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"A CRITICAL ANALYSIS OF WATER LOGGING PROBLEM IN "BHAL" REGION OF GUJARAT, INDIA"

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Abstract: Waterlogging is one type of condition of land in the soil strata is saturated with water temporarily otherwise permanently in this situation lands water table raised and go at the level of complete saturation of root zone and no air circulation in in soil profile. this situation causes the decreases of oxygen and increase the carbon dioxide level in soil profile. In this critical analysis of water logging problem in BHAL region of Bhavnagar from Nari to SANES village to protect forest area, farmers land also human and animal lives with damage other properties due to waterlogging effect. In this area main reason behind the waterlogging problem is heavy rain flash flood of river and local obstruction of salt pan location and their bund to changing natural tributaries flow and the gradient of natural tributaries. In this project analyzing and define probable solution of this waterlogging area. In this area industrial waste water and flash flood of more than four rivers and salt pan excess water logged in the villages and farms due to haphazardly dewatering of salt pan water also problem of high tide of gulf of Khambhat ocean in this area so establish a natural flow of river tributaries and maintain river gradient and remove local obstruction between natural flow.

Index Terms **- water logging, Channel Slope, Bed characteristic, water, flash flood, Bhal region, salt pan, river slop, river block, soil characteristic.**

I. INTRODUCTION

Waterlogging is a condition of land in which the soil profile is saturated with water either temporarily or permanently. In waterlogging lands, the water table rises to an extent that the soil pores in the crop root zone are saturated resulting in restriction of the normal circulation of air. This causes a decline in the level of oxygen and increases in the level of carbon dioxide. Generally, the water table is located at or near the surface resulting in poorly drained soils, adversely affecting crop production. Areas with water level within 2m below the ground surface are considered as prone to waterlogging and those with water table within 2-3m are considered to be at risk. Waterlogging can reduce agricultural and economic value of land causing yield reductions or at times, total crop failures. Waterlogging is a drainage problem.

Waterlogging is a drainage problem that results of high-water inflow caused by rain, runoff, interflow, rise in groundwater, over irrigation or flooding. Drainage problems can be caused by low water outflow due to low infiltration rate, low hydraulic conductivity, flat terrain, lack of outlet or restricted outlet in the soil. In irrigated agriculture, drainage should be part of the overall design and implementation to avoid problems of waterlogging. Waterlogging can be caused by natural conditions or human induced activities, as follows.

Waterlogging results in stagnant water which can host disease vectors such as malaria, snails and slugs. It impairs sanitary conditions and can bring on diseases like malaria and bilharzias, resulting in unhealthy environment for human population, animals and plants in an area. Waterlogging can have both beneficial and negative effects. Beneficial effects include being a habitat for certain plants and animal e.g., mudfish. Also, the wetlands regulate the hydrogeology, resulting in more sustainable river flow. However, for agriculture purpose, waterlogging can have negative impacts on the soil, crops and farm operations.

Remote Sensing is the science of acquiring information about the earth's surface without actually being in contact with it. This is done by sensing and recording reflected or emitted energy and processing, analyzing and applying that information. Remote sensing system capture radiation in different wavelength reflected / emitted by the earth's features and recorded it either directly on the film as in case of aerial photography or in digital medium used for generating the images. Remote sensing provides valuable data over

vast area in a short time about resources, meteorology and environment leading to better resource management and accelerating development.

Figure 1 Bhal Region Map

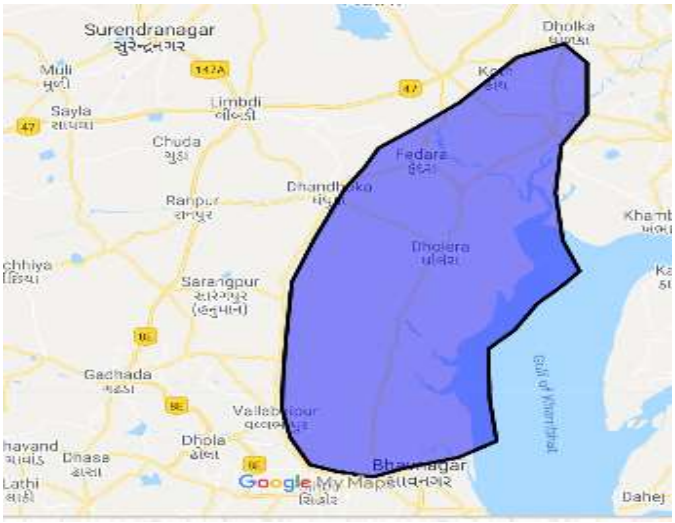


Figure 2 Periphery of Total Water-Logged Area

This region can be classified as a ~ 15 kms wide coastal wetland comprising of marshy areas towards the Gulf of Khambhat and of freshwater bodies in a landward margin of ~ 10 kms, which remains flooded during monsoon. Because of this diversified edaphic condition, the flora represents a combination of salt tolerant halophytes growing in marshy area, less salt tolerant species and aquatic plants occurring in inland areas.

II. DETA COLLECTION AND STUDY AREA

The Bhal Region, covers a geographically backward region of Gujarat having a fragile ecosystem. The geographical setting is the main reason for the backwardness of the region. The physiographic and climatic conditions have made the landscape drought-prone in summer and flood-prone in the rainy season. Generally flooded areas are more productive with fertile alluvial soil, but unfortunately, the Bhal region does not reflect this type of character. The Gujarat coast is bounded by the Arabian sea and by the Gulf of Kutch and Khambhat and 'Bhal' region is situated on left side of the Gulf of Khambhat. It is ~100 km long and ~25 km wide belt extending from near Bhavnagar to the northern end of the Gulf. Annual rainfall is about 650mm; low temperature in winter (~ 100C) and high in summer (~ 430C) result in sharp temporal variations. Tidal inundations from the Gulf of Khambhat and freshwater flows in river mouths, make the 'Bhal' region very unique and fascinating for botanical studies. Approximately 60% of the global population lives in coastal areas having high ecological and economic significance and values. ‘Bhal’ region is situated on the south-west border of Saurashtra, spreading in 2 revenue districts of Bhavnagar and Ahmedabad on the left border of the Gulf of Khambhat (Cambay).

This region can be classified as a ~ 15 kms wide coastal wetland comprising of marshy areas towards the Gulf of Khambhat and of freshwater bodies in a landward margin of ~ 10 kms, which remains flooded during monsoon. Because of this diversified edaphic condition, the flora represents a combination of salt tolerant halophytes growing in marshy area, less salt tolerant species and aquatic plants occurring in inland areas. Rivers of Bhal region has their catchment area in Shihor-Malnath Hill Range, Shetrunjay Hill Range and Hill range of Amreli and Rajkot district. Mainly rivers in this area of Bhal region are Kalubhar, Ghelo, Gautami, Bhikado, Khari, Keri, Sonpari, maleshri. study area is starting from Bhavnagar city last village is Nari to end Sanes village. and it is around to total 255 sq.km area of Bhavnagar district in this Bhal region.

Figure 3 Bhal Study Area

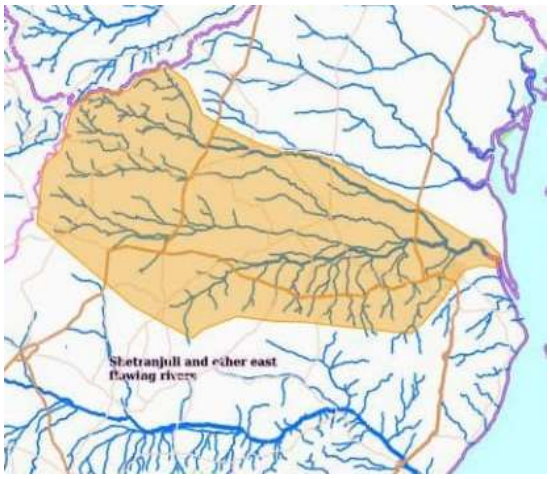


Figure 4 Bhal Rivers catchment Area

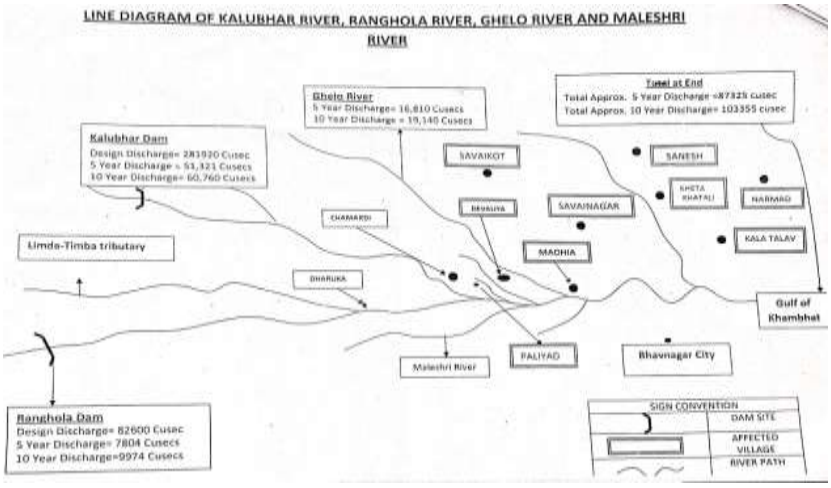


Figure 5 Bhal Rivers and dam locations line diagram

- Dam are in bhal region is kalubhar and ranghola.
- Kalubhar dam have 16 gates and max. flood is 2,81,920 cusecs. Storage capacity is 26.11 Mm3.
- Ranghola dam have automatic 47 gates and max flood 82,600 cusec. Storage capacity is 36.818 Mm3.
- Main rivers like, ghelo, maleshri, gheldi, sonpari, keri this all are connecting in this Khambhat gulf.
- All this Dam and other rivers total discharge is approx. 3,64,520 cusecs.

III. METHODOLOGY

In this study there is 4 to 5 stages in methodology first of primary investigation then local body survey and remote sensing survey and then find the minor problem identification then detailed survey to define the major problem identification and then find the major issues then and then provide the probable solution for the problem identified and this method use step by step to and last provide the probable solution to control and save the human life and other wet land to increase the agricultural lend and control the salinity in this whole are.

PRIMARY INVESTIGATION

In this investigation refers the local body survey local public communication and then define the minor problem identification and refer also general publications and news paper to aware about the location and study area and situation of place.

Figure 6 Bhal area visit field survey

REMOTE SENSING SURVEY

In this step remote sensing work find the whole area and their river network and also last 5-year situation and geological formation of lend. And in this survey use the google earth pro software and also Bhuvan our Indian satellite system and also other so many software to use the remote sensing survey.

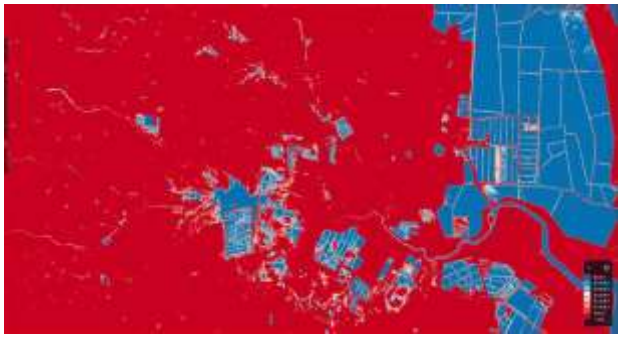


Figure 7 May-2019 Bhal region area

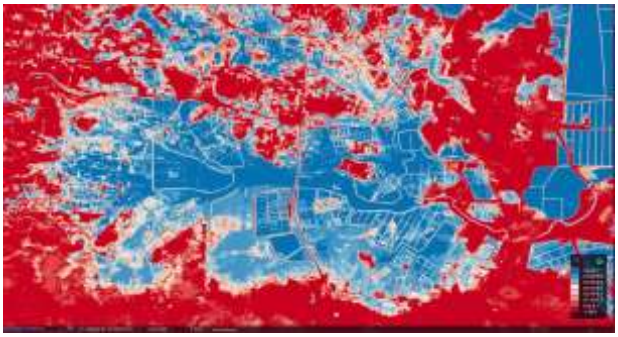


Figure 8 Sep-2020 Bhal region area

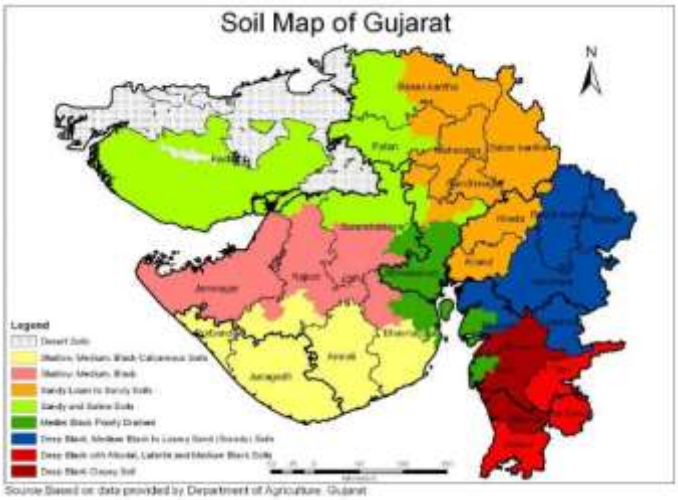
DETAILED SURVEY

In this detail survey go for the field visit and define the locations of the problem identification. And after the problem identification making one counter sheet profile and making topography sheet. Andin detail survey field visit is first step and then work in remote sensing data and finalized the probable solution of problem.

Figure 9 Madhiya brig

Figure 10 kalubhar river water logging area

Also, in this area take the soil sample soil report and define the which type of soil characteristic and other soil data in this area in this soil mainly the soil is saline soil and poorly drained soil so due to water logging there is more effect on agricultural land so hear is 2 major problem due to water logging and height of soil pan bunds.



District Name	Taluka Name	Soil Type
BHAVNAGAR	GADHADA	Shallow, medium black
BHAVNAGAR	UMRALA	Shallow, medium black
BHAVNAGAR	BHAVNAGAR	Medim Black poorly drained
BHAVNAGAR	GHOGHA	Shallow medium black calcareous soils.
BHAVNAGAR	SIHOR	Shallow medium black calcareous soils.
BHAVNAGAR	BOTAD	Shallow, medium black
BHAVNAGAR	VALLABHIPUR	Medim Black poorly drained

Figure 11 Gujrat soil report

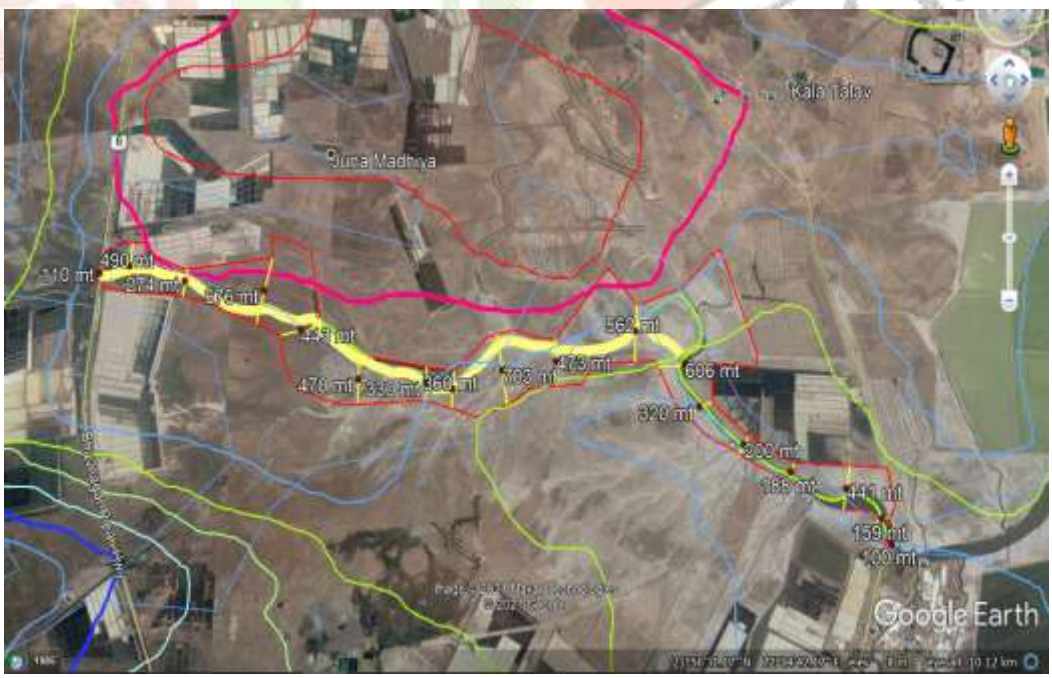


Figure 12 counter sheet of Bhal water logging area

IV. CONCLUSION

As per work on this water logging problem data collection and analysis site visit and remote sensing conclude that the main water logging problem is due to high tide and poor drainage system at pick timing in monsoon session so that for the provide probable solutions and implementations to reduce the water logging and other salinity problem.

- Provide proper and natural drainage system at Madhuli brig to cable brig almost 6 km long natural Chenal reestablish and derezzing stream Approximate derezzing quantity 6000*12*1.5= 72,000 qu3 m.
- Also remove local obstructions in between natural drainage.
- Reduce salt pan bund heights their obstruction structures and improve proper drainage network.
- Also provide a hydraulic design like tide regulator and bandhara at Gundala khdi to control salinity and high tide impact on agricultural land.
- In hydraulic design the tide regulator and bandra is very costly and use very accurate and detail analysis to making design and provide hydraulic design on site.
- For good agricultural bed and good soil structure use less water loss irrigation system like drip and sprinkle irrigation.
- Also in all dams provide a proper schedule for gate opening and maintain water level in dam.

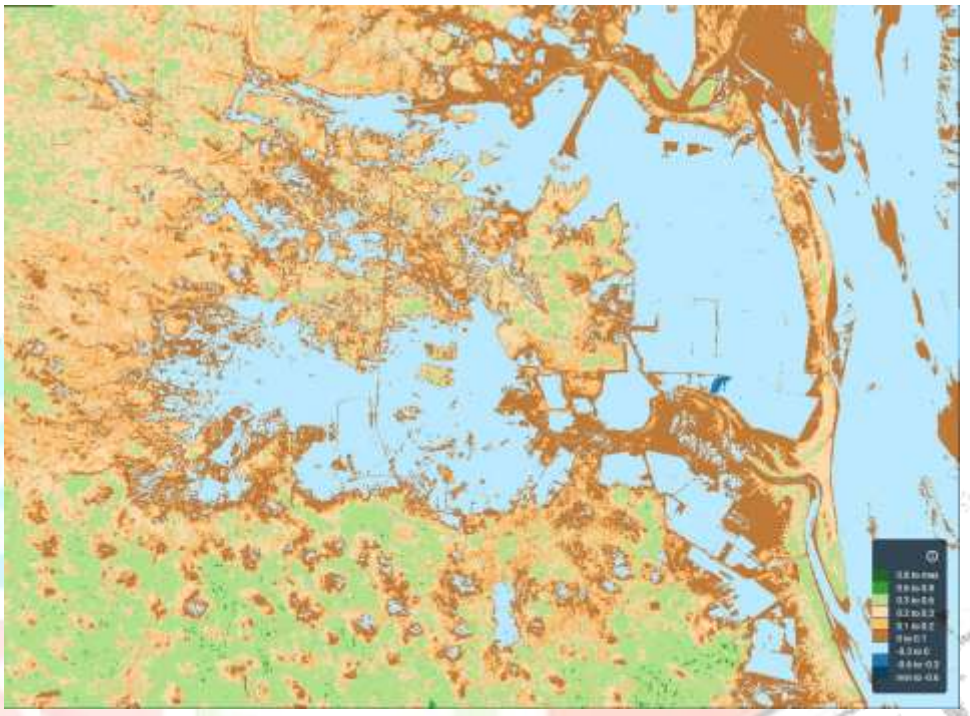


Figure 13 remote sensing data image from bhuvan of Bhal water logging area

Figure 14 remote sensing data image from bhuvan kalubhar cricks to be naturilized

V. ACKNOWLEDGMENT

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