ADDRESSING VULNERABILITY ISSUES FOR CANALS

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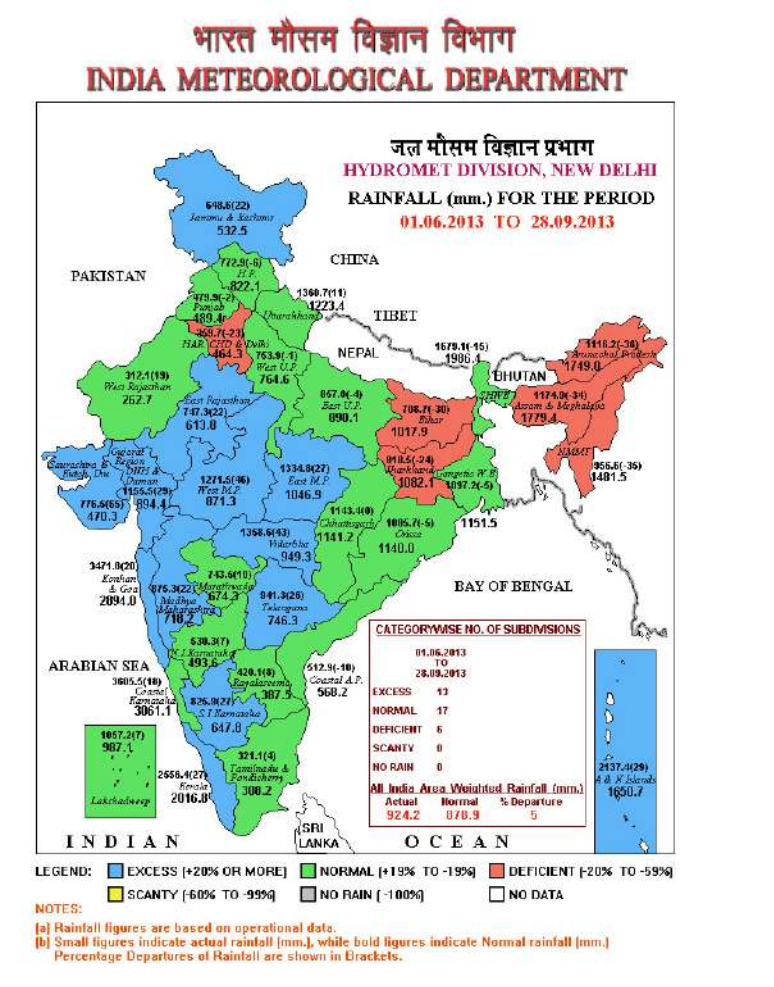
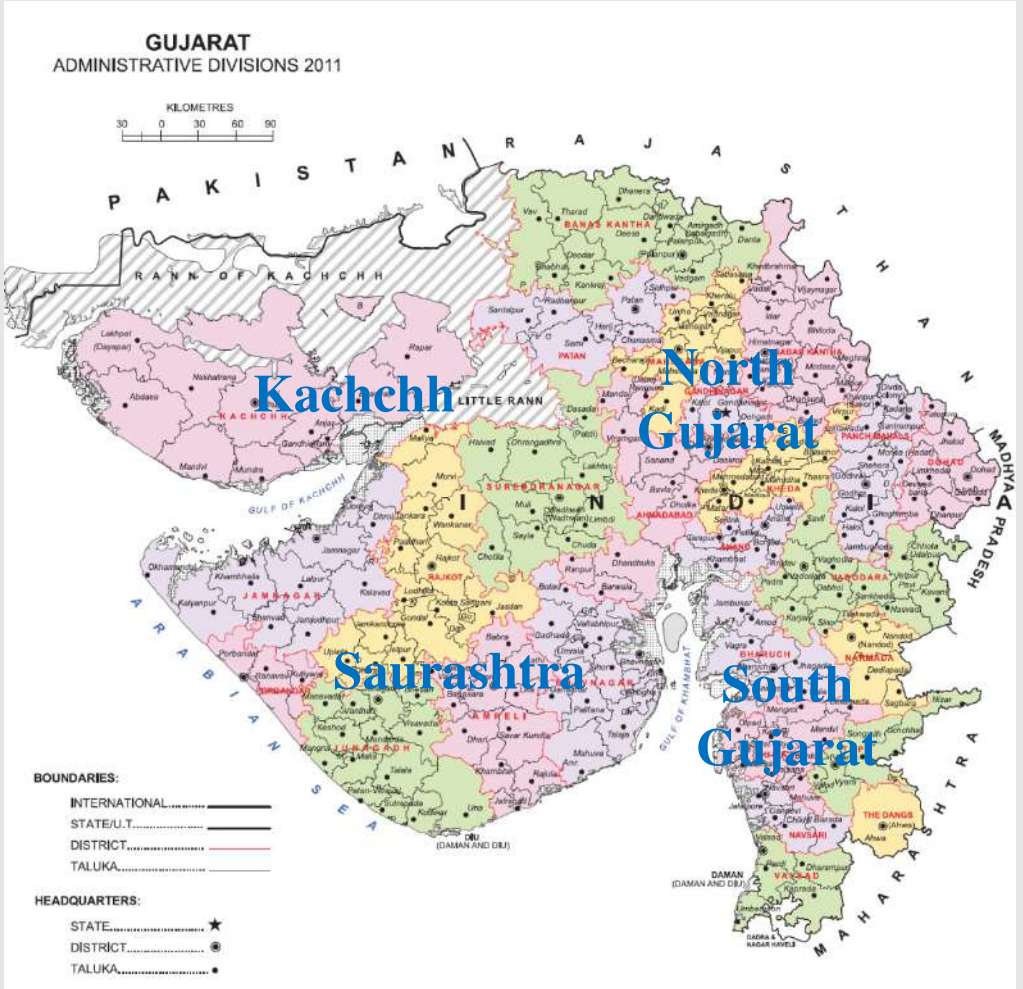
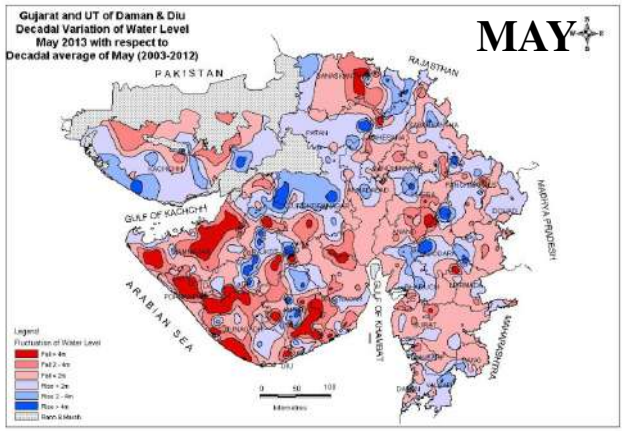
Government of Gujarat

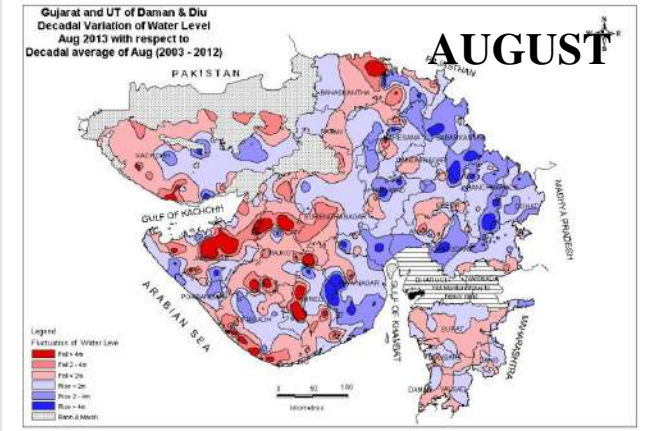
GUJARAT - OVERVIEW

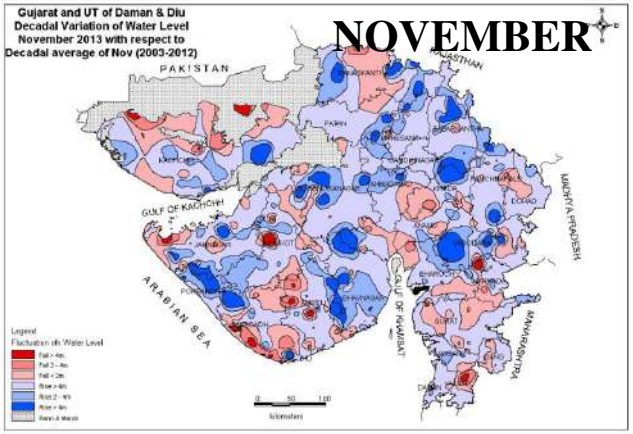


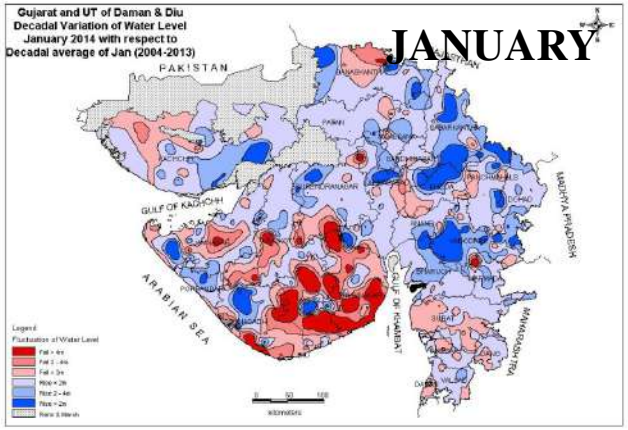


DRAUGHT TOLERANCE – DECADAL BASIS



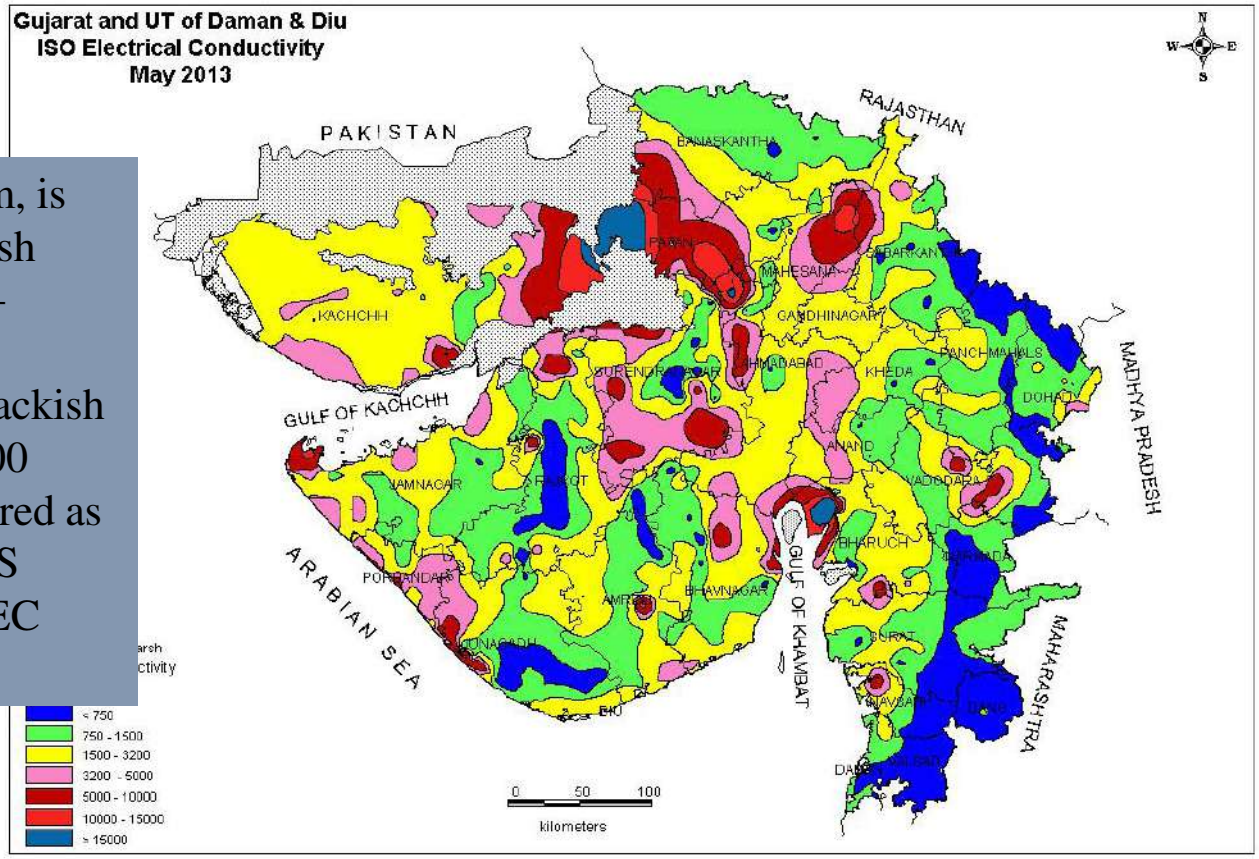






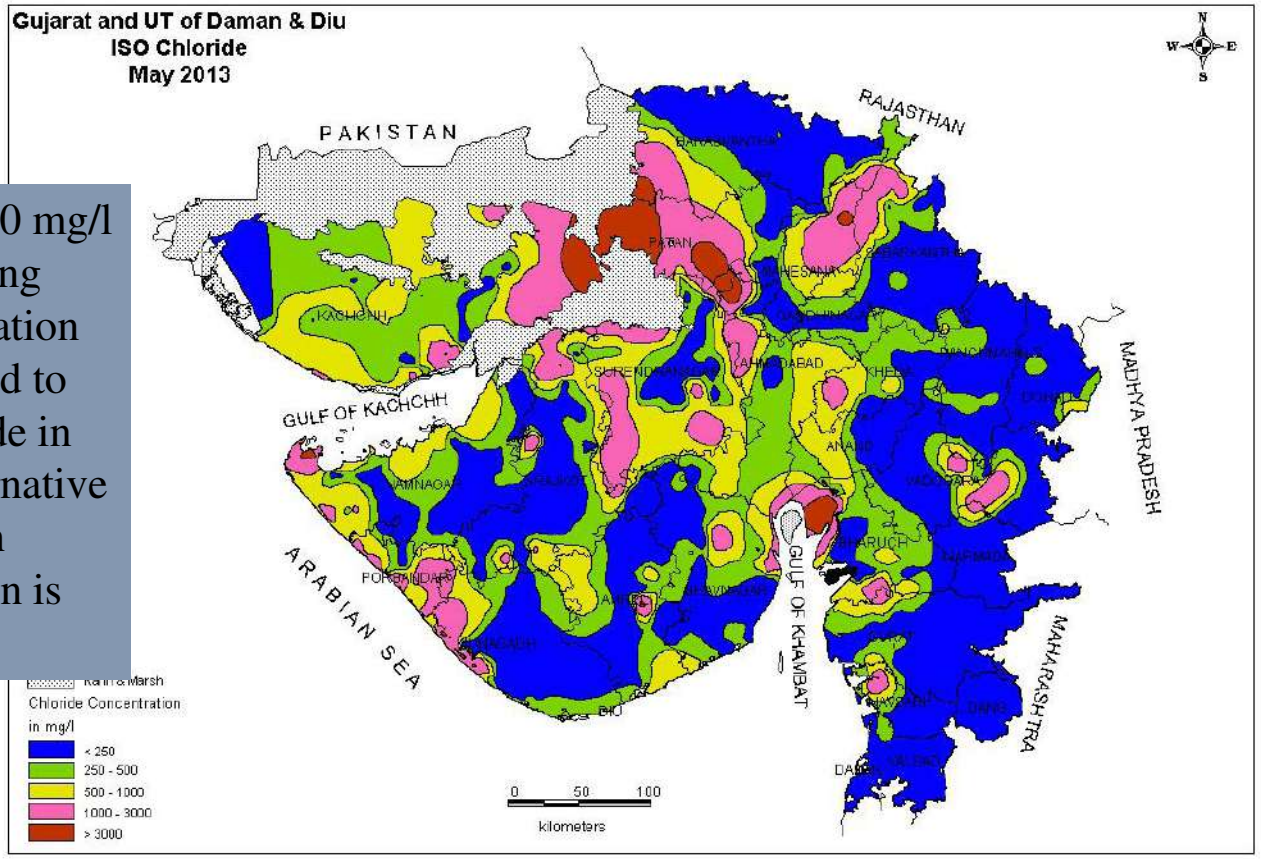
GROUND WATER QUALITY

EC < 1500 µS/cm, is considered as fresh water, EC 1500 – 15000 µS/cm, is considered as Brackish water and > 15000 µS/cm is considered as saline water (TDS (ppm) = 0.64 X EC (µS/cm))



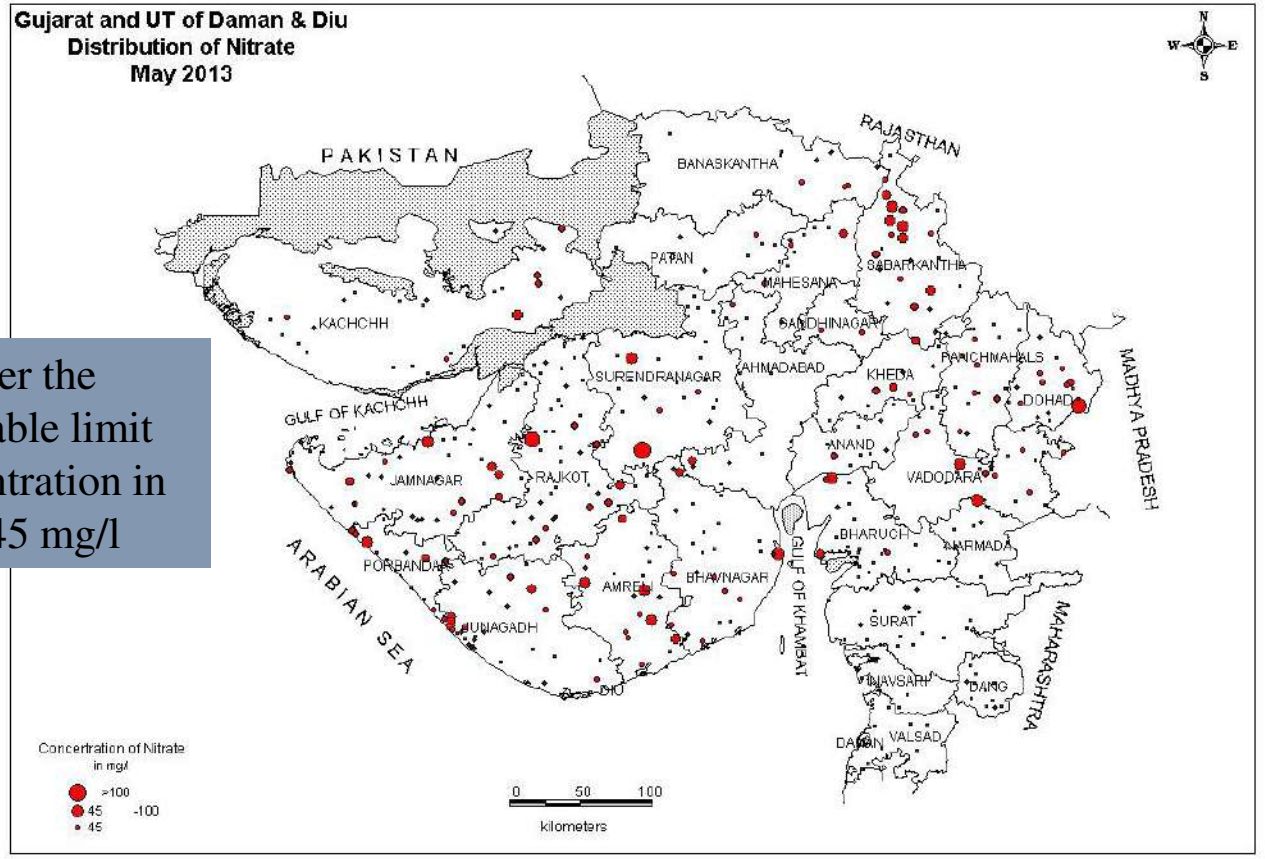
GROUND WATER QUALITY

desirable limit of 250 mg/l of chloride in drinking water; this concentration limit can be extended to 1000 mg/l of chloride in cases where no alternative source of water with desired concentration is available



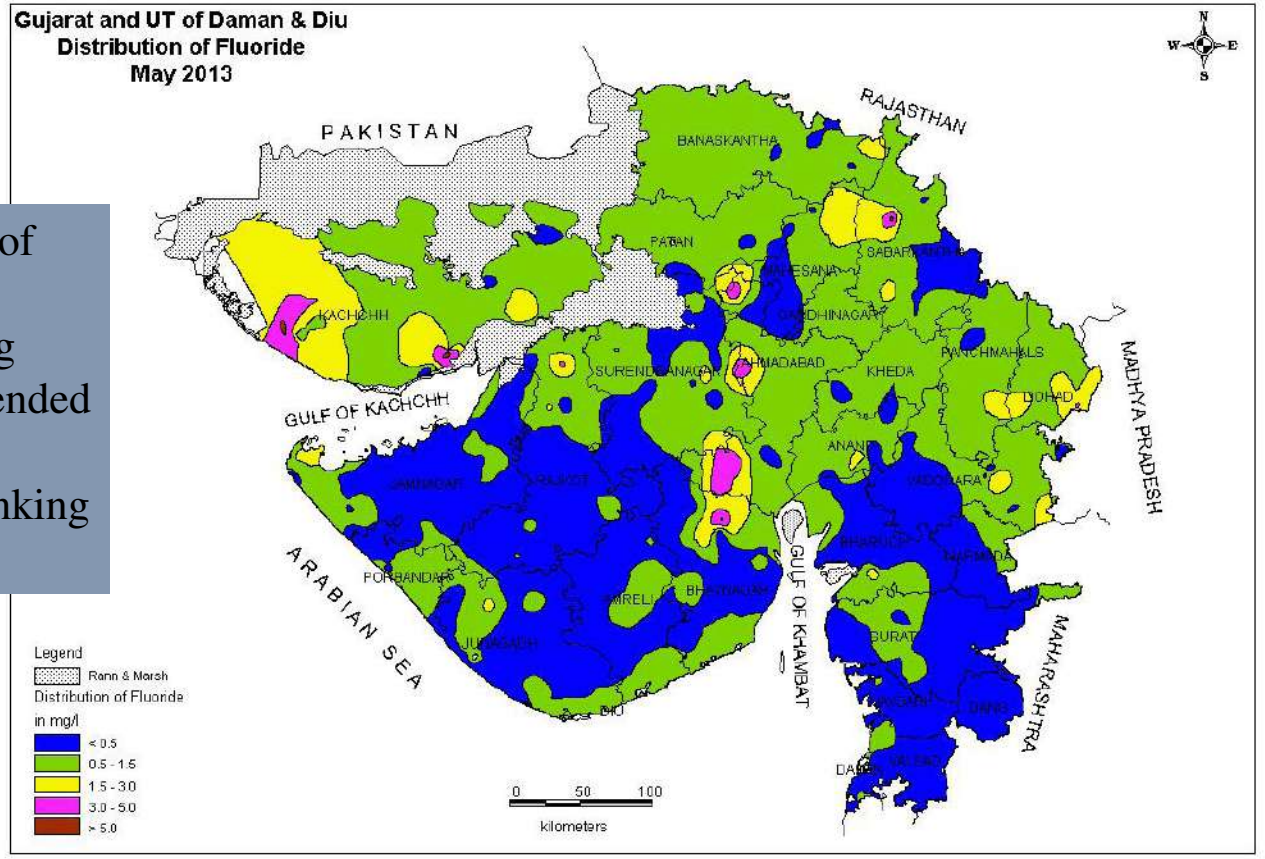
GROUND WATER QUALITY

for drinking water the maximum desirable limit of nitrate concentration in groundwater is 45 mg/l



GROUND WATER QUALITY

an upper desirable limit of 1.0 mg/l of fluoride concentration in drinking water, which can be extended to 1.5 mg/l in case no alternative source of drinking water is available



REGIONWISE WATER AVAILABILITY IN GUJARAT

REGION	AREA IN % OF GUJARAT	SURFACE WATER Mm^3	GROUND WATER Mm^3	TOTAL WATER Mm^3	PER CAPITA AVAILABILITY m^3 PER ANNUM
South and Central Gujarat	25	31750	3950	35700 (71 %)	1695 *(1880)
Saurashtra	33	3600	4300	7900 (16 %)	487 *(540)
North Gujarat	20	2100	3300	5400 (11 %)	309 *(343)
Kachchh	22	650	450	1100 (2 %)	658 *(730)
Total	**100**	**38100**	**12000**	**50100 (100 %)**	**893 *(990)**

*** Indicates figures based on 2001**

RECENT FLOOD


2017- 7-28 3:46:28PM


2017- 7-28 3:48:52PM


2017- 7-28 3:50:56PM

WHY DISASTERS DESTORY CANALS

- Flood
- Earthquake

Main causes of damage –

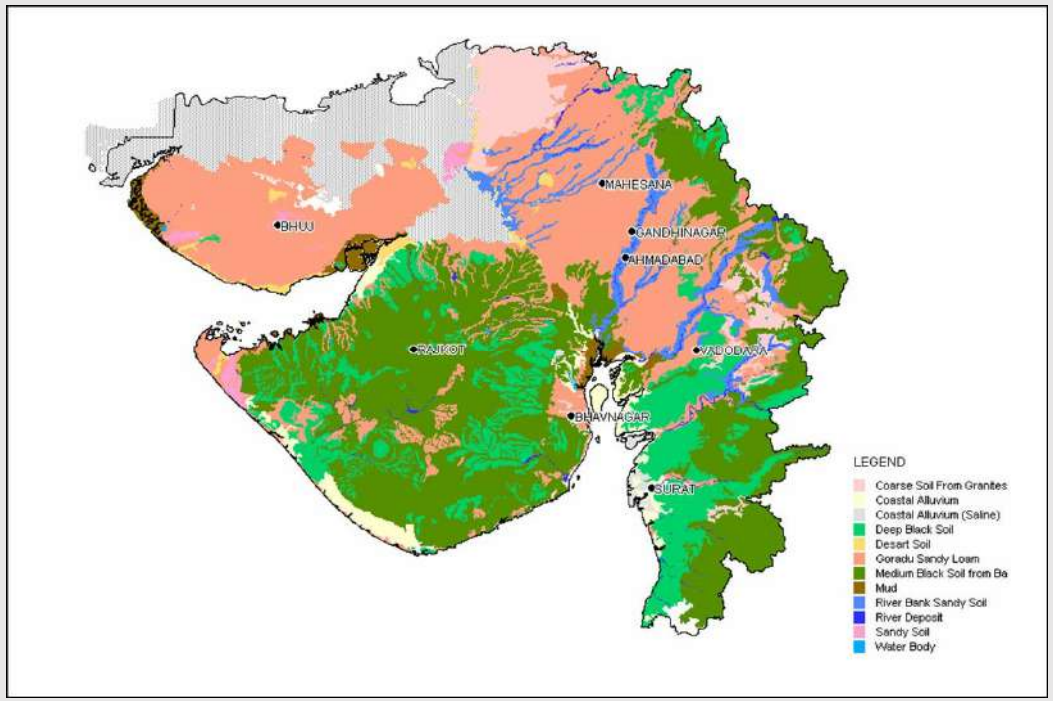
- Inundation
- Sheet flow
- Over capacity discharge
- Shaking
- Material
- Construction methodology

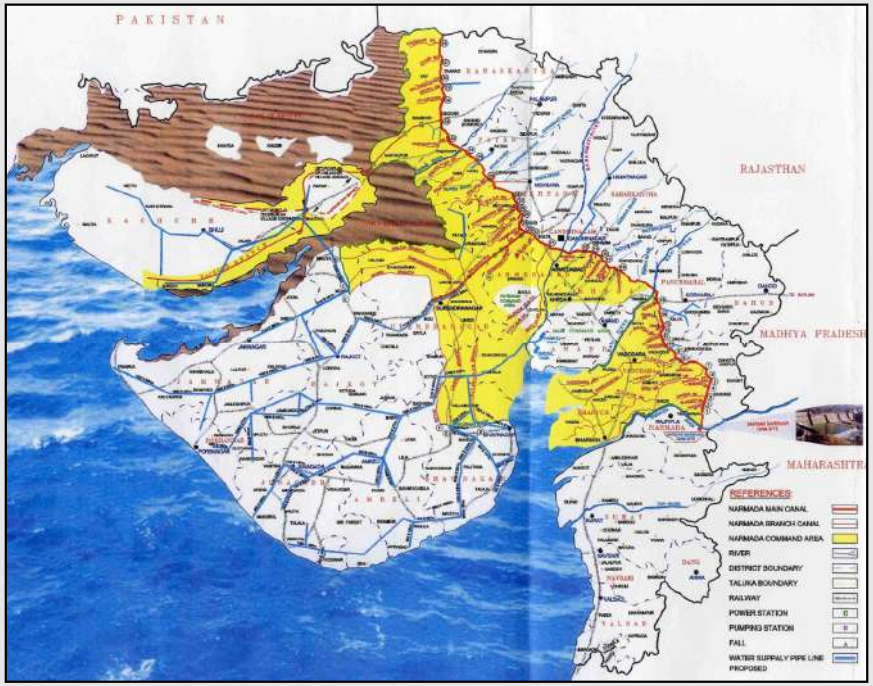
CASE STUDY – 1
ADDRESSING SEEPAGE AND STABILITY ISSUES IN CANALS WITH SANDY SOILS

OVERVIEW OF THE PROBLEM

- Tail Branch Canals of Sardar Sarovar Project passing through sandy soil and their command areas adjoining dessert
- Capacity about 15 cumec and length about 20 Kilometer
- All the canals have cutting, partial banking and banking – banking up to 3.5 meter
- SM soil with almost uniform particles and hence compaction the biggest problem

OVERVIEW OF THE PROBLEM





OVERVIEW OF THE PROBLEM

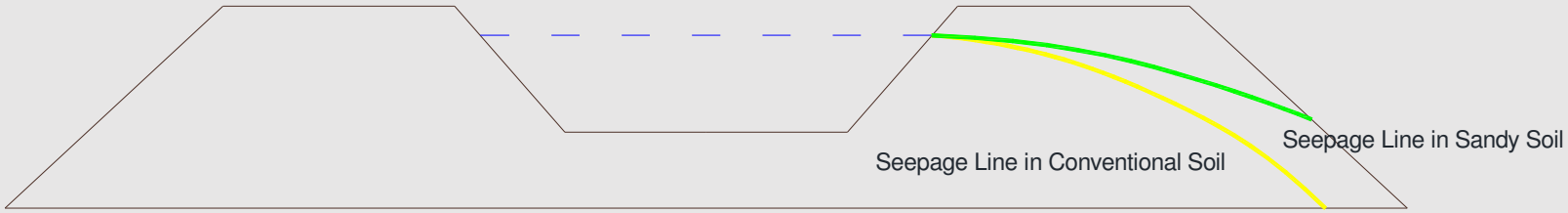
- Tail Branch Canals of Sardar Sarovar Project passing through sandy soil and their command areas adjoining dessert

- Capacity about 15 cumec and length 20 TO 28 Kilometer

- All the canals have cutting, partial banking and banking – banking up to 3.5 meter

- SM soil with almost uniform particles and hence compaction the biggest problem

OVERVIEW OF THE PROBLEM



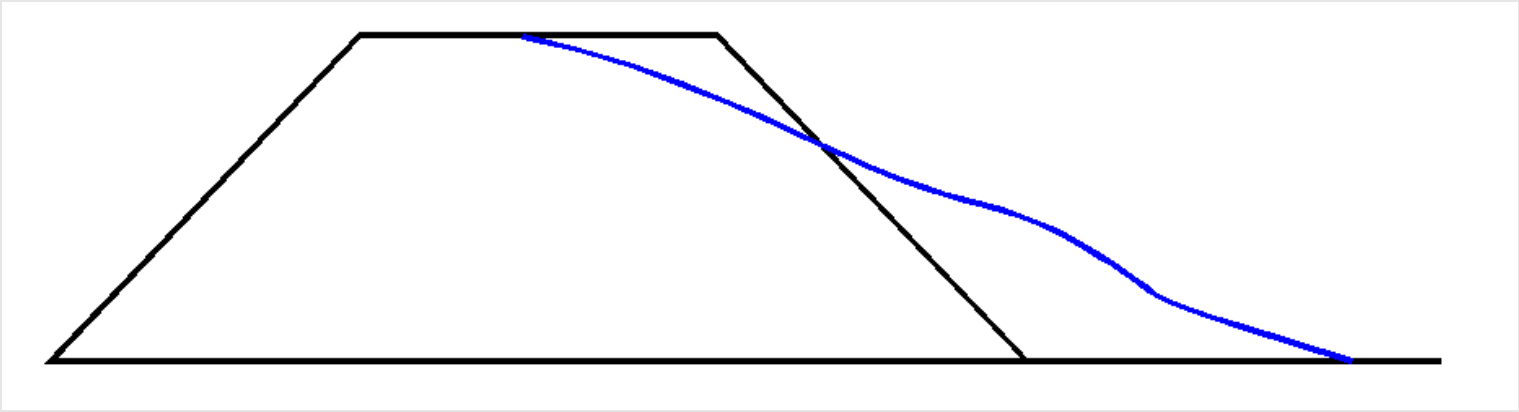
Difficulty in compaction and high permeability, both required to be addressed – larger section required

High permeability means flatter hydrostatic line requiring much larger width of embankment - economic viability adversely affected

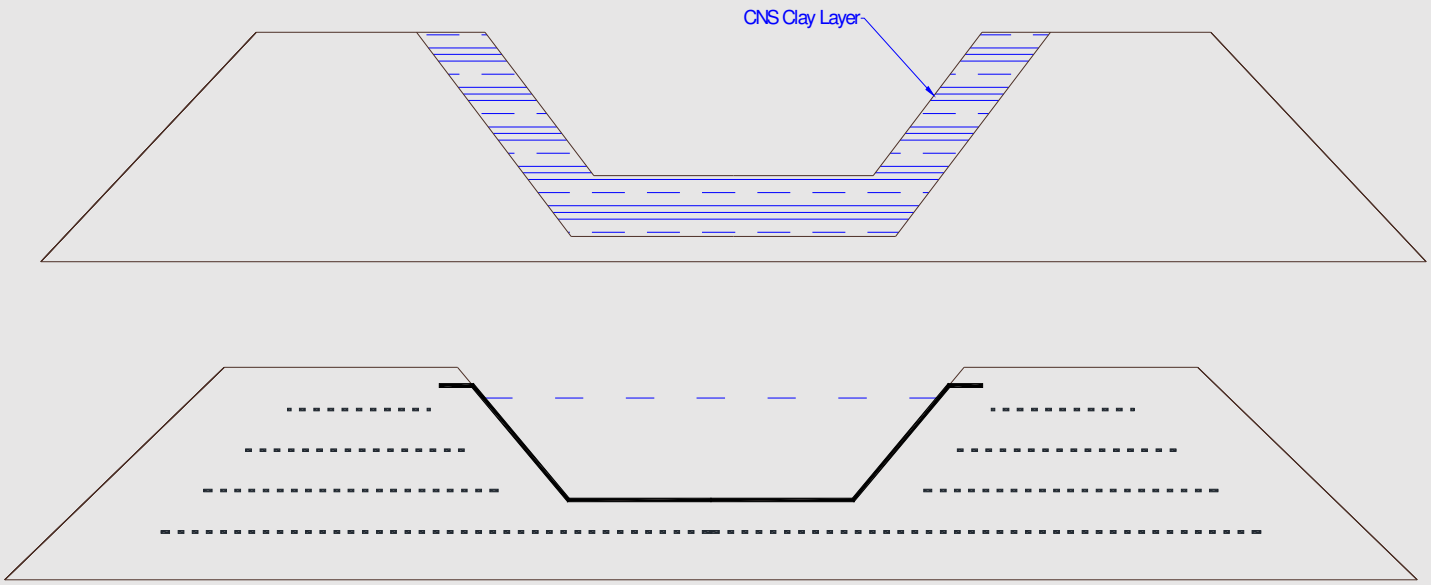
Lower compaction results in susceptibility to disintegration i.e. stability failure

OVERVIEW OF THE PROBLEM

- Fluctuations in water levels – variations in pore pressure
- Sudden variations in pore pressure may cause spreading or dispersion failure of the embankment



OVERVIEW OF THE PROBLEM



GCL checks the seepage path

Geogrid checks the disintegration of sand particles

GEOSYNTHETIC CLAY LINER

- Geosynthetic clay liners (GCLs) include a thin layer of finely-ground bentonite clay. When wetted, the clay swells and becomes a very effective hydraulic barrier.

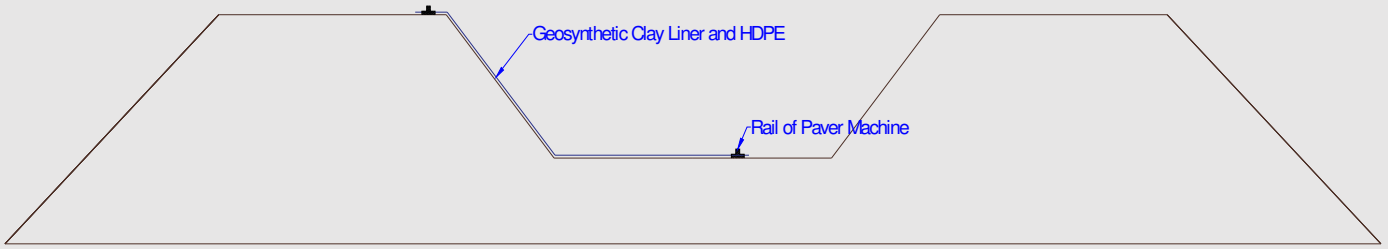
- GCLs are manufactured by sandwiching the bentonite within or layering it on geotextiles and/or geomembranes, bonding the layers with needling, stitching and/or chemical adhesives.

GEOGRID FOR REINFORCED EMBANKMENT

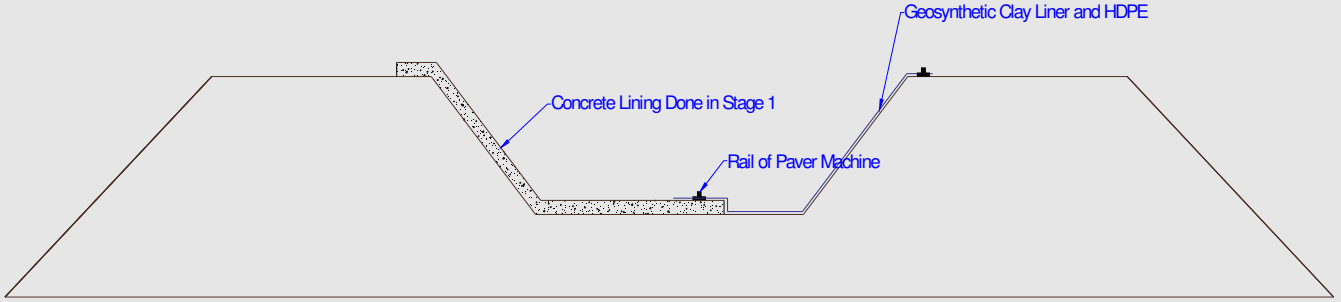
Three levels of Geogrid
1st Layer at [CBL – 0.30] m level
2nd Layer at [CBL + 0.40] m level
3rd Layer at [FSL - 0.40] m level

Property		Test Method	Unit	TG U-60
Ultimate Tensile Strength	MD CD	ASTM D-6637	kN/m	60 20
Reduction Factor (RF) and Machine Direction Long Term Design Strength (LTDS)				
Creep				1.55
Installation Damage	Sand/ Silt/ Clay			1.05
	<7.5 mm Gravel			1.15
Durability	pH – 4 to 9			1.15
LTDS – 120 Years, 40° C : Sand/ Silt/ Clay ; pH – 4 to 9			kN/m	32
LTDS – 120 Years, 40° C : Gravel < 7.5 mm ; pH – 4 to 9			kN/m	29.3
Aperture (± 2 mm)			mm	30 X 25

SOLUTION USING GEOGRID AND GEOMEMBRANE



First Stage of Concrete Lining With Paver Machine



Second Stage of Lining With Paver Machine

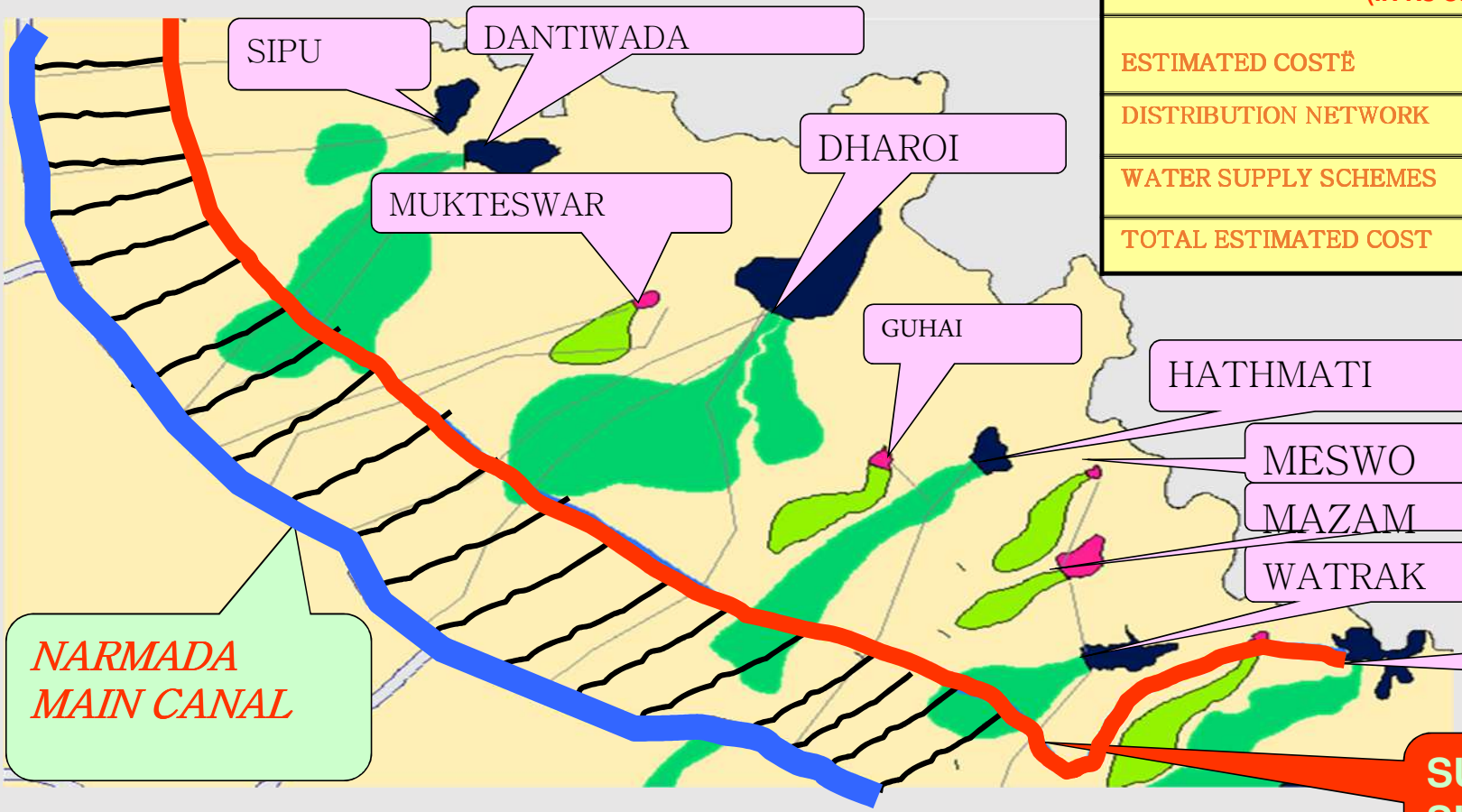
SOLUTION USING GEOGRID AND GEOMEMBRANE

SOLUTION USING GEOGRID AND GCL

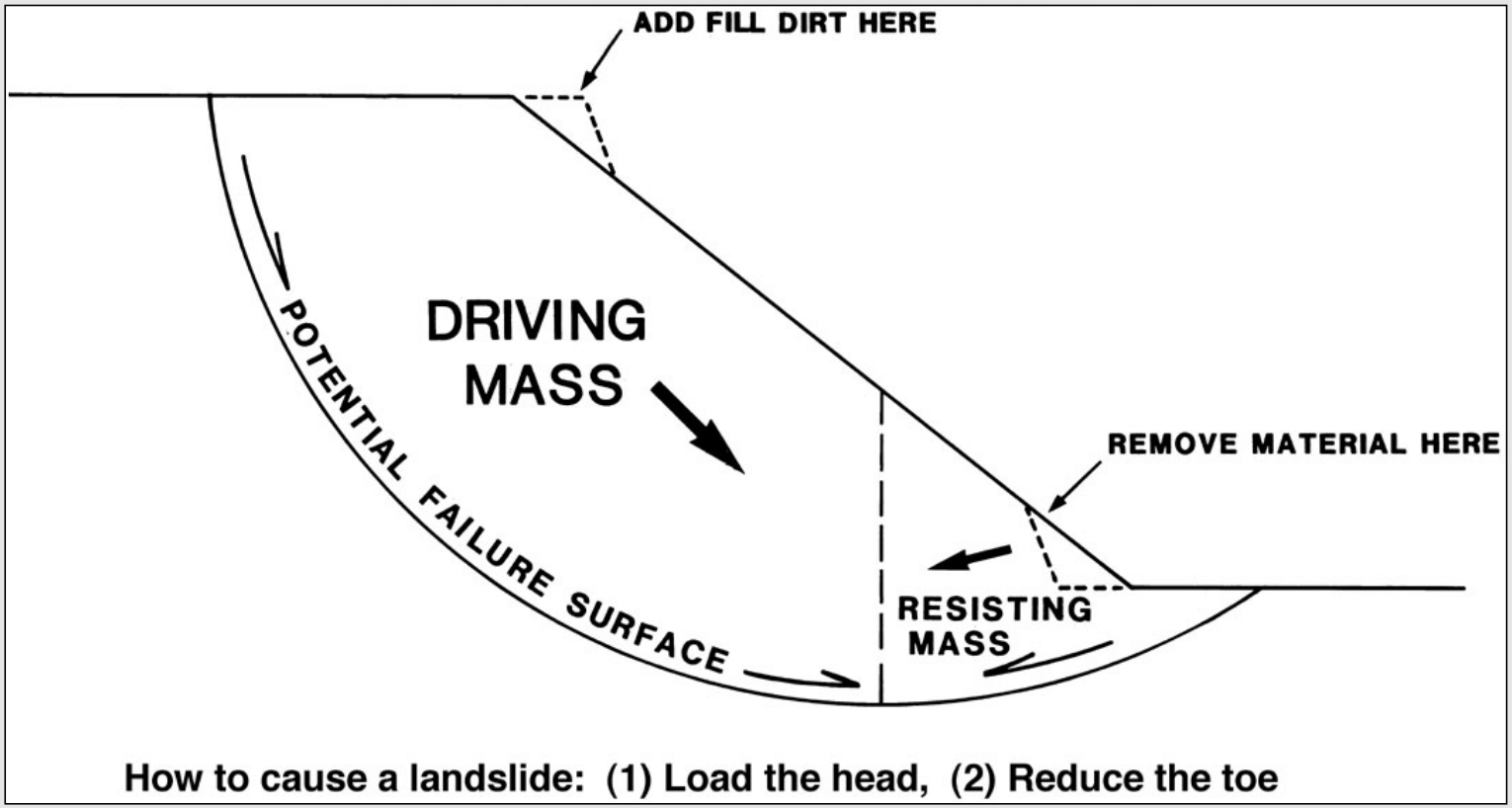
CASE STUDY – 2
ADDRESSING SLOPE FAILURE OF CANAL IN SANDY SOILS

SUJALAM SUPHALAM CANAL

PLANNING TO LIFT 1 MAFT NARMADA FLOOD WATER TO FILL RESERVOIRS OF NORTH GUJARAT REGION (IN Rs CRORES)	
ESTIMATED COSTË	2969 .00
DISTRIBUTION NETWORK	73.00
WATER SUPPLY SCHEMES	923.00
TOTAL ESTIMATED COST	4425.00

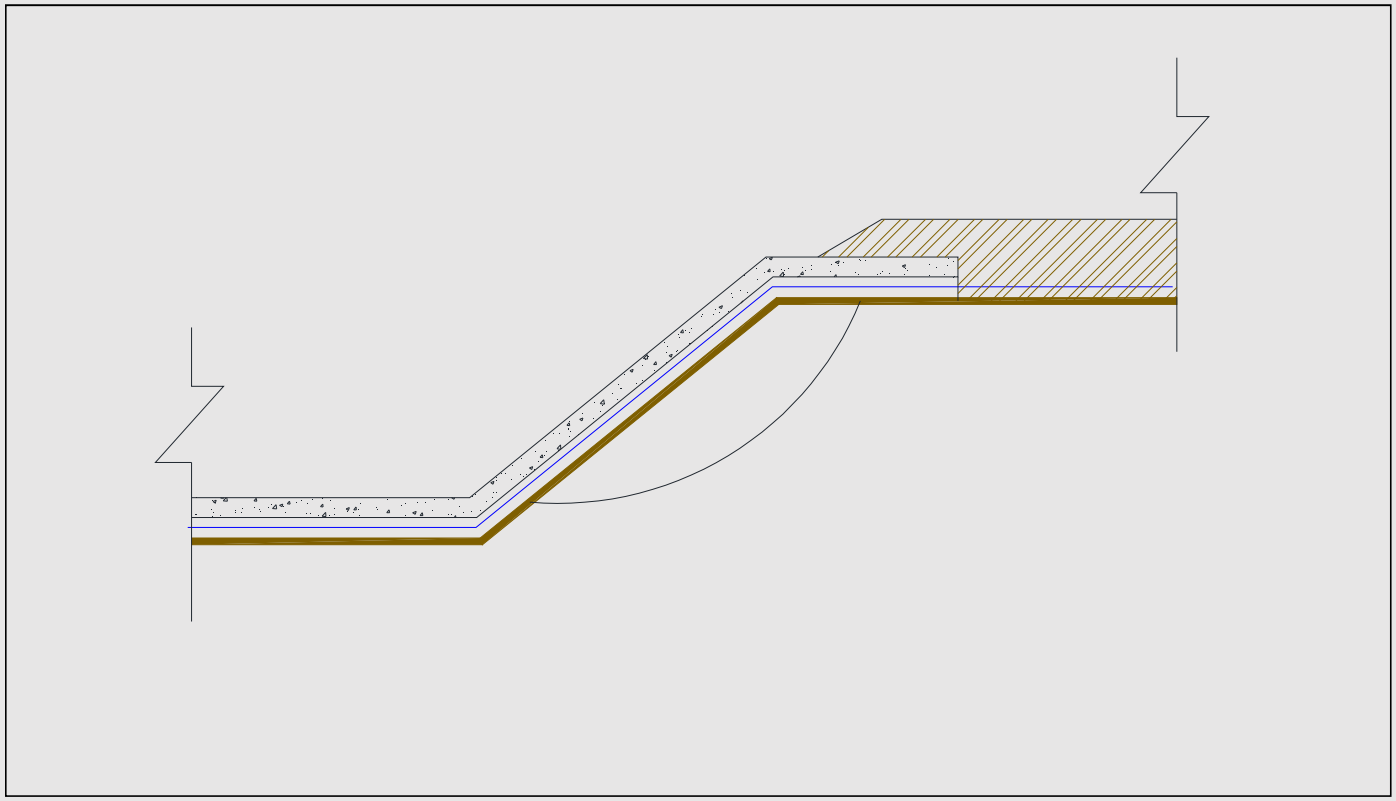


CANAL SLOPE FAILURE



Slip Circle Failure

SOLUTION



Tensile Strength of Geomembrane and Shear Strength of Concrete Lining to be added to Shear Strength of Soil


THANKS TO ALL