PROPOSED EXPANSION OF CALCUTTA LEATHER COMPLEX

Village Bantala, Post Bhojerhat, Tehsil & District South 24 Parganas, West Bengal

KOLKATA METROPOLITAN DEVELOPMENT AUTHORITY (KMDA)

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LIST OF ABREVIATIONS

amsl	Above Mean Sea Level
bgl	Below Ground Level
CETP	Common Effluent Treatment Plant
CGWB	Central Ground Water Board
CLC	Calcutta Leather Complex
DMP	Disaster Management Plan
EIA	Environment Impact Assessment
IE	Industrial Estate
KMDA	Kolkata Metropolitan Development Authority
MoEF&CC	Ministry of Environment Forests and Climate Change
PPE	Personal Protective Equipment
R&D	Research and Development
SEAC	State Expert Appraisal Committee
SLF	Secured Landfill
ToR	Terms of Reference
TSDF	Treatment, Storage, and Disposal Facility for Hazardous Waste
WBPCB	West Bengal Pollution Control Board

CHAPTER 1 – INTRODUCTION

1.0 Purpose of The Report

EIA is a process of evaluating the anticipated environmental impacts, both beneficial and adverse, of a proposed project, taking into account various inter related socio-economic, cultural and health impacts.

The purpose of an EIA is to present the potential impacts and the anticipated benefits of a project to the concerned authorities, so that they may reach an informed decision by evaluating both the positive and negative impacts due to the given project. An EIA is intended to facilitate an informed and transparent decision-making process while seeking to avoid, reduce or mitigate potential adverse impacts through the consideration of alternative options or processes.

1.1 Identification of The Project

The Government of West Bengal in 1992 as a part of sustainable industrial development in West Bengal decided to relocate all leather industries in Kolkata to a new leather complex to for the prevention of environmental pollution caused by the 538 tanneries operating in three tannery clusters of Tangra (267 tanneries), Tiljala (223 tanneries) and Topsia (48 tanneries) in Kolkata.

CLC located at Village Bantala, Post Bhojerhat, Tehsil & District – South 24 Parganas, West Bengal has been developed exclusively for the industries involved in the manufacturing of leather and leather goods. It is a self-sustained facility providing electricity, water and waste management facilities to the tanneries. All tanneries in Kolkata have already received order to relocate their plants to the CLC.

CLC currently houses 383 leather and leather goods manufacturing units within its premises with a total capacity to accommodate 602 tanneries. The proposed expansion would enable another 228 units to relocate or set up their units within CLC and enable to increase the processing capacity of CLC from 1,000 MTPD to 1,600 MTPD.

1.2 Identification of The Project Proponent

CLC has been developed by Kolkata Metropolitan Development Authority, Government of West Bengal.

1.3 Brief Description of The Project

To tackle the problem of environmental pollution within the city of Kolkata due to various leather tanneries, the Government of West Bengal in 1992 decided to relocate all tanneries in the city to a new exclusive complex. This complex would be built with modern technology and would be equipped with a CETP which would treat the wastewater and a secured landfill for the disposal of solid waste generated by the tanneries and the CETP.

443.75 Ha was allotted to Calcutta Leather Complex for setting up an integrated leather manufacturing complex situated about 12 km away from the Eastern limits of Kolkata at Village Bantala, Post Bhojerhat, Tehsil & District – South 24 Parganas, West Bengal.

CLC is a self-sustained facility which meets all the needs of the tanneries situated within it. This includes an R&D centre, electricity, water and treatment and disposal of wastewater discharged from the tanneries.

Table 1.1 – Salient Features of The Project

S. No.	Parameter	Detail
1	Project Name	Expansion of Calcutta Leather Complex
2	Project Proponent	KMDA
3	Project Location	Village Bantala, Post Bhojerhat, Tehsil & District – South 24 Parganas, West Bengal
4	Expansion Area	Approx. 40 Ha

5	Current Leather Processing Capacity	1,000 MTPD
6	Proposed Leather Processing Capacity	1,600 MTPD
7	Manpower Required for Expansion	3,000 direct job opportunities 7,200 indirect job opportunities
8	Electricity Requirement	7.23 MVA supplied received from West Bengal State Electricity Board at 132 KV level through 2 132/33 KV, 50 MVA transformers.
9	Water Requirement for Expansion	4.22 MLD (1.05 MLD Drinking Water and 3.17 MLD Process Water)
10	Wastewater Generation	49.15 MLD

1.3.1 Nature of The Project

The project intends to relocate all the tanneries engaged in the manufacturing of leather and leather goods in Kolkata to the CLC located at Village Bantala, Post Bhojerhat, Tehsil & District – South 24 Parganas, West Bengal primarily from the three leather clusters of Tangra, Tiljala and Topsia in Kolkata. All tanneries in Kolkata have already received order to relocate their plants to the CLC.

CLC currently houses 383 leather and leather goods manufacturing units within it premises with a total capacity to accommodate 602 tanneries. The proposed expansion would enable another 228 units to relocate or set up their units within CLC in order to increase the processing capacity of CLC from 1,000 MTPD to 1,600 MTPD.

1.3.2 Size of The Project

The project covers an area of 443.75 Ha and has facilities for raw materials, processing zones, leather and leather goods industries, transport yard, CETP etc. The proposed expansion spred across approx. 40 Ha would enable another 228 units to relocate or set up their units within CLC, details of which have been provided in **Table 1.2** and **Figure 1.2**.

Table 1.2 – Location of Units Under Proposed Expansion

Zone	No. of Units
ZONE 10A	
A	34
B	32
C	24
D	18
E	27
F	6
G	5
H	5
J	7
K	6
ZONE 11	
	64
Total	**228**

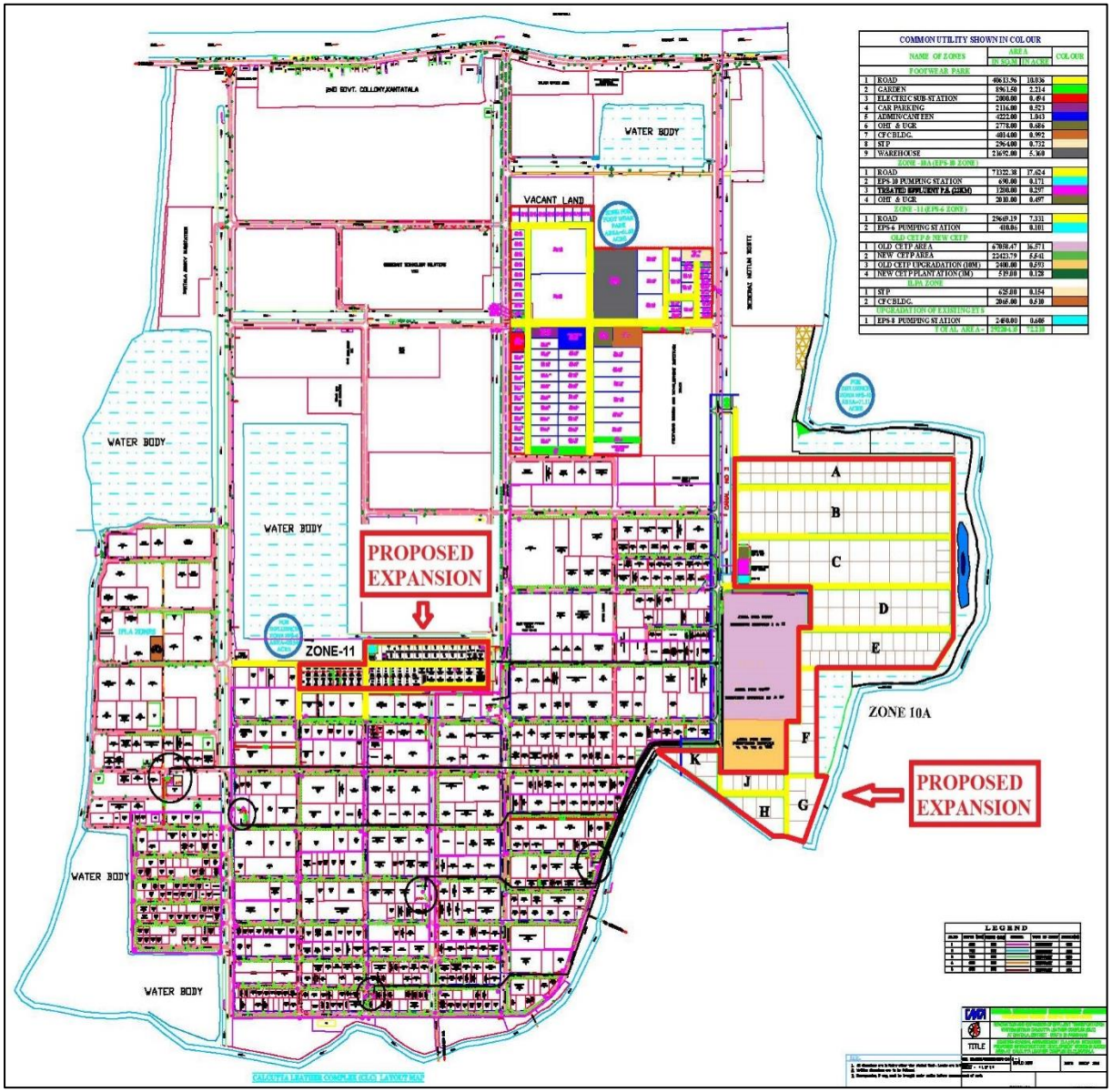


Figure 1.1 – Proposed Expansion Area

1.3.3 Location of The Project

CLC is located at Village Bantala, Post Bhojerhat, Tehsil & District – South 24 Parganas, West Bengal. The project site is well connected with the state's capital Kolkata 12 km away in the West direction. Several transportation facilities including roadways, airport and seaport are available in the nearby vicinity of the project. **Table 1.3** provides a list of various amenities available near the project and **Figure 1.2** depicts the location of various facilities available within the project site.

Table 1.3 – Amenities Near the Project

S. No.	Amenity	Distance (km)	Direction
1	**Habitation**		
	Mondal Para	Adjacent	North
	Gangapur	Adjacent	East
	Bhatipota	0.7	East
	Bhojerat	1.2	East
	Bantala	Adjacent	West
	Calcutta	12	West
2	**Roadways**		
	SH3/Basanti Highway	Adjacent	North
	Tardah-Bhojerhat Road	0.65	East
	Tardah-Kheyadah Road	2.4	South West
3	**Railway Station**		
	Howrah Railway Station	19.5	East
4	**Airport**		
	Netaji Subhash Chandra Bose International Airport	17	North West

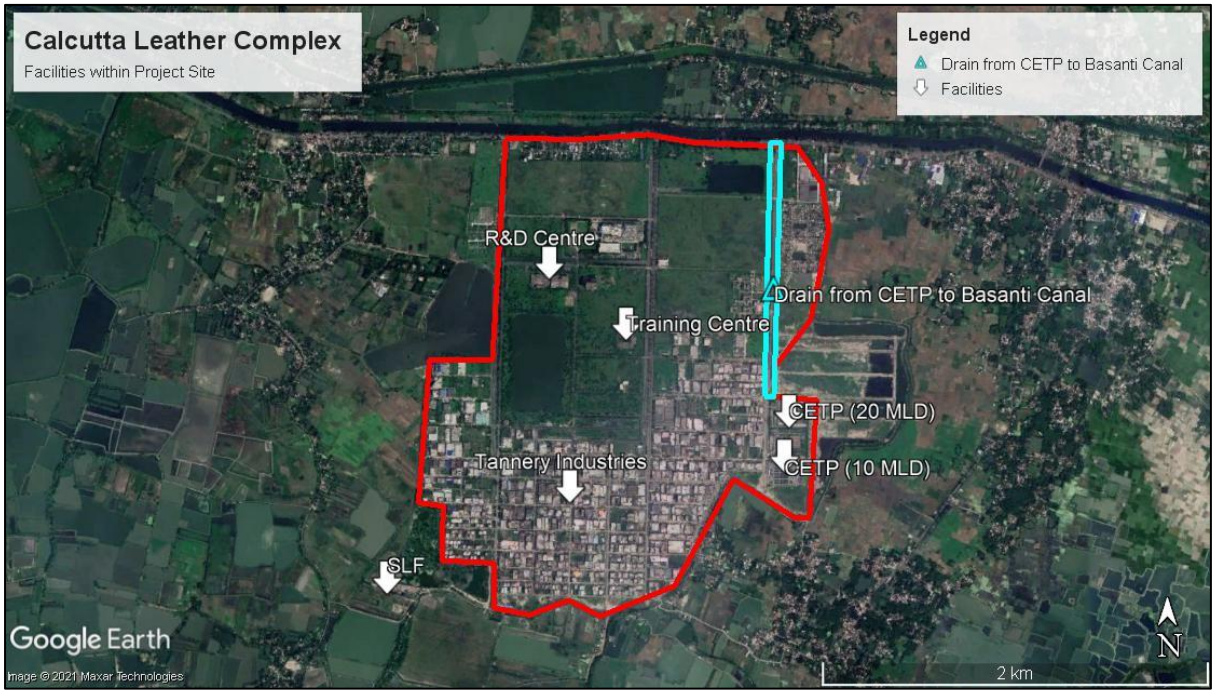


Figure 1.2 – Facilities Within the Project Site

The project site coordinates and its location has been shown in **Table 1.4** and **Figure 1.3**.

Table 1.4 – Project Coordinates

Boundary Point	Latitude	Longitude
A	22°30'28.85"N	88°30'53.32"E
B	22°30'29.74"N	88°31'5.39"E
C	22°30'28.37"N	88°31'13.76"E
D	22°30'27.63"N	88°31'32.58"E
E	22°30'21.57"N	88°31'36.82"E
F	22°30'13.89"N	88°31'38.26"E
G	22°30'6.82"N	88°31'37.37"E
H	22°29'58.71"N	88°31'34.90"E
I	22°29'50.90"N	88°31'28.41"E
J	22°29'45.80"N	88°31'28.26"E
K	22°29'45.23"N	88°31'35.99"E
L	22°29'25.64"N	88°31'34.72"E
M	22°29'25.49"N	88°31'32.20"E
N	22°29'32.04"N	88°31'20.95"E
O	22°29'14.21"N	88°31'10.20"E
P	22°29'9.15"N	88°30'56.80"E
Q	22°29'11.87"N	88°30'50.98"E
R	22°29'9.44"N	88°30'44.03"E
S	22°29'10.63"N	88°30'37.55"E
T	22°29'18.01"N	88°30'37.59"E
U	22°29'18.43"N	88°30'28.12"E
V	22°29'27.59"N	88°30'28.31"E
W	22°29'28.09"N	88°30'23.81"E
X	22°29'51.95"N	88°30'25.86"E
Y	22°29'52.04"N	88°30'37.29"E
Z	22°30'28.64"N	88°30'39.53"E

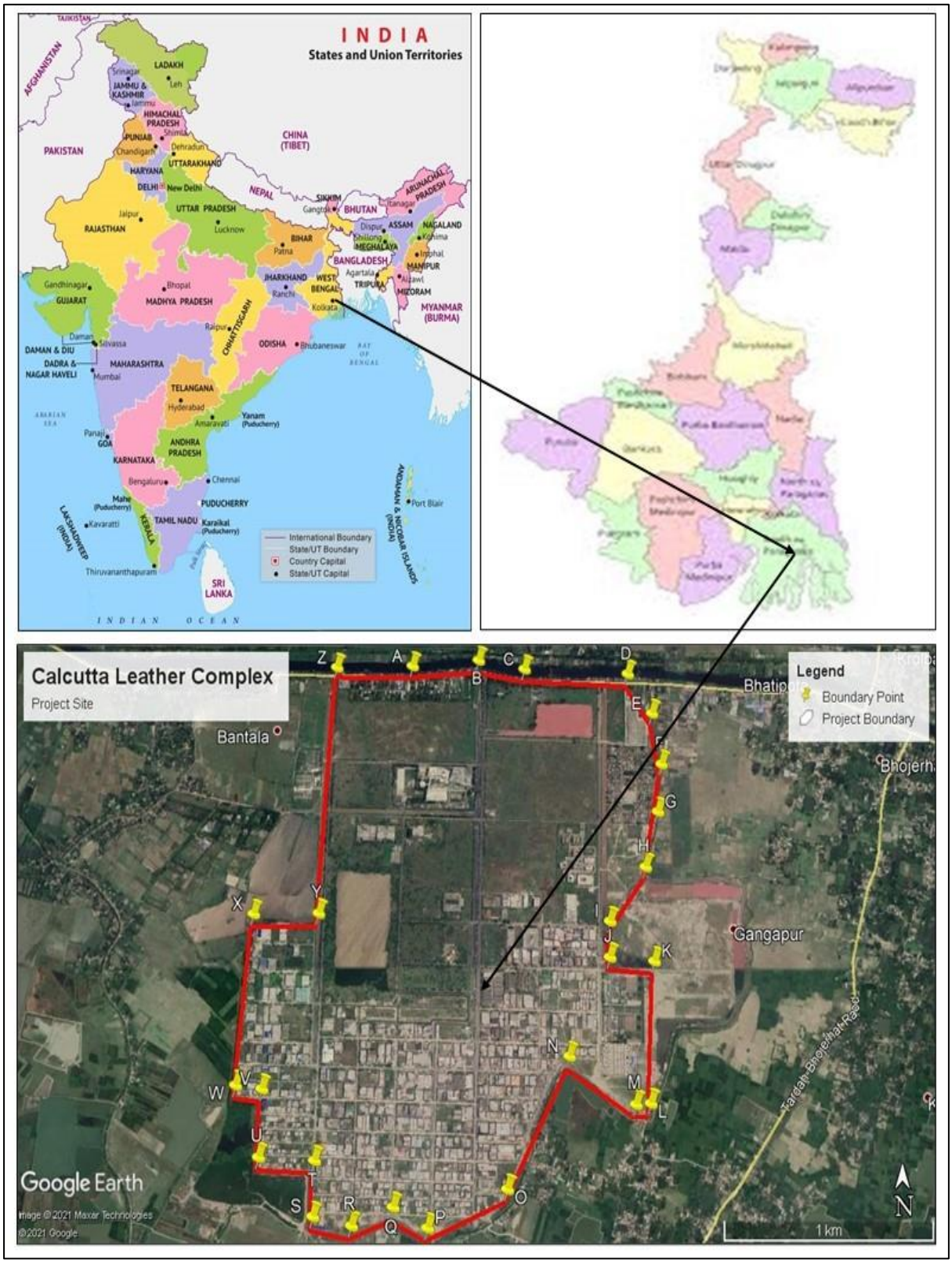


Figure 1.3 – Location of The Project

(Source: Google Earth)

1.3.4 Importance of The Project

1.3.4.1 West Bengal

West Bengal and Kolkata in particular has developed into a leather and leather goods manufacturing and export hub accounting for approximately 50% of the total leather and leather goods exports in India.

Out of the total 2020 tanneries in India, West Bengal has about 26.6% or 538 tanneries. It houses approximately 230 leather footwear units and 436 leather goods units having a 30% of the entire leather sector within the state.

The following factors have enabled West Bengal to immerge as the top leather and leather goods manufacturer in India –

1. Easy availability of good quality raw materials
2. Strong tannery and leather processing base
3. Availability of the special soft quality cow Nappa leather preferred by German brands
4. Presence of support industries like leather chemicals, metal fittings, ancillary product suppliers
5. Availability of skilled labour
6. Good connectivity through roads, sea ports and airports
7. State of the art factories in compliance with international standards (SA-8000, BSCI, REACH)
8. Presence of reputed educational institutions for training in design, manufacturing processes and technology such as the Government College of Engineering and Leather Technology
9. Duty free import of raw material for manufacturing of export oriented finished products

The project will enable the Government of West Bengal to achieve the following objectives –

1. Relocation of all existing tanneries in Kolkata to CLC where they can operate in a pollution-controlled environment.
2. Development of CLC as a modern export-oriented leather hub.
3. Assist the leather industry in West Bengal to grow and prosper.

1.3.4.2 Indian Economy

The leather industry holds a prominent place in the Indian economy for its consistency in high export earnings. It is among the top ten foreign exchange earners for India with an annual turnover of over USD 12.50 billion, the export of leather and leather products increased to USD 5.85 billion during 2015-16.

1.4 Scope of The Study

1.4.1 Regulatory Framework

1.4.1.1 The Environment (Protection) Act, 1986

The Environment (Protection) Act, 1986 provides for the protection and improvement of environment and for matters connected to it.

The Act provides the Government power to take all such measures as it deems necessary or expedient for the purpose of protecting and improving the quality of the environment and preventing, controlling and abating environmental pollution.

1.4.1.2 The Water (Prevention and Control of Pollution) Act, 1974

The Water (Prevention and Control of Pollution) Act, 1974 provides for the prevention and control of water pollution and the maintaining or restoring of wholesomeness of water.

The Act provides for the establishment of Boards for the prevention and control of water pollution, and conferring on and assigning to the Boards, powers and functions to achieve the aforementioned objectives.

It comes into force due to generation of wastewater from the project.

1.4.1.3 The Air (Prevention and Control of Pollution) Act, 1981

The Air (Prevention and Control of Pollution) Act, 1981 provides for the prevention, control and abatement of air pollution.

The Act provides for the establishment of Boards for the prevention, control and abatement of air pollution, and conferring on and assigning to the Boards, powers and functions to achieve the aforementioned objectives.

It comes into force due to air pollution from dust generation and emissions from point source of emissions, fugitive emissions, vehicles and due to various leather and leather goods manufacturing processes.

1.4.1.4 The Noise Pollution (Regulation and Control) Rules, 2000

The Noise Pollution (Regulation and Control) Rules, 2000 establishes Ambient Air Quality Standards in respect of Noise for different zones during day time and night time.

The noise levels in any area/zone shall not exceed the ambient air quality standards· in respect of noise.

1.4.1.5 Solid Waste Management Rules, 2016

Solid Waste Management Rules, 2016 regulates the management and handling of the solid wastes other than industrial waste, hazardous waste, hazardous chemicals, biomedical wastes, e-waste, lead acid batteries and radioactive waste, including collection, storage, segregation, transportation, processing and disposal of solid wastes.

1.4.1.6 Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016

Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 provides for the management of hazardous and other wastes.

Hazardous wastes shall be properly stored within the individual units and the CETP followed by either disposal to the secured landfill or to authorised recyclers.

1.4.2 Regulatory Scope

The regulatory scope of the EIA is comprised of the following chapters based on Appendix III of EIA Notification, dated 14.09.2006 (Generic Structure of Environmental Impact Assessment Document) –

1. Introduction
2. Project Description
3. Description of The Environment
4. Anticipated Environmental Impacts and Mitigation Measures
5. Analysis of Alternatives
6. Environmental Monitoring Programme

7. Additional Studies
8. Project Benefits
9. Environmental Management Plan
10. Summary and Conclusion
11. Disclosure of Consultants Engaged

1.4.3 Terms of Reference

Table 1.5 presents ToR for IE. These conditions can thus be complied with for CLC located at Village Bantala, Post Bhojerhat, Tehsil & District – South 24 Parganas, West Bengal for the proposed expansion to be in line with various conditions that are generally imposed by SEAC and/or EAC for the Development/Expansion of IEs.

Table 1.5 – ToR Conditions

S. No.	Condition	Compliance
1	Executive summary of the project – giving a prima facie idea of the objectives of the proposal, use of resources, justification, etc. In addition, it should provide a compilation of EIA report including EMP and post-project monitoring plan in brief.	Detailed summary of the project has been given in **Chapter 10** including the objective of the proposed project, resource requirement and its justification. The chapter also provides a compilation of the EIA report including EMP and the post-project monitoring plan in brief.
Project Description		
2	Details of the industries, for which the estate is being planned and their proposed capacities of installation, if available. In the absence of complete details, indicate the type of industries and capacity being considered.	The proposed expansion will enable another 228 leather industries to set up their units within CLC leading to an increase in the leather production capacity from 1,000 MTPD to 1,600 MTPD. CLC will enable the following types of leather industries to set up their units – 1. Raw skin/hide to finished leather.

		2. Wet blue to finished leather. 3. Finished leather to leather goods. Or a combination of the above as per the requirement of the industry.
3	Land requirement for the project including the peripheral greenbelt inside the boundary.	About 40 Ha of land is required for the proposed expansion. Approximately 13.2 Ha of land will be brought under greenbelt development udnder this phase of expansion.
4	Justification for selecting the proposed size of the IEs.	CLC is an existing industrial area meant to relocate all previously existing tanneries present in the city of Kolkata. The proposed expansion will enable another 228 tanneries to setup their leather and leather goods manufacturing units within Zone 10A and Zone 11 spread over an area of approx. 36.8 Ha and 3.2 Ha.
5	Details on strategy being followed for development of IE.	CLC has been developed as an integrated leather manufacturing hub which will cater to the requirements of the units operating within the complex. These facilities include creation of infrastructure such as providing a continuous and reliable source of water, electricity and wastewater treatment. CLC will also construct a road network connecting the upcoming tanneries with the existing road network for the movement of raw materials, finished goods and workers.

		R&D centre within CLC will provide the tanneries better quality control over the raw materials and finished products as well as the possibility to avail the expertise of the R&D centre. The training centre in CLC will enable the tanneries to train and the upgrade the skillset of the workers engaged in the tanneries. It will also allow the workers to easily adapt to any new technology that comes from time to time.
6	Layout map of estate indicating processing zones, admin area, roads, plots, green belt, common utilities area, etc., shall be shown along with contour map. Landscape plan including open spaces may be described.	The layout of the project site has been provided in **Annexure I**.
7	Classify the proposed industries based on their pollution potential to the extent possible i.e., A1 to A4 categories for air pollution and W1 to W4 categories for water pollution - CPCB Guidance may be referred for classification.	The pollution load of the industries will vary depending upon their manufacturing capacity. However, installation of suitable pollution control devices/measures will be mandatory before the commencement of operations in these units.
8	Backward and forward linkages of the IEs (availability of input resources and markets for the products / by-products and anticipated benefits for the regional development).	Backward and forward linkages of the proposed expansion have been discussed in detail in **Chapter 8** from **Page 224** to **226**.
9	Details of Infrastructure Development within the IE and in the region.	CLC already has water and effluent transportation networks along with a CETP and chrome recovery plant within

		the complex itself. Roads have also been built to provide easy access to existing as well as upcoming units. The proposed expansion will connect the upcoming units with the existing network of roads, draining network and water and wastewater treatment facilities.
10	Details on known industrial activity-specific proposed processes, resource consumption and rejects assessment.	Details regarding resource requirement has been provided in **Chapter 2 Section 2.8** from **Page 55** to **57**.
11	Details on estimated quantity of fuel required, fuel type, nature, source and transportation.	The total power demand for the proposed expansion is estimated at 7.23 MVA. Power is received from West Bengal State Electricity Board at 132 KV level through 2 132/33 KV, 50 MVA transformers. A 132/33 KV substation is located in the Eastern part of the complex and the other 132/33 KV substation is routed through the North/East boundary road.
12	Details on estimated water balance taking into account conservation measures, reuse and recycling of treated effluents.	The required process water for the proposed expansion is 3.17 MLD. About 1.05 MLD of water is required for drinking purposes and will also be made available from these tubewells from where it will be pumped to 10 overhead tanks located in different zones through a different distribution system.
13	Individual and/or common facilities for waste collection, treatment, recycling and disposal (all effluent, emission and refuse including MSW, and hazardous wastes)	After preliminary treatment at the ETPs present within the units, the discharged effluent will be treated at the CETP. Hazardous waste will be sold to

		authorised dealers or disposed off at the SLF.
14	Commitment from the concerned authorities regarding availability of power, water and sewerage network.	Power is received from West Bengal State Electricity Board at 132 KV level through 2 132/33 KV, 50 MVA transformers while the project makes use of ground water to fulfil its water requirements. Effluent treatment will take place within the CLC in its CETP.
15	Details of Solid Waste management including arrangements for hazardous waste management and e-waste.	Solid waste will be disposed off Solid Waste Management Rules, 2016. Hazardous waste will be disposed off at the SLF or sold to authorised dealers.
16	Details on provisions made for safety in storage of materials, products and wastes.	Details regarding the safe storage of materials, products and wastes has been discussed in **Chapter 4 Section 4.7** from **Page 203** to **205**.
17	Details on use of local building materials. The provisions of fly ash Notification should be kept in view.	Local building materials will be given preference for the construction of infrastructure facilities.
18	Detailed plan of treated water disposal, reuse and utilization/management.	Details regarding wastewater treatment and disposal has been provided in waste management have been provided in **Chapter 2 Section 2.8.3** on **Page 56**.
19	In case of site levelling involving quarrying, details thereof.	No major levelling is required as the proposed project is a case of expansion in an existing industrial area.
20	Any litigation pending against the project and /or any direction /order passed by any Court of Law related to the environmental pollution and impacts in the last two years, if so, details thereof.	No litigation is pending against the project.

Description of the Environment		
21	The project study area for EIA studies shall be up to a distance of 10 km from the boundary of the proposed IE.	A 10 km distance from the project site has been taken as the study area for the proposed expansion.
22	Landuse based on satellite imagery including location specific sensitivities such as national parks / wildlife sanctuary, villages, industries, etc. for the study area.	Landuse data has been presented in **Chapter 3** as **Table 3.2** and **Figure 3.4** on **Page 66** and **67**. No national park and wildlife sanctuary is present within the 10 km study area of the project site and whereas the study area has 109 villages and 4 towns within itself. The project site hosts 383 industries and plans to host another 228 units after the proposed expansion.
23	Demography details of all the villages falling within the study area.	Demography details of all the villages falling within the study area has been provided in **Chapter 3 Section 3.6** from **Page 112** to **170**.
23	Topography details of the project area.	Topography details have been provided in **Chapter 3 Section 3.1.2** from **Page 64** to **66**.
24	Anticipated pollution loads from each of the known composition of industrial units.	The anticipated pollution load has been discussed in **Chapter 4 Table 4.5** on **Page 177**. The pollution load due to upcoming tanneries will vary depending upon their manufacturing capacity and the type of product that will be produced.
25	Details of rainwater harvesting and how it will be used in the IE & outfall.	Rain water harvesting will be carried out during the proposed expansion in order to reduce the overall water requirement due to the project as per CGWB guidelines.

26	The baseline data to be collected from the study area w.r.t. different components of environment viz. air, noise, water, land, and biology and socio-economic.	Baseline monitoring data has been collected from the study area with respect to air, noise, water, land, and biology and socio-economic environment and has been presented in **Chapter 3 Section 3.1** to **3.6** from **Page 62** to **170**.
27	Identification of existing potential sources of pollution in the study area.	Units currently operational within the CLC are the main source of pollution with the core zone. Other sources of pollution (in the buffer zone) have been identified by conducting baseline data collection with results being presented in **Chapter 3 Section 3.1** to **3.6** from **Page 62** to **170**.
28	Present and projected population; present and proposed land use; planned development activities, issues relating to squatting and relocation, community structure, employment, distribution of income, goods and services; recreation; public health and safety; cultural peculiarities, aspirations and attitudes shall be explored in study.	Present population data has been presented in **Chapter 3 Section 3.6.5** from **Page 125** to **126**. No major change in the population is expected due to the proposed expansion as hiring of locals will be encouraged. Only skilled personnel will shift to the study area and therefore, a minor influx in the population is expected. The proposed units are expected to manufacture leather and leather products. No issues related to squatting and relocation are expected as the land is in possession of KMDA. Anticipated positive and negative impacts and appropriate mitigation measures have been discussed in

		Chapter 4 Section 4.6 from **Page 201** to **203**.
29	Details regarding availability of social infrastructure and future projections, details of facilities such as sanitation, fuel, restroom etc. to be provided to the labour force during construction as well as to the casual workers including truck drivers during operation phase.	Details regarding availability of social infrastructure has been provided in **Chapter 3 Section 3.6** from **Page 112** to **170**. Sanitation, restroom etc. will be provided to the labour force during construction as well as to the casual workers including truck drivers during operation phase within CETP. Individual industry owners will be responsible for providing sanitation and resting facilities for their casual labourers and truck drivers during construction and operation phase.
30	Detailed study of the hydrological and geo-hydrological conditions of the project area including a contour plan indicating slopes and showing drainage pattern and outfall.	Hydrological and geohydrological conditions of the study area as well as the region including the contour plan indicating slopes and showing drainage pattern and outfall has been provided in **Chapter 3 Section 3.2.2** on **Page 75** and **Figure 3.2** on **Page 64**.
31	Information regarding surface hydrology and water regime and impact of the same, if any due to the project.	Information regarding surface hydrology and water regime has been provided in **Chapter 3 Section 3.2.1** from **Page 72** to **75**. Proper drainage network already exists within the CLC to catch surface runoff. Thus, the impact on surface water will be negligible.

32	Examine soil characteristics, topography, rainfall pattern and soil erosion.	Topography, soil characteristics, rainfall pattern and soil erosion has been examined in **Chapter 3 Section 3.1.2** from **Page 64** to **66, Section 3.1.5.2.2** from **Page 70** to **71, Section 3.3.2** from **Page 86** to **87** and in **Chapter 4 Section 4.1** from **Page 173** to **175** respectively.
33	Details on surface water quality of nearby water sources and other surface drains.	Details on surface water quality of nearby water sources and other surface drains has been provided in **Annexure II**.
34	Details of groundwater quality in and around the IE.	Details of groundwater quality in and around CLC has been provided in **Annexure II**.
35	Examine water quality with reference to Persistent Organic Pollutants, if relevant.	The effluent generated from the tanneries will be transported to the CETP via impervious drainage pipelines. The CETP will in turn will be used to treat and bring various pollutant levels within permissible limits before discharging the treated effluent. Thus, no impact is anticipated due to persistent organic pollutants. The surface and ground water quality reports have been provided in **Annexure II**.
36	Details on water quality for parameters such as pH, Temperature (°C), Total Ammonia, Phenolic compounds* (as C_6H_5OH), Total Chromium, Copper, Nickel, Lead, Arsenic, Cadmium, Selenium, Fluoride, Boron, etc.	Both surface water and ground water quality has been analysed by a NABL accredited laboratory. The water quality reports are attached in **Annexure II**.

37	Details on existing ambient air quality and expected, stack and fugitive emissions for PM10, PM 2.5, SO_2, NO_x, and evaluation of the adequacy of the proposed pollution control devices to meet standards for point sources and to meet AAQ standards.	Existing ambient air quality data within and around CLC has been presented in **Annexure II**.
38	Details on noise levels at sensitive/commercial receptors.	Ambient noise quality has been analysed and attached as **Annexure II**.
39	One season meteorological data excluding monsoon season.	One season meteorological data has been presented as **Annexure II**.
40	Proposed baseline monitoring network.	Baseline monitoring network has been discussed in **Chapter 9 Section 6.2** from **Page 212** to **214.**
41	Fuel analysis to be provided (sulphur, ash content and mercury). Details of auxiliary fuel, if any including its quantity, quality, storage, etc., should also be given.	Fuel analysis has been provided in **Chapter 2 Section 2.8.7** on **Page 58**.
42	Examine entry/exit of the project including the crossings from the highway and provision of service roads on the basis of traffic density studies and analysis.	Traffic analysis has been performed and presented in **Chapter 4 Section 4.8** on **Page 205**.
43	Climatic conditions of the study area shall be monitored for hourly wind speed, wind direction, relative humidity, ambient dry and wet bulb temperatures and precipitation.	Climatic conditions for the study area has been provided and presented in **Chapter 3 Table 3.12**, **Table 3.13** and **Table 3.14** on **Page 88** to **91**.
44	Ecological status (terrestrial and aquatic) of the study area.	Baseline biological environment has been discussed in **Chapter 3 Section 3.5** from Page **107** to **112**.
45	If ecologically sensitive attributes fall within the study area, proponent shall describe the sensitivity (distance, area and	East Calcutta wetland lies to the North and North West of the project site as

	significance) and propose the additional points based on significance. Ecological sensitive attributes include − National parks − Wild life sanctuaries Game reserve − Tiger reserve/elephant reserve/turtle nesting ground − Mangrove area − Wetlands − Reserved and Protected forests, etc. − Any other closed/protected area under the Wild Life (Protection) Act, 1972, any other area locally applicable	shown in **Chapter 3 Figure 3.4** on **Page 67**. No national park, wildlife sanctuary game reserve, tiger reserve/elephant reserve/turtle nesting ground, mangrove area, reserved forests and protected forests are present within the study area.
46	If any incompatible land use attributes fall within the study area, proponent shall describe the sensitivity (distance, area and significance) and propose the additional points based on significance. Incompatible land use attributes include: − Public water supply areas from rivers/surface water bodies, from ground water − Scenic areas/tourism areas/hill resorts − Religious places, pilgrim centers that attract over 10 lakh pilgrims a year − Protected tribal settlements (notified tribal areas where industrial activity is not permitted) − Monuments of national significance, World Heritage Sites − Cyclone, Tsunami prone areas (based on last 25 years);	Two surface water bodies exist within the core zone as shown in **Chapter 3 Figure 3.3** on **Page 65**. Besides this, several water bodies such as Basanti Canal and small ponds exist within the buffer zone of the study area as shown in **Chapter 3 Figure 3.4** on **Page 67**. These maybe used as a source of public water supply. East Calcutta lies to the North and North West of the project site as shown in **Chapter 3 Figure 3.4** on **Page 67**. The area is prone to cyclones. Cyclone Yaas and Cyclone Amphal have made landfall in the region recently. No religious place/pilgrim centre that attract over 10 lakh pilgrims a year, protected tribal settlements, monuments of national significance, world heritage

	− Airport areas − Any other feature as specified by the State or local government and other features as locally applicable, including prime agricultural lands, pastures, migratory corridors, etc.	sites, tsunami prone areas and airport lies within the study area.
47	If the location falls in Valley, specific issues connected to the natural resources management shall be studied and presented.	Project site does not fall in a valley.
48	If the location falls in CRZ area: A CRZ map duly authenticated by one of the authorized agencies demarcating LTL, HTL, CRZ area, location of the project and associate facilities w.r.t. CRZ, coastal features such as mangroves, if any. – Provide the CRZ map in 1:10000 scale in general cases and in 1:5000 scale for specific observations. – Proposed site for disposal of dredged material and environmental quality at the point of disposal/impact areas. – Fisheries study should be done w.r.t. Benthos and Marine organic material and coastal fisheries.	Project site does not fall within the CRZ area.
Anticipated Environmental Impacts and Mitigation Measures		
49	Anticipated generic environmental impacts due to this project which may be evaluated for significance and based on corresponding likely impacts VECs may be identified. Baseline studies may be conducted for all the concerned VECs and	Anticipated impacts on VECs due to the proposed expansion and their appropriate mitigation measures have been presented in **Chapter 4 Section 4.1** to **4.8** from **Page 173** to **205**.

	likely impacts will have to be assessed for their magnitude in order to identify mitigation measures.	
50	While identifying the likely impacts, also include the following for analysis of significance and required mitigation measures: − impacts due to transportation of raw materials and end products on the surrounding environment − impacts on surface water, soil, groundwater, drainage due to project activities − impacts due to air pollution − impacts due to odour pollution − impacts due to noise − impacts due to fugitive emissions − impact on health of workers due to proposed project activities	Anticipated impacts due to the proposed expansion and their appropriate mitigation measures w.r.t. transportation of raw materials and end products, surface water, soil, groundwater, drainage due to project activities, air pollution, odour pollution, noise, fugitive emissions and health of workers due to proposed project activities have been presented in **Chapter 4 Section 4.1** to **4.8** from **Page 173** to **205**.
51	Proposed odour control measures.	No significant odour emissions generally occurs. The operation of tanneries and the CETP will produce characteristic odour in general. However, this can be curtailed by planned storage of raw materials, provision of adequate ventilation, containment of VOC emissions, scheduled disposal of solid and liquid waste. Mitigation measures such as greenbelt development along the periphery will be carried out. Usage of odour control spray

		material where and whenever any abnormal odour generation occurs as an interim measure.
52	Examine in detail the proposed site with reference to possible impact of infrastructure covering water supply, pipelines, roads, storm water drainage, sewerage, power, temporary waste storage facilities, treated wastewater disposal (land/sewer/surface water bodies), common facilities, etc.	The impact of the proposed expansion along with the appropriate mitigation measures covering water supply, roads, storm water drainage, sewerage, power, temporary waste storage facilities, treated wastewater disposal etc. have been discussed in detail in **Chapter 4 Section 4.1** to **4.8** from **Page 173** to **205**.
53	Cumulative impact on regional supportive capacity shall be studied in terms of population density, water supply, sewerage, storm water drainage, power supply, educational facilities, medical facilities, public transport, traffic etc.	The impact of the proposed expansion along with the appropriate mitigation measures covering water supply, roads, storm water drainage, sewerage, power, temporary waste storage facilities, treated wastewater disposal etc. have been discussed in detail in **Chapter 4 Section 4.1** to **4.8** from **Page 173** to **205**.
54	Details on positive and negative impacts, direct and indirect impacts, induced impacts.	Details on positive and negative impacts, direct and indirect impacts, induced impacts have been discussed in **Chapter 4 Section 4.6** from **Page 201** to **203** and **Chapter 8** from **Page 224** to **226**.
55	Traffic management plan including parking and loading/unloading areas may be described. Traffic survey should be carried out on week days and weekends and also analyze the anticipated traffic increase.	Parking/unloading areas are marked in the CLC master plan presented in **Annexure I**. Traffic survey has been carried out and its findings presented in **Chapter 4 Section 4.8** on **Page 205**.

56	Odour mitigation plan may be described. Also make provision of green cover as a measure for mitigation of dust and noise and buffer between habitation and industry.	Odour control measures have been discussed in above in **ToR Condition No. 51**. Greenbelt development will take place along the internal roads, open areas as well as along the periphery of the project site.
57	Rain water harvesting proposals should be made with due safeguards for groundwater quality. Maximize recycling of water and utilization of rain water.	Rain water harvesting in the proposed expansion of CLC will be carried out. Rain water shall be utilised for plantation purposes, cleaning of common areas and for firefighting.
58	Temporary plans for the housing of construction labour within the site with all necessary infrastructure and facilities such as fuel for cooking, mobile toilets, mobile Sewage Treatment Plant (STP), safe drinking water, medical health care, crèche, etc.	Temporary plans for the housing of construction labour within the site with all necessary infrastructure and facilities such as fuel for cooking, mobile toilets, mobile STP, safe drinking water, medical health care, crèche, etc. will be provided during the construction phase.
59	Proposed measures for occupational safety and health of the workers.	Proposed measures for occupational safety and health of the workers have been discussed in **Chapter 6 Section 6.5** on **Page 215**.
60	Impact of the project on local infrastructure of the area such as road network and whether any additional infrastructure would need to be constructed and the agency responsible for the same with time frame.	Impact of the proposed expansion on the road network has been discussed in **Chapter 4 Section 4.8** on **Page 205**. No additional infrastructure would be required outside the project site as the current road network seems to be adequate to cater to the anticipated increase in vehicular movement.

61	Action plan for the greenbelt development – species, width of plantations, planning schedule etc. within the boundary around the IE in accordance to CPCB published guidelines.	Greenbelt development will take place along the internal roads, open areas as well as along the periphery of the project site.
62	In case of likely impact from the proposed project on the surrounding reserve forests, Plan for the conservation of wild fauna in consultation with the State Forest Department.	Not applicable as no reserve forest exists within the study area.
Analysis of Alternative Resources and Technologies		
63	Comparison of alternate sites considered and the reasons for selecting the proposed site. Conformity of the site with the prescribed guidelines in terms of CRZ, river, highways, railways, etc.	Reasons for site selection has been discussed in **Chapter 5** on **Page 211**. The proposed expansion is within the existing CLC complex.
64	Evaluate alternative disposal modes of effluent and solid wastes, from the point of view of disposal points and associated impacts.	The proposed expansion will treat the effluent generated by individual tanneries at the CETP after it has been pretreated within individual units. Hazardous waste will be sold to authorised dealers or sent for disposal at the existing SLF.
Environmental Monitoring Program		
65	Monitoring programme for pollution control at source.	Monitoring programme has been discussed in detail in **Chapter 6** from **Page 212** to **215**.
66	Monitoring pollutants at receiving environment for the appropriate notified parameters – air quality, groundwater, surface water, etc. during operational phase of the project.	Monitoring programme has been discussed in detail in **Chapter 6** from **Page 212** to **215**.

67	Specific programme to monitor safety and health protection of workers. Appropriate monitoring network has to be designed and proposed, to assess the possible residual impacts on VECs.	Regular medical checkup of labourers and workers will be carried out during construction and operation phase of the proposed expansion. Monitoring programme has been discussed in detail in **Chapter 6** from **Page 212** to **214**.
68	Details of in-house monitoring capabilities and the recognized agencies if proposed for conducting monitoring.	In house monitoring capabilities have been discussed in **Chapter 6 Section 6.3** on **Page 214**.
Additional Studies		
69	Details on risk assessment and damage control during different phases of the project and proposed safeguard measures.	Risk assessment due to the proposed project has been discussed in **Chapter 7 Section 7.1** from **Page 216** to **217** and risk control has been discussed in **Section 7.4** from **Page 218** to **222**.
70	Details on socio-economic development activities such as commercial property values, generation of jobs, education, social conflicts, cultural status, accidents, etc.	Benefits arising due to the implementation of the proposed expansion has been discussed in detail in **Chapter 8** from **Page 224** to **226**.
71	Proposed plan to handle the socio-economic influence on the local community.	Proposed plan to handle the socio-economic influence on the local community has been discussed in **Chapter 4 Section 4.6** from **Page 201** to **203**.
72	Details on compensation package for the people affected by the project, considering the socio-economic status of the area, homestead oustees, land oustees, and landless labourers.	The land is in possession of KMDA and so the issue of resettlement and rehabilitation of local population is not anticipated for the proposed expansion.

73	The historical importance of the area shall also be examined in the study. While this analysis is being conducted, it is expected that an assessment of public perception of the proposed development be conducted.	There is no historical importance of the area. The area was selected as it is away from Kolkata city and would thus enable upcoming tanneries to set up their units in the integrated complex.
74	Describe the application of industrial ecology concept for planning of IEs. Explore possibility of utilizing waste of one unit as raw material for the other units.	Waste materials such as trimmings, shavings and buffing dust can be used within the fellow units to produce products such as bags, shoes, garments, glue etc.
75	Specific chemical emergency response and proposed rescue system.	Risk of various disasters and necessary risk reduction/mitigation measures along with emergency response measures and rescue system has been described in **Chapter 7 Section 7.1** from **Page 216** to **217** and **Section 7.4** from **Page 218** to **222**.
76	Details on corporate social responsibility proposal.	Details of CSR have been discussed in **Chapter 9 Section 9.10** on **Page 288**.
Environmental Management Plan		
77	Administrative and technical organizational structure to ensure proposed post-project monitoring programme for approved mitigation measures.	An Environment Management Cell will be set up having duties and responsibilities as described in **Chapter 9 Section 9.1** on Page **227**.
78	EMP devised to mitigate the adverse impacts of the project should be provided along with item-wise cost of its implementation.	Details of CSR have been discussed in **Chapter 9 Section 9.12** on **Page 289**.
79	Allocation of resources and responsibilities for plan implementation.	KMDA will be responsible for resource allocation and project implementation.

		Allocation of resources and responsibilities for plan implementation will be the responsibility of the Calcutta Leather Complex Tanners Association which will be supervised by KMDA during the operational phase.
80	Details of the emergency preparedness plan and on-site and off-site disaster management plan.	On-site DMP has been presented in **Chapter 7 Section 7.5** from **Page 222** to **222**. District DMP will be followed as off-site disaster management plan.

CHAPTER 2 – PROJECT DESCRIPTION

2.0 General

The chapter gives a detailed description about the proposed additional manufacturing capacity of CLC as well as the various raw materials that are required for the proposed expansion.

2.1 Type of Project

CLC is meant for the relocation of all industries involved in the manufacturing of leather and leather goods present within the three leather clusters of Tangra, Tiljala and Topsia in Kolkata to the CLC located at Village Bantala, Post Bhojerhat, Tehsil & District – South 24 Parganas, West Bengal along with setting up of new leather industries within the integrated complex. The proposed expansion will enable another 228 industries to set up their leather manufacturing units within the CLC increasing the production capacity from 1,000 MTPD to 1,600 MTPD.

2.2 Need for the Project

The Government of West Bengal in 1992 as a part of sustainable industrial development in West Bengal decided to relocate all leather industries in Kolkata to a new leather complex to for the prevention of environmental pollution caused by the 538 tanneries operating in three tannery clusters of Tangra (267 tanneries), Tiljala (223 tanneries) and Topsia (48 tanneries) in Kolkata.

CLC located at Village Bantala, Post Bhojerhat, Tehsil & District – South 24 Parganas, West Bengal has been developed exclusively for the industries involved in the manufacturing of leather and leather goods. It is a self-sustained facility providing an R&D centre, electricity and water, and waste management facilities to the tanneries. All tanneries in Kolkata have already received order to relocate their plants to the CLC.

CLC currently houses 383 leather and leather goods manufacturing units within it premises with a total capacity to accommodate 602 tanneries. The proposed expansion would enable another 228 units to relocate or set up their units within CLC in order to increase the processing capacity of CLC from 1,000 MTPD to 1,600 MTPD.

2.3 Location of the Project

CLC is located at Village Bantala, Post Bhojerhat, Tehsil & District – South 24 Parganas, West Bengal. The project site is well connected with the state's capital Kolkata 12 km away in the West direction. Several transportation facilities including roadways, airport and seaport is available in the nearby vicinity of the project. The project site coordinates and its location has been shown in **Table 2.1** and **Figure 2.1**.

Table 2.1 – Project Coordinates

Boundary Point	Latitude	Longitude
A	22°30'28.85"N	88°30'53.32"E
B	22°30'29.74"N	88°31'5.39"E
C	22°30'28.37"N	88°31'13.76"E
D	22°30'27.63"N	88°31'32.58"E
E	22°30'21.57"N	88°31'36.82"E
F	22°30'13.89"N	88°31'38.26"E
G	22°30'6.82"N	88°31'37.37"E
H	22°29'58.71"N	88°31'34.90"E
I	22°29'50.90"N	88°31'28.41"E
J	22°29'45.80"N	88°31'28.26"E
K	22°29'45.23"N	88°31'35.99"E
L	22°29'25.64"N	88°31'34.72"E
M	22°29'25.49"N	88°31'32.20"E
N	22°29'32.04"N	88°31'20.95"E
O	22°29'14.21"N	88°31'10.20"E
P	22°29'9.15"N	88°30'56.80"E
Q	22°29'11.87"N	88°30'50.98"E
R	22°29'9.44"N	88°30'44.03"E
S	22°29'10.63"N	88°30'37.55"E
T	22°29'18.01"N	88°30'37.59"E
U	22°29'18.43"N	88°30'28.12"E
V	22°29'27.59"N	88°30'28.31"E

W	22°29'28.09"N	88°30'23.81"E
X	22°29'51.95"N	88°30'25.86"E
Y	22°29'52.04"N	88°30'37.29"E
Z	22°30'28.64"N	88°30'39.53"E

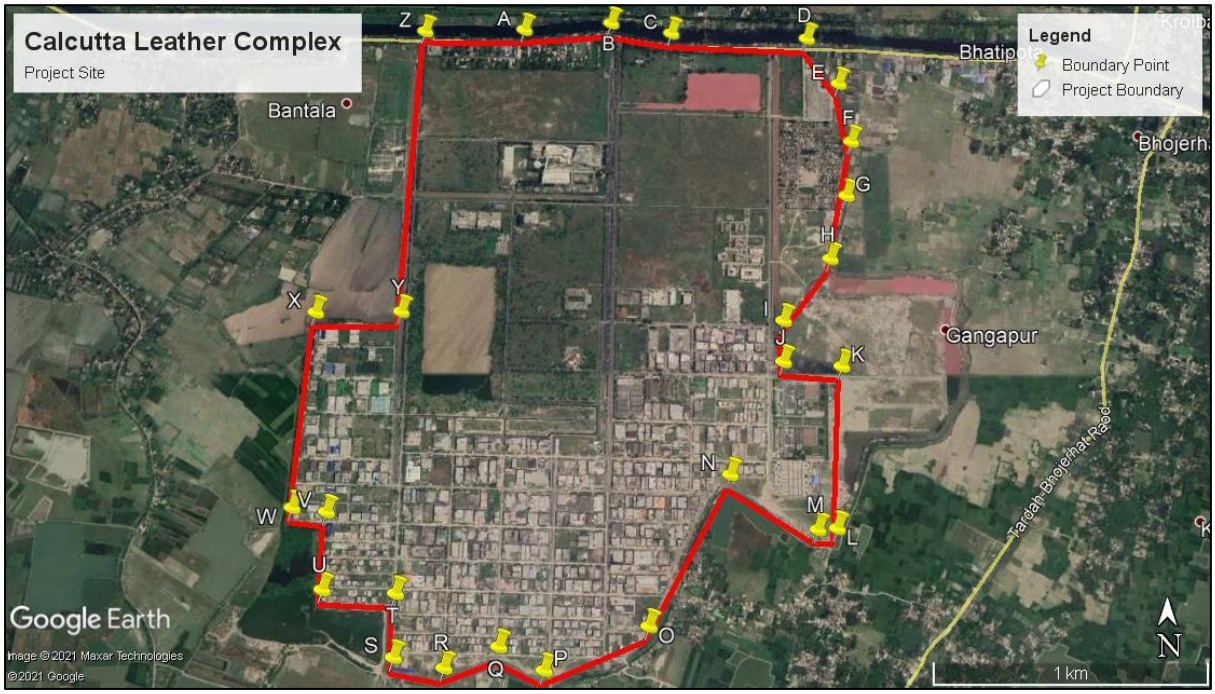


Figure 2.1 – Location of The Project

2.4 Magnitude of Operation

CLC would host 602 leather and leather goods manufacturing units when fully operational. The complex currently produces 1,000 MTPD of leather and is expected to produce 1,600 MTPD of leather after the completion of the proposed expansion.

As on date, around 383 tanneries have moved their manufacturing units to CLC while the proposed expansion will enable another 228 tanneries to set up their units within the CLC.

2.5 Proposed Schedule for Approval and Implementation

Around 383 tanneries out of a total of 602 tanneries have already moved their operations to the CLC complex. **Table 2.2** provides a list of members currently operating their units from the CLC.

Table 2.2 – Existing CLC Members List

S. No.	Name of Member	Zone No.	Plot No.
1	Ajmeri Leather Works	1	29 – 30
2	Alam Tannery Pvt. Ltd.	1	53
3	Arshi Leather	1	41 & 42
4	Balaji Chemicals	1	67AA
5	Bengal Tanning Industries	1	75
6	Bharat Tanneries	1	24, 25
7	Billfold Leathers	1	68A
8	Chun Hing Tannery	1	51
9	Crescent Tannery	1	44
10	Dash International	1	22,22A
11	Dilshad Ahmed & Co.	1	73
12	East Point Skin Co.	1	33
13	Gateway Leathers Pvt. Ltd	1	17
14	Galaxy Leathers	1	65A
15	Globe Tannery	1	3,637
16	Hena Leather & Co.	1	47
17	ITI Exports Pvt. Ltd.	1	74
18	Integrated Supply Centre	1	62A
19	Irfan Tannery	1	23
20	Jaikishan Ram	1	65C
21	K.R. Leather Works	1	65AA
22	K. H. Leather Industries	1	66A
23	Kanungoe Leathers Pvt. Ltd.	1	32
24	Labbaik International	1	34
25	Leather Image	1	40
26	Leather India Tannery	1	71
27	Li Wei Seong Tannery	1	70
28	M. Yahya & Co.	1	43

29	Misbahul Haque & Co.	1	20
30	N. J. Leather Enterprise	1	54
31	Nadeem Impex	1	8
32	New Horizons Ltd	1	52
33	Nisa Enterprise	1	46
34	Oxford Tanners	1	5 to 7
35	Patranabis Leather Industries	1	18
36	Rabbani International	1	68B
37	Ragubans Ram	1	65B
38	Reliable Leather Works	1	59
39	Saman Tanning Industries	1	67A
40	Samsun International	1	60
41	Sarfaraz Akhtar	1	60A
42	Shrimani Silpayan India Pvt. Ltd.	1	49
43	Sohail Enterprise	1	61
44	Star Leather	1	45
45	Stout (India) Industries	1	12 & 13
46	Supreme Tannery	1	31
47	Taj Cuir Pvt. Ltd.	1	15 – 16
48	Tanmaco	1	35
49	Taslim Tannery	1	28
50	Te Chong Tannery	1	19
51	Tiger Overseas	1	50
52	Tiger Tanning Industries	1	72 & 72A
53	Trendx Leather House	1	65
54	Tulsyan Impex Pvt. Ltd.	1	11
55	Victory Tannery	1	3,839
56	Winsome Leathers	1	14
57	Abshar International	2	155
58	Adil Enterprise	2	197
59	Ah Fee Tannery	2	90

60	Ahmed Hossain & Meghnath Ghosh	2	117B
61	Ahmed Tannery	2	185 to 187
62	Ainul Haque & Brothers	2	146
63	Aryan International	2	160
64	Asma Tannery	2	92
65	Beauty Leather Works	2	166
66	Beekay Leather Industries	2	156
67	Bengal Reptile Exporting Co. (1958) Pvt. Ltd.	2	76
68	Classic Tannery Pvt. Ltd	2	129 to 131
69	Continental Export Corporation	2	116 A
70	Creative Pelt Pvt. Ltd.	2	151
71	Dilshad Ahmed	2	118
72	Dolphin Leathers	2	107
73	Elrich International	2	84
74	Enam Tanners	2	100
75	Exact Leather & Accessories	2	79
76	Excellent Leather Industries	2	190
77	Faiz Tanning Industry	2	161
78	Fashion Lederwaren	2	140
79	Firdous International	2	178
80	Ganaur Ram & Sons	2	1,38,139
81	Global Tanning Industries	2	86A
82	Good Will Leather	2	167
83	H. F. Enterprise	2	173
84	H. K. Tannery	2	122
85	H.M. Enterprise	2	116
86	I.S.S Leathers Co.	2	175
87	Iftekharul Hassan & Others	2	145
88	Indotan	2	98
89	Industrial Leather Mfg. Co.	2	159
90	International Overseas Exporters	2	1,41,142

91	International Tanning Syndicate	2	8,081
92	Jameel Leather	2	97
93	J. K. Tannery	2	128
94	Leather Trend	2	93
95	Leather N – Leather	2	183
96	Leather – N- Leather	2	184
97	Libra Tanners Pvt. Ltd.	2	95
98	Maldha Leather	2	180A
99	Manish Trading Co.	2	157
100	Mik International	2	135
101	Momina Tannery	2	196
102	Masood Alam & Co.	2	99
103	N. A. Trading	2	124
104	N. M. Tannery	2	125
105	Neha Enterprise	2	133
106	Nishat Shakeel & Mr. Md. Shakeel	2	192
107	Nudrat Tanning Syndicate	2	96
108	O. S. Split Job Works	2	153
109	Park Leather Co.	2	163
110	Radiant Leathers Pvt. Ltd.	2	103
111	Rajendra Manchanda	2	164
112	Reptile and Chrome Tannery	2	78ABC
113	Royal Crest Tanners & Exporters	2	78
114	Sai Enterprise	2	121A
115	S. L. Tannery	2	1,26,127
116	S. S Trading	2	180
117	Sadia International	2	109
118	Sahil Tannery	2	195
119	Senior Tanning Corporation	2	123
120	Shama Creation Pvt. Ltd	2	132
121	Shana Leather Corporation	2	182

122	Shanmuni Tannery	2	191
123	Sheerma Tanning Industries	2	111
124	Soni Leathers	2	143
125	Special Leather Industries	2	104
126	Style Hide Pvt. Ltd.	2	148
127	Sumbul Tanning Corporation	2	1,01,102
128	Sunrise Tanning Industries	2	110
129	Super Tans India	2	120
130	Superior Trading	2	121
131	Supreme Tanning Industries	2	170
132	Tannex International	2	112
133	Taitan Leather Pvt. Ltd.	2	165
134	Trans Rubber Industries	2	152
135	Vinit Gloves Mfg. Pvt. Ltd.	2	87
136	Zed Ess Leather	2	114A
137	Ali Jawed Tannery	3	269
138	Alia Leather Co	3	252, 253
139	Arfat Tanning Industries	3	270
140	Aslam Tanning Industries Pvt. Ltd.	3	217, 218
141	Bismillah Tanning Industries	3	266, 267
142	Bukhara Leather Industries	3	276
143	Diamond International	3	271
144	Eqbal Ahmed & Co.	3	251
145	G. A. Jolli	3	228, 229
146	G. B. S Tanners Pvt. Ltd.	3	223, 223A
147	Hindustan Tanning Industries	3	262, 263
148	International Tanning Corporation	3	224, 225
149	Jaffs Leather Works	3	239
150	Lais Leather Industries Pvt. Ltd.	3	254, 255
151	Leather Que	3	260, 261
152	Leatherex Tanning Industries	3	215, 216

153	Mani Leather Industries	3	258, 259
154	Mercury Exports.	3	240 to 242
155	New Punjab Tannery	3	273
156	Pioneer Tanning Industries	3	256, 257
157	Punjab Leather Enterprise	3	272
158	Punjab Tannery	3	274, 275
159	Salim Leather Corporation	3	264, 265
160	Sarim Enterprise	3	247, 248
161	Shadab Enterpries	3	249, 250
162	Star Tanning Industries	3	2,30,231
163	Taj Tanning Industries	3	232 to 234
164	Toptans	3	2,26,227
165	Trident Leather	3	219 to 221
166	Zia Hide & Skin Agency	3	243
167	Aaqib Tannery	4	286, 287
168	Aftab Tannery	4	313 to 315
169	Agra Fine Leather Tannery	4	291
170	Ajma Exports	4	317
171	B. D. Tannery	4	311
172	Citizen Leather	4	289, 290
173	Dolphin Leather Impex	4	301 to 305
174	Fancy Skin Tannery	4	312
175	India Tannery	4	336
176	Iqbal Tannery	4	292 to 293
177	K. G. N Tanning Industries	4	325 to 327
178	Manzoorul Islam & Others.	4	297 – 298
179	Nappier Leather Paint (Tannery)	4	340 – 341
180	Nasim Tanning Industries	4	309
181	Orintal Leather Industries	4	299, 300
182	Paragon Leather Co.	4	288
183	Senior Rubber Works	4	328 to 330

184	Shifa International	4	339
185	Shamshad Ahmed	4	335
186	Shakti Chemicals Stores	4	318 to 320
187	Shilpa Exports	4	295, 296
188	Super Tanners Syndicate	4	342
189	Usmani Hide & Skin Agency	4	334
190	Webta Pvt. Ltd.	4	307, 308
191	Zenith Exports Syndicate	4	338
192	A N S Leather Co	5	389 to 391
193	Ah Tiam Tannery	5	415
194	Ah Yin Tannery	5	422
195	Albert Tannery	5	435
196	C. P.L Tannery	5	369
197	Chan Lin Tannery	5	444
198	Chen Lan Po Tannery	5	379
199	Chiang Sheng Tannery	5	377
200	Chieh Shing Tannery	5	355
201	Chien Hsing Tannery	5	424
202	Chung Wah Tannery	5	382
203	Clement Export	5	376
204	Crown Tannery	5	388, 388A
205	Chang Hing Tannery	5	396
206	Da Li Tannery	5	393
207	Diamond Tannery & Co	5	385
208	Fook Hing Tannery	5	439
209	Fu Sheen Tannery	5	368
210	Good Will Service Co.	5	406
211	Goodwill Tannery	5	416
212	Hen Ley Tannery	5	354
213	Hock Soon Tannery	5	401
214	How Fa Tannery	5	428

215	Hsiang Li Tannery	5	357
216	Hsin Yah Tannery	5	420
217	Hsiung Brothers Tannery	5	443
218	Hsiung Leather Industries	5	353
219	Hupson Tannery	5	363
220	J. S. Leather	5	359
221	Ka Fung Tannery	5	399
222	Kamal Chem	5	375
223	Kim Wah Tannery	5	405
224	Koh Sinn Tannery- 1	5	408
225	Koh Sinn Tannery- 2	5	409
226	Kong Yuan Tannery	5	436
227	Lee Youn Chin Tannery	5	412
228	Lian Sheng Tannery	5	384
229	M. S. Enterprise	5	429A
230	Olympic Tannery	5	407
231	S. M. Overseas	5	380
232	S. T. Tannery	5	411
233	Sein Yee Tannery	5	356
234	Sheong Shi Tannery	5	397, 398
235	Shih Mei Tannery	5	400
236	Shui Yuan Tannery	5	413
237	Sin Sin Tannery	5	440
238	Sing Hing Tannery	5	378
239	Thai Chung Tannery	5	402, 402 A
240	Tien Sheng Tannery	5	367
241	Two Star Tannery	5	394
242	Ula Leather	5	348
243	Universal Leather Agency	5	349
244	Wanson Leather Industries	5	364
245	Wei Hing Tannery	5	430

246	Yao Shing Tannery	5	383
247	Ye Fong Tannery	5	350, 351
248	Yun King Tannery	5	395
249	Zen International	5	417
250	A. R. Enterprise	6	544
251	Chen Kuo Jung	6	565
252	Hasan Exports Pvt. Ltd	6	568
253	Labbaik International – 2	6	542
254	Milan Tannery	6	567
255	Monira Leather Works	6	549
256	Prime Industries	6	547
257	S. M. International	6	548
258	Standard Leather Pvt. Ltd.	6	561
259	Alam & Co	7	534
260	Badruddoja & Sons	7	531
261	Bhola Ram	7	503
262	Crown Leather Tannery	7	485
263	Ecotan	7	466
264	Ekta Tannery	7	497
265	Emperor Tannery	7	460
266	Euro International	7	508
267	Fong Hsing Tannery	7	481
268	Four Star Tannery	7	491, 491A
269	French Tannery	7	459
270	G. C. Enterprise Pvt. Ltd.	7	512
271	Galaxy Hides	7	509
272	Harijan Tannery – A	7	457A
273	Harijan Tannery – B	7	457B
274	Hsing Son Tannery	7	483
275	Karmakar Leather	7	477
276	Kwality Exports	7	513

277	Leather Impex	7	471, 471A
278	Lederman Collections	7	516
279	Lokenath Leather	7	525
280	M. K. Product	7	452
281	Neha Leather	7	519
282	Nezamuddin Tannery	7	465
283	Nishat Traders	7	487
284	Pauls Leather Service	7	510 ,510A
285	Pristine Leather Fashion	7	530
286	Raj Tannery	7	472
287	Ravinder Kumar	7	494, 495
288	Royco Tanners Pvt. Ltd.	7	514
289	Ranjit Tannery Pvt. Ltd.	7	453
290	S L W & Co.	7	502
291	S.T. Leather	7	470
292	Saiya Tanning Industries	7	475
293	Space Tanning Industries	7	462
294	Super Hide & Skin Agency	7	467
295	Shing Hing Tannery	7	480
296	United Chrome Tannery	7	498
297	Welmac Leather	7	474
298	Yan Chong Tannery	7	469
299	Zen International	7	522
300	Victory Leather	7	456
301	Ah Sein Tannery	8	642
302	A. S. G Leather Pvt Ltd.	8	607 – 607A
303	Azad Traders	8	605, 605A
304	Canton Tannery Pvt. Ltd.	8	611, 612
305	Champion Tannery Pvt. Ltd.	8	619
306	Chang Leather Industries	8	664
307	Chiu Lee Tannery	8	632, 632 A

308	Chu & Co.	8	602
309	Chung Yin Tannery	8	665
310	Ciria Tanning Co. Pvt. Ltd	8	628A
311	Dugros Leather India Pvt. Ltd	8	622
312	Eurotan	8	631
313	F. E. Enterprise	8	643
314	Fu Leather Industries	8	621, 621A
315	Firoz Tanners	8	669
316	H. M. Ayyub Skin Industries	8	653
317	Indian Tanning Industries Pvt. Ltd.	8	599, 600
318	Jagsons Tanning Industries	8	601
319	Kaff Tanners	8	636
320	Kamran Akhtar	8	657
321	Kaycee Trading	8	618
322	Kuo Tien Tannery	8	661
323	Ka Lim Tannery	8	598
324	La France	8	644A
325	Lord Ganesh Leather Works	8	650
326	L 2 Leather Works	8	639
327	M & Sons	8	670
328	Mow Chong Tannery	8	614
329	Parveen Tannery	8	606, 606A
330	Pioneer Leather Industries	8	617
331	Rajsons Leather Co	8	646, 647
332	Rahmani Enterprise	8	625
333	Shee Sen Leathers Pvt. Ltd	8	628, 629
334	Sip Shing Tannery	8	620, 620A
335	Tai Lien Tannery	8	603
336	Tai Lim Tannery	8	648
337	Top Asia Tannery	8	654
338	Trust -N- Trade	8	658

339	United Friendship Tannery	8	640, 640A
340	Weblec (India)	8	649
341	Wing Sung Tannery	8	616
342	Zee Leather	8	656
343	A. N. M. Leathers	9	775A
344	Atlantic Leather Fashion	9	781
345	Ayesha Export	9	752
346	Bahadur Tannery	9	808
347	Buddhuram Brother & Haridas	9	785,785A
348	Chandra Leather	9	832
349	Chang Kai Tannery	9	766
350	Ching Sue Tannery Pvt. Ltd.	9	764
351	Chiusons & co.	9	836, 836 A
352	Classic Point	9	777
353	Dinesh Ram	9	814
354	Dinesh Tannery	9	835
355	Ek Onkar Tanneries	9	841
356	Four Star Tannery	9	828
357	Globe Tannery & Co.	9	827
358	Great China Tannery	9	765
359	Hamdard Leather Tanners	9	755A
360	Hira International	9	789 A
361	J. B. Tannery	9	818
362	K. K. Traders	9	791
363	K. D. Tannery	9	812
364	Khadeem Hossain	9	758 – 758A
365	Lian Wah Tannery	9	762
366	Lucky Hide Pvt. Ltd.	9	746
367	Md. Saud	9	787
368	Pakeeza Leather	9	793
369	Pious Leather	9	749

370	Prime Leather	9	755B
371	Prameshwar Das	9	844
372	Rajendra Das	9	775
373	Ram Das & Others	9	797
374	Roshan Traders	9	811
375	S. D. A Tannery	9	783
376	Shalimar Tanning Pvt. Ltd.	9	815
377	Sheo Shankar Das & B. Ram	9	780
378	Umesh Ram	9	809,809A
379	Wei Chung Tannery	9	771
380	Ye Theam Tannery	9	769
381	Yun Ching Tannery	9	834
382	Yunkiu Leather Export Corporation	9	772
383	Yogendra Das & Surendra Das	9	842

With the proposed expansion, it is expected another 228 tanneries will shift their manufacturing units to the CLC in the future, details of which have been provided in **Table 2.3** and **Figure 2.2**. All tanneries in Kolkata have already received order to relocate their plants to the CLC.

Table 2.3 – Location of Units under Proposed Expansion

Zone	No. of Units
Zone 10A	
A	34
B	32
C	24
D	18
E	27
F	6
G	5
H	5
J	7
K	6

Zone 11	
	64
Total	**228**

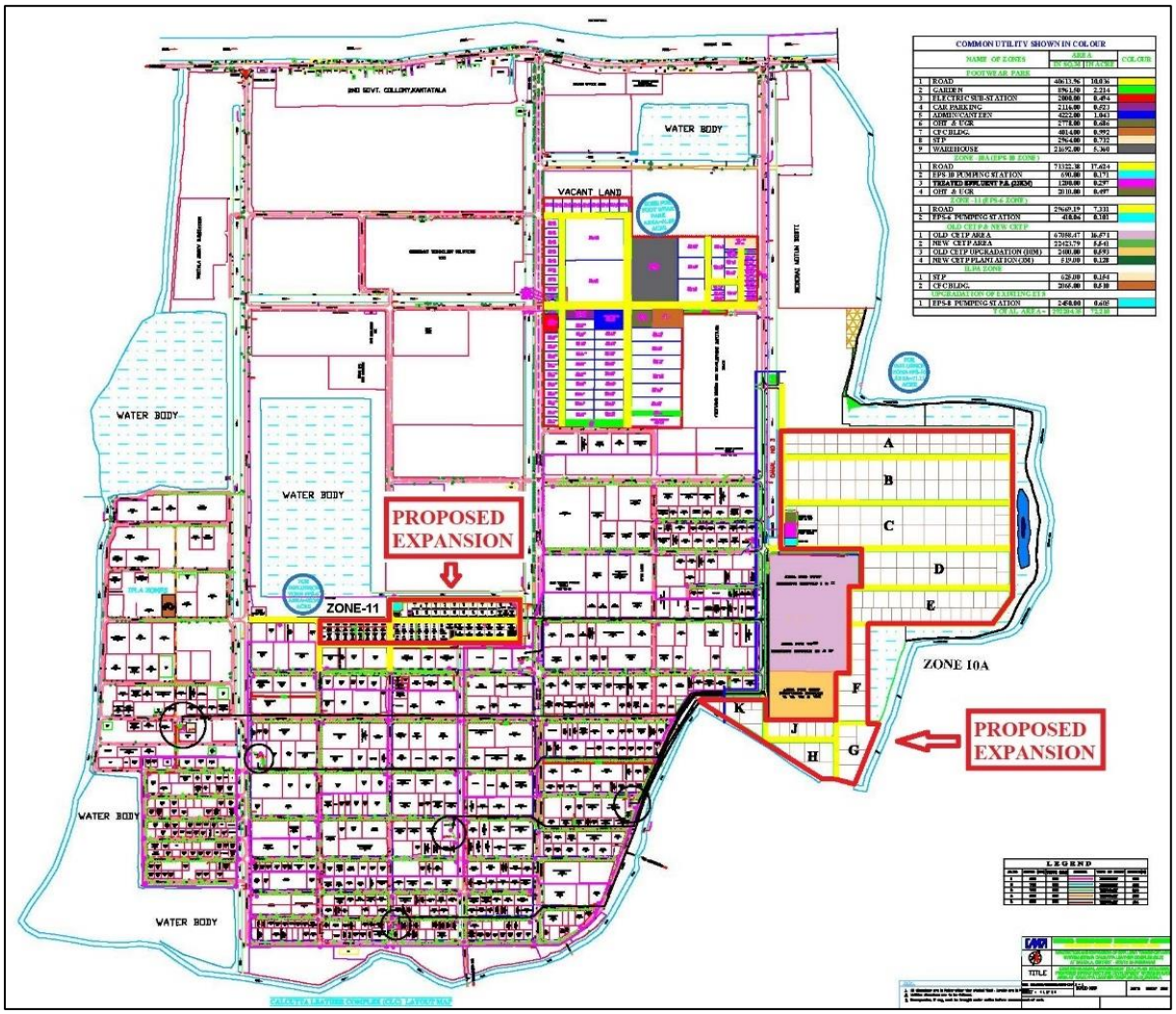


Figure 2.2 – Location of Units under Proposed Expansion

2.6 Industrial Estate Development

Tanneries require several facilities near their project sites for optimal and efficient operations. These facilities include infrastructure such as a continuous and reliable source of water, electricity and wastewater treatment.

Availability and easy access to a R&D centre will provide the tanneries better quality control over the raw materials and finished products as well as the possibility to avail the expertise of the R&D centre.

A nearby training centre enables the tanneries to train and the upgrade the skillset of the workers engaged in the tanneries. It will also allow the workers to easily adapt to any new technology that comes from time to time.

2.7 Technology and Process Description of Leather Industries

Animal skin consists of epidermis, a layer of fatty tissue called areolar and inner corium. Collagen, semi-soluble protein, present in corium is converted into highly durable leather through tanning operations.

The skin of cows and buffaloes is called hide while the skin of goats and sheep is called skin. In India, around 80% of hides i.e., cows and buffaloes skin comes from animals that died naturally due to ban on cow slaughter in many parts of the country. Goat and sheep skins, however, are by products of meat industry and are thus readily available. Hides are 1-3 m^2 in size and weigh about 10-20 kg while skins are smaller in size, about 0.4-0.5 m^2 and lighter in weight around 1-2 kg.

Slaughter hides and skins contain 60-70% of moisture content, which make them liable to bacterial attack, which in turn decomposes them. The preservation of hides and skins in a tannery can be split into following four main categories –

1. Preservation of hides and skins storage
2. Beam house operations
3. Tanning operations
4. Post-tanning and finishing operations

Tanneries also employ abatement techniques for the treatment of wastewater, solid waste and air emissions generated during these processes either within their complex, at a central treatment plant or a combination of the two.

Operations carried out in the beam house, tanyard, and post-tanning areas are referred to as wet processes, as they are performed in processing vessels such as drums.After post-tanning operations, the leather is subjected to dry finishing operations. Processes employed in each of the category changes depending on the raw materials used and the final products required.

2.7.1 Tanning Process

The process of converting raw hides and skins into leather is called tanning. The operations falling in pre-tanning, tanning and post-tanning operations are depicted in **Figure 2.3**.

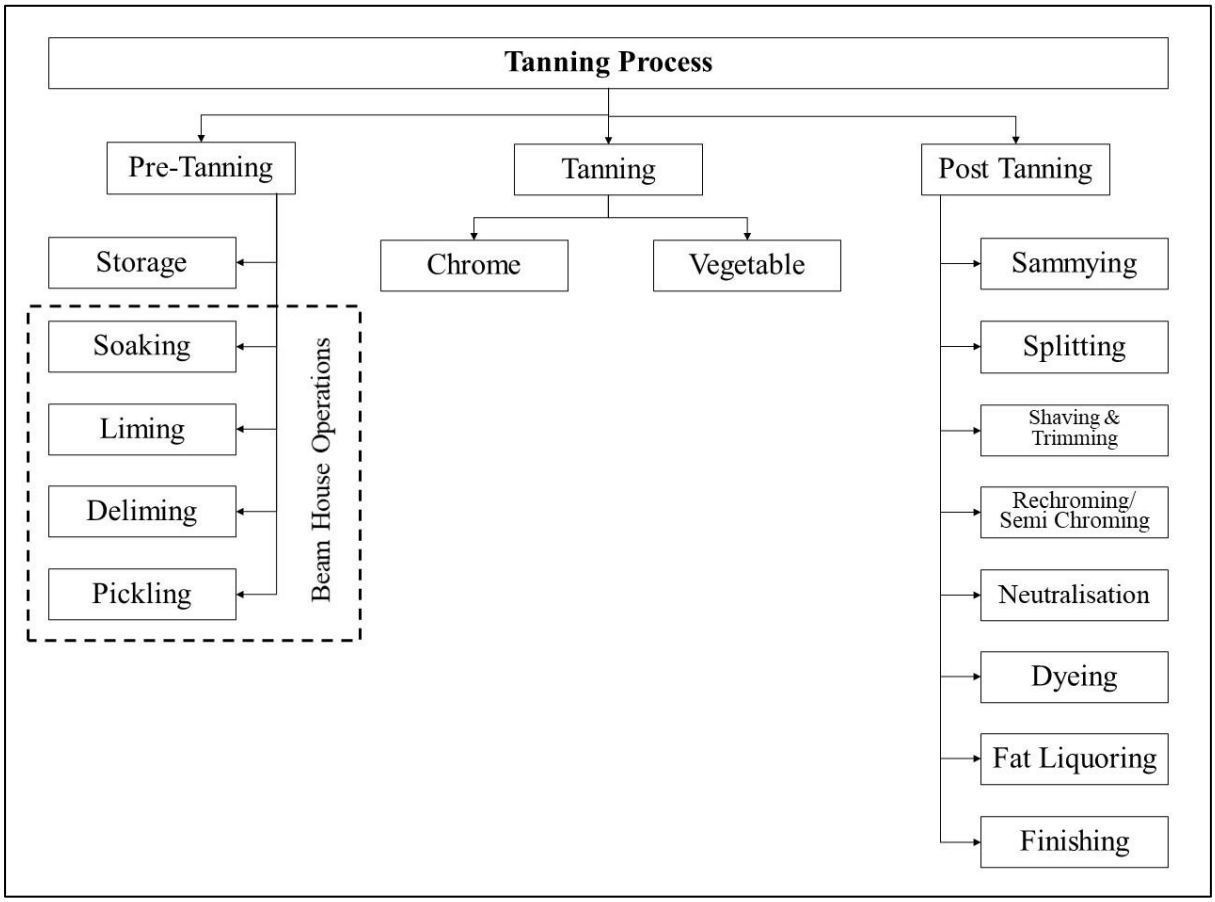


Figure 2.3 – Tanning Process

2.7.1.1 Pre-Tanning Operations

2.7.1.1.1 Raw Hides/Skins

Usually, the hides/skins consist 65% water and 30-35% proteins and fat. Bacterial degradation takes place due to the high amount of moisture present in the hides/skins. Inorder to prevent this, the moisture content needs be brought down toless than 30%. This dehydration is usually achieved by applying 30-45% by weight common salt i.e., Sodium Chloride to the hides/skins.

2.7.1.1.2 Sorting

Hides and skins are sorted into several grades based on size, weight or quality.

2.7.1.1.3 Trimming

Trimming is generally carried out during the sorting process. Some of the edges such as legs, tails, heads, etc. of the raw hides and raw skins can be cut off. Trimming may be performed in the abattoir or in the tanneries.

2.7.1.1.4 Curing and Storing

Curing can be defined as the process that prevents the decomposition of hides and skins from the time they are flayed in the abattoir until the processes in the beam house begins. Whenever a raw material cannot be processed immediately, it needs to be cured.

Popular methods of long-term preservation are salting and drying while short-term preservation of about 2-5 days includes cooling using crushed ice or refrigerated storage, and biocides.

Curing can be performed in the abattoir, at the hide market or at the tannery. In certain cases, it might be necessary to repeat curing in the tannery, for instance, chilled hides can be salted for longer storage or if salting was not sufficiently efficient.

Hides and skins are generally stored on pallets in ventilated or air-conditioned and/or cooled areas, depending on the method of curing chosen. From storage, the hides and skins are taken to the beam house.

2.7.1.1.5 Soaking

The main objective of this process is to remove the salt used during curing, rehydrating the material and to get rid of unwanted materials such as dung, blood, soil, etc. The duration of soaking may range from several hours to a few days. Depending on the type of raw materials used, soaking additives such as surfactants, enzyme preparations and bactericides may be used. The process of soaking can be classified into three stages –

1. **Dirt Soaking**

   In dirt soaking, 300-400% by weight of water is used to remove the unwanted materials.

2. **Main Soaking**

   The purpose of main soaking is to rehydrate the material. In this operation, water, non-anionic wetting agent (0.2 % concentrated Soda ash and 0.05% concentration preservatives) are used.

3. **Final Soaking**

   Only water is used for the washing purpose in this operation. Major part of salt associated with preservation of skin/ hides is removed during the soaking operation.

2.7.1.1.6 Liming

The purpose of this operation is to facilitate the removal of hair, flesh, fat (partially), inter-fibrillary protein and to open-up the fibrous structure for osmotic swelling and can be classified into two parts –

1. Dehairing

Lime (8-10 %) along with Sodium Sulphide (3 %) is applied to the skin to remove hair.

2. Re Liming

To open up fibrous structure, lime, soda ash, caustic soda, etc., are applied. The pH of the skin being processed will rise to 12-12.5.

2.7.1.1.7 Fleshing

The excess flesh is removed manually or by using fleshing machines. The quantity of wet fleshings is in the range of 10-15% of the weight of raw hides/skins.

2.7.1.1.8 Deliming

Deliming is used to adjust the pH to 8-8.5 in order to enhance the enzymatic activity, which converts some of the proteins into soluble form. pH correction i.e., from12-12.5 to 8-8.5 is done by using Ammonium Chloride in case of soft leather and Ammonium Sulphate in case of hard leather.

2.7.1.1.9 Pickling

Pickling can be described as a process used to correct the pH suitable to the tanning operation and to prevent swelling of the leather i.e., dehydration of the leather. In this process, water (80%), salts(8-10%), Formic Acid (0.28-0.3%), Sulphuric Acid (0.75-2% based on thickness) are applied.

pH Correction: For vegetable tanning, a pH 4-4.5 is maintained whereas, a pH of 2.5-7.3 is maintained in case of chrome tanning.

Prevention of Swelling: 8-10% by float weight of salts are used to prevent the swelling of the leather enabling dehydration of leather to take place.

2.7.1.2 Tanning Operations

Two types of tanning processes exist; chrome tanning and vegetable tanning. Of the total leather production in India, more than 80% is based on chrome tanning and the rest 20%is based on vegetable tanning.

2.7.1.2.1 Chrome Tanning

7-10% basic Chromium Sulphate containing 25% Chromium (III) Oxide and 25-30% Sodium Sulphate is used in chrome tanning. Part of the pickle bath is used for chrome tanning operation. The pH is increased to 3.8-4.0 at the end of chrome tanning process which is called basification. The semi-finished leather after chrome tanning is called wet blue.

2.7.1.2.2 Vegetable Tanning

Vegetable tanning makes use of plant extracts. The pH falls down from4- 4.5 to 3-3.5. Though this process is free of any heavy metal use, the leather developed from this process has comparatively weaker heat resistance and dye-holding capacity.

2.7.1.3 Post-Tanning Operations

Post-tanning operations comprises of rechroming of semi-finished wet blue leather, neutralization, dyeing, fat liquoring and finishing while post-tanning of vegetable tanned semi-finished leather consist of semi-chrome tanning, neutralization, dyeing, fat liquoring and finishing. However, the operations vary depending upon the final product.

2.7.1.3.1 Sammying

It is a mechanized process to remove excess moisture in the wet blue.

2.7.1.3.2 Splitting

After sammying, the material is split into required thickness using a splitting machine.

2.7.1.3.3 Shaving and Trimming

The semi-finished leather is levelled using a shaving machine.

2.7.1.3.4 Rechroming

Depending on the quality of wet blue, re-chroming may be carried out to improve the chromium content in the leather.

2.7.1.3.5 Semi Chroming

In case of vegetable tanned semi-finished leather, chrome tanning may begiven depending on the final leather quality.

2.7.1.3.6 Neutralization

pH is adjusted to 4.5-6.5.

2.7.1.3.7 Dyeing

The leather is coloured using dyes such as anionic dyes, acid dyes, direct, metal complex compounds and basic dyes.

2.7.1.3.8 Fat Liquoring

Natural/synthetic oils are applied for fat liquoring, thereby imparting softness to the leather.

2.7.1.3.9 Finishing

Phenolics, melamine, acrylics, polymers, naphthalene, etc., are used for finishing to impart fullness to the leather.

2.7.2 Input vs Output in The Tannery Process

Various raw materials required during various tanning operations and the output and waste generated due to these tanning operations have been provided in **Figure 2.4**.

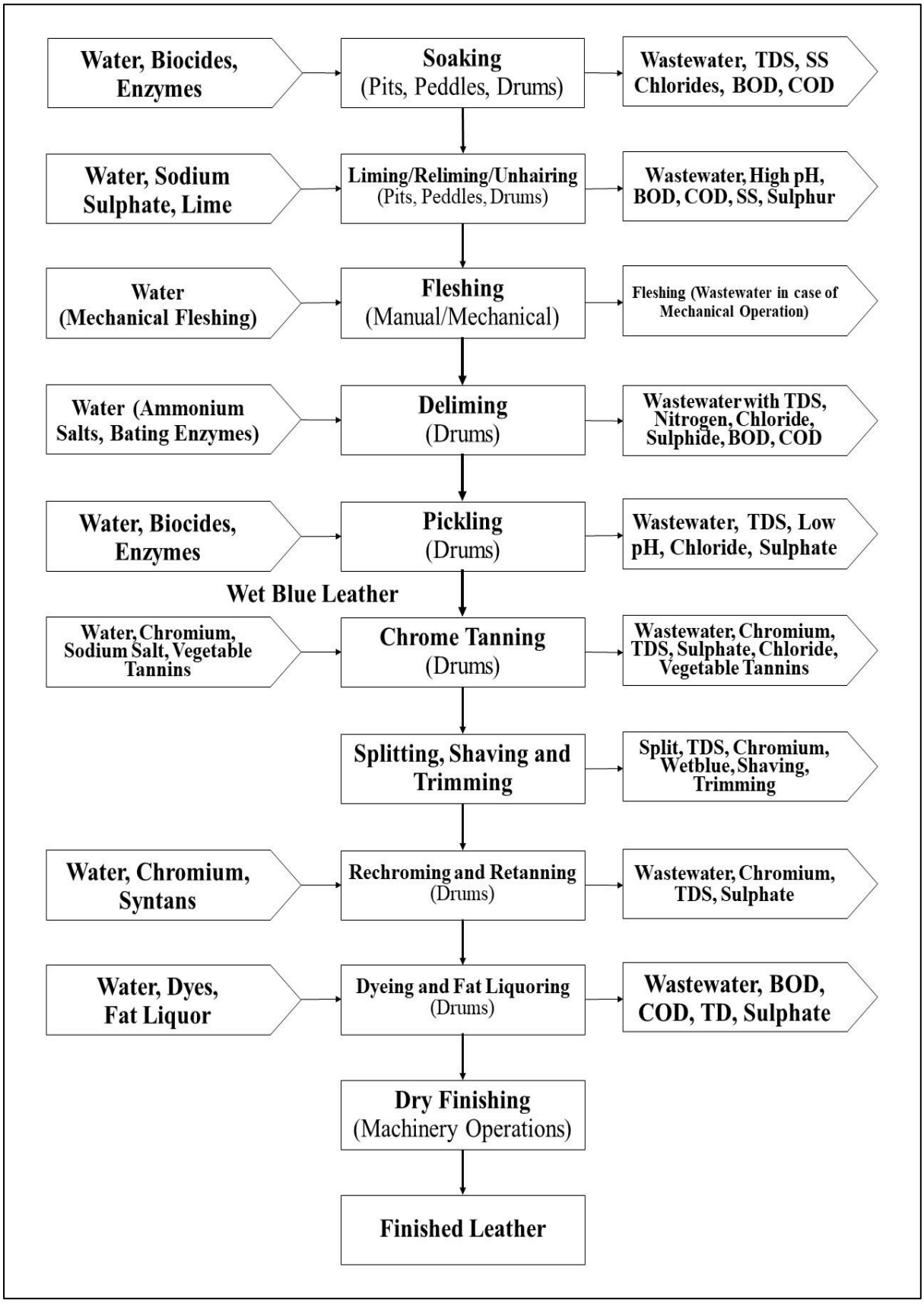


Figure 2.4 – Input and Output During Various Tanning Operations

2.8 Resource Requirement

2.8.1 Water Requirement

Tanneries require huge quantity of water for manufacturing tanned leather from raw hides and skins. However, this process water need not be as pure as potable water and hence raw water pumped from tubewells and/or surface water can be sufficiently utilised.

The required process water for the proposed expansion is 3.17 MLD.

This quantity will be made available from 25 deep tubewells that have been dug in the area. Hydrological studies have shown the existence of underground aquifers capable of yielding about 1,800-2,000 KLD if pumping is carried out for 16 hours/day with 8 hours as the time for recoupment of the water in the tubewells.

Development and yield test confirms 27,000 GPH of water availability from a 12-inch diameter.

The water from the tubewells will be pumped into the water bodies through which water will be available all over CLC.

About 1.05 MLD of water will be required for domestic purposes for the proposed expansion and will also be made available from these tubewells from where it will be pumped to 10 overhead tanks located in different zones through a different distribution system.

2.8.2 Wastewater Generation

The approximate volume of wastewater generated for manufacturing 1 MT of finished hides/skins from raw hides/skins is estimated as follows –

Table 2.4 – Wastewater Generated Due to Leather Manufacturing

S. No.	Process	Wastewater Generated (KL/MT)
1	Soaking	6
2	Beam house operations	6
3	Pickling and chrome tanning	1.5
4	Wet Finish (Rechroming, dyeing and fat liquor)	3
5	Composite (includes washing)	30

Table 2.5 – Current Wastewater Generation

S. No.	Purpose	Wastewater Generated	Quantity	Total Wastewater Generation (KLD)
1	Domestic	35 lpcd	33,000 people	1155
2	Manufacturing	30 KL/MT	1,000 MTPD	30000
Total				**31155**

Table 2.6 – Wastewater Generation After Proposed Expansion

S. No.	Purpose	Water Requirement	Quantity	Total Wastewater Generation (KLD)
1	Domestic	35 lpcd	33,000 people	1155
2	Manufacturing	30 KL/MT	1,600 MTPD	48000
Total				**49155**

2.8.3 Wastewater Treatment

The wastewater generated from the leather and leather goods manufacturing units will be partially treated within the leather and leather goods manufacturing units, followed by treatment at the 30 MLD CETP (comprising of 6 modules of 5 MLD each). However, additional plant capacity will be required in order to handle the increased effluent flowrate upon after the proposed expansion.

The wastewater will be transported from the work areas to the CETP via underground HDPE pipeline network under gravity.

Chrome effluent from tanneries will be segregated, collected and dispatched by individual tanneries to the chrome recovery unit in the CETP.

Table 2.7 – Characteristics of Wastewater of CETP

S. No.	Parameter	Unit	Inlet	Maximum Permissible Limit of the Outlet
1	pH	-	8.0-9.0	6.5-9.0
2	COD	mg/L	4000	250
3	BOD	mg/L	2000	30
4	TSS	mg/L	980	100
5	Sulphide	mg/L	150	1
6	Total Chromium	mg/L	61	2

7	Oil and Grease	mg/L	-	10

2.8.4 Electricity Requirement

The total power demand for the proposed project is estimated at 7.23 MVA. Power will be received from West Bengal State Electricity Board at 132 KV level through 2 132/33 KV, 50 MVA transformers.

A 132/33 KV substation is located in the Eastern part of the complex and the other 132/33 KV substation is routed through the North/East boundary road.

Table 2.8 – Power Substations

Capacity	Quantity
2x5 MVA	3
4x5 MVA	1
1x5 MVA	2
3x5 MVA	2

Six 33 KV lines are used to transmit power from the 132/33 KV substations. Two 33 KV circuits are used for each 30 MVA load. Each substation has a number of 33/11 KV 5 MVA transformers. 33 KV bus work, sectionalizing, transformer taps and 11 KV O/G feeders are provided for reliable downstream power distribution.

There are both 11 KV and 415 V consumers in the CLC. High load consumers i.e., where demand is more than 50 KVA, power will be fed with 11 KV grid. For low load consumers i.e., where demand is below 50 KVA, the requirement will be met from 11 KV/433 V transformer type substations located at the load centres for a cluster of such consumers.

11 KV overhead lines will be routed for distribution of power to the consumers. To avoid crossing of overhead lines, substations end take off will be by means of 11 KV XLPE cables buried underground to 11 KV overhead distribution lines.

2.8.5 Road Network

Roads will be constructed within the proposed expansion area to provide connectivity of the upcoming tanneries within the CLC as well as outside the CLC.

These roads will be used for transporting raw materials, finished goods, waste and workers to and from the upcoming tanneries.

Roughly 85,000 m^2 of roads will be laid to facilitate movement of workers and vehicles to and from the upcoming units and will require the following materials –

Table 2.9 – Approximate Raw Materials Required for Road Construction

S. No.	Construction Material	Unit	Quantity Required per 100 m^2	Total Quantity Required
1	Paving Asphalt	kg	0.18	153
2	Bitumen	MT	0.18	15300
3	Stone chippings 12.5/13.2 mm nominal size @ 1.80 m^3/100 m^2	m^3	2.25	1912.5
4	Stone chippings 10/11.2 mm nominal size @ 0.9 m^3/100 m^2	m^3	1.12	952

2.8.6 Drainage Network

Water supply network, storm water drainage and effluent drains will be laid down within the proposed expansion area to cater to the needs of water, stormwater removal and effluent transport of/from the tanneries.

Freshwater will be made available from the 10 overhead tanks located in different zones through a different distribution system while the wastewater will be transported from the tanneries to the CETP via underground HDPE pipeline network under gravity.

Approx. 2,500 m of 12" HDPE pipes will be laid for transporting the effluent from the upcoming tanneries to the CETP for this purpose.

2.8.7 Fuel Requirement

DG sets to be used during the construction and operation phase (in case of power failure) will require diesel for their operation.

The amount of diesel required during the operational phase will vary depending upon the number of units installing a DG set and their manufacturing capacity. Individual units will be advised not to use any banned fuels and to meet emission norms.

Table 2.10 – Fuel Analysis of 2-D Grade Diesel

S. No.	Test	Unit	Limit
1	Flash point	°C	52
2	Water and sediment	% by volume	Max. 0.05
3	Distillation		
(a)	Physical	°C	282-338
(b)	Simulated	°C	300-356
4	Viscosity @ 40 °C	mm^2/s	1.9-4.1
5	Ash content	% by mass	Max. 0.01
6	Sulphur content		
(a)	S15	µg/g	Max. 15
(b)	S500	% by mass	Max. 0.05%
(c)	S5000	% by mass	Max. 0.5%
7	Aromatics		
(a)	Cetane index		40
(b)	Aromaticity	% by volume	Max. 35%

CHAPTER 3 – DESCRIPTION OF THE ENVIRONMENT

3.0 General

Baseline environmental monitoring is vital part of predicting and evaluating potential environmental impacts which helps in understanding existing environmental conditions. This helps in defining the focus of the environmental impact analysis and the areas that need protection through appropriate and viable mitigation measures.

Baseline environment monitoring allows us to estimate the carrying capacity of environment and enables us to reach the conclusion if a proposed project can be feasible or not. We can arrive at this conclusion by comparing the predicted anticipated environmental impacts due to the project to the baseline study and can prepare a mitigation plan to manage the harmful effects due to the proposed expansion of CLC.

Baseline environment monitoring consists of a core zone comprising of area within the project site and a study area comprising of 10 km area in the vicinity of the project site.

All the environmental aspects have been studied including land use, soil quality, surface and ground water quality, ambient air quality, ambient noise quality, flora and fauna and socio-economic conditions. Metrological data has also been collected to know the baseline temperature, humidity, wind speed, wind direction and predominant down wind direction.

3.0.1 Laboratory Details

Primary data has been collected by a NABL accredited laboratory. All the laboratory reports are attached as **Annexure II**. Details of NABL accredited laboratory are presented in **Table 3.1**.

Table 3.1 – Laboratory Details

S. No.	Particulars	Details
1	Laboratory Name	Ultra Testing and Research Laboratory
2	Laboratory Address	C-43, Sector 88, Phase II, Noida, Uttar Pradesh – 201304

3	Laboratory Accreditation Details	Certificate No. TC-8198 Valid Till: 15.11.2022

Secondary data has been collected from government literature and website, like CPCB, New Delhi, IMD and Census Survey of India, 2011.

10 km buffer map showing the study area has been provided in **Figure 3.1** below with core and buffer zone.

3.0.2 Methodology

Baseline attributes like ambient air, water, meteorology, noise, soil, ecology and biodiversity and socio economy condition were collected as per standard ToR. Secondary data was also collected from various government department as well as local people.

Methodology adopted in this study is as follows –

1. Collection of soil samples from 6 locations in the study area to analyse physical and chemical characteristics of soil quality.
2. Collection of surface samples from 4 locations and ground water samples from 6 locations within study area to analyse the existing water quality in the study area.
3. Installation of air monitoring dust samplers (for PM10, PM2.5) at 6 locations in the study area for the collection of primary air pollutants.
4. Noise measurement at 6 locations to analyse the existing situation in the study area.
5. Carrying out of a detailed biological study for the Core and Buffer Zone.
6. Literature review that includes identification of relevant data and articles from various publications, various government agencies and other sources for socio-economy, demography has been done with primary data collection in 10 km of the study area.
7. Carrying out of field studies during the study period (January – March 2021) to establish the existing baseline conditions.

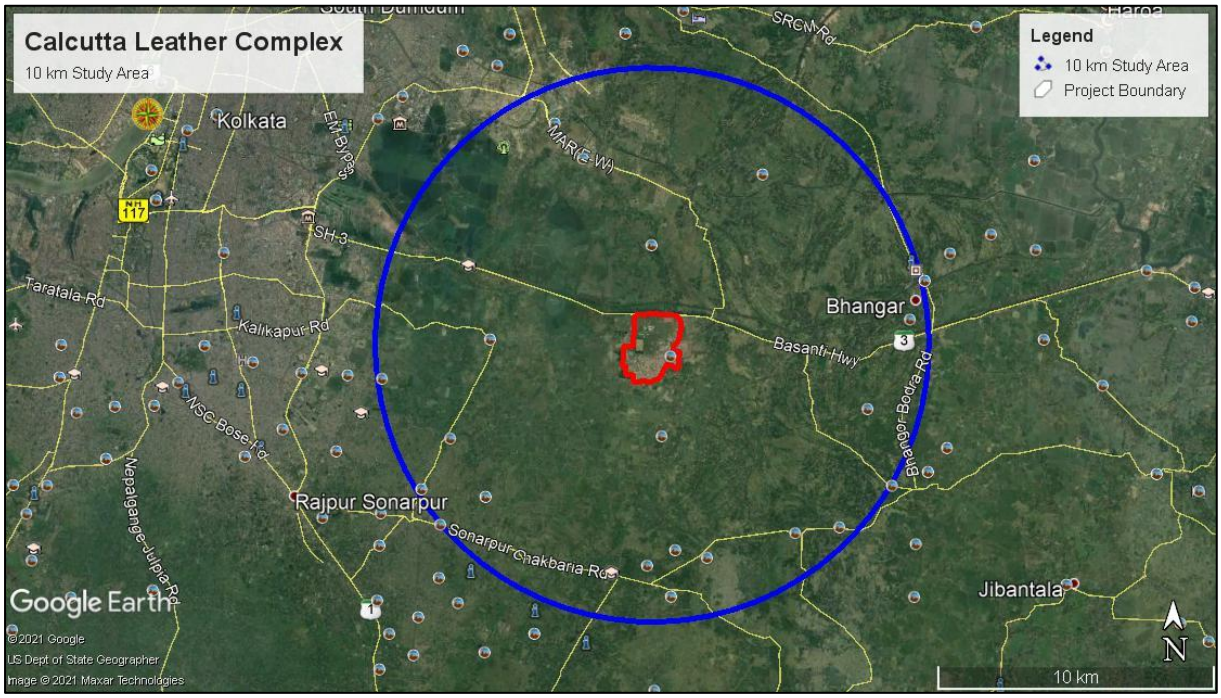


Figure 3.1 – 10 km Study Area of the Project

(Source: Google Earth)

3.1 Land Environment

Existing status of baseline conditions of land use can be determined by studying the changes in the land use pattern and by collecting data from secondary sources such as census records.

3.1.1 Topography

The entire district is situated in the Gangetic delta. A large area in the Southern part of the district is covered with the dense jungle of Sundarban with numerous rivers and its tributaries in between leading to the presence of numerous islands in the area. Some of these islands remain submerged under water. In the Northern part of the district, Baruipur-Jaynagar Plain and Kulpi-Diamond Harbour Plain are present which are 5-6 m amsl.

The district can be divided into the following four sub-micro regions –

1. South Hugli Flats
2. South Bidyadhari Plain
3. Hooghly Delta
4. Sundarbans

3.1.1.1 South Hugli Flats

From the Northern boundary of the district (Kolkata) to Diamond Harbour in the South, this is a narrow flat alluvial land along the river of Hooghly which also forms the district boundary in the West. Flowing South-West, Hooghly river receives the Rupnarayan river in the Hugli point and then turns East for about 12 km until it reaches the Diamond Harbour. From there it again turns Southwards and falls into Bay of Bengal. Hugli river is a navigable river and ships reach Kolkata Port through this river during hightides.

3.1.1.2 South Bidyadhari Plain

This plain area has its general slope towards the South. Situated in the Northern part of the district, Matla river is the most prominent river of this plain. There are many streams and water channels which are locally known as khals.

3.1.1.3 Hooghly Delta

Lying in the South-Western part of the district, the Hooghly river forms the district boundary in the West. The river falls into the Bay of Bengal and has a Southern slope. Before falling into Bay of Bengal, it bifurcates into two channels. The main channel passes to the West and the other called Baratala to the East of Sagar Island. The Southern part of the Hugli Delta has numerous channels and islands of which Henry's Island, Sagar Island, Frederick Island and Fraserganj Island are some of the islands. It is a land of strong tides which sometimes reaches 3-5 m in height.

3.1.1.4 Sundarbans

Almost the entire area under Indian part of Sundarbans is contained in South 24 Parganas. A dense mangrove forest amongst numerous river sand streams, thousands of islands, rich flora and fauna along with human presence has made Sundarbans world famous. The area is known for the Royal Bengal Tiger (Panthera tigris tigris), as well as numerous fauna including species of birds, spotted deer, crocodile sand snakes. The fertile soil of Sundarbans helps intensive agriculture. Sundarbans functions as a protective barrier for millions of inhabitants living in the Southern part of the district. Sundarbans is stretched between India and Bangladesh with India's share at19%. The Bay of Bengal lies in the Southern part of Sundarbans and the rivers of the region falls there. Thus, it has become a region of transition between the fresh water of the rivers and the saline water of the Bay of Bengal.

(Source: District Census Handbook, South 24 Parganas, Village and Town Directory, Part XII-A, Directorate of Census Operations, West Bengal, Series-07)

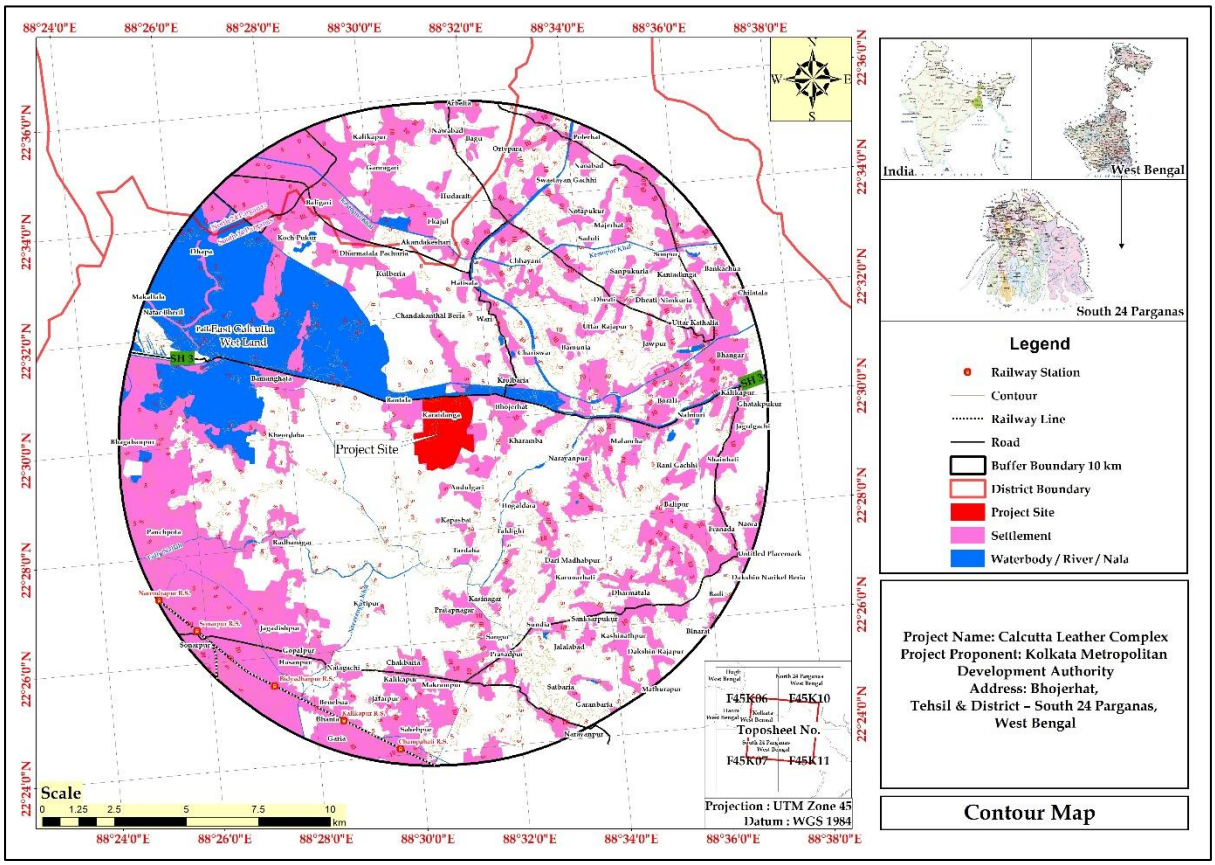


Figure 3.2 – Drainage Pattern of Study Area

3.1.2 Study Area

The area around the CLC reflects a gently rolling ground with the highest level at the South West and Southern Zone. On the Southern fringes runs the Karaidanga Canal which cuts into the site and moves to the Eastern boundary of the CLC. The general site is slightly low lying and at the road proximity 1.8 m below road level. The SH on the Northern boundary of the CLC maintains an up and down rolling gradient.

Since the bed of the Karaidanga Canal is much lower than the general ground level at the CLC, therein no flooding of the CLC area. Water however stagnates and gets stored in the Karaidanga Canal as its discharge outlet on the SWF is difficult at times. Sometimes, the water level at SWF is high due to tidal backflow, discharge from the Karaidanga Canal is rendered impossible. Thus, the drainage of the CLC site is ultimately dependent on the water level at

SWF. The CLC site, therefore must have enough water storing capacity and water harvesting would be essential.

About 900 ML or 26 days of water requirement for normal process water requirement of 30 MLD to of waterbodies have also been developed within the CLC project site covering an area of about 40.47 Ha.

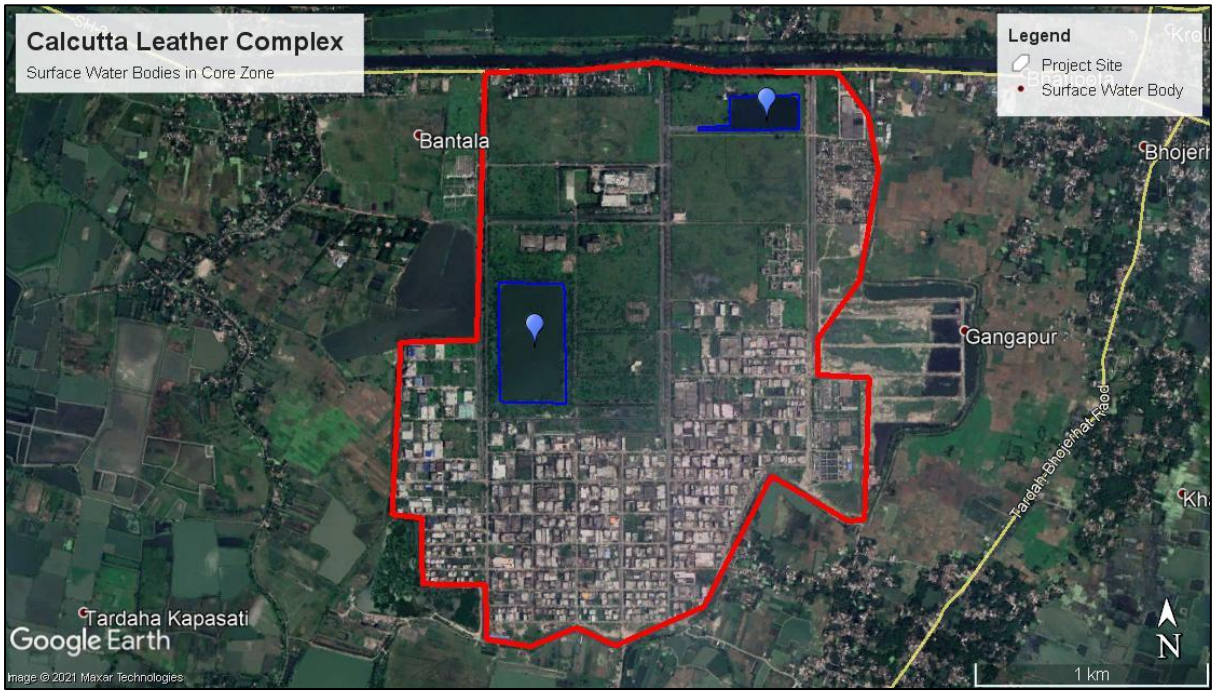


Figure 3.3 – Rain Water Harvesting Ponds within CLC

The road level of Kolkata-Basanti State Highway at the North East corner of CLC is at 100.22 m and normal water level of SWF is found to be around 96.625 m.
The CLC site was much lower than the road level and was thus filled to bring the finished ground level up to 98.40 m so that self draining of the project site by gravity is possible.
The plinth of the buildings are and will be kept at 0.45 m above finished ground level while the roads are kept at 0.20 m above the finished ground level.

Storm water drainage has been constructed to accommodate rainfall intensity of 50 mm per hour on maximum area of 90,000 m^2 for secondary drains and 30 mm per hour rainfall intensity for main drains having a minimum catchment area of about 1,35,000 m^2 and maximum catchment area of about 4,80,000 m^2.

All the secondary drains are connected to the main drains with a minimum drop of 200 mm at the junction points. The main drains flowing towards Kolkata-Basanti Road are connected to SWF and those flowing to the back side of the CLC area are connected to the Karaidanga Canal.

3.1.3 Land Use Pattern

South 24 Parganas is situated in the Proper Delta of Lower Ganga Plain. It is above the flood level and the physical features are similar to deltaic land of the country. The Northern inland tract is fairly well raised and the Southern portion is low-lying Sundarbans towards the seaboard. The Sundarbans are a network of tidal channels, river creeks and islands. There are some swampy marshes covered with low forest and scrub wood. The low land gradually declines towards the coast.

As per land utilization statistics for the year 2010-11 around 44.94% land of the total reporting area belong to the forest, 37.78% land is under cultivation and 15.11% land is categorized for non-agricultural use for South 24 Parganas district.
(Source: District Census Handbook, South 24 Parganas, Village and Town Directory, Part XII-A, Directorate of Census Operations, West Bengal, Series-07)

Present land use of study area has been prepared from latest satellite imagery. Specialised land use data has been prepared by using ArcGIS software. Land use and land cover has been analysed for the study area for the agricultural land, forest, open scrub, water body etc.
To assess the land use pattern surrounding the 10 km radius of the project, a detailed study was carried out. The land use pattern study reveals that the 10 km environment is predominantly agricultural land.

Table 3.2 – Present Land Use Pattern of Study Area

S. No.	Type	Land Use Existing Area (Ha)	Percentage of Total Area (%)
1	Agriculture Land	22014.83	52.92
2	Open Scrub	95.93	0.23
3	Settlement	15042.29	36.16
4	Waterbody/Canal/Nala	4445.25	10.69
Total		**41598.3**	**100**

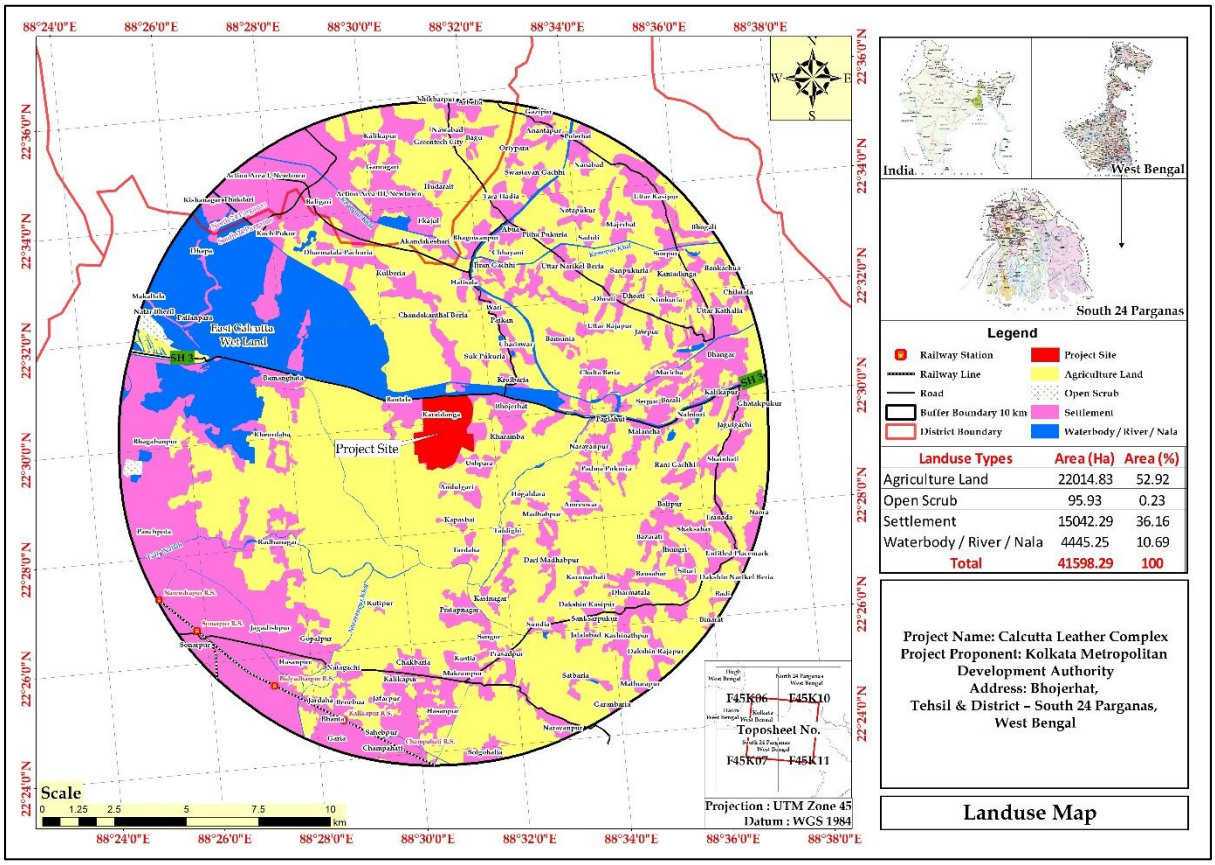


Figure 3.4 – Land Use Pattern of Study Area

3.1.4 Seismicity of the Area

The project site is located in Village Bantala, Post Bhojerhat, Tehsil & District – South 24 Parganas, West Bengal and falls under Moderate Intensity Zone (Seismic Zone III).

3.1.5 Soil Characteristics

3.1.5.1 Soil Type

The soil type in South 24 Parganas district is divided into the following three groups –

1. Entisols
2. Alfisols
3. Aridisols

The Entisols are present in the Western corner of the district, the Alfisols which are typically deltaic alluvium soils, are present in central portion, and the Aridisols which are saline and saline-alkali in nature are present in the Southern part of the district.

(Source: Ground Water Information Booklet, South 24 Parganas District, West Bengal, Central Ground Water Board, 2013)

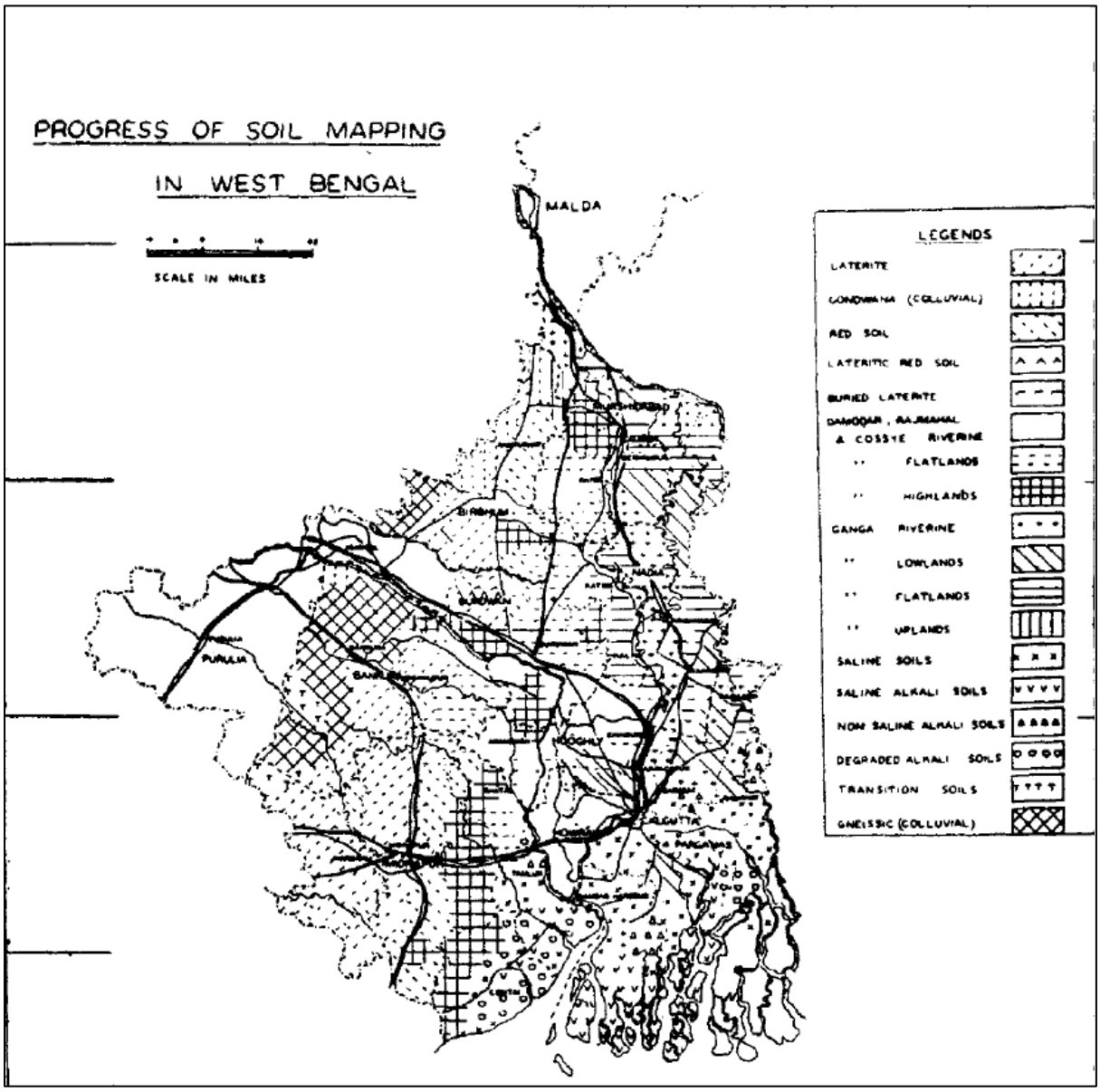


Figure 3.5 – Soil Map of West Bengal

(Source: P. Chakravarti and Miss S. Chakravarti, State Agricultural Research Institute, Kolkata, 06.12.1957)

3.1.5.2 Soil Quality

3.1.5.2.1 Soil Sampling

Soil samples have been taken from 6 sites within the study area. Distance and direction of soil sampling locations from project site have been given **Table 3.3** and **Figure 3.6**.

The soil samples were collected between the study period of January to March session of 2021.

The present study on the soil quality establishes the baseline characteristics within the study area. The objective of soil sampling is as follows –

1. To determine the baseline soil characteristics in the study area.
2. To determine the impact of the project on soil characteristics.

Table 3.3 – Soil Monitoring Locations

Station	Location	Latitude	Longitude
SQ1	Within Project Site	22°29'55.09"N	88°31'1.45"E
SQ2	Mahes Pukuria	22°26'41.25"N	88°31'17.28"E
SQ3	Chandakanthal Beria	22°32'18.12"N	88°30'55.90"E
SQ4	Abua (Road Intersection)	22°33'36.06"N	88°32'38.90"E
SQ5	Bajbarantala Road Sonarpur-Bamanghata Road Crossroad (Near Goalapota)	22°29'58.51"N	88°27'37.90"E
SQ6	Panapukur	22°31'11.06"N	88°35'55.91"E

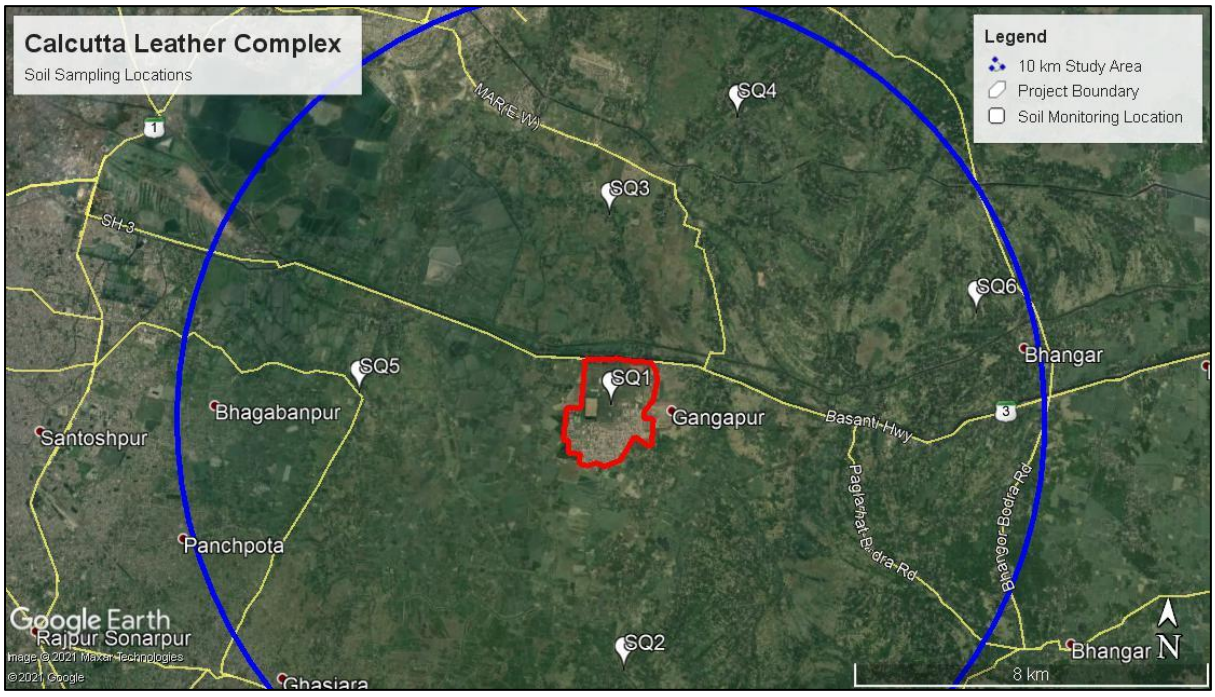


Figure 3.6– Soil Monitoring Locations

3.1.5.2.2 Soil Monitoring Analysis

Soil quality has been analysed as per Indian standards prescribed by government. Soil samples have been taken from 6 locations. Soil quality analysis results are presented in **Table 3.4** and **Annexure II**.

Table 3.4 – Soil Monitoring Analysis

S. No.	Parameter	Unit	SQ1	SQ2	SQ3	SQ4	SQ5	SQ6
1	Texture	-	Silt Clay Loam	Clay Loam	Clay Loam	Sandy Clay Loam	Sandy Clay	Clay Loam
2	Sand	%	18.57	28.49	36.64	51.57	46.81	36.37
3	Clay	%	30.70	36.39	32.26	27.90	38.19	32.38
4	Silt	%	50.73	35.12	31.10	20.53	15.00	31.25
5	pH	-	6.85	7.68	6.86	7.32	7.89	6.93
6	Electrical Conductivity	µmhos /cm	327.5	293.6	367.3	368.5	412	274.6
7	Potassium (as K)	mg/kg	155.69	191.22	209.64	127.58	192.53	195.08
8	Sodium (as Na)	mg/kg	209.06	261.34	306.27	228.17	211.42	238.75
9	Calcium (as Ca)	mg/kg	3077.66	3318.24	3804.75	2965.48	3445.61	3444.74
10	Magnesium (as Mg)	mg/kg	701.59	558.97	706.05	877.00	535.83	779.19
11	Sodium Absorption Ratio	-	0.88	1.10	1.20	0.95	0.88	0.96
12	Water Holding Capacity	%	45.58	47.64	46.01	29.73	31.03	42.81
13	Total Kjeldahl Nitrogen	%	0.076	0.10	0.082	0.066	0.071	0.067
14	Phosphorous	mg/kg	49.66	56.31	62.59	53.51	56.21	52.10
15	Bulk Density	g/cc	1.27	1.30	1.29	1.30	1.28	1.27

16	Organic Matter	%	0.98	1.36	1.14	1.00	0.97	1.28
17	Porosity	%	39.61	42.13	40.25	42.53	41.87	40.66

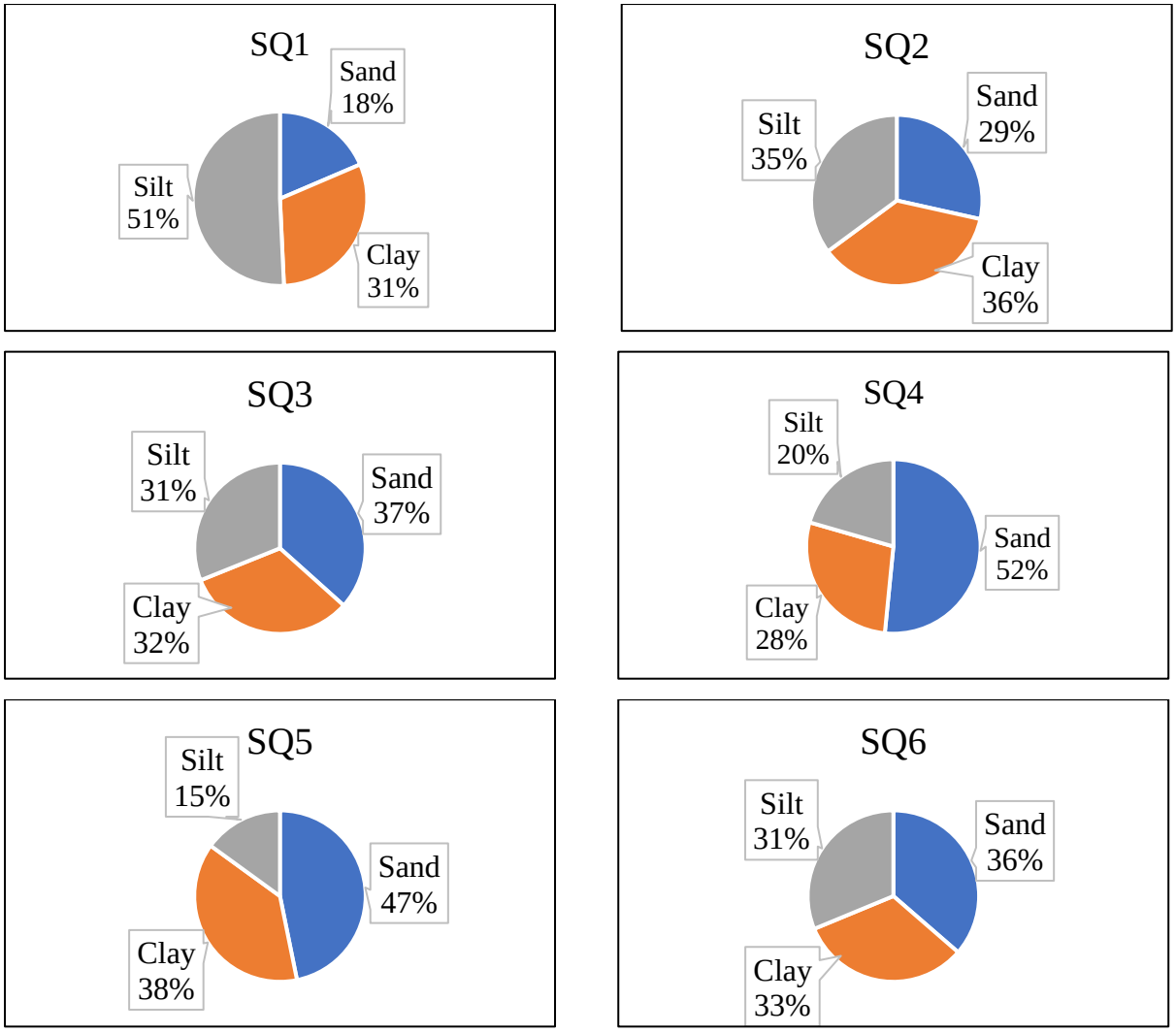


Figure 3.7 – Soil Quality Within Study Area

3.1.5.2.3 Soil Analysis Inference

Physical characteristics of soil were characterized through specific parameters viz bulk density, porosity, water holding capacity, pH, electrical conductivity and texture.

Soil pH plays an important role in the availability of nutrients. Soil microbial activity as well as solubility of metal ions is also dependent on pH. In the study area, variations in the pH of the soil were found to be slightly acidic to slightly basic from 6.85 to 7.68.

Electrical conductivity is a measure of the soluble salts and ionic activity in the soil. In the collected soil samples, the conductivity ranges from 274.6 to 412 µmhos/cm.

The soils with low bulk density have favourable physical condition where as those with high bulk density exhibit poor physical conditions for agriculture crops.

3.2 Water Environment

3.2.1 Surface Hydrology

The proposed project of Expansion of CLC is located near the Ganges Delta. The Gangetic Delta even though famous for water-related catastrophes in a major rural river basin where limitations in quantity, quality, and timing of available water are producing disastrous conditions, but far from the region of catastrophes due to the locational advantage of the side layer of the funnel.

The project area is rich in surface water and there are several water bodies including Calcutta Wetlands, Basanti Canal, etc are present. The water quality is also good and the location is more or less plain. However, the changes and consequences in the hydrologic regime due to climate- and human-induced stresses. Flow duration curves (FDCs), rainfall elasticity, and temperature sensitivity were used to assess the water flow patterns. Hydrologic and climate indices were computed to provide insight on hydro-climatic variability and trend. Significant increases in temperature, evapotranspiration, hot days, heating, and cooling degree days indicate the region is heading toward a warmer climate. Understanding the causes and directions of hydrologic changes is essential to formulate improve water resources management in the region.

Surface water measurement can be fairly simple in some situations and very complex in others. Depth of water, terrain, and velocity are important when determining flow rates and volumes. Three types of surface water measurement are overland flow, discharge of rivers, and water storage in lakes and reservoirs.

Overland flow, also called sheet flow is surface water runoff that is moving within a watershed toward a river. Overland flow does not usually continue for more than a short distance because it combines with other moving water bodies to collect in natural or artificial waterways. Overland flow can be mathematically calculated using the Rational Formula:

$$Q = KiA$$

where,

Q = peak rate of runoff in cubic feet or cubic meters per second

K = runoff coefficient

i = intensity of rainfall in inches or centi-meters per hour

A = watershed area in acres or hectares

Table 3.5 – Runoff Coefficients for The Rational Formula

Runoff Area	Value of k
Business	
Downtown	0.70–0.95
Neighbourhood	0.50–0.70
Residential	
Single-family	0.30–0.50
Apartments	0.50–0.70
Industrial	
Light	0.50–0.80
Heavy	0.60–0.90
Parks, Cemeteries	0.10–0.25
Playgrounds	0.20–0.35

3.2.1.1 Flood Events

Floods occur when precipitation and runoff exceed the capacity of a river channel to carry the increased discharge. Nature has provided river channels and floodplains to carry runoff water from the land surface to the oceans. A floodplain is simply an extended channel that carries high- water volumes. The amount of water carried by a river changes daily but often receives little attention in humid areas unless water overflows its banks. Floods are an inevitable component of any river system, since runoff volumes vary with time.

3.2.1.2 Flood Frequency

Flood damage can be predicted based on the intensity of a storm and the topography of a region. A flood with a recurrence interval of 50 years means that it has a 1 in 50 chance of occurring in any given year (a 50-year flood, or Q50). A 100-year flood, or Q100, has a 1 in 100 chance of occurring in any given year.

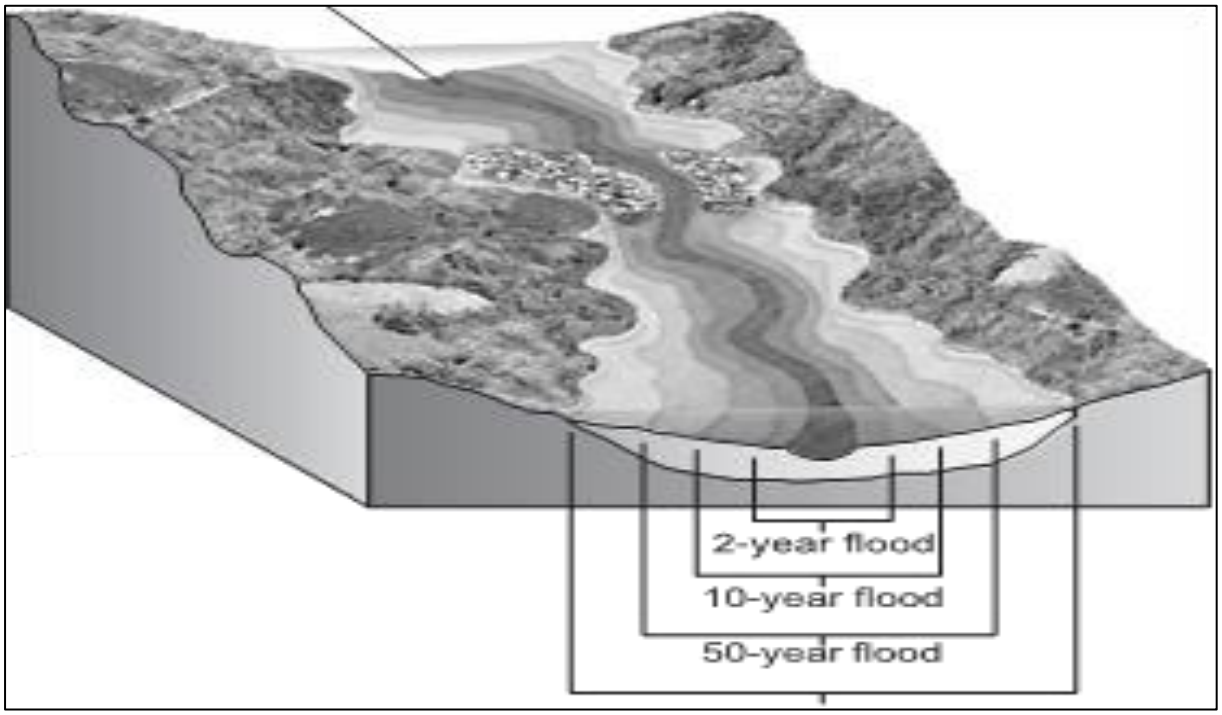


Figure 3.8 – Flood Damage Intensity

The frequency of flooding is based on history – how often have floods occurred in a region, what frequency of a 1 in 500 chance, or a probability of 0.002 in any one year, of a given discharge (based on a river hydrograph) of flooding a given area.

A 100-year flood is most commonly used for floodplain management, flood insurance regulations, and engineering designs of dam spillways, road culverts, bridge abutments, and other structures to meet estimated maximum surface water flow volumes. The term 100-year flood is commonly misunderstood by the public and leads to confusion that can have important consequences regarding flood frequency and the hazards associated with proposing a project in a flood zone.

The natural processes of rivers and lakes can have significant effects on humans and the surrounding environment. Surface water runoff patterns, sediment transport and deposition, and lake cycles greatly affect the use and management of water resources around the world.

The measurement of water has developed into an elaborate science that relies on meticulous field measurements, engineering equations, and the use of satellites to closely monitor river and lake stages. Predictions are now being calculated on probable maximum precipitation and probable maximum floods in order to help planners and engineers design various public

projects such as culverts, bridges, and other developments that could be impacted by flooding. GIS was used to develop planning and assessment tool to prevent property damage from floods. Based on the history, the project area is not flood prone and the drainage pattern is congenial for the project development.

3.2.2 Ground Water Hydrogeology

Ground water bearing aquifers are present in South 24 Parganas district within Quaternary and Tertiary sediments and generally occur under confined condition in the depth range of 75-360 m with numerous alternations of clayee and sandy layers of varying thickness.

The confined aquifers can be divided into two groups in the district from North to extreme South. The upper one, usually in the depth span of 20-160 m has a sandy gravel layer as a marker bed at its base which pinches out Eastward. The ground water in general is brackish to saline (Chloride ranging from 1750-6300 mg/L) except at a few places occurring in this upper group of aquifers and is not in use.

The lower group of aquifer occurring in the depth range of 160-360 m, is separated from the upper group by a thick impermeable sticky clay bed which is laterally extensive with varying thickness. The ground water occurring in this lower group of aquifer is generally fresh and is used extensively. This confined productive aquifer is recharged by rainwater through the recharging exposed area along Kalyani-Ranaghat-Shantipur area in Nadia district in the North; along Bangaon-Gaighata section in North 24 Parganas district in the North East; and along Tarakeswar-Nalikul-Mogra-Pandua area in Hugli, district in the North West.

The piezometric surface of the lower group of confined aquifers as monitored in the year 2006 from the hydrograph network stations, lies from 1.70-6.00 m bgl during pre-monsoon period and from 0.50-5.80 m bgl during post-monsoon period. The average slope of the piezometric surface during pre-monsoon of 2006 in this district is 1:1500 towards South East.

(Source: Ground Water Information Booklet, South 24 Parganas District, West Bengal, Central Ground Water Board, 2013)

3.2.3 Ground Water Level Behaviour

CGWB has measured the depth to water level during April 2019 from 1312 ground water monitoring wells out of 1500 existing wells and newly established wells. Five groups were made based on the range of water levels, viz. 0-2, 2-5, 5-10, 10-20 and greater than 20 m bgl.

(Source: Central Ground Water Board, Ground Water Year Book of West Bengal and Andaman and Nicobar Islands, 2019-20)

Table 3.6 – CGWB's Ground Water Monitoring Wells

S. No.	Range of Water Levels (m bgl)	Number of Wells	Percentage (%)
1	0-2	130	9.9
2	2-5	373	28.4
3	5-10	523	39.9
4	10-20	236	18.0
5	> 20	50	3.6

(Source: Central Ground Water Board, Ground Water Year Book of West Bengal and Andaman and Nicobar Islands, 2019-20)

Except in a very few parts where ground water occurs under both unconfined and confined conditions, the fresh water bearing aquifers in South 24 Parganas district is under confined condition.

In order to have an idea of the dynamic ground water potential of this district, an attempt has been made to estimate the total quantity of ground water flow by applying Darcy's Law equation of flow of fluids through porous media, which is Q = TIL; where Q is the Quantity of water flowing through a section of aquifer, T is the Transmissivity of aquifer, I is the hydraulic gradient of the piezometric surface and L is the length of groundwater flow-path in the section of the aquifer under consideration, perpendicular to the flow direction.

For the area under consideration in this district and taking average values of T=2000 m^2/day, I = 1:1500 & L = 140 km, the Q is computed as 68 MCM. Hence, the dynamic groundwater flow towards the principal direction of SE, in this area, is considered to be 68 MCM per annum.

To assess the annual ground water draft through groundwater development structures, the total number of shallow and deep tubewells is taken into account. As per the 3rd Minor Irrigation Census 2001, the district has 9278 STWs and 28 DTWs. Considering average unit draft of 0.014 MCM/yr for STW and 0.21 MCM/yr for DTW, the Net Ground Water draft is computed as 135.77 MCM per annum.

(Source: Ground Water Information Booklet, South 24 Parganas District, West Bengal, Central Ground Water Board, 2013)

Water quality assessment is an essential component of any EIA study. Such assessment helps in evaluating the existing health of a water body and suggesting appropriate mitigation measures to minimize the potential impact due to a development project.

3.2.4 Surface Water Quality

To analyse the surface water quality in the study area, sampling and analysis has been carried out by NABL accredited laboratory for primary data.

3.2.4.1 Surface Water Sampling

Surface water samples have been taken from 4 sites within the study area. Distance and direction of surface water sampling locations from project site have been given **Table 3.7** and **Figure 3.9**.

The water samples were collected between the study period of January to March session of 2021.

The present study on the surface water quality establishes the baseline characteristics within the study area. The objective of surface water sampling is as follows –

1. To determine the baseline surface water characteristics in the study area.
2. To determine the impact of proposed project on surface water characteristics.

Table 3.7 – Surface Water Monitoring Locations

Station	Location	Latitude	Longitude
SWQ1	Pond within project site	22°29'51.16"N	88°30'44.74"E
SWQ2	Basanti Canal (Upstream)	22°31'11.03"N	88°28'1.88"E
SWQ3	Basanti Canal (Downstream)	22°29'57.48"N	88°33'35.28"E
SWQ4	Pond on the East boundary of the project site	22°29'58.51"N	88°30'30.56"E

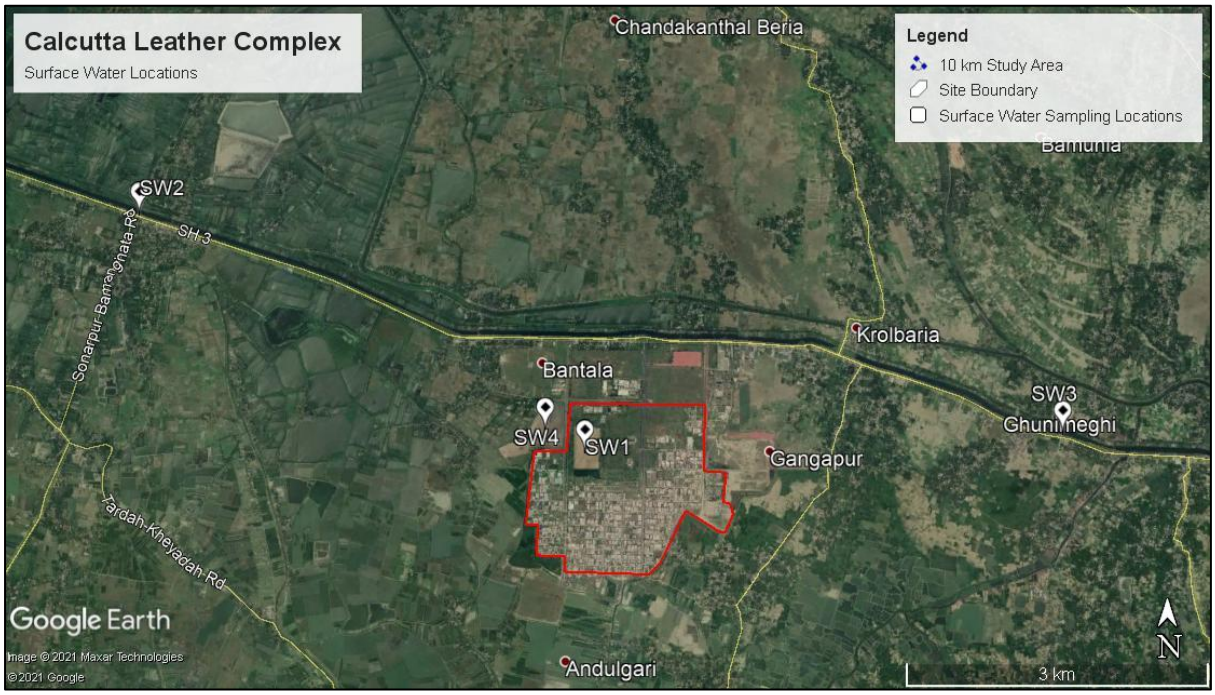


Figure 3.9– Surface Water Monitoring Locations

3.2.4.2 Surface Water Monitoring Analysis

Surface water quality has been analysed as per Indian standards prescribed by government. Surface water samples have been taken from 4 locations. Surface water quality analysis results are presented in **Table 3.8** and **Annexure** .

Table 3.8 – Surface Water Monitoring Analysis

S. No.	Parameter	Unit	SWQ1	SWQ2	SWQ3	SWQ4
1	pH	-	7.76	6.85	6.89	6.96
2	Temperature	^{O}C	28.8	28.2	28.2	29.0
3	Turbidity	NTU	18.6	8.4	8.8	11.6
4	Conductivity (at 25 °C)	µs/cm.	1176	1550	1563	6389
5	Total Suspended Solids	mg/L	36	22	25	30
6	Total Alkalinity (as $CaCO_3$)	mg/L	280	290	290	320
7	Biological Oxygen Demand (at 27 °C for 3 days)	mg/L	10.50	4.50	5.00	6.50

8	Dissolved Oxygen (as O_2)	mg/L	5.10	7.4	7.2	5.8
9	Calcium (as Ca)	mg/L	44.00	56.00	60.00	84.00
10	Magnesium (as Mg)	mg/L	36.45	36.45	34.02	58.32
11	Chloride (as Cl)	mg/L	144.64	163.92	173.56	964.24
12	Iron (as Fe)	mg/L	0.17	0.11	0.13	0.15
13	Fluoride (as F)	mg/L	0.25	0.16	0.20	0.37
14	Total Dissolved Solids	mg/L	706	930	938	3833
15	Total Hardness (as $CaCO_3$)	mg/L	260	290	290	450
16	Sulphate (as SO_4)	mg/L	125.37	28.30	29.87	195.72
17	Phosphate (as P)	mg/L	4.02	1.68	1.68	3.63
18	Sodium (as Na)	mg/L	82	92.88	93.12	322.84
19	Manganese (as Mn)	mg/L	<0.1	<0.1	<0.1	<0.1
20	Total Chromiun (as Cr)	mg/L	<0.05	<0.05	<0.05	<0.05
21	Zinc (as Zn)	mg/L	0.48	0.26	0.29	0.78
22	Potassium (as K)	mg/L	12.68	8.52	9.53	46.12
23	Nitrate (as NO_3)	mg/L	7.49	2.77	2.65	8.24
24	Cadmium (as Cd)	mg/L	<0.01	<0.01	<0.01	<0.01
25	Lead (as Pb)	mg/L	<0.01	<0.01	<0.01	<0.01
26	Copper (as Cu)	mg/L	<0.01	<0.01	<0.01	<0.01
27	Chemical Oxygen Demand (as O_2)	mg/L	48	32	40	48
28	Arsenic (as As)	mg/L	<0.01	<0.01	<0.01	<0.01
29	Total Coliform	MPN/100 mL	1.2×103	484	496	964

3.2.4.3 Surface Water Analysis Inference

pH: pH is one of the most important parameters of water quality. Excessively high or low pH is detrimental for the use of water. A high pH makes the taste bitter. Low pH water can corrode or dissolve metals and other substances. pH was found from 6.85 to 7.76 which is within the permissible range of 6.5 to 8.5.

Turbidity: Turbidity is defined as the cloudiness of water, i.e., ability of light to pass through water. It is caused by suspended material in water such as clay, silt, organic material, and other particulate materials. Highly turbid water is aesthetically unpleasing, can provide hiding places for pathogens and act as an adsorption media for heavy metals. Turbidity was found from 8.4 to 18.6 NTU which is within the permissible range of less than 1,000 NTU.

Hardness: Hard water can cause problems such as scale deposits in hot water pipes and difficulty in producing lather with soap. Total hardness was found in the range of 260 to 450 mg/L as $CaCO_3$ with the permissible limit being 300 mg/L as $CaCO_3$ as per IS2296 Class A.

Alkalinity: The alkalinity of water is defined as its acid-neutralizing capacity. The high levels of acidity or alkalinity in water may be an indication of industrial or chemical pollution. Alkalinity was found in the range of 280 to 320 mg/L as $CaCO_3$.

Chloride: Chloride ions in drinking water do not cause any harmful effects on public health, but high concentrations can cause an unpleasant salty taste. Presence of relatively high chloride concentration in freshwater may indicate wastewater pollution. Chloride was found in the range of 114.64 to 964.24 (at SWQ4) mg/L with the permissible limit being 250 mg/L as per IS2296 Class A.

Sulphate: High Sulphate concentration can cause objectionable tastes or unwanted laxative effects. Sulphate was found in the range of 28.30 to 195.72 mg/L which is within permissible limit of 400 mg/L.

Nitrate: Excessive nitrate concentration can cause blue baby disease or methemoglobinemia in which nitrate ions react with haemoglobin reducing the blood's ability to hold oxygen. Nitrate was found in the range of 2.65 to 8.24 mg/L which is within permissible limit of 20 mg/L.

Fluoride: A moderate amount of fluoride ions in drinking water contributes to good dental health. However, excessive fluoride causes discoloured teeth, a condition known as dental fluorosis. Fluoride was found in the range of 0.16 to 0.37 mg/L which is within permissible limit of 1.5 mg/L.

Dissolved Oxygen: Dissolved oxygen is considered as one of the most important parameters of surface water quality. The higher the concentration of dissolved oxygen, the better the water quality. Dissolved Oxygen was found in the range of 5.1 to 7.4 mg/L which is more than the minimum value of 4 mg/L.

Biochemical Oxygen Demand: Microorganisms metabolize organic material as their food source consuming oxygen in the process. The amount of oxygen required by the microbes for the complete decomposition of organic material is known as Biochemical Oxygen Demand. Biochemical Oxygen Demand was found in the range of 4.5 to 10.5 mg/L which is more than permissible limit of 2 mg/L as per IS2296 Class A. By virtue of the readings, wastewater contamination has been observed in the nearby surface water bodies.

Chemical Oxygen Demand: Chemical Oxygen Demand can be defined as the total amount of oxygen required for the complete decomposition biodegradable and the non-biodegradable substances. Chemical Oxygen Demand was found in the range of 32 to 48 mg/L.

Heavy Metals: Heavy metals have a wide range of harmful effects that differ from one metal to another. They may be acute fatal poisons such as Arsenic and Chromium or may produce chronic diseases such as Cadmium, Mercury and Lead. All heavy metals were found within permissible limits.

3.2.5 Ground Water

Arsenic in groundwater in sporadic manner has been identified in 9 blocks in this district. The concentration of arsenic varies from 0.001-3.32 mg/L. Groundwater exploration by CGWB reveals that in arsenic affected area, arsenic free deeper aquifers are available which are capable of yielding arsenic-free water.

Due to brackish/saline nature of shallow aquifers (10-150 m bgl) shallow tubewells are not favourable in the coastal blocks. The chemical analyses of the groundwater samples from these shallow aquifers show that, chloride ranges from 1,854-13,581 mg/L and Electrical Conductivity ranges from 5,960-41,350 µs/cm at 25°C. Due to salinity, shallow tubewells are not feasible for either drinking or irrigation purposes. To overcome these problems, fresh groundwater bearing deeper aquifers (160-360 m bgl) are tapped and as alternate source, surface water is used for drinking (after treatment) and irrigation purposes.

(Source: Ground Water Information Booklet, South 24 Parganas District, West Bengal, Central Ground Water Board, 2013)

To analyse the ground water quality in the study area, sampling and analysis has been carried out by NABL accredited laboratory for primary data.

3.2.5.1 Ground Water Sampling

Ground water samples have been taken from 6 sites within the study area. Distance and direction of surface water sampling locations from project site have been given **Table 3.9** and **Figure 3.10**.

The water samples were collected between the study period of January to March session of 2021.

The present study on the ground water quality establishes the baseline characteristics within the study area. The objective of ground water sampling is as follows –

1. To determine the baseline ground water characteristics in the study area.
2. To determine the impact of proposed project on ground water characteristics.

Table 3.9 – Ground Water Monitoring Locations

Station	Location	Latitude	Longitude
GWQ1	Within Project Site	22°29'55.09"N	88°31'1.45"E
GWQ2	Mahes Pukuria	22°26'41.25"N	88°31'17.28"E
GWQ3	Chandakanthal Beria	22°32'18.12"N	88°30'55.90"E
GWQ4	Abua	22°33'36.06"N	88°32'38.90"E
GWQ5	Goalapota	22°29'58.51"N	88°27'37.90"E
GWQ6	Panapukur	22°31'11.06"N	88°35'55.91"E

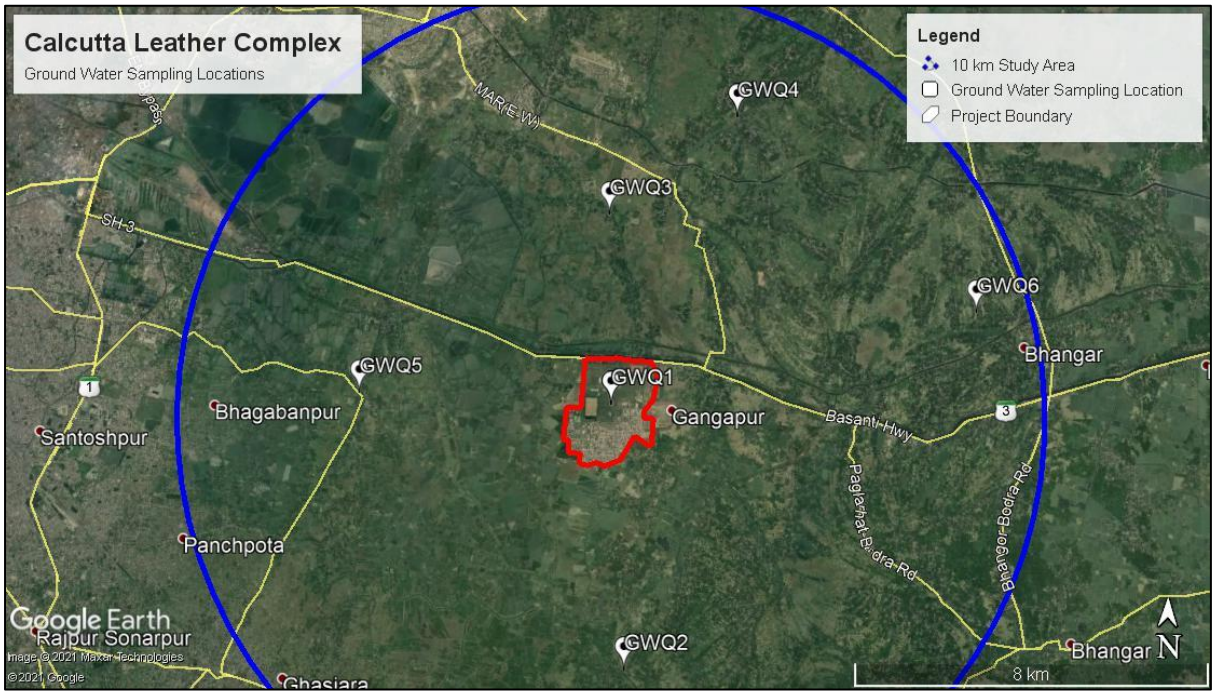


Figure 3.10– Surface Water Monitoring Locations

3.2.5.2 Ground Water Monitoring Analysis

Ground water quality has been analysed as per Indian standards prescribed by government. Ground water samples have been taken from 6 locations. Ground water quality analysis results are presented in **Table 3.10** and **Annexure** .

Table 3.10 – Ambient Ground Water Monitoring Analysis

S. No.	Parameter	Unit	GWQ1	GWQ2	GWQ3	GWQ4	GWQ5	GWQ6	Permissible Limit in Absence of Alternative
1	pH	-	6.96	7.05	7.42	6.86	7.11	6.98	-
2	Colour	Hazen	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	15
3	Odour	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
4	Taste	-	Agreeable	Agreeable	Saline	Agreeable	Agreeable	Saline	Agreeable
5	Turbidity	NTU	<0.5	<0.5	0.8	1.7	<0.5	<0.5	5

6	Total Hardness (as $CaCO_3$)	mg/L	570	450	1100	400	430	580	600
7	Calcium(as Ca)	mg/L	156.00	88.00	324.00	84.00	80.00	144.00	200
8	Magnesium(as Mg)	mg/L	43.74	55.89	70.47	46.17	55.89	53.46	100
9	Chloride(as Cl)	mg/L	356.77	115.71	621.30	33.75	106.07	430.50	1000
10	Iron(as Fe)	mg/L	0.16	0.11	0.15	0.13	0.23	0.17	0.3
11	Fluoride(as F)	mg/L	0.75	0.11	0.30	0.14	0.16	0.39	1.5
12	Free Residual chlorine	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1
13	Total Dissolved Solid	mg/L	1594	1268	2886	721	1206	1953	2000
14	Phenolic Compound (as C_6H_5OH)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002
15	Anionic Detergents (as MBAS)	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1.0
16	Sulphate (as SO_4)	mg/L	6.29	17.29	35.76	206.13	11.20	134.01	400
17	Nitrate (as NO_3)	mg/L	5.32	1.07	3.58	6.70	4.67	9.05	45
18	Alkalinity(as CaCO3)	mg/L	360	390	390	400	460	380	600
19	Chloramines (as Cl_2)	mg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	4
20	Cadmium (as Cd)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003
21	Lead (as Pb)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
22	Total Chromium (as Cr)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.05
23	Copper (as Cu)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	1.5
24	Total Ammonia	mg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5
25	Nickel (as Ni)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.2
26	Zinc (as Zn)	mg/L	0.86	0.61	0.74	0.48	0.85	0.93	15
27	Manganese (as Mn)	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.3
28	Boron (as B)	mg/L	0.16	<0.1	0.19	<0.1	<0.1	0.15	1
29	Selenium (Se)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
30	Arsenic (as As)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.05
31	E.coli	E.Coli/100 mL	Not Detected (<2)	Not Detected (<2)	Not Detected (<2)	Not Detected (<2)	Not Detected (<2)	Not Detected (<2)	Shall not be detectable in 100

									mL sample
32	Total Coliform	MPN/100 mL	Absent	Absent	Absent	Absent	Absent	Absent	Shall not be detectable in 100 mL sample

3.2.5.3 Ground Water Analysis Inference

Turbidity: Turbidity is defined as the cloudiness of water, i.e., ability of light to pass through water. It is caused by suspended material in water such as clay, silt, organic material, and other particulate materials. Highly turbid water is aesthetically unpleasing, can provide hiding places for pathogens and act as an adsorption media for heavy metals. Turbidity was found from less than 0.5 to 1.7 NTU which is within the permissible limit of 5 NTU.

pH: pH is one of the most important parameters of water quality. Excessively high or low pH is detrimental for the use of water. A high pH makes the taste bitter. Low pH water can corrode or dissolve metals and other substances. pH was found from 6.86 to 7.42.

Total Dissolved Solids: Excessive TDS can give water a bitter, metallic or salty taste, along with creating an unpleasant odour. Total Dissolved Solids were found in the range of 721 to 2,886 mg/L with the permissible limit being 2,000 mg/L.

Alkalinity: The alkalinity of water is defined as its acid-neutralizing capacity. The high levels of acidity or alkalinity in water may be an indication of industrial or chemical pollution. Alkalinity was found in the range of 360 to 460 mg/L as $CaCO_3$ which is within permissible limit of 600 mg/L as $CaCO_3$.

Chloride: Chloride ions in drinking water do not cause any harmful effects on public health, but high concentrations can cause an unpleasant salty taste. Presence of relatively high chloride concentration in freshwater may indicate wastewater pollution. Chloride was found in the range of 33.75 to 621.30 mg/L which is within permissible limit of 1,000 mg/L.

Sulphate: High Sulphate concentration can cause objectionable tastes or unwanted laxative effects. Sulphate was found in the range of 6.29 to 206.13 mg/L which is within permissible limit of 400 mg/L.

Nitrate: Excessive nitrate concentration can cause blue baby disease or methemoglobinemia in which nitrate ions react with haemoglobin reducing the blood's ability to hold oxygen. Nitrate was found in the range of 1.07 to 9.05 mg/L which is within permissible limit of 45 mg/L.

Fluoride: A moderate amount of fluoride ions in drinking water contributes to good dental health. However, excessive fluoride causes discoloured teeth, a condition known as dental fluorosis. Fluoride was found in the range of 0.11 to 0.75 mg/L which is within permissible limit of 1.5 mg/L.

Heavy Metals: Heavy metals have a wide range of harmful effects that differ from one metal to another. They may be acute fatal poisons such as Arsenic and Chromium or may produce chronic diseases such as Cadmium, Mercury and Lead. All heavy metals were found within permissible limits.

3.3 Air Environment

3.3.1 Climate

The normal climate of the district is hot and humid throughout the year with well distributed rainfall during the monsoon season. The maximum temperature as recorded at Diamond Harbour is 37°C and the minimum is 9°C during the year 2011.

The skies are moderately clouded in May, heavily clouded in monsoon season and clear or lightly clouded during rest of the year. Winds are generally stronger in Sundarbans and its surroundings. Nor'westers from March to May and the Bay cyclones during the monsoon ravage the land every year.

(Source: District Census Handbook, South 24 Parganas, Village and Town Directory, Part XII-A, Directorate of Census Operations, West Bengal, Series-07)

3.3.2 Rainfall

The normal annual rainfall in this district is of the tune of 1800 mm.

(Source: Ground Water Information Booklet, South 24 Parganas District, West Bengal, Central Ground Water Board, 2013)

3.3.3 Climatological Data

Climatological Normals are very useful statistics used to describe the average weather of a location and serve as a benchmark for comparing current climatic conditions. Climatological Normals give a comprehensive month wise account of the climate of a place with extremes in temperatures and rainfall and annual averages. The World Meteorological Organisation defines Climatological Normals as arithmetic averages of the climatological data computed for consecutive period of 30 years, whereas period averages are arithmetic averages of the climatological data computed for shorter periods of at least 10 years.

Climate varies with time and space for a variety of reasons. Therefore, Climatological Normals are updated every decade to keep up with changes in climate that might have taken place during the period.

Table 3.11 provides details of the nearest IMD station from the project site.

Table 3.11 – Details of IMD Station

S. No.	Parameter	Detail
1	Station Name	Kolkata (Dum Dum)
2	Coordinates	22°39'N 88°27'E
3	Elevation	6 m amsl
4	Location and Environment of Observatory	Partly in the Terminal building and partly in the Radio-sonde building at the Civil Aerodrome. The surrounding area is plain and open for several kms around. Wind instruments are on the terrace of the control tower with satisfactory exposure.
5	Date of Establishment	01.09.1939
6	Observation Period	1981-2007

(Source: Climatological Normals, 1981-2010, India Meteorological Department)

The Climatological Table presented in **Table 3.12** give normal values for 8:30 am and 5:30 pm for various meteorological parameters as indicated by I and II respectively. Extreme values of maximum/minimum temperatures, rainfall data and wind data has presented. The frequencies of weather phenomena have been compiled from daily weather reports. All available data from the starting of the observatory to the end of 2010 have been considered while preparing extremes of maximum temperature, minimum temperature and total rainfall. Climatological Normals for some elements are derived from less than 30 years of record as indicated by the number of years data used.

Table 3.12 – Climatological Data

Month		Air Temperature (°C)		Relative Humidity (%)	Rainfall		Mean Wind Speed (km/h)	No. of Days with Wind Speed (km/h)		
		Highest	Lowest		Monthly Total (mm)	No. of Rainy Days		20-61	1-19	0
January	I	32.5	5	75	12.4	1	3.3	0	22	9
	II			60				0	11	20
February	I	37.3	6.1	71	23.3	1.7	4.1	0	21	7
	II			53				0	17	11
March	I	40.6	12.1	69	31.3	2.2	5.6	0	26	5
	II			49				0	23	8
April	I	42.8	16.6	71	55.2	3.5	8.2	0	28	2
	II			60				0	28	2
May	I	43.1	17.6	73	156.5	7	8.8	1	28	2
	II			66				1	28	2
June	I	43.7	19.2	79	293	12.6	8.1	0	28	2
	II			76				0	28	2
July	I	39.2	20.1	89	347.4	17.1	7.2	0	28	3
	II			81				0	28	3
August	I	37.7	21.1	89	344.1	16.9	6.8	0	27	4
	II			82				0	27	4

September	I	36.7	21.7	81	305.5	13.2	5.8	0	26	4
	II			82				0	24	6
October	I	36.8	15.7	75	161.9	6.8	3.9	0	23	8
	II			74				0	15	16
November	I	36	11.7	70	17.5	1.3	3.2	0	22	8
	II			67				0	7	23
December	I	33	6.1	72	8.8	0.5	3	0	21	10
	II			64				0	7	24
Annual Total or Mean	**I**	**43.7**	**5**	**75**	**1757**	**83.9**	**5.7**	**0**	**300**	**63**
	II	**6**	**1**	**68**				**0**	**244**	**118**
Number of Years		**69**		**26**	**30**		**27**	**26**		

(Source: Climatological Normals, 1981-2010, India Meteorological Department)

Table 3.13 provides the wind speed and wind direction recorded at IMD's observatory station at Kolkata (Dum Dum). This data can be used then be used to determine the predominant wind direction for the project site, which has been provided in **Table 3.15**.

Table 3.13 – Wind Speed and Wind Direction

Month		Percentage No. of Days Wind From									Mean Wind Speed (km/h)
		North	North East	East	South East	South	South West	West	North West	Calm	
January	I	3	7	7	3	2	14	13	15	36	4.1
	II	4	6	10	3	1	3	13	25	35	
February	I	2	5	9	5	1	13	20	12	33	5.5
	II	6	6	11	3	0	4	13	27	30	
March	I	4	4	7	4	2	14	15	14	36	6
	II	7	8	8	2	1	6	19	21	28	
April	I	4	4	8	4	2	14	16	13	35	5.6

	II	6	5	7	2	1	5	20	31	23	
May	I	3	6	18	10	2	8	22	10	21	6.9
	II	5	6	16	4	1	6	24	19	19	
June	I	2	9	18	9	1	13	22	8	18	6.2
	II	3	9	22	7	1	7	22	14	15	
July	I	1	7	26	9	1	12	14	3	27	6.1
	II	1	12	25	5	0	6	11	8	32	
August	I	1	5	17	7	1	13	19	4	33	4.4
	II	1	7	19	5	1	5	16	8	38	
September	I	1	8	8	7	1	15	14	7	39	4.3
	II	4	8	12	3	1	5	13	17	37	
October	I	2	3	7	3	1	10	10	8	56	3
	II	4	6	6	1	0	4	11	17	51	
November	I	1	4	3	3	1	15	8	7	58	2.5
	II	3	5	4	2	0	6	12	13	55	
December	I	3	3	6	4	2	16	17	11	38	3.6
	II	3	5	5	3	1	5	16	25	37	
Annual Total or Mean	**I**	**2**	**5**	**11**	**6**	**1**	**13**	**16**	**9**	**37**	**4.9**
	II	**4**	**7**	**12**	**3**	**1**	**5**	**16**	**19**	**33**	
Mean		**21**									**12**

(Source: Climatological Normals, 1981-2010, India Meteorological Department)

Table 3.14 – Dry & Wet Bulb for the Study Area

Month		Mean			
		Dry Bulb	Wet Bulb	Daily Max	Daily Min
January	I	17.6	15.1	25.6	12.9
	II	21.7	17		
February	I	21.6	18.3	29	16.6
	II	25.7	19.4		
March	I	26.7	22.3	33.3	21.3
	II	30	22.2		
April	I	29.7	25.7	35.5	24.7

	II	31.8	25.6		
May	I	30.3	27.1	35.6	25.9
	II	31.3	26.8		
June	I	30.5	27.6	34.3	26.5
	II	30.7	27.3		
July	I	29.5	27.2	32.9	26.3
	II	29.7	27.1		
August	I	29.4	27.2	32.7	26.4
	II	29.3	27		
September	I	29.4	26.9	32.8	25.9
	II	29	26.5		
October	I	28.3	25	32.2	23.8
	II	28.2	24.8		
November	I	24.2	20.5	29.9	19
	II	25.4	21.1		
December	I	19.4	16.4	26.8	14
	II	21.9	17.7		
Annual Total or Mean	**I**	26.5	23.3	31.7	21.9
	II	27.9	23.5		
Number of Years		26	26	27	27

(Source: Climatological Normals, 1981-2010, India Meteorological Department)

Table 3.15 – Prominent Wind Direction

Month	Prominent Wind Direction	Wind Speed (km/h)
January	North	20.5
February	North	19
March	South	22.5
April	South	48
May	South	48.5
June	South	40.5
July	South	38
August	South	28.5
September	South	29.5
October	North	13.5
November	North	22

December	North	21.5
Mean	**South**	**36.5**

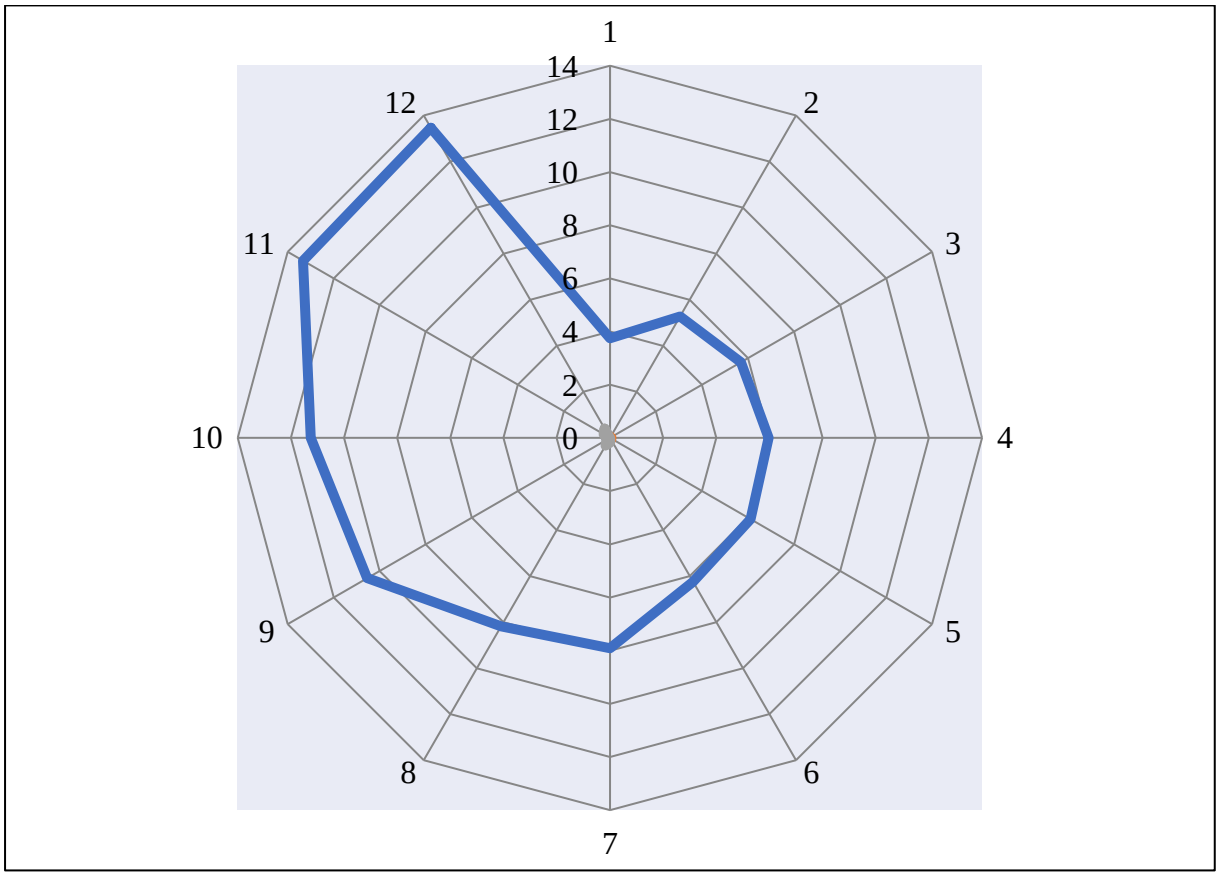


Figure 3.11 – Wind Rose Diagram

3.3.3.1 Ambient Air Sampling

Ambient air samples have been taken from 6 sites within the study area. Distance and direction of ambient air sampling locations from project site have been given **Table 3.16** and **Figure 3.12**.

The ambient air samples were collected between the study period of January to March session of 2021.

The present study on the ambient noise quality establishes the baseline characteristics within the study area. The objective of ambient air sampling is as follows –

3. To determine the baseline ambient air characteristics in the study area.

4. To determine the impact of proposed project on ambient air characteristics.

Table 3.16 – Ambient Air Monitoring Locations

Station	Location	Latitude	Longitude
AAQ1	Within Project Site	22°29'55.09"N	88°31'1.45"E
AAQ2	Mahes Pukuria	22°26'41.25"N	88°31'17.28"E
AAQ3	Chandakanthal Beria	22°32'18.12"N	88°30'55.90"E
AAQ4	Abua (Road Intersection)	22°33'36.06"N	88°32'38.90"E
AAQ5	Bajbarantala Road Sonarpur-Bamanghata Road Crossroad (Near Goalapota)	22°29'58.51"N	88°27'37.90"E
AAQ6	Panapukur	22°31'11.06"N	88°35'55.91"E

Station	Location	Distance from Project Area (km)	Direction from Project Area	Project Area /Study Area	Environmental Setting
AAQ1	Within Project Site	-	-	Project Area	-
AAQ2	Mahes Pukuria	4.6	South	Study Area	Downwind
AAQ3	Chandakanthal Beria	3.4	North	Study Area	Upwind
AAQ4	Abua (Road Intersection)	6.1	North	Study Area	Upwind
AAQ5	Bajbarantala Road Sonarpur-Bamanghata Road Crossroad (Near Goalapota)	4.8	West	Study Area	Cross Wind
AAQ6	Panapukur	7.9	East	Study Area	Cross Wind

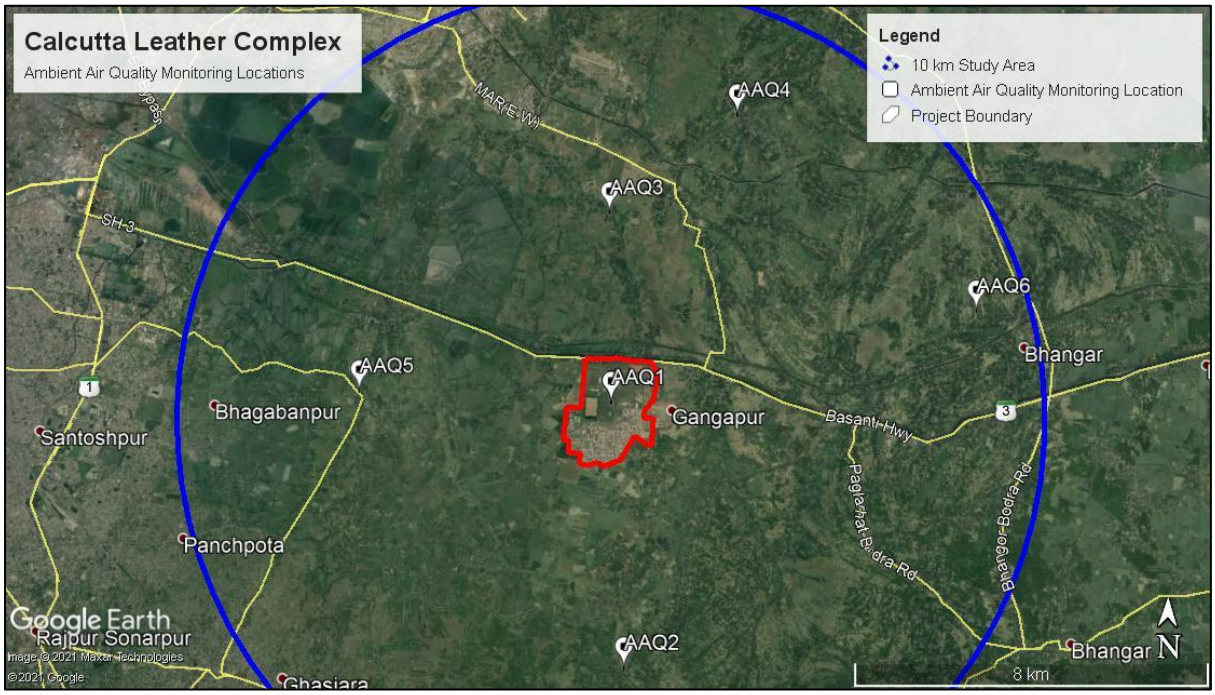


Figure 3.12– Ambient Air Monitoring Locations

3.3.3.2 Ambient Air Monitoring Analysis

Ambient air quality has been analysed as per Indian standards prescribed by government. Ambient air samples have been taken from 6 locations. Ambient air quality analysis results are presented in **Table 3.17** and **Annexure II**.

Table 3.17 – Ambient Air Monitoring Analysis

Date	PM_{10} (µg/m3)	$PM_{2.5}$ (µg/m3)	SO_2 (µg/m3)	NO_2 (µg/m3)	CO (µg/m3)
	IS: 5182: Pt-23	Gravimetric	IS: 5182: Pt-2	IS: 5182: Pt-6	IS: 5182: Pt-10
AAQ1					
01.01.2021	189.97	133.14	13.57	24.96	0.74
04.01.2021	186.29	124.75	14.77	23.41	0.78
08.01.2021	179.39	121.30	13.83	22.55	0.79
11.01.2021	182.83	118.30	14.56	22.15	0.81
15.01.2021	184.36	128.03	13.63	20.16	0.78

18.01.2021	190.32	125.92	14.45	23.83	0.69
22.01.2021	191.82	130.07	15.04	25.48	0.71
25.01.2021	189.18	120.43	13.78	20.22	0.75
29.01.2021	177.25	132.09	16.88	24.34	0.81
01.02.2021	187.10	123.03	15.53	22.55	0.80
05.02.2021	193.81	130.79	13.92	23.41	0.72
08.02.2021	189.24	136.83	13.36	23.59	0.79
12.02.2021	191.34	121.30	14.02	25.46	0.88
15.02.2021	183.61	119.13	17.00	24.52	0.66
19.02.2021	195.54	123.45	14.77	26.21	0.75
22.02.2021	185.47	131.41	13.63	23.83	0.79
26.02.2021	186.61	124.32	13.92	24.34	0.75
01.03.2021	186.44	130.64	13.59	22.15	0.72
05.03.2021	189.45	128.63	13.78	24.34	0.81
08.03.2021	192.17	130.68	13.63	25.01	0.80
12.03.2021	190.55	138.13	13.92	24.34	0.77
15.03.2021	188.42	133.19	13.73	24.00	0.70
19.03.2021	185.09	139.13	14.02	24.52	0.76
22.03.2021	191.09	128.26	13.74	24.27	0.95
AAQ2					
01.01.2021	81.52	43.33	10.86	20.42	0.56
04.01.2021	82.34	41.39	12.94	23.58	0.58
08.01.2021	79.99	39.71	12.22	21.05	0.61
11.01.2021	84.45	43.22	11.62	21.84	0.57
15.01.2021	80.62	42.77	11.50	22.15	0.59
18.01.2021	85.62	44.06	12.17	20.02	0.61
22.01.2021	79.27	39.13	11.33	22.63	0.62
25.01.2021	84.33	42.13	11.09	20.30	0.65
29.01.2021	84.84	39.71	12.09	20.60	0.61
01.02.2021	85.07	45.22	11.33	20.75	0.62
05.02.2021	81.01	43.83	11.92	22.15	0.61
08.02.2021	80.34	42.17	12.75	20.75	0.60
12.02.2021	84.23	42.58	11.91	22.39	0.59
15.02.2021	82.20	43.60	12.66	20.60	0.58

19.02.2021	81.63	38.62	11.50	21.61	0.65
22.02.2021	84.27	43.07	12.94	21.76	0.62
26.02.2021	83.83	41.41	12.25	21.26	0.57
01.03.2021	82.51	42.08	13.44	21.69	0.63
05.03.2021	79.38	41.44	11.25	20.60	0.60
08.03.2021	85.12	43.52	13.90	24.74	0.64
12.03.2021	82.39	42.55	12.34	22.15	0.57
15.03.2021	83.84	43.83	11.78	20.30	0.59
19.03.2021	80.13	42.73	12.52	22.47	0.61
22.03.2021	78.26	39.34	12.68	22.50	0.58
AAQ3					
01.01.2021	79.11	41.67	11.54	21.15	0.56
04.01.2021	76.57	41.25	12.90	22.41	0.58
08.01.2021	79.41	43.80	12.13	22.80	0.61
11.01.2021	84.45	43.22	11.62	21.84	0.57
15.01.2021	79.16	40.97	11.59	22.44	0.59
18.01.2021	78.71	39.86	12.18	21.43	0.61
22.01.2021	79.33	41.87	11.25	22.28	0.62
25.01.2021	80.18	41.54	10.25	21.48	0.65
29.01.2021	83.66	39.30	11.84	21.08	0.61
01.02.2021	77.57	40.58	10.55	21.53	0.62
05.02.2021	81.05	39.30	10.32	21.99	0.61
08.02.2021	79.25	41.28	12.75	22.15	0.60
12.02.2021	78.61	38.56	12.70	20.67	0.59
15.02.2021	83.45	43.91	12.04	22.63	0.58
19.02.2021	81.91	40.00	11.54	21.69	0.65
22.02.2021	78.14	41.25	12.22	22.59	0.62
26.02.2021	83.85	41.12	10.25	22.75	0.57
01.03.2021	82.82	39.72	11.46	21.54	0.63
05.03.2021	79.71	41.29	11.91	21.46	0.60
08.03.2021	85.92	39.57	12.48	21.23	0.64
12.03.2021	81.24	41.12	11.62	22.75	0.57
15.03.2021	83.02	40.00	12.35	21.00	0.59
19.03.2021	77.02	43.07	12.26	22.67	0.61

22.03.2021	78.76	41.87	11.95	20.60	0.58
AAQ4					
02.01.2021	137.12	77.20	14.67	24.93	0.74
05.01.2021	123.84	78.21	14.16	23.33	0.78
09.01.2021	127.88	77.70	15.47	22.47	0.79
12.01.2021	121.01	74.69	14.35	23.66	0.81
16.01.2021	124.17	73.10	15.14	23.83	0.78
19.01.2021	127.29	78.33	14.25	23.50	0.69
23.01.2021	135.20	76.96	15.58	24.90	0.71
26.01.2021	127.48	76.82	16.78	23.83	0.75
30.01.2021	121.00	72.69	16.82	24.25	0.81
02.02.2021	129.47	79.03	15.39	22.36	0.80
06.02.2021	131.79	77.70	15.47	23.41	0.72
09.02.2021	129.81	76.40	16.88	23.59	0.79
13.02.2021	128.87	77.83	14.02	25.46	0.75
16.02.2021	121.05	74.84	16.82	24.25	0.66
20.02.2021	131.21	78.59	14.45	25.66	0.67
23.02.2021	124.97	75.68	17.71	23.58	0.79
27.02.2021	123.50	76.83	16.88	24.34	0.75
02.03.2021	125.45	75.63	15.14	24.74	0.72
06.03.2021	127.96	71.65	16.88	24.34	0.81
09.03.2021	129.28	77.87	16.64	24.92	0.80
13.03.2021	126.63	72.60	15.30	24.08	0.77
16.03.2021	128.32	77.87	15.94	24.00	0.70
20.03.2021	124.78	77.70	13.92	24.34	0.76
23.03.2021	128.88	76.39	16.78	24.20	0.80
AAQ5					
02.01.2021	115.61	77.20	14.67	24.93	0.74
05.01.2021	124.26	78.48	14.20	23.42	0.78
09.01.2021	131.67	71.11	15.93	23.13	0.79
12.01.2021	120.77	77.35	14.30	24.49	0.81
16.01.2021	128.38	76.25	14.93	24.94	0.78
19.01.2021	130.00	71.49	14.56	24.92	0.69
23.01.2021	129.79	77.52	14.98	25.08	0.71

26.01.2021	127.39	76.77	13.97	23.81	0.75
30.01.2021	122.49	73.21	14.82	23.49	0.81
02.02.2021	129.91	74.62	15.37	23.07	0.80
06.02.2021	130.94	72.91	13.69	23.25	0.72
09.02.2021	129.81	76.40	14.77	24.15	0.79
13.02.2021	128.41	64.55	13.97	25.18	0.88
16.02.2021	114.73	75.38	14.82	25.37	0.75
20.02.2021	123.89	77.77	14.30	25.39	0.69
23.02.2021	126.14	76.21	15.78	24.66	0.79
27.02.2021	123.50	76.83	14.06	24.34	0.75
02.03.2021	124.57	75.10	15.04	24.57	0.72
06.03.2021	130.45	72.70	15.70	24.70	0.84
09.03.2021	128.37	77.32	13.90	24.74	0.80
13.03.2021	125.29	73.10	15.14	23.83	0.77
16.03.2021	128.32	75.32	15.94	24.00	0.70
20.03.2021	131.93	69.57	14.02	25.46	0.76
23.03.2021	134.25	78.73	16.91	24.39	0.82
AAQ6					
02.01.2021	84.56	42.21	10.79	21.54	0.55
05.01.2021	83.24	43.22	12.30	21.84	0.61
09.01.2021	81.33	43.48	12.04	21.69	0.62
12.01.2021	84.51	42.92	10.86	19.88	0.55
16.01.2021	77.13	44.95	11.96	20.57	0.57
19.01.2021	80.10	44.79	12.66	22.91	0.58
23.01.2021	86.26	42.17	11.76	21.12	0.62
26.01.2021	81.32	42.98	10.40	22.15	0.65
30.01.2021	78.19	40.56	12.25	20.89	0.61
02.02.2021	79.94	43.56	11.58	22.17	0.62
06.02.2021	81.05	43.94	10.32	21.44	0.61
09.02.2021	79.25	42.13	12.75	21.41	0.60
13.02.2021	80.76	40.06	12.91	22.66	0.59
16.02.2021	82.20	39.85	12.27	22.61	0.58
20.02.2021	81.88	42.80	11.62	22.02	0.65
23.02.2021	85.76	44.68	12.75	23.07	0.62

27.02.2021	83.88	43.33	10.45	21.69	0.57
02.03.2021	82.82	40.14	11.46	21.54	0.63
06.03.2021	79.05	40.97	11.73	21.18	0.60
09.03.2021	85.92	43.83	12.89	21.41	0.64
13.03.2021	81.91	39.02	11.21	22.57	0.57
16.03.2021	82.93	41.52	12.85	19.63	0.59
20.03.2021	76.63	43.03	12.40	20.64	0.61
23.03.2021	79.03	44.90	12.17	21.29	0.58

3.3.3.3 Ambient Air Analysis Inference

Based on the statistical analysis, graphical representation has been provided in the following figures for all the parameters at each location.

1. Coarse Particulate Matter (PM10)

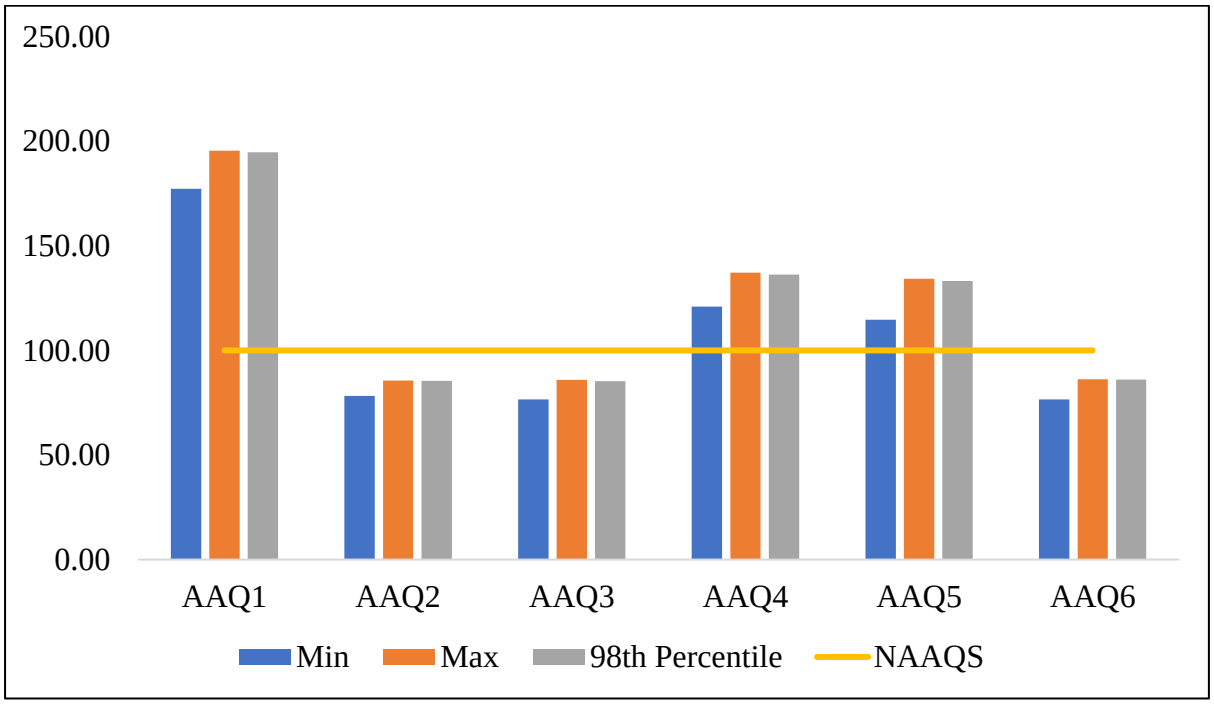


Figure 3.13 – Baseline Scenario of PM10

PM10 can be defined as particles with a diameter less than 10 µm. They are called coarse particles and contain dust from roads, industries and particles formed under combustion. Depending on their size, coarse particles can lodge in the trachea or in the bronchi.

The minimum and maximum PM10level recorded within the study area was 76.57 and 195.54 µg/m^3 respectively with the 98th percentile ranging between 85.24 to 194.74 µg/m^3.

The 24-hourly average PM10 value were compared with the NAAQS and found that PM10 concentration in AAQ1, AAQ4 and AAQ5 are greater than the permissible value of 100 µg/m^3.

2. Fine Particulate Matter (PM2.5)

PM2.5 can be defined as particles with a diameter of less than 2.5 µm. They are called fine particles and contain secondary aerosols, combustion particles and recondensed organic metallic vapour and acid components. It can reach all the way down to the alveoli in the lungs.

The minimum and maximum PM2.5 level recorded within the study area was 38.56 and 139.13 µg/m^3 respectively with the 98th percentile ranging between 43.86 to 138.67 µg/m^3.

The 24-hourly average PM2.5 value were compared with the NAAQS and found that PM2.5 concentration in AAQ1, AAQ4 and AAQ5 are greater than the permissible value of 60 µg/m^3.

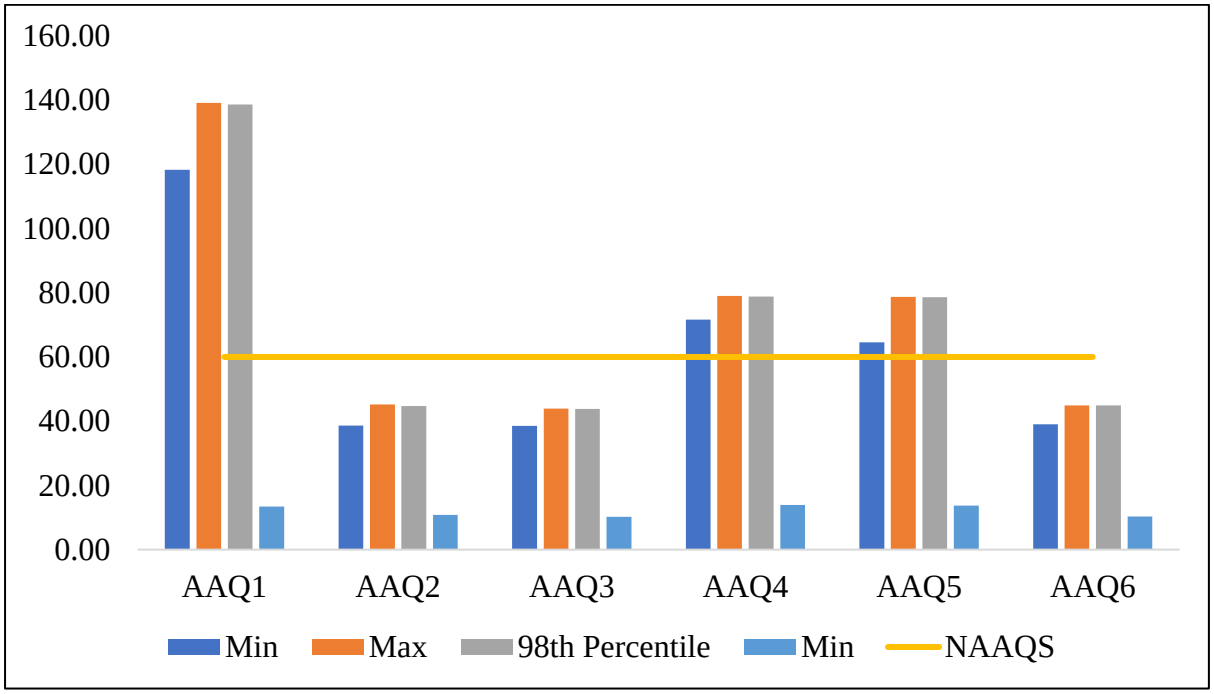


Figure 3.14 – Baseline Scenario of PM2.5

3. Sulphur Dioxide (SO_2)

Sulphur Dioxide is an inorganic gaseous pollutant. Sulphur Dioxide emissions are usually emitted wherever combustion of any fuel containing Sulphur takes place. Sulphur in the fuel will combine with oxygen to form Sulphur Dioxide.

Sulphur Dioxide in atmosphere is significant because of its toxicity and is capable of causing illness and lung injury. Further it can combine with water in the air to form toxic acid aerosols that can corrode metal surfaces, fabrics and the plant leaves. It is also an irritant to the eyes and respiratory system. Excessive exposure to Sulphur Dioxide can cause breathing related diseases as it affects the lungs.

The minimum and maximum SO_2 level recorded within the study area was 10.25 and 17.71 µg/m^3 respectively with the 98th percentile ranging between 12.83 to 17.33 µg/m^3.

The 24-hourly average SO_2 value were compared with the NAAQS and found that the SO_2 concentration recorded at all sampling stations are within the permissible value of 80 µg/m^3.

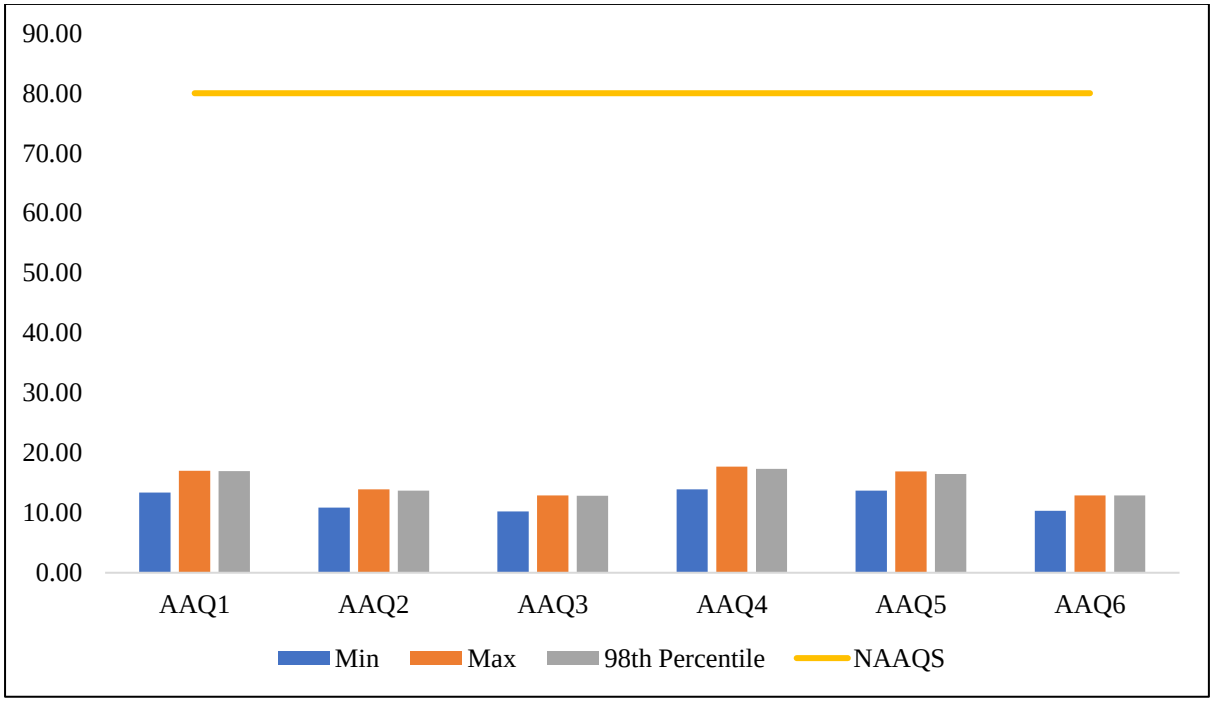


Figure 3.15 – Baseline Scenario of SO_2

4. Oxides of Nitrogen (NO_2)

The important sources of oxides of Nitrogen are from utilities and auto exhaust due to vehicular movement.

Oxides of Nitrogen in the presence of sunlight undergo reactions with a number of organic compounds to produce effects associated with photochemical smog. It has inherent ability to produce deleterious effects by themselves like toxicity. It can cause asphyxiation when its concentration is high enough to reduce the oxygen concentration in the air.

The minimum and maximum NO_2 level recorded within the study area was 19.63 and 26.21 µg/m^3 respectively with the 98th percentile ranging between 22.78 to 25.88 µg/m^3.

The 24-hourly average NO_2 value were compared with the NAAQS and found that the NO_2 concentration recorded at all sampling stations are within the permissible value of 80 µg/m^3.

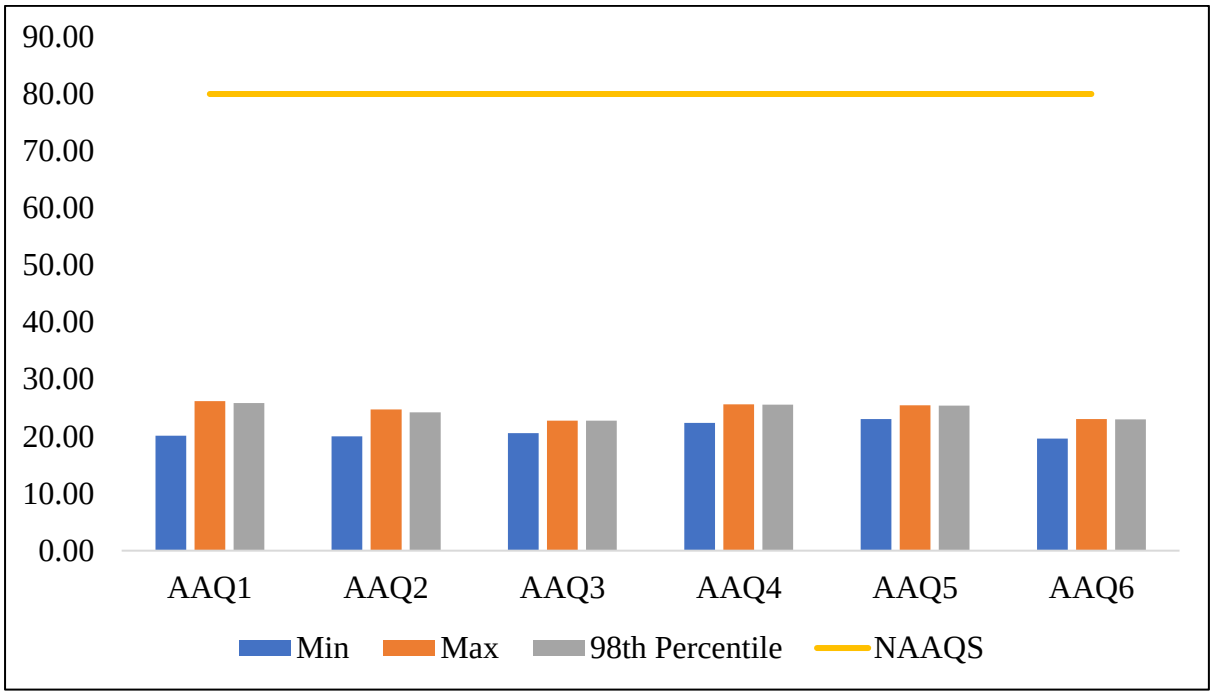


Figure 3.16 – Baseline Scenario of NO_2

5. Carbon Monoxide (CO)

Carbon monoxide is a colourless, odourless, and tasteless gas that is slightly dense than air. It is toxic to haemoglobic animals if present in high concentration. In the atmosphere, it is spatially variable and short lived and plays a role in the formation of ground level ozone.

The minimum and maximum CO level recorded within the study area was 0.55 and 0.95 mg/m^3 respectively with the 98th percentile ranging between 0.65 to 0.92 mg/m^3.

The 1-hour average CO value were compared with the NAAQS and found that the CO concentration recorded at all sampling stations are within the permissible value of 4 mg/m^3.

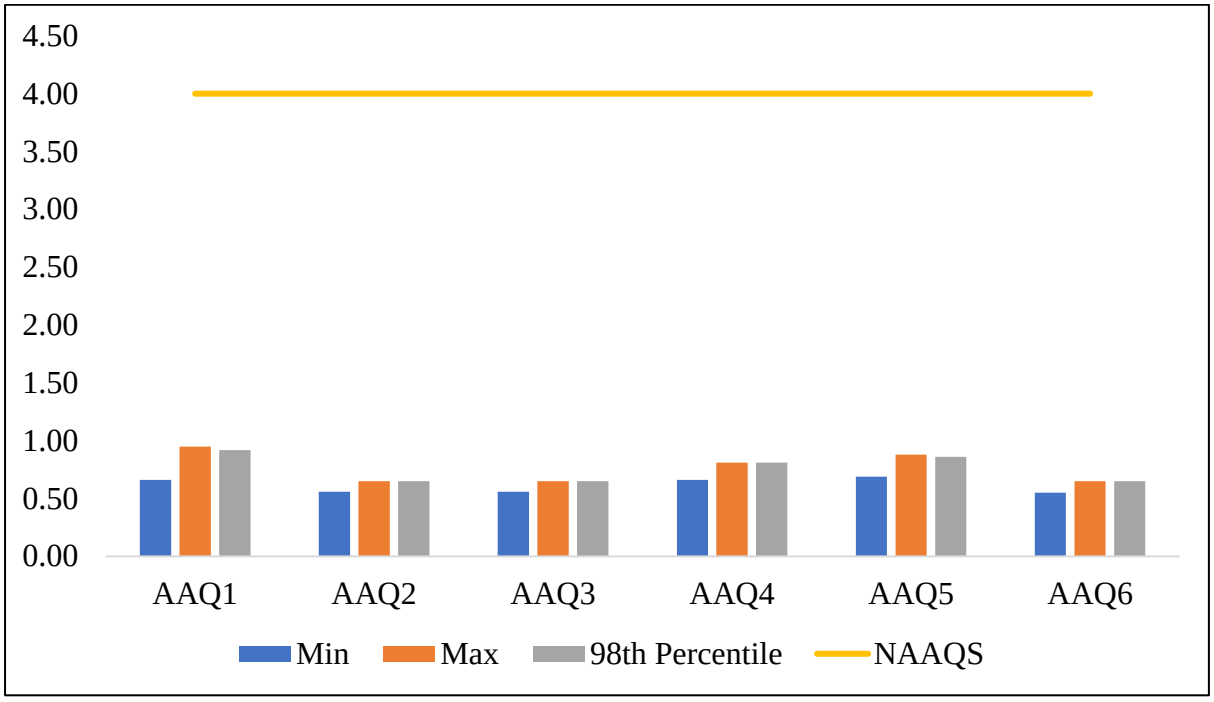


Figure 3.17 – Baseline Scenario of CO

3.4 Noise Environment

Noise is be defined as an unpleasant and unwanted sound.

Exposure to prolonged or excessive noise has been shown to cause a range of health problems from stress, poor concentration, productivity losses in the workplace, communication difficulties and fatigue from lack of sleep, to more serious problems such as cardiovascular disease, cognitive impairment, tinnitus and hearing loss.

Animals use sound for a variety of functions, such as to navigate, find food, attract mates, and avoid predators. Noise pollution makes it difficult for them to accomplish these tasks, which affects their ability survive.

3.4.1 Ambient Noise Standards

MoEF&CC, New Delhi has notified the noise standards vide gazette notification dated 14.02.2000 for different zones under the Environment Protection Act, 1986 and have been presented in **Table 3.18**.

Table 3.18 – Ambient Noise Quality Standards

S. No.	Category of Area	Noise, L_{eq} (dB)	
		Day Time	Night Time
1	Industrial Area	75	70
2	Commercial Area	65	55
3	Residential Area	55	45
4	Silence Zone	50	40

Note –

1. Daytime is from 6.00 am to 10.00 pm and night time is from 10.00 pm to 6.00 am.
2. Silence zone is defined as area up to 100 m around premises of hospitals, educational institutions and courts. Use of vehicle horns, loud speakers and bursting of crackers is banned in these zones.

3.4.1.1 Ambient Noise Monitoring Locations

Ambient noise monitoring has been performedat6 sites within the study area. Distance and direction of ambient noise monitoring locations from project site have been given **Table 3.19** and **Figure 3.18**.

The ambient noise samples were collected between the study period of January to March session of 2021.

The present study on the ambient noise monitoring establishes the baseline characteristics within the study area. The objective of ambient noise monitoring is as follows –

1. To determine the baseline ambient noise characteristics in the study area.
2. To determine the impact of proposed project on ambient noise characteristics.

Table 3.19 – Ambient Noise Monitoring Locations

Station	Location	Distance from Project Area (km)	Direction from Project Area	Project Area /Study Area	Environmental Setting
ANQ1	Within Project Site	-	-	Project Area	Industrial
ANQ2	Mahes Pukuria	4.6	South	Study Area	Residential
ANQ3	Chandakanthal Beria	3.4	North	Study Area	Residential
ANQ4	Abua (Road Intersection)	6.1	North	Study Area	Commercial
ANQ5	Bajbarantala Road Sonarpur-Bamanghata Road Crossroad (Near Goalapota)	4.8	West	Study Area	Commercial
ANQ6	Panapukur	7.9	East	Study Area	Residential

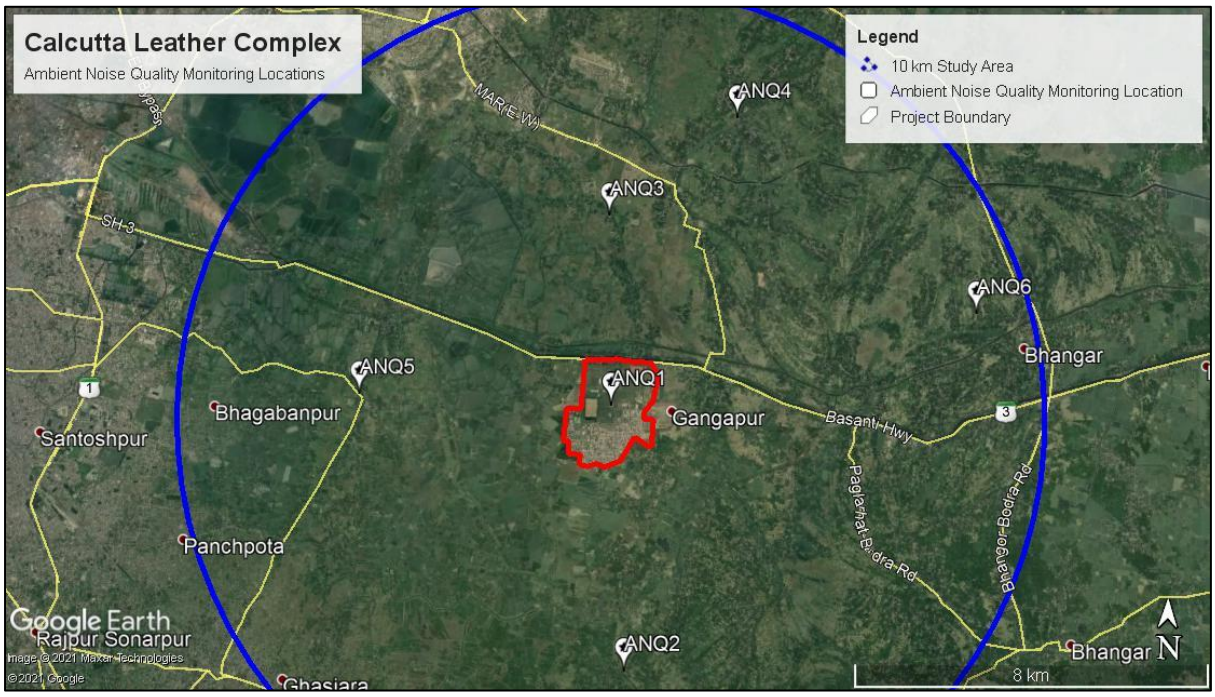


Figure 3.18– Ambient Air Monitoring Locations

3.4.1.2 Ambient Noise Monitoring Analysis

Ambient noise quality has been analysed as per Indian standards prescribed by government. Ambient noise monitoring was performedat6 locations. Ambient noise quality analysis results are presented in **Table 3.20** and **Annexure** .

Table 3.20 – Ambient Noise Monitoring Analysis

Station	Ambient Noise Level (dB(A))		Area Category	Permissible Limit (dB(A))	
	Day Time	Night Time		Day Time	Night Time
ANQ1	65.2	55.5	Industrial	75	70
ANQ2	50.3	41.0	Residential	55	45
ANQ3	50.5	42.5	Residential	55	45
ANQ4	62.3	52.3	Commercial	65	55
ANQ5	61.8	52.9	Commercial	65	55
ANQ6	52.2	42.4	Residential	55	45

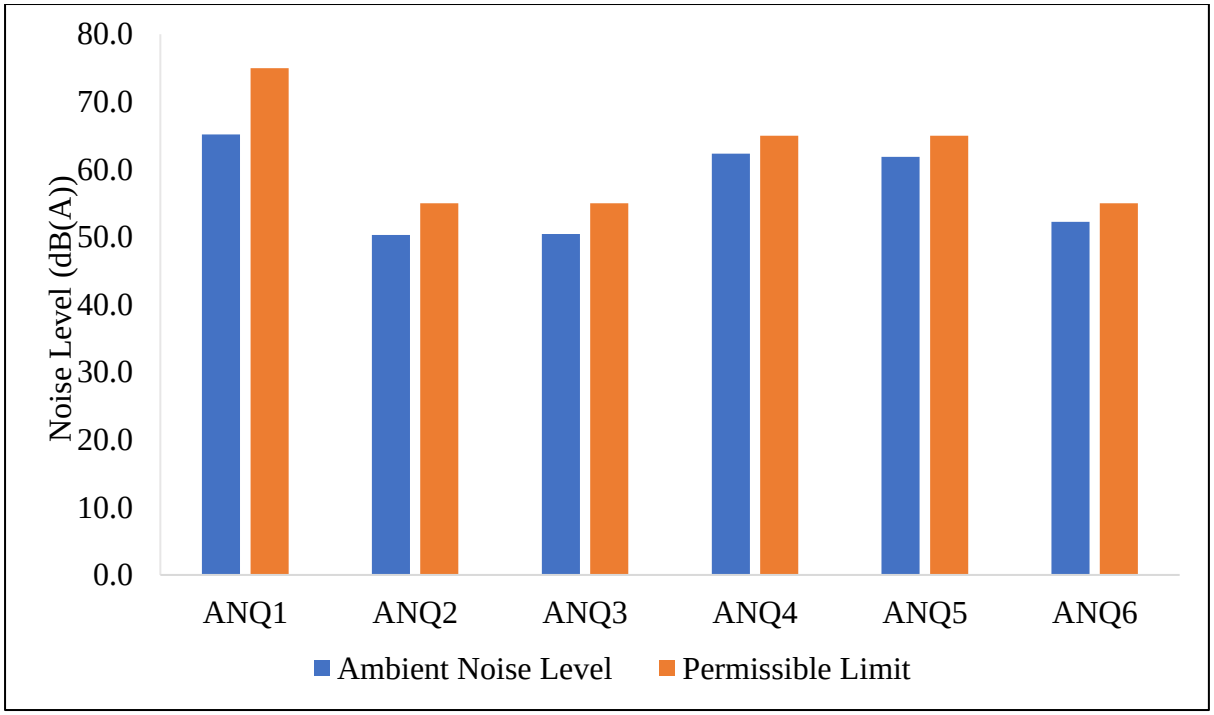


Figure 3.19 – Day Time Ambient Noise Monitoring Analysis

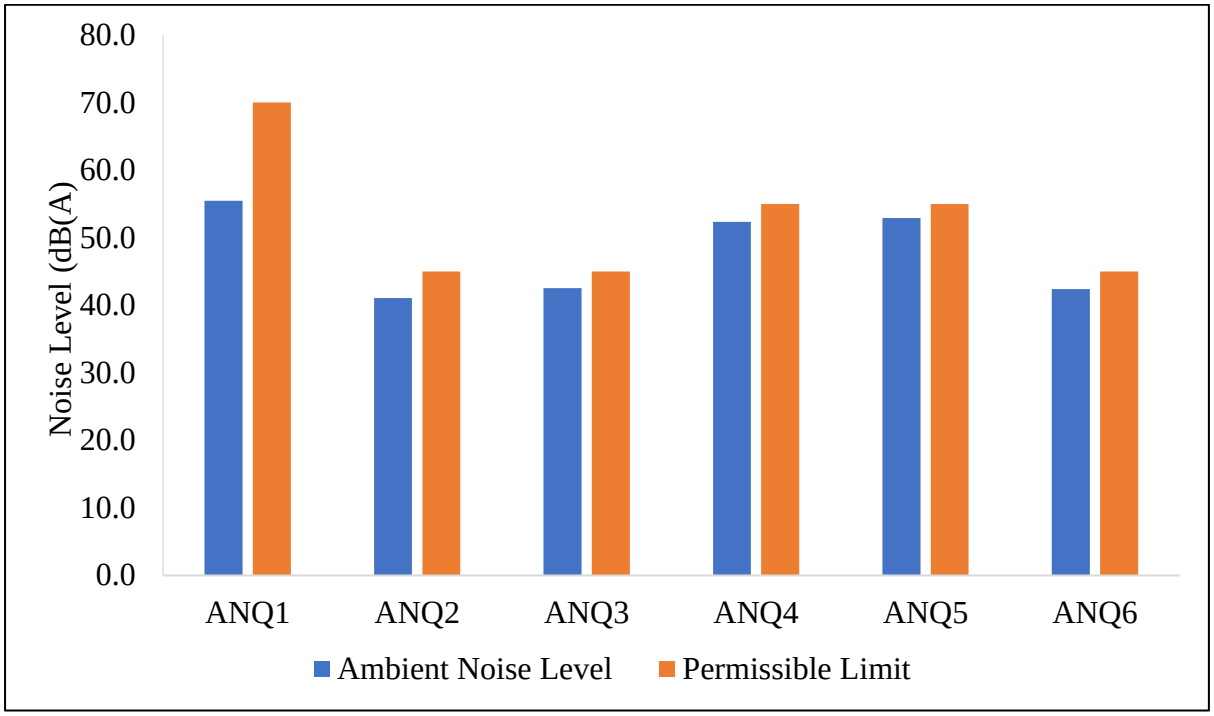


Figure 3.20 – Night Time Ambient Noise Monitoring Analysis

3.4.1.3 Ambient Noise Analysis Inference

Noise levels were within permissible range for all the stations during both day time and night time in industrial, commercial and residential areas within the study area.

3.5 Biological Environment

The need for conservation of environmental quality and biodiversity of within the study area of the proposed project warrants the need for conducting a study of the biological environment. Ecological systems have complex interrelationship between biotic and abiotic components. Biotic components comprise of flora and fauna which interact not only within and between themselves but also with the abiotic components i.e., physical and chemical components of the environment.

The objectives of ecological study during the study period are the following –

1. To characterize the flora, fauna and avifauna
2. To identify susceptible and sensitive areas

3.5.1 Methodology Adopted

Ecology biodiversity study was conducted in both buffer and core zones. Reconnaissance field surveys were carried out for identification of plants and animals in both core and buffer zones of the study area. The information presented in this chapter has been collected through field studies, consultation with various government departments, locals and collation of available literature with various institutions and organizations.

Table 3.21 – Flora Present Within the Study Area

S. No.	Family and Scientific Name	Vernacular Name
	Trees	
1	**Fabaceae**	
1.1	*Albizia lebbeck*	Siris
1.2	*Acacia nilotica*	Desi Baval
1.3	*Albizzia odoratissima*	Kalo Siras
1.4	*Albizzia procera*	Killai (kelvo)
1.5	*Cassia fistula*	Garmalo
1.6	*Dalbergia sissoo*	Sissoo
1.7	*Delonix regia*	Gulmohar
1.8	*Millettia pinnata*	Karanj
2	**Anacardiaceae**	
2.1	*Mangifera indica*	Mango
3	**Meliaceae**	
3.1	*Azadirachta indica*	Limdo
4	**Leguminosae**	
4.1	*Bauhinia purpurea*	Kachnar
5	**Myrtaceae**	
5.1	*Eucalyptus species*	Nilgiri
5.2	*Focus glomerata*	Umero
5.3	*Ficus religiosa*	Pipdo
5.4	*Syzygium cumini*	Jamun

6	**Combretaceae**	
6.1	*Terminalia arjuna*	Arjun
6.2	*Terminalia catappa*	Almon Tree
6.3	Arecaceae	
6.4	*Cocos nucifera*	Nariyal
6.5	*Areca catechu*	Betel Nut
7	**Moraceae**	
7.1	*Artocarpus heterophyllus*	Jackfruit
7.2	*Focus glomerata*	Goolar
8	**Sapotaceae**	
8.1	*Madhuca longifolia*	Mahua
9	**Rubiaceae**	
9.1	*Neolamarckia cadamba*	Kadam
10	**Rutaceae**	
10.1	*Murraya koenigii*	Mithi Neem
	Shrubs	
1	**Rosaceae**	
1.1	*Rosa damascena*	Rose
2	**Apocynaceae**	
2.1	*Calotropis procera*	Calotrops (Mandar)
2.2	*Carissa conjesta*	Karonda
2.3	*Nerium indicum*	Kaner
3	**Rutaceae**	
3.1	*Cirtus limon*	Lemon (Nimbu)
4	**Fabaceae**	
4.1	*Clerodendro nincerne*	Vilayati Mendi
4.2	*Tephrosia purpurea*	Sarphonk
4.3	Prosopis juliflora	Junglee Kikar (Gando Baval)
5	**Solanaceae**	
5.1	*Datura metel*	Dhantura
6	**Malvaceae**	

6.1	*Hibiscus rosa-sinensis*	Jasud
7	**Lythraceae**	
7.1	*Lawsonia inermis*	Mendi
8	**Oleaceae**	
8.1	*Nyctanthus arbortristis*	Parijatak
	Herbs	
1	**Papaveraceae**	
1.1	*Argemone mexicana*	Satyanashi
2	**Amaranthaceae**	
2.1	*Achyranthes aspera*	Latjira
3	**Apocynaceae**	
3.1	*Catharanthus roseus*	Barmasi
4	**Solanaceae**	
4.1	*Capsicum annum*	Marchi
4.2	*Datura metel*	Ganthovalo Dhanturo
4.3	*Solanum nigrum*	Makoy
5	**Asteraceae**	
5.1	*Eclipta Alba*	Bhringraj
5.2	*Ageratum Conzyzoides*	Jungli pudina
6	**Fabaceae**	
6.1	*Trigonella foenum-graecum*	Methi
7	**Musaceae**	
7.1	*Musa paradisiacal*	Kela
8	**Lamiaceae**	
8.1	*Ocimum sanctum*	Tulsi
9	***Acanthaceae***	
9.1	*Andrographis paniculata*	Chiretta
	Climbers	
1	**Vitaceae**	
1.1	*Ampelocissus latfolia*	Wild grape
2	**Nyctaginaceae**	

2.1	*Bougainvillea spectabilis*	Bougainvelia
3	**Cucurbitaceae**	
3.1	*Cucurbita maxima*	Kolu
3.2	Trichosanthes dioica	Parval
4	**Araceae**	
4.1	Epipremnum aureum	Money plant

Table 3.22 – Fauna Present Within the Study Area

S. No.	Scientific Name	Common Name	Schedule as per WPA 1972
Mammals			
1	*Rattus rattus*	Rat	Schedule V
2	*Mus musculus*	Mouse	Schedule V
3	*Chiroptera*	Bat	Schedule V
4	*Felis catus*	House cat	-
5	*Felis chaus*	Jungle Cat	Schedule II
6	*Vulpes bengalensis*	Common Fox	Schedule IV
7	*Canis aureus*	Jackal	Schedule II
8	*Funambulus palmarum*	Three Stripped Squirrel	-
9	*Funambulus pennantii*	Five stripped Squirrel	-
Birds			
1	*Ardeola grayii*	Indian pond heron	Schedule IV
2	*Bubulcus ibis*	Cattle egret	Schedule IV
3	*Egretta garzetta*	Little egret	Schedule IV
4	*Phalacrocorax fuscicollis*	Indian cormorant/ Indian shag	Schedule IV
6	*Elanus caeruleus*	Blackwinged kite	Least Concern
7	*Vanellus indicus*	Red-wattled lapwing	Schedule IV
8	*Vanellus malabaricus*	Yellow-wattled lapwing	Schedule IV
12	*Sterna aurantia*	Indian river tern	Least Concern
13	*Columba livia*	Blue rock pigeon	Schedule IV

14	*Streptopelia decaocto*	Indian ring dove	Least Concern
15	*Streptopelia chinensis*	Spotted dove	Least Concern
16	*Psittacula krameri*	Rose ringed parakeet	Least Concern
17	*Psittacula cyanocephala*	Blossom headed parakeet	Not listed
18	*Eudynamys scolopacea*	Koel	Least Concern
20	*Alcedo atthis*	Common kingfisher	Schedule IV
21	*Halcyon smyrnensis*	White breasted kingfisher	Schedule IV
22	*Coracias benghalensis*	Indian roller	Schedule IV
24	*Dicrurus adsimilis*	Black drongo	Schedule IV
26	*Acridotheres tristis*	Indian myna	Schedule IV
27	*Pycnonotus cafer*	Red vented bulbul	Schedule IV
29	*Megalurus palustris*	Striated marsh warbler	Least Concern
36	*Ploceus philippinus*	Baya	Schedule IV
Reptiles			
1	*Calotes versicolor*	Common garden lizard	Not listed
2	*Calotes rouxi*	Roux's forest lizard	Not listed
3	*Sitana ponticeriana*	Fan-throated lizard	Not listed
4	*Chameleon zeylanicus*	Indian chameleon	Not listed
5	*Ptyas mucosa*	Rat Snake	Not listed
6	*Bungarus caeruleus*	Indian Krait	Not listed

3.6 Socio-Economic Environment

Socio-economic study can be used to identify, evaluate and determine the socio economic and cultural impacts of a proposed development project on the lives of current or future residents of a community or geographic area. Socio economic study encompasses the demographic structure of the study area, social group present, livelihood profile of the community, literacy & illiteracy structure, occupational structure i.e., total workers, main workers, marginal workers and non-workers, basic amenities like education facilities, medical facilities etc.

The objectives of the socio-economic study are as follows –

1. To study the socio-economic status of the people living in the study area of the proposed project.

2. To assess the impact of the proposed project on socio-economic environment.
3. To assess the impact of the proposed project on quality of life.
4. To evaluate the proposed community development measures.

3.6.1 Methodology Adopted

Primary data has been collected through a sample survey of selected villages & towns present in the study area while secondary data has been collected from Office of the Registrar General & Census Commissioner, Ministry of Home Affairs, Government of India.

The details regarding population composition, literacy, occupational structure etc. have been collected from secondary sources and analysed. Details regarding amenities available in the study area have also been collected from secondary sources.

3.6.2 Concepts & Definition

(a) Study Area: The study area of the proposed project includes landmarks, both natural and man made falling within it. It can be categorised into core zone and buffer zone.

- **Core Zone:** The core zone of the proposed project consists of the area falling within the project site.
- **Buffer Zone:** The buffer zone of the proposed project consists of the area falling within a radius of 10 km from the core zone/project site.

(b) Household: A household is defined as a group of persons who normally live together and take their meals from a common kitchen unless the exigencies of work prevents any of them from doing so. Persons in a household may be related or unrelated or a mix of both. There may be one member households, two member households or multi-member households.

(c) Village: A revenue village is the basic unit for rural areas which has definite surveyed boundaries. The revenue village may comprise of one or more hamlets, however, the entire village is treated as one unit.

(d) Town: All places satisfying the following three criteria simultaneously are treated as Census Towns.

- A minimum population of 5,000
- At least 75 % of male working population engaged in non-agricultural pursuits

- A density of population of at least 400 km^2

(e) Sex Ratio: Number of females per 1,000 males in a population.

(f) Literate: Any person aged 7 years and above who can read and write with understanding in any language is considered as a literate. It is not necessary for a person to have received any formal education or passed any minimum educational standard is a literate. Literacy could have been achieved through adult literacy classes or through any non-formal educational system. People who are blind and can read in Braille are also considered as literates.

(g) Literacy Rate: Literacy rate is defined as the percentage of literates in a given population.

3.6.2.1 Work and Workforce

(a) Work: Work is defined as participation in any economically productive activity with or without compensation, wages or profit. Such participation may be physical and/or mental in nature. Work involves actual work and effective supervision and direction of work. It also includes part time help or unpaid work on farm, family enterprise or in any other economic activity.

(b) Labour Force: The number of people employed and unemployed in a given geographical entity. The size of the labour force is the sum total of persons employed and unemployed.

(c) Workers: All persons engaged in work are workers. Reference period for determining a person as worker and non-worker is one year preceding the date of enumeration.

(d) Work Participation Rate: It is the percentage of workers (main workers and marginal workers) to the total population.

(e) Main Worker: A person who has worked for major part of the reference period i.e., six months or more during the last one year preceding the date of enumeration in any economically productive activity is termed as 'main worker'.

(f) Marginal Worker: A person who worked for 3 months or more but less than six months of the reference period i.e., in the last one year preceding the date of enumeration in any economic activity is termed as 'marginal worker'.

(g) Cultivator: A person is classified as cultivator if he or she is engaged in cultivation of land owned or from government or from private persons or institutions for payment in money, kind or share. Cultivation also includes effective supervision or direction in cultivation. Cultivation involves ploughing, sowing, harvesting and production of cereals and millet crops such as wheat, paddy, jowar, bajra, ragi, etc., and other crops such as

sugarcane, tobacco, ground-nuts, tapioca, etc., and pulses, raw jute and kindred fibre crop, cotton, cinchona and other medicinal plants, fruit growing, vegetable growing or keeping orchards or groves, etc. Cultivation does not include the plantation crops like tea, coffee, rubber, coconut and betel nuts (areca). The workers engaged in Plantation crops are recorded under "other workers".

(h) Agricultural Labourer: A person who works on another person's land for wages in cash or kind or share is regarded as an agricultural labourer. She/he has no risk in the cultivation, but merely works on another person's land for wages. An agricultural labourer has no right of lease or contract on land on which she/he works.

(i) Household Industry Worker: Household industry is defined as an industry conducted by one or more members of the household at home or within the village in rural areas and only within the precincts of the house where the household lives in urban areas. The larger proportion of workers in household industry should consist of members of the household. The activity relate to production, processing, servicing, repairing or making and selling of goods. It does not include professions such as Doctor, Musician, Dancer, Waterman, Astrologer, Dhobi, Barber, etc. or merely trade or business, even if such professions, trade or services are run at home by members of the household.

(j) Other Worker: All workers other than cultivators or agricultural labourers or household industry workers are classified as other workers.

(k) Non-Worker: A person who has not worked at all in any economically productive activity during the reference period i.e., last one year preceding the date of enumeration is termed as 'non worker'.

3.6.2.2 Educational Institutes

(a) Pre-Primary Schools: Pre-primary schools include Nursery, K.G., Pre-basic, Play school, etc. These may or may not be recognized by the competent authorities.

(b) Primary Schools: Schools providing education from Standard I and upward up to and inclusive of Standard V are classified as Primary Schools.

(c) Middle Schools: Schools providing education from Standard VI and upward up to and inclusive of Standard VIII are classified as Middle Schools. A School with Class I to VIII is treated as two units, i.e. one Primary School and one Middle School.

(d) Secondary Schools: Schools providing education from Standard IX and upwards up to and inclusive of Standard X are classified as Secondary Schools. A composite school with

Standards I to X standard is treated as three separate units and counted separately under the categories of Primary School, Middle School and Secondary School.

(e) Senior Secondary Schools: Schools and colleges that provide education for Standards XI and XII and first and second year of the Pre-University Course fall under this category. There are Senior Secondary Schools with Standard I and upwards up to Standard XII.

(f) Vocational Schools/ITI: It is a vocational training institute imparting trainings in specific fields acquiring necessary skill, which will make the trainees employable or create them opportunities of self-employment.

(g) Polytechnics: An Institution providing certificate/diploma (not equivalent to degree) in any technical subject like engineering, vocational courses like embroidery, fashion designing etc. It may be Government or Private.

(h) Degree Colleges: Educational institutes falling within the following categories are categorised as degree colleges –

- **Arts/Science/Commerce Colleges:** These are all educational institutions that provide post-PUC level education leading to University degree/diploma in any subject or combination of subjects and also post-graduate levels of education. The college offering courses in Arts, Science or Commerce either separately or in combination are covered under this category.
- **Engineering Colleges:** It is a graduate/post-graduate degree college providing Bachelor of Engineering or Bachelor of Technology or post-graduate engineering degrees like Masters of Technology.
- **Medical Colleges:** These are graduate/post-graduate degree colleges providing MBBS or equivalent degree in alternative medicine like Ayurveda, Unani, Homeopathy etc. or post-graduate medical degrees like M.D or equivalent in the above branches of medicine.
- **Management College/Institutes:** It offers courses like Diploma in Management, Post-Graduate Diploma in Management, Masters of Business Administration and specializations in different disciplines of Management like Marketing, Human Resources Development etc.

3.6.2.3 Medical Facilities

The following institutions fall within the category of medical facilities –

(a) Hospitals (Allopathic and Alternative Medicine): A hospital is an institution, where sick or injured are given medical or surgical care.

(b) Community Health Centres: They are designed to provide referral health care for cases from primary health centres and those in need of specialist health care approaching community health centres directly.

(c) Primary Health Centres: It is the first contact point between a village community and the Government medical officer. It acts as a referral unit for 6 sub-centres. It has a medical officer and para medical staff.

(d) Primary Health Sub-Centres: It is the first contact point between the primary health care system and the community. Each PHS has a sanctioned strength of one male and one female health worker.

(e) Maternity and Child Welfare Centres: It provides prenatal and postnatal services for both mother and child. The services include regular check-up of pregnant women, giving folic tablets, counselling, delivery, immunisation of children with check-up etc.

(f) TB Clinics: The diagnosis and treatment of TB are functions of the general health services and hence it is a part and parcel of Primary Health Care. Specialized units such as the district Tuberculosis Centre act as referral centres. TB clinics are established by the Government of India under the National Tuberculosis Control Programme and implemented through a network of district Tuberculosis centre. The functions of sub-district level Tuberculosis unit are implementation, monitoring and supervision of Tuberculosis control activities in its designated geographical areas.

(g) Health Centres: Clinic where medicine and medical supplies are dispensed. It has no in-patient facility. A clinic (or an outpatient clinic) is a small private or public health facility that is devoted to the care of outpatients, often in a community, in contrast to larger hospitals, which also treat inpatients.

(h) Dispensaries: Place where patients are treated and medicines provided but with no inpatient facility. Immunizations, MCH services and sometimes pathological tests are carried out here.

(i) Mobile Health Clinics: These are mobile vans well equipped with a range of health services to villages located far away from the primary health centres, community health centres or any public health sources. The vans visit villages on designated days to deliver the health care services. The services generally offered are OPD, antenatal and postnatal, B.P. examination, X-ray, ECG, Immunisation, First Aid etc.

(j) Family Welfare Centres: Check-up and counselling is provided to the pregnant and married women regarding small family norm and devices for having a small family. Temporary and permanent contraceptive devices are provided here.

(k) Nursing Homes: A nursing home is a long-term care facility licensed by the state that offers 24-hour room and board and health care services including basic and skilled nursing care, rehabilitation and a full range of other therapies, treatments and programs to old and sick people. The difference between a hospital and a nursing home is that a nursing home gives importance to convalescence from a disease while a hospital gives medical treatment for the disease.

(l) Medicine Shops: A shop which sells drugs and medicines of any system of medicine viz. allopathic, homeopathic, ayurvedic or unani medicines is considered as a medicine shop. Sometimes some shops and paan shops also keep ordinary medicines, like Crocin, Burnol etc. These shops are not taken as medicine shops.

Veterinary Hospitals: Mostly run by the State Government or local body for treatment and preventive measures against diseases of domestic animals like cows, buffaloes etc. in rural areas.

3.6.2.4 Infrastructure

(a) Drinking Water: The following are the main source of drinking water facilities available in the village.

- **Treated Tap Water:** It is provided to the villagers through pipes within their premises or to the villagers through common taps (public taps/community water points) by the Government departments, local bodies, panchayats, public or private estate agencies, etc. after treatment.
- **Hand Pump:** Hand pump means where ground water is taken out manually by operating a hand pump.
- **Tube Well/Borehole:** Tube well denotes the ground water source from where ground water is taken out through electrical or diesel pump.

(b) Sub-Post Office: Sub-post office includes Extra Departmental Post Offices and those providing franchise postal services and also part time services in lieu of some honorarium.

The limited postal services include sale of stamps, receipt of letters and money orders and also distribution of letters.

(c) Internet Cafes/Common Service Centres: If the village is having the facility of Cyber Cafes or shops owned by private individuals providing the facility of surfing of the internet, then the village is considered to be having access to internet/cyber cafe facility.

(d) National Highways: These are main highways running through the length and breadth of the country.

(e) State Highway: These are roads of a state linking district headquarters and important cities within a State and connecting them with National Highways or Highways of the neighbouring States.

(f) Major District Roads: These are important roads within a district, serving areas of production and markets and connecting these with each other or with the main Highways.

(g) Other District Roads: These are roads serving rural areas of production and providing them with outlet to market centres, taluka headquarters, block development headquarters or other main roads.

(h) Banks and Credit Societies: Banking facility means a place where a person can operate a bank account.

(i) Commercial Banks: These may be banks wholly owned by the Government of India. or by Indian or Foreign Companies.

(j) Cooperative Banks: A cooperative bank is a financial entity which belongs to its members, who are at the same time the owners and the customers of their bank.

(k) Agricultural Credit Societies: Major objectives of the these are to supply agricultural credit to meet the requirements of funds for agricultural production, the distribution of essential consumer commodities, the provision.

(l) Availability of Electricity/Power: If power is actually available, whatever may be the form of its use, it is indicated affirmative. If the village is having electricity for domestic purposes and the residents are using the same for domestic use, then it is considered that domestic power supply is available. If the electricity authority has not given domestic supply to the households on their request and people are using unauthorized electricity either by stealthily or misuse the supply meant for agricultural or industrial purposes, then it is not considered as availability of electricity for domestic purposes. However, if the village goes out of power due to temporary technical problems such as, transformer failures, theft of electrical equipment, etc. it is considered that electricity is available.

Supply of electricity is considered available even when there is a temporary ban on new domestic connections. Connections to residential houses, bungalows, clubs, hostels and hospitals run on non-commercial basis, charitable, educational and religious institutions are included in the domestic category.

(Source: District Census Handbook, Rohtak, Village and Town Directory, Part XII-A, Directorate of Census Operations, Haryana, Series-07)

3.6.3 Description of the District

The erstwhile Twenty Four Parganas district was bifurcated on 1st March 1986 into two parts viz. North Twenty Four Parganas and South Twenty Four Parganas.

South Twenty Four Parganas is the largest district of West Bengal State and the second most populous district, located at the South East corner of West Bengal between 22°12'3" and 22°46'55" North latitude and between 87°58'45" and 88°22'10"East longitude covering an area of 9,960 km^2.

District Kolkata is located to the North of district South Twenty Four Parganas, districts Haora and Purba Medinipur are located to the West, district North Twenty Four Parganas lies in the East. It shares a long international border with Bangladesh to the East and Bay of Bengal is on the South. Most of the Southern and Eastern part of the district is included in the Sundarbans.

(Source: District Census Handbook, South 24 Parganas, Village and Town Directory, Part XII-A, Directorate of Census Operations, West Bengal, Series-07)

3.6.4 Description of the Study Area

The 10 km study area is divided into two zones, namely, core zone and buffer zone. The proposed project covers 109 villages and 4 towns.

Table 3.23 – Total Geographical Area of the Study Area

S. No.	Village/Town Name	District Name	Total Geographical Area (Ha)
1	Anantapur	Uttar Dinajpur	166.38

2	Naoabad	South Twenty Four Parganas	63.18
3	Uttar Kasipur	South Twenty Four Parganas	664.89
4	Swastayan Gachhi	South Twenty Four Parganas	398
5	Jot Bhim	South Twenty Four Parganas	97.88
6	Koch Pukur	South Twenty Four Parganas	89.37
7	Majerhat	South Twenty Four Parganas	422.92
8	Pitha Pukuria	South Twenty Four Parganas	490.66
9	Tara Hadia	South Twenty Four Parganas	75.087
10	Saduli	South Twenty Four Parganas	239.98
11	Dakshin Khayerpur	South Twenty Four Parganas	52.46
12	Hat Gachha	South Twenty Four Parganas	298.66
13	Dharmatala Pachuria	South Twenty Four Parganas	602.14
14	Abua	South Twenty Four Parganas	61.52
15	Bhaga Banpur	South Twenty Four Parganas	272.51
16	Kulberia	South Twenty Four Parganas	384.57
17	Nangalbeki	South Twenty Four Parganas	65.58
18	Hatisala	Dakshin Dinajpur	62.12
19	Jiran Gachhi	South Twenty Four Parganas	169.93
20	Bamunia	South Twenty Four Parganas	801.96
21	Sonpur	South Twenty Four Parganas	95.52
22	Chandakanthal Beria	South Twenty Four Parganas	177.98
23	Uttar Narikel Beria	South Twenty Four Parganas	93.03
24	Rampur	South Twenty Four Parganas	72.91
25	Hadia	Purba Medinipur	258.8
26	Uttar Kathalia	South Twenty Four Parganas	257.36
27	Sanpukuria	South Twenty Four Parganas	58.88
28	Kachua	Purba Medinipur	62.73
29	Nimkuria	South Twenty Four Parganas	177.81
30	Wari	Maldah	304.91
31	Dheati	South Twenty Four Parganas	54.93
32	Benota	South Twenty Four Parganas	1040.52

33	Uttar Rajapur	South Twenty Four Parganas	112.53
34	Paikan	South Twenty Four Parganas	101.67
35	Chariswar	South Twenty Four Parganas	209.22
36	Jawpur	South Twenty Four Parganas	147.76
37	Panapukur	South Twenty Four Parganas	199.31
38	Hogaldara	South Twenty Four Parganas	78.51
39	Suk Pukuria	South Twenty Four Parganas	69.78
40	Kalikapur	South Twenty Four Parganas	85.8
41	Tardaha Kapasati	South Twenty Four Parganas	1715.87
42	Kharki	North Twenty Four Parganas	86.9
43	Chalta Beria	South Twenty Four Parganas	157.66
44	Chak Maricha	South Twenty Four Parganas	125.45
45	Kghodhati	South Twenty Four Parganas	307.13
46	Bhatipota	South Twenty Four Parganas	196.68
47	Krolbaria	South Twenty Four Parganas	179.92
48	Ghunimeghi	South Twenty Four Parganas	236.1
49	Maricha	North Twenty Four Parganas	335.41
50	Karaidandga	South Twenty Four Parganas	122.62
51	Gangapur	South Twenty Four Parganas	522.53
52	Goalapota	South Twenty Four Parganas	47.6
53	Chak Barali	South Twenty Four Parganas	137.19
54	Deara	South Twenty Four Parganas	264.2
55	Nalmuri	South Twenty Four Parganas	142.75
56	Serpur	South Twenty Four Parganas	41.06
57	Narayanpur	South Twenty Four Parganas	69.64
58	Kharamba	South Twenty Four Parganas	288.49
59	Kumar Pukuria	South Twenty Four Parganas	105.23
60	Bairampur	South Twenty Four Parganas	112.91
61	Kheadaha	South Twenty Four Parganas	246.03
62	Jagulgachhi	South Twenty Four Parganas	281.26
63	Tardaha	South Twenty Four Parganas	794.08

64	Dakshin Gazipur	South Twenty Four Parganas	41.9
65	Malancha	South Twenty Four Parganas	112.54
66	Padma Pukuria	South Twenty Four Parganas	143.26
67	Bagbaria Narayanpur	South Twenty Four Parganas	24.77
68	Tihuria	South Twenty Four Parganas	385.36
69	Saitgachhi	South Twenty Four Parganas	93.24
70	Rani Gachhi	South Twenty Four Parganas	255.36
71	Ushpara	South Twenty Four Parganas	123.33
72	Andulgari	South Twenty Four Parganas	308.81
73	Mousal	South Twenty Four Parganas	127.5
74	Dara	Paschim Medinipur	205.01
75	Saihati	South Twenty Four Parganas	90.61
76	Chak Bhikan	Dakshin Dinajpur	73.86
77	Madhabpur	Dakshin Dinajpur	65.54
78	Balipur	North Twenty Four Parganas	127.19
79	Amreswar	South Twenty Four Parganas	161.8
80	Shaksahar	South Twenty Four Parganas	182.36
81	Bazarati	South Twenty Four Parganas	184.33
82	Taldighi	South Twenty Four Parganas	63.54
83	Bangoda	South Twenty Four Parganas	130.92
84	Jhungri	South Twenty Four Parganas	103.73
85	Karunarhati	South Twenty Four Parganas	151.45
86	Kashia Danga	South Twenty Four Parganas	186.16
87	Dari Madhabpur	South Twenty Four Parganas	249.22
88	Samukpota	South Twenty Four Parganas	393.51
89	Bausahar	South Twenty Four Parganas	114.85
90	Pratapnagar	Nadia	337.52
91	Dharmatala	South Twenty Four Parganas	91.6
92	Garal	South Twenty Four Parganas	168.53
93	Kamar Hati	South Twenty Four Parganas	53.97
94	Mahes Pukuria	South Twenty Four Parganas	48.74

95	Kasinagar	South Twenty Four Parganas	276.08
96	Narayantala	South Twenty Four Parganas	43.84
97	Dhapa Manpur (P)	South Twenty Four Parganas	2417.56
98	Kasinathpur	North Twenty Four Parganas	161.93
99	Kalikapur	North Twenty Four Parganas	140.81
100	Bagun	Uttar Dinajpur	82.99
101	Nawabad	North Twenty Four Parganas	173.01
102	Jhalgachhi	North Twenty Four Parganas	57.91
103	Chakpachuria	North Twenty Four Parganas	382.32
104	Ganragari	North Twenty Four Parganas	167.23
105	Patharghata	North Twenty Four Parganas	572.74
106	Hudarait	North Twenty Four Parganas	220.07
107	Baligari	North Twenty Four Parganas	46.94
108	Chhapna	North Twenty Four Parganas	119.92
109	Akandakeshari	North Twenty Four Parganas	164.5
110	Radhanagar (CT)	South Twenty Four Parganas	528.94
111	Bhangar Raghunathpur (CT)	South Twenty Four Parganas	151
112	Kulberia (CT)	North Twenty Four Parganas	52.27
113	Maricha (CT)	South Twenty Four Parganas	80.63
Total			**26297.7**

(Source: As per Census Data, 2011)

Table 3.24 – Comparison of Existing Demographic Details

S. No.	Particular	West Bengal State	South 24 Parganas District	10 km Study Area
1	Area (km^2)	88752	9960	263
2	Density (people/km^2)	1029	819	1412
3	Total Population	91347736	8161961	371449
4	Male Population	46927389	4172782	190759
5	Female Population	44420347	3989179	180690
6	Sex Ratio	947	956	947

7	Total Child Population (0-6 Years)	10112599	806415	49493
8	Child Sex Ratio	947	964	959
9	Literate Population (%)	77.08	77.51	64.30
10	Male Literates (%)	82.67	83.35	54.69
11	Female Literates (%)	71.16	71.4	45.31

(Source: As per Census Data, 2011)

3.6.5 Population in Project Study Area

There are 109 villages and 4 towns within the 10 km study area having a total population of3,71,449people with 1,90,759 males and 1,80,690 females and a sex ration of 947. There are 78,520 households in the study area with an average density of 4.73 people per household.

The total child population, i.e., people aged 6 years or less is 49,493 with a child sex ratio of 959 females per 1000 males, showing an adverse trend in sex ratio as the male population is higher compared to the female population.

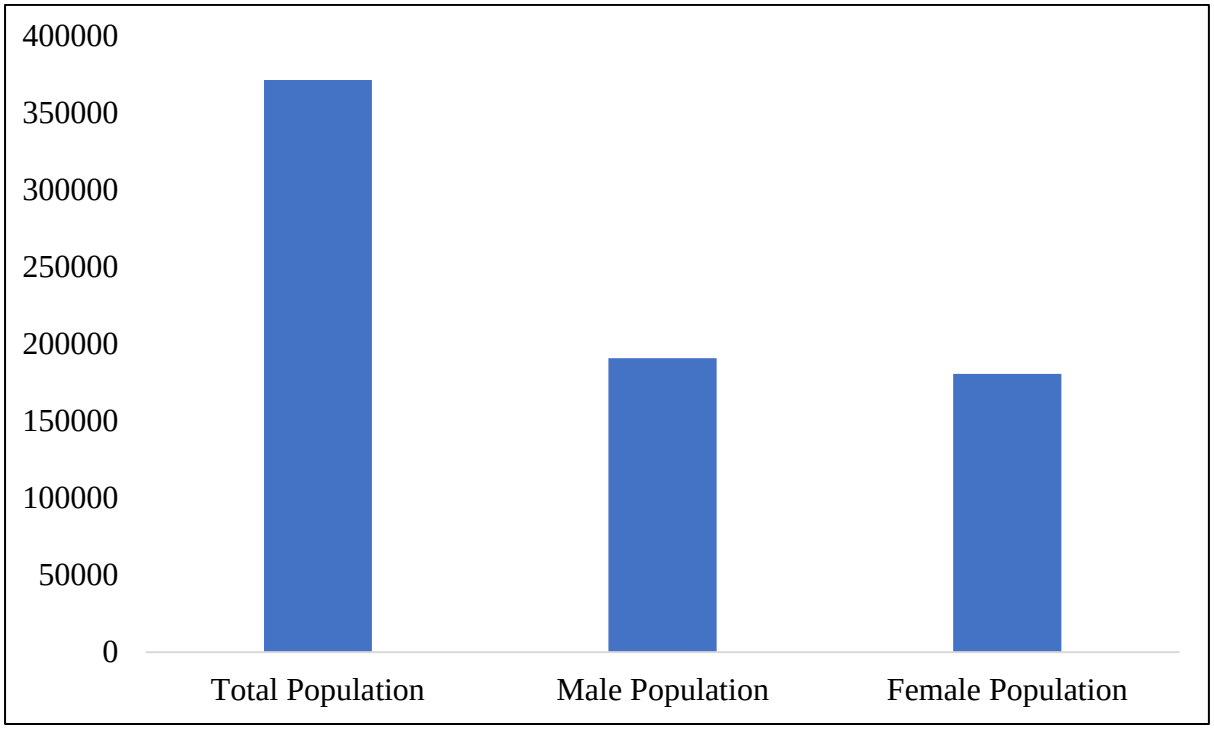


Figure 3.21– Demographic Structure of the Study Area

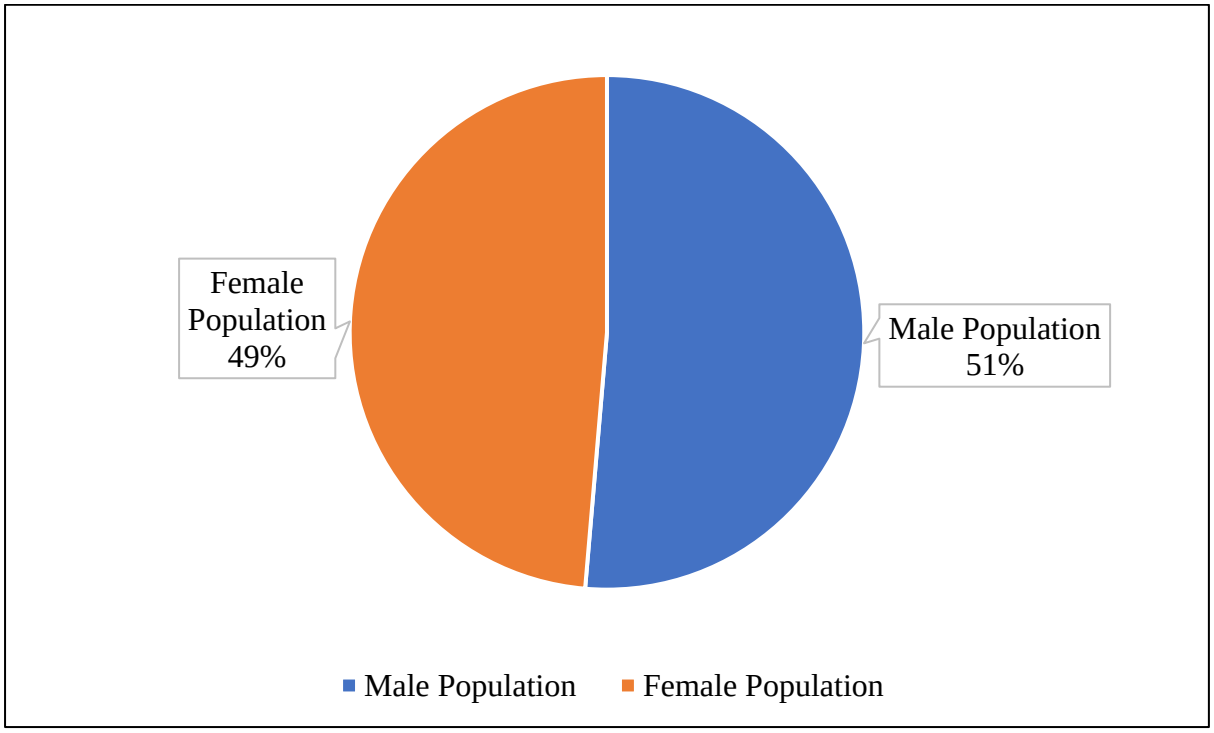


Figure 3.22– Gender Structure of the Study Area

3.6.6 Social Structure

1. The total number of SC within the study area is 1,16,620 which is 31.40% of the total population.

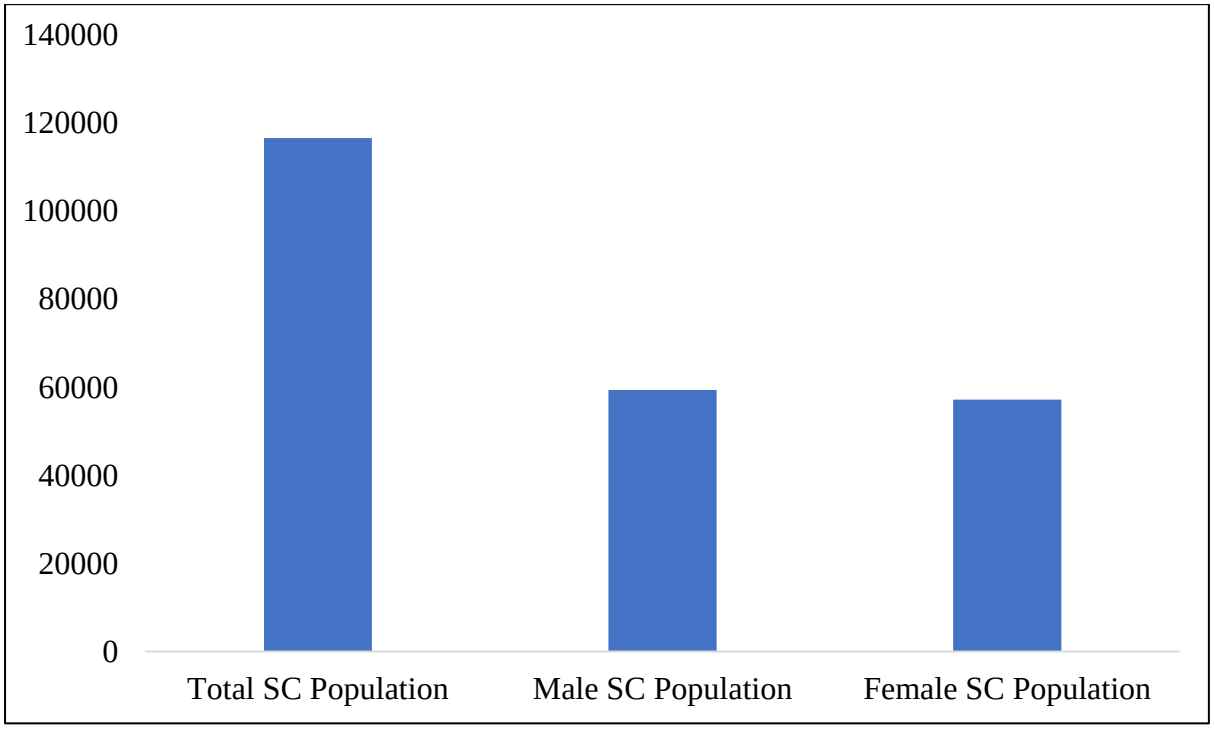


Figure 3.23 – Schedule Caste Population in The Study Area

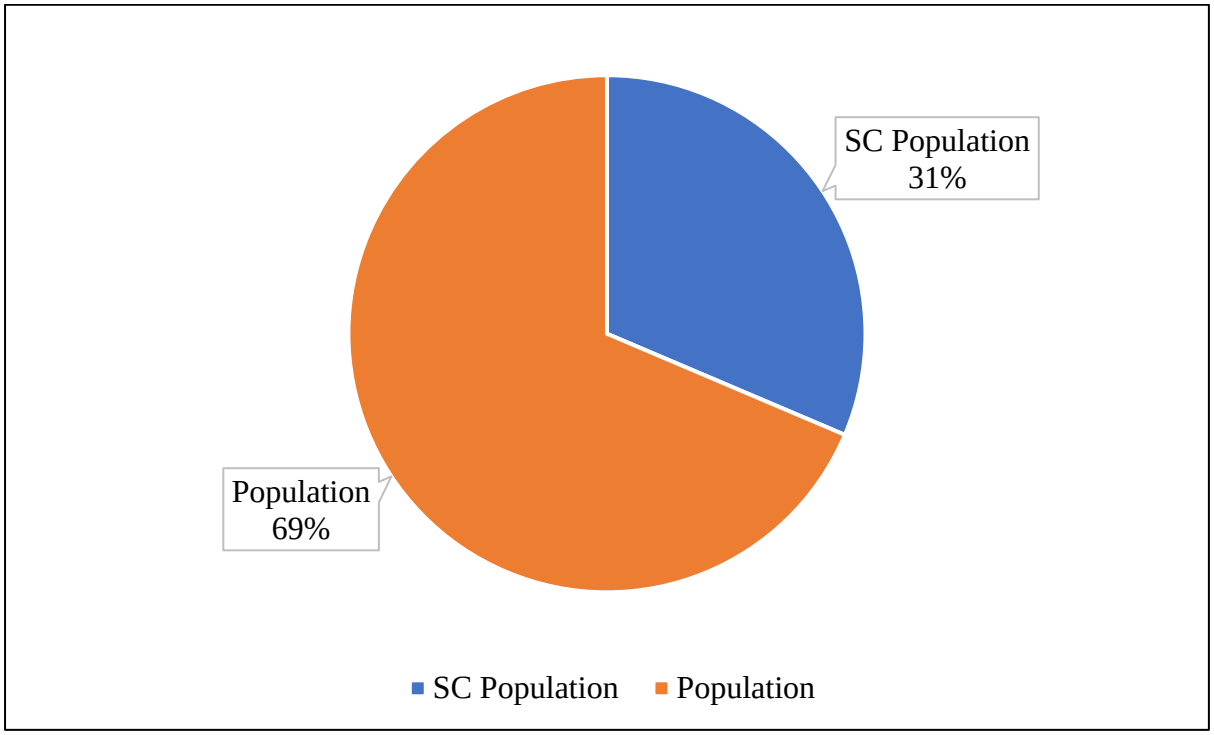


Figure 3.24– Schedule Caste Percentage of the Study Area

2. The total number of ST within the study area is 7,042which is 1.90% of the total population.

Figure 3.25 – Schedule Tribe Population in The Study Area

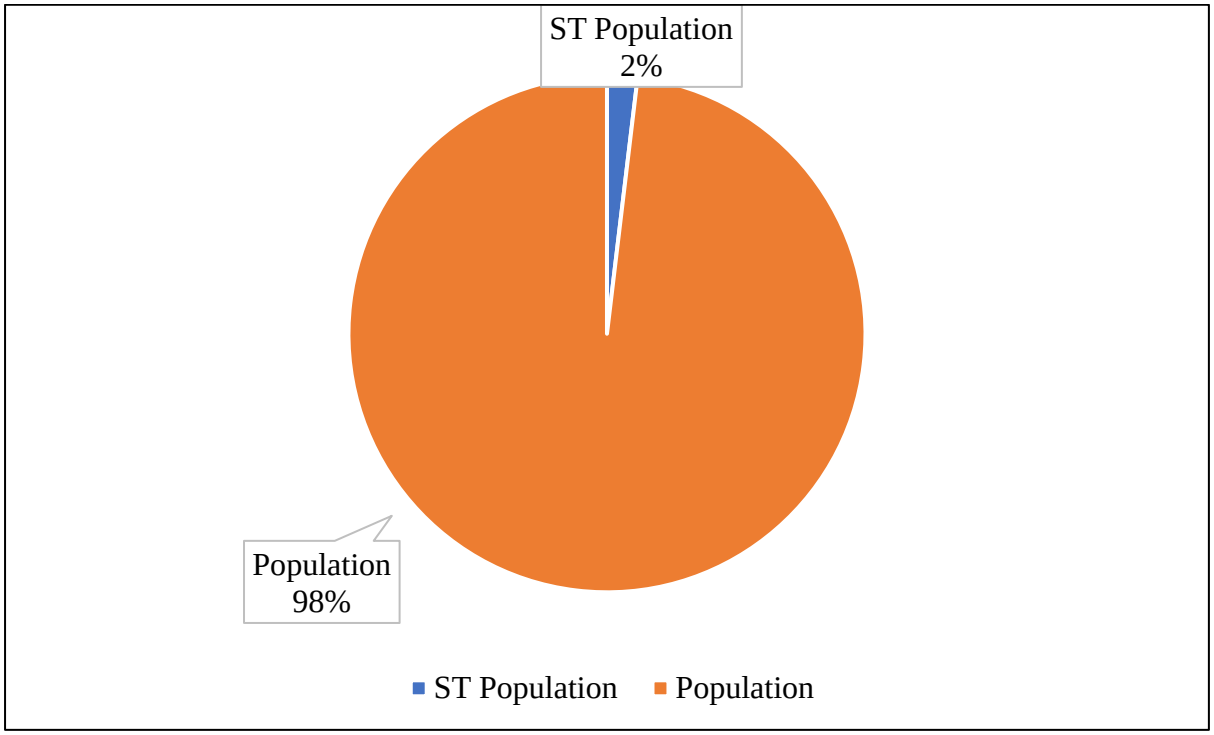


Figure 3.26– Schedule Tribe Percentage of the Study Area

3.6.7 Literacy

The total number of literates within the 10 km study area is 2,38,846 people which translates to 63.30% of total population.

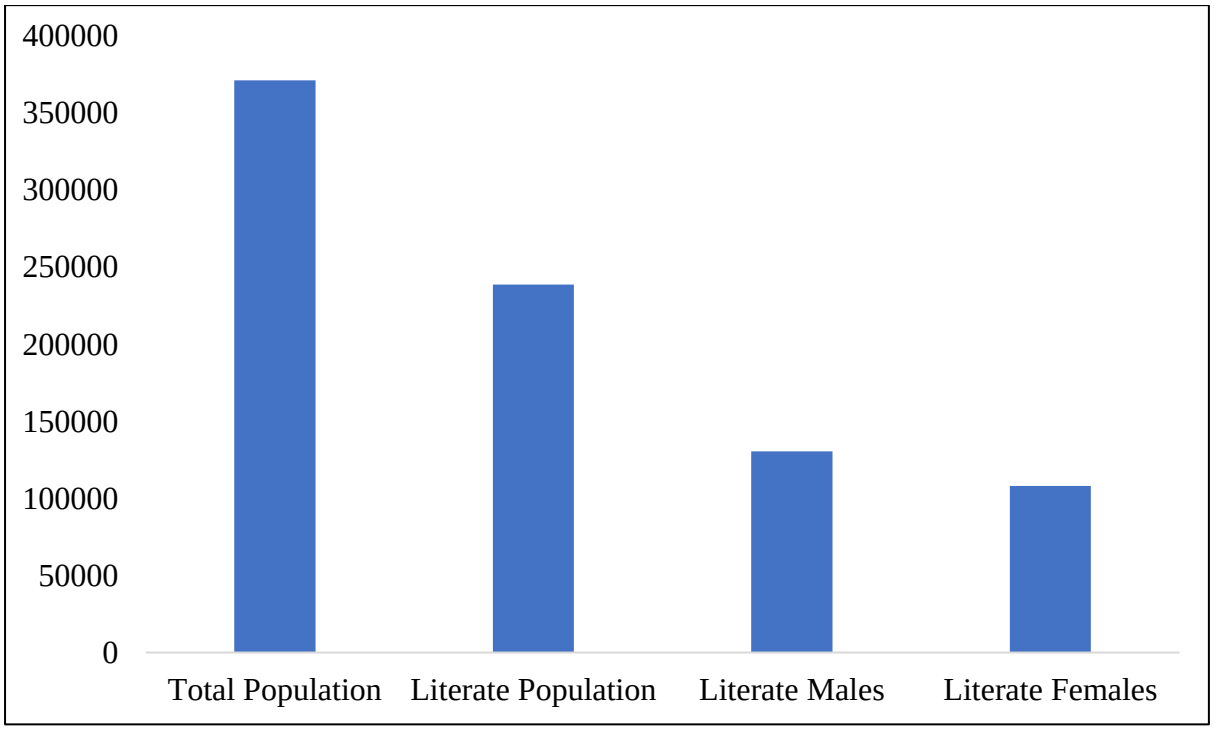


Figure 3.27– Literate Population in the Study Area

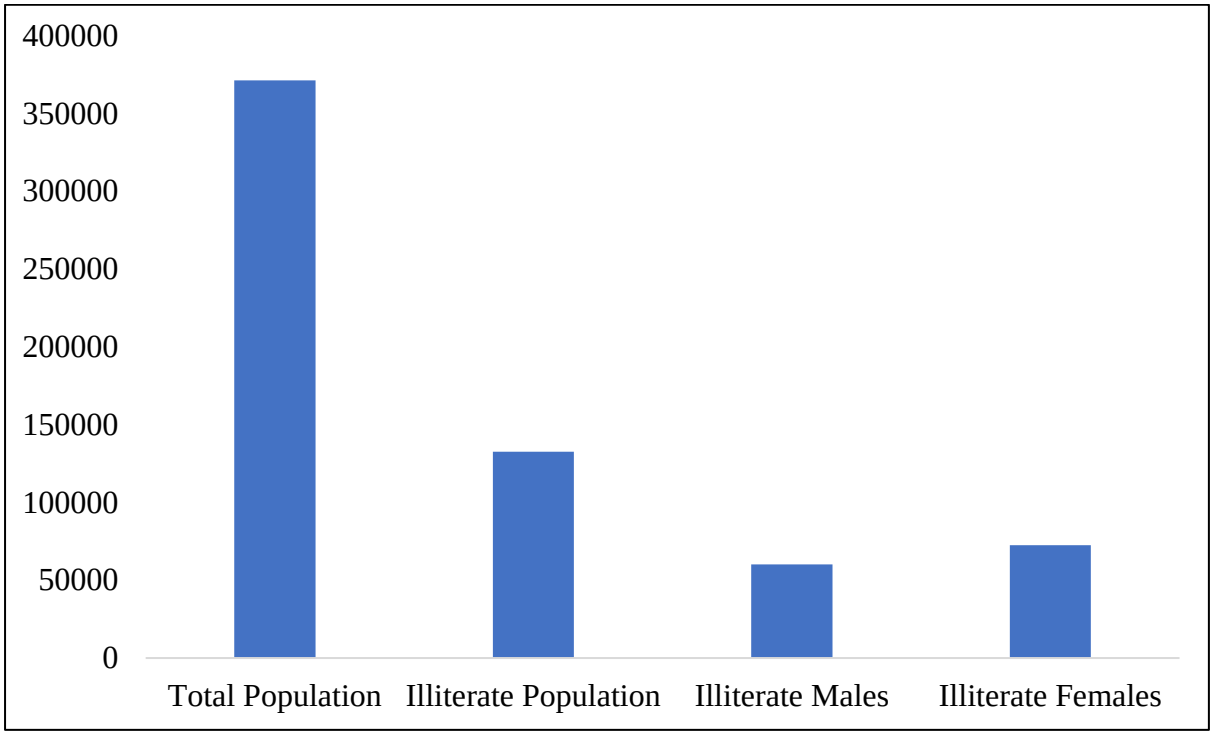


Figure 3.28– Illiterate Population in the Study Area

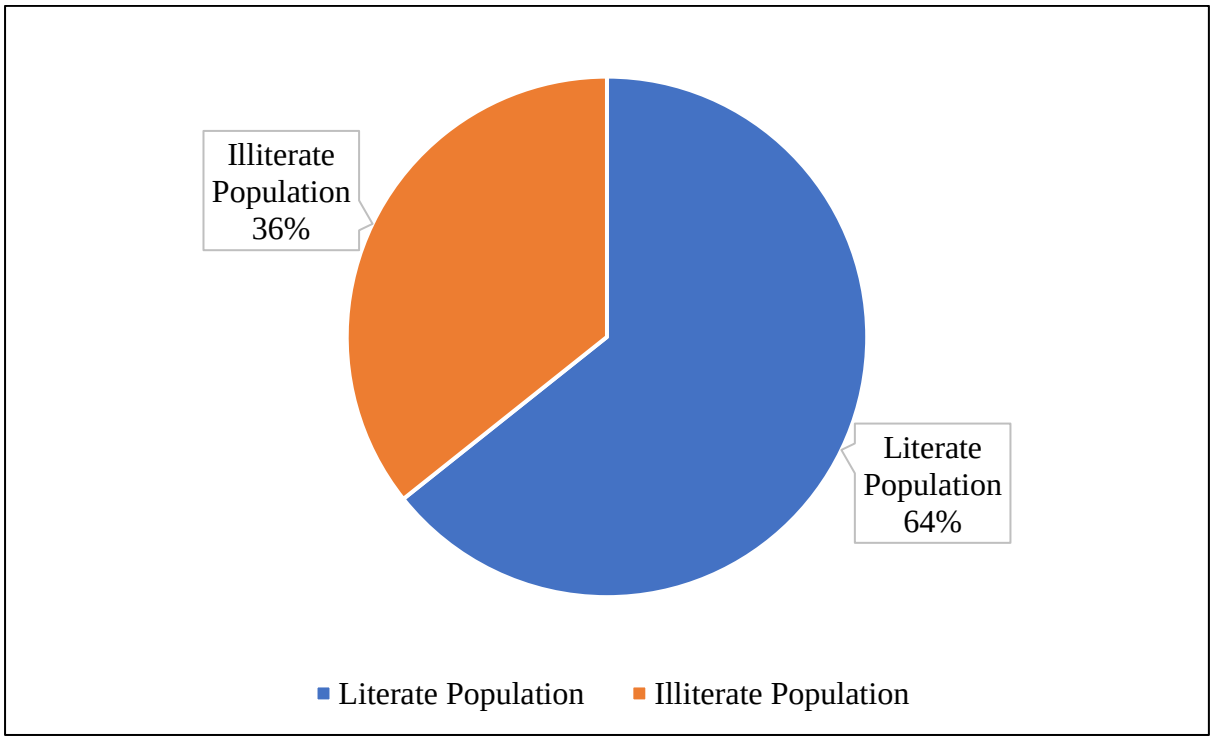


Figure 3.29– Literacy in the Study Area

Table 3.25 – Demographic Structure of the Project Study Area

S. No.	Name	No. of Households	Population			Sex Ratio	Child Population (0-6 Years)		
			Total	Male	Female		Total	Male	Female
1	Anantapur	649	3140	1641	1499	913	451	238	213
2	Naoabad	140	571	281	290	1032	59	30	29
3	Uttar Kasipur	2288	10782	5620	5162	918	1498	760	738
4	Swastayan Gachhi	1358	6966	3652	3314	907	1002	528	474
5	Jot Bhim	409	1859	905	954	1054	213	115	98
6	Koch Pukur	450	2598	1296	1302	1004	360	188	172
7	Majerhat	1543	7797	4065	3732	918	1152	578	574
8	Pitha Pukuria	2090	11078	5821	5257	903	1686	889	797
9	Tara Hadia	277	1390	753	637	845	181	89	92
10	Saduli	859	4230	2227	2003	899	600	320	280
11	Dakshin Khayerpur	124	657	356	301	845	94	54	40
12	Hat Gachha	1341	5882	2957	2925	989	697	351	346
13	Dharmatala Pachuria	1309	5789	2923	2866	980	697	359	338
14	Abua	334	1766	919	847	921	259	124	135
15	Bhaga Banpur	679	3376	1732	1644	949	495	261	234
16	Kulberia	827	3787	1922	1865	970	498	243	255
17	Nangalbeki	300	1653	835	818	979	273	134	139
18	Hatisala	725	3810	1914	1896	990	608	299	309

19	Jiran Gachhi	1069	5193	2724	2469	906	773	378	395
20	Bamunia	3056	15582	8156	7426	910	2390	1218	1172
21	Sonpur	673	3323	1693	1630	962	492	243	249
22	Chandakanthal Beria	284	1229	608	621	1021	166	78	88
23	Uttar Narikel Beria	363	1935	1013	922	910	335	172	163
24	Rampur	281	1427	740	687	928	231	107	124
25	Hadia	1765	7921	4002	3919	979	796	393	403
26	Uttar Kathalia	1784	8628	4374	4254	972	1207	577	630
27	Sanpukuria	550	2654	1386	1268	914	370	201	169
28	Kachua	728	3648	1891	1757	929	537	284	253
29	Nimkuria	1092	5604	2958	2646	894	852	424	428
30	Wari	572	3057	1560	1497	959	496	271	225
31	Dheati	112	610	315	295	936	99	50	49
32	Benota	1747	7850	3989	3861	967	1106	561	545
33	Uttar Rajapur	302	1464	760	704	926	216	119	97
34	Paikan	472	2007	1038	969	933	226	121	105
35	Chariswar	796	4097	2120	1977	932	553	283	270
36	Jawpur	424	2134	1101	1033	938	288	149	139
37	Panapukur	1219	5770	2915	2855	979	828	418	410
38	Hogaldara	316	1510	763	747	979	175	96	79
39	Suk Pukuria	173	785	390	395	1012	89	38	51
40	Kalikapur	486	2004	1032	972	941	157	91	66
41	Tardaha Kapasati	2763	11869	5960	5909	991	1572	785	787

42	Kharki	295	1288	636	652	1025	116	59	57
43	Chalta Beria	829	4167	2090	2077	993	644	317	327
44	Chak Maricha	803	3990	2042	1948	953	597	289	308
45	Kghodhati	815	3619	1830	1789	977	398	201	197
46	Bhatipota	706	3383	1722	1661	964	474	248	226
47	Krolbaria	767	3577	1856	1721	927	410	224	186
48	Ghunimeghi	816	4151	2113	2038	964	599	295	304
49	Maricha	741	3125	1608	1517	943	317	161	156
50	Karaidandga	242	1145	584	561	960	152	84	68
51	Gangapur	657	2911	1505	1406	934	428	204	224
52	Goalapota	43	188	95	93	978	21	15	6
53	Chak Barali	1215	5978	3109	2869	922	846	459	387
54	Deara	758	3152	1582	1570	992	301	141	160
55	Nalmuri	700	3411	1735	1676	965	488	241	247
56	Serpur	193	830	426	404	948	113	56	57
57	Narayanpur	312	1341	679	662	974	93	40	53
58	Kharamba	1011	4591	2352	2239	951	607	303	304
59	Kumar Pukuria	162	656	330	326	987	76	40	36
60	Bairampur	403	2018	1042	976	936	276	160	116
61	Kheadaha	450	1930	985	945	959	211	114	97
62	Jagulgachhi	643	2926	1512	1414	935	378	184	194
63	Tardaha	1039	4706	2391	2315	968	564	282	282
64	Dakshin Gazipur	152	664	350	314	897	75	45	30

65	Malancha	430	2134	1083	1051	970	316	158	158
66	Padma Pukuria	782	3907	1997	1910	956	595	329	266
67	Bagbaria Narayanpur	145	709	360	349	969	92	42	50
68	Tihuria	920	3773	2015	1758	872	345	175	170
69	Saitgachhi	335	1549	798	751	941	184	90	94
70	Rani Gachhi	834	4265	2195	2070	943	693	364	329
71	Ushpara	704	3210	1626	1584	974	456	233	223
72	Andulgari	665	2602	1463	1139	778	265	159	106
73	Mousal	383	1631	849	782	921	165	82	83
74	Dara	256	1269	660	609	922	155	77	78
75	Saihati	236	1182	604	578	956	163	80	83
76	Chak Bhika	303	1634	855	779	911	266	137	129
77	Madhabpur	172	714	383	331	864	52	28	24
78	Balipur	324	1549	792	757	955	208	106	102
79	Amreswar	575	2899	1511	1388	918	412	204	208
80	Shaksahar	733	3698	1899	1799	947	487	236	251
81	Bazarati	439	2147	1109	1038	935	285	145	140
82	Taldighi	462	2328	1192	1136	953	391	195	196
83	Bangoda	390	1910	975	935	958	253	132	121
84	Jhungri	481	2306	1202	1104	918	307	167	140
85	Karunarhati	450	2148	1117	1031	923	331	174	157
86	Kashia Danga	623	2936	1477	1459	987	417	215	202
87	Dari Madhabpur	1248	6556	3369	3187	945	1108	568	540

88	Samukpota	468	2021	1014	1007	993	208	95	113
89	Bausahar	495	2635	1334	1301	975	356	164	192
90	Pratapnagar	657	2785	1438	1347	936	293	150	143
91	Dharmatala	163	671	360	311	863	95	52	43
92	Garal	390	1747	900	847	941	197	98	99
93	Kamar Hati	279	1306	675	631	934	188	102	86
94	Mahes Pukuria	147	625	320	305	953	53	30	23
95	Kasinagar	136	539	283	256	904	49	28	21
96	Narayantala	536	2647	1369	1278	933	358	185	173
97	Dhapa Manpur (P)	186	776	369	407	1102	81	41	40
98	Kasinathpur	470	2166	1115	1051	942	228	124	104
99	Kalikapur	345	1666	878	788	897	197	111	86
100	Bagu	342	1435	750	685	913	128	66	62
101	Nawabad	505	2277	1180	1097	929	233	130	103
102	Jhalgachhi	344	1641	877	764	871	191	100	91
103	Chakpachuria	1042	5024	2565	2459	958	705	364	341
104	Ganragari	403	1907	944	963	1020	251	120	131
105	Patharghata	1787	8039	4110	3929	955	896	457	439
106	Hudarait	513	2369	1206	1163	964	292	138	154

107	Baligari	209	1025	540	485	898	154	87	67
108	Chhapna	511	2519	1276	1243	974	328	167	161
109	Akandakeshari	626	2847	1445	1402	970	346	184	162
110	Radhanagar (CT)	1546	6675	3375	3300	977	711	376	335
111	Bhangar Raghunathpur (CT)	1327	6037	3025	3012	995	835	404	431
112	Kulberia (CT)	1680	6993	3543	3450	973	579	302	277
113	Maricha (CT)	1042	4842	2456	2386	971	634	310	324
Total		**78520**	**371449**	**190759**	**180690**	**-**	**49493**	**25260**	**24233**

(Source: As per Census Data, 2011)

Table 3.26 – Population Breakup of the Project Study Area

S. No.	Name	SC Population			ST Population			Literate Population			Illiterate Population		
		Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female
1	Anantapur	272	134	138	21	12	9	1907	1032	875	1233	609	624
2	Naoabad	569	279	290	0	0	0	332	172	160	239	109	130
3	Uttar Kasipur	1151	609	542	0	0	0	6705	3618	3087	4077	2002	2075

4	Swastayan Gachhi	149	82	67	0	0	0	4632	2489	2143	2334	1163	1171
5	Jot Bhim	1743	852	891	0	0	0	1307	675	632	552	230	322
6	Koch Pukur	0	0	0	0	0	0	1737	909	828	861	387	474
7	Majerhat	29	15	14	0	0	0	4955	2634	2321	2842	1431	1411
8	Pitha Pukuria	0	0	0	0	0	0	7209	3828	3381	3869	1993	1876
9	Tara Hadia	18	10	8	0	0	0	1015	588	427	375	165	210
10	Saduli	540	285	255	8	3	5	2549	1403	1146	1681	824	857
11	Dakshin Khayerpur	0	0	0	0	0	0	453	253	200	204	103	101
12	Hat Gachha	5115	2557	2558	141	66	75	3814	2141	1673	2068	816	1252
13	Dharmatala Pachuria	4780	2388	2392	55	27	28	3574	2001	1573	2215	922	1293
14	Abua	0	0	0	0	0	0	1158	637	521	608	282	326
15	Bhaga Banpur	215	111	104	0	0	0	2090	1096	994	1286	636	650
16	Kulberia	2442	1243	1199	269	128	141	2351	1299	1052	1436	623	813
17	Nangalbeki	0	0	0	0	0	0	1026	522	504	627	313	314

18	Hatisala	272	125	147	0	0	0	2174	1116	1058	1636	798	838
19	Jiran Gachhi	0	0	0	0	0	0	3147	1690	1457	2046	1034	1012
20	Bamunia	294	147	147	240	108	132	10097	5482	4615	5485	2674	2811
21	Sonpur	24	16	8	0	0	0	1874	975	899	1449	718	731
22	Chandakanthal Beria	1155	566	589	5	1	4	764	433	331	465	175	290
23	Uttar Narikel Beria	0	0	0	0	0	0	1253	661	592	682	352	330
24	Rampur	3	2	1	0	0	0	879	473	406	548	267	281
25	Hadia	7060	3563	3497	344	166	178	5237	2963	2274	2684	1039	1645
26	Uttar Kathalia	248	123	125	4	3	1	5801	3034	2767	2827	1340	1487
27	Sanpukuria	0	0	0	0	0	0	1856	1000	856	798	386	412
28	Kachua	251	133	118	0	0	0	2115	1146	969	1533	745	788
29	Nimkuria	0	0	0	0	0	0	3723	2070	1653	1881	888	993
30	Wari	0	0	0	17	6	11	1820	953	867	1237	607	630
31	Dheati	0	0	0	0	0	0	378	201	177	232	114	118
32	Benota	5468	2775	2693	600	303	297	4455	2544	1911	3395	1445	1950

33	Uttar Rajapur	372	200	172	0	0	0	893	470	423	571	290	281
34	Paikan	472	240	232	0	0	0	1419	790	629	588	248	340
35	Chariswar	207	112	95	46	22	24	2479	1353	1126	1618	767	851
36	Jawpur	439	230	209	1	0	1	1586	865	721	548	236	312
37	Panapukur	648	334	314	1	0	1	3745	2006	1739	2025	909	1116
38	Hogaldara	1473	742	731	2	1	1	1064	591	473	446	172	274
39	Suk Pukuria	785	390	395	0	0	0	590	327	263	195	63	132
40	Kalikapur	1486	777	709	13	7	6	1660	901	759	344	131	213
41	Tardaha Kapasati	7038	3503	3535	2560	1305	1255	6380	3675	2705	5489	2285	3204
42	Kharki	1061	530	531	171	81	90	874	476	398	414	160	254
43	Chalta Beria	368	183	185	0	0	0	2546	1323	1223	1621	767	854
44	Chak Maricha	0	0	0	0	0	0	2560	1366	1194	1430	676	754
45	Kghodhati	3116	1559	1557	166	80	86	2296	1290	1006	1323	540	783
46	Bhatipota	1041	524	517	0	0	0	2250	1211	1039	1133	511	622
47	Krolbaria	1939	990	949	19	10	9	2397	1344	1053	1180	512	668
48	Ghunimeghi	1292	639	653	20	11	9	2758	1481	1277	1393	632	761

49	Maricha	357	189	168	141	75	66	2246	1216	1030	879	392	487
50	Karaidandga	1114	565	549	0	0	0	739	416	323	406	168	238
51	Gangapur	2314	1190	1124	10	4	6	1426	822	604	1485	683	802
52	Goalapota	184	93	91	3	2	1	100	54	46	88	41	47
53	Chak Barali	23	15	8	0	0	0	3919	2145	1774	2059	964	1095
54	Deara	2876	1444	1432	122	62	60	2261	1283	978	891	299	592
55	Nalmuri	15	11	4	0	0	0	2089	1104	985	1322	631	691
56	Serpur	230	124	106	0	0	0	477	266	211	353	160	193
57	Narayanpur	0	0	0	0	0	0	1075	589	486	266	90	176
58	Kharamba	1212	636	576	0	0	0	2671	1483	1188	1920	869	1051
59	Kumar Pukuria	58	28	30	587	296	291	443	234	209	213	96	117
60	Bairampur	0	0	0	0	0	0	1316	687	629	702	355	347
61	Kheadaha	1632	829	803	71	35	36	1291	730	561	639	255	384
62	Jagulgachhi	1566	823	743	4	3	1	1857	1036	821	1069	476	593
63	Tardaha	2552	1302	1250	1103	575	528	2758	1595	1163	1948	796	1152
64	Dakshin Gazipur	155	80	75	0	0	0	520	279	241	144	71	73

65	Malancha	438	231	207	0	0	0	1309	700	609	825	383	442
66	Padma Pukuria	220	119	101	0	0	0	2380	1262	1118	1527	735	792
67	Bagbaria Narayanpur	539	282	257	0	0	0	374	216	158	335	144	191
68	Tihuria	3337	1770	1567	9	6	3	2764	1602	1162	1009	413	596
69	Saitgachhi	382	199	183	0	0	0	1047	572	475	502	226	276
70	Rani Gachhi	637	337	300	0	0	0	2731	1486	1245	1534	709	825
71	Ushpara	1500	738	762	0	0	0	1720	928	792	1490	698	792
72	Andulgari	2192	1190	1002	88	48	40	1752	1079	673	850	384	466
73	Mousal	1596	829	767	5	2	3	1115	647	468	516	202	314
74	Dara	620	337	283	0	0	0	763	443	320	506	217	289
75	Saihati	0	0	0	0	0	0	804	441	363	378	163	215
76	Chak Bhika	0	0	0	0	0	0	1061	587	474	573	268	305
77	Madhabpur	698	374	324	0	0	0	485	299	186	229	84	145
78	Balipur	0	0	0	0	0	0	997	541	456	552	251	301
79	Amreswar	389	223	166	0	0	0	1780	1027	753	1119	484	635

80	Shaksahar	226	115	111	0	0	0	2355	1296	1059	1343	603	740
81	Bazarati	0	0	0	0	0	0	1351	749	602	796	360	436
82	Taldighi	0	0	0	0	0	0	1342	722	620	986	470	516
83	Bangoda	711	376	335	0	0	0	1220	661	559	690	314	376
84	Jhungri	0	0	0	0	0	0	1620	904	716	686	298	388
85	Karunarhati	730	384	346	0	0	0	1282	734	548	866	383	483
86	Kashia Danga	837	416	421	0	0	0	1958	1064	894	978	413	565
87	Dari Madhabpur	0	0	0	0	0	0	3582	1918	1664	2974	1451	1523
88	Samukpota	1928	970	958	0	0	0	1236	703	533	785	311	474
89	Bausahar	258	125	133	0	0	0	1708	940	768	927	394	533
90	Pratapnagar	1845	968	877	0	0	0	1787	1018	769	998	420	578
91	Dharmatala	662	353	309	0	0	0	514	296	218	157	64	93
92	Garal	1602	819	783	0	0	0	1022	601	421	725	299	426
93	Kamar Hati	715	378	337	0	0	0	763	426	337	543	249	294
94	Mahes Pukuria	420	217	203	1	1	0	403	227	176	222	93	129

95	Kasinagar	539	283	256	0	0	0	357	216	141	182	67	115
96	Narayantala	139	65	74	0	0	0	1910	1050	860	737	319	418
97	Dhapa Manpur (P)	593	279	314	1	1	0	366	199	167	410	170	240
98	Kasinathpur	400	191	209	11	5	6	1609	863	746	557	252	305
99	Kalikapur	769	412	357	0	0	0	1175	652	523	491	226	265
100	Bagu	1409	735	674	0	0	0	1141	635	506	294	115	179
101	Nawabad	2058	1061	997	0	0	0	1637	916	721	640	264	376
102	Jhalgachhi	331	175	156	0	0	0	1095	590	505	546	287	259
103	Chakpachuria	3299	1653	1646	54	29	25	3116	1699	1417	1908	866	1042
104	Ganragari	973	487	486	1	1	0	1326	698	628	581	246	335
105	Patharghata	3759	1891	1868	16	9	7	5682	3090	2592	2357	1020	1337
106	Hudarait	1741	892	849	0	0	0	1538	871	667	831	335	496

107	Baligari	339	191	148	14	10	4	698	391	307	327	149	178
108	Chhapna	49	24	25	13	7	6	1785	909	876	734	367	367
109	Akandakeshari	2750	1395	1355	0	0	0	2101	1155	946	746	290	456
110	Radhanagar (CT)	5298	2649	2649	9	7	2	4302	2411	1891	2373	964	1409
111	Bhangar Raghunathpur (CT)	145	80	65	11	2	9	3875	2047	1828	2162	978	1184
112	Kulberia (CT)	1724	875	849	65	30	35	5675	2983	2692	1318	560	758
113	Maricha (CT)	0	0	0	0	0	0	3161	1718	1443	1681	738	943
Total		**11620**	**59385**	**57235**	**7042**	**3550**	**3492**	**23884 6**	**13062 8**	**10821 8**	**13260 3**	**6013 1**	**7247 2**

(Source: As per Census Data, 2011)

3.6.8 Occupational Structure

Occupational structure of the population in the 10 km study area of the proposed project has been studied with reference to the total workers and non-workers. Total workers have been grouped into two categories of main workers and marginal workers. Main workers and marginal workers in turn can be further grouped into four categories namely cultivators, agricultural labourers, household workers and other workers.

3.6.8.1 Total Workers

The number of total workers in the study area are 1,27,605 or 34.35% of the total population out of which 1,07,832 (84.50%) are male workers and 19,773 (15.50%) are female workers. Total workers are further divided into main workers and marginal workers –

1. Main Workers

Total number of main workers in the 10 km study area are 1,01,487 people or 79.53% of total workers, out of which 91,293 (89.96%) are male main workers and 10,194 (10.04%) are female main workers.

i. Cultivators

Total main cultivators in the 10 km study area are 23,276 people which is 22.93% of main workers population.

ii. Agricultural Labourers

Total main agricultural labourers in the 10 km study area are 19,743 people which is 19.45% of main workers population.

iii. Household Industry Labourers

Total main household industry labourers in the 10 km study area are 4,759 people which is 8.45% of main workers population.

iv. Other Workers

Total main other workers in the 10 km study area are 51,600 people which is 50.84% of main workers population.

2. Marginal Workers

Total number of marginal workers in the 10 km study area are 26,118 people or 20.47% of total workers, out of which 16,539 (63.32%) are male marginal workers and 9,579 (36.68%) are female marginal workers.

i. Cultivators

Total main cultivators in the 10 km study area are 2,975 people which is 11.39% of main workers population.

ii. Agricultural Labourers

Total main agricultural labourers in the 10 km study area are 9,674 people which is 37.04% of main workers population.

iii. Household Industry Labourers

Total main household industry labourers in the 10 km study area are 2,208 people which is 8,45% of main workers population.

iv. Other Workers

Total main other workers in the 10 km study area are 11,261 people which is 43.12% of main workers population.

3.6.8.2 Non Workers

Total number of non workers in the 10 km study area are 2,43,844 people or 65.65% of total workers, out of which 82,927 (34.01%) are male non workers and 16,0917 (65.99%) are female non workers.

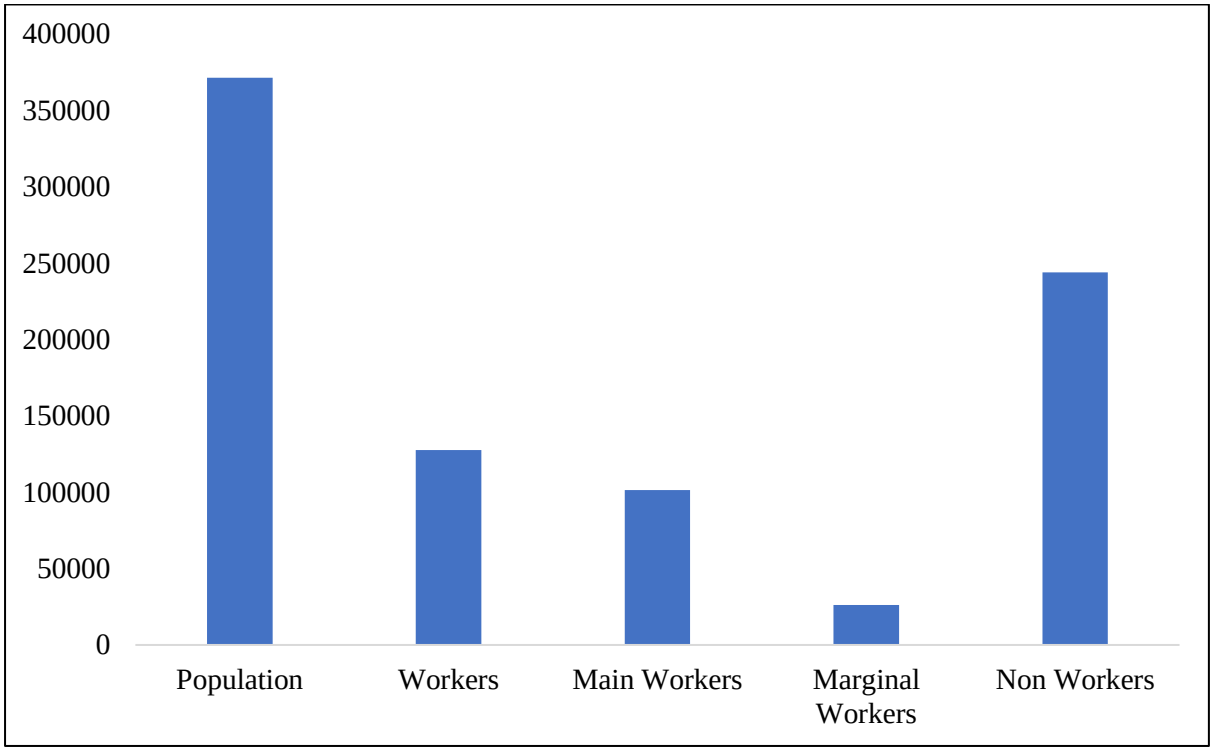


Figure 3.30 – Worker Distribution within the Study Area

A detailed breakup of the occupational structure within the 10 km study area of the proposed project is given in **Table 3.27**, **Figure 3.31** and **Table 3.28**.

Table 3.27– Occupational Pattern of the Study Area

S. No.	Parameter		Detail		
1	**Population**	**Total**	**371449**		
		Male	190759		
		Female	180690		
2	**Workers**	**Total**	**127605**	**34.35**	**% of total population**
		Male	107832	84.50	% of workers
		Female	19773	15.50	% of workers
3	**Main Workers**	**Total**	**101487**	**79.53**	**% of total workers**
		Male	91293	89.96	% of main workers
		Female	10194	10.04	% of main workers
		Cultivators	23276	22.93	% of main workers
		Agricultural Labourers	19743	19.45	% of main workers
		Household Industry Workers	4759	4.69	% of main workers
		Others	51600	50.84	% of main workers
4	**Marginal Workers**	**Total**	**26118**	**20.47**	**% of total workers**
		Male	16539	63.32	% of marginal workers
		Female	9579	36.68	% of marginal workers
		Cultivators	2975	11.39	% of marginal workers
		Agricultural Labourers	9674	37.04	% of marginal workers
		Household Industry Workers	2208	8.45	% of marginal workers
		Others	11261	43.12	% of marginal workers
5	**Non Workers**	**Total**	**243844**	**65.65**	**% of total population**
		Male	82927	34.01	% of non workers
		Female	160917	65.99	% of workers

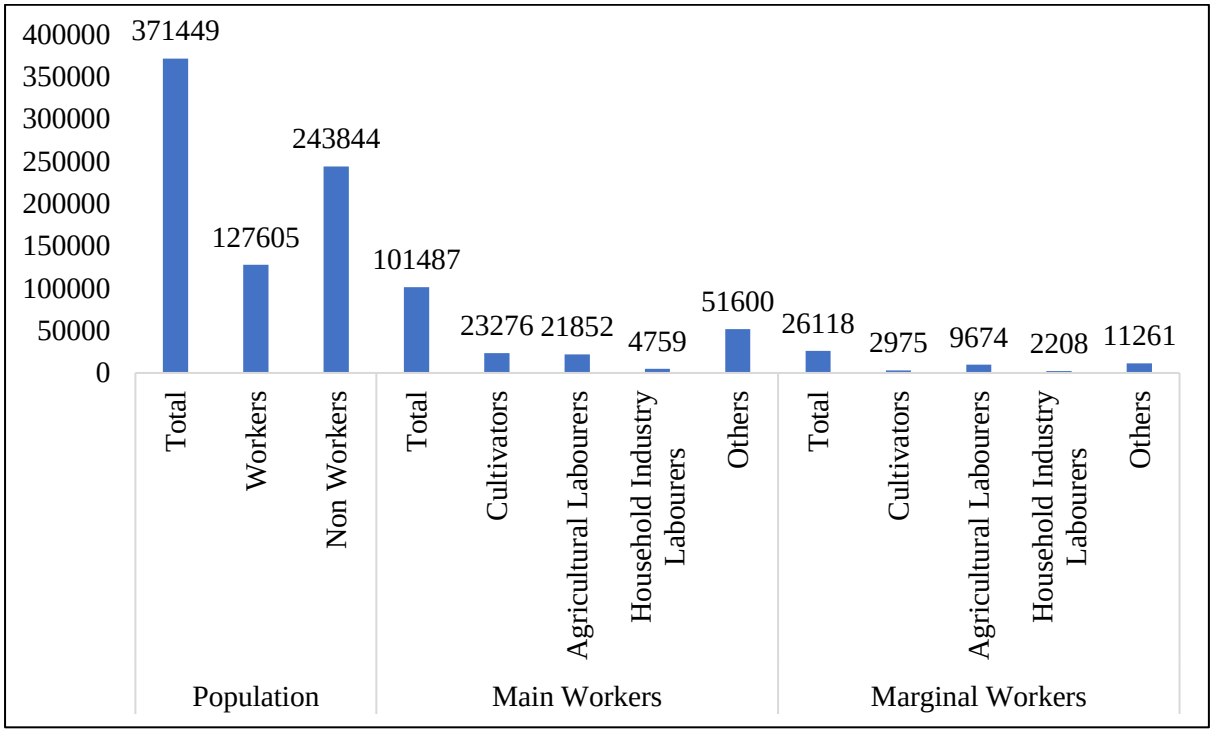


Figure 3.31 – Occupational Pattern in the Study Area

Table 3.28 – Occupational Structure of the Study Area

S. No.	Name	Population			Main Workers					Marginal Workers				
		Total	Workers	Non Workers	Total	Cultivators	Agricultural Labourers	Household Industry Labourers	Others	Total	Cultivators	Agricultural Labourers	Household Industry Labourers	Others
1	Anantapur	3140	1022	2118	775	111	191	37	436	247	6	166	9	66
2	Naoabad	571	272	299	161	19	38	0	104	111	6	41	1	63
3	Uttar Kasipur	10782	3842	6940	3154	703	596	158	1697	688	93	162	59	374
4	Swastayan Gachhi	6966	2178	4788	1891	483	641	30	737	287	18	144	15	110
5	Jot Bhim	1859	584	1275	489	17	54	8	410	95	3	36	4	52
6	Koch Pukur	2598	792	1806	710	43	122	90	455	82	16	9	4	53
7	Majerhat	7797	2627	5170	2238	793	608	160	677	389	52	140	38	159
8	Pitha Pukuria	11078	3235	7843	2817	814	901	125	977	418	40	216	49	113

9	Tara Hadia	1390	501	889	412	97	62	14	239	89	0	62	2	25
10	Saduli	4230	1407	2823	1267	816	91	92	268	140	38	36	10	56
11	Dakshin Khayerpur	657	198	459	169	19	13	4	133	29	2	7	1	19
12	Hat Gachha	5882	2356	3526	1803	362	312	21	1108	553	80	236	21	216
13	Dharmatala Pachuria	5789	1937	3852	1533	378	262	39	854	404	44	173	20	167
14	Abua	1766	532	1234	435	84	70	5	276	97	14	14	8	61
15	Bhaga Banpur	3376	1128	2248	856	213	317	9	317	272	14	40	5	213
16	Kulberia	3787	1282	2505	883	441	180	27	235	399	60	156	49	134
17	Nangalbeki	1653	471	1182	438	197	132	4	105	33	3	9	3	18
18	Hatisala	3810	1119	2691	939	283	499	11	146	180	9	96	3	72
19	Jiran Gachhi	5193	1566	3627	1328	356	250	60	662	238	48	86	9	95
20	Bamunia	15582	5336	10246	4241	1166	1476	268	1331	1095	158	318	98	521
21	Sonpur	3323	1364	1959	984	138	127	31	688	380	16	44	24	296
22	Chandakanthal Beria	1229	373	856	276	59	75	3	139	97	2	74	0	21
23	Uttar Narikel Beria	1935	642	1293	576	202	110	25	239	66	23	29	3	11
24	Rampur	1427	441	986	236	49	102	11	74	205	15	128	7	55
25	Hadia	7921	3267	4654	2467	601	631	49	1186	800	35	310	8	447
26	Uttar Kathalia	8628	2777	5851	2287	451	532	120	1184	490	40	110	75	265
27	Sanpukuria	2654	858	1796	661	104	132	90	335	197	9	57	46	85
28	Kachua	3648	1389	2259	984	324	194	146	320	405	96	129	49	131
29	Nimkuria	5604	2184	3420	1529	290	228	260	751	655	51	362	86	156
30	Wari	3057	961	2096	832	241	150	30	411	129	12	37	9	71

31	Dheati	610	192	418	81	21	12	0	48	111	6	68	0	37
32	Benota	7850	3072	4778	2163	883	712	33	535	909	37	683	59	130
33	Uttar Rajapur	1464	460	1004	415	266	32	7	110	45	34	7	0	4
34	Paikan	2007	582	1425	379	65	28	15	271	203	7	148	5	43
35	Chariswar	4097	1413	2684	1135	303	179	140	513	278	41	93	14	130
36	Jawpur	2134	763	1371	691	254	44	48	345	72	5	7	9	51
37	Panapukur	5770	2003	3767	1567	264	289	130	884	436	24	97	54	261
38	Hogaldara	1510	509	1001	293	142	84	2	65	216	30	143	1	42
39	Suk Pukuria	785	251	534	237	45	113	0	79	14	1	10	0	3
40	Kalikapur	2004	623	1381	415	43	39	15	318	208	25	89	10	84
41	Tardaha Kapasati	11869	4174	7695	3470	525	1640	25	1280	704	56	253	15	380
42	Kharki	1288	529	759	312	15	1	4	292	217	4	37	0	176
43	Chalta Beria	4167	1529	2638	1102	164	246	483	209	427	37	115	226	49
44	Chak Maricha	3990	1429	2561	1169	276	427	210	256	260	52	113	12	83
45	Kghodhati	3619	1332	2287	940	211	168	14	547	392	86	157	12	137
46	Bhatipota	3383	1003	2380	900	388	54	6	452	103	24	20	4	55
47	Krolbaria	3577	1461	2116	1157	274	196	60	627	304	46	60	48	150
48	Ghunimeghi	4151	1481	2670	1178	272	215	13	678	303	56	26	21	200
49	Maricha	3125	1264	1861	905	257	360	3	285	359	75	106	1	177
50	Karaidandga	1145	369	776	139	4	5	0	130	230	51	101	0	78
51	Gangapur	2911	1032	1879	914	66	98	5	745	118	26	12	1	79
52	Goalapota	188	86	102	41	15	9	1	16	45	12	18	4	11
53	Chak Barali	5978	1888	4090	1762	175	183	55	1349	126	16	14	17	79
54	Deara	3152	1127	2025	743	137	145	20	441	384	40	77	6	261

55	Nalmuri	3411	1218	2193	1092	175	152	9	756	126	11	10	1	104
56	Serpur	830	233	597	186	27	20	5	134	47	6	14	4	23
57	Narayanpur	1341	452	889	437	3	52	3	379	15	1	6	0	8
58	Kharamba	4591	1475	3116	1312	397	96	11	808	163	52	22	18	71
59	Kumar Pukuria	656	442	214	397	369	16	3	9	45	18	21	0	6
60	Bairampur	2018	636	1382	601	211	109	10	271	35	7	20	1	7
61	Kheadaha	1930	771	1159	501	111	153	5	232	270	22	71	7	170
62	Jagulgachhi	2926	984	1942	809	229	147	9	424	175	15	28	2	130
63	Tardaha	4706	2010	2696	943	535	131	18	259	1067	286	546	88	147
64	Dakshin Gazipur	664	226	438	210	33	13	2	162	16	5	4	0	7
65	Malancha	2134	884	1250	638	305	145	5	183	246	12	199	0	35
66	Padma Pukuria	3907	1211	2696	871	231	137	57	446	340	27	94	11	208
67	Bagbaria Narayanpur	709	276	433	253	20	7	9	217	23	0	3	5	15
68	Tihuria	3773	1455	2318	1170	320	287	32	531	285	29	176	8	72
69	Saitgachhi	1549	560	989	478	148	79	34	217	82	14	7	6	55
70	Rani Gachhi	4265	1259	3006	1170	346	440	47	337	89	38	21	6	24
71	Ushpara	3210	943	2267	721	196	244	11	270	222	27	41	4	150
72	Andulgari	2602	1003	1599	823	235	42	10	536	180	20	140	3	17
73	Mousal	1631	547	1084	472	106	171	6	189	75	25	31	1	18
74	Dara	1269	400	869	373	61	182	0	130	27	10	5	0	12
75	Saihati	1182	426	756	357	71	73	25	188	69	7	15	1	46
76	Chak Bhika	1634	514	1120	499	218	215	17	49	15	8	5	0	2
77	Madhabpur	714	222	492	198	56	125	4	13	24	1	14	1	8

78	Balipur	1549	488	1061	369	36	205	10	118	119	4	59	4	52
79	Amreswar	2899	920	1979	714	424	101	14	175	206	49	122	3	32
80	Shaksahar	3698	1358	2340	1083	111	248	139	585	275	25	72	51	127
81	Bazarati	2147	759	1388	620	95	426	3	96	139	19	111	1	8
82	Taldighi	2328	644	1684	606	123	214	4	265	38	11	8	0	19
83	Bangoda	1910	628	1282	418	165	116	10	127	210	6	126	50	28
84	Jhungri	2306	926	1380	691	132	132	65	362	235	16	32	95	92
85	Karunarhati	2148	848	1300	533	264	80	8	181	315	47	197	11	60
86	Kashia Danga	2936	934	2002	582	196	128	6	252	352	9	320	0	23
87	Dari Madhabpur	6556	2129	4427	1684	332	563	28	761	445	42	197	90	116
88	Samukpota	2021	627	1394	456	44	254	2	156	171	62	73	4	32
89	Bausahar	2635	792	1843	662	158	157	13	334	130	17	80	3	30
90	Pratapnagar	2785	1010	1775	733	61	31	25	616	277	16	91	8	162
91	Dharmatala	671	398	273	98	20	33	4	41	300	8	102	153	37
92	Garal	1747	658	1089	534	35	103	12	384	124	1	27	1	95
93	Kamar Hati	1306	497	809	335	73	78	7	177	162	19	11	22	110
94	Mahes Pukuria	625	187	438	155	62	38	10	45	32	3	19	1	9
95	Kasinagar	539	194	345	101	15	42	7	37	93	8	58	6	21
96	Narayantala	2647	796	1851	675	18	24	12	621	121	6	53	3	59
97	Dhapa Manpur (P)	776	347	429	227	19	34	7	167	120	13	12	2	93
98	Kasinathpur	2166	663	1503	661	115	42	10	494	2	0	0	0	2
99	Kalikapur	1666	528	1138	503	168	112	2	221	25	3	12	0	10

100	Bagu	1435	465	970	459	228	48	29	154	6	2	1	0	3
101	Nawabad	2277	678	1599	662	200	162	26	274	16	1	6	5	4
102	Jhalgachhi	1641	533	1108	529	112	84	4	329	4	0	2	0	2
103	Chakpachuria	5024	1459	3565	1092	25	50	44	973	367	29	29	79	230
104	Ganragari	1907	575	1332	551	132	94	5	320	24	3	3	1	17
105	Patharghata	8039	2451	5588	2201	64	312	35	1790	250	7	32	13	198
106	Hudarait	2369	730	1639	543	169	23	14	337	187	8	170	2	7
107	Baligari	1025	341	684	281	136	17	1	127	60	3	5	24	28
108	Chhapna	2519	708	1811	685	11	29	20	625	23	3	4	1	15
109	Akandakeshari	2847	889	1958	622	76	0	5	541	267	34	0	2	231
110	Radhanagar (CT)	6675	2547	4128	1777	76	222	50	1429	770	42	181	24	523
111	Bhangar Raghunathpur (CT)	6037	2081	3956	1831	47	181	226	1377	250	10	50	78	112
112	Kulberia (CT)	6993	2571	4422	2371	0	5	78	2288	200	6	2	18	174
113	Maricha (CT)	4842	1886	2956	1453	12	53	276	1112	433	8	33	52	340
Total		**371449**	**127605**	**243844**	**101487**	**23276**	**21852**	**4759**	**51600**	**26118**	**2975**	**9674**	**2208**	**11261**

(Source: As per Census Data, 2011)

3.6.9 Infrastructural Facilities and Amenities

The following section provides a detail account of various amenities and infrastructure facilities available to the villages/town present within the 10 km study area of the proposed project.

1. **Medical Facilities**

   According to the Census 2011, there are 162 medical facilities, 336 non-government medical facilities and 5 veterinary facilities available within the study area.

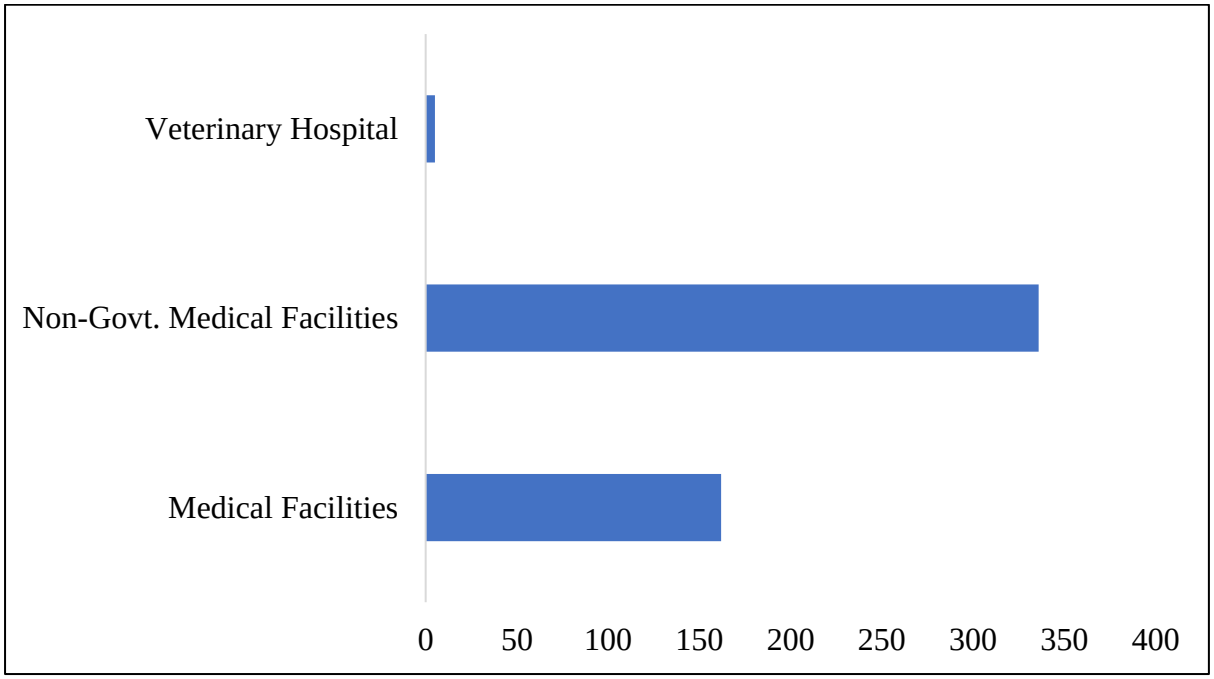


Figure 3.32 – Medical Facilities in the Study Area

2. **Educational Facilities**

   According to the Census 2011, there are 171 Govt. Pre-Primary Schools, 29 Private Pre-Primary Schools (Nursery/LKG/UKG), 176 Govt. Primary Schools, 13Private Primary Schools, 47 Govt. Middle Schools, 7Private Middle Schools, 21 Govt. Secondary Schools, 2 Private Secondary Schools, 15Govt. Senior Secondary Schools, 2 Private Senior Secondary Schools, 2 Govt. Vocational Training Schools/ITI, 1 Private Vocational Training School/ITI, 1 Govt. Polytechnic and 1 Govt. College.

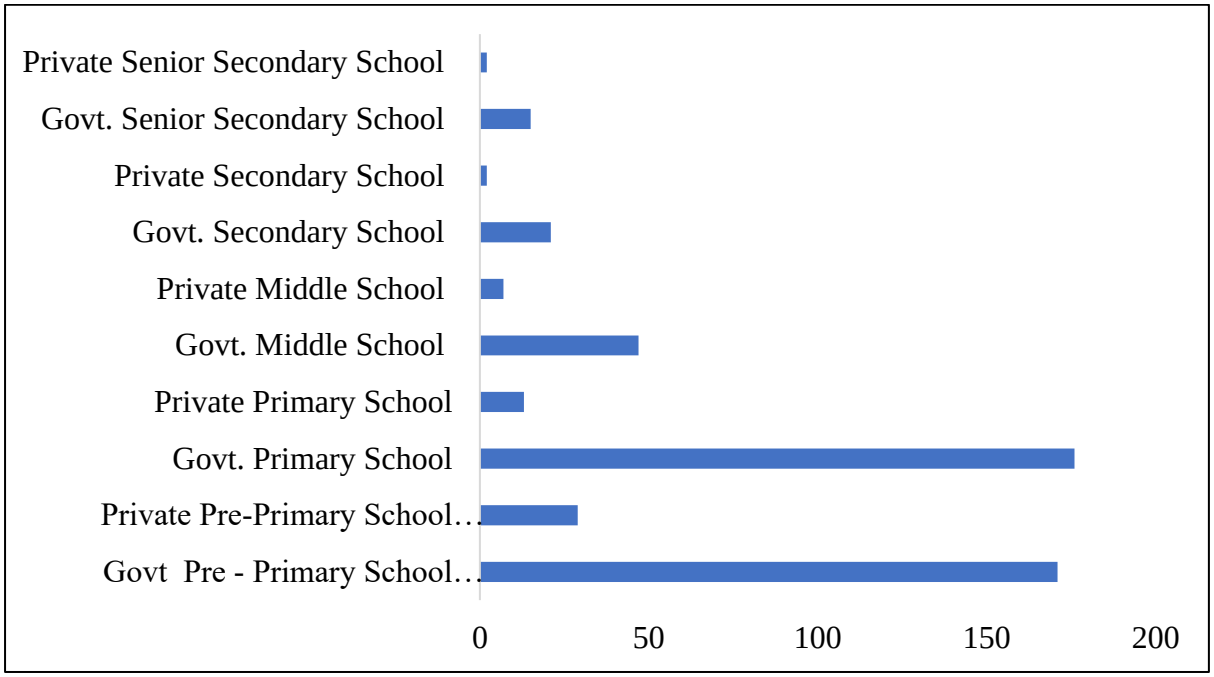


Figure 3.33 – Educational Institutes in the Study Area

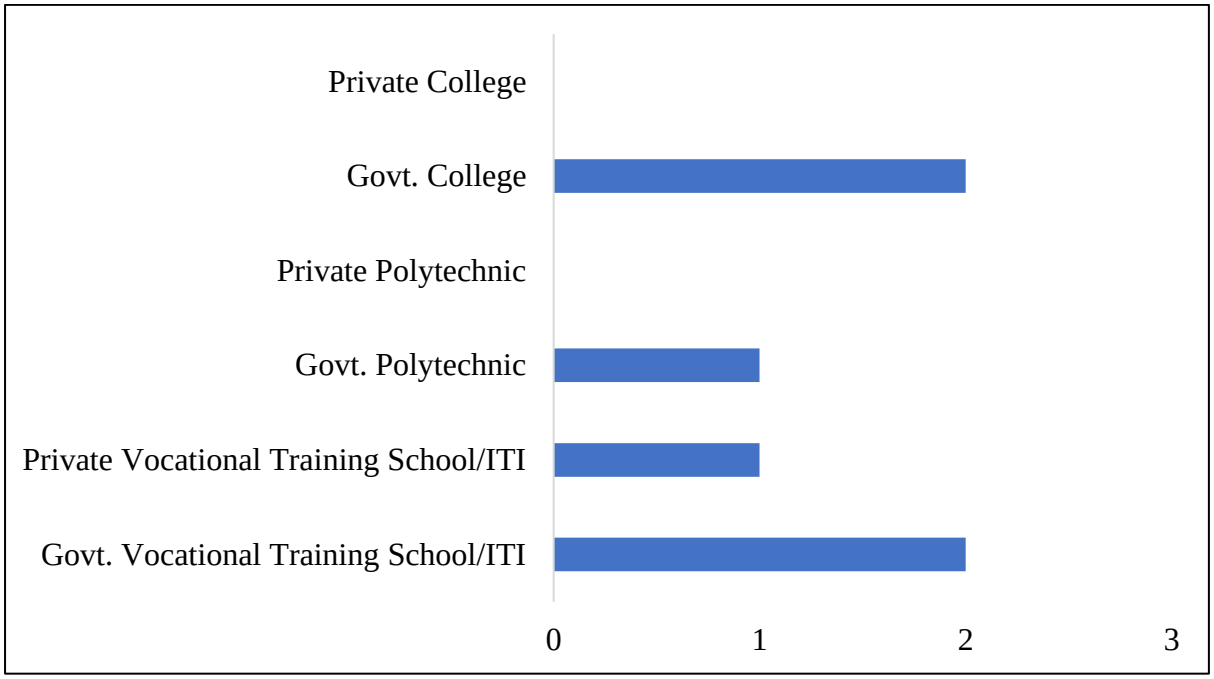


Figure 3.34 – Higher Educational Institutes in the Study Area

Table 3.29 – Amenities Available Within the Study Area

S. No.	Village/Town Name	Tap Water-Treated Functioning All round the year	Hand Pump Functioning All round the year	Tubewell Functioning All round the year	Closed Drainage	Open Drainage	Area Covered under Total Sanitation Campaign	Post Office	Sub Post Office	Mobile Phone Coverage	Internet Cafes/Common Service Centre	Public Bus Service	Private Bus Service	Railway Station
1	Anantapur	N/A	A	A	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A
2	Naoabad	N/A	A	N/A	N/A	A	A	N/A	N/A	A	N/A	N/A	N/A	N/A
3	Uttar Kasipur	N/A	A	N/A	N/A	N/A	A	N/A	N/A	A	A	N/A	A	N/A
4	Swastayan Gachhi	N/A	A	A	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A
5	Jot Bhim	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A
6	Koch Pukur	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	N/A	N/A	N/A
7	Majerhat	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A	A
8	Pitha Pukuria	N/A	N/A	N/A	N/A	N/A	A	N/A	A	A	A	N/A	N/A	N/A
9	Tara Hadia	N/A	N/A	A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

10	Saduli	A	A	A	N/A	N/A	N/A	A	N/A	A	N/A	N/A	N/A	N/A
11	Dakshin Khayerpur	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A
12	Hat Gachha	N/A	A	A	N/A	A	N/A	N/A	A	A	N/A	N/A	N/A	N/A
13	Dharmatala Pachuria	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A
14	Abua	N/A	N/A	A	N/A	A	N/A	A	N/A	A	A	A	A	N/A
15	Bhaga Banpur	N/A	A	A	N/A	A	N/A	N/A	N/A	A	A	N/A	N/A	N/A
16	Kulberia	N/A	A	N/A	N/A	N/A	A	A	N/A	A	N/A	N/A	N/A	N/A
17	Nangalbeki	N/A	A	A	A	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A
18	Hatisala	N/A	A	A	N/A	A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A
19	Jiran Gachhi	N/A	A	A	N/A	N/A	A	N/A	N/A	A	N/A	N/A	N/A	N/A
20	Bamunia	N/A	A	A	N/A	A	A	A	N/A	A	N/A	N/A	N/A	N/A
21	Sonpur	N/A	A	A	N/A	A	N/A	N/A	A	A	A	N/A	A	N/A
22	Chandakanthal Beria	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
23	Uttar Narikel Beria	A	A	A	A	A	N/A	A	A	A	N/A	N/A	N/A	N/A
24	Rampur	N/A	A	N/A	N/A	N/A	A	N/A	N/A	A	A	N/A	N/A	N/A
25	Hadia	N/A	A	N/A	N/A	N/A	A	A	N/A	A	N/A	N/A	N/A	N/A

26	Uttar Kathalia	N/A	A	N/A	N/A	A	A	N/A	N/A	A	A	N/A	A	N/A
27	Sanpukuria	N/A	A	A	A	A	A	A	A	N/A	A	N/A	N/A	N/A
28	Kachua	N/A	A	A	N/A	N/A	A	N/A	N/A	A	N/A	N/A	N/A	N/A
29	Nimkuria	N/A	A	N/A	N/A	N/A	A	N/A	N/A	A	A	N/A	N/A	N/A
30	Wari	N/A	A	A	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A
31	Dheati	N/A	A	A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
32	Benota	N/A	A	N/A	N/A	N/A	N/A	N/A	A	A	N/A	N/A	N/A	N/A
33	Uttar Rajapur	N/A	A	A	N/A	A	A	N/A	N/A	A	N/A	N/A	N/A	N/A
34	Paikan	N/A	A	N/A	N/A	A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A
35	Chariswar	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	N/A	A	A	N/A
36	Jawpur	N/A	A	A	N/A	A	A	A	N/A	A	N/A	N/A	N/A	N/A
37	Panapukur	N/A	A	A	N/A	A	A	N/A	N/A	A	A	N/A	N/A	N/A
38	Hogaldara	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
39	Suk Pukuria	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A
40	Kalikapur	N/A	A	N/A	N/A	A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A
41	Tardaha Kapasati	N/A	A	N/A	N/A	A	A	N/A	A	A	A	A	A	N/A
42	Kharki	A	A	A	N/A	A	A	N/A	N/A	A	N/A	N/A	N/A	N/A
43	Chalta Beria	N/A	A	A	N/A	N/A	N/A	N/A	A	A	N/A	N/A	N/A	N/A
44	Chak Maricha	N/A	A	A	N/A	A	A	N/A	N/A	A	N/A	N/A	N/A	N/A

45	Kghodhati	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A
46	Bhatipota	N/A	A	N/A	N/A	A	A	N/A	A	A	N/A	A	A	N/A
47	Krolbaria	N/A	A	A	N/A	N/A	N/A	A	N/A	A	N/A	A	A	N/A
48	Ghunimeghi	N/A	A	A	N/A	A	A	N/A	A	A	A	A	A	N/A
49	Maricha	A	A	A	N/A	A	A	N/A	N/A	A	N/A	N/A	N/A	N/A
50	Karaidandga	N/A	A	N/A	N/A	N/A	A	N/A	N/A	A	N/A	A	A	N/A
51	Gangapur	N/A	A	N/A	N/A	N/A	A	N/A	N/A	A	N/A	A	A	N/A
52	Goalapota	N/A	N/A	N/A	N/A	A	N/A	N/A	A	A	N/A	N/A	N/A	N/A
53	Chak Barali	N/A	A	N/A	N/A	A	A	N/A	A	A	N/A	A	A	N/A
54	Deara	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A
55	Nalmuri	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	A	N/A	A	A	N/A
56	Serpur	A	A	A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
57	Narayanpur	A	A	N/A	N/A	A	A	A	N/A	A	N/A	A	A	N/A
58	Kharamba	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A
59	Kumar Pukuria	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A
60	Bairampur	N/A	A	A	N/A	A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A
61	Kheadaha	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A
62	Jagulgachhi	N/A	A	A	N/A	A	N/A	N/A	N/A	A	N/A	A	A	N/A
63	Tardaha	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A

64	Dakshin Gazipur	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	N/A
65	Malancha	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A
66	Padma Pukuria	N/A	A	A	N/A	A	A	N/A	N/A	A	N/A	N/A	N/A	N/A
67	Bagbaria Narayanpur	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A
68	Tihuria	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A
69	Saitgachhi	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	A	N/A
70	Rani Gachhi	N/A	A	A	N/A	A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A
71	Ushpara	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A
72	Andulgari	N/A	A	N/A	N/A	N/A	A	N/A	N/A	A	N/A	N/A	N/A	N/A
73	Mousal	N/A	A	N/A	N/A	A	A	N/A	N/A	A	N/A	N/A	N/A	N/A
74	Dara	N/A	A	A	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A
75	Saihati	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	A	N/A	A	A	N/A
76	Chak Bhikan	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A
77	Madhabpur	N/A	A	A	N/A	A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A
78	Balipur	N/A	A	N/A	N/A	A	A	N/A	N/A	A	N/A	N/A	N/A	N/A
79	Amreswar	N/A	A	N/A	N/A	A	A	N/A	N/A	A	N/A	N/A	N/A	N/A
80	Shaksahar	N/A	A	A	N/A	N/A	A	A	N/A	A	A	N/A	N/A	N/A
81	Bazarati	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

82	Taldighi	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
83	Bangoda	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
84	Jhungri	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
85	Karunarhati	A	A	N/A	N/A	A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A
86	Kashia Danga	A	A	N/A	N/A	A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A
87	Dari Madhabpur	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
88	Samukpota	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A
89	Bausahar	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
90	Pratapnagar	N/A	A	N/A	N/A	A	N/A	N/A	N/A	A	N/A	N/A	A	N/A
91	Dharmatala	N/A	A	A	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A
92	Garal	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A
93	Kamar Hati	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A
94	Mahes Pukuria	N/A	A	N/A	N/A	A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A
95	Kasinagar	A	A	N/A	N/A	A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A
96	Narayantala	A	A	N/A	N/A	A	A	N/A	N/A	A	N/A	A	A	N/A
97	Dhapa Manpur (P)	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
98	Kasinathpur	N/A	A	N/A	N/A	A	A	N/A	A	N/A	N/A	A	A	N/A
99	Kalikapur	N/A	A	N/A	A	A	A	N/A	N/A	N/A	N/A	A	A	N/A

100	Bagun	N/A	A	A	N/A	A	N/A	N/A	N/A	A	N/A	A	A	N/A
101	Nawabad	N/A	N/A	N/A	N/A	A	A	N/A	N/A	A	N/A	A	A	N/A
102	Jhalgachhi	N/A	A	A	N/A	A	A	N/A	N/A	A	N/A	N/A	A	N/A
103	Chakpachuria	N/A	A	N/A	N/A	A	A	N/A	A	N/A	N/A	N/A	N/A	N/A
104	Ganragari	A	A	N/A	N/A	A	A	N/A	N/A	N/A	N/A	A	A	N/A
105	Patharghata	A	A	N/A	N/A	A	A	N/A	A	A	A	A	A	N/A
106	Hudarait	N/A	N/A	A	N/A	A	A	N/A	N/A	A	N/A	A	A	N/A
107	Baligari	N/A	A	A	N/A	A	A	N/A	N/A	A	N/A	N/A	N/A	N/A
108	Chhapna	A	A	N/A	N/A	A	A	N/A	A	A	A	A	A	N/A

109	Akandakeshari	N/A	A	N/A	N/A	A	A	N/A	A	N/A	N/A	N/A	N/A	N/A

S. No.	Village/Town Name	National Highway	State Highway	Major District Road	Other District Road	All Weather Road	Navigable Waterways	ATM	Commercial Bank	Cooperative Bank	Agricultural Credit Societies	Sports Field	Power Supply For Domestic Use	
1	Anantapur	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	A	
2	Naoabad	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	
3	Uttar Kasipur	N/A	N/A	A	A	A	N/A	N/A	A	N/A	N/A	N/A	A	
4	Swastayan Gachhi	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	
5	Jot Bhim	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	A	A	
6	Koch Pukur	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	
7	Majerhat	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	A	A	
8	Pitha Pukuria	N/A	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	
9	Tara Hadia	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	
10	Saduli	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	A	A	

11	Dakshin Khayerpur	N/A	N/A	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A
12	Hat Gachha	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A
13	Dharmatala Pachuria	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A
14	Abua	N/A	N/A	A	N/A	A	N/A	N/A	A	N/A	N/A	A	A
15	Bhaga Banpur	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A
16	Kulberia	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A
17	Nangalbeki	N/A	N/A	A	N/A	A	N/A	N/A	N/A	N/A	N/A	A	A
18	Hatisala	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A
19	Jiran Gachhi	N/A	N/A	N/A	N/A	A	A	N/A	N/A	N/A	N/A	N/A	A
20	Bamunia	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	A
21	Sonpur	N/A	N/A	A	A	A	A	N/A	A	N/A	N/A	A	A
22	Chandakanthal Beria	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A
23	Uttar Narikel Beria	N/A	N/A	A	N/A	A	N/A	A	N/A	N/A	N/A	A	A
24	Rampur	N/A	N/A	N/A	A	A	N/A	N/A	N/A	N/A	N/A	A	A
25	Hadia	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	A	N/A	A	A
26	Uttar Kathalia	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A

27	Sanpukuria	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A
28	Kachua	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	A
29	Nimkuria	N/A	N/A	A	A	A	N/A	N/A	N/A	N/A	N/A	A	A
30	Wari	N/A	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A
31	Dheati	N/A	N/A	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A
32	Benota	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A
33	Uttar Rajapur	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A
34	Paikan	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	A
35	Chariswar	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	A
36	Jawpur	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A
37	Panapukur	N/A	N/A	A	A	A	N/A	N/A	A	N/A	A	A	A
38	Hogaldara	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A
39	Suk Pukuria	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	A	A
40	Kalikapur	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A
41	Tardaha Kapasati	N/A	A	N/A	A	A	N/A	N/A	A	N/A	A	N/A	A
42	Kharki	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	A	N/A	A	A
43	Chalta Beria	N/A	N/A	N/A	A	A	A	N/A	N/A	N/A	N/A	A	A
44	Chak Maricha	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	A	A
45	Kghodhati	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	A	A

46	Bhatipota	N/A	A	N/A	N/A	A	N/A	N/A	A	N/A	N/A	A	A
47	Krolbaria	N/A	A	N/A	A	N/A	A	N/A	A	N/A	N/A	A	A
48	Ghunimeghi	N/A	A	N/A	A	A	N/A	N/A	A	N/A	N/A	A	A
49	Maricha	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A
50	Karaidandga	N/A	A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	A	A
51	Gangapur	N/A	A	N/A		A	N/A	N/A	A	N/A	N/A	A	A
52	Goalapota	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A
53	Chak Barali	N/A	A	N/A	A	A	A	N/A	N/A	N/A	N/A	N/A	A
54	Deara	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	A	A
55	Nalmuri	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A
56	Serpur	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	A	A
57	Narayanpur	N/A	N/A	N/A	N/A	A	A	N/A	N/A	N/A	N/A	A	A
58	Kharamba	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	A	A
59	Kumar Pukuria	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A
60	Bairampur	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	A	A
61	Kheadaha	N/A	N/A	N/A	N/A	A	N/A	N/A	A	N/A	N/A	A	A
62	Jagulgachhi	N/A	N/A	A	A	A	A	A	A	N/A	N/A	A	A
63	Tardaha	N/A	N/A	N/A	A	A	N/A	N/A	A	N/A	N/A	A	A
64	Dakshin Gazipur	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	A	A

65	Malancha	N/A	N/A	N/A	A	A	N/A	N/A	N/A	N/A	N/A	A	A
66	Padma Pukuria	N/A	N/A	N/A		A	N/A	N/A	N/A	N/A	N/A	A	A
67	Bagbaria Narayanpur	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	A
68	Tihuria	N/A	N/A	N/A	N/A	A	N/A	N/A	A	N/A	N/A	A	A
69	Saitgachhi	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A
70	Rani Gachhi	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	A
71	Ushpara	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	A
72	Andulgari	N/A	N/A	N/A		A	N/A	N/A	N/A	N/A	N/A	A	A
73	Mousal	N/A	N/A	N/A	A	A	N/A	N/A	N/A	N/A	A	A	A
74	Dara	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A
75	Saihati	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A
76	Chak Bhikan	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A
77	Madhabpur	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A
78	Balipur	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A
79	Amreswar	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	A	A
80	Shaksahar	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	A	A
81	Bazarati	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	A
82	Taldighi	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A

83	Bangoda	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	A
84	Jhungri	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	A	N/A	A	A
85	Karunarhati	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	A	A
86	Kashia Danga	N/A	N/A	N/A	A	A	N/A	N/A	N/A	N/A	N/A	A	A
87	Dari Madhabpur	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A
88	Samukpota	N/A	N/A	N/A	A	A	N/A	N/A	N/A	N/A	N/A	A	A
89	Bausahar	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A
90	Pratapnagar	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	A
91	Dharmatala	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	A	A
92	Garal	N/A	N/A	N/A	A	A	N/A	N/A	N/A	N/A	N/A	A	A
93	Kamar Hati	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	A	A
94	Mahes Pukuria	N/A	N/A	N/A	A	A	N/A	N/A	N/A	N/A	N/A	A	A
95	Kasinagar	N/A	N/A	N/A		A	N/A	N/A	N/A	N/A	N/A	A	A
96	Narayantala	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	A
97	Dhapa Manpur (P)	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	A	A
98	Kasinathpur	N/A	N/A	A	A	A	N/A	N/A	A	N/A	A	A	A
99	Kalikapur	N/A	A	A	A	A	N/A	N/A	N/A	N/A	N/A	A	A

100	Bagun	N/A	N/A	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A
101	Nawabad	N/A	N/A	N/A	A	A	N/A	N/A	N/A	N/A	N/A	A	A
102	Jhalgachhi	N/A	N/A	A	N/A	A	N/A	N/A	N/A	N/A	N/A	A	A
103	Chakpachuria	N/A	N/A	A	A	A	N/A	N/A	A	N/A	A	A	A
104	Ganragari	N/A	N/A	A	A	A	N/A	N/A	A	N/A	A	A	A
105	Patharghata	N/A	N/A	A	A	A	N/A	N/A	A	N/A	A	A	A
106	Hudarait	N/A	N/A	N/A	A	A	A	N/A	N/A	N/A	N/A	A	A
107	Baligari	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A
108	Chhapna	N/A	N/A	A	A	A	N/A	N/A	A	N/A	A	A	A

109	Akandakeshari	N/A	N/A	A	A	A	N/A	N/A	A	N/A	A	A	A	

(Source: As per Census Data, 2011)

3.7 Solid Waste

3.7.1 Construction and Demolition Waste

Construction and demolition waste can be defined as waste comprising of building materials, debris and rubble resulting from construction, remodelling, repair and demolition of any civil structure.

The WBPCB vide memo no. 36(1-125)/3S-290/2018 dated 01.02.2018 directed all 125 urban local bodies in the state to ensure compliance with the provisions of Construction and Demolition Management Rules, 2016 and with the subsequent guidelines issued by CPCB and to ensure that the prescribed notice is displayed at construction sites under jurisdiction of each of urban local body.

(Source: WBPCB)

3.7.2 Hazardous Waste

Hazardous waste can be defined as any waste which by reason of characteristics such as physical, chemical, biological, reactive, toxic, flammable, explosive or corrosive, causes danger or is likely to cause danger to health or environment, whether alone or in contact with other wastes or substances.

At present there are more than 900 hazardous waste generating units in West Bengal. There is 1 Common Hazardous Waste TSDF (M/s West Bengal Waste Management Ltd.) located at Purba Srikrishnapur, Haldia, Purba Medinipur that caters all units in the state. M/s West Bengal Waste Management Ltd., was developed jointly by the Haldia Development Authority and M/s Ramky Enviro Engineers Ltd., a Hyderabad based company under a Public Private Partnership. The development was facilitated by the Department of Environment, Government of West Bengal and MoEF&CC, Government of India through financial assistance of Rs. 2 crores each. The facility started operation in the year 2006 and has an incinerator, a secured landfill site, waste stabilization unit, temporary waste storage sheds, vehicle wash area and a well-equipped laboratory. It also has a biomedical waste, solid waste and plastic waste treatment and disposal facilities within the same premises. The waste handling capacity of the facility is as follows –

1. Direct Landfilling – 1,20,000 MTPA
2. Landfilling after stabilization – 60,000 MTPA
3. Incineration – 10,800 MTPA

(Source: WBPCB)

3.7.3 Municipal Solid Waste

There are 2 landfill sites in operation and 6 common regional sanitary landfill facility constructed in West Bengal. 100 dumpsites are present in West Bengal. 22 municipalities have installed compost plants of which 9 compost plants are operational at present. 13 sanitary landfills have been developed involving 25 urban local bodies including a regional landfill developed by the KMDA in Hooghly district for 6 municipalities of which 2 landfills are operational at present.

(Source: Annual Report on Implementation of Solid Waste Management Rules 2018-19, CPCB)

CHAPTER 4 – ANTICIPATED ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

4.0 General

The primary objective of an EIA report for a project at a given location is to bring out all the significant positive and negative impacts arising from the project and its activities which need to be undertaken during different phases of its life cycle and suggest suitable, specific and implementable mitigation measures to prevent, minimise and/or control the anticipated negative impacts and maximise the positive impacts.

The impacts need to be predicted on physico-chemical ecological and socio-economic components of the environment using suitable techniques and instruments.

Figure 4.1 – Impact Causal Chain

The entire exercise can be sub divided into the following four stages –

1. Identification and describing the major project related activities involved during different phases of the project during construction and operation phases of the project. This has already been discussed in detail in **Chapter 2 Section 2.6** from **Page 47** to **48**.

2. Predicting changes in the environmental parameters along with the likelihood of occurrence and the severity of these changes. The anticipated impacts due to various project related activities on the land, water, air, noise, biological and socio-economic environment has been discussed in **Table 4.1**, **Table 4.2**, **Table 4.6**, **Table 4.7**, **Table 4.8**, **Table 4.11**, **Table 4.12**, **Table 4.14** and **Table 4.15** below.
3. Suggesting suitable mitigation measures for prevention or mitigation of the anticipated impacts to an acceptable level by bringing unacceptable negative anticipated impacts within limits set by regulatory authorities. Mitigation measures for the anticipated impacts due to the proposed project have been presented in **Table 4.1**, **Table 4.2**, **Table 4.6**, **Table 4.7**, **Table 4.8**, **Table 4.11**, **Table 4.12**, **Table 4.14** and **Table 4.15** below.
4. Proposing and implementation of regular environment monitoring to ensure the implementation of the proposed prevention/mitigation measures and evaluate their effectiveness. The monitoring mechanism and its timeline has been discussed in **Chapter 6 Section 6.2** from **Page 212** to **214**.

4.1 Land Environment

As already discussed in **Chapter 3 Section 3.1.3** from **Page 66** to **67**, the land area within the 10 km study area is predominantly agricultural land.

Soil and land impacts primarily include the following –

1. Loss of top soil due to excavation
2. Contamination of top soil with excavated sub-soil
3. Soil erosion
4. Decline in soil/land productivity due to fertile soil getting carried away
5. Water logged soil
6. Sediment transportation to water courses
7. Soil compaction causing changes in soil productivity and water percolation leading to changes in run off
8. Land affected due to material handling, leaching and spillages
9. Changes in drainage pattern
10. Land contamination

The following are the anticipated impacts and the proposed mitigation measures that may occur due to the proposed expansion on the surrounding land environment –

Table 4.1 – Anticipated Impacts and Proposed Mitigation Measures for Land Environment

Anticipated Impacts	Proposed Mitigation Measures
Construction Phase	
1. Compaction of soil due to heavy earth moving vehicles.	1. Movement of heavy earth moving vehicles will be limited to already constructed roads and within the construction areas.
2. Contamination of soil due to oil spillage, mixing of cement etc.	1. Hazardous substances such as diesel required for the operation of construction machineries and vehicles will be kept in a storage yard having an impervious surface. 2. Precast drains will be used as much as possible.
3. Dumping of construction waste in the vicinity of the project area.	1. Reuse of construction waste onsite will be encouraged. 2. Any construction waste that cannot be reused at the project site shall be disposed off as per Construction and Demolition Waste Management Rules, 2016.
4. Spillage of oil and grease from the vehicles and/or storage sheds.	1. Oil shall be stored in storage sheds having an impermeable surface. 2. A ditch shall be constructed around the to intercept any runoff.
5. Change in topography.	1. All constructional activities will be limited within the industrial land i.e., the project site only thus, impact on topography is not anticipated.

Operation Phase	
1. Impact on soil due to disposal of solid waste in the nearby vicinity.	1. Dried sludge from the CETP will be disposed off in the SLF.
2. Soil erosion.	1. Greenbelt development will take place along the internal roads, open areas as well as along the periphery of the project site will be taken up.
3. Spillage of wastewater onto nearby land. 4. Heavy metal contamination of land environment.	1. Wastewater will be partially treated in upcoming individual units followed by treatment at the CETP. 2. Wastewater will be transported to the CETP via impervious drainage system. 3. Chromium recovery unit has been provided in the CETP. 4. Heavy metal concentration in the CETP treated effluent will be as per WBPCB norms.

4.2 Water Environment

There is a likelihood of the project having an impact on the nearby water environment due to the construction and operational activities. Any construction activity is likely to have a significant impact on the existing water environment, not only because construction activities are water intensive in nature but also because of contamination of nearby water sources due to runoff, waste dumping etc. Besides, the operation of the leather manufacturing units within the CLC are expected to produce significant wastewater and other solid wastes which have the potential of causing surface and ground water pollution.

The following are the anticipated impacts and the proposed mitigation measures due to the project on the surrounding water environment –

Table 4.2 – Anticipated Impacts and Proposed Mitigation Measures for Water Environment

Anticipated Impacts	Proposed Mitigation Measures
Construction Phase	
1. Water required for dust settlement, compaction and curing.	1. Dust suppression will be carried out through sprinklers to conserve water.
2. Discharge and seepage of domestic wastewater generated by labourers and other onsite workers.	1. Mobile toilets will be provided for the labourers for the collection of wastewater which will be treated in portable STP.

Unit 1-6 of the existing CETP having a combined capacity of 30 MLD and the proposed Unit 7 and 8 of 10 MLD CETP have been designed to treat the incoming effluent from the upcoming leather industries. The influent and effluent details have been provided in **Table 4.3**.

Table 4.3 – Design Criteria for CETP

S. No.	Parameter	Unit	Inlet	Outlet
1	pH	-	8.0-9.0	6.5-9.0
2	COD	mg/L	4000	250
3	BOD	mg/L	2000	30
4	TSS	mg/L	980	100
5	Sulphide	mg/L	150	1
6	Total Chromium	mg/L	61	2
7	Oil and Grease	mg/L	-	10

Table 4.4 – Current Pollution Load for the CETP

S. No.	Parameter	Unit	Inlet	Outlet
1	COD	kg/d	120000	8750
2	BOD	kg/d	70000	900
3	TSS	kg/d	34300	3000
4	Sulphide	kg/d	5250	30

5	Total Chromium	kg/d	2135	60
6	Oil and Grease	kg/d	-	300

Table 4.5 – Current Pollution Load for the CETP

S. No.	Parameter	Unit	Inlet	Outlet
1	COD	kg/d	192000	12000
2	BOD	kg/d	96000	1440
3	TSS	kg/d	47040	4800
4	Sulphide	kg/d	7200	48
5	Total Chromium	kg/d	2928	96
6	Oil and Grease	kg/d	-	480

4.2.1 Surface Water

The project site contains two surface water bodies near its Northern and Western boundary as shown in **Figure 4.2**. Several surface water bodies are also present within the 10 km study area of the project, details of which have been provided in **Figure 4.2** and **Figure 4.3**.

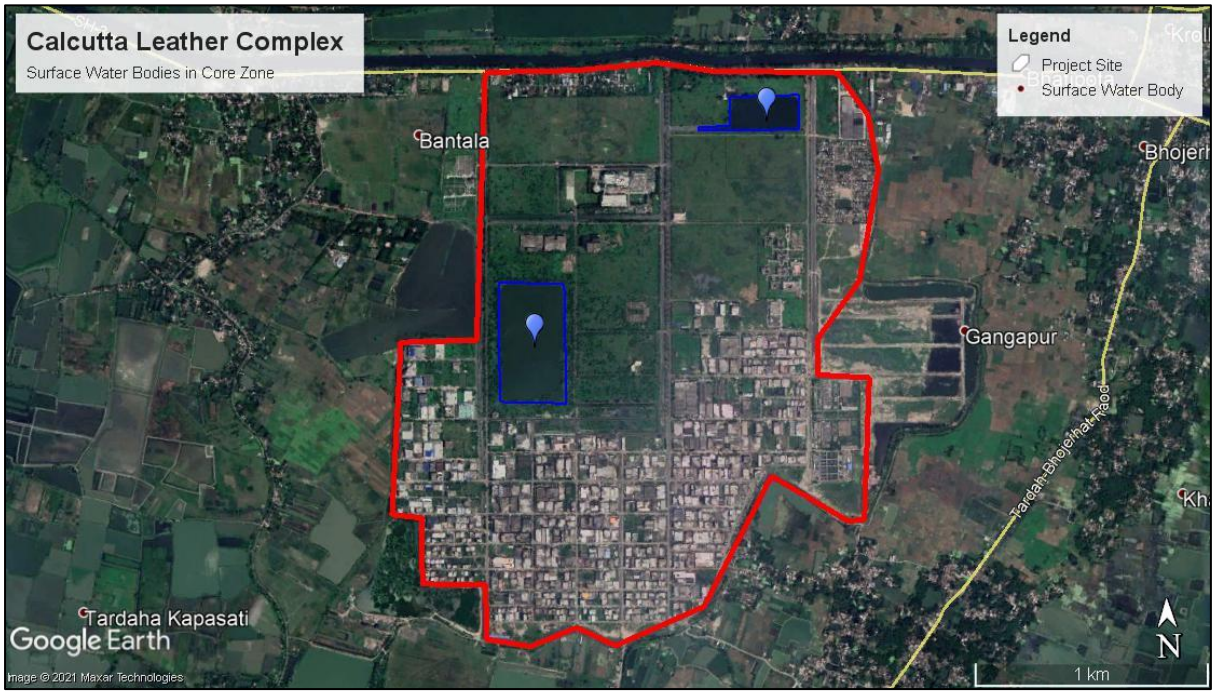


Figure 4.2 – Surface Water Bodies within the Core Zone

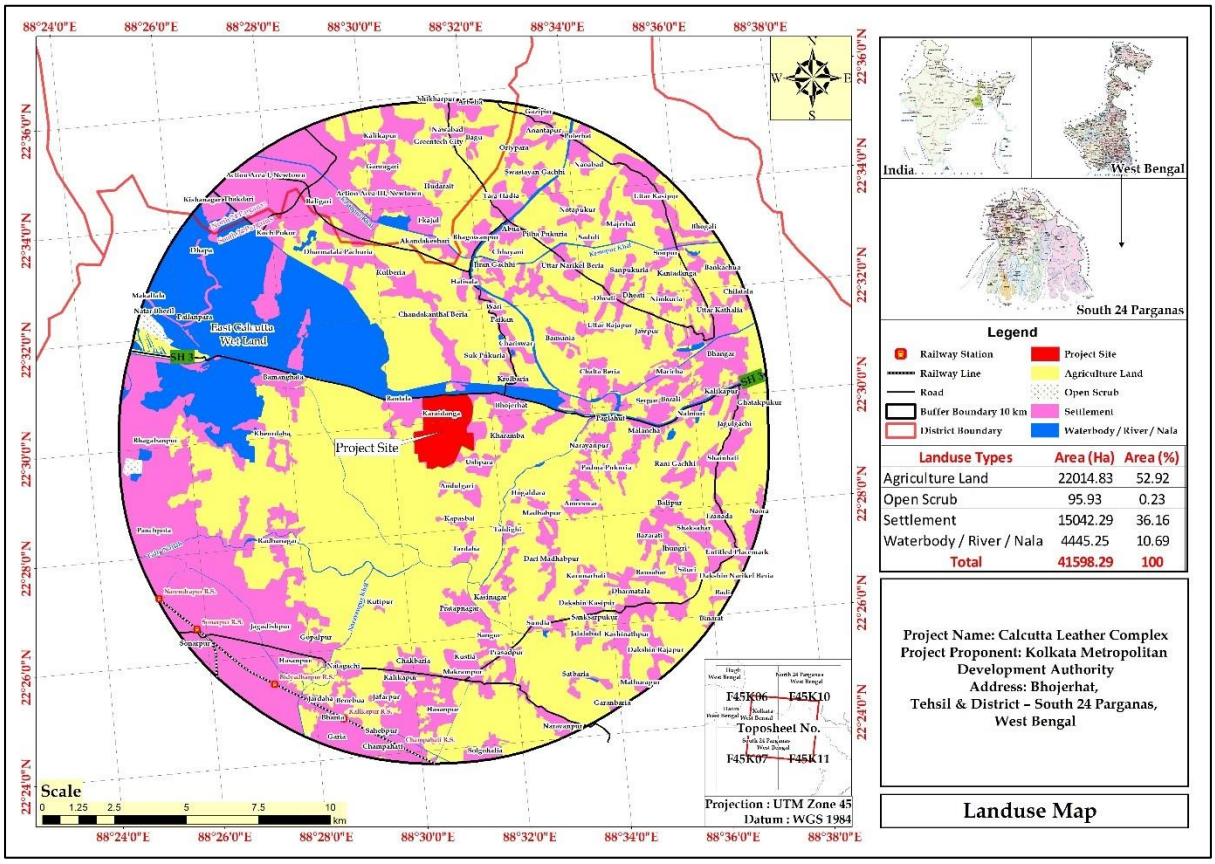


Figure 4.3 – Surface Water Bodies within the Buffer Zone

The following are the anticipated impacts and the proposed mitigation measures due to the construction and operation phase of proposed project on the nearby surface water bodies –

Table 4.6 – Anticipated Impacts and Proposed Mitigation Measures for Surface Water

Anticipated Impacts	Proposed Mitigation Measures
Construction Phase	
1. Pollution of surface water bodies due to dumping of construction waste.	1. Reuse of construction waste onsite will be encouraged. 2. Any construction waste that cannot be reused at the project site, shall be disposed off as per Construction and Demolition Waste Management Rules, 2016.

2. Soil runoff from the site leading to surface water contamination.	1. Storm water drainage network will be constructed to intercept soil runoff. 2. Construction of desilting tanks along with rain water harvesting pits will take place. 3. Regular cleaning and maintenance of desilting and storm water drains will take place.
Operation Phase	
1. Discharge of wastewater from the units to nearby water bodies.	1. All wastewater generated due to the upcoming units during the project's operational phase shall be sent to the CETP where it will be treated and discharged to Basanti Canal via the CETP drain. 2. The discharged effluent will have pollutant concentrations as per WBPCB norms.
2. Heavy metal contamination of surface water bodies.	1. Wastewater will be partially treated in proposed individual units followed by treatment at the CETP. 2. Wastewater will be transported to the CETP via impervious drainage system. 3. Chromium recovery unit has been provided in the CETP. 4. Heavy metal concentration in the CETP discharged effluent will be as per WBPCB norms.

4.2.2 Ground Water

The following are the anticipated impacts and the proposed mitigation measures due to the construction and operation phase of proposed project on the ground water –

Table 4.7 – Anticipated Impacts and Proposed Mitigation Measures for Ground Water

Anticipated Impacts	Proposed Mitigation Measures
Construction Phase	
1. Extraction of ground water for construction related activities and domestic requirement.	1. Rain water harvesting will be practised for recharge of ground water bodies. 2. Rain water collected in the surface water bodies present within the CLC will be utilised for meeting the water requirements of various units thereby helping in reducing the overall ground water requirement.
Operation Phase	
1. Extraction of ground water for domestic requirement, plantation purposes and manufacturing processes.	1. Rain water harvesting will be practised in for recharge of ground water bodies. 2. Rain water collected in the surface water bodies present within the CLC will be utilised for meeting the water requirements of various units thereby helping in reducing the overall ground water requirement. 3. Treated wastewater from the CETP can also be used for plantation purposes and for meeting flushing requirements in order to further reduce the overall groundwater requirement.

4.3 Air Environment

Any construction activity is likely to have a temporary impact on the nearby air environment due to the movement of vehicles, operation of machineries and general construction activities such as cement mixing, compaction etc. while operational phase needs to deal with problems such as emissions, odour problems etc.

The air pollutants present in the ambient air have a potential of causing risk to human health, soil, surface water, flora and fauna. Some of the typical health effects of air pollution are as follows –

1. Reduced lung function, especially for people suffering for lung related diseases
2. Asthma attacks
3. Respiratory systems and diseases such as chronic obstructive pulmonary disease, chronic bronchitis, silicosis
4. Reduced physical activity
5. Increase in medicine usage and hospitalisation
6. Premature death

4.3.1 Anticipated Impacts and Proposed Mitigation Measures

The following are the anticipated impacts and the proposed mitigation measures due to the construction and operation phase of proposed project on the ambient air environment –

Table 4.8 – Anticipated Impacts and Proposed Mitigation Measures for Ambient Air Environment

Anticipated Impacts	Proposed Mitigation Measures
Construction Phase	
1. Dust generation due to construction operations and movement of vehicles.	1. It will be ensured that dust suppression is carried out at regular intervals. 2. It will be ensured that material, especially loose material brought in for construction purposes will be covered. 3. It will be ensured that maximum speed of vehicles will be restricted to reduce emissions. Speedbumps and signs will be used for this purpose.
2. Emissions from operation of construction equipment and movement of vehicles.	1. Only PUC certified vehicles will be allowed to enter the project site.

	2. Regular maintenance of construction machinery and vehicles will help in controlling excessive emissions.
3. Wind erosion due to site clearance and preparation.	1. Vegetation such as small bushes and grass will be cleared only at areas where immediate construction needs to take place. 2. Plantation activities, especially along the periphery will be carried out to contain the erosion within the project site during construction phase as much as possible.
Operation Phase	
1. Vehicular movement will be the major source of air pollution.	1. Only PUC certified vehicles will be allowed to ply within the project site. 2. Vehicle speed shall be restricted to prevent excessive emissions through signboards and speed bumps. 3. Greenbelt development will be carried out to absorb and reduce the overall air pollution.

4.4 Noise Environment

Generation of noise will be mainly due to the construction activities that will be carried out within the project site such as excavation, compaction, road laying etc. as well as due to the movement of vehicles within the project site.

High noise levels cause discomfort to human beings and affects vegetation and animals and can include the following symptoms –

1. Temporary or permanent deafness
2. Physiological problems like fatigue, irritation, insomnia, illness and digestive disorders
3. Psychological/sociological disturbances like speech interference, annoyance, lack of concentration, and sleep interference

4. Damage to habitats
5. Poor quality of crops
6. Disruption to normal breeding patterns among different fauna

Table 4.9 – Permissible Exposure Noise Levels

Total Time of Exposure (hr/day)	Sound Pressure Level (dB(A))
8	90
6	92
4	95
6	97
2	100
1	105

4.4.1 Noise Level Prediction

Noise level prediction from point source emissions, propagating in a system of spherical waves from that point through the air is described by the following equation –

$$L_{p2} = L_{p1} - 20 \log \left(\frac{r_2}{r_1}\right)$$

where

L_{p2} = noise level at distance r_2

L_{p1} = noise level at distance r_1

This equation illustrates that noise level decreases with increasing distance from the source.

Noise level prediction from line source emissions, propagating in a system of cylindrical or half cylindrical waves is described by the following equation –

$$Noise\ Level_2 = Noise\ Level_1 - 10 \log \left(\frac{r_2}{r_1}\right)$$

For a continuous noise source, the average sound level is the equivalent sound level (Leq). It is a constant noise level which, in a given situation and time period, conveys the same sound energy as does the actual time varying sound in the same period. When multiple sources of point source noise are located nearby, the cumulative noise at the source can be estimated with addition of decibel values provided in **Table 4.10**.

Table 4.10 – Addition of Cumulative Noise

Difference Between the Two Decibel Values	Amount to be Added to the Higher Level
0	3.0
1	2.5
2	2.0
3	2.
4	1.5
5	1.0
6	1.0
7	1.0
8	0.5
9	0.5
10	0.0

The noise level resulting from multiple noise sources can be estimated from the following equation –

$$L_p = 10\log\left[10^{L_{p1}/10} + 10^{L_{p2}/10} + 10^{L_{p3}/10} + \ldots\ldots\ldots\ldots\ldots + 10^{L_{pn}/10}\right.$$

where

Lp = resultant noise level

L_{p1}, L_{p2}, L_{p3}……. L_{pn} = Noise level from source 1, 2, 3 …… n

(Source: Environmental Impact Assessment – A Practical Guide for Professional Practice, A K A Rathi)

4.4.2 Anticipated Impacts and Proposed Mitigation Measures

The following are the anticipated impacts and the proposed mitigation measures due to the construction and operation phase of proposed project on the ambient noise environment –

Table 4.11 – Anticipated Impacts and Proposed Mitigation Measures for Ambient Noise Environment

Anticipated Impacts	Proposed Mitigation Measures
Construction Phase	
1. Noise generation due to construction machinery.	1. Regular maintenance of construction machinery will be encouraged to reduce noise levels.
2. Noise generation due to vehicles.	1. Only PUC certified vehicles will be allowed to enter the project site. 2. Regular maintenance of vehicles will ensure that vehicles do not make a lot of noise. 3. Greenbelt development will take place to reduce the overall noise levels.
Operation Phase	
1. Vehicular movement will be the major source of noise pollution.	1. Only PUC certified vehicles will be allowed to ply within the project site. 2. No honking zones will be made near residential and institutional areas. 3. Greenbelt development will be carried out to reduce the overall noise levels.

4.5 Biological Environment

The impact on biological environment due to the proposed project during construction and operational phase will be minimal as no significant flora and fauna were found within the core zone as described in **Chapter 3 Section 3.5** from **Page 107** to **112**.

The following are the anticipated impacts and the proposed mitigation measures due to the construction and operation phase of proposed project on the biological environment –

Table 4.12 – Anticipated Impacts and Proposed Mitigation Measures for Biological Environment

Anticipated Impacts	Proposed Mitigation Measures
Construction Phase	
1. Loss of vegetation due to construction activities.	1. The core zone where construction is proposed is devoid of any significant natural vegetation. Isolated patches of grass, shrubs etc are present. There will be negligible loss of flora. 2. Greenbelt development will take place along the periphery and within the project site.
2. Displacement of fauna.	1. No fauna population was observed within the core zone. 2. Avifauna such as crows, pigeons etc. will benefit from greenbelt development that will take place along the periphery of the project.
Operation Phase	
1. Vehicular movement transporting the sludge from the CETP to SLF will be a major source of air and noise pollution impacting the fauna.	1. Only PUC certified vehicles will be allowed to ply within the project site. 2. Greenbelt development will be carried out to reduce the overall noise levels, air pollution as well as provide a habitat for the avifauna.
1. Sludge generation from the CETP.	1. Sludge from the CETP will be disposed off in the SLF.

Greenbelt development will take place over an area of approx. 13.2 Ha in the proposed expansion and can constitute the planting of the following species –

Table 4.13 – Proposed Species for Greenbelt Development

S. No.	Scientific Name	Common Name	Family	Sensitive/Tolerant	Growth Rate	Regeneration	Evergreen/Deciduous
1	*Abutilon indicum*	Country mallow	Malvaceae	Tolerant	Quick growing	Through Seeds	Deciduous
2	*Acacia catechu*	The catch tree	Mimoseae	Tolerant	Quick growing	By Seeds	Evergreen
3	*Acacia dealbata*	Silver wattle	Mimoseae	Tolerant	Quick growing	By Seeds	Evergreen
4	*Acacia farnesiana*	babul	Mimoseae	Tolerant	Quick growing	By Seeds	Evergreen
5	*Acacia leucophloea Willd.*	Safed babul	Mimoseae	Tolerant	Quick growing	By Seeds	Deciduous
6	*Acacia mearnsii de Wild.*	Black wattle	Mimoseae	Tolerant	Quick growing	By Seeds, Root, Suckers	Evergreen
7	*Acacia Nilotica*	babul	Mimoseae	Tolerant	Quick growing	By Seeds	Evergreen
8	*Acacia pennata*	Biswal	Mimoseae	Tolerant	Quick growing	By Seeds	Evergreen
9	*Acacia polyacantha Willd.*		Mimoseae	Tolerant	Quick growing	By seeds	Semi-Deciduous
10	*Acacia senegai*	Kumta	Mimaseae	Tolerant	Quick growing	By Seeds	Deciduous
11	*Acacia sinuata*	Shikakai	Mimaseae	Tolerant	Quick growing	By Seeds	

12	*Achras sapota*	Chikoo	Sapotaceae	Tolerant	Slow growing during early stages	Grafting	Evergreen
13	*Actinodaphne angustifolia*	Pisa	lauraceae	Tolerant	Slow	By Seeds	Evergreen
14	*Adenanthero pavonina*	Bodigumehi	Mimaseae	Tolerant	Quick growing	By Seeds	Deciduous
15	*Aegle marmelos*	Beal tree	Fuloceae	Tolerant	Slow growing	By Seeds	Evergreen
16	*Ailanthus altissimo*		Simarubaceae	Tolerant	Quick growing	By Seeds	Deciduous
17	*Ailanthus excelsa*	Tree of heaven	Simarubaceae	Tolerant	Quick growing	By Seeds	Deciduous
18	*Alangium chinense*	Budanar	Alangiaceae	Tolerant	Quick growing	By Seeds	Deciduous
19	*Albizia chinensis*	Siron	Mimaseae	Tolerant	Quick growing	By Seeds	Deciduous
20	*Albizia lebbeck*	siris	Mimaseae	Tolerant	Quick growing	By Seeds	Deciduous
21	*Albizia moluccano*	Subobul	Mimaseae	Tolerant	Quick growing	By Seeds	Evergreen
22	*Albizia odoratissimo*	Kala siris	Mimaseae	Tolerant	Quick growing	By Seeds	Evergreen
23	*Albizia procera*	white siris	Mimaseae	Tolerant	Quick growing	By Seeds	Deciduous
24	*Aleurites fordii*	Tungoil tree	Euphorbiaceae	Tolerant	Quick growing	By seeds	Deciduous
25	*Alstonia acholaris*	Devil tree	Apacynaceae	Tolerant	Quick growing	By Seeds	Evergreen

26	*Anona squamosa*	Custard apple	Anonaceae	Tolerant	Fast Growing	By Seeds	Evergreen
27	*Anona reticulata*	Luvuni	Anonaceae	Tolerant	Fast Growing	By Seeds	Evergreen
28	*Anogeissus latifolia*	button tree	Combretaceoe	Tolerant	Slow growing	By Seeds	Evergreen
29	*Anthocephalus chinensis*	kadamba	Rubiaceae	Tolerant	Quick growing	By Seeds	Deciduous
30	*Aphanamixis polystachya*	Rohituka tree	Meliaceae	Tolerant	Slow growing	By Seeds	Evergreen
31	*Artocarpus heterophyllus*	Jack fruit tree	Urticaceae	Tolerant	Slow Growing	By Seeds	Evergreen
32	*Artocarpus lacucha*	Dahua	Urticaceae	Tolerant	Quick growing	By Seeds	Deciduous
33	*Azadirachta indica*	Neem	Meliaceae	Tolerant	Quick growing after 1st season	By Seeds	Evergreen
34	*Balanites roxburghii*	Desert - Date	Balanitaceae	Tolerant	Quick growing	By Seeds	Evergreen
35	*Bambusa arundinocia*	wans	Poaceae	Tolerant	Quick growing	By cuttings	Deciduous
36	*Bambusa vulagris*	Golden bambao	Poaceae	Tolerant	Quick growing	Cuttings	Deciduous
37	*Borringtonia acutangula*	Indian Oak	Borringtonioceae	Tolerant	Quick growing	By cuttings	Evergreen

38	*Borringtonia racemosa*		Borringtonioceae	Tolerant	Fast growing	By Seeds	Evergreen
39	*Bauhinia acuminata*	Kanchan	Caesalpinaceae	Tolerant	Quick growng	By Seeds	Deciduous
40	*Bauhinia purpurea*	Dev kanchan	Caesalpinaceae	Tolerant	Quick growng	Through Seeds	Deciduous
41	*Bauhinia aracemosa*	Asundro	Caesalpinaceae	Tolerant	Quick growng	By Seeds	Deciduous
42	*Bauhinia semla*	Semla	Caesalpinaceae	Tolerant	Quick growng	By Seeds	Deciduous
43	*Bauhinia varigata*	Kavindara	Caesalpinaceae	Tolerant	Quick growng	By Seeds	Deciduous
44	*Bischofia javanica*	Bischopwood	Bischofiaceae	Tolerant	Quick growng	By Seeds	Semi-Deciduous
45	*Bougainvillea spectabilis*	Bougainvillea	Nyctaginaceae	Tolerant	Quick growing	By seeds	Evergreen
46	*Bridelia squamosa*	Khaja	Eupharbiaceae	Tolerant	Quick growing	By seeds	Deciduous
47	*Braussantia papyrifera*	Jangli taat	maraceae	Tolerant	Quick growing	By seeds, cuttings, air-layering	Deciduous
48	*Buchanania lonzan*	Charoli	Anacardiacea	Tolerant	Quick growing	By seeds, suckers and roots	Evergreen
49	*Buteo monosperma*	Khakharo	Fabaceae	Tolerant	Slow growing	By seeds	Deciduous

50	*Coesalpinia pulcherrima*	White gold mohur	Cesalpinaceae	Tolerant	Quick growing	By seeds, cuttings	Evergreen
51	*Callistemon citrinus*	Battle brush	Mytaceae	Tolerant	Slow growing	Cuttings	Evergreen
52	*Calophyllum inophyllum*	Udi	Clusiaceae	Tolerant	Slow Growing	By seeds	Evergreen
53	*Calotropis gigantea*	Akand	Asclepiadaceae	Tolerant	Quick growing	Cuttings	Evergreen
54	*Calotropis procera*	Akand	Asclepiadaceae	Tolerant	Quick growing	Cuttings	Evergreen
55	*Carissa spinarum*	Garunda	Apocynacea	Tolerant	Quick growing	By seeds	Evergreen
56	*Cassia fistula*	Amaltas	Caesalpinaceae	Tolerant	Quick growing	By seeds	Deciduous
57	*Cassia javanica*		Caesalpinaceae	Tolerant	Quick growing	Through Seeds	Deciduous
58	*Cassia pumilo*	Yellow cassia	Caesalpinaceae	Tolerant	Quick growing	By seeds	Evergreen
59	*Cassia siamea*	iran waad	Caesalpinaceae	Tolerant	Fast Growing	By seeds	Evergreen
60	*Casuarina equisetifolia*	Jangli saru	casurinaceae	Tolerant	Quick growing	By seeds	Evergreen
61	*Ceiba pentandra*	Kapok	Bambacaceae	Tolerant	Quick growing	By seeds	Deciduous
62	*Caltis australis*	Mahita	Ulmaceae	Tolerant	Quick growing	By seeds	Deciduous
63	*Citrus aurantium*	Niba	Rutaceae	Tolerant	Quick growing	By cuttings	Evergreen
64	*Citrus limon*	nebu	Rutaceae	Tolerant	Slow growing	By cuttings	Evergreen

65	*Clerodendrum inerme*	Banjai	Verbenaceae	Tolerant	Quick growing	By seeds	Evergreen
66	*Clerodendrum Infortunatum*	Bhant	Verbenaceae	Tolerant	Quick growing	By seeds	Evergreen
67	*Cocos nucifera*	Coconut tree	Arecaceae	Tolerant	Slow growing	By seeds	Evergreen
68	*Cordia dichotoma*	Bargunda	Cardiaceae	Tolerant	Quick growing after 1st Year	By seeds	Evergreen
69	*Dalbergia latifalia*	Shishom	Fabaceae	Tolerant	Quick growing	By Seeds, root, cuttings	Semi-Deciduous
70	*Dalbergia sisoo*	Sissoo	Fabaceae	Tolerant	Moderate during 1st yaer and rapid afterwards	By seeds	Evergreen
71	*Delonix regia*	Gulmohur	Caesalpinaceae	Tolerant	Quick growing	By seeds	Deciduous
72	*Dendrocalamus strictus*	Nakorvans	Poaceae	Tolerant	Quick growing	By seeds	Deciduous
73	*Derris indica*	Oil tree	Fabaceae	Tolerant	Quick growing	By seeds	Evergreen
74	*Dryptes roxburghii*	Putronjivo	Eupharbiaceae	Tolerant	Slow growing	By seeds	Evergreen
75	*Emblica officinalis*	Amali	Eupharbiaceae	Tolerant	Quick growing	By seeds	Deciduous

76	*Embryopteris peregrina*		Ebenaceae	Tolerant	Quick growing	By Seeds	Deciduous
77	*Erythrina variegata*	coral tree	Fabaceae	Tolerant	Quick growing	By seeds	Deciduous
78	*Eucalyptus citriodora*	Lemon scented gum	Mytaceae	Tolerant	Quick growing	By seeds	Evergreen
79	*Eucalyptus hybrid*	mysore gum	mytaceae	Tolerant	Quick growing	By seeds	Evergreen
80	*Exbucklandia populnea*	bipli	Hamamelidaceae	Tolerant	Slow growing	By seeds	Evergreen
81	*Ficus benghalensis*	Banyan tree	Moraceae	Tolerant	Quick growing	By cuttings	Evergreen
82	*Ficus benjamina*	Chilubor	Moraceae	Tolerant	Quick growing	By seeds	Evergreen
83	*Ficus elastica*	Indian Rubber	Moraceae	Tolerant	Quick growing	By cuttings	Evergreen
84	*Ficus gibbosa*	Datir	Moraceae	Tolerant	Quick growing	By cuttings	Evergreen
85	*Ficus glomerata*	Dumur	Moraceae	Tolerant	Quick growing	By seeds	Evergreen
86	*Ficus hispida*	umbar	maraceae	Tolerant	Quick growing	By seeds	Evergreen
87	*Ficus religiosa*	Peepal	Moraceae	Tolerant	grows slow in early stages later grows fast	Cuttings	Evergreen
88	*Ficus semicordata*	Jahephali	Moraceae	Tolerant	Quick growing	By seeds	Evergreen

89	*Gorcinia indica*	Kokom	Guttiferaceae	Tolerant	Slow growing (1st Year)	By Seeds	Evergreen
90	*Garcinia talbotii*		Guttiferaceae	Tolerant	Slow growing	By Seeds	Evergreen
91	*Gardenia jasminoides*	Anant	Rubiaceae	Tolerant	Quick growing	By seeds	Evergreen
92	*gardenia resinifera*	Dikamali	Rubiaceae	Tolerant	Quick growing	By seeds	Evergreen
93	*Grevillea robusta*	silky oak	Proteoceae	Tolerant	Quick growing	By seeds	Evergreen
94	*Grewia elastica*	Dhaman	Tilaceae	Tolerant	Quick growing	By seeds	Deciduous
95	*Grewia subinequalis*	Phalsa	Tilaceae	Tolerant	Quick growing	By seeds	Evergreen
96	*Hamelia patens*		Rubiaceae	Tolerant	Quick growing	By seeds, cuttings	Evergreen
97	*Hibiscus rasa sinensis*	jasum	Malvaceae	Tolerant	Quick growing	By cuttings	Evergreen
98	*Hippophae rhamnoides*	Common seabuckthorn	Elaeagnaceae	Tolerant	Quick growing	By seeds, stem cuttings, suckers	Deciduous
99	*Ixora chinensis*		Rubiaceae	Tolerant	Quick growing	By cuttings	Evergreen
100	*Ixora caccinea*	rangan	Rubiaceae	Tolerant	Quick growing	By cuttings	Evergreen
101	*Ixora rasea*		Rubiaceae	Tolerant	Quick growing	By cuttings	Evergreen

102	*Ixora undulata*		Rubiaceae	Tolerant	Quick growing	By cuttings	Evergreen
103	*Jacgranda mimoseafolia*	Gulmohur	Caesalpinaceae	SensiTolerantive	Quick growing	By Seeds	Deciduous
104	*Juniperus communis*	havasha	Pinaceae	Tolerant	Quick growing	By cuttings	Evergreen
105	*Kigelia africana*	sausage tree	bignoniaceae	Tolerant	Quick growing	By cuttings	Evergreen
106	*Lagerstroemia parviflora*	phurush	Lythraceae	Tolerant	Quick growing	By cuttings	Deciduous
107	*Lagerstroemia speciosa*	Jaraal	Lythraceae	Tolerant	Quick growing	By seeds	Evergreen
108	*Lantana camara*	natahugide	Verbenaceae	Tolerant	Quick growing	By cuttings	Evergreen
109	*Lawsonia inermis*	Medi	Lythraceae	Tolerant	Quick growing	By cuttings	Evergreen
110	*Madhuca longifolia*	mahudo	sopotaceae	Tolerant	Quick growing	By seeds	Deciduous
111	*Mollotus philippensis*	kamala	Eupharbiaceae	Tolerant	Quick growing	By seeds	Evergreen
112	*Mongifera indica*	mango	Anacardiacea	SensiTolerantive	Quick growing after 1st year	By seeds	Evergreen
113	*Melaleuca leucadendron*	Cajaput	Mytaceae	Tolerant	Quick growing	By seeds	Evergreen

114	*Milletro peguensis*		Fabaceae	Tolerant	Quick growing	By Seeds	Evergreen
115	*Milingtonia*	Buch	bignoniaceae	SensiTolerantive	Quick growing	By seeds	Evergreen
116	*Mimusopa hexandra*	Khirni	Sapotaceae	Tolerant	Quick growing	By cuttings	Evergreen
117	*Moringa oleifero*	Drumstick tree	Moringoceae	SensiTolerantive	Quick growing	By cuttings	Deciduous
118	*Morus alba*	Tuti	Moroceae	SensiTolerantive	Quick growing	By cuttings	Evergreen
119	*Murraya paniculata*	Marchula	Rutaceae	Tolerant	Quick growing	cuttings	Evergreen
120	*Nerium indicum*	Pink oleander	Apocynacea	Tolerant	Quick growing	cuttings	Evergreen
121	*Nyctanthus arbor-tristis*	Beng	Oleaceae	Tolerant	Quick growing	By Seeds, cuttings	Deciduous
122	*Ouginia oojeinensis*	Tonoch	Fabaceae	Tolerant	Quick growing	cuttings	Deciduous
123	*Peltophorum pterocarpum*	Copper pod tree	Caesalpinaceae	Tolerant	Quick growing	By seeds	Evergreen
124	*Phoenix sylvestris*	Khajur	Arecaceae	Tolerant	Slow Growing	By seeds	Evergreen
125	*Pinus khasiana*	Khasipine	Pinaceae	SensiTolerantive	Slow growing	By Seeds	Evergreen
126	*Pinus roxburghii*	Chilgozo	Pinaceae	SensiTolerantive	Slow growing	By seeds	Evergreen
127	*Pinus wallichiana*	Chir pine	Pinaceae	SensiTolerantive	Slow growing	By seeds	Evergreen
128	*Pithecellobium ducle*	Vilayatimili	Mimosaceae	Tolerant	Quick growing	By seeds	Evergreen

129	*Painciana pulcherrima*	guletura	Caesalpinaceae	Tolerant	Quick growing	By cuttings	Evergreen
130	*Polyalthia longifolia*	Devdaru	Anonaceae	SensiTolerantive	Quick growing	Through Seeds	Evergreen
131	*Populus alba*	White poplar	Salicaceae	SensiTolerantive	Quick growing	By Seeds, stem, root cutting, root sucker	Deciduous
132	*Populus ciliate*	Himalayan poplar	Salicaceae	SensiTolerantive	Quick growing	By Seeds, stem, root cutting, root sucker	Deciduous
133	*Populus deltoides*	Caroline poplar	Salicaceae	SensiTolerantive	Quick growing	By Seeds, stem, root cutting, root sucker	Deciduous
134	*Popu lus euphratica*	Indian poplar	Salicaceae	SensiTolerantive	Quick growing	By Seeds, stem, root cutting, root sucker	Deciduous
135	*Populus nigra*	Poplar	Salicaceae	SensiTolerantive	Quick growing	By seeds	Deciduous
136	*Prosopis chilensis*	Gandaa babul	mimos eae	Tolerant	Quick growing	By seeds	Evergreen
137	*Prosopis cineraria*	Khejri	mimos eae	Tolerant	Quick growing	By seeds	Evergreen

138	*Psidivm guayava*	Amrud	Mytaceae	Tolerant	Quick growing	By seeds	Evergreen
139	*Pterygota alata*	Tula	Sterculiaceae	Tolerant	Quick growing	By seeds	Semi-Deciduous
140	*Quercus palustris*	Oak	Fagaceae	Tolerant	Quick growing		Deciduous
141	*Quercus petraea*	Oak	Fagaceae	Tolerant	Quick growing		Deciduous
142	*Quercus rubra*	Oak	Fagaceae	Tolerant	Quick growing		Deciduous
143	*Ricinus communis*	Erandi	Eupharbiaceae	Tolerant	Quick growing	By seeds	Evergreen
144	*Salix alba*	European willow	Salicaceae	Tolerant	Quick growing	By stem cutting, root cutting	Deciduous
145	*Salix babylonica*	Weeping willow	Salicaceae	Tolerant	Quick growing	By stem, root cutting, suckers	Deciduous
146	*Salix caprea*	The sallow	Salicaceae	Tolerant	Quick growing	By cuttings	Deciduous
147	*Salix fragilis*	Kashmir willow	Salicaceae	Tolerant	Quick growing	By seeds, cuttings	Deciduous
148	*Salix tetrasperma*	jalmala	Salicaceae	Tolerant	Quick growing	By cuttings	Deciduous
149	*Samaneo samon*	rain tree	Mimosaceae	Tolerant	Quick growing	By cuttings	Evergreen
150	*Sapindus emarginatus*	Soapnut	Sapindaceae	Tolerant	Quick growing	By seeds	Evergreen
151	*Sapium sebiferum*	Makhan tree	Eupharbiaceae	Tolerant	Quick growing	By seeds	Deciduous
152	*Saraca asoka*	Ashok	Caesalpinaceae	Tolerant	Quick growing	By seeds	Evergreen

153	*Sesbania grandiflora*	Agathi	Fabaceae	Tolerant	Quick growing	By seeds	Evergreen
154	*Sesbania sesban*	Jainti	Fabaceae	Tolerant	Quick growing	By seeds	Evergreen
155	*Sesbania speciosa*	Seemaiagathi	Fabaceae	Tolerant	Quick growing	By seeds	Evergreen
156	*Soymida febrifuga*	Rahan	Meliaceae	Tolerant	Quick growing	By seeds	Deciduous
157	*Spondias pinnata*	Wild Mango	Anacardiacea	Tolerant	Quick growing after 1st year	By Seeds	Deciduous
158	*Sterculia foetida*	Jangli badam	Sterculiaceae	Tolerant	Quick growing	By seeds	Deciduous
159	*Sterculia guttat*	Kukur golder	Sterculiaceae	Tolerant	Quick growing	By seeds	Deciduous
160	*Strychnos nux-vomica*	Kuchla	Loganiaceae	Tolerant	Quick growing	By seeds	Deciduous
161	*Syncarpia glomulifera*	Turpentine tree.	Mytaceae	Tolerant	Quick growing	By seeds	Evergreen
162	*Syzygium cumini*	jomon	Mytaceae	Tolerant	Quick growing	By seeds	Evergreen
163	*Tabernaemantana divaricata*	Chandani	Apacynaceae	Tolerant	Quick growing	By cuttings	Evergreen
164	*Tamarindus indica*	imli	Caesapinaceae	Tolerant	Quick growing	By seeds	Evergreen
165	*Tecomo stans*	Koreneklor	bignoniaceae	Tolerant	Quick growing	By seeds	Evergreen
166	*Tectono grandis*	sogwon	Verbenaceae	Tolerant	Quick growing	By seeds	Deciduous

167	*Terminalia alata*	Asan	Combretaceoe	Tolerant	Quick growing	By seeds, cutting	Deciduous
168	*Terminalia arjuna*	Sadado	Combretaceoe	Tolerant	Quick growing	By seeds	Deciduous
169	*Terminalia Bellerica*	Bahera	Combretaceoe	Tolerant	Quick growing	By seeds	Deciduous
170	*Terminalia Catappa*	Deshi badam	Combretaceoe	Tolerant	Quick growing	By seeds	Deciduous
171	*Terminalia chebulo*	Harra	Combretaceoe	Tolerant	Quick growing	By seeds	Deciduous
172	*Thespesia populneoides*	paraspipal	molvaceae	Tolerant	Quick growing	By cuttings	Evergreen
173	*Thevetia peruviana*	pila kaner	Apocynoceae	Tolerant	Quick growing	By seeds	Evergreen
174	*Thuja occidentalis*	White cedar	Cupressaceae	Tolerant	Quick growing	By cuttings	Evergreen
175	*Thuja plicata*	Giant arborvitae	Cupressaceae	Tolerant	Quick growing	By cuttings	Evergreen
176	*Trema orientalis*	Gio	Ulmaceae	Tolerant	Quick growing	By seeds	Evergreen
177	*Ulmus wallichiana*	Mored pabuna	Ulmaceae	Tolerant	Quick growing	By seeds	Evergreen
178	*Zizyphus mauritiana*	Ber	Rhomnaceae	Tolerant	Quick growing	By seeds	Evergreen
179	*Zizyphus rugosa*	Suran	Rhamnaceae	Tolerant	Quick growing	By seeds	Evergreen
180	*Zizyphus xylopyra*	Kat	Rhamnaceae	Tolerant	Quick growing	By seeds	Evergreen

(Source: Guidelines for Developing Greenbelts, CPCB, March 2000)

Ashok (*Saraca asoka*)

Mango (*Mongifera indica*)

Babul (*Acacia farnesiana*)

Neem (*Azadirachta indica*)

Figure 4.4 –Proposed Species for Greenbelt Plantation

4.6 Socio-Economic Environment

The proposed expansion will have several positive impacts for the workers engaged during its construction phase, namely –

1. Locals, both skilled and unskilled labourers/workers will be provided with employment opportunities at the project site.
2. Several indirect employment opportunities will also be created during the construction phase of the proposed expansion.
3. It will also enable the labourers to gain access to better healthcare through the regular medical camps that will be established.

The project will lead to the establishment of several leather manufacturing and leather processing units during its operational phase and will have the following positive impacts –

1. The project site will provide an ideal place for leather industries to move their operations with easy access to raw materials, continuous water and electricity supply and solid, liquid and hazardous waste management system.
2. The upcoming units will augment the supply of finished leather and leather products available for both domestic consumption and for exports boosting the local economy and our foreign exchange reserves.

Benefits arising out of the proposed project during its construction and operation phase has been discussed in further detail in **Chapter 8** from **Page 224** to **226**.

Besides the above-mentioned positive impacts, the project also has the potential/possibility of creating certain negative impacts. The following are the anticipated negative impacts and the proposed mitigation measures due to the construction and operation phase of proposed expansion on the socio-economic environment –

Table 4.14 – Anticipated Impacts and Proposed Mitigation Measures for Socio-Economic Environment

Anticipated Impacts	Proposed Mitigation Measures
Construction Phase	
1. Occupational hazards for workers engaged in construction activities.	1. Providing workers with safety gadgets such as masks, earmuffs and other PPE will be mandatory before the start of any construction activities. 2. Regular medical checkup of workers will be carried out. 3. Workers will be provided clean drinking water and sanitation facilities. 4. Fire extinguishers and buckets of sand will be provided in the fire-prone areas.

	5. Storage of flammable and hazardous materials shall be done as per established rules and regulations by the upcoming units.
Operation Phase	
1. Increased demand on existing resources. Water: 4.22 MLD Electricity: 7.23 MVA	1. Rain water harvesting for ground water recharge and its utilisation for various purposes within the CLC can be carried out. 2. It is strongly recommended to recycle the treated effluent from the CETP for plantation and flushing purposes for reducing the overall water requirement of the project. This recommendation has been accepted by the project authorities and will be implemented in the future. 3. Energy efficient devices such as LED bulbs to reduce the overall electricity consumption will take place.

4.7 Solid Waste

The construction phase waste will comprise of excavated and demolition material while operational phase waste may comprise of domestic, industrial and hazardous wastes. The different types of wastes need to be handled as per their needs and regulatory requirements. It is not possible to dispose off all type of wastes onto the land and has to be dealt with depending upon their type and characteristics.

The following solid wastes are expected to be generated during the construction and operational phase of the proposed expansion –

Table 4.15 – Solid Waste Generation and its Disposal

Anticipated Impacts	Proposed Mitigation Measures
Construction Phase	
1. Construction and demolition waste The construction and demolition waste includes debris, concrete, steel and other metals, pallets, packaging and paper products, fluorescent tubes, wood beams, joists, studs, baseboards, bricks etc.	1. Specific areas within the project site shall be allotted for temporary storage of construction and demolition waste. 2. Construction and demolition waste storage area will be covered to prevent it affecting its surroundings. 3. Construction and demolition waste will be either reused within the project site or disposed off as per Construction and Demolition Waste Management Rules, 2016.
2. Hazardous waste Hazardous wastes include products such as paints, cleaners, oils, batteries, etc. that contain potentially hazardous ingredients	1. Hazardous wastes will be stored separately. 2. Hazardous wastes will be disposed off as per Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.
Operation Phase	
1. Municipal solid waste Domestic wastes include food leftovers, vegetable peels, plastic, clothes, ash, etc.	1. A three bin system will be adopted for the segregation of waste into non-recyclable waste (dark grey bin), food waste (green bin) and paper (blue bin). 2. These wastes will in turn be disposed of Municipal Solid Wastes (Management and Handling) Rules, 2000.
2. Hazardous Waste PETP and CETP sludge, leather pieces/scrambles, salt, buffing dust,	1. PETP and CETP sludge, leather pieces/scrambles, salt, buffing dust and shaving dust will be sent to SLF for disposal.

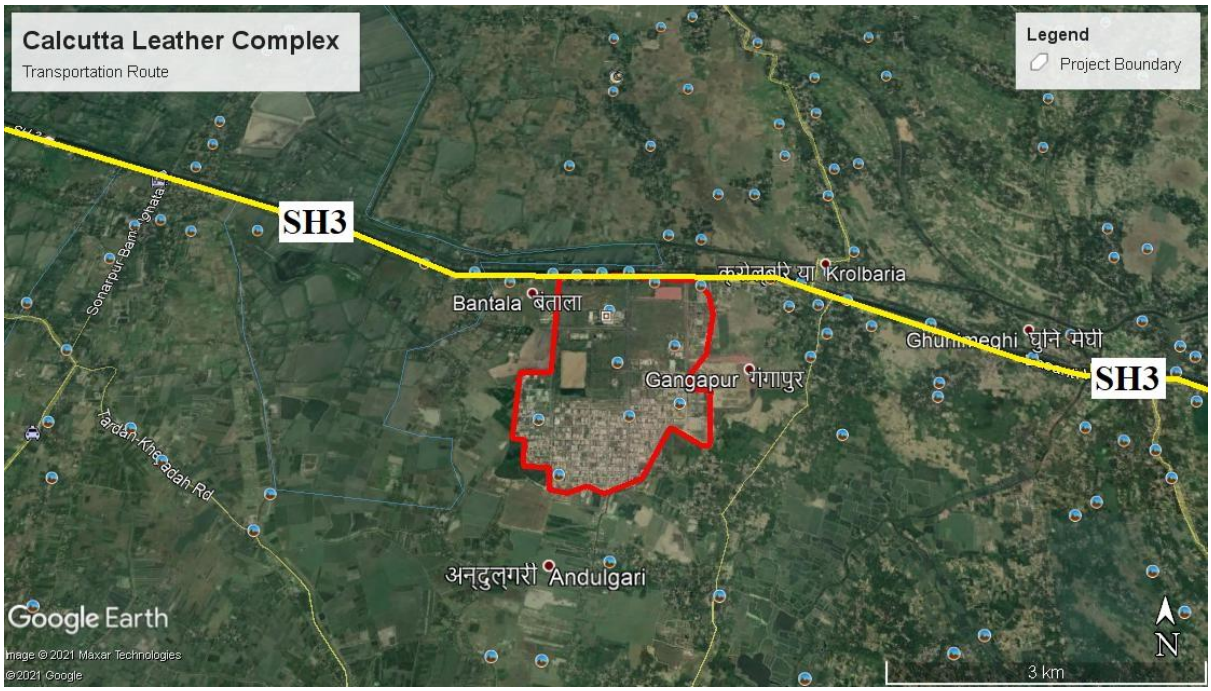
shaving dust, used oil and used battery waste	2. Used oil and used battery waste will be sold to authorised companies as per norms by the units.
3. Empty bags, drums and containers containing chemical traces.	1. Empty bags, drums and containers containing chemical traces will be sold to authorised persons as per norms.

4.8 Traffic Study

4.8.1 Vehicular Traffic Density

Traffic study was carried out as to estimate the existing traffic density. Enumeration and calculation of traffic density as per IRC 106:1990 has been calculated to estimate level of services.

SH3 is a 8-lane divided (two way) road with a width of about 90'. Transportation survey was carried out on SH3 ON 20.03.2021 between 9:00 AM to 9:00 PM from Kolkata towards Krolbaria and from Krolbaria towards Kolkata.



presents the location selected for traffic study.

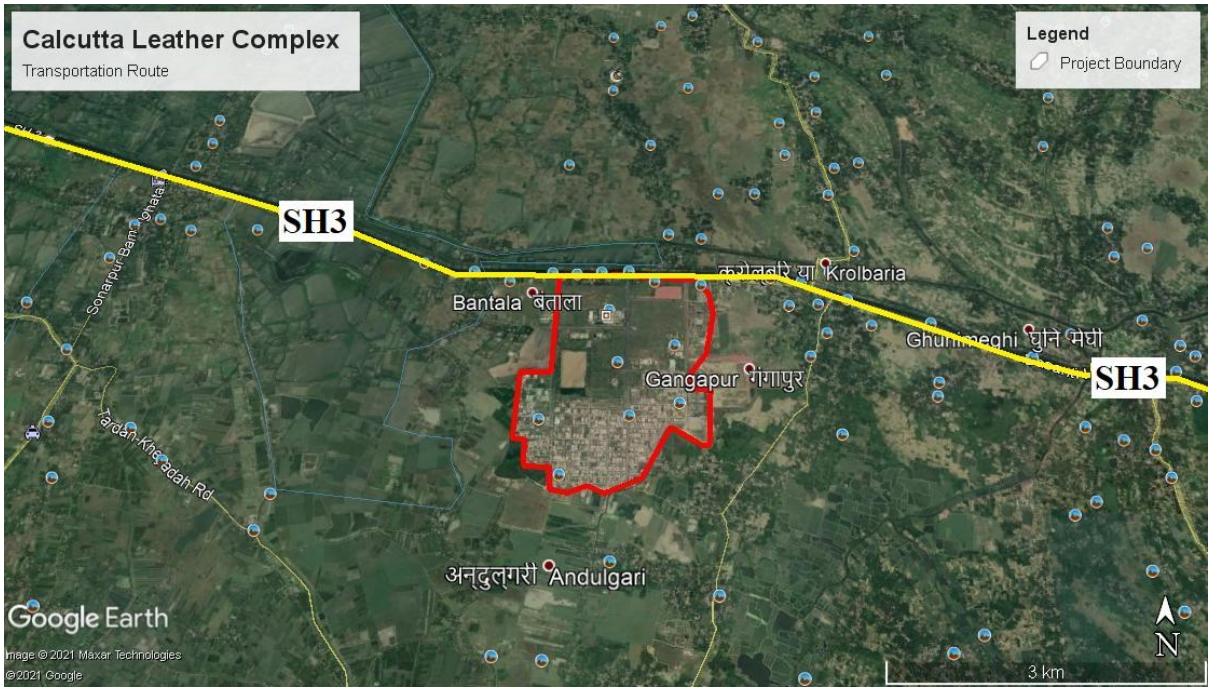


Figure 4.5 – Location of Traffic Study

Table 4.16 and **Table 4.17** provides the PCU factors of various modes of transportation and the performance of a given road network based on the traffic load on it. These values are used to calculate the carrying capacity of a given road network and the impact the proposed project will have on road's carrying capacity. A V/C value of more than 1 is indicates the existing road infrastructure is incapable of ensuring smooth flow of traffic and would thus need to be expanded.

Table 4.16 – PCU Factors of Various Modes of Transportation

S. No.	Mode	Equivalent PCU Factor	
		Percentage Composition of Vehicle Type in Traffic Stream	
		5%	≥ 10%
Fast Vehicles			
1	Two Wheelers	0.5	0.75
2	Passenger Cars and Pick-Up Vans	1	1
3	Auto-Rickshaw	1.2	2
4	Light Commercial Vehicles	1.4	2

5	Trucks and Buses	2.2	3.7
6	Agricultural Tractor Trailers	4	5
Slow Vehicles			
7	Cycle	0.4	0.5
8	Cycle Rickshaw	1.5	2
9	Tonga (Horse Driven Vehicle)	1.5	2
10	Hand Cart	2	3

(Source: IRC:106-1990)

Table 4.17 – Performance of a Given Roadway Based on its V/C Ratio

S. No.	Performance	LOS	V/C
1	Excellent	A	0.0 - 0.2
2	Very Good	B	0.2 - 0.4
3	Good / Average / Fair	C	0.4 - 0.6
4	Poor	D	0.6 - 0.8
5	Very Poor	E	0.8 - 1.0

The existing traffic, V/C ratio & LOS and traffic density are presented below –

Table 4.18 – Existing Traffic Scenario

S. No.	Mode	Conversion Factor	Value from Field Survey	Total PCU
Fast Vehicles				
1	Two Wheelers	0.5	822	411
2	Passenger Cars and Pick-Up Vans	1	2237	2237
3	Auto-Rickshaw	1.2	966	1159.2
4	Light Commercial Vehicles	1.4	1165	1631
5	Trucks and Buses	2.2	1649	3627.8
6	Agricultural Tractor Trailers	4	0	0
Slow Vehicles				

7	Cycle	0.4	553	221.2
8	Cycle Rickshaw	1.5	0	0
9	Tonga (Horse Driven Vehicle)	1.5	0	0
10	Hand Cart	2	0	0
Total			**7392**	**9287.2**
Type of Carriageway (8-Lane Divided – Two Way)				**43200**
V/C Ratio				**0.21**

The roadway studied under the traffic study is having "B" LOS i.e. "very good" performance and can thus easily handle the existing traffic load.

There will be an increase in the traffic load on the existing road network upon the beginning of the construction and operation phase of the proposed project. **Table 4.19** and **Table 4.20** presents the traffic conditions during the construction and operation phase of the project respectively.

Table 4.19 –Traffic Scenario During the Construction Phase of the Project

S. No.	Mode	Conversion Factor	Value from Field Survey	Total PCU
Fast Vehicles				
1	Two Wheelers	0.5	822	411
2	Passenger Cars and Pick-Up Vans	1	2237	2237
3	Auto-Rickshaw	1.2	966	1159.2
4	Light Commercial Vehicles	1.4	1165	1631
5	Trucks and Buses	2.2	1877	4129.4
6	Agricultural Tractor Trailers	4	0	0
Slow Vehicles				
7	Cycle	0.4	553	221.2
8	Cycle Rickshaw	1.5	0	0
9	Tonga (Horse Driven Vehicle)	1.5	0	0
10	Hand Cart	2	0	0
Total			**7620**	**9788.8**

Type of Carriageway (8-Lane Divided - Two Way)	**43200**
V/C Ratio	**0.23**

The value is less than 1; therefore, carrying capacity of the road can bear the additional traffic load of 228 trucks/day which will be added during the construction phase of the proposed expansion.

From the above analysis it can be seen that the V/C ratio will change to 0.23 from 0.21 with LOS remaining same at "B" which is "very good".

Table 4.20 – Traffic Scenario During the Operation Phase of the Project

S. No.	Mode	Conversion Factor	Value from Field Survey	Total PCU
Fast Vehicles				
1	Two Wheelers	0.5	822	411
2	Passenger Cars and Pick-Up Vans	1	2465	2465
3	Auto-Rickshaw	1.2	966	1159.2
4	Light Commercial Vehicles	1.4	1621	2269.4
5	Trucks and Buses	2.2	1649	3627.8
6	Agricultural Tractor Trailers	4	0	0
Slow Vehicles				
7	Cycle	0.4	553	221.2
8	Cycle Rickshaw	1.5	0	0
9	Tonga (Horse Driven Vehicle)	1.5	0	0
10	Hand Cart	2	0	0
Total			**8076**	**10153.6**
Type of Carriageway (8-Lane Divided - Two Way)				**43200**
V/C Ratio				**0.24**

The value is less than 1; therefore, carrying capacity of the road can bear the additional traffic load of 228 passenger cars and 456 light commercial vehicles which will be added during the operation phase of the proposed expansion.

From the above analysis it can be seen that the V/C ratio will change to 0.24 from 0.21 with LOS remaining same at "B" which is "very good".

CHAPTER 5 – ANALYSIS OF ALTERNATIVES

5.0 General

Consideration of alternatives to a project proposal is a requirement of EIA process. During the scoping process, alternatives to a proposal can be considered or refined, either directly or by reference to the key issues identified. A comparison of alternatives helps to determine the best method of achieving the project objectives with minimum environmental impacts or indicates the most environmentally friendly and cost-effective option.

5.1 Site Selection

Tanneries in the city of Kolkata used to operate mainly out of the three leather clusters of Tangra, Tiljala and Topsia. However, in order to reduce the air pollution in the city of Kolkata, the Supreme Court ordered the relocation of all tanneries based in Kolkata outside of the city premises.

The Government of West Bengal conceived CLC as an integrated complex housing all activities related to the leather industry in a modern and environmentally friendly manner while providing all basic infrastructure facilities such as water, electricity and easy access to transportation.

The project intends to relocate all the tanneries engaged in the manufacturing of leather and leather goods to the CLC located at Village Bantala, Post Bhojerhat, Tehsil & District – South 24 Parganas, West Bengal primarily from the three leather clusters of Tangra, Tiljala and Topsia in Kolkata.

The project site is located outside the city limits of Kolkata. However, it has easy access to the city via SH3 located on the Northern border of the project site. It will also be able to cater to both domestic as well as international demands through easy access to railway station (Howrah Railway Station) and airport (Netaji Subhash Chandra Bose International Airport) located 19.5 km and 17 km in the East and North West direction respectively.

The proposed expansion is within the existing CLC complex and does not have any eco-sensitive zone within or near its boundaries. This would thus provide the prospective proponents an excellent environment to set up their tanneries in CLC.

CHAPTER 6 – ENVIRONMENTAL MONITORING PROGRAM

6.0 General

Regular monitoring of environmental parameters is required to assess the status of the surrounding environment during the construction and operation phase the project. A detailed understanding of the existing baseline environmental conditions along with the data gathered from the monitoring programme will serve as an indicator for any deterioration in environmental conditions due to the project. Suitable mitigatory steps can then be implemented to safeguard the environment.

Environmental monitoring is an important measure to determine the efficiency of mitigatory measures. Any EIA is carried over for only a specified period of time and the baseline data gathered cannot bring out all variations induced by the natural or human activities. Therefore, regular monitoring of the environmental parameters is essential monitor the changes in the environmental quality. The objectives of the environmental monitoring program are as follows –

1. Verification of effectiveness of planning decisions
2. Measurement of effectiveness of operational procedures
3. Identification of any deviation from existing/expected baseline conditions
4. Verification of effectiveness of additional mitigatory measures implemented if required

6.1 Implementation of Mitigatory Measures

The mitigation measures suggested in **Chapter 4** in **Table 4.1**, **Table 4.2**, **Table 4.6**, **Table 4.7**, **Table 4.8**, **Table 4.11**, **Table 4.12**, **Table 4.14** and **Table 4.15** from **Page 174** to **205** will be implemented in a phased manner so as to reduce the impact on various components of the environment due to the construction and operation phase of the project.

6.2 Environmental Monitoring Program

Regular monitoring of environmental parameters ensures effective implementation of various mitigatory mechanisms along with limiting the pollution caused due to the various activities of the project.

Along with the baseline data, a regular monitoring programme will serve as an indicator for deterioration in the environmental conditions due to construction and operation of the project. The implementation of the monitoring programme will not just be confined to the project site but will also encompass the 10 km study area of the project.

The environmental monitoring program will include the following components –

1. Environmental baseline monitoring
2. Data analysis and its interpretation
3. Organizational set up for ensuring the proper and time bound manner implementation of the environmental program

The environmental monitoring will be conducted for the following parameters –

1. Soil quality
2. Water quality (surface water, ground water and CETP treated water)
3. Ambient air quality
4. Ambient noise levels

6.2.1 Soil Quality Monitoring

Parameters: Physical parameters, Particle size distribution, Electrical Conductivity, Cation Exchange capacity, Permeability, Water holding capacity, Porosity, Sodium Absorption ratio, pH, Electrical Conductivity, Organic Carbon, Moisture content, Organic matter, Calcium, Magnesium, Chloride, Sulphate, Heavy metals, Nutrient contents etc.

Frequency: Single sampling of each location every half year

6.2.2 Surface Water Quality Monitoring

Parameters: pH, temp, turbidity, magnesium hardness, Total Hardness, total alkalinity, chloride, sulphate, nitrate, fluoride, sodium, potassium, salinity, Total nitrogen, total phosphorus, DO, BOD, COD, Phenol, Heavy metals, Total coliform, Faecal coliform.

Frequency: Grab Samples of each location (single sample in each location every half year).

6.2.3 Ground Water Quality Monitoring

Parameters: As per IS3025.

Frequency: Single sample from each location every half year

6.2.4 Ambient Air Quality Monitoring

Parameters: As per National Ambient Air Quality Standards

Frequency: One 24 hrs sampling for every half year.

6.2.5 Ambient Noise Quality Monitoring

Parameters: Hourly equivalent noise level, Day-time (06:00 am to 09:00 pm) &Night-time (09:00 pm to 06:00 am) Noise level.

Frequency:1 sampling in each location every half year.

6.3 In-House Monitoring Programme

The project site will have an air monitoring station within the complex in order to measure the ambient air quality within CLC.

Besides this, the CETP will also have a laboratory for measuring various parameters of the untreated and treated effluent such as pH, total suspended solids, BOD, COD, TSS, chromium etc.

Testing of these parameters will take place at a regular interval so as to maintain a log of ambient air and effluent quality and take remediation measures if required.

6.4 Environment Management Cell

In order to maintain the environmental quality within prescribed standards, regular monitoring of various environmental components will be carried out during the construction and operation phase of the project.

The environment management cell will be responsible for the following –

1. Implementation and management of various environmental control measures.
2. Monitoring the efficiency of various mitigatory measures that have been implemented.
3. Ensuring the regular monitoring of the various environmental components.
4. Liasoninig with various regulatory authorities such as the MoEF&CC, Department of Environment – Government of West Bengal and WBPCB whenever required.

6.5 Occupational Health and Safety

To avoid any adverse effect on the health and safety of workers due to various pollutants especially during construction phase, the following measures will be adopted –

1. Provision of drinking water and sanitation facilities
2. Construction workers will be provided with PPE such as dust masks, helmets, shoes etc.
3. Regular maintenance and testing of all equipment and vehicles
4. Periodical medical examination of workers
5. First aid facility
6. Worker training for use of first aid in case of an accident

To avoid any adverse effect on the health and safety of workers due to various pollutants during operation phase, the following measures will be adopted –

1. Providing the workforce with suitable PPE
2. Regular training of workforce
3. Making a DMP for CLC
4. Training of workforce in administrating first aid in case of an accident

CHAPTER 7 – ADDITIONAL STUDIES

7.0 General

The project also needs to undertake the preparation and implementation of a risk assessment and DMP in order to prevent, prepare and deal with any unforeseen accidents, be it natural or anthropogenic in nature.

7.1 Risk Assessment

Risk assessment is a process used to identify hazards and risk factors that have a potential to cause harm to people and/or property, analysis and evaluation of the risk associated with that hazard and determination of suitable measures to eliminate the hazard or control the risk when the hazard cannot be eliminated.

Figure 7.1 – Components of Risk Assessment

The objective of any risk assessment process is to identify and evaluate the hazards and implement control measures to minimise and if possible, eliminate the hazards.

Risk assessments form an integral part of an occupational health and safety management plan for any proposed project and help in achieving the following –

1. Creating awareness of hazards and risk
2. Identifying vulnerable group/population
3. Determining the required control program for a given hazard
4. Determining the effectiveness of the control measure(s)
5. Prioritizing hazards and control measures
6. Meeting regulatory requirements

7.2 Hazard Identification

The proposed expansion is vulnerable to both natural as well as anthropogenic hazards, described in **Table 7.1**.

Table 7.1 – Potential Hazards for the Proposed Expansion

Natural Hazards	Man-Made Hazards
1. Flooding Flooding may occur due to excessive rain. 2. Earthquake The project falls under Moderate Damage Risk Zone (Seismic Zone III).	1. Fire and Explosion Fire and explosion due to improper fuel storage. 2. Electrical Short circuit in leather units from wires, machinery and/or lighting source. 3. Mechanical Malfunction/improper usage of machinery and vehicles.

Table 7.2 – Vulnerability Analysis for the Proposed Expansion

S. No.	Hazard	Risk Analysis	
		Construction Phase	Operation Phase
1	**Natural Disasters**		
1.1	Flooding	Areas under construction. Storage yard for construction materials and fuel.	Leather units, R&D centre, training centre and CETP.

		Vehicles and construction machinery.	
1.2	Earthquakes	Areas under construction of leather units. Storage yard for construction materials and fuel.	Leather units, R&D centre, training centre and CETP.
2	**Anthropogenic Disasters**		
2.1	Fire and Explosion	Storage yard for construction materials and fuel. Vehicles and construction machinery.	Leather units, R&D centre, training centre and CETP.
2.2	Electrical	Storage areas used to house fuel.	Leather units, R&D centre, training centre and CETP.
2.3	Mechanical	Any active construction area within the project.	Leather units, R&D centre, training centre and CETP.

7.3 Risk Analysis

Risk analysis is defined as the process of identifying and analysing potential events that could negatively impact the construction and operation phase of any given project and is required in order to help the project proponent to avoid or mitigate those risks.

Performing a risk analysis includes considering the possibility of an adverse event caused by natural processes or by adverse events caused by malicious or inadvertent anthropogenic activities.

7.4 Risk Control

The following measures will be implemented during the construction and operational phase of the project in order to eliminate or minimise the severity of the above-mentioned hazards –

Table 7.3 – Risk Control Measures for the Proposed Expansion

S. No.	Hazard	Risk Control Measures	
		Construction Phase	**Operation Phase**
1	**Natural Disasters**		

1.1	Flooding	No construction activities will be allowed out during the monsoon season.	The finished ground level of CLC project site has been kept at 98.40 m while the normal water level of SWF is found to be around 96.625 m which enables self-draining of the project site by gravity. Storm water drainage also enables the efficient collection, transportation and removal of rain water. To prevent the backflow of water from SWF and Karaidanga Canal into the complex during floods and for effective discharge of storm water from the complex, a pump house has been constructed at the end of each main drain flowing towards the front side of the complex and overflow type weir on each main drain flowing towards the back side of the complex. By constructing the pump houses and overflow type weirs, all the main drains will be utilised for the storage of process water. The bottom level of the drains are at 93.00 m at the pump house locations and the weir

			locations and the water level can go upto 96.75 m level which is above the water level of SWF and High Flood Line of Karaindanga Canal. When water in the drain crosses 96.75 m level in the drain flowing towards the front side of the complex, the water will enter into the sump of the pump house and it will go on accumulating in the sump till the water level comes upto 95.80 m level when the water will flow to the SWF through the pipes. During flood time, when the water level will be above 95.80 m level, the storm water flow will be pumped out from the complex to SWF through the pipes.
1.2	Earthquakes	All workers working on site will be educated to prevent loss of life. Assembly points will be clearly marked within the site.	It will be ensured that all infrastructure is constructed as per existing bylaws. Assembly points will be clearly marked within the site.
2	**Anthropogenic Disasters**		
2.1	Fire and Explosion	Flame proof lighting will be provided within fuel storage sheds.	Fire alarms, fire hydrants and fire extinguishers will be provided.

		Fire hydrants, extinguishers and buckets of sand will be provided near vulnerable areas. Regular maintenance of vehicles and machinery will be ensured. Only skilled workers will be allowed to operate vehicles and machinery.	Regular maintenance of machinery will be carried out. Only skilled workers will be allowed to operate vehicles and machinery.
2.2	Electrical	Flame proof lighting will be provided within fuel storage sheds. Fire hydrants, extinguishers and buckets of sand will be provided near vulnerable areas. Danger signs will be put up at vulnerable and high risk areas. Only authorised skilled personnel will be allowed to operate and maintain electrical controls.	Regular maintenance of electrical devices and machinery will be carried out. Only authorised skilled personnel will be allowed to operate and maintain electrical controls.
2.3	Mechanical	Fire extinguishers and buckets of sand will be provided near vulnerable areas. Regular maintenance of vehicles and machinery will be ensured. Only skilled workers will be allowed to operate vehicles and machinery.	Regular maintenance of machinery will be carried out. Only skilled workers will be allowed to operate vehicles and machinery.

7.5 Disaster Management Plan

The DMP is a guide, giving general considerations, directions and procedures for handling of emergencies likely to arise during construction and operation of a project. The DMP has been prepared for the proposed project on the basis of the hazard identification and risk analysis.

In the unlikely event that a disaster occurs, disaster management kicks in. This includes instituting procedures pertaining to a number of issues such as communication, rescue and rehabilitation.

The DMP is aimed to ensure safety of life, protection of environment and protection of infrastructure. For the effective implementation of a DMP, it needs to be widely circulated and personnel training needs be given.

The objective of a DMP is to make use of the combined resources of the workers at the project site and outside services to achieve the following –

1. Rescuing and providing medical treatment to the affected people
2. Safeguarding other people
3. Minimizing damage to the environment and infrastructure
4. Rehabilitation of affected people (in operational phase)
5. Preserve relevant records for the subsequent inquiry into the cause and circumstances of the emergency

7.5.1 Fire Fighting Facilities

Sufficient fire extinguishers will be installed at vulnerable locations such as fuel storage yards, construction areas, within leather units etc.

Fire alarms and fire extinguishers will be made available for fire protection during operational phase.

7.5.2 Emergency Facilities

Emergency communication system will be available at all times to report any emergency. Contact details of nearest hospital, police department, fire brigade and other important bodies will be kept handy.

Table 7.4 – Emergency Contact Numbers

S. No.	Emergency Contact	Contact Number
1	Police	100
2	Fire Fighting Department	101
3	Hospital Ispat Coorporative Hospital Ohio Hospital	108 +91 – 80012-57528 +91-33-6602-6602/6604, +91 – 9073-999-299

CHAPTER 8 – PROJECT BENEFITS

8.0 General

Any infrastructure project will naturally bring benefits to the local population and economy. The purpose of an EIA is to minimise the negative impacts due to the project by implementing suitable mitigation measures and maximise the positive impacts that will be brought about due to its implementation.

Any given project has two major components attached to it, namely, backward linkages and forward linkages, which can be defined as follows –

1. **Backward Linkages**

   Backward linkages can be defined as channels that can are created between the project proponent and its suppliers and/or the people dependent on the project which leads to the exchange of money, materials and information.

   Backward linkages enable investments in sectors and facilities upon which the project depends.

2. **Forward Linkages**

   Forward linkages are channels that are created between the project proponent and its customers (owners and workers) which leads to the exchange of money, materials and information.

   Forward linkages enable subsequent investment in sectors and facilities which depend upon the project.

8.1 Project Beneficiaries

The project beneficiaries are divided into three broad categories based on the following parameters –

1. Backward Linkages
2. Forward Linkages
3. Others

8.1.1 Backward Linkages

Backward linkages will create the following benefits due to the proposed expansion –

1. **Construction Workers**

   The construction of various infrastructure facilities will enable the construction workers to find employment and a source of income and lead to improvement in their standard of living. The construction labourers would also benefit from labour welfare schemes that will be enacted for them such as regular health check-ups.

2. **Construction Industry**

   The construction industry will also be a beneficiary of the proposed expansion as it will be employed for the construction of the infrastructure facilities.

3. **Transportation Industry**

   The raw materials required for various construction related activities needs to be transported to the construction site along with transportation and recycle/disposal of any waste generated during the construction phase.

   This will lead to the development of the transportation industry. It may also lead to an increase in the sales of transportation vehicles such as trucks.

   It will also provide indirect employment to several truck drivers and mechanics engaged in the maintenance of these vehicles, thereby providing employment to the locals and creating wealth for the owners and their employees engaged in the transportation sector.

4. **Indirect Beneficiaries**

   Many people while not directly employed by the project proponent would indirectly benefit from the proposed expansion by engaging in various activities such as suppliers of essential services such as temporary housing, catering etc.

8.1.2 Forward Linkages

Forward linkages will create the following benefits due to the proposed expansion –

1. Leather and Leather Goods Manufacturers

Leather and leather goods manufacturers will be the ultimate end users of the units and the infrastructure provided by KMDA in CLC and it is for them that the proposed expansion is being executed. The proposed expansion will enable them to gain access to several facilities during the operational phase of the project resulting in the following positive impacts –

i. CLC will provide them with an integrated, modern, state of the art and environmentally friendly area to conduct their businesses with easy and constant access to critical infrastructure needs such as water, power and waste management solutions.

ii. CLC is extremely well connected with various transportation centres such as roadways, railways and airport and is close to Kolkata, the capital of West Bengal. Thus, the complex provides easy access to various domestic and international customers.

iii. The project site will also host a R&D centre and a training centre which will enable the owners to provide training to their workforce.

2. Employees

The proposed expansion in its operational phase will hire several workers for the operation of the CETP and the maintenance of the infrastructure such as roads, drains etc.

Workers working in the R&D centre and the training centre will also benefit due to the proposed expansion.

This will enable to secure a steady source of income leading to an improvement in their standards of living.

8.2 Conclusion

The proposed expansion will be beneficial for the upcoming units in the proposed expansion, the workers employed during the construction and operation phase of the proposed expansion as well as augmenting the supply of leather and leather goods during its operational phase.

CHAPTER 9 – ENVIRONMENTAL MANAGEMENT PLAN

9.0 General

EMP deals with the mitigation of negative impacts due to the project within the 10 km study area and is needed to ensure the effective implementation of the proposed mitigation measures as discussed in **Chapter 4 Table 4.1**, **Table 4.2**, **Table 4.6**, **Table 4.7**, **Table 4.8**, **Table 4.11**, **Table 4.12**, **Table 4.14** and **Table 4.15** from **Page 174** to **205**.

The administration of an EMP requires the establishment of an environmental management cell for the implementation, monitoring and analysis of the proposed mitigation measures.

9.1 Environment Management Cell

In order to maintain the environmental quality within prescribed standards, regular monitoring of various environmental components will be carried out during the construction and operation phase of the project.

The environment management cell will be responsible for the following –

1. Implementation and management of various environmental control measures.
2. Monitoring the efficiency of various mitigatory measures that have been implemented.
3. Ensuring the regular monitoring of the various environmental components.
4. Liasoninig with various regulatory authorities such as the MoEF&CC and WBPCB whenever required.

9.2 Land Environment

The following are the anticipated impacts and the proposed mitigation measures due to the construction and operation phase of project on the surrounding land environment –

Table 9.1 – Anticipated Impacts and Proposed Mitigation Measures for Land Environment

Anticipated Impacts	Proposed Mitigation Measures
Construction Phase	
1. Compaction of soil due to heavy earth moving vehicles.	1. Movement of heavy earth moving vehicles will be limited to already

	constructed roads and within the construction areas.
2. Contamination of soil due to oil spillage, mixing of cement etc.	1. Hazardous substances such as diesel required for the operation of construction machineries and vehicles will be kept in a storage yard having an impervious surface. 2. Precast drains will be used as much as possible.
3. Dumping of construction waste in the vicinity of the project area.	1. Reuse of construction waste onsite will be encouraged. 2. Any construction waste that cannot be reused at the project site shall be disposed off as per Construction and Demolition Waste Management Rules, 2016.
4. Spillage of oil and grease from the vehicles and/or storage sheds.	1. Oil shall be stored in storage sheds having an impermeable surface. 2. A ditch shall be constructed around the to intercept any runoff.
5. Change in topography.	1. All constructional activities will be limited within the industrial land i.e., the project site only thus, impact on topography is not anticipated.
Operation Phase	
1. Impact on soil due to disposal of solid waste in the nearby vicinity.	1. Dried sludge from the CETP will be disposed off in the SLF.
2. Soil erosion.	1. Greenbelt development will take place along the internal roads, open areas as well as along the periphery of the project site will be taken up.

3. Spillage of wastewater onto nearby land. 4. Heavy metal contamination of land environment.	1. Wastewater will be partially treated in upcoming individual units followed by treatment at the CETP. 2. Wastewater will be transported to the CETP via impervious drainage system. 3. Chromium recovery unit has been provided in the CETP. 4. Heavy metal concentration in the CETP treated effluent will be as per WBPCB norms.

9.3 Water Environment

The following are the anticipated impacts and the proposed mitigation measures due to the construction phase of project on the surrounding water environment –

Table 9.2 – Anticipated Impacts and Proposed Mitigation Measures for Water Environment

Anticipated Impacts	Proposed Mitigation Measures
Construction Phase	
1. Water required for dust settlement, compaction and curing.	1. Dust suppression will be carried out through sprinklers to conserve water.
2. Discharge and seepage of domestic wastewater generated by labourers and other onsite workers.	1. Mobile toilets will be provided for the labourers for the collection of wastewater which will be treated in portable STP.

9.3.1 Surface Water

The following are the anticipated impacts and the proposed mitigation measures due to the construction and operation phase of project on the nearby surface water bodies –

Table 9.3 – Anticipated Impacts and Proposed Mitigation Measures for Surface Water

Anticipated Impacts	Proposed Mitigation Measures
Construction Phase	
1. Pollution of surface water bodies due to dumping of construction waste.	1. Reuse of construction waste onsite will be encouraged. 2. Any construction waste that cannot be reused at the project site, shall be disposed off as per Construction and Demolition Waste Management Rules, 2016.
2. Soil runoff from the site leading to surface water contamination.	1. Storm water drainage network will be constructed to intercept soil runoff. 2. Construction of desilting tanks along with rain water harvesting pits will take place. 3. Regular cleaning and maintenance of desilting and storm water drains will take place.
Operation Phase	
1. Discharge of wastewater from the units to nearby water bodies.	1. All wastewater generated due to the upcoming units during the project's operational phase shall be sent to the CETP where it will be treated and discharged to Basanti Canal via the CETP drain. 2. The discharged effluent will have pollutant concentrations as per WBPCB norms.
2. Heavy metal contamination of surface water bodies.	1. Wastewater will be partially treated in proposed individual units followed by treatment at the CETP.

	2. Wastewater will be transported to the CETP via impervious drainage system. 3. Chromium recovery unit has been provided in the CETP. 4. Heavy metal concentration in the CETP discharged effluent will be as per WBPCB norms.

9.3.2 Ground Water

The following are the anticipated impacts and the proposed mitigation measures due to the construction and operation phase of project on the ground water –

Table 9.4 – Anticipated Impacts and Proposed Mitigation Measures for Ground Water

Anticipated Impacts	Proposed Mitigation Measures
Construction Phase	
1. Extraction of ground water for construction related activities and domestic requirement.	1. Rain water harvesting will be practised for recharge of ground water bodies. 2. Rain water collected in the surface water bodies present within the CLC will be utilised for meeting the water requirements of various units thereby helping in reducing the overall ground water requirement.
Operation Phase	
2. Extraction of ground water for domestic requirement, plantation purposes and manufacturing processes.	1. Rain water harvesting will be practised in for recharge of ground water bodies. 2. Rain water collected in the surface water bodies present within the CLC will be utilised for meeting the water requirements of various units thereby helping in reducing the overall ground water requirement.

	3. Treated wastewater from the CETP can also be used for plantation purposes and for meeting flushing requirements in order to further reduce the overall groundwater requirement.

9.3.1 Wastewater Treatment

The effluent generated by the individual tanneries will be transported via underground HDPE pipes to the CETP located within the CLC where it will be treated before being discharged into Basanti Canal.

Unit 1-6 of the existing CETP have a combined capacity of 30 MLD and the proposed Unit 7 and 8 of 10 MLD CETP have been designed to treat the incoming effluent from the upcoming leather industries.

9.3.1.1 Trade Effluent Generation and Characteristics

Volume of Trade Effluent (effluent) and its characteristics vary from tannery to tannery. They may also vary within the same tannery from time to time. The Trade Effluent from beam house process viz. soaking, liming, deliming, etc., are highly alkaline, containing decomposing organic matter, hair, lime, sulphide and organic nitrogen with high BOD and COD. The Trade Effluent from tanyard process viz. pickling, chrome tanning is acidic and coloured. Effluent from vegetable tanning contains high organic matter. The chrome tanning wastes contain high amounts of chromium mostly in the trivalent form. The characteristics of combined Trade Effluent before treatment and after treatment are given in **Table 9.5**.

Table 9.5 – Characteristics of Trade Effluent

S. No.	Parameters	Average Concentration (mg/L)
1	BOD	1850
2	COD	4500
3	Chloride	5500
4	TSS	3750
5	Total Cr	165

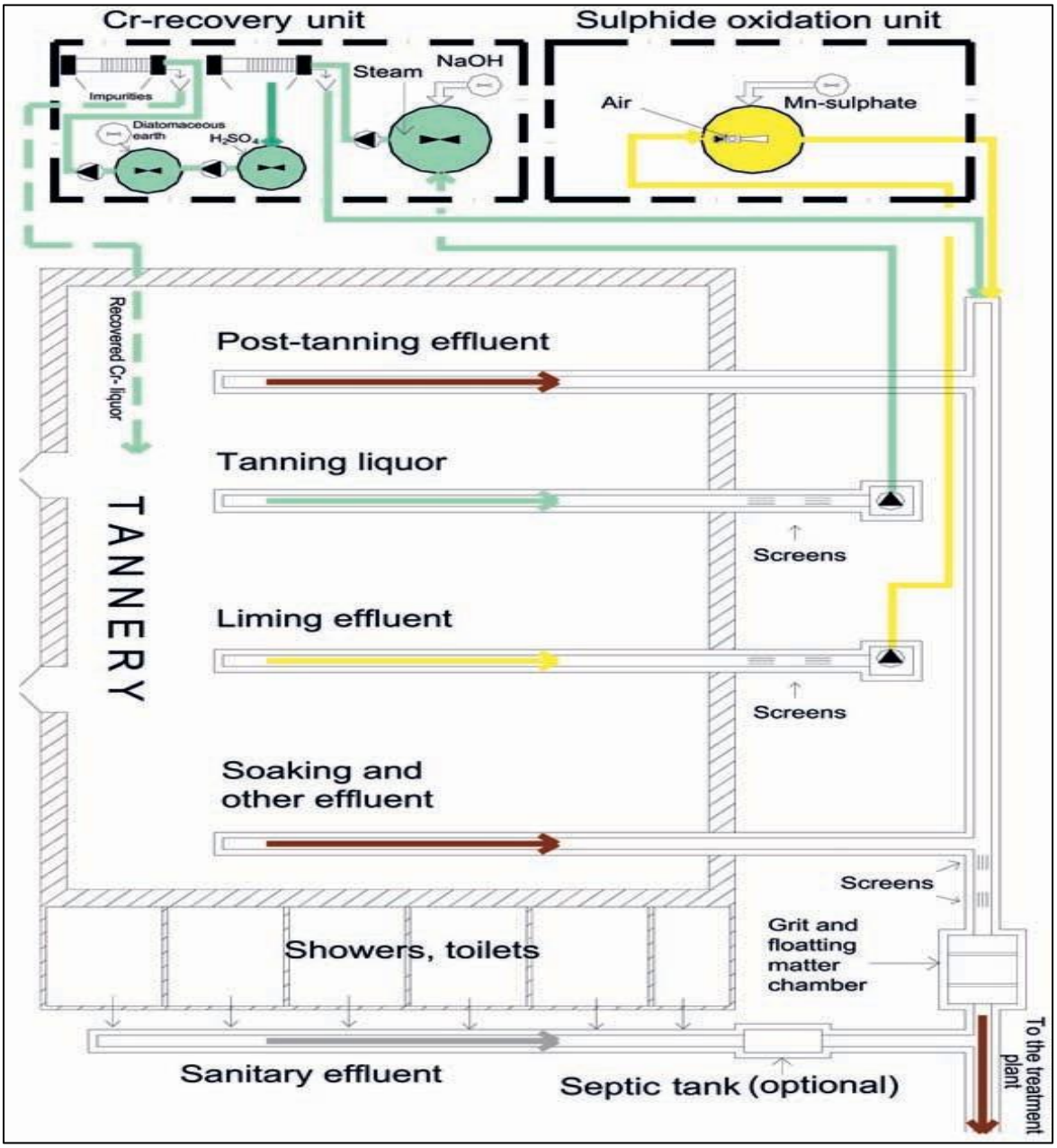


Figure 9.1 – Layout of In-House Segregation of Streams Inside Individual Tanneries Including Chrome Recycling and Oxidation of Sulphides In Liming Effluent

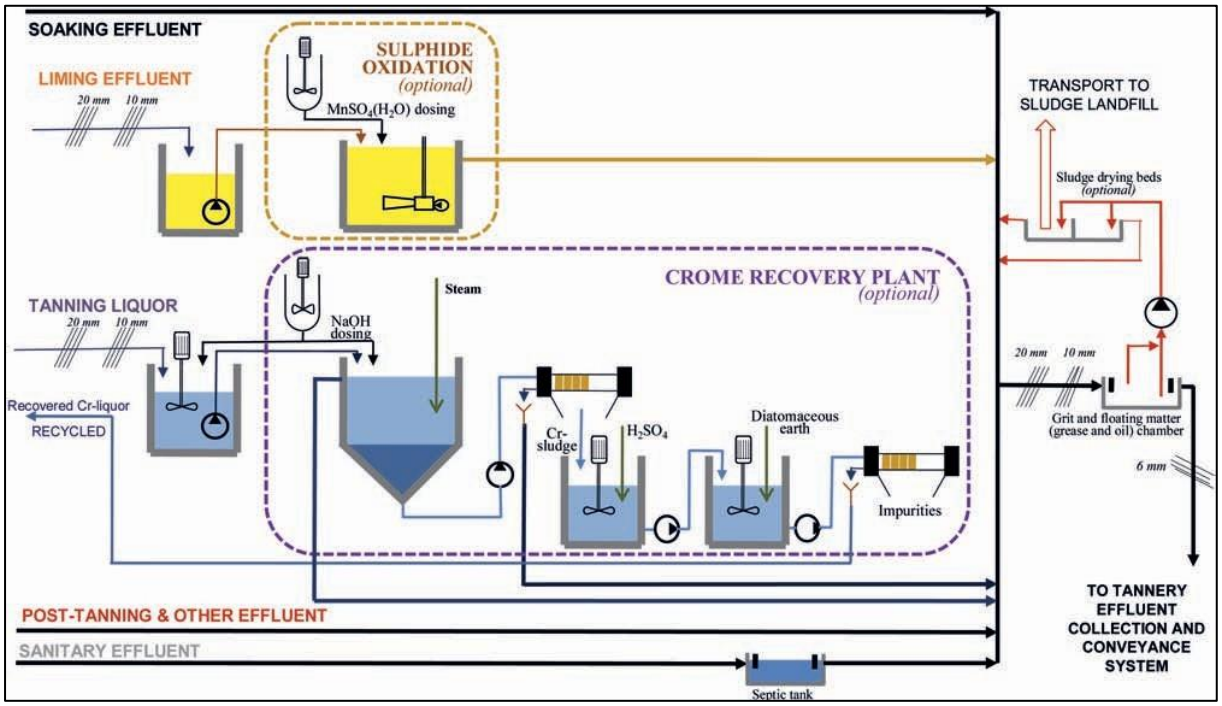


Figure 9.2 – Flowchart of In-House Segregation of Streams Including Chrome Recycling, Treatment of Liming Effluents and Pre-Treatment of Mixed Effluent

It is very important to segregate these streams and to pretreat them separately according to their characteristics to avoid possible safety risks (formation of deadly hydrogen sulphide) and to reduce the cost of treatment and sludge disposal (to avoid contamination of sludge with Cr). The mixing of liming and tanning streams gives rise not only to the obnoxious smell typical of poorly managed tanneries; the resulting lethally poisonous gas, hydrogen sulphide (H2S), is still by far the most frequent killer in tannery accidents, which occur mainly in inadequately ventilated spaces, especially in pits and channels.

Table 9.6 – Pollution Load Per Tonne of Hides/Skins Processed

S. No.	Parameters	Pollution Load (kg)
1	Volume (m^3)	40
2	BOD	70
3	COD	180
4	Chlorides (Cl)	270
5	Dissolved Solids	600

6	Suspended Solids (SS)	100
7	Sulphides (S)	4
8	Chromium (Cr)	30

Process-wise generation of trade effluent and their characteristics are explained in **Table 9.7**.

Table 9.7 – Characteristics of Tannery Effluent

S. No.	Parameter	Soaking	Beam House Operation (Liming, Reliming, Fleshing, Deliming)	Pickling & Chrome Tanning	Wet Finish – Rechroming Dyeing &Fat Liquor	Composite (Including Washings)
1	Volume of the effluent (L/MT) of hides/skins	6000 - 9000	6000 – 10000	1500 – 3000	3000 – 5000	30000 – 40000
2	pH	7.5 - 8.0	8 - 12	2.2 – 4.0	3.5 - 4.5	7.0 - 9.0
3	BOD 5 day at 20°C (Total)	1100 - 2500	2000 - 8000	400 - 800	1000 – 2000	1200 – 3000
4	COD (Total)	3000 - 6000	3000 – 15000	1000 - 3000	2500 – 7000	2500 – 8000
5	Sulphide (as S)	-	50 – 200	-	-	30 – 150
6	TS	35000 - 55000	6000 - 20000	30000 - 60000	4000 – 10000	15000 – 25000
7	TDS	32000 - 48000	5000 – 15000	29000 - 58000	3400 – 9000	13000 – 20000
8	TSS	3000 - 7000	3000 – 15000	1000 - 2000	600 – 1000	2000 – 5000
9	Chlorides (as Cl)	15000 - 30000	3000 – 6000	15000 - 25000	500 – 1000	6000 – 9500
10	Total Cr	-	-	1500 - 3000	30 – 60	80 – 200

- All values except pH are expressed in mg/L
- Volume of Trade Effluent applicable for hides (cow & buffalo) and goatskins.

9.3.1.2 Effluent Treatment

9.3.1.2.1 Preliminary Treatment

Typically, in the case of CETPs servicing tannery clusters often found in developing countries, it is essential to have pre-treatment units installed in individual tanneries. Their role is to remove large particles, sand/grit and grease, but also to significantly reduce the content of chrome and sulphides before the effluent is discharged into the collection network.

Physical-Chemical Treatment (Primary)

The objective here is the removal of settleable organic and inorganic solids by sedimentation, and the removal of materials that will float (scum) by skimming. Approximately 25-50% of the incoming bio- chemical oxygen demand (BOD_5), 50-70% of total suspended solids (SS), and 65% of the oil and grease are removed during primary treatment. The effluent and sludge from primary sedimentation are referred to as primary effluent and sludge.

Biological Treatment (Secondary)

In most cases, secondary treatment follows primary treatment, its goal being the removal of biodegradable dissolved and colloidal organic matter using aerobic biological treatment processes. Aerobic biological treatment is carried out in the presence of oxygen by aerobic micro-organisms (principally bacteria) that metabolize the organic matter in the wastewater, thereby producing more micro-organisms and inorganic end products (principally CO2, NH3, and H2O). Several aerobic biological processes are used for secondary treatment and the differences among them have to do primarily with the manner in which oxygen is supplied to the micro-organisms and with the rate at which organisms metabolize the organic matter.

Advanced (Tertiary) Treatment

Tertiary or advanced wastewater treatment is employed to reduce residual COD load and/or when specific wastewater constituents are not removed by previous treatment stages.

Sludge Handling and Disposal

Effluent treatment plants produce treated, “cleaned” effluent and sludge because inherently the primary aim of wastewater treatment is the removal of solids and some potentially hazardous substances from the wastewater. Furthermore, biologically degradable organic substances are converted into bacterial cells, and the latter are removed from the wastewater.

9.3.1.2.2 Primary treatment

Objectives

1. To eliminate the coarse material normally present in the raw wastewater that could clog/block pumps, pipes and possibly sewer lines.
2. To mix and balance well different tannery streams and thus produce homogenized "raw material" that can be treated in a consistent manner.
3. To adjust pH and eliminate toxic substances (sulphides) and avoid shock loads that can negatively affect the rather sensitive biological treatment.
4. To significantly decrease the BOD/COD load and thus simplify the biological treatment phase and reduce its cost.

To summarize, the purpose is to eliminate the coarse matter, remove almost completely Cr and sulphides, remove the major part of suspended solids, and considerably reduce the BOD and COD content.

Basic Steps: Screening (bar, self-cleaning), pumping/lifting, fine screening, equalization and sulphide oxidation, chemical treatment (coagulation, flocculation) settling and sludge dewatering

i. Screening

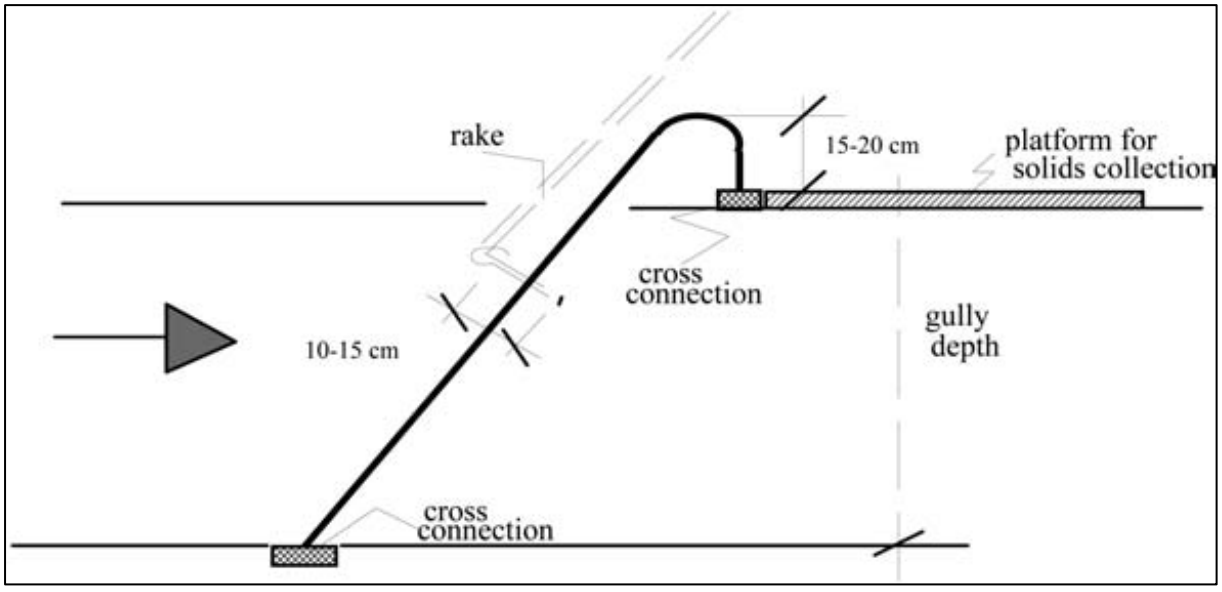


Figure 9.3 – Rough Bar Screen, Side View

Quite often a grease-and-sand trap is also included, usually before fine screening and pumping. Primary and secondary sludge are handled/dewatered together; however, since some CETPs have only primary treatment and the main part of sludge is generated during that stage, sludge dewatering is covered here.

ii. Removal of Grit and Floating Matter

A simple, non-aerated grit-and-floating-matter removal chamber is usually placed in a horizontal gravity channel immediately after the rough screen.

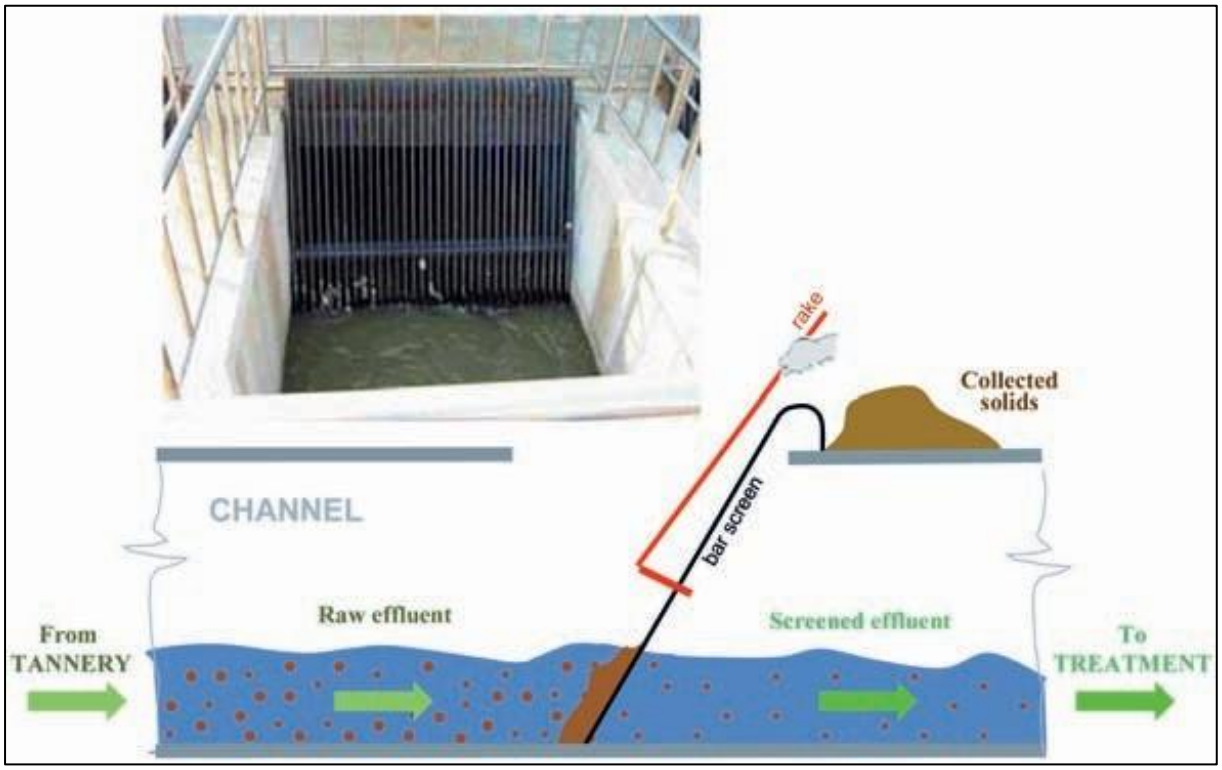


Figure 9.4 – Rough Bar Screen, Operation Principle

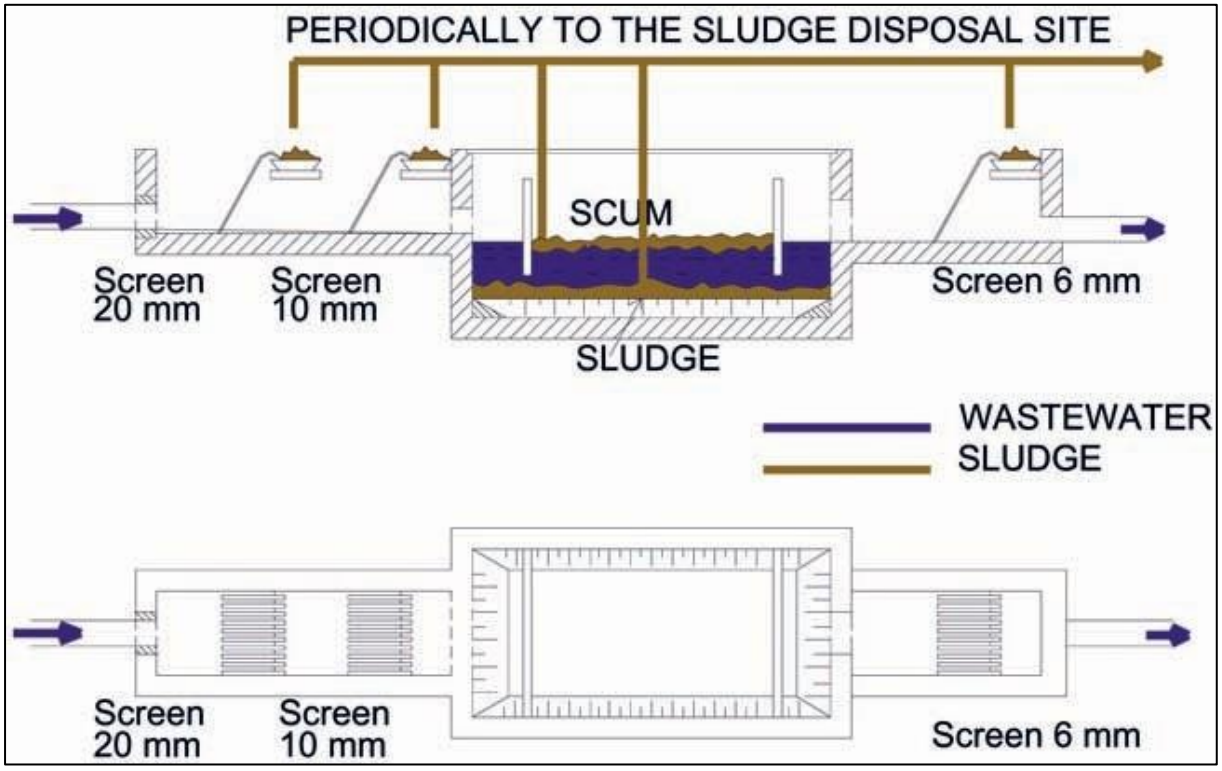


Figure 9.5 – Simple, Non-Aerated Grit-And-Floating-Matter Removal Chamber

CETPs require more sophisticated, aerated systems for the removal of grit and floating matter.

Self-Cleaning Screens

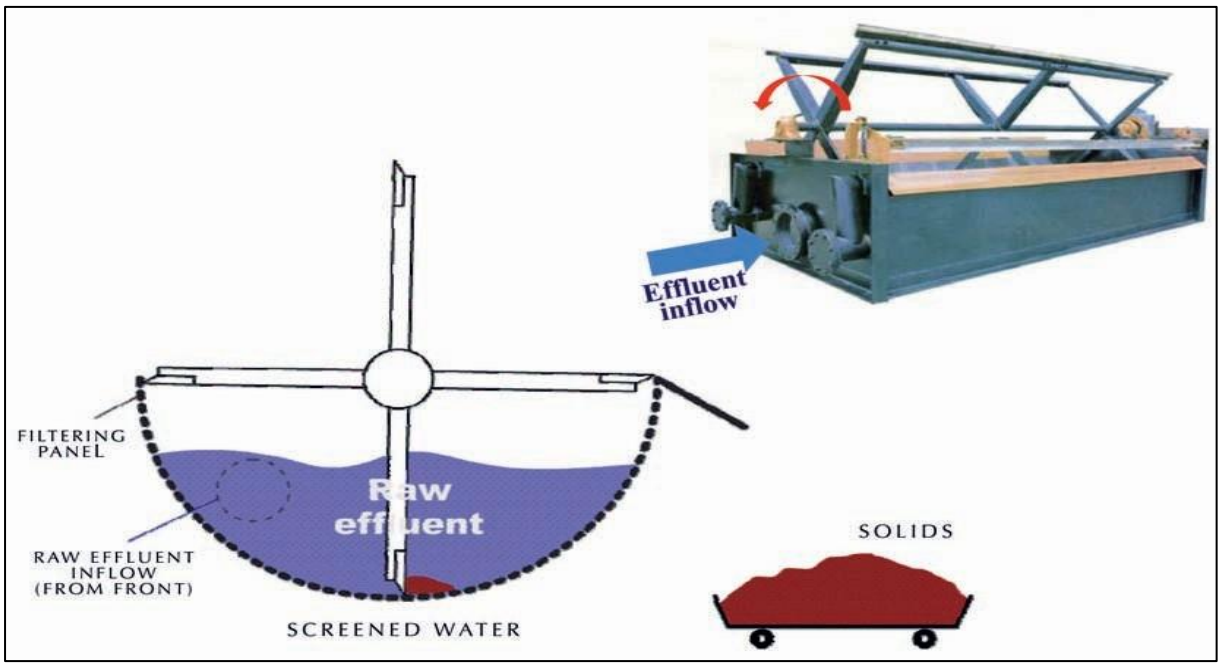


Figure 9.6 – Self-Cleaning, Rotary-Brush Screen, Parkwood Type

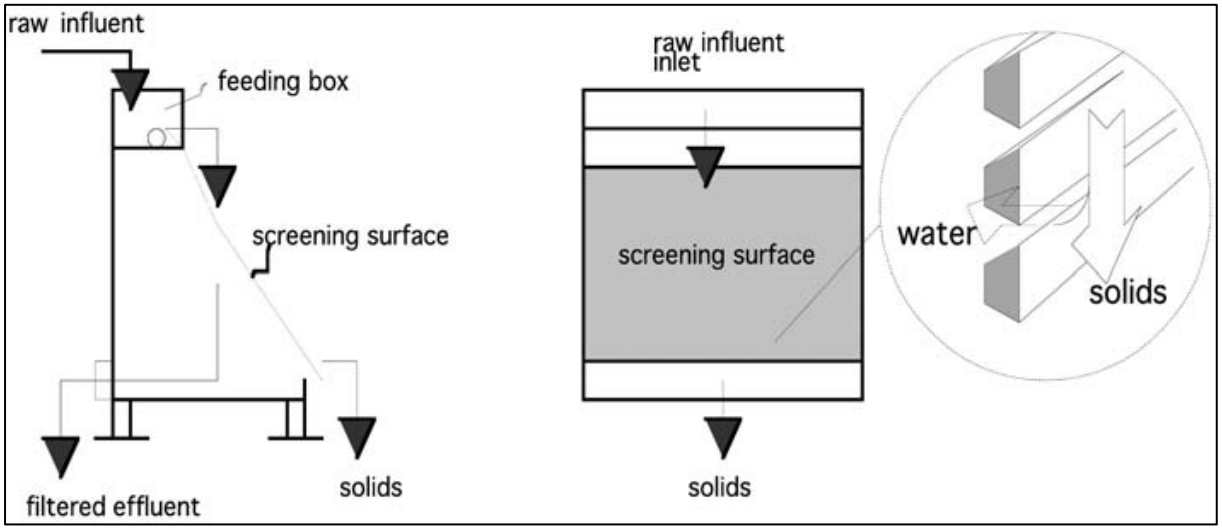


Figure 9.7 - Self-Cleaning Screen, Hydrosieve Type

iii. Pumping/Lifting

It is not possible to transfer effluents throughout the CETP by gravity only; at least one, often more pumping/lifting stations are needed, the first typically located before the rotary screen. Depending on specific requirements (capacity/flow), different types of pumps are used. For medium-scale CETPs, submersible pumps are generally used for this purpose, for large-volume ones, screw (Archimedes) pumps are preferred.

Submersible Pump

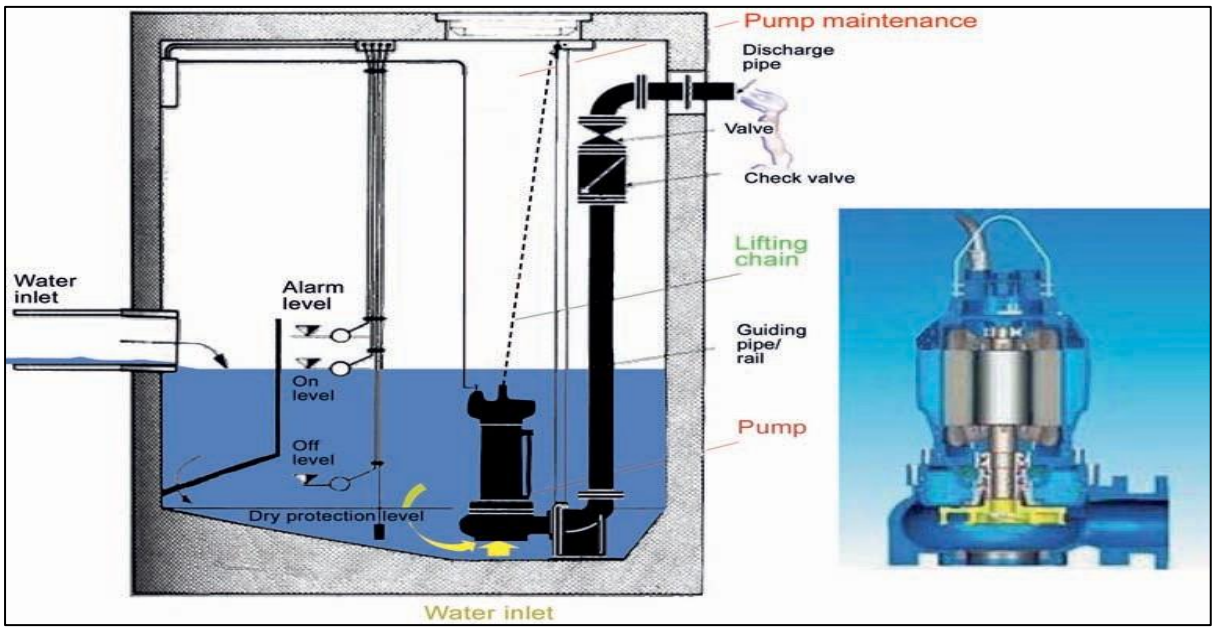


Figure 9.8 – Submersible Pump

Screw (Archimedes) Pump

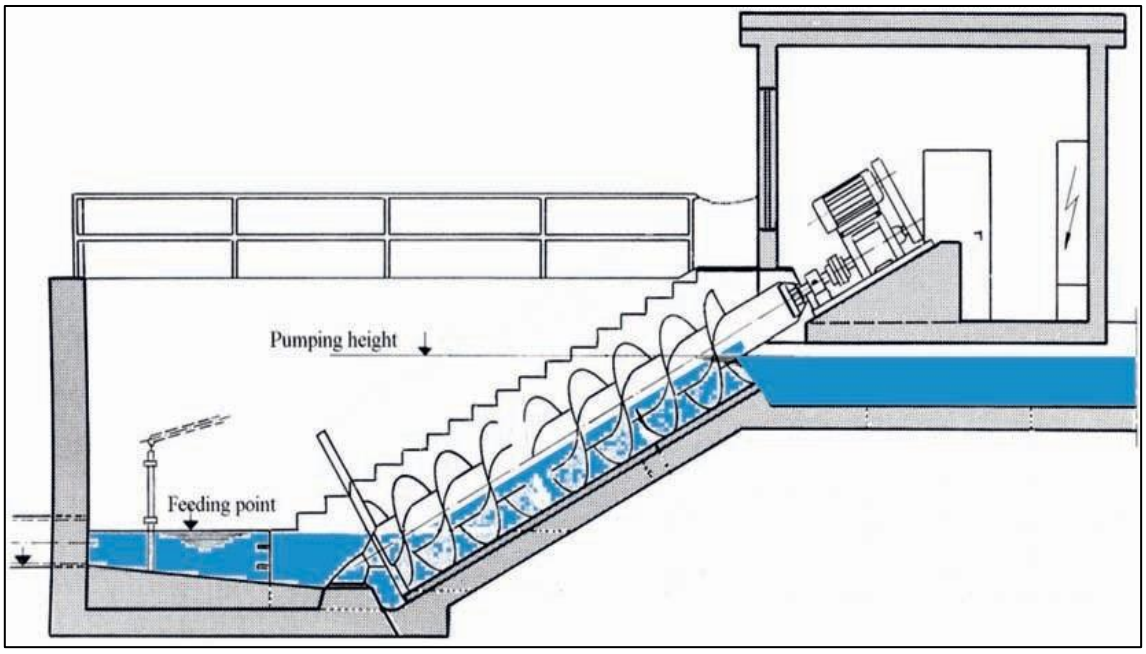


Figure 9.9 – Schematic View of an Archimedes-Type Lifting Pump

iv. Fine Screening

Fine screening should drastically reduce the amount of fine suspended solids. The figures below show rotary-drum screens with outer and inner flow.

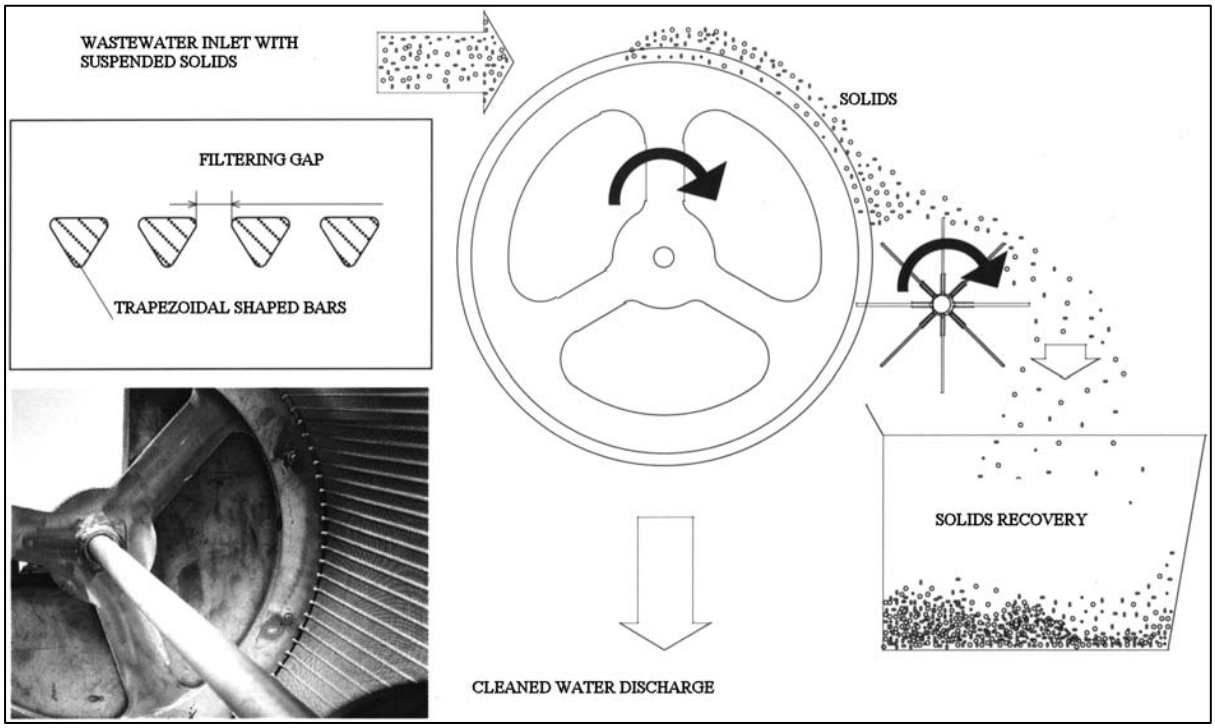


Figure 9.10 – Rotary-Drum (Konica) Screen, Outer Flow

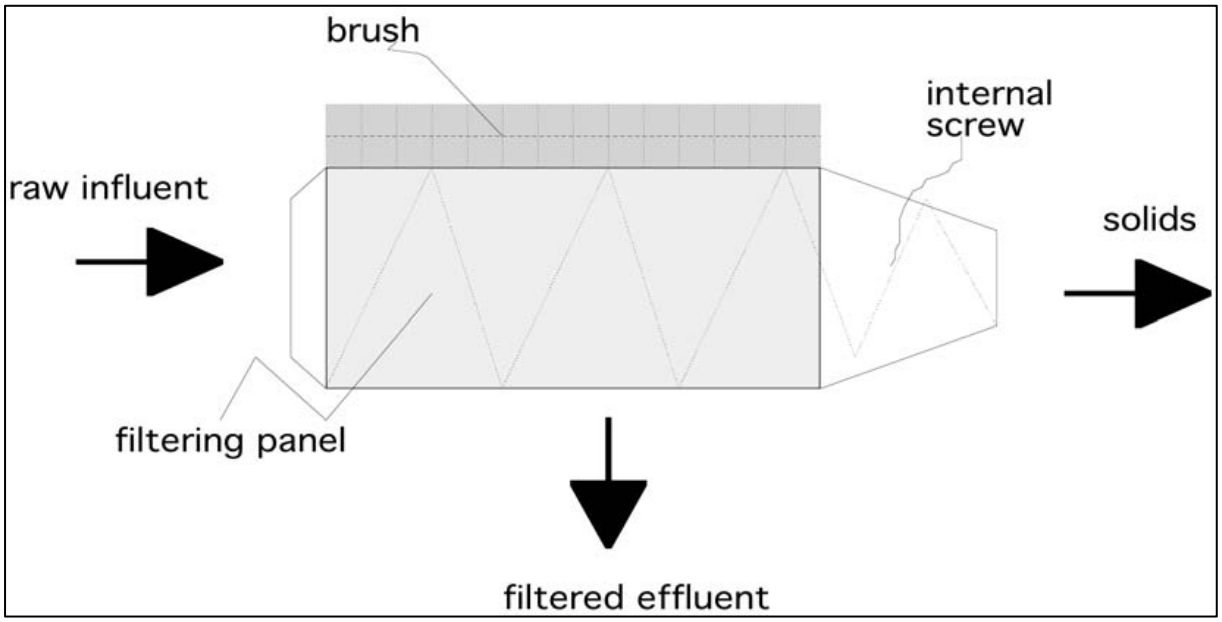


Figure 9.11 – Rotary-Drum Fine Screen, Inner Flow

v. Equalization – Homogenization – Sulphide Oxidation

The main aims here are –

1. Homogenization of the effluent (quantity and quality)
2. Sulphide elimination, mostly by catalytic oxidation.

It is very important to keep all particulate matters in suspension, i.e., to avoid settling of solids. This is achieved by using mixing-cum-aeration devices such as diffused-air systems (preferred), Venturi ejectors, and fixed or floating aerators (lately avoided due to lower efficiency and the problem of aerosols). In practice, to play it safe, the volume of the equalization tank corresponds to the total daily effluent discharge.

Approximately 1 kg of O_2 is needed to oxidize 1 kg of S^{2-} to thiosulphate, whereas the oxygen transfer efficiency is about 1.5 kg O_2/kWh (simplified approximation: 1 kg S^{2-} = 1 kg O_2 = 1kWh). Again, in practice, attention is focused on the energy required to keep the solids in suspension (some 50 W/m^3), which is then sufficient for sulphide oxidation; the amount of catalyst, $MnSO_4 \cdot 4H_2O$, industrial purity, is about 20 g per cubic meter of tank capacity.

Whichever the mixing/aeration system chosen; it is necessary to be possible to remove the mixing device without stopping the treatment process. The inlet and the outlet of the equalization tank should be as far away from each other as possible to allow proper mixing (and no short-circuiting).

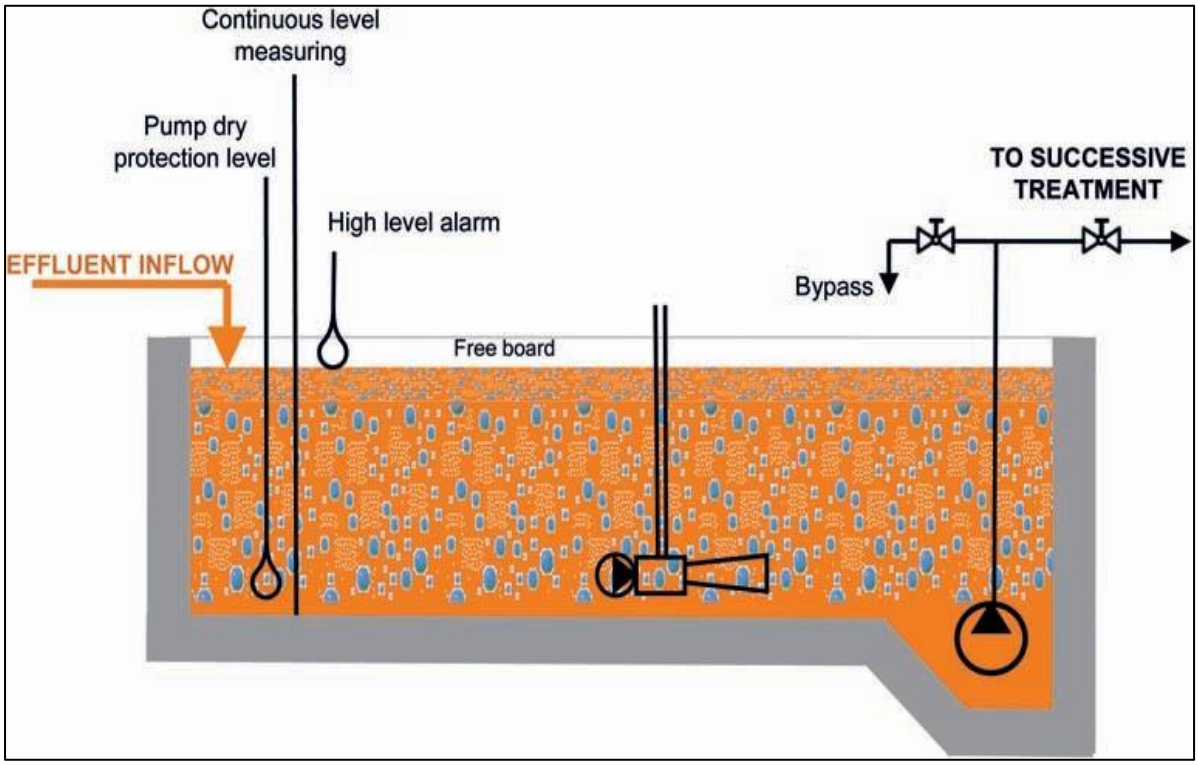


Figure 9.12 – Schematic View of an Equalization-Homogenization Tank

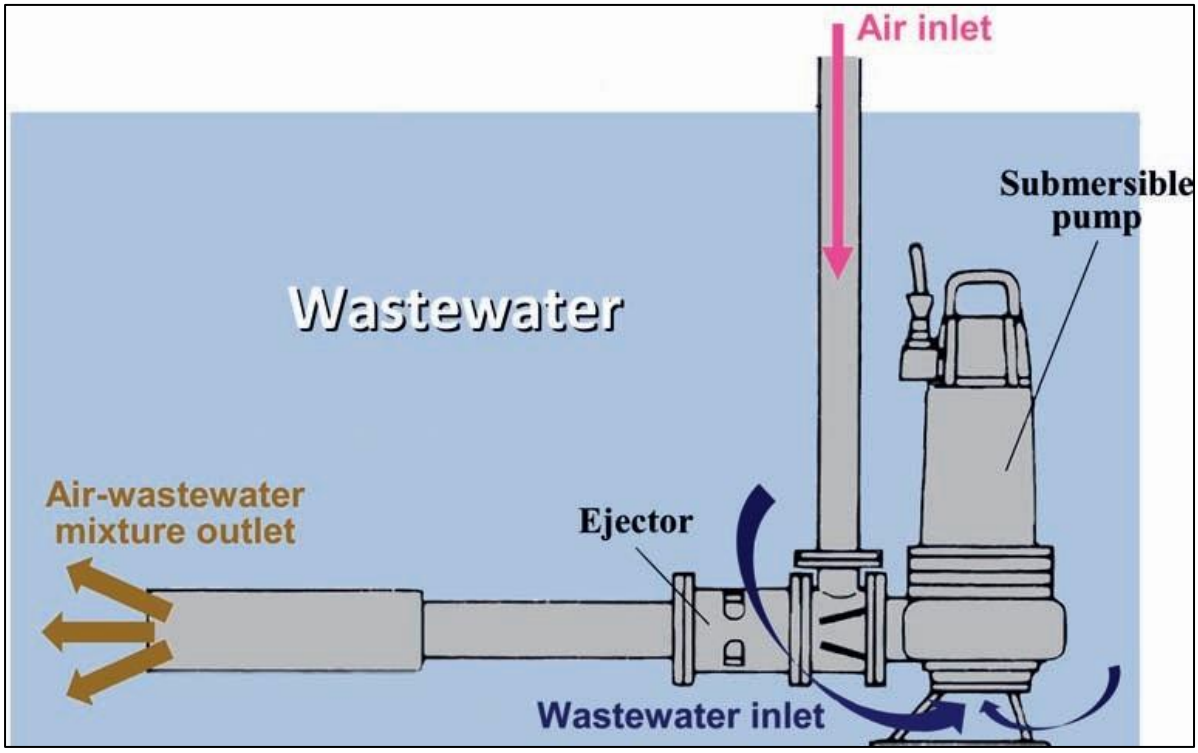


Figure 9.13 – Venturi-Type Ejector Often Installed for Mixing and Aeration in The Homogenization Tank

A typical equalization tank will have transfer pumps for equalized effluent. The capacity of the pumps is based on tank capacity, transfer time and head. One pump of cast iron with inside parts of stainless steel and one stand-by pump are sufficient unless effluent volume is very high (say 1,500 m^3/d or more). The pumping line(s) are also a good place to set an electro-magnetic flow meter.

vi. Chemical Treatment (Coagulation, Flocculation)

Chemicals are added in order to improve and accelerate the settling of suspended solids, especially of fine and colloidal matter.

In wastewater treatment operations, the processes of coagulation and flocculation are employed to separate suspended solids from water. These terms are often used interchangeably, or the single term – be it "coagulation" or "flocculation" – is used to describe both; sometimes "flocculation" is understood as the second stage of "coagulation". In fact, they are two distinct processes usually carried out in sequence as a combination of physical and chemical procedures. Finely dispersed solids (colloids) suspended in wastewater are stabilized by negative electric charges on their surfaces, causing them to repel each other. Since this prevents these charged particles from colliding to form larger masses, called flocs, they do not settle.

Coagulation is the destabilization of colloids by neutralizing the forces that keep them apart. Cationic coagulants provide positive electric charges to reduce the negative charge (zeta potential) of the colloids. As a result, the particles collide to form larger particles (flocs). Rapid mixing is required to disperse the coagulant throughout the liquid. Care must be taken not to overdose the coagulants as this can cause a complete charge reversal and thus re-stabilize the colloid complex.

Flocculation is the action of polymers to form bridges between flocs and bind particles into large agglomerates or clumps. In this process it is essential that the flocculating agent be added by slow and gentle mixing to allow for contact between the small flocs and to agglomerate them into larger particles. The newly formed agglomerated particles are quite fragile and can be broken apart by shear forces during mixing. Care must also be taken not to overdose the polymer as doing so will cause settling/clarification problems.

Once suspended particles are flocculated into larger particles, they can usually be removed from the liquid by sedimentation, filtration, straining or floatation. The flocculation reaction not only increases the size of floc particles in order to settle them faster, but also affects the physical nature of flocs making them less gelatinous and thereby easier to dewater.

The inorganic coagulants are compounds that break colloidal suspensions and help floc forming. The most frequently used coagulants in tannery effluent treatment are –

1. **Alum:** Industrial Aluminium Sulphate $Al_2(SO_4)_3 \cdot 18H_2O$
2. **Iron Sulphate:** Industrial $FeSO_4 \cdot 7H_2O$
3. **Iron Chloride:** Industrial $FeCl_3 \cdot 6H_2O$
4. **Lime:** Industrial Calcium Hydroxide $Ca(OH)_2$

Coagulant aid – flocculants – are water-soluble organic (anionic) polyelectrolytes that support agglomeration of colloidal and very fine suspended matter thus enhancing the impact of coagulation.

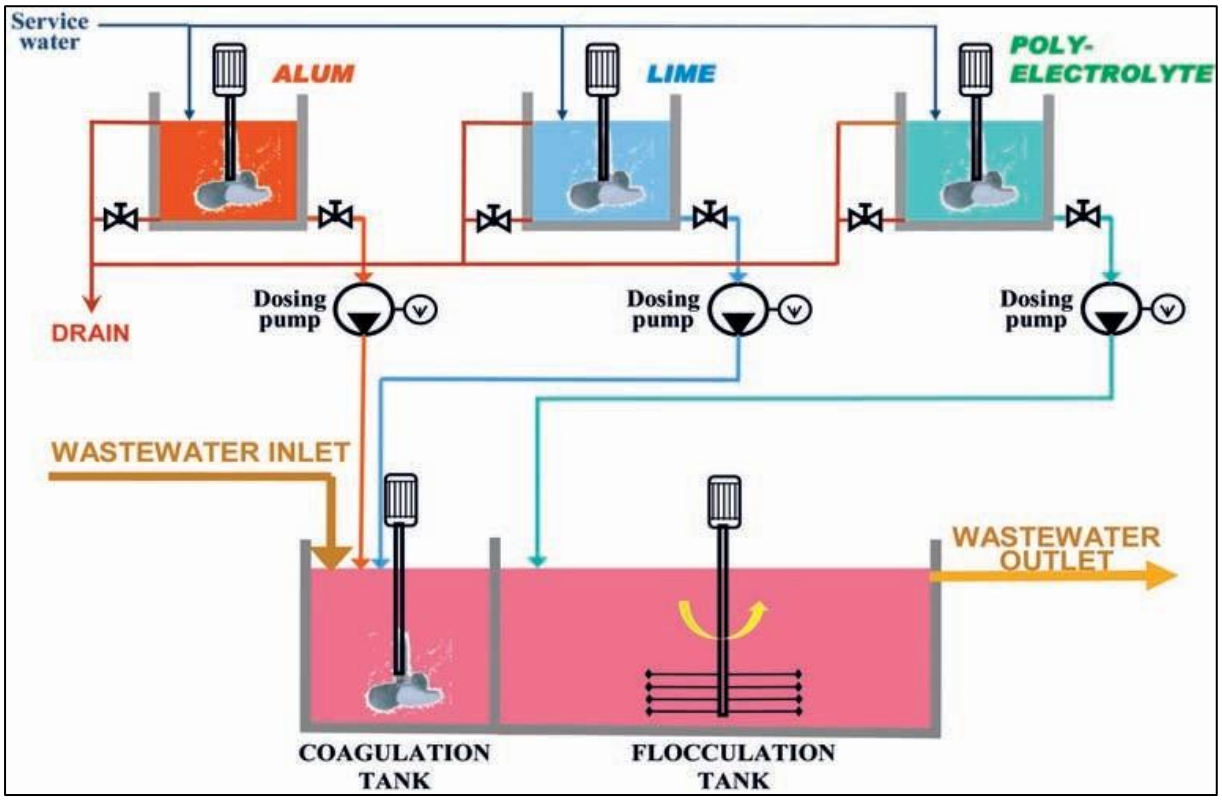


Figure 9.14 – Schematic View of The Coagulation And Flocculation System

For optimal results, appropriate dosing is essential; it should not be overlooked that, in addition to costs, these chemicals also influence not only pH (acidification) but also TDS. On-the-spot investigation – jar tests using either sophisticated apparatus or simple tools (shown below) – is a must.

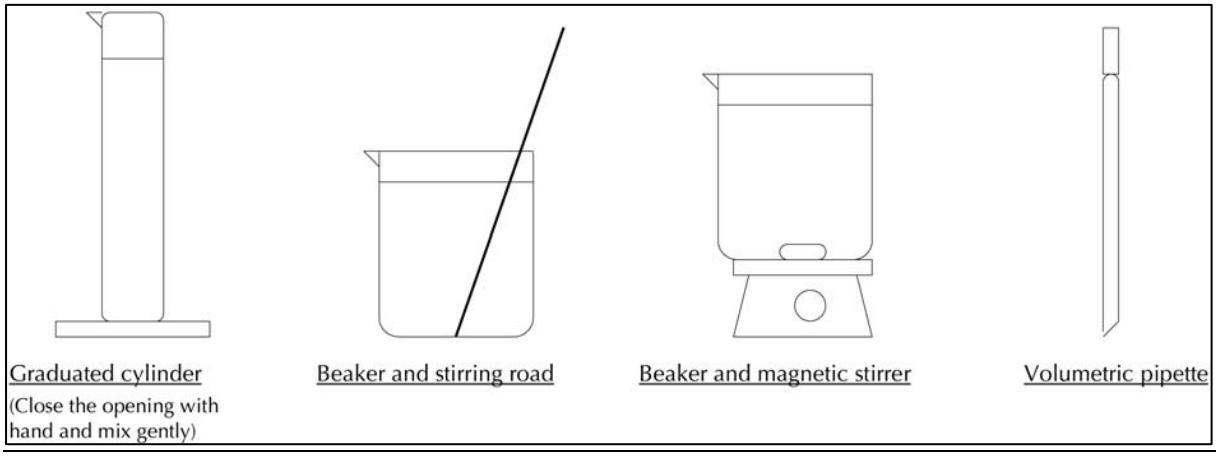


Figure 9.15 – Some Simple Laboratory Utensils

Chemicals (pre)dissolved in small tanks with stirrers are usually added in the flash mixers – special "boxes" for rapid mixing placed before the primary settling tank. The contact time in the flash mixer is about 5 minutes for coagulation and some 20 minutes for flocculation; in the latter case, slow mixing to avoid floc shearing is essential. Hence, for example, if the capacity of the equalized effluent transfer pump is 60 m3/h, the usable volume of the coagulation and flocculation tank respectively should be 60 · 1/12 = 5 m3 and 60 · 1/3 = 20 m3.

Ideally, two tanks should be available for the preparation of each chemical – one for solution preparation, the other for feeding the solution to the effluent. By having two tanks, levels of chemical dosing can be better controlled. The feeding of chemicals is done by dosing pumps.

Figure 9.16 – Coagulant/Flocculant Dosing Station

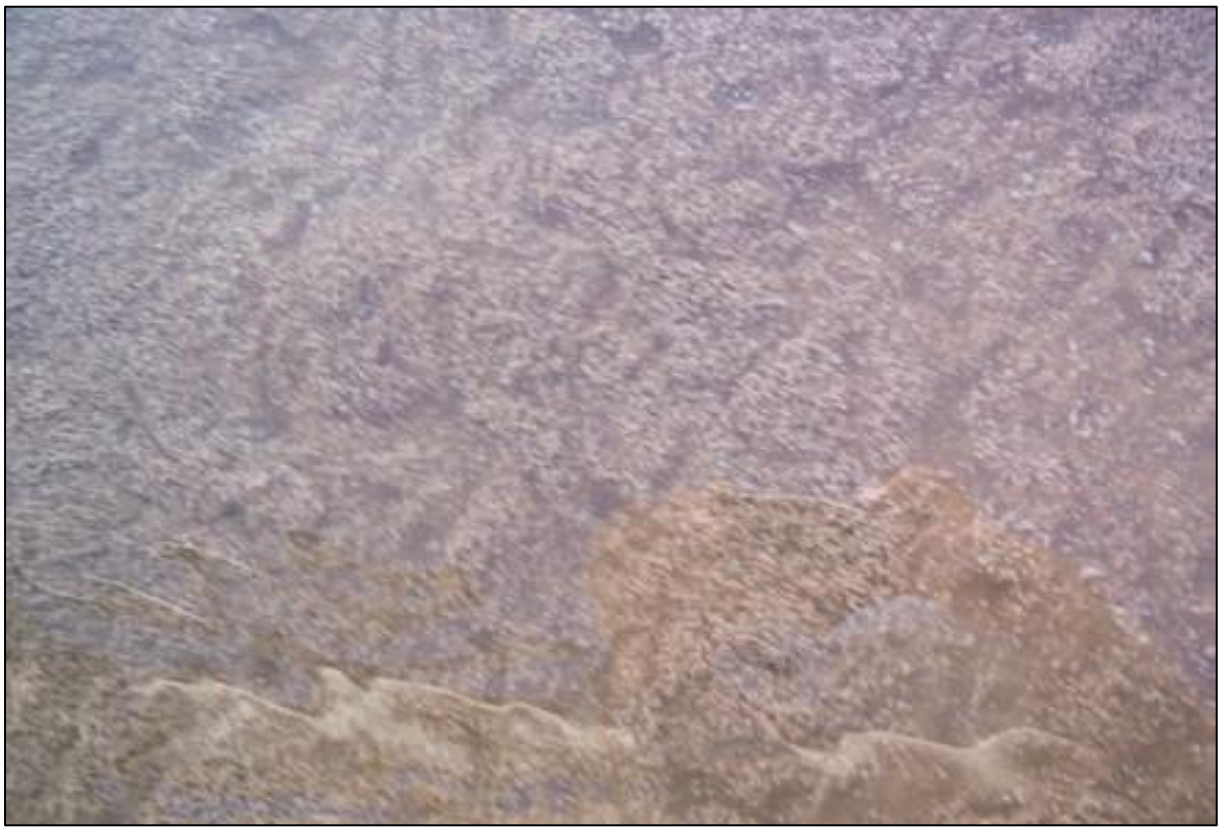


Figure 9.17 – Flocs After Coagulation-Flocculation

vii. Settling – Primary Sedimentation

The main objective at this stage is the removal of suspended solids; however, various constituents such as fats, waxes, mineral oils, floating non-fatty materials, etc. ("grease"), not already removed in the grit-and- oil chamber (usually positioned between screening and equalization), are also separated here.

Primary settling tanks (clarifiers) are either circular (more commonly used) or rectangular with continuous grease (scum) removal at the top and sludge removal at the bottom. The key design parameters are –

1. Detention time – usually 1 to 2 hours (vertical clarifiers of the Dortmund type);
2. Surface hydraulic loading, expressed in m^3/m^2 of tank surface per hour or m/h, typically 1 to 2 m^3/m^2 per hour;
3. surface solids rate, expressed in kg/m^2 and indicating the quantity of SS crossing the surface area of the tank over a certain time span (hour, day).

The surface solids rate is most frequently used in the design of sludge thickeners but, due to the quantity (4-6 g/L) and flocculent nature of tannery effluent solids, it is useful in controlling the primary sedimenta- tion as well. Circular tanks are generally preferred as recirculation is easier. A mechanical device (scraper) is necessary in larger settling tanks.

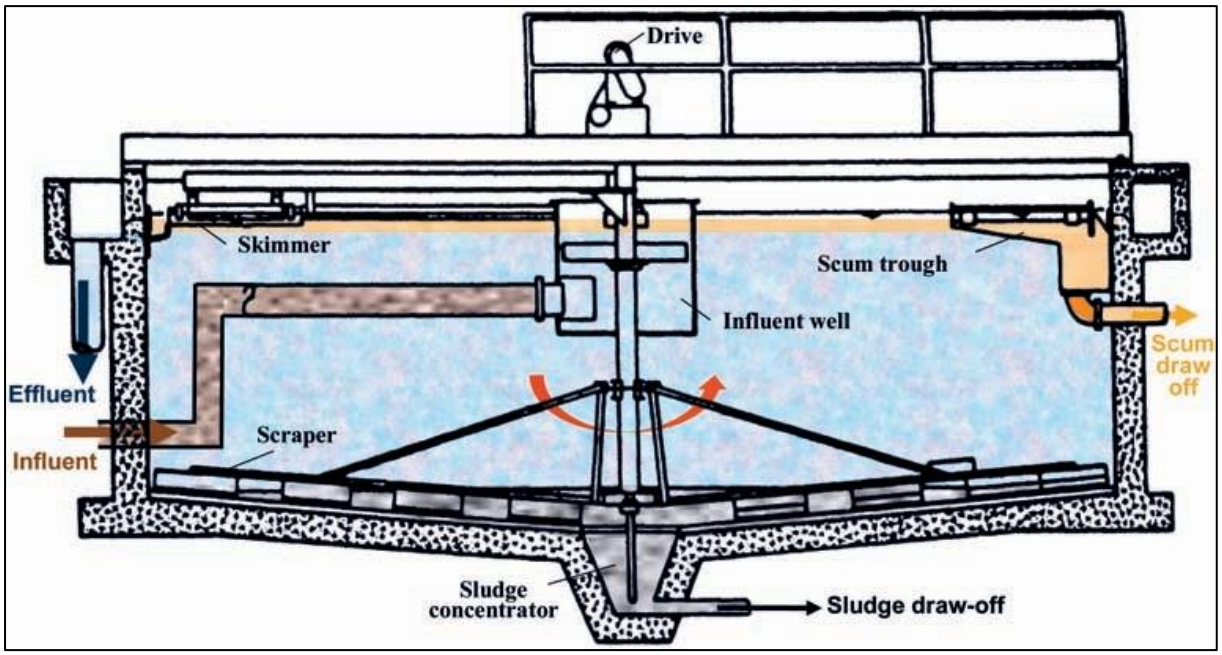


Figure 9.18 – Cross Section of a Typical Circular Sedimentation Tank

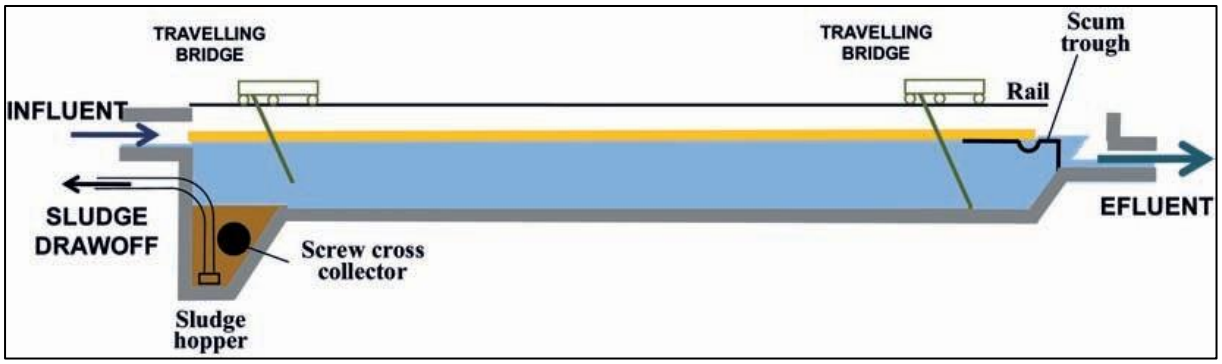


Figure 9.19 – Cross Section of a Rectangular Sedimentation Tank with Travelling Bridge Shown in Two Positions

Figure 9.20 – Sedimentation Tank (Empty & Operational)

In some cases, mainly due to space shortage, solids are removed by flotation, usually by the dissolved-air flotation (DAF) system.

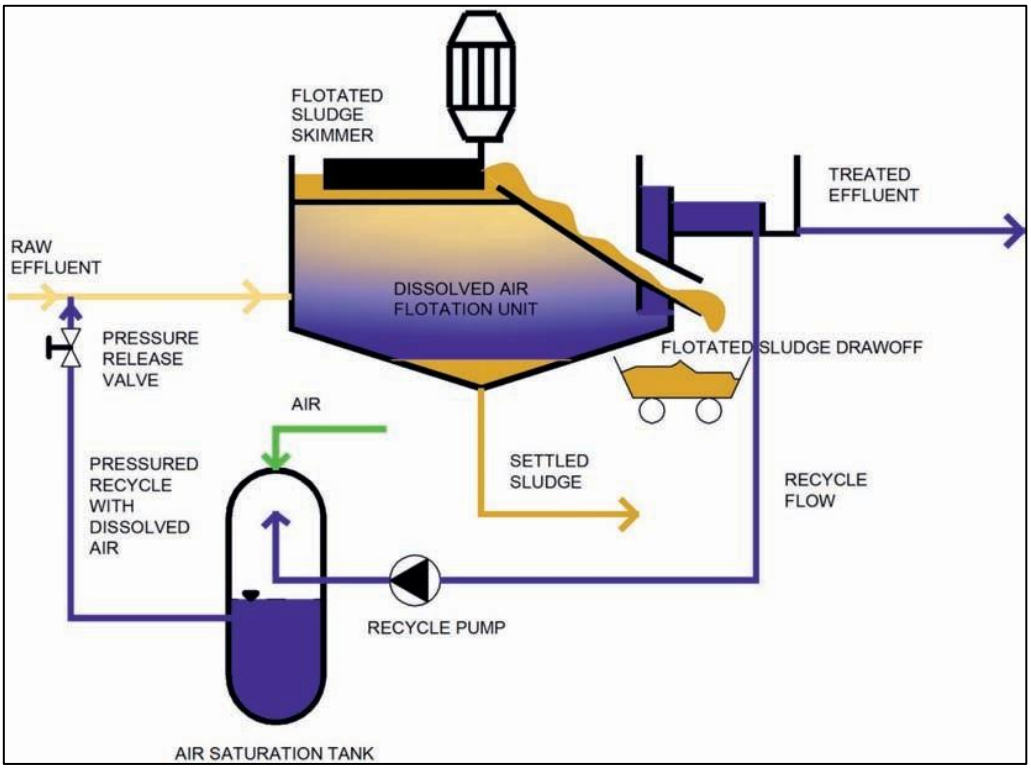


Figure 9.21 – Schematic View of a DAF Unit

viii. Sludge Dewatering

The sludge drawn from the bottom of the tank is in the form of slurry with a dry-solid (DS) content of only 2-4%. For its evacuation, special pumps – usually of the Mohno type – are used.

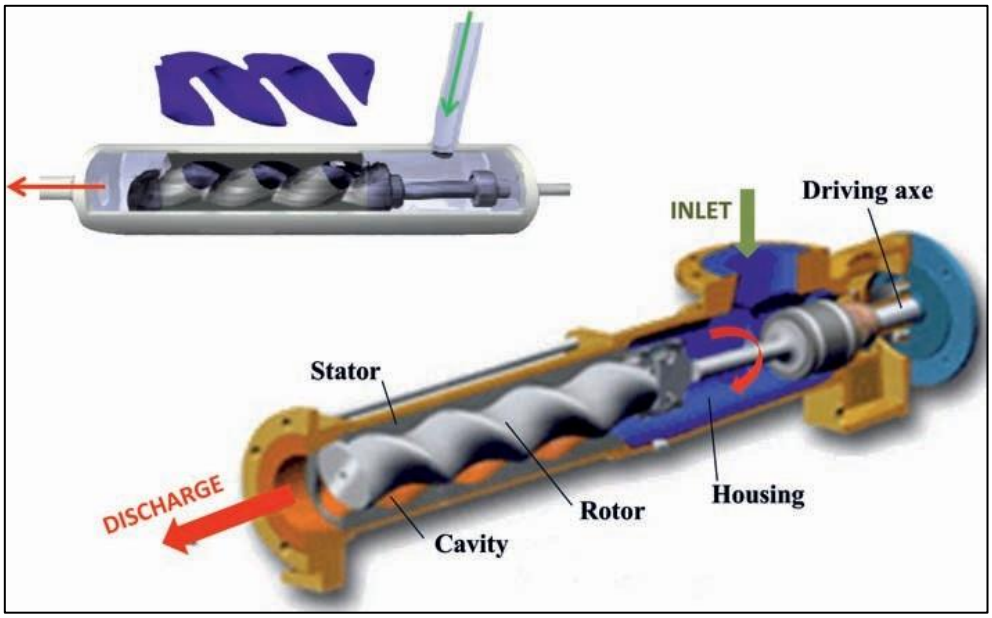


Figure 9.22 – Cross Section of A Progressing Cavity Pump For Sludge Transfer

For further handling and disposal of sludge, it is necessary to reduce drastically the water content. This is usually achieved by –

1. Thickening in sludge thickeners (very much like circular clarifiers).
2. Mechanical dewatering in filter presses, belt-filter presses or decanters (centrifuges).
3. Natural drying in sludge-drying beds. In addition to power and chemical requirements, the key parameter for equipment selection is the achievable dry matter content in the dewatered sludge.

ix. Sludge Thickener

The construction of the sludge thickener is in practice identical with that of the sedimentator although in some cases the Dortmund type with self-desludging slopes is also used.

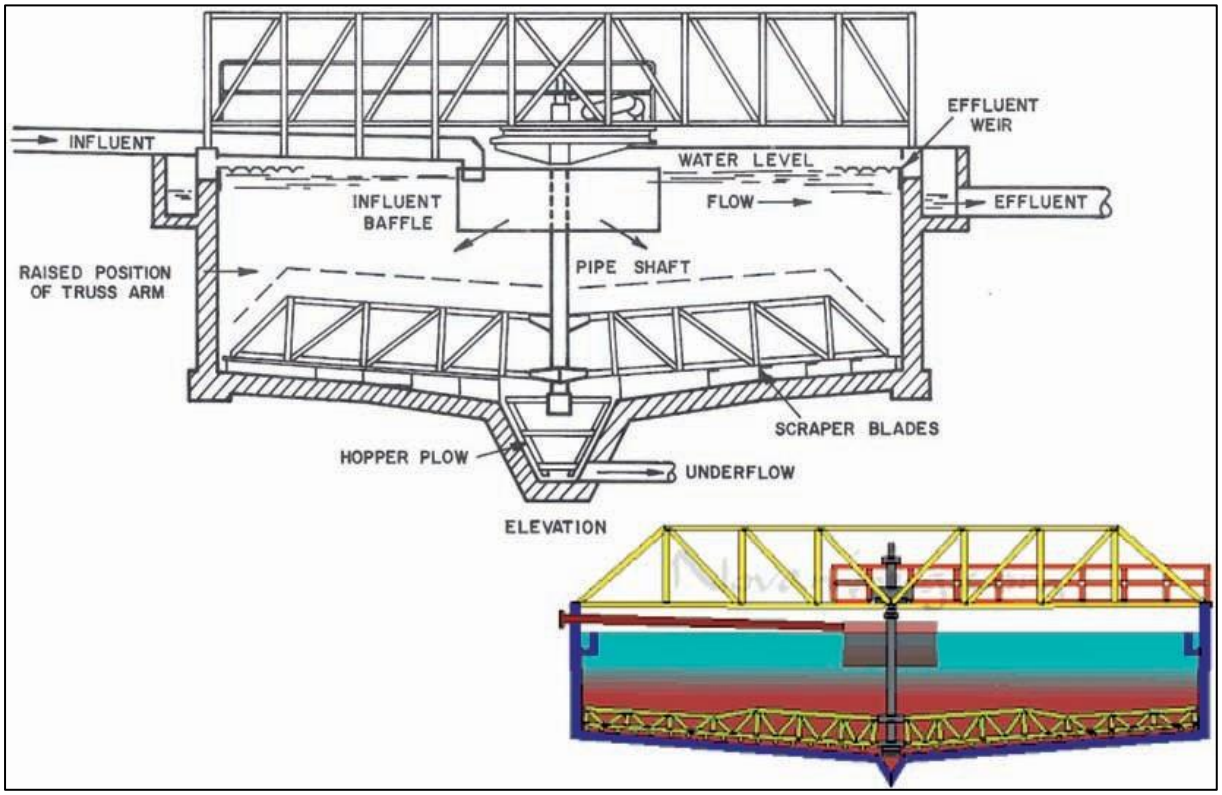
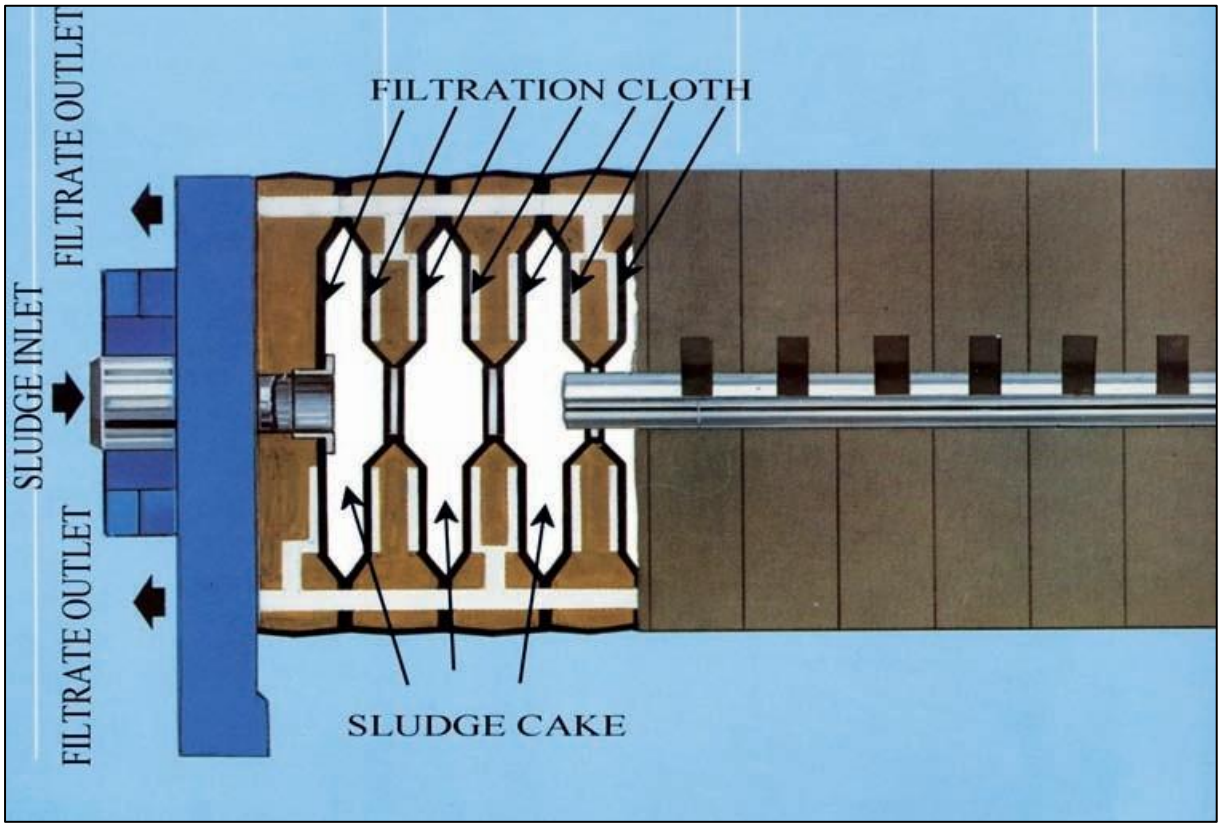


Figure 9.23 – Cross Section of a Gravity Thickener



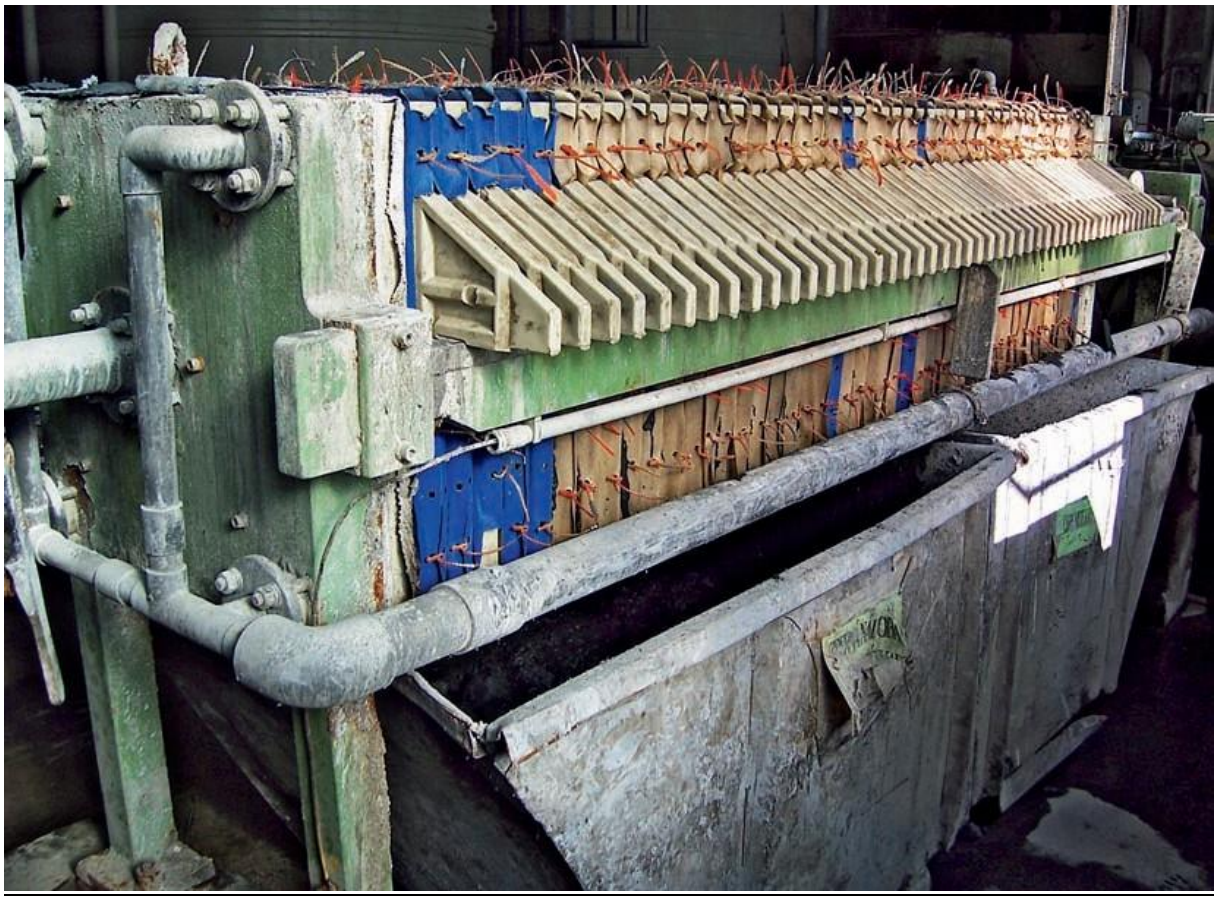
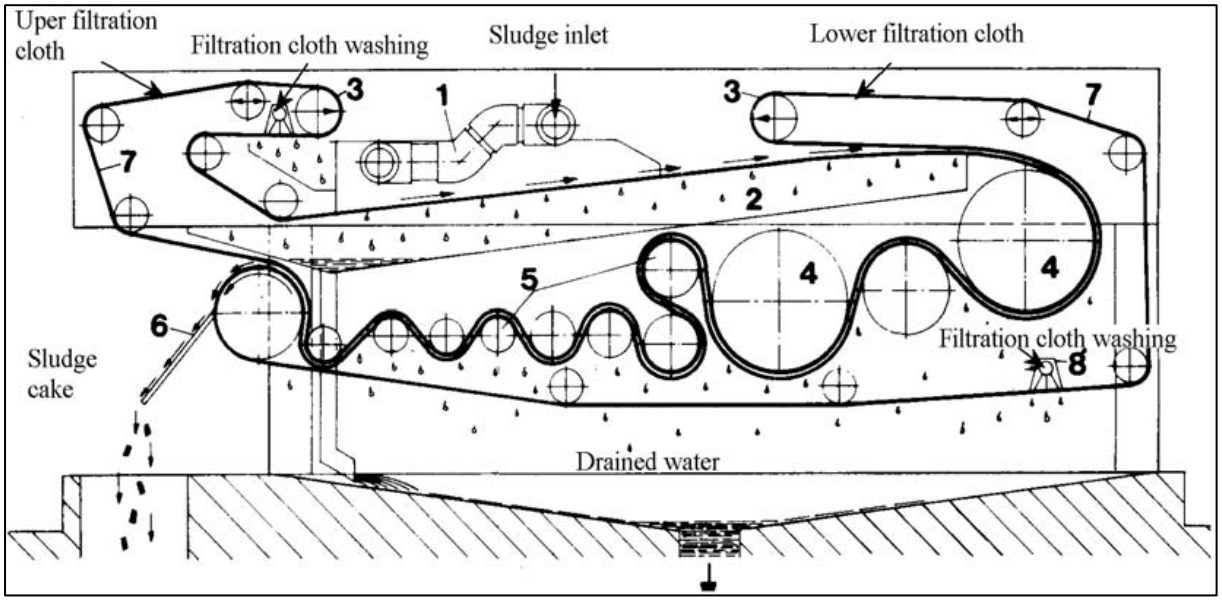


Figure 9.24 – Cross Section of a Recessed-Plate Press for Sludge Dewatering

x. Belt-Filter Press



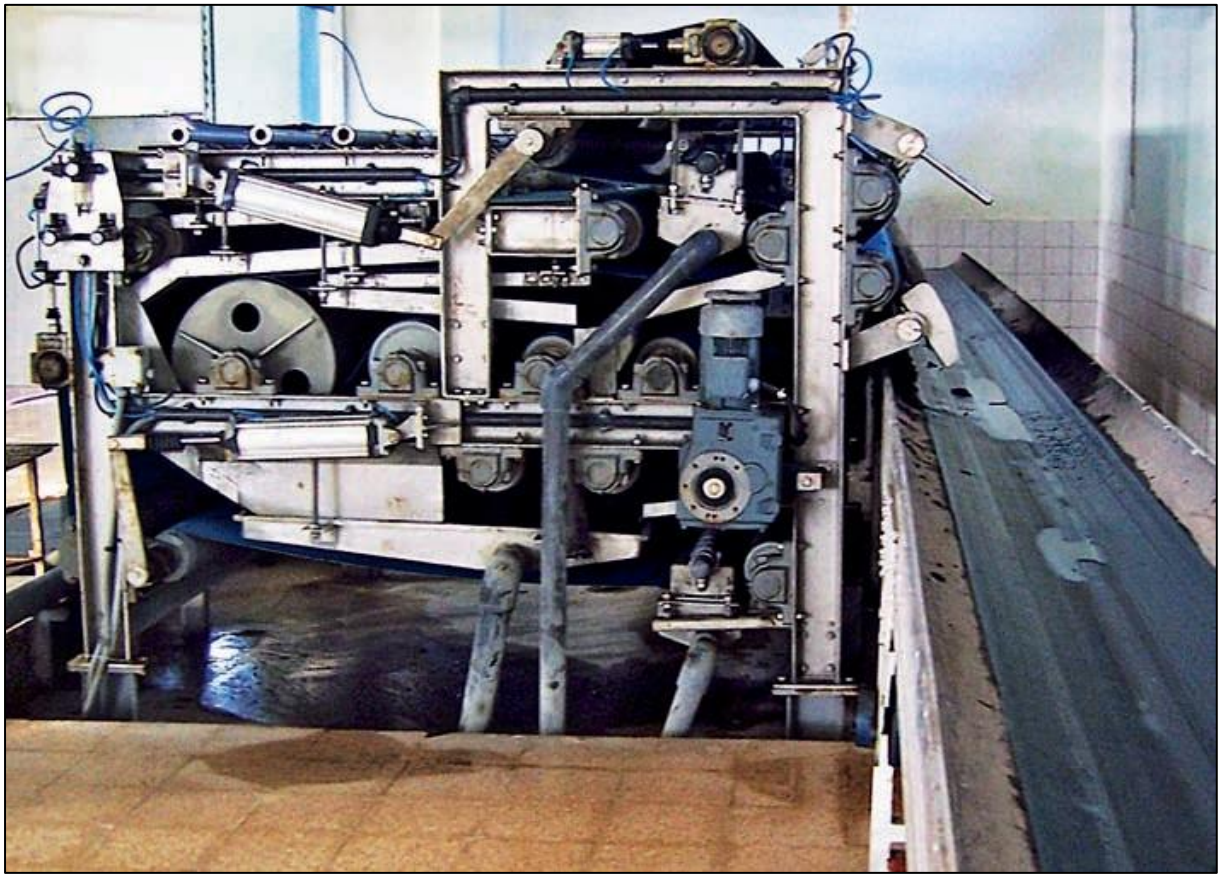
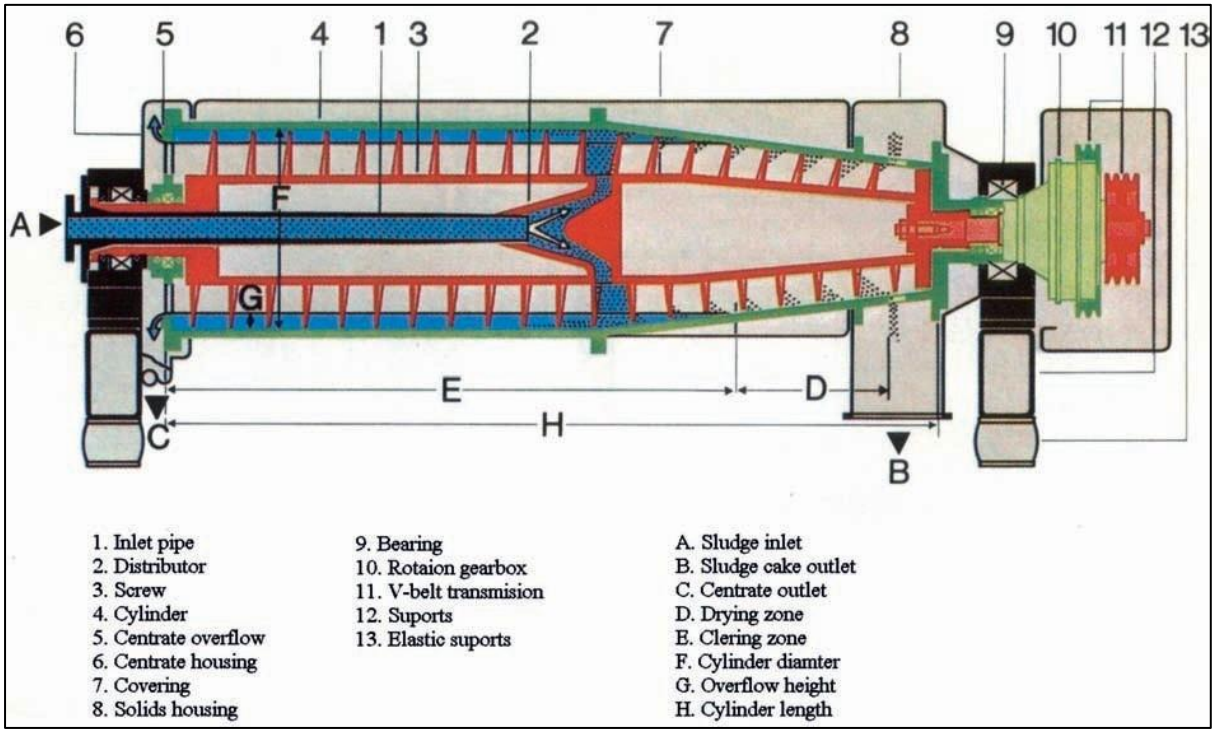


Figure 9.25 – Cross Section of a Belt-Type Press For Sludge Dewatering

xi. Centrifuge

By increasing dewatering level, improving wear and tear resistance (especially in the case of sludge containing fine sand) as well as by lowering irritating noise, centrifuges have succeeded in conquering a lot of ground in the treatment of tannery effluents.



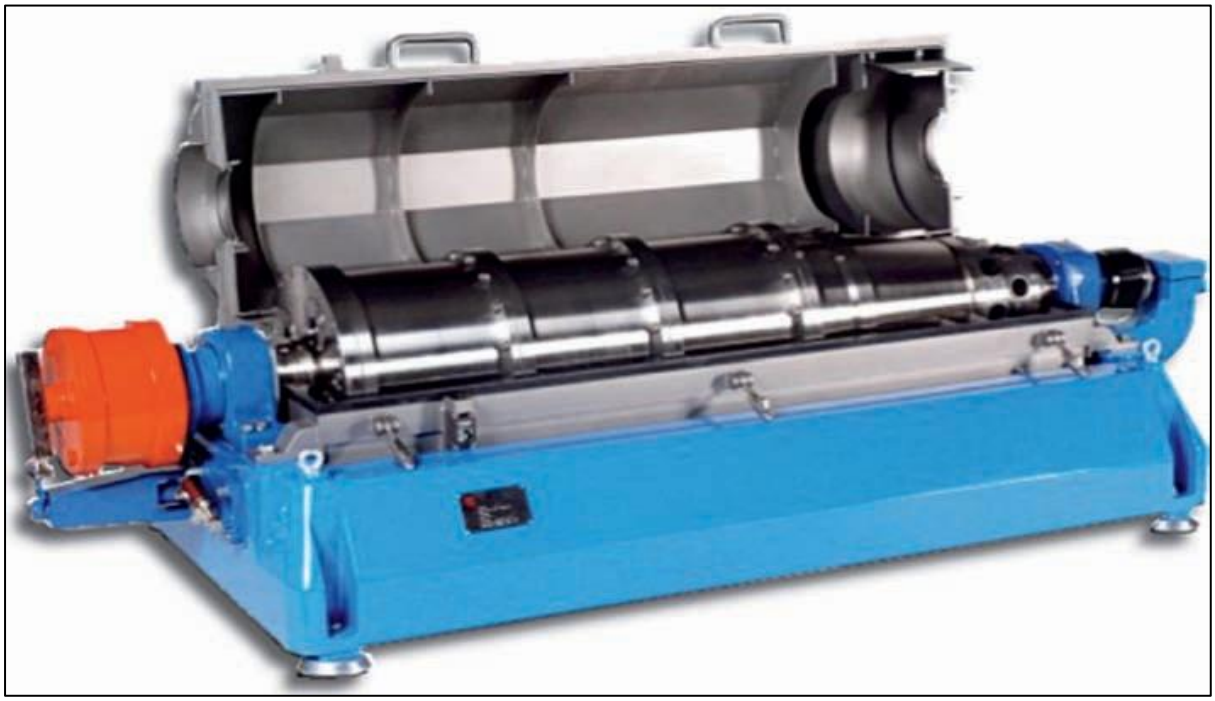


Figure 9.26 – Cross Section of a Sludge Dewatering Centrifuge

Mechanical dewatering effects are nowadays from 30 to 40% DS, depending on initial concentration, chemical preconditioning and equipment make.

xii. Sludge-Drying Beds

Easily constructed with locally available materials, drying beds were perceived as the best solution for tanneries in hot-climate developing countries. However, they require a lot of area, the output during rainy seasons drops considerably, there is the problem of malodour, they are not easy to clean and made ready for the next batch, etc. For these reasons, sludge-drying beds are still used mainly by small tanneries not close to residential areas and/or as fall-back units used during breakdowns of mechanical dewatering equipment.

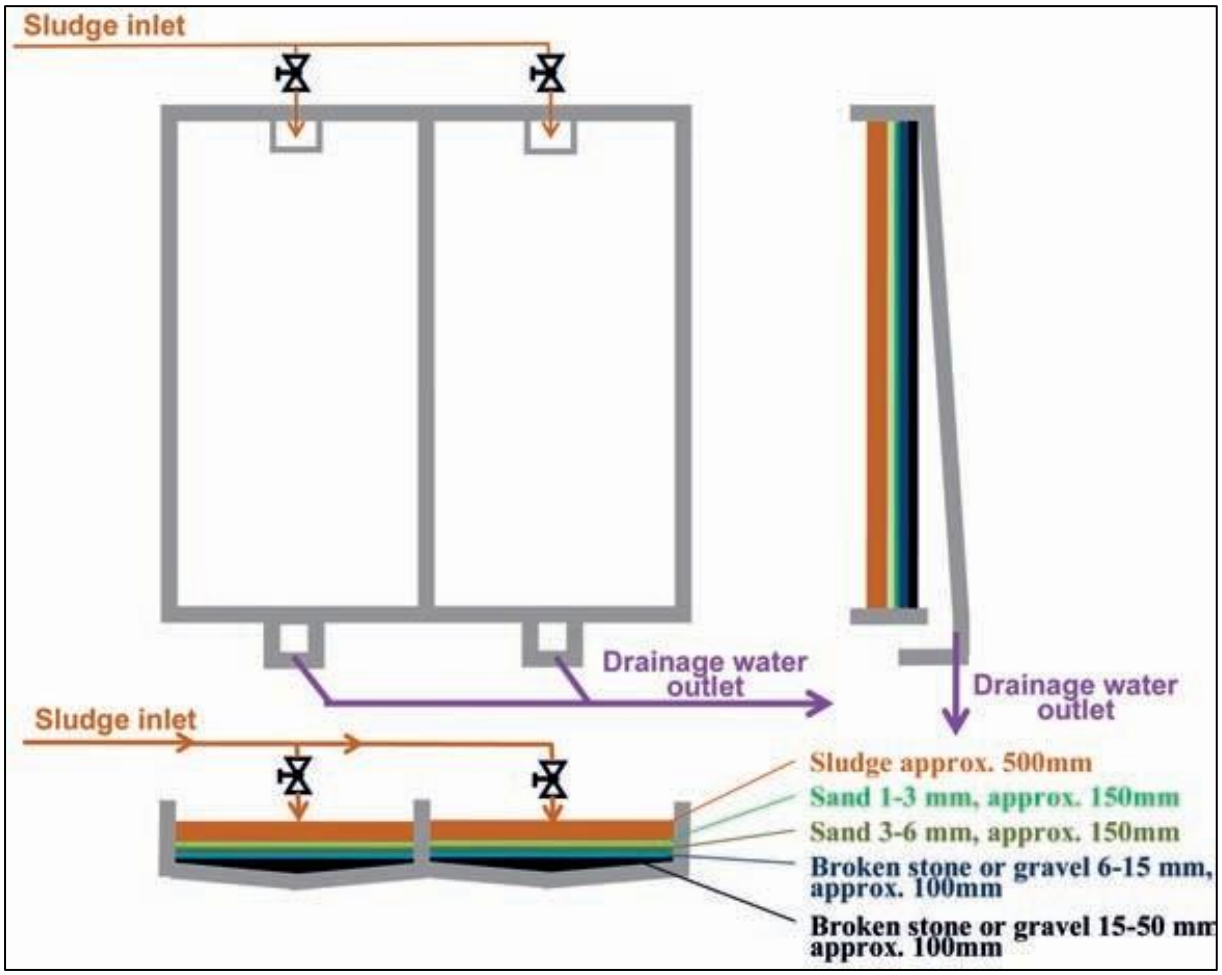


Figure 9.27 – Schematic Views of Sludge-Drying Beds

The products of primary treatment are –

1. **Primary treated effluent:** Overflow from the primary settling tank – with only residual amounts of chrome and sulphide and significantly reduced BOD, COD and SS content; and
2. **Dewatered sludge:** With approximately 40% DS; its chrome content depends on the type and efficiency of the chrome management system applied.

For the fortunate tanneries coupled to the sewage system, on-site treatment ends here – the biological treat- ment takes place together with urban wastewater in large WWWs. Usually, industrial effluents are only a small fraction of the total volume so that the salinity (TDS) they bring along does not represent a problem.

Table 9.8 – Purification Efficiency of Treatment Stages Referred To Raw Effluent

S. No.	Parameter	Physical-Chemical		Biological	
		Reduction (%)	Approx. Value (mg/L)	Reduction (%)	Approx. Value (mg/L)
1	TSS	80-90	300-600	95-98	20-50
2	BOD	50-65	750-1500	97-99	20-30
3	COD	50-65	1500-3000	87-93	250-400
4	TKN	40-50	250-300	60	100-200
5	Cr	92-97	5-10	99-99.5	< 1
6	S^{2-}	80-90	10-20	99-99.5	< 1
7	TDS, mainly Cl- and $(SO_4)^{2-}$	No reduction			

* Approximately at the load level of 0.30 kg BOD_5/kg MLSS, oxygen requirement of 2.0 kg O_2/kg BOD5 and MLSS 3300 g/m^3

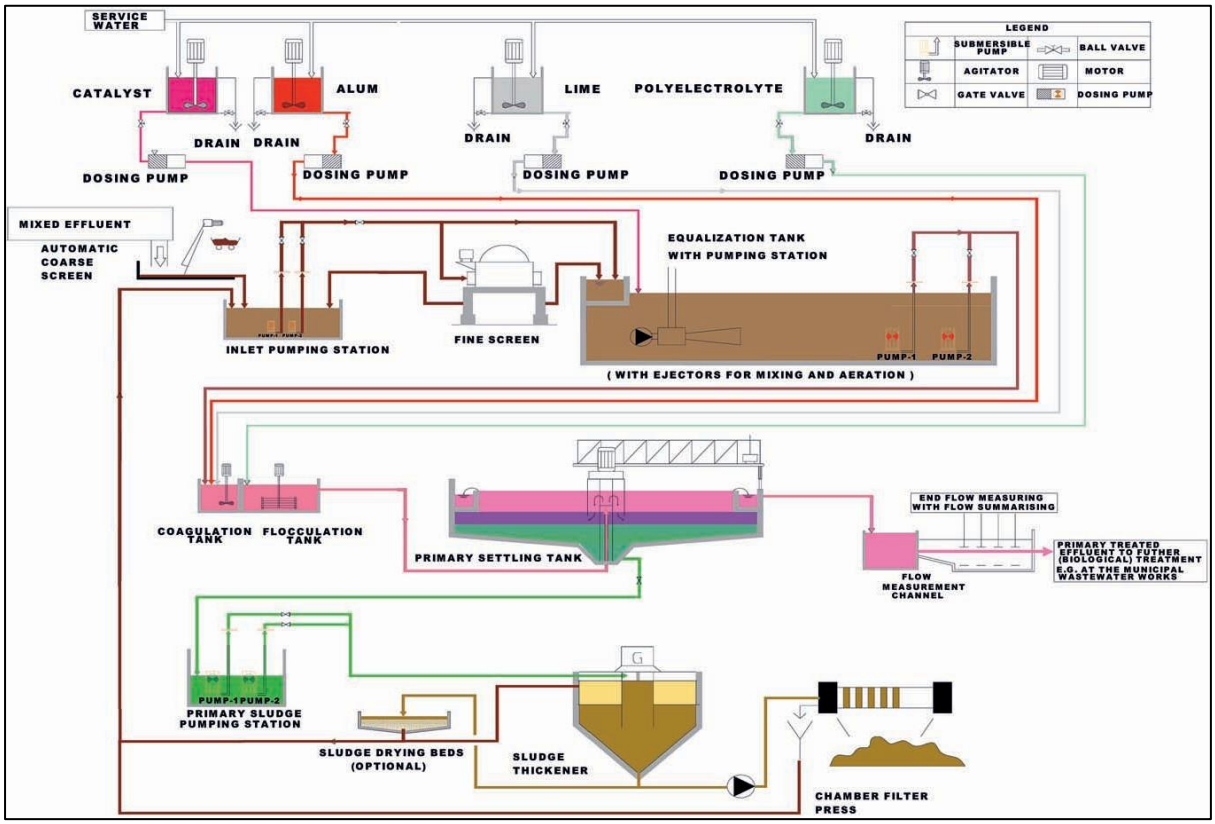


Figure 9.28 – Simplified Flowchart of The Physical-Chemical (Primary) Tannery Effluent Treatment

9.3.1.2.3 Biological (secondary) treatment

Objective and Basic Principles

The main objective at this stage is to further reduce the amount of organic (expressed as BOD and COD) and other substances still present in the effluent after the primary treatment and thereby satisfy the standards/limits for discharge into surface waters (rivers, lakes).

The biological treatment duplicates processes that take place in nature, but under controlled conditions and, especially, at a highly accelerated pace; however, the efficiency of this treatment largely depends on the biodegradability of the polluting substrate, i.e., its inherent capacity to decompose by biological processes. The remaining suspended and colloidal solids are removed by flocculation and adsorption.

While biological treatment may be aerobic, facultative or anaerobic (or some combination thereof), in practice, almost only aerobic systems are used; exceptionally, in countries with a hot climate and where a lot of land is available, facultative (preferably aerated/facultative) lagoons are also used.

Due to the inherent characteristics of tannery effluents, primarily their sulphide/sulphate content, in practice, anaerobic treatment is used only in sludge digestion. Among many variations of the aerobic process, the most widely used method is (complete-mix) activated sludge treatment with extended aeration; despite some very interesting features, membrane bioreactors have not made significant inroads in the tanning sector.

The activated sludge process is an aerobic, biological process, which uses the metabolism of micro- organisms to remove substances causing oxygen demand. The qualitative biochemical reaction taking place in the organic matter stabilization process can be summarized in the following manner –

Inert matter + organic matter + oxygen + nutrients + micro-organisms new micro-organisms + CO2 + H_2O + additional inert matter

Simply said, we stimulate micro-organisms to convert (eat and digest) harmful, oxygen-demanding organic compounds into an environmentally more acceptable form (micro-organisms) and low-energy, stable com- pounds like water and carbon dioxide. The microbial community that does that job comprises various species of bacteria, fungi, protozoa, sometimes rotifers (multicellular animals only found in very stable activated sludge with long retention times), even nematodes, the composition of the population depending on a plethora of factors.

Let us recall that BOD is defined as the quantity of oxygen required during the stabilization of decomposable organic and oxidizable inorganic matter by aerobic biological action under standard conditions, usually over only five days instead of 20. The manometric method is even faster but less accurate and reliable. COD is the quantity of oxygen consumed for the total oxidation of the oxidizable matter (organic and inorganic) with dichromate as the oxidizing agent. The COD is always greater than its BOD.

Generally, the biological stage is the most complex part of the overall effluent treatment process, with highest investment and operational costs, its day-to-day running requiring considerable skills and experience.

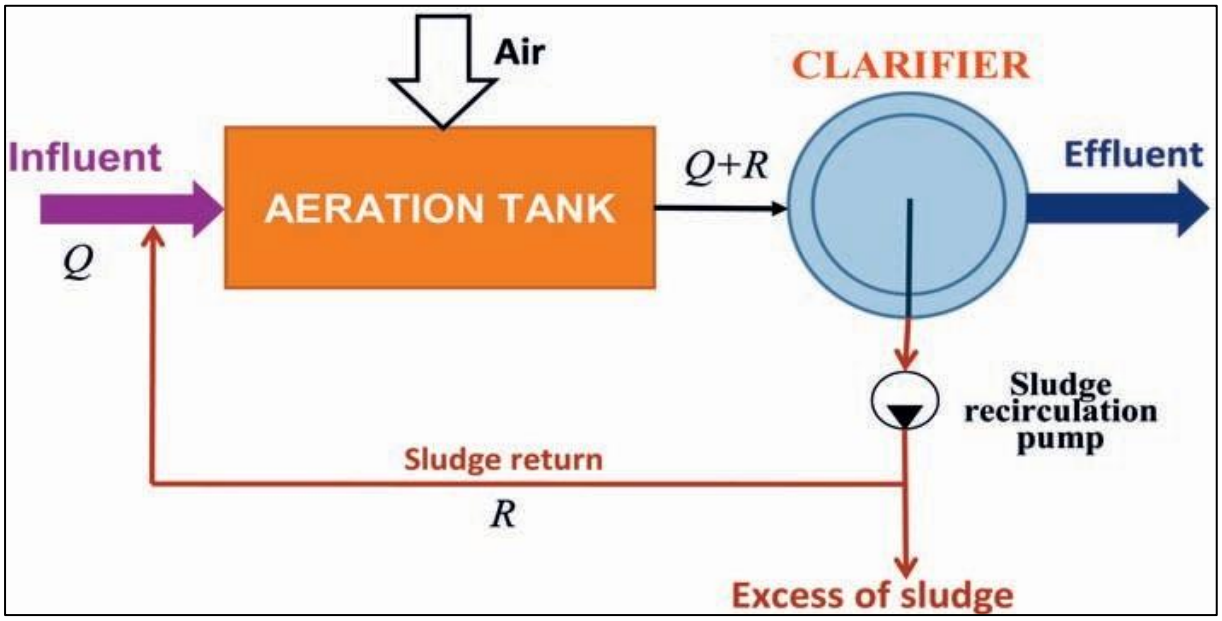


Figure 9.29 – A Simplified Flow Diagram of The Activated Sludge Process

Main Operational Parameters

The main operational parameters/expressions important to understanding the process are –

Total influent volume, Q: volume of treated effluent (m^3/day)

Tank volume, V: aeration tank volume (m^3)

Organic loading, F: total BOD_5 applied (kg/day)

F = (f x Q)/1,000

where f is the BOD5 of the influent (mg/l)

Mixed liquor suspended solids, M = (MLSS x V)/1000

where MLSS is the concentration of SS in mixed liquor in the aeration tank (mg/l)

Loading factor, F/M: BOD_5 kg per day per kg of mixed liquor suspended solids (MLSS) in the aeration tank (mg/l)

Hydraulic retention time, T = (V/Q) x 24

where V is aeration tank volume (m^3)

A uniform inlet flow over the entire day provides optimum conditions for absorbing the effect of possible peaks of organic load or toxic substances (shock loads) and enhancing the efficiency of secondary sedimentation.

The BOD here is in practice taken to represent the amount of food provided to the micro-organisms contained in the system. Due to the difficulty of obtaining reliable BOD5 values, COD is sometimes used.

Hydraulic retention time is actually the average time (in hours) the influent spends passing through the aeration tank; the extended aeration process, typical for tannery effluents, is usually longer than 24 hours.

Extended aeration plants are characterized by the introduction of wastewater directly into the reactor basin, long aeration, high sludge return ratio, low sludge wastage and high MLSS: the F/M (kg BOD/kg MLSS per day) ratio is only ≤ 0.05 – 0.1 in contrast to the conventional (0.15-0.4) or high-load type (0.4-1.0).

Table 9.9 – Activated Sludge Process F/M Ratio

S. No.	Process	F/M Ratio	Kg O_2/kg BOD
1	Extended aeration	0.1	2.0
2	Conventional	0.4	1.2
3	High load	1.0	0.8

The F/M, the food to biomass (floc) ratio is a parameter crucial for operational conditions and the performance of the biological process; regrettably, it cannot be determined quickly, on-the-spot.

Other Operational Parameters

Quite important are also parameters like the sludge age expressed as the mean cell-residence time (MCRT), generally not less that 20 days, and the return activated sludge (RAS) – the volume of settled bio- logical sludge recycled to the aeration tank as a percentage of the influent volume Q; in the extended aera- tion process, it is about 80-100%.

The following parameters are, in particular, regularly monitored –

1. Dissolved oxygen (DO) is the content of molecular oxygen in the aeration tank (mg/l); it is one of the most important factors determining the efficiency/performance of wastewater biological treatment. Extended aeration units are usually operated in such a way as to keep the DO of the mixed liquor at about 2 mg/l.
2. pH. The optimum pH range for aerobic processes is between 7.0 and 7.5 with an effective process range of 6-9. In alkaline wastes, the reaction with CO2 produced by respiration neutralizes the excess alkali, making addition of acid unnecessary. Adjustment with lime or other alkali becomes necessary only if pH drops below 6.
3. Temperature affects the metabolic and growth rates of the organisms responsible for the biological processes. Generally, as the temperature is raised 10-30°C, the growth rate increases. However, higher temperature negatively affects the water solubility of oxygen and the oxygen transfer rate (solubility decreases with a rise in temperature). For this reason, an increase of the aeration rate becomes neces- sary during the hot season.
4. Nutrients: The nutritional balance of an aerobic system is primarily based upon satisfying the requirements of the cell structure produced by the removal of BOD from waste. Efficient and successful biological oxi- dation requires a minimal quantity of nitrogen and phosphorus. A BOD:N:P ratio of 100:5:1 in the waste usually insures adequate nutrition. Tannery effluent is very rich in nitrogen and sometimes poor in phosphorus.
5. Sludge volume index (SVI) is the volume occupied by 1 g of activated sludge after settling the aerated mixed liquor in a 1,000 ml graduated cylinder or Imhoff cone for 30 minutes. It provides a good indi- cation of sludge compacting characteristics, very helpful in controlling the activated sludge process, especially in determining return sludge pumping requirements to maintain different mixed-liquor concentrations.

$$SVI = \frac{1000 \times settled\ sludge\ volume}{suspended\ solids}\ \frac{mL/L}{mL/L}$$

Well settleable and mineralized sludges have SVI <100.

Aeration Devices

Water (effluent) aeration is important business that employs a wide range of equipment. In addition to cost, reliability, etc., the key criterion is the amount of air (oxygen) transfer per kW installed. Here is one – rather arbitrary – classification –

i. **Surface aerators**

Radial flow, low speed, 20-60 rpm Axial flow, high speed, 300-1200 rpm Brush rotor (oxidation ditch)

ii. **Submerged turbines**

iii. **Diffusers**

Bubblers – porous and non-porous diffusers Tubular Jets (developed from Venturi ejectors)

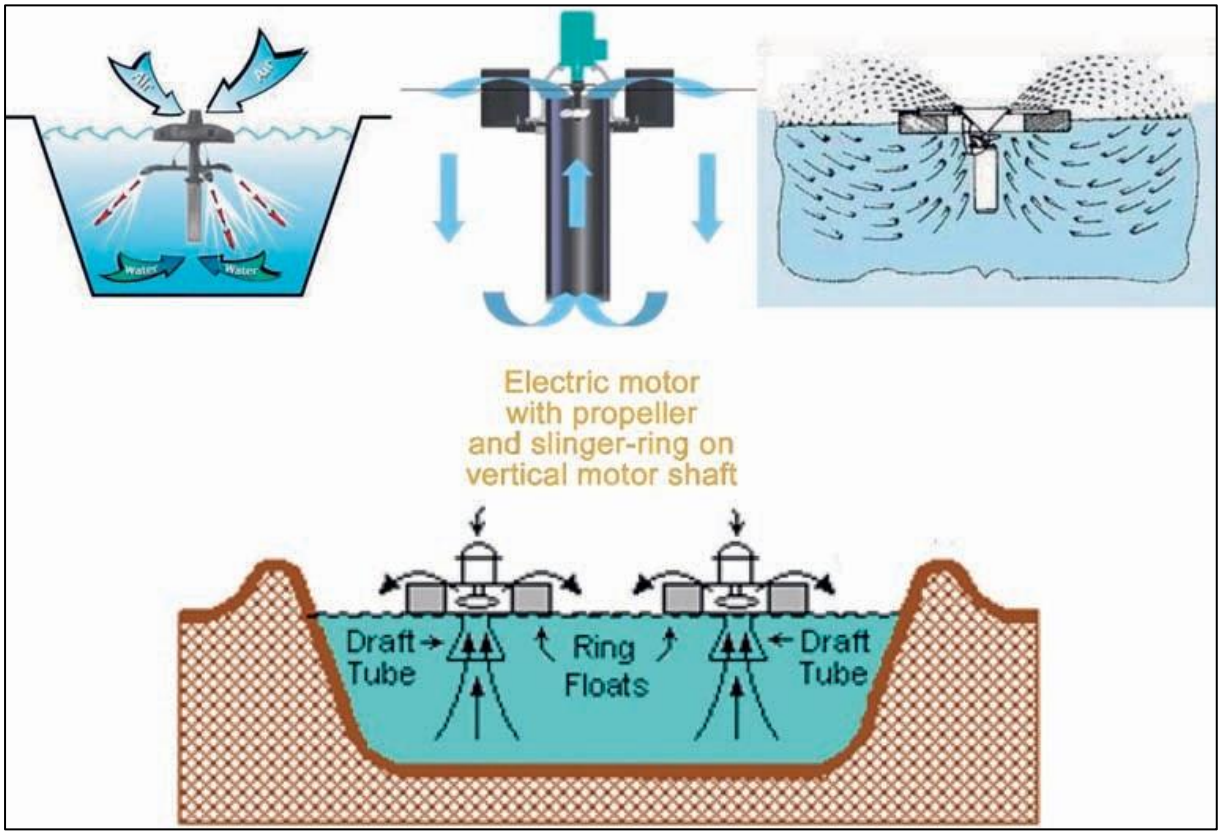


Figure 9.30 – Surface (Floating) Aerators

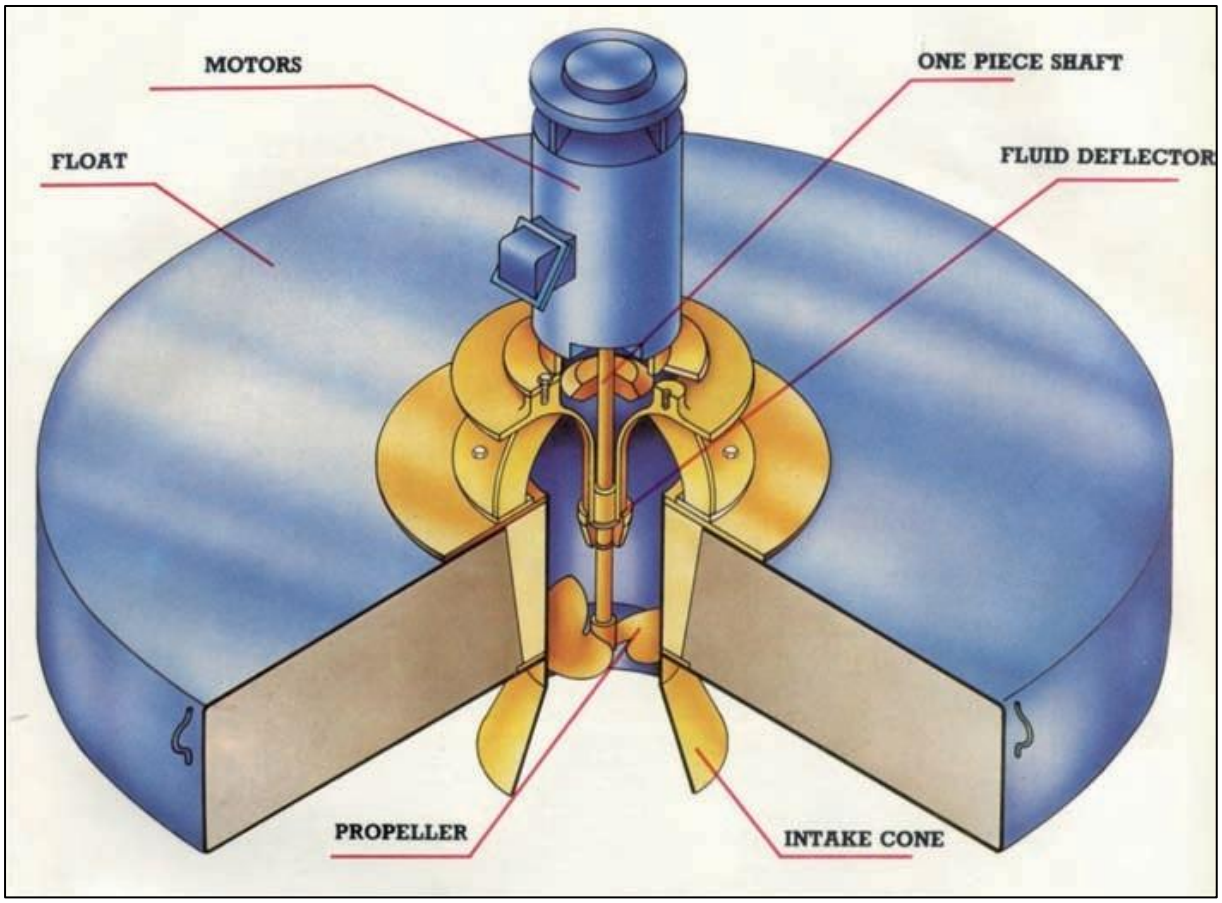


Figure 9.31 – Cross Section of Floating Aerator

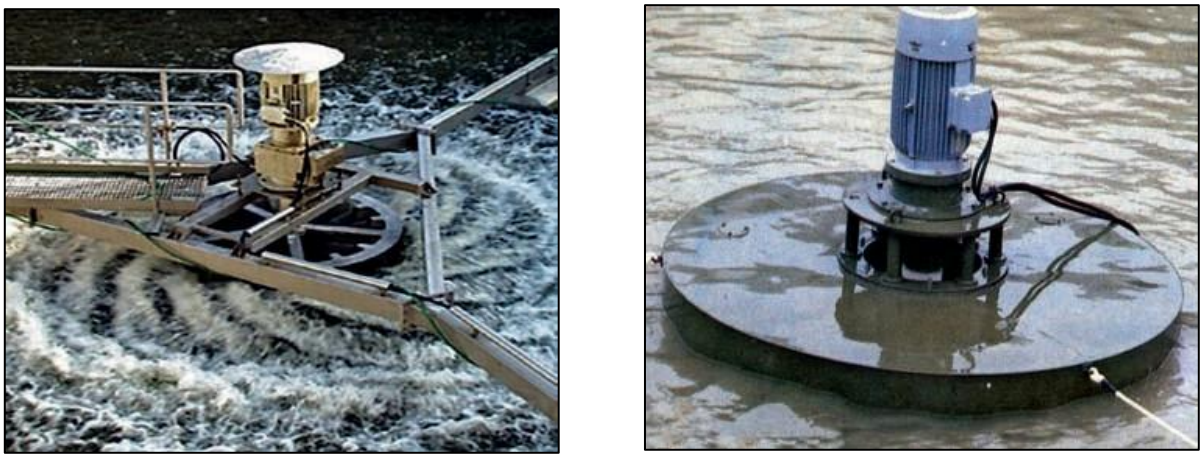


Figure 9.32 – Surface Aerators

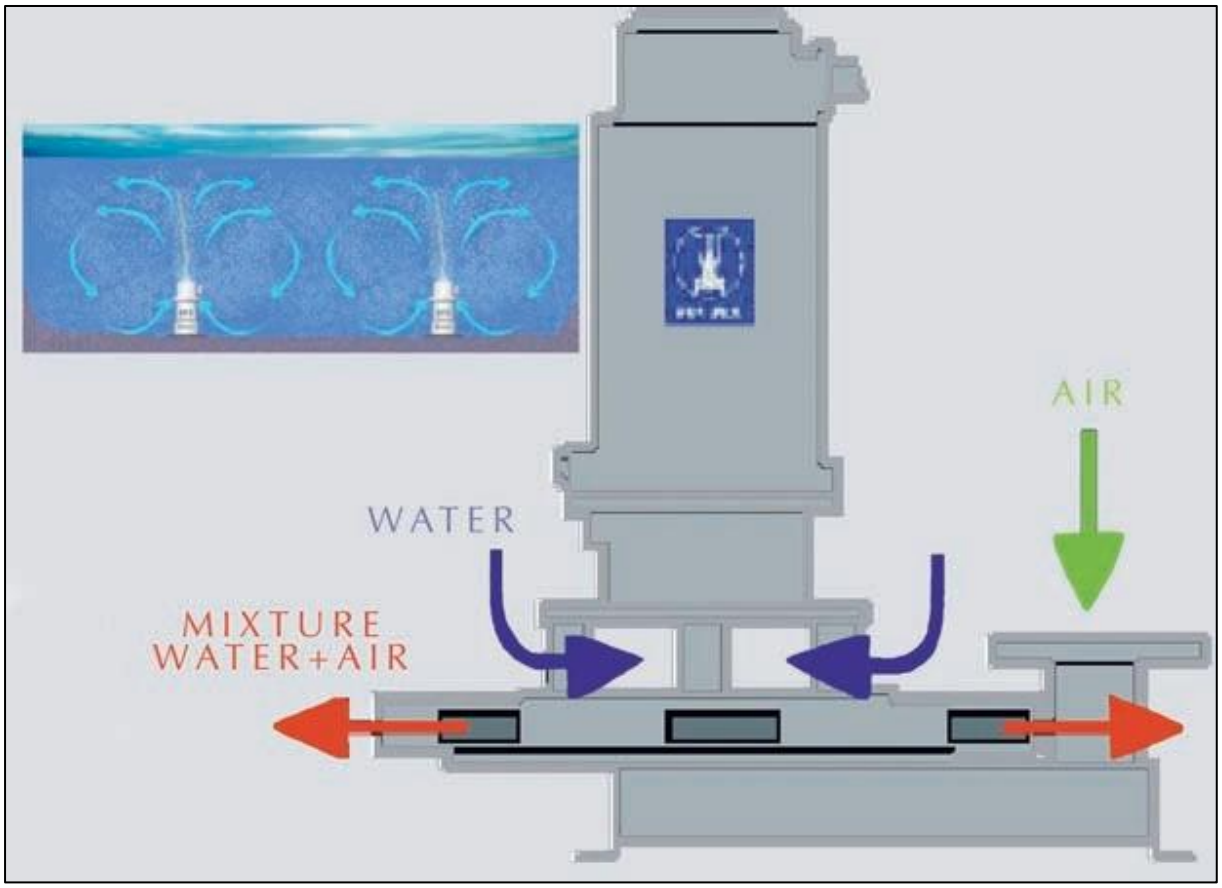


Figure 9.33 – Forced-Air, Submersed Turbine Aerator

Figure 9.34 – Bottom Air Diffuser Grid with One Section and Fine-Bubble Dome Diffuser

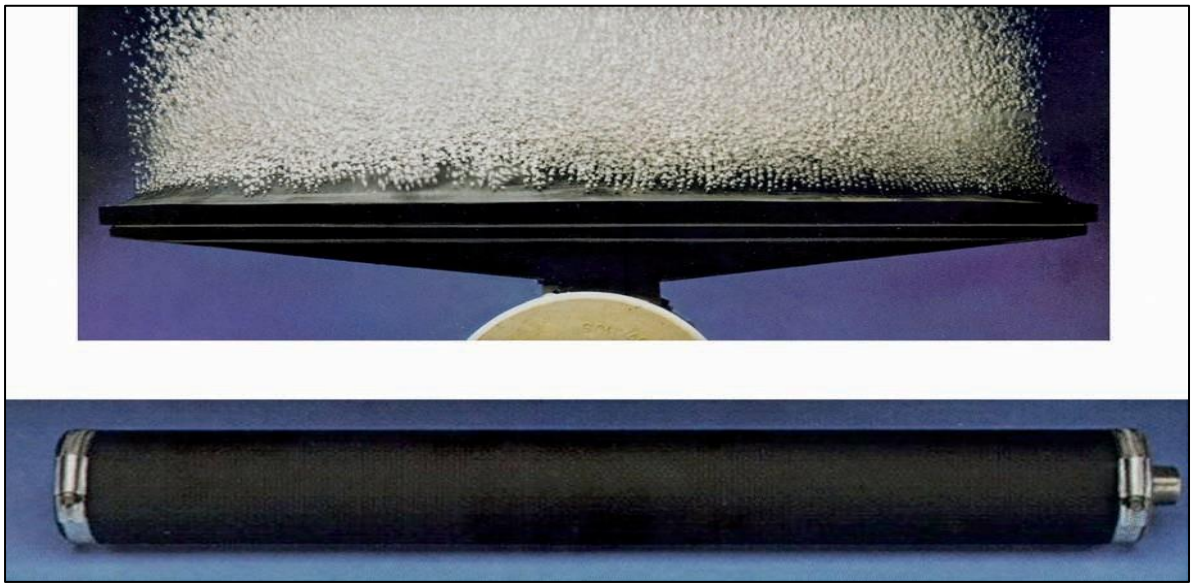


Figure 9.35 – Fine-Bubble Diffusers, Dome and Tubular Type

Aeration Basins and Oxidation Ditch

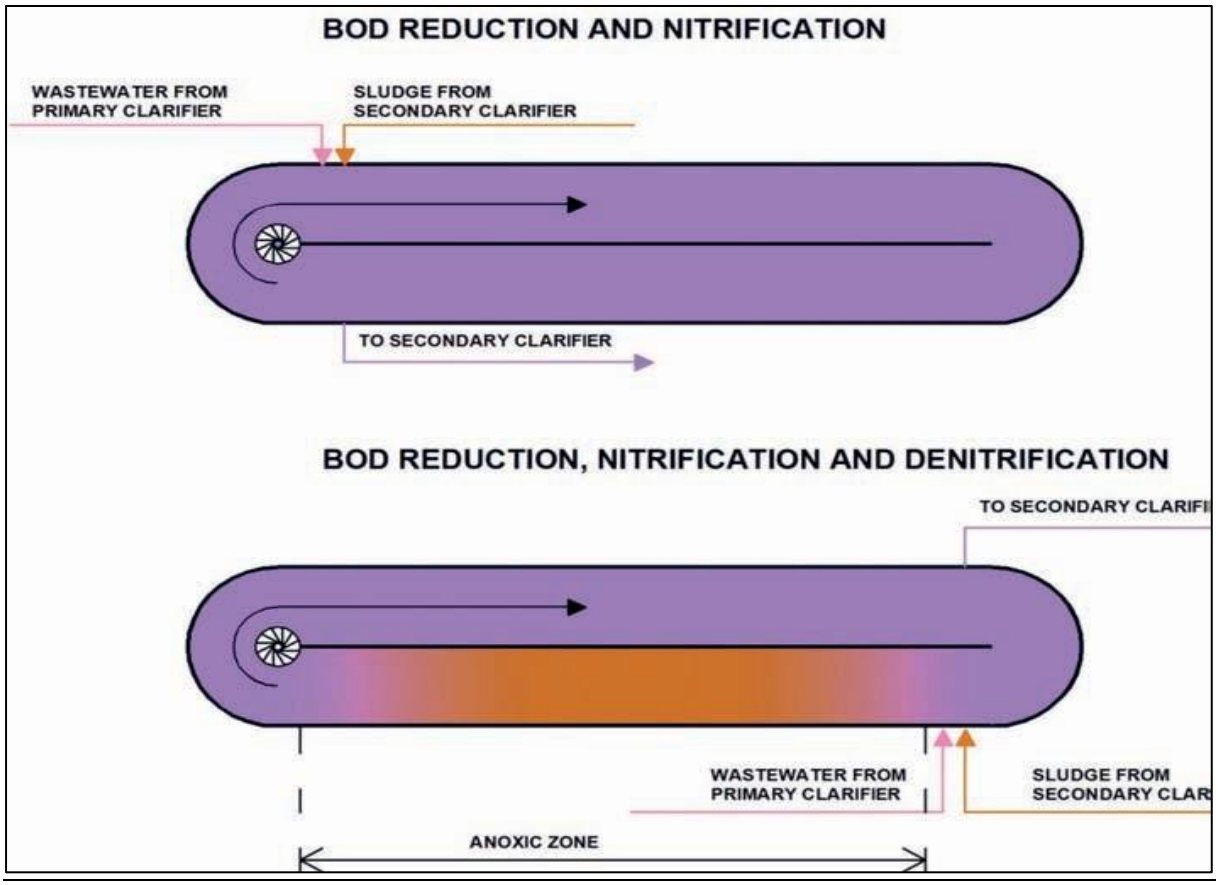


Figure 9.36 – Schematic Diagram of Oxidation Ditches with Bod Removal, Nitrification And Denitrification

The possibly best biological treatment of tannery effluents is the oxidation ditch (OD) and its various derivatives – a circular aeration basin (racetrack-shaped), with rotary-brush or vertical-rotor (carrousel) aerators that extend across the width of the ditch.

In addition to its simple construction and easy maintenance, the main advantage of the OD is its resilience to variations in flow, pollution load, including shock loads. It is even possible to combine several ovals and maintain different aeration regimes suitable for nitrification and denitrification.

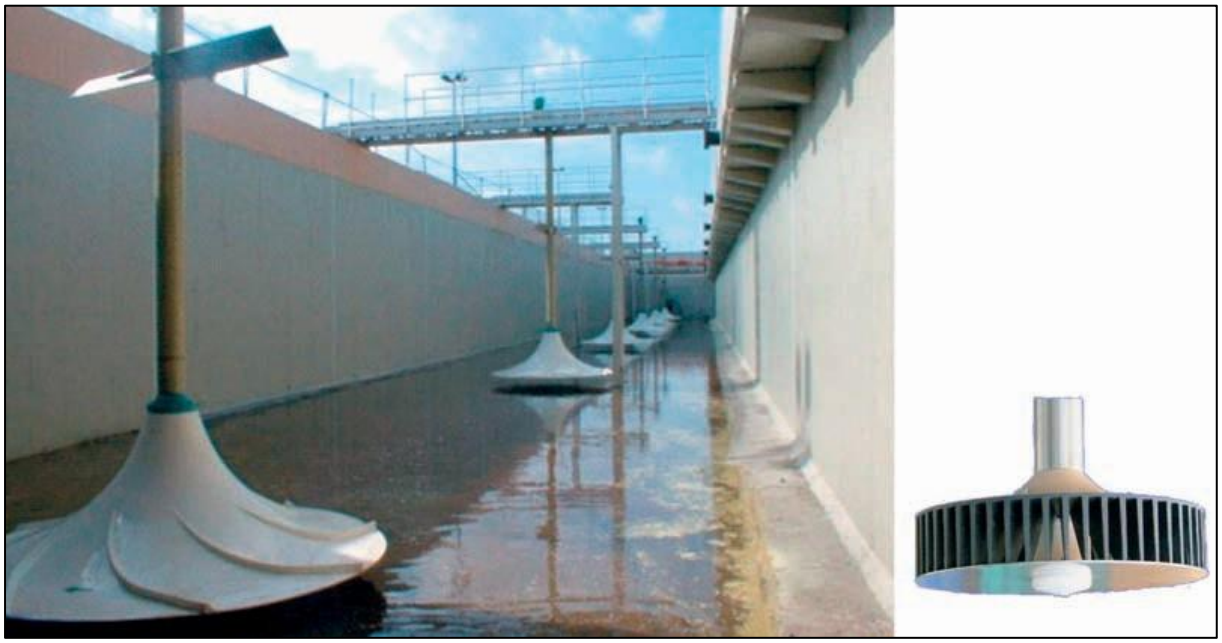


Figure 9.37 – Submerged Turbine Aerators In Oxidation Ditch

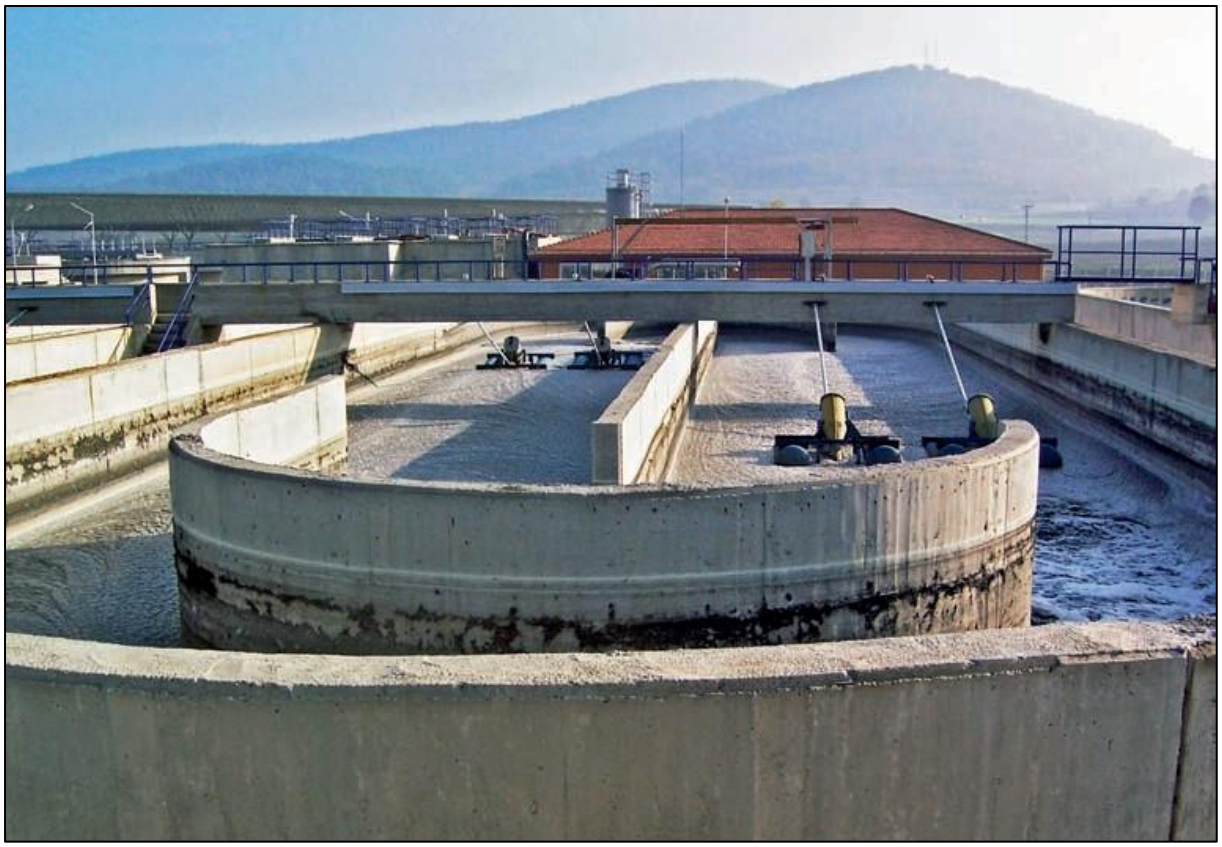


Figure 9.38 – Oxidation Ditch in Operation

Secondary Sedimentators

Their design is very similar to those of primary sedimentators, but the operational conditions are different. Also, the (excess – wastage) sludge evacuated at the tank bottom is normally bulkier and more difficult to dewater.

Surface hydraulic loading – or surface overflow rate (SOR) – is the vertical velocity of the influent in the secondary sedimentation tank (m^3/m^2 of tank surface per hour, m/h).

SOR of approximately 0.5 m^3/m^2 per hour is generally used for secondary sedimentation of tannery effluents, i.e., less than for primary clarifiers.

Surface solid rate (SSR) is the quantity per hour of MLSS (kg) crossing the surface area of the secondary sedimentation tank (kg/m^2 of tank surface per hour) (see primary sedimentation).

SSR values between 2.0 and 3.0 kg/m^2 per hour are generally used for secondary sedimentation of tannery effluents. The overflow from the secondary clarifiers represents the fully treated effluent usually fit for discharge into a final recipient.

In order to satisfy the legal limits for nitrogen (ammonia and TKN), very often nitrification and denitrification stages need to be introduced into the biological system. Nitrification requires extensive aeration as well as a low F:M ratio (<0.1) to facilitate conversion of nitrogen containing organic matter into nitrate and nitrite salts. During the denitrification stage, which for operational reasons can take place either at the very beginning or at the end of the biological treatment, these salts are converted under anoxic conditions into neutral nitrogen gas (N_2) and water.

Anaerobic Biological Treatment

As mentioned earlier, despite its high performance, comparatively lower costs and wide use in other industries, anaerobic treatment has failed to make inroads in the tanning industry. The main reason is that tannery effluent treatment leads to the development of a highly toxic, corrosive and flammable gas, hydrogen sulphide (H2S); difficulties and risks in dealing with this gas prevail over other, positive features of anaerobic treatment.

9.3.1.2.4 Advanced (Tertiary) Treatment

In certain cases, despite extensive physical-chemical and biological treatment in a well-designed CETP, the quality of the final effluent does not meet the promulgated discharge limits. The usual culprit is the recalcitrant COD, i.e., compounds that the micro-organisms present in the floc are unable to decompose.

In such cases, it is necessary to resort to additional, usually more sophisticated and rather expensive treatments such as mineralization of organic compounds by oxidation with H2O2 in the presence of ferrous sulphate (Fenton process and its derivatives). Ozonation is sometimes included not so much to kill potentially harmful micro-organisms but to destroy part of the residual COD.

9.3.1.3 Sludge Handling

Mechanical Sludge Dewatering

The main purpose of sludge dewatering is not only to reduce the volume and weight of material to be transported but also to attain the dry matter content required for disposal at landfills.

The equipment used for this purpose – recessed-plate filters, belt presses and decanter centrifuges – was already described earlier. Here is a short comparative overview of the main

characteristics and efficiencies of the various systems as well as changes in DS content throughout the treatment process.

Table 9.10 – Characteristics of Sludge Dewatering Equipment

S. No.	Equipment	Decanter	Belt Press	Plate-Filter Press
1	Way of operation	Continuous	Batch	Continuous
2	Sludge conditioning	Required	Not required	Required
3	Washing water	Not required	Required	Not required
4	Labour	Only supervision	Only supervision	Required during cake discharge
5	Sensitive to sludge variability	Very sensitive	Very sensitive	Less sensitive
6	Energy demand (electricity)	High	Medium	Low
7	Maintenance	Sophisticated	Medium	Low

(1) Polyelectrolyte (usually cationic): 2-4 g/kg of DS.

(2) Sludge conditioning with inorganic chemicals (iron salts and lime) is not strictly necessary, but recommendable for enhancing filtration rate and general performance.

(3) About 10 m^3/h of clean water at 4 bars per meter of belt width are required for continuous belt washing.

(4) Periodical cleaning of filtering cloth is required (at least once per week).

Table 9.11 – Dry Matter Content In Sludge Depending On Process Stage and/or Type Of Dewatering Equipment

S. No.	Treatment Stage, Equipment	DS Content (%)
1	Sludge after primary clarifier	3-5
2	Thickened mixed primary and secondary sludge (at aspecific load of about 60 kg DS/m^2)*	6-8
3	Chamber-filter press with chemical conditioning	35-45
4	Belt-filter press with use of PE	20-25
5	Centrifuge-decanter	20-30

6	Sludge after stabilisation with CaO (most after belt-filter press or centrifuge)	60-90
* Average values for mixed (primary + secondary) tannery sludges		

Utilization and Disposal

In comparison with sanitary sludges, tannery sludge has greater inorganic matter content, greater heavy metal content, especially chromium and greater sulfur compound content. However, the main stumbling block is the chromium content, with legislation and practice varying a lot from country to country.

A number of solutions for utilization and/or safe disposal of tannery sludge have been proposed, practiced, tested, and applied at pilot and industrial scale: landfill, land application, composting, anaerobic digestion, thermal treatment, vitrification, pyrolysis, brick making, etc., none of them proving satisfactory enough. There is certainly no universal solution for sludge utilization/application. Each CETP produces sludge of specific characteristics and different regions and countries have quite different regulations regarding sludge utilization. Therefore, prior to any CETP construction, a detailed assessment of options should be prepared and the most suitable application proposed.

In any case, handling, storage and transport of sludge and solid wastes from PTPs and CETPs should also be safe and not contaminate the surroundings; thus, for example, the collection points should be pro- tected against bad weather (rain, for example).

Figure 9.39 – Containers for Solid Waste

9.3.1.4 Odour Issue

Odours associated with wastewater are difficult to quantify because they are caused by a wide variety of compounds and they are a nuisance that is more qualitative than quantitative – sensitive persons easily detect very low concentrations of odoriferous substances in the air (sulphides/other sulphur compounds, ammonia, amines, etc.). Local geographic and climatic conditions such as wind direction, land shape, air humidity, ground and air temperature, etc. play an important role. Along the treatment line, the main sources of bad smell are –

1. Equalization and sulphide oxidation
2. Sludge thickening
3. Biological aeration
4. In-plant storage of dewatered sludge
5. (Temporary) sludge disposal site

Yet, the main source of bad smell remains the stripping of hydrogen sulphide; it is not the concentration of sulphide per se, but the lowering of pH: the not disassociated H2S is present only at pH below 10. Thus, it is crucial to control pH and, if needed, alkalis like NaOH or lime are added to achieve pH > 9.5-10. More extensive, uninterrupted aeration may help, but sometimes rigorous (and expensive) methods such as adding hydrogen peroxide or pure oxygen are necessary. Nowadays, in some places, nearly the entire CETP is covered and the air is purified.

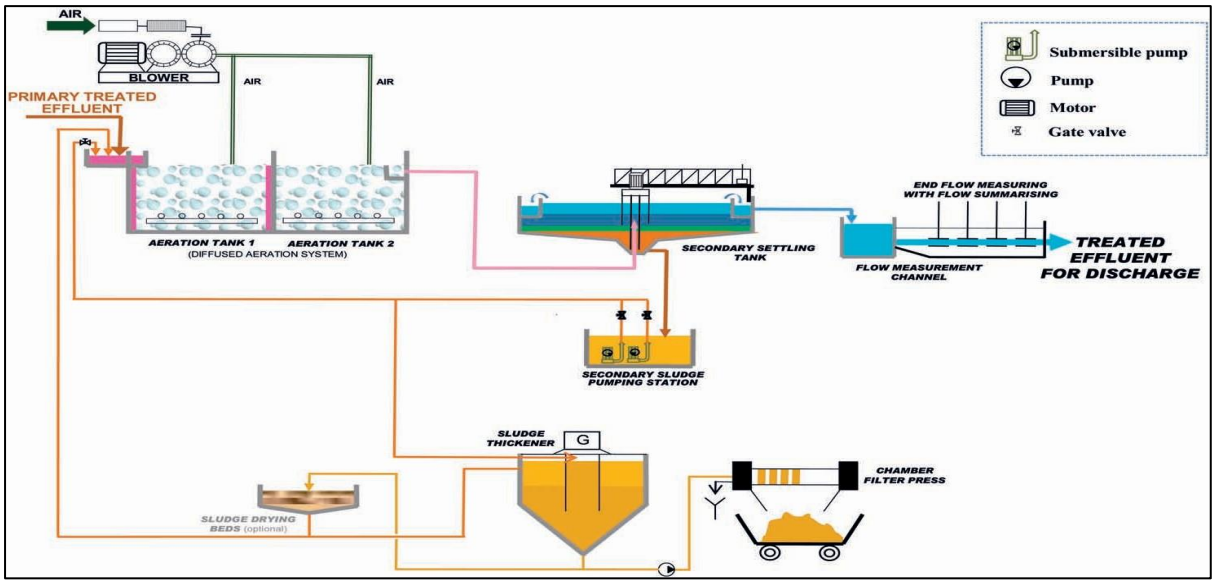


Figure 9.40 – Simplified Flowchart of The Biological (Secondary) Tannery Effluent Treatment

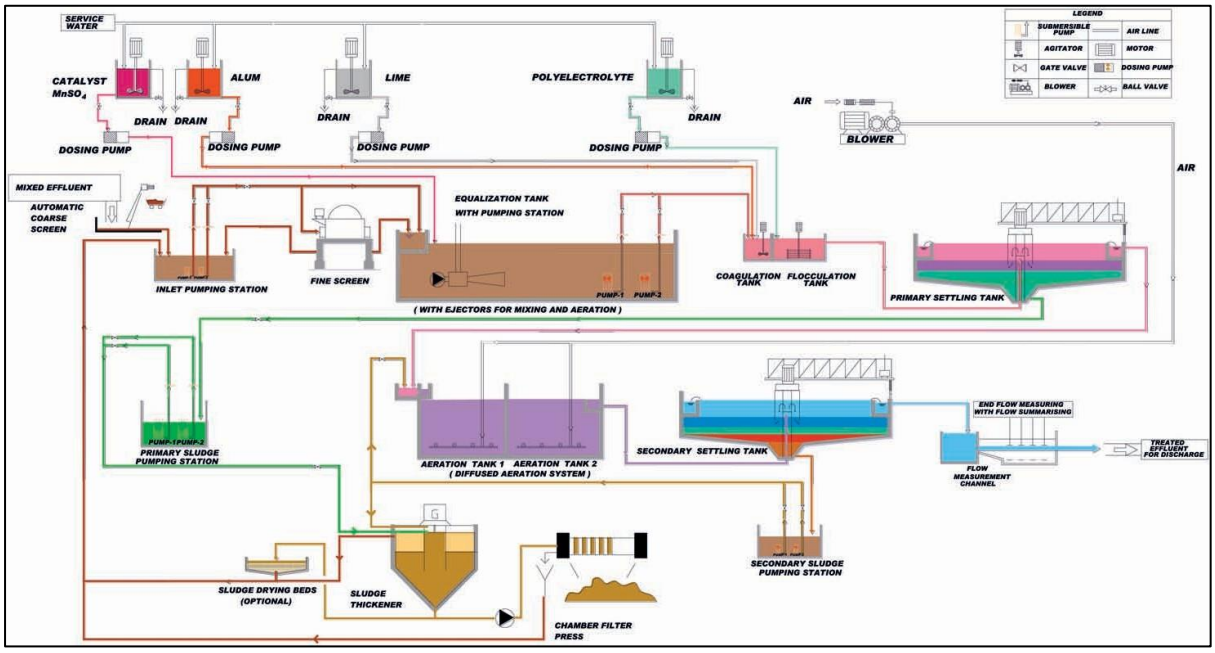


Figure 9.41 – Simplified Flowchart of A Full-Fledged Tannery Effluent Treatment Plant

9.3.1.5 Monitoring, Costs, OSH, Management

The extent of monitoring activities largely depends on local legal requirements and CETP size and it includes a wide range of parameters: effluent volume(s), peak loads, pollution loads, chemical dosing, dissolved oxygen (DO), sludge volume index (SVI), etc.

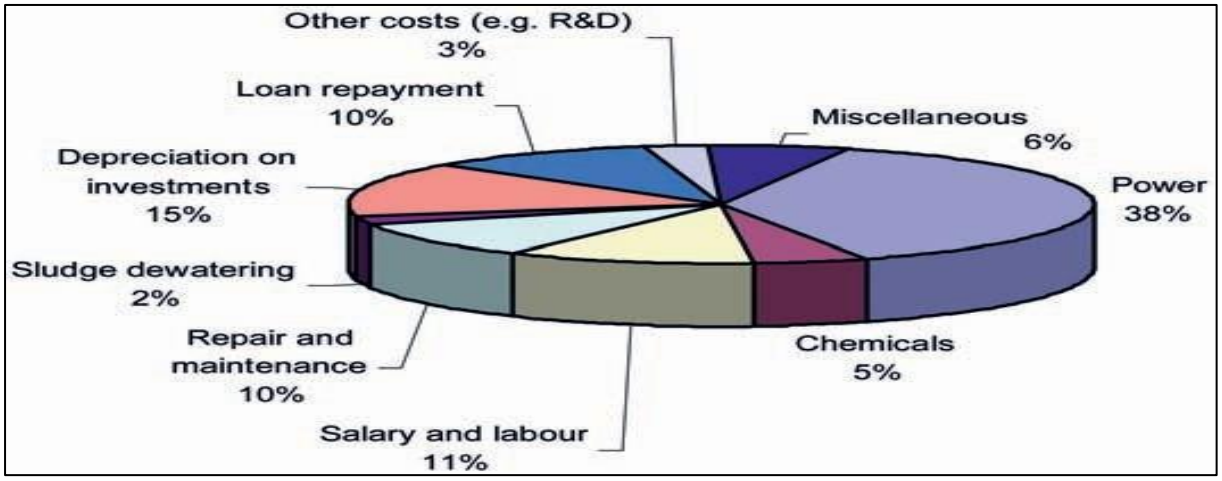


Figure 9.42 – Structure of Average Treatment Costs at Selected CETPs In India in 2005

The costs of treatment vary a lot, depending on the local costs of –

1. Power

2. Chemicals
3. Financing
4. Labour
5. Sludge utilization and disposal options, etc.

In India, the largest component is power, while sludge handling and disposal costs are comparatively low. If the reverse osmosis (RO) stage for desalination is installed, the cost of energy escalates further. In industrialized countries, the largest cost component is dewatering and safe disposal of solids (sludge).

While working out the costs of an CETP is quite straightforward, different methods are applied to compute the distribution of CETP operation costs among individual tanneries. The key parameters used are typically the following –

1. Water consumption, m^3/day
2. Production capacity, tonnes of wet-salted hides/day
3. Actual pollution load in terms of COD, suspended solids, sulphides and Cr
4. Production output, m2/day of wet blue, crust or finished leather

In developing countries, cost calculation methods for CETPs are usually very simple, being based solely on effluent volume and type of tanning, whereas in Italy, for example, these methods are very sophisticated and are based on many factors measured on-/off-line or estimated.

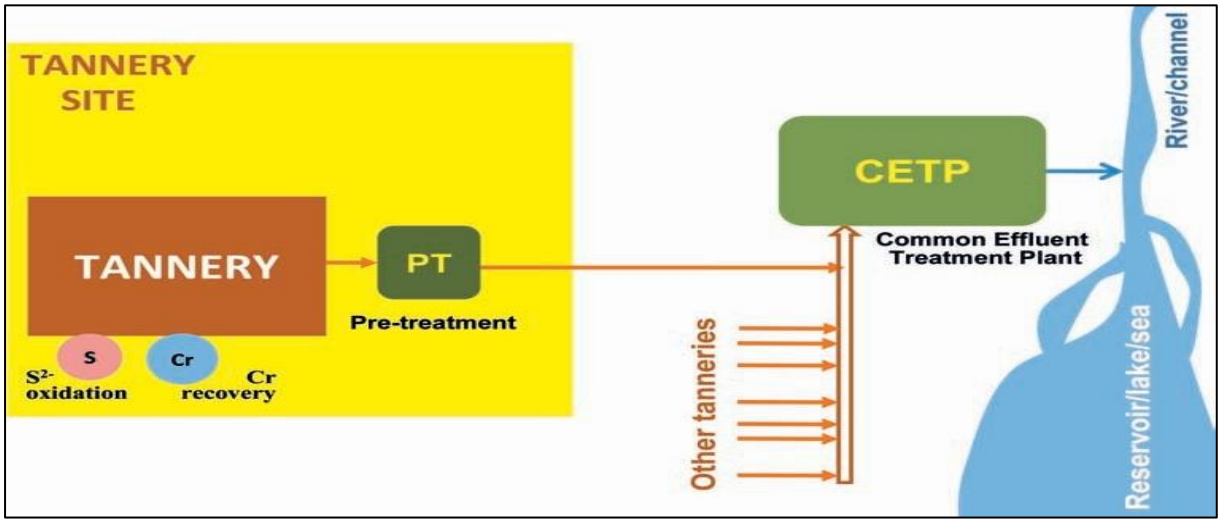


Figure 9.43 – Schematic Chart of Typical Effluent Treatment Setup for Clusters in India

When it comes to occupational safety and health at work (OSH) in CETPs, the main focus is on hydrogen sulphide gas. As mentioned earlier, hydrogen sulphide is an extremely toxic and irritating gas. It has a strong odour of rotten eggs but, paradoxically, it is perceived only at lower concentrations. This explains the numerous accidents despite its known toxicity.

Table 9.12 – Poisoning Effects of Hydrogen Sulphide Gas

Exposure	Time	Impact on Unprotected Person
0.03	No time limit	No effect
0.08-2.0	No time limit	(Mal)odour Threshold
10	Upto 8 hours	No effect
15	Upto 15 mins	Threshold limit value
15-200	Upto 15 mins	Headache, nausea, general weakness, pain in legs
200-500	1 min	Irritation of nose and throat, vertigo, blurring of vision, loss of consciousness lasting a few minutes
500-900	1 min	Profound coma, convulsions, disorientation after recovery
> 900	1 min	Instant coma and death

New toxicological data have led authorities in some countries to start reducing the recommended chronic- exposure limits to hydrogen sulphide – the 8-hour time-weighted average of the threshold limit value (TLV- TWA8) for H_2S came down from 10 ppm to 1 ppm, and the short-term exposure limit (TLV-STEL) from 15 ppm to 5 ppm; as a result, even confirming compliance with the new standards will be a challenge.

Instruments used to detect and monitor H_2S exposure can be either fixed or portable, whereas personal detectors are worn by employees and typically sound an alarm at levels between 10 ppm and 15 ppm. Due to this nearly permanent life threatening hazard, H_2S meters are always positioned at critical points and/or carried by staff. Also, certain activities such as entering pits can be carried out only in the presence of skilled supervisors (the worker performing such an operation must also wear a safety harness).

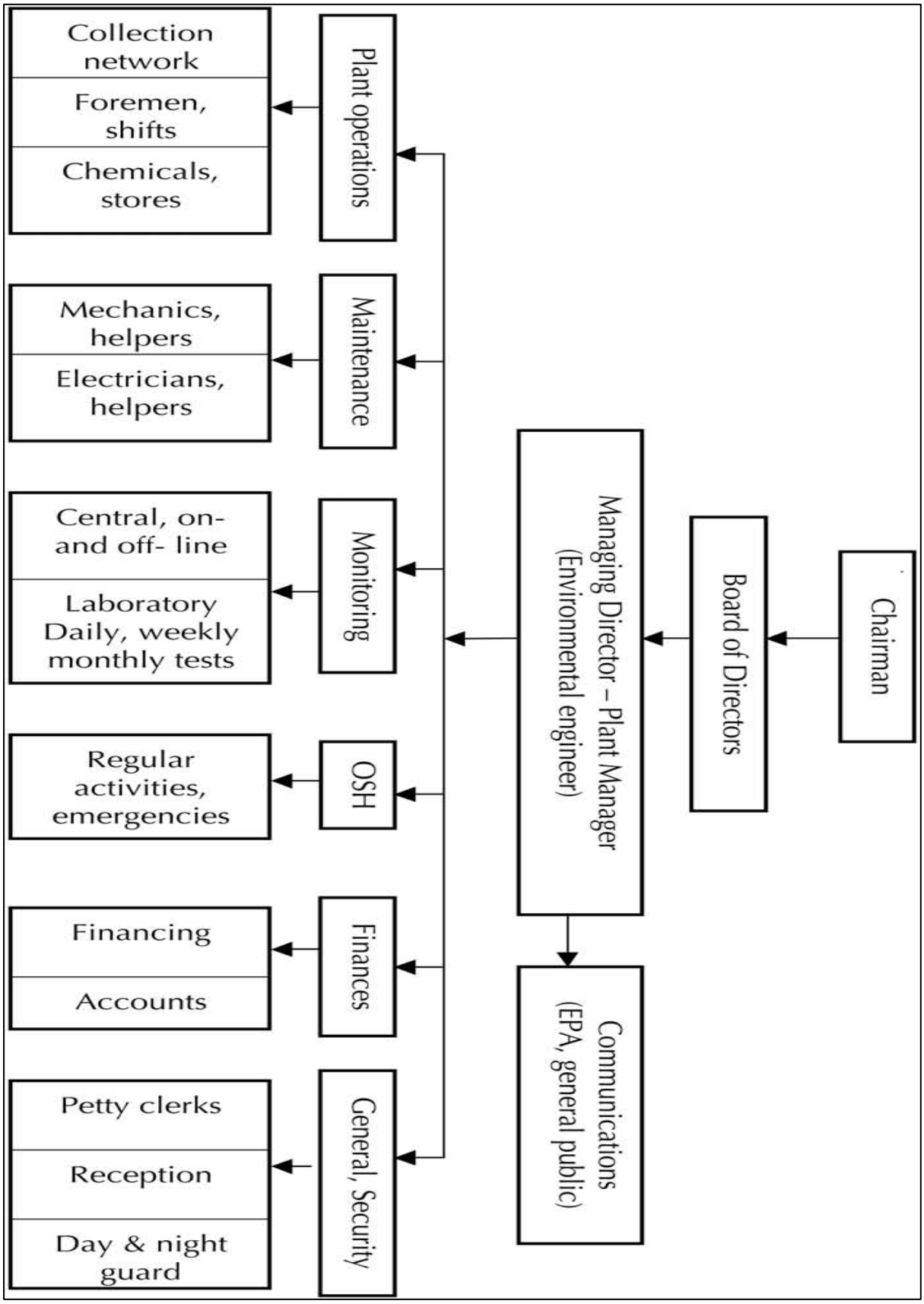


Figure 9.44 – CETP Organisational Structure

Otherwise, general and specific measures concerning equipment and chemicals also apply to CETPs.

Nowadays it is taken for granted that in a well-managed leather complex there is a person of appropriate competence and at an appropriate level of seniority who deals exclusively with increasingly complex environmental issues, especially those related to effluent treatment; in some countries, this is a legal requirement.

9.3.1.6 Conclusion

The treatment of tannery effluents is by now a well-established technology, and modular common effluent treatment plants servicing traditional tannery clusters or newly created leather industry zones is a widely accepted approach.

9.3.1.7 Air Emissions

Table 9.13 - Sources of Air Emissions and Preventive Methods

Emission To Air	Source Operations in Tannery	Suggestive Methods of Prevention
Organic Solvents	Degreasing Finishing	1. Usage of water-based formulations for spray dyeing 2. Usage of roller coating techniques or curtain coating machines wherever applicable 3. Usage of spraying units with economizers and high volume / low-pressure spray guns 4. Avoid usage of internationally banned solvents 5. Usage of wet scrubbers, activated carbon adsorption, bio-filters (to remove odors), cryogenic treatment, and catalytic or thermal oxidation.
VOCs	Spray-finish Machines Dryers	

Sulfides	Beam house and Effluent treatment	1. Maintain a basic pH over 10 in the equalization and sulphide oxidation tanks. 2. Avoid breeding anaerobic conditions in sulphate containing materials. 3. Add manganese sulphate to treated effluent. 4. Use adequate ventilation
Ammonia	Beam House Deliming Dehairing Drying after dye-penetration	1. Adequate ventilation followed by wet scrubbing
Dust	Storage handling of powdery chemicals Dry shaving Buffing Dust removal machines Milling drums, Stalking	1. Centralized system 2. Employing cyclones 3. Usage of scrubbers/bag filters, as needed.

Emissions of sulfur dioxide may occur during bleaching, post-tanning operations, or carbon dioxide (CO_2) deliming, but they are not typically a significant source of emissions.

Table 9.14 – Odour Emissions to Air

Odorous Emissions to Air	Source Operations in Tannery	Suggestive Methods Oof Prevention
NH_3	Beam house operations	Prompt curing of raw hides Reduce the time that sludge remains in the thickener, dewater thickened sludge by centrifugation or filter press, and dry the resulting filter cake. Sludge
H_2S	Beam house operations CETP collection tanks	
	CETP Primary Treatment Units	Containing less than 30 % solids may Generate especially strong odors Ventilate tannery areas and control exhaust from odorous areas (e.g., where Trade Effluent sludge is thickened and dewatered), through use of a biofilter and / or a wet scrubber with acid, alkali, or oxidant
	CETP Sludge Dewatering System CETP Anaerobic Lagoons	
VOCs	Finishing Operations	
CH_4	CETP Anaerobic Lagoons	

(Source: Draft report of the Expert Committee on Odour Pollution and its Control, July 2007, CPCB)

9.3.1.8 Solid Waste

Solid waste includes salt from raw skin / hide dusting; raw skin / hide trimmings; hair from the liming / dehairing process, which may contain lime and sulfides; and fleshing from raw skins / hides. Other solid waste from tannery industry includes wet-blue shavings, containing Cr_2O_3; wet-blue trimming, which is generated from the finishing processes and contains Chromium oxide (CrO), syntans, and dye; and buffing dust, which also contains CrO, syntans, and dye. The reducing characteristics of tannery sludge stabilize Cr(III) with respect to Cr(VI), due to the presence of organic matter and sulfides.

Prevention and control measures for solid waste include the following –

1. Reduce inputs of process agents (particularly precipitation agents in Trade Effluent treatment) to the extent practically applicable
2. Segregate different waste / residue fractions to facilitate recovery and re-use (e.g., to manufacture pet toys, pet food, leather fiberboard)
3. Recycle sludge as compost / soil conditioner or in anaerobic digestions for energy generation. Process sludge may be used for composting / agriculture after appropriate assessment for contaminants and potential impacts to soil and groundwater
4. Fleshings could be degraded through bio-methanation process – CLRI research findings are encouraging.

9.3.2 Chrome Recovery Unit

Intensive uses of chrome as tanning agent, because of superior characteristics conferring to leathers, are inducing negative effects to environment, especially by the high aggressivity of chromium salts. Our paper presents some researches for reducing of chrome loses by its recovery from tannery effluents, after separation as insoluble compounds. There are discussed the main experimental results performed using different precipitation agents, and operational conditions that influence the separation process (e.g., pH, temperature, addition of precipitation agents) in order to obtain a high efficiency of chrome recovery.

Appreciated as a very complex tanning agent which contributes special characteristics to leathers, chrome is a reducing element, but chrome salts are very aggressive, their action being negative for environment or all contacting bodies. Theseare the main reasons for which it is manifesting an accentuated tendency to reduce or even eliminate chrome into the leather tanning manufacturing by using natural vegetal tanning agents extracted from bark, wood, fruits or tree leaves etc. Nevertheless, the properties conferred to leathers by these vegetal

tanning agents does not attained the special qualities performed when is using chrome, and in our country the chrome salts continue to be use at industrial scale set-up into tanning engineering.

The Trade Effluents generated by leather manufacturing have a dark colour,contain dangerous compounds (e.g., sulphides), wastes of tanning agents, sugars, phenolic compounds, organic acids, compounds of peptonized leathers and a rich bacterial flora; also, the biochemical oxygen demand (BOD_5) of these Trade Effluents is high enough (400-900 mg/L). These Trade Effluents, especially those generated from small tanning units, present variations of flow and composition more important than those observed at high industrial units.

To reduce the aquatic environment pollution must be respected the actual legislative demands, that mean the application of treatment technologies that includes both mechanical-physical operations (sedimentation, filtration) and chemical processes (coagulation-flocculation, oxidation, reduction) and biological ones.Thus, biological treatment at apH value of 9, permits to obtain efficiency degrees of 85-95 % for BOD_5 removal.

To recover the chrome from Trade Effluents can be used different variants such as: ionic exchange, electrodialysis, microbiological collection. Generally, the Trade Effluents from tanning units contain a high quantity of chrome salts (5 – 6 g/L), and the chrome recovery is resorting to evaporation and precipitation of aqueous solutions. It is important for Trade Effluent treatment to perform both reduction of dangerous compounds discharged (e.g., sulphides) and recovery of usefull compounds, such as Cr^{3+}.

Chrome recovery from Trade Effluents generated from tanning units is generally carried out by precipitation as hydroxides, using different alkaline reagents (e.g., NH_4OH, Na_2CO_3, $NaHCO_3$, MgO), at a pH value of 8. There are presented comparative results performed with precipitation agents in order to obtain the most advantageous conditions for chrome recovery and subsequent reuse.

9.3.2.1 Method Of Analysis and Treatment

The chrome concentration of Trade Effluent was established indirectly by iodometric method after oxidation at dichromate by boiling with hydrogen peroxide. Also, the determination of chrome concentration from Trade Effluent was performed by a spectrophotometric method based on formation of a coloured compound with EDTA in acetate - acetic acid buffer. The

same spectrophotometric method was used for determination of chrome recovery degree after separation by precipitation.

The Trade Effluents generated from a chrome tanning unit have low acidic reaction all the time, are intensively polluted with organic matters, and contain a high quantity of chrome and sodium salts (5 – 6 g/L). The Trade Effluent was initially characterized concerning the pH, colour, organic load and chrome content using actual standardized methods.

From these Trade Effluents the chrome was recovering almost exclusively by precipitation as hydroxide, at a pH value of 8, using different alkaline reagents.

The precipitation reaction can be expressed by equilibria:

$$Cr^{3+} + 3OH \leftrightharpoons Cr(OH)_3 \qquad (1)$$

The precipitation equilibrium depends firstly of hydrogen ions concentration(pH value), of metallic ion concentration and hydroxide solubilization, respectively[10]. As the hydroxide is lower soluble, the precipitation starts (and finished) at a lowerpH value, the precipitation interval depending on metallic ion valency.

Practically, the chrome precipitation as hydroxide was performed through displacement of existing hydrolysis equilibrium into the solution of metallic ion –

$$Cr^{3+} + 3H_20 \leftrightharpoons Cr(OH)_3 + 3H^+ \qquad (2)$$

As a result, the precipitation can be performed with all reagents that link hydrogen ions generated at equilibrium (2) such as: hydroxides, carbonates (bicarbonates), according to the following reactions –

$$H^+ + OH^- = H_20 \qquad (3)$$

$$H^+ + CO^{2-} = HCO^- \qquad (4)$$

Precipitation as hydroxide using reagents having alkaline character represents a convenient variant of chrome reduction and recovery from Trade Effluents generatedinto a leather

tanning unit. The procedure is indicated especially in the case of high concentrations of metallic ions, when other variants are not so efficient or too expensive.

Between the investigated precipitation reagents, the best results were performed with $NaHCO_3$ (chrome recovery degree higher than 94 %) and MgO (chrome recovery degree of ca 90 %). Although in the case of MgO the variation interval of chrome recovery degrees is relatively high, it seems that a rapid falling down of the solid phase appears. This phenomenon can be explained by the shape of reagent – aqueous suspension – solid particles being nucleus that facilitate the precipitate agglomeration.

The temperature of precipitation seems to have no high influence on chrome recovery degree, fact that is an advantage for the application of this procedure at environmental conditions.

The chrome bearing effluent segregated at source and treated separately for the separation / recovery of Chromium Salts in the form of Chromic Acid. Recovered Chrome is taken back into the process. Magnesium Oxide is the chemical used for the recovery of Chromium.

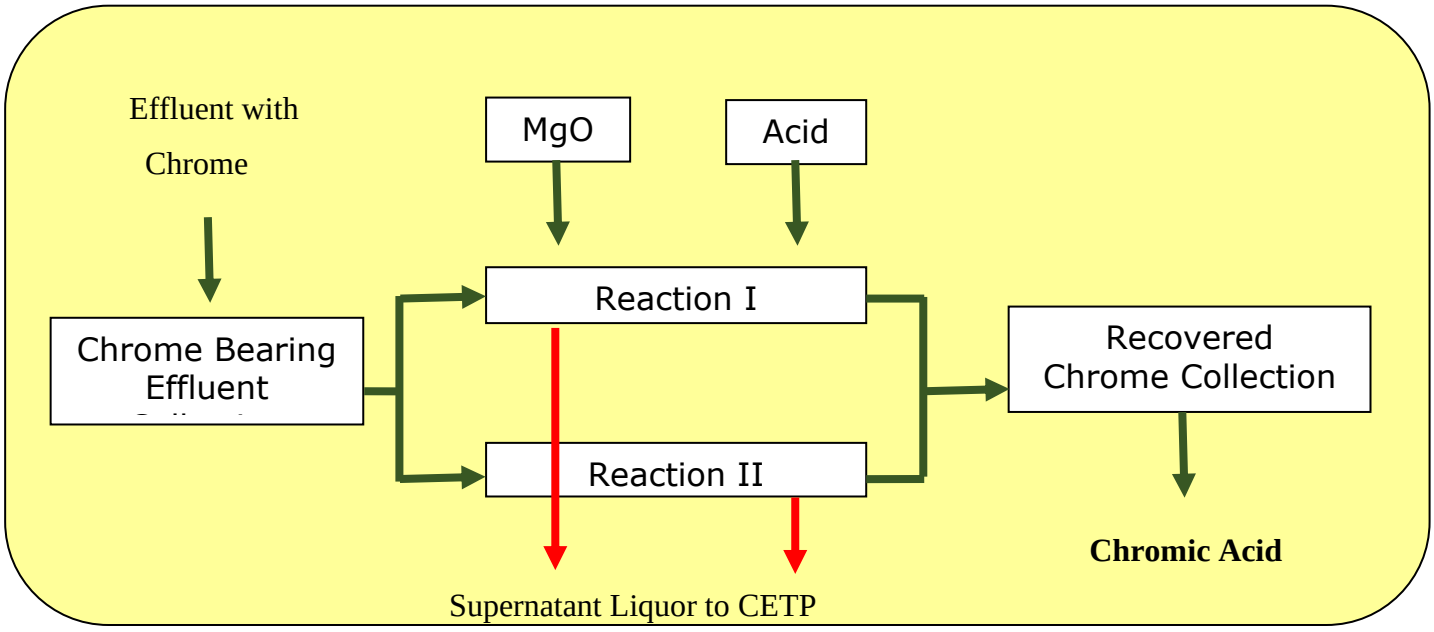


Figure 9.45 – Schematic Diagram – Chrome Recovery Plant

Table 9.15 – Units and Equipment of the CRP

S. No.	Name of the Unit	Material of Construction	No. of Units
1	Collection Tank	RCC with Lining	1
2	Reaction Chamber	MS - FRP	2

3	Agitator	SS	1
4	Chrome Collection Tank	HDPE	1
5	Chrome Effluent Transfer Pumps	SS	1 + 1
6	Piping & Valves	Non-corrosive	Complete

9.4 Air Environment

The following are the anticipated impacts and the proposed mitigation measures due to the construction and operation phase of project on the ambient air environment –

Table 9.16 – Anticipated Impacts and Proposed Mitigation Measures for Ambient Air Environment

Anticipated Impacts	Proposed Mitigation Measures
Construction Phase	
1. Dust generation due to construction operations and movement of vehicles.	1. It will be ensured that dust suppression is carried out at regular intervals. 2. It will be ensured that material, especially loose material brought in for construction purposes will be covered. 3. It will be ensured that maximum speed of vehicles will be restricted to reduce emissions. Speedbumps and signs will be used for this purpose.
2. Emissions from operation of construction equipment and movement of vehicles.	1. Only PUC certified vehicles will be allowed to enter the project site. 2. Regular maintenance of construction machinery and vehicles will help in controlling excessive emissions.
3. Wind erosion due to site clearance and preparation.	1. Vegetation such as small bushes and grass will be cleared only at areas where immediate construction needs to take place.

	2. Plantation activities, especially along the periphery will be carried out to contain the erosion within the project site during construction phase as much as possible.
Operation Phase	
1. Vehicular movement will be the major source of air pollution.	1. Only PUC certified vehicles will be allowed to ply within the project site. 2. Vehicle speed shall be restricted to prevent excessive emissions through signboards and speed bumps. 3. Greenbelt development will be carried out to absorb and reduce the overall air pollution.

9.5 Noise Environment

The following are the anticipated impacts and the proposed mitigation measures due to the construction and operation phase of project on the ambient noise environment –

Table 9.17 – Anticipated Impacts and Proposed Mitigation Measures for Ambient Noise Environment

Anticipated Impacts	Proposed Mitigation Measures
Construction Phase	
1. Noise generation due to construction machinery.	1. Regular maintenance of construction machinery will be encouraged to reduce noise levels.
2. Noise generation due to vehicles.	1. Only PUC certified vehicles will be allowed to enter the project site. 2. Regular maintenance of vehicles will ensure that vehicles do not make a lot of noise. 3. Greenbelt development will take place to reduce the overall noise levels.

Operation Phase	
1. Vehicular movement will be the major source of noise pollution.	1. Only PUC certified vehicles will be allowed to ply within the project site. 2. No honking zones will be made near residential and institutional areas. 3. Greenbelt development will be carried out to reduce the overall noise levels.

9.6 Biological Environment

The following are the anticipated impacts and the proposed mitigation measures due to the construction and operation phase of project on the biological environment –

Table 9.18 – Anticipated Impacts and Proposed Mitigation Measures for Biological Environment

Anticipated Impacts	Proposed Mitigation Measures
Construction Phase	
1. Loss of vegetation due to construction activities.	1. The core zone where construction is proposed is devoid of any significant natural vegetation. Isolated patches of grass, shrubs etc are present. There will be negligible loss of flora. 2. Greenbelt development will take place along the periphery and within the project site.
2. Displacement of fauna.	1. No fauna population was observed within the core zone. 2. Avifauna such as crows, pigeons etc. will benefit from greenbelt development that will take place along the periphery of the project.

Operation Phase	
1. Vehicular movement transporting the sludge from the CETP to SLF will be a major source of air and noise pollution impacting the fauna.	1. Only PUC certified vehicles will be allowed to ply within the project site. 2. Greenbelt development will be carried out to reduce the overall noise levels, air pollution as well as provide a habitat for the avifauna.
2. Sludge generation from the CETP.	1. Sludge from the CETP will be disposed off in the SLF.

9.7 Socio-Economic Environment

The following are the anticipated negative impacts and the proposed mitigation measures due to the construction and operation phase of project on the socio-economic environment –

Table 9.19 – Anticipated Impacts and Proposed Mitigation Measures for Socio-Economic Environment

Anticipated Impacts	Proposed Mitigation Measures
Construction Phase	
1. Occupational hazards for workers engaged in construction activities.	1. Providing workers with safety gadgets such as masks, earmuffs and other PPE will be mandatory before the start of any construction activities. 2. Regular medical checkup of workers will be carried out. 3. Workers will be provided clean drinking water and sanitation facilities. 4. Fire extinguishers and buckets of sand will be provided in the fire-prone areas. 5. Storage of flammable and hazardous materials shall be done as per established rules and regulations by the upcoming units.

Operation Phase	
1. Increased demand on existing resources. Water: 4.22 MLD Electricity: 7.23 MVA	1. Rain water harvesting for ground water recharge and its utilisation for various purposes within the CLC can be carried out. 2. It is strongly recommended to recycle the treated effluent from the CETP for plantation and flushing purposes for reducing the overall water requirement of the project. This recommendation has been accepted by the project authorities and will be implemented in the future. 3. Energy efficient devices such as LED bulbs to reduce the overall electricity consumption will take place.

9.8 Solid Waste

The following solid wastes are expected to be generated during the construction and operational phase of the project –

Table 9.20 – Solid Waste Generation and its Disposal

Anticipated Impacts	Proposed Mitigation Measures
Construction Phase	
1. Construction and demolition waste The construction and demolition waste includes debris, concrete, steel and other metals, pallets, packaging and paper products, fluorescent tubes, wood beams, joists, studs, baseboards, bricks etc.	1. Specific areas within the project site shall be allotted for temporary storage of construction and demolition waste. 2. Construction and demolition waste storage area will be covered to prevent it affecting its surroundings. 3. Construction and demolition waste will be either reused within the project site or disposed off as per Construction and

	Demolition Waste Management Rules, 2016.
2. Hazardous waste Hazardous wastes include products such as paints, cleaners, oils, batteries, etc. that contain potentially hazardous ingredients	1. Hazardous wastes will be stored separately. 2. Hazardous wastes will be disposed off as per Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.
Operation Phase	
1. Municipal solid waste Domestic wastes include food leftovers, vegetable peels, plastic, clothes, ash, etc.	1. A three bin system will be adopted for the segregation of waste into non-recyclable waste (dark grey bin), food waste (green bin) and paper (blue bin). 2. These wastes will in turn be disposed of Municipal Solid Wastes (Management and Handling) Rules, 2000.
2. Hazardous Waste PETP and CETP sludge, leather pieces/scrambles, salt, buffing dust, shaving dust, used oil and used battery waste	1. PETP and CETP sludge, leather pieces/scrambles, salt, buffing dust and shaving dust will be sent to SLF for disposal. 2. Used oil and used battery waste will be sold to authorised companies as per norms by the units.
3. Empty bags, drums and containers containing chemical traces.	1. Empty bags, drums and containers containing chemical traces will be sold to authorised persons as per norms.

9.9 Upcoming Tanneries

Implementation of various pollution control measures will be made mandatory for the prospective unit operators of the tanneries before the commencement of operations.

This will help in preserving the existing land, water, air, noise, biological and socio-economic environment within the study area by minimising the negative impacts and maximising the positive impacts due to the development of the leather industries within CLC.

The following measures can be implemented by the upcoming tanneries in this regard –

1. Installation of a primary ETP unit within the tannery in order to reduce the overall suspended solids to less than 600 mg/L, chromium concentration of 45 mg/L and bring pH within 6.5-9.0.
2. Installation of air pollution control devices in order to control the point sources of air pollution and the improve the overall ambient air quality.
3. Providing adequate stack height and provision of Diesel Oxygen Catalytic Convertor (DOCC) for DG sets as per CPCB norms.
4. Providing of acoustic enclosures in DG sets to obtain insertion loss of minimum 25 dB(A).
5. Making use of low noise generating tanning drums in order to reduce the noise generation in the process house of tanneries.

9.10 Corporate Social Responsibility Budget Allocation

As per the notification of Ministry of Corporate Affairs G.S.R. 129(E) dated 27.02.2014 and its subsequent amendments, 2% of the average net profit of the last three financial years will be contributed for various CSR activities for the benefit of nearby communities. These activities can include the following –

1. Organising skill development camps in nearby villages such as tailoring classes etc.
2. Installation of public toilets, benches etc.
3. Installation of solar street lights in nearby villages.
4. Social forestry.

9.11 Corporate Environmental Responsibility

The Office Memorandum F. No. 22-65/2017-IA.III dated 01.05.2018 of MoEF&CC can be taken as a guideline in order to calculate and assign resources under CER for the proposed expansion. Being a brownfield project, 1% of the total project expansion cost can be used under various CER activities.

As per MoEF&CC Notification F.No.22-65/2017-IA.III dated 30.09.2020, the budget allocated for CER activities has been diverted to EMP implementation.

9.12 Environment Management Plan Budget Allocation

The following activities can be assigned resources under EMP –

1. Treatment of effluent from various tanneries within the CTP along with chromium recovery in the chrome recovery unit within the CETP.
2. Providing acoustic enclosures for the DG sets installed in the CETP.
3. Disposal of sludge at the SLF.
4. Providing an environmental laboratory for testing of untreated and treated effluent parameters and installation of an ambient air quality monitoring station within the CLC.
5. Regular medical checkup of workers.
6. Greenbelt plantation along the internal roads, periphery of the project site and in open areas.

CHAPTER 10 – SUMMARY AND CONCLUSIONS

10.0 General

The EIA report presents a clear picture of the existing baseline scenario within the 10 km study area of the project. It further predicts the beneficial and the negative impacts the project would have on the land, water, air, noise, biological and socio-economic environment. The purpose of the EIA is to maximise the benefits that will accrue from the integrated leather complex and mitigate if not eliminate any adverse impact.

This has been achieved through baseline data collection, simulating models, running analysis and proposing mitigatory measures for both the construction and operation phase of the project.

10.1 Introduction

CLC currently houses 383 leather and leather goods manufacturing units within its premises with a total capacity to accommodate 602 tanneries. The proposed expansion would enable another 228 units to relocate or set up their units within CLC and enable to increase the processing capacity of CLC from 1,000 MTPD to 1,600 MTPD.

Table 10.1 – Salient Features of The Project

S. No.	Parameter	Detail
1	Project Name	Expansion of Calcutta Leather Complex
2	Project Proponent	KMDA
3	Project Location	Village Bantala, Post Bhojerhat, Tehsil & District – South 24 Parganas, West Bengal
4	Expansion Area	Approx. 40 Ha
5	Current Leather Processing Capacity	1,000 MTPD
6	Proposed Leather Processing Capacity	1,600 MTPD
7	Manpower Required for Expansion	3,000 direct job opportunities 7,200 indirect job opportunities

8	Electricity Requirement	7.23 MVA supplied received from West Bengal State Electricity Board at 132 KV level through 2 132/33 KV, 50 MVA transformers.
9	Water Requirement for Expansion	4.22 MLD (1.05 MLD Drinking Water and 3.17 MLD Process Water)
10	Wastewater Generation	49.15 MLD

10.2 Location of the Project

CLC is located at Village Bantala, Post Bhojerhat, Tehsil & District – South 24 Parganas, West Bengal. The project site is well connected with the state's capital Kolkata 12 km away in the West direction. Several transportation facilities including roadways, airport and seaport is available in the nearby vicinity of the project. The project site location has been shown in **Figure 10.1**.

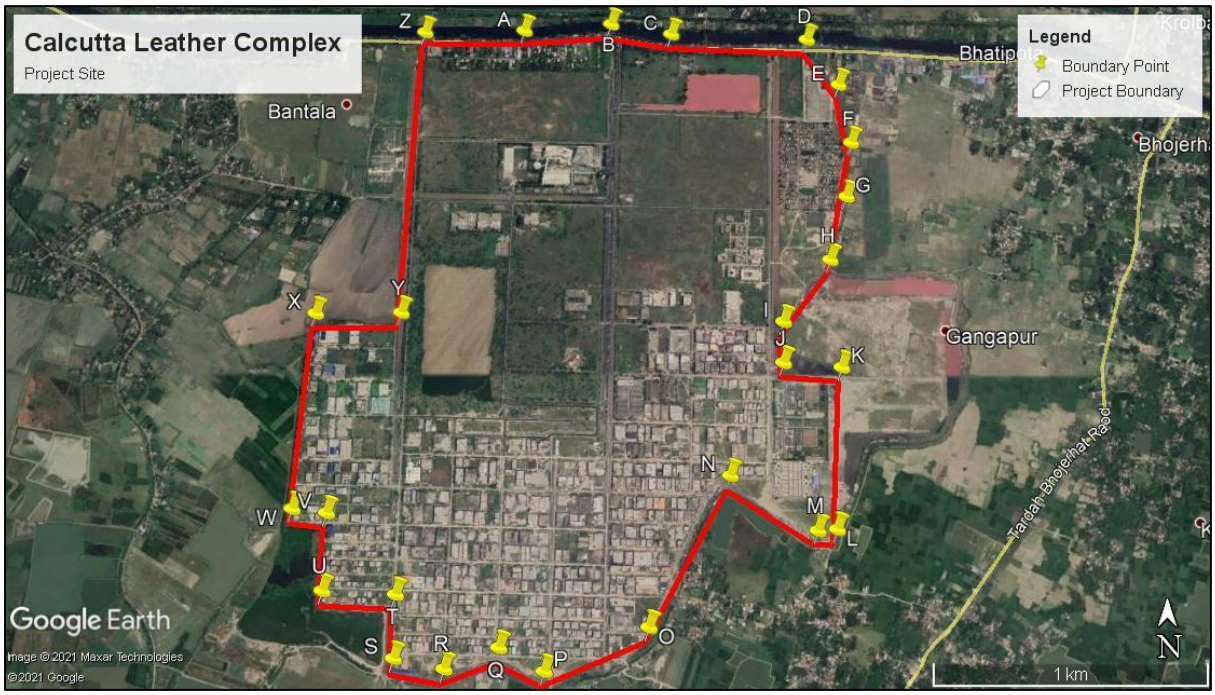


Figure 10.1 – Location of The Project

10.3 Proposed Expansion

With the proposed expansion, it is expected another 228 tanneries will shift their manufacturing units to the CLC in the future, details of which have been provided in **Table 2.3** and **Figure 2.2**.

Table 10.2 – Location of Units under Proposed Expansion

Zone	No. of Units
Zone 10A	
A	34
B	32
C	24
D	18
E	27
F	6
G	5
H	5
J	7
K	6
Zone 11	
	64
Total	**228**

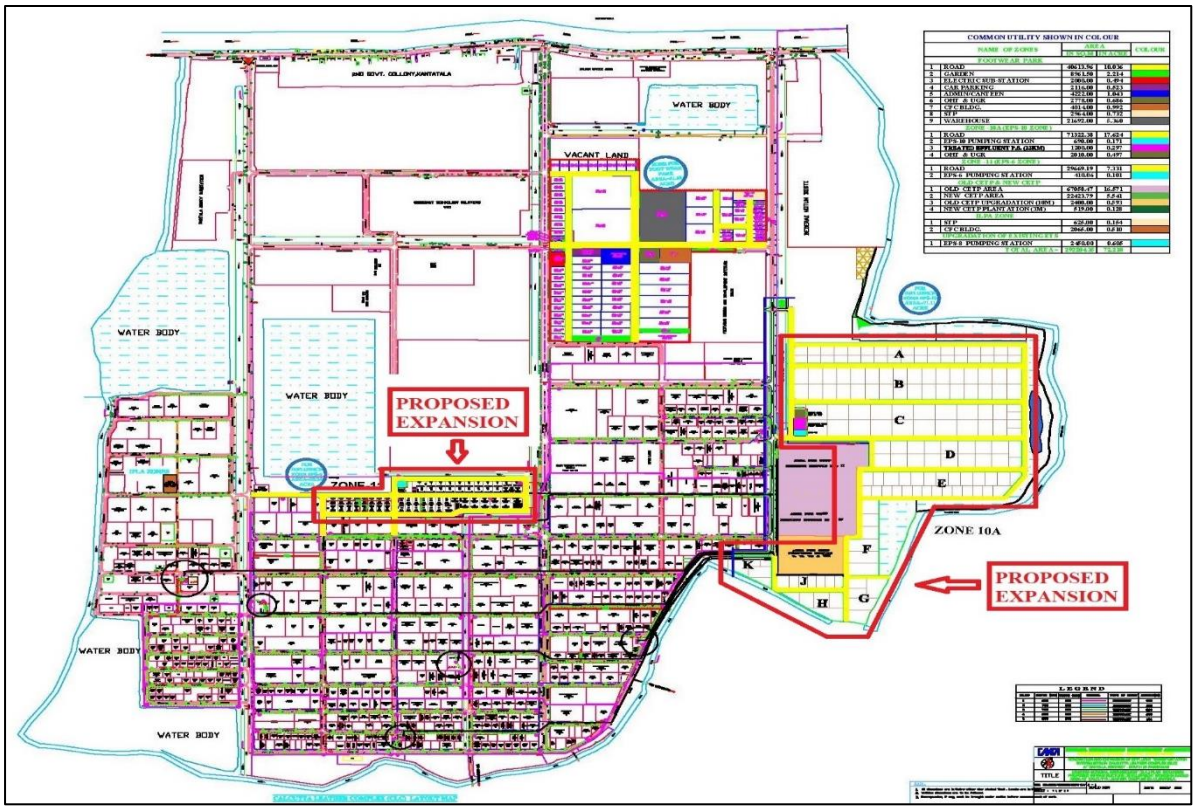


Figure 10.2 – Location of Units under Proposed Expansion

10.4 Resource Requirement

10.4.1 Water Requirement

Table 10.3 – Water Requirement for the Proposed Expansion

S. No.	Purpose	Water Requirement (MLD)
1	Domestic	1.05
2	Manufacturing	3.17
Total		**4.22**

10.4.2 Wastewater Generation

Table 10.4 – Wastewater Generation After Proposed Expansion

S. No.	Purpose	Water Requirement	Quantity	Total Wastewater Generation (KLD)
1	Domestic	35 lpcd	33,000 people	1155
2	Manufacturing	30 KL/MT	1,600 MTPD	48000
Total				**49155**

10.4.3 Electricity Requirement

The total power demand for the proposed project is estimated at 21 MVA. Power will be received from West Bengal State Electricity Board at 132 KV level through 2 132/33 KV, 50 MVA transformers.

A 132/33 KV substation is located in the Eastern part of the complex and the other 132/33 KV substation is routed through the North/East boundary road.

10.4.4 Road Network

Roads will be constructed within the proposed expansion area to provide connectivity of the upcoming tanneries within the CLC as well as outside the CLC.

Roughly 85,000 m^2 of roads will be laid to facilitate movement of workers and vehicles to and from the upcoming units and will require the following materials –

Table 10.5 – Approximate Raw Materials Required for Road Construction

S. No.	Construction Material	Unit	Quantity Required per 100 m^2	Total Quantity Required

1	Paving Asphalt	kg	0.18	153
2	Solvent	kg	12.6	10710
3	Stone chippings 12.5/13.2 mm nominal size @ 1.80 m^3/100 m^2	m^3	2.25	1912.5
4	Stone chippings 10/11.2 mm nominal size @ 0.9 m^3/100 m^2	m^3	1.12	952

10.4.5 Drainage Network

Water supply network, storm water drainage and effluent drains will be laid down within the proposed expansion area to cater to the needs of water, stormwater removal and effluent transport of/from the tanneries.

Freshwater will be made available from the 10 overhead tanks located in different zones through a different distribution system while the wastewater will be transported from the tanneries to the CETP via underground HDPE pipeline network under gravity.

Approx. 2,500 m of HDPE pipes will be laid for transporting the effluent from the upcoming tanneries to the CETP for this purpose.

10.4.6 Fuel Requirement

DG sets to be used during the construction and operation phase (in case of power failure) will require diesel for their operation.

The amount of diesel required during the operational phase will vary depending upon the number of units installing a DG set and their manufacturing capacity. Individual units will be advised not to use any banned fuels and to meet emission norms.

10.5 Baseline Monitoring Analysis

10.5.1 Land Environment

Physical characteristics of soil were characterized through specific parameters viz bulk density, porosity, water holding capacity, pH, electrical conductivity and texture.

In the study area, variations in the pH of the soil were found to be slightly acidic to slightly basic from 6.85 to 7.68. Electrical conductivity is a measure of the soluble salts and ionic activity in the soil. In the collected soil samples, the conductivity ranges from 274.6 to 412 µmhos/cm.

10.5.2 Water Environment

10.5.2.1 Surface Water Analysis Inference

pH: pH was found from 6.85 to 7.76 which is within the permissible range of 6.5 to 8.5.

Turbidity: Turbidity was found from 8.4 to 18.6 NTU which is within the permissible range of less than 1,000 NTU.

Hardness: Total hardness was found in the range of 260 to 450 mg/L as $CaCO_3$ with the permissible limit being 300 mg/L as $CaCO_3$ as per IS2296 Class A.

Alkalinity: Alkalinity was found in the range of 280 to 320 mg/L as $CaCO_3$.

Chloride: Chloride was found in the range of 114.64 to 964.24 (at SWQ4) mg/L with the permissible limit being 250 mg/L as per IS2296 Class A.

Sulphate: Sulphate was found in the range of 28.30 to 195.72 mg/L which is within permissible limit of 400 mg/L.

Nitrate: Nitrate was found in the range of 2.65 to 8.24 mg/L which is within permissible limit of 20 mg/L.

Fluoride: Fluoride was found in the range of 0.16 to 0.37 mg/L which is within permissible limit of 1.5 mg/L.

Dissolved Oxygen: Dissolved Oxygen was found in the range of 5.1 to 7.4 mg/L which is more than the minimum value of 4 mg/L.

Biochemical Oxygen Demand: Biochemical Oxygen Demand was found in the range of 4.5 to 10.5 mg/L which is more than permissible limit of 2 mg/L as per IS2296 Class A. By virtue of the readings, wastewater contamination has been observed in the nearby surface water bodies.

Chemical Oxygen Demand: Chemical Oxygen Demand was found in the range of 32 to 48 mg/L.

Heavy Metals: All heavy metals were found within permissible limits.

10.5.2.2 Ground Water Analysis Inference

Turbidity: Turbidity was found from less than 0.5 to 1.7 NTU which is within the permissible limit of 5 NTU.

pH: pH was found from 6.86 to 7.42.

Total Dissolved Solids: Total Dissolved Solids were found in the range of 721 to 2,886 mg/L with the permissible limit being 2,000 mg/L.

Alkalinity: Alkalinity was found in the range of 360 to 460 mg/L as $CaCO_3$ which is within permissible limit of 600 mg/L as $CaCO_3$.

Chloride: Chloride was found in the range of 33.75 to 621.30 mg/L which is within permissible limit of 1,000 mg/L.

Sulphate: Sulphate was found in the range of 6.29 to 206.13 mg/L which is within permissible limit of 400 mg/L.

Nitrate: Nitrate was found in the range of 1.07 to 9.05 mg/L which is within permissible limit of 45 mg/L.

Fluoride: Fluoride was found in the range of 0.11 to 0.75 mg/L which is within permissible limit of 1.5 mg/L.

Heavy Metals: All heavy metals were found within permissible limits.

10.5.3 Ambient Air Analysis Inference

10.5.3.1 Coarse Particulate Matter (PM10)

The minimum and maximum PM10level recorded within the study area was 76.57 and 195.54 µg/m^3 respectively with the 98th percentile ranging between 85.24 to 194.74 µg/m^3.

The 24-hourly average PM10 value were compared with the NAAQS and found that PM10 concentration in AAQ1, AAQ4 and AAQ5 are greater than the permissible value of 100 µg/m^3.

10.5.3.2 Fine Particulate Matter (PM2.5)

The minimum and maximum PM2.5 level recorded within the study area was 38.56 and 139.13 µg/m^3 respectively with the 98th percentile ranging between 43.86 to 138.67 µg/m^3.

The 24-hourly average PM2.5 value were compared with the NAAQS and found that PM2.5 concentration in AAQ1, AAQ4 and AAQ5 are greater than the permissible value of 60 µg/m^3.

10.5.3.3 Sulphur Dioxide (SO_2)

The minimum and maximum SO_2 level recorded within the study area was 10.25 and 17.71 µg/m^3 respectively with the 98th percentile ranging between 12.83 to 17.33 µg/m^3.

The 24-hourly average SO_2 value were compared with the NAAQS and found that the SO_2 concentration recorded at all sampling stations are within the permissible value of 80 µg/m^3.

10.5.3.4 Oxides of Nitrogen (NO_2)

The minimum and maximum NO_2 level recorded within the study area was 19.63 and 26.21 µg/m^3 respectively with the 98th percentile ranging between 22.78 to 25.88 µg/m^3.

The 24-hourly average NO_2 value were compared with the NAAQS and found that the NO_2 concentration recorded at all sampling stations are within the permissible value of 80 µg/m^3.

10.5.3.5 Carbon Monoxide (CO)

The minimum and maximum CO level recorded within the study area was 0.55 and 0.95 mg/m^3 respectively with the 98th percentile ranging between 0.65 to 0.92 mg/m^3.

The 1-hour average CO value were compared with the NAAQS and found that the CO concentration recorded at all sampling stations are within the permissible value of 4 mg/m^3.

10.5.4 Ambient Noise Quality

Noise levels were within permissible range for all the stations during both day time and night time in industrial, commercial and residential areas within the study area.

10.6 Anticipated Impacts and Mitigation Measures

10.6.1 Land Environment

The following are the anticipated impacts and the proposed mitigation measures due to the construction and operation phase of project on the surrounding land environment –

Table 10.6 – Anticipated Impacts and Proposed Mitigation Measures for Land Environment

Anticipated Impacts	Proposed Mitigation Measures
Construction Phase	
6. Compaction of soil due to heavy earth moving vehicles.	2. Movement of heavy earth moving vehicles will be limited to already constructed roads and within the construction areas.
7. Contamination of soil due to oil spillage, mixing of cement etc.	3. Hazardous substances such as diesel required for the operation of construction machineries and vehicles will be kept in

	a storage yard having an impervious surface. 4. Precast drains will be used as much as possible.
8. Dumping of construction waste in the vicinity of the project area.	3. Reuse of construction waste onsite will be encouraged. 4. Any construction waste that cannot be reused at the project site shall be disposed off as per Construction and Demolition Waste Management Rules, 2016.
9. Spillage of oil and grease from the vehicles and/or storage sheds.	3. Oil shall be stored in storage sheds having an impermeable surface. 4. A ditch shall be constructed around the to intercept any runoff.
10. Change in topography.	2. All constructional activities will be limited within the industrial land i.e., the project site only thus, impact on topography is not anticipated.
Operation Phase	
5. Impact on soil due to disposal of solid waste in the nearby vicinity.	2. Dried sludge from the CETP will be disposed off in the SLF.
6. Soil erosion.	2. Greenbelt development will take place along the internal roads, open areas as well as along the periphery of the project site will be taken up.
7. Spillage of wastewater onto nearby land. 8. Heavy metal contamination of land environment.	5. Wastewater will be partially treated in upcoming individual units followed by treatment at the CETP. 6. Wastewater will be transported to the CETP via impervious drainage system. 7. Chromium recovery unit has been provided in the CETP.

	8. Heavy metal concentration in the CETP treated effluent will be as per WBPCB norms.

10.6.2 Water Environment

The following are the anticipated impacts and the proposed mitigation measures due to the construction phase of project on the surrounding water environment –

Table 10.7 – Anticipated Impacts and Proposed Mitigation Measures for Water Environment

Anticipated Impacts	Proposed Mitigation Measures
Construction Phase	
3. Water required for dust settlement, compaction and curing.	2. Dust suppression will be carried out through sprinklers to conserve water.
4. Discharge and seepage of domestic wastewater generated by labourers and other onsite workers.	2. Mobile toilets will be provided for the labourers for the collection of wastewater which will be treated in portable STP.

10.6.2.1 Surface Water

The following are the anticipated impacts and the proposed mitigation measures due to the construction and operation phase of project on the nearby surface water bodies –

Table 10.8 – Anticipated Impacts and Proposed Mitigation Measures for Surface Water

Anticipated Impacts	Proposed Mitigation Measures
Construction Phase	
3. Pollution of surface water bodies due to dumping of construction waste.	3. Reuse of construction waste onsite will be encouraged. 4. Any construction waste that cannot be reused at the project site, shall be disposed off as per Construction and Demolition Waste Management Rules, 2016.

4. Soil runoff from the site leading to surface water contamination.	4. Storm water drainage network will be constructed to intercept soil runoff. 5. Construction of desilting tanks along with rain water harvesting pits will take place. 6. Regular cleaning and maintenance of desilting and storm water drains will take place.
Operation Phase	
3. Discharge of wastewater from the units to nearby water bodies.	3. All wastewater generated due to the upcoming units during the project's operational phase shall be sent to the CETP where it will be treated and discharged to Basanti Canal via the CETP drain. 4. The discharged effluent will have pollutant concentrations as per WBPCB norms.
4. Heavy metal contamination of surface water bodies.	5. Wastewater will be partially treated in proposed individual units followed by treatment at the CETP. 6. Wastewater will be transported to the CETP via impervious drainage system. 7. Chromium recovery unit has been provided in the CETP. 8. Heavy metal concentration in the CETP discharged effluent will be as per WBPCB norms.

10.6.2.2 Ground Water

The following are the anticipated impacts and the proposed mitigation measures due to the construction and operation phase of project on the ground water –

Table 10.9 – Anticipated Impacts and Proposed Mitigation Measures for Ground Water

Anticipated Impacts	Proposed Mitigation Measures
Construction Phase	
2. Extraction of ground water for construction related activities and domestic requirement.	3. Rain water harvesting will be practised for recharge of ground water bodies. 4. Rain water collected in the surface water bodies present within the CLC will be utilised for meeting the water requirements of various units thereby helping in reducing the overall ground water requirement.
Operation Phase	
3. Extraction of ground water for domestic requirement, plantation purposes and manufacturing processes.	4. Rain water harvesting will be practised in for recharge of ground water bodies. 5. Rain water collected in the surface water bodies present within the CLC will be utilised for meeting the water requirements of various units thereby helping in reducing the overall ground water requirement. 6. Treated wastewater from the CETP can also be used for plantation purposes and for meeting flushing requirements in order to further reduce the overall groundwater requirement.

10.6.3 Air Environment

The following are the anticipated impacts and the proposed mitigation measures due to the construction and operation phase of project on the ambient air environment –

Table 10.10 – Anticipated Impacts and Proposed Mitigation Measures for Ambient Air Environment

Anticipated Impacts	Proposed Mitigation Measures
Construction Phase	
4. Dust generation due to construction operations and movement of vehicles.	4. It will be ensured that dust suppression is carried out at regular intervals. 5. It will be ensured that material, especially loose material brought in for construction purposes will be covered. 6. It will be ensured that maximum speed of vehicles will be restricted to reduce emissions. Speedbumps and signs will be used for this purpose.
5. Emissions from operation of construction equipment and movement of vehicles.	3. Only PUC certified vehicles will be allowed to enter the project site. 4. Regular maintenance of construction machinery and vehicles will help in controlling excessive emissions.
6. Wind erosion due to site clearance and preparation.	3. Vegetation such as small bushes and grass will be cleared only at areas where immediate construction needs to take place. 4. Plantation activities, especially along the periphery will be carried out to contain the erosion within the project site during construction phase as much as possible.
Operation Phase	
2. Vehicular movement will be the major source of air pollution.	4. Only PUC certified vehicles will be allowed to ply within the project site. 5. Vehicle speed shall be restricted to prevent excessive emissions through signboards and speed bumps.

	6. Greenbelt development will be carried out to absorb and reduce the overall air pollution.

10.6.4 Noise Environment

The following are the anticipated impacts and the proposed mitigation measures due to the construction and operation phase of project on the ambient noise environment –

Table 10.11 – Anticipated Impacts and Proposed Mitigation Measures for Ambient Noise Environment

Anticipated Impacts	Proposed Mitigation Measures
Construction Phase	
3. Noise generation due to construction machinery.	2. Regular maintenance of construction machinery will be encouraged to reduce noise levels.
4. Noise generation due to vehicles.	4. Only PUC certified vehicles will be allowed to enter the project site. 5. Regular maintenance of vehicles will ensure that vehicles do not make a lot of noise. 6. Greenbelt development will take place to reduce the overall noise levels.
Operation Phase	
2. Vehicular movement will be the major source of noise pollution.	4. Only PUC certified vehicles will be allowed to ply within the project site. 5. No honking zones will be made near residential and institutional areas. 6. Greenbelt development will be carried out to reduce the overall noise levels.

10.6.5 Biological Environment

The following are the anticipated impacts and the proposed mitigation measures due to the construction and operation phase of project on the biological environment –

Table 10.12 – Anticipated Impacts and Proposed Mitigation Measures for Biological Environment

Anticipated Impacts	Proposed Mitigation Measures
Construction Phase	
3. Loss of vegetation due to construction activities.	3. The core zone where construction is proposed is devoid of any significant natural vegetation. Isolated patches of grass, shrubs etc are present. There will be negligible loss of flora. 4. Greenbelt development will take place along the periphery and within the project site.
4. Displacement of fauna.	3. No fauna population was observed within the core zone. 4. Avifauna such as crows, pigeons etc. will benefit from greenbelt development that will take place along the periphery of the project.
Operation Phase	
2. Vehicular movement transporting the sludge from the CETP to SLF will be a major source of air and noise pollution impacting the fauna.	3. Only PUC certified vehicles will be allowed to ply within the project site. 4. Greenbelt development will be carried out to reduce the overall noise levels, air pollution as well as provide a habitat for the avifauna.
3. Sludge generation from the CETP.	2. Sludge from the CETP will be disposed off in the SLF.

10.6.6 Socio-Economic Environment

The following are the anticipated negative impacts and the proposed mitigation measures due to the construction and operation phase of project on the socio-economic environment –

Table 10.13 – Anticipated Impacts and Proposed Mitigation Measures for Socio-Economic Environment

Anticipated Impacts	Proposed Mitigation Measures
Construction Phase	
2. Occupational hazards for workers engaged in construction activities.	6. Providing workers with safety gadgets such as masks, earmuffs and other PPE will be mandatory before the start of any construction activities. 7. Regular medical checkup of workers will be carried out. 8. Workers will be provided clean drinking water and sanitation facilities. 9. Fire extinguishers and buckets of sand will be provided in the fire-prone areas. 10. Storage of flammable and hazardous materials shall be done as per established rules and regulations by the upcoming units.
Operation Phase	
2. Increased demand on existing resources. Water: 4.22 MLD Electricity: 7.23 MVA	4. Rain water harvesting for ground water recharge and its utilisation for various purposes within the CLC can be carried out. 5. It is strongly recommended to recycle the treated effluent from the CETP for plantation and flushing purposes for reducing the overall water requirement of the project. This recommendation has

	been accepted by the project authorities and will be implemented in the future. 6. Energy efficient devices such as LED bulbs to reduce the overall electricity consumption will take place.

10.6.7 Solid Waste

The following solid wastes are expected to be generated during the construction and operational phase of the project –

Table 10.14 – Solid Waste Generation and its Disposal

Table 10.15

Anticipated Impacts	Proposed Mitigation Measures
Construction Phase	
3. Construction and demolition waste The construction and demolition waste includes debris, concrete, steel and other metals, pallets, packaging and paper products, fluorescent tubes, wood beams, joists, studs, baseboards, bricks etc.	4. Specific areas within the project site shall be allotted for temporary storage of construction and demolition waste. 5. Construction and demolition waste storage area will be covered to prevent it affecting its surroundings. 6. Construction and demolition waste will be either reused within the project site or disposed off as per Construction and Demolition Waste Management Rules, 2016.
4. Hazardous waste Hazardous wastes include products such as paints, cleaners, oils, batteries, etc. that contain potentially hazardous ingredients	3. Hazardous wastes will be stored separately. 4. Hazardous wastes will be disposed off as per Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.

Operation Phase	
4. Municipal solid waste Domestic wastes include food leftovers, vegetable peels, plastic, clothes, ash, etc.	3. A three bin system will be adopted for the segregation of waste into non-recyclable waste (dark grey bin), food waste (green bin) and paper (blue bin). 4. These wastes will in turn be disposed of Municipal Solid Wastes (Management and Handling) Rules, 2000.
5. Hazardous Waste PETP and CETP sludge, leather pieces/scrambles, salt, buffing dust, shaving dust, used oil and used battery waste	3. PETP and CETP sludge, leather pieces/scrambles, salt, buffing dust and shaving dust will be sent to SLF for disposal. 4. Used oil and used battery waste will be sold to authorised companies as per norms by the units.
6. Empty bags, drums and containers containing chemical traces.	2. Empty bags, drums and containers containing chemical traces will be sold to authorised persons as per norms.

10.6.8 Upcoming Tanneries

Implementation of various pollution control measures will be made mandatory for the prospective unit operators of the tanneries before the commencement of operations.

This will help in preserving the existing land, water, air, noise, biological and socio-economic environment within the study area by minimising the negative impacts and maximising the positive impacts due to the development of the leather industries within CLC.

The following measures can be implemented by the upcoming tanneries in this regard –

1. Installation of a primary ETP unit within the tannery in order to reduce the overall suspended solids to less than 98 mg/L and bring pH within 8-9.
2. Installation of air pollution control devices in order to control the point sources of air pollution and the improve the overall ambient air quality.
3. Providing adequate stack height to DG sets as per CPCB norms.

4. Providing of acoustic enclosures to DG sets and making use of low noise generating process drums in order to reduce the noise generation.

10.7 Environmental Monitoring Program

10.7.1 Soil Quality Monitoring

Parameters: Physical parameters, Particle size distribution, Electrical Conductivity, Cation Exchange capacity, Permeability, Water holding capacity, Porosity, Sodium Absorption ratio, pH, Electrical Conductivity, Organic Carbon, Moisture content, Organic matter, Calcium, Magnesium, Chloride, Sulphate, Heavy metals, Nutrient contents etc.

Frequency: Single sampling of each location every half year

10.7.2 Surface Water Quality Monitoring

Parameters: pH, temp, turbidity, magnesium hardness, Total Hardness, total alkalinity, chloride, sulphate, nitrate, fluoride, sodium, potassium, salinity, Total nitrogen, total phosphorus, DO, BOD, COD, Phenol, Heavy metals, Total coliform, Faecal coliform.

Frequency: Grab Samples of each location (single sample in each location every half year).

10.7.3 Ground Water Quality Monitoring

Parameters: As per IS3025.

Frequency: Single sample from each location every half year

10.7.4 Ambient Air Quality Monitoring

Parameters: As per National Ambient Air Quality Standards

Frequency: One 24 hrs sampling for every half year.

10.7.5 Ambient Noise Quality Monitoring

Parameters: Hourly equivalent noise level, Day-time (06:00 am to 09:00 pm) &Night-time (09:00 pm to 06:00 am) Noise level.

Frequency:1 sampling in each location every half year.

10.7.6 In-House Monitoring Programme

The project site will have an air monitoring station within the complex in order to measure the ambient air quality within CLC.

Besides this, the CETP will also have a laboratory for measuring various parameters of the untreated and treated effluent such as pH, total suspended solids, BOD, COD, TSS, chromium etc.

Testing of these parameters will take place at a regular interval so as to maintain a log of ambient air and effluent quality and take remediation measures if required.

10.8 Corporate Social Responsibility Budget Allocation

As per the notification of Ministry of Corporate Affairs G.S.R. 129(E) dated 27.02.2014 and its subsequent amendments, 2% of the average net profit of the last three financial years will be contributed for various CSR activities for the benefit of nearby communities. These activities can include the following –

1. Organising skill development camps in nearby villages such as tailoring classes etc.
2. Installation of public toilets, benches etc.

10.9 Corporate Environmental Responsibility

The Office Memorandum F. No. 22-65/2017-IA.III dated 01.05.2018 of MoEF&CC can be taken as a guideline in order to calculate and assign resources under CSR for the proposed expansion. Being a brownfield project, 1% of the total project expansion cost can be used under various CSR activities.

The following activities can be taken up for this purpose –

1. Installation of solar street lights in nearby villages.
2. Providing drinking water network in the nearby villages.
3. Social forestry

10.10 Environment Management Plan Budget Allocation

The following activities can be assigned resources under EMP –

1. Treatment of effluent from various tanneries within the CTP along with chromium recovery in the chrome recovery unit within the CETP.
2. Providing acoustic enclosures for the DG sets installed in the CETP.
3. Disposal of sludge at the SLF.

4. Providing an environmental laboratory for testing of untreated and treated effluent parameters and installation of an ambient air quality monitoring station within the CLC.
5. Regular medical checkup of workers.
6. Greenbelt plantation along the internal roads, periphery of the project site and in open areas.

CHAPTER 11 – DISCLOSURE OF CONSULTANT ENGAGED

Declaration by Experts contributing to the EIA of Calcutta Leather Complex (CLC) of Kolkata Metropolitan Development Authority (KMDA) located at Village Bantala, Post Bhojerhat, Tehsil & District – South 24 Parganas, West Bengal.

I, hereby, certify that I was a part of the EIA team in the following capacity that developed the above EIA.

EIA Coordinator

Name: Subrata Chowdhury

Signature:

Period of Involvement: March 2018– Till date

Contact Information: SBA Enviro Systems Pvt. Ltd, 201, DDA Local Shopping Centre, E-Block, Vikaspuri, New Delhi – 110018

Table 11.1 – Functional Area Experts

S. No.	Functional Areas	Name of the Experts	Involvement Period & Task	Signature and Date
1	AP	Sajjathe Sulthan	Consultancy provided in functional area of Air Pollution Prevention, Monitoring and Control. (March 2018– Till date)	
2	AQ	Sajjathe Sulthan	Consultancy provided in functional area of Meteorology, Air Quality Modeling & Prediction. (March 2018– Till date)	

3	WP*	Sajjathe Sulthan	Consultancy provided in functional area of Water Pollution Prevention, Control & Prediction of impacts. (March 2018 – Till date)	
4	SHW*	Sajjathe Sulthan	Consultancy provided in functional area of Solid Waste & Hazardous Waste Management. (March 2018 – Till date)	
5	SE*	S C Bhargava	Consultancy provided in functional area of Socio Economics. (March 2018 – Till date)	
6	EB*	Parikshit Gautam	Consultancy provided in functional area of Ecology & Biodiversity (March 2018 – Till date)	
7	HG*	Yamesh Sharma	Consultancy provided in functional areas of Hydrology, Ground Water & Water Conservation. (March 2018 – Till date)	
8	NV*	Yamesh Sharma	Consultancy provided in functional area of Noise study. (March 2018 – Till date)	
9	RH	Pinaki Dasgupta	Consultancy provided in functional area of Risk and Hazard. (March 2018 – Till date)	

NABET Certificate No.: NABET/EIA/1720/SA094

Issue Date: TC-8198

Valid Till: 15.11.2022

Table 11.2 – Functional Area Details

S. No.	Functional Area Code	Complete Name of the Functional Areas
1	AP	Air Pollution Prevention, Monitoring & Control
2	AQ	Meteorology, Air Quality Modelling & Prediction
3	WP	Water Pollution Prevention, Control & Prediction of Impacts
4	SHW	Solid Waste & Hazardous Waste Management
5	SE	Socio-Economics
6	EB	Ecology & Biodiversity
7	HG	Hydrology, Ground Water & Water Conservation
8	NV	Noise/Vibration
9	RH	Risk Assessment & Hazard Management

I, **Sajjathe Sulthan**, hereby, confirm that the above-mentioned experts prepared the EIA Report of Calcutta Leather Complex (CLC) of Kolkata Metropolitan Development Authority (KMDA) located at Village Bantala, Post Bhojerhat, Tehsil & District – South 24 Parganas, West Bengal. I also confirm that I shall be fully accountable for any misleading information mentioned in this statement.

Signature:

Name: Sajjathe Sulthan

Designation: Technical Director

Name of the EIA Consultant Organization: SBA Enviro Systems Pvt. Ltd, 201, DDA Local Shopping Centre, E-Block, Vikaspuri, New Delhi – 110018

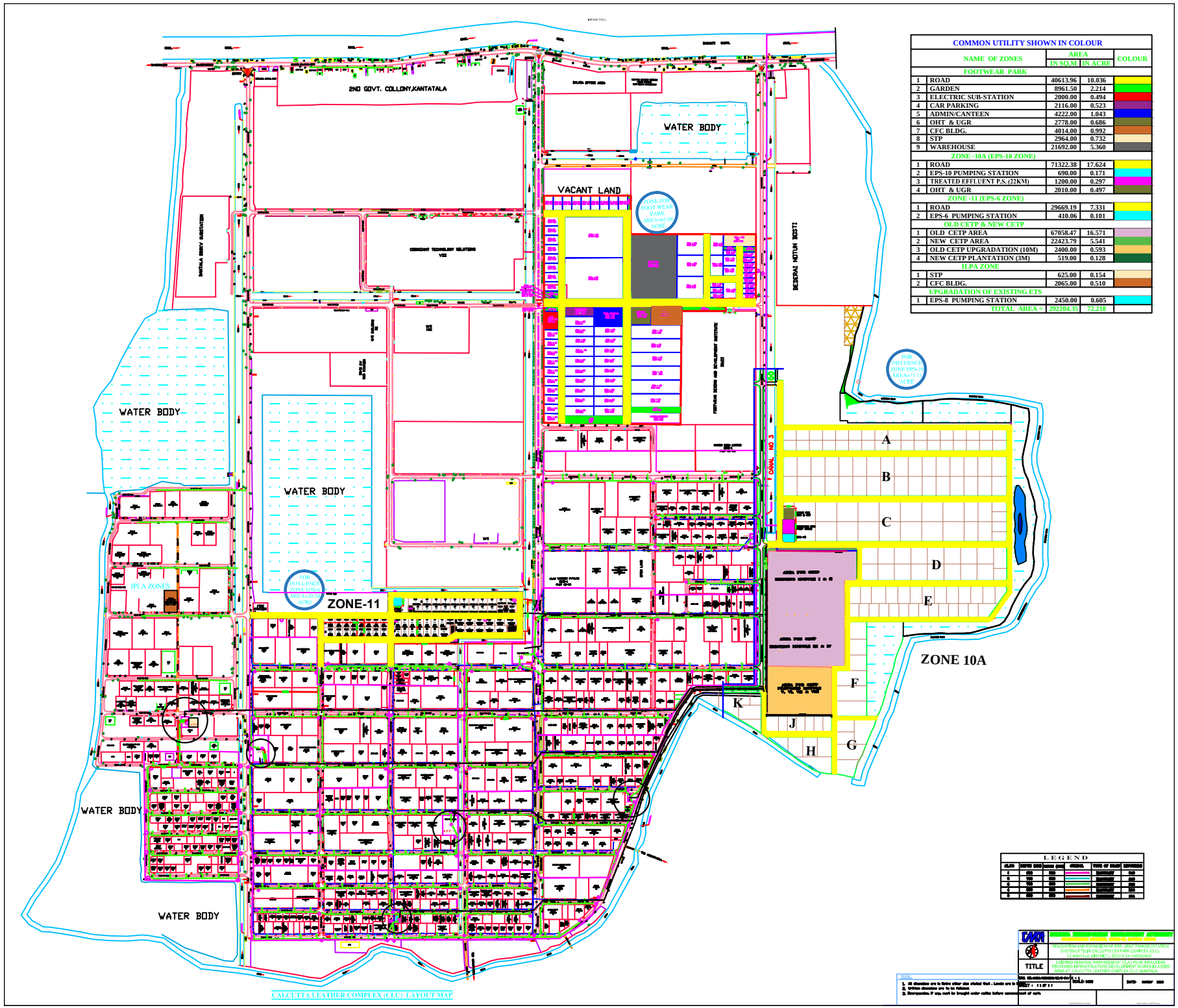
****

LIST OF ANNEXURES

Annexure No.	Heading
I	Master Plan
II	Laboratory Monitoring Reports
III	GIS Maps
IV	Accreditation Certificates

ANNEXURE I

MASTER PLAN



COMMON UTILITY SHOWN IN COLOUR				
	NAME OF ZONES	AREA IN SQ.M	AREA IN ACRE	COLOUR
	FOOTWEAR PARK			
1	ROAD	40613.96	10.036	
2	GARDEN	8961.50	2.214	
3	ELECTRIC SUB-STATION	2000.00	0.494	
4	CAR PARKING	2116.00	0.523	
5	ADMIN/CANTEEN	4222.00	1.043	
6	OHT & UGR	2778.00	0.686	
7	CFC BLDG.	4014.00	0.992	
8	STP	2964.00	0.732	
9	WAREHOUSE	21692.00	5.360	
	ZONE -10A (EPS-10 ZONE)			
1	ROAD	71322.38	17.624	
2	EPS-10 PUMPING STATION	690.00	0.171	
3	TREATED EFFLUENT P.S. (22KM)	1200.00	0.297	
4	OHT & UGR	2010.00	0.497	
	ZONE -11 (EPS-6 ZONE)			
1	ROAD	29669.19	7.331	
2	EPS-6 PUMPING STATION	410.06	0.101	
	OLD CETP & NEW CETP			
1	OLD CETP AREA	67058.47	16.571	
2	NEW CETP AREA	22423.79	5.541	
3	OLD CETP UPGRADATION (10M)	2400.00	0.593	
4	NEW CETP PLANTATION (3M)	519.00	0.128	
	ILPA ZONE			
1	STP	625.00	0.154	
2	CFC BLDG.	2065.00	0.510	
	UPGRADATION OF EXISTING ETS			
1	EPS-8 PUMPING STATION	2450.00	0.605	
	TOTAL AREA =	292204.35	72.210	

CALCUTTA LEATHER COMPLEX (CLC) LAYOUT MAP

TITLE

ANNEXURE II

LABORATORY

MONITORING REPORTS

ULTRA TESTING & RESEARCH LABORATORY
(An ISO 9001:2015, OHSAS 45001:2018, 14001:2015 (EMS) Certified)
Laboratory: C-43, Sector-88, Phase-II, Noida, U.P.
Ph.: No.: +91-9971912476, 9350952231
E-mail: ultrarescarchlab@gmail.com
Website: http://www.ultralabnoida.com
Ultra Lab
TC-8198

TEST REPORT

Soil Sample Analysis

Discipline/Group-Chemical/ Pollution & Environment

Report Code: **SS-25032021-01** Issue Date: 31/03/2021

ISSUED TO : **SBA ENVIRO SYSTEMS PVT.LTD.**
201, DDA LOCAL SHOPPING CENTER, BLOCK E, VIKASPURI
DELHI -110018

Project Name : Calcutta Leather Complex of Kolkata Metropolitan Development Authority
Bhojerhat, Tehsil & District- South 24 Parganas, State - West Bengal

Sample Drawn On : 23/03/2021
Sample Drawn By : UTRL
Sample Description : Soil
Sample Quantity : 2.0 kg
Sampling Location : Project Site
Analysis Duration : 25/03/2021 To 31/03/2021

RESULTS

S.No	Parameter	Units	Result	Test Method
1	Texture	-	Silt Clay Loam	UTRL/LAB/SOIL/SOP/05
	Sand	%	18.57	UTRL/LAB/SOIL/SOP/05
	Clay	%	30.70	UTRL/LAB/SOIL/SOP/05
	Silt	%	50.73	UTRL/LAB/SOIL/SOP/05
2	pH(1:2.5 Suspension)	-	6.85	IS: 2720 (Part-26),1987
3	Electrical Conductivity (1:2.5 Suspension)	µmhos/cm	327.5	IS: 14767
4	Potassium	mg/kg	155.69	UTRL/LAB/SOIL/SOP/07
5	Sodium	mg/kg	209.06	UTRL/LAB/SOIL/SOP/06
6	Calcium	mg/kg	3077.66	UTRL/LAB/SOIL/SOP/08
7	Magnesium	mg/kg	701.59	UTRL/LAB/SOIL/SOP/08
8	Sodium Absorption Ratio	-	0.88	UTRL/LAB/SOIL/SOP/14
9	Water Holding Capacity	%	45.580	UTRL/LAB/SOIL/SOP/11
10	Total Kjeldahl Nitrogen	%	0.08	UTRL/LAB/SOIL/SOP/15
11	Phosphorous	mg/kg	49.66	UTRL/LAB/SOIL/SOP/09
12	Bulk Density	gm/cc	1.27	UTRL/LAB/SOIL/SOP/10
13	Organic Matter	%	0.98	IS: 2720 (Part-22)
14	Porsority	%	39.61	UTRL/LAB/SOIL/SOP/17

End Of Report

Note:-

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4. The Report can not be used as evidence in a court of law without the written approval of the lab.

For Ultra Testing & Research Laboratory

Checked By

(Authorized Signatory)

TECHNICAL MANAGER

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ULTRA TESTING & RESEARCH LABORATORY
(An ISO 9001:2015, OHSAS 45001:2018, 14001:2015 (EMS) Certified)
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Ph.: No.: +91-9971912476, 9350952231
E-mail: ultraresearchlab@gmail.com
Website: http://www.ultralabnoida.com
Ultra Lab
TC-8198

TEST REPORT

Soil Sample Analysis

Discipline/Group-Chemical/ Pollution & Environment

Report Code: **SS-25032021-02** Issue Date: 31/03/2021

ISSUED TO : **SBA ENVIRO SYSTEMS PVT.LTD.**
201, DDA LOCAL SHOPPING CENTER, BLOCK E, VIKASPURI
DELHI -110018

Project Name : Calcutta Leather Complex of Kolkata Metropolitan Development Authority
Bhojerhat, Tehsil & District- South 24 Parganas, State - West Bengal

Sample Drawn On : 23/03/2021
Sample Drawn By : UTRL
Sample Description : Soil
Sample Quantity : 2.0 kg
Sampling Location : Mahes Pukuria
Analysis Duration : 25/03/2021 To 31/03/2021

RESULTS

S.No	Parameter	Units	Result	Test Method
1	Texture	-	Clay Loam	
	Sand	%	28.49	UTRL/LAB/SOIL/SOP/05
	Clay	%	36.39	UTRL/LAB/SOIL/SOP/05
	Silt	%	35.12	UTRL/LAB/SOIL/SOP/05
2	pH(1:2.5 Suspension)	-	7.68	UTRL/LAB/SOIL/SOP/05
3	Electrical Conductivity (1:2.5 Suspension)	µmhos/cm	293.6	IS: 2720 (Part-26) 1987
4	Potassium	mg/kg	191.22	IS: 14767
5	Sodium	mg/kg	261.34	UTRL/LAB/SOIL/SOP/07
6	Calcium	mg/kg	3318.24	UTRL/LAB/SOIL/SOP/06
7	Magnesium	mg/kg	558.97	UTRL/LAB/SOIL/SOP/08
8	Sodium Absorption Ratio	-	1.10	UTRL/LAB/SOIL/SOP/08
9	Water Holding Capacity	%	47.640	UTRL/LAB/SOIL/SOP/14
10	Total Kjeldahl Nitrogen	%	0.10	UTRL/LAB/SOIL/SOP/11
11	Phosphorous	mg/kg	56.31	UTRL/LAB/SOIL/SOP/15
12	Bulk Density	gm/cc	1.30	UTRL/LAB/SOIL/SOP/09
13	Organic Matter	%	1.36	UTRL/LAB/SOIL/SOP/10
14	Porsority	%	42.13	IS: 2720 (Part-22)
				UTRL/LAB/SOIL/SOP/17

End Of Report

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ULTRA TESTING & RESEARCH LABORATORY

(An ISO 9001:2015, OHSAS 45001:2018, 14001:2015 (EMS) Certified)
Laboratory: C-43, Sector-88, Phase-II, Noida U.P.
Ph.: No.: +91-9971912476, 9350952231
E-mail: ultraresearchlab@gmail.com
Website: http://www.ultralabnoida.com

TC-8198

TEST REPORT

Soil Sample Analysis

Discipline/Group-Chemical/ Pollution & Environment

Report Code: **SS-25032021-03** Issue Date: 31/03/2021

ISSUED TO : **SBA ENVIRO SYSTEMS PVT.LTD.**
201, DDA LOCAL SHOPPING CENTER, BLOCK E, VIKASPURI
DELHI -110018

Project Name : Calcutta Leather Complex of Kolkata Metropolitan Development Authority
Bhojerhat, Tehsil & District- Soulh 24 Parganas, State - West Bengal

Sample Drawn On : 23/03/2021
Sample Drawn By : UTRL
Sample Description : Soil
Sample Quantity : 2.0 kg
Sampling Location : Chandakanthal Beria
Analysis Duration : 25/03/2021 To 31/03/2021

RESULTS

S.No	Parameter	Units	Result	Test Method
1	Texture	-	Clay Loam	UTRL/LAB/SOIL/SOP/05
	Sand	%	36.64	UTRL/LAB/SOIL/SOP/05
	Clay	%	32.26	UTRL/LAB/SOIL/SOP/05
	Silt	%	31.10	UTRL/LAB/SOIL/SOP/05
2	pH(1:2.5 Suspension)	-	6.86	IS: 2720 (Part-26).1987
3	Electrical Conductivity (1:2.5 Suspension)	µmhos/cm	367.3	IS: 14767
4	Potassium	mg/kg	209.64	UTRL/LAB/SOIL/SOP/07
5	Sodium	mg/kg	306.27	UTRL/LAB/SOIL/SOP/06
6	Calcium	mg/kg	3804.75	UTRL/LAB/SOIL/SOP/08
7	Magnesium	mg/kg	706.05	UTRL/LAB/SOIL/SOP/08
8	Sodium Absorption Ratio	-	1.20	UTRL/LAB/SOIL/SOP/14
9	Water Holding Capacity	%	46.010	UTRL/LAB/SOIL/SOP/11
10	Total Kjeldahl Nitrogen	%	0.08	UTRL/LAB/SOIL/SOP/15
11	Phosphorous	mg/kg	62.59	UTRL/LAB/SOIL/SOP/09
12	Bulk Density	gm/cc	1.29	UTRL/LAB/SOIL/SOP/10
13	Organic Matter	%	1.14	IS: 2720 (Part-22)
14	Porsority	%	40.25	UTRL/LAB/SOIL/SOP/17

End Of Report

Note:-

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For Ultra Testing & Research Laboratory

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Website: http://www.ultralabnoida.com

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TC-8198

TEST REPORT

Soil Sample Analysis

Discipline/Group-Chemical/ Pollution & Environment

Report Code: **SS-25032021-04** Issue Date: 31/03/2021

ISSUED TO : **SBA ENVIRO SYSTEMS PVT.LTD.**
201, DDA LOCAL SHOPPING CENTER, BLOCK E, VIKASPURI
DELHI -110018

Project Name : Calcutta Leather Complex of Kolkata Metropolitan Development Authority
Bhojerhat, Tehsil & District- South 24 Parganas, State - West Bengal

Sample Drawn On : 23/03/2021
Sample Drawn By : UTRL
Sample Description : Soil
Sample Quantity : 2.0 kg
Sampling Location : Abua (Road Intersection)
Analysis Duration : 25/03/2021 To 31/03/2021

RESULTS

S.No	Parameter	Units	Result	Test Method
1	Texture	-	Sandy Clay Loam	UTRL/LAB/SOIL/SOP/05
	Sand	%	51.57	UTRL/LAB/SOIL/SOP/05
	Clay	%	27.90	UTRL/LAB/SOIL/SOP/05
	Silt	%	20.53	UTRL/LAB/SOIL/SOP/05
2	pH(1:2.5 Suspension)	-	7.32	IS: 2720 (Part-26),1987
3	Electrical Conductivity (1:2.5 Suspension)	µmhos/cm	368.5	IS: 14767
4	Potassium	mg/kg	127.58	UTRL/LAB/SOIL/SOP/07
5	Sodium	mg/kg	228.17	UTRL/LAB/SOIL/SOP/06
6	Calcium	mg/kg	2965.48	UTRL/LAB/SOIL/SOP/08
7	Magnesium	mg/kg	877.00	UTRL/LAB/SOIL/SOP/08
8	Sodium Absorption Ratio	-	0.95	UTRL/LAB/SOIL/SOP/14
9	Water Holding Capacity	%	29.730	UTRL/LAB/SOIL/SOP/11
10	Total Kjeldahl Nitrogen	%	0.07	UTRL/LAB/SOIL/SOP/15
11	Phosphorous	mg/kg	53.51	UTRL/LAB/SOIL/SOP/09
12	Bulk Density	gm/cc	1.30	UTRL/LAB/SOIL/SOP/10
13	Organic Matter	%	1.00	IS: 2720 (Part-22)
14	Porsority	%	42.53	UTRL/LAB/SOIL/SOP/17

End Of Report

Note:-

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E-mail: ultraresearchlab@gmail.com
Website: http://www.ultralabindia.com

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TC-8198

TEST REPORT

Soil Sample Analysis

Discipline/Group-Chemical/ Pollution & Environment

Report Code: **SS-25032021-05** Issue Date: 31/03/2021

ISSUED TO : **SBA ENVIRO SYSTEMS PVT.LTD.**
201, DDA LOCAL SHOPPING CENTER, BLOCK E, VIKASPURI
DELHI -110018

Project Name : Calcutta Leather Complex of Kolkata Metropolitan Development Authority
Bhojerhat, Tehsil & District- South 24 Parganas, State - West Bengal

Sample Drawn On : 23/03/2021
Sample Drawn By : UTRL
Sample Description : Soil
Sample Quantity : 2.0 kg
Sampling Location : Near Goalapota
Analysis Duration : 25/03/2021 To 31/03/2021

RESULTS

S.No	Parameter	Units	Result	Test Method
1	Texture	-	Sandy Clay	UTRL/LAB/SOIL/SOP/05
	Sand	%	46.81	UTRL/LAB/SOIL/SOP/05
	Clay	%	38.19	UTRL/LAB/SOIL/SOP/05
	Silt	%	15.00	UTRL/LAB/SOIL/SOP/05
2	pH(1:2.5 Suspension)	-	7.89	IS: 2720 (Part-26),1987
3	Electrical Conductivity (1:2.5 Suspension)	µmhos/cm	412	IS: 14767
4	Potassium	mg/kg	192.53	UTRL/LAB/SOIL/SOP/07
5	Sodium	mg/kg	211.42	UTRL/LAB/SOIL/SOP/06
6	Calcium	mg/kg	3445.61	UTRL/LAB/SOIL/SOP/08
7	Magnesium	mg/kg	535.83	UTRL/LAB/SOIL/SOP/08
8	Sodium Absorption Ratio	-	0.88	UTRL/LAB/SOIL/SOP/14
9	Water Holding Capacity	%	31.030	UTRL/LAB/SOIL/SOP/11
10	Total Kjeldahl Nitrogen	%	0.07	UTRL/LAB/SOIL/SOP/15
11	Phosphorous	mg/kg	56.21	UTRL/LAB/SOIL/SOP/09
12	Bulk Density	gm/cc	1.28	UTRL/LAB/SOIL/SOP/10
13	Organic Matter	%	0.97	IS: 2720 (Part-22)
14	Porsority	%	41.87	UTRL/LAB/SOIL/SOP/17

End Of Report

Note:-

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For Ultra Testing & Research Laboratory

Checked By

(Authorized Signatory)

ULTRA TESTING & RESEARCH LABORATORY
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E-mail: ultraresearchlab@gmail.com
Website: http://www.ultralabnoida.com
Ultra Lab
TC-8198

TEST REPORT

Soil Sample Analysis

Discipline/Group-Chemical/ Pollution & Environment

Report Code: **SS-25032021-06** Issue Date: 31/03/2021

ISSUED TO : **SBA ENVIRO SYSTEMS PVT.LTD.**
201, DDA LOCAL SHOPPING CENTER, BLOCK E, VIKASPURI
DELHI -110018

Project Name : Calcutta Leather Complex of Kolkata Metropolitan Development Authority
Bhojerhat, Tehsil & District- South 24 Parganas, State - West Bengal

Sample Drawn On : 23/03/2021
Sample Drawn By : UTRL
Sample Description : Soil
Sample Quantity : 2.0 kg
Sampling Location : Panapukur
Analysis Duration : 25/03/2021 To 31/03/2021

RESULTS

S.No	Parameter	Units	Result	Test Method
1	Texture	-	Clay Loam	
	Sand	%	36.37	UTRL/LAB/SOIL/SOP/05
	Clay	%	32.38	UTRL/LAB/SOIL/SOP/05
	Silt	%	31.25	UTRL/LAB/SOIL/SOP/05
2	pH(1:2.5 Suspension)	-	6.93	UTRL/LAB/SOIL/SOP/05
3	Electrical Conductivity (1:2.5 Suspension)	µmhos/cm	274.6	IS: 2720 (Part-26),1987
4	Potassium	mg/kg	195.08	IS: 14767
5	Sodium	mg/kg	238.75	UTRL/LAB/SOIL/SOP/07
6	Calcium	mg/kg	3444.74	UTRL/LAB/SOIL/SOP/06
7	Magnesium	mg/kg	779.19	UTRL/LAB/SOIL/SOP/08
8	Sodium Absorption Ratio	-	0.96	UTRL/LAB/SOIL/SOP/08
9	Water Holding Capacity	%	42.810	UTRL/LAB/SOIL/SOP/14
10	Total Kjeldahl Nitrogen	%	0.07	UTRL/LAB/SOIL/SOP/11
11	Phosphorous	mg/kg	52.10	UTRL/LAB/SOIL/SOP/15
12	Bulk Density	gm/cc	1.27	UTRL/LAB/SOIL/SOP/09
13	Organic Matter	%	1.28	UTRL/LAB/SOIL/SOP/10
14	Porsority	%	40.66	IS: 2720 (Part-22)
				UTRL/LAB/SOIL/SOP/17

End Of Report

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For Ultra Testing & Research Laboratory

Checked By

(Authorized Signatory)

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E-mail: ultraresearchlab@gmail.com
Website: http://www.ultralabindia.com
Ultra Lab
TC-8198

TEST REPORT

Surface Water Sample Analysis
Discipline/Group-Chemical/Water

Report Code: WW-31032021-01 Issue Date: 31/03/2021

ISSUED TO : **SBA ENVIRO SYSTEMS PVT.LTD.**
201, DDA LOCAL SHOPPING CENTER, BLOCK E, VIKASPURI
DELHI, 110018

Project Name	: Calcutta Leather Complex of Kolkata Metropolitan Development Authority Bhojerhat, Tehsil & District- South 24 Parganas, State - West Bengal
Sample Drawn On	: 23/03/2021
Sample Drawn By	: UTRL
Sample Description	: Surface Water
Sampling Location	: Sample Collected fromProject Site Pond
Sampling Procedure	: IS 3025(Part-01)
Sample Quantity	: 2.0 Litre
Analysis Duration	: 25/03/2021 To 31/03/2021

RESULTS

S.No	Parameter	Test Method	Results	Units	Tolerance Limit as per IS:2296				
					Class A	Class B	Class C	Class D	Class E
1	pH	IS:3025(Part-11)	7.76	-	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5
2	Temperature	IS:3025(Part-09)	28.8	°C	-	-	-	-	-
3	Turbidity	IS:3025(Part-10)	18.6	NTU	-	-	-	-	-
4	Conductivity @25°C	IS:3025(Part-14)	1176	µs/cm.	-	-	-	1000	2250
5	Total Suspended Solid	IS:3025(Part-17)	36	mg/l	-	-	-	-	-
6	Total Alkalinity (as $CaCO_3$)	IS:3025(Part-23)	280	mg/l	-	-	-	-	-
7	Biological Oxygen Demand (Max.)	IS:3025(Part-44)	10.50	mg/l	2	3	3	-	-
8	Dissolved Oxygen (as O_2) Min.	IS:3025(Part-38)	5.1	mg/l	6	5	4	4	-
9	Calcium(as Ca)	IS:3025(Part-40)	44.00	mg/l	80	-	-	-	-
10	Magnesium(as Mg)	IS:3025(Part-46)	36.45	mg/l	24	-	-	-	-
11	Chloride(as Cl),Max	IS:3025(Part-32)	144.64	mg/l	250	-	-	-	600
12	Iron(as Fe),Max	IS:3025(Part-53)	0.17	mg/l	0.3	-	50	-	-
13	Fluoride(as F),Max	IS:3025(Part-60)	0.26	mg/l	1.5	1.5	1.5	-	-
14	Total Dissolved Solid	IS:3025(Part-16)	706	mg/l	500	-	1500	-	2100

Contd. To report Code: WW-31032021-01

ULTRA TESTING & RESEARCH LABORATORY
(An ISO 9001:2015, OHSAS 45001:2018, 14001:2015 (EMS) Certified)
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Contd. To report Code: WW-31032021-01

15	Total Hardness (as $CaCO_3$)	IS:3025(Part-21)	260.00	mg/l	300	-	-	-	-
16	Sulphate (as SO_4)Max	IS:3025(Part-24)	125.37	mg/l	400	-	400	-	1000
17	Phosphate (as P)	IS:3025(Part-31)	4.02	mg/l	-	-	-	-	-
18	Sodium (as Na)	IS:3025(Part-45)	82.32	mg/l	-	-	-	-	-
19	Manganese (as Mn)	IS:3025(Part-59)	<0.1	mg/l	0.5	-	-	-	-
20	Total Chromiun (as Cr	IS:3025(Part-52)	<0.05	mg/l	0.05	0.05	0.05	-	-
21	Zinc (as Zn)	IS:3025(Part-49)	0.48	mg/l	15	-	15	-	-
22	Potassium (as K)	IS:3025(Part-45)	12.68	mg/l	-	-	-	-	-
23	Nitrate (as NO_3),Max	IS: 3025 (Part-34)	7.50	mg/l	20	-	50	-	-
24	Cadmium (as Cd)	IS-3025(Part-41)	<0.01	mg/l	0.01	-	0.01	-	-
25	Lead (as Pb)	IS:3025(Part-47)	<0.01	mg/l	0.1	-	0.1	-	
26	Copper (as Cu)	IS:3025(Part-42)	<0.01	mg/l	1.5	-	1.5	-	-
27	Chemical Oxygen Demand (asO_2)	IS-3025(Part-58)	48.00	mg/l	-	-	-	-	-
28	Arsenic (as As)	IS:3025(Part-37)	<0.01	mg/l	0.05	0.2	0.2	-	

End Of Report

Remarks:-

Class A-Drinking water without conventional treatment but after disinfection.
Class B-Water for outdoor bathing.
Class C-Drinking water with conventional treatment followed by disinefection.
Class D-Water for fish culture and wild life propagation.
Class E-Water for irrigation, industrial cooling and control waste disposal.

Note:-

1. The results given above are related to the tested sample, for various parameters, as observed at the time of sampling. The customer asked for the above tests only.
2. This test report will not be used for any publicity/legal purpose.
3. The test samples will be disposed off after two weeks from the date of issue of test report, unless until specified by the customer.
4. The Report can not be used as evidence in a court of law without the written approval of the lab.

For ULTRA TESTING & RESEARCH LABORATORY

Checked By

(Authorized Signatory)

ULTRA TESTING & RESEARCH LABORATORY
(An ISO 9001:2015, OHSAS 45001:2018, 14001:2015 (EMS) Certified)
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Ph.: No.: +91-9971912476, 9350952231
E-mail: ultraresearchlab@gmail.com
Website: http://www.ultralabnoida.com

TEST REPORT

Surface Water Sample Analysis

Report Code: WW-31032021-01 Issue Date: 31/03/2021

ISSUED TO : **SBA ENVIRO SYSTEMS PVT.LTD.**
201, DDA LOCAL SHOPPING CENTER, BLOCK E, VIKASPURI
DELHI, 110018

Project Name : Calcutta Leather Complex of Kolkata Metropolitan Development Authority Bhojerhat, Tehsil & District- South 24 Parganas, State - West Bengal

Sample Drawn On : 23/03/2021
Sample Drawn By : UTRL
Sample Description : Surface Water
Sampling Location : Sample Collected fromProject Site Pond
Analysis Duration : 25/03/2021 To 31/03/2021

RESULTS

S.No	Parameter	Test Method	Results	Units	Tolerance Limit as per IS:2296				
					Class A	Class B	Class C	Class D	Class E
1	Total Coli Form	IS:1622	1.2×10^{3}	MPN/100ml	50	500	5000	-	-

End Of Report

Remarks:-

Class A-Drinking water without conventional treatment but after disinfection.
Class B-Water for outdoor bathing.
Class C-Drinking water with conventional treatment followed by disinefection.
Class D-Water for fish culture and wild life propagation.
Class E-Water for irrigation, industrial cooling and control waste disposal.

Note:-

1. The results given above are related to the tested sample, for various parameters, as observed at the time of sampling. The customer asked for the above tests only.
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3. The test samples will be disposed off after two weeks from the date of issue of test report, unless until specified by the customer.
4. The Report can not be used as evidence in a court of law without the written approval of the lab.

For ULTRA TESTING & RESEARCH LABORATORY

Checked By

(Authorized Signatory)

ULTRA TESTING & RESEARCH LABORATORY
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Ultra Lab
TC-8198

TEST REPORT

Surface Water Sample Analysis
Discipline/Group-Chemical/Water

Report Code: WW-31032021-02 Issue Date: 31/03/2021

ISSUED TO : **SBA ENVIRO SYSTEMS PVT.LTD.**
201, DDA LOCAL SHOPPING CENTER, BLOCK E, VIKASPURI
DELHI, 110018

Project Name : Calcutta Leather Complex of Kolkata Metropolitan Development Authority
Bhojerhat, Tehsil & District- South 24 Parganas, State - West Bengal
Sample Drawn On : 23/03/2021
Sample Drawn By : UTRL
Sample Description : Surface Water
Sampling Location : Sample Collected from Basanti Canal (Upstream)
Sampling Procedure : IS 3025(Part-01)
Sample Quantity : 2.0 Litre
Analysis Duration : 25/03/2021 To 31/03/2021

RESULTS

S.No	Parameter	Test Method	Results	Units	Tolerance Limit as per IS:2296				
					Class A	Class B	Class C	Class D	Class E
1	pH	IS:3025(Part-11)	6.85	-	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5
2	Temperature	IS:3025(Part-09)	28.2	^{0}C	-	-	-	-	-
3	Turbidity	IS:3025(Part-10)	8.4	NTU	-	-	-	-	-
4	Conductivity @25°C	IS:3025(Part-14)	1550	µs/cm.	-	-	-	1000	2250
5	Total Suspended Solid	IS:3025(Part-17)	22	mg/l	-	-	-	-	-
6	Total Alkalinity (as $CaCO_3$)	IS:3025(Part-23)	290	mg/l	-	-	-	-	-
7	Biological Oxygen Demand (Max.)	IS:3025(Part-44)	4.50	mg/l	2	3	3	-	-
8	Dissolved Oxygen (as O_2) Min.	IS:3025(Part-38)	7.4	mg/l	6	5	4	4	-
9	Calcium(as Ca)	IS:3025(Part-40)	56.00	mg/l	80	-	-	-	-
10	Magnesium(as Mg)	IS:3025(Part-46)	36.45	mg/l	24	-	-	-	-
11	Chloride(as Cl),Max	IS:3025(Part-32)	163.92	mg/l	250	-	-	-	600
12	Iron(as Fe),Max	IS:3025(Part-53)	0.11	mg/l	0.3	-	50	-	-
13	Fluoride(as F),Max	IS:3025(Part-60)	0.16	mg/l	1.5	1.5	1.5	-	-
14	Total Dissolved Solid	IS:3025(Part-16)	930	mg/l	500	-	1500	-	2100

Contd. To report Code: WW-31032021-02

TECHNICAL MANAGER

ULTRA TESTING & RESEARCH LABORATORY
(An ISO 9001:2015, OHSAS 45001:2018, 14001:2015 (EMS) Certified)
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E-mail: ultraresearchlab@gmail.com
Website: http://www.ultralabindia.com
TC-8198

15	Total Hardness (as $CaCO_3$)	IS:3025(Part-21)	290.00	mg/l	300	-	-	-	-
16	Sulphate (as SO_4)Max	IS:3025(Part-24)	28.30	mg/l	400	-	400	-	1000
17	Phosphate (as P)	IS:3025(Part-31)	1.68	mg/l	-	-	-	-	-
18	Sodium (as Na)	IS:3025(Part-45)	92.88	mg/l	-	-	-	-	-
19	Manganese (as Mn)	IS:3025(Part-59)	<0.1	mg/l	0.5	-	-	-	-
20	Total Chromiun (as Cr)	IS:3025(Part-52)	<0.05	mg/l	0.05	0.05	0.05	-	-
21	Zinc (as Zn)	IS:3025(Part-49)	0.26	mg/l	15	-	15	-	-
22	Potassium (as K)	IS:3025(Part-45)	8.52	mg/l	-	-	-	-	-
23	Nitrate (as NO_3),Max	IS: 3025 (Part-34)	2.77	mg/l	20	-	50	-	-
24	Cadmium (as Cd)	IS-3025(Part-41)	<0.01	mg/l	0.01	-	0.01	-	-
25	Lead (as Pb)	IS:3025(Part-47)	<0.01	mg/l	0.1	-	0.1	-	
26	Copper (as Cu)	IS:3025(Part-42)	<0.01	mg/l	1.5	-	1.5	-	-
27	Chemical Oxygen Demand (asO_2)	IS-3025(Part-58)	32.00	mg/l	-	-	-	-	-
28	Arsenic (as As)	IS:3025(Part-37)	<0.01	mg/l	0.05	0.2	0.2	-	

End Of Report

Remarks:-

Class A-Drinking water without conventional treatment but after disinfection.
Class B-Water for outdoor bathing.
Class C-Drinking water with conventional treatment followed by disinefection.
Class D-Water for fish culture and wild life propagation.
Class E-Water for irrigation, industrial cooling and control waste disposal.

Note:-

1. The results given above are related to the tested sample, for various parameters, as observed at the time of sampling. The customer asked for the above tests only.
2. This test report will not be used for any publicity/legal purpose.
3. The test samples will be disposed off after two weeks from the date of issue of test report, unless until specified by the customer.
4. The Report can not be used as evidence in a court of law without the written approval of the lab.

For ULTRA TESTING & RESEARCH LABORATORY

Technical Manager

Checked By

(Authorized Signatory)

ULTRA TESTING & RESEARCH LABORATORY
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TEST REPORT

Surface Water Sample Analysis

Report Code: WW-31032021-02 Issue Date: 31/03/2021

ISSUED TO : **SBA ENVIRO SYSTEMS PVT.LTD.**
201, DDA LOCAL SHOPPING CENTER, BLOCK E, VIKASPURI
DELHI, 110018

Project Name : Calcutta Leather Complex of Kolkata Metropolitan Development Authority
Bhojerhat, Tehsil & District- South 24 Parganas, State - West Bengal

Sample Drawn On : 23/03/2021
Sample Drawn By : UTRL
Sample Description : Surface Water
Sampling Location : Sample Collected from Basanti Canal (Upstream)
Analysis Duration : 25/03/2021 To 31/03/2021

RESULTS

S.No	Parameter	Test Method	Results	Units	Tolerance Limit as per IS:2296				
					Class A	Class B	Class C	Class D	Class E
1	Total Coli Form	IS:1622	484	MPN/100ml	50	500	5000	-	-

"End Of Report"

Remarks:-

Class A-Drinking water without conventional treatment but after disinfection.
Class B-Water for outdoor bathing.
Class C-Drinking water with conventional treatment followed by disinfection.
Class D-Water for fish culture and wild life propagation.
Class E-Water for irrigation, industrial cooling and control waste disposal.

Note:-

1. The results given above are related to the tested sample, for various parameters, as observed at the time of sampling. The customer asked for the above tests only.
2. This test report will not be used for any publicity/legal purpose.
3. The test samples will be disposed off after two weeks from the date of issue of test report, unless until specified by the customer.
4. The Report can not be used as evidence in a court of law without the written approval of the

For ULTRA TESTING & RESEARCH LABORATORY

Checked By

(Authorized Signatory)

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Ultra Lab
TC-8198

TEST REPORT

Surface Water Sample Analysis
Discipline/Group-Chemical/Water

Report Code: WW-31032021-03 **Issue Date: 31/03/2021**

ISSUED TO : **SBA ENVIRO SYSTEMS PVT.LTD.**
201, DDA LOCAL SHOPPING CENTER, BLOCK E, VIKASPURI
DELHI, 110018

Project Name	: Calcutta Leather Complex of Kolkata Metropolitan Development Authority Bhojerhat, Tehsil & District- South 24 Parganas, State - West Bengal
Sample Drawn On	: 23/03/2021
Sample Drawn By	: UTRL
Sample Description	: Surface Water
Sampling Location	: Sample Collected from Basanti Canal (Down stream)
Sampling Procedure	: IS 3025(Part-01)
Sample Quantity	: 2.0 Litre
Analysis Duration	: 25/03/2021 To 31/03/2021

RESULTS

S.No	Parameter	Test Method	Results	Units	Tolerance Limit as per IS:2296				
					Class A	Class B	Class C	Class D	Class E
1	pH	IS:3025(Part-11)	6.89	-	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5
2	Temperature	IS:3025(Part-09)	28.2	^{o}C	-	-	-	-	-
3	Turbidity	IS:3025(Part-10)	8.8	NTU	-	-	-	-	-
4	Conductivity @25°C	IS:3025(Part-14)	1563	µs/cm.	-	-	-	1000	2250
5	Total Suspended Solid	IS:3025(Part-17)	25	mg/l	-	-	-	-	-
6	Total Alkalinity (as $CaCO_3$)	IS:3025(Part-23)	290	mg/l	-	-	-	-	-
7	Biological Oxygen Demand (Max.)	IS:3025(Part-44)	5.00	mg/l	2	3	3	-	-
8	Dissolved Oxygen (as O_2) Min.	IS:3025(Part-38)	7.2	mg/l	6	5	4	4	-
9	Calcium(as Ca)	IS:3025(Part-40)	60.00	mg/l	80	-	-	-	-
10	Magnesium(as Mg)	IS:3025(Part-46)	34.02	mg/l	24	-	-	-	-
11	Chloride(as Cl),Max	IS:3025(Part-32)	173.56	mg/l	250	-	-	-	600
12	Iron(as Fe),Max	IS:3025(Part-53)	0.13	mg/l	0.3	-	50	-	-
13	Fluoride(as F),Max	IS:3025(Part-60)	0.20	mg/l	1.5	1.5	1.5	-	-
14	Total Dissolved Solid	IS:3025(Part-16)	938	mg/l	500	-	1500	-	2100

Contd. To report Code: WW-31032021-03

TECHNICAL MANAGER

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Website: http://www.ultralabnoida.com
Ultra Lab

Contd. To report Code: WW-310520B-405

15	Total Hardness (as $CaCO_3$)	IS:3025(Part-21)	290.00	mg/l	300	-	-	-	-
16	Sulphate (as SO_4)Max	IS:3025(Part-24)	29.87	mg/l	400	-	400	-	1000
17	Phosphate (as P)	IS:3025(Part-31)	1.68	mg/l	-	-	-	-	-
18	Sodium (as Na)	IS:3025(Part-45)	93.12	mg/l	-	-	-	-	-
19	Manganese (as Mn)	IS:3025(Part-59)	<0.1	mg/l	0.5	-	-	-	-
20	Total Chromium (as Cr)	IS:3025(Part-52)	<0.05	mg/l	0.05	0.05	0.05	-	-
21	Zinc (as Zn)	IS:3025(Part-49)	0.29	mg/l	15	-	15	-	-
22	Potassium (as K)	IS:3025(Part-45)	9.53	mg/l	-	-	-	-	-
23	Nitrate (as NO_3),Max	IS: 3025 (Part-34)	2.65	mg/l	20	-	50	-	-
24	Cadmium (as Cd)	IS-3025(Part-41)	<0.01	mg/l	0.01	-	0.01	-	-
25	Lead (as Pb)	IS:3025(Part-47)	<0.01	mg/l	0.1	-	0.1	-	-
26	Copper (as Cu)	IS:3025(Part-42)	<0.01	mg/l	1.5	-	1.5	-	-
27	Chemical Oxygen Demand (asO_2)	IS-3025(Part-58)	40.00	mg/l	-	-	-	-	-
28	Arsenic (as As)	IS:3025(Part-37)	<0.01	mg/l	0.05	0.2	0.2	-	

End Of Report

Remarks:-

Class A-Drinking water without conventional treatment but after disinfection.
Class B-Water for outdoor bathing.
Class C-Drinking water with conventional treatment followed by disinefection.
Class D-Water for fish culture and wild life propagation.
Class E-Water for irrigation, industrial cooling and control waste disposal.

Note:-

1 The results given above are related to the tested sample, for various parameters, as observed at the time of sampling. The customer asked for the above tests only.
2 This test report will not be used for any publicity/legal purpose.
3 The test samples will be disposed off after two weeks from the date of issue of test report, unless until specified by the customer.
4 The Report can not be used as evidence in a court of law without the written approval of the lab.

Gaurav
Checked By

For ULTRA TESTING & RESEARCH LABORATORY

TECHNICAL MANAGER

(Authorised Signatory)

Ultra Lab

ULTRA TESTING & RESEARCH LABORATORY

(An ISO 9001:2015, ISO 45001:2018, ISO 14001:2015 Certified)
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Website: http://www.ultralabnoida.com

TEST REPORT

Surface Water Sample Analysis

Report Code: WW-31032021-03 Issue Date: 31/03/2021

ISSUED TO : **SBA ENVIRO SYSTEMS PVT.LTD.**
201, DDA LOCAL SHOPPING CENTER, BLOCK E, VIKASPURI
DELHI, 110018

Project Name : Calcutta Leather Complex of Kolkata Metropolitan Development Authority
Bhojerhat, Tehsil & District- Soulh 24 Parganas, State - West Bengal

Sample Drawn On : 23/03/2021
Sample Drawn By : UTRL
Sample Description : Surface Water
Sampling Location : Sample Collected from Basanti Canal (Down stream)
Analysis Duration : 25/03/2021 To 31/03/2021

RESULTS

S.No	Parameter	Test Method	Results	Units	Tolerance Limit as per IS:2296				
					Class A	Class B	Class C	Class D	Class E
1	Total Coli Form	IS:1622	496	MPN/100ml	50	500	5000	-	-

"End Of Report"

Remarks:-

Class A-Drinking water without conventional treatment but after disinfection.
Class B-Water for outdoor bathing.
Class C-Drinking water with conventional treatment followed by disinefection.
Class D-Water for fish culture and wild life propagation.
Class E-Water for irrigation, industrial cooling and control waste disposal.

Note:-

1. The results given above are related to the tested sample, for various parameters, as observed at the time of sampling. The customer asked for the above tests only.
2. This test report will not be used for any publicity/legal purpose.
3. The test samples will be disposed off after two weeks from the date of issue of test report, unless until specified by the customer.
4. The Report can not be used as evidence in a court of law without the written approval of the laboratory.

For ULTRA TESTING & RESEARCH LABORATORY

Checked By

(Authorized Signatory)

ULTRA TESTING & RESEARCH LABORATORY
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E-mail: ultraresearchlab@gmail.com
Website: http://www.ultralabindia.com
Ultra Lab
TC-8198

TEST REPORT

Surface Water Sample Analysis
Discipline/Group-Chemical/Water

Report Code: WW-31032021-04 Issue Date: 31/03/2021

ISSUED TO : **SBA ENVIRO SYSTEMS PVT.LTD.**
201, DDA LOCAL SHOPPING CENTER, BLOCK E, VIKASPURI
DELHI, 110018

Project Name : Calcutta Leather Complex of Kolkata Metropolitan Development Authority
Bhojerhat, Tehsil & District- South 24 Parganas, State - West Bengal

Sample Drawn On : 23/03/2021
Sample Drawn By : UTRL
Sample Description : Surface Water
Sampling Location : Sample Collected from Pond on the East boundary of the project site
Sampling Procedure : IS 3025(Part-01)
Sample Quantity : 2.0 Litre
Analysis Duration : 25/03/2021 To 31/03/2021

RESULTS

S.No	Parameter	Test Method	Results	Units	Tolerance Limit as per IS:2296				
					Class A	Class B	Class C	Class D	Class E
1	pH	IS:3025(Part-11)	6.96	-	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5
2	Temperature	IS:3025(Part-09)	29.0	°C	-	-	-	-	-
3	Turbidity	IS:3025(Part-10)	11.6	NTU	-	-	-	-	-
4	Conductivity @25°C	IS:3025(Part-14)	6389	µs/cm.	-	-	-	-	-
5	Total Suspended Solid	IS:3025(Part-17)	30	mg/l	-	-	-	1000	2250
6	Total Alkalinity (as $CaCO_3$)	IS:3025(Part-23)	320	mg/l	-	-	-	-	-
7	Biological Oxygen Demand (Max.)	IS:3025(Part-44)	6.50	mg/l	2	3	3	-	-
8	Dissolved Oxygen (as O_2) Min.	IS:3025(Part-38)	5.8	mg/l	6	5	4	4	-
9	Calcium(as Ca)	IS:3025(Part-40)	84.00	mg/l	80	-	-	-	-
10	Magnesium(as Mg)	IS:3025(Part-46)	58.32	mg/l	24	-	-	-	-
11	Chloride(as Cl),Max	IS:3025(Part-32)	964.24	mg/l	250	-	-	-	600
12	Iron(as Fe),Max	IS:3025(Part-53)	0.15	mg/l	0.3	-	50	-	-
13	Fluoride(as F),Max	IS:3025(Part-60)	0.37	mg/l	1.5	1.5	1.5	-	-
14	Total Dissolved Solid	IS:3025(Part-16)	3833	mg/l	500	-	1500	-	2100

Contd. To report Code: WW-31032021-04

TECHNICAL MANAGER

ULTRA TESTING & RESEARCH LABORATORY
(An ISO 9001:2015, OHSAS 45001:2018, 14001:2015 (EMS) Certified)
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Ph.: No.: +91-9971912476, 9350952231
E-mail: ultraresearchlab@gmail.com
Website: http://www.ultralabnoida.com
TC-81198

Contd. To report Code: WW-3105/2021-22

15	Total Hardness (as $CaCO_3$)	IS:3025(Part-21)	450.00	mg/l	300	-	-	-	-
16	Sulphate (as SO_4)Max	IS:3025(Part-24)	195.72	mg/l	400	-	400	-	1000
17	Phosphate (as P)	IS:3025(Part-31)	3.63	mg/l	-	-	-	-	-
18	Sodium (as Na)	IS:3025(Part-45)	322.84	mg/l	-	-	-	-	-
19	Manganese (as Mn)	IS:3025(Part-59)	<0.1	mg/l	0.5	-	-	-	-
20	Total Chromiun (as Cr)	IS:3025(Part-52)	<0.05	mg/l	0.05	0.05	0.05	-	-
21	Zinc (as Zn)	IS:3025(Part-49)	0.78	mg/l	15	-	15	-	-
22	Potassium (as K)	IS:3025(Part-45)	46.12	mg/l	-	-	-	-	-
23	Nitrate (as NO_3),Max	IS: 3025 (Part-34)	8.24	mg/l	20	-	50	-	-
24	Cadmium (as Cd)	IS-3025(Part-41)	<0.01	mg/l	0.01	-	0.01	-	-
25	Lead (as Pb)	IS:3025(Part-47)	<0.01	mg/l	0.1	-	0.1	-	-
26	Copper (as Cu)	IS:3025(Part-42)	<0.01	mg/l	1.5	-	1.5	-	-
27	Chemical Oxygen Demand (asO_2)	IS-3025(Part-58)	48.00	mg/l	-	-	-	-	-
28	Arsenic (as As)	IS:3025(Part-37)	<0.01	mg/l	0.05	0.2	0.2	-	-

End Of Report

Remarks:-

Class A-Drinking water without conventional treatment but after disinfection.
Class B-Water for outdoor bathing.
Class C-Drinking water with conventional treatment followed by disinefection.
Class D-Water for fish culture and wild life propagation.
Class E-Water for irrigation, industrial cooling and control waste disposal.

Note:-

1. The results given above are related to the tested sample, for various parameters, as observed at the time of sample. The customer asked for the above tests only.
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3. The test samples will be disposed off after two weeks from the date of issue of test report, unless until specified by the customer.
4. The Report can not be used as evidence in a court of law without the written approval of the lab.

For ULTRA TESTING & RESEARCH LABORATORY

Checked By

(Authorised Signatory)

ULTRA TESTING & RESEARCH LABORATORY
(An ISO 9001:2015, ISO 45001:2018, ISO 14001:2015 Certified)
Laboratory: C-43, Sector-88, Phase-II, Noida, U.P.
Ph.: No.: +91-9971912476, 9350952231
E-mail: ultraresearchlab@gmail.com
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TEST REPORT

Surface Water Sample Analysis

Report Code: WW-31032021-04 Issue Date: 31/03/2021

ISSUED TO : **SBA ENVIRO SYSTEMS PVT.LTD.**
201, DDA LOCAL SHOPPING CENTER, BLOCK E, VIKASPURI
DELHI, 110018

Project Name : Calcutta Leather Complex of Kolkata Metropolitan Development Authority
Bhojerhat, Tehsil & District- South 24 Parganas, State - West Bengal

Sample Drawn On : 23/03/2021
Sample Drawn By : UTRL
Sample Description : Surface Water
Sampling Location : Sample Collected from Pond on the East boundary of the project site
Analysis Duration : 25/03/2021 To 31/03/2021

RESULTS

S.No	Parameter	Test Method	Results	Units	Tolerance Limit as per IS:2296				
					Class A	Class B	Class C	Class D	Class E
1	Total Coli Form	IS:1622	964	MPN/100ml	50	500	5000	-	-

"End Of Report"

Remarks:-
Class A-Drinking water without conventional treatment but after disinfection.
Class B-Water for outdoor bathing.
Class C-Drinking water with conventional treatment followed by disinefection.
Class D-Water for fish culture and wild life propagation.
Class E-Water for irrigation, industrial cooling and control waste disposal.

Note:-
1 The results given above are related to the tested sample, for various parameters, as observed at the time of sampling. The customer asked for the above tests only.
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For ULTRA TESTING & RESEARCH LABORATORY

Checked By

(Authorized Signatory)

ULTRA TESTING & RESEARCH LABORATORY

(An ISO 9001:2015, OHSAS 45001:2018, 14001:2015 (EMS) Certified)
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E-mail: ultraresearchlab@gmail.com
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TC-8198

TEST REPORT

Water Sample Analysis
Discipline/Group-Chemical/Water

Report Code: W-31032021-01 **Issue Date: 31/03/2021**

ISSUED TO : **SBA ENVIRO SYSTEMS PVT.LTD.**
201, DDA LOCAL SHOPPING CENTER, BLOCK E, VIKASPURI
DELHI, 110018

Project Name : Calcutta Leather Compley of Kolkata Metropolitan Development Authoritu Bhojerhat, Tehsil & District- Soulh 24 Parganas, State - West Bengal

Sample Drawn On : 23/03/2021
Sample Drawn By : UTRL
Sample Description : Ground Water
Sampling Location : W-1 Project Site; W-2 Mahes Pukuria; W-3 Chandakanthal Beria
Sampling Procedure : IS 3025(Part-01)
Sample Quantity : 2.0 Litre
Analysis Duration : 25/03/2021 to 31/03/2021

RESULTS

S.No	Parameter	Test Method	Results (Location) W-1	W-2	W-3	Units	Acceptable Limit	Permissible Limit in the Absence of Alternate Source
1	pH	IS:3025(Part-11)	6.96	7.05	7.42	-	6.5-8.5	-
2	Colour	IS:3025(Part-04)	<5.0	<5.0	<5.0	Hazen	5	15
3	Odour	IS-3025(Part-05)	Agreeable	Agreeable	Agreeable	-	Agreeable	Agreeable
4	Taste	IS:3025(Part-07)	Agreeable	Agreeable	Saline	-	Agreeable	Agreeable
5	Turbidity	IS-3025(Part-10)	<0.5	<0.5	0.8	NTU	1	5
6	Total Hardness (as $CaCO_3$)	IS:3025(Part-21)	570	450	1100	mg/l	200	600
7	Calcium(as Ca)	IS:3025(Part-40)	156.00	88.00	324.00	mg/l	75	200
8	Magnesium(as Mg)	IS:3025(Part-46)	43.74	55.89	70.47	mg/l	30	100
9	Chloride(as Cl)	IS:3025(Part-32)	356.77	115.71	621.30	mg/l	250	1000
10	Iron(as Fe)	IS:3025(Part-53)	0.16	0.11	0.15	mg/l	0.3	No Relaxation
11	Fluoride(as F)	IS:3025(Part-60)	0.75	0.11	0.30	mg/l	1	1.5
12	Free Residual chlorine	IS:3025(Part-26)	<0.1	<0.1	<0.1	mg/l	0.2	1
13	Total Dissolved Solid	IS:3025(Part-16)	1594	1268	2886	mg/l	500	2000
14	Phenolic Compound (as C_6H_5OH)	IS: 3025 (Part-43)	<0.001	<0.001	<0.001	mg/l	0.001max	0.002 Max
15	Anionic Detergents (as MBAS)	Annex K of IS 13428	<0.1	<0.1	<0.1	mg/l	0.2	1.0

Contd. To report W-31032021-(Page 1 of 2)

ULTRA TESTING & RESEARCH LABORATORY TECHNICAL MANAGER

16	Sulphate (as SO_4)	IS:3025(Part-24)	6.29	17.29	35.76	mg/l	200	400
17	Nitrate (as NO_3)	IS: 3025 (Part-34)	5.32	1.07	3.58	mg/l	45	No Relaxation
18	Alkalinity(as CaCO3)	IS:3025(Part-23)	360	390	390	mg/l	200	600
19	Chloramines (as Cl_2)	IS:3025(Part-26)	< 1.0	< 1.0	< 1.0	mg/l	4	No Relaxation
20	Cadmium (as Cd)	IS-3025(Part-41)	<0.001	<0.001	<0.001	mg/l	0.003	No Relaxation
21	Lead (as Pb)	IS:3025(Part-47)	<0.01	<0.01	<0.01	mg/l	0.01	No Relaxation
22	Total Chromium (as Cr)	IS:3025(Part-52)	<0.01	<0.01	<0.01	mg/l	0.05	No Relaxation
23	Copper (as Cu)	IS:3025(Part-42)	<0.01	<0.01	<0.01	mg/l	0.05	1.5
24	Total Ammonia	IS: 3025 (Part-34)	<0.5	<0.5	<0.5	mg/l	0.5	No Relaxation
25	Nickel (as Ni)	IS:3025(Part-54)	<0.01	<0.01	<0.01	mg/l	0.02	0.2
26	Zinc (as Zn)	IS:3025(Part-49)	0.86	0.61	0.74	mg/l	5	15
27	Manganese (as Mn)	IS:3025(Part-59)	<0.1	<0.1	<0.1	mg/l	0.1	0.3
28	Boron (as B)	IS:3025(Part-57)	0.16	<0.1	0.19	mg/l	0.5	1
29	Selenium (Se)	IS:3025(Part-56)	<0.01	<0.01	<0.01	mg/l	0.01	No Relaxation
30	Arsenic (as As)	IS:3025(Part-37)	<0.01	<0.01	<0.01	mg/l	0.01	0.05

End Of Report

Note:-

1 The results given above are related to the tested sample, for various parameters, as observed at the time of sampling. The customer asked for the above tests only.
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For ULTRA TESTING & RESEARCH LABORATORY

Checked By

(Authorized Signatory)

ULTRA TESTING & RESEARCH LABORATORY TECHNICAL MANAGER

ULTRA TESTING & RESEARCH LABORATORY

(An ISO 9001:2015, ISO 45001:2018, ISO 14001:2015 Certified)
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E-mail: ultraresearchlab@gmail.com
Website: http://www.ultralabnoida.com

TEST REPORT

Bacteriological Quality of Drinking Water

Report Code : W-31032021-01 **Issue Date: 31/03/2021**

Issued To : **SBA ENVIRO SYSTEMS PVT.LTD.**
201, DDA LOCAL SHOPPING CENTER, BLOCK E, VIKASPURI
DELHI, 110018

Project Name : Calcutta Leather Compley of Kolkata Metropolitan Development Authoritu Bhojerhat, Tehsil & District- Soulh 24 Parganas, State - West Bengal

Sample Drawn On : 23/03/2021
Sample Drawn By : UTRL
Sample Description : Ground Water

Sampling Location	W-1	W-2	W-3
	: Project Site	Mahes Pukuria	Chandakanthal Beria

Analysis Duration : 25/03/2021 to 31/03/2021

RESULTS
As per IS 10500:2012

S.No	Parameter	Test Method	Results			Units	Requirements
			W-1	W-2	W-3		
1	E.coli	IS-1622	Not Detected (<2)	Not Detected (<2)	Not Detected (<2)	E.Coli/100ml	Shall not be detectable in100 ml sample
2	Total Coliform	IS-1622	Absent	Absent	Absent	MPN/100ml	Shall not be detectable in100 ml sample

End Of Report

Note:-

1 The results given above are related to the tested sample, for various parameters, as observed at the time of sampling. The customer asked for the above tests only.
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For ULTRA TESTING & RESEARCH LABORATORY

Checked By

TECHNICAL MANAGER

(Authorized Signatory)

ULTRA TESTING & RESEARCH LABORATORY

(An ISO 9001:2015, OHSAS 45001:2018, 14001:2015 (EMS) Certified)
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Ph.: No.: +91-9971912476, 9350952231
E-mail: ultraresearchlab@gmail.com
Website: http://www.ultralabnoida.com

TC-8198

TEST REPORT

Water Sample Analysis
Discipline/Group-Chemical/Water

Report Code: W-31032021-02 **Issue Date: 31/03/2021**

ISSUED TO : **SBA ENVIRO SYSTEMS PVT.LTD.**
201, DDA LOCAL SHOPPING CENTER, BLOCK E, VIKASPURI
DELHI, 110018

Project Name : Calcutta Leather Compley of Kolkata Metropolitan Development Authoritu Bhojerhat, Tehsil & District- Soulh 24 Parganas, State - West Bengal

Sample Drawn On : 23/03/2021
Sample Drawn By : UTRL
Sample Description : Ground Water
Sampling Location : W-4 Abua | W-5 Goalapotaa | W-6 Panapukur
Sampling Procedure : IS 3025(Part-01)
Sample Quantity : 2.0 Litre
Analysis Duration : 25/03/2021 to 31/03/2021

RESULTS

S.No	Parameter	Test Method	Results			Units	Acceptable Limit	Permissible Limit in the Absence of Alternate Source
			Location					
			W-4	W-5	W-6			
1	pH	IS:3025(Part-11)	6.86	7.11	6.98	-	6.5-8.5	-
2	Colour	IS:3025(Part-04)	<5.0	<5.0	<5.0	Hazen	5	15
3	Odour	IS-3025(Part-05)	Agreeable	Agreeable	Agreeable	-	Agreeable	Agreeable
4	Taste	IS:3025(Part-07)	Agreeable	Agreeable	Saline	-	Agreeable	Agreeable
5	Turbidity	IS-3025(Part-10)	1.7	<0.5	<0.5	NTU	1	5
6	Total Hardness (as $CaCO_3$)	IS:3025(Part-21)	400	430	580	mg/l	200	600
7	Calcium(as Ca)	IS:3025(Part-40)	84.00	80.00	144.00	mg/l	75	200
8	Magnesium(as Mg)	IS:3025(Part-46)	46.17	55.89	53.46	mg/l	30	100
9	Chloride(as Cl)	IS:3025(Part-32)	33.75	106.07	430.50	mg/l	250	1000
10	Iron(as Fe)	IS:3025(Part-53)	0.13	0.23	0.17	mg/l	0.3	No Relaxation
11	Fluoride(as F)	IS:3025(Part-60)	0.14	0.16	0.39	mg/l	1	1.5
12	Free Residual chlorine	IS:3025(Part-26)	<0.1	<0.1	<0.1	mg/l	0.2	1
13	Total Dissolved Solid	IS:3025(Part-16)	721	1206	1953	mg/l	500	2000
14	Phenolic Compound (as C_6H_5OH)	IS: 3025 (Part-43)	<0.001	<0.001	<0.001	mg/l	0.001max	0.002 Max
15	Anionic Detergents (as MBAS)	Annex K of IS 13428	<0.1	<0.1	<0.1	mg/l	0.2	1.0

Contd. To report W-31032021-02 (Page 1 of 2)

ULTRA TESTING & RESEARCH LABORATORY ★ TECHNICAL MANAGER

Contd. To report W-31032021- (Page 2 of 2)

16	Sulphate (as SO_4)	IS:3025(Part-24)	206.13	11.20	134.01	mg/l	200	400
17	Nitrate (as NO_3)	IS: 3025 (Part-34)	6.70	4.67	9.05	mg/l	45	No Relaxation
18	Alkalinity(as CaCO3)	IS:3025(Part-23)	400	460	380	mg/l	200	600
19	Chloramines (as Cl_2)	IS:3025(Part-26)	< 1.0	< 1.0	< 1.0	mg/l	4	No Relaxation
20	Cadmium (as Cd)	IS-3025(Part-41)	<0.001	<0.001	<0.001	mg/l	0.003	No Relaxation
21	Lead (as Pb)	IS:3025(Part-47)	<0.01	<0.01	<0.01	mg/l	0.01	No Relaxation
22	Total Chromium (as Cr)	IS:3025(Part-52)	<0.01	<0.01	<0.01	mg/l	0.05	No Relaxation
23	Copper (as Cu)	IS:3025(Part-42)	<0.01	<0.01	<0.01	mg/l	0.05	1.5
24	Total Ammonia	IS: 3025 (Part-34)	<0.5	<0.5	<0.5	mg/l	0.5	No Relaxation
25	Nickel (as Ni)	IS:3025(Part-54)	<0.01	<0.01	<0.01	mg/l	0.02	0.2
26	Zinc (as Zn)	IS:3025(Part-49)	0.48	0.85	0.93	mg/l	5	15
27	Manganese (as Mn)	IS:3025(Part-59)	<0.1	<0.1	<0.1	mg/l	0.1	0.3
28	Boron (as B)	IS:3025(Part-57)	<0.1	<0.1	0.15	mg/l	0.5	1
29	Selenium (Se)	IS:3025(Part-56)	<0.01	<0.01	<0.01	mg/l	0.01	No Relaxation
30	Arsenic (as As)	IS:3025(Part-37)	<0.01	<0.01	<0.01	mg/l	0.01	0.05

End Of Report

Note:-

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For ULTRA TESTING & RESEARCH LABORATORY

Checked By

TECHNICAL MANAGER

(Authorized Signatory)

ULTRA TESTING & RESEARCH LABORATORY

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Website: http://www.ultralabnoida.com

TEST REPORT

Bacteriological Quality of Drinking Water

Report Code : W-31032021-02 **Issue Date: 31/03/2021**

Issued To : **SBA ENVIRO SYSTEMS PVT.LTD.**
201, DDA LOCAL SHOPPING CENTER, BLOCK E, VIKASPURI
DELHI, 110018

Project Name : Calcutta Leather Compley of Kolkata Metropolitan Development Authoritu Bhojerhat, Tehsil & District- Soulh 24 Parganas, State - West Bengal

Sample Drawn On : 23/03/2021
Sample Drawn By : UTRL
Sample Description : Ground Water
Sampling Location : W-4 Abua; W-5 Goalapotaa; W-6 Panapukur
Analysis Duration : 25/03/2021 to 31/03/2021

RESULTS
As per IS 10500:2012

S.No	Parameter	Test Method	Results			Units	Requirements
			W-4	W-5	W-6		
1	E.coli	IS-1622	Not Detected (<2)	Not Detected (<2)	Not Detected (<2)	E.Coli/100ml	Shall not be detectable in100 ml sample
2	Total Coliform	IS-1622	Absent	Absent	Absent	MPN/100ml	Shall not be detectable in100 ml sample

End Of Report

Note:-

1 The results given above are related to the tested sample, for various parameters, as observed at the time of sampling. The customer asked for the above tests only.
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For ULTRA TESTING & RESEARCH LABORATORY

Checked By

(Authorized Signatory)

ULTRA TESTING & RESEARCH LABORATORY TECHNICAL MANAGER

Ultra Lab

ULTRA TESTING & RESEARCH LABORATORY

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E-mail: ultraresearchlab@gmail.com
Website: http://www.ultralabnoida.com

TC-8138

TEST REPORT

Ambient Air Quality Analysis

Report Code: AAQ-30032021-01 Issue Date: 30/05/2021

ISSUED TO : SBA ENVIRO SYSTEMS PVT.LTD.
201, DDA LOCAL SHOPPING CENTER, BLOCK E, VIKASPURI
DELHI -110018

Project Name : Calcutta Leather Complex of Kolkata Metropolitan Development Authority
Bhojerhat, Tehsil & District- Soulh 24 Parganas, State - West Bengal

Sampling Protocol : UTRL/STP/AIR/01 | Location : AQ1 (Project Site)

Analysis Duration : 05/01/2021 To 30/03/2021 | Sample Drawn By : UTRL

TEST RESULT

S.No	Date	Particulate Matter PM10 (µg /m^3)	Particulate Matter PM2.5 (µg /m^3)	Sulphur Dioxide SO_2 (µg /m^3)	Nitrogen Dioxide NO_2 (µg /m^3)	Carbon monoxide CO (mg /m^3)
		IS:5182(Part-23	IS:5182(Part-24	IS:5182(Part-2)	IS:5182(Part-6)	IS:5182) Part-10)
1	01/01/2021	189.97	133.14	13.57	24.96	0.74
2	04/01/2021	186.29	124.75	14.77	23.41	0.78
3	08/01/2021	179.39	121.30	13.83	22.55	0.79
4	11/01/2021	182.83	118.30	14.56	22.15	0.81
5	15/01/2021	184.36	128.03	13.63	20.16	0.78
6	18/01/2021	190.32	125.92	14.45	23.83	0.69
7	22/01/2021	191.82	130.07	15.04	25.48	0.71
8	25/01/2021	189.18	120.43	13.78	20.22	0.75
9	29/01/2021	177.25	132.09	16.88	24.34	0.83
10	01/02/2021	187.10	123.03	15.53	22.55	0.80
11	05/02/2021	193.81	130.79	13.92	23.41	0.72
12	08/02/2021	189.24	136.83	13.36	23.59	0.79
13	12/02/2021	191.34	121.30	14.02	25.46	0.88
14	15/02/2021	183.61	119.13	17.00	24.52	0.66
15	19/02/2021	195.54	123.45	14.77	26.21	0.75
16	22/02/2021	185.47	131.41	13.63	23.83	0.79
17	26/02/2021	186.61	124.32	13.92	24.34	0.75
18	01/03/2021	186.44	130.64	13.59	22.15	0.72
19	05/03/2021	189.45	128.63	13.78	24.34	0.83
20	08/03/2021	192.17	130.68	13.63	25.00	0.80
21	12/03/2021	190.55	138.13	13.92	24.34	0.77
22	15/03/2021	188.42	133.19	13.73	24.00	0.70
23	19/03/2021	185.09	139.13	14.02	24.52	0.76
24	22/03/2021	191.09	128.26	13.74	24.27	0.95
Minimum		**177.25**	**118.30**	**13.36**	**20.16**	**0.66**
Maximum		**195.54**	**139.13**	**17.00**	**26.21**	**0.95**
Average		**187.81**	**128.04**	**14.29**	**23.74**	**0.77**
98th Percentile		**194.74**	**138.67**	**16.94**	**25.88**	**0.92**
NAAQS,For 24 Hourly Monitoring		**100.0**	**60.0**	**80.0**	**80.0**	**4.0**

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For Ultra Testing & Research Laboratory
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(An ISO 9001:2015, OHSAS 45001:2018, 14001:2015 (EMS) Certified)
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Ph.: No.: +91-9971912476, 9350952231
E-mail: ultraresearchlab@gmail.com
Website: http://www.ultralabnoida.com
Ultra Lab
TC-8198

TEST REPORT

Ambient Air Quality Analysis

Report Code: AAQ-30032021-02 Issue Date: 30/03/2021

ISSUED TO : SBA ENVIRO SYSTEMS PVT.LTD.
201, DDA LOCAL SHOPPING CENTER, BLOCK E, VIKASPURI
DELHI -110018

Project Name :Calcutta Leather Complex of Kolkata Metropolitan Development Authority
Bhojerhat, Tehsil & District- Soulh 24 Parganas, State - West Bengal

Sampling Protocol : UTRL/STP/AIR/01 Location : AQ2 (Mahes Pukuria)

Analysis Duration : 05/01/2021 To 30/03/2021 Sample Drawn By : UTRL

TEST RESULT

S.No	Date	Particulate Matter PM10 (µg /m^3)	Particulate Matter PM2.5 (µg /m^3)	Sulphur Dioxide SO_2 (µg /m^3)	Nitrogen Dioxide NO_2 (µg /m^3)	Carbon monoxide CO (mg /m^3)
		IS:5182(Part-23	IS:5182(Part-24	IS:5182(Part-2)	IS:5182(Part-6)	IS:5182(Part-10)
1	01/01/2021	81.52	43.33	10.86	20.42	0.56
2	04/01/2021	82.34	41.39	12.94	23.58	0.58
3	08/01/2021	79.99	39.71	12.22	21.05	0.60
4	11/01/2021	84.45	43.22	11.62	21.84	0.57
5	15/01/2021	80.62	42.77	11.50	22.15	0.59
6	18/01/2021	85.62	44.06	12.17	20.02	0.61
7	22/01/2021	79.27	39.13	11.33	22.63	0.62
8	25/01/2021	84.33	42.13	11.09	20.50	0.65
9	29/01/2021	84.84	39.71	12.09	20.60	0.61
10	01/02/2021	85.07	45.22	11.33	20.75	0.62
11	05/02/2021	81.01	43.83	11.92	22.15	0.61
12	08/02/2021	80.34	42.17	12.75	20.75	0.60
13	12/02/2021	84.23	42.58	11.91	22.39	0.59
14	15/02/2021	82.20	43.60	12.66	20.60	0.58
15	19/02/2021	81.63	38.62	11.50	21.61	0.65
16	22/02/2021	84.27	43.07	12.94	21.76	0.62
17	26/02/2021	83.83	41.41	12.25	21.26	0.57
18	01/03/2021	82.51	42.08	13.44	21.69	0.63
19	05/03/2021	79.38	41.44	11.25	20.60	0.60
20	08/03/2021	85.12	43.52	13.90	24.74	0.64
21	12/03/2021	82.39	42.55	12.34	22.15	0.57
22	15/03/2021	83.84	43.83	11.78	20.50	0.59
23	19/03/2021	80.13	42.73	12.52	22.47	0.61
24	22/03/2021	78.26	39.34	12.68	22.50	0.58
Minimum		**78.26**	**38.62**	**10.86**	**20.02**	**0.56**
Maximum		**85.62**	**45.22**	**13.90**	**24.74**	**0.65**
Average		**82.38**	**42.14**	**12.12**	**21.60**	**0.60**
98th Percentile		**85.39**	**44.68**	**13.69**	**24.21**	**0.65**
NAAQS,For 24 Hourly Monitoring		**100.0**	**60.0**	**80.0**	**80.0**	**4.0**

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E-mail: ultraresearchlab@gmail.com
Website: http://www.ultralabnoida.com
Ultra Lab

TEST REPORT

Ambient Air Quality Analysis

Report Code: AAQ-30032021-03 Issue Date: 30/03/2021

ISSUED TO : SBA ENVIRO SYSTEMS PVT.LTD.
201, DDA LOCAL SHOPPING CENTER, BLOCK E, VIKASPURI
DELHI -110018

Project Name : Calcutta Leather Complex of Kolkata Metropolitan Development Authority
Bhojerhat, Tehsil & District- Soulh 24 Parganas, State - West Bengal

Sampling Protocol : UTRL/STP/AIR/01 | Location : AQ3 (Chandakanthal Beria)

Analysis Duration : 05/01/2021 To 30/03/2021 | Sample Drawn By : UTRL

TEST RESULT

S.No	Date	Particulate Matter PM10 (µg /m^3)	Particulate Matter PM2.5 (µg /m^3)	Sulphur Dioxide SO_2 (µg /m^3)	Nitrogen Dioxide NO_2 (µg /m^3)	Carbon monoxide CO (mg /m^3)
		IS:5182(Part-23	IS:5182(Part-24	IS:5182(Part-2)	IS:5182(Part-6)	IS:5182(Part-10)
1	01/01/2021	79.11	41.67	11.54	21.15	0.56
2	04/01/2021	76.57	41.25	12.90	22.41	0.58
3	08/01/2021	79.41	43.80	12.13	22.80	0.60
4	11/01/2021	84.45	43.22	11.62	21.84	0.57
5	15/01/2021	79.16	40.97	11.59	22.44	0.59
6	18/01/2021	78.71	39.86	12.18	21.43	0.61
7	22/01/2021	79.33	41.87	11.25	22.28	0.62
8	25/01/2021	80.18	41.54	10.25	21.48	0.65
9	29/01/2021	83.66	39.30	11.84	21.08	0.61
10	01/02/2021	77.57	40.58	10.55	20.53	0.62
11	05/02/2021	81.05	39.30	10.32	21.99	0.63
12	08/02/2021	79.25	41.28	12.75	22.05	0.60
13	12/02/2021	78.61	38.56	12.70	20.67	0.59
14	15/02/2021	83.45	43.91	12.04	22.63	0.58
15	19/02/2021	81.91	40.00	11.54	21.69	0.65
16	22/02/2021	78.14	41.25	12.22	22.59	0.62
17	26/02/2021	83.85	41.12	10.25	22.75	0.57
18	01/03/2021	82.82	39.72	11.46	21.54	0.63
19	05/03/2021	79.71	41.29	11.91	21.46	0.60
20	08/03/2021	85.92	39.57	12.48	21.25	0.64
21	12/03/2021	81.24	41.12	11.62	22.75	0.57
22	15/03/2021	83.02	40.00	12.35	21.00	0.59
23	19/03/2021	77.02	43.07	12.26	22.67	0.61
24	22/03/2021	78.76	41.87	11.95	20.60	0.58
Minimum		**76.57**	**38.56**	**10.25**	**20.60**	**0.56**
Maximum		**85.92**	**43.91**	**12.90**	**22.80**	**0.65**
Average		**80.54**	**41.09**	**11.74**	**21.84**	**0.60**
98th Percentile		**85.24**	**43.86**	**12.83**	**22.78**	**0.65**
NAAQS.For 24 Hourly Monitoring		**100.0**	**60.0**	**80.0**	**80.0**	**4.0**

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Ultra Lab

TEST REPORT

Ambient Air Quality Analysis

Report Code: AAQ-30032021-04 Issue Date: 30/03/2021

ISSUED TO : SBA ENVIRO SYSTEMS PVT.LTD.
201, DDA LOCAL SHOPPING CENTER, BLOCK E, VIKASPURI
DELHI -110018

Project Name : Calcutta Leather Complex of Kolkata Metropolitan Development Authority
Bhojerhat, Tehsil & District- Soulh 24 Parganas, State - West Bengal

Sampling Protocol : UTRL/STP/AIR/01 | Location : AQ4 Abua (Road Intersection)

Analysis Duration : 05/01/2021 To 30/03/2021 | Sample Drawn By : UTRL

TEST RESULT

S.No	Date	Particulate Matter PM10 (µg /m^3) IS:5182(Part-23	Particulate Matter PM2.5 (µg /m^3) CPCB Volume – 1 Gravimetric	Sulphur Dioxide SO_2 (µg /m^3) IS:5182(Part-2)	Nitrogen Dioxide NO_2 (µg /m^3) IS:5182(Part-6)	Carbon monoxide CO (mg /m^3) IS:5182(Part-10)
1	02/01/2021	137.12	77.20	14.67	24.93	0.74
2	05/01/2021	123.84	78.21	14.16	23.33	0.78
3	09/01/2021	127.88	77.70	15.47	22.47	0.79
4	12/01/2021	121.01	74.69	14.35	23.66	0.81
5	16/01/2021	124.17	73.10	15.14	23.83	0.78
6	19/01/2021	127.29	78.33	14.25	23.50	0.69
7	23/01/2021	135.20	76.96	15.58	24.90	0.71
8	26/01/2021	127.48	76.82	16.78	23.83	0.75
9	30/01/2021	121.00	72.69	16.82	24.25	0.80
10	02/02/2021	129.47	79.03	15.39	22.36	0.80
11	06/02/2021	131.79	77.70	15.47	23.41	0.72
12	09/02/2021	129.81	76.40	16.88	23.59	0.79
13	13/02/2021	128.87	77.83	14.02	25.46	0.75
14	16/02/2021	121.05	74.84	16.82	24.25	0.66
15	20/02/2021	131.21	78.59	14.45	25.66	0.67
16	23/02/2021	124.97	75.68	17.71	23.58	0.79
17	27/02/2021	123.50	76.83	16.88	24.34	0.75
18	02/03/2021	125.45	75.63	15.14	24.74	0.72
19	06/03/2021	127.96	71.65	16.88	24.34	0.81
20	09/03/2021	129.28	77.87	16.64	24.92	0.80
21	13/03/2021	126.63	72.60	15.30	24.08	0.77
22	16/03/2021	128.32	77.87	15.94	24.00	0.70
23	20/03/2021	124.78	77.70	13.92	24.34	0.76
24	23/03/2021	128.88	76.39	16.78	24.20	0.80
Minimum		**121.00**	**71.65**	**13.92**	**22.36**	**0.66**
Maximum		**137.12**	**79.03**	**17.71**	**25.66**	**0.81**
Average		**127.37**	**76.35**	**15.64**	**24.08**	**0.76**
98th Percentile		**136.24**	**78.83**	**17.33**	**25.57**	**0.81**
NAAQS,For 24 Hourly Monitoring		**100.0**	**60.0**	**80.0**	**80.0**	**4.0**

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For Ultra Testing & Research Laboratory

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TC-8158

TEST REPORT

Ambient Air Quality Analysis

Report Code: AAQ-30032021-05 Issue Date: 30/03/2021

ISSUED TO : SBA ENVIRO SYSTEMS PVT.LTD.
201, DDA LOCAL SHOPPING CENTER, BLOCK E, VIKASPURI
DELHI -110018

Project Name :Calcutta Leather Complex of Kolkata Metropolitan Development Authority
Bhojerhat, Tehsil & District- Soulh 24 Parganas, State - West Bengal

Sampling Protocol : UTRL/STP/AIR/01 | Location : AQ5(Bajbarantala Road Sonarpur - Bamanghata Road Crossroad (Near Goalaporta)

Analysis Duration : 05/01/2021 To 30/03/2021 | Sample Drawn By : UTRL

TEST RESULT

S.No	Date	Particulate Matter PM10 (µg /m^3)	Particulate Matter PM2.5 (µg /m^3)	Sulphur Dioxide SO_2 (µg /m^3)	Nitrogen Dioxide NO_2 (µg /m^3)	Carbon monoxide CO (mg /m^3)
		IS:5182(Part-23	IS:5182(Part-24	IS:5182(Part-2)	IS:5182(Part-6)	IS:5182(Part-10)
1	02/01/2021	115.61	77.20	14.67	24.95	0.74
2	05/01/2021	124.26	78.48	14.20	25.42	0.78
3	09/01/2021	131.67	71.11	15.93	23.13	0.79
4	12/01/2021	120.77	77.35	14.50	24.49	0.81
5	16/01/2021	128.38	76.25	14.93	24.94	0.78
6	19/01/2021	130.00	71.49	14.56	24.92	0.69
7	23/01/2021	129.79	77.52	14.98	25.08	0.71
8	26/01/2021	127.39	76.77	13.97	23.81	0.75
9	30/01/2021	122.49	73.21	14.82	25.49	0.83
10	02/02/2021	129.91	74.62	15.37	23.07	0.80
11	06/02/2021	130.94	72.91	13.69	23.25	0.72
12	09/02/2021	129.81	76.40	14.77	24.15	0.79
13	13/02/2021	128.41	64.55	13.97	25.18	0.88
14	16/02/2021	114.73	75.38	14.82	25.37	0.75
15	20/02/2021	123.89	77.77	14.30	25.99	0.69
16	23/02/2021	126.14	76.21	15.78	24.66	0.79
17	27/02/2021	123.50	76.83	14.06	24.34	0.75
18	02/03/2021	124.57	75.10	15.04	24.57	0.72
19	06/03/2021	130.45	72.70	15.70	24.70	0.84
20	09/03/2021	128.37	77.32	13.90	24.74	0.80
21	13/03/2021	125.29	73.10	15.14	23.83	0.77
22	16/03/2021	128.32	75.32	15.94	24.00	0.70
23	20/03/2021	131.93	69.57	14.02	25.46	0.76
24	23/03/2021	134.25	78.73	16.91	24.39	0.82
Minimum		**114.73**	**64.55**	**13.69**	**23.07**	**0.69**
Maximum		**134.25**	**78.73**	**16.91**	**25.46**	**0.88**
Average		**126.70**	**74.83**	**14.82**	**24.39**	**0.77**
98th Percentile		**133.19**	**78.61**	**16.47**	**25.43**	**0.86**
NAAQS,For 24 Hourly Monitoring		**100.0**	**60.0**	**80.0**	**80.0**	**4.0**

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Website: http://www.ultralabnoida.com
Ultra Lab
TC-8198

TEST REPORT

Ambient Air Quality Analysis

Report Code: AAQ-30032021-06 Issue Date: 30/03/2021

ISSUED TO : SBA ENVIRO SYSTEMS PVT.LTD.
201, DDA LOCAL SHOPPING CENTER, BLOCK E, VIKASPURI
DELHI -110018

Project Name : Calcutta Leather Complex of Kolkata Metropolitan Development Authority
Bhojerhat, Tehsil & District- Soulh 24 Parganas, State - West Bengal

Sampling Protocol : UTRL/STP/AIR/01 | Location : AQ6 (Panapukur)

Analysis Duration : 05/01/2021 To 30/03/2021 | Sample Drawn By : UTRL

TEST RESULT

S.No	Date	Particulate Matter PM10 (µg /m^3)	Particulate Matter PM2.5 (µg /m^3)	Sulphur Dioxide SO_2 (µg /m^3)	Nitrogen Dioxide NO_2 (µg /m^3)	Carbon monoxide CO (mg /m^3)
		IS:5182(Part-23	IS:5182(Part-24	IS:5182(Part-2)	IS:5182(Part-6)	IS:5182(Part-30)
1	02/01/2021	84.56	42.21	10.79	21.54	0.55
2	05/01/2021	83.24	43.22	12.30	21.84	0.61
3	09/01/2021	81.33	43.48	12.04	21.69	0.62
4	12/01/2021	84.51	42.92	10.86	19.88	0.55
5	16/01/2021	77.13	44.95	11.96	20.57	0.57
6	19/01/2021	80.10	44.79	12.66	22.90	0.58
7	23/01/2021	86.26	42.17	11.76	21.12	0.62
8	26/01/2021	81.32	42.98	10.40	22.15	0.65
9	30/01/2021	78.19	40.56	12.25	20.89	0.61
10	02/02/2021	79.94	43.56	11.58	22.17	0.62
11	06/02/2021	81.05	43.94	10.32	21.44	0.61
12	09/02/2021	79.25	42.13	12.75	21.41	0.60
13	13/02/2021	80.76	40.06	12.91	22.66	0.59
14	16/02/2021	82.20	39.85	12.27	22.61	0.58
15	20/02/2021	81.88	42.80	11.62	22.02	0.65
16	23/02/2021	85.76	44.68	12.75	23.07	0.62
17	27/02/2021	83.88	43.33	10.45	21.69	0.57
18	02/03/2021	82.82	40.14	11.46	21.54	0.65
19	06/03/2021	79.05	40.97	11.73	21.18	0.60
20	09/03/2021	85.92	43.83	12.89	21.41	0.64
21	13/03/2021	81.91	39.02	11.21	22.57	0.57
22	16/03/2021	82.93	41.52	12.85	19.63	0.59
23	20/03/2021	76.63	43.03	12.40	20.64	0.61
24	23/03/2021	79.03	44.90	12.17	21.29	0.58
Minimum		**76.63**	**39.02**	**10.32**	**19.63**	**0.55**
Maximum		**86.26**	**44.95**	**12.91**	**23.07**	**0.65**
Average		**81.65**	**42.54**	**11.85**	**21.58**	**0.60**
98th Percentile		**86.10**	**44.92**	**12.90**	**23.00**	**0.65**
NAAQS,For 24 Hourly Monitoring		**100.0**	**60.0**	**80.0**	**80.0**	**4.0**

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E-mail: ultraresearchlab@gmail.com
Website: http://www.ultralabnoida.com
TC-8198

TEST REPORT

Noise Report

Report Code: N-25032021-01 **Issue Date: 31/03/2021**

ISSUED TO : **SBA ENVIRO SYSTEMS PVT.LTD.**
201, DDA LOCAL SHOPPING CENTER, BLOCK E, VIKASPURI
DELHI, 110018

Project Name : Calcutta Leather Complex of Kolkata Metropolitan Development Authority ,
Bhojerhat , Tehsil & District- South 24 Parganas (West Bengal)

Monitoring Date : 23/03/2021
Sample Drawn By : UTRL
Sample Description : Ambient Noise
Weather Condition : Clear
Monitoring Duration : 24 hrs

TEST RESULT

S.No	Location	Observed Value Leq dB(A)			Limit as per CPCB Guidelines Leq. dB(A)		Zone
		Day*	Night*	Day/Night	Day*	Night*	
1	Project Site	65.2	55.5	65.3	75.0	70.0	Industrial
2	Mahes Pukuria	50.3	41.0	50.6	55.0	45.0	Residential
3	Chandakanthal Beria	50.5	42.5	51.3	55.0	45.0	Residential

*Day Time	Leq(6.00AM TO 10.00 PM)
*Night Time	Leq(10.00PM TO 6.00 AM)

Note:-

End Of Report

1 The results given above are related to the tested sample, for various parameters, as observed at the time of sampling. The customer asked for the above tests only.
2 This test report will not be used for any publicity/legal purpose
3 The test samples will be disposed off after two weeks from the date of issue of test report, unless until specified by the customer.
4 The Report can not be used as evidence in a court of law without the written approval of the lab.

For Ultra Testing & Research Laboratory

Checked By

(Authorized Signatory)

Assuring you of best our services at all times.

ULTRA TESTING & RESEARCH LABORATORY
(An ISO 9001:2015, OHSAS 45001:2018, 14001:2015 (EMS) Certified)
Laboratory: C-43, Sector-88, Phase-II, Noida, U.P.
Ph.: No.: +91-9971912476, 9350952231
E-mail: ultraresearchlab@gmail.com
Website: http://www.ultralabnoida.com
Ultra Lab
TC-8138

TEST REPORT

Noise Report

Report Code: N-25032021-02 Issue Date: 31/03/2021

ISSUED TO : **SBA ENVIRO SYSTEMS PVT.LTD.**
201, DDA LOCAL SHOPPING CENTER, BLOCK E, VIKASPURI
DELHI, 110018

Project Name : Calcutta Leather Complex of Kolkata Metropolitan Development Authority ,
Bhojerhat , Tehsil & District- South 24 Parganas (West Bengal)

Monitoring Date : 24/03/2021
Sample Drawn By : UTRL
Sample Description : Ambient Noise
Weather Condition : Clear
Monitoring Duration : 24 hrs

TEST RESULT

S.No	Location	Observed Value Leq dB(A)			Limit as per CPCB Guidelines Leq. dB(A)		Zone
		Day*	Night*	Day/Night	Day*	Night*	
1	Abua (Road Intersection)	62.3	52.3	62.3	65.0	55.0	Commercial
2	Bajbarantala Road Sonarpur - Bamanghata Road Crossroad (Near Goalapota)	61.8	52.9	62.2	65.0	55.0	Commercial
3	Panapukur	52.2	42.4	52.3	55.0	45.0	Residential

*Day Time	Leq(6.00AM TO 10.00 PM)
*Night Time	Leq(10.00PM TO 6.00 AM)

Note:-

End Of Report

1 The results given above are related to the tested sample, for various parameters, as observed at the time of sampling. The customer asked for the above tests only.
2 This test report will not be used for any publicity/legal purpose
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For Ultra Testing & Research Laboratory

Checked By

(Authorized Signatory)

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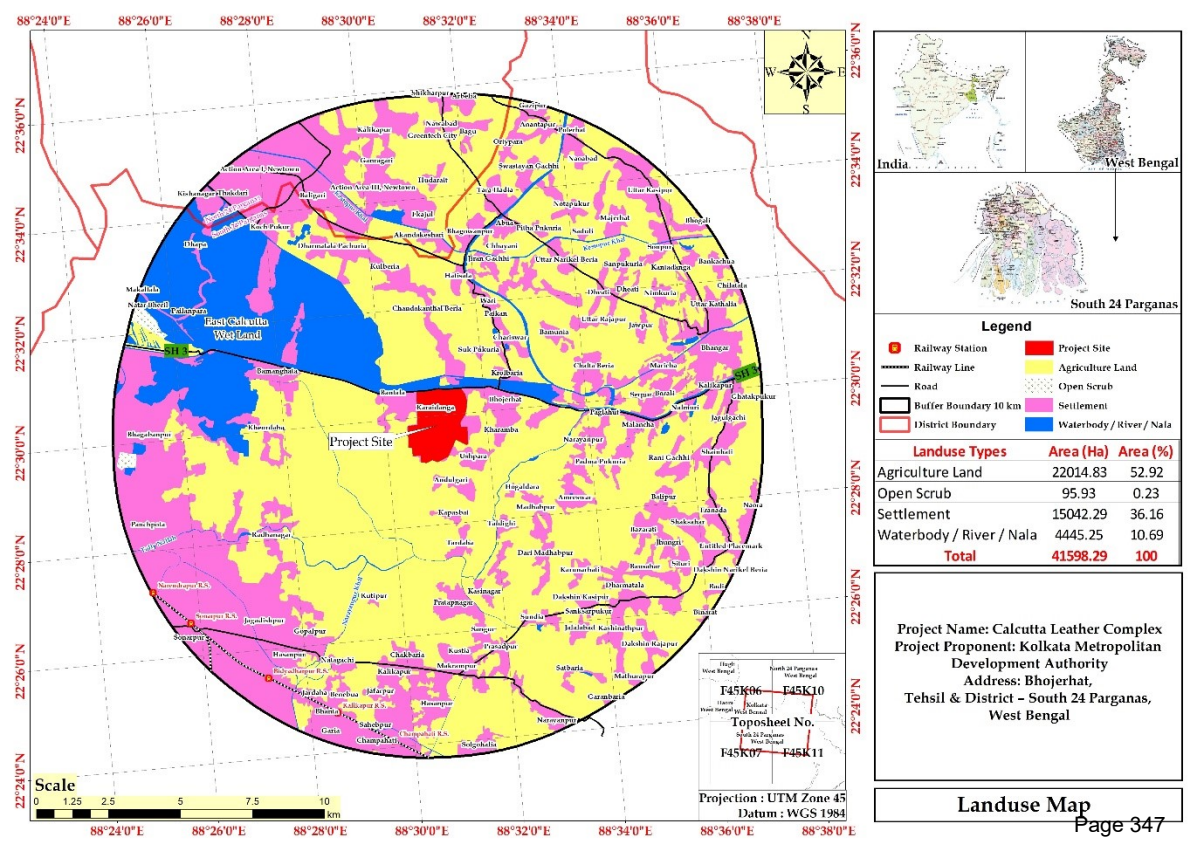
ANNEXURE III

GIS MAPS



Landuse Types	Area (Ha)	Area (%)
Agriculture Land	22014.83	52.92
Open Scrub	95.93	0.23
Settlement	15042.29	36.16
Waterbody / River / Nala	4445.25	10.69
Total	41598.29	100

Project Name: Calcutta Leather Complex
Project Proponent: Kolkata Metropolitan Development Authority
Address: Bhojerhat,
Tehsil & District – South 24 Parganas,
West Bengal

Landuse Map

88°24'0"E 88°26'0"E 88°28'0"E 88°30'0"E 88°32'0"E 88°34'0"E 88°36'0"E 88°38'0"E

22°36'0"N 22°34'0"N 22°32'0"N 22°30'0"N 22°28'0"N 22°26'0"N 22°24'0"N

N W E S

Arbelia
Nawabad
Bagu
Kalikapur
Ortypara
Polerhat
Ganragari
Naoabad
Swastayan Gachhi
Hudarait
Baligari
Kestopur Khal
Ekajul
Notapukur
Majerhat
North 24 Parganas
South 24 Parganas
Koch Pukur
Saduli
Akandakeshari
Dhapa
Dharmatala Pachuria
Kestopur Khal
Sonpur
Chhayani
Kulberia
Sanpukuria
Kantadanga
Bankachua
Hatisala
Chilatala
Makaltala
Dheati
Dheati Nimkuria
Natar Bheril
Chandakanthal Beria
Wari
Uttar Kathalia
Pail
East Calcutta Wet Land
Uttar Rajapur
Jawpur
SH 3
Chariswar
Bamunia
Bhangar
Bamanghata
Krolbaria
SH 3
Kalikapur
Bantala
Borali
Ghatakpukur
Bhojerhat
Karaidanga
Nalmuri
Jagulgachi
Kheordaha
Bhagabanpur
Project Site
Kharamba
Malancha
Narayanpur
Rani Gachhi
Shainhati
Andulgari
Balipur
Hogaldara
Kapasbat
Eranada
Naora
Taldighi
Panchpota
Radhanagar
Tolly Nallah
Tardaha
Untitled Placemark
Dari Madhabpur
Karunarhati
Dakshin Narikel Beria
Dharmatala
Badi
Narendrapur R.S.
Kasinagar
Kultipur
Pratapnagar
Sanksarpukur
Sundia
Binarat
Sonarpur R.S.
Jagadishpur
Sangur
Kashinathpur
Sonarpur
Jalalabad
Dakshin Rajapur
Gopalpur
Prasadpur
Hasanpur
Natagachi
Chakbaria
Bidyadharpur R.S.
Kalikapur
Makrampur
Satbaria
Mathurapur
Jafarpur
Benebua
Garanbaria
Kalikapur R.S.
Bhanta
Sahebpur
Narayanpur
Champahati R.S.
Garia

Scale
0 1.25 2.5 5 7.5 10 km

Hugli West Bengal
North 24 Parganas West Bengal
F45K06 F45K10
Haora West Bengal
Kolkata West Bengal
Toposheet No.
South 24 Parganas West Bengal
F45K07 F45K11

Projection : UTM Zone 45
Datum : WGS 1984

India
West Bengal
South 24 Parganas

Legend

- Railway Station
- Contour
- Railway Line
- Road
- Buffer Boundary 10 km
- District Boundary
- Project Site
- Settlement
- Waterbody / River / Nala

Project Name: Calcutta Leather Complex
Project Proponent: Kolkata Metropolitan Development Authority
Address: Bhojerhat, Tehsil & District – South 24 Parganas, West Bengal

Contour Map

ANNEXURE IV

ACCREDITATION CERTIFICATES

Quality Council of India

National Accreditation Board for Education & Training

CERTIFICATE OF ACCREDITATION

SBA Enviro Systems Private Limited, New Delhi

201, DDA Local Shopping Centre, E Block, Vikaspuri, New Delhi 110018

The organization is accredited as Category-A under the QCI-NABET Scheme for Accreditation of EIA Consultant Organization, Version 3: for preparing EIA-EMP reports in the following Sectors –

Sl. No.	Sector Description	Sector (as per)		Cat.
		NABET	MoEFCC	
1.	Mining of minerals - Opencast only	1	1 (a) (i)	A
2.	River Valley projects	3	1 (c)	A
3.	Thermal power plants	4	1 (d)	A
4.	Metallurgical industries (ferrous & non-ferrous)	8	3 (a)	B
5.	Leather/skin/hide processing industry	15	4 (f)	A
6.	Synthetic organic chemicals industry	21	5 (f)	A
7.	Industrial estates/ parks/ complexes/areas, export processing Zones (EPZs), Special Economic Zones (SEZs), Biotech Parks, Leather Complexes	31	7 (c)	B
8.	Building and construction projects	38	8 (a)	B
9.	Townships and Area development projects	39	8 (b)	B
10.	Food Processing	40(v)	--	--

Note: Names of approved EIA Coordinators and Functional Area Experts are mentioned in RAAC minutes dated Feb 19, 2021 posted on QCI-NABET website.

The Accreditation shall remain in force subject to continued compliance to the terms and conditions mentioned in QCI-NABET's letter of accreditation bearing no. QCI/NABET/ENV/ACO/21/1670 dated March 30, 2021. The accreditation needs to be renewed before the expiry SBA Enviro Systems Private Limited, New Delhi following due process of assessment.

Sr. Director, NABET
Dated: March 30, 2021

Certificate No.
NABET/EIA/2023/RA 0198

Valid till
May 24, 2023

For the updated List of Accredited EIA Consultant Organizations with approved Sectors please refer to QCI-NABET website.

National Accreditation Board for Testing and Calibration Laboratories

CERTIFICATE OF ACCREDITATION

ULTRA TESTING & RESEARCH LABORATORY

has been assessed and accredited in accordance with the standard

ISO/IEC 17025:2017

"General Requirements for the Competence of Testing & Calibration Laboratories"

for its facilities at

C-43, SECTOR-88, NOIDA, GAUTAM BUDDHA NAGAR, UTTAR PRADESH, INDIA

in the field of

TESTING

Certificate Number: TC-8198

Issue Date: 16/11/2020 **Valid Until:** 15/11/2022

This certificate remains valid for the Scope of Accreditation as specified in the annexure subject to continued satisfactory compliance to the above standard & the relevant requirements of NABL.
(To see the scope of accreditation of this laboratory, you may also visit NABL website www.nabl-india.org)

Name of Legal Identity : Ultra Testing & Research Laboratory

Signed for and on behalf of NABL

N. Venkateswaran
Chief Executive Officer