

Non Network Sanitation

UTTARAKHAND

- Context & Priorities

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Uttarakhand State was formed on 9th November 2000 as 27th state of India. It is located in the foot hills of the Himalayan Mountain Ranges.



53,483 km²
Area



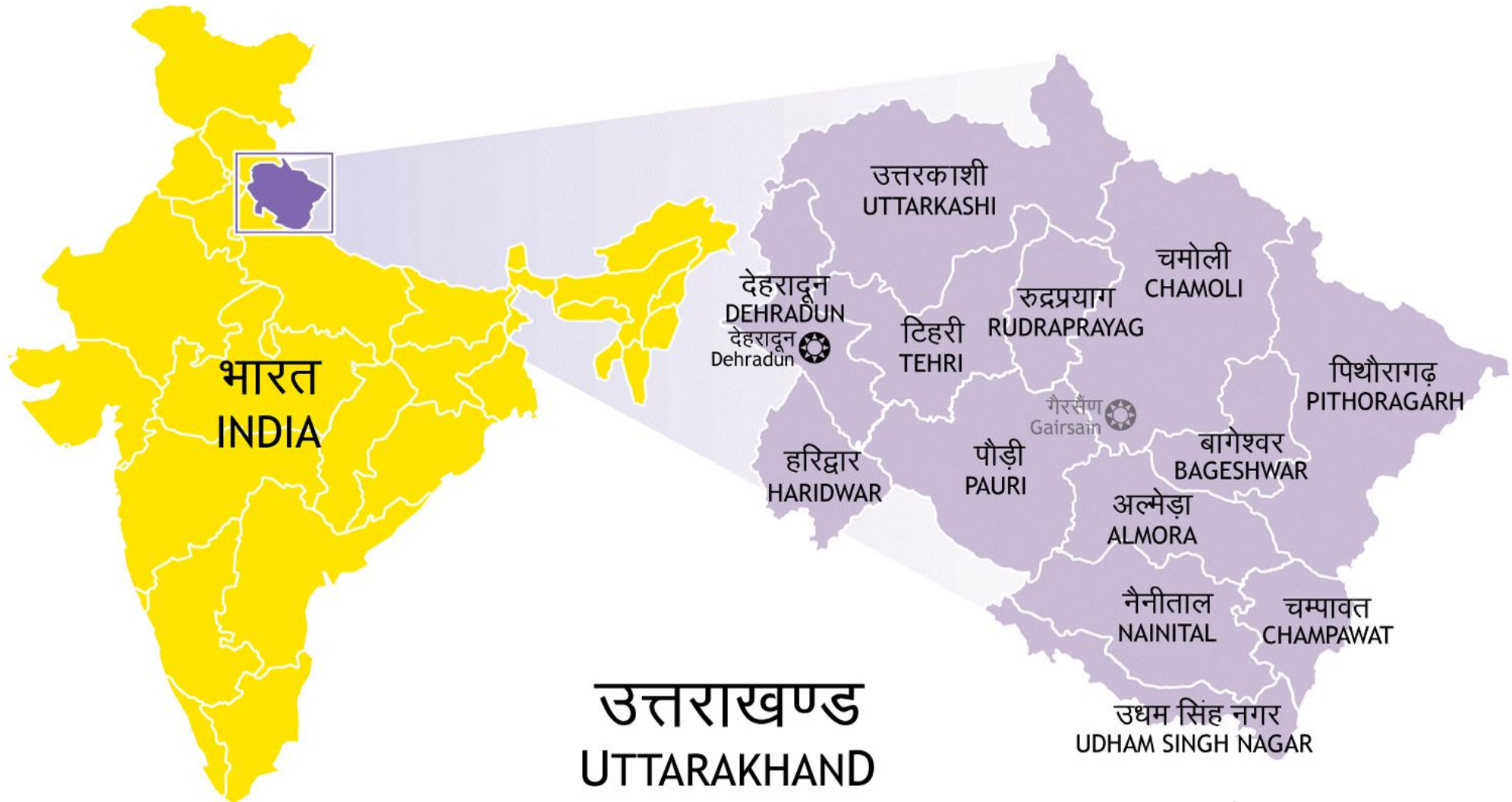
Temperate
Climate



Sub zero to 43^oc
Temperature



1,550 mm
Rainfall



The state has **13** districts, out of which nine are located in the hilly region and four are in the plain region

ADMINISTRATION AND GEOGRAPHY



The state of Uttarakhand is divided into two administrative divisions, called Garhwal Division and Kumaon Division

Garhwal Division

Lying in the Himalayas, it is bounded in the north by Tibet, on the east by Kumaon region, on the south by Uttar Pradesh state, and on the northwest by Himachal Pradesh state

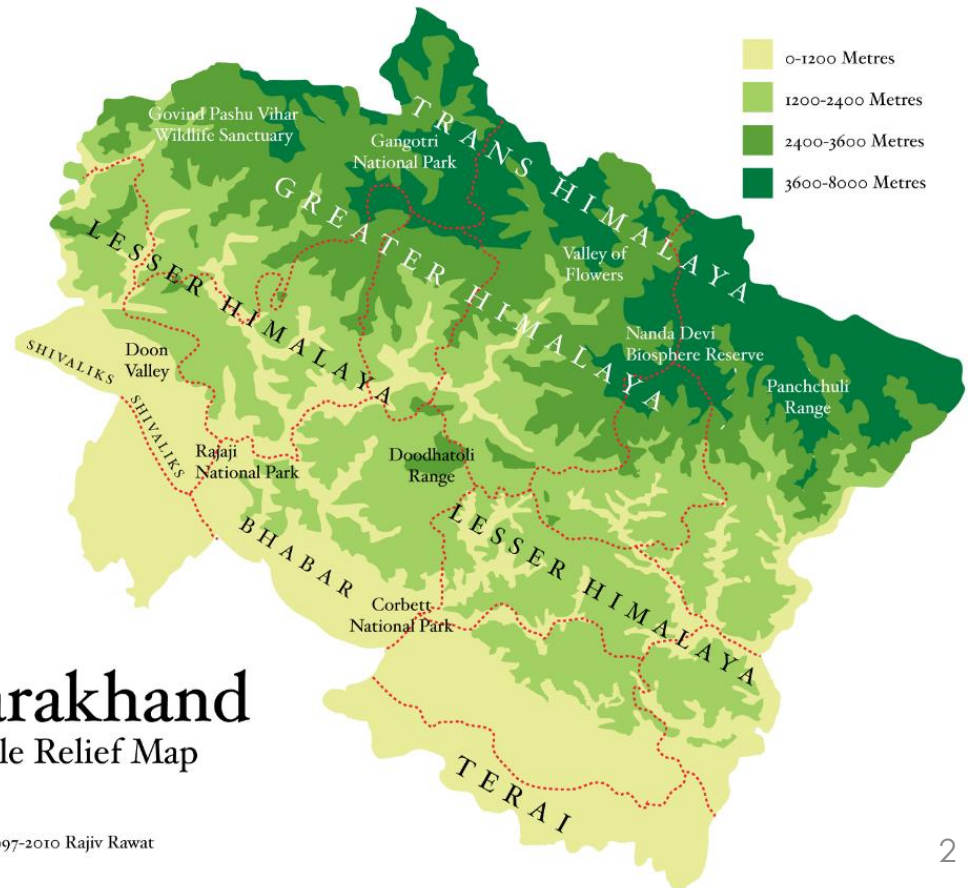
Kumaon Division

It is bounded in the north by Tibet, on the east by Nepal, on the south by Uttar Pradesh state, and on the west by Garhwal region. It is home to famous Indian Army regiment, the Kumaon Regiment

Geographically the state is divided into 5 zones; the Terai, the Doons, the Lesser Himalayas, the Greater Himalaya and the Trans Himalaya

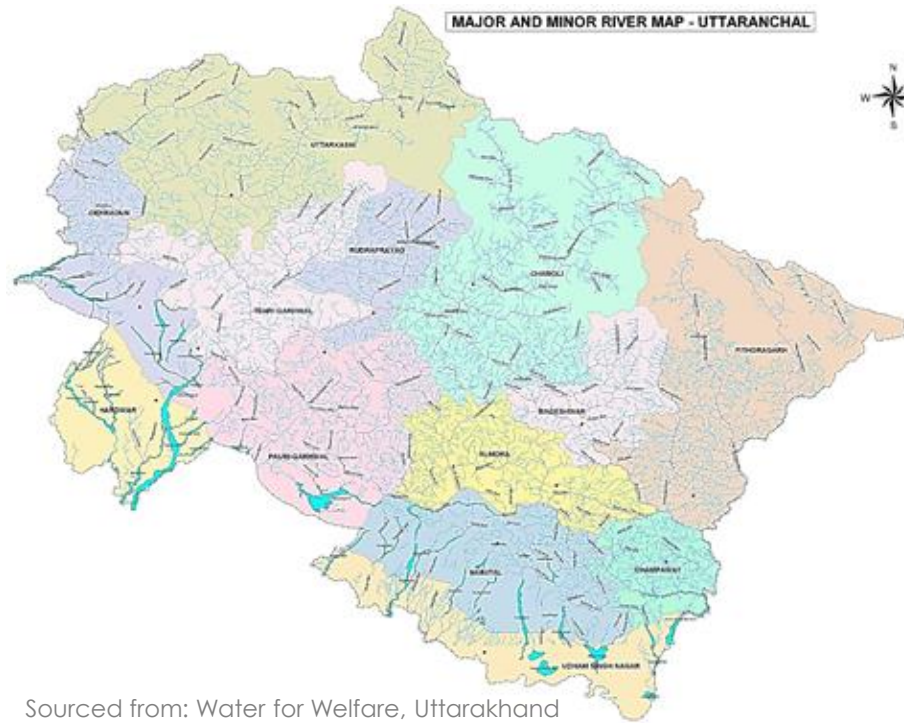
86% of the state is mountainous.

The climate, soil texture, groundwater and other features vegetation and biodiversity vary significantly from south to north of the state.



Uttarakhand
Simple Relief Map

NATURAL RESOURCES



Hydrography of Uttarakhand

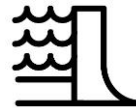
Uttarakhand State is a water rich state with several hydrological features. Due to the undulating topography, the state has several rivers and lakes.



23
Major Rivers



12
Major Lakes



11
Major Dams

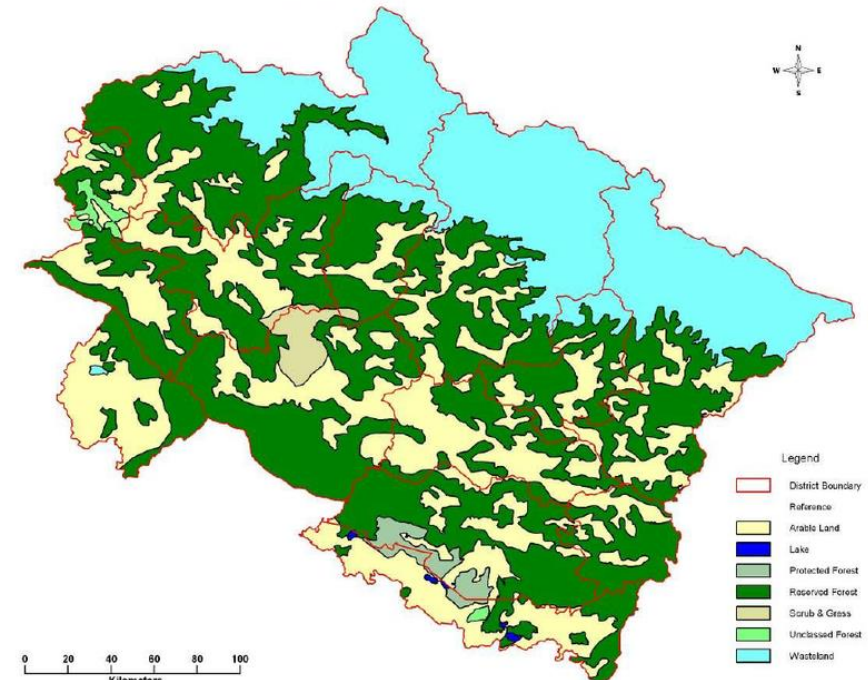


11
Major Glaciers

Sourced from: Water for Welfare, Uttarakhand

Land use types	Area (in '000 ha)	Percentage
Total geographic area	5,348	
Forests	3,800	63.42
Not available for land cultivation	450	7.51
Permanent pastures and other grazing lands	192	3.20
Land under misc. tree crops and groves	389	6.49
Culturable wasteland	317	5.29
Fallow land	143	2.39
Net area sown	701	11.70

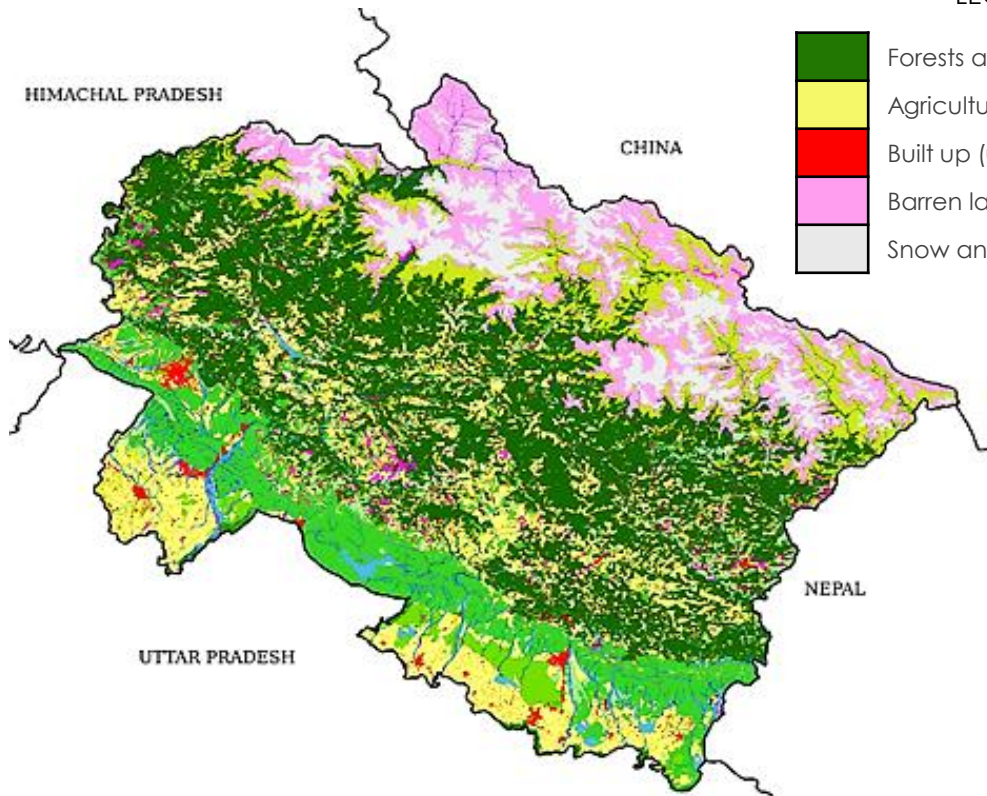
Forest Map, Uttarakhand



Prepared by: Malavika Chauhan

FACTORS INFLUENCING SANITATION SYSTEMS

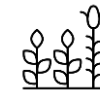
Land Use Map



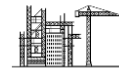
LEGEND



60-70%
Forest



20-30%
Agriculture



< 1%
Built Up



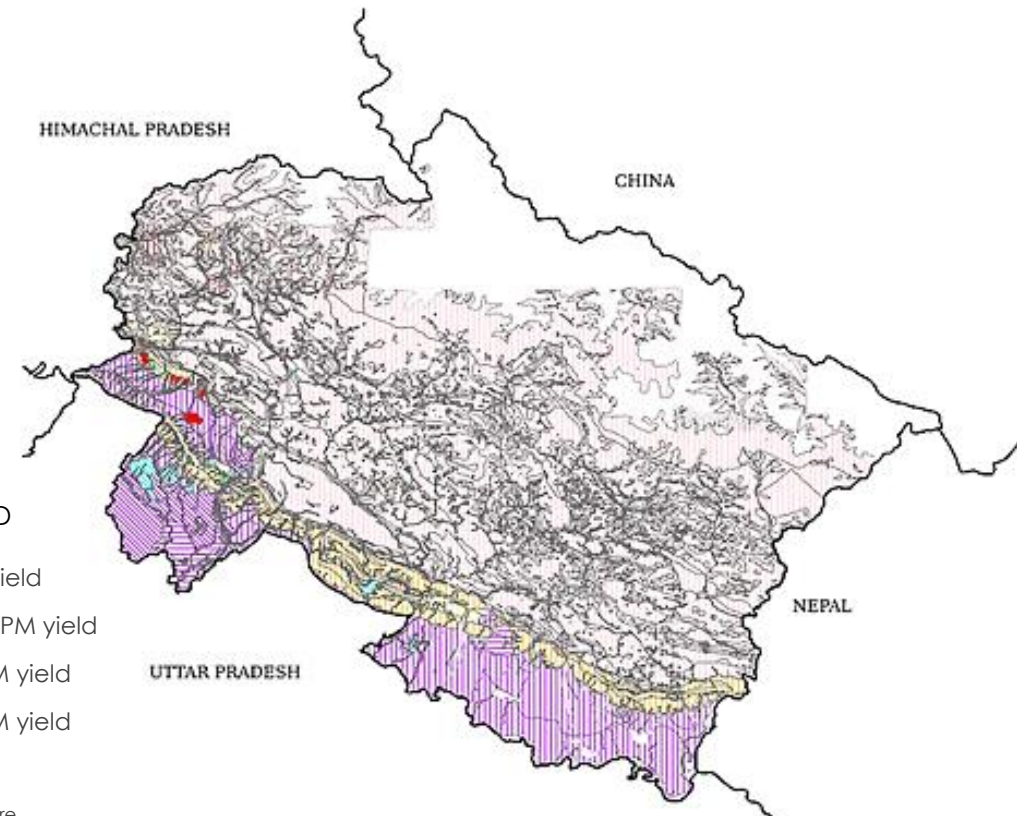
4-8%
Barren



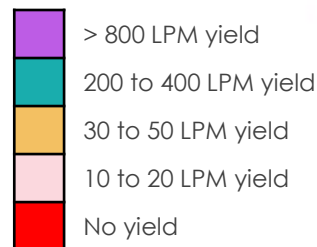
4-8%
Snow

The ground water table is very high in the Terai and the Doon region of the Uttarakhand State. The ground water table falls down as one goes from the Lesser Himalayas to Greater Himalayas.

Due to availability of fresh water, the water borne sanitation system is prominent in the state. Although it seems that centralised sewerage systems are favourable, the presence of high water table create complexities for implementation of such infrastructure projects.



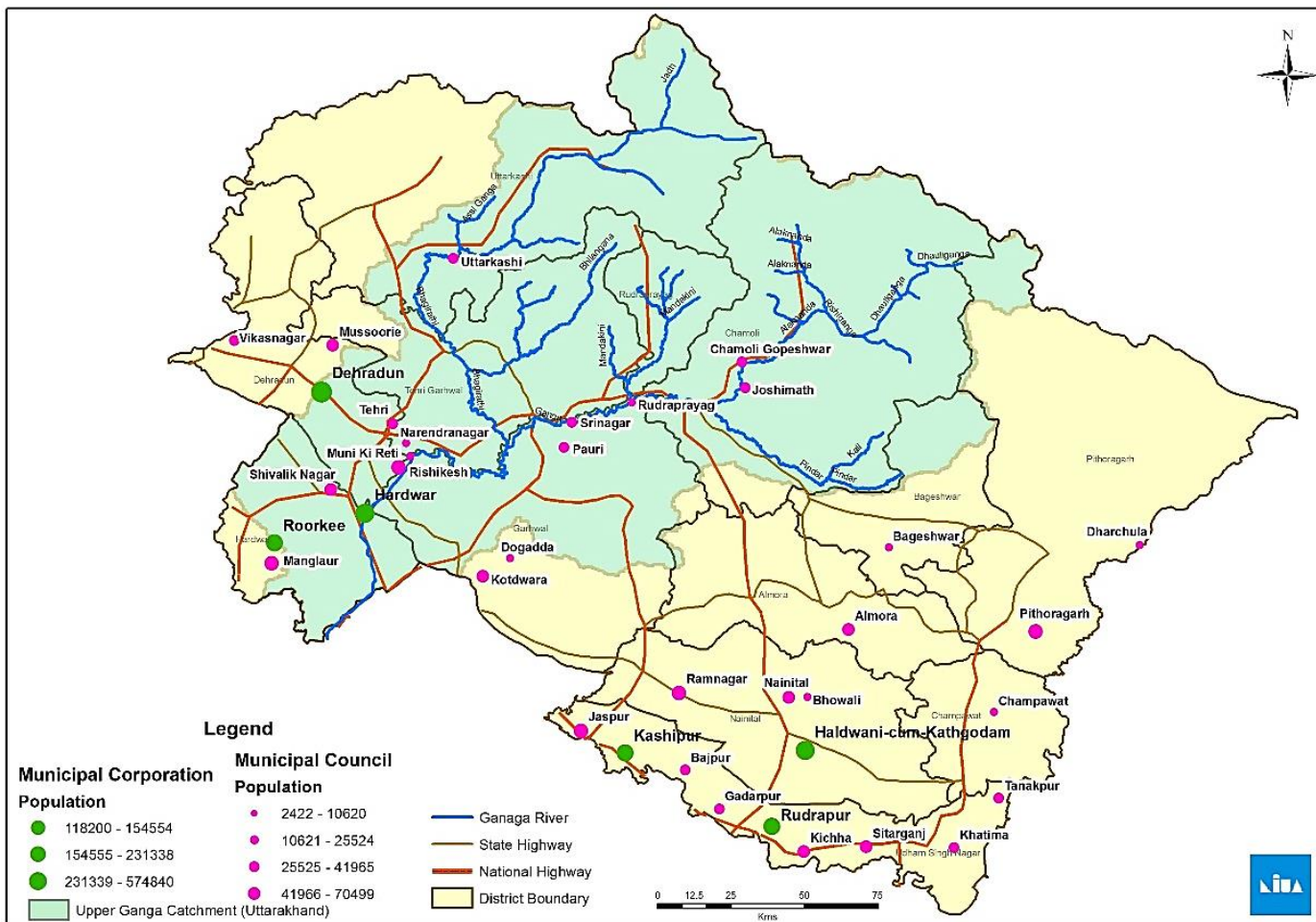
LEGEND



Note: All the yields are measured for 30 to 80 m deep well

Ground Water Table Map





Urban Local Bodies

6 Nagar Nigam

Population 1 – 5 lakh
Mostly off site sanitation system consisting of sewer and STPs

31 Nagar Palika Parishad

Population < 50,000
Mostly onsite sanitation system consisting of septic tanks

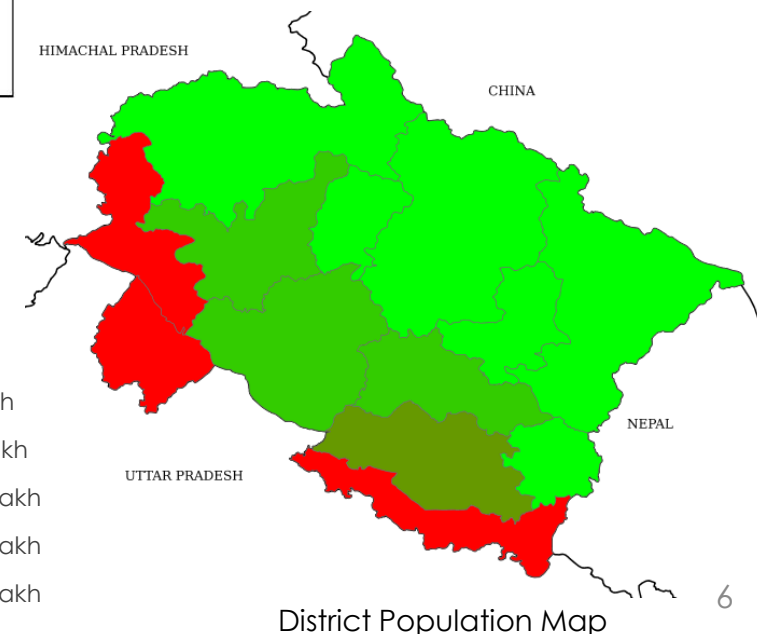
41 Nagar Palika Panchayat

Population < 15,000
Mostly onsite sanitation system consisting of septic tanks

The 6 Nagar Nigams are included in the AMRUT scheme. The city of Haridwar is also one of the city focused under Namami Gange scheme.

The district of Udham Singh Ngar, Haridwar and Dehradun are situated in the plain region and have good access to fresh water resources, hence the population is concentrated in the Terai and Doon region of Uttarakhand.

The population density of the districts in the state of Uttarakhand varies from 40 persons per km² to 850 persons per km².



SEWERED SANITATION SYSTEMS

FACTS AND OBSERVATIONS



User Interface

- Almost 100 % coverage through IHHT, CT
- Flush toilet
- Domestic wastewater
- 20% HHs cannot be connected to sewerage

- Due to availability of water, flush toilets are prevalent,
- 100% utilization of sewerage network is not achieved in any city,
- Approximately 20% of the households in most of the cities cannot be connected to sewerage due to site constraints.



Conveyance

- Sewer clogging
- Challenges during laying of sewers
- Sewer length: 826 km
- Sewer connections: 65322
- O&M Expense: INR 1 lakh per km or INR 1200 per connection

- Silt carried by storm water clogs the sewers,
- In Terai region, the presence of high water table makes laying of gravity sewers and its operation difficult,
- In Lower Himalayan region, the requirement of drop manholes is high. This increases the cost of the laying sewers.



Treatment

- **Pey Jal Nigam**
- No. of STPs: 28
- Capacity: 225 MLD
- Utilised: 103 MLD
- **Jal Sansthan**
- No. of STPs: 10
- Capacity: 95 MLD

- Many STPs are under execution. Those which are built are yet to be commissioned,
- Due to inadequate utilization of sewerage network, the STPs are underutilized,
- Underutilizing the STP capacity, increases unit cost of treatment of wastewater.



Reuse/Disposal

- Disposal in surface water

- Reuse of the treated wastewater is not practiced due to easy availability of fresh water,
- The disposal of the wastewater is mostly done in the surface water bodies such as rivers.

NON-SEWERED SANITATION SYSTEMS

FACTS AND OBSERVATIONS



User Interface

- Almost 100 % coverage through IHHT, CT
- Flush toilet
- Blackwater goes to septic tank
- Grey water disposed separately

- Due to availability of water, flush toilets are prevalent,
- Blackwater consisting excreta, urine, anal cleansing and flush water enters the septic tank,
- Grey water from the kitchen and bath is disposed separately into the drains.



Containment

- Mandatory to have septic tank
- Baffled tanks but not as per prescribed by CPHEEO manual
- Land constraints
- Unlined bottom

- If sewerage network connection is not possible, households need to have a septic tank,
- Standard designs are not followed for constructing of septic tank,
- Sloppy terrain puts land constraints during construction of septic tanks.



Conveyance

- ULBs do not have vacuum trucks
- No presence of private operators
- No demand for emptying of septic tank
- Manually emptied into ditches

- Most of the ULBs are not equipped to provide desludging services,
- Private operators are not present because of meager profit margins,
- Manual emptying of septic tank is prevalent in cities located in mountainous region.



Treatment

- Co treatment is practiced in Dehradun
- Illegally dumped in water bodies or land
- Rudrapur to have first SeTP!

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- Private operators are not present because of meager profit margins,
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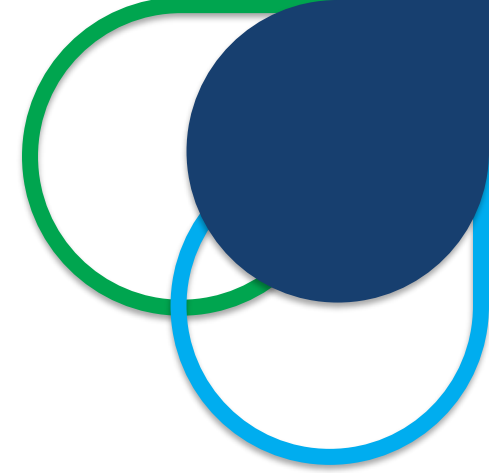


Reuse/Disposal

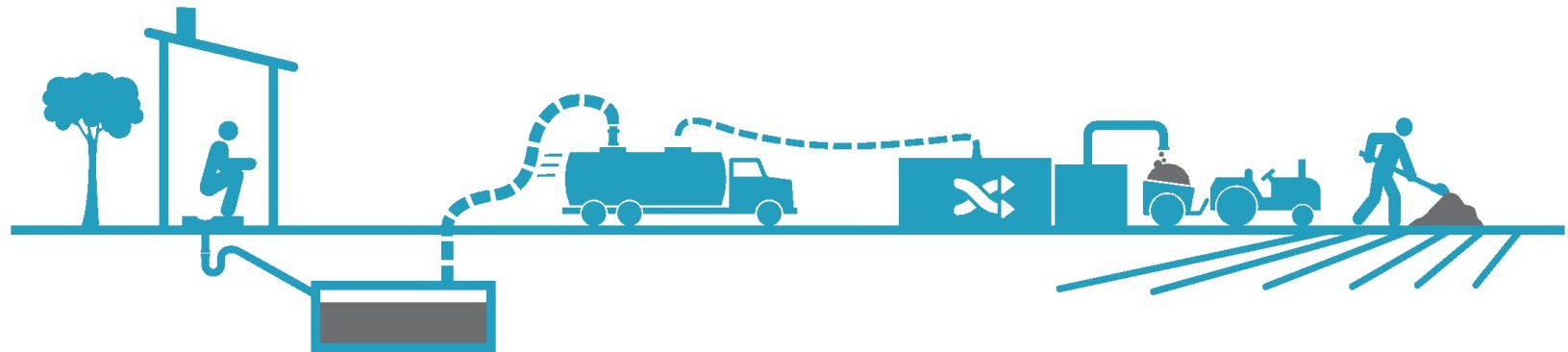
- Co treatment is practiced
- Illegally dumped in water bodies or land
- Rudrapur to have first SeTP!

- Co treatment is practiced in STP in Dehradun,
- In most of the ULBs the septage is disposed illegally on land or surface water body,
- A SeTP is planned in Rudrapur of capacity of 125 KLD.

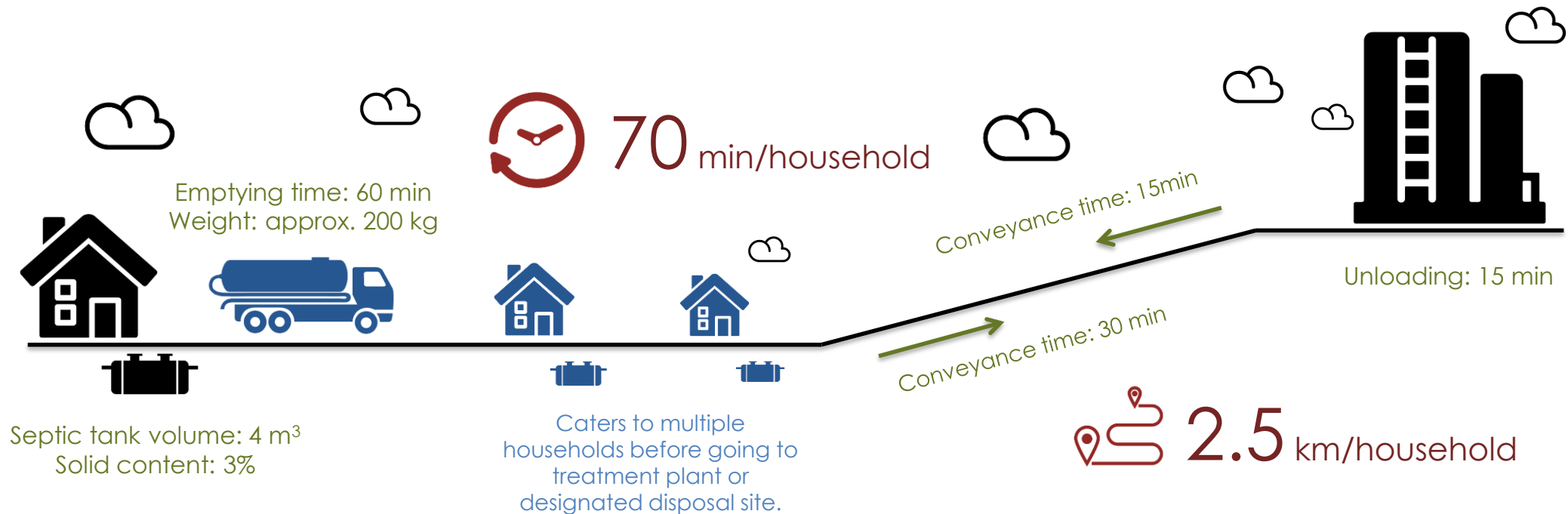




Septage Management Options for UTTARAKHAND



DEWATERING TRUCKS / MOBILE TREATMENT TRUCKS



Background of Emptying and Conveyance

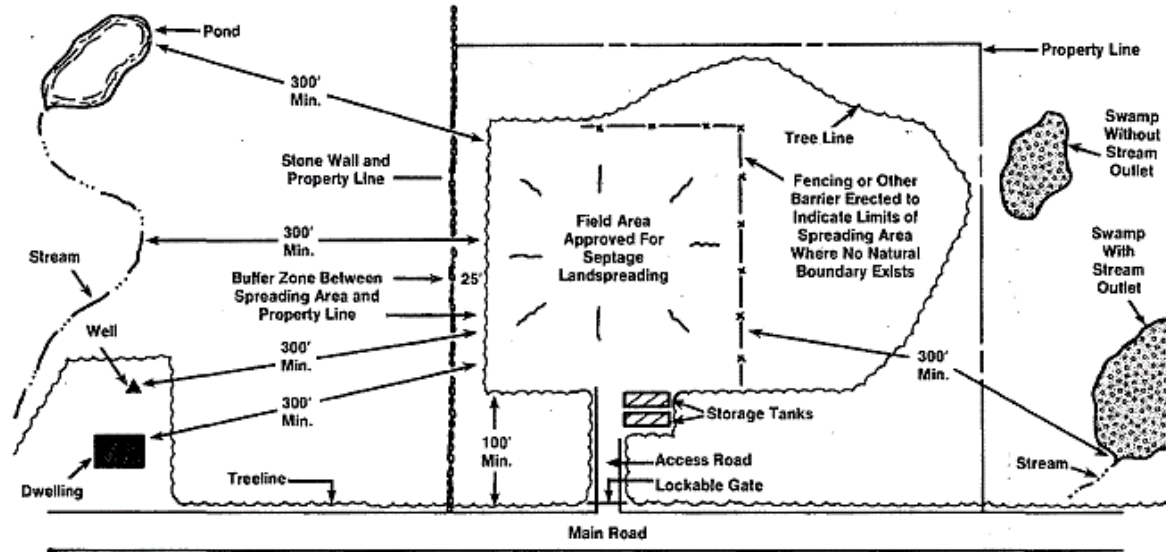
- The vacuum truck empties the septage from septic tank which contains less than 5% solids. These solids are easily separable and contribute to the TSS, BOD and COD,
- The constituent of interest in septage are solids,
- Water is heavy to transport and occupy most of the space in the vacuum truck,
- The completely filled trucks are difficult to navigate and drive up the hill.

Dewatering Trucks / Mobile Treatment Trucks

- Dewatering trucks provide primary treatment to septage i.e. it employs process of solid liquid separation and dewatering,
- The dewatered sludge is stored in the tank and conveyed to the designated disposal site,
- Process of removal of solids from septage results in significant decreases of the TSS, BOD and COD in the liquid component and hence it can be returned back to the septic tank,
- The Mobile Treatment Trucks also provides treatment of the liquid component to achieve treated water disposal norms.

SCIENTIFIC LAND APPLICATION OF SEPTAGE

- Guidelines for safe, scientific land application of septage are required
- Identification & delineation of site for safe land application needs to be done



US EPA Manual on Septage Treatment and Disposal

- Stringent monitoring of the site as well the process needs to be done to avoid hazard to the environment
- Safe land application can be done as shown below

Typical Septage Application Site

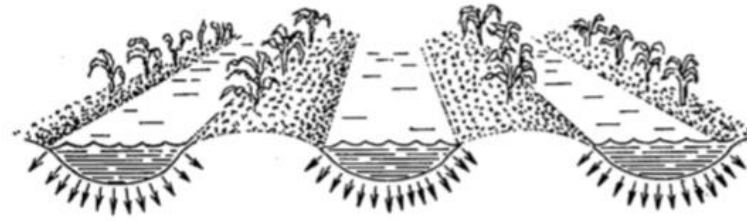
R. Maguire, Virginia Tech



Subsurface Incorporation

Special equipment is required for incorporation of septage in the top layer of the soil.

Scientific land application of septage can be performed on the wasteland, fallow land and unused pasture and grazing land. This will improve the soil quality over a period of time.



Ridge and Furrow Irrigation

Although special equipment is not required, manpower will be required for creating furrows. The septage is applied under gravity.



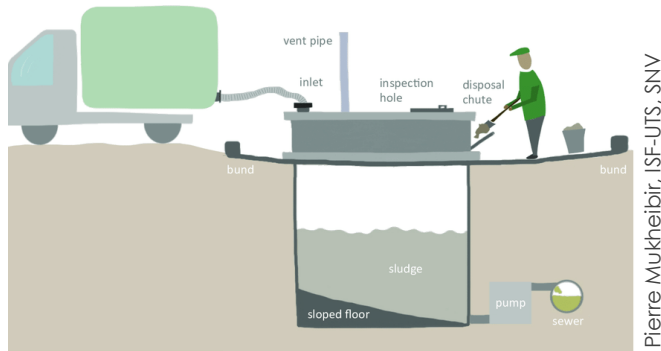
Deep Row Entrenchment

Special equipment will be required for excavating deep trench. The septage undergoes solid – liquid separation over a period of time.

OWSSB, Odisha Government

CO TREATMENT OF SEPTAGE AT STP

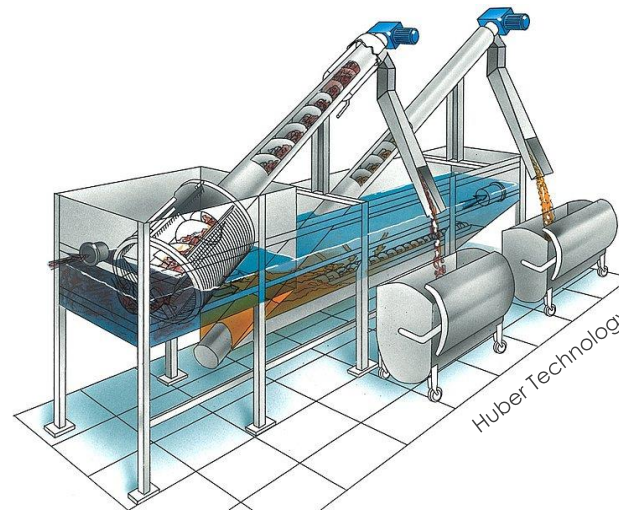
Although septage is much more concentrated, co treatment with sewage is possible at STP. It is safe to co treat, if pre treated septage is dosed properly to the incoming sewage.



Pierre Mukheibir, ISF-UTS, SNV

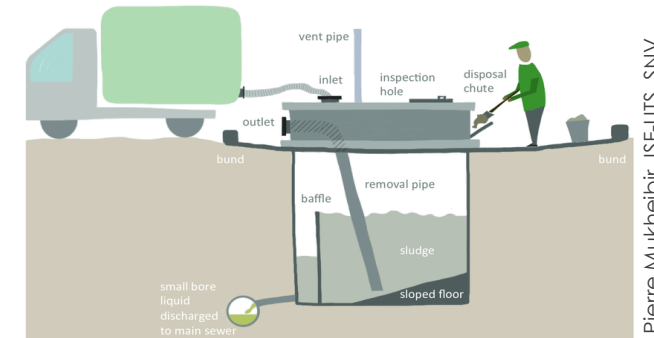
Septage Receiving Station

- Septage receiving stations are constructed at / near the STP,
- The function of the station is to pre treat the septage and transfer the septage to the STP,
- Components of Septage Receiving Station
 - ✓ Dumping station
 - ✓ Screening
 - ✓ Grit removal
 - ✓ Equalisation tank
 - ✓ Odour control unit
- ✓ It ensures that the components of the STP do not encounter shock loading in terms of TSS and BOD, COD.



Mechanized Receiving Station

- Mechanized transfer station are installed where there is paucity of space and civil construction is difficult.,
- This station pretreats the septage and washes the screenings and grit, allowing it to be handled safely for disposal,
- The water can be disposed in the sewer network.



Pierre Mukheibir, ISF-UTS, SNV

Septage Transfer Station

- Septage transfer station are constructed when hauling distance are uneconomical,
- The function is to pretreat the septage and transfer the supernatant to the sewer or drains,
- The thickened sludge is emptied and transferred to the treatment plant or scientific disposal site.

Appropriate Septage Treatment Chain For Hilly Regions

Solid Liquid Separation	Geobags	Settling thickening tank	Settling thickening tank	Settling thickening tank
Stabilization			Lime stabilization	
Dewatering/ Drying	Sun drying	Planted drying beds	Mechanical dewatering	Mechanical dewatering/ drying
Pathogen reduction	Storage		Drying	Incineration

NOTE: Recommendations for the septage treatment chain are made based on the observations of representative cities and secondary data provided during the city visits. Feasibility study followed by DPR should be carried out before implementation of the SeTP.

Applicability: ULBs with low population density in the hilly region.

Feature: The solid liquid separation ensures that the organic loading in the liquid component is significantly reduced.

Applicability: NP and NPP with moderate population density.

Feature: The planted drying bed does not need much maintenance and is quite robust if operated properly.

Applicability: NPP and NN with relatively high population density.

Feature : The mechanical dewatering ensures, not much land is occupied and the SeTP can be located near to the city.

Applicability: NPP and NN with relatively high population density, performing scheduled desludging.

Feature : Incineration ensures that the quantum of the end product is small and can be easily disposed safely.



This report has been prepared by Ecosan Services Foundation, Pune for National Institute of Urban Affairs under the Sanitation Capacity Building Platform. The task involved visit to representative cities, followed by collating secondary data and analysing it. The information presented and recommendations are based on the observations made during the city visits and the structured interviews conducted of stakeholders such as officials from the Urban Development Department, Pey Jal Nigam and Jal Sansthan of Government of Uttarakhand.

