

Assessment of Flood Effect on Semi-Arid Special Investment Region using 1D Hydrodynamic Modeling

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Dholera Special Investment Region (DSIR) is a Greenfield Industrial City planned and located approximately **100 km South West of Ahmedabad**.

Total land area of DSIR is about **920 square kilometre** (sq km) of which 520 sq km has been allocated for town planning and approximately 400 sq km falls under coastal regulation zone (CRZ) of Gulf of Khambhat.

(http://dicdl.in/planning/?q=development_highlight)

The proposed area principally comprises of **mud flats** with large parts under salt ingression from a network of **intertidal channels** connected to the Gulf of Khambhat.

(<http://www.gsdma.org/Content/flood-seismic-vulnerability-4206>)

By 2050, the city will have the capacity and resources to support a population of two million and provide employment for around **800,000** people.

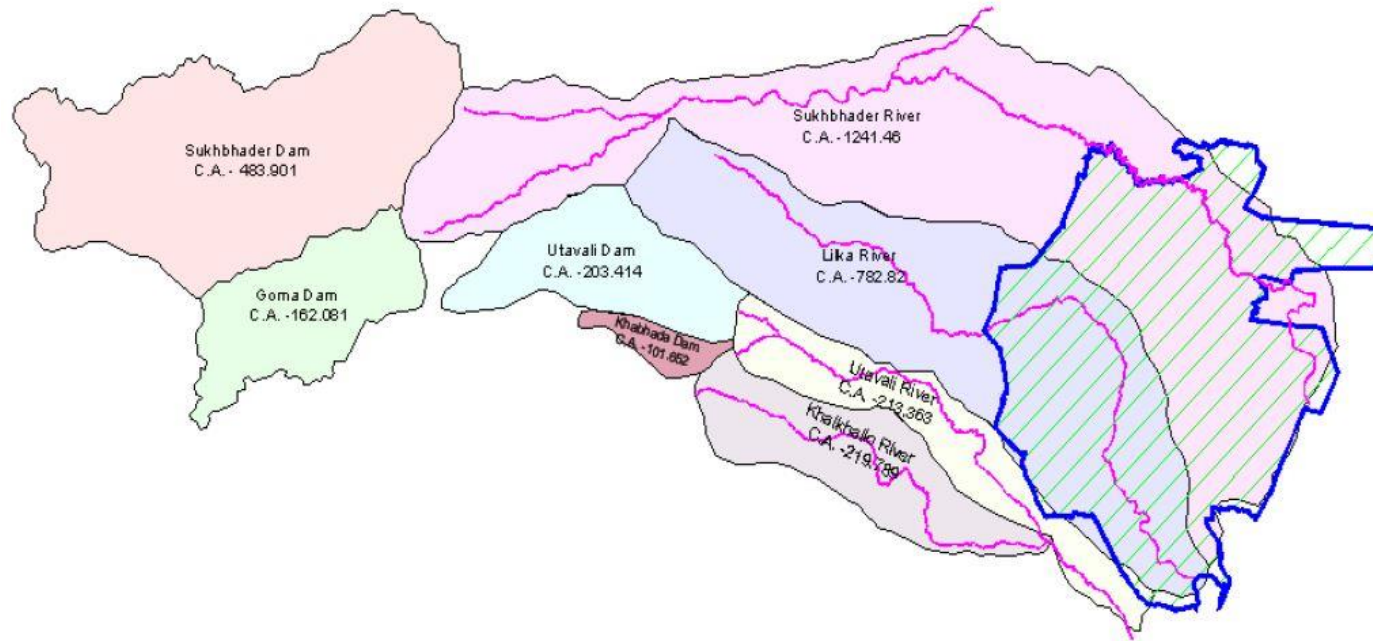
(<https://aecom.com/projects/dholera-special-investment-region/>)



DSIR is a delta region and is blessed by number of rivers starting from river **Sukhbhadar** in the north to **Lilka**, **Utavali**, and **Padalio** River at extreme south and local khadi (creek) namely Bhadar Creek, Vankol Creek, Bavaliyari Creek and Sonari Creek to Gulf of Cambay.

Flooding is one of the natural calamity which can affect the DSIR as the terrain profile of DSIR is flat and lowlying. It is in the delta region of four rivers. In the monsoon season, when there is heavy rainfall and high tide in the gulf of Cambay, the backwaters **inundate** the whole DSIR area **for number days**.

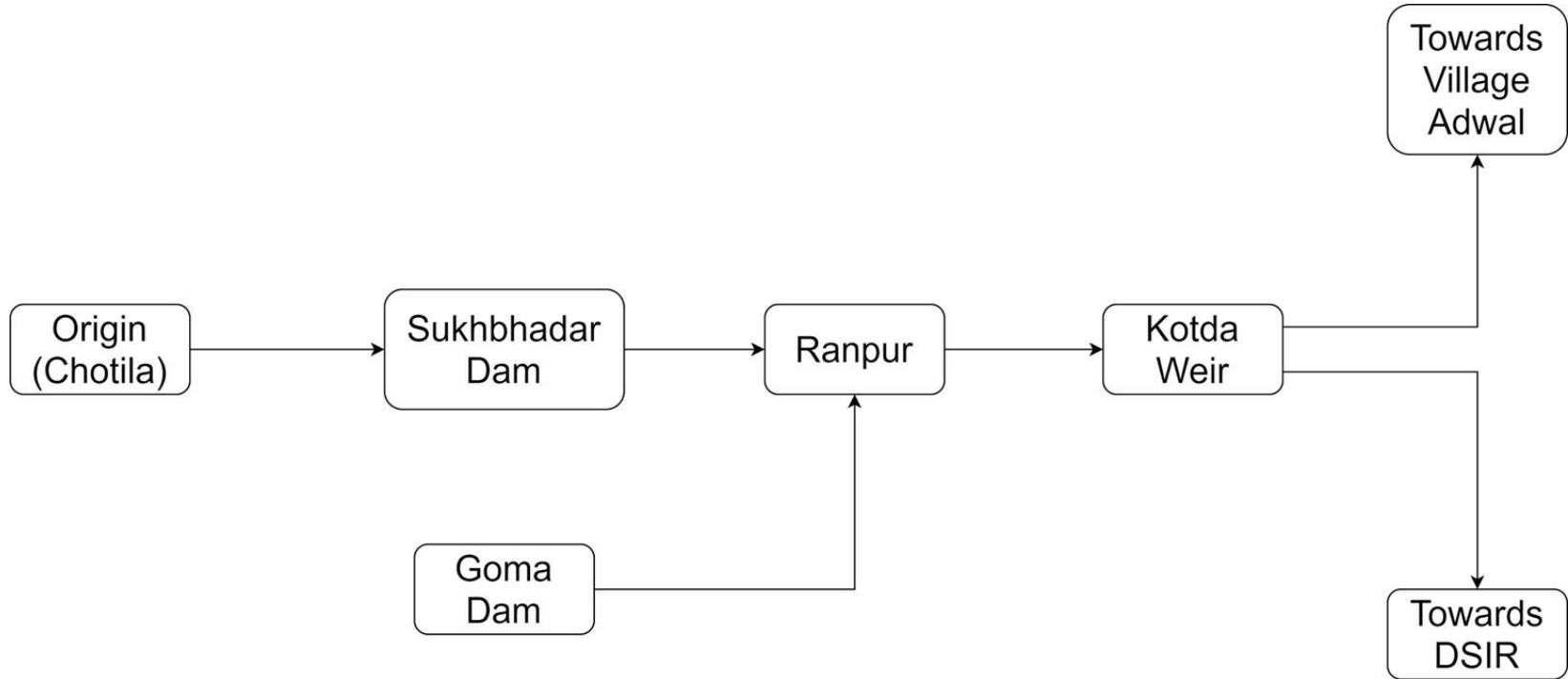
(<http://www.gsdma.org/Content/flood-seismic-vulnerability-4206>)



Map showing the rivers and its catchment area flowing through the DISR region
(<http://www.gsdma.org/Content/flood-seismic-vulnerability-4206>)

There are two major dams on Sukhbhadar River namely Sukhbhadar Dam (spillway capacity: 10699 m³/s) at village Nana Bhadla and Goma Dam at village Nana Paliyad.

The weir known as **Kotda Cut Weir** on Sukhbhadar river about 6 km upstream of Dhandhuka town. The Kotda cut weir divides the flood water of Sukhbhadar River into two channels known as **Northern channel** flowing towards Adwal village and **Southern channel** flowing towards Dhandhuka town and traverses through the DSIR region and meets the gulf of Cambay.



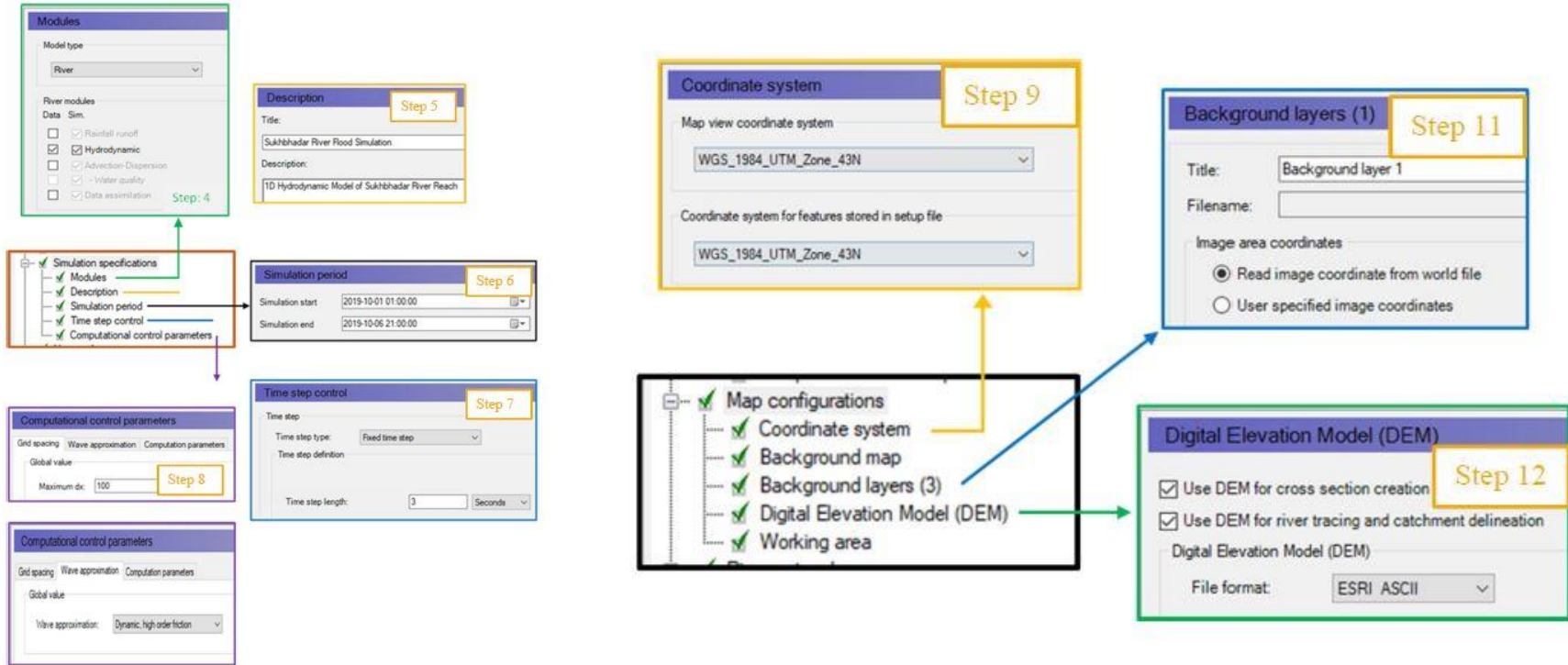
Line diagram of Sukhbhadar River basin downstream of Sukhbhadar Dam

Data Sources

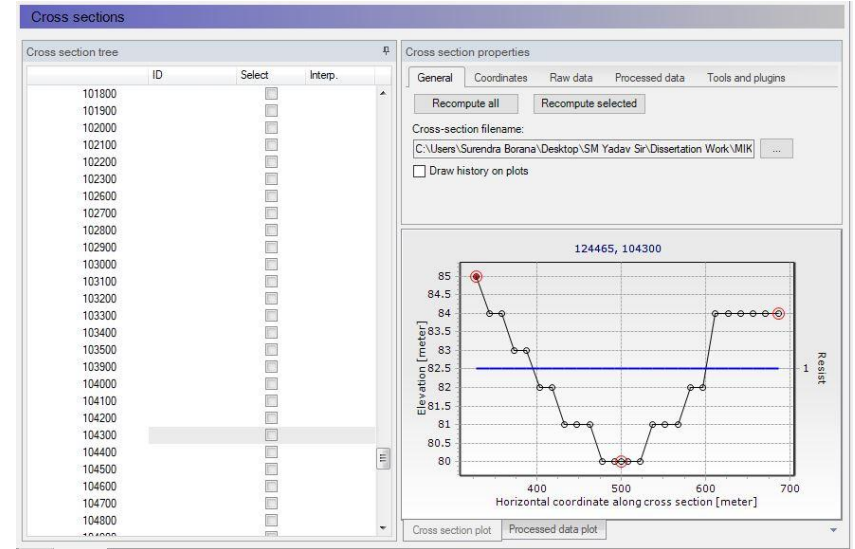
Sr. No.	Data	Source
1	Digital Elevation Model of study area with 30m resolution	AW3D30
2	Hourly discharge data for Sukhbhadar River	Sukhbhadar Dam Authority
3	Tide data of Gulf of Cambay i.e. High tide, normal tide and low tide at study area	Gujarat Maritime Board (GMB) or Kalpasar Dept
4	Predicted tidal data of Bhavnagar Port	Survey of India (SOI)
5	Master plan of DSIR area	DICDL / GIDB
6	Salient features of irrigation schemes of Sukhbhadar River and its tributaries	State Water Data Centre (SWDC), Gandhinagar

1D HYDRODYNAMIC MODELLING IN MIKE HYDRO RIVER

- Creating MIKE HYDRO River Model
- Simulation Specifications
- Map Configuration
- River Network
- Cross section
- Boundary Conditions and Initial Conditions
- Hydrodynamic Parameter
- Results

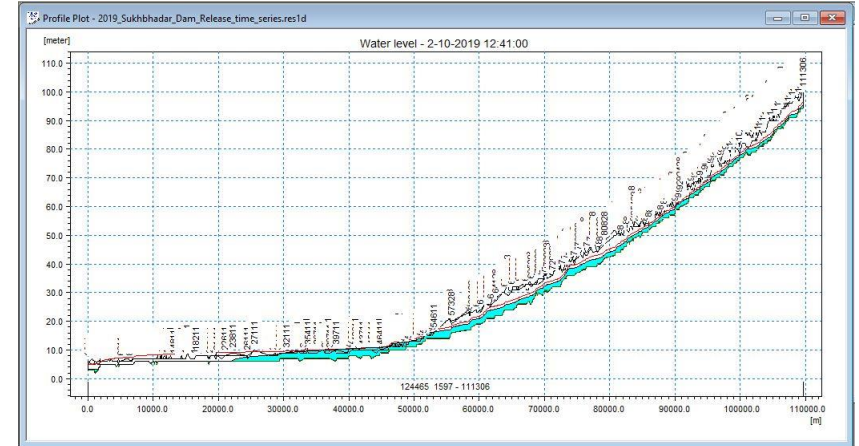
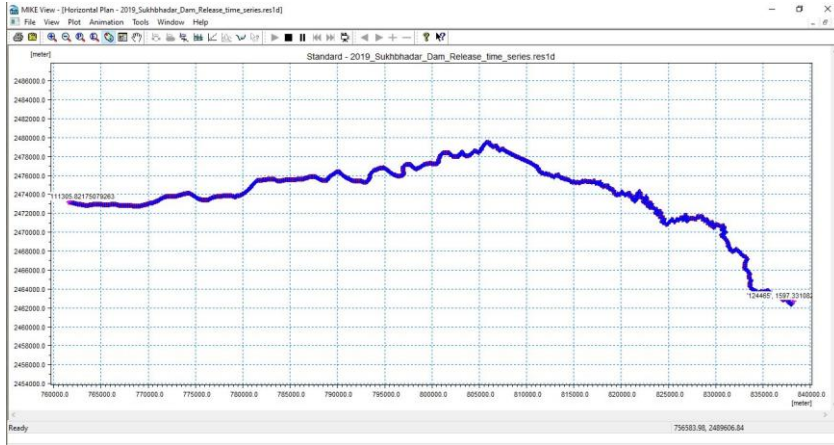


Step to setup Simulation Specification in MIKE HYDRO model



River network & Cross Section Editor used in MIKE HYDRO River Model

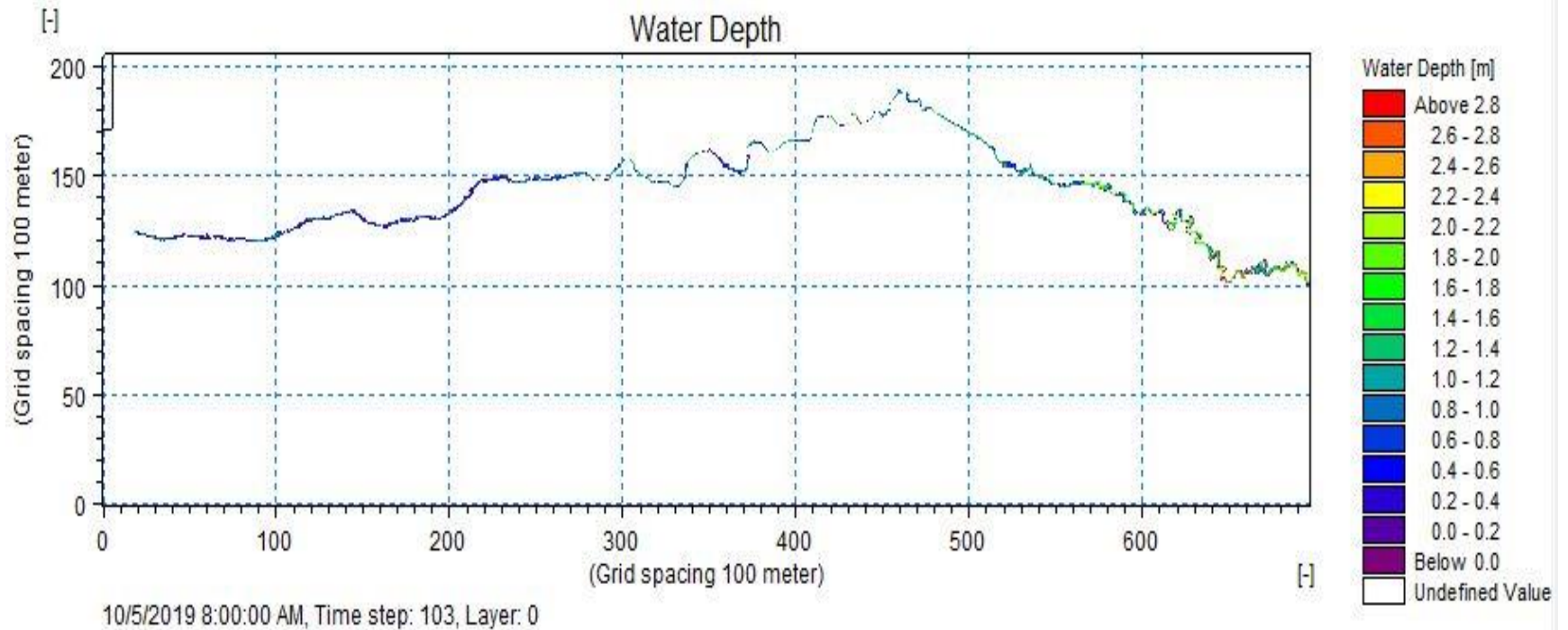
- 16. The 1D hydrodynamic model of Sukhbhadar River has been developed in MIKE HYDRO River for the flood event of year 2019 and calibrated for simulation period of 2019-10-01 01:00:00 to 2019-10-06 21:00:00 , total period of 140 hour.
- 17. The maximum release from Sukhbhadar Dam during the simulation period was 250.38 m³/s.



The window of MIKE VIEW & Water level profile for the Sukhbhadar River

Observed and simulated depths for different values of Manning's n

Location	Coordinates	Chainage	Date & Time of Observation	Manning's n	Observed Depth (m)	Simulated Depth (m)
Ranpur	22.3521 N, 71.7178 E	92327.9	3 Oct 2019 11:26 AM	0.04	0.6	0.46
				0.05		0.54
				0.06		0.61
Nagnesh	22.3675 N, 71.7637 E	86627.9	3 Oct 2019 12:30 PM	0.04	0.5	0.34
				0.05		0.45
				0.06		0.52

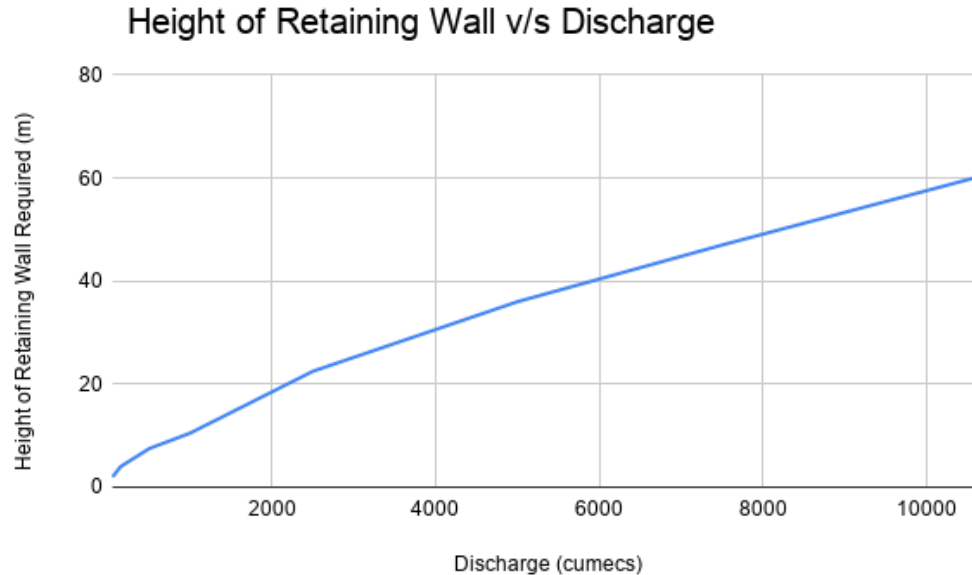


Critical flood reaches of Sukhbhadar study River reach

The developed 1D hydrodynamic model was run for various discharges and maximum height of retaining wall required at particular location of the study reach to prevent flooding is presented in the figure.

As the discharge is increased , considerable stretch of the river reach is affected by flooding. Specially, downstream of Dhandhuka as the area is almost flat and the capacity of river is too low.

The results from the present study can be used to suggest flood mitigation measures for the affected villages in the Sukhbhadar River reach and Special Investment Region.



Height of retaining wall required for various discharges

The critical river sections and flood prone areas have been identified from 1D hydrodynamic model and it shows that from Sukhbhadar Dam to Dhandhuka i.e. from chainage 111300 m to 55481.3 m few stretches of the villages are affected by flood waters these includes **Loya, Saganpur, Ranpur, Kinara, Nagnesh and Sontha**.

From Dhandhuka to Gulf of Cambay, almost **all the villages are affected by flood** as the discharge carrying capacity of the river in this stretch is very low.

Limitation of study

Due to less measured data of depth in the study river reach, it is difficult to validate develop model precisely. In the present analysis, model is validated using limited data collected during site visit. The Ranpur gauging site which is in the downstream of Sukhbhdar dam has been closed since last few years. It is recommended to make this site operative. The detailed analysis considering high releases from Sukhbhadar Dam and measured depth in the river and flood plain area help to strengthen this study. The role of storage reservoirs, existing canal network, newly constructed roads, storm drains and other proposed flood mitigation measures are not considered in the present analysis.

FUNDING

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CITE AS

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FUTURE RESEARCH COLLOBORATION CONTACT

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