

# Initial Environmental Examination

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Document Stage: Draft  
Project Number: 42266-026  
July 2018

**IND: Kolkata Environmental Improvement Investment Program (Tranche 3) – Sewage Treatment Plant (SD29)**

**Package No. SD29/2017-18: Construction of Sewage Treatment Plant (40 MLD) at Bank Plot, M.G. Road, Joka**

Prepared by Kolkata Municipal Corporation, Government of West Bengal for the Asian Development Bank.

## CURRENCY EQUIVALENT

(as of 20 July 2018)

Currency Unit	–	Indian rupee (₹)
₹1.00	=	\$0.014
\$1.00	=	₹68.94

## ABBREVIATIONS

ADB	-	Asian Development Bank
ASI	-	Archaeological Survey of India
BOD	-	biochemical oxygen demand
COD	-	chemical oxygen demand
CPCB	-	Central Pollution Control Board
CPHEEO	-	Central Public Health and Environmental Engineering Organization
CTE	-	consent to establish
CTO	-	consent to operate
DPR	-	detailed project report
DSC	-	design and supervision consultant
DWF	-	dry weather flow
KMC	-	Kolkata Municipal Corporation
EARF	-	environmental assessment and review framework
EIA	-	environmental impact assessment
EKW	-	East Kolkata Wetlands
EMP	-	environmental management plan
GRC	-	grievance redress committee
GRM	-	grievance redress mechanism
IEE	-	initial environmental examination
KEIP	-	Kolkata Environmental Improvement Project
KEIIP	-	Kolkata Environmental Improvement Investment Program
KMC	-	Kolkata Municipal Corporation
MFF	-	multitranches financial facility
MSDS	-	Material Data Safety Sheet
NIOSH	-	National Institute of Occupational Health
O&M	-	operation and maintenance
PMC	-	program management consultant
PMU	-	program management unit
REA	-	rapid environmental assessment
ROW	-	right-of-way
SEP	-	Site environmental plan
SEMR	-	semi-annual environmental monitoring report
SPS	-	Safeguard Policy Statement
STP	-	sewage treatment plant
SWF	-	storm water flow
TMP	-	traffic management plan
TSS	-	total suspended solids
WBPCB	-	West Bengal Pollution Control Board
WBSEB	-	West Bengal State Electricity Board
WBSETCL	-	West Bengal State Electricity Transmission Co. Ltd
WBWML	-	West Bengal Waste Management Ltd.

## WEIGHTS AND MEASURES

m <sup>3</sup> /h	-	cubic meter per hour
dB(A)	-	decibel in A network
ft	-	feet
ha	-	hectare
km	-	kilometer
lpcd	-	liter per capita per day
m	-	meter
m/yr	-	meter per year
mg/l	-	milligram per liter
MLD	-	million liters per day
mm	-	millimeter
MPN	-	most probable number
t	-	metric ton
NTU	-	Nephelometric turbidity Unit

### NOTE

In this report, "\$" refers to United States dollars.

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## EXECUTIVE SUMMARY

The Kolkata Environmental Improvement Investment Program (KEIIP) is a key urban infrastructure initiative of the Kolkata Municipal Corporation (KMC), and aims to improve the urban environment and quality of life in parts of Kolkata Municipal Area mainly through the delivery of improved water supply, sewerage, drainage and sanitation. The Project will be implemented over an 8-year period from 2014 to 2022. The Program is also proposed to be implemented using a multitranche financing facility (MFF) of Asian Development Bank (ADB). At present KEIIP Tranche 1 and 2 projects are under implementation. Packages under Tranche 3 are under finalization.

ADB requires the consideration of environmental issues in all aspects of the Bank's operations, and the requirements for environmental assessment are described in ADB's Safeguard Policy Statement (SPS), 2009. This states that ADB needs environmental assessment of all project loans, program loans, sector loans, sector development program loans, and loans involving financial intermediaries, and private sector loans.

This initial environmental examination (IEE) report is for the one of the sewerage & drainage (S&D) subprojects of Tranche 3 "Construction of Bank Plot Sewage Treatment Plant (STP)". Tranche 3 loan will be signed later but construction work for specific Tranche 3 sub projects are scheduled to commence during first quarter of 2018 and will be completed in 24 months, i.e. by 1st quarter of 2020.

The IEE aims to: (i) provide critical facts, significant finding, and recommended actions; (ii) present the national and local legal and institutional framework within which the environmental assessment has been carried out; (iii) provide information on existing geographic, ecological, social and temporal context including associated facilities within the subproject's area of influence; (iv) assess the subproject's likely positive and negative direct and indirect impacts to physical, biological, socioeconomic, and physical cultural resources in the subproject's area of influence; (v) identify mitigation measures and any residual negative impacts that cannot be mitigated; (vi) describe the process undertaken during project design to engage stakeholders and the planned information disclosure measures and the process for carrying out consultation with affected people and facilitating their participation during project implementation; (vii) describe the subproject's grievance redress mechanism for resolving complaints about environmental performance; (viii) present the set of mitigation measures to be undertaken to avoid, reduce, mitigate, or compensate for adverse environmental impacts; (ix) describe the monitoring measures and reporting procedures to ensure early detection of conditions that necessitate particular mitigation measures; and (x) identify entities responsible for carrying out the mitigation and monitoring measures.

Potential negative impacts have been identified in relation to pre-construction, construction and operation phases of the improved infrastructure, but no permanent environmental impacts were identified as being due to either the subproject design or location. Mitigation measures have been developed to reduce all negative impacts to acceptable levels. These were discussed with specialists responsible for the engineering aspects, and as a result some measures have already been included in the designs for the infrastructure. This means that the number of impacts and their significance have already been reduced by amending the design.

The public participation processes have been undertaken during project detailed design stage, which ensures that stakeholders are engaged during the preparation/finalization of the IEE. The planned information disclosure measures and process for carrying out consultation with affected people will facilitate their participation during project implementation.

The subproject's grievance redress mechanism (GRM) will provide the citizens with a platform for redress of their grievances and describes the informal and formal channels, time frame and mechanisms for resolving complaints about environmental performance.

The environmental management plan (EMP) will guide the environmentally-sound construction of the subproject and ensure efficient lines of communication between KMC, PMU, DSC and the contractors. The EMP will: (i) ensure that the activities are undertaken in a responsible non-detrimental manner; (ii) provide a pro-active, feasible and practical working tool to enable the measurement and monitoring of environmental performance on site; (iii) guide and control the implementation of findings and recommendations of the environmental assessment conducted for the subproject; (iv) detail specific actions deemed necessary to assist in mitigating the environmental impact of the subproject; and (v) ensure that safety recommendations are complied with.

The contractor for the packages will be required to submit to KMC/PMU, for review and approval, site environmental plan (SEP) including: (i) details of proposed sites/locations for construction work camp, storage areas, hauling roads, lay down areas, disposal areas for solid and hazardous wastes; (ii) specific mitigation measures following Tables 29 to 33 of the EMP to ensure no significant environmental impacts; (iii) monitoring program as per SEP; and (iv) budget for SEP implementation. No works are allowed to commence prior to approval of SEP.

A copy of the EMP/approved SEP will be kept on site during the construction period at all times. The EMP has been made binding on contractor operating on the site and included in the bid and contract documents. Non-compliance with, or any deviation from, the conditions set out in this document constitutes a failure in compliance.

The subproject is unlikely to cause significant adverse impacts because: (i) most of the individual components involve straightforward construction and operation, so impacts will be mainly localized; (ii) in most cases the predicted impacts are localized and likely to be associated with the construction process at isolated locations and are produced because the process is invasive, involving excavation, obstruction at specific construction locations, and earth movements; and (iii) being located mainly along roads and built-up area will not cause direct impact on terrestrial and aquatic biodiversity values. The potential adverse impacts that are associated with design, construction, and operation can be mitigated to standard levels without difficulty through proper engineering design and the incorporation or application of recommended mitigation measures and procedures.

Therefore, as per ADB SPS, the subproject is classified as environmental Category B and does not require further environmental impact assessment.



## I. INTRODUCTION

1. The city of Kolkata is the seventh largest metropolis in India, and had 4.5 million residents in 2011. It is the largest city in the state of West Bengal, and has been the biggest contributor to West Bengal's gross state domestic product. The continuous improvement in the city's urban environment is necessary to increase labor productivity through better health status of the urban population, especially when it has been experiencing lower population growth. There have been, however, geographical disparities in access and quality of the water supply and sewerage services, because the Kolkata Municipal Corporation (KMC), an urban local body with a mandate to provide these services under the KMC Act of 1980, has an aging water supply system, and has inadequate sewer coverage in the city's peripheral areas.<sup>1</sup> The Asian Development Bank (ADB) loans have assisted KMC in the expansion of the sewerage coverage through the Kolkata Environmental Improvement Project (KEIP) since 2000.<sup>2</sup> The Kolkata Environmental Improvement Investment Program (KEIIP) will help KMC not only to continue sewer network expansion and treatment on a larger scale, but also gradually improve efficiency in water supply operations, which will enable KMC to generate operating surplus for capital investment in water supply and sewerage.<sup>3</sup>

2. On 26 September 2013, ADB approved the provision of loans under a multitranche financing facility (MFF) for KEIIP for an aggregate amount not exceeding \$400 million. The impact of KEIIP will be enhanced access to water supply and sanitation in KMC. The outcome will be improved water supply, sewerage and drainage service quality and operational sustainability in selected areas of KMC. Thus, KEIIP has three outputs: (i) inefficient water supply assets rehabilitated; (ii) sewerage extension along with sewage treatment facilities to peripheral areas continued; and (iii) financial and project management capacity further developed.

3. The KMC is KEIIP's executing agency. A project management unit (PMU) created under KMC is implementing KEIIP.

4. The first loan under the MFF, Tranche 1 or Loan 3053-IND, amounting to \$100 million, was approved by ADB on 22 October 2013, signed on 3 March 2014 and made effective on 30 May 2014. Project 1, supported by Tranche 1, included subprojects for improvement of infrastructure, operations and sustainability in sewerage, drainage and water supply in KMC. While Project 2, supported by the Tranche 2, included physical and non-physical investments in water supply and sanitation improvement in KMC. Project 2 is aligned with improved access to water supply and sanitation in KMC as defined by KEIIP. Tranche 2 loan 3413- IND was signed on 21<sup>st</sup> November 2016 and physical work has already started.

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<sup>1</sup> The 1899 Calcutta Municipal Act defined the administrative domain of the municipal authority as covering 25 wards and 48.5 km<sup>2</sup>. Many boundary changes followed, the latest one in January 1984, when Boroughs XI, XII, XIII, XIV, and XV were annexed to KMC. These boroughs are popularly known as the "added areas." Recently, the KMC has been further expanded by including Joka area in the southern part of the city creating 3 additional wards under a new Borough XVI.

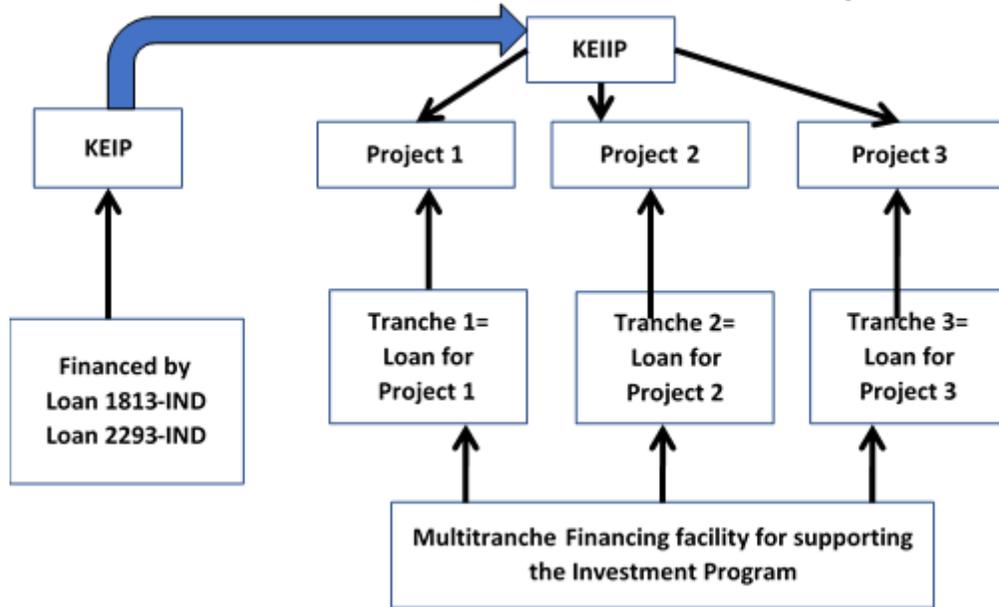
<sup>2</sup> ADB. 2000. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to India for the Calcutta Environmental Improvement Project*. Manila (Loan 1813-IND, \$250 million, approved on 15 November 2000). The project completion date is 30 June 2012.

ADB 2006. *Report and Recommendation of the President to the Board of Directors: Proposed Supplementary Loan to India for the Kolkata Environmental Improvement Project*. Manila (Loan 2293-IND: \$80 million, approved on 20 November 2006). The project completion date is 30 June 2012.

<sup>3</sup> ADB provided project preparatory technical assistance. ADB. 2009. *Technical Assistance to India for Preparing for Kolkata Environmental Improvement Project II*. Manila.

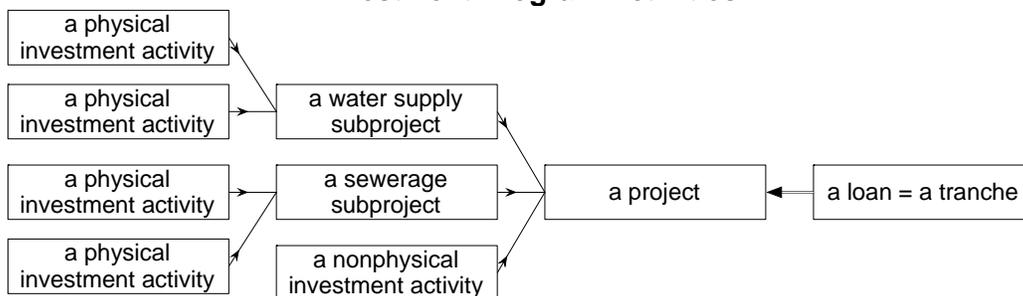
5. At present KEIP Tranche 1 and 2 are under implementation. The new sub project “Construction of Bank Plot STP” is considered under Tranche 3. Tranche 3 project will be implemented over a 4-year period from 2018 to 2022.

**Figure 1: Relationship between Kolkata Environmental Improvement Project and the Kolkata Environmental Improvement Investment Program**



6. The KEIP included: (i) water supply, including pumping and transmission system; and (ii) sewerage and drainage (S&D) including dry weather flow (DWF) and storm water flow (SWF) pumping stations; and (iii) construction of sewage treatment plant.

**Figure 2: Structure of a Project, Subprojects, and Kolkata Environmental Improvement Investment Program Activities**



7. The proposed Project 3 supported under Tranche 3 of KEIP includes S&D works with STPs and water supply. Availability of proper locations for construction of STPs was one of the primary reasons why these were not considered under earlier sub-projects implemented or to be implemented under Tranches 1 and 2. Many of the S&D sub-projects will become functional within next 2 years and it would be mandatory to treat the sewage (DWF) conforming to the latest CPCB guidelines before discharging it into the water bodies. In this context, four Sewage Treatment Plants (STPs) have been proposed to be constructed under the Tranche 3. Table 1 below shows tentative package list for S&D work under Tranche 3.

**Table 1: Sewerage and Drainage Packages under Tranche 3**

No.	Package Name	Package No.
1	Improvement of S&D Network and construction of a Pumping Station in Alipore Body Guard Line premises in ward 74 and laying of sewer line along Diamond Harbour Road by Micro-tunnelling method and Cut & Cover method.	SD-27
2	Construction of WBSETCL STP (45 MLD).	SD-28
3	Construction of STP at Bank Plot (40 MLD).	SD-29
4	Construction of Rajpur - Sonarpur STP (25 MLD).	SD-30
5	Development of S&D network and construction of pumping station in Joka Area and adjoining area (Part of Ward 124, 142,143 & 144).	SD-31
6	Improvement of S&D system in Mukundapur Area and construction of pumping station.	SD-32
7	Construction of Lalababau Pumping station.	SD-34
8	Development of S&D network and construction of pumping station in Suti Sub Basin (Part of Ward 127).	SD-35
9	Improvement of S&D network in Rajdanga area and construction of pumping station.	SD-36
10	Construction of STP for Rajdanga (15 MLD).	SD-37

**Table 2: Information regarding Sewage Treatment Plants**

Sewage Treatment Plant	Load	Footprint	Treatment Method	Distance to Nearest Receptor	Receiving Waters
Sewage Treatment Plant (STP) 1: STP near West Bengal State Electricity Transmission Company Limited (WBSETCL), Joka	45 million liters per day (MLD)	STP located off the Diamond Harbour Road, adjacent to the West Bengal State Electricity Transmission Company Limited (WBSETCL) in ward 144 of KMC  <b>Total STP area</b> 1.09 hectare (ha), i.e., 10,900 square meter (m <sup>2</sup> )	Sequencing Batch Reactor (SBR)	150 meter (m)	Dry weather flow (DWF) generated from Sewerage and drainage (S&D) systems in parts of Borough XVI and parts of Borough XIV, south Kolkata.  Treated effluent to be discharged into Churial canal 400 m distance  (Ref. schematic diagram S-1)
STP 2: STP at Bank Plot	40 MLD	STP located off the Mahatma Gandhi Road in Ward 143 of KMC primarily identified as Bank Plot  <b>Total STP area</b> 1.06 ha, i.e., 10,600 m <sup>2</sup>	SBR	85 m	DWF from Churial Extension pumping station. The DWF collected will be then pumped to the proposed STP for treatment.  Treated effluent to be discharged into Churial canal 1200 m distance  (Ref. schematic diagram S-2)
STP 3: Rajpur Sonarpur STP	23 MLD	STP located off the Rania Road in Rajpur Sonarpur Municipality  <b>Total STP area</b> 0.368 ha, i.e., 3,680 m <sup>2</sup>	SBR	62 m	DWF from Vivekananda Road Pumping station. The DWF collected will be then pumped to the proposed STP for treatment.  Treated effluent to be discharged into Rania canal 400 m distance  (Ref. schematic diagram S-3)

8. An overriding requirement under Tranche 3 is construction of Sewage Treatment Plant (STP) for treatment of raw sewage.

9. Sub project and their components of each loan agreement are to comply with relevant and applicable safeguard requirements of the Government of India, the Government of West Bengal, and the Safeguards Policy Statement (SPS), 2009 of ADB.

10. The provision for the use of frameworks is required for implementation of the investment program under the MFF to guide safeguard assessments in all tranches, as well as in non-sensitive components of each project under the investment program where detailed design takes place.

11. ADB classified the Project as environment Category B and accordingly initial environmental examination (IEE) is required for all subprojects. The present document is the IEE for one of the S&D subprojects under Tranche 3 "Construction of Bank Plot STP".

12. Construction work will commence during 1st quarter of 2018 and will be completed in 24 months.

13. The IEE aims to: (i) provide critical facts, significant finding, and recommended actions; (ii) present the national and local legal and institutional framework within which the environmental assessment has been carried out; (iii) provide information on existing geographic, ecological, social and temporal context including associated facilities within the subproject's area of influence; (iv) assess the subproject's likely positive and negative direct and indirect impacts to physical, biological, socioeconomic, and physical cultural resources in the subproject's area of influence; (v) identify mitigation measures and any residual negative impacts that cannot be mitigated; (vi) describe the process undertaken during project design to engage stakeholders and the planned information disclosure measures and the process for carrying out consultation with affected people and facilitating their participation during project implementation; (vii) describe the subproject's grievance redress mechanism for resolving complaints about environmental performance; (viii) present the set of mitigation measures to be undertaken to avoid, reduce, mitigate, or compensate for adverse environmental impacts; (ix) describe the monitoring measures and reporting procedures to ensure early detection of conditions that necessitate particular mitigation measures; and (x) identify who is responsible for carrying out the mitigation and monitoring measures.

14. Few packages are likely to be developed later under Tranche 3 loan. The IEE may therefore require updating later.

## **II. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK**

### **A. ADB Policy**

15. ADB requires the consideration of environmental issues in all aspects of ADB's operations, and the requirements for environmental assessment are described in ADB SPS, 2009. This states that ADB requires environmental assessment of all project loans, program loans, sector loans, sector development program loans, and loans involving financial intermediaries, and private sector loans.

16. ADB SPS requires PMU to apply pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized

standards such as the World Bank Group's Environment, Health and Safety Guidelines. Applicable to Project 3 are Environmental, Health and Safety (EHS) Guidelines on (i) General EHS Guidelines, (ii) Water and Sanitation; (ii) Waste Management, and other as may be applicable. These standards contain performance levels and measures that are normally acceptable and applicable to projects. When Government of India regulations differ from these levels and measures, PMU will achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the borrower/client will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS and EHS Guidelines.

17. To improve environmental quality more stringent international standard will be followed. The applicable standard for air quality and noise levels are shown in Appendixes 1, 2 and 3.

18. **Screening and Categorization.** The nature of the environmental assessment required for a project depends on the significance of its environmental impacts, which are related to the type and location of the project, the sensitivity, scale, nature and magnitude of its potential impacts, and the availability of cost-effective mitigation measures. Projects are screened for their expected environmental impact and are assigned to one of the following four categories:

- (i) **Category A.** A proposed project is classified as category A if it is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An environmental impact assessment is required.;
- (ii) **Category B.** A proposed project is classified as category B if its potential adverse environmental impacts are less adverse than those of category A projects. These impacts are site-specific, few if any of them are irreversible and, in most cases, mitigation measures can be designed more readily than for category A projects. An initial environmental examination is required;
- (iii) **Category C.** A proposed project is classified as category C if it is likely to have minimal or no adverse environmental impacts. No environmental assessment is required although environmental implications need to be reviewed; and
- (iv) **Category FI.** A proposed project is classified as category FI if it involves investment of ADB funds to or through a financial intermediary.

19. **Environmental Management Plan.** An environmental management plan (EMP), which addresses the potential impacts and risks identified by the environmental assessment, shall be prepared. The level of detail and complexity of the EMP and the priority of the identified measures and actions will be commensurate with the Project's impact and risks.

20. **Public Disclosure.** The IEE will be put in an accessible place (e.g., local government offices, libraries, community centers, etc.), and a summary translated into local language for the project affected people and other stakeholders. The following safeguard documents will be put up in ADB's website so that the affected people, other stakeholders, and the general public can provide meaningful inputs into the project design and implementation:

- (i) for environmental category A projects, a draft EIA report at least 120 days before Board consideration;
- (ii) final or updated EIA and/or IEE upon receipt; and
- (iii) environmental monitoring reports submitted by the program management unit (PMU) during project implementation upon receipt.

## B. National and State Laws

21. Implementation of the subproject will be governed by the national and State of West Bengal environmental acts, rules, regulations, and standards. These regulations impose restrictions on activities to minimize/mitigate likely impacts on the environment. It is the responsibility of the project executing and implementing agencies to ensure subprojects are consistent with the legal framework, whether national, state or municipal/ local. Compliance is required in all stages of the subproject including design, construction, and operation and maintenance.

22. The following legislations are applicable to the subproject:

- (i) Environmental (Protection) Act of 1986, its rules and amendments;
- (ii) Environmental Impact Assessment (EIA) Notification of 2006 and 2009;
- (iii) Water (Prevention and Control of Pollution) Act of 1974, its Rules, and amendments;
- (iv) Air (Prevention and Control of Pollution) Act of 1981, its Rules and amendments;
- (v) Central Pollution Control Board (CPCB) Environmental Standards;
- (vi) The Ancient Monument and Archaeological Sites and Remains (Amendment and Validation) Act 2010;
- (vii) The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 (LARR);
- (viii) Wetlands (Conservation and Management) Rules, 2010;
- (ix) Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016;
- (x) Noise Pollution (Regulation and Control) Rules of 2000 as amended up to 2011;
- (xi) National Institute of Occupational Safety and Health Criteria for a recommended standard: occupational noise exposure, NIOSH Publication No. 98-126;
- (xii) West Bengal Trees (Protection and Conservation in Non-Forest Areas) Act, 2006;
- (xiii) East Kolkata Wetlands (Conservation and Management) Act, 2006; and
- (xiv) The Child Labour (Prohibition and Regulation) Amendment Act, 2016, The Child Labour (Prohibition and Regulation) Act, 1986.

23. Per Government of India Central Pollution Control Board (CPCB)'s Guidelines on Odor Pollution & Its Control,<sup>4</sup> odorous compounds to be monitored in waste water treatment plants are: (i) H<sub>2</sub>S, and (ii) mercaptans (Methyl mercaptan [methanethiol]). Section 7 provides odor control technologies that are required to be considered in designs and Section 9 provides international legislations, standards, and regulations regarding odor (Australia, Belgium, Canada, Denmark, Germany, Japan, New Zealand, the Netherlands, the UK, and the US) that will be applicable to wastewater treatment plants. Major recommendations of the CPCB Expert Committee on Odour Pollution and its Control include the following (highlighted relevant to KEIIP):

- (i) The report of the expert committee may be adopted as a guideline for odor pollution and its control.
- (ii) In order to develop and implement effective control program on odor pollution, it is necessary to measure odor in a manner that is accurate, precise and acceptable. The instrumental method may be adopted for known compounds and for mixtures of unknown substances, sensory method is preferred. The currently accepted

<sup>4</sup> Central Pollution Control Board, Ministry of Environment and Forests, Government of India. 2008. [Guidelines on Odour Pollution & Its Control](#). Delhi.

- method EN 13725: 2003, Forced-Choice presentation, may be standardized and adopted in India also.
- (iii) There is a need for generation of data based information on the magnitude of the odorous gases/chemicals at point source as well as in the ambient environment around these sources.
  - (iv) Ambient standards for odor pollution should be evolved after adequate becomes available to formulate them.
  - (v) Source specific (point source as well as diffused source) standard for odor emission should be evolved for odorous industries such as Pulp & Paper, Fertilizer, Pesticides, Tanneries, Sugar & Distillery, Chemical, Dye & Dye Intermediates, Bulk Drugs & Pharmaceuticals, Landfill and Waste Water Treatment Plant etc.
  - (vi) Human resource may be developed with international exposure and assistance to work in the field of odor pollution control.
  - (vii) All out efforts should be made to operate and maintain treatment plants, air pollution control devices, dump sites, TSDF etc. to achieve optimal reduction in odor pollution.
  - (viii) Hot spot of odor pollution may be tackled with knowledge and technology presently available in the country.
  - (ix) Pilot plants / Best Management Practices to control odor pollution may be installed/ demonstrated sector wise to display the technology. Such installation may be sponsored and financial assistance provided, if required.
  - (x) Green belts with suitable species of plants / trees and other physical methods may be adopted for control of odor pollution especially near odor producing industrial processes and waste disposal sites.

24. The summary of environmental regulations and mandatory requirements for the subproject is shown in Table 3.

**Table 3: Applicable Environmental Regulations for Sewerage and Drainage Subproject**

Law	Description	Requirement
EIA Notification	The EIA Notification of 2006 and 2009 (replacing the EIA Notification of 1994), set out the requirement for environmental assessment in India. This states that Environmental Clearance is required for certain defined activities/projects, and this must be obtained before any construction work or land preparation (except land acquisition) may commence. Projects are categorized as A or B depending on the scale of the project and the nature of its impacts. Category A projects requires Environmental Clearance from the National Ministry of Environment, Forest and Climate Change (MOEFCC). Category B projects require Environmental Clearance from the State Environmental Impact Assessment Authority (SEIAA).	The proposed components of this STP construction sub projects are not listed in the EIA Notification's "Schedule of Projects Requiring Prior Environmental Clearance" and thus Environmental Clearance is not required.
Water (Prevention and Control of Pollution) Act of 1974, Rules of 1975, and amendments	Control of water pollution is achieved through administering conditions imposed in consent issued under provision of the Water (Prevention and Control of Pollution) Act of 1974. These conditions regulate the quality and quantity of effluent, the location of discharge and the frequency of monitoring of	Construction of STP will require CTE and CTO from WBPCB, before starting of construction and before commissioning of STP respectively.

Law	Description	Requirement
	effluents. Any component of the Project having the potential to generate sewage or trade effluent will come under the purview of this Act, its rules and amendments. Such projects have to obtain Consent to Establish (CTE) under Section 25 of the Act from West Bengal Pollution Control Board (WBPCB) before starting implementation and Consent to Operate (CTO) before commissioning. The Water Act also requires the occupier of such subprojects to take measures for abating the possible pollution of receiving water bodies.	
Air (Prevention and Control of Pollution) Act of 1981, Rules of 1982 and amendments.	The subprojects having potential to emit air pollutants into the atmosphere have to obtain CTE under Section 21 of the Air (Prevention and Control of Pollution) Act of 1981 from WBPCB before starting implementation and CTO before commissioning the project. The occupier of the project/facility has the responsibility to adopt necessary air pollution control measures for abating air pollution.	For the subproject, the following will require CTE and CTO from WBPCB: (i) diesel generators; and (ii) hot mix plants, wet mix plants, stone crushers, etc. if installed for construction. All relevant forms, prescribed fees and procedures to obtain the CTE and CTO can be found in the WBPCB website ( <a href="http://www.wbpcb.gov.in">www.wbpcb.gov.in</a> ). CTE to be obtained by KMC prior to award of contract. CTO to be obtained prior to commissioning. CTO renewal to be undertaken by KMC during operations stage.
Environment (Protection) Act, 1986 and CPCB Environmental Standards.	Emissions and discharges from the facilities to be created or refurbished or augmented shall comply with the notified standards notified.	Appendix 1 provides applicable standards for ambient air, air emission, effluents, receiving water bodies, and drinking water at the consumer end. Contractors are required to ensure all emissions and discharges during civil works conform to all applicable standards
Noise Pollution (Regulation and Control) Rules, 2002 amended up to 2010.	Rule 3 of the Act specifies ambient air quality standards in respect of noise for different areas/zones.	Appendix 2 provides applicable noise standards. Contractors are required to ensure all noise-producing activities during civil works conform to applicable standards
National Institute of Occupational Safety and Health (NIOSH) Publication No. 98-126	NIOSH has laid down criteria for a recommended standard: occupational noise exposure. The standard is a combination of noise exposure levels and duration that no worker exposure shall equal or exceed.	Appendix 3 provides applicable NIOSH occupational noise standards. Contractors are required to provide hearing-protection equipment and ensure exposures of workers to noise-generating activities are within allowed NIOSH standards.
Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016	According to the Rules, hazardous wastes are wastes having constituents specified in Schedule II of the Rules if their concentration is equal to or more than the limit indicated in the said schedule (Appendix 4).	If during excavation works, the excavated material is analyzed to be hazardous, they are to be stored and disposed of only in such facilities as may be authorized by the WBPCB for the purpose
Forest (Conservation) Act, 1980 and Forest Conservation Rules, 2003 as amended	As per Rule 6, every user agency, who wants to use any forest land for non-forest purposes shall seek approval of the Central Government.	No notified forest land within the subproject area.
Wetlands (Conservation and Management) Rules, 2010	The Rules specify activities which are harmful and prohibited in the wetlands such as industrialization, construction, dumping of untreated waste and effluents, and reclamation. The Central Government may	The subproject is not within the East Kolkata Wetlands thus no permission from the Central Government is required.

Law	Description	Requirement
	permit any of the prohibited activities on the recommendation of Central Wetlands Regulatory Authority.	
The Ancient Monument and Archaeological Sites and Remains (Amendment and Validation) Act 2010	The Rules designate areas within a radius of 100 m and 200 m from the "protected property/ monument/ area" as "prohibited area" and "regulated area" respectively. Henceforth, no permission for construction of any public projects or any other nature shall be granted in the prohibited areas of the protected monument and protected area. In respect of regulated area, the Competent Authority may grant permission for construction, reconstruction, repair and renovation on the basis of recommendation of the National Monument Authority duly taking note of heritage bye-laws, which shall be prepared in respect of each protected monument and protected area.	There are no protected properties in the subproject area. However, in case of chance finds, the contractors will be required to follow a protocol as defined in the environmental management plan (EMP).
The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 (LARR) The Act shall come into force on January 1, 2014 as notified by the Central Government.	Private land acquisition is guided by the provisions and procedures under this Act. Before the acquisition of any land, the Government is required to consult the concerned Panchayat or Municipal Corporation and carry out a Social Impact Assessment in consultation with them. The Act provides a transparent process for land acquisition for industrialization, development of essential infrastructural facilities and urbanization by giving adequate financial compensation to the affected people.	No land acquisition is required for the sub project. All lands are available under project implementation authority. A Due diligence report has been prepared in accordance with the ADB SPS, 2009.
West Bengal Trees (Protection and Conservation in Non-Forest Areas) Act, 2006	The Act states that those who want to fell trees will have to obtain permission from the Forest Directorate, Government of West Bengal. Violators (means whoever fells or causes to be felled any tree or cuts, uproots or otherwise disposes of any fallen tree or contravenes the permission granted) shall be punished with imprisonment up to one year or with fine of ₹5000/- or both. Also, until plantation of requisite number of trees is undertaken, the violators will be fined for each day of default of ₹50/-. In case the development agency or entrepreneur fails to implement the plantation plan, the defaulter might have to face an imprisonment up to two years or fine that may extend to ₹10,000/- or with both.	Permission from the Divisional Forest Officer (Utilization Division), Forest Directorate, Government of West Bengal will be required if trees, particularly those looked upon as sacred groves, identifies as belonging to an endangered species, or given the status of heritage, will be cut/felled.
East Kolkata Wetlands (Conservation and Management) Act, 2006	In August 2002, 12,500 hectares (ha) of the East Kolkata Wetland area was included in the 'Ramsar List' making it a 'wetland of International Importance'. The Ramsar convention is playing a vital role by providing certain basic guidelines to draw up suitable plans for the maintenance and sustenance of the wetlands. Among these, the three most important guiding principles are: (i) maintenance of the special characteristics of the ecosystem; (ii) wise use of its resources with an eye towards sustainability; and (iii) economic development for the wetland	The subproject is not within the East Kolkata Wetlands thus no permission from the Central Government is required.

Law	Description	Requirement
	community. The East Kolkata Wetlands Management Authority (EKWMA) has the power to enforce land use control in the substantially water body-oriented areas and other areas in the East Kolkata wetlands.	
The Child Labour (Prohibition and Regulation) Amendment Act, 2016 The Child Labour (Prohibition and Regulation) Act, 1986	No child below 14 years of age will be employed or permitted to work in any of the occupations set forth in the Act's Part A of the Schedule or in any workshop wherein any of the processes set forth in Part B of the Schedule. Child can help his family or family enterprise, which is other than any hazardous occupations or processes set forth in the Schedule, after his school hours or during vacations	No children between the age of 14 to 18 years will be engaged in hazardous working conditions.

CTE = consent to establish, CTO = consent to operate, EIA = environmental impact assessment, EMP = environmental management plan, KMC = Kolkata Municipal Corporation, WBPCB = West Bengal Pollution Control Board.

### III. DESCRIPTION OF THE SUBPROJECT

#### A. Existing Situation

25. **Project background.** Both in Tranche 1 and Tranche 2, there are a number of sewerage and drainage sub-projects. However, owing to various hindrances, no sewage treatment plant (STP) could be initiated under these tranches. In order to treat the DWF conveyed through S&D networks after completion these sub-projects, STPs would be urgently needed. Four (4) STPs have been planned, those are near WBSETCL, Joka, Bank Plot, Rajpur- Sonarpur and Rajdanga area. The objective of the sewage treatment plant subproject which will be executed under Tranche 3 is:

- (i) to select appropriate and suitable wastewater treatment technology adhering to latest discharge norms by CPCB;
- (ii) to ensure that the technology selected can be executed within the land area available for treating the command area's dry weather flow (DWF);
- (iii) to adopt the selected wastewater treatment technology for the expected flow at a particular site and to devise an appropriate design;
- (iv) to provide a treated wastewater discharge mechanism in the canals and water bodies of Kolkata which will ensure amelioration of its water quality;
- (v) to reduce environmental impact/ health hazards that is caused by open discharge of domestic wastewater; and
- (vi) to ensure that river Ganga is not polluted which is a priority of the state and national government.

26. This IEE report is for "Construction of Bank Plot STP".

#### Bank Plot Sewage Treatment Plant

27. The STP is proposed to be located off the Mahatma Gandhi Road in Ward 143 of KMC primarily identified as Bank Plot (Figure 4 for complete catchment area).

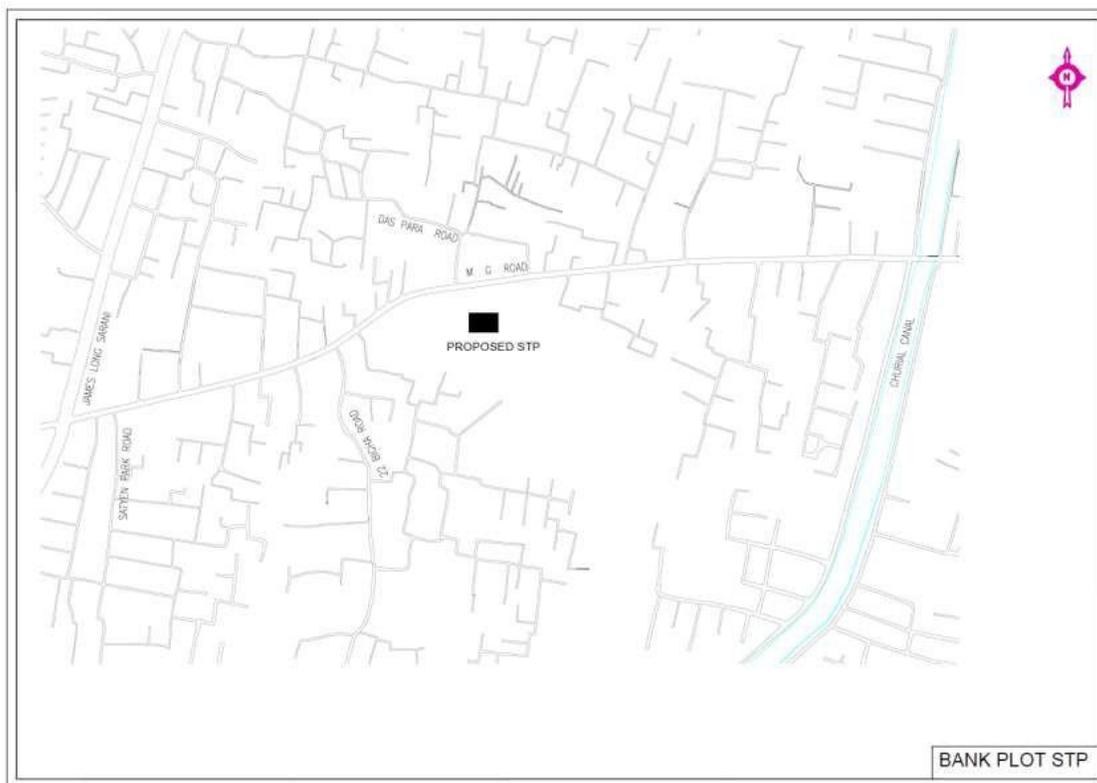
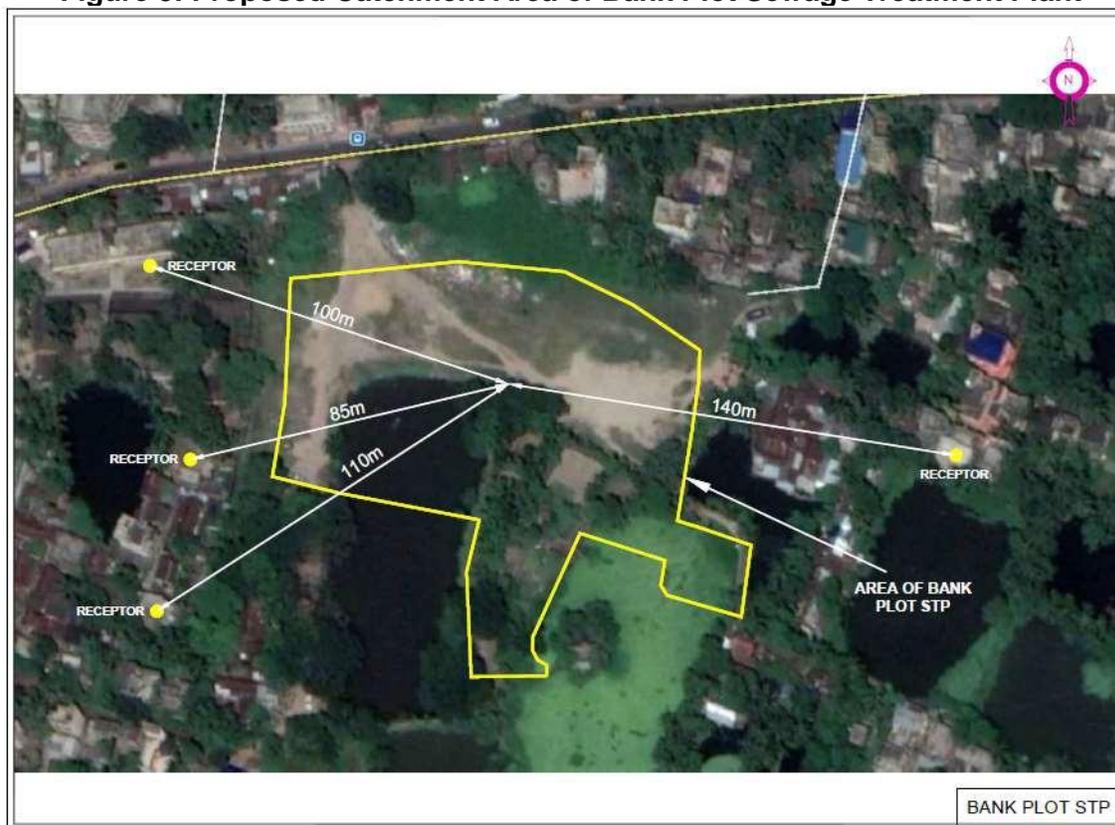
28. SBR treatment process is in fact a process of extended aeration for removal of nitrogen, phosphorous, etc.; therefore, chances of generation of odor are minimal. There will be only one point of generation of noise at the STPs. This is at desludging area (centrifuge pump and centrifuges). Enclosure around the desludging area has been included in the preliminary design. Noise impact from the STP is likely to be minimal. Two main sources of generation of odor in STP are raw sewage receiving chamber and desludging area. There is no raw sewage pumping station within the STP premises and waste water will be received under flowing condition. Therefore, risk of odor from this source is minimal. SBR basin will also be under aeration for 50% of the day which will ensure minimum odor generation. The other main source of odor may be the dewatered sludge from the centrifuges. This dewatered sludge area will be enclosed from three sides to keep the area isolated so as to control odor dissemination.

29. After treatment of collected sewage in the STP, effluent will be discharged in the canal conforming to national standard for discharge of treated effluent from STP to water bodies. The national standard is concentration based (not load based) and the compliance to this standard will be ensured through periodic monitoring of the treated effluent (as per the direction to be given by West Bengal Pollution Control Board in their Consent to Operate license) during the operation phase of the STP. This canal is principally a drainage channel to carry storm water and as such there is no human use.

30. During construction, increased traffic, excess generation of dust and noise due to construction activities may cause some inconveniences to the local population. Mitigation measures are already considered in the IEE to keep this at a minimum. Community consultations have already been carried out. During detailed design stage multiple consultations at various levels will be carried out ensuring clear communication to the affected persons about the likely transient impact during construction and continued impact, if any, during the operation stage.

31. During trial operation and early operation stage, West Bengal Pollution Control Board will be requested to carry out noise and odor monitoring at the near receptors in order to check compliance with acceptable standards. The contractor is bound by contract to undertake suitable corrective measures if compliance is not attained.

Figure 3: Proposed Catchment Area of Bank Plot Sewage Treatment Plant



32. The catchment area covers parts of wards 122 under (Borough XIII) and 123,124, 142 & 143 wards under Borough XVI. The population of the catchment for the design horizon (2030) is 2, 15,745 and its total catchment is approximately 1371.54 Ha, which will serve as the command area for the proposed STP.

33. **Existing Sewerage and Drainage and Sewage Treatment Plant System.** The sub project area used to be dependent largely on septic tank arrangement for household sanitary systems and open surface drainage systems mainly for storm water and effluents of septic tanks. In many cases, the drains do not have any proper outlet and terminated into low land/ canal. All these existing practices have been partially controlled by ongoing S&D schemes under KEIP but without any dedicated wastewater treatment facility leading to the following system inadequacies:

- (i) no treatment of collected wastewater (DWF);
- (ii) open wastewater discharge into nearby canals and ponds (pukur) from adjoining areas; and
- (iii) the system is non-compliment with the latest discharge standards of treated sewage set by CPCB.

## B. Components of the Subproject

### Bank Plot Sewage Treatment Plant

34. The STP is designed for the year 2030 as per the CPHEEO norms, which recommends 15 years design horizon with 2015 as base year. It will be also in line with the design projections done for designing of Sewerage and Drainage (S&D) system. The quantity of wastewater generation estimated for the year 2045 is estimated to be 40 MLD, which will be the ultimate design horizon for the project. Although the design horizon is 2030, the design has been done in such a way that it can take additional loads for the year 2045. The difference between the design capacity required for 2030 (34 MLD) and 2045 (40 MLD) is only 6 MLD. Given the land constraints and small difference (6 MLD) SBR technology provides a good option of changing the operational parameters to achieve this gap. It is possible to operate the same plant for both capacities, by adjusting operational parameters like Food to Mass (F/M) ratio and minor modification in the hydraulic retention times. The batch operation mode and SCADA/ PLC control options utilized in the SBR plants make it possible smoothly. The preliminary design is done using this principle, but the detailed design of the process will be the prerogative of the selected contractor/vendor as per the turn key contract.

35. The quality of influent wastewater is assumed to be in line with CPHEEO recommendation. They are also on conservative side which is good since the wastewater influent quality in a combined sewer system varies depending on the season and flow conditions inside the sewer. The following table depicts the influent wastewater characteristics assumed for design of STP.

**Table 4: Influent Wastewater Characteristics**

No.	Parameters	Units	Values
1	pH	-	5.5 to 9.0
2	Biochemical Oxygen Demand (BOD <sub>5</sub> )	mg/l	200
3	Chemical Oxygen Demand (COD)	mg/l	350
4	Total Suspended Solids (TSS)	mg/l	375
5	Total Kjeldahl Nitrogen (TKN)	mg/l	45
6	Total Phosphorous (TP)	mg/l	7

No.	Parameters	Units	Values
7	Fecal Coliform	MPN/100 ml	1 x 10 <sup>6</sup>
8	Total Coliform	MPN/100 ml	1 x 10 <sup>7</sup>

36. The effluent norms for wastewater discharge are going to follow the latest CPCB standards as described in the Table 5.

**Table 5: Effluent Wastewater Characteristics Required as per Latest Central Pollution Control Board Norm, 2015**

No	Parameters	Units	Values
1	pH	-	6.5 to 9.0
2	Biochemical Oxygen Demand (BOD <sub>5</sub> )	mg/l	≤ 10
3	Chemical Oxygen Demand (COD)	mg/l	≤ 50
4	Total Suspended Solids (TSS)	mg/l	≤ 10
5	Ammonia Nitrogen (NH <sub>3</sub> -N)	mg/l	≤ 5
6	Total Nitrogen (TN)	mg/l	≤ 10
7	Total Phosphorous (TP)	mg/l	≤ 2
8	Faecal Coliforms	MPN/100 ml	≤ 100

37. Figure 4 shows google map of location of STP. Alignment for proposed treated effluent discharge to canal is shown in Figure 5. Layout plan for the STP is given in Figure 6. SBR process diagram for Bank Plot STP is given in Figure 7. All the figures are attached at the end of this section.

38. Appendix 5 illustrates few photographs of work locations.

39. Appendix 6 shows SBR technology, as considered for treatment of sewage effluent.

### **C. Need of the Subproject**

#### Bank Plot Sewage Treatment Plant

40. In the command area of the proposed STP, development of the trunk S&D network for the part of the areas has been considered under Tranche 2 and remaining part will be implemented under Tranche 3. The network will collect the dry weather flow (DWF) at the Churial Extension pumping. The DWF collected will be then pumped to the proposed STP for treatment. It is expected that the proposed STP will be functional before completion of the S&D network.

41. The collected DWF can be treated to the environmentally sustainable levels as per the latest CPHEEO/CPCB norms. The treated effluent from the STP will be discharged to the nearby Churial canal. Once the project is completed it is expected that the water quality in Churial canal will improve, which in turn will create more hygienic conditions along its length. It will also help in controlling the pollution of River Ganga as the Churial canal finally merges in it. A number of site visits has been conducted in the sub-project areas to finally identify a land which can be developed into a STP. In summary following are the main reasons for taking up this project:

- (i) to ensure that the command area has a fully functioning S&D network of which STP is a crucial component;
- (ii) to improve public health, for population living on the banks of the canals as well as areas around it; and

- (iii) to improve water quality of River Ganga by treating waste water before discharging for fulfilling Government Policy and one of the objectives of cleaning river Ganga.

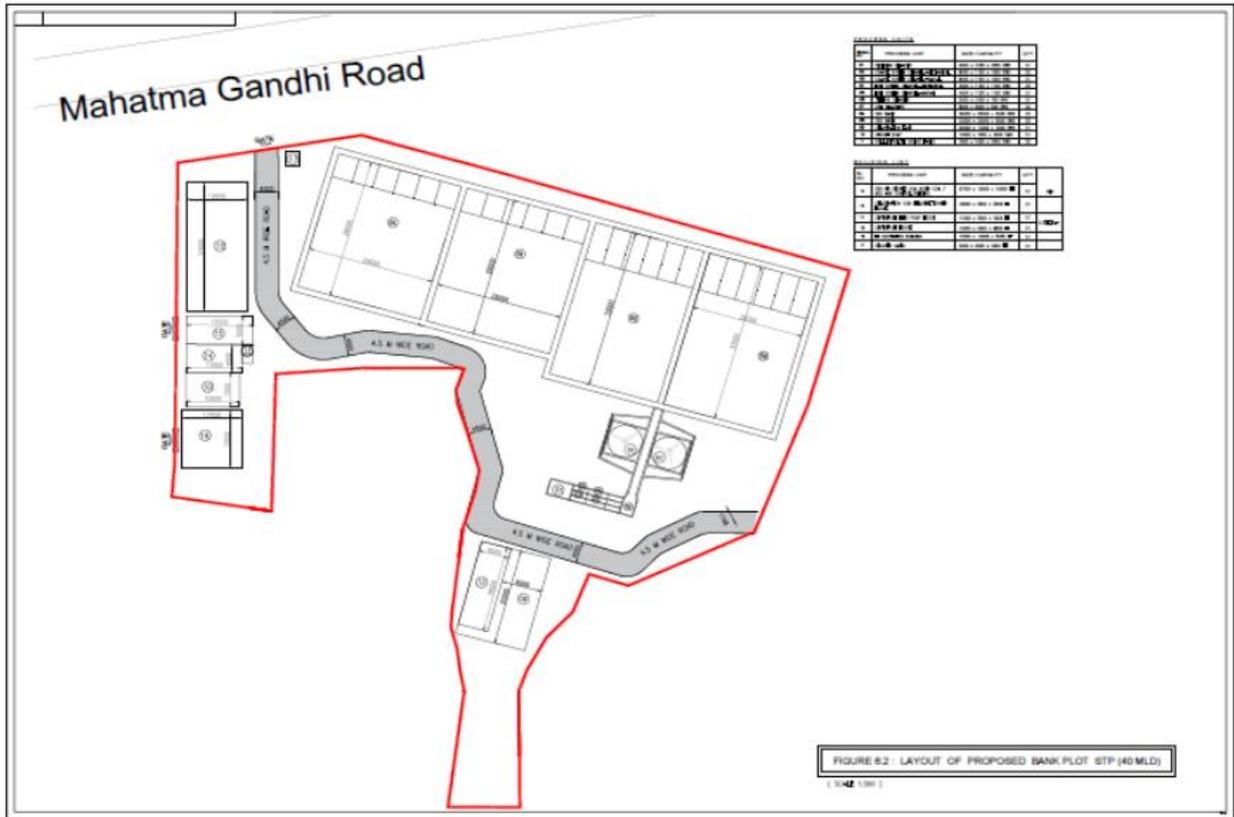
**Figure 4: Google Map of Bank Plot Sewage Treatment Plant**



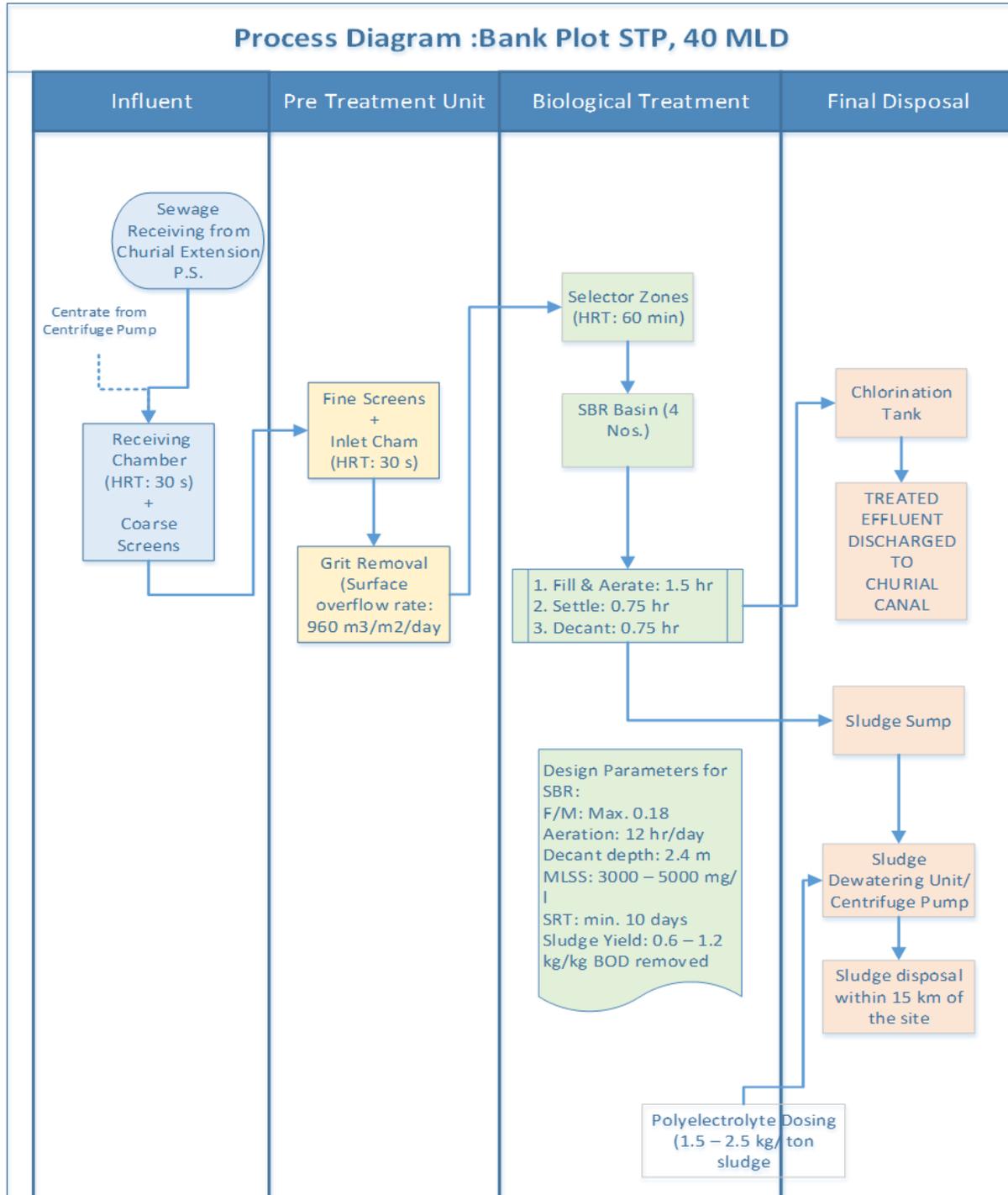
**Figure 5: Alignment for Proposed Treated Effluent Discharge to Canal from Bank Plot Sewage Treatment Plant**



Figure 6: Layout Plan for Bank Plot Sewage Treatment Plant



**Figure 7: Sequencing Batch Reactor Process Diagram, Bank Plot Sewage Treatment Plant**



#### D. Salient Features of the Subproject

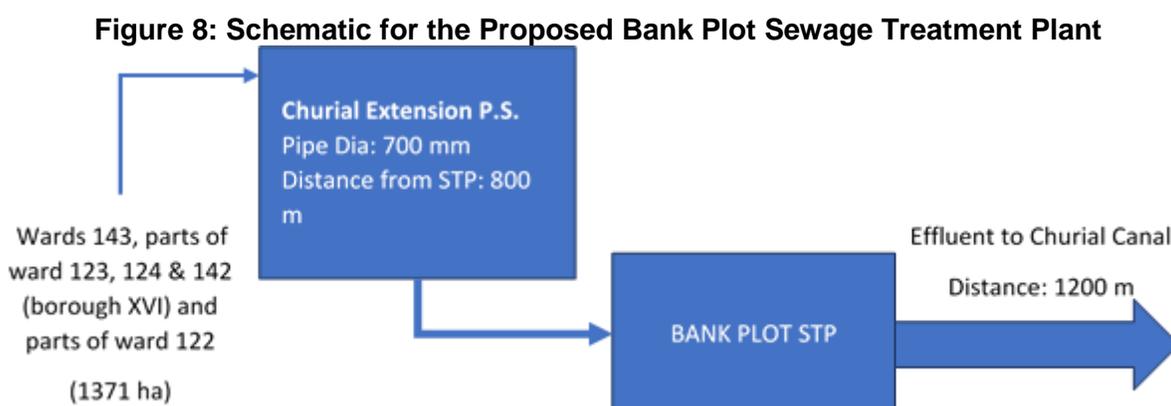
42. Based on the objective and need of the sub project, the following scope has been devised as per preliminary design. It includes all the activities to make the STP functional.

### Bank Plot Sewage Treatment Plant

- (i) design and construction of sewage treatment plant of 40 MLD SBR technology on Bank Plot land;
- (ii) installation of DWF pumps at Churial Extension Pumping station (P.S.);
- (iii) laying of DWF influent pumping main from Churial Extension Pumping station to Bank Plot STP - 800 m pumping mains 700 mm dia (DI pipes);
- (iv) laying of 1200 m effluent discharge line to Churial Canal- 800 mm dia MS pipe; and
- (v) area development of the Bank Plot STP site including storm water drainage, area lighting, plantation of trees/ green belt and other allied works.

43. The work will be implemented on BOOT basis. Contractor will do final design and accordingly scope will be revised.

44. A basic schematic diagram can be seen in Figure 8.



45. During construction phase estimated solid wastes to be handled and disposed under the said STP sub projects is given in the following Table 6.

**Table 6: Estimate of Solid Waste to be Generated under Sewage Treatment Plant Project**

Component	Package No. SD29/2017-18
Estimated approx. volume of soil to be excavated (m <sup>3</sup> )	12940
Estimated approx. volume of excess excavated soil to be disposed (m <sup>3</sup> )	3575
Estimated approx. volume of road crust to be removed and disposed (m <sup>3</sup> )	140

46. Approximate generation of sludge from STP is shown below.

**Table 7: Expected generation of sludge from Sewage Treatment Plant**

No.	Sewage Treatment Plant	Capacity	Expected Sludge Generation	Strategy of Disposal
1	Bank Plot STP	40 MLD	32 m <sup>3</sup> /day i.e. 11,680 m <sup>3</sup> /year	Sludge after dewatering will be truckable (20% solids content) and can be used as manure/compostable.

m<sup>3</sup> = cubic meter, m<sup>3</sup>/year = cubic meter per year, STP = sewage treatment plant, MLD = million liters per day, % = percent.

## E. Implementation Schedule

47. Sewage Treatment Plant will be constructed through Turn Key/BOOT contract. Contractor will do the detailed designing of STP and pipeline before start of the construction work. Draft IEE will be updated after finalization of the design. Construction work will commence on 2018 and is to be completed in 24 months for the STP sub projects under Tranche 3. Expected date of bidding is September 2017 and commencement of contract will be February 2018.

48. Tentative schedule is given below.

**Table 8: Expected Generation of Sludge from Sewage Treatment Plant**

Activity	SD29/2017-18
Submission by contractor of Site Environmental Plan (SEP) by Contractor	Within 28 days after receiving notice under commencement of work
Review and approval by KMC of contractor's SEP, proposed locations for construction work camps, storage areas, hauling roads, lay down areas, disposal areas for solid and hazardous wastes.	Within 21 days
Construction	24 months (February 2018 to February 2020)
Commissioning period	
Operation and maintenance period	60 months from completion

## IV. DESCRIPTION OF THE ENVIRONMENT (BASELINE DATA)

49. Baseline environmental conditions per detailed engineering design and final alignment/locations will be determined during IEE updating. Results will be reported in the final IEE to be submitted to ADB for review and approval. Detailed surveys will include identification of any properties, wells, physical cultural resources or any other sensitive receptors within 500m of the alignments/sites. Final IEE will include all sampling sites/locations which will form part of the environmental monitoring program.

### A. Physical Resources

50. **Topography, Drainage, and Natural Hazards.** Regionally KMC area is mostly flat and sloping in general from north to south and from west to east. The southwestern part of Borough XV and different parts of Borough XII are low lying.

51. The primary surface water resource for Kolkata is the Hooghly River. In addition, the city has a large number of water bodies and canals that are heavily used for everything from water supply, bathing, washing, aquaculture, and recreation to waste disposal. Hooghly River forms the western boundary of the KMC area. Bidyadhari and Kulti rivers meander along the eastern boundaries of KMC and discharge directly in to the Bay of Bengal. These rivers, along with an elaborate network of canal systems connected to these rivers are the recipients of entire drainage from KMC and its adjacent areas. Drainage of KMC area is generally divided in to the following drainage basins according to the topography and land use: Kolkata Basin; Bagjola Basin; Tollys Nullah Basin; Manicktala Basin; Tollygunge – Panchanagram (T-P) Basin; Keorapukur Basin; Monikhali Basin; and Churial Basin.

52. The KMC area, with its generally flat terrain condition, receives more than 1,582 mm of rainfall yearly mainly spread over a 4 months period and comprised of mainly medium density – high frequency long duration storms. Due to the absence of an efficient drainage system to cater

such an adverse condition, large areas of KMC suffer from prolonged inundation during monsoon causing severe health and economic hazards to the inhabitants.

53. The waste and storm water of the KMC area is carried by a system of natural and man-made canal system as follows:

- (i) bagjola canal system – flowing in easterly direction;
- (ii) kestapur canal system – flowing in southerly direction;
- (iii) beliaghata (Circular) canal system;
- (iv) storm water flow (SWF) – Dry Weather Flow (DWF) canal system flowing in easterly direction towards East Kolkata Wetlands carrying the pumped storm and sewage water of Kolkata;
- (v) tolly's nala system;
- (vi) T-P system;
- (vii) monikhali system and
- (viii) churial system.

54. Drainage basin and catchment area map of KMC is presented in Figure 9.

55. The principal features of the existing drainage basin layout for the KMC area were delineated in the Master Plan for Water Supply, Sewerage & Drainage in Calcutta Metropolitan District (1966-2000) prepared by CMPO. In the S&D Master Plan prepared for the Kolkata City in 2007 under KEIP, certain changes in basin boundaries have been identified from the earlier recommendations due to alterations arising out of changes in the existing drainage network of the areas.

56. The KMC area is divided into nine major drainage basins namely Kolkata basin, Manicktala basin, Tolly's Nullah basin, Topsisia - Tangra basin, Hooghly basin, Tollygunge - Panchannagram (TP) basin, Bagjola basin, Monikhali basin and Churial basin. Out of these, the sub-project area comprising parts of Boroughs XIII and XIV come under Churial Basin. Figure 9 shows the catchment delineation of the different drainage basins within KMC area. The project area falls in Churial *canal* basin



60. **Geology and Mineral Resources.** The subproject area is underlain by Quaternary sediments consisting of clay, silt, and various grades of sand, gravel, and pebbles. Lithological logs show the presence of a clay bed at the top, with a thickness of 10 to 40m. There is a further clay bed 250 to 650 m below ground level. There is a group of granular aquifers between these layers, and these are being tapped as a ground water resource. Regional subsoil data covering a large area in subproject area reveal six levels of strata up to a depth of about 50 m below ground level. Near surface general stratigraphy of the project area is given in Table 9.

**Table 9: Near Surface Stratigraphy of the Project Area**

Horizon I	Stratum I	Brownish grey/ light brown, silty clay/ clayey silt/ sandy silt with occasional lenses of silty fine sand; encountered from the top ground surface to a depth of about 3 to 4 m; occasionally only fill material of widely varying characteristics (about 4 m).
	Stratum II	Grey/ dark gray silty clay with semi-decomposed timber pieces, having lenses of silt and peaty clay; encountered between depths 3-4m and approximately 15m below ground level (about 10m).
Horizon II	Stratum III	Bluish grey and mottled brown/ grey, silty clay with kankar nodules and minute pockets of silt and sand (about 5.5m).
	Stratum IV	Brown/ yellowish brown, sandy silt/ silty fine sand/ clayey silt with lenses and pockets of brown/ grey silty clay (about 6m).
	Stratum V	Mottled brown/ grey, grey silty clay and brown silty clay frequently showing laminar character (about 18m).
	Stratum VI	Brown/ light brown, silty fine to medium sand (9m +).

61. The Horizon I comprising Strata I and II represents generally soft sediments. The second horizon comprising Strata III to VI have two clay layers (Stratum III and V) separated by a predominantly cohesion less layer (Stratum IV). Stratum VI is definitely water bearing and shallow tube wells in Kolkata region draw water from this stratum. The sediments of the second horizon are oxidized and are consolidated. The sequence is intercepted at several locations by deposits of the recent river system, parts of which are now dry.

62. There is no mineral occurrence in the area.

63. **Soil.** The Kolkata area may be divided into two groups based on the soil types: Entisols and Alfisols. The Entisols are present at the western part of the area and the other part is represented by Alfisols. These soils are typically deltaic alluvial soils. The agro-climatic zone characterization of the area is Gangetic alluvium group of soils rich in calcium. Free calcium carbonate occurs in surface soils and the soil profile shows low to medium levels of organic matter and medium levels of available phosphate and potash. Kolkata and the neighboring areas are represented predominantly by clayey soils. Table 10 lists the physical and chemical characteristics of soil sampled and analyzed from the five selected Boroughs of KMC in the southern part of the city.

**Table 10: Soil Quality in Five Boroughs of Kolkata Municipal Corporation**

No.	Parameters	Sample (S1)	Sample (S2)	Sample (S3)	Sample (S4)	Sample (S5)
1	Sand (%)	14.0	15	20	22.0	24.0
2	Silt (%)	32.0	30	40	44.0	30.0
3	Clay (%)	54.0	65.0	60.0	34.0	46.0
4	pH	8.5	9.3	6.9	9.7	9.47
5	Available nitrogen (mg/kg)	1250	1428.0	1071.0	2356.2	904.4

No.	Parameters	Sample (S1)	Sample (S2)	Sample (S3)	Sample (S4)	Sample (S5)
6	Available phosphorus (mg./kg)	180	230	190	280	210
7	Available potassium (mg./kg)	58	80	62.5	90	52.0
8	Iron (mg/kg)	326.0	266.9	250.0	5433.57	3125.87
9	Zinc (mg/kg)	29.1	25.0	28.5	31.1	31.48
10	Copper (mg/kg)	5.81	7.69	8.5	21.94	<0.4
11	Hexavalent chromium (mg/kg)	<1.0	<1.0	<1.0	<1.0	<1.0
12	Trivalent chromium (mg/kg)	11.67	8.33	5	28.33	25.0
13	Nickel (mg/kg)	10.0	13.2	8	14.8	14.0
14	Arsenic (mg/kg)	<0.1	<0.1	<0.1	<0.1	<0.1
15	Lead (mg./kg)	12.35	12.8	8.5	25.19	13.33
16	Cadmium (mg./kg)	<0.4	<0.4	<0.4	<0.4	<0.4

Notes: S1 - HL Sarkar Road, Borough XI, Ward 113; S2 - Near Chowbagha, Borough XII, Ward 108; S3 - Motilal Gupta Road, Borough XIII, Ward 122; S4 - Near Kalitala Market, Borough XIV, Ward 125; and S5 - Near Badartala, Borough XV, Ward 141.

64. **Climate.** The climate is hot and humid from March to October. It is somewhat cool from November to February. Rains are received principally from June to September with frequent pre-monsoon showers and nor'westers during April and May. The winter season begins in November and continues to February, followed by the summer season, which continues until mid-June. The monsoon starts in mid-June and goes up to mid-September, sometimes extending up to October.

65. April and May are the hottest months with monthly mean maximum temperature above 35 degree Celsius (°C). Mean maximum temperature is above 30°C from March to October. Relatively low monthly mean minimum temperatures occur during December (15.2°C), January (14.1°C) and February (18.1 °C). Mean monthly minimum temperature is relatively high and is between 26°C and 27°C during the months of May, June, July and August.

66. The average annual rainfall is about 1919 mm with the four monsoon months (June to September). Rainfall peaks in July. Average number of rainy days is about 146 days per annum. During monsoon months, it is not uncommon to receive 75 mm to 100 mm of rainfall in a 24-hour period. Such heavy rainfall may occur from 4 to 10 times in a year.

67. Wind is light to gentle with maximum monthly average speed 7.22 kilometer per hour (km/h). The post-monsoon and winter months (October-February) experience very light wind. The average monthly wind speed during pre-monsoon and monsoon are 6.10 and 5.03 km/h, respectively. The mean annual wind speed is 4.28 km/hr. The prevalent wind direction was from southwest during most of the time in the year, except during winter when the northerly wind became significant. However, during cyclonic storms and depressions especially those occurring in September to October, high wind speed reaching around 100 km/hour is uncommon.

68. **Air Quality.** The concentrations of air pollutants in Kolkata are highly variable over the seasons. They are at their highest during winter months (November to February) and at their lowest during monsoon months (June to September). 24-hourly suspended particulate matter (SPM) concentration in the winter months generally ranges between 300 and 400 microgram per cubic meter ( $\mu\text{g}/\text{m}^3$ ), sometimes reaching values in excess of 500  $\mu\text{g}/\text{m}^3$ . 24-hourly respirable particulate matter (RPM) concentration in those months is mostly in the range of 150 to 200  $\mu\text{g}/\text{m}^3$  but often exceeds 200  $\mu\text{g}/\text{m}^3$ . During monsoon months, the 24-hourly SPM and RPM concentrations come down to around 100  $\mu\text{g}/\text{m}^3$  and around 50  $\mu\text{g}/\text{m}^3$  respectively. Similarly, 24-hourly nitrogen oxides ( $\text{NO}_x$ ) concentrations are around 50  $\mu\text{g}/\text{m}^3$  during the monsoon months but rises to around 90  $\mu\text{g}/\text{m}^3$ , sometime exceeding 100  $\mu\text{g}/\text{m}^3$ , during the winter months. Except

for a slight build-up during the winter months, 24-hourly sulphur dioxide (SO<sub>2</sub>) concentrations are mostly around 5 to 7 µg/m<sup>3</sup> during most months of the year. The month of October generally shows a rapid transition from low concentrations of all pollutants to the succeeding high concentration months. But the transition from high concentration in winter months to that of low in monsoon months is rather gradual through the months of March, April and May. Seasonal variations in temperature, wind, rainfall, and other factors account for this.

69. When compared with national air quality standard for residential areas the ambient air quality of Kolkata does not meet the national standard in respect of PM<sub>2.5</sub>, PM<sub>10</sub> and NO<sub>x</sub> in terms of both arithmetic annual average and also percent of time the daily concentration exceeding the prescribed standard. However, the concentration of SO<sub>2</sub> adequately meets the national standard on both counts.

70. Ambient air quality data for Behala Chowrastha area near project site is shown in table below. PM<sub>10</sub>, PM<sub>2.5</sub> and NO<sub>2</sub> are always above the standard. Due to construction activity (water supply, metro rail) at that area air pollutants level in ambient air are always higher.

**Table 11: Ambient Air Quality at Behala Chowrastha 2012-2013**

Month	Concentration								Concentration in PM <sub>10</sub>			
	PM <sub>10</sub> (µg/m <sup>3</sup> )	PM <sub>2.5</sub> (µg/m <sup>3</sup> )	SO <sub>2</sub> (µg/m <sup>3</sup> )	NO <sub>2</sub> (µg/m <sup>3</sup> )	NH <sub>3</sub> (µg/m <sup>3</sup> )	O <sub>3</sub> (µg/m <sup>3</sup> )	CO (mg/m)	C <sub>6</sub> H <sub>6</sub> (µg/m <sup>3</sup> )	B(a)P (ng/m <sup>3</sup> )	As (ng/m <sup>3</sup> )	Pb (µg/m <sup>3</sup> )	Ni (ng/m <sup>3</sup> )
Oct'12	79.93	43.44	8.15	56.44	21.30	31.01	0.78	0.31	0.84	7.49	0.21	3.33
Nov'12	146.42	82.09	12.47	74.42	29.42	32.02	1.09	0.72	0.98	9.21	0.44	7.70
Dec'12	267.42	123.00	11.90	77.19	26.60	43.53	1.00	0.50	0.12	3.65	0.31	6.38
Jan'13	326.97	169.00	13.27	78.68	23.48	45.68	1.05	0.80	0.12	5.86	0.39	11.13
Feb'13	254.00	140.43	10.57	68.57	20.10	40.30	1.05	0.87	0.12	3.79	0.34	8.76
Mar'13	153.00	73.56	8.43	55.39	16.43	38.24	1.00	0.91	0.12	2.16	0.20	4.70

Source: Annual Report West Bengal Pollution Control Board, 2012-2013.

71. Overall, average ambient air quality level of Kolkata is shown below. From 2013-2015 concentration of PM<sub>10</sub>, PM<sub>2.5</sub> and NO<sub>2</sub> are always above the standard.

**Table 12: Average Ambient Air Quality of Kolkata**

Year	PM10 (µg/m <sup>3</sup> )			PM2.5 (µg/m <sup>3</sup> )			SO <sub>2</sub> (µg/m <sup>3</sup> )			NO <sub>2</sub> (µg/m <sup>3</sup> )		
	Value	Standard	% days of NC	Value	Standard	% days of NC	Value	Standard	% days of NC	Value	Standard	% days of NC
2013	124	60	46	69	40	41	8	50	0	43	40	6
2014	131	60	50	71	40	47	6	50	0	47	40	10
2015	114	60	41	61	40	38	4	50	0	45	40	4

Source: State of the Environment Report West Bengal, 2016.

72. **Surface Water Quality.** The primary surface water resource for Kolkata is the Hooghly River that skirts the western margin of Kolkata. In addition, the project area has a large number of water bodies and canals that are heavily used for everything: from bathing, washing, aquaculture and waste disposal. A large quantity of water is drawn from the Hooghly River for various uses and returns as wastewater to the river without little treatment. Industrial and domestic

pollution along with runoff from adjoining areas has led to deterioration in river water quality. Summary chemical analysis Hooghly river water at Garden reach are given below in Table 13.

**Table 13: Water Quality of Hooghly River at Garden Reach**

No.	Parameter	Unit	Test result (11.01.11)	Test result (07.04.11)	Test result (08.07.10)
1	Conductivity	µs/cm	336	371	214
2	Dissolved O <sub>2</sub> (DO)	mg/l	12.2	4.4	5.7
3	pH	Unit	8.27	8.03	7.4
4	Temperature	°C	16	29	27
5	BOD	mg/l	5.55	3.8	5.9
6	Nitrate-N	mg/l	0.04	1	0.31
7	Fecal Coliform	MPN/100ml	250000	8000	22000
8	Total Coliform	MPN/100ml	350000	11000	33000
9	Ammonia-N	mg/l	BDL	0.164	0.225
10	Phosphate - P	mg/l		0.25	0.04
11	Chloride	mg/l		29.14	14.56
12	Lead	microgram/l		7.48	

BDL = Below Detection Limit, us/cm = micro siemen per centimetr; mg/l = milligram per liter; MPN/100 mL = Most Probable Number per one hundred milliliter; ug/l = Microgram per liter; There are no government standards for (tidal) river water.

Source: WBPCB, www.wbpcb.gov.in.

73. The drainage canals in the southern part of the city are Kalagachia, Suti, Churial, Manikhali, Begore, Keorapukur, Western channel joining Keorapukur, Rania, Tollygunge-Panchanangram Main canal, Intercepting channel, Suti khal (eastern part), different Lead canals to Tollygunge-Panchanangram Main, Mundapara khal etc. Chemical analysis of water of Churial and Keorapukur canals shows that concentration of total dissolved solids (TDS) is high. Also, BOD and COD are high in both the samples. Concentrations of heavy metals [Pb, Cd, Hg, As, Cr (III) & Cr (VI)] were always below their respective detection limits (Table 14). Water of these canals does not meet the primary water quality criteria for even bathing water.

**Table 14: Quality of Churial and Keorapukur Canal Water**

No.	Parameters	Sample (CW 1)	Sample (CW 2)
1	pH	7.23	7.12
2	Total suspended solid (mg/l)	30.0	32.5
3	Total dissolved solid (mg/l)	741.0	650.0
4	DO (mg/l)	4.6	5.2
5	COD (mg/l)	109.92	67.96
6	BOD <sub>3</sub> days, 27°C (mg/l)	35.0	18.0
7	Chloride (mg/l)	131.87	138.0
8	Sulphate (mg/l)	12.0	26.5
9	Nitrate (mg/l)	25.0	19.0
10	Sodium (mg/l)	80.5	70.0
11	Potassium (mg/l)	20.0	18.5
12	Calcium (mg/l)	66.77	51.06
13	Magnesium (mg/l)	28.22	23.52
14	Phosphorus (mg/l)	8.54	4.5
15	Lead (mg/l)	<0.3	<0.3
16	Cadmium (mg/l)	<0.04	<0.04
17	Mercury (mg/l)	<0.9	<0.9
18	Arsenic (mg/l)	<0.01	<0.01
19	Trivalent Chromium (mg/l)	<0.2	<0.2
20	Hexavalent Chromium (mg/l)	<0.1	<0.1

No.	Parameters	Sample (CW 1)	Sample (CW 2)
21	Zinc (mg/l)	0.04	0.8
22	Phenolic Compound (mg/l)	<0.1	<0.1
23	Cyanide (mg/l)	<0.05	<0.05
24	Ammoniacal Nitrogen (mg/l)	6.8	3.0
25	Kjeldahl Nitrogen (mg/l)	23.5	8.5
26	Total Nitrogen (mg/l)	35	15.0
27	Total Ammonia (mg/l)	8.22	3.63
28	Total Coliform (CFU/100 ml)	4.5 x 10 <sup>3</sup>	3.2 x 10 <sup>3</sup>

BOD = Biochemical Oxygen Demand, DO = Dissolved Oxygen, mg/l = milligram per litre, CFU = Colony Forming Unit.

Note: Treated effluent will discharge into Churial canal.

CW 1: Churial canal (Borough XIV, Ward 124)-

CW 2: Keorapukur canal (Borough XIII, Ward 122)

Source: KEIP Phase 1.

74. Chemical analysis of Churial canal water and Tolly's *nullah* was carried out under KEIP Phase 2 (during KEIP project preparation) which shows high BOD, TVS, Odour threshold and coliform pollution (Table 15).

**Table 15: Chemical Analysis of Canal Water**

Parameters	SW1	SW-2
	Tolly's Nullah	Churial Khal near Diamond Harbour Road Crossing
Temperature(°C)	32.5	21.50
Colour unit	2.0	2.0
Turbidity(NTU)	16.78	11.50
Odour (TON)	8.0	8.0
pH	6.52	7.47
Total solids(mg./l)	1078.0	582.0
TDS(mg./l)	950.0	365.0
TSS(mg./l)	68.0	67.0
TVS(mg./l)	165.0	128.0
DO(mg./l)	4.8	3.8
B.O.D. (mg./l)	40.0	45.0
C.O.D. (mg./l)	150.0	160.0
Oil & Grease(mg./l)	4.5	5.0
Lead(mg./l)	-	<0.03
Chromium (III) (mg./l)	-	<0.20
Chromium (VI) (mg./l)	-	<0.05
Arsenic(mg./l)	-	<0.01
Cadmium(mg./l)	-	<0.01
Nickel(mg./l)	-	<0.20
Copper(mg./l)	-	<0.05
Zinc(mg./l)	1.1	0.24
Iron(mg./l)	0.93	1.8
Ammoniacal Nitrogen(mg./l)	11.0	16.5
Kjeldahl Nitrogen(mg./l)	20.5	30.0
Total Nitrogen(mg./l)	32.67	58.5
Total Ammonia(mg./l)	13.31	19.96
Free Ammonia(mg./l)	0.00	0.75
Sulphide(mg./l)	3.2	3.60
Mercury(mg./l)	-	<0.0001
Salinity (ppt)	-	0.025
Faecal coliform (MPN/100ml)	3.4 X 10 <sup>6</sup>	3.2 X 10 <sup>6</sup>

BOD = Biochemical Oxygen Demand, COD = Chemical Oxygen Demand, NTU = Nephelometric Turbidity Units, mg/l = milligram/liter, MPN/100 ml = Most Probable Number per one hundred milliliter, ppt = parts per thousand, TON = Threshold Odor Number.

Source: Primary data generated during present IEE preparation for KEIP, Date of sampling 01.06.2012.

75. **Groundwater.** The aquifers that are tapped for ground water in Kolkata are under confined condition because of the presence of a thick clay layer near the surface. Such aquifers occur at various depths separated by other clay layers. Generally, the first aquifer is encountered at a depth of about 15 m followed by other aquifers with a principal one at about 90 m depth. The shallow aquifer is not used for bulk water tapping purposes, and is generally only tapped for spot supply of through hand pumps. A further deep aquifer occurs at depths approximately between 150 and 200m, and majority of deep tube wells for organized supply of drinking water tap this aquifer. The earliest geohydrological data for the configuration of the piezo metric surface beneath Kolkata are available for the post-monsoon period of 1956. It shows that in the northern part of the city, the piezo metric surface was about 0.5-1.0 m above sea level and progressively declined below mean sea level towards the south. There was a drastic change in the pattern in the pre-monsoon of 1958 when a small depression in the piezo metric surface was created with the center near Park Street lying at 5 m below mean sea level. The piezo metric surface contour plan therefore defined a centripetal ground water flow pattern changing from an open north to south to a closed one. This ovoid ground water through with long axis trending northwest-southeast persisted since then progressively going down with the central part having piezo metric surface lying at (-) 13 m below the mean sea level in the pre-monsoon of 1998. The fall in elevation of the piezo metric surface over a period of 40 years is of the order of at least 5 m at the extreme eastern part of Kolkata. The fall of piezo metric surface in Command Hospital (Alipore), Kudghat and Tiljala area are 2.08, 3.06 and 3.24 m respectively. The area of depression is roughly bounded by the triangle formed by Narkeldanga, Park Circus and Alipore National Library.

76. As part of KEIP II DPR preparation for added area, geohydrological investigations were carried out in January 2009 in seventeen wards distributed in Borough XI to XV. In these areas, ground water occurs mainly under confined to semi-confined conditions in 13 wards (108, 109, 111, 115, 122, 123, 124, 125, 126, 127, 139, 140 & 141). Depths of piezo metric surface from ground level in these wards varied between 9.3m to 14.11m. In wards 110, 112, 113 & 114, due to presence of near surface aquifers under water table conditions the depths to water level in the tube wells in these wards are between 1.3m to 2.9m. An aquitard occurs near surface over the entire studied area and ground water from this aquitard is tapped by dug wells. The depths to water table varied between 0.50m to 7.95m in these dug wells. With most areas reporting water levels within 1 to 2m from the ground surface.

77. Ground water in KMC area under two principal types, viz. a) Bicarbonate type and b) Chloride type. Ground Water in the area west of a line connecting BBD Bag, Park Street and Jadavpur is of Biocarbonate type whereas in the area east of this line ground water is of Chloride type. The two anionic types were further subdivided each into two types on the basis of predominance of cation concentration. These are (i) Calcium – magnesium bicarbonate; (ii) Sodium bicarbonate; (iii) Calcium –Magnesium chloride; and (iv) Sodium chloride.

**Table 16: Ground water facies at project area of Kolkata Municipal Corporation**

Type	Facies	Distribution and Characteristics of Groundwater Facies	Borough
Bicarbonate	Ca-Mg- HCO <sub>3</sub>	Occurrence in the entire western and south-central part of the city, south of Taltala-Kasba- Santoshpur tract in the NNW- SSE direction concentration of chloride low, in	IX, XI, XII, XIII, XIV, and XV

Type	Facies	Distribution and Characteristics of Groundwater Facies	Borough
		some places around New Alipore, Khidirpur, Elgin Road and Harish Park etc., chloride concentration as low as 11mg/l to 67 mg/l. Sodium concentration from 14 to 32 mg/l and average total dissolved solid 500mg/l.	
	Na- HCO <sub>3</sub>	Occurrence in the southern part of the city and particularly Behala, Tollygunge, Jadavpur and Putiari Soft with total hardness less than 150 mg/l; softening of ground water probably due to base exchange of calcium- magnesium ion with sodium ion from sodium montmorillonite clay.	X, XII

78. **Noise.** Noise level in Kolkata high and exceeds the national standard. Average noise level in typical residential areas away from the busy streets varies between 47.0 to 66.0 dBA with only about 20% of the measurement sites have noise level conforming to the prescribed noise level of 55 dBA (residential area; daytime). Noise level near busy roads expectedly have relatively high but variable noise level depending on the density of vehicle moving on the roads at the time of measurements. The range of measured noise levels was between 58.0 and 88.0 with more than 85% of the measurements show a value above 70 dBA. The measurement sites included some roads in front of school/college/hospital.

## B. Ecological Resources

79. **Vegetation.** The Kolkata region, except a small part that is falling in East Kolkata Wetlands to the east is in a region of moist tropical deciduous vegetation with fresh water aquatic plants. Because of the continuous expansion of human habitation and heavy population pressure, the nature of the vegetation is rapidly changing and there are fewer herbaceous plants in some parts of the area. The few undisturbed areas along canal banks, road sides and small orchards within the residential area offer more varied vegetation. There is no demarcated forest.

80. **Wildlife.** Common jungle cats, foxes (*Vulpes bengalensis*), house rats (*Rattus rattus*), and mice (*Mus muscatus*), kingfisher (*Alcedo* sp.) are present. Of the reptiles, garden lizards (*Calotes versicolor*), snakes (*Natrix* sp., *Viper* sp.), and kraits (*Bungarus caeruleus*) are common. The bird life includes house crows (*Acridotheres tristis*), house sparrows (*Paser domesticus*), and pigeons (*Coluamba livia*). Amphibians such as Indian bullfrogs (*Rana tigrina*), annelids such as earthworms (*Eisenia foetida*), and arthropods such as cockroaches (*Periplanata americana*), butterflies and ants (*Tapinoma sessile*) are common. There are no endangered faunal species in the subproject area.

81. **Aquatic Flora and Fauna.** Anchored and free floating and submerged hydrophytes like Kachuri pana (*Eichhornia crassipes*), Azolla (*Azolla pinnata*), Sagittaria (*Sagittaria* sp.), Hogla (*Typha angustifolia*) etc. can be seen in the many open water bodies other than Hooghly river. Such water bodies often contain fishes such as Rohu (*Labeo rohita*), Catla (*Catla catla*), and Bata (*Labeo bata*). Phytoplankton like Spirogyra sp., Zygnema sp., Navicula sp., Nostoc sp., Hydrodistyom sp., etc. and zooplankton like Cyclops sp., Paramecium sp., Euglena sp., Diaptomus sp., larvae of culex sp. etc. are ubiquitous.

82. **East Kolkata Wetlands.** The East Kolkata Wetlands (EKW), located on the eastern fringes of Kolkata city, is a part of the extensive inter-distributory wetland regimes formed by the Gangetic delta. The total area is 12,500 ha. Only a small part of KMC area falls within the limits of EKW. The EKW area includes one of the largest assemblages of sewage fed fishponds. The importance of this wetland lies in the fact that these sustain the world's largest and oldest integrated resource recovery practice based on a combination of agriculture and aquaculture, and provide livelihood support to a large, economically underprivileged population of around 27,000 families, which depend upon various wetland products, primarily fish and vegetables for sustenance. Based on its immense ecological and socio cultural importance, the Government of India, declared East Kolkata Wetlands as Wetland of International Importance under Ramsar Convention in 2002. EKW is a classic example of harnessing natural resources of the wetland system for fisheries and agriculture through ingenuity of local communities with their traditional knowledge. The wetland has been included by the Ramsar Convention as one of the 17 case studies on wise use of wetlands at the global level. The wetland provides strong arguments for integration of traditional knowledge of local communities into conservation and management practices. More than 1000 MLD of untreated sewage from Kolkata are discharged in to the fisheries of EKW for natural treatment in the fishponds.

83. The ecology of the EKW area has undergone a dramatic change since the beginning of the 19th century due to cessation of tidal (brackish water) influx from Bidyadhari and Matla rivers in to the then saline marshy area with brackish water fisheries. The change is not only due to natural causes like siltation but also due to developmental activities and hydrological interventions. The brackish water fisheries of earlier years were converted in to sewage fed fisheries bringing in a changed ecosystem and establishing a new biodiversity in the EKW areas.

84. There is no forest patch within EKW. There are no endangered species but there are a number of rare mammals, reptiles, fish and bird species. According to the Ramsar information database, there are rare mammals such as Marsh mongoose, small Indian mongoose, Palm civet and small Indian civet, which are significant in and around the EKW.

85. The representative aquatic flora and fauna of the EKW are listed in Table 17 and Table 18, respectively.

**Table 17: Representative Aquatic Flora of the East Kolkata Wetlands**

Type of flora	Species
Free floating forms	<i>Eichhornia sp.</i> , <i>Spirodella sp.</i> , <i>Pistia sp.</i> , <i>Ceratophyllum/Utricularia sp.</i> , <i>Axolla sp.</i> ,
Fixed anchored forms	<i>Vallisneria sp.</i> , <i>Hydrilla sp.</i> , <i>Najas sp.</i> , <i>Nymphaea sp.</i> , <i>Nymphoides sp</i>
Emergent amphibious forms	<i>Marsilea sp.</i> , <i>Impomoea sp.</i> , <i>Enhydra sp.</i> , <i>Colocasia sp.</i> ,
Facultative forms	<i>Typha sp.</i> , <i>Cyperus sp.</i> ,
Algal forms	<i>Synandra sp.</i> , <i>Spirogyra sp.</i> , <i>Zygnema sp.</i> , <i>Nitelea sp.</i> ,

Source: Utilization scenario of Kolkata Wetlands (1996) 2. Urban Ecology, Ghosh A.K 1988.

**Table 18: Representative Fauna of the East Kolkata Wetlands**

Type of Fauna	Species
Waterfowl	<i>Phalacrocdax niger</i> , <i>Ardeola gravii</i> ; <i>Babulcus ibis</i> ; <i>Egretta garzatta</i>
Waders	<i>Tringa hypoleucos</i> ; <i>Calibris minuta</i>
Kingfisher	<i>Ceryle rudies</i> ; <i>Alcedo athhis</i> ; <i>Pelargopsis capensis</i> ; <i>Halcyon Smyrnesis</i>
Aquatic reptiles	<i>Lissemys punctata</i> , <i>Enhydris enhydris</i> , <i>xenochrophis piscator</i>
Amphibians	<i>Rana cyanophyctis</i> ; <i>Rana tigerina</i> , <i>Rana limnocharis</i> , <i>Microphyla ornata</i> ; <i>Bufo melanostictus</i>
Fish	<i>Catla catla</i> ; <i>Labeo rohita</i> ; <i>L.calbasu</i> ; <i>L.bata</i> ; <i>Cirrhinus mrigala</i> , <i>Hypophthalmich thysmolitrix</i> , <i>Microvertebrates Puntius sarana</i> , <i>P.ticto</i> , <i>Amblypharygodon mola</i> ; etc.
Mollusca	<i>Bellamya bengalensis</i> ; <i>Pila globosa</i> ; <i>Diagnostoma sp.</i> , <i>Lymnea sp.</i> , <i>Gyrulus sp.</i> , <i>Thiara sp.</i> , etc.

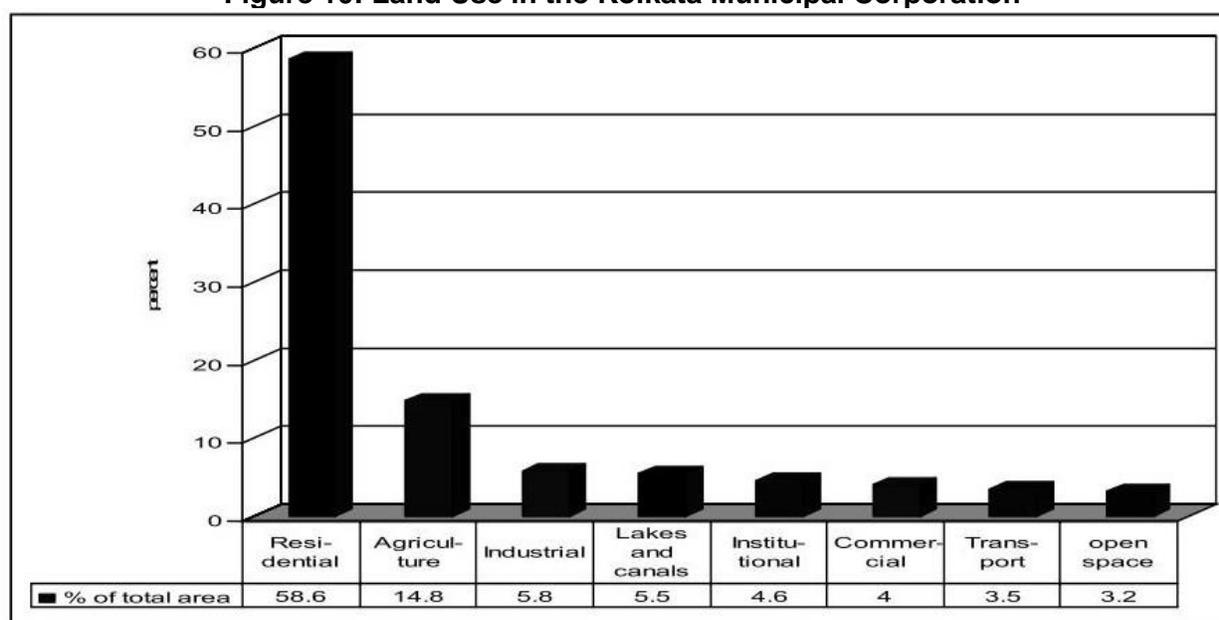
Type of Fauna	Species
Annelida	<i>Oligochaeta; Brachuria; Limno drilus sp., Hirudines – Glassophonia sp.,</i>
Insecta	<i>Hemiptera: Anisops sp., Limnogonus sp., Plea sp., Hydrometra sp., Micronecta sp.,</i>

Source: Utilization scenario of Kolkata Wetlands (1996) 2. Urban Ecology, Ghosh A.K 1988.

### C. Economic Development

86. **Land use.** The metropolitan area of Kolkata has grown from a few small villages to its present status as India's most populous city. The predominant land use in the KMC is residential, as shown in figure below. However, for most residential areas a more exact description will be mixed use. There are industrial sites throughout the city, in all 15 Boroughs and in 71 of the 144 wards. Urban planning is one of the responsibilities of the KMC. The KMDA also has a role in land planning, with a broader geographic scope than KMC.

**Figure 10: Land Use in the Kolkata Municipal Corporation**



Source: KEIIP SAR Volume 2 Initial Environmental Examination S & D, June 2012.

87. Land use 3 km around proposed STP is shown below.

**Table 19: Land Use Percentage around Bank Plot Sewage Treatment Plant**

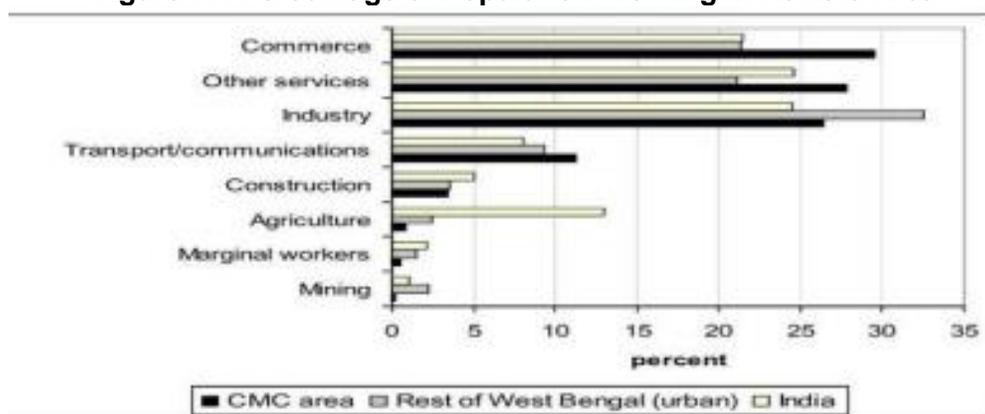
No.	Land use/Land cover	Land use type	Percentage (%)
1	Settlement	Urban	37
2	Plantation and habitation	Plantation around habitation	22
3	Grassland/barren	Grassland/barren	22
4	Water bodies	Pond/tank/river	12
5	Canal	Water body	7
			<b>100</b>

Source: KEIIP data.

88. **Commerce and industry.** Kolkata is a service center rather than an industrial center. As shown on figure below, the proportion of the population working in industry is similar to the India urban average, but below that of the rest of urban West Bengal.

89. Industrial growth has been accelerating in West Bengal with the introduction of the New Economic Policy (1992); the average annual growth of industrial production has moved up to 5.05%. While the organized industries are located in Cossipore area (Borough I), small scale industries as lead recycling, tanneries etc. are located in the Tiljala/Topsia area (Borough VII). It may be noted that all the tanneries are being relocated to a specially designated site at Karaidanga about 25 km away with all environmental safeguards. Only green i.e. non-polluting industries are permitted to be set up in KMC area. Permission from WBPCB is mandatory for discharging of waste in to municipal sewer or land or inland surface water body. For discharge to municipal sewer, industries must treat the effluent to the acceptable discharge limit as prescribed. Port related industries such as oil handling facilities etc. are found in the Garden Reach area viz Borough XV.

**Figure 11: Percentage of Population Working in Kolkata Area**



Source: KEIIP SAR Volume 2 Initial Environmental Examination S & D, June 2012.

90. **Water supply.** The water supply system of Kolkata is very old, operated from 1865. Present (2013) average per capita supply is 134 lpcd, which is very near to desired supply of 150 lpcd (for metropolitan cities). But the supply is very uneven, ranging from 310 lpcd to 40 lpcd. Unaccounted for water (UFW) is 40%. Average supply period is 8 hours a day. Residual pressure is very low. The average terminal pressure at consumer end is around 2.5 m of water head. In some areas, it ranges around 0.5 m-1.0 m of water head. About 10% of supply in Kolkata is from ground water. The source is affected by arsenic in some locations and TDS and Fe values are often above permissible values. From quality and health point of view the ground water source needs to be replaced. Coverage by piped water supply is 92%, which is nearing 100%. But the rest 8% is near the periphery of the study area and far from surface water source. The two main water works are Palta and Garden Reach.

91. **Transportation.** The Kolkata's transportation system is multi-modal and highly heterogeneous. Public transportation comprises everything from human-powered rickshaws to a subway system. Main thoroughfares in Kolkata are crowded with taxis, buses, two-wheelers, three-wheelers, hawkers, and a myriad of pedestrians all vying for limited space on the streets.

92. **Electrical Power.** Power supply in Kolkata dates back to 1898, when Calcutta Electric Supply Corporation was formed for generation, transmission and distribution of electrical energy in and around the city of Kolkata. From about 100 kw demand in 1898, the system has grown to about 1200 MW in 1998. Apart from its own generation, CESC Limited, presently a licensee of WBSEB, purchases power from the latter and also from Damodar Valley Corporation (DVC). The generating stations that operate in Kolkata area are Mulajore, capacity 150 MW, New Cossipore

160 MW, Titagarh 240 MW, Southern 135 MW, and Budge-budge 250 MW. In addition, 300-400 MW of power is supplied by West Bengal State Power Development Corporation and Damodar Valley Corporation. All these power plants are coal-based.

93. **Sanitation and Sewerage.** In the core city area, all properties, except the slums, are directly connected to the underground sewer network, meaning a total number of 358,750 households directly connected which is equivalent to 75% of all households in the core city area. The slum areas are in general served by communal toilets connected to septic tanks. In the outer areas served by KEIP a total number of 70,000 house connections would be constructed once the project is finalized in June 2012. This means a coverage of 22% of the total population in the KEIP areas. In the outer areas not yet served house connections to underground sewers don't exist by lack of any underground sewer system, meaning 0% coverage. This brings the average total for the entire KMC area at 44% as compared to the national target level of 100% but nevertheless it is way above the national average of 28%.

94. According to the 2001, Census 96% of the KMC population has access to individual or community toilets within walking distance in the service area. This compares favorably with the national average of 82% and is near the national benchmark of 100%. Most of the KMC slum areas are provided with communal toilet facilities within walking distance. Only 4% of the KMC population has no sanitation facilities and uses gutters, open drains, channels or vacant land for sanitation. This is mostly in the urban fringe areas where population densities are still relatively low. The 2011 Census results in this respect are not yet available but it is likely that the percentage of the population without toilets would further decrease over the years.

95. The collection efficiency of sewage is 71%, which is higher than the percentage of people with direct sewer connections because it also includes sewage collected through the interceptor sewer system. The collection efficiency is around 90% in the core city area as well as in the KEIP areas. The remaining outer areas have no formal sewer system yet and collection is zero.

96. The treatment capacity of the existing treatment plants and the East Kolkata Wetlands (EKW) is sufficient to serve the entire central city (100%) and the KEIP areas (100%). The total average for KMC is 88% because the outer areas not yet served by KEIP generate 12% of the wastewater for the entire KMC. The effluent quality at the outlets of the East Kolkata Wetlands and the existing treatment plants fully comply with national norms.

97. The extent of re-use is very high because 90% of all sewage from KMC ends up in the fisheries of the EKW where it serves as quality food for the fisheries. Effluent from other treatment facilities is partially re-used for agricultural purposes before it finally discharges into the Hooghly River. On average 93% of wastewater generated in KMC is re-used, comparing very favorable to the national target of 20%.

98. **Solid Waste Management.** The solid waste management system consists of three main components: Collection, Transportation and Disposal.

99. The majority (90%) of collection is done by KMC and 10% is contracted out to private contractors. House-to-house (doorstep) collection has been introduced in 75% of the KMC area. Other areas are served by street sweepers who operate manually. Many roads are too narrow to allow access for motorized collection vehicles. Primary collection is mostly by open hand carts and delivery at secondary collection sites (vats). There are 694 such collection points – 392 open vats and 302 bulk containers or direct loading. Open vats are generally poorly managed with spillage of disposed waste from the bulk containers or from open vat boundaries creating in most

cases an unhygienic environment. In 2011, source segregation has been introduced as a pilot project in seven wards. PMU design team is following innovative design principles for the combined effluent discharge systems. Certain weir structures are constructed in intercepting manholes (where both DWF and SWF gets mixed). The weirs are designed to attain necessary dilution level of the waste water and the rain water as per the acceptable standards. Water would only overflow over the weirs and would be discharged into drainage canals when the dilution level is reached. This would happen only in case of rains. Also by following this system, the first flush would go to the STPs rather being discharged into the canals. The height of the weirs are fixed with the help of the hydrodynamic models. On the other hand, when there are no rains (dry weather), since the waste water could not overflow over those weirs, it would directly flow into the STPs.

100. In 2011, 75% of the KMC area is served by a door-to-door collection system and 25% by street sweeping. This compares favorably to the national average of 51% but is still far below the 100% benchmark target. In the core city area, 80% of the population is served by door-to-door collection. In the outer areas, this is less (60% - 70%). Collection frequency also differs. The central city and most of the surrounding outer areas are served daily, but some of the lower density fringe areas are only served once or twice per week.

101. The KMC estimates that only 3% of waste generated is not collected but (illegally) disposed in channels, vacant land and used for infill, meaning that collection efficiency is close to the national benchmark target of 100%.

102. From secondary collection sites, the waste is transported in trucks to the final disposal site. KMC transports 30% of waste, while 70% of solid waste transportation is contracted out to the private sector. Private contractors mostly use open trucks with a tarpaulin covering the waste. They make about 600 trips per day carrying an average of about 5.5 t per trip. The remaining 30% of the total collected waste is transported by municipal vehicles making about 315 daily trips carrying on average about 3.5-4.9 t per trip. KMC has 125 tipper trucks and 137 dumper placers, 15 tractor trailers, 17-wheel loaders and 12 mechanical sweepers, 32 street sweeping/washing vehicles and 8 wrecker vans daily in operation. KMC has eight garages where transportation vehicles are stationed. Major vat points that accommodate garbage more than 30 t are serviced from Dhapa garage with Pay loaders and 11 m<sup>3</sup> capacity Tipper Trucks. Other vats are serviced by manual loading vehicles and Dumper placers. The street washing vehicles clean major thoroughfares every day. Three of the refuse collector vehicles are engaged for cleaning wastes from 300 trash bins along sixteen major roads.

103. The KMC has two waste disposal sites. The Garden Reach dumping ground is a small facility with little remaining capacity. It receives currently about 10 t/day of waste mainly from borough XV nearby. The main dumping ground is at Dhapa in the east of KMC at approximately 8 km from the city center. This dump site is nearing its maximum capacity and has been authorized by West Bengal Pollution Control Board to operate for one more year only. It received an average of 4286 t/day solid waste in 2011 out of which 300 t/day was diverted to the privately operated Dhapa composting plant.

104. The extent of scientific disposal of solid waste is currently zero and should become 100% in accordance with the national benchmark target. Both the Dhapa and the Garden Reach dump site are not operated as sanitary landfill in accordance with national standards. There is no formal leachate treatment, no proper soil cover and informal, unorganized rag pickers operate at the sites. KMC has an interim permit from WBPCB to operate the Dhapa landfill facility for one year.

105. West Bengal has one Common Hazardous Waste Treatment, Storage and Disposal Facility (CHWTSDF) at Haldia (about 100 km south of Kolkata) that commenced operations in 2005. The facility was jointly developed by the Haldia Development Authority and the Hyderabad based private company, M/s Ramky Enviro Engineers Ltd. who formed a joint venture company named M/s West Bengal Waste Management limited (WBWML) for the development and operation of the facility. The CHWTSDF at Haldia operated by M/s WBWML has completed almost four years of successful operation. The facility caters to units in the entire state of West Bengal.

#### **D. Social and Cultural Resources**

106. **Communities and Population.** The population of the KMC area is 4.45 million with a growth rate -1.93% (2001 to 2011). Approximately one third (32%) of the KMC population lives in bustees and substandard housing. The Project team prepared population projections to 2022 based on the using previous census data of 2001, 1991 and 1981. These projections show a declining population trend for the KMC area, increasing from 4.38 million in 1991 to 4.56 million in 2022. This hike will indicate a general growth of population in the south and south-eastern part of Kolkata which has a tremendous growth potential. The average household no. for the total KMC area is 972,264 and the average household size of Kolkata Municipal Corporation is 4.61 in 2011. Population density of KMC is very high 24,783 persons/sq.km. in 2011. Household numbers are 972,264 and average household size is 4.61 in 2011.

107. **Institutions.** A number of institutions are present in the KMC area and may have a role in the Project's development. These can be classified in to several categories, as follows: government administration and services, police and security, urban development, and environmental protection.

108. **Government Administration and Services.** The agency with the most important role in the Project is KMC. Municipal administration in Kolkata dates from 1727. The functions of the first Corporation were then limited to provision of local roads and drainage and conservancy service. The present system of municipal government has come through an evolutionary process over a long period, resulting in KMC being assigned the responsibility for the following services: regulation of land use; regulation of construction of buildings; planning for economic and social development; roads and bridges; water supply; public health, sanitation, conservancy and solid waste management; urban forestry, protection of the environment and promotion of ecological aspects; safeguarding interests of weaker sections of society, including the handicapped; slum improvement; urban poverty alleviation; provision of urban amenities such as parks gardens, playgrounds; promotion of cultural, educational and aesthetic aspects; burials and burial grounds, cremation and cremation grounds; cattle grounds, prevention of cruelty to animals; vital statistics including registration of births and deaths; public amenities including street lighting, parking lots, bus stops and public conveyance; and regulation of slaughterhouses and tanneries.

109. **Environmental Protection.** The WBPCB has the overall responsibility to set policy and standards for the protection of the environment, following the lead of the Central Pollution Control Board. This includes air, noise, hazardous waste, and water quality standards, and the requirement for the preparation of EIAs. The WBPCB also carries out water and air quality monitoring, and might be involved in the environmental quality monitoring program that will be a part of this project. No designated protected area lies within 10 km radius of the S & D subproject sites. Kolkata does not fall under the Coastal Regulation Zone (CRZ).

110. **Education.** The population of is fairly literate, around 90% of males and females being literate. School enrollment is moderately for all segments of the population. 85% of males and

80% of females report at least a primary school education. 27% of the population has completed secondary school and 9% have graduated from college.

111. **Religion.** About 80% of the residents of KMC are Hindus. Most belong to general castes (84%), with the balance belonging to scheduled caste or scheduled tribes. There are significant concentrations of Muslims in the bustees.

112. **Languages.** The mother tongue reported by 74% of the population is Bengali, with Hindi and Urdu represented by 14% and 12% of the population respectively. Interestingly, those living in standard residential housing report 91% Bengali, while those in sub-standard housing reporting only 58% Bengali and 25% Hindi.

113. **Occupation.** About 6% of households report unemployment: 5% for those living in standard residential areas and 7% for those in bustees and refugee colonies. Of those employed, there is a broad variety of employment types, with no single category predominating over others.

114. **Education, Health and Health Care Facilities.** A listing for Boroughs XI-XV indicated that there are more than 150 government and private educational institutes within the Boroughs. The list includes primary, secondary and higher secondary schools, degree colleges, technical and professional institutes. A number of reputed institutions has recently been established in ward 108. Public health varies according to socio-economic level and location. As of 2008, there are more than forty health centers, government hospitals/dispensaries, private hospitals and nursing homes within the study area. Mention may be made of Ruby General Hospital (ward 108), Manovikash Kendra (ward 108), R N Tagore International Institute for Cardiac Sciences (ward 109), Peerless Hospital and B K Roy Research Centre (ward 109) and Thakurpukur Cancer Hospital (ward 124). Health care facilities appear to be on the low side in wards 112, 113 and 122. Malaria is seasonally prevalent. Cardio-vascular diseases are increasingly prevalent among people over 40, while waterborne diseases such as gastrointestinal diseases are common among children less than 15 years of age.

115. **Aesthetic Resources.** The main aesthetic resources of Kolkata as a whole consist of historic buildings and many small lakes and other water bodies. Both of these resources are recognized as being in need of restoration, and a number of efforts are under way to accomplish this. Foreign tourism is not yet a well-developed industry in Kolkata, and there are opportunities for making tourism a profitable industry while still conserving the urban beauty of the area.

116. **Cultural Resources.** The buildings of north Kolkata reflect the traditional culture of the zamindar and rajas, whereas the structures in central Kolkata reflect the British colonial style. The buildings and churches in this area are around 50 to 100 years old. Most of the archaeological monuments are maintained either by the Department of Archaeology or by private concerns like Rama Krishna Mission or Trusts. Some of the valuable monuments are Metcalfe Hall, Gwalior Monument, Victoria Memorial, Shahid Minar, Indian Museum, Cossipore, Club, Town Hall, Tagore's Baitak Khana, Fort William, Vivekananda's house, and Roy's Naroiial – Cossipore. There are also a few monuments at Tollygunge and Kalighat areas.

117. As the subproject is concentrated primarily in the added areas of KMC, the project will not hamper any precincts of cultural or historical significance.

118. **Recreational and Other Facilities.** More than twenty large playgrounds are present in Boroughs XI to XVI area. There are innumerable temples, maths, mosques and a few churches

scattered over the area. Housing complexes with their own recreational areas have come up especially in wards, 108, 109 and 110.

## V. ANTICIPATED IMPACTS AND MITIGATION MEASURES

119. **Methodology.** Issues for consideration have been raised by the following means: (i) input from interested and affected people; (ii) desktop research of information relevant to the proposed subproject; (iii) site visit, limited measurements by specialized agency and professional assessment by Environment Specialist engaged by the implementing agency; and (iv) evaluation of proposed design scope and potential impacts based on the environment specialist's past experience.

120. The methodology used to rate the impacts was qualitative. Each category was divided into a number of different levels. These levels were then assigned various criteria as indicated in Table 20.

**Table 20: Summary of Quantifiers and Qualifiers Used for Assessment Purposes**

Duration (time-scale)	Short-term	Impact restricted to construction (0-18 months).
	Medium-term	Impact will continue throughout operation (after construction 30 years).
	Long-term	Impacts will exist beyond the life of the S&D works (>50 years).
	Permanent	Impacts will have permanent potential.
Geographic spatial scale	Site	The impact will be limited to within the site boundaries.
	Local	The impact will affect surrounding areas.
	Regional	The impact will affect areas far beyond the site boundary but limited to the State of West Bengal.
Significance rating before mitigation (positive / negative)	Low	The impact will have a minimal effect on the environment.
	Medium	The impact will result in a measurable deterioration in the environment.
	High	The impact will cause a significant deterioration in the environment.
Mitigation	n/a	No mitigation necessary.
	Full	Full mitigation/reversal of the impact is possible.
	Partial	Only partial mitigation/reversal of the impact is possible.
	None	No mitigation or reversal of the impact is possible.
Degree of Certainty	Definite	(>90%)
	Possible	(50%)
	Unsure	(<40%)

121. Categorization of the subproject has been undertaken using ADB's REA Checklist for Sewerage and Drainage (Appendix 7).

### A. Planning and Design Phase

122. The subproject components will be located in properties held by KMC and through public ROWs and existing roads. No land acquisition is required for the construction in the project.

123. The plan and technical design of the S&D subproject are based on the specifications of the Manual on Water Supply and Treatment developed by the Ministry of Urban Development's Central Public Health and Environmental Engineering Organization (CPHEEO). Engineering decisions considered the results of the population to be served, design period, the nature and location of facilities to be provided, the optimum utilization of the existing network and wastewater disposal. S&D management aims at improving the S&D system.

124. The design of the STP is based on the notified Indian National Standard of discharge of treated effluents into inland surface water (drainage canals in the present case). The Standard takes into account use (in the present case conveyance of storm water only) and assimilative capacity (in the present case threshold concentrations of relevant pollutants). Thus, it satisfies the requirements of World Bank EHS Guidelines.

125. Design basis of STP is shown below.

**Table 21: Bank Plot Sewage Treatment Plant**

No.	Design Parameters	Capacity
1	Average Flow	40.00 MLD
2	Peak Factor	2.25
3	Peak Flow	90 MLD
4	Free Board level at Churial Canal (discharge invert level of treated effluent pumping main shall be 500 mm above canal embankment level)	3.1 m
5	Natural Ground Level (NGL) at near existing road	3.5 m
6	Distance of disposal point from Site	1200 m

126. The salient design considerations are presented in Table 22.

**Table 22: Salient Design Considerations of Sewerage and Drainage Works – Sewage Treatment Plant Construction**

Parameter	Design Consideration
Design Period	30 Years
Design Population and area	<b>For Bank Plot STP:</b> The projects cover parts of wards 122 (Borough XIII), 123,124, 142 &143 under Borough XVI. The population of the catchment for the design horizon (2030) is 2, 15,745 and its total catchment is approximately 1371.54 Ha.
Design to meet S&D bench mark target	100%
Treated effluent discharge standards	pH = 6.5 to 9.0, Biochemical Oxygen Demand (BOD <sub>5</sub> ) = ≤ 10 mg/l, Chemical Oxygen Demand (COD)= ≤ 50 mg/l, Total Suspended Solids (TSS)= ≤ 10 mg/l, Ammonia Nitrogen (NH <sub>3</sub> -N) = ≤ 5 mg/l, Total Nitrogen (TN) = ≤ 10 mg/l, Total Phosphorous (TP)= ≤ 2 mg/l, Faecal Coliforms = ≤ 100 MPN/100 ml.
Sewage Treatment Plant	Construction of reactor chambers, basin – 40 MLD STP- SBR technology at Bank Plot.
Design of pumps and accessories Alignment of sewage mains	Pumps and accessories has been designed for the year of 2030 Alignment of the S&D lines is guided by existing road alignment wherever available.
Design of the Pipe work	Influent will be carried from battery point of pumping station to STP and after treatment effluent discharge into the canal through pipeline.
Pipe materials	DI pipes from pumping station to treatment plant. Then MS pipe for discharge of treatment effluent from STP to canal.
Pipe laying	The pipe will be laid for pumping main and effluent discharge by conventional open trenching (cut & cover method) method in stretches along the ROW.
Ecological diversity	The subproject is situated within an existing build up area and no areas of ecological diversity occur within the subproject. The nature and locality of the subproject is such that its implementation is unlikely to have any impact on biodiversity of the area. However, the subproject may affect existing trees for construction of STP. Permission will be obtained from the Forest Directorate for felling trees, if required prior to start of civil works. Any landscaping to be undertaken will be done with locally indigenous species and low maintenance requirements.

Parameter	Design Consideration
Land use and livelihoods	The key efforts undertaken to minimize impacts are: (i) before the preparation of engineering design, a survey of the properties of the pipe laying alignment and STP area is to be conducted with regard to their ownership with the objective that minimum proprietary land is utilized for the subproject; (ii) diverting the alignment towards the available government land and ROWs to avoid land acquisition A. due diligence report has been prepared to address any social impact.
Traffic flow and access	A traffic Management Plan will be developed to provide vehicle and pedestrian access and maintain community linkages. Local communities along the alignment will be continuously consulted regarding location of construction camps, access and hauling routes and other likely disturbances during construction. The road closure together with the proposed detours will be communicated via advertising, pamphlets, radio broadcasts, road signages, etc. The implementation of the road detours will also be dependent on advance road signages indicating the road detour and alternative routes. KMC will coordinate with the traffic police for the implementation of the Traffic Management Plan.
Sludge Management	The sludge from STP would be sent to sludge sump for storage. This sludge is expected to have a consistency between 0.8 – 1 % Dry Solid. This would then be sent to centrifuges for dewatering. The sludge is dosed with polyelectrolyte solution prior to feeding in centrifuge pump to help achieve higher solid concentration. The dewatered sludge will have a 20 – 25 % DS which is semi solid (wet cake) in nature and can be trucked for transportation. The centrifuge pump is placed in such a way that the solids can be stored in a container or a truck beneath it. The wet cakes produce will have to be disposed by the contractor (who is awarded the contract) as per the instruction of engineer within 15 km of the plant site. This sludge is stabilized and therefore it could be used as a soil conditioner or landfilled. It can also be sent to a composting plant since it is nutrient rich which would help in improving the compost quality produced. Final design will be one by BOOT contractor.
Environmental Monitoring	The environmental laws place a responsibility on KMC not to pump untreated DWF in the canal and the DWF pumping will commence only when arrangement of monitoring outflows from the STP is constructed and transmission of the results of such monitoring to WBPCB is in place. The regulations also specify the parameters to be monitored, the frequency of monitoring and the method of sampling. The WBPCB can independently sample the quality of the receiving waters, and this data can be used to assess whether the STPs are discharging effluents of acceptable quality.

127. The design considerations were discussed with the specialists responsible for the engineering aspects, and as a result measures have already been included in the subproject preliminary design for the infrastructure. This means that the number of impacts and their significance has already been reduced by amending the preliminary design. BOOT contractor will do final design on the basis of design basis and consideration.

#### A. Construction Phase

128. The more specific design would actually be done by the vendor/contractor selected for final design/ engineering of the plant. Construction of STP is simple civil works of process unit some buildings, retaining cum boundary wall, internal roads and pathways. A list of buildings other than process units is given in Table 23.

**Table 23: Buildings to be constructed for the proposed Sequencing Batch Reactor plant-Bank Plot Sewage Treatment Plant**

No.	Buildings		Length (m)	Width (m)	Height (m)	
1	SBR air blower cum admin cum/ MCC and control building	1	27	12	10	(G+1)
2	Chlorination cum chlorine turner house	1	18	6	5	
3	Centrifuge feed pump house	1	11	6	4.5	
4	Centrifuge house	1	13	6	9.5	
5	Security cabin	1	3	3	3	
6	HT Substation building	1	12	12	5	

129. In addition, electromechanical equipment will be installed at STP.

130. Proposed Treatment scheme for Bank Plot STP is given below.

**Table 24: Proposed Treatment Scheme for Bank Plot Sewage Treatment Plant**

No.	Treatment unit	Remarks
1	Receiving of Raw Sewage	1
2	Coarse Screening	(2 Mechanical + 1 Manual)
3	Flow Measurement	(Incoming Pumping main: 1, Outgoing: 1)
4	Fine Screening	(2 Mechanical + 1 Manual)
5	Stilling Chamber	(1 No.)
6	De-gritting	(2 Mechanical)
7	Biological Treatment based on Sequential Batch Reactor (SBR) technology	Min. 2 Basins
8	Chlorination Tank	1 No.
9	Chlorine Tonner House	1 No.
10	Treated Effluent Pump	1 No.
11	Sludge Sump	1 No.
12	Polyelectrolyte dosing tank	As required
13	Sludge Dewatering Unit	Centrifuge Feed Pump and Centrifuges as per Bidders
14	Automation and Control	PLC based automation system for all the components of the STP

131. For pumping main and effluent discharge pipelines cut & cover method will be utilized. The works will be along or adjacent to roads' un-used ROWs below the level of utilities avoiding properties. The works will involve earth-moving and excavation; mostly those involved in common and simple construction works. Materials will be brought in on trucks and offloaded by hand. Excavation, if necessary will be by backhoe and supplemented by manual digging. Excess spoils will be loaded into trucks for disposal.

132. Table 25 presents an indication of what activities and facilities are likely to be undertaken during construction of the subproject, including the associated inputs and outputs.

**Table 25: Summary of Activities and Facilities, Resource Use, and Produced Outputs during Construction Phase**

Activities and Facilities	Inputs/Resource Use	Outputs/Waste Production
Construction camp and its associated facilities (including lay-down areas)	Cement	Old asphalt (removed from road carriageway during road restoration) <sup>a</sup> in case of pipe laying
Storage camps and lay-down areas	Chemical additives used in concrete/asphalt (i.e. retarders)	Waste concrete and other construction rubble
Materials and equipment stockpiles	Paving blocks/bricks	Used fuels, lubricants, solvents and other hazardous waste
Handling and storage of hazardous materials including chemicals additives, gravel, cement, concrete and lubricants	Aggregate (sand and stone)	General waste
Source of water	Gravel	Contaminated soil
	Water	
	Drinking, cooking and sanitation at construction camps	

Activities and Facilities	Inputs/Resource Use	Outputs/Waste Production
Vegetation clearance as per requirement Bulk earthworks, grading and contouring. Movement of construction staff, equipment and materials Importation of selected materials Temporary detours Noise and vibrations Dust suppression Waste production and temporary storage/disposal i.e. used fuels, waste concrete and bitumen, spoil materials and general waste Use of asphalt/bitumen (and associated storage and mixing areas, chemicals) Concrete batching plant, if required (and associated storage and mixing areas, chemicals) Rehabilitation of disturbed areas Interaction between construction workforce and local communities Management of the passing pedestrians and points of congestion Reminders to affected people of construction with time frames	Water for dust suppression Water applied to base and sub-base layers during compaction Water for application to sub-base and base layers prior to compaction Petrochemicals Other chemicals/lubricants/paints Construction vehicles, machinery and equipment Temporary energy supply to construction camps Topsoil used during re-vegetation and rehabilitation Plant material for re-vegetation (seeds, sods, plant specimens) Labor Recruitment of construction work force Skills training Control of movement of public needs barriers particularly at pipe laying area (not just danger tape) to prevent people from falling in trenches during construction	Soil contaminated with petrochemicals (i.e. oils and lubricants) and other chemicals Sewage and grey water (temporary construction camp sanitation) Spoil material (excess soil removed during excavations) Noise and vibrations (construction vehicles and machinery) Lighting at construction camps, equipment yards and lay-down areas Plant material removed from servitude/right-of-way during vegetation clearance Smoke and fumes Burning of waste Burning of vegetation cover Fires used for cooking and space heating (construction camps) Vehicle exhaust emissions

<sup>a</sup> The opening of roads may involve the stripping and demolition of old asphalt layers. Ideally, old asphalt shall be reused during restoration of the road in order to avoid large quantities of waste being produced. However, depending on the availability and cost of virgin aggregate in the area through which the road is aligned, reusing the old asphalt may be more costly than using virgin aggregate.

133. The following table (Table 26) outlines potential impacts during the construction phase gathered from a process that included a review of available documentation, verified during the site visit, i.e. how, where and when the proposed development can interact and affect the environment significantly, and details what mitigation measures may be taken to counteract these impacts. The impact and mitigation will be re-assessed after finalization of design by BOOT contractor.

**Table 26: Summary of Anticipated Potential Environmental Impacts during Construction Phase**

Environmental Aspect	Summary of Implications and Mitigation		Assessment of Impacts			
	Potential Impacts	Mitigation	Significance before Mitigation	Geographic Spatial Scale	Duration	Mitigation
Climate	<p>The nature and intensity of rainfall events in an area, has implications for storm water management.</p> <p>Smoke from burning activities could have wider spread on windy days especially when dust could be blown off site.</p>	<p>Consider seasonal climatic variations during scheduling of construction activities in the area.</p> <p>Do excavations and other clearing activities only during agreed working times and permitted weather conditions.</p> <p>Implement storm water control as per method approved by PMU.</p> <p>No open fires permitted on site</p>	Medium (negative)	Site	Short-term	Full Mitigation Possible
Air Quality	<p>Sensitive receptors (e.g. hospitals, schools, religious place) may be affected temporarily by increased traffic and related impacts during the transportation of materials at construction phase.</p> <p>Fugitive dust can also impact on roadside air quality during construction. Exhaust fumes from construction machinery, and potential smoke from cooking fires.</p> <p>Burning of waste and cleared vegetation</p> <p>Odors from use of toilet 'facilities' other than provided facilities.</p>	<p>Guidelines that deal with the control of air pollution and dusts on site have been outlined in the environmental management plan (EMP)</p> <p>Ensure compliance with the Air Act. Ensure compliance with emission standards Undertake monitoring of air pollution levels in potential problem areas.</p> <p>Manage (including storage, transport, handling and disposal) hazardous substances used. Avoid dust generating construction activities during strong winds. Cover soil loads in transit. Cover stockpiles of soil or apply suitable dust palliative such as water or commercial dust suppressants. Regularly service vehicles off-site in order to limit gaseous emissions. No open fires permitted on site Place portable toilets on-site and maintain on a daily basis.</p>	Medium (negative)	Local	Short-term	Partial Mitigation Possible
Geology and soil	Strong water flows into open excavations below the water	The design of the site drainage system is adequate to control runoff from the	Medium (negative)	Site	Short-term	Full Mitigation Possible

Environmental Aspect	Summary of Implications and Mitigation		Assessment of Impacts			
	Potential Impacts	Mitigation	Significance before Mitigation	Geographic Spatial Scale	Duration	Mitigation
	<p>table will occur, causing collapse of excavated area. Layers of mixed fill cover natural ground surface in many places.</p> <p>Contamination from spillage of petroleum products, spent engine oil and oil leaks from construction vehicle maintenance taking place on site.</p>	<p>excavated tranche and open areas in line with topographical features of the site. Rehabilitate all sites during construction including construction camps, stockpile area, temporary access and hauling routes, as soon as possible after the disturbance has ceased.</p> <p>Contractor to exercise strict care in the disposal of construction waste, with proof of disposal at an approved site provided after offloading each waste load and this logged/registered.</p> <p>Contain contaminated water and dispose off site at an approved disposal site in consultation with WBPCB.</p> <p>Dispose of waste from the oil interceptors only through suitable waste-handling contractor and request for safe disposal certificates.</p> <p>Mix cement, concrete and chemicals on a concrete plinth and contain spillages or overflows into the soil.</p> <p>Do not allow vehicle maintenance on site. If oil spills occur, dispose contaminated soil at a disposal site in consultation with WBPCB.</p> <p>Stockpile subsoil and overburden in all construction and lay down areas. Protect topsoil and subsoil from contamination. Return for backfilling in the correct soil horizon order.</p>				
Drainage and hydrology	The proposed construction is situated within an existing built up area. Due to the nature and	The site surface has been engineered and shaped in such a way that rapid and efficient evacuation of runoff is achieved.	Medium (negative)	Site	Short-term	Full Mitigation Possible

Environmental Aspect	Summary of Implications and Mitigation		Assessment of Impacts			
	Potential Impacts	Mitigation	Significance before Mitigation	Geographic Spatial Scale	Duration	Mitigation
	locality of the subproject there is unlikely any significant impacts on water resources within the immediate area.	Provide containment areas for potential pollutants at construction camps, refueling depots, asphalt plants and concrete batching plants. Implement waste management practices. Control and manage transport, storage, handling and disposal of hazardous substances.				
Biodiversity Fauna and Flora	The proposed development is situated within an existing built up area. No areas of ecological diversity occur within the subproject location. Due to the nature and locality of the subproject, the proposed development is unlikely to cause any significant impact on biodiversity within the area. As per design there will be no requirement for tree felling. This will be further assessed during implementation stage	Permission will be obtained (if required) from the KMC for the cutting/felling of trees prior to start of civil works. Ensure any landscaping to be undertaken will be done with locally indigenous species and low maintenance requirements.	Low (negative)	Site	Short-term	Full Mitigation Possible
Land Uses	Due to the location and nature of the subproject, there will be no as such interference with access. Existing public transport facilities and operations will be not affected. There will be only disruptions on pedestrian movements, due to traffic and construction related noise, visual, and air pollution particularly during laying of pipe.	KMC has consulted with various organizations, departments, etc. within the area and will be continued during the construction phase.  Consult with local authority, organizations, etc. regarding location of construction camps, access and hauling routes, and other likely disturbances during construction.  Provide clear and realistic information regarding employment opportunities and other benefits for local communities in order to prevent unrealistic expectations.  Make use of local labor, materials, goods and services as far as possible	Low (negative)	Local	Short-term	Partial Mitigation Possible

Environmental Aspect	Summary of Implications and Mitigation		Assessment of Impacts			
	Potential Impacts	Mitigation	Significance before Mitigation	Geographic Spatial Scale	Duration	Mitigation
		<p>Provide walkways and metal sheets where required to maintain access across for people and vehicles.</p> <p>Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.</p>				
Infrastructure and Services	<p>There is likely to have temporary disruption of infrastructure and services during the pumping main pipe laying</p> <p>There are a number of existing infrastructure and services (roads, telecommunication lines, power lines and various pipelines within the vicinity of the subproject.</p>	<p>Undertake utility shifting prior to commencing pipe laying</p> <p>Keep construction-related disturbances to a minimum.</p> <p>Consult with affected service providers regarding impacts on access to infrastructure and services and alternatives.</p> <p>Provide backup or alternative services during construction-related disruptions, for example by providing generators for power supply.</p> <p>Provide access points to infrastructure and services.</p> <p>Monitor complaints by the public.</p>	Low (negative)	Local	Short-term	Full Mitigation Possible
Traffic	<p>Increased volume of construction vehicles on the roads may lead to increased wear and tear of roads in the vicinity of the subproject site.</p> <p>Road safety concerns due to slow moving construction vehicles.</p> <p>Traffic flow within the vicinity will be affected particularly at pumping main route.</p> <p>The temporary road closure will result in a decrease in overall network performance in terms of queuing delay, travel times/speeds.</p>	<p>Prepared and follow Traffic Management Plan (TMP). The objective of the TMP is to ensure safety of all the road-users along the work zone and to address: (i) protection of work crews from hazards associated with moving traffic; (ii) mitigation of the adverse impact to the road capacity and delays to the road-users; (iii) maintenance of access to adjoining properties; and (iv) issues that may delay the subproject works.</p> <p>Negotiate with privately-owned public transport operators regarding the affected public transport facilities and routing.</p> <p>Clear roads signs will be erected for the full length of the construction period. Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.</p>	Medium (negative)	Regional	Short-term	Partial Mitigation Possible

Environmental Aspect	Summary of Implications and Mitigation		Assessment of Impacts			
	Potential Impacts	Mitigation	Significance before Mitigation	Geographic Spatial Scale	Duration	Mitigation
	<p>The road closure will impact on a public transport operations and routing for a short period. Pedestrian movements will be affected by the partial road closure.</p>	<p>Ensure the City Traffic Police will be available on site.</p> <p>Communicate road closure together with the proposed detour via advertising, pamphlets, radio broadcasts, road signage, etc. The implementation of the road detour is also dependent on advance road signage indicating the road detour and alternative routes.</p> <p>Define clearly construction routes. Strictly control access of all construction and material delivery vehicles. Enforce speed limits. Do not allow deliveries during peak traffic hours Template for traffic management plan is attached as Appendix 8.</p>				
Health and Safety	<p>Construction related activities may lead to injuries. Open fires in construction camp can result in accidents Safety of workers and general public may be compromised due to difficult site conditions. Poor waste management practices and unhygienic conditions at temporary ablution facilities can breed diseases. Standing water due to inadequate storm water drainage systems, inadequate waste management practices, pose a health hazard to providing breeding grounds for disease vectors such as mosquitoes, flies and snails.</p>	<p>Implement good housekeeping practices at the construction camp. Strictly implement health and safety measures and audit on a regular basis. Secure enclosed construction site. Use reputable contractors. Provide warning signs of hazardous working areas. Clearly demarcate excavations and provide barriers (not just danger tape) to protect pedestrians from open trenches. Thoroughly train workers assigned to dangerous equipment. Workers have the right to refuse work in unsafe conditions. Undertake waste management practices (Planned disposal of sludge from STP). Control speed and movement of construction vehicles Exclude public from the site</p>	High (negative)	Site and Local	Short-term	Partial Mitigation Possible

Environmental Aspect	Summary of Implications and Mitigation		Assessment of Impacts			
	Potential Impacts	Mitigation	Significance before Mitigation	Geographic Spatial Scale	Duration	Mitigation
	<p>The use of hazardous chemicals in restoration of roads can pose potential environmental, health and safety risks. Road safety may be affected during construction, especially when traffic is detoured.</p>	<p>Ensure all workers are provided with and use Personal Protective Equipment.</p> <p>Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas</p> <p>Ensure that qualified first-aid can be provided at all times. Ensure equipped first-aid stations are easily accessible throughout the site;</p> <p>Provide medical insurance coverage for workers.</p> <p>Provide clean eating areas where workers are not exposed to hazardous or noxious substances;</p> <p>Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted;</p> <p>Ensure moving equipment is outfitted with audible back-up alarms;</p> <p>Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate.</p> <p>Health and Safety Plan is attached as Appendix 9</p>				
Noise and Vibrations	<p>Use of heavy vehicles and equipment may generate high levels of noise. Vibrations resulting from bulk earthworks and compaction may create significant disturbances to nearby people.</p>	<p>Locate concrete batching, asphalt lay down areas and construction camps away from sensitive receptors.</p> <p>Restrict construction activities to reasonable working hours where near sensitive receptors.</p>	High (negative)	Local	Short-term	Partial Mitigation Possible

Environmental Aspect	Summary of Implications and Mitigation		Assessment of Impacts			
	Potential Impacts	Mitigation	Significance before Mitigation	Geographic Spatial Scale	Duration	Mitigation
	Disturbance from afterhours work.	Keep adjacent landowners informed of unusually noisy activities planned. Regulate roadworthiness of vehicles. Ensure that machinery in a good state of maintenance. Fit and maintain silencers to all machinery on site. Monitor noise levels in potential problem areas.				
Aesthetics, Landscape Character, and Sense of Place	The presence of heavy duty vehicles and equipment, temporary structures at construction camps, stockpiles, may result in impacts on aesthetics and landscape character	Properly fence off storage areas. Collect all domestic solid waste central point of disposal and feed into the city waste collection system. Contractor to exercise strict care in disposing construction waste. Identify suitable waste disposal site with enough capacity to hold additional waste to be generated by the construction activities. Retain mature trees on and around the site where possible. Remove unwanted material and litter on a frequent basis. Template for spoil management plan is attached as Appendix 10.	Medium (negative)	Local	Short-term	Partial Mitigation Definite
Workers Conduct	Construction workers on site disrupting adjacent land uses by creating noise, generating litter, and possible loitering.	Ensure strict control of laborers Minimize working hours to normal working times Control littering Ensure no overnight accommodation is provided.	Low (negative)	Local	Short-term	Full Mitigation Definite
Employment Generation	The subproject will provide employment opportunities for local people during construction. Expectations regarding new employment will be high especially among the unemployed individuals in the area.	Employ local (unskilled) labor if possible Training of labor to benefit individuals beyond completion of the subproject. Ensure recruitment of labors will take place offsite. Ensure at least 50% of all labor is from surrounding communities in the contractual documentation.	Medium (positive)	Local	Short-term	Partial Mitigation Possible

Environmental Aspect	Summary of Implications and Mitigation		Assessment of Impacts			
	Potential Impacts	Mitigation	Significance before Mitigation	Geographic Spatial Scale	Duration	Mitigation
	<p>Labor gathering at the site for work can be a safety and security issue, and must be avoided.</p> <p>The training of unskilled or previously unemployed persons will add to the skills base of the area.</p>					
Archaeological and Cultural Characteristics	<p>The proposed development will not require demolition of ASI- or state-protected monuments and buildings</p>	<p>Ensure that construction staff members are aware of the likelihood of heritage resources being unearthed and of the scientific importance of such discoveries.</p> <p>Contact ASI or the State Department of Archaeology if any graves be discovered and all activities will be ceased until further notice.</p> <p>Contact ASI or the State Department of Archaeology if any heritage resources or objects, defined in the Act, be discovered and all activities will be ceased until further notice.</p> <p>Cease all activities immediately and do not move any heritage object found without prior consultation with ASI or the State Department of Archaeology</p> <p>No structures older than 100 years will be allowed to be demolished, altered or destructed without a permit from ASI or the State Department of Archaeology.</p>	<p>Low (negative)</p>	<p>Local</p>	<p>Short-term</p>	<p>Full Mitigation Definite</p>

## B. Operation and Maintenance Phase

134. The system has a design life of 30 years, during which it is not expected to require major repairs or refurbishments and shall be operated with little maintenance beyond routine actions required to keep the pumps and other equipment in working order. The stability and integrity of the system will be monitored periodically to detect problems and allow remedial action if required. Repairs will be small-scale involving manual, temporary, and short-term works involving regular checking and recording of performance for signs of deterioration, servicing and replacement of parts.

135. The main requirement for maintenance of the S&D conveyance system will be for the detection and repair of leaks. The generally flat topography and the usage of good quality pipes shall mean that pipeline breaks are very rare, and that leaks are mainly limited to joints between pipes.

136. Sludge should be treated in a manner consistent with WHO Guidelines for the Safe Use of Wastewater, Excreta and Greywater in addition to any national requirements that exist for land reuse. Dewatering and any other odor generating process will be fully enclosed at the same time. H<sub>2</sub>S will be monitored to ensure no build up at any time.

137. **Operation of Sewage Treatment Plant.** The STP operation will be mostly automated with less human intervention in the process, so scope for human error and its effect on efficiency is very limited. Design also includes provision for automated shutdown in the incidence of high BOD (above design capacity) entering the plant. However, it must be ensured that the facility is operated with standard operating procedures and only by trained staff. Ensuring uninterrupted power supply with back-up facility is a must.

138. Potential health hazards due to improper sludge disposal methods. Sludge will be regularly accumulated in the SBR basins during each process batch. This sludge from basins will be collected into sludge sump and conveyed to centrifuge unit for dewatering and thickening. The sludge in the form of a wet cake will be further air-dried in the sludge drying beds. The treatment and drying processes kill enteric bacteria and pathogens, and because of its high content of nitrates, phosphates and other plant nutrients, the sludge is an excellent organic fertilizer for application to the land. Personal Protection Equipment's shall be provided. Some part of the sludge may be disposed at Dhapa dumping ground.

139. O&M is part of the BOOT contract and Contractor will submit the O&M manual.

140. Chances for Ground water contamination due to proximity to STP site and health risk due to abstraction of polluted ground water through bore wells by the people residing near the STP sites. The proposed STP will be completely lined on its wall and floor. Therefore, the infiltration of water will be negligible.

141. The impact due to odor nuisance may be considered as medium since the proposed STP unit will be provided with aerators, which will ease the biodegradation process and thereby reduce odor problems and also the proposed buffer zone around the site will reduce the impact on nearest habitations. Buffer zone in the form of landscaping and earthwork shall be created and well maintained around the site by municipal corporation. O&M of STP will be conducted regularly to reduce odor problems to the neighborhoods.

142. The Indian National Standard on ambient air quality will be followed. The Indian standard and the standard in EHS guideline do not include odor and H<sub>2</sub>S thresholds. However, to minimize H<sub>2</sub>S generation, (i) the sludge sump is equipped with coarse aerator which will prevent septic/anaerobic condition, thereby reducing H<sub>2</sub>S production, (ii) the centrifuge (dewatering system) and dewatered sludge collection system will be enclosed to minimize outside odor dissemination.

143. **Noise.** There will be only one point of generation of noise at the STPs. This will be at the desludging area (centrifuge pump and centrifuges). Enclosure around the desludging area has been included in the preliminary design. Noise impact from the STP is likely to be minimal.

144. **Odor.** Two main sources will be: (i) raw sewage receiving chamber, and (ii) desludging area. There is no raw sewage pumping station within the STP premises and waste water will continuously be flowing, therefore, odor from the facility will be minimal. During trial operation and early operation stage, West Bengal Pollution Control Board will be requested to carry out noise and odor monitoring at the nearby receptors in order to check compliance with acceptable standards. The contractor is bound by contract to undertake suitable corrective measures if compliance is not attained.

145. However, it is suggested to develop an Emergency Response Plan (ERP) in case of release of bad odors from the facility.

146. **Sludge Handling.** The sludge production in SBR process is lower compared to conventional ASP due to longer solid retention times and the sludge produced is also stabilized. The sludge would be sent to sludge sump for storage. This sludge is expected to have a consistency between 0.8 – 1 % Dry solid. This would then be sent to centrifuges for dewatering. The sludge is dosed with polyelectrolyte solution prior to feeding in centrifuge pump to help achieve higher solid concentration. The dewatered sludge will have a 20 – 25 % DS which is semi solid (wet cake) in nature and can be trucked for transportation. The centrifuge pump is placed in such a way that the solids can be stored in a container or a truck beneath it. The wet cakes produces will have to be disposed by the contractor (who is awarded the contract) as per the instruction of engineer within 15 km of the plant site. This sludge is stabilized and therefore it could be used as a soil conditioner or landfilled. It can also be sent to a composting plant since it is nutrient rich which would help in improving the compost quality produced.

147. The SBR treatment process is a process of extended aeration for the removal of nitrogen, phosphorous and other similar gases, and will be aerating for half the day, making the chances of odor generation minimal. The other main source of odor may be the dewatered sludge from the centrifuges. This dewatered sludge area will be enclosed from three sides to keep the area isolated so as to control odor dissemination.

148. **Sewage Discharge.** The treated effluent will be discharged in the Churial Canal which is approximately 1400 m for Bank Plot STP. The level of discharge will have to match the Freeboard level of the canal to avoid any backflow during monsoons. The discharge could be by gravity or whether an effluent pumping station is required is being investigated and detailed at the DPR stage.

149. After treatment of collected sewage in the STP, effluent will be discharged to the canal conforming to national standard for discharge of treated effluent from STP to water bodies. The national standard is concentration based (not load based) and the compliance to this standard will be ensured through periodic monitoring of the treated effluent (per the direction to be given by West Bengal Pollution Control Board in their Consent to Operate license) during the operation phase of the STP. The canal is mainly a drainage channel to carry storm water and, as such, there is no human use.

150. Expected sludge generation from STP is given below. This is tentative, final volume can be assessed during final design.

**Table 27: Expected Sludge Generation from Sewage Treatment Plant**

<b>Sewage Treatment Plant</b>	<b>Capacity</b>	<b>Expected Sludge Generation</b>	<b>Strategy of Disposal</b>
Bank Plot STP	40 MLD	32 m <sup>3</sup> /day i.e. 11,680 m <sup>3</sup> / year	Sludge after dewatering will be truckable (20 % solids content) and can be used as manure/ compostable.

151. Table 28 presents an indication of what activities and facilities are likely to be undertaken during operation and maintenance of the subproject, including the associated inputs and outputs.

**Table 28: Summary of Activities and Facilities, Resource Use, and Produced Outputs during Operation and Maintenance Phase**

<b>Activities and Facilities</b>	<b>Inputs/Resource Use</b>	<b>Outputs/Waste Production</b>
Operation activities Wastewater flow and pumping Maintenance activities Upkeep and repair of pumps Sludge removal from STP and sewer lines.	Labor Vehicles and equipment used for inspections and maintenance Fuels and lubricants Electricity.	Wastewater Sludge Potential for water source contamination.

152. The following Table 31 outlines potential impacts during the operation and maintenance phase gathered from a process that included a review of available documentation, verified during the site visit, i.e. how, where and when the proposed development can interact and affect the environment significantly, and details what mitigation measures may be taken to counteract these impacts.

**Table 29: Summary of Anticipated Potential Environmental Impacts during Operation and Maintenance**  
(including defect liability)

Environmental Aspect	Summary of Implications and Mitigation		Assessment of Impacts			
	Potential Impacts	Mitigation	Significance before Mitigation	Geographic Spatial Scale	Duration	Mitigation
Air Quality	Sensitive receptors (e.g. hospitals, schools, religious places) may be affected temporarily by increased traffic (due to transportation of materials during repairing work) and related impacts during S & D pipe line maintenance.	Ensure compliance with the Air Act. Ensure compliance with emission standards Regularly service vehicles off-site in order to limit gaseous emissions.	Low (negative)	Local	Short-term	Partial Mitigation Possible
Biodiversity Fauna and Flora	The proposed development is situated within an existing built up locality. No areas of ecological diversity occur within the subproject location. Due to the nature and locality of the subproject, the proposed development is unlikely to have any significant impact on biodiversity within the area during maintenance works	Ensure no accidental damage to local flora and fauna.	Low (negative)	Site	Short-term	Full Mitigation Possible
Land Uses	Due to the location and nature of the subproject, there will be interference with access only during maintenance works of pipe line. Existing public transport facilities and operations will be affected in case of road closure and detours. There will be disruptions to health services, local businesses, transport services, pedestrian movements, due to traffic and maintenance-related noise, visual, and air pollution.	Put a sign of "Keep Clear" near critical roads. Consult with local authority, organizations, etc. regarding location of construction camps, access and hauling routes, and other likely disturbances. Provide clear and realistic information regarding detours and alternative accesses for local communities and businesses in order to prevent unrealistic expectations. Increase workforce in front of critical areas such as institutions, place of worship, business establishment, health center, and schools. Consult businesses and institutions regarding operating hours and factoring this in work schedules. Provide sign boards for pedestrians to inform nature and duration of	Low (negative)	Local	Short-term	Partial Mitigation Possible

Environmental Aspect	Summary of Implications and Mitigation		Assessment of Impacts			
	Potential Impacts	Mitigation	Significance before Mitigation	Geographic Spatial Scale	Duration	Mitigation
		construction works and contact numbers for concerns/complaints.				
Health and Safety	<p>Danger of operations and maintenance-related injuries. Safety of workers and general public must be ensured. Poor waste management practices and unhygienic conditions at the improved facilities can breed diseases. Standing water due to inadequate storm water drainage systems, inadequate waste management practices, pose a health hazard to providing breeding grounds for disease vectors such as mosquitoes, flies and snails. Fire and electrocution hazards in the STP</p>	<p>Implement good housekeeping practices at STP.          Strictly implement health and safety measures and audit on a regular basis.          Provide warning signs of hazardous working areas.          Clearly demarcate excavations and provide barriers (not just danger tape) to protect pedestrians from open trenches.          Thoroughly train workers assigned to dangerous equipment.          Workers have the right to refuse work in unsafe conditions.          Undertake waste management practices- specifically periodic removal of sludge from STP.          Ensure all workers are provided with Personal Protective Equipment.          Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas.          Ensure that qualified first-aid can be provided at all times. Ensure equipped first-aid stations are easily accessible throughout the site          Provide medical insurance coverage for workers.          Provide clean eating areas where workers are not exposed to hazardous or noxious substances;          Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted;          Ensure moving equipment is outfitted with audible back-up alarms;</p>	Medium (negative)	Site and Local	Short-term	Partial Mitigation Possible

Environmental Aspect	Summary of Implications and Mitigation		Assessment of Impacts			
	Potential Impacts	Mitigation	Significance before Mitigation	Geographic Spatial Scale	Duration	Mitigation
		<p>Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate.</p> <p>Ensure occupational and community H&amp;S incidents and near misses against performance targets of zero incident Health and Safety Plan is attached as Appendix 9.</p>				
Noise and Vibrations	<p>Sensitive receptors (hospitals, schools, religious places) may be affected temporarily by increased traffic and related impacts during pipe repairing work</p> <p>Disturbance from afterhours work.</p>	<p>Restrict maintenance activities to reasonable working hours where near sensitive receptors.</p> <p>Keep adjacent landowners informed of unusually noisy activities planned.</p> <p>Fit and maintain silencers to all machinery on site.</p> <p>Monitor noise levels in potential problem areas.</p>	Low (negative)	Local	Short-term	Partial Mitigation Possible
Workers Conduct	<p>Maintenance workers on site disrupting adjacent land uses by creating noise, generating litter, and possible loitering.</p>	<p>Ensure strict control of laborers</p> <p>Minimize working hours to normal working times</p> <p>Control littering</p>	Low (negative)	Local	Short-term	Full Mitigation Definite
Waste Water Quality check at the inlet and outlet of the STP	<p>Failure to ensure the recommended contaminant limit could cause the deterioration water quality where it is discharging</p>	<ul style="list-style-type: none"> <li>Conduct Daily/Weekly/Monthly quality check at inlet and outlet of STP</li> </ul>	Medium (negative)	Local	Short-term	Full Mitigation Definite
Sludge	<p>Pollution and health hazards due to improper sludge disposal methods Contaminated work area may cause health hazards</p>	<ul style="list-style-type: none"> <li>Safe sludge handling methods shall be employed. PPE shall be provided. Sludge shall be dried in drying beds before disposal.</li> <li>Sludge Management Plan shall be implemented</li> <li>Testing of sludge before disposal</li> </ul>	High (negative)	Local	Medium-term to Long-term	Partial Mitigation Possible

Environmental Aspect	Summary of Implications and Mitigation		Assessment of Impacts			
	Potential Impacts	Mitigation	Significance before Mitigation	Geographic Spatial Scale	Duration	Mitigation
Sewage treatment – odor problem	Odor nuisance from the treatment plants	<ul style="list-style-type: none"> <li>• Buffer zone in the form of landscaping and earthwork shall be created and well maintained around the site.</li> <li>• No development zone will be declared around the STP premises.</li> <li>• This impact may be considered as negligible due to location of plant site and proposed buffer provision.</li> <li>• Odor monitoring will be conducted per CPCB Guidelines on Odor Pollution and Its Control where odor is to be monitored and controlled at source/s.</li> </ul>	High (negative)	Local	Medium-term to Long-term	Partial Mitigation Possible
Discharge of Hazardous Chemicals into Sewer lines	Damage to sewer and health risk to sewer cleaning and STP workers, negative impact on performance of STP and pollution in water bodies receiving treated effluent	<ul style="list-style-type: none"> <li>• Ensure that no wastewater, except domestic sewage is disposed into the sewers; the rules and regulations will be strictly implemented to avoid discharge of hazardous chemicals into sewers.</li> </ul>	High (negative)	Local	Medium-term to Long-term	Partial Mitigation Possible
Storage and handling of chlorine	The safety risk due to handling of chlorine	<p>During the operation phase, it is necessary that:</p> <ul style="list-style-type: none"> <li>• Chlorinator facility is operated only by trained staff and as per the standard operating procedures</li> <li>• In case of any accident and/or maintenance activity, the staff should follow documented procedures only</li> <li>• It is suggested to develop an Emergency Response System (ERS) for the chlorine leakage.</li> </ul>	High (negative)	Local	Medium-term to Long-term	Partial Mitigation Possible

### C. Summary of Site Specific Mitigation Measures

153. The important site-specific mitigation/safeguard measures due to the below mentioned site situations are summarized as in table (Table 30) below:

**Table 30: Site Specific Mitigation Measures for the Sewage and Drainage Subproject**

Work Component	Sector	Mitigation Measures
<b>Package- SD</b> <b>29/2017-18</b> Construction of Sewage Treatment Plant, pumping mains, effluent discharge pipe lines and allied works at Bank Plot land	Bank Plot sewage treatment plant Laying of pumping main pipe line Laying of treated effluent discharge pipe line	<ol style="list-style-type: none"> <li>1. The location of the proposed STP is at Bank Plot land. Land is under KMC.</li> <li>2. Alignment of pumping main and treated effluent discharge pipeline is located within govt. ROW – no land acquisition is required</li> <li>3. STP location is isolated from traffic and pedestrian movement area. Only during transportation of construction materials, short term impact may be expected. During pipe laying work particularly from Churial Extension PS to STP implementation of traffic management plan will be required</li> <li>4. Material storage will be planned within designated area without impeding movement of people</li> <li>5. Site camp with toilet and drinking water facilities is to set up at available vacant areas without inconveniencing local residents and without restricting movement of vehicles</li> <li>6. Noise generation from construction activity will be regulated and activity should be planned during day time only</li> <li>7. Joining of pipes is to be planned such that the site is not flooded</li> <li>8. No impact is expected on nearby water body</li> <li>9. Suitable display board are to be put up at strategic points of the site giving salient information on the work component, time schedule and name &amp; contact numbers of responsible persons of PMU and Contractor</li> <li>10. Security fencing is to be provided throughout the construction period around excavations</li> <li>11. Excess solid waste/ spoil or construction waste is to be disposed at sites pre-approved by PMU.</li> </ol>

### D. Cumulative Impact Assessment

154. The Bank Plot STP will be constructed in open land of KMC. No other major civil construction activities are known to be taking place in the area. Other pipe laying works are in areas where no major civil constructions are in progress. In brief there are no major construction activities within the present sub project areas. The cumulative impact is less significant.

155. Table 31 summarizes the cumulative impacts resulting from the subproject when added to other present and reasonably future actions within reasonably foreseeable (30-year) period. During this time period, it is expected that many other actions will be implemented that will affect the environmental conditions.

**Table 31: Cumulative Impact Assessment of Sewerage and Drainage Subproject- Sewage Treatment Plant Construction**

Environmental Aspect	Summary of Implications and Mitigation		Assessment of Environmental Impacts			
	Potential Impacts	Mitigation	Significance before Mitigation	Geographic Spatial Scale	Duration	Mitigation
Improvement in sewerage and drainage (S&D) infrastructure construction of sewage treatment plant (STP)	Increase in amount of treated effluent to discharge	Kolkata Municipal Corporation (KMC) undertaking sewerage and drainage improvement subproject	High (negative)	Site/Local	Long-term	Full Mitigation Definite
Cumulative land use and growth-inducing impacts	With sufficient S&D facilities, development can proceed to the degree that sewerage and drainage is not a constraint	KMC to develop additional facilities beyond the design year to accommodate growth if it is to occur	High (negative)	Site/Local	Long-term	Full Mitigation Possible
Cumulative Air Quality Impacts	The subproject can collectively generate construction-related air emissions.	See mitigation measures in the environmental management plan (EMP)	Low (negative)	Site/Local	Short-term	Partial Mitigation Possible
Cumulative Noise Impacts	Noise is a localized issue that diminishes in intensity with distance from the source. Construction of the proposed facilities along with construction activities of other development in the subproject area can potentially increase construction-related noise impacts on land uses directly adjacent to the construction sites.	Such cumulative noise impacts will be temporary and will not likely occur during sensitive nighttime hours. See mitigation measures in the EMP	Low (negative)	Site/Local	Short-term	Partial Mitigation Possible

## **VI. INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION**

### **A. Public participation during the preparation of the Initial Environmental Examination**

156. Issues/concerns/suggestions raised during consultations pertain to construction schedule, and support of stakeholders to the Project. No issues/concerns raised on potential impacts and participants accepted mitigation measures as specified in the EMPs.

157. Meaningful consultations for sensitive receptors, particularly around the STPs, will be conducted during detailed design phase and will be reported in the final IEE.

158. The public participation process included identifying interested and affected people (stakeholders); informing and providing the stakeholders with sufficient background and technical information regarding the proposed development; creating opportunities and mechanisms whereby they can participate and raise their viewpoints (issues, comments and concerns) with regard to the proposed development; giving the stakeholders feedback on process findings and recommendations; and ensuring compliance to process requirements with regards to the environmental and related legislation.

159. The primary stakeholders are: (i) local residents, shopkeepers and businesspeople who live and work around STP and alongside the roads where pipeline will be laid; and (ii) custodians and users of socially- and culturally-important areas.

160. The secondary stakeholders are: (i) KMC as the executing agency; (ii) KEIIP officials as implementation agency; (iii) WBPCB, government department (like Environment department, Government of West Bengal, Forest Directorate, Government of West Bengal, Ministry of Environment, Forests and Climate Change, Government of India) and relevant government agencies (like CPCB, National Environmental Engineering Research Institute), including state and local authorities responsible for land acquisition; (iv) non-government organizations, university professors, and community-based organizations (CBOs) working in the affected communities; (v) other community representatives (prominent citizens, religious leaders, elders, women's groups); (vi) beneficiary community in general; and (vii) ADB, the government of India, and Ministry of Finance.

161. The following methodologies will be used for carrying out public consultation:

- (i) local communities, Individuals affected to be given priority while conducting public consultation;
- (ii) walk-through informal group consultations along the proposed pumping main pipeline;
- (iii) the local communities to be informed through public consultation with briefing on project interventions including its benefits; and
- (iv) the environmental concerns and suggestions made by the participants to be listed out, discussed and suggestions to be noted for consideration during implementation.

162. Formal consultations have been carried out with concerned Minutes of the meeting is attached as Appendix 11. These were supplemented by series of informal discussions by the PMC engineering Consultants with Chief Engineers of KMC and Director General (Projects), PMU mainly on understanding current situation and optimum design to be adopted in order to attain the objectives of taking up the work items.

## **B. Future Consultation and Disclosure**

163. The public consultation and disclosure program will remain a continuous process throughout the subproject implementation and shall include the following:

### **1. Consultation during Detailed Design**

164. Focus-group discussions with affected persons and other stakeholders to hear their views and concerns, so that these can be addressed in subproject design wherever necessary. Regular updates on the environmental component of the subproject will be kept available at the PMU office of KMC.

165. KMC will conduct information dissemination sessions at major intersections and solicit the help of the local community leaders/prominent citizens to encourage the participation of the people to discuss various environmental issues.

166. The PMU, with assistance of DSC will conduct information dissemination sessions in the subproject area. During EMP implementation PMU and DSC will organize public meetings and will apprise the communities about the progress on the implementation of EMP in the subproject works.

### **2. Consultation during Construction**

167. Public meetings with affected communities (if any) to discuss and plan work programs and allow issues to be raised and addressed once construction has started.

168. Smaller-scale meetings to discuss and plan construction work with local communities to reduce disturbance and other impacts, and provide a mechanism through which stakeholders can participate in subproject monitoring and evaluation.

169. During construction, increased traffic, excess generation of dust and noise due to construction activities may cause some inconveniences to the local population. Mitigation measures are already considered in the IEE to keep this at a minimum. Community consultations have already been carried out. During detailed design stage, multiple consultations at various levels will be carried out ensuring clear communication to the affected persons about the likely transient impact during construction and continued impact, if any, during the operation stage.

### **3. Project Disclosure**

170. A communications strategy is of vital importance in terms of accommodating traffic during road closure. Local communities will be continuously consulted regarding location of construction camps, access and hauling routes and other likely disturbances during construction. The road closure together with the proposed detours will be communicated via advertising, pamphlets, road signages, etc.

171. One public information campaign via newspaper/radio/TV is proposed to explain the subproject details to a wider population. Public disclosure meetings at key project stages will be organized to inform the public of progress and future plans.

172. For the benefit of the community, a summary of the IEE will be translated in the local language and made available at the offices of KMC, PMU and DSC. Hard copies of the English version of the IEE will be accessible to citizens as a means to disclose the document and at the same time creating wider public awareness. Electronic version of the IEE will be placed in the official website of the KEIIP and the official website of ADB after approval of the IEE by Government and ADB. The PMU will issue Notification on the start date of implementation of the S&D subproject in KEIIP web site ahead of the implementation works.

## VII. GRIEVANCE REDRESS MECHANISM

173. **Common Grievance Redress Mechanism.** A common grievance redress mechanism (GRM) has been established for social, environmental or any other subproject related grievances.

174. **Grievance Redress Process.** PMU will maintain a Complaint Cell at KEIIP office located in 206 A J C Bose Road Kolkata 700017 headed by a designated Grievance Officer (currently the Administrative Officer) under Project Director. The Complaint Cell will also serve as Public Information Centers, where, apart from grievance registration, information on the Project, subprojects, social and environmental safeguards, etc. can be provided.

175. At every Borough of KMC under which works are in progress, a Public Relations & Grievance Redressal Unit is to be established for information disclosure on request from public and for receipt of complaints.

176. At Contractors' site offices, complaint and suggestion books will be available for lodging any complaint. The concerned Executive Engineers of KEIIP will monitor these books and if possible take necessary actions for redressal of minor complaints with intimation to the complainant.

177. The Grievance Registration/Suggestion Form will be available at the Complaints Cell and in Borough Offices and will also be downloadable from the KEIIP/KMC websites. Grievances/suggestions of affected persons can be dropped in suggestion boxes or conveyed through phone or mail. Affected Persons will also be able to register grievances - social, environmental or other, personally at the Complaint Cell and at Borough offices of KMC. The Grievance Officer and designated official at the Boroughs will be able to correctly interpret/record verbal grievances of non-literate persons and those received over telephone.

178. All complaints (unresolved at local site/Borough level) relating to KEIIP will be sent to the Project Director, KEIIP including those received in the KMC/KEIIP website for redressal. The Grievance Officer will resolve simple unresolved issues and in case of complicated issues, consult/seek the assistance of the Environment/Social Specialist of the DSC/PMU. Grievances not redressed through this process within one month of registration will be brought to the notice of the Project Director, KEIIP. Action taken in respect of all complains will be communicated to the complainant by letter, over phone or e-mail or whatsapp as the case may be.

179. Periodic community meetings with affected communities to understand their concerns and help them through the process of grievance redress (including translation from local dialect/language, recording and registering grievances of non-literate affected persons and explaining the process of grievance redress) will be conducted if required. The above Grievance Redress Process will be discussed with the stakeholders at the proposed disclosure workshop.

180. **Grievance Redressal Committee:** An apex grievance redress committee (GRC) has already been constituted by the Project Director to address grievances pertaining to broader concerns related to the program/subproject. A PMU level GRC has already been constituted by the Project Director to address grievances. Grievances not resolved at borough level are referred to PMU level. However, grievances that cannot be resolved at PMU level will be referred to an apex GRC.<sup>5</sup> Still unresolved issues will be referred to an appropriate court of law.

181. The time limit for grievance redressal will be as follows:

- (i) Site level – 7 days;
- (ii) Borough level – 7 days;
- (iii) GRC – PMU level – 15 days; and
- (iv) Apex GRC -15 days

182. Appendix 12 shows office order related to set up of GRC.

183. Consultation Arrangements. This will include group meetings and discussions with affected persons, to be announced in advance and conducted at the time of day agreed on with affected persons and conducted to address general/common grievances; and if required with the Environment/Social Specialist of PMU/DSC for one-to-one consultations. Non-literate affected persons/ vulnerable affected persons will be assisted to understand the grievance redress process, to register complaints and with follow-up actions at different stages in the process.

184. Record keeping. Records will be kept by PMU/Borough Office/Contractors' site office of all grievances received including contact details of complainant, date the complaint was received, nature of grievance, agreed corrective actions and the date these were in effect, and final outcome.

185. Information Dissemination Methods of the GRM. Grievances received and responses provided will be documented and reported back to the affected persons. (Appendix 13 -Sample Grievance Registration Form). The number of grievances recorded and resolved and the outcomes will be displayed/disclosed in the offices of the different Boroughs of KMC and web. The phone number where grievances are to be recorded will be prominently displayed at the construction sites.

186. Periodic Review and Documentation of Lessons Learned. PMU will periodically review the functioning of the GRM and effectiveness of the mechanism, especially on the Project's ability to prevent and address grievances.

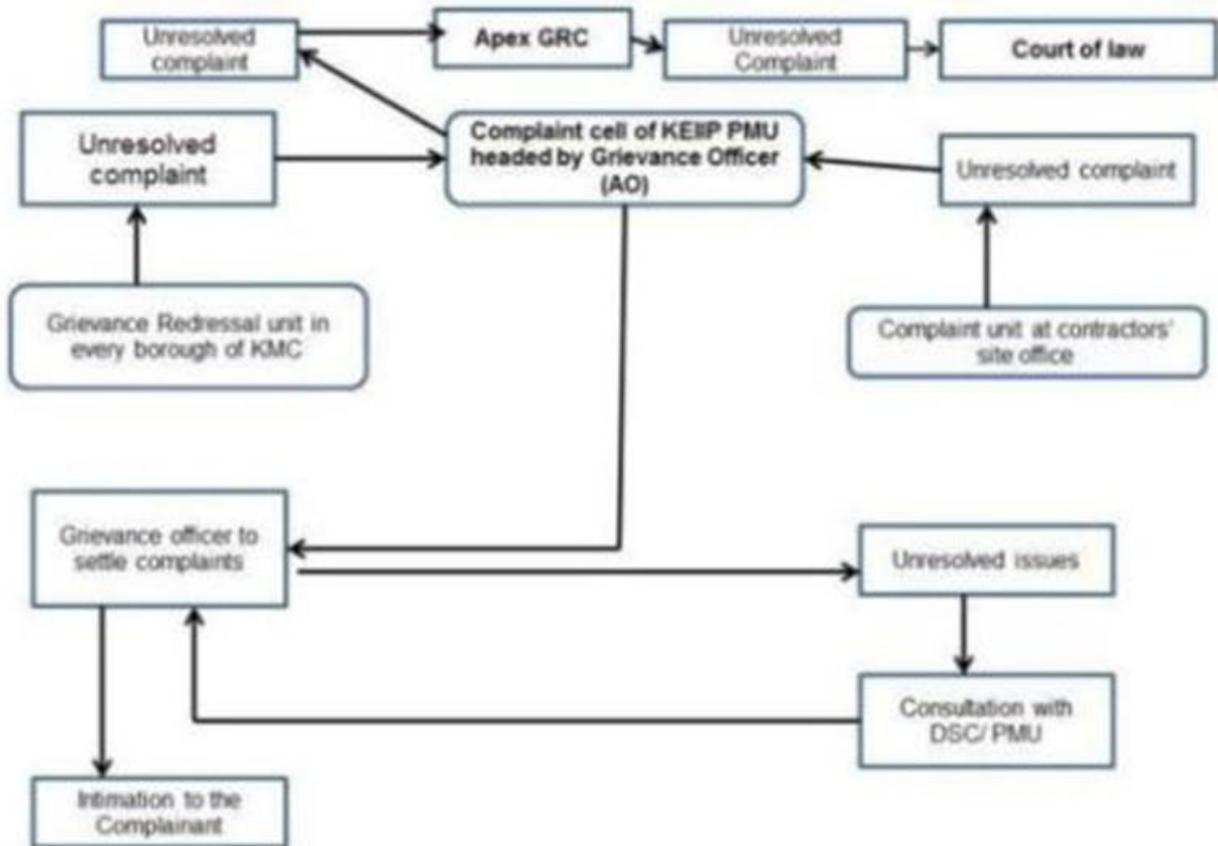
187. Costs. All costs involved in resolving the complaints (meetings, consultations, communication and reporting / information dissemination) will be borne by PMU.

188. Figure 13 shows GRM flow chart.

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<sup>5</sup> The apex GRC will have the following members: KMC Commissioner as Chairperson, KEIIP Project Director, Director General (P), KEIIP, Environment/Social Safeguard Officer, Administrative Officer as the convener, representatives of affected persons, community-based organizations (CBOs), and eminent citizens. The GRC must have at least two women members.

**Figure 12: Grievance Redress Mechanism system in Kolkata Environmental Improvement Investment Program**



DSC = design and supervision consultant, GRC = grievance redress committee, KMC = Kolkata Municipal Corporation, PMU = program management unit.

### VIII. ENVIRONMENTAL MANAGEMENT PLAN

189. The EMP will guide the environmentally sound construction of the subproject and ensure efficient lines of communication between the PMU, DSC, and the contractors. The EMP identifies activities according to the following three phases of development: (i) Site Establishment and Preliminary Activities; (ii) Construction Phase; and (iii) Post Construction/Operational Phase.

190. The purpose of the EMP is to ensure that the activities are undertaken in a responsible non-detrimental manner with the objectives of: (i) provide a pro-active, feasible and practical working tool to enable the measurement and monitoring of environmental performance on site; (ii) guide and control the implementation of findings and recommendations of the environmental assessment conducted for the subproject; (iii) detail specific actions deemed necessary to assist in mitigating the environmental impact of the subproject; and (iv) ensure that safety recommendations are complied with. The contractors for the packages will be required to submit to PMU for review and approval Site Environmental Plan (SEP) including: (i) proposed sites/locations for construction work camps, storage areas, hauling roads, lay down areas, disposal areas for solid and hazardous wastes; (ii) specific mitigation measures following the EMP to ensure no significant environmental impacts; (iii) monitoring program as per SEP; and (iv) budget for SEP implementation. No physical works are allowed to commence prior to approval of SEP.

191. A copy of the final EMP/approved SEP must be kept on site during the construction period at all times.<sup>6</sup> The EMP will be made binding on contractor operating on the site and will be included within the Contractual Clauses. Non-compliance with, or any deviation from, the conditions set out in this document constitutes a failure in compliance. It shall be noted that the Supreme Court of India<sup>7</sup> mandates those responsible for environmental damage must pay the repair costs both to the environment and human health and the preventative measures to reduce or prevent further pollution and/or environmental damage. (The polluter pays principle).

192. The Contractor is deemed not to have complied with the EMP/approved SEP if:

- (i) Within the boundaries of the site, site extensions and haul/ access roads there is evidence of contravention of clauses;
- (ii) If environmental damage ensues due to negligence;
- (iii) The contractor fails to comply with corrective or other instructions issued by the PMU/DSC within a specified time; and
- (iv) The Contractor fails to respond adequately to complaints from the public

#### **A. Institutional Arrangement**

193. The institutional arrangement will follow KEIIP's organizational structure and functions (Figure 13). The subproject will be implemented and monitored by the Project Management Unit (PMU). The KEIIP's PMU Environment Specialist is overall in-charge on Environmental safeguard of the program. The responsibilities of the Environmental Specialist will ensure that (i) environmental safeguard issues are addressed; (ii) EMP/approved SEP is implemented; (iii) physical and non-physical activities under the subproject are monitored; and (iv) monitoring reports are prepared on time and submitted to ADB.

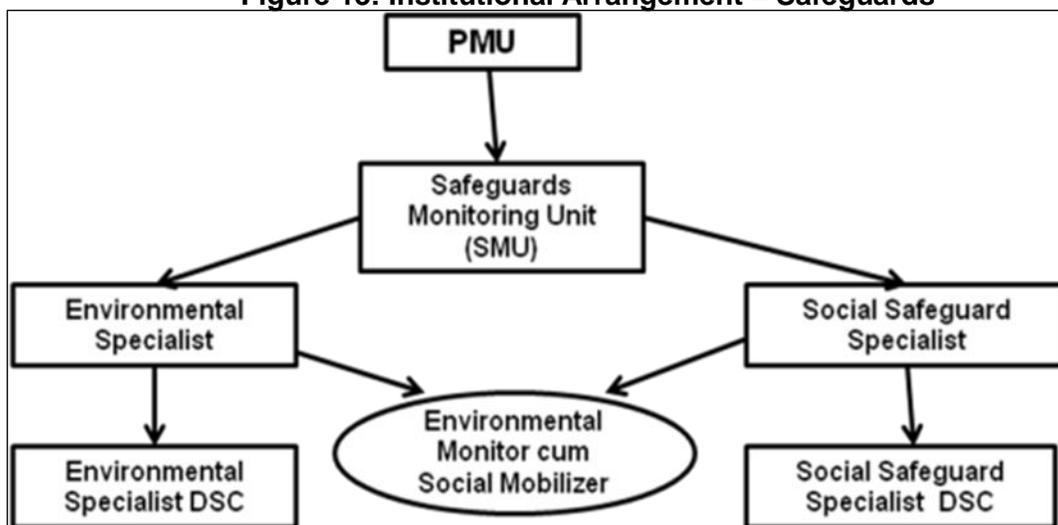
194. The PMU- SMU will be supported by the Design and Supervision Consultants (DSC). An Environment Specialist will be engaged to ensure: (i) EMP/ approved SEP is implemented; (ii) surveys and measurements are undertaken; (iii) inspections and observations throughout the construction period are recorded to ensure that safeguards and mitigation measures are provided as intended; and (iv) statutory clearances and permits from government agencies/other entities are obtained prior to start of civil works.

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<sup>6</sup> Final EMP will be developed by BOOT contractor after finalization of design

<sup>7</sup> Writ Petition No. 657 of 1995. The Supreme Court, in its order dated Feb.4, 2005 that "The Polluter Pays Principle means that absolute liability of harm to the environment extends not only to compensate the victims of pollution, but also to the cost of restoring environmental degradation. Remediation of damaged environment is part of the process of sustainable development."

Figure 13: Institutional Arrangement – Safeguards



DSC = design and supervision consultant, PMU = program management unit.

195. Table 32 gives the institutional roles and responsibilities in all phases of the subproject.

Table 32: Institutional Roles and Responsibilities: Environmental Safeguard

Phase	Project Management Unit/ Safeguards Monitoring Unit	Design and Supervision Consultant	ADB
Subproject identification stage		<ul style="list-style-type: none"> <li>Design and supervision consultant (DSC) to screen subprojects with inputs based on the environmental assessment and review framework (EARF) subproject selection guidelines</li> </ul>	
Subproject appraisal stage	<ul style="list-style-type: none"> <li>Program management unit (PMU) to review the rapid environmental assessment (REA) checklists and draft initial environmental examination (IEE).</li> <li>PMU to disclose on its website the approved IEE.</li> <li>PMU to ensure disclosure of information throughout the duration of the subproject.</li> </ul>	<ul style="list-style-type: none"> <li>DSC to conduct REA for each subproject using checklists and to prepare IEE</li> </ul>	<ul style="list-style-type: none"> <li>ADB to review the REA checklists and reconfirm the categorization.</li> <li>ADB will review and approve EIA reports (Category A) and IEE reports (Category B) subprojects.</li> <li>ADB to disclose on its website the submitted EIA/IEE report.</li> </ul>
Preliminary Design Phase and then final design phase	<ul style="list-style-type: none"> <li>Safeguard monitoring unit (SMU) of PMU with the assistance of DSC to incorporate the EMP, environmental mitigation and monitoring measures into contract documents.</li> </ul>	<ul style="list-style-type: none"> <li>DSC to revise the IEE and EMP in accordance with detailed design changes (which to be done by BOOT contractor).</li> <li>DSC to ensure incorporation of preliminary design based EMP in bid documents and contracts.</li> <li>DSC to prepare inventory of utilities to be affected by the subproject.</li> </ul>	<ul style="list-style-type: none"> <li>ADB will review and approve updated EIA reports (Category A) and IEE reports (Category B) subprojects.</li> <li>ADB to disclose on its website updated EIA/IEE report.</li> </ul>

Phase	Project Management Unit/ Safeguards Monitoring Unit	Design and Supervision Consultant	ADB
Pre-construction Phase	<ul style="list-style-type: none"> <li>• DSC to conduct public consultation and disclosure during IEE process and comments will be reflected in the IEE report.</li> <li>• PMU to monitor the disclosure and public consultation.</li> <li>• PMU and DSC to approve contractor's proposed locations for construction work camps, storage areas, hauling roads, lay down areas, disposal areas for solid and hazardous wastes</li> </ul>	<ul style="list-style-type: none"> <li>• DSC to conduct baseline environmental conditions and inventory of affected trees</li> <li>• DSC to ensure statutory clearances and permits from government agencies/other entities are obtained prior to start of civil works.</li> <li>• DSC to consult affected people and ensure RP is implemented (if required as per project design) prior to start of civil works.</li> <li>• DSC to ensure disclosure of information prior to start of civil works and throughout the duration of the construction period.</li> <li>• DSC to approve contractor's site-specific environmental plan (such as traffic management plan, waste management plan, locations for camp sites, storage areas, lay down areas, and other sites/plans specified in the EMP).</li> </ul>	
Construction Phase	<ul style="list-style-type: none"> <li>• SMU will review 6-monthly monitoring and EMP implementation report including the status of Project compliance with statutory clearances and with relevant loan covenants and submit the 6-monthly report to ADB and seek permission to disclose the same in the Project web site.</li> </ul>	<ul style="list-style-type: none"> <li>• DSC to monitor the implementation of mitigation measures by Contractor.</li> <li>• DSC to prepare monthly progress reports including a section on implementation of the mitigation measures (application of EMP and monitoring plan)</li> <li>• DSC (as per EMP) will conduct environmental quality monitoring during construction stage (ambient air and noise, and water quality).</li> <li>• DSC to prepare the 6 monthly (semi-annual) monitoring report on environment by focusing on the progress in implementation of the EMP and issues encountered and measures adopted, follow-up actions required, if any.</li> </ul>	<ul style="list-style-type: none"> <li>• ADB to review the 6-monthly report, provide necessary advice if needed to the PMU and approve the same.</li> <li>• ADB to disclose on its website environmental monitoring reports.</li> </ul>
Pre-operation Phase (Commissioning and Defect Liability Period)	<ul style="list-style-type: none"> <li>• PMU to review monitoring report of DSC on post-construction activities by the contractors as specified in the EMP</li> </ul>	<ul style="list-style-type: none"> <li>• DSC to monitor post-construction activities by the contractors as specified in the EMP.</li> </ul>	
Operation Phase	<ul style="list-style-type: none"> <li>• Initially BOOT contractor will do all monitoring up to their contract period after that KMC to conduct</li> </ul>		

Phase	Project Management Unit/ Safeguards Monitoring Unit	Design and Supervision Consultant	ADB
	monitoring, as specified in the environmental monitoring plan. <ul style="list-style-type: none"> <li>• WBPCB to monitor the compliance of the standards regarding drinking water quality, ground water, ambient air, effluent quality from treatment plant, as applicable.</li> </ul>		

CTE = consent to establish, CTO = consent to operate, DSC = Design and Supervision Consultant, EIA = environmental impact assessment, EMP = environmental management plan, IEE = initial environmental examination, KMC = Kolkata Municipal Corporation, PMU = program management unit; REA = rapid environmental assessment, SMU= safeguard monitoring unit, WBSPCB = West Bengal State Pollution Control Board.

196. The safeguards monitoring unit will:

- (i) prepare the REA checklist, to draft the EIA/IEE and to disclose the approved EIA/IEE in the website;
- (ii) ensure that Environmental Clearance, Consent to Establishment and Consent to Operate and other certificates, as required, are obtained in time from appropriate authorities and to ensure compliances with conditions imposed;
- (iii) ensure incorporation of the EMP, environmental mitigation and monitoring measures into the contract documents;
- (iv) monitor disclosure and public consultation arranged by DSC during IEE process and to ensure that comments are reflected in the IEE report;
- (v) ensure disclosure of information throughout the duration of the subproject through suitable visual means and publications;
- (vi) provide necessary input for grievance redress;
- (vii) approve contractor's proposed locations for construction work camps, storage areas, hauling roads, lay-down areas, and disposal areas for solid and hazardous wastes on recommendations of DSC;
- (viii) guide the Contractor for drawing up of Site Environmental Management Plan and to approve the same;
- (ix) induct the Contractor for taking up the construction following environmental and social safeguards;
- (x) facilitate scheduled monitoring during implementation of the project;
- (xi) carry out regular onsite monitoring and guide the Contractor to adopt the required site management standard;
- (xii) ensure the required health and safety measures at work site;
- (xiii) obtain in time and to review the monthly monitoring report of the Contractors;
- (xiv) prepare 6-monthly monitoring and EMP implementation report, including the status of project compliance, statutory clearances and relevant loan covenants, and submit the approved 6-monthly report to ADB and seek permission to disclose the same in the investment program website;
- (xv) prepare monitoring report on post-construction activities by the contractors as specified in the EMP.

197. The Contractor will be required to:

- (i) assist to DSC for updating of report after detailed design;

- (ii) submit Site environmental plan (SEP) covering proposed sites / locations for construction work camps, storage areas, hauling roads, lay down areas, disposal areas for solid and hazardous wastes;
- (iii) comply with all applicable legislation, is conversant with the requirements of the EMP/ approved SEP;
- (iv) brief his staff, employees, and laborer about the requirements of the EMP/ approved SEP;
- (v) ensure any sub-contractors/ suppliers who are utilized within the context of the contract comply with the environmental requirements of the EMP/ approved SEP. The Contractor will be held responsible for non-compliance on their behalf;
- (vi) supply method statements for all activities requiring special attention as specified and/or requested by the DSC Environment Specialist during the duration of the Contract;
- (vii) provide environmental awareness training to staff, employees, and laborers;
- (viii) bear the costs of any damages/compensation resulting from non-adherence to the EMP/approved SEP or written site instructions;
- (ix) conduct all activities in a manner that minimizes disturbance to directly affected residents and the public in general, and foreseeable impacts on the environment; and
- (x) ensure that the PMU Environment Coordinators are timely informed of any foreseeable activities that will require input from the DSC Environment Specialist.

## B. Environmental Management and Mitigation Measures

198. Table 33 outlines the site establishment and preliminary activities.

**Table 33: Site Establishment and Preliminary Activities**

(to be revised by contractors for package-specific Site Environmental Plan after finalization of design)

Sr. No.	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
1.	Legislation, Permits and Agreements	In all instances, KMC, service providers, contractors and consultants must remain in compliance with relevant local and national legislation.	PMU and DSC	Prior to moving onto site and during construction
		DSC to obtain statutory clearances and permits from government agencies/other entities	PMU	Prior to start of civil works
		Contractor to submit proof of compliance to Air Act (in relation to hot mixing, stone crushers, diesel generators)	DSC Environment Specialist	Prior to moving onto site and during construction
		A copy of the EMP/approved SEP must be kept on site during the construction period	PMU Environment Specialist and DSC Environment Specialist	At all times
2.	Access to Site	Access to site will be via existing roads. The Contractor will need to ascertain the existing condition of the roads and repair damage shall not occur due to construction.	DSC Environment Specialist	Prior to moving onto site and during construction

Sr. No.	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
		The Local Traffic Department shall be involved in the planning stages of the road closure and detour (if any) and available on site in the monitoring of traffic in the early stages of the operations during road closure	DSC Environment Specialist	Prior to moving onto site
		The Local Traffic Department must be informed at least a week in advance if the traffic in the area will be affected.	DSC Environment Specialist	Prior to moving onto site
		The location of all affected services and servitudes must be identified and confirmed.	DSC Environment Specialist	Prior to moving onto site
		All roads for construction access must be planned and approved ahead of construction activities. They shall not be created on an ad-hoc basis.	PMU Environment Specialist and DSC Environment Specialist	Prior to moving onto site and during construction.
		No trees/shrubs/groundcover source may be removed or vegetation stripped without the prior permission.	PMU Environment Specialist and DSC Environment Specialist	Before and during construction.
		Contractors shall construct formal drainage on all temporary haulage roads in the form of side drains and miter drains to prevent erosion and point source discharge of run-off.	DSC Environment Specialist	Prior to moving onto site.
3.	Setting up of Construction Camp <sup>a</sup>	Choice of site for the contractor's camp requires the DSC Environment Specialist's permission and must take into account location of local residents, businesses and existing land uses, including flood zones and slip / unstable zones. A site plan must be submitted to the DSC Environment Specialist for approval.	DSC Environment Specialist and PMU Environment Specialist	During surveys and preliminary investigations and prior to moving onto the site
		The construction camp may not be situated on a floodplain or on slopes greater than 1:3.	PMU Environment Specialist and DSC Environment Specialist	During surveys and preliminary investigations and prior to moving onto the site
		If the Contractor chooses to locate the camp site on private land, he must get prior permission from both the DSC Environment Specialist and the landowner.	PMU Environment Specialist and DSC Environment Specialist	During site establishment and ongoing – weekly inspections
		<p>In most cases, on-site accommodation will not be required. The construction camp can thus be comprised of:</p> <ul style="list-style-type: none"> <li>• site office</li> <li>• toilet facilities</li> <li>• designated first aid area</li> <li>• eating areas</li> <li>• staff lockers and showers (where water and waterborne sewers are available)</li> <li>• storage areas</li> <li>• batching plant (if required)</li> <li>• re-fuelling areas (if required)</li> <li>• maintenance areas (if required)</li> <li>• crushers (if required)</li> </ul>	DSC Environment Specialist	During set-up

Sr. No.	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
		Cut and fill must be avoided where possible during the set-up of the construction camp.	DSC Environment Specialist	During site set-up
		The contractor shall make adequate provision for temporary toilets for the use of their employees during the construction phase. Such facilities, which shall comply with local authority regulations, shall be maintained in a clean and hygienic condition. Their use shall be strictly enforced.	DSC Environment Specialist	During site establishment and ongoing – weekly inspections
		Under no circumstances may open areas or the surrounding bush be used as a toilet facility.	DSC Environment Specialist	Ongoing
		Bins and/or skips shall be provided at convenient intervals for disposal of waste within the construction camp.	DSC Environment Specialist	During site set-up and ongoing
		Bins shall have liner bags for efficient control and safe disposal of waste	DSC Environment Specialist	Ongoing
		Recycling and the provision of separate waste receptacles for different types of waste shall be encouraged.	DSC Environment Specialist	During site set-up and ongoing
4.	Establishing Equipment Lay-down and Storage Area <sup>b</sup>	Choice of location for equipment lay-down and storage areas must take into account prevailing winds, distances to adjacent land uses, general on – site topography and water erosion potential of the soil. Impervious surfaces must be provided where necessary	PMU Environment Specialist and DSC Environment Specialist	During site set-up
		Storage areas shall be secure so as to minimize the risk of crime. They shall also be safe from access by children / animals etc.	DSC Environment Specialist	During site set-up
		It is very important that the proximity of residents, businesses, schools etc. is taken into account when deciding on storage areas for hazardous substances or materials. Residents living adjacent to the construction site must be notified of the existence of the hazardous storage area	PMU Environment Specialist and DSC Environment Specialist	During site set-up
		Equipment lay-down and storage areas must be designated, demarcated and fenced if necessary.	DSC Environment Specialist	During site set-up
		Fire prevention facilities must be present at all storage facilities	DSC Environment Specialist	During site set-up
		Proper storage facilities for the storage of oils, paints, grease, fuels, chemicals and any hazardous materials to be used must be provided to prevent the migration of spillage into the ground and groundwater regime around the temporary storage area(s). These pollution prevention measures for storage shall include a bund wall high enough to contain at least 110% of any stored volume. The contractor shall submit a method statement for approval	DSC Environment Specialist	During site set-up and ongoing
		These storage facilities (including any tanks) must be on an impermeable surface that is protected from the ingress of storm	DSC Environment Specialist	During site set-up and ongoing

Sr. No.	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
		water from surrounding areas in order to ensure that accidental spillage does not pollute local soil or water resources		
		Fuel tanks must meet relevant specifications and be elevated so that leaks may be easily detected.	DSC Environment Specialist	During site setup and monitored
		Material Safety Data Sheets (MSDSs) shall be readily available on site for all chemicals and hazardous substances to be used on site. Where possible the available, MSDSs shall additionally include information on ecological impacts and measures to minimize negative environmental impacts during accidental releases or escapes	DSC Environment Specialist and Contractor	Ongoing
		Staff dealing with these materials/substances must be aware of their potential impacts and follow the appropriate safety measures. The contractor must ensure that its staff is made aware of the health risks associated with any hazardous substances used and has been provided with the appropriate protective clothing/equipment in case of spillages or accidents and have received the necessary training	DSC Environment Specialist and Contractor	Ongoing
		Contractors shall submit a method statement and plans for the storage of hazardous materials and emergency procedures.	DSC Environment Specialist	Prior to establishment of storage area
5.	Materials Management – Sourcing <sup>c</sup>	Contractors shall prepare a source statement indicating the sources of all materials (including topsoil, sands, natural gravels, crushed stone, asphalt, clay liners etc.), and submit these to the DSC Environment Specialist for approval prior to commencement of any work.	PMU Environment Specialist and DSC Environment Specialist	On award of contract
		Where possible, a signed document from the supplier of natural materials shall be obtained confirming that they have been obtained in a sustainable manner and in compliance with relevant legislation	PMU Environment Specialist and DSC Environment Specialist	On receipt of natural materials
		Where materials are borrowed (mined), proof must be provided of authorization to utilize these materials from the landowner/material rights owner and the Department of Minerals	DSC Environment Specialist	On receipt of borrowed (mined) materials
6.	Education of site staff on general and Environmental Conduct <sup>d</sup>	Ensure that all site personnel have a basic level of environmental awareness training	PMU Environment Specialist, DSC Environment Specialist and Contractor	During staff induction and ongoing
		Staff operating equipment (such as excavators, loaders, etc.) shall be adequately trained and sensitized to any potential hazards associated with their task	DSC Environment Specialist and Contractor	During staff induction, followed by ongoing monitoring

Sr. No.	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
		No operator shall be permitted to operate critical items of mechanical equipment without having been trained by the Contractor and certified competent by DSC	DSC Environment Specialist and Contractor	During staff induction, followed by ongoing monitoring
		All employees must undergo safety training and wear the necessary protective clothing	DSC Environment Specialist and Contractor	During staff induction, followed by ongoing monitoring
		<p>A general regard for the social and ecological well-being of the site and adjacent areas is expected of the site staff. Workers need to be made aware of the following general rules:</p> <ul style="list-style-type: none"> <li>• No alcohol / drugs to be present on site</li> <li>• Prevent excessive noise</li> <li>• Construction staff are to make use of the facilities provided for them, as opposed to ad-hoc alternatives (e.g. fires for cooking, the use of surrounding bus as a toilet facility are forbidden)</li> <li>• No fires to be permitted on site</li> <li>• Trespassing on private / commercial properties adjoining the site is forbidden</li> <li>• Other than pre-approved security staff, no workers shall be permitted to live on the construction site</li> <li>• No worker may be forced to do work that is potentially dangerous or for what he / she is not trained to do</li> </ul>	DSC Environment Specialist and Contractor	During staff induction, followed by ongoing monitoring
6.	Social Impacts <sup>e</sup>	Open liaison channels shall be established between the site owner, the developer, operator, the contractors and interested and affected people such that any queries, complaints or suggestions can be dealt with quickly and by the appropriate person(s).	PMU Environment Coordinator and DSC Environment Specialist	Prior to moving onto site and ongoing
		A communications strategy is of vital importance in terms of accommodating traffic during road closure if any. The road closure (particularly during laying of pipes) together with the proposed detour needs to be communicated locally	PMU Environment Specialist	Prior to moving onto site and ongoing
		Advance road signage indicating the road detour and alternative routes. Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.	PMU Environment Specialist	Prior to moving onto site and ongoing
		Storage facilities and other temporary structures on site shall be located such that they have as little visual impact on local residents as possible.	DSC Environment Specialist and PMU Environment Specialist	During surveys and preliminary investigations and site set-up.
		In areas where the visual environment is particularly important or privacy concerns for surrounding buildings exist, the site	DSC Environment Specialist and PMU	During surveys and preliminary

Sr. No.	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
		may require screening. This could be in the form of shade cloth, temporary walls, or other suitable materials prior to the beginning of construction.	Environment Specialist	investigations and site set-up.
		Special attention shall be given to the screening of highly reflective materials on site.	PMU Environment Specialist	During site set-up
7.	Noise Impacts	Construction and transportation vehicles are to be fitted with standard silencers prior to the beginning of construction	DSC Environment Specialist and PMU Environment Specialist	During site set-up
		Equipment that is fitted with noise reduction facilities (e.g. side flaps, silencers, etc.) will be used as per operating instructions and maintained properly during site operations	DSC Environment Specialist and PMU Environment Specialist	During site set-up
8.	Dust/Air Pollution <sup>f</sup>	Vehicles travelling during transportation of materials along the access roads must adhere to speed limits to avoid creating excessive dust.	PMU Environment Specialist	Ongoing.
		Camp construction / haulage road construction – areas that have been stripped of vegetation must be dampened periodically to avoid excessive dust.	PMU Environment Specialist	Ongoing – more frequently during dry and windy conditions
		The Contractor must make alternative arrangements (other than fires) for cooking and / or heating requirements. LPG gas cookers may be used provided that all safety regulations are followed.	DSC Environment Specialist	Ongoing.
9.	Soil Erosion	The time that stripped areas are left open to exposure shall be minimized wherever possible. Care shall be taken to ensure that lead times are not excessive.	DSC Environment Specialist and PMU Environment Specialist	Throughout the duration of the subproject.
		Wind screening and storm water control shall be undertaken to prevent soil loss from the site.	DSC Environment Specialist and PMU Environment Specialist	During site set-up
		Procedures that are in place to conserve topsoil during the construction phase of the subproject are to be applied to the set up phase. i.e. topsoil is to be conserved while providing access to the site and setting up the camp.	DSC Environment Specialist and PMU Environment Specialist	Ongoing monitoring. during site set-up
10.	Storm water <sup>9</sup>	To prevent storm water damage, the increase in storm water run-off resulting from construction activities must be estimated and the drainage system assessed accordingly. A drainage plan must be submitted to the DSC Environment Specialist for approval and must include the location and design criteria of any temporary stream crossings (siting and return period etc.).	DSC Environment Specialist	During surveys and preliminary Investigations.
		During site establishment, storm water culverts and drains are to be located and covered with metal grids to prevent blockages if deemed necessary by the DSC Environment Specialist. (e.g. due to demolition work).	DSC Environment Specialist	During site setup.

Sr. No.	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
		Temporary cut off drains and berms may be required to capture storm water and promote infiltration.	PMU Environment Specialist	During site setup.
11.	Water Quality <sup>h</sup> .	Storage areas that contain hazardous substances must be banded with an approved impermeable liner	DSC Environment Specialist	During site setup.
		Spills in banded areas must be cleaned up, removed and disposed of safely from the banded area as soon after detection as possible to minimize pollution risk and reduced banding capacity.	DSC Environment Specialist and PMU Environment Specialist	During site setup.
		A designated, banded area is to be set aside for vehicle washing and maintenance. Materials caught in this banded area must be disposed of to a suitable waste site or as directed by the DSC Environment Specialist	DSC Environment Specialist and PMU Environment Specialist	During site setup.
		Provision shall be made during set up for all polluted runoff to be treated to the DSC Environment Specialist's approval before being discharged into the storm water system. (This will be required for the duration of the project.)	DSC Environment Specialist and PMU Environment Specialist	During site setup and to be monitored weekly
12.	Conservation of the Natural Environment <sup>i</sup>	No vegetation may be cleared without prior permission from the DSC Environment Specialist.	DSC Environment Specialist and PMU Environment Specialist	During site setup and ongoing.
		Trees that are not to be cleared shall be marked beforehand with danger tape. The PMU Environment Specialist must be given a chance to mark vegetation that is to be conserved before the Contractor begins clearing the site	DSC Environment Specialist and PMU Environment Specialist	During site set-up
		Care must be taken to avoid the introduction of alien plant species to the site and surrounding areas. (Particular attention must be paid to imported material)	PMU Environment Specialist	Ongoing in camp Site, haulage Areas
13.	Set-up of Waste Management Procedure	The excavation and use of rubbish pits on site is forbidden	PMU Environment Specialist	Ongoing
		Burning of waste is forbidden.	PMU Environment Specialist	Ongoing
14.	Cultural Environment	Prior to the commencement of construction, all staff need to know what possible archaeological or historical objects of value may look like, and to notify the DSC Environment Specialist/Contractor shall such an item be uncovered.	PMU Environment Specialist	During site set-up and ongoing.
15.	Security and Safety	Lighting on site is to be set out to provide maximum security and to enable easier policing of the site, without creating a visual nuisance to local residents or businesses.	DSC Environment Specialist	During site set-up
		Material stockpiles or stacks, such as, pipes must be stable and well secured to avoid collapse and possible injury to site workers / local residents.	PMU Environment Specialist	Ongoing

Sr. No.	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
		Flammable materials shall be stored as far as possible from adjacent residents / businesses.	PMU Environment Specialist	Ongoing
		All interested and affected persons shall be notified in advance of any known potential risks associated with the construction site and the activities on it. Examples are: <ul style="list-style-type: none"> <li>• stringing of power lines</li> <li>• excavation for the micro-tunnel equipment</li> <li>• earthworks/earthmoving machinery on beside houses/infrastructure/sensitive receptors</li> <li>• risk to residences/sensitive receptors along haulage roads / access routes</li> </ul>	PMU Environment Specialist and DSC Environment	24 hours prior to activity in question

<sup>a</sup> Careful planning of the construction camp can ensure that time and costs associated with environmental management and rehabilitation are reduced.

<sup>b</sup> Storage areas can be hazardous, unsightly and can cause environmental pollution if not designed and managed carefully.

<sup>c</sup> Materials must be sourced in a legal and sustainable way to prevent offsite environmental degradation.

<sup>d</sup> These points need to be made clear to all staff on site before the subproject begin.

<sup>e</sup> It is important to take notice of the needs and wishes of those living or working adjacent to the site. Failure to do so can cause disruption to work.

<sup>f</sup> It is important to take notice of the needs and wishes of those living or working adjacent to the site. Failure to do so can cause disruption to work.

<sup>g</sup> Establishment of the camp site and related temporary works can reduce air quality. Serious financial and environmental impacts can be caused by unmanaged storm water.

<sup>h</sup> Incorrect disposal of substances and materials and polluted run-off can have serious negative effects on groundwater quality

<sup>i</sup> Alien plant encroachment is particularly damaging to natural habitats and is often associated with disturbance to the soil during construction activities. Care must be taken to conserve existing plant and animal life on and surrounding the site.

199. Table 34 outlines management of construction activities and workforce.

**Table 34: Management of Construction and Workforce Activities**  
(to be revised by contractors for package-specific SEP after finalization of design)

No.	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
1.	Access to Site	Contractor shall ensure that all side and miter drains and scour check walls on access and haul roads are functioning properly and are well maintained.	DSC Environment Specialist	Weekly and after heavy rains.
		Contractor shall ensure that access roads are maintained in good condition by attending to potholes, corrugations and storm water damage as soon as these develop.	DSC Environment Specialist	Weekly inspection.
		If necessary, contractor to employ a staff to clean surface roads adjacent to construction sites where materials have been spilt.	DSC Environment Specialist	When necessary
		Contractor to avoid unnecessary compaction of soils by heavy vehicles.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to restrict construction vehicles to demarcated access, haulage routes and turning areas.	DSC Environment Specialist	Ongoing monitoring.

No.	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
2.	Maintenance of Construction Camp	Contractor to monitor and manage drainage of the camp site to avoid standing water and soil erosion.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to ensure run-off from the camp site must not discharge into neighbors' properties.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to maintain toilets in a clean state and shall be moved to ensure that they adequately service the work areas	DSC Environment Specialist	Weekly inspection
		Contractor to ensure that open areas or the surrounding bush are not being used as a toilet facility.	DSC Environment Specialist	Weekly inspection
		Contractor to ensure all litter is collected from the work and camp areas daily.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to empty bins and/or skips regularly, dispose wastes at the pre-approved sites, keep all disposal waybills for review.	DSC Environment Specialist	Weekly inspection
		Contractor to ensure eating areas are regularly serviced and cleaned to the highest possible standards of hygiene and cleanliness.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to ensure that his camp and working areas are kept clean and tidy at all times.	DSC Environment Specialist	Weekly monitoring
3.	Staff Conduct	Contractor to monitor performance of construction workers, ensure points relayed during their induction have been properly understood and are being followed. If necessary, the DSC Environment Specialist and/or a translator shall be called to the site to further explain aspects of environmental or social behavior that are unclear.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to ensure rules that are explained in the worker conduct section, must be followed at all times. <sup>a</sup>	DSC Environment Specialist	Ongoing monitoring.
4.	Dust and Air Pollution <sup>b</sup>	Contractor to ensure vehicles travelling to and from the construction site adhere to speed limits so as to avoid producing excessive dust.	DSC Environment Specialist	Ongoing monitoring.
		A speed limit of 30km/h must be adhered to on all dirt roads.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to dampen access and other cleared surfaces whenever possible and especially in dry and windy conditions to avoid excessive dust.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to utilize screening using wooden supports and shade cloth where dust is unavoidable in residential/commercial/sensitive receptors areas	DSC Environment Specialist	As directed by the DSC Environment Specialist.
		Contractor to keep vehicles and machinery in good working order and meet manufacturers specifications for safety, fuel consumption etc.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to check and repair equipment as soon as possible if excessive emissions are observed.	DSC Environment Specialist	As directed by the DSC Environment Specialist.
		No fires are allowed on site except for the burning of firebreaks.	DSC Environment Specialist	Ongoing monitoring.
5.	Soil Erosion	Once an area has been cleared of vegetation, the top layer (nominally 150mm) of soil shall be removed and contractor to stockpile in the designated area.	DSC Environment Specialist	Ongoing monitoring.

No.	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
		Contractor to commence top soiling and re-vegetation immediately after completion of an activity and at an agreed distance behind any particular work front.	DSC Environment Specialist	As each activity is completed.
		Contractor to ensure storm water control and wind screening to prevent soil loss from the site.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to dispose unusable soils and spoils to pre-approved disposal sites. <sup>c</sup>	DSC Environment Specialist	Ongoing monitoring.
		Contractor to protect all embankments, unless otherwise directed by the DSC Environment Specialist, by a cut off drain to prevent water from cascading down the face of the embankment and causing erosion.	DSC Environment Specialist	Immediately after the creation of the embankment/ stripping of vegetation.
6.	Storm water	Contractor shall not in any way modify nor damage the banks or bed of streams, wetlands, other open water bodies and drainage lines adjacent to or within the designated area, unless required as part of the construction project specification. Where such disturbance is unavoidable, modification of water bodies shall be kept to a minimum in terms of: (i) removal of riparian vegetation; and (ii) opening up of the stream channel	PMU Environment Specialist and DSC Environment Specialist	Ongoing monitoring.
		Contractor to dispose earth, stones, and rubbles and prevent obstruction of natural water pathway, i.e.: these materials must not be placed in storm water channels, drainage lines.	DSC Environment Specialist	Monitoring throughout the duration of the subproject.
		Contractor to check periodically sites' drainage system to ensure that the water flow is unobstructed.	DSC Environment Specialist	Monthly inspection.
		Contractor to control un-channeled flows. Where large areas of soil are left exposed, rows of straw/ hay or bundles of cut vegetation shall be dug into the soil in contours to slow surface wash and capture eroded soil.	DSC Environment Specialist	As surfaces become exposed.
		Contractor to slow down flows where surface run-off is concentrated (e.g. along exposed roadways/tracks) by contouring with hay bales or bundled vegetation generated during site clearance operation. If the area must be used for construction vehicles, berms may be used instead. The berms must be at least 30 cm high and well compacted. The berms shall channel concentrated flow into detention ponds or areas protected with hay bales for flow reduction and sediment capture	DSC Environment Specialist	Ongoing monitoring.
7.	Water Quality <sup>d</sup>	Contractor to ensure mixing/decanting of all chemicals and hazardous substances take place either on a tray or on an impermeable surface and dispose waste from these to pre-approved disposal sites.	DSC Environment Specialist	Regular monitoring (refer to the environmental monitoring program)
		Contractor to ensure every effort is made that any chemicals or hazardous substances do not contaminate the soil, Channel, Canal or groundwater on site.	DSC Environment Specialist	Regular monitoring (refer to the environmental monitoring program)

No.	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
		Contractor to ensure run-off from vehicle or plant washing does not enter surface water body or the groundwater and ensure wash water passes through an oil-grease trap prior to discharge.	DSC Environment Specialist	Regular monitoring (refer to the environmental monitoring program)
		Contractor to prohibit site staff in using any open water body or natural water source adjacent to or within the designated site for the purposes of bathing, washing of clothing or for any construction or related activities. Municipal water (or another source approved by the DSC Environment Specialist) shall instead be used for all activities such as washing of equipment or disposal of any type of waste, dust suppression, concrete mixing, compacting etc.	DSC Environment Specialist	Regular monitoring (refer to the environmental monitoring program)
		Contractor shall refer to emergency contact numbers of WBPCB in order to deal with spillages and contamination of aquatic environments.	PMU Environment Specialist and DSC Environment Specialist	As necessary
8.	Conservation of Natural Environment	Contractor is to check vegetation clearing and tree-felling have prior permission as the work front progresses.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to ensure only trees that have been marked beforehand are to be removed.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to prohibit site staff from gathering firewood, fruits, plants, crops or any other natural material on-site or in areas adjacent to the sites.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to prohibit site staff from hunting of birds and animals on-site or in areas adjacent to the sites.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to immediately re-vegetate stripped areas and remove aliens species by weeding. This significantly reduces the amount of time and money that must be spent on alien plant management during rehabilitation.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to ensure, where possible, cleared indigenous vegetation is kept in a nursery for use at a later stage (such as site rehabilitation process).	DSC Environment Specialist	As the work front progresses.
9.	Materials Management	Contractor to ensure stockpiles do not obstruct natural water pathways.	DSC Environment Specialist.	As necessary.
		Contractor to ensure stockpiles do not exceed 2m in height unless otherwise permitted by the DSC Environment Specialist.	DSC Environment Specialist	As necessary.
		Contractor to cover stockpiles exposed to windy conditions or heavy rain with vegetation, cloth, or tarps.	DSC Environment Specialist	As necessary.
		Contractor to ensure stockpiles are kept clear of weeds and alien vegetation growth by regular weeding	DSC Environment Specialist	Monthly monitoring
		Contractor to ensure all concrete mixing take places on a designated, impermeable surface.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to ensure vehicles transporting concrete to the site are not washed on-site.	Contractor	Ongoing monitoring.
		Contractor to prohibit mixing of lime and other powders during excessively windy conditions.	DSC Environment Specialist	As necessary
		Contractor to store all substances required for vehicle maintenance and repair in sealed	DSC Environment Specialist	Ongoing monitoring.

No.	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
		containers until they can be disposed of/removed from the sites.		
		Contractor to ensure hazardous substances/materials are transported in sealed containers or bags	DSC Environment Specialist	Ongoing monitoring
		Contractor to prohibit spraying of herbicides/pesticides during windy condition	DSC Environment Specialist	As necessary.
10.	Waste Management	Contractor to place refuse in designated skips/bins, rubbles in demarcated areas, remove from the site, and transport to the pre-approved disposal sites. Waybills proving disposal at each site shall be provided for the DSC Environment Specialist's inspection.	DSC Environment Specialist	Checked at each site meeting.
		Contractor to prohibit littering on-site and clear the site of litter at the end of each working day.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to encourage recycling by providing separate receptacles for different types of waste and make sure that staffs are aware of their uses.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to clean toilets regularly; and avoid contamination of soils, water, pollution and nuisance to adjoining areas.	DSC Environment Specialist	Weekly monitoring.
11.	Social Impacts <sup>e</sup>	Contractor to restrict activities and movement of staff to designated construction areas.	DSC Environment Specialist	Ongoing.
		Contractor to assist in locating DSC Environment Specialist and/or PMU Environment Specialist in the event a construction staff is approached by members of the public or other stakeholders.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to ensure conduct of construction staff, when dealing with the public or other stakeholders, shall be in a manner that is polite and courteous at all times. Failure to adhere to this requirement may result in the removal of staff from the site.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to ensure disruption of access for local residents is minimized and approved by the DSC Environment Specialist.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to provide walkways and metal sheets where required to maintain access across for people and vehicles.	DSC Environment Specialist	Ongoing monitoring
		Contractor to increase workforce in front of critical areas (if any along pipe line) such as institutions, place of worship, business establishment, hospitals, and schools.	DSC Environment Specialist	Ongoing monitoring
		Contractor to consult businesses and institutions regarding operating hours and factoring this in work schedules.	DSC Environment Specialist	At least 1 week prior to the activity taking place.
		Contractor to inform affected persons around pipe laying area in writing of disruptive activities at least 24 hours beforehand. This can take place by way of leaflets giving DSC Environment Specialist and Contractor's details or other method approved by the DSC Environment Specialist.	DSC Environment Specialist	At least 24 hrs prior to the activity taking place.
		Contractor to provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.	DSC Environment Specialist	At least 1 week prior to the activity taking place.

No.	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
		Contractor to ensure lighting at the construction site is to be pointed downwards and away from oncoming traffic and nearby houses.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to ensure machinery and vehicles are in good working order to minimize noise nuisance.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to restrict noisy activities to the daytime.	DSC Environment Specialist	Ongoing monitoring.
		A complaints register (refer to the Grievance Redress Mechanism) shall be housed at the site office. This shall be in carbon copy format, with numbered pages. Any missing pages must be accounted for by the Contractor. This register is to be tabled during monthly site meetings.	DSC Environment Specialist	Monthly monitoring.
		Interested and affected people' need to be made aware of the existence of the complaints book and the methods of communication available to them.	PMU Environment Coordinator and DSC Environment Specialist	Ongoing monitoring.
		Contractor to initially handle and document queries and complaints; submit these for inclusion in complaints register; bring issues to DSC Environment Specialist's attention immediately; and take remedial action as per DSC Environment Specialist's instruction	PMU Environment Coordinator and DSC Environment Specialist	As necessary.
		Contractor to assign staff for formal consultation with the interested and affected people in order to explain and answer questions on the construction process.	DSC Environment Specialist	Ongoing monitoring.
12.	Cultural Environment	Contractor to note possible items of historical or archaeological value include old stone foundations, tools, clayware, jewellery, remains, fossils etc. If something of this nature be uncovered, contractor to stop work immediately and notify the DSC Environment Specialist which in turn inform the PMU and coordinate with ASI or State Department of Archaeology.	DSC Environment Specialist	As required.

<sup>a</sup> (i) no alcohol / drugs to be present on site; (ii) prevent excessive noise; (iii) construction staff are to make use of the facilities provided for them, as opposed to ad-hoc alternatives (e.g. fires for cooking, the use of surrounding bus as a toilet facility are forbidden); (iv) no fires to be permitted on site; (v) trespassing on private / commercial properties adjoining the site is forbidden; (vi) other than pre-approved security staff, no workers shall be permitted to live on the construction site; (vii) no worker may be forced to do work that is potentially dangerous or for what he / she is not trained to do.

<sup>b</sup> Main causes of air pollution during construction are dust from vehicle movements and stockpiles, vehicle emissions and fires.

<sup>c</sup> Estimated total volume of unused excavated earth material to be disposed is approx. 3575 cubic meters and road crust of approx. 140 cubic metres.

<sup>d</sup> Water quality is affected by the incorrect handling of substances and materials. Soil erosion and sediment is also detrimental to water quality. Mismanagement of polluted run-off from vehicle and plant washing and wind dispersal of dry materials into rivers and watercourses are detrimental to water quality.

<sup>e</sup> Regular communication between the Contractor and the interested and affected parties is important for the duration of the contract.

**Table 35: Site Specific Environmental Management Plan for the Sewerage and Drainage Subproject**

Work Component	Subproject Areas	Environment Management Measures
<b>Package- Tr-3/SD 29 - Construction of Sewage Treatment Plant, pumping mains, effluent discharge pipe lines and allied works at Bank Plot land</b>	Bank Plot sewage treatment plant Laying of pumping main pipe line Laying of treated effluent discharge pipe line	<ol style="list-style-type: none"> <li>1. Excess earth is to be utilized in filling up of low lying areas promoting sound solid waste management practices. Ponds if present at or near site should not be filled up with construction solid waste</li> <li>2. Local terrestrial ecology is to be preserved by not clear felling of trees if present. Scrubs are to be removed wherever absolutely required</li> <li>3. Local water environment should not be degraded by discharging waste water indiscriminately. Nearby canals and drains meant for carrying storm water will be used for discharge of waste water. No waste water should be discharged in ponds.</li> <li>4. Extant ambient noise level is to be maintained at the current level by regulating noise generation from construction activity with activity planned during day time only</li> <li>5. Pre-construction stage ambient air quality (especially dust concentration) is to be maintained at the current level by suitable dust control measures like periodic spraying of water at the dust generating sources.</li> <li>6. Toilets of work camp sites should have adequate sanitary provisions so as not to pollute land and/or water environment</li> <li>7. Maintaining all occupational and personnel safety requirement during construction and operation</li> </ol>

200. Table 36 outlines the EMP for post-construction activities.

**Table 36: Environmental Management Plan Post-Construction Activities (Defects Liability Period)**

(to be revised by contractors for package-specific Site Environmental Plan)

No.	Activities	Management/Mitigation	Responsible for Monitoring	Frequency
1.	Construction Camp	All structures comprising the construction camp are to be removed from site	DSC Environment Specialist	Subproject completion
		The area that previously housed the construction camp is to be checked for spills of substances such as oil, paint etc. and these shall be cleaned up.	DSC Environment Specialist	Subproject completion
		All hardened surfaces within the construction camp area shall be ripped, all imported materials removed, and the area shall be top-soiled and re-grassed using the guidelines set out in the re-vegetation specification that forms part of this document.	DSC Environment Specialist	Subproject completion
		The Contractor must arrange the cancellation of all temporary services.	DSC Environment Specialist	Subproject completion
2.	Vegetation	All areas that have been disturbed by construction activities (including the construction camp area) must be cleared of alien vegetation.	DSC Environment Specialist	Subproject completion
		Open areas (particularly buffer zone of STP) are to be re-planted as per the re-vegetation specification.	DSC Environment Specialist	Subproject completion
		All vegetation that has been cleared during construction is to be removed from site or used as much as per the re-	DSC Environment Specialist	Subproject completion

No.	Activities	Management/Mitigation	Responsible for Monitoring	Frequency
		vegetation specification, (except for seeding alien vegetation).		
		The Contractor is to water and maintain all planted vegetation until the end of the defects liability and operation contract period and is to submit a method statement regarding this to the DSC Environment Specialist.	DSC Environment Specialist	Subproject completion
3.	Land Rehabilitation	All surfaces hardened due to construction activities are to be ripped and imported materials thereon removed.	Contractor	Subproject completion
		All rubble is to be removed from the site to an approved disposal site. Burying of rubble on site is prohibited.	Contractor	Subproject completion
		The site is to be cleared of all litter.	Contractor	Subproject completion
		Surfaces are to be checked for waste products from activities such as concreting or asphaltting and cleared in a manner approved by the DSC Environment Specialist.	Contractor	Subproject completion
		All embankments are to be trimmed, shaped and replanted to the satisfaction of the DSC Environment Specialist.	DSC Environment Specialist and Contractor	Subproject completion
		Borrow pits are to be closed and rehabilitated in accordance with the pre-approved management plan for each borrow pit. The Contractor shall liaise with the DSC Environment Specialist regarding these requirements.	DSC Environment Specialist	Subproject completion
		The Contractor is to check that all watercourses are free from building rubble, spoil materials and waste materials.	Contractor	Subproject completion
4.	Materials and Infrastructure	Fences, barriers and demarcations associated with the construction phase are to be removed from the site unless stipulated otherwise by the DSC Environment Specialist.	DSC Environment Specialist	Subproject completion
		All residual stockpiles must be removed to spoil or spread on site as directed by the DSC Environment Specialist.	DSC Environment Specialist	Subproject completion
		All leftover building materials must be returned to the depot or removed from the site.	Contractor	Subproject completion
		The Contractor must repair any damage that the construction works has caused to neighboring properties.	Contractors	As directed by the DSC Environment Specialist.
5	General	A meeting is to be held on site between the DSC Environment Specialist, PMU Environment Specialist and the Contractor to approve all remediation activities and to ensure that the site has been restored to a condition approved by the DSC Environment Specialist.	DSC Environment Specialist and PMU Environment Specialist	On completion of the construction and maintenance phases
		Temporary roads must be closed and access across these blocked.	DSC Environment Specialist and PMU	On completion of construction

No.	Activities	Management/Mitigation	Responsible for Monitoring	Frequency
			Environment Specialist	
		Access or haulage roads that were built must be rehabilitated by removing temporary bridges and any other materials placed in/or near to watercourses. Re-vegetation of banks or streambeds must be as necessary to stabilize these and must be approved by the DSC Environment Specialist.	DSC Environment Specialist and Contractor	On completion of construction
		All areas where temporary services were installed are to be rehabilitated to the satisfaction of the DSC Environment Specialist	DSC Environment Specialist and Contractor	On completion of construction

DSC = design and supervision consultant, PMU = program management unit, STP = sewage treatment plant.

201. Table 37 outlines EMP for Operation and Maintenance activities.

**Table 37: Environmental Management Plan Operation and Maintenance Activities**  
(covering defect liability period and operation phase)

No.	Activities	Management/Mitigation	Responsible for Monitoring	Frequency
1.	Pollution monitoring	Monitor the environmental quality in terms of STP treated effluent discharge, sludge and ambient air quality and noise levels.	O&M contractor in association with Environmental Monitoring Laboratory approved by DSC	As necessary on regular basis
2.	Leaks detection and repairs	Conduct pipe repairs the soonest time possible to avoid disruption of service and disturbance to users/sensitive receptors.	O&M contractor in association with DSC and KMC	As necessary.
3	Sewerage	<ul style="list-style-type: none"> <li>• Follow standard procedures as prescribed by O&amp;M Manual for STP, which to be developed by BOOT contractor</li> <li>• Ensure that all necessary equipment and tools are available for regular maintenance, especially for sewer network</li> <li>• Ensure there is no overflow of sewers due to blockages or leaks; in case of occurrence, attend to these at the earliest</li> <li>• Implement all necessary mitigation measures suggested during construction (to avoid disturbance and inconvenience to people, business and traffic)</li> <li>• Ensure operation and maintenance of influent and treated effluent pipeline as per the standard operating procedures to avoid, over flows, blockages, etc. and immediately conducting the maintenance work in case of such occurrences</li> <li>• Implement Emergency Response System which to be developed by</li> </ul>	O&M contractor in association with DSC and KMC	As necessary on regular basis

No.	Activities	Management/Mitigation	Responsible for Monitoring	Frequency
		BOOT contractor		
4.	Sludge disposal from sewage treatment plant	<p>Analyze for hazardous elements and accomplish safe disposal at pre-approved sites (preferably utilization after drying of sludge)</p> <p>As per the recommendations of CPHEEO Manual, November 2013 (Central Public Health and Environmental Engineering Organisation), section 5, page 81, the sludge from the treatment plant can be used as good agriculture soil filler.</p> <p>Excess may be disposed at Dhapa dumping ground after permission from WBPCB</p>	O&M contractor in association DSC and KMC	As necessary
5	Discharge of Hazardous Chemicals into Sewer lines	<p>Damage to sewer and health risk to sewer cleaning and STP workers, negative impact on performance of STP and pollution in water bodies receiving treated effluent</p>	O&M contractor in association DSC and KMC	As necessary
6	Handling of hazardous chemicals like chlorine	<p>Handling Chlorine gas cylinders during O&amp;M period:</p> <p>Technical precautions:</p> <ul style="list-style-type: none"> <li>- Ventilate chlorine rooms adequately.</li> <li>- Use only suitable and tested chlorine gas equipment.</li> <li>- Use only approved gas warning equipment and water spraying equipment (external operation).</li> <li>- Ensure that there are short escape routes into the open. (Escape doors must open outwards.)</li> <li>- Renew the connection seal every time the chlorine cylinders are exchanged.</li> </ul> <p>Handling Chlorine cylinders:</p> <ul style="list-style-type: none"> <li>- Proper training shall be given to the staff handling Chlorine gas cylinders and be repeated at least once a year. Only trained and designated staff shall handle gas cylinders containing chlorine.</li> <li>- Chlorine cylinders shall be stored with the valve cap attached securely together, with a suitable seal and the protecting cap on. Filled and empty gas cylinders should be stored separately.</li> <li>- To prevent heating of the chlorine cylinders, they should be kept out of direct sunlight.</li> <li>- Valves on chlorine gas cylinders should be operated by hand without use of force. Valves of filled or empty chlorine cylinders should always be closed securely with the correct cap.</li> <li>- It is advised to store chlorine gas cylinders in an adequately</li> </ul>	O&M contractor in association DSC and KMC	As necessary

No.	Activities	Management/Mitigation	Responsible for Monitoring	Frequency
		<p>ventilated room and ensure short escape routes into the open air.</p> <ul style="list-style-type: none"> <li>- Operating instructions Material safety Data Sheet (MSDS) shall be displayed in accordance with the regulations on hazardous substances.</li> <li>- When exchanging chlorine cylinders and performing vacuum and pressure tests, suitable breathing mask with filter like full face mask shall be used along with suitable protective gloves and shoes.</li> </ul> <p>Procedure in the case of Emergency:</p> <ul style="list-style-type: none"> <li>- Proceed according to Emergency plan and inform the concerned authority immediately.</li> <li>- If leakage of chlorine gas cannot be controlled using the water spray equipment, call the fire brigade immediately to attend.</li> <li>- If the chlorine concentration is above the maximum workplace concentration level (0.5 ppm), use suitable compressed air breathing apparatus and a protective chemical suit.</li> </ul> <p>First Aid:</p> <ul style="list-style-type: none"> <li>• Persons who have inhaled chlorine gas shall be moved to a site with fresh air and they require immediate medical attention.</li> <li>• If the injured persons are breathless, artificial respiration is necessary. Otherwise, they should be made to inhale nebulized dexamethasone.</li> <li>• If chlorine comes into contact with eyes or skin, it should be rinsed off immediately with plenty of water and consult doctor.</li> <li>• Contaminated clothing should be removed immediately</li> </ul>		
7	Trees and landscaping maintenance	<p>Young trees require sufficient water until their roots are able to tap available groundwater.</p> <p>Make every effort to water existing trees during periods of drought.</p> <p>When pruning cut as close as possible to the branch collar. Do not injure or remove the collar.</p>	O&M contractor in association DSC and KMC	As necessary.

### C. Environmental Monitoring Program

202. Table 38 outlines the environmental monitoring program to ensure implementation of the management and mitigation measures specified in the EMP. The table shall be read within the context of the body of the entire EMP.

**Table 38: Environmental Monitoring Program**  
(to be revised by contractors for package-specific Site Environmental Plan)

Aspect	Parameter	Standards	Location	Duration / Frequency	Implementation	Supervision
<b>1. Site establishment and preliminary activities</b>						
Legislation, Permits and Agreements	CTE and CTO for the STP, hot mix, stone crushers, and diesel generators)	Air (Prevention and Control of Pollution) Act of 1981, Rules of 1982 and amendments Water (Prevention and Control of Pollution) Act of 1974, Rules of 1975, and amendments	-	CTE prior to moving onto site and during construction and CTO before operation	Contractor	PMU / DSC
	Cutting Permit for Scheduled Trees if required	West Bengal Trees (Protection and Conservation in Non-Forest Areas) Act, 2006	-	Prior to moving onto site	DSC	PMU
	Copy of final approved EMP	ADB SPS	Subproject site, offices, website, library, etc.	At all times	Contractor	PMU/DSC
Access to site	Existing conditions	EMP	All access and haul roads	Prior to moving onto site	DSC Environment Specialist	PMU
	Road closures and traffic rerouting	Traffic Management Plan and EMP	All affected roads	One week in advance of the activity	DSC Environment Specialist Contractor	PMU
	Notifications and road signages	Traffic Management Plan and EMP	All affected roads	One week in advance of the activity	DSC Environment Specialist Contractor	PMU
Construction camp	Approval of location and facilities	EMP	As identified	Prior to moving onto site	Contractor with the DSC Environment Specialist and PMU Environment Specialist	PMU/DSC
Equipment Lay-down and Storage Area	Approval of location and facilities	EMP	As identified	Prior to moving onto site and during site set-up	Contractor with the DSC Environment Specialist and PMU Environment Specialist	PMU/DSC

Aspect	Parameter	Standards	Location	Duration / Frequency	Implementation	Supervision
Materials management – sourcing	Approval of sources and suppliers	EMP	as identified	Prior to procurement of materials	Contractor with the DSC Environment Specialist and PMU Environment Specialist	PMU/DSC
Education of site staff	Awareness Level Training - Environment - Health and Safety	EMP and records	-	During staff induction, followed by scheduled as determined	Contractor with the DSC Environment Specialist and PMU Environment Specialist	PMU/DSC
Social impacts	Public Consultations, Information Disclosure, Communication Strategy	EARF, ADB SPS and EMP	Subproject site	Prior to moving onto site and ongoing	Contractor with the DSC Environment Specialist, PMU Environment Specialist	Implementing Agency (KMC)
	GRM Register	EMP	Subproject site	Prior to moving onto site and ongoing	Contractor with the DSC Environment Specialist, PMU Environment Specialist	Implementing Agency (KMC)
Noise	Baseline Data for noise level in dB(A) $L_{eq}$	National Noise Standards	Four locations near construction sites as specified by the engineer	Prior to site set-up	Contractor with the DSC Environment Specialist and PMU Environment Specialist	PMU/DSC
Air quality	Baseline ambient data for particulate matters 10 and 2.5 (PM <sub>10</sub> , PM <sub>2.5</sub> ), sulfur dioxides (SO <sub>2</sub> ) and nitrogen dioxide (NO <sub>2</sub> )	National Ambient Air Quality Standards	Four locations near construction sites as specified by the engineer	Prior to site set-up	Contractor with the DSC Environment Specialist and PMU Environment Specialist	PMU/DSC
Soil erosion	Soil erosion management measures	EMP	As identified by the engineer	During site set-up and throughout the duration of the subproject	Contractor with the DSC Environment Specialist and PMU Environment Specialist	PMU/DSC
Storm water	Storm water management measures	EMP	As identified by the engineer	During site set-up and throughout the duration of the subproject	Contractor with the DSC Environment Specialist and PMU Environment Specialist	PMU/DSC

Aspect	Parameter	Standards	Location	Duration / Frequency	Implementation	Supervision
Water quality	Baseline qualitative characteristics	EMP	Subproject sites <sup>a</sup>	Prior to site set-up	Contractor with DSC Environment Specialist and PMU Environment Specialist	PMU/DSC
Conservation of Natural Environment	Existing conditions	EMP	Subproject sites	Prior to site set-up	Contractor with DSC Environment Specialist and PMU Environment Coordinator	PMU/DSC
Waste management procedure	Disposal sites	EMP	As determined	Prior to site set-up and ongoing throughout the subproject	Contractor with DSC Environment Specialist and PMU Environment Coordinator	PMU/DSC
Cultural environment	Chance finds	ASI Act and EMP	As determined	Prior to site set-up and ongoing throughout the subproject	Contractor with DSC Environment Specialist and PMU Environment Coordinator	PMU/DSC
<b>2. Construction phase</b>						
Access to Site	Qualitative characteristics	Pre-subproject condition and EMP	All access and haul roads	Referred to EMP table on management of construction and workforce activities	Contractor	DSC Environment Specialist
Construction camp	Qualitative characteristics	Pre-subproject condition and EMP	Specific sub project site	Referred to EMP table on management of construction and workforce activities	Contractor	DSC Environment Specialist
Staff conduct	Site Records (Accidents, Complaints)	EMP	Subproject sites	Ongoing	Contractor	DSC Environment Specialist
Air quality	PM <sub>10</sub> , PM <sub>2.5</sub> , SO <sub>2</sub> , NO <sub>2</sub>	National Ambient Air Quality Standards	Four locations near construction sites as specified by the engineer (DSC).	Once in four months (three times in an year except monsoon)	Contractor with close coordination with the DSC Environment Specialist	PMU/DSC

Aspect	Parameter	Standards	Location	Duration / Frequency	Implementation	Supervision
Soil erosion	Soil erosion management measures	EMP	Subproject sites	Ongoing	Contractor	DSC Environment Specialist
Storm water	Soil erosion management measures	EMP	Subproject sites	Ongoing	Contractor	DSC Environment Specialist
Water quality	Qualitative characteristics	EMP and pre-existing conditions	Subproject sites	Ongoing	Contractor	DSC Environment Specialist
Conservation of Natural Resources	Number of scheduled trees	Tree-cutting permit and EMP	Subproject sites	Ongoing	Contractor	DSC Environment Specialist
	Vegetation conditions	EMP	Subproject sites	Ongoing	Contractor	DSC Environment Specialist
Materials management	Qualitative characteristics	EMP	Subproject sites	Ongoing	Contractor	DSC Environment Specialist
Waste management	Qualitative characteristics	EMP	Subproject sites	Ongoing	Contractor	DSC Environment Specialist
	Disposal manifests	EMP	Subproject sites	Ongoing	Contractor	DSC Environment Specialist
Social impacts	Public Consultations, Information Disclosure, Communication Strategy	EARF, ADB SPS and EMP	Subproject sites	Ongoing	Contractor with the DSC Environment Specialist, PMU Environment Specialist	Implementing Agency (KMC)
	GRM Register	EMP	Subproject sites	Ongoing	Contractor with the DSC Environment Specialist, PMU Environment Specialist	Implementing Agency (KMC)
Cultural environment	Chance finds	ASI Act and EMP	Subproject sites	Ongoing	Contractor	DSC Environment Specialist
Noise quality	Noise Level in dB(A) $L_{eq}$	National Noise standards	Four locations near construction sites as specified by the engineer (DSC).	Once in three months (four times in a year)	Contractor with close coordination with the DSC Environment Specialist	PMU/DSC
<b>3. Post-construction activities</b>						
Construction camp	Pre-existing conditions	EMP	Construction camp	Subproject completion	Contractor	DSC Environment Specialist
Vegetation	Pre-existing conditions	Tree-cutting Permit and EMP	Subproject sites	Subproject completion	Contractor	DSC Environment Specialist

Aspect	Parameter	Standards	Location	Duration / Frequency	Implementation	Supervision
Land rehabilitation	Pre-existing conditions	EMP	Subproject sites	Subproject completion	Contractor	DSC Environment Specialist
Materials and infrastructure	Pre-existing conditions	EMP	Subproject sites	Subproject completion	Contractor	DSC Environment Specialist
General	Records	EMP	Subproject sites	Subproject completion	Contractor with DSC Environment Specialist and PMU Environment Specialist	PMU/DSC
<b>4. Operation and maintenance (defect liability period and as per BOOT contract agreement)</b>						
Sewage discharge	Quality of tested effluent	CPHEEO Manual and discharge standard	STP site	At least once in a day	O&M contractor in association with Environmental Monitoring Laboratory approved by DSC/ KMC	PMU/DSC
Testing of sludge	Hazardous chemical parameters	Hazardous chemical management rule	From STP	Once in 6 months (defect liability period and operation period)	O&M contractor in association with Environmental Monitoring Laboratory approved by DSC/KMC	PMU/DSC
Air quality	PM <sub>10</sub> , PM <sub>2.5</sub> , SO <sub>2</sub> , NO <sub>2</sub>	National Ambient Air Quality Standards	Two locations as specified by IA	Once in 6 months (defect liability period and operation period)	O&M contractor in association with Environmental Monitoring Laboratory approved by DSC/KMC	PMU/DSC
Noise quality	Noise Level in dB(A) L <sub>eq</sub>	As per National Noise standards	Two locations as specified by the IA	Once in 6 months (defect liability period and operation period)	O&M contractor in association with Environmental Monitoring Laboratory approved by DSC/KMC	PMU/DSC

203. A training program has been developed to build the capability of KMC and PMU in implementing the EMP. The suggested outline of the training program is presented in Table 39.

**Table 39: Training Program on Environmental Safeguards and its Implementation**

<b>Module</b>	<b>Frequency of sessions</b>	<b>Target participants</b>	<b>Conducting agency</b>
Environmental Safeguards Requirements comprising (i) ADB's Safeguards Policy Statement of 2009, (ii) environmental documentation requirements and (iii) Environmental requirements of India particularly those applicable to KEIP subprojects, international obligations (common for all subprojects)	Once in Pre-construction stage	Senior Construction Supervisors of DSC, Safety Officers of Contractors, KEIP Senior Engineers	DSC and PMU with assistance from INRM, ADB, New Delhi and WBPCB
IEE and EMP of S & D subproject covering STP works	Once during Pre-construction stage	Safety officers of Contractors and Construction supervisors of DSC	DSC and PMU
Workshop on implementation of EMP of S & D subproject covering STP works of KEIP: lessons learnt and way forward	Once during Construction stage	Senior Construction Supervisors of DSC, PMC Engineers, Safety Officers of Contractors, KEIP Senior Engineers	DSC with assistance from PMU

#### **D. Environmental Management and Monitoring Cost**

204. The Contractor's cost for site establishment, preliminary, construction, and defect liability activities will be incorporated into the contractual agreements, which will be binding on him for implementation. The air quality, surface water quality, and noise level monitoring of construction and defect liability phases will be conducted by the contractor.

205. The operation phase mitigation measures are again of good operating practices, which will be the responsibility of implementing agency (KMC). The air quality and noise level monitoring during the operation and maintenance phase will be organized by the operating offices of KMC as part of their routine office expenses.

206. The activities identified in environmental monitoring program mainly includes site inspections and informal discussions with workers and local people and this will be the responsibility of PMU and DSC, costs of which are part of project management. Tables 42 and 43 summarizes the indicative cost to implement the EMP during pre-construction & construction phase and operation phase respectively. The contractor for each package will provide detailed costs as part of package-wise SEPs.

**Table 40: Indicative Costs for Environmental Monitoring Program Implementation- Preconstruction and Construction Phase**

Item	Parameters	Project Phase	Sampling Station	Duration and Frequency	Quantity	Unit cost (₹)	Total cost (₹)	Source of funds
<b>1. Survey and monitoring</b>							<b>4,00,000</b>	Survey and Investigation /Contingency
Ambient air	PM <sub>10</sub> , PM <sub>2.5</sub> , SO <sub>2</sub> , NO <sub>2</sub> and CO	Pre-construction & Construction	1. Bank Plot STP 2 stations near pipe laying areas	<b>Pre-construction</b> – One time at 2 locations of STP Two location at pipe laying - one time <b>Construction phase-</b> Thrice in a year at 2 locations of STP for 24 months Two locations at pipe laying–thrice in a year for 12 months	4 nos.  2x6= 12 nos.  2x3= 6 nos.  <b>Total 22 nos.</b>	12,000	2,64,000	Contractor budget
Noise	Leq in dBA	Pre-construction & Construction	1. Bank Plot 2 stations near pipe laying areas	<b>Pre-construction</b> – One time at 2 locations of STP Two locations at pipe laying - one time <b>Construction phase-</b> Four time in a year at 2 locations of STP for 24 months Two locations at pipe laying– one location thrice in a year for 12 months	4 nos.  2x8=16 nos.  2x4=8 nos.  <b>Total 28 nos.</b>	2000	56,000	Contractor budget
Ground water/Surface	As per Drinking water standard	Construction	As per requirement-Bank plot STP	Once in a quarter for 8 quarters in a year for 2 years	8nos.	10,000	80,000	Contractor budget
<b>2. Capacity building/ Training/</b>							<b>100,000</b>	Survey and Investigation /Contingency

Item	Parameters	Project Phase	Sampling Station	Duration and Frequency	Quantity	Unit cost (₹)	Total cost (₹)	Source of funds
workshop expenses								
3. Environmental Permits if any							50,000	Government Counterpart funds
4. Plantation in and around STP							-	Considered under Engineering project cost
<b>Total (INR)</b>							<b>550,000</b>	
<b>Total (US\$)</b>							<b>(approx.)</b>	
<b>Note/s: INR 65 = US\$ 1</b>							<b>8,461</b>	

**Table 41: Indicative Costs for Environmental Monitoring Program Implementation- Operation phase**

Item	Parameters	Project Phase	Sampling Station	Duration and Frequency	Quantity	Unit cost (₹)	Total cost (₹)	Source of funds
Ambient air	PM <sub>10</sub> , PM <sub>2.5</sub> , SO <sub>2</sub> , NO <sub>2</sub> and CO	Operation	Bank Plot STP	<b>Operation phase-</b> Once in 6 months at 2 locations- for 5 years	20 nos.	12,000	2,40,000	Contractor budget
Noise level	Leq in dBA	Operation	Bank Plot STP	<b>Operation phase-</b> Once in 6 months at 2 locations- for 5 years	20 nos.	2000	40,000	Contractor budget
Sludge Testing	Parameters for hazardous materials	Operation	Bank Plot STP	<b>Operation phase-</b> Once in 6 months at 2 locations- for 5 years	20 nos.	15,000	3,00,000	Contractor budget
Sewage effluent raw and treated	Standard parameters as per manual	Operation of STP	Bank Plot STP	Throughout the operation period on regular basis	Approx. 1500 nos.	5,000.	75,00,000	Contractor budget
<b>Total (₹)</b>							<b>80,80,000</b>	
<b>Total (\$)</b>							<b>(approx)</b>	
<b>Note/s: ₹65 = \$1</b>							<b>124,308</b>	

## **E. Monitoring and Reporting**

207. Prior to commencement of any civil work, the contractor will submit a compliance report to DSC ensuring that all identified pre-construction environmental impact mitigation measures as detailed in the EMP will be undertaken. DSC will review the report and thereafter PMU will allow commencement of civil works.

208. DSC will organize an induction course for the training of contractors preparing them on:

- (i) EMP/approved SEP implementation including environmental monitoring requirements related to identified mitigation measures; and
- (ii) taking immediate actions to remedy unexpected adverse impacts or ineffective mitigation measures found during the course of implementation.

209. During the construction phase, results from internal monitoring by the contractor will be reflected in their weekly EMP/approved SEP implementation reports to the DSC Construction Supervisors. These weekly report will be retained in DSC office for reference.

210. Monthly reports will also be prepared by Contractors summarizing compliance with monitoring requirements, details on any noncompliance, remedial actions taken and additional environmental mitigation measures if necessary and will be duly authorized by the respective Construction Supervisors/ Managers. The format of the monthly environmental monitoring report is given in Appendix 14.

211. Environmental monitoring activities involving measurements will require engagement of external agencies and will be organized by the Contractors. Based on monthly reports and measurements, DSC will draft a Semi-annual Environmental Monitoring Report (SEMR). The formats of suggested SEMR along with Sample Environmental Site Inspection Report and Sample Checklist for Construction Safety are given in Appendix 15.

212. The PMU will review, approve and submit to ADB the SEMR by 1st July and 1st January each year. Once concurrence from the ADB is received the report will be uploaded in the KEIIP website.

213. Based on review of environmental monitoring results, future modifications in the EMP/approved SEP could be undertaken with the concurrence of the ADB. These will be generally undertaken, if required, upon review of the SEMR by the PMU to ADB following agreed procedures and mechanisms.

214. For Projects likely to have anticipated adverse environmental impacts during operation, monitoring may continue at the minimum on an annual basis during the operation phase. Monitoring reports will be posted in a location accessible to the public.

215. For projects likely to have significant adverse environmental impact. The KMC external auditor will document significant monitoring results, identify the necessary corrective actions, and reflect them in a corrective action plan. The KMC, in each quarter, will study the compliance with the action plan developed in the previous quarter. Compliance with loan covenants will be screened by the KMC.

216. ADB will review project performance against the KMC's commitments as agreed in the legal documents. The extent of ADB's monitoring and supervision activities will be commensurate

with the subproject's risks and impacts. Monitoring and supervising of social and environmental safeguards will be integrated into the project performance management system.

217. ADB's monitoring and supervision activities are carried out on an on-going basis until a Project Completion Report (PCR) is issued. ADB issues a PCR within 1-2 years after the project is physically completed and in operation.

## **IX. RECOMMENDATIONS AND CONCLUSION**

218. The process described in this document has assessed the environmental impacts of all elements of the specific sewerage and drainage subproject of KEIIP under Tranche 3 in the Kolkata City. Potential negative impacts were identified in relation to pre-construction, construction and operation of the improved infrastructure. No environmental impacts were identified as being due to either the subproject design or location. Mitigation measures have been developed to reduce all negative impacts to acceptable levels. These were discussed with specialists responsible for the engineering aspects, and as a result some measures have already been included in the designs for the infrastructure. This means that the number of impacts and their significance has already been reduced by amending the design.

219. The public participation processes undertaken during project design ensure stakeholders are engaged during the preparation of the IEE. The planned information disclosure measures and process for carrying out consultation with affected people will facilitate their participation during project implementation.

220. The subproject's Grievance Redress Mechanism will provide the citizens with a platform for redress of their grievances and describes the informal and formal channels, time frame and mechanisms for resolving complaints about environmental performance.

221. The EMP will guide the environmentally-sound construction of the subproject and ensure efficient lines of communication between KMC, PMU, DSC and the contractors. The EMP will (i) ensure that the activities are undertaken in a responsible non-detrimental manner; (i) provide a pro-active, feasible and practical working tool to enable the measurement and monitoring of environmental performance on site; (ii) guide and control the implementation of findings and recommendations of the environmental assessment conducted for the subproject; (iii) detail specific actions deemed necessary to assist in mitigating the environmental impact of the subproject; and (iv) ensure that safety recommendations are complied with.

222. A copy of the EMP/approved SEP will be kept on site during the construction period at all times. The EMP will be made binding on all contractors operating on the site and will be included within the Contractual Clauses. Non-compliance with, or any deviation from, the conditions set out in this document constitutes a failure in compliance.

223. The subproject is unlikely to cause significant adverse impacts because: (i) most of the individual components involve straightforward construction and operation, so impacts will be mainly localized; (ii) in most cases the predicted impacts are likely to be associated with the construction process and are produced because the process is invasive, involving excavation, obstruction at specific construction locations, and earth movements; and (iii) being located mainly in built-up areas will not cause direct impact on terrestrial biodiversity values. The potential adverse impacts that are associated with design, construction, and operation can be mitigated to standard levels without difficulty through proper engineering design and the incorporation or application of recommended mitigation measures and procedures.

224. Therefore, as per ADB SPS, the subproject is classified as environmental Category B and does not require further Environmental Impact Assessment.

## AMBIENT AIR, AIR EMISSION AND EFFLUENT STANDARDS

### A. Notification by Ministry of Environment & Forests, Government of India

#### 1. Environment (Protection) Seventh Amendment Rules, 2009

**Table A1.1. Ambient Air Quality Standards**

Pollutant	Time Weighted Average	Industrial, Residential, Rural and Other Areas	Sensitive Area (Notified by Central Govt)	Method of Measurement
Sulphur Dioxide (SO <sub>2</sub> ), µg/m <sup>3</sup>	Annual*	50	20	<ul style="list-style-type: none"> <li>• Improved West &amp; Gaeke method</li> <li>• Ultraviolet Fluorescence</li> </ul>
	24 hours**	80	80	
Nitrogen Oxide (NO <sub>2</sub> ), µg/m <sup>3</sup>	Annual*	40	30	<ul style="list-style-type: none"> <li>• Jacobs &amp; Hochheiser modified (NaOH – NaAsO<sub>2</sub>) method</li> <li>• Gas Chemiluminescence</li> </ul>
	24 hours**	80	80	
Particulate Matter (PM <sub>10</sub> ) (Size <10 µm) µg/m <sup>3</sup>	Annual*	60	60	<ul style="list-style-type: none"> <li>• Gravimetric</li> <li>• TOEM</li> <li>• Beta Attenuation</li> </ul>
	24 hours**	100	100	
Particulate Matter (PM <sub>2.5</sub> ) (Size <2.5 µm) µg/m <sup>3</sup>	Annual <sup>8</sup>	40	40	<ul style="list-style-type: none"> <li>• Gravimetric</li> <li>• TOEM</li> <li>• Beta Attenuation</li> </ul>
	24 hours**	60	60	
Ozone (O <sub>3</sub> ) µg/m <sup>3</sup>	8 hours**	100	100	<ul style="list-style-type: none"> <li>• UV photometric</li> <li>• Chemiluminescence</li> <li>• Chemical method</li> </ul>
	1 hour**	180	180	
Lead (Pb) µg/m <sup>3</sup>	Annual*	0.5	0.5	<ul style="list-style-type: none"> <li>• AAS method after sampling using EPM 2000 or equivalent filter paper</li> </ul>
	24 hours**	1.0	1.0	
Carbon Monoxide (CO), mg/m <sup>3</sup>	8 hours**	2.0	2.0	<ul style="list-style-type: none"> <li>• Non Dispersive Infrared Spectroscopy</li> </ul>
	1 hour**	4.0	4.0	
Ammonia (NH <sub>3</sub> ),	Annual*	100	100	<ul style="list-style-type: none"> <li>• Chemiluminescence</li> <li>• Indophenol blue method</li> </ul>
	24 hours**	400	400	
Benzene (C <sub>6</sub> H <sub>6</sub> ) µg/m <sup>3</sup>	Annual*	5	5	<ul style="list-style-type: none"> <li>• Gas Chromatography continuous analyzer</li> <li>• Adsorption and desorption followed by GC analysis</li> </ul>
Benzo(o)pyrene (BaP) particulate phase only ng/m <sup>3</sup>	Annual*	1	1	<ul style="list-style-type: none"> <li>• Solvent extraction followed by GC/HPLC analysis</li> </ul>
Arsenic (As), ng/m <sup>3</sup>	Annual*	6	6	<ul style="list-style-type: none"> <li>• AAS/ICP method after sampling using EPM 2000 or equivalent filter paper</li> </ul>
Nickel (Ni) ng/m <sup>3</sup>	Annual*	20	20	<ul style="list-style-type: none"> <li>• AAS/ICP method after sampling using EPM 2000 or equivalent filter paper</li> </ul>

Source: Central Pollution Control Board, New Delhi, Notification dated 18th November 2009

Notes:

\* Indicates Annual Arithmetic Mean of Minimum 104 measurement in a year measured twice a week, 24 hourly at uniform intervals.

\*\*24 hourly/8 hourly/1 hourly values should be met 98% of the time in a year. However, 2% of the time, it may exceed by not on two consecutive days.

## B. Emission standards for diesel generator sets

### 1. CPCB emission regulations, Part IV, COINDS/26/1986-87

#### Stack Height

The minimum height of stack to be provided with each generator set can be worked out using the following formula:

$$H = h + 0.2x (KVA)^{0.5}$$

Where:

H = Total height of stack in metre

h = Height of the building in metres where the generator set is installed

KVA = Total generator capacity of the set in KVA

Based on the above formula the minimum stack height to be provided with different range of generator sets may be as follows:

For Generator Sets	Total Height of stack in metre
50 KVA	Height of the building + 1.5 metre
50-100 KVA	Height of the building + 2.0 metre
100-150 KVA	Height of the building + 2.5 metre
150-200 KVA	Height of the building + 3.0 metre
200-250 KVA	Height of the building + 3.5 metre
250-300 KVA	Height of the building + 3.5 metre

Similarly for higher KVA ratings a stack height can be worked out using the above formula.

### 2. GSR 371(E) 17 May 2002, amendment to Environment (Protection) Rules 2002 and

*(The Emission Limits for new diesel engines (up to 800 KW) for Generator Sets (GENSETS) were notified by the Environment (Protection) Amendment Rules 2002 vide GSR 371(E), dated 17th May 2002 at Sl. No. 95 and as amended vide GSR 520(E), dated 1st July 2003, GSR 448 (E) dated 12th July, 2004, GSR 520(E) dated 12th August 2004 and GSR 280(E) dated 11th April, 2008 under Environment (Protection) Act, 1986)*

Para 95. Emission limits for new diesel engines (up to 800 W) for gen set application

The emission limits for new diesel engines up to 800 kw, for gen set applications shall be as follows:

Capacity of diesel engine	Date of implementation	Emission limits (g/kw-hr) for				Smoke limit (light absorption coefficient, m-1) (at full load)	Test cycle	
		NO <sub>x</sub>	HC	CO	PM		Torque %	Weighting factors
1	2	3	4	5				
		NO <sub>x</sub>	HC	CO	PM		Torque %	Weighting factors
Up to 19 KW	1.7.2005	9.2	1.3	3.5	0.3	0.7	100 75	0.05 0.25
> 19 KW up to 176 KW	1.1.2004	9.2	1.3	5.0	0.5	0.7	50	0.30
	1.7.2004	9.2	1.3	3.5	0.3	0.7	25	0.30
> 176 KW up to 800 KW	1.11.2004	9.2	1.3	3.5	0.3	0.7	10	0.10

**A. Effluent****1. Schedule VI of Environment (Protection) Rules, 1986****Table A1.2. General standards for discharge of environmental pollutants: Effluents**

Sl no	Parameter	Standards			
		Inland surface water	Public sewers	Land of Irrigation	Marine/ coastal areas
		(a)	(b)	(c)	(d)
1.	Colour and odor	remove as far as practicable			
2.	Suspended solids, mg/l. max.	100	600	200	(a) For process waste water 100 (b) For cooling water effluent 10% above total suspended matter of influent.
3.	Particle size of suspended solids	shall pass 850 micron IS Sieve			(a) Floatable solids, max. 3mm. (b) Settable solids (max 850 micron)
4.	pH value	5.5. to 9.0	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0
5.	Temperature	shall not exceed 50°C above the receiving water temperature			shall not exceed 50°C above the receiving water temperature
6.	Oil and grease, mg/l, max.	10	20	10	20
7.	Total residual chlorine, mg/l. max.	1.0			1.0
8.	Ammonical nitrogen (as N.) mg/l max	50	50		50
9.	Total Kjeldahl Nitrogen (as NH <sub>3</sub> ) mg/l. max	100			100
10.	Free ammonia (as NH <sub>3</sub> ), mg/l. max	5.0			5.0
11.	Biochemical oxygen demand (3 days at 27°C), mg/l. max.	30	350	100	100
12.	Chemical oxygen demand, mg/l, max.	250			250
13.	Arsenic (as As) mg/l, max.	0.2	0.2	0.2	0.2
14.	Mercury (as Hg), mg/l, max.	0.1	0.1	0.1	0.1
15.	Lead (as Pb) mg/l, max	0.1	1.0		2.0
16.	Cadmium (as Cd) mg/l. max	2.0	1.0		2.0
17.	Hexavalent chromium (as Cr. +6). Mg/l, max	0.1	2.0		1.0
18.	Total Chromium (as Cr) mg/l, max	2.0	2.0		2.0
19.	Copper (as Cu) mg/l, max	3.0	3.0		3.0

SI no	Parameter	Standards			
20.	Zinc (as Zn) mg/l, max	5.0	15		15
21.	Selenium (as Se) mg/l, max	0.05	0.05		0.05
22.	Nickel (as Ni) mg/l, max	3.0	3.0		5.0
23.	Cyanide (as CN) mg/l, max	0.2	2.0	0.2	0.2
24.	Fluoride (as F) mg/l, max	2.0	15		15
25.	Dissolved phosphates (as P) mg/l, max	5.0			
26.	Sulfide (as S) mg/l, max	2.0			5.0
27.	Phenolic compounds (as C <sub>6</sub> H <sub>5</sub> OH) mg/l, max	1.0	5.0		5.0
28.	Radioactive materials: (a)Alfa emitters microcurie/ml, max. (b)Beta emitters micro curie/ml, max.	10 <sup>-7</sup>	10 <sup>-7</sup>	10 <sup>-8</sup>	10 <sup>-7</sup>
		10 <sup>-6</sup>	10 <sup>-6</sup>	10 <sup>-7</sup>	10 <sup>-6</sup>
29.	Bio-assay test	90% Survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent
30.	Manganese (as Mn)	2 mg/l	2 mg/l		2 mg/l
31.	Iron (as Fe)	3 mg/l	3 mg/l		3 mg/l
32.	Vanadium (as V)	0.2 mg/l	0.2 mg/l		0.2 mg/l
33.	Nitrate Nitrogen	10 mg/l			20 mg/l

These standards shall be applicable for industries, operations or process other than those industries operations or process for which standards have been specified in schedule of the Environment Protection Rules, 1989.

## B. Applicable Ambient Air Quality Standards per ADB SPS

Following requirements of ADB SPS, PMO and RPMOs shall apply pollution prevention and control technologies and practices consistent with international good practice. When the Government of India regulations differ from these levels and measures, PMO shall achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific subproject circumstances, PMO will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS.

**Table A1.3: Applicable Ambient Air Quality Standards per ADB SPS**

Parameter	Location <sup>a</sup>	Applicable Standards Per ADB SPS <sup>e</sup> (µg/m <sup>3</sup> )
PM <sub>10</sub>	Industrial Residential, Rural and Other Areas	20 (Annual) <sup>c</sup> 50 (24-hr) <sup>c</sup>
	Sensitive Area	20 (Annual) <sup>c</sup> 50 (24-hr) <sup>c</sup>
PM <sub>25</sub>	Industrial Residential, Rural and Other Areas	10 (Annual) <sup>c</sup> 25 (24-hr) <sup>c</sup>
	Sensitive Area	10 (Annual) <sup>c</sup> 25 (24-hr) <sup>c</sup>

SO <sub>2</sub>	Industrial Residential, Rural and Other Areas	50 (Annual) <sup>b</sup> 20 (24-hr) <sup>c</sup> 500 (10-min) <sup>c</sup>
	Sensitive Area	20 (Annual) <sup>b</sup> 20 (24-hr) <sup>c</sup> 500 (10-min) <sup>c</sup>
NO <sub>2</sub>	Industrial Residential, Rural and Other Areas	40 (Annual) <sup>b</sup> 80 (24-hr) <sup>b</sup> 200 (1-hr) <sup>c</sup>
	Sensitive Area	30 (Annual) <sup>b</sup> 80 (24-hr) <sup>b</sup> 200 (1-hr) <sup>c</sup>
CO	Industrial Residential, Rural and Other Areas	2,000 (8-hr) <sup>b</sup> 4,000 (1-hr) <sup>b</sup> 100,000 (15-min) <sup>d</sup>
	Sensitive Area	2,000 (8-hr) <sup>b</sup> 4,000 (1-hr) <sup>b</sup> 100,000 (15-min) <sup>d</sup>
Ozone (O <sub>3</sub> )	Industrial Residential, Rural and Other Areas	100 (8-hr) <sup>b</sup> 180 (1-hr) <sup>b</sup>
	Sensitive Area	100 (8-hr) <sup>b</sup> 180 (1-hr) <sup>b</sup>
Lead (Pb)	Industrial, Residential, Rural and Other Areas	0.5 (Annual) <sup>b</sup> 1.0 (24-hr) <sup>b</sup>
	Sensitive Area	0.5 (Annual) <sup>b</sup> 1.0 (24-hr) <sup>b</sup>
Ammonia (NH <sub>3</sub> )	Industrial Residential, Rural and Other Areas	100 (Annual) <sup>b</sup> 400 (24-hr) <sup>b</sup>
	Sensitive Area	100 (Annual) <sup>b</sup> 400 (24-hr) <sup>b</sup>
Benzene (C <sub>6</sub> H <sub>6</sub> )	Industrial Residential, Rural and Other Areas	5 (Annual) <sup>b</sup>
	Sensitive Area	5 (Annual) <sup>b</sup>
Benzo(o)pyrene (BaP) particulate phase only	Industrial Residential, Rural and Other Areas	0.001 (Annual) <sup>b</sup>
	Sensitive Area	0.001 (Annual) <sup>b</sup>
Arsenic (As)	Industrial Residential, Rural and Other Areas	0.006 (Annual) <sup>b</sup>
	Sensitive Area	0.006 (Annual) <sup>b</sup>
Nickel (Ni)	Industrial Residential, Rural and Other Areas	0.02 (Annual) <sup>b</sup>
	Sensitive Area	0.02 (Annual) <sup>b</sup>

<sup>a</sup> Sensitive area refers to such areas notified by the India Central Government.

<sup>b</sup> Notification by Ministry of Environment and Forests, Government of India Environment (Protection) Seventh Amendment Rules, 2009

<sup>c</sup> WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide. *Global update 2005*. WHO. 2006

<sup>d</sup> Air Quality Guidelines for Europe Second Edition. WHO 2000.

<sup>e</sup> Per ADB SPS, the government shall achieve whichever of the ambient air quality standards is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the executing agency of the government will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS.

**Table A1.6: Applicable Standards for Discharge of Environmental Pollutants (Effluent)**

Pollutants	Units	Applicable Standard per ADB SPS <sup>a, b, c</sup>
pH	pH	6 – 9 <sup>b</sup>
BOD	mg/l	20 <sup>a</sup>
COD	mg/l	125 <sup>b</sup>
Total nitrogen	mg/l	10 <sup>b</sup>

Total phosphorus	mg/l	2 <sup>b</sup>
Oil and grease	mg/l	10 <sup>b</sup>
Total suspended solids	mg/l	<50 <sup>a</sup>
Total coliform bacteria	MPN b / 100 ml	400a <sup>b</sup>

<sup>a</sup> Environment (Protection) Amendment Rules, 2017.

<sup>b</sup> Health-based guideline values.

<sup>c</sup> Per ADB SPS, the government shall achieve whichever of the ambient air quality standards is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the executing agency of the government will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS.

## NOISE STANDARDS

### A. Noise Pollution (Regulation and Control) Rules, 2002 as amended up to 2010

#### Rule 3. Ambient air quality standards in respect of noise for different areas/zones

1. The ambient air quality standards in respect of noise for different areas/zones shall be such as specified below;
2. The State Government shall categorize the areas into industrial, commercial, residential or silence areas/zones for the purpose of implementation of noise standards for different areas; and
3. An area comprising not less than 100 meters around hospitals, educational institutions and courts may be declared as silence area/zone for the purpose of these rules.

Area Code	Category of Area	Limit in dB(A) $L_{eqa}$	
		Day Time	Night Time
A.	Industrial area	75	70
B.	Commercial area	65	55
C.	Residential area	55	45
D.	Silence zone	50	40

Notes:

1. Day time is reckoned in between 6 a.m. and 10 p.m.
2. Night time is reckoned in between 10 PM and 6 AM.
3. Silence zone is an area comprising not less than 100 m around hospitals, educational institutions, courts, religious places or any other area which is declared as such by the competent authority
4. Mixed categories of areas may be declared as one of the four above mentioned categories by the competent authority.

\* dB(A)  $L_{eq}$  denotes the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.

A "decibel" is a unit in which noise is measured.

"A", in dB(A)  $L_{eq}$ , denotes the frequency weighting in the measurement of noise and corresponds to frequency response characteristics of the human ear.

$L_{eq}$  is an energy mean of the noise level over a specified period.

#### Rule 5. Restrictions on the use of Loud Speakers/Public Address system and sound producing instruments

1. Any sound producing instrument shall not be used at night time except in closed premises for communication within, like auditoria, conference rooms, community halls, banquet halls or during a public emergency;
2. The noise level at the boundary of the public place, where any noise source is being used shall not exceed 10 dB (A) above the ambient noise standards for the area or 75 dB (A) whichever is lower;

#### Rule 5A. Restrictions on the use of sound emitting construction equipment.

1. Sound emitting construction equipment shall not be used or operated during night time in residential areas and silence zones.

**B. Noise limit for generator sets run with petrol or kerosene**

1. The noise limit for generator sets run with petrol or kerosene notified by Environment (Protection) (Amendment) Rules, 2000, vide G.S.R. 742 (E), dated 25th September, 2000, at serial no. 91, and as amended by Environment (Protection) (Amendment) Rules, 2001, vide G.S.R. 628 (E), dated 30th August, 2001 and Environment (Protection) (Amendment) Rules, 2011, vide G.S.R. 215 (E), dated 15th March, 2011, under the Environment (Protection) Act, 1986 is as follows:

	Noise Limit from	
	September 1, 2002	September 1, 2003
Sound Power Level LWA	90 dBA	86 dBA

**C. Noise limit for generator sets run with diesel**

1. Noise limit for Generator Sets run with Diesel notified by Environment (Protection) second Amendment Rules vide GSR 371(E), dated 17th May 2002 at serial no.94 and its amendments vide GSR No 520(E) dated 1st July 2003; GSR 448(E), dated 12th July 2004; GSR 315(E) dated 16th May 2005; GSR 464(E) dated 7th August 2006; GSR 566(E) dated 29th August 2007 and GSR 752(E) dated 24th October 2008; G.S.R. 215 (E), dated 15th March, 2011 under the Environment (Protection) Act, 1986) is as follows:  
 Para 50. Noise limit for diesel generator sets (up to 1000 KVA) manufactured on or after the 1st January, 2005  
 The maximum permissible sound pressure level for new diesel generator (DG) sets with rated capacity up to 1000 KVA, manufactured on or after the 1st January, 2005 shall be 75 dB(A) at 1 metre from the enclosure surface. The diesel generator sets should be provided with integral acoustic enclosure at the manufacturing stage itself.  
 The implementation of noise limit for these diesel generator sets shall be regulated as given in paragraph 3 below.
2. Noise limit for DG sets not covered by paragraph 1.

Noise limits for diesel generator sets not covered by paragraph 1, shall be as follows:-

- 2.1 Noise from DG set shall be controlled by providing an acoustic enclosure or by treating the room acoustically, at the users end.
- 2.2 The acoustic enclosure or acoustic treatment of the room shall be designed for minimum 25 dB (A) insertion loss or for meeting the ambient noise standards, whichever is on the higher side ( if the actual ambient noise is on the higher side, it may not be possible to check the performance of the acoustic enclosure/acoustic treatment. Under such circumstances the performance may be checked for noise reduction up to actual ambient noise level, preferably, in the night time). The measurement for Insertion Loss may be done at different points at 0.5 m from the acoustic enclosure/ room, then averaged.
- 2.3 The DG set shall be provided with proper exhaust muffler with insertion loss of minimum 25 dB (A).
- 2.4 Guidelines for the manufacturers/ users of Diesel Generator sets shall be as under:

- (i) The manufacturer shall offer to the user a standard acoustic enclosure of 25 dB (A) insertion loss and also a suitable exhaust muffler with insertion loss of 25 dB(A);
- (ii) The user shall make efforts to bring down the noise levels due to the DG set, outside his premises, within the ambient noise requirements by proper citing and control measures;
- (iii) Installation of DG set must be strictly in compliance with the recommendations of the DG set manufacturer; and
- (iv) A proper routine and preventive maintenance procedure for the DG set should be set and followed in consultation with the DG set manufacturer, which would help prevent noise levels of the DG set from deteriorating with use.

GSR.7 dated 22 December 1998 amendment to Environment Protection Rules 1986

2.5 Standards/guidelines for control of Noise Pollution from Stationary Diesel Generator (DG) Sets.

- (i) Noise Standards for DG Sets (15-500 KVA)

The total sound power level,  $L_w$ , of a DG set should be less than,  $94+10 \log_{10} (KVA)$ , dB(A), at the manufacturing stage, where, KVA is the nominal power rating of a DG set. This level should fall by 5 dB(A) every five years, till 2007, i.e. in 2002 and then in 2007.

- (ii) Mandatory acoustic enclosure/acoustic treatment of room for stationary DG sets (5 KVA and above)

Noise from the DG set should be controlled by providing an acoustic enclosure or by treating the room acoustically.

The acoustic enclosure/acoustic treatment of the room should be designed for minimum 25 dB(A) Insertion Loss or for meeting the ambient noise standards, whichever is on the higher side (if the actual ambient noise is on the higher side, it may not be possible to check the performance of the acoustic enclosure/acoustic treatment. Under such circumstances, the performance may be checked for noise reduction up to actual ambient noise level, preferably, in the nighttime). The measurement for Insertion Loss may be done at different points at 0.5m from the acoustic enclosure/room, and then averaged.

The DG set should also be provide with proper exhaust muffler with Insertion Loss of minimum 25 dB(A).

3. Guidelines for the manufacturers/users of DG sets (5KVA and above)

- 3.1 The manufacturer should offer to the user a standard acoustic enclosure of 25 dB(A) insertion Loss and also a suitable exhaust muffler, with insertion loss of 25dB(A).
- 3.2 The user should make efforts to bring down the noise levels due to the DG set, outside his premises, within the ambient noise.
- 3.3 The manufacturer should furnish noise power levels of the unsilenced DG sets as per standards prescribed under (A).
- 3.4 The total sound power level of a DG set, at the user's end, shall be within 2 dB(a) of the total sound power level of the DG set, at the manufacturing stage as prescribed under (A).

- 3.5 Installation of a DG set must be strictly in compliance with the recommendations of the DG set manufacturer.
- 3.6 A proper routine and preventive maintenance procedure for the DG set should be set and followed in consultation with the DG set manufacturer, which would help prevent noise levels of the DG set from deteriorating with use.

**D. GSR 742(E) dated 30.08.1990 amended GSR 422 (E) dated 19 May 1993**

Noise limits for domestic appliances and construction equipment at the manufacturing stage in dB(A)

Window air conditioners of 1 -1.5 tonne	68
Air coolers	60
Refrigerators	46
Compactors (rollers), front loaders, concentrate mixers, cranes (movable), vibrators and saws	75

**E. Applicable Ambient Noise Level Standards per ADB SPS**

Following requirements of ADB SPS, PMO and RPMOs shall apply pollution prevention and control technologies and practices consistent with international good practice. When the Government of India regulations differ from these levels and measures, PMO shall achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific subproject circumstances, PMO will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS.

**Applicable Ambient Noise Level Standards per ADB SPS**

Receptor/ Source	Applicable Standards Per ADB SPS <sup>c</sup> (dBA)	
	Day time	Night time
Industrial area	70 <sup>b</sup>	70 <sup>b</sup>
Commercial area	65 <sup>a</sup>	55 <sup>a</sup>
Residential Area	55 <sup>a</sup>	45 <sup>a</sup>
Silent Zone	50 <sup>a</sup>	40 <sup>a</sup>

<sup>a</sup> Noise Pollution (Regulation and Control) Rules, 2002 as amended up to 2010.

<sup>b</sup> Guidelines for Community Noise. WHO. 1999.

<sup>c</sup> Per ADB SPS, the government shall achieve whichever of the ambient air quality standards is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the executing agency of the government will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS.

**OCCUPATIONAL NOISE EXPOSURE**

National Institute of Occupational Safety and Health

Criteria for a recommended standard: occupational noise exposure

NIOSH Publication no. 98-126

Combination of noise exposure levels and duration that no worker exposure shall equal or exceed

Exposure Level (dBA)	Duration		
	Hours	Minutes	Seconds
80	25	24	-
81	20	10	-
82	16	-	-
83	12	42	-
84	10	5	-
85	8	-	-
86	6	21	-
87	5	2	-
88	4	-	-
89	3	10	-
90	2	31	-
91	2	-	-
92	1	35	-
93	1	16	-
94	1	-	-
95	-	47	37
96	-	37	48
97	-	30	-
98	-	23	49
99	-	18	59
100	-	15	-
103	-	7	30
105	-	4	43
110	-	1	29

## **HAZARDOUS AND OTHER WASTES (MANAGEMENT AND TRANSBOUNDARY MOVEMENT) RULES, 2016 DATED 4TH APRIL 2016**

These rules shall apply to the management of hazardous and other wastes as specified in the Schedules to these rules but shall not apply to: (a) waste-water and exhaust gases as covered under the provisions of the Water (Prevention and Control of Pollution) Act, 1974 (6 of 1974) and the Air (Prevention and Control of Pollution) Act, 1981 (14 of 1981) and the rules made thereunder and as amended from time to time; (b) wastes arising out of the operation from ships beyond five km of the relevant baseline as covered under the provisions of the Merchant Shipping Act, 1958 and the rules made thereunder and as amended from time to time; (c) radio-active wastes as covered under the provisions of the Atomic Energy Act, 1962 (33 of 1962) and the rules made thereunder and as amended from time to time; (d) bio-medical wastes covered under the Bio-Medical Wastes (Management and Handling) Rules, 1998 made under the Act and as amended from time to time; and (e) wastes covered under the Municipal Solid Wastes (Management and Handling) Rules, 2000 made under the Act and as amended from time to time. 8 (44 of 1958) and the rules made thereunder and as amended from time to time;

**Responsibilities of State Government for environmentally sound management of hazardous and other wastes.** – (1) Department of Industry in the State or any other government agency authorised in this regard by the State Government, to ensure earmarking or allocation of industrial space or shed for recycling, pre-processing and other utilisation of hazardous or other waste in the existing and upcoming industrial park, estate and industrial clusters; (2) Department of Labour in the State or any other government agency authorised in this regard by the State Government shall: (a) ensure recognition and registration of workers involved in recycling, preprocessing and other utilisation activities; (b) assist formation of groups of such workers to facilitate setting up such facilities; (c) undertake industrial skill development activities for the workers involved in recycling, pre-processing and other utilisation; and (d) undertake annual monitoring and to ensure safety and health of workers involved in recycling, pre-processing and other utilisation. (3) Every State Government may prepare integrated plan for effective implementation of these provisions and to submit annual report to the Ministry of Environment, Forest and Climate Change, in the Central Government.

**Grant of authorisation for managing hazardous and other wastes.** (1) Every occupier of the facility who is engaged in handling, generation, collection, storage, packaging, transportation, use, treatment, processing, recycling, recovery, pre-processing, co-processing, utilisation, offering for sale, transfer or disposal of the hazardous and other wastes shall be required to make an application in Form 1 to the State Pollution Control Board and obtain an authorisation from the State Pollution Control Board within a period of sixty days from the date of publication of these rules. Such application for authorisation shall be accompanied with a copy each of the following documents, namely: (a) consent to establish granted by the State Pollution Control Board under the Water (Prevention and Control of Pollution) Act, 1974 (25 of 1974) and the Air (Prevention and Control of Pollution) Act, 1981 (21 of 1981); (b) Consent to operate granted by the State Pollution Control Board under the Water (Prevention and Control of Pollution) Act, 1974 (25 of 1974) and/or Air (Prevention and Control of Pollution) Act, 1981, (21 of 1981); (c) in case of renewal of authorisation, a self-certified compliance report in respect of effluent, emission standards and the conditions specified in the authorisation for hazardous and other wastes: Provided that an application for renewal of authorisation may be made three months before the expiry of such authorisation: Provided further that- (i) any person authorised under the provisions of the Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008, prior to the date of commencement of these rules, shall not be required to make an application for authorisation till the period of expiry of such authorisation; (ii) any person engaged in recycling or reprocessing of the hazardous waste specified in Schedule IV and having registration under

the provisions of the Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008, shall not be required to make an application for authorisation till the period of expiry of such registration. (1) On receipt of an application complete in all respects for the authorisation, the State Pollution Control Board may, after such inquiry as it considers necessary, and on being satisfied that the applicant possesses appropriate facilities for collection, storage, packaging, transportation, treatment, processing, use, destruction, recycling, recovery, pre-processing, co-processing, utilisation, offering for sale, transfer or disposal of the hazardous and other waste, as the case may be, and after ensuring technical capabilities and equipment complying with the standard operating procedure or other guidelines specified by the Central Pollution Control Board from time to time and through site inspection, grant within a period of one hundred and twenty days, an authorisation in Form 2 to the applicant, which shall be valid for a period of five years subject to such conditions as may be laid down therein. For commonly recyclable hazardous waste as given in Schedule IV, the guidelines already prepared by the Central Pollution Control Board shall be followed: Provided that in the case of an application for renewal of authorisation, the State Pollution Control Board may, before granting such authorisation, satisfy itself that there has been no violation of the conditions specified in the authorisation earlier granted by it and same shall be recorded in the inspection report. (2) The authorisation granted by the State Pollution Control Board under sub-rule (3) shall be accompanied by a copy of the field inspection report signed by that Board indicating the adequacy of facilities for collection, storage, packaging, transportation, treatment, processing, use, destruction, recycling, recovery, pre-processing, co-processing, utilisation, offering for sale, transfer or disposal of the hazardous and other wastes and compliance to the guidelines or standard operating procedures specified by the Central Pollution Control Board from time to time. (4) The State Pollution Control Board may, for the reasons to be recorded in writing and after giving reasonable opportunity of being heard to the applicant, refuse to grant any authorisation under these rules. (5) Every occupier authorised under these rules, shall maintain a record of hazardous and other wastes managed by him in Form 3 and prepare and submit to the State Pollution Control Board, an annual return containing the details specified in Form 4 on or before the 30th day of June following the financial year to which that return relate. (6) The State Pollution Control Board shall maintain a register containing particulars of the conditions imposed under these rules for management of hazardous and other wastes and it shall be open for inspection during office hours to any interested or affected person. (7) The authorised actual user of hazardous and other wastes shall maintain records of hazardous and other wastes purchased in a passbook issued by the State Pollution Control Board along with the authorisation. (8) Handing over of the hazardous and other wastes to the authorised actual user shall be only after making the entry into the passbook of the actual user.

**Power to suspend or cancel an authorisation.** - (1) The State Pollution Control Board, may, if in its opinion the holder of the authorisation has failed to comply with any of the conditions of the authorisation or with any provisions of the Act or these rules and after giving him a reasonable opportunity of being heard and after recording reasons thereof in writing cancel or suspend the authorisation issued under rule 6 for such period as it considers necessary in the public interest. (2) Upon suspension or cancellation of the authorisation, the State Pollution Control Board may give directions to the person whose authorisation has been suspended or cancelled for the safe storage and management of the hazardous and other wastes, and such occupier shall comply with such directions.

**Storage of hazardous and other wastes.-** (1) The occupiers of facilities may store the hazardous and other wastes for a period not exceeding ninety days and shall maintain a record of sale, transfer, storage, recycling, recovery, pre-processing, co-processing and utilisation of such wastes and make these records available for inspection: Provided that the State Pollution Control Board may extend the said period of ninety days in following cases, namely:- (i) small

generators (up to ten tonnes per annum) up to one hundred and eighty days of their annual capacity; (ii) actual users and disposal facility operators up to one hundred and eighty days of their annual capacity; (iii) occupiers who do not have access to any treatment, storage, disposal facility in the concerned State; or (iv) the waste which needs to be specifically stored for development of a process for its recycling, recovery, pre-processing, co-processing or utilisation; (v) in any other case, on justifiable grounds up to one hundred and eighty days.

**Utilisation of hazardous and other wastes.** - (1) The utilisation of hazardous and other wastes as a resource or after pre-processing either for co-processing or for any other use, including within the premises of the generator (if it is not part of process), shall be carried out only after obtaining authorisation from the State Pollution Control Board in respect of waste on the basis of standard operating procedures or guidelines provided by the Central Pollution Control Board. (2) Where standard operating procedures or guidelines are not available for specific utilisation, the approval has to be sought from Central Pollution Control Board which shall be granting approval on the basis of trial runs and thereafter, standard operating procedures or guidelines shall be prepared by Central Pollution Control Board: Provided, if trial run has been conducted for particular waste with respect to particular utilisation and compliance to the environmental standards has been demonstrated, authorisation may be granted by the State Pollution Control Board with respect to the same waste and utilisation, without need of separate trial run by Central Pollution Control Board and such cases of successful trial run, Central Pollution Control Board shall intimate all the State Pollution Control Board regarding the same. (3) No trial runs shall be required for co-processing of waste in cement plants for which guidelines by the Central Pollution Control Board are already available; however, the actual users shall ensure compliance to the standards notified under the Environment (Protection) Act, 1986 (29 of 1986), for cement plant with respect to co-processing of waste: Provided that till the time the standards are notified, the procedure as applicable to other kind of utilisation of hazardous and other waste, as enumerated above shall be followed.

**Standard Operating Procedure or guidelines for actual users.** - The Ministry of Environment, Forest and Climate Change or the Central Pollution Control Board may issue guidelines or standard operating procedures for environmentally sound management of hazardous and other wastes from time to time.

**SCHEDULE II**  
[See rule 3 (1) (17) (ii)]

**List of waste constituents with concentration limits**

**Class A:** Based on leachable concentration limits [Toxicity Characteristic Leaching Procedure (TCLP) or Soluble Threshold Limit Concentration (STLC)]

Class	Constituents	Concentration in mg/l
(1)	(2)	(3)
A1	Arsenic	5.0
A2	Barium	100.0
A3	Cadmium	1.0
A4	Chromium and/or Chromium (III) compounds	5.0
A5	Lead	5.0
A6	Manganese	10.0
A7	Mercury	0.2
A8	Selenium	1.0
A9	Silver	5.0
A10	Ammonia	50*
A11	Cyanide	20*
A12	Nitrate (as nitrate-nitrogen)	1000.0
A13	Sulphide (as H <sub>2</sub> S)	5.0
A14	1,1-Dichloroethylene	0.7
A15	1,2-Dichloroethane	0.5
A16	1,4-Dichlorobenzene	7.5
A17	2,4,5-Trichlorophenol	400.0
A18	2,4,6-Trichlorophenol	2.0
A19	2,4-Dinitrotoluene	0.13
A20	Benzene	0.5
A21	Benzo (a) Pyrene	0.001
A22	Bromodichloromethane	6.0
A23	Bromoform	10.0
A24	Carbon tetrachloride	0.5
A25	Chlorobenzene	100.0
A26	Chloroform	6.0
A27	Cresol (ortho+ meta+ para)	200.0
A28	Dibromochloromethane	10.0
A29	Hexachlorobenzene	0.13
A30	Hexachlorobutadiene	0.5
A31	Hexachloroethane	3.0
A32	Methyl ethyl ketone	200.0
A33	Naphthalene	5.0
A34	Nitrobenzene	2.0
A35	Pentachlorophenol	100.0
A36	Pyridine	5.0
A37	Tetrachloroethylene	0.7
A38	Trichloroethylene	0.5

**Class B: Based on Total Threshold Limit Concentration (TTLC)**

Class	Constituent	Concentration in mg/kg
(1)	(2)	(3)
B1	Asbestos	10000
B2	Total Petroleum Hydrocarbons (TPH) (C5 - C36)	5,000

**Note:**

- (1) The testing method for list of constituents at A1 to A61 in Class-A, shall be based on Toxicity Characteristic Leaching Procedure (TCLP) and for extraction of leachable constituents, USEPA Test Method 1311 shall be used.
- (2) The testing method for list of constituents at A62 to A79 in Class- A, shall be based on Soluble Threshold Limit Concentration (STLC) and Waste Extraction Test (WET) Procedure given in Appendix II of section 66261 of Title 22 of California Code regulation (CCR) shall be used.
- (3) In case of ammonia (A10), cyanide (A11) and chromium VI (A64), extractions shall be conducted using distilled water in place of the leaching media specified in the TCLP/STLC procedures.
- (4) A summary of above specified leaching/extraction procedures is included in manual for characterization and analysis of hazardous waste published by Central Pollution Control Board and in case the method is not covered in the said manual suitable reference method may be adopted for the measurement.
- (5) In case of asbestos, the specified concentration limits apply only if the substances are in a friable, powdered or finely divided state.
- (6) The hazardous constituents to be analyzed in the waste shall be relevant to the nature of the industry and the materials used in the process.
- (7) Wastes which contain any of the constituents listed below shall be considered as hazardous, provided they exhibit the characteristics listed in Class-C of this Schedule :

1.	Acid Amides
2.	Acid anhydrides
3.	Amines
4.	Anthracene
5.	Aromatic compounds other than those listed in Class A
6.	Bromates, (hypo-bromites)
7.	Chlorates (hypo-chlorites)
8.	Carbonyls
9.	Ferro-silicate and alloys
10.	Halogen- containing compounds which produce acidic vapours on contact with humid air or water e.g. silicon tetrachloride, aluminum chloride, titanium tetrachloride
11.	Halogen- silanes
12.	Halogenated Aliphatic Compounds
13.	Hydrazine (s)

14.	Hydrides
15.	Inorganic Acids
16.	Inorganic Peroxides
17.	Inorganic Tin Compounds
18.	Iodates
19.	(Iso- and thio-) Cyanates
20.	Manganese-silicate
21.	Mercaptans
22.	Metal Carbonyls
23.	Metal hydrogen sulphates
24.	Nitrides
25.	Nitriles
26.	Organic azo and azoxy Compounds
27.	Organic Peroxides
28.	Organic Oxygen Compounds
29.	Organic Sulphur Compounds
30.	Organo- Tin Compounds
31.	Organo nitro- and nitroso compounds
32.	Oxides and hydroxides except those of hydrogen, carbon, silicon, iron, aluminum, titanium, manganese, magnesium, calcium
33.	Phenanthrene
34.	Phenolic Compounds
35.	Phosphate compounds except phosphates of aluminum, calcium and iron
36.	Salts of pre-acids
37.	Total Sulphur
38.	Tungsten Compounds
39.	Tellurium and tellurium compounds
40.	White and Red Phosphorus
41.	2-Acetylaminofluorene
42.	4-Aminodiphenyl
43.	Benzidine and its salts
44.	Bis (Chloromethyl) ether
45.	Methyl chloromethyl ether
46.	1,2-Dibromo-3-chloropropane
47.	3,3'-Dichlorobenzidine and its salts
48.	4-Dimethylaminoazobenzene
49.	4-Nitrobiphenyl
50.	Beta-Propiolactone

#### **CLASS C : Based on hazardous Characteristics**

Apart from the concentration limit given above, the substances or wastes shall be classified as hazardous waste if it exhibits any of the following characteristics due to the presence of any hazardous constituents:

**Class C1: Flammable-** A waste exhibits the characteristic of flammability or ignitability if a representative sample of the waste has any of the following properties, namely:-

- (i) flammable liquids, or mixture of liquids, or liquids containing solids in solution or suspension (for example, paints, varnishes, lacquers, etc; but not including substances or wastes otherwise classified on account of their dangerous characteristics), which give off a flammable vapour at temperature less than 60°C. This flash point shall be measured as per ASTM D 93-79 closed-cup test method or as determined by an equivalent test method published by Central Pollution Control Board;
- (ii) it is not a liquid and is capable, under standard temperature and pressure, of causing fire through friction, absorption of moisture or spontaneous chemical changes and, when ignited, burns vigorously and persistently creating a hazard;
- (iii) it is an ignitable compressed gas;
- (iv) It is an oxidizer and for the purposes of characterisation is a substance such as a chlorate, permanganate, inorganic peroxide, or a nitrate, that yields oxygen readily to stimulate the combustion of organic matter.

**Class C2: Corrosive-** A waste exhibits the characteristic of corrosivity if a representative sample of the waste has either of the following properties, namely:-

- (i) it is aqueous and has a pH less than or equal to 2 or greater than or equal to 12.5;
- (ii) it is a liquid and corrodes steel (SAE 1020) at a rate greater than 6.35 mm per year at a test temperature of 55 °C;
- (iii) it is not aqueous and, when mixed with an equivalent weight of water, produces a solution having a pH less than or equal to 2 or greater than or equal to 12.5;
- (iv) it is not a liquid and, when mixed with an equivalent weight of water, produces a liquid that corrodes steel (SAE1020) at a rate greater than 6.35 mm per year at a test temperature of 55 °C.

*Note:*

For the purpose of determining the corrosivity, the Bureau of Indian Standard 9040 C method for pH determination, NACE TM 01 69 : Laboratory Corrosion Testing of Metals and EPA 1110A method for corrosivity towards steel (SAE1020) to establish the corrosivity characteristics shall be adopted.

**Class C3: Reactive or explosive-** A waste exhibits the characteristic of reactivity if a representative sample of the waste it has any of the following properties, namely:-

- (i) it is normally unstable and readily undergoes violent change without detonating;
- (ii) it reacts violently with water or forms potentially explosive mixtures with water;
- (iii) when mixed with water, it generates toxic gases, vapours or fumes in a quantity sufficient to present a danger to human health or the environment;
- (iv) it is a cyanide or sulphide bearing waste which, when exposed to pH conditions between 2 and 12.5, can generate toxic gases, vapours or fumes in a quantity sufficient to present a danger to human health or the environmental;
- (v) it is capable of detonation or explosive reaction if it is subjected to a strong initiating source or if heated under confinement;
- (vi) it is readily capable of detonation or explosive decomposition or reaction at standard temperature and pressure;
- (vii) it is a forbidden explosive.

**Class C4: Toxic-** A waste exhibits the characteristic of toxicity, if, :-

- (i) the concentration of the waste constituents listed in Class A and B (of this schedule) are equal to or more than the permissible limits prescribed therein;
- (ii) it has an acute oral LD50 less than 2,500 milligrams per kilogram;
- (iii) it has an acute dermal LD50 less than 4,300 milligrams per kilogram;
- (iv) it has an acute inhalation LC50 less than 10,000 parts per million as a gas or vapour;
- (v) it has acute aquatic toxicity with 50% mortality within 96 hours for zebra fish (*Brachidanio rerio*) at a concentration of 500 milligrams per litre in dilution water and test conditions as specified in BIS test method 6582 – 2001.
- (vi) it has been shown through experience or by any standard reference test- method to pose a hazard to human health or environment because of its carcinogenicity, mutagenicity, endocrine disruptivity, acute toxicity, chronic toxicity, bio-accumulative properties or persistence in the environment.

**Class C5: Substances or Wastes liable to spontaneous combustion** -Substances or Wastes which are liable to spontaneous heating under normal conditions encountered in transport, or to heating up on contact with air, and being then liable to catch fire.

**Class C6: Substances or Wastes which, in contact with water emit flammable gases-** Substances or Wastes which, by interaction with water, are liable to become spontaneously flammable or to give off flammable gases in dangerous quantities.

**Class C5: Oxidizing** - Substances or Wastes which, while in themselves not necessarily combustible, may, generally by yielding oxygen cause, or contribute to, the combustion of other materials.

**Class C8: Organic Peroxides** - Organic substances or Wastes which contain the bivalent O–O structure, which may undergo exothermic self-accelerating decomposition.

**Class C9: Poisons (acute)** - Substances or Wastes liable either to cause death or serious injury or to harm human health if swallowed or inhaled or by skin contact.

**Class C10: Infectious substances** - Substances or Wastes containing viable micro-organisms or their toxins which are known or suspected to cause disease in animals or humans.

**Class C11: Liberation of toxic gases in contact with air or water** - Substances or Wastes which, by interaction with air or water, are liable to give off toxic gases in dangerous quantities.

**Class C12: Eco-toxic-** Substances or Wastes which if released, present or may present immediate or delayed adverse impacts to the environment by means of bioaccumulation or toxic effects upon biotic systems or both.

**Class C13: Capable**, by any means, after disposal, of yielding another material, e.g., leachate, which possesses any of the characteristics listed above.

**PHOTO ILLUSTRATION OF PROJECT LOCATION**



Bank Plot STP site



Bank Plot STP site



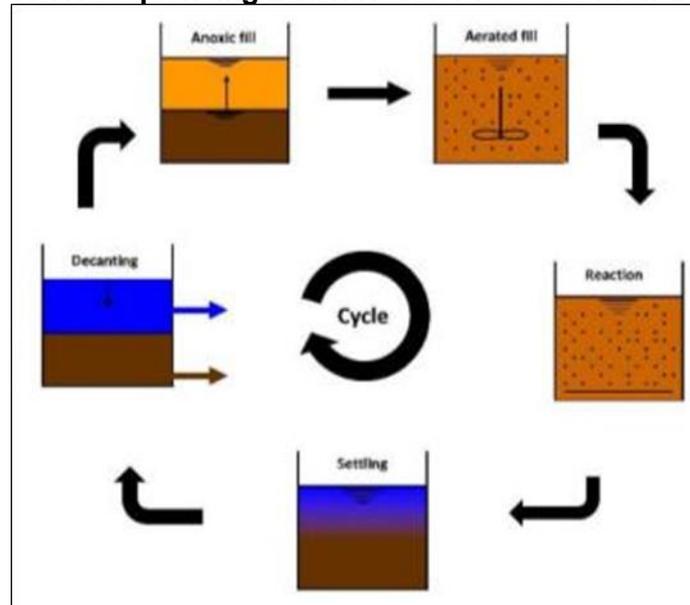
Churial Canal bridge on M G Road near treated effluent discharge point



Treated effluent from Bank Plot STP discharge point on Churial canal

## SEQUENCING BATCH REACTOR

1. Sequencing Batch Reactor (SBR)) processes employed to treat municipal wastewater and wastewater from a variety of generators (domestic and industries including refineries and petrochemical plants).
2. This technology offers several operational and performance advantages over the conventional activated sludge process. The SBR process performs all the functions of a conventional activated sludge plant (biological removal of pollutants, solids/liquid separation and treated effluent removal) by using a single variable volume basin in an alternating mode of operation, thereby dispensing with the need for final clarifiers and high return activated sludge pumping capacity.
3. The SBR incorporates a high level of process sophistication in a configuration, which is cost and space effective and offers a methodology that has operational simplicity, flexibility and reliability that is not available in conventionally configured activated sludge systems. Its unique design provides an effective means for the control of filamentous sludge bulking, a common problem with conventional processes and other activated sludge systems.
4. The sequencing batch reactor (SBR) WWTP is designed to achieve organic matter removal, nitrification and denitrification. In practice, different modifications are possible, which depend on various parameters including the influent quality, the capacity of the WWTP etc. Figure A6.1 illustrates the SBR WWTP setup. The plant will operate under flow-paced batch operation, i.e. the plant will receive the same volumetric loading during every cycle. There are many variants of SBR and the configuration of the system may vary from type to type.
5. A mixed fill operation is foreseen. The first phase of filling takes place under anoxic conditions, where only mixing and no aeration is provided. Under these conditions the denitrification of the nitrates that were produced in the previous cycle and are found in the sludge occurs. The second phase of mixing takes place under aerobic conditions, where aeration is provided by the use of jet aerators.
6. The reaction phase refers to the phase where no wastewater enters the basin anymore and where aeration and mixing units are on. Although carbonaceous BOD removal and nitrification occurs practically also during the aerated filling, this phase is referred to as reaction in literature. During the settling stage, the activated sludge is allowed to settle. The decanting phase is used to remove the clear supernatant without entraining settled sludge. In some cases, an idle phase is provided at the end of each cycle and before the next filling begins. However, at high flow rates this phase may be eliminated and therefore it is not foreseen in the setup.

**Table A6.1: Sequencing Batch Reactor Process Flow Diagram**

7. The SBR maximizes operational: simplicity, reliability and flexibility. Important reasons for choosing SBR over conventional constant volume activated sludge aeration and clarifier process include:

- (i) operates under continuous reduced loading through simple cycle adjustment;
- (ii) operates with feed-starve selectivity,  $S_0/X_0$  operation (control of limiting substrate to micro-organism ratio), and aeration intensity to prevent filamentous sludge bulking and ensures endogenous respiration (removal of all available substrate), nitrification and denitrification together with enhanced biological phosphorus removal;
- (iii) simultaneous (co-current) nitrification and denitrification by variation of aeration intensity;
- (iv) tolerates shock load caused by organic and hydraulic load variability. The system is easily configured and adjusted for short-term diurnal and long-term seasonal variations;
- (v) elimination of secondary clarifier;
- (vi) inherent ability to remove nutrients without chemical addition, by controlling the oxygen demand and supply;
- (vii) provision for energy optimization through nutrient removal mechanisms. The feed water carbonaceous BOD used in denitrification and enhanced biological phosphorus removal reduces overall oxygen demand and hence energy requirement;
- (viii) capital and operating cost advantages; and
- (ix) fully Automation reduces skilled human resources and errors.

8. Therefore, by adapting SBR following advantages could be achieved which were briefly captured in the comparative table:

### **I. Less Land Requirement**

9. The land required for similar capacity of SBR would be less than half the land area as compared to a conventional Activated Sludge Process (ASP) as these advanced ASPs have built in Primary and Secondary Clarifiers. The land thus saved can be effectively utilized for any other purposes. SBR along with MBR are the only technologies, which could be set up in the available land. If the land saved is factored in the capital cost then the Capital cost of the SBR based STP plants many times works out to negligible. Most importantly, if land is limited, SBR can be built in two tiers.

### **II. Lower Power Consumption**

10. Sequential Batch Reactor (SBR) Process consumes only 50% power as compared to existing Activated Sludge Process.

11. This unique feature of power saving is possible through automation and Oxygen Uptake Rate (OUR) Controller wherein only the required volume of oxygen is provided through Variable Frequency Drive fitted Blowers thus saving a lot of power.

### **III. Operation & Maintenance Cost**

12. The typical total O&M cost for SBR Process will work out to only Rs 1.50 per cu.m. as compared to over Rs 5.00 per cu. m. for Conventional Activated Sludge Process based STPs (without tertiary treatment and Nitrogen & Phosphorous removal). Thus ,saving on account of O&M alone would be more than Rs 12 Crores per annum for 100 MLD Plant

### **IV. In-built Nitrogen and Phosphorous Removal**

13. SBR based STP plants have built-in feature for removal of Nitrogen & Phosphorous and therefore the fully digested dewatered sludge can be directly used as manure as it is rich in N&P (Nitrogen and Phosphorous), whereas for a ASP based STP, a separate plant nitrification and de-nitrification plants would be required will be required to achieve Total Nitrogen in treated effluent to less than 10mg/l.

### **V. Less Construction Time**

14. Apart from low land and power requirement, construction time for a STP based on SBR will be lesser due to lower number of units required in its process. The cost of replacement is also low since all the submerged parts can be made of stainless steel and there are very few moving parts as compared to conventional Activated Sludge Process.

### **VI. Flexibility**

15. It can run effectively within wide range of flow fluctuation then that of design flow. This can operate efficiently for 25 % to 135% of design flow. Chances of shock load disturbance will be largely minimized.

16. As per the information available from various sources more than 80 nos. of Sewage Treatment Plants based on SBR Process are in operation all over the country. Most of the Government bodies and Municipal Corporations have adapted this technology to save on Capital, Land and Operating Cost.

17. In order to ensure the SBR Based Sewage Treatment Plants achieve desired level of treatment through Automation ( PLC /SCADA ), it is advisable that as in the case of other States in India who have invited tenders based on this Process , the role of Technology provider for this process be also defined in the tender so that the these Plants are designed properly and responsibility is also taken by Technology Provider to establish the Performance to get the treated Sewage Parameters consistently during the entire economic life of the Plant.

18. The above treated parameters can achieved if all the Bidders are made to sign MOU with the Technology Provider for the Tested Proven Process for SBR in India as the Civil Contractor on his own cannot design the Process and Automation for the SBR based Sewage Treatment Plant as indicated in the tender.

19. Since the cost of Process and key equipment for advanced technology (SBR) will constitute app. 12-15% of the total cost, all the participating Bidders can sign the MOU for Process Technology Provider to enable Government Bodies get competitive offers within the stipulated estimated cost of the Plants.

## RAPID ENVIRONMENTAL ASSESSMENT CHECKLIST

**Instructions:**

- (i) The project team completes this checklist to support the environmental classification of a project. It is to be attached to the environmental categorization form and submitted to the Environment and Safeguards Division (RSES) for endorsement by the Director, RSES and for approval by the Chief Compliance Officer.
- (ii) This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB's (a) checklists on involuntary resettlement and Indigenous Peoples; (b) poverty reduction handbook; (c) staff guide to consultation and participation; and (d) gender checklists.
- (iii) Answer the questions assuming the "without mitigation" case. The purpose is to identify potential impacts. Use the "remarks" section to discuss any anticipated mitigation measures.

**Country/Project Title:** **India/Kolkata Environmental Improvement Investment Program (KEIIP)  
Tranche 3 - Sewerage and Drainage Improvement- Construction of STP**

**Sector Division:** **Urban Development**

Screening Questions	Yes	No	Remarks
<b>A. Project siting</b> Is the project area...			
▪ Densely populated?	✓		Project sites are located in urban areas
▪ Heavy with development activities?	✓		No negative impacts are envisaged as infrastructure will be established on government land and pipes will be constructed on ROW. Minimal road disruption is likely. Measures like best activity scheduling, traffic management, etc. will be employed to minimize the impact to acceptable levels.
Adjacent to or within any environmentally sensitive areas?			
▪ Cultural heritage site		✓	
▪ Protected area		✓	
▪ Wetland		✓	
▪ Mangrove		✓	
▪ Estuarine		✓	
▪ Buffer zone of protected area		✓	
▪ Special area for protecting biodiversity		✓	
▪ Bay		✓	
<b>B. Potential Environmental Impacts</b> Will the Project cause...			
▪ impairment of historical/cultural monuments/areas and loss/damage to these sites?		✓	Not anticipated.
▪ interference with other utilities and blocking of access to buildings; nuisance to neighboring areas due to	✓		Anticipated during construction activities. However, impacts are temporary and short in duration. The EMP ensures measures are included to mitigate the impacts.

Screening Questions	Yes	No	Remarks
noise, smell, and influx of insects, rodents, etc.?			
▪ dislocation or involuntary resettlement of people?		✓	No displacement of communities is required in Project 3.
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		✓	Not applicable.
▪ impairment of downstream water quality due to inadequate sewage treatment or release of untreated sewage?		✓	Collected sewage will be treated at the STPs proposed in Project 3
▪ overflows and flooding of neighboring properties with raw sewage?		✓	Project 3 will improve current situation of discharging sewage to open drains
▪ environmental pollution due to inadequate sludge disposal or industrial waste discharges illegally disposed in sewers?		✓	STP designs include sludge management. Industrial waste discharges to the sewers will not be allowed and prevented in the proposed sewer network system.
▪ noise and vibration due to blasting and other civil works?	✓		Increased noise is anticipated during construction activities. However, impacts are temporary and short in duration. The EMP ensures measures are included to mitigate the impacts.
▪ risks and vulnerabilities related to occupational health and safety due to physical, chemical, and biological hazards during project construction and operation?	✓		The EMP ensures occupational health and safety measures are included. Chemicals will not be used during construction and operation activities.
▪ discharge of hazardous materials into sewers, resulting in damage to sewer system and danger to workers?		✓	Not anticipated. The subproject sites are predominantly residential areas. Thus discharge of hazardous materials into sewers are unlikely. Measures have been included in the design to prevent discharge of industrial and hazardous materials into the sewer network system
▪ inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances, and protect facilities?		✓	Buffer zones are included in the design of the STPs and pumping stations.
▪ road blocking and temporary flooding due to land excavation during the rainy season?		✓	Not anticipated. Construction activities will be conducted during non-monsoon season.
▪ noise and dust from construction activities?	✓		Anticipated during construction activities. However, impacts are temporary and short in duration. The EMP ensures measures are included to mitigate the impacts.
▪ traffic disturbances due to construction material transport and wastes?	✓		Anticipated during construction activities. However, impacts are temporary and short in duration. The EMP ensures measures are included to mitigate the impacts. Construction contractors will be required to coordinate with the local traffic police and they will prepare Traffic Management Plan
▪ temporary silt runoff due to construction?	✓		Run-off during construction will be more. However, impacts are temporary and short in

Screening Questions	Yes	No	Remarks
			duration. The EMP ensures measures are included to mitigate the impacts. Construction contractors will be prohibited from stockpiling loose materials along drain channels and will be required to immediately dispose any waste materials.
<ul style="list-style-type: none"> <li>▪ hazards to public health due to overflow flooding, and groundwater pollution due to failure of sewerage system?</li> </ul>		✓	Not anticipated. Design life of the subproject is 30 years. Project 3 includes support to KMC in enhancing its operational capacity to ensure system will not fail.
<ul style="list-style-type: none"> <li>▪ deterioration of water quality due to inadequate sludge disposal or direct discharge of untreated sewage water?</li> </ul>		✓	Not anticipated. STP designs include sludge management and EMPs ensure mitigation measures and monitoring are implemented. The STP includes an Operation and Maintenance (O&M) Manual to ensure effluent complies with government standards.
<ul style="list-style-type: none"> <li>▪ contamination of surface and ground waters due to sludge disposal on land?</li> </ul>		✓	Not anticipated. STP designs include sludge management and EMPs ensure mitigation measures and monitoring are implemented.
<ul style="list-style-type: none"> <li>▪ health and safety hazards to workers from toxic gases and hazardous materials which maybe contained in confined areas, sewage flow and exposure to pathogens in untreated sewage and unstabilized sludge?</li> </ul>		✓	Not anticipated. Confined spaces are not applicable to the sewer network. Capacity of the STPs are designed to ensure sewerage will not overflow and sufficiently treated. Sludge, which is proposed to be reused as soil conditioner and/or fertilizer, will be treated and stabilized.
<ul style="list-style-type: none"> <li>▪ large population increase during project construction and operation that causes increased burden on social infrastructure (such as sanitation system)?</li> </ul>		✓	Priority in employment will be given to local residents. Construction contractors will be required to provide workers camp with water supply and sanitation. Mangalore ULB will provide manpower to operate the improved system.
<ul style="list-style-type: none"> <li>▪ social conflicts between construction workers from other areas and community workers?</li> </ul>		✓	Priority in employment will be given to local residents.
<ul style="list-style-type: none"> <li>▪ risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation?</li> </ul>		✓	Not applicable. Construction will not involve use of explosives and chemicals. Trenching will be done manually.
<ul style="list-style-type: none"> <li>▪ community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?</li> </ul>		✓	Operational area will be clearly demarcated and access will be controlled. Only worker and project concerned members will be allowed to visit the operational sites.

### A Checklist for Preliminary Climate Risk Screening

**Country/Project Title:** India/ Construction of STP

**Sector :** Urban Development

**Subsector:** Waste water

**Division/Department:** Kolkata Municipal Corporation

Screening Questions	Score	Remarks <sup>a</sup>
<p><b>Location and Design of project</b></p>	<p>Is siting and/or routing of the project (or its components) likely to be affected by climate conditions including extreme weather related events such as floods, droughts, storms, landslides?</p>	<p>1</p> <p>The project area is vulnerable to high risks of flooding. Flooding can easily overwhelm sewage / drainage systems, including sewage treatment plant. Projected sea level rise is expected to exacerbate flooding, storm surge, as well as the risks of saltwater intrusion.</p> <p>A technical assistance on Strengthening Climate Resilience of Kolkata City through Improved Planning, Flood and Disaster Risk Management, through the UCCRTF, aims to support the EA in further strengthening its climate resilience through: (i) implementation of early flood warning system and (ii) capacity development in climate resilient planning and disaster management. The TA will provide some physical investment (e.g., software and hardware for the early warning systems, as well as non-physical investments such as hydraulic modeling, installation of systems, and capacity development, etc.</p>
	<p>Would the project design (e.g. the clearance for bridges) need to consider any hydro-meteorological parameters (e.g., sea-level, peak river flow, reliable water level, peak wind speed etc.)?</p>	<p>1</p> <p>The increased frequency of heavy rainfall leads to severe flooding and waterlogging in the city. Impacts include increased flooding, increased siltation and blockage of drainage.</p> <p>Increased cyclone intensity will lead to possible high storm surges resulting to infrastructure damage, e.g. clogging of drainage systems. Inundation of low-lying treatment facilities and outfall may require relocations</p>

Screening Questions		Score	Remarks <sup>a</sup>
			<p>and cause discharge to back flow, respectively.</p> <p>Proposed investments will not pass through major cross drainages and river. Pipes are designed to handle peak flow demands.</p> <p>Examples of measures adopted while designing the sewerage and drainage network, associated facilities such as pumping stations, and water supply system, include hydraulic modelling and sizing of systems using increased precipitation scenarios, prioritizing areas with higher risks of increased inundation, constructing all pipes below ground, avoiding flood plains for siting of any pumping stations or associated structures, among others.</p>
<b>Materials and Maintenance</b>	Would weather, current and likely future climate conditions (e.g. prevailing humidity level, temperature contrast between hot summer days and cold winter days, exposure to wind and humidity hydro-meteorological parameters likely affect the selection of project inputs over the life of project outputs (e.g. construction material)?	0	No significant effect
	Would weather, current and likely future climate conditions, and related extreme events likely affect the maintenance (scheduling and cost) of project output(s)?	0	No significant
<b>Performance of project outputs</b>	Would weather/climate conditions, and related extreme events likely affect the performance (e.g. annual power production) of project output(s) (e.g. hydro-power generation facilities) throughout their design life time?	1	<p>Blockage of drainage/sewage systems likely to become more frequent in the future due to increased flooding.</p> <p>Regular maintenance activities are incorporated in the EMP</p>

<sup>a</sup> If possible, provide details on the sensitivity of project components to climate conditions, such as how climate parameters are considered in design standards for infrastructure components, how changes in key climate parameters and sea level might affect the siting/routing of project, the selection of construction material and/or scheduling, performances and/or the maintenance cost/scheduling of project outputs.

Options for answers and corresponding score are provided below:

Response	Score
Not Likely	0
Likely	1
Very Likely	2

Responses when added that provide a score of 0 will be considered low risk project. If adding all responses will result to a score of 1-4 and that no score of 2 was given to any single response, the project will be assigned a medium risk category. A total score of 5 or more (which include providing a score of 1 in all responses) or a 2 in any single response, will be categorized as high risk project.

**Result of Initial Screening (Low, Medium, High):** Medium Risk

**Other Comments:** Project team, with support from SARD Front Office Climate Unit, used the Climate Risk Screening Report to confirm the climate risk rating, which was “medium”.

**Prepared by:** PMU, Kolkata Municipal Corporation

## **SAMPLE TRAFFIC MANAGEMENT PLAN**

### **A. Principles**

1. One of the prime objectives of this TMP is to ensure the safety of all the road users along the work zone, and to address the following issues:

- (i) the safety of pedestrians, bicyclists, and motorists travelling through the construction zone;
- (ii) protection of work crews from hazards associated with moving traffic;
- (iii) mitigation of the adverse impact on road capacity and delays to the road users;
- (iv) maintenance of access to adjoining properties; and
- (v) Avoid hazards in addressing issues that may delay the project.

### **B. Operating Policies for Traffic Management Plan**

2. The following principles will help promote safe and efficient movement for all road users (motorists, bicyclists, and pedestrians, including persons with disabilities) through and around work zones while reasonably protecting workers and equipment:

- (i) make traffic safety and temporary traffic control an integral and high-priority element of every project from planning through design, construction, and maintenance;
- (ii) inhibit traffic movement as little as possible;
- (iii) provide clear and positive guidance to drivers, bicyclists, and pedestrians as they approach and travel through the temporary traffic control zone;
- (iv) inspect traffic control elements routinely, both day and night, and make modifications when necessary;
- (v) pay increased attention to roadside safety in the vicinity of temporary traffic control zones;
- (vi) train all persons that select, place, and maintain temporary traffic control devices;
- (vii) keep the public well informed; and
- (viii) make appropriate accommodation for abutting property owners, residents, businesses, emergency services, railroads, commercial vehicles, and transit operations.

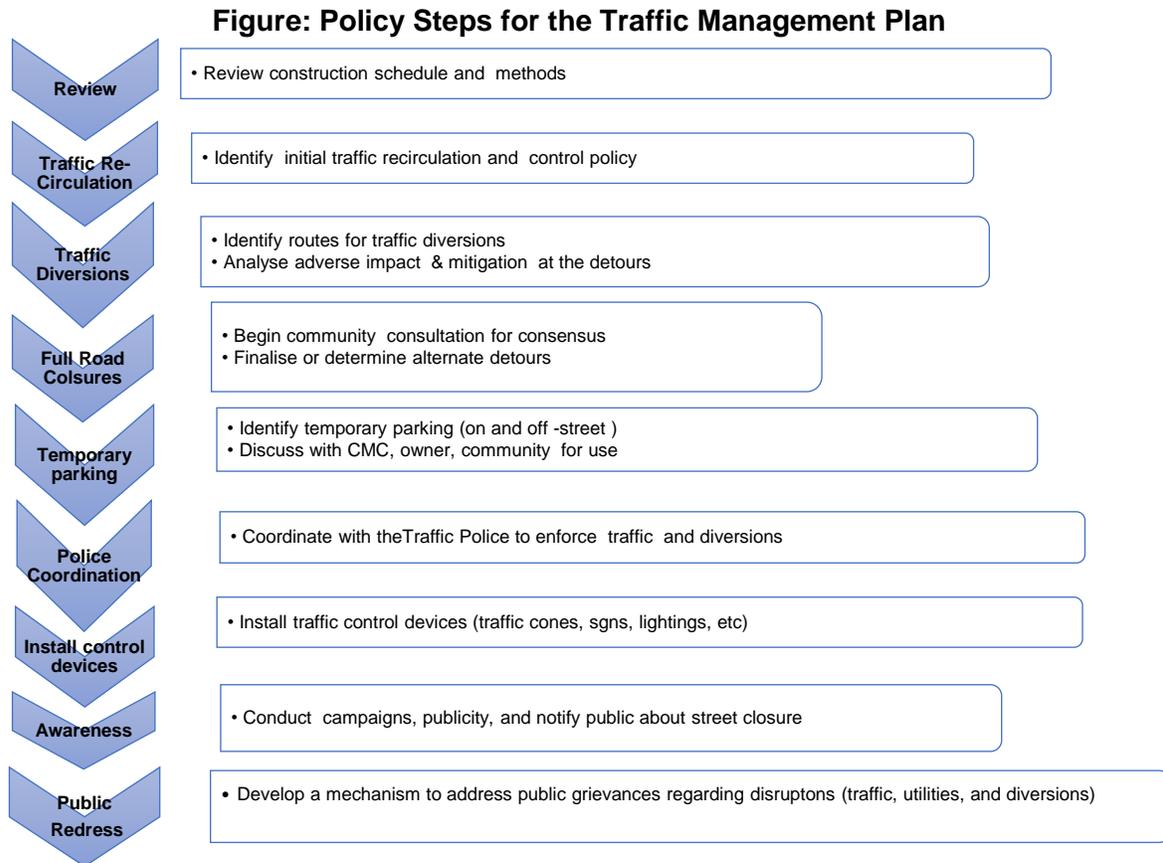
### **C. Analyze the impact due to street closure, if required**

3. Apart from the capacity analysis, a final decision to close a particular street and divert the traffic should involve the following steps:

- (i) approval from the PMU, local administration to use the local streets as detours;
- (ii) consultation with businesses, community members, traffic police, Public Works Department, etc., regarding the mitigation measures necessary at the detours where the road is diverted during the construction;
- (iii) determining of the maximum number of days allowed for road closure, and incorporation of such provisions into the contract documents;
- (iv) determining if additional traffic control or temporary improvements are needed along the detour route;
- (v) considering how access will be provided to the worksite;

- (vi) contacting emergency service, school officials, and transit authorities to determine if there are impacts to their operations; and
- (vii) developing a notification program to the public so that the closure is not a surprise. As part of this program, the public should be advised of alternate routes that commuters can take or will have to take as result of the traffic diversion.

4. If full road-closure of certain streets within the area is not feasible due to inadequate capacity of the Detour Street or public opposition, the full closure can be restricted to weekends with the construction commencing on Saturday night and ending on Monday morning prior to the morning peak period.



**D. Public awareness and notifications**

5. As per discussions in the previous sections, there will be travel delays during the constructions, as is the case with most construction projects, albeit on a reduced scale if utilities and traffic management are properly coordinated. There are additional grounds for travel delays in the area, as most of the streets lack sufficient capacity to accommodate additional traffic from diverted traffic as a result of street closures to accommodate the works.

6. The awareness campaign and the prior notification for the public will be a continuous activity which the project will carry out to compensate for the above delays and minimize public claims as result of these problems. These activities will take place sufficiently in advance of the time when the roadblocks or traffic diversions take place at the particular streets. The reason for

this is to allow sufficient time for the public and residents to understand the changes to their travel plans. The project will notify the public about the roadblocks and traffic diversion through public notices, ward level meetings and city level meeting with the elected representatives.

7. The DSC/ PMU will also conduct an awareness campaign to educate the public about the following issues:

- (i) traffic control devices in place at the work zones (signs, traffic cones, barriers, etc.);
- (ii) defensive driving behaviour along the work zones; and
- (iii) reduced speeds enforced at the work zones and traffic diversions.

8. It may be necessary to conduct the awareness programs/campaigns on road safety during construction.

9. The campaign will cater to all types of target groups i.e. children, adults, and drivers. Therefore, these campaigns will be conducted in schools and community centers. In addition, the project will publish a brochure for public information. These brochures will be widely circulated around the area and will also be available at the PIU, and the contractor's site office. The text of the brochure should be concise to be effective, with a lot of graphics. It will serve the following purpose:

- (i) explain why the brochure was prepared, along with a brief description of the project;
- (ii) advise the public to expect the unexpected;
- (iii) educate the public about the various traffic control devices and safety measures adopted at the work zones;
- (iv) educate the public about the safe road user behaviour to emulate at the work zones;
- (v) tell the public how to stay informed or where to inquire about road safety issues at the work zones (name, telephone, mobile number of the contact person; and
- (vi) indicate the office hours of relevant offices.

## **E. Vehicle Maintenance and Safety**

10. A vehicle maintenance and safety program shall be implemented by the construction contractor. The contractor should ensure that all the vehicles are in proper running condition and it comply with roadworthy and meet certification standards of West Bengal Govt./ Gol. All vehicles to be used shall be in perfect condition meeting pollution standards of West Bengal Govt./Gol. The vehicle operator requires a pre state of shift checklist. Additional safety precautions will include the requirement for:

- (i) driver will follow the special code of conduct and road safety rules of Government of India;
- (ii) drivers to ensure that all loads are covered and secured drivers to ensure operation equipment can't leak materials hauled; and
- (iii) vehicles will be cleaned and maintained in designed places.

## **F. Install traffic control devices at the work zones and traffic diversion routes**

11. The purpose of installing traffic control devices at the work zones is to delineate these areas to warn, inform, and direct the road users about a hazard ahead, and to protect them as well as the workers. As proper delineation is a key to achieve the above objective, it is important to install good traffic signs at the work zones. The following traffic control devices are used in work zones:

- (i) signs;
- (ii) pavement markings;
- (iii) channelizing devices;
- (iv) arrow panels; and
- (v) warning lights.

12. Procedures for installing traffic control devices at any work zone vary, depending on road configuration, location of the work, construction activity, duration, traffic speed and volume, and pedestrian traffic. Work will take place along major roads, and the minor internal roads. As such, the traffic volume and road geometry vary. The main roads carry considerable traffic; internal roads in the new city areas are wide but in old city roads very narrow and carry considerable traffic. However, regardless of where the construction takes place, all the work zones should be cordoned off, and traffic shifted away at least with traffic cones, barricades, and temporary signs (temporary “STOP” and “GO”).

13. The work zone should take into consideration the space required for a buffer zone between the workers and the traffic (lateral and longitudinal) and the transition space required for delineation, as applicable. For the works, a 30 cm clearance between the traffic and the temporary STOP and GO signs should be provided. In addition, at least 60 cm is necessary to install the temporary traffic signs and cones.

14. Traffic police should regulate traffic away from the work zone and enforce the traffic diversion result from full street closure in certain areas during construction. Flaggers/ personnel should be equipped with reflective jackets at all times and have traffic control batons (preferably the LED type) for regulating the traffic during night time.

15. In addition to the delineation devices, all the construction workers should wear fluorescent safety vests and helmets in order to be visible to the motorists at all times. There should be provision for lighting beacons and illumination for night constructions.

16. The PMU, DSC and contractor will coordinate with the local administration and traffic police regarding the traffic signs, detour, and any other matters related to traffic. The contractor will prepare the traffic management plan in detail and submit it along with the EMP for the final approval.

## HEALTH AND SAFETY PLAN

(To be implemented by the Construction contractor)

### A. RESPONSIBILITY AND AUTHORITY FOR EHS MANAGEMENT

#### Project In charge (PI)

- (i) the project PI will have overall responsibility of Health & Safety (H & S) Management at the site and improving safety and health in all areas. He/ She shall:
- (ii) comply with Client's requirements, HS-Policy of the company and relevant statutory requirements that are applicable to the relevant work;
- (iii) ascertain that all plants and machinery utilized at the project site meets the safety standard and are safe for use;
- (iv) get familiar with and demonstrate his commitment to continual improvement in HS performance;
- (v) ensure that all personnel are aware of commitment to environmental protection and worker safety;
- (vi) monitor HS performance of the personnel and activities under his control;
- (vii) ensure that safe system of work are implemented and maintained by the project Engineers / Supervisors / Foreman and employees at the work site;
- (viii) ensure that Site HS Plan is accessible to all relevant parties;
- (ix) ensure that sufficient induction training for all employees and workers is given before commencement of work at site and subsequently for new inductees;
- (x) undertake program of regular HS Inspection at site; and
- (xi) arrange and chair monthly Site HS Management Review Meeting.

#### Site/Front In-charge

The Site/Front In-charge will be responsible to the PI for implementation of HS operational control procedures. In the absence of PI, he/she would take control of the Site. His/Her duties are similar to that of the PI.

#### Site Engineers/Supervisors

- (i) they will be responsible to the PI / Site / Front In-charge for implementing the requirements of this plan. In particular they are required to:
- (ii) be familiar with Site HS Plan;
- (iii) maintain safe working conditions and good housekeeping in all areas under his supervision;
- (iv) enforce use of PPE as requested by Project Specific Rules and regulations;
- (v) liaise and cooperate with Site Safety HS Officer and ensure that defects brought to attention are corrected;
- (vi) immediately Inform & report to the HS-Officer while any accident, near misses, dangerous occurrence, occupational poisoning or diseases shall be noticed within the project sites;
- (vii) plan safety in accordance with the approved work methodology for daily work activities;

- (viii) prepare Standard Operating Procedure (S.O.P) and General Risk Assessment (GRA) for each activity and it should be explained to employee before begins work;
- (ix) establish and maintain proper communication with all workers with regard to EHS; and
- (x) provide proper supervision for the work.

### **Health & Safety (HS) Officer**

He will be accountable to the PI for fulfilling the duties assigned to him and ensure implementation of HS Plan.

His / Her duties will include:

- (i) monitor and advise relevant personnel on compliance with HS statutory obligations at the site;
- (ii) facilitate inclusion of safety elements into work Method Statement;
- (iii) highlight the requirement of safety through Tool-Box / other meetings;
- (iv) conduct investigation of all accident/dangerous occurrences and recommend appropriate safety measures;
- (v) advice & co-ordinate for implementation of operational control procedures etc;
- (vi) convene safety meeting & minute the proceeding for circulation & follow-up action;
- (vii) provide copies of site / office inspection report to relevant managers;
- (viii) plan procurement of PPEs and safety devices and inspect their healthiness;
- (ix) report to PI/Divisional Manager on all matters pertaining to status of safety and promotional program at site level;
- (x) facilitate administration of FIRST – AID;
- (xi) facilitate screening of workman and safety induction;
- (xii) conduct fire drill and facilitate emergency preparedness;
- (xiii) design campaigns, competitions and other special emphasis programs to promote safety in the work place;
- (xiv) notify site personnel non-conformance to safety norms observed during site visits / site inspections;
- (xv) attend and participate in Site HS Management Review Meetings;
- (xvi) access and advise PI on the perceived HS training needs of project personnel; and
- (xvii) monitor HS performance of subcontractors and make appropriate recommendations for performance improvement.

### **Employees**

All employees will be accountable for conforming to the requirement of the HS Plan and statutory requirements. In particular every employee will be required to:

- (i) take care of environmental protection and safety of himself & others;
- (ii) co-operate to fulfill statutory HS obligations;
- (iii) co-operate in pursuit of continuous HS performance Improvement; and
- (iv) conform to requirement of Project HS plan;
- (v) report defects in lifting appliances, lifting gears, transport equipments and any other equipments or tools & tackles to your immediate superior;
- (vi) not to remove or interfere with any fencing, gangway, ladder, covering, life saving appliances, lighting and other things whatsoever required by site safety rules & regulations;
- (vii) take care of personal protective equipment;

- (viii) don't let your work put another worker in danger;
- (ix) use only means of access provided for specific work at site;
- (x) avoid horseplay, practical jokes or other activities to create a hazard;
- (xi) don't use drugs or alcohol on the job;
- (xii) keep the latrines, urinals, wash points, canteen and other facilities provided in a clean and hygienic condition; and
- (xiii) report any unsafe work practice and any injury or accident to your supervisor.

## **B. SAFETY AND HEALTH OPERATIONAL CONTROL PROCEDURES**

To minimize hazards and risks, control measures shall be introduced in the following order of priority:

- (i) engineering controls;
- (ii) administrative controls; and
- (iii) PPE

## **C. SITE SAFETY RULES**

- (i) no one (including staff and workers etc.) will be allowed to enter the work site without prior induction training & without required PPE;
- (ii) before start of work every day, five minutes pre work briefing shall be conducted by each respective front engineers / supervisor with subcontractor's job supervisor present. The job to be undertaken that day shall be explained;
- (iii) once every week toolbox talks on specific topics will be conducted by the front engineer/supervisor in the presence of safety officer, all talks will be documented on the company's specified format. Toolbox talks will also be given whenever a new activity is taken up or a new gang turns up for work;
- (iv) no Staff or workers will be allowed to enter the work site or to start his everyday activity without necessary job related PPE's. If there is any non compliance, Safety Officer or Site Management will issue a warning and if it is repeated impose fine on the concerned person and concerned Sub contractors;
- (v) smoking is strictly prohibited in all parts of the worksites except specific smoking zone as authorized by the site safety dept;
- (vi) working under influence of drugs, alcohol etc. is strictly prohibited on worksite;
- (vii) carrying unwanted flammable items, explosives etc. strictly prohibited at site;
- (viii) no vehicle shall be permitted to enter the work site or introduced into the job without prior induction by the plant and safety dept;
- (ix) it is mandatory that all vehicle driver and operator of lifting equipments etc. (heavy Vehicles like JCB, Tipper, and Crane etc.) should possess valid authorization certificates from the site plant dept. before starting of their respective job;
- (x) it is mandatory that all electrical operated machinery's, equipments etc. (like Vacseal Pump, water pump, welding rectifiers/ transformers, diesel welding generators, panels, Switch gear, starter switch, D G Shed etc.) should be duly certified by Contractor's Electrical dept. prior to introduce into operation;

- (xi) prior to introduction of any lifting tools, tackles, machinery's etc. in operation it is mandatory to conduct Third Party Competent Persons checking as per requirement and the Safe Working Load (SWL) should be marked on the equipment;
- (xii) all employees including workers must know about the exact location and use of fire Fighting equipments. Never restrict the access towards the firefighting equipment, always keep the access free from any obstructions;
- (xiii) considering emergency situation always keep the access around the work site area free from any obstruction for rescue operation;
- (xiv) everyone including workers should inform about the accident / incident and dangerous Occurrence to Site In charge, Site Engineer & Safety Officer;
- (xv) always stay alert and keep your mind on the work, when you are engaged in the site work;
- (xvi) before starting of everyday work, routine checking of lifting equipments, Tools & Tackles, Winch, all types of pumps etc. to be done by concern Engineer, Supervisor and Worker;
- (xvii) don't carry out unfamiliar work without proper instruction. Any error due to ignorance can cause serious damage;
- (xviii) when working at site especially around the moving machinery's, operating winch machine etc., wearing of loose clothing like dhoti, lungi, open sleeve shirt etc. are strictly prohibited;
- (xix) don't leave any tools or materials haphazardly, where they can cause obstruction and create tripping hazards;
- (xx) all platforms, walkways, gangways, ramp, work area etc. must be kept clear at all time;
- (xxi) during gas cutting uses of FLASH BACK ARRESTOR / non return valve are mandatory on each cylinder s & torch side;
- (xxii) it is mandatory to use of Earth Leakage Circuit Breaker (ELCB) / Miniature Circuit Breaker (MCB) / Residual Current Circuit Breaker (RCCB) etc. on all site temporary electrical facilities;
- (xxiii) always use minimum three cores double insulated cables for site electrification job;
- (xxiv) during lifting a load by a crane use of guy rope on both ends is mandatory;
- (xxv) never use compressed air for cleaning of your clothes or getting relief from excessive heat;
- (xxvi) it is mandatory to install Reverse Horn on all vehicles (Like JCB, Tipper and site vehicle) and swing horn & over hoist limit switches for lifting equipments like Cranes;
- (xxvii) all materials must be stored in a safe manner and height of stacking should be maintained (below the man height) to protect collapsing of the stack and when material shifting work is carried out manually;
- (xxviii) horseplay inside the site during or after the job is strictly prohibited;
- (xxix) never roll the compressed gas cylinders (DA & O<sub>2</sub>) at site, either shift it manually or by gas trolley. Use of gas trolley is mandatory for all cutting sets;
- (xxx) keep all gas cylinders inside proper shed in upright condition and lock it properly;

- (xxxix) keep Diesel / Oil in its tank under the shed. Use oil spill trays below diesel tanks;
- (xxxixii) follow the speed limit of 20 Km/hr inside the work premises religiously;
- (xxxixiii) maintaining hygienic environment at camp site; and
- (xxxixiv) consideration of women worker health at working place.

#### **D. FIRST - AID FACILITIES AND MEDICAL TREATMENT**

- (i) each worksite/area shall be equipped with it's a first aid box catering to the needs of particular work front;
- (ii) medical causality evacuation and treatment procedures involving the nearest clinic / Hospitals shall be instituted; and
- (iii) appointment of trained first aider.

#### **E. EMERGENCY PREPAREDNESS AND RESPONSE PLAN**

##### ***Approach***

The aim of this emergency preparedness and response plan is to guide personnel in an accident or emergency situation to prevent or minimize injury, damage and material loss and also to prevent or mitigate environmental impact from the accident or emergency.

##### ***Emergency Preparedness facility***

Following emergency preparedness facilities have been provided at the site:

- (i) all the buildings and structures are well supplied with fire fighting devices;
- (ii) proper security arrangements are functioning round the clock;
- (iii) there is quick and efficient transport as well as communication system;
- (iv) smoking is prohibited throughout the flammable premises;
- (v) water is kept available for firefighting purpose;
- (vi) sufficient number of trained manpower is available to extinguish any fire and attend emergency;
- (vii) sufficient number of Personal Protective Equipment like helmet and gloves are available;
- (viii) audible emergency alarm/whistles are provided;
- (ix) first Aid Kit is available;
- (x) all key personnel have been provided communication mean such as telephone / walkie-talkie / mobiles. Any message can be communicated immediately;
- (xi) all work fronts / floating crafts will have emergency lights and Torches;
- (xii) all exit doors are kept unobstructed;
- (xiii) it is ensured that access to fire extinguishers is not obstructed;
- (xiv) proper containers are used for flammable liquids;
- (xv) safe distance of POL is maintained from any point of ignition;
- (xvi) welding and cutting equipment is checked before and after use;
- (xvii) main electrical equipment is switched off when not in use;
- (xviii) all workers and staff are familiarized with the firefighting system;
- (xix) escape routes are well defined;
- (xx) the POL dumps and gas cylinders are barricaded; and
- (xxi) fire extinguishers are refilled on time.

<b>Sr. No.</b>	<b>Item</b>	<b>Nos.</b>	<b>Location</b>
1	First aid kits	01 each	In all work fronts
3.	Sand / Fire buckets	As required	Store/workshop/office/ Site office container/ All DG Rooms / casting Yard etc.,
4	Fire Extinguishers	As required	Store/workshop/office/ Site office container/ All DG Rooms / casting Yard etc.,
5	Safety Helmets	Depends on no. of labour	Site Store
6	Safety Shoes Pairs	10 Nos. (Each sizes)	Site Store
7	STRETCHERS	4-6 Nos.	First Aid room / Ambulance / Store
8	OIL SPILL ABSORBENT MATERIALS (HESIAN CLOTH / FOAM)	Sufficient Quantity	Site Store

**F. Reporting System for Emergency**  
**Important Telephone Numbers of Persons at Corporate /Division Level**

Local Fire Station
Private Hospital
Police Station

## OUTLINE OF SPOIL MANAGEMENT PLAN

### 1.0 Purpose and application

SMP is to describe how the project will manage the spoil generated and reuse related to design and construction works. This is an integral part of EMP. The objective of SMP is to reuse of spoil from works in accordance with the spoil management hierarchy outlined in this document.

### 2.0 Objectives of Spoil Management Plan:

The objectives of SMP are:

- (i) to minimize spoil generation where possible;
- (ii) maximize beneficial reuse of spoil from construction works in accordance with spoil management hierarchy;
- (iii) manage onsite spoil handling to minimize environmental impacts on resident and other receivers;
- (iv) minimize any further site contamination of land, water, soil; and
- (v) manage the transportation of spoil with consideration of traffic impacts and transport related emissions.

### 3.0 Structure of Spoil Management Plan:

Section 1: Introduction of SMP

Section 2: Legal and other requirements

Section 3: Roles and responsibilities

Section 4: Identification and assessment of spoil aspects and impacts

Section 5: Spoil volumes, characteristics and minimization

Section 6: Spoil reuses opportunities, identification and assessment

Section 7: On site spoil management approach

Section 8: Spoil transportation methodology

Section 9: Monitoring, Reporting, Review, and Improvements

### 4.0 Aspects and Potential Impacts

The key aspects of potential impacts in relation to SMP are listed in table below

<b>Aspects</b>	<b>Potential Impacts</b>
Air Quality	Potential for high winds generating airborne dust from the stock piles
Sedimentation	Potential for sediment laden site runoff from spoil stockpiles and potential for spillage of spoil from truck on roads
Surface and Groundwater	Contamination of water (surface and ground water)
Noise	Associated with spoil handling and haulage and storage
Traffic	Impacts associated with spoil haulage
Land Use	Potential for spoil to be transported to a receivable site that doesn't have permission for storage/disposal
Design specifications	Limitations on opportunities to minimize spoil generation
Sustainability	Limited sites for storage, reuse opportunities

## 5.0 Spoil volumes, characteristics and minimization

5.1 Spoil volume calculations: Estimate the volumes of spoils produced from each of the construction sites.

5.2 Characterization of spoil: Based on the type of spoil; characterization is done (sand stone, mud mix materials, reusable materials)

## 5.3 Adopt Spoil Reduce, Reuse Opportunities

An overview of the assessment methodology to be used is mentioned below:

- (i) consideration of likely spoil characteristics;
- (ii) identification of possible reuse sites; and
- (iii) screening of possible reuse opportunities.

5.4 Identification of possible safe disposal sites for spoil: Those spoils, which cannot be reuse, shall be properly disposed in designated areas, such disposal areas should be identified in project locations. Such disposal areas should be safe from environmental aspects and there should be any legal and resettlement related issues. Such areas need to be identified and prior cliental approval should be obtained to use it as spoil disposal area. The local administration must be consulted and if required permission should be obtained from them.

## 5.5 Storage and stock piling

## 5.6 Transportation and haulage route

6.0 Based on the above, the contractor will prepare a SMP as an integral part of EMP and submit it to the DSC for their review and approval.

## STAKEHOLDERS MINUTES OF THE MEETING

### A. Summary of Stakeholder Consultation

Date	Location	Number of Participants				Participant Details	Key Discussions
		Male	Female	% of Female	Total		
08 July 2017	Bank Plot near Bank plot STP	3	18	86%	21	Local residents, shop owners, housewives, businessmen, Service men, representatives of KEIIP and Contractors	<ul style="list-style-type: none"> <li>✓ Suitable wastewater treatment technology will be selected adhering to latest discharge norms by CPCB</li> <li>✓ it will be ensured that the technology selected can be executed within the land area available for treating the command area's dry weather flow (DWF)</li> <li>✓ The subproject will provide a wastewater discharge in the canals and water bodies of Kolkata which will ensure amelioration of its water quality</li> <li>✓ Short term impact on air quality- dust generation, noise level, access problem, inconvenience for public and movement of vehicle.</li> <li>✓ Application of mitigation measures as per EMP to mitigate short term impact</li> <li>✓ The project work will reduce environmental impact/ health problems that is caused by open discharge of domestic wastewater</li> <li>✓ It will be ensured that river Ganga is not polluted which is a priority of the state and national government.</li> </ul>



**Community Consultation**

### List of Participant

#### KOLKATA ENVIRONMENTAL IMPROVEMENT INVESTMENT PROGRAMME

#### List Of Participants In Community Consultation

Date: 8.7.17

Place: Kuli Ful

Sl. No.	Name	Signature
1	Chunuki Halder	Chunuki Halder
2	Smrita Gayen	স্মিটা গায়ন
3	Smrita Bayen	স্মিটা বায়েন
4	Chhanda Naskar	চন্দা নস্কর
5	Pushpa Das	পুষ্পা দাস
6	Sandhya Naskar	Sandhya Naskar
7	Prakash Karmakar	প্রকাশ কর্মকার -
8	Paarul Karmakar	পারুল কর্মকার
9	Punpa Karmakar	পুন্পা কর্মকার
10	Jumpa Karmakar	জুন্পা কর্মকার
11	Gitu Prakash Hela	গিতা প্রকাশ
12	Bhagwan Hela	ভগবান হেলা
13	Raju Jena	Raju
14	Ritu Halder	রিটু হালদার
15	Jhuma Saha	জুমা সাহা



**GRIEVANCE REDRESSAL MECHANISM OF KOLKATA ENVIRONMENTAL IMPROVEMENT INVESTMENT PROGRAM – APPROVAL NOTICE**

**GRIEVANCE REDRESSAL MECHANISM OF KEIIP WORKS**

- Display of address of Contractors' site office at all work locations.
- ( At Contractors' site office Complaint & Suggestion Books are to be made available for lodging any complaint. The concerned Executive Engineer of KEIIP to periodically monitor these Books and take necessary actions for redressal with intimation to the complainant.
- At every Borough under which works are under progress, a Public Relation & Grievance Redressal Unit, comprising of a few KEIIP staff to be established for availing detailed information of the works, registering of complaint and act as Liaison for its redressal under intimation to the complainant.)
- In KEIIP office at 206, A.J.C. Bose Road, Kolkata - 700 017, the Administrative Officer, KEIIP will be In-charge of the grievance redressal matters under the Project Director.
- Complaints may also be lodged through KEIIP website and KMC website.
- Through KMC WhatsApp no. 8335988888, all complaints relating to KEIIP will be sent to the Project Director, KEIIP for redressal.
- A Grievance Redressal Committee (GRC) has been constituted consisting of :
  - 1) Administrative Officer, KEIIP - Member
  - 2) Dy. C.E.(I), KEIIP - Member
  - 3) Social Safeguard Specialist, KEIIP -Member
  - 4) Environmental Specialist, KEIIP -Member
  - 5) Special Officer (Coord.), KEIIP - Member Secretary (Convener)
  - 6) Team Leader, DSC, KEIIP - Member

under the Project Director, KEIIP for regular monitoring of the entire process.

TL/DSC may ensure 'x' above.

Di: 12.08.2015

TL/DSC  
AO ✓  
SO/C

As proposed. AO & SO/C will please also take necessary action as proposed above.

12/8/15

**SAMPLE GRIEVANCE REGISTRATION FORM**

(To be available also in Bengali, Hindi)

The \_\_\_\_\_ Project welcomes complaints, suggestions, queries and comments regarding project implementation. We encourage persons with grievance to provide their name and contact information to enable us to get in touch with you for clarification and feedback.

Should you choose to include your personal details but want that information to remain confidential, please inform us by writing/typing **\*(CONFIDENTIAL)\*** above your name. Thank you.

Date		Place of registration			
Contact Information/Personal Details					
Name		Gender	* Male * Female	Age	
Home Address					
Village / Town					
District					
Phone no.					
E-mail					
Complaint/Suggestion/Comment/Question Please provide the details (who, what, where and how) of your grievance below:					
If included as attachment/note/letter, please tick here:					
How do you want us to reach you for feedback or update on your comment/grievance?					

**FOR OFFICIAL USE ONLY**

Registered by: (Name of Official registering grievance)	
Mode of communication: Note/Letter E-mail Verbal/Telephonic	
Reviewed by: (Names/Positions of Official(s) reviewing grievance)	
Action Taken:	
Whether Action Taken Disclosed:	Yes No
Means of Disclosure:	

## MONTHLY ENVIRONMENTAL MONITORING REPORT – FORMAT

### ENVIRONMENTAL MONITORING AND EVALUATION

#### MONTHLY ENVIRONMENTAL COMPLIANCE MONITORING FORMAT FOR SUB-PROJECT

<b>SECTOR:</b>
<b>MONTH/YEAR:</b>
<b>PROJECT (PACKAGE):</b>
<b>WORKING LOCATION:</b>
<b>DATE OF OBSERVATION:</b>
<b>NAME OF THE MONITORING PERSON FROM DSC (Designation):</b>

Sr. No.	Environmental Issues	Level of application of EMP					Suggestion/Remarks
		Poor	Below Satisfactory	Partially satisfactory	Satisfactory	Excellent	
<b>1.</b>	<b>Mitigation/protection of Land Environment</b>						
1a	Proper storage of construction materials and petroleum products –avoidance of land pollution						
1b	Conservation of top soil						
1c	Proper disposal of unusable soils and spoils to pre-approved disposal sites						
1d	Storm water control and wind screening to prevent soil loss from the site.						
<b>2.</b>	<b>Mitigation/protection of Air Environment</b>						
2a	Water sprinkling at construction site for arresting dust (if any during dry period)						
2b	Cover or damp down sand stockpiled at site						
2c	Utilize screen by using wooden supports and shade cloth where dust is unavoidable in residential/ commercial /sensitive receptors areas						
2d	Keep vehicles and machinery in good working order and meet manufacturers specifications for safety, fuel consumption etc						
2e	Covering of materials carrying vehicles-reducing dust hazard						
2f	Vehicles and Equipments having Pollution Under Control Certificate						
2g	No fires are allowed on site						
2h	Carrying out air quality monitoring						
<b>3.</b>	<b>Mitigation of Noise</b>						
3a.	Regular maintenance of noise producing equipment						
3b.	At sensitive locations enclosures provided around generator set and other noise producing machinery						

Sr. No.	Environmental Issues	Level of application of EMP					Suggestion/Remarks
		Poor	Below Satisfactory	Partially satisfactory	Satisfactory	Excellent	
3c.	Use of ear plug by the workers at noise generating location						
3d	Locate concrete batching, asphalt, crushing plants, lay down areas and construction camps away from sensitive receptors						
3e	Plan construction activities to reasonable working hours where near sensitive receptors.						
3f	Fit and maintain silencers to all machinery on site						
3g	Monitor noise levels in potential problem areas						
<b>4.</b>	<b>Mitigation/protection of Water Environment</b>						
4a.	Protection of water bodies nearby the project site by application of suitable mitigation measures- not to discharge waste water in nearby water body						
4b	Chemicals or hazardous substances do not contaminate the water body, or groundwater on site.						
<b>5.</b>	<b>Mitigation/protection of Biological Environment</b>						
5a	Vegetation clearing and tree-felling have prior permission as the work front progresses.						
5b.	Plant and maintain five trees for every one removed- in case of tree felling (if any)						
5c	Clearing of indigenous vegetation is kept in a nursery for use at a later stage (such as site rehabilitation process)						
<b>6.</b>	<b>Mitigation of Socio-economic Environment</b>						
6a.	Level of mitigation measures for local people- placement of caution tape and barricade at excavated area						
6b.	Avoidance of pick traffic hour for carrying of materials like pipe						
6c.	Arrangement of employment at least 50% of workforce from communities near sites						
<b>7.</b>	<b>Mitigation of overall environment, safety and health</b>						
7a.	Use of Personal Protective Equipment like helmet, gumboot, gloves, nose mask, safety belt and earplugs at working place						

Sr. No.	Environmental Issues	Level of application of EMP					Suggestion/Remarks
		Poor	Below Satisfactory	Partially satisfactory	Satisfactory	Excellent	
7b.	Provision of warning signs of hazardous working areas						
7c.	Visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas						
7d.	Maintaining safety during movement of equipment						
7e	Arrangement of First Aid box and fire extinguisher at Labour camp and site office and First Aid box at all working sites						
7f	Use of modern vehicles and machinery and maintain as specified						
7g.	Demarcation of excavations and provide barriers (not just danger tape) to protect pedestrians from open trenches.						
7h.	Enclosure at construction site						
7i	Placement of public information board with mention of safety requirement at working places						
7j	Boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage						
8	<b>Material Management</b>						
8a	Storage of stockpiles. Stockpiles do not obstruct natural water pathways						
8b	Exposure of stockpile to windy conditions or heavy rain with vegetation, cloth, or tarps.						
8c	Proper transportation of hazardous materials						
9	<b>Camp site Management</b>						
9a	Camp and working areas are kept clean and tidy						
9b	Proper drainage of the camp site						
9c	Discharge into neighbours' properties.						
9d	Maintenance of toilets in a clean state						
9e	Maintenance of eating area						
9f	Arrangement of solid waste collection bin, dispose wastes at the pre-approved sites						
9g	Collection of litter from the work and camp areas						

Sr. No.	Environmental Issues	Level of application of EMP					Suggestion/Remarks
		Poor	Below Satisfactory	Partially satisfactory	Satisfactory	Excellent	
<b>8.</b>	<b>Mitigation of Sensitive environment</b>						
8a.	Level of protection at religious, cultural and historic sites if any nearby						
8b.	Maintaining working schedule by avoiding sensitive time						

**Note: Put ✓ mark in EMP application column**

Remarks column need to be filled up considering present state along with suggestion and site photos

For each sub-project monitoring should be done at all the working sites

Suggestion should be provided against EMP application level

In case of non applicable – please write NA/NR in Remarks column

**(Name & Signature of monitoring person of DSC)**

**(Name & Signature of Safety Officer of Contractor)**

**(Name and Signature of TL/Dy TL DSC/ Environment Specialist of DSC)**

**(Name & Signature of Environment Specialist of PMU)**

## ENVIRONMENTAL MONITORING FORMAT - SEMI ANNUAL

### I. INTRODUCTION

#### A. Background

Overall project description, objectives and outputs

#### B. Report purpose

Environmental category of the sub-projects

### II. IMPLEMENTATION PROGRESS

#### i. Status of Subprojects

Description and Status of sub project- under implementation or to be awarded

##### Summary of Subprojects

Sr. No.	Package No.	Components	Status

##### Status of Awarded Sub-project Under the Program

Package No.	Component	Start Date	Number of Days/Months to Complete Work	Target date of completion	% Physical Progress on report date	Works Completed on report date

#### B Compliance of Safeguard Loan Covenants

Table provides a summary of compliance to the loan covenants related to environmental safeguards.

No. (List schedule and paragraph number of Loan Agreement)	Covenant	Status of Compliance	Action Required

#### C Implementation Arrangement

- (i) Implementation arrangement of environment monitoring;
- (ii) Responsibility of contractor, project management authority and design and monitoring consultant; and
- (iii) Details safeguard team of the project.

### III. ENVIRONMENTAL PROCEDURE REVIEW

#### A Environmental Legal Requirement

Provides a list of national and state laws, rules, policies and regulations applicable to program

### Environmental Legal Requirements Applicable to Specific Project

Component	Applicable Legislation	Compliance	Action Required

#### B Compliance with Environmental Legal Requirements

Describe present status of Environment, forest and other clearances are mentioned below.

Status of Compliance with National and State Legal Requirements upto report period

Package	Main package work	National and State Legal Requirement	Status	Conditions of the Clearance/NOCs

### IV. COMPLIANCE STATUS WITH THE ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

There should be reporting on the following items which can be incorporated in the checklist of routine Environmental Site Inspection Report followed with a summary in the semi-annual report send to ADB. Visual assessment and review of relevant site documentation during routine site inspection needs to note and record the following:

- (i) what are the dust suppression techniques followed for site and if any dust was noted to escape the site boundaries?
- (ii) if muddy water was escaping site boundaries or muddy tracks were seen on adjacent roads;
- (iii) adequacy of type of erosion and sediment control measures installed on site, condition of erosion and sediment control measures including if these were intact following heavy rain;
- (iv) are there designated areas for concrete works, and re-fuelling?
- (v) are there spill kits on site and if there are site procedures for handling emergencies;
- (vi) is there any chemical stored on site and what is the storage condition?
- (vii) is there any dewatering activities if yes, where is the water being discharged;
- (viii) how are the stockpiles being managed?
- (ix) how is solid and liquid waste being handled on site?
- (x) review of the complaint management system;
- (xi) checking if there are any activities being under taken out of working hours and how that is being managed.

Package wise compliance status as per site specific EMP. Blank sample monitoring table as follows,

**Blank Summary Monitoring Table –Sewerage & Drainage sub project- Sewage Treatment Plant**

**Table A15.1. Pre-construction Stage**

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
Utilities/Tree cutting	(i) Identify and include locations and operators of these utilities in the detailed design documents to prevent unnecessary disruption of services during construction phase; and (ii) Require construction contractors to prepare a contingency plan to include actions to be done in case of unintentional interruption of services. (iii) Collection of tree cutting permission with assistance PMU/DSC						
Traffic Management	(i) Prepare a short traffic management schedule during preconstruction phase.						
Social and Cultural Resources	(i) Consult Archaeological Survey of India (ASI) or concerned department in Kolkata to obtain an expert assessment of the archaeological potential of the site; (ii) Consider alternatives if the site is found to be of medium or high risk; (iii) Develop a protocol for use by the construction						

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
	contractors in conducting any excavation work, to ensure that any chance finds are recognized and measures are taken to ensure they are protected and conserved.						
Construction work camps, hot mix plants, stock pile areas, storage areas, and disposal areas.	(i) Prioritize areas within or nearest possible vacant space in the subproject location; (ii) If it is deemed necessary to locate elsewhere, consider sites that will not promote instability and result in destruction of property, vegetation and drinking water supply systems; (iii) Do not consider residential areas; (iv) Take extreme care in selecting sites to avoid direct disposal to water body which will inconvenience the community; and (v) Avoid setting up of labour camp near river						
Sources of Materials	(i) Prioritize sites already permitted by the Mining Department; (ii) If other sites are necessary, inform construction contractor that it is their responsibility to						

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
	verify the suitability of all material sources and to obtain the approval of SIPMIU and (iii) If additional quarries will be required after construction is started, inform construction contractor to obtain a written approval from PMU						

DSC = Design Supervision Consultant, PMU = Project Management Unit

**Table A15.2. Construction Stage**

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
Climate	Consider seasonal climatic variations during scheduling of construction activities in the area. Do excavations and other clearing activities only during agreed working times and permitted weather conditions. Implement storm water control as per method approved by PMU. No open fires permitted on site						

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
Air Quality	<p>Guidelines that deal with the control of air pollution and dusts on site have been outlined in the Environmental Management Plan (EMP)</p> <p>Ensure compliance with the Air Act.</p> <p>Ensure compliance with emission standards</p> <p>Undertake monitoring of air pollution levels in potential problem areas.</p> <p>Manage (including storage, transport, handling and disposal) hazardous substances used.</p> <p>Avoid dust generating construction activities during strong winds.</p> <p>Cover soil loads in transit.</p> <p>Cover stockpiles of soil or apply suitable dust palliative such as water or commercial dust suppressants.</p> <p>Regularly service vehicles off-site in order to limit gaseous emissions.</p> <p>No open fires permitted on site</p> <p>Place portable toilets on-site and maintain on a daily basis.</p>						

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
Geology and soil	<p>The design of the site drainage system is adequate to control runoff from the micro-tunnels and open areas in line with topographical features of the site.</p> <p>Rehabilitate all sites during construction including construction camps, stockpile area, temporary access and hauling routes, as soon as possible after the disturbance has ceased.</p> <p>Contractor to exercise strict care in the disposal of construction waste, with proof of disposal at an approved site provided after offloading each waste load and this logged/registered.</p> <p>Contain contaminated water and dispose off site at an approved disposal site in consultation with WBPCB.</p> <p>Dispose of waste from the oil interceptors only through suitable waste-handling contractor and request for safe disposal certificates.</p> <p>Mix cement, concrete and chemicals on a concrete plinth and</p>						

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
	<p>contain spillages or overflows into the soil. Do not allow vehicle maintenance on site. If oil spills occur, dispose contaminated soil at a disposal site in consultation with WBPCB.</p> <p>Stockpile subsoil and overburden in all construction and lay down areas. Protect topsoil and subsoil from contamination. Return for backfilling in the correct soil horizon order.</p>						
Drainage and hydrology	<p>The site surface has been engineered and shaped in such a way that rapid and efficient evacuation of runoff is achieved.</p> <p>Provide containment areas for potential pollutants at construction camps, refueling, depots, asphalt plants and concrete batching plants.</p> <p>Implement waste management practices. Control and manage transport, storage, handling and disposal of hazardous substances.</p>						

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
Biodiversity Fauna and Flora	<p>Permission will be obtained (if required) from the PMU for the cutting/felling of trees prior to start of civil works.</p> <p>Ensure any landscaping to be undertaken will be done with locally indigenous species and low maintenance requirements.</p>						
Land uses	<p>PMU has consulted with various organizations, departments, etc within the area and will be continued during the construction phase.</p> <p>Put a sign of "Keep Clear" near critical roads (e.g. in front of fire and police stations and hospitals).</p> <p>Consult with local departments, organizations, etc regarding location of construction camps, access and hauling routes, and other likely disturbances during construction.</p> <p>Provide clear and realistic information regarding detours and alternative accesses for local communities and businesses in order to</p>						

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
	<p>prevent unrealistic expectations. Provide clear and realistic information regarding employment opportunities and other benefits for local communities in order to prevent unrealistic expectations. Make use of local labor, materials, goods and services as far as possible Provide walkways and metal sheets where required to maintain access across for people and vehicles. Increase workforce in front of critical areas such as institutions, place of worship, business establishment, hospitals, and schools. Consult businesses and institutions regarding operating hours and factoring this in work schedules. Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.</p>						
Infrastructure and Services	Undertake utility shifting prior to commencing						

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
	<p>pipe laying/micro-tunneling.                      Keep construction-related disturbances to a minimum.                      Consult with affected service providers regarding impacts on access to infrastructure and services and alternatives.                      Consult with affected communities or businesses prior to foreseeable disruptions, for example notifying residents of a temporary severance of water supply.                      Provide backup or alternative services during construction-related disruptions, for example by providing generators for power supply.                      Provide access points to infrastructure and services.                      Monitor complaints by the public.</p>						
Traffic	<p>Reroute traffic and close roads according the Traffic Management Plan (TMP). The objective of the TMP is to ensure safety of all the road-users along the</p>						

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
	<p>work zone and to address: (i) protection of work crews from hazards associated with moving traffic; (ii) mitigation of the adverse impact to the road capacity and delays to the road-users; (iii) maintenance of access to adjoining properties; and (iv) issues that may delay the subproject works.</p> <p>Negotiate with privately-owned public transport operators regarding the affected public transport facilities and routing.</p> <p>Negotiate with business owners and social service operations regarding the loss of parking and loading bays.</p> <p>Clear roads signs will be erected for the full length of the construction period. Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.</p> <p>Ensure the City Traffic Police will be available on site.</p>						

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
	<p>Communicate road closure together with the proposed detour via advertising, pamphlets, radio broadcasts, road signage, etc. The implementation of the road detour is also dependent on advance road signage indicating the road detour and alternative routes.</p> <p>Define clearly construction routes.</p> <p>Strictly control access of all construction and material delivery vehicles.</p> <p>Enforce speed limits.</p> <p>Do not allow deliveries during peak traffic hours</p>						
Health and Safety	<p>Implement good housekeeping practices at the construction camp.</p> <p>Strictly implement health and safety measures and audit on a regular basis.</p> <p>Secure enclosed construction site.</p> <p>Use reputable contractors.</p> <p>Provide warning signs of hazardous working areas.</p> <p>Clearly demarcate excavations and provide</p>						

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
	<p>barriers (not just danger tape) to protect pedestrians from open trenches.</p> <p>Thoroughly train workers assigned to dangerous equipment. Workers have the right to refuse work in unsafe conditions.</p> <p>Undertake waste management practices (Planned disposal of sludge from STP) particularly for STP</p> <p>Control speed and movement of construction vehicles</p> <p>Exclude public from the site</p> <p>Ensure all workers are provided with and use Personal Protective Equipment.</p> <p>Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas</p> <p>Ensure that qualified first-aid can be provided at all times. Ensure equipped first-aid stations are easily accessible throughout the site;</p>						

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
	<p>Provide medical insurance coverage for workers.</p> <p>Provide clean eating areas where workers are not exposed to hazardous or noxious substances;</p> <p>Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted;</p> <p>Ensure moving equipment is outfitted with audible back-up alarms;</p> <p>Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate.</p>						

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
Noise and Vibrations	<p>Locate concrete batching, asphalt, crushing plants, lay down areas and construction camps away from sensitive receptors.</p> <p>Restrict construction activities to reasonable working hours where near sensitive receptors.</p> <p>Keep adjacent landowners informed of unusually noisy activities planned.</p> <p>Regulate roadworthiness of vehicles.</p> <p>Ensure that machinery in a good state of maintenance.</p> <p>Fit and maintain silencers to all machinery on site.</p> <p>Monitor noise levels in potential problem areas.</p>						
Aesthetics, Landscape Character, and Sense of Place	<p>Properly fence off storage areas.</p> <p>Collect all domestic solid waste central point of disposal and feed into the city waste collection system.</p> <p>Contractor to exercise strict care in disposing construction waste.</p> <p>Identify suitable waste disposal site with</p>						

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
	<p>enough capacity to hold additional waste to be generated by the construction activities.                      Retain mature trees on and around the site where possible.                      Remove unwanted material and litter on a frequent basis.</p>						
Workers Conduct	<p>Ensure strict control of laborers                      Minimize working hours to normal working times                      Control littering                      Ensure no overnight accommodation is provided.</p>						
Employment Generation	<p>Employ local (unskilled) labor if possible                      Training of labor to benefit individuals beyond completion of the subproject.                      Ensure recruitment of labors will take place offsite.                      Ensure at least 50% of all labor is from surrounding communities in the contractual documentation.</p>						
Archaeological and Cultural Characteristics	<p>Ensure that construction staff members are aware of the likelihood of heritage resources</p>						

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
	<p>being unearthed and of the scientific importance of such discoveries. Contact ASI or the State Department of Archaeology if any graves be discovered and all activities will be ceased until further notice.</p> <p>Contact ASI or the State Department of Archaeology if any heritage resources or objects, defined in the Act, be discovered and all activities will be ceased until further notice.</p> <p>Cease all activities immediately and do not move any heritage object found without prior consultation with ASI or the State Department of Archaeology</p>						

DSC = Design Supervision Consultant, H&S = health and safety, RPM = respirable particulate matter., SPM = suspended particulate matter, PMU = Project Management Unit; PIU = Project Implementation Unit.

**Table A15.3. Defects Liability and Operation Stage**

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
Air Quality	Ensure compliance with the Air Act. Ensure compliance with emission standards Regularly service vehicles off-site in order to limit gaseous emissions.						
Biodiversity Fauna and Flora	Ensure no accidental damage to local flora and fauna.						
Land Uses	Put a sign of "Keep Clear" near critical roads (e.g. in front of fire and police stations and hospitals). Consult with local departments, organizations, etc regarding location of construction camps, access and hauling routes, and other likely disturbances. Provide clear and realistic information regarding detours and alternative accesses for local communities and businesses in order to prevent unrealistic expectations. Provide walkways and metal sheets where required to maintain						

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
	<p>access across for people and vehicles.</p> <p>Increase workforce in front of critical areas such as institutions, place of worship, business establishment, hospitals, and schools.</p> <p>Consult businesses and institutions regarding operating hours and factoring this in work schedules.</p> <p>Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.</p>						
Health and Safety	<p>Implement good housekeeping practices at pumping stations.</p> <p>Strictly implement health and safety measures and audit on a regular basis.</p> <p>Provide warning signs of hazardous working areas.</p> <p>Clearly demarcate excavations and provide barriers (not just danger tape) to protect pedestrians from open trenches.</p> <p>Thoroughly train workers assigned to dangerous equipment.</p>						

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
	<p>Workers have the right to refuse work in unsafe conditions.</p> <p>Undertake waste management practices- specifically periodic removal of sludge from pumping stations.</p> <p>Ensure all workers are provided with Personal Protective Equipment.</p> <p>Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas</p> <p>Ensure that qualified first-aid can be provided at all times. Ensure equipped first-aid stations are easily accessible throughout the site;</p> <p>Provide medical insurance coverage for workers.</p> <p>Provide clean eating areas where workers are not exposed to hazardous or noxious substances;</p> <p>Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or</p>						

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
	<p>substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted;</p> <p>Ensure moving equipment is outfitted with audible back-up alarms;</p> <p>Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate.</p>						
Noise and Vibrations	<p>Restrict maintenance activities to reasonable working hours where near sensitive receptors. Keep adjacent landowners informed of unusually noisy activities planned.</p> <p>Fit and maintain silencers to all machinery on site.</p> <p>Monitor noise levels in potential problem areas.</p>						

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
Workers Conduct	Ensure strict control of laborers Minimize working hours to normal working times Control littering						
Solid Waste	Regular removal through municipal system and approved disposal (preferably within STP area)						
Waste Water Quality check at the inlet and outlet of the STP	Conduct Daily/Weekly/Monthly quality check at inlet and outlet of STP						
Sludge	Safe sludge handling methods shall be employed. PPE shall be provided. Sludge shall be dried in drying beds before disposal. Sludge Management Plan shall be implemented Testing of sludge before disposal						
Sewage treatment – odor problem	Buffer zone in the form of landscaping and earthwork shall be created and well maintained around the site.						

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
	No development zone will be declared around the STP premises. This impact may be considered as negligible due to location of plant site and proposed buffer provision.						
Discharge of Hazardous Chemicals into Sewer lines	Ensure that no wastewater, except domestic sewage is disposed in to the sewers; the rules and regulations will be strictly implemented to avoid discharge of hazardous chemicals into sewers.						
Storage and handling of chlorine	During the operation phase, it is necessary that: <ul style="list-style-type: none"> <li>• Chlorinator facility is operated only by trained staff and as per the standard operating procedures</li> <li>• In case of any</li> </ul>						

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring	Compliance status
	accident and/or maintenance activity, the staff should follow documented procedures only <ul style="list-style-type: none"> <li>• It is suggested to develop an Emergency Response System (ERS) for the chlorine leakage.</li> </ul>						

**V. ENVIRONMENTAL MONITORING AND EVALUATION**

Provide the monitoring results as per the parameters outlined in the EMP. Append supporting documents where applicable, including Environmental Site Inspection Reports.

**Ambient Air Quality Monitoring Data at working sites**

Package	Monitoring location	Monitoring stage	Date of monitoring	Parameters				
				SO <sub>2</sub> µg/m <sup>3</sup>	NO <sub>2</sub> µg/m <sup>3</sup>	PM <sub>2.5</sub> µg/m <sup>3</sup>	PM <sub>10</sub> µg/m <sup>3</sup>	HC µg/m <sup>3</sup>

**Noise Level Monitoring Data at Working Sites**

Package	Sampling Locations	Implementation Stage	Date of Monitoring	Day Time Leq dB(A)	Night Time Leq dB(A)

Water quality monitoring data as per standard parameters

- (i) Comparison of during construction data with base line data;
- (ii) Mitigation measures against impact; and
- (iii) Performance monitoring

**Table for Performance Fact Sheet for Required Environmental Consents/Clearances of the project**

Package	Name of Contractor	EMP Part of contract Document(Yes / No)	Environmental Consents / Clearances Required					Pollution Under Control (PUC) Certificates for Contractor's Vehicles
			Tree Cutting	Crusher	Batching Plant	Hot Mix Plant	Diesel Generator Set	

**Table for Performance Fact Sheet for EMP Implementation of the project**

Package Number	Name of Contractor	EMP Part of contract Document(Yes / No)	Contractor Social/ Environment Person	Overall Status of EMP Implementation	Field to be Monitored as per EMP														
					Source of	Camp Sites	Landscape and	Air Quality	Noise Level	Traffic	Ecological	Accessibility	Water Quality	Occupational	Community Health & safety	Socio cultural	Employment		
					In compliance (2) / Partial Compliance (1) / Not in compliance (0) / Not applicable (n/a)														

**V. CONSULTATIONS AND DISCLOSURES CONDUCTED**

- A. Detail of consultation done during project implementation and proposed schedule of consultation
- B. Detail of training conducted

**VI. GRIEVANCE REDRESSAL**

- A. Detail of grievances recorded and cases resolve

**VII. FINDINGS AND RECOMMENDATIONS**

A. Based on site observation and document check corrective action plan to be drawn

**Table Corrective Action Plan**

	Non-compliance	Action Required	Responsible	Target Date	Indicator of Compliance

**Appendix of the Report-**

- LOCATION MAP OF THE PROJECT AREA
- IMPLEMENTATION SCHEDULE
- PHOTO ILLUSTRATION OF PROJECT LOCATIONS COVERING EMP COMPLIANCE
- SITE SPECIFIC EMP
- Spoil Management Plan
- AIR, NOISE, WATER QUALITY DATA – MONITORING TEST REPORT CERTIFICATE
- Site specific Health & Safety plan
- Records of trainings conducted during training period
- Workers insurance certificate
- Availability of labour work package wise
- Tree felling permission or other relevant NOC
- Traffic Management plan
- Environment, health and safety budget
- Public consultation during project implementation
- Sample Grievance Registration Form

**SAMPLE ENVIRONMENTAL SITE INSPECTION REPORT**

Project Name \_\_\_\_\_

Contract Number \_\_\_\_\_

Name: \_\_\_\_\_ Date: \_\_\_\_\_

Title: \_\_\_\_\_ DMA: \_\_\_\_\_

Location: \_\_\_\_\_ Group: \_\_\_\_\_

Weather Condition: \_\_\_\_\_

Initial Site Condition: \_\_\_\_\_

Concluding Site Condition:

Satisfactory \_\_\_\_\_ Unsatisfactory \_\_\_\_\_ Incident \_\_\_\_\_ Resolved \_\_\_\_\_ Unresolved \_\_\_\_\_

Incident:

Nature of incident:

\_\_\_\_\_

Intervention Steps:

\_\_\_\_\_

Incident Issues

Project Activity Stage	Survey	
	Design	
	Implementation	
	Pre-Commissioning	
	Guarantee Period	

Inspection

Emissions	Waste Minimization
Air Quality	Reuse and Recycling
Noise pollution	Dust and Litter Control
Hazardous Substances	Trees and Vegetation

Site Restored to Original Condition    Yes       

Signature \_\_\_\_\_

Name \_\_\_\_\_ Name \_\_\_\_\_

## SAMPLE CHECKLIST FOR CONSTRUCTION SAFETY

Sl. No.	Safety Issues	Yes	No	Non-Compliance	Corrective Action	Penalty	Remarks
1	Appointment of qualified construction safety officers						
2	Approval for construction safety management plan by the SC						
3	Approval for traffic management/control plan in accordance with IRC: SP- 55-2001						
4	Maintenance of the existing road stretches handed over to the contractor.						
5	Provision of temporary traffic barriers/barricades/caution tapes in construction zones						
6	Provision of traffic signboards						
7	Provision for flags and warning lights						
8	Providing plastic crash barrier						
10	Provision of adequate staging, form work, and access (ladders with handrail) for works at a height of more than 3 m						
11	Provision of adequate shoring / bracing/barricading/lighting for all deep excavations of more than 3 m depth.						
12	Demarcations (fencing, guarding, and watching) at construction sites						
13	Provision for sufficient lighting, especially for						

Sl. No.	Safety Issues	Yes	No	Non-Compliance	Corrective Action	Penalty	Remarks
	night time work						
14	Arrangements for controlled access and entry to construction zones						
15	Safety arrangements for road users/pedestrians						
16	Arrangements for detouring traffic to alternate facilities						
17	Regular inspection of work zone traffic control devices by authorized contractor personnel						
18	Construction workers' safety - Provision of personnel protective equipment						
19	A. Helmets						
	B. Safety shoes						
	C. Dust masks						
	D. Hand gloves						
	E. Safety belts						
	F. Reflective jackets						
	G. Earplugs for labour						
20	Workers employed on bituminous works, stone crushers, concrete batching plants, etc. provided with protective goggles, gloves, gumboots, etc.						
21	Workers engaged in welding work shall be provided with welder protective shields						
22	All vehicles are provided with reverse horns.						
23	All scaffolds, ladders, and other safety devices shall be maintained in safe and sound						

Sl. No.	Safety Issues	Yes	No	Non-Compliance	Corrective Action	Penalty	Remarks
	condition.						
24	Regular health check up for labor/ contractor's personnel						
25	Ensuring sanitary conditions and all waste disposal procedures and methods in the camps.						
26	The contractor shall provide adequate circuit for traffic flow around construction areas, control speed of construction vehicles through road safety and training of drivers, provide adequate signage, barriers, and flag persons for traffic control						
27	Provision of insurance coverage for the contractor's personnel						

Contractor

Consultant