P-14-DHARAMSI-CHEMICAL-32018

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REPORT

FOR

EXPANSION PROJECT OF EXISTING COMMODITY CHEMICALS AND SPECIALITY CHEMICALS MANUFACTURING UNIT FROM 31384 MT/M TO 32510 MT/M CAPACITIES (INCREASE BY 1126 MT/M)

BY

THE DHARAMSI MORARJI CHEMICAL CO. LTD.

PLOT NO. 105 IN MIDC INDUSTRIAL AREA,
P.O. DHATAV, TALUKA : ROHA,
DISTRICT : RAIGAD,
STATE : MAHARASHTRA

PREPARED BY

EQUINOX
Equinox Environments (India) Pvt. Ltd.

EQUINOX ENVIRONMENTS (I) PVT. LTD.,

ENVIRONMENTAL; CIVIL & CHEMICAL ENGINEERS, CONSULTANTS & ANALYSTS,
KOLHAPUR (MS)
E-mail: projects@equinoxenvi.com, eia@equinoxenvi.com

AN ISO 9001 : 2015 & QCI - NABET ACCREDITED ORGANIZATION

2018 - 2019

THE DHARAMSI MORARJI CHEMICAL CO. LTD.

CIN NUMBER : L24110MH1919PLC000564

FACTORY : Plot No.105, MIDC AREA, P.B. No.4, AUDYOGIK VASAHAT ROHA, DIST. RAIGAD - 402 116.

Phone No.: (02194) 263553-4-5. Fax : (02194) 263557

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Ref. No.: **Date: Dec 17, 2018**

To,
The Member Secretary,
Expert Appraisal Committee (Industry-II),
Agni Block, Ministry of Environment, Forest
& Climate Change (MoEFCC),
Indira Paryavaran Bhavan, Jor Bagh Road,
New Delhi - 110 003.

Sub.: 'Grant of Environmental Clearance' in respect of proposed expansion of commodity chemicals and speciality chemicals Manufacturing unit from 31384 MT/M to 32510 MT/M by **The Dharamsi Morarji Chemical Company Limited (TDMCCL)** at Plot No. 105 in MIDC Industrial Area, P.O. Dhatav, Taluka: Roha, District: Raigad, State: Maharashtra.

Ref.: Standard ToRs vide letter No. IA-J-11011/74/2018-IA-II (I) dated 3rd May 2018.
(Refer copy enclosed at Enclosure - I)

Dear Sir,

This has reference to the application in 'Form - I' format submitted to MoEFCC; New Delhi on 27.02.2018 for grant of Terms of Reference (ToRs). The same was in respect of proposed expansion of commodity chemicals and speciality chemicals Manufacturing unit from 31384 MT/M to 32510 MT/M by **The Dharamsi Morarji Chemical Company Limited (TDMCCL)** at Plot No. 105 in MIDC Industrial Area, P.O. Dhatav, Taluka: Roha, District: Raigad, State: Maharashtra. Subsequently, Standard ToRs vide letter No. IA-J-11011/74/2018-IA-II (I) dated 3rd May 2018 were issued for preparation of EIA report.

Now, we are hereby submitting the final EIA report by incorporating requisite compliance towards the Standard ToRs issued. A soft copy of EIA report is being uploaded on MoEFCC website. Moreover, hard copy of the same along with CD containing soft copy would be submitted to your office.

Sir, you are requested please to consider our proposal at the earliest and grant an Environmental Clearance to our expansion project.

Please do the needful & oblige.

Thanking you.

Yours faithfully,

Mr. Shirish Pandit.
Senior Vice President (Operations)

Encl.: As Above.

ISO 9001 : 2015
BUREAU VERITAS Certification

PRODUCTION AND DISPATCH OF SULPHURIC ACID OF DIFFERENT GRADES. OLEUMS (COMMERCIAL) 23% AND 65%, SULPHURIC ANHYDRIDE (STABILISED), DIETHYL SULPHATE, DIFFERENT GRADES OF SODIUM VINYL SULFONATE, CHLOROSULFONIC ACID, PHENOL SULFONIC ACID, BENZENE SULFONYL CHLORIDE, BENZENE SULFONIC ACID, DIPHENYL SULFONES, SULFONAMIDES
CERTIFICATE NO. : IND 15.5565U/Q

ACKNOWLEDGEMENT

I am extremely thankful to the management of **The Dharamsi Morarji Chemical Company Limited (TDMCCL)**, Plot No. 105 in MIDC Industrial Area, P.O. Dhatav, Taluka: Roha, District: Raigad, State: Maharashtra, for entrusting assignments of the EIA studies and Environmental Clearance procurement in respect of proposed expansion of existing commodity chemicals and speciality chemicals manufacturing unit. It was indeed a great experience to have interactions, involvement and discussions with the management and technical experts of TDMCCL. Their knowledge and co-operation as well as support given during the EIA Report preparation impressed me a lot. Sharing of thoughts and planning with **Mr. Shirish Pandit (Vice President, Operations)** was always an interesting thing during the course of assignment. Thank you very much Sir !

The prompt response as well as help from Mr. Shirish Pandit, Mr. M.G.Ganu and Mr. A.K. Nagarch during providing certain information, documentation and data related to the production, processes and details of manufacturing is duly appreciated.

I must thank our Technical Directors namely Prof. (Dr.) Jay Samant, Dr. (Mrs.) Anuradha Samant, and our empanelled experts Mr. Vinaykumar Kurakula, Mr. B. S. Lole, Dr. J.B. Pishte and Prof. (Dr.) Bhaskar N. Thorat for their able and timely contributions in the EIA studies and report preparation. Despite their busy schedules in the universities, colleges and own professions, they were always available, on time, for the necessary inputs; field visits and discussions.

My staff of the EIA Study Cell here must receive a commendation and credit for all the in-house management and inputs during the monitoring, report preparation and presentations. The In-house experts of various functional areas have contributed their best.

Last but not the least, the contributions from my non-technical staff members and laboratory team is also duly appreciated here.

DR. SANGRAM GHUGARE

Chartered Engineer
Chairman & MD
Equinox Environments (India) Pvt. Ltd. (EEIPL); Kolhapur

CAUTION

The information, data, figures, flow charts and drawings in respect of manufacturing processes, mass balance, chemical reactions, production lay-outs and instrumentation details included in this Environmental Impact Assessment (EIA) Report are the sole property of **The Dharamsi Morarji Chemical Company Limited (TDMCCL), Plot No. 105 in MIDC Industrial Area, P.O. Dhatav, Taluka: Roha, District: Raigad, State: Maharashtra.** Some of the products, reactions and process methodologies may be patented.

The style and format of this EIA Report as well as the data, processing and presentations of various environmental features, environmental management planning; designs; drawings; plates; calculations, demonstrations on attributes towards pollution control and abatement aspects etc. are the intellectual property of **M/s. Equinox Environments (India) Pvt. Ltd. (EEIPL); Kolhapur.**

Under no circumstances, any part of this report may be used; reproduced; translated; recorded or copied in any form and manner except by the Govt. authorities requiring this report for taking decisions, based on details and information provided in same, during the Environmental Clearance procedure carried out as per EIA Notification No. S.O. 1533 (E) dated 14.09.2006 as amended from time to time.

DR. SANGRAM GHUGARE

Chartered Engineer
Chairman & MD
Equinox Environments (India) Pvt. Ltd. (EEIPL); Kolhapur
Environmental and Civil Engineers, Consultants& Analysts
ISO 9001 : 2015 & QCI-NABET accredited Organization

CERTIFICATE

Declaration by Expert contributing to the EIA in respect of proposed expansion of existing commodity chemicals and speciality chemicals manufacturing unit by **"The Dharamsi Morarji Chemical Company Limited (TDMCCL)"** located at Plot No. 105 in MIDC Industrial Area, P.O. Dhatav, Taluka: Roha, District: Raigad, State: Maharashtra.

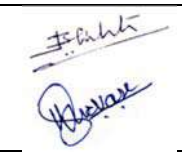
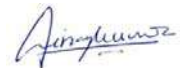
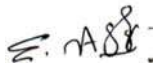
We, hereby, certify that we were a part of the EIA team in the following capacity that developed the above EIA.

- **EIA Outward No.** **P-14-DHARAMSI-CHEMICAL-32018**
- **EIA Coordinator**

1. Name : Prof. (Dr.) Bhaskar N. Thorat 
   : Ms. Sulakshna Ayarekar 
   : Dr. Sangram Ghugare 
2. Period of Involvement : October 2017 - December 2017
3. Contact Information : eia@equinoxenvi.com

Functional Area Expert:

Sr. No.	Functional Areas	Name of the expert/s	Involvement (Period & Task**)	Signature
1	**WP***	Prof. (Dr.) Bhaskar N. Thorat	Refer enclosed Separate sheet	
2	**EB***	Prof.(Dr.) Jay Samant Ms. Sulakshna Ayarekar Dr. Rohan Lad		  
3	**SE***	Dr. Anuradha Samant Mr. Neeraj Powar		

Sr. No.	Functional Areas	Name of the expert/s	Involvement (Period & Task**)	Signature
4	AP*	Dr. Sangram Ghugare Mr. Yuvraj Damugade Dr. Rohan Lad Mr. Sangram Patil		
5	AQ*	Mr. Yuvraj Damugade Ms. Tejal Patil Mr. Sangram Patil		
6	HG*	Dr. J.B. Pishte	Refer enclosed Separate sheet	
7	GEO*	Mr. Vaibhav Survase		
8	SHW*	Mr. Vinay Kumar Kurakula		
9	RH*	Prof. (Dr.) Bhaskar N. Thorat		
10	NV*	Mr. Vinay Kumar Kurakula		
11	LU*			
12	SC	Mr. Balakrishna Lole		

Sr. No.	Functional Areas	Involvement	
		Period	**Task**
1	**WP**	January 2018 – December 2018	1. Detailed study of the production process and operations there under was carried out initially. There under, mass balance of raw materials, intermediates and final products was conducted along with the chemists and experts from the Industry. 2. The different chemical reactions involved in manufacturing were understood and quantification of effluents, emission & residues was done. 3. Overall water budgeting and effluent generation statistics was carried out. Categorization of effluent streams based on characterization done. Based on probable characteristics of the effluents, separation of various effluent streams in the industry (depending up on strengths and flow rates) was done. 4. Verification of water supply source and its adequacy was evaluated. 5. Planning of water quality monitoring in the study area was done and requisite information was provided to the Lab for undertaking the assignment. 6. For the environmental clearance, exercise was done towards preparation of the application, EIA report which included project framing and report preparation in line with policies, guidelines and legislation related to water pollution followed by defending of the project before expert committee at MoEF; for obtaining actual environmental clearance.
2	**EB**	January 2018 - July 2018	1. Planning of survey time table and schedule toward monitoring of ecological & biodiversity status of the study region. 2. Selection of terrestrial and aquatic ecological sites based on criteria namely location of project, likely sources of pollution, wind directions in different seasons and location of water bodies w.r.t their distances from site and direction of flow when applicable, aerial distances of the sampling sites from project. 3. Interaction with local residents for obtaining information about various species of animals and birds usually observed their existence and importance in the study region. 4. Study of terrestrial fauna by sighting, noting pug-marks, calls, sounds, droppings, nests and burrows etc. 5. Collection of samples from nearby water body for studying the aquatic flora and fauna. 6. Conducting ecological & wildlife surveys and preparation of status reports. 7. Interaction with Govt. offices and agencies for certain secondary data and information pertaining to region specific issues. 8. Review of rules, legislation and criteria towards knowing and understanding inclusion in the study region of any eco-sensitive zones, wild life sanctuaries, reserves etc. 9. Collection, compilation and presentation of the data as well as incorporation of same in to the Draft EIA report.

Sr. No.	Functional Areas	Involvement	
		Period	**Task**
3	**SE**	February 2018 - July 2018	1. Collection of data on socio-economic aspects in study area through surveys. 2. To evaluate the parameters defining socio-economic conditions of the population. 3. Analysis of the identified social attributes like population distribution, availability of public utilities etc. through secondary sources and literature like district census handbook. 4. Public opinions and recording of events for future industrialization in the study area. 5. Collection of socio-economic data from secondary sources like taluka offices, Collectorate, agriculture dept. irrigation dept., central ground water board etc. 6. Compilation of primary and secondary data and its inclusion in EIA report. 7. Study of sociological aspects like human settlement, demographic and infrastructural facilities available in study area.
4	**AP**	December 2018 - December 2018	1. Involved in detailed study of mass balance w.r.t. raw materials & products especially from view point of process emissions. 2. Different emissions were analyzed and line of action to control them was decided. Accordingly, along with interaction with the process experts from the industry scrubber types and media were decided. 3. Also, solvent recovery plant/system was given a priority thought from pollution control and economy point of views. 4. Carried out study of the type and capacity of the boiler and its operations including type and nature of the fuels to be used. Accordingly, composition of probable stack emissions & their control measures were thought of. 5. Planning and designing of APC equipment / systems was done from viewpoints of efficiencies, capital as well as O & M cost & suitability.
5	**AQ**	February 2018 - December 2018	1. Designing of Ambient AQM network for use in prediction modeling and micro metrological data development 2. Sec. metrological data collection 3. Development and application of air quality models in prediction of pollutant dispersion,
6	**HG**	February 2018 - July 2018	1. Collection, analysis and evaluation of data pertaining to surface hydrology of the region. Hydrogeological studies, data processing; analysis and evaluation, Ground water table measurement and monitoring network methodology preparation. 2. Planning and scheduling of groundwater sampling stations in the region. 3. Computation of ground water recharge, flow rates and allied data. 4. Determination of impact of withdrawal of groundwater. Studies w.r.t. artificial recharge and rainwater harvesting. Contribution to the EIA report preparation.
7	**GEO**	February 2018 - July 2018	1. Study of geology & general geological configuration of the region as well as sub-surface geology. Ancillary studies and data analysis w.r.t. demography, climatic conditions, land uses and soils 2. Geological and geo-morphological analysis and evaluation. Preparation of drainage map , geo-morphological map, Stratigraphy and lithology studies. Evaluation and analysis of preliminary geological explorations in the region including

Sr. No.	Functional Areas	Involvement	
		Period	Task
			study of structural, physical & Indian geology.
8	**SHW**	February 2018 - June 2018	1. Under SHW study, mass balance of raw materials and products' was checked and verified thoroughly. It included detailed study of process operations under proposed manufacturing activities. Further, a detailed survey of manufacturing operations including their mass balance analysis was conducted through actual site visits and interactions with experts from the industry. This being commodity chemicals and speciality chemicals manufacturing unit involved in all the manufacturing were studied in detailed manner. 2. Solid wastes generation in different steps of manufacturing was identified and their quantification done was checked. 3. Identification of various hazardous wastes generated through manufacturing process, their quantification categorically was done through study of process reactions. 4. Verification was done towards the practices of storage and disposal of HW under proposed facility which included checked of the steps towards procurement of CHWTSDF memberships, maintain of records of the waste generation and forwarding to the disposal facility, notices and directions received from MPCB in this regard. Also it was checked that the planning towards handling of these wastes and their storage were done as per CPCB and MoEF guidelines. 5. The dedicated areas demarked and developed in the industrial premises for HW were checked for their adequacy and functional sufficiency. 6. Had an interaction with process people and management towards possibilities of recycling and reuse of solid wastes in order to reduce their quantities which included study of planning, collection and segregation methodologies.
9	**RH**	February 2018 - June 2018	1. All the necessary literature for processes storage of hazardous chemicals for proposed was studied before visit. 2. A walk through survey of the entire proposed hazardous areas was done. 3. Company has prepared HAZOP report for processes. Suggested to carry of similar HAZOP studies for all new production plants and implement recommendations to minimize risk of accident due to process upsets. 4. Verification of adequacy of on-site emergency preparedness plan for proposed unit. 5. Identification of probable emergencies and procedures for preparedness for handling the same was verified. 6. Adequacy of proposed setup for higher production was guaranteed by the client. 7. Adequacy of disaster management plan prepared was checked. 8. It was suggested to carry out quantities risk analysis.
10	**NV**	February 2018 - June 2018	1. Detail study of manufacturing process and identification of probable noise and vibration sources was done. In proposed unit, prominently the noise sources were production plant, boiler area. Also, DG set was one of such locations having high potential for noise. 2. Verification of noise levels Monitoring (both work zone and ambient) in the industrial premises and study region done by the Lab team during primary data generation for EIA.

Sr. No.	Functional Areas	Involvement	
		Period	**Task**
			3. Verification of Planning and designing of noise attenuation measures. Apart from the separation, insulation, isolation techniques implemented in-hose, outside measures like planning, designing and implementation of Green Belt was done. Therein, plants having prominent role in noise attenuation were implemented. 4. Site visit was done for verification of sampling locations, ambient noise monitoring stations and the data collected 5. Evaluation of impact of noise sources on surrounding community especially in light of – (a) characteristics of noise sources (instantaneous, intermittent or continuous), (b) the time of day at which noise occurs, (c) the location of noise w.r.t. noise sensitive land use implemented.
11	**LU**	February 2018 - June 2018	1. Land use land cover mapping using NRSC Satellite image, 2. Satellite image processing, Image classification, Technical analysis and study for setting up of facility, planning of storage facility.
12	**SC**	February 2018 - June 2018	1. Involvement physical analysis & characterization of the soils. 2. Assessment of fertility and productivity of soils in the region. 3. Evaluation / prediction of impacts on soils due to various liquid, gaseous & solid pollutants. 4. Studies w.r.t. soil salinity & reclamation management in the region. 5. Interpretation of soil analysis, results and data including comparison of same with standard soil classification. 6. Collection, study and evaluation of soil information from data obtained from secondary sources & its interpretation.

Declaration by the Head of the Accredited Consultant Organization/authorized person.

I, **Dr. Sangram Ghugare**, hereby confirm that the above mentioned experts prepared the final EIA in respect of proposed expansion of existing commodity chemicals and speciality chemicals manufacturing unit by **"The Dharamsi Morarji Chemical Company Limited (TDMCCL)"** located at Plot No. 105 in MIDC Industrial Area, P.O. Dhatav, Taluka: Roha, District: Raigad, State: Maharashtra.

I also confirm that the consultant organization shall be fully accountable for any mis-leading information mentioned in this statement.

Signature: 

Name: Dr. Sangram Ghugare

Designation: Chairman & MD

Name of the EIA Consultant Organization: M/s. Equinox Environments (I) Pvt. Ltd. (EEIPL); Kolhapur.

NABET Certificate No. & Issue Date: NABET/EIA/1518/RA 0050 , May 29, 2017

ABBREVIATIONS

AAQM	Ambient Air Quality Monitoring
AGL	Above Ground Level
ARL	Above Roof Level
AP	Air Pollution
AM	Arithmetic Mean
AQ	Air Quality
ALOHA	Areal Locations of Hazardous Atmospheres
ACGIH	American Conference Government of Industrial Hygienists
APC	Air Pollution Control
BRICS	Brazil, Russia, India, China and South Africa
BIS	Bureau of Indian Standards
BOD	Biochemical Oxygen Demand
BEES	Battelle Environmental Evaluation System
CAGR	Compound Annual Growth Rate
CCE	Chemistry And Chemical Engineering
CGWB	Central Ground Water Board
CMD	Cubic Meter per Day
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CEC	Cation Exchange Capacity
COD	Chemical Oxygen Demand
CPCB	Central Pollution Control Board
CHWTSDF	Common Hazardous Waste Treatment, Storage & Disposal Facility
CREP	Corporate Responsibility For Environmental Protection
CER	Corporate Environment Responsibility
CETP	Common Effluent Treatment Plant
CTE	Consent to Establish
CTO	Consent to Operate
CWC	Central Water Commission
dB (A)	Decibel (Ambient)
DG	Diesel Generator
DIRD	Directorate of Irrigation Research and Development
DO	Dissolved Oxygen
ESC	Enterprise Social Commitment
EAC	Expert Appraisal Committee
EB	Ecology And Biodiversity
EC	Electrical conductivity
EC	Environmental Clearance
ESA	Ecologically Sensitive Area
EEIPL	Equinox Environments (India) Private Limited
EIA	Environmental Impact Assessment
EMC	Environmental Management Cell
EMP	Environmental Management Plan
EPA	Environmental Protection Act
EHS	Environment, health and safety
ETP	Effluent Treatment Plant
FO	Furnace Oil
FAE	Functional Area Expert

FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GPS	Global Positioning System
GC	Gas Chromatography
GEO	Geology
GMP	Good Management Practice
GSDA	Ground Water Surveys and Development Agency
HVS	High Volume Air Sampler
HG-GEO	Hydro Geology and Geology
HAZOP	Hazard and Operability Study
HIRA	Hazard Identification and Risk Analysis
HDPE	High Density Polyethylene
HSD	High Speed Diesel
IAEC	Indian Atomic Energy Commission
IMD	India Metrological Department
IRS	Indian Remote Sensing
IS	Indian Standards
IDLH	Immediately Dangerous to Life or Health
ISO	International Organization For Standardization
KL	Kilo Liter
KLPD	Kilo Liter per Day
KVA	Kilo Volt Ampere
LC	Land Cover
LDO	Light Diesel Oil
LU	Land Use
LUP	Land Use Planning
MSEDCL	Maharashtra State Electricity Distribution Company Limited
MSEB	Maharashtra State Electricity Board
MSDS	Material Safety Data Sheet
MIDC	Maharashtra Industrial Development Corporation
MoU	Memorandum of understanding
MEE	Multiple Effective Evaporator
MoEFCC	Ministry of Environment, Forest and Climate Change
MPCB	Maharashtra Pollution Control Board
MCLS	Maximum Credible Loss Scenario
MSL	Mean Sea Level
MT	Metric Tone
MS	Mild Steel
N	North
NPC	Noise Pollution Control
NAAQS	National Ambient Air Quality Standards
NW	North - West
NFPA	National Fire Protection Association
NO_x	Oxides of Nitrogen
NTU	Nephelometric Turbidity Unit
NBSS	National Bureau of Soil Survey
NV	Noise and Vibration
OHS	Occupational Health Hazards and Safety
OHC	Occupational Health Center
O&M	Operation and Maintenance

OHSAS	Occupational Health and Safety Assessment Series
OSHA	Occupational Safety and Health Administration
PM	Particulate Matter
PEL	Permissible Exposure level
PHA	Preliminary Hazard Analysis
PHA	Process Hazard Analysis
PPE	Personal Protective Equipment
PP	Project Proponent
R&R	Rehabilitation and Resettlement
R&D	Research and Development
SSP	Single Superphosphate
SEIAA	State Environment Impact Assessment Authority
SPCB	State Pollution Control Board
SC	Soil conservation
SE	Socio - Economics
SHW	Solid and Hazardous Waste
SAR	Sodium Adsorption ratio
SO_2	Sulphur Dioxide
SPM	Suspended Particulate Matter
SS	Suspended Solids
STP	Sewage Treatment Plant
SOP	Standard Operating Procedure
SW	South - west
TDMCCL	The Dharamsi Morarji Chemical Company Limited
TG	Turbo Generator
TDS	Total Dissolved Solids
TFH	Thermic Fluid Heater
ToR	Terms of Reference
TPH	Tones Per Hour
USEPA	US Environmental Protection Agency
VOC	Volatile organic component
WPC	Water Pollution Control
WHC	Water Holding Capacity
W	West
ZLD	Zero Liquid Discharge

CONFIGURATION OF REPORT

Chapter 1 - Introduction

This chapter is an introductory chapter, presenting the background information of the project, its location, objective of the project and scope of the study and documentation.

Chapter 2 - Project Description

This chapter deals with the technology and process to be used for the proposed expansion project. It also deals with the sources of pollution and mitigation measures under existing and expansion activity.

Chapter 3 - Description of the Environment

In this chapter the study of various attributes of environment such as Air, Water, Noise, Soil, Land Use Pattern, Geology, Hydro-geology and Ecology is carried out so as to know the existing environmental status. Also, the present social status is discussed to know if there are any sensitive issues in the area.

Chapter 4 - Anticipated Environmental Impacts and Mitigation Measures

This chapter presents the conclusion drawn by studying the impact considering both the pre - project and post - project scenario. It describes the sum impact of the proposed expansion project and mitigation measures for abatement of the pollution.

Chapter 5 - Analysis of Alternatives

Various alternatives in terms of site selection and technology to be used are discussed in this chapter and the environment friendly and best suited technology is selected for the expansion project.

Chapter 6 - Environmental Monitoring Program

This chapter deals with the planning of Environmental Monitoring Program both during construction phase and operational phase to assess the performance of pollution control equipments to be installed.

Chapter 7 - Additional Studies

This chapter illustrates the possible risk area under the proposed expansion project and the safety and disaster management plan prepared to mitigate the same.

Chapter 8 - Project Benefits

This chapter describes the predictable benefits due to proposed expansion project of commodity chemicals and speciality chemicals manufacturing unit.

Chapter 9 - Environment Management Plan

This chapter deals with the protection and mitigation measures for abatement of pollution after execution of the project. It also deals with the roles and responsibilities of the environmental management cell for proper implementation of the Environmental Management Plan.

Chapter 10 - Summary and Conclusion

This chapter summarizes the conclusion of the EIA report.

Chapter 11 - Disclosure of Consultants Engaged

In this chapter the name and brief resume of the consultant organization engaged in preparation of the EIA report is presented.

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LIST OF FIGURES

Chapter 1

INTRODUCTION

1.1 INTRODUCTION

'Environmental Impact Assessment (EIA)' is the process of evaluating likely environmental impacts, both positive and negative, of a new or expansion project by taking into account natural, social and economic aspects. It also comprises of suggesting possible mitigation measures, for the negative impacts, before implementation of the project. The main objectives of an EIA report are -

- To describe a pre-project baseline condition with respect to Environmental Indicators.
- To identify possible sources of pollution and their environmental impacts including identifying risks associated with setting up of a new /expansion project and suggesting appropriate mitigation measures for alleviating adverse impacts to the extent possible.
- To suggest environmental / risk management plans for implementing the mitigation measures.
- The ultimate aim of the EIA report preparation is that the project proponent (PP) can use this report as a manual for developing company's environmental strategy, communication and formulating environmental policy.

1.2 THE PROJECT & PROPONENTS

The Dharamsi Morarji Chemical Company Limited (TDMCCL) headquartered in Mumbai (India), is an ISO 9001:2008 certified organization. **Established in 1919**, TDMCCL was the first producer of Sulphuric Acid and Phosphate fertilizers in India. Over the years, the brand of the Company ("Ship") came to be recognized as the quality standard for Single Superphosphate (SSP). Today, TDMCCL is one of the leading chemical companies in India. A company with innovative products and focus on specialty chemicals. With focused Research and Development (R&D) efforts, processes for downstream sulphur-based chemicals were commercialized. What is visible now is a culmination of efforts by the entire team sustainable performance with zero dependence on Government policy, net foreign exchange earnings, and sales to over 25 countries in 5 continents. TDMCCL offers customized products and thoughtful solutions to our global customers.

The Proposed expansion project - The Dharamsi Morarji Chemical Company Limited (TDMCCL) is located at Plot No. 105 in MIDC Industrial Area, P.O. Dhatav, Taluka: Roha, District: Raigad, State: Maharashtra.

This report is made in the overall context of Environmental Impact Assessment (EIA) Notification No. S. O. 1533 (E) dated 14.09.2006 and amendments thereto issued by the Ministry of Environment, Forest and Climate Change (MoEFCC); New Delhi. As per the said notification the project comes under Category B, listed at item 5 (f). In light of draft notifications dated 10.03.2014, 04.09.2015, 27.02.2017 and 03.10.2018 in respect of ESA (Ecologically Sensitive Area) of Western Ghats and due to applicability of general conditions, the category of the project change from ***Category "B"*** **to** ***Category "A"*****.** The EIA report is prepared by incorporating required information with regards to the project as mentioned in the Standard Terms of Reference (ToR) issued by MoEFCC, New Delhi vide letter No. IA-J-11011/74/2018-IA-II (I) to TDMCCL on 3rd May 2018.

Table 1.1 Promoter of TDMCCL

Sr. No.	Name	Designation
1.	Mr. Laxmikumar Narottam Goculdas	Chairman
2.	Mr. Haridas Tricumdas Kapadia	Director
3.	Mr. Madhu Thakorlal Ankleshwaria	Director
4.	Mr. Arvind Wasudeo Ketkar	Director
5.	Ms. Mitika Laxmikumar Goculdas	Director

1.3 ACHIEVEMENTS OF TDMCCL

TDMCCL have been honored by -

- Indian Chemical Council (ICC) granted permission to TDMCCL for use of Responsible Care Logo, for a period of one year from August, 2016 to July, 2017.
- Indian Chemical Council (ICC) awarded Certificate of Merit to TDMCCL for Water Resource Management in Chemical Industry on 30th September, 2015.
- Indian Chemical Council (ICC) awarded Certificate of Merit to TDMCCL for Efficient Waste Management in Chemical Industry on 30th September, 2016.

1.4 THE PLACE

The proposed expansion will be carried out at existing set up of TDMCCL. Total plot area acquired by TDMCCL **88355 m^2** (**8.84 Ha**), the total built up area is **40925 m^2** (4.09 Ha). For more details about area break-up refer **Chapter - 2 (Table 2.3)**. (Refer **Figure 1.1 and Figure 1.2**)

1.5 PROJECT IMPORTANCE TO THE COUNTRY & REGION

- Every business needs to reconcile innovative technologies and novel products to achieve sustainability, stability and to set new horizons.
- These new products and processes are outcome of the intellect, hardship and integrity of in-house built R&D team.
- This project will provide additional employment for the local communities.
- The additional monetary gains to the organization will provide opportunity for the implementation of corporate social activities. This will result into overall improvement of the standard of living of the society.
- As all the processes are environment friendly, it will help in conservation of natural resources and environment protection.
- Some of the products are import substitutes. Hence, it will contribute in saving of foreign exchange.
- Some of the products will attract additional export business which will boost the chemical sector and economy.
- Amongst the proposed products, some are pharmaceutical intermediates which will contribute and support growth of the healthcare sector.
- This project will provide additional business to the supporting commercial enterprises.
- This project will improve the overall growth and sustainability of the organization, which in turn contribute to the Gross Domestic Product (GDP) of our country.

Figure 1.1 Location of the Project Site

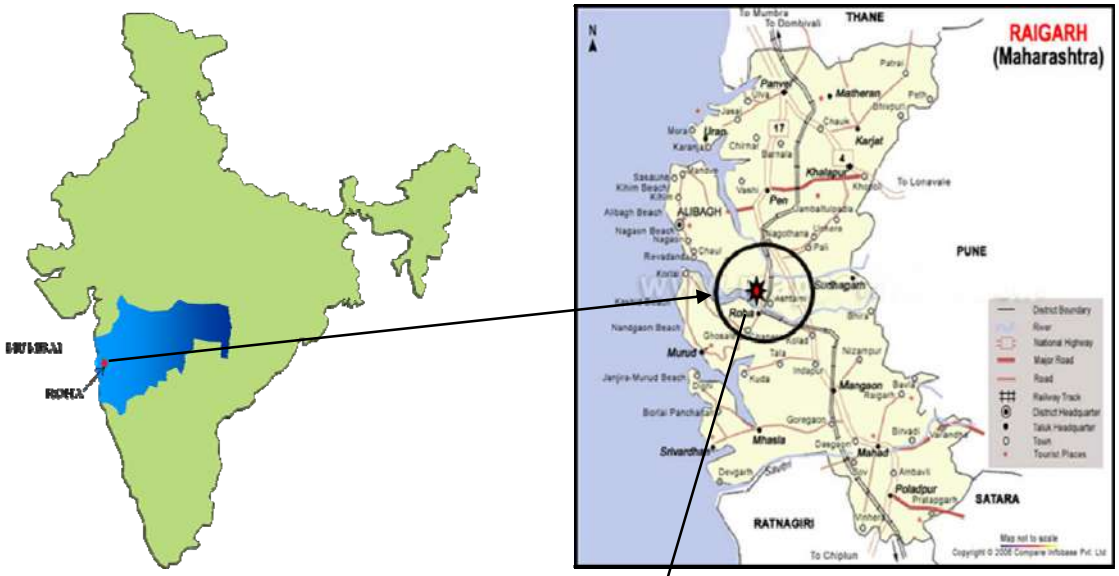


Figure 1.2 Expansion Project Site

18°25'33.00" N Latitude, 73°08'31.41" E Longitude

1.6 SCOPE OF THE STUDY

1.6.1 Details of Regulatory Scoping carried out as per Terms of Reference

The TDMCCL has submitted a duly filled online Form-I application to MoEFCC, New Delhi on 27.02.2018 for grant of Terms of Reference (ToR). This EIA report has been complied with the Standard ToR issued by the MoEFCC. The summarized details of same are provided in following table -

Table 1.2 Summary with the Terms of Reference

Sr. No.		List of ToR's	Compliance
A		**Standard Terms of Reference**	
1.		**Executive Summary**	Refer Chapter 10, Pages 222-231
2.		**Introduction**	
	i.	Details of the EIA Consultant including NABET accreditation.	Refer Chapter 11, Pages 232-241
	ii.	Information about the project proponent.	Refer Chapter 1, Table 1.1 Pages 1-2
	iii.	Importance and benefits of the project.	Refer Chapter 1, Section 1.5, Page 2-3 Refer Chapter 8, Pages 212-213
3.		**Project Description**	
	i.	Cost of project and time of completion.	Capital investment for proposed expansion of existing commodity chemicals and speciality chemicals manufacturing unit is Rs. 10.00 Crores. For more details, Refer Chapter 2, Section 2.5, Table 2.4, Page 22, Section 2.5.1 Table 2.5, Page 22
	ii.	Products with capacities for the proposed project.	Refer Chapter 2, Section 2.6.3, Table 2.17, Pages 33-34
	iii.	If expansion project, details of existing products with capacities and whether adequate land is available for expansion, reference of earlier EC if any.	Refer Chapter 2, Section 2.6.3, Table 2.17, Pages 33-34 Refer **Appendix - B** for existing Consent Orders, Pages 256-279
	iv.	List of raw materials required and their source along with mode of transportation.	Refer Chapter 2, Section 2.6.3.1, Table 2.18, Pages 34-35, Section 2.7.2.2, Table 2.27, Pages 46
	v.	Other chemicals and materials required with quantities and storage capacities.	Refer Chapter 7, Section 7.8.6, Table 7.6 Pages 195-196**,** **Appendix - E** for product wise raw materials, Pages 305-394
	vi.	Details of Emission, effluents, hazardous waste generation and their management.	Refer Chapter 2, Effluent Details - Section 2.7.1.2, Table 2.22, Page

Sr. No.		List of ToR's	Compliance
			39, Emission Details - Section 2.7.2, Table 2.25, Page 45, Hazardous waste generation & management - Section 2.7.4 Pages 48-50
	vii.	Requirement of water, power, with source of supply, status of approval, water balance diagram, man-power requirement (regular and contract).	Refer Chapter 2, Section 2.7.1.1, Pages 38-39 (Water consumption), Section 2.6.1, Pages 22-23 (Electricity requirement), Section 2.2.1, Pages 18-19 (Manpower), **Appendix - G**, Pages 396-412 (status of approval for water), **Enclosure - II**, Pages 250-254 (status of approval for electricity)
	viii.	Process description along with major equipments and machineries, process flow sheet (quantative) from raw material to products to be provided.	Refer Chapter 2, Section 2.6.2, Table 2.7 to Table 2.16, Pages 25-32 (List of Equipment), **Appendix - E**, Pages 305-394 (Process description, process flow sheet (quantative))
	ix.	Hazard identification and details of proposed safety systems.	Refer Chapter - 7, Section 7.6 to 7.8, Pages 185-201
	x.	Expansion/modernization proposals:	
	c.	Copy of all the Environmental Clearance (s) including Amendments thereto obtained for the project from MOEF/SEIAA shall be attached as an Annexure. A certified copy of the latest Monitoring Report of the Regional Office of the Ministry of Environment and Forests as per circular dated 30th May, 2012 on the status of compliance of conditions stipulated in all the existing environmental clearances including Amendments shall be provided. In addition, status of compliance of Consent to Operate for the ongoing / existing operation of the project from SPCB shall be attached with the EIA-EMP report.	The plot of TDMCCL in MIDC Dhatav, Taluka: Roha, District: Raigad was procured in **year 1976** on which existing unit of TDMCCL is established**.** Subsequently, **t**he existing unit was **commissioned in year 1978**. Therefore, it is observed that establishment of existing unit of TDMCCL in MIDC Dhatav is well before the "EIA Notification No. S.O. 60 (E) dated 27.01.1994 and "EIA Notification No. S.O. 1533 (E) dated 14.09.2006 published by MoEFCC. In light of fact presented above, it could be seen that, the existing unit did not attract the condition for procurement of Environmental Clearance (EC) and hence only MPCB

Sr. No.		List of ToR's	Compliance
			consent was procured in case of TDMCCL. Recent Consent to Operate (CTO) is procured from Maharashtra Pollution Control Board (MPCB) in the year 2015 vide Consent order No. Formate 1.0 / BO / CAC - Cell / EIC No RD - 2952 - 15 / 28th CAC / 4541 dated 21.04.2015. Refer **Appendix** - B copy of Consent to Operate (CTO) issued by MPCB, Pages 256-279
	d.	In case the existing project has not obtained environmental clearance, reasons for not taking EC under the provisions of the EIA Notification 1994 and / or EIA Notification 2006 shall be provided. Copies of Consent to Establish / No Objection Certificate and Consent to Operate (in case of units operating prior to EIA Notification 2006, CTE and CTO of FY 2005-2006) obtained from the SPCB shall be submitted. Further, compliance report to the conditions of consents from the SPCB shall be submitted.	The plot of TDMCCL in MIDC Dhatav, Taluka: Roha, District: Raigad was procured in **year 1976** on which existing unit of TDMCCL is established**.** Subsequently, **t**he existing unit was **commissioned in year 1978**. Therefore, it is observed that establishment of existing unit of TDMCCL in MIDC Dhatav is well before the "EIA Notification No. S.O. 60 (E) dated 27.01.1994 and "EIA Notification No. S.O. 1533 (E) dated 14.09.2006 published by MoEFCC. In light of fact presented above, it could be seen that, the existing unit did not attract the condition for procurement of Environmental Clearance (EC) and hence only MPCB consent was procured in case of TDMCCL. Recent Consent to Operate (CTO) is procured from Maharashtra Pollution Control Board (MPCB) in the year 2015 vide Consent order No. Formate 1.0 / BO / CAC - Cell / EIC No RD - 2952 - 15 / 28th CAC / 4541 dated

Sr. No.		List of ToR's	Compliance
			21.04.2015. Refer **Appendix - B** copy of Consent to Operate (CTO) issued by MPCB, Pages 256-279, **Appendix - B** Consent compliance report issued by MPCB, Pages 256-279
4.		**Site Details**	
	i.	Location of the project site covering village, Taluka / Tehsil, District and State, Justification for selecting the site, whether other sites were considered.	The proposed expansion of commodity chemicals and speciality chemicals will be conducted under existing unit of TDMCCL. No any other site is considered for expansion project. Refer Chapter 2, Section 2.3, Pages 19-21
	ii.	A toposheet of the study area of radius of 10 km and site location on 1:50,000 /1:25,000 scale on an A3/A2 sheet. (including all eco-sensitive areas and environmentally sensitive places)	Refer Chapter 3, Figure 3.5 for Toposheet on Page 62
	iii.	Details w.r.t. option analysis for selection of site.	As the expansion of commodity chemicals and speciality chemicals will be conducted under existing premises of TDMCCL. Industry has sufficient land for expansion and hence no any alternative sites were considered.
	iv.	Co-ordinates (lat-long) of all four corners of the site.	(i) 18°25'29.92"N 73° 8'41.55"E (ii) 18°25'23.89"N 73° 8'38.04"E (iii) 18°25'33.98"N 73° 8'25.67"E (iv) 18°25'37.87"N 73° 8'26.89"E (v) 18°25'38.44"N 73° 8'31.33"E (vi) 18°25'36.93"N 73° 8'35.37"E (vii) 18°25'32.63"N 73° 8'33.51"E
	v.	Google map-Earth downloaded of the project site.	Refer Chapter 3, Figure 3.1, Page 58

Sr. No.		List of ToR's	Compliance
	vi.	Layout maps indicating existing unit as well as proposed unit indicating storage area, plant area, greenbelt area, utilities etc. If located within an Industrial area / Estate / Complex, layout of Industrial Area indicating location of unit within the Industrial area / Estate.	Refer **Appendix - A** for plot layout, Page 255
	vii.	Photographs of the proposed and existing (if applicable) plant site. If existing, show photographs of plantation / greenbelt, in particular.	Refer Chapter 1, Figure 1.2, Page 3, Refer Chapter 2, Figure 2.1, Page 24, Refer Chapter 2, Figure 2.7, Page 54
	viii.	Landuse break-up of total land of the project site (identified and acquired), government / private - agricultural, forest, wasteland, water bodies, settlements etc. shall be included. (not required for industrial area)	Refer Chapter 3, Section 3.3.4, Pages 64-67
	ix.	A list of major industries with name and type within study area (10 km radius) shall be incorporated. Land use details of the study area.	Refer Chapter 3, Section 3.2.2, Table 3.2, Page 56
	x.	Geological features and Geo-hydrological status of the study area shall be included.	Refer Chapter 3, Section 3.6, Pages 83-91
	xi.	Details of Drainage of the project up to 5 km radius of study area. If the site is within 1 km radius of any major river, peak and lean season river discharge as well as flood occurrence frequency based on peak rainfall data of the past 30 years. Details of Flood Level of the project site and maximum Flood Level of the river shall also be provided. (mega green field projects)	Refer Chapter 3, Section 3.5, Pages 81-83
	xii.	Status of acquisition of land. If acquisition is not complete, stage of the acquisition process and expected time of complete possession of the land.	Not Applicable
	xiii.	R&R details in respect of land in line with state Government policy.	Not Applicable
5.		**Forest and wildlife related issues (if applicable):**	

Sr. No.		List of ToR's	Compliance
	i.	Permission and approval for the use of forest land (forestry clearance), if any, and recommendations of the State Forest Department. (if applicable)	Not Applicable
	ii.	Landuse map based on High resolution satellite imagery (GPS) of the proposed site delineating the forestland *(in case of projects involving forest land more than 40 ha)*	Not Applicable
	iii.	Status of Application submitted for obtaining the stage I forestry clearance along with latest status shall be submitted.	Not Applicable
	iv.	The projects to be located within 10 km of the National Parks, Sanctuaries, Biosphere Reserves, Migratory Corridors of Wild Animals, the project proponent shall submit the map duly authenticated by Chief Wildlife Warden showing these features vis-à-vis the project location and the recommendations or comments of the Chief Wildlife Warden-thereon.	Not Applicable
	v.	Wildlife Conservation Plan duly authenticated by the Chief Wildlife Warden of the State Government for conservation of Schedule I fauna, if any exists in the study area.	Not Applicable
	vi.	Copy of application submitted for clearance under the Wildlife (Protection) Act, 1972, to the Standing Committee of the National Board for Wildlife.	Not Applicable
6.		**Environmental Status**	
	i.	Determination of atmospheric inversion level at the project site and site-specific micrometeorological data using temperature, relative humidity, hourly wind speed and direction and rainfall.	By using meteorological data the windrose have been plot. The same are reflected in chapter 4, section 4.3.2.1, Pages 132-136
	ii.	AAQ data (except monsoon) at 8 locations for PM_{10}, $PM_{2.5}$, SO_2, NO_X, CO and other parameters relevant to the project shall be collected. The monitoring stations shall be based CPCB guidelines and take into account the pre-dominant wind direction, population zone and sensitive receptors	Refer Chapter 3, Section 3.8, Pages 93-98

Sr. No.		List of ToR's	Compliance
		including reserved forests.	
	iii.	Raw data of all AAQ measurement for 12 weeks of all stations as per frequency given in the NAQQM Notification of Nov. 2009 along with - min., max., average and 98% values for each of the AAQ parameters from data of all AAQ stations should be provided as an annexure to the EIA Report.	Refer Chapter 3, Section 3.8, Pages 93-98
	iv.	Surface water quality of nearby River (100 m upstream and downstream of discharge point) and other surface drains at eight locations as per CPCB / MoEF&CC guidelines.	Refer Chapter 3, Section 3.9, Pages 99-105
	v.	Whether the site falls near to polluted stretch of river identified by the CPCB / MoEF&CC, if yes give details.	Not Applicable
	vi.	Ground water monitoring at minimum at 8 locations shall be included.	Refer Chapter 3, Section 3.9, Pages 99-105
	vii.	Noise levels monitoring at 8 locations within the study area.	Refer Chapter 3, Section 3.10, Pages 105-109
	viii.	Soil Characteristic as per CPCB guidelines.	Refer Chapter 3, Section 3.4, Pages 68-81
	ix.	Traffic study of the area, type of vehicles, frequency of vehicles for transportation of materials, additional traffic due to proposed project, parking arrangement etc.	Refer Chapter 2, Table 2.26, Page 45, Table 2.27 Page 46
	x.	Detailed description of flora and fauna (terrestrial and aquatic) existing in the study area shall be given with special reference to rare, endemic and endangered species. If Schedule-I fauna are found within the study area, a Wildlife Conservation Plan shall be prepared and furnished.	Refer Chapter 3, Section 3.12, Page 113-120
	xi.	Socio-economic status of the study area.	Refer Chapter 3, Section 3.11, Page 109-113
7.		**Impact and Environment Management Plan**	

Sr. No.		List of ToR's	Compliance
	i.	Assessment of ground level concentration of pollutants from the stack emission based on site-specific meteorological features. In case the project is located on a hilly terrain, the AQIP Modelling shall be done using inputs of the specific terrain characteristics for determining the potential impacts of the project on the AAQ. Cumulative impact of all sources of emissions (including transportation) on the AAQ of the area shall be assessed. Details of the model used and the input data used for modelling shall also be provided. The air quality contours shall be plotted on a location map showing the location of project site, habitation nearby, sensitive receptors, if any.	Refer Chapter 4, Section 4.3.2.1, Pages 132-135
	ii.	Water Quality modelling - in case of discharge in water body.	Refer Chapter 4, Section 4.3.4, Pages 137-142
	iii.	Impact of the transport of the raw materials and end products on the surrounding environment hall be assessed and provided. In this regard, options for transport of raw materials and finished products and wastes (large quantities) by rail or rail-cum road transport or convey or cum- rail transport shall be examined.	Refer Chapter 2, Table 2.26, Page 45, Table 2.27 Page 46
	iv.	A note on treatment of wastewater from different plant operations, extent recycled and reused for different purposes shall be included. Complete scheme of effluent treatment. Characteristics of untreated and treated effluent to meet the prescribed standards of discharge under E (P) Rules.	Refer Chapter 2, Section 2.7.1.2, Pages 39-43, Figure 2.3, Page 42, Figure 2.4, Page 43
	v.	Details of stack emission and action plan for control of emissions to meet standards.	Refer Chapter 2, Section 2.7.2, Pages 44-45, Table 2.25, Page 45
	vi.	Measures for fugitive emission control.	Refer Chapter 2, Section 2.7.2.4, Page 47
	vii.	Details of hazardous waste generation and their storage, utilization and management. Copies of MOU regarding utilization of solid and hazardous waste in cement plant shall also be included. EMP shall include the concept of waste-minimization, recycle / reuse /recover techniques, Energy conservation, and natural resource	Refer Chapter 2, Section 2.7.4, Pages 48-50, **Appendix - I** for CHWTSDF Membership letter, Page - 414

Sr. No.		List of ToR's	Compliance
		conservation.	
	viii.	Proper utilization of fly ash shall be ensured as per Fly Ash Notification, 2009. A detailed plan of action shall be provided.	Not Applicable
	ix.	Action plan for the green belt development plan in 33 % area i.e. land with not less than 1,500 trees per ha. Giving details of species, width of plantation, planning schedule etc. shall be included. The green belt shall be around the project boundary and a scheme for greening of the roads used for the project shall also be incorporated.	Refer Chapter 2, Section 2.9, Page 52
	x.	Action plan for rainwater harvesting measures at plant site shall be submitted to harvest rainwater from the roof tops and storm water drains to recharge the ground water and also to use for the various activities at the project site to conserve fresh water and reduce the water requirement from other sources.	Refer Chapter 2, Section 2.10, Page 52-53
	xi.	Total capital cost and recurring cost / annum for environmental pollution control measures shall be included.	Refer Chapter 2, Section 2.8, Page 52
	xii.	Action plan for post-project environmental monitoring shall be submitted.	Refer Chapter 6, Section 6.7, Pages 179-180
	xiii.	Onsite and Offsite Disaster (natural and Man-made) Preparedness and Emergency Management Plan including Risk Assessment and damage control. Disaster management plan should be linked with District Disaster Management Plan.	Refer Chapter 7, Section 7.12, Pages 210-211, **Appendix - S** for Onsite Emergency Plan, Pages 568-737
8.		**Occupational health**	
	i.	Plan and fund allocation to ensure the occupational health & safety of all contract and casual workers.	Refer Chapter 7, Section 7.10, Pages 209-210

Sr. No.		List of ToR's	Compliance
	ii.	Details of exposure specific health status evaluation of worker. If the workers' health is being evaluated by pre designed format, chest x rays, Audiometry, Spirometry, Vision testing (Far & Near vision, colour vision and any other ocular defect) ECG, during pre placement and periodical examinations give the details of the same. Details regarding last month analyzed data of above mentioned parameters as per age, sex, duration of exposure and department wise.	Refer Chapter 7, Section 7.10, Pages 209-210, **Appendix - R** for Health Check-up Report, Page 668-678
	iii.	Details of existing Occupational & Safety Hazards. What are the exposure levels of hazards and whether they are within Permissible Exposure level (PEL). If these are not within PEL, what measures the company has adopted to keep them within PEL so that health of the workers can be preserved.	Not Applicable
	iv.	Annual report of health status of workers with special reference to Occupational Health and Safety.	Refer Chapter 7, Section 7.10, Pages 209-210, **Appendix - R** for Health Check-up Report, Page 668-678
9.		**Corporate Environment Policy**	
	i.	Does the company have a well laid down Environment Policy approved by its Board of Directors? If so, it may be detailed in the EIA report.	Refer Chapter 9, Pages 214-221
	ii.	Does the Environment Policy prescribe for standard operating process / procedures to bring into focus any infringement / deviation / violation of the environmental or forest norms / conditions? If so, it may be detailed in the EIA.	Not Applicable
	iii.	What is the hierarchical system or Administrative order of the company to deal with the environmental issues and for ensuring compliance with the environmental clearance conditions? Details of this system may be given.	Refer Chapter 9, Section 9.2, Page 214-215

Sr. No.	List of ToR's	Compliance
iv.	Does the company have system of reporting of non compliances / violations of environmental norms to the Board of Directors of the company and / or shareholders or stakeholders at large? This reporting mechanism shall be detailed in the EIA report.	Refer Chapter 9, Pages 214-221
10.	Details regarding infrastructure facilities such as sanitation, fuel, restroom etc. to be provided to the labor force during construction as well as to the casual workers including truck drivers during operation phase.	Not Applicable
11.	Enterprise Social Commitment (ESC)	
i.	Adequate funds (at least 2.5 % of the project cost) shall be earmarked towards the Enterprise Social Commitment based on Public Hearing issues and item-wise details along with time bound action plan shall be included. Socio-economic development activities need to be elaborated upon.	**Rs. 25.00 Lakhs** (2.5 % of Capital Investment - 10.00 Cr.) has been earmarked for CER activities. Refer Chapter 6, Table 6.3, Pages 176-177
12.	Any litigation pending against the project and/or any direction/order passed by any Court of Law against the project, if so, details thereof shall also be included. Has the unit received any notice under the Section 5 of Environment (Protection) Act, 1986 or relevant Sections of Air and Water Acts? If so, details thereof and compliance/ATR to the notice(s) and present status of the case.	Not Applicable
13.	'A tabular chart with index for point wise compliance of above ToR.	Refer Chapter 1, Section 1.6, Pages 4-16
B	**Specific Terms of Reference**	
1.	Details on solvents to be used, measures for solvent recovery and for emissions control.	Refer Chapter 2, Section 2.7.1.3, Page 44
2.	Details of process emissions from the proposed unit and its arrangement to control.	Refer Chapter 2, Section 2.7.2.3, Pages 46-47
3.	Ambient air quality data should include VOC, other process-specific pollutants* like NH_3*, chlorine*, HCl*, HBr*, H_2S*, HF* etc.,(*-as applicable)	Refer Chapter 3, Section 3.8, Pages 93-98

Sr. No.	List of ToR's	Compliance
4.	Work zone monitoring arrangements for hazardous chemicals.	Refer Chapter 6, Section 6.7, Pages 179-180
5.	Detailed effluent treatment scheme including segregation of effluent streams for units adopting 'Zero' liquid discharge.	Refer Chapter 2, Section 2.7.1.2, Pages 39-43, Figure 2.3, Page 42, Figure 2.4, Page 43
6.	Action plan for odour control to be submitted.	Refer Chapter 2, Section 2.7.6, Page 51
7.	A copy of the Memorandum of Understanding signed with cement manufacturers indicating clearly that they co-process organic solid / hazardous waste generated.	Not Applicable
8.	Authorization / Membership for the disposal of liquid effluent in CETP and solid / hazardous waste in TSDF, if any.	Refer Chapter 2, Section 2.7.4, Pages 48-50, **Appendix - I** for CHWTSDF Membership letter, Page - 414
9.	Action plan for utilization of MEE / dryers salts.	Instead of RO / MEE TDMCCL is going to achieve ZLD unit where neutral effluent after primary clarifier shall be feed to the unit. This effluent will be concentrated to about 25 to 30% TDS level and dried further to get solid residue. Heat pump is used to concentrate the effluent by evaporation. Water Vapor is then condensed and recycled. Apart from the electrical energy provided for heating the effluent, heat pump also utilizes the heat released during condensation of water vapor for evaporating the inlet effluent water. This technology is the best example of conservation and effective utilization of energy. The concentrated stream will be subjected for drying in de-moisturizer. The installation and commissioning of this facility will be completed within short period.
10.	Material Safety Data Sheet for all the Chemicals are being used/will be used.	**Appendix - O** for MSDS, Pages 511-551
11.	Authorization / Membership for the disposal of solid / hazardous waste in TSDF.	**Appendix - I** for CHWTSDF Membership letter, Page - 414

Sr. No.	List of ToR's	Compliance
12.	Details of incinerator if to be installed.	Not Applicable
13.	Risk assessment for storage and handling of hazardous chemicals / solvents. Action plan for handling & safety system to be incorporated.	Chapter 7, Section 7.8, Pages 188-201
14.	Arrangements for ensuring health and safety of workers engaged in handling of toxic materials.	Chapter 7, Section 7.8.5, Page 195

Chapter 2

PROJECT DESCRIPTION

2.1 TYPE OF PROJECT

The proposed project by **The Dharamsi Morarji Chemical Company Limited (TDMCCL)** is an expansion project of existing commodity chemicals and speciality chemicals manufacturing unit from 31384 MT/M to 32510 MT/M capacities (**Increase by 1126 MT/M**). The promoters have vast experience in this field and are well aware of the manufacturing processes w.r.t. various products. They have made thorough study of entire project planning as well as implementation schedule.

2.2 NEED FOR THE PROJECT

- **Commercial classification of chemicals** - Chemicals produced by chemical industry can be divided essentially into three broad categories -

  (i) Commodity chemicals or bulk commodities or bulk chemicals - are chemicals produced in large quantities to satisfy global markets and in general their applications can be traced back to their chemical structure; for this reason, two commodities produced by two different suppliers but with the same chemical structure and purity are almost identical and they can be easily interchanged; they are produced by continuous plant and in general their cost is relatively low; examples of chemical commodities are ammonia and ethylene oxide.

  (ii) Speciality chemicals or effect chemicals or specialty chemicals - are constituted by a mixture of different chemical substances, that is designed and produced in order to be applied to a specific application; the formulation of specialities is the result of scientific researches carried out by the producer company, so each formulation and associated properties are unique and for this reason in the majority of the cases it is not possible to easily interchange two different specialities produced by two different suppliers; examples of applications of speciality chemicals are pharmaceuticals industry and agriculture; they are produced by batch plant and in general their cost is higher if compared with commodity chemicals. Speciality chemicals are materials used on the basis of their performance or function hence also termed as "performance" chemicals or "formulation" chemicals. Some of the categories of speciality chemicals are adhesives, agrichemicals, cleaning materials, cosmetic additives, construction chemicals, elastomers, flavors, food additives, fragrances, industrial gases, lubricants, polymers, surfactants and textile auxiliaries. Other industrial sectors such as automotive, aerospace, food, cosmetics, agriculture manufacturing and textiles are highly dependent on such products. **Specialty chemicals often are protected by patents.**

  (iii) Fine chemicals - as the commodity chemicals, they are chemical substances characterized by their chemical structure, but on the contrary of commodity chemicals, they are produced in a small quantity; fine chemicals can be used as components in the formulation of speciality chemicals; for example active ingredients of pharmaceutical drugs are fine chemicals, but the pharmaceutical drug is a speciality chemical; examples of applications of fine chemicals are pharmaceuticals industry, agriculture, photography chemicals and electronic chemicals; they are produced by batch plant and in general their cost is relatively high.

- The global specialty chemicals market is expected to attain a size of $582.3 billion in 2017-18 and is forecasted to reach $782.2 billion by 2023, registering a compound annual growth rate (CAGR) of 5.1% during 2018-2023. The major factors driving the market growth are increasing demand of these chemicals in emerging economies, ongoing technological advancements in the market of these chemicals and increasing penetration of end use industries.

- In the base case scenario, with current initiatives of industry and government, the Indian chemical industry could grow at 11% p.a. by 2017-18. However, the industry could aspire to grow much more and its growth potential is limited only by its aspirations. In such an optimistic scenario, high end-use demand based on increasing per capita consumption, improved export competitiveness and resultant growth impact for each sub-sector of the chemical industry could lead to an overall growth rate of over 15% p.a. by 2017-18 (~6% of global industry). This has a potential for further upside in the future considering India's increasing competitiveness in manufacturing.

- Driven by the rapidly growing population and increasing consumer spending, the specialty chemicals and or commodity chemicals market in emerging economies is expected to witness a good growth in the coming years. The growing middle-class population in these economies and rising industrialization in the fields of food, agriculture, cosmetics and many other manufacturing sectors are creating the demand of these chemicals in emerging economies. BRICS countries such as China, India and Brazil especially, are witnessing increased demand of specialty chemicals.

- For instance, in 2014, India launched 'Make in India' initiative, that has enhanced the competitiveness of the chemical sector in the country, by permitting 100% foreign direct investment (FDI) and de-licensing the manufacturing of most chemicals. All these factors are driving the growth of the specialty chemicals market in emerging economies.

- India has a skilled workforce as well as high managerial and technical competence in comparison to its peers in Asia.

- Cost-efficiency continues to create opportunities for Indian companies in emerging markets andin Asia.

- Hence, considering all and the ever-increasing demand for chemical sectorin India and in abroad as well as changing market conditions for manufacture and sale of products has prompted the promoters to go for expansion of existing commodity chemicals and speciality chemicals.

2.2.1 Employment Generation Potential

The existing project hasprovided employment opportunities to the skilled and semi-skilled local populace, especially in small-scale business and other related services. Following table gives details about the number of workers that have been employed from local area in the existing unit and also man power will be required for expansion activities. Details are as follows -

Table 2.1 Details of Manpower

Sr. No.	Existing		Expansion		Remark
	Unskilled	Skilled	Unskilled	Skilled	
1.	100	85	13	12	Out of total 210 manpower about 75 % are employed from local area
Tot.	185		25		

2.2.2 Export Potential of the Products

As discussed in Chapter-1, in India around 60% of the total commodity chemicals and speciality chemicals produce is exported. There is a good demand for products from manufacturing of commodity chemicals and speciality chemicals, in India as well as abroad. Here, 80% products of TDMCCL would be consumed in Indian market whereas 20% products would be exported.

2.3 PROJECT LOCATION AND SITE SELECTION

The activities under proposed expansion would be carried out in the existing setup of TDMCCL located at Plot No. 105 in MIDC Industrial Area, P.O. Dhatav, Taluka: Roha, District: Raigad. Geographical location of site is 18°25'33.00" N Latitude, 73°08'31.41" E Longitude and falls under the Survey of India Toposheet No.: 47 F2, 47 F3 and Western Ghats Eco-sensitive area (ESA) falling in the state of Maharashtra (1:75000 scale).

Site History : While making selection of site for existing activities of TDMCCL, certain aspects were taken into consideration prominently as-

1. **Availability of water**: Maharashtra Industrial Development Corporation (MIDC) has developed Water Supply Scheme in 1976. The Corporation has taken raw water from Kundalika River, after processing water, the clean water distribute in Industrial Area.
2. **Availability of Electricity**: MIDC has allotted plot to Maharashtra State Electricity Board(MSEB) in which 100/22 KV sub-station has been installed and commissioned.
3. **Availability of Road :** The MIDC has developed road facility in Roha Industrial area. All internal roads approaching the plots are asphalted and streetlight are erected on the road.
4. **Availability of Manpower** :Skilled as well as Unskilled
5. **Availability of Connectivity**:Transport of raw material as well as finished product was easier and economical by all means -
   a. Mode of Transportation By Road: Area is situated on the Roha - Kolad road
      - Nearest State Highway :Nagothana-Pali - Khopoli (SH No. 92) at 10.70 km : Borlai Panchaitan - Mangaon - Tala (SH No. 97) at 25.28 km
      - Nearest National Highway :Panvel - Kanyakumari (NH No. 66) at 8.03 km
   b. Mode of Transportation By Rail:
      - Nearest Railway Station :Roha Railway Stationat 3.04 km
   c. Mode of Transportation By Air:
      - Nearest Airport :Chhatrapati Shivaji International Airport, Mumbai at 79.38 km
      - Pune International Airport, Lohagaon at 82.74 km
   d. Mode of Transportation By Water:
      - Nearest port :Jawaharlal Nehru Port Trust at 55.27 km
6. **Availability of Common Effluent Disposal Facility**:A Common Effluent Disposal Scheme is under construction to make the area eco-friendly. This scheme will be operated

as a joint venture between MIDC and the industries in the area. The Scheme will take care for effluent collection, treatment and disposal.

7. **Availability of Fire Station**: Fire station building been constructed along with firemen's.
8. **Availability ofCommon Facility Centre**: This facility centre houses a post Office and rest house, many other facilities are planned i.e. Grahak Bhandar, Bank of Maharashtra, in the centre.
9. **No rehabilitation and resettlement required** as the site is located in Notified industrial area.
10. **Adequate facility in existing setup** for manufacturing of additional quantity of products.
11. **Residential Facilities**: The Corporation has allotted residential plots to Company for the residential purpose.
12. **Availability of good communication Facilities** : In addition to on route long run buses, the Local routes from Kolad, Mahad, Alibaug, Pen etc. are operated by State Transport (S.T.) through the industrial Area.

Table 2.2 Salient Features of Project Site

No.	Particulars	Details
1.	Name and Address of the Industry	**The Dharamsi Morarji Chemical Company Limited (TDMCCL)** Plot No. 105 in MIDC Industrial Area, P.O. Dhatav, Taluka: Roha, District: Raigad, State: Maharashtra.
2.	Land acquired for the plant	88355 m^2 (8.84 Ha)
3.	Co-ordinates (lat-long) of all four corners of the site	(i) 18°25'29.92"N 73° 8'41.55"E (ii) 18°25'23.89"N 73° 8'38.04"E (iii) 18°25'33.98"N 73° 8'25.67"E (iv) 18°25'37.87"N 73° 8'26.89"E (v) 18°25'38.44"N 73° 8'31.33"E (vi) 18°25'36.93"N 73° 8'35.37"E (vii) 18°25'32.63"N 73° 8'33.51"E
4.	Elevation	11m above Mean sea level(MSL)
5.	Nearest habitation / Schools/ hospitals	Village Roth Budruk at 0.40 km
6.	Nearest city	Roha city at 2.89 km
7.	Nearest highway	(i) Nagothana - Pali - Khopoli (SH No. 92) at 10.70 Km (ii) Borlai Panchaitan - Mangaon - Tala (SH No. 97) at 25.28 km (iii) Panvel - Kanyakumari (NH No. 66) at 8.03 km
8.	Nearest railway station from project site	Roha Railway Station at 3.04km
9.	Nearest airport	(i) Chhatrapati Shivaji International Airport, Mumbai at 79.38 km

No.	Particulars	Details
		(ii) Pune International Airport, Lohagaon at 82.74 km
10.	Nearest tourist places	Nil within 10 km radius
11.	Defense installations	Nil within 10 km radius
12.	Archaeological important place/ Historical Monuments	Nil within 10 km radius
13.	Ecological sensitive zones	Village Dhatav wherein the MIDC is setup have appeared in the list of ESA village of Western Ghats Ecologically Sensitive Area (ESA) Village draft notification dated 10.03.2014, 04.09.2015, 27.02.2017 and 03.10.2018.
14.	Reserved /Protected forest / National Parks/ Wildlife Sanctuary / wetland / estuaries / bioreserves (from Project Site)	1. At a distance of 1.48 km & 1.89 km from the Reserved Forest which was declared under Section 34 of Indian Forest Act, 1878 by Bombay Castle Gazette No. 3F dated 01.03.1879. 2. At a distance of 0.44 km & 0.39 km from the Protected Forest which was declared under Section 28 of the Indian Forest Act No. VII of 1878, as amended by Acts No. V of 1890 and No. V of 1901 by Bombay Government Gazette No. 1963I dated 28.02.1907.
15.	Nearest streams / Rivers / water bodies (from Project Site)	River Kundalika at 1.25 Km

Refer **Figure 2.1** for Photographs of Existing Industrial Setup of TDMCCL.

2.4 DETAILS OF LAND REQUIREMENT

Total land area acquired by the TDMCCL is 8.84 Ha (88355m^2). Out of this, 4.09 Ha (40925m^2) is built up area. Detailed area statement is as follows -

Table 2.3 Project Area Statement

Sr. No.	Description	Area (m^2)
1.	Plant Area (Existing)	10325
2.	Proposed Plants Area	1500
3.	Raw Material and Product Storage Area	6300
4.	Effluent Treatment Plant Area (ETP)	800
5.	Office Building Area	1500
6.	Parking Area (12% of Plot area)	9450
7.	Residential Colony Area	1000
8.	Internal Roads Area	10050
9.	**Total Built up Area** (46.32% of Plot area)	**40925**
10.	**Total Green Belt Area** (33.39% of Plot area)	**29500**
11.	**Open space Area** (20.29% of Plot area)	**17930**
12.	**Total Area**	**88355**

Refer **Appendix - A** for Total Plot Layout Plan of TDMCCL.

2.5 PROJECT OPERATIONS, APPROVALS AND IMPLEMENTATION

Presently, in the existing commodity chemicals and speciality chemicals set up of TDMCCL the products listed under **Table No. 2.17** is being manufactured. The same has been accorded in valid MPCB Consent to Operate (CTO) in the year 2015 vide Consent order No. Formate 1.0 / BO / CAC - Cell / EIC No RD - 2952 - 15 / 28th CAC / 4541 dated 21.04.2015. Refer **Appendix** – **B** for Copy of valid MPCB CTO w.r.t. existing unit of TDMCCL.

The plot of TDMCCL in MIDC Dhatav, Taluka: Roha, District: Raigad was procured in year 1976 on which existing unit of TDMCCL is established**.** Refer **Appendix** – **C** for Land Lease Agreement between MIDC Authority and TDMCCL. Subsequently, the existing unit was commissioned in year 1978. Therefore, it is observed that establishment of existing unit of TDMCCL in MIDC Dhatav is well before the "EIA Notification No. S.O. 60 (E) dated 27.01.1994 and "EIA Notification No. S.O. 1533 (E) dated 14.09.2006 published by MoEFCC.In light of fact presented above, it could be seen that, the existing unit did not attract the condition for procurement of Environmental Clearance (EC) and hence only MPCB consent was procured in case of TDMCCL. Refer copy of CTO issued by MPCB in **year 1997** which was well before the EIA Notification, 2006 enclosed at **Appendix - B**.

The proposed expansion project would be implemented only after procurement of all approvals and permissions namely EC; consents from MPCB, permissions from various other Govt. departments etc. Detailed investment is as follows -

Table 2.4 Investment Details of Project

Sr. No.	Description	Capital Investment (Crs.)
1.	For Existing Unit	84.07
2.	For Expansion	10.00
3.	**Total after Expansion**	**94.07**

2.5.1 Approval and Implementation Schedule

Table 2.5 Expansion Project Implementation Schedule

Sr.No.	Activity	Implementation Schedule
1.	Grant of EC by MoEFCC; New Delhi	February 2019
2.	Application for Consent to Operate from MPCB	March 2019
3.	Trials and Commissioning of plant	March 2019

2.6 TECHNOLOGY AND PROCESS DESCRIPTION

2.6.1 Energy Requirement

The average power supply required to the tune of 27000 KW Hr/Day for the existing unit, presently taken from Maharashtra State Electricity Distribution Company Limited (MSEDCL) and the same would be the source for the proposed expansion activities. The average power supply to the tune of 3000 KW Hr/Day is required for the proposed expansion activities. In case of a power failure, DG sets of 830 KVA, 1310 KVA and 125 KVA are used to provide uninterrupted power supply to emergency facilities.

Solar panels are already installed on site which harvests electricity of 335 KWp per day under existing unit. Management of TDMCCL have planned for harvesting of additional electricity of 100 KWp per day through solar panels to reduce electricity intake from MSEDCL which is in process. The detailed electricity break up is as follows -

Table 2.6 Electricity Break Up

A) Generation of Electricity on site

Source Electricity (KWH)				
Purchased	Generated			Total
	DG	TG	Solar	
611120	6330	203608	15903	**836961**

B) Detail Electricity Break up

Sr. No.	Area of Utilization	Electricity Consumption (KWH)
1.	Sulphuric Acid Plant	320318
2.	Chloro Sulphonic Acid Plant	50534
3.	Benzene Sulphonyl Chloride Plant	139810
4.	Diethyl Sulphate Plant	43144
5.	Sodium Vinyl Sulphamate Plant	184000
6.	Multi Purpose Plant - 1	4500
7.	Multi Purpose Plant - 2	4964
8.	Effluent Treatment Plant	14160
9.	IAEC Boiler	21944
10.	Workshop + Old PCC + Canteen	40082
11.	TG / DG Auxiliary	6062
12.	Transmission Loss	7443
13.	**Total**	**836961**

FIGURE NO. 2.1 - EXISTING INDUSTRIAL VIEW OF THE DHARAMSI MORARJI CHEMICAL COMPANY LTD., MIDC DHATAV, TAL.: ROHA, DIST.: RAIGAD

2.6.2 List of Equipments

Following table represents details about the reactors and equipments under existing as well as proposed activities-

Table 2.7 List of Equipments and Reactors for Sulphuric Acid Plant

No.	Name of Equipment	Quantity	MOC	Capacity/size
1.	Molten Sulphur Pump No.1	1	MS	3.5 m^3/hr
2.	Molten Sulphur Pump No.2	1	MS	3.5 m^3/hr
3.	Turbo Blower	1	MS	30000 Nm^3/hr
4.	DT - Fat Acid Pump	1	Alloy	370 m^3/hr
5.	IPAT Acid Pump	1	Alloy	270 m^3/hr
6.	Acid Cooler Water Pump No.1	1	MS	700 m^3/hr
7.	Acid Cooler Water Pump No.2	1	MS	700 m^3/hr
8.	65% Oleum Tower Pump	1	MS	50 m^3/hr
9.	65% Oleum Cooling Water Pump	1	MS	100 m^3/hr
10.	Booster Tank Pump	1	CF8M	12 m^3/hr
11.	65% Oleum Storage Tank Pump	1	CF8M	12 m^3/hr
12.	23% Oleum Cooling Tower Pump	1	MS	250 m^3/hr
13.	23% Oleum Storage Pump	1	SS	50 m^3/hr
14.	Boiler Feed Water Pump No.1	1	MS	15 m^3/hr
15.	Boiler Feed Water Pump No.2	1	MS	15 m^3/hr
16.	Pump for Vent Scrubber of Storage Tank	1	CF8M	12 m^3/hr
17.	23% Oleum Pump No.1	1	CF8M	240 m^3/hr
18.	23% Oleum Pump No.2	1	CF8M	50 m^3/hr
19.	Sulphur Melter - 1	1	RCC	10 MT/hr
20.	Sulphur Melter - 2	1	NA	NA
21.	Impure Sulphur Tank	1	RCC	10 MT/hr
22.	Impure Sulphur Pump	1	MS	7 m^3/hr
23.	Pre Coat Tank	1	MS Brick Lined	10 MT
24.	Pre Coat TankPump	1	MS	7 m^3/hr
25.	Sulphur Filter	1	MS and SS	10 MT/hr
26.	Molten Sulphur Storage Tank	1	MS Brick Lined	200 MT
27.	Sulphur Burner	1	MS Brick Lined	ϕ 4 m x10.7 m
28.	Auxiliary Blower	1	MS	15000 Nm^3/hr
29.	Drying Tower	1	MS Brick Lined	--
30.	Convertor	1	MS Brick Lined	13.5 MT/hr
31.	Super Heater	1	MS	263 m^2
32.	Hot Heat Exchanger	1	MS	803 m^2
33.	Cold Heat Exchanger	1	MS	1214 m^2
34.	IPAT	1	MS Brick Lined	ϕ 4 m x14 m
35.	Economizer	1	MS	425 m^2
36.	Acid Pump Tank (APT)	1	MS Brick Lined	ϕ 6 m x 2.4 m
37.	Acid Cooler	1	SS316	337 m^2
38.	23% Oleum Storage Tank	1	MS	150MT
39.	Cooling Tower for 98% Acid Cooler	1	Natural Draft	1500 TR
40.	Cooling Tower for 23% Oleum	1	Natural Draft	500 TR
41.	FAT	1	MS Brick Lined	ϕ 3.2 m x11.7m

No.	Name of Equipment	Quantity	MOC	Capacity/size
42.	98% Acid Storage Tank No.1	1	MS	1200 MT
43.	98% Acid Storage Tank No.2	1	MS	1200 MT
44.	98% Acid Storage Tank No.3	1	MS	1200 MT
45.	Battery Acid Tank	1	SS	100 MT
46.	98% S.A. Emergency Tank	1	MS	10 MT
47.	Pump Tank for Lorry Filling	1	CF8M	12 m^3/hr
48.	Pump Tank for Lorry FillingScrubber	1	CF8M	12 m^3/hr
49.	98% Acid Lorry Filling Tank No.1	NA	NA	NA
50.	98% Acid Lorry Filling Tank No.2	NA	NA	NA
51.	Alkali Scrubber	1	MS Rubber Lined	ϕ 2m x 9.6m
52.	Alkali Scrubber Pump	1	CF8M	50 m^3/hr
53.	SO_3 Condenser	1	MS	240 m^2
54.	SO_3 Generator	1	MS	80 MTPD
55.	SO_3 Storage Tank	1	MS	5MT
56.	SO_3 Mixer	1	MS	2MT
57.	SO_3 Lorry Filling Tank	1	MS	5MT
58.	65% Oleum Storage Tank (Capsule Type 150 MT cap.)	1	MS	150 MT
59.	65% Oleum Lorry Filling Tank	1	MS	10 MT
60.	65% Oleum Heat Exchanger	1	SS Tube	--
61.	65% Oleum Tower	1	MS	2 MT/hr
62.	23% Oleum Tower	1	MS	ϕ 4m x 11.6m
63.	23% Oleum Heat Exchanger	1	SS Tube	--
64.	23% Oleum Storage Tank	1	MS	150 MT
65.	23% Oleum Lorry Filling Tank	NA	NA	NA
66.	Vent Scrubber for 23% and 65% Oleum (on APT)	1	SS	ϕ 0.4m x 1.5m
67.	Instrument Compressor	1	MS	100 CFM
68.	Raw Water Pump No.1	1	MS	29 m^3/hr
69.	Raw Water Pump No.2	1	MS	29 m^3/hr
70.	Cation Vessel	2	MS	1 KL
71.	Anion Vessel	2	MS	1 KL
72.	Mixed Bed Vessel	2	MS	1 KL
73.	Condensate Water Pump No.1	1	MS	28 m^3/hr
74.	Condensate Water Pump No.2	1	MS	28 m^3/hr
75.	LP Dosing Pump No.1	1	SS	1 kg/cm^2 g
76.	LP Dosing Pump No.2	1	SS	1 kg/cm^2 g
77.	HP Dosing Pump No.1	1	SS	40 kg/cm^2 g
78.	HP Dosing Pump No.2	1	SS	40 kg/cm^2 g
79.	DG Set No - 310 KVA	1	MS	310 KVA
80.	DG Set No- 830 KVA	1	MS	830 KVA
81.	External Cooling Water Pump	1	CI	50 m^3/hr
82.	Internal Cooling Water Pump	1	CI	65 m^3/hr
83.	Caustic Lye Tank	1	MS	5 KL
84.	Melter Agitator Gearbox	1	PB	15:1 Ratio
85.	HSD Tank Pump	1	MS	5 m^3/hr
86.	Impure Tank Agitator Gearbox	1	PB	15:1 Ratio

No.	Name of Equipment	Quantity	MOC	Capacity/size
87.	Pre Coat Tank Agitator Gearbox	1	PB	15:1 Ratio
88.	Delawal Turbine	1	Alloy	500 KW
89.	Cooling Water Pump	1	MS	360 m^3/hr
90.	Cooling Tower for Delawal Turbine	2	Plastic/ND	500 TR
91.	Cooling Tower for 65% Oleum and Liquid SO_3	1	Plastic	100 + 300 TR
92.	Scrubber for Lorry Filling Vent	1	SS	ϕ 0.4m x 1.5m
93.	HSD Storage Tank	1	MS	10 MT
94.	Furnace Oil Storage Tank	1	MS	30MT
95.	IAEC Boiler	1	MS	5 TPH
96.	65% Oleum Storage Tank (Double walled - 50 MT cap.)	1	MS	50 MT
97.	Heat Recovery Unit (Ravi industries make)	1	MS	10 m^2

Table 2.8 List of Equipments and Reactors for Chloro Sulphonic Acid Plant

No.	Name of Equipment	Quantity	MOC	Capacity/size
1.	HCL Feed Pump No.1	1	Epoxy	15 m^3/hr
2.	HCL Feed Pump No.2	1	Epoxy	15 m^3/hr
3.	HCL Scrubber Pump No.1	1	Epoxy	15 m^3/hr
4.	HCL Scrubber Pump No.1	1	Epoxy	15 m^3/hr
5.	70% Waste Acid Pump	1	PVDF	25 m^3/hr
6.	Chloro Pump Tank with Pump	1	MS Brick Lined	10 MT
7.	Chloro Cooling Water Pump No.1	1	MS	100 m^3/hr
8.	Chloro Cooling Water Pump No.2	1	MS	100 m^3/hr
9.	98% Acid Transfer Pump	1	CF8M	12 m^3/hr
10.	Air Blower No.1	1	MS	15 HP
11.	Air Blower No.2	1	MS	15 HP
12.	Chloro Transfer Pump No.1	1	CF8M	10 m^3/hr
13.	Chloro Transfer Pump No.2	1	CF8M	10 m^3/hr
14.	HCL - Storage Tank	2	PP/FRP	40 KL
15.	HCL - Pump Tank	1	PP / FRP	1 KL
16.	HCL - Scrubber Pump Tank No.1	1	PP / FRP	ϕ 0.8 m x 4 m
17.	HCL - Scrubber Pump Tank No.2	1	PP / FRP	ϕ 0.8 m x 4 m
18.	Chimney	1	PP / FRP	30 m Ht.
19.	98% S.A. Pump Tank	1	MS	10 MT
20.	HCL Generator	1	MS Brick Lined	ϕ 1m x 7.8 m
21.	Dechlorinator	1	MS Brick Lined	ϕ 1m x 4 m
22.	Graphite Heat Exchanger	1	Graphite	--
23.	Chloro Heat Exchanger	1	SS	--
24.	Reaction Tower - T1	1	MS Brick Lined	ϕ 0.9m x 2.0 m
25.	Reaction Tower - T2	1	MS Brick Lined	ϕ 0.9m x 5.3 m
26.	Reaction Tower - T3	1	MS Brick Lined	ϕ 0.9m x 5.3 m
27.	Chloro Storage Tank No.1	1	MS	35 MT
28.	Chloro Storage Tank No.2	1	MS	35 MT

Table 2.9 List of Equipments and Reactors for Benzene Sulphonyl Chloride Plant

No.	Name of Equipment	Quantity	MOC	Capacity/size
1.	Wet BSCL Pump	1	PP	10 m^3/hr,15 m head
2.	Dry BSCL Pump	1	PP	5 m^3/hr, 20 m head
3.	RMPT Pump	1	SS	--
4.	Chloro Storage Tank Pump	1	SS	--
5.	Hot Water Pump	1	MS	--
6.	Chilled Water Pump	1	MS	--
7.	70% S.A. Tank Alpha Pump	2	PP	25 m^3/hr,25 m head
8.	30% HCL Pump	1	PP	5.5 m^3/hr,20 m head
9.	Caustic Scrubbing Tank Pump	1	PP	5.5 m^3/hr,20 m head
10.	Ejector Water Pump No.1	1	MS	80 m^3/hr, 40 m head
11.	Ejector Water Pump No.2	1	MS	80 m^3/hr, 40 m head
12.	Ejector Water Pump No.3	1	MS	80 m^3/hr, 40 m head
13.	Dechlorinator Air Blower	1	PP / FRP	7.5 HP motor
14.	GLR No.1 Gearbox	1	MS	--
15.	GLR No.2 Gearbox	1	MS	--
16.	Mixer Tank Gearbox	1	MS	1 HP motor
17.	Air Blower	1	PP / FRP	10 HP, 10 inch suction
18.	Benzene Pump	1	SS	5 m^3/hr, 25 m head
19.	250 KG Weighing And Filling Machine	1	--	--
20.	Himgiri Cooling Fan	1	PP / FRP	--
21.	BSCL Receiving Tank Pump	1	PP	10 m^3/hr,20 m head
22.	Wash Water Tank Pump	1	PP	5.5 m^3/hr,20 m head
23.	Fresh Water Tank Pump	1	PP	25 m^3/hr,25 m head
24.	Dechlorinator Scrubber Pump No.1	1	PP	5 m^3/hr,20 m head
25.	Dechlorinator Scrubber Pump No.2	1	PP	5 m^3/hr,20 m head
26.	15% HCL Scrubbing Tank Pump	1	PP	7 m^3/hr,15 m head
27.	Settler No.2 Gearbox	1	--	1HP
28.	Settler No.3 Gearbox	1	--	1HP
29.	Cooling Tower Pump	1	MS	350 m^3/hr,30 m head
30.	BSCL Storage Pump	1	PP	--
31.	DPS Tank Gearbox	2	--	5 HP
32.	BSCL Storage Tank Pump No.1	1	PP	5 m^3/hr,20 m head
33.	BSCL Storage Tank Pump No.2	1	PP	5 m^3/hr, 20 m
34.	HCL Transferring Pump	1	PP	7 m^3/hr,20 m head
35.	GLR No.5	1	glass	5 KL

Table 2.10 List of Equipments and Reactors for Sodium Vinyl Sulphamate Plant

No.	Name of Equipment	Quantity	MOC	Capacity/size
1.	Reactor R1 Old	1	MS/SS CLAD	10 MT
2.	Reactor R1 New	1	MS	10 MT
3.	Reactor R2 b / Neutralizer Gearbox	1	MS	6”
4.	Neutralizer Circulation Pump	1	MS	110 m^3/hr
5.	Product Pump	1	PP	5 m^3/hr
6.	98% Scrubber Pump	1	MS	12 m^3/hr

No.	Name of Equipment	Quantity	MOC	Capacity/size
7.	Reactor R1 - Sulphonator S1	1	MS	10 KL
8.	Neutralizer S2	1	SS	15 KL
9.	DES Slurry Day Tank	1	SS	1 KL
10.	DES Slurry Storage Tank	1	SS	10 KL
11.	Caustic Tank	3	MS	30 KL
12.	Caustic Pump	1	Alloy	12 m^3/hr
13.	98% Acid Scrubber	1	SS	3.278 m height*324 OD
14.	SO_3 Service Tank	1	MS Jac	5 MT
15.	SO_3 Metering Pump	1	SS	180 LPM
16.	Concentrator	1	MS	6 MT
17.	Sulphate Neutch Tank	1	MS	--
18.	Filtrate Tank	1	SS	--
19.	Dilutor	1	PP / FRP	7 MT
20.	Carbon Treatment Tank	1	MS	5 MT
21.	Carbon Neutch Filter	2	MS	--
22.	Pp Filtrate Tank	1	PP	2 KL
23.	Product Tank No. 1	1	SS	17 KL
24.	Product Tank No. 2	1	PP / FRP	6 KL
25.	Product Tank No. 3	1	PP / FRP	29 KL
26.	Product Tank No. 4	1	SS	30 KL
27.	Product Tank No. 5	1	SS	21 KL
28.	DM Water Tank	2	SINTEX	2 KL
29.	50% Acid Tank	1	PP / FRP	2 KL
30.	Hot Well Tank Pump	2	CI	150 m^3/hr
31.	Caustic Service Tank	1	MS	1 KL

Table 2.11 List of Equipments and Reactors for Diethyl Sulphate Plant

No.	Name of Equipment	Quantity	MOC	Capacity/size
1.	Alcohol Transfer Pump	1	MS	2 m^3/hr
2.	Alcohol Metering Pump	1	MS	2000 LPH
3.	SO_3Metering Pump	1	SS	4000 LPH
4.	R1 Pump	1	SS	63 m^3/hr
5.	Ejector Water Pump (50 HP, Cooling Tower)	1	SS	80m^3/hr
6.	Hot Water Pump	1	SS	65m^3/hr
7.	98% Acid Pump	1	SS	--
8.	Ammoniation Slurry Pump	1	SS	20 m^3/hr
9.	Reactor R2 Agitator Gearbox	1	CI	1:15
10.	Ejector Mazda	1	MS-TEFLON	5 STAGE/1 TORR
11.	Ammoniation Tank No.1 Agitator Gearbox	1	CI	1:20
12.	Ammoniation Tank No.2 Agitator Gearbox	1	CI	1:20
13.	SDS Storage Tank	1	MS	100KL
14.	Reactor No. T1	1	MS	3KL
15.	Reactor No. T2	1	PP/FRP	4KL

No.	Name of Equipment	Quantity	MOC	Capacity/size
16.	Reactor No. T3	1	HDPE	12KL
17.	Alcohol Feed Tank	1	MS	1KL
18.	SO_3Feed Tank	1	SS	9.7MT
19.	PHE	2	SS	48 m^2
20.	Ammoniation Tank No.1	1	MS	20MT
21.	Ammoniation Tank No.2	1	MS	20MT
22.	98% Scrubber Tank	1	MS-Brick Lined	3MT
23.	Hot Water Pump	1	CI	65m^3/hr
24.	Hot Water Tank	1	MS	3KL
25.	Water Pump for Ammoniation Tank	1	MS	15 m^3/hr
26.	Tower No.1	1	GLR	5KL
27.	Tower No.2	1	GLR	3KL
28.	Reboiler and Tower No.3	1	SS	1KL
29.	Vessel and Tower No.5	1	NA	NA
30.	Condenser No.1 A	1	SS Tube	20 m^2
31.	Condenser No.1 B	1	SS Tube	20 m^2
32.	Condenser No.2	1	SS Tube	20 m^2
33.	Condenser No.3	1	SS Tube	20 m^2
34.	Condenser No.5	1	NA	NA
35.	Seal Pot No.1 A	1	PVC	2MT
36.	Seal Pot No.1 B	1	PVC	2MT
37.	Seal Pot No.2	1	PVC	2MT
38.	Seal Pot No.3	1	PVC	1MT
39.	DES Storage Tank No.1	1	PP/FRP	20MT
40.	DES Storage Tank No.2	1	PP / FRP	20 MT
41.	DES Storage Tank No.3	1	PP / FRP	20 MT
42.	DES Storage Tank No.4	1	PP / FRP	50 MT
43.	Feed Tank	1	MS	13MT
44.	DES Intermediate Tank No.1	1	MS	1MT
45.	Ammoniated Slurry Feed Tank	1	MS	2KL
46.	Sludge Tank No.1	1	MS	10MT
47.	Sludge Tank No.2	1	MS	10MT

Table 2.12 List of Equipments and Reactors for Multi Purpose Plant - 1

No.	Name of Equipment	Quantity	MOC	Capacity/size
1.	Glass Lined Reactor	14	MS Glass Lined	5 KL
2.	Glass Lined Reactor	1	MS Glass Lined	1.6 KL
3.	Glass Lined Reactor	1	MS Glass Lined	3 KL
4.	Glass Lined Reactor	1	MS Glass Lined	0.65 KL
5.	Glass Lined Reactor	1	MS Glass Lined	0.1 KL
6.	SS Reactor	5	SS	5 KL
7.	SS Reactor	3	SS	1 KL
8.	SS Centrifuge	2	SS	48”
9.	MSRL	2	MSRL	36”
10.	FBD	1	SS	200 Kgs

Table 2.13 List of Equipments and Reactors for Multi Purpose Plant - 2

No.	Name of Equipment	Quantity	MOC	Capacity/size
1.	RCVD	2	SS	1 KL
2.	Multi Mill	1	SS	100 Kgs/hr
3.	Sifter	1	SS	25 Kgs/hr
4.	Sparkler Filter	3	SS	100 Ltrs.
5.	ANFD	1	SS	500 Ltrs.
6.	Vacuum Pumps	8	MS	--
7.	Steam Ejector System	8	MS	200 Kgs Steam/hr
8.	Chilling Plant	2	MS	50 TR
9.	Thermopack	2	MS	4 Lakh Kcal/hr
10.	Cooling Tower	1	MS	40 TR
11.	Alcohol Evaporator	1	MS	0.5 KL
12.	Convertor	1	MS	1.2 KL
13.	Heat Exchanger	3	MS	20 m^2
14.	Technical DEE Distillation Unit	1	SS	4 TPD
15.	Caustic Column	2	MS	0.5 KL
16.	Pure DEE Distillation Unit	1	SS	3 KL
17.	Alcohol Recovery Unit	1	MS	5 KL
18.	Cooling Tower	1	FRP	200 TR

Table 2.14 List of Equipment and Reactors for Benzene Sulphonic Acid and Other Sulphonic Acids Plant

No.	Name of Equipment	Quantity	MOC	Capacity/size
1.	Glass Lined Reactor	1	Glass	5 KL
2.	Condenser	2	Glass	1Mtr
3.	Reflux Glass Column	2	Glass	1Mtr
4.	Receiver	1	Glass	50 Ltrs.
5.	Temperature Indicator	1	--	--
6.	Vacuum Manometer	1	Glass	--
7.	Water Manometer	1	Glass	--
8.	Pressure Gauge	1	MS	--
9.	Steam Ejector	1	Graphite	--
10.	Blower	1	PP / FRP	--
11.	HCl Scrubber	1	PP / FRP	--
12.	HCl Scrubber Tank	1	PP / FRP	5 KL
13.	Graphite Cooler	1	Graphite	--
14.	Weighing Scale	1	MS	300 Kg
15.	Water Feed Tank	1	HDP	50 Ltrs.
16.	Refrigerated Packing Storage	1	MS	--

Table 2.15 Proposed List of Equipments and Reactors for Multi Purpose Plant - 1 and Multi Purpose Plant - 2

No.	Name of Equipment	Quantity		MOC	Capacity/size
		MPP-1	MPP-2		
1.	Glass Lined Reactor	2	2	MS Glass Lined	5 KL
2.	Glass Lined Reactor	1	--	MS Glass Lined	2 KL
3.	Glass Lined Reactor	1	--	MS Glass Lined	3 KL
4.	Glass Lined Reactor	1	--	MS Glass Lined	0.65 KL
5.	Glass Lined Reactor	--	1	MS Glass Lined	0.1 KL
6.	SS Reactor	3	2	SS	5 KL
7.	SS Reactor	--	3	SS	1 KL
8.	SS Centrifuge	1	1	SS	48”
9.	MSRL	1	1	MSRL	36”
10.	FBD	--	1	SS	200 Kgs
11.	RCVD	1	1	SS	1 KL
12.	Multi Mill	--	1	SS	100 Kgs/Hr
13.	Sifter	--	1	SS	25 Kgs/Hr
14.	Sparkler Filter	1	2	SS	100 Ltrs
15.	ANFD	--	1	SS	500 Ltrs
16.	Vacuum Pumps	4	4	MS	--
17.	Steam Ejector System	6	2	MS	200 Kgs Steam/Hr
18.	Chilling Plant	1	1	MS	50 TR
19.	Thermopack	1	1	MS	4 Lakh Kcalories/Hr
20.	Cooling Tower	--	1	MS	40 TR
21.	Alcohol Evaporator	1	--	MS	0.5 KL

Table 2.16 List of Equipments for Effluent Treatment Plant (ETP)

No.	Name of Equipment	Quantity	MOC	Capacity/size
1.	Equalizing Tank Agitator Gearbox	2	CI	5 HP
2.	Neutralizer Agitator Gearbox	1	CI	10 HP
3.	Lime Slurry Tank Gearbox	1	CI	5 HP
4.	Primary Raker Gearbox	1	CI	10 HP
5.	Secondary Raker Gearbox	1	CI	10 HP
6.	Dewatering Pump	2	CI	12.5 LPS
7.	Sludge Pump	1	SS	30 m^3/hr
8.	Sanitary Pump	1	MS	12.5 LPS
9.	Roots Blower	2	CI	0.4 kg/cm^2
10.	V - Notch Pump	3	MS	20 m^3/hr
11.	Filter Press	1	MS and PP	2 m^3/hr
12.	Primary Clarifier	1	RCC	98 m^3
13.	Secondary Clarifier	1	RCC	69 m^3

2.6.3 Products, Byproducts and Raw Materials

The different products presently being manufactured and those considered for manufacture under expansion & their maximum production quantities are as -

Table 2.17 List of Products and Byproducts

A) List of Products-

Sr. No.	Name of Products	Production (MT/Month)		
		Current	Expansion	After Expansion
1.	Sulphamic Acid	500	0	500
2.	Diethyl Sulphate	200	100	300
3.	Benzene Sulphonyl Chloride	570	30	600
4.	Sulphuric Acid	8333	0	8333
5.	Oleum	4167	0	4167
6.	Sulphur Trioxide	2750	0	2750
7.	Sodium Vinyl Sulphonate/Other Sulphonates	150	50	200
8.	Phenol Sulphonic Acid	50	0	50
9.	Chlorosulphonic Acid	2000	0	2000
10.	Diethyl Ether	50	150	200
11.	Benzene Sulphonic Acid/Other Sulphonic Acids	20	0	20
12.	N-Phenyl Benzene Sulphonamide	30	70	100
13.	Methane Sulphonic Anhydride	5	0	5
14.	Para Chloro Benzene Sulphonyl Chloride	25	0	25
15.	4,4-Dihydroxy Diphenyl Sulphone	0	30	30
16.	3,3-Dinitro Diphenyl Sulphone	0	30	30
17.	3,3-Diamino Diphenyl Sulphone	0	20	20
18.	Para Chloro Thiophenol	0	10	10
19.	Bis (4-Chlorophenyl) Disulphide	0	10	10
20.	Thiophenol	0	20	20
21.	4-Methyl Mercapto Acetophenone	0	10	10
22.	Silicon Sulphate	0	10	10
23.	Para Nitro Benzene Sulphonyl Chloride	0	10	10
24.	Lasamide	0	10	10
25.	Diethyl Phthalate	0	100	100
26.	Dimethyl Phthalate	0	100	100
27.	Potassium Salt of Sulphonated Sulphone	0	10	10
28.	N-Butyl Benzene Sulphonamide	0	10	10
29.	Methyl Ester of Benzene Sulphonic Acid	0	5	5
30.	Ethyl Ester of Benzene Sulphonic Acid	0	5	5
31.	Para Chloro Benzene Sulphonic Acid	0	10	10
32.	Para Toluene Sulphonic Acid	0	10	10
33.	Dimethyl Aniline	0	80	80
34.	Mono Methyl Aniline	0	20	20
35.	Diethyl Aniline	0	30	30
36.	Sodium Isethionate	0	10	10

Sr. No.	Name of Products	Production (MT/Month)		
		Current	Expansion	After Expansion
37.	4,4-Dichloro Diphenyl Sulphone	0	10	10
38.	Mono Ethyl Aniline	0	70	70
39.	1,3-Benzene Disulphonyl Chloride	0	10	10
40.	Menthyl Lactate	0	5	5
	Total	**18850**	**1045**	**19895**

B) List of Byproducts-

Sr. No.	Name of Byproducts	Production (MT/Month)		
		Current	Expansion	After Expansion
1.	Calcium Sulphate	398	2	400
2.	Phosphoric Acid	2	18	20
3.	Sodium Sulphate	400	0	400
4.	Sodium Sulphite	110	0	110
5.	Dilute Sulphuric Acid	11600	0	11600
6.	Diphenyl Sulphone	24	6	30
7.	Sodium Chloride Solution	0	5	5
8.	Ammonium Chloride Solution	0	50	50
	Total	**12534**	**81**	**12615**
	Total (Products and Byproducts)	**31384**	**1126**	**32510**

Refer **Appendix - D** for Chemical name of Products with CAS Number.

Note : i)

Description	Products	Byproducts	Total
Existing	14	6	20
Expansion	26	2	28
Total	**40**	**8**	**48**

ii) Production Blocks - Existing: 8 Nos., Expansion: Nil

iii) Manufacturing Capacity - Existing **31384 MT/M** + Expansion **1126 MT/M** = After Expansion **32510 MT/M**

2.6.3.1 Raw Materials

The details on consumption of raw materials required for existing and proposed manufacturing activities are as follows-

Table 2.18 List of Collective Quantity of Raw material required per Batch

Sr. No.	Name of Chemical	Total Quantity (kg/Batch)
1.	Purified Water	22132.04
2.	Urea	310
3.	Sulphuric Acid (98%)	4540
4.	Oleum (65%)	2073
5.	Ethanol	5166
6.	Sulphur Trioxide (liq.)	4480

Sr. No.	Name of Chemical	Total Quantity (kg/Batch)
7.	Ammonia	140
8.	Benzene	650
9.	Chloro Sulphonic Acid	7512
10.	Sulphur	330
11.	Oxygen (from Air)	490
12.	Sulphuric Acid	2510
13.	Sulphur Trioxide (gas)	1000
14.	DES Slurry	220
15.	Calcium hydroxide	1085
16.	Phenol	1800
17.	Hydrochloric Acid (30%)	1000
18.	Benzene Sulphonyl Chloride	4990
19.	Aniline	5360.7
20.	Sodium Hydroxide	334
21.	Methane Sulphonic Acid	275
22.	Phosphorous Pentoxide	68.75
23.	Mono Chloro Benzene	1012
24.	Para Chloro Benzene Sulphonyl Chloride	2920
25.	Ferric Chloride	4
26.	Diphenyl Sulphone	178
27.	Fuming Nitric Acid	105
28.	3,3'-Dinitro Diphenyl Sulphone	710
29.	Iron Powder	580
30.	Aq. Ethanol (50%)	250
31.	Red Phosphorous	619
32.	Para Chloro Thiophenol	251
33.	Hydrogen Peroxide	30
34.	Phosphoric Acid (85%)	1000
35.	Thioanisole	1242
36.	Acetyl Chloride	785.4
37.	Aluminum Chloride	1330
38.	Silicon Oil	350
39.	Para- Nitro Aniline	318
40.	Sodium Nitrite	159
41.	Hydrochloric Acid	252
42.	Thionyl Chloride	548
43.	2,4 - Dichlorobenzoic Acid	453
44.	Phosphorus Trichloride	366.84
45.	Phthalic Anhydride	3647
46.	Methanol	4025.3
47.	Diphenyl Sulphone	331
48.	Potassium carbonate	103
49.	N-butylamine	171
50.	Para - Toluene Sulphonyl Chloride	1107
51.	Dimethyl Ether	2111.4
52.	Diethyl Ether	509.2
53.	$Ca(OH)_2$	487

Sr. No.	Name of Chemical	Total Quantity (kg/Batch)
54.	L-Menthol	179.73
55.	L-Lactic acid	100

2.6.3.2 Manufacturing Processes, Flow Charts and Mass Balance of the Products

Refer **Appendix -E** for details on manufacturing processes, processes flow charts, product-wise raw materials, mass balance for each product.

Table 2.19 List of Products with e-factor

Sr. No.	Name of Products	e-factor
1.	Sulphamic Acid	0.23
2.	Diethyl Sulphate	2.02
3.	Benzene Sulphonyl Chloride	0.67
4.	Sulphuric Acid	1.00
5.	Oleum	0.00
6.	Sulphur Trioxide	0.00
7.	Sodium Vinyl Sulphonate/Other Sulphonates	0.00
8.	Phenol Sulphonic Acid	0.00
9.	Chlorosulphonic Acid	0.00
10.	Diethyl Ether	0.37
11.	Benzene Sulphonic Acid/Other Sulphonic Acids	0.23
12.	N-Phenyl Benzene Sulphonamide	0.26
13.	Methane Sulphonic Anhydride	0.00
14.	Para Chloro Benzene Sulphonyl Chloride	0.96
15.	4,4-Dihydroxy Diphenyl Sulphone	0.17
16.	3,3-Dinitro Diphenyl Sulphone	5.96
17.	3,3-Diamino Diphenyl Sulphone	1.47
18.	Para Chloro Thiophenol	0.25
19.	Bis (4-Chlorophenyl) Disulphide	0.24
20.	Thiophenol	1.52
21.	4-Methyl Mercapto Acetophenone	0.22
22.	Silicon Sulphate	0.00
23.	Para Nitro Benzene Sulphonyl Chloride	1.33
24.	Lasamide	3.43
25.	Diethyl Phthalate	0.09
26.	Dimethyl Phthalate	0.11
27.	Potassium Salt of Sulphonated Sulphone	0.77
28.	N-Butyl Benzene Sulphonamide	0.30
29.	Methyl Ester of Benzene Sulphonic Acid	0.48
30.	Ethyl Ester of Benzene Sulphonic Acid	2.00
31.	Para Chloro Benzene Sulphonic Acid	0.19
32.	Para Toluene Sulphonic Acid	2.12
33.	Dimethyl Aniline	0.39
34.	Mono Methyl Aniline	0.17
35.	Diethyl Aniline	0.18
36.	Sodium Isethionate	2.99

Sr. No.	Name of Products	e-factor
37.	4,4-Dichloro Diphenyl Sulphone	0.14
38.	Mono Ethyl Aniline	0.12
39.	1,3-Benzene Disulphonyl Chloride	0.13
40.	Menthyl Lactate	0.08

2.6.3.3 Manufacturing capacity per production block

The manufacturing capacity for each block is as follows-

Table 2.20 Manufacturing Capacity for Each Production Block

Sr. No.	Production Block	Capacity of Block	Name of Products to be manufactured
1.	Sulphuric Acid Plant (SA)	8333 MT/M	1. Sulphuric Acid 2. Oleum (23%) 3. Oleum (65%) 4. Sulphur Trioxide
2.	Chloro Sulphonic Acid Plant (CSA)	2000 MT/M	1. Chlorosulphonic Acid
3.	Benzene Sulphonyl Chloride Plant (BSCL)	594 MT/M	1. Benzene Sulphonyl Chloride
4.	Sodium Vinyl Sulphamate Plant (SVS)	150 MT/M	1.Sodium Vinyl Sulphonate/ Other Sulphonates 2.Phenol Sulphonic Acid
5.	Diethyl Sulphate Plant (DES)	200 MT/M	1.Diethyl Sulphate
6.	Multi Purpose Plant - 1 (MPP-1)	50 MT/M	1. Sulphamic Acid 2. N-Phenyl Benzene Sulphonamide 3. Para Chloro Benzene Sulphonyl Chloride 4. 4-Methyl Mercapto Acetophenone 5. Para Nitro Benzene Sulphonyl Chloride 6. Lasamide 7. Potassium Salt of Sulphonated Sulphone 8. Methyl Ester of Benzene Sulphonic Acid 9. Ethyl Ester of Benzene Sulphonic Acid 10. 1,3-Benzene Disulphonyl Chloride 11. Menthyl Lactate
7.	Multi Purpose Plant - 2 (MPP-2)	50 MT/M	1. Diethyl Ether 2. Methane Sulphonic Anhydride 3. 4,4-Dihydroxy Diphenyl Sulphone 4. 3,3-Dinitro Diphenyl Sulphone 5. 3,3-Diamino Diphenyl Sulphone

Sr. No.	Production Block	Capacity of Block	Name of Products to be manufactured
			6. Para Chloro Thiophenol 7. Bis (4-Chlorophenyl) Disulphide 8. Thiophenol 9. Diethyl Phthalate 10. Dimethyl Phthalate 11. Dimethyl Aniline 12. Mono Methyl Aniline 13. Diethyl Aniline 14. Sodium Isethionate 15. 4,4-Dichloro Diphenyl Sulphone 16. Mono Ethyl Aniline
8.	Benzene Sulphonic Acid and Other Sulphonic Acids Plant (BSA)	20 MT/M	1. Benzene Sulphonic Acid/Other Sulphonic Acids 2. Silicon Sulphate 3. Para Chloro Benzene Sulphonic Acid 4. Para Toluene Sulphonic Acid

2.7 SOURCES OF POLLUTION AND MITIGATION MEASURES

The basic sources of pollution from the existing and proposed expansion of commodity chemicals and speciality chemicals manufacturing unit are mainly operations and processes in the industry, boiler, Thermopack and DG Sets.

Detailed identification and quantification of impacts, due to above mentioned sources, arepresented under the heads-(1) Water Pollution (2) Air Pollution (3) Noise Pollution (4) Hazardous Wastes (5) Solid Waste (6) Land Pollution.

2.7.1 Water Pollution

Water pollution may be defined as presence of impurities in water in such quantities and of such nature that impair/restrict use of water for the stated purpose. In short, it can be said that the water is not potable. Fresh water requirement for the proposed activity shall be taken from MIDC water supply scheme. In TDMCCL, water shall be required for process, washing (laboratory, floor andcleaning of equipments), boiler, cooling tower make up as well as for domestic purpose.

The assignment w.r.t. water pollution (WP) aspect was done by **Prof. (Dr.) Bhaskar Thorat** who is an empaneled EEIPL's Functional Area Expert (FAE) for WP.

2.7.1.1 Total Water Requirement

1370 CMD fresh water consumption is sanction for existing unit as per valid MPCB CTO dated 21.04.2015. The daily water requirement in the industry for various operations and processes has been shown in the following table -

Table 2.21 Total Water Requirement under Existing and Expansion Activities

No.	Description	Water Consumption (CMD)		
		Existing (As per CTO)	**Expansion**	**After Expansion**
1.	**Domestic**	#90	0	#90
2.	**Industrial**			
	a. Process	#520	#50	#570
	b. Laboratory & Washing			
	c. Cooling Makeup	#725	#167	892 (#672+*220)
	d. Boiler Feed	#25	#5	#30
	Industrial Total (a+b+c+d)	#1270	#222	1492 (#1272 +*220)
3.	**Gardening**	#10	0	#10
4.	**Total (1+2+3)**	**#1370**	**#222**	**1592 (#1372 +*220) Recycle 14%**
Note: # - Fresh water from MIDC water supply scheme**, *** - Treated Effluent Recycle				

Total water requirement after expansion for proposed project would be 1592 CMD. Out of which 220 CMD (14 %) would be treated water from ETP whereas 1372 CMD (86%) would be fresh water taken from MIDC water supply scheme. Fresh water requirement for project is met from the MIDC water supply scheme. The MIDC procures water from Kundalika River and after treatment the same is provided to different industries in the MIDC**.** Refer **Appendix -F** for Certificate of Merit for Water Resource Management in Chemical Industry by Indian Chemical Council (ICC) and **Appendix -G** for Water Permission Letter.

From fact presented above, it is observed that through change in product mix additional permissionis not required for fresh water under proposed expansion. Current permission for fresh water granted in valid CTO is adequate under proposed expansion.

2.7.1.2 Total Effluent Generation

Total 300 CMD effluent generation from trade and domestic is sanction for existing unitas per valid MPCB CTO dated 21.04.2015. The details of effluent generation under existing and proposed expansion are as follows -

Table 2.22 Total Effluent Generation under Existing and Expansion Activities

No.	Description	Effluent Generation (CMD)		
		Existing	**Expansion**	**After Expansion**
1.	**Domestic**	9.6	1.8	11.4
2.	**Industrial**			
	a. Process	60	10	70
	b. Laboratory & Washing	45	0	45
	c. Cooling Tower B/d	89	20	109
	d. Boiler B/d	6	0.5	6.5
	Industrial Total (a+b+c+d)	200	30.5	230.5
3.	**Total (1+2)**	**209.6**	**32.3**	**241.9**

Effluent generated from existing manufacturing and utility operations is to the tune of **209.6 CMD** which is treated in existing ETP of 300 CMD capacity comprising of Primary, Secondary and Tertiary treatment operations. At present, the treated water from ETP, achieving prescribed standards is discharged to Common Effluent Treatment Plant (CETP), Roha.Presently, domestic wastewater is treated in septic tanks followed by soak pits. The overflow from soak pits is used for gardening purpose.

Industrial effluent generated from spillages, leakages and floor washings from all process plants, comes to the grit chamber through underground pipelines. Oily mater that floats on the top is skimmed off. The effluent is then taken to the equalization tanks from where it is sent to the neutralizer. Lime slurry is prepared in the slurry tank. Lime slurry can be fed to the equalization tank or to the neutralizer. pH of the effluent is maintained between7-8. Neutralized effluent is then pumped to the primary clarifier. The clear water from the top of the clarifier overflows into the two bio-reactors which are in series and sludge from the bottom of primary clarifier is fed to fully automatic pneumatic filter. Filtrate from the filter is pumped back to the primary clarifier. Water from bioreactors overflows into the secondary clarifier. Water from the secondary clarifier is passed through tertiary filter (carbon and sand filter) by pump. This water is pumped to the CETP through MIDC sewers sludge from the bottom of secondary clarifier is fed to fully automatic pneumatic filter. Dry filter cake is sent to Common Hazardous Waste Treatment, Storage & Disposal Facility (CHWTSDF), Taloja, Mumbai for final disposal. Refer **Appendix – H** for Certificate of Merit for Efficient Waste Management in Chemical Industry by Indian Chemical Council (ICC) and **Appendix -I** for CHWTSDF Membership Letter.

Under expansion, the management has decided to achieve **Zero Liquid Discharge (ZLD)** by installation of evaporators and the condensate would be recycled in industrial operations. No any effluent would be discharged outside the premises. Moreover, for domestic waste water, Sewage Treatment Plant (STP) of **20 CMD** is proposed. The treated water from STP would be used for gardening.

From fact presented above, it is observed that current ETP has the capacity to treat additional load from expansionthrough change in product mix.

Table 2.23 Details of ETP

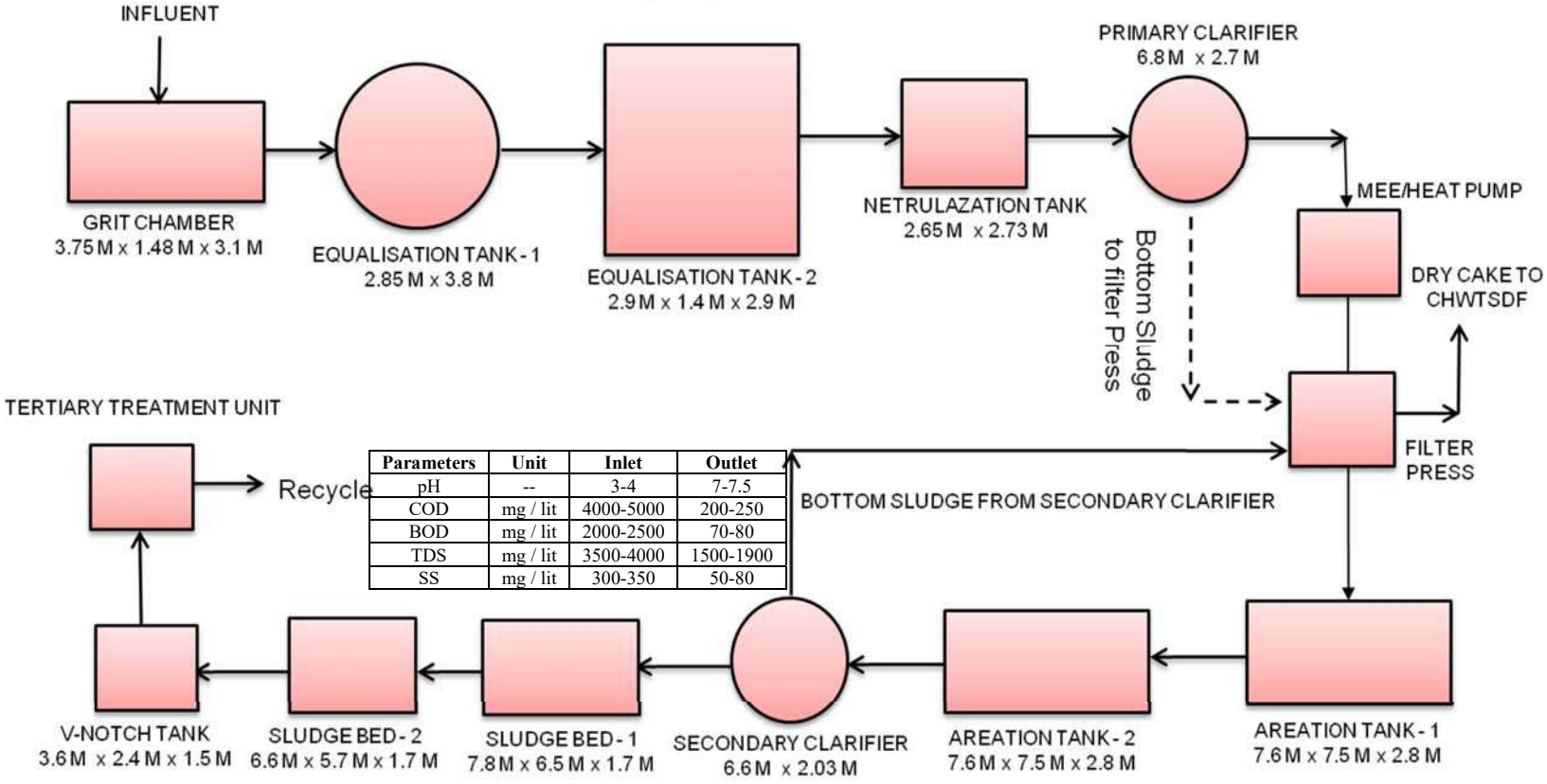
Sr. No.	Description	Length (m)	Diameter (m)	Height (m)	Volume (m^3)	Function
1.	GritChamber	3.75	1.48	3.1	17.21	Separation of floating impurities
2.	EqualizationTank -1	NA	2.85	3.8	24.24	Homogenization of influent
3.	EqualizationTank -2	2.9	1.4	2.9	11.77	
4.	Neutralization Tank	NA	2.65	2.73	15.05	Neutralization
5.	Primary Clarifier	NA	6.8	2.7	98.05	Settling of suspended particles
6.	Secondary Clarifier	NA	6.6	2.03	69.45	
7.	Aeration Tank -1	7.6	7.5	2.8	159.6	Mix, circulate, or dissolve air into a liquid or another substance
8.	Aeration Tank -2	7.6	7.5	2.8	159.6	
9.	Sludge Bed-1	7.8	6.5	1.7	86.19	Liquid drain and for drying
10.	Sludge Bed-2	6.6	5.7	1.7	63.95	
11.	V-Notch Tank	3.6	2.4	1.5	12.96	For collection of treated effluent

Refer **Figure 2.2** for Photographs of Existing ETP, **Figure 2.3** for Flow diagram of ETP and **Figure 2.4** for Layout of ETP of TDMCCL.

FIGURE NO. 2.2 - PHOTOGRAPHS OF EXISTING ETP OF THE DHARAMSI MORARJI CHEMICAL COMPANY LTD., MIDC DHATAV, TAL.: ROHA, DIST.: RAIGAD

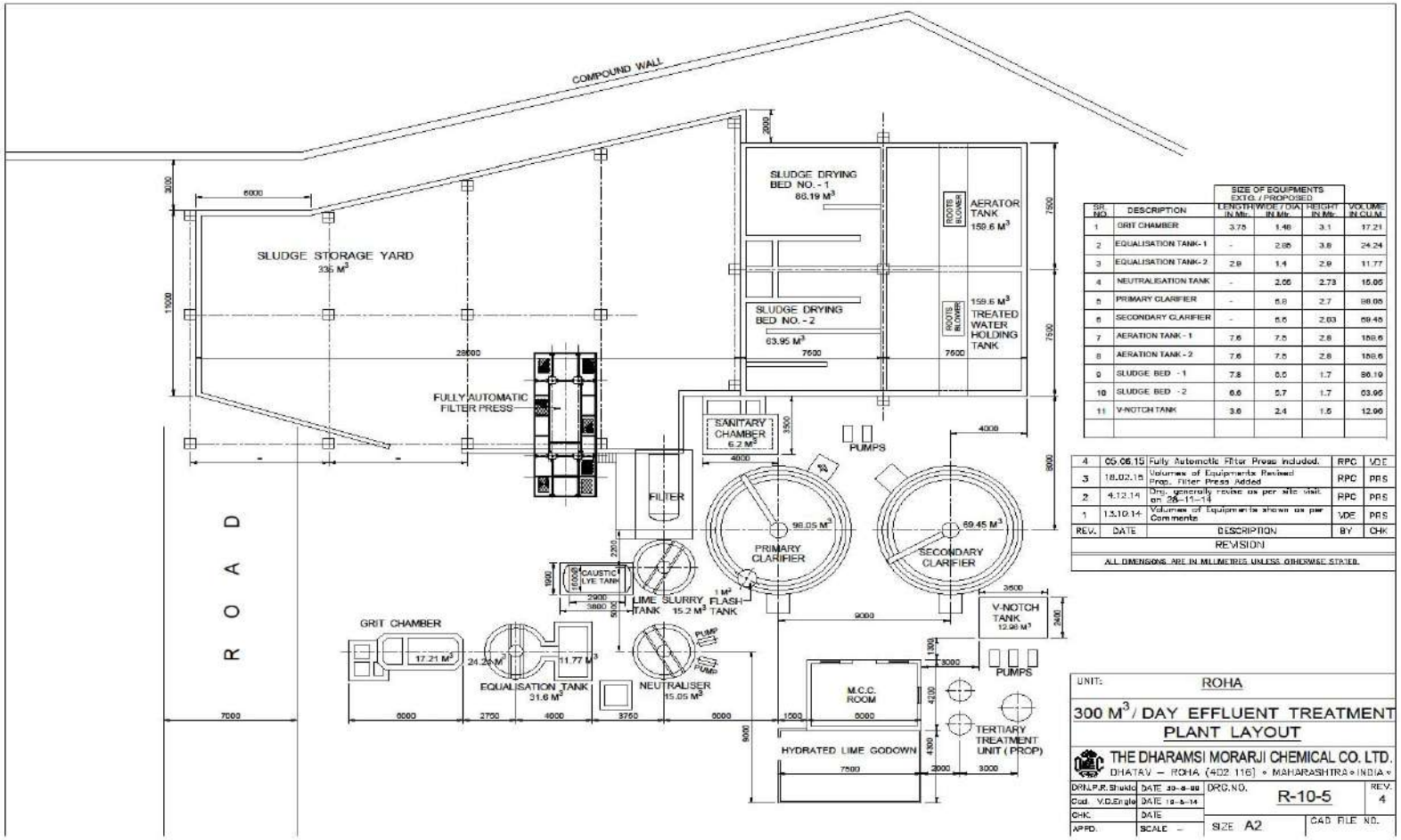
Figure 2.3 Flow diagram of ETP

Capacity of ETP - 300 CMD



Parameters	Unit	Inlet	Outlet
pH	--	3-4	7-7.5
COD	mg / lit	4000-5000	200-250
BOD	mg / lit	2000-2500	70-80
TDS	mg / lit	3500-4000	1500-1900
SS	mg / lit	300-350	50-80

Figure 2.4 Layout of ETP



SR. NO.	DESCRIPTION	SIZE OF EQUIPMENTS EXTG. / PROPOSED LENGTH IN Mtr.	WIDE / DIA IN Mtr.	HEIGHT IN Mtr.	VOLUME IN CU.M.
1	GRIT CHAMBER	3.75	1.46	3.1	17.21
2	EQUALISATION TANK- 1	-	2.85	3.8	24.24
3	EQUALISATION TANK- 2	2.9	1.4	2.9	11.77
4	NEUTRALISATION TANK	-	2.05	2.73	15.05
5	PRIMARY CLARIFIER	-	5.8	2.7	98.05
6	SECONDARY CLARIFIER	-	5.5	2.63	89.45
7	AERATION TANK - 1	7.6	7.5	2.8	159.6
8	AERATION TANK - 2	7.6	7.5	2.8	159.6
9	SLUDGE BED - 1	7.8	5.5	1.7	88.19
10	SLUDGE BED - 2	6.6	5.7	1.7	63.95
11	V-NOTCH TANK	3.6	2.4	1.5	12.96

REV.	DATE	DESCRIPTION	BY	CHK
4	09.06.15	Fully Automatic Filter Press included.	RPC	VDE
3	18.02.15	Volumes of Equipments Revised Prop. Filter Press Added	RPC	PRS
2	4.12.14	Dtg. generally revise as per site visit on 26-11-14	RPC	PRS
1	13.10.14	Volumes of Equipments shown as per Comments	VDE	PRS

REVISION

ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.

UNIT: ROHA

300 M³ / DAY EFFLUENT TREATMENT PLANT LAYOUT

THE DHARAMSI MORARJI CHEMICAL CO. LTD.
DHATAV – ROHA (402 116) • MAHARASHTRA • INDIA •

DRN. P.R.Shukla	DATE 30-8-99	DRG. NO. R-10-5	REV. 4
Cod. V.D.Engle	DATE 18-6-14		
CHK.	DATE		
APPD.	SCALE –	SIZE A2	CAD FILE NO.

2.7.1.3 Solvent Recovery System

Various solvents are being used during the manufacturing process of commodity chemicals and speciality chemicals. These solvents are recovered and reused in process. The path of solvent recovery being followed is presented as follows-

- After completion of reaction the solvents are recovered in a distillation unit.
- The distillation unit has two condensers (shell and tube type).
- The first condenser has cooling tower water, while the second condenser has the chilled water at 0 - 2^0 C as coolants.
- After the vapors are condensed, the condensate along with un-condensed vapors is passed through a trap which is cooled externally with chilled water.
- The vents of condenser and receiver are connected to scrubber system.
- All the reaction vessels and centrifuges are connected to a common line. These fumes and exhausts are sucked by ID fan and scrubbed by alkali.
- The air after scrubbing is let out into the atmosphere and the scrubbed water is sent to ETP for further treatment.
- This wet scrubber absorbs acidic vapors, traces of solvents etc. and purified gas stream is let out into the atmosphere.
- For the acid mist control two No's of mist eliminators are provided.

Product-wise solvent recovery is presented in following table -

Table 2.24 Quantification of Recovered Solvent

Sr. No.	Product Name	Stage	Solvent	Input Quantity of solvent (Kg/batch)	Quantity recovered and recycled (Kg/batch)	Quantity lost (Kg/batch)	% of solvent recovered
1.	4,4' DHDPS	Reaction	Mesitylene	430	425	5	99
2.	4,4' DHDPS	Isolation	Ethanol	400	336	64	85
3.	Menthyl Lactate	Reaction	MCB	300	288	12	96
4.	3,3' DAPS	Reaction	Ethanol (50%)	250	200	50	80

Note: The above solvents are not included in Class 1 category.

2.7.2 Air Pollution

Air Pollution can be defined as presence in the outdoor atmosphere of one or more air contaminants (i.e. dust, fumes, gas, mist, odour, smoke or vapour) in sufficient quantities, of such characteristics and of such duration so as to threaten to be injurious to human, plant or animal life or to property, or which reasonably interferes with comfortable enjoyment of life or property.

The assignment w.r.t. Air Pollution (AP) aspect was done by **Mr. Yuvraj Damugade** who is an in-house EEIPL's FAE and also involved in the overall exercise w.r.t. Air Quality and Modeling studies i.e. AQ aspect w.r.t. the project.

Under existing unit as well as proposed expansion main source of emissions are boiler, thermopack and DG Sets. Major emissions are in the form of suspended particulate matter

(SPM), SO_x and NO_x. The existing boiler (5 TPH capacity) is operated on Furnace oil (FO) @ 63 kg/hr with adequate stack height of 35 m and Thermic Fluid Heater (TFH, 4 lakhs Kcal/hr capacity) is operated on High speed diesel (HSD) @ 47 kg/hr with stack height of 30m are provided on site. DG sets of capacities 125, 830 and 1310 KVA are operated on HSD / Light diesel oil (LDO) @ 210 kg/hr with adequate stack height of 4.20 m, 7.70 m, 7.70 mrespectively above roof level (ARL). DG sets are used only in case of power failure. Moreover, process emissions are in the form of acidic/ alkaline/solvent vapours emitted from existing. The same is taken care off through seven scrubbers each of 5 kg/hr capacity. Existing scrubbers will be utilized under expansion activity.

Existing boiler, TFH and DG sets are sufficient for proposed expansion. Boiler runs occasionally as steam is available from Sulphuric acid plant only. (Steam generated from Sulphuric Acid Plant : 335 MTD at 40 kg/cm^2 at 400^{0}C)

Table 2.25 Details of Stack

Sr. No.	Description	Boiler	TFH	DG Set (3 No.)
1.	Stack No.	S-7	S-2	S-4, S-5, S-6
2.	Capacity	5 TPH	4 lakhs Kcal/hr	125,830,1310 KVA
3.	Fuel type	FO	HSD	HSD / LDO
4.	Fuel quantity (kg/hr)	63	47	210
5.	MoC	MS	MS	MS
6.	Shape	Round	Round	Round
7.	Stack Height (m)	35	30	4.20,7.70,7.70 ARL
8.	Diameter/size (m)	0.35	0.3	0.41,0.41,0.75
9.	Calorific Value, in kcal/kg	10000	10500	10000
10.	Sulphur Content, % (w/w)	3.5 Max.	1.0	1.0
11.	Ash Content, in % (w/w)	0.15 Max.	2.0	--
12.	Gas quantity (Nm^3/hr)	5390	789	10932
13.	Gas Temperature (^{0}C)	165	99	160
14.	Exit gas velocity (m/sec)	3.3	3.1	7.1
15.	Source of Pollution	SPM, SO_x and NO_x		

2.7.2.1 Transportation details for Products

Table 2.26 Transportation Details of Final Product

Sr. No.	Product Name	Mode of Transport	Truck/ Tanker	Frequency of vehicles	Distance Travelled (km)	Qty. of Product Transported (MT/M)
1.	Sulphuric Acid	Road	Tanker	15 / Day	150	6750
2.	Oleum (23 %)	Road	Tanker	1 / Week	150	100
3.	Oleum (65 %)	Road	Tanker	2 / Day	130	1200
4.	Sulphur Trioxide	Road	Tanker	2 / Week	150	80
5.	Benzene Sulphonyl Chloride	Road	ISO Tanks	3 / Week	200	300
6.	Diethyl Sulphate	Road	Tanker	1 / Week	130	50
7.	Chlorosulphonic	Road	Tanker	2 / Month	130	30

Sr. No.	Product Name	Mode of Transport	Truck/ Tanker	Frequency of vehicles	Distance Travelled (km)	Qty. of Product Transported (MT/M)
	Acid					
8.	Sodium Vinyl Sulphonate	Road	ISO Tanks	2 / Week	Export	200
9.	Phenol Sulphonic Acid	Road	Truck	1 / Month	700	50
10.	N-Phenyl Benzene Sulphonamide	Road	Truck	4 / Month	600	50
11.	Diethyl Ether	Road	Truck	4 / Month	500	50
12.	Benzene Sulphonic Acid	Road	Truck	4 / Month	1200	20

2.7.2.2 Transportation details for Raw Materials

Table 2.27 Transportation details of Raw Material

Sr. No.	Raw Material (RM)	Mode of Transport	Truck / Tanker	Frequency of vehicles	Distance Travelled (km)	Qty. of RM Transported (MT/M)
1.	Sulphur Solid	Road	Truck	9 / Day	1700	2700
2.	Sulphur Molten	Road	Tanker	2 / Day	130	1000
3.	Benzene	Road	Tanker	1 / 2 Day	130	225
4.	Caustic Lye	Road	Tanker	2 / Week	250	200
5.	SDS	Road	Tanker	2 / Week	200	100 KL/M
6.	Liquor Ammonia	Road	Tanker	1 / Week	130	30
7.	Hydrochloride Acid	Road	Tanker	4 / Week	4	120
8.	Phenol	Road	Truck	1 / Month	130	10
9.	Aniline	Road	Tanker	2 / Month	400	16

2.7.2.3 Process Emissions

Process emissions are in the form of acidic/alkaline/solvent vapours and are controlled through installation of Scrubbers. Production units are provided with scrubbers. There would be in allseven scrubbers on site after expansion. Details of same are given in following table-

Table 2.28 Details of scrubbers

Sr. No.	Stack No.	Scrubber Attached to Process Plant	No. of Scrubbers	Dia. (m)	Ht. (m)	Process Emission scrubbed	Packing Material used in scrubber	Mode of regeneration of the Packing Material	Scrubbing Media used in scrubber	Disposal/ Recycle/ Reuse of Scrubbed media
1.	3	SA	1	2	9.63	SO_2, SO_3, Acid Mist	Intalox Ceramic Saddles	Washing with water	5 to10% Caustic solution	Disposed after treatment in ETP
2.	6	BSCl	Water scrubber :	0.5	2	HCl	Berl Ceramic	Washing with water	Water	Dilute HCl is

Sr. No.	Stack No.	Scrubber Attached to Process Plant	No. of Scrubbers	Dia. (m)	Ht. (m)	Process Emission scrubbed	Packing Material used in scrubber	Mode of regeneration of the Packing Material	Scrubbing Media used in scrubber	Disposal/ Recycle/ Reuse of Scrubbed media
			2				Saddles			recycled to CSA Plant
			Alkali scrubber : 1	0.5	6	HCl	Berl Ceramic Saddles	Washing with water	Water	Sent to ETP treatment in ETP
3.	5	CSA	3	0.9	5.37	HCl	Intalox Ceramic Saddles	Washing with water	Liquid SO_3	Recycled back to CSA Plant

2.7.2.4 Fugitive Emissions

The sources of fugitive emissions identified under existing and expansion activities are - (a) Process Operations (b) Related Miscellaneous Operations (c) Material Storage (d) Equipment Leaks (e) Fuel Storage Area

- **Process operations** -Here emissions from loading - unloading, mixing and filling operations are taken into considerations

- **Material Loading Emissions** - Emissions may occur during material loading in mixing and filling due to the displacement of organic vapours. Emissions may be emitted from a mixing tank when the device is uncovered or when a lid is open.

- **Surface Evaporation** - Surface evaporation may occur during mixing, dispersingoperations etc. if the vessel contents are exposed to the atmosphere.

- **Filling Losses** - Emissions from product filling occur during transfer and free-fall into the receiving container.

An emission control system typically consists of a capture device and a removal device. The capture device (such as a hood or enclosure) captures the emission-laden air from the emission area and ducts carry the exhaust air stream to removal equipment such as a recovery device or a destructive control device. The volatile matter getting release from the storage tanks, process piping, reactors, fuel storage and combustion are handled by various preventive measures mentioned as below -

- Solvent Recovery System: To Control of Solvent Losses and Process Emissions.
- The raw materials bags are opened in dispensing rooms provided with ID Fan followed by bag filters and scrubbers for controlling the emission released during handling of material.
- Each and every process emissions is passed through scrubber and finally released into atmosphere through adequate stack height.
- Preventive maintenance is done so as to prevent any leakage and spillage and thereby reducing the fugitive emission sources.
- Green belt is provided on all sides of fuel storage yard.

2.7.3 Solid Waste

Solid wastes from the Industries are categorized as hazardous and non-hazardous. Non-hazardous waste is defined as the waste that contributesno damage to human or animal life. However, it only adds to the quantity of waste.

The assignment w.r.t. Solid and Hazardous Wastes (SHW) aspect was done by **Mr. Vinay Kumar Kurakula** who is an empanelled EEIPL's Functional Area Expert (FAE) for SHW.Details of solid waste generated or to be generated from existing and expansion activities are given in following table-

Table 2.29 Solid Waste for Existing and Expansion Activities

Sr. No.	Type of Solid Waste	Quantity (kg/Annum)			Disposal
		Existing	Expansion	Total	
1.	Paper Waste	100	0	100	Sale to Authorized Party
2.	Broken Glass	10	0	10	
3.	HDPE Bags	100	0	100	
4.	Sulphur Sludge	120 MT/Annum	0	120 MT/Annum	CHWTSDF, Taloja

2.7.4 Hazardous Wastes

Wastes that pose substantial dangers immediately or over a period of time to human, plant or animal life are classified as Hazardous Wastes (HW). The different types of hazardous wastes generation details have been shown in following table-

Table 2.30 Hazardous Wastes for Existing and Expansion Activities

Sr. No.	Type of Hazardous Waste	Category	Quantity (kg/Day)			Disposal
			Existing	Expansion	Total	
1.	Chemical Sludge from Waste Water Treatment	35.3	833	109	942	CHWTSDF, Taloja / Sale to Authorized Party Membership No.- MWML - HzW - ROH - 313 (Valid up to 21.03.2020)
2.	Residues , Dust or Filter cakes	17.1	203	0	203	
3.	Spent Catalyst	17.2	4000 Lit./Annum	0	4000 Lit./Annum	

Refer **Appendix-I** for CHWTSDF membership letter.

2.7.4.1 Storage of Hazardous Wastes

The hazardous waste generated from manufacturing operations as well as from wastewaterpurification processes would be stored in a leachate proof tank which shall be stored in aleachate proof yard to be provided on site. Following **Figure 2.5** and **Figure 2.6** shows the section of storage tank and storage area. The details w.r.t. packing, storage, transportation and disposal of hazardous waste are provided in following table -

Table 2.31 Storage and Disposal of Hazardous Waste

Sr. No.	Hazardous Waste with Categories	Mode of Packing	Storage	Mode of Transportation	Disposal
1.	**Cat. No. 35.3** - Chemical Sludge from Waste Water Treatment	Sludge generated in the ETP treatment process collected into sludge bed where after the same are bagged for dispatch to CHWTSDF	Drums, containers and ETP sludge bags are stored in dedicated Hazardous Waste Storage yard in the premises. These drums, containers and bags will not be stored for more than ninety days on site.	Through trucks of Authorized transporter	CHWTSDF
2.	**Cat. No. 17.1** - Residues, Dust or Filter cakes	They will be bagged and dispatched to CHWTSDF		Through trucks of Authorized transporter	CHWTSDF
3.	**Cat. No. 17.2** - Spent Catalyst	Stored in Hazardous Waste Storage yard		Through trucks of Authorized transporter	Sale to Authorized Party/ CHWTSDF

Figure 2.5 Hazardous Waste Storage Tank

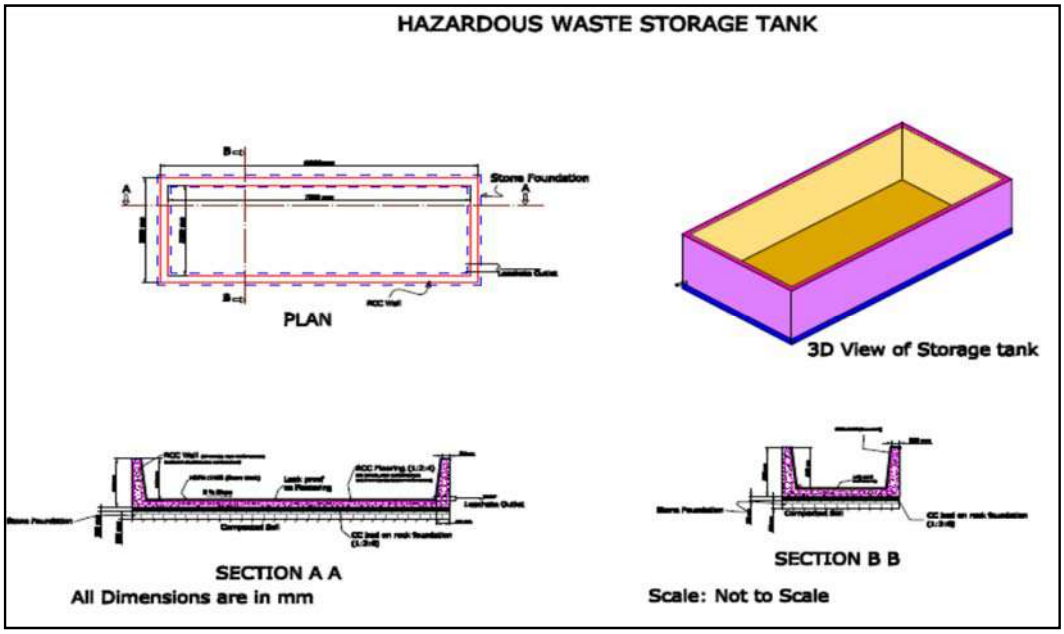
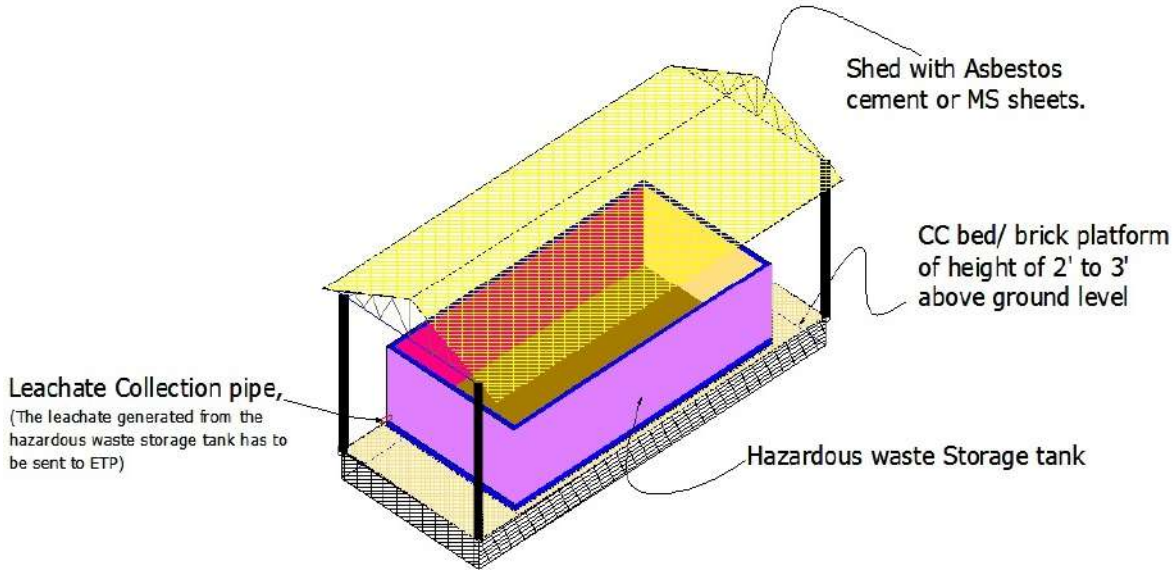


Figure 2.6 3D Diagram of Hazardous Waste Storage Tank



2.7.5 Noise Pollution

Noise is normally defined as objectionable or unwanted sound which is without agreeable quality and essentially non-euphonious. The concern on noise depends upon noise level near the source, in the work environment and near residential zone. Earlier, noise was summarized to be exclusively an occupational problem. But since the effects are found also on people who are not directly involved, it has acquired wider dimension. Hence, it is necessary to know the noise levels near the sources as well as near residential colonies.

2.7.5.1 Sources of Noise Pollution

There is no any major noise generating sources in proposed expansion activities. The noise generating sources under existing unit are Boiler, Reactors, Compressors and DG Set etc. The same would be kept in isolated areas. Further, proper acoustic treatments wherever required would also be provided to have the ambient noise levels as per CPCB standards. Among these, prominent source of noise would be the Boiler house. The workers would be provided with earmuffs and other Personal Protective Equipments (PPE's) which would give the reduction of 30 dB (A). The DG Sets would also be considered as one of the major sources of noise generation. However, this is not continuous source. Only in case of power failure, DG Set would be operated. Isolated and sound insulating structural arrangements would be provided to DG set. Moreover, as per Noise Pollution Regulation and Control (Amendment) Rules, 2010 it is enclosed in a canopy. Also, a silencer is provided to it as noise pollution control equipment.

Table 2.32 Noise Levels within the Industry

Sr. No.	Noise Area Within the Industry	Noise level in dB (A)
1.	Sulphuric Acid Plant	54
2.	Chloro Sulphonic Acid Plant	54
3.	Benzene Sulphonyl Chloride Plant	51
4.	Sodium Vinyl Sulphamate Plant	46
5.	Diethyl Sulphate Plant	45
6.	Benzene Sulphonic Acid and Other Sulphonic Acids Plant	42
7.	Biological Treatment Plant	49
8.	Maintenance DG shed	61

2.7.6 Odour Pollution

There are different odours sources in the existing set up, which include raw material and product storage places, process operations, loading/unloading sections etc. which could give rise to smell nuisance. To abate the odour problem, the industry has taken following steps in its existing unit. Under expansion same practice shall be adopted.

- All the feed, loading and unloading pumps for products and raw materials are fitted with mechanical seals instead of glands to reduce leakages through pumps.
- The products and raw materials loading and unloading area are provided with fumes extraction system comprising of circulation pump with blower and scrubber. The bulk storage tanks are connected to scrubber for taking care of fumes coming out from vent.
- The scrubbers are filled with plain water depending on the nature of the fumes.
- Adoption of Good Management Practices (GMPs).
- Arranging awareness and training camps for workers.
- Provision and use of PPE's like masks by everybody associated with odour potential prone areas.
- Installation of appropriate, adequate and efficient exhaust and ventilation system to remove and control odour from work zone areas.

2.7.7 Land Pollution

Land pollution may occur through a number of actions such as use of untreated effluent for gardening / irrigation, dumping of solid wastes in an uncontrolled manner and overall inefficient housekeeping and bad operation practices. Appropriate and adequate management practices including good housekeeping and periodic monitoring of various attributes contributing to dust are being undertaken in existing unitand same practice shall be adopted under expansion activities.

2.7.8 Anticipated Occupational Health Hazards and Safety

- The Occupational Healthand Safety (OHS) hazards anticipated in the plant is mostly due to chemical exposure hazard and physical hazard due to electrical and mechanical operations and maintenance works.
- Major anticipated occupational health and safety hazards are due to chemical exposure.
- Accidental skin or eye irritation andburns, respiratory andpulmonary diseases on exposure to chemicals orsolvent vapours, inhalation of chemical vapours.

- Liver, Kidney, CNS, CVS functions on chronic exposure.
- Accidents resulting from unsafe conditions due to poor housekeeping and not using the PPE's.
- Accidents due to unsafe practice of operation and maintenance like gas cutting and wielding may lead to injuries to various parts of the body.
- Muscular and skeletal disorders like muscular pains, spinal and joint pains due to ergonomic problems, lifting with wrong postures etc.

2.8 OPERATION AND MAINTENANCE COST

The capital as well as Operational and Maintenance (O & M) cost towards environmental aspects under proposed activities would be as follows -

Table 2.33 Capital as well as O & M Cost

Sr. No.	Description	Cost Component (Rs. Lakhs)	
		Capital	O & M/Year
1.	Air Pollution Control (APC) - Scrubbers, Stacks	5	20
2.	Water Pollution Control (WPC) - ETP, ZLD	150	150
3.	Noise Pollution Control (NPC)	20	--
4.	Occupational Health and Safety	--	7
5.	Environmental Monitoring and Management	--	1.6
6.	Green Belt Development	--	10
7.	Other		
7a.	Sulphur Sediment to MWML	--	13.44
7b.	Waste Catalyst to MWML	--	0.5
	Total	**175**	**202.54**

2.9 GREEN BELT DEVELOPMENT PLAN

As mentioned under **Table No.2.3**; the total plot area of TDMCCL is 88355m^2 (8.84 Ha). An area of 40925m^2 is the actual area on which the industrialactivities are carried out. As per MoEFCC norm 2.95 Ha area (around 4425 trees) is to be brought under green belt which accounts for 33 % of plot area. But under existing unit only 1000 trees have been planted. Under expansion, green belt will be augmented by 3500 No. of trees. After commissioning of the expansion the existing green belt shall be subsequently augmented in phase wise manner. Thick plantation barrier will be provided on the periphery of the MIDC industrial plot. Augmentation of avenue tree plantation along all the internal and approach roads shall be done. Refer **Figure 2.7** for Photographs of Existing green belt.

2.10 RAIN WATER HARVESTING ASPECT

Being a chemical based industry here collection of the rainwater getting accumulated from direct precipitation on the total roof area is taken in to account. The rainwater thus becoming available from terraces as well as roofs of various structures and units in the industrial premises is collected through arrangements of channels and pipes to be provided as per appropriate slopes at the roof level. The collected rain water is then taken to ground and either stored in open excavated tanks / ditches in the ground in the premises. The total amount of water that isreceived in the form of rainfall over an area is called the rainwater

endowment of that area. Out of this, the amount that can be effectively harvested is called the water harvesting potential. For the calculation of harvested rain water which would become available subsequent to rooftop harvesting, a computation method from the 'Hydrology and Water Resource Engineering' has been adopted. There under, "A. N. Khosla's Formula" has been followed. The allied calculations are as under -

Table 2.34 Details of Roof Top Area

Sr. No.	Description	Length x Width	Area (square feet)
1.	Control Room SA	40 x 20	800
2.	A Type Building	(30x25) x 3	2250
3.	D Type Building	(30x25) x 3	2250
4.	CType Building	(50x22) x 2	2200
5.	Canteen Hall	100 x 28	2800
6.	Engineering stores	80 x 40	3200
7.	Admin Building	60 x 30	1800
8.	ETP Shed	90 x 40	3600
	Total Area	-	**18900**

The average annual rainfall in the area = 3029 mm.

Now, as per "A. N. Khosla's Formula", the average annual accumulation can becalculated by using the following equation-

R = [P- (t/2.12)]

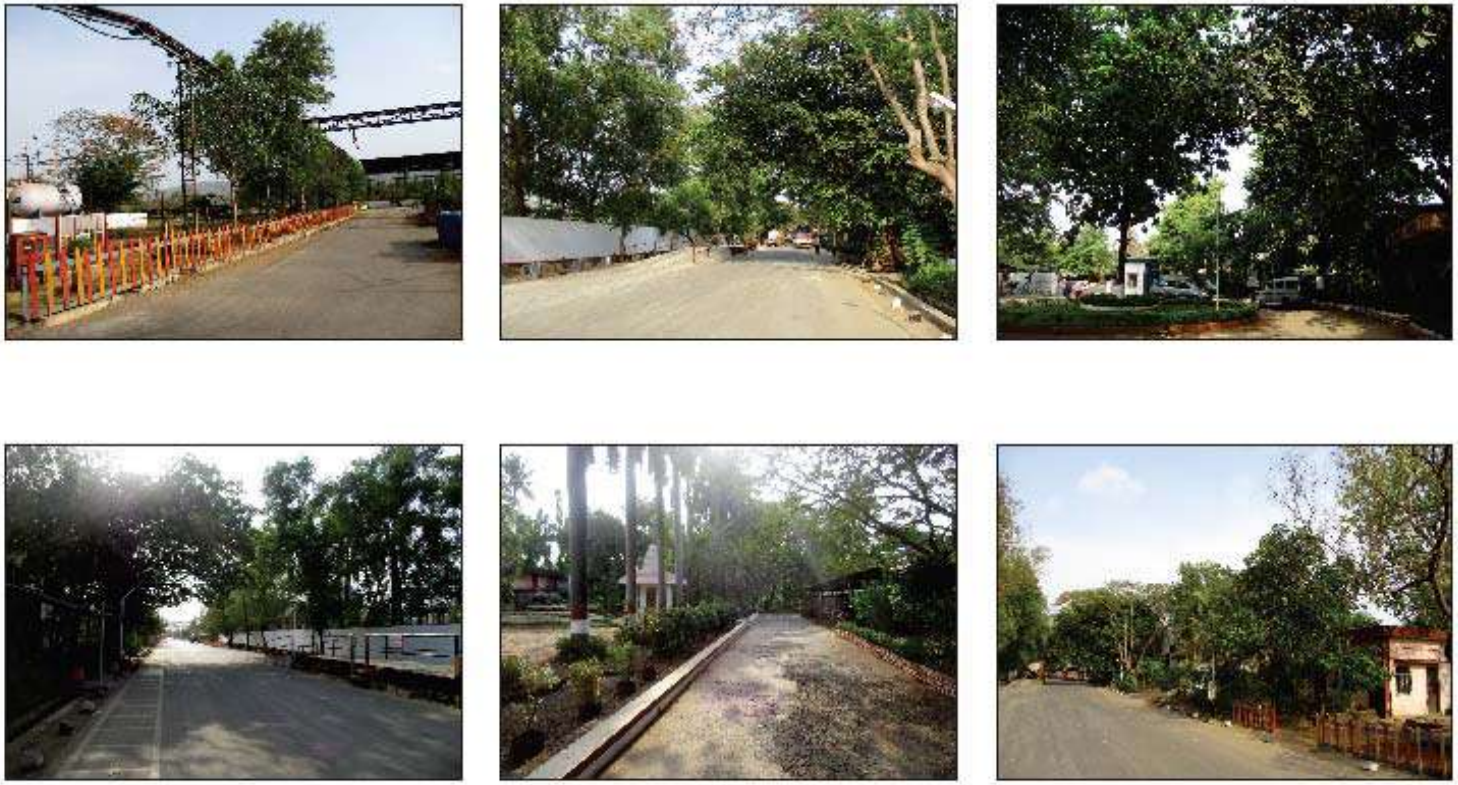
Where,
R = Average annual accumulation in cm, for the catchment area.
P =The corresponding average annual rainfall or precipitation in cm, over the entire catchment. (In current case it is 3029 mm i.e. 303 cm)
t=Mean annual temperature in degree centigrade. (In current case it is 26.4^0C.)

∴The accumulation on the entire catchment area will be,

R = [303 - (26.4/2.12)]
= 290.54 say 291 cm

∴ Volume acquired by this accumulation water will be,
= 291 cm × Roof Top Area
= 2.91 m × 1756 m^2
= 5109.96 m^3

FIGURE NO. 2.7 - EXISTING GREEN BELT AT
THE DHARAMSI MORARJI CHEMICAL COMPANY LTD., MIDC DHATAV, TAL.: ROHA, DIST.: RAIGAD



Chapter 3

DESCRIPTION OF THE ENVIRONMENT

3.1 INTRODUCTION

This chapter incorporates description of existing environmental status in the 'Study Area' which is a region within a circle of 10 Km radius with the industry / plant at its center. The existing environmental condition of the study area is representative of impacts due to all the industries, units and projects in it and is described with respect to the topography, climate, hydro-geological aspects, atmospheric conditions, water quality, soil characteristics, flora, fauna, socio-economic profile, land use and places of archaeological importance. The study area in respect of proposed expansion project by TDMCCL is located at Plot No. 105 in MIDC Industrial Area, P.O. Dhatav, Taluka: Roha, District: Raigad. The project site lies between 18°25'33.00" N Latitude and 73°08'31.41" E Longitude.

3.2 LAND USE AND LAND COVER (LU & LC)

The term Land Use relates to the human activity or economic function associated with a specific piece of Land, while the term Land Cover relates to the type of feature present on the surface of the earth (Lillesand and Kiefer, 2000). The knowledge of Land Use Land Cover is important for many planning and management activities as it is considered as an essential element for modeling and understanding the earth system. Land use maps are presently being developed from local to National to Global Scales for Environmental Impact Studies. The satellite Remote Sensing technology has found its acceptance worldwide for rapid resource assessment and monitoring, particularly in the developing world. All these advancement have widened the applicability of Remotely Sensed data in various areas, like forest cover, vegetation type mapping, and their changes in regional scale. If satellite data is judiciously used along with the sufficient ground data, it is possible to carry out detailed forest inventories, monitoring of land Use and vegetation cover at various scales.

The assignment w.r.t. land use and land cover mapping of study area using LISS IV Satellite Image has been done by **Mr. Vinaykumar Kurakula** who is an empanelled Functional Area Expert (FAE) of EEIPL for **LU & LC**. The scope of work methodology involved and allied details are presented in following paragraphs.

3.2.1 Scope of Work

Major objective of the assignment was to prepare LU & LC of the study area and simultaneously demarcating topographic features especially emphasizing drainage map of the region.

3.2.2 Study Area

For the present study, an area of 10 Km radius from TDMCCL Plant (which comes about 314.15 m^2) has been marked and selected as per guidelines. Also, there are many industries located in study area. The lists of major industrial units have been tabulated in **Table 3.2** and their sources of pollution have been mentioned in **chapter - 4**. Existing status of industrial areas in Raigad district are mentioned in following table -

Table 3.1 Existing Status of Industrial Areas in Raigad district

Name of Area	Area (In Ha.)	No. of Plots Developed	No. of Plots Allotted	Prevailing Rate Per m^2 (In Rs.)	No. of Units Production
Mahad	471.96	339	337	295/-	136
Add.Mahad	429.49	139	128	250/-	15
Roha	**244.69**	**129**	**129**	**800/-**	**97**
Usar	217.19	2	2	335/-	02
Nagothane	895.33	3	3	875/-	03
Vile Bhagad	764.16	427	417	635/-	0
Taloja	863.19	436	423	6645/-	326
Patalganga	647.62	17	--	2260/-	--
Total	4533.63	149	1439	--	579

Table 3.2 List of Major Industries near TDMCCL Industry

Sr. No.	Name of the Industry	Address
1.	Rhodia Specialty Chemicals India Limited (Formaly Albright & Wilson Chemicals India Ltd.)	Plot No.103/104 MIDC Area, Dhatav, Tal.: Roha.
2.	Anshul Specialty Molecules Limited	Plot No.108, 109 & 110 MIDC Area, Dhatav, Tal.: Roha.
3.	Aryan Pesticides Private Limited	Plot No.1, 2, 26 & 27 MIDC Area, Dhatav, Tal.: Roha.
4.	Bec Chemicals Private Limited	Plot No. 24, MIDC Area, Dhatav, Tal.: Roha.
5.	Calchem Industries India Limited	Plot No. 61 & 62, MIDC Area, Dhatav, Tal.: Roha.
6.	Clariant Chemicals India Limited	Plot No.113/114, MIDC Area, Dhatav, Tal.: Roha.
7.	Excel Industries Limited	Plot No.112, 20/1, Os-2, MIDC Area, Dhatav, Tal.: Roha.
8.	Iftex Oil & Chemicals Limited	Plot No.22/2, MIDC Area, Dhatav, Tal.: Roha.
9.	Kisan Irrigations Limited	Plot No. 69/70, MIDC Area, Dhatav, Tal.: Roha.
10.	Kores (India) Limited	Plot No. 59A, 65b, 66c & 66a, MIDC Area, Dhatav, Tal.: Roha.
11.	Lime Chemicals Limited	Plot No. 43, MIDC Area, Dhatav, Tal.: Roha.
12.	Mark Omega Organic Industries Limited	Plot No. 44/45, MIDC Area, Dhatav, Tal.: Roha.
13.	Neelikon Food Dyes & Chemicals Ltd.	Plot No. 67, MIDC Area, Dhatav, Tal.: Roha.
14.	Pepsico India Holdings Limited	Plot100/1, MIDC Area, Dhatav, Tal.: Roha.
15.	Rathi Dye Chem Limited	Plot No. 40, MIDC Area, Dhatav, Tal.: Roha.
16.	Roha Dychem Private Limited	Plot No. 42, MIDC Area, Dhatav, Tal.: Roha.
17.	Sadhana Nitro Chem Limited	Plot No. 47, MIDC Area, Dhatav, Tal.: Roha.
18.	Sudarshan Chemical Industries Ltd.	Plot No. 46, MIDC Area, Dhatav, Tal.: Roha.
19.	Arjun Food Colorants Manufacturing Private Limited	Plot No. 22/1-B, MIDC Area, Dhatav, Tal.: Roha.
20.	Unichem Laboratories Private Limited	Plot No. 99, MIDC Area, Dhatav, Tal.: Roha.
21.	Vidhi Dyestuffs Manufacturing Ltd.	59/B/68, MIDC Area, Dhatav, Tal.: Roha.

3.2.3 Purpose of Land Use Mapping

Land use study requires data regarding topography, zoning, settlement, industry, forest, roads and traffic etc. The collection of this data was done from various secondary sources viz. census books, revenue records, state and central government offices, Survey of India toposheet etc. and through primary field surveys as well as high resolution multi spectral satellite image from IRS RESOURCESAT 2 Satellite with LISS IV sensor. The date of pass of the image is 08.01.2016. The image has a spatial resolution of 5M x 5M. Apart from LULC Map, topographic features of the region were extracted covering village locations, streams, roads, river in the satellite image. In addition to this, natural drainage network is also captured to prepare drainage map as required. The purposes of land use studies are -

- To determine the present land use pattern
- To analyze the impact on land use due to industrial growth in the study area
- To give recommendations for optimizing the future land use pattern vis-à-vis growth of industries in the study area and its associated impacts

3.2.4 Methodology for LU & LC Study

The overall methodology adopted and followed to achieve the objectives of the present study involves the following steps -

- Satellite data of IRS Resourcesat-2 sensor is geometrically corrected and enhanced using principal component method and Nearest Neighborhood resampling technique.
- Preparation of basic themes like layout map, transport & settlement map and from the satellite image by visual interpretation.
- Essential maps (related to natural resources) like Land use / Land cover map are prepared by visual interpretation of the satellite imagery. Visual interpretation is carried out based on the image characteristics like tone, size, shape, pattern, texture, location, association, background etc. in conjunction with existing maps / literature.
- Preliminary quality check and necessary corrections are carried out for all the maps prepared.
- All the maps prepared are converted into soft copy by digitization of contours and drainages. In that process editing, labeling, mosaicing, quality checking, data integration etc. are done, finally Land use areas are measured in Square Kilometers. Refer **Figure 3.1** for Google Image showing 10 km radius study area circle.

Figure 3.1 Google Image Showing 10 Km Radius Study Area Circle

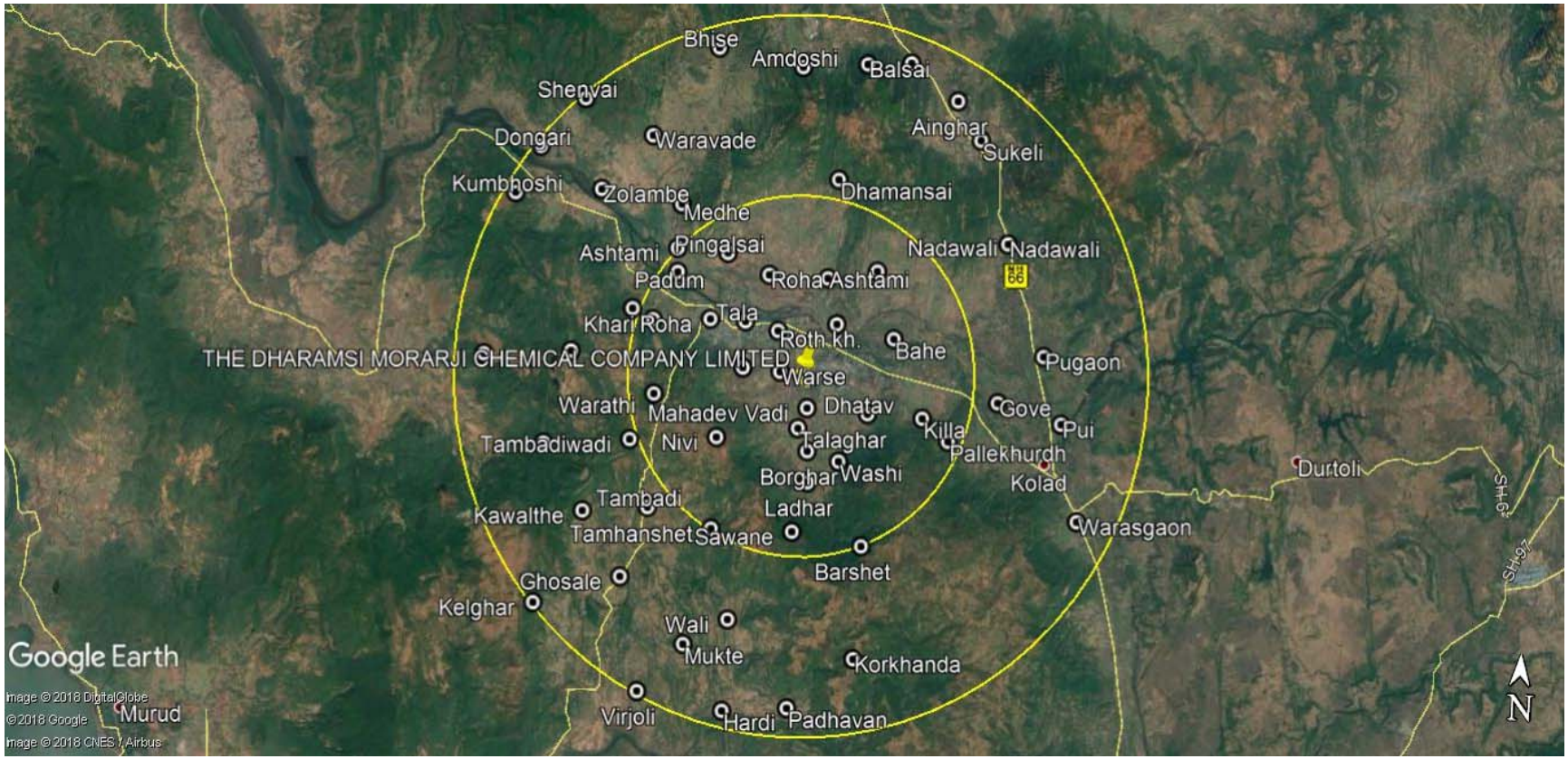
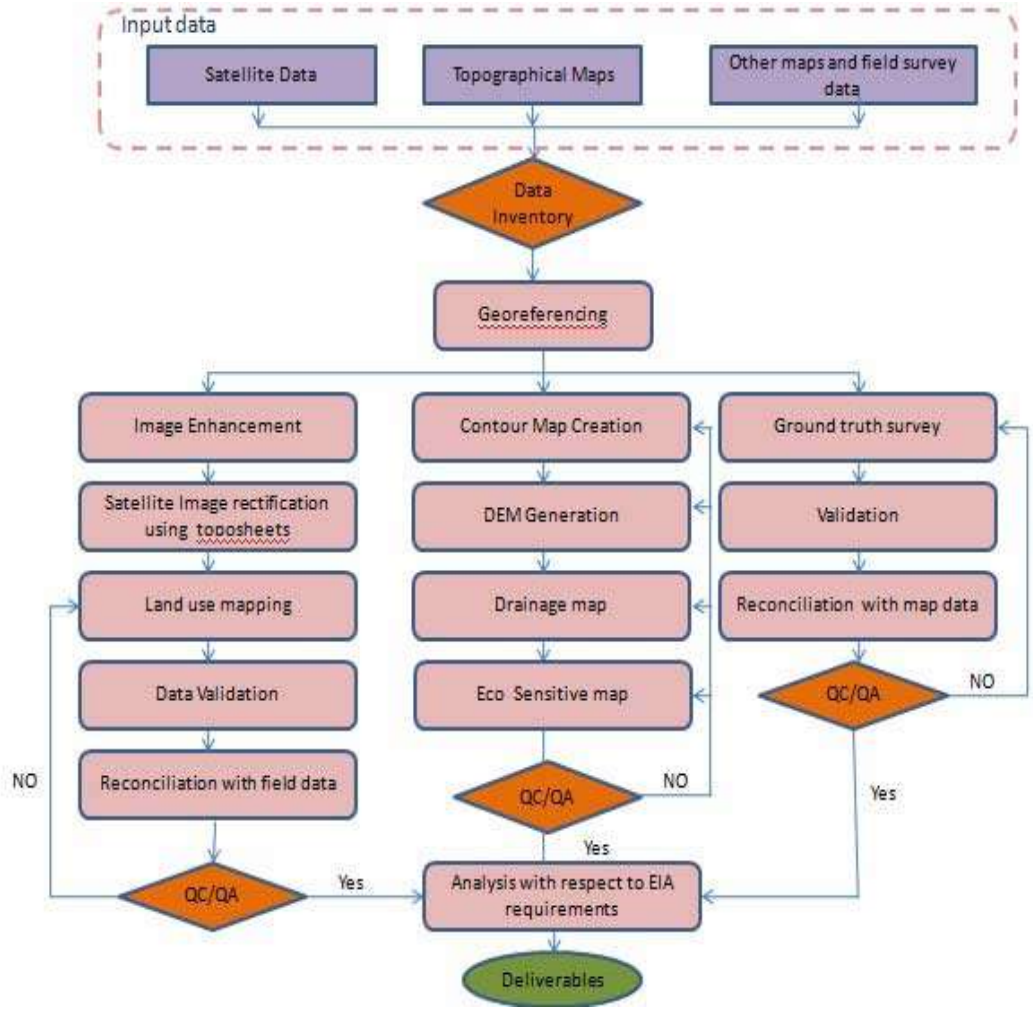


Figure 3.2 Process Flow Chart



3.2.5 Satellite Data: Obtained from NRSC, Hyderabad

Table 3.3 Source of Satellite Data

Sr. No.	Satellite Data	Date	Format
1.	IRS–Resourcesat2	18 DEC 2016	TIFF

Since all the data of the study area were geo-referenced to UTM 43N WGS84 projection system, the satellite images were also obtained with the same coordinate system from NRSA. Before image classification was carried out, the satellite image was pre-processed. All the processing and classification of the satellite images were performed in the ERDAS Imagine 9.1 software. The data was delivered in separate bands of 2, 3 and 4. As such, the first step was to stack together to get a composite. The scenes were then mosaiced together since the study area covered parts of both the scenes. Once a satisfactory mosaic was done whereby the joins were no longer visible and the radiometric resolution of both the scenes were matched. This subset of the original images was then run through the unsupervised classification tool of the software to finally create the grouping of classes present in the study area. The location of TDMCCL industry is shown on satellite image in **Figure 3.3** and visual interpretation keys used for the study are given in **Figure 3.4**.

Figure 3.3 Satellite Image

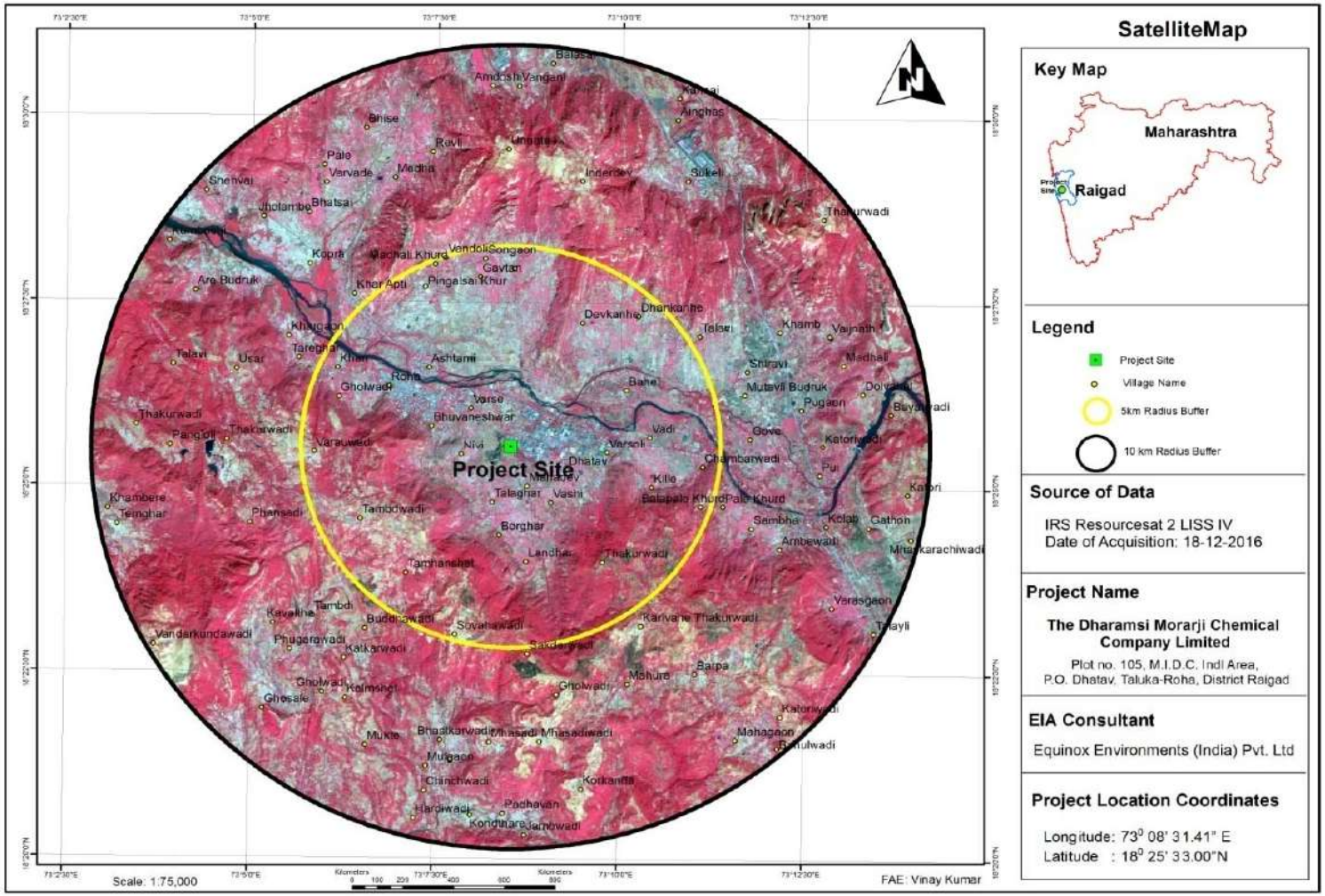
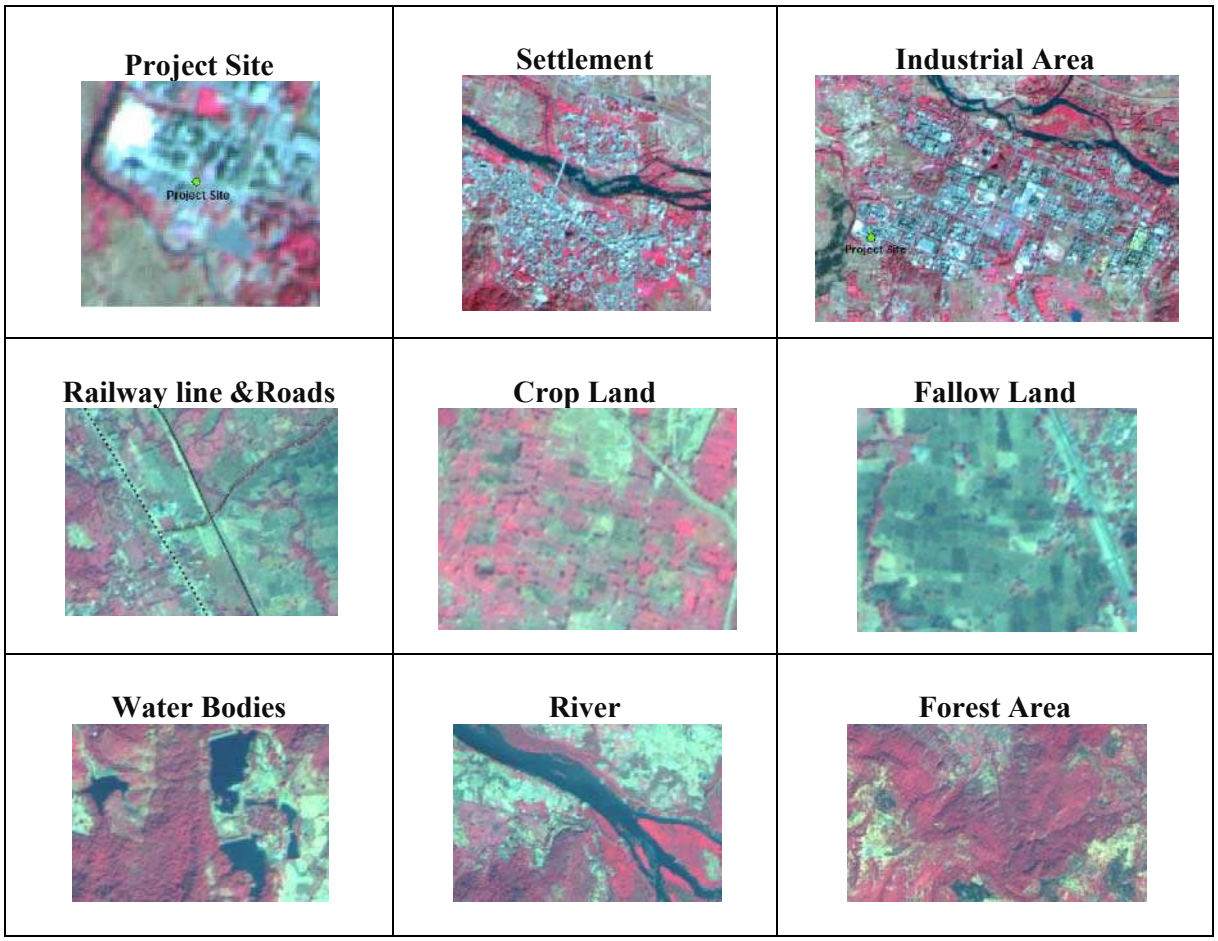


Figure 3.4 Visual Interpretation Key Used for the Study



3.3 LAND USE STUDIES

It includes study of topographic features and land use under which area statistics for Land Use Land Cover classes and Land Use Land Cover statistics are included.

3.3.1 Topographical Features

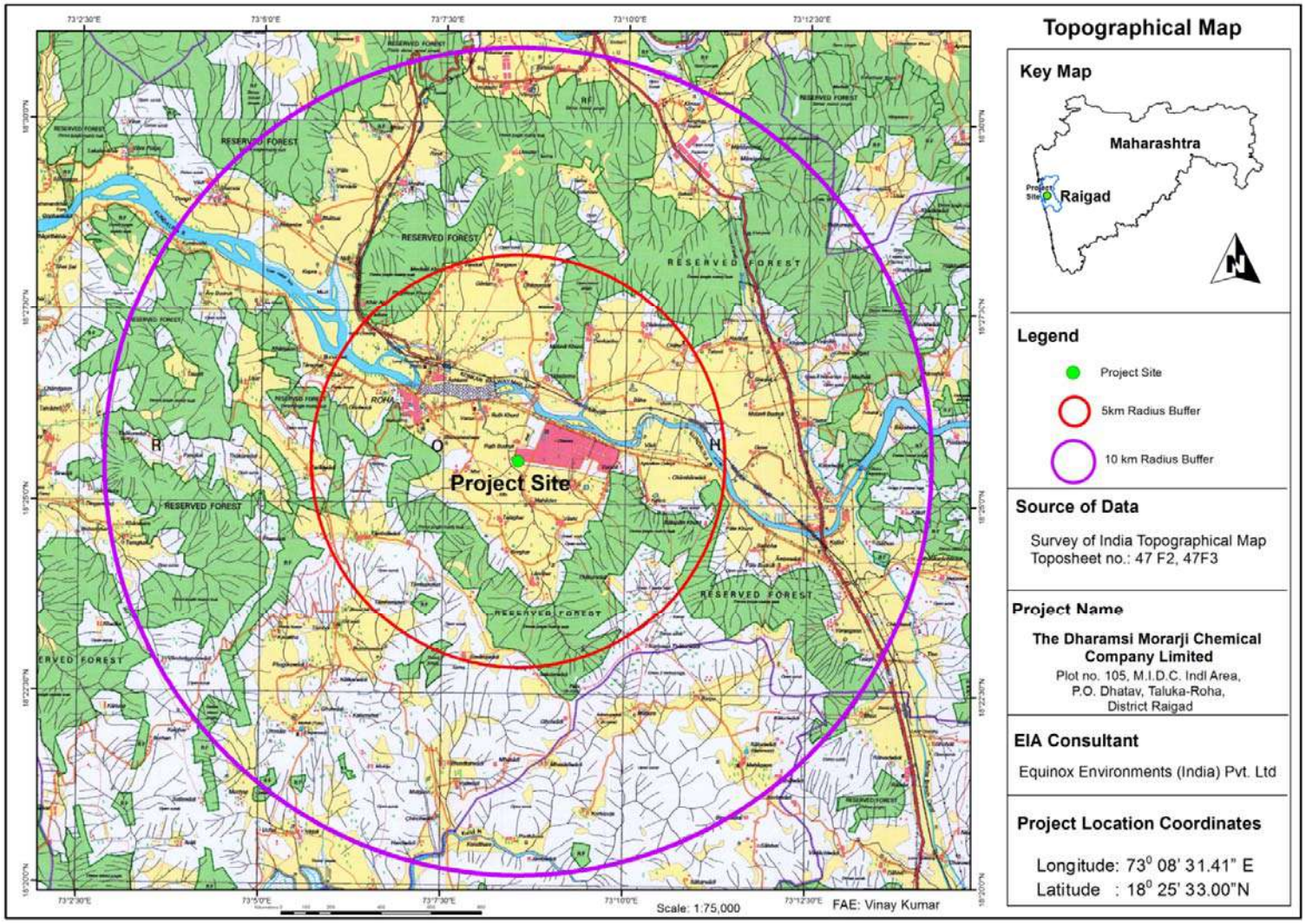
Topographical Data: Obtained from Survey of India

Table 3.4 Source of Topographical Data

Sr. No.	Toposheet No.	Type	Format
1.	42 F2, 42F3	Scanned	TIFF

In the present study, the essential maps generated from topo-sheets are layout map, drainage map, Contour Map. The maps are prepared to a certain scale and with attributes complying with the requirement of ToR. The location of entities on the earth's surface is then specified by means of an agreed co-ordinate system. For most GIS, the common frame of co-ordinate system used for the study is UTM co-ordinates system. All the maps are first Geo-referenced. The same procedure was also applied on remote sensing data before it is used to prepare the Essential maps. The topographical map (**Refer Figure 3.5**) of industrial site of scale 1:75000 was obtained from Survey of India.

Figure 3.5 Topographical Map

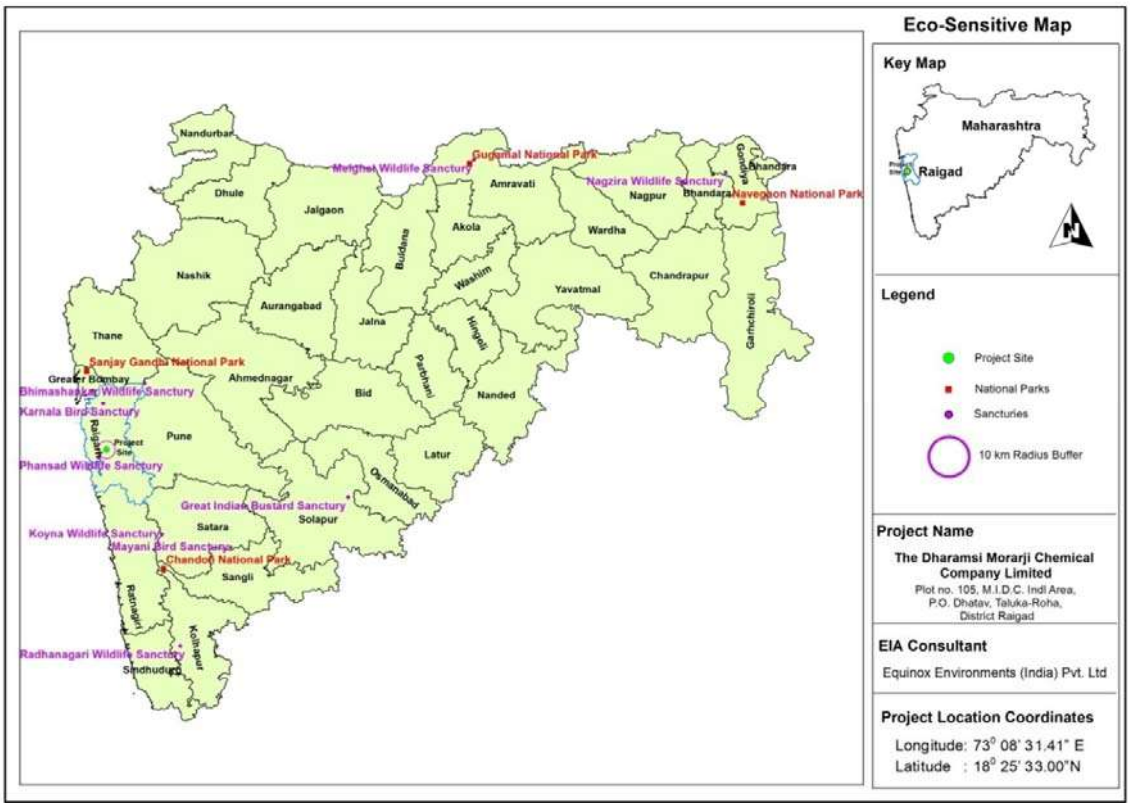


3.3.2 Eco-Sensitive Map

Eco-sensitive map is a matter of more concern because the project should not hamper the natural eco system and surrounding natural resources. The Eco- sensitive map of the project site was developed on the Maharashtra state map showing all the eco-sensitive area of Maharashtra state. The proposed expansion unit is in MIDC area, there are no eco-sensitive areas within the 10 km of proposed expansion unit. The nearest sanctuary is Phansad Wild life Sanctuary. Although, there are no eco-sensitive areas with 10 km of proposed unit, the plant management shall take precautionary measures and not to release pollutants that can damage the surrounding eco system.

The Eco-sensitive map **(Refer Figure 3.6**) showing Wild Life Sanctuary and National Park in Maharashtra state.

Figure 3.6 Map showing Wild Life Sanctuary and National Park in Maharashtra



3.3.3 Land Use Map Analysis

Land use Map Analysis done based on the image color, texture, Tone etc. Following steps are used to analyze the Land use pattern of project site -

- Collection of IRS Resourcesat-2 images and made fused and blended the images for color combinations using Image interpreter-Utilities and Layer stack option available in ERDAS.
- Identification AOI and made a buffer of 10 km radius.
- Enhance the Fused and blended IRS Resourcesat-2 image using the Spatial, Radiometric and Temporal options in ERDAS.

- Rectified the IRS Resourcesat-2 image using Georeferencing technique, Toposheet to get UTM coordinate system.
- Subset the IRS Resourcesat-2 images and Toposheet using 10 Km buffer AOI.
- Automatic classifications done for IRS Resourcesat-2 images using maximum iterations and number of options in unsupervised classification options.
- Created the signature file by selecting the more samples of different features with AOI on Unsupervised classification image.
- Export to Vector layer from supervised classification image.
- Conducting QC / QA and finalized the data.

3.3.4 Land Use of Study Area

Land use map (**Refer Figure 3.8**) developed was based on the image color, texture, tone and also ground truth verification data. Ground truth verification was carried out to validate the results of classified image and reconciliation was carried out with actual location of land mark features such as water bodies, agriculture land etc.

The supervised classification of the satellite image revealed following classes -

Table 3.5 Area Statistics for Land Use & Land Cover Classes

Sr. No.	Classes	Area (Ha)	Percentage (%)
1.	Built Up Area	1635	5.20
2.	Crop Land	7102	22.61
3.	Fallow Land	1090	3.47
4.	Scrub Land	8625	27.45
5.	River	465	1.48
6.	Mining Area	515	1.64
7.	Forest Area	11915	37.93
8.	Water Bodies	68	0.22
	Total	**31415**	**100.00**

Figure 3.7 Graphical Presentation of Land Use & Land Cover Classification

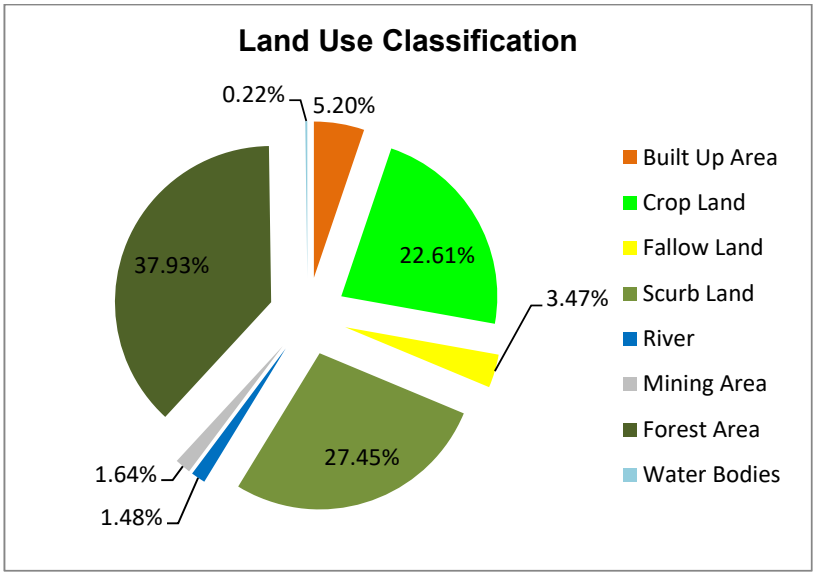
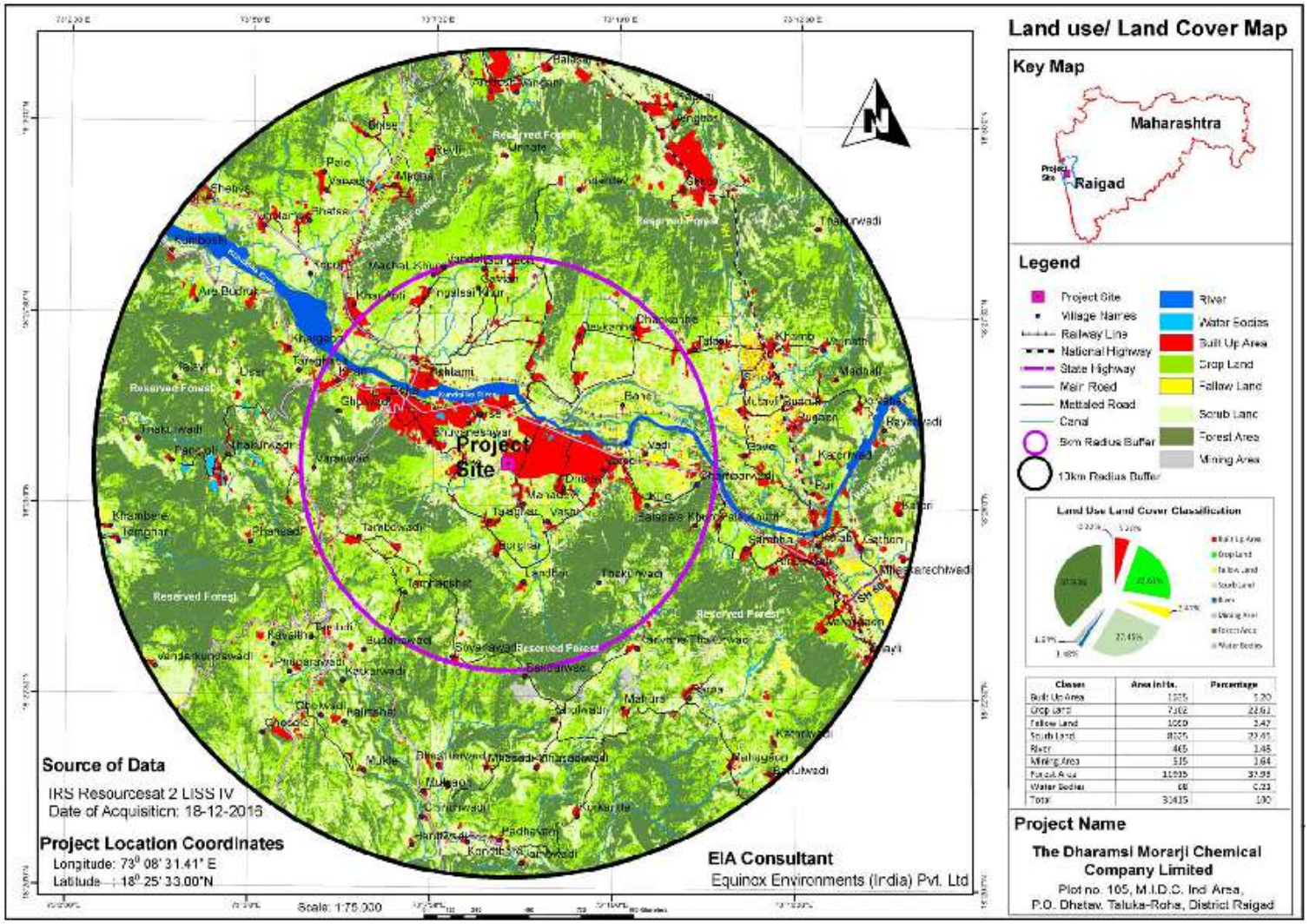


Figure 3.8 Land Use and Land Cover Map



Interpretation:

- **Built Up Area:** Built Up Area cover about 5.20 % of area within 10 km radius of study area. The surrounding villages around the project site are well developed with road, electricity and water connectivity.

- **Cropland:** 22.61 % of the study are is crop land, the major crop in the area are rice and wheat.

- **Fallow land:** Fallow land that covers about 3.47% area within 10 km radius buffer. This fallow land is because of changing of crop type and leaving the land uncultivated to get fertile. Some of the fallow land is seen because of hilly region where there is lack of continuous water supply.

- **Water Bodies:** It occupies about 0.22% in this study area.

- **Forest land:** Forest land covers about 37.93% of area within 10 km radius of study area. The covers with all type of plant species.

- **Scrub:** It is found that the some part of study area is also covered with dense scrub covering about 27.45% of total study area.

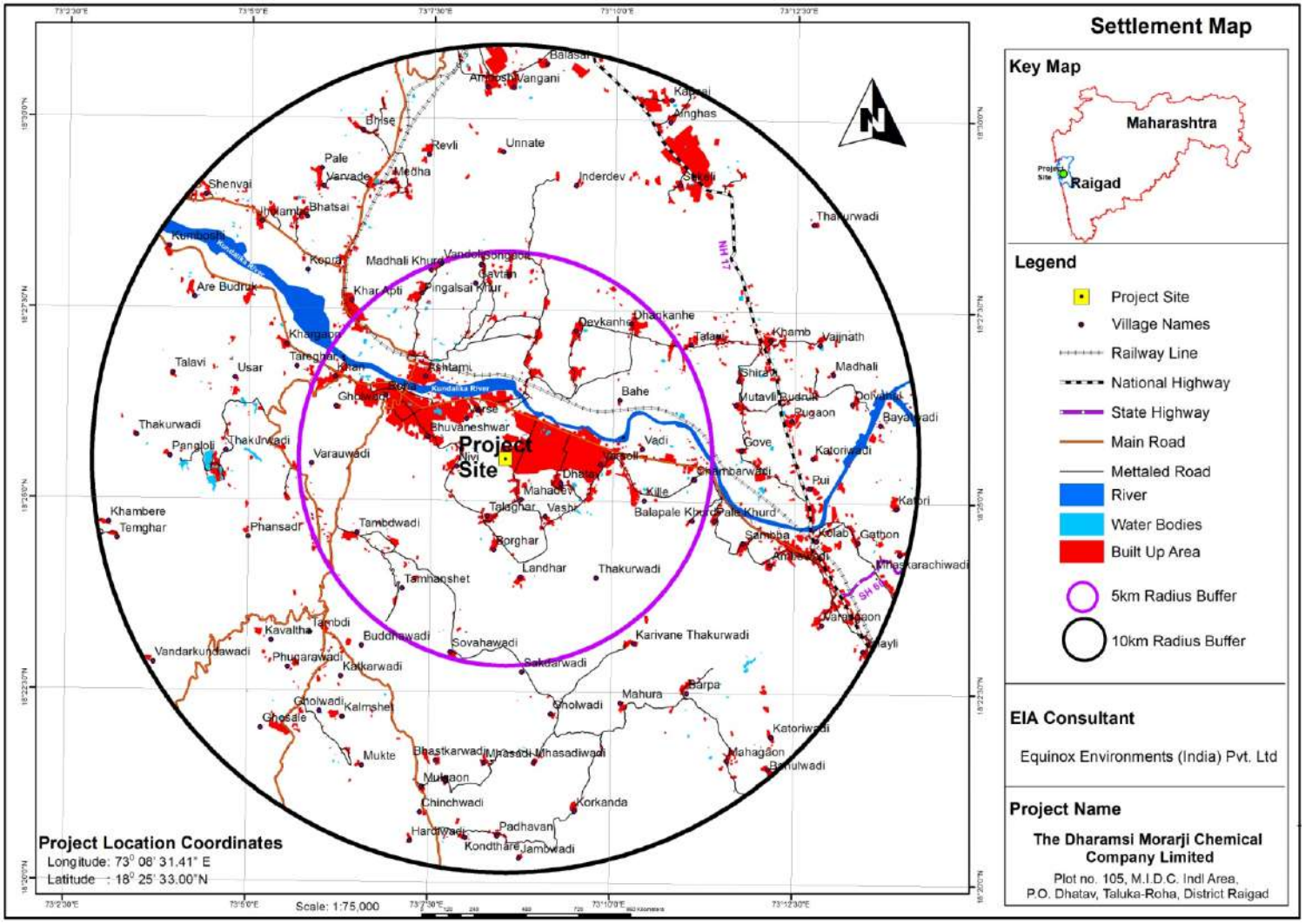
- **Mining:** The mining area is about 1.64% of study area, mainly rock cutting for aggregate for construction.

3.3.5 Settlement Map

The area has good literacy rate and there is a lot of development taking place in this area. All the villages are well connected with the roads.

The settlement map shows the location of villages along with the roads and industries as shown in figure below -

Figure 3.9 Settlement Map



3.4 SOIL CHARACTERISTICS

3.4.1. Soil Quality: Present status

Soil quality is the capacity of a specific kind of soil to function, within natural or managed ecosystem boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality and support human health and habitation. Soil quality reflects how well a soil performs the functions of maintaining biodiversity and productivity, partitioning water and solute flow, filtering and buffering, nutrient cycling and providing support for plants and other structures. Thus, soil quality plays vital role in any particular geographical phenomenon of ecology as well as physico-chemical environment. Soil quality can indicate the current as well as future issues related with the water, ecology and life in the particular region. Thus, it is clearly visible that soil.

Contamination may result in eventuality in form of contamination of water, ecological destruction, and loss of productivity, food crisis and so threat to life. The major source of contamination is wastes from industries as well as overuse of fertilizers & pesticide. Thus, to determine the exact impacts of any proposed expansion project, it is very essential to determine the existing status of soil quality and existing stress through a study of soil quality assessment.

Considering this, for studying soils of the region, sampling locations were selected to assess the existing soil conditions in and around the project area representing various, physiographic conditions, geology, land form and land use conditions. The physical, chemical characteristics were determined. The samples were collected by soil auger and other required equipments, up to a depth of 30 cm. as per standard soil sampling procedure , given in Soil survey manual, All India soil and land use survey, New Delhi-1970 of Ministry of agriculture, Govt. of India.

The assignment w.r.t. Soil conservation (SC) has been done by **Mr. B. S. Lole** who is an empanelled Functional Area Expert (FAE) of EEIPL for **SC**.

3.4.2. Methodology

3.4.2.1 Methodology of Data Generation

The present study of the soil profile establishes the baseline characteristics and this will help in future identification of the incremental concentrations if any, due to the operation of the project. The sampling locations have been identified with the following objectives -

- To determine the baseline soil characteristics of the study area
- To determine the impact of industrialization on soil characteristics
- To determine the impact on soils more importantly from agricultural productivity point of view

Eight locations in and around the proposed expansion plant boundary were selected for soil sampling. At each location, soil samples were collected from surface 0 to 30 cm depth and are homogenized and collected after quartering. The homogenized samples were analyzed for physical and chemical characteristics. The soil samples were collected during post-monsoon season. (21st Nov., 2017)

The samples have been analyzed by NABL accredited laboratory as per the established scientific methods for physico-chemical parameters. The methodology adopted for each parameter is described in following table -

Table 3.6 Analytical Techniques for Soil Analysis

Parameter	Method (ASTM Number)
Grain size distribution	Sieve analysis (D 422 - 63)
Textural classification	Chart developed by Public Roads Administration
Bulk density	Sand replacement, core cutter
Sodium absorption ratio	Flame photometric (D 1428 - 82)
pH	pH meter (D 1293 - 84)
Electrical conductivity	Conductivity meter (D 1125 - 82)
Nitrogen	Kjeldahl distillation (D 3590 - 84)
Phosphorus	Molybdenum blue, colourimetric (D 515 - 82)
Potassium	Flame photometric (D 1428 - 82)
Iron	AAS (D 1068 - 84)
Zinc	AAS (D 1691 - 84)
Boron	Surcumin, colourimetric (D 3082 - 79)
Chlorides	Argentometric (D 512 - 81 Rev 85)

3.4.2.2 Sources of Information

In addition to field surveys, other sources of information were National Bureau of Soil Survey and Land Use Planning (NBSS and LUP) as well as District Census Data from Census of India, 2011.

3.4.3. Soil Types

The chief soil found in the study region is very shallow, well drained, loamy soils on very gently sloping undulating and rolling lands with moderate erosion; associated with moderately deep, well drained, clayey soils on very steeply sloping lands with severe erosion and moderate stoniness. The study area consists of very shallow, well drained, loamy soils on very steeply sloping elongated ridges / hills with very serve erosion; associated with shallow moderately well drained; clayey soils on very gently lands with moderate erosion. Also the study area consists of very shallow, somewhat drained, loamy soils on moderately steeply sloping dissected hills and intervening valleys with serve erosion; associated with moderately deep, moderately well drained, clayey soils on very gently sloping lands with moderate erosion. (Refer **Figure 3.10** and **Figure 3.10** for Soil sample location map)

Overall, Eight soil sampling points were selected. The locations are listed in **Table 3.7** and analysis report under **Table 3.8**.

Figure 3.10 Soil Map

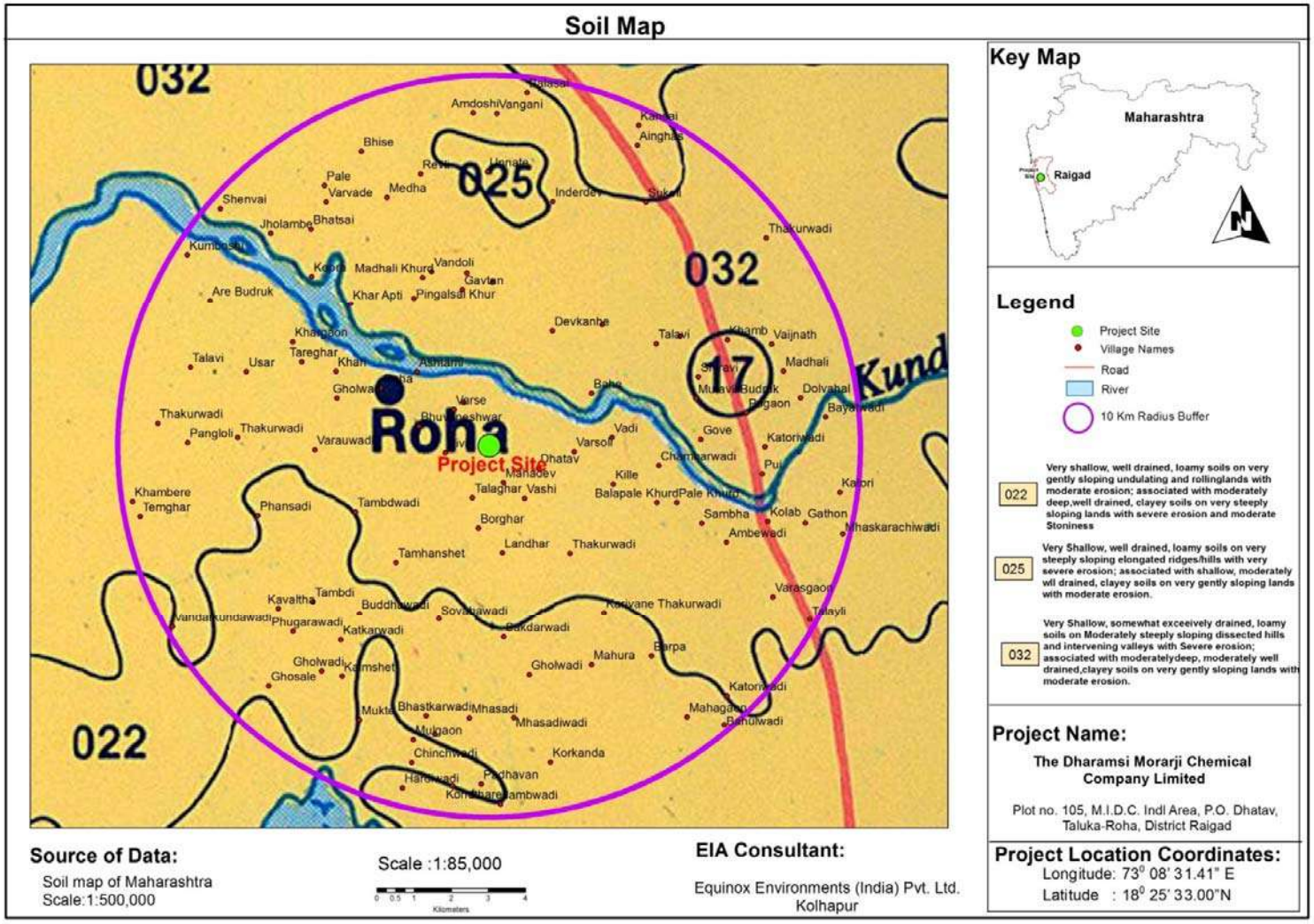


Table 3.7 Soil Sampling Locations

Station Code	Name of the Sampling Point	Co-ordinates	Elevation (Ft)	Direction w.r.t. the Industrial Site
S1	Industrial Site	18^0 25’33”00 N 73^0 08’31”41 E	52.3	--
S2	Dhatav	18^0 25’17”1 N 73^0 09’20”7 E	47.9	SE
S3	Talaghar	18^0 24’94”9 N 73^0 08’49”4 E	50.8	SW
S4	Landhar	18^0 24’17”6 N 73^0 08’78”4 E	48.1	SW
S5	Nivi	18^0 21’29”8 N 73^0 07’74”3 E	57.1	W
S6	Udadhavne	$18^0$26’61”0 N 73^0 12’91”6 E	38.8	N
S7	Ashtami	18° 26’93”4'N 73° 7’08”8'E	03	NW
S8	Sambe	$18^0$24’63”5 N 73^0 12’07”9 E	44.3	SE

Figure 3.11 Soil Sample Location map

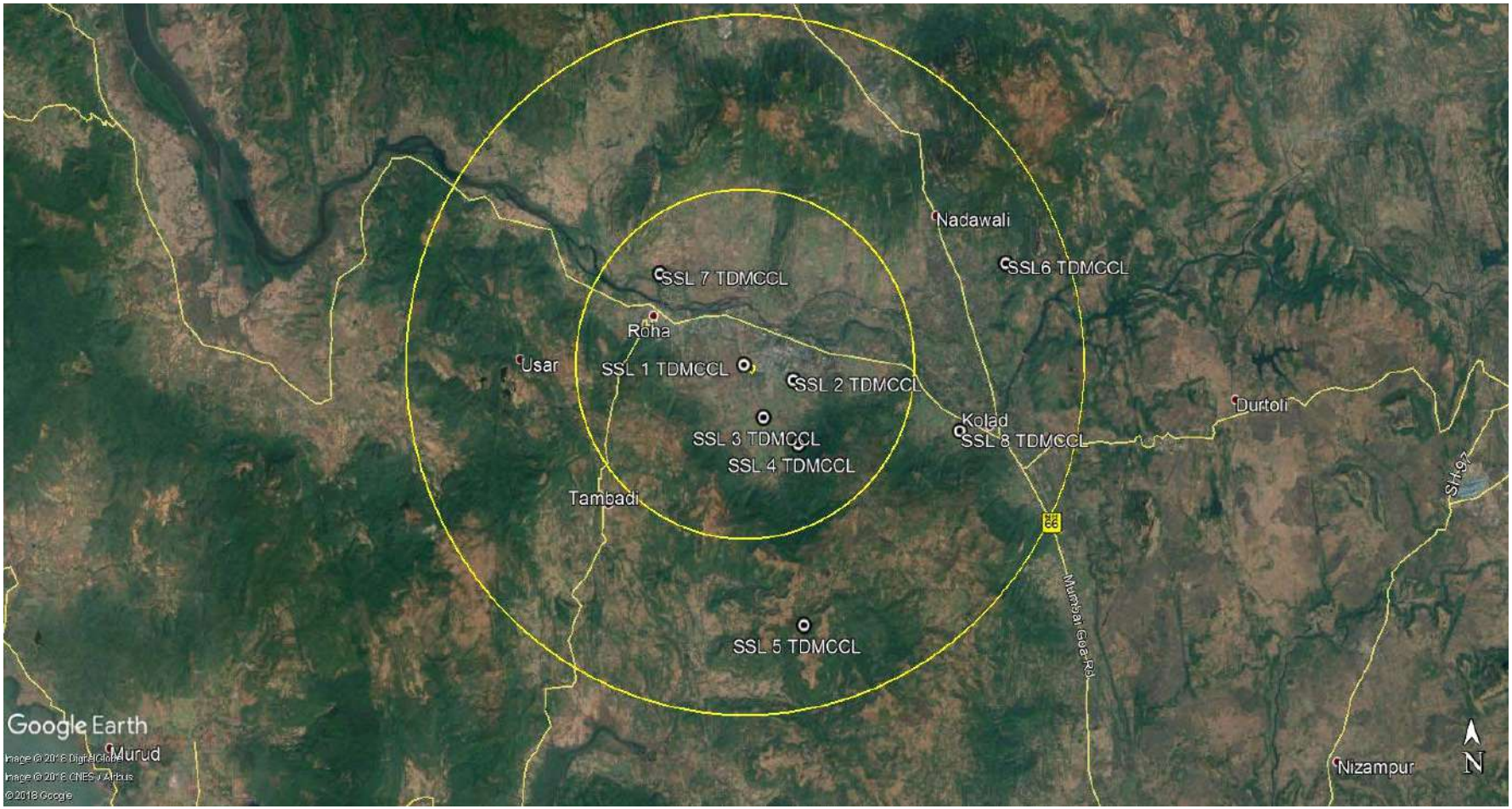


Table 3.8 Existing Soil Characteristics

Sr. No.	Parameter	Unit	Location							
			Ind. Site (S1)	Dhatav (S2)	Talaghar (S3)	Landhar (S4)	Nivi (S5)	Udadhavane (S6)	Ashtami (S7)	Sambe (S8)
A	**Physical Parameter**									
1.	Soil Texture									
a.	Sand	%	16	18	15	8	18	20	28	29
b.	Silt	%	27	24	20	22	30	31	34	38
c.	Clay	%	57	58	65	70	52	57	38	33
2.	Bulk Density	gm/cc	1.28	1.24	1.31	1.51	1.15	1.18	1.22	1.27
3.	Permeability	cm/hr	0.52	0.54	0.16	0.13	0.47	0.52	1.55	1.61
4.	Water Holding Capacity	%	61.18	52.14	55.00	58.30	42.27	37.53	45.61	37.13
5.	Porosity	%	33.27	54.54	50.40	55.79	47.89	32.58	45.81	39.54
B	**Chemical Parameter**									
6.	pH (1:5 Aq. Extraction at 24°C)	--	6.71	6.84	7.15	7.22	6.53	7.18	7.33	7.28
7.	Conductivity (1:5 Aq. Extraction at 24°C)	mS/cm	0.22	0.13	0.14	0.17	0.19	0.23	0.24	0.20
8.	Cation Exchange Capacity	meq/100 gm	46.54	45.21	45.56	47.14	46.08	44.82	45.77	46.92
9.	Exchangeable Calcium	meq/100 gm	22.44	20.63	25.93	24.89	20.19	24.51	25.51	23.64
10.	Exchangeable Magnesium	meq/100 gm	13.54	15.87	12.49	13.18	16.31	11.63	10.59	13.20
11.	Exchangeable Potassium	meq/100 gm	7.23	5.12	5.55	5.97	7.23	7.44	6.01	6.79
12.	Exchangeable Sodium	meq/100 gm	3.33	3.59	2.59	3.10	2.35	1.24	3.66	3.29
13.	Sodium Adsorption Ratio (SAR)	--	0.79	0.84	0.59	0.71	0.55	0.29	0.86	0.77
14.	Available Nitrogen as N	kg/ha	44.29	47.59	54.60	67.21	71.14	57.18	69.25	70.28
15.	Available Phosphorus as P	mg/kg	22.18	20.14	16.10	18.25	15.74	19.24	24.15	27.37
16.	Water Soluble Chlorides as Cl	mg/kg	22.52	23.18	0.01	37.21	44.15	47.18	50.24	27.14
17.	Water Soluble Sulphates as SO_4	mg/kg	2.74	2.29	3.10	3.25	3.18	3.24	3.30	3.24
18.	Aluminum as Al	mg/kg	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
19.	Iron as Fe	mg/kg	1.18	2.03	5.00	3.09	4.11	4.27	5.12	3.89
20.	Manganese as Mn	mg/kg	2.11	2.14	7.50	3.27	4.28	4.77	4.81	4.09

Sr. No.	Parameter	Unit	Location							
			Ind. Site (S1)	Dhatav (S2)	Talaghar (S3)	Landhar (S4)	Nivi (S5)	Udadhavane (S6)	Ashtami (S7)	Sambe (S8)
21.	Boron as B	mg/kg	Nil	Nil	Nil	Nil	0.04	0.03	Nil	0.007
22.	Zinc as Zn	mg/kg	1.14	1.12	1.10	1.54	1.51	1.29	1.11	1.18
23.	Chromium as Cr	mg/kg	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
24.	Lead as Pb	mg/kg	0.92	0.88	1.00	1.14	1.21	1.27	1.18	1.94
25.	Nickel as Ni	mg/kg	Nil	Nil	Nil	Nil	Nil	Nil	0.002	0.001
26.	Arsenic as As	mg/kg	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.	Mercury as Hg	mg/kg	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.	Cadmium as Cd	mg/kg	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
29.	Organic Carbon	%	1.41	1.52	1.34	1.38	1.27	1.74	1.18	1.62
30.	Organic matter	%	2.43	2.61	2.31	2.37	2.18	2.99	3.11	2.79

Method of testing: As per SSSA/Soil Analysis by M. L. Jackson/USEP **Note**: Analysis result for soil are given at **Annexure - I.**

3.4.4 General Observations

From the interpretation of field data, physical and chemical data it can be concluded that -

As per the physical data soils are fine texture, having low bulk density, imperatively high water holding capacity and moderately slow to slow permeability. As per physical characters soils are rated as moderate to good for agriculture. As per chemical characters soil reaction (pH) soils are neutral and electrical conductivity (EC) is non saline (normal). Organic matter is sufficient. Macro nutrient like nitrogen is very low to low and phosphorus is low, potassium is low, calcium, magnesium are medium to good and base saturation is moderate to good, sodium is below the limit to make soil saline or sodic or alkali. Micro-nutrients, Mn (low may cause deficiency), Zn, B, Fe, Al (nil to low, will cause deficiency), SO_4 very low and Cl are high. Cation Exchange Capacity is high indicating moderate to good fertility. Exchangeable Ca is medium to good with medium to good base saturation, Ex. K is low, and Ex. Na is also low not indicating any alkalinity. Sodium adsorption ratio indicates the soils are normal. Thus as per analysis of soils data and field observation the land represented by eight samples can be classified as class III e land i.e. moderate soils on plain to gentle slopes subject to water erosion, as per land capability classification (USDA)

Interpretation -

- **Physical characteristics** - The physical characteristics include Bulk density, grain size distribution (textural analysis).

- **Grain size distribution:** Texture indicates relative proportion of various sizes of primary soil particles such as sand, silt and clay present in the soil. Based on their quantities present in the soil sample and using the textural classification diagram. The textural classes of eight soil samples are clay loam to clay (fine texture.) Bulk density values confirm the textural class.
- **Bulk Density:** In case of bulk density total soil space (space occupied by solid and pore spaces combined) are taken in to consideration. Thus Bulk Density is defined as the mass (weight) of a unit volume of a dry soil. This volume would, of course include both solids and pores. Soil texture, soil structure and organic matter content are the factors influencing the bulk density of a soil. Bulk Density, besides being an interesting and significant physical characteristic, is very important as a basis for certain computations. The Bulk density of the eight soil sample under consideration ranges between 1.15 to 1.51 gm/cc, and confirms the fine texture of the soils of the area under study.
- **Porosity:** The pore space of a soil is the space occupied by air and water and is expressed as percent pore space. The amount of this pore space is determined by structural conditions, that is by inter - related influence of texture, compactness and aggregation. Porosity is also related to aeration and retention and movement of water in the soil. The porosity of eight soil sample ranges between 33.27 to 54.54 % and is moderate to good in accordance to the texture of soil, and considered moderate to good for air and water movement in the soil for crops.
- **Permeability**: Permeability is the entry of fluid from one medium to another. In soil - water relationship, it means entry of water from air in to soil. Permeability rate is defined as maximum rate at which a soil in a given condition can absorb rain or irrigation water as it comes at soil surface, permeability rate is the rate of water entry in to the soil when flow is non-divergent. It is a surface and sub surface character, and is expressed as mm/sec or cm/hr. Permeability of eight samples under study is between 1.13 to 1.61 cm/hr, and classified as moderately slow to slow for agriculture and conservation, indicating good availability of moisture to cops after rain or irrigation.
- **Water Holding Capacity (WHC):** Water holding capacity of soil is the maximum amount of moisture, a dry soil is capable of holding, under given standard condition. If the moisture content is increased further percolation result WHC is of great value to practical agriculture, since it provides a simple means to determine moisture content. WHC required for good crop growth is 35 to 70%. The WHC of the eight soil samples is between 37.13 to 61.18 % and is moderate to good indicating availability of water for crop growth indicating somewhat less frequent water application for growing crops.

- **Chemical Characteristics** - The parameters considered for chemical analysis are - Soil reaction (pH), Electrical conductivity (EC), Cation Exchange Capacity (CEC)) Cations, like Calcium, Magnesium, Sodium and Potassium, water soluble sulphates ,and chlorides, Sodium Adsorption Ratio (SAR), Macro nutrients like Available Nitrogen, total Organic carbon, organic matter, Available phosphorus, available potassium, Micro nutrients like Iron, Zinc, manganese and boron. Heavy metals like Chromium(Cr), Lead (Pb), Nickel (Ni), Arsenic(As), Mercury (Hg) and Cadmium (Cd).

- **Soil reaction (pH**): The nutritional importance of pH is illustrated, thus hydrogen ion concentration has influence not only on, solubility of nutrients, but also upon facility with which these nutrients are absorbed by plants, even already in soil solution for e.g. Fe, Mn and Zn become less available as pH rises from 4.5 to 7. At pH 6.5 to7.0 utilization of nitrate and ammonia nitrogen becomes more available. In case of phosphorus it becomes less available to plant as pH increases above 8.5, due to its fixation in exchange complex of soil. For the eight soil sample under consideration the pH ranges between 6.53 to 7.33 indicating soils are neutral, and suitable for growing all crops.
- **Electrical Conductivity (EC):** The salt content of the soils are estimated by EC measurements, and is useful to designate soils as normal or sodic (saline). Electrical conductivity is expressed as µmhos/cm at 25°C, µsmhos/ cm or mmhos /cm or sm/cm. The EC of eight soil samples is between 0.13 to 0.24 µs/cm and are below the limits to be called as saline and hence the soils are normal for crop growth.
- **Organic Carbon / Organic matter (%):** Although accounting for only a small part of the total soil mass in mineral soils, organic matter influences physical, chemical, and biological activities in the soil. Organic matter in the soil is plant and animal residue which serves as a reserve for many essential nutrients, especially nitrogen. Determination of organic matter helps to estimate the nitrogen which will be released by bacterial activity for the next season depending on the conditions, soil aeration, pH, type of organic material, and other factors. The eight soil samples under consideration contain 2.18 to 3.11 % organic matter; OM is calculated from organic carbon estimation. As per crop requirements the soils are having sufficient organic matter content required for growing crop in next season.
- **Available Nitrogen (N):** Nitrogen is a part of all living cells and is a necessary part of all proteins, enzymes and metabolic processes involved in the synthesis and transfer of energy. Nitrogen is a part of chlorophyll, the green pigment of the plant that is responsible for photosynthesis. Helps plants with rapid growth, increasing seed and fruit production and improving the quality of leaf and forage crops. The available nitrogen in the eight samples in question, as per analysis ranges between 44.2 to 71.14 kg/ha showing very low to low nitrogen content for crop growth.
- **Available Phosphorus (P):** Like nitrogen, phosphorus (P) is an essential part of the process of photosynthesis. Involved in the formation of all oils, sugars, starches etc. Helps with the transformation of solar energy into chemical energy; proper plant maturation; withstanding stress. Effects rapid growth. Encourages blooming and root growth. The phosphorus content of soil of eight samples ranges between 15.74 to 27.37 kg/ha and falls under low category for crop growth.
- **Available Potassium (K):** Potassium is absorbed by plants in larger amounts than any other mineral element except nitrogen and, in some cases, calcium. Helps in the building of protein, photosynthesis, fruit quality and reduction of diseases. The Potassium content of eight soil samples ranges between 37.56 to 51.14 kg/ha and is very less for crop growth.
- **Cation Exchange Capacity (CEC):** The total amount of exchangeable cations that a soil can retain is designated as cation exchange capacity (CEC) and usually expressed as me/100 gm of soil. Determination of amount of cations present in soil is useful, because CEC influences the availability of adsorbed cations to both higher plants and soil microorganisms. Thus CEC is directly related to fertility of soils. The CEC of the eight samples ranges between 45.21 to 46.92 me/100 gm soil. A soil with low CEC indicates low fertility and soils with high CEC indicates high fertility. Eight soil

samples are fine textured having high percentage of clay with dominating montmorrilonitic clay mineral, showing high CEC, in turn fertility is also high.

- **Exchangeable Calcium (Ca^{++}):** Calcium, an essential part of plant cell wall structure, provides for normal transport and retention of other elements as well as strength in the plant. It is also thought to counteract the effect of alkali salts and organic acids within a plant and soil acidity. The exchangeable calcium content of eight soil samples ranges between 20.19 to 25.93 me/100gm soil, and having high base saturation percentage (ranging from 43.81 to 56.91%). For normal crop growth a calcium base saturation percent of soils between 50 to 75% is required.
- **Exchangeable Magnesium (Mg^{++}):** Magnesium is part of the chlorophyll in all green plants and essential for photosynthesis. It also helps activate many plant enzymes needed for growth. The magnesium content of the eight soil samples ranges between10.59 to 16.31 me/100 gm soil, which is further adding to base saturation. Magnesium base saturation percent of 5 to 15 % is normal.
- **Exchangeable Sodium (Na^{+})**: Though sodium is not an essential plant nutrient, but it has some role in potassium nutrition. Sodium also has a role in affecting the pH of soils. Sodium present above a certain limit makes soil alkaline which affect soil physical condition, and fixing of available phosphorus. Out of the eight samples sodium ranges between 1.24 to 3.59 me/100gm soil, which is below the content (i.e. ESP is below 15%) at which soil show, saline alkali or alkaline properties, hence no adverse effect on soils.
- **Sodium Adsorption ratio (SAR):** Sodium adsorption ratio is ratio of Na^{+} to under root of $Ca^{++}Mg^{++}$ by 2. SAR values of soil solution along with EC and pH helps in diagnosing soils as normal, saline, saline-alkali or alkali. The eight soil samples show SAR values between 1.11 to 1.27 and indicate that samples are normal. (SAR below 13)
- **Iron (Fe)**: Iron is essential for crop and other plants for chlorophyll formation. Iron deficiency likely occurs in soils with high pH, poor aeration, excessive phosphorus, or low organic matter. It may be produced also by an imbalance of Mo, Cu, and Mn. In plants, the deficiency shows up as a pale green leaf color (chlorosis) with sharp distinction between green veins and yellow inter-venial tissues. The iron content of eight samples ranges between 1.18 to 5.12% and is very low to low. Thus may cause problem of iron deficiency.
- **Aluminum (Al):** Exchangeable Aluminum (Al) is not present in a plant available form in soils with a pH above 5.5 and therefore tests for extractable aluminum need only be done on distinctly acid soils. In soils with a pH range of 4.5 - 5.5 are those most likely to be affected by aluminum toxicity. In the eight samples the total Aluminum is nil which is very low.
- **Manganese (Mn):** Is an important plant micro nutrient and is required by plants in second greater quantity compared to iron, like any other element, it can have limiting factor on plant growth, if it is deficient or toxic in plant tissue. Manganese is used in plants as major contribution to various biological systems, including photo synthesis, respiration and nitrogen assimilation. Mn content in the eight samples ranges between 2.11 to 7.50 mg/kg and is low and may cause deficiency in plants.
- **Zinc (Zn):** Zn deficiency most often is present in sandy soils with neutral or alkaline pH, or with low organic matter. Total zinc may be high but the availability depends on other factors. In the present eight samples zinc content ranges between1.10 to 1.14 mg/kg or ppm and are low, considered deficient for crop growth.
- **Boron (B):** There is a very narrow range between deficiency and toxicity in boron. Deficiencies are more often when organic matter is low and dry weather slows the

decomposition. Uptake of boron is reduced at pH level higher than 7.0. Plant toxicity symptoms manifest as leaf tip and marginal chlorosis. Boron toxicity occurs in dry areas and is generally associated with irrigation water. In the eight samples of the project the boron content is nil is low and cause deficiency to crops.

- **Water-Soluble Sulphates as SO_4:** This test measures readily available sulphur in the form of dissolved plus absorbed sulphate. Sulphur testing is important where low sulphur or sulphur-free fertilizers are used, such as high analysis NPK fertilizers. Retention of sulphate sulphur by the soil is related to its phosphate retention, with high leaching losses of sulphate being associated with low phosphate retention soils. This should also be taken into account when considering sulphur fertilizer options. In the eight samples the water soluble sulphate as SO_4 ranges between 2.29 to 3.30 mg/kg and very low.
- **Water Soluble Chlorides as Cl:** The Cl^- anion does not form complexes readily, and shows little affinity (or specificity) in its adsorption to soil components. Thus, Cl^- movement within the soil is largely determined by water flows. Chlorine is an essential micronutrient for higher plants. It is present mainly as Cl^-. Chloride is a major osmotically active solute in the vacuole and is involved in both turgor and osmo regulation. In the cytoplasm it may regulate the activities of key enzymes. In addition, Cl^-also acts as a counter anion and Cl^- fluxes are implicated in the stabilization of membrane potential, regulation of intracellular pH gradients and electrical excitability. In the eight samples the water soluble chloride ranges between 22.54 to 50.24 mg/kg and is high.
- **Heavy Metals:** Soils may become contaminated by the accumulation of heavy metals and metalloids through emissions from the rapidly expanding industrial areas, mine tailings, disposal of high metal wastes, leaded gasoline and paints, land application of fertilizers, animal manures, sewage sludge, pesticides, wastewater irrigation, coal combustion residues, spillage of petrochemicals, and atmospheric deposition. Heavy metals constitute an ill-defined group of inorganic chemical hazards, and those most commonly found at contaminated sites are lead (Pb), chromium (Cr), arsenic (As), zinc (Zn), cadmium (Cd),), mercury (Hg) and nickel (Ni) Soils are the major sink for heavy metals released into the environment by aforementioned anthropogenic activities and unlike organic contaminants which are oxidized to carbon (IV) oxide by microbial action, most metals do not undergo microbial or chemical degradation and their total concentration in soils persists for a long time after their introduction Changes in their chemical forms (speciation) and bioavailability are, however, possible. The presence of toxic metals in soil can severely inhibit the biodegradation of organic contaminants. Heavy metal contamination of soil may pose risks and hazards to humans and the ecosystem through direct ingestion or contact with contaminated soil, the food chain. (soil-plant-human or soil-plant-animal-human), drinking of contaminated ground water, reduction in food quality (safety and marketability) via phyto-toxicity, reduction in land usability for agricultural production causing food insecurity, and land tenure problems.
- **Chromium (Cr):** Chromium mobility depends on sorption characteristics of the soil, including clay content, iron oxide content, and the amount of organic matter present. Chromium can be transported by surface runoff to surface waters in its soluble or precipitated form. Soluble and un-adsorbed chromium complexes can leach from soil into groundwater. The leachability of Cr (VI) increases as soil pH increases. Most of Cr released into natural waters is particle associated, however, and is ultimately deposited into the sediment. In the eight samples the chromium is nil hence no chromium contamination.

- **Lead (Pb)**: Typical mean Pb concentration for surface soils worldwide averages 32 mg kg^{-1} and ranges from 10 to 67 mg kg^{-1}. The most serious source of exposure to soil lead is through direct ingestion of contaminated soil or dust. In general, plants do not absorb or accumulate lead. However, in soils testing high in lead, it is possible for some lead to be taken up. Studies have shown that lead does not readily accumulate in the fruiting parts of vegetable and fruit crops (e.g. corn, beans, squash, tomatoes, strawberries and apples). Higher concentrations are more likely to be found in leafy vegetables (e.g. lettuce) and on the surface of root crops (e.g. carrots). Since plants do not take up large quantities of soil lead, the lead levels in soil considered safe for plants will be much higher than soil lead levels where eating of soil is a concern (pica). Generally, it has been considered safe to use garden produce grown in soils with total lead levels less than 300 ppm. The risk of lead poisoning through the food chain increases as the soil lead level rises above this concentration. Even at soil levels above 300 ppm, most of the risk is from lead contaminated soil or dust deposits on the plants rather than from uptake of lead by the plant. In the eight samples the Lead ranges between 0.88 to 1.94 mg/kg and within permissible limit.
- **Nickel (Ni):** Nickel is an element that occurs in the environment only at very low levels and is essential in small doses, but it can be dangerous when the maximum tolerable amounts are exceeded. It usually takes a long time for nickel to be removed from air. The larger part of all Ni compounds that are released to the environment will adsorb to sediment or soil particles and become immobile as a result. In acidic soils, however, Ni becomes more mobile and often leaches down to the adjacent groundwater. In the eight soil samples, the nickel content is below the limit i.e. nil.
- **Arsenic (As)**: Arsenate can adsorb or co-precipitates with metal sulfides and has a high affinity for other sulfur compounds. Elemental arsenic and arsine, AsH_3, may be present under extreme reducing conditions. Biotransformation (via methylation) of arsenic creates methylated derivatives of arsine. As compounds adsorb strongly to soils and are therefore transported only over short distances in groundwater and surface water. In the eight samples the arsenic values are below detectible limit and within permissible limit.
- **Mercury (Hg)**: Sorption to soils, sediments, and humic materials is an important mechanism for the removal of Hg from solution. Sorption is pH dependent and increases as pH increases. Mercury may also be removed from solution by co-precipitation with sulphides. Under anaerobic conditions, both organic and inorganic forms of Hg may be converted to alkylated forms by microbial activity, such as by sulfur-reducing bacteria. Elemental mercury may also be formed under anaerobic conditions by demethylation of methyl mercury, or by reduction of Hg (II). Acidic conditions ($pH < 4$) also favor the formation of methyl mercury, whereas higher pH values favor precipitation of HgS (s). In the eight samples the mercury content is below detectible limit and within permissible limit.
- **Cadmium (Cd)**: The application of agricultural inputs such as fertilizers, pesticides, and bio-solids (sewage sludge), the disposal of industrial wastes or the deposition of atmospheric contaminants increases the total concentration of Cd in soils, and the bioavailability of this Cd determines whether plant Cd uptake occurs to a significant degree. Cadmium is very bio-persistent but has few toxicological properties and, once absorbed by an organism, remains resident for many years. The eight samples contain cadmium is nil and within permissible limits.

Comments: From the interpretation of field data, physical and chemical data it can be concluded that - As per the physical data soils are fine texture, having low bulk density, imperatively high water holding capacity, and moderately slow to slow permeability. As per physical characters soils are rated as moderate to good for agriculture. As per chemical characters soil reaction (pH) soils are neutral and electrical conductivity (EC) is non saline (normal). Organic matter is sufficient. Macro nutrient like nitrogen is very low to low and phosphorus is low, potassium is low, calcium, magnesium are medium to good and base saturation is moderate to good. Sodium is below the limit to make soil saline or sodic or alkali. Micro-nutrients, Mn (low may cause deficiency), Zn, B, Fe, Al (nil to low, will cause deficiency), SO_4 very low and Cl are high. Cation Exchange capacity is high indicating moderate to good fertility. Exchangeable Ca is medium to good with medium to good base saturation, Ex K is low, and Ex Na is also low not indicating any alkalinity. Sodium adsorption ratio indicates the soils are normal. As observed during field visit of 10 km buffer area from boundary of proposed expansion plant. From Geomorphologic point of view, the area consists of slightly undulating plain topography with average elevation ranging from 3 to 15 m AMSL. The Main geomorphic units are: Coastal zone in west, Central zone: Fertile, low lying land and Hilly zone: highly uneven with forest cover.

In general, area is characterized by slightly undulating and flat terrain. As per soil map of Maharashtra at 1:500000 scale by NBSS & LUP, the family association observed in the area are - 1) Very shallow, well drained, loamy soils on very gently sloping elongated ridge hills with very severe erosion; associated with shallow moderately well drained, clayey soils on very gently sloping land with moderate erosion. 2) Very shallow, somewhat excessively drained, loamy soils on moderately steeply sloping dissected hills and intervening valleys with severe erosion; associated with deep, moderately well drained, clayey soils on very gently sloping lands with moderate erosion. Thus as per analysis of soils data and field observation the land represented by eight samples can be classified as class III land i.e. moderate soils on plain to gentle slopes subject to water erosion, as per land capability classification (USDA).

Table 3.9 Standard Soil Classification

Sr.No.	Soil Test	Classification	
1.	pH	< 4.5 Extremely acidic 4.51-5.50 Very strongly acidic 5.51-6.00 moderately acidic 6.01-6.50 slightly acidic 6.51-7.30 Neutral	7.31-7.80 slightly alkaline 7.81-8.50 moderately alkaline 8.51-9.0 strongly alkaline 9.01 very strongly alkaline
2.	Salinity Electrical Conductivity (µmhos/cm) (1ppm = 640 µmho/cm)	Up to 1.00 Average 1.01-2.00 harmful to germination 2.01-3.00 harmful to crops (sensitive to salts)	--
3.	Organic Carbon (%)	Up to 0.2: very less 0.21-0.4: less 0.41-0.5 medium	0.51-0.8: on an average sufficient 0.81-1.00: sufficient > 1.0 more than sufficient
4.	Nitrogen (Kg/ha)	Up to 50 very less	151-300 Better

Sr.No.	Soil Test	Classification	
		51-100 less 101-150 good	> 300 sufficient
5.	Phosphorus (Kg/ha)	Up to 15 very less 16-30 less 31-50 medium	51-65 on an average sufficient 66-80 sufficient > 80 more than sufficient
6.	Potash (Kg/ha)	0 very less 120-180 less 181-240 medium	240-300 average 301-360 better above 360 more than sufficient

Source: Hand Book of Agriculture, Indian Council of Agricultural Research

3.5 DRAINAGE AND GEOMORPHOLOGY

3.5.1 Drainage

The topography of the region governs the drainage pattern of that area. The assignment w.r.t. geology and hydro-geological studies was conducted by **Dr. J. B. Pishte**; the empanelled Functional Area Expert of EEIPL for **HG & GEO**.

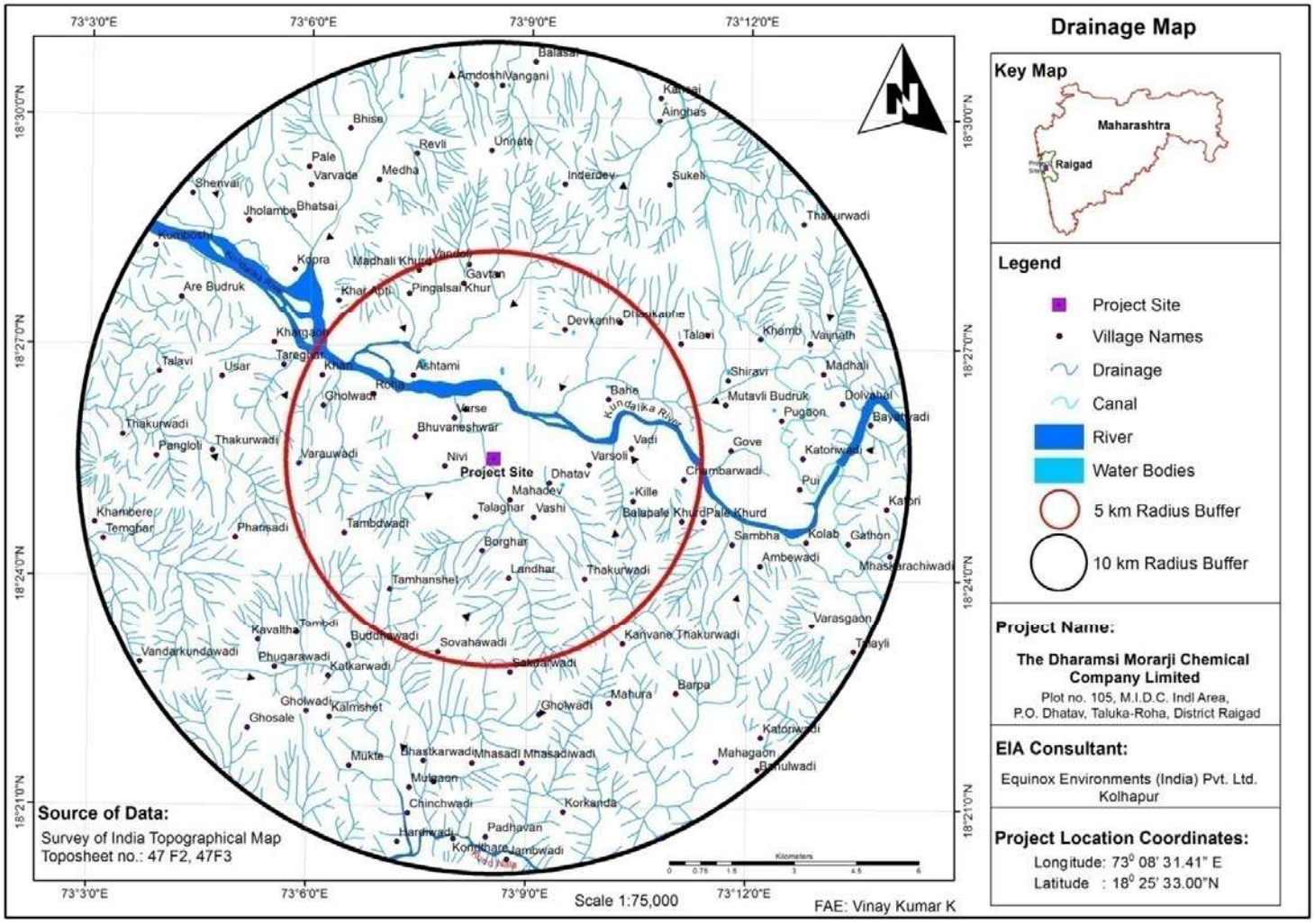
The Roha MIDC is situated in the Kundalika River valley, about 19 km upstream from the shoreline of the Arabian Sea. It is located on the west side of the Kolad - Roha road along the left bank of the river. As this project is proposed expansion within the area of MIDC, Roha; it will constitute a part of the cumulative environmental impact of the entire industrial area. The geological and hydrogeological studies for EIA with reference to this project were carried out in the area on the basis of previous literature and observations made during field visits.

The Raigad district is bounded by the Arabian Sea on the west and, on the east, its boundary runs partly along the foothill zone and partly along the watershed of the major Sahyadrian scarp. The topographic set up of the district is very uneven and rugged. From the coastline on the west to the water divide in the east, three topographic divisions can be identified. The coastline is characterized by alternative bluffs and curved bays having narrow hinterlands. The central region of the district has many plateau and hills rising from the valleys. The Eastern part of the district is much rugged merging with the Sahyadris which are running North South direction. The eastern horizon is marked by Sahyadri hills. Hill slopes are mostly covered with forests. The plains are under cultivation or plantation. The coastal tract is mostly marshy land or wasteland. The drainage system in Raigad district consists of six river basins. All rivers are westerly flowing. (Refer **Figure 3.12** for Drainage map) The drainage system may be divided into three groups as follows -

The Northern region : Drained by river Panvel, Ulhas, Patalganga and Amba
The Central region : Drained by Kundalika, Mandad
The South region : Savitri and its tributaries

The rivers are tidal for a considerable extent and can be divided into two well-marked sections, above and below the limit of the tide. The upper courses are steep and rugged, with torrential waters flowing during the monsoon season. Besides the general parallel drainage pattern of the rivers, the tributary pattern tends, at places, to be rectangular suggesting the adaptation of the stream to the local rock structure.

Figure 3.12 Drainage Map



3.5.2 Geomorphology

The study area forms part of the coastal plain of Raigad district. It is situated in the level land between low hills ridges bounding the Kundalika river valley in the central region of the district. The river flows in the NNW direction through the area, corresponding to major fractures / joints. It drains the narrow central belt of the coastal plain into the Chaul creek (Refer **Figure 3.13** for Geomorphology map**)**. The river course in the study area is characterized by torrential flows in monsoon, with high carrying capacity and strong erosion power which has scraped the channel floor making it rocky and rugged (**Plate 1**).

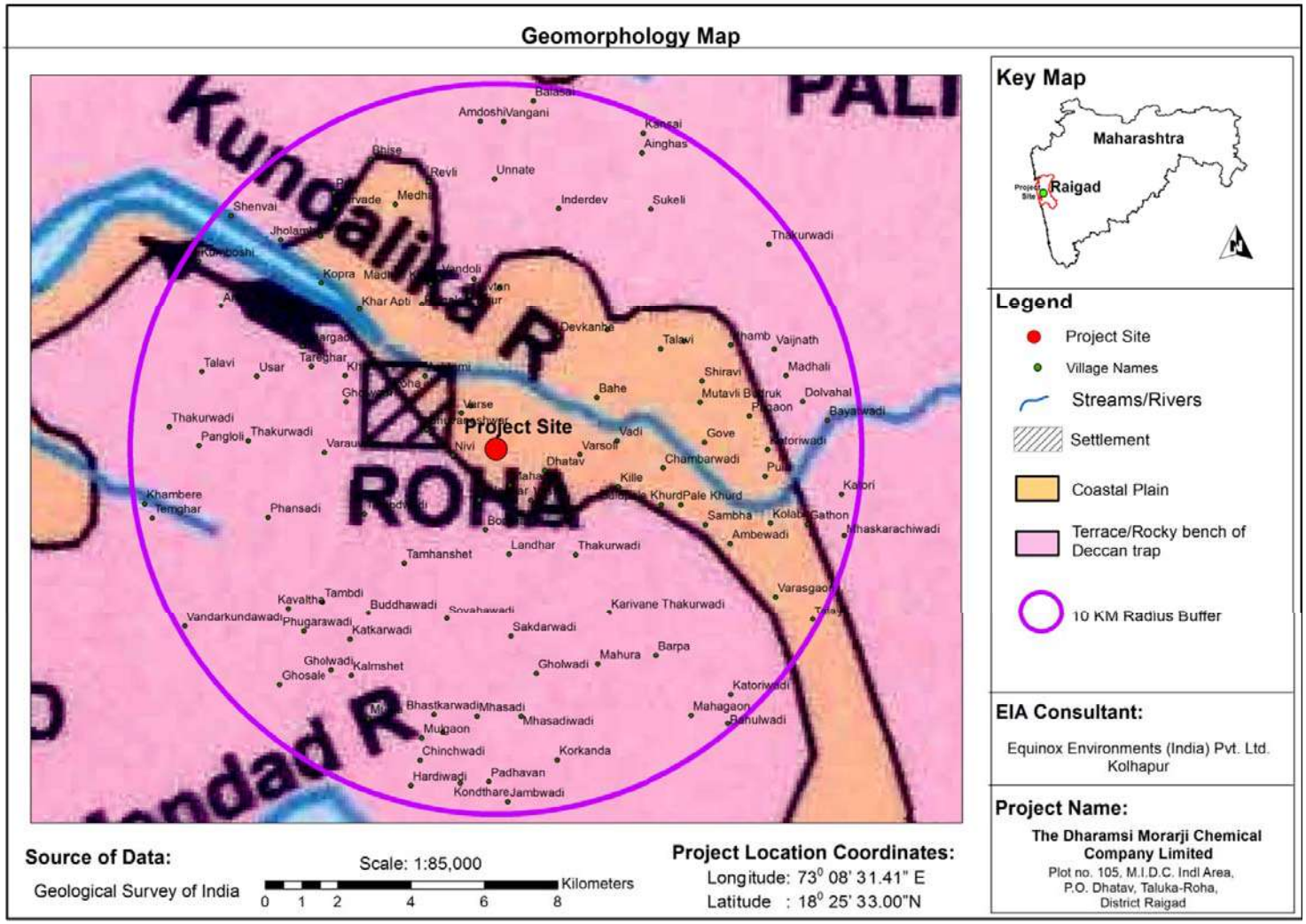
Plate 1 Photograph of Kundalika River Channel

3.6 GEOLOGY AND HYDROGEOLOGY

3.6.1 Introduction

The information presented covers geological and hydro-geological investigations in the study area. The scope of work includes geological and hydro-geological observations involving rock types, geological set up, geomorphology, drainage system and investigations involving groundwater level measurements in dug wells, analyses for quality of ground water, estimation of rainwater harvesting potential and possible means and methods for it etc. and preparation of respective maps for presenting in the report. The study of the Geology and Hydro Geology was done by **Dr. J. B. Pishte**; the empanelled Functional Area Expert of EEIPL for **HG & GEO.**

Figure 3.13 Geomorphology Map



3.6.2 Geology

Geologically the Raigad district forms a part of the Deccan Trap Group of rocks. The entire district is covered by dark grey to grey and bluish coloured basaltic lava flows and laterites. The lava flows are spread out in the form of horizontal sheets or beds. (Refer **Figure 3.14** for Geological map) In the Western Ghats the lava flows form innumerable spurs, hills and hill ranges; bold, flat, topped ridges; lofty peaks and plateaus with impressive cliffs. In the plains and valleys, the lava flows occur below a blanket of soil of variable thickness. A characteristic feature of these lava flows is their horizontal disposition and considerable lateral extent with almost incredible uniformity in their composition and appearance. Two types of basalts are recognized in Deccan Traps viz. the hard, compact basalt and vesicular / amygdaloidal basalt. The compact basalt is more common than the vesicular type. The hard, compact basalt is tough and shows fine to medium grained in texture. Vertical, inclined, prismatic and columnar joints and horizontal sheet joints are commonly found in this type. These rocks wither by exfoliation into massive, spheroidal boulders, which are usually seen on the hill slopes and foothills.

The comparatively softer, amygdaloidal and scoriaceous traps, purple to greenish in colour, usually showing rounded and elongated or tubular cavities with infillings of secondary minerals like calcite, zeolites and a variety of secondary quartz. These generally occupy the lower portion of the ridges and slopes and usually the valleys and plains. At higher altitudes, hills and plateaus are capped by laterite which a product of weathering of basalt in tropical climate with alternate seasons of heavy monsoon rains and hot dry summer. Laterite is dark brown to yellowish in colour and composed of iron oxides and hydroxides. At lower altitudes, the weathering of basalts give rise to a greyish to dirty green, friable *murum,* which on decomposition and decay yield a rich and fertile reddish-brown to coffee brown and black soil. The laterite on disintegration gives rise to a dusty, reddish to reddish-brown soil. The entire region in interspersed with a large number of lineaments criss-crossing each other. The lineaments in the coast are not randomly distributed but appear to be grouped in sets. The majority of lineaments along the coastal area follow a NNE-SSW and a few N-S trends. (Power, 1993;.Das, 1999; Das and Mukherjee, 2002c).

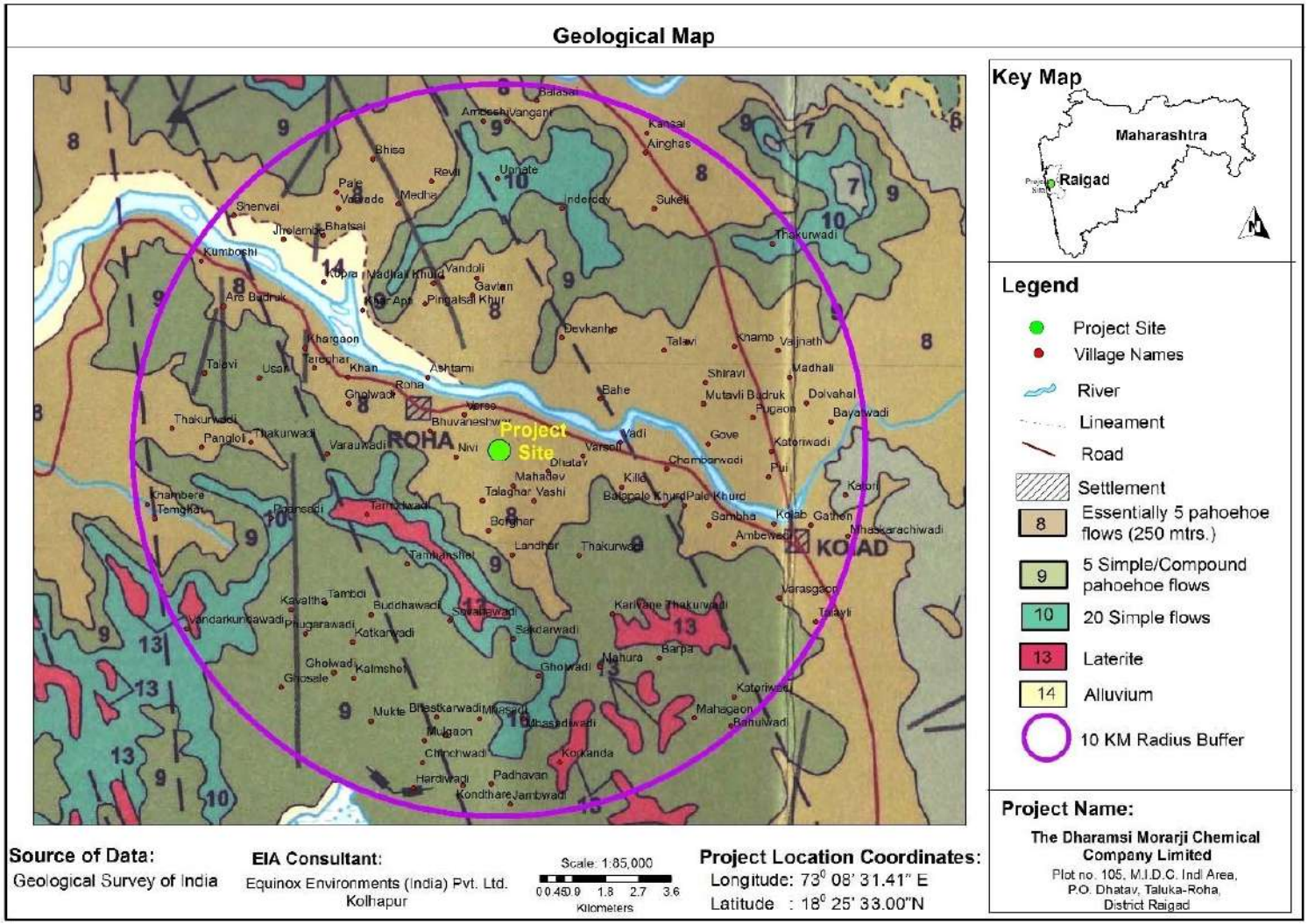
3.6.2.1 Study area: EIA Aspect of Geology

The geology of the Dhatav MIDC area is characterized by occurrence of mainly hard compact basalt with smaller extent of vesicular / amygdaloidal basalt under a thin cover of soil **(Plate 2 & 3)**. Outcrops and exposures are found mainly along stream courses. The Kundalika River and its tributaries show many rocky and rugged outcrops in their channels in the area. There are also found many SE-NW trending linears, which control the course of west flowing rivers like Amba and Kundalika. These rivers take a sudden SE-NW turn near the coast. (Power, 1993;.Das, 1999; Das and Mukherjee, 2002c).

3.6.3 Hydrogeology

Due to plenty of rainfall, moderate to high drainage density and fractured nature of the basaltic rocks at many places, the area has a good groundwater potential. The groundwater table in the western part of the district is comparatively shallow and in spite of the presence of so many coastal inlets and creeks, the occurrence of saline water intrusion into the fresh water system is few. Safe drinking water is available at almost all the places. The depth of wells ranges between 3.50 to 8.50 m.

Figure 3.14 Geological Map



The SWL in winter ranges between 1 to 3.50 m and in summer it ranges between 4 to 8.00 m. Majority of the wells go dry in the summer season due to poor productive aquifer.

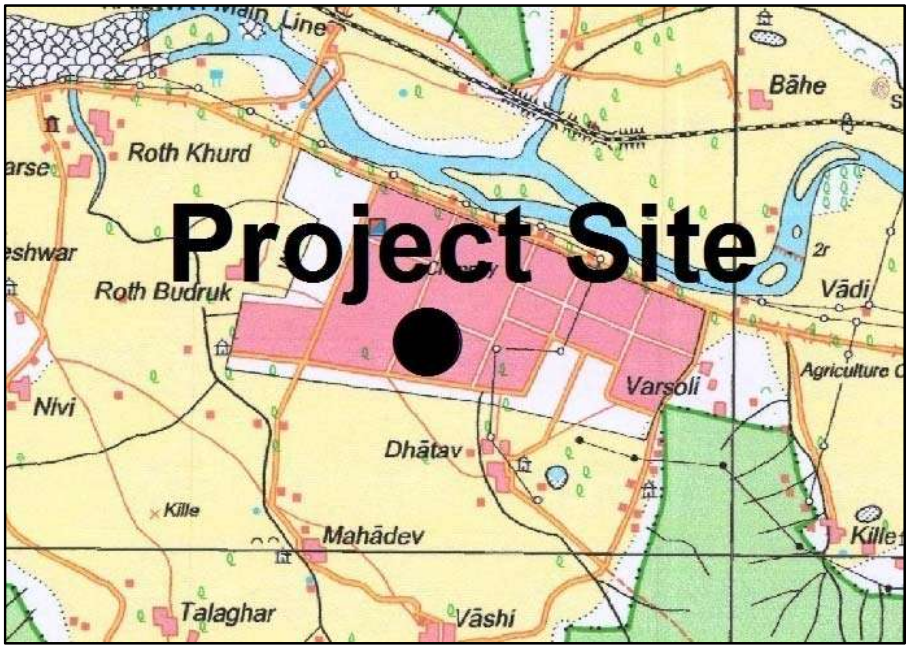
Plate 2 Compact basalt with sheet joints in left bank of Kundalika River, Dhatav

Plate 3 Vesicular /Amygdaloidal basalt in (Ganga) stream channel west of Dhatav

3.6.3.1 Study area: EIA Aspect of hydrogeology

The Dhatav MIDC layout is in a plain terrain close to the foot of hills towards Southwest. Two streams originating in these hills are relevant to the EIA studies regarding Hydrogeology and Geology (HG-GEO). The smaller stream passes through the MIDC area while the larger one called 'Ganga' by locals, passes along the western-northern periphery of the MIDC. Both the streams drain into Kundalika River on the north-eastern side of the MIDC. As the MIDC is situated within the drainage basins of these two streams, it appears safe to assume that the impact of the proposed project and other units in this industrial area on hydrogeology and geology will be limited to these two basins only; and the area beyond these drainage basins is not likely to be affected by activities in or effluents from the MIDC. (Refer **Figure 3.15**).

Figure 3.15 Part of Drainage Map showing closer view of streams in the Roha



3.6.3.2 Ground water Resources

No open wells or bore wells were found in entire the MIDC area. No wells are found on the right bank of Kundalika River. Only three open wells, one near Bhavani Mandir **(Plate 4)**, Roth Khurd **(Plate 5)** and two in Dhatav village **(Plate 6)** were observed.

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During interaction, the residents of the area appeared satisfied with the water supply from MIDC. They have not used water from the wells since long time. Hence they didn't feel the need to dig wells for water supply. The population in the villages on right bank of Kundalika River is dependent on canal water as well as open and bore wells. These sources of water are not likely to be affected by the effluents from MIDC, if any; as they are situated in a different drainage basin than that of the MIDC.

Plate 4 Location 2 - Bhavani Mandir, Roth Khurd

Plate 5 Location 3 - Dhatav village

Plate 6 Location 4 - Dhatav village

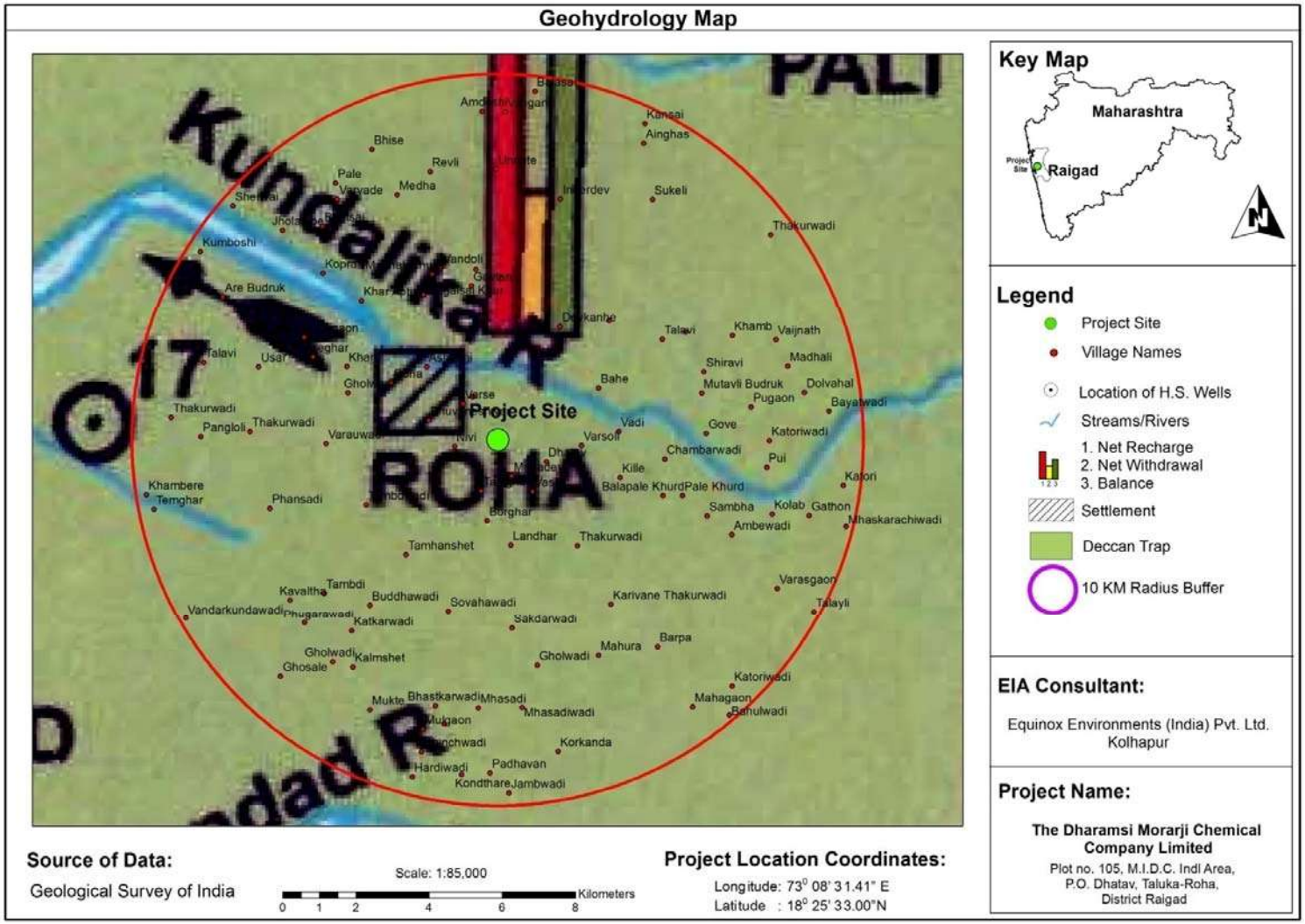
3.6.3.3 Groundwater Quality

The water quality in these wells is reported to be good, but the residents are not using groundwater for any purpose as the water supply from MIDC satisfies their requirements. Overall, no adverse remarks regarding quality of water were made by the residents. We could see turtles and fishes in the wells in Dhatav at the time of visit which can be considered as an indicator of reasonably good quality of water.

Representative samples of groundwater were collected for analysis of quality of water (Plate 4, 5, 6). The report of analyses of these samples is given in **Table No. 3.17**. It is apparent that some of the quality parameter viz. TDS, Calcium as Ca, Magnesium as Mg, total hardness and Coliform bacteria exceed the acceptable limits (IS 10500-2012). This can be considered as baseline status of the quality of groundwater with reference to this Project.

Hydrogeology is an interdisciplinary subject; it can be difficult to account fully for the chemical, physical, biological and even legal interaction between soil, water, nature and society. The study of the interaction between groundwater movement and geology can be quite complex. Groundwater does not always flow in the subsurface down-hill following the surface topography; groundwater follows pressure gradients (flow from high pressure to low) often following fractures and conduits in circuitous paths. (Refer **Figure 3.16** for Geo-Hydrological map)

Figure 3.16 Geo-Hydrological Map



3.7 METEOROLOGY

3.7.1 Introduction

Micro-meteorological data within the study area during the air quality survey period is an indispensable part of air pollution studies. The meteorological data recorded during the monitoring period is very useful for proper interpretation of the baseline information as well as for input to the predictive models for air quality dispersion. Historical data on meteorological parameters will also play an important role in identifying the general meteorological status of the region. Site specific data can be compared with the historical data in order to identify changes, which may have taken place due to the rapid industrialization in the area.

The micro-meteorological parameters regulate the transport and diffusion of pollutants released into the atmosphere. The principal variables, which affect the micrometeorology, are horizontal connective transport (average wind speed and direction), vertical connective transport (atmospheric stability and inversion conditions) and topography of the area. The climate of the study area and surrounding region is generally dry except in the southwest monsoon season. The year may broadly be divided into four seasons.

Winter season	:	December to February
Pre-monsoon season	:	March to May
Monsoon season	:	June to September
Post monsoon season	:	October and November

Temperature

Generally the district experienced moist and humid climate. The climate of the district is typical of that on the west coast of India, with plentiful, regular and seasonal rainfall during the monsoon season. Being a coastal district, the diurnal and seasonal variations in temperature is not large. The mean minimum and maximum temperatures observed are 16.1°C and 40.4°C respectively.

Rainfall

The south- west monsoon commences by about the first week of June and the rains continue till about the beginning of October. The average rainfall for the district is 3492 mm. The rainfall increases rapidly from the coast towards the Sahyadri on the eastern border of the district. Nearly 95 per cent of the annual rainfall is received during the south-west monsoon season. The rainfall is regular and the variations are from year to year.

3.7.2 Methodology

The methodology adopted for monitoring surface observations is as per the standard norms laid down by Bureau of Indian Standards (BIS) and the Indian Meteorology Department (IMD). On-site monitoring was undertaken for various meteorological variables in order to generate the data, which is then compared with the meteorological data generated by IMD from the Mumbai, IMD station.

3.7.2.1 Methodology of Data Generation

Meteorological data has been generated at the site. The meteorological parameters were monitored for one season i.e. from October 2017-December 2017. Details of parameters monitored, equipments used and the frequency of monitoring are given in **Table 3.10**.

Table 3.10 Meteorological Parameters

Sr. No.	Parameters	Instrument	Frequency
1.	Wind Speed	Cup Counter Anemometer	Every hour
2.	Wind Direction	Wind Vane	Every hour
3.	Temperature	Min./Max. Thermometer	Once in a day
4.	Relative Humidity	Dry/Wet bulb Thermometer	Twice a day

3.7.2.2 Sources of Information

Secondary information on meteorological conditions has been collected from IMD station at Mumbai. Wind speed & direction, temperature, relative humidity, rainfall intensity have been compiled from IMD station, Mumbai. Also references were taken from book - Climatological Normals (1971-2000). Similarly, data on cloud cover is compiled from climatologically tables for the Mumbai IMD Station. Details are tabulated in **Annexure - II.**

3.7.2.3 Wind Pattern at Project Site during Study Period

Wind Speed and direction are recorded at site every hour. The predominant wind during the study season is from **North East (NE) direction**.

3.8 AIR QUALITY

3.8.1 Introduction

The ambient air quality with respect to the study zone of 10 Km radius around proposed expansion site forms the baseline information. The study area represents mostly rural environment. The various sources of air pollution in the study area are vehicular traffic, industrial activities and domestic firewood burning. The impact of these emissions is reflected in the results of ambient air quality. The major air pollutants released into atmosphere from the different sources are PM_{10}, $PM_{2.5}$, SO_2, NO_x, NH_3 and to small extent CO. However, this again varies with type of the source.

This section describes the selection of sampling locations, parameters, frequency of sampling, and methodology of sampling and analytical techniques for analysis of collected samples. Presentation of results for the period October 2017 to December 2017 survey is done followed by observations. All the requisite monitoring assignments, sampling and analysis was conducted through the laboratory of M/s. Horizon Services, Pune which is NABL accredited and MoEFCC; New Delhi approved organization. Study w.r.t. air quality was done by **Mr. Yuvraj Damugade** FAEs and **Mr. Sangram Patil** who is FAA of EEIPL for AQ.

3.8.2 Methodology

3.8.2.1 Selection of Sampling Locations

The baseline status of the ambient air quality has been assessed through an ambient air quality monitoring network. The design of monitoring network, in the air quality surveillance program, is based on considerations namely - (1) Meteorological conditions (2) Topography of the study area (3) Representativeness of regional background air quality for obtaining baseline status and (4) Representativeness of likely industrial impact areas.

Ambient air monitoring was conducted in the study area to assess the quality of air for SO_2, NO_x, CO, PM_{10}, $PM_{2.5}$,VOC, NH_3, HCl, Lead, Ozone, Benzene, Benzopyrene, Arsenic and Nickel.

Ambient AAQM stations were set up at Eight locations with due consideration to the above mentioned points, details of which are presented below. Monitoring of air quality was done here over a period of one season. **Annexure - III** may be referred for AAQM data.

Table 3.11 AAQM Locations Details

Station Code	Name of the Station	Distance from the Site (in Km)	Direction w.r.t. the Site
A1	Industrial Site	--	--
A2	Roth Bk.	0.81	NW
A3	Talaghar	2.18	SW
A4	Nivi	2.20	W
A5	Talavali	4.47	NE
A6	Washi	1.61	S
A7	Varsoli	1.51	E
A8	Barshet	4.98	SE

3.8.2.2 Frequency & Parameters for Sampling

The frequency adopted for sampling is two days per week, 24 hourly for all six ambient air quality stations. The baseline data w.r.t. air environment, for all the six monitoring stations, was generated. Details of same are presented in following table -

Table 3.12 AAQ Parameters and Monitoring Frequency

Sr. No.	Parameters	Frequency of Monitoring	Method of Analysis as per IS: 5182
1.	PM_{10}	Continuous, 24 Hourly, twice a week	Gravimetric Method (IS:5182, Part IV)
2.	$PM_{2.5}$	Continuous, 24 Hourly, twice a week	
3.	SO_2	8 Hourly, three samples/day, twice a week	Modified West-Gaeke Method (IS:5182, Part II) (Sodium Tetrachloro mercurate)
4.	NO_x	8 Hourly, three samples/day, twice a week	Jacobs and Hochheiser Method (IS:5182, Part VI)
5.	NH_3	8 Hourly, three samples/day, twice a	APHA Method No. 401

Sr. No.	Parameters	Frequency of Monitoring	Method of Analysis as per IS: 5182
		week	
6.	VOC	Continuous, 24 Hourly, twice a week	APHA Method No. 109
7.	CO	8 Hourly, three samples/day	NDIR Method (IS:5182, Part X).
8.	Lead	Continuous, 24 Hourly, twice a week	IS 5182 (Part 22):2006
9.	Ozone	8 Hourly, three samples/day, twice a week	APHA Method No. 417
10.	Benzene	8 Hourly, three samples/day	IS 5182 (Part 11):2006
11.	Benzopyrene	8 Hourly, three samples/day	IS 5182 (Part 12):2006
12.	Arsenic	8 Hourly, three samples/day	APHA Method No. 302
13.	Nickel	8 Hourly, three samples/day	NAAQS Manual

Note : Sampling was done as per CPCB guideline, April 2003
Source: Air samples were analyzed as per IS:5182 "Method for Measurement of Air Pollution"

- **Duration of Sampling**

The duration of sampling for PM_{10}, $PM_{2.5}$ was once 24 hourly, for SO_2, NO_x, CO, Lead was once 8 hourly three samples per day and for VOC, NH_3, Ozone, Benzene, Benzopyrene, Arsenic and Nickel was 8 hourly one sample per day.

3.8.3 Presentation of Results

The summary of results for analysis of AAQ is presented in **Table 3.13** which is based on observations recorded during one monitoring season (October 2017 - December 2017). Therein, also various statistical parameters like Arithmetic Mean (AM), 98 Percentile, Maximum and Minimum values have been presented subsequent to computation from the data collected. Moreover, the permissible AAQ limits are presented in **Table 3.13**.

Table 3.13 Summary of the AAQ Levels for Monitoring Season
[October 2017 - December 2017]

Parameters with Unit		Location							
		Industrial Site (A1)	Roth Bk. (A2)	Talaghar (A3)	Nivi (A4)	Talavali (A5)	Washi (A6)	Varsoli (A7)	Barshet (A8)
PM_{10} $\mu g/m^3$	Max.	60.10	45.20	70.10	55.10	48.10	72.00	65.90	72.60
	Min.	50.60	37.29	60.40	45.70	45.70	50.80	50.40	68.20
	Avg.	55.72	40.80	65.59	49.96	47.06	64.16	57.03	70.14
	98 %	58.24	42.51	67.11	51.58	48.10	71.00	59.29	71.43
$PM_{2.5}$ $\mu g/m^3$	Max.	22.00	11.60	20.50	13.40	13.10	20.90	18.40	22.30
	Min.	14.20	8.50	15.50	10.80	10.80	11.90	11.50	18.60
	Avg.	16.02	10.32	17.39	12.20	12.06	17.55	14.98	20.11
	98 %	17.51	11.01	18.61	13.13	13.07	20.55	15.87	21.46
SO_2 $\mu g/m^3$	Max.	28.90	17.10	17.80	15.00	13.50	25.00	26.80	19.50
	Min.	18.20	5.00	12.50	11.60	11.60	15.20	14.60	15.10
	Avg.	22.00	15.34	15.29	13.46	12.72	19.03	20.87	16.69
	98 %	23.97	16.14	16.41	14.39	13.45	22.64	22.80	18.30

Parameters with Unit		Location							
		Industrial Site (A1)	Roth Bk. (A2)	Talaghar (A3)	Nivi (A4)	Talavali (A5)	Washi (A6)	Varsoli (A7)	Barshet (A8)
NOx µg/m^3	Max.	42.00	23.60	20.80	20.40	17.10	29.40	30.10	25.10
	Min.	29.40	8.00	16.20	15.40	15.40	20.50	20.40	20.00
	Avg.	34.27	20.93	18.45	17.14	16.16	24.54	26.36	22.08
	98 %	39.19	22.46	19.70	18.46	17.05	27.82	28.31	24.04
NH_3 µg/m^3	Max.	22.00	9.80	10.00	12.30	9.10	11.20	10.10	12.00
	Min.	16.20	8.20	8.00	7.90	7.90	8.20	8.20	8.40
	Avg.	18.60	8.89	9.09	9.65	8.54	9.58	9.22	10.03
	98 %	19.86	9.39	9.58	10.50	9.07	10.82	9.71	11.22
CO mg/m^3	Max.	0.089	0.068	0.091	0.090	0.040	0.094	0.100	0.090
	Min.	0.020	0.010	0.015	0.020	0.020	0.025	0.050	0.025
	Avg.	0.059	0.035	0.053	0.051	0.030	0.065	0.075	0.048
	98 %	0.082	0.050	0.063	0.063	0.039	0.081	0.086	0.059
Lead (Pb) µg/m^3	Max.	0.990	BDL	0.190	0.690	0.690	0.980	BDL	0.980
	Min.	0.010	BDL	0.029	0.026	0.040	0.065	BDL	0.010
	Avg.	0.094	BDL	0.092	0.088	0.111	0.122	BDL	0.119
	98 %	0.260	BDL	0.119	0.290	0.667	0.349	BDL	0.381
Ozone µg/m^3	Max.	13.50	15.10	12.80	11.23	10.00	11.20	12.60	10.60
	Min.	9.20	10.40	6.00	8.40	8.40	7.50	7.90	7.50
	Avg.	10.98	12.20	9.01	9.61	9.09	9.59	9.88	8.67
	98 %	12.19	13.56	10.71	10.48	9.94	10.84	11.27	9.45
Benzene µg/m^3	Max.	0.450	BDL	BDL	0.430	0.310	BDL	BDL	BDL
	Min.	0.370	BDL	BDL	0.240	0.240	BDL	BDL	BDL
	Avg.	0.400	BDL	BDL	0.332	0.288	BDL	BDL	BDL
	98 %	0.424	BDL	BDL	0.365	0.310	BDL	BDL	BDL
Benzo(a) pyrene mg/m^3	Max.	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
	Min.	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
	Avg.	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
	98 %	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Arsenic mg/m^3	Max.	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
	Min.	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
	Avg.	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
	98 %	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Nickel mg/m^3	Max.	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
	Min.	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
	Avg.	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
	98 %	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
VOC µg/m^3	Max.	100.10	40.50	42.00	80.00	68.60	38.90	40.00	36.40
	Min.	80.40	30.00	30.50	60.50	60.50	30.10	34.90	30.10
	Avg.	90.58	35.00	34.79	68.45	64.50	35.75	37.43	33.78
	98 %	96.39	37.17	37.84	74.28	68.45	38.47	38.92	35.19

Note -

- PM_{10}, $PM_{2.5}$, NOx, SO_2 ,VOC, NH_3, HClare computed based on 24 hourly values.
- CO is computed based on 8 hourly values

Table 3.14 National Ambient Air Quality Standards (NAAQS) Specified by CPCB Notification (New Delhi, the 18th November, 2009)

Parameters		Zone Station	
		Industrial and mixed use zone	Residential and rural zone
PM_{10} µg/m^3	A.A.	60	60
	24 Hr	100	100
$PM_{2.5}$ µg/m^3	A.A.	40	40
	24 Hr	60	60
SO_2 µg/m^3	A.A.	50	20
	24 Hr	80	80
NOx µg/m^3	A.A.	40	30
	24 Hr	80	80
CO mg/m^3	8 Hr	2	2
	1 Hr	4	4
NH_3 µg/m^3	A.A.	100	100
	24 Hr	400	400
Lead (Pb) µg/m^3	A.A.	0.50	0.50
	24 Hr	1	1
Ozone µg/m^3	8 Hr	100	100
	1 Hr	180	180
Benzene µg/m^3	Annual	5	5
Benzo(a) Pyrene mg/m^3	Annual	1	1
Arsenic mg/m^3	Annual	6	6
Nickel mg/m^3	Annual	20	20
VOC µg/m^3	NS	NS	NS

Note - A.A. - Annual Average, NS - Not Specified

3.8.4 Observations based on Period of October 2017 to December 2017

The observations in respect of results presented in **Table 3.13** are given below -

- **Particulate Matter (PM_{10})**

PM_{10} values at all the eight locations are attributed to windblown dust. The 98 percentile values at stations viz. Industrial Site, Roth Bk., Talaghar, Nivi, Talavali, Washi, Varsoli and Barshet are observed between 42.5 µg/m^3 to 71.4 µg/m^3 which are below the permissible value of 100 µg/m^3 designated for residential/Industrial zones. Average PM_{10} values ranges between 40.8 µg/m^3 to 70.1 µg/m^3.

- **Particulate Matter ($PM_{2.5}$)**

All the observed values are within the permissible limits for residential and rural conditions i.e. 60 µg/m^3. The average values ranges between 10.3 µg/m^3 to 20.1 µg/m^3.

- **Sulphur Dioxide (SO_2)**

All the observations are well below the permissible limits of 80 μg/m^3. Considering the meteorology of the site, average SO_2 concentrations ranges between 12.7 μg/m^3 to 22.0 μg/m^3.

- **Nitrogen Oxides (NOx)**

All the observed values are within the permissible limits for residential and rural conditions i.e. 80 μg/m^3. The average values ranges between 16.2 μg/m^3 to 34.3 μg/m^3.

- **Carbon Monoxide (CO)**

The average concentration of CO at selected monitoring sites was found in between 0.0 mg/m^3 to 0.1 mg/m^3 which are within the permissible limits of NAAQM standards.

- **Ammonia (NH_3)**

All the observations are well below the permissible limits of 400 μg/m^3. Considering the meteorology of the site, average NH_3 concentrations ranges between 8.5 μg/m^3 to 18.6 μg/m^3.

- **Lead (Pb)**

Lead (Pb) concentration at sites Roth Bk. and Varsoli were found to be below detectable limits (BDL), while average value is 0.1 μg/m^3 for other each sites.

- **Ozone (O_3)**

The average concentrations of O_3 at selected sampling sites are in between 8.7 μg/m^3 to 12.2 μg/m^3 which are within permissible limits.

- **Benzene (C_6H_6)**

Benzene concentration at sites namely Roth Bk., Talaghar, Washi, Varsoli and Barshet was below detectable limits (BDL). At other sites the average benzene concentration was found to be in the range between 0.3 μg/m^3 to 0.4 μg/m^3.

- **Benzo(a) Pyrene (BaP), Arsenic (As) and Nickel (Ni)**

The average concentration of Benzo(a) Pyrene, Arsenic and Nickel was found to be below detectable limits (BDL) at all sites respectively.

- **VOC**

The average VOC concentration at Industrial site is 90.6 μg/m^3; due to proximity of other industries in the MIDC, the industrial site location showed relatively higher value of VOC. At other sites the average VOC concentration was found to be in the range between 33.8 μg/m^3 to 68.4 μg/m^3.

3.9 WATER QUALITY

3.9.1 Introduction

Selected water quality parameters, for surface and ground water resources, within the study area have been considered for assessing water environment and evaluating impact due to the proposed expansion project activities. Understanding the water quality is important in the preparation of environmental impact assessment and to identify critical issues with a view to suggest appropriate mitigation measures for implementation.

The assignment w.r.t. water pollution aspect was done by **Prof. (Dr.) Bhaskar Thorat** who is an empanelled Functional Area Expert (FAE) for **WP**.

3.9.2 Methodology

3.9.2.1 Methodology of Data Generation

Reconnaissance survey was undertaken and monitoring locations were finalized based on (1) toposheet and drainage map to identify major water bodies and (2) likely areas which can represent baseline conditions. Sampling and analysis of water samples for physical, chemical and heavy metals were undertaken through NABL & MoEFCC; New Delhi approved laboratory of **M/s. Horizon Services, Pune**. Eight locations for ground water and eight locations for surface water were selected which are listed below in **Table 3.15** and **Table 3.16** respectively.

Table 3.15 Monitoring Locations for Ground Water

Station Code	Name of the Station	Distance from Proposed Site (in Km)	Direction w.r.t. the Proposed Site
GW1	Roth Kh.	1.81	NW
GW2	Dhatav 1	0.72	S
GW3	Dhatav 2	0.74	S
GW4	Roth Bk.	1.00	NW
GW5	Muthavali	2.76	NW
GW6	Malsai	3.53	N
GW7	Bahe	1.96	NE
GW8	Dhankanhe	4.00	NE

Table 3.16 Monitoring Locations for Surface Water

Station Code	Name of the Station	Distance from Proposed Site (in Km)	Direction w.r.t. the Proposed Site
SW1	Pale Kh.	4.63	E
SW2	Udhavane	1.46	NW
SW3	Mahadevwadi	0.98	SW
SW4	Confluence	2.41	NW
SW5	Roth Bk.	1.79	NW
SW6	Zolambe	8.87	NW
SW7	Dhatav	1.00	S
SW8	Killa	2.54	E

3.9.3 Sampling Procedure for Primary Data Generation

Ground and surface water sources, covered in an area of 10 Km radius from the proposed expansion site were examined for physico-chemical, heavy metal and bacteriological parameters in order to assess the effect of industrial and other activities on surface and ground water. The samples were collected and analyzed as per procedures specified in 'Standard Methods for the Examination of Water and Wastewater' published by American Public Health Association (APHA). Samples for chemical analysis were collected in polyethylene carboys. Moreover, samples were collected in sterilized glass bottles for bacteriological test. Parameters analyzed at the site were pH, temperature, odour, turbidity and dissolved oxygen using portable water analysis kits. Selected physico-chemical and bacteriological parameters have been analyzed for projecting the existing water quality status in the core area. Results for the parameters analyzed in surface water samples, are compared with Class 'C' water as per IS 10500:1991, Revised 2012; "Specifications for Drinking Water".

3.9.4 Presentation of Ground Water Results for Survey from October 2017 - December 2017

Table 3.17 Summary of Ground Water

Sr. No.	Parameter	Unit	Location								Limits IS 10500:2012
			Roth kh. (GW1) Open Well	Dhatav 1 (GW2) Open Well	Dhatav 2 (GW3) Open Well	Roth Bk. (GW4) Bore Well	Muthavali (GW5) Bore Well	Malsai (GW6) Open Well	Bahe (GW7) Community Bore Well	Dhankanhe (GW8) Bore Well	
1.	pH	--	7.34	7.03	7.54	7.63	7.21	7.16	7.35	7.52	6.5-8.5
2.	Turbidity	NTU	0.20	0.10	0.12	0.22	0.34	0.25	0.19	0.14	001.00
3.	Electrical Conductance	mS/cm	1.27	1.26	0.77	1.33	1.38	1.45	1.37	1.43	Not Specified
4.	Total Dissolved Solids	mg/lit	**846.26**	**842.07**	**515.74**	**894.33**	**926.93**	**971.20**	**919.97**	**955.82**	500.00
5.	Total Suspended Solids	mg/lit	28.15	33.02	12.39	15.63	20.9	22.54	15.42	16.87	Not Specified
6.	Chemical Oxygen Demand	mg/lit	6.59	13.18	12.69	13.65	15.20	18.52	15.76	19.87	Not Specified
7.	Biochemical Oxygen Demand	mg/lit	3.83	5.11	5.05	5.98	6.11	7.24	6.01	7.50	Not Specified
8.	Chlorides as Cl^-	mg/lit	91.50	87.40	84.26	99.71	100.52	87.19	105.41	85.27	<250.00
9.	Sulphates as SO_4	mg/lit	80.5	65.40	72.87	83.49	90.18	104.50	83.88	95.92	<200.00
10.	Copper as Cu	mg/lit	0.001	0.002	0.000	0.005	Nil	0.006	Nil	0.001	<0.05
11.	Nickel as Ni	mg/lit	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	<0.02
12.	Total Chromium as Cr	mg/lit	Nil	Nil	**0.06**	Nil	0.002	0.004	0.006	Nil	<0.05
13.	Zinc as Zn	mg/lit	0.020	0.030	0.002	0.001	0.003	0.001	0.004	0.001	<5.00
14.	Mercury as Hg	mg/lit	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	<0.001
15.	Arsenic as As	mg/lit	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	<0.01
16.	Iron as Fe	mg/lit	Nil	0.06	0.01	0.015	0.013	0.016	0.016	0.012	<0.30
17.	Sodium as Na	mg/lit	29.64	55.79	32.15	36.51	40.19	28.96	29.74	24.38	Not Specified
18.	Potassium as K	mg/lit	4.10	5.90	5.63	6.61	7.29	4.26	5.27	5.51	Not Specified
19.	Cadmium as Cd	mg/lit	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	<0.003
20.	Lead as Pb	mg/lit	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	<0.01
21.	Boron as B	mg/lit	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	<0.50
22.	Calcium as Ca	mg/lit	71.30	**92.67**	**82.57**	**79.81**	**76.27**	**89.79**	**95.23**	**91.68**	<75.00
23.	Magnesium as Mg	mg/lit	**31.20**	20.23	25.63	26.69	28.21	**30.39**	21.45	**32.69**	<30.00
24.	Total Hardness as $CaCO_3$	mg/lit	**306.79**	**315.02**	**312.02**	**309.49**	**306.90**	**349.68**	**326.45**	**363.88**	<200.00
25.	Phosphate as PO_4	mg/lit	0.12	1.70	1.86	0.74	0.97	1.44	1.69	1.26	Not Specified

Sr. No.	Parameter	Unit	Location								Limits IS 10500:2012
			Roth kh. (GW1) Open Well	Dhatav 1 (GW2) Open Well	Dhatav 2 (GW3) Open Well	Roth Bk. (GW4) Bore Well	Muthavali (GW5) Bore Well	Malsai (GW6) Open Well	Bahe (GW7) Community Bore Well	Dhankanhe (GW8) Bore Well	
26.	Fluorides as F	mg/lit	0.15	0.12	0.17	0.22	0.25	0.35	0.26	0.24	<1.0
27.	Nitrites as NO_2	mg/lit	0.034	0.041	0.026	0.012	0.016	0.015	0.036	0.022	Not Specified
28.	Nitrates as NO_3	mg/lit	0.30	0.40	0.36	0.33	0.41	0.56	0.48	0.44	<45.00
29.	Total Nitrogen	mg/lit	0.50	0.60	0.45	0.46	0.52	0.63	0.50	0.55	Not Specified
30.	Carbonates as CO_3^{2-}	mg/lit	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Not Specified
31.	Bicarbonates as HCO_3^-	mg/lit	170.10	163.70	150.69	188.24	193.19	195.41	193.55	185.96	Not Specified
32.	Ammonical Nitrogen	mg/lit	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Not Specified
33.	Total Coliforms	No./ 100 ml	**60**	**33**	**59**	**62**	**82**	**78**	**56**	**68**	No. /100 ml
34.	Fecal Coliforms	No./ 100 ml	**Present**	**Present**	**Present**	**Present**	**Present**	**Present**	**Present**	**Present**	Absent

Note - Analysis results for the Ground water are given at **Annexure - IV.**

Table 3.18 Summary of Surface Water

Sr. No	Parameter	Unit	Location								Limits IS 10500:2012
			Pale Kh. (SW1) Upstream	Udhavane (SW2) Midstream	Mahadevwadi (SW3)	Confluence (SW4)	Roth Bk. (SW5) Down stream	Zolambe (SW6) Down stream	Dhatav (SW7)	Killa (SW8)	
1.	Colour	--	Colorless	Colorless	Colorless	Colorless	Colorless	Colorless	Colorless	Colorless	--
2.	Odour	--	Agreeable	Agreeable	Slightly smell	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
3.	pH	--	7.41	7.52	8.15	7.72	7.63	7.77	7.45	7.58	6.5-8.5
4.	Conductivity	µS/cm	152.25	256.64	1051.38	350.53	296.62	396.37	445.55	589.21	Not Specified
5.	Total Dissolved Solids (TDS)	mg/lit	102.18	172.24	**705.62**	235.26	199.08	266.02	297.80	393.80	< 500.00
6.	Turbidity	NTU	0.8	0.9	**2.1**	**1.2**	**1.1**	**1.4**	0.7	0.5	1.00
7.	Total Suspended Solids	mg/lit	19.00	24.00	112.00	32.00	30.00	39.00	45.00	59.00	Not Specified
8.	Chemical Oxygen Demand	mg/lit	13.00	16.00	37.90	20.50	18.50	22.40	15.63	19.98	Not Specified
9.	BOD 3 days at 27° C	mg/lit	5.00	6.00	13.00	8.50	7.20	9.45	6.21	7.23	Not Specified
10.	Ammonical Nitrogen	mg/lit	NIL	NIL	10.50	NIL	NIL	NIL	NIL	NIL	Not Specified
11.	Nitrate as NO_3	mg/lit	0.20	0.32	**46.56**	4.25	2.55	5.18	3.15	4.61	45.00
12.	Nitrite as NO_2	mg/lit	NIL	NIL	1.29	0.001	NIL	NIL	0.002	0.004	Not Specified
13.	Phosphorous as P	mg/lit	0.01	0.50	0.90	0.59	0.55	0.60	0.31	0.41	Not Specified
14.	Nitrogen as N	mg/lit	0.03	0.60	1.10	0.72	0.69	0.78	0.60	0.89	Not Specified
15.	Sodium as Na	mg/lit	0.02	0.06	0.09	0.07	0.06	0.07	0.05	0.06	Not Specified
16.	Potassium as K	mg/lit	NIL	NIL	1.80	0.062	0.052	0.066	NIL	1.20	Not Specified
17.	Calcium as Ca	mg/lit	10.09	15.23	**89.62**	29.60	20.29	35.63	19.87	23.54	75.00
18.	Magnesium as Mg	mg/lit	4.10	7.89	**39.63**	10.29	8.28	17.79	8.45	11.79	30.00
19.	Total Hardness as $CaCO_3$	mg/lit	42.12	70.58	**387.33**	116.39	84.84	162.37	84.48	107.42	200.00
20.	Carbonates as CO_3^{2}-	mg/lit	NIL	NIL	1.69	NIL	NIL	NIL	NIL	NIL	Not Specified
21.	Bicarbonates as HCO_3	mg/lit	27.30	52.16	311.26	76.40	62.59	89.62	74.51	102.53	Not Specified
22.	Chlorides as Cl^-	mg/lit	2.90	10.00	89.85	17.80	13.52	19.30	25.84	32.19	250.00
23.	Sulphates as SO_4	mg/lit	13.00	20.00	77.50	32.00	23.18	34.60	22.16	25.69	200.00
24.	Iron as Fe	mg/lit	0.21	0.23	**0.99**	0.27	0.25	0.27	**0.39**	**0.48**	0.30
25.	Copper as Cu	mg/lit	0.002	NIL	0.004	NIL	NIL	NIL	NIL	NIL	0.05
26.	Zinc as Zn	mg/lit	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	5.00

Sr. No	Parameter	Unit	Location								Limits IS 10500:2012
			Pale Kh. (SW1) Upstream	Udhavane (SW2) Midstream	Mahadevwadi (SW3)	Confluence (SW4)	Roth Bk. (SW5) Down stream	Zolambe (SW6) Down stream	Dhatav (SW7)	Killa (SW8)	
27.	Arsenic as As	mg/lit	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	0.01
28.	Cadmium as Cd	mg/lit	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	0.003
29.	Chromium as Cr	mg/lit	0.01	0.02	1.60	0.09	0.06	0.11	0.13	0.19	Not Specified
30.	Lead as Pb	mg/lit	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	0.01
31.	Mercury as Hg	mg/lit	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	0.001
32.	Fluoride as F^-	mg/lit	NIL	NIL	**1.4**	NIL	NIL	NIL	NIL	0.8	1.00
33.	Boron as B	mg/lit	NIL	NIL	0.20	NIL	NIL	NIL	NIL	NIL	0.50
34.	Total Coli form	No./ 100ml	**50**	**75**	**125**	**83**	**79**	**92**	**58**	**84**	No. /100 ml

Note - Analysis results for the Surface water are given at **Annexure - V.**

3.9.4.1 General Observations

Ground water and surface water sources covered within 10 km radial distance from Site were examined for Physico-chemical and bacteriological parameters in order to assess the effect of industrial and other activities on ground water. The analysis was done as per the procedure laid down in the standard methods for the examination of water and wastewater (APHA). The salient observations are as indicated below as -

Ground Water

The ranges described here cover all the sampling locations in the study area. The pH values are observed to be in the range of 7.03 to 7.63, which are well within the limits conforming to the drinking water standards (IS: 10500). Total Dissolved Solids in the ground waters, in the study area as a whole, are not within the permissible limit of 500 mg/l. This is equally and reflects higher hardness level, in the range of 306.79 - 363.88 mg/l. Higher levels of Ca, Mg, and Total Hardness were observed almost above the permissible limits. Also the total coliforms and Fecal Coliforms observed.

Surface Water

The range described underneath encompasses all the sampling locations. The pH values range from 7.41 to 8.15. They represent neutral to alkaline conditions. Total dissolved solids were observed to be in the range of 102.18 -393.80 mg/l. The TDS values are within the permissible limit of 500 mg/l. The COD ranges from 13 to 37.90 mg/l. The Inorganic constituent like Nitrites, Sodium, Potassium are observed to be within the permissible limits. It is observed that all the parameters are within the prescribed limits. Except the value of TDS, Ammonical Nitrogen, Ca, Mg, Fe, B and total Hardness at Mahadevwadi village exceeds the limit. This indicates that there is no pollution of the surface water bodies other than Mahadevwadi. The surface water quantity can be stated as good for remaining villages.

3.10 NOISE LEVEL SURVEY

3.10.1 Introduction

Under the proposed project, so there would not be much construction activity on the site, Although, level of construction activities shall not be very high, still some specific sources of noise like welding, transportation, movement of earth movers, tractors, concrete or asphalt mixing etc. should be carried out in a controlled manner. Neither the plant nor the construction workers should be exposed to excessive noise levels.

The physical description of sound concerns its loudness as a function of frequency. Noise in general is that sound which is composed of many frequency components of various loudness distributed over the audible frequency range. Various noise scales have been introduced to describe, in a single number, the response of an average human to a complex sound made up of various frequencies at different loudness levels. The most common and universally accepted scale is the 'A' weighted scale which is measured as dB (A). This is more suitable for audible range of 20 to 20000 Hz. The scale has been designed to weigh various components of noise according to the response of a human ear.

The impact of noise sources on surrounding community depends on -

- Characteristics of noise sources (instantaneous, intermittent or continuous in nature). It can be observed that steady noise is not as annoying as the one, which is of continuously varying loudness.
- The time of day at which noise occurs, for example high noise levels at night in residential areas are not acceptable because of sleep disturbance.
- The location of the noise source, with respect to noise sensitive land use, which determines the loudness and period of exposure.

The Environmental Impact of noise can have several effects varying from Noise Induced Hearing Loss to Annoyance depending on loudness of noise levels. The environmental impact assessment of noise from the industrial activity, vehicular traffic can be undertaken by taking into consideration various factors like potential damage to hearing, physiological responses, annoyance and general community responses.

The study area of 10 km radius with reference to the proposed expansion plant site has been covered for noise environment. The four zones viz. Residential, Commercial, Industrial and Silent Zones have been considered for noise monitoring. Some of the major arterial roads

were covered to assess the noise due to traffic. Noise monitoring was undertaken for 24 hours at each location.

The main objective of noise pollution impact assessment in the study area is to assess the impact of total noise generated by industries and vehicular traffic on the human settlements within 10 km radius. The main objectives of the studies conducted are -

- Assessment of background noise levels
- Identification and monitoring the major noise sources of the existing activity
- Impact of noise on the workers as well as on general population.

The assignment w.r.t. Noise level survey was done by **Mr. Vinaykumar Kurakula** who is an empanelled Functional Area Expert (FAE) of EEIPL for **Noise and Vibration (NV).**

3.10.2 Identification of Sampling Locations

A preliminary reconnaissance survey was undertaken to identify the major noise generating sources in the area. Noise generating sources have been identified with respect to the activities viz. industrial noise and ambient noise due to industries and traffic, which have impact on sensitive areas. The noise sampling locations have been indicated below as -

3.10.2.1 Ambient Noise Monitoring Stations

The noise survey involved determination of noise levels, in decibels, at following eight locations in the study area. Noise levels were recorded at every clock hour for a continuous 24-hour period.

Table 3.19 Noise Sampling Locations

Station Code	Name of the Location Point	Distance w.r.t. Plant Site (in km)	Direction w.r.t. Plant Site
N1	Industrial Site	--	--
N2	Warse	2.27	SW
N3	Mahadevwadi	1.16	SW
N4	Dhatav	1.48	ES
N5	Bahe	2.06	NE
N6	Udadhavane	2.40	NW
N7	Roha Town	3.93	NW
N8	Killa	2.31	SE

- **Parameters Measured During Monitoring** -

A noise rating developed by EPA for specification of community noise from all the sources is the day-night sound level, (L_{dn}). It is similar to a 24-hour equivalent sound level except that during the night-time period, which extends from 10 PM to 6 AM, a 10 dB (A) weighing penalty is added to the instantaneous sound level before computing 24 hour average. This night time penalty is added to account for the fact that noise during night, when people usually sleep, is judged more annoying than the same noise during the daytime.

For noise levels measured over a given period of time interval, it is possible to describe important features of noise using statistical quantities. This is calculated using the percent of the certain noise levels exceeding during the time interval. The notation for the statistical quantities of noise levels is described below -

L_{10} is the noise level exceeded 10 percent of the time,
L_{50} is the noise level exceeded 50 percent of the time,
L_{90} is the noise level exceeded 90 percent of the time,
$L_{day}$is equivalent noise level measured over a period of time during day (6 AM to 10 PM),
L_{night} is equivalent noise level measured over a period of time during night (10 PM to 6 AM).

- **Equivalent Sound Pressure Level (L_{eq})** -

The L_{eq} is the equivalent continuous sound level that is equivalent to the same sound energy as the actual fluctuating sound measured in the same period. This is necessary because sound from noise source often fluctuates widely during a given period of time.

This is calculated from the following equation -

$$L_{eq} = L_{50} + \frac{(L_{10} - L_{90})^2}{60}$$

L_{dn} - The noise rating developed for community noise from all sources is all Day-Nights Sound Level (L_{dn}). It is similar to a 24 hr equivalent sound level except during night time period (10 PM to 6 AM) a 10 dB (A) weighing penalty is added to the instantaneous sound level before computing the 24 hr average. The L_{dn} for a given location in a community may be calculated from the hourly L_{eq}'s, by the equation -

$$L_{dn} = 10 \log \{1/24[15(10^{Ld/10}) + 9 (10^{(Ln+10)/10})]\}$$

Where L_d is the equivalent sound level during the daytime (6 AM to 10 PM) and L_n is the equivalent sound level during the nighttime (10 PM to 6 AM).

3.10.2.2 Method of Monitoring

A detailed noise level survey was undertaken to study the levels of noise, as the high noise levels may cause adverse effect on human beings and the associated environment. The noise level monitoring was carried out through **M/s. Horizon Services, Pune** which is NABL accredited and MoEFCC; New Delhi approved organization.

3.10.2.3 Standards for Noise Levels

- **Ambient Noise Levels Standards**

MoEFCC has notified ambient air quality standards in respect of noise vide Gazette notification Dated 14th February, 2000. It is based on the 'A' weighted equivalent noise level (L_{eq}). The standards are given in following table -

Table 3.20 Ambient Noise Level Standards

Area code	Category	Limits in dB (A) L_{eq}	
		Day Time	Night Time
A	Industrial Area	75	70
B	Commercial Area	65	55
C	Residential Area	55	45
D	Silence Zone	50	40

Ref: Noise Pollution (Regulation and Control) Rules, 14th Feb 2000.

- **Standards for Occupational Noise (U.S.A) -**

Industrialized countries have specified limits for occupational noise exposure. The permissible noise exposure limit for industrial workers is primarily concerned with the harmful aspect of noise and its objective is to protect the hearing of majority of working people. The **American Conference Government of Industrial Hygienists (ACGIH), USA** has prescribed the following permissible noise exposure limits for industrial workers. These limits are given in **Table 3.21** as -

Table 3.21 Standards for Occupational Exposure

Exposure Time in Hour/Day	Limit in dB (A)
8	090
4	093
2	096
1	099
1/2	102
1/4	105
1/8	108
1/16	111
1/32	114

Exposure to continuous or intermittent noise louder than 115 dB (A) should not be permitted. Exposure to pulse or impact noise should not exceed 140 dB (A).

- **OSHA Standards -**

The **Occupational Safety and Health Administration (OSHA)** has also prescribed the following allowable limits to noise exposure for industrial workers. These are given in the following **Table 3.22** as -

Table 3.22 OSHA Standards for Occupational Exposure

Duration per Day (in hours)	Sound Level in dB (A)
8	085
6	087
4	090
3	092

Duration per Day (in hours)	Sound Level in dB (A)
2	095
1.5	097
1	100
0.5	105
0.25	110

3.10.3 Presentation of Results

The ambient noise levels measured are presented in **Table 3.23.** The table indicates equivalent noise levels viz. L_{10}, L_{50}, L_{90}, L_{day}, L_{night} and L_{dn} at different places located within the study area. Similarly, these values viz. L_{eq}, L_{day}, L_{night} and L_{dn} are compared with the limits.

Table 3.23 Ambient Noise Levels

Sr. No.	Location	Average Noise Level in dB (A)					
		L_{10}	L_{50}	L_{90}	$L_{eq(day)}$	$L_{eq(night)}$	L_{dn}
1.	N1	70.7	71.9	73.6	72.1	63.7	72.8
2.	N2	42.3	51.2	52.7	53.0	44.3	53.6
3.	N3	47.0	49.2	53.6	50.0	43.1	51.4
4.	N4	49.1	52.2	56.7	53.1	35.0	51.5
5.	N5	48.4	51.4	53.0	51.7	35.0	50.2
6.	N6	38.1	46.0	53.3	49.8	32.3	48.2
7.	N7	43.9	47.1	48.4	47.5	41.3	49.3
8.	N8	42.2	46.0	48.5	46.6	42.8	50.0

Note: Analysis results for Noise are given at **Annexure - VI.**

3.11 SOCIO-ECONOMIC PROFILE

3.11.1 Introduction

Socio-economic (SE) status of any population is an indicator for development of the region. Any developmental project will have bearing on the living conditions and on the economic base of population in particular and the region as a whole. Similarly, the proposed expansion industry will have its share of socio-economic influence in the study area. The section delineates the overall appraisal of socially relevant attributes.

The data collection, for evaluation of impact of the proposed expansion project on socio-economic aspects in the study area, has been done through primary household survey and through the analysis of secondary data available on study area. Survey of selected eighteen villages within the 10 Km radius of the study area was carried out with the help of an interview schedule. The villages within a close proximity of the project were given more weightage as hypothetically these villages are more affected positively or negatively. The objective of this survey was to understand the current socio-economic status of selected villages and the perception of the local people about the existing industries located in Roha MIDC as well as to know their awareness regarding the proposed project by AFCMPL. The following data was collected in the month of January, 2018 by **Dr. A. J. Samant** in-house FAE and Technical Director of EEIPL for **SE** and **Mr. Neeraj D. Powar** in -house FAE.

3.11.2 Methodology

The survey of 18 villages, selected out of 92 villages within the 10 Km radius of TDMCCL, was carried out with the help of a structured close ended interview schedule, comprising of 36 questions in Marathi. The schedule was administered in month of December, 2017. Simple random disproportionate sampling technique was used. A total of 180 locals were covered during the study (Refer **Table 3.24**).

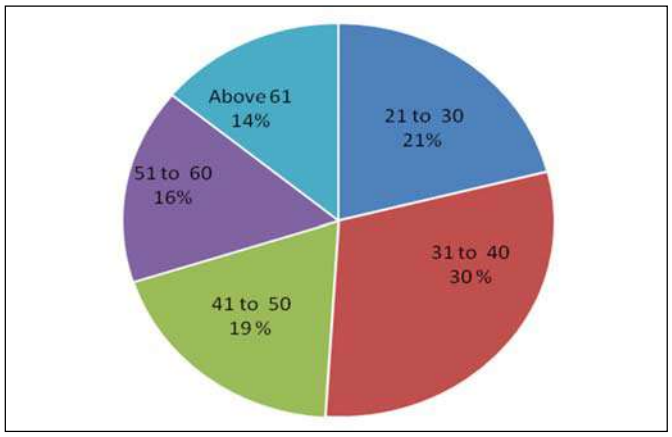
Table 3.24 Details of Sample Size

Sr. No.	Village	Number of Sample Size
1.	Dhatav	10
2.	Roha	10
3.	Ashtami	10
4.	Nivi	10
5.	Borghar	10
6.	Balapade Kh.	10
7.	Tamhanshet	10
8.	Tambadiwadi	10
9.	Devakanhe	10
10.	Roth Kh.	10
11.	Roth Bk.	10
12.	Gove	10
13.	Mahadevwadi	10
14.	Madhali Kh.	10
15.	Bhuvaneshwar	10
16.	Wandoli	10
17.	Kharapati	10
18.	Pugaon	10
	Total	**180**

3.11.3 Results and Discussion

The villages in the study area are small and most of them are well connected by all weather roads. The male: female ratio among the respondents was 59:41 respectively. The difference in the ratio is visible as female members are usually less responsive. Even thought their availability is more, however educated women employed as teacher (high school), Gram Panchayat members and PHC-employee are deliberately in target respondent due to their exposure and education.

Fig. 3.17 Age Distribution within Sample size



- Within the sample size, (30%) between 31 to 40 years, (21%) between 21 to 30 years, (19%) were between the age-group 41 to 50 years, (16%) between 51 to 60 years and remaining (14%) above 60 years. (Fig.3.17).
- A majority of the respondents within the sample size were literate as only (11%) were illiterate. The literates had up to primary (35%), secondary (32%), higher secondary (15%), graduate (6%) and post graduate (1%) level education.
- Within the surveyed area the respondents were reported to be involved in diverse livelihood activities such as agriculture, service, agriculture labour and business. Majority (67%) of the respondents had agriculture as their main occupation. Around (31%) were involved in diverse services mostly in industries located in Roha MIDC; only few (10%) carried out business related activities.
- Many (62%) of the respondents from the study area had an annual income between Rs. 75,000 to 1,50,000 (25%) of the respondents had their annual income above Rs.1,50,000. whereas remaining (13%) of the respondents had their annual income below Rs.75,000. However people are not accurate while revealing their actual income this was observed from their life style.
- Major crops grown in the area, according to respondents are rice (75%), val (42%), vari (10%), millets (3%) and vegetables (2%). Major fruit orchards in the area, according to respondents are mango, coconut, cashew nut and supari.
- In most villages (76%) the population depended for drinking water in the form of river. On the other hand (24%) relied on groundwater and other sources as well in the form of wells and bore wells. According to a majority (85%) of the respondents there is no shortage of water in the area as it is available sufficiently throughout year.
- Though a majority (97%) of the respondents revealed that there was no change in water quality in their area, remaining (3%) perceived change in water quality which was attributed to the industrial waste water. This response was stronger by locals from villages Roth Khurd, Roth Budruk. This is due to close proximity of these villages to MIDC and nalla passing through these villages into which effluent is discharged by industries. This was also observed during visit to these villages. Among these, (70%) of the respondents perceived negative effect on health of locals due to drinking of polluted water e.g. digestion problems.
- When enquired about the negative environmental effects of existing industries in MIDC, there were mixed opinions from the respondents, (72%) of them said they are experiencing any negative effect namely air and odour pollution (55%), on health (20%), effect on local animals (7%), other negative impacts (3%) and loss of cultivable land (17%). Complaints

about odour and air pollution problem were more by respondents from villages Roth Khurd, Roth Budruk and Killa. Impacts due to this were breathing problem, eye and throat irritation. In these village locals have stopped rearing domestic animals due to their health problems as a result of polluted water. Regarding fish the same was revealed that there is fish population loss throughout the flow of the river.

- (61%) of the respondents expressed that the industries from Roha MIDC provided job opportunities in the form of unskilled work, daily wage and transport jobs. It was observed that in most villages, more than 25 persons from each village, in the study area, were working in one or other industry of MIDC. Most respondents had changed their profession from traditional farming to working in industries of MIDC. About (63%) of the respondents said that this employment is not seasonal and lasts for whole year and therefore is sustainable. According to respondents, (25%) to (50%) of the work force in Roha MIDC is from outside states like Uttar Pradesh, Bihar due to the low wages accepted by them.
- A large majority of the respondents (82%) were unaware of the proposed project by TDMCCL. When asked about their opinion on this, mixed opinions were expressed. (43%) were hopeful about increase in employment (40%) felt that this will further increase the pollution while (12%) perceived that there would be no change in existing conditions.
- When asked about contribution by Industries of Roha MIDC, respondents said that only Medical van is being provided by some of the industries, many more facilities need to be provided e.g. development of open spaces for playgrounds, waste water management system, drinking water facility.
- (66%) respondents stated that library / reading room is existed in their village. (47%) of respondents mentioned that there was a cultural centre for the use of villagers in the village. (65%) stated that there was madanpam in front of their temples which was utilised for multiple purposes. PHC centres in working conditions existed in the village according to (59%) respondent and availability of doctors in the village was mentioned by (84%).
- Only (6%) respondents did not have toilets but there were to be built in due course due to government compulsion as compare to this according to the respondent (1%) mention that all schools did not have toilets. According to (93%) of the respondents there were self help group in their respective areas for socio-economic upliftment of the locals. However no specific business was carried out by these self help groups except gathering money and releasing loans.
- There were diverse expectations of the respondents from TDMCCL. About (81%) stressed on need for better health facility, (13%) demanded domestic waste water management and (3%) asked for solid waste treatment facilities.

3.11.4 General observation in the study area through SIA survey

It was observed that most of the villages are well connected by roads having basic facilities like drinking water (provided by MIDC), educational facilities, toilets and electricity. Moreover, it was interesting to note that village Dhatav had received an award for Swatch Bharat Mission. Villages namely Roth Budruk and Roth Khurd which are close to MIDC were found to be negatively affected by air pollution, odour problem and water pollution. In some villages like Pui and Khamb, rabbi crops like rice were being cultivated due to easy availability of water through canal. Direct and indirect job opportunities in MIDC and both kharif and rabbi crops have uplifted the economic condition of the locals. However, it was interesting to observe that, locals residing in wadis above villages Pugao, Palle khurd, Killa and Washi were known to be Adivasis. Most of these were illiterate, economically backward and dependent on gathering wood for their livelihood. They had no water facility in their village and this was their demand.

3.11.5 Conclusion

Most respondents from all villages are dependent on agriculture and working in MIDC for their livelihood. Major crops grown in the area is rice and wal. A majority of the population within the sample size had a quantum able income which is mostly due to job opportunities in MIDC. Cumulative impact due to various industries in MIDC is adversely affecting the environment in the region. Due to the chemical industries every household had at least one chemical graduate in their house however they were not satisfied by the payment and are now migrating to Mumbai, thus the population of workers from other states was increasing.

3.11.6 Suggestions

Provision of full-time working health centre is inclusive of qualified doctor should be provided by the industries in Roha MIDC. Free compulsory education should be provided to Adivasi community in the area. Play grounds, incentives for increasing Marathi schools. Due to the chemical effect on the colour of crops and the condition of soil, many locals had given up farming. A large population grows wal a type of pulse.

3.12 ECOLOGY

The in-house Functional Area Experts of EEIPL for EB **Prof. (Dr.) Jay Samant**, **Dr. Rohan Lad** and EB research scholar **Mr. Anup Gargate** were involved in the present overall exercise w.r.t. ecology and biodiversity aspects of the study area around TDMCCL project.

3.12.1 Study area

The study area in 10 km radius from the project site (314.2 sq km) forms part of Roha and Mangaon tehsils of Raigad district. About 90 % of the study area falls in Roha while 10 % in the south comes under Mangaon Tehsil. The climate of the area is predominantly sub tropical and moderate throughout the year. The area receives annual average rainfall ranging between 13110 mm to 24417 mm and the soil types are dominated by loamy soil which influences the ecology and biodiversity of the region. The major part of hill forest is mixed, consisting of evergreen and semi-evergreen type and on hill slopes with moist deciduous type tree cover. There are barren patches on hilly plateaus, particularly of the main ridges and spurs of the Western Ghats.

Out of the total of 93 villages within10 km radius of the project site, a total 38 villages (41%) fall in the **Western Ghats ESA** (**Appendix - V**). Out of which 7 villages are located within the 5 km radius from the project site and remaining 31 villages in 5 km to 10 km radius. During this study 25 representative villages out of the total 93 villages were field surveyed for Ecology and Biodiversity (EB) and village questionnaire. This comprised 13 villages within 5 km radius (**Two from ESA**) and 12 villages between 5 and 10 km radius (**Six from ESA**). The names of the study villages are given in **Table 3.25**.

Table 3.25 Study villages, Villages from the Western Ghats ESA and their distance from project site

Villages In 0 km to 5 km radius					Villages In 5 Km to 10 Km radius				
Sr. No.	Village Name	EB Survey	Quest. Survey	ESA	Sr. No.	Village Name	EB Survey	Quest. Survey	ESA
1.	Ashtami	-	Õ	-	14.	Amdoshi	-	Õ	-
2.	Bahe	Õ	Õ	-	15.	Are	-	Õ	Õ
3.	Devakhane	Õ	Õ	Õ	16.	Ghosale	-	Õ	Õ
4.	Dhatav	Õ	-	Õ	17.	Kharpati	-	Õ	-
5.	Gove	-	Õ	-	18.	Mandavshet	Õ	Õ	-
6.	Killa	Õ	Õ	-	19.	Pugaon	Õ	-	-
7.	Landhar	-	Õ	-	20.	Pui	Õ	Õ	-
8.	Mahadev wadi	Õ	Õ	-	21.	Tambadi	-	Õ	Õ
9.	Pale Kh.	Õ	-	-	22.	Usar	Õ	-	Õ
10.	Pingalsai	-	Õ	-	23.	Vaijnath	Õ	-	Õ
11.	Roth Bk.	-	Õ	-	24.	Wandoli	-	Õ	Õ
12.	Roth Kh.	-	Õ	-	25.	Zolambe	Õ	Õ	-
13.	Udhadavane	Õ	-	-					

3.12.2 Methodology

For familiarization of the study area, a preliminary survey was conducted in the study area on 3rd and 4th November, 2017. During EB study, toposheet (surveyed in 1967-68 and updated during 2005-06), IRS LISS IV satellite imagery and LULC maps based on them are used. Similarly relevant data from District Census (2011), Raigad District Gazetteer, district forest report and relevant literature was referred. At time of field visits ground truthing was done for local Ecology by confirming the LULC maps for major macro and micro habitats in the study area. The key terrestrial habitats such as hills, grassland, scrub, agriculture land habitats were identified in the vicinity of all the study villages. Aquatic habitats studied included water-bodies near villages Killla, Devkhane, Bahe, Mahadevwadi, Pugaon, MIDC area and Pui Dam and stretch of Kundlika River i.e. up stream, mid stream and downstream of Roha MIDC. The survey was conducted from early morning till evening on the five days in winter month i.e. 16 to 20 January 2018. The green belt survey of TDMCCL industrial plot was carried out on 31 May 2018.

Biodiversity field study involved random method for vegetation and opportunistic sighting for fauna (Larsen and Viana, 2016). Flora was recorded for identification and species dominance at level of major tree species. Field binoculars of makes Nikon (12 X 50 - 5.2^0), Olympus (7 X 35 - 7^0) and Minolta (5 X 50 - 7^0) were used during the observations. The Book of Indian Birds by Salim Ali (1996) and Birds of Southern India by Grimmet et al. (2005) for bird and The Book of Indian Reptiles and Amphibians by Daniel (2002) for herpatofauna and Freshwater Fishes of Peninsular India by Ranjit Daniels (2002) for fish were referred as field guides. Photo documentation was done during habitat and biodiversity survey using Canon Power-shot (S X 30 IS HD 35X,14 Megapixels) camera to note present environmental status of the habitats. Bird survey was conducted following standard point count method (Altmann, 1974). Extensive Photo documentation was done throughout the study to record the direct and indirect environmental impacts of industrial activities in Roha

region on ecology and biodiversity in the area. The data thus collected was used to estimate diversity and status of threatened bird species.

A structured close ended interview schedule, comprising of 21 Ecology-Biodiversity related questions in local Marathi language, was administered to get authentic information from the locals on the status of EB in the study area. In this stratified random sampling method was used. In which by design 70% of the respondents were 50+ year age group in the sample size of 90 respondents, from the 19 study villages. This exercise was focused to get perception on the environmental changes, particularly in local ecology and biodiversity over the years.

3.12.3 Ecology

3.12.3.1 Field Observation

Most of the region is hilly, rugged and in places with slope of the Western Ghats spurs, and number of hillocks all over the study area forming catchments of numerous streams which ultimately meet river Kundalika in the basin at the centre of the study area. The undulating hill slopes and flatter hilltops are cultivated revenue or owned lands habitats admixed with reserved forests. These areas are scattered with open scrubs and grasslands habitats. The study area is a mosaic of habitats comprised of hills with forests and scrub, slopes and lowlands with homesteads and cultivation. Manmade water bodies and swamps in the vicinity of study villages namely Killla, Devkhane, Bahe, Mahadevwadi, Pugaon, Vaijnath, Udadavane and Roha MIDC area and medium dam at village Pui and River Kundlika with its tributaries provide habitat for aquatic biodiversity. The agriculture fields, horticulture farms and grasslands are spread on either sides of river Kundlika and around MIDC area, and the forest and scrub areas around villages Pale khurd, Killa, Vaijnath, Mandavshet, Usar, Landhar, Vandoli and Pingalsai are habitats suitable for terrestrial biodiversity. The study area is a good mosaic of intermixed rich and diverse macro and micro habitats comprising of Western Ghats spurs, coastal plains, undulating terrain, manmade wetlands, river basin, estuarine habitats and mangroves, those support good ecology and biodiversity.

However, during field visits many small water logged areas, totally polluted and highly eutrophicated are also observed in and around project site and MIDC area. At some wetlands i.e. near Roha Dychem and Excel industries, effluents and solid wastes are released making them polluted. Also the chemical industries closely located on the banks of Kundalika River and her major tributary streams such as Lander nalla are also a potential threat to the ecology of the wetlands and their biota.

3.12.3.2 Questionnaire findings

The respondents from the 19 villages reported presence of numerous seasonal waterfalls in the area. According to few respondents good mangroves habitats were also present earlier in the littoral part of Kundalika River. Most of these disappeared due to the continuous discharge of fresh water after Pui dam construction, as the tidal influence of brackish water was permanently affected. According to the respondents the past habitat status in general in the area is now qualitatively and quantitatively changed according to their location and landuse. The multiple weightage given by the respondents revealed that the major habitats in the area are as forest (84%), scrub (79%), agriculture land (76%), fallow land (63%) and grassland (54%). The present status of theses habitats as per them suggested decrease in the forest, grassland and scrub area with increase in agricultural, habitations and industrial area.

Not much change is reported in fallow lands, plateaus, stony cliffs and waterfall habitats. The major habitats such as forest, scrub and agriculture tallies with the LULC studies.

In case of some aquatic habitats there are changes in both quality and quantity of the water as reported by the respondents. Some respondents (37%) reported problems of wetland pollution and decrease in number of water holes, while deforestation was reported by (25%) and grassland destruction by (12%). The reasons for this habitat change are attributed in descending order to Industrialization (54%), forest fire (45%), rapid urbanization (40%), tree cutting and industrial pollution (27%) each. It is followed by sewage pollution (21%), agriculture expansion and increase in weeds (14%), grass burning (11%) and stone quarrying (6%). The present cumulative landuse, as per the respondents is agriculture (78%), industrial (43%), residential (42%) and infrastructure (20%) and Protected Areas (7%) these observations are restricted to their village environs.

3.12.4 Biodiversity

3.12.4.1 Field Observation

The water-bodies in villages namely Killa, Devkhane, Bahe, Mahadevwadi, Pugaon,Vaijnath, Udadavane, and Roha MIDC area, and medium dam at village Pui were studied along with the major stretch of River Kundalika and her tributary streams in the study area to observe their biodiversity, this was restricted to avifauna as birds are considered indicators of environmental health of the habitats.

In all a total of 589 birds belonging to 15 orders, 30 families and 54 species were recorded during the brief field survey, out of which 32 species were common resident, 16 species were not common resident, 3 species were not common winter visitor and 3 species were common winter visitor. Considering less number of study sites, limited time and few opportunistic observations, this avian diversity is a good indicator of biodiversity, mainly due to the mosaic of natural and manmade habitats in the region. Moreover, according to IUCN, 2017 status, black headed Ibis (*Threskiornis melanocephalus)* becomes Near Threatened bird species, which was reported in exceptionally large number at Pugaon village. As per feeding guild some bird species (14) recorded are dependent on multiple food sources while others depend on single source. The total 54 bird species recorded comprised of piscivorous (10), insectivorous (19), carnivorous (15), omnivorous (12), granivorous (5), nectarivorous (7) and frugivorous (9). This clearly indicates the wide spectrum of food availability in the mosaic of diverse micro habitats in the study area. Attempt has been made to evaluate the species diversity index (SDI). The indices calculated revealed Shannon Wiener diversity index (H) 4.71, Evenness (j) 1.18, Simpson Index (D) 0.90 and Species Richness (d) 19.13. Bird species list is enclosed (**Appendix - V**). Some butterfly species were also observed with their associated host plants during field study. (**Appendix - V**).

3.12.4.2 Questionnaire findings

In the questionnaire survey on biodiversity, the respondents reported 26 tree species as common in the study area. The dominant tree species in the region is Teak (*Tactona grandis*), which has been extensively pruned over years and the current teak forest is mostly a secondary growth. In case of social forestry plantation, it is noted that traditionally government planted Nilgiri (Eucalyptus sp.), Teak (*Tactona grandis*), Australian Babhul (*Acacia auriculiformis)* and Subabhul (*Leucaena leucocephala)*. Except teak other species are exotic. The same is true for Roha MIDC and urban area, where largely exotic tree species

are planted mainly for beautification purpose, without any consideration for environmental trees needs in industrialized area. In agriculture crops grown are 'Bhat' - Paddy *(Oryza sativa),* 'Nachani' - finger millet *(Eleusine coracana),* 'Vari' - jungle rice *(Echinochloa colona),* 'Wal' - Indian bean *(Lablab purpureus),* 'Bajari' – Perl millet *(Pennisetum glaucum)* and local varieties of vegetables. The tree species grown in horticulture are dominated by Mango (*Mangifera indica*), Jackfruit (*Garcinia indica*), Sapodilla (*Manilkara zapota)*, Cashew (*Anacardium occidentale*) and Coconut (*Cocos nucifera*).

According to the respondents wildlife in the area in past included tiger, panther, sloth bear, hyena, fox, Indian wolf, Indian porcupine, spotted deer, mouse deer, barking deer, Indian guar, wild boar, giant squirrel, bonnet macaque, common Langur, black naped hare, giant fruit bat and three-striped palm squirrel. Out of these tiger is now almost missing in the region. Tiger being 'rare' is listed as 'endangered', whereas panther, Indian guar and sloth bear as 'vulnerable' and hyena is listed as 'near threatened' by IUCN (2015). Habitat loss is reported as a major cause for dwindling biodiversity in the study area. This is mainly due to deforestation, traditional agriculture practices like 'slash and burn" and 'rab', manmade forest fires, agriculture expansion, poaching and, now rapid increase in the impacts of industrialization, urbanization and associated infrastructure development. It is further aggravated by diverse types of industrial pollutions from the Roha MIDC and around.

It is learnt that the Indian fox population has drastically gone down as their main food Crabs is eradicated from fields by local farmers using toxin 'Foret'. The senior locals observed that lately the endangered white rump vultures *(Gyps bengalensis)* have completely disappeared from this area due to polluted Caracas. It was realised that the knowledge of birds and reptile species, mainly with the local young and youth, is scanty and restricted to limited common faunal and floral species only.

In fish diversity, respondents mentioned around 22 local freshwater fish species. It was also reported that the earlier brackish water fish are no longer found Kundalika river, mainly due to perennial discharge from Pui dam and river pollution due to industries in the basin. Out of the introduced fish species Tilapia, Cyprinus, Catla and Rohu are common. It is important to note that according to IUCN, status (2015), from the local fish one species i.e. Cyprinus (*Cyprinus carpio)* is Vulnerable, Aheer (*Anguilla Anguilla*) is Critically Endangered and two other species namely Vam (*Anguilla bengalensis*) and Valshivda (*Wallago attu*) have become Near Threatened.

As expected there was almost no information about existence of invertebrate biodiversity with the locals. However, most (77%) respondents generally mentioned presence of spiders, butterflies, scorpions and crabs in their locality. Importantly, more than half (54%) of the respondents, particularly the seniors, who had witnessed changing environmental conditions and landuse and biodiversity in the past, alleged decline in present biodiversity in the area. This transformation in ecology and biodiversity over the years is attributed to factors namely change in landuse due to deforestation (46%), Urbanizations (31%) and agriculture expansion (25%). Few have reported poaching of wild animals which still exist, while others (29%) have directly related it to the recent industrialization in the Roha MIDC area.

3.12.4.3 Environmental Impact of Proposed Project on Ecology and Biodiversity in the region

The study area i.e. 5 km around the proposed project site in Roha MIDC is already occupied by some large chemical industries mainly dealing with agro chemicals and thus all the macro and micro habitats in the region are already affected by air, water and soil pollution. Therefore it is believed that the additional impact of TDMCCL expansion is not likely to substantially contribute in the existing cumulative pollution load on the ecology and Biodiversity of the region. However environs of some villages in the radius between 5 km and 10 km still have good terrestrial and wetland habitats which are relatively less affected in Borghar, Devkhane and Vashi villages and therefore they need to be protected and conserved for ecology and biodiversity within.

The environmental impacts were considered for worst case scenario i.e. direct discharge of untreated wastewater. The factory site is less than 1 km from River Kundlika, and its tributary, a large perennial stream Landher, that flows directly close and along the entire south and west border of the TDMCCL industrial plot. Currently more than 20 fish species are found in river Kundlika, out of which according to IUCN two are Near Threatened, one is Vulnerable and one is Critically Endangered. Discharge of untreated wastewater, effluents and surface runoff from the industry in the River, streams and surrounding swamps may cause negative impact on the aquatic habitat and its littoral biodiversity including fishes.

3.12.5 Recommendations

3.12.5.1 Green Belt

As per the ToR of TDMCCL (dt. 3-5-2018), 33% of the total plot area of the industry is to be maintained as Green belt with ‘trees’ planted @ 1500/Ha. According to the norms (CPCB, 2000) the green belt of diverse tree species is required to be all along the periphery of the total industrial land for environmental protection purpose.

It is observed that the total land acquired by the industry is 8.84 Ha, thus the 33% of land for green belt comes to about 2.91 Ha with, around 4425 trees to be planted as per the norms. According to the proponent area of 2.95 Ha is already developed under green belt, which comes to 33.39 % of the total industrial plot area, with a plantation of about 5000 plants. However, during site visit it was observed that part of the said existing plantation is of ornamental plants i.e. shrubs, bushes, lawns, palms and some trees for beautification purpose, rather than large growing tree species in adequate number for environment protection as required (CPCB, 2000). Presently parts of the plot periphery are not fully covered by desired green belt trees, particularly at north-west and south side. Whereas, there is enough scope to plant new trees in vacant spaces within and all along the periphery of the total plot.

- **Green Belt plan**

It is noted that green open space on the south and west border of the plot is in fact unmanaged area covered by wild bushes, shrubs, weed and creepers. The vast area shown for proposed car parking has few old tall trees which need to be conserved as a part of green belt. Number of dead, fallen, and uprooted trees and degraded vegetation is observed on the site. The post monsoon Google earth satellite image (28 October 2017) shows natural growth of weeds all along the Landhar stream at south boundary which creates illusion of green belt. However the summer season image (4 January 2017) reflects realistic picture. Considering the existing

ornamental and sundry vegetation in the green belt, it is suggested to update the required number of woody trees by planting large saplings of suitable local trees species, all along the periphery of the industrial plot.

Also as per the ToR (Ref. 5(f):A 7 ix) it is necessary for the proponent to provide details of species, width of plantation, planning schedule etc. of the green belt plantation, old and proposed. It must be ensured that this green belt shall be all around the total plot boundary and a scheme for greening of the roads used for the project shall also be incorporated. This information is yet to be furnished by the proponent.

It is recommended that for better survival results the new saplings of the tree species should be over three year old and around 5 feet in height. Provision of drip irrigation by using good quality recycled water from the industry needs to be made. The adequate number of trees should be ready and performing their ecological function by the time the proposed industrial expansion is functional. Preferably no fruit trees to be planted in industrial Green belt as per the norms to avoid possible harmful chemical contamination of fruits by bioaccumulation and biomagnifications of toxins. Instead plantation of sturdy indigenous and evergreen mixed species of trees to be used for environment protection as well as natural beautification.

3.12.5.2 Corporate Environment Responsibility (CER) Activity

The three villages in the study area namely 1. Borghar, 2. Vashi and 3. Devkhane are recommended for adoption by the industry for protection of their ecology and biodiversity, which is almost in near natural state. Conservation activities such as tree plantation, removal of weeds and exotics, solid waste and sewage management, environment awareness campaign involving locals particularly youth and women should be undertaken. Besides controlling negative impacts of industrial pollution on the village population this would help improve health of the residents, most of who may be employed in the same industry and MIDC. This initiative will motivate the locals to protect their own ecology and biodiversity in and around the villages.

Under CER activity, review of the initiatives implemented by the same and other larger neighboring industries in the MIDC and their results be considered before finalizing new CER activities by TDMCCL. These proposed activities needs to be different than routinely carried out and merely ritual practice by most industries. Thus CER activities by TDMCCL in environmental protection should be innovative and unique and should to be a role model for other industries.

3.12.6 General observations and Recommendations

1. Natural forests and grassland habitats in the region are being fragmented and degraded due to deforestation, industrialization and agriculture expansion.
2. The number of water bodies i.e. river, streams, tanks, ponds, marshes in the study area provide suitable habitat to good biodiversity. Diverse fauna, including migratory birds gets affected due to polluted water bodies as a result of contamination of both solid and liquid industrial waste as per the perception of locals and our observations. There is decline in fish diversity and density in river Kundalika due to industrial effluents.
3. The green belt being critical for industrial pollution control and also mandatory, should be properly developed and maintained on priority, particularly for health of the workers and people around the industrial unit.

4. A phase wise 3 year tree plantation program for around 5000 trees should be carried out under CER activity. Within 5 Km radius area in selected and active villages. This should be implemented as (a) thick block plantation of large native tree species for environmental protection through Carbon sequestration as well as environmental protection and nature conservation on common lands in villages and (b) Avenue plantation on village roads, around schools, temples, village ponds, open spaces, grounds, etc. where protection through people's participation is ensured.
5. The industry, by involving workers and locals, should demonstrate, encourage, and promote suitable eco-friendly alternatives green technologies under CER activity in the identified cooperative villages in the area stressing and demonstrating, rain water harvesting, solar lighting, organic farming, and such innovative simple to use 'green technologies'.
6. It must be ensured that no untreated effluent and seepage from the open sulfur storage is discharged by TDMCCL industry into Kundalika river directly or through adjoining Ladhar nala.

Chapter 4

ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

4.1 INTRODUCTION

Evaluation of impacts on the environmental parameters, due to the proposed expansion project, is an important aspect to be studied. This chapter incorporates both, qualitative and quantitative descriptions of various environmental impacts due to project of TDMCCL in Roha MIDC of Raigad. Various scientific techniques are available to predict and evaluate impact of developmental activities under expansion project on physical, ecological and socio – economic environments. Predictions are superimposed over base line status (pre-project).

'Environmental Impact' can be defined as any alteration of the environmental conditions or creation of a new set of environmental conditions, adverse or beneficial, caused or induced by the action or set of actions under consideration. Generally, environmental impacts can be categorized as either primary or secondary. Primary impacts are those which are attributed directly to the project. On the other hand, secondary impacts are the ones which are indirectly induced and typically include the associated investments and changed patterns of social and economic activities by the proposed action.

Proposed expansion project may influence the environment of the study area in two phases as under:

- **Construction Phase:** During the construction period, the impact may be temporary.
- **Operation Phase:** Post construction phase may have long term effects on the environment.

4.2 CONSTRUCTION PHASE

The activities under proposed expansion shall be carried out in the existing setup of TDMCCL. No construction of building would be required for expansion. Only work related to installation of equipments and machineries as required under activities would be done on site. Hence, no any significant impact on topography is envisaged due to proposed expansion activities.

4.3 OPERATION PHASE

Operational phase activities may have impacts - minor or major, positive or negative on environmental attributes such as land and soils, surface and ground water hydrology, micro meteorology, land use, water use, water and air quality, ecology, socio economics and noise environment.

4.3.1 Impacts due to Process & Products

There are number of aspects and reasons in commodity chemicals and speciality chemicals manufacturing plant, which result into exerting impacts on various environmental disciplines. Problems related with pollution and related impacts could arise due to – (1) manufacturing process itself (2) products (3) by products & co-products (4) intermediate products (4) catalysts used (5) process conditions & configurations (6) raw materials, and (7) the waste streams.

Table 4.1 Identification of impacts on environment due to operation activities for proposed expansion project of TDMCCL

Sr. No.	Environ-mental Aspect	Activities / Operation	Impact Identification	Type of Impact (Minor / Major)	Remark
1.	**Air**	Raw material Transportation, loading and unloading and raw material storage area	Due to Release of VOCs chemicals during loading & unloading of raw material, it may cause impact on air environment.	**Major (Quantifiable)**	The impacts due to boiler operations may have **significant** impacts on the air environment. At a glance details of identification and quantification of the impact during operation phase at TDMCCL site may be referred at **Chapter 4**
		Production Activity	1)Release of process emission in the form of Ammonia, HCl 2) VOCs of solvent		
		Boiler Operation (Fuel Burning Operations –Existing boiler of capacity : 5 TPH, TFH – 4 Lakhs Kcal/Hr, and125, 830, 1310 KVA D.G. Set	The boiler operations may increase the baseline concentrations of SO_2. This may have impact on air quality.		
2.	**Water**	Reactor Section	Process water spills may impact on water environment.	**Major (Quantifiable)**	The impacts due to operation activities are significant. The quantification of accidental discharge into nearby water body is given below at **Section 4.3.4** of this Chapter. At a glance details of identification and quantification of the impact during operation phase at TDMCCL site may be referred at **Chapter 4**
		Effluent Treatment Plant	Accidental discharge of untreated effluent in nearby water body, this may cause impact on water quality.		
3.	**Noise**	Production Area	Use of Pumps, compressors and reactor blades are identified sources of Noise pollution and same shall cause increase in noise level concentrations.	**Minor (Quantifiable)**	The impacts due to operation activities are negligible i.e. insignificant. But, the impact of noise on workers would be significant if the exposure is increased beyond 8 hours without any PPE.
4.	**Solid & Hazardous Waste**	Boiler Operations	Ash generation - improper handling, storage and disposal of ash may cause bad aesthetics.	**Minor (Non-quantifiable)**	The impacts due to operation activities are negligible i.e. insignificant. The solid and hazardous waste generated would be properly handled and disposed off as done under existing unit At a glance details of identification and quantification of the impact during operation phase at TDMCCL site may be
		Reactor	Distillation residue, Process residue, Spent Carbon which would be generated at reactor section which may be source of solid and hazardous waste. The improper handling,	**Minor (Non-quantifiable)**	

Sr. No.	Environ-mental Aspect	Activities / Operation	Impact Identification	Type of Impact (Minor / Major)	Remark
			storage may cause bad aesthetics. Also Solid waste generated from maintenance activities of reactor in the form of Rubber & plastic hose , gasket & packing, thermocol, glass wool etc.		referred at **Chapter 4**
		Effluent Treatment Plant(ETP)	Sludge from ETP which is one of the sources of solid and hazardous waste generation. The improper handling, storage may cause bad aesthetics.		
5.	**Risk & Hazard**	Production Area and Raw material storage area.	Spillage ofHCl, Sulphuric acid, Oleum, Caustic lye. Poor handling and improper storage of raw materials may have adverse impact on man and environment.	**Major**	Worst case scenarios predicting the impacts due to hazardous raw materials or chemicals are presented in **Chapter 7**.
6.	**Hydrology, ground water and water conservation, Geology (HG-GEO)**	Process effluents, Effluent treatment plant.	Accidental discharge of untreated effluent, surface overflow, and usage of groundwater if any may cause impact on ground water.	**Major**	No ground water will be used under proposed expansion project of TDMCCL. Though the type of impact is major impact but there will be no any discharge of effluent in the ground water body. Hence, the impact is non-quantifiable.
7.	**Ecology and Biodiversity**	TDMCCL project and presence of other industries and MIDC near project.	There may be impact on ecology and biodiversity in the study area due to uncontrolled air emissions boiler operations (air quality) and other release of fugitive emissions. Discharge of untreated wastewater (sewage/ effluents) in the River and surrounding swamps cause significant impact on the aquatic habitat and its biodiversity	**Minor (Non-quantifiable)**	5 km around the project site is already occupied by large chemical and other industries, all the macro and micro habitats in the region are already affected by air, water and soil pollution. Therefore the additional impact of Lona industry is not likely to substantially contribute in the existing cumulative pollution load on the ecology and Biodiversity of the region. Refer **Chapter 3**, **Section 3.12**for observations of Ecology and Biodiversity.

Potential problems in above areas and possible approaches to minimize and/ or avoid adverse impacts through process and product modifications could be enumerated as follows

Table 4.2 Process& Products Modifications for Pollution Control and Impact Minimization

Sr. No.	Areas	Potential Problems Causing Impacts	Mitigation Measures to Minimize / Avoid the Impact
A	**By-product & Co-product**		
1	Quantity & Quality	a. Process inefficiencies result in the generation of undesired by-products and co-products. Inefficiencies will require larger volumes of raw materials and result in additional secondary products. b. Inefficiencies can also increase fugitive emissions and wastes generated through material handling.	a. Increase product yield to reduce by-product and co-product generation and raw material requirements.
2	Uses & Outlets	a. By-products and co-products are not fully utilized, generating material or waste that must be managed.	a. Identify uses and develop a sales outlet. Collect information necessary to firm up a purchase commitment such as minimum quality criteria, maximum impurity levels that can be tolerated, and performance criteria.
B	**Catalysts**		
1	Composition	a. The presence of heavy metals in catalysts can result in contaminated process wastewater from catalyst and ling and separation. These wastes may require special treatment and disposal procedures or facilities. Heavy metals can be inhibitory or toxic to biological wastewater treatment units. b. Sludge from wastewater treatment units may be classified as hazardous due to heavy metals content. Heavy metals generally exhibit low toxicity thresholds in aquatic environments and may bio accumulate.	a. Catalysts comprised of noble metals, because of their cost, are generally recycled by both onsite and offsite re-claimers.
2	Preparation and Handling	a. Emissions or effluents are generated with catalyst activation or regeneration. b. Catalyst attrition and carry over into product requires de-ashing facilities, which are a likely source of wastewater and solid waste. c. Catalyst is spent and needs to be replaced.	a. Obtain catalyst in the active form. b. Provide in-situ activation with appropriate processing/activation facilities. c. Develop a more robust catalyst or support. d. In situ regeneration eliminates unloading/ loading emissions

Sr. No.	Areas	Potential Problems Causing Impacts	Mitigation Measures to Minimize / Avoid the Impact
		d. Pyrophoric catalyst needs to be kept wet, resulting in liquid contaminated with metals. e. Short catalyst life	and effluents versus offsite regeneration or disposal. e. Use a non pyrophoric catalyst. Minimise amount of water required to handle and store safely. f. Study and identify catalyst de-activation mechanisms. Avoid conditions which promote thermal or chemical deactivation. By extending catalyst life, emissions and effluents associated with catalyst handling and regeneration can be reduced.
3	Effectiveness	a. Catalyzed reaction has by-product formation, incomplete conversion and less-than perfect yield.	a. Reduce catalyst consumption with a more active form. A higher concentration of active ingredient or increased surface area can reduce catalyst loadings. b. Use a more selective catalyst which will reduce the yield of undesired by-products. c. Improve reactor mixing/ contacting to increase catalyst effectiveness. d. Develop a thorough understanding of reaction to allow optimization of reactor design. Include in the optimization, catalyst consumption and by-product yield.
C	**Intermediate Products**		
1	Quantity and Quality	a. Intermediate reaction products or chemical species, including trace levels of toxic constituents, may contribute to process waste under both normal and upset conditions. b. Intermediates may contain toxic Constituents or have characteristics that are harmful to the environment.	a. Modify reaction sequence to reduce amount or change composition of intermediates. b. Modify reaction sequence to change intermediate properties. c. Use equipment design and process control to reduce releases.
D	**Process Conditions / Configuration**		
1	Temperature	a. High heat exchange tube temperatures cause thermal cracking/decomposition of many chemicals. These lower	a. Select operating temperatures at or near ambient temperature whenever possible.

Sr. No.	Areas	Potential Problems Causing Impacts	Mitigation Measures to Minimize / Avoid the Impact
		molecular weight by-products are a source of "light ends" and fugitive emissions. High localized temperature gives rise to polymerization of reactive monomers, resulting in "heavies" or "tars." Such materials can foul heat exchange equipment or plug fixed-bed reactors, thereby requiring costly equipment cleaning and production outage. b. Higher operating temperatures imply "heat input" usually via combustion which generates emissions. c. Heat sources such as furnaces and boilers are a source of combustion emissions. d. Vapour pressure increases with increasing temperature. Loading/ unloading, tank age and fugitive emissions generally increase with increasing vapour pressure. e. Water solubility of most chemicals increases with increasing temperature	b. Use lower pressure steam to lower temperatures. c. Use intermediate exchanger's to avoid contact with furnace tubes and walls. d. Use staged heating to minimise product degradation and unwanted side reactions. e. Use superheat of high-pressure steam in place of furnace. f. Monitor exchanger fouling to correlate process conditions which increase fouling, avoid conditions which rapidly foul exchangers. g. Use online tube cleaning technologies to keep tube surfaces clean to increase heat transfer. h. Use scraped wall exchangers in viscous service. i. Use falling film re-boiler, pumped re-circulation re-boiler or high-flux tubes. j. Explore heat integration opportunities (e.g., use waste heat to preheat materials and reduce the amount of combustion required.) k. Use thermo-compressor to upgrade low-pressure steam to avoid the need for additional boilers and furnaces. l. If possible, cool materials before sending to storage. m. Use hot process streams to reheat feeds. n. Add vent condensers to recover vapours in storage tanks or process. o. Add closed dome loading with vapour recovery condensers. p. Use lower temperature (vacuum processing).

Sr. No.	Areas	Potential Problems Causing Impacts	Mitigation Measures to Minimize / Avoid the Impact
2	Pressure	a. Fugitive emissions from equipment. b. Seal leakage potential due to pressure differential. c. Gas solubility increases with higher pressures.	a. Equipment operating in vacuum service is not a source of fugitives; however, leaks into the process require control when system is degassed. b. Minimise operating pressure. c. Determine whether gases can be recovered, compressed, and reused or require controls.
3	Corrosive Environment	a. Material contamination occurs from corrosion products. Equipment failures result in spills, leaks and increased maintenance costs. b. Increased waste generation due to addition of corrosion inhibitors or neutralization.	a. Improve metallurgy or provide coating or lining. b. Neutralize corrosivity of materials contacting equipment. c. Use corrosion inhibitors. d. Improve metallurgy or provide coating or lining or operate in a less corrosive environment.
4.	Batch vs Continuous Operations	a. Vent gas lost during batch fill. b. Waste generated by cleaning/ purging of process equipment between production batches. c. Process inefficiencies lower yield and increase emissions. d. Continuous process fugitive emissions and waste increase over time due to equipment failure through a lack of maintenance between urnarounds.	a. Equalize reactor and storage tank vent lines. b. Recover vapours through condenser, adsorber, *etc.* c. Use materials with low viscosity. Minimise equipment roughness. d. Optimize product manufacturing sequence to minimise washing operations and cross contamination of subsequent batches. e. Sequence addition of reactants and reagents to optimize yields and lower emissions. f. Design facility to readily allow maintenance so as to avoid unexpected equipment failure and resultant release.
5	Process Operation / Design	a. Numerous processing steps create wastes and opportunities for errors. b. Non-reactant materials (solvents, absorbents, *etc.*) create wastes. Each chemical (including water) employed within the process introduces additional potential waste sources; the composition of generated wastes also tends to become more complex. c. High conversion with low yield results in wastes.	a. Keep it simple. Make sure all operations are necessary. More operations and complexity only tend to increase potential emission and waste sources. b. Evaluate unit operation or technologies (e.g., separation) that do not require the addition of solvents or other non-reactant chemicals. c. Recycle operations generally

Sr. No.	Areas	Potential Problems Causing Impacts	Mitigation Measures to Minimize / Avoid the Impact
		d. Non-regenerative treatment systems result in increased waste versus regenerative systems.	improve overall use of raw materials and chemicals, there by both increasing the yield of desired products while at the same time reducing the generation of wastes. A case-in-point is to operate at a lower conversion per reaction cycle by reducing catalyst consumption, temperature, or residence time. Many times, this can result in a higher selectivity to desired products. The net effect upon recycle of un-reacted reagents is an increase in product yield, while at the same time reducing the quantities of spent catalyst and less desirable by-products. d. Regenerative fixed bed treating or desiccant operation (e.g. aluminium oxide, silica, activated carbon, molecular sieves, etc.) will generate less quantities of solid or liquid waste than non regenerative units (e.g., calcium chloride or activated clay). With regenerative units though, emissions during bed activation and regeneration can be significant. Further, side reactions during activation/ regeneration can give rise to problematic pollutants.
E	**Product**		
1	Process Chemistry	a. Insufficient R&D into alternative reaction pathways may miss pollution opportunities such as waste reduction or eliminating a hazardous constituent.	a. R & D during process conception and laboratory studies should thoroughly investigate alternatives in process chemistry that affect pollution prevention.
2	Product Formulation	a. Product based on end-use performance may have undesirable environmental impacts or use raw materials or components that generate	a. Reformulate products by substituting different material or using a mixture of individual chemicals that meet

Sr. No.	Areas	Potential Problems Causing Impacts	Mitigation Measures to Minimize / Avoid the Impact
		excessive or hazardous wastes.	end-use performance specifications.
F	**Raw Materials**		
1	Purity	a. Impurities may produce unwanted by-products and waste. Toxic impurities, even in trace amounts, can make a waste hazardous and therefore subject to strict and costly regulation. b. Excessive impurities may require more processing and equipment to meet product specifications, increasing costs and potential for fugitive emissions, leaks, and spills. c. Specifying purity greater than needed by the process increases costs and can result in more waste generation by the supplier. d. Impurities in clean air can increase inert purges. e. Impurities may poison catalyst prematurely resulting in increased wastes due to yield loss and more frequent catalyst replacement.	a. Use higher purity materials. b. Purify materials before use and reuse if practical. c. Use inhibitors to prevent side reactions. d. Achieve balance between feed purity, processing steps, product quality and waste generation. e. Specify purity no greater than what the process needs. f. Use pure oxygen. g. Install guard beds to protect catalysts.
2	Vapour Pressure	a. Higher vapour pressures increase fugitive emissions in material handling and storage. b. High vapour pressures with low odour threshold material scan cause nuisance odours.	a. Use material with lower vapour pressure. b. Use materials with lower vapour pressure and higher odour threshold.
3	Water Solubility	a. Toxic or non-biodegradable materials that are water soluble may affect wastewater treatment operation, efficiency, and cost. b. Higher solubility may increase potential for surface and ground water contamination and may require more careful spill prevention, containment, and cleanup (SPCC) plans. c. Higher solubility may increase potential for storm water contamination in open areas. d. Process waste water associated with water washing or hydrocarbon /water phase separation will be impacted by containment solubility in water. Appropriate wastewater treatment will be impacted.	a. Use less toxic or more biodegradable materials. b. Use less soluble materials. c. Use less soluble materials. d. Prevent direct contact with storm water by diking or covering areas. e. Minimise water usage. f. Reuse wash water. g. Determine optimum process conditions for phase separation. h. Evaluate alternative separation technologies (coalescers, membranes, distillation, *etc.*)

Sr. No.	Areas	Potential Problems Causing Impacts	Mitigation Measures to Minimize / Avoid the Impact
4	Toxicity	a. Community and worker safety and health concerns result from routine and non-routine emissions. Emissions sources include vents, equipment leaks, wastewater emissions, emergency pressure relief, *etc.* b. Surges or higher than normal continuous levels of toxic materials can shock or miss wastewater biological treatment systems resulting in possible fines and possible toxicity in the receiving water.	a. Use less toxic materials. b. Reduce exposure through equipment design and process control. Use systems which are passive for emergency containment of toxic releases. c. Use less toxic material. d. Reduce spills, leaks, and upset conditions through equipment and process control. e. Consider effect of chemicals on biological treatment; provide unit pre-treatment or diversion capacity to remove toxicity. f. Install surge capacity for flow and concentration equalization.
5	Regularity	a. Hazardous or toxic materials are stringently regulated. They may require enhanced control and monitoring; increased compliance issues and paperwork for permits and record keeping; stricter control for handling, shipping, and disposal; higher sampling and analytical costs; and increased health and safety costs.	a. Use materials which are less toxic or hazardous. b. Use better equipment and process design to minimise or control releases; in some cases, meeting certain regulatory criteria will exempt a system from permitting or other regulatory requirements.
6	Form of Supply	a. Small containers increase shipping frequency which increases chances of material releases and waste residues from shipping containers (including wash waters). b. Nonreturnable containers may increase waste.	a. Use bulk supply, ship by pipeline, or use "jumbo" drums or sacks. b. In some cases, product may be shipped out in the same containers the material supply was shipped in without washing. c. Use returnable shipping containers or drums.
7	Handling and Supply	a. Physical state (solid, liquid, gaseous) may raise unique environmental, safety, and health issues with unloading operations and transfer to process equipment. b. Large inventories can lead to spills, inherent safety issues and material expiration.	a. Use equipment and controls appropriate to the type of materials to control releases. b. Minimise inventory by utilizing just-in-time delivery.

Sr. No.	Areas	Potential Problems Causing Impacts	Mitigation Measures to Minimize / Avoid the Impact
G	**Waste Streams**		
1	Quantity and Quality	a. Characteristics and sources of waste streams are unknown. b. Wastes are generated as part of the process.	a. Document sources and quantities of waste streams prior to pollution prevention assessment. b. Determine what changes in process conditions would lower waste generation of toxicity. c. Determine if wastes can be recycled back into the process.
2	Composition	a. Hazardous or toxic constituents are found in waste streams. Examples are: sulfides, heavy metals, halogenated hydrocarbons, and polynuclear aromatics.	a. Evaluate whether different process conditions, routes, or reagent chemicals (*e.g.*, solvent catalysts) can be substituted or changed to reduce or eliminate hazardous or toxic compounds.
3	Properties	a. Environmental fate and waste properties are not known or understood	a. Evaluate waste characteristics using the following type properties: corrosivity, ignitability, reactivity, BTU content (energy recovery), biodegradability, aquatic toxicity, and bio-accumulation potential of the waste and of its degradable products, and whether it is a solid, liquid, or gas.
4	Disposal	a. Ability to treat and manage hazardous and toxic waste unknown or limited	a. Consider and evaluate all onsite and offsite recycle, reuse, treatment, and disposal options available. Determine availability of facilities to treat or manage wastes generated.

4.3.2 Impact on Air Quality

A) Emissions from Fuel Burning

- Major sources of air pollution are Boiler, Thermic Fluid Heater (TFH) and DG sets (3 Nos.)in the industry as well as vehicles used for transportation.
- Under existing plant, one boiler of capacity5 TPH, one TFH of 4 Lakhs Kcal/Hr. are provided with stack height of 35 M and 30 M respectively. Under expansion, no new boiler would be installed.
- Three DG sets of capacity of 125 KVA, 830 KVA, 1310 KVA respectively are provided on site.

Table 2.25 of Chapter 2 may be referred for details on boiler, TFH and D.G. Sets. The stack emissions from these shall be particulate matter, SO_2, CO, NO_X. In addition, the vehicular exhaust may also contribute to air pollution through release of SO_2, CO, NO_X.

4.3.2.1 GLC Evaluation through Air Dispersion Modeling

In order to study the movement of particulate matter release into atmosphere from the source, Air Dispersion Model – AERMOD developed by the US Environmental Protection Agency (USEPA) is used. The software helps in knowing details of particulate and gases dispersed in the downwind direction and finally reaching the ground at farther distance from the source. The ground level concentrations mainly depend upon the strength of the emission source and micrometeorology of the study area. No new boiler will be installed under proposed expansion by TDMCCL. Hence, AERMOD software is not used for understanding increase in baseline concentrations of ambient air. Site-specific and meteorological collected for one season for period from Oct. 2017 – Nov. 2017 – Dec. 2017. Refer Figure 4.1 for windrose Predominant wind directions and wind speeds are tabulated in following table-

The site specific meteorological data and AAQM data werecollected for one season for period from October 2017 –December 2017.The predominant wind direction and wind speeds are tabulated in following table.

Table 4.3 Predominant Wind Directions

Sr. No.	Season	Time (Hrs.)	Predominant wind Direction	Nearest Habitation Downwind
1	Winter	08:30	E	Varsoli
		17:30	NW	Roth Bk.
2	Post-monsoon	08:30	E	Gove
		17:30	NW	Roth Kh.
3	Monsoon	08:30	SW	Talaghar
		17:30	SW	Kile
4	Pre-monsoon	08:30	NE	Bahe
		17:30	NW	Roth Kh.

From the AAQM data, the 24 hourly 98percentile concentrations of PM_{10}, $PM_{2.5}$, SO_2, NO_x, CO,NH_3, Pb, O_3, BaP, As, Ni, C_6H_6 and VOC in ambient air, recorded during the field study conducted for season October, November and December 2017, are considered as baseline values. For identifying impacts due to operations of existing nearby industries on the region, the average concentrations of above mentioned parameters in the study area are considered to be the 'Baseline Concentrations' and further determination of impact, due to proposed activities in the TDMCCL industry on the ambient air quality will be done.

Table 4.4 Baseline Concentrations at Site

Parameter	98 Percentile Concentration	NAAQS	Remark
PM_{10}	58.2µg/m^3	100 µg/m^3	Baseline concentrations for PM_{10}- 58.2µg/m^3, $PM_{2.5}$ - 17.5µg/m^3, SO_2 - 24µg/m^3, NOx – 39.2µg/m^3. The baseline concentrations for all parameters monitored are well within the limits. Refer Chapter 3, Section 3.9 for more details.
$PM_{2.5}$	17.5µg/m^3	60 µg/m^3	
SO_2	24.0µg/m^3	80 µg/m^3	
NO_X	39.2µg/m^3	80 µg/m^3	
NH_3	19.9 µg/m^3	400 µg/m^3	
CO	0.1mg/m^3	2 mg/m^3	
Pb	0.3µg/m^3	1µg/m^3	
O_3	12.2 µg/m^3	180 µg/m^3	
Benzene	0.4 µg/m^3	5 µg/m^3	
BaP	BDL	1 ng/ m^3	
As	BDL	6 ng/ m^3	
Ni	BDL	20 ng/ m^3	
VOC	96.4 µg/m^3	--	

B) Fugitive Emissions

The sources of fugitive emissions identified under existing and expansion activities are - (a) Process Operations (b) Related Miscellaneous Operations (c) Material Storage (d) Equipment Leaks (e) Fuel Storage Area. Further, there could be fugitive emissions of materials like fine dust, powder or gases due to escape of unused raw materials, VOCs etc. from various reactors, storage tanks, pneumatic conveyors etc.

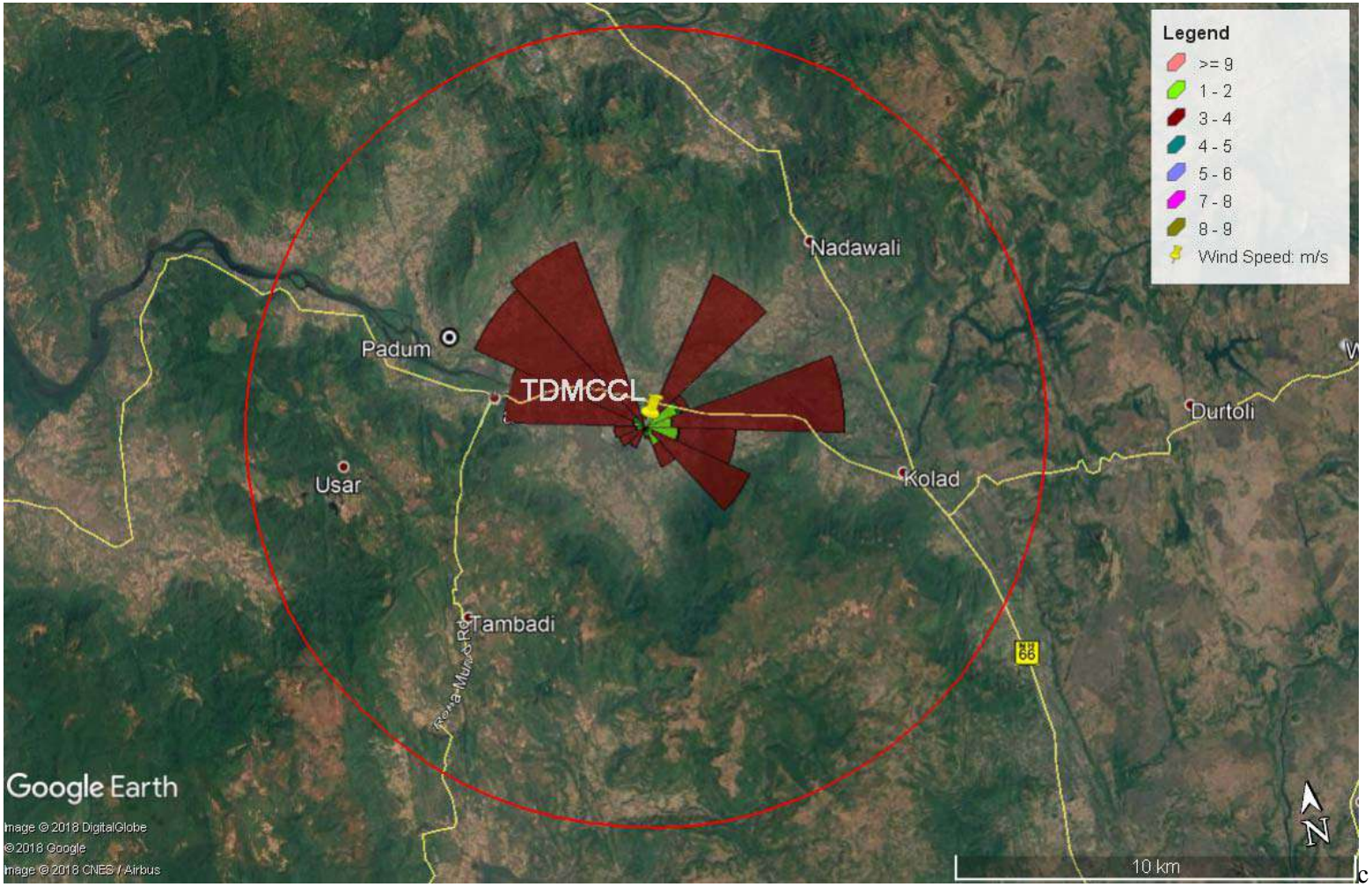
C) Process Emissions

Sources of process emissions under activities of TDMCCL shall be mainly due to mixing and blending equipment, reactors, filters, separators, product purifiers and packing operations. The emissions may be in the form of excess and un-reacted gases, VOCs, fume of reactions etc. which could result during various actions like active product formation process, purging of vessels before loading and unloading, surface evaporations and filling. More details about this aspect are given in Chapter 2. The solvents that shall be stored in bulk quantities on TDMCCL site include Sulphuric Acid, Hydrochloric Acid and Oleum. As such, major impacts of VOCs due to these materials have been taken into consideration. The VOCs are found to be responsible in formation of ozone. In presence of nitrogen oxides (NOx) and sunlight, VOCs react with oxygen in the air to produce ozone, the most toxic component of the form of pollution commonly known as smog. Ozone attacks lung tissue, and is very injurious, even in very low concentrations. Following table describes effects of VOCs if exposed to air.

Table 4.5 Human Health Impact of Process Emissions

No.	Raw Material	Impacts on Human Health
1	HCl	Skin may burns. Inhalation of the spray mist may produce severe irritation of respiratory tract, characterized by coughing, choking, or shortness of breath.
2	Oleum	Dangerous to human health, rapidly destructive to all body tissues, causing severe burns which may result in scarring.
3	Ammonia	Severely irritating to nose, throat, and lungs. Symptoms may include burning sensations, coughing, wheezing, shortness of breath, headache and nausea. Overexposure may affect central nervous system.

Figure 4.1Windrose for October –November –December 2017



c

D) Odour Pollution

There will be different odour prone areas in the TDMCCL industry. They include raw material & product storage places, process operations, loading /unloading sections etc. which could give rise to odour nuisance. This nuisance could have very irritating effect on human beings and animals that get exposed to the smell resulting into coughing, sneezing, inflammation of upper respiratory track, irritation of eyes, and sensation of nausea. The unsanitary conditions responsible for odour trouble could give rise to other nuisance like fly and insect infestation.

4.3.2.2 Mitigation Measures

A) Emissions from Fuel Burning

- Provision of scrubbers is done to control process emissions which are in the form of acidic/alkaline/solvent vapours.
- Regular self-monitoring of the AAQ and work zone air quality is being done by the industry through approved labs to check and control dust levels/concentrations at certain places so that same could be kept always below the stipulated norms.
- Efficiencies of dust control equipment in the industry shall be monitored regularly (at least once a month) under performance evaluation.

B) Fugitive Emissions

- Installation of appropriate, adequate and efficient exhaust and ventilation system to remove and control dust from work zone areas. Provision of appropriate APC equipment to collect and remove dust from work zone including their monitoring routinely.
- Personal protective equipment such as masks, aprons, gloves, goggles etc. shall be provided to the workers same as that of existing.
- Green belt development of adequate density and with appropriate types of plants shall be made to control and attenuate dust transfer in the premises. Also, well planned shelter belt and mass plantation shall be provided along ash storage yards to curb littering of the materials due to wind. All internal roads, yards and open storage areas will be provided with well compacted and constructed surface layering.

C) Process Emissions

- Sources of process emissions under proposed activities of TDMCCL shall be mainly mixing equipments, reactors, filters, separators, product purifiers and packing operations. The emissions may be in the form of excess and un-reacted gases, VOCs, fume of reactions etc. which could result during various actions like active product formation process, purging of vessels before loading and unloading, surface evaporations and filling.
- The solvents that shall be stored in bulk quantities on TDMCCL site include Hydrochloric Acid. As such, major impacts of VOCs due to these materials have been taken into consideration. The VOCs are found to be responsible in formation of ozone.

C) Odour Pollution

To abate the odour nuisance, TDMCCL has a concrete planning which includes following steps and actions-

- All reactions and storages are being done in nitrogen blanketing. Blanketing helps reducing the oxygen content in the vapor space of storage tank or process vessel, making it inert. This eliminates the possibility of fire or explosion, decreases evaporation and protects tank from structural corrosion damage.
- All the feed, loading & unloading pumps for products and raw material are being fitted with mechanical seals instead of glands to reduce leakages through pumps.
- Adoption ofGood Management Practices (GMPs).Arranging awareness and training camps for workers.
- Provision and use of PPEs like masks to everybody work in odour potential prone areas.
- Installation of appropriate, adequate and efficient exhaust and ventilation system to remove and control odour from work zone areas.
- Provision of Fume Extraction System with circulation pump, blower & scrubber to storage areas.
- Provision of scrubbers to reactors to control process emissions.

4.3.3 Impact on Climate

Impact on the climatic conditions, due to the proposed expansion activities under TDMCCL expansion is not envisaged especially as emissions of flue gases with very high temperatures, to the atmosphere, are not expected.

4.3.4 Impact on Water Resources and Its Quality

A) Surface water and Its Quality

Under TDMCCL expansion project, the total water requirement after expansion would be 1592 M^3/Day (100% quantity). Out of which, 220 M^3/Day (14%) would be recycle water in process, 1372 M^3/Day (86%) would be fresh water taken from MIDC Water supply scheme.

As far as trade industrial effluent is concerned, effluent generated from the existing and proposed expansion is to the tune of 230.5 CMD. Treatment scheme of effluent is presented at Chapter -2, same could be referred for more information.

In Table 4.6, quantification of overall pollution load is presented. Moreover, an impact due to accidental discharge of untreated trade effluents in Kundalika river (surface water) has been duly identified, quantified and presented in Table No.4.7, 4.8.

Table 4.6 Quantification of Pollutants from Waste water

Parameter	Conc. of Pollutants generated (mass/volume)	Quantity of Pollutants generated (mass/day)	Conc. of Pollutants after Treatment (mass/volume)	Quantity of Pollutants after Treatment (mass/day)	MPCB Standards	
					mass / volume	mass / day
	Raw Effluent		Treated Effluent			
Raw Effluent- 230.5 CMD			Treated Effluent-220 CMD			
pH	3-4	--	7-7.5	--	--	--
BOD	2500 mg/lit	576.25 Kg/day	80 mg/lit	17.6 Kg/day	<80 mg/lit	17.6 Kg/day
COD	5000 mg/lit	1152.5 Kg/day	250 mg/lit	55 Kg/day	<150 mg/lit	33 Kg/day
TDS	4000 mg/lit	922 Kg/day	1900 mg/lit	418 Kg/day	<2100 mg/lit	462 Kg/day
SS	350 mg/lit	80.67Kg/day	80mg/lit	17.6Kg/day	<100 mg/lit	22 Kg/day

If the above-mentioned effluents are let out in the environment without any treatment, it may have impact on surface water quality as well as on soil quality. If untreated effluent enters any surface water body; there could be number of adverse effects. First of all, suspended particles in it increase turbidity which can reduce amount of light penetration of water thereby disrupting growth of photosynthetic plants and activities of micro-organisms especially phytoplanktons and zooplanktons. This could have subsequent adverse effects on rest of the aquatic community that depend on these components of the food chain. The suspended particulates when get settled at bottom of the water body, will add undesirable sediments. Further, due to organic matter in the effluent, dissolved oxygen level in receiving water body gets depleted immediately as a result of intense oxidation of the organics by aerobic microbes. Moreover, nitrogen and phosphorus in wastewaters act as nutrients that help aggravating problems of 'Eutrophication' in the water bodies. Uncontrolled growth of aquatic weeds, and eruption of algal blooms seriously affect the quality of water and aesthetics. The channels of streams and waterways may get blocked and algal dominance could reduce dissolved oxygen levels during night times as a result of respiration; an action exactly opposite to photosynthesis that releases oxygen by taking CO_2 during day time. Excessive presence of CO_2 in the waters may lead to fall in pH as a result of formation of weak acids and this again could have prominent impact on pH sensitive reactions in the water body and benthic deposits. Serious fish kill can happen due to depletion of DO levels in addition to effluent induced toxicity in the receiving waters. Some of the toxins in industrial wastewaters may have mild effects on the human health whereas the other ones can be fatal. If such waters are consumed by human beings or animals, diseases and disorders like cancer, protein urea and kidney damage (excess protein in urine), pulmonary fibrosis, anemia, reproductive failure or acute poisoning can take place.

4.3.4.1 Calculations for Quantification of Impact on Kundalika River (Surface Water)

Accidental discharge of untreated trade effluent from **TDMCCL** find its way to nearest nalla on south direction as per the drainage pattern of premises. Subsequently, from point of confluence near industry the effluent via nalla discharge shall meet River Kundalika at a distance of 1.25Km towards North direction.

a) When untreated effluent mixed into Nallah towards SouthDirection of Project Site

Table 4.7 Quantification of Impact due to discharge of untreated effluent into Nallah

Accidental Case Scenario (Discharge of Untreated Effluent in Nallah)									
Sr. No.	**Parameter**	**C_i**	**Q_i**	**C_S**	**Q_S**	**$C_i*Q_i+C_s*Q_s$**	**$C_f=(C_i*Q_i+C_S*Q_s)/(Q_i+Q_S)$**	**Inland surface Water (CPCB Standards) (mg/L)**	
								A	**B**
1	BOD	2500	10.07	72	0.001	25175.1	2499.76	**2**	**3**
2	COD	5000	10.07	125	0.001	50350.1	4999.52	**--**	**--**
3	TDS	4000	10.07	1800	0.001	40281.8	3999.78	**2100**	**500**

C_i - Concentration of pollutant in the stream (untreated effluent), mg/L
C_s–Baseline Concentration of pollutant in the stream (Nalla), upstream of wastewater discharge, Mg/L
C_f - Concentration of pollutant in the stream (Nalla), downstream of wastewater discharge, mg/L
Q_i- Wastewater discharge rate, M^3/hr.
Q_s- Nalla flow rate, M^3/s
A - Inland Surface Water Standards for Irrigation purpose
B - Inland Surface Water Standards for Drinking purpose

b) When Contaminated Nalla with untreated effluents gets discharged into Kundalika River

Table 4.8 Quantification of Impact due to Contaminated Nallah with untreated effluents into Kundalika River

Accidental Case Scenario (Discharge of Untreated Effluent in River)									
Sr. No.	**Parameter**	**C_i**	**Q_i**	**C_S**	**Q_S**	**$C_i*Q_i+C_s*Q_s$**	**$C_f=(C_i*Q_i+C_S*Q_s)/(Q_i+Q_S)$**	**Inland surface Water (CPCB Standards) (mg/L)**	
								A	**B**
1	BOD	2500	0.001	13	0.11	3.9	35.41	**2**	**3**
2	COD	5000	0.001	37.9	0.11	9.2	82.60	**--**	**--**
3	TDS	4000	0.001	705.62	0.11	81.6	735.30	**2100**	**500**

C_i - Concentration of pollutant in the stream (Nallah), upstream of wastewater discharge, mg/L
C_s–Baseline Concentration of pollutant in Kundalika river, upstream of wastewater discharge, mg/L
C_f - Concentration of pollutant in Kundalika river, downstream of wastewater discharge, mg/L
Q_i- NallaWastewater discharge rate, M^3/hr.
Q_s- River flow rate, M^3/s
A - Inland Surface Water Standards for Irrigation purpose
B - Inland Surface Water Standards for Drinking purpose

c) Facts and Interpretations –

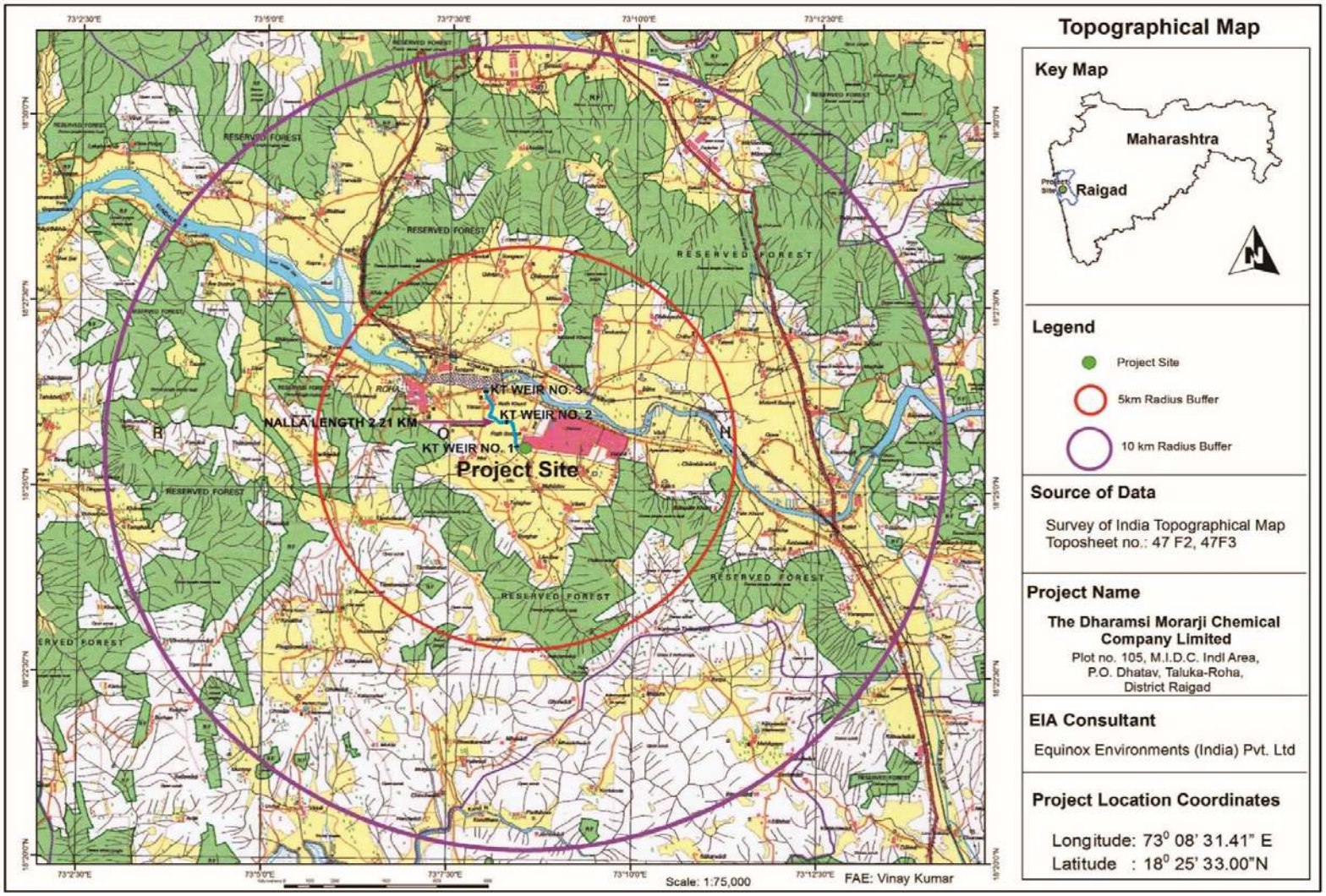
- When untreated effluent from ETP finds a way to nallah,it is observed that on downstream of point of discharge, the BOD, COD & TDS of nallah water shall become 2499.76 mg/lit, 4999.52 mg/lit and 3999.78 mg/lit resp. which otherwise are - 72 mg/lit, 125 mg/lit and1800 mg/lit.
- When this polluted nallah water (due to untreated effluent from ETP) joins the Kundalika river, it is predicted that on downstream of point of discharge, the BOD, COD & TDS of river water shall become 35.41 mg/lit, 82.60 mg/lit and 735.30 mg/lit resp. which otherwise are – 13 mg/lit, 37.9 mg/lit and 705.62 mg/lit.

- It could cause significant impact as there is change in upstream and downstream concentration of measured water parameters of the Kundalika River.
- Increase in concentrations of above parameters shall exert negative impact on the aquatic biota and the fresh water ecosystem; listed below-
  - Increasing concentration of Suspended particles would result in turbidity which reduces light penetration thereby disrupting growth of photosynthetic plants and disturb the food chain.
  - Nitrogen and Phosphorus in wastewater act as nutrients that help aggravating problems of 'Eutrophication' and algal dominance, organic matter in the effluent could reduce dissolved oxygen levels and cause fish kill due to depletion of DO levels, excessive presence of CO_2 through respiration process in eutrophied waters may lead to fall in pH which results in formation of weak acids and affects the pH sensitive reactions in the water body and benthic deposits, increase in ground water TDS levels could lead to salinity problems of soils, gastro enteric disorders, problems of urine stone etc. in humans, corrosion, pitting and similar problems with metallic objects due to salt deposition and scaling.

d) Mitigation Measures –

1. Construction of three KT weirs in the Nallah stretch from Industry to River Kundalikaand putting baffles in KT weir to control discharge subsequent to ingress of Raw spentwash & untreated effluent in to the Nallah so as to carry out flow obstruction.
2. Stopping / arresting untreated effluent entry to nallah by diverting flow through leaking pipe. Lifting the stored volume upstream the KT weir by portable pumps & sending it back to tank or discharging same on nearby farm land for irrigation.
3. Pumping of contaminated discharge from nallah from first weir to tank & action of flushing & dilution to subsequent weirs
4. Faster communication to people residing along the nallah & river about ingress of effluents in the streams followed by an appeal for not consuming the waters for domestic purposes and animal consumption.

Figure 4.2 Image Showing KT Weirs



B) Ground Water

Water required for existing operations is obtained from the Kundalika River. As ground water will not be a source of fresh water for the proposed expansion project there will not be any impact on ground water reserve (quantity in the area).

The ground water quality is dependent on the natural geological formations and can get affected by industrial discharges under unfavorable geological structural conditions near such discharges. The subsurface geological features indicate presence of Deccan Trap.

However, quality of ground water could get affected adversely if untreated effluent from the industry is discharged on land and storage of hazardous waste is done in unlined pits and yards with adequate and appropriate leachate management. Organics in effluents may impart BOD & COD to water and increase in ground water TDS concentration could lead to salinity problems of soils. The hardness increase due to effluent access to ground water is again an undesirable effect. Introduction of colour to ground water due to contamination of effluents shall not only be important from aesthetics but same may also have health concern.

Contaminated ground water if utilized by residents of the region for drinking purpose it may affect the health. High TDS may lead to gastro enteric disorders, problems of urine stone etc. If utilized for industrial purposes, softening and demineralization may incur huge costs. Moreover, the pipelines and other metallic infrastructure involved in conveyance can undergo corrosion, pitting and similar problems due top salt deposition on exposed surfaces.

4.3.4.2 Mitigation Measures

A) Surface Water

- Under expansion, the management has decided to achieve Zero Liquid Discharge (ZLD) by installation of evaporators and the condensate would be recycled in industrial operations. No any effluent would be discharged outside the premises.
- The concepts of advanced mechanization and automation is introduced in an ETP provided under existing unit so as to optimize power and chemical consumption as well as to minimize chances of reduced efficiencies due to human errors and non-efficient operation and maintenance practices.
- Domestic effluent would be treated in proposed STP and overflow would be used for gardening in own premises/ green belt development. Thus, no any untreated / treated /domestic effluent would be discharged in any nearby water body.

B) Ground Water

- No ground water from any bore well / open well to be used for manufacturing processes and operations in the industry.
- Hazardous waste storage yard is made leak proof by providing HDPE liners under platform of the yard to avoid ground water contamination. Refer Fig. No.2.6 of Chapter 2 for details.
- No any hazardous waste would be disposed off in unscientific manner either in the Industry premises or in the study area after expansion. Industry has already procured membership of CHWTSDF for disposal of Hazardous waste.

- Hazardous waste shall not be stored on site for more than 90 days as per the Hazardous Wastes (Management Handling & Transboundry Movement) Rules 2008 and amendment thereat.
- No any treated / untreated effluent would be discharged on land in Industrial premises or study area.

4.3.5 Impact on Geology

National Geological Monuments or protected / reserved areas of geological interest are not located within the area of geological influence of the project.

Most of the units in this MIDC are chemical industries which do not require excavations, or activities leading to ground vibrations etc except at the time of civil construction. Direct impact on geology of the area is not envisaged; however, accidental leakages of chemicals on ground surface can enhance the rate of weathering of soil and sub-surface rocks thereby reducing their bearing capacity. Seismologically the area falls in the Earthquake zone- IV of India. Considering the seismicity in Maharashtra, this area falls within 'moderate' risk zone indicating a possibility of earthquakes of moderate intensity in the area

4.3.5.1 Mitigation Measures

Knowledge of activities related to geology in the area should be updated continuously. Consistent care should be taken to avoid accidental leakages of chemicals on ground surface which can create risk of damage to foundations of the civil structures in the area.

During excavations in construction phase of the project, special attention should be given to geological stability of the foundation of the buildings in the premises and the surroundings. As the area falls in the moderate risk zone of earthquake, appropriate precautions should be taken to make the buildings / plant 'earthquake proof'.

4.3.6 Impact of Solid and Hazardous Wastes

- Haphazard and uncontrolled storage of ash on site shall lead to littering and suspension of the particles in air due to strong wind currents causing problems of air pollution and aesthetics. Improper utilization / disposal of solid waste would harm soil quality and fertility of the nearby agricultural fields.
- Chemical sludge from waste water treatment, Residues, dust or filter cakes, spent catalyst is generated as hazardous waste.
- The high concentration of metal ions, lead, zinc, chromium and copper in used oil can be toxic to ecological systems and to human health if they are emitted from the exhaust stack of uncontrolled burners and furnaces. Some of the additives (zincdialkyl – dithio - phosphates, molybdenum disulphide, other organo - metallic compounds etc.) used in lubricants can contaminate the environment severely. Certain compounds in used oils like PAH can be very dangerous to human and animal health being carcinogenic and mutagenic. Lubricating oil is transformed by the high temperatures and stress of an engine's operation. This results in oxidation, nitration, cracking of polymers and decomposition of organ- metallic compounds. Other contaminants also accumulate in oil during use - fuel, antifreeze / coolant, water, wear metals, metal oxides and combustion products.

4.3.6.1 Mitigation Measures

- Separate area is earmarked for hazardous waste storage. Hazardous waste generated would be stored, bagged and dispatched to CHWTSDF for further disposal after expansion.

4.3.7 Impact on Soil and Agriculture

Impact of any project on soil environment can be at different stages of project like construction phase and operational phase. Causes of impact can be air (Flue gas), Water (effluents) and solids (Waste and hazardous material). Impact can be primary, secondary or tertiary. Impact can be positive or negative.

The project site is located in MIDC Roha, Dist.: Raigad, Maharashtra. The entire land is a flat terrain. The expansion is carried out in existing premises of TDMCCL where there is no change in land use pattern since the area is earmarked for industrial purpose.

4.3.7.1 Mitigation Measures

- Trade effluent generated will be treated in ETP. No any effluent is discharged into water body.
- Domestic effluent would be treated in proposed STP and overflow would be used for gardening in own premises/ green belt development. Thus, no any untreated / treated /domestic effluent would be discharged in any nearby water body.
- Separate area is earmarked for hazardous waste storage. Hazardous waste generated is stored, bagged and dispatched to CHWTSDF for further disposal. This area is covered from the top and from the sides and have impervious flooring, so as to prevent contamination of the surrounding soil environment if any. This same practices shall be followed under expansion.

4.3.7.2Cumulative impact

Roha has a huge industrial setup. This area is a Chemical Industry Zone as declared by Maharashtra Industrial Development Corporation (MIDC), which was set up in the 1970s, is located at Dhatav. Roha Industrial Area has many industrial units. Majority of these are chemical process industries. The late '70s and early '80s saw a major influx of people related to the chemicals industry which gave a unique cosmopolitan nature to Roha, which was till then only farming and trading town. Chemical industries are operating in this area since 1970. As per 8 collected soil samples and their analysis in buffer zone of 10 km, no contamination was observed indicating no cumulative impact on soils of buffer area.

4.3.8 Impact on Noise Levels

The criteria on which noise impacts are analyzed depend upon the people who are being affected. Broadly, there are two types viz. people who are working near the source and the people who stay near the industry. People working near the source need risk criteria for hearing damage while the people who stay near the industry need annoyance and psychological damage as the criteria for noise level impact analysis. It is quite obvious that the acceptable noise level for the latter case is less than the former case. So, the noise impact analysis can be of two types namely (1) Noise impact analysis on working environment; and (2) Noise impact analysis on community.

A) Noise Impact Analysis on Working Environment

For Noise Levels in the industrial unit, the potential noise generating sources are categorized under three major heads - noise from machinery, noise from sirens / work areas, noise from transportation. The total noise generated by operations of all equipments in the existing Industrial Unit would be between 70 to 75 dB(A).Constant exposure to such levels, can result in damage to ear drums and loss of hearing, high blood pressure, cardio-vascular disease and stress, heart problems among the workers. It may also disturb psychological condition of the workers. The actual resultant noise levels outside the factory will be much lesser in the ambient air after considering attenuation. Therefore, the impact of proposed activities would be insignificant.

The noise levels in work environment are compared with the standards prescribed by Occupational Safety and Health Administration (OSHA-USA), which in turn were enforced by Government of India through model rules framed under Factories' Act. These standards were established with the emphasis on reducing hearing loss.

Table 4.9 Permissible Exposure in Case of Continuous Noise

Sr. No.	Total Time of Exposure (continuous or a number of short term exposures) per Day, in hours	Sound Pressure dB (A)	Remarks
1	8.00	90	1. No exposures in excess of dB (A) are permitted.
2	6.00	92	2. For any period of exposure falling in between any figure and the next higher or lower figure as indicated in column 2, the permissible sound pressure level is to be determined by extrapolation on a proportionate scale.
3	4.00	95	
4	3.00	97	
5	2.00	100	
6	1.50	102	
7	1.00	105	
8	0.75	107	
9	0.50	110	
10	0.25	115	

B) Noise Impact Analysis on Community

Noise pattern from the source is computed with the help of following formula.

Noise Level at distance r_2= (Noise level at distance r_1) -20 log (r_2/r_1).

The noise levels get reduced considerably in the range of 20-30% because of natural obstructions. The permissible noise levels, for different categories of area, as prescribed by MoEFCC are given in Table 4.9. The resultant noise levels at the receptor in different

areas/zones are envisaged to be within permissible limits. If noise levels exceed the limit, people who stay near the industry get disturbed due to reasons like annoyance and psychological reasons. The present ambient noise monitored at all villages in the study area is within reasonable limits. The noise generated from an industry gets attenuated considerably because of natural barriers like walls, vegetation, houses etc. or gets deflected along the wind direction.

Table 4.10Standards in Respect of Ambient Noise Levels

Sr. No.	Category of Area	Limits in dB (A), L_{eq}	
		Day time (6 AM to 10 PM)	Night time (10 PM to 6 AM)
1	Industrial area	75	70
2.	Commercial area	65	55
3.	Residential area	55	45
4.	Silence zone (Hospitals, Educational Institutes & Courts)	50	40

4.3.8.1 Mitigation Measures

- Noise monitoring is done regularly in the noise prone areas and within the industry where workers will get exposed.This same practices will be followed under expansion.
- Use of heavy duty muffler systems on high noise generating equipment.
- Proper oiling, lubrication and maintenance would be carried out for the machineries and equipment to reduce the noise generation.
- Personal protective devices such as ear muffs, ear plugs, masks will be strictly enforced for the workers engaged in high noise prone zones.
- During each shift of 8 hours duration, maximum permissible limits of 115 dB(A) shall never be exceeded, in the work zone, even for a short duration.

Thus, it can be stated that noise impact due to the proposed expansion activities could be significant on Working Environment without control measures, while the noise impact on community would be negligible.

4.3.9 Impact on Land Use

The vegetation and drainage of any region are related to each other and reflect inter-locking or inter-connectivity between the same. The healthy vegetation shows well developed drainage pattern.

In Roha taluka wherein the MIDC has been setup, important hill system is there. Heavy rainfall situations are there. The first major land use is crop land and forest land, within 10 Km radius buffer. This crop land and forest land is because of Western Ghat influenced area around study area. Some of the fallow land is seen where there is lack of continuous water supply.

In study area, Kundalika River is flowing from eastdirection to west and a nallah is flowing from Southto North direction towards N and meets the Kundalika River. These two servers as major water source for the cropland in the study area. As it can be seen in the drainage maps, there are many small drains connecting to the Kundalika River. The land acquired for

expansion project of TDMCCL is located in Roha MIDC, which is a notified industrial area. River Kundalika is located 1.25 Km from project site. The existing drainage pattern shall not be disturbed due to TDMCCL's proposed expansion project.

Implementation of TDMCCLs project in the notified industrial area (Roha MIDC, Roha) shall not have any substantial impact on the overall land use pattern of the study area. The project shall come up on a well-defined and developed plot in the industrial area.

4.3.10 Impact on Ecology and Bio-diversity

The study area i.e. 5 km around the project site in Roha MIDC, which is already occupied by large chemical industries mainly dealing with production of agro and industrial chemical and thus all macro and micro habitats in the region to an extent are already affected by air, water and soil pollution. Therefore the additional impact of TDMCCL is not likely to substantially contribute in the existing cumulative pollution load on the ecology and Biodiversity of the region. However, some areas in the radius between 5 km and 10 km radius, having good terrestrial and wetland habitats, are relatively less affected (eg.Vaijnath, Landhar) and therefore need to be protected and conserved for its ecology and biodiversity within.

The possible environmental impacts were considered for worst case scenario (direct discharge of untreated wastewater into river Kundalika). The factory site is about 1.25 km from River Kundalika. Currently more than 20 fish species are found in river Kundalika, out of which 2 are near Threatened, one is vulnerable and one is critically endangered to this area. Discharge of untreated wastewater (sewage/ effluents) in the river and surrounding swamps will cause increased adverse impact on the aquatic habitat and its biodiversity including fishes.

4.3.10.1 Mitigation Measures

- Natural forests and grassland habitats in the region are being fragmented and degraded due to deforestation, agriculture expansion and industrialization.
- The number of water bodies like river, streams and water tanks in the study area provide suitable habitat to biodiversity. Avifauna including migratory birds particularly gets affected due to polluted wetlands as a result of contamination of solid and liquid industrial waste from Roha MIDC; particularly there is decline in fish diversity in river Kundalika due to industrial effluents.
- The green belt being mandatory should be maintained on top priority for pollution control, particularly for health of the workers and people around the industrial unit.
- The industry to adopt latest advanced technology for energy and water conservation and treatment of wastes.
- The pollution control measures as per the EMP should strictly be implemented by the industry.

4.3.11 Impact on Occupational Health and Hazard

Occupational health and safety is an important consideration under any industrial or developmental project. Following tables gives details about the anticipated occupational health hazards from proposed activities as well as precautionary measures to be taken for same.

Table 4.11Occupational Health and Safety

Sr. No.	Reason For Anticipated Hazards	Health Hazard	Work Place	Control To prevent the Hazard	Precautionary engineering Controls provided
1	Toxicity, Due to Exposure, Spillage, Leakage, emissions	Skin Irritation, Decreased muscle strength, Headache, Drowsiness, Long Term Exposure: Kidney, Liver Damage	Production area, Solvents Handling area	Supplied air mask while handling Ammonia. Avoidance of employees with premedical conditions for handling Ammonia/ Respirators approved by NIOSH. EN or equivalent IS Spill control materials like sorbent pads and booms. HAZOP study. Setting up a Standard Operating Procedures (SOP) for all critical operations, reactions and separations.	The condensers would be provided with Chilled water & Chilled Brine circulation to avoid the emissions. Spill control training. Hazard communication: Training willbe conducted, PPE usage, Training & Educating the usage of PPE's All the operations shall be carried out in closed conditions, with scrubbing systems for emissions . Have following alarm and interlock system • Utility failure alarm • Agitator failure alarm • High temperature alarm • Alarm for High rate of addition of limiting reactant which is added at controlled rate. • Raw material (limiting reactant) addition rate should be controlled by flow control loop. (FT, FIC, FCV). Controlling parameter being reactor temperature. • FCV and/or On-Off valve should be interlocked with the reaction mass temperature and agitator tripping. Hot work Permit: • It is absolutely essential to establish Hot work permit system for any hot work to be carried out in the factory, especially in the areas which store flammable solvents of Class A.

Sr. No.	Reason For Anticipated Hazards	Health Hazard	Work Place	Control To prevent the Hazard	Precautionary engineering Controls provided
2	Exposure to Finished Products	Commodity and specialty chemicals	Production area	All the solid chemicals &finished products handling shall be done without Manual Intervention, directly handled in closed conditions by vacuum conveying. Respirators approved by NIOSH. EN or equivalent IS. Full face protection. Emergency shower and eye wash Spill control use of materials like sorbent pads and booms. HAZOP study. SOP for all critical operations, reactions and separations.	Hazard communication training will be conducted, PPE usage. Training & Educating the usage of PPE's All The operations shall be carried out in closed conditions, Oncology Products handling shall be done in isolators with powder scrubbing systems for finished products with detoxification liquids. Have alarm and interlock system, Hot work Permit as mentioned under point 1 above.
3	Physical injuries	Contact with rotating parts -Slip, trip and falls -electric shocks, Fire	Production area, Mechanical workshop, electrical Panel Boards	Good housekeeping, Circuit breakers, Effective work permit system. Fire hydrant system. HAZOP study. SOP for all critical operations, reactions and separations.	Effective Interlocksfor Reactors. Have alarm and interlock system, Hot work Permit as mentioned under point 1 above.

Further,

- All the employees are provided with personal protective equipments like safety helmets, goggles, face shields, heat resistance shoes, dust asks/respirators, self contained breathing apparatus, breathing air masks etc.
- Mock drills as per 'On site Emergency Plan' as approved by Chief Inspector of factories are conducted for fire hydrant systems, firefighting equipment. All the emergency systems are placed in good working condition. Same is made available during emergency conditions by adopting the effective preventive maintenance. Emergency preparedness of teams as per the onsite emergency plan shall be ensured by conducting the effective training through mock drills including evacuation plans.

- Industry undertakes pre-employment health check up followed by periodical health checkup every year with special attention to occupational health hazards &is conducted for all the employees.
- All the work places are provided with the MSDS of chemicals & materials being handled and all equipment operating & production operating, chemicals handling, procedures are displayed in Industry. All the concerned employees are trained and made aware of the hazards in handling the chemicals. Refer MSDS enclosed at **Appendix- O**
- Inspection & breakdown maintenance of all the equipment including pollution control equipment are undertaken by proper work permit systems.

4.3.12 Impact on Historical Places

There are no historical places in the study area and hence no impact is envisaged under expansion project.

4.4 EVALUATION OF IMPACT

Evaluations of impacts on the environmental parameters due to the proposed expansion project of TDMCCL will be an important aspect to be studied. For evaluation of the impacts, *Battelle Environmental Evaluation System (BEES)* has been implemented. Description of same is presented in following paragraphs.

4.4.1 BATTELLE ENVIRONMENTALEVALUATION SYSTEM (BEES)

Battelle Environmental Evaluation System (BEES) has been used for evaluation of impacts arising out of different project activities. The BEES is a simple yet very effective methodology for conducting environmental impact analysis. It is based on a hierarchical assessment of environmental quality indicators. The system incorporates classification consisting of four levels-

- Level I: Categories,
- Level II: Components,
- Level III: Parameters, and
- Level IV: Measurements.

Each Category (Level I) is divided into several components, each Component (Level II) into several parameters, and each Parameter (Level III) into one or more measurements. The Environmental Evaluation System (EES) identifies a total of four (4) categories, twenty (20) components and eighty six (86) parameters.

BEES assessment for environmental impacts due to the proposed expansion activities of TDMCCL is based on commensurate "environmental impact units (EIU)". Two EIU scores are produced, one 'with' and another 'without' the proposed project activities. The difference between the two scores is a measure of the environmental impact. The scores are based on magnitude and importance of specific impacts.

In addition to the EIU scores, the EES labels major adverse environmental impacts with a "red flag." These flags point to fragile elements of the environment, for which more detailed studies are warranted.

Table 4.12 shows a complete list of categories, components, and parameters of the Battelle EES. Column 1 shows the four (4) categories, Column 2 shows the twenty (20) components, and Column 3 shows the eighty six (86) parameters.

The BEES methodology is based on assigning importance unit to each of the parameters. Collectively, these "importance units" are referred to as "parameter importance units" or PIUs. Parameters have been assigned important weights by an interdisciplinary team of experts based on the ranked-pair wise comparison techniques. A total of 1000 PIUs are distributed among the 86 parameters based on value judgments. The individual PIUs are shown in Column 4 of Table 4.13, the summation component PIUs are shown in Column 5, and the summation category PIUs are shown in Column 6. Effectively, for each parameter i, its $(PIU)_i$ represents a weight w_i

Each PIU_i or w_i requires a specific quantitative measurement. The methodology converts different measurements into common units by means of a scalar or "value function." A scalar has the specific measurement on x-axis and a common environmental quality scale or "value" on the y-axis. The latter varies in the range $0 \leq V_i \leq 1$. A value of $V_i = 0$ indicates very poor quality, while $V_i = 1$ indicates very good quality.

Values of $V_i = V_{i,0}$ are obtained for conditions 'without' the project, and $V_i = V_{i,1}$ for conditions 'with' the project. The condition 'without' the project represents the current condition, while that 'with' the project represents the predicted future condition. The environmental impact $E_I$is evaluated as follows:

$E_I = \sum [V_{i,1} w_i] - \sum [V_{i,0} w_i]$for i = 1 to n, where n = number of parameters (86).

For $E_I > 0$, the situation 'with' the project will better than 'without' the project, indicating that the project has positive environmental benefits. Conversely, for $E_I < 0$, the situation 'with' the project is worse than 'without' the project, indicating that the project has negative environmental benefits, i.e. certain negative impacts. A large negative value of E_I indicates the existence of substantial negative impacts.
The assigned weights or PIU's represent the relative importance of each parameter within the overall system. Once established, they should be kept constant; otherwise, the environmental impact assessment would be difficult to replicate.

The potential problem areas are represented by those parameters for which the V_i value changes significantly in the adverse direction, as measured by the following relation (in percent)-

$$\Delta V_i (\%) = 100 (V_{i,0} - V_{i,1}) / V_{i,0}$$

These parameters are tagged with 'red flags' to indicate potential problems which may warrant more detailed attention. For parameters in the ecology category, a minor red flag applies when $5\% < \Delta V_i < 10\%$; a major red flag when $\Delta V_i > 10\%$. In all other categories, a minor red flag applies when $\Delta V_i < 30\%$ whereas a major red flag when $\Delta V_i \geq 30\%$. The EES can be applied for the evaluation of project impacts, to select specific alternatives, or during the planning process to minimize potential adverse impacts of proposed projects. In the latter case, a feedback loop is used to continually modify the project through successive iterations. Projects developed with the help of EES are expected not only to minimize environmental impacts, but also help improve selected portions of the environment

4.5 ENVIRONMENTAL IMPACT EVALUATION FOR TDMCCL EXPANSION PROJECT

Environmental quality assessment for the proposed expansion project of TDMCCL has been undertaken through evaluation of relevant environmental parameters. These parameters represent various components and categories of environment namely-

1. **Biological Environment**
2. **Environmental Pollution**
   - Water
   - Air
   - Soil
   - Noise
3. Aesthetics
4. Human Interest

Functional relationship (value functions) has been developed for each of the selected parameter, resulting in parameter measurement with environmental quality.

The allocation of PIUs, among the selected environmental parameters, represents a consequence of opinion of members of an interdisciplinary team of experts. Accordingly, the major environmental categories i.e. biological environment, environmental pollution, aesthetics and human interests are allocated 240, 402, 153 and 205 PIUs respectively, out of total of 1000 units.

The exhaustive list of parameters and associated PIUs used for impact assessment of the activities of TDMCCLare presented in Table -4.13

Though the BEES is considered to be the best available environmental evaluation technique, conflicting conclusions among decision makers could arise in the interpretation of evaluated results. The primary factors giving rise to such difference in opinion are at uncertainty and subjectivity in the allocation of PIUs to different environmental parameters and uncertainty caused by the aggregation of individual parameter scores to yield the final project score under different project impact scenarios. It is, therefore, necessary to take into account such variability and uncertainty while inferring the impact of a development project on the surrounding environment.

In order to study the influence of variation of PIU allocation on project evaluation, sensitivity analysis was performed by varying the PIUs for all environmental categories from 0 to 1000 with step size of 50 units. While performing the sensitivity analysis, the aggregate of PIUs allocated among these categories was kept fixed at 1000 units. This gave rise to numerous environmentally beneficial, indifferent or adverse decisions.

4.5.1 Biological Environment

Total plot area of the industry is 88355 Sq. M. Total Green belt developed and to be developed is on an area of 2.95 Ha i.e. 33% of Plot area.Augmentation of green belt would be done in phase wise manner.

4.5.1.1 Terrestrial Environment

a) Natural Vegetation

Natural vegetation in the study area comprises Banyan, Sag, Peepal, Umbar, Tamarind, Drumstick, Babhul, Neem, Ain, Kinjal, Kumbh, Bhokar, Palas, Katesavar, Behada, Hirda, Karanj, Pangara, Bahava, Apta, Arjun, Tamhan, Anjani, Jambhul, Amba, Shirish, Ranbiba, Shisav, Karwand, and Gulmohar. In the acquired area, the industry would do some land leveling. There would be no any trees to be cut under the expansion project implementation. Green Belt development, on an area of about 33 % of the total plot, is implemented as per the guidelines of MoEFCC and CPCB and as per the plan mentioned in chapter 2nd section 2.9. Apart from this green belt development, open areas around the offices &buildings would be covered with the grasses, shrubs & plants for landscaping. Outskirts of the area would be planted with fast growing trees as indicated in the Environmental Management Plan. In totality, green belt development on the acquired area would imply positive benefits in terms of the extensive plantation and proper planning of same as indicated in a separate chapter on the green belt development plan.

b) Crops

In the study area, under 10 Km radius crops like paddy, Finger millet, jungle rice, beans, Pearl millet and vegetables common crops. Also, mango, jackfruit, sapodilla, cashew, coconut and garcinia etc were observed in study area. The project would not have any significant negative impact on crops. As the treated effluent would be recycled for process operations and boiler and thermic fluid heater are provided with adequate stacks.

c) Species Diversity

No negative impacts are envisaged due to the proposed project activities on local species diversity. Infact, plantation of variety of species, as induced in the Environmental Management Plan, would improve ecosystem of the area. This will improve the local ecosystem marginally.

d) Food & Web Index

No adverse effect on food & web cycle is expected. However, due to green belt plan in the acquired area, improvement in the food web index is expected.

e) Rare & Endangered Species

However, no negative impacts are envisaged due to the expansion project since there will not be any adverse effects like loss of habitat, fragmentation of habitat or contamination of habitat. However, plantation of variety of the species, as induced in the Environmental Management Plan, would improve the ecosystem of the area marginally.

i) Plant Species

Plant species noted in the study area are normal species found in semi-arid zone. No negative impact on these species is expected.

ii) Animal Species

No critically endangered wild animal species are found in the study area. Animals observed in study area are Indian Wolf, Common Mongoose, Common Langur, Indian Hare, Three Striped Palm Squirrel, Bonnet Macaque etc. These are normal species found in the Maharashtra Zone. No negative or positive impact on these species is expected.

iii) Pest Species

No pest or parasitic species are found in the area. Hence, no any negative or positive impact is envisaged.

4.5.1.2 Aquatic Environment

a) Natural Vegetation

The existing quality of natural vegetation is good. No harmful aquatic weeds are observed in the surface waters.

b) Species Diversity

As effluent from existing as well as expansion project would not be discharged directly to any water body, the diversity of any aquatic plant or animal species will not get affected.

c) Food & Web Index

As the aquatic life is not going to be affected there will not be any impact on the food and web index.

4.5.2 Environmental Pollution

Parameters for the above-mentioned category are divided into four parts as (1) Water, (2) Soil, (3) Air, (4) Noise

Impacts of the proposed expansion project activities on these components are summarized below:

4.5.2.1 Water

Parameters which represent the water environment are mainly pH, COD, BOD, TDS, Oil& Grease. Trade industrial effluent generated from expansion industrial activities shall be 230.5M^3/Day. This effluent shall be segregated in existing ETP comprising of primary, secondary and tertiary treatments. Treated water from ETP is recycled back in process for cooling.

Domestic effluent after expansion would be treated in proposed STP. Thus, no any untreated / treated /domestic effluent would be discharged in any nearby water body.

4.5.2.2 Soil

Analysis of soil in the acquired area shows that it is good for cultivation. In case of the study area, the soil chemistry will not change because no any untreated/ treated/ domestic effluent would be discharged on land. Moreover, the hazardous and solid waste generated would be properly stored in lined area and disposed off by forwarding it to CHWTSDF as done under existing unit.

a) Land Use Pattern

No change in the land use pattern of study area is expected. The expansion will be carried out in existing premises which is located in MIDC area. Thus, the designated land use is solely for the industrial purpose.

b) Soil Chemistry

Soil observed is neutral, mostly clayey loams. This indicates presence of clay material. The porosity varies between 33.57–54.54, which can be categorized as moderate. pH index indicates neutral nature of the soil. The bulk density is observed 1.15 to 1.51 gm/cc. Soils from this study area have EC values below the limits to be called as saline and hence the soils are normal for crop growth. The water retention capacity is observed in range of 37% to 61%, which can be stated as moderate to good. The Sodium Adsorption Ratio (SAR) is in the range of 1.11 to 1.27

c) Soil Erosion

Development of the green belt plan as mentioned in chapter 2ndprevents the soil erosion from the project premises. Also, grassland on the open lands helps arresting the erosion of soil. Thus, there will not be any soil erosion from the acquired area.

4.5.2.3 Air

The average concentration of PM_{10}, $PM_{2.5,}SO_2$ & NO_x monitored at site is 58.24µg/M^3, 17.51µg/M^3, 23.97µg/M^3 and 39.19µg/M^3 respectively. These are well within the limits specified by MPCB / CPCB.

4.5.2.4 Noise

Major sources of the noise generation are Boiler, Reactors & Compressors; Fans and Pumps, Vehicles, D. G. Sets. All the machinery including pumps and compressors are lubricated and well fixed to minimize noise. The D.G Set sunder existing unit are enclosed in separate canopy. However, this would not be a continuous source of noise as the same would be operated in case of electricity failure. Isolation, insulation, separation techniques would be adopted under the expansion activities to reduce noise effects on the work environment as well as on the ambient noise levels. Prevention of noise with the plans suggested in EMP would suffice the control of noise pollution.

4.5.2.5 Vibration

No major source of vibration would be present in the industry under existing and proposed operations.

4.5.3 Aesthetics

4.5.3.1 Topographical Character

a) Landscape

Topography & landscape of the area indicates plain terrain. Changes would occur in the form of general leveling and digging for construction purposes. Debris arising from the construction would be utilized for filing of low-lying area. Thus, even if some changes may occur in the topography of the area, it would bring out positive impact in the form of leveling and landscaping.

b) Green Belt

Natural vegetation and its diversity will increase due to green belt development.

c) Visual Quality of Air

There will not be any effect on the visual quality of the air.

d) Visual Quality of Water

There will not be any effect on the visual quality of the water body present in the study area.

e) Sound

There might be small increase in the noise levels around the existing project site. This is taken care by proper isolation, insulation, separation techniques and provision of green belt development plan as suggested above.

4.5.4 Human Interest

Human interest will not be affected negatively. The proposed expansion project activities will provide direct and indirect employment to residents of nearby locality. As such, the overall effect will be positive.

a) Community Health

The TDMCCL project would not have any impact on health and sanitation of the study region. The domestic effluents from proposed expansion activities would be treated in proposed STP and overflow would be used for gardening in own premises. Also, there will be zero discharge w.r.t. trade effluent. Hence, sanitation in the study area as well as acquired area would not have any positive or negative impact.

b) Employment

The existing project has provided employment opportunities to the skilled and semi-skilled local populace, especially in small-scale business and other related services.

c) Economy

The economy of the study area would have somewhat positive impact due to the expansion project activities. Through, primary and secondary level employment as well as contractual jobs becoming available, the overall economy of the study area would impart positive effects on it. The small contract jobs at local level would improve the economy at the micro level. It was observed that majority of the population within the sample size had considerable income which is mostly due to job opportunities in MIDC.

d) Transportation & Communication

Due to requirement of raw materials and dispatch of products to market, transportation in the project area would be increased. The local transporters would be benefited primarily. Further, common communication facilities are available in project area since the area is well developed MIDC area.

e) Education

All the required education facilities up to postgraduate levels are available at the Roha. From the socio-economic survey of 10 Km study area, it was observed that the literates had up to primary (35%), secondary (32), higher secondary (15%), graduate (6%) and post graduate (1%) level education. However, it was interesting to observe that, locals residing in wadis above villages Pugao, Pallekhurd, Killa and Washi were known to be Adivasis. Most of these were illiterate, economically backward and dependent on gathering wood for their living.

Free compulsory education should be provided to Adivasi community in the area.

f) Water Supply

The plot being located in the Roha MIDC, the water required for proposed operations would be taken from MIDC water supply scheme. Further, drinking water is supplied to near by villages through MIDC water supply scheme, Roha.

g) Occupational Health

Occupational health is usually the concern in case of routine industrial operations. Regular health checkup camps and facilities such as doctors, dispensary, hospitals, ambulance etc. are the prerequisites of a good program. The present unit has all such facilities and amenities. The proposed infrastructure and practices in TDMCCL unit would suffice for the requirements towards occupational health & safety measures under the expansion project. Moreover, the industry would adopt measures suggested in the EMP. Thus, no occupational health problem would anticipated under the proposed expansion project.

Table 4.12 Application of BEES for Impact Evaluation due to TDMCCL, Roha MIDC, Raigad

Categories	Components	Parameters	Parameter Importance Units (PIUs)			$V_{i,0}$ Without Project	$V_{i,1}$ With Project	ΔV_i	$W_i \Delta V_i$
			Parameter $PI\backslash W_i$	Component PIUs	Category PIUs				
1	2	3	4	5 = Sum of 4	6 = Sum of 5	7	8	9=8-7	10=9X4
Biological Environment (Ecology)	Species & Populations (Terrestrial Flora, Terrestrial Fauna, Aquatic Biota)	1. Terrestrial browsers and grazers	14		240	0.5	0.5	0	0
		2. Terrestrial crops (Farm land)	14			0.6	0.6	0	0
		3. Terrestrial natural vegetation. (Grass, Flowers, Trees & Shrubs.)	14			0.5	0.6	0.1	1.4
		4. Terrestrial pest species	14			0.6	0.6	0	0
		5. Terrestrial upland birds	14			1.0	1.0	0	0
		6. Aquatic commercial fisheries.	14			0.7	0.7	0	0
		7. Aquatic natural vegetation	14			0.6	0.6	0	0
		8. Aquatic pest species	14			0.5	0.5	0	0
		9. Fish	14			0.6	0.6	0	0
		10. Water fowl	14	140		0.6	0.6	0	0
	Habitats & Communities	11. Terrestrial food web index	08			0.8	0.8	0	0
		12. Land use	10			0.7	0.7	0	0
		13. Terrestrial rare and endangered species.	15			0.3	0.5	0.2	3.0
		14. Terrestrial species diversity	10			0.8	0.8	0	0
		15. Aquatic food web index	08			0.7	0.7	0	0
		16. Aquatic rare & endangered species	08			0.5	0.5	0	0
		17. River characteristics	10			0.5	0.5	0	0
		18. Aquatic species diversity	10			0.6	0.6	0	0
		19. Habitat Removal, Contamination of Habitat (Aquatic Biota)	08			0.7	0.7	0	0
		20. Terrestrial Fauna - Fragmentation of Terrestrial Habitat,	13	100		0.4	0.4	0	0
Environmental Pollution	Water	21. Basin hydrologic loss (alteration of hydraulic regime, alteration of surface runoff,	20		402	0.6	0.5	- 0.1	- 2.0

Categories	Components	Parameters	Parameter Importance Units (PIUs)			$V_{i,0}$ Without Project	$V_{i,1}$ With Project	ΔV_i	$W_i \Delta V_i$
			Parameter PI\W$_i$	Component PIUs	Category PIUs				
1	2	3	4	5 = Sum of 4	6 = Sum of 5	7	8	9=8-7	10=9X4
		alteration of aquifers)							
		22. BOD (Water Quality - WQ)	28			0.6	0.5	-0.1	-2.8
		23. Dissolved Oxygen (WQ)	33			0.8	0.8	0	0
		24. Fecal Coliforms (WQ)	10			0.6	0.6	0	0
		25. Inorganic carbon (WQ)	26			0.6	0.6	0	0
		26. Inorganic nitrogen (WQ)	26			0.6	0.6	0	0
		27. Inorganic phosphate (WQ)	26			0.6	0.6	0	0
		28. Pesticides (WQ)	10			0.3	0.3	0	0
		29. pH (WQ)	25			1.0	1.0	0	0
		30. Stream flow variation (alteration of river, nalla, channel)	30			0.8	0.8	0	0
		31. Temperature.	33			1.0	1.0	0	0
		32. TDS (WQ)	10			0.8	0.7	0.1	-1.0
		33. Toxic substances (WQ)	10			0.7	0.7	0	0
		34. Turbidity (WQ)	25	312		0.6	0.6	0	0
	Air	35. CO_2(Air Quality-AQ)	8			0.8	0.8	0	0
		36. Nitrogen oxides (AQ)	7			0.8	0.8	0	0
		37. Particulate matter (AQ)	14			0.6	0.5	0	0
		38. Photochemical oxidants (AQ)	3			1.0	1.0	0	0
		39. Sulfur dioxide (AQ)	10			0.6	0.5	-0.1	-1.0
		40. Other (process & fugitive emissions	10	52		0.7	0.6	-0.1	-1.0
	Land (Soil)	41. Land use	10			0.6	0.7	0.1	1.0
		42. Soil erosion	6			0.8	0.8	0	0
		43. Soil Quality	12	28		0.7	0.7	0	0
	Noise	44. Noise	10	10		0.8	0.8	0	0
Aesthetics Cultural	Land	45. Surface material	6		158	0.8	0.8	0	0
		46. Relief and topographic character	16			1.0	1.0	0	0
		47. Width and alignment	10	32		0.8	0.8	0	0
	Air	48. Odor and visual	3			0.7	0.6	-0.1	-0.3
		49. Sounds	2	5		0.8	0.8	0	0
	Water	50. Appearance	16			1.0	1.0	0	0
		51. Land &water interface	16			1.0	1.0	0	0
		52. Odor &floating materials	10			0.8	0.8	0	0

Categories	Components	Parameters	Parameter Importance Units (PIUs)			$V_{i,0}$ Without Project	$V_{i,1}$ With Project	ΔV_i	$W_i \Delta V_i$
			Parameter $PI\backslash W_i$	Component PIUs	Category PIUs				
1	2	3	4	5 = Sum of 4	6 = Sum of 5	7	8	9=8-7	10=9X4
		53. Water surface area	10			1.0	1.0	0	0
		54. Wooded & geologic shoreline	10	62		0.8	0.8	0	0
	Biota	55. Animals- domestic	5			1.0	1.0	0	0
		56. Animals – wild	5			0.6	0.6	0	0
		57. Diversity of vegetation types	12			0.7	0.8	0.1	1.2
		58. Variety within vegetation types	8	30		0.8	0.9	0.1	0.8
	Manmade Objects	59. Manmade objects	9	9		0.8	0.8	0	0
	Composition	60. Composite effect	10			0.7	0.7	0	0
		61. Unique composition	10	20		1.0	1.0	0	0
Human Interest (Social, Cultural)	Educational / Scientific Packages	62. Archaeological	6		200	1.0	1.0	0	0
		63. Training in new technologies& skill development	13			0.5	0.7	0.2	2.6
		64. Ecological Effects on crops, Reduction of farm land	9			0.8	0.8	0	0
		65. Geological	10			1.0	1.0	0	0
		66. Hydrological	10	48		0.7	0.7	0	0
	Historical Packages (Infrastructure and services)	67. Architecture and styles	5			1.0	1.0	0	0
		68. Conflicts with projects of urban , commercial or industrial development	10			0.9	0.9	0	0
		69. EventsRecreation	10			1.0	1.0	0	0
		70. Persons	12			1.0	1.0	0	0
		71. Religions and Cultures	10			1.0	1.0	0	0
		72. Western frontier	8	55		1.0	1.0	0	0
	Cultures	73. Indians	13			1.0	1.0	0	0
		74. Other ethnic groups	5			1.0	1.0	0	0
		75. Religious groups	5	23		1.0	1.0	0	0
	Mood/Atmosphere	76. Awe-Inspiration	8			1.0	1.0	0	0
		77. Isolation / solitude	8			1.0	1.0	0	0
		78. Mystery	4			1.0	1.0	0	0
		79. Oneness with nature	8	28		1.0	1.0	0	0
	Security and Safety	80. Increase in crime and accidents caused	5			0.5	0.5	0	0
	Health	81. Temporary acute and chronic.	5			0.7	0.7	0	0

Categories	Components	Parameters	Parameter Importance Units (PIUs)			$V_{i,0}$ Without Project	$V_{i,1}$ With Project	ΔV_i	$W_i \Delta V_i$
			Parameter PI\W$_i$	Component PIUs	Category PIUs				
1	2	3	4	5 = Sum of 4	6 = Sum of 5	7	8	9=8-7	10=9X4
	Life Patterns (Economy)	82. Employment opportunities (Creation of new economic activities. Generation of Temporary & Permanent Jobs)	16			0.7	0.9	0.2	3.2
		83. Income for state & private sector.	5			0.5	0.6	0.1	0.5
		84. Saving for consumers and private consumers Savings in foreign currency for the state.	5			0.6	0.7	0.1	0.5
		85. Housing. (Commercial value of properties, Electricity tariff)	5			0.6	0.6	0	0
		86. Social interactions (Conflict due to negotiations & / or compensation payments, Political conflicts, Demonstration and Social Conflicts.	5	46		0.6	0.6	0	0
The Battelle EES Environmental Impact Analysis Cumulative Index Ei									+4.7

Table4.13 Identification of RED Flags to the Potential Problem Areas in BEES for TDMCCL

Parameters	PIUs W_i	$V_{i,0}$ Without Project	$V_{i,1}$ With Project	ΔV_i	$\Delta V_{i,r}$ #	Red Flag
1	2	3	4	5 = 4-3	6 = 5/3 X 100	7
21.Basin hydrologic loss (alteration of hydraulic regime, alteration of surface runoff, alteration of aquifers)	20	0.6	0.5	-0.1	-17%	Minor
22. BOD (Water Quality - WQ)	28	0.6	0.5	-0.1	-17%	Minor
32. TDS (WQ)	10	0.8	0.7	-0.1	-12%	Minor
39. Sulphur Di-oxide (AQ)	10	0.6	0.5	-0.1	-17%	Minor
40. Other (Process Emissions)	10	0.7	0.6	-0.1	-14%	Minor
48.Odor& Visual	3	0.7	0.6	-0.1	-14%	Minor

- In the Battelle EES, the potential problem areas are represented by those parameters for which the V_i value changes significantly in the adverse direction, as measured by the following relation (negative values, in percent)

$\Delta V_{i,r} = 100 [V_{i,1} - V_{i,0}] / V_{i,0}$.These parameters are tagged with 'red flags' to indicate potential problems which may warrant more detailed attention. For parameters in the ecology category, a minor red flag applies when 5% <ΔVi,r ≤ 10%, and a major red flag when ΔVi,r> 10 %. In all other categories, a minor red flag applies when ΔVi,r ≤ 30% or ΔVi ≤ 0.1, and a major red flag when ΔVi,r> 30% or ΔVi> 0.1.

4.6 THE MITIGATION MEASURES

The potential problem areas mentioned in above Table 4.13 would be having adverse impact due to project activities under expansion. The various mitigation measures to minimize the impact on different parameters are presented below-

1. Basin Hydrologic Loss

This parameter that comes under 'Environment Pollution' category. For the present and proposed expansion activities in TDMCCL water is taken from MIDC Water supply scheme. The existing and proposed activities considered together shall require water quantity to the tune of 1592 M^3/Day. Out of this total requirement 220 M^3/Day would be recycle water in process for cooling whereas 1372 M^3/Day (86%) would be the fresh water taken from Kundalika River. Hence the treated water from ETP after achieving prescribed standards will be recycled back into process for cooling.

To minimize the negative impact up to some extent, TDMCCL has planned to reduce its fresh water demand by about 14% through recycling the treated effluent. Thus, the industry shall reuse 220M^3/day of its treated effluent for cooling tower make up and in process operations. This step shall facilitate the benefits namely; achieving 'Zero Discharge' of trade effluent in the environment and saving in fresh water demand.

2. B.O.D.

Through the manufacturing operations under expansion in TDMCCL project, effluents would be generated from process, laboratory, washing, cooling and boiler blow downs etc. The total effluent generated from various operations and processes in proposed expansion project shall be treated in existing ETP of 300 CMD capacity comprising of Primary, Secondary and Tertiary treatment operations. At present, the treated water from ETP, achieving prescribed standards is discharged to Common Effluent Treatment Plant (CETP), Roha. Presently, domestic wastewater is treated in septic tanks followed by soak pits. The overflow from soak pits is used for gardening purpose.

Under expansion, the management has decided to achieve Zero Liquid Discharge (ZLD) by installation of evaporators and the condensate would be recycled in industrial operations. No any effluent would be discharged outside the premises. Moreover, for domestic waste water, Sewage Treatment Plant (STP) of 20 CMD is proposed. The treated water from STP would be used for gardening.

Green belt development and complete utilization of the treated domestic wastewater for the plantation therein shall prevent any degradation of the ground as well as surface water

quality. As a result of actions described above, there shall not be any discharge of treated or untreated effluents in any water body. This shall avoid adverse impact of the industry on environment especially due to the organic pollution of attributes such as water and land.

3. TDS

This parameter comes under water component of environmental pollution category. It has got importance since during manufacturing processes various salts are used as raw materials in considerable quantities. Moreover, many times salts are generated as intermediate or end products of number of chemical reactions. Subsequently, through procedures of product finishing, refining or purifying, effluents containing huge concentrations of TDS are generated. If such effluents of high TDS are discharged on land or in surface waters or if they find access to ground water, serious negative impacts could result. The TDS in surface and ground water may increase, the water could become hard, the soils can become saline. These changed properties of water, land and soils, in turn, could demand costly measures for making them useful or fit for consumption towards various purposes. More details about this aspect have been described in earlier sections of this chapter while stating impacts and their mitigation measures.

4. SO_2

The SO_2shall get released to atmosphere as stack emissions due to burning of fuel. There the quantum of SO_2emission shall be of more concern. In light of such event, the mitigation measure in the form of adequate stack height of 35M, 30 Mhas been considered.

5. Other (Process & Fugitive Emissions)

This parameter comes under 'Environmental Pollution' Category (Component – Air). There would be process emissions in the form of sulphur dioxide, HCl as well as VOCs as process and fugitive emissions. Same are controlled through installation of scrubbers and fume extraction systems. Further, the scrubbed material shall be forwarded to secondary uses or sent to ETP. Thus, no any process emissions shall be let out into ambient air.

6. Odour and Visual

This parameter comes under 'Aesthetics' category for component of air in the BEES. Although, there would be the minor predicted negative impact (14% as shown in Table 4.18) of this parameter, due consideration for same is equally important. This is because the said parameter is related with aesthetics in respect of ambient air in the industrial premises and in surrounding region. The odor may be because of fugitive emissions from different process operations during manufacturing as well as unhygienic and poor storage conditions in the industrial premises of waste materials (discarded product batches, spent organics & catalysts, mother liquor etc.), sludge, solid and hazardous wastes. Odour nuisance would be controlled by curbing emissions responsible for same at the source itself. Further, provision of scrubber, efficient ventilation and exhaust systems, proper O & M as well as good house-keeping shall exercise adequate control on factors responsible for odour nuisance.

4.7 IMPACTS DUE TO DECOMISSIONING ACTIVITY

4.7.1 Decommissioning Phase

"Decommissioning" is a procedure to make an equipment or manufacturing setup unfit for its reuse for its designed function. This could be done by cutting project components into small pieces, demolition of buildings, disconnecting circuits and removing of all infrastructures set up thereby making it unusable.

4.7.2 Planning for Decommissioning of the TDMCCL Project –

When a plan for decommissioning of the TDMCCL plant would be confirmed, initially a detailed survey of the site and entire plant shall be carried out. Detailed photography and videography shall be done. A review of all documents shall be taken and thorough checking shall be done w.r.t. permissions from all concerned Govt. authorities for the decommissioning. If required, competent personnel shall be arranged at the site to supervise the entire assignment.

Subsequent to survey, a planning towards sequence and chronology of decommission and dismantling shall be done by taking in to consideration following –

1. Number and types of buildings like administration building (2 storeyed) and security office in RCC and brick work, manufacturing plant in MS &RCC, allied piping, staging and supports etc.
2. All electrification infrastructure with cables and cable trays, transformers, poles and lighting, underground cable trenches, etc.

For demolishing RCC structure, no any blasting is recommended as the site is in Roha MIDC and surrounded by other chemical industries. Same would be done by using hydraulic breakers. Fabricated structure would be dismantled by gas cutting.

Inventory of left over hazardous chemicals after shutdown would be done. These chemicals based on their characteristics would be scientifically collected and disposed off for authorized re-processor or forwarded to CHWTSDF. This would be done also for safe disposal of used / unused chemicals from the industry. The decommissioning would be done by detoxification followed by dismantling activity under trained manpower and expert supervision.

A) Detoxification

For detoxification of reactor, column, bulk storage tanks following in-situ methods are suggested -

a. **Hot Water/ Air Purging**: Hot air /water shall be purged through the units until specified criteria are met.
b. **Dilute Acid Wash:** Some of the equipment and pipelines shall be given acid wash to detoxify them. Dilute HCl (5-10%) is suggested for this purpose.
c. **Water Wash:** Finally a thorough water wash of the equipment and pipelines is recommended, before they are dismantled from their supports.

The used water shall be diverted to ETP for its treatment and safe disposal.

B) Dismantling

All the equipment, pipelines and structural components shall be dismantled only after in-situ detoxification has been carried out as specified above. The pipelines would be dismantled first followed by the equipment and finally by the structure. The dismantling of the units will begin from the topmost floor and proceed towards the ground floor. Large equipment shall be dismantled in sections wherever possible. The dismantled metal components would be disposed off by sale to authorized parties. Demolition of RCC buildings would be done manually and debris generated would be used for filling low lying areas.

After dismantling and disposal of all dumps to disposal sites, there would be necessity to check soil contamination due to leakages and spillages. The top soil samples in industrial site be analyzed and the quality would be checked.

Table 4.14 Identification of Impacts due to Decommissioning of TDMCCL Project

No.	Env. Aspect	Activities / Operation	Impact Identification	Measures
1.	**Land Use**	Dismantling and decommissioning of industrial set up.	No impact on land use as the site is in notified industrial area, post-decommissioning use would be industrial only.	--
2.	**Air**	• Washing of reactors, pipeline during detoxification. • Cutting, demolition and dismantling operations	• Fugitive emissions due to fumes of acid/ alkali during washing of reactors, distillation column, storage tanks, pipeline etc. • Fugitive dust during demolition of building.	• Scrubbing of emissions through scrubbers attached to reactors and subsequent demolition of both. • Water sprinkling to suppress dust during demolition work.
3.	**Water**	• Washing activities of tanks, reactor, piplines, columns etc.	• Washing discharges getting access into nearby nalla under uncontrolled operational conditions.	• Washing discharges to ETP; treatment & disposal through same as ZLD. Demolition of ETP shall be the last activity.
4.	**Solid and Hazardous Waste**	• Cutting wastes, scrap, demolition wastes etc. • Oils and lubricants removed from equipment, any un-disposed HW left at site (residue, chemical sludge, spent catalyst, spent carbon)	• Littering of wastes • Bad aesthetics • Leachate formation & Gr. water contamination	• Solid wastes disposal to authorized re-processor, sale. • HW disposal to CHWTSDF
5.	**Noise**	• Cutting & drilling during decommissioning • Dismantling of reactors, columns, buildings etc.	Increase in noise levels during decommissioning.	PPEs to manpower involved in decommissioning and safety measures to will be followed.
6.	**Risk & Hazard**	Dismantling &Decommissioning of equipments& buildings.	Accidents, chemical spillages, storage tanks explosion during detoxification & dismantling.	Use of PPEs, expert and experienced supervision, due follows up of safety norms & procedures.

Chapter 5

ANALYSIS OF ALTERNATIVES

5.1 INTRODUCTION

While preparing EIA report, it is necessary that one should consider project alternatives and their relative potential impacts on the environment. Selection of alternative would be thus more critical in an industrial development where time, money, environment and natural resources are at stake. Hence, selection of alternative must be both practical and rational, taking into consideration the constraint of the proposed expansion projectby TDMCCL.

5.2 ANALYSIS OF ALTERNATIVE TECHNOLOGIES

5.2.1 Raw Material Alternative

The product will require certain raw materials. The raw materials for existing and proposed activities listed in Chapter - 2 are adopted because of their purity and desirable form. It avoids a probability of discards or non-specification outcome. It also follows the mass balance more faithfully than when impurities are involved.

5.2.2 Technology Alternatives

To reduce the carbon footprint by our business operations, we aim to use renewable energy sources for the process requirements, wherever necessary. We have plans to use all the latest available energy efficient and environmental friendly technologies to contain or minimize the impact on Environment.

- **Green Initiative by TDMCCL-**

1. Waste Heat Boiler -

- **Under existing unit**

TDMCCLis utilizing the heat generated during Sulphur Burning as a heating source for generation of steam in waste heat Boiler. Here, TDMCCL generates about 300-330 MT of steam daily. It is a green technology as no new fuel burning is done for steam generation thereby reducing the green house gases. After in-house utilization of steam generated from waste heat boiler, about 60 MT/day of steam is supplied to immediate neighboring industries. Here, once again there is reduction of green house gas emissions as no additional fuel like FO,Coal etc. burning is done by neighboring industries for generation of steam.This activity helps reduce the carbon footprint equivalent to 13 MT per day.

- **Expansion Activity**

Under expansion same activity would be continued.

(Reference: ICC data assuming sub bituminous coal used for generation of electricity 96.07 Kg by CO_2/GJ)

2. Dedicated equipments -

Most of major products are manufactured in dedicated equipments hence no washings are required. This reduces the effluent load.

3. Solar Power-

TDMCCL have installed a 335 KWp capacity Solar Power Plant in May 2016. All future installation's roofs will be south-wardly inclined to install more solar panels for higher solar power generation.

Figure 5.1 Solar power plant installed on site of TDMCCL

4. Rain Water Harvesting-

TDMCCL's housing colonies, control room; ETP-solid waste storage and SVS plant roofsare connected to rain water harvesting system. This rain water was collected in bore well to maintain the ground water level. (Refer **Figure 5.2**) But recently, may in 2018 a water pond of 1000 KL capacity is built. The harvested rainwater from the adjoining installation is connected to this pond. This harvested water would be used for Industrial purpose. This is one more step towards the green initiative. The total expense of this project is 20 Lac. (Refer **Figure 5.3**)

Figure 5.2Rain Water Harvesting on site of TDMCCL

Figure 5.3 Water Pond on site of TDMCCL

BEFORE	AFTER
	

5. Biogas Plant-

TDMCCL installed a biogas plant in which canteen waste and colony kitchen waste is consumed for biogas generation. This biogas is used in canteen.

Figure 5.4 Biogas Plant on site of TDMCCL

6. ALTERNATIVE FOR RO / MEE -

Instead of RO/ MEE TDMCCL is going to achieve ZLD unit where neutral effluent after primary clarifier shall be feed to the unit.This effluent will be concentrated to about 25 to 30% TDS level and dried further to get solid residue. Heat pump is used to concentrate the effluent by evaporation. Water Vapor is then condensed and recycled. Apart from the electrical energy provided for heating the effluent, heat pump also utilizes the heat released during condensation of water vapor for evaporating the inlet effluent water. This technology is the best example of conservation and effective utilization of energy. The concentrated stream will be subjected for drying in de-moisturizer. The installation and commissioning of this facility will be completed within short period.

- **Principle and Concept -**

In most cases, industrial process water is passed through ETP, RO and Multi effect Evaporator (ME) process. Typically, RO reject is passed through the ME. Steam inside ME process is generated by direct heating principle. It is done by equipment like boilers, electric heaters, solar water heater or high vacuum pump systems. No matter how efficient these systems are, the efficiency or COP (coefficient of performance) is always less than 1; since there are some losses in the process of heating. It is also important to note that all the above equipment uses some conventional source of heat energy which is expensive and the cost is increasing day by day. For example, Steam boilers or Hot water generators use High Speed Diesel as the source of heat. Since these sources of heat or fuels are often expensive, the operating costs of such systems are mostly on the higher side.With regards to this context, progressive revelations suggested what if we could use some form of vacuum system clubbed with a heat pump system which could recover up to 95% water in distilled form from waste effluents.

Our system does exactly the same; it works on principle of evaporation and condensation clubbed with a vacuum system to get distilled water. Typically, hot side of heat pump is connected to the evaporator coils inside a "vacuum evaporation chamber". Heat pump maintains the Freon gas's temperature in the evaporator coil at around 105°C to 110°C. Waste water is sprayed on the evaporator coils at a constant rate, if effluents are viscous in nature then they are stirred inside the vacuum chamber which is surrounded by evaporator coils. Water evaporates after getting in touch with hot coils and vapours are formed. Vapours are then sucked into a condensing chamber (condensing chamber is connected to the cooling side of heat pump) through blowers. Finally, the water gets condensed on the cooling coils and is drained out into a fresh water tank. The condensed water that we get is free soluble metals, oils, caustic minerals, chemicals and other impurities.

The wet slurry which is formed post evaporation is passed on to a dryer where we get powdered form waste, hence achieving 100% zero liquid and zero water discharge status. The Heat pump based effluent to distilled water convertor system finds application in Industrial & Commercial facilities like FMCG, Automotive - Paints shop applications & Industrial washing machines, Pharmaceutical - API & Formulation units, Textiles, Chemicals, Hotels, Hospitals, Luxury Resorts & Spas, Serviced Apartments, Residential Training centre's and many other types of facilities.

- **Advantages & Business impact of system**

- 60% -70% reductions in operating cost compared to the ETP, RO & ME setup
- Single stage unit with water recovery up to 95% in distilled form
- Concentrate can be converted in dry powder for easy disposal
- Average payback can be as attractive as 1 to 1.5 year
- Accelerated depreciation benefits up to 80%
- Higher manpower productivity
- Economic Life of ~15 years (As per ASHRAE)

Refer **Appendix - J** for Heat Pump Based Effluent to Distilled Water Convertor diagram.

7. Disposal Procedure for Used Catalyst in Reaction-

Used catalyst of sulphuric acid plant is sent to Mumbai Waste Management Ltd (MWML) for disposal at MPCB approved designated site at Taloja. Our organization is registered member of MWML. Mumbai Waste Management Ltd. is an approved agency by MPCB.

5.3 ANALYSIS OF ALTERNATIVE SITES

The proposed project by TDMCCL is an expansion project of existing commodity chemicals and speciality chemicals manufacturing set-up. Industry has sufficient infrastructure in existing unit for the same and hence no any alternative sites were considered.

Chapter 6

ENVIRONMENTAL MONITORING PROGRAM

6. 1 INTRODUCTION

With knowledge of baseline conditions, monitoring program will serve as an indicator for any deterioration in environmental conditions due to operation of the project. This will enable in taking up suitable steps, in time, to safeguard the environment. Monitoring is an important tool for control of pollution since efficiency of control measures can only be determined by monitoring.

In TDMCCL project, monitoring of various environmental parameters is being carried out on a regular basis for existing unit. Moreover, after expansion same would be continued to ascertain the following -

- State of pollution within the plant and in its vicinity
- Examine the efficiency of pollution control systems installed in the plant
- Generate data for predictive or corrective purposes in respect of pollution. The same could serve as basis for future impact assessment studies for project
- To verify the impacts predicated due to the proposed expansion project
- To identify the trends with time in the levels of parameters

Environmental monitoring after implementation of expansion project is important assess performance of pollution control equipments installed. The sampling and analysis of environmental attributes including monitoring locations will be as per the guidelines of the Central Board / State Pollution Control Board. Accordingly, environmental monitoring will be conducted on regular basis by TDMCCL to assess the pollution level in the plant as well in the surrounding area with the following objectives -

- To verify the impacts predicated due to the proposed expansion project
- To identify the trends with time in the levels of parameters
- To check or assess the efficiency of the various pollution controlling measures
- To ensure that new parameters, other than those identified in the impact assessment study, do not become critical through the commissioning of proposed expansion project
- Establish database for future impact assessment studies towards expansion projects

The details of proposed mitigation measures that have been suggested in order to achieve economic development due to the proposed expansion of TDMCCL project without harming the nature are as follow -

6. 2 ENVIRONMENTAL MONITORING PROGRAM DURING CONSTRUCTION PHASE

As discussed in chapter- 4, No construction of building would be required for expansion as most of infrastructure would be used from existing unit. Only work related to installation of equipments and machineries as required under proposed activities would be done on site for which local labors shall be used.Hence, no any impact on topography will envisaged due to proposed expansion activities.

6. 3 ENVIRONMENTAL MONITORING PROGRAM DURING THE POST CONSTRUCTION/ OPERATIONAL PHASE

During operational stage, continuous air emissions from boilers, wastewater disposal, non-hazardous waste, hazardous as spent chemicals used in process, used oily wastes are

expected. The following attributes which merit regular monitoring based on the environmental setting and nature of project activities are listed below -

- Source emissions and ambient air quality
- Ground water levels and ground water quality
- Water and waste water quality (water quality, effluent & sewage quality etc.)
- Solid and hazardous waste characterization (oily wastes, ETP sludge, used and waste oil);
- Soil quality
- Noise levels (equipment and machinery noise levels, occupational exposures and ambient noise levels)
- Ecological preservation and afforestation

6.3.1 Air Pollution Management

Apart from the ambient air and source monitoring during operation stage of TDMCCL project, following recommendations are also suggested -

- Air pollution control equipment would be interlocked with the process as per the guidelines of CPCB
- If the emissions exceed the standards, the corresponding units of the plant which are contributing the excessive pollutant load are stopped till the qualities of pollutant discharged from those units are brought down to the required level
- In case of failure of pollution control equipment, the production process connected to it would be stopped
- Under no circumstances, the emissions shall exceed the limits mentioned in the consent letter
- Online monitoring system would be installed under proposed expansion project
- In case of power failure, alternate electric source would be provided which would be sufficient to operate the APC equipment continuously.

6.3.2 Water Management

The total water requirement after expansion project would be **1592 m^3/day**. Out of which **220 m^3/day** treated effluent recycle whereas **1372 m^3/day** would be the **fresh water** taken from the MIDC water supply scheme. The MIDC procures water from Kundalika River and after treatment the same is provided to different industries in the MIDC. For detail water requirement refer Chapter - 2.

The effluent generated from existing activities is already handled and treated as per CREP guidelines. After commissioning of expansion activity same shall be handled and treated as per CREP guidelines. Refer Chapter - 2 for effluent generation and disposal. Salient features of the water management aspect are -

- The industry has provided effluent collection, treatment and disposal facilities. Proper operation and maintenance of same is done to achieve desired results.
- No untreated industrial effluent is allowed to be disposed off on land or in any surface water body.
- The pipeline and storage tanks meant for effluent conveyance and storage are checked periodically to avoid any leakages. Leakage, if any, will harm the surrounding soil and

water environment significantly. High Density Polyethylene (HDPE) & stainless steel are used as pipeline and valves material respectively.

- Flow meter is already installed at ETP inlet and Outlet to record the daily flow of the water. Same practice shall be followed under expansion activities.
- Pumps in the ETP are supplied with alternate electric supply source in case of power failure.

6.3.3 Noise Level Management

Vital aspects of the noise pollution and its mitigation measures are mentioned in Chapter - 4. Moreover, people working in close vicinity of high noise generating equipments would be provided with PPE such as ear plugs, ear muffs etc.

- Industry would take care while procuring major noise generating machines/ equipments to ensure that manufacturers have taken adequate measures to minimize generation of noise.
- Thick bushy trees would be planted in and around the industrial area to intercept noise transmission to the nearby villages.
- Allocation of work would be managed so that no worker would be exposed to noise more than 90 dB (A) for more than 8 hours.
- Creating awareness about noise pollution among the workers.
- The overall noise levels in and around the plant area would be kept well within the standards by providing noise control measures including acoustic hoods, silencers, enclosures etc. on all sources of noise generation.
- Monitoring shall include developing a sampling strategy to identify employees to be included in the hearing conservation program. Each employee being monitored shall be notified of the results. Employees may observe the monitoring by the Industry. The Industry shall establish and maintain an audiometric testing program that shall be performed by a qualified person at no cost to the employees.
- Record keeping will include maintaining audiometric test records by the industry for duration of the affected employment.

Table 6.1 Trees with Good Canopy for Noise Attenuation

No.	Scientific Name	Common Name	Habit	Ht (M)	Evergreen	Crown Shape
1.	*Azadirachtaindica*	Neem	Tree	20	Evergreen	Spreading
2.	*Alstoniascholaris*	Devil Tree	Tree	15	Evergreen	Round
3.	*Derris indica*	Karanj	Tree	10	Evergreen	Round
4.	*Anthocephalus indicus*	Kadamb	Tree	15	Evergreen	Round
5.	*Polyalthialongifolia*	Ashok	Tree	15	Evergreen	Conical/ Rounded
6.	*Butea monosperma*	Palas	Tree	10	Deciduous	Oblong / Ovoid
7.	*Ficusreligiosa*	Pipal	Tree	10-15	Evergreen	Round

6.3.4 Land Management

There are no chances of change in the soil characteristics due to air pollutants and suspended particulates from the proposed expansion activity. There would be no any discharge of untreated domestic or industrial effluent from proposed or existing activities.The solid and

hazardous waste is being stored in dedicated area provided on site. Same practice shall be adopted after expansion.

6.3.5 Dust Management

Trouble with dust in work zone and ambient atmospheres would be controlled in unit by certain dedicated measures. An action plan have been prepared and implemented in the existing unit that includes following. Same measures would be followed after expansion.

- Installation of appropriate, adequate and efficient exhaust and ventilation system to remove and control dust from work zone areas.
- Inlet and outlet of pollution control equipment shall be provided with necessary sampling arrangements as per guidelines of CPCB.
- Dust collected from the APC equipment will be properly handled and disposed off.
- APC equipment would be interlocked with process as per the guidelines of CPCB.
- PPEs such as masks, aprons, gloves, goggles etc. shall be provided to workers.
- Implementation of green belt of adequate density and type shall be made to control and attenuate dust transfer in premises.
- Provision of properly surfaced internal roads and work premises (tarred and concrete) shall be made to curb dust generation and its suspension due to vehicular movement.

6.3.6 Odour Management

There are different odour sources in the industry.The raw materials& product storage places, process operations, loading/unloading sections etc. could give rise to smell nuisance. To abate the odour nuisance, following steps are being taken under existing unit-

- All the feed, loading & unloading pumps for products and raw materialsare fitted with mechanical seals instead of glands to reduce leakages.
- The products and raw materials loading & unloading area are provided with fumes extraction system comprising of circulation pump with blower and scrubber. The bulk storage tanks are connected to scrubber for taking care of fumes coming out from vent.
- Separate dispensing room wherein transferring of powered raw material is done.
- Adoption of Good management practices (GMPs).
- Arranging awareness and training camps for workers.
- Provision and use of PPEs like masks by everybody associated with odour prone areas.
- Installation of appropriate, adequate and efficient exhaust and ventilation system to remove and control odour from work zone areas.

6. 4 OPERATION CONTROL AND EQUIPMENT MAINTENANCE

All the equipments and machinery used would be maintained properly and would be kept clean. The quality of stack emission depends very much on the operating parameters of plant. Improper combustion of fuel in the boiler increases unburnt carbon particles in the exhaust flue gases therefore proper maintenance is an important factor. The lubricants used for various equipment and fuel-handling areas would contribute to the pollution aspect. It would be taken care of, at the source, by looking after possible spillage, drippings, leakage etc. in the plant.

6. 5 OCCUPATIONAL HEALTH & SAFETY MEASURES

The following measures are taken up by the existing unit -

- As per the requirement of Factory Act, there is provision made for of Occupational Health Centre (OHC). There under, a qualified visiting doctor has been appointed.
- Regular medical checkup of employees is carried out and records are maintained.
- An ambulance is available all the time i.e. 24X7.
- Workmen Compensation Policy and / or Public Liability Insurance as well as Mediclaim Health Policy have been done for all the workers (temporary and permanent) in the Industry and which is renewed every year.

Following measures shall be taken under proposed expansion activity -

- Infrastructure of existing Occupational Health Centre shall be enhanced in order to provide medical facilities to all the workers as well as nearby village/town people.
- An ambulance shall be available all the time i.e. 24 x 7 will be used.
- Regular medical check-up of newly employed workers under expansion shall also be done and record shall be maintained.
- Provision of Workmen Compensation Policy as well as Mediclaim Health Policy shall be done for workers under expansion (temporary & permanent) and shall be renewed every year.
- Display of sigh boards in hazard areas in local language.
- Provision of PPEs to all workers.

Following equipment and gadgets have been kept in the OHC of TDMCCL.

Table 6.2 Health Care Facility Equipment

Sr. No.	Instrument	Use
1.	Stethoscope	Used to hear sounds from movements within the body, like heart beats, intestinal movement, breath sounds etc.
2.	Reflex testing hammer (padded)	To test motor reflexes of the body
3.	Sphygmomanometer (Blood pressure meter)	To record the patient's blood pressure
4.	A thin beam electric torch	To see into the eye, body's natural orifices etc. and to test for pupillary light reflex etc.
5.	A watch / stopwatch	Used in recording rates like heart rate, respiratory rate, etc.; for certain tests of hearing
6.	A measuring tape	For size measurements
7.	A weighing machine	To record the weight
8.	Tuning forks	To test for deafness and to categorize it
9.	Kidney dish	As a tray for instruments, gauze, tissue etc.
10.	Thermometer	To record the body temperature
11.	Gas cylinders	Supply of oxygen, nitrous oxide, carbon dioxide etc.
12.	Oxygen mask or tubes	Delivering gases up to the nostrils to assist in oxygen intake or to administer aerosolized or gaseous drugs

Sr. No.	Instrument	Use
13.	Vaporizer	To produce vapours
14.	Instrument sterilizers	Used to sterilize instruments in absence of an autoclave
15.	Dressing drums	Storage of gowns, cotton, linen etc.
16.	Syringe of different sizes and needles	For injections and aspiration of blood or fluid from the body
17.	Otoscope	To look into the external ear cavity

6. 6 MEASURES FOR SOCIO-ECONOMIC DEVELOPMENT

6.6.1 Better Employment Opportunities

In order to run existing and expansion project, 210 nos. manpower are required.Out of which 75 % are employed from local populace.

6.6.2 Corporate Environment Responsibility (CER) Plan

- The planning for CER shall be started with the identification of the activities/projects and may be undertaken in the periphery of Industrial area.
- Corporate Environment Responsibility Action Plan shall be prepared based on the casual approach to the project; based accountability approach, integrated with the social and environment concerns related to the business of the integrated project complex.
- Selection of activities under CER shall be made to ensure that the benefits reach the smallest unit i.e. village, panchayat, block or district. CER planning shall be done for long-term sustainable approach.
- Long term CER plan should be broken down into medium term and short term plans. Each of these plans shall clearly specify.

6.6.2.1 List of Activities to be undertaken for Corporate Environment Responsibility (CER) Planning

Rs. 25.00 Lakhs (2.5 % of Capital Investment - Rs.10.00Crs.) have been earmarked for CER activities. Activities to be undertaken under CER have been considered based on SE survey conducted in the study area.

Table 6.3 Budgetary Allocation

Sr. No.	CER Activity	Details	Total Amount Rs. (In Lakhs)
1.	Provision for Environment awareness campaign & Conservation of the ecology and biodiversity	For creating environment awareness in locals; particularly youth generation and socially active members	**2.5**
2.	Tree Plantation and Maintenance (3 Villages: Landhar, Vaijnath and Tamhanshet)	No of Trees in villages = 5000 for 3 Years Cost of Tree Plantation/Village = **5 Lakhs** Total cost of Tree Plantation in 3	**15**

Sr. No.	CER Activity	Details	Total Amount Rs. (In Lakhs)
		villages= Rs. 5 Lakhs / Village x 3 = **15 Lakhs**	
3.	Implementation of rain water harvesting	Roof Top Harvesting in 2 Villages Total 20 RWH Sets (500 Lit RCC Tank; Piping; Plumbing, Filter etc.) 20 RWH Sets x Rs. 25,000 / Set = **Rs. 5 Lakhs**	**5**
4.	Promotion of Government Missions (Central/State)	Participation & Promotion of Govt. Missions namely - Pradhanmantri Vidya Laxmi Karyekram (Literacy Promotion), Save the Girl Child, Swatch Bharat Abhiyan, Digital & Cash Less Economy etc.	**2.5**
		Total	**25**

For implementing the above mentioned CER plan, a CER committee will be formed in the industry. A senior official will be the chairman, environment officer will be the secretary and representatives from village grampanchayat will be the members. These activities shall be put in action and completed in a period of **3 years** after commissioning of project.

Table 6.4 CER Implementation Schedule

Sr. No.	CER Activity	Year 2019	Year 2020	Year 2021	Year of Completion
1.	Provision for Environment awareness campaign & Conservation of the ecology and biodiversity (2.5 Lakhs)	Rs.1.25 Lakhs	Rs.1.25 Lakhs	--	2020
2.	Tree Plantation and Maintenance (3 Villages: Landhar, Vaijnath and Tamhanshet) (15 Lakhs)	Rs.5 Lakhs	Rs.5 Lakhs	Rs.5 Lakhs	2021
3.	Implementation of rain water harvesting (5 Lakhs)	Rs.2.5 Lakhs	Rs.2.5 Lakhs	--	2020
4.	Promotion of Government Missions (Central/State) (2.5 Lakhs)	Rs.1.25 Lakhs	Rs.1.25 Lakhs	--	2020
Total		**Rs.10 Lakhs**	**Rs.10 Lakhs**	**Rs.5 Lakhs**	**Rs.25 Lakhs**

6.6.2.2 Measures for Improvement of Ecology

Following steps would be taken -

- Afforestation program under proposed program
- Keeping noise levels under control at night time
- Operation of APC equipments and sufficient height of stacks
- Provision of appropriate effluent treatment facilities

- **General Guidelines**

1. Green belt of adequate width and density would be provided to mitigate the effects of noise.
2. Plantation activities shall be done according to naturally occurring vegetation. Exotic species shall be avoided.
3. Provision of shrubs and thick trees at storage and disposal places of the solid waste would be made.
4. Additional trees would be planted along the roads, around solid waste storage area as well as along the periphery**.**
5. All the necessary steps would be taken & care would be observed under the project regarding proper maintenance of the industrial premises.
6. Use of e-mail and other modern communication systems would be followed to conserve the papers and attain speedy interaction in daily business activitiesor Use of recyclable papers, if possible, would be done.
7. Promoting measures of energy and water conservation, wherever possible, would be adopted.
8. Activities like slide shows or expert's lectures on Local Biodiversity shall be arranged for the staff to make them aware about the plant and animal species found nearby; also it will reduce unnecessary human-wild conflict. This will eventually reduce the damage to biodiversity by the employees.

6. 7 ENVIRONMENTAL MONITORING PROGRAM SCHEDULE

In the proposed expansion unit, monitoring in respect of air, water and noise would be done regularly and records of same would be maintained.The routine monitoring program, as detailed in **Table No.6.5,** would be implemented at site.

Table 6.5 Environmental Monitoring During Project Operation Stage

Sr. No.	Attribute	Location	Parameters for Monitoring	Frequency of Monitoring	Person Responsible	Conducted By
1.	Air Emissions	Ambient Air Quality (AAQ) Upwind-1 & Downwind-2 (Near Main Gate, Near Boiler House, Near Godown)	PM_{10}, $PM_{2.5}$, SO_2, NO_X, CO, VOC, NH_3	Six Monthly or CPCB / MPCB requirement	Environmental Engineer	MoEFCC and NABL Approved External Laboratory
		AAQ Two Locations within the industrial premises.		Monthly or CPCB / MPCB requirement		
		Workzone Air Quality Monitoring in manufacturing blocks		Monthly or CPCB/MPCB norms		
2.	Stack Emissions	Boiler - 1 No. and TFH 1 No. and 3 DG Set	SO_2, SPM, NOx	Monthly		MoEFCC & NABL Approved Laboratory
3.	Noise	Ambient Noise - 4 villages within 5 Km from site Dhatav, Roth Bk., Killa, Bahe.	Spot Noise Level recording; Leq(n), Leq(d), Leq(dn)	Six Monthly or CPCB / MPCB requirement	Environmental Engineer	MoEFCC and NABL Approved External Laboratory.
		Ambient Noise Locations within the industrial premises -		Monthly		
		Workzone Noise at areas - Boilers, Production Blocks, ETP, Recovery Plant.		Monthly		
4.	Effluents	ETP- (Treated & Untreated) 2 Nos. of Samples	PH, TSS, TDS, BOD, COD, Chlorides, Sulphates, Oil &Grease IS10500	Monthly	Environmental Engineer	MoEFCC and NABL Approved External Laboratory.
5.	Drinking water	Factory canteen	Parameters as per drinking water Std	Monthly	--	MoEFCC & NABL Approved lab

Sr. No.	Attribute	Location	Parameters for Monitoring	Frequency of Monitoring	Person Responsible	Conducted By
6.	Water Quality (Ground Water & Surface Water)	Locations in Study Area are- Ground Water (GW): Roth Bk., Dhatav. Surface Water (SW): Mahadevwadi., Roth Bk.	Comprehensive monitoring as per IS 10500	Six Monthly or CPCB / MPCB requirement	Environmental Engineer	MoEFCC and NABL Approved External Laboratory.
7.	Waste management	Implement waste management plan that Identifies and characterizes every waste associated with existing and expansion activities and which identifies the procedures for collection, handling & disposal of each waste arising.	Records of Solid Waste Generation, Treatment and Disposal shall be maintained	Twice a year	Environmental Engineer	By TDMCCL
8.	Emergency Preparedness such as fire fighting	Fire protection and safety measures to take care of fire and explosion hazards, to be assessed and steps taken for their prevention.	On site Emergency Plan, Evacuation Plan, fire fighting mock drills	Twice a year	Safety Officer	By TDMCCL
9.	Green Belt	Additional Plantation of indigenous trees in premises along compound wall, internal roads, buildings as well as nearby villages.	Survival rate of planted sapling	In consultation with DFO	Environmental Engineer/ Safety Officer	By TDMCCL
10.	Health Check up	Employees and migrant labor health check ups	All relevant health checkup parameters as per factories act.	Once in a Year	Safety Officer	By TDMCCL
11	CER	As per activities	--	Twice a year	--	By TDMCCL

6. 8 IMPLEMENTATION SCHEDULE FOR ENVIRONMENTAL MANAGEMENT ASPECTS

The mitigation measures suggested in **Chapter - 4** i.e. Anticipated Environment & Mitigation measures will be implemented so as to reduce the impact on environment due to the operations of the proposed expansion plant. In order to facilitate easy implementation of mitigation measures, the phased priority of implementation is given in below table -

Table 6.6 Implementation of Environmental Monitoring Program

Sr. No	Attribute Time Period		Implementation Schedule	
			Immediate	Progressive
1.	Air Pollution Control	Before commissioning of the Plant	*	----
2.	Water Pollution Control	Before commissioning of the Plant	*	----
3.	Noise Control	Before commissioning of the Plant	*	----
4.	Solid Waste Management	Stage wise	----	*
5.	Green Belt Development & Rainwater Harvesting	Stage wise	*	*
6.	Ecological Aspects	Stage wise	----	*
7.	Socio - economic Aspects	Stage wise	----	----

Note-* indicates implementation priority.

6. 9 ENVIRONMENTAL MANAGEMENT PLAN FOR WORST SCENARIOS

6.9.1 Operating Phase

The impacts and mitigation measures are discussed in Chapter-4. The details of management plan during worst case scenario are given in following table -

Table 6.7 The Details of Management Plan During Worst Case Scenario

No.	Aspect	Scenario	Recommendations	Responsibility
1.	Air	Increase in concentration levels of PM_{10} & $PM_{2.5}$ beyond limits due to non-functioning of APC due to clogging / burning of filters bag.	1. Installation of online monitoring system and continuous checking of parameters 2. Provision of backup filter bags. 3. Provision of D.G. Set for uninterrupted power supply in case of power failure for operation of APC continuously. 4. Immediate shut down of the industry should be taken if APC is under maintenance for more than 8 hours. Manufacturing would be started only when APC is operating efficiently. 5. Immediate vicinity residents, schools & hospital should be warned of	Environmental Engineer

No.	Aspect	Scenario	Recommendations	Responsibility
			uncontrolled release of air emissions. They should be informed of precautions to be taken. 6. Plantation of trees which can curb dust emissions.	
2.	Water	Accidental discharge of untreated effluent into nearby nallah and the discharge of same from nallah to Kundalika river, leakages, spillages	1. Installation of online monitoring system and continuous checking of outlet parameters 2. Provision of separate guard tank for collecting the contaminated water from nallah due to accidental discharge of effluent. 3. The contaminated water would be treated in ETP to be provided on site. 4. If the quantum of contaminated effluent is beyond control then immediate shut down of the industry should be taken. The collected water from nallah/river would be stored and treated in ETP. The treated water would be discharged in nearby nallah. 5. Provision of additional pumps in working condition on site 6. Immediate vicinity residents, schools & hospital should be warned about contamination of nallah and surface water. They should be informed of precautions to be taken.	Environmental Engineer
3.	Risk and Hazard	Liquid spills, leakages of chemicals or leakages of harmful fumes into the atmosphere, Spillages of hazardous chemicals. Bursting of reactors under high pressure and temperature. Accidental disaster in industry causing impact on human and surrounding	1. Provision of fire extinguishers. 2. Availability of Safety equipments, PPEs. 3. Immediate shut down of the industry should be taken in case of uncontrolled release of emissions or fumes or hazardous chemicals spills. 4. Immediate vicinity residents, schools & hospital should be warned about release of hazardous fumes and spillages of chemicals. They should be informed about precautions to be taken. 5. Periodic monitoring of all the safety equipments and also check the availability and working condition of the same.	Safety Officer
4.	Noise	Continuous exposure of workers in high noise generating area (more than eight hours)	1. Inspecting use of PPEs like earplugs, earmuffs and other allied equipments by workers. 2. Periodic verification of working condition of acoustic enclosures 3. Responsibility of safety officer to check whether any worker is exposed in high noise generation area for more	Safety Officer

No.	Aspect	Scenario	Recommendations	Responsibility
			than the limit. 4. Planning and designing of dense green belt surrounding the boiler and production area which will help in attenuating noise.	

In addition to above management plan, the industry shall conduct monthly meeting of all responsible persons along with top management for taking review on environmental safeguards, accidents and implementation of mitigation measures. The persons who shall be present for the meeting are Top Management, Departmental Heads, Safety Officer, Environment Officer, Environment Chemist or any authorized person. During this, finalization of budget required for environmental management would also be done and approval of same would be taken from top management. The agenda of meeting would be as follows -

1. Review of environmental permissions and their renewals.
2. Review of preventive maintenance of all equipments like pumps, ID fans, APC, ETP units etc.
3. Review of air emissions and ETP outlet monitoring results.
4. Review of status of mitigation measures suggested.
5. Review of wastes disposed off outside Industry.
6. Review of accidents occurred and damage caused to environment.
7. Allocation of funds for environment management.
8. Status of implementation of CER plan.
9. Review of complaints if any from nearby residents, government authority etc.
10. Review of root cause analysis done and action taken on earlier complaints.
11. Review of actions pending from earlier meeting.

Chapter 7

ADDITIONAL STUDIES

7.1 PUBLIC CONSULTATION

The proposed project site is situated in MIDC Industrial Area, P.O. Dhatav, Taluka: Roha. Hence, as per Environmental Impact Assessment (EIA) Notification No.S.O.1533 (E) dated 14th September 2006; and amendment thereat, the proposed project does not requires conducting of public hearing. The EIA report has been complied by incorporating required information with regards to the project as mentioned in the Standard Terms of Reference (ToR) issued by MoEFCC, New Delhi vide letter No. IA-J-11011/74/2018-IA-II (I) to TDMCCL on 3rd May 2018.

7.2 RISK ASSESSMENT

The techniques of risk impact analysis differ in detail from case to case, but nevertheless always follow the same basic principles, viz. the identification of a full and representative set of failure cases which could cause major disasters. Determination of geographical area in which more than a specified level of damage could occur in each failure case. Each of these steps involves considerable analysis. The Preliminary Hazard Analysis (PHA) is performed as the first step in a Hazard Assessment. It starts with the type of accident involving toxic, flammable, explosive material. The procedure specifies system elements (plant components such as storage tank) or event (overloading of a tank) that can lead to a hazardous condition.

The proposed expansion of commodity chemicals and speciality chemicals must be undertaken and implemented by the management of **The Dharamsi Morarji Chemical Company Limited (TDMCCL)** in their own premises. The risk assessment and hazards management (RH) was done by **Prof. (Dr.) Bhaskar N. Thorat** who is an empanelled EEIPL's Functional Area Expert (FAE) for RH. The proposed project must be formulated in such a fashion and manner, so that utmost care of safety norms and Environment Protection Act shall be taken care of.

7.3 BRIEF DESCRIPTION REGARDING PROJECT

TDMCCL management has planned to go for an expansion of existing commodity chemicals and speciality chemicals manufacturing unit. It involves number of equipments like reactors, condensers and distillation columns. The process types are mainly of Sulphonation, Chlorosulphonation, Hydrolysis, Diazotization, Dehydration, Condensation & catalytic reactions. The process involves solvents like Methyl Alcohol, Ethyl Alcohol, Benzene, Chlorobenzene, Xylene etc.

7.4 OBJECTIVE OF THE RISK ASSESSMENT AND HAZARDS MANAGEMENT

1. Identify hazards and nature of hazard in the process, storage and handling of hazardous chemicals.
2. Carry out Qualitative risk analysis for the process and suggest mitigation measures.
3. Carry out Quantitative risk analysis of the storage of hazardous chemicals and estimate the threat zones for Most Credible and Worst case scenarios.
4. Suggest mitigation measures to reduce the risk / probability of the accident to the minimum.
5. Incorporate these measures for ensuring safe operations and safe layout and for effective preparation of On-site and Off-site emergency plans.
6. Suggest Guidelines for On-site and Off-site emergency plan.

7.5 METHODOLOGY

A] Identify hazards based on

- Processes description received based
- Identify Hazardous Chemicals handled and stored
- Inventory of Hazardous chemicals
- Proposed storage facilities for hazardous chemicals
- Plant layout
- Safety measures to be adopted by the company

B] Hazard Assessment

- By Qualitative Risk Assessment
- By Quantitative Risk Assessment by Hazard Index calculations and estimate threat zones by using ALOHA (Areal Locations of Hazardous Atmospheres)

C] Recommendations

- Recommend mitigation measures based upon the above
- Recommending guidelines for the preparation of On-site Emergency plan

7.6 HAZARD IDENTIFICATION

Following are the major areas of hazard identified -

1. Reaction and separation sections of production plant
2. The storage and handling of hazardous raw materials
3. Handling of the materials or the process equipment by the operator or worker
4. Transportation of the products and raw materials

7.6.1 Classification of Chemicals

In a Chemical Industry for PHA, classification of different chemicals to be used based on their properties is an important factor. The classification of chemicals to be used by TDMCCL is presented in following table -

Table 7.1 Classification of Chemicals

Sr. No.	Group of Chemicals	Chemical used in TDMCCL	Handling	Spill	Storage
1.	Flammable Chemicals	1. Acetyl Chloride 2. Mesitylene 3. N-Butyl Amine 4. Benzene 5. Chlorobenzene 6. Ethyl Alcohol 7. Methyl Alcohol 8. Xylene 9. Red Phosphorus	1. Keep container dry 2. Keep away from heat 3. Keep away from sources of ignition 4. Keep away	1. Absorb with an inert material and put the spilled material in an appropriate waste disposal 2. Absorb with DRY earth, sand or other non-	1. Store in a segregated and approved area 2. Keep container in a cool, well-ventilated area 3. Avoid all possible sources of

Sr. No.	Group of Chemicals	Chemical used in TDMCCL	Handling	Spill	Storage
		10. Sulphur precipitated	from incompatibles such as oxidizing agents, alkalis, moisture, acids, metals 5. Keep away from direct sunlight or strong incandescent light 6. Avoid contact with skin and eyes 7. Avoid shock and friction 8. Do not breathe gas / fumes / vapor / spray 9. Do not ingest 10. In case of insufficient ventilation, wear suitable respiratory equipment 11. Never add water to this product 12. Empty containers pose a fire risk, evaporate the residue under a fume hood	combustible material 3. Do not touch spilled material 4. Use water spray curtain to divert vapor drift 5. Prevent entry into sewers, basements or confined areas; dike if needed 6. Eliminate all ignition sources 7. Use appropriate tools to put the spilled solid in a convenient waste disposal container 8. Be careful that the product is not present at a concentration level above TLV 9. Call for assistance on disposal	ignition (spark or flame) 4. Keep container tightly closed and sealed until ready for use 5. Flammable materials must be stored in a separate safety storage cabinet or room 6. Corrosive materials must be stored in a separate safety storage cabinet or room 7. Store in a metallic or coated fiberboard drum using a strong polyethylene inner package 8. Store in light-resistant containers 9. Do not store above 23°C 10. Do not store above 8°C in case of H_2O_2
2.	Corrosive Chemicals	1. Acetyl Chloride 2. Benzene Sulphonyl Chloride 3. Chlorosulphonic Acid 4. Hydrochloric Acid 30 % 5. Hydrochloric Acid 6. Hydrogen Peroxide 7. Lactic Acid 8. N-Butyl Amine 9. Nitric Acid 70 % 10. Nitric Acid 30 % 11. Phosphorous Trichloride 12. Sulphur Trioxide 13. Sulphuric Acid 14. Thionyl Chloride 15. Aluminum Chloride 16. Calcium Hydroxide 17. Para Toluene Sulphonyl Chloride 18. Phenol 19. Phosphorous Pentoxide 20. Phthalic Anhydride 21. Sodium Hydroxide			

7.7 QUALITATIVE RISK ANALYSIS

7.7.1 REACTION AND SEPARATION SECTIONS OF PRODUCTION PLANT

The manufacturing processes are described earlier in the 2nd chapter. Basically these involve reactions like Sulphonation, Chlorosulphonation, Condensation, Oxidation, Quenching, Absorption, Recrystallization, Hydrolysis, Dehydration, Diazotization, Distillation and Recovery of solvents (used as reaction media), Un-reacted components, Neutralization, Purification of the product etc. In such commodity chemicals and specialty chemicals production plants, in the reaction section, separation sections are the major hazards. The

hazards identified are as -

1. Fire
2. Explosion and toxic release
3. Exposure to hazardous chemicals
4. Wrong operation
5. Failure of utilities and failure of safety systems

- **Hazard identification in Reaction Section**

Minimum risk is of most importance and this can be achieved by selecting an intrinsically safe process and optimizing operating process parameters near to the atmospheric conditions. But this is not possible most of the time. Hence, it is necessary to install safe guards and build in perfect operating procedure that will minimize chances of accident to the minimum. Also types of reaction taking place during the process are of prime importance. It may be exothermic or endothermic. The sulphonation reaction will be carried out predominately as most of the products are sulphur based. These reactions are hazardous. It is known that Sulphonation is highly exothermic reactions and even less exothermic reactions. Other than sulphonation various reactions are also involved in the production premises.

Refer **Appendix - K** for Process Hazard Analysis of BSCl plant, Process Hazard Analysis of DES plant and Process Hazard Analysis of SVS plant.

- **Major Hazard in Reactions**

It is known that highly exothermic reactions and even mildly exothermic reactions can lead to the uncontrollable rise in temperatures and pressures in the reactors and ultimately to the conditions of run-away reaction, (mostly in highly exothermic reactions and which use solvents as reaction media or and flammable and explosive chemicals) and this results in catastrophic explosion and fire.

- **Hazards Identified**

The major reason for occurrence of uncontrollable rise in temperature is accumulation of un-reacted reactants. This accumulation of un-reacted reactant has to be avoided at any cost.

- **Mitigation Measures**

- Setting up a Standard Operating Procedure (SOP) for all critical operations, reactions and separations.
- Once the SOP and operating parameters have been finalized, strictly following it, 24 x 7, particularly for batch operations without any change of procedure.
- Must have in built system to check that the procedures (SOPs) are not violated at any time and no short cuts are taken in batch processes. Manufacturing and production of commodity chemicals and speciality chemicals are in majority batch processes.
- Have following alarm and interlock system (essential for highly exothermic reactions and alarms recommended for all exothermic reactions).

1. Utility failure alarm
2. Agitator failure alarm
3. High temperature alarm

- Alarm for High rate of addition of limiting reactant which is added at controlled rate.
- Raw material (limiting reactant) addition rate must be controlled by flow control loop Flow Transmitter (FT), Flow Indicator Controller (FIC), Flow control valve (FCV). Controlling parameter being reactor temperature.
- FCV and / or On-Off valve must be interlocked with the reaction mass temperature and agitator tripping.

❖ **Hazards causes from leakages of gases during manufacturing process**

Release of hazardous or toxic gases like SO_3 fumes involving from storage of Oleum and sulphonation. The exposure to these gases can be harmful, in case of leakage, through flange joints to the workers in the plant and to the environment, if these are released into the atmosphere.

Table 7.2 TLV and IDLH values

Sr. No.	Chemical Name	Threshold limit value (TLV)	Immediately dangerous to Life or Health (IDLH)
1.	Sulphuric Acid	1 mg/m^3	15 mg/m^3
2.	Oleum 23%	0.2 mg/m^3	15 mg/m^3

➢ **Mitigation measures to control the leakages of gases**

1. Installation of efficient scrubbers / absorbers and ensuring proper operation as per design conditions.
2. The appropriate Personal Protective Equipments (PPEs) and breathing devices must be readily available and all the operators and staff must be trained in use of these PPEs.
3. Emergency instructions, in local languages must be displayed prominently near the work place.
4. It is also recommended to install gas leak detectors for highly toxic gases at appropriate locations.

7.8 STORAGE AND HANDLING OF HAZARDOUS RAW MATERIALS

7.8.1 Hazard Identification

This is another area of major concern for fire, explosion and exposure to and release of toxic liquids and gases and there is risk of persons, outside the factory limits getting affected.

➢ **The aim for RH analysis is -**

1. To identify the hazardous materials handled and stored at the plant site. Based on the hazardous properties, conditions of storage.
2. Quantify the hazards in case of major fire, explosion or toxic release by visualization of Maximum Credible Accident Scenarios.
3. Incorporate the results of QRA for safe layout of hazardous chemicals storage in tank

farm as well as in the warehouse and factory layout, in addition to the requirements of statutory rules and regulations.
4. Suggest mitigation measures to reduce the risk / possibility of the accident to the minimum.
5. Incorporate all these measures to arrive at Safe Disaster Management Plan, On-site and Off-site Emergency preparedness plan, if there is any possibility of off-site emergency. For storage and handling of the potentially hazardous material also.

- **Hazard Analysis and Risk Assessment**

Hazard analysis is the process of determining the release probabilities and quantities, emission or release rates, the routes / pathways by which the released substances could reach the receptors, the fate of the substances in environmental media through which they are transported or moved and the characteristics of the receptors at risk.

- **Characterization of Hazardous Raw Materials**

For the manufacture of above products number of organic / inorganic chemicals are used. Out of these, hazardous raw chemicals have been characterized into -

1. Flammable solvents
2. Toxic and hazardous chemicals
3. Corrosive chemicals

Products manufacturing under existing and proposed expansion activities involve handling of number of raw materials and hazardous chemicals. Raw materials required in less / small quantities are stored in drums, bags and carboys.

- **Warehouse Storage**

- **Hazard Identification**

Major hazards involved in storage of flammable liquids in the containers, like drums are Fires and vapour explosion due to leakage of liquids coming in contact with ignition source. The extent of a fire or explosion hazard depends on the amount of flammable vapour given off from a liquid which is determined by -

1. Temperature of the liquid
2. The volatility of the liquid
3. How long the liquid is exposed for; and the air movement over the surface

Other physical properties of the liquid give additional information on how vapour / air mixtures may develop and also on the potential hazards. These physical properties include - flashpoint, auto-ignition temperature, viscosity, lower explosion limit and upper explosion limit.

- **Effect of Flash Point**

Generally, a liquid with a flashpoint below the ambient temperature of the surroundings will give off sufficient vapour to mix with the air and be ignited. The lower the flashpoint of a liquid, the higher is the risk.

- **Health hazards**

Flammable liquids can pose a health hazard if they are ingested; come into contact with skin or eyes, or their vapours are inhaled. For example, **methanol is toxic as well as flammable**. Information on the health hazards of a particular liquid, and on any specific precautions required, must be obtained from the Material Safety Data Sheet (MSDS) or from the supplier.

- **Mitigation Measures**

The storage is as per the rules and regulations of Petroleum Act, The petroleum Rules 2002.

Lot of vegetation and growth of trees around the storage must be removed. The fencing around the tank needs to be relooked and can be reduced as per the rules. And there must be no growth of vegetation and trees inside the fencing.

7.8.2 Storage of Hazardous Chemicals

The Following solvents will be stored -

Table 7.3 List of Flammable solvents Stored in Warehouse

Sr. No.	Chemical Name	NF Value	Flammable Limit	Max. Qty. Stored	Drums	Number of Drums
1.	Benzene	3	Lower : 1.2 % Upper : 7.8 %	30 KL	NA	NA
2.	Chlorobenzene	3	Lower : 1.3 % Upper : 7.1 %	15 MT	NA	NA
3.	Ethyl Alcohol	3	Lower : 3.3 % Upper : 19 %	363 KL	NA	NA
4.	Methyl Alcohol	3	Lower : 6 % Upper : 36.5 %	1 KL	Yes	5
5.	Acetyl Chloride	3	Lower : 7.3 % Upper : NA	0.5 MT	Yes	5
6.	N-Butyl Amine	3	Lower : 1.7 % Upper : 9.8 %	0.5 MT	Yes	5

Refer **Appendix - L** for layout of Benzene storage tank and Ammonia storage tank.

Table 7.4 List of Solvents for proposed products and its storage on site

Sr. No.	Product Name	Solvent Name	Consumption (MT/Yr.)	Storage Tank Cap. (MT)
1.	4-Methyl Mercapto Acetophenone	O-Dichloro Benzene	72	4
2.	4,4-Dihydroxy Diphenyl Sulphone	Mono Ethylene Glycol	255	5
3.	4,4-Dihydroxy Diphenyl Sulphone	Mesitylene	180	5
4.	Menthyl Lactate	Heptane	36	3
5.	3,3-Diamino Diphenyl Sulphone	SDS	27	3

7.8.3 Main Hazards in Storage of Chemicals

The main hazards from the storage of flammable liquids are fire and explosion, involving either the liquid or the vapour given off from it. Fires or explosions are likely to occur when liquid or vapour is released and comes into contact with a suitable ignition source, or alternatively, when a heat or fire source comes into contact with the container.

- **Common causes or contributory factors of such incidents include**

1. Lack of awareness of the properties of flammable liquids
2. Operator error, due to lack of training
3. Inadequate or poor storage facilities
4. Hot work on or close to flammable liquid containers
5. Inadequate design, installation or maintenance of equipment
6. Decanting flammable liquids in unsuitable storage areas
7. Exposure to heat from a nearby fire
8. Dismantling or disposing of containers containing flammable liquids

- **Mitigation measures to avoid fire and explosion**

1. Proper and adequate training to the operators, contract works on the hazards and precautions SOP they must follow while handling and transferring flammable liquids. Making sure that they don't lose the fear of hazards involved in handling of flammable solvents and toxic chemicals and consequence of the accident.

2. **Maintenance and Modifications:** Many incidents involving flammable liquids occur during maintenance and repairs. The likelihood is increased if the work is done by staff or outside contractors who have little knowledge of the hazards associated with flammable liquids. You must only employ experienced contractors. A guide which gives sound practical advice for selecting and managing contractors must be used while employing a contractor.

3. **Hot Work Permit:** It is absolutely essential to establish Hot work permit system for any hot work to be carried out in the factory, especially in the areas which store flammable solvents of Class A and this must be strictly followed for any hot work carried out.

4. It is essential that no maintenance work is done until the potential hazards of the work have been clearly identified and assessed; the precautions needed have been specified in detail; the necessary safety equipment has been provided; and adequate and clear

instruction has been given to all those concerned.

5. In most cases, a permit-to-work (PTW) system must be used to control maintenance operations in areas where flammable liquids are stored or used. PTWs are formal management documents. They must only be issued by those with clearly assigned authority to do so and the requirements stated in them must be complied with before the permit is issued and the work covered by it is undertaken. Individual PTWs need to relate to clearly defined individual pieces of work. PTWs must normally include the location and nature of the work intended; identification of the hazards, including the residual hazards and those introduced by the work itself; the precautions necessary, for example, isolations; the personal protective equipment required; the proposed time and duration of the work; the limits of time for which the permit is valid; and the person in direct control of the work.

6. **Information and Training**: Adequate training and knowledge of the properties of flammable liquids are essential for their safe storage. You need to inform all staff on the site about the hazards of storing flammable liquids and about the need to exclude sources of ignition and heat from the designated storage areas. Those responsible for the operation of the store also need to receive specific training in how to deal with spillages and leaks, and emergency procedures.

7. **The VICES principles** - There are five general principles for ensuring that the risks of fire and explosion, from the storage of flammable liquids in containers, are controlled and minimized. An aid to remembering these five principles is the acronym 'VICES'. There is no order of priority of the principles implied by the use of the acronym.

   i. **Ventilation** - Good ventilation means vapours given off from a spill, leak, or release, will be rapidly dispersed. A good standard of ventilation is required in buildings or rooms used for storing flammable liquids, to disperse the vapours from any small releases. The ventilation arrangements need to take into account the heavy nature of the vapours and to ensure adequate air movement at high and low levels. Five air changes per hour are normally sufficient to ensure vapour levels in the store are kept to a low level. For small buildings, the simplest method of ensuring adequate ventilation is to provide fixed, permanent openings.

   ii. **Ignition** - Ignition sources will be removed from the storage area, by flame proof electrical fittings, no sparking by ensuring permit system during maintenance work, Declaration of ***No Smoking*** and ***No Naked Flame*** area will be followed.

   iii. **Containment** - Use of proper containers, providing spill kit, proper drainage of spillage to safe place, collection and recycle , Containers will be stored in at ground level (singly or in stacks). This enables leaks or releases to be quickly seen, and allows for any vapours to be dispersed effectively by natural ventilation.

   iv. **Exchange** - Substituting with less flammable liquid.

   v. **Separation** - Flammable liquids will be stored well away from other processes and general storage areas. If necessary the storage will be separated by a physical barrier, wall or partition.

8. Material Safety Data Sheet (MSDS) is maintained for each chemical to which workers are exposed in the facility; Instructions have been followed as per the MSDS for handling chemical and products.

9. Employees are trained for handing risks of each chemical being stored.

10. Spill cleanup kits have been provided in all areas where chemicals must be stored. A written down procedure have been formulated and training imparted to employee for spill control and cleaning.

11. Adequate and proper personal protective equipment have been provided and enforce to use while working.

12. All chemicals are stored safely and securely. Chemicals have been stored away from forklift traffic areas.

13. Drums / carboys of chemicals are stored in designated place in warehouse, separated by at least one meter and have been arranged based upon the compatibility / non compatibility properties. Provision of two gates for the warehouse is applied.

14. Sufficient fire extinguishers DCP Type & CO_2 Type & Foam Type have been provided inside the warehouse & at the entry.

15. No dispensing in storage area is allowed.

Periodic retraining will normally be required. The training must include the following aspects-

- The types of flammable liquid stored their properties and hazards
- Use of protective clothing
- Housekeeping.
- Reporting of faults and incidents, including minor leaks and spills
- Emergency procedures, including raising the alarm, calling the fire brigade and the use of appropriate fire-fighting equipment

Following are the major mitigation measures -

- Good Ventilation in the storage area
- No ignition source
- To be stored in good containers
- No spillage. Control of spillage
- Adequate separation from each other and other storage areas and process areas

7.8.4 Mitigation measures for storage of chemicals in warehouse

- **Warehouse Design**

Warehouse for the storage of chemicals in drums of the area must be constructed as per the **IS code 3594** and other relevant standards. Major points are from the code are given below -

1. Roadways around warehouse must be minimum 5 meters wide and compound gates minimum 4.5 m wide
2. Floor areas - Warehouse must be divided to have maximum 750 m^2 area by separating walls. Dimensions Length x Width not exceeding 40 meter
3. Floors must have 2 hrs. fire resistance
4. Buildings used for storage of hazardous and extra-hazardous goods must be preferably of single storied structure and in no case must exceed 2 stories in height
5. In no case must a storage building exceed 1S m in height
6. Floor Drainage - The floors must be of watertight construction and Scuppers of not less than 20 cm sq. cross sectional area must be provided at no more than 6 m intervals or as required to take care of maximum water discharge from hydrant / sprinkler system.
7. External Drainage - External drains of not less than 25 cm width and 30 cm depth must be provided along the side of each building and so constructed that any flow of water from the building be directed to a suitable ground tank or reservoir or public drainage system in the vicinity not leading to a natural water source. No external drainage of warehouses storing hazardous goods must be connected to public drainage system which leads directly to a natural water source.
8. Every storage / warehouse building must have a minimum of two exit doorways, and at the rate of one exit doorway per every 30 m length of the external walls of the building.
9. The means of exit as well as the exit ways, travel distances, etc. must be as per the guidelines given in IS 1641:1988. If used for storage of hazardous goods, it must conform to Type I of IS 1642:1989.

- **Additional measures for improving Warehouse Safety**

  Measures for improvement in the design of warehouse -

1. Dividing warehouse into fire compartments, by suitably designed firewalls, to limit the spread of fire.
2. Limiting the quantity of hazardous chemicals stored.
3. It is safe practice to store explosive, self igniting, oxidizing and organic peroxides separately, preferably in different compartments.
4. Storage of chemicals must be planned by categorizing these based on their hazardous properties, like toxicity, flammability, explosibility for which MSDS needs to be critically studied.
5. Based on the above, proper segregation of materials must be achieved.
6. Installation of smoke, fire and toxic gas leak detectors.
7. It must be easily possible to reach and attend toxic chemical leakage.
8. There must be enough space, and pathways for easy approach and escape.
9. Having all flameproof fittings inside the warehouse.

Adequate fire fighting arrangements inside the ware house and fire hydrant line is available. Fire hydrant layout is appended at **Appendix - M**

7.8.5 Storage of Toxic Chemicals

Table 7.5 List of Toxic Chemicals (In drums and Warehouse)

Sr. No.	Chemical Name	NH Value	Max. Qty. Stored (MT)	Size of Container	No. of Containers
1.	Aluminum Chloride	3	0.5	50 L	10
2.	Para Toluene Sulphonyl Chloride	3	2.0	50 L	40
3.	Phenol	4	20	20 KL	1
4.	Phosphorous Pentoxide	3	0.5	50 L	10
5.	Phthalic Anhydride	3	25	50 Kg Bags	500
6.	Sodium Hydroxide	3	100	Tanker	5
7.	Sodium Nitrite	3	0.5	50 Kg Bags	10
8.	Acetyl Chloride	3	0.5	100 L	5
9.	Aniline	3	10	Tanker	1
10.	Chlorosulphonic Acid	3	60	Tanker	4
11.	Hydrochloric Acid	3	5.0	Tanker	1
12.	Lactic Acid	3	0.5	50 L	10
13.	Methane Sulphonic Acid 99 %	3	0.5	200 L Drums	2
14.	N-Butyl Amine	3	0.5	200 L Drums	3
15.	Nitric Acid 70 %	4	1.0	Tanker	1
16.	Phosphorous Trichloride	4	1.0	200 Lit GI Drums	5
17.	Sulphur Trioxide	3	1.0	Tanker	1
18.	Sulphuric Acid	3	10	Tanker	1
19.	Thionyl Chloride	4	0.5	200 Lit GI Drums	3

7.8.6 Storage of Acids and Alkalis

Table 7.6 List of Acids and Alkalis stored in Tanks/drums

Sr. No.	Chemical Name	Max Storage at Site	No. of Tanks	Size Diameter x Height / Length	MOC	Dyke Wall dimensions
1.	Ammonia	19.5 MT (9.75 + 9.75)	2	2.8 M x 2.5 M, St-1 & 2	MS	11.8 M x11.2 M x1.1M, St-1 & 2
2.	Benzene	60 KL (30+30)	2	2.65 M x 5.8 M, St-1 & 2	MS	10.2 M x 8 M x 0.65 M, St-1 & 2
3.	Sulphuric Acid	36000 MT (1200 +1200 1200)	3	10.5 M x 8 M St-1,2 &3	MS	990 M^3
4.	Oleum 23%	300 MT (150 +150)	2	3.5 M x 8 M, St1 & 2	MS	14.3 M x 11.2 M x 0.8M St -1 &2
5.	Oleum 65%	50 MT	1	3.3 M x 4 M	MS	39.8 M x 30 M x 0.8 M
6.	Chlorosulphonic Acid	195 MT (65 + 65+65)	3	2.4 M x 4.1 M 3 No	MS	8 M x 5.4 M x 0.8 M, St-1 &2 (CSA Plant) 6.8 M x 4.5 M x 1.25 M, St-3 (BSCl Plant)
7.	Sulphur Trioxide	29 MT (9.7 + 5.3 + 14)	3	1.8 M x 2.5 M, St (CSA Plant) 1.5 M x 3 M, St (DES Plant) 1.2 M x 6 M, St (SVS Plant)	MS	NA

Sr. No.	Chemical Name	Max Storage at Site	No. of Tanks	Size Diameter x Height / Length	MOC	Dyke Wall dimensions
8.	SDS (Alcohol)	363 KL (100 + 263)	2	2.7 M x 3.5 M, St-1 3.5 M x 5.5 M, St-2	MS	13.6 M x 20 M x 0.85M, St-1 & 2
9.	Caustic Lye	96 MT (13+13+35+35)	4	1.5 M x 5.22 M, ST-1 &2 (SVS Plant) 2.3 M x 6 M, St-3 (SVS Plant) 2.5M x 7.8 M, St (SA Plant)	MS	7.2 M x 5.3M x 0.4M, St1 & 2 (SVS Plant) 7 M x 4 M x 0.8 M St-3 (SVS Plant) 5.3 M x 8.7 M x 0.3 M ST (SA Plant)
10.	Hydrochloric Acid	118 KL (11+15+12+40+40)	5	2.4 M x 2.5 M St-1 (BSCL Plant) 3.1 M x 2.5 M, St-2 BSCL Plant) 3.1 M x 2 M, st-3 (BSCL Plant) 5.2 M x 6 M, St-1 & 2 (CSA Plant)	PP FRP	3.6 M x 5.2 M x1.25 M, St-1(BSCl Plant) 10.3 M x 6.2 M x1.25M, St-2 & 3 (BSCl Plant) 5.1M x 7.2 M x1.3 M, St-1 & 2 (CSA Plant)
11.	Aniline	12 MT	1	2.2 M x 3.96 M	MS	3.5 M x 6.8 M x 0.61 M
12.	Monochlorobenzene	11 MT	1	1.98 M x 3.05M	MS	2.6 M x 5.2 M x 0.85M
13.	Benzene Sulphonyl Chloride	130 KL (10+20+20+40+40)	5	2.1M x 3 M, S-1 2.5 M X 4.2 M St-2 &3 3.2 M X 5 M, St-4 &5	PP FRP	3.8 M x 5.2 M x 0.7M, St-1 10.8 M x 6.2 M x1 M, St2 &3 7.3 M x19.3M x 0.7 M, St-4& 5
14.	Diethyl Sulphate	104 MT (19.5+19.5+15+50)	4	2.6 M x 5.9 M , St 1 & 2 2.55 M x 3.8 M, St-3 3.8 M x 5 M, St -4	PP FRP	11 M x 8 M x 0.2 M, St-1,2 &3 6.7 M x 5.2 M x 0.85 M, St-4
15.	Sodium Vinyl Sulphonate	104 KL (17+6+29.15+30+21.26)	5	3.5 M x 3 M, St-1 2 M x 2 M, St-2 3.5 M x 3 M, St-3 2.8 M x 4 M, St-4 3.4 M x 5.9 M, St-5	PP FRP	3.4 M x 12 M x 0.75 M, St 1 &2 5.7 M x12 M x 0.75 M, St-3 6 M x14.4 M x1 M, St-4 & 5

All the tanks are surrounded by Dyke walls.

7.8.7 Handling of the Materials / Process Equipment

List of equipments may be referred in **Chapter - 2.**

Safety measures adopted during handling of hazardous chemicals/equipments are as follows -

A. Care during Handling, Use and Storage of Hydrochloric Acid -

- **Hazard Identification**

Leakage HCL storage tank particularly will cause serious environment pollution problem and may harm the workers in the factory, as TLV for HCL gas is = 3-5 ppm only.

- **Mitigation Measures**

Following mitigation measures are suggested to minimize possibility of major leak from HCL tank and air pollution in particular. But these are applicable and relevant for all acid storage tanks.

HCL storage tank leakage can create serious risks, not only to people on-site, but also to the emergency services, to the general public off-site and to the environment. The greatest risk of significant harm is a large spill or leak from tanks or pipe work or associated plant. The main causes of such incidents include -

1. Failure to detect corrosion and replace corroded components
2. Damage caused by the impact of vehicles or other objects
3. Overfilling
4. Small spills and leaks can produce serious injuries if people come into contact with the liquid or inhale the fumes. Minor incidents can develop into major incidents if prompt emergency action is not taken.
5. The basic aim to suggest mitigation measures is to minimize the likelihood of a spillage; reduce the consequences of such an incident, particularly with regard to people and the environment.

- **Location of the tank**

When selecting the location of acid storage tanks, the consideration must be given to the distance of the proposed tank farm from -

1. The site boundary
2. Roadways and site thoroughfares
3. Occupied buildings
4. Storage or processing of other dangerous substances particularly incompatible substances such as strong alkalis and oxidising agents; water courses and boreholes.

The tanks are aboveground and must be installed on the foundation (and the supports for horizontal tanks). These must normally be of concrete with the required load bearing strength and thickness.

- **Dyke walls**

The tanks must be covered with the dyke walls. The purpose of the dyke wall is to -

1. Prevent the liquid entering drainage or other water systems.
2. Prevent the spread of the liquid which could present a hazard to other plant or personnel both on and off site.
3. Prevent contamination of land.
4. Allow the controlled recovery or treatment of the spilled material.
5. The dyke walls and floor must be constructed of materials resistant to the acid being stored. Acid resistant tiles are available and bricks and cement can be faced with acid resistant coatings. Coatings will require maintenance and regular renewal. The choice of materials will depend on the acid itself, its concentration and temperature.
6. The bund must have sufficient capacity to contain the largest predictable spillage. A bund capacity of 110% of the capacity of the largest storage vessel within the bund will normally be sufficient. Consideration must be given to the provision of individual dyke walls for each acid tank to prevent damage to other tanks if a leak occurs. Chemicals which react with the acid must not share the same bund.
7. The dyke walls must have sufficient strength to contain an acid spill.
8. Rainwater must not be allowed to accumulate in the bund.
9. Provision must be made for the removal of bund contents. (e.g. acid spills or rainwater)
10. These can be, providing a sump. And a manually controlled sump pump, must be provided. Bund liquids must be analyzed as necessary before removal or disposal to prevent contamination of drainage systems.
11. If a drain valve is used it must be kept locked in the closed position and only used by authorised personnel. The drain valve and any associated piping must be made of materials compatible with the acid stored.

- **Vents and Overflow lines of the storage tank**

1. Atmospheric tanks must have separate vent and overflow lines. The overflow must be sized to prevent any pressure build up within the tank in the event of an overfill. The overflow diameter must be equal to or greater than the inlet diameter. Normally, the overflow is at least 100 mm (4 inches) in diameter and at least 350 mm below the vent base. It must terminate as close to the ground as possible within the bund or other contained area. To prevent fuming, a dip leg and small water lute can be used.
2. To prevent release of fumes into the atmosphere, vent lines of bulk acid tanks must feed into a scrubber unit. The scrubber must be designed to cope with the fumes given off and the pressures generated during the filling of the tank. The scrubber must be so designed that HCL fumes escaping must be within the norms set by the statutory authorities.
3. Water, sodium hydroxide solution or dilute acid solution can be used as the scrubbing medium. Provision must be made to monitor the pH of the scrubbing solutions.
4. **Piping:** While designing the piping and piping routing it is advisable to have minimum flange joints. The line must be so routed to avoid walkways and joints over the walk ways.
5. All pipe lines of acid, being of High Density Polyethylene (HDPE) MOC, must be protected against foreseeable impact from vehicles or mobile plant.

B. Care during Handling, Use and Storage of Sulphuric Acid -

➢ **Mitigation Measures**

- **Dyke walls**

Spill Protection Good practice suggests that the storage tank must be provided with a retaining dike or other suitable secondary containment with a capacity of at least 110% of the capacity of the storage tank. Where the storage tank might be a part of a tank farm, the dike must normally be sized for at least 110% of the capacity of the largest tank in the tank farm. Diked areas are primarily intended for emergency containment of major leaks. The floor must be impervious and may have crushed limestone on top for neutralizing minor leaks must they occur. Suitable materials of construction must be concrete, concrete block, or similar materials, and could include polypropylene sheet linings or epoxy and polyester coatings. Provision must be made for removing any accumulated rainwater that is not dissipated through normal evaporation. The diking must be constructed to permit prompt recovery by pumping directly into tank cars or transports, flushing the residue with copious quantities of water to suitable treatment facilities in order to minimize personnel safety problems. See "Spill and Vapor Control" section for additional recommendations.

- **Safety Precautions for handling of Sulphuric Acid**

Sulphuric Acid can be handled and used safely by following proper precautions based on known effects of the chemical on personnel and equipment. Sulphuric acid is a very strong acid which can severely burn skin and eyes and may be fatal if swallowed. Fumes from sulfuric acid systems including SO_2, SO_3 and hydrogen are irritating and dangerous. They can injure the lungs and mucous membranes if inhaled.

- **Safety Clothing and Equipment**

The principal health hazard from sulphuric acid is through contact of the acid with body tissues, which can be severely burned, depending upon the length of contact and strength of acid. Adequate protection must be provided to persons working with sulfuric acid.

- **The personal protective equipment required for handling sulfuric acid**

1. Full face shield, hard hats, goggles and protective gloves are usually required during routine operations which involve the handling of sulfuric acid. (Never wear contact lenses when handling sulfuric acid)
2. Gloves must always be inspected prior to their use, and, if damage is suspected and not visible, they must be tested with air pressure. Special arm protectors or glove inserts can also be worn to prevent this from happening.
3. For full protection during tank car or transport unloading and during maintenance, each workman must be fully clothed. He must wear goggles under a full face shield, a hard hat, rubber safety boots, a rubber covered jacket and pants, and rubber gauntlet gloves. Tops of the boots must be covered by the trousers. For emergency situations, a complete rubber suit and rubber hood, with rubber gauntlet gloves and rubber safety boots, are recommended.
4. In situations where fumes or mist from sulfuric acid are present, a NIOSH approved respirator must be worn. Self-contained breathing equipment approved by NIOSH must

always be on hand and is required to be worn when working in areas of reduced oxygen content such as when servicing empty sulfuric acid tanks.
5. Protective clothing must be washed and preferably neutralized after each use and checked to insure that it is free of pinholes and tears.
6. The maintenance of all protective clothing and equipment must be a continuing operation to ensure their ready availability for use in an emergency.

- **First Aid**

1. **Bodily Contact** - Contaminated clothing must be removed under the shower and the application of water must be continued for at least 15 minutes. If burns can still be felt, consult a physician. Do not use burn ointments or alkali's as they may hinder further treatment. If acid enters the eyes, they must be washed thoroughly with water for at least 15 minutes. Consult a physician at once. If a physician is not immediately available, it is advisable to continue the irrigation for another 15 minutes.

2. **Ingestion** - In case of ingestion and if the individual is conscious, have him drink large amounts of lime water or milk of magnesia. If these are not readily available, drink large amounts of water immediately to dilute the acid. Consult a physician at once. Do not give emetics or baking soda. Inhalation if exposed to mist or vapors arising from sulfuric acid, the individual must be removed at once to an uncontaminated area and a physician called. The individual must be kept under observation until the possibility of developing a delayed pulmonary reaction is no longer present. If oxygen inhalation apparatus is available, oxygen may be administered under the direction of a physician.

3. **Safety Showers and Eyewash Fountains** - Continuous flow safety showers and eyewash fountains must be conveniently located and clearly marked. Their location and use must be known and understood by all personnel. Periodic inspections, preferably on a weekly basis, must be made to insure that they are in proper working order at all times. It is recommended they be equipped with both visible and audible alarms so that those in the areas are alerted when someone may need assistance. Water temperature must be approximately 27 °C (80 °F) to permit long periods of washing without adding to the victim's discomfort.

- **Showers and eyewash fountains must meet the following criteria**

1. Water must be in the form of a quick acting safety shower, protected against freezing, and installed wherever sulfuric acid is handled.
2. Showers must provide deluge water rather than spray.
3. Eyewash fountains must also be provided.
4. The pathways to these water supplies must always be kept free and clear.

- **Spill and Vapor Control Accidental spills of Sulphuric Acid**

Environmental effects resulting in damage to plant and animal life can occur from releases of sulfuric acid. Every effort must be taken to prevent discharge of this chemical into the environment. Regulatory and / or disaster control agencies must be notified, as may be applicable, of significant releases into the environment water, and neutralized with a lime slurry, limestone, soda ash or other alkaline material. Care must be taken when adding water or a neutralizer to a spill of sulfuric acid, as the chemical reaction will be immediate and can

be quite violent. Fumes from the reaction can be extensive and, if not handled properly, will add to the severity of the situation. To minimize the reaction and fuming, the spill can be covered with earth, sprayed with water and neutralized. The resulting slurry or residue can be removed and transferred to an approved disposal site. Any remaining material can then be further neutralized and flushed with water in accordance with local regulations. Major spills may be handled in a similar manner, however, special assistance and / or procedures may be required. In this case, evacuate the area, contain the spill or stop the leak if possible.

Refer **Appendix - N** for Hazard and Operability Study (HAZOP) study of Sulphuric Acid plant.

C. Care during Handling, Use and Storage of Thionyl Chloride -

With respect to Thionyl Chloride following precautions are special because of peculiar dangers for man and environmental. It reacts violently with water. Contact with water liberates toxic gas. Hence the drums of Thionyl Chloride are separately stored in a separate area which is not covered with sprinkler system and in water tight containers. Spill Kit and absorbing material used for removing the spill will be readily available in ample quantity. Workers controlling the spill wear proper PPEs to strictly avoid contact with skin, as this is very corrosive chemical. All other workers will evacuate the warehouse and / or area where the spill has occurred. Siren will be sounded and higher authorities will be informed to take necessary action. Actions to be taken in case of spill will form an important part of Onsite Emergency Plan and mock drill.

- **Mitigation Measures**

1. Thionyl Chloride reacts with water violently releasing toxic gases like SO_2. Hence drums will be stored in dry place and ensure that there is no water seepage or leakage etc. in the area where drums are stored.
2. Operator vigilance and frequent checking of drum quality and condition and installation of leak detectors is highly recommended.
3. Spill kits, recommended PPEs will be available all the time in sufficient quantities and in an easily accessible place. Only trained operators will deal with leakages and alert authorities.
4. No manual handling of even small quantities is recommended. If and when unavoidable, it will be ensured that all the precautions necessary against sudden failure of the container have been taken.
5. All necessary PPEs will be used while manually transferring of handling Thionyl Chloride.
6. Use local ventilation exhausts conditions, if not possible use breathing apparatus, recommended PPEs.
7. Workers need to be properly informed and trained to handle this.
8. As far as possible use suitable air operated pump to transfer Thionyl Chloride from the work place to the user end.
9. Eye and shower facilities must be installed at the nearest possible position and it must be ensured that it is always in working condition.
10. Spill kit must be kept handy to absorb small leaks and disposal.

7.9 QUANTITATIVE RISK ANALYSIS

7.9.1 National Fire Protection Association (NFPA) Rating

NFPA rating for raw materials are summarized in following table -

Table 7.7 NFPA Rating of Raw Material

Sr. No.	Name of Chemical	NH	NF	NR
1.	Aluminum Chloride	3	0	0
2.	Calcium Hydroxide	2	0	0
3.	Iron Metal	1	2	1
4.	Menthol	2	2	0
5.	Para Nitro Aniline	2	1	0
6.	Para Toluene Sulphonyl Chloride	3	1	2
7.	Phenol	4	2	0
8.	Phosphorous Pentoxide	3	0	2
9.	Phthalic Anhydride	3	1	0
10.	Potassium Carbonate	2	0	0
11.	Red Phosphorus	1	1	1
12.	Sodium Carbonate	2	0	1
13.	Sodium Hydroxide	3	0	1
14.	Sodium Nitrite	3	0	1
15.	Sulphur precipitated	2	1	0
16.	Urea	2	1	0
17.	Acetyl Chloride	3	3	2
18.	Aniline	3	2	0
19.	Benzene Sulphonyl Chloride	2	1	2
20.	Chlorosulphonic Acid	3	0	2
21.	Hydrochloric Acid	3	0	1
22.	Hydrochloric Acid 30 %	2	0	1
23.	Hydrogen Peroxide	2	0	1
24.	Lactic Acid	3	1	0
25.	Mesitylene	0	2	0
26.	Methane Sulphonic Acid 70 %	3	0	0
27.	N-Butyl Amine	3	3	0
28.	Nitric Acid 70 %	4	0	0
29.	Nitric Acid 30 %	3	0	1
30.	Phosphorous Trichloride	4	0	2
31.	Silicon oil	0	1	0
32.	Sulphur Trioxide	3	0	2
33.	Sulphuric Acid	3	0	2
34.	Thionyl Chloride	4	0	2
35.	Benzene	2	3	0
36.	Chlorobenzene	2	3	0
37.	Ethyl Alcohol	2	3	0
38.	Methyl Alcohol	1	3	0
39.	Xylene	2	3	0

Sr. No.	Name of Chemical	NH	NF	NR
40.	Sulphur Trioxide	3	0	2

Refer **Appendix - O** for MSDS of most hazardous chemicals.

7.9.2 Quantification of Hazards due to Storage of Hazardous Materials

Worst case scenarios for leakage / spillage of hazardous raw materials using ALOHA software are done. This is summarized in following table -

Table 7.8 Risk Assessment - Worst Case Scenarios and Mitigation Measures

Sr. No.	Raw Material	Scenario of Spillage/ Leakage	Area of Spread	Mitigation Measures
1.	**HCL (30 %)**	Evaporating Puddle	• **Red** : 166 meters --- (100 ppm = AEGL-3 [60 min]) • **Orange:** 516 meters --- (22 ppm = AEGL-2 [60 min]) • **Yellow:** 1.3 kilometers --- (7.5 mg/(cu m))	• **Small Spill**: Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. If necessary: Neutralize the residue with a dilute solution of sodium carbonate. • **Large Spill:** Corrosive liquid. Poisonous liquid. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Use water spray curtain to divert vapor drift. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Neutralize the residue with a dilute solution of sodium carbonate. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.
2.	**Oleum (65%)**	Evaporating Puddle	• **Red** : 534 meters --- (160 mg/(cu m) = AEGL-3 [60 min]) • **Orange** : 3.3	• **Spills and disposal:** Personnel handling this material should be thoroughly trained to handle spills and releases. In case of spills, dike by using absorbent or impervious materials such as sand or clay. Stop leakage if possible

Sr. No.	Raw Material	Scenario of Spillage/ Leakage	Area of Spread	Mitigation Measures
			kilometers ---- (8.7 mg/(cu m) = AEGL-2 [60 min]) • **Yellow**: greater than 10 kilometers ---- (0.2 mg/(cu m) = AEGL-1 [60 min])	without risk. Flush spilled area with water and neutralise the site with soda ash, sodium bicarbonate or lime. Do not allow it to contaminate the groundwater system. Waste must be disposed of in accordance with federal, state or local regulations, as applicable.
3.	**Chloro Benzene**	Leak from hole in horizontal cylindrical tank	• **Red** : less than 10 meters(10.9 yards) ---- (10.0 kW/(sq m) = potentially lethal within 60 sec) • **Orange**: less than 10 meters(10.9 yards) ---- (5.0 kW/(sq m) = 2nd degree burns within 60 sec) • **Yellow**: 15 meters ---- (2.0 kW/(sq m) = pain within 60 sec)	• **Small Spill:** Absorb with an inert material and put the spilled material in an appropriate waste disposal. • **Large Spill:** Flammable liquid. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.
4.	**Ethanol**	Leak from hole in vertical cylindrical tank	• **Red** : less than 10 meters(10.9 yards) ---- (10.0 kW/(sq m) = potentially lethal within 60 sec) • **Orange**: less than 10 meters(10.9 yards) ---- (5.0 kW/(sq m) = 2nd	• **Small Spill:** Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. • **Large Spill:** Flammable liquid. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent

Sr. No.	Raw Material	Scenario of Spillage/ Leakage	Area of Spread	Mitigation Measures
			degree burns within 60 sec) • **Yellow**: 11 meters --- (2.0 kW/(sq m) = pain within 60 sec)	entry into sewers, basements or confined areas; dike if needed. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.
5.	**Sulphur Trioxide**	Leak from hole in horizontal cylindrical tank	• **Red** : 298 meters --- (160 mg/(cu m) = AEGL-3 [60 min]) • **Orange**: 1.9 kilometers --- (8.7 mg/(cu m) = AEGL-2 [60 min]) • **Yellow**: greater than 10 kilometers --- (0.2 mg/(cu m) = AEGL-1 [60 min])	• **Small Spill**: Absorb with an inert material and put the spilled material in an appropriate waste disposal. • **Large Spill**: Corrosive liquid. Poisonous liquid. Stop leak if without risk. If the product is in its solid form: Use a shovel to put the material into a convenient waste disposal container. If the product is in its liquid form: Absorb with DRY earth, sand or other noncombustible material. Do not get water inside container. Absorb with an inert material and put the spilled material in an appropriate waste disposal. Do not touch spilled material. Use water spray curtain to divert vapor drift. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal.
6.	**Benzene**	Leak from hole in horizontal cylindrical tank	• **Red** : less than 10 meters(10.9 yards) --- (10.0 kW/(sq m) = potentially lethal within 60 sec) • **Orange**: less than 10 meters(10.9 yards) --- (5.0 kW/(sq m) = 2nd	• **Small Spill**: Absorb with an inert material and put the spilled material in an appropriate waste disposal. • **Large Spill**: Flammable liquid. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Be

Sr. No.	Raw Material	Scenario of Spillage/ Leakage	Area of Spread	Mitigation Measures
			degree burns within 60 sec) • **Yellow:** less than 10 meters(10.9 yards) --- (2.0 kW/(sq m) = pain within 60 sec)	careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Refer **Appendix - P** for severity mapping carried for hazardous chemicals.

➢ **Conclusions and Recommendations from QRA results**

Many of the following mitigation / safety measures are already been installed and are in place as plant is operational, the rest will be adopted -

1. QRA results of pool fire in case of Chlorobenzene, Sulphur Trioxide and Ethanol, i.e. in the case of flammable solvents stored in the tank, the threat zones estimated for the radiation effects are within or less than 10 meters in all the scenarios considered. Because of less quantity stored.
2. However flame lengths estimated are in the range of 10 to 11 meters, which can cause escalate the fire situations because of heating of the nearest tank.
3. Automatic Sprinkler system will be provided to counter this effect.
4. Tanks will be placed within the well designed dyke wall of 6 m by 12 meters to contain and recover the spillage.
5. QRA results for toxic chemicals indicate that the threat zones as estimated based on PAC values and other recommended values, workers inside the warehouse and factory will be affected and on-site emergency plan will have to be put in action and if necessary also Off site emergency plan will have to be activated, if the leakage gets unnoticed for a long period of time like 30 to 60 minutes.
6. It is recommended to provide close watch on all the toxic chemicals stored for leak detection by the alert staff.
7. Adequate training and retraining needs to be provided for the workers, including contract workers.
8. Along with smoke detectors, adequate number of toxic gas leak detectors must be installed inside the warehouse.
9. All manual handling of drums must be avoided.
10. Special and all recommended PPEs must be used while handling of toxic chemicals, particularly suspect and confirmed carcinogenic chemicals.
11. Adequate spill kits in adequate quantities must be readily available inside the warehouse and plant to deal effectively with spillages.
12. Boards in local language must be displayed instructing workers to effectively deal with spillages and leakages.

7.9.3 Fire Protection

The hazard of fire is very essential to identify because the direct impact of fire or explosion is on the worker or the operator who is actually operating in the accident areas. So to prevent the fire, number of fire extinguishers, smoke detectors have already been implemented in respective unit areas. Details of same are as follows -

Table 7.9 Details of fire Extinguishers

Sr.No.	Type Of Ext.	Capacity	Location
1.	DCP	5 Kgs	Reception
2.	DCP	5 Kgs	Admin library
3.	DCP	5 Kgs	Factory gate
4.	CO_2	2 Kgs	Factory gate
5.	FOAM	9 lits	Stores F. side
6.	FOAM	9 lits	Stores B. side
7.	CO_2	4.5 Kgs	Maint./ w.s.
8.	DCP	10 kgs	Instrument
9.	CO_2	4.5Kgs	Instrument
10.	DCP	10 Kgs	NH3 Tank
11.	FOAM	9 lits	NH3 Tank
12.	FOAM	9 lits	NH3 Tank
13.	FOAM	9 lits	Benzene Tank
14.	FOAM	9 lits	Benzene Tank
15.	DCP	10 Kgs	Benzene Tank
16.	DCP	5 Kgs	E.T.Plant
17.	FOAM	9 lits	SVS Plant
18.	FOAM	9 lits	SVS Plant
19.	DCP	10 Kgs	SVS Plant
20.	CO_2	6.8 Kgs	SVS Cabin
21.	CO_2	6.8 Kgs	SVS Cabin
22.	DCP	5 Kgs	BSR Godown
23.	CO_2	4.5 Kgs	CSA Plant
24.	DCP	5 Kgs	SA Plant (CR)
25.	CO_2	2 Kgs	SA Plant (CR)
26.	CO_2	2 Kgs	SA Plant (CR)
27.	CO_2	4.5 Kgs	SA Maint Office
28.	CO_2	4.5 Kgs	SA Maint Office
29.	CO_2	6.5 Kgs	D.G.Room
30.	CO_2	2 Kgs	Ele. PCC Room
31.	CO_2	2 Kgs	Ele. PCC Room
32.	DCP	10 Kgs	Ele. PCC Room
33.	CO_2	6.5 Kgs	Ele. PCC Room
34.	CO_2	4.5 Kgs	Transfomer Area
35.	FOAM	9 lits	DES Plant (Gr.)
36.	DCP	10 Kgs	DES Plant (1^{st})
37.	FOAM	9 lits	DES Plant (2^{nd})
38.	FOAM	9 lits	DES Plant (3^{rd})

Sr.No.	Type Of Ext.	Capacity	Location
39.	CO_2	6.8 Kgs	MP-1 (Gr.Floor)
40.	CO_2	4.5 Kgs	MP-1 (Gr.Floor)
41.	CO_2	4.5 Kgs	MP-1(Gr.Floor)
42.	DCP	10 Kgs	BSCL(Gr.Floor)
43.	DCP	10 Kgs	BSCL (1^{st}.Floor)
44.	FOAM	9 lits	BSCL(2^{nd} Floor)
45.	DCP	10 Kgs	BSCL (3^{rd} Floor)
46.	FOAM	9 lits	BSCL (4^{th} Floor)
47.	FOAM	9 lits	MP-2 (Gr Floor)
48.	FOAM	9 lits	MP-2 (1^{st} Floor)
49.	CO_2	2 Kgs	MP-2 Panel Roo
50.	CO_2	4.5 Kgs	Lab / R&D
51.	CO_2	4.5 Kgs	Lab / R&D
52.	FOAM	9 lits	Lab / R&D
53.	FOAM	9 lits	Lab / R&D
54.	FOAM	9 lits	Lab / R&D
55.	CO_2	4.5 Kgs	Prod. Office
56.	DCP	10 Kgs	Safety Eq. Room
57.	DCP	5 Kgs	Safety Eq. Room
58.	DCP	5 Kgs	Safety Eq. Room
59.	CO_2	4.5 Kgs	Safety Eq. Room
60.	DCP	10Kgs	Kata Room
61.	FOAM	9 lits	Safety Eq. Room
62.	FOAM	9 lits	Safety Eq. Room
63.	Foam Trolley	300 Lits	Safety Eq. Room

7.9.3.1 Fire Load

Fire Load = (M x C) /A

Where, M= Combustible quantity in Kg
C= Calorific value of combustible in kcal/Kg
A= Total Area in sq mtr

- **Specially Denatured Spirit -**

  363 KL (290.4 MT, 290400 Kg), Calorific value: 7098.47 kcal/Kg, Total Area: 88355 m^2
  Fire Load = (290400 x 7098.47) / 88355 = 23330.8 Kcal / m^2

- **Benzene -**

  23 KL (19.78 MT, 19780 Kg), Calorific Value: 10111 kcal/Kg, Total Area: 88355 m^2
  Fire Load = (19780 x 10111)/88355 = 2263.5 Kcal / m^2

- **Diethyl ether -**

  (50 MT, 50000 Kg), Calorific Value: 10277.24 kcal/Kg , Total Area: 88355 m^2
  Fire Load = (50000 x 10277.24)/88355 = 5815.9 Kcal / m^2

- **Sulphur** -

  (5000 MT, 5000000 Kg), Calorific Value: 2198.8 kcal/Kg , Total Area: 88355 m^2
  Fire Load = (5000000 x 2198.8)/88355 = 124429.8 Kcal / m^2

- **HSD** -

  (1.935 MT, 1935 Kg), Calorific Value: 10707.45 kcal/Kg , Total Area: 88355 m^2
  Fire Load = (1935 x 2198.8)/88355 = 234.49 Kcal / m^2

- **Furnace Oil** -

  (47.5 MT, 47500 Kg), Calorific Value: 10500 kcal/Kg, Total Area: 88355 m^2
  Fire Load = (47500 x 10500)/88355 = 5644.8 Kcal / m^2

Table 7.10 Details of Fire Load

Sr.No.	Description	Fire Load (Kcal / m^2)
1.	Specially Denatured Spirit	23330.8
2.	Benzene	2263.5
3.	Diethyl Ether	5815.9
4.	Sulphur	124429.8
5.	HSD	234.49
6.	Furnace Oil	5644.8
	Total	**161719.3**

Refer **Appendix - Q** for Hazard Identification and Risk Analysis (HIRA), Immediately Dangerous to Life or Health (IDLH), Maximum Credible Loss Scenario (MCLS).

7.10 Occupational Health Center (OHC)

OHC has been provided as per factories act. Health checkup of all employees and contract labors have been carried out before employment and at regular intervals and record for the same are maintained. It is ensured that adequate stock of critical anti-dote for toxic chemicals are always kept in the OHC.

Company has prepared well designed health check up plan for its employees and contract workers. Health check-up parameters have been identified based upon the chemicals to which workers are likely to be exposed. Some of the parameters are given below -

Table 7.11 Details of Occupational Health Monitoring

Sr. No.	Chemical Name	Target organs	Parameters for occupational Health monitoring	Frequency
1.	Thionyl Chloride	Skin sensitization. CNS Peripheral Nervous system, Decreased muscle strength	Pre placement medical condition. Skin condition. Urine samples for testing presence of hexanedione. Exhaled air sampling.	Pre-placement Annual

Sr. No.	Chemical Name	Target organs	Parameters for occupational Health monitoring	Frequency
2.	Ammonia	Respiratory system	LFT and lung damage test.	Pre-placement Annual
3.	Methanol	Skin-dermatitis Liver Optic atrophy Blindness	Integrity of skin Profile of liver Integrity of eyes for pre existence of eye disease.	Pre-placement Annual
4.	Hydrochloric Acid	Kidney, Liver Lungs-Bronchitis	Pre-placement medical check-up Liver function test. Urinalysis for presence of Acid.	Pre-placement Annual
5.	Xylene	If inhaled or swallowed and is a central nervous system depression. Skin and eye irritation.	Pre-placement medical check-up Of eyes, nose, throat,	Pre-placement Annual

Note: Antidote for the chemicals can be suggested by the health officer and appropriate actions shall be taken.

Detailed Health check up report may be referred in **Appendix - R.**

7.11 SAFETY HEALTH AND ENVIRONMENT POLICY

The functions of the Secretary will be to -

1. Receive recommendations from the Safety Committee and evaluate them for implementation.
2. Inspect the scene of accidents and investigate cases thereof.
3. Present reports to the Safety Committee of safety activities.
4. Study reports and recommendation from the Factory Inspector and implement recommendation.
5. Organize safety captions; arrange safety posters and the display thereof.
6. Arrange and distribute safety literature with a view to promote safety consciousness.
7. Liaison with labor institutions, Factory Inspector and other bodies. Promote safety measures with a view to improve methods, appliances, apparel etc.
8. Ensure that the contractor and his employees working in the premises of the company observe safe method of work.
9. Maintain a register recording minutes of committee Meeting and show the register to Factory Inspector during his visit to the Factory.

7.12 ONSITE EMERGENCY & DISASTER MANAGEMENT PLAN

The company has 85 skilled and 100 unskilled workers presently employed. There is OHC center at the site fulfilling all the requirements of the factory act, based upon the number of workers employed. The same facilities will be expanded for additional workers, likely to be employed after expansion. Special medical tests need to be included in the pre employment and six monthly and annual medical checkups of the workers, as numbers of toxic chemicals as well as suspect and confirmed carcinogenic chemicals are handled. This has to done in consultations with the experienced and professional doctor and it has to be ensured that stock

of necessary anti-dote for toxic chemicals will be always available at OHC It will be ensured that adequate stock of critical anti-dote for toxic chemicals will be always kept in the OHC.

Refer **Appendix - S** for On-site Emergency Plan has already been incorporated for existing plant.

7.13 OFF SITE DISASTER CONTROL PLAN

Off-site Emergency Plan for Raigad district is available and in place.

7.14 EHS POLICY

Industry has clearly defined EHS policy and it must be known to all employees and must be properly displayed.

Refer **Appendix - T** for TDMCCL EHS policy.

7.15 QUALITY POLICY

Industry has clearly defined Quality policy and it must be known to all employees and must be properly displayed.

Refer **Appendix - U** for TDMCCL Quality policy.

Chapter 8

PROJECT BENEFITS

8.1 PROJECT BENEFITS

Any industrial activity helps in improving the social status of the locality. Existing project by TDMCCL has helped in improvement of infrastructure and social structure in the command area and has lead to sustainable development. Also, after expansion, community that inhabit in the nearby areas will be benefited directly or indirectly by this expansion project. Following benefits due to the proposed expansion project are expected.

8.1.1 Improvementin the Physical Infrastructure

Due to a number of actions and planning proposed by the TDMCCL management, status of physical infrastructure in command area of the industry is bound to improve. Thus there shall be a positive impact on this aspect. Following are certain steps that the industry would take -

- The industry continues contributing towards strengthening in infrastructural facilities in the study area which shall directly beneficial to the residents. The improvements in roads, water supply and sanitation, health care etc. would be some important areas.
- Continues contribution towards rain water harvesting systems to be employed in nearby villages (off-site works) will improve the ground water table. As no any ground water shall be utilized for the proposed expansion also, it will be useful to the surrounding farmers for domestic and irrigation requirements.
- Augmentation of existing green belt and plantation of additional trees in the industrial area and its surrounding shall help in improving the aesthetic beauty of the surrounding environment giving a pleasant look and improvising the air quality. Also green belt willhelp in arresting dust emissions as well as noise.

8.1.2 Improvementin the SocialStatus

Benefits of TDMCCL projects in improving overall socioeconomic status of the study area are as under -

- Presence of TDMCCL has created enormous potential towards creating employment in the region. Both primary and secondary jobs and contract jobs are created which principally benefit the local residents. As much as 75% of the nearby villagers have been employed under existing set up of TDMCCL. Same practice shall be continued under the expansion projects also.
- The people residing in the nearby areas are benefited from CER activities being carried out by the project proponents such as assistance to educational facilities in the study area that have helpedin enhancing the literacy rate. Subsequent to expansion an amount of **Rs. 25.00 Lakhs** is earmarked for CER activities in study area.
- Due to the awareness programs, taken up by the Industry, people residing in nearby areas have been benefited. This includes education, ecology and biodiversity conservation, environment awareness etc.
- The industry shall organize various campaigns and workshops regarding medical and health check up for workers/labours. This will help improve overall health status.

8.2 ACTIVITIES DONE BY TDMCCL UNDER CER

The details about CER already undertaken by TDMCCL through existing unit are as follows-

1. Empowering teachers by handholding them to use Interactive Communication Technology (ICT) in education through interactive e-learning content.
2. Create a fun learning environment for the student. Further which inculcate liking towards the subject.
3. Need base training for teacher catering to ICT.
4. Donation for the Laboratory Equipment.
5. Educational Materials Issued to Local Villagers.
6. Creating Awareness about Renewable Energy Resources.
7. Arranging sports activity
8. Arranging Pulse Polio and Eye-checkup camps, Medical Checkup camps.

Table 8.1 Yearly Expenses incurred on CER & Social Welfare (In INR)

Year	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Social& Cultural	34404	67154	90705	118404	178000	144651
Education	4650	5545	25213	33944	372200	369730
Sport	13000	4352	6500	12000	9700	75000
Medical	2500	6500	7500	48000	51500	11000
Total	**54554**	**83551**	**129918**	**212348**	**611400**	**600381**

8.2.1 Proposed CER Plan

An amount of Rs. 25.00 Lakhs have been earmarked towards proposed activities under CER plan. The same is about 2.5% of Capital investment Rs. 10.00Crs. Detailed CER plan have been at chapter 6. (Section 6.6)

8.3 EMPLOYMENT POTENTIAL

In any industrial activityall three types i.e. skilled, semi skilled and unskilled people are required. In TDMCCL preference is given for employment to local people based on qualification and requirement. Under existing unit 75 - 80 % of employees are from local populace.As TDMCCL has planned for expansion of existing commodity chemicals and speciality chemicals availability of employment may further enhance. Hence, it can be stated that by the existing and proposed activities in TDMCCL, employment potential certainly will have positive impact for all the three classes namely - skilled, semi-skilled and unskilled.

8.4 OTHER TANGIBLE BENEFITS

After execution of the project the above mentioned benefits shall accrue. Apart from this other tangible benefits which could result are mentioned below-

- After expansion, the industry will meet the national interest of economical growth through sustainable development, as the there is a good demand of products in India as well as abroad. Out of the total products more than 60 - 75 % of the products will be exported.
- First Aid Training and fire safety training will be given to all the workers.
- Insurance Policies for the workers will be made available.
- Improvement in the aesthetic through green belt development.
- The ground water recharging shall be done by arresting rain water.

Chapter 9

ENVIRONMENTAL MANAGEMENT PLAN (EMP)

9.1 INTRODUCTION

Environment Management Plan (EMP) is required for ensuring sustainable development. It should not affect the surrounding environment adversely. The management plan presented in this chapter would be implemented under the proposed expansion unit.

The EMP aims at controlling pollution at source with available and affordable technology followed by treatment measures. Waste minimization and waste recycling measures are emphasized. In addition to the Industry specific control measures, the proposed expansion industry would adopt following guidelines -

- Application of Low and Non Waste Technology in the production process
- Adoption of reuse and recycling technologies to reduce generation of wastes and to optimize the production cost of the industry
- The recycling and reuse of industrial waste not only reduces the waste generation but also can be an economic gain to the industry. Further, the management of the TDMCCL will take all the necessary steps to control and mitigate the environmental pollution. Moreover, while implementing the project the management will follow guidelines issued by CPCB.

The EMP is prepared based on the existing environmental status of the project location and the anticipated impacts of the project activities on environment.

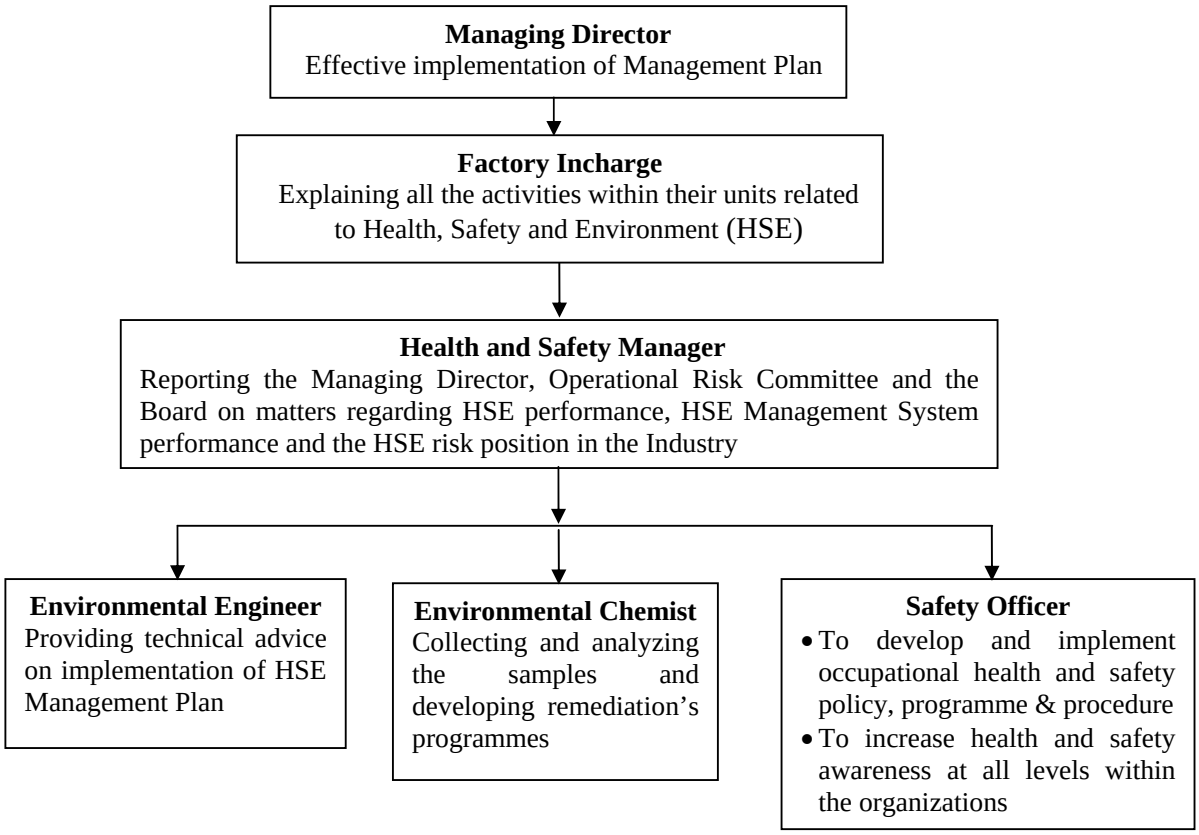
9.2 ENVIRONMENTAL MANAGEMENT CELL (EMC)

As a part of the EMP, it is essential to formulate an Environmental Management Cell (EMC). TDMCCL is already having a cell functioning under existing project. The cell works under V.P. (Operations) of the Industry and responsible persons from certain departments have been taken as members. The EMC is responsible for all the activities and actions as well as outputs and management of entire infrastructure provided for control and abatement of pollution in the TDMCCL project. Further, the cell is also active in protecting state of environment in the study area around existing campus of TDMCCL. Various programs and tasks towards conservation, awareness, promotion, review etc. are undertaken and implemented through the existing environmental management cell of TDMCCL. This cell is also being responsible for taking care of actions and implementations subsequent to the expansion program of the project. Further, the EMC will be adequately expanded by incorporation of certain new members since the work load on existing ones is going to be increased substantially subsequent to commissioning of expansion project. Following table gives details about EMC in the industry -

Table 9.1 Environmental Management Cell

Sr. No.	Name	Designation
1.	Mr. S.R. Pandit	V.P. (Operations)
2.	Mr. Badal Datta	Chief Engineer- Maintenance & Projects
3.	Mr. A.K. Nagarch	G.M. (R&D)
4.	Mr. Geo Francis	Sr. Manager (Production)
5.	Mr. M.G. Ganu	Sr. Manger (Quality Assurance)

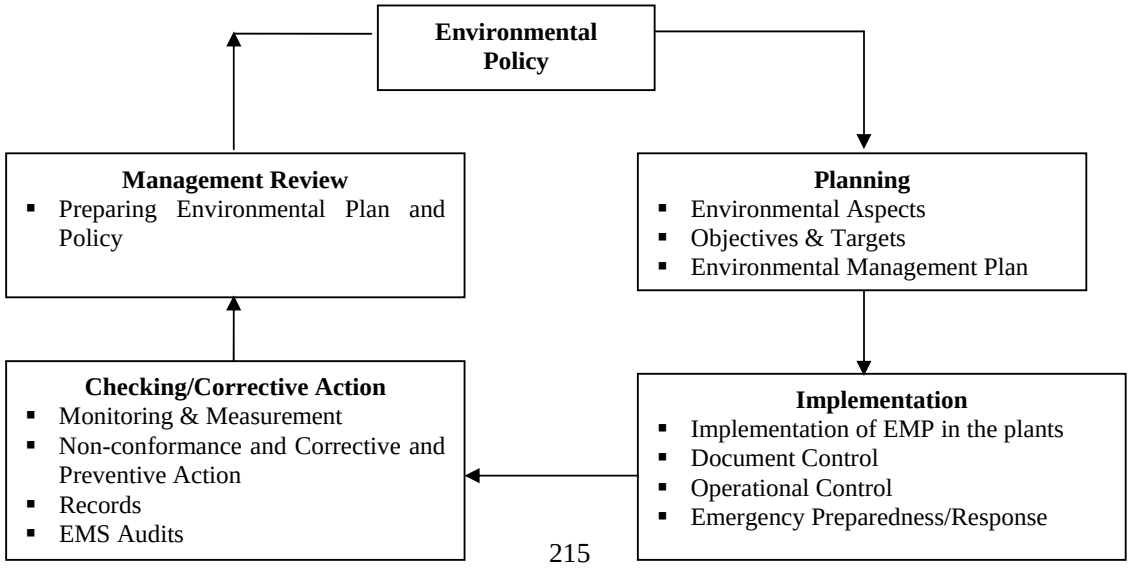
Figure 9.1 Environmental Management Cell and Responsibilities



Members of the Environmental Management Cell would be well qualified and experienced in the concerned fields. Some of the routine tests of waste water such as pH, solids, temperature etc. would be carried out in the laboratory to be established on proposed project site. Also, for additional tests of water, waste water, soil, air etc. services of accreditated laboratories as well as that of a consultant would be hired.

9.3 WORKING OF ENVIRONMENTAL MANAGEMENT PLAN

Figure 9.2 Environmental Management Plan



9.4 RECOMMENDATION AND IMPLEMENTATION SCHEDULE

The mitigation measures suggested for proposed expansion unit in Chapter - 4 would be implemented. This will reduce the impact on environment due to the proposed expansion project. To facilitate easy implementation, the recommendations suggested are grouped in different phases. The important measures are implemented in earlier unit and some few are planned under expansion project.

9.4.1 Summary of Recommendations

Table 9.2 Summary of Recommendations

Sr. No	Aspect	Description	Recommendations & Proposed Action
1.	Water Consumption	As far as the water conservation is concerned, it has been suggested to the Project Proponents (PP) to make maximum use of the treated water. The total water requirement after expansion project would be **1592 m^3/day**. Out of which **220 m^3/day** treated effluent recycle whereas **1372 m^3/day** would be the **fresh water** taken from the MIDC water supply scheme. The MIDC procures water from Kundalika River and after treatment the same is provided to different industries in the MIDC.	a) To mitigate the impact on river, the industry has planned to implement certain Measures which would augment the aquifer capacity in the region. The same include conservation of fresh water through application of reuse and recycle concepts and implementation of intensive rain water harvesting scheme in the industrial premises so as to arrest the runoff and recharge it to the ground water / harvesting pit. Also, to maximum extent water shall be recycled.
2.	Effluent Treatment	Effluent generated from existing manufacturing and utility operations is to the tune of 209.6 CMD which is treated in existing ETP of 300 CMD capacity comprising of Primary, Secondary and Tertiary treatment operations. At present, the treated water from ETP, achieving prescribed standards is discharged to Common Effluent Treatment Plant (CETP), Roha. Presently, domestic wastewater is treated in septic tanks followed by soak pits. The overflow from soak pits is used for gardening purpose. Industrial effluent generated from spillages, leakages and floor washings from all process plants, comes to the grit chamber through underground	a) Installation of online monitoring system and continuous checking of outlet parameters. b) Provision of separate guard tank for collecting the contaminated water from river due to accidental discharge of effluent. c) The contaminated water would be treated in ETP to be provided on site. d) If the quantum of contaminated effluent is beyond control then immediate shut down of the industry should be taken. The collected water from river would be stored and

Sr. No	Aspect	Description	Recommendations & Proposed Action
		pipelines. Oily mater that floats on the top is skimmed off. The effluent is then taken to the equalization tanks from where it is sent to the neutralizer. Lime slurry is prepared in the slurry tank. Lime slurry can be fed to the equalization tank or to the neutralizer. pH of the effluent is maintained between 7-8. Neutralized effluent is then pumped to the primary clarifier. The clear water from the top of the clarifier overflows into the two bio-reactors which are in series and sludge from the bottom of primary clarifier is fed to fully automatic pneumatic filter. Filtrate from the filter is pumped back to the primary clarifier. Water from bioreactors overflows into the secondary clarifier. Water from the secondary clarifier is passed through tertiary filter (carbon and sand filter) by pump. This water is pumped to the CETP through MIDC sewers sludge from the bottom of secondary clarifier is fed to fully automatic pneumatic filter. Dry filter cake is sent to CHWTSDF, Taloja, Mumbai for final disposal. Under expansion, the management has decided to achieve **Zero Liquid Discharge (ZLD)** by installation of evaporators and the condensate would be recycled in industrial operations. No any effluent would be discharged outside the premises. Moreover, for domestic waste water, STP of 20 CMD is proposed. The treated water from STP would be used for gardening.	treated in ETP. The treated water would be discharged in nearby river. e) Provision of additional pumps in working condition on site. f) Immediate vicinity residents, schools & hospital should be warned about contamination of river and surface water. They should be informed of precautions to be taken.
3.	Air Pollution Control	The existing boiler (5TPH capacity) is operated on Furnace oil (FO) @ 63 kg/hr with adequate stack height of 35 m and Thermic Fluid Heater (TFH, 4 lakhs Kcal/hr capacity) is operated on High speed diesel (HSD) @ 47 kg/hr with stack height of 30 m are provided on site. DG sets of capacities 125, 830 and 1310 KVA are operated on HSD /	a) In light of scenarios for non-functioning of APC equipment ID fans would be provided on site as back up. Provision and maintenance of D.G. for continuous operation of APC. Inspection & breakdown maintenance of pollution control equipment shall be

Sr. No	Aspect	Description	Recommendations & Proposed Action
		Light diesel oil (LDO) @ 210 kg/hr with adequate stack height of 4.20 m, 7.70 m, 7.70 m respectively above roof level (ARL). DG sets are used only in case of power failure. Moreover, process emissions are in the form of acidic / alkaline / solvent vapours emitted from existing. The same is taken care off through seven scrubbers each of 5 kg/hr capacity. Existing scrubbers will be utilized under expansion activity. Existing boiler, TFH and DG sets are sufficient for proposed expansion. Boiler runs occasionally as steam is available from Sulphuric acid plant only. (Steam generated from Sulphuric Acid Plant: 335 MTD at 40 kg/cm^2 at 400^0C.	undertaken by proper work permit systems. b) Installation of online monitoring system and continuous checking of parameters. c) Provision of DG Set for uninterrupted power supply in case of power failure for operation of APC continuously. d) Immediate shut down of the industry should be taken if APC is under maintenance for more than 8 hours. Manufacturing would be started only when APC is operating efficiently.
4.	Solid Waste Management	The generated Paper waste, broken glass, HDPE bags and sulphur sludge forwarded to CHWTSDF Taloja.	a) Adequate storage, disposal shall be done. b) Minimizing storage time of solid waste and immediate disposal within ninety days.
5.	Noise Control Measures	The noise generating sources under existing unit are Boiler house, Water treatment plant, ETP, Reactors, Compressors and DG Set etc. Same shall be sources under expansion.	a) Provision and use of earmuffs in high noise area. b) Providing separate sitting and control room for workers. c) Changing of shifts and exposure time to high noise area would be reduced.
6.	Ecological & Socio-economic Aspects	1. A phase wise 3 year tree plantation program for around 5000 trees shall be carried out under CSR activity. Within 10 Km radius area in selected and active villages. This should be implemented as (a) thick block plantation of large trees for environmental protection through Carbon sequestration and as Oxygen Park on common lands in villages where protection is ensured, this would also act as bird habitats, and (b) Avenue plantation on village roads, and around open spaces, grounds, schools, etc. The details of ecology and biodiversity	a) The green belt being mandatory should be mentioned on top priority, particularly for health of the workers and people around the industrial unit. Pollution control measures should strictly be implemented by the industry. b) The industry, by involving workers and locals, should demonstrate, encourage, and promote suitable eco-friendly alternatives green technologies under CER activity in the villages in the

Sr. No	Aspect	Description	Recommendations & Proposed Action
		(flora, fauna, fishes, etc.) observed in existing unit are described in Chapter 3. 2. It shall be ensured that no untreated effluent is discharged by the industry into river through any way any time. 3. The industry to adopt latest advanced technology for energy conservation and treatment of wastes. 4. The pollution control measures as per the EMP shall strictly be implemented by the industry.	10 km vicinity, stressing and demonstrating, rain water harvesting, solar lighting, organic farming, and innovative simple to use 'green technologies'.
7.	CER	1. The implementations under CER shall be done in a time bound manner. 2. Planning for CER shall be started with the identification of activities / projects and may be undertaken in periphery of industrial area.	As mentioned in above point.

All the recommendations are implemented so as to improve the environmental condition as a whole.

9.5 ENVIRONMENTAL POST MONITORING PROGRAMME

After commissioning of the project, regular monitoring of Environmental Attributes such as Ambient Air Quality, Stack Emissions, Noise and Effluent would be done on regular basis. Refer Chapter 6 for details w.r.t Post Monitoring Program to be conducted

Following compliance against the consent conditions after commissioning of project would be observed under the Water (Prevention & Control of Pollution) Act, 1974, Air (Prevention & Control of Pollution) Act 1981, Hazardous Waste (Management, Handling & Transboundary Movement) Rules 2010.

Table 9.3 Compliance against the Consent Condition

Sr. No.	Description	Frequency	Remark
1.	Renewal of Consent	Once in a year	Application for renewal shall be done 60 days before the expiry date.
2.	Environmental Statement	Once in a year	Would be submitted for every financial year before 30th September of next year.
3.	Hazardous Waste Returns	Once in a year	Would be submitted for every financial year before 30th June of next year.
4.	Cess Returns	Monthly	Twelve Returns would be submitted every year.
5.	Submission of six	Twice in a	Two compliance reports per Year.

Sr. No.	Description	Frequency	Remark
	monthly reports to R.O., MoEFCC, Nagpur towards EC conditions	Year	

9.5.1 Monitoring Equipment

➢ **Air Quality and Meteorological Instruments**

- Fine Dust Sampler
- Weather station with Wind Vane, Anemometer, Thermometer, Dry / Wet Bulb Thermometer, Rain-gauge
- Spectrophotometer
- Single pan balance up to 0.0001 gm detection levels.
- Relevant chemicals as required
- Oven

➢ **Water and Waste Water Quality**

- BOD Incubator
- COD reflux assembly
- Refrigerator
- Thermometer
- pH meter
- Stop watch
- Distilled water plant
- Pipette box
- Titration set
- Relevant chemicals and glass wares

➢ **Noise Levels**

Sound level meter in different scales like A, B and C with slow and fast response options.

➢ **Soil Characteristics**

Soil samplers (auger) to collect soil samples.

9.6 COMPLIANCE WITH RECOMMENDATIONS OF THE CREP GUIDELINES

Following activities are undertaken by TDMCCL under existing unit and same practice shall be followed after commissioning of expansion activity towards CREP norms -

- As there is minimum quantity of effluent generated; TDMCCL have single stream for effluent treatment process.
- Installation of Heat Pump Based Effluent to Distilled Water Convertor for **Zero Discharge** of effluent. The installation and commissioning of this facility will be completed within short period.

- Proper infrastructure for handling and storage of hazardous waste. As per nature it would be forwarded to CHWTSDF / Authorized Re-processor.
- For control of air pollutants APC Equipment must be provided. To control the process emissions scrubbers to be provided.
- Post project implementation: Environmental Monitoring & Environmental Auditing to be carried out regularly.
- Environment Management Cell and Certification System

9.6.1 Other Compliance

No other compliances would be required.

Chapter 10

SUMMARY AND CONCLUSION

10.1 INTRODUCTION

This EIA report has been prepared for proposed expansion of existing commodity chemicals and speciality chemicals manufacturing unit by **TDMCCL** located at Plot No. 105 in MIDC Industrial Area, P.O. Dhatav, Taluka: Roha, District: Raigad, State: Maharashtra. The company has taken into consideration the need to meet the demands of the international market; the proponents of the industry have planned to go for expansion of manufacturing of proposed commodity chemicals and speciality chemicals manufacturing unit.

This report is made in the overall context of Environmental Impact Assessment (EIA) Notification No. S.O.1533 (E) dated 14.09.2006 and amendments thereto issued by the Ministry of Environment, Forest and Climate Change (MoEFCC); New Delhi. As per the provision of "EIA Notification No. S.O. 1533 (E)" dated 14.09.2006; amended on 25.06.2014, the proposed project comes under Category - "B"**.** But in light of **Draft Notification of the Eco-Sensitive Areas (ESA) for Western Ghats published by MoEFCC** dated 10.03.2014, 04.09.2015, 27.02.2017 and 03.10.2018 therein village Dhatav, wherein the Roha MIDC is setup have appeared in the list of ESA villages for Western Ghats. Accordingly, the category of the project changes from '**Category - B' to 'Category - A'.**

Existing capital investment of TDMCCL is Rs. 84.07 Cr. For the proposed expansion, capital investment will be Rs.10.00 Cr. Total capital investment will be **Rs. 94.07 Cr**.

10.2 PROJECT AT A GLANCE

Table 10.1 Salient Features of TDMCCL Project Site

No.	Particulars	Details
1.	Name and Address of the Industry	**The Dharamsi Morarji Chemical Company Limited (TDMCCL)** Plot No. 105 in MIDC Industrial Area, P.O. Dhatav, Taluka: Roha, District: Raigad, State: Maharashtra.
2.	Land acquired for the plant	88355 m^2 (8.84 Ha)
3.	Co-ordinates (lat-long) of all four corners of the site	(i) 18°25'29.92"N 73° 8'41.55"E (ii) 18°25'23.89"N 73° 8'38.04"E (iii) 18°25'33.98"N 73° 8'25.67"E (iv) 18°25'37.87"N 73° 8'26.89"E (v) 18°25'38.44"N 73° 8'31.33"E (vi) 18°25'36.93"N 73° 8'35.37"E (vii) 18°25'32.63"N 73° 8'33.51"E
4.	Elevation	11 m above Mean sea level (MSL)
5.	Nearest habitation / Schools / hospitals	Village Roth Budruk at 0.40 km
6.	Nearest city	Roha city at 2.89 km

No.	Particulars	Details
7.	Nearest highway	(i) Nagothana - Pali - Khopoli (SH No. 92) at 10.70 Km (ii) Borlai Panchaitan - Mangaon - Tala (SH No. 97) at 25.28 km (iii) Panvel - Kanyakumari (NH No. 66) at 8.03 km
8.	Nearest railway station from project site	Roha Railway Station at 3.04 km
9.	Nearest airport	(i) Chhatrapati Shivaji International Airport, Mumbai at 79.38 km (ii) Pune International Airport, Lohagaon at 82.74 km
10.	Nearest tourist places	Nil within 10 km radius
11.	Defense installations	Nil within 10 km radius
12.	Archaeological important place / Historical Monuments	Nil within 10 km radius
13.	Ecological sensitive zones	Village Dhatav wherein the MIDC is setup have appeared in the list of ESA village of Western Ghats Ecologically Sensitive Area (ESA) Village draft notification dated 10.03.2014, 04.09.2015, 27.02.2017 and 03.10.2018.
14.	Reserved / Protected forest / National Parks / Wildlife Sanctuary / wetland / estuaries / bioreserves (from Project Site)	1. At a distance of 1.48 km & 1.89 km from the Reserved Forest which was declared under Section 34 of Indian Forest Act, 1878 by Bombay Castle Gazette No. 3F dated 01.03.1879. 2. At a distance of 0.44 km & 0.39 km from the Protected Forest which was declared under Section 28 of the Indian Forest Act No. VII of 1878, as amended by Acts No. V of 1890 and No. V of 1901 by Bombay Government Gazette No. 1963I dated 28.02.1907.
15.	Nearest streams / Rivers / water bodies (from Project Site)	River Kundalika at 1.25 Km

10.3 PROCESS DESCRIPTION

10.3.1. Products and Byproducts

The details of products that are being manufactured under existing as well as those to be manufactured under expansion are presented in the following table -

Table 10.2 List of Products

A) List of Products -

Sr. No.	Name of Products	Production (MT/Month)		
		Current	Expansion	After Expansion
1.	Sulphamic Acid	500	0	500
2.	Diethyl Sulphate	200	100	300
3.	Benzene Sulphonyl Chloride	570	30	600
4.	Sulphuric Acid	8333	0	8333
5.	Oleum	4167	0	4167
6.	Sulphur Trioxide	2750	0	2750
7.	Sodium Vinyl Sulphonate/Other Sulphonates	150	50	200
8.	Phenol Sulphonic Acid	50	0	50
9.	Chlorosulphonic Acid	2000	0	2000
10.	Diethyl Ether	50	150	200
11.	Benzene Sulphonic Acid/Other Sulphonic Acids	20	0	20
12.	N-Phenyl Benzene Sulphonamide	30	70	100
13.	Methane Sulphonic Anhydride	5	0	5
14.	Para Chloro Benzene Sulphonyl Chloride	25	0	25
15.	4,4-Dihydroxy Diphenyl Sulphone	0	30	30
16.	3,3-Dinitro Diphenyl Sulphone	0	30	30
17.	3,3-Diamino Diphenyl Sulphone	0	20	20
18.	Para Chloro Thiophenol	0	10	10
19.	Bis (4-Chlorophenyl) Disulphide	0	10	10
20.	Thiophenol	0	20	20
21.	4-Methyl Mercapto Acetophenone	0	10	10
22.	Silicon Sulphate	0	10	10
23.	Para Nitro Benzene Sulphonyl Chloride	0	10	10
24.	Lasamide	0	10	10
25.	Diethyl Phthalate	0	100	100
26.	Dimethyl Phthalate	0	100	100
27.	Potassium Salt of Sulphonated Sulphone	0	10	10
28.	N-Butyl Benzene Sulphonamide	0	10	10
29.	Methyl Ester of Benzene Sulphonic Acid	0	5	5
30.	Ethyl Ester of Benzene Sulphonic Acid	0	5	5
31.	Para Chloro Benzene Sulphonic Acid	0	10	10
32.	Para Toluene Sulphonic Acid	0	10	10
33.	Dimethyl Aniline	0	80	80
34.	Mono Methyl Aniline	0	20	20
35.	Diethyl Aniline	0	30	30
36.	Sodium Isethionate	0	10	10
37.	4,4-Dichloro Diphenyl Sulphone	0	10	10

Sr. No.	Name of Products	Production (MT/Month)		
		Current	Expansion	After Expansion
38.	Mono Ethyl Aniline	0	70	70
39.	1,3-Benzene Disulphonyl Chloride	0	10	10
40.	Menthyl Lactate	0	5	5
	Total	**18850**	**1045**	**19895**

B) List of Byproducts -

Table 10.3 List of Byproducts

Sr. No.	Name of Byproducts	Production (MT/Month)		
		Current	Expansion	After Expansion
1.	Calcium Sulphate	398	2	400
2.	Phosphoric Acid	2	18	20
3.	Sodium Sulphate	400	0	400
4.	Sodium Sulphite	110	0	110
5.	Dilute Sulphuric Acid	11600	0	11600
6.	Diphenyl Sulphone	24	6	30
7.	Sodium Chloride Solution	0	5	5
8.	Ammonium Chloride Solution	0	50	50
	Total	**12534**	**81**	**12615**
	Total (Products and Byproducts)	**31384**	**1126**	**32510**

10.3.2. Raw Materials

The details of raw material consumption w. r.t existing and proposed expansion products are presented in following table. Moreover, product-wise of raw materials required for existing and proposed activity, are presented at **Appendix - E**.

Table 10.4 List of Collective quantity of Raw material required per batch

Sr. No.	Name of Chemical	Total Quantity (kg/Batch)
1.	Purified Water	22132.04
2.	Urea	310
3.	Sulphuric Acid (98%)	4540
4.	Oleum (65%)	2073
5.	Ethanol	5166
6.	Sulphur Trioxide (liq.)	4480
7.	Ammonia	140
8.	Benzene	650
9.	Chloro Sulphonic Acid	7512
10.	Sulphur	330
11.	Oxygen (from Air)	490
12.	Sulphuric Acid	2510
13.	Sulphur Trioxide (gas)	1000
14.	DES Slurry	220
15.	Calcium hydroxide	1085
16.	Phenol	1800

Sr. No.	Name of Chemical	Total Quantity (kg/Batch)
17.	Hydrochloric Acid (30%)	1000
18.	Benzene Sulphonyl Chloride	4990
19.	Aniline	5360.7
20.	Sodium Hydroxide	334
21.	Methane Sulphonic Acid	275
22.	Phosphorous Pentoxide	68.75
23.	Mono Chloro Benzene	1012
24.	Para Chloro Benzene Sulphonyl Chloride	2920
25.	Ferric Chloride	4
26.	Diphenyl Sulphone	178
27.	Fuming Nitric Acid	105
28.	3,3'- Dinitro Diphenyl Sulphone	710
29.	Iron Powder	580
30.	Aq. Ethanol (50%)	250
31.	Red Phosphorous	619
32.	Para Chloro Thiophenol	251
33.	Hydrogen Peroxide	30
34.	Phosphoric Acid (85%)	1000
35.	Thioanisole	1242
36.	Acetyl Chloride	785.4
37.	Aluminum Chloride	1330
38.	Silicon Oil	350
39.	Para - Nitro Aniline	318
40.	Sodium Nitrite	159
41.	Hydrochloric Acid	252
42.	Thionyl Chloride	548
43.	2,4 - Dichlorobenzoic Acid	453
44.	Phosphorus Trichloride	366.84
45.	Phthalic Anhydride	3647
46.	Methanol	4025.3
47.	Diphenyl Sulphone	331
48.	Potassium carbonate	103
49.	N-butylamine	171
50.	Para - Toluene Sulphonyl Chloride	1107
51.	Dimethyl Ether	2111.4
52.	Diethyl Ether	509.2
53.	$Ca(OH)_2$	487
54.	L-Menthol	179.73
55.	L-Lactic acid	100

10.4 MANUFACTURING PROCESSES, FLOW CHARTS AND MASS BALANCE OF THE PRODUCTS

Refer **Appendix - E** for details on manufacturing processes, processes flow charts, mass balance for each product.

10.5 SOURCES OF POLLUTION AND MITIGATION MEASURES

10.5.1 Water Pollution

Total water requirement after expansion for proposed project would be 1592 CMD. Out of which 220 CMD (14 %) would be treated water from ETP whereas 1372 CMD (86 %) would be fresh water taken from MIDC water supply scheme. Fresh water requirement for project is met from the MIDC water supply scheme. The MIDC procures water from Kundalika River and after treatment the same is provided to different industries in the MIDC**.** Refer **Appendix - F** for Certificate of Merit for Water Resource Management in Chemical Industry by Indian Chemical Council (ICC) and **Appendix - G** for Water Permission Letter.
From fact presented above, it is observed that through change in product mix additional permission is not required for fresh water under proposed expansion. Current permission for fresh water granted in valid CTO is adequate under proposed expansion.

Effluent generated from existing manufacturing and utility operations is to the tune of 209.6 CMD which is treated in existing ETP of 300 CMD capacity comprising of Primary, Secondary and Tertiary treatment operations. At present, the treated water from ETP, achieving prescribed standards is discharged to Common Effluent Treatment Plant (CETP), Roha. Presently, domestic wastewater is treated in septic tanks followed by soak pits. The overflow from soak pits is used for gardening purpose.

Industrial effluent generated from spillages, leakages and floor washings from all process plants, comes to the grit chamber through underground pipelines. Oily mater that floats on the top is skimmed off. The effluent is then taken to the equalization tanks from where it is sent to the neutralizer. Lime slurry is prepared in the slurry tank. Lime slurry can be fed to the equalization tank or to the neutralizer. pH of the effluent is maintained between 7-8. Neutralized effluent is then pumped to the primary clarifier. The clear water from the top of the clarifier overflows into the two bio-reactors which are in series and sludge from the bottom of primary clarifier is fed to fully automatic pneumatic filter. Filtrate from the filter is pumped back to the primary clarifier. Water from bioreactors overflows into the secondary clarifier. Water from the secondary clarifier is passed through tertiary filter (carbon and sand filter) by pump. This water is pumped to the CETP through MIDC sewers sludge from the bottom of secondary clarifier is fed to fully automatic pneumatic filter. Dry filter cake is sent to CHWTSDF, Taloja, Mumbai for final disposal. Refer **Appendix - H** for Certificate of Merit for Efficient Waste Management in Chemical Industry by Indian Chemical Council (ICC) and **Appendix - I** for CHWTSDF Membership Letter.

Under expansion, the management has decided to achieve **Zero Liquid Discharge (ZLD)** by installation of evaporators and the condensate would be recycled in industrial operations. No any effluent would be discharged outside the premises. Moreover, for domestic waste water, STP of 20 CMD is proposed. The treated water from STP would be used for gardening.

From fact presented above, it is observed that current ETP has the capacity to treat additional load from expansion through change in product mix.

10.5.2 Air Pollution

- Under existing unit as well as proposed expansion main source of emissions are boiler, thermopack and DG Sets. Major emissions are in the form of suspended particulate matter (SPM), SO_x and NO_x.
- The existing boiler (5TPH capacity) is operated on Furnace oil (FO) @ 63 kg/hr with adequate stack height of 35 m and Thermic Fluid Heater (TFH, 4 lakhs Kcal/hr capacity) is operated on High speed diesel (HSD) @ 47 kg/hr with stack height of 30 m are provided on site.
- DG sets of capacities 125, 830 and 1310 KVA are operated on HSD / Light diesel oil (LDO) @ 210 kg/hr with adequate stack height of 4.20 m, 7.70 m, 7.70 m respectively above roof level (ARL). DG sets are used only in case of power failure.
- Moreover, process emissions are in the form of acidic / alkaline / solvent vapours emitted from existing. The same is taken care off through seven scrubbers each of 5 kg/hr capacity. Existing scrubbers will be utilized under expansion activity.
- Existing boiler, TFH and DG sets are sufficient for proposed expansion. Boiler runs occasionally as steam is available from Sulphuric acid plant only. (Steam generated from Sulphuric Acid Plant : 335 MTD at 40 kg/cm^2 at 400^{0}C)

10.5.3 Noise Pollution

- Source of noise generation would be the Boiler House, Reactors, Compressors, DG Set, Water treatment Plant, ETP etc.
- Major source of noise generation would be the Boiler house. Insulation helps in limiting noise levels. The workers entering inside the plant are protected by earmuffs, which would give the reduction of 30 dB (A).
- D.G. Sets shall be enclosed in a separate canopy to reduce the noise levels.
- Green belt is developed to attenuate the noise levels.

10.5.4 Solid Waste

Solid wastes generated from the existing as well as expansion activities are categorized as Hazardous and Non-Hazardous Wastes. Details of solid waste generated / to be generated from existing & expansion activities are given in following table -

Table 10.5 Solid Waste Details for Existing and Expansion Activities

Sr. No.	Type of Solid Waste	Quantity (kg/Annum)			Disposal
		Existing	Expansion	Total	
1.	Paper Waste	100	0	100	Sale to Authorized Party
2.	Broken Glass	10	0	10	
3.	HDPE Bags	100	0	100	
4.	Sulphur Sludge	120 MT/Annum	0	120 MT/Annum	CHWTSDF, Taloja

10.5.5 Hazardous Waste

Table 10.6 Hazardous Waste Details for Existing and Expansion Activities

Sr. No.	Type of Hazardous Solid Waste	Category	Quantity (kg/Day)			Disposal
			Existing	Expansion	Total	
1.	Chemical Sludge from Waste Water Treatment	35.3	833	109	942	CHWTSDF, Taloja / Sale to Authorized Party Membership No. - MWML - HzW - ROH - 313 (Valid up to 21.03.2020)
2.	Residues , Dust or Filter cakes	17.1	203	0	203	
3.	Spent Catalyst	17.2	4000 Lit./Annum	0	4000 Lit./Annum	

Refer **Appendix - I** for CHWTSDF membership letter**.**

10.5.6 Odour Pollution

There are different odour sources in the existing set up, which include raw material & product storage places, process operations, loading / unloading sections etc. which could give rise to smell nuisance. To abate the odour problem, the industry has taken following steps under its existing unit. The same practice shall be adopted under expansion.

- All the feed, loading and unloading pumps for products and raw materials are fitted with mechanical seals instead of glands to reduce leakages through pumps.
- The products and raw materials loading and unloading area are provided with fumes extraction system comprising of circulation pump with blower and scrubber. The bulk storage tanks are connected to scrubber for taking care of fumes coming out from vent.
- The scrubbers are filled with plain water depending on the nature of the fumes.
- Adoption of Good Management Practices (GMPs).
- Arranging awareness and training camps for workers.
- Provision and use of PPE's like masks by everybody associated with odour potential prone areas.
- Installation of appropriate, adequate and efficient exhaust and ventilation system to remove and control odour from work zone areas.

10.6 RAINWATER HARVESTING ASPECT

Being a chemical based industry here collection of the rainwater getting accumulated from direct precipitation on the total roof area will take in to account.

- Roof Top harvesting area - 1756 m^2
- Roof Top harvesting yield is - 5109.96 m^3

10.7 GREEN BELT DEVELOPMENT

The total plot area of TDMCCL is 88355 m^2 (8.84 Ha). An area of 40925 m^2 is the actual area on which the industrial activities are carried out. As per MoEFCC norm 2.95 Ha area (around 4425 trees) is to be brought under green belt which accounts for 33 % of plot area. But under existing unit only 1000 trees have been planted. Under expansion, green belt will be augmented by 3500 No. of trees. After commissioning of the expansion the existing green belt shall be subsequently augmented in phase wise manner. Thick plantation barrier will be provided on the periphery of the MIDC industrial plot. Augmentation of avenue tree plantation along all the internal and approach roads shall be done. Refer **Figure 2.7** for Photographs of Existing green belt.

10.8 ENVIRONMENTAL MONITORING PROGRAM

Monitoring of various environmental parameters will be carried out on a regular basis to ascertain the following -

- State of pollution within the plant and in its vicinity
- Examine the efficiency of Pollution Control Systems installed in the plant
- Generate data for predictive or corrective purpose in respect of pollution
- To assess environmental impacts

The project management will carry out the monitoring regularly and record shall be maintained of the same. For details w.r.t. post monitoring program to be conducted; refer Chapter - 9 (Section 9.5).

10.9 ENVIRONMENT MANAGEMENT PLAN

The Environment Management Plan aims at controlling pollution at source with available and affordable technology followed by treatment measures. Under the existing unit of TDMCCL has effectively implemented the EMP. As a part of the EMP, it is essential to formulate an Environmental Management Cell (EMC). The TDMCCL is already having a cell functioning under existing project. The cell works under Managing Director of the Industry and responsible persons from certain departments have been taken as members. For more details, the separate chapter on EMP may be referred.

10.10 CONCLUSION

The proposed of expansion of existing commodity chemicals and speciality chemicals manufacturing unit by **TDMCCL** will help to elevate the economic growth at the local level as well as national level. It will also generate the employment in the study region, thereby improving the standard of living in the region. The proposed expansion activity would not disturb the land use pattern in the study region of 10 km. No Rehabilitation is involved under this project.

Driven by the rapidly growing population and increasing consumer spending, the specialty chemicals and or commodity chemicals market in emerging economies is expected to witness a good growth in the coming years. The growing middle-class population in these economies and rising industrialization in the fields of food, agriculture, cosmetics and many other manufacturing sectors are creating the demand of these chemicals in emerging economies.

BRICS countries such as China, India and Brazil especially, are witnessing increased demand of specialty chemicals.

The proposed expansion project is further beneficial for society without hampering the environment and thereby accomplishing the aim of sustainable development.

Chapter 11

DISCLOSURE OF CONSULTANT ORGANIZATION

11.1 THE ORGANIZATION

Equinox Environments (India) Pvt. Ltd. (EEIPL) is a major company under the 'Equinox Group'. It is one of the leading environmental consultants in the country and renders all the environmental services, under one roof, needed by various industries. EEIPL is an ISO 9001:2015 certified organization (DNV-GL) that has been duly accredited through QCI - NABET for the Ministry of Environment, Forest& Climate Change (MoEFCC); New Delhi as recognized and approved 'Environmental Consultant' at the National Level. EEIPL operates through its offices located in Kolhapur, Pune, New Mumbai, New Delhi, Hydrabad and Baltimore (US). Through the organization, various services are offered that are related to environmental engineering, pollution control & itsabatement, industrial safety, health &hygiene. EEIPL's set up comprises of engineers, eminent scientists, chemists, technicians & associates. Moreover, organization is having back up of a most modern laboratory infrastructure. NABL accredited lab, also approved by Govt. of India through the MoEF; New Delhi has received OHSAS 18001:2007 certifications from DNV GL.

The 'Equinox Group' is in the environmental business for last nineteen years and have rendered services as well as expert consultation to a number of industries such as sugar factories, power plants, distilleries, foundries, sponge iron & steel plants, textile industries, bulk drug manufacturing units and chemical industries, food processing & beverage manufacturing units, asbestos products & roofing, timber and particle board Industries etc. Further our website -**www.equinoxenvi.com**- may be visited for additional details regarding our activities, achievements and list of our esteemed clients as well as our Key Personnel.

Quality Council of India

National Accreditation Board for Education & Training

Certificate of Accreditation

Equinox Environments (I) Pvt. Ltd.

F-11, Namdev Nest, 1160-B, 'E' Ward, Sykes Extension,
Opp. Kamala College, Kolhapur – 416 001 (M.S.)

***Accredited as Category - A** organization under the QCI-NABET Scheme for Accreditation of EIA Consultant Organizations, 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 including opencast / underground mining	1	1 (a) (i)	A
2	Thermal power plants	4	1 (d)	B
3	Metallurgical industries both primary & secondary	8	3 (a)	B
4	Asbestos milling and asbestos based products	12	4 (c)	A
5	Chlor-alkali industry	13	4 (d)	A
6	Pesticides industry and pesticide specific intermediates (excluding formulations)	17	5 (b)	A
7	Petro-chemical complexes (industries based on processing of petroleum fractions & natural gas and/or reforming to aromatics)	18	5 (c)	A
8	Petrochemical based processing (processes other than cracking &reformation and not covered under the complexes)	20	5 (e)	A
9	Synthetic organic chemicals industry (dyes & dye intermediates; bulk drugs and intermediates excluding drug formulations; synthetic rubbers; basic organic chemicals, other synthetic organic chemicals and chemical intermediates)	21	5 (f)	A
10	Distilleries	22	5 (g)	A
11	Sugar Industry	25	5 (j)	B
12	Common hazardous waste treatment, storage and disposal facilities (TSDFs)	32	7 (d)	A
13	Common municipal solid waste management facility (CMSWMF)	37	7 (i)	B
14	Building and construction projects	38	8 (a)	B
15	Townships and Area development projects	39	8 (b)	B
16	Electro Plating and metal Processing	40(ii)	-	A
17	Food Processing	40(v)	-	A

Note: Names of approved EIA Coordinators and Functional Area Experts are mentioned in SA AC minute dated Feb 9, 2018 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/18/0676 dated June1, 2018.The accreditation needs to be renewed before the expiry date by Equinox Environments (I) Pvt. Ltd, following due process of assessment.

Sr. Director, NABET
Dated: June1, 2018

Certificate No.
NABET/EIA/1518/ SA 063

Valid upto
Oct 21, 2018

For the updated List of Accredited EIA Consultant Organizations with approved Sectors please refer to QCI-NABET website.

NATIONAL ACCREDITATION BOARD FOR EDUCATION & TRAINING

QUALITY COUNCIL OF INDIA

QCI Office, 6th Floor, ITPI Building, Ring Road, I.P. Estate, New Delhi

Scheme for Accreditation of EIA Consultant Organizations

Accreditation Committee Meeting for Surveillance Assessment held on February 09, 2018

The following members were present during the meeting:

1. Dr. S.R. Wate - Chairman
2. Dr. G.K. Pandey - Member
3. Dr. S. P.Chakrabarti - Member
4. Prof. Umesh Kulshrestha - Member

Prof. B.B. Dhar, Dr. Nalini Bhat , Prof. C.P. Kaushik and Prof. G.J. Chakrapani expressed their inability to attend the meeting.

Mr. A.K. Jha – Senior Director, Dr.S.K Mishra – Joint Director, Dr. Pawan Kumar Singh – Assisstant Director and Ms.Meenakshi Arora – Accreditation Officer were present in the meeting.

1.0 Case for Surveillance Assessment

The following case was discussed and decisions taken as noted below.

1.1 Equinox Environments (I) Pvt. Ltd, Kolhapur

The ACO has been assessed as per Version 3 of the Scheme. Result of the 2nd Surveillance assessment (SA) is given below :

1.1.1 Category of Approval :

ACO has scored more than 60% marks. Hence, the organization accreditation is continued with Cat.A.

1.1.2 Scope of Accreditation

Sl. No.	NABET Scheme Sectors	Sector Description	Cat.	Sector No.(MoEFCC Notification dated Sep. 14, 2006 and Amendments)
1	1	Mining of minerals including opencast / underground mining	A	1 (a) (i)
2	4	Thermal power plants	B	1 (d)

3	8	Metallurgical industries both primary & secondary	B	3 (a)
4	12	Asbestos milling and asbestos based products	A	4 (c)
5	13	Chlor-alkali industry	A	4 (d)
6	17	Pesticides industry and pesticide specific intermediates (excluding formulations)	A	5 (b)
7	18	Petro-chemical complexes (industries based on processing of petroleum fractions & natural gas and/or reforming to aromatics)	A	5 (c)
8	20	Petrochemical based processing (processes other than cracking &reformation and not covered under the complexes)	A	5 (e)
9	21	Synthetic organic chemicals industry (dyes & dye intermediates; bulk drugs and intermediates excluding drug formulations; synthetic rubbers; basic organic chemicals, other synthetic organic chemicals and chemical intermediates)	A	5 (f)
10	22	Distilleries	A	5 (g)
11	25	Sugar Industry	B	5 (j)
12	32	Common hazardous waste treatment, storage and disposal facilities (TSDFs)	A	7 (d)
13	37	Common municipal solid waste management facility (CMSWMF)	B	7 (i)
14	38	Building and construction projects	B	8 (a)
15	39	Townships and Area development projects	B	8 (b)
16	40(ii)	Electro Plating and metal Processing	A	-
17	40(v)	Food Processing	A	-

1.1.3 Sectors approved for EIA Coordinators (ECs)

a.Assessed as per SA norms – for ECs approved earlier:

Sl. No.	Name	Earlier approval status (in RA/subsequently)		Approval status (after SA)		Remarks
		Sectors approved	Cat.	Sectors approved	Cat.	
In-house						
1	Sangram Ghugare	4	B	CA	B	Upgraded to Cat. A in Sector 21.
		21	B	CA	A	
		22	A	CA	A	
		25	B	CA	B	
2	Sulakshana Ayarekar	21	B	CA	A	Upgraded to Cat. A in Sector 21.
Empanelled						
3	Vinay kumar Kurakula	32	B	CA	A	Upgraded to Cat. A in Sector 32
		37	B	CA	B	

b. Assessed as per IA norms – for new Sectors of approved ECs and fresh ECs proposed:

Sl. No.	Name	Functional Area			Cat.	Remarks
		Applied	Recommended	Approved		

DNV·GL

MANAGEMENT SYSTEM CERTIFICATE

Certificate No:
183398-2015-AQ-IND-RvA

Initial certification date:
28, August, 2012

Valid:
28, August, 2015 - 27, August, 2018

This is to certify that the management system of

Equinox Environments (I) Pvt. Ltd.
Enviclean Associates
Clinviron Consultants' Combine
(Environmental and Civil Engineers, Consultants and Analysts)

Flat No. 11, Namdev Nest Apartment, 1160-B, 'E' Ward, Sykes Extension, Opp. Kamala College, Kolhapur - 416 001, Maharashtra, India

has been found to conform to the Quality Management System standard:
ISO 9001:2008

This certificate is valid for the following scope:
Consultation and project management for
a) Environmental impact assessment
b) Prevention / control of pollution from effluents, emissions, noise & solid wastes
c) Revival and conservation of lake / river

Place and date:
Chennai, 03, August, 2015

MEMBER OF MULTILATERAL RECOGNITION ARRANGEMENT IAF
MGMT. SYS.
RvA C 024

The RvA is a signatory to the IAF MLA

For the issuing office:
DNV GL – Business Assurance
ROMA, No. 10, GST Road, Alandur,
Chennai, PIN - 600 016, India

Sivadasan Madiyath
Management Representative

Lack of fulfilment of conditions as set out in the Certification Agreement may render this Certificate invalid.
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assurance.dnvgl.com

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भारत का राजपत्र
The Gazette of India

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अधिसूचना

नई दिल्ली, 13 जुलाई, 2010

का.आ. 1662(अ).—केन्द्रीय सरकार, पर्यावरण (संरक्षण) नियम, 1986 के नियम 10 के साथ पठित पर्यावरण (संरक्षण) अधिनियम, 1986 (1986 का 29) की धारा 12 की उप-धारा (1) के खण्ड (ख) और धारा 13 द्वारा प्रदत्त शक्तियों का प्रयोग करते हुए, नीचे दी गई सारणी के स्तंभ (2) में विनिर्दिष्ट प्रयोगशालाओं को उक्त अधिनियम और उसके अधीन बनाए गए नियमों के अधीन ऐसी प्रयोगशालाओं को सौंपे गए कृत्यों के क्रियान्वित करने के लिए पर्यावरणीय प्रयोगशालाओं के रूप में और स्तंभ (3) में विनिर्दिष्ट व्यक्तियों को, उक्त अधिनियम की धारा 11 के अधीन सशक्त अधिकारियों को पूर्वोक्त सारणी के स्तंभ (4) में विनिर्दिष्ट अवधि के लिए भेजे गए वायु, जल, मृदा या अन्य पदार्थों के नमूनों का विश्लेषण करने के प्रयोजनों के लिए सरकारी विश्लेषक के रूप में मान्यता प्रदान करती है और उस प्रयोजन के लिए भारत सरकार के पर्यावरण और वन मंत्रालय की अधिसूचना सं. का.आ. 1174(अ), तारीख 18 जुलाई, 2007 में निम्नलिखित और संशोधन करती है, अर्थात् :—

उक्त अधिसूचना से संलग्न सारणी में :—(i) क्रम संख्यांक 12 और 21 और उससे संबंधित प्रविष्टियों के स्थान पर निम्नलिखित क्रम संख्यांक और प्रविष्टियां रखी जाएंगी, अर्थात् :—

सारणी

क्रम सं.	प्रयोगशाला का नाम	सरकारी विश्लेषणकर्ता का नाम	से लागू और तक विधिमान्य
(1)	(2)	(3)	(4)
"12	मैसर्स होराईजन सर्विस (इन्वायरमैंटल एंड सेफ्टी), 39, श्यामसुन्दर सोसायटी, नियर महात्रे ब्रिज, पुणे-411033 (महाराष्ट्र)	(1) श्री कुणाल मनोहर नरगोलकर (2) डॉ अर्चना वग्कोले (3) श्री अमित आनंद पाटकी	13-7-2010 से 12-7-2015
21	मैसर्स चौकसी लैबोरेट्रीज लि. 6/3, मनोरमागंज, इंदौर - 452001 (मध्य प्रदेश)	(1) श्री सुनील चौकसी (2) श्री केविश व्यास (3) श्रीमति शैला देशपांडे	13-7-2010 से 12-7-2015"

(ii) क्रम संख्या 81 और उससे संबंधित प्रविष्टियों के पश्चात् निम्नलिखित क्रम संख्या और प्रविष्टियां अन्त:स्थापित की जाएंगी अर्थात :—

क्रम सं.	प्रयोगशाला का नाम	सरकारी विश्लेषणकर्ता का नाम	से लागू और तक विधिमान्य
(1)	(2)	(3)	(4)
"82	मैसर्स एनर्जी एंड रिसोर्सिज इंसटीच्यूट, 6 सी, दरबारी सेठ ब्लॉक इंडिया हैबिटेट सेंटर कॉम्प्लेक्स, लोदी रोड, नई दिल्ली-110003	(1) श्री अंशुमान (2) श्री आर. सुरेश (3) श्री वेद प्रकाश शर्मा	13-7-2010 से 12-7-2015
83	मैसर्स हरियाणा टेस्ट हाउस एंड कंसल्टेंसी सर्विसेज, 50-सी, सेक्टर 25, भाग-II, हुड्डा पानीपत-132104 (हरियाणा)	(1) श्री एम. एल. दुआ (2) श्री टी. एल. मेहता (3) सुश्री दीपा सरदाना	13-7-2010 से 12-7-2015
84	मैसर्स डीटाक्स कॉर्पोरेशन प्राइवेट लिमिटेड, तीसरी मंजिल, के. जी. चेम्बर्स, गुजरात समाचार प्रेस के सामने, रिंग रोड, सूरत-395002 (गुजरात)	(1) श्री अमित रोनोसे (2) श्री जितेन्द्र खसकिया (3) डॉ. भावना मेहरा	13-7-2010 से 12-7-2015
85.	मैसर्स थापर सेन्टर फॉर इन्डस्ट्रीअल रिसर्ज डेवेलप्मेंट (टीसीआईआरडी) थापर टेक्नालोजी कैम्पस, पोस्ट बाक्स नं. 68, भद्सोन रोड पटियाला-147001 (पंजाब)	(1) श्री आकेपाति सिवाराम रेडडी (2) श्री जे. नागेन्द्र बाबू (3) श्री मुकेश अग्रवाल	13-7-2010 से 12-7-2015"

[फा. सं. क्यू-15018/7/2003-सीपीडब्ल्यू]

रजनीश दुबे, संयुक्त सचिव

टिप्पण :—मूल अधिसूचना भारत के राजपत्र, असाधारण में संख्यांक का.आ. 1174(अ), तारीख 18 जुलाई, 2007 द्वारा प्रकाशित की गई थी और अधिसूचना सं. का.आ. 1539(अ), तारीख 13 सितम्बर, 2007, का.आ. 1811(अ), तारीख 24 अक्तूबर, 2007, का.आ. 55(अ), तारीख 9 जनवरी, 2008, का.आ. 428(अ), तारीख 4 मार्च, 2008, का.आ. 865(अ), तारीख 11 अप्रैल, 2008, का.आ. 1894(अ), तारीख 31 जुलाई, 2008, का.आ. 2728(अ), तारीख 25 नवम्बर, 2008, का.आ. 1356(अ), तारीख 27 मई, 2009, का.आ. 1802(अ), तारीख 22 जुलाई, 2009 और का.आ. 2399(अ), तारीख 18 सितम्बर, 2009 और का.आ. 3122(अ), तारीख 7 दिसम्बर, 2009 और का.आ. 3123(अ), तारीख 7 दिसम्बर, 2009 और का.आ. 142(अ), तारीख 21 जनवरी, 2010 और का.आ. 619(अ), तारीख 19 मार्च, 2010 द्वारा उसमें पश्चात्वर्ती संशोधन किए गए ।

MINISTRY OF ENVIRONMENT AND FORESTS

NOTIFICATION

New Delhi, the 13th July, 2010

S.O. 1662(E).—In exercise of the powers conferred by clause (b) of sub-section (1) of Section 12 and Section 13 of the Environment (Protection) Act, 1986 (29 of 1986) read with rule 10 of the Environment (Protection) Rules, 1986, the Central Government hereby recognizes the laboratories specified in column (2) of the Table given below as environmental laboratories to carry out the functions entrusted to such laboratories under the said Act and rules made thereunder, and the persons specified in column (3) as Government Analysts for the purposes of analysis of samples of air, water, soil or other substances sent for analysis by the Central Government or the officer empowered under Section 11 of the said Act, for a period specified in column (4) of the Table aforesaid, and for that purpose makes the following further amendments in the notification of the Government of India in the Ministry of Environment and Forests, number S.O. 1174 (E), dated the 18th July, 2007, namely :—

In the Table appended to the said notification :—

(i) for serial numbers 12 and 21 the entries relating thereto, the following serial numbers and entries shall be inserted, namely :—

TABLE

Sl. No.	Name of the Laboratory	Name of the Government Analyst	Recognition with effect from and valid up to
(1)	(2)	(3)	(4)
"1?	M/s. Horizon Services (Environmental and Safety), 39, Shyamsunder Society Near Mhatre Bridge, Pune-411033 (Maharashtra)	(1) Shri Kunal Manohar Nargolkar (2) Dr. Archana Waykole (3) Shri Amit Anand Patki	13-7-2010 to 12-7-2015
21	M/s. Choksi Laboratories Ltd., 6/3, Manoramaganj, Indore-452001 (Madhya Pradesh)	(1) Shri Sunil Choksi (2) Shri Kavish Vyas (3) Mrs. Shaila Deshpande	13-7-2010 to 12-7-2015"

(ii) after serial number 81 and the entries relating thereto, the following serial number and entries shall be inserted, namely :—

Sl. No.	Name of the Laboratory	Name of the Government Analyst	Recognition with effect from and valid up to
(1)	(2)	(3)	(4)
"82	M/s. The Energy and Resources Institute, 6C, Darbari Seth Block, India Habitat Centre Complex, Lodhi Road, New Delhi-110003	(1) Mr. Anshuman (2) Mr. R. Suresh (3) Mr. Ved Prakash Sharma	13-7-2010 to 12-7-2015
83	M/s. Haryana Test House and Consultancy Services, 50-C, Sector-25 Part-II HUDA, Panipat-132104 (Haryana)	(1) Shri M.L. Dua (2) Shri T.L. Mehta (3) Ms. Deepa Sardana	13-7-2010 to 12-7-2015
84	M/s. Detox Corporation Pvt. Ltd., 3rd Floor, K.G. Chambers, Opp. Gujarat Samachar Press, Ring Road, Surat-395002 (Gujarat)	(1) Mr. Amit Renose (2) Mr. Jitendra Khasakia (3) Dr. Bhavna Mehra	13-7-2010 to 12-7-2015
85	M/s. Thapar Centre for Industrial Research & Development (TCIRD) Thapar Technology Campus Post Box No. 68, Bhadson Road Patiala-147001 (Punjab)	(1) Dr. Akepati Sivaram Reddy (2) Shri J. Nagendra Babu (3) Shri Mukesh Agarwal	13-7-2010 to 12-7-2015"

[F.No. Q.15018/7/2003-CPW]

RAJNEESH DUBE, Jt. Secy.

Note :—The principal notification was published in the Gazette of India, Extraordinary *vide* number S.O. 1174(E), dated the 18th July, 2007 and subsequently amended *vide* Notification numbers S.O. 1539(E), dated the 13th September, 2007, S.O. 1811(E), dated the 24th October, 2007, S.O. 55 (E), dated 9th January, 2008, S.O. 428(E), dated the 4th March, 2008, S.O. 865(E), dated the 11th April, 2008, S.O. 1894(E) dated the 31st July, 2008, S.O. 2728(E), dated the 25th November, 2008, S.O. 1356(E), dated the 27th May, 2009, S.O.1802 (E), dated 22nd July, 2009 and S.O. 2399(E), dated the 18th September, 2009 and S.O. 3122(E), dated the 7th December, 2009 and No. S.O. 3123(E), dated the 7th December, 2009, S.O. 142(E), dated the 21st January, 2010, S.O. 619(E), 19th March, 2010.

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Speed Post

File No. Q-15018/18/2015-CPW
Government of India
Ministry of Environment Forests and Climate Change
(CP Division)

Indira Paryavaran Bhawan,
2nd Floor Prithvi Wing,
Jor Bagh Road, Aliganj,
New Delhi – 110 003'
Dated: 12th November, 2015.

To,

M/s Horizon Services (Analytical Laboratory),
Shree K3/4, S. N.10,
Erandawane Housing Society,
Opposite Deenanath Mangeshkar Hospital,
Pune-411004, Maharashtra

Subject: Renewal of recognition of M/s Horizon Services(Analytical Laboratory), Shree K3/4, S. N.10,Erandawane Housing Society, Opposite Deenanath Mangeshkar Hospital, Pune-411004, Maharashtra as Environmental Laboratory under the Environment (Protection) Act, 1986 - reg.

Sir,

Please refer to your application seeking renewal of recognition of your laboratory under Environment (Protection)Act,1986.As approved by the competent authority, it has been decided to accord renewal of recognition to your Environmental laboratory under Environment (Protection)Act, 1986.The terms & conditions as given in the Annexure – III,IV&V have already been agreed by you. Further action to notify your laboratory in the official gazette is being taken.

You are requested to participate in the Analytical Quality Control (AQC) exercise conducted by the Central Pollution Control Board and provide quarterly monitoring reports of your lab.

It may be noted that periodic surveillance of recognized Environmental Laboratory under Environment (Protection) Act, 1986 will be undertaken by Central Govt./CPCB to assess the proper functioning ,systematic operation and reliability of data generated at the laboratory

Your's faithfully,

(Dr. (Ms.) Rubab Jaffer),
Deputy Director

National Accreditation Board for Testing and Calibration Laboratories

(An Autonomous Body under Department of Science & Technology, Govt. of India)

CERTIFICATE OF ACCREDITATION

HORIZON SERVICES (ANALYTICAL LABORATORY)

has been assessed and accredited in accordance with the standard

ISO/IEC 17025:2005

"General Requirements for the Competence of Testing & Calibration Laboratories"

for its facilities at

Shree K 3/4, S. No. 10, Erandawane Housing Society, Pune, Maharashtra

in the discipline of

CHEMICAL TESTING

(To see the scope of accreditation of this laboratory, you may also visit NABL website www.nabl-india.org)

Certificate Number T-2874

Issue Date 11/03/2016 **Valid Until** 10/03/2018

This certificate remains valid for the Scope of Accreditation as specified in the annexure subject to continued satisfactory compliance to the above standard & the additional requirements of NABL.

Signed for and on behalf of NABL

241

N. Venkateswaran	Anil Relia	Prof. S. K. Joshi
Program Manager	Director	Chairman

ENCLOSURE - I

STANDARD ToR LETTER

No.IA-J-11011/74/2018-IA-II(I)

Goverment of India

Minister of Enviroment,Forest and Climate Change

Impact Assessment Division

***

Indira Paryavaran Bhavan,
Vayu Wing,3rd Floor,Aliganj,
Jor Bagh Road,New Delhi-110003
03 May 2018

To,

M/s THE DHARAMSI MORARJI CHEMICAL COMPANY LIMITED
Plot.No.- 105,M.I.D.C. Indl. Area, P.O. Dhatav, Taluka-Roha, District- Raigad, State-Maharashtra.,
Mumbai City-400001
Maharashtra

Tel.No.2194-63553; Email:shirish.pandit23@gmail.com

Sir/Madam,

This has reference to the proposal submitted in the Ministry of Environment, Forest and Climate Change to prescribe the Terms of Reference (TOR) for undertaking detailed EIA study for the purpose of obtaining Environmental Clearance in accordance with the provisions of the EIA Notification, 2006. For this purpose, the proponent had submitted online information in the prescribed format (Form-1) along with a Pre-feasibility Report. The details of the proposal are given below:

1. Proposal No.:	IA/MH/IND2/73219/2018
2. Name of the Proposal:	The Dharamsi Morarji Chemical Company Limited
3. Category of the Proposal:	Industrial Projects - 2
4. Project/Activity applied for:	5(f) Synthetic organic chemicals industry (dyes & dye intermediates; bulk
5. Date of submission for TOR:	27 Mar 2018

In this regard, under the provisions of the EIA Notification 2006 as amended, the Standard TOR for the purpose of preparing environment impact assessment report and environment management plan for obtaining prior environment clearance is prescribed with public consultation as follows:

5(f): STANDARD TERMS OF REFERENCE FOR CONDUCTING ENVIRONMENT IMPACT ASSESSMENT STUDY FOR SYNTHETIC ORGANIC CHEMICALS INDUSTRY (DYES & DYE INTERMEDIATES; BULK DRUGS AND INTERMEDIATES EXCLUDING DRUG FORMULATIONS; SYNTHETIC RUBBERS; BASIC ORGANIC CHEMICALS, OTHER SYNTHETIC ORGANIC CHEMICALS AND CHEMICAL INTERMEDIATES) AND INFORMATION TO BE INCLUDED IN EIA/EMP REPORT

A. STANDARD TERMS OF REFERENCE

1) Executive Summary

2) Introduction

i. Details of the EIA Consultant including NABET accreditation

ii. Information about the project proponent

iii. Importance and benefits of the project

3) Project Description

i. Cost of project and time of completion.

ii. Products with capacities for the proposed project.

iii. If expansion project, details of existing products with capacities and whether adequate land is available for expansion, reference of earlier EC if any.

iv. List of raw materials required and their source along with mode of transportation.

v. Other chemicals and materials required with quantities and storage capacities

vi. Details of Emission, effluents, hazardous waste generation and their management.

vii. Requirement of water, power, with source of supply, status of approval, water balance diagram, man-power requirement (regular and contract)

viii. Process description along with major equipments and machineries, process flow sheet (quantative) from raw material to products to be provided

ix. Hazard identification and details of proposed safety systems.

x. Expansion/modernization proposals:

c. Copy of all the Environmental Clearance(s) including Amendments thereto obtained for the project from MOEF/SEIAA shall be attached as an Annexure. A certified copy of the latest Monitoring Report of the Regional Office of the Ministry of Environment and Forests as per circular dated 30th May, 2012 on the status of compliance of conditions stipulated in all the existing environmental clearances including Amendments shall be provided. In

addition, status of compliance of Consent to Operate for the ongoing Iexisting operation of the project from SPCB shall be attached with the EIA-EMP report.

d. In case the existing project has not obtained environmental clearance, reasons for not taking EC under the provisions of the EIA Notification 1994 and/or EIA Notification 2006 shall be provided. Copies of Consent to Establish/No Objection Certificate and Consent to Operate (in case of units operating prior to EIA Notification 2006, CTE and CTO of FY 2005-2006) obtained from the SPCB shall be submitted. Further, compliance report to the conditions of consents from the SPCB shall be submitted.

4) Site Details

i. Location of the project site covering village, Taluka/Tehsil, District and State, Justification for selecting the site, whether other sites were considered.

ii. A toposheet of the study area of radius of 10km and site location on 1:50,000/1:25,000 scale on an A3/A2 sheet. (including all eco-sensitive areas and environmentally sensitive places)

iii. Details w.r.t. option analysis for selection of site

iv. Co-ordinates (lat-long) of all four corners of the site.

v. Google map-Earth downloaded of the project site.

vi. Layout maps indicating existing unit as well as proposed unit indicating storage area, plant area, greenbelt area, utilities etc. If located within an Industrial area/Estate/Complex, layout of Industrial Area indicating location of unit within the Industrial area/Estate.

vii. Photographs of the proposed and existing (if applicable) plant site. If existing, show photographs of plantation/greenbelt, in particular.

viii. Landuse break-up of total land of the project site (identified and acquired), government/ private - agricultural, forest, wasteland, water bodies, settlements, etc shall be included. (not required for industrial area)

ix. A list of major industries with name and type within study area (10km radius) shall be incorporated. Land use details of the study area

x. Geological features and Geo-hydrological status of the study area shall be included.

xi. Details of Drainage of the project upto 5km radius of study area. If the site is within 1 km radius of any major river, peak and lean season river discharge as well as flood occurrence frequency based on peak rainfall data of the past 30 years. Details of Flood Level of the project site and maximum Flood Level of the river shall also be provided. (mega green field projects)

xii. Status of acquisition of land. If acquisition is not complete, stage of the acquisition process and expected time of complete possession of the land.

xiii. R&R details in respect of land in line with state Government policy.

5) Forest and wildlife related issues (if applicable):

i. Permission and approval for the use of forest land (forestry clearance), if any, and recommendations of the State Forest Department. (if applicable)

ii. Landuse map based on High resolution satellite imagery (GPS) of the proposed site delineating the forestland *(in case of projects involving forest land more than 40 ha)*

iii. Status of Application submitted for obtaining the stage I forestry clearance along with latest status shall be submitted.

iv. The projects to be located within 10 km of the National Parks, Sanctuaries, Biosphere Reserves, Migratory Corridors of Wild Animals, the project proponent shall submit the map duly authenticated by Chief Wildlife Warden showing these features vis-à-vis the project location and the recommendations or comments of the Chief Wildlife Warden-thereon.

v. Wildlife Conservation Plan duly authenticated by the Chief Wildlife Warden of the State Government for conservation of Schedule I fauna, if any exists in the study area.

vi. Copy of application submitted for clearance under the Wildlife (Protection) Act, 1972, to the Standing Committee of the National Board for Wildlife.

6) Environmental Status

i. Determination of atmospheric inversion level at the project site and site-specific micro-meteorological data using temperature, relative humidity, hourly wind speed and direction and rainfall.

ii. AAQ data (except monsoon) at 8 locations for PM10, PM2.5, SO2, NOX, CO and other parameters relevant to the project shall be collected. The monitoring stations shall be based CPCB guidelines and take into account the pre-dominant wind direction, population zone and sensitive receptors including reserved forests.

iii. Raw data of all AAQ measurement for 12 weeks of all stations as per frequency given in the NAQQM Notification of Nov. 2009 along with - min., max., average and 98% values for each of the AAQ parameters from data of all AAQ stations should be provided as an annexure to the EIA Report.

iv. Surface water quality of nearby River (100m upstream and downstream of discharge point) and other surface drains at eight locations as per CPCB/MoEF&CC guidelines.

v. Whether the site falls near to polluted stretch of river identified by the CPCB/MoEF&CC, if yes give details.

vi. Ground water monitoring at minimum at 8 locations shall be included.

vii. Noise levels monitoring at 8 locations within the study area.

viii. Soil Characteristic as per CPCB guidelines.

ix. Traffic study of the area, type of vehicles, frequency of vehicles for transportation of materials, additional traffic due to proposed project, parking arrangement etc.

x. Detailed description of flora and fauna (terrestrial and aquatic) existing in the study area shall be given with special reference to rare, endemic and endangered species. If Schedule-I fauna are found within the study area, a Wildlife Conservation Plan shall be prepared and furnished.

xi. Socio-economic status of the study area.

7) Impact and Environment Management Plan

i. Assessment of ground level concentration of pollutants from the stack emission based on site-specific meteorological features. In case the project is located on a hilly terrain, the AQIP Modelling shall be done using inputs of the specific terrain characteristics for determining the potential impacts of the project on the AAQ. Cumulative impact of all sources of emissions (including transportation) on the AAQ of the area shall be assessed. Details of the model used and the input data used for modelling shall also be provided. The air quality contours shall be plotted on a location map showing the location of project site, habitation nearby, sensitive receptors, if any.

ii. Water Quality modelling - in case of discharge in water body

iii. Impact of the transport of the raw materials and end products on the surrounding environment hall be assessed and provided. In this regard, options for transport of raw materials and finished products and wastes (large quantities) by rail or rail-cum road transport or conveyor-cum-rail transport shall be examined.

iv. A note on treatment of wastewater from different plant operations, extent recycled and reused for different purposes shall be included. Complete scheme of effluent treatment. Characteristics of untreated and treated effluent to meet the prescribed standards of discharge under E(P) Rules.

v. Details of stack emission and action plan for control of emissions to meet standards.

vi. Measures for fugitive emission control

vii. Details of hazardous waste generation and their storage, utilization and management. Copies of MOU regarding utilization of solid and hazardous waste in cement plant shall also be included. EMP shall include the concept of waste-minimization, recycle/reuse/recover techniques, Energy conservation, and natural resource conservation.

viii. Proper utilization of fly ash shall be ensured as per Fly Ash Notification, 2009. A detailed plan of action shall be provided.

ix. Action plan for the green belt development plan in 33 % area i.e. land with not less than 1,500 trees per ha. Giving details of species, width of plantation, planning schedule etc. shall be included. The green belt shall be around the project boundary and a scheme for greening of the roads used for the project shall also be incorporated.

x. Action plan for rainwater harvesting measures at plant site shall be submitted to harvest rainwater from the roof tops and storm water drains to recharge the ground water and also to

use for the various activities at the project site to conserve fresh water and reduce the water requirement from other sources.

xi. Total capital cost and recurring cost/annum for environmental pollution control measures shall be included.

xii. Action plan for post-project environmental monitoring shall be submitted.

xiii. Onsite and Offsite Disaster (natural and Man-made) Preparedness and Emergency Management Plan including Risk Assessment and damage control. Disaster management plan should be linked with District Disaster Management Plan.

8) Occupational health

i. Plan and fund allocation to ensure the occupational health & safety of all contract and casual workers

ii. Details of exposure specific health status evaluation of worker. If the workers' health is being evaluated by pre designed format, chest x rays, Audiometry, Spirometry, Vision testing (Far & Near vision, colour vision and any other ocular defect) ECG, during pre placement and periodical examinations give the details of the same. Details regarding last month analyzed data of above mentioned parameters as per age, sex, duration of exposure and department wise.

iii. Details of existing Occupational & Safety Hazards. What are the exposure levels of hazards and whether they are within Permissible Exposure level (PEL). If these are not within PEL, what measures the company has adopted to keep them within PEL so that health of the workers can be preserved,

iv. Annual report of heath status of workers with special reference to Occupational Health and Safety.

9) Corporate Environment Policy

i. Does the company have a well laid down Environment Policy approved by its Board of Directors? If so, it may be detailed in the EIA report.

ii. Does the Environment Policy prescribe for standard operating process / procedures to bring into focus any infringement / deviation / violation of the environmental or forest norms / conditions? If so, it may be detailed in the EIA.

iii. What is the hierarchical system or Administrative order of the company to deal with the environmental issues and for ensuring compliance with the environmental clearance conditions? Details of this system may be given.

iv. Does the company have system of reporting of non compliances / violations of environmental norms to the Board of Directors of the company and / or shareholders or stakeholders at large? This reporting mechanism shall be detailed in the EIA report

10) Details regarding infrastructure 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.

11) Enterprise Social Commitment (ESC)

i. Adequate funds (at least 2.5 % of the project cost) shall be earmarked towards the Enterprise Social Commitment based on Public Hearing issues and item-wise details along with time bound action plan shall be included. Socio-economic development activities need to be elaborated upon.

12) Any litigation pending against the project and/or any direction/order passed by any Court of Law against the project, if so, details thereof shall also be included. Has the unit received any notice under the Section 5 of Environment (Protection) Act, 1986 or relevant Sections of Air and Water Acts? If so, details thereof and compliance/ATR to the notice(s) and present status of the case.

13) 'A tabular chart with index for point wise compliance of above TOR.

B. SPECIFIC TERMS OF REFERENCEFOREIASTUDIES FOR SYNTHETIC ORGANIC CHEMICALS INDUSTRY (DYES & DYE INTERMEDIATES; BULK DRUGS AND INTERMEDIATES EXCLUDING DRUG FORMULATIONS; SYNTHETIC RUBBERS; BASIC ORGANIC CHEMICALS, OTHER SYNTHETIC ORGANIC CHEMICALS AND CHEMICAL INTERMEDIATES)

1. Detailsonsolvents to be used,measuresfor solventrecovery and for emissions control.
2. Details of process emissions from the proposed unit and its arrangement to control.
3. Ambient air quality data should include VOC, otherprocess-specificpollutants* like NH3*, chlorine*, HCl*, HBr*, H2S*, HF*,etc.,(*-asapplicable)
4. Work zone monitoring arrangements for hazardous chemicals.
5. Detailed effluent treatment scheme including ssegregation of effluent streams for units adopting 'Zero' liquid discharge.
6. Action plan for odour control to be submitted.
7. A copy of the Memorandum of Understanding signed with cement manufacturers indicating clearly that they co-process organic solid/hazardous waste generated.
8. Authorization/Membership for the disposal of liquid effluent in CETP and solid/hazardous waste in TSDF, if any.
9. Action plan for utilization of MEE/dryers salts.
10. Material Safety Data Sheet for all the Chemicals are being used/will be used.
11. Authorization/Membership for the disposal of solid/hazardous waste in TSDF.

12. Details of incinerator if to be installed.
13. Risk assessment for storage and handling of hazardous chemicals/solvents. Action plan for handling & safety system to be incorporated.
14. Arrangements for ensuring health and safety of workers engaged in handling of toxic materials.

***

THE DHARAMSI MORARJI CHEMICAL CO. LTD.

CIN NUMBER : L24110MH1919PLC000564

FACTORY : Plot No.105, MIDC AREA, P.B. No.4, AUDYOGIK VASAHAT ROHA, DIST. RAIGAD - 402 116.

Phone No.: (02194) 263553-4-5. Fax : (02194) 263557

Responsible Care®

Date – December 17, 2018

DECLARATION

This is to state that the 'EIA Report' submitted herewith has been prepared in respect of proposed expansion of commodity chemicals and speciality chemicals Manufacturing unit from 31384 MT/M to 32510 MT/M by **The Dharamsi Morarji Chemical Company Limited (TDMCCL)** at Plot No. 105 in MIDC Industrial Area, P.O. Dhatav, Taluka: Roha, District: Raigad, State: Maharashtra.

The information, data and details presented in this report are true to the best of our knowledge. The primary and secondary data have been generated through actual exercise conducted from time to time as well as procured from the concerned Govt. offices / departments has been incorporated here subsequent to necessary processing, formulation and compilation.

The Dharamsi Morarji Chemical Company Limited
Plot No. 105 in MIDC Industrial Area, P.O. Dhatav, Taluka: Roha, District: Raigad, State: Maharashtra. 402116

Project Proponent

M/s. Equinox Environments (I) Pvt. Ltd., (EEIPL)
F-11, Namdev Nest 1160 – B, 'E' Ward, Sykes Extension, opp. of Kamla College, Kolhapur - 416 001.

Environmental Consultant

ISO 9001 : 2015 BUREAU VERITAS Certification

PRODUCTION AND DISPATCH OF SULPHURIC ACID OF DIFFERENT GRADES. OLEUMS (COMMERCIAL) 23% AND 65%, SULPHURIC ANHYDRIDE (STABILISED), DIETHYL SULPHATE, DIFFERENT GRADES OF SODIUM VINYL SULFONATE, CHLOROSULFONIC ACID, PHENOL SULFONIC ACID, BENZENE SULFONYL CHLORIDE, BENZENE SULFONIC ACID, DIPHENYL SULFONES, SULFONAMIDES
CERTIFICATE NO. : IND 15.5565U/Q