

IMPACT ASSESSMENT OF SAUNI YOJANA BY RIVER INTERLINKING IN SAURASHTRA REGION

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Abstract: Scarcity of water is generally caused by improper management of water resources which also inhibits the growth of the nation. One of the many ways to solve the problem of shortage of water is by constructing the canal or dam network. The enormous task of linking the dam requires multidisciplinary investigations. Hydrological and agricultural parameters prove a dominant role in the selection of suitable path for the construction of the canal. The Saurashtra Narmada Avtaran Irrigation Yojana is programmed to resolve the water crisis of the scarce regions of Saurashtra. The Yojana is divided into 4 links. This paper deals with the study of the alignment of these 4 links of the "SAUNI YOJANA" with the help of ArcGIS and QGIS software.

Keywords: Sauni Yojana, Canal Alignment, Canal System, Remote Sensing, GIS, Saurashtra

I. INTRODUCTION

In the agriculturally rich country like India, water is very important natural resource. It is the most basic human need and valuable natural asset. Many states of India face the problem of scarcity of water. This problem can be prevented by proper linking and management of river interlinking systems. Gujarat state often faces the acute water crisis. 71% area of Gujarat is water deficit area. SAUNI YOJANA is one of the projects developed for the optimization of water of the Narmada River.

SAUNI YOJANA was launched by PM Narendra Modi to divert 1 MAFT excess overflowing flood water of Narmada to Saurashtra region. The project is divided into 4 links (Fig.1) including 115 dams of Rajkot, Jamnagar, Morbi, Surendranagar, Amreli and Junagadh. These dams are filled with water of Narmada River to provide water for irrigation and drinking purpose. Thus the present study is about alignment of these 4 links of SAUNI YOJANA with the help of ArcGIS and QGIS software.

A. Saurashtra Narmada Avtaran Irrigation Yojana (SAUNI YOJANA):

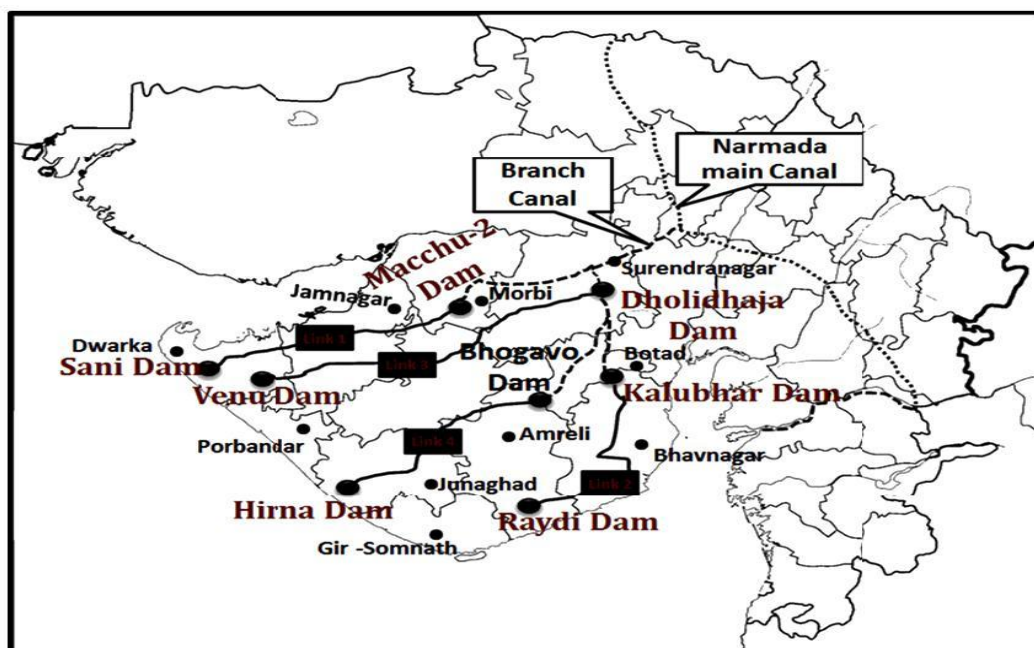


Fig1: Proposed SAUNI YOJANA Project

Source: <https://www.examrace.com/Study-Material/General-Studies/Geography/SAUNI-Yojana-YouTube-Lecture-Handouts.html>

The state of Gujarat was facing severe water scarcity and several regions remain arid and receive scarce rainfall, thus facing frequent droughts. People of Saurashtra and Kutch regions were facing acute shortage of water for drinking and irrigation and were forced to migrate to other regions. Almost 70% of dams, reservoirs and other water bodies of this region had become dry and large area of the Kutch-Saurashtra region was dependent on water supply through tankers. In a bid to mitigate this problem, the Gujarat government undertook the development of a state water supply grid, Swarnim Gujarat Saurashtra-Kutch Water Grid Project. It was developed by Gujarat Water Infrastructure Limited (GWIL) to augment water supply to these areas in the state.

With implementation of the Sauni Yojana, the excess water from the Sardar Sarovar Dam is to be supplied to parched regions of Saurashtra using pipe canals. It acts as a link project and aims to fill irrigation dams which include canal networks to channelize water to the farmland. The project also has a potential to create about 8,800 jobs each year.

SPML Infra has completed an important Irrigation Project in Gujarat called Saurashtra Narmada Avtaran Irrigation (SAUNI Yojana) launched by Shri Narendra Modi in September 2012 during his tenure as the Chief Minister of Gujarat. The project envisage to divert one million acre feet (1 MAF) water of Narmada Dam to Saurashtra to distribute it to 115

Reservoirs through a total of 1115 km four link pipelines to irrigate 1.8 million hectare of land, mainly in Saurashtra, Kutch and north Gujarat, benefiting millions of farmers. It will also supply irrigation water to 2.46 lakh hectares in drought-prone Barmer and Jalore districts in Rajasthan and some parts of Maharashtra apart from generating hydropower. About 1,650 MLD of water is supplied to 39 million people across these regions and with the good crop; it is boosting the economy of the state.

II. STUDY AREA

The 'Kathiawar' properly known as Saurashtra region comprises of mainly seven districts i.e. Bhavnagar, Amreli, Surendranagar, Rajkot, Junagadh, Porbandar and Jamnagar. The region is divided into 69 talukas with a population of 1.12 crore (1991). The Saurashtra region is spread over area of 64,338 sq.km. and it lies between 20°40'- 23°25'N latitude and 69°53'- 72°20'E longitude. The region is mostly covered by black and alluvial soil as well as hard rocks. Climatic condition of Saurashtra region is dry as the rainfall in this zone is less than 500mm.

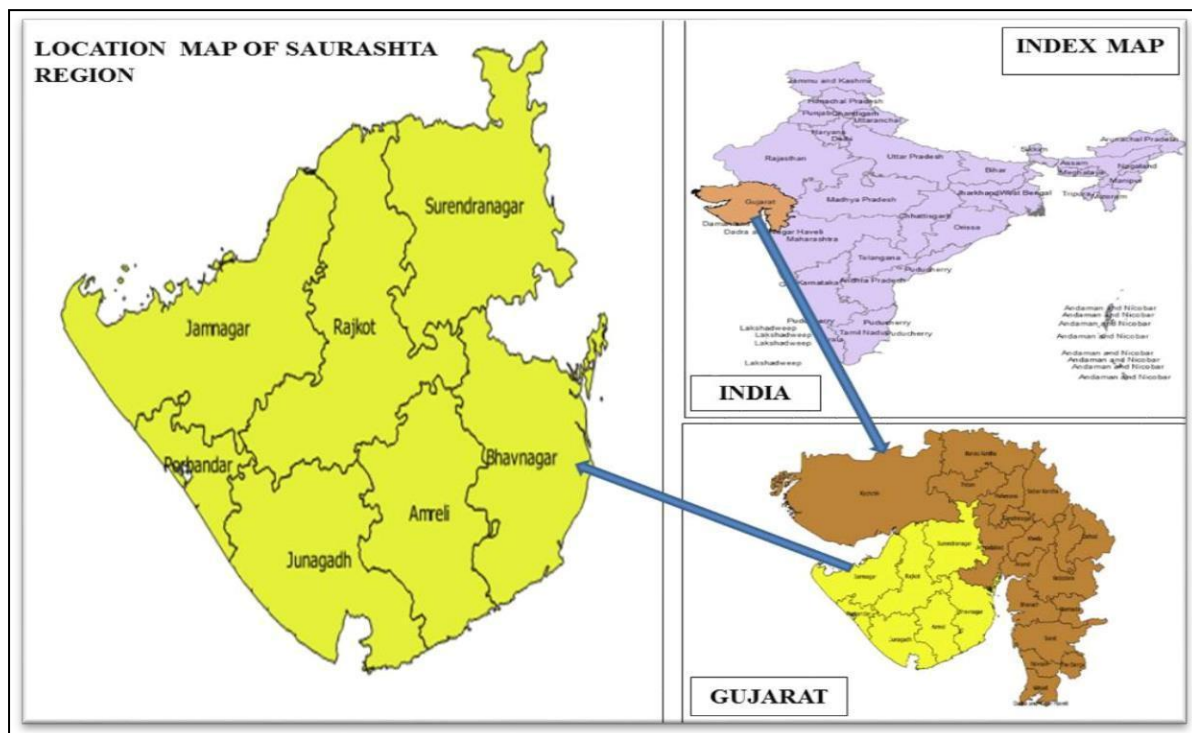


Fig2: Location Map of Saurashtra Region covered in Sauni Yojana

Saurashtra region consist of approximately 71 rivers flowing from the centre towards the sea. All these river basins are mostly homogeneous in their Hydro meteorological characteristics, all the rivers have shorter lengths and gets flooded instantaneously. The areas of Saurashtra are mostly water deficient because the rivers are seasonal and there is no perennial flow. Except Shetrunji River and Bhadar River, all other rivers become dry after monsoon and thus water is supplied to this region by many irrigation projects, from which SAUNI Yojana is major project which deals with the 4 links:

a) *Link 1: From Machhu-II dam of Morbi district to Sani Dam of Jamnagar District*

Machhu 2 dam located at 22.75°N and 70.86°E from Morbi and Sani Dam at 21.97°N and 69.49°E from Japur of Jamnagar district. The major portion coming under this link is covered by Porphyritic Amygdaloidal rock. Jamnagar and

Morbi receives about 487mm precipitation annually and weather condition is dry with varying temperature of 18°C in January to 31°C in June.

b) *Link 2: From Limbdi Bhogavo-II Dam of Surendranagar District to Raydi Dam of Amreli District*

Bhogavo Dam located at 22.54°N and 71.64°E from Vadod village in Surendranagar to Raydi dam located at 21.14°N and 71.25°E from Raydi village in Amreli district. The geology of Surendranagar and Morbi district includes majorly hard rock and Basalt. Surendranagar receives 505 mm rainfall while Amreli receives 572 mm rainfall annually. Temperature varies between 33°C in May to 19°C in January in both the districts

c) *Link 3: From Dholidhaja Dam of Surendranagar District to Venu-I Dam of Rajkot District*

Dholidhaja dam located at 22.73°N and 71.60°E in Surendranagar district to Venu-1 dam located at 21.45°N and 70.14°E from Gadhetad village of Rajkot district. Nyari dam of Rajkot and surrounding area is formed by Amygdaloidal Porphyritic dense basaltic rock. The average rain fall in Rajkot is 674 mm while in Surendranagar it is 505 mm. Both the districts are dry and face the average temperature of around 32°C in May and 19°C in January.

d) *Link 4: From Limbdi Bhogavo-II Dam of Surendranagar District to Hiran-II Irrigation scheme of Junagadh*

Bhogavo-2 dam located at 22.28°N and 71.26°E in Surendranagar district to Hiran-2 dam located at 21.02°N and 70.46°E in Umrethi village of Junagadh district. Sheldedumal dam located in Amreli has Porphyritic Amygdaloidal Basalt same as the entire region of Surendranagar and Junagadh. Junagadh receives 872 mm rainfall annually while Surendranagar receives 505 mm. Temperature varies from 20°C in winter to 30°C in summer.

III. METHODOLOGY

The following procedure has been adopted to prepare the required thematic maps such as location map, canal maps and satellite images of the irrigation channel.

1. The toposheets showing the proposed canal route is collected from the website of Water Resource Department of Gujarat (WRD).
2. The spatial data is collected from Global Administrative Areas (GADM) data. Then this digital data was geo-referenced for the generation of thematic maps.
3. Thematic layers of canal location are digitized with the use of study area shape files in Arc Map software of ARC GIS 10.2.2 by visual interpretation technique.
4. After preparation of necessary thematic layers the proposed canal alignment is plotted with specific criteria.
5. The same prepared layer for each link is then created over the Google Earth to identify topography and geology of final canal. Maps generated from Google Earth also helps in analyzing the suitable alignment of canal routes for each link connecting from Sardar Sarovar Dam to the reaches of Saurashtra region.
6. The prepared maps of proposed canal alignment are integrated with bed level and ground level of canal according to design of canal.

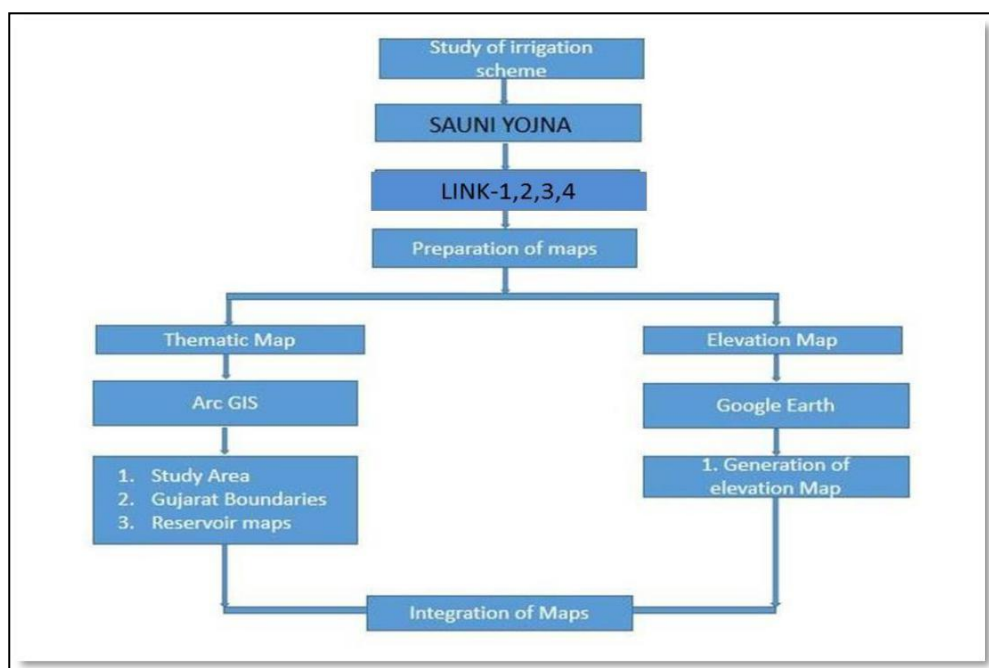


Fig.3 Method of Generating Maps from QGIS and ArcGIS

IV. SAUNI YOJANA LINKS

The Main 4 links which comes under SAUNI YOJANA are given below:

A. Link 1: From Machhu-II dam of Morbi district to Sani Dam of Jamnagar District

Having carrying capacity of 1200 cusecs, 30 reservoirs of Rajkot, Morbi, Devbhoomi Dwarka and Jamanagar Districts will be filled and 2,02,100 acre area will be benefitted. The works for about 57.67 Km long pipeline of initial reach of this link are awarded.

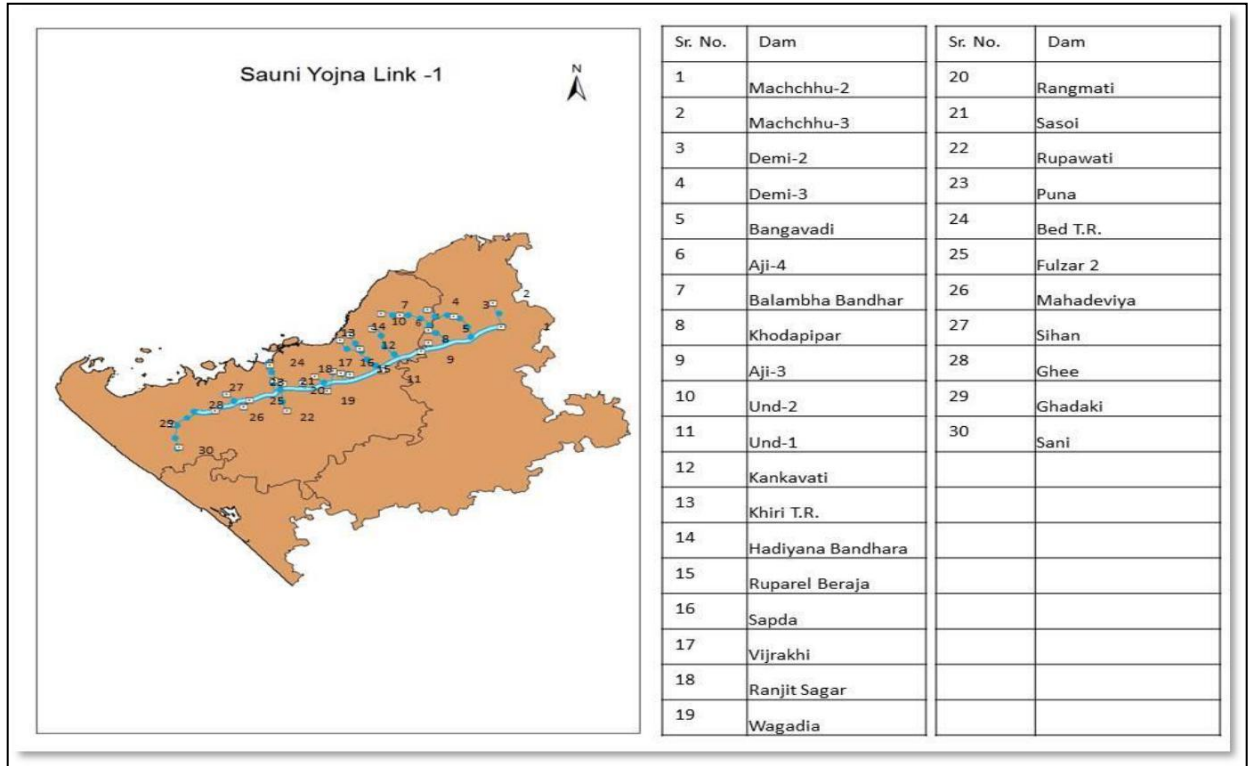


Fig.4 Alignment of pipeline in Link 1

B. Link 2: From Limbdi Bhogavo-II Dam of Surendranagar District to Raydi Dam of Amreli District

Having carrying capacity of 1050 cusecs, 17 reservoirs of Bhavnagar, Botad and Amreli Districts and area of 2,74,700 acres will be benefitted. The works for about 51.28 Km long pipeline of initial reach of this link are awarded and are under progress.

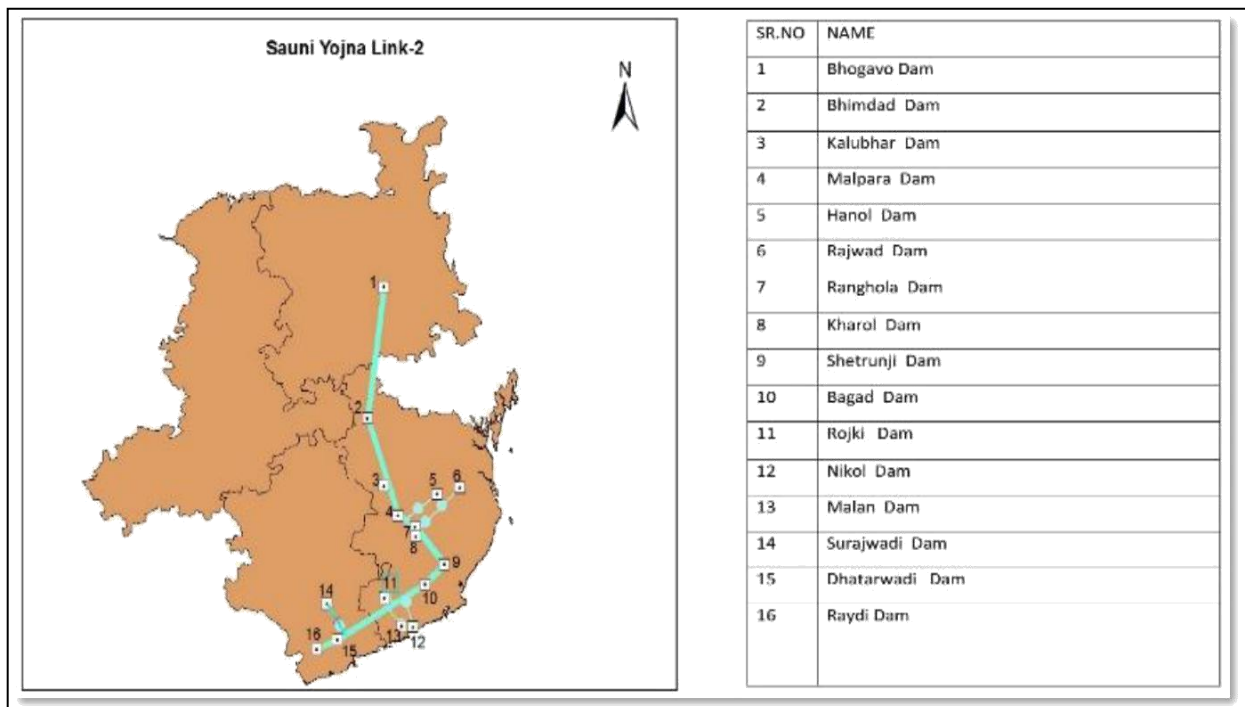


Fig.5 Alignment of pipeline in Link 2

C. Link 3: From Dholidhaja Dam of Surendranagar District to Venu-I Dam of Rajkot District

Having carrying capacity of 1200 cusecs, 28 reservoirs of Rajkot, Jamanagar, Dwarka, Porbandar, Morbi and Surendranagar Districts and 1,98,067 acre area will be benefitted. The works for about 66.30 Km long pipeline of initial reach of this link are awarded and are under progress.

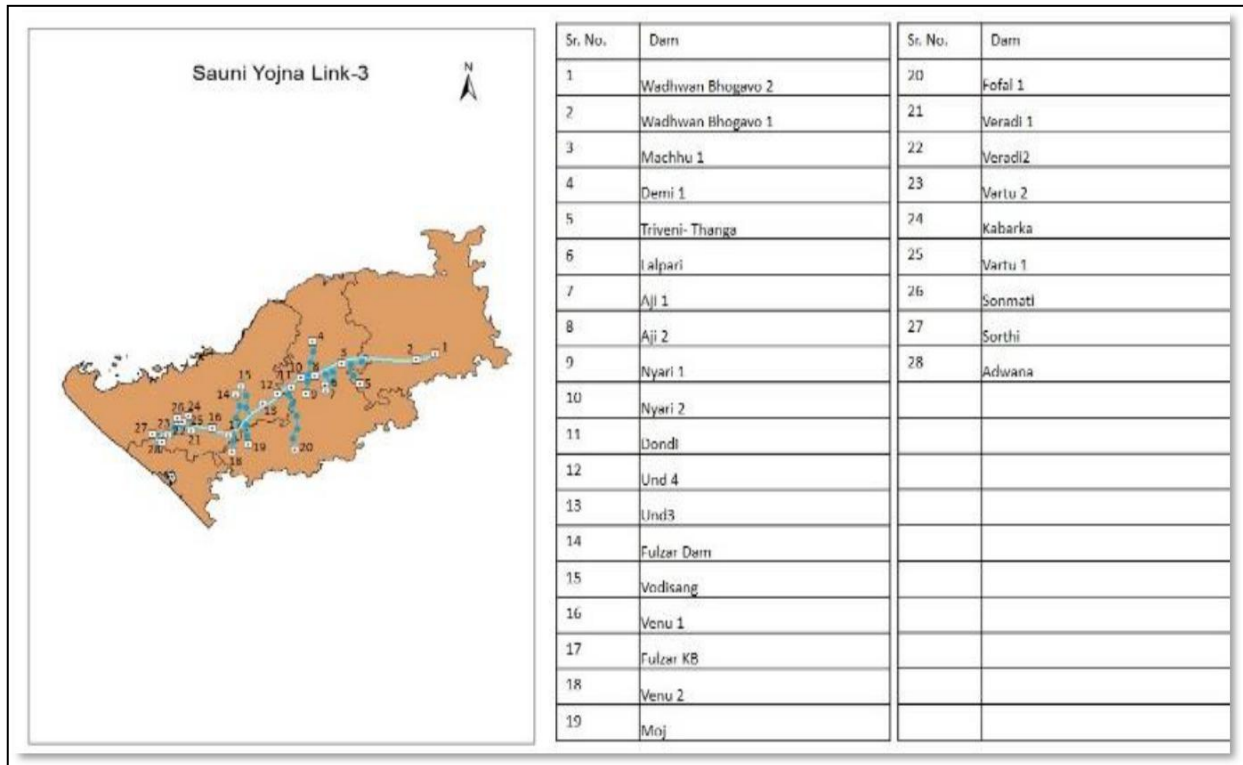


Fig 6: Alignment of pipeline in Link 3

D. Link 4: From Limbdi Bhogavo-II Dam of Surendranagar District to Hiran-II Irrigation scheme of Junagadh

Having carrying capacity of 1200 cusecs , 40 reservoirs of Rajkot, Surendranagar, Junagadh, Porbandar, Gir Somnath, Amreli and Botad Districts and area of 3,47,722 acre will be benefitted. The works for about 54.70 Km long pipeline of initial reach of this link are awarded and are under progress.

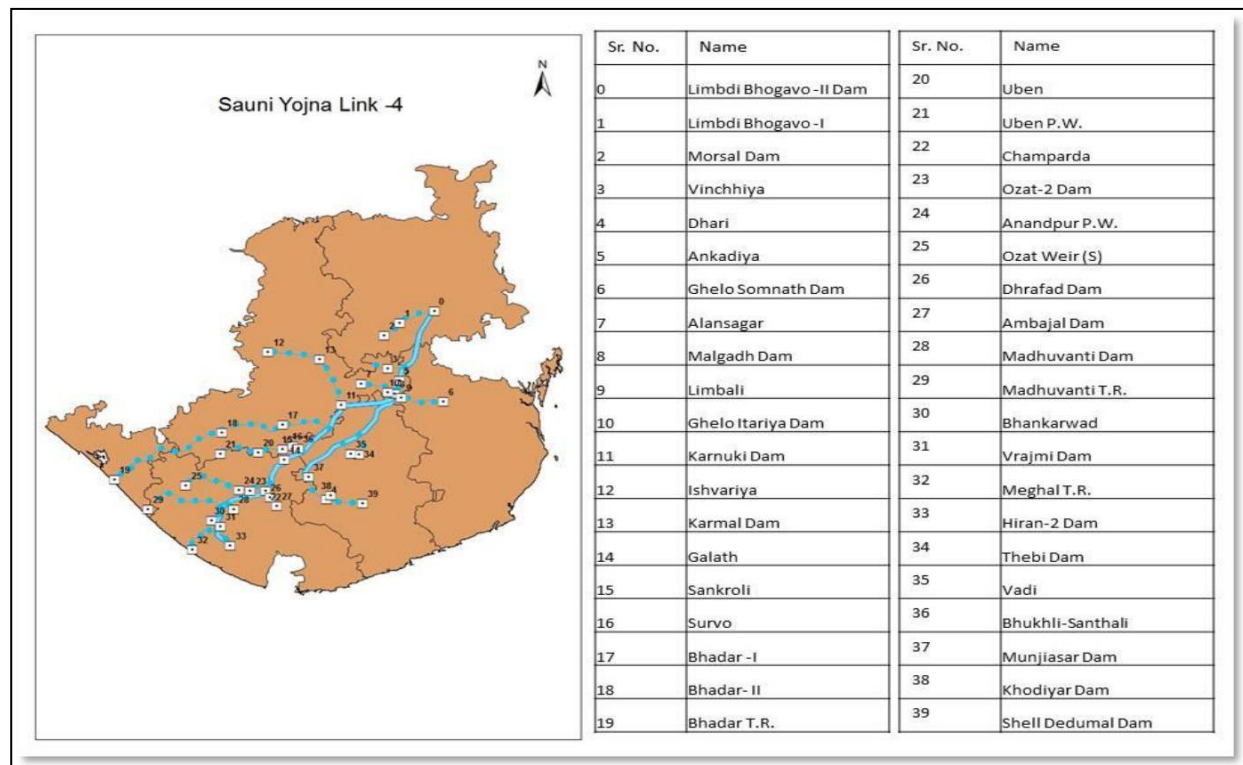
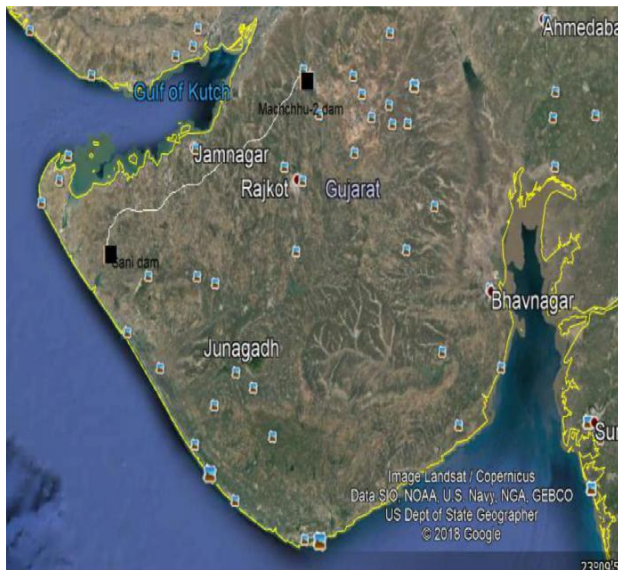


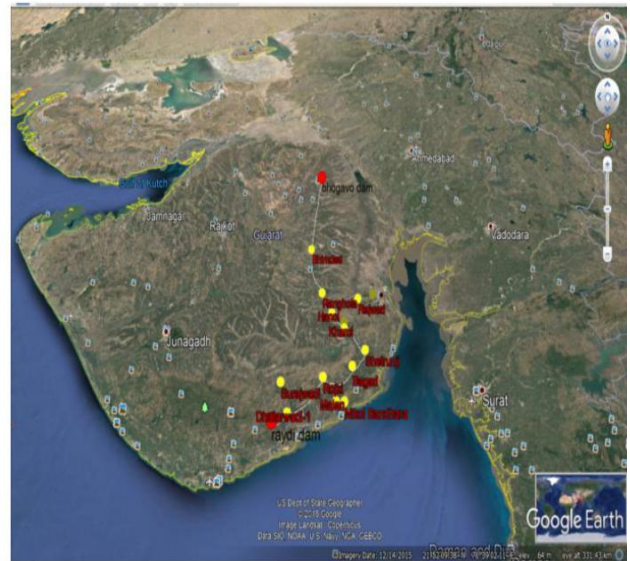
Fig 7: Alignment of pipeline in Link 4

SATELLITE IMAGES OF SAUNI YOJANA LINKS

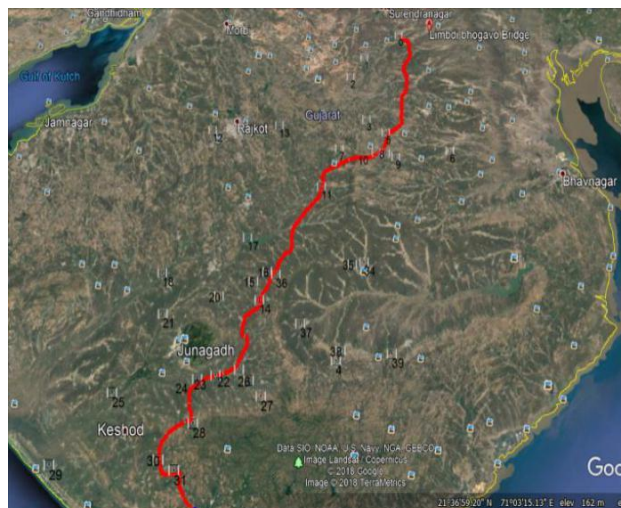
Below are the images which represent the satellite view of each link when all the dams are connected:



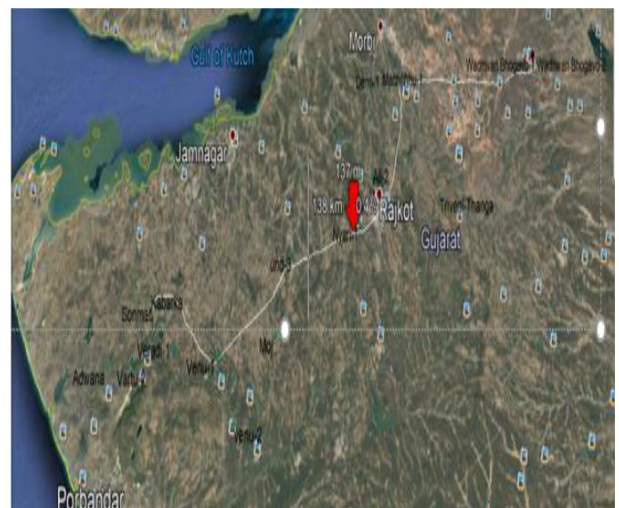
SAUNI YOJANA LINK 1



SAUNI YOJANA LINK 2



SAUNI Yojana Link 3



SAUNI Yojana Link 4

Fig.8 Google Earth Images Showing Various Links of SAUNI Yojana

V. ALIGNMENT OF CANAL

To establish a suitable alignment from source to destination various features on earth surface like rivers, lakes, forests, roads, railways, in the given area have been considered. For alignment of canal some of the basic criteria were followed as below:

1. Depending on slope and contour, the alignment of canal was selected in such a way that flow of water is gravity flow and no pumping is required as far as possible
2. All dams of study area where no surplus water is identified will flow through the other water bodies like pond, lake and small dams.
3. Populated and built up areas have been avoided.
4. The area selected has minimum cutting and filling operations which reduce the cost of the project.
5. As far as possible, diversion of surplus water has been done through the natural drainage so that minimum land acquisitions are required.
6. The alignment has been provided in such a way that the canal crosses the natural stream or reservoir at its narrowest point in the vicinity so that it can feed them if there is any future requirement
7. Alignment does not have to cross too much drainage, thereby reducing the number of cross drainage works.
8. Too many curves are avoided in alignment of canal.

VI.RESULTS AND DISCUSSION

□ The Link 1 of Sauni Yojana starts from Machhu 2 dam of Morbi district and ends at Sani dam of Jamnagar district. Thus the water is provided by this link to both Jamnagar as well as Morbi districts.

The construction of this link has been completed, yet the further expansion can be made in this link by providing water to scarce regions of Saurashtra like Halvad, Dhanisara, and Wankaner, etc. These regions can be provided with water by canal system. The water can be supplied from the Machhu River situated in Morbi district and also various scarce regions of Jamnagar like Khambhalia, Dhrol, Lalpur, Kalyanpur and Jamjodhpur, etc, can be imparted water through the linking of canals.

□ The Link 2 begins from Bhogavo 2 dam of Surendranagar to Raydi dam of Amreli district. Thus this link helps in providing water to regions like Surendranagar and Amreli.

This link has yet to be constructed and hence it has large scope of future expansion. Future expansion can be manipulated by providing water to the dry regions of Bhavnagar districts like Vavadi, Gariyadhar, Botad, Sihor, Palitana, Gadhada and the dry regions of Amreli district like Bagasara, Rajula, Khambha, Lathi, and Babra etc.

□ Dholidhaja dam of Surendranagar district to Venu 1 dam of Rajkot district are included in Link 3. The length of canal is 8 km and providing water to 8 villages of Upleta Taluka, Rajkot. However, if the canal length is increased then 5 more nearby villages can be supplied with water to solve the problems of scarcity and further cultivate the area.

Moreover, Demi 1 dam has an effective storage capacity of 19.95 Mm³ and supplies water to 12 villages of Morbi Taluka, mostly by the canal system. Here geological condition are very supportive and rock type is encountered at the dam site which provides a favourable condition to expand the capacity of dam. Thus, enables to supply water to more villages either by pipeline or canal system.

□ Link 4 connects Limbdi Bhogavo 2 of Surendranagar district to Hiran 2 of Junagadh district having canal length of 16.50 km. Dhari dam of this link provides water to total 4 village i.e. 1 in Surendranagar and 3 in Rajkot.

Jasadan Taluka has 1001 villages, if capacity of Dhari dam increases then at least 5 villages of Jasadan Taluka and 4 villages of Chotila taluka can be benefited with a good amount of water supply.

Former capacity of Machhu dam was to provide water to 20 villages. Thus if the water carrying capacity of the dam is expanded then it can provide water to 15 more villages of Morbi district.

Bhadar 1 dam is one of the major dam providing water to 46 villages including 13 in Jetpur, 21 in Dhoraji, 8 in Junagadh and 4 in Upleta. The effective storage capacity of dam is 221 Mm³. The canal constructed using low cost water pipe line is sufficient to provide water to the remaining villages in Rajkot district.

VII.CONCLUSION

Application of Remote Sensing and GIS is highly useful in study and planning of alignment of pipeline network system. The present study on 'Sauni Yojana: From Draught to life by River Interlinking in Saurashtra Region' comprises various maps that illustrates the proposed link project and aims to fill irrigation of dams which includes canal networks to channelise water to the farmland. In this study, the alignment of network is prepared such to fulfill the objective of filling 115 major dams by diverting floodwaters overflowing from the Sardar Sarovar Dam across the Narmada River to the drought areas. The maps generated in the present study elaborate the information about the proposed alignment of project and the future expansion scope in the nearby regions.

Details of the Proposed Canal Network:

Cost of Project: INR 5940 Million.

Length: 40.95 km MS Pipeline of 3000 mm diameter with 17.5 mm thickness.

Coating: Outside 3 LPE minimum 3.7 mm coating conforming to DIN 30670, Inside 406 micron thick solvent free food grade epoxy coating and heat shrink sleeve at welding joints.

Pipe welding: 32,61,824 km

No of bends: 26 Nos.

No of valves: 24 Nos.

Total concreting: 22,100 cum

Total excavation: 16,77,080 cum

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B) *Links:*

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