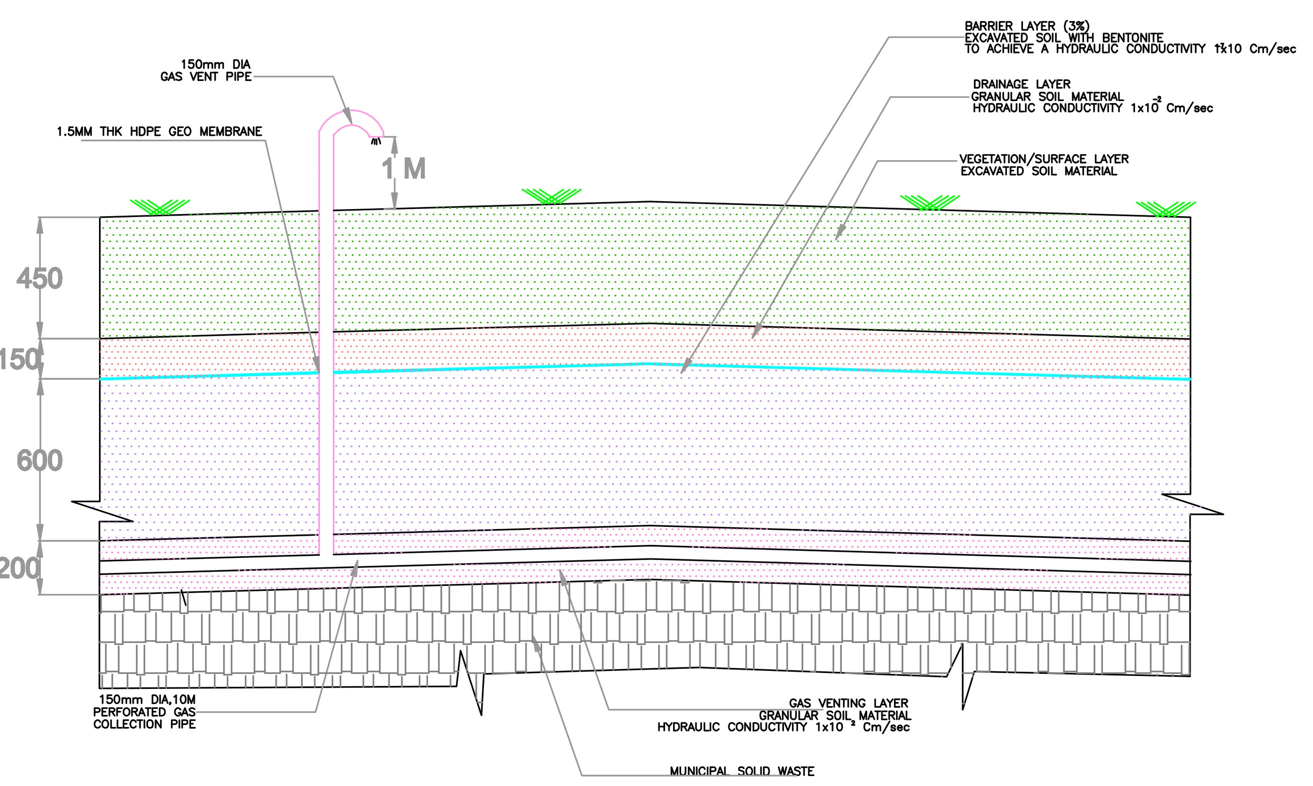
LEGEND :

- MSW LANDFILL TOP SLOPE
- HAZARDOUS LANDFILL TOP SLOPE
- LANDFILL BOTTOM SLOPE
- BUND
- GREENERY
- ROAD
- 6" Borehole -Ground Water Monitoring









TYPICAL CROSS SECTION OF FINAL COVER SYSTEM

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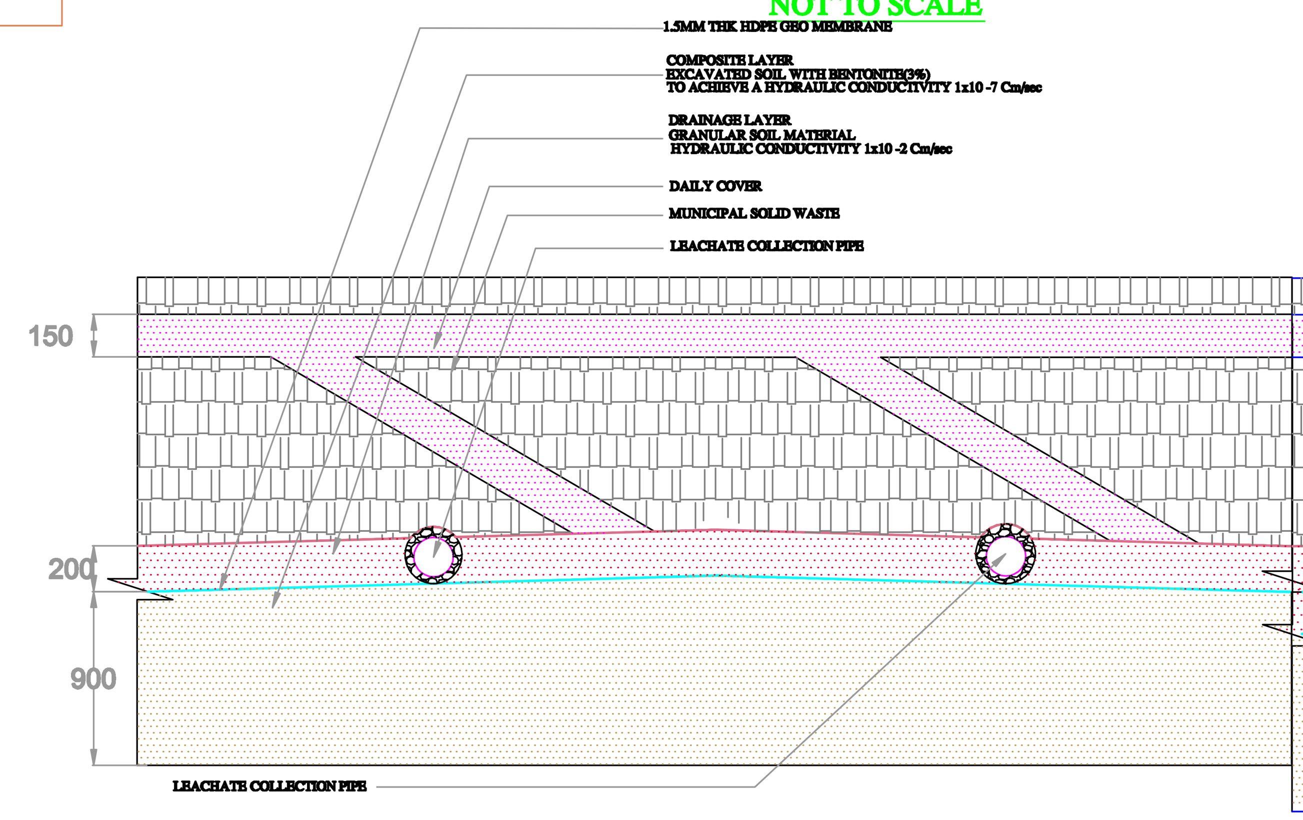

TYPICAL CROSS SECTION OF COMPOSITE LINER SYSTEM

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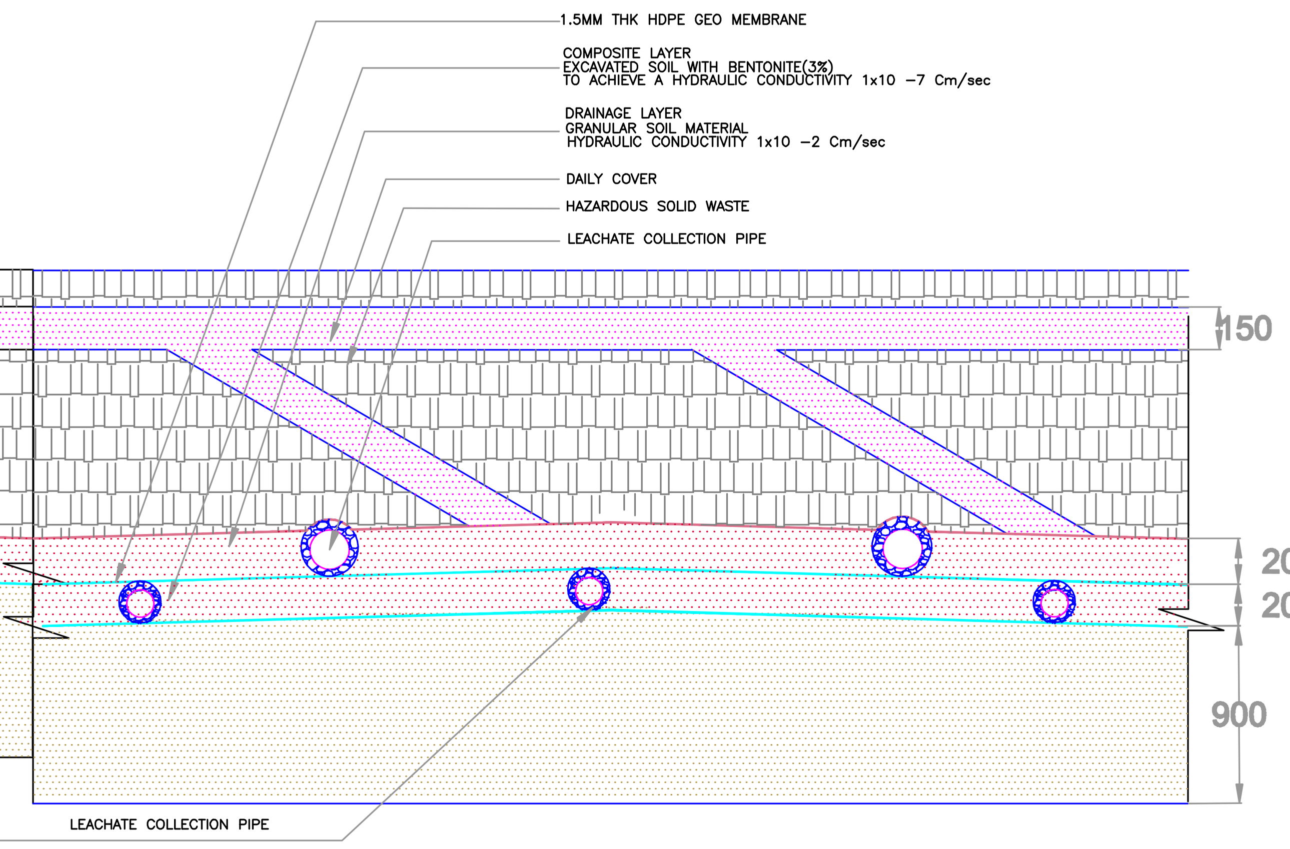

TYPICAL CROSS SECTION OF HAZARDOUS LAND FILL LINER SYSTEM

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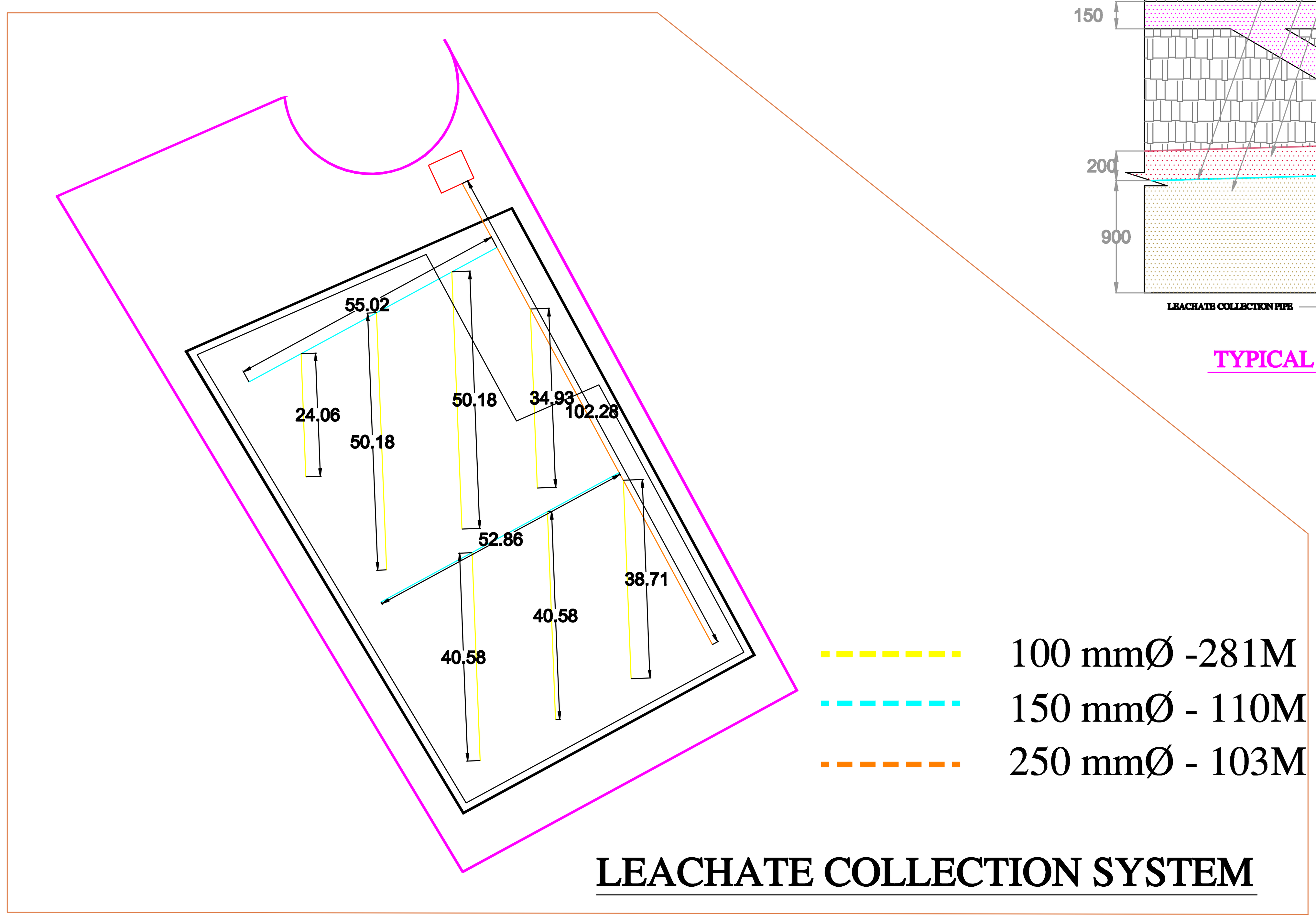


LEACHATE COLLECTION SYSTEM

	DESCRIPTION	SIZE (M)	AREA (Sq.M)
1	- SECURITY ROOM	3.00 x 3.00	9.00
2	- OFFICE ROOM	6.00 x 6.00	36.00
3	- CHANGE ROOM & TOILET	6.00 x 6.00	36.00
4	- TEMPORARY HOLDING AREA	7.50 x 3.50	26.25
5	- LEACHATE COLLECTION TANK	7.00 x 6.00	42.00
6	- COVER MATERIAL SORAGE		167.10
7	- LEACHATE PRE -TREATMENT AREA		164.40
8	-ELECTRICAL PANEL ROOM	3.00 x 3.00	9.00

REV No.	DESCRIPTION	DATE	SIGN

CONSULTANT :-

Mahindra Consulting Engineers Ltd. Chennai

PREPARED	: M.PRIYA	16.02.2009
CHECKED	: A.SRIVASAN	16.02.2009
APPROVED	: C.S.NARAYANAN	16.02.2009

CLIENT :-

DEPARTMENT FOR INTERNATIONAL DEVELOPMENT

PROJECT TITLE

ECONOMIC ZONES DEVELOPMENT

LOCATION: KALIAKOIR, BANGLADESH

DRAWING TITLE

LAYOUT FOR SOLID WASTE MANAGEMENT

CHECK SCALE (print may be photo-reduced)

PROJ.No. P723

JOB No :

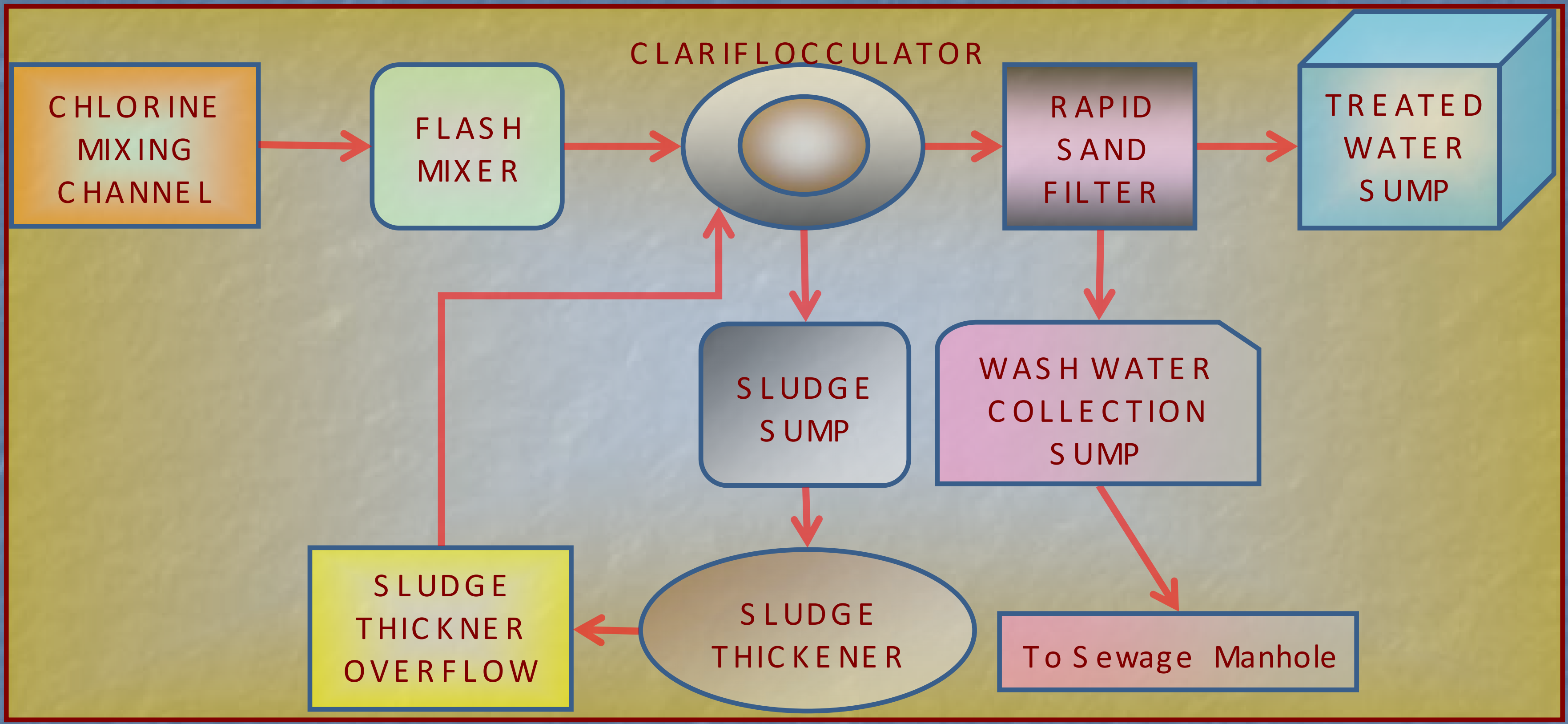
SCALE:- 1: 750

DRAWING No.

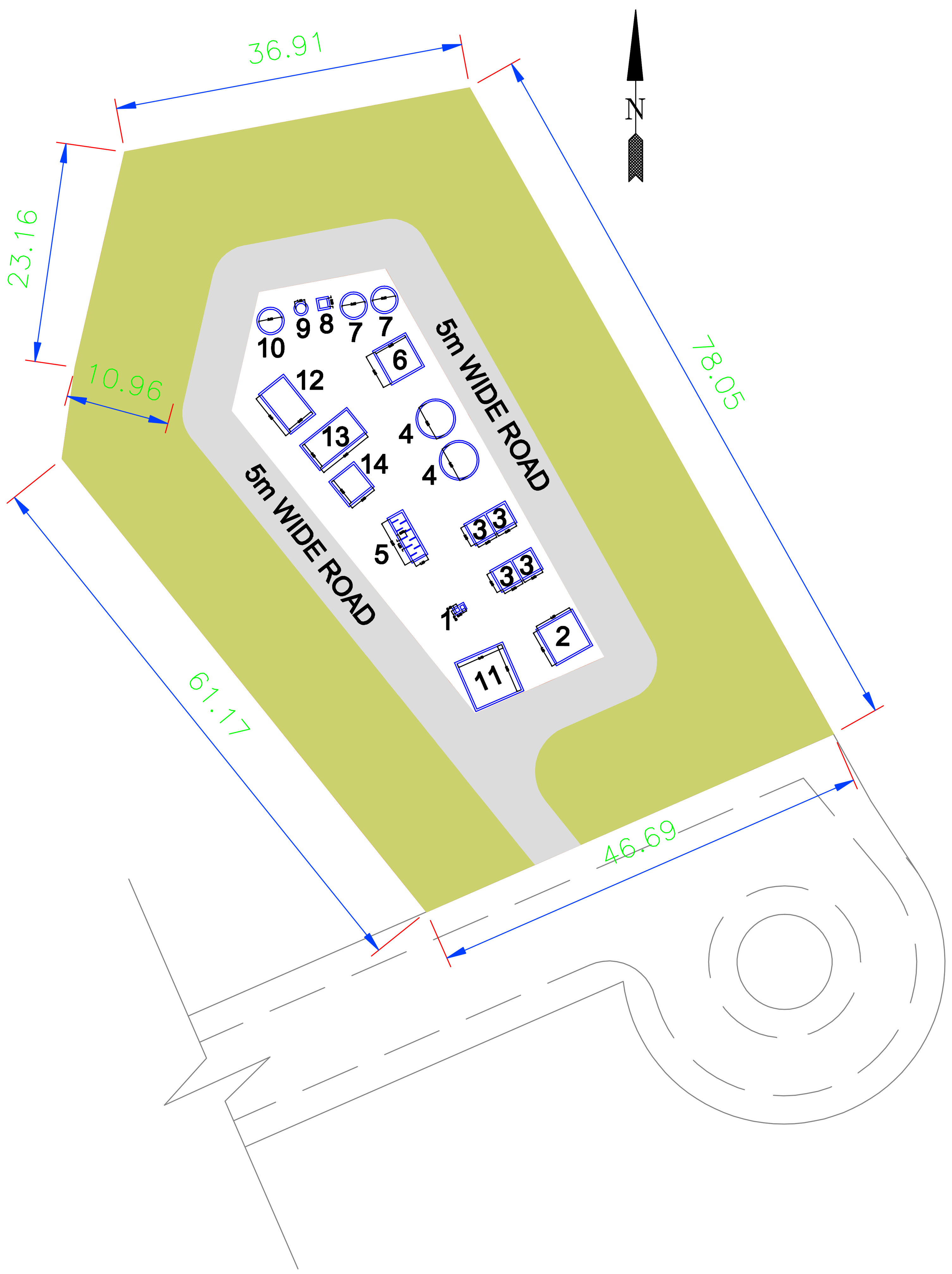
MACE-P723-KAL-MSW-001

FILE NAME :SWM/BANGLADESH/KALIAKOIR

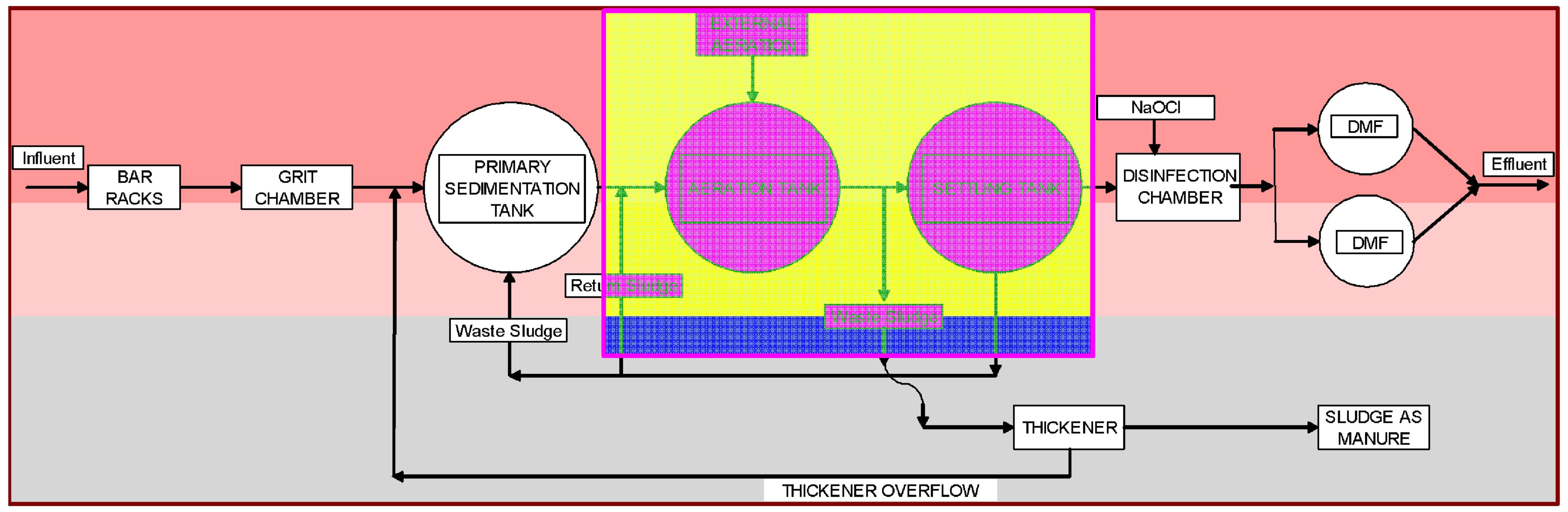
WATER TREATMENT PLANT – PROCESS FLOW DIAGRAM



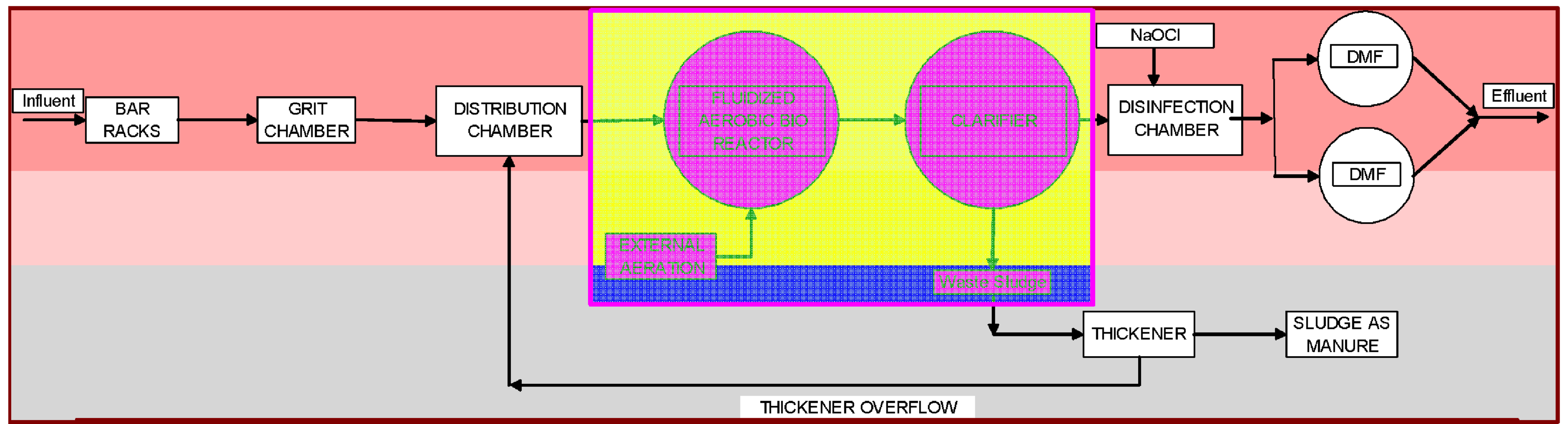
KEY PLAN



SEWAGE TREATMENT – ACTIVATED SLUDGE PROCESS



SEWAGE TREATMENT – FLUIDIZED AEROBIC BIO REACTOR PROCESS



Note: **Highlighted secondary treatment portion is the influencing factor for a sewage treatment plant and hence can vary accordingly**

S.NO.	DESCRIPTION	SIZE
1	BAR SCREEN CHAMBER	0.4m L X 0.4m W 1.8m T.D
2	COLLECTION TANK	4m L X 4m W X 5.3M T.D
3	FLUIDIZED AEROBIC BIOLOGICAL REACTOR	2.2m L X 2.2m W X 6m T.D
4	CLARIFIER	3.8m Dia X 3.8m T.D
5	ZIG ZAG TANK	5m L X 1.5m W X 2m T.D
6	CLARIFIED WATER TANK	3.7m L X 3.6m W X 4.3m T.D
7	DUAL MEDIA FILTER	2.5m Dia X 2m T.D
8	SLUDGE HOLDING TANK	0.9m L X 0.9m W X 3.3m T.D
9	THICKENER	1.1m Dia X 3.8m T.D
10	ACTIVATED CARBON FILTER	2.5m Dia X 2m T.D
11	TERMINAL PUMPING STATION	5.2m L X 5.1m W X 7.2m T.D
12	SHED FOR BLOWERS	3m L X 6m W X 3m T.D
13	SHED FOR CENTRIFUGE	5m L X 3m W X 3m T.D
14	MCC ROOM	3m L X 3m W X 3m T.D

Notes :

1. ALL DIMENSIONS & LEVELS ARE IN METRE.

Total Area : 262.63 Ac

REV No.	DESCRIPTION	DATE	SIGN

CONSORTIUM MEMBERS:

Price Waterhouse Coopers
IIFC , Bangladesh
DevConsultants,Bangladesh

CONSULTANT:

Mahindra Consulting Engineers Ltd.
Chennai

PLANNING:	M.Siraj	10.12.2008
CHECKED 1:	A.Srinivasan	11.12.2008
CHECKED 2:	A.L.Suresh Kumar	12.12.2008
APPROVED:	C.S.Narayanan	15.12.2008

PROJECT TITLE :

Economic Zones Development

LOCATION:

KALIAKOIR, BANGLADESH

DRAWING TITLE:

SEWERAGE TREATMENT PLANT LAYOUT
INDUSTRIAL AREA

CLIENT:

Department For International Development

PROJECT CODE : P 723 JOB NO:

CHECK SCALE (print may be photo-reduced)

5m 10m 15m

SCALE : 1:400 A1 Landscape

DRAWING No : R0

MACE-P723-KAL-STP-INS-017

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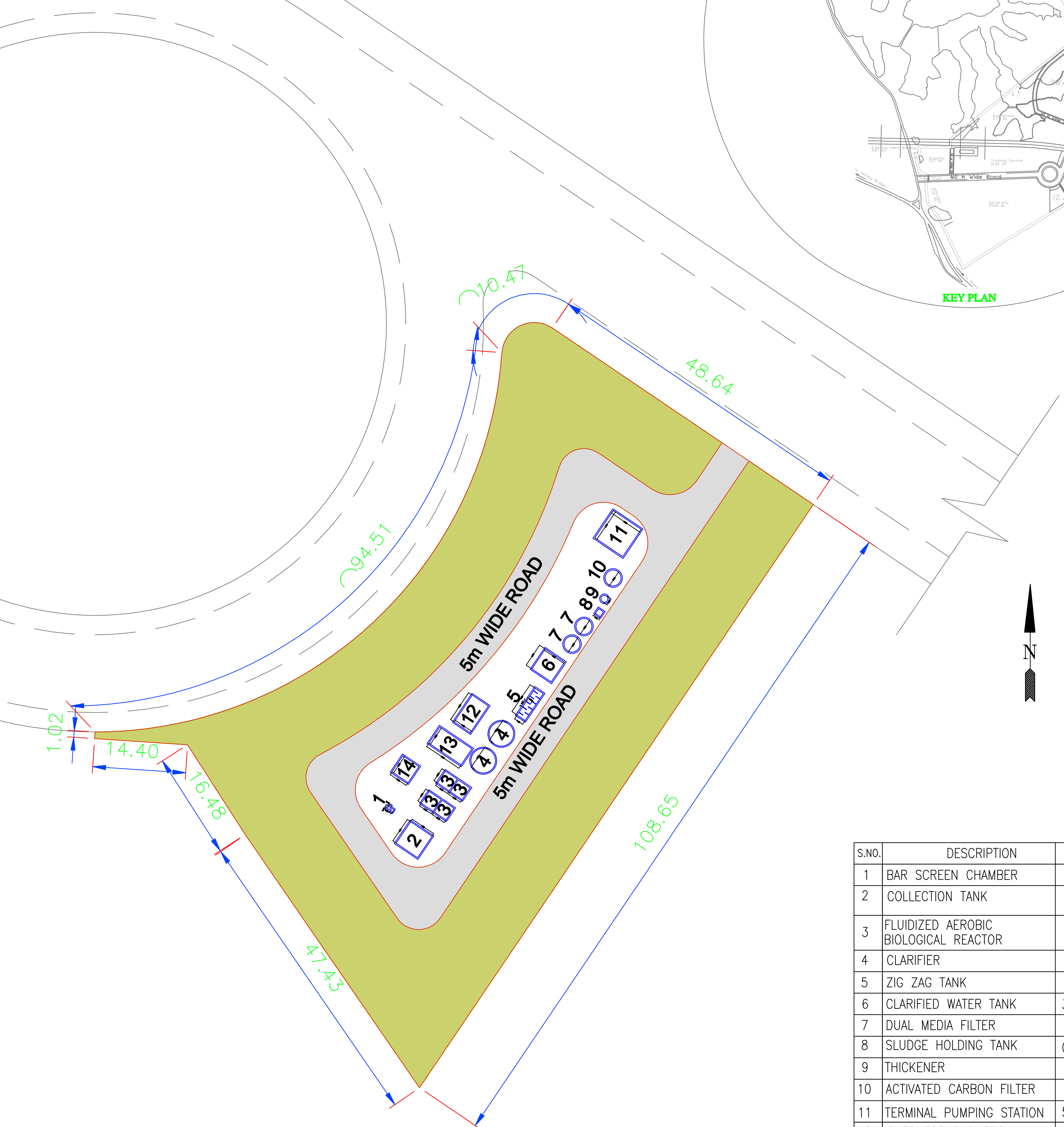
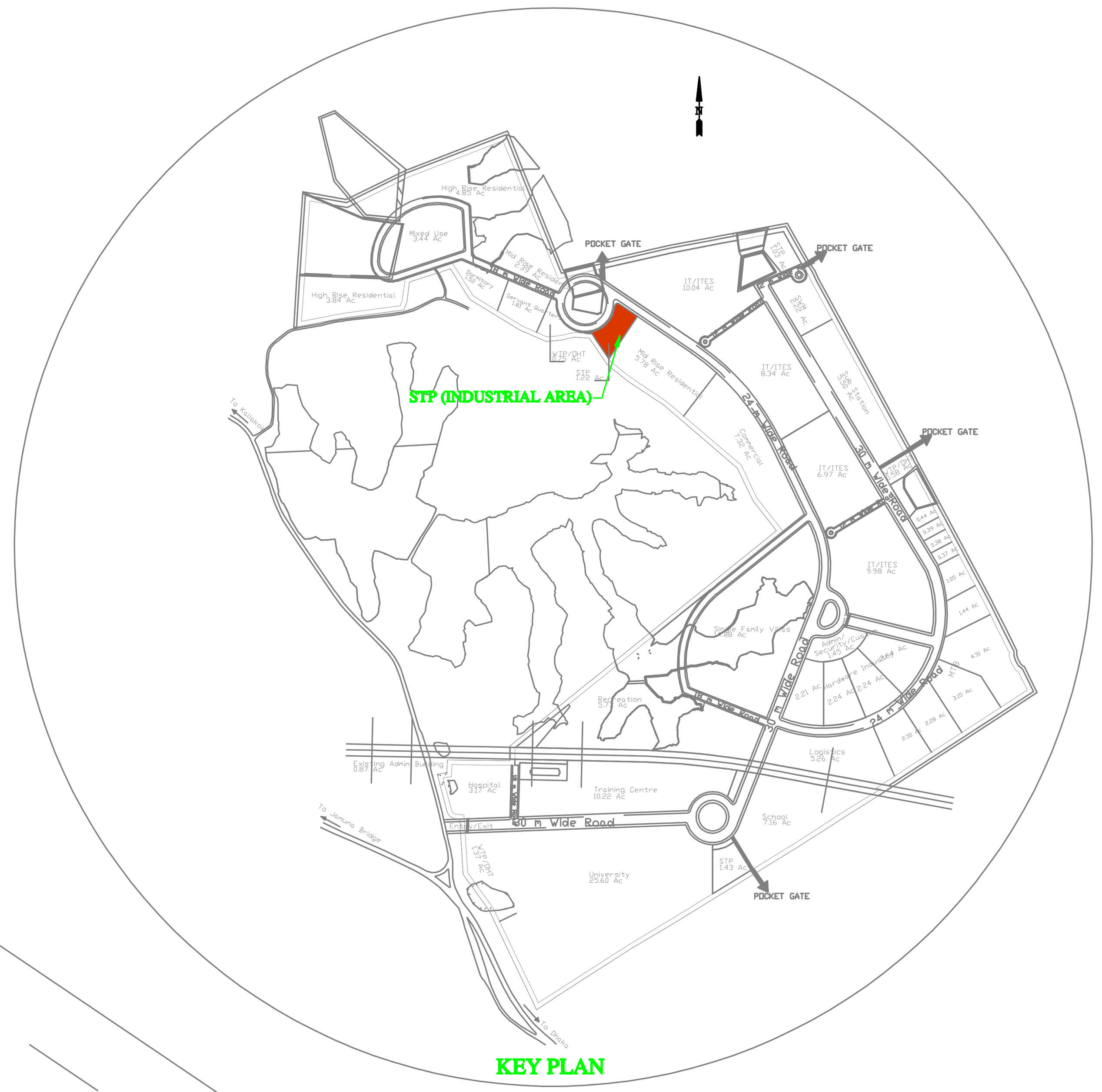
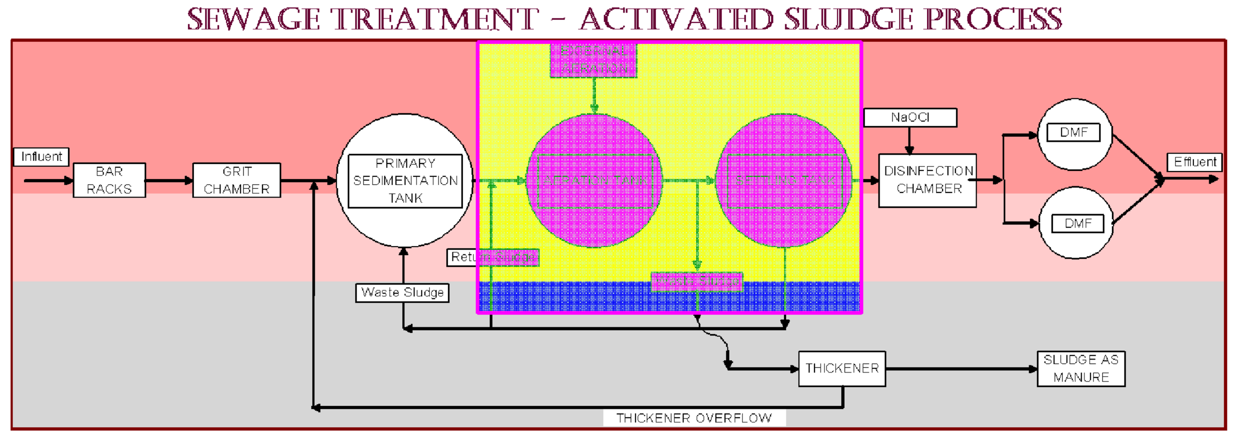
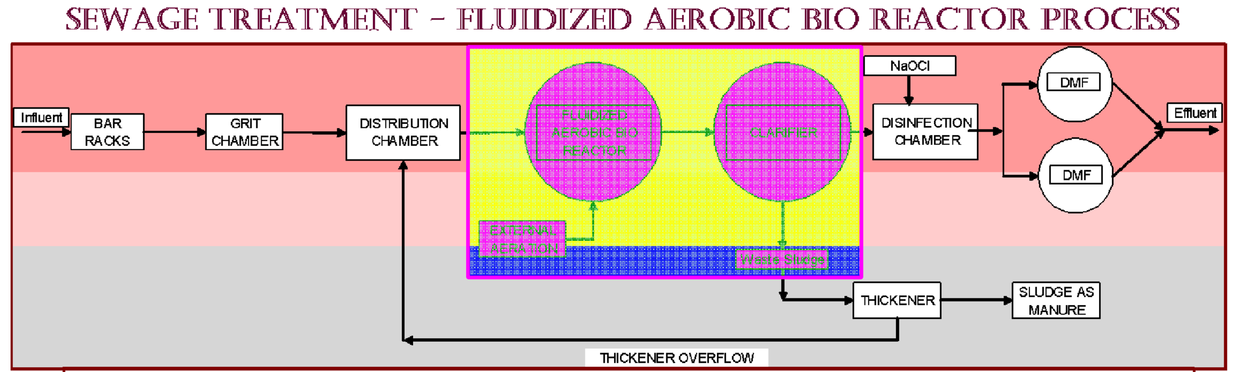




SEWAGE TREATMENT - ACTIVATED SLUDGE PROCESS



SEWAGE TREATMENT - FLUIDIZED AEROBIC BIO REACTOR PROCESS



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Price Waterhouse Coopers
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CONSULTANT:

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PLANNING:	M.Siraj	10.12.2008
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APPROVED:	C.S.Narayanan	15.12.2008

PROJECT TITLE :

Economic Zones Development

LOCATION:

KALIAKOIR, BANGLADESH

DRAWING TITLE:

SEWERAGE TREATMENT PLANT LAYOUT
RESIDENTIAL AREA

CLIENT:

Department For International Development

PROJECT CODE : P 723 JOB NO:

CHECK SCALE (print may be photo-reduced)

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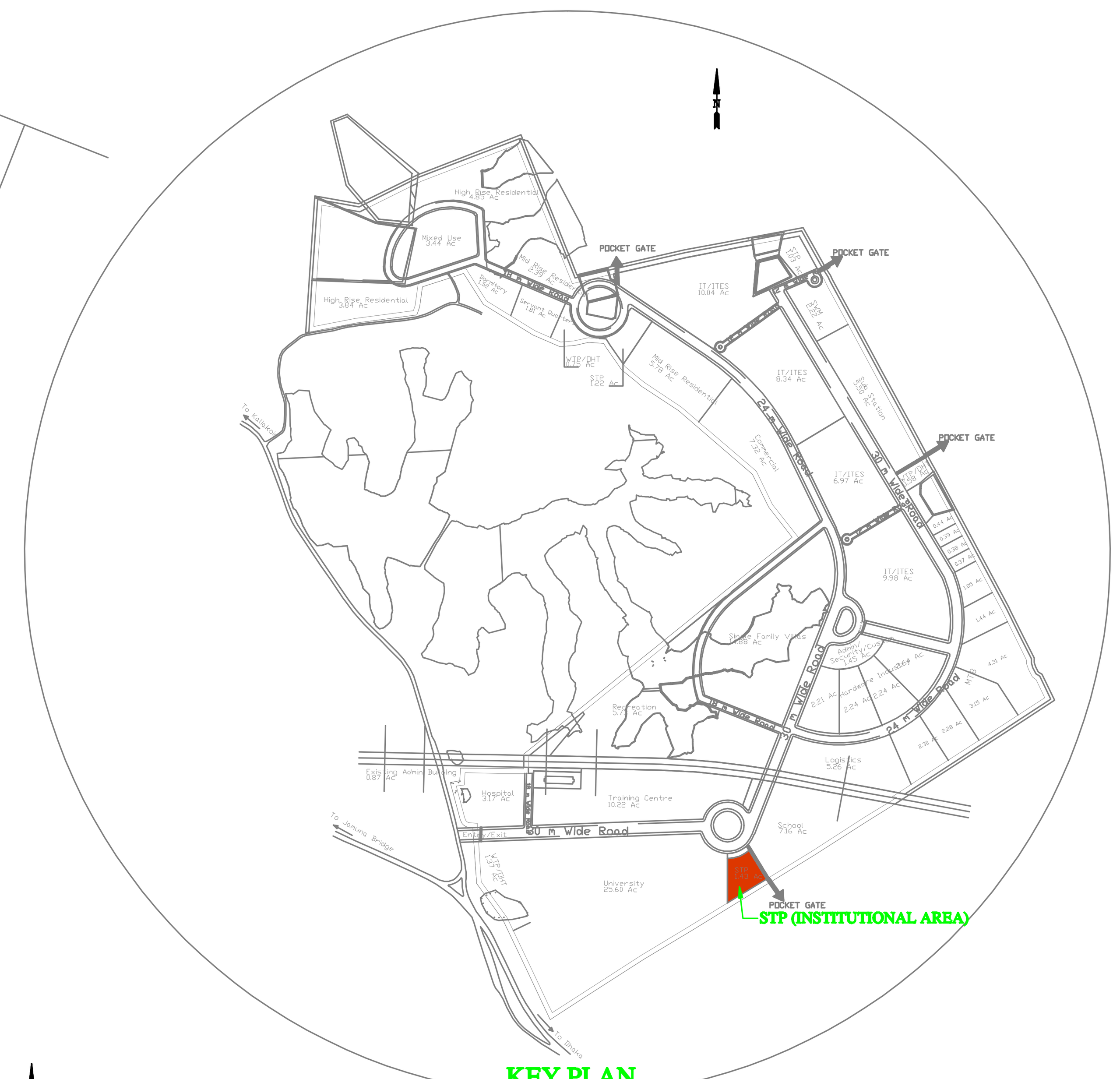
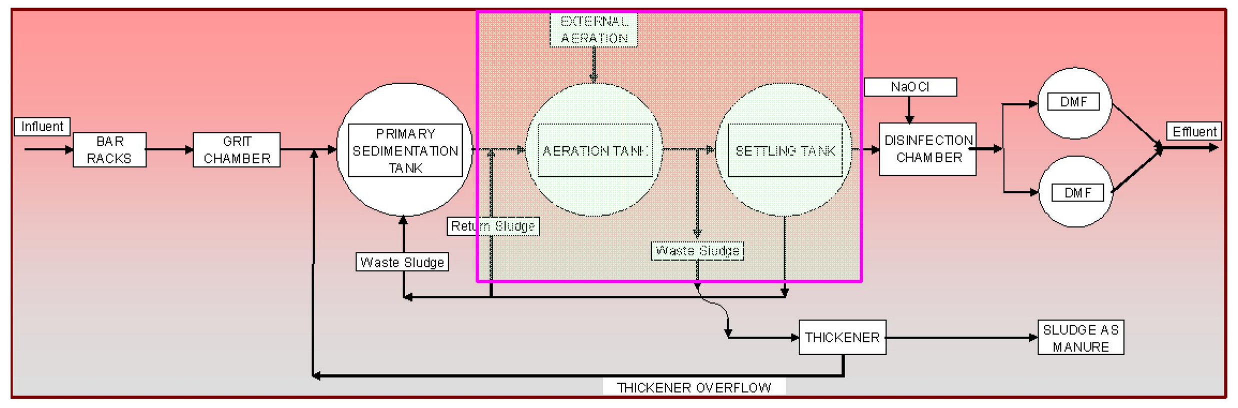


KEY PLAN

SEWAGE TREATMENT - ACTIVATED SLUDGE PROCESS



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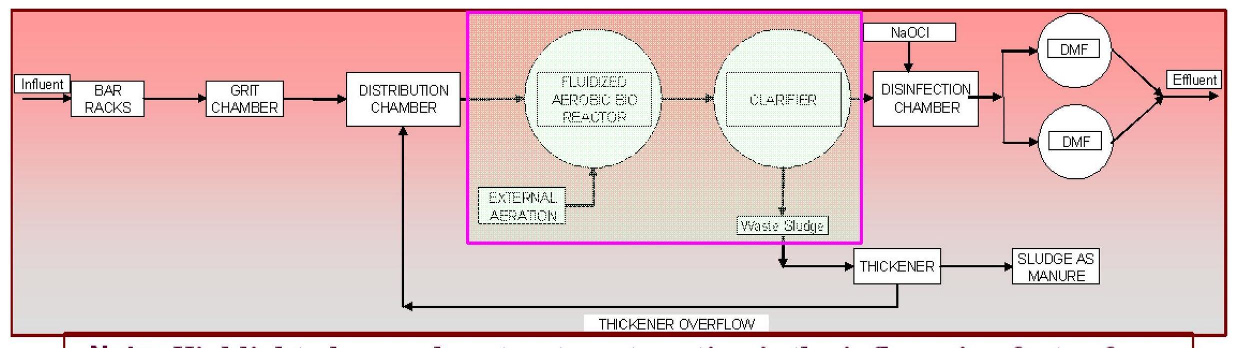

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CONSORTIUM MEMBERS:

Price Waterhouse Coopers
IIFC , Bangladesh
DevConsultants,Bangladesh

CONSULTANT:

Mahindra Consulting Engineers Ltd.
Chennai

PLANNING:	S.Rajesh	10.12.2008
CHECKED 1:	A.Srinivasan	11.12.2008
CHECKED 2:	A.L.Suresh Kumar	12.12.2008
APPROVED:	C.S.Narayanan	15.12.2008

PROJECT TITLE :

Economic Zones Development

LOCATION:

KALIAKOIR, BANGLADESH

DRAWING TITLE:

SEWERAGE TREATMENT PLANT LAYOUT
INSTITUTIONAL AREA

CLIENT:

Department For International Development

PROJECT CODE : P 723 JOB NO:

CHECK SCALE (print may be photo-reduced)

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