Regd. Of. : 1st Floor, ABS Tower,
Old Padra Road, Vadodara-390 007.
Phone : +91-265-2341648, 2341649
Fax : +91-265-2336908
E-mail : marketing@oneirochemicals.net
CIN No. U24230GJ2004PLC044960

Works :
S. NO. 475/P,
At & Po. Ekalbara-391 440.
Ta. Padra, Dist. Vadodara.
Phone : +91-2662-244101

ONEIRO
CHEMICALS LIMITED

10.06.2015

To,
Director,
IA Division (Industry-II),
Ministry of Environment, Forest & Climate change
Indira Paryavaran Bhavan,
Jorbaug Road,
New Delhi.

Sub: Environment Clearance for Expansion of Bulk Drugs manufacturing unit at Village: Ekalbara, Taluka: Padra, Dist: Vadodara, Gujarat.

Ref: Minutes of 38th Reconstituted Expert Appraisal Committee (Industry-2) held on 20th-21st April, 2015. File no. J-11011/124/2013 & F. No. J-11011/372/2013-IA II (I).

Respected Sir,

This is regarding with above referred meeting for Environmental Clearance, honorable committee has asked following additional information and documents to recommend our case.

1. **Recommendation from the GPCB in respect of proposed expansion.**
   Pls. refer **Annexure-I** for recommendation from the GPCB in respect of proposed expansion.
2. **Layout map of existing project and proposed expansion indicating all the components as well as greenbelt.**
   Layout map including above details is enclosed as **Annexure-II.**
3. **Effluent treatment scheme considering segregation of effluent into high COD/TDS streams.**
   Effluent treatment scheme - flow diagram for stream segregation (High COD/High TDS from process) is enclosed as **Annexure-III.**
4. **Geo-hydrological study of the area.**
   Geo-hydrological study report of the area is enclosed as **Annexure-IV.**

We hope that, above details may meet with your requirement to recommend our case for Environment Clearance.

Thanking you,
For, **Oneiro Chemicals Ltd.**

Authorized Signatory

GPCB

GUJARAT POLLUTION CONTROL BOARD

PARYAVARAN BHAVAN
Sector-10-A, Gandhinagar-382 021.
Website : www.gpcb.gov.in

R.P.A.D.

No: GPCB/CCA-VRD- 741(4)/ID 22368- 31499 2 Dt: 21/05/2015

To

Dr. T. Chandini - Director
Ministry of Environment & Forests,
Govt. of India (I.A. Division)
Paryavaran Bhawan, CGO Complex,
Lodhi Road, New Delhi-110003

Sub: Proposed Expansion of Synthetic Organic Chemicals : Manufacturing Bulk Drugs & its Intermediates (19.5 MTPM to 37.5 MTPM) at Block No. 475/P, 469/A, 469/ B/1, 469/ B/2, 470/1, 471, 472/A, 472/B, 473, Village: Ekalbara, Taluka: Padra, District: Vadodara, Gujarat by Oneiro Chemicals Limited.

Ref: 1. This Office letter no. GPCB/CCA-VRD- 741(4)/ID 22368- dt.
2. Request letter received from project proponent dt. 20/04/2015.

Respected Sir,

This is with reference to the above subject and letters under reference. As requested by the Project Proponent under the instruction of the Ministry of Environment, Forests and Climate Change, New Delhi during meeting held on 20th April, 2015, the Board hereby recommends the project of M/s. Oneiro Chemicals Limited as follows:

M/s. Onerio Chemical Ltd. has proposed for expansion of Bulk Drugs Manufacturing Plant at plot no./block no. 475/P, 469/A, 469/B/1, 469/B/2, 470/1, 472/A, 472/B, 473, Village Ekalbara, Taluka Padra, District Vadodara, Gujarat. Industrial effluent generation will be increased from 80 m3 /day to 89 m3/day after expansion. Industrial effluent will be sent to Common Effluent Treatment Plant of Enviro Infrastructure Co. Ltd. (EICL), Umraya,Vadodara for its further treatment and disposal. Now, That CETP of EICL has been granted Environment Clearance as well as Consent to Establish for additional effluent capacity of 2250 KLD (Total capacity 4500 KLD). Bag-filter along with stack of adequate height will be provided to agro briquettes/FO fired boiler/ thermic fluid heater. Hazardous wastes will be sent to authorized Common Secured Landfill site or Common

Hazardous Waste Incineration facility or will sell for reuse/ utilization by authorised recyclers/re-processors.

The existing industrial unit is having valid Consents and Authorisation (CCA) under the provisions of the Water Act, 1974, Air Act, 1981 and Hazardous Waste Rule, 2008. The compliance report of CTO is submitted to you vide letter under reference no. (1).

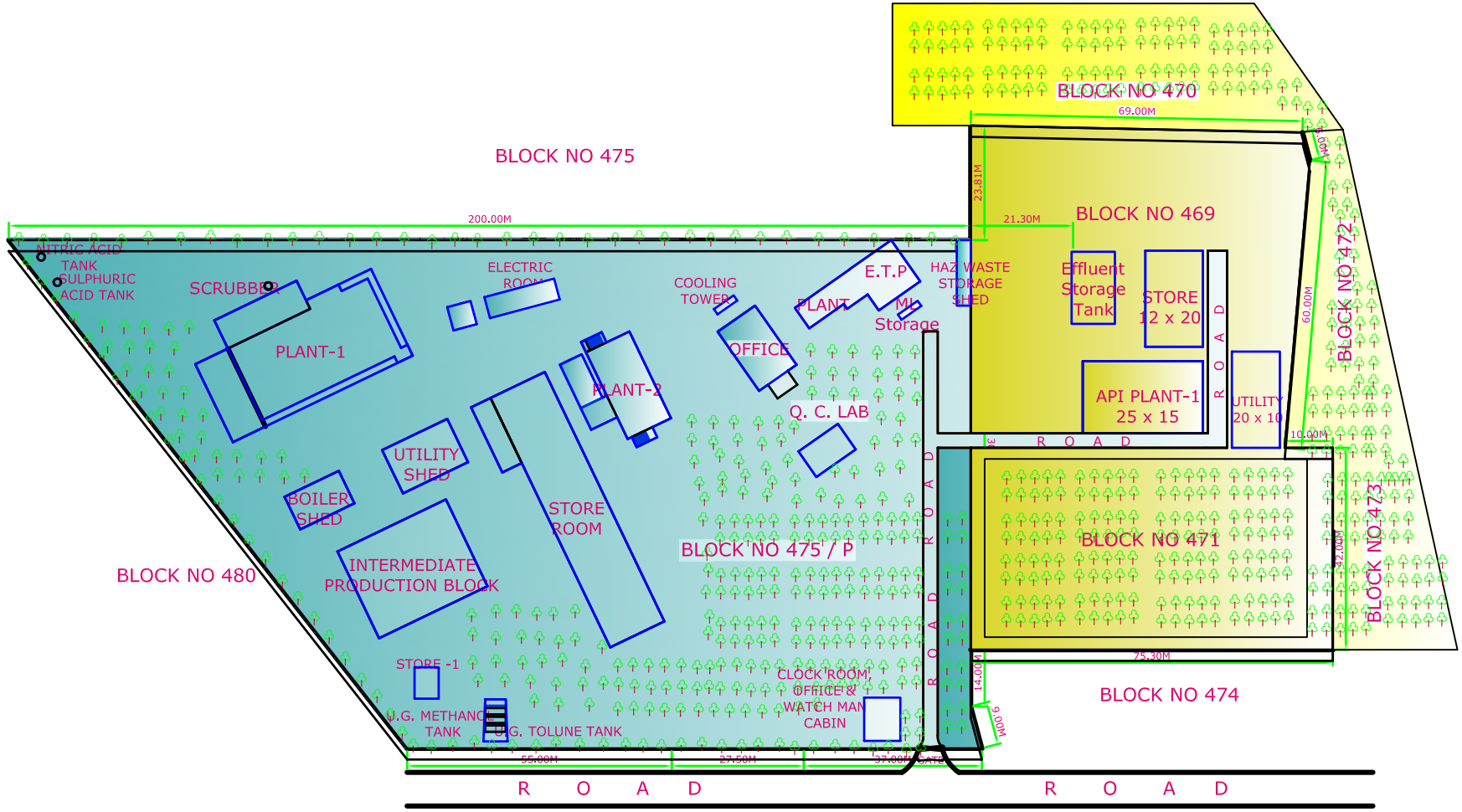
After carefully considering the technical and environmental aspects of the proposed expansion project, the Gujarat Pollution Control Board hereby **recommends** the above mentioned proposed project for its expanded capacities.

This is for your information and further necessary action please.
Thanking you,

(K. C Mistry)
Member Secretary

Copy to :

1. Shri Dushyant D. Patel – Chairman,
   M/s. Oneiro Chemicals Limited Block No. 475/P, 469/A, 469/ B/1, 469/ B/2, 470/1, 471, 472/A, 472/B, 473, Village: Ekalbara, Taluka: Padra, District: Vadodara, Gujarat.
2. Regional Office, Vadodara.....for information please.
3. Unit -12 (Vadodara).



EXISTING PLOT WITH AVAILABLE INFRASTRUCTURE

PROPOSED PLOT WITH PROPOSED INFRASTRUCTURE

PLOT PLAN

ONERIO CHEMICALS LTD.

BLOCK NO 475 / P ,P.O.EKALBARA,
TAL-PADRA, DIST -BARODA.

TITLE	KEY PLAN			
SUB TITLE	KEY PLAN			
	SIGN	DATE	REV. NO	NORTH
PREPARED BY	VISHAL		00	
CHECKED BY				
APPROVED BY				
SCALE	1CM : 5MTR		REV.DATE	
DRG. NO. :				

M.9428876287

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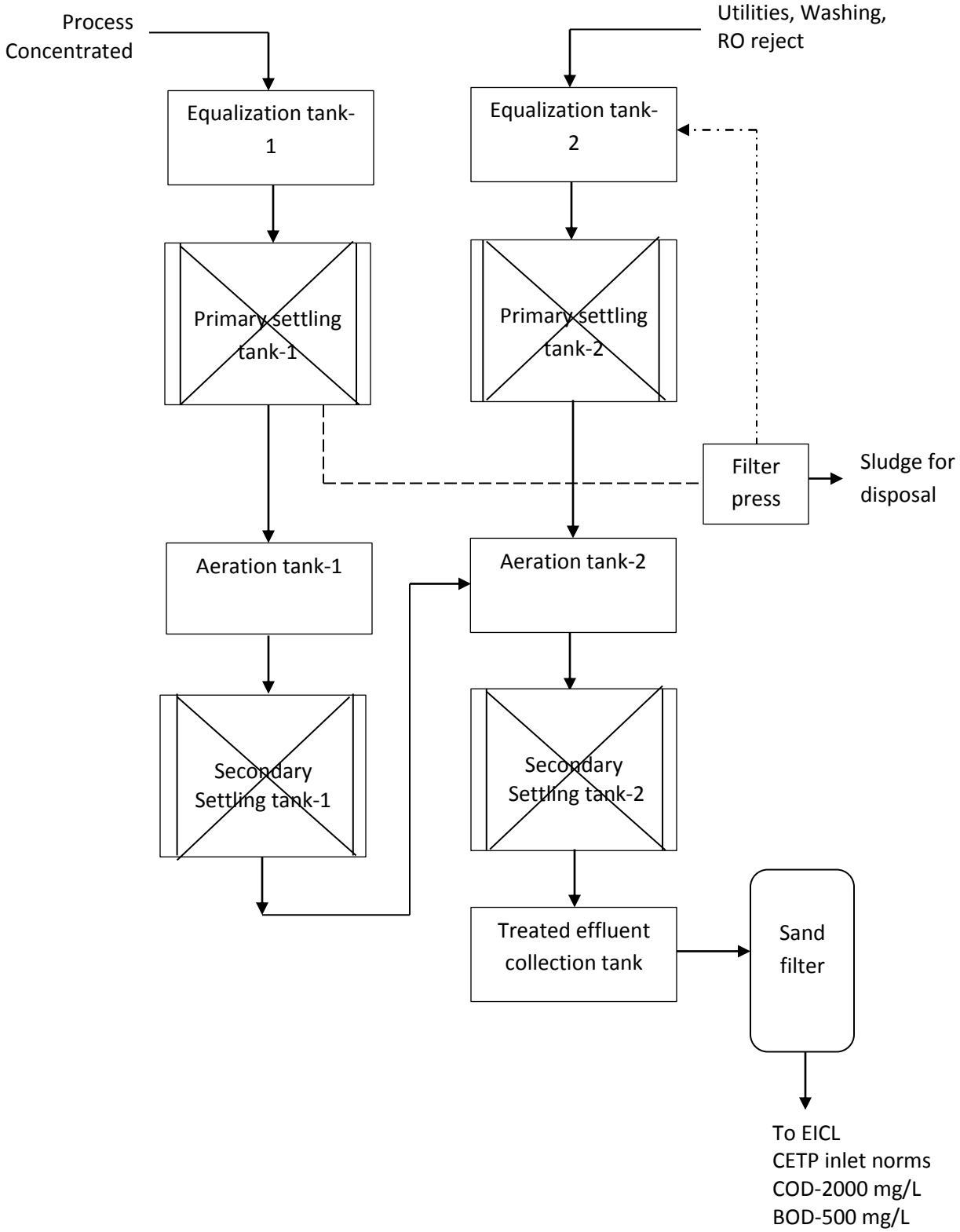
PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT
PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT

Annexure-III

Effluent treatment scheme - flow diagram for stream segregation (High COD/High TDS from process)



A REPORT ON

GEO-HYDROLOGICAL STUDY AROUND PLANT AREA, VILLAGE EKALBARA, TALUKA PADRA

FOR

ONERIO CHEMICALS LIMITED, VADODARA

GEO ENGINEERING SERVICES

7, Amarnagar, Near Khodiyar Nagar

New VIP Road, Vadodara E

– Mail: gesvdr@yahoo.com

Report Number: GES/VAD-150525-07 dated 30/05/2015

(P.O. Number –NIL dated 25/05/2015)

1. INTRODUCTION

1.1 Location:

Padra is a town of Vadodara district in the Gujarat state. Padra is located 16 kilometers SW from Vadodara city and having geographical area of 534.60 sq. km.

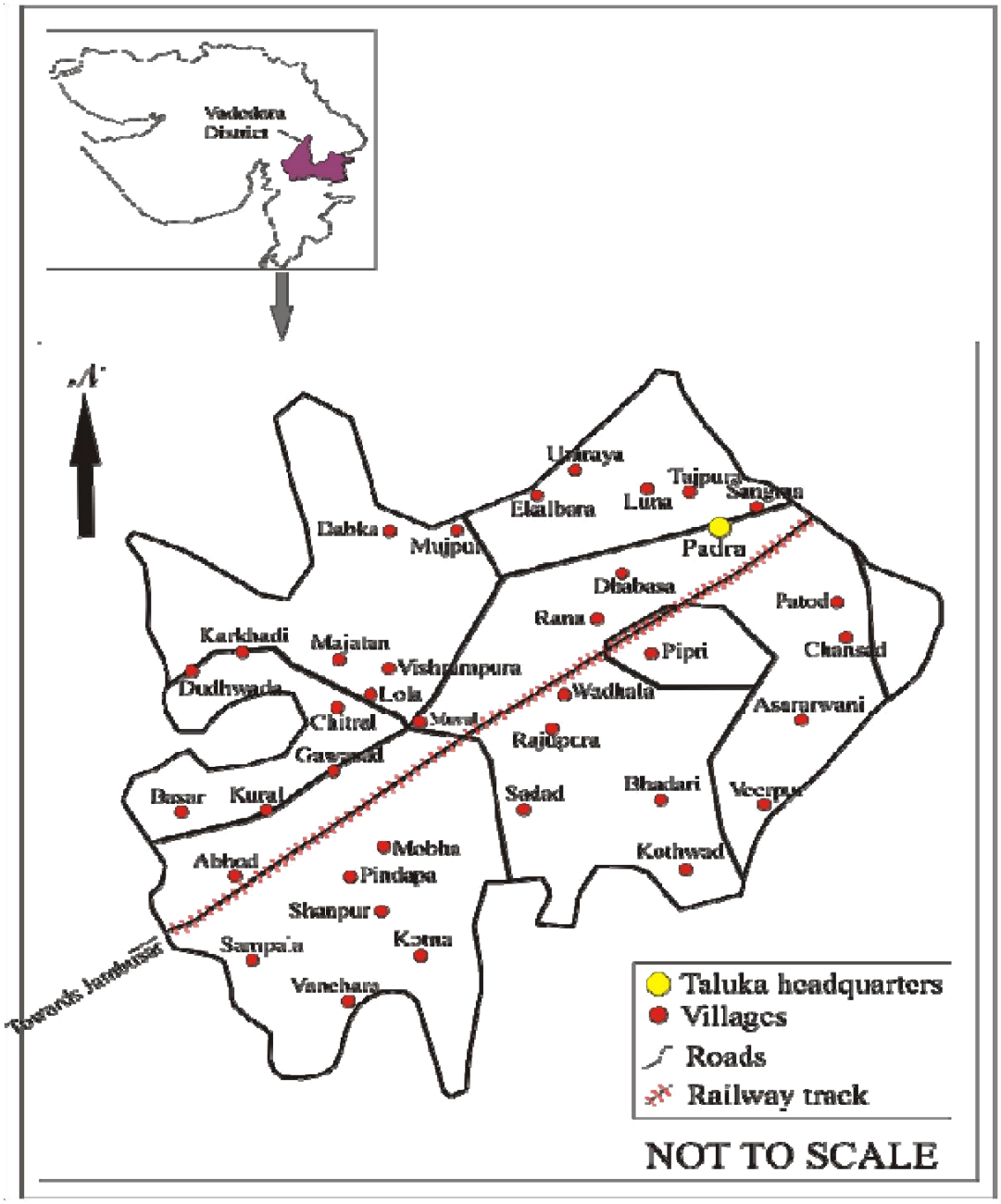


Figure 1.1: Location Map of the Padra taluka

It is located between latitudes 22° 14'N to 22^0 23'N and longitudes 73° 05'E to 73^0 08'E in the Vadodara district. It is bounded on the north by Mahi River, while in the extreme south by Narmada River. A large canal network of the Narmada River encircles the whole taluka. A four lane road is present which connects Vadodara, Padra and Jambusar. Padra taluka is well known for vegetable farming, producing Toor or Tuvar Dal, Cotton & Tobacco.

1.2 Company Background:

Oniero Chemicals Limited intends to expand its manufacturing facility at Plot number 475/P, 469/A, 469/ B/1, 469/ B/2, 470/1, 471, 472/A, 472/B, 473, village –Ekalbara, Taluka – Padra, District Vadodara State – Gujarat. Oneiro Chemicals Ltd. is an ISO 9001:2008 & a GMP Certified Company and vertically integrated manufacturer of active pharmaceutical ingredients (APIs), Pellets & Intermediates in Multi Therapeutics Segments.

1.3 Meteorology:

The area experiences sub humid climate. The summer season extends from March to June with maximum temperature of 45^0C. The winter season extends from October to February with minimum temperature of 10^0C. The short term average rainfall in the study area (2001 – 2013) is 1025mm.

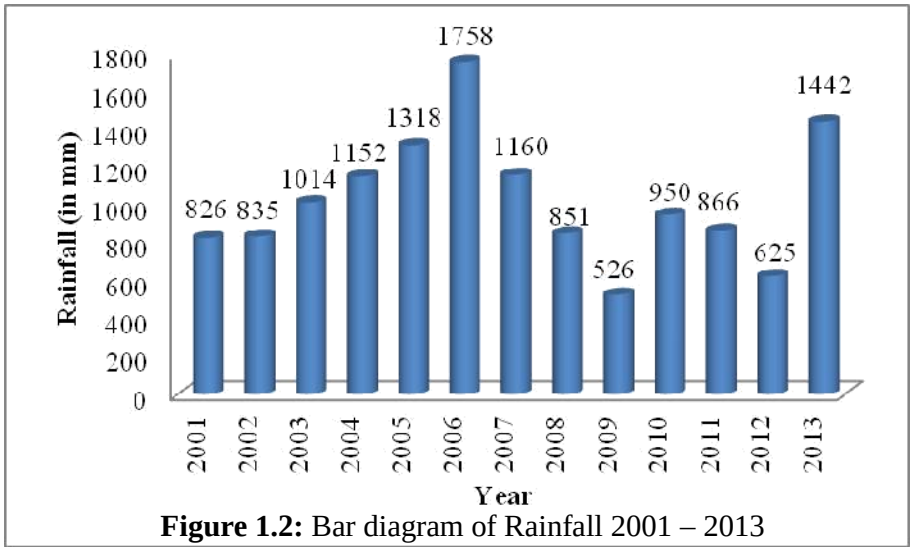


Figure 1.2: Bar diagram of Rainfall 2001 – 2013

(Source: Indian Meteorological Department)

Year	Rainfall (mm
2001	826
2002	835
2003	1014
2004	1152
2005	1318
2006	1758
2007	1160
2008	851
2009	526
2010	950
2011	866
2012	625
2013	1442
Average	**1025**

Table 1.1: Average Annual Rainfall 2001 – 2013

1.4 Geology:

Topographically the area is flat in nature. The western part of the district, i.e., Savli, Dabka, Koral, Chandod, Padra, Karjan, Dabhoi and Sinor are mainly composed of Silty sand, Clayey silt, fine Sand with Kanker and Gravels. The study area comprises of numerous patches and elongated deposits of Quaternary alluvium along the western part of district near Study area. Major geology of the Study area comprises of Channel-fill, Flood plain and Tidal flat deposits. The environment of deposition is fluvial in nature. The lithology of the Study area falls under Katpur Formation of Holocene age. The nature of aquifer of Quaternary alluvium is both confined and un-confined in nature. In the western region of the district the quality of ground water shows a good to moderate value.

Formation	Age	Lithology
Katpur	Holocene	Channel-fill & Flood Plain deposits
		Tidal flat & Marsh deposits
		Flood Plain & Delta deposits
		Sand Sheets

Table 1.2: Geological succession of Study area

(Source: Geological Survey of India, 2002)

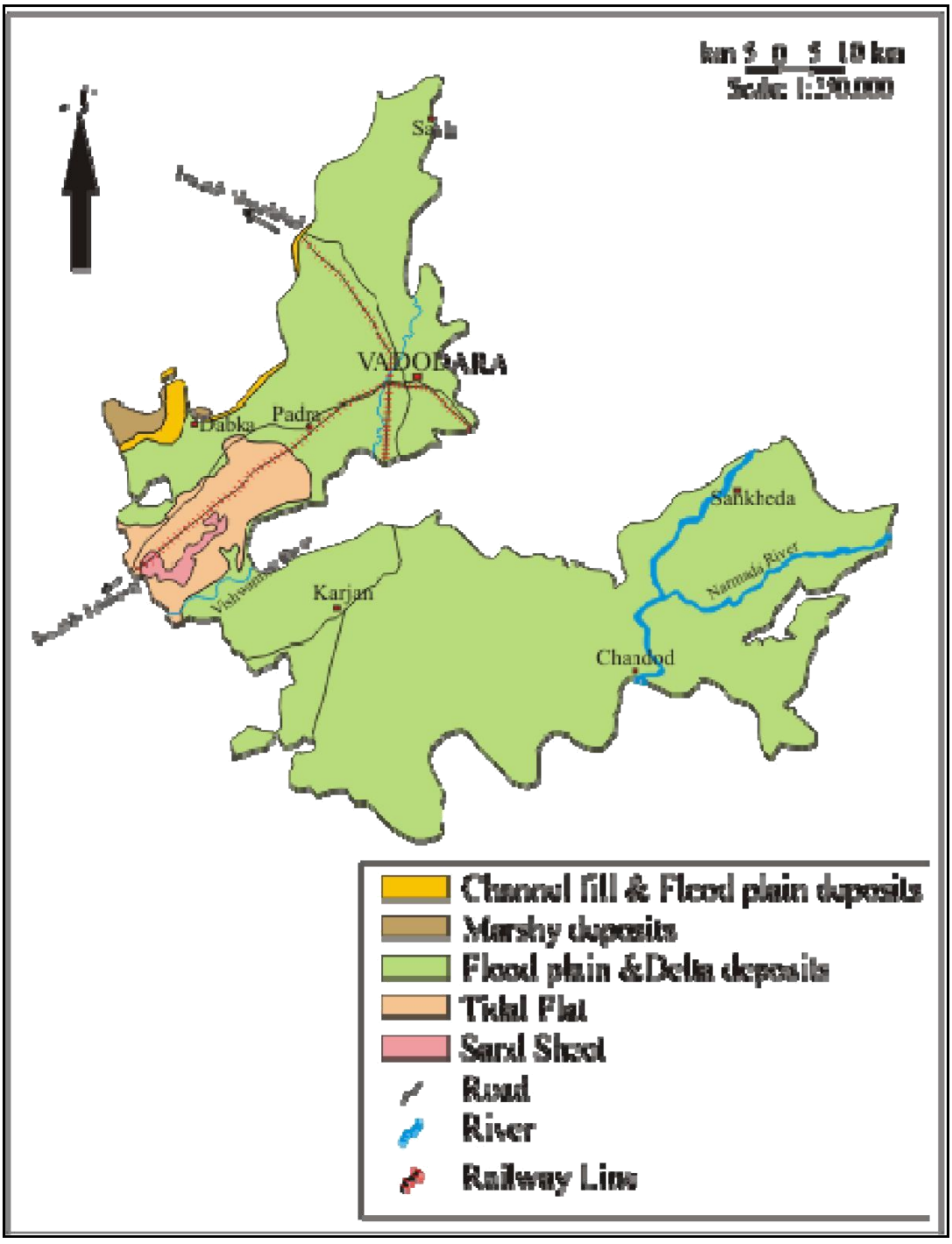


Figure 1.3: Geological Map of Padra Taluka

(Source: Geological Survey of India, 2002)

1.5 Geomorphology:

Vadodara district can be divided in two major geomorphic units, eastern hilly, medium to high relief terrain and the western plain area. The western plain has got flat low lying surface and a thick pile of alluvium. The Mahi, Narmda and Vishwamitri had deposited these thick piles of alluvium in the whole district. The Vadodara Plain occupies central parts of the district and extends over Padra, Savli, Waghodia, Dabhoi, Karjan, Sinor and Sankheda talukas. The study area falls in the western part of the district enclosing within the Alluvial Plain geomorphic unit. Figure 1.4 shows various geomorphic units of the Vadodara district and Padra Taluka. The highest altitude is 33.80m and lowest altitude is 22.13m.

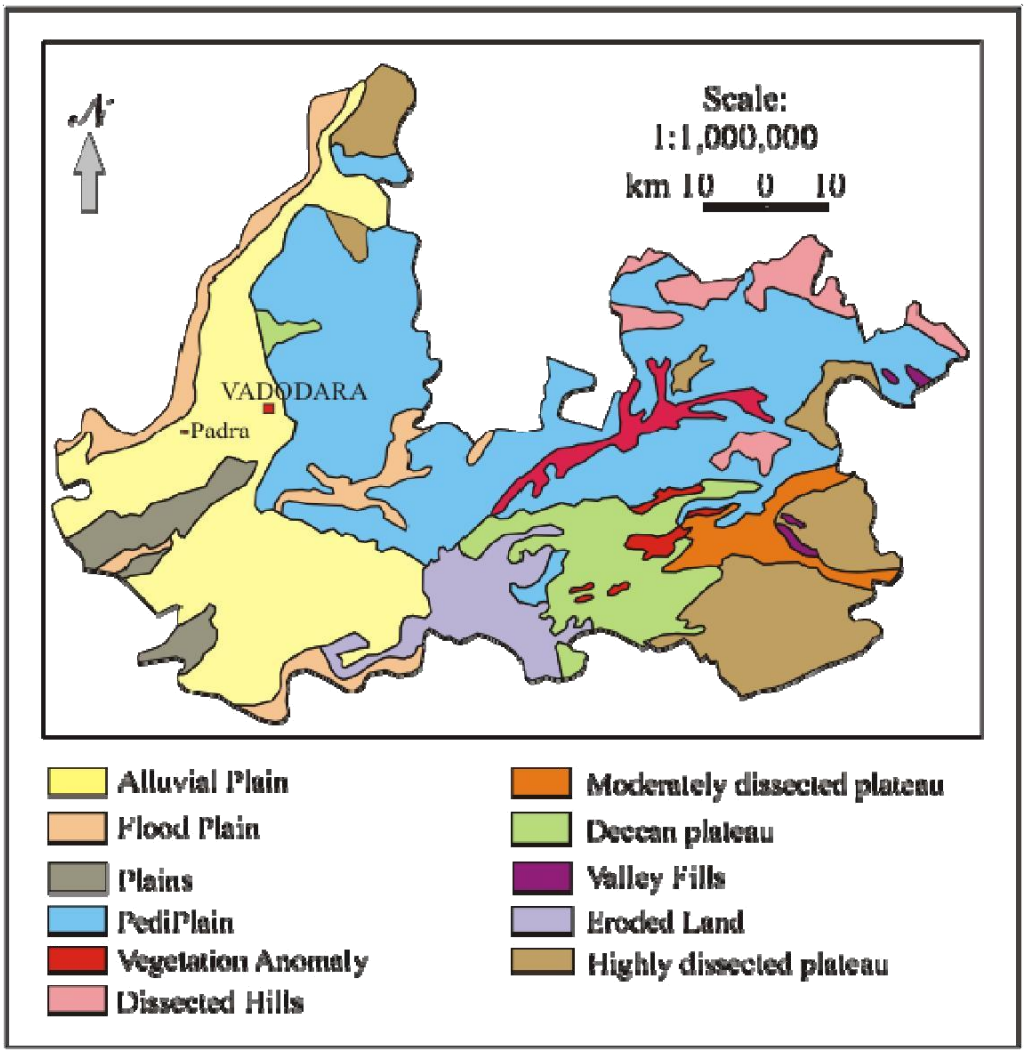


Figure 1.4: Geomorphic Map of the Vadodara District

(Source: Geological Survey of India, 2002)

1.6 Drainage:

The major rivers encircling the western part of Vadodara district are shown below in tabular form. Mahi River, forming the northwestern border of the district, flows southwesterly direction whereas the westerly flowing Narmada River forms the southern part of the district.

Sr. No.	River	Flow Direction
1	Mahi	NE – SW
2	Vishwamitri	E – W
3	Jambuva	E – W
4	Dhadhar	E - W

Table 1.3: Table shows Flow pattern of rivers in Vadodara

(Source: GWRDC, Gandhinagar)

1.6 Soils:

The soils of the district are loamy, clayey, mixed calcareous and montmorillonitic. The study area is occupied by the alluvial type of fine, loamy, calcareous soil. The following figure depicts the soil in the Vadodara district and study area.

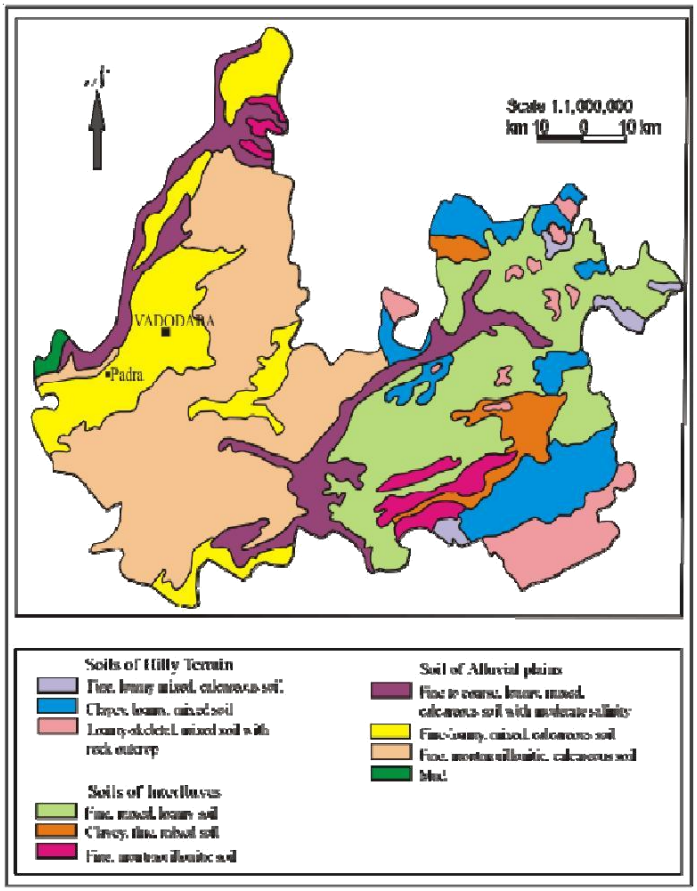


Figure 1.5: Soil Map of the Vadodara District
(Source: Geological Survey of India, 2002)

2. METHODOLOGY

2.1 Introduction:

For the proposed study the approach and methodology adopted, and various equipments and instruments used are discussed below. The methodology adopted for the study is shown diagrammatically in the Figure – 2.1

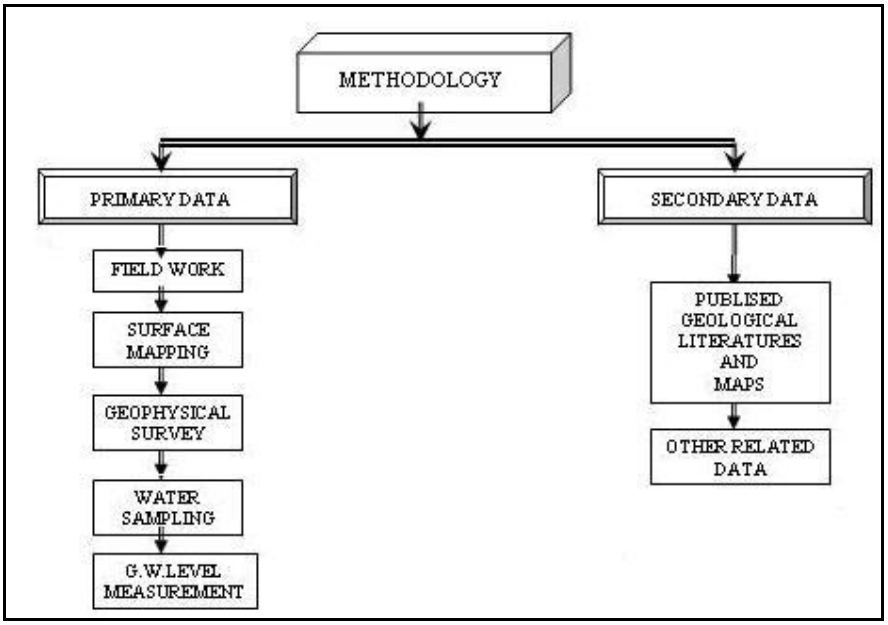


Figure 2.1: Flow chart showing methodology adopted for the study

2.2 Data collection:

During study the data collection process was divided into

i) Primary Data Collection and

ii) Secondary Data Collection.

Primary Data Collection was done in the field, while secondary data was collected from previous works such as published and unpublished reports and maps, etc.

i) Primary Data Collection

During study various primary data such as static water level in various wells, chemical analysis of the water samples, geological and geophysical data, etc. were obtained during the fieldwork. Various methods and materials used during the fieldwork are discussed below.

Materials and Methods:

Groundwater level Measurements:

To detect fluctuations in the groundwater table, groundwater levels in the tube wells and dug wells were measured. In order to get as correct levels as possible, an interruption in putting of at least two hours is necessary. The measurement of SWL (Static Water level) 8

was done with the help of Water level Indicator. Its mechanism works on the principle of sensing when the sensor comes in contact with water. Simultaneously an odometer is present within the instrument which helps us to know about the depth in m.

Equipment: Water Level Indicator with a Sound sensor

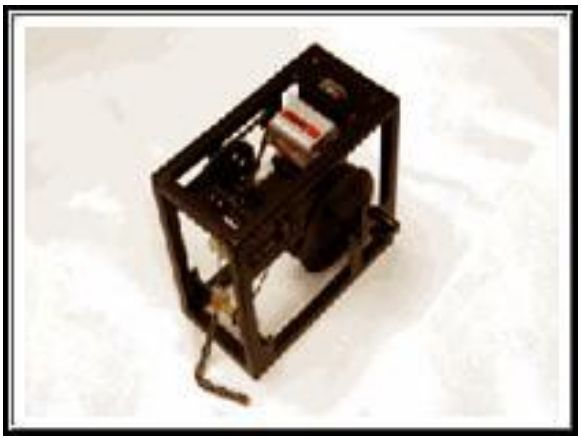


Plate 2.1: Photographs show Water Level Indicator

Plate 2.2: Photographs show measurement of water level with Water level indicator

Plate 2.3: Photographs show water sample collection

Global Positioning System (GPS): Global Positioning System (GPS) is a satellite based navigational system. GPS calculates the position of a certain spot by registering pulses from satellites. GPS was used to give co-ordinates of wells, existing structures and other important features. The position format was lat/log and 3D position accuracy was used.

Equipment: Silva GPS Compass XL 1000 and Garmin E- trax Vista.

Plate 2.4: Photograph shows GPS device

ii) Secondary Data Collection

The secondary data taken from other agencies like Government Census Department and Groundwater Department. We have collected secondary data from various other sources too, e.g. Geological Survey of India (GSI)

2.3 Processing of field data:

For processing the field data various software were used. Surfer 8 was used to make the maps and graphs.

Surfer is a computer program from Golden Software Inc., Colorado, USA, which creates contour maps or surface plots. Input data in Surfer were irregularly spaced XYZ data from the fieldwork for e.g. GPS points and TDS values. These data were interpolated onto a grid file. From the grid file contour maps and surface plots were produced.

3. GEO HYDROLOGY

3.1 Introduction:

Alluvium is the main aquifer in the study area. Geologically the area is covered by thick alluvial deposits composed of hard sticky brownish clay and fine medium grained sand and kankars. These Quaternary alluvial deposits of recent to sub-recent age uncomfortably overlie the Tertiary sediments. The Tertiary sediments are marine in nature; hence the ground water in this formation is saline.

3.2 Water Level:

Total 7 wells were inventoried in the study area in the month of June 2015. The water levels were measured at each location. However, at some locations, it was not possible to measure the water level as the tube wells were packed and the water level indicator instrument could not be lowered. The following table (Table:-3.1) describes the details of locations from where water levels were measured and groundwater samples were collected. While the Figure:-3.1, shows the location map of wells inventoried in the study area.

Coordinates		Symbol/ID	Location	SWL (in m)
295202	2462055	W-1	Project Site	39.79
295203	2460996	W-2	Dariyapura	27.68
295204	2461148	W-3	Dabka	35.37
295205	2462786	W-4	Ekalbara	38.78
295206	2463664	W-5	Umraya	27.04
295207	2462973	W-6	Luna	31.09
295208	2464966	W-7	Jaspur	38.58

Table 3.1: Table shows the well inventoried in village

The deepest water level was found in W-1 (Oniero Chemicals, Project site), viz. 39.79 m. The shallowest water level was found in W-5 (Kanubhai Purohit, Umraya village), viz. 27.04 m deep from the existing ground surface. The contour map of reduced water level is prepared for determination of ground water flow direction. The general groundwater flow direction is found to be North West which is apparent from the figure. 3.3.

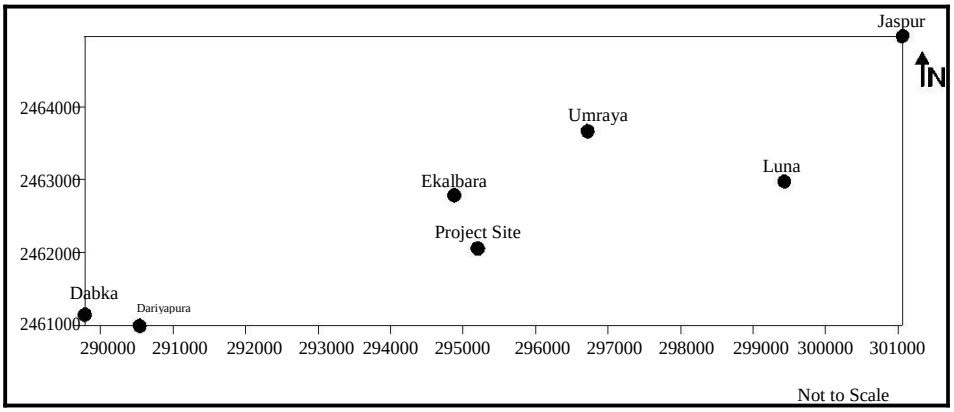


Figure 3.2:- Locations of wells inventoried in study area

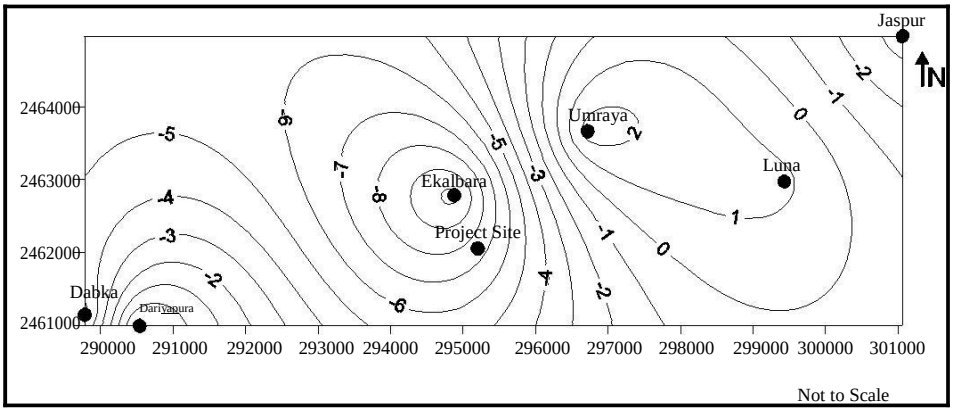


Figure 3.3: Contour Map of Reduced Water Level

3.3 Groundwater Quality:

The groundwater samples were collected by Geo Engineering Services and sent to San Envirotech Pvt. Ltd., Ahmedabad for chemical analysis. The objective of the study depends on the chemical analysis data as it provides a relevant mode for interpretation of existing subsurface groundwater as well as surface water quality conditions and their suitability for drinking and irrigation purpose.

pH (Hydrogen Ion Concentration):

PH is a hydrogen ion concentration. Generally, based on the pH value, water can be divided in to three classes, namely:

(1) If pH is less than 7, water is said to be **ACIDIC** in nature,

(2) For **FRESH** water pH is equal to 7 and

(3) If pH is more than 7, water is classified as **ALKALINE**.

The maximum pH value was found in W-5 (Kanubhai Purohit, Umraya village), viz.8.06 whereas the minimum pH value was 7.27 in W-7 (Sanjaybhai Patel, Jaspur Village). Figure 3.3 shows the contour diagram of the pH value of water samples in study area.

The desirable limit as per the IS: 10500:2012 is 6.5 to 8.5. The pH value ranges from 7.27 to 8.06 in water samples. All water samples are within the desirable limits as per IS: 10500:2012.

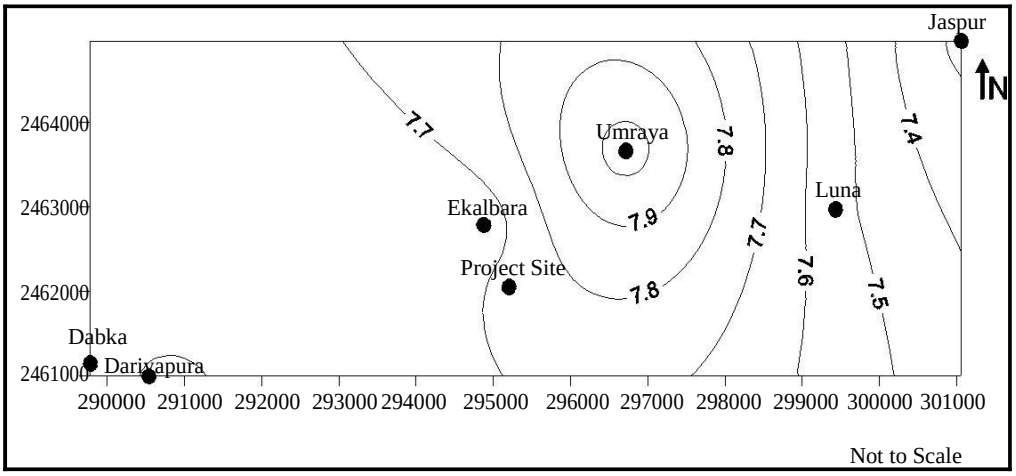


Figure 3.4: Contour Map of pH values

TDS (Total Dissolved Solids):

The salt content in the water may be expressed in Total Dissolved Solids (TDS). TDS is the amount of materials (inorganic salts and small amounts of organic material) dissolved in water and is commonly expressed in terms of milligrams per liter. If the salt concentration in water increases, it is difficult for plants to extract the water.

The maximum TDS value was found in W-5 (Kanubhai Purohit, Umraya village), viz. 1736 ppm whereas the minimum TDS value was 1098 ppm in W-6 (Vipulbhai Patel, Luna Village).

The desirable TDS limit is 500 ppm and permissible TDS limit is 2000 ppm. All water samples collected and analysed are found within the permissible limit.

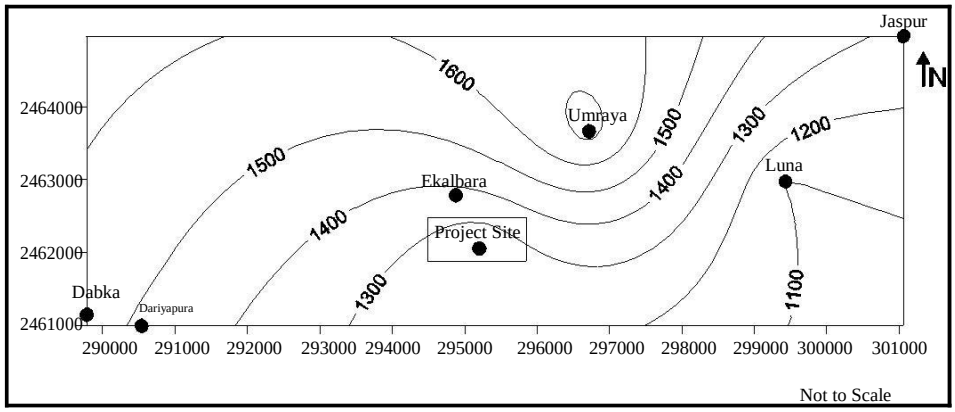


Figure 3.5: Contour Map of TDS values.

Total Hardness as $CaCO_3$:

Hardness of water is due to carbonates, sulphates and chlorides of calcium and magnesium. Total hardness is classified as under:

The maximum value of hardness as $CaCO_3$ found is 594 ppm in W-3 (Ganpatsinh Jhadav, Dabka Village) and minimum 326 ppm in W-1 (Oniero Chemicals, Project Site). All the water samples are of slightly hard to extremely hard category of classification. As per the IS 10500:2012, 300 ppm is desirable limit and 600 ppm is the permissible limit.Figure3.7 shows the contour map of total hardness in the study area.

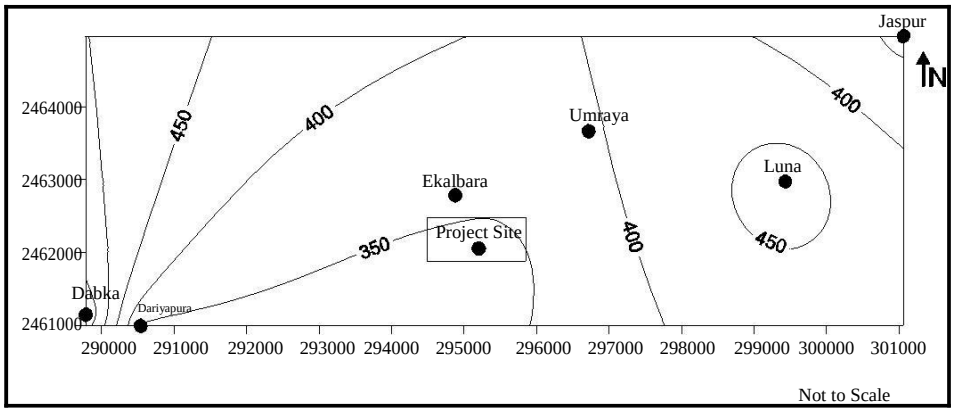


Figure 3.7: Contour map of Total Hardness as $CaCO_3$ values

Chloride (Cl):

The chloride content as per Indian Standards 10500:2012 desirable limit is 250 ppm and permissible limit is 1000 ppm. The chloride content above the desirable limit can cause the change in taste of water, corrosion and potability.

Maximum chloride content of 853 ppm found in W-5 (Kanubhai Purohit, Umraya Village) and minimum concentration of chloride content was found in water sample of W-6 (Vipulbhai Patel, Luna Village), i.e., 469 ppm.

All the water samples are within the permissible limit of IS: 10500:2012.

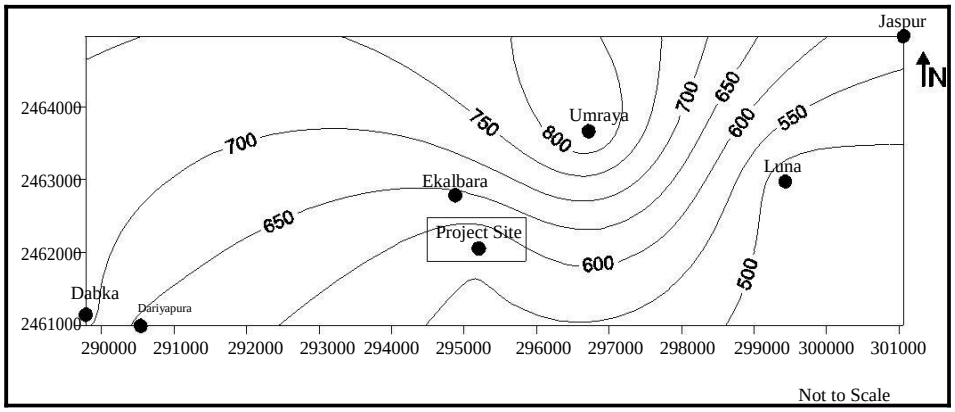


Figure 3.8: Contour map of Cl values.

Total Alkalinity:

Total Alkalinity having desirable limit of 200 mg/l and permissible limit are 600 mg/l as per Indian Drinking Water Standards 10500:2012.

The maximum concentration of total alkalinity is found in W-6 (Vipulbhai Patel, Luna Village), i.e., 384 ppm and minimum is 271 ppm in water sample of W-5 (Kanubhai Purohit, Umraya Village).

Total Alkalinity content in the study area is within the permissible limit of the Indian Standard of Drinking Water 10500:2012.

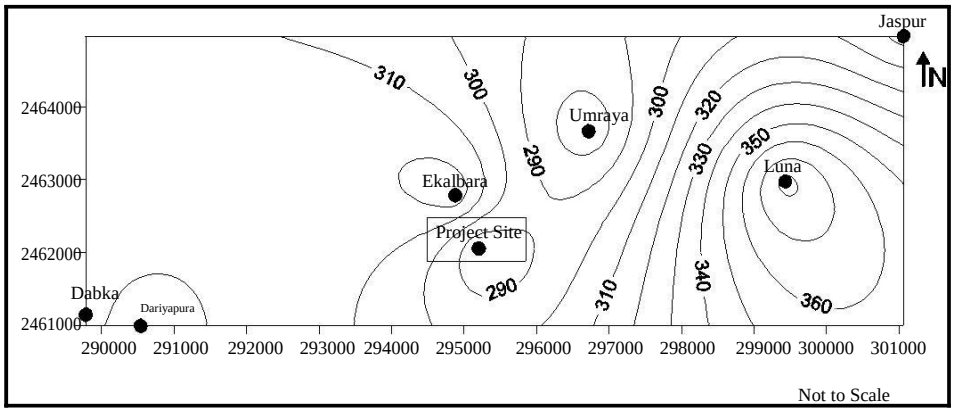


Figure 3.9: Contour map of Total Alkalinity values.

Calcium:

Calcium above the desirable limit causes the encrustation in water supply system and adverse effects on domestic use. The Calcium content is within the desirable limit of IS: 10500:2012 in all the water samples. As per Indian Standards 75 ppm is the desirable limit and 200 is the permissible limit.

The maximum 116 ppm Calcium is found in W-3 (Ganpatsinh Jhadav, Dabka Village) and minimum 48 ppm in water sample of W-4 (Raghuvir sinh Jhadav, Ekalbara Village).

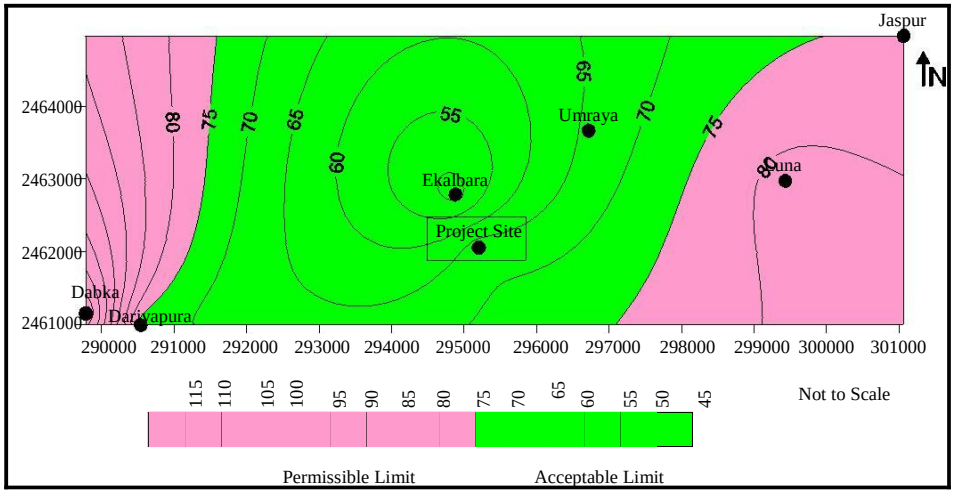


Figure 3.10: Contour map of Ca values

Magnesium:

Magnesium (Mg) is having a desirable limit of 30 ppm and permissible limit is 100 ppm as per Indian Drinking Water standards 10500:2012. The effect of having above the desirable limit is encrustation to water supply structure and adverse effect on domestic use**.**

The minimum value of Mg is 36 ppm in W-7 (Sanjaybhai Patel, Jaspur Village) and maximum value is 74 ppm in W-3 (Ganpatsinh Jadhav, Dapka Village).

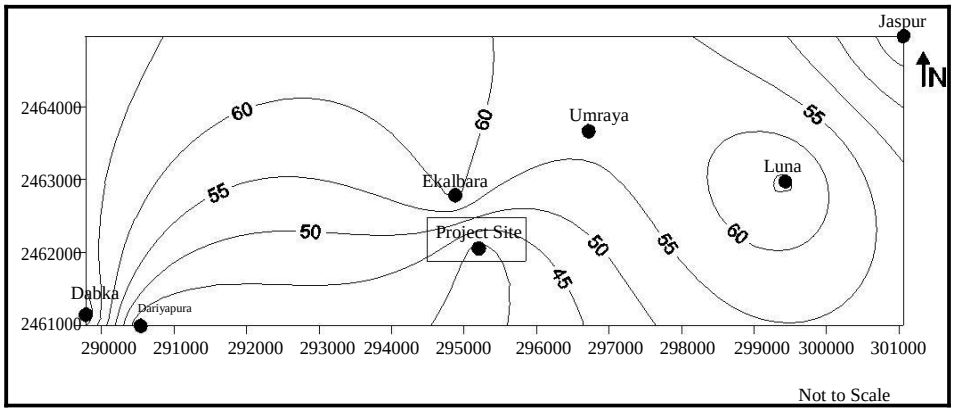


Figure 3.11: Contour map of Mg values

Nitrate:

Nitrates having desirable limit of 45 ppm and permissible limit are 100 ppm as per Indian Drinking Water Standards 10500:2012.

The minimum concentration of nitrate is found water sample of W-5 (Kanubhai Purohit, Umraya Village), i.e., 6.8 ppm and maximum is 19.7 ppm in W-7 (Sanjaybhai Patel, Jaspur Village). Nitrate content in the study area is within the permissible limit of the Indian Standards.

Nitrate content in drinking water is considered important for its adverse health effects and moderately toxic. In higher concentrations, nitrate may produce a disease known as methaemoglobinaemia (blue babies) which generally affects bottle-fed infants. Repeated heavy doses of nitrates on ingestion may also cause carcinogenic diseases.

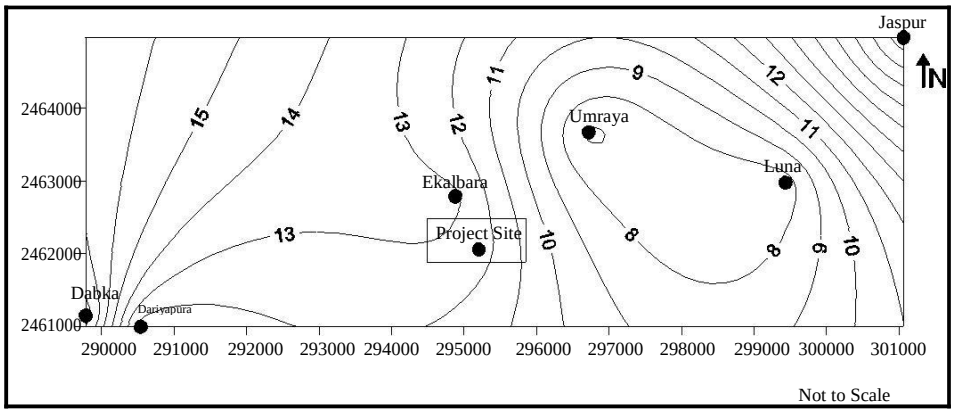


Figure 3.12: Contour map of Nitrate values

Fluoride:

Fluoride having desirable limit of 1 ppm and permissible limit are 1.5 ppm as per Indian Drinking Water Standards 10500:2012.

The minimum concentration of fluoride in water samples was found in W-6 (Vipulbhai Patel, Luna Village), i.e., 0.58 ppm and maximum is 1.26 ppm in W-5 (Kanubhai Purohit, Umraya Village).

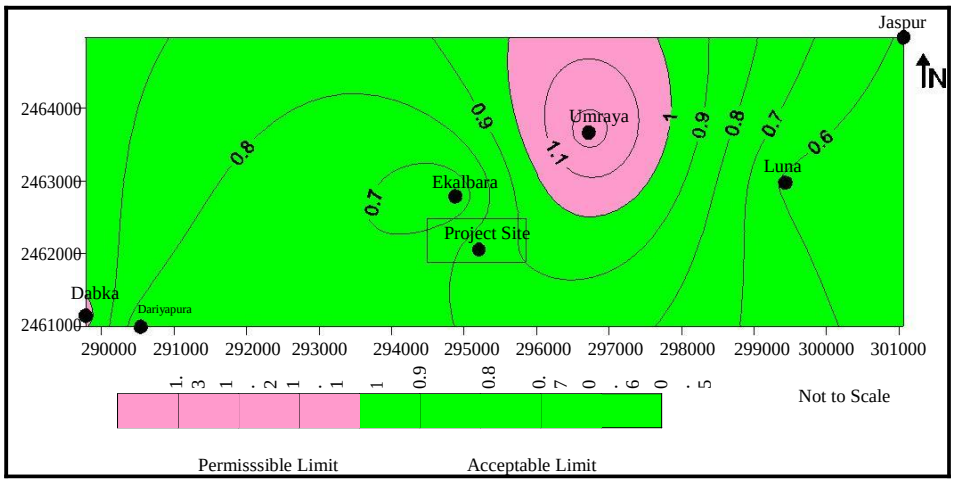


Figure 3.13: Contour map of Fluoride values.

Sulphate (SO4):

Sulphate is having desirable limit of 200 ppm and permissible limit is 400 ppm as per Indian Drinking Water Standards 10500:2012. The minimum concentration of Sulphate is found in W-5 (Kanubhai Purohit, Umraya Village), i.e., 62 ppm, while maximum of 102 ppm in W-2 (Ramanbhai Padhiyar, Dariyapura Village).All the values are found in the desirable limit as per Indian Drinking Water Standards 10500:2012.

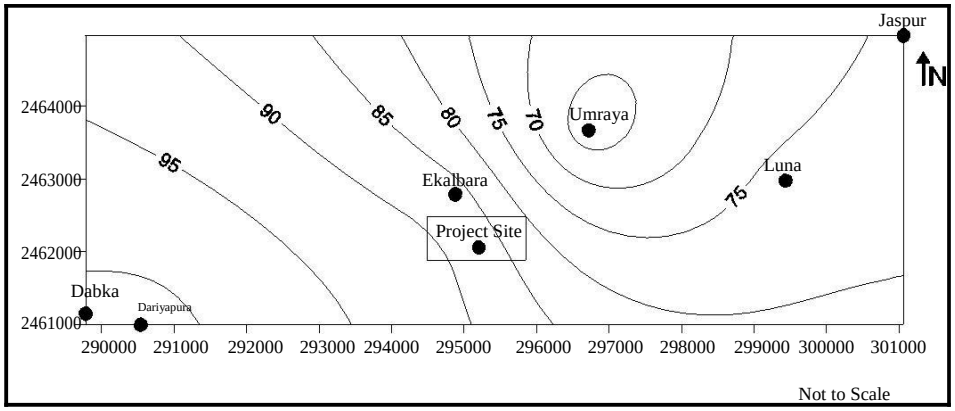


Figure 3.14: Contour map of Sulphate values.

Electrical Conductivity (EC):

Electrical conductivity is useful to determine its usefulness for irrigation water. In the study area, the EC value in groundwater samples is ranging between 1572 µmho/cm (Vipulbhai Patel, Luna) and 2468 µmho/cm (Kanubhai Purohit, Umraya).

As per the IS 11624:1986 classification all the groundwater sample EC values fall in the 'Good' class. The table 3.2 shows the classification of water based on EC values.

Table 3.2: Table shows water category based on EC values

Class	EC (µmho/cm)	No. of groundwater samples
Low	< 1500	0
Good	1500 – 3000	7
High	3000 – 6000	0
Very High	> 6000	0

(Source: IS 11624:1986)

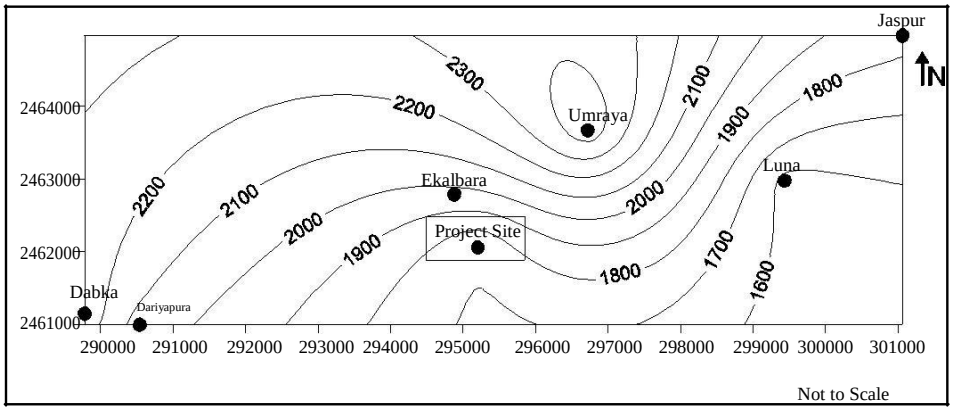


Figure 3.15: Contour map of EC values

4. RAINWATER HARVESTING

4.1 Introduction:

Geologically the area is composed of alluvium and is a part of Gujarat Alluvium Plain (GAP). The groundwater occurs in semi confined to confined conditions.

4.2 Water Balance:

The water requirement for various uses in the plant is given in following table. The total existing consumption of water is 135 m^3, this will be increased by 41m^3 and the total water consumption will be 176 m^3 per day.

Table 4.1: Table shows water consumption

Sr. No.	Source	Existing Water Consumption m^3/day	After expansion Water Consumption m^3/day
1	Domestic	10	12
2	Gardening	15	20
3	Industrial	110	144
Total		**135**	**176**

Hence, if we assume 300 operational days in a year, the total water consumption is 52800m^3 per annum. The total rain water available for harvesting by assuming average plot area of 31000 square meter and run off co efficient 0.65 is 19065 m^3 per annum. There is deficit of 33735m^3 per annum.

M/s Onerio chemicals limited is advisable to take appropriate measures to harvest the rain water with due care of chance of contamination. M/s Onerio chemicals limited can participate in CSR activity by intervening nearby villages water shed for contributing in artificial recharge.

The general design of artificial recharge well is given in the Figure 4.1.

4.3 Rainwater harvesting plan:

The static water level in the study area varies between 27.04m to 39.79m, particularly the project site has static water level is 39.79m from the existing groundwater level. The area is having potential to artificial groundwater recharge and hence it is advisable to recharge the groundwater aquifer. Hence, the groundwater recharge structure artificial recharge well is suggested.

However, the quality of groundwater is fair. The rain water can be collected and utilised for domestic, plantation and industrial use as the rain water is having good quality of water. For this, they can construct an artificial recharge well for recharge of rain water

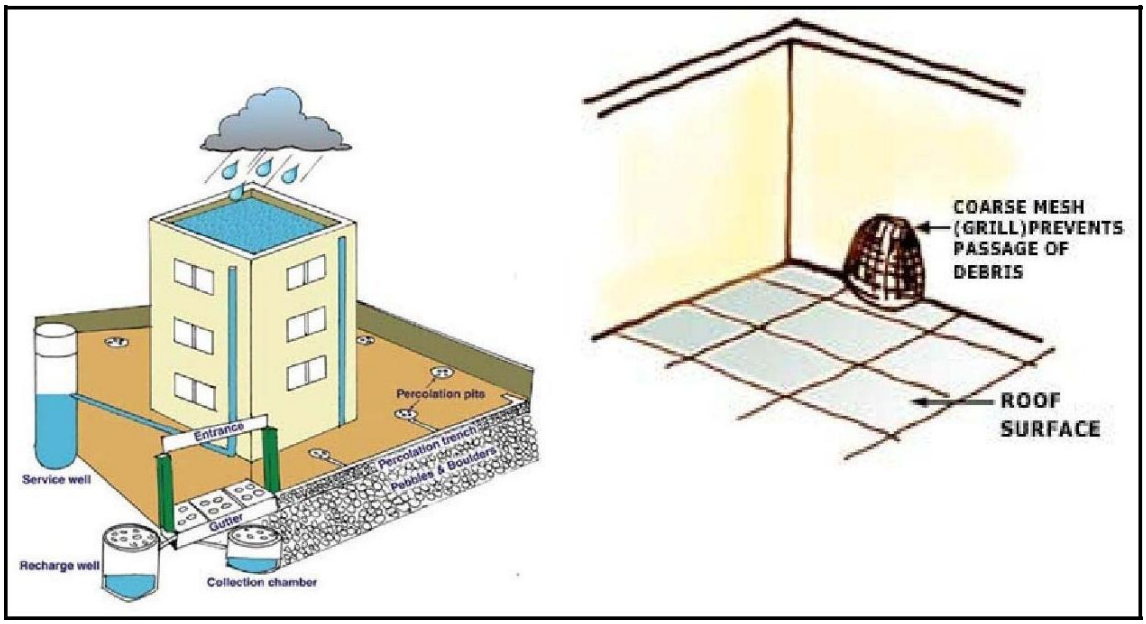
appropriate location. The general design of the recharge well is given in the Figure 4.1. It is suggested that 45m depth with appropriate sedimentation tank can be constructed.

Maintenance of the recharging system:

Periodic maintenance required for reliable and higher quality water supply. During raining season the entire system to be checked before and after rains and cleaned after every dry period. Before first shower storage tanks should be cleaned and flushed of all sediments and debris. For the groundwater recharging purpose only roof top area runoff water will be used.

Also, the roof top will be cleaned before monsoon and coarse mesh is used to prevent the debris on the entrance of the water at roof.

The first shower should be flushed so the any sediment can be washed away.



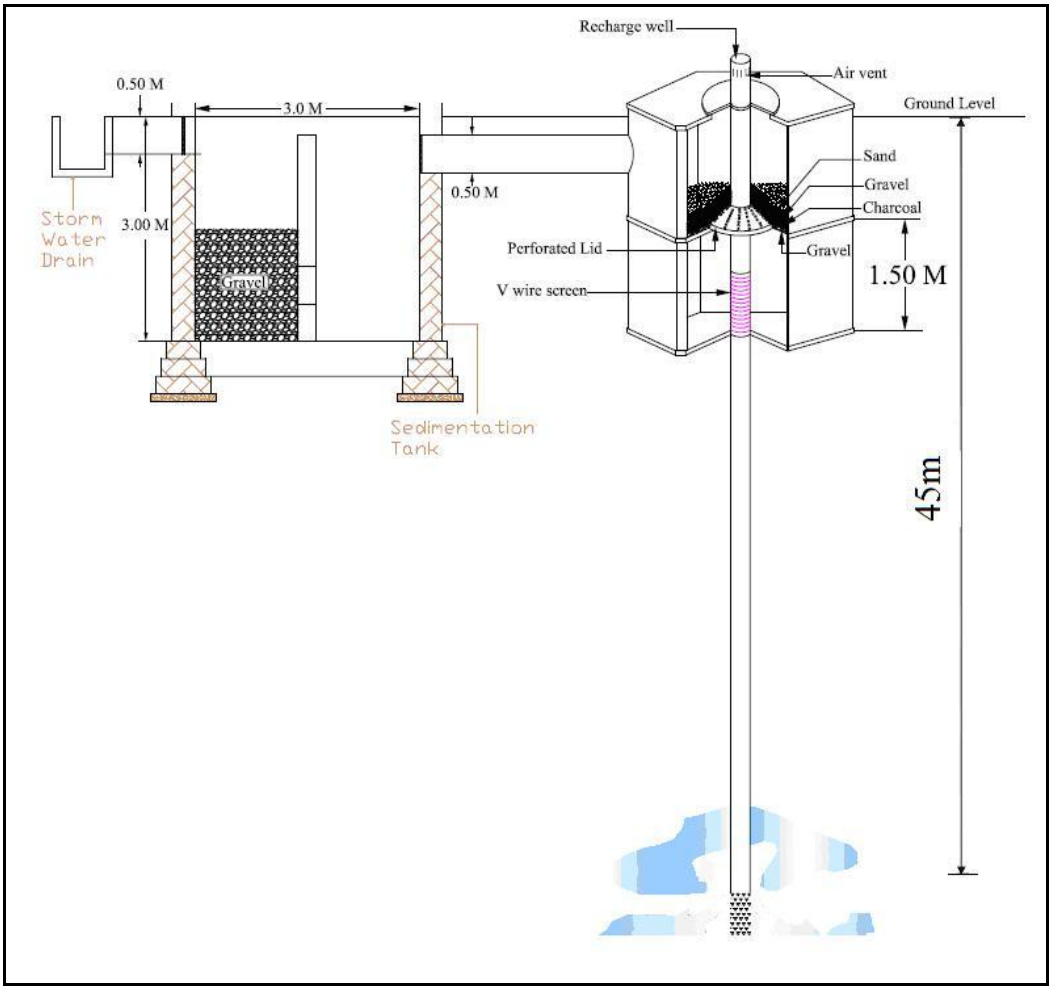


Figure 4.1: General design of artificial recharge well

5. IMPACT ASSESSMENT

5.1 Introduction:

The impact on the geohydrological environment of the study area is estimated both quantitatively and qualitatively.

5.2 Impact Assessment:

The impact on the geohydrological environment particularly on groundwater regime (as the industry is going to use groundwater) is estimated and tabulated as below table 5.2. The score and type of impact is assessed as per table 5.1.

Table 5.1: Environment Impact

Score	Description
1	Significant Adverse Environment Impact
2 to 3	Negative Adverse Environment Impact
4 to 7	Neutral Environment Impact
8	Good Positive Environment Impact
9	Very Good Positive Environment Impact
10	Excellent Positive Environment Impact

The overall impact of the project site is assessed in terms of water quality and quantity. The water level in the study area is shallow and the industry is going to use groundwater. It is recommended to take necessary steps for use of groundwater and also for the artificial recharge through various rainwater harvesting scheme particularly construction of recharge well.

Table 5.2: Impact assessment

Estimation Type	Parameter	Method/tools for estimation	Present condition	Expected Impact	Score	Impact Type
Qualitative	Groundwater	Sampling/Chemical analysis	Water quality is fair to good	Water may get deteriorate	3	Negative
	Waste disposal	Data collected from the customer/Consultant	Data not available/estimated	---	--	--
	Surface water	Industry is not going to use surface water	----	Nil	5	Neutral
Quantitative	Groundwater	Water level measurement	Water level is medium	Water level will be affected	3	Negative
		Aquifer type	Semi confined-consolidated	---	5	Neutral
		Aquifer Performance test	Permeable strata	----	6	Neutral
		Water Balance	Water balance negative	---	3	Negative
		Groundwater extraction	Water level goes down	Water level affected	3	Negative
	Surface water	-----	-----	-----	-----	-----

6.3 Monitoring:

It is recommended to monitor the geohydrological environment of the study area. The monitoring well of 45m depth shall be constructed in SW, NW and SE and NE corner of the plant for monitoring. The groundwater samples and groundwater level measured at interval of 6 months i.e. post monsoon (September – October) and pre monsoon (April – May). The chemical analysis and water level data recorded for monitoring.

Construction of monitoring well:

Drilling: The monitoring well shall be constructed at feasible location of suggested depth. The drilling of the well shall be carried out as per Indian Standard 2800 (Part 1&2): 1991. The drilling shall be carried out with the help of rotary drilling. The samples shall be collected during the advancement of drilling at an interval of 1.0m depth. The samples properly labeled and brought for grain size analysis in the laboratory. The drill chart shall be prepared by Geologist.

Casing: The casing of appropriate size (approximate 100mm diameter) lowered as per the grain size analysis (gradation curve) prepared and suggested by Geologist.

Gravel packing: The well shall be properly packed with gravel of rounded to sub rounded. The gravel packed in accordance with Indian Standard 4097:1967

Well Development: The well shall be developed properly if necessary cast sodium hexametaphsopahte in well before development with the help of suitable air compressor or submersible motor. So, that the drilling fluid will be removed and water come silt/sand free. The well development shall be carried out in accordance with Indian Standard 11189:1985.

Sampling and water level measuring: The water sample shall be collected and initial water level shall be measured and recorded. The water sample shall be sent for chemical analysis to test its quality parameter.

Sealing: The well shall be sealed and locked proper to avoid undue contamination. The well seal should be opened at the time of next monitoring in future.

The monitoring plan is tabulated in table 6.3. It is also recommended to repeat the geohydrological study in every five years for the study area.

Table 6.3: Monitoring plan

Sr.No.	Parameter	Method of monitoring	Period of monitoring	Frequency of monitoring	Remark
1	Ground water Level	Construction of monitoring well in plant premises. Water level measurement	Pre monsoon (April - May) Post Monsoon (September - October)	Twice a year	The data recorded and monitored. The geohydrological study should be repeated in every five years interval
2	Groundwater Quality	water sample collection			

5.4 Water Resource Management Plan:

The water resource management plan addresses potential adverse or negative impacts and to introduce standards of good practice to be adopted. The Water Resource Management plan describes both generic and specific measures, the implementation of which is aimed at mitigating potential impacts associated with the geo hydrological environment.

Water Saving:

1. To the possible extent water is saved at each point of use by taking proper care in maintenance of drain pipe, tap etc from leakage. There should be display board for optimum use of water in wash room, toilet or at other appropriate locations.
2. Use of recycled water, if possible, in cleaning of toilets or gardening after proper treatment and testing for its intended use.
3. Use of sprinkler or drip irrigation method in garden irrigation
4. Adoption of machinery – equipments, methods, if possible and economic viable, for manufacturing

Artificial Recharge:

It is recommended to construct recharge wells of 45m depth and 150mm diameter with sedimentation tank to artificial recharge groundwater with available runoff during rainy season

7. CONCLUSION

1. The study area is located at survey number 475/P, village Ekalbara, Taluka Padra, district Vadodara. The study area is comprises of industrial and agricultural fields
2. Geologically, the study area is comprises of Quaternary unconsolidated sediments of Holocene age
3. Vadodara district can be divided in two major geomorphic units, eastern hilly, medium to high relief terrain and the western plain area
4. The study area is a part of Mahi river basin. The major drainage in the study area is Mahi and Vishwamitri
5. Geohydrologically, ground water is available in semi confined to un confined aquifer in the study area. Quaternary Alluvium is the main aquifer in the study area
6. The static water level is ranging between 27.04 m to 39.79m from the existing ground surface. The direction of groundwater flow is NW
7. The pH value ranges between 7.27 and 8.04 in the study area
8. The TDS value ranges between 1098 and 1736 mg/l
9. It is recommend to construct artificial recharge well of 45m depth and 150mm diameter at appropriate location with sedimentation tank
10. The short term average annual rainfall is 1025mm. The rainfall pattern is erratic
11. The rainwater available harvesting is 19065 m^3/annum. The water requirement is 52800 m^3/annum and hence the -33735 m^3/annum water deficit
12. The impact on geohydrological environment is assessed in terms of quality and quantity
13. The monitoring and management plan is suggested by construction of monitoring well and appropriate means of water saving techniques and artificial recharge well construction and construction of monitoring well respectively

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