GEO-HYDROLOGICAL STUDY OF MATATILA DAM, JHANSI (U. P.)
USING REMOTE SENSING TECHNIQUES

Huny Sharma
Research Scholar Mahatma Gandhi Kashi Vidyapith, Varanasi

Declaration of Author: I hereby declare that the content of this research paper has been truly made by me including the title of the research paper/research article, and no serial sequence of any sentence has been copied through internet or any other source except references or some unavoidable essential or technical terms. In case of finding any patent or copy right content of any source or other author in my paper/article, I shall always be responsible for further clarification or any legal issues. For sole right content of different author or different source, which was unintentionally or intentionally used in this research paper shall immediately be removed from this journal and I shall be accountable for any further legal issues, and there will be no responsibility of Journal in any matter. If anyone has some issue related to the content of this research paper's copied or plagiarism content he/she may contact on my above mentioned email ID.

ABSTRACT

This study was conducted on the Matalita dam situated in Jhansi District of Uttar Pradesh, India; the remote sensing techniques have been proved to be very efficient in identification geo-hydrological and geo-environmental aspects of the study area. In the present paper IRS-P6 LISS-IV Mx (5.8 m) data has been used. The various thematic maps have been generated and integrated on 1:15,000 scale.

Geology, geomorphology, hydro-geomorphology, geo-hydrology, structure, soils, erosion, and land use land cover helped in identification of the potential zones for development planning and forecasting limitations to their implementation with seasonal accuracy. Lineaments and their intersections appear to be potential sites for groundwater. Bewas drainage basin is suitable for surface reservoirs and check dams. The study shows that the integration of all attributes provide more accurate results in identification of geo-environmental and geo-hydrological characteristics.

Keywords:
Geo-environmental, geo-hydrological, hydro-geomorphology, and remote sensing

INTRODUCTION

Geo-environmental, geo-hydrology, and groundwater exploration means to identify and to locate the zone of occurrence and recharge of groundwater in a particular
basin or a catchment. Geological set up is established for knowing about surface and subsurface nature of terrain. In other words, the composition of rock with its hydrological character is known.

Topographic and surficial features are mapped in order to determine from highest to lowest area, where water from different higher places can move and accumulate. These particular zones are present in various terrains. The identification of such focal places from the entire area, are thus selected for groundwater exploration.

For integrated resources development and environmental management planning remote sensing is providing useful base line information, in conjunction with ground truths on soils, land use, vegetation, surface & groundwater, geology, landforms, topography, settlements, among others, in a regional perspective.

Remote Sensing techniques are now being widely used for land resource surveys. Its importance of having fairly accurate, updated and timely information on natural resources for planning effective development cannot be over-emphasized.

Data collection is costly and time consuming; hence, it is important that more efficient means of data collection be developed and utilized. In this regard, the utility of remote sensing technology in obtaining reliable, timely natural resources related information in a speedier manner for data base generation is well recognized. The technology is fast progressing.

**Drainage Network**

Drainage network analysis is important for geo-environmental and geo-hydrological studies. Drainage density of a region depends on the climatic factors, landforms, slopes and stage of geomorphic cycle, lithology and its permeability etc. Hence, drainage density is an important index in geo-hydrological studies, and can be evaluated from aerial photographs.

Permeability has a fundamental influence on drainage density. In bedrock areas, drainage textures and patterns depend, among others, on the lithological character of underlying rocks and their structural disposition. A drainage map of the study area has been prepared using the IRS-P6 LISS-IV Mx (5.8 m) on 1:50000

**Slope Analysis**
Slope is the most important and specific feature of the earth’s surface form. Maximum slope line is well marked in the direction of a channel reaching downwards on the ground surface. In any region valley slopes, occupy most of the area of erosional relief in greater extent in comparison to flood plains, river terraces and other local depositional landforms.

In geomorphology, the slope is combined effect of 'form' (Environmental conditions of slopes such as the geology, climate and vegetal cover) and 'process' (agents, such as soil creep, surface wash and the process of weathering). 'Form' and 'Processes' - both have existed right from the remote past. The sequence of the past forms prepares the way for the present ones, and this constitutes the evolution of a slope.

Deccan traps are the most important formations in the study area due to their large aerial extent. The weathered jointed, fractured and vesicular units of basalts form moderately potential aquifers. The zeolitic basalt in weathered form also makes good aquifer.

A common weathering product of the trap is a friable light greenish or yellowish green. Basalt Vindhyan contact is not a promising zone. The alluvial deposits are confined mostly to the area along the river courses and in the northeastern parts of the study area. It is composed of fine to medium sand, silt, clay and kankar, which are high potential aquifers.

**Structure**

Lineaments play significant role in groundwater exploration particularly in hard rocks. Water well yields often show a positive correlation with linear features or with the intersection of two features. Therefore, groundwater prospecting based on mapping of landforms and lineaments (Hydro-geomorphological mapping) is now very common using remote sensing data.

Lineaments are defined as linear features of geological significance extending in length over several kilometres. These linear features usually represent faults, fractures or shear zones and are identified on satellite images on the basis of tonal contrast, stream / river alignment, and differences in vegetation and knick-points in topography. Lineament study of the area from remotely sensed imagery provides important information on sub-surface fractures that
may control the movement and storage of groundwater.

Therefore, a lineament map of the study area has been prepared using IRS-P6 LISS-IV Mx data. A glance at this map shows that there are four predominant sets of lineaments present in the basalt.

**Hydro-Geomorphology**

Application of remote sensing in geology and geomorphology for quick geohydrological evaluation has been proved to be very effective tool. A combined analysis of landforms (geomorphology), rocks as well as structures (geology) such as faults, folds, fractures etc. in relation to groundwater occurrence aspects with the help of remote sensing of ground truth is considered very useful in preparing integrated hydro-geomorphologic maps.

**Land Use and Land Cover**

Land is the most important natural resource, which embodies soil, water and associated flora and fauna involving the total ecosystem. Comprehensive information on the spatial distribution of land use/land cover categories and the pattern of their change is a prerequisite for management and utilization of the land resources of the study area.

The land use pattern of any terrain is a reflection of the complex physical processes acting upon the surface of the earth. These processes include impact of climate, geologic and topographic conditions on the distribution of soils, vegetation and occurrence of water. For better development and management of the catchment areas of reservoirs, it is necessary to have timely and reliable information on environmental status.

**Ground Water Scenario**

The occurrence and movement of groundwater depend upon the rock formations present in the area. It also depends upon the topography, structure, and geomorphology, as well as hydro-geological properties of the water-bearing materials.

The hydrogeological properties of water-bearing formation with a view to throw light on any possibility of inflow of ground waters from the hard rock as well as unconsolidated hydro-litho units into the aquifers of the study area.

Alluvium comprises of silt, sand, gravel, and clay particles, it is an excellent aquifer;
basalt belongs to Deccan Traps, and sandstone belongs to Vindhyan Supergroup, it is a moderate aquifer in the study area. Depth to water level represents the position of water table with reference to ground surface.

**Ground Water**

A groundwater favourable zonation of the study area has been analyzed by the using of ModelBuilder Application in ESRI ArcGIS 9.3.1 with the lithological structural, lineament density, drainage density, land use, hydro-geomorphological elements, and the background of the survey of India topographical maps on 1:50,000 scale. On the basis of integration of these maps groundwater favourable zones of the study area were identified.

The hydro-geomorphological units such as Alluvial Plain, Valley Fills, Deccan Plateau, Buried Pediment (sand stone) are most favourable zones for groundwater exploration & development in the study. Hence, these areas are marked as good to very good favourable zones. These zones are distributed mostly in the north, and middle of the study area and only some few in the southern portion of the area.

A glance reveals that the northern part and some of the southern part of the study area have excellent groundwater potential as compared to the upper middle basin and east- south-eastern part of the basin. These are also verified from field check. This information is very useful for the further groundwater development in the study area.

**CONCLUSION**

Remote sensing techniques with an emphasis on geology, geomorphology, physiography, hydro-geomorphology, structure, geo-hydrology, land use/land cover help in identification of the potential zones for developmental planning and predicting limitations to their implementation with reasonable accuracy.

Lineaments particularly joints/fractures and their intersection appear to be potential sites for groundwater exploitation. The valley fills and buried pediments are good groundwater potential zones. From the drainage analysis, it is clear that the Bewas catchment is suitable for surface reservoir and check dams.

**REFERENCES**

Howarth, P.J. ed. Canadian Symposium on Remote Sensing


