BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL,

WESTERN ZONE BENCH PUNE AT PUNE .

ORIGINAL APPLICATION NO. 20 OF 2026 (WZ)

SURTAJI HAMIRJI JADEJA **APPLICANT**

V/S

STATE OF GUJARAT AND OTHERS **RESPONDENTS**

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PUNE

DATE : 22/04/2026

ADVOCATE FOR RESPONDENT NO.10

BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL,

WESTERN ZONE BENCH PUNE AT PUNE .

ORIGINAL APPLICATION NO. 20 OF 2026 (WZ)

SURTAJI HAMIRJI JADEJA **APPLICANT**

V/S

STATE OF GUJARAT AND OTHERS **RESPONDENTS**

REPLY ON BEHALF OF RESPONDENT NO.10

(M/s SHREE BHAGWATI BUILD INFRA PVT. LTD.)

MAY IT PLEASE THE HON'BLE TRIBUNAL

THE RESPONDENT NO.10 MOST RESPECTFULLY SUBMITS THAT :-

1. At the outset, it is submitted that, the contents of the Original Application are not admitted by the Respondent no.10 and that the contents therein are false and incorrect. The Respondent No.10 submits that the statements and averments made in the Original Application are not admitted except so far they are expressly admitted herein under. It is further submitted that, the Respondent No.10 craves leave of this Hon'ble Tribunal to file a detailed reply if necessary in the present proceeding. At the outset, the Original Application filed by the Applicant is devoid of any merit and is liable to be dismissed with compensatory cost. The Applicant has

not approached this Hon'ble Tribunal with clean hands and has suppressed material facts herein, and thus the present Application is required to be dismissed.

2. The Respondent No.10 submits that, the Respondent No.10 herein has all the requisite necessary permissions to operate the plant and the same has been suppressed by the Applicant before this Hon'ble Tribunal and hence, the present Original Application is required to be dismissed. The Respondent No.10 submits that the Applicant as a dishonest litigant is not entitled for any relief from this Hon'ble Tribunal.

3. The Respondent No.10 submits that the present Original Application is not maintanable as the Respondent No.10 has been issued Consent to Operate on 13th February 2026 which is valid till 17th December 2030. The Respondent No.10 submits that none of the permissions received by the Respondent No.10 have been challenged before any of the forum by the Applicant and in the garb of an appeal, the present Original Application has been filed, which is not permissible and maintainable.

FACTS OF THE CASE

4. The Respondent No.10 submits that, the Respondent No.10 is a Company registered and incorporated under the provisions of the Companies Act, 1956, and is having its head office at D-202, Chandanbala Flats, Opp. Suvidha Shopping Center, Mahalaxmi Cross Road, Ahmedabad- 380007. The Respondent No.10 is engaged in the field of construction.

5. The Respondent No.10 herein was awarded a salt work lease area from an un-surveyed land near Lakhpat Sayra, Mudhan, and Zara villages in Lakhpat Taluka of Kachchh district in the State of Gujarat. The Kachchh Collector has allotted a total area of 15 thousand hectares for the purpose of solar salt production and extraction of other chemicals from the residual bittern. The salt lease is acquired with the object of augmenting the increasing need of salt for various industries in Kachchh and in India.

6. Thereafter the Respondent No.10 addressed a letter dated 19.05.2022 to the Gujarat Coastal Zone Management Authority (GCZMA) requesting for the CRZ clearance. The CRZ clearance came to be granted to the Respondent No.10 on 12.08.2024. The copy of the CRZ clearance dated 12.08.2024 is annexed hereto and marked as **ANNEXURE-R-1**.

7. The Respondent No.10 submits that, for undertaking the said activity the Respondent No.10 approached the Respondent No.5 (GPCB) for grant of Consent to Establish. The Consent to Establish was granted to the Respondent No.10 on 10.10.2022. The copy of the said Consent to Establish is annexed hereto and marked as **ANNEXURE-R-2**. The Respondent No.10 thereafter got the EIA study prepared for its project. It is submitted that, as per the EIA Notification of 2006, the project of the Respondent No.10 does not fall in the list of projects required in Environment Impact Assessment study. However, as per the CRZ notification 2011, and the recent amendment of 28.11.2024, the salt works project falls under the permissible activities in CRZ area and hence, the Respondent No.10 carried out the said EIA study. The copy of the EIA study is annexed hereto and marked as **ANNEXURE-R-3**.
8. The Respondent No.10 further submits that, the Respondent No.10 has also obtained the NOC from the Central Ground Water Authority (CGWA) on 12.09.2023. The copy of NOC of the Central Ground Water Authority (CGWA) is annexed hereto and marked as **ANNEXURE-R-4**.
9. The Respondent No.10 has also conducted the HAZOP Study Report dated 22.01.2024 for the risk management involved in setting up of the

present plant. The copy of the HAZOP is annexed hereto and marked as **ANNEXURE-R-5**.

10. The Respondent No.10 further submits that, the Respondent No.10 has also received the 'Consent to Operate' dated 13.02.2026 and the said Consent to Operate is valid upto 17.12.2030. The copy of the said Consent to Operate dated 13.02.2026 is annexed hereto and marked as **ANNEXURE-R-6**.

11. It is submitted that, as stated above, all the permissions which were mandated under the law have been obtained by the present Respondent and the same has not been challenged by the Applicant herein before any forum and hence the present Application is not maintainable and devoid of any merit and is required to be dismissed forthwith with exemplary costs

PARAWISE REPLY

12. With respect to the contents of paragraph Nos.1 and 2, the same do not required any comments and therefore, the Respondent No.10 does not wish to offer any comments therein.

13. With respect to the contents of paragraph No.3, the genuineness of the documents is disputed by the present Respondent and hence the same is denied.

14. With respect to the contents of paragraph No.4, the present Respondent is not aware about the same and hence no comments are offered.
15. With respect to the contents of paragraph No.5, the same are denied as the present Respondent is in possession of all requisite clearances.
16. With respect to the contents of paragraph Nos.6 and 7, the same are partially correct.
17. With respect to the contents of paragraph No.8, the present Respondent is not aware about the same and hence no comments are offered.
18. With respect to the contents of paragraph No.9, the same are disputed by the present Respondent as the contents therein are false and incorrect. The present Applicant has not approached this Hon'ble Tribunal with clean hands and has suppressed material facts therein.
19. With respect to the contents of paragraph No.10, the same are denied as the Respondent No.10 is already in possession of the No Objection Certificate (NOC) granted by the Central Ground Water Authority (CGWA). The said NOC has not been challenged by the Applicant before any forum, and that the present Respondent is complying with the conditions mentioned in the said NOC. The Respondent No. 10 further states that the borewells are situated on a separate parcel of land owned by the answering Respondent, located at a distance of approximately 1.5 to 2 kilometres from the project area.

20. With respect to the contents of paragraph No.11, the same are denied by the Respondent No.10. The Respondent No.10 submits that the Mamlatdar, Lakhpat vide his letter dated 18.12.2025 has observed that there is no illegality committed by the Respondent No.10. Copy of the said letter dated 18.12.2025 is annexed hereto and marked as **ANNEXURE – R-7**.

21. With respect to the contents of paragraph No.12, it is denied by the Respondent No.10 that it had operated the unit after the receipt of the Consent to Establish and thus puts the Applicant to the strict proof thereof to prove that the present Respondent has operated the unit.

22. With respect to the contents of paragraph No.13 it is submitted that, the Respondent No.10 has received the valid Consent to Operate, it is valid and subsisting till the year 2030, and hence the contents therein are denied as the same are false.

23. With respect to the contents of paragraph No.14 it is submitted that, the same is denied, as stated earlier the activity of the Respondent No.10 does not fall within the purview of the schedule of EIA notification 2006, and has therefore not necessary to obtain the environmental clearance. However, the Respondent No.10 is already in possession of the CRZ Clearance and the same has been produced before this Hon’ble Tribunal.

24. It is thus submitted that, the Applicant has approached this Hon'ble Tribunal with unclean hands and has misled this Hon'ble Court by suppressing material documents and is thus not entitled to any relief of whatsoever nature. The present Application is thus devoid of any merits and is required to be dismissed with compensatory costs. Affidavit in Support of this, is filed herewith

PUNE
DATE 22/ 04 /2026

ADVOCATE FOR RESPONDENT NO.10

BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL,

WESTERN ZONE BENCH PUNE AT PUNE .

ORIGINAL APPLICATION NO. 20 OF 2026 (WZ)

SURAJJI AMIRJI JADEJA . ..**APPLICANT**

V/S

STATE OF GUJARAT AND OTHERS... **RESPONDENTS**

AFFIDAVIT TO THE REPLY ON BEHALF OF RESPONDENT NO.10

MAY IT PLEASE THE HON'BLE COURT:

I, Priyank Shrirajbhai Jhaveri, Age 42 years, Occu. Service, working with the Respondent No.10 M/s Shree Bhagwati Build Infra Pvt. Ltd., having address at D/202, Chandanbala Flats, Opp. Suvidha Shopping Center, Mahalaxmi Cross Road, Ahmedabad-380007 do hereby state on solemn affirmation as under:-

01. That the Respondent NO.10 is filing the reply to the present Original Application. The facts and circumstances are well set out in the main body of the Reply. The Respondent NO.10 adopts, maintains, confirms, repeats and reiterate whatever has been stated in the main body of the reply and for the sake of brevity, convenience and in order to avoid repetition, craves leave of this Hon'ble Tribunal to treat the statements, averments and submissions in the main body of the Reply as part and parcel of this Affidavit as if the same are reproduced herein ad-seriatim, with a view to avoid repetition and for the sake of brevity.

NOTARY YOGENDRA S. RAJPUT Reg. No. 5399/08 Ahmedabad (MY COMMISSION EXP. ON 24/5/2028) GOVERNMENT OF INDIA

SHREE BHAGWATI BUILD ... PVT. LTD.

Priyank S. Jhaveri

02. I say that whatever stated in the Reply and the present Affidavit is true and correct to the best of my knowledge, information and belief and the legal advice, which I believe to be true.

Solemnly affirmed at Ahmedabad, on 22nd day of April, 2026.

SHREE BHAGWATI BUILD INFRA PVT. LTD.

AFFIANT

DIRECTOR

M/s Shree Bhagwati Build Infra Pvt.Ltd.

I know the Affiant

ADVOCATE

NOTARY GOVERNMENT OF INDIA
YOGENDRA S. RAJPUT
Reg. No. 5399/08
Ahmedabad
(MY COMMISSION EXP. ON 24/02/2028)

Solemnly Affirmed & Signed before Me

3417/2026

22 APR 2026

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ANNEXURE-R-1

JASAV P. GADHVI
MEMBER SECRETARY
SEIAA (GUJARAT)

GOVERNMENT OF INDIA
MOEF & CC
STATE ENVIRONMENT IMPACT
ASSESSMENT AUTHORITY
GUJARAT

No. SEIAA/GUJ/CRZ/ 1156 /2024 Date: 12 AUG 2024 BY R.P.A.D.
Time Limit

Sub: CRZ Clearance for the project of salt by Shree Bhagwati Build Infra Private Limited Greater rann of Kutch in north of Sayra, Vil. Mudhan, Zara, Ta. Lakhpat, Dist. Kutch.

Dear Sir,

This has reference to your application for CRZ clearance along with Form-I as per CRZ Notification 2011, A CRZ map indicating the High Tide Line, Low Tide Line, CRZ Boundary, etc. prepared by the National Center for Sustainable Coastal Management(NCSCM), Chennai, along with superimposition of the proposed activities on CRZ map and its report prepared by NCSCM. EIA report prepared by Bhagvati Enviro Care Pvt. Ltd., dated **19/05/2022** seeking CRZ clearance submitted to the Forests & Environment Department (F&ED), Gujarat.

The proposal is for CRZ Clearance for the proposed project of salt works in 15000 Ha for salt production of 11,00,89,285 MT salt per year by solar evaporation system at Vil. Mudhan, Zara, Ta. Lakhpat, Dist. Kutch, Gujarat

The GCZMA vide their letter dated **14/01/2024** had recommended to the SEIAA, Gujarat, to grant the CRZ Clearance for the above-mentioned project based on its meeting held on **14/07/2022.** Thereafter SEIAA discuss the proposal 02/08/2024 & referred back to SEAC later on SEAC send revised compilation dated 07/08/2024. The proposal was considered by SEIAA, Gujarat in its meeting held on **09/08/2024** at Gandhinagar. After careful consideration, the SEIAA hereby accords CRZ Clearance to above project under the provisions of CRZ Notification, 2011 subject to the compliance of the following conditions.

A. CONDITIONS :

A. 1 SPECIFIC CONDITION :

1. PP shall strictly adhere to all conditions of GCZMA recommendation issued vide letter no.ENV-10-2022-67-T-Cell dated 04.01.2024
2. As per CRZ recommendation total land area of 15000 ha by the Government of Gujarat at un surveyed land located in Lakhpat Taluka of Kutch District. Further, out of the total land area, 1339.5 ha is under CRZ-IB (Intertidal area), 41.9 ha is under CRZ-III (No Development Zone) and 13618.6 lies outside CRZ area. In order to develop saltpan and allied infrastructure as per CRZ Notification-2011 and any amendments thereof on land area of 1339.5 ha, CRZ clearance from the Gujarat Coastal Zone Management Authority would be required and shall not carry out any non-permitted activities in CRZ area as below:

Sr. no.	CRZ- Classification	Area in ha	Area in %
1.	CRZ- IB	1339.52	8.9
2.	CRZ-II (NDZ)	41.87	0.3
3.	Outside CRZ	13618.61	90.8
Total		15000	100

3. PP shall not carry out all any CRZ activities in prohibited area as per provision of CRZ notification.
4. Proponent shall carry out salt work, as per GCZMA recommendation. while, remaining outside 13618.61 Hectare area, proponent shall carry out salt pan activity, only after obtaining of CRZ opinion and permission, if outside area does not fall in prohibited CRZ area.
5. PP shall ensure that before commencing salt pan pond construction, proposed traffic routes should be inspected for any signs of bird nesting (especially ground-nesting species); and every effort should be made to try to avoid disturbing breeding birds.
6. In no case, any natural water runoff, creek or storm water flow shall be altered or restricted due to construction of salt pans.
7. The groundwater shall not be tapped to meet with the water requirements in any case.
8. No effluent or sewage or wastes shall be discharged into the sea / creek or in the CRZ area and shall be treated/ managed to conform to the norms prescribed the by the Gujarat Pollution Control Board and shall be reused/ recycled as per the approval of the Board.
9. M/s. Shree Bhagwati Build Infra Private Limited shall obtain consents/ authorization/permission of the Gujarat Pollution Control Board under applicable Water (Prevention and Control of Pollution) Act, 1974, Air (Prevention

State Level Environment Impact Assessment Authority SEIAA Gujarat

and Control of Pollution) Act 1981 and Rules made under Environment (Protection) Act' 1986. Discharge of pollutants shall not exceed the limits prescribed under Environmental Acts/Rules.

10. M/s. Shree Bhagwati Build Infra private Limited shall adopt the necessary soil conservation measures to prevent any exposed soil from being eroded or blown over.
11. A separate budget shall be earmarked for environmental management and socio- economic activities and details thereof shall be furnished to this Department. The details with respect to the expenditure from this budget head shall also be furnished.
12. Project proponent has prepared Environment Management Plan with following objectives:
    - To ensure that environment friendly business practices are followed during construction and operational phases to minimize environmental impacts.
    - To avoid, or where avoidance is not possible, minimize, mitigate, or compensate for adverse impacts on workers affected communities and the surroundings.
    - To ensure occupational health and safety practices are followed during construction and operation phase.
    - To ensure that the pollutant concentration in the workplace does not exceed the stipulated Standards.
    - To monitor impacts on the environment and the effectiveness of mitigating measures during operation.
    - To ensure that the environmental control systems are adopted at the project site and are operating satisfactorily.
13. PP shall provide barriers such as screens and trees/shrubs around site boundaries to provide some buffer against dust propagation.
14. PP shall ensure that Construction sites should be provided with temporary facilities for collection and disposal of sewage.
15. PP shall ensure that Salt tolerant plants (shrubs, creepers, trees) shall also be planted at borders of salt pan bunds.

A. 3 OPERATION PHASE:

A. 3.1 WATER :

1. The water meter shall be installed and records of monthly water consumption shall be maintained regularly.

A. 3.2 AIR:

2. The fugitive emission in the work area shall be monitored. The emission shall conform to the standards prescribed by the concerned authorities from time to time (e.g. Directors of Industrial Safety & Health).

A. 3.3 SOLID / HAZARDOUS WASTE:

3. Project Proponent shall strictly comply with the rules and reguiations with regards to handling and disposal of Hazardous waste in accordance with the Hazardous and Other Wastes (Management and Transboundary Movement) Rules 2016, as may be amended from time to time. Authorization of the GPCB must be obtained for collection / treatment / storage / disposal of hazardous wastes & other wastes.
4. Hazardous wastes shall be dried, packed and stored in separate designated hazardous waste storage facility with pucca bottom and leachate collection facility, before its disposal.
5. Oil spills if any shall be properly collected and disposed as per the prevailing Rules.
6. Necessary arrangements shall be made for safe disposal of municipal solid wastes as per the provisions of the Solid Wastes Management Rules, 2016 as amended from time to time and solid wastes shall not be released in marine water / coastal area in any case.
7. Used oil shall be sold only to the registered recyclers.
8. Any non-hazardous waste shall be disposed off as per the Hazardous and Other Wastes (Management and Transboundary Movement) Rules 2016.

A. 3.4 SAFETY:

9. First Aid Boxes shall be provided in adequate quantity at strategic locations.
10. Transportation of materials shall be as per the Motor Vehicle Act & Rules.
11. Occupational health surveillance of the workers shall be done and its records shall be maintained. Pre-employment and periodical medical examination for all the workers shall be undertaken as per the prevailing norms.

A. 3.5 NOISE:

12. The overall noise level in and around the area shall be kept well within the prescribed standards by providing noise control measures including acoustic insulation, hoods, silencers, enclosures vibration dampers etc. on all sources of noise generation. The ambient noise levels shall conform to the standards prescribed under the Environment (Protection) Act and Rules. Workplace noise levels for workers shall be as per the Factories Act and Rules.

B. OTHER CONDITIONS:

13. The applicant shall inform the public that the project has been accorded environmental/CRZ clearance by the SEIAA and that the copies of the clearance letter are available with the GPCB and may also be seen at the Website of SEIAA/ SEAC/ GPCB. This shall be advertised within seven days from the date of the clearance letter, in at least two local newspapers that are widely circulated in the region, one of which shall be in the Gujarati language and the other in English. A copy each of the same shall be forwarded to the concerned Regional Office of the Ministry.
14. A separate environmental management cell with qualified personnel shall be created for environmental monitoring and

State Level Environment Impact Assessment Authority Gujarat SEIAA

management during construction and operational phases of the project.

15. Project proponent shall have to contribute financially for taking up the socio-economic upliftment activities in this region in consultation with the Forests and Environment Department and the District Collector/ District Development Officer.
16. Environment Audit report indicating the changes, if any, with respect to the baseline environmental quality in the coastal and marine environment shall be submitted every year by project proponent, to Forests & Environment Department [F&ED], Gujarat and the SEIAA.
17. Project Proponent shall bear the cost of the external agency that may be appointed by SEIAA or Forests & Environment Department [F&ED], Gujarat for supervision / monitoring of proposed activities and the environmental impacts of the proposed activities.
18. Any other condition that may be stipulated by the SEIAA / F&ED from time to time for environmental protection / management purpose shall have to be complied with by Project Proponent.
19. The project authorities must strictly adhere to the stipulations made by the Gujarat Pollution Control Board (GPCB), State Government and any statutory authority.
20. No further expansion or modifications in the plant likely to cause environmental impacts shall be carried out without obtaining prior Environment & CRZ Clearance from the concerned authority.
21. The above conditions will be enforced, inter-alia under the provisions of the Water (Prevention & Control of Pollution) Act,1974, Air (Prevention & Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986, the Hazardous and Other Wastes (Management and Transboundary Movement) Rules 2016 and the Public Liability Insurance Act, 1991 along with their amendments and rules.
22. The project proponent shall undertake socio-economic developmental / community welfare activities as per the CSR Rules 2014.
23. The project authorities shall earmark adequate funds to implement the conditions stipulated by SEIAA as well as GPCB along with the implementation schedule for all the conditions stipulated herein. The funds so provided shall not be diverted for any other purpose.
24. The project proponent shall also comply with any additional condition that may be imposed by the SEAC or the SEIAA or any other competent authority for the purpose of the environmental protection and management.
25. It shall be mandatory for the project management to submit half-yearly compliance report in respect of the stipulated CRZ clearance terms and conditions in soft copies to the regulatory authority concerned, on 1st June and 1st December of each calendar year.
26. Concealing factual data or submission of false/fabricated data and failure to comply with any of the conditions mentioned above may result in withdrawal of this clearance and attract action under the provisions of Environment (Protection) Act, 1986.
27. The SEIAA may revoke or suspend the clearance, if implementation of any of the above conditions is not found satisfactory.
28. The company in a time bound manner shall implement these conditions. The SEIAA reserves the right to stipulate additional conditions, if the same is found necessary.
29. The project authorities shall inform the GPCB, Regional Office of MoEF and SEIAA about the date of financial closure and final approval of the project by the concerned authorities and the date of start of the project.
30. This CRZ clearance is valid for seven years from the date of issue.
31. Any appeal against this CRZ clearance shall lie with the National Green Tribunal, if preferred, within a period of 30 days as prescribed under Section 16 of the National Green Tribunal Act, 2010.
32. Submission of any false or misleading information or data which is material to screening or scoping or appraisal or decision on the application makes this CRZ clearance cancelled.

With regards,
Yours sincerely,

(ASAV P. GADHVI)
Member Secretary

State Level Environment Impact Assessment Authority • Gujarat • SEIAA

Issued to:
Shree Bhagwati Build Infra Private Limited
Vil. Mudhan, Zara, Ta. Lakhpat, Dist. Kutch

Copy to:-
1. The Director (Environment) & Additional Secretary, Block No.14, 8th floor, Forest & Environment Department, New

Sachivalay, Gandhinagar- 382010.

2. The Additional Chief Secretary, Forests & Environment Department, Govt. of Gujarat, Block 14, 8th floor, New Sachivalaya, Gandhinagar-382010.
3. The Chairman, Central Pollution Control Board, Parivesh Bhavan, CBD -cum-Office Complex, East Arjun Nagar, New Delhi-110032.
4. The Chief Conservator of Forests (Central), Ministry of Environment & Forests, Regional Office (WZ), E-5, Arera Colony, Link Road-3, Bhopal-462016, MP
5. Monitoring Cell, Ministry of Environment and Forests, Paryavaran Bhavan, CGO Complex, New Delhi-110003.
6. The Member Secretary, Gujarat Pollution Control Board, Paryavaran Bhavan, Sector-10 A, Gandhinagar-382010.
7. Select File.

State Level Environment Impact Assessment Authority • Gujarat • SEIAA

TRUE COPY ADVOCATE

GPCB

GUJARAT POLLUTION CONTROL BOARD

PARYAVARAN BHAVAN, SECTOR 10-A,
GANDHINAGAR - 382010,
(T) 079-23232152

ANNEXURE-R-2

"Consent to Establish"
(CTE-120568)

NO: GPCB/CCA-KUTCH-1997/ID-76360/ **Date:** **BY R.P.A.D.**

To,
M/s. Shree Bhagwati Buildinfra Pvt. Ltd.,
Unsurveyed,
At- Mota Rann,
Tal: Bhuj,
Dist: Kutch – 370 001.

Sub: Consent to Establish (NOC)-Amendment under Section 25 of Water Act 1974 and Section 21 of Air Act 1981

Ref: Your application for CTE Inward no. **257470** received dated **17/06/2022.**

Without prejudice to the powers of this Board under the Water (Prevention and Control of Pollution) Act-1974, the Air Act-1981 and the Environment (Protection) Act-1986 and without reducing your responsibilities under the said Acts in any way, this is to inform you that this Board grants **Consent to Establish for set up an industrial plant at Unsurveyed, At- Mota Rann, Tal: Bhuj, Dist: Kutch.**

1. The validity of this order will be up to **16/06/2029.**
2. The list of the products to be manufacture is as below:

Sr. No.	Product	Quantity
1.	Bromine (Br2)	1250 MT/Month
2.	NaCl (salt)	5,00,000 MT/Month

SUBJECT TO THE FOLLOWING CONDITIONS:

1. Industry shall not carry out any activity which may attract the applicability of EIA notification-2006 & its amendment.
2. Industry shall not carry out any activities in violation to CRZ notification- 2011 & amended time to time.
3. No ground water shall be withdrawal without obtaining prior permission from competent authority.
4. Industry shall obtain fresh water from valid source having permission of the competent authority.
5. Industry use only approved fuels as per the GPCB notification.
6. Industry shall install bromine and chlorine sensors in the plant.
7. Bromine concentration at work zone area shall always be less than 0.1 ppm.
8. Industry shall take adequate measures to control fugitive emission due to storage, handling & transportation of products, raw materials, coal/ lignite & fly ash.
9. Industry shall provide dedicated storage facilities/ silos for storage of fly ash. Fly ash shall be disposed off only as per CPCB guideline.
10. Industry shall comply with coal handling guideline of this Board.

11. Industry shall provide dedicated storage area for coal/ lignite with adequate water sprinkling system to control fugitive emission.
12. Industry shall renew Public Liability Insurance Policy time to time & submit a copy of the same to this office.
13. Industry shall submit compliance of Manufacturing, Storage and Import of Hazardous Chemicals Rules – 1989 framed under the Environment (Protection) Act-1989 including site notification, onsite emergency plan & safety Audit report time to time.
14. Industry shall comply with circular of the Board dated 27/08/2021 regarding retrofitting of emission control/ equipment in D.G. Set of capacity 125 KVA and above as per system& procedure for emission compliance testing of Retrofit Emission Control Devices (RECD) for D.G. Set issued by CPCB dated 01/02/2022 at the earliest and submit compliance.
15. Industry shall manage Solid Wastes generated from industrial activities as per Solid Waste Management Rules-2016 (solid waste as defined in Rule-3(46)).
16. As per Provisions of Rule 18 of Solid Waste Management Rules-2016 you are directed to make an arrangement in utilities to replace at least five percent (5%) of total solid fuel requirement by 'Refused Derived Fuel'.

3. **CONDITIONS UNDER WATER ACT 1974:**

3.1 Total water consumption 2542.5 KLD. Industry shall provide DM plant, out of which
   a. DM permeate, about 508 KLD, shall be used for industrial purpose & 25 KLD shall be used for domestic purpose.
   b. DM reject, about 120 KLD, shall be used for preparation of lime slurry & remaining (1889.5 KLD) shall be used for salt washing in salt pan.

3.2 The quantity of the brine water consumption shall not exceed 48400 KLD.

3.3 The quantity of the industrial waste water from manufacturing process and other ancillary operation shall not exceed 532 KL/Day.

3.4 Industry shall operate Effluent Treatment Plant (ETP) adequately so that treated industrial effluent shall conform to the following norms:

PARAMETERS	PRESCRIBED LIMITS
pH	6.5 to 8.5
Temperature	40°C
Colour (Pt.Co. scale) in units	100 units
Suspended Solids	100 mg/L
Oil and Grease	10 mg/L
Ammonical Nitrogen	50 mg/L

All efforts shall be made to remove colour & unpleasant odour as far as practicable

3.5 There shall be no discharge of industrial effluent. Treated effluent 48932 KLD (brine water: 48400 KLD + Industrial effluent from process: 532 KLD), after necessary treatment shall be discharged into solar evaporation pond & recycled in to process, in order to achieve Zero Liquid Discharge.

GUJARAT POLLUTION CONTROL BOARD
PARYAVARAN BHAVAN, SECTOR 10-A,
GANDHINAGAR - 382010,
(T) 079-23232152
GPCB

3.6 Industry shall provide solar evaporation pond with leakage proof flooring and lining.
3.7 Industry shall provide fixed pipeline with flow meter for reuse of treated effluent & for conveyance of treated effluent to solar pond and maintain its record.
3.8 Industry shall provide fixed pipeline and flow meter for reuse/ recycling of treated effluent and maintain its records at site.
3.9 The quantity of domestic waste water (Sewage) shall not exceed 5 KL/Day
3.10 The Industry shall provide Sewage Treatment Plant (STP) of adequate capacity adequately so that treated domestic effluent shall comply with following norms:

PARAMETERS	PERMISSIBLE LIMIT
pH	6.5 to 9.0
BOD (3 days at 27° C)	20 mg/L
Suspended Solids	100 mg/L
Fecal Coliform	<1000 MPN/100 ml

3.11 The treated domestic effluent confirming to above norms shall be discharged on land for gardening and plantation purpose within premises.
3.12 Industry shall provide fixed pipeline network with flow meter for even distribution of treated domestic effluent and maintain its record.
3.13 Disposal system for storm water shall be provided separately. In no circumstances storm water shall be mixed with the industrial effluent.

4. CONDITIONS UNDER AIR ACT 1981:

4.1 The following shall be used as fuel in Boilers & D.G. Sets respectively;

Sr. No.	Utility	Fuel	Quantity
1.	Boiler (5 TPH & 1 TPH)	Coal/ Lignite	1.9 MT/Hr
2.	D.G. Sets	HSD	225 L/Hr

4.2 The applicant shall install & operate comprehensive adequate air pollution control system in order to achieve prescribed norms.
4.3 The flue gas emission through stack attached to Boilers & D.G. Sets shall conform to the following standards:

Sr. No	Stack Attached To	Stack Height	APCM	Parameter	Permissible limit
1	Boiler (5 TPH)	40 m	ESP & Water Scrubber (common)	Particulate Matter	150 mg/Nm^3
2	Boiler (1 TPH)				
3	D.G. Set (3 nos.) (125 KVA each)	11 m	Acoustic Enclosure	SO_2	100 ppm
4	D.G. Set (3 nos.) (25 KVA each)	11 m	Acoustic Enclosure	NO_x	50 ppm

4.4 The process gas emission through stack attached to reaction vessel & Feed Enrichment Section shall conform to the following standards;

Sr. No	Stack Attached To	Stack Height	APCM	Parameter	Permissible limit
1	Reaction Vessel	12 m	Packed Column Scrubber	HCl Chlorine Bromine	20 mg/NM^3 9 mg/NM^3 2 mg/NM^3
2	Feed Enrichment Section Stack	12 m	Packed Column Scrubber	HCl Chlorine Bromine SO_2	20 mg/NM^3 9 mg/NM^3 2 mg/NM^3 50 mg/NM^3

4.5 The concentration of the following parameters in the ambient air within the premises of the industry shall not exceed the limits specified hereunder as per National Ambient Air Quality Standards issued by MoEF & CC dated 18th November-2009.In addition to following parameters Industry shall also carry out AAQ monitoring of all other applicable parameter as per MoEF notification dated 18/11/2009 and submit the report to the Board.

Sr. No.	Pollutant	Time Weighted Average	Concentration in Ambient air in ug/m^3
1.	Sulphur Dioxide (SO_2)	Annual 24 Hours	50 80
2.	Nitrogen Dioxide (NO_2)	Annual 24 Hours	40 80
3.	Particulate Matter (Size less than 10 µm) or PM_{10}	Annual 24 Hours	60 100
4.	Particulate Matter (Size less than 2.5 µm) or $PM_{2.5}$	Annual 24 Hours	40 60

4.6 The level of Noise in ambient air within the premises of industrial unit shall not exceed following levels:

Between 6 am to 10 pm: 75 dB (A)
Between 10 pm to 6 am: 70 dB (A)

4.7 **D.G. Sets Conditions**

The D.G. Set shall have acoustic enclosure and shall comply with the standards specified at Sr. no. 95 of Schedule-I of the rule-3 of E.P. Rules -1986 and Noise pollution level as per the Air Act-1981.

D.G. Sets standards: -

The flue gas emission through stack attached to D.G. Sets shall conform to the following standards.

a) The minimum height of stack to be provided with each of the generator set shall be H=h + 0.2 (KVA) 1/2, where H= Total stack height in meter, h= height of the building in meters where or by the side of which the generator set is installed.

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PARYAVARAN BHAVAN, SECTOR 10-A,

GANDHINAGAR - 382010,

(T) 079-23232152

b) Noise from DG set shall be controlled by providing an acoustic enclosure or by creating the room acoustically, at the users end.

c) The acoustic enclosure or acoustic treatment of the room shall be designed for minimum 25 dB (A) insertion loss or for meeting the ambient noise standards, whichever is on the higher side (if the actual ambient noise is on the higher side, it may not be possible to check the performance of the acoustic enclosure/ acoustic treatment. Such circumstances the performance may be checked for noise reduction up to actual ambient noise level, preferably, in the night time). The measurement for insertion loss may be done at different points at 0.5 m from the acoustic enclosure/room, and the averaged.

d) The D.G. Set shall be provided with proper exhaust muffler with insertion loss of minimum 25 dB (A).

e) All efforts shall be made to bring down the noise level due to the D.G. Set, outside the premises, within the ambient noise requirements by proper siting and control measures. Installation of a D.G. Sets must be strictly in compliance with the recommendations of the D.G. Set manufacturer.

f) A proper routine and preventive maintenance procedure for the D.G. Set should be set and followed in consultation with the DG Set manufacture which would help prevent noise levels of the DG Set from deteriorating with use.

5. CONDITIONS UNDER HAZARDOUS WASTE RULES:

5.1 The applicant shall have to comply with provisions of Hazardous and other Waste (Management and Trans Boundary Movement) Rules 2016.

5.2 The applicant shall obtain membership of common TSDF site for disposal of Hazardous waste as categorized in Hazardous and other Waste (Management and Trans Boundary Movement) Rules 2016.

5.3 The applicant shall obtain membership of common Hazardous Waste incinerator for disposal of incinerable waste.

5.4 The applicant shall provide temporary storage facilities for each type of Hazardous Waste as per Hazardous and other Waste (Management and Trans Boundary Movement) Rules 2016.

5.5 The applicant shall obtain registration/authorization for recycling/reprocessing any hazardous waste before procuring material/starting production as per HW Rules 2016.

5.6 The applicant shall obtain authorization for recovery/reuses of any hazardous waste material as per HW Rules 2016.

6. GENERAL CONDITIONS

6.1 The applicant shall however, not without the prior consent of the Board bring into use any new or altered outlet for the discharge of effluent or gaseous emission or sewage waste or hazardous waste from the proposed industrial plant. The applicant is required to make applications to this Board for this purpose in the prescribed forms under the provisions of the Water Act-1974, the Air Act-1981 and the Environment (Protection) Act-1986 60 days before commencing the production.

6.2 Any change in personnel, equipment or working conditions as mentioned in the consents form/order should immediately be intimated to this Board.

6.3 The waste generator shall be totally responsible for (i.e. Collection, storage, transportation and ultimate disposal) of the wastes generated.

6.4 Records of waste generation, its management and annual return shall be submitted to Gujarat Pollution Control Board in Form – 4 by 30th June of every year.

6.5 In case of any accident, details of the same shall be submitted in Form – 5 to Gujarat Pollution Control Board.

6.6 Applicant shall comply relevant provision of "Public Liability Insurance Act-91".

6.7 Unit shall take all concrete measures to show tangible results in waste generation reduction, voidance, reuse and recycle. Action taken in this regards shall be submitted within 03 months and also along with Form 4.

6.8 In case of change of ownership/management the name and address of the new owners/partners/directors/proprietor should immediately be intimated to the Board.

6.9 Adequate plantation shall be carried out all along the periphery of the industrial premises in such a way that the density of plantation is at least 1000 trees per acre of land and a green belt of 10 meters width shall be developed.

6.10 If it is established by any competent authority that the damage is caused due to their industrial activities to any person or his property in that case they are obliged to pay the compensation as may be determined by the competent authority.

For and on behalf of
Gujarat Pollution Control Board

(Smt U.K. Upadhyay)
Senior Environment Engineer

ANNEXURE-R-3

RAPID ENVIRONMENTAL IMPACT ASSESSMENT REPORT FOR 15000 HECTARE PROPOSED SALTPAN LEASES IN LAKHPAT TALUKA OF KUTCH DISTRICT IN GUJARAT BY BHAGWATI BUILDINFRA PVT. LTD.

Prepared by

BHAGWATI ENVIRO CARE PVT. LTD.

[ISO 9001, ISO 14001 & OHSAS: 18001 CERTIFIED COMPANY]

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URL: www.bhagwatienviro.com

APRIL-2022

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APRIL-2022

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CHAPTER- 1
INTRODUCTION

1.1. PURPOSE OF THE REPORT

M/s. Bhagwati Buildinfra Pvt. Ltd. has been awarded a salt work lease area from unsurveyed land near Lakhpat, Sayra, Mudhan and Zara villages in Lakhpat Taluka of Kutch District of Gujarat. Kutch district collectorate has allotted total of 15000 ha. land for purpose of solar salt production and extraction of other chemicals from residual bittern. This salt lease is acquired with the object of augmenting the increasing need of salt for various industries in Kutch and in India.

As per Environment Impact Assessment Notification dated 14th September, 2006, the proposed project does not fall in the list of projects requiring Environmental Impact Assessment Study. However, as per the CRZ (Coastal Regulation Zone) Notification 2011 and the recent amendment on 28th November 2014, the "salt works" project falls under permissible activities in CRZ area. As per the amendment the salt pan project will require an EIA (Environmental Impact Assessment) study and its subsequent clearance from Gujarat Coastal Zone Management Authority (GCZMA) for obtaining CRZ Clearance as defined in the CRZ Notification.

In view of the above-mentioned requirement M/s. Bhagwati Buildinfra Pvt. Ltd. assigned Rapid EIA study to Bhagwati Enviro Care Pvt. Ltd. (QCINABET Accredited Consultants) for conducting EIA study of the proposed saltpans in Lakhpat Taluka of Kutch district of Gujarat.

1.2. PROJECT PROPONENT

Shree Bhagwati Buildinfra Pvt Ltd was incorporated in the year 2008 under the Companies Act, 1956 vide (CIN: U24100GJ2008PTC052664). The Director of the Company, Mr. Amam Shah comes from business group in specialized applications. Having an experience of 21 years, his expertise in managing of assets in business with special applications relating to effective utilization and working staff for administrative needs and managing finance for the projects in pipeline. The company

has clear vision for effective utilization of available resources and strength to efficiently convert into profitable venture. The proponent and the owner hails from the family running publication business of international repute i.e., Gujarat Samachar run by proprietary Concern, Lok Prakashan Ltd., a cash rich company which is in high profitability business since 1932. proponent is thus associated with financially sound Business group and has clear visions of Business development. While handled various civil projects he has been a catalyst to generated handsome profitability specially those involving intense capital expenditure and longer time schedules. In the last few years, company has spearheaded the development of several landmark realty projects, including residential and commercial offerings in various areas all over Ahmedabad. It has also acquired several properties through the official liquidator during auction bidding in Ahmedabad and Baroda. Gujarat Samachar group has prided on its commitment in delivering true value to small and medium investors/businesses/organizations, by practicing efficiency and cost-effectiveness in an industry that is notorious for its lack of both. It is the same commitment that it brings to new diversifications, including marine infrastructure. Its expanded portfolio now includes the ports and maritime sector. They are currently building an all-weather port at Navlakhi, Morbi District.

Proponent has now decided to use their experience to manufacture Industrial salt and in future, production of Bromine along with other Marine Chemicals (Bromine, Magnessiumm Potassium derivatives), the raw materials of which i.e., brine is available in the Greater Rann of Kutch. The production capacity of the project will be initially 5.0 Million Metric Tonnes (MMT) of Industrial salt for Export as well as for Indian market together with 5100000 M^3 of bittern per annum.

1.3. BRIEF DISCRIPTION OF PROJECT

The proposed lease area falls in the unsurveyed land north of Sayra, Mudhan, Zara villages in Lakhpat Taluka of Kutch District of. This project is for production of solar salt from seawater. Brief details of the proponents, project, products, area etc. are given in Table-1.1.

Table-1.1.: Brief Profile of the Proponent and project

Name of the Applicant	Shree Bhagwati Buildinfra Private Limited
Company CIN:	U24100GJ2008PTC052664
Correspondence Address	A/112, Siddhi Vinayak Towers, Behind DCP Office, Off S.G. Highway, Makarba, Ahmedabad- 380051 Ph: 9825012917 Email: bhagwatibuildinfra@gmail.com
Total land area Allotted	15000 hectares
Land Development	15000 hectares (Salt pan, access roads, bunds, Bromine/chemical plant)
Village name, Taluka, Survey No. of the Allotted land	Greater Rann of Kutch, Ta: Lakhpat, unsurvayed land
Cost of the Project	Total cost Rs. 75 Cr. (Salt works)
Means of Finance	Total requirement Rs. 75 Cr. Investment from Promoters and Promoter group Rs. 25 Cr. Term Loan from Financial Institutions Rs. 50 Cr.
Estimated Salt production & consumption	• 5.0 Million Metric Ton over period of time • Domestic markets and export • Other chemicals to be extracted from Bittern (Bromine, Magnesium and Potassium derivatives)
Means of transport of produced salt	• Through Conveyor Belt, Trucks , Barges
Site Accessibility	• Kandla Port at approx. 210 km • Bhuj Railway station approx. 120 km • Gaduli Santalpur- Bhu-Hajipir Road
Relevant Environmental Regulations	• Coastal Regulation Zone Notification 2011 and amendment thereof
CRZ classification of lease area	• 1339.5 ha. in CRZ-IB (Intertidal area) • 41.9 ha. in CRZ-III (No Development Zone)
Components planned in CRZ Area	• Brine channel 10 mt. width & 5.0 km length • Brine Pumping station & well • Brine condenser pans 2620 ha.
Sensitive eco-systems in study area (CRZ-IA)	• None
Employment generation	• From surrounding villages • 150 Direct, 450 Indirect • 300 during construction & 150 during operational phase
Machinery requirement	Pumping Station, Salt Washery, Conveyor belt, Bittern Pipeline, Bromine plant
Facilities for labour	Labour shelters, rest shades, Cyclone shelter house, Drinking water facility, medical facility, ambulance, at project site. Labour accommodation camp at Mudhan village land owned by company,

1.4. SIGNIFICANCE OF PROJECT

India is ranked fourth after the US and China in global production of salt. The average annual production of salt in India is 300 Lakh Metric tonnes and in the year 2018-2019, Gujarat produced 260 Lakh Metric Tonnes. Annually, India requires 90 lakh tonnes of salt for domestic consumption, an equal amount for industrial use. India exports 50 lakh tonnes of salt every year, as part of various international treaties and agreements, and an additional 34-40 lakh tonnes depending on demand. Kutch is a major producer of salt in India and its production is also significant globally. Kutch is bestowed with a long coastline and due to scanty rainfall, dry-weather; fairy high temperature, high wind velocity and suitable soil conditions, the region is extremely rich in salt deposits. Salt Industry in Kutch district is one of the biggest industries. Gujarat Is producing about 70% of the total production of salt and Kutch district contributes about 40% of Gujarat's total production. Still vast majority of the Rann of Kutch area lies underutilized for salt production.

Western Kutch region particularly the Greater Rann of Kutch which is adjacent to Lakhpat has great potential for salt production due to its closeness to sea water, scanty rainfall, few rainy days, rainshadow area, no human population, no forest land ample sunlight and wind. Lakhs of tones of salt that is produced naturally in the region gets washed away every year in western part of Great Rann of Kutch which falls in ideal salt production zone. Such high potential salt production land remains un utilized in the region. If utilized optimally, this land could provide great opportunities for economic developments in the region.

Salt is one the major and essential food items for human beings and an important raw material for various salt-based industries like soda ash, Caustic Soda, Chlorine, Sodium Metal, Hydrochloric acid etc. Salt has some other important uses in fish curing, tanning of hides and skins, water softening, salting out of soap, ore dressing, food preservation, washing powder, dyes & intermediates, chemicals.

The proposed lease would augment the increasing need of salt for various salt-based industries in the region and in India. Such large-scale availability of salt as

raw material in the region would attract number of salt-based industries in the region. This would bring in investments in Kutch and in Gujarat. This could have overall impact on production sector in Kutch, Gujarat and in India and it may also contribute to GDP of India.

1.5. VARIOUS OTHER GOVERNMENTAL APPROVALS SOUGHT

The project has received several permissions from statutory authorities and government bodies for the establishment of the project, which include –

i. District Inspector of Land Record, Bhuj;
ii. Chief Conservator of Forests, Kutch Bhuj;
iii. Geologist, Geology and Mining Department, Bhuj, Kutch;
iv. Deputy Salt Commissioner, Ahmedabad,
v. Revenue Department ,Gandhinagar

Details of these permission is mentioned in the lease allotment letter by the District Collector, Kutch, Bhuj (Annexure-1).

1.6. SCOPE OF THE STUDY

The scope of the present EIA is to provide factual information on environmental settings such as air, soil, water, noise, landuse patterns, ecology and sociology in study area of 10km radius from the proposed salt lease area in Lakhpat Taluka of Kutch district in Gujarat. This study was carried out to develop understanding of the environmental and social parameters of the study area and anticipate impacts of project activities on the surrounding environment and provide environment management plan. The EIA study will be submitted to Gujarat Coastal Zone Management Authority to obtain CRZ clearance for proposed salt lease area in unsurveyed land in Lakhpat Taluka of Kutch district of Gujarat that fall in CRZ Zone-Ib, & CRZ-III.

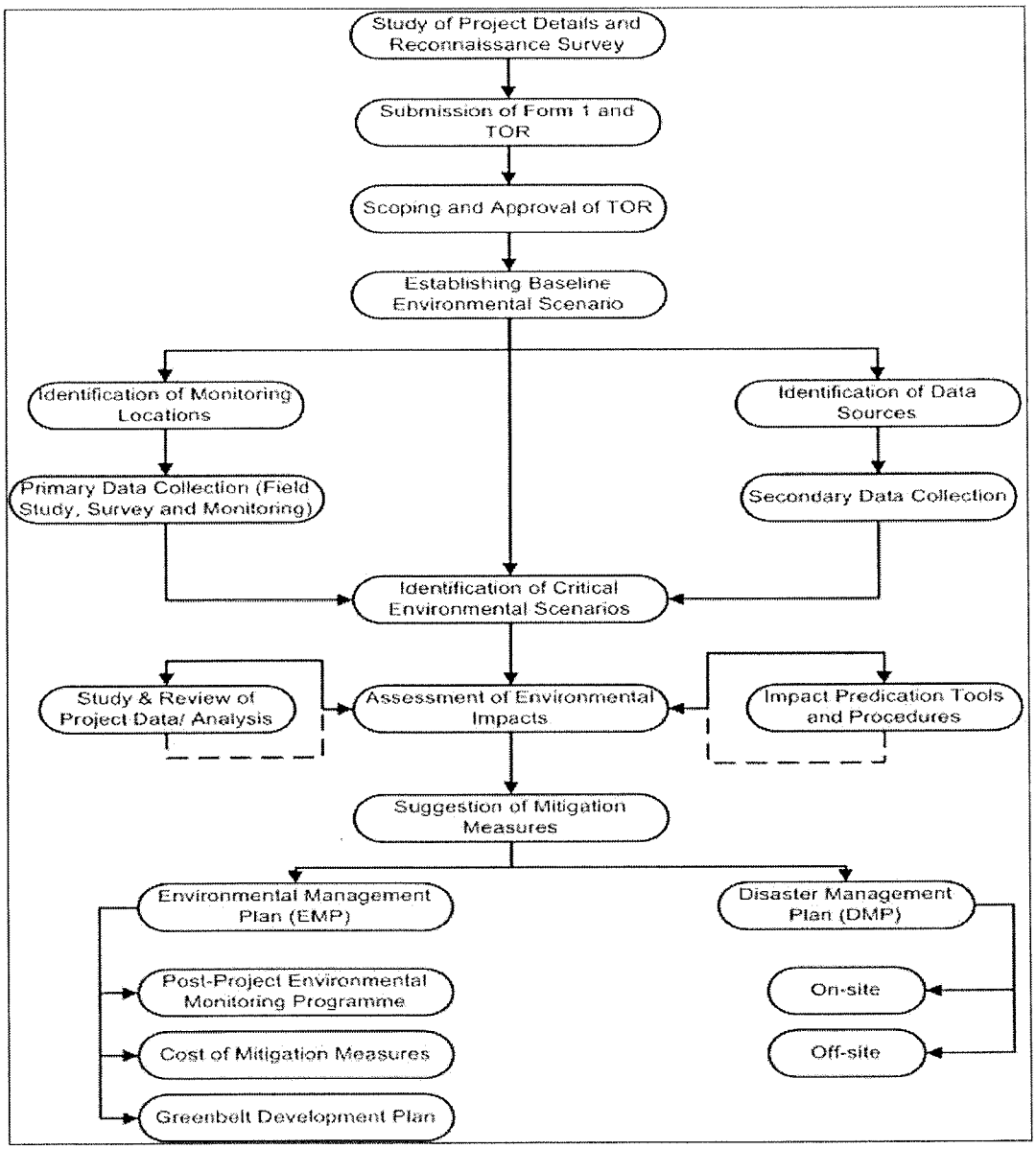
1.7. OBJECTIVES OF EIA

- Develop basic understanding on the present environmental settings in the project area.
- Assess the potential impacts of project activities on the surrounding environment.

- Suggest preventive and mitigation measures for minimizing the adverse impacts of project activities on the surrounding environment.
- Provide an environment management plan for the project.

1.8. METHODOLOGY FOR EIA/EMP

The proposed lease area is termed as core zone and area within 10 km radius from the periphery of proposed lease area is referred as buffer zone which considered for identifying and assessing impacts in respect of air, water, noise, landuse, land-based biota, and socio-economic environment. The core zone and buffer zone together comprised the study area. Methodology is described in flow chart.



The baseline data on parameters of the above-mentioned aspects over a season provides means for identifying possible impacts-positive and adverse. An environmental impact assessment and environmental management plan comprising an overall assessment of the impact due to project activities over baseline condition of the existing environment and a mitigation action plan to counter the adverse impact is defined. An environmental monitoring programme is also chalked out to provide scientific support to future actions of environmental protections.

This report is based on the field monitoring conducted for one season during winter October to December 2021. The other baseline environmental aspects of project site and its surrounding areas, as well as the ecological environment in the vicinity of project site was collected to evaluate the existing environment. The basic aim of this study was to generate a scientific baseline data for the study area. It is always necessary to have a baseline for the state of marine life, which is essential tool for comparative determination of changes in conditions over a period of time after the completion of the proposed project and also during the operation stage of the project to evaluate the environmental status. The environmental components studied and parameters monitored during the period along with the frequency & methodology adopted for the study is provided in forth coming chapter. The monitoring and testing have been done as per the guidelines of MOEF&CC and the IS standards. Monitoring was conducted for various environmental parameters which are mentioned in chapter-3 at length.

1.9. STRUCTURE OF EIA:

This EIA report has been prepared on the basis of available on-site primary data (survey/ monitoring) and secondary/literature data. The EIA report contains project features, baseline environmental setup, assessment of environmental impacts, and formulation of mitigation measures, environmental management and monitoring plan with risk & assessment Report. The report includes 12 Chapters. The structure of the EIA Report with necessary tables, drawings and annexure is as follows:

Chapter 1: Introduction

This chapter provides background information on need of project, need of Rapid EIA study and brief of the project. The scope and EIA methodology adopted in

Preparations of EIA report is also described in this Chapter. It also covers the identification of project & project proponent, brief description of nature, size, location of the project. Scope of the study details about the regulatory scoping carried out as per the generic structure given in the EIA Notification, 2006.

Chapter 2: Project Description

This chapter deals with the project details of the proposed products, with type of project, need for the project, location, size & magnitude of operation including associated activities required by and for the project, proposed schedule for approval and implementation, including technical details of raw material, quality and quantity etc.

Chapter 3: Description of the Environment

This chapter presents the existing environmental status of the study area around the proposed project including topography, drainage pattern, water environment, geological, climate, transport system, land use, flora & fauna, socio-economic aspects, basic amenities etc. Environmental assessment of the project site in regard to its capability to receive the proposed project is also discussed in this Chapter.

Chapter 4: Anticipated Environmental Impacts and Mitigation Measures

This chapter describes the overall impacts of the proposed project activities and underscores the areas of concern, which need mitigation measures. It predicts the overall impact of the proposed project on different components of the environment viz. air, water, land, noise, biological, and socio-economic.

Chapter 5: Analysis of Alternatives (Technology & site)

This chapter describes the site selection criteria and analysis of proposed alternative technologies.

Chapter 6: Environmental Monitoring Program

Technical aspects of monitoring the effectiveness of mitigation measures have been given in this Chapter.

Chapter 7: Additional Studies

This chapter deals with the public consultation & Risk assessment carried out for the proposed project. Unit is not located in notified area so; public consultation is required.

Chapter 8: Project Benefits

This chapter deals with the benefits to the local surrounding people due to proposed project.

Chapter 9: Environment cost benefit Analysis

During the scoping stage; no recommendation of environmental cost benefit analysis is suggested by the appraisal committee.

Chapter 10: Environmental Management Plan

This chapter details the inferences drawn from the environmental impact assessment exercise. It describes the overall impacts of the proposed activities during construction and operation phases and underscores the areas of concern, which need mitigation measures. It also provides mitigation and control measures for environmental management plan (EMP) for minimizing the negative environmental impacts and to strengthen the positive environmental impacts of the proposed project.

Chapter 11: Summary & Conclusion of EIA Report

This chapter provides the summary and conclusions of the EIA study of the Proposed project with overall justification for implementation of the project and also explanation of how, adverse effects will be mitigated.

Chapter 12: Disclosure of Consultants Engaged

This chapter provides the disclosure of consultants engaged to carry out the EIA study along with other additional studies.

1.10. LIMITATIONS OF THE STUDY

Since the EIA study is conducted for Salt production units that fall near the India-Pakistan International Border area and under the influence of defence establishment, permission for carrying out various studies using equipment, camera, GPS etc. was restricted. Hence the study has collected only one-month environmental data. However, ecological and other data collection was not influenced as it involved only observations on flora, fauna social aspects.

The study undertaken is structured around the project information as provided by the project proponent, any change in the proposed activities may result in variation of outcome. The study is based on field visits, literature survey, consultation with local people etc. Professional judgment and subjective interpretation of facts has been applied for this study. All information's and inferences presented herein are based on the specifics currently available within the limits of the scope of work, information provided by the client or its representative, existing secondary data and schedule.

CHAPTER- 2
PROJECT DESCRIPTION

2.1. PROJECT LOCATION

Entire lease area is located in unsurveyed land north of Sayra, Mudhan and Zara villages, in Lakhpat Taluka of Kutch District of Gujarat (Map-2.1; 2.2; 2.3).

State: Gujarat

District: Kutch

Taluka: Lakhpat

Village: Rann of Kutch (near village Mudhan)

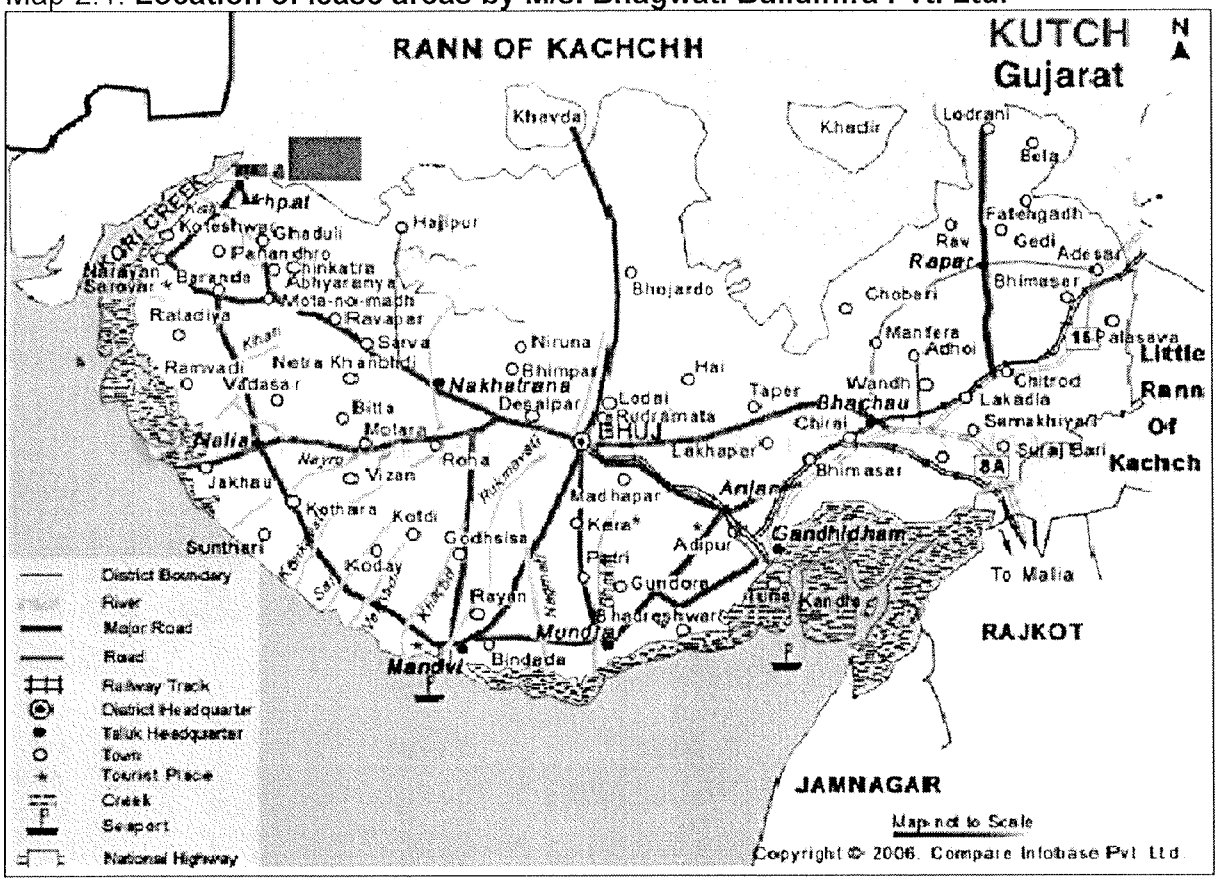
Survey No: Unsurveyed land of Rann of Kutch

Toposheet No: F42D1, F42D2, F42D6, F42C13

Table-2.1: Coordinates of proposed salt lease areas

#	East	North
01	E 518127.920	N 2634026.056
02	E 514158.867	N 2632047.958
02A	E 513119.312	N 2632001.596
03	E 513004.455	N 2626433.409
04	E 506866.234	N 2626424.412
05	E 505694.826	N 2626864.079
06	E 499504.549	N 2629447.550
07	E 499532.612	N 2631146.410
08	E 495097.305	N 2629887.864
09	E 493858.572	N 2630600.713
10	E 496405.574	N 2630346.922
11	E 494782.540	N 2634669.963
12	E 494782.080	N 2636728.930
13	E 498966.000	N 2636731.639
14	E 499003.322	N 2641304.855
15	E 502554.957	N 2641277.297
16	E 502425.252	N 2635321.960
17	E 513163.895	N 2634162.973

Map-2.1: **Location of lease areas by M/s. Bhagwati Buildinfra Pvt. Ltd.**



2.2. SITE SUITABILITY

The proposed salt work lease area is in the Western Kutch region particularly the Greater Rann of Kutch which are adjacent to Lakhpat have great potential for salt production due to following factors.

- Semi-Arid, dry climate
- Closeness to sea water/creek,
- Suitable soil condition
- Availability of vast land
- Scanty rainfall/ Rainshadow region
- No human settlements
- No forest or Protected Areas
- High temperature and ample sunlight
- High wind velocity

The Rann of Kutch, particularly unsurveyed land falling western part of Great Rann of Kutch is ideal salt production zone. Lakhs of tones of salt is produced naturally in this region and it gets washed away every year. Such high potential salt production land remains unutilized in the region. If utilized optimally, this land could provide great opportunities for economic developments in the region.

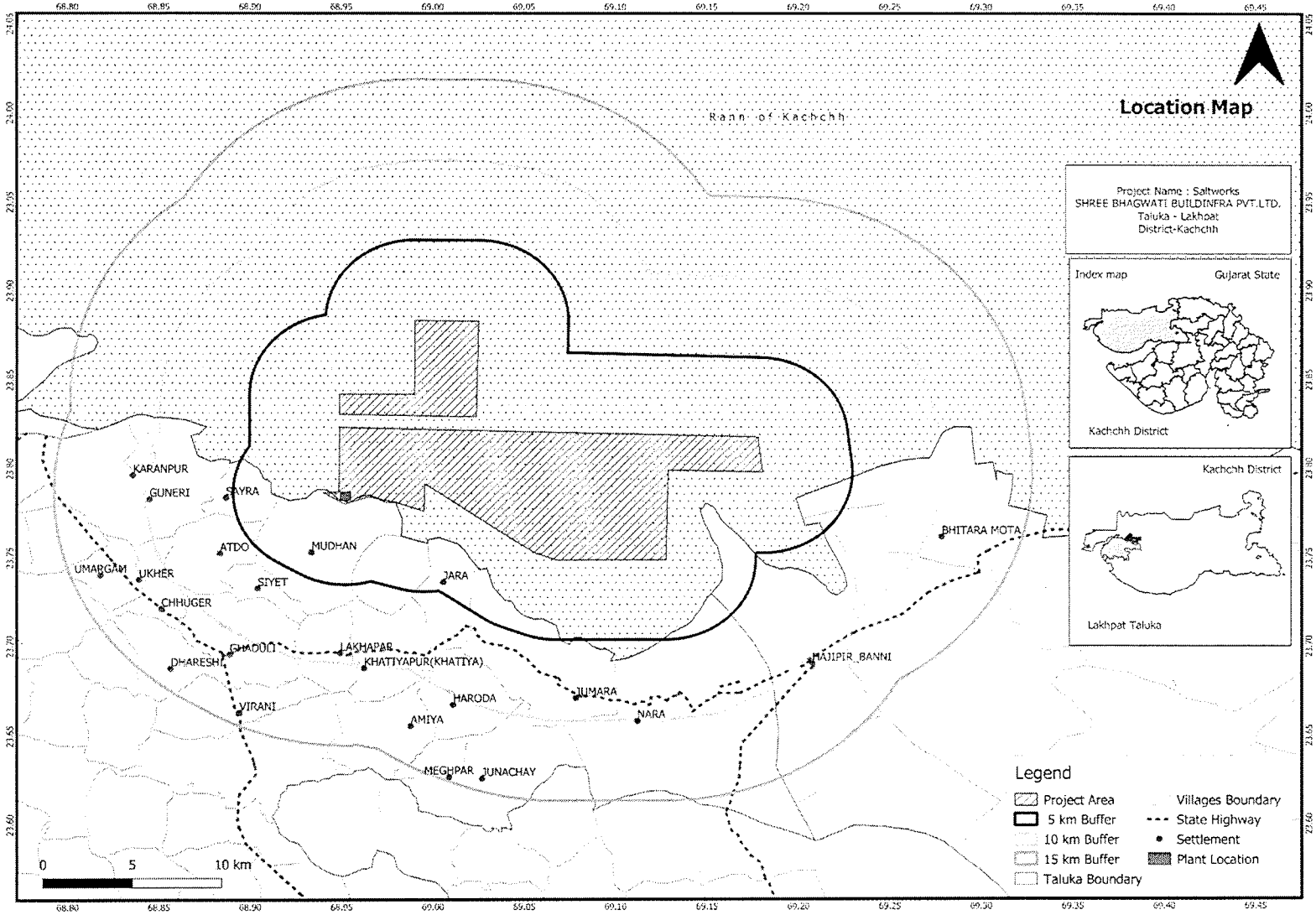
2.3. PROFILE & STATUS OF SALT INDUSTRY

Salt is a Central subject in the Constitution of India and appears as item No. 58 of the Union list of the 7thSchedule, which reads; "Manufacture, Supply and Distribution of salt by Union Agencies; and Regulation and control of manufacture, supply and distribution of salt by other agencies. The Saltpan industries are considered as environment friendly industries due to its natural process of manufacturing of final product. One of the prime requirements for these industries is to have tidal water for the further natural process of evaporation to make crystallized salt. Considering the nature of the salt manufacturing process of these industries the MoEF&CC has also given relaxation from the environment clearance as well under CRZ notification. India is the third largest Salt producing Country in the World after China and USA with Global annual production being about 230 million tonnes. The growth and achievement of Salt Industry over the last 60 years has been spectacular. When India attained Independence in 1947, salt was being imported from the United Kingdom & Adens to meet its domestic requirement. But today it has not only achieved self-sufficiency in production of salt to meet its domestic requirement but also in a position of exporting surplus salt to foreign countries. The production of salt during 1947 was 1.9 million tonnes which has increased manyfold to record production of about 280 lakh tonnes during the year 2016-17. Future Global demand for salt is projected to climb annually through 2018 to 340 million metric tons.

Sources of Salt: The main sources of salt in India are from following sources.

- Sea brine
- Lake brine
- Sub-soil brine and
- Rock salt deposits

Map-2.2: Location of proposed lease areas with 10 km Buffer zone.



Major salt producing centres

Sea water is an inexhaustible source of salt. Salt production along the coast is limited by weather and soil conditions. The major salt producing centres are. Marine Salt works along the coast of Gujarat (Jamnagar, Mithapur, Jhakhar, Chira, Bhavnagar, Rajula, Dahej, Gandhidham, Kandla, Maliya, Lavanpur), Tamil Nadu (Tuticorin, Vedaranyam, Covelong), Andhra Pradesh (Chinnaganjam, Iskapalli, Krishnapatnam, Kakinada & Naupada), Maharashtra (Bhandup, Bhayandar, Palghar), Orissa (Ganjam, Sumadi) and West Bengal (Contai). Inland Salt Works in Rajasthan using lake brine and sub-soil brine viz. Sambhar Lake, Nawa, Rajas, Kuchhaman, Sujangarh and Phalodi. Salt works in Rann of Kutch using sub-soil brine viz: Kharaghoda, Dhrangadhra; Santalpur. Rock Salt Deposits at Mandi in the State of Himachal Pradesh.

There are about 11799 salt manufacturers engaged in production of Common salt in an extent of about 6.09 lakh acres in the Country. It is estimated that 87.6 per cent of the total number of salt manufacturers are small salt producers (having an individual extent of less than 10 acres for salt manufacture), 5.8% is large scale producers (having an individual extent of more than 100 acres) and 6.6 % is medium scale producers (having an individual extent between 10 and 100 acres). Average Annual Production of Salt in India is 215.80 lakh tones whereas ever high production of 240 lakh tones was recorded during 2009-10 followed by 221 lakh tonnes during 2012-13 (Up to 2/13). Gujarat, Tamil Nadu and Rajasthan are surplus Salt producing States accounting for about 96% of the Country's production. Gujarat contributes 76.7 per cent to the total production, followed by Tamil Nadu (11.16 %) and Rajasthan (9.86%). The rest 2.28% production comes from Andhra Pradesh, Maharashtra, Orissa, Karnataka, West Bengal, Goa, Himachal Pradesh, Diu & Daman. On an average 62% of the total production is from large salt producers followed by small scale producers (28%) and rest by medium scale producers.

State-wise Salt Production

Gujarat has been the leading salt producing state in country as it has about 1600 km long coast line which constitutes two of the three gulfs of the country. In year 2010-

11, Gujarat produced 35.54 lakh tones of Iodised salt in the country and the production was 39.63 lakh tones and 39.62 lakh tones in 2011-12 and 2012-13 respectively. The state of Gujarat is followed by Rajasthan and Tamilnadu with production of 11.67 lakh tones and 10.03 lakh tones respectively.

The average annual supplies of salt for human consumption are about 59 lakh tonnes and that for industrial consumption is about 107 lakh tones; 60% of the salt for human consumption moves by rail and 40 % by road. 88% of the salt for industrial consumption moves by road, 10 % by rail and 2% by coastal shipment to various industries; when the total indigenous supplies are taken, 72 per cent moves by road, 27% moves by rail and 1% by sea.

India exports surplus production of salt to the tune of about 35 lakh tones on an average; during the year 2011-12, a record export of 38 lakh tones was achieved primarily due to surge of demand from China. Other major countries importing salt from India are Japan, Bangladesh, Indonesia, South Korea, North Korea, Malaysia, U.A.E., Vietnam, Qatar etc.

Government of India has adopted the strategy of Universal Salt Iodisation and Consumption for elimination of Iodine Deficiency Disorders (IDD) in the country under the National Iodine Deficiency Disorders Control Programme (NIDDCP). Iodine is supplemented in the diet through Iodised Salt for combating IDD. The Programme was started in 1962 initially confining to Goitre endemic areas but after 1984 it was implemented throughout the country. Thus, as on date, a significant progress has been made on Universal Salt Iodisation. The country produces about 62 lakh tones of Iodised salt and about 59.7akh tones of iodised salt is supplied for human consumption against the requirement of about 60.5 lakh tones for entire population. The country has created more than adequate salt iodisation capacity of over 175 lakh tones.

Salt Industry is labour intensive in the country. About 1.11 lakh labourers are employed daily in the Salt Industry on an average. Salt Commissioner's Organisation

has put in place a number of Labour Welfare Schemes ameliorating the working and living conditions of salt labourers.

Salt Industry in Gujarat

India is the third largest salt producing country in and Gujarat is the largest salt producing state of the country. Gujarat provides land on lease to the individuals/companies for manufacture of salt and salt-based chemicals. Gujarat accounts for 77% of total salt produced in India. Salt industry is labour intensive. It is estimated that averages of 1.09 lac labourers are employed in industry. In the state, salt is produced in Kutch, Surendranagar, Bhavnagar, Rajkot, Jamnagar, Junagadh, Porbandar, Patan, Anand, Valsad, Bharuch, Navsari, Surat, and Banaskatha District. Details of Salt produced in the state during last 3 years are as under. The State has notable presence of salt manufacturing units as well as chemical industries based on these resources.

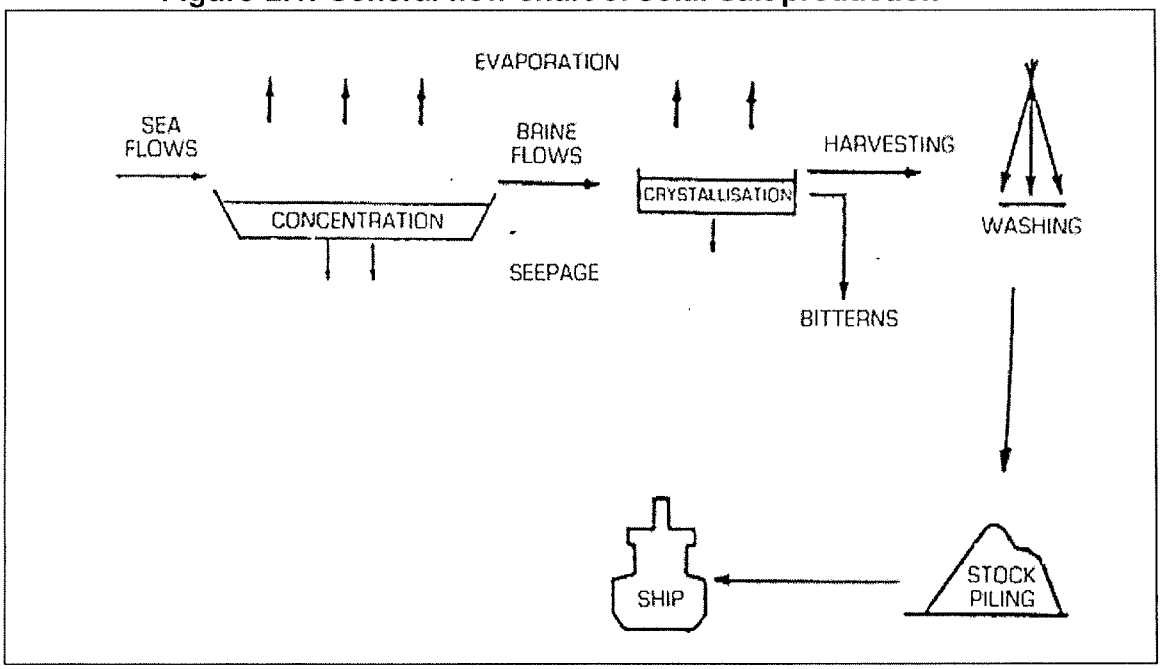
2.4. TECHNOLOGY & PROCESS

The science for solar salt production from seawater by solar evaporation bases its principle on the concentration and brine saturation through evaporation in large ponds, in order to attain the fractional crystallization of the different dissolved salts. Fractional crystallization is given to a process by which, through successive crystallisation and removal of redissolving crystals, the salts in a solution may be extracted and purified. General flow chart of solar salt production is given in Figure-2.1.

Salt works are constituted by series of hydraulically connected ponds to propitiate a brine flow through reservoir and ponds. Its main objective is to increase the density of seawater while it concentrates by the solar evaporation, precipitating the undesirable salts in the various ponds and crystallizing sodium chloride in the crystallizing pans in the purest possible form. The intake of required volumes of seawater is a very important aspect to fulfil in the production process. This volume of water will undergo a reduction in the way brine concentrate by the effects of the evaporation. Salinity reduces the evaporation rate and increases the energy intake

by other physical processes. Under equilibrium condition, salty solution reaches higher temperature compared to that of pure water.

Figure-2.1: General flow chart of solar salt production



The seawater from the initial reservoir or pond must gravitate sequentially or as a "plug flow" which is equivalent to a continuous flow through all the ponds with no back-mixing by means of the regulating gates. In the way this process goes on and brine acquires the expected concentration for each pond, the flow must pass to the following pond by the opening of the gates. This operation is performed in a sequential manner via running the water already concentrated from one pond to the other in a predetermined order. The drawn-out volume is replaced from a previous pond or from the seawater, in the case of the first pond.

M/s. Bhagwti Buildinfra Pvt. Ltd. has land area covering 15000 hectares, consequently, the brine flow would be designed to be as long as possible and slow as well, to give adequate time for evaporation to occur. To lengthen the brine flow, pond would be divided in selected places in accordance with the land configuration.

The brine height in the "plug flow" varies with the brine runs through the various ponds. The brine height in the initial reservoir or pond is the greatest in the plug flow.

It (brine height) decreases with increase in concentration. It is noteworthy that the brine with the highest concentration in the final concentration pond has the lowest height. Hence, the drop in water height with concentration assists to gravitate the brine through the plug.

In the last concentration ponds calcium sulphate salts are crystallized. This is evenly seen in the last concentration phase, from 19° to 25° Baume. Brine reaching a density of 25° Baume in the evaporation-concentration process begins the crystallization of the sodium chloride. It is said that brine is saturated with respect to this salt. The brine feeding to the crystallizing pans is made at 25° -27.5° Baume. The pans are filled up to 10-15 cm height. When by the effects exerted by evaporation brine further concentrates and reduces in height, its density is measured until it reaches 29 ° Baume. At the concentration, this brine is expelled because if it is allowed to concentrate more, it would precipitate an excessive quantity of magnesium salts. Besides, this phenomenon would slow down the salt crystallization process.

Crystallized salt is not completely pure sodium chloride, although it is the predominant precipitate substance during the crystallization process. A little gypsum also precipitates especially in the first stage of crystallization. Also, some quantities of magnesium salts co-crystallize together with the sodium chloride. For this reason, salt technology is said to comprise the fractional crystallization of the dissolved salts to obtain the most possible pure sodium chloride.

After the drainage of the bitterns, crystallizing pans are filled again with fresh brine at 25° Baume up to the indicated height, thus the cycle is repeated. Crystallizing pans are likely to have a spillway channel in order to evacuate the bittern's mother liquors. The high content of magnesium salts of these bitters delays production, because it reduces significantly the evaporation rate.

2.4.1. PRODUCTS AND CAPACITY

The lease area is acquired for production of solar salt. During salt production there would be production of bittern. The bittern would be further processed to extract

variety of other chemicals. These chemicals would be extracted in a bromine/chemical plant to be located outslide the CRZ area but within the lease area. Details of the products and their proposed production are mentioned in Table-2.2.

Table-2.2: Proposed production of salt and other chemicals from bittern

No	Component	Production
Products from Saltworks from lease area		
1	Proposed Salt production	5.0 MMT
2	Bittern Production	5100000 M^3
Products from Bittern (Chemical Plant to be located outside CRZ)		
3	Sulphate of Potash (SOP)	50000
4	Bromine (Br2)	100000
5	Epsomite (MgSO4.7H2O)	12000
6	Magnesium Oxide (MgO)	50000
7	Tetra Bromo Bisphenol -A(TBBA)	5000
8	Bis-di-Bromo Propyle Ether (BDDP)	3000
9	Deca Bromo Diphenyl Ether (DBDE)	2000
10	Hexa Bromo Benzene (HBB)	1000
11	Hydro Bromic Acid- 48%(HBR)	3000
12	Magnesium Chloride-46 % (MgCl2)	60000
13	Magnesium Sulphate-98 % (MgSO4)	60000

2.4.2. PUMPING CAPACITY

Pumping stations will be necessary to lift the sea water, brine flow to the brine or head reservoir and bittern pump. All the pumps will be driven by Three Phase electricity supplied by PGVCL (Paschim Gujarat Vij Company Limited). The pumping capacity to the reservoir should ensure a daily transfer of sea water to be stored in the reservoir, the details of the pumping requirement is as follows.

2.4.3. SEA WATER INTAKE & PUMPING

Sea water intake will be done through a 10-meter-wide sea water channel. Total 110089285 M^3 of sea water intake is anticipated for 15000 ha. 22 vertical (Twenty operational and two stand by) pumps (24 inch) with 60 HP Motor will be installed for 15000 ha. Lease area. Intake pumps will be installed on pillars and a sump will be constructed for channelizing sea water. Since the sea water at the creek is highly concentrated (aprox. 8 Be^0) and hyper saline with (42 ppt) it is likely to be devoid of

marine organism, however, properly designed barrier nets/screens and wooden filters will be provided on three sides of the sump in order to reduce Impingement of marine organism.

Brine Pump

High density brine pumping to the crystallization pan will be done by SPL4 Model pump of capacity of approximately 400l/sec. 60HP pumps with 2900 RPM capacity will be used for the same.

Bittern Pump

The bittern will be pumped from crystallization pan to the bittern pond using Mix Flow 25/30 HP Kirloskar Pumps. The motors with 30 HP of 750 RPM will be used.

2.4.4. SALT HARVESTING

Salt harvesting (winning) is proposed to be manual and mechanical. This will create new employment in the Lakhpat Area. Salt harvesting entails 4 main activities:

- Drawing out of the salt layer from the pan bed
- Loading of the salt to the hauling means
- Haulage of the salt to the stacking yard
- Stacking (piling) of the salt.

Cutting of the salt layer is performed by introducing paddles between the layer and the bottom bed of the pan to break and separate the salt. Ridging of the cut salt is to form small piles or ridges using shovels or paddle rackets to facilitate the shovelling into wheelbarrow or trailers. Then follow the loading of the salt by shovelling it from the ridge to the transportation means. Haulage outside the pan will be in the wheelbarrows or wagons. Then follows the stacking, which is performed by means of a conveyor belt stacker.

The salt, harvesting from the pans will be piled (stacked) in the open salt stacking yard. In the open stacking yard, the salt heap will be formed. The conveyor belt stacker will form 7 metres height salt heap. The salt heap will be of conical-pyramidal shape to protect the harvested salt against rainfall.

To minimise the haulage distance from the pans to the stacking yards, the stack yard is designed at a central location. From the heap salt will be either bagged or hauled in bulk for transportation or delivered for processing to the salt iodination plant.

2.4.5. PROJECT ACTIVITIES

Constructional Phase

Activities for this phase are as follows:

- Clearing the site of vegetative cover
- Construction of perimeter around site
- Construction of channel for laying pipe lines from the sea front
- Construction of service road for pipe system
- Laying of pipes for water intake
- Construction of peak reservoir for collection of intake water
- Construction of channels for water flow
- Construction of ponds and embankments / bunds
- Construction of buildings (pump houses, workshop, sheds, offices, etc.)
- Building of new access roads, pipeline and conveyer belt corridors
- Installation of plant and equipment (Bromine plant, ETP, STP, FPS, Salt Washery, Desalination plant)
- Installation of 5 MW Solar energy facility (in future) for captive use only.

Vegetation clearance

Excavators are to be used for clearing the site of vegetative cover. Since the area is flat and natural saltpans, overburden storage does not require.

Embankments and ponds

- Perimeter embankments are to be made to demarcate the area
- Ponds to be dug and earthen bunds to be made
- Graded roads and inter-ways to be made

Erection of structures

- Pump houses to be built
- Warehouses / sheds to be built
- An office complex housing offices, restrooms, laboratory etc. to be constructed

- Shed for mechanical workshop, stores and consumables to be built
- Water intake pipes leading up to the peak reservoir to be laid
- Sheds for labors and workers
- Storage area sheds
- Washery plant
- Desalination plant of 2.0 MLD
- 5 MW Solar energy production facility for captive use.

Installation of plant and equipment

Machinery such as pumps, electrical switchgear and cabling, washery plant, salt refinery plant, packaging machinery, generators, etc. to be installed.

Operational Phase

The operation phase of the project shall consist of:

- Pumping water through the pipes to the peak reservoir
- Release the sea water in a controlled pattern to various evaporating ponds
- Attend to the evaporation processes
- Harvest the crystallized salt from the pans
- Wash the salt and stack for draining and drying
- Process and pack the salt
- Transfer to warehouse in readiness for sale

2.4.6. RAW MATERIAL SUPPLY AND INPUTS

Sea Water

The major raw material – seawater of a reasonably high salinity – is available in plentiful quantities. Since the evaporating ponds are at a distance from the sea, daily tidal movements shall not affect levels of concentration in the evaporating ponds. Controlled flow into and out of these ponds shall also preserve concentration levels. Considering 80 KL (kilo litres) of sea water requirement for every ton of salt production, approximately 11, 00, 89,285 M^3 per year of sea water will be pumped into 15000 ha, salt works respectively for the natural evaporation process.

Fresh Water requirements

Fresh water shall be required for:

- General washing and cleaning purposes in washery & bromine plant
- Washing of equipment

- Drinking purposes

Considering 300 workers during project construction stage and 150 workers during operation stage approximately 15.0 KLD water will be required during construction and 7.5 KLD water will be required during operation stage of the project for drinking, flushing and other domestic purpose. Fresh water will be supplied to the project area using tankers initially and during operational phase it would be met from desalination plant. In addition, the company shall install tanks to store water obtained from the tankers to cater for different times of non-supply by the tankers.

2.4.7. ENERGY AND FUEL REQUIREMENTS

There is a well-equipped supply from the national grid in the region and this can meet power requirements. Company has approval of power supply 500kv from PGVCL. Company will apply for additional 2.0MW power supply from PGVCL. Apart from this, the company is also planning for 5.0 MW captive solar power generation. However, initially, generators, shall be used as an alternate source of power and at locations that are not connected to power lines. Fuel and lubricants can be obtained from nearby filling stations at Dayapar. Solar operated lights would also be used for remote areas in the salt pans during operational phase.

2.4.8. SEWAGE FACILITIES

Total or maximum sewage generation from the project is approximately 15.0 KLD during construction stage and 7.5 KLD during operation stage. A septic tank shall be constructed to receive sewage from the sanitary facilities. As and when it becomes full, it shall be emptied. Sludge tanker services are available from private operators will be hired.

2.4.9. WORKER REQUIREMENTS

The villages of Lakhpat, Guneri, Mudan, Zara, Zumara, Luna, Bhitara, Hajipir etc. shall provide the required workers for the salt work operations. The estimated worker force requirement during construction stage is 300 and during operation stage is 150. Skilled and semiskilled workers required during the construction phase can be sought from nearby areas. Since this is a not developed industrialized centre, workers trained at welding, structural, masonry, plumbing, electrical works, operation of earth moving machinery, cranes, forklifts, auto mechanics shall be difficult to

bring. Administrative, support and skilled and unskilled workers staff can be sought from either of the towns of Bhuj or other parts of the country.

2.5. GENERAL LAYOUT OF SALT PANS

The proposed lease areas are located in unsurveyed land near villages Mudhan and Zara villages in Lakhpat Taluka of Kutch district in Gujarat. The concession area covers 15000 hectares and consists of evaporating pond area of approximately 8258 hectares and the crystallizing pans area of 3515 hectares. The Brine Pond and bittern pond areas are approximately 182 and 618 ha. Around 2117 ha. Area would be kept for stake yard and administration block. Whereas approximately 310 ha. area would be left along the boundary of the proposed 15000 ha. lease area.

The layout of the proposed project is shown in Map-2.2, Map-2.3, the area details are provided in the Table- 2.3.

Table-2.3: Sections of salt works planned in layout plan (Area in ha.).

Lease	Area ha.	Reservoirs	Condensers	Pre crystallizers	Crystallizers	Brine pond	Bittern pond	Stack yard / Admin	Left legal
Area	15000	920	7338	435	3080	182	618	2117	310

2.6. ACCESSIBILITY OF THE SITE

The 15000 ha. lease by Bhagwati Buildinfra Pvt.Ltd. is close to mainland of Mudhan village in South-West direction. It will also be accessible through Hajipir-Archean Chemical Road aligned North-South of the lease. Therefore, the transportation of the equipment, vehicles and salt can easily be done. However, the internal roads etc. shall be constructed by the proponents.

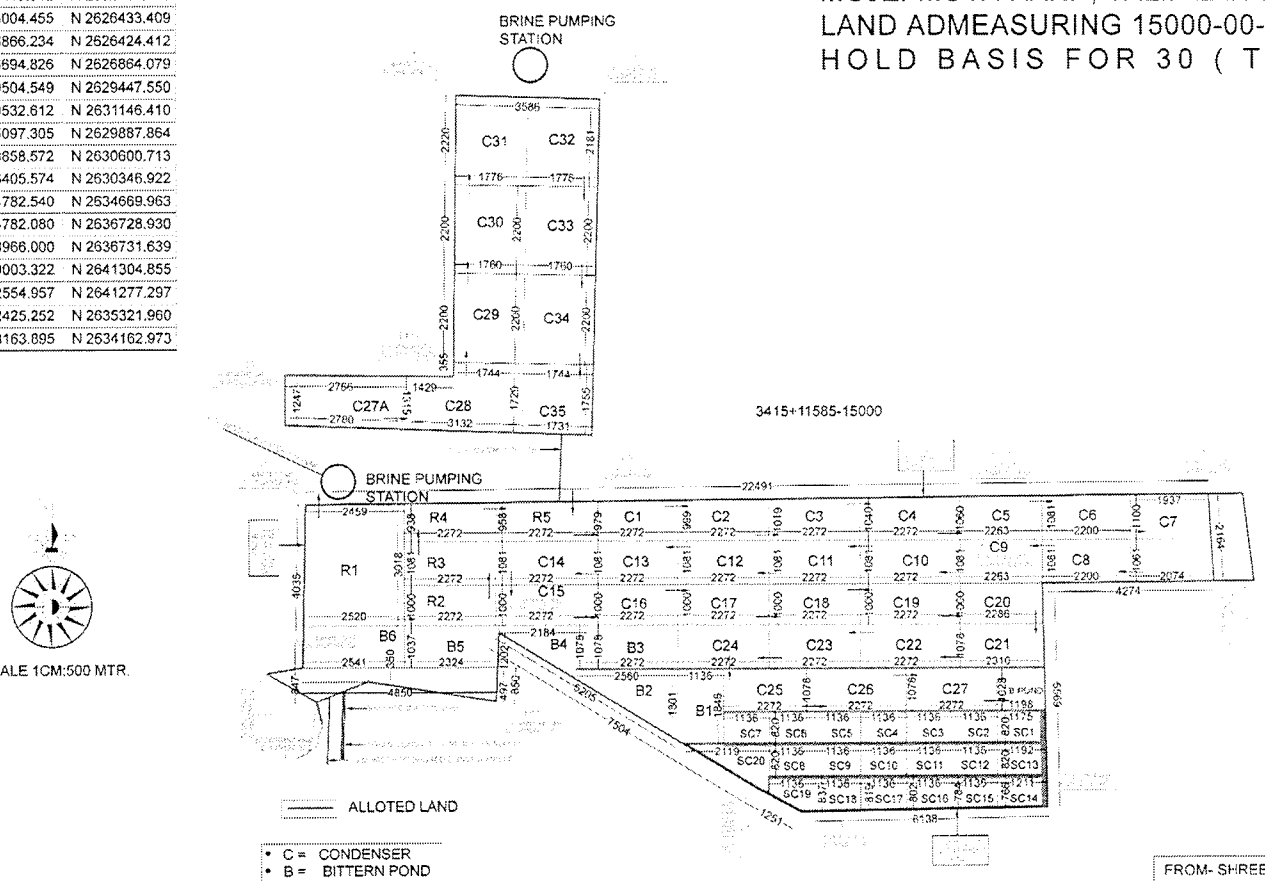
2.7. MAINTENANCE OF THE PROJECT SITE

Although the salt production does not require full time presence of manpower on site, regular and thorough inspections of the water balance is a must. This includes inspection of ponds, water pumps, bunds, access tracks, and electrical infrastructure.

Map-2.3: Layout plan of Bhagwati Buildinfra Pvt. Ltd. 15000 ha. salt works.

S.N.		
01	E 518127.920	N 2634026.056
02	E 514158.867	N 2632047.958
02A	E 513119.312	N 2632001.596
03	E 513004.455	N 2626433.409
04	E 506866.234	N 2626424.412
05	E 505694.826	N 2626864.079
06	E 499504.549	N 2629447.550
07	E 499532.612	N 2631146.410
08	E 495097.305	N 2629887.864
09	E 493858.572	N 2630600.713
10	E 496405.574	N 2630346.922
11	E 494782.540	N 2634669.963
12	E 494782.080	N 2636728.930
13	E 498966.000	N 2636731.639
14	E 499003.322	N 2641304.855
15	E 502554.957	N 2641277.297
16	E 502425.252	N 2635321.960
17	E 513163.895	N 2634162.973

PROPOSED LAYOUT PLAN FOR PRODUCTION OF SALT BROMINE AND MARINE CHEMICALS OF MOJE:-MOTA RANN, TAL.:- LAKHPAT, DIST.:-KUTCH LAND ADMEASURING 15000-00-00 SQ.MTR. LEASE HOLD BASIS FOR 30 (THIRTY) YEARS



Site facilities such as haulage roads and bunds require constant repair or maintenance. Maintenance involves regular repairing of roads, inspection of roads and visits of staff to the project site to monitor the safety of the following.

- Inspection and maintenance of existing infrastructure
- Inspection of Pumping station
- Inspection of Electrical systems
- Inspection of roads and maintenance

2.8. EXISTING SALT PANS & INDUSTRIES IN THE LANDSCAPE

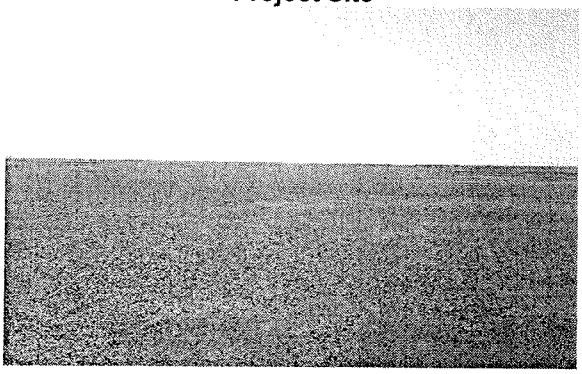
There are large salt works and salt-based industries present within the same landscape. These include Satyam Brine chem, Chemical factory and large-scale Salt works by Archean Chemicals are located at their salt works (Map-2.3).

2.9. PHOTOGRAPHS OF THE PROJECT SITE & BUFFER AREA

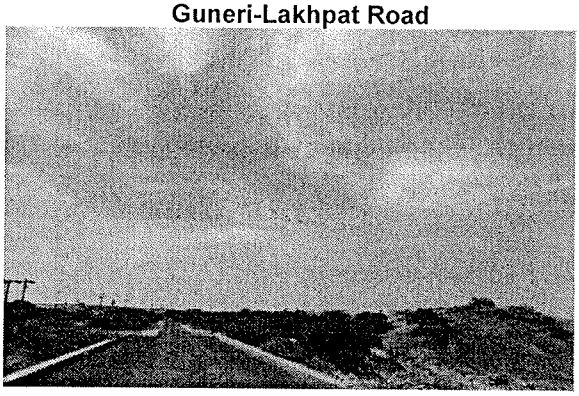
The project site and its buffer are photographs are shown in Plate-2.1.

Plate-2.1: Project site and buffer area photographs.

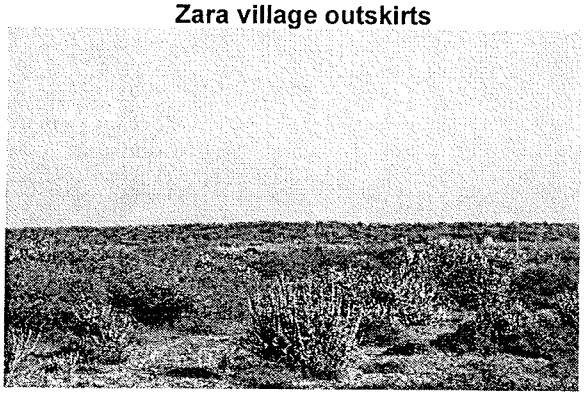
Project Site



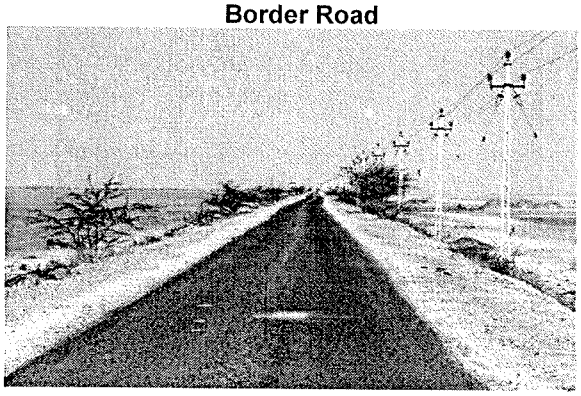
Guneri-Lakhpat Road



Zara village outskirts



Border Road



CHAPTER- 3
DESCRIPTION OF THE ENVIRONMENT

Preparation of this study need a set of baseline data on which the evaluation can be done. It is necessary to collect baseline data about different environmental attributes that are being affected by the development of salt works in the region which, in turn, defines an existing environmental quality of the region to serve as the baseline data. The baseline studies started with site visits and reconnaissance survey in the study area and monitoring locations were fixed for the primary data on the basis of potential impacts of the proposed salt works. Here an attempt has been made to collect the information about an existing environment on the below mentioned eight major environmental attributes:

i. Land Environment (landuse, soil, geology, topography)
ii. Meteorology
iii. Air Environment
iv. Water Environment
v. Noise Environment
vi. Marine & Coastal Ecology
vii. Terrestrial Ecology
viii. Socio-economic

3.1. STUDY AREA & PROJECT LOCATION

The study area for Baseline Environmental Quality is the area with a radius of 10 Kms keeping project site as a centre (Map-3.1). Total 17 villages fall in the study area as mentioned in the Table-3.1. Project site being in the salt affected or saline mudflats which lies as wasteland, majority of the area under 10km radius falls in the saline mudflats/wasteland category. Most of the villages are less populated and the cattle

Map-3.1: Study Area of 10 km buffer around 3 salt work lease areas.

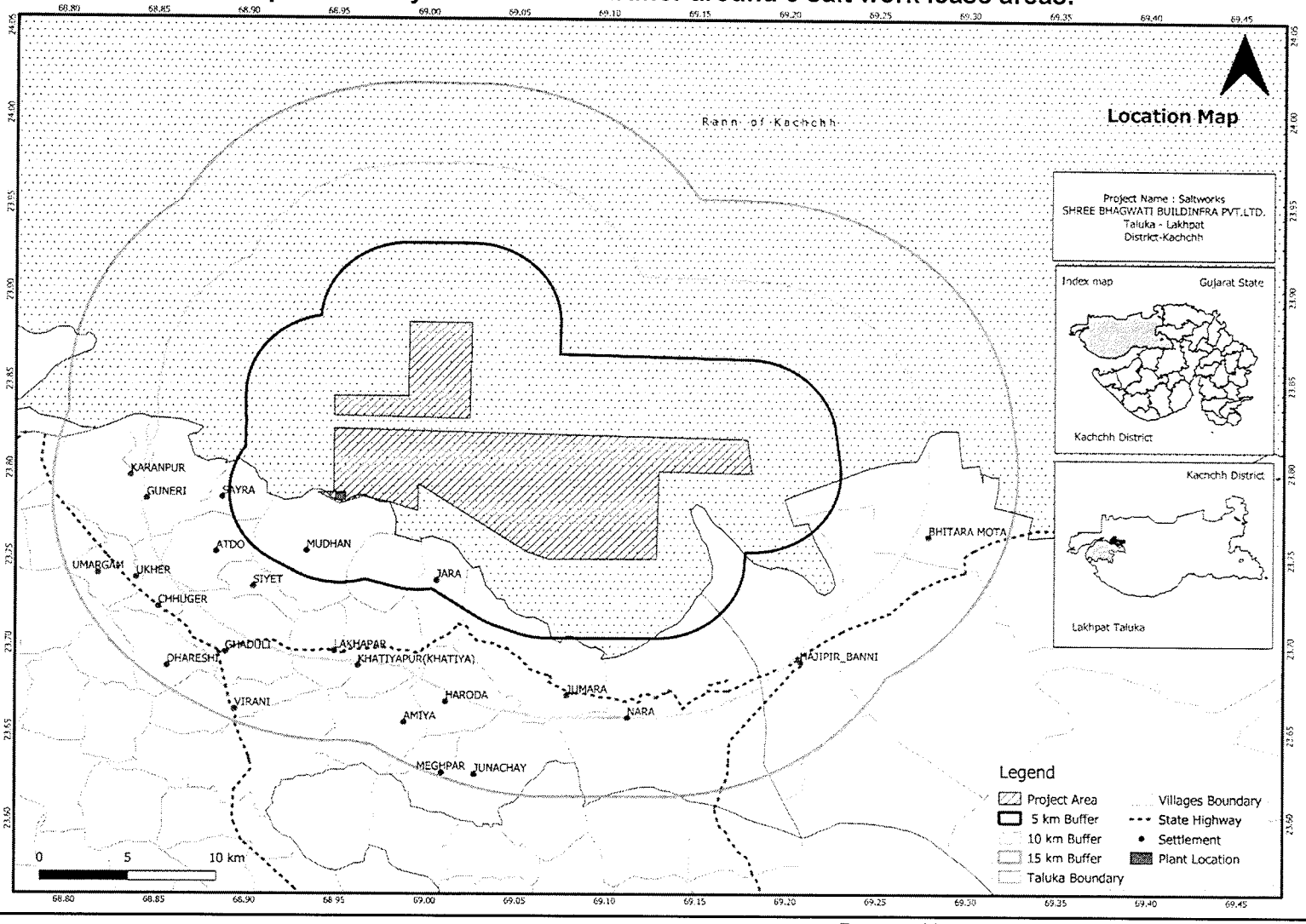


Table-3.1: Names and directions of villages in the study area

Sr. No.	Name of village	Direction
1	Karanpar	West
2	Baana	South
3	Guneri	West
4	Sayra	West
5	Mudan	South-West
6	Atdo	South-West
7	Ukher	South
8	Jara	South
9	Nara	South
10	Jumara	South
11	Hajipir	South-East
12	Khatiya	South
13	Lakhapar	South
14	Chhuger	South-West
15	Siyot	South-West
16	Ghaduli	South-West
17	Bhitara Mota	East

herders dwell these village. The study area is generally located in the western most part of India and maintains more than 24 km distance from the India-Pakistan international border. The area is influenced by tidal water and has saline mudflats that are most suitable for salt works. Large majority of the study area is devoid of vegetation; however, salt tolerant hardy and halophyte vegetation is seen sparsely distributed on the landward side.

Most of the proposed area is under the influence of the Border Security Force (BSF) and defence establishments due to national security reasons. Any civilians moving in the saline mudflat areas that are under the vigilance of the defence have to take prior permissions. Lakhpat, the last frontier of Kutch, is an amazing sea fort situated in the mouth of Kori Creek. The literal meaning of Lakhpat is the city of millionaire. Historically it was very important trading post connecting Gujarat to Sindh. Rice used to be cultivated and Lakhpat earned annual revenue of 800,000 Koris just from rice. Lakhpat used to generate an income of 100,000 Koris every day from maritime activities. The decline of the prosperity started when an earthquake diverted the flow of the Sindhu/Indus River away from it in 1819. An attraction is the Lakhpat Gurudwara Sahib, religious place for the Sikhs. Guru Nanak on his way to Mecca for

3.2. GENERAL ENVIRONMENTAL SENSITIVITY SCENARIO

Table-3.2: Current environmental Settings in the study area

Sr.No	Particulars	Details
1.	National Park/Wildlife Sanctuary	None within 10 km radius. Narayan Sarovar Wildlife Sanctuary is located beyond 13 km from the proposed lease areas
2.	Nearest Major Road	State Highway 42 Bhuj Lakhpat 11.0 km
3.	Nearest Railway Station	Bhuj, 110 kms, South-East direction
4.	Nearest Airport	Bhuj Domestic Airport at 110 km South East direction
5.	Protected Forest	None within 10 km radius
6.	Reserve Forest	Reserve forests (Section-20 in total 9 villages and section-4 in 2 villages
7.	Tiger Reserve/Elephant Reserve / Turtle Nesting Ground	None within 10 km radius
8.	Core Zone of Biosphere Reserve	None within 10 km radius
9.	Habitat for migratory birds	No major migratory bird hotspot present within 10.0 km
10.	Nature Parks / Dense tree covers	The area is mostly covered with wasteland and short saline scrub
11.	Stream/Rivers	Small seasonal streams that flows from south to north are present near Sayra, Mudhan and Zara villages within 10 km radius
12.	Estuary/Sea	Arabian Sea at 57 km, SW direction
13.	Mangroves	Inland mangrove patch at 13.0 km in East direction of proposed location Very few, small & scattered mangroves present near Kori-creek end.
14.	Archaeological &Cultural Heritage sites	Siyot Buddhist cave 6.6 km East, Lakhpat Gurudwara Sahib & Lakhpat Fort a tourist destination at 17.0km
15.	Nearest Temple	Temples at approximately 5.5 km and a mosque in Lakhpat village at 17.0k m from the project location
16.	Nearest School	Primary School at Guneri at approximately 5 km from project site

Haj stayed over here and even today Guru Nanakji's footwear and the palkhi worshiped by the Udasi Sect. The Gurudwara is declared a protected monument by the Archaeological Department. Being low rainfall, dry and salt affected area the landscape does not support good agriculture practice. Only rain fed agriculture is practiced in the region.

3.3. STUDY PERIOD

To establish the existing environmental scenario, field studies and monitoring were carried out for the one season (winter) October to December 2021.

3.4. METHODOLOGY FOR BASELINE STUDY

The baseline environmental study for the EIA of proposed project of M/s. Bhagwati Buildinfra Private Limited has been conducted as per the guidelines of MoEF&CC. To accomplish the purpose of the environmental assessment, preferred study area of the project site has been examined for generation and collection of baseline data for valued environmental components as per the guideline of CRZ for rapid EIA studies by the GCZMA. Hence, a general methodology described in below flowchart, was adopted to obtain baseline data of representative of existing environment.

Step-1	• Study are identification
Step-2	• Identification of Environmental Attributes & parameters to be studied
Step-3	• Study period and monitoring period defining
Step-4	• Selection of monitoring locations and network design for sampling for each parameter based on standard guidelines
Step-5	• Determining frequency and duration of monitoring • Selection of Methods for monitoring/sampling and analysis • Collection of secondary data • Equipment and infrastructure setup • Monitoring team formulation and mobilization
Step-6	• Field records of monitoring and analysis of samples • QC and QA procedures
Step-7	• Tabulation of results of analysis and summarizing to conclude about the status of environmental attributes

3.5. FREQUENCY AND METHODOLOGY FOR MONITORING

The frequency of environmental monitoring considered for Rapid EIA study was in line with the guidelines issued by GCZMA. Technical EIA guidance manual published by MoEF&CC and other guidelines provided by CPCB from time to time were also taken into consideration while deciding the same. Frequency & Methodology of environmental monitoring for various attributes considered for the study are illustrated in Table-3.3, Table-3.4 and on Map-3.2.

Table-3.3: Methodology and frequency of sampling for various environmental parameters in the study area.

Sr. No.	Attribute	Parameters	No. of Sampling Location	Frequency Monitoring / Data Collection
1	Meteorology	Wind speed & direction,temperature, relative humidity,rainfall	Project Site & nearby project site	Data collected from Envitrans (Denvilab Technologies)
2	Ambient Air Quality	PM10, PM2.5, SO2, NOX, CO, HC, Pb, Ozone, Benzene, Benzo pyrene, Arseni, Nickle.	7	24 hourly samples twice a week. CO 8 hourly samples twice a week.
3	Noise Level	Noise levels in dB(A) Leq	7	At least one day in aseason for day time and night time on a working & nonworking day.
4	Surface water Quality	Physical, chemical and bacteriological parameters including pH, temperature, turbidity, magnesium hardness, total alkalinity, chloride, sulphate, fluoride, salinity, DO, BOD, COD, Heavy metals, Total coliforms, fecal coliforms,	7	Once in a season
5	Ground water quality	Physical, chemical and bacteriological parameters including pH, temperature, turbidity, magnesium hardness, total alkalinity, chloride,	7	Once in a season, Sampling was carried out by sampling team of Bhagwati Enviro Care Pvt. Ltd.

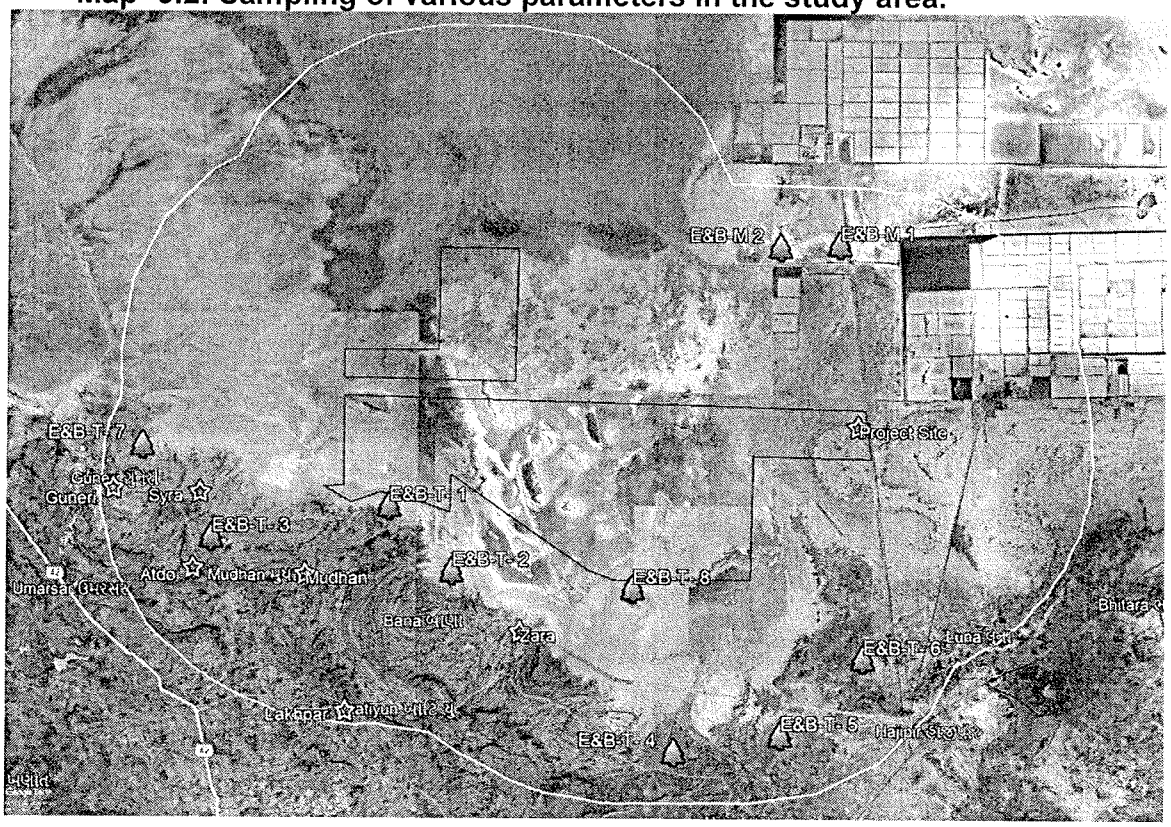
		sulphate, fluoride, salinity, DO, BOD, COD, Heavy metals, Total coliforms, fecal coliforms,		
6	Biological Environment	Existing flora and fauna.	Study Area	Through field visits carried out by AFAE E&B Mr. Parth Jethva and substantiated through secondary data sources.
7	Soil Characteristics	Physical, chemical and biological parameters to assess agricultural and afforestation potential including pH, Permeability, Electrical conductivity, Nitrites, Phosphates, TPH, Fluorides, Heavy metals, SAR, Total hydrocarbons and cation exchange capacity.	7	Once in a season Sampling was carried out by sampling team of Bhagwati Enviro Care Pvt. Ltd.
8	Land Use / land Cover	Land use for different land use Classifications.	Study Area	Land use / Land Cover Analysis using satellite image (sentinel 2A of Nov.2021) and using open source QGIS software.
9	Socio Economic Environment	Socio-economic characteristics, labour force characteristics,population statistics existing amenities in the study area and quality of life.	Study Area	Based on field survey and data collected from Census of India

Table-3.4: Details of sampling locations for various parameters

Location	Geo Coordinates		Physical Parameters					Ecology & Biodiversity	
			Air	Surface water	Ground Water	Noise	Soil	Mar-ine	Terr-estrial
Project Site	23°49'20.7"N	69°10'42.0"E	✓	✓	✓	✓	✓		
Zara	23°43'41.0"N	69°01'34.8"E	✓	✓		✓			
Lakhapar	23°41'45.1"N	68°57'00.1"E	✓		✓	✓	✓		
Atdo	23°45'12.0"N	68°52'58.8"E	✓	✓	✓	✓	✓		
Mudhan	23°45'04.0"N	68°55'55.2"E	✓		✓	✓	✓		
Guneri	23°47'07.9"N	68°50'52.4"E	✓		✓	✓	✓		
Sayra	23°47'02.6"N	68°53'08.5"E	✓		✓	✓	✓		
E&B T-1	23°46'18.07"N	68°58'6.49"E							✓
E&B T-2	23°44'43.17"N	68°59'45.75"E							✓
E&B T-3	23°45'31.63"N	68°53'27.04"E							✓
E&B T-4	23°40'19.87"N	69° 5'37.23"E							✓
E&B T-5	23°40'44.88"N	69° 8'27.28"E							✓
E&B T-6	23°42'36.87"N	69°10'37.78"E							✓
E&B T-7	23°47'45.22"N	68°51'36.92"E							✓
E&B T-8	23°44'17.99"N	69° 4'32.25"E							✓
E&B M-1	23°52'40.37"N	69° 9'59.67"E						✓	
E&B M-2	23°52'36.93"N	69° 8'25.73"E						✓	

E&B T= Ecology & biodiversity terrestrial; E&B M= Ecology & biodiversity Marine

Map- 3.2: Sampling of various parameters in the study area.



3.6. LAND ENVIRONMENT

3.6.1. LANDUSE CLASSES

Comprehensive land use and land cover information is very vital for efficient management of land resources and protection of conservation site, if any. Satellite remote sensing, in conjunction with geographic information systems, has been widely applied and been recognized as a powerful and effective tool in analyzing land cover/use categories This study made use of remotely sensed data and GIS technologies; to evaluate qualitatively and quantitatively outcome of part of land cover/use distribution. Obtained results were compared, visualized and analyzed, in Geographic Information System.

Digital image analysis of remotely sensed multispectral most recent satellite data (Sentinal 2A) freely available from website (https://scihub.copernicus.eu) was done on the Quantum GIS 2.8 using SAGA and Semiautomatic classification plug-ins to determine the land classes within project site area and in 10 km buffer from the boundary of the project site. The study area was covered by one Sentinal 2A image. Data for the month of November 2021 was chosen keeping the dry season in mind to segregate the irrigated farming and fallow land present in the study area. The satellite data are ortho-rectified and further radiometric correction was carried out in QGIS. The Universal Transverse Mercator projection was used with WGS84 spheroid & datum. The geometrically corrected raster images were mosaiced to prepare a single dataset covering the entire study area using standard raster analysis plug-in available in QGIS 2.8. Classified data were subjected to majority filter in SAGA tools within QGIS 2.8 platform to merge isolated pixels. Supervised classification was carried out using MultiSpec software program based on field observations and control plots for different land cover classes. The image was classified into nine land cover classes. Area under each of the land cover categories was calculated for project site and extended area of interest within 10 km buffer on site boundary. For terrain visualization, raw satellite image is also provided with project area superimposed on it (Map-3.2, Figure-3.1). Ground verification of the land cover classification was done by several field visits traversing project site and

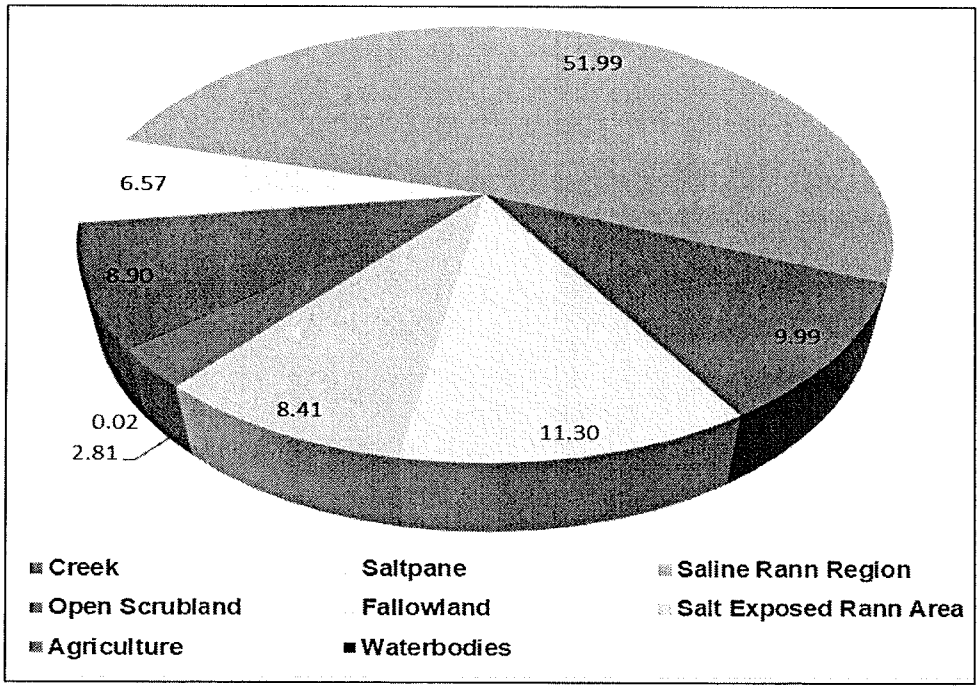
the entire area of interest within 10 km from the boundary of the project site for various classes using the handheld Garmin 12 XL GPS receiver.

The study area for the analysis of landuse of the proposed project is shown in Map-3.3. Total 1154.4 square km area is taken for the land use classification. The various land use type with their respective classification is presented in Table-3.5.Total 9 important land uses are classified using GIS domain. These are 1) Agriculture, 2) Creek, 3) Fallow land, 4) Open scrubland, 5) Saline Rann region, 6) Salt exposed Rann Area, 7) Saltpans and 8) Waterbodies.

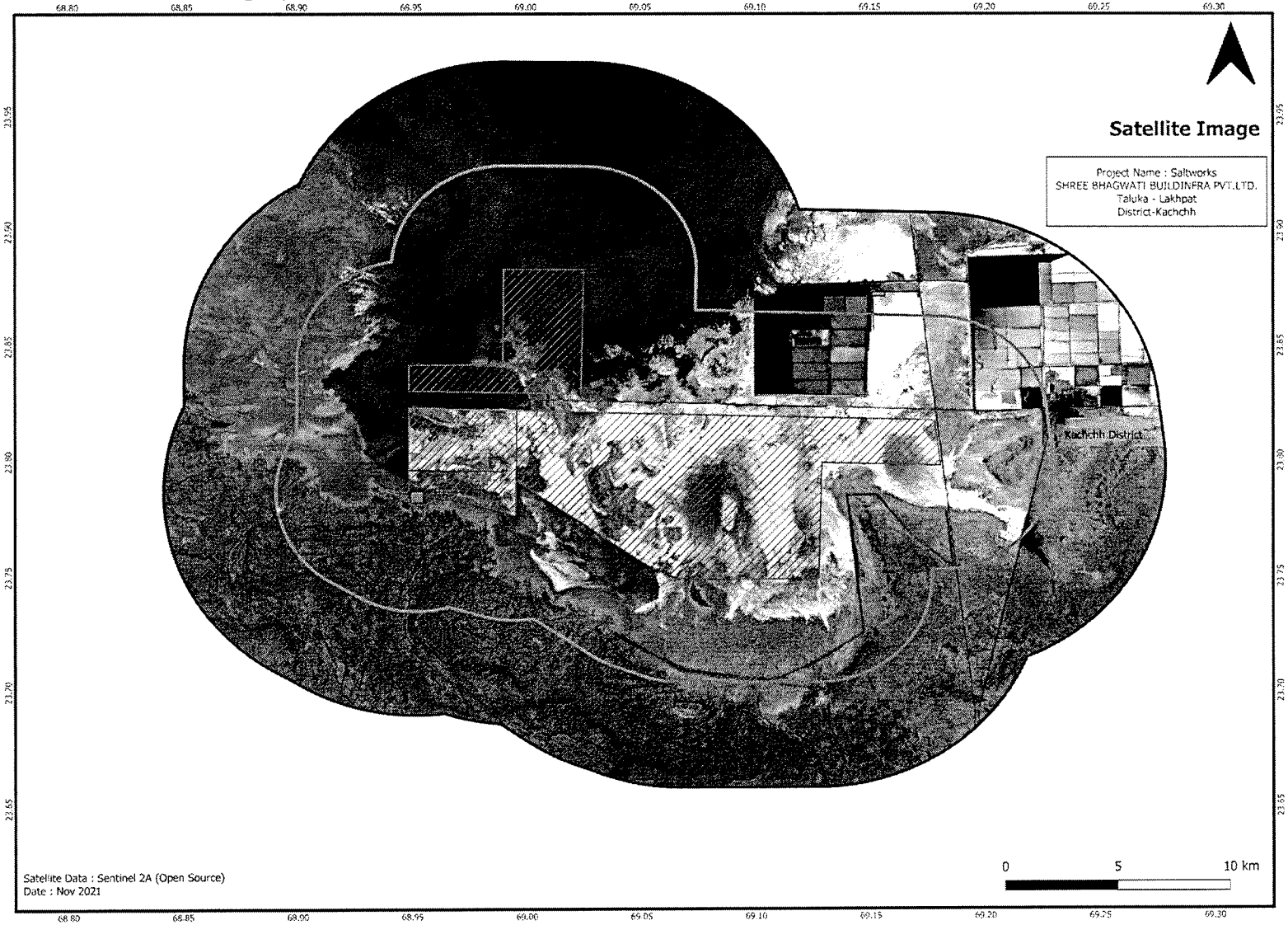
Table-3.5: Landuse classes in the study area

#	Landuse Class	Area (ha.)	% Area
1	Agriculture	3249.38	2.81
2	Creek	10273.71	8.90
3	Fallowland	13048.11	11.30
4	Open Scrubland	11540.62	9.99
5	Saline Rann Region	60045.85	51.99
6	Salt Exposed Rann Area	9713.28	8.41
7	Saltpans	7588.18	6.57
8	Waterbodies	27.26	0.02
	Total	**115486.39**	**100.0**

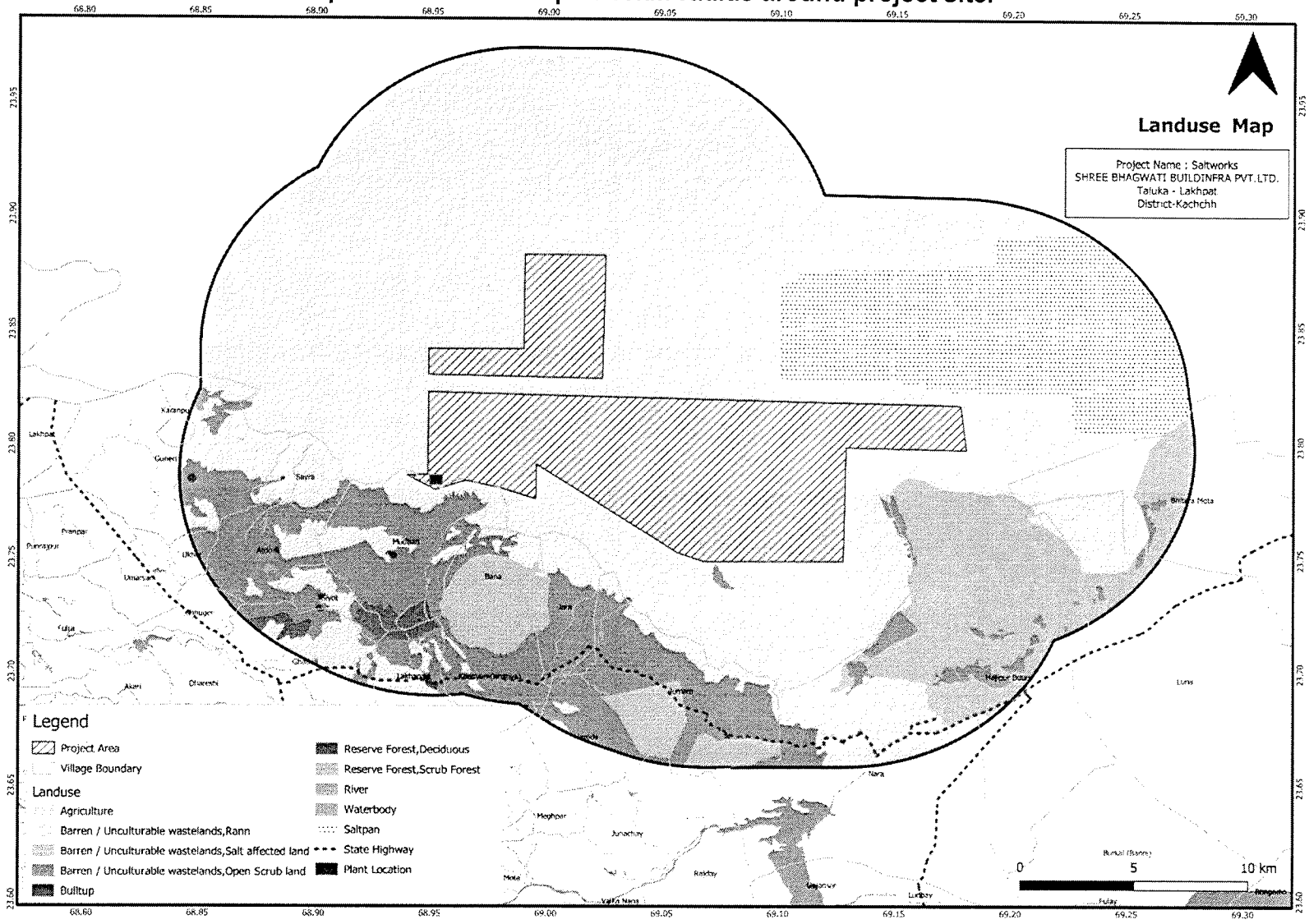
Figure-3.1: Proportions of various landuse classes in the study area.



Map- 3.3: Raw satellite image (Sentinal-2A of November-2021) of 10km radius showing project site and surrounding area.



Map- 3.4: Landuse map of 10km radius around project site.



3.6.2. TOPOGRAPHY

Core Area: The topography of the proposed lease area is largely flat with no undulation. The terrain details studied through field visits, Google Earth and satellite image of study area (Map-3.3) suggests that the general slope of the site is towards West. However, in 15000 ha lease area, as we move from East to west there are small islands or say beyts (elevated areas) which are located in the middle of lease area. The centre of the 15000 ha. lease area has elevation from 1 to 5 AMSL suggesting the presence of high-tide mudflats. The South-Western boundary almost touches the revenue land of Mudhan village. Lease area maintains around 40-45 km distance from the main Kori creek.

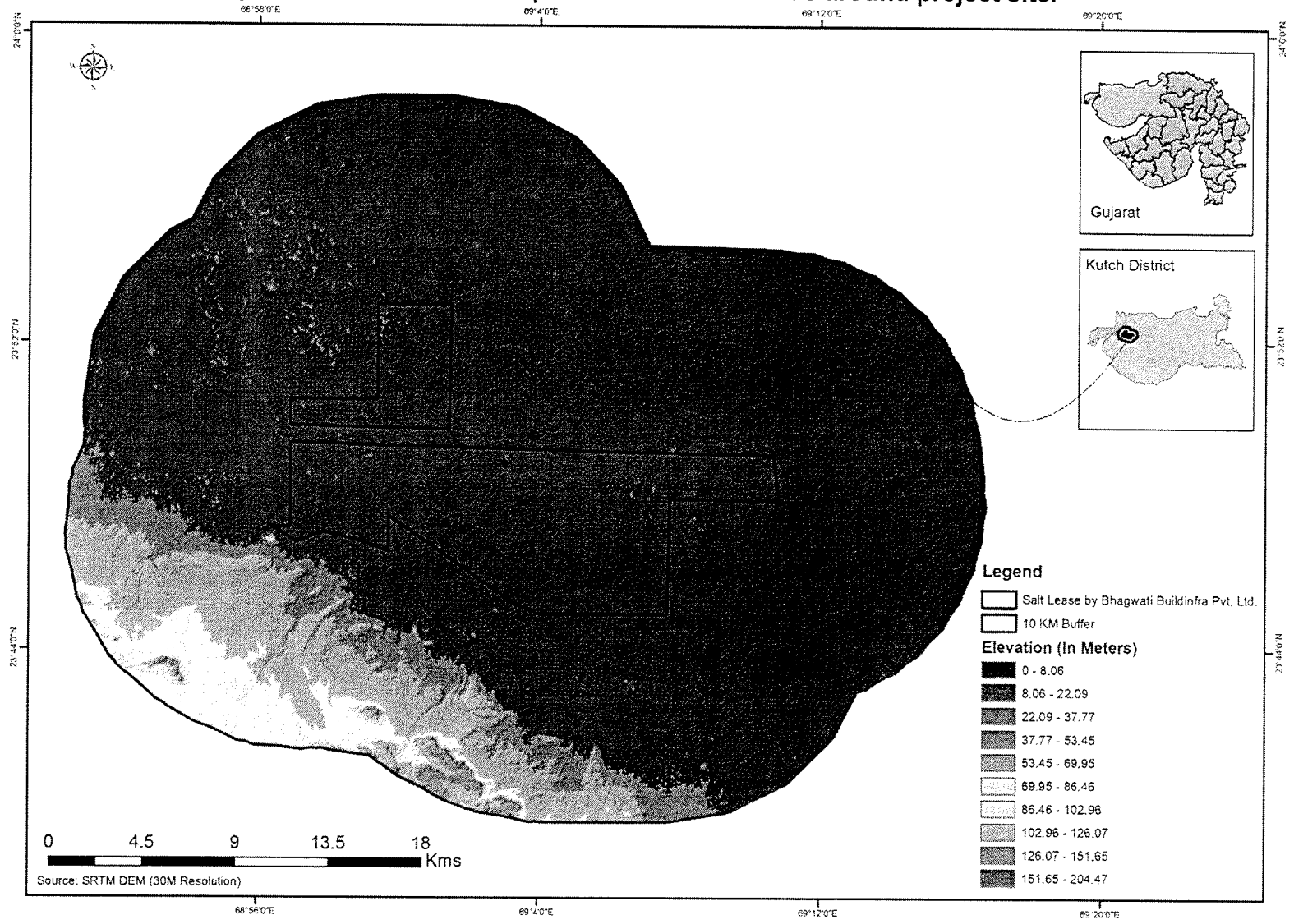
Buffer Area: Majority of the buffer area fall in the unsurveyed saline mudflats land of Great Rann of Kutch region. Lakhpat fort is located in West direction of the buffer area. Number of small drainages formed between the limestone deposits drains runoff to low lying Rann of Kutch area which ultimately drains into Kori creek. General slope is from South to North which drains run off to the low-lying saline mudflats where lease area is proposed. The elevation range in the 10 km study area is between -1 to 180 mtrs AMSL. There are very good limestone deposits in the landward side which has attracted few mining and cement industries. Agriculture land is minimum as it falls in the rainshadow area.

3.6.3. GEOLOGY

Since the Mesozoic, the Rann of Kutch was extension of the shallow Arabian Sea until geological uplift closed off the connection with the sea, creating a vast lake that was still navigable during the time of Alexander the Great. But over the centuries, silting has created a vast, saline mudflat. During the brief wet season, the mudflat becomes flooded. Then it becomes parched under the relentless, searing heat of the long dry season; the ecoregion has one of the highest annual evaporation rates in the region.

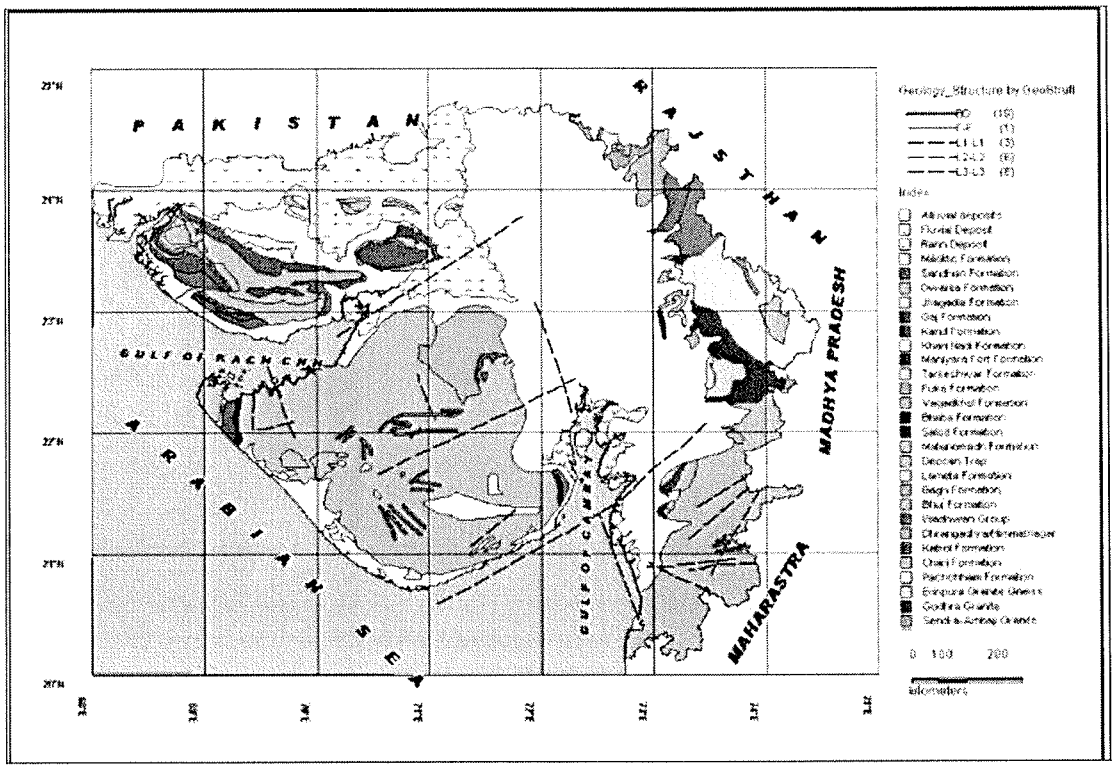
The strata around Lakhpat Fort are composed mainly of limestones with subordinate shales. The basal part, which are exposed in Lakhpat fort and adjoining area are highly fossiliferous strata of Paleogene age comprise mainly limestones and shales.

Map- 3.5: Terrain details as per DEM of 10km radius around project site.



There are marine tertiary rocks that lie exposed near Lakhpat on the edge of Rann of Kutch. Limestone here is directly overlies the laterites derived from the Deccan traps. Limestones are reddish and laterized and contain thin bands of white to reddish clay or shale with minor bands of gypsum.

Map-3.6: Geological Structure of Gujarat State (Source: Water Resources Dept from http://guj-nwrws.gujarat.gov.in/)



3.6.4. HYDROGEOLOGY

Hydrology is the science that deals with the depletion and replenishment of water resources. It deals with surface as well as ground water. The water below the water table is known as ground water and water above the water table is known as soil moisture.

The land is virtually an 'island' resembling a tortoise "Katchua or Kachbo", surrounded by sea water. Kutch was also known as the kutchdweep or Kutchbet." The Great Rann of Kutch" which dominates a major portion of the district. The Great Rann of Kutch and the Little Rann of Kutch respectively-uninhabitable deserts which during the monsoon season (June to October) are often completely submerged by

floods. Great Rann (~ 2m MSL) in the north and Little Rann in the east comprising vast saline wasteland. The boundaries of these main geomorphic zones are bounded by the major E-W trending faults. The study area connects with Kori Creek which drains Rann of Kutch water into Arabian Sea. However, during monsoon and high tide time water from Kori creek enters into study area and Rann of Kutch. Therefore, the proposed lease area falls in the important interface of seawater (from creek) and runoff from the north and north-east side including water from Luni River.

Ground water in Rann of Kutch area i.e., flat land is hyper saline and alkaline. Almost brine with higher Baume is available from the ground. However, on the mainland i.e., towards Lakhpat and south ward the main source of water is rain water stored in lakes and pond as well as the ground water. Ground water is utilized for almost all uses in the area. Generally, there are rain water storage ponds at each village of the study area, which are used by the villagers for irrigation, domestic applications other than drinking and also for cattle feeding.

The hydrogeology investigation work carried out in the study area, reveals that the entire study area comprises of a cover of thick Alluvium with a few sporadic outcrops of Deccan Trap and Limestone towards southern part of the region. The area is almost flat covered by sediments and clayey soil and has gentle southerly and south westerly slope.

3.6.5. SOIL CHARACTERISTICS

Total 6 soil samples were collected from different places in the study area (Table-3.6a and Table-3.6b). At each sampling site, the samples were collected at random at a depth of 60 cms and mixed together to form a composite sample. Large stones, gravels and plant roots were removed from soil. The soil was then crushed and water suspension was prepared. The supernatant liquid was then subjected to Physico-Chemical analysis. Standard Procedures were followed for analysis. The results of soil analysis are tabulated in Table-3.6a, Table-6b.

Table-3.6a: Physico-chemical properties of soil in the study area.

#	Parameters	Unit	Project site	Lakhapar	Atdo
Date of Sampling			17/10/2021	17/10/2021	17/10/2021
1	pH (5% - Solution)	--	9.9	7.8	7.9
2	Total Hardness		630	460	520
3	Calcium	mg/Kg	160.2	124.2	112.2
4	Magnesium	mg/Kg	70.8	36.5	58.5
5	Sodium	mg/Kg	614	613	698
6	Potassium	mg/Kg	74	47	61
7	Total Alkalinity	mg/Kg	167	160	140
8	Chloride	mg/Kg	901.6	913.6	885.2
9	Organic Carbon	%	1.6	0.83	1.3
10	Organic matter	%	2.67	1.43	2.24
11	Available Nitrogen	%	0.024	0.022	0.023
12	Available Phosphorus	mg/Kg	1.12	1.08	1.01
13	Boron	mg/Kg	< 0.1	< 0.1	< 0.1
14	Cadmium	mg/Kg	< 0.01	< 0.01	< 0.01
15	Chromium	mg/Kg	< 0.01	< 0.01	< 0.01
16	Cobalt	mg/Kg	< 0.01	< 0.01	< 0.01
17	Copper	mg/Kg	< 0.01	< 0.01	< 0.01
18	Nickel	mg/Kg	< 0.01	< 0.01	< 0.01
19	Zinc	mg/Kg	8.8	8.6	7.4
20	Lead	mg/Kg	4.6	2.9	3.9
21	Bulk Density	g/cm^3	1.86	1.56	1.56
22	Texture	--			
23	Slit (%)	%	39	40	27
24	Clay (%)	%	35	29	23
25	Sand (%)	%	26	31	50
26	Electrical Conductivity	µmho/cm	214	271	181
27	Cation Exchange Capacity	mg/ 100 gm	37.3	31.8	31.3

Table-3.6b: Physico-chemical properties of soil in the study area.

#	Parameters	Unit	Mudhan	Guneri	Sayra
Date of Sampling			17/10/2021	17/10/2021	17/10/2021
1	pH (5% - Solution)	--	7.9	8.1	8.0
2	Total Hardness		680	640	560
3	Calcium	mg/Kg	188.3	168.3	148.3
4	Magnesium	mg/Kg	51.1	53.6	46.3
5	Sodium	mg/Kg	684	687	691
6	Potassium	mg/Kg	54	71	67
7	Total Alkalinity	mg/Kg	220	220	200
8	Chloride	mg/Kg	899.4	799.4	713.6
9	Organic Carbon	%	0.83	1.1	0.76
10	Organic matter	%	1.37	1.89	1.31
11	Available Nitrogen	%	0.023	0.031	0.035
12	Available Phosphorus	mg/Kg	1.19	1.37	1.07
13	Boron	mg/Kg	< 0.1	< 0.1	< 0.1
14	Cadmium	mg/Kg	< 0.01	< 0.01	< 0.01
15	Chromium	mg/Kg	< 0.01	< 0.01	< 0.01
16	Cobalt	mg/Kg	< 0.01	< 0.01	< 0.01
17	Copper	mg/Kg	< 0.01	< 0.01	< 0.01
18	Nickel	mg/Kg	< 0.01	< 0.01	< 0.01
19	Zinc	mg/Kg	3.9	5.9	6.1
20	Lead	mg/Kg	3.4	4.3	4.6
21	Bulk Density	g/cm^3	1.72	1.75	1.89
22	Texture	--			
23	Slit (%)	%	22	28	29
24	Clay (%)	%	11	11	16
25	Sand (%)	%	67	61	55
26	Electrical Conductivity	µmho/cm	188	224	229
27	Cation Exchange Capacity	mg/ 100 gm	32.2	33.9	34.6

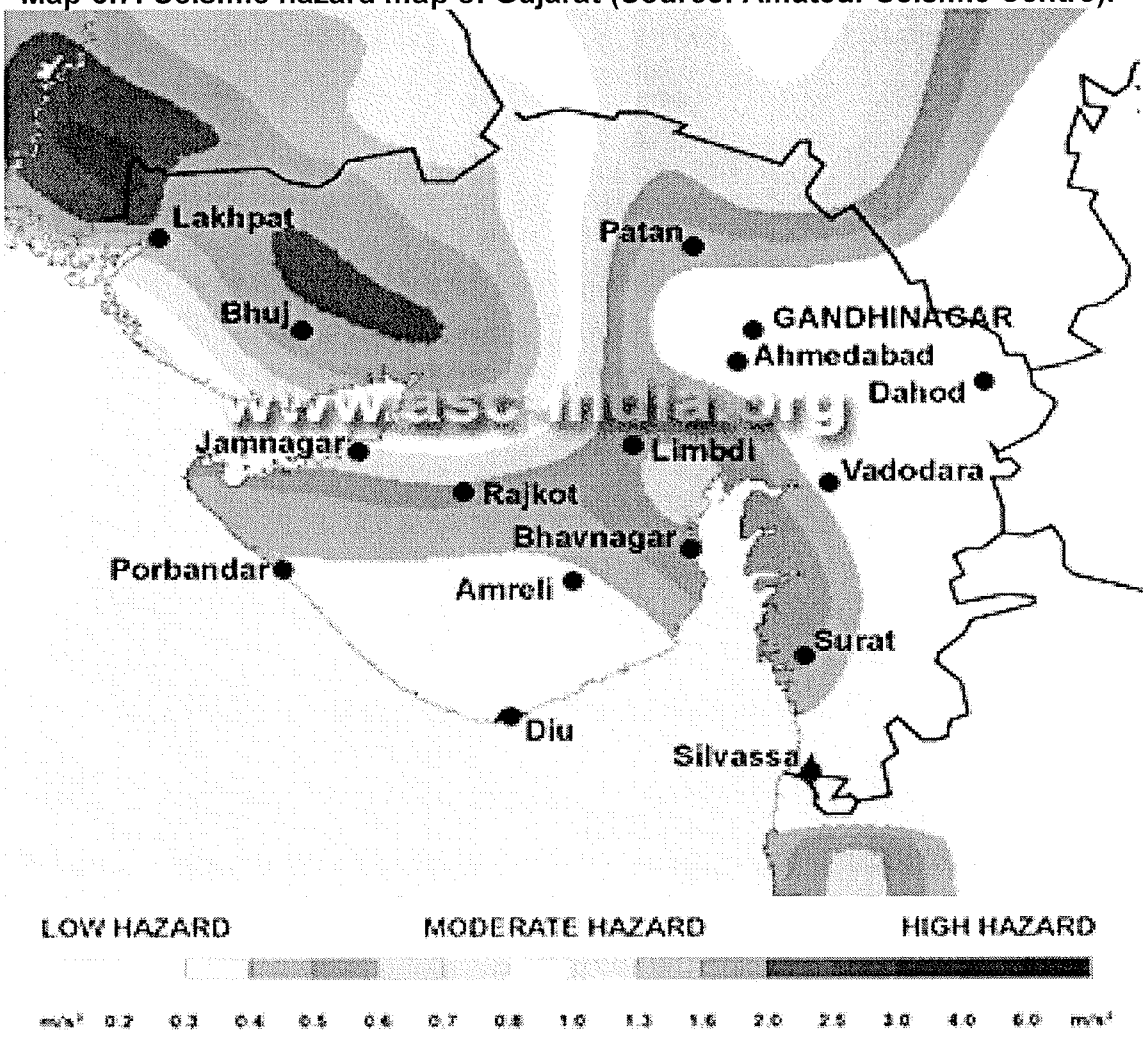
The soil samples were analyzed for all the important parameters like pH, electrical conductance, calcium, magnesium, nitrogen, phosphorus, potassium, etc. The range of variation of different parameters found in the study area is explained briefly below.

- The pH values in the study area are varying from 7.8 to 9.9 indicating that the soils are falling in alkaline class.
- Soil texture is clay loam type which easily forms hard clusters which are not beneficial for plant growth.
- Due to high soil salinity at the project site, the plant growth was not observed as salinity reduces nitrogen accumulation in plants and imbalance of the uptake of the essential nutrients.

3.6.6. SEISMIC ENVIRONMENT

The seismicity of the Kutch region is associated with the interaction of Indian plate with Euroasian plate. Although the indentation of the Indian plate into the Euroasian plate is mostly accommodated by the sinistral Chaman fault, it seems that thrust type faulting and associated folding of the sedimentary rocks are also taking place along this plate boundary zone. The possible active faults in the region of Kutch (Malik et al. 2000) are as follows; a) Nagar Parkar Fault, b) Allah bund Fault, c) Kachchh Mainland Fault, d) Katrol Hill Fault, e) Naira River Fault, f) Bhujpur Fault and g) Wagad Fault. The region that continues to be tectonically an active area and it is designated to seismically active zone V of the Indian Sub-continent. The seismic hazard map of Gujarat is shown in Map-3.7.

Map-3.7: Seismic hazard map of Gujarat (Source: Amateur Seismic Centre).



3.7. METEOROLOGY

Meteorological conditions, of the site, regulates the transport and diffusion of air-pollutants released into the atmosphere. Ambient temperature, wind speed, wind direction and atmospheric stability are called primary or basic Meteorological Parameters because the dispersion and diffusion of pollutants depend mainly on these Parameters. Humidity, precipitation, pressure and visibility are secondary Meteorological Parameters as this control the dispersion of the pollutants indirectly by affecting primary Parameters.

3.7.1. METHODOLOGY

Meteorological data were obtained from Envitrans (Denvilab Technologies) for the parameters namely ambient temperature, wind speed, wind direction, relative humidity for the period Oct-Nov-Dec 2021. The Wind Rose diagram for the month of Oct-Nov-Dec 2021 is shown in Figure- 3.2.

3.7.2. SITE SPECIFIC METEORLOGICAL DATA

3.7.2.1. AMBIENT TEMPERATURE

The monthly variations of monthly highest and monthly lowest temperatures recorded are as follows:

Location –Project site	Temperature, °C		
	Oct - 2021	Nov - 2021	Dec - 2021
Minimum	19.4	15.5	10.1
Maximum	33.9	32.3	28.2
Average	26.3	23.8	19.2

3.7.2.2. WIND SPEED

Location –Project Site	Wind Velocity, m/s		
	Oct - 2021	Nov - 2021	Dec - 2021
Minimum	0	0	0
Maximum	8.24	7.85	8.11
Average	3.2	3.7	3.6

3.7.2.3. WIND DIRECTION

Wind direction study is important to understand the air pollution conditions as it determines the direction of transport of air pollutants. The mean wind direction will be indicative of the direction of travel of the pollutants. The meteorological parameters namely: ambient temperature, wind speed, wind direction and stability class were obtained from Envitrans (Denvilab Technologies) for the Period of Oct-Nov-Dec 2021. As specific mixing heights were not available, mixing height based on CPCB publication "Spatial Distribution of Hourly Mixing Depth over Indian Region", PROBES/88/2002-03 has been used. The windrose diagram is shown in Figure No. 3.2. Details of Wind Rose (Frequency Distribution data) is provided in Table-3.7. whereas, Windrose Frequency Count data is provided in Table-3.8.

Figure 3.2: Study period Wind Rose (Oct-Dec, 2021)

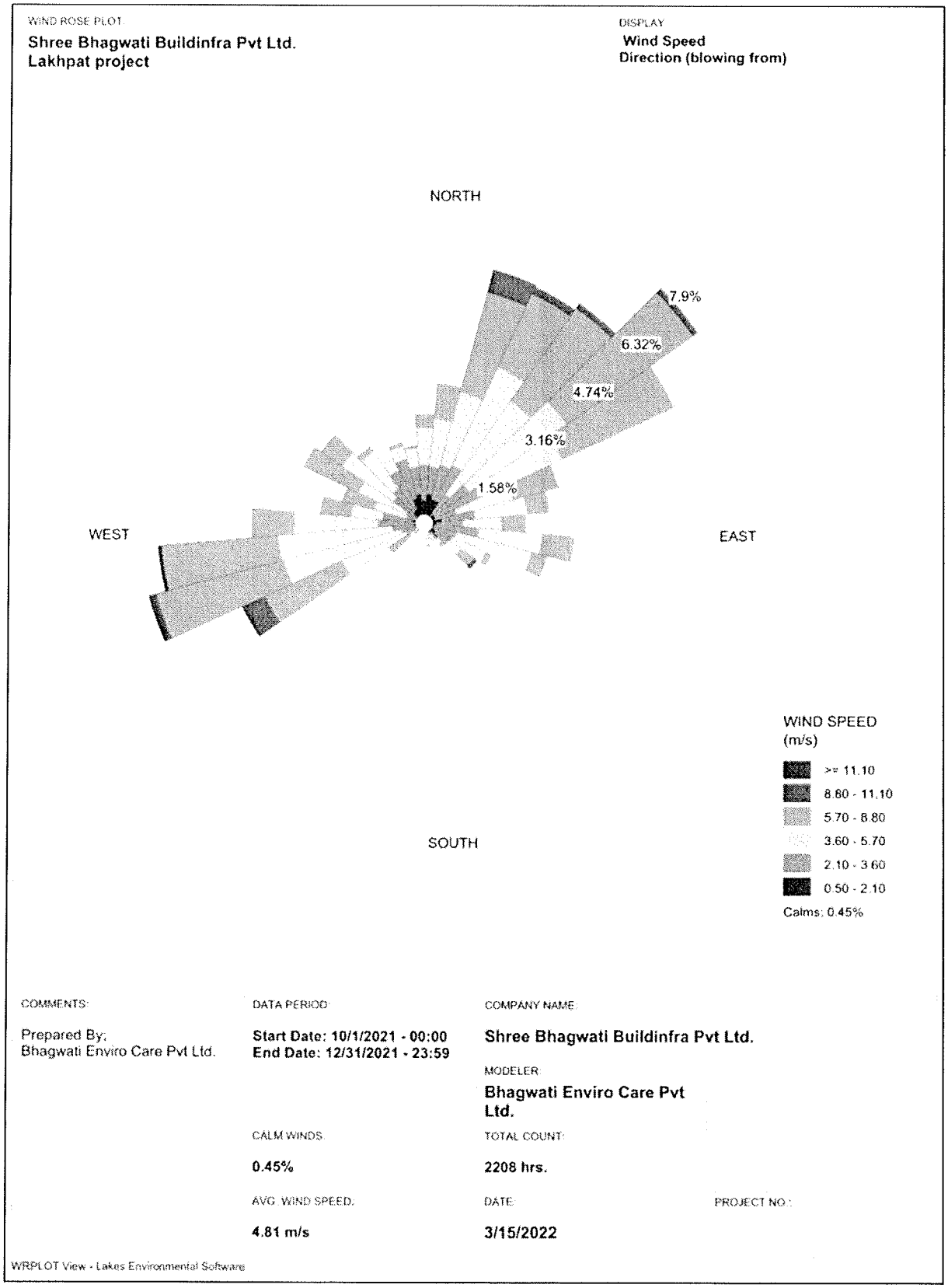


Table No.3.7: Wind Rose (Frequency Distribution data)

#	Directions Wind Classes (m/s)	0.50 - 2.10	2.10 - 3.60	3.60 - 5.70	5.70 - 8.80	8.80 - 11.10	>= 11.10	Total (%)
1	355 - 5	0.543	0.815	0.860	0.317	0.000	0.000	2.535
2	10-15	0.679	0.634	1.132	0.815	0.000	0.000	3.259
3	15 - 25	0.589	0.815	1.766	2.399	0.543	0.000	6.111
4	25 - 35	0.589	0.905	2.535	1.856	0.181	0.000	6.066
5	35 - 45	0.181	0.634	2.671	2.626	0.136	0.000	6.247
6	45 - 55	0.272	0.996	2.761	3.576	0.136	0.000	7.741
7	55 - 65	0.272	1.268	1.992	2.852	0.000	0.000	6.383
8	65 - 75	0.091	0.679	1.358	1.086	0.000	0.000	3.214
9	75 - 85	0.407	0.770	1.222	0.498	0.000	0.000	2.897
10	85 - 95	0.272	0.634	0.905	0.543	0.000	0.000	2.354
11	95 - 105	0.226	1.041	1.494	0.724	0.000	0.000	3.486
12	105 - 115	0.181	0.589	1.811	0.362	0.000	0.000	2.943
13	115 - 125	0.136	0.589	0.860	0.136	0.000	0.000	1.720
14	125 - 135	0.317	0.362	0.362	0.362	0.091	0.000	1.494
15	135 - 145	0.136	0.317	0.136	0.091	0.000	0.000	0.679
16	145 - 155	0.045	0.226	0.181	0.000	0.000	0.000	0.453
17	155 - 165	0.045	0.136	0.226	0.000	0.000	0.000	0.407
18	165 - 175	0.045	0.091	0.362	0.045	0.000	0.000	0.543
19	175 - 185	0.000	0.000	0.000	0.091	0.000	0.000	0.091
20	185 - 195	0.045	0.000	0.000	0.000	0.000	0.000	0.045
21	195 - 205	0.181	0.000	0.000	0.000	0.000	0.000	0.181
22	205 - 215	0.045	0.000	0.045	0.000	0.000	0.000	0.091
23	215 - 225	0.045	0.000	0.000	0.272	0.000	0.000	0.317
24	225 - 235	0.000	0.136	0.272	0.589	0.000	0.000	0.996
25	235 - 245	0.091	0.362	1.630	1.947	0.589	0.000	4.617
26	245 - 255	0.045	0.498	2.807	3.033	0.181	0.000	6.564
27	255 - 265	0.226	0.498	2.671	2.671	0.091	0.000	6.157
28	265 - 275	0.136	0.905	1.947	0.996	0.000	0.000	3.984
29	275 - 285	0.272	0.679	0.724	0.724	0.000	0.000	2.399
30	285 - 295	0.045	0.362	0.770	0.770	0.000	0.000	1.947
31	295 - 305	0.091	0.362	1.222	1.403	0.000	0.000	3.078
32	305 - 315	0.226	0.634	1.449	0.589	0.000	0.000	2.897
33	315 - 325	0.317	0.679	1.041	0.136	0.000	0.000	2.173
34	325 - 335	0.362	0.996	0.317	0.000	0.000	0.000	1.675
35	335 - 345	0.589	0.951	0.317	0.091	0.000	0.000	1.947
36	345 - 355	0.679	0.634	0.453	0.045	0.000	0.000	1.811
	Sub-Total	8.420	19.194	38.298	31.643	1.947	0.000	99.502
	Calms							0.453
	Missing/Incomplete							0.045
	Total							100.000

Table-3.8 : Windrose Frequency Count

#	Directions / Wind Classes (m/s)	0.50 - 2.10	2.10 - 3.60	3.60 - 5.70	5.70 - 8.80	8.80 - 11.10	>= 11.10	Total
1	355 - 5	12	18	19	7	0	0	56
2	May-15	15	14	25	18	0	0	72
3	15 - 25	13	18	39	53	12	0	135
4	25 - 35	13	20	56	41	4	0	134
5	35 - 45	4	14	59	58	3	0	138
6	45 - 55	6	22	61	79	3	0	171
7	55 - 65	6	28	44	63	0	0	141
8	65 - 75	2	15	30	24	0	0	71
9	75 - 85	9	17	27	11	0	0	64
10	85 - 95	6	14	20	12	0	0	52
11	95 - 105	5	23	33	16	0	0	77
12	105 - 115	4	13	40	8	0	0	65
13	115 - 125	3	13	19	3	0	0	38
14	125 - 135	7	8	8	8	2	0	33
15	135 - 145	3	7	3	2	0	0	15
16	145 - 155	1	5	4	0	0	0	10
17	155 - 165	1	3	5	0	0	0	9
18	165 - 175	1	2	8	1	0	0	12
19	175 - 185	0	0	0	2	0	0	2
20	185 - 195	1	0	0	0	0	0	1
21	195 - 205	4	0	0	0	0	0	4
22	205 - 215	1	0	1	0	0	0	2
23	215 - 225	1	0	0	6	0	0	7
24	225 - 235	0	3	6	13	0	0	22
25	235 - 245	2	8	36	43	13	0	102
26	245 - 255	1	11	62	67	4	0	145
27	255 - 265	5	11	59	59	2	0	136
28	265 - 275	3	20	43	22	0	0	88
29	275 - 285	6	15	16	16	0	0	53
30	285 - 295	1	8	17	17	0	0	43
31	295 - 305	2	8	27	31	0	0	68
32	305 - 315	5	14	32	13	0	0	64
33	315 - 325	7	15	23	3	0	0	48
34	325 - 335	8	22	7	0	0	0	37
35	335 - 345	13	21	7	2	0	0	43
36	345 - 355	15	14	10	1	0	0	40
	Sub-Total	186	424	846	699	43	0	2198
	Calms							10
	Missing/Incomplete							1
	Total							2209

3.7.2.4.RELATIVE HUMIDITY

Mean Monthly Relative Humidity for Meteorological station were obtained from Envitrans (Denvilab Technologies) for the Period of Oct-Nov-Dec 2021 is given in Table No.3.9.

Table-3.9: Relative Humidity in the study area

Location –Project site	Temperature, °C		
	Oct - 2021	Nov - 2021	Dec - 2021
Minimum	16.00	16.00	13.00
Maximum	100.00	97.00	95.00
Average	61.35	42.18	52.10

3.8. AMBIENT AIR QUALITY

The prime objective of the baseline air monitoring was to evaluate the existing air quality of the area. This will also be useful for assessing the conformity to standards of the ambient air quality during the operation of the proposed project. The collection of base line information for Air Environment includes identification of specific air pollutants being released into the atmosphere having significant impact on neighbourhood. The Ambient Air Quality status, with respect to the identified air pollutants, has been studied at eight major locations. This has been done through Air Quality surveillance program and based on standard methods. The back-ground air quality for PM10, PM2.5, Sulphur Dioxide (SO2), Oxides of Nitrogen (NOx), CO, HC including VOCs was monitored. The monitoring for these parameters has been done at sites located in different directions and situated within the study area in and around the project site (Table-3.4; Map-3.2).

3.8.1. METHODOLOGY ADOPTED FOR AIR QUALITY SURVEY

3.8.2. SELECTION OF SAMPLING LOCATIONS :

The baseline status of the air quality in the study area has been assessed through a scientifically designed ambient air quality monitoring network (Plate-3.1). The design of monitoring network in the air quality surveillance program has been based on the following considerations:

- Meteorological conditions on synoptic scale;
- As the site is close to the international border, the availability of permissions for operation of the monitoring location was considered;
- The methodology for conducting the baseline environmental survey and selection of sampling locations considered the guidelines given in the EIA manual of the MoEF&CC;
- Topography of the study area;
- Representatives of regional background air quality for obtaining baseline status; and
- Representatives of likely impact areas.

3.8.3. FREQUENCY AND PARAMETERS FOR SAMPLING

Ambient air quality monitoring has been carried out with a frequency of two days per week at four locations during study period. The ambient air quality parameters along with their frequency of sampling are given in Table 3.10., 3.11, Due to restrictions imposed by Border Security Force, only 8 hrs data during the day time were possible to collect form the project site.

3.8.4. INSTRUMENTS USED FOR SAMPLING

Dust Samplers of Polltech Instruments were used for monitoring PM10 (<10 microns), PM2.5 (<2.5 microns) and gaseous pollutants like SO2 and NO2. Gas Chromatography techniques have been used for the estimation of CO and HCs

3.8.5. SAMPLING AND ANALYTICAL TECHNIQUES

PM2.5 and PM10 have been estimated by gravimetric method. Modified West and Gaeke method (IS-5182 Part-II, 1969) has been adopted for estimation of SO2. Jacobs-Hochheiser method (IS-5182 Part-IV, 1975) has been adopted for the estimation of NOx. The techniques used for ambient air quality monitoring and its minimum detectable levels are given in Table-3.11.

3.8.6. RESULTS AND DISCUSSION-AMBIENT AIR QUALITY

The recorded data at all the AAQ monitoring stations have been analysed for various statistical parameters like arithmetic mean, maximum and minimum. The average, Minimum and Maximum values of Ambient Air quality in the study area are given in

Table-3.12. Whereas, the summarized location wise data are tabulated in Table-3.13(A-G).

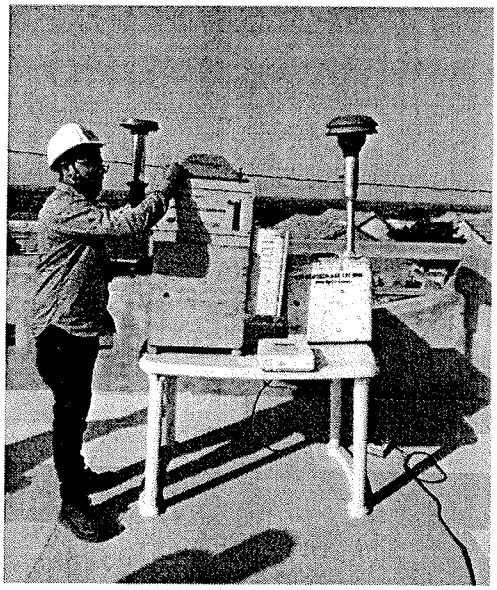
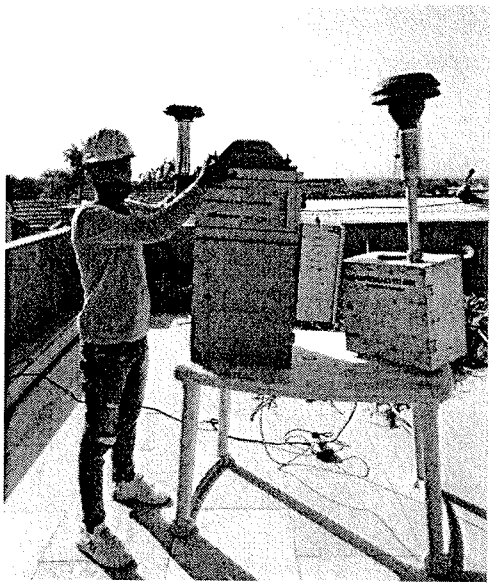
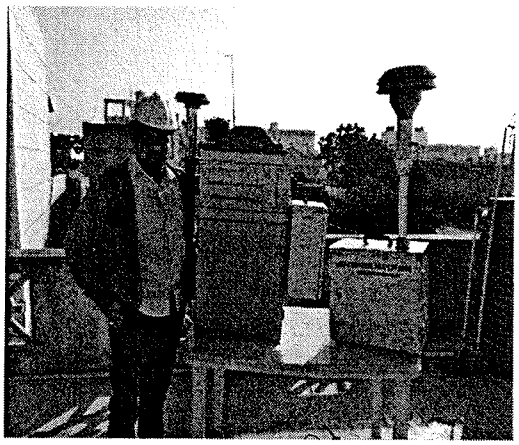
Table 3.10: Monitored Parameters and Frequency of Sampling

Sr.No	Parameters	Sampling Frequency
1.	Particulate Matter (PM_{10})	24 hourly sample twice a week for three months
2.	Particulate Matter ($PM_{.2.5}$)	24 hourly sample twice a week for three months
3.	Sulphur dioxide (SO_2)	24 hourly samples twice a week for three months
4.	Oxides of Nitrogen (NO_x)	24 hourly samples twice a week for three months
5.	HC	24 hourly samples once a week for three months
6.	O_3	8 hourly samples twice a week for three months
7.	CO	8 hourly samples twice a week for three months

Table 3.11: Techniques Used for Ambient Air Quality Monitoring

Sr. No.	Parameter	Technique	Technical Protocol	Minimum Détectable Limit ($\mu g/m^3$)
1	PM_{10}	Respirable Dust Sampler (Gravimetric method)	IS-5182 (Part-IV)	5.0
2	$PM_{2.5}$	Respirable Dust Sampler (Gravimetric method)	IS-5182 (Part-IV)	4.0
3.	Sulphur Dioxide	Modified West and Gaeke	IS-5182 (Part-II)	4.0
4	Nitrogen Oxide	Jacob & Hochheiser	IS-5182 (Part-VI)	4.0
5	HC	Gas Chromatography	USEPA	
6	O_3	Online Ozone meter	USEPA	

Plate- 3.1: Ambient Air Quality Monitoring in the study area.

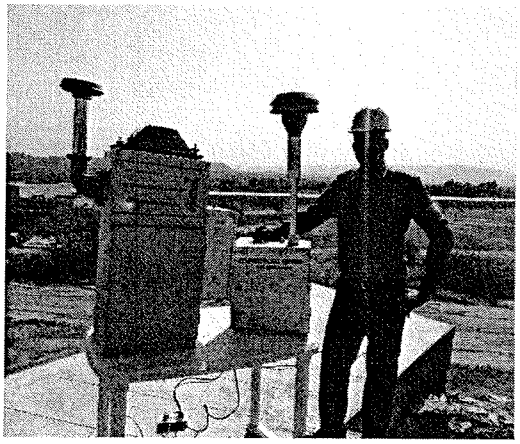
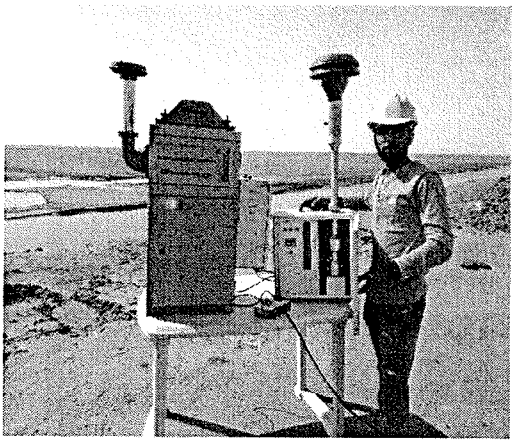



Table-3.12: Ambient Air Quality Analysis Results (min., max, Average and 98 %) for Individual locations in the study area.

Sr. no.	Sampling Location		PM_{10}	$PM_{2.5}$	SO_2	NO_X
01	Project Site	Min	65.74	24.77	6.81	4.87
		Max.	79.36	37.53	13.33	13.80
		Avg.	73.45	31.59	9.31	10.29
		98 %	79.24	36.86	13.33	13.80
02	Zara	Min	62.74	25.05	7.68	5.28
		Max.	75.17	37.75	16.38	14.61
		Avg.	69.96	32.36	10.00	9.80
		98 %	74.72	37.64	14.95	13.22
03	Lakhapar	Min	65.67	24.90	6.38	7.31
		Max.	75.39	36.73	21.01	13.80
		Avg.	70.00	31.42	9.50	10.11
		98 %	75.12	36.39	17.15	13.22
04	Atdo	Min	64.90	24.84	7.10	4.87
		Max.	78.57	34.67	14.64	16.64
		Avg.	72.59	31.31	11.23	9.92
		98 %	78.57	34.67	14.35	16.30
05	Mudhan	Min	65.46	25.01	9.13	6.49
		Max.	77.91	35.81	27.82	17.05
		Avg.	71.90	30.66	12.50	10.15
		98 %	77.66	35.35	22.84	16.37
06	Guneri	Min	60.82	25.12	5.65	6.49
		Max.	79.94	37.29	25.36	15.42
		Avg.	72.64	31.69	12.27	10.34
		98 %	79.70	36.49	20.12	15.25
07	Sayra	Min	64.86	29.84	9.56	4.87
		Max.	80.09	37.31	18.40	16.23
		Avg.	73.51	34.46	12.55	10.41
		98 %	79.72	37.07	17.24	15.32

Table- 3.13 A: Ambient Air Quality Analysis at Project Site**

No	Date of Sample	PM_{10}	$PM_{2.5}$	SO_x			NO_x		
		GPCB limit 100 µg/m³	GPCB limit 60 µg/m³	GPCB limit 80 µg /m³			**GPCB limit 80 µg /m³**		
		24 Hrs	24 Hrs		8 hrs			8 hrs	
1	07-10-2021	**72.19**	**30.10**	**	8.55	**	**	7.71	**
2	10-10-2021	**70.15**	**36.07**	**	9.13	**	**	8.12	**
3	14-10-2021	**79.10**	**35.62**	**	9.85	**	**	8.52	**
4	17-10-2021	**67.83**	**33.40**	**	9.42	**	**	8.52	**
5	21-10-2021	**69.74**	**33.79**	**	11.59	**	**	8.12	**
6	24-10-2021	**71.34**	**31.26**	**	9.42	**	**	4.87	**
7	28-10-2021	**73.18**	**37.53**	**	9.13	**	**	8.52	**
8	31-10-2021	**72.67**	**33.15**	**	8.69	**	**	8.12	**
9	04-11-2021	**74.13**	**24.77**	**	10.43	**	**	13.39	**
10	07-11-2021	**65.74**	**32.58**	**	11.16	**	**	12.18	**
11	11-11-2021	**72.67**	**28.26**	**	10.87	**	**	11.36	**
12	14-11-2021	**72.35**	**26.77**	**	13.33	**	**	9.33	**
13	18-11-2021	**75.85**	**33.44**	**	10.87	**	**	13.39	**
14	21-11-2021	**76.00**	**32.29**	**	8.98	**	**	13.39	**
15	25-11-2021	**77.91**	**28.53**	**	9.56	**	**	12.18	**
16	28-11-2021	**76.38**	**25.29**	**	11.88	**	**	8.93	**
17	02-12-2021	**73.09**	**34.22**	**	13.33	**	**	8.12	**
18	05-12-2021	**77.04**	**30.27**	**	9.27	**	**	9.33	**
19	09-12-2021	**71.48**	**28.68**	**	10.00	**	**	10.15	**
20	12-12-2021	**79.36**	**34.30**	**	9.13	**	**	13.80	**
21	16-12-2021	**77.15**	**33.45**	**	9.27	**	**	10.96	**
22	19-12-2021	**76.77**	**29.53**	**	13.33	**	**	11.36	**
23	23-12-2021	**71.04**	**32.98**	**	10.87	**	**	10.55	**
24	**26-12-2021**	**69.58**	**31.86**	**	**8.98**	**	**	**13.80**	**

***= Due to restricctions imposed by Border Security Force (BSF) only 8 hourly data was possible to collect from the project site.*

Table- 3.13 B: Ambient Air Quality Analysis at Zara

No	Date of Sample	PM_{10}	$PM_{2.5}$	SO_x			NO_x		
		GPCB limit 100 µg/m³	GPCB limit 60 µg/m³	GPCB limit 80 µg /m³			**GPCB limit 80 µg /m³**		
		24 Hrs	24 Hrs	8 hrs	8 hrs	8 hrs	8 hrs	8 hrs	**8 hrs**
1	07-10-2021	**71.78**	**37.52**	8.55	9.42	8.12	9.33	9.33	**10.96**
2	10-10-2021	**74.19**	**33.02**	9.42	10.29	8.84	6.09	10.96	**8.12**
3	14-10-2021	**73.72**	**28.37**	8.55	9.42	7.68	7.71	8.12	**12.18**
4	17-10-2021	**69.95**	**34.46**	9.42	9.42	8.12	6.49	9.33	**10.55**
5	21-10-2021	**69.22**	**34.33**	10.72	13.48	11.30	7.31	8.93	**12.99**
6	24-10-2021	**72.12**	**32.14**	10.29	11.16	8.98	5.28	8.12	**10.96**
7	28-10-2021	**72.09**	**26.98**	10.58	9.13	9.71	10.15	14.61	**10.15**
8	31-10-2021	**64.30**	**34.67**	10.29	14.78	12.61	9.33	9.74	**11.36**
9	04-11-2021	**69.43**	**33.16**	9.85	13.33	12.75	6.49	11.36	**8.12**
10	07-11-2021	**66.83**	**30.02**	10.00	12.46	11.74	7.71	8.12	**12.58**
11	11-11-2021	**75.17**	**36.69**	11.45	16.38	15.07	6.49	9.74	**10.96**
12	14-11-2021	**64.59**	**35.82**	8.84	9.42	7.97	7.31	9.33	**12.99**
13	18-11-2021	**66.44**	**34.22**	9.71	10.29	8.55	5.28	8.52	**11.36**
14	21-11-2021	**67.98**	**33.90**	10.00	10.87	8.84	10.15	12.99	**9.74**
15	25-11-2021	**69.69**	**32.08**	8.84	10.00	8.12	9.33	8.12	**10.15**
16	28-11-2021	**69.17**	**37.75**	9.27	10.00	8.55	7.31	9.74	**8.12**
17	02-12-2021	**70.52**	**33.16**	9.27	10.00	8.55	6.49	8.12	**11.36**
18	05-12-2021	**62.74**	**25.05**	9.56	8.84	8.84	11.36	11.77	**10.96**
19	09-12-2021	**69.22**	**33.24**	8.98	9.85	8.12	12.18	12.99	**11.77**
20	12-12-2021	**68.80**	**29.12**	10.00	10.87	8.84	10.55	11.36	**8.52**
21	16-12-2021	**72.14**	**26.93**	10.29	11.16	8.98	12.58	13.39	**11.77**
22	19-12-2021	**72.33**	**32.98**	8.98	10.29	8.55	11.36	10.96	**10.15**
23	23-12-2021	**74.04**	**32.29**	9.56	10.43	8.84	8.52	9.33	**8.52**
24	**26-12-2021**	**72.67**	**28.79**	**9.56**	**10.43**	**8.84**	**10.55**	**10.96**	**9.74**

Table- 3.13 C: Ambient Air Quality Analysis at Lakhapar

No	Date of Sample	PM_{10}	$PM_{2.5}$	SO_x			NO_x		
		GPCB limit 100 µg/m³	GPCB limit 60 µg/m³	GPCB limit 80 µg /m³			**GPCB limit 80 µg /m³**		
		24 Hrs	24 Hrs	8 hrs	8 hrs	8 hrs	8 hrs	8 hrs	**8 hrs**
1	07-10-2021	**69.58**	**26.07**	10.00	8.98	8.98	11.77	12.18	**11.36**
2	10-10-2021	**73.31**	**33.88**	10.00	17.39	8.84	12.58	13.39	**11.77**
3	14-10-2021	**68.08**	**29.55**	14.93	21.01	14.20	10.55	11.36	**8.52**
4	17-10-2021	**75.39**	**28.97**	14.20	15.51	7.25	12.58	13.80	**11.77**
5	21-10-2021	**73.41**	**33.83**	10.72	16.81	8.55	11.36	11.36	**10.15**
6	24-10-2021	**73.02**	**33.60**	9.56	8.84	8.84	8.93	9.74	**8.52**
7	28-10-2021	**67.70**	**29.66**	8.26	8.84	7.25	8.93	8.12	**10.15**
8	31-10-2021	**66.31**	**33.46**	7.68	8.55	7.25	8.93	7.71	**10.15**
9	04-11-2021	**68.33**	**29.54**	8.69	9.42	8.12	10.96	11.77	**10.15**
10	07-11-2021	**70.57**	**35.54**	9.71	10.00	8.40	10.96	11.36	**10.15**
11	11-11-2021	**65.89**	**35.99**	8.98	9.85	8.26	10.15	10.55	**9.74**
12	14-11-2021	**65.67**	**33.88**	9.71	12.03	8.98	8.12	8.12	**7.71**
13	18-11-2021	**68.60**	**33.60**	9.13	9.85	8.12	10.96	11.77	**10.15**
14	21-11-2021	**68.55**	**31.62**	7.54	8.26	6.38	9.74	11.77	**10.15**
15	25-11-2021	**70.36**	**36.73**	7.54	8.84	7.39	9.74	11.36	**10.15**
16	28-11-2021	**73.03**	**33.31**	8.40	10.87	8.55	8.12	8.12	**8.52**
17	02-12-2021	**65.74**	**24.90**	8.40	12.03	8.84	8.52	7.71	**9.74**
18	05-12-2021	**70.26**	**32.79**	7.54	8.55	7.25	9.74	8.52	**12.58**
19	09-12-2021	**68.85**	**29.05**	8.26	9.13	7.68	8.93	9.33	**10.55**
20	12-12-2021	**72.36**	**26.80**	7.54	8.55	6.81	8.12	12.99	**9.74**
21	16-12-2021	**74.81**	**33.80**	8.26	8.55	7.25	7.71	10.15	**10.15**
22	19-12-2021	**67.75**	**32.28**	9.42	12.03	9.85	9.74	10.55	**7.31**
23	23-12-2021	**72.56**	**28.93**	8.98	9.85	7.97	7.71	9.74	**11.36**
24	**26-12-2021**	**69.84**	**26.21**	**9.27**	**8.26**	**8.55**	**8.52**	**12.99**	**9.33**

Table- 3.13 D: Ambient Air Quality Analysis at Atdo

No	Date of Sample	PM_{10}	$PM_{2.5}$	SO_x			NO_x		
		GPCB limit 100 µg/m³	GPCB limit 60 µg/m³	GPCB limit 80 µg /m³			**GPCB limit 80 µg /m³**		
		24 Hrs	24 Hrs	8 hrs	8 hrs	8 hrs	8 hrs	8 hrs	**8 hrs**
1	08-10-2021	**73.31**	**34.10**	7.68	8.69	7.39	8.52	8.52	**10.15**
2	11-10-2021	**73.71**	**30.27**	8.55	9.42	8.12	5.68	10.15	**7.31**
3	15-10-2021	**71.34**	**24.84**	7.68	8.55	7.10	7.31	7.31	**10.96**
4	18-10-2021	**78.57**	**32.29**	8.55	8.69	7.39	6.09	8.52	**9.74**
5	22-10-2021	**78.57**	**33.15**	9.71	12.32	10.14	6.49	8.12	**11.77**
6	25-10-2021	**76.80**	**32.59**	9.27	10.00	8.26	4.87	7.71	**10.15**
7	29-10-2021	**72.33**	**25.63**	9.71	8.55	8.84	8.93	13.39	**9.74**
8	01-11-2021	**78.42**	**32.12**	9.42	13.48	11.59	8.52	8.52	**10.15**
9	05-11-2021	**75.29**	**25.89**	8.98	12.03	11.59	6.09	10.55	**7.31**
10	08-11-2021	**69.42**	**27.13**	8.98	11.30	10.72	7.31	7.71	**11.36**
11	12-11-2021	**65.46**	**29.65**	11.74	12.61	10.58	9.33	9.33	**11.36**
12	15-11-2021	**64.90**	**32.02**	12.90	13.77	11.45	7.31	8.52	**9.74**
13	19-11-2021	**73.31**	**32.91**	13.33	14.35	11.74	13.39	12.99	**8.52**
14	22-11-2021	**74.97**	**27.84**	11.74	13.33	10.87	12.58	8.12	**8.93**
15	26-11-2021	**73.00**	**33.09**	12.46	13.48	11.45	9.33	9.74	**6.90**
16	29-11-2021	**70.47**	**32.81**	12.46	13.48	11.45	8.52	8.12	**9.74**
17	03-12-2021	**73.69**	**31.92**	12.75	11.74	11.74	15.42	11.77	**9.33**
18	06-12-2021	**70.00**	**31.43**	12.03	13.19	10.72	16.64	12.99	**10.15**
19	10-12-2021	**75.75**	**33.98**	13.33	14.35	11.74	13.80	11.36	**7.31**
20	13-12-2021	**73.80**	**34.67**	13.77	14.64	12.03	16.64	13.39	**10.15**
21	17-12-2021	**75.12**	**29.40**	12.03	13.77	11.30	15.02	10.96	**8.52**
22	20-12-2021	**68.03**	**34.66**	12.75	13.77	11.74	11.36	9.33	**7.31**
23	24-12-2021	**66.64**	**34.67**	12.75	13.77	11.74	14.20	10.96	**8.52**
24	**27-12-2021**	**69.21**	**34.44**	**13.19**	**12.03**	**12.03**	**15.83**	**12.18**	**9.74**

Table- 3.13 E: Ambient Air Quality Analysis at Mudhan

No	Date of Sample	PM_{10} GPCB limit 100 µg/m³	$PM_{2.5}$ GPCB limit 60 µg/m³	SO_x GPCB limit 80 µg /m³			NO_x GPCB limit 80 µg /m³		
		24 Hrs	24 Hrs	8 hrs	8 hrs	8 hrs	8 hrs	8 hrs	8 hrs
1	08-10-2021	**71.52**	**32.46**	13.33	23.33	11.59	17.05	13.39	**10.15**
2	11-10-2021	**66.78**	**33.29**	19.71	27.82	18.84	14.20	11.36	**7.31**
3	15-10-2021	**65.46**	**32.36**	18.55	20.43	9.56	17.05	13.80	**10.15**
4	18-10-2021	**69.95**	**34.81**	14.35	22.17	11.45	15.42	11.36	**8.93**
5	22-10-2021	**70.52**	**29.66**	12.75	11.74	11.74	11.77	9.74	**7.31**
6	25-10-2021	**70.67**	**27.80**	10.87	11.59	9.71	11.77	8.12	**8.93**
7	29-10-2021	**72.76**	**26.93**	10.29	11.30	9.56	11.77	7.71	**8.93**
8	01-11-2021	**74.00**	**26.53**	11.59	12.46	10.72	14.61	11.77	**8.93**
9	05-11-2021	**70.89**	**32.65**	12.90	13.48	11.30	14.61	11.36	**8.93**
10	08-11-2021	**69.42**	**33.68**	12.03	13.33	11.16	13.39	10.55	**8.52**
11	12-11-2021	**77.91**	**25.45**	10.00	11.16	9.13	10.55	12.99	**8.52**
12	15-11-2021	**77.37**	**31.12**	10.87	11.30	9.56	9.74	10.15	**8.93**
13	19-11-2021	**74.19**	**29.29**	12.46	15.94	13.19	12.99	10.55	**6.49**
14	22-11-2021	**70.55**	**28.37**	12.03	13.33	10.58	9.74	9.74	**10.15**
15	26-11-2021	**76.01**	**28.64**	12.46	10.87	11.30	11.36	12.99	**8.12**
16	29-11-2021	**70.72**	**34.62**	10.43	11.59	9.71	11.36	8.52	**8.52**
17	03-12-2021	**76.21**	**35.81**	11.30	12.46	10.72	7.71	10.15	**6.49**
18	06-12-2021	**76.12**	**28.07**	10.29	11.30	9.42	9.33	7.31	**9.74**
19	10-12-2021	**75.64**	**34.34**	11.30	11.59	9.71	7.71	8.52	**8.52**
20	13-12-2021	**68.75**	**33.64**	12.90	16.38	13.48	8.12	8.12	**10.15**
21	17-12-2021	**69.00**	**26.92**	10.72	12.03	9.85	11.36	7.31	**8.52**
22	20-12-2021	**70.98**	**33.35**	11.16	12.17	10.43	8.12	8.52	**6.49**
23	24-12-2021	**71.53**	**25.01**	11.16	12.17	10.43	7.71	7.71	**8.93**
24	**27-12-2021**	**68.59**	**31.14**	**11.59**	**10.87**	**10.72**	**14.20**	**10.96**	**8.52**

Table- 3.13 F: Ambient Air Quality Analysis at Guneri

No	Date of Sample	PM_{10}	$PM_{2.5}$	SO_x			NO_x		
		GPCB limit 100 µg/m³	GPCB limit 60 µg/m³	GPCB limit 80 µg /m³			**GPCB limit 80 µg /m³**		
		24 Hrs	24 Hrs	8 hrs	8 hrs	8 hrs	8 hrs	8 hrs	**8 hrs**
1	08-10-2021	**67.34**	**25.12**	10.87	11.88	9.71	15.02	11.36	**8.93**
2	11-10-2021	**70.09**	**26.43**	12.03	13.04	10.72	12.58	10.55	**6.90**
3	15-10-2021	**71.78**	**32.92**	12.46	13.33	11.16	15.02	11.77	**9.33**
4	18-10-2021	**72.45**	**33.78**	10.87	12.46	10.29	13.80	10.15	**7.71**
5	22-10-2021	**74.50**	**32.87**	11.59	12.46	10.72	10.55	8.52	**6.90**
6	25-10-2021	**76.44**	**27.04**	11.59	12.46	10.72	12.99	10.15	**7.31**
7	29-10-2021	**72.14**	**32.87**	12.03	11.01	11.16	14.61	11.36	**8.93**
8	01-11-2021	**70.14**	**26.69**	12.17	21.16	10.58	15.42	11.77	**9.33**
9	05-11-2021	**74.86**	**27.60**	17.82	25.36	17.10	12.99	10.55	**6.90**
10	08-11-2021	**60.82**	**35.13**	16.95	18.69	8.84	15.42	12.18	**9.33**
11	12-11-2021	**67.47**	**35.51**	12.46	13.48	11.74	11.36	8.52	**7.31**
12	15-11-2021	**70.26**	**34.82**	12.90	15.65	11.74	12.99	10.55	**7.71**
13	19-11-2021	**67.26**	**32.16**	11.30	12.46	10.72	12.58	10.55	**7.31**
14	22-11-2021	**65.40**	**32.92**	12.46	12.90	10.87	11.36	8.52	**7.31**
15	26-11-2021	**69.53**	**37.29**	10.72	11.88	9.85	10.55	8.12	**6.49**
16	29-11-2021	**76.89**	**34.17**	12.46	13.33	11.01	12.99	10.55	**8.12**
17	03-12-2021	**79.94**	**28.81**	10.72	16.95	14.20	14.61	10.96	**8.52**
18	06-12-2021	**76.05**	**32.02**	13.33	14.49	10.29	11.36	8.93	**7.71**
19	10-12-2021	**74.08**	**32.17**	10.72	8.55	8.12	13.39	10.55	**8.12**
20	13-12-2021	**77.28**	**27.25**	11.88	10.00	6.96	12.58	10.55	**7.71**
21	17-12-2021	**73.66**	**29.53**	11.59	10.87	5.65	11.36	8.93	**7.71**
22	20-12-2021	**79.42**	**32.60**	12.03	13.33	11.16	10.96	8.12	**6.90**
23	24-12-2021	**77.39**	**35.55**	10.87	11.59	9.71	13.80	10.55	**8.52**
24	**27-12-2021**	**78.19**	**35.36**	**14.49**	**15.07**	**11.59**	**14.61**	**10.15**	**6.90**

Table- 3.13 G: Ambient Air Quality Analysis at Sayra

No	Date of Sample	PM_{10}	$PM_{2.5}$	SO_x			NO_x		
		GPCB limit 100 µg/m³	GPCB limit 60 µg/m³	GPCB limit 80 µg /m³			**GPCB limit 80 µg /m³**		
		24 Hrs	24 Hrs	8 hrs	8 hrs	8 hrs	8 hrs	8 hrs	**8 hrs**
1	09-10-2021	**72.25**	**30.65**	15.80	18.40	17.24	10.55	10.96	**8.93**
2	12-10-2021	**70.14**	**33.67**	15.07	15.94	12.46	14.20	10.15	**8.52**
3	16-10-2021	**73.98**	**36.33**	17.24	15.51	17.24	13.39	8.12	**8.12**
4	19-10-2021	**74.55**	**37.31**	10.87	12.03	10.43	12.99	10.55	**8.12**
5	23-10-2021	**70.89**	**36.40**	14.93	16.23	13.77	14.61	11.77	**8.93**
6	26-10-2021	**69.01**	**36.41**	12.03	12.46	10.58	14.20	11.36	**8.93**
7	30-10-2021	**73.61**	**35.97**	11.16	12.03	10.58	14.20	10.96	**8.52**
8	02-11-2021	**72.97**	**34.17**	12.03	13.33	11.30	12.99	10.15	**8.12**
9	06-11-2021	**68.38**	**32.36**	10.87	12.17	10.43	10.55	8.12	**6.49**
10	09-11-2021	**64.86**	**34.17**	12.46	15.36	11.30	14.20	11.36	**8.93**
11	13-11-2021	**68.39**	**35.00**	13.33	12.46	13.77	12.58	8.12	**9.74**
12	16-11-2021	**77.53**	**29.84**	13.33	12.03	16.23	13.80	8.12	**10.96**
13	20-11-2021	**79.28**	**35.26**	12.46	11.30	9.56	10.15	4.87	**8.52**
14	23-11-2021	**76.05**	**35.25**	10.87	11.59	9.71	11.77	8.12	**8.93**
15	27-11-2021	**74.08**	**34.67**	10.29	11.30	9.56	11.77	7.71	**8.93**
16	30-11-2021	**78.57**	**33.78**	11.16	12.17	10.43	12.58	8.12	**10.55**
17	04-12-2021	**73.05**	**35.03**	12.46	13.33	10.87	11.36	8.52	**8.93**
18	07-12-2021	**80.09**	**36.79**	11.59	12.46	10.72	12.99	8.52	**10.15**
19	11-12-2021	**78.68**	**31.57**	12.46	15.51	11.59	14.20	8.12	**11.36**
20	14-12-2021	**77.54**	**36.41**	11.88	12.46	10.43	10.55	4.87	**8.52**
21	18-12-2021	**72.25**	**35.90**	11.30	12.03	9.85	12.18	8.52	**9.33**
22	21-12-2021	**70.72**	**36.35**	10.72	11.59	9.71	12.58	8.12	**8.93**
23	25-12-2021	**72.76**	**33.77**	12.75	13.77	11.74	16.23	13.39	**10.15**
24	**28-12-2021**	**74.55**	**29.97**	**14.20**	**14.78**	**12.32**	**15.83**	**12.18**	**9.74**

3.8.7. OBSERVATIONS

- The concentration of $PM_{2.5}$ was found to be between 24.7 µg/m^3 to 37.09 µg/m^3. The average concentration was 31.9 µg/m^3.
- The concentration of PM_{10} was between 60.82 µg/m^3 to 80.09 µg/m^3 and the average concentrations were observed was 72.01 µg/m^3
- The SOx concentrations were between 5.6 µg/m^3 to 27.82 µg/m^3. The average concentrations were observed was 10.14 µg/m^3.
- The NO_x concentrations were between 4.87 µg/m^3 to 17.05 µg/m^3 with average values being observed was 11.05 µg/m^3.
- The VOC concentrations were between 0.26 µg/m^3 to 1.16 µg/m^3 with average values being observed was 0.57 µg/m^3.
- The CO concentrations were between 52.24 µg/m^3 to 58.11 µg/m^3 with average values being observed in the range of 68.7 µg/m^3.

3.8.8. CONCLUSIONS

All the parameters were found well within the prescribed statutory limits (average limits) of CPCB as per NAAQS 2009 (Annexure-2).

3.9. NOISE ENVIRONMENT

Noise, often defined as unwanted sound, interferes with speech communication, causes annoyance, distracts from work and disturbs sleep thus deteriorating quality of human environment. The noise is generated from multiple sources such as medium and heavy industries, urban activities in the commercial and human settlements, and vehicular traffic in the region. 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 scale which is measured in dB (A). This is more suitable for audible range of 20 to 20,000Hz and weighs the components according to the response of a human ear.

The noise level in the study area was measured through Leutron sound level meter, for a period of one day for 30 minutes interval at each monitoring station (Table-3.4;

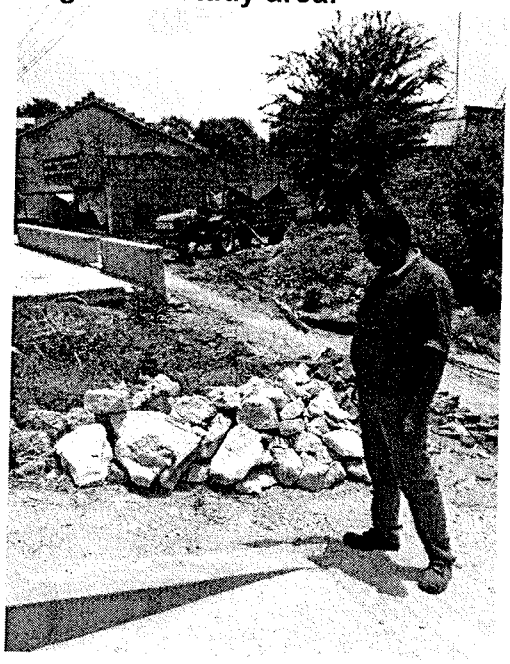
Map-3.2, Plate-3.2). In the study area noise levels were monitored in 7 locations at different locations for day and night time and are given Table-.3.14.

The impact of noise sources on surrounding community depends on:

- Characteristics of noise sources (instantaneous, intermittent or continuous in nature.)
- 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 (NIHL) to annoyance; depending on loudness of noise levels. The main objective of noise monitoring in the study area is to establish the baseline noise levels, and assess the impact of the likely noise expected due to construction and operation of the proposed project.

Plate-3.2: Ambient Noise reading in the study area.



3.9.1. METHODOLOGY FOR NOISE SURVEY

A preliminary reconnaissance survey has been undertaken to identify the major noise generating sources in the area. The monitoring has been conducted at 5 (five) locations in the study area. Noise levels were recorded continuously over 24 hour's period. The details of the locations are provided in Table-3.4 and shown on Map-3.2. Noise levels were measured using an Integrating Sound Level Meter manufactured by Rion (model no. NL - 20). The sound level meter measures continuous equivalent noise level (Leq). Noise measurements were undertaken at all location for 24 hours. The day noise level has been monitored during 6 am to 10 pm and night levels during 10 pm to 6 am at all 7 ambient locations. However due to restrictions by the Border Security Force (BSF), project site ambient noise data were not possible to collect after 4:30 PM.

3.9.2. RESULTS AND DISCUSSION

The ambient noise levels measured and analyzed for equivalent noise levels viz. Leq (24hrly), Lday, Lnight at ambient locations for the study period are presented in Table - 3.14.

Table 3.14: Noise levels in the study area

Date	15-10-2021	19-10-2021	22-10-2021	16-10-2021	20-10-2021	23-10-2021	17-10-2021
Monitoring Time	**Project Site**	**Zara**	**Lakhapar**	**Atdo**	**Mudhan**	**Guneri**	**Sayra**
6.00 am	**	35.5	35.0	38.0	37.0	38.2	32.3
6.30 am	**	36.0	36.3	38.0	38.8	38.2	33.0
7.00 am	**	36.0	36.0	39.2	38.0	39.0	33.0
7.30 am	**	37.0	37.0	39.0	39.0	39.6	34.5
8.00 am	20.2	38.0	37.0	40.0	40.0	40.0	35.0
8.30 am	25.1	39.7	41.0	41.0	41.0	41.4	35.0
9.00 am	24.3	39.0	43.0	39.1	41.1	41.0	36.3
9.30 am	34.0	45.0	44.0	44.0	39.0	46.0	36.0
10.00 am	25.0	48.0	45.0	46.0	42.0	41.0	37.0
10.30 am	36.0	41.5	45.5	47.0	41.0	44.0	38.0
11.00 am	29.0	39.0	46.0	47.1	42.0	48.0	37.1
11.30 am	31.2	42.0	46.0	45.0	43.0	47.3	39.0
12.00 pm	32.0	37.0	47.0	46.0	43.8	47.0	36.0
12.30 pm	30.9	39.0	46.2	47.0	45.0	48.0	39.8
1.00 pm	34.0	45.0	46.0	48.0	44.8	49.0	39.0
1.30 pm	33.1	42.3	45.0	49.3	44.0	47.0	41.9
2.00 pm	30.0	41.0	45.0	48.0	43.0	47.0	43.0

2.30 pm	33.9	39.0	44.0	47.0	41.5	48.0	44.4
3.00 pm	36.0	45.3	44.5	45.6	39.0	49.0	46.0
3.30 pm	36.3	47.0	43.5	44.0	40.0	48.9	45.0
4.00 pm	34.8	48.0	43.0	42.2	41.8	41.0	46.0
4.30 pm	33.6	47.0	44.2	40.1	40.0	42.0	43.0
5.00 pm	**	39.0	45.0	38.1	39.0	45.0	44.4
5.30 pm	**	45.0	45.0	49.0	41.0	43.0	47.0
6.00 pm	**	42.0	46.0	48.0	43.0	49.8	49.0
6.30 pm	**	39.0	46.1	47.1	43.0	48.0	42.0
7.00 pm	**	45.0	44.0	48.0	47.0	47.0	39.5
7.30 pm	**	39.3	44.0	47.0	47.0	39.4	37.0
8.00 pm	**	41.0	43.0	49.0	46.0	42.0	36.0
8.30 pm	**	45.0	43.0	46.5	47.0	46.0	36.5
9.00 pm	**	42.0	42.1	41.0	45.5	40.0	39.0
9.30 pm	**	39.6	40.0	38.0	41.0	40.5	38.0
10.00 pm	**	38.0	39.0	39.0	39.0	39.0	37.0
10.30 pm	**	37.0	38.5	38.6	39.0	38.0	36.0
11.00 pm	**	38.3	38.0	37.0	38.5	38.0	35.4
11.30 pm	**	35.0	37.0	38.9	38.0	37.0	35.0
12.00 am	**	36.5	37.7	38.0	37.3	37.0	34.0
12.30 am	**	35.0	36.0	39.0	37.0	36.0	34.0
1.00 am	**	38.0	38.0	38.8	36.3	35.3	35.4
1.30 am	**	35.0	37.0	39.0	37.0	35.0	33.0
2.00 am	**	37.0	35.5	37.0	36.0	34.0	33.0
2.30 am	**	37.7	36.0	37.0	37.5	34.0	32.0
3.00 am	**	36.0	34.9	36.0	36.0	36.0	32.3
3.30 am	**	35.0	35.0	35.0	35.0	35.0	33.0
4.00 am	**	34.0	34.0	37.6	37.9	37.5	32.1
4.30 am	**	35.5	35.0	38.0	38.0	38.0	32.1
5.00 am	**	37.0	37.0	37.0	37.0	37.0	34.5
5.30 am	**	36.0	36.0	36.9	37.0	36.0	33.6

** = *Due to restricctions imposed by Border Security Force (BSF) only 8 hourly data was possible to collect from the project site.*

3.9.3. OBSERVATIONS

Noise levels (Leq) observed during daytime in the study area was 41.3 dB(A) in the range of 20.2 to 49.8 dB(A) while during nighttime it averaged 36.4 dB(A) and ranged between 32 dB(A) to 39 dB(A) .

The ambient noise levels in the area are under the influence of some residential and traffic noise. The noise level at all the location is within permissible limits (Annexure-3).

3.10. WATER QUALITY AND WATER USE

3.10.1. WATER USE

The water will be drawn from tankers during the construction phase as well as the operation phase of the project.

3.10.2. WATER QUALITY

Selected water quality parameters of ground water and surface water resources within 10 km radius of the study area have been studied (Table-) for assessing the hydrological environment to evaluate anticipated impact of the proposed project. Understanding the water quality is essential in the preparation of Environmental Impact statement. It also assists to identify critical issues with a view to suggest appropriate mitigation measures for implementation to curb the deterioration of various hydrological sources in the vicinity of the project site. The purpose of this study is to:

- Assess the water quality characteristics for critical parameters;
- Evaluate the impacts on agricultural productivity, habitat conditions, natural resources in the vicinity; and
- Predict the likely impacts of water quality due to the project and related activities.

3.10.3. METHODOLOGY

Reconnaissance survey was undertaken and monitoring locations were finalized based on:

- Drainage pattern;
- Likely areas which can represent baseline conditions.
- Likely areas representing different activities/likely impact areas

Three surface water and six ground water sources covering 10-km radial distance were examined (Plate-3.3) for physico-chemical and heavy metals in order to assess the effect of industrial and other activities on surface and ground water. The samples were analyzed as per the procedures specified in Standard methods for the

Examination of Water and Wastewater published by American Public Health Association (APHA). The samples for chemical analysis were collected in polyethylene carboys. The samples collected for metal content were acidified with 1 ml HNO3. Selected physico – chemical parameters have been analyzed for projecting the existing water quality status in the study area.

Plate-3.3 : Surface Water Sample collection in the study area.

Atdo Lake Surface Water

Guneri Ground Water

Project Site Surface Water

Zara- Surface Water

3.10.4. RESULTS OF WATER QUALITY

Three surface water and six ground water samples were collected as grab samples and analyzed for various parameters. The analyzed results were compared with the standards for drinking water as per IS 10500 (Annexure-4). The water sampling locations are listed Table-3.4; and the results of ground water and surface water quality is given in Table-3.15.

Table-3.15: Ground water and surface water quality analysis data for study area.

#	Parameter	Ground water (17-10-2021)						Surface Water (Date: 17-10-2021)			Unit	Permissible Limit GW	Permissible Limit SW
		Project site	Lakhapar	Atdo	Mudhan	Guneri	Sayra	Project site Sea water	Zara Sea Water	Atdo Lake			
1	pH	8.2	7.4	7.5	7.8	7.5	7.4	8.0	8.0	7.4	--	6.5-8.5	6.5-8.5
2	Colour	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	--	--	--
3	Odour	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	--	--	--
4	Turbidity	< 1	< 1	< 1	< 1	< 1	< 1	1.4	< 1	< 1	NTU	10	10
5	Total Dissolved Solids	1640	3049	1942	998	1280	1058	384655	235553	361	mg/lit	2000	2000
6	Total Hardness	520	967	614	316	406	336	69000	40500	114	mg/lit	600	600
7	Calcium	92.3	171.3	108.1	55.3	71.3	59.3	12505	7214	20.3	mg/lit	--	--
8	Magnesium	70.5	131.2	83.8	43.3	55.9	45.8	9210	5360	15.5	mg/lit	--	--
9	Sodium	384	725	455	230	300	250	90099	55175	85	mg/lit	--	--
10	Potassium	28	52	34	17	22	18	6584	4032	6	mg/lit	--	--
11	Chloride	583.2	1078.7	689.3	352.2	454.4	374.8	136777	83759	128.4	mg/lit	1000	1000
12	Sulphate	59	110	71	36	46.3	38	13861	8488	13	mg/lit	400	400
13	Phenolic Compound	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	mg/lit	0.002	0.002
14	Mineral Oil	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	mg/lit	0.03	0.03
15	Suspended Solids	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	10	5	4	mg/lit	--	--
16	Chemical Oxygen Demand	< 4	< 4	< 4	< 4	< 4	< 4	20.1	19.2	18.1	mg/lit	--	250
17	Biological Oxygen demand	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	mg/lit	--	30
18	Ammonical Nitrogen	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	mg/lit	--	50
19	Alkalinity	768	449	67	800	190	160	110000	75000	169	mg/lit	600	600
20	Copper	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	mg/lit	1.5	1.5
21	Nitrate	0	1	0	0.2	0.38	0.32	83.17	50.93	0.08	mg/lit	45	45

22	Phosphate	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	mg/lit	--	--
23	Iron	0	0	0	0.12	0.13	0.11	4.5	3.7	0.05	mg/lit	1	1
24	Mercury	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	mg/lit	0.001	0.001
25	Cadmium	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	mg/lit	0.01	0.01
26	Arsenic	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	mg/lit	0.01	0.01
27	Lead	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	mg/lit	0.05	0.05
28	Chromium	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	mg/lit	0.05	0.05

3.10.5. RESULTS AND DISCUSSION

- The pH limit fixed for drinking water samples as per IS:10500 (Annesure-5)is 6.5 to 8.5. Beyond this range the water will affect the mucus membrane and or water supply system. During the study period, the pH was varying for ground waters from 7.4 to 8.2 and for surface water also varied from 7.4 to 8.0 suggesting it to be highly alkaline water.
- The desirable limit for chloride is 250mg/l as per IS: 10500 whereas the permissible limit of the same is 1000 mg/l beyond this limit taste, corrosion and palatability are affected. The Chloride levels in the ground water samples collected in the study area were ranging from 352.2 mg/l to a maximum of 1078.7 mg/lit and for surface water sample of location Atdo lake was minimum i.e., 128.4 and in the project site it was highest 136777 mg/l.
- The TDS is also a pivotal parameter in the ground water quality. The desirable limit for the TDS is 500 mg /lit and beyond this value palatability decreases and may cause gastro- intestinal irritation. The TDS values varied from a minimum value of 998 mg/lit to a maximum value of 3049 mg/lit. The TDS level is 361 mg/l for Atdo lake water sample and 384655 mg/lit. for the sea water sample.
- The desirable limit for the nitrates is 45 mg/lit and beyond this limit causes methmoglobinimia. The nitrates varied from BDL range for one location to 1.0 mg/lit.

3.11. ECOLOGY & BIODIVESITY

3.11.1. MARINE & COASTAL ENVIRONMENT

Marine and coastal environment includes, preparation of Coastal Regulatory Zone maps of the project area, study of coast characteristics, tide levels, shoreline status, intertidal areas, sensitive eco-systems, habitat types, marine planktons and benthos etc.

3.11.1.1.COASTAL REGULATORY ZONE (CRZ) CLASSIFICATION

The proposed lease area is divided in to two blocks, northern and southern block. Most part of the lease area is located far away from the Arabian Sea. No part of the southern block is not located within the CRZ area. Whereas, the northern block is located near small tertiary creek areas in its northern most part where only a small

part (1339.52 ha.) falls within CRZ-IB and CRZ-III (41.87 ha.) with 100 meter No Development Zone (NDZ) as per CRZ maps prepared by Institute of Remote Sensing -Anna University Chennai (Table-3.16; Map-3.8, Map-3.9).

Table-3.16: CRZ classification of the proposed lease area

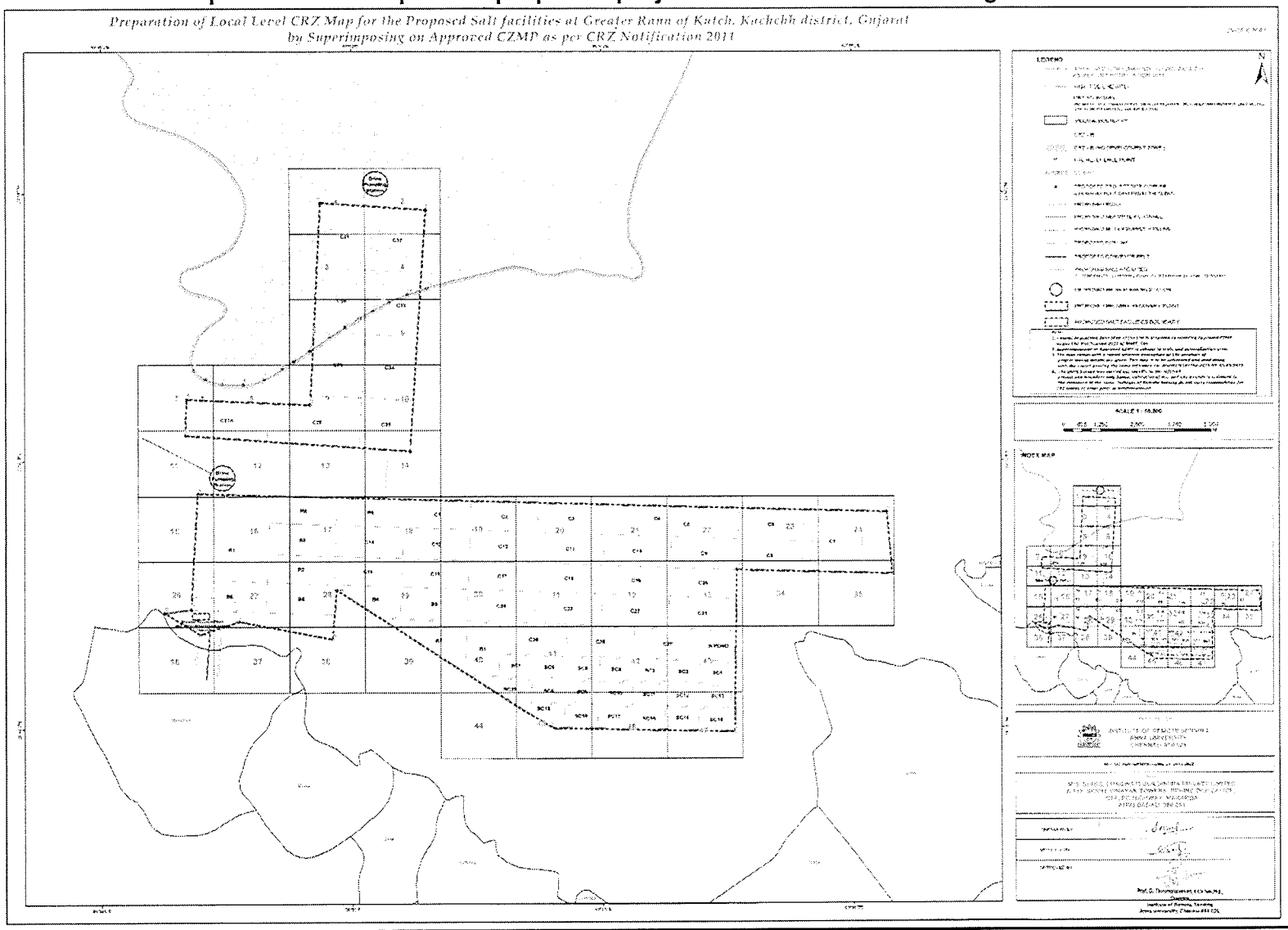
Sl.No.	CRZ - Classification	Area in Hectares	Area in %
1	CRZ - IB	1339.52	8.9
2	CRZ - III (NDZ)	41.87	0.3
3	Outside CRZ	13618.61	90.8
	Total	15000	100

Only 8.9 % of the proposed salt lease falls in the CRZ of tertiary creek area which lies at a substantial distance from the intertidal zone, creeks and mudflats. Therefore, a small part of the proposed salt works falling in relatively biologically inactive area is less likely to affect the marine environment of the Kori creek region. Moreover, most of the lease area is located outside CRZ area (90.8%) as per the approved coastal zone management maps prepared by National Centre for Sustainable Coastal Management (NCSCM) and map prepared by the IRS Anna University Chennai. Small portion of lease in the northern part the proposed lease receives tidal water. However, due to high evaporation rate and higher temperature, presence of marine flora and fauna is negligible in this area. The area around Kori creek is restricted for civilians due to proximity to international border and security reasons. Moreover, this area is inaccessible due to wet and active mudflats. Therefore, the present study has made efforts to study phytoplankton, zooplankton, benthos and marine macro flora and fauna in the study area around tidal creeks in the northern part of the study area. The study involved status of mangroves and other halophytic vegetation and fauna such as mudskippers and birds etc.

3.11.1.2. VARIOUS & COMPONENTS PLANNED WITHIN & OUTSIDE CRZ AREAS

The lease area is divided in to two major blocks i.e., northern block having an area of 2620 ha. and southern block Which has an area of 12380 ha. As per approved CRZ maps and the map prepared by authorized agency, only 9.2% area falls in CRZ, rest of the area falls outside CRZ. Various components planned for saltworks; their dimensions and locations with respect to CRZ zones is provided in Table-3.17.

Map- 3.8: CRZ- map of the proposed project area and its surrounding area.



Map- 3.9: Proposed Lease area super imposed on approved CZMP – Map Nos. GJ 280, 290, 291.

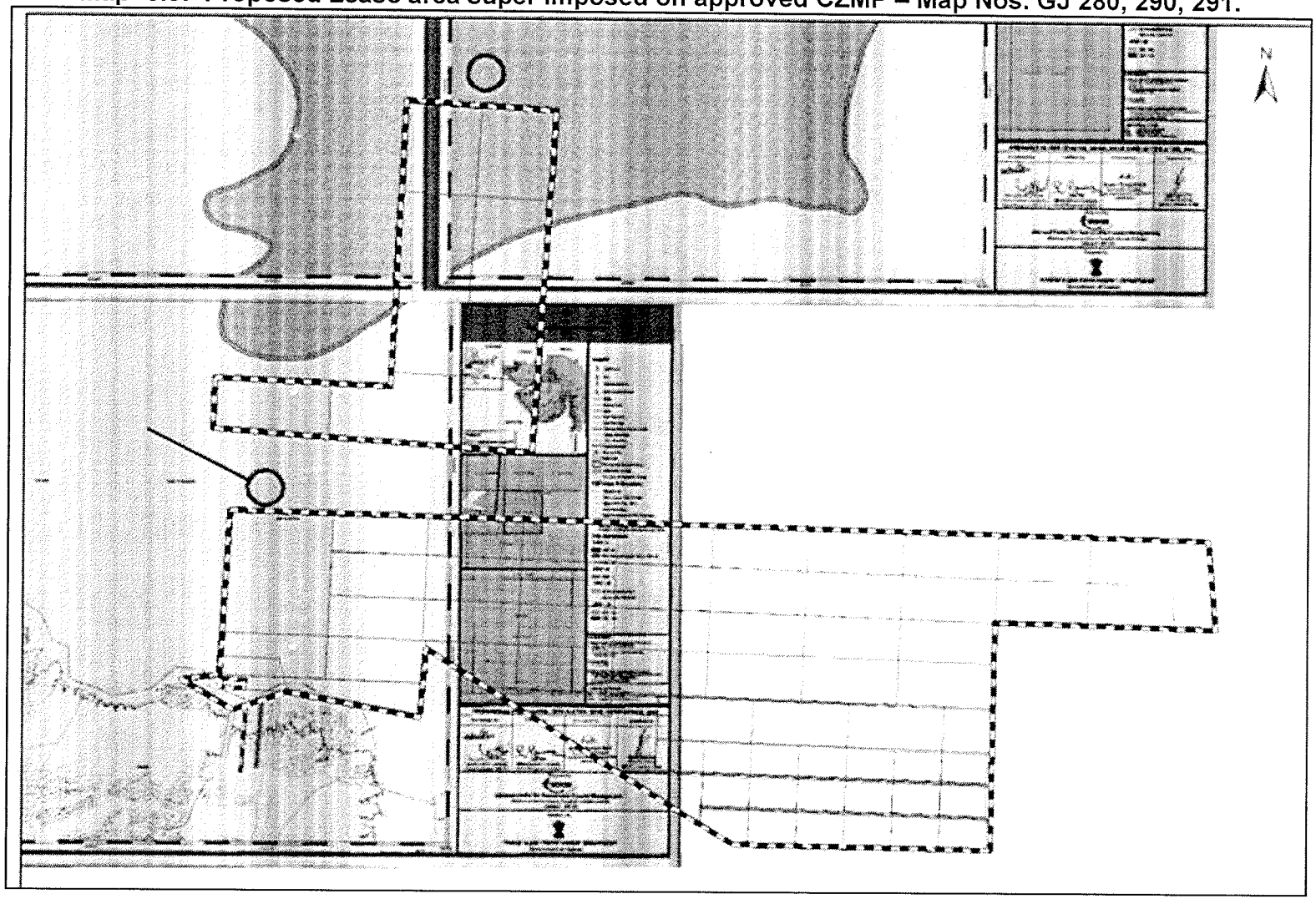


Table-3.17: Various components of saltworks with their dimensions and locations with respect to CRZ area.

#	Facility/ Component	Details/ Dimensions	Outside CRZ Area		Within CRZ Area		
			Within Lease (13618.61 ha)	Outside Lease	Within Lease Are		Outside Lease Area
					CRZ-IB (1339.52 ha)	CRZ3 (NDZ) (41.87 ha)	CRZ-IB
1	Northern block brine water channel	10 mt. width 5.0km length		✓			
2	Northern block Brine Pumping station	12 pumps (10 working 2 standby) Mix Flow 25/30 HP Kirloskar Pumps			✓		
3	Southern block brine water channel	10 mt. width 15.0km length		✓			
4	Northern block Brine Pumping station	12 pumps (10 working 2 standby) Mix Flow 25/30 HP Kirloskar Pumps	✓				
5	Well for pumping station	15X15 meters	✓		✓		
6	Brine water condenser pans	2620 ha.			✓		
7	Brine condensers, Reservoirs, crystallizers, bittern ponds,	9953 ha.					
8	Access road internal	on the saltpan bunds	✓		✓	✓	
9	Access road external	Hajipir to site, Mudhan to site		✓			
10	Conveyor belt		✓	✓			
11	Bittern Pipeline	From bittern pond to bromine plant	✓	✓			
12	Bromine Extraction Plant	5.0 MT capacity	✓				
13	Stack yard & admin building	2117 ha.	✓				
14	Area left open as per rules	310 ha.	✓				
15	Salt washery		✓				

3.11.1.3. CHARACTERISTICS OF COAST

Kachchh coast line is unique among the geomorphic features of Indian Coast line. Total length of Kachchh coastline is approximately 475 km. Out of which 200 km (42.10%) is within Kori-creek, Sir-creek and adjacent area, 175 km (36.84%) is facing Arabian Sea in the outer part of Gulf of Kachchh and 100 km (21.0%) is in the inner side of Gulf of Kachchh. The large part of the area is covered under shallow sea waters during high tides. So, deltaic coast mainly comprises vast tidal flats in a tide dominated coastal set up. It is a tide dominated coastline.

Proposed 15000 ha. lease area maintains substantial distance from the tip or the eastern most end of the Kori creek. Majority of the proposed lease area in the eastern side generally remain dry and open salt exposed land during the dry season.

3.11.1.4.SHORE LINE STATUS

Western most part of Gujarat coast, known as Kori Creek, is a part of lower Indus deltaic plain and is characterised by network of tidal creeks. Coastal wetlands of the Rann of Kachchh broadly comprise high tide mudflats with or without salt encrustation, salt marsh vegetation and mangrove around the Kori creek area.

The proposed area lies far from the coastline as demarcated in the National Assessment of shoreline change by Institute of Ocean Management and the Ministry of Environment and Forest, Government of India. According to the shoreline assessment maps the project area do not fall in the categories mentioned in the shoreline changes categories. This is due to the proposed area's locations lies away from the coast of Lakhpat. Based on the scientific investigations the deltaic coast of Kachchh has been interpreted as a major prograding coast as these receives maximum contribution of fluvial sediments from Indus (Sindhu) River outside the Kachchh mainland.

3.11.1.5.KORI CREEK

The deltaic coast is mainly covered by tidal flats and hence it has only one sub-segment i.e., Tidal flat. Western coast of Kori creek contains vast tidal mud flats, tidal sand flats, tidal creeks, inshore crescent barrier beaches and mangroves. The deposits are accumulated at distal part of Indus delta, which are redistributed by waves, tides and currents operating in the area at present to give rise to mainly

depositional features except tidal creeks. It forms part of larger deltaic coast of Indus (Sindhu) River. This coastal segment is mainly made up of depositional landforms and emerging coastal features. Southernmost part facing Arabian Sea is wave dominated; remaining part is a tide dominated coastline. South-western part near Sir Creek is protected by hard rock exposures. Sir Creek (named after the British representative) is a strip of water and forms international border between India and Pakistan on western most tip of the Rann of Kachchh marshlands. The creek, which opens up into the Arabian Sea, divides the Kachchh region of the Indian state of Gujarat with the Sindh province of Pakistan. It is located at approximately 23°58′N-68°48′E to 23.96°N-68.87°E. Originally and locally it is called 'Baan Ganga'. The creek itself is located in the uninhabited marshlands. During the monsoon season between June and September, the creek floods its banks and envelops the low-lying salty mudflats around it. This coastal segment is mainly made up of depositional landforms and emerging coastal features.

3.11.1.6.HIGH-TIDAL MUD FLATS

These are mudflat above normal high tide and are usually inundated during highest of high tide. The tidal flat grows in response to net landward sediment transport, but eventually it may reach an equilibrium state, without further growth. These occupy around 5343 Km^2 area and occur in the tide dominating regions of the Gulf of Kachchh and Gulf of Khambhat. They are also observed in area north of Kori creek towards the Great Rann of Kachchh. Most of the salt pans are located within high-tidal mud flat areas. These are the areas most vulnerable to sea-level rise. Major part of the deltaic coast is composed of supra-tidal mud flats in the study area. The mud flats are dissected by numerous tidal creeks. The tidal mud flats are merged with saline sand flats towards NE direction. NE-SW length of tidal mud flats reaches up to 55 km while E-W width is reaching up to 40 km. Maximum height is about 2 m. It is deposited as delta of Indus (Sindhu) river.

Dense networks of tidal creeks are present all along the active tidal flats. The creeks are mostly showing trellis to sub-trellis pattern and tectonic control on their formation. No creeks are present in the proposed lease area. These supra-tidal mudflats are not biologically active mudflats as these areas do not receive daily tides. Therefore, these mudflats remain dry and salt exposed land most of the time in dry seasons.

Except for a few scattered and stunted xerophytic plants on elevated areas, no other forms of vegetation exist in the proposed lease areas.

3.11.1.7.TIDE LEVELS

The tidal amplitude at the Kori creek is 3.0 mtrs. In the Gulf of Kachchh, the mean high water spring increases from 3 m at Kori Creek to 5.6 m at Mundra and further to 7.3 m at Navlakhi on its northern coast, gradually decreasing to 5.4 m at Sikka and finally to 3.5 m at Okha on its southern coast.

3.11.1.8.SEA WATER SALINITY

The average range of Coastal water salinity is 38-42 ppt. The salinity varies from season to season. Due to high evaporation rate, the sea water in creeks almost gets converted in brine i.e., approx. 8^0 Baume during winter and summer.

3.11.1.9.CORAL REEF

As per the coral reef atlas published by Gujarat Ecology Commission, there are no coral establishments found in close vicinity of the proposed project area and even in the study area. This is due to supra-tidal mudflats present in the Kori creek and surrounding area.

3.11.1.10. MANGROVES

As per the 'Mangrove Atlas of Gujarat' published by the Gujarat Ecology Commission, Gandhinagar, the coastal area adjacent to proposed lease areas do not have presence of mangroves except few scattered clumps of stunted mangroves around tip of the small creeks arising from the Kori creek area which lies outside the study area.

The proposed lease areas fall in the high-tidal or supra-tidal mudflats and do not fall in the biologically active intertidal mudflats. These areas do not receive daily tide and remains as salt exposed dry land during dry season of the year and therefore, these lease areas are not suitable for mangrove growth or plantation. Hence the proposed lease area is less likely to form part of potential mangrove restoration/plantation areas.

However, there is a natural inland mangrove patch present outside the study area i.e., 13.5 km east of the proposed lease area (at 23°48'24.90"N, 68°48'31.51"E). The

species of mangrove present in this patch is *Avicenna marina*. It is observed that the natural slope is towards North. Therefore, it is less likely that present project would cause any direct impact on this important inland mangrove area. However, the project proponent shall also ensure that no direct or indirect harm is caused to this important natural inland mangrove patch as it is one of its kinds in the region and has great ecological and academic significance.

3.11.1.11. FISHERIES ACTIVITY

There are no fishing harbors in the close vicinity of the coast of Lakhpat. Closest fishing harbor is located at Koteshwar Jetty near Narayan Sarovar which is 25 km South-West of the proposed project site. However, few families of local villagers from Lakhpat Fort are known to go for casual fishing activities in upper tidal mudflats of Kori creek. Such fishermen are called 'Pagadiya fishermen' from the local village. Pagadiya fishermen in this area generally look for "Mudskipper" near Lakhpat coast. Mudskipper is a small mudflat dwelling fish and has less economical or market value. Mudskipper fishing does not require nets or boats it is done by placing sticks or hands inside the burrows.

Due to international border related security restrictions, the fishermen can enter the port only on particular days of the week permitted by the BSF. The main issue of the Narayan Sarovar Fisher folk is border restrictions due to which they are forced to remain in the sea for 3 days, leading to problems in fish quality.

The main fishing grounds of the Narayan Sarovar Fisher folk are the Kori creek end between Koteshwar and Lakhpat. A unique aspect of the Narayan Sarovar area w.r.t pagadiya fishing is that women are involved in full time pagadiya fishing. There are estimated 30-40 fulltime pagadiya fisherwomen. Men go for pagadiya fishing only during the boat fishing ban season.

In parts of the Lakhpat coast other than Narayan Sarovar, there is no boat fishing due to border restrictions. Pagadiya fishing is done as a part time occupation along with agriculture and animal husbandry. Due to border restrictions, the pagadiya fisher folk are allowed to enter the sea only during the day. However, the pagadiya fisher folk don't face much of a problem as the nets remain fixed and they only need to collect the fish every day. The main issues of the fisher folk are the decline in fish

catch due to effluents released by industries on the coast and receding of tidal water due to tapping of rivers upstream. The intertidal zone off Lakhpat village which was famous for prawn production some 15 years ago, now no longer productive due to receding of sea water and sedimentation.

3.11.1.12. PHYTO PLANKTONS

Phytoplankton are the primary source of food in the marine environment. The concentration and numerical abundance of the phytoplankton indicate the fertility of a region. The plankton population depends primarily upon the nutrients present in the seawater and the sunlight for photosynthesis. This primary production is an important source of food for the higher organisms in the marine food chain. Total 4 marine water samples from the northern area of lease and outside lease area using standard methodology. Mixed plankton sample (phytoplanktons & Zooplanktons) were obtained from the sub surface layer, at each sampling locations by towing the net horizontally with gentle weight to allow sampling in shallow saline water of Rann of Kutch. After the manual tow of about 5 minutes at speed of 1-1.5 m/s, plankton net was pulled up and washed down to the tail and collected the plankton adhered to plankton net in the collection bucket at the bottom by springing outer and inner surface of the net with sea water, while the net was hanging with the mouth upward. Samples were preserved on site using Lygol's Iodine solution. Counting and identification was done with the help of compound microscope. Dominant Phytoplankton genera are listed in Table-3.17.

Table-3.18: Major Phytoplankton Genera recorded from the study area.

Phytoplankton	Location 1	Location 2	Location 3	Location 4
Phytoplankton cell count (no/L)	8000	7500	6000	12,500
Total Genera (no.)	8	7	6	7
Major Genera	Coscinodiscus	Chaetoceros	Coscinodiscus	Chaetoceros
	Melosira	Coscinodiscus	Nitzschia	Coscinodiscus
	Nitzschia	Nitzschia	Oscillatoria	Nitzschia
	Oscillatoria	Oscillatoria	Pleurosigma	Oscillatoria
	Pleurosigma	Pleurosigma	Synedra	Synedra
	Synedra	Thalassionema	Triceratium	Thalassionema
	Thalassionema	Triceratium		Triceratium
	Triceratium			

The numerical abundance of phytoplankton population varied between 6000 to 12500 nos./l from all 4 locations. Mean cell count of all locations was 8,500 no./Lit.

3.11.1.13. ZOOPLANKTONS

Zooplanktons are drifting organism living in the oceans, particularly the pelagic and littoral zones, as well as in rivers, lakes and ponds. Zooplanktons are the heterotrophic group of plankton as they feed on phytoplankton. Zooplankton can be subdivided into two groups; holoplankton (spend entire lifecycle as plankton) and meroplankton (spend part of lifecycle as plankton). The meroplankton group consist of larval and young stages of animals that will adopt a different lifestyle once they mature (e.g.. larvae of fish, shrimp, crab). They play an important role in the conservation of energy from primary producer (phytoplankton) to higher trophic levels. The zooplankton occurrence and distribution influence pelagic fishery potentials. Thus, they are the initial prey for most fish larvae as well as for many plankton-eating adult fishes.

Total 4 samples collected for phytoplanktons were used for the zooplankton study also. Therefore, the method of sample collection and unit were same as phytoplankton study.

Table-3.19 : Abundance of Zooplankton in study area (ind/Lit)

#	Species		S1	S2	S3	S4
1	*Acartia danae*	Copepoda	1		3	1
2	*Acartia erythraea*	Copepoda	2	4		1
3	*Acartia southwelli*	Copepoda	6	7	5	8
4	*Bestiola similis*	Copepoda	1	2		
5	*Euterpina acutifrons*	Copepoda	3		2	2
6	*Mesochara sp.*	Copepoda	8	6	4	9
7	*Oithona sp.*	Copepoda	6	4		7
8	*Artemia salina*	Crustaceans	17	20	19	21
9	*Brachyuran zoeae*	Crustaceans	12		14	9
10	*Crustacean nauplii*	Crustaceans	1	4		2
11	*Shrimp larvae*	Crustaceans	1		1	
12	*Dictyocysta sp.*	Protozoa	1			
13	*Eutintinnus tenuis*	Protozoa	2		4	4
14	*Favella sp.*	Protozoa	6		8	7

The zooplankton abundance ranged from 1 to 21 in all the 4 locations. A total of 14 species were recorded from the study area. Of all, *Artemia, Brachyuran, Acartia*

southwelli were the most abundant plankton in the study area. Labidocera sp. was the least abundant zooplankton which occurred in only four sampling points. Low density and diversity of Zooplanktons could be due to hypersaline, shallow water with higher temperature in the water-logged area in the study area.

3.11.1.14. BENTHIC MARINE FAUNA

Van veen sampler was used for sampling bottom sediments for analysis of benthic fauna. Sediment samples were taken from total 4 locations, the sediments were sieved on site, however we did not fine presence of any benthos in any of the 4 locations probably due to prevailing hyper saline conditions in the study area. The area of sampling dries up every year ang gets converted into a natural saltpan. This area has long term deposition of Gypsum. The reason for no benthos in the study area could be the hypersaline conditions where shallow water has very wide temperature range that rises during the day and during winter night it goes down.

3.12. TERRESTRIAL ECOLOGICAL ASSESSMENT

Field visits were carried out from October to December 2021 to understand and assess the impacts of proposed project activities on flora and fauna and natural habitats. We evaluated the distribution and abundance of flora and fauna in project core area and in the buffer area separately.

The ecological assessment involved information on following.

- General ecological assessment
- Sensitive receptors- Protected areas, ESZs, forests, etc.
- Study of flora
- Study of fauna

3.12.1. GENERAL ECOLOGICAL ASSESSMENT

The observations and assessment of overall ecological scenario presented in this chapter include details of flora, fauna, natural habitats, protected areas, wildlife species and their migration corridors etc. Such baseline information provides better understanding of the situation and overall ecological importance of the area. Data collected and the information gathered from secondary literature on flora, fauna,

protected area, natural habitats, wildlife species etc., were analyzed and results are presented as follow.

3.12.2. BIOGEOGRAPHIC ZONE

The region falls in Indo-Malay Realm (IM 1303) and Deserts and Xeric Shrublands Biome as defined by WWF. The North-western Thorn Scrub Forests [IM1303] ecoregion represents a large expanse of degraded dry forest surrounding the Thar Desert. Neither exceptionally species-rich nor high in endemism, the ecoregion nevertheless harbors viable populations of antelopes.

As per classification of Indian Biogeographic zones by Rodgers et al. (2000), Kachchh district falls under Biogeographic Zone 3 - the Indian Desert and the Biogeographic Province Kutch Desert- 3B.

3.12.3. FOREST TYPE:

As per the landuse classification of the study area, there are 11 villages which have total 7288.7 ha. area under 'Reserve Forests' of Section-20 & section 4 (Map-3.1 and Table-3.19; Map-3.10). The entire land within the proposed lease area is classified as unsurvayed land and does not fall under any kind of forest area.

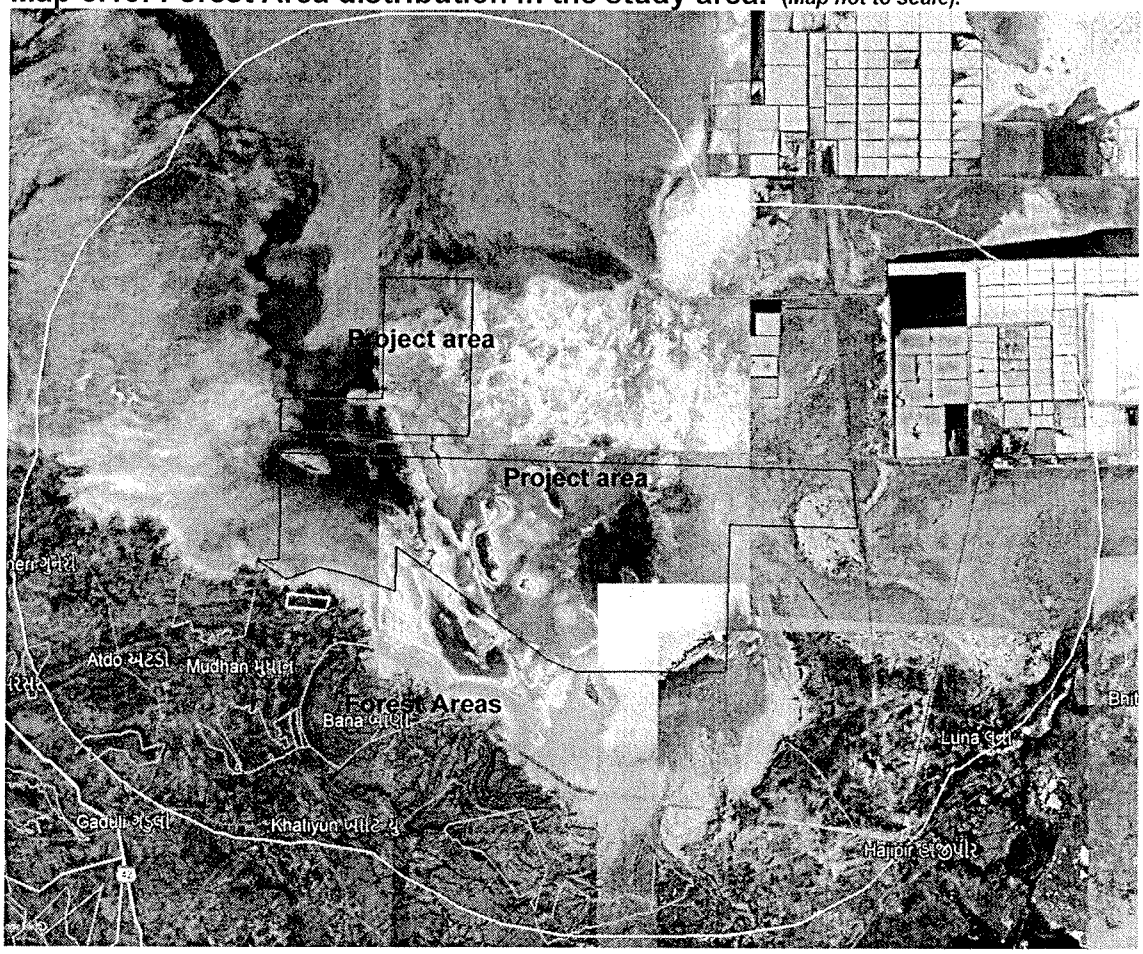
Table-3.20: Reserve Forest areas in the study area

No	Village	Survey No	Forest category	Section	Area ha.
1	Zara	10/2	Reserve	20	598.8
2	Zumara	132/p	Reserve	20	296.5
3	Zumara	132/p	Reserve	20	685.7
4	Zumara	132/p	Reserve	20	543.0
5	Nara	252/p2	Unclass	4	293.0
6	Nara	252/p3	Unclass	4	1520.0
7	Ukher	7/p2	Reserve	20	142.0
8	Gaduli	508/p	Reserve	20	196.1
9	Mudhan	150/p2	Reserve	20	636.9
10	Mudhan	150/p3	Reserve	20	506.4
11	Bana		Reserve	20	1870.3
				Total	**7288.7**

As per the forest classification of Champian and Seth (1968), vegetation of Kachchh district classified under the "Northern Tropical Thorn Forest". This can be further divided in to 5/D-Dry deciduous Scrub, 6/E4 -Salvadora scrub, 6B/C-Desert Thorn Forest, 5/E3 -Babul (*Acacia nilotica*) forest, 6B/DS2-Tropical Euphorbia scrub,

5/DS5-Dry Savannah type vegetation, Acacia nilotica- Salvadora association, 6/E2-Gorad (*Acacia Senegal*), 6B/ DS1-Zizyphus scrub and Capparis association.

Map-3.10: Forest Area distribution in the study area. ***(Map not to scale).***

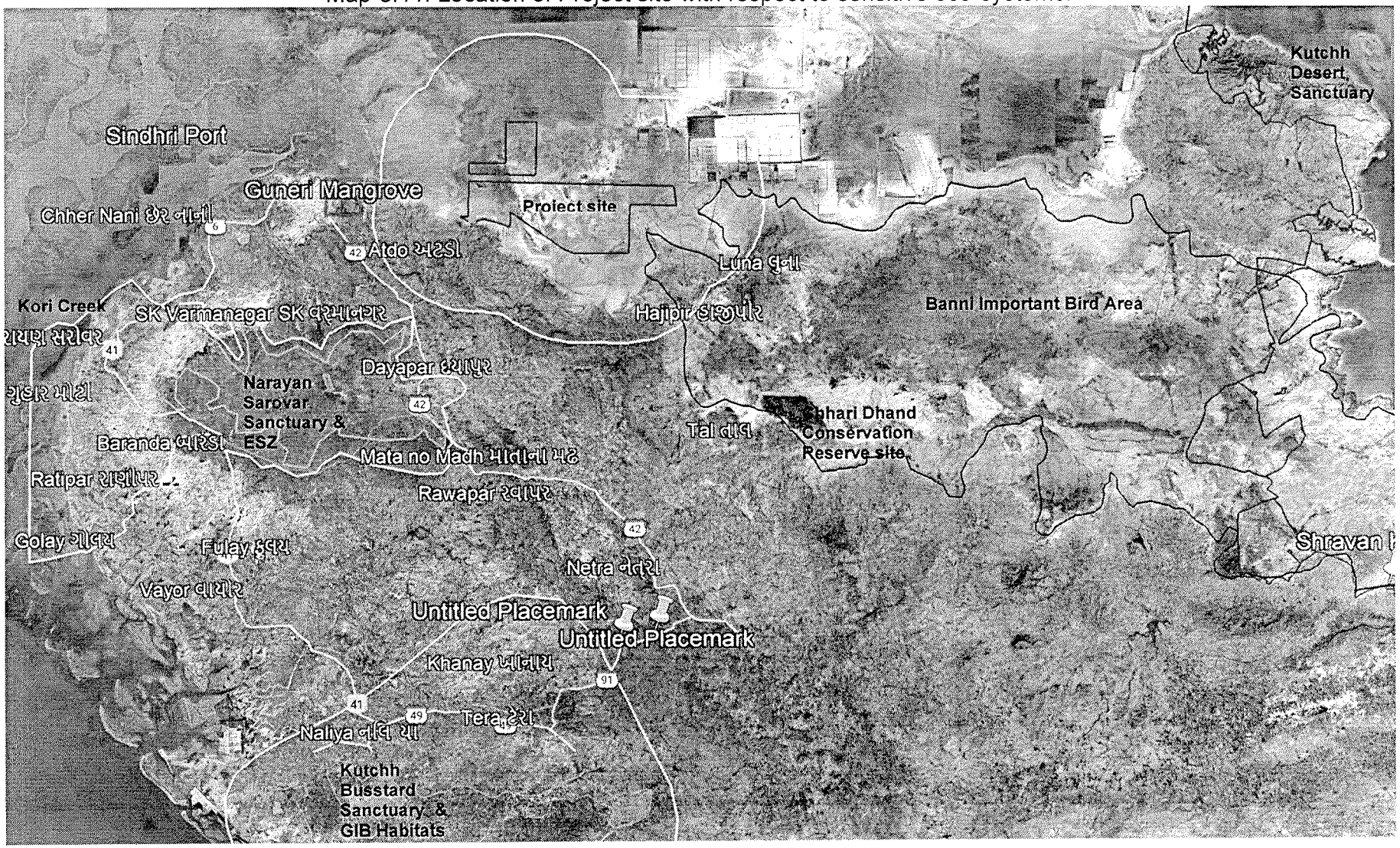


3.12.4. PROTECTED AREAS & SENSITIVE ECOSYSTEMS

Protected areas: As per our information there is no Sanctuary, National Park, or notified wildlife corridors or notified wetlands located within the core area of proposed salt work lease area. Narayan Sarovar Wildlife Sanctuary is located at more than 13 km distance in South of the core area (Map-3.11).

Eco-Sensitive Zone: The core area, i.e., proposed salt work lease area falls outside the notified eco-sensitive zone of Narayan Sarovar Wildlife Sanctuary. The eco-sensitive zone Gazette notification declared recently on 31st May 2012 (S.O. 1257(E)) has listed out several activities to be prohibited, regulated and promoted.

Map-3.11: Location of Project site with respect to sensitive eco-systems.



The proposed salt work lease areas fall beyond 12.0 km from the notified eco-sensitive zone of Narayan Sarovar Wildlife Sanctuary (Map-3.10).

Important Bird Area: 'Flamingo City' located in the Kutch Desert Wildlife Sanctuary is one of the Important Bird Areas (IBA) identified by Birdlife International. Flamingo City is located at 92.0 km in East direction from the lease area in Kutch district. Another IBA is grasslands of Naliya which is located at 70 km in South direction. Banni grassland IBA is only 2.0 km from the proposed lease area, whereas Chhari Dhandh area is also identified IBA in Kutch which are located at around 21.0 km from the lease area in South-East direction.

Waterbodies: Our observations and literature review suggest that there are only 2-3 small to medium sized check dam/salinity prevention bund present in the 5.0 km buffer area of the proposed lease area. Apart from being important hydrological features in the semi-arid area, such check dams provide important habitat for many bird species and water source for wildlife in the region. One waterbody in South direction is located at 1.0 km distance from the proposed lease area. Great Rann of Kutch and Kori creek are brackish water and marine waterbodies respectively are also present in the 5.0 km buffer.

3.12.5. FLORAL DIVERSITY AND VEGETATION

The biodiversity and abundance parameters of vegetation/plant species in the core area and in the buffer area of the proposed site are described below.

Core area: The lease area falls completely in the saline mudflat in the arid-semi arid climatic condition. However, there are small elevated areas made of sand, gravels and saline soil deposition. These elevated areas host *Prosopis juliflora* an invasive tree species, undershrubs like *Tamarix aphylla*, grasses like *Aeluropus lagopoides* and herbs species such as *Suaeda fruticosa, Salicornia brachiate* and *Cressa cretica* etc. These herbs are halophytes that grows on hyper saline soil conditions. Our field survey and literature review suggest that rest of the mudflat is mostly devoid of vegetation with scattered clumps of *Suaeda* species. Details of vegetation survey results are discussed in forth coming sections.

Buffer area: Majority of the buffer area is occupied by saline mudflats, salt exposed hightidal mudflats and on landward side limestone exposed land. On landward side maximum area is covered by agriculture land, uncultivable wasteland and thorny scrub forest land. *Prosopis juliflora, Acasia nilotica, Caparis deciduas, Euphorbia nerifolia Zizyphus numularia, Salvadora oliodes, Salvadora persic* among the wild plants. Sorghum, cotton, sesame among the cultivated crops are the most dominant plants in the buffer area. Few species of medicinal plants such as of *Commiphora wightii* and *Tribulus terrestris* are present in the buffer area of the proposed lease area falling on landward side. *Commiphora wightii* is listed as Critically Endangered species by the IUCN and it is a conservation concern species of the Kutch region.

About 2.0 km in South of the proposed saltwork lease area, there is a natural inland mangrove patch. This mangrove patch is unique as it is far away from the sea coast. It is one of those few natural mangrove patches that grew inland. It is in that sense this mangrove patch is important and needs to be protected by the forest department and industries operating in this area. Since it is located close to the proposed lease area, proponents shall take care of the area, so that none of their activities or people directly or indirectly harms this important natural mangrove patch.

Floral abundance and characteristics: Total 86 plants species were encountered during study, which is not exhaustive for the study area as during rapid assessment many species are likely to have missed by our team (Table-3.20). These include 7 species of climbers, 20 species of Grass, 27 herbs, 15 shrubs and 17 tree species in the buffer areas of proposed lease area (Table-3.20). The area falls in Arid-semi arid condition. As per classification of biome, biogeographic zone, biogeographic province, this area falls in Indian Desert/ Kutch Desert/Northern Thorny Scrub Forest. These designations to the study area suggest lower abundance, density and diversity of plants in the region is reflected in our floral study of the lease area.

Table-3.21: Floral species richness & their socio-economical usages

No	Species	Form	Economic Use						
			Food	Fodder	Medicinal	Timber	Fuel wood	Cultural & religious	Aesthetic
1	*Abrus precatorius*	Climber			1				
2	*Aristolochia bracteolata*	Climber							
3	*Aristolochia indica*	Climber							
4	*Canavalia maritima*	Climber							
5	*Cayratia carnosa*	Climber							
6	*Citrullus fistulosus*	Climber							
7	*Coccinia grandis*	Climber							
8	*Aeluropus lagopoides*	Grass		1					
9	*Apluda mutica*	Grass							
10	*Aristida adscensionis*	Grass							
11	*Aristida funiculata*	Grass		1					
12	*Aristida histricula*	Grass		1					
13	*Cenchrus ciliaris*	Grass		1					
14	*Chloris barbata*	Grass		1					
15	*Chloris quinquesetica*	Grass		1					
16	*Chrysopogon fulvus*	Grass		1					
17	*Cymbopogon martinii*	Grass			1				
18	*Cyperus difformis*	Grass		1	1				
19	*Cyperus flavidus*	Grass		1					
20	*Dactyloctenium aegypticum*	Grass		1					
21	*Dactyloctenium sindicum*	Grass		1					
22	*Desmostachya bipinnata*	Grass		1					
23	*Dichanthium annulatum*	Grass		1					
24	*Eragrostis cilianensis*	Grass		1					
25	*Heteropogon contortus*	Grass		1					
26	*Ischaemum indicum*	Grass		1					
27	*Sporolobus maderaspatenus*	Grass		1					
28	*Achyranthus aspera*	Herb						1	
29	*Aerva javanica*	Herb			1				
30	*Ageratum conezoides*	Herb			1				
31	*Argemone mexicana*	Herb			1				
32	*Casia auriculata*	Herb		1	1				
33	*Censia coromandelica*	Herb							
34	*Citrulus colocynthis*	Herb			1				
35	*Coculus hirsutus*	Herb			1				
36	*Cressa cretica*	Herb		1	1				
37	*Crotolaria lutescens*	Herb							
38	*Cynodon dactylon*	Herb		1					
39	*Fagonia indica*	Herb		1					

40	*Indigofera cordifolia*	Herb		1					
41	*Indoneesiella echioides*	Herb		1	1				
42	*Justicia procumbens*	Herb		1					
43	*Lepidagathis trimerus*	Herb							
44	*Leptochloa fusca*	Herb							
45	*Metanus emarginatus*	Herb							
46	*peristrophe bicalyculata*	Herb							
47	*Plantago ovata*	Herb							
48	*Salicarnia brachiata*	Herb			1				
49	*Scirpus tuberosus*	Herb		1					
50	*Solanum xanthocarpum*	Herb			1				
51	*Suaeda meritima*	Herb		1	1				
52	*Tephrosia purpurea*	Herb			1				
53	*Tribulus terrestris*	Herb			1				
54	*Typha angustata*	Herb			1				
55	*Abutilon fruticosum*	Shrub							
56	*Abutilon indicum*	Shrub							
57	*Aloe barbandensis*	Shrub			1				1
58	*Balanites aegyptica*	Shrub			1		1		
59	*Calotropis procera*	Shrub			1			1	
60	*Capparis decidua*	Shrub	1	1	1				
61	*Commiphora wightii,*	Shrub			1				
62	*Euphorbia nerifolia*	Shrub		1					
63	*Grewia flavescens*	Shrub							
64	*Grewia tenax*	Shrub							
65	*Hibiscus rosa-sinensis*	Shrub							
66	*Prosopis juliflora*	Shrub		1		1	1		
67	*Salvadora oliodes*	Shrub		1	1	1			
68	*Salvadora persica*	Shrub		1	1	1			
69	*Zizyphus numularia*	Shrub	1	1	1				
70	*Acacia leucophloea*	Tree		1			1		
71	*Acacia nilotica*	Tree		1	1				
72	*Acacia senegal*	Tree			1		1		
73	*Acacia tortilis*	Tree			1		1		
74	*Azadirachta indica*	Tree	1	1	1	1	1		1
75	*Butea monosperma*	Tree			1	1		1	1
76	*Cassia fistula*	Tree			1	1	1		1
77	*Delonix elata*	Tree		1	1	1	1		1
78	*Derris indica*	Tree		1	1	1	1		1
79	*Ficus benghalensis*	Tree		1	1	1	1	1	1
80	*Ficus religiosa*	Tree		1	1	1	1	1	1
81	*Ficus virens*	Tree		1	1	1	1	1	
82	*Peltophorum pterocarpum*	Tree							
83	*Phoenix sylvestris*	Tree	1		1		1	1	1
84	*Pithecellobium dulce*	Tree	1		1		1		

85	*Plumeria rubra*	Tree					1		1
86	*Prosopis cineraria*	Tree	1	1	1	1	1		

Dominant plant species: Based on our direct observations during the surveys we found that *Prosopis juliflora, Acacia nilotica, Acacia leucophloea* in trees; *Zizyphus numularia, Capparis deciduas, Callotropis procera* in shrubs whereas, *Aeluropus lagopoides, Cymbopogon martinii* and *Aristida* in grasses and *Suaeda meritima, Suaeda fruticose, Indigofera cordifolia, Fagonia indica, Justicia procumbens* in herbs are the most dominant species in the region.

Invader or exotic species: *Prosopis juliflora* is an evergreen tree native to South America, Central America and the Caribbean. In the United States, it is well known as mesquite. It is fast growing, nitrogen-fixing and tolerant to arid conditions and saline soils. *Prosopis juliflora* is an exotic and invasive widespread, multi-branched shrub/tree species in the India. It has been invading grasslands, native scrubland and forests of Gujarat and India. Our study showed that the *Prosopis juliflora* is one of the most dominant and wide spread in the core and buffer areas of the saltwork site.

Endangered/Threatened/protected species: Our field survey in the study area suggest that there are no endangered, endemic, rare plant species present within the proposed lease area boundary i.e., core area. However, we found two important species i.e., *Commiphora wightii* and *Tribulus terrestris* in the buffer area with low abundance. These plants have high medicinal values and are facing the threats of extinction by overexploitation for commercial purpose (GUIDE, 2009, Joshi et al. 2005) from Kachchh.

However, Gujarat Forest Department has accomplished a large-scale project on plantation of *Commiphora wightii* in Gujarat. Through this project thousands of plants were raised and planted in entire Kachchh region. This project has improved the number and density of the species in the region.

Species with ethno-botanical values: There are number of grass, herbs, shrubs and trees species which have various usages in the day-to-day life of people and

their livestock. These plants are used for food, fodder, medicinal usages, fuel wood, timber, culture and religion, aesthetic purposes. Various ethno-botanical usages of plants present in core and buffer areas are given in Table-3.20.

3.12.6. FAUNAL DIVERSITY AND SPECIES INVENTORY

Diversity of fauna: The present study has made assessment of 3 major higher vertebrate classes such as Reptiles, Birds and Mammals. The assessment of fauna representing higher trophic levels in the ecosystem was carried out since their diversity acts as indicators of the health of the ecosystem in which they live. The details of the results/observations are given as

Herpetofauna: Among herpetofauna common amphibian species of frogs were reported from the study area during survey from the ponds and rest in the study area during random searches in the month of November. Majority of the reptile species are fossorial in habit, therefore the assessment of reptiles and their diversity etc. holds special significance for any intensive land-based activities. In the present study we identified a total of 17 species of reptiles (Table- 3.21) within the buffer area and none in the core area. Of the reported reptiles species in the buffer area, 2 species of turtle i.e. Indian Flap shell turtle (*Lissemus punctatea*) and Indian Monitor Lizard (*Varanus bengalensis*) is listed as Schedule-I of Wildlife Protection Act 1972. The Indian Flap shell turtle was reported from waterbody in buffer area and the Indian Monitor Lizard is reported from terrestrial habitats in the buffer area which are common throughout country are listed as Schedule-I in WPA. Whereas, Spiny tailed Lizard, and Indian Chameleon are listed as Schedule-II species. Rest of the reptiles species belong to Schedule-IV. A species of Snakes i.e., John Sand Boa is listed as Near Threatened and the Asian spiny-tailed lizard is listed as Vulnerable by the IUCN Redlist. Majority of the reptile species reported from the core and buffer area fall in Least Concerned category of IUCN. No endangered, rare, threatened or endemic species of reptiles were reported from the saltwork lease core area. However, Spiny tailed Lizard and Red-sand boar being a protected species with restricted distribution reported from the buffer area may need specific conservation actions during the saltwork operation and activities.

Table 3.22: Checklist of reptiles reported in the study area.

No	Species	Scientific name	IWPA (1972)	IUCN Status
1	Bufo melanostictus	Common Indian toad	Sch-IV	LC
2	Bufo stomaticus	Indian Marbled toad	Sch-IV	LC
3	*Agama minor*	Short tailed Agama	Sch-IV	LC
4	*Bungarus caeruleus*	Common Krait	Sch-IV	LC
5	*Calotes versicolor*	Garden lizard	Sch-IV	LC
6	*Chamaeleo zeylanicus*	Asian Chameleon	Sch-IV	LC
7	*Echis carinatus*	Saw scaled Viper	Sch-IV	LC
8	*Eryx johni*	John Sand Boa	Sch-IV	NT
9	*Hemidactylus flaviviridis*	Northern house gecko	Sch-IV	LC
10	***Lissemus punctatea***	**Flap shell Turtle**	**Sch-I**	LC
11	*Mubuya carinata*	Common Skink	Sch-IV	LC
12	*Naja naja*	Common cobra	Sch-II	LC
13	*Natrix piscator*	Cheakered Keelback	Sch-IV	LC
14	*Ophiops jordoni*	Jordon's snake-eye	Sch-IV	NE
15	*Saara hardwickii*	spiny-tailed lizard	Sch-II	VU
16	*Sitana ponticeriana*	Fan throated lizard	Sch-IV	LC
17	***Varanus bengalensis***	**Indian monitor lizard**	**Sch-I**	**LC**

Birds: During the study we observed a total of 111 bird species in the study area. Almost all the bird species are reported from landward side in the study area. Majority of the species (81) are resident specie whereas only 30 species were found to be migratory. Of these recorded 111 species, 103 belong to 'Least Concerned' category rated by IUCN whereas only 8 species i.e., Painted Stork, Pallid Harrier, Dalmatian pelican, Black tailed Godwit, Lesser Flamingo, Oriental Darter, Oriental white ibis, Pallid harrier, and Eurasian curlew belong to Near Threatened Species.

Majority of the birds reported from the core and buffer area belong to the Schedule-IV of Wildlife Protection Act 1972 (Table-3.22). Whereas only 9 species are protected under Schedule-I of IWPA 1972 and House crow protected under Schedule-V. The birds were recorded mainly from scrubland and open areas interspersed with scattered thorny bushes in southern side of the lease in terrestrial habitats. The bird species groups observed in the study area were represented by species of open scrubland such as Passerines, Raptors and waterbirds etc.

Majority of the birds observed in the study area represent birds of semi-arid non-forested landscapes with several small ponds and lakes in the villages etc. Moreover, majority of the bird species reported in the present study are abundant and common in rural lakes, ponds and scrublands etc.

Majority of the resident species reported in the study area are known to breed in this region as well as in entire Gujarat. No rare, endangered, endemic bird species were found to breed in the core lease area.

Table-3.23: Bird species reported during study

#	Name of Species		Status		
	Common Name	Scientific Name	IWPA 1972	IUCN	Migratory/ Resident
1	Ashy Prinia	*Prinia socialis*	Sch-IV	LC	R
2	Asian Koel	*Eudynamys scolopacea*	Sch-IV	LC	R
3	Barn owl	*Tyto alba*	Sch-IV	LC	R
4	Baya Weaver	*Ploceus philippinus*	Sch-IV	LC	R
5	Black drongo	*Dicrurus macrocercus*	Sch-IV	LC	R
6	Black Francolin	*Francolinus francolinus*	Sch-IV	LC	R
7	Black headed Gull	*Larus ridibundas*	Sch-IV	LC	M
8	**Black shoulder kite**	***Elanus caeruleus***	**Sch-I**	**LC**	**R**
9	Black winged stilt	*Himantopus himantopus*	Sch-IV	LC	R
10	Black-tailed Godwit	*Limosa limosa*	Sch-IV	**NT**	M
11	Blue rock pigeon	*Columba livia*	Sch-IV	LC	R
12	Brown headed Gull	*Larus brunnicephalus*	Sch-IV	LC	M
13	Cattle egret	*Bulbulcus ibis*	Sch-IV	LC	R
14	Chestnut-bellied Sandgrouse	*Pterocles exustus*	Sch-IV	LC	R
15	Comb Duck	*Sarkidiornis melanotos*	Sch-IV	LC	R
16	Common babbler	*Turdoides caudatus*	Sch-IV	LC	R
17	Common Coot	*Fulica atra*	Sch-IV	LC	R
18	Common Crane	*Grus grus*	Sch-IV	LC	R
19	Common Crested Lark	*Galerida cristata*	Sch-IV	LC	R
20	Common Greenshank	*Tringa nebularia*	Sch-IV	LC	M
21	Common Iora	*Aegithina tiphia*	Sch-IV	LC	R
22	Common Kingfisher	*Alcedo atthis*	Sch-IV	LC	R
23	Common Moorhen	*Gallinula chloropus*	Sch-IV	LC	R
24	Common myna	*Acridotheres tristis*	Sch-IV	LC	R
25	Common Quail	*Coturnix coturnix*	Sch-IV	LC	M
26	Common Redshank	*Tringa totanus*	Sch-IV	LC	M
27	Common Sandpiper	*Actitis hypoleucos*	Sch-IV	LC	M
28	Common tailor bird	*Orthotomus sutorius*	Sch-IV	LC	R
29	Common Woodshrike	*Tephrodornis pondicerianus*	Sch-IV	LC	R

30	Coppersmith Barbet	*Megalaima haemacephala*	Sch-IV	LC	R
31	Cream-coloured Courser	*Cursorius cursor*	Sch-IV	LC	M
32	**Dalmatian Pelican**	***Pelecanus crispus***	**Sch-IV**	**NT**	M
33	Desert Wheatear	*Oenanthe deserti)*	Sch-IV	LC	M
34	Dunlin	*Calidris alpine*	Sch-IV	LC	M
35	Dusky Crag-Martin	*Hirundo concolor*	Sch-IV	LC	R
36	Eurasian collared dove	*Streptopelia decaocto*	Sch-IV	LC	R
37	Eurasian Curlew	*Numenius arquata*	Sch-IV	**NT**	M
38	Eurasian Oystercatcher	*Haematopus ostralegus*	Sch-IV	LC	M
39	**Eurasian Spoonbill**	***Platalea leucorodia***	**Sch-I**	**LC**	R
40	Franklin's Prinia	*Prinia hodgsonii*	Sch-IV	LC	R
41	Golden Oriole	*Oriolus oriolus*	Sch-IV	LC	R
42	Graceful Prinia	*Prinia gracillis*	Sch-IV	LC	R
43	Great Cormorant	*Phalacrocorax carbo*	Sch-IV	LC	R
44	Great White Pelican	*Pelecanus onocrotalus*	Sch-IV	LC	M
45	Greater couckal	*Centropus sinensis*	Sch-IV	LC	R
46	Greater Flamingo	*Phoenicopterus roseus*	Sch-IV	LC	R
47	Greater hoopoe-lark	Alaemon alaudipes	Sch-IV	LC	R
48	Greater Painted-Snipe	*Rostratula benghalensis*	Sch-IV	LC	R
49	Green bee eater	*Merops orientalis*	Sch-IV	LC	R
50	Green Sandpiper	*Tringa ochropus*	Sch-IV	LC	M
51	Grey francolin	*Francolinus pondicerianus*	Sch-IV	LC	M
52	Grey heron	*Ardea cinerea*	Sch-IV	LC	M
53	Hoopoe Common	*Upupa epops*	Sch-IV	LC	R
54	House crow	*Corvus splendens*	Sch-V	LC	R
55	House sparrow	*Passer domesticus*	Sch-IV	LC	R
56	Indian Eagle-owl	*Bubo bengalensis*	Sch-IV	LC	R
57	**Indian Peafowl**	***Pavo cristatus***	**Sch-I**	**LC**	R
58	Indian pond heron	*Ardeola grayii*	Sch-IV	LC	R
59	Indian robin	*Saxicoloides fulicata*	Sch-IV	LC	R
60	Indian Roller	*Coracias benghalensis*	Sch-IV	LC	R
61	Indian silverbill	*Lonchura malabarica*	Sch-IV	LC	R
62	Jungle babbler	*Turdoides striatus*	Sch-IV	LC	R
63	Jungle Crow	*Corvus macrorhynchos*	Sch-IV	LC	R
64	Kentish Plover	*Charadrius alexandrinus*	Sch-IV	LC	M
65	Large Egret	*Casmerodius albus*	Sch-IV	LC	R
66	Laughing dove	*Streptopelia senegalensis*	Sch-IV	LC	R
67	Lesser Flamingo	*Phoenicopterus minor*	Sch-IV	NT	R
68	Lesser Whistling Duck	*Dendrocygna javanica*	Sch-IV	LC	R
69	Little cormorant	*Phalacrocorax niger*	Sch-IV	LC	R
70	Little egret	*Egretta garzetta*	Sch-IV	LC	R
71	Little grebe	*Tachybaptus ruficollis*	Sch-IV	LC	R
72	Little Ringed Plover	*Charadrius dubius*	Sch-IV	LC	M
73	Long tailed shrike	*Lanius schach*	Sch-IV	LC	R
74	**Marsh Harrier**	***Circus aeruginosus***	**Sch-I**	**LC**	M

75	Marsh Sandpiper	*Tringa stagnatilis*	Sch-IV	LC	M
76	Median Egret	*Mesophoyx intermedia*	Sch-IV	LC	R
77	Montagu's harrier	*Circus pygargus*	Sch-I	LC	M
78	**Oriental Darter**	***Anhinga melanogaster***	**Sch-IV**	**NT**	R
79	**Oriental Honey Buzzard**	***Pernis ptilorhyncus***	**Sch-I**	**LC**	R
80	Oriental magpie robin	*Copsychus saularis*	Sch-IV	LC	R
81	Oriental White Ibis	*Threskiornis melanocephalus*	Sch-IV	**NT**	R
82	Oriental White-eye	*Zoosterops palpebrosus*	Sch-IV	LC	R
83	Painted Stork	*Mycteria leucocephala*	Sch-IV	**NT**	R
84	Pallid harrier	*Circus macrourus*	Sch-I	NT	M
85	Pied Avocet	*Recurvirostra avosetta*	Sch-IV	LC	M
86	Pied Kingfisher	*Ceryle rudis*	Sch-IV	LC	R
87	Purple Moorhen	*Porphyrio porphyrio*	Sch-IV	LC	R
88	Purple sunbird	*Nectarinia asiatica*	Sch-IV	LC	R
89	Red vented bulbul	*Pycnonotus cafer*	Sch-IV	LC	R
90	Red wattled lapwing	*Vanellus indicus*	Sch-IV	LC	R
91	River Tern	*Sterna aurantia*	Sch-IV	LC	R
92	Rose ringed parakeet	*Psittacula krameri*	Sch-IV	LC	R
93	Ruff	*Philomachus pugnax*	Sch-IV	LC	M
94	Rufus tailed lark	*Ammomanes phoenicurus*	Sch-IV	LC	R
95	**Shikra**	***Accipiter badius***	**Sch-I**	**LC**	R
96	Short-eared owl	*Asio flammeus*	Sch-IV	LC	M
97	Short-toed Eagle	*Circaetus gallicus*	Sch-IV	LC	R
98	Southern Grey Shrike	*Lanius meridionalis*	Sch-IV	LC	R
99	Spotted Owlet	*Athene brama*	Sch-IV	LC	R
100	Stone-Curlew	*Burhinus oedicenemus*	Sch-IV	LC	R
101	Sykes's Crested Lark	*Galerida deva*	Sch-IV	LC	R
102	Terek Sandpiper	*Xenus cinereus*	Sch-IV	LC	M
103	Variable Wheatear	*Oenanthe picata*	Sch-IV	LC	M
104	Western Reef Egret	*Egretta gularis*	Sch-IV	LC	R
105	White throated kingfisher	*Halcyon smyrnensis*	Sch-IV	LC	R
106	White Wagtail	*Motacilla alba*	Sch-IV	LC	M
107	White-eared Bulbul	*Pycnonotus leucotis*	Sch-IV	LC	R
108	**White-eyed Buzzard**	***Butastur teesa***	**Sch-I**	**LC**	R
109	Wire-tailed Swallow	*Hirundo smithii*	Sch-IV	LC	R
110	Wood Sandpiper	*Tringa glareola*	Sch-IV	LC	M
111	Yellow wattled lapwing	*Vanellus malarbaricus*	Sch-IV	LC	R

Mammals: We observed a total 18 mammal species in the buffer area and none in the core area of the saltwork lease site (Table-3.23). The common mammalian species that were directly observed in the core area is Nilgai, Wild Pig, and Indian Hare. No endangered or Schedule-I species reported from the core area of the proposed lease area (Table-3.23).

Table-3.24: Mammals reported from study area

#	Name of Species		Status	
	Scientific Name	Common Name	IWPA 1972	IUCN
1	Chinkara	*Gazella bennettii*	Sch-I	LC
2	Common mongoose	*Herpestes edwardsi*	Sch-II	LC
3	Desert Fox	*Vulpes vulpes*	Sch-I	LC
4	Greater Mouse-tailed Bat	*Rhinopoma microphyllum*	Sch-V	LC
5	House rat	*Rattus rattus*	Sch-V	LC
6	Indian Flying Fox	*Pteropus giganteus*	Sch-V	LC
7	Indian Fox	*Vulpes bengalensis*	Sch-II	LC
8	Indian Hare	*Lepus nigricollis*	Sch-IV	LC
9	Indian Jackal	*Canis aureus*	Sch-II	LC
10	Indian porcupine	*Hystrix indica*	Sch-IV	LC
11	Jungle cat	*Felis chaus*	Sch-II	LC
12	Lesser Mouse-tailed Bat	*Rhinopoma hardwickii*	Sch-V	LC
13	Nilgai	*Boselaphus tragocamelus*	Sch-III	LC
14	Indian Hedgehog	*Paraechinus micropus*	Sch-IV	LC
15	Palm squirrel	*Funambulus pennanti*	Sch-IV	LC
16	Small Indian Civet	*Viverricula indica*	Sch-IV	LC
17	Striped hyena	*Hyaena hyaena*	Sch-III	NT
18	Wild Pig	*Sus scrofa*	Sch-III	LC

However, Desert fox and Chinkara protected under Schedule-I of WPA 1972 and reported as Least Concerned by IUCN were reported to be present in the buffer area. Indian Jackal, Jungle cat, Indian Fox, Common Mongoose are protected under Schedule-II of IWPA 1972. Whereas Hyena, Nilgai, Wild pig protected under Schedule-III. India Hyena is reported as Near Threatened by IUCN which is reported from the buffer area in the study area. Rest of the species are protected under Schedule-IV of WPA.

Majority of the mammalian species (except for Schedule-I) recorded during the survey in the buffer area are present throughout semiarid, non-forested and non-protected landscapes especially in Kutch and in Gujarat.

Dominant fauna: Based on our observations, interview survey of local people, forest officials and NGOs working in nature conservation activities in Kutch region, we found that Nilgai, Wild Pig, Indian hare are most common and dominant mammal species present in the landscape. Whereas there were several birds species belong to Passerine were most common and dominant group of birds

present in the core and buffer area of the saltwork lease area. Among reptiles, Spiny tailed Lizard, common garden lizard, monitor lizard etc. were most common species present in the buffer areas of the lease.

Wildlife corridors and breeding habitats: Our observations suggested that there is no rare, endangered, conservation concern species of fauna present within the core lease area. Moreover, core area as of today is not a part of any special habitat (breeding, feeding, roosting etc.) for any of the important fauna and does not provide any contiguity of habitats between two important wildlife habitats or any other protected areas. Moreover, the Narayan Sarovar Wildlife Sanctuary is located at a safe distance i.e., more than 13.0 km from the core lease area, therefore; the movement of any important faunal species from Narayan Sarovar Wildlife Sanctuary is less likely to be affected.

However, the breeding of Indian Fox, Hyena, Desert Fox etc. cannot be ruled out in buffer area. Since the habitat and landscapes are similar to that of Narayan Sarovar Sanctuary. While interviewing local people, it was also confirmed that of some carnivores do breed in the buffer area of the lease area which are Indian fox, Desert Fox, Hyena etc. The breeding of Spiny tailed Lizard is also reported from the buffer lease area. The impact of saltwork activities on the important flora and fauna are assessed and mitigation measures are recommended in the conservation action plan in forth coming chapters.

3.13. SOCIO-ECONOMIC ENVIRONMENT

Socio-economic study of the area is a part of environmental impact assessment study. Socio-economics, a component of environment includes description of demography, available basic amenities like housing, health care services, transportation, education and cultural activities. Information on the above-mentioned parameters have been collected to define the socio-economic profile of the study area (10-km radius). The socio-economic baseline profile of the study area is a representation of the primary survey done in the sample villages in and around the existing and proposed salt works lease areas. Data from secondary sources like the Primary Census Abstract and Village Directory of 2011, district

statistical abstract, have also been utilized to profile the socio-economic condition of the community.

Study consisted of data collation on the baseline social and economic indices of the study area. Relevant data were presented under various subheadings, including: social environment (socio- cultural, demography, education and literacy) economic survey includes the (worker details, employment/unemployment, etc.)

Total population of the surrounding area of the project site as per census 2011 is 11877 only and the sex ratio of the area is 934 females per 1000 males (Table-3.24.).

Cultural and Religious Factors

There are no ethnic minority groups affected by the project also there is no cultural and aesthetic place affected by the project activity.

Literacy Status

As per 2011 census, percentage of literate population of study area is about 54.46% within that 33.12 % are male literate and 21.31% are female. It indicates that the female literacy rate is quite poor as compare to the national literacy rate which is 53.07%

Table-3.25: Summary of Population in the Study Area. *(Source: Census CD of Gujarat 2011)*

Sr No	Parameters	Numbers (%)
1	Total number of Households	2263
2	Total Population	11877
3	Total Male Population	6562
4	Total Female Population	5355
5	Sex Ratio(per 1000 Male)	934 (Females per 1000 Male)
6	SC Population	1615 (13.50%)
7	ST Population	36 (0.32%)
8	Literate Population	6760 (56.92%)
9	Male Literate	2239 (33.12%)
10	Female Literate	1442 (21.34%)
11	Main Worker	3846 (32.38%)
12	Marginal	123 (1.0%)
13	Non-Worker	7908 (66.58%)

Employment Pattern

Livestock rearing, seasonal agriculture and wages is the main source of income for the local community. Details of each occupation is provided as under.

Table- 3.26: Village-Wise Population and employment Structure in the Study Area

#	Name of village	Total No. of Houses	Pop-ulation	Sche-dule Caste	Sche-dule Tribe	Literacy	Total Wor-kers	Main Worker	Marginal Worker
1.	Karanpar								
2.	Baana								
3.	Guneri	161	967	200	0	67.38%	356	356	
4.	Sayra	52	343	0	0	69.57%	127	127	0
5.	Mudan	100	659	191	0	59.28%	203	203	0
6.	Atdo	88	511	144	0	50.62%	201	197	4
7.	Ukher								
8.	Jara	44	205	0	0	44.72%	57	57	0
9.	Nara	432	2,265	393	1	56.77%	738	730	8
10.	Jumara	246	1,097	0	0	48.13%	422	416	6
11.	Hajipir								
12.	Khatiya	62	317	141	0	66.80%	82	80	2
13.	Lakhapar	173	1,042	138	0	59.52%	346	331	15
14.	Chhuger	33	165	0	0	49.65%	66	50	16
15.	Siyot	97	500	110	0	59.19%	227	226	1
16.	Ghaduli	482	2,460	295	22	73.29%	770	762	8
17.	Bhitara Mota	293	1,346	3	16	35.10%	374	311	63
		2263	**11877**	**1615**	**39**	**56.92%**	**3969**	**3846**	**123**

Agriculture

Only 7.2% of total study area falls under the Agriculture landuse category. Agriculture in this region is poor due to poor soil quality, scanty rainfall, high temperature and very low human population. Due to area falling in rain shadow area, agriculture in this region is risky affair. Investing in agriculture is often risky due to erratic rain pattern in the region. However, people still depend on rainfed and only one season crop. They saw sesame, cumin, jira, isabgul, sorghum and cotton in this region.

Livestock

Livestock rearing is one of the most important economic activities of the local community. Jats, Rabaris, Sodha etc. are the major communities that depend on

livestock business. Due to erratic rainfall livestock rearing is preferred over agriculture which is less risky. Moreover, the grasses and fodder for goats, sheep, camel is easily available in vast open scrublands in the region. There is a considerable section of people who are living on animal rearing.

Labour Activity

As per the census data 2011, the total main working population in the study area is 30.27% Marginal working group is 3.89% remaining major Part 65.83% are Non workers. Details of occupational structure of the villages within the surrounding of the project area are given in given in the Table-3.25.

Salt Farming

Salt farming is one of the key economic activities in the Kutch district. It is a seasonal activity that spans about six months of the year supporting close to a lakh people in the region. It is also pertinent to point out here that this salt meets about 30% of India's needs. Salt workers are known as 'agariyas'. They engage in their occupation between October and November and between April and May, after which they mostly engage as agriculture labour and/or cultivate crops in their lands.

Infrastructure facilities in the study area

A definitive way to measure the quality of life in this region is to ascertain the presence, accessibility and utility of the social and physical infrastructure in the study area.

Electricity

Almost all households cover the Electricity facility in the study area no power cut problem in the region.

Transportation and communication

The transportation and communication facility in the study is quite insufficient, even though the road network is good. This is due to low population in the region.

Drinking water

Drinking water is one of the scares resources in the region. Majority of the villages have village ponds/lakes that is traditionally used for drinking still continues in this

region. However, now some except remote villages, Narmada water through pipelines provide drinking water supply to villages which is irregular and insufficient.

Education

Only primary school facility is available in the villages in the study area, but for secondary and higher education facility students have to travel too far or have to move in bigger towns.

Health Facilities

Information on the sample villages reveals that the health facility is not adequate in the study area.

Other facilities

The availability of facilities in the villages of the study area like, facilities of bus stops, regular market, post office, banks in most cases are located at a distance of more than 20-30 kms.

CHAPTER- 4

ANTICIPATED ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

4.1. ANTICIPATED ENVIRONMENTAL IMPACTS

Every industrial activity has some impact on the environment which broadly can be divided into two categories, positive and negative impacts. The overall environmental impacts are broadly divided into impacts during construction phase and operation phase of the proposed salt work projects.

Impacts of proposed salt works on surrounding environment and ecology area were identified mainly by using information presented in previous Chapter-2 & Chapter-3. The baseline information on environment and ecology ware also substantiated through secondary information. Finally, the baseline information was juxtaposed with the project activities. Specific impacts were visualized in terms of seasonal issues related to environment and ecology.

Following the approach, impacts on various components of environment, ecology and biodiversity were assessed. The component wise identification of potential impacts is deliberated below.

Continuous emissions of air pollutants and noise are not expected during construction and operation phase of the project. Hence, only qualitative impacts on relevant environmental components are assessed according to applicable equator principles of EPFIs. The impacts are identified phase wise i.e., construction and operational phases.

4.1.1. IMPACTS DURING CONSTRUCTION PHASE

The main activities to this phase can be stated as follows:

- Site preparation/ earth work/ earthen bunds and road networks
- Material handling such as stones, pipelines etc.
- Movement of heavy earth moving machines such as Hitachi/jcb/ tractors etc.
- Construction activity / laying of pipes for water intake

- Construction of pump houses
- Construction of canals, storage ponds, drainage channels, crystallizers, link roads, offices, workshop, warehouse facility etc.,
- Installation of electric cables and related activity
- Installation of machinery and other on-site equipment

These activities could have the following impacts:

- Impacts on marine ecology
- Impacts on terrestrial ecology
- Air and noise pollution
- Land degradation
- Solid and liquid waste generation
- Occupational health and safety
- Socio - economic impacts

4.1.1.1. IMPACTS ON MARINE ECOLOGY

Since the proposed salt works lease areas are located in supra-tidal mudflats (Map-3.8) at a distance from the marine area the impacts of saltworks on marine environment are envisaged to be negligible. Since the salt is produced form the sea water, salt works are permissible activities on the sea coasts. Moreover, the study area i.e., 10 km periphery did not show presence of mangroves, coral reef, sand dunes, Seaturtle nesting sites or any other sensitive and important marine habitats. However, only a small fraction (8.8%) of the proposed lease area falls in the intertidal area around creeks i.e., CRZ-IB and CRZ-III (Map-3.8). Following could have short term and long-term impacts on marine ecology and environment.

- **Sedimentation & safety of mangroves of Kori Creek:** Baseline status of vegetation (Map-3.4) clearly suggests that the lease area i.e., core area do not support major vegetation except clumps of *Prosopis juliflora* and halophytes such as *Suaeda* species etc., on slightly elevated saline areas. There are no mangroves present within the core area. However, mangroves located in the mudflats in the surrounding areas of Kori Creek could be affected if proper care is not taken during construction phase. Large scale movement of the earth for creation of embankment and bunds may drain into the creeks particularly during monsoon season if no proper care is

taken. Such loose soil can temporarily cause sedimentation and block the creeks and micro drainages in the areas. This may temporarily cause impacts on flora and fauna of creek environment.

- **Sedimentation & impacts on active mudflats around Kori Creek:** CRZ mapping carried out by authorized agencies as well as our baseline survey clearly suggests that the lease area i.e., core area do not have presence of active mudflats (CRZ-IA). However, outside the study area there few creeks that connects with active mudflats around Kori creek. If sediments from the project during construction phase flows to these areas it could lead to temporarily blockade of small creeks and induce changes in the active mudflats. This may cause impacts on flora and fauna of active mudflats.

- **Safety of Inland mangroves:** There is a natural inland mangrove patch present in the close proximity of the proposed lease area (at 23°48'24.90"N, 68°48'31.51"E). This inland mangrove patch lies beyond the study area. It lies at more than 13.0 km east of the proposed lease area. It is observed that the natural slope is towards North. However, if any roads, transportation etc. are carried out without considering hydrological regime could affect this mangrove area. Therefore, it is important that company ensures that no discharge, emissions proceeds towards that mangrove patch through small creeks or air.

- **Impacts on marine ecology:** The phytoplankton, zooplankton and marine benthos abundance and diversity are low in the study area as hypersaline conditions and high temperature does not allow survival of organisms in the water-logged area i.e., CRZ area in the study area. Moreover, proposed project activity is not going discharge any effluents into the surrounding area of the lease as it is only a salt manufacturing activity. However, sedimentation during the construction phase shall be checked so that the surrounding area does not get sediment flows arising due to bund construction for the saltpans. If the bittern is not handled properly and if it is released or leaked in the surrounding area it could affect the surrounding

area ecology and it could flow into the Kori creek in long run. Therefore, it is important that project proponent shall ensure proper bittern management. The project proponent has also planned marine chemical extraction plant in the lease are falling outside the CRZ areas (Map-3.8). The bittern would be channelized into this plant and marine chemicals such as bromine etc. would be extracted.

4.1.1.2. IMPACTS ON TERRESTRIAL ECOLOGY:

IMPACT ON FLORA

It is learnt from the baseline data that the proposed lease area support only a few plant species that includes small clumps of *Prosopis juliflora* and other common halophytes on small raised areas which will be removed during construction phase. Majority of the buffer area also consist of Rann of Kutch landscape which is devoid of vegetation. However, terrestrial landscape located in southern side of the study aera has open scrubland as well as agriculture land that hosts vegetation typical of the semiarid to arid landscape. The buffer area has one of the species of higher conservation significance (e.g., *Commiphora wightii*). However, their population is quite small and isolated in the buffer area. Local people collect its resin for its economical values.

There is a natural 'inland mangrove' patch present beyond 13.0 km east of the proposed lease areas (at 23°48'24.90"N, 68°48'31.51"E). The species of mangrove present in this patch is *Avicennia marina.* Project proponent and their staff working at site must be made aware of the importance of this area.

IMPACT ON FAUNA

Though, the impacts of solar saltworks and related activities may be on several faunal taxa, but for the present study mainly vertebrate classes i.e., reptiles, birds and mammals are analyzed for identification of impacts, mitigation and future monitoring purpose. Therefore, in the present study impacts on the reptiles, birds and mammals particularly important, Schedule-I, endangered, endemic and flagship species of the landscape are identified.

SPECIFIC IMPACTS ON MARINE FAUNA:

The proposed lease area lies in supra tidal region in western most part of the Rann of Kutch region. This area owing to higher evaporation rate, high temperature and hypersaline conditions the lease area does not support marine life in the region. Therefore, the core area of the proposed lease is less likely to have any impacts on the marine life within the core area. However, if the sedimentation during construction phase and leakage of any hazardous waste (oil, grease etc.) in to surrounding area may in long term flow into the active mudflats, creeks, mangrove habitats that are located beyond the study area and affect the population of marine fauna such as mudskeepers and crabs etc.

SPECIFIC IMPACTS ON HERPETOFAUNA:

There is total 17 herpetofauna species reported from the study area. However, no herpetofauna species reported from the core area of the proposed lease area. All the herpetofauna species are reported from the terrestrial habitats south of the lease area in the study area. A species of snake i.e., Red-sand boa (Near threatened) and Indian spiny-tailed lizard (Vulnerable) and the Schedule-I species such as Indian Monitor lizard, Indian Flap-shelled turtle etc. are species of higher conservation significance in the study area. These species are not found in and around the lease area due to unsuitable habitat (hypersaline, high temperature, high evaporation rate). However, if the project activities are not carried out carefully, it could potentially affect them such as following,

- Large scale movement of vehicles in buffer area, and increase in salinity due to spillage of salt may result in gross loss of their habitats where they breed and thrive throughout the year.

SPECIFIC IMPACTS ON BIRDS

There are number of bird species present in the core and buffer area. The saltwork activities are less likely to affect the birds. However, waterbirds such as flamingo, pelicans, waders, grebes etc. are seen in good numbers in saltpans across the state.

Waterbirds: It is observed that the proposed lease area falls on the strategic location i.e., on migratory routes of waterbirds. The migratory waterbirds such as

Pelicans, Waders, Ducks, Grebes, Gulls etc. are likely to be benefited by the presence of saltworks as it happens in other parts of the state. Species such as flamingos that breeds in Great Rann of Kutch and Little Rann of Kutch may find this saltworks as best feeding and roosting habitats. The saltwork bunds also are used by several species of birds for roosting, basking etc. during the day time.

SPECIFIC IMPACTS ON MAMMALS

Observations and information suggest presence of total 18 species of mammals with several important species i.e., Chinkara, Desert Fox and Indian Fox in the terrestrial habitats in the buffer area of the study area. The species include Chinkara and Desert Fox which are protected under the Schedule-I of Indian Wildlife Protection Act 1972.

These mammals are likely to be using surrounding area for feeding, breeding and waterbodies in the buffer area for their requirement of water. The impacts of saltworks activities are likely to be similar on carnivores and herbivore species present in the buffer area. Since these species are on the top of ecological pyramid and represent secondary and tertiary consumers, they are likely to respond to any changes in the ecosystem. Therefore, changes in overall habitat qualities in the buffer area are likely to affect these species.

- The direct disturbance to these species by vehicle traffic, human intrusion in wildlife habitat may be the issue of some concern.
- The peripheral areas of saltworks may have decreased productivity of grasses and other vegetation due to salt spread, dusting etc. which can lead to decreased food availability for the herbivores etc.
- Large scale saltworks would require increased movements of heavy vehicles, trucks, cranes, etc. Increased traffic may cause increase in road kills of various small to medium sized mammals.
- Laboure's often unconsciously resort to poaching of small to medium sized animals for their food and protein requirements.

4.1.1.3. VEHICULAR TRAFFIC IMPACT

Access Roads & Routes: There are two access roads, through the Gaduli-Santalpur highway to the proposed lease area. Hajipir-Archean chemical road provides access to the eastern part of the lease area whereas, Gaduli-Santalpur highway provides access to the lease area near Mudhan village. Company has also planned to construct a 30 Mtr. wide approach road of approx. 15.0 KM length from plant location to join the state highway (SH-42). The route of this proposed road is from plant location -Mudhan-Atdo-Chuger-SH-42. The proposal for this road is submitted to the government of Gujarat and the file is in process.

Traffic Intensity: During construction phase, the movement of number of heavy vehicles i.e., trucks, heavy earth moving machineries, tractors, etc. would increase which would require appropriate traffic management to avoid accidents, injury and possible loss of human lives and wildlife species. Though, no traffic is envisaged in the CRZ area falling in the lease area except during construction phase. Total envisaged traffic during construction of saltwork bunds, washery, access mud roads, Bromine extraction plant would be as mentioned in Table-4.1.

Table-4.1: Envisaged Traffic intensity during construction & operational phases

Vehicle type	Purpose	Construction	Operational
Heavy Earth Moving Machines	Earth work	40	4
Tractors	Earth work & bund construction	50	20
Trucks (in absence of conveyor belt)	Transportation of soil, salt, bromine	30	600
Pick-up vehicles	Transportation equipments	10	5
LMVs	Staff and Worker movements	10	10
Conveyor Belt (28-30 km)	Transportation of Salt	0	

This would also increase emission of dust which would settle in the surrounding area. Since this region has very sparse human population and the surrounding area is hyper saline where vegetation density is much lower, this impact is likely to be lower for the humans and ecology.

4.1.1.4. IMPACTS ON AIR ENVIRONMENT

DOZER OPERATION

The construction will begin with creation of embankments/bunds which will involve the use of number of Dozers (JCB, Hitachi, Grader, Roller etc.). As the site topography consists of dry, flat, saline mudflats, the dozer operations will generate some amount of dust.

SITE CLEARANCE

Generally, during the site clearance for the construction of the project, certain amount of dust is likely to be generated. However, in the present case, the clarence of site is not required as it already fall in natural saltpans which are flat and clear.

HAULING OF CONSTRUCTION MATERIALS TO THE SITE

By hauling of construction materials to the site, some amount of fugitive air borne dust is likely.

STOCKING OF SOIL, SAND AND GRAVEL

Soil, sand and gravel or pebbles required for the foundation work and other constructional activities will have to be stacked at site. Certain amount of dust generation is likely due to this operation.

The amount of dust generated from the construction activity can vary according to the area to be cleared and the season. But the change in concentrations will not be substantial as to exceed the guideline levels of ambient air mentioned by NAAQS.

4.1.1.5. IMPACTS ON NOISE ENVIRONMENT

Noise from increased vehicular traffic to and from the site, operation of other machinery and equipment and the presence of a large numbers of workers assembled at the site shall altogether cause an increase in the ambient noise level.

4.1.1.6. IMPACTS ON LAND ENVIRONMENT

The site is mostly devoid of natural vegetation except some clumps of *Prosopis juliflora* and halophytes on elevated areas are present. The landscape is uniform

throughout i.e., dry, flat, salt exposed land. No levelling activity is required for the proposed project; hence land degradation is not anticipated.

4.1.1.7. SOLID AND LIQUID WASTE GENERATION:

Unusable materials, plastic and other wrappers and containers, excavated material, unserviceable equipment and machine parts, among others, shall create solid waste on the site.

Fluid waste include flows from sanitary facilities, oil and lubricants spillage. To prevent contamination of water sources and outbreaks of human infections, conditions shall have to be managed properly.

4.1.1.8. SOCIO-ECONOMIC IMPACTS:

Overall, there shall be a very positive impact on income generation, employment levels and general well-being of people in the region.

During the constructional phase, direct and indirect employment shall benefit the local populace and increase their incomes through salary payments for construction workers and indirect payments /earnings to food sellers, transport operators and other hawkers.

Activity	Employment
Civil Work	50
Salt extraction	150
Administration, Marketing, others	50
Indirect	450
Total Manpower	600

This is expected to improve living standards for the local community. Since there is no object of cultural or social importance on the site, there shall be no destruction or impact of destruction.

4.1.1.9. OCCUPATIONAL HEALTH AND SAFETY:

Normal hazards such as temperature shocks, dehydration, noise, air pollution, etc., are likely to occur during construction phase of the project. All these issues must be addressed to ensure a safe working environment and wellbeing of employees.

4.1.2. OPERATIONAL PHASE IMPACTS

The operational phase activities are as follows:

- Pump seawater into the reservoirs and release it gradually into the evaporating ponds.
- Monitor the process of evaporation and continue channeling the water to down the line ponds and crystallizers.
- Attend to saline concentration details and precipitation of salt
- Harvest the crystallized salt
- Wash and dry the salt harvested
- Management or use of bittern for further chemical extraction
- Process the salt and package it
- Store packed bags into designated warehouses
- Transport bags or loose salt through trucks to the end users.

Potential impacts associated with the above-listed activities are:

- Noise pollution
- Vehicular traffic impacts
- Air pollution
- Solid and liquid waste generation
- Visual and aesthetic impacts
- Terrestrial ecological impacts
- Impacts on marine ecology
- Socio-economic impacts
- Occupational health and safety
- Bittern generation
- Conditions at intake point
- Potential flooding in the region

Evaluation and assessment of the impacts are presented below:

4.1.2.1. NOISE POLLUTION

Noise levels are going to rise in the vicinity of the salt works. Sources of noise are likely to be at the pump houses, vehicle movements, generators, washery, and earth moving equipment. Workers shall also add to the ambient noise levels. Workers at the pump houses, generators, washery, and other equipment shall particularly be exposed to higher noise levels.

4.1.2.2. VEHICULAR TRAFFIC IMPACTS:

During routine operational phases, vehicular movement shall be far less than during the constructional phase. However, the effects can be summarized as below:

- Noise pollution of trucks and other vehicles
- Safety hazard to pedestrians and domestic animals
- Decrease in ambient air quality due to exhaust / fumes of vehicles and other machinery.

4.1.2.3. AIR POLLUTION IMPACTS

Fumes of exhaust from DG sets and water due to evaporation shall cause a change in the quality of ambient air.

4.1.2.4. SOLID WASTE GENERATION

Food wrappers, paper waste, packaging materials; discarded spares from machinery can be classified as some of the solid waste that shall be generated at the site.

4.1.2.5. LIQUID WASTE GENERATION

Fluid waste from sanitary facilities, oil and lubricant spillage, effluents from salt washing are the major liquid waste that will be generated.

Source	Use
Washery- water with salt impurities	Settlement tank to Reservoir
Bromine Plant ETP -treated water	to Reservoir
STP-treated water	Bunds and road stabilization
Sludge from ETP & STP	Bunds and road stabilization

All these, if allowed to release into the environment shall generate a negative impact:

4.1.2.6. VISUAL AND AESTHETIC IMPACTS

The site area is currently unoccupied and undeveloped. When the project becomes operational, the ponds, machinery and equipment, buildings and movement all around shall cause visual intrusion.

4.1.2.7. ECOLOGICAL IMPACTS:

The Arabian sea is located beyond 55 km south west direction. No major mangroves, coral reef, active mudflats, sand dunes or the sea turtle habitats are located in close proximity to the proposed salt leas sites. However, few marine and terrestrial ecological impacts are anticipated which are discussed in different sections below.

Impingement and entrainment: The large-scale intake of seawater from the creek may result in the impingement and entrainment of marine organisms. Impingement occurs when fish and other large organisms are trapped on the intake screen, resulting in their injury or death. Entrainment occurs when organisms small enough to pass through the intake screens, such as plankton, fish eggs, and larvae, are killed during processing of the salt water.

Leakage of brine & bittern in to surrounding area: Leakage of brine into surrounding area is one of the risk factor associated with salt works. If it flows into Kori-creek than it can cause damage to few mangrove plants as well as some marine organisms dwelling in the creek environ.

Damage to Inland Mangrove: There is a natural inland mangrove patch present beyond study area which lies beyond 13.0 km from proposed lease area (at 23°48'24.90"N, 68°48'31.51"E). It is observed that the natural slope is towards North. If brine or bittern flows into the surrounding environment and during the high-tide time it can flow up to this mangrove patch. Therefore, it is important that company ensures that no discharge proceeds towards that mangrove patch through small creek.

4.1.2.8. BITTERN GENERATION

The slimy residual liquid (bittern) will consist of more than 70% Sodium Chloride. At this level of concentration, it is not likely to crystallize. This shall be initially pumped back into the initial reservoirs to increase concentration there, which shall result in a reduction in the production cycle. However, the bittern is an important source and raw material for extracting marine chemicals such as bromine, magnesium chloride murrate of potash i.e., potassium chloride etc. The location of the proposed plant

for extraction of bromine from bittern lies within the lease area (outside CRZ areas) in south-western corner of the lease. Total 5100000 M^3 of bittern will be produced per annum at the project site.

4.1.2.9. SEA WATER INTAKE

The construction of a pump house, lying of pipes and operation of the pumps shall cause changes in the landscape at the intake point. An increased noise level shall also be experienced in the environs of the pump house. The pump basin itself must also be designed to withstand and accommodate the conditions of the creek. One of the most important aspects of pump basin is the removal of "trash" from the water. Trash not only refers to solid materials such as driftwood and plastic containers, but also marine plants and animals which can find their way into the intake system. Another important design factor is the supply of an evenly distributed flow of water to the pump suction bells.

The large-scale intake of seawater from the creek may result in the impingement and entrainment of marine organisms. Impingement occurs when fish and other large organisms are trapped on the intake screen, resulting in their injury or death. Entrainment occurs when organisms small enough to pass through the intake screens, such as plankton, fish eggs, and larvae, are killed during processing of the salt water.

The high amount of seawater intake is required for large scale salt works. Such a high amount of sea water intake could increase the possibility of fish, planktons, larvae, kelp and other marine life being drawn into the system. Proper design of seawater intake system shall be developed for the proposed project.

4.1.2.10. POTENTIAL FLOODING

Generally, salt pans are likely to be flooded because of the flat coastal lands on which they are created. This could be because of tidal impacts or unusually high rainfall. In the present case, the distance of the saltpan site from the sea could eliminate the potential threat of sea water flooding. The Kori-creek is located beyond 20.0 km from the western boundary of the proposed lease area. Kori-creek is one of the important drainage that allows the runoff from Great Rann of Kutch to

enter in to the Arabian Sea. Saltpan bunds shall be constructed in a manner that it allows free flow of rain water particularly runoff from the catchment areas. If the runoff is blocked in monsoon it can lead to heavy flooding and inundation/submergence of the area. However, wasteness, flatness and openness of the landscape suggest that the flooding could rarely occur in this region.

4.1.2.11.DISASTER RISKS

It is often observed that communities living in remote and isolated locations do not receive timely and reliable warnings of impending disasters. Due to its connectivity with tidal creeks, it could be subjected to natural disaster such as tsunami, cyclones, heavy flooding, chemical & industrial accidents. Hence, it is necessary to have robust and effective early warning systems, which can play crucial role in saving lives and limiting the extent of damage to assets. Outreach and reliability of warnings are key factors for planning and implementing response measures. Post disaster advisories like information on rescue, relief and other services are important to ensure law, order, and safety of workers. A special study on disaster risk assessment and mitigation is presented in chapter-.

4.1.2.12.OCCUPATIONAL HEALTH AND SAFETY

Hazards associated with salt operations shall occur. These include prolonged exposure to brine solutions, chilling cold leading to hypothermia, lifting and using heavy objects such as pickaxes, shovels, etc., and operating other mechanized equipment could be hazardous.

4.1.2.13.SOCIO-ECONOMIC IMPACTS

Employment generation: M/s. Bhagwati Buildinfra Pvt. Ltd. shall be employing workers from the surrounding villages and localities (Table-4.2). There is also bound to be some additional employment for specialized categories of skilled workers. This shall exert a nominal pressure on amenities available. Cattle grazers belonging to local community shall be given priority for non-technical jobs in the saltwork operations.

Table-4.2: Employment generation from the proposed project activities.

Activity	Employment
Civil Work	50
Salt extraction	150
Administration, Marketing, others	50
Indirect	450
Total Manpower	600

Therefore, it is envisaged that this project shall positively impact on income levels of the local community. The number of people employed shall rise and current levels of unemployment shall reduce. Direct payments (salaries and wages) shall boost local income levels.

Ancillary activities: Ancillary services such as food-vending, sundry hawking, transport and communication shall provide a chance of earning that was hitherto absent. Construction of stalls and related activity shall provide an avenue for local artisans as well to boost their incomes. The pattern of human migration to city centers for lack of local opportunities shall also be slightly reversed.

Taxes & Levies: The operations of salt works shall contribute to an increase in Traditional, District and National revenues through contributions of taxes, royalties, levies and other charges.

Corporate Environment Responsibilities (CER) : M/s. Bhagwati Buildinfra Pvt. Ltd. shall also be obliged to cater for social needs and wellbeing of the communities through its CER funds as per rules and regulations (MoEF&CC OM No: F.No.22-65/2017-IA.III Dated: 1stMay, 2018). Following are broad list of CER activities proposed over a period of time. These activities would be carried out based on priorities and within the budget limits as per applicable rules and regulations.

Health care improvement

- Installation of RO units in village, schools
- Constructing water tanks (community water tanks) in schools and communities.

- Construction of toilets at schools and community centers at the selected village
- Supporting hospitals medicines & equipment
- Organizing quarterly primary healthcare camps for general health checkup
- Organizing annual special healthcare camps for eye, skin, polio etc.
- Providing ambulance facilities/vans to some of the identified hospitals and allow usage of company's ambulance for villagers in case of medical emergency

Improvement of Education & skill development

- Distribution of books and educational stationery Items to school students
- Financial assistance to the deprived students
- Engage with SHG members around project sites to develop alternate source of livelihood opportunities through skill development programs

Improving public infrastructure in villages

- Provide basic infrastructures in the schools
- Installation of solar streetlights in villages
- Installation of RO units in village, schools
- Renovating schools and public complexes
- Renovating aanganwadi centres
- Constructing toilet complexes

Social Welfare activities

- Distribution of dry ration, basic medical kits and relief materials during scarcity/disaster situations

Environmental protection and conservation

- Installation of customized off-grid solar solutions in schools, villages
- Tree plantation and conservation drive around project site
- Rainwater harvesting and construction of check dams to help village around the project site for irrigation and ground water recharge
- Generate environmental awareness amongst local people and school students by organizing awareness camps

4.1.2.14. BORDER SECURITY

Since the proposed lease area is located near India-Pakistan international borders, laborer's and workers sometime tend to loose direction and sometime cross the border. Therefore, appropriate security protocol must be developed in consultation with local police, BSF and defense establishments to avoid any such incidences.

4.2. ENVIRONMENTAL IMPACT MITIGATION PLAN (EMP)

This section proposes an environment mitigation plan during the construction and operational phase of the proposed salt work projects. The environmental mitigation plan is recommended to achieve the following objectives:

4.2.1. OBJECTIVES OF EMP

- To ensure that environment friendly business practices are followed during construction and operational phases to minimize environmental impacts.
- To avoid, or where avoidance is not possible, minimize, mitigate, or compensate for adverse impacts on workers, affected communities and the surroundings.
- To ensure occupational health and safety practices are followed during construction and operation phase.
- To ensure that the pollutant concentration in the workplace does not exceed the stipulated Standards.
- To monitor impacts on the environment and the effectiveness of mitigation measures during operation.
- To ensure that the environmental control systems are adopted at the project site and are operating satisfactorily

Environmental Management Plan, which covers relevant features of Environment, Health and Safety required for salt work project is recommended to be followed during the construction and operational phases of the project (Table-4.3 & Table-4.4).

To operate in an eco-friendly manner, M/s. Bhagwati Buildinfra Pvt. Ltd. shall be committed to mitigating the negative impacts of its operations. The following measures shall be instituted towards ensuring safety of environment ecology and the workers.

Table-4.3: Environmental Management Plan: Construction Phase

S.No.	Key Environmental & Social Issues	Mitigation Measures	Implementation
1.	Blockade of runoff due to construction of embankment or bund for salt pans	• Kori-creek located beyond 3.0 km from the western boundary of the M/s. Bhagwati Buildinfra Pvt. Ltd. lease area is one of the important drainage that allows the runoff from Great Rann of Kutch to enter in to the Arabian Sea. If the runoff is blocked in monsoon it can lead to heavy flooding and inundation/submergence of the area. • Saltpan bunds shall be constructed in a manner that it allows the free flow of water particularly runoff from the catchment areas. • Project proponent has kept more than 800 meters gap between northern and southern parts of the lease, which would allow free flow of runoff. This would ensure no flooding or waterlogging in the region due to blockade of runoff.	Project authorities
2.	High tide & Flooding	• Bunds and embankments shall be constructed in such a way so that unusually high tides cannot cause damage to the bunds of salt work areas. • Ensure proper design of the bunds and drainages so that high-tides and runoff during monsoon shall not cause flooding in the area. • Project proponent has kept more than 800 meters gap between northern and southern parts of the lease, which would allow free flow of runoff. This would ensure no flooding or waterlogging in the region due to blockade of runoff. • In case of flooding ensure human safety through implementation of appropriate disaster management plan.	Project authorities
3.	Sedimentation & safety of mangroves of Kori Creek.	• Though, Kori Creek lies beyond 13 km, project proponent shall ensure that the loose soil and sediments do not travel along the wind and also through runoff during monsoon and block the drainages and damage the mangroves of Kori Creek and other organisms.	Project authorities

S.No.	Key Environmental & Social Issues	Mitigation Measures	Implementation
4.	Safety of Inland mangroves	• There is a natural inland mangrove patch present beyond the study area i.e.,13.0 km from the proposed lease area (at 23°48'24.90"N, 68°48'31.51"E). Though the natural slope is towards North, it is still important that company ensures that no discharge proceeds towards that mangrove patch through small creeks. • The company shall ensure that no direct or indirect harm is caused to this important natural inland mangrove patch as it is one of its kinds in the region and has great ecological and academic significance. • Company must ensure that none of their laborer or employee cut or utilize these mangroves for any of their requirements.	Project authorities
5.	Protection of Wildlife	• There are number of terrestrial wildlife species present in the buffer area of proposed lease areas. • Company shall ensure that no staff members and drivers shall engage in chasing, killing or poaching of any wildlife species present in the surrounding areas. • All the staff members & drivers shall be instructed in advance of their importance and applicable laws and consequences thereof. • All the vehicles and transportation shall be done through public roads, no off-road drives of any vehicle shall be done by company staff and drivers.	Project authorities
6.	Damage to existing roads	• Care should be taken so that the roads are not damaged due to heavy and overloaded vehicles.	Project authorities
7.	Noise & emission by vehicles	• Vehicle used for transportation should be well maintained & approved by concerned statutory authority. • Vehicle used should have valid Pollution Under Control (PUC) certificate	Project authorities

S.No.	Key Environmental & Social Issues	Mitigation Measures	Implementation
		• Un authorize sitting on the vehicle should be restricted/ avoided • Consider factor of Safety for Crane as per standard (this is different for different part of crane). • Overloading should be avoided. • Follow the preventive maintenances practice especially in the Crane. • All vehicle drivers shall be instructed to drive on prescribed roads only	
8.	Damage and disturbance to land environment outside project site	• Restriction on construction activities outside of the project site. • No labor camps shall be established in the natural habitats outside project site • All vehicle drivers shall be instructed to drive on prescribed roads only • Construction waste should be stored, separately disposed off, as per the Construction and Demolition Waste Management Rules, 2016	Project authorities
9.	Storage of construction materials	• Store construction materials in an enclosure so that there are no impacts on surrounding natural habitats • No sedimentation or dust emission shall be created due to storage of construction materials • Construction waste should be stored, separately disposed off, as per the Construction and Demolition Waste Management Rules, 2016	Project authorities
10.	Noise from construction related equipments	• Maintain and service the equipments properly to adhere to applicable noise standards.	Project authorities
11.	Worker safety and	• The project proponent shall comply with all the relevant labour Laws applicable to them,	Project authorities

S.No.	Key Environmental & Social Issues	Mitigation Measures	Implementation
	working conditions	including Laws relating to their employment, health, safety, welfare, immigration and emigration, and shall allow them all their legal rights • Establish and maintain a safe working environment without risk to health at all workplaces, machinery, equipment and processes under the control of the project authority, including control measures for chemical, physical and biological substances and agents • Project authorities shall ensure that adequate facilities and amenities are provided for construction workers, either in leased houses and/or a workers' accommodation camp, including: adequate living/sleeping facilities and space per person; potable water that meets national standards; safety from wild animal attacks; appropriate climatic conditions in the worker accommodation; toilets, washing and cleaning facilities; canteen/mess/food area or fuel for cooking; and facilities for management and disposal of garbage, sewage and other waste. • The project authorities shall periodically review and monitor the condition of the labour accommodations through the construction phase.	
12.	Availability of first aid kit at site	• Ensure the availability of first aid kits and medicine as per requirement under the Factory Act and medicines are not expired.	Project authorities
13.	First aid Training	• Train persons for effective use of first aid facilities in case of any injury	Project authorities
14.	Occupational hazards & safety	• Since some part could be very wet, vehicles and human can get stuck into muck. Ensure that no such accidents take place during construction of bunds etc. • Ensure compliance of all safety and health rules and uses of necessary safety appliances throughout the construction period.	Project authorities
15.	Public health and safety	• Ensure adequate supply of hygienic drinking water to avoid dehydration problem in the open arid landscape. • Advise workers to wear proper caps and head gears so that sun stroke can be avoided.	Project authorities

S.No.	Key Environmental & Social Issues	Mitigation Measures	Implementation
		• Ensure adequate supply of medicine, water and food for workers. • Take proper care during loading and unloading to avoid any mechanical injury • Provide and effective use of necessary safety appliance like, Safety net, Safety belt etc. • Prevent unauthorized personnel from accessing the salt works areas or restricted areas. • Provide the temporary shades at regular intervals in salt works area, so workers can take rest • Keep contact numbers and address of nearby medical services in case of emergency use. • Provide caps, gumboots, sunglasses, tools and clothes to salt workers. • Organize regular health & eye checkup camps for workers • Arrange an ambulance facility (24x7) during construction phase, so that any health criticality could be addressed in time.	
16.	Training and awareness	• Arrange periodical training programmes for salt workers for personal safety and security as well keeping environment clean	Project authorities
17.	Impact on visual resources	• Minimize construction of new roads. and structures with a neutral non-reflective colour, so that they blend with the surroundings.	Project authorities
18.	Border security	• Ensure no workers or staff moves into the unknown areas. They shall be updated with directions and limits of the salt work boundaries. • Company authorities, staff and workers must comply with the protocol set up by the defense establishments for working in this sensitive border area.	Project authorities

Table-4.4:Environmental Management Plan: Operation Phase.

S.No	Environmental Issues	Mitigation Measures	Implementation
1.	Flooding	• Kori-creek located beyond 13.0 km from the western boundary of the lease area is one of the important drainage that allows the runoff from Great Rann of Kutch to enter in to the Arabian Sea. If the runoff is blocked in monsoon it can lead to heavy flooding and inundation or submergence of the area. • Ensure proper management of the bunds and drainages so that high-tides and runoff during monsoon shall not cause flooding in the area. • In case of flooding ensure human safety.	Project authorities
2.	Impingement &Entrainment of marine organisms	• Though, there are low abundance and diversity of benthos and marine macro fauna in the creek waters that reach the edge of the proposed lease, large scale seawater intake from creek area may result in impingement and entrainment of some marine organisms. • Use proper filters, screens at intake points to avoid impingement of marine organisms like fish, crabs, etc.	Project authorities
3.	Leakage of brine & bittern in to surrounding area	• Though there are no mangroves in close vicinity to the project site, concentrated brine or bittern or any other pollutants if leaked, can cause damage to mangroves and the other marine life forms in the Kori creek area in long run. • Project authorities shall ensure that no brine or bittern, garbage, solid waste, oil, grease etc. are allowed to flow in to the surrounding area or in the creeks. • Salt works are designed in such a way so that the bittern storage & evaporation pans are located away from the creek area i.e., in south and south-western side. • Bittern would be supplied to the chemical extraction plant through pipeline, where chemicals such as Bromine would be extracted and residual liquor would be channelized back in to brine	Project authorities

S.No	Environmental Issues	Mitigation Measures	Implementation
		reservoirs. This would ensure zero liquid discharge from the process.	
4.	Noise pollution	• Proper maintenance of equipments such as pumps and heavy vehicles etc. shall be ensured.	Project authorities
5.	Land pollution	• Zero discharge of oil and grease from the DG sets or vehicles or any components shall be ensured throughout the operation life. Project authorities shall make an agreement with GPCB registered Oil & Grease Recyclers so that safe discharge of oil & grease is ensured from pumping station, vehicles, electric appliances etc. • Solid waste disposal system shall be in place as per Solid Waste Management rule 2016. Segregation of waste at source shall be carried out before appropriate disposal. • Construction and demolition waste should be stored separately and disposed off as per the Construction and Demolition Waste Management Rules, 2016. • STP of 4-5 KLD shall be installed at the site for treating sewage and domestic waste water. Treated water from STP should be used for stabilizing embankments through raising salt tolerant grasses and herbs.	Project authorities
6.	Traffic and safety	• Enforce traffic control measures including speed limits during loading and transportation of salt from the site. Also ensure safe driving on salt pan bunds.	Project authorities
7.	Training & Awareness	• Train persons for effective use of first aid facilities in case of any injury	Project authorities
8.	Occupational Health & Safety	• Since some part could be very wet, vehicles and human can get stuck into muck. Ensure that no such accidents take place during maintenance of roads and bunds etc. • Ensure compliance of all safety and health rules and uses of necessary safety appliances throughout the construction period.	Project authorities

S.No	Environmental Issues	Mitigation Measures	Implementation
9.	Public health and safety	• Ensure adequate supply of hygienic drinking water to avoid dehydration problem in the open arid landscape. • Advise workers to wear proper caps and head gears so that sun stroke can be avoided. • Ensure adequate supply of medicine, water and food for workers. • Take proper care during loading and unloading to avoid any mechanical injury • Provide and effective use of necessary safety appliance like, Safety net, Safety belt etc. • Prevent unauthorized personnel from accessing the salt works areas or restricted areas. • Provide the temporary shades at regular intervals in salt works area, so workers can take rest • Keep contact numbers and address of nearby medical services in case of emergency use. • Provide caps, gumboots, sunglasses, tools and clothes to salt workers. • Organize regular health & eye checkup camps for workers	Project authorities
10.	EHS assessment	• Project authorities should periodically evaluate and assess the EHS functions.	Project authorities
11.	Border security	• Ensure no workers or staff moves into the unknown areas. They shall be updated with directions and limits of the salt work boundaries. • Company must comply with the protocol set up by the defense establishments. • Company shall maintain the bunds and approach roads properly so that during any inspection by forest department or defense staff it is convenient to them.	Project authorities

4.2.2. MITIGATION OF CONSTRUCTIONAL PHASE IMPACTS:

Even though this phase shall be short and localized to a large extent, it is proposed that the management shall effectively and efficiently carry out meditative efforts.

4.2.2.1. MARINE ECOLOGY IMPACTS

Though, as mentioned earlier, the proposed salt lease areas are not falling on the coast of sea. The Arabian sea lies at 45 km south-west direction from the proposed lease areas. These lease areas fall in CRZ-IB & III as per classification. These areas do not fall close to or within any important marine habitats such as mangroves, coral reefs, sand dunes, Seaturtle nesting sites or biologically active intertidal mudflats etc. Therefore, the chances of salt work activities affecting marine environment and ecology is very little. However, there are few concerns which proponents shall take utmost care are mentioned below.

- Ensure that the loose soil and sediments do not travel along the tidal water back to the creeks and block the drainages and damage the mangroves of Kori Creek and other organisms.
- There is a natural inland mangrove patch present in the close proximity of the proposed lease area (at 23°48'24.90"N, 68°48'31.51"E). It is observed that the natural slope is towards North. However, it is still important that company ensures that no discharge proceeds towards that mangrove patch through small creek.
- The company shall also ensure that no direct or indirect harm is caused to this important natural inland mangrove patch as it is one of its kinds in the region and has great ecological and academic significance.
- Company must ensure that none of their laborer or employee cut or utilize these mangroves for any or their requirements.

4.2.2.2. TERRESTRIAL ECOLOGICAL IMPACTS:

MITIGATION MEASURES FOR FLORA

There is a natural inland mangrove patch present in the close proximity of the proposed lease area (at 23°48'24.90"N, 68°48'31.51"E). The species of mangrove present in this patch is *Avicennia marina*. It is observed that the natural slope is towards North. However, it is still important that company ensures that no discharge proceeds towards that mangrove patch through small creek. The company shall also ensure that no direct or indirect harm is caused to this important natural inland mangrove patch as it is one of its kinds in the region and has great ecological and academic significance.

Company must ensure that none of their laborer or employee cut or utilize these mangroves or any natural vegetation for any or their requirements. Apart from above mentioned sensitive species, most of the plant species present in arid condition has dependent fauna. Therefore, taking utmost care for all type of vegetation shall be the approach by the company. Moreover, since the habitat outside core area i.e., in buffer area is likely to support some of the important flora species company should take utmost precautions not to degrade these areas by constructing temporary roads, dumping materials, solid wastes, garbage or any other form of material in to the surroundings.

MITIGATION MEASURES FOR FAUNA

Reptiles: It is recommended that prior to construction of approach roads in new areas; company should ensure safe rehabilitation of such this species. The rehabilitation shall not be done in winter as this species is cold blooded and hibernate during winter. Local biologist or trackers can be consulted in rehabilitating these individuals from their holes. Taking care of water pollution and safe handling, storage and transportation of salt and bittern discharges shall take care of Indian Flap Shell Turtle.

Migratory birds: It is suggested that company shall ensure that none of their staff disturbs, harms or hunt the migratory and local resident waterbirds when they operationalize this saltpans.

Mammals: It is recommended that company shall comply with all the pollution control and other conditions imposed by the forest department. Compliance of all the conditions imposed in forest NOC would take care of majority of the issue of wildlife conservation in the buffer and core area. The impact on these species cannot be evident in short term, but can take long time. Therefore, the status of some of the species of higher conservation significance needs to be assessed on regular bases in order to evaluate cumulative impacts leading to any changes in their population and status in the buffer area. Company shall regularly assess the status of species of conservation significance in the buffer area. The details of each of the mammal species are described as follow.

Apart from pollution control measures, it is also important to carefully plan saltpan bunds. Some of the terrestrial mammals may utilize saltpan bunds for making their dens, hiding and resting during the day time. The animals such as Indian Jackal, Indian Fox, Desert Fox etc. may in future utilize the saltpan bunds. The direct disturbance to these species by vehicle traffic, human intrusion in wildlife habitat may be the issue of some concern. However, since the saltwork lease area has different characteristics than their natural habitats, it is less likely to affect these mammals

Chinkara (*Gazella bennettii*): Indian gazelle is a shy animal and avoids human habitation. It stands at 65 centimeters and weighs about 23 kilograms. It can go without water for long periods and can get sufficient fluids from plants and dew. Although most individuals are seen alone, they can sometimes be spotted in groups of up to four animals. It lives in grasslands and desert areas in India. Its population is on the decline due to it being hunted for game. Narayan Sarovar Wildlife Sanctuary is known for Chinkara population. The sanctuary is also known as Narayan Sarovar Chinkara Sanctuary. The species is common in landscape of Kutch and North Gujarat. The species is listed as Schedule-I in Wildlife Protection Act 1972 and as Least Concerned by IUCN. The species needs safe, undisturbed arid semi-arid plains.

This species is likely to be present in the buffer area. However, its food and habitat requirements are not found in the proposed lease area, therefore the saltworks is less likely to directly affect the chinkara population in the region. However, all the

precautions in terms of dusting, disturbance by vehicle and human presence needs to be taken so that the species is not disturbed which is commonly observed in the immediate periphery of the proposed lease area.

4.2.2.3. VEHICULAR TRAFFIC IMPACT

Road signs indicating entry points, turning points and access points shall be erected. Movement of heavy machinery shall be monitored and piloted around the site.

Speed limit of 30km/h shall be enforced on all vehicles and 5-10km/h for mobile equipment on the site, and those entering and leaving the site. Caution signs to drive with care shall be installed at strategic points of the road.

However, the location of the site in vast open area makes vehicular noises have negligible effect on surrounding environment and people.

4.2.2.4. AIR AND NOISE POLLUTION

Water shall be sprayed regularly on access and temporary roads to dampen the carrying of dust. Plant and equipment using fuels and vehicles shall be periodically serviced to reduce emissions of fumes and exhaust. Workers at vulnerable spots like Heavy earth moving equipments working area and other construction areas shall be supplied with nose-masks.

Due to the remoteness of the site, it is not anticipated that noise shall permeate to nearby human settlements. Workers shall be provided with earmuffs, and noise-reducing devices shall be fitted to plant machineries.

4.2.2.5. LAND DEGRADATION

Drains shall be provided to channel run-off of rain water. Rann of Kutch area with natural saltpans would be converted into commercial saltworks in the lease area. Surrounding area of the saltworks shall not be degraded by the project activities such as transportation, spilling of construction raw materials, salt, bittern, chemicals, oil, grease, or solid waste. Appropriate air, water and solid waste pollution management shall be in place as described above.

4.2.2.6. SOLID AND LIQUID WASTE GENERATION:

Waste soil, rock and other debris shall be utilized to fill other places within the site. A lot of material shall also be required for construction of buildings and filling the access roads to be constructed. Branches, stumps and other pieces of wood shall be carted off to approve dumpsites.

Liquid waste (mainly sewage) generated during the constructional phase shall be managed by installing a 4-5 KLD sewage treatment plant at appropriate place.

Oil spillages and other liquid waste shall be identified and collected in the drums to prevent seepage into undesired areas or the water bodies and the environment at large. This shall help in removing the potential threat to aquatic life as well.

4.2.2.7. OCCUPATIONAL HEALTH AND SAFETY

First aid facilities shall be provided on site to take care of minor accidents and injuries. Situations requiring more medical attention shall be referred to medical clinics either at nearby areas with necessary facilities or to Bhuj the nearest city.

Workers and personnel shall be provided with safety goggles, helmets, safety boots and nose masks as and when required. The wearing of this apparel shall be strictly enforced to forestall mishaps. Lifting machinery such as forklifts and cranes shall be provided.

4.2.2.8. SOCIO-ECONOMIC IMPACT

It is anticipated that the surrounding locales shall benefit from the project. As far as possible, labour shall be sought from the nearby towns and settlements. There is enough land surrounding the proposed area to graze the cattle. This shall have no effect on existing facilities and or amenities. The employment opportunity to 600 individuals shall provide boost to economic activity and raise income levels of local people.

4.2.3. MEASURES TO MITIGATE OPERATIONAL PHASE IMPACTS

4.2.3.1. MARINE ECOLOGY IMPACT MITIGATION

Impingement and entrainment: Proponent shall design intake pump system by engaging experts in the field. The intake system shall have bio filters and screens to avoid impingement of marine macro fauna such as fish and other large organisms. Intake systems shall be maintained on regular basis to avoid clogging of screens and barrier nets etc.

Leakage of brine & bittern in to surrounding area: Company shall ensure that the crystallizer and bitten evaporation ponds are located away from the Kori Creek system so that the brine & bittern do not flow into the creek systems. The bittern shall be used completely or sold to vendors who utilize it to extract precious marine chemicals out of it.

Damage to Inland Mangrove: Company shall inform all their staff and workers not to disturb natural inland mangrove patch located west of lease area. Workers shall not step into nearby area where natural mangrove occurs. No huts or settlements shall be made by any of the workers near the natural inland mangrove patch. It is also important that company ensures that no discharge proceeds towards that mangrove patch through small creek.

4.2.3.2. NOISE POLLUTION

As mentioned earlier in the report, noise pollution shall be from the pumps, generators, when in use, washery and other machinery.

Wherever possible, noise-reducing devices like air tight enclosures shall be fixed on machinery. Workers at particular locations shall be provided with ear muffs to lessen the impact from noise pollution. Vehicles and machinery shall be regularly serviced to ensure efficient performance and lower noise generation.

4.2.3.3. VEHICULAR TRAFFIC IMPACTS

To control the flow of traffic and reduce the potential for accidents, warning signs for regulating speeds, one-way lanes, indicating turning points for vehicles and earth

moving equipment, marking parking and stopping zones, speed bumps and rumble strips shall be erected in the project area as well as in approaches and junctions. Single-lane roads shall be manned at both ends regulating the entry of vehicles on such roads. Signs instructing drivers to reduce speed as they enter the Bhuj-Lakhpat Highway road shall be put up. Random checks shall be conducted to ensure follow-up of these rules. Heavy vehicles and articulator trucks shall be made to install rooftop-revolving lights of a brilliant colour.

4.2.3.4. AIR POLLUTION

Most of the air pollution would be due to dust arising from the constant movements of the vehicles on mud roads. Majority of roads connecting project site from highway are already tarred and asphalted. All routes, which are untarred, shall be sprayed with water twice a day to minimize rising of dust and air pollution. Workers exposed to the risks of inhaling dusty air shall be provided with dust or nose masks.

4.2.3.5. SOLID AND LIQUID WASTE GENERATION

Office and domestic wastes and discarded packaging materials are expected to be the major solid waste. Waste bins shall be placed at common activity points to enable collection of such waste. STP of 3-4 KLD shall take care of liquid waste from sewage and effluents. Treated waste water could be used for stabilizing bunds or spraying on roads to suppress dust emissions due to vehicular traffic.

Arrangements shall be made with local bodies for regular collection of such waste and for dislodging of STP slurry for final conveyance to designated dump and collection sites.

4.2.3.6. VISUAL AND AESTHETIC IMPACTS

Similar to the constructional phase, pedestrians, motorists and inhabitants shall be treated to the sight of heaps of salt, ponds of water and other equipment. They shall also be impacted by scores of workers walking around the site (carrying out their duties).

The company proposes to create barriers of trees, grass and shrubs and screen the site away passers-by. Short, leafy trees such as the stunted neem shall be planted to achieve this goal.

4.2.3.7. ECOLOGICAL IMPACTS

The impact during operation phase on flora and fauna and the overall ecology of the area is same as impacts during construction phase as discussed in section 5.1.1. In case of salt operation closure, the area will be reclaimed to maintain the pre-operational environment.

4.2.3.8. SOCIO-ECONOMIC IMPACTS

The proposed site has no cemeteries, sacred groves or any unique cultural practice that shall be impacted by the project. On the other hand, the project shall open new opportunities for direct and indirect employment, vocation and income earning ventures for the local populace. The surrounding village population may also benefit from employment opportunities for the youth and food and sundry businesses shall flourish. Income levels shall rise and lead to improved living standards and more disposable income. Economic activity shall also increase in the region.

The District Assembly shall have greater inflow of revenue and taxes and in turn be able to increase their outlays and provide more developments to the area. The national economy would also benefit from the foreign exchange earnings of exports, taxes, duties and levies.

Proponent shall contribute to the Corporate Social Responsibility fund towards increasing amenities beneficial to the local community such as provision of social infrastructure such as water for human and livestock, repairing and creation of roads, improving school infrastructure, plantation of trees of higher economic values etc.

4.2.3.9. OCCUPATIONAL HEALTH AND SAFETY

Prolonged exposure to strong brine solutions is hazardous to the skin of the workers. To mitigate this, workers shall be rotated from one section of the ponds to another sections every month. The company shall provide boots, gloves and other safety

equipment. The usage of these equipment shall be strictly enforced. Adequate and hygienic sanitary facilities shall be provided. Washrooms shall also be built to enable workers to thoroughly rinse themselves after close of work.

Changing rooms, clothes washing facilities and potable water shall also be provided at the site. First Aid shall be at hand all times, and it is envisaged that a qualified nurse be in attendance during peak working hours.

Where it is necessary, medical facilities of doctors and nearby hospitals shall be sought. Workers at sensitive areas shall be provided with earmuffs, nose masks and goggles. A specific goggles/spectacles (UV filtered / photochromatic /anti-glare) shall be provided to all workers who are likely to get longer exposure of sun and salt in the project area. The type of glasses shall be finalized in consultation with ophthalmologists. Eye check-up of the workers shall be carried out at a regular intervals (preferably at every 6 months). It is also important that the company shall maintain the bunds and approach roads properly so that during any inspection by forest department or defense staff it is convenient to them.

Proponent shall be committed to the well-being of its workers in all aspects.

4.2.3.10. BITTERN MANAGEMENT

Total of 5100000 M^3 bittern would be generated per annum at the project site. Proponents shall design the bittern utilization system in such a manner that it will not harm the surrounding environment. The bittern produced during the salt making process will be pumped to total 6 bittern collection ponds of area approx. 103 ha. totaling approx. 618 ha. The bittern shall be kept to settle and evaporate. After increasing its concentration, bitter shall be sent to Bromine recovery plant to be located at the south-western corner of the lease area. The last pond where bittern is collected could produce gypsum. The gypsum produced in the bittern pond would be extracted as and when required. The gypsum has considerable demand in various industries including cement industry.

Therefore, bittern being precious resource for extraction of several marine chemicals, it would not be released back in to the brine reservoir or in the surrounding environ. Almost all the quantity of bittern produced during salt extraction

process would be utilized completely for extraction of the chemicals. Any liquor produced after extraction of chemicals in the plant, it would be canalized back to reservoir ponds or condenser ponds.

4.2.3.11. CONDITIONS AT INTAKE POINT

M/s. Bhagwati Buildinfra Pvt. Ltd. shall take all precautionary measures to mitigate the negative impacts at intake area. Pump house noise shall be mitigated by providing tight enclosure around the structure. The pumps shall be maintained periodically for smooth running without much noise.

4.2.3.12. POTENTIAL FLOODING

The identified impacts of flooding are mainly due to seawater and heavy rain. The large distance between the site and seashore as well as substantial gap between two sections of saltworks may eliminate the potential threat of seawater flooding in the region. However, even if it occurs, company shall ensure all safety measures for the workers and staff.

CHAPTER- 5
ANALYSIS OF ALTERNATIVES

5.1 SITE ALTERNATIVES

The alternatives analysis plays a key role for evaluation of the proposed site and technologies to avoid or minimize environmental impacts of proposed project. M/s. Bhagwati Buildinfra Pvt. Ltd. proposed produce 5.0 Metric Million Tonnes of Industrial salt for export as well as for Indian market together with 5100000 M^3 of bittern per annum for extraction of marine chemical such as Bromine. For such a large quantity of production of industrial salt, the raw material brine is available in the Greater Rann of Kutch. Therefore, M/s. Bhagwati Buildinfra Pvt. Ltd. has acquired the proposed salt work lease area in the Western Kutch region particularly the Greater Rann of Kutch.

The proposed lease area is located in unsurveyed land of Rann of Kutch north of Sayra, Mudhan and Zara villages, in Lakhpat Taluka of Kutch District of Gujarat (Map-2.1; 2.2; 2.3). This region has great potential for salt production due to following factors.

- Semi-Arid, dry climate
- Closeness to sea water/creek,
- Suitable soil condition
- Availability of vast land
- Scanty rainfall/ Rainshadow region
- No human settlements
- No forest or Protected Areas
- High temperature and ample sunlight
- High wind velocity

The Rann of Kutch, particularly unsurveyed land falling western part of Great Rann of Kutch is ideal salt production zone. Lakhs of tones of salt is produced naturally in this region and it gets washed away every year. Such high potential salt production land remains unutilized in the region. If utilized optimally, this land could provide great opportunities for economic developments in the region.

Since land for proposed unit is adequate so, there is no need to analyze any alternate site for expansion.

5.2 ALTERNATIVES TECHNOLOGIES

There is simple and standard and proven method for salt extraction/ production from marine brine water being practiced in Gujarat and Indian coast. Therefore, no alternate technology for production of salt is sought or required, hence no alternative technology has been analysed. Thus, no new or untested technology will be used and will be based on Zero liquid Discharge.

CHAPTER- 6
ENVIRONMENTAL MONITORING PLAN

6.1 PREAMBLE

The post construction or operational phase environmental monitoring program serves as the key tool to keep track on performance of mitigation measures implemented & pollution control technologies installed to prevent impacts associated with various operations of the project. Environmental monitoring will be undertaken primarily to determine the environmental effects of human activities, and secondarily to increase understanding of cause-effect relationships between human activity and environmental change. Thus, environmental monitoring is the effective observation of site conditions and work activities; and identification of potential non-compliance situations and initiation of corrective or remedial actions. Monitoring is as important as that of control of pollution, since the efficiency of control measures can only be determined by monitoring. Based on the findings of the Environmental Impact Assessment study, various mitigation measures have been proposed, which have been detailed out in Environmental Management Plan (EMP). In order to monitor the impacts and efficacy of these plans monitoring of various environmental attributes have been proposed during and after the construction phase of the project. A well-defined environmental monitoring programme would be employed with trained and qualified staff of Environmental Management Cell of the proposed project to monitor the environmental attributes of the area with respect to EMP as well as the guidelines of the GPCB/CPCB. Environmental monitoring schedule proposed to be adopted by the project.

6.2 MONITORING OF ENVIRONMENT

From the monitoring point of view, the important components are air, water, soil and noise. Unit will carry out regular monitoring by NABL/MOEF approved laboratory. Regular monitoring of all significant environmental parameters is essential to check the compliance status vis-à-vis the environmental laws and regulation. A comprehensive environmental monitoring program prepared for the purpose of implementation in the proposed unit by the EMC is described below Table 6.1.

The objective of the monitoring will be as follows.

- To verify the results of the impact assessment study with respect to the proposed project.
- To study the trend of concentration values of the parameters, which have been, identified as critical and planning the mitigate measures.
- To check and assess the efficacy of pollution control equipment.
- To implement the EMP, a structured Environment Management Cell (EMC) interwoven with the management system will be created.
- EMC will undertake regular monitoring of the proposed pollution control system and conduct yearly audit of the environmental performance of the system. It will also check that the stipulated measures are being satisfactory implemented and operated.

All the above observations will be complied and documented by the EMC to serve the following purposes.

- Identification of any environmental problems that are occurring in the lease area.
- Initiating or providing solution to those problems through designed channels and verification of the implementation status
- Controlling activities inside the lease are, until the environmental problem has been corrected.
- Suitably responds to emergency situations

The industry will engage recognized laboratories to carry out all necessary monitoring parameters. Qualified staff has been appointed for the purpose of Operation and maintenance of the pollution control facilities. Stand-by facilities are provided to all the facilities so as to ensure fail proof treatment.

Table 6.1: Environmental Monitoring Plan

S. No.	Aspect	Source of Impact	Monitoring Method and it's Parameters	Frequency	Executing Agency	Monitoring Agency
1.0	**Construction Phase: Since the construction would involve only creation of earthen bunds for storage of sea water and its evaporations, hence the anticipated impacts are low.**					
1.1	Local Manpower Absorption	Construction Work	Contractor's report No. of people working in the project	Daily	Contractor	Bhagwati Buildinfra Pvt. Ltd.
1.2	Air Quality	transportation vehicles & construction materials	Survey & observations; Levels of SPM, RSPM, SO_2 and NOx	Weekly	Bhagwati Buildinfra Pvt. Ltd.	Bhagwati Buildinfra Pvt. Ltd.
1.3	Public Health (salt worker's health and staff)	Constant exposure of salt to skin, working in high solar irradiation could result in health issues related to eye, skin, heat stock	Regular medical checkup (skin, eye, kidney and general health checkup of salt worker and staff members present at site	Monthly (construction & operational phase)	Bhagwati Buildinfra Pvt. Ltd.	Bhagwati Buildinfra Pvt. Ltd.
2.0	**Operation Phase: Since the construction would involve only creation of earthen bunds for storage of sea water and its evaporations, hence the anticipated impacts are low**					
2.1	Water Quality & Quantity	Surface & Ground water quality within the buffer Area	Surveys, sample collection & field measurement; check for bittern spillage	Quarterly	Bhagwati Buildinfra Pvt. Ltd.	GCZMA/ Recognized Env. Agency
2.2	Treated Water Quality	Treated water will be used for stabilizing roads and bunds	STP sample collection & quality analysis	Quarterly (Third Party)	Bhagwati Buildinfra Pvt. Ltd.	GCZMA/ Recognized Env. Agency
2.3	Air Quality	Emissions from utility	Air quality monitoring at 2-3 location within (SPM,	Ambient - Quarterly (24	Bhagwati Buildinfra Pvt.	GCZMA/ Recognized Env. Agency

			RSPM,).	hourly-by Third Party)	Ltd.	
2.4	Noise Level	Noise level compliance with respect to industrial standards	Ambient Equivalent Sound Pressure Levels (Leq) in day and Night time at 4 to 6 location.	Ambient - Quarterly (24 hourly-by Third Party)	Bhagwati Buildinfra Pvt. Ltd.	GCZMA/ Recognized Env. Agency
2.5	Biological Environment	Status of ecology & biodiversity (inland mangrove, Kori creek mangrove, terrestrial flora and fauna, vegetation in reserve forests)	Species richness and abundance of flora and fauna between Oct-Dec,	At every 2 years	Bhagwati Buildinfra Pvt. Ltd.	GCZMA/ Recognized Env. Agency
2.6	Solid Waste Management	Disposal of waste	Monitoring of waste collection, segregation and disposal	Fortnightly	Bhagwati Buildinfra Pvt. Ltd.	GCZMA/ Recognized Env. Agency
2.7	Hazardous Waste Management	Hazardous waste as required by hazardous waste authorization	Monitoring of bittern for its zero discharge or spillage in to the surrounding area, ensure its segregation, storage, use for bromine, reuse residual liquor in to the salt production cycle	Fortnightly	Bhagwati Buildinfra Pvt. Ltd.	GCZMA/ Recognized Env. Agency
		Generation of used drums, bags and records of their dispatch to approved vendors.	Maintain Records	Daily	Bhagwati Buildinfra Pvt. Ltd.	GCZMA/ Recognized Env. Agency
		Generation of waste oil and their treatment	Maintain Records	Daily	Bhagwati Buildinfra Pvt. Ltd.	GCZMA/ Recognized Env. Agency

CHAPTER- 7

ADDITIONAL STUDYIES- DISASTER RISK ASSESSMENT & MITIGATION PLAN

India is a disaster-prone country. Its sub-tropical location, long coast line and seismic geology makes it vulnerable to major natural hazards like earthquakes, cyclone, flood and draught. It is estimated that 85% of India is prone to sub-natural disaster and estimated 57% of India is vulnerable to earthquake. India is one of the four most quake prone areas in the world. Every year at least four cyclones of varying intensity hit parts of India's 6000 km long coast line. Every year more than 50 million Indians are affected and some 5000 die in natural disasters. In view of its susceptibility, any projects located particularly on the coast requires an appropriate Disaster Management Plan (DMP).

7.1. DISASTER RISK ASSESSMENT & MITIGATIO PLAN OBJECTIVES

The basic objective of Disaster Management Plan for M/s. Bhagwati Buildinfra Pvt. Ltd. salt works is to minimize the impact of disaster on human lives and property, relief to those affected and restoration of normalcy at the earliest of action. This objective can be achieved by undertaking the following course

1. Improving preparedness at the project site level through risk and vulnerability analysis.
2. Ascertaining the status of existing resources and facilities available with various Government departments, Police, Fire, Port, Municipal Council, Panchayat, Private Sectors, NGOs and Community for management of disaster, for deployment of resources in disaster situation and to face disaster in most effective way.
3. Documentation of disasters in the project with a view to compile critical information and develop insight into management of disasters and evolve future strategies.

4. To protect life and property and to ensure mitigation of disaster to the maximum extent possible with relief to those affected and restoration of normalcy to the earliest.

7.2. DISASTER RISKS ANALYSIS:

We carried out disaster vulnerability analysis for the proposed project in view of its location and proposed activities (Table-7.1). The location and the type of activities of the proposed project make it vulnerable to various types of natural and manmade disasters which are mentioned below.

- Close to Arabian Sea through Kori Creek, (influenced by Flood/hightide/runoff)
- Rann of Kutch (influenced by wind/high temperature/drought)

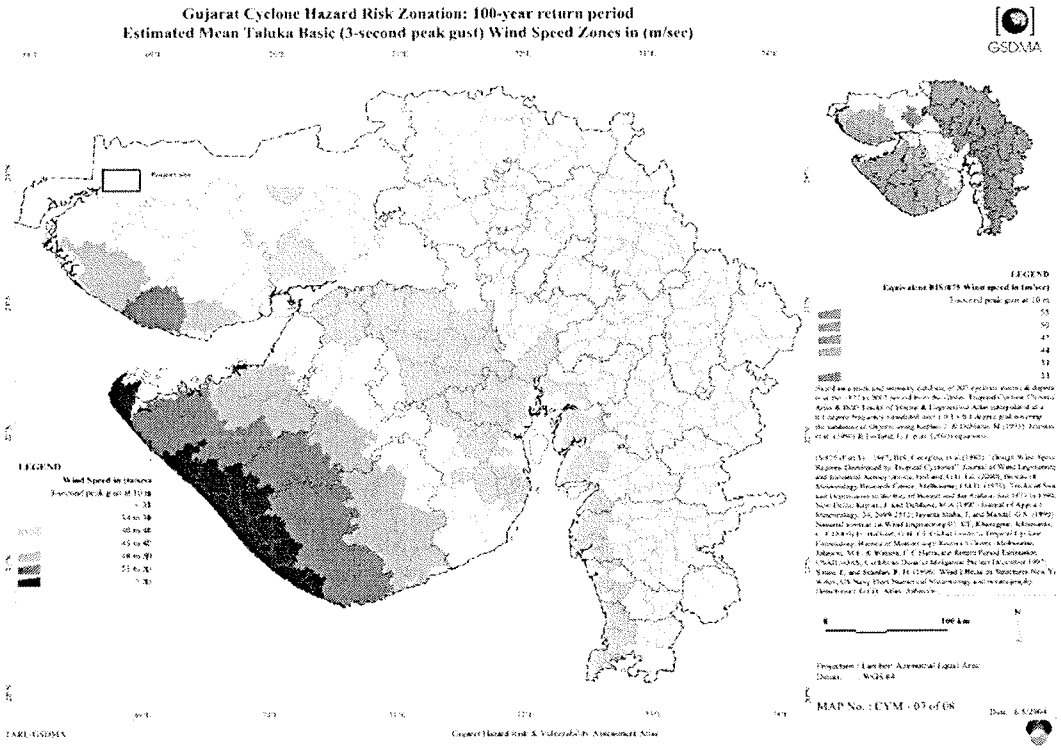
The natural disaster such as Earthquakes, Cyclones, Flash floods, Tsunami, Man-made disasters like fire and occupational hazards, accidents likely to be common in large scale remote saltpan operations. The social and economic losses on account of disaster are often immeasurable. Usually, the worst affected people are the poor and marginalized. Human suffering and misery as well as material losses from a large number of natural disasters can be mitigated significantly by taking adequate preventive actions and timely post disaster response.

7.3. NATURAL DISASTERS

7.3.1. CYCLONE RISK AND MITIGATION PLAN

Cyclone Risk: Cyclones are associated with strong winds, torrential rains and storm surges (abrupt rise of sea level at the time storm crossing the coast). Storm surges is the most destructive phenomena associated with a cyclone. Gujarat/Kutch cost is prone to cyclones (Map-7.1). There is significant increase in the frequency of cyclones hitting Gujarat coast after year 2000 (IMD website). Due to these low-lying areas along the coast will be inundated by the sea water which can result in the loss of human lies in large unless the people are evacuated from those areas.

Map-7.1: Cyclone hazrd risk zones of Gujarat



Source: Gujarat State Disaster Management Authority http://www.gsdma.org/

Cyclone Mitigation Plan: A cyclone is a storm accompanied by high-speed whistling and howling winds. It brings torrential rains. Cyclonic storms often develop over Arabian ocean. Its strong winds blow at great speed. When a cyclonic storm approaches, the skies begin to darken accompanied by lightning and thunder and a continuous downpour of rain.

Safety activity to be performed before and during cyclone

- Install sirens & emergency warning systems
- Evacuate manpower in the event of cyclone
- All structures shall be made cyclone proof
- Have your dwellings checked before a cyclone season starts and carry out whatever repairs that are needed.
- Create storm awareness by discussing effects of a cyclonic storm with members so that everyone knows what one can and should do in an emergency. This helps to remove fear and anxiety and prepares everyone to respond to emergencies quickly.

Table-7.1: Risk Assessment and Vulnerability Analysis & Mitigation Measures

Category	Disaster	Reason	Risk Duration	Risk Level	Mitigation
Natural Disaster	Cyclone	• Gujarat/Kutch cost is prone to cyclones • There is significant increase in the frequency of cyclones hitting Gujarat coast after year 2000 (IMD website).	Pre-monsoon & Monsoon	Medium	• Install sirens & emergency warning systems • Evacuate manpower in the event of cyclone • All structures shall be made cyclone proof
	Flood	• Lies near Kori creek, Equinox tides/ high tides along heavy rain may cause flooding in the area. • Rainwater from large catchment area of Rann of Kutch drains into Arabian sea through Kori creek and Sir creek area.	Monsoon	Medium	• Ensure timely evacuation of people in the event of flooding • Create & maintain effective storm water & natural drainage systems around project site
	Drought	• Lies in Rann of Kutch with generally scanty rainfall area	Summer	Low	• Ensure required potable water in summer for workers
	Earthquake	• Kutch region falls in Seismic Zone-V,	Any time	High	• Quick response & evacuation system shall be in place. • Ensure earthquake proof structures
	Tsunami	• Kutch region falls in Seismic Zone-V,	Any time	Low	• Ensure evacuation of people to safer locations • Be aware of national and local news through radio and television • Keep telephone numbers of various Emergency response teams i.e., Gujarat State Disaster Management Authority (GSDMA) and District Kutch Disaster Management plan (Disaster Management | District Kachchh, Government of Gujarat | India).

Man Made Disaster	Fire	Stored fuel for DG sets & vehicles	Any time	Low	• Evacuation of people to safe places in the event of fire • Ensure safe storage of fuel, • Install sufficient fire extinguishers near fuel stores
	War situation	Proximity of international border	Any time	Very low	• Evacuation of manpower from the site. • Obey defines instructions in the event of war or border tension
	Occupational Hazards	Accidents, extreme temperature, difficult working condition, solar radiation,	Any time	Medium	• Train workers to work safely in the extreme climatic conditions
	Health Issues	Lack of basic health facilities, Harsh weather conditions of desert (50° C to 4° C), Lack of protective gear, Malnutrition, lack of vegetables and fruits in the diet, Prolonged exposure to salt, Prolonged exposure to brine	Any time	High	• Train workers to work safely in the extreme climatic conditions • Provide PPE to workers • Carryout health check-ups every 2-3 months • Provide health care facilities and emergency van for workers

- Keep your valuables and documents in containers, which cannot be damaged by water.
- Keep trees and shrubs trimmed site access road. Remove damaged and decayed parts of trees to make them resist wind and reduce the potential for damage. Cut weak branches and make winds blow through.
- All doors, windows and openings should be secured.
- Continue to listen to warning bulletins and keep in touch with local officials. Keep radio sets in working condition. Battery powered radio sets are desirable.
- Evacuate people to places of safety when advised.
- Store extra drinking water & food in covered vessels.

Activities which should not be done during cyclone

- During the storm do not venture out unless advised to evacuate.
- If you have a vehicle and wish to move out, leave early before the onset of a cyclone.
- Avoid remaining on the top floor of dwellings. Stay close to the ground.
- Avoid taking shelters near damaged buildings or near trees.
- Do not touch power lines. One may get electrocuted.

Activities which are recommended to do after storm/ Cyclone

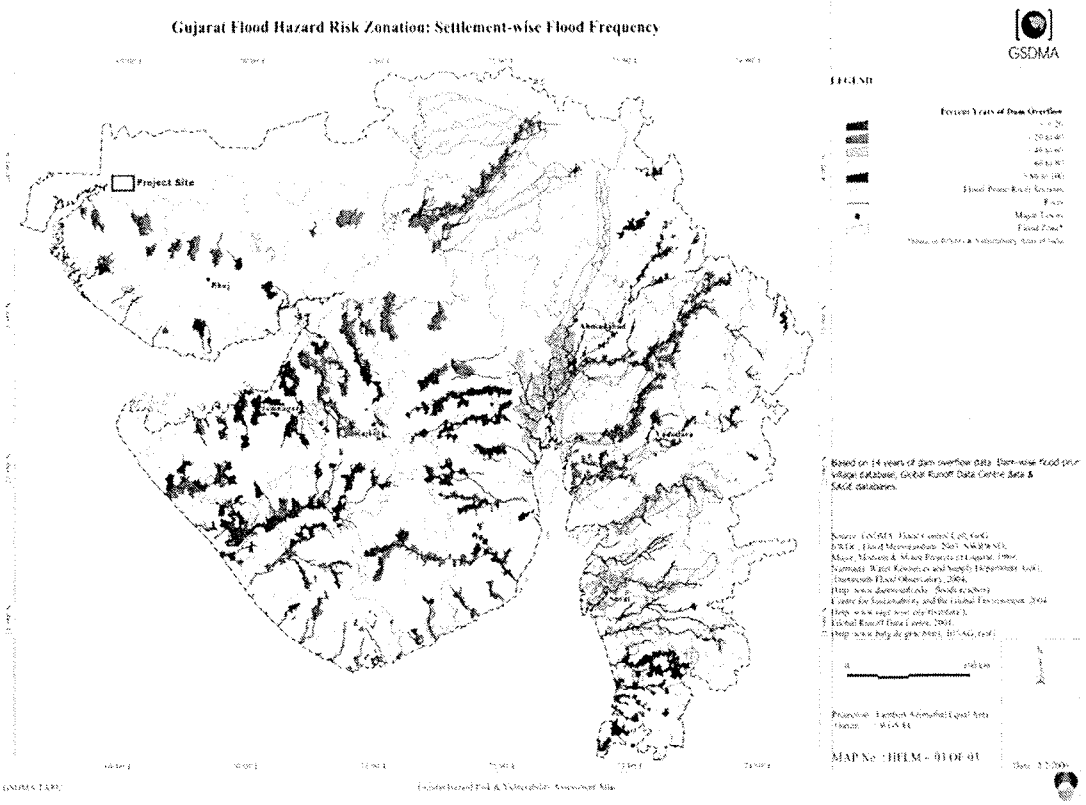
- Watch out for broken glass and other sharp items in debris.
- Watch out for snakes and insects. Try to call for help.
- Listen to the advice of local officials and emergency workers.
- Be sure that the storm has subsided before venturing out.
- It is advisable to wait for the "all clear message" on radio and TV networks.
- Wait for emergency relief teams to arrive. It may take a little time before relief becomes effective.
- Stay away from flooded areas.

7.3.2. FLOOD RISK AND MITIGATION PLAN

Flood Risk: The most floods can arise from abnormally high precipitation, storm surges from tropical storms. Besides the problem of flooding in the Kori creek basins, heavy intensity rains could cause local flooding in certain areas where the drainage is either naturally poor or the drains are choked due to various reasons such as siltation in the drains and lack of maintenance.

Health problems related to flood can be either due to direct impact on human population such as drowning and in direct impact on existing health infrastructure resulting into defective functioning of the available facilities i.e., water supply power supply and sanitation facilities forcing the people to consume unsafe water and stay in in sanitary conditions, leading to water borne disease.

Map- 7.2: Flood Mitigation Plan for Gujarat.



Source: Gujarat State Disaster Management Authority http://www.gsdma.org/

Heavy rains and floods bring heavy damages to the site facilities and the affected population is exposed to adverse climatic condition leading to disease particularly respiratory infection and fever.

Flood Mitigation Plan: Safety activity to be performed before and during floods

- Ensure timely evacuation of people in the event of flooding
- Create & maintain effective storm water & natural drainage systems around project site
- Keep your valuables and documents in containers, which cannot be damaged by water.
- Keep torches and spare batteries. These must be kept in secure places and handy.
- Make plans for people who are either sick, suffer from disabilities.
- All doors, windows and openings should be secured.
- Continue to listen to warning bulletins and keep in touch with local officials. Keep radio sets in working condition. Battery powered radio sets are desirable.
- Evacuate people to places of safety when advised.
- Store extra drinking water in covered vessels.

Activities which should not be done during floods

- During the flood do not venture out unless advised to evacuate.
- If you have a vehicle and wish to move out, leave early before the onset of a flood.
- Avoid remaining on the top floor of dwellings. Stay close to the elevated ground area.
- Avoid taking shelters near damaged buildings or near trees.
- Do not touch power lines. One may get electrocuted.

Activities which are recommended to do after flood

- Watch out for broken glass and other sharp items in debris.

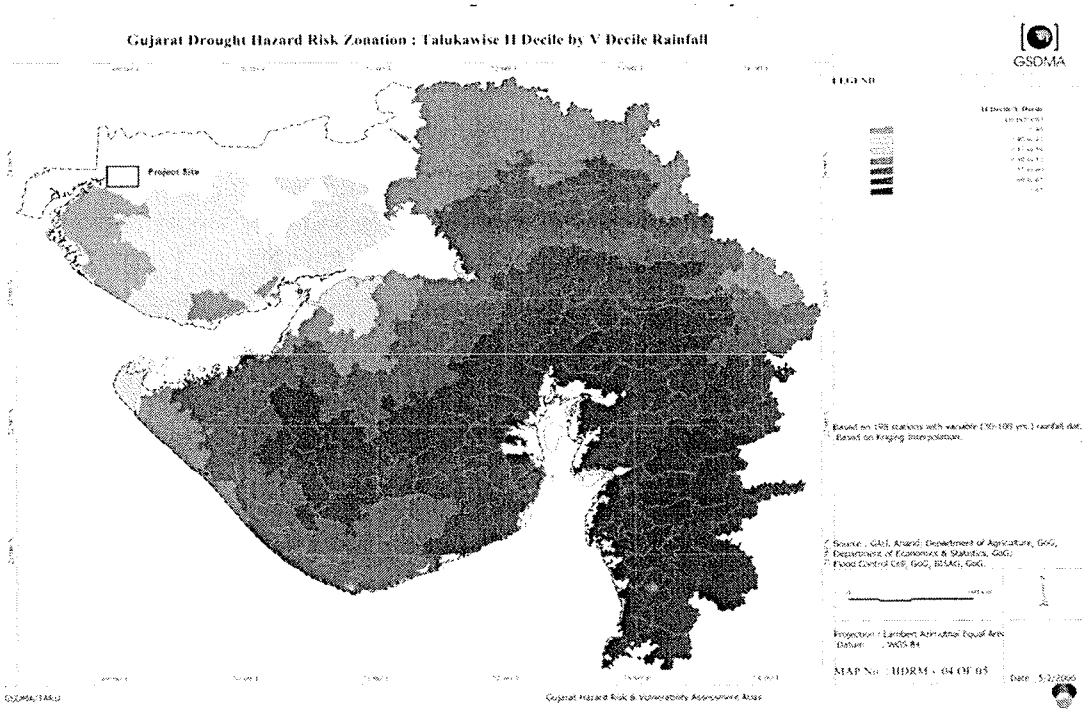
- Watch out for snakes and insects. Try to call for help.
- Listen to the advice of local officials and emergency workers.
- Be sure that the flood has subsided before venturing out.
- It is advisable to wait for the "all clear message" on radio and TV networks.
- Wait for emergency relief teams to arrive. It may take a little time before relief becomes effective.
- Stay away from flooded areas.

7.3.3. DROUGHT RISK AND MITIGATION PLAN

Drought Risk

- Proposed site lies in Rann of Kutch with generally scanty rainfall area.
- Soil having high salt content is alkaline soil.
- During high tide sea water ingresses in Rann of Kutch area,

Map-7.3: Drought risk zones of Gujarat



Source: Gujarat State Disaster Management Authority http://www.gsdma.org/

Mitigation Plan- Drought: Activities which are recommended to do after Drought

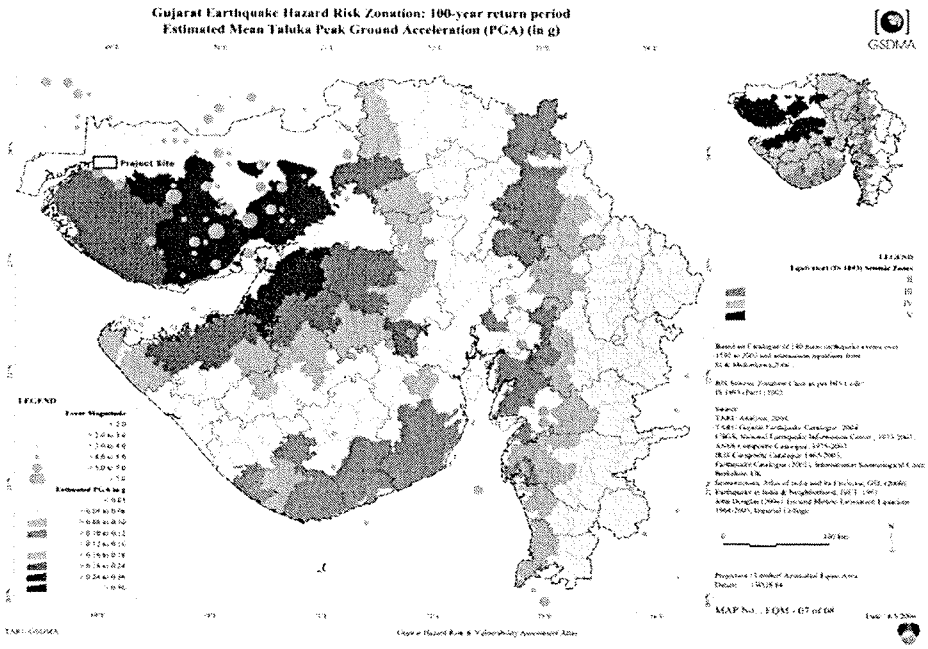
- Ensure required supply of potable water in summer for workers
- Rainwater harvesting
- Advise workers to conserve water

7.3.4. EARTHQUAKE RISK AND MITIGATION PLAN

Earthquake Risk: The proposed site is geographically part of Gujarat in Kutch region on the Arabian Sea Coast. During last 200 years, Gujarat recorded 9 earthquakes of moderate to severe intensity in the years 1819, 1845, 1847, 1848, 1864, 1903, 1938, 1956, 2001.

According to earthquake hazard map of India, site is located in the seismic zone -V with probable earthquake of 5.0 to 8.0 magnitude on Richter scale.

Map-.7.4: Earthquake risk zones of Gujarat.



Source: Gujarat State Disaster Management Authority http://www.gsdma.org/

Although, the seismic risk of Kutch region is comparatively less than the Himalayan and the other active areas, Kutch region has produced during very recent times one of the greatest known earthquakes, viz. the 1819 Allahbund earthquake rated. Map-.1 shows the distribution of earthquakes in Kutch region. Most of epicenters

of earthquakes are closely associated with well known faults. Large earthquakes are mostly associated with Allahbund fault while some large earthquakes seem to be associated with Kathiawar uplift.

The Lakhpat area of Kutch Region has also observed some earthquakes with high frequency in the past, the various earthquakes recorded in the lakhpat Region since 1668 to 2008 as per the records of Institute of Seismological Research, Gujarat is tabulated below (Table-7.2).

Table-7.2: Details of Earthquake in Lakhpat Region

Year	Month	Date	Lat (N)	Long (E)	Magnitude	Intensity	Ref
1844			24.33	69.5	4.3		USGS
1845	04	19	23.8	68.9	6.3	VIII	OLD
1845	06	19	23.8	68.9	5.7	VII	OLD
1890	06	01	23.83	68.83	4.0		MALIK
1892	01	11	23.83	70.00	3.5		MALIK
1893	11	04	23.83	68.83	3.5		MALIK
1896	02	26	23.83	69.67	3.5		MALIK
1904	11	30	24.33	69.58	3.5		MALIK
1911	10	11	24.33	69.50	3.5		MALIK

Reference: OLD- Oldham, 1883, Catalogue of Indian Earthquakes, Mem. Geol. Surv. India, 19, 163-215.

MALIK- Malik et al., 1999, Modern and historic Seismicity of Kachchh Peninsula, western India. Jour. Geol. Soc., 54, pp. 545-550.

Earthquake Mitigation Plan Earthquake is another natural disaster which can make a larger Impact on human beings and as well as on other livings and non-livings. Strategy can be prepared to reduce the possible impact of the earthquake and it can be briefly described as per following points;

General Information about the Earthquake

- Quick response & evacuation system shall be in place.
- Ensure earthquake proof structures
- Take the training for first aid and fire fighting

- Do not keep heavy and fragile things in the selves
- Do don't hang photo frames, mirrors, or glasses up your desk

Recommended activity during Earthquake

- Do not panic
- If already inside, then Stay indoors. Get under a heavy desk or table and hang on to it.
- If fire breaks out, drop on the floor and crawl towards the exist
- If you are out doors during the quake, keep away from buildings, trees and electricity lines. Walk towards open places, in a calm and composed manner.
- If you are driving, quickly but carefully move your car to clear area. Stay inside the car until shaking stops

Recommended activity after Earthquake

- Listen to radio-TV and other media for Government Announcement
- Check for injuries to yourself and those around you. Take first aid where you can
- Extinguish fire, if any
- Examine walls, floors, doors, staircases and windows to make sure that the building is not in danger of collapsing Do not enter into the unsafe or risky buildings.
- Switch off electric lines

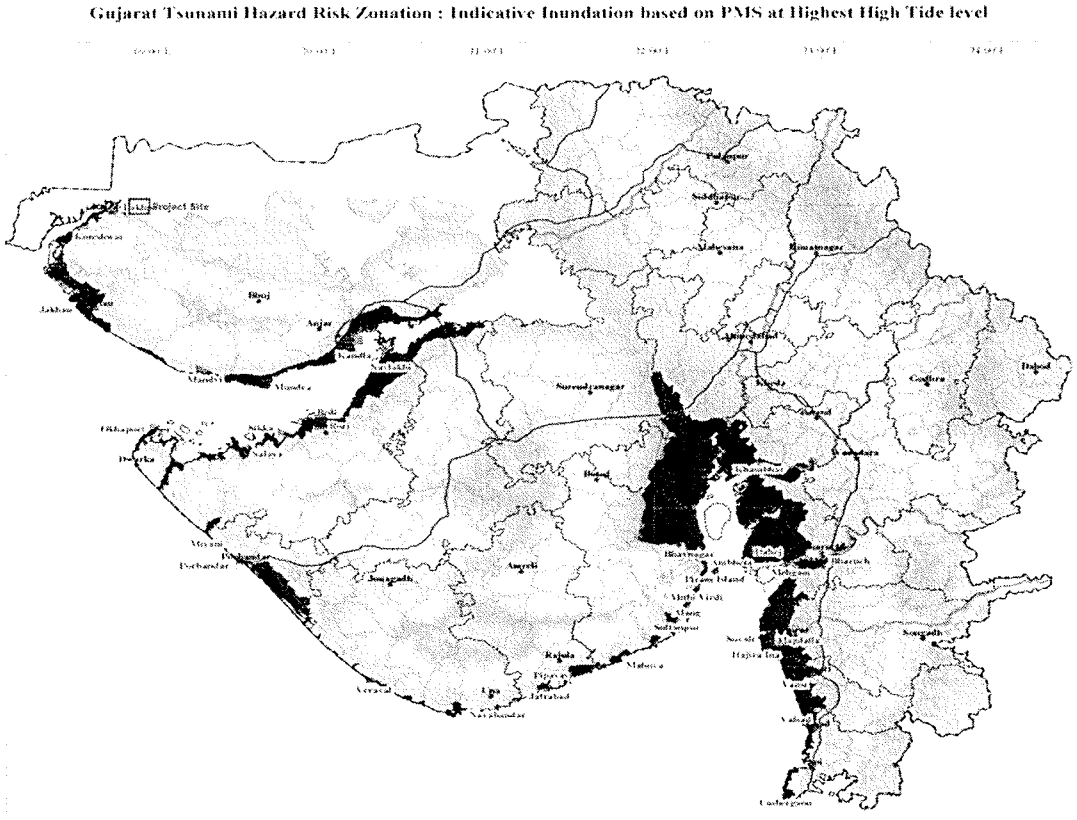
7.3.5. TSUNAMI RISK AND MITIGATION PLAN

Tsunami Risk: Proposed site lies near to coast line of Arabian Sea. Tsunami is triggered by earthquakes. The proposed site lies in Earthquake prone area (Seismic zone-V) inside the Arabian Sea, fault line near to Karachi Arabian Sea could trigger tsunami any time. Tsunami risk zone map prepared by GSDMA is provided in Map-.

Tsunami Mitigation Plan: The phenomenon Tsunami is a series of travelling ocean waves of extremely long length generated primarily by earthquakes

occurring below or near the ocean floor. Following safety measures needs to be learnt before, during and after the occurrence of tsunami.

Map- 7.5: Tsunami risk zone of Gujarat.



Source: Gujarat State Disaster Management Authority http://www.gsdma.org/

Before

- Be familiar with the tsunami warning signals. People living along the coast should consider an earthquake or a sizable ground rumbling as a warning signal. A noticeable rapid rise or fall in coastal waters is also a sign that a tsunami is approaching.
- Make sure all employees know how to respond to a tsunami. Make evacuation plans. Pick an inland location that is elevated.
- After an earthquake or other natural disaster, roads in and out of the vicinity may be blocked, so pick more than one evacuation route.
- Teach plant personnel how and when to turn off gas, electricity, and water.

- Prepare emergency kit beforehand. The emergency kit should contain Flashlight and extra batteries, battery-operated radio and extra batteries, First aid kit Emergency food and water, Essential medicines etc.

During

- Listen to a radio or television to get the latest emergency information, and be ready to evacuate if asked to do so.
- If you hear a tsunami warning, move at once to higher ground and stay there until local authorities say it is safe to return.
- Move in an orderly, calm and safe manner to the evacuation site
- Stay away from the shoreline.

After

- Stay tuned to a battery-operated radio for the latest emergency information.
- Help injured or trapped persons.
- Stay out of damaged buildings. Use a flashlight/torch when entering damaged buildings. Check for electrical shorts and live wires. Do not use appliances or lights until an electrician has checked the electrical system.
- Open windows and doors to help dry the building.
- Check food supplies and test drinking water.
- Fresh food that has come in contact with flood waters may be contaminated and should be thrown out.

7.4. MAN MADE DISASTERS

7.4.1. FIRE RISK AND MITIGATION MEASURE

Fire Risk: In view of fire hazards, various safety interlocks, alarm devices and preventive systems have been built in the design of the fuel storage area to protect against occurrences of such hazards. This fuel is used for DG Sets and Vehicles.

Mitigation measure for Firefighting facilities: For providing protection against fire, all equipment will be adequate Passive Fire Protection measures.

- Evacuation of people to safe places in the event of fire
- Ensure safe storage of fuel,
- Install sufficient fire extinguishers near fuel stores
- Adequate separating distances will be maintained between fuel storage area and other facility.
- To prevent fire from spreading through ventilation an appropriate location with auto closing arrangements will be provided.
- Major portable firefighting equipments such Dry chemical powder extinguishers and CO2 extinguishers shall be provided in the site.
- However, details of equipment, no., and location should be decided based on norms.

7.4.2. WAR SITUATION RISK AND MITIGATION MEASURE

War Situation Risk: Proposed site is proximity of international border of India and Pakistan.

Mitigation measure for War Situation.

- Daily update Boarder security Force (BSF) manpower working on site.
- Site office and BSF office connected through the telephone line
- Blow the Siren war situation and Evacuation of manpower from the site.
- Obey defense instructions in the event of war or border tension

7.4.3. OCCUPATIONAL HAZARDS RISK AND MITIGATION

Occupational Hazards Risk: Proposed site area worker have to phase extreme temperature, difficult working condition, solar radiation, unavailable potable water (dehydration), accessible most of area by only walking and major manual work.

Mitigation measure of occupational Hazards

- Train workers to work safely in the extreme climatic conditions
- Provide proper personal protective equipment (PPE) to work extreme condition

The following safety items should be available to tackle the emergency:

- Breathing apparatus sets and First aid boxes
- Fixed pipe Air line breathing apparatus and a portable Air line breathing apparatus
- Gloves with safety shoes protect saline water
- Suits
- Emergency vehicle and transport facilities

7.4.4. HEALTH ISSUE RISK AND MITIGATION

Health Issue Risk: Lack of basic health facilities, Harsh weather conditions of desert (50° C to 4° C), Lack of protective gear, Malnutrition, lack of vegetables and fruits in the diet, Prolonged exposure to salt, Prolonged exposure to brine

Mitigation measure for Health Issue

- Train workers to work safely in the extreme climatic conditions
- Provide PPE to workers
- Carryout health checkups every 2-3 months
- Provide health care facilities and emergency van for workers
- Provide shade or rest room area near to remote area
- Data on the number of people working in different sections
- List of Nearby medical services with their contact numbers

7.5. MOCK DRILLS & UPDATING OF PLAN

Mock Drills: As per Factory Act 1948, mocks drills should be conducted at least once in six month.

Updating of Plan: The Disaster Management Plan shall be reviewed in the event of any major change being affected within the site and the plan is revised incorporating the changes therein, as & when required or once in two years

7.6. GENERALDISASTER MANAGEMENT MEASURES

- Company shall train their staff to manage emergencies that may arise from storms & cyclones, lightning, earthquake, tsunami, flooding, fire, war situation, droughts etc.
- Train all the workers in site exit and orientation and layout plan of the salt works.
- All the staff members employed to manage operational salt works shall keep important phone numbers and contact details to solve emergency issues. These includes following.
    - Company's responsible administrator/decision maker
    - District level disaster management units
    - Closest Fire station
    - Closest Doctors Ambulance
    - Closest Forest & Environment department
    - Company's Emergency response team members
    - Closest police station
    - Village heads & Panchayat
    - Important power supply points from where company receives power
- Post information boards about public safety hazards and emergency contact information.
- Safety issues may arise with unauthorized public access to salt work areas (e.g., unauthorized movements within the salt work areas).Prevention and control measures to manage unauthorized access issues include: Use gate passes for site access, construct gates on main entrance roads, provide identity cards to workers. Keep complete identity details of all the workers employed in the salt works and establish professional security system with latest technologies using cctv cameras etc.

CHAPTER- 8
PROJECT BENEFITS

The proposed project brings numerous benefits to the study area, state and nation, which are mentioned as follow.

8.1. PRODUCTION OF SALT & BROMINE & OTHEER CHEMICALS

India is ranked fourth after the US and China in global production of salt. The average annual production of salt in India is 300 Lakh Metric tonnes and in the year 2018-2019, Gujarat produced 260 Lakh Metric Tonnes. Annually, India requires 90 lakh tonnes of salt for domestic consumption, an equal amount for industrial use. India exports 50 lakh tonnes of salt every year, as part of various international treaties and agreements, and an additional 34-40 lakh tonnes depending on demand. Kutch is a major producer of salt in India and its production is also significant globally. Kutch is bestowed with a long coastline and due to scanty rainfall, dry-weather; fairy high temperature, high wind velocity and suitable soil conditions, the region is extremely rich in salt deposits. Salt Industry in Kutch district is one of the biggest industries. Gujarat Is producing about 70% of the total production of salt and Kutch district contributes about 40% of Gujarat's total production. Still vast majority of the Rann of Kutch area lies underutilized for salt production.

Western Kutch region particularly the Greater Rann of Kutch which is adjacent to Lakhpat has great potential for salt production due to its closeness to sea water, scanty rainfall, few rainy days, rainshadow area, no human population, no forest land ample sunlight and wind. Lakhs of tones of salt that is produced naturally in the region gets washed away every year in western part of Great Rann of Kutch which falls in ideal salt production zone. Such high potential salt production land remains un utilized in the region. If utilized optimally, this land could provide great opportunities for economic developments in the region.

Salt is one the major and essential food items for human beings and an important raw material for various salt-based industries like soda ash, Caustic

Soda, Chlorine, Sodium Metal, Hydrochloric acid etc. Salt has some other important uses in fish curing, tanning of hides and skins, water softening, salting out of soap, ore dressing, food preservation, washing powder, dyes & intermediates, chemicals.

The proposed saltwork project would produce 5.0 MMT and 100 MT Bromine would augment the increasing need of salt for various salt-based industries in the region and in India. Such large-scale availability of salt as raw material in the region would attract number of salt-based industries in the region. This would bring in investments in Kutch and in Gujarat. This could have overall impact on production sector in Kutch, Gujarat and in India and it may also contribute to GDP of India.

8.2. OTHER BENEFITS

- Utilization 15000 hectares of vast natural saltpans for economic gains which otherwise remains unutilized.
- Production and sale of industrial salt (5.0 MMT) and marine chemicals such as Bromine etc. could contribute to the GDP of state and country by way taxes.
- Increase availability of cheaper salt as raw material for several salt-based industries.
- Increased employment opportunities in the project activities for local people from surrounding villages 150 direct, 450 indirect (300 during construction & 150 during operational phase)
- There would be allied infrastructure and business growth which would increase indirect jobs and business opportunities for the local and surrounding communities such as daily wage laborers, transporters and raw material suppliers during the construction activity.
- The proposed salt works and bromine extraction plant would improve local physical infrastructure such as roads etc.
- Improved habitats for some bird species such as flamingos and waterbirds
- The development of bunds and internal roads would improve surveillance infrastructure for Border Security Force and Defence agencies.

CHAPTER- 9

ENVIRONMENTAL COST BENEFIT ANALYSIS

9.1 JUSTIFICATION

Since this chapter is not relevant to the project activities, therefore, no environmental cost and benefit analysis was carried out. However, in general the project has envisaged higher economic and socio-economic benefits than the environmental damage as it is located in natural saltpans only.

CHAPTER- 10

ENVIRONMENTAL MANAGEMENT PLAN

An Environmental Management Plan (EMP) can be defined as "an environmental management tool used to ensure that undue or reasonably avoidable adverse impacts of the construction, operation and decommissioning of a project are prevented; and that the positive benefits of the projects are enhanced". EMPs are therefore important tools for ensuring that the management actions arising from Environmental Impact Assessment (EIA) processes are clearly defined and implemented through all phases of the project life cycle. This plan also helps an organization map its progress toward achieving continual improvements. The typically consists of the following:

- Environment Protection Plan to reduce impacts and risks. Issues related to existing legislation, codes of good engineering practice, proponent commitment, and similar other tasks are also discussed here.
- Summary of Impacts and Risks. These are the actual expected impacts and risks of the projects, which shall need to be managed, monitored, and reported.
- Impact Management and Environmental Enhancement to balance adverse impacts by providing alternate benefits to adversely impacted persons or biophysical systems.
- Environmental Affects monitoring (monitoring plans).
- Impact Reporting.

10.1. IMPLEMENTATION OF ENVIRONMENTAL MANAGEMENT PLAN

The implementation of the Environmental management plan depends on:

- Institutional strengthening needs
- Training and technical assistance needs
- Public participation

- EMP Implementation Schedule
- EMP Costs

The emphasis is on identifying issues and options, to guide the detailed design of specific EMP measures as part of programme and project feasibility studies. Environmental Management Planning gives you the tools to assess and manage environmental issues during every phase of your project or operations. The outcome shall minimize the risk of costly, time-consuming environmental issues, while maximizing productivity and performance. It provides a framework through which environmental priorities, responsibilities and risks are systematically managed. EMPs, which are often a key component of a project's regulatory filings, provide the basis for assurance that environmental factors shall be carefully managed throughout the project lifecycle. The proposed plan discusses appropriate measures to be considered during construction as well as operation phases.

10.2. ENVIRONMENTAL MANAGEMENT PLAN

Environmental protection plan includes the mitigation measures and other environmental management activities for any project. This is an important aspect to preserve & improve the environmental quality of project area.

Table-10.1: Environmental Management Plan

Environmental Impacts	Before	Mitigation	After Mitigation
		Pre-Construction	
Lack of awareness of the project in the area	High	Undertake public consultation in the projects area of influence to establish any issues and/or concerns of the Salt Project from the local communities	Low
Visual and noise impact of inappropriate siting of salt processing plant, washery and work areas	High	Minimize noise impacts by way of maintenance of machines and vehicles	Medium

		Construction Phase	
Groundwater contamination by oil, grease, and fuel in equipment areas	Medium	Control collection and recycling of lubricants Have precautions to avoid accidental spills	Low
Movement and presence of vehicles (bulldozers, front-end loaders, trucks) on and around the project area	High	Control movement of construction vehicles. Provide "parking" areas for vehicles not being used at any one time, control haphazard movements of vehicles by appropriate traffic management plan	Medium
Noise impact of the construction activities at the project site	Medium	Minimize noise impacts by way of maintenance of machines and vehicles	Low
Dumping of construction materials / spillage on land adjacent to processing salt pan activities	Medium	Management of waste materials must be stipulated in the management plan	Low
Risk to health and safety of employees	High	Ensure all employees have safety gear – hard hats, gloves, and Steel-toed boots. UV filtered glasses to protect eyes Emergency procedures in place in case of accidents	Low
		Operation Phase	
Movement and presence of vehicles (bulldozers, front-end loaders, trucks) on and around the project area	High	Control movement of construction vehicles. Provide "parking" areas for vehicles not being used at any one time	Medium
Air contamination by windblown & transport spillage of salt and vehicle movements	Med	Monitoring and control of air quality, spraying of water on haulage roads, control haphazard movements of vehicles by appropriate traffic management plan	Low
Reduced natural salt regeneration on the project area due to over exploitation of salt layer	High	Maintain sustainable exploitation of salt layer Monitor biological aspects of the Salt works.	Medium
Visual impact of the salt operations at the lake to tourist	High	Locate washery and salt processing facility to ensure site area is organized and clear of	Medium

areas		solid wastes	
Noise impact of the salt operations	High	Minimize harvesting operations during peak tourism times i.e. Weekends	Low
Salt washing plant and stockpiling area – generation of waste, oil spillage etc.	Medium	Ensure strict control of waste Confine work area	Low
Health problems associated with working in the salt environment e.g., windblown salt	High	Ensure all have Safety gear – hard hats, gloves, steel-toed boots, UV protective glasses. Provide protective clothing for workers Provide health facilities for workers During windy conditions if air quality deteriorates, ensure workers where face mask	Low
Positive impact of short- and long-term employment for locals	Low	Maximize employment of local people where possible Careful attention to the recruitment of workers It is fair and also does not enter conflict. Optimize secondary/informal employment opportunities, especially for women	High

10.3. ENVIRONMENTAL MANAGEMENT CELL

Apart from having an Environmental Management Plan, it is also necessary to have a permanent organizational set up charged with the task of ensuring its effective implementation of mitigation measures and to conduct environmental monitoring. The major duties and responsibilities of Environmental Management Cell shall be as given below:

- To implement the environmental management plan;
- To ensure regulatory compliance with all relevant rules and regulations;
- To ensure regular operation and maintenance of pollution control devices;
- To minimize environmental impacts of operations as by strict adherence to the EMP;

- To initiate environmental monitoring as per approved schedule;
- Review and interpretation of monitored results and corrective measures in case monitored results are above the specified limit;
- Maintain documentation of good environmental practices and applicable environmental laws as ready reference;
- Maintain environmental related records.
- Coordination with regulatory agencies, external consultants, monitoring laboratories.
- Maintain of log of public complaints and the action taken.

10.4. HIERARCHICAL STRUCTURE OF ENVIRONMENTAL MANAGEMENT CELL

A dedicated person who will report to the site manager should supervise normal activities of the EMP cell.

10.5. AWARENESS AND TRAINING

Training and human resource development is an important link to achieve sustainable operation of the facility and environmental management. For successful functioning of the project, relevant EMP should be communicated to the following groups of people:

10.6. STAFF AND CONTRACTORS

The staff and contractor must be made aware of the importance of waste segregation and disposal, water and energy conservation. This awareness can be provided through trainings and periodic meetings. They should be informed of their responsibilities for successful operation of various environmental management schemes inside the premises of the proposed development.

10.7. SITE STAFF

Relevant personnel at site must be trained for the following:

- Collection, transport, treatment and disposal of solid and hazardous waste

- Requirements of the Disaster Management Plan in case of an emergency.
- Techniques for waste minimization, water conservation and energy conservation.
- Applicable environmental, health and safety regulations and compliance requirements for the same.
- Functioning of the Environmental Management System including environmental monitoring, reporting and documentation needs.

10.8. RECORD KEEPING AND REPORTING

Record keeping and reporting of performance is an important management tool for ensuring sustainable operation of the proposed development. Records should be maintained for regulatory, monitoring and operational issues. Typical record keeping requirements for the proposed development is summarized in Table-10.2.

10.9. ENVIRONMENTAL AUDITS AND CORRECTIVE ACTION PLANS

To assess whether the implemented EMP is adequate, periodic environmental audits will be conducted. These audits will be followed by Corrective Action Plans (CAP) to correct various issues identified during the audits.

Table-10.2: Record Keeping Requirements

Sr.No	Parameter	Particulars
1.	Solid Waste Handling and Disposal	• Daily quantity of waste received • Daily quantity treated and recycled • Daily quantity sent for disposal
2.	Hazardous Wastes	• Quantity of waste generated • Quantity of wastes sent out for treatment/disposal. • Waste manifests as per regulations
3.	Regulatory Licenses (Environmental)	• Environmental Permits / Consents from SPCB / MoEF&CC

		• Copy of waste manifests as per requirement
4.	Monitoring and Survey	• Records of all monitoring carried out as per the finalized monitoring protocol.
5.	Accident reporting	• Date and time of the accident • Sequence of events leading to accident • Name of hazardous waste involved in the accident • Chemical datasheet assessing effect of accident on health and environment • Emergency measure taken • Step to prevent recurrence of such events
6.	Other	• Log book of compliance • Equipment inspection and calibration records, where applicable • Vehicle maintenance and inspection records

CHAPTER- 11

SUMMARY, CONCLUSION & RECOMMENDADTIONS

11.1. PROJECT SUMMARY

Name of the Applicant	**Shree Bhagwati Buildinfra Private Limited**
Company CIN:	U24100GJ2008PTC052664
Correspondence Address	A/112, Siddhi Vinayak Towers, Behind DCP Office, Off S.G. Highway, Makarba, Ahmedabad- 380051 Ph: 9825012917 Email: bhagwatibuildinfra@gmail.com
Total land area Allotted	15000 hectares for saltworks
Land Development	15000 hectares (Salt pan, access roads, bunds, Bromine plant)
Village name, Taluka, Survey No. of the Allotted land	Greater Rann of Kutch, Ta: Lakhpat,unsurveyed land
Cost of the Project & Means of Finance	Total cost Rs. 75 Cr. (Salt works) Investment from Promoters and Promoter group Rs. 25 Cr. Term Loan from Financial Institutions Rs. 50 Cr.
Environment regulation	Out of total 15000-acre lease area 1381.8 acre falls within in CRZ, which requires CRZ clearance from GCZMA
Commencement of salt production	3 years after possession of the land
Estimated production	5.0 MMT and 100 MT Bromine
Nearest Port	Kandla Port at approx. 210 km
Nearest Railway Station	Bhuj Railway station at a distance of approx. 120 km
National highway	Gandhidham- Ahmedabad
Consumption of salt	Domestic market as well as export
Means of transport	Through Conveyor Belt, Trucks , Barges
Employment generation	From surrounding villages 150 Direct, 450 Indirect
Machinery requirement	Pumping Station, Salt Washery, Conveyor belt, Bittern Pipeline, Bromine plant
Facilities for labour	Labour shelters, rest shades, Cyclone shelter house, Drinking water facility, medical facility, ambulance, at project site. Labour accommodation camp at Mudhan village land owned by company,

11.2. SUMARY OF IMPACTS

The environmental impacts of projects or actions generally encompass a broad range of impact from Air and Noise pollution to effect on employment and neighbourhood as well as on social structure. All of these impacts vary in magnitude as well as in their beneficial or adverse classification. The potential negative and positive impacts are mentioned as below.

11.2.1. POTENTIAL NEGATIVE IMPACTS & RISKS

- Risk of temporary damage to Kori creek mangroves & creek environ in case of leakage of concentrated brine or bittern
- Low impacts are envisaged due to Impingement & Entrainment of marine organisms at brine pumping stations
- Risk of leakage of brine & bittern in to surrounding area
- Increased movement of vehicles (600/day) in otherwise calm environ
- Increased border security issues due to laborers & workers
- Visual impacts as vast, dry flat saline mudflats would be converted into saltpans
- Disaster risk of flooding during unusually high tides and cyclonic rains.

11.2.2. POSITIVE IMPACTS& PROJECT BENEFITS

- Utilization of vast natural saltpans for economic gains which otherwise remains unutilized.
- Production and sale of industrial salt and marine chemicals such as Bromine etc. could contribute to the GDP of state and country by way taxes.
- Increase availability of cheaper salt as raw material for several salt-based industries.
- Increased employment opportunities for local people (600 individuals).
- There would be a growth in indirect jobs and business opportunities for the local and surrounding communities such as daily wage laborers, transporters and raw material suppliers during the construction activity.
- Improved habitats for some bird species such as flamingos and waterbirds

- Improved infrastructure such as roads for the local villages.
- Improved overall socio-economic conditions due to employments and CSR

11.3. STRENGTHS OF PROJECT

- Environmentally non-polluting industry and do not fall in EIA notification 2006.
- All the negative impacts can be mitigated with proper care and responsibility
- Proposed lease areas do not fall close to the coast of Arabian Sea.
- Proposed lease areas do not fall on or near important marine habitats such as

  Mangrove ecosystems
  Coral reef ecosystems
  Sand dunes ecosystems
  Sea turtle nesting sites
  Fishing Area
  Fishing Harbours

- No Protected Areas or their eco-sensitive zones or any important sites of high conservation values.
- Proposed lease areas do not fall on biologically active mudflats or within potential mangrove restoration areas.
- No vegetation in the proposed site.
- No human settlements, R&R not required.

11.4. CONCLUSION

In view of the project nature (commercial saltworks on natural saltpan), location (away from sensitive eco-systems, protected areas and human settlements), suitable physical environmental conditions for salt production (high temperature, high evaporation rate, high wind velocity etc.) nature and types of impacts (mostly manageable with mitigation measures), It can be concluded on that due to the adequate provision and efficient operation of Environmental Management Systems and after the implementation of the proposed mitigation measures and environmental management plans, the project activities during the construction

and operation phase would have manageable & largely have reversible impacts on the environment, and on balance the project would be beneficial to surrounding communities and the region socio-economically.

11.5. RECOMMENDATIONS

- If salt works are constructed and operated safely, carefully and by taking care of surrounding environment and ecology, it could provide great economic benefits.
- The proponent shall strictly follow all the environmental safety rules and regulations as prescribed by Ministry of Environment and Forest, Government of India, Gujarat Coastal Zone Management Authority and Gujarat Pollution Control Board.
- Proponent shall take adequate mitigation measures for Ambient Air Quality to maintain it within the permissible limit as prescribed by National Ambient Air Quality Standards.
- Transport of raw materials and products shall be carried out through closed conveyor belt, pipeline and trucks. Trucks transporting salt and other materials shall ensure that it does not spillout on roads.
- Some impact as seen on flora and fauna shall be mitigated as per the mitigation measures suggested in the report.
- The Solid waste management practice for the project should ensure that the area is not affected due to dumping of waste.
- Zero liquid discharge from the project must be ensured through reuse & recycling of effluent, treated water, bittern, liquor etc.
- It is recommended that proper facilities of drinking water and sanitation to be provided to the workforce during the construction and operation of the proposed project.
- Proper living condition with appropriate facilities for labours should be provided.
- CSR activities shall be prioritized, planned and carried out based on consultation with the stakeholders (local community and government agencies).

CHAPTER- 12
DISCLOSURE OF CONSULTANTS ENGAGED

12.1 DETAILS OF CONSULTANTS

Bhagwati Enviro care Pvt. Ltd. is one of the leading environmental consulting organizations based at Ahmedabad, Gujarat. Engaged in providing consulting, engineering, designing, auditing, monitoring & testing and other regulatory compliance services. It was established in January 98 and consists of the highly qualified and well-experienced engineers, scientists, chemists. This technical team is supported by a pool of highly qualified and experienced associated experts from various disciplines.

We have successfully completed more than 1500 projects in the field of consulting, auditing, monitoring & testing, pollution control i.e., Design, Installation and commissioning of wastewater treatment plants and air pollution control equipment, during last 20 years. We are also dealing in the projects of waste minimization and cleaner production technology.

We are having a strong team of Technocrats and Scientists. We have well equipped MOEF and NABL approved analytical laboratory facility including facilities to analyze physical, chemical and biological parameters as per the requirements of the State Pollution Control Board and our clients.

Our team of technocrats and scientists are well experienced to deal with the Design, Installation and Commissioning of wastewater treatment plants and air pollution control equipment and also well conversant to the projects of Waste Minimization and Cleaner Production Technology.

12.2 DETAILS OF CONSULTANT'S ACCREDITATIONS

The organization has obtained below mentioned recognition and accreditations to provide you competent and efficient services (Annexure-5).

- **QCI-NABET accreditation as an EIA Consultant Organization**

- **QCI-NABL accreditation for Chemical Testing Laboratory under ISO/IEC 17025:2005 standards**
- **Reorganization as Environmental Auditor by Gujarat Pollution Control Board.**
- **ISO 9001:2008 certificate for the Management System.**
- **ISO 14001:2015 certificate for the Management System.**
- **ISO 18001:2007certificate for the Management System.**
- **MOEF Recognized Environmental laboratory under the Environment Protection Act 1986.**

The organization has been engaged in carrying out EIA studies and preparation of EIA/EMP report for the varied range of industries and developmental activity since 2003. Besides the EIA study the organization is prepared and confident to render the following services in the field of environmental engineering,

- Technical consultation & assistance to ensure & assure complete Environ-Legal compliance including liaison with statutory bodies in order to get the required permits, clearances & consents.
- Assessment of Environmental Pollution Load.
- Guidance to get water consent, Air consent and Solid Waste Authorization.
- & M contracts for ETP, STP and CETP.
- New project consultancy for Environmental Management System.
- After careful study of the existing effluent treatment plant if required we suggest suitable addition/up gradation/modification in existing Effluent Treatment Plant so as to meet with the standards as specified by the state pollution control board as per the mode of disposal.
- Preparation of application form to get **NOC for Establishment of the unit and Consent for Operation** from the state pollution control board **providing technical guidance** to the clients to do the technical correspondence and also consulting work with state pollution control board.
- Designing and executing turnkey project of Effluent Treatment Plant (ETP), Solid & Liquid Waste Incinerator and Air Pollution Control Equipment

- Schedule II Environmental Audit as per the order and guidelines of Honorable High Court of Gujarat and GPCB.
- Details Process study to reduce the pollution at source and to reuse / recycle effluent.
- Preparing adequacy and efficacy report on Environmental management System for the existing unit as well as proposed unit.
- Conducting laboratory scale experiments to study treatability of industrial effluent and preparing Treatability report.
- Preparing Feasibility report on the Effluent Treatment Plant.
- Performance study of existing pollution control facility and suggesting scheme for the optimization of the facility.
- Monitoring and analysis of Water, Wastewater, Air Pollution (Stack & Ambient), Solid Waste and soil.
- Monitoring and analysis of Work Area Environment and filling-up Form-37 as per the requirements under Factory Act-1948 and Gujarat Factory Rules.
- Services of chartered Engineers for chemical projects.

भारत सरकार
जल शक्ति मंत्रालय
जल संसाधन, नदी विकास
और गंगा संरक्षण विभाग
केन्द्रीय भूमि जल प्राधिकरण
Government of India
Ministry of Jal Shakti
Department of Water Resources,
River Development & Ganga Rejuvenation
Central Ground Water Authority

ANNEXURE-R-4

(भूजल निकासी हेतु अनापत्ति प्रमाण पत्र)

NO OBJECTION CERTIFICATE (NOC) FOR GROUND WATER ABSTRACTION

Project Name:	Shree Bhagwati Buildinfra Private Limited		
Project Address:	Rann Of Kachchh, Taluka- Lakhpat, Kachchh District		
Village:	Mudhan	Block:	Lakhpat
District:	Kachchh	State:	Gujarat
Pin Code:			
Communication Address:	Shree Bhgavati Buildinfra Private Limited, A/114, Siddhi Vinayak Towers, Behind Dcp Office, Makarba, Opposite S.g. Highway, Ahmadabad City, Ahmadabad, Gujarat - 380051		
Address of CGWB Regional Office :	Central Ground Water Board West Central Region, Swami Narayan College, Building, Shah Alam Tolnaka, Ahmadabad, Gujarat - 380022		

1. **NOC No.:** CGWA/NOC/IND/ORIG/2023/19212
2. **Date of Issuence** 12/09/2023
3. Application No.: 21-4/10732/GJ/IND/2023
4. Category: (GWRE 2022) Safe
5. Project Status: New Project
6. NOC Type: New
7. **Valid from:** 12/09/2023
8. **Valid up to:** 11/09/2026
9. Ground Water Abstraction Permitted:

Fresh Water		Saline Water		Dewatering		Total	
m³/day	m³/year	m³/day	m³/year	m³/day	m³/year	m³/day	m³/year
		2542.50	928012.50				

10. Details of ground water abstraction /Dewatering structures

	Total Existing No.:0						Total Proposed No.:6					
	DW	DCB	BW	TW	MP	MPu	DW	DCB	BW	TW	MP	MPu
Abstraction Structure*	0	0	0	0	0	0	0	0	0	6	0	0

*DW- Dug Well; DCB-Dug-cum-Bore Well; BW-Bore Well; TW-Tube Well; MP-Mine Pit;MPu-Mine Pumps

11. Ground Water Abstraction/Restoration Charges paid (Rs.):
12. Number of Piczometers(Observation wells) to be constructed/ monitored & Monitoring mechanism.

No. of Piezometers	Monitoring Mechanism		
	Manual	DWLR**	DWLR With Telemetry
2	0	1	1

**DWLR - Digital Water Level Recorder

(Compliance Conditions given overleaf)

This is an auto generated document & need not to be signed.

Validity of this NOC shall be subject to compliance of the following conditions:

Mandatory conditions:

1) Installation of tamper proof digital water flow meter with telemetry on all the abstraction structure(s) shall be mandatory for all users seeking No Objection Certificate and intimation regarding their installation shall be communicated to the CGWA within 30 days of grant of No Objection Certificate.

2) Proponents shall mandatorily get water flow meter calibrated from an authorized agency once in a year.

3) Construction of purpose-built observation wells (piezometers) for ground water level monitoring shall be mandatory as per Section 14 of Guidelines. Water level data shall be made available to CGWA through web portal. Detailed guidelines for construction of piezometers are given in Annexure-II of the guidelines.

4) Proponents shall monitor quality of ground water from the abstraction structure(s) once in a year. Water samples from bore wells/ tube wells / dug wells shall be collected during April/May every year and analysed in NABL accredited laboratories for basic parameters (cations and anions), heavy metals, pesticides/ organic compounds etc. Water quality data shall be made available to CGWA through the web portal.

5) In case of mining projects, additional key wells shall be established in consultation with the Regional Director, CGWB for ground water level monitoring four (4) times a year (January, May, August and November) in core as well as buffer zones of the mine.

6) In case of mining project the firm shall submit water quality report of mine discharge/ seepage from Govt. approved/ NABL accredited lab.

7) The firm shall report compliance of the NOC conditions online in the website (www.cgwa-noc.gov.in) within one year from the date of issue of this NOC.

8) Industries abstracting ground water in excess of 100 m 3 /d shall undertake annual water audit through certified auditors and submit audit reports within three months of completion of the same to CGWA. All such industries shall be required to reduce their ground water use by at least 20% over the next three years through appropriate means.

9) Application for renewal can be submitted online from 90 days before the expiry of NOC. Ground water withdrawal, if any, after expiry of NOC shall be illegal & liable for legal action as per provisions of Environment (Protection) Act, 1986.

10) This NOC is subject to prevailing Central/State Government rules/laws/norms or Court orders related to construction of tube well/ground water abstraction structure / recharge or conservation structure/discharge of effluents or any such matter as applicable.

General conditions:

11) No additional ground water abstraction and/or de-watering structures shall be constructed for this purpose without prior approval of the Central Ground Water Authority (CGWA).

12) The proponent shall seek prior permission from CGWA for any increase in quantum of groundwater abstraction (more than that permitted in NOC for specific period).

13) Proponents shall install roof top rain water harvesting in the premise as per the existing building bye laws in the premise.

14) The project proponent shall take all necessary measures to prevent contamination of ground water in the premises failing which the firm shall be responsible for any consequences arising thereupon.

15) In case of industries that are likely to contaminate the ground water, no recharge measures shall be taken up by the firm inside the plant premises. The runoff generated from the rooftop shall be stored and put to beneficial use by the firm.

16) Wherever feasible, requirement of water for greenbelt (horticulture) shall be met from recycled / treated waste water.

17) Wherever the NOC is for abstraction of saline water and the existing wells (s) is /are yielding fresh water, the same shall be sealed and new tubewell(s) tapping saline water zone shall be constructed within 3 months of the issuance of NOC. The firm shall also ensure safe disposal of saline residue, if any.

18) Unexpected variations in inflow of ground water into the mine pit, if any, shall be reported to the concerned Regional Director, Central Ground Water Board.

19) In case of violation of any NOC conditions, the applicant shall be liable to pay the penalties as per Section 16 of Guidelines.

20) This NOC does not absolve the proponents of their obligation / requirement to obtain other statutory and administrative clearances from appropriate authorities.

21) The issue of this NOC does not imply that other statutory / administrative clearances shall be granted to the project by the concerned authorities. Such authorities would consider the project on merits and take decisions independently of the NOC.

22) In case of change of ownership, new owner of the industry will have to apply for incorporation of necessary changes in the No Objection Certificate with documentary proof within 60 days of taking over possession of the premises.

23) This NOC is being issued without any prejudice to the directions of the Hon'ble NGT/court orders in cases related to ground water or any other related matters.

24) Proponents, who have installed/constructed artificial recharge structures in compliance of the NOC granted to them previously and have availed rebate of upto 50% (fifty percent) in the ground water abstraction charges/ground water restoration charges, shall continue to regularly maintain artificial recharge structures.

25) Industries which are likely to cause ground water pollution e.g. Tanning, Slaughter Houses, Dye, Chemical/ Petrochemical, Coal washeries, pharmaceutical, other hazardous units etc. (as per CPCB list) need to undertake necessary well head protection measures to ensure prevention of ground water pollution as per Annexure III of the guidelines.

26) In case of new infrastructure projects having ground water abstraction of more than 20 m3/day, the firm/entity shall ensure implementation of dual water supply system in the projects.

27) In case of infrastructure projects, paved/parking area must be covered with interlocking/perforated tiles or other suitable measures to ensure groundwater infiltration/harvesting.

28) In case of coal and other base metal mining projects, the project proponent shall use the advance dewatering technology (by construction of series of dewatering abstraction structures) to avoid contamination of surface water.

29) The NOC issued is conditional subject to the conditions mentioned in the Public notice dated 27.01.2021 failing which penalty/EC/cancellation of NOC shall be imposed as the case may be.
30) This NOC is issued subject to the clearance of Expert Appraisal Committee (EAC) (if applicable).

(Non-compliance of the conditions mentioned above is likely to result in the cancellation of NOC and legal action against the proponent.)

CENTRAL GROUND WATER AUTHORITY

Department of Water Resources, River Development and Ganga Rejuvenation
Ministry of Jal Shakti, Govt. of India

Receipt

(As per the MoJS guidelines dated 24.09.2020 vide SO No. 3289(E) and amendments dated 29.09.2023 vide SO No. 1509(E))
https://cgwa-noc.gov.in

Application No,:	21-4/10732/GJ/IND/2023	Date:12/09/2023
Name of Firm:	SHREE BHAGWATI BUILDINFRA PRIVATE LIMITED	
AppType Category:	*Salt works Salt manufacturing*	
Application Type:	*Industrial*	
PAN/GSTIN No. of Firm/Individual:	*NA / NA*	

SN	Description	Amount (Rs.)
1.	Application Processing Fee	10000.00
2.	Ground Water Abstraction charges	
3.	Ground Water Restoration charges	0
4.	Environmental Compensation Charges (ECRGW) *(Date From to) Days-*	
5.	Penalty for non-Compliance of NOC conditions *Condition to be mentioned*	
6.	Adjustment Charges	
7.	Rebate	
8.	Charges for correction/modification in the existing issued No Objection Certificate	

S.No.	Description	Rate
(i)	Change in User ID	Rs. 5000
(ii)	Change in firm Name	Rs. 5000
(iii)	Extension of No Objection Certificate	Rs. 5000
(iv)	Issuance of duplicate No Objection Certificate	Rs. 5000
(v)	Issuance of corrigendum to No Objection Certificate	Rs. 5000
(vi)	Any other items/correction etc.	

Rs. Rupees Ten Thousand Only	**10000.00**

This is an system generated invoice, hence, does not require ink signed.

18/11, जामनगर हाउस, मानसिंह रोड, नई दिल्ली - 110011 / 18/11, Jamnagar House, Mansingh Road, New Delhi-110011
Phone: (011) 23383561 Fax: 23382051, 23386743
Website: cgwa-noc.gov.in

Term and conditions:

i. All disputes are subject to Delhi Jurisdiction.
ii. Any complaint in regard to the rates will not be entertained.

Member-Secretary
CGWA, New Delhi

ANNEXURE-R-5

HAZARD AND OPERABILITY STUDY REPORT OF BROMINE RECOVERY PLANT

M/S. SHREE BHAGWATI BUILDINFRA PVT LTD GUJARAT

PREPARED BY

ASIA PACIFIC RISK MANAGEMENT SERVICES PVT. LTD.

www.aprms.com

REV.	DATE	ORIGINATOR	REVIEWED	APPROVED	DESCRIPTION
1	22-01-2024	KSC	KNS		FINAL
0	04-01-2024	KSC	KNS		FOR REVIEW/COMMENT

Disclaimer

This report has been prepared by APRMS, Chennai with all reasonable skill, care and diligence within the terms of the Contract with the client, incorporating our General Terms and Conditions of Business and taking account of the resources devoted to it by agreement with the client.

We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above. This report is confidential to the client and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on the report at their own risk.

TABLE OF CONTENTS

LIST OF ABBREVIATIONS

APRMS	Asia Pacific Risk Management Services Limited
CW	Cooling Water
DCS	Distributed Control System
FT	Flow Transmitter
FI	Flow Indication
FIC	Flow Indication Control
FCV	Flow Control Valve
HE	Heat Exchanger
IA	Instrument Air
LT	Level Transmitter
LG	Level Gauge
LI	Level Indication
LPS	Low Pressure Steam
LS	Level Switch
NA	Not Applicable
PCV	Pressure Control Valve
PSV	Pressure Safety Valve
PT	Pressure Transmitter
PI	Pressure Indication
PDI	Pressure Differential Indicator
PG	Pressure Gauge
SOP	Standard Operating Procedure
TT	Temperature transmitter
TI	Temperature Indication
TIC	Temperature Indication Control

LIST OF GLOSSARY OF TERMS

HAZOP	Formal systematic critical examination to the process and engineering intentions of new or existing facilities to assess the hazard potential of mal-operation or malfunction of individual items of equipment and their consequential effects on the facility as a whole.
INTENTION	Defines how the plant is expected to operate in the absence of deviation at the study.
NODE	The locations (P&ID) at which the process parameters are investigated for deviations.
DEVIATION	A departure from the design and operating intention.
CAUSE	These are the reasons why deviation might occur. Once a deviation has been shown to have credible cause, it can be treated a meaningful deviation. Causes can be hardware failure, human error, an unanticipated process state, external disruption etc.
CONSEQUENCE	The Results of the deviation when they occur
GUIDE WORDS	During examination sessions the study team tries to visualize all possible deviations from every design and operating intention. Broadly speaking, there are seven kinds of deviation, each of which can be associated with a distinctive word or phrase. Collectively, these are called 'guide words' because when used in association with a design and operating intention they guide and stimulate creative thinking towards appropriate deviations.
SAFEGUARD	Existing protective devices that either prevents the cause or safe guard against the adverse consequences. Safeguards need not be restricted to hardware. Credit can be taken for procedural aspects such as regular plant inspections.
RECOMMENDATION / ACTION	Consequences and safeguard are considered. If they are inadequate recommendation / action are made to remove the cause or mitigate or eliminate the consequences
HAZARD	A deviation which could cause damage, injury or other form of loss.

EXECUTIVE SUMMARY

M/s. Shree Bhagwati Buildinfra Pvt Ltd (SBBPL) has a Bromine Recovery Plant in Gujarat.

M/s. SBBPL has engaged the services of M/s. Asia Pacific Risk Management Services Private Limited to conduct HAZOP Study for their Bromine Recovery Plant.

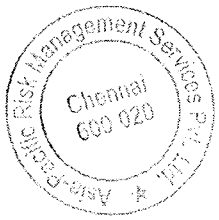
This report details the results of HAZOP study for Bromine Recovery Plant, based on IEC 61882. The session was led by HAZOP facilitator from APRMS and the proceedings of the session were recorded by HAZOP scribe from APRMS. HAZOP study was carried out using HAZOP Manager software.

The objective of the Hazop study is to identify and evaluate the potential hazardous events and significant operability problems associated with the Bromine Recovery Plant and to generate recommendations / actions that reduce the probability and severity of an incident.

Thirteen (13) nodes and One (1) General Node were selected from the given 27 P&IDs provided by SBBPL and potential causes were examined by applying appropriate guide words. Consequences arising out of the causes were evaluated and measures to eliminate or minimize the undesirable consequences were recommended.

Total recommendations made were 126 to mitigate the identified problems.

The compiled list of recommendations / actions is provided in Section – 8.



1. INTRODUCTION

1.1.PROJECT BACKGROUND

M/s. Shree Bhagwati Buildinfra Pvt Ltd (SBBPL) has a Bromine Recovery Plant in Gujarat.

M/s. SBBPL has engaged the services of M/s. Asia Pacific Risk Management Services Private Limited to conduct HAZOP Study for their Bromine Recovery Plant.

HAZOP Facilitator & Scribe from Asia Pacific Risk Management Services Pvt Ltd conducted the Hazop session.

1.2.ABOUT CONSULTANT

Asia Pacific Risk Management Services Private Limited, India is engaged in carrying out Risk Management for various industries and insurers/insurance brokers. APRMS has a unique and balanced blend of various disciplines to carry out the services like Safety audit, Electrical audit, HAZID (Hazard Identification), HIRA (Hazard Identification & Risk Assessment), HAZOP, QRA (Quantitative Risk Assessment), Consequence Analysis, SIL (Safety Integrity Level), ERDMP (Emergency Response and Disaster Management Plan), Accident Investigation, Review of Fire Protection System, Safety training and Insurance and Claims Management.

2. OBEJECTIVE AND SCOPE OF SYSTEM

The objective of the Hazop study is to identify and evaluate the potential hazardous events and significant operability problems associated. And to generate recommendations /actions that reduce the probability and severity of an incident.

3. TEAM COMPOSITION

The study is performed by a team of people who are familiar with the plant operation, working under the guidance of a leader who is experienced in use of the HAZOP method.

Participants in the HAZOP Session is listed below –

S. No	Participants	Discipline	Company
1	KN Subramanian	HAZOP Chairman	APRMS
2	S Monish	HAZOP Scribe	APRMS
3	Kalpesh Chaudhari	HAZOP Scribe	APRMS
4	V Manickam	Detail Engineering	DDIN
5	Sujit Gujrathi	Detail Engineering	DDIN
6	Yogesh Patil	Detail Engineering	DDIN

7	Shriram Kulkarni	Detail Engineering	DDIN
8	Atul Mehere	Detail Engineering	DDIN
9	Rainer Weckend	Detail Engineering	DD Germany
10	Adrian Wolf	Detail Engineering	DD Germany
11	Jayesh Barad	Production	Bhagwati
12	M Shiv Shankar	Instrumentation	Bhagwati
13	Rajib Kumar Dasmohapatra	Operations	Bhagwati
14	Ranveer Singh	EHS	Bhagwati

4. DOCUMENT REFERENCE

S. No.	Drawing/Doc No
1	SER222300033-PID-200 SH 1 OF 10 Rev 6
2	SER222300033-PID-200 SH 2 OF 10 Rev 6
3	SER222300033-PID-200 SH 3 OF 10 Rev 6
4	SER222300033-PID-200 SH 4 OF 10 Rev 6
5	SER222300033-PID-200 SH 5 OF 10 Rev 6
6	SER222300033-PID-200 SH 6 OF 10 Rev 6
7	SER222300033-PID-200 SH 7 OF 10 Rev 6
8	SER222300033-PID-200 SH 9 OF 10 Rev 6
9	SER222300033-PID-200 SH 10 OF 10 Rev 6
10	SER222300033-PID-800 SH 1 OF 4 Rev 6
11	SER222300033-PID-800 SH 2 OF 4 Rev 6
12	SER222300033-PID-800 SH 3 OF 4 Rev 6
13	SER222300033-PID-800 SH 4 OF 4 Rev 6
14	SER222300033-PID-200
15	IEC/W2228/P&ID/001 REV 0 SHEET 1 OF 2
16	IEC/W2228/P&ID/001 REV 0 SHEET 2 OF 2
17	ABO-22-01
18	SER222300033-PID-200 SH 8 OF 10
19	CPDI-50/10.54 REV 1 SH 1 OF 2

20	HP-10/10.54 REV 2 SH 2 OF 2
21	SER222300033-P&ID-800 SH 4 OF 4 REV 1
22	PID-FES-22-01 REV R-1
23	ABO-22-01 REV R-0
24	PID-FBS-22-03 REV R-1
25	PID-FSB-22-01 REV R-0
26	SER222300033-PID-200 SH 1 OF 10 REV 1
27	AB/WOB/CT-1026A (reference sketch)

5. LIST OF NODES FOR HAZOP STUDY

The following nodes are considered for the HAZOP study-

NODE NO.	NODE DESCRIPTION
1	Chlorine Handling System
2	Reaction System
3	Purification of Bromine Product
4	200-C-3020 and Plant scrubber
5	Cooling Tower
6	Chiller Package
7	Bromine Storage
8	Air Compressor & Dryer (Deleted)
9	Boiler System – 5 Ton
10	Process Water System
11	Caustic Storage & Dilution Tank
12	Bottling Scrubber
13	General
14	FES – Feed Enrichment Section (Cold Process)

6. HAZOP METHODOLOGY

A HAZOP study is a formal systematic procedure used to review the design and operation of a potentially hazardous facility. It is used to identify deviations from normal safe operation, which could lead, to hazards or operability problems, and to define any actions necessary to deal with these.

The basic assumption in a HAZOP study is that if a process is operated within its design envelope (or design intent) then there are no hazard or operability issues. The HAZOP study therefore looks for deviations that could cause the process to move away from the design intent i.e. take the process outside the design envelope. The study systematically looks for these deviations outside design intent by use of suitable combinations of guidewords and parameters.

6.1. HAZOP PROCEDURE

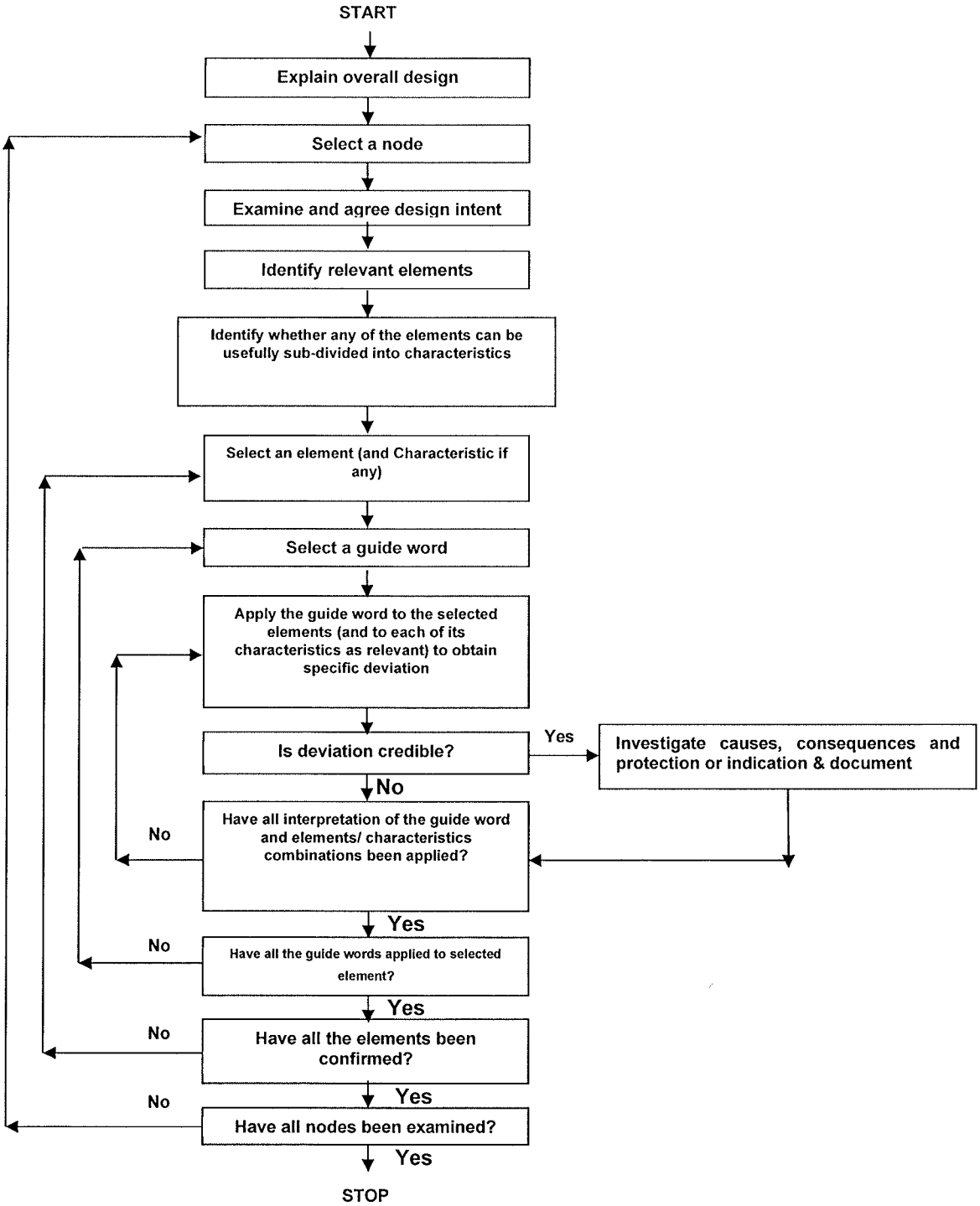
The HAZOP technique uses combination of guide word and parameter, e.g. High Flow, to make a list of deviations that are possible in the process. The guidewords are systematically applied to a segment of the process/operation in order to promote discussion on possible deviations from the design intention. The team searches for causes for the deviation to occur. Once causes for the deviation have been listed, the team works out the consequence of the said deviation. The next step will involve listing out the existing safeguards that either –

a. Avoid the cause from occurring (therefore avoiding the deviation itself)
b. Completely mitigate / reduce the impact of the consequence
c. Create operator awareness about deviation, cause and or consequence (such as provision of alarms, gas detectors etc.)

If the listed safeguards are seen to be inadequate, then the team brainstorms to come up with new safeguards (i.e. recommendation / action) to increase safety and decrease operability issues.

The HAZOP Flowsheet procedure of different step is shown in Figure - 1

Figure - 1


START
Explain overall design
Select a node
Examine and agree design intent
Identify relevant elements
Identify whether any of the elements can be usefully sub-divided into characteristics
Select an element (and Characteristic if any)
Select a guide word
Apply the guide word to the selected elements (and to each of its characteristics as relevant) to obtain specific deviation
Is deviation credible?
Yes
Investigate causes, consequences and protection or indication & document
No
Have all interpretation of the guide word and elements/ characteristics combinations been applied?
No
Yes
Have all the guide words applied to selected element?
No
Yes
Have all the elements been confirmed?
No
Yes
Have all nodes been examined?
No
Yes
STOP

6.2. HAZOP GUIDEWORDS AND PARAMETERS

These are simple words which are used to qualify or quantify the intention in order to guide and stimulate the HAZOP process and so discover deviations. These guide words are applicable to both the more general parameters (e.g. react, transfer) and to the more specific parameters (e.g. pressure, temperature, flow). With the general parameters, meaningful deviations are usually generated for each guide word. Moreover, it is not unusual to have more than one deviation from the application of one guide word. For example, "more reaction" could mean either that a reaction takes place at a faster rate, or that a greater quantity of product results. With the specific parameters, some modification of the guide words may be necessary. In addition, it is not unusual to find that some potential deviations are eliminated by physical limitation. For example, if the design intention of a pressure or temperature is being considered, the guide words "more" or "less" may be the only possibilities. The common guide words used in the study are listed in table below.

Table 6-1 Guide Words

Guide Words	Meaning
No	Negation of the design intent
Less	Less of a physical property when there should be quantitative decrease
More	More of a physical property than there should be quantitative increase
Reverse	Logical Opposite of the design intent
High	Quantitative increase from expected performance standard
Low	Quantitative decrease from expected performance standard

An example list of deviations formed by combining parameters and guide words is shown in the table below:

Table 6-2: HAZOP analysis parameters

Guide Word	Parameter	Deviations
More	Flow	More Flow
Less/No	Flow	Low/No flow
Reverse	Flow	Reverse Flow
More	Pressure	More Pressure
Less	Pressure	Less Pressure
More	Temperature	More Temperature
Less	Temperature	Less Temperature

6.3. NODE

Location at which, the process parameter is investigated for deviation. A reference number is identified for the selected node.

6.4. CAUSES

The reason for the deviation could occur. Once a deviation has been shown to have credible cause, it can be treated a meaningful deviation. Hazop team identified several causes for one deviation. Causes can be hardware failure, human error, an unanticipated process state, external disruption etc.

6.5. CONSEQUENCES

The results of the deviation it occurs. Consequence shall be basically focused on possible major effects in terms of health, safety, environmental damage and economic losses. Consequences may both comprise process hazards and operability problems, like plant shut-down or reduced quality of the product. Hazop team identified several consequences for one cause.

6.6. SAFEGUARDS

Safeguards are existing protective devices that either prevents the cause or safeguard against the adverse consequences. Safeguards need not be restricted to hardware. Credit can be taken for procedural aspects such as regular plant inspections.

Based on severity of consequence, The Hazop team identified suitable safeguard to prevent and control of hazard. For each safeguard, the team verified that its operation is safe and will not generate additional unplanned Hazards.

6.7. RECOMMENDATION / ACTION

The recommendation / action is provided if the existing safeguards are inadequate or insufficient information on hazard and related safeguards. Recommendations / actions are made to remove the cause or mitigate or eliminate the consequences.

6.8. HAZOP ASSUMPTION

The following are the assumptions made for the Hazop study.

- Hazard/Deviations resulting from a double jeopardy (two simultaneous failures) were not considered unless there is a common mode failure, as the probability of such failure is remote.
- In cases of parallel equipment (similar standby/spare equipment) inside the unit, the study was conducted for one set of equipment. The actions from this study will therefore apply for the corresponding parallel system as well.
- A single check valve was deemed to be an acceptable safeguard against reverse flow, unless the team felt that failure of the valve would lead to unacceptable consequence, or the differential pressure was so high that leakage would be inevitable.
- Equipment/ Machinery were assumed to be designed, manufactured commissioned and inspected with no defect. Rupture of equipment was not considered.
- Hazop assumes the integrity of the maintenance procedures and protocols have been devised and carried out properly at the appropriate turnarounds.
- Plant is operated by trained manpower. Operators were assumed to be well trained and provided with suitable documentation to assist in normal operations and emergency procedures.

6.9. HAZOP LIMITATIONS

The limitation for this Hazop study are as follows:

- Hazop presumes all equipment, pipes incorporated in P&ID are designed and constructed on the basis of relevant codes and the safeguards mentioned in the codes are incorporated.

7. FINDINGS OF THE REVIEW

HAZOP studies are, by definition, a qualitative study. The decisions made by the HAZOP team members are based on their experience and knowledge. All discussions were recorded using HAZOP Manager Software. The use of software enabled the on-line recording of the team discussion. The discussion from the study is recorded on log sheets called the Hazop Worksheet. The worksheet in table format, on which the minutes of Hazop workshop were recorded, has the following columns

- Deviation
- Causes
- Consequences
- Existing safeguards
- Recommendations/Actions

The Hazop study worksheet is enclosed as APPENDIX – 2 of this document.

During the HAZOP Study 126 recommendations were made, wherever the HAZOP team members determined the existing control measures were inadequate.

The Hazop study recommendations are enclosed as Section- 8 of this document.

8. LIST OF RECOMMENDATIONS / ACTIONS

NODE	ACTION	ACTION NO
1	Ensure ASV at upstream of vaporizer will also close at high level / high pressure (PT-001) at vaporiser	1
1	Provide Chlorine & Bromine Analyser at the final vent of Plant scrubber 200-SCRB-002	2
1	Ensure de- superheated temperature indication and alarm is provided in LPS supply	3
1	Ensure Interlock to close ASV- 001 with a delay timer at low pressure in Chlorine manifold to vaporizer.	4
1	Ensure and avoid Flip flop situation during chlorine tonner manifold changeover	5
1	Ensure Load cell in all the tonners connected with the chlorine manifold	6
1	Ensure hood with blower connected to scrubbing system from tonner area	7
1	Ensure Leak collection pipe at the ground level of tonner area.	8
1	SOP to be prepared for safe filter cleaning	9
1	Ensure Chlorine, Bromine detectors based on F&G mapping study	10
1	Ensure Fume half hoods provided for all containers & it is connected to scrubber	11
1	Ensure emergency fume hood (mobile) is provided	12
1	Appropriate PPE (full suit) to be made available in tonner and Vaporiser area	13
1	Ensure wall is provided around chlorine tonner of appropriate height to prevent chlorine release to environment.	14
1	Ensure Chlorine detector is provided at condensate collection point and testing the condensate before transferring to boiler	15
1	Ensure periodic inspection & painting of pipeline, structures in tonner and vaporiser area	16
2	Review for connecting overflow through LSH-C-2010 to 200-T-002 instead of 200-T-001 A	17

NODE	ACTION	ACTION NO
2	Provide temperature Indication with high temperature alarm upstream of FCV-C-3020	18
2	Review the interlock I-54 (to be deleted)	19
2	Study and review to provide interlock chlorine and steam 200-C-2010. Study also to stop steam to 200-C-3010.	20
2	Study and review for providing flow switch in cooling water 200-E-2012 A/B and interlock to stop feed to reaction section at no flow detection.	21
2	Provide on/off valve in open condition instead of LCV-E-2013 to keep continuous effluent flow to waste treatment	22
2	Provide NRV in the downstream of XV-C-2010/2 to prevent reverse flow	23
2	Provide NRV in the downstream of XV C 2010/1 to prevent reverse flow	24
3	Provide temperature indication with alarm in vent line down steam of 200-E-3012 A and B	25
3	Provide high temperature alarm in TIA -2001	26
3	Provide temperature indication with alarm in vent line downstream of 200-E-3012 A and B	27
3	Function of QIS to be checked and confirmed	28
3	Condensate recovery from 200-E-3011 to be indicated in P&ID and it is to be corrected.	29
3	Contaminated condensate not to be transferred to BFW tank.	30
3	[1]. Ensure redundancy provided in DCS for Control card, UPS power, battery backup, dual communication bus etc	31
3	Provide hardware interlock for plant shutdown at PT 2007 high high.	32
3	Provide hardware interlock for plant shutdown at LS 2009 activation	33
3	Provide hardware interlock for plant shutdown at DPIA 2027 high high	34
3	Ensure flange guards are provided in pipeline handling bromine	35

NODE	ACTION	ACTION NO
4	Provide equalising line from iso tanker to plant scrubber at appropriate location	36
4	Review to provide high level switch, On/off valve and interlock to close on/off valve at high high level OR Provide overflow line of Scrubber Tank-1 and Tank-2 to drain pit	37
4	Provide temperature indication in the scrubber tank 1 & 2 also in the vapour inlet line to scrubber	38
4	Review to provide safety relief valve at 200-P-003 A and B separately and discharge to be connected to 200-P-003 A and B	39
4	Provide a standby pump for scrubber tank 1 and tank 2 circulation	40
4	Provide flow indication in the circulation line of the pump 200-P-022 A/B to monitor suction line of pump	41
4	Review I-2 interlock during the complete shutdown due to PIA P022 A/B low pressure	42
4	Review to provide interlock to start the standby blower at the failure of running blower	43
5	Provide level indication with high and low level alarm	44
5	Provide low level switch is CW SUMP (above low low level in LIA T-005 level) with high priority alarm	45
5	Provide CW flow indication in CW to CH UNIT.	46
5	If none of the cooling water pump is running, provide interlock with a delay time to close main chlorine feed control valve (during operation- similar to startup check interlock)	47
5	Ensure Self-cleaning facility provided in CW system	48
6	Review for automatic level makeup with float system in hot well in chiller package	49
6	If none of the CHW water pump is running, provide interlock with a delay time to close main chlorine feed control valve (during operation- similar to startup check interlock)	50
7	Provide high level switch in Bromine tank 200 T-004A and critical alarm on high level	51

NODE	ACTION	ACTION NO
7	Provide interlock to shutoff bromine section if both product tanks are high high level	52
7	Provide WIA-7004A and LIA T-004A high level alarm as critical alarm	53
7	Ensure dyke with drain pit is provided for all bromine storage tank.	54
7	Ensure for providing drain pit pump to transfer contaminated material to ETP/ reject storage tank	55
9	Review for providing high level switch or level measurement with appropriate instrument in the coal bunker and interlock to stop upstream equipment (coal crusher, belt conveyor and bucket conveyor) for increased safety	56
9	Review to provide online CO analyser for monitoring for increased safety (to avoid afterburning)	57
9	SOP to develop for operator action	58
9	Same tag number for temperature indication (TI 401A) in furnace and downstream equipment. Interlock will be based on which temperature indication, is to be indicated in the control logic. Similarly for steam pressure interlock.	59
9	Is there any VFD in FD or ID fan to adjust the air flow rate to control combustion? If not, how combustion air flow is controlled?	60
9	Provide pressure indication in the inlet of preheater	61
9	Ensure to pull cord for manual stopping of conveyor (if the conveyor is too long)	62
9	Provide linear heat detection over the conveyor belt and initiation of firefighting system of the particular belt automatically if required	63
9	Automatic fire extinguishing system for the coal fire to be developed if required	64
9	Provide fire retardant belt for coal conveying (if the conveyor is too long)	65
9	Ensure fire hydrant system is available around the coal yard	66
9	Ensure manual call points are available and alarms are provided in the control room	67

NODE	ACTION	ACTION NO
9	Ensure round the clock surveillance	68
9	Ensure insulation is provided at the bottom hopper	69
9	Ensure PPE are provided for the maintenance crew	70
9	Ensure interlock action I102 with the pressure switch and pressure transmitter	71
9	Provide interlock to trip the furnace at high furnace temperature	72
9	Provide furnace pressure indication and update interlock I104	73
9	Provide interlock to stop coal feed if steam drum level is low (safety interlock)	74
9	Ensure negative draft in the furnace before opening the peep hole / inspection hole by providing draft gauge nearer to the peep hole / inspection hole	75
9	Ensure conveyors & other downstream equipment are connected with hood	76
9	Ensure coal received in the coal yard is tested for the quality	77
9	Provide interlock to stop feed conveyor on bucket elevator failure	78
9	Review for providing zero speed switch in all the conveyors to deduct the failure	79
9	Provide interlock to stop all the upstream equipment in belt conveyor failure 79 Review for providing zero sped switch in all the conveyors to deduct the failure	80
9	Dust collector of sufficient capacity to be installed in areas where the coal dust generation will be high	81
9	Ensure ash loading operation is carried out in a closed area and make provision of ash conditioner (with water spraying)	82
9	Ensure alternate arrangement is made to dispose the ash directly from hopper through RAV	83
9	Ensure sampling point and online stack analyser for NOx & SOx	84
10	Review to provide interlock to trip 200-P-017 A/B pump at low low level in 200-T-017	85

NODE	ACTION	ACTION NO
11	Provide selector switch for caustic unloading & transfer to process	86
11	Provide interlock to stop 200 P-011/012 at high level in LIA T-011 during unloading operation	87
11	Provide secondary containment like Dyke for the caustic storage tank	88
11	Provide Alkali resistance Tiles inside the caustic Dyke.	89
11	Provide minimum distance between inside wall of the dyke to Basement of storage tank half of the height of storage tank to avoid Spigot flow and spill over caustic outside dyke area	90
11	Provide water flow meter in PW line for operation flexibility	91
11	Provide interlock to stop 200 P-011/012 at low low level in LIA T-011 during transfer operation	92
11	Review to provide interlock to stop 200 P-011/12 at low low level in 200 T-012 during transfer operation	93
11	Provide flange guards for pipeline handling 48 % caustic	94
12	Provide level indication in scrubber tank-1 & 2	95
12	Review to provide NRV in the bromine vapor line from bottling area	96
12	Provide level indication in scrubber tank-1 & 2	97
12	Provide a standby pump for scrubber tank 1 and tank 2 circulation	98
12	Provide flow indication in the circulation line of the pump 200-P-023A/B to monitor suction line of pump	99
12	Review to provide bromine analyser at blower vent	100
12	Review to provide interlock to start the standby blower at the failure of running blower	101
13	Ensure IA will be available for safe shutdown of the plant	102
13	Ensure UPS provided for emergency lighting	103
13	Ensure UPS provided for power back up for DCS	104
13	Ensure Emergency DG set provided with automatic startup on power failure	105

NODE	ACTION	ACTION NO
13	Provide UPS for blowers, pumps, chilled water pumps and other critical equipment in the project	106
13	Provide high point vent & low point drain in the pipe header	107
13	Provide end blind in all the equipment drain and drain point of all toxic material	108
13	Review to provide recirculation pipeline with flow control to maintain a minimum flow for the pump all the time	109
14	I-6 will close ABO system. SO2 generation will not stop by I-6. SOP to incorporate procedure to stop SO2 generation in case of I-6 activation. SCADA to display the message.	110
14	Incorporate procedure to stop ABO operation in case the fluctuation is very high	111
14	Mother liquor transfer pump system to be shown in PID and HAZOP to be revisited	112
14	On chlorine supply failure to respective ABO unit, provide system to stop the acid supply, chlorine supply, SO2 supply (manually). SOP to incorporate procedure for safe shutdown of respective ABO module including stoppage of blower (ABO) & sea water.	113
14	SOP to incorporate procedure for 100-P008A failure including action on SO2 package	114
14	SOP to incorporate procedure for safe shutdown of respective ABO module including stoppage of blower (ABO) & sea water on mother liquor failure	115
14	Ensure CW circulation pump failure alarm	116
14	Provide the temperature indication with alarm in outlet of SO2 line. SOP to be incorporated for high temperature of SO2 for safe operation.	117
14	Provide flow glass in CW pump discharge line	118
14	Sample point to be provided in CW pump discharge	119
14	Provide slope at acid unloading area and a drain collection pit for sulphuric acid tanker / unloading hose leakage	120
14	Ensure acidproof tiles are used in acid unloading tanker, tank dyke and acid pump area	121

NODE	ACTION	ACTION NO
14	Ensure stoppage of chlorine, sulphuric acid, brine pump. SOP to incorporate procedure to stop sea water & SO2 generation.	122
14	Ensure supply of SO2 to ABO unit. SOP to incorporate procedure for SO2 supply failure.	123
14	Equipment and instruments tag numbers to be updated	124
14	PIDs to be updated	125
14	Interlocks to be made specific and its specific action to be indicated	126

APPENDIX – 1- ATTENDANCE SHEET

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GUJARAT POLLUTION CONTROL BOARD

PARYAVARAN BHAVAN, SECTOR 10-A,
GANDHINAGAR - 382010,
(T) 079-23232152

ANNEXURE-R-6

By R.P.A.D

In exercise of the power conferred under section-25 of the Water (Prevention and Control of Pollution) Act-1974, under section-21 of the Air (Prevention and Control of Pollution)-1981 and Authorization under rule 6(2) of the Hazardous and Other Waste (Management and Transboundary) Rules, 2016 framed under the Environmental (Protection) Act-1986. This Board is empowered to Grant CC&A.

And whereas Board has received consolidated consent application inward no. **109000637 dated 18/12/2025** for the **Consolidated Consent and Authorization** (CC & A) of this Board under the provisions / rules of the aforesaid Acts. Consents & Authorization are hereby granted as under:

CONSENTS AND AUTHORISATION:
(Under the provisions /rules of the aforesaid environmental acts)
To,
M/s. Shree Bhagwati Buildinfra Private Limited,
Unsurveyed Land, at Mota rann, Kutch,
Mudhan, Tal: Bhuj,
Dist: Kutch- 370 001.

1. **Consent Order No. AWH-153102 Date of issue: 31/01/2026.**
2. The consents shall be valid upto **17/12/2030** for the use of outlet for the discharge of treated effluent and emission due to operation of industrial plant for manufacturing of the following items/ products:

Sr. no.	Product	Quantity
1	Bromine	1250 MT/Month
2	Salt	5,00,000 MT/Month

Subject to specific condition:

1. Industry shall not carry out any activity which may attract the applicability of EIA notification-2006 & its amendment.
2. Industry shall comply with circular of the Board dated 27/08/2021 regarding retrofitting of emission control/ equipment in D.G. Set of capacity 125 KVA and above as per system & procedure for emission compliance testing of Retrofit Emission Control Devices (RECD) for D.G. Set issued by CPCB dated 01/02/2022 at the earliest and submit compliance.

3. **CONDITIONS UNDER THE WATER ACT:**

3.1 Total water consumption 2542.5 KLD. Industry shall provide DM plant, out of which

a. DM permeate, about 508 KLD, shall be used for industrial purpose & 25 KLD shall be used for domestic purpose.
b. DM reject, about 120 KLD, shall be used for preparation of lime slurry & remaining shall be used for salt washing in salt pan.

3.2 The quantity of the brine water consumption shall not exceed 48400 KLD.

3.3 Source of Water: - CGWA.

3.4 The quantity of the total water consumption for industrial purpose shall not exceed 2517.5 KL/Day

3.5 The quantity of the fresh water consumption for domestic purpose shall not exceed 25 KL/Day.

3.6 The quantity of industrial effluent generated from manufacturing process & other ancillary operation shall not exceed 532 KL/Day.

3.7 The quantity of domestic waste water (Sewage) shall not exceed 5 KL/Day.

3.8 Industry shall operate Effluent Treatment Plant (ETP) adequately so that treated industrial effluent shall conform to the following norms:

PARAMETERS	PRESCRIBED LIMITS
pH	6.5 to 8.5
Temperature	40°C
Colour (Pt. Co. scale) in units	100 units
Suspended Solids	100 mg/L
Oil and Grease	10 mg/L
Phenolic Compounds	1 mg/L
Ammonical Nitrogen	50 mg/L

All efforts shall be made to remove colour & unpleasant odour as far as practicable

3.9 There shall be no discharge of industrial effluent. Treated effluent 48932 KLD (brine water: 48400 KLD + Industrial effluent from process: 532 KLD), after necessary treatment shall be discharged into solar evaporation pond & recycled in to process, in order to achieve Zero Liquid Discharge.

3.10 Industry shall provide solar evaporation pond with leakage proof flooring and lining.

3.11 Industry shall provide fixed pipeline with flow meter for reuse of treated effluent & for conveyance of treated effluent to solar pond and maintain its record.

3.12 Industry shall provide fixed pipeline and flow meter for reuse/ recycling of treated effluent and maintain its records at site.

3.13 Sewage shall be treated separately in establish STP with conform to the following standards as per Hon.ble NGT order in the matter of OA No.1069/2018 dated 30/04/2019.

PARAMETERS	GPCB NORMS
pH	5.5-9.0
Biochemical Oxygen Demand (BOD)	10 mg/L
Total suspended solids (TSS)	20 mg/L
Chemical Oxygen Demand (COD)	50 mg/L
Nitrogen –Total	10 mg/L
Phosphorous-Total (for discharge into Ponds, Lakes)	1.0 mg/L
Fecal Coliform	Desirable-100 MPN/100ml Permissible -230 MPN/100 ml

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3.14 Treated domestic effluent conforming to above standard shall be discharged on land for gardening and plantation purpose within premises only. In no case waste water shall be discharged outside premises.

3.15 Industry shall provide fixed pipeline network with flow meter for even distribution of treated domestic effluent and maintain its record.

3.16 Disposal system for storm water shall be provided separately. In no circumstances storm water shall be mixed with the industrial effluent.

4. CONDITIONS UNDER THE AIR ACT:

4.1. The following shall be used as fuel in Boilers and D.G. Sets respectively:

Sr. No.	Utility	Fuel	Quantity
1.	Boilers	Coal/Lignite	1.9 MT/Hr
2.	D.G. Set (2 nos.) (125 KVA)	HSD	720 Liter/Day each
3.	D.G. Set (2 nos.) (650 KVA)	HSD	1950 Liter/Day each
4.	D.G. Set (3 nos.) (500 KVA)	HSD	1680 Liter/Day each

4.2. The applicant shall install air pollution control system in order to achieve emission norms.

4.3. The flue gas emission through stack attached to Boilers & D.G. Sets shall conform to the following standards.

Sr. No	Stack attached to	Stack height	APCM	Parameter	Permissible limit
1.	Boiler (1 TPH)	55 mtr common stack	ESP & Water scrubber (common)	PM SO_2 NO_x	150 mg/Nm^3 100 ppm 50 ppm
2.	Boiler (5 TPH)				
3.	D.G. Set (2 nos.) (125 KVA)	11 mtr	Acoustic Enclosure	PM SO_2 NO_x	150 mg/Nm^3 100 ppm 50 ppm
4.	D.G. Set (2 nos.) (650 KVA)	11 mtr	Acoustic Enclosure		
5.	D.G. Set (3 nos.) (500 KVA)	11 mtr	Acoustic Enclosure		

4.4. The process gas emission through stack attached to reaction vessel & feed enrichment section stack shall conform to the following standards.

Sr. No	Stack attached to	Stack height	APCM	Parameter	Permissible limit
1.	Reaction Vessel	12 mtr	Packed Column Scrubber	PM	150 mg/Nm^3
2.	Feed Enrichment Section Stack	12 mtr	Packed Column Scrubber	PM	150 mg/Nm^3

4.5. The concentration of the following parameters in the ambient air within the premises of the industry shall not exceed the limits specified hereunder as per National Ambient Air Quality Standards issued by MoEF & CC dated 18th November-2009.In addition to following parameters Industry shall also carry out AAQ monitoring of all

other applicable parameter as per MoEF notification dated 18/11/2009 and submit the report to the Board.

Sr. No.	Pollutant	Time Weighted Average	Concentration in Ambient air in µg/M^3
1.	Sulphur Dioxide (SO_2)	Annual 24 Hours	50 80
2.	Nitrogen Dioxide (NO_2)	Annual 24 Hours	40 80
3.	Particulate Matter (Size less than 10 µm) or PM_{10}	Annual 24 Hours	60 100
4.	Particulate Matter (Size less than 2.5 µm) or $PM_{2.5}$	Annual 24 Hours	40 60

4.6. The applicant shall provide portholes, ladder, platform etc at chimney(s) for monitoring the air emissions and the same shall be open for inspection to/and for use of Board's staff. The chimney(s) vents attached to various sources of emission shall be designed by numbers such as S-1, S-2, etc. and these shall be painted/ displayed to facilitate identification.

4.7. The industry shall take adequate measures for control of noise levels from its own sources within the premises so as to maintain ambient air quality standards in respect of noise to less than 75dB(A) during day time and70 dB (A) during night time. Daytime is reckoned in between 6a.m. and10 p.m. and nighttime is reckoned between 10 p.m. and 6 a.m.

4.8. D.G. Sets Conditions

The D.G. Set shall have acoustic enclosure and shall comply with the standards specified at Sr. no. 95 of Schedule-I of the rule-3 of E.P. Rules -1986 and Noise pollution level as per the Air Act-1981.

D.G. Sets standards:-

The flue gas emission through stack attached to D.G. Sets shall conform to the following standards.

a) The minimum height of stack to be provided with each of the generator set shall be H=h + 0.2 (KVA) 1/2, where H= Total stack height in meter, h= height of the building in meters where or by the side of which the generator set is installed.

b) Noise from DG set shall be controlled by providing an acoustic enclosure or by treating the room acoustically, at the users end.

c) The acoustic enclosure or acoustic treatment of the room shall be designed for minimum 25 dB (A) insertion loss or for meeting the ambient noise standards, whichever is on the higher side (if the actual ambient noise is on the higher side, it may not be possible to check the performance of the acoustic enclosure/ acoustic treatment. Such circumstances the performance may be checked for noise reduction up to actual ambient noise level, preferably, in the night time). The measurement for insertion loss may be done at different points at 0.5 m from the acoustic enclosure/room, and the averaged.

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d) The D.G. Set shall be provided with proper exhaust muffler with insertion loss of minimum 25 dB (A).
e) All efforts shall be made to bring down the noise level due to the D.G. Set, outside the premises, within the ambient noise requirements by proper siting and control measures.
f) Installation of a D.G. Sets must be strictly in compliance with the recommendations of the D.G. Set manufacturer.
g) A proper routine and preventive maintenance procedure for the D.G. Set should be set and followed in consultation with the DG Set manufacture which would help prevent noise levels of the DG Set from deteriorating with use.

5. AUTHORIZATION as per HAZARDOUS AND OTHER WASTE (MANAGEMENT AND TRANSBOUNDARY) RULES, 2016 Form-2 [See rule 6 (2)]

Form for grant of authorization for occupier or operator handling Hazardous waste

5.1 Authorization order No:-**AWH- 153102** date of Issue: **31/01/2026.**

5.2 **M/s. Shree Bhagwati Buildinfra Private Limited,** is hereby granted an authorization based on the enclosed signed inspection report for generation, collection, treatment, storage, transport of hazardous waste on the premises situated at unsurveyed land, at mota rann, Mudhan, Tal: Bhuj, Dist: Kutch.

Sr. No	Waste	Quantity	Schedule/ Category	Facility
1	Used/ Spent Oil	0.05 MTA	I-5.1	Collection, storage & reuse as lubricate within premises.
2	ETP Sludge	4500 MTA	I-35.3	Collection, storage & reuse back in plant.

5.3 The authorization shall be valid upto 17/12/2030.

5.4 The authorization is subject to the conditions stated below and such other conditions as may be specified in the rules from time to time under the Environment (Protection) Act-1986.

5.5 The authorization is granted to operate a facility for collection, storage within factory premises transportation and ultimate disposal of Hazardous wastes as per condition no.5.2 to the industry having valid CCA of this Board.

5.6 TERMS AND CONDITIONS OF AUTHORISATION

1. The applicant shall comply with the provisions of the Environment (Protection) Act-1986 and the rules made there under.
2. The authorization or its renewal shall be produced for inspection at the request of an officer authorized by the Gujarat Pollution Control Board.
3. The persons authorized shall not rent, lend, sell, and transfer or otherwise transport the hazardous wastes without obtaining prior permission of the Gujarat Pollution Control Board.

4. Any unauthorized change in personnel, equipment or working conditions as mentioned in the authorization order by the persons authorized shall constitute a beach of this authorization.
5. The person authorized shall implement Emergency Response Procedure (ERP) for which this authorization is being granted considering all site specific possible scenarios such as spillages, leakages, fire etc. and their possible impacts and also carry out mock drill in this regard at regular interval of time;
6. The person authorized shall comply with the provisions outlined in the Central Pollution Control Board guidelines on "Implementing Liabilities for Environmental Damages due to Handling and Disposal of Hazardous Wastes and Penalty"
7. It is the duty of the authorized person to take prior permission of the Gujarat Pollution Control Board to close down the facility.
8. An application for the renewal of an authorization shall be made as laid down in rules 6(2) under Hazardous and Other Waste Rules, 2016.
9. The imported hazardous and other wastes shall be fully insured for transit as well as for any accidental occurrence and its clean-up operation.
10. The record of consumption and fate of the imported hazardous and other wastes shall be maintained.
11. The hazardous and other wastes which gets generated during recycling or reuse or recovery or pre-processing or utilization of imported hazardous or other wastes shall be treated and disposed of as per specific conditions of authorization.
12. The importer or exporter shall bear the cost of import or export and mitigation of damages if any.
13. Any other conditions for compliance as per the Guidelines issued by the Ministry of Environment, Forest and Climate Change or Central Pollution Control Board from time to time.
14. The waste generator shall be totally responsible for (i.e. collection, storage, transportation and ultimate disposal) the wastes generated.
15. Records of waste generation, its management and annual return shall be submitted to Gujarat Pollution Control Board in Form-4 by 30th day of June of every year for the preceding period April to March.
16. In case of any accident, details of the same shall be submitted on Form-11 to Gujarat Pollution Control Board.
17. As per "Public Liability Insurance Act-91" company shall get Insurance Policy, if applicable.
18. Empty drums and containers of toxic and hazard material shall be treated as per guideline published for "Management & Handling of discarded containers". Records of the same shall be maintained and forwarded to Gujarat Pollution Control Board regularly.
19. In case of transport of hazardous wastes to a facility for (i.e. treatment, storage and disposal) existing in a State other than the State where hazardous wastes are generated, the occupier shall obtain 'No Objection Certificate' from the State Pollution Control Board or Committee of the concerned State of Union Territory Administration where the facility exists.
20. Unit shall take all concrete measures to show tangible results in waste generation, reduction, avoidance, reuse and recycle. Actions taken in this regard shall be submitted within three months and also along with Form-4.

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21. Industry shall have to display the relevant information with regards to hazardous waste as indicated in the Hon. Supreme Court's Order in W.P. No.657 of 1995 dated 14th October, 2003.
22. Industry shall have to display on-line data outside the main factory gate with regard to quantity and nature of hazardous chemicals being handled in the plant, including wastewater and air emissions and solid hazardous wastes generated within the factory premises.

6 SPECIFIC CONDITIONS:-

6.1 The authorized actual user of hazardous and other wastes shall maintain records of hazardous and other wastes purchased in a passbook issued by the State Pollution Control Board along with the authorization.

6.2 Handling over of the hazardous and other wastes to the authorized actual user shall be only after making the entry in the passbook of the actual user.

6.3 In case of renewal of authorization, a self-certified compliance report in respect of effluent, emission standards and the conditions specified in the authorization for hazardous and other wastes shall be submitted to SPCB.

6.4 The occupier of the facility shall comply Standard operating procedure/guidelines published by MOEF&CC or CPCB or GPCB from time to time.

6.5 Unit shall comply provisions of E-Waste Management Rules-2016.

6.6 The disposal of Hazardous Waste shall be carried out as per the waste Management hierarchy.

6.7 The occupiers of facilities shall not store the hazardous and other wastes for a period not exceeding **ninety days**. Prior permission of the Board shall be obtained for extension of the storage period.

6.8 The occupier shall maintain the records of generation, sale, storage, transport, recycling, co processing and disposal of hazardous waste and make available during the inspection.

6.9 The transportation of the hazardous waste shall be carried out in GPS mounted dedicated vehicles.

7 GENERAL CONDITIONS: -

7.1 Any change in personnel, equipment or working conditions as mentioned in the consents form/order should immediately be intimated to this Board.

7.2 Applicant shall also comply with the general conditions given in annexure I.

7.3 Whenever due to accident or other unforeseen act or ever, such emissions occur or is apprehended to occur in excess of standards laid down such information shall be forthwith reported to Board, concerned Police Station, Office of Directorate of Health Service, Department of Explosives, Inspectorate of Factories and local body.

7.4 In case of failure of pollution control equipments, the production process connected to it shall be stopped. Remedial actions/measures shall be implemented immediately to bring entire situation normal.

7.5 The Environmental Management Unit/Cell shall be setup to ensure implementation on and monitoring of environmental safeguards and other conditions stipulated by

statutory authorities. The Environmental Management Cell/Unit shall directly report to the Chief Executive of the organization and shall work as a focal point for internalizing environmental issues. These cells/units also coordinate the exercise of environmental audit and preparation of environmental statements.

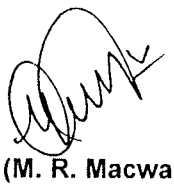
7.6 The Environmental audit shall be carried out yearly and the environmental statements pertaining to the previous year shall be submitting to this State Board latest by 30th September every year.

7.7 The Board reserves the right to review and/or revoke the consent and/or make variations in the conditions, which the Board deems, fit in accordance with Section 27 of the Act.

7.8 In case of change of ownership/management the name and address of the new owners/ partners/directors/proprietor should immediately be intimated to the Board.

7.9 Industry shall have to display the relevant information with regard to hazardous waste as indicated in the Hon. Supreme order in w.p. no. 657 of 1995 dated 14th October 2003.

For and on behalf of
GUJARAT POLLUTION CONTROL BOARD



(M. R. Macwana)
Unit Head
Date: - /02/2026

NO: PC/CCA-KUTCH-1997/GPCB ID-76360/
Issued to:
M/s. Shree Bhagwati Buildinfra Private Limited,
Unsurveyed Land, at Mota rann,
Mudhan, Tal: Bhuj,
Dist: Kutch- 370 001.

GUJARAT POLLUTION CONTROL BOARD

GPCB
PARYAVARAN BHAVAN, SECTOR 10-A,
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By R.P.A.D

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Subject to specific condition:

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3.1 Total water consumption 2542.5 KLD. Industry shall provide DM plant, out of which

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Colour (Pt. Co. scale) in units	100 units
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All efforts shall be made to remove colour & unpleasant odour as far as practicable

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3.10 Industry shall provide solar evaporation pond with leakage proof flooring and lining.

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3.12 Industry shall provide fixed pipeline and flow meter for reuse/ recycling of treated effluent and maintain its records at site.

3.13 Sewage shall be treated separately in establish STP with conform to the following standards as per Hon.ble NGT order in the matter of OA No.1069/2018 dated 30/04/2019.

PARAMETERS	GPCB NORMS
pH	5.5-9.0
Biochemical Oxygen Demand (BOD)	10 mg/L
Total suspended solids (TSS)	20 mg/L
Chemical Oxygen Demand (COD)	50 mg/L
Nitrogen –Total	10 mg/L
Phosphorous-Total (for discharge into Ponds, Lakes)	1.0 mg/L
Fecal Coliform	Desirable-100 MPN/100ml Permissible -230 MPN/100 ml

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3.14 Treated domestic effluent conforming to above standard shall be discharged on land for gardening and plantation purpose within premises only. In no case waste water shall be discharged outside premises.

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3.16 Disposal system for storm water shall be provided separately. In no circumstances storm water shall be mixed with the industrial effluent.

4. <u>CONDITIONS UNDER THE AIR ACT:</u>

4.1. The following shall be used as fuel in Boilers and D.G. Sets respectively:

Sr. No.	Utility	Fuel	Quantity
1.	Boilers	Coal/Lignite	1.9 MT/Hr
2.	D.G. Set (2 nos.) (125 KVA)	HSD	720 Liter/Day each
3.	D.G. Set (2 nos.) (650 KVA)	HSD	1950 Liter/Day each
4.	D.G. Set (3 nos.) (500 KVA)	HSD	1680 Liter/Day each

4.2. The applicant shall install air pollution control system in order to achieve emission norms.

4.3. The flue gas emission through stack attached to Boilers & D.G. Sets shall conform to the following standards.

Sr. No	Stack attached to	Stack height	APCM	Parameter	Permissible limit
1.	Boiler (1 TPH)	55 mtr common stack	ESP & Water scrubber (common)	PM SO_2 NO_x	150 mg/Nm^3 100 ppm 50 ppm
2.	Boiler (5 TPH)				
3.	D.G. Set (2 nos.) (125 KVA)	11 mtr	Acoustic Enclosure	PM SO_2 NO_x	150 mg/Nm^3 100 ppm 50 ppm
4.	D.G. Set (2 nos.) (650 KVA)	11 mtr	Acoustic Enclosure		
5.	D.G. Set (3 nos.) (500 KVA)	11 mtr	Acoustic Enclosure		

4.4. The process gas emission through stack attached to reaction vessel & feed enrichment section stack shall conform to the following standards.

Sr. No	Stack attached to	Stack height	APCM	Parameter	Permissible limit
1.	Reaction Vessel	12 mtr	Packed Column Scrubber	PM	150 mg/Nm^3
2.	Feed Enrichment Section Stack	12 mtr	Packed Column Scrubber	PM	150 mg/Nm^3

4.5. The concentration of the following parameters in the ambient air within the premises of the industry shall not exceed the limits specified hereunder as per National Ambient Air Quality Standards issued by MoEF & CC dated 18th November-2009.In addition to following parameters Industry shall also carry out AAQ monitoring of all

other applicable parameter as per MoEF notification dated 18/11/2009 and submit the report to the Board.

Sr. No.	Pollutant	Time Weighted Average	Concentration in Ambient air in µg/M³
1.	Sulphur Dioxide (SO_2)	Annual 24 Hours	50 80
2.	Nitrogen Dioxide (NO_2)	Annual 24 Hours	40 80
3.	Particulate Matter (Size less than 10 µm) or PM_{10}	Annual 24 Hours	60 100
4.	Particulate Matter (Size less than 2.5 µm) or $PM_{2.5}$	Annual 24 Hours	40 60

4.6. The applicant shall provide portholes, ladder, platform etc at chimney(s) for monitoring the air emissions and the same shall be open for inspection to/and for use of Board's staff. The chimney(s) vents attached to various sources of emission shall be designed by numbers such as S-1, S-2, etc. and these shall be painted/ displayed to facilitate identification.

4.7. The industry shall take adequate measures for control of noise levels from its own sources within the premises so as to maintain ambient air quality standards in respect of noise to less than 75dB(A) during day time and70 dB (A) during night time. Daytime is reckoned in between 6a.m. and10 p.m. and nighttime is reckoned between 10 p.m. and 6 a.m.

4.8. D.G. Sets Conditions

The D.G. Set shall have acoustic enclosure and shall comply with the standards specified at Sr. no. 95 of Schedule-I of the rule-3 of E.P. Rules -1986 and Noise pollution level as per the Air Act-1981.

D.G. Sets standards:-

The flue gas emission through stack attached to D.G. Sets shall conform to the following standards.

a) The minimum height of stack to be provided with each of the generator set shall be H=h + 0.2 (KVA) 1/2, where H= Total stack height in meter, h= height of the building in meters where or by the side of which the generator set is installed.

b) Noise from DG set shall be controlled by providing an acoustic enclosure or by treating the room acoustically, at the users end.

c) The acoustic enclosure or acoustic treatment of the room shall be designed for minimum 25 dB (A) insertion loss or for meeting the ambient noise standards, whichever is on the higher side (if the actual ambient noise is on the higher side, it may not be possible to check the performance of the acoustic enclosure/ acoustic treatment. Such circumstances the performance may be checked for noise reduction up to actual ambient noise level, preferably, in the night time). The measurement for insertion loss may be done at different points at 0.5 m from the acoustic enclosure/room, and the averaged.

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d) The D.G. Set shall be provided with proper exhaust muffler with insertion loss of minimum 25 dB (A).
e) All efforts shall be made to bring down the noise level due to the D.G. Set, outside the premises, within the ambient noise requirements by proper siting and control measures.
f) Installation of a D.G. Sets must be strictly in compliance with the recommendations of the D.G. Set manufacturer.
g) A proper routine and preventive maintenance procedure for the D.G. Set should be set and followed in consultation with the DG Set manufacture which would help prevent noise levels of the DG Set from deteriorating with use.

5. AUTHORIZATION as per HAZARDOUS AND OTHER WASTE (MANAGEMENT AND TRANSBOUNDARY) RULES, 2016 Form-2 [See rule 6 (2)]

Form for grant of authorization for occupier or operator handling Hazardous waste

5.1 Authorization order No:-**AWH- 153102** date of Issue: **31/01/2026.**

5.2 **M/s. Shree Bhagwati Buildinfra Private Limited,** is hereby granted an authorization based on the enclosed signed inspection report for generation, collection, treatment, storage, transport of hazardous waste on the premises situated at unsurveyed land, at mota rann, Mudhan, Tal: Bhuj, Dist: Kutch.

Sr. No	Waste	Quantity	Schedule/ Category	Facility
1	Used/ Spent Oil	0.05 MTA	I-5.1	Collection, storage & reuse as lubricate within premises.
2	ETP Sludge	4500 MTA	I-35.3	Collection, storage & reuse back in plant.

5.3 The authorization shall be valid upto 17/12/2030.

5.4 The authorization is subject to the conditions stated below and such other conditions as may be specified in the rules from time to time under the Environment (Protection) Act-1986.

5.5 The authorization is granted to operate a facility for collection, storage within factory premises transportation and ultimate disposal of Hazardous wastes as per condition no.5.2 to the industry having valid CCA of this Board.

5.6 TERMS AND CONDITIONS OF AUTHORISATION

1. The applicant shall comply with the provisions of the Environment (Protection) Act-1986 and the rules made there under.
2. The authorization or its renewal shall be produced for inspection at the request of an officer authorized by the Gujarat Pollution Control Board.
3. The persons authorized shall not rent, lend, sell, and transfer or otherwise transport the hazardous wastes without obtaining prior permission of the Gujarat Pollution Control Board.

4. Any unauthorized change in personnel, equipment or working conditions as mentioned in the authorization order by the persons authorized shall constitute a beach of this authorization.
5. The person authorized shall implement Emergency Response Procedure (ERP) for which this authorization is being granted considering all site specific possible scenarios such as spillages, leakages, fire etc. and their possible impacts and also carry out mock drill in this regard at regular interval of time;
6. The person authorized shall comply with the provisions outlined in the Central Pollution Control Board guidelines on "Implementing Liabilities for Environmental Damages due to Handling and Disposal of Hazardous Wastes and Penalty"
7. It is the duty of the authorized person to take prior permission of the Gujarat Pollution Control Board to close down the facility.
8. An application for the renewal of an authorization shall be made as laid down in rules 6(2) under Hazardous and Other Waste Rules, 2016.
9. The imported hazardous and other wastes shall be fully insured for transit as well as for any accidental occurrence and its clean-up operation.
10. The record of consumption and fate of the imported hazardous and other wastes shall be maintained.
11. The hazardous and other wastes which gets generated during recycling or reuse or recovery or pre-processing or utilization of imported hazardous or other wastes shall be treated and disposed of as per specific conditions of authorization.
12. The importer or exporter shall bear the cost of import or export and mitigation of damages if any.
13. Any other conditions for compliance as per the Guidelines issued by the Ministry of Environment, Forest and Climate Change or Central Pollution Control Board from time to time.
14. The waste generator shall be totally responsible for (i.e. collection, storage, transportation and ultimate disposal) the wastes generated.
15. Records of waste generation, its management and annual return shall be submitted to Gujarat Pollution Control Board in Form-4 by 30th day of June of every year for the preceding period April to March.
16. In case of any accident, details of the same shall be submitted on Form-11 to Gujarat Pollution Control Board.
17. As per "Public Liability Insurance Act-91" company shall get Insurance Policy, if applicable.
18. Empty drums and containers of toxic and hazard material shall be treated as per guideline published for "Management & Handling of discarded containers". Records of the same shall be maintained and forwarded to Gujarat Pollution Control Board regularly.
19. In case of transport of hazardous wastes to a facility for (i.e. treatment, storage and disposal) existing in a State other than the State where hazardous wastes are generated, the occupier shall obtain 'No Objection Certificate' from the State Pollution Control Board or Committee of the concerned State of Union Territory Administration where the facility exists.
20. Unit shall take all concrete measures to show tangible results in waste generation, reduction, avoidance, reuse and recycle. Actions taken in this regard shall be submitted within three months and also along with Form-4.

GPCB

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21. Industry shall have to display the relevant information with regards to hazardous waste as indicated in the Hon. Supreme Court's Order in W.P. No.657 of 1995 dated 14th October, 2003.
22. Industry shall have to display on-line data outside the main factory gate with regard to quantity and nature of hazardous chemicals being handled in the plant, including wastewater and air emissions and solid hazardous wastes generated within the factory premises.

6 SPECIFIC CONDITIONS:-

6.1 The authorized actual user of hazardous and other wastes shall maintain records of hazardous and other wastes purchased in a passbook issued by the State Pollution Control Board along with the authorization.

6.2 Handling over of the hazardous and other wastes to the authorized actual user shall be only after making the entry in the passbook of the actual user.

6.3 In case of renewal of authorization, a self-certified compliance report in respect of effluent, emission standards and the conditions specified in the authorization for hazardous and other wastes shall be submitted to SPCB.

6.4 The occupier of the facility shall comply Standard operating procedure/guidelines published by MOEF&CC or CPCB or GPCB from time to time.

6.5 Unit shall comply provisions of E-Waste Management Rules-2016.

6.6 The disposal of Hazardous Waste shall be carried out as per the waste Management hierarchy.

6.7 The occupiers of facilities shall not store the hazardous and other wastes for a period not exceeding **ninety days**. Prior permission of the Board shall be obtained for extension of the storage period.

6.8 The occupier shall maintain the records of generation, sale, storage, transport, recycling, co processing and disposal of hazardous waste and make available during the inspection.

6.9 The transportation of the hazardous waste shall be carried out in GPS mounted dedicated vehicles.

7 GENERAL CONDITIONS: -

7.1 Any change in personnel, equipment or working conditions as mentioned in the consents form/order should immediately be intimated to this Board.

7.2 Applicant shall also comply with the general conditions given in annexure I.

7.3 Whenever due to accident or other unforeseen act or ever, such emissions occur or is apprehended to occur in excess of standards laid down such information shall be forthwith reported to Board, concerned Police Station, Office of Directorate of Health Service, Department of Explosives, Inspectorate of Factories and local body.

7.4 In case of failure of pollution control equipments, the production process connected to it shall be stopped. Remedial actions/measures shall be implemented immediately to bring entire situation normal.

7.5 The Environmental Management Unit/Cell shall be setup to ensure implementation on and monitoring of environmental safeguards and other conditions stipulated by

statutory authorities. The Environmental Management Cell/Unit shall directly report to the Chief Executive of the organization and shall work as a focal point for internalizing environmental issues. These cells/units also coordinate the exercise of environmental audit and preparation of environmental statements.

7.6 The Environmental audit shall be carried out yearly and the environmental statements pertaining to the previous year shall be submitting to this State Board latest by 30th September every year.

7.7 The Board reserves the right to review and/or revoke the consent and/or make variations in the conditions, which the Board deems, fit in accordance with Section 27 of the Act.

7.8 In case of change of ownership/management the name and address of the new owners/ partners/directors/proprietor should immediately be intimated to the Board.

7.9 Industry shall have to display the relevant information with regard to hazardous waste as indicated in the Hon. Supreme order in w.p. no. 657 of 1995 dated 14th October 2003.

For and on behalf of
GUJARAT POLLUTION CONTROL BOARD

(M. R. Macwana)
Unit Head

NO: PC/CCA-KUTCH-1997/GPCB ID-76360/ **Date: - /02/2026**

Issued to:

M/s. Shree Bhagwati Buildinfra Private Limited,
Unsurveyed Land, at Mota rann,
Mudhan, Tal: Bhuj,
Dist: Kutch- 370 001.

ANNEXURE-R-7

મામલતદાર અને એક્ઝીક્યુટીવ મેજીસ્ટ્રેટની કચેરી,

લખપત, મુ.દયાપર-કચ્છ

ફોન:- (ઓ) ૦૨૮૩૯-૨૩૩૩૪૧ ઈ-મેઈલ: mam-lakhapat@gujarat.gov.in

નં.જમન-વશી-૧૯૦૩-૨૦૨૫ તા.૧૬/૧૨/૨૦૨૫

પ્રતિ,

મે.મદદનીશ કલેક્ટર સાહેબશ્રી,

નખત્રાણા - કચ્છ

વિષય:- શ્રી ભગવતી બિલ્ડ ઇન્ફ્રા કંપની દ્વારા મુધાન થી સાયરા તેમજ ગુનેરી ગેરકાયદેસર રીતે રસ્તો બનાવી તેમજ ગેરકાયદેસર માટીની ચોરી કરવા બાબત

સંદર્ભ:- શ્રી મુધાન જુથ ગ્રામ પંચાયતની તા.૧૬/૧૨/૨૦૨૫ વાળી રજુઆત અરજી.

સવિનય ઉપરોક્ત વિષય અન્વયે જણાવવાનું કે, શ્રી મુધાન જુથ ગ્રામ પંચાયતની તા.૧૬/૧૨/૨૦૨૫ વાળી રજુઆત મુજબ મુધાન અનસર્વે નંબર રણ વિસ્તારમાં શ્રી ભગવતી બિલ્ડ ઈન્ફ્રા કંપની બ્રોમીન તેમજ નીમક ઉત્પાદનની કંપની આવેલી છે. આ કંપની દ્વારા અગાઉ મુધાન ગામની ગૌચર જમીન તેમજ માલિકીની જમીન માંથી ગેરકાયદેસર રસ્તો બનાવીને કંપનીના વાહનોને પરિવહન કરતા હતા ત્યારે ગ્રામજનો દ્વારા તેનો સખત વિરોધ કરીને તેને કાયદાકિય રીતે રસ્તો બંધ કરી દેવામાં આવેલ છે. ઉપરોક્ત કંપની પોતાનો માર્ગ મંજુર કરાવેલ નથી અને આડેધડ મનફાવે ત્યાંથી રસ્તો બનાવીને વાહનો કાઢે છે જેનાથી ખેડુતોને, માલધારીઓને તેમજ જંગલખાતાની જમીનને ભારે નુકશાન થઈ રહ્યુ છે હાલમાં કંપની મુધાન ગામની ઉત્તર બાજુથી માલિકીના સ.નં.૧૨૭, ૧૨૮ ની ઉત્તરબાજુથી સરકારી જમીનમાં ગેરકાયદેસર રીતે માટીની ચોરી કરીને રસ્તાનો કામ ચાલુ કરેલ છે. જો આ રસ્તામાંથી કેમિકલના વાહનો તેમજ નીમકની ગાડીઓ પસાર થાશે તો જમીન ખારી થઈ જાશે જેનાથી ખેડુતો અને માલધારીઓને નુકશાન થાશે. રસ્તા પર નીમક પડશે. જે વરસાદ થતા આ નિમકવાળો પાણી ખેતરોમાં જશે અને જેનાથી ખેતરો ખારા થઈ જાશે તેમજ સરકારી મીઠી જમીન છે તે પણ ખારી થઈ જાશે તેમજ કંપની દ્વારા જે રસ્તો બનાવવામાં આવે છે જેનાથી કુદરતી વહેણ પણ બંધ થઈ જશે વરસાદનો પાણી બધો રણમાં જાય છે જે રસ્તો બનાવતા પાણી રોકાઈ જાશે જેનાથી મીઠી જમીન છે તેમાં ખારા પાણી ભરાશે તેમજ ખેડુતોના ખેતરો પણ ડૂબમાં જાશે જેનાથી ભારે નુકશાન જાય તેમ છે. ઉપરોક્ત કંપની દ્વારા અગાઉ મુ.ઝારા ગામથી કંપની સુધી ગેરકાયદેસર રીતે માર્ગ બનાવવામાં આવેલ છે તે માર્ગની ઉંચાઈ ૬ થી ૭ ફૂટ કરવામાં આવેલ છે. જેનાથી નદીઓ અને વોંકડાઓના પાણી રોકાઈ જાશે અને હાલમાં મુધાનથી સાયરા સુધી માર્ગ બનાવે છે જેનાથી પણ કુદરતી વહેણ રોકાઈ જાશે તો ખેડુતોને હિજરત કરવાનો સમય આવી જાશે આ કંપની કાયદાને નેવે મૂકી દીધેલ છે મનફાવે ત્યાંથી ગેરકાયદેસર રસ્તા બનાવે છે કંપની દ્વારા ગેરકાયદેસર રીતે ઝારાથી કરી મુધાન તેમજ સાયરા સુધી રસ્તો બનાવીને કુદરતી વહેણ બંધ કરી દીધેલ છે. હાલમાં ઉપરોકત કંપની દ્વારા કંપનીથી કરી મુધાન સરકારી જમીન જંગલખાતાની જમીન સાયરા ગુનેરી સુધી જે ગેરકાયદેસર રસ્તો બનાવવાનો ચાલુ છે અને માટી ચોરી કરીને રસ્તો બનાવે છે તેને તાત્કાલિક ધોરણે બંધ કરાવવા અરજદારશ્રીએ રજુઆત કરેલ છે. જે અન્વયે અત્રેથી અમો તથા સર્કલ ઓફીસરશ્રી દ્વારા તા.૧૮/૧૨/૨૦૨૫ ના રોજ સ્થળ ઉપર મુલાકાત કરતાં મુલાકાત સમયે કોઈ રૂકાવટ જોવા મળેલ નથી પરંતુ કંપનીના હાજર પ્રતિનિધિ દ્વારા જણાવેલ છે કે, રાધાકિષ્ના B.S.F. ચોકી તરફ જવાનો રસ્તો સાયરા ગામના સરકારી ટ્રા.સ.નં. માંથી પસાર થાય છે. તે રસ્તાનો હાલ કંપની ઉપયોગ કરે છે. પરંતુ મુધાન ગામના ઈસમો દ્વારા આ રસ્તા ઉપર કંપનીના વાહનોને અવર જવર કરતાં અટકાવે છે. કંપની દ્વારા મોજે મુધાન અને ખટીયુ તથા અનસર્વેડ જમીન ઉપરથી અગાઉ રસ્તાની

માંગણી કરેલ છે. પરંતુ તે રસ્તો ગામ તરફથી પસાર થતો હોઈ તે માંગણી ધ્યાને કરવા રજુઆત કરેલ છે. તે રસ્તો ઉપરથી કંપની ના વાહનો અવરજવર કરતા અટકાવેલ છે. તે સાચરા ગામના સ.નં. પરથી પસાર થાય છે જે રસ્તો પસાર થાય છે તે જમીન આજુ બાજુ ઝાંડા બાવળો આવેલ છે. કોઈ મીઠી ઝાડી આવેલ નથી કે કોઈને પણ અડચણરૂપ નથી. તેમજ કંપની દ્વારા કોઈ પણ રસ્તો બનાવેલ નથી માત્ર હયાત રસ્તાનો ઉપયોગ કરે છે. તેમ છતાં ચમુક ઈસમો દ્વારા અંગત સ્વાર્થ ખાતર રસ્તો રોકવામાં અવી રહેલ છે. કંપની દ્વારા મીઠા પરીવહન માટે સંપૂર્ણ નિયમોનું પાલન કરવા બંધાયેલ છે. તે મુજબની રજુઆત કંપનીના પ્રતિનિધિએ કરેલ છે.

અત્રેની સ્થળ વિઝિટ દરમ્યાન પણ કંપની દ્વારા હયાત બી.એસ.એફ તરફ જવાનો રસ્તાનો ઉપયોગ કરતાં હોવાનું જણાવેલ છે. જે અંદાજીત મુખ્ય ગ્રામ્ય માર્ગથી બી.એસ.એફ. ચોકી સુધી ૨ કીમી જેટલો રસ્તો છે. તેમજ બી.એસ.એફ ચોકી થી અનસર્વેડ જમીનમાં કંપની દ્વારા રસ્તો બનાવેલ છે. જેની લંબાઈ અંદાજિત ૫ થી ૬ કિમી છે. જે રસ્તો રણ વિસ્તારમાં જ આવેલ છે. અને અનસર્વેડ જમીનમાં આવેલ છે. માત્ર ૨ કિમી રસ્તો જે સાચરા અને ગુનેરીના સરકારી ટ્રા.સ.નં. પરથી પસાર થાય છે. તે રસ્તો ગ્રામ લોકો દ્વારા રોકવામાં આવેલ છે. જે તપાસ દરમ્યાન કોઈ રુકાવટ જોવા મળેલ નથી. ગ્રામલોકોએ ભવિષ્યની ચિંતાને લઈને રજુઆત કરેલ છે. જેથી અરજદારની અરજી દફ્તરે કરવામાં આવે છે. જે આપ સાહેબશ્રીને વિદિત થવા વિનંતી છે.

મામલતદાર-લખપત

બિડાણ :- ઉપર મુજબ

<u>નકલ રવાના:-</u>

- પોલીસ ઇન્સ્પેક્ટરશ્રી, દયાપર તા.લખપત-કચ્છ.

  /- ઉક્ત બાબતે સરપંચશ્રી કે અન્ય ઇસમો દ્વારા રસ્તો રોકવામાં ન આવે તે બાબતે જરૂરી કાયદો વ્યવસ્થા જાળવવા સારૂ.

- સરપંચશ્રી, મુધાન, તા.લખપત-કચ્છ.

  /- ઉક્ત કંપની દ્વારા કોઈ પણ રસ્તો બનાવેલ નથી માત્ર હયાત રસ્તાનો ઉપયોગ કરે છે જે બાબતે આપશ્રી કે અન્ય ઇસમો દ્વારા રસ્તો ન રોકવા સુચના આપવામાં આવે છે.

ANNEXURE-R-7-English Translation

Office of the Mamlatdar and Executive Magistrate,
Lakhpat, Mu. Dayapar-Kutch
Phone:- (O) 02839-233341
No. Jaman/Vashi/1903/2025

E-mail:- mam-lakhapat@gujarat.gov.in
Date: 18/12/2025

To,
The Hon'ble Assistant Collector Sir,
Nakhatrana - Kutch.

Subject:-
Regarding the illegal construction of a road and illegal soil theft by Shri Bhagwati Build Infra Company from Mudhan to Sayra and Guneri.

Reference:-
Application submitted by Shri Mudhan Juth Gram Panchayat dated 16/12/2025.

With due respect to the above-mentioned subject, it is to be stated that, as per the representation dated 16/12/2025 from Shri Mudhan Juth Gram Panchayat, Shri Bhagwati Build Infra Company, which produces bromine and salt, is located in the unsurveyed Rann area of Mudhan. This company had previously constructed an illegal road through the gauchar (pasture) land and privately owned land of Mudhan village for the transportation of its vehicles, which was strongly opposed by the villagers and the road was legally closed. The aforementioned company has not had its route approved and constructs roads wherever it pleases, causing great damage to farmers, pastoralists, and the forest department's land. Currently, the company has started work on a road by illegally stealing soil from government land on the north side of survey numbers 127 and 128 of Mudhan village. If vehicles carrying chemicals and salt pass through this road, the land will become saline, causing harm to farmers and pastoralists. Salt will fall on the road. When it rains, this salty water will enter the fields, making the fields saline, and the government's sweet soil will also become saline. Also, the road being built by the company will block the natural water flow. All the rainwater goes into the Rann, but by building the road, the water will be blocked, causing saline water to fill the sweet soil and the farmers' fields will also be submerged, resulting in great loss. The aforementioned company had previously illegally constructed a road from Mu. Zara village to the company, and the height of that road was raised by 6 to 7 feet. This will block the water of rivers and streams, and currently, it is building a road from Mudhan to Sayra, which will also block the natural flow. The time will come for the farmers to migrate. This company has disregarded the law and is building illegal roads wherever it pleases. The company has blocked the natural flow by illegally constructing a road from Zara to Mudhan and Sayra. Currently, the aforementioned company is continuing to build an illegal road from the company to Mudhan, government land, forest department land, Sayra, and Guneri, and is building the road by stealing soil, for which the applicant has made a representation to stop it immediately. In this regard, we and the Circle Officer visited the site on 18/12/2025. During the visit, no obstruction was observed, but the company's representative present stated that the road leading to the Radhakrishna B.S.F. post passes through the government Tra.S.No. of Sayra village. The company is currently using that road. However, individuals from Mudhan village are preventing the company's vehicles from plying on this road. The company had previously made a representation to stop the obstruction of the road on the land of Mouje Mudhan and Khatiyu and unsurveyed land.

has been requested. However, as that road passes through the middle of the village, a representation has been made to file the request. The company's vehicles have been stopped from plying on that road. It passes through Survey No. of Sayra village. The land through which the road passes has wild babul trees around it. There are no sweet bushes, nor is it an obstruction to anyone. Also, no road has been constructed by the company; it only uses the existing road. Despite this, some individuals are blocking the road for their personal gain. The company is bound to follow all rules for salt transportation. A representation to this effect has been made by the company's representative.

During the site visit here, it was also stated that the company was using the existing road leading towards the B.S.F. The road is approximately 2 km from the main village road to the B.S.F. post. Furthermore, a road has been constructed by the company in the unsurveyed land from the B.S.F. post, which is approximately 5 to 6 km in length. This road is located in the desert area and in the unsurveyed land. Only a 2 km road, which passes through the government Tra.S.No. of Sayra and Guneri, is being blocked by the villagers. During the investigation, no obstruction was found. The villagers have made a representation due to concerns about the future. Therefore, the applicant's application is being filed. This is a request to inform your honor.

Mamlatdar, Lakhpat

Enclosure :- As above

Copy forwarded to:-

> Police Inspector, Dayapar, Ta. Lakhpat-Kutch.

/- To maintain the necessary law and order so that the road is not blocked by the Sarpanch or other individuals regarding the above matter.

> Sarpanch, Mudhan, Ta. Lakhpat-Kutch.

/- No road has been constructed by the said company; it only uses the existing road. You or other individuals are instructed not to block the road regarding this matter.