(88)

# SUMMER INTERNSHIP REPORT

# ON

## MAPPING OF WATER BODIES IN AND AROUND ALIGARH DISTRICT (U.P.) USING GEOGRAPHICAL INFORMATION SYSTEM (GIS)

**Organising Institute**

National Institute of Hydrology
राष्ट्रीय जल विज्ञान संस्थान
आपो हिष्टा मयोभुवः

**National Institute of Technology**

**Roorkee**


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# ***Content***

# ***ABOUT NATIONAL INSTITUTE OF HYDOLOGY (NIH)***

**National Institute of Hydrology (NIH)** is a Government of India society under Ministry of Water Resources and has been functioning as a research Institute in the area of hydrology and water resources in the country since December 1978 in Roorkee City.

The institute acts as a center of excellence for transfer of technology, human resources development and institutional development in specialized areas of hydrology and conducts user defined, demand-driven research through collaboration with relevant national and international organizations.

The institute vigorously pursues capacity development activities by organizing training programs for field engineers, scientists, researchers, NGOs etc. The institute is focusing studies and R&D in the thrust areas of impact of climate change on water resources; integrated water resources management; groundwater modeling and management; flood and drought management; regional hydrology; hydrology of extremes; reservoir/lake sedimentation; watershed hydrology; and water quality assessment in specific areas.

## *ALIGARH DISTRICT ATGLANCE*

### *INTRODUCTION*

Aligarh district is situated on the western part of Uttar Pradesh occupying a small part of Ganga – Yamuna doab. It lies between latitude $27^0$35' and $28^0$10'N and longitudes $77^0$29'00" and $78^0$36'00"E falling in survey of India Toposheet Nos. 53H, L & 54E. The northern boundary of the district is contiguous with that of Bulandshar district. Ganga river forms the natural boundary between Aligarh and Budaun in the north eastern corner of the district whereas the Yamuna in the northwest forms the state boundary between Uttar Pradesh & Haryana. Administratively the Aligarh district has an area of 3650 sq.km. which has been divided into five tehsils and 12 community development blocks . It has 122 Nyay Panchayats having 855 Gram Sabhas and 1210 villages.

Aligarh has a monsoon-influenced humid subtropical climate, typical of north-central India. Summers start in April and are hot with temperatures peaking in May. The average temperature range is 28–38 °C (82–100 °F). The monsoon season starts in late June, continuing till early October, bringing high humidity. Aligarh gets most of its annual rainfall of 800 millimetres (31 in) during these months. Temperatures then decrease, and winter sets in December, and continues till February. Temperatures range between 5–11 °C (41–52 °F). Winters in Aligarh are generally mild, but 2011–12 experienced the lowest temperature of 1 °C. The fog and cold snaps are extreme.

## 1. GENRAL INFORMATION

| | | | |
|---|---|---|---|
| i. | Geographical Area (Sq. Km.) | : | 3650 |
| ii. | Administrative Divisions (as on 31.03.2006) Number of Tehsil/Block Number of Panchayat/Villages | : | 5/12 122/1210 |
| iii. | Population (as on 2001 census) | : | 2992286 |
| iv. | Average Annual Rainfall (mm) | : | 708.7 |

## 2. GEOMORPHOLOGY

Major Physiographic Units :

i. Recent Flood Plain
ii. Terrace Zone
iii. Older Alluvial Plain

Major Drainages : Ganga & Yamuna

## 3.LAND USE (Sq. Km.)

| | | | |
|---|---|---|---|
| a) | Forest area | : | 25.77 |
| b) | Net area sown | : | 3008.65 |

**4. MAJOR SOIL TYPES** : Bhur, Matiyar & Domat

## 5. IRRIGATION BY DIFFERENT SOURCES (Sq. Km.)

| | | |
|---|---|---|
| Dugwells | : | - |
| Tubewells / Borewells | : | 50.53 / 2496.78 |
| Tanks / Ponds | : | - |
| Canals | : | 333.24 |
| Other Sources | : | - |
| Net Irrigated Area | : | 2881.14 |
| Gross Irrigated Area | : | 4315.47 |

**6. NUMBER OF GROUND WATER MONITORING WELLS OF CGWB (As on 31-3-2007)**

| | | |
|---|---|---|
| No. of Dugwells | : | 13 |
| No. of Piezometers | : | - |

**7. PREDOMINANT GEOLOGICAL FORMATIONS** : Alluvium

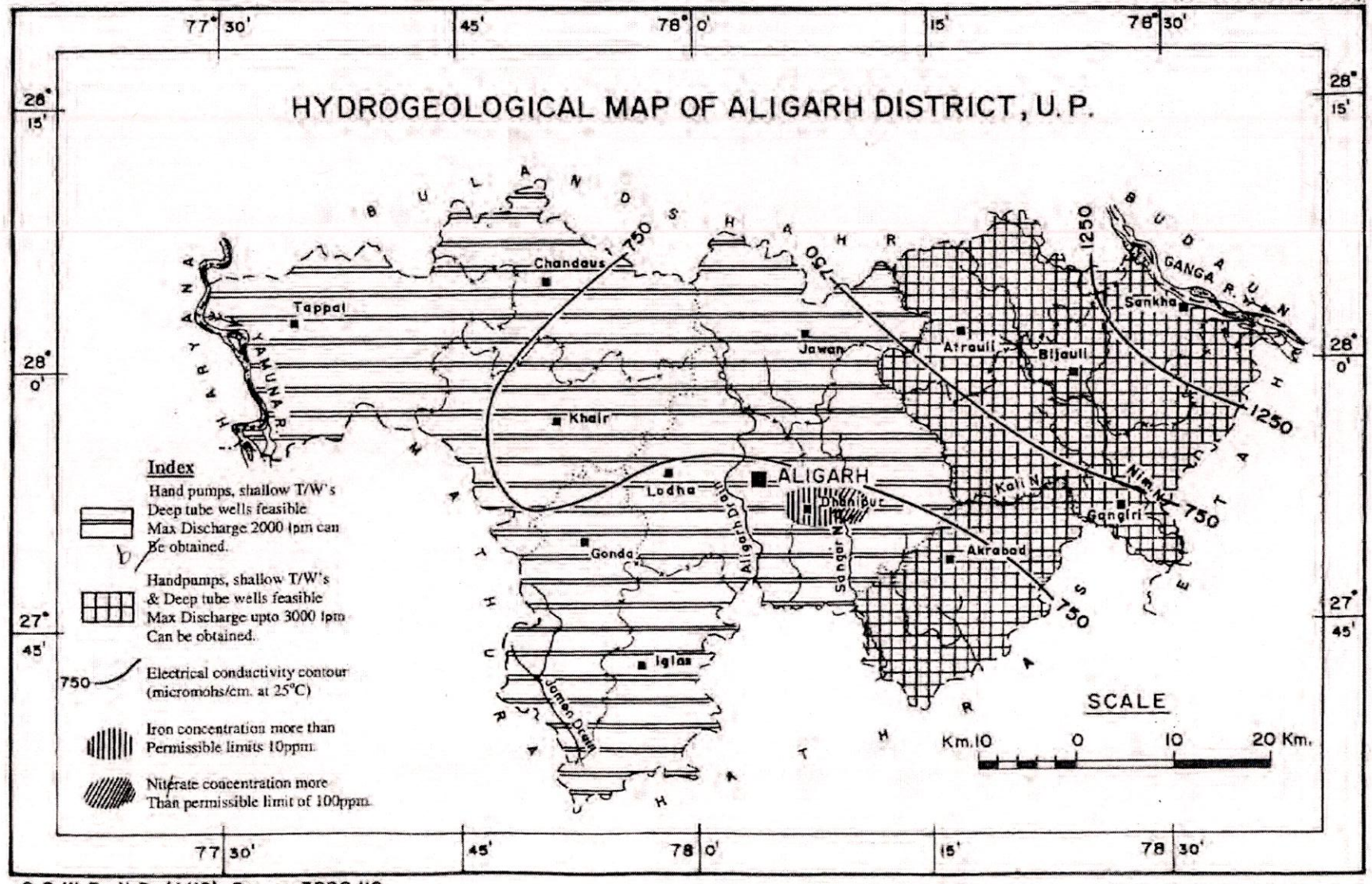
**8. HYDROGEOLOGY**

| | | |
|---|---|---|
| Major water bearing formation | : | Sand of various grades |
| Pre-monsoon Depth to water level during 2007 | : | 2.06-21.00 mbgl |
| Post-monsoon Depth to water level during 2007 | : | 1.96-17.00 mbgl |
| Long term water level trend in 10 years (1998-2007) in m/yr | :: | Premonsoon Rise 0.014 – 0.375 m/yr. Premonsoon Decline 0.010 – 0.319 m/yr. Postmonsoon Rise 0.286 – 0.594 m/yr. Postmonsoon Decline 0.0024 – 0.277 m/yr. |

PLATE-V

Part of Toposheets No. 53 H, L & 54 E, I

# HYDROGEOLOGICAL MAP OF ALIGARH DISTRICT, U. P.

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## *Introduction*

A GIS (Geographic Information System) is a powerful tool used for computerized mapping and spatial analysis. A GIS provides functionality to capture, store, query, analyze, display and output geographic information.

GIS is a computer-based system that stores geographically referenced data, links it with non-graphic attributes (data in tables) allowing for a wide range of information processing including manipulation, analysis and modeling. A GIS also provides for map display and production.

## *Components of ArcGIS Desktop 10.1*

**ArcMap, ArcCatalog, (and ArcToolbox)**

ArcGIS Desktop is comprised of a set of integrated applications, which are accessible from the Start menu of your computer: ArcMap and ArcCatalog.

- ArcMap is the main mapping application which allows you to create maps, query attributes, analyze spatial relationships, and layout final projects.
- ArcCatalog organizes spatial data contained on your computer and various other locations and allows for you to search, preview, and add data to ArcMap as well as manage metadata and set up address locator services (geocoding).
- ArcToolbox is the third application of ArcGIS Desktop. Although it is not accessible from the Start menu, it is easily accessed and used within ArcMap and ArcCatalog. ArcToolbox contains tools for geoprocessing, data conversion, coordinate systems, projections, and more. This workbook will focus on ArcMap and ArcCatalog.

**Data Management – ArcCatalog**

**Searching and Content**

Finding and using data is at the center of any GIS project. Let's get started by opening ArcCatalog:

1. Double-click with the left mouse button on the ArcCatalog icon on the desktop, or from the Windows Start menu, select 'Programs' > 'ARCGIS' > 'ArcCatalog.

## ***Common GIS File Types***

**Geodatabase** – The personal geodatabase, or geographic database, file is called the "modern container for GIS data" and is specific to ArcGIS. Geodatabases define, manage, process and store all the types of data that can be used in ArcGIS (i.e., feature, rasters, relationships, measurements, attributes, etc) inside either a Microsoft Access database (.mdb) or a full relational database (SQL Server, Oracle, Informix or DB2).

**Shapefiles** – ArcGIS shapefile format is a widely adopted standard and comprises three or more associated files. Be careful copying this data to a disk. You *must* get all of the files associated with a single layer. They will have a variety of file extensions: .shp, .shx, .dbf and sometimes others. If you are copying shapefiles, we recommended that you use the 'File' > 'Data' > 'Export Data' function in ArcMap or through ArcCatalog. This will automatically copy all files associated with a layer. Also, be aware that some of these files may be very large in size.

**Layer** – According to ESRI, the layer file (.lyr) stores symbology, symbology classifications, labeling properties, scale dependency, and definition. If you save something in this format it means that, unlike shapefiles, colors and other characteristics are saved and will appear the same every time you open it.

**Coverages** – "A coverage stores a set of thematically associated data considered to be a unit. It usually represents a single layer, such as soils, streams, roads, or land use. In a coverage, features are stored as both primary features (points, arcs, polygons) and secondary features (tics, links, annotation)." Source: *ESRI Data Dictionary*.

**CAD (computer-aided design)** – "A computer-based system for the design, drafting, and display of graphical information." Although most commonly used to support engineering, planning, and illustrating activities, these files can be used in a GIS. Source: *ESRI Data Dictionary*.

**Image formats** – ArcGIS accepts and uses a variety of image files (.tiff, .jpg, .jp2, .png, etc).

## ***PREPARING ARCMAP***

1. Open ArcMap
2. Select "A new empty map" when prompted with the opening screen
3. Before you start, let's save the project. File management is very important in any GIS project, and therefore, where and how you save your project should be approached with great care. An ArcMap project typically consists of multiple elements:
a. Your main project file (.mxd)
b. Vector layers (.shp and associated files)

c. Raster layers (.png, .jpg or .tif and associated files)
Notice when you add a raster image file (ex: NewYork_1964.png) to an ArcMap project, new files will be cre ated automatically in the same root folder where your file resides.

4. Therefore, it is recommended that you put all files in your project in a single folder. Once you have determined the location for your project, go to File, Save and save your project.
5. It is also highly encouraged to do the following steps to ensure that you are saving your project with relative path names. This ensures that if you move your project to another computer or to an external drive, it can still find all relevant project files:
a. Go to File, Document Properties
b. Click on the Data Source Options button
c. Select Store relative path... for your map document and click OK.

6. Now let's set the project's coordinate system. Go to View, Data Frame Properties
7. Click on the Coordinate System tab
8. Under Select a Coordinate System, click on the coordinate system designated by your instructor. This will differ depending on the purpose and location of your map. If you plan to georeference many maps, you may want to add this to your favorites first by clicking on the Add to Favorites button.
9. Now let's activate the toolbars that you will use in this tutorial. Go to Tools, Customize, and select the Toolbars tab. Make sure the following tools are checked:
a. Effects
b. Georeferencing

10. Now it's time to bring in satellite imagery that will be used as the basis of georeferencing your map.

11. Go to File->Add Data->Add Basemap and select a satellite imagery basemap. In this tutorial we will be using Bing Maps Road.
12. Use the main map tools to navigate the map to the general location of the image you want to georeference.

**GEOREFERENCING**
Your ArcMap project is now ready to begin the Georeferencing process. You will now add the raster image to the project and apply control points to match the raster image to the underlying geography based on common features. For best results, try finding features that are easy to identify, such as:
- Main street intersections
- Piers
- Bridges
- Peninsulas
- Rivers

Also, as much as possible, choose control points that are spread out evenly across the map region.

1. Click on the Add Data button , select the raster file to be georeferenced. Use the Connect to Folder button if necessary. If it prompts you to build pyramids, click Yes. Building pyramids may take a few minutes. ArcMap may become largely unresponsive during this process. The progress bar of this process is given at the bottom of ArcMap. If prompted with an "Unknown Spatial Reference" alert box, click OK.
   Since the raster image has no spatial parameters, it will not show up on the map. When the process is completed, the raster image will be added as a layer to your project.

2. At this point, georeferencing may commence. You will be using the Georeferencing toolbar.

3. On the Georeferencing toolbar, make sure your raster image is selected as your target layer then click on the Georeferencing button and select Fit To Display.

4. Use the following tools from the georeferencing toolbar to locate your raster image as best as you can to its actual position on the Microsoft map. You will fine tune this later, so it does not have to be a perfect match at this stage.

   Rotate: Click, hold and drag your mouse left/right to rotate in the desired direction.
   Move: Click and drag to shift the source layer.
   Scale: Click, hold and drag your mouse left/right to scale the source layer.

5. You may want to change the opacity of your map to help you locate the map correctly. Use the Effects toolbar to adjust the transparency of the map layer, and to check the accuracy of the transformation with the Swipe Layer tool.

6. You will now add control points to correlate the historical map to the Microsoft map, selecting spots in the former and their matching counterparts in the latter. The two should sync up with the addition of points .

7. Click on the Add Control Point button .

8. Click ONCE on the intersection of Beaver St. and Broad St. from the 1964 raster image. It should produce a GREEN cross on the map. On the Microsoft map, click on the equivalent intersection. You may have to pan and/or zoom in and out

of the map to find the corresponding location. When you have found the correct location, click on the map. This should produce a RED cross.

11. Turn the raster layer back ON. Your map now has one control point. Notice that the map has shifted based on the location of the first control point. Repeat these steps to add at least 2 more control points.

12. Each time you add a new control point, the map gets shifted/warped to find the "best" fit possible. Continue adding control points until you are satisfied with the georeferencing results.

13. Once you are satisfied with the results, click the View Link Table button in the Georeferencing toolbar. This opens a table that contains all your control points. Select all your control points and save them in your project folder. This will allow you to quickly restore your work in case your georeferenced map is lost.

14. Click on the Georeferencing button and select Update Georeferencing. This ensures that all the control points are saved.

***Digitised and Georefenced Map of Harduaganj Power Plant area in Aligarh district : Scale(1:250000)***

***References :***


1. ***http://nihroorkee.gov.in/***
2. ***http://www.cgwb.gov.in/***
3. ***http://resources.arcgis.com/en/help/***