



# Initial Environment Examination

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Project Number: 42266-025  
March 2020

## IND : Kolkata Environmental Improvement Investment Program - Tranche 2

Prepared by : Kolkata Municipal Corporation

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**Asian Development Bank**

**From:** Project Director KEIP <pdkeiip@gmail.com>

**Sent:** Friday, August 9, 2019 5:58 PM

**To:** Pradeep Kumar Pandey <ppandey@adb.org>

**Cc:** Sourav MAJUMDER <smajumder@adb.org>; Soumya Ganguly <soumya6@yahoo.com>; Narayan chandra Mondal <ncmcbs@yahoo.in>

**Subject:** Re: Revised Procurement Plan of Tranche-2, KEIP

Dear Mr. Pandey,

In response to your mail dt. 30.7.2019 we would like to clarify as desired by you as follows :

(i) The contract package of SD20 (WS20) as proposed is part of the original scope of the project under rehabilitation of water supply facility and increase in coverage, climate resilience and operational sustainability of KMC's Water Supply Services.

(ii) Please find attached the sub project appraisal report and related safeguard documents

Hope, this will serve the purpose, Your early approval will enable us to take necessary actions regarding preparation of bid document to expedite the bidding procedure.

With best wishes,

Project Director  
Kolkata Environment Improvement Investment Programme  
Kolkata Municipal Corporation  
Kolkata



2019 09 24 24.09.19

# **Initial Environmental Examination**

**Document Stage: Draft**

**Package Number: KEIIP/NCB/TR-2/ WS 20/2019 - 20**

**AUGUST, 2019**

**IND: Kolkata Environmental Improvement Investment  
Program (Tranche 2) – WS20**

**Construction of Pumping Station to Handle Sludge Water  
of Garden Reach Water Works (GRWW)**

Prepared by Kolkata Municipal Corporation (KMC) for the  
Bank

Asian Development

## ABBREVIATIONS

ADB	Asian Development Bank
ASI	- Archaeological Survey Of India
BOD	- Biochemical Oxygen Demand
COD	- Chemical Oxygen Demand
CPCB	- Central Pollution Control Board
CTE	- Consent To Establish
CTO	- Consent To Operate
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
GW RW	- Garden Reach Water Works
IEE	- Initial Environmental Examination
KEIP	- Kolkata Environmental Improvement Project
KEIIP	Kolkata Environmental Improvement Investment Program
MFF	- Multi-tranche Financial Facility
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
- S&D - Sewerage And Drainage
- SEMR - Semi-Annual Environmental Monitoring Report
- SPS - Safeguard Policy Statement
- SWF - Storm Water Flow
- TMP - Traffic Management Plan
- WBPCB - West Bengal Pollution Control Board
- WTP - Water Treatment Plant

## WEIGHTS AND MEASURES

m <sup>3</sup> /h	cubic meter per hour
dB(A)	decibel in A network
°C	degree Celsius
km	kilometer
kVA	kilovolt-ampere
m	meter
µg/m <sup>3</sup>	microgram per cubic meter
mg/l	milligram per liter
MLD	million liters per day
mm	millimeter
MPN/100ml	Most Probable Number per one hundred milliliters
NTU	Nephelometric Turbidity Unit
km <sup>2</sup>	square kilometer

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## EXECUTIVE SUMMARY

The Asian Development Bank (ADB) loan had assisted KMC since 2000 in the expansion of the drainage and sewerage coverage and in increased water supply through the completed Kolkata Environmental Improvement Project (KEIP). On 26 September 2013, ADB approved the provision of loan under a multi tranche financing facility (MFF) as Kolkata Environment Improvement Investment Program (KEIIP) for an aggregate amount not exceeding \$400 million. The KEIIP will enhance access to water supply and sanitation in KMC. The outcome will be improvement in water supply, sewerage and drainage service quality and operational sustainability in selected areas of KMC. Specifically KEIIP has three outputs: (i) inefficient water supply assets rehabilitation; (ii) continued drainage and sewerage extension along with sewage treatment facilities to peripheral areas; and (iii) further development of financial and project management capacity.

Tranche 2 or Loan 3413-IND was signed on 21st November 2016. Project 2, supported by Tranche 2, included physical and non-physical investments in water supply and sanitation improvement in KMC. The subproject "Construction of Pumping station to Handle Sludge Water of Garden Reach Water Works (GRWW)" is now under consideration under Tranche 2.

ADB classified the KEIIP as environment Category B and accordingly Initial Environmental Examination (IEE) is required for all subprojects belonging to KEIIP. The present document is the IEE for the above subproject under Tranche 2, viz, "Construction of Pumping station to Handle Sludge Water of Garden Reach Water Works (GRWW)". Construction work of the subproject will be implemented from 2019 to 2021(18 months).

There is a nearby low lying area in Garden Reach WTP serving as sludge pond since the construction GRWW. These include 4 (Four) interconnected ponds. From each WTP (module developed in stages) the sludge water is discharged to all the 4 ponds. There are two separate lines which are functioning at present as disposal channels from this low lying area of sludge pond. One is a 1200 mm Gravity main and the other is an open drain. Both these channels discharge the decanted sludge water into Monikhali canal. The gravity main channel has a low slope of 0.05 m in 1200 m length. It discharges water to Monikhali Canal only when the water level in the canal remains below its FDL (Flow Discharge Level) i.e.1.5 m. The discharge level of the another channel is also much below the FDL of the canal. Therefore discharge is not regular and the pipe line gets choked by sediments. During rain, backflow of water occur frequently and the whole area becomes inundated. Another reason behind this flooding is that in due course of time the capacity of the WTP increased from 20 MGD to 185 MGD at present. In addition to this, one 25 MGD plant is under implementation

and another new 25 MGD plant is planned after 5 years totally to 235 MGD. With increase in capacity the plants are producing proportionately more sludge water than before. Further over a period of time, the total available area became less due to establishment of some dwelling blocks.

In this context a Lifting Pumping Station is proposed within the sludge pond area for secure discharge arrangement into Monikhali Canal. It will enhance the smooth operation of the WTP and prevent the adjacent area from water logging/ inundation. Direct beneficiary to the project is about 4000 resident living around the sludge pond; but indirect beneficiary will be the people living in Borough X to XV of KMC.

Components of the sub-project will thus include – (1) Construction of a Dry Pit Pump house with fore bay and collection pit, (2) Construction of Electrical Sub – station, (3) Construction of boundary wall, toilet block etc.

The proposed subproject will 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. Considering the SPS (2009) and REA checklist categorisation the sub-project has been categorised as environment **Category B** and accordingly Initial Environmental Examination (IEE) is required for the sub -project.

This IEE was conducted based on preliminary Sub-Project Appraisal Report (SAR). The IEE covers all activities proposed under the project. The core zone of impact is limited to the area directly impacted by the new construction or reconstruction or rehabilitation of the project components. Assessment is carried out for all components of environment covering terrestrial and aquatic ecology, soil, air, water, noise and socio economic aspects.

Assessment of anticipated impacts has been done based on qualitative aspects with different levels and various criteria like short term, long term, medium-term and permanent , low , high , medium , local, regional etc. 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 design. This means that the number of impacts and their significance have already been reduced by amending the design. Also anticipated impacts have been considered during construction, operation and maintenance phases. Most of the impacts are short term site specific and low in nature. On Implementation of the EMP the impacts will be insignificant.

The pump house will be constructed in KMC land. No other major civil construction activities are known to be taking place in the area. Hence, the cumulative impact is not significant.

Consultation with different stakeholders during preparation of the IEE revealed the fact that local people are happy with the project and they have assured all support in implementation of the subproject. Future consultations will continue during pre-construction and construction activities of the subproject. IEE of the subproject will be disclosed as per loan covenants and PAM.

An apex GRM has already been constituted by the Project Director to address grievances pertaining to broader concerns related to the program/subproject in KEIP. This GRM will be operative for this subproject also.

An environmental management plan (EMP) which addresses the potential impacts and risks identified by the environmental assessment has been 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. In EMP specific measures has been suggested for protection of sludge ponds during pre-construction and construction activities. EMP also include Environmental monitoring mechanism during implementation, operation, maintenance and defect liability period. Cost of EMP implementation for this subproject has been estimated as INR 370,000.00. EMP will be a part of the BOQ of the Bid document.

As stated the subproject will not cause any significant adverse impact. 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

Kolkata is the seventh largest metropolitan city in India. Its population was 4.5 million in 2011. It is the largest city in the state of West Bengal. A continuous increase in municipal facilities and services is required to have a better living condition improving in turn the environment of the city. There are also geographical disparities in access and quality of the water supply and sewerage with the “added area” of Kolkata Municipal Corporation (KMC) facing maximum inadequacy of such facilities.

The Asian Development Bank (ADB) loans had assisted KMC since 2000 in the expansion of the drainage and sewerage coverage and in increased water supply through the completed Kolkata Environmental Improvement Project (KEIP)<sup>1</sup>. On 26 September 2013, ADB approved the provision of loans under a multi tranche financing facility (MFF) as Kolkata Environment Improvement Investment Program (KEIIP) for an aggregate amount not exceeding \$400 million. The KEIIP will enhance 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) continued drainage and sewerage extension along with sewage treatment facilities to peripheral areas; and (iii) further development of financial and project management capacity.

The Program is being carried out by the Govt. of West Bengal (GoWB) acting through KMC as the Executing Agency (EA).

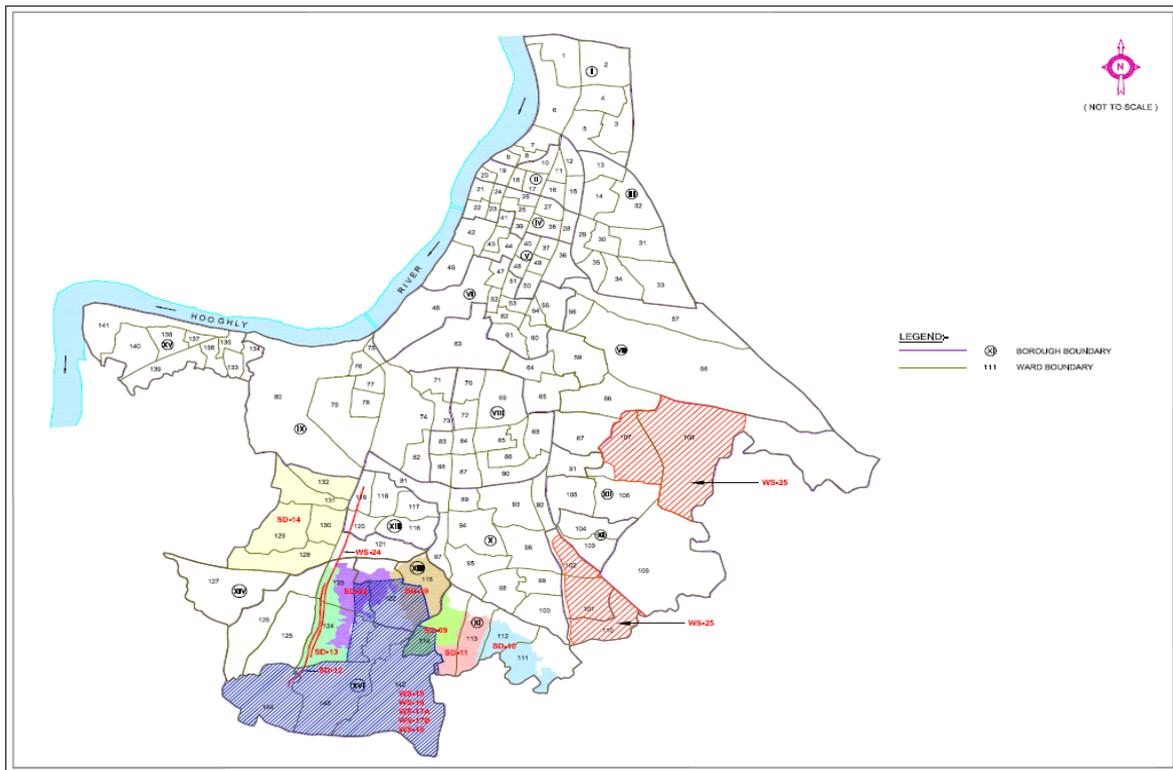
The first loan under the MFF, Tranche 1 or Loan 3053-IND, amounting to \$100 million, was approved by ADB on 22 October 2013, signed on 3 March 2014. Project 1, supported by Tranche1, included subprojects for improvement of infrastructure, operations and sustainability in sewerage, drainage and water supply in KMC.

Tranche 2 or Loan 3413-IND was signed on 21st November 2016. Project 2, supported by Tranche 2, included physical and non-physical investments in water supply and sanitation improvement in KMC.

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<sup>1</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.



**Figure 1: Location of proposed work considered in Tranche -2**

At present all 3 Tranches under KEIIP are in implementation. The subproject “**Construction of Pumping station to Handle Sludge Water of Garden Reach Water Works (GRWW)**” is considered under Tranche 2. This project will be implemented over a period of 18 months (2019 to 2021).

The subprojects 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.

ADB classified the KEIIP 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 subprojects under Tranche 2 “Construction of Pumping station to Handle Sludge Water of Garden Reach Water Works (GRWW)”.

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.

### **Extent of IEE**

IEE was conducted based on preliminary Sub-Project Appraisal Report (SAR). The IEE covers all activities proposed under the project. The core zone of impact is taken as direct impact of the new construction or reconstruction or rehabilitation of the project component. IEE also covers the direct impact of the sub-project component. Assessment is carried out for all components of environment covering terrestrial and aquatic ecology, soil, water, noise and socio economic aspects.

### **IEE Content**

The IEE has been largely structured as per SPS, 2009 and includes following eight chapters.

Executive Summary

Chapter 1- Introduction

Chapter 2- Policy, Legal and Administrative Framework

Chapter 3- Description of Project

Chapter 4- Description of Environment

Chapter 5- Anticipated Impacts and Mitigation Measures

Chapter 6- Information Disclosure, Consultation, and Participation

Chapter 7- Environment Management Plan and Grievance Redress Mechanism

Chapter 8 - Conclusion and Recommendation

## II. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

### A. ADB Policy

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.

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 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.

**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<sup>2</sup>:

- (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,

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<sup>2</sup> As per SPS, 2009

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.
- (iv) **Category FI.** A proposed project is classified as category FI if it involves investment of ADB funds to or through a FI.

Considering the above categorisation the sub-project has been categorised as environment **Category B** and accordingly initial environmental examination (IEE) is required for the sub - projects.

**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.

**Public Disclosure.** The IEE will be put in an accessible place (e.g., local government offices, libraries, community centres, 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**

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 (O&M).

The following legislations are applicable to the subproject:

- (i) Environmental (Protection) Act of 1986, its rules and amendments;
- (ii) 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 and 2017;
- (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, National Institute of Occupational Health (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
- (xiv) The West Bengal Inland Fisheries Act, 1984 and The West Bengal Inland Fisheries (Amendment) Act, 1993
- (xv) The Child Labor (Prohibition and Regulation) Amendment Act, 2016.
- (xvi) Construction and Demolition Management Rule 2016 of MOEF & CC (26 March 2016)
- (xvii) Department of Environment's direction under Air Act 1981 for control of air pollution from construction activities in West Bengal. (Department of Environment Government of West Bengal, December 10, 2009) Circular No - EN/3170/ T- IV-7/ 001/ 2009.

The summary of environmental regulations and mandatory requirements for the subproject is shown in Table 1

**Table 1: Applicable Environmental Regulations for Sewerage and Drainage Subproject**

Law	Description	Requirement
Environmental Impact Assessment (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 subproject 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 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.	Construction of pumping station and S&D network will not require CTE and CTO from WBPCB

Law	Description	Requirement
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, CTE and CTO from WBPCB will be required if the contractor use: diesel generators during construction.;
Environment (Protection) Act, 1986 and Central Pollution Control Board (CPCB) Environmental Standards.	Emissions and discharges from the facilities to be created or refurbished or augmented shall comply with the notified standards notified.	<p><b>Appendix 1</b> provides applicable standards for ambient air, air emission, effluents, receiving water bodies, and drinking water at the consumer end.</p> <p>Contractors are required to ensure all emissions and discharges with in National standards as stated above during construction.</p>
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.	<p><b>Appendix 2</b> provides applicable noise standards.</p> <p>Contractors are required to ensure the National Noise standards during construction.</p>
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.	<p><b>Appendix 3</b> provides applicable NIOSH Occupational noise standards.</p> <p>Contractors are to ensure exposures of workers within allowed NIOSH standards.</p>
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 ( <b>Appendix 4</b> ).	If during excavation works, if 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

Law	Description	Requirement
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 and 2017	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 permit any of the prohibited activities on the recommendation of Central Wetlands Regulatory Authority.	The subproject is not within the East Kolkata Wetlands hence, permission from the Central Government is not required.
The Ancient Monument and Archaeological Sites and Remains (Amendment and Validation) Act 2010	<p>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.</p> <p>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</p> <p>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</p>	There are no protected properties within 100m & 200m of 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)	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	<p>Land identified for Pumping station is KMC own land hence R&amp;R is not required.</p> <p>A Due diligence report has been prepared in accordance with the ADB SPS, 2009.</p>

Law	Description	Requirement
	compensation to the affected people.	
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.	No tree cutting is required as per present design if required permission from the Divisional Forest Officer (Utilization Division), Forest Directorate, Government of West Bengal will be obtained
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 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 subproject is not within the East Kolkata Wetlands thus no permission is required from the Central Government and East Kolkata Wetlands Management Authority (EKWMA).
The Child Labour (Prohibition and Regulation) Amendment	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	No children between the ages of 14 to 18 years will be engaged in hazardous working conditions.

Law	Description	Requirement
Act, 2016	<p>the Schedule or in any workshop wherein any of the processes set forth in Part B of the Schedule.</p> <p>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</p>	
Construction and Demolition Management Rule 2016 of MOEF & CC (26 March 2016)	<p>Applies to everyone who generates construction and demolition waste. Every waste generator shall segregate construction and demolition waste and deposit at collection centre or handover it to the authorised processing facilities</p> <p>Shall ensure that there is no littering or deposition so as to prevent obstruction to the traffic or the public or drains.</p>	No demolition of any structure as per present design , if required contractor will ensure to comply with the rules and KMC will monitor the compliances.
Department of Environment's direction under Air Act 1981 for control of air pollution from construction activities in West Bengal . (Department of Environment Government of West Bengal, December 10, 2009) Circular No - EN/3170/ T- IV-7/ 001/ 2009.	<p>West Bengal Pollution Control Board conducted a study with the help of the Asian Development Bank and it is revealed that the contribution of the construction activities is one of the source of air pollution in Kolkata and its surroundings and also suggested some guideline to minimise such impacts</p>	Contractor will follow the guideline and KMC will ensure implementation of the guidelines.

Following labor acts applicable for the project:

- Workmen Compensation Act, 1923.
- Employees PF and Miscellaneous Provisions Act, 1952.
- Maternity Benefit Act, 1951.
- Contract Labour (Regulation and Abolition) Act, 1970.
- Minimum Wages Act, 1948.
- Payment of Wages Act, 1936.
- The inter-state migrant workmen (regulation of Employment and Conditions of service) act, 1979.

Details of the labour acts and other relevant acts are shown in **Appendix 5**.

In addition to national and state rules and regulations, international conventions such as the International Union for Conservation of Nature and Natural Resources (IUCN), Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), Convention on Migratory Species of Wild Animals (CMS), Ramsar Convention on Wetlands of International Importance and Millennium Development Goals are applicable for selection and screening of subprojects under restricted/sensitive areas. India is a party to these conventions. The said package is not linked with any international rules and regulations.

During the design, construction, and operation of the project the borrower/client will 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*.<sup>3</sup> These standards contain performance levels and measures that are normally acceptable and applicable to projects. When host country regulations differ from these levels and measures, the borrower/client 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 this document.

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

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<sup>3</sup> IFC World Bank Group. [Environmental, Health and Safety Guidelines](#).

### **III. DESCRIPTION OF THE SUBPROJECT**

#### **A. Existing Situation**

**Garden Reach Water Works.** KMC has two existing water works for drinking water supply: Palta and Garden Reach. Garden Reach Water Work is located on the western boundary of Kolkata in Borough XV of KMC and Mahestala Municipality. The plant was established in 1982 with 20 MGD capacity. Initially it was set up by KMWSA for supplying water to Kolkata Adjoining areas. Subsequently excepting Maheshtala & Budge-Budge Municipality others were taken over by KMC as added area. KMWSA was taken over by KMDA. The present capacity of the plant is 185 MGD. With increasing demand one 25 MGD unit is under implementation and additional one new 25 MGD planned after 5 years totally to 235 MGD. The source of raw water is the Hooghly River.

Garden Reach water supply scheme comprises of:

- (i) Raw water pumping station (RWPS)
- (ii) Treatment plant comprising of flash mixer, clariflocculators, rapid sand filters
- (iii) Clear water reservoir
- (iv) Clear water pumping station
- (v) Chlorination arrangement

The treatment process is a conventional Rapid Sand Filtration system. It consists of a Raw Water Channel (RWC), Chemical House (CH) with coagulant dosing units, Flash Mixer (FM), Clariflocculators (CF), Rapid Sand Filters (RSF), and Clear Water Reservoir (CWR) and chlorination arrangement.

#### **B. Project Background and Existing sludge handling system**

There is a nearby low lying area in Garden Reach WTP serving as sludge pond since commencement. There are 4 (Four) interconnected ponds. From each WTP (module developed in stage) the sludge water discharge line got connection to all the 4 ponds. Blank flanges are used to close 3 out of 4 opening at a time, i.e. only one channel remains open at a time to discharge sludge water in the pond area. After filling of that particular pond, the total set up gets shifted to another pond. After settling with time, the solid part of the sludge get separated and settled and the clear supernatant water is discharged into River Hooghly via Monikhali Canal. It takes about one month period of time for settling of sludge completely. Sludge is taken manually through private agency from each pond in alternate year.

There are two separate lines which are functioning at present as disposal channels from this low lying area of sludge pond. One is a 1200 mm Gravity main and the other is an open drain. Both these channel discharge the decanted sludge water into Monikhali canal. This gravity main channel has a mild slope of 0.05 m in 1200 m length. It discharge water to Monikhali Canal only when the water level in the canal remain below its FDL (Flow Discharge Level) i.e.1.5 m. the discharge level of the another channel is also much below the FDL of the canal.

Therefore discharge is not regular and the pipe line gets chocked by sediments. During rain, backflow of water occur frequently and the whole area becomes inundated.

Another reason behind this flooding is in due course of time the capacity of the WTP increased from 20 MGD to 185 MGD at present. In addition to this, one 25 MGD plant is under implementation and another new 25 MGD plant is planned after 5 years totalling to 235 MGD. With increase in capacity the plants are producing proportionately more sludge water than before. However over the period of time, the total available area became less due to establishment of some dwelling blocks.

As KMC has taken up scheme for smooth Water Supply throughout the Kolkata Municipal Corporation area through KEIIP, it is required to arrange smooth operation of WTP's by allowing discharging sludge water to the sludge pond regularly. Functionally to make this happen sludge pond should have area to accommodate this excess sludge water. Therefore, it is now become very much necessary that excess water from the sludge pond should be discharged regularly to keep the system functional.

### **C. Need of the Sub Project**

In this context a **Pumping Station** is proposed within the sludge pond area along with a pressure main line for secure discharge arrangement into Monikhali Canal. It will enhance the smooth operation of the WTP and prevent the adjacent area from water logging/ inundation. Direct beneficiary to the project who will be saved from water logging is around 4000 residents at abutting area of the sludge pond but indirect beneficiary will be the people who live in Borough X to XV of KMC as they will get more & steady flow of treated water from GRWW.

### **D. Components of the Subproject**

Main scope of work of the sub - project will include - Construction of Pumping Station to handle sludge handling system of Garden Reach Water Works (GRWW) with modification of the existing system for disposal of runoff water from sludge ponds. The pressure main for

this project is being separately dealt with by KMC. Components of the sub-project will thus include -

- Construction of a Dry Pit Pump house with fore bay and collection pit,
- Construction of Electrical Sub – station
- Construction of boundary wall, toilet block etc.

The location and the layout of the pumping station is shown in Figure 2 and 3 respectively.



**Figure 2: Location of proposed pumping station**

### **E. Implementation Schedule**

Construction work will be implemented from January 2020 to June 2021 (18 months).



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

##### A. Physical Resources

###### Topography & drainage

Regionally KMC area is mostly flat and sloping in general from north to south and from west to east. The southern portion of the Boroughs XI, XIII, XIV and XVI are low lying and marshy. Similarly, the south western part of Borough XV and different parts of Borough XII are low lying. Garden Reach Water Works falls under Borough XV. The broad topographical features of the subproject area are given in Table 2.

**Table 2: Topographical information of Borough XV in KMC**

Basin	Ground level	General slope
XV	Elevations range varying from 5.50m to 1.50m from MSL	Generally from north to south and west to east direction.

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. 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.

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). Kestopur Canal system – flowing in southerly direction

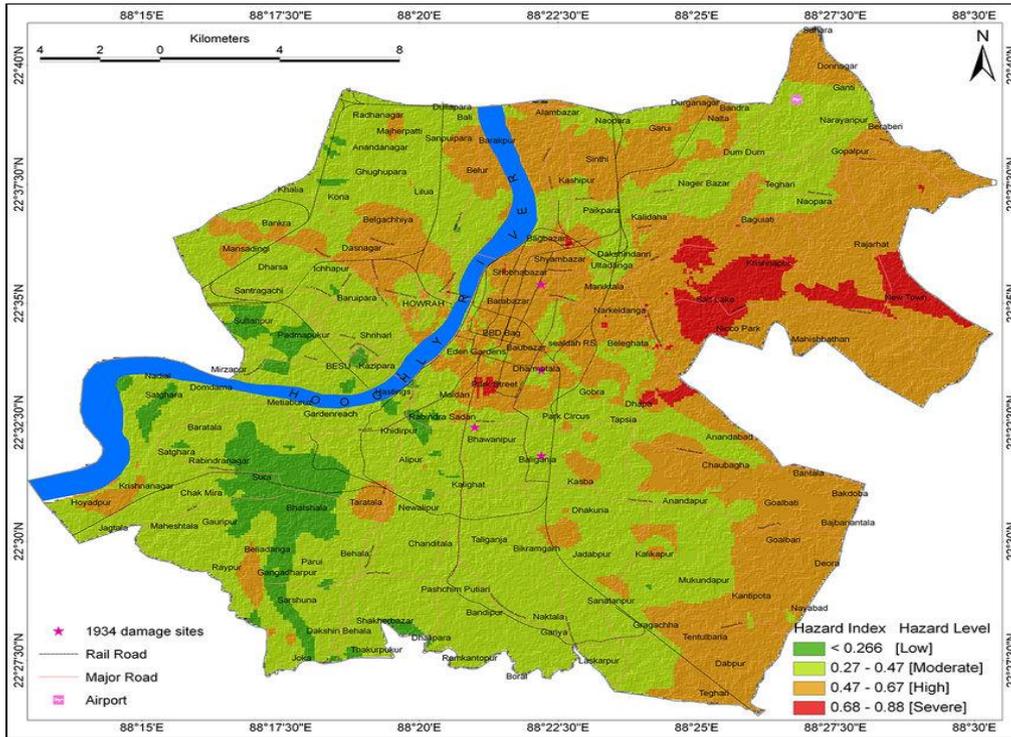
- (iii). Beliaghata (Circular) Canal system
- (iv). Storm Water Flow (SWF) – Dry Weather Flow (DWF) canal system flowing in easterly direction towards East Kolkata Wetlands carrying the pumped storm and sewage water of Kolkata
- (v). Tolly's *nala* system
- (vi). T-P system
- (vii). Monikhali system
- (viii). Churial system

### **Natural hazards**

Natural hazards in southern part of Kolkata (project influence area in general) include water logging and flooding during monsoon months. In areas like Behala, Tollygunge, Joka and Garden Reach even a small shower causes water logging in many localities which takes considerable period to evacuate. Some pockets remain inundated for even 3 to 4 months in a year. All these result due to poor and inadequate drainage facility in the areas. However, with the completion of KEIP I and KEIIP Phase 1 and 2 S & D subprojects situations have improved to a great extent. Duration of flooding varies from hours to days, depending on the facility available, nature of topography and outfall conditions in and around different localities. However, July is the worst month, followed by June and August. Some part of sub project areas of Joka is low laying.

In revised seismic zones map of India (IS 1893; Part 1, 2002) eastern part of Kolkata falls in Zone IV while the area to the west falls in Zone III.

Figure 4 show hazard map of Kolkata.



**Figure 4: Hazard Index map of Kolkata**

### **Geology and Mineral Resources**

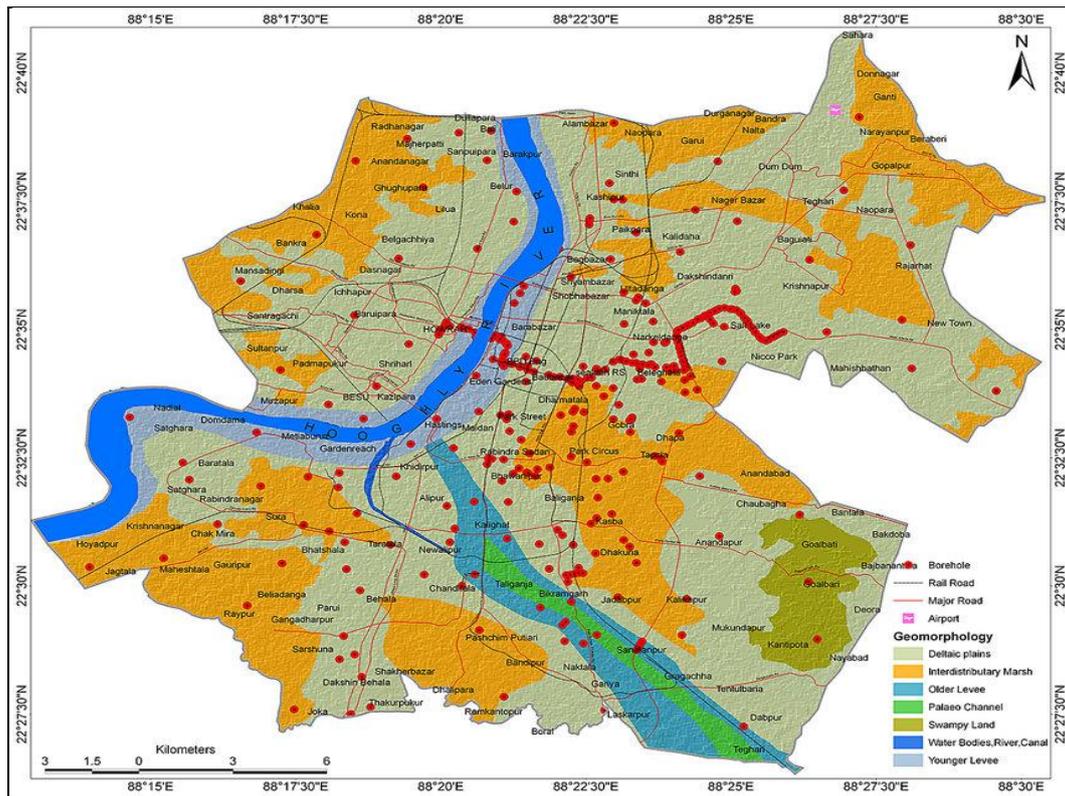
The subproject area is underlain by Quaternary sediments consisting of clay, silt, and various grades of sand, gravel, and pebbles. Lithological logs show the presence of a clay bed at the top, with a thickness of 10 to 40m. There is a further clay bed 250 to 650 m below ground level. There is a group 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 stratigraphy of Kolkata Region is given in Table 3.

**Table 3: Near Surface Stratigraphy of Kolkata Region**

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 +).

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 cohesionless 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. There no mineral occurrence in the area.

Geomorphology of Kolkata is shown in Figure 5.



**Figure 5: Geomorphological map of Kolkata**

## 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 4 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 4: Soil Quality in Five Boroughs of Kolkata Municipal Corporation**

Sl. 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

Sl. No.	Parameters	Sample (S1)	Sample (S2)	Sample (S3)	Sample (S4)	Sample (S5)
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
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

## 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.

April and May are the hottest months with monthly mean maximum temperature above 35 degree Celcius ( $^{\circ}\text{C}$ ). Mean maximum temperature is above  $30^{\circ}\text{C}$  from March to October. Relatively low monthly mean minimum temperatures occur during December ( $15.2^{\circ}\text{C}$ ), January ( $14.1^{\circ}\text{C}$ ) and February ( $18. ^{\circ}\text{C}$ ). Mean monthly minimum temperature is relatively high and is between  $26^{\circ}\text{C}$  and  $27^{\circ}\text{C}$  during the months of May, June, July and August.

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.

Wind is light to gentle with maximum monthly average speed 7.22 kilometer per hour (km/hr). 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/hr 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 not uncommon.

### **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 ( $\text{SO}_2$ ) concentrations are mostly around 5 to  $7 \mu\text{g}/\text{m}^3$  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.

Recent ambient air quality at Taratala road (near project site) and at intake point of the Garden Reach water works given in Table 5 indicate that concentration of PM<sub>10</sub> is above the National standard .

**Table 5: Month-Wise Average Ambient Air Quality at Taratala Road**

Sl No.	Location	Months	SO <sub>2</sub>	NO <sub>2</sub>	PM <sub>2.5</sub>	PM <sub>10</sub>
1	Taratala Road near Jhinjira Bazar (Shaft No. 6)	January 2015	8.20	36.54	31.21	126.80
2	Garden Reach Intake point and treatment plant-near Surinam Ghat	March 2015	7.49	30.16	52.36	121.89
3	Taratala Road Shaft no. 7	July 2015	15.20	36.15	30.10	80.20
4	Taratala Road, Shaft No. – 7 Brace Bridge	July 2015	14.31	34.20	28.82	73.22
5	Taratala Road Shaft no. 1	December 2015	16.05	42.72	28.68	78.37
6	Taratala Road, Shaft 11	April 2016	18.72	45.35	29.96	88.83
7	Taratala Road, Shaft 03	June 2016	16.88	43.52	26.02	82.45
8	Taratala Road, Shaft 13	September 2016	16.14	46.70	27.50	92.53

9	Taratala Road Shaft No. 15	April 2017	14.47	48.50	28.50	94.55
10	Garden Reach Intake point jetty and treatment plant	November 2017	8.89	15.74	18.77	56.03

{Standard = 1. PM<sub>10</sub> for industrial, Residential and Rural and other areas: 60 µg/m<sup>3</sup> (Annual); 100 µg/m<sup>3</sup> (24 Hour); 2. NO<sub>2</sub> for industrial, Residential and Rural and other areas: 40 µg/m<sup>3</sup> (Annual); 80 µg/m<sup>3</sup> (24 Hour); 3. SO<sub>2</sub> for industrial, Residential and Rural and other areas: 50 µg/m<sup>3</sup> (Annual); 80 µg/m<sup>3</sup> (24 Hour)}

*(Source: Primary data generated under KEIIP Tranche 1 and 2 work)*

Results of limited time air quality monitoring carried out during 2011 by KEIIP near GRWW are reproduced in Table 6. The result is not in compliance with the National Ambient Air Quality Standard in respect of PM<sub>10</sub> and NO<sub>x</sub>.

### 6: Ambient Air Quality around Garden Reach Pumping Station

Date	Shift wise sample no.	Pollutants level in µg/cum				
		PM <sub>10</sub>	SPM	SO <sub>2</sub>	NO <sub>x</sub>	CO
20.10.2011 to 21.10.2011	1/1 1/2 1/3	123.8 123.7 120.8	238.5 230.8 238.5	6.2 6.0 5.8	32.5 30.0 28.5	<125 <125 <125
22.10.2011 to 23.10.2011	2/1 2/2 2/3	126.8 120.5 126.8	241.8 218.3 223.8	6.2 6.0 5.8	30.0 25.0 28.3	<125 <125 <125
24.10.2011 to 25.10.2011	3/1 3/2 3/3	140.7 136.7 118.8	243.8 231.8 216.2	6.0 5.8 6.0	32.6 28.5 31.2	<125 <125 <125
29.10.2011 to 30.10.2011	4/1 4/2 4/3	110.9 102.8 116.7	221.8 212.5 218.3	5.7 5.6 6.0	25.0 21.8 26.5	<125 <125 <125
31.10.2011 to 01.11.2011	5/1 5/2 5/3	112.6 116.8 120.5	210.5 186.2 218.3	6.0 5.5 5.6	26.5 21.8 25.0	<125 <125 <125
03.11.2011 to 04.11.2011	6/1 6/2 6/3	116.8 112.7 120.8	218.3 210.8 208.3	6.1 5.6 5.8	28.2 23.5 25.0	<125 <125 <125
07.11.2011 to 08.11.2011	7/1 7/2 7/3	132.7 120.5 126.7	236.8 212.1 218.3	6.0 5.6 5.9	35.0 26.2 25.0	<125 <125 <125
09.11.2011 to 10.11.2011	8/1 8/2 8/3	106.8 102.7 116.2	190.2 186.2 210.8	5.6 5.5 5.8	25.0 21.8 26.5	<125 <125 <125

*(Source: Primary data generated under KEIP Phase 2.)*

### Surface Water Quality

The primary resource of surface water 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 livelihood purposes. A large volume 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 by WBPCB in 2010 & 2011 is given below in Table 7.

**Table 7. Water quality of Hooghly river at Garden Reach**

SI No.	Parameter	Unit	Test result (dated 11.01.11)	Test result (dated 07.04.11)	Test result (dated 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	

Source: WBPCB, [www.wbpcb.gov.in](http://www.wbpcb.gov.in)

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

Water sample from Hooghly river near Garden Reach were also collected and analysed under KEIP Tranche-1 project in November 2011, results has been shown in Table 8. The results of both the table (table 8 &9) indicate the same characteristics and also capture the subtle variation between high and low tide. The samples showed high coliform contamination.

**Table 8: Chemical analysis of surface water** (taken from Hooghly River near Garden Reach)

SI No.	Parameter	Unit	SW-1(Hooghly river near Garden Reach during Low Tide)	SW-2 (Hooghly river near Garden Reach during High Tide)	SW-3 (Supply clear water GRWW)
1	Turbidity	NTU	23.5	20.37	1.2
2	DO	mg/l	6.2	6.4	7.0
3	pH	Unit	7.58	7.67	7.67
4	COD	mg/l	40.0	30.0	<5.0
5	BOD	mg/l	6.0	5.0	<2.0
6	TDS	mg/l	180	170	182
7	TSS	mg/l	48	39	<10.0
8	Kjeldahl Nitrogen	mg/l	5.25	4.50	1.65
9	Total Nitrogen	mg/l	18.5	15.0	8.50
10	Salinity	mg/l	0.03	0.029	0.03
11	Oil & Grease	mg/l	<1.0	<1.0	<1.0
12	Fecal Coliform	MPN/100ml	6.7x10 <sup>3</sup>	5.6x10 <sup>3</sup>	<2

Source: Primary data generated under KEIP Phase 2.

Water from sludge pond which is discharged into Manikhali canal was analysed **under KEIP in November 2011**. The results are given in **Table 9** and compared with CPCB standard for effluents reveal the fact that water is fit for discharge into inland surface water body (Monikhali canal).

**Table 9: Chemical analysis of waste water (after treatment) in GRWW**

SI No.	Parameter	Unit	Garden Reach WTP	Applicable CPCB standards for discharge in inland surface water
1	Turbidity	NTU	18.50	-
2	DO	mg/l	5.6	-
3	pH	Unit	7.20	5.5-8.0
4	COD	mg/l	60	250
5	BOD	mg/l	8.0	30
6	TDS	mg/l	375	-
7	TSS	mg/l	47	100
8	Kjeldahl Nitrogen	mg/l	3.50	100
9	Ammoniacal Nitrogen	mg/l	<0.08	50
10	Salinity	mg/l	.04	-
11	Oil & Grease	mg/l	<1.0	10
12	Fecal Coliform	MPN/100ml	<2	-

Source: Primary data generated under KEIP Phase 2 ,November 2011

### **Groundwater**

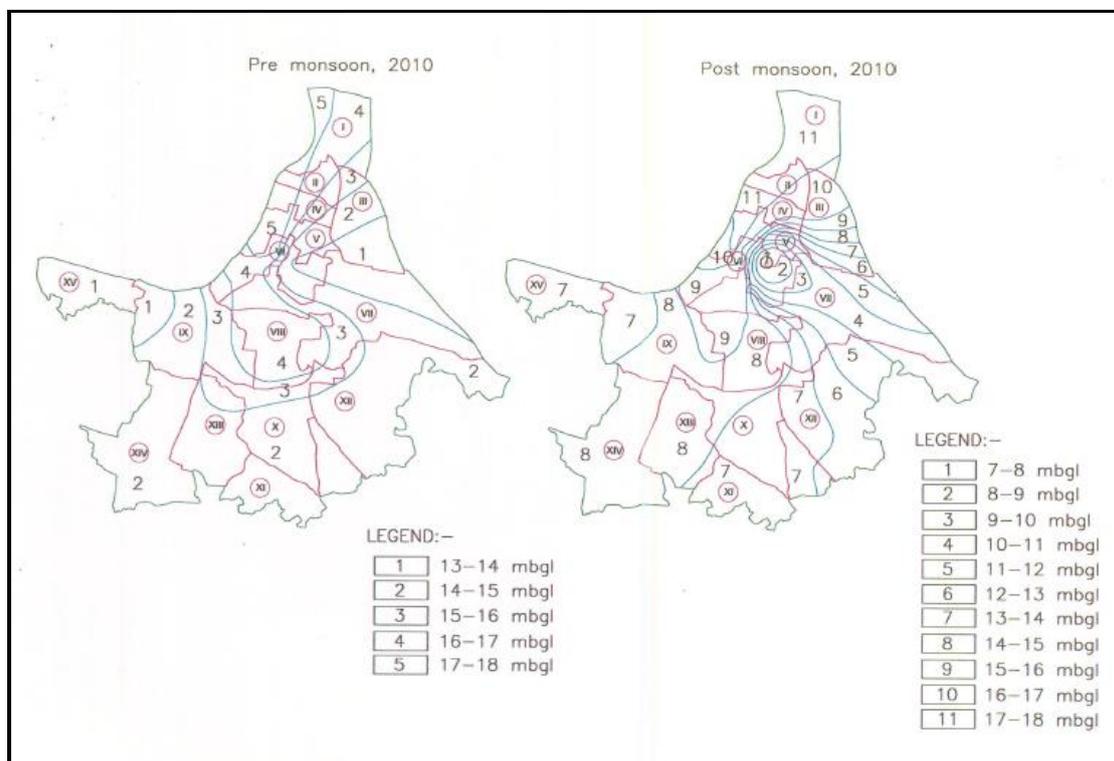
The aquifers that are tapped for ground water in Kolkata are under confined condition because of the presence of a thick clay layer near the surface. Such aquifers occur at various depths separated by other clay layers. Generally the first aquifer is encountered at a depth of about 15 m followed by other 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.

In Garden Reach area, groundwater occurs in both shallow as well as in deep aquifers. Ground water levels in these sectors were measured during November 2011 under Tranche 1. The depth to piezometric surface was measured in two types of water abstracting structures – dug well and tube well (cylinder type) in this area. The depth to piezometric surface or depth to water levels in dug wells (generally present within the clay horizon – aquiclude) is very close to the land surface. The depth generally ranges between 1.0 to 1.22 m below ground level (bgl). During the same period the piezometric surface in the deeper aquifer zones (>40 m bgl) rested at a deeper level generally ranging between 9.5 and 10.7 m bgl.

In the Taratala – Garden Reach sector, the depth to piezometric surface or depth to water levels in dug wells is very close to the land surface. The depth ranges between 0.42 to 0.9 m bgl. The depth to water level is low at the Garden Reach site than the Taratala region. During the same period the piezometric surface in the deeper aquifer zones (>40 m bgl) rested at a deeper level – generally above 15 m bgl.

Ground water quality was monitored under KEIP Phase 1 around the project sites during November, 2011 -12 and the results are reproduced in Table 10 below. Water quality is rather high in TDS but within acceptable limit. Fe concentration is also high. No heavy metal pollution especially that of arsenic has been detected.

**Figure 6: Ground water map of KMC area (2010) showing project area**



**Table 10: Ground water quality around GRWW**

Parameters	GW – 1 Near Taratala More (Tube well)	GW – 2 Near Moyla Depot (Tube well)	GW – 3 Near Garden Reach Water Works (Tube well)	National drinking water standard Permissible limit
Temperature(°C)	19.50	18.0	18.5	-
Colour unit	1.0	1.0	1.0	5
Turbidity(NTU)	2.8	5.1	6.8	1
Odour	No odour observed	No odour observed	No odour observed	Agreeable
pH	7.57	7.45	7.76	6.5-8.5
TSS (mg./l)	<10	<10	<10	-
TDS(mg./l)	560.0	617.0	615.0	500
Total hardness(mg./l)	240.0	380.0	388.0	200
Chloride(mg./l)	72.53	79.12	76.93	250
Sulphate(mg./l)	5.0	36.5	3.5	200
Nitrate(mg./l)	12.5	35.80	25.0	45
Sodium(mg./l)	138.5	228.0	180.0	-
Potassium(mg./l)	30.0	42.10	25.0	-
Calcium(mg./l)	56.11	99.14	60.92	75
Magnesium(mg./l)	21.12	12.48	21.12	30
Iron(mg./l)	0.64	1.61	2.34	0.3
Zinc(mg./l)	0.65	0.65	0.28	5.0
Phosphorus(mg./l)	0.14	0.04	0.06	-
Fluoride(mg./l)	<0.02	<0.02	<0.02	1.0

Parameters	GW – 1 Near Taratala More (Tube well)	GW – 2 Near Moyla Depot (Tube well)	GW – 3 Near Garden Reach Water Works (Tube well)	National drinking water standard Permissible limit
Lead(mg./l)	<0.03	<0.03	<0.03	0.01
Cadmium(mg./l)	<0.01	<0.01	<0.01	0.003
Arsenic(mg./l)	<0.01	<0.01	<0.01	0.01
Chromium (III) (mg./l)	<0.20	<0.20	<0.20	-
Chromium(VI) (mg./l)	<0.01	<0.01	<0.01	0.05
Phenolic compound(mg./l)	<0.001	<0.001	<0.001	0.001
Cyanide(mg./l)	<0.05	<0.05	<0.05	0.05
Mercury(mg./l)	<0.0001	<0.0001	<0.0001	0.001
Total coliform (MPN/100 ml)	<2	<2	<2	Not detectable

Source: Primary data generated under KEIIP, November , 2011-12

Notes: NTU = Nephelometric Turbidity Units; TON = Threshold Odor Number; mg/l = milligram/litre;  
 MPN/100 ml = Most Probable Number per one hundred millilitre; TSS = Total Suspended Solid  
 TDS = Total Dissolved Solid

## Noise

Noise level in Kolkata is high and exceeds the national standard. Ambient noise level monitoring was carried out in the subproject area under KEIP Phase 2 work and the results are reproduced in Table 11. Data indicate that day time noise level varies from 67.5 to 81.0 dBA where as night time noise varies from 62 to 66 dBA . Both day time and night time noise exceeds the National noise standards. High noise in the area may be due to continuous heavy traffic movement.

**Table11: Ambient Noise level in Garden Reach area**

Station No.	Location	Date and time	Minimum dB(A)	Maximum dB(A)	Leq dB(A)
N1	Santoshpur new road 1 No. railway gate	20.10.2011 (day time)	68.5	73.9	71.89
		20.10.2011 (Night time)	63.7	70.2	67.89
N2	Santoshpur Panchadeep Market	20.10.2011 (day time)	67.9	78.5	74.26
		20.10.2011 (Night time)	64.2	72.1	70.18
N3	Near Brace Bridge Railway Station	20.10.2011 (day time)	78.5	85.3	80.16
		20.10.2011 (Night time)	61.2	73.8	69.18
N4	Near State Bus Terminal	20.10.2011 (day time)	78.3	85.4	81.10
		20.10.2011 (Night time)	63.8	78.9	70.18
N5	Near Water Works Main Gate	20.10.2011 (day time)	68.3	75.3	72.36
		20.10.2011 (Night time)	58.7	68.5	65.89
N6	Near Philips Main Gate	20.10.2011 (day time)	72.1	84.2	79.89
		20.10.2011 (Night time)	61.8	70.2	67.89
N7	Near Nature Park	20.10.2011 (day time)	69.9	84.3	80.68
		20.10.2011 (Night time)	58.7	67.8	64.18
N8	Garden Reach Water Works Pump Room	20.10.2011 (day time)	64.3	75.5	71.30
		20.10.2011 (Night time)	62.7	72.8	69.50
N9	Near Gas Factory Main Gate	20.10.2011 (day time)	70.4	76.8	74.78
		20.10.2011 (Night time)	63.7	69.2	66.18
N10	Near Garden Reach Pumping Station	20.10.2011 (day time)	58.1	68.5	63.78
		20.10.2011 (Night time)	53.2	67.5	62.89

## B. Ecological Resources

Garden Reach area is situated in the south western part of Kolkata near bank of Hooghly river. It is located north-east of Maheshtala, west of Kidderpore and to the north of Taratala and Behala. (source: Wikipedia)

### 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.

Ward-wise rapid ecological survey carried out in connection with the Detailed Project Report (DPR) preparation of investment program indicates that road side plantation in the semi-urban to semi-rural wards 109, 110, 111, 126, 127, 139, 140 and 141 is characterized predominantly by Subabul (*Leucaena glauca*), Kadam (*Anthocephalus cadamba*), Bilaiti babul (*Pithecellobium dulce*), Krishnachura (*Caesalpinia pulcherrima*) etc. In the semi-urban ward 112 the road side plantation species are mainly Kadam (*Anthocephalus cadamba*), Chatim (*Alstonia schoparis*), etc. The urbanized wards 113, 114, 115, 122, 123, 124 and 125 have road side plantation with main species like Subabul (*Leucaena glauca*), Krishnachura (*Caesalpinia pulcherrima*), Bot (*Ficus benghalensis*), Ashwatha (*Ficus religiosa*), Kadam (*Anthocephalus cadamba*), Simul (*Bombax ceiba*), Baash (*Bambusa arundinaceae*), etc. Private plantation within residential area include different types of fruit, ornamental trees, flowering plants, etc., the main species being Mango (*Mangifera indica*), Kanch kala (*Musa paradisiaca*), Coconut (*Cocos nucifera*), Supari (*Areca catechu*), Rangan (*Ixora chinensis*), Kolkey phul (*Thevetia peruviana*), Kamini (*Murraya exotica*), Jaba (*Hibiscus rosasinensis*), Bel (*Aejle marmelos*), Mussaenda (*Mussaenda phillipica*), Nim (*Azadirachta indica*), Tentul (*Tamarindus indica*) etc.

### **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. No endangered faunal species reported in the subproject area.

### **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.

The aquatic ecology of Hooghly River is not known precisely. However, it is known that pollution-resistant species of phytoplankton and zooplankton dominates. The fish resources

include the Ubiquitous Hilsa. Under KEIP limited aquatic ecological survey was carried out in Hooghly River near Palta and Garden Reach areas during November-December, 2011 at the following locations:

- (i) Dhobi Ghat (Palta) - (AW1)
- (ii) Mangal Pandey Ghat (Palta) - (AW2)
- (iii) Budge Budge Ferry Ghat (Near Budge Budge Station) –Garden Reach;( AW3)
- (iv) Charial Bazar Ghat (Near Budge Budge Police Station) – Garden Reach (AW4)
- (v) Pujali Ferry Ghat (Near Pujali Guest House) – Garden Reach - (AW5)
- (vi) New Raw Water intake jetty (Near CESC Southern Generating Station)  
Garden Reach - (AW6)
- (vii) Old Raw Water intake jetty (Near CESC Southern Generating Station) –  
Garden Reach - (AW7)
- (viii) Bichali Ghat (Near CESC Southern Generating Station) – Garden Reach -  
(AW8)

The data are given in the Tables 12, 13, 14 and 15. Data reveal the fact that Hooghly river has moderate phytoplankton and Zooplankton species richness and relative diversity<sup>4</sup> during both high tide and low tide .

**Table 12: Phytoplankton in Hooghly River during High tide**

	Phytoplankton Species	Sampling Station [plankton count x 10 <sup>3</sup> /m <sup>3</sup> ]							
		AW 1	AW2	AW3	AW4	AW5	AW6	AW7	AW8
1.	<i>Melosira sp.</i>	0.9	1.3	1.2	1.4	1.6	1.3	1.8	1.1
2.	<i>Spirogyra sp.</i>	1.7	1.2	1.6	1.5	1.3	1.9	1.2	0.8
3.	<i>Microcystis sp.</i>	1.2	0.8	1.8	1.7	1.4	1.1	1.4	1.3
4.	<i>Anabaena sp.</i>	0.6	0.3	0.9	1.1	1.6	0.8	1.5	0.9
5.	<i>Nitzschia sp.</i>	1.6	1.1	1.7	2.1	2.3	1.7	2.2	1.9
6.	<i>Tetraedron sp.</i>	1.4	1.2	1.6	1.9	1.8	1.9	1.8	2.3
7.	<i>Oscillatoria sp.,</i>	1.8	1.7	2.1	2.5	2.7	1.8	2.8	2.1
8.	<i>Spirulina sp.</i>	2.1	2.1	2.6	2.1	2.4	0.8	2.5	1.6
9.	<i>Euglena sp.</i>	1.3	1.1	1.4	1.8	1.7	0.6	1.8	0.8
10.	<i>Eudorina sp.</i>	1.4	0.8	1.7	1.9	2.0	1.2	2.0	1.8
<b>N = Total Plankton Count X 10<sup>3</sup>/m<sup>3</sup></b>		14.0	11.6	16.6	18.0	18.8	13.10	19.00	14.60
<b>H = Shannon-Weaver Index</b>		2.25	2.21	2.27	2.28	2.28	2.23	2.27	2.30

<sup>4</sup> Shannon-Wiener Index (1.5 – 3.5)

**Table 13: Phytoplankton in Hooghly River during Low tide**

	Phytoplankton Species	Sampling Station [plankton count x 10 <sup>3</sup> /m <sup>3</sup> ]							
		AW1	AW2	AW3	AW4	AW5	AW6	AW7	AW8
1.	<i>Melosira sp.</i>	0.3	0.9	1.0	0.9	1.5	1.5	1.9	1.6
2.	<i>Spirogyra sp.</i>	0.8	0.8	0.9	0.8	1.1	1.0	0.8	1.1
3.	<i>Microcystis sp.</i>	0.9	0.3	1.2	1.1	0.8	0.8	0.9	1.0
4.	<i>Anabaena sp.</i>	-	-	0.3	0.3	0.2	0.2	0.2	0.3
5.	<i>Nitzschia sp.</i>	0.8	0.5	1.2	1.3	0.4	0.5	1.5	0.6
6.	<i>Tetraedron sp.</i>	1.0	0.8	0.9	1.7	1.8	1.7	1.7	1.8
7.	<i>Oscillatoria sp.,</i>	1.1	1.3	1.2	1.8	2.1	2.0	2.2	2.1
8.	<i>Spirulina sp.</i>	1.3	1.8	1.3	1.6	1.9	1.8	1.0	1.7
9.	<i>Euglena sp.</i>	0.8	1.3	1.1	1.3	1.5	1.5	1.2	1.4
10.	<i>Eudorina sp.</i>	0.3	0.4	1.3	1.2	1.3	1.4	1.2	1.3
<b>N = Total Plankton Count X 10<sup>3</sup>/m<sup>3</sup></b>		7.3	8.1	10.4	12.0	12.6	12.40	12.60	12.90
<b>H = Shannon-Weaver Index</b>		2.11	2.06	2.25	2.23	2.17	2.18	2.19	2.20

**Table 14: Zooplankton in Hooghly river during High tide.**

	Zooplankton species	Sampling Station [plankton count x 10 <sup>3</sup> /m <sup>3</sup> ]							
		AW1	AW2	AW3	AW4	AW5	AW6	AW7	AW8
<b>I</b>	<b>Cladocera</b>								
1	<i>Diaphanosoma sp.</i>	130	90	210	190	320	125	80	215
2	<i>Moina sp.</i>	400	370	470	380	480	350	380	412
<b>II</b>	<b>Copepoda</b>								
3	<i>Acartiella sp.</i>	230	210	280	470	480	225	223	260
4	<i>Diaptomus</i>	300	290	430	550	580	320	280	318
5	<i>Pseudodiaptomus sp.</i>	60	60	150	140	270	65	72	120
6	<i>Cyclopina sp.</i>	80	70	130	180	140	90	315	135
<b>III</b>	<b>Nauplia</b>								
7	<i>Lamelibranchs</i>	350	330	450	480	370	326	290	415
<b>IV</b>	<b>Miscellaneous</b>								
8	<i>Lucifer sp.</i>	320	280	370	310	280	290	310	350
<b>N = Total Plankton Count X 10<sup>3</sup>/m<sup>3</sup></b>		1870	1700	2490	2700	2920	1791	1950	2225
<b>H = Shannon-Weaver Index</b>		1.92	1.91	1.99	1.98	2.00	1.94	1.96	1.99

**Table 15: Zooplankton in Hooghly River during low tide.**

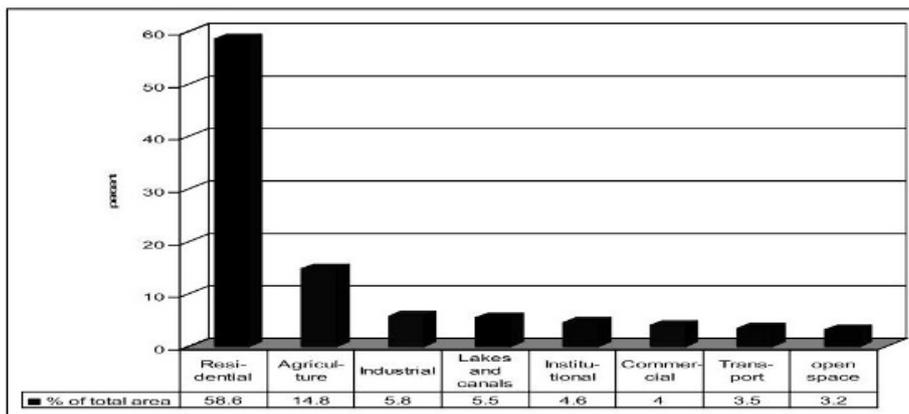
	Zooplankton species	Sampling Station [plankton count x 10 <sup>3</sup> /m <sup>3</sup> ]							
		AW1	AW2	AW3	AW4	AW5	AW6	AW7	AW8
<b>I</b>	<b>Cladocera</b>								
1	<i>Diaphanosoma sp.</i>	80	70	130	90	120	90	72	185
2	<i>Moina.sp</i>	370	360	370	240	340	310	352	240
<b>II</b>	<b>Copepoda</b>								
3	<i>Acartiella sp</i>	190	180	180	260	260	212	180	235
4	Diaptomus	280	270	300	310	380	285	260	280
5	<i>Pseudodiaptomus sp</i>	60	50	120	90	190	52	60	112
6	<i>Cyclopina sp</i>	60	70	80	110	80	81	280	120
<b>III</b>	<b>Nauplia</b>								
7	<i>Lamelibranchs</i>	300	280	350	260	350	280	265	370
<b>IV</b>	<b>Miscellaneous</b>								
8	<i>Lucifer sp</i>	290	270	170	310	170	260	290	326
<b>N = Total Plankton Count X 10<sup>3</sup>/m<sup>3</sup></b>		1630	1550	1700	1670	1890	1570	1759	1868
<b>H = Shannon-Weaver Index</b>		1.90	1.89	1.95	1.97	1.97	1.93	1.95	2.00

**C. Economic Development**

**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 16 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 7: The predominant land use in the KMC Area**



The land use pattern in the subproject area is predominantly semi urban with scattered residential colonies. However, very little commercial activities are also observed in some parts. Joka Cancer Hospital and IIM Kolkata are the major health and educational facilities present within the project area respectively.

The new extension of the metro railway line, under construction, terminates in Joka. The Diamond Harbour Road, being the trunk road to Sager island (religious spot) and Kulpi (developing area for future harbor access) passes within 5 km of the project area. Joka is the doorway from south of West Bengal to Kolkata. Institutional, commercial and industrial activities will definitely enhance and expand. Construction of residential towers are already at place. It is expected that there will be boom in this area.

### **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.

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.

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

#### **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.

### **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.

### **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.

### **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 water supply subproject sites. Kolkata does not fall under the Coastal Regulation Zone (CRZ).

## **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.

## **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.

## **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.

## **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.

## **Education, Health and Health Care Facilities**

A listing for Boroughs XI-XVI indicated that there are more than 180 government and private educational institutes within the Boroughs. The list includes primary, secondary and higher secondary schools, degree colleges, technical and professional institutes. Public health varies according to socio-economic level and location. There are more than fifty 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.

## **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.

## **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 Naroi – Cossipore. There are also a few monuments at Tollygunge and Kalighat areas. All these building and monuments are far away (10 to 15 km) from the project site so the project will not hamper any precincts of cultural or historical significance.

## **Recreational and other facilities**

More than twenty five large play grounds 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.

There is a garden known as “ Nature Park” which is generally a garden used for picnic and recreation by local people , is about more than 5 km from the project location .

## **V. ANTICIPATED IMPACTS AND MITIGATION MEASURES**

### **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.

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 16.

**Table 16: Summary of Quantifiers and Qualifiers Used for Assessment Purposes**

Duration (time-scale)	Short-term	Impact restricted to construction (0-27 months).
	Medium-term	Impact will continue throughout operation (after construction-30 years).
	Long-term	Impacts will exist beyond the life of the project components (>30 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%)

Categorization of the subproject has been undertaken using ADB's REA Checklist for Water supply (**Appendix 6**).

#### **A. Planning and Design Phase**

The subproject will be located in KMC land. Hence land acquisition and encroachment on private property will not be required.

The plan and technical design of the subproject are based on the specifications of CPHEEO Manual (2013), KMC practices, KEIIP practices & standard practices. Whenever felt necessary guidelines laid down in other internationally accepted manuals has been followed.

Engineering decisions considered for this project is to collect the runoff from settling tank (pond) through an interconnected earthen open channel to an underground open reservoir, through a Fore bay channel. From this reservoir water will be pumped out to a pressure main. Pumps are placed in a dry pit which forms part of the main pump house. Adjacent to pump house electrical sub-station is proposed. For safety the total structure is enclosed by a boundary wall with gate.

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 design. This means that the number of impacts and their significance has already been reduced by amending the design.

#### **B. Construction Phase**

The following table (Table 17) 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 design considerations were discussed with the specialists responsible for the engineering aspects, and as a result measures have already been included in the subproject design for the infrastructure. This means that the number of impacts and their significance has already been reduced by amending the design.

**Table 17: Summary of Activities and Facilities, Resource Use, and Produced Outputs during Construction Phase**

Activities and Facilities	Inputs/Resource Use	Outputs/Waste Production
<p>Construction camp and its associated facilities (including lay-down areas)</p> <p>Storage camps and lay-down areas</p> <p>Materials and equipment stockpiles</p> <p>Handling and storage of hazardous materials including chemicals additives, gravel, cement, concrete and lubricants</p> <p>Source of water</p> <p>Vegetation clearance</p> <p>Bulk earthworks, grading and contouring.</p> <p>Drilling and blasting</p> <p>Movement of construction staff, equipment and materials</p> <p>Importation of selected materials</p> <p>Temporary detours</p> <p>Noise and vibrations</p> <p>Dust suppression</p> <p>Waste production and temporary storage/disposal i.e. used fuels, waste concrete and bitumen, spoil materials and general waste</p> <p>Use of asphalt/bitumen (and associated storage and mixing areas, chemicals)</p> <p>Concrete batching plan (and associated storage and mixing areas, chemicals)</p> <p>Rehabilitation of disturbed areas</p> <p>Interaction between construction workforce and local communities</p> <p>Management of the passing pedestrians and points of congestion</p> <p>Implementation of the Resettlement Plan prior to start of construction</p>	<p>Cement</p> <p>Chemical additives used in concrete / asphalt (i.e. retarders)</p> <p>Paving blocks/bricks</p> <p>Aggregate (sand and stone)</p> <p>Gravel</p> <p>Water</p> <p>Drinking, cooking and sanitation at construction camps</p> <p>Water for dust suppression</p> <p>Water applied to base and sub-base layers during compaction</p> <p>Water for application to sub-base and base layers prior to compaction</p> <p>Petrochemicals</p> <p>Other chemicals/lubricants/paints</p> <p>Construction vehicles, machinery and equipment</p> <p>Temporary energy supply to construction camps</p> <p>Topsoil used during re-vegetation and rehabilitation</p> <p>Plant material for re-vegetation (seeds, sods, plant specimens)</p> <p>Labor</p> <p>Recruitment of construction workforce</p> <p>Skills training</p> <p>Control of movement of public</p>	<p>Old asphalt (removed from road carriageway during road restoration)<sup>a</sup></p> <p>Waste concrete and other construction rubble</p> <p>Used fuels, lubricants, solvents and other hazardous waste</p> <p>General waste</p> <p>Contaminated soil</p> <p>Soil contaminated with petrochemicals (i.e. oils and lubricants) and other chemicals</p> <p>Sewage and grey water (temporary construction camp sanitation)</p> <p>Spoil material (excess soil removed during excavations)</p> <p>Noise and vibrations (construction vehicles and machinery)</p> <p>Lighting at construction camps, equipment yards and lay-down areas</p> <p>Plant material removed from servitude/right-of-way during vegetation clearance</p> <p>Smoke and fumes</p> <p>Burning of waste</p> <p>Burning of vegetation cover</p> <p>Fires used for cooking and space heating (construction camps)</p> <p>Vehicle exhaust emissions</p>

<b>Activities and Facilities</b>	<b>Inputs/Resource Use</b>	<b>Outputs/Waste Production</b>
Reminders to affected people of construction with timeframes	needs barriers (not just danger tape) to prevent people from falling in trenches during construction	

The following table (Table 18) 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

**Table 18 :Potential impacts during the 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>	Low (negative)	Site	Short-term	Full Mitigation Possible
Air Quality	<p>Sensitive receptors (e.g. hospitals, schools, religious places) may be affected temporarily by increased traffic and related impacts during the 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>Odours 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.</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</p>	Medium (negative)	Local	Short-term	Partial Mitigation Possible

		<p>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 at least portable toilets on-site and maintain on a daily basis.</p>				
Geology and soil	<p>Strong water flows into open excavated area</p> <p>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>The design of the site drainage system is adequate to control runoff from the excavated 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</p> <p>Contain contaminated water and dispose off site at an approved disposal site in consultation with WBPCB.</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.</p> <p>If oil spills occur, dispose contaminated soil at a disposal site in consultation with</p>	Low (negative)	Site	Short-term	Full Mitigation Possible

		<p>WBPCB.</p> <p>Stockpile subsoil and overburden in all construction and lay down areas. Utilization of overburden/ excavated earth for project site development or disposal at designated areas</p>				
Drainage and hydrology	<p>The proposed development is situated within an existing built up area. Due to the nature and locality of the subproject there is unlikely any significant impacts on water resources within the immediate area.</p>	<p>The site surface has been engineered and shaped in such a way that rapid and efficient evacuation of runoff is achieved.</p> <p>No contamination of water body nearby</p> <p>Provide containment areas for potential pollutants at construction camps, refueling, depots and concrete batching plants.</p> <p>Implement waste management practices.</p> <p>Control and manage transport, storage, handling and disposal of hazardous substances.</p>	Medium (negative)	Site	Short-term	Full Mitigation Possible
Biodiversity Fauna and Flora	<p>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</p> <p>As per preliminary design there will be no requirement for tree felling. This will be further assessed during detail design stage</p>	<p>Permission will be obtained (if required) from the KMC 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>	Low (negative)	Site	Short-term	Full Mitigation Possible

Land Uses	<p>Due to the location and nature of the subproject, there will be limited interference with access.</p> <p>There will be no as such road closure.</p> <p>There will be no as such disruptions to health services, education services, local businesses, transport services, pedestrian movements, due to traffic and construction</p>	<p>KMC has consulted with various organizations, departments, etc within the area and will be continued during the construction phase.</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>Make use of local labor, materials, goods and services as far as possible</p> <p>Provide sign boards for pedestrians/ locality nearby to inform nature and duration of construction works and contact numbers for concerns/complaints.</p>	Low (negative)	Local	Short-term	Partial Mitigation Possible
Infrastructure and Services	<p>No infrastructure services in sub project area , hence no impact on infrastructure services</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, if any</p> <p>Consult with affected communities or businesses prior to foreseeable disruptions, for example notifying residents of a temporary severance of water 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

<p>Traffic</p>	<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 may be affected.</p> <p>Considering nature of the project the impact will be insignificant</p>	<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 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> <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</p>	<p>Low  (negative)</p>	<p>Regional</p>	<p>Short-term</p>	<p>Partial Mitigation Possible</p>
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		<p>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>				
Protection of Sludge ponds and existing outlets leading to Manikhali canal	Construction related activities may lead to pollution of Sludge ponds and existing outlets leading to Manikhali canal	<p>Barricade the sludge pond / canal during construction.</p> <p>Do not allow construction related wastes to enter in to the sludge pond /canal etc.</p> <p>Do not allow construction camp wastes to enter in to the sludge pond /canal etc.</p> <p>Do not allow cement slurry, oil spillage, vehicle washing in to the sludge pond / canal etc.</p> <p>No bathing fishing in to the sludge ponds/ canal by the contractor workers</p> <p>Regular monitor the construction sites</p> <p>Erect awareness signboard for protection of sludge pond and canal.</p>	High (negative)	Site and Local	Short-term	Full I Mitigation Possible
Health and Safety	<p>Construction related activities may lead to injuries.</p> <p>Open fires in construction camp can result in accidents</p> <p>Safety of workers and general public may be compromised due to difficult site conditions.</p>	<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</p>	High (negative)	Site and Local	Short-term	Partial Mitigation Possible

	<p>Poor waste management practices and unhygienic conditions at temporary ablution facilities can breed diseases.</p> <p>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>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> <p>Workers have the right to refuse work in unsafe conditions.</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 at night</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>				
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		<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 <b>Appendix 7</b></p>				
Noise and Vibrations	<p>Sensitive receptors (hospitals, schools, religious places) may be affected temporarily by increased traffic and related impacts</p> <p>Disturbance from afterhours work.</p>	<p>Locate concrete batching, lay down areas and construction camps away from sensitive receptors.</p> <p>Restrict construction activities to reasonable working hours</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>Monitor noise levels in potential problem areas.</p>	Medium (negative)	Local	Short-term	Partial Mitigation Possible
Aesthetics, Landscape Character, and Sense of Place	<p>The presence of heavy duty vehicles and equipment, temporary structures at construction camps, stockpiles, may result in impacts on aesthetics and landscape character</p>	<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>	Medium (negative)	Local	Short-term	Partial Mitigation Definite

		Identify suitable waste disposal site to hold additional waste to be generated by the construction activities. Remove unwanted material and litter on a frequent basis.				
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. Labor gathering at the site for work can be a safety and security issue, and must be avoided. The training of unskilled or previously unemployed persons will add to the skills base of 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
Archaeological and Cultural Characteristics	The proposed development will not require demolition of ASI- or state-protected monuments and buildings	Ensure that construction staff members are aware of the likelihood of heritage resources 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	Low (negative)	Local	Short-term	Full Mitigation Definite

		<p>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>				
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### C. Operation and Maintenance phase

The system have a design life of 30 years, during which the system shall not require any major repairs or refurbishments and shall operate with little maintenance beyond routine actions required to keep the pumps and other equipment in working order. O&M activity for a period of 5 years under the scope of this contract and shall be conceived out as per specification of O&M services.

**Table 19: Summary of Activities and Facilities, Resource Use, and Produced Outputs during Operation and Maintenance Phase**

Activities and Facilities	Inputs/Resource Use	Outputs/Waste Production
Operation activities	Labor	Sludge/ Storm water
Sludge/ Storm water flow pumping	Vehicles and equipment used	
Maintenance activities	for inspections and	
Upkeep and repair of pumps	maintenance	
	Lubricants	
	Electricity	

The following Table 20 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 20: 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 and related impacts during S & D network maintenance.	<p>Ensure compliance with the Air Act.</p> <p>Ensure compliance with emission standards</p> <p>Regularly service vehicles off-site in order to limit gaseous emissions.</p>	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 no interference with access during maintenance works	<p>Put a sign of “Keep Clear” near critical roads.</p> <p>Consult with local authority, organizations, etc. regarding location of construction camps, access and hauling routes, and other likely disturbances.</p> <p>Provide clear and realistic information regarding detours and alternative accesses for local communities and businesses in order to prevent unrealistic expectations.</p> <p>Provide walkways and metal sheets where required to maintain access across for people</p>	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>and vehicles.</p> <p>Increase workforce in front of critical areas such as institutions, place of worship, business establishment, health center, 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>Danger of operations and maintenance-related injuries.</p> <p>Safety of workers and general public must be ensured.</p> <p>Poor waste management practices and unhygienic conditions at the improved facilities can breed diseases.</p> <p>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>Fire and electrocution hazards in</p>	<p>Comply with IFC EHS Guidelines on Occupational Health and Safety- ref. <a href="https://www.ifc.org/wps/wcm/connect/.../Final+-+General+EHS+Guidelines">https://www.ifc.org/wps/wcm/connect/.../Final+-+General+EHS+Guidelines</a></p> <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>	Low (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
	the pumping stations.	<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 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>				

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</p> <p>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</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
Solid Waste	<p>Solid waste/sludge from screens in</p>	<p>Regular removal through municipal system and</p>	High	Local	Medium-	Partial

Environmental Aspect	Summary of Implications and Mitigation		Assessment of Impacts			
	Potential Impacts	Mitigation	Significance before Mitigation	Geographic Spatial Scale	Duration	Mitigation
	the pump house	approved disposal (preferably within pumping station area initially and then to Dhapa dumping ground after due permission from WBPCB)	(negative)		term to Long-term	Mitigation Possible
Wastewater	Excess accumulation of sewage due to various reasons Excess accumulation of storm water	Ensure adequate pumping	High (negative)	Local	Medium-term to Long-term	Partial Mitigation Possible

#### D. Summary of Site Specific Mitigation Measures

Site specific mitigation/safeguard measures for the project are summarized as in table (Table 21) below. It will be revised along with progress of work and in case of change of scope.

**Table 21: Site Specific Mitigation Measures for pumping station to handle sludge water of GRWW**

Work Component	Mitigation measures
Dry pit pump house Collection pit Boundary Wall Toilet block	<ol style="list-style-type: none"> <li>1. The location of the proposed pumping station will be KMC land, hence no land acquisition.</li> <li>2. Project location is isolated from traffic and pedestrian movement area. Only during transportation of construction materials, short term impact may be expected.</li> <li>3. Material storage will be planned within designated area without impeding movement of people.</li> <li>4. Site camp with toilet and drinking water facilities is to set up at available vacant areas without causing any inconvenience to local residents and without restricting movement of vehicles.</li> <li>5. Noise generation from construction activity will be regulated and activity should be planned during day time only.</li> <li>6. No additional impact on nearby water body and sludge ponds.</li> <li>7. 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>8. Security fencing is to be provided around the construction site and excavations during construction.</li> <li>9. No disposal of construction waste into Canal, Sludge pond and river.</li> <li>10. Excess solid waste/ spoil or construction waste is to be disposed at sites pre-approved by PMU.</li> <li>11. All workers and staffs will be provided with PPE.</li> </ol>

#### Cumulative Impact Assessment

The pump house will be constructed in KMC Land. No other major civil construction activities are known to be taking place in the area. Hence, the cumulative impact is not significant.

### VI. INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

#### A. Public participation during the preparation of the IEE

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.

The primary stakeholders are: (i) local residents, shopkeepers and business people who live and work alongside the roads where pipeline will be laid and facilities will be provided; and (ii) custodians and users of socially- and culturally-important buildings in affected areas.

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, NEERI), 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, and Ministry of Finance.

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

- Local communities, Individuals affected, traders and local shopkeepers who may be directly affected to be given priority while conducting public consultation.
- Walk-through informal group consultations along the proposed water supply pipe laying stretch.
- The local communities to be informed through public consultation with briefing on project interventions including its benefits.
- The environmental concerns and suggestions made by the participants to be listed out, discussed and suggestions to be noted for consideration during implementation.

There are series of informal discussions by the DSC & 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. Issues related to consultation and design consideration is shown in Table 22 below.

**Table 22: Summary of Consultation Issues**

Issues raised by the participants	Consideration in design
<ul style="list-style-type: none"> <li>➤ The commencement of the project work and duration.</li> <li>➤ Water logging during heavy monsoon is a big challenge for the local people.</li> <li>➤ Absence of drainage network and Scarcity of drinking water in the project area</li> <li>➤ Application of protection measures including safety during construction</li> </ul>	<ul style="list-style-type: none"> <li>▪ Work will be started very soon, within 6 months</li> <li>▪ Drainage package (pumping station) considered separately to tackle water logging in the area</li> <li>▪ KMC has taken all initiative to supply Sufficient water as per demand and completely treated water will be supplied after treatment</li> <li>▪ Application of Environment Management Plan during project implementation</li> </ul>

Consultation Strategy- Public Information and communication plan for the proposed project is given below.

**Table 23: Public Information and Communication Strategy Plan**

<b>Stages of consultation</b>	<b>Public consultation and communication plan</b>	<b>Participant – target group</b>	<b>Conducted by</b>	<b>Cost involved</b>
During survey and finalization of working areas	Project awareness  Explaining possible impact	Local people at project influence area  Authority of Sensitive receptors –like hospital, educational institutes, religious places	DSC, PMU with the help of community consultation group of KMC	Project cost - PMU
During implementation of the project – construction phase	Project impact and mitigation strategy  Communication through leaflets and information disclosure at ward or borough level	Impacted locals and business	DSC, PMU with the help of community consultation group of KMC	Project cost - PMU
Post construction	Project benefit  Disclosure through media – like newspaper, TV, Information, education and communication (IEC) materials	Benefited person at project influenced area	DSC, PMU with the help of community consultation group of KMC	Project cost - PMU

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

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

i. Consultation during detailed design

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 kept available at the PMU office of KMC.

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.

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.

ii. Consultation during construction:

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; and

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;

iii. Project disclosure

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.

One public information campaigns 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.

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

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

**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.

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.

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.

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.

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 complaints will be communicated to the complainant by letter, over phone or e-mail or whatsapp as the case may be.

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.

**Grievance Redressal Committee (GRC):** An apex GRC has already been constituted by the Project Director to address grievances pertaining to broader concerns related to the program/subproject in KEIIP. This GRC will be applicable for this project also.

**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-

illiterate 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.

**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.

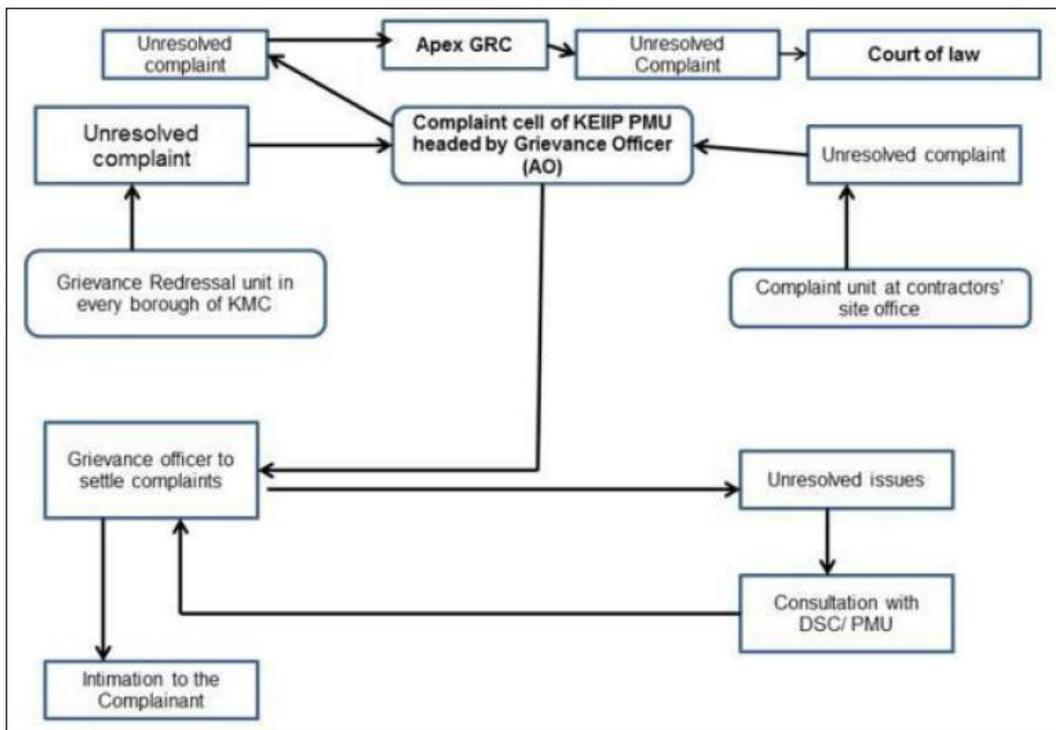
**Information Dissemination Methods of the GRM.** Grievances received and responses provided will be documented and reported back to the affected persons. (Appendix 13 - Sample Grievance Registration Form). The number of grievances recorded and resolved and the outcomes will be displayed/disclosed in 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.

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.

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

Figure 8 shows GRM flow chart.

**Figure 8: GRM system in KEIIP**



## VIII. ENVIRONMENTAL MANAGEMENT PLAN

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 (Pre construction Phase); (ii) Construction Phase; and (iii) Post Construction/Operational Phase.

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 contractor 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 Tables 24 to 27 of 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.

A copy of the EMP/ approved SEP must 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. It shall be noted that the Supreme Court of India<sup>5</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).

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.
- (iv). The Contractor fails to respond adequately to complaints from the public.

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

The institutional arrangement will follow KEIIP's organizational structure and functions (Figure 12). 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.

PMU will be supported by the Design and Supervision Consultants (DSC). An Environment Specialist 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.

Table 24 gives the institutional roles and responsibilities in all phases of the subproject.

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<sup>5</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."

**Table 24: Institutional Roles and Responsibilities: Environmental Safeguard**

Phase	PMU	DSC	ADB
Subproject identification stage		<ul style="list-style-type: none"> <li>• DSC to screen subprojects with inputs based on the EARF subproject selection guidelines</li> </ul>	
Subproject appraisal stage	<ul style="list-style-type: none"> <li>• PMU to review the REA checklists and draft 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>
Detailed Design Phase	<ul style="list-style-type: none"> <li>• 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 if warranted.</li> <li>• DSC to ensure incorporation of EMP in bid documents and contracts.</li> <li>• DSC to prepare inventory of utilities to be affected by the subproject.</li> <li>• DSC to conduct baseline environmental conditions and inventory of affected trees</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>
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>	<p>DSC to ensure statutory clearances and permits from government agencies/other entities are obtained prior to start of civil works.</p> <p>DSC to consult affected people and ensure RP is implemented prior to start of civil works.</p> <p>DSC to ensure disclosure of information prior to start of civil works and throughout the duration of the construction period.</p> <p>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).</p>	

Phase	PMU	DSC	ADB
Construction Phase	<ul style="list-style-type: none"> <li>PMU 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>	<p>DSC to monitor the implementation of mitigation measures by Contractor.</p> <ul style="list-style-type: none"> <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>	<p>ADB to review the 6 monthly report, provide necessary advice if needed to the PMU and approve the same.</p> <ul style="list-style-type: none"> <li>ADB to disclose on its website environmental monitoring reports.</li> </ul>
Pre-operation Phase (Commissioning and Defect Liability Period)	PMU to review monitoring report of DSC on post-construction activities by the contractors as specified in the EMP	<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>KMC to conduct monitoring, as specified in the environmental monitoring plan.</li> <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>		

Notes: WBPCB = West Bengal State Pollution Control Board, KMC = Kolkata Municipal Corporation, 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, PMU = Project Management Unit; REA = Rapid Environmental Assessment,

**The Contractor will be required to:**

- (i). 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

- (ii). Comply with all applicable legislation, is conversant with the requirements of the EMP/ approved SEP;
- (iii). Brief his staff, employees, and laborer about the requirements of the EMP/ approved SEP;
- (iv). 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;
- (v). 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;
- (vi). Provide environmental awareness training to staff, employees, and laborers;
- (vii). Bear the costs of any damages/compensation resulting from non-adherence to the EMP/ approved SEP or written site instructions;
- (viii). Conduct all activities in a manner that minimizes disturbance to directly affected residents and the public in general, and foreseeable impacts on the environment.
- (ix). Ensure that the PMU Environment Specialist is timely informed of any foreseeable activities that will require input from the DSC Environment Specialist.

#### **B. Environmental Management and Mitigation Measures**

Table 25 outlines the site establishment and preliminary activities to be considered by contractor during preparation of SEMP

**Table 25: Site Establishment and Preliminary Activities (to be revised by contractors during preparation of SEP)**

<b>Sr. No.</b>	<b>Activity</b>	<b>Management/Mitigation</b>	<b>Responsible for Monitoring</b>	<b>Frequency</b>
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	DSC Environment Specialist	Prior to moving onto site and during

Sr. No.	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
		repair damage shall not occur due to construction.		construction
		The Local Traffic Department shall be involved in the planning stages of the road closure and detour 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 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>6</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
		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
		In most cases, on-site accommodation will not be required. The construction	DSC Environment Specialist	During set-up

<sup>6</sup> Careful planning of the construction camp can ensure that time and costs associated with environmental management and rehabilitation are reduced.

Sr. No.	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
		camp can thus be comprised of: <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>		
		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>7</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	DSC Environment Specialist	During site set-up

<sup>7</sup> Storage areas can be hazardous, unsightly and can cause environmental pollution if not designed and managed carefully

Sr. No.	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
		It is very important that the proximity of resident 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 are	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 water from surrounding areas in order to ensure that accidental spillage does not pollute local soil or water resources	DSC Environment Specialist	During site set-up and ongoing
		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.	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.	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

Sr. No.	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
5.	Materials Management – Sourcing <sup>8</sup>	Contractors shall prepare a source statement indicating the sources of all materials (including 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>9</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
		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> </ul>	DSC Environment Specialist and Contractor	During staff induction, followed by ongoing monitoring

<sup>8</sup> Materials must be sourced in a legal and sustainable way to prevent offsite environmental degradation.

<sup>9</sup> These points need to be made clear to all staff on site before the subproject begin.

Sr. No.	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
		<ul style="list-style-type: none"> <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>		
6.	Social Impacts <sup>10</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. The road closure together with the proposed detour needs to be communicated via advertising, pamphlets, radio broadcasts, road signage, etc	PMU Environment Coordinator	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, elevated tanks 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 may require screening. This could be in the form of shade cloth, temporary walls, or other suitable	DSC Environment Specialist and PMU Environment Specialist	During surveys and preliminary investigations and site set-up.

<sup>10</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.

Sr. No.	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
		materials prior to the beginning of construction.		
7.	Noise Impacts	Construction vehicles/ equipments are be to 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>11</sup>	Vehicles travelling 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
10.	Storm water <sup>12</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.

<sup>11</sup> Establishment of the camp site, and related temporary works can reduce air quality.

<sup>12</sup> Serious financial and environmental impacts can be caused by unmanaged stormwater.

Sr. No.	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
		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.
		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>13</sup> .	Storage areas that contain hazardous substances must be bunded with an approved impermeable liner	DSC Environment Specialist	During site setup.
		Spills in bunded areas must be cleaned up, removed and disposed of safely from the bunded area as soon after detection as possible to minimise pollution risk and reduced bunding capacity.	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>14</sup>	No vegetation will 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	The excavation and use of rubbish pits on site is forbidden	PMU Environment Specialist	Ongoing

<sup>13</sup> Incorrect disposal of substances and materials and polluted run-off can have serious negative effects on groundwater quality

<sup>14</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.

Sr. No.	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
	Procedure			
		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 must be stable and well secured to avoid collapse and possible injury to site workers / local residents.	PMU Environment Specialist	Ongoing
		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</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

Table 26 outlines management of construction activities and workforce to be considered by contractor during preparation of SEP

**Table 26: Management of Construction and Workforce Activities (to be revised by contractors during preparation of SEP)**

Sr. 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	DSC Environment Specialist	Weekly and after heavy rains.

		properly and are well maintained.		
		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.
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	DSC Environment Specialist	Ongoing monitoring.

		or social behavior that are unclear.		
		Contractor to ensure rules that are explained in the worker conduct section, <sup>15</sup> must be followed at all times	DSC Environment Specialist	Ongoing monitoring.
4.	Dust and Air Pollution <sup>16</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/hr 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 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.
		Undertake monitoring of air pollution levels in potential problem areas	DSC Environment Specialist	Ongoing monitoring.
		Cover stockpiles of soil or apply suitable dust palliative such as water or commercial dust suppressants.	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.
		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. Volume will be estimated during detail design	DSC Environment Specialist	Ongoing monitoring.

<sup>15</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>16</sup> Main causes of air pollution during construction are dust from vehicle movements and stockpiles, vehicle emissions and fires.

6	Noise & vibration	Locate concrete batching, lay down areas and construction camps away from residential houses.	DSC Environment Specialist	Ongoing monitoring.
		Restrict construction activities to reasonable working hours	DSC Environment Specialist	Ongoing monitoring.
		Keep adjacent landowners informed of unusually noisy activities planned	DSC Environment Specialist	Ongoing monitoring.
		Regulate roadworthiness of vehicles.	DSC Environment Specialist	Ongoing monitoring.
		Ensure that machinery in a good state of maintenance.	DSC Environment Specialist	Ongoing monitoring.
		Monitor noise levels in potential problem areas.	DSC Environment Specialist	Ongoing monitoring.
7	Storm water drainage and hydrology	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 or ponds	PMU Environment Specialist and DSC Environment Specialist	Monitoring throughout the duration of the subproject.
		The site surface has been engineered and shaped in such a way that rapid and efficient evacuation of runoff is achieved	DSC Environment Specialist	Ongoing monitoring.
		Provide containment areas for potential pollutants at construction camps, refueling, depots and concrete batching plants.	DSC Environment Specialist	Ongoing monitoring.
		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.
		Control and manage transport, storage, handling and disposal of hazardous substances.	DSC Environment Specialist	Ongoing monitoring.
8	Water Quality <sup>17</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	DSC Environment	Regular monitoring (refer to the

<sup>17</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.

		substances do not contaminate the soil	Specialist	environmental monitoring program)
		Contractor to prohibit site staff in using any stream, other 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
9	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 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.
10.	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 place 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 containers until they can be disposed of/removed from the sites.	DSC Environment Specialist	Ongoing monitoring.
		Contractor to ensure hazardous substances/materials are transported in sealed containers or bags	DSC Environment Specialist	Ongoing monitoring
11	Land uses	KMC has consulted with various organizations, departments, etc within the area and will be continued during the construction phase.	DSC Environment Specialist	Ongoing monitoring.
		Consult with local departments, organizations, etc regarding location of construction camps, access and hauling routes, and other likely disturbances during construction.	DSC Environment Specialist	Ongoing monitoring.
		Make use of local labor, materials, goods and services as far as possible	DSC Environment Specialist	Ongoing monitoring.
		Provide sign boards for locality nearby to inform nature and duration of construction works and contact numbers for concerns/complaints.	DSC Environment Specialist	Ongoing monitoring.
12	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.	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,	DSC Environment Specialist	Weekly monitoring.

		pollution and nuisance to adjoining areas.		
13	Health & safety	<ul style="list-style-type: none"> <li>• Implement good housekeeping practices at the construction camp.</li> <li>• Strictly implement health and safety measures and audit on a regular basis.</li> <li>• Secure enclosed construction site.</li> <li>• Use reputable contractors.</li> <li>• Provide warning signs of hazardous working areas.</li> <li>• Clearly demarcate excavations and provide barriers (not just danger tape) to protect pedestrians from open trenches.</li> <li>• Thoroughly train workers assigned to dangerous equipment.</li> <li>• Workers have the right to refuse work in unsafe conditions.</li> <li>• Control speed and movement of construction vehicles</li> <li>• Exclude public from the site</li> <li>• Ensure all workers are provided with and use Personal Protective Equipment.</li> <li>• Ensure the visibility of workers through their use of high visibility vests when working at night</li> <li>• Ensure that qualified first-aid can be provided at all times. Ensure equipped first-aid stations are easily accessible throughout the site;</li> <li>• Provide medical insurance coverage for workers.</li> <li>• Provide clean eating areas where workers are not exposed to hazardous or noxious substances;</li> <li>• 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;</li> <li>• 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.</li> <li>• Health and Safety Plan is attached as <b>Appendix 7</b></li> </ul>	DSC Environment Specialist	Weekly monitoring.
14.	Social Impacts <sup>18</sup>	Contractor to restrict activities and movement of staff to designated	DSC Environment	Ongoing.

<sup>18</sup> Regular communication between the Contractor and the interested and affected parties is important for the duration of the contract.

		construction areas.	Specialist	
		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 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	Ongoing monitoring.
		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.
		Contractors to ensure lighting on the construction site is 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	DSC Environment Specialist	Monthly monitoring.

		tabled during monthly site meetings.		
		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 Specialist 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 Specialist 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.
15.	Archaeological and Cultural Characteristics	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.

**Table 27 & 28 outlines the post-construction activities to be to be under taken by the contractor.**

***Table 27: Post-Construction Activities (Defects Liability Period)- (to be revised by contractors before operation)***

<b>Sr. no.</b>	<b>Activities</b>	<b>Management/Mitigation</b>	<b>Responsible for Monitoring</b>	<b>Frequency</b>
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

<b>Sr. no.</b>	<b>Activities</b>	<b>Management/Mitigation</b>	<b>Responsible for Monitoring</b>	<b>Frequency</b>
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 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-vegetation specification, (except for seeding alien vegetation).	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
		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.

Sr. no.	Activities	Management/Mitigation	Responsible for Monitoring	Frequency
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 Environment Specialist	On completion of construction
		Access or haulage roads that were built must be rehabilitated	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

**Table 29: Operation and Maintenance Activities (covering defect liability period)**

Sr. No.	Activities	Management/Mitigation	Responsible for Monitoring	Frequency
1.	Pollution monitoring	Monitor the environmental quality in terms of Pumps' discharge, ambient air and noise levels.	Contractor in association with Environmental Monitoring Laboratory of KMC	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.	KMC	As necessary.
3	Health & Safety	<ul style="list-style-type: none"> <li>• Implement good housekeeping practices at pumping stations.</li> <li>• Strictly implement health and safety measures and audit on a regular basis.</li> <li>• Provide warning signs of hazardous working areas.</li> <li>• Clearly demarcate excavations and provide barriers (not just danger tape) to protect pedestrians from open trenches.</li> <li>• Thoroughly train workers assigned to dangerous equipment.</li> <li>• Workers have the right to refuse work in unsafe</li> </ul>	Contractor KMC	As necessary on regular basis

Sr. No.	Activities	Management/Mitigation	Responsible for Monitoring	Frequency
		<p>conditions.</p> <ul style="list-style-type: none"> <li>• Ensure all workers are provided with Personal Protective Equipment.</li> <li>• Ensure the visibility of workers through their use of high visibility vests when working at night</li> <li>• Ensure that qualified first-aid can be provided at all times. Ensure equipped first-aid stations are easily accessible throughout the site;</li> <li>• Provide medical insurance coverage for workers.</li> <li>• Provide clean eating areas where workers are not exposed to hazardous or noxious substances;</li> <li>• Ensure moving equipment is outfitted with audible back-up alarms;</li> <li>• 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.</li> </ul>		
4.	Works conduct	<p>Ensure strict control of laborers</p> <p>Minimize working hours to normal working times</p> <p>Control littering</p>	Contractor	On regular basis

### C. Environmental Monitoring Program

Table 30 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 30: Environmental Monitoring Program**

Aspect	Parameter	Standards	location	duration / frequency	Implementation	Supervision
1. Site establishment and preliminary activities						
Legislation, Permits and Agreements	CTE and CTO for the hot mix, stone crushers,	Air (Prevention and Control	-	Prior to moving onto site and	Contractor	PMU / DSC

Aspect	Parameter	Standards	location	duration / frequency	Implementation	Supervision
	and diesel generators)	of Pollution) Act of 1981, Rules of 1982 and amendments.		during construction		
	Cutting Permit for Scheduled Trees – if any	West Bengal Trees (Protection and Conservation in Non-Forest Areas) Act, 2006	-	Prior to moving onto site	DSC	PMU
	Copy of EMP	ADB SPS	subproject site, offices, website, library, etc.	At all times	Contractor	PMU/DSC
Access to site	Existing conditions New development	EMP	all access and haul roads	Prior to moving onto site	DSC Environment Specialist	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
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 /DSC	Implementing Agency (KMC)

Aspect	Parameter	Standards	location	duration / frequency	Implementation	Supervision
	GRM Register	EMP	subproject site	prior to moving onto site and ongoing	Contractor with the DSC Environment Specialist, PMU Environment Specialist, PMU/DSC	Implementing Agency (KMC)
Noise	Baseline Data for noise level in dB(A) $L_{eq}$	National Noise Standards	Two 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 ( $PM_{10}$ , $PM_{2.5}$ ), sulfur dioxides ( $SO_2$ ), nitrogen dioxide ( $NO_2$ ), and hydrocarbons (HC)	National Ambient Air Quality Standards	Two 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
Water quality	Baseline qualitative characteristics-pond water	EMP	subproject sites <sup>19</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	PMU/DSC

<sup>19</sup> Subproject sites include approved construction site, equipment lay-down and storage area, water courses along the subproject site, open drainages

Aspect	Parameter	Standards	location	duration / frequency	Implementation	Supervision
					Specialist	
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 Specialist	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 Specialist	PMU/DSC
<b>2. Construction phase</b>						
Access to Site	Qualitative characteristics	Pre-subproject condition and EMP	all access and haul roads	refer to EMP table on management of construction and workforce activities	Contractor	DSC Environment Specialist
Construction camp	Qualitative characteristics	Pre-subproject condition and EMP	all access and haul roads	refer 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> and HC	National Ambient Air Quality Standards	Two locations near construction sites as specified by the engineer (DSC).	once in four months (three times in an year)	Contractor with close coordination with the DSC Environment Specialist	PMU/DSC
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

Aspect	Parameter	Standards	location	duration / frequency	Implementation	Supervision
						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, PMU/DSC	Implementing Agency (KMC)
	GRM Register	EMP	subproject sites	Ongoing	Contractor with the DSC Environment Specialist, PMU Environment Specialist, PMU/DSC	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	Two locations near construction sites as specified by the engineer (DSC).	once in four months (three times in an year)	Contractor with close coordination with the DSC Environment Specialist	PMU/DSC
<b>C. 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
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

Aspect	Parameter	Standards	location	duration / frequency	Implementation	Supervision
<b>C. Operation and maintenance (defect liability period)</b>						
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 the Environment Spl.	once in 6 months (defect liability period)	Contractor in association with Environmental Monitoring Laboratory	PMU/DSC
Noise quality	Noise Level in dB(A) L <sub>eq</sub>	As per National Noise standards	Two locations as specified by the Environment Spl	once in 6 months (defect liability period)	Contractor in association with Environmental Monitoring Laboratory	PMU/DSC

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 31.

**Table 31: Training Program on environmental safeguards and its implementation**

Module	Frequency of sessions	Target participants	Conducting agency
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 KEIIP subprojects, international obligations (common for all subprojects)	Once in Pre-construction stage	Senior Construction Supervisors of DSC, Safety Officers of Contractors, KEIIP Senior Engineers	DSC and PMU with assistance from INRM, ADB, New Delhi and WBPCB
IEE and EMP of water supply subproject	Once during Pre-construction stage	Safety officers of Contractors and Construction supervisors of DSC	DSC and PMU
Workshop on implementation of EMP of water supply subproject of KEIIP: lessons learnt and way forward	Once during Construction stage	Senior Construction Supervisors of DSC, PMC Engineers, Safety Officers of Contractors, KEIIP Senior Engineers	DSC with assistance from PMU

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

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.

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.

The activities identified in environmental monitoring programme 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. Table 32 summarizes the indicative cost to implement the EMP.

**Table 32: Indicative Costs for EMP Implementation- pre construction and construction phase (to be revised during preparation of SEP)**

Item	Parameters	Project Phase	Sampling Station	Duration and Frequency	Quantity	Unit cost (INR)	Unit cost (INR)	Source of funds
<b>1. Survey and monitoring</b>								
Ambient air	PM10, PM2.5, SO <sub>2</sub> , NO <sub>2</sub> and CO	Pre Construction & construction	Pumping station site	1½ years Once in a quarter for 3 quarter in a year	Approx. 5 nos.	15,000	75,000	Contractor budget
Noise	Leq in dBA	Pre Construction & construction	Pumping station site	1½ years Once in a quarter for 3 quarter in a year	Approx. 5 nos.	1000	5,000	Contractor budget
Surface water	As per CPCB standard	Pre Construction, construction and operation	Nearby ponds and other surface water/ supply water source	Once in a quarter for 3 quarters in a year for 1½ years	10 nos.	12,000	120,000	Contractor budget
<b>2. Capacity building/ Training/ workshop expenses</b>							100,000	Contractor budget
<b>3. Environmental Permits if any</b>							50,000	Contractor budget
Total (INR)							<b>3,50,000</b>	

## **E. Monitoring and Reporting**

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.

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

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

Monthly reports will 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 7**.

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

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.

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.

For projects likely to have significant adverse environmental impacts, the KMC will retain qualified and experienced external experts to verify its monitoring information. 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.

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.

## **IX. RECOMMENDATIONS AND CONCLUSION**

The process described in this document has assessed the environmental impacts of all elements of the Construction of Pumping Station to Handle Sludge Water of Garden Reach Water Works (GRWW), sub-project of KEIIP under Tranche 2 in the Kolkata City. Potential negative impacts were identified in relation to pre-construction, construction and operation of the improved infrastructure. No significant 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.

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.

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.

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.

EMP will be part of the contractor's contract document. Implementation of the EMP will be contractor's contractual obligation.

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.

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 (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.

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

**Appendix 1: Standards Ambient Air, Air Emission, Effluents, Receiving Water Bodies, Drinking Water at Consumer End**

A) Notification by Ministry of Environment and Forests, Government of India

Environment (Protection) Seventh Amendment Rules, 2009

Ambient Air Quality Standards

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

<b>Pollutant</b>	<b>Time Weighted Average</b>	<b>Industrial, Residential, Rural and Other Areas</b>	<b>Sensitive Area (Notified by Central Govt)</b>	<b>Method of Measurement</b>
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	
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	1.1.2004	9.2	1.3	5.0	0.5	0.7	50	0.30
up to 176 KW	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

3) Environment Protect third amendment rules 2002 vide 489(E) 9 July, 2002

Para 96. Emission standards for diesel engines (engine rating more than 0.8 Mw (800 Kw) for power plant, generator set applications and other requirements

Parameter	Area Category	Total engine rating of the plant (includes existing as well as new generator sets)	Generator sets commissioning date		
			Before 1/7/2003	Between 1/7/2003 and 1/7/2005	On or after 1/7/2005
NO <sub>x</sub> (as NO <sub>2</sub> ) (AT 15% O <sub>2</sub> ), dry basis, in ppmv	A	Up to 75MW	1100	970	710
	B	Up to 150MW			
	A	More than 75MW	1100	710	360
	B	More than 150MW			
NMHC (as C) (at 15% O <sub>2</sub> ), mg/Nm <sup>3</sup>	Both A and B		150	100	
PM (at 15% O <sub>2</sub> ),	Diesel Fuels -	Both A and B	75	75	

Parameter		Area Category	Total engine rating of the plant (includes existing as well as new generator sets)	Generator sets commissioning date		
				Before 1/7/2003	Between 1/7/2003 and 1/7/2005	On or after 1/7/2005
mg/Nm <sup>3</sup>	HSD & LDO					
	Furnace Oils - LSHS & FO	Both A and B		150	100	
CO (at 15% O <sub>2</sub> ), mg/Nm		Both A and B		150	150	
Sulphur content in fuel		A		<2%		
		B		<4%		
Fuel specification		For A only	Up to 5MW	Only Diesel Fuels (HSD, LDO) shall be used.		
Stack height (for generator sets commissioned after 1/7/2003)		Stack height shall be maximum of the following, in meter: (i) $14 Q^{0.3}$ , Q = Total SO <sub>2</sub> emission from the plant in kg/hr (ii) Minimum 6 m above the building where generator set is installed. (iii) 30 m.				

Note:

1. Acronyms used: MW : Mega (10<sup>6</sup>) Watt, FO : Furnace Oil, NO<sub>x</sub> : Oxides of Nitrogen: HSD : High Speed Diesel, NO<sub>2</sub> : Nitrogen Dioxide, LDO : Light Diesel Oil; O<sub>2</sub> : Oxygen, LSHS : Low Sulphur Heavy Stock, NMHC : Non- Methane Hydrocarbon kPa : Kilo Pascal, C : Carbon, mm : Milli (10<sup>-3</sup>) metre, PM : Particulate Matter kg/hr : Kilo (10<sup>3</sup>) gram per hour, CO : Carbon Monoxide, mg/Nm<sup>3</sup> : Milli (10<sup>-3</sup>) gram per ; SO<sub>2</sub> : Sulphur Dioxide Normal metre cubic, ppmv : part per million (10<sup>6</sup>) by volume

2. Area categories A and B are defined as follows:

3. Category A: Areas within the municipal limits of towns/cities having population more than 1million and also up to 5 km beyond the municipal limits of such towns/cities. Category B: Areas not covered by category A.

4. Individual units with engine ratings less than or equal to 800 KW are not covered by this notification.

5. Only following liquid fuels viz. High Speed Diesel, Light Diesel Oil, Low Sulphur Heavy Stock and Furnace Oil or liquid fuels with equivalent specifications shall be used in these power plants and generator sets.

6. For expansion Project, stack height of new generator sets shall be as per total Sulphur Dioxide emission (including existing as well as additional load).

7. For multi engine plants, fuels shall be grouped in cluster to get better plume rise and dispersion. Provision for any future expansion should be made in planning stage itself.

8. Particulate Matter, Non-Methane Hydrocarbon and percent moisture (dry basis). Carbon Monoxide results -are to be normalized to 25°C, 1.01 Kilo Pascal (760 mm of mercury) pressure and zero

9. Measurement shall be performed at steady load conditions of more than 85% of the rated load.

10. Continuous monitoring of Oxides of Nitrogen shall be done by the plants whose total engine capacity is more than 50 Mega Waft. However, minimum once in six month monitoring for other parameters shall be adopted by the plants.

ii) Effluent

A) Schedule VI of Environment (Protection) Rules, 1986

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 odour	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	30	350	100	100

Sl no	Parameter	Standards			
	27°C), mg/l. max.				
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
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.	10 <sup>-7</sup> 10 <sup>-6</sup>	10 <sup>-7</sup> 10 <sup>-6</sup>	10 <sup>-8</sup> 10 <sup>-7</sup>	10 <sup>-7</sup> 10 <sup>-6</sup>

Sl no	Parameter	Standards			
	(b)Beta emitters micro curie/ml, max.				
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) CPCB Primary Water Quality Criteria

The Central Pollution Control Board (CPCB), an apex body in the field of water quality management, has developed a concept of "designated best use". According to which, out of several uses a particular water body is put to, the use which demands highest quality of water is called its "designated best use", and accordingly the water body is designated. The CPCB has identified 5 such "designated best uses". All those water bodies, which are used for drinking without any treatment, but with disinfection (chlorination), are termed as "A" Class Water, those which are used for outdoor bathing are termed as "B" Class Water, those which are used for drinking after conventional treatment are termed as "C" Class Water, those which are used for propagation of wildlife and fisheries are termed as "D" Class Water and those which are used for irrigation, cooling and controlled waste disposal are termed as "E" Class Water. For each of these five "designated best uses", the CPCB has identified water quality requirements in terms of few chemical characteristics, known as primary water quality criteria. The "designated best uses" along with respective water quality criteria is given in Table below.

**Table. Best use based classification of surface waters in India**

S.No	Designated-Best-Use	Class of Water	Criteria
1	Drinking Water Source without conventional treatment but after disinfection	A	1. Total Coliform Organism MPN/100 ml: 50 or less
			2. pH: between 6.5 and 8.
			3. Dissolved Oxygen: 6mg/1 or more
			4. Biochemical Oxygen Demand 5 days 20°C: 2mg/1 or less
2	Outdoor bathing (Organised)	B	1. Total Coliform Organism MPN/100 ml: 500 or less
			2. pH: between 6.5 and 8.5
			3. Dissolved Oxygen: 5mg/1 or more
			4. Biochemical Oxygen Demand 5 days 20°C: 3mg/1 or less

S.No	Designated-Best-Use	Class of Water	Criteria
3	Drinking water source after conventional treatment and disinfection	C	1. Total Coliform Organism MPN/100 ml: 5000 or less
			2. pH: between 6 to 9
			3. Dissolved Oxygen: 4mg/1 or more
			4. Biochemical Oxygen Demand 5 days 20°C: 3mg/1 or less
4	Propagation of Wild life and Fisheries	D	1. pH: between 6.5 to 8.5
			2. Dissolved Oxygen: 4mg/1 or more
5	Irrigation, Industrial Cooling, Controlled waste disposal	E	1. pH: between 6.0 to 8.5
			2. Electrical Conductivity at 25OC micro mhos/cm: Max 2250
			3. Sodium Absorption Ratio Max.: 26
			4. Boron Max.: 2mg/1

C) Drinking water standard at consumer end is under revision and the draft version is given in the following Table

**Indian Standards for Drinking Water - Specification (BIS 10500: 1991) revised 2012**

Sl. No	Substance or characteristic	Requirement (Acceptable Limit)	Undesirable effect outside the acceptable limit	Permissible limit in the absence of alternate source	Method of Test (Ref to IS)	Remarks
1. Organoleptic and physical parameters						
i)	Color, Hazen units, Max	5	Above 5 consumer acceptance decreases	15	3025 (Part 5)	
ii).	Odour	Agreeable	-	Agreeable	3025 (Part 5)	a)Test cold when heated b)Test at several dilutions
iii)	Taste	Agreeable	-	Agreeable	3025 (Part 7 & 8)	Test to be conducted only after safety has been established
iv)	Turbidity, NTU, Max	1	Above 5 consumer acceptance decreases	5	3025 (Part 10)	-

Sl. No	Substance or characteristic	Requirement (Acceptable Limit)	Undesirable effect outside the acceptable limit	Permissible limit in the absence of alternate source	Method of Test (Ref to IS)	Remarks
v)	Dissolved solids, mg/l, Max	500	Beyond this palatability decreases and may cause gastrointestinal irritation	2000	3025 (Part 16)	-
vi)	pH Value	6.5 to 8.5	Beyond this range the water will affect the mucous membrane and/or water supply system	No Relaxation	3025 (Part 11)	-
vii)	Total hardness (as CaCO <sub>3</sub> ), mg/l., Max	200	Encrustation in water supply structure and adverse effects on domestic use	600	3025 (Part 21)	

Note 1: It is recommended that the acceptable limit is to be implemented. Values in excess of those mentioned under the water not acceptable, but still may be tolerated in the absence of an alternative source but up to the limits indicated under permissible limit in the absence of alternate source in col (5), above which the sources will have to be rejected.

**General parameters concerning substances undesirable in excessive amounts**

i)	Iron (as Fe) mg/l, Max	0.3	Beyond this limit taste/appearance are affected, has adverse effect on domestic uses and water supply structures, and promotes iron bacteria	No relaxation	3025 (Part 53)	Total concentration of Manganese (as Mn) and Iron (as Fe) shall not exceed 0.3 mg/l
ii)	Aluminium (as Al), mg/l, Max	0.1	Beyond this limit taste/ appearance are affected, has adverse effect on domestic uses and water supply structures	0.3	IS 3025 (Part 59)	-
iii)	Copper (as Cu), mg/l, Max	0.05	Astringent taste, discoloration and corrosion of pipes, fittings and utensils will be caused beyond this	1.5	IS 3025 (Part 42)	-

Sl. No	Substance or characteristic	Requirement (Acceptable Limit)	Undesirable effect outside the acceptable limit	Permissible limit in the absence of alternate source	Method of Test (Ref to IS)	Remarks
iv)	Manganese (as Mn), mg/l, Max	0.1	Beyond this limit taste/ appearance are affected, has adverse effect on domestic uses and water supply structures	0.3	IS 3025 (Part 59)	Total concentration of Manganese (as Mn) and Iron (as Fe) shall not exceed 0.3 mg/l
v)	Zinc (as Zn), mg/l, Max	5	Beyond this limit it can cause astringent taste and an opalescence in water	15	IS 3025 (Part 49)	-
vi)	Magnesium (as Mg), mg/l, Max.	30	Encrustation in water supply structure and adverse effects on domestic use	No relaxation	IS 3025 (Part 46)	-
vii)	Barium (as Ba), mg/l, Max	0.7	May lead to cardiovascular problem	No relaxation	Annex F of IS 13428*/ S 15302	-
viii)	Calcium (as Ca) mg/l, Max	75	Encrustation in water supply structure and adverse effects on domestic use	200	3025 (Part 40)	-
ix)	Silver (as Ag), mg/l, Max	0.1	-	No relaxation	Annex J of IS 13428	-
x)	Selenium (as Se), mg/l, Max	0.01	Beyond this the water becomes toxic	No relaxation	3025 (Part 56) or IS 15303*	-
xi)	Molybdenum (as Mo), mg/l, Max	0.07	Beyond this it may cause osteoporosis/ bone disorders	No relaxation	3025 (Part 2; 2002)/ ISO 11885: 1996	-
xii)	Boron (as B), mg/l, Max	0.5	-	1.0	3025 (Part 57)	-
xiii)	Nitrate (as NO <sub>3</sub> ) mg/l,	45	Beyond this methaemoglobina	No relaxation	3025 (Part 34)	

Sl. No	Substance or characteristic	Requirement (Acceptable Limit)	Undesirable effect outside the acceptable limit	Permissible limit in the absence of alternate source	Method of Test (Ref to IS)	Remarks
	Max		mia takes place/may be indicative of pollution			
xiv)	Sulfate (as SO <sub>4</sub> ) mg/l, Max	200	Beyond this causes gastro intestinal irritation when magnesium or sodium is present	400	3025 (Part 24)	May be extended to 400 provided that Mg does not exceed 30
xv)	Sulphide (as H <sub>2</sub> S), mg/l, Max	Below detectable limit	Beyond this it may cause objectionable taste and odor	No relaxation	3025 (Part 29)	-
xvi)	Fluoride (as F) mg/l, Max	1.0	Fluoride may be kept as low as possible. High fluoride may cause fluorosis	1.5	3025 (Part 60)	-
xvii)	Chlorides (as Cl) mg/l, Max.	250	Beyond this taste corrosion and palatability are affected	1000	3025 (Part 32)	-
xviii)	Ammonia (as total ammonia – N), mg/l, Max	0.5	Toxicological effect about 200 mg per kg of body weight	No relaxation	3025 (Part 34)	-
xix)	Chloramines (as Cl <sub>2</sub> ), mg/l, Max	0.2	Eyes, nose irritation, anaemia, stomach discomfort	No relaxation	3025 (Part 26) or APHA 4500-CIG	-
xx)	Residual, Free chlorine, mg/l, Min	0.2	-	-	3025 (Part 26)	To be applicable only when water is chlorinated. Tested at consumer end. When protection against viral infection is

Sl. No	Substance or characteristic	Requirement (Acceptable Limit)	Undesirable effect outside the acceptable limit	Permissible limit in the absence of alternate source	Method of Test (Ref to IS)	Remarks
						required, it should be minimum 0.5 mg/l.
xxi)	Total alkalinity in Calcium carbonate, mg/l, Max	200	Beyond this limit taste becomes unpleasant	600	3025 (Part 23)	-
xxii)	Phenolic Compounds (as C <sub>6</sub> H <sub>5</sub> OH) mg/l, Max.	0.001	Beyond this may cause objectionable taste and odor	0.002	3025 (Part 43)	-
xxiii)	Mineral Oil mg/l, Max	Below detectable limit	Beyond this limit undesirable taste and odor after chlorination takes place	No relaxation	3025 (Part 39) Infra red partition method	-
xxiv)	Anionic detergents (as MBAS) mg/l, Max	0.2	Beyond this limit it can cause a light froth in water	1.0	Annex K to IS 13428-	-

Note 2: in case of dispute, the method by \*\* shall be referee method.

Note 3: It is recommended that the acceptable limit is to be implemented. Values in excess of those mentioned under Acceptable render the water not acceptable, but still may be tolerated in the absence of an alternative source but up to the limits indicated under permissible limit in the absence of alternate source in col (5), above which the sources will have to be rejected.

#### Parameters concerning toxic substances

i)	Total Chromium (as Cr <sub>6+</sub> ), mg/l, Max	0.05	May be carcinogenic above this limit	No relaxation	3025 (part 52)	-
ii)	Total Arsenic (as As) mg/l, Max	0.01	Beyond this the water becomes toxic	0.05	3025 (part 37)	
iii)	Mercury (as Hg) mg/l, Max	0.001	Beyond this the water becomes toxic	No relaxation	3025 (part 48)/Mercury Analyser	-
iv)	Cadmium (as Cd) mg/lit, Max	0.003	Beyond this the water becomes toxic	No relaxation	3025 (part 41)	
v)	Lead (as Pb) mg/l, Max	0.01	Beyond this the water becomes toxic	No relaxation	3025 (part 47)	
vi)	Nickel (as Ni),	0.02	Beyond this the	No	3025 (part	

Sl. No	Substance or characteristic	Requirement (Acceptable Limit)	Undesirable effect outside the acceptable limit	Permissible limit in the absence of alternate source	Method of Test (Ref to IS)	Remarks
	mg/l, Max		water becomes toxic	relaxation	54)	
vii)	Cyanide (CN), mg/l, Max	0.05	Beyond this the water becomes toxic	No relaxation	3025 (part 27)	
viii)	Polynuclear Aromatic Hydrocarbons (as PAH), mg/l, Max	0.0001	May be carcinogenic	No relaxation	APHA 6440	-
ix)	Polychlorinated biphenyls, mg/l. Max	0.0005	May be carcinogenic	No relaxation	ASTM 5175/APH A 6630	-

Bacteriological quality of drinking water	
Organisms	Guidelines
E. coli or thermo-tolerant coliform bacteria	Must not be detectable in any 100 ml sample
Total coliform bacteria	Must not be detectable in any 100 ml sample

### **Appendix 2: 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.

(5) 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) Leqa	
		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) Leq 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) Leq, denotes the frequency weighting in the measurement of noise and corresponds to frequency response characteristics of the human ear.  
Leq 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

(2) 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;

(4) 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.

(3) 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

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

*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 meter 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).

2.5 Guidelines for the manufacturers/ users of Diesel Generator sets shall be as under:-

01. 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).

02. 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.

03. Installation of DG set must be strictly in compliance with the recommendations of the DG set manufacturer.

04. 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

83. 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 night time). 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).

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

01 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).

02. The user should make efforts to bring down the noise levels due to the DG set, outside his premises, within the ambient noise

03 The manufacturer should furnish noise power levels of the unsilenced DG sets as per standards prescribed under (A).

04. 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).

05. Installation of a DG set must be strictly in compliance with the recommendations of the DG set manufacturer.

06. 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 tons	68
Air coolers	60
Refrigerators	46
Compactors (rollers), front loaders, concentrate mixers, cranes (movable), vibrators and saws	75

### **Appendix 3: 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

**Appendix 4: Hazardous and Other Wastes (Management And Transboundary Movement) Rules, 2016 Dated 4<sup>th</sup> 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 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 authorized in this regard by the State Government, to ensure earmarking or allocation of industrial space or shed for recycling, pre-processing and other utilization 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 authorized in this regard by the State Government shall,- (a) ensure recognition and registration of workers involved in recycling, preprocessing and other utilization 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 utilization; (d) undertake annual monitoring and to ensure safety and health of workers

involved in recycling, pre-processing and other utilization. (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 authorization 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, utilization, 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 authorization from the State Pollution Control Board within a period of sixty days from the date of publication of these rules. Such application for authorization 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 authorization, a self-certified compliance report in respect of effluent, emission standards and the conditions specified in the authorization for hazardous and other wastes: Provided that an application for renewal of authorization may be made three months before the expiry of such authorization: Provided further that- (i) any person authorized 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 authorization till the period of expiry of such authorization; (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 authorization till the period of expiry of such registration. (2) On receipt of an application complete in all respects for the authorization, 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, utilization, 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 authorization 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 authorization, the State Pollution Control Board may, before granting such authorization, satisfy itself that there has been no violation of the conditions specified in the authorization earlier granted by it and same shall be recorded in the inspection report. (3) The authorization granted by the State Pollution Control Board under sub-rule (2) 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, utilization, 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 authorization under these rules. (5) Every occupier authorized 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 relates.

(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 authorized 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

authorization. (8) Handing over of the hazardous and other wastes to the authorized actual user shall be only after making the entry into the passbook of the actual user.

**Power to suspend or cancel an authorization.-** (1) The State Pollution Control Board, may, if in its opinion the holder of the authorization has failed to comply with any of the conditions of the authorization 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 authorization issued under rule 6 for such period as it considers necessary in the public interest. (2) Upon suspension or cancellation of the authorization, the State Pollution Control Board may give directions to the person whose authorization 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 utilization 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 tons 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 utilization; (v) in any other case, on justifiable grounds up to one hundred and eighty days.

**Utilization of hazardous and other wastes.-** (1) The utilization 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 authorization 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 utilization, 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 utilization and compliance to the environmental standards has been demonstrated, authorization may be granted by the State Pollution Control Board with respect to the same waste and utilization, 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 utilization 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.

## **Appendix 5: Different Labour Laws**

### **Workmen Compensation Act, 1923**

As per Act if personal injury is caused to a workman by accident arising out of and in the course of his employment his employer shall be liable to pay compensation in accordance with the provisions

### **Employees PF and Miscellaneous Provisions Act, 1952**

This Act to provide for the institution of provident funds, pension fund and deposit-linked insurance fund for employees in factories and other establishments. An establishment to which this Act applies shall continue to be governed by this Act notwithstanding that the number of persons employed therein at any time falls below twenty.

### **Maternity Benefit Act, 1951**

This is an Act to regulate the employment of women in certain establishment for certain period before and after child-birth and to provide for maternity benefit and certain other benefits.

No employer shall knowingly employ a woman in any establishment during the six weeks immediately following the day of her delivery or her miscarriage.

### **Contract Labour (Regulation and Abolition) Act, 1970**

This is an Act to regulate the employment of contract labour in certain establishments and to provide for its abolition in certain circumstances and for matters connected therewith. Applicability of Act, (i) Every establishment in which 20 or more workmen are employed or were employed on any day of the preceding twelve months as contract labour and (ii) Every contractor who employs or who employed 20 or more workmen on any day of the preceding twelve months. As per Act Registration certificate to be obtained by principal employer

### **Minimum Wages Act, 1948**

This is an Act to provide for fixing minimum rates of wages in certain employments. The Minimum Wages Act 1948 is an Act of Parliament concerning Indian labour law that sets the minimum wages that must be paid to skilled and unskilled labours. The Indian Constitution has defined a 'living wage' that is the level of income for a worker which will ensure a basic standard of living including good health, dignity, comfort, education and provide for any contingency. However, to keep in mind an industry's capacity to pay the constitution has defined a 'fair wage'. Fair wage is that level of wage that not just maintains a level of employment, but seeks to increase it keeping in perspective the industry's capacity to pay.

### **Payment of wages Act 1936**

The Payment of Wages Act regulates the payment of wages to certain classes of persons employed in industry and its importance cannot be under-estimated. The Act guarantees payment of wages on time and without any deductions except those authorized under the Act. The Act provides for the responsibility for payment of wages, fixation of wage period, time and mode of payment of wages, permissible deduction as also casts upon the employer a duty to seek the approval of the Government for the acts and permission for which fines may be imposed by him and also sealing of the fines, and also for a machinery to hear and decide complaints regarding the deduction from wages or in delay in payment of wages, penalty for malicious and vexatious claims. The Act does not apply to persons whose wage is Rs. 10,000 or more per month. The Act also provides to the effect that a worker cannot contract out of any right conferred upon him under the Act.

The inter-state migrant workmen (regulation of Employment and Conditions of service) act, 1979

This is an Act to regulate the employment of inter-State migrant workmen and to provide for their conditions of service and for matters connected therewith. "Inter-State migrant workman" means any person who is recruited by or through a contractor in one State under an agreement or other arrangement for employment in an establishment in another State, whether with or without the knowledge of the principal employer in relation to such establishment. No principal employer of an establishment to which this Act applies shall employ inter-State migrant workmen in the establishment unless a certificate of registration in respect of such establishment issued under this Act is in force.

## Appendix 6: 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 2 - Construction of Pumping Station to Handle Sludge Water of Garden Reach Water Works (GRWW)

**Sector Division:** Urban Development and Water Division

Screening Questions	Yes	No	Remarks
<b>A. Project siting</b>			
Is the project area...			
▪ Densely populated?	✓		Kolkata is densely populated. As per 2011 census, the urban population of Kolkata is 4.45 million and population density is 24,783 persons per square kilometer.
▪ Heavy with development activities?		✓	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		✓	

Screening Questions	Yes	No	Remarks
▪ 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 applicable.
▪ interference with other utilities and blocking of access to buildings; nuisance to neighboring areas due to noise, smell, and influx of insects, rodents, etc.?		✓	Not anticipated
▪ Dislocation or involuntary resettlement of people?		✓	No displacement of communities is required.
▪ 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?		✓	Not applicable.
▪ Overflows and flooding of neighboring properties with raw sewage?		✓	Project will improve the current situation flooding in neighboring localities.
▪ Environmental pollution due to inadequate sludge disposal or industrial waste discharges illegally disposed in sewers?		✓	Design of pumping station include sludge management.
▪ 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 applicable. Treated effluent from water treatment plants will be pumped out to nearby discharge channel.
▪ inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances, and protect facilities?		✓	Not required as the pumping station will handle the decanted water of sludge pond of the water treatment plant only.
▪ 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

Screening Questions	Yes	No	Remarks
			in duration. The EMP ensures measures are included to mitigate the impacts.
<ul style="list-style-type: none"> <li>▪ Traffic disturbances due to construction material transport and wastes?</li> </ul>		✓	Not anticipated.
<ul style="list-style-type: none"> <li>▪ Temporary silt runoff due to construction?</li> </ul>	✓		Run-off during construction will be more. However, impacts are temporary and short in 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>		✓	Project will improve the current situation flooding in neighboring localities. Design life of the subproject is 30 years. Project 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. The project will handle the treated effluent of water treatment plant only.
<ul style="list-style-type: none"> <li>▪ Contamination of surface and ground waters due to sludge disposal on land?</li> </ul>		✓	Not anticipated.
<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 construction of pumping station.
<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>		✓	Not applicable.
<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</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.

Screening Questions	Yes	No	Remarks
the community throughout project construction, operation and decommissioning?			

### A Checklist for Preliminary Climate Risk Screening

**Country/Project Title:** India/ Sewerage drainage and pumping station

**Sector :** Urban Development

**Subsector :** Waste water

**Division/Department:** Kolkata Municipal Corporation

Screening Questions	Score	Remarks <sup>a</sup>
<b>Location and Design of project</b>	0	No significant effect
	0	No significant effect
<b>Materials and Maintenance</b>	0	No significant effect
	0	No significant effect
<b>Performance of project outputs</b>	0	No significant effect Regular maintenance activities are incorporated in the EMP

<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”.

**Other Comments:** \_\_\_\_\_

Prepared by: PMU, Kolkata Municipal Corporation

### Appendix 7: Blank Format of Monthly Environmental Monitoring Report

#### MONTHLY ENVIRONMENTAL MONITORING REPORT - FORMAT

#### ENVIRONMENTAL MONITORING AND EVALUATION

#### Monthly Environmental Compliance Monitoring Format for Subproject

<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	
1.	<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						

Sr. No.	Environmental Issues	Level of application of EMP					Suggestion/ Remarks
		Poor	Below Satisfactory	Partially satisfactory	Satisfactory	Excellent	
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 Equipment 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)						

Sr. No.	Environmental Issues	Level of application of EMP					Suggestion/ Remarks
		Poor	Below Satisfactory	Partially satisfactory	Satisfactory	Excellent	
6.	<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						
7.	<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						
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						

Sr. No.	Environmental Issues	Level of application of EMP					Suggestion/Remarks
		Poor	Below Satisfactory	Partially satisfactory	Satisfactory	Excellent	
	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						

Sr. No.	Environmental Issues	Level of application of EMP					Suggestion/Remarks
		Poor	Below Satisfactory	Partially satisfactory	Satisfactory	Excellent	
9g	Collection of litter from the work and camp areas						
<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-applicability, – 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)**

## **Appendix 8: Photo Illustration of Project Location**



Existing Sludge pond



Sludge pond during monsoon



Earthen channel



Monikhali Canal