HYDROGEOLOGY IN WATERSHED PLANNING

Advanced Center for Water Resources Development and Management

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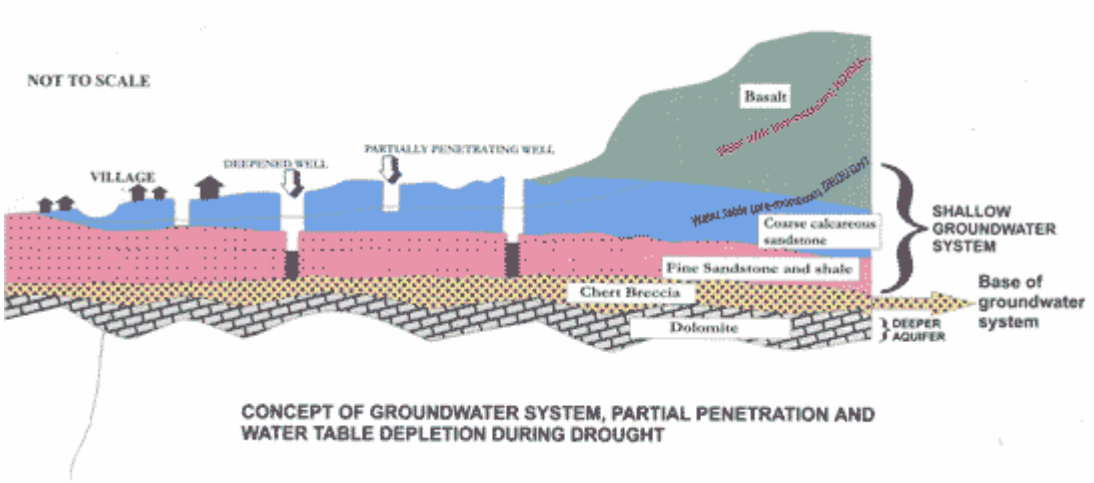
Groundwater

Water in the saturated pores of a rock is commonly referred to as groundwater



CONCEPT OF GROUNDWATER SYSTEM, PARTIAL PENETRATION AND WATER TABLE DEPLETION DURING DROUGHT

Hydrogeology is the study of Groundwater

Importance of Groundwater

- Groundwater is increasingly becoming ***the*** primary source for Agricultural, Domestic and Industrial needs in many parts.
- Groundwater is important for maintaining the ecology of a place. The water in rivers and streams are to a large extent from ground water.
- Groundwater provides a means of protective irrigation for the critical dry periods between rainfalls.

- It also provides people a buffer for drought years.
- Water Management in any context cannot ignore Groundwater.
- Rain-Surface-Groundwater interaction needs to be understood.

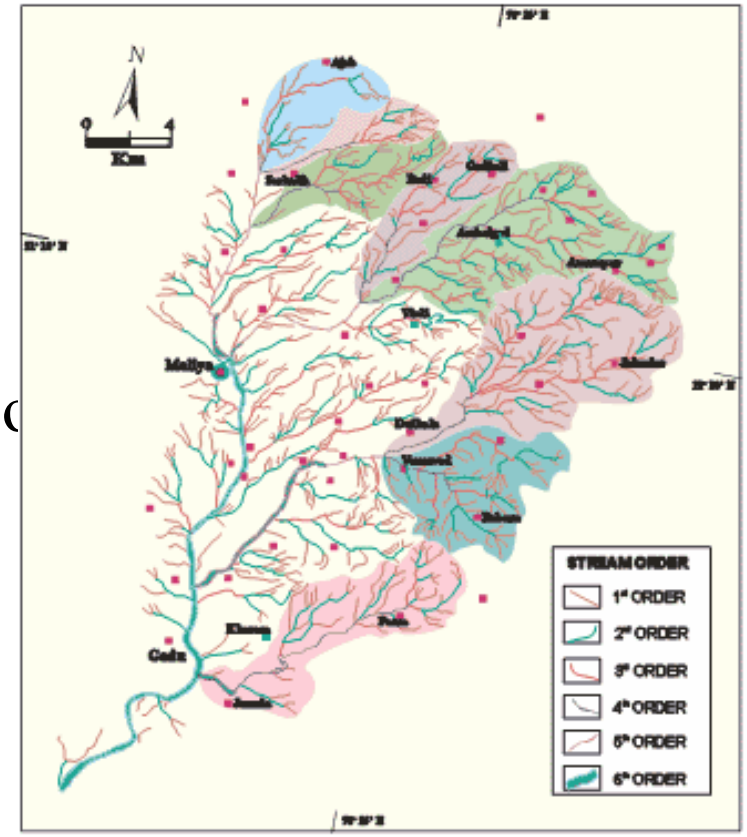
Science of Hydrogeology for Watershed development

- Watershed Development in rainfed areas involves sustainable augmentation of water resources through harvesting, conservation and recharge
- This depends on the soils and the underlying geology & rocks.
- Hydrogeology helps understand soils and rocks and how they affect the storage & transmission of groundwater
- Therefore the efficiency of watershed programme is tied to a good understanding of the hydrogeology of the area.

Hydrogeology in Watershed Programmes

Hydrogeology is essential in:

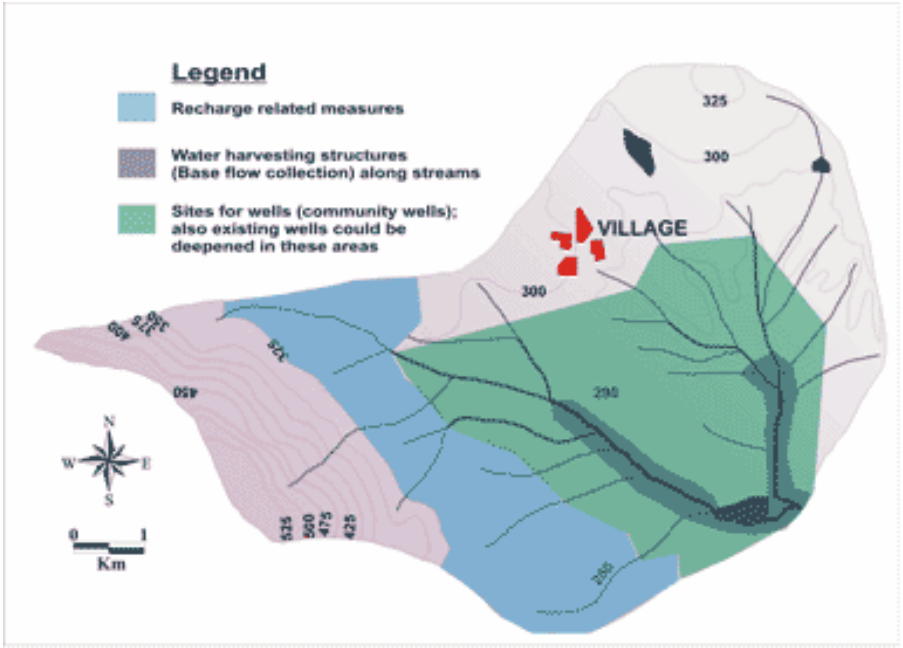
- PLANNING STAGE : Understanding Groundwater – why and where to conserve, recharge and protect?
- DESIGN & IMPLEMENTATION: Develop Groundwater only on the basis o understanding – how to obtain and how much to use?
- IMPACTS AND MAINTENANCE : Manage Groundwater – preserve its quantity and quality i.e. ensure sustainability



The use of maps in all three stages improves efficiency and saves time

Understanding Groundwater

- Groundwater availability depends upon the capability of rocks and rock material underneath the surface of the earth, to store and transmit water
- This requires an understanding of the
  - Geology – Rock formation
  - Soil – Materials
  - Drainage – Topography/terrain of the land
  - Aquifer information



How to begin?

- We look at a case-study in Karnataka showcasing successful watershed planning and impact measurement using the science of hydrogeology.

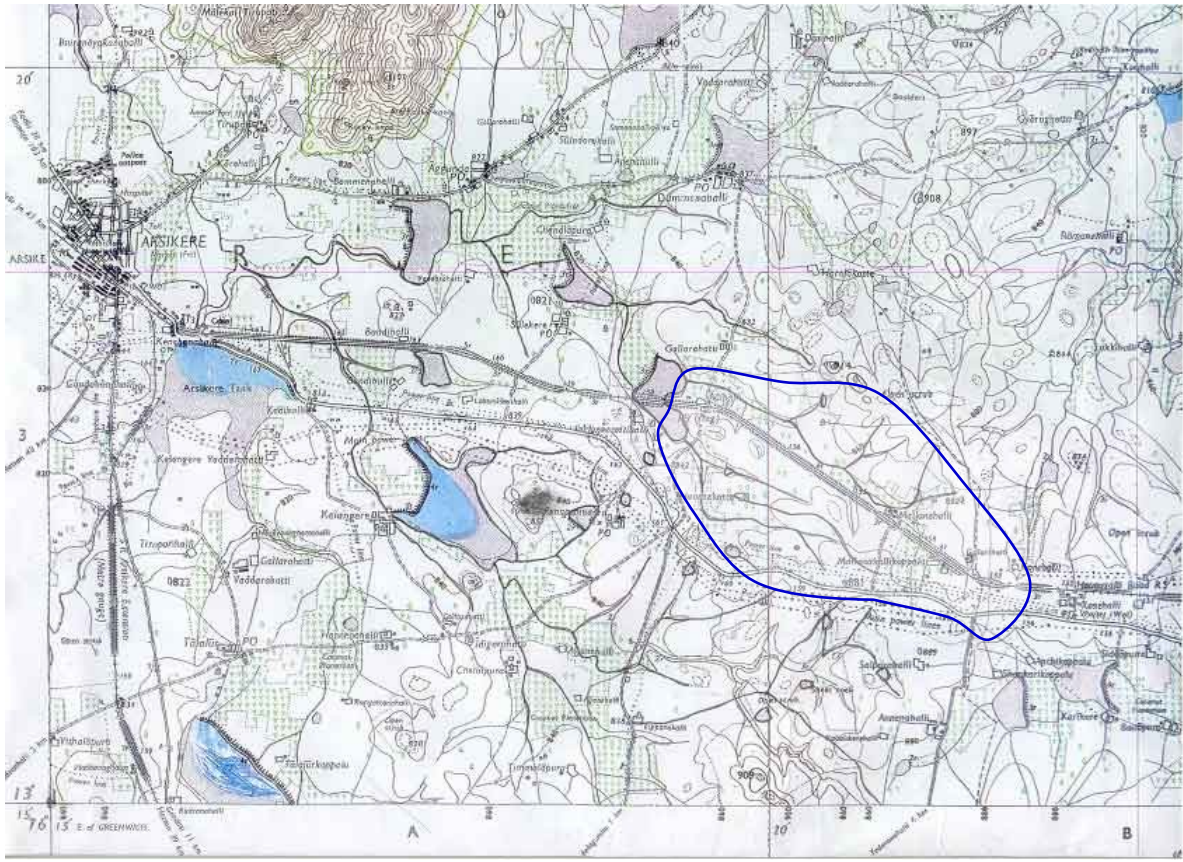
- By using maps for understanding the geology, soils, drainage and aquifer information, the watershed structures are positioned for maximum efficiency.

TOPOSHEET

The starting point is the Topographic Sheet which has information about the features on the ground.

Topo sheets are available with the Survey of India.

A toposheet is **required** to prepare a basemap of the watershed.

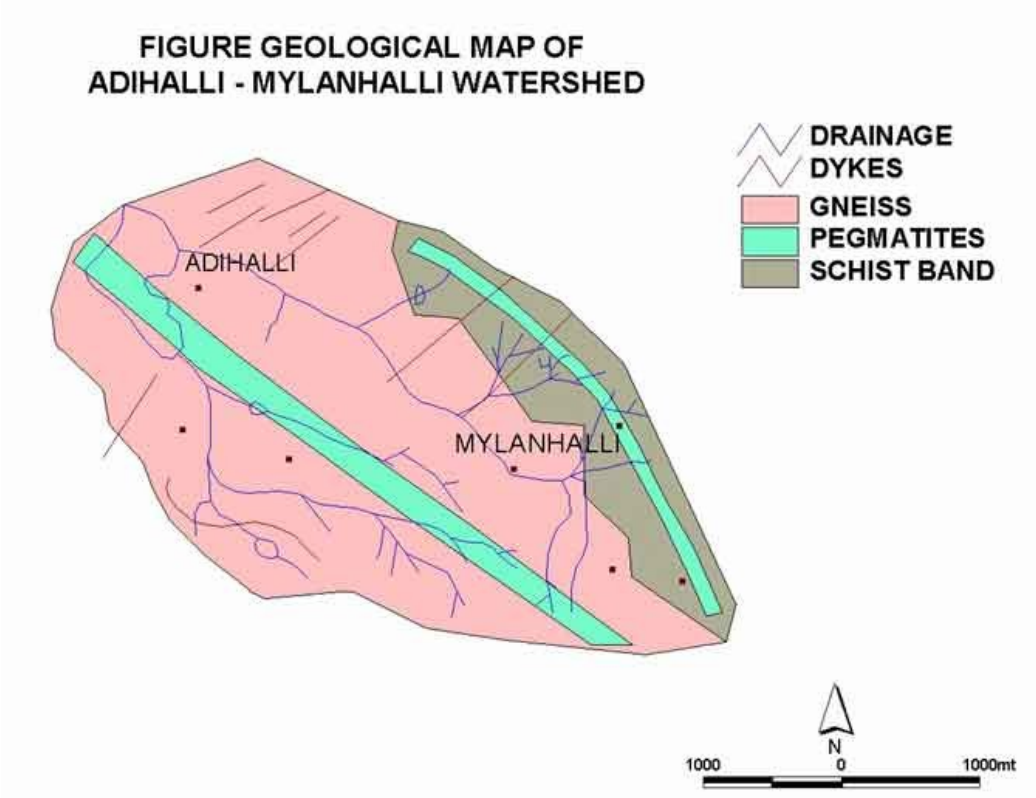


GEOLOGY

The geology map provides information on the rock types exposed in the watershed.

This map is created by geological mapping of the area by a geologist.

A geological map helps understand the physical framework through which ground water moves and in stored in a watershed.

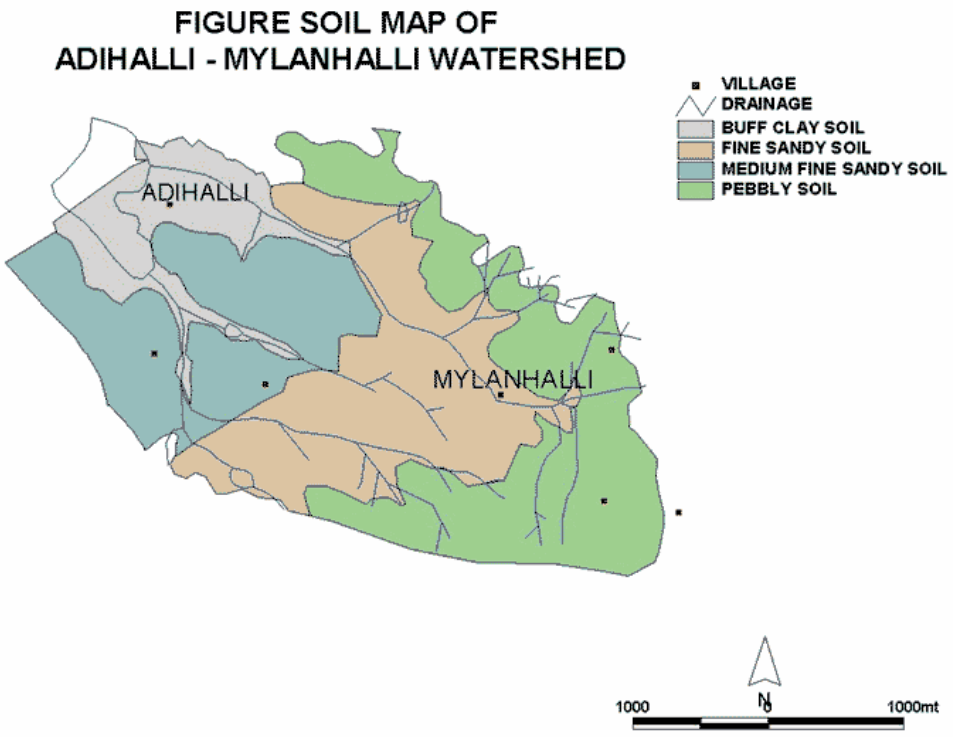


SOILS

Soils form an important interface between surface water and ground water.

Soils in a watershed can be mapped alongside geological mapping by a soil scientist or a geologist.

A soil map is important in watershed development because it helps to understand whether or not water will infiltrate through the soil zone, at what rate, what quantity and in which season

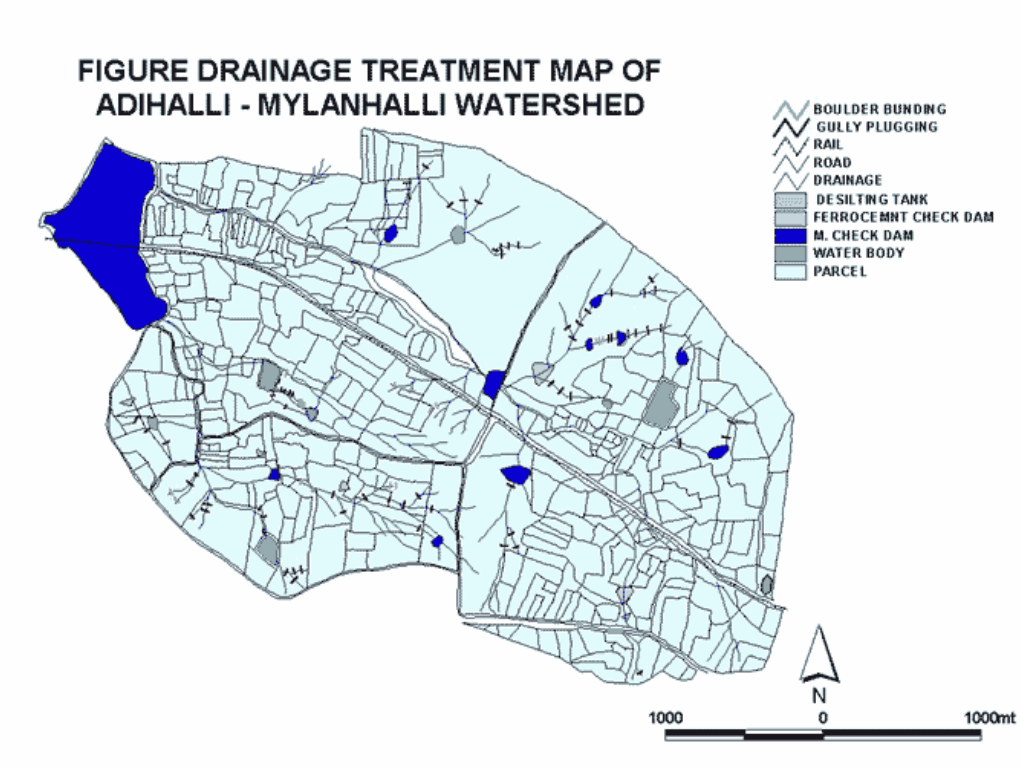


DRAINAGE TREATMENT

The drainage map explains location of existing structures on the drainage line.

This is done by mapping it out on the field through a participatory process or by anyone involved in the design or implementation of the watershed programme.

This map is useful to understand interventions at upstream, downstream, middle reaches and the impact on the current situation.

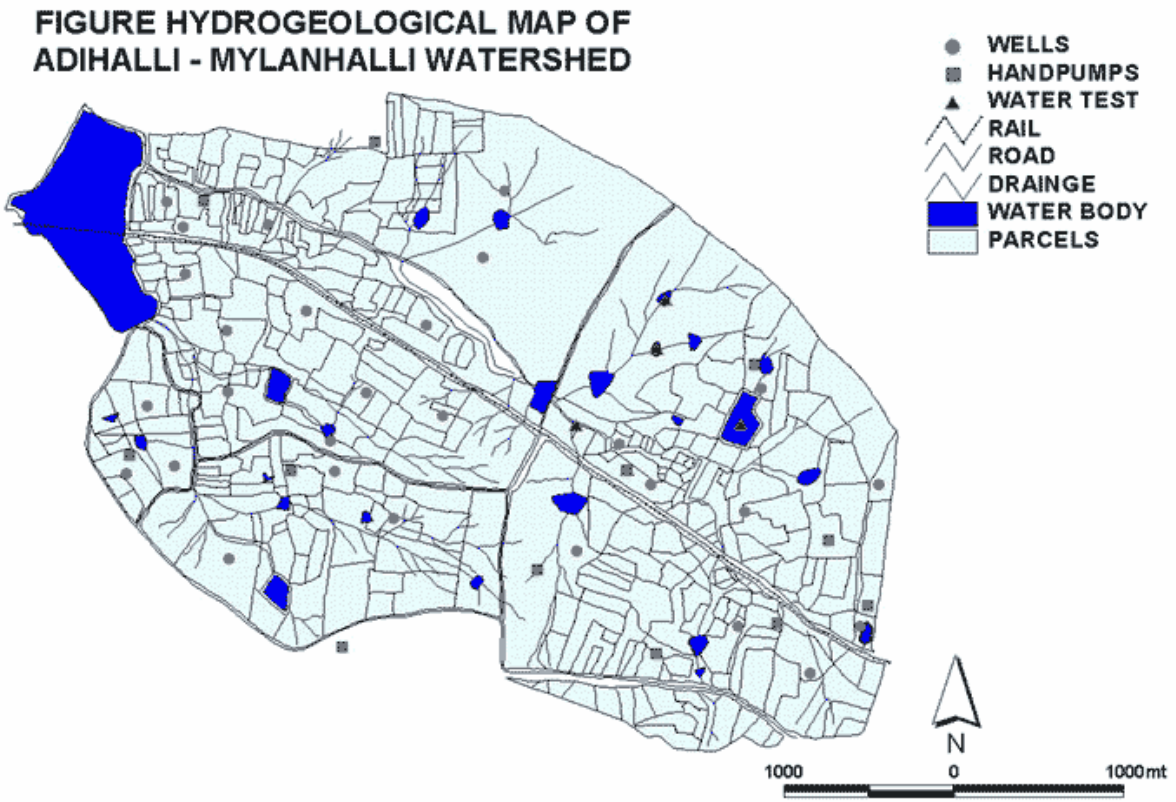


HYDROGEOLOGY

This map is a geological map superimposed with structures like wells and modes of using water.

It is created by a hydrogeologist or a geologist and is usually participatory in nature.

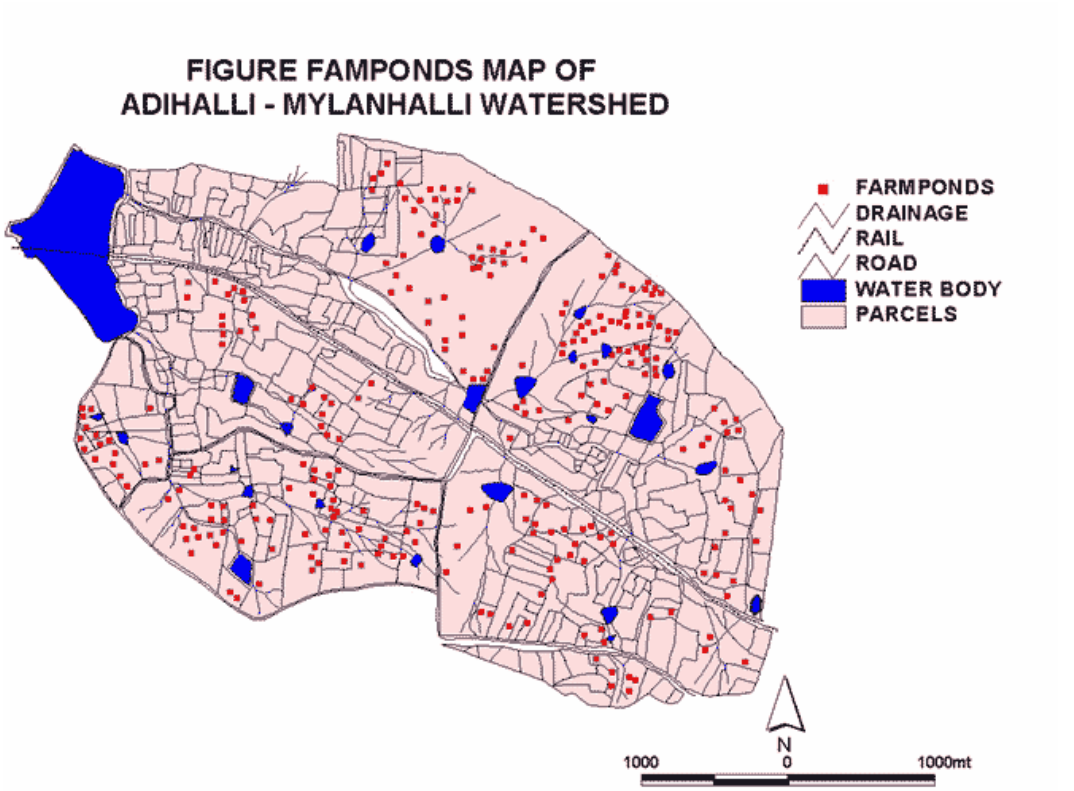
A geological map is the basic necessity for creating a hydro geological map.



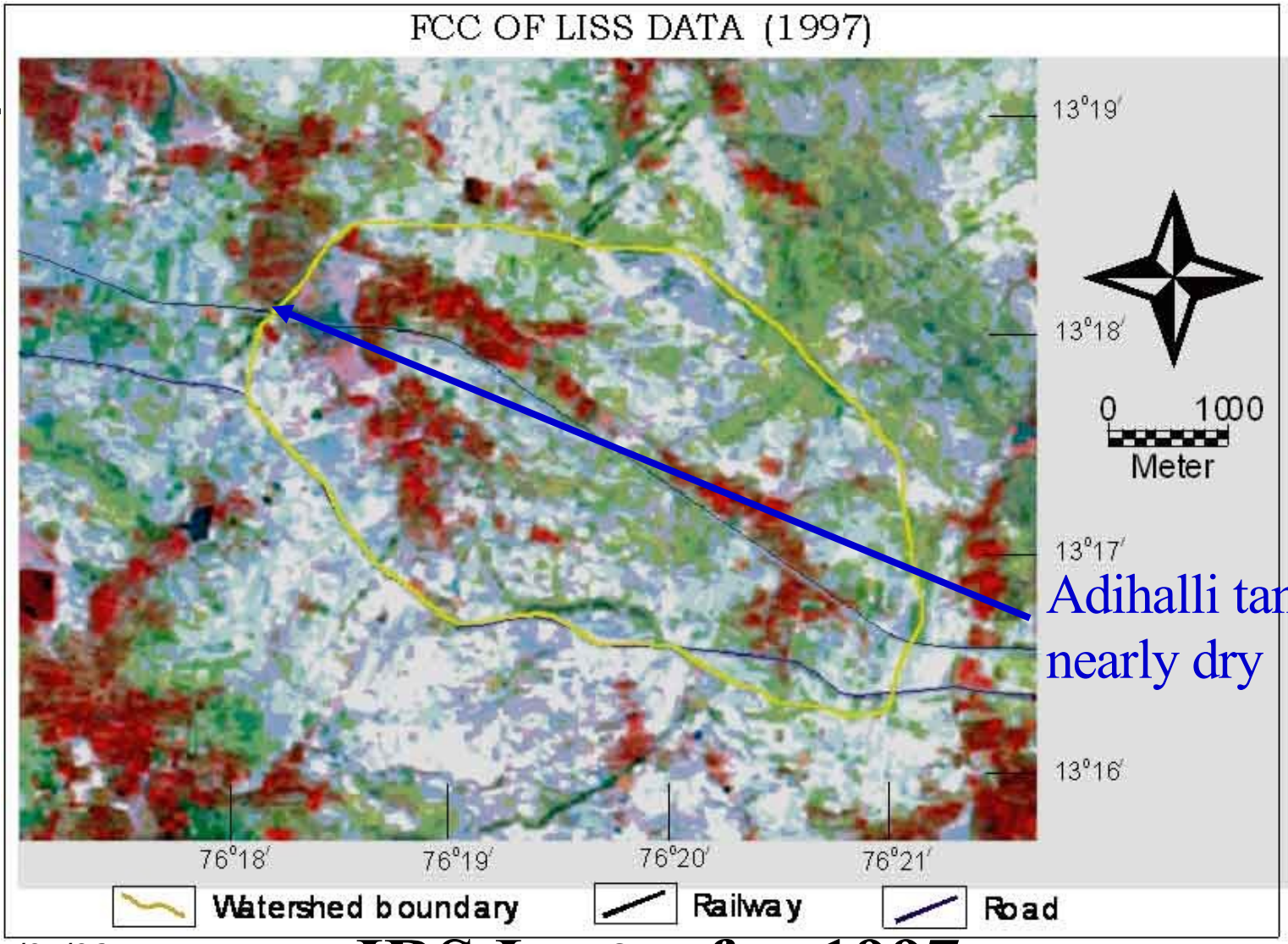
FARM PONDS

In addition to the previous maps, specific maps like the location of farm ponds in the watershed can be derived through the mapping exercise.

This can be used as a planning tool to decide the sites for farm ponds and also as a tool for impact assessment

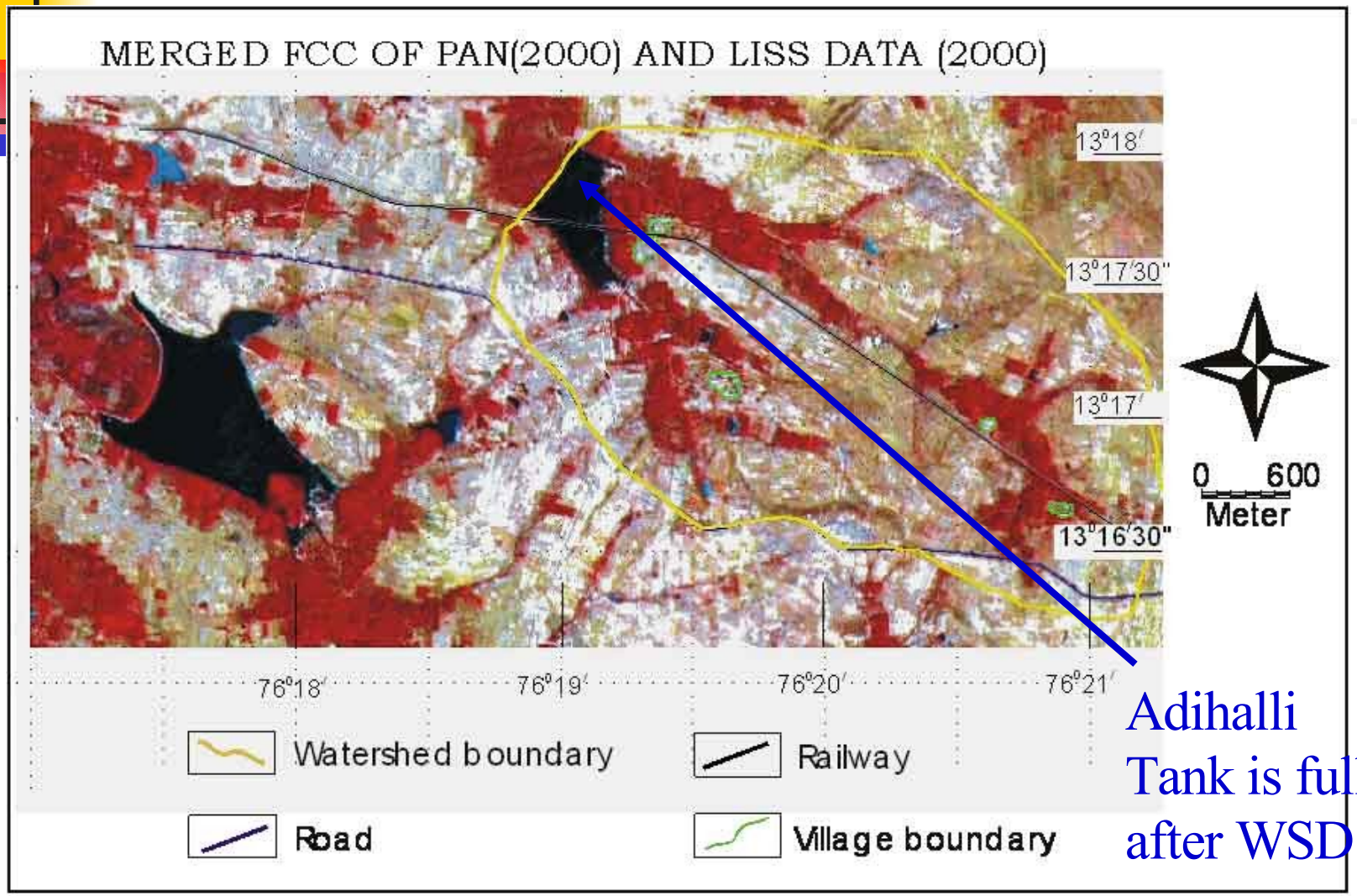


Imapct Assessment Using Maps



IRS Image for 1997

IRS Image for 2000



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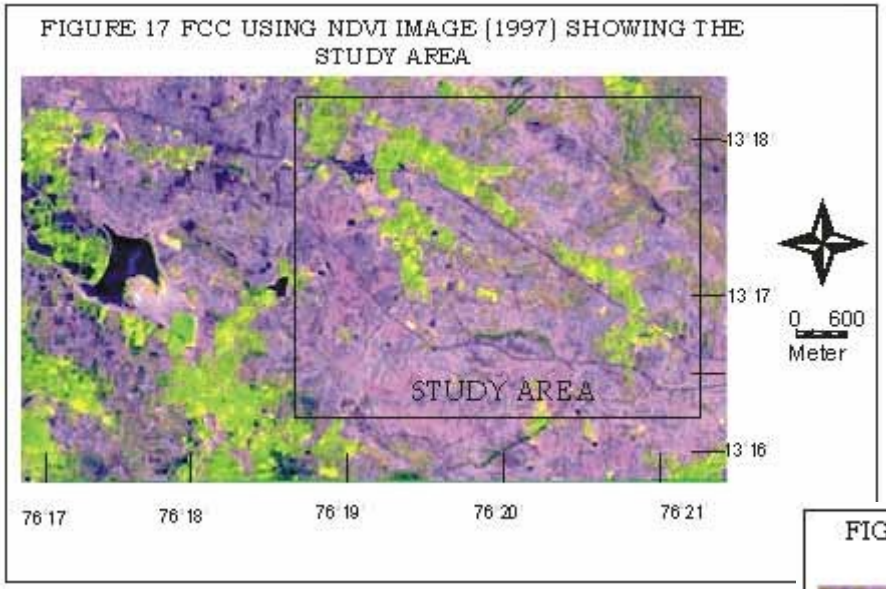
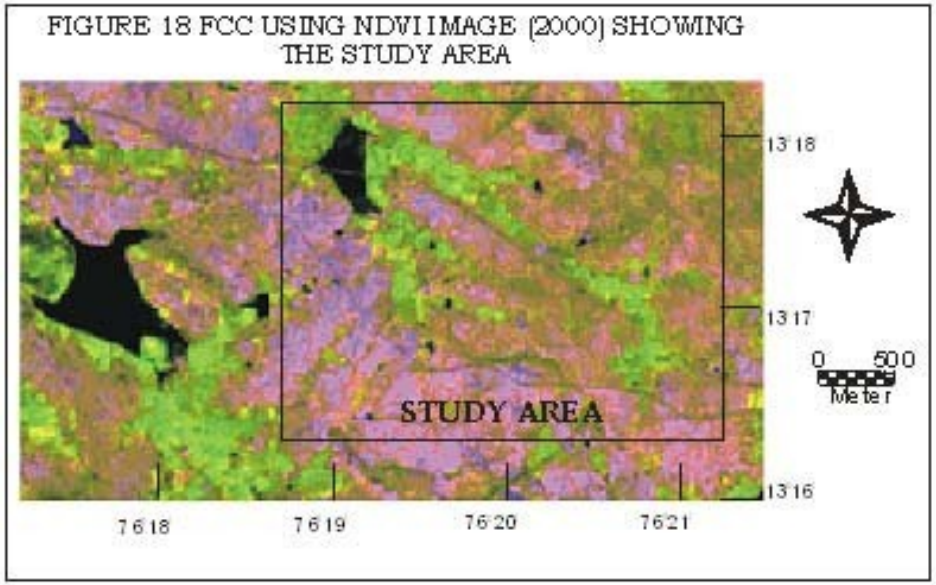


Increase in vegetation, mainly in the form of irrigated crops from 1997 to 2000



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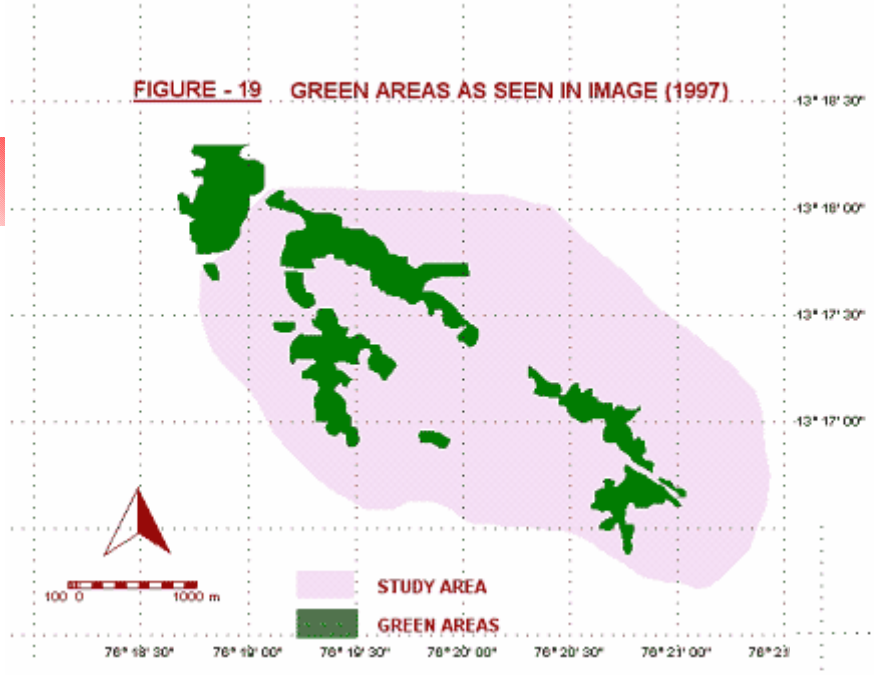
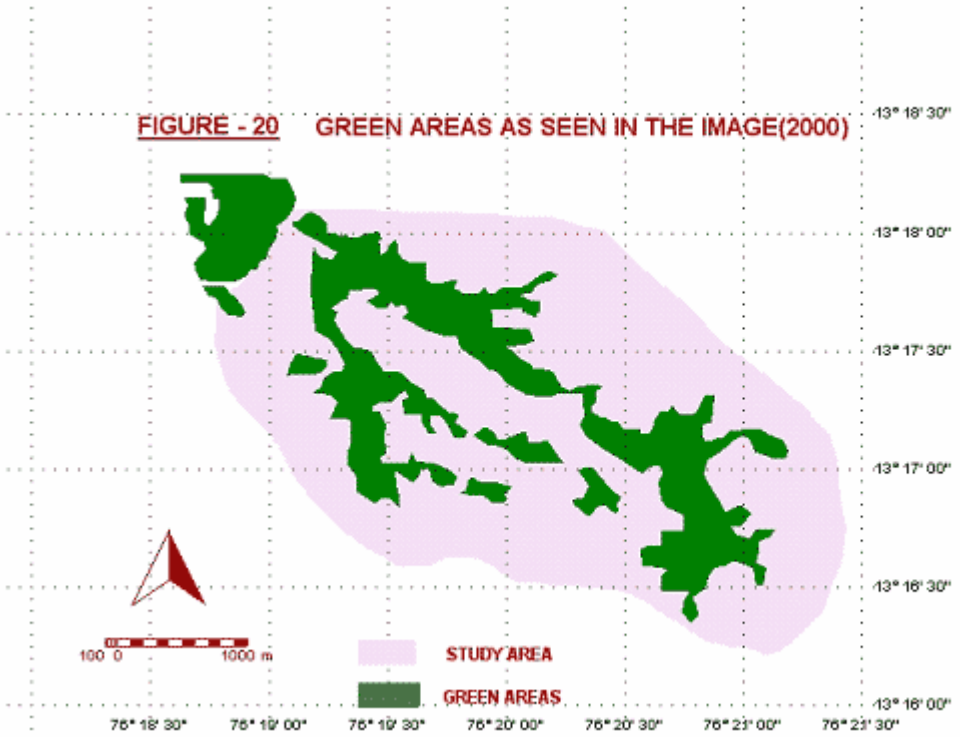


Green area has increased by as much as 50% from 1997 to 2000



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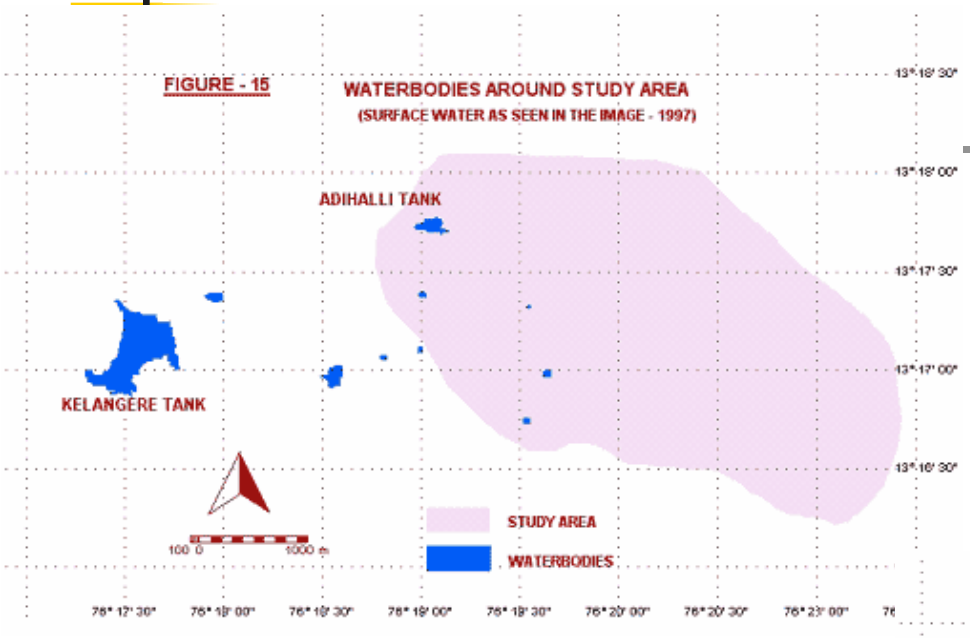
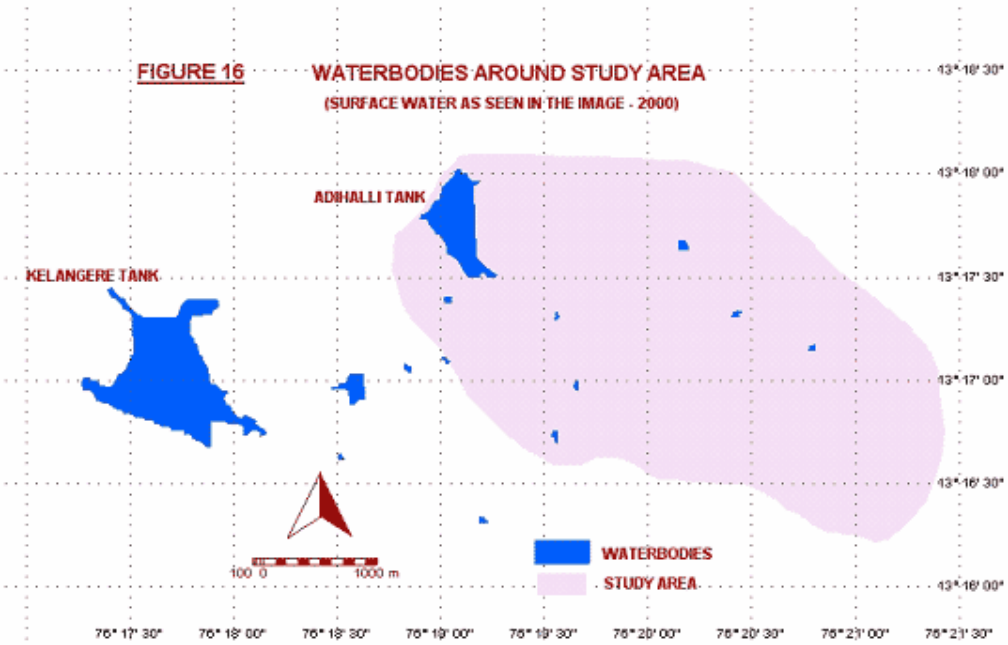


The size of the surface water bodies has increased during this period



Conclusion

- As the above case-study shows, understanding and applying the science of hydrogeology to a Watershed programme is a necessary condition for efficacy.
- Toposheets, geological, soil, drainage and hydrogeological maps play an important role.
- Usage of maps makes the process faster, more accurate and eliminates guesswork in locating structures.
- It also is a very effective tool for impact measurement