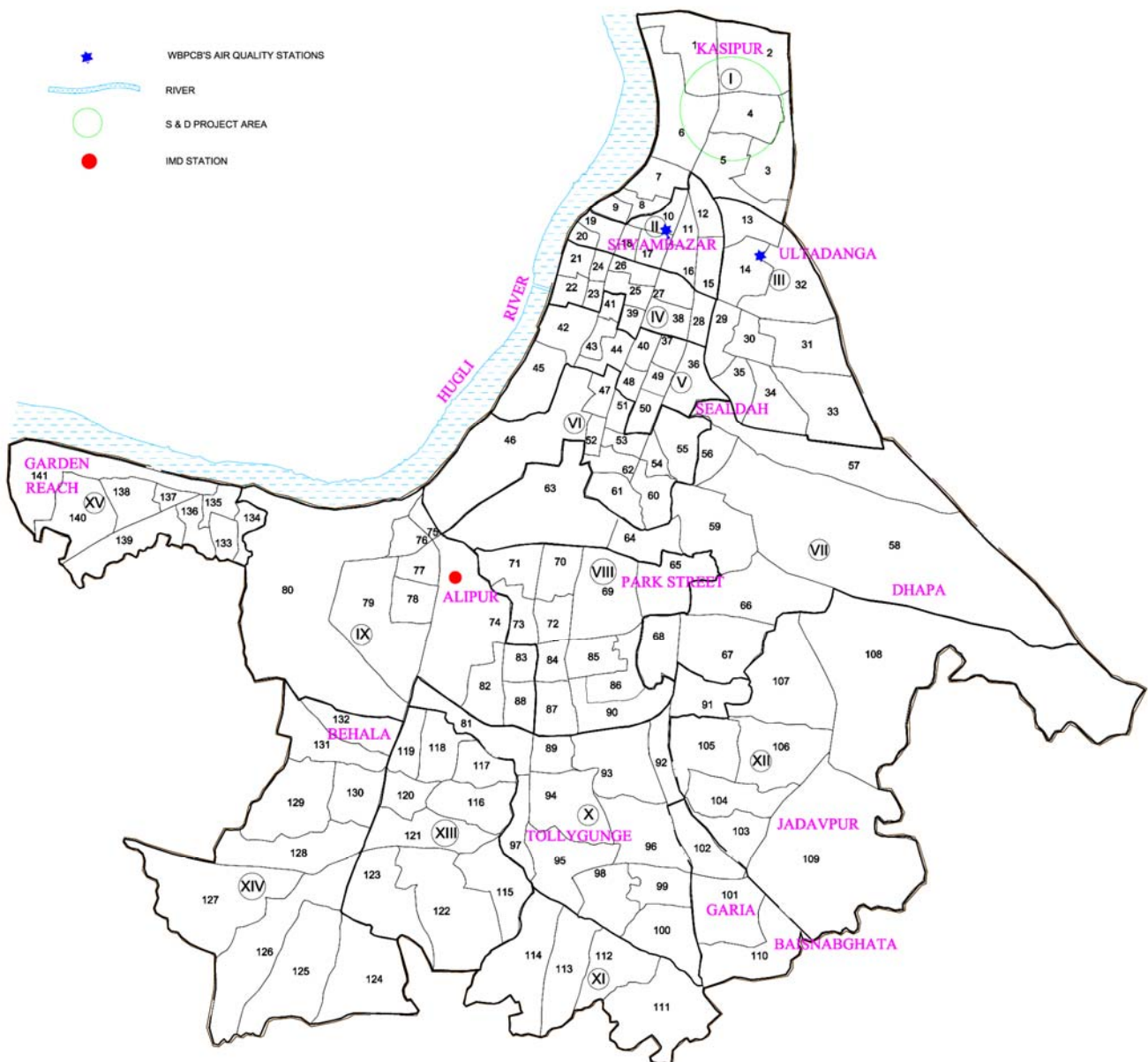


INITIAL ENVIRONMENTAL EXAMINATION REPORT ON SEWERAGE AND DRAINAGE PROJECT OF BOROUGH I



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1.0 INTRODUCTION

The Kolkata Municipal Corporation (KMC), with assistance from the Asian Development Bank (ADB) has embarked upon Kolkata Environmental Improvement Project (KEIP). The project is aimed at achieving a sustainable improvement in the environment of Kolkata through implementation of an urban infrastructure and environmental management investment programme.

Sewerage and Drainage (S & D) Project, a key sub project of KEIP, is being implemented to provide comprehensive drainage and sewerage coverage in the 'added areas' of boroughs I, XI, XII, XIII, XIV and XV covering Wards 1 – 6 and 101 – 141. The existing drainage and sewerage network in these boroughs is inadequate and needs augmentation and/or improvement considering the development of the area and anticipated growth.

This Initial Environmental Examination (IEE) study pertains to the sewerage and drainage scheme proposed for borough I.

Feasibility study of KEIP conducted by EGIS Consulting Australia PTY Limited, in accordance with the ADB guidelines, has determined the project to be a Category B Project. All Category B projects are judged to have some adverse environmental impacts, but of lesser degree and significance than those of Category A projects. A Category B project requires preparation of IEE to determine if the project would require a detailed Environmental Impact Assessment (EIA). If EIA is not warranted then the IEE is considered as the final environmental assessment report of the project.

1.1 Purpose

The purpose of IEE is to document screening of the environmental consequences of the sub-project in accordance with the ADB guidelines, to identify potential adverse and beneficial environmental impacts, and to document the mitigation and monitoring measures that would be incorporated in the project to eliminate or minimise the adverse impacts.

1.2 Scope

The components of this subproject include installation of new pipe lines where drainage and sewerage network does not exist and replacement of existing pipe lines where damaged or determined to be of inadequate capacity along with desilting of existing drainage and sewerage system. As such the study is limited to these project components and does not include associated pumping stations and sewage treatment plant as these are not a part of this sub-project.

The study is based on available secondary data and design data.

2.0 DESCRIPTION OF THE PROJECT

2.1 Need for Project

The proposed project will provide sewerage and drainage coverage in borough I of KMC. The sewerage and drainage facilities available in the area are inadequate. Some of the areas do not have any organised sewerage or drainage network while in the remaining area, although a network of sewer lines exist (provided under GAP), the system is not functioning properly due to inadequacies in design, capacity, maintenance and other factors. Owing to inadequate drainage, several pockets in the borough are prone to flooding.

2.2 Location

The project area is located at the northern part of KMC (Plate I). The project area is bounded by Baranagar Municipality in the north, Circular Canal (Maratha Ditch) in the south, railway line (Sealdah Main Section) in the east and river Hooghly in the west. The entire project area is having a very flat terrain with ground level varying from 3 m to 7 m above msl. It covers the areas of Kashipur, Sinthi, Chitpur, Paikpara and Tala.

2.3 Coverage

According to the census data of 2001, the total population of project area of borough I comprises of wards 1 through 6 is 2,63,380 (Plate 1). The proposed drainage and sewerage scheme will cover a catchments area of approximately 1,111 hectares divided in to 7 basins and is estimated to serve in 2035 a population of approximately 4,05,891 people. A detail of coverage of the proposed scheme is shown in Table 1.

TABLE 1 : COVERAGE OF S & D PROJECT OF BOROUGH I

Item	Basin 1	Basin 2	Basin 3	Basin 4	Basin 5	Basin 6	Basin 7	Total
Catchment area (ha)	52.342 + 1.696 ^a	209.876 + 0.967 ^a	23.650	172.319 + 181.486 ^a	164.242 + 55.980 ^b	103.233 + 81.674 ^b	63.821	1111.286
Design population								
2001	22291 + 2133 ^a	72949 + 890 ^a	–	45284 + 62634 ^a	61910 + 16214 ^b	38157 + 21618 ^b	22789	366869
2007	22573 + 2160 ^a	72398 + 901 ^a	–	47141 + 65274 ^a	61482 + 17549 ^b	37901 + 23400 ^b	22529	373308
2021	21859 + 2092 ^a	75133 + 873 ^a	–	48677 + 67502 ^a	59595 + 24088 ^b	36947 + 32124 ^b	22075	390965
2035	21240 + 2032 ^a	77503 + 848 ^a	–	50174 + 69463 ^a	57966 + 29389 ^b	36372 + 39189 ^b	21715	405891

a = Contribution from Baranagar Municipality; b = Contribution from South Dum Dum Municipality

2.4 Project Schedule

The preliminary construction work of the sub-project is expected to commence in January, 2006.

2.5 Proposed Drainage and Sewerage Network

The proposed drainage and sewerage network will retain 43 km of existing pipeline and would include laying of approximately 21 km of new pipe and replacement of about 16 km of existing pipes. In addition, all existing drainage and sewerage network that would remain will be de-silted and thoroughly cleaned. Details of the proposed scheme are provided in Table 2.

Combined sewerage and drainage system is proposed in large part of the designed scheme. For design purpose the project area is divided into number of basins. Storm water run-off from generated in the project area will get ultimately drained into major surface water bodies of the area such as Hooghly River, Circular Canal (Maratha Ditch) and Bagjola Canal. DWF generated in the area will be intercepted at different locations and pumped into Bangur STP using existing 8 pumping stations after renovation and 2 new pumping stations.

TABLE 2: DETAILS OF THE PROPOSED S & D SCHEME OF BOROUGH I

Component	Basin 1	Basin 2	Basin 4	Basin 5	Basin 6	Basin 7	Total
Estimated approximate volume of soil to be excavated from new and replaced pipes and manholes (m ³)	4,657	35,243	50,096	51,086	37,882	4,603	183,567
Estimated approximate volume of excess excavated soil to be disposed (m ³)	2,329	16,775	24,621	23,972	7,140	2,896	77,733
Estimated approximate volume of silt to be removed and disposed from cleaning of existing pipes (m ³)	1,078	531	841	609	6,207	102	9,368
Estimated approximate volume of precipitate to be removed from cleaning of existing drainage channels (m ³)	81	605	726	600	202	167	2,381
Estimated approximate volume of road crust to be removed (m ³)	572	3,839	5,736	4,998	3,130	369	18,644
Approximate Length of existing drainage and sewerage line (km)	7,315	11,105	11,175	16,555	10,225	3,060	59,435

Component	Basin 1	Basin 2	Basin 4	Basin 5	Basin 6	Basin 7	Total
Approximate Length of existing drainage and sewerage line to be replaced (km)	940	2,515	3,655	5,800	2,800	455	16,165
Approximate Length of proposed new drainage and sewerage line (Km)	0	5,525	9,465	2,110	3,020	1,070	21,170
Diameter of new pipes (mm)	250-2,000						
Depth of trench (m)	1.0.-6.7						
Road Width (m)	1.5-14.0						

Sewer/drain lines will be constructed beneath the existing roads. Combined sewerage system has been proposed along most of the roads where lines will be laid along centre of the roads.

3.0 DESCRIPTION OF THE ENVIRONMENT

3.1 Physical Resources

Geology and Soil: Geological Survey of India (GSI bulletin, 1964) has classified the area as that of Quaternary age formed out of deposits of alluvial and deltaic sediments of the river Ganga and its tributaries. Lithologically, the alluvial fill consists of clay, silt, fine to coarse sand and sand mixed with fine pebbles. The thickness of the upper clay bed varies between 10 to 40 m while the basal clay bed exists at depths of 250 to 650 m below the land surface. Between these layers, confined aquifer occur which is being tapped as a ground water resource. The linear area along the Tolly's Nullah represents a palaeo-channel of one of the distributaries of Hugli river.

The soil of the project area is primarily Entisols, younger alluvial type and can be characterised as predominantly clayey type.

Climate: The climate of the project area is humid and tropical. The weather is typically warm and humid during summer from March to May, sultry during monsoon or rainy season from June to September and comfortable during winter from October to February.

Climatological data of the Alipur observatory (Plate I) reported by India Meteorological Department (IMD) for the period 1990-1999 indicates the following: the maximum temperatures were recorded in May (mean maximum 35.2 °C) while the minimum temperatures occurred during January (mean maximum 14.14 °C). The relative humidity ranged between 86.2% in August to 53.7% in March. The average annual rainfall was about 1919.0 mm. A long term average is about 1650 mm. The winds were predominantly southwesterly during the summer and monsoon season and northerly

during the winter months. The wind speed is highest during summer months with average speed of 6.0 km/hr while during the winter months the average wind speed is 2.63 km/hr.

Air Quality: The air quality monitored by the WBPCB at Shyambazar and Ultadanga stations, both of which are within 1 km of the project area (Plate I), can provide some indication of the air quality within the project area.

The levels of various pollutants measured at these two locations during the months from April, 2003 to March, 2004 are presented in Table 3.

TABLE 3: AMBIENT AIR QUALITY STATISTICS OF TWO STATIONS OF WBPCB IN KMC AREA BASED ON DAILY 24-HOURLY DATA FROM APRIL, 2003 TO MARCH, 2004.

A = Average concentration in microgram per cubic metre from 24-hourly data

B = Number of days the daily value exceeded the standard out of total days monitored based on 24-hourly data

Station Name	Month with Year	SPM		RPM		SO ₂		NO _x	
		A	B	A	B	A	B	A	B
1. Shyambazar	Apr., 2003	183	2/8	70	1/8	4	0/8	43	0/8
	May, 2003	188	3/9	59	0/9	3	0/9	45	0/9
	Jun., 2003	142	0/8	41	0/8	2	0/8	41	0/8
	July, 2003	141	0/9	47	0/9	2	0/9	39	0/9
	Aug., 2003	119	0/9	49	0/9	2	0/9	41	0/9
	Sep., 2003	127	0/8	52	0/8	3	0/8	43	0/8
	Oct., 2003	143	1/9	62	0/9	5	0/9	48	0/9
	Nov., 2003	273	8/8	149	6/8	13	0/8	70	2/8
	Dec., 2003	399	9/9	235	9/9	14	0/9	75	4/9
	Jan. 2004	381	9/9	222	9/9	16	0/9	67	0/9
	Feb., 2004	353	8/8	211	8/8	18	0/8	74	3/8
	Mar., 2004	311	9/9	143	9/9	13	0/9	61	1/9
	Apr., 2003 -Mar., 2004	230	49/103	112	42/103	8	0/103	54	10/103
2. Ultadanga	Apr., 2003	156	1/9	61	0/9	4	0/9	55	0/9
	May, 2003	179	2/9	61	0/9	3	0/9	53	0/9
	Jun., 2003	161	0/8	57	0/8	2	0/8	41	0/8
	July, 2003	133	0/10	45	0/10	3	0/10	37	0/10
	Aug., 2003	110	0/8	45	0/8	3	0/8	39	0/8
	Sep., 2003	117	0/9	48	0/9	3	0/9	43	0/9
	Oct., 2003	135	0/8	59	0/8	4	0/8	47	0/8
	Nov., 2003	277	9/9	154	9/9	8	0/9	77	4/9
	Dec., 2003	401	9/9	247	9/9	10	0/9	79	4/9
	Jan. 2004	379	8/8	227	8/8	14	0/8	73	3/8
	Feb., 2004	343	8/8	192	8/8	12	0/8	76	6/8
	Mar., 2004	300	9/9	140	8/9	8	0/9	57	0/9
	Apr., 2003 -Mar., 2004	224	46/104	111	42/104	6	0/104	56	17/104

Source : www.wbpcb.gov.in

Based on the above data it appears that the pollutant levels of SPM, RPM, SO₂ and NO_x in the project area are likely to remain below the limiting ambient air quality standards of residential area during the typical summer (April-May) and the typical monsoon (July-August) months. During the typical winter months (December-January) levels of SPM and RPM are likely to exceed the standard. NO_x concentration in these months is variable exceeding the standard in some of the days.

Ground Water: Calcutta city receives its supply of water from both surface (80 per cent) and sub surface (20 per cent) sources. In some areas of Calcutta the uncontrolled pumping of groundwater by heavy-duty pumps has lowered the level of the ground-water by 10 m in the last thirty-five years. Intrusion of brackish water in the southern part of the city has gained momentum due to over-pumping of water from the aquifers. A further threat arises from the industries generating toxic effluents. These effluents contaminate the ground water considerably. (CMDA Report.1997).

A study conducted by Geological Survey of India reveals that Calcutta is underlain by quaternary sediments consisting of clay, silt, various grades of sand, gravel and a few beds of pebble. Lithological logs show the presence of a clay bed at the top of the geological succession from Tribeni in the north to Bansdroni with a varying thickness from 10 m to 40 m.

There is another clay bed between depths of 254 and 614 m below ground level. Between these two clay beds there is a group of granular aquifers and intervening clay lenses. Between 60 – 180 m occur the main aquifers that tube wells tap. The Central Ground Water Board study indicates depletion of water table due to the unplanned way of drawing the ground water. (Biswas A. K, & Saha A.K. 1986).

The ground water quality from deep tube wells (Table 4) showed high concentrations of chlorides and the chemical composition is not satisfactory, but free of bacterial contamination. Hardness and the concentrations of Fe, Cl, SO₄ increase from north to south.

TABLE 4: QUALITY OF GROUND WATER FROM LARGE-DIAMETER TUBE WELLS

Location	Depth of aquifer trapped	PH	Iron Fe (mg/L)	Chloride Cl (mg/L)	Sulphate SO ₄ (mg/L)	Total hardness CaCO ₃ (mg/L)
North Calcutta						
North Calcutta	114 - 138	7.6	0.1	180	-	588
Central Calcutta						
Convent lane	106 - 137	7.4	0.6	446.1	NIL	831
Roy Charan Pal lane	108 - 138	7.8	0.5	439.7	NIL	801
East Calcutta						
Pagla danga	103 - 134	-	0.5	321.6	NIL	581
West Calcutta						
Watgunge Street Sahebpuhur	-	-	1.1	931.0	NIL	763
South Calcutta						
Kankulia	109 - 139	7.4	0.6	802.7	NIL	593
Dhakuria	117 - 147	7.5	Trace	310.0	-	280
Bijoygarh	107 - 137	-	0.8	891.1	NIL	586
Naktala	107 - 137	7.8	1.3	1,258.7	31.6	1,009

Source: *Calcutta's Urban Future, Government of West Bengal, 1991*

Unplanned activities for abstraction of ground water from subsoil of Calcutta have changed the flow direction substantially in the last 40 years. It has been reversed from southward flowing in 1956 to northward flowing in 1996 (CMDA Report. 1997). Considering the above information the ground water should be properly utilised.

Surface Water: River Hooghly is one of the prime surface water bodies existing adjacent to project area. A huge quantity of water is drawn from the Hooghly River for various uses in different parts of Kolkata and returns as waste water to the river without treatment. Industrial and domestic pollution along with run-off from watersheds from the adjoining areas has led to a deterioration in the quality of water in the river.

NEERI conducted a study of Hooghly River Water Quality in 1976/1977. The results can be compared to a more recent sampling carried out in 1996-97 by the WBPCB. Table 5 shows that there has been no discernible improvement in the water quality of the Hooghly River in the twenty-year period.

TABLE 5: COMPARISON OF WATER QUALITY IN THE HOOGHLY RIVER BETWEEN 1976 AND 1996

Parameters	Palta		Dakshineswar/Kamarhati		Garden Reach	
	1976/77	1996/97	1976/77	1996/97	1976/77	1996/97
pH	8.1	7.5	7.7	7.5	7.9	7.4
Suspended solids (mg/l)	312	NA	187.2	NA	292	NA
Turbidity (NTU)	281	391.2	226	378.7	237	346.8
Conductivity (μ mhos)	273	204	294.3	197.8	318	209.6
Chlorides (mg/L)	8.2	3.5	9.8	14.2	12.5	20.9
Dissolved Oxygen (mg/L)	6.9	5.7	6.4	5.59	6.3	5.58
Total coliforms (MPN/mL)	2.7×10^4	1.6×10^5	4.6×10^4	5.98×10^4	2.98×10^4	8×10^4
Fecal coliforms (MPN/mL)	3.4×10^4	1.97×10^4	2.5×10^4	2.2×10^4	3.81×10^4	2.0×10^4

Note Palta is upstream of Calcutta, Dakshineswar/Kamarhati is in the Calcutta area close to project area and Garden Reach represents a portion of the river downstream of Calcutta

Noise: Like any other major cities Kolkata is also very noisy. Vehicular traffic is the main source of noise pollution. The study of road traffic noise level by WBPCB in the vicinity area (Shyambazar and Ultadanga) shows levels of Leq 24, L_D , L_N have improved over years (Table 6).

TABLE 6: NOISE

Monitoring Location	Leq 24			L_D			L_N		
	1993	1999	2004	1993	1999	2004	1993	1999	2004
Shyambazar	91.1	69.0	68.4	92.8	78.8	69.1	83.7	75.8	64.0
Ultadanga	88.5	68.2	69.2	90.4	78.6	70.2	79.3	72.0	60.9

Leq 24 = 24 hours equivalent continuous noise level
 L_D = day time equivalent noise level i.e. $L_{Aeq(16h)}$
 L_N = night time equivalent noise level i.e. $L_{Aeq(8h)}$

3.2 Ecological Resources

As the project area is highly urbanised, presence of wild life or endangered species is very unlikely. In addition, within the project area there are no forests, protected areas, coastal resources or fisheries.

3.3 Economic Development

Land Use: Predominant land use within the project area is residential and mixed type (residential, commercial and industrial).

Industries: Cossipore gun and shell factory is an important industry existing within the project area. Few small scale industries are also located inside the project area.

Water Supply: Water supply in the area is presently dependent on surface water and ground water from deep tube wells. Palta Water Works mostly meets the demand of 47 MLd, the rest is met from individual sources such as private tube wells in high rise buildings and other shallow tube wells.

Sewerage and Drainage: A considerable portion within the project area is having drainage system with conduit (piped/ boxed) network executed by different agencies viz. KMC/ KMDA/ KMWSA. Remaining areas are served by surface drains – either covered or open. Drains of unlined section – although to a limited extent still exist within the project area. The existing drainage network functions effectively as a combined system with most of the household septic tanks connected to the drainage network. Thus, besides storm run-off all the conduits (piped or boxed) as well as surface drains cater sullage. Certain portions within the project area are devoid of any organized drainage facility.

For abating the pollution to river Hooghly, the drains (piped or boxed) outfalling into and polluting the river were proposed to be intercepted and the dry weather flow (DWF) diverted through underground piped network towards treatment plant. Under Ganga Action Plan (GAP) scheme pipelines were laid along a few roads together with construction of interception arrangements and pumping stations. Although, it was primarily meant to carry DWF, at present is catering storm water flow (SWF) as well.

Most of the households within the project area are having septic tanks – majority of which are connected either to the underground conduits or to the surface drainage systems nearby. Besides septic tanks, pour flush latrines are also in existence, although to a limited extent. It is reported that dry pit latrine system has been totally eradicated from the project area.

Transportation: The main mode of transportation within the project area is by road. As per the site visit information the project area does not have any substantial stretches of road with widths of 3 m or below. There is no frequent congestion of roads reported from the project area. Important roads within the project area are: Ratan Babu Road, Rustomjee Pausee Road, Cossipore Road, Khagendra Chatterjee Road, K P S Road, Dilarjung Road, Lock Gate Road, Dum Dum Road, Nilmoni Dey Lane, Khudiram Bose Sarani etc.

Electrical Power: Project area falls inside the service area of Calcutta Electric Supply Corporation (CESC). Total demand of power in the KMC area exceeds 1200 MW. CESC generates about 800 MW at its 5 coal fired thermal power plants and purchases 300-400 MW from West Bengal State Electricity Board and Damodar Valley Corporation (IEE for KEIP, January 2000).

3.4 Environmental and other Significant Features

Environmental and other significant features present in the project area such as water bodies, schools, hospitals, markets etc were noted from field visits. Small number of these features considered to be affected by project activities during the construction phases will be protected by adequate environmental management measures.

4.0 POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

The proposed project would influence the environment in two distinct phases:

- i. During the construction phase which would be temporary and short term;
- ii. During the operation phase which would have long term effects

Checklist of potential environmental impacts of the project is presented in Table 7 and the impacts are discussed in the following sections.

TABLE 7- ENVIRONMENTAL CHECKLIST OF S & D PROJECT OF BOROUGH I

Actions Affecting Environmental Resources and values (A)	Damages to Environment (B)	Recommended Feasible Protection Measure (C)	IEE(D)				Comments
			No Significant Effect (D1)	Potential Significant Effect Small Mod (D2)	Major (D3)	(D4)	
Problems related to siting for facilities							
Interference with other utilities	Nuisance/disturbances to public	Careful planning/design		<input type="checkbox"/>			To the extent feasible existing utilities will be bypassed
Interference with street traffic/blocking of access to building	Nuisance/disturbances to public	Careful planning/design			<input type="checkbox"/>		Due to narrow roads some traffic congestion is likely
Inadequate resettlement provision	Social inequities	Adequate resettlement planning and budgeting	<input type="checkbox"/>				None expected, minor encroachment will be bypassed
Impairment of historical/cultural monuments/ areas	Loss of impairment of these values	Careful planning/design, plus offsetting measures	<input type="checkbox"/>				None expected

Actions Affecting Environmental Resources and values (A)	Damages to Environment (B)	Recommended Feasible Protection Measure (C)	IEE(D)				Comments
			No Significant Effect (D1)	Potential Significant Effect Small Mod Major (D2) (D3) (D4)			
Problems Relating to Design Phase							
Overflow/bypassing hazards	Contamination of environment plus flooding	Proper design/O&M plus operations monitoring		<input type="checkbox"/>			Adequate design measures have been incorporated
Hazardous materials illegally in sewer	Damage to sewer system plus danger to workmen, downstream contamination	Do		<input type="checkbox"/>			Monitoring by KMC and WBPCB will prevent this
Inadequate management of industrial wastes discharge to sewers	Damage to pipes, down stream contamination	Do		<input type="checkbox"/>			Do
Hazards of sulfide corrosion	Damage to sewer system	Do		<input type="checkbox"/>			
Problems During Construction Stage							
Silt runoff from construction operation or exposed surface	Soil erosion plus damage to water quality and aesthetics	Do		<input type="checkbox"/>			
Local flooding from dewatering of excavation sites, flushing of pipes and hydraulic testing	Hazard and nuisance to workers and public	Do		<input type="checkbox"/>			
Dumping of silt and construction spoils	Soil and groundwater contamination	Do		<input type="checkbox"/>			
Construction accidents and hazardous materials contacts or spills	Injuries and health safety of workers and public	Do		<input type="checkbox"/>			
Dust/odour/fumes/noise/vibration from construction	Health hazard/nuisance to workers and public	Careful planning, control and monitoring		<input type="checkbox"/>			
Accidental damage to utilities	Public inconvenience due to disruption of services	Appropriate planning plus prompt repair		<input type="checkbox"/>			
Traffic congestion and blockage of access	Accidents/nuisance to public	Appropriate traffic and access control measures			<input type="checkbox"/>		Plan to be done In consultation with Kolkata Police traffic management

Actions Affecting Environmental Resources and values (A)	Damages to Environment (B)	Recommended Feasible Protection Measure (C)	IEE(D)				Comments
			No Significant Effect (D1)	Potential Significant Effect			
							Small Mod Major (D2) (D3) (D4)
Problems During Operation Stage							
Water logging and/or overflowing of sewer due to clogged sewer lines/gully pits	Health hazard and public nuisance	Proper design construction, O&M, plus monitoring			<input type="checkbox"/>		KMC will undertake periodic cleaning of sewer lines and gully pits
Workers exposed to toxic gases in sewers and hazardous materials in sewage during maintenance work	Serious/health/safety hazards	Proper design construction and O&M, including handling of emergencies plus operations stage monitoring		<input type="checkbox"/>			
Cave-in of sewer lines	Safety hazard to public and workers	Do		<input type="checkbox"/>			
Inadequate operations stage monitoring	Nuisance/hazard to public	Proper O&M and monitoring		<input type="checkbox"/>			

4.1 Environmental Impacts - Construction Phase

During the construction phase there would be some impact on air, noise and water quality, and management of solid waste. Also there would be some impact on quality of life due to inconvenience caused to public as a result of construction activities.

Air quality impacts are likely from general construction activities including land clearing, trenching, laying of pipes, construction of foundations and superstructures, handling and transportation of construction and demolition materials, and from wind erosion of open sites and stock pile areas.

Noise pollution will occur from operation of construction equipment including earth moving and material handling equipment.

Water quality impacts may occur from runoff and waste and sewage generated from construction activities.

Within the road flanks there are unlikely to have trees, which would need to be removed as a result of construction. There are few small temples and some illegal structures on the flanks. Design of the proposed network will ensure that these encroachments are bypassed or removed.

The project would require disposal of approximately 1,08,000 m³ of excavated materials including 18,500 m³ road crusts, 2,500 m³ of precipitate removed from cleaning of open channels and 87,000 m³ of silt and earth removed from desilting of existing pipes and excavation works. Disposal of excavated soil, roads crust, and precipitate from drainage channels will not pose a problem, however, disposal of silt may require adequate protection.

Some inconvenience to public may result from restricted access to buildings and structures and temporary dislocation of civic amenities like water supply, drainage and sewerage, electricity, telephone and cable TV connection due to relocation or replacement of these facilities.

Traffic dislocation, lack of access to buildings and air and noise pollution caused by construction activities could have some adverse impact on trade and commerce in the service area.

Unforeseen accidents could result in personal injury and/or damage to private or public property.

Due to design constraints it will not be feasible to provide drainage and sewerage coverage in all the parts of borough I which may result in some discontent from public residing in these areas that will not be covered by the project. The awareness programme to be undertaken to address this issue and other public concerns are discussed in Section 6.0 - Public Consultation.

4.2 Mitigation Measures - Construction Phase

Following measures are recommended for mitigating or minimizing the environmental impacts that are likely to occur during the construction phase of the proposed project. The contractor under supervision and direction of DSC shall implement these mitigation measures.

Prevention of erosion

1. Construction will be scheduled so that large areas of soil are not laid bare during the monsoon.
2. Ground disturbances will be phased so that it is limited to workable size.
3. Exposed surface will be resurfaced and stabilized as soon as possible.
4. Trenches will have adequate backfill to prevent subsequent street settlement. Upon completion of backfill the surface shall be restored fully to the level that existed prior to the construction of the sewer.

Prevention of dust nuisance

1. On exposed construction surfaces during dry/windy periods fugitive dust generation will be suppressed by spraying of water or other suitable means.

2. Workers working in dust prone areas will be provided with masks and goggles.
3. Excavated material transported by trucks will be covered and/or wetted to prevent dust nuisance.

Noise and emission from vehicles and construction activities

1. All construction vehicles will be properly maintained and will have valid "Pollution Under Control Certificate"
2. Noisy construction activities will be carried out only during normal working hours and local residents will be advised of any unusual or unavoidable noise.
3. Where feasible sound barrier will be provided in inhabited areas.

Relocation of utility services

1. Utility services such as telephone line, electric poles, and water lines etc. that will be impacted by project construction will be identified.
2. Concerned authorities will be informed and their assistance sought to remove, relocate and restore services of these utilities prior to commencement of construction.
3. It will be ensured that these utilities are not damaged due to construction activities.

Prevention of dust and noise during material handling operation

Dust and noise producing activities such as stone crushing, bitumen and cement batching plant etc. will be preferably located downwind and away from habitation settlement wherever practicable.

Prevention of soil, ground and/or surface water contamination

1. Silt after dewatering will be immediately disposed in approved disposal site.
2. Excess excavated soil and spoils will be disposed in approved disposal site.

Prevention of water logging/ flooding

1. De-watering during trenching and water testing of new lines will be regulated in a manner so that it does not lead to water logging of the nearby area.

Road safety and traffic management during construction

KMC in coordination with its consultants will prepare a traffic management plan for approval of Kolkata Police. The plan will include:

1. Measures to be taken to prevent traffic congestion.
2. Provision of temporary safe access to buildings, which will be blocked due to construction.
3. Measures to be taken for safe passage of traffic including temporary diversions, and/or separation of motor vehicle traffic from non-motorized and pedestrian traffic where necessary.

4. Measures to be taken to ensure safety of traffic passing through the construction area including signs, marking flags, lights and flagmen as may be required.

Prevention of Accidents and Damage to Property

All necessary precautions will be taken to prevent accidents and/or damage to property.

Measures taken by the contractor will include but not limited to:

1. Safe execution of construction work
2. Providing adequate health and safety protection to workers.
3. Sufficient insurance coverage covering all risks including property damage, third party liability, workmen compensation and transit insurance.

Health and safety of work force

1. All occupational and health and safety requirements for workforce will be adhered to.
2. Periodic health check up of workers will be provided
3. A physician's services will be retained to handle emergencies.
4. During sewer line cleaning operation the line will be adequately vented to ensure that no toxic or hazardous gases are present in the line and the gases present in the sewer line will be analyzed for hazardous/toxic gases before commencing cleaning operation, if warranted.
5. Workers engaged in cleaning of sewer lines will be provided with proper protective cover including gumboots, rubber gloves and gas masks.

Environmental health and safety considerations at construction camp sites and construction worksites

1. Camps/compounds will be located so that they do not interfere with the existing drainage system.
2. Camps/compounds will be contained by surrounding the site with a bund or earth mound with controlled drainage outlet.
3. Campsites will have adequate provision of shelter, water supply, excreta and solid waste management as far as practicable.
4. Construction work-site will be properly barricaded and have adequate provision of drinking water, toilets and dispensing of first aid.
5. Appropriate control measures will be taken to prevent insect/vector diseases especially malaria by measures such as spraying and/or preventing creation of stagnant pool of water

Prevention of impacts on places of cultural importance

1. Routing of sewer/drain lines will avoid places of cultural importance including shrines, temples, maazars, mosques etc. to the extent feasible or they will be relocated.

2. Safe access to these places will be maintained.

Protection of trees

Routing of sewer/drain lines will avoid impacting trees to the extent feasible. Prior approval of the Forest Department, GoWB will be obtained where trees have to be felled for laying the pipes.

4.3 Environmental Impacts - Operation Phase

During the operation phase the environmental impacts are likely to be mostly positive. These positive impacts have been discussed in Section 4.5. However, there could be some adverse impacts due inadequate operation and maintenance or control.

Lack of proper operation and maintenance of the system could cause over flow of sewage and water logging during rainy season, which would be a nuisance and health hazard to public.

Due to lack of control there may be discharge of hazardous industrial effluents into sewer, which can damage the sewer system, or interfere with the downstream treatment process or pass through the treatment plant and cause damage to the environment.

There is a potential health hazard to workers engaged in sewer maintenance workers. These workers are likely to be exposed to toxic gases and hazardous materials present in the sewage and are likely to contract communicable diseases from exposure to pathogens present in the sewage.

4.4 Mitigation Measures - Operation Phase

1. Since a combined sewerage and drainage system has been proposed instead of a separate storm water drainage system due to space restriction it is likely that some silting will occur due to difficulty in achieving self cleansing velocity during DWF. To alleviate the siltation problem it would be necessary for KMC to undertake continual routine maintenance of the system. Periodic preventive maintenance carried out by KMC would prevent flooding or water logging caused by clogged drains.
2. Monitoring activities carried out by the West Bengal Pollution Control Board would ensure that untreated effluent from industry is not discharged into the proposed sewer system.
3. KMC will ensure that the proper health and safety precautions are adhered to during sewer cleaning operation.

4.5 Positive Impacts of the project

Improvement in sewerage and drainage as a result of this project would minimize water logging and/or flooding in the service area and ensure better sanitation practices. This would lead to:

1. Abatement of nuisance and public health hazard in the service area. Improved sanitary conditions would result in reduction in incidence of parasitic infections, hepatitis and various gastrointestinal diseases including cholera and typhoid which occur either through direct contact with fecal material or contamination of water supply and food.
2. Fewer incidence of illness would lead to reduction in health care expenditure and lost workdays.
3. Fewer incidence of disruption of transportation.
4. Accelerate economic growth as a result of improved quality of life within the service area.

A significant population of the service area who are poor and live in slums would benefit the most from the proposed project as they suffer the most when there is flooding and/or water logging in the service area. Other benefits of the project would include:

1. Improvement of water quality of surface water bodies of the area such as Hooghly River, Circular Canal and Bagjola Canal as a result of interception of DWF from the service area into this canal.
2. Design of efficient waste water collection and transportation (to STP) system will abate the chance of contamination from industrial effluent sporadically discharged into sewer system.
3. Contamination of local ponds and canals as a result of sewage overflow and flooding will be prevented or minimized.
4. Employment generation during the construction phase
5. Transportation within the service area will be improved due to improved road conditions as a result of resurfacing of roads sections damaged by the project.
6. The project aims at conversion of all the surface drains to underground conduits as well as conversion of septic tank system to sewerage system. As such majority of the existing surface drains will not be utilized in the proposed system, in fact will be converted to roads. All these activities will uplift the general health standard and aesthetics of the area.

5.0 MONITORING PLAN

Effective implementation of the mitigation measures to mitigate or minimise the environmental impacts would require the project to undertake a comprehensive monitoring programme. The objective of the monitoring programme is to ensure that the construction and operation activities are carried out in an environmentally sensitive and responsible manner, and in accordance with the recommendations of IEE. Recommended monitoring activities of the proposed project is presented in Table 8

TABLE 8 --SUMMARY OF ENVIRONMENTAL MONITORING PROGRAMME OF S & D PROJECT OF BOROUGH I

Monitoring Category	Type of Monitoring	Minimal Frequency	Monitoring Agency
CONSTRUCTION PHASE			
Soils			
Excavation and back filling	Monitor adherence to contract specifications	Daily	Contractor/DSC
Erosion	Monitor proper management of excavated soil/silt including timely removal of material from project site	Monthly	Contractor/DSC
Surface and Ground Water Quality			
Surface runoff management	Monitor measures to chennelise surface runoff	Daily	Contractor/DSC
Contamination from waste and sewage generated from construction activities	Monitor measures taken to prevent contamination of ground and/or surface water from waste and sewage generated from construction activities	Daily	Contractor/DSC
Air/Noise Pollution			
Dust emission during site preparation, excavation	Monitor adequacy of dust suppression measures undertaken	Daily	Contractor/DSC
Storage and transportation of construction materials, excavated soil and silt	Monitor adequacy of measures undertaken to prevent fugitive dust	Daily	Contractor/DSC
Noise and emissions from construction vehicles	Monitor 'Pollution under Control' certificate are current for construction vehicles	Quaterly	Contractor/DSC
Noise pollution from construction activities	Monitor preventive measures being implemented to curb noise	Daily	Contractor/DSC
Solid Waste			
Disposal of excavated soil and silt	Monitor to ensure excavated soil and silt are being disposed in approved sites	Daily	Contractor/DSC
Flooding/Water logging			
Blockage of drainage due to construction activities	Monitor to ensure construction activities does not cause flooding or water logging at the project site.	Weekly	Contractor/DSC
Health and safety of construction workforce			
Health and safety requirements	Monitor adherence to all occupational and safety requirements	Weekly	Contractor/DSC
Health check up of workers	Monitor adequacy of health check up service provided including attendance of the physician retained and the extent to which the workforce is availing this service	Monthly	Contractor/DSC/PMC
Provision of health and safety protection gear	Monitor availability of adequate number of protective gear	Monthly	Contractor/DSC

Monitoring Category	Type of Monitoring	Minimal Frequency	Monitoring Agency
	equipment needed		
Maintenance of health and safety records of work force	Review and monitor health and safety records to ensure all project related accidents are being properly investigated and reported	Monthly	Contractor/DSC
Sanitary conditions of construction campsite	Monitor provision of shelter, water supply, excreta and solid waste management at campsites	Monthly	Contractor/DSC
Road Safety and Traffic Management			
Traffic management plan	Obtain approval to traffic management plan from Kolkata Police		DSC/KMC/Contractor
	Monitor adherence to the traffic management plan	Fortnightly	Contractor/DSC/KMC
Review road safety record	Review and monitor road safety records to ensure all project related road accidents are being properly investigated and reported	Monthly	Contractor/DSC/KMC
Community Life and Economic Activities			
Access to public and private properties	Monitoring impact of project on dwelling and business in the project area	Daily	Contractor/DSC
Damage to public and private property	Monitor construction activities to ensure public and private property is not damaged	Weekly	Contractor/DSC/KMC
	Review and monitor property damage report to ensure timely resolution of claims etc.	Monthly	Contractor/DSC/KMC
Hardship and inconvenience to public and business	Monitor to ensure that communities and business face minimal hardship and inconvenience due to construction activities	Weekly	Contractor/DSC
Public Awareness			
Awareness campaign highlighting the long term benefit of the project and public cooperation to overcome short term construction phase inconveniences	Review and monitor effectiveness of the awareness campaigns conducted	Fortnightly	PRC/NGO/DSC
OPERATION PHASE			
Operation and Maintenance of the System			
Preventive and unscheduled maintenance as result of accidents or damage to the system	Monitor adequacy of implementation of preventive and all unscheduled maintenance work including periodic cleaning of the system, timely completion of work, health and safety of maintenance crew and allocation of human and financial resources to carry out the preventive and unscheduled maintenance work	Monthly	KMC
Operation and maintenance of down stream equipment.			
Provision of adequate financial and human resources to carry		Monthly	

Monitoring Category	Type of Monitoring	Minimal Frequency	Monitoring Agency
out O&M activities	Monitor to ensure proper O&M of down stream equipment of the system including lifting and pumping stations and STP		
Discharge of Industrial Effluents			
Discharge of industrial effluent into the sewer	Monitor discharge of industrial effluent into the sewer including review of consent to operate forms submitted to the WBPCB and analysis of wastewater sample from industries discharging into the sewer system.	Ongoing Monthly	WBPCB

6.0 PUBLIC CONSULTATION

Public consultation started prior to commencement of engineering design. Meetings were held with the borough Chairman and Councillors to appraise them and solicit feedback on the KEIP projects and the proposed scheme. Several field visits were undertaken to identify problems with existing drainage and sewerage system in the project area through interactions with local ward Councillors, borough Engineers and some primary stakeholders in areas where problems were noted. In addition, NGO Consultants undertook an awareness campaign to inform public about the various components of KEIP project and to highlight the benefits that the public would derive from these projects. Details of public consultation undertaken is provided in Table 9

TABLE 9 PUBLIC CONSULTATIONS UNDERTAKEN IN S & D PROJECT OF BOROUGH I

Date	Meeting/Activity	Participant	Subject
08-10-2002	Consultation Meeting	Borough Chairman, Councillors of all Wards, borough engineers, NGO Field Coordinators, DSC and PRC representatives	Project overview and to identify community needs
23-10-2002	Distribution of KEIP Leaflets	NGO Consultant	200 copies of KEIP leaflets were given to all Ward Councillors for distribution to public
29-10-2002	Consultation Meeting	Councillor of Ward -1, Executive engineer (KMC), NGO, DSC representatives	Status of slums and S & D condition within the ward
31-10-2002	Consultation Meeting	Councillor of Ward -2, Executive engineer & SAE (KMC), NGO,	General drainage condition of the area

Date	Meeting/Activity	Participant	Subject
		DSC representatives	
01-11-2002	Consultation Meeting	Councillor of Ward -5, Executive engineer & SAE (KMC), NGO, DSC representatives	General drainage condition of the area
02-11-2002	Consultation Meeting	Councillor of Ward -4, Executive engineer & SAE (KMC), DSC representatives	General drainage condition of the area
05-11-2002	Consultation Meeting	Councillor of Ward -6, Executive engineer (KMC), NGO, DSC representatives	General drainage condition of the area
11-11-2002	Consultation Meeting	Councillor of Ward -3, Executive engineer (KMC), DSC representatives	General drainage condition of the area

During the construction phase of the project, ongoing dialogue will be maintained with the borough Officials to keep them informed of the project status. Also, public awareness campaigns will be undertaken by NGO/PRC Consultants to seek public support and cooperation for the project. Public awareness initiatives will focus on public acceptance of short term inconvenience and hardship that are likely due to the construction activities and mandatory requirement of obtaining sewer connections and decommissioning and demolishing of septic tanks upon completion of the project.

7.0 FINDINGS AND CONCLUSION

A matrix of environmental impacts, as shown below in Table 10, was developed from examination of potential environmental impacts and mitigation measures discussed in Section 4.0.

TABLE 10- MATRIX OF ENVIRONMENTAL IMPACTS S & D PROJECT OF BOROUGH I

	Physical Resources			Environmental Attributes				Human and Economic Development						Quality of Life Values						
	Topography	Soils/Geology	Erosion/Sedimentation	Surface Water	Ground Water	Air Quality/Noise	Ecology	Land Use	Communities	Trade/Commerce/In	Infrastructure	Housing	Transportation	Socioeconomic	Resettlement	Public Health	Flooding/Water	Cultural/Historical	Aesthetics	Recreation
Construction Phase	□	↓	↓	↓	↓	↓	□	□	↓	↓	↓	□	↓	□	□	↓	□	↓	↓	
Operations or Post Project	□	□	□	↑	↑	□	□	□	↑	↑	↑	↑	↑	□	↑	↑	□	↑	↑	

- Insignificant impact, no change over existing conditions
- ↓ Minor short time negative impact ↓ Moderate short-term negative impact
- ↑ Positive impact ↑ Significant positive impact

As evidenced from the above matrix, the project is not expected to cause any long term irreversible environmental impact. Most of the environmental impacts that are likely will occur for a short duration during the construction phase of the project. Adequate preventive measures have been incorporated to mitigate or minimise these impacts. The project upon completion would realise several positive impacts, most significant of which being reduction of public health hazard as result of improved drainage and sewerage conditions in the service area. In consideration of the above, a detailed EIA is not warranted and this IEE may be considered as the final environmental assessment of the project.