

# Water Resources Research Institute

## WRRI



National Water Research Center (NWRC), Delta Barrage, 13621, Egypt  
Tel.: +202 4218 8787 Fax.: (202)42184344  
Email: [wrrri@wrrri.org.eg](mailto:wrrri@wrrri.org.eg) Web: [www.wrrri.org.eg](http://www.wrrri.org.eg)

### Outline

The Water Resources Research Institute (WRRI) is one of twelve research institutes comprising the National Water Research Center (NWRC) of the Ministry of Water Resources and Irrigation (MWRI). It is located on the campus of the NWRC in El Qanater El khairiya, 25 km North of Cairo a short distance downstream the Delta Barrage overlooking Damietta Branch of the Nile.

WRRI is pioneer in the fields of, Wadi hydrology studies, flash floods risks, the Nile River basin studies, groundwater development, and integrated water resources management. In addition, to plan and design appropriate projects for flood protection works, taking into account economic, environmental and social dimensions. WRRI is keen to engage innovative researches that enhance understanding of integrated Water Resources Management, and to implement effective strategies to address the barriers that have prevented full participation of women and stakeholders in projects. WRRI strives to maintain high standards of competence in its work.

**Vision:** Making the WRRI a leader organization conducting cutting-edge research in water resources.

**Mission:** To conduct, coordinate and integrate multi-disciplinary research to address critical national and regional priorities (Arab and Nile Basin Countries) in water resources.

### Main Objectives:

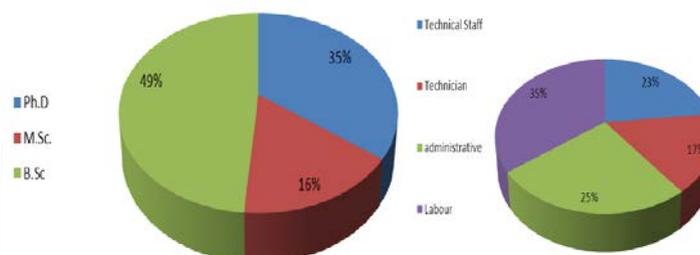
- ✗ Creating knowledge,
- ✗ Delivering Solutions,
- ✗ Building Capacities, and
- ✗ Coordinate and partnership.

### Human Resources

The WRRI has about 159 personnel. The technical staff includes 37 professionals covering the disciplines of hydrology, hydro-geology, civil engineering, geology, geo-physics, agronomy, survey and hydraulics, socio-economy and environment. Most of the staff members has benefitted from international and regional short and long-term training and hold research degrees.



WRRI Building in Qanater



WRRI personnel and qualifications

### Specializations

1. Performing hydrological and geo-hydrological research to evaluate and develop traditional and non-traditional water resources and studying related environmental, social, and economical implications.
2. Conducting necessary water policies targeting more efficient programs for horizontal and vertical expansion for sustainable development.

3. Studying the most appropriate procedures for forecasting flash floods, rainfall, and inflow of the Nile River to support planning and management of water resources.
4. Studying side effects of Upper Nile projects and presenting various alternatives to minimize their negative impacts.

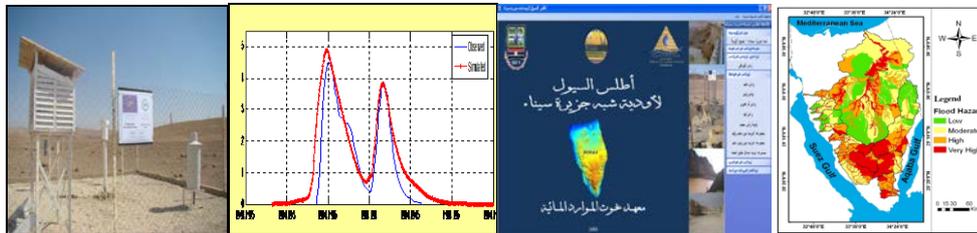
### Institute's Departments

The institute has four main departments.

#### Hydrology Department

The main activities of this department are:

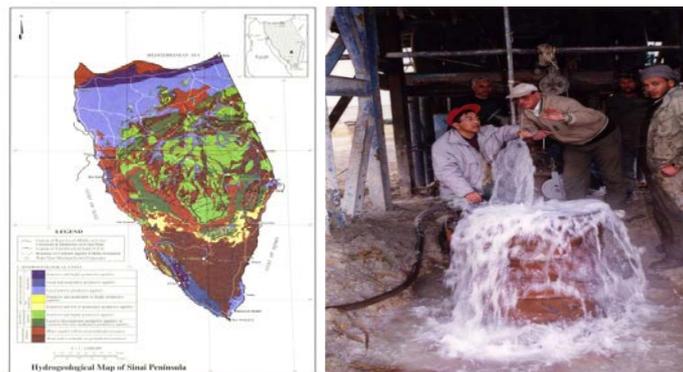
- ❖ Establishing digital monitoring station to observe and measure different meteorological parameters
- ❖ Analyzing satellite images, topographical, and geomorphological maps. Developing an integrated hydrological database.
- ❖ Studying rainfall – runoff relationships.
- ❖ Developing Innovative early warning system.
- ❖ Designing, constructing and supervising different water structures.
- ❖ Estimating flash flood volumes for water harvesting and protection.
- ❖ Conducting hydraulic analysis to determine floodplain.
- ❖ Developing flood hazard and risk maps.
- ❖ Preparing flood Atlas for Egyptian governorates.



#### Geohydrology Department

The main activities of this department are:

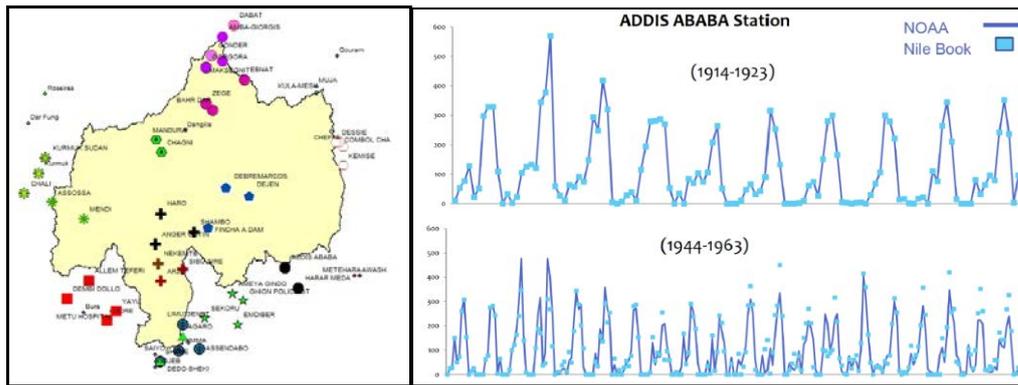
- ❖ Research studies of shallow and deep regional aquifers.
- ❖ Groundwater development and Management
- ❖ Performing well fields design and supervising well drilling.
- ❖ Developing hydrogeological maps, and groundwater Atlas



#### Nile Basin Department

The main activities of this department are:

- ❖ Finding solutions to minimize the negative downstream impacts of large development projects in upstream riparian country
- ❖ GIS analysis and Mapping of the Nile basin hydrology.
- ❖ High and low flood analysis and prediction
- ❖ Evaluation and feasibility Studies of Nile basin projects.
- ❖ Evaluation and feasibility Studies of Nile basin projects.



## Water Resources Management and Planning Department

The main activities of this department are:

- ❖ Integrated water resources management to balance environmental and socioeconomic requirements.
- ❖ Best practice in transboundary water resources management.
- ❖ Developing studies for traditional and nontraditional water resources.
- ❖ Legislation for efficient use and protection of water resources.
- ❖ Design of surface and groundwater monitoring network based on influence coverage to incorporate real time information.
- ❖ Set procedures and standards for optimum utilization of flood protection and water harvesting structures.

## Facilities and Tools

WRI employs the most modern techniques and technologies to accomplish the anticipated tasks.

### ➤ Integrated Computer Network

The Institute has technical facilities to perform various tasks as information and communication technology (ICT). These tasks have been developed to support information systems especially hardware and applications to store, convert, process, secure, retrieve securely all the required datasets. The institute operates two types of computers; 69 desktop computers and 19 Laptops with their accessories like plotters, printers and scanners which are regularly upgraded. All PCs and other devices are connected by a Local Area Network (LAN) and can access the internet through Mikrotik Routerboard in 1 ADSL 4 MB.

The institute has developed a backup system for storing and retrieving data and information. The Institute has host storage for e-mails and has a website: [www.wrii.org.eg](http://www.wrii.org.eg). Advanced software are used in WRII such as: Rockorks 12, Aquifer Test Pro, HYFRAN, GMS, Aquachem and others to conduct simulation studies.

### ➤ Remote Sensing and GIS Mapping Unit.

The institute uses the remote sensing and GIS in the application of water resources studies.

### ➤ Early Warning System Network

Early Warning Systems (EWS) can provide additional lead time which may reduce damages. Yet, many challenges still exist to achieve operational, accurate forecasts. Rainfall events in arid areas are hard to forecast as they are irregular, highly variable in space and time and often highly localized. Also, hydrological and hydraulic understanding are challenging due to insufficient insights in the response of a Wadi to rainfall events

### ➤ Geophysical Instruments

Geophysical methods are applied to investigate subsurface materials and structures which are likely to have significant engineering implications. WRII is carrying out geophysical and lithological studies to determine the aquifer geometry and the best location for test wells at water harvesting structures

### ➤ Surveying Equipment

The Institute has very powerful surveying system that is responsible for all field work requested prior to any research study. The system is equipped with the following facilities and instruments:

- GPS 1230 Leica Model
- GPS Navigation ( Magellan Explorist 600)
- Total Station 1203 Leica Model
- Total Station 1100 Leica Model

### ➤ **Database Unit**

WRRI processes a tremendous amount of data and information. Most of the data are computerized and regularly updated. The institute developed geo-referenced Nile basin database using the latest data monitoring tools. The database includes meteorological data of 72 weather stations and digital rainfall recorders covering Sinai Peninsula, Eastern desert, Northwestern coast from Alexandria to El Sallum and Nile valley (Upper Egypt). The database includes also the hydrogeological data of different aquifer systems in the desert areas.

### ➤ **Monitoring Network**

Different types of stations are installed all over Egypt to measure rainfall, temperature, humidity, solar radiation, wind speed and direction and evaporation. Water level recorders are also installed at the outlet of representative experimental basins.

### ➤ **Mathematical Models**

**Modflow Model:** is used for analyzing groundwater flow under various hydrologic conditions by solving the partial differential equations describing the movement of groundwater through porous media, it predicts the movement of groundwater, decline or rise in the level and the spread of highly saline water into the aquifer based on the boundary conditions, hydrogeological layers, external stresses such as wells and steams.

#### **Watershed Modeling System (WMS):**

The Watershed Modeling System (WMS) is a modeling system for watershed hydrology and hydraulics. WMS is capable of automated delineation of sub-watershed boundaries and flood extent. WMS includes graphical display options to aid in understanding the drainage characteristics of terrain surfaces as well as several computation features

#### **Hydrologic Modeling system (HEC-HMS) and Gridded Surface Subsurface Hydrologic Analysis (GSSHA) are used to simulate different basins.**

**HEC-HMS:** is designed to simulate the precipitation-runoff processes of dendritic drainage basins. It can be applied for a wide range of geographic areas for solving the widest possible range of problems. This includes large river basin water supply and flood hydrology, and small urban or natural watershed runoff. The model output hydrographs are used directly or in conjunction with other software for studies of water availability, urban drainage, flow forecasting, future urbanization impact, reservoir spillway design, flood damage reduction, floodplain regulation, and systems operation.

### ➤ **Library**

WRRI maintains a specialized library that contains more than 1000 text books, scientific journals and periodicals related to hydrology, groundwater, water resources development, computer sciences, project management, Geographic Information System (GIS) and remote sensing, and the Nile basin data volumes. The Institute owns a complete set of Audio visual equipment as well as photography workshops.

### **Training Courses**

WRRI organizes several workshops and training courses in cooperation with the Training Sector for Water Resources and Irrigation and the Hydraulics Research Institute Training Center. These courses are directed to Arab, African and Egyptian engineers and researchers. Examples of these courses are:

- Appropriate Management of Land and Water Resources for Sustainable Agriculture in Arid and Semi Arid Regions.
- Rain Water Harvesting and Flash Flood Mitigation Measures.

### **Regional and International Cooperation**

WRRI obtained excellent regional and international recognized reputation through conducting technical consultancy services and cooperation with different agencies that have similar interests all over the world. It is actively cooperating with Saudi Arabia consultancy and governmental agencies, Japan International Cooperation Agency (JICA), European Union (EU) consultants, and China research institutes in several joint projects and training courses that address a range of water related issues. In addition, WRRI has recently completed several projects focusing on IWRM and projects related to stakeholder engagement such as:-

- Flash Flood Management (FlaFloM) LIFE Project (2007-2010)
- Rainfall estimation from remote sensing data in Sinai peninsula (2007-2009)
- Flow Regimes from International and Experimental Network Data (FRIEND/Nile) project (2001-2006) and (2006-2011)

### **Consultancy services**

WRRI can provide expert consultations for interested agencies and clients all over the world. The consultation includes studies, supervision, experimental, and field investigations as well as training of engineers, technicians working in the field of water-related projects. Consultations cover the following fields:

- Site and field investigations for optimum design and implementation of flash floods mitigation measures
- Statistical analysis of Hydrological data
- Hydrologic studies for water harvesting, and flood protection
- Hydrological and optimization studies to secure Egypt limited water resources due to upper Nile basin development
- Hydraulic studies for management of wadi flood plains
- Surface and groundwater modeling
- Environmental and socioeconomic studies of water resources projects
- Performing studies of water resources policies and strategies for supporting decision makers.
- Supervising implementation process of different type of infrastructures and mitigation measures
- Designing and implementation of database, hydrological, hydrogeological, hydro-chemical and meteorological monitoring network.
- Processing and analyzing different types of Earth observation Images.
- Enhancement of pilot projects for testing different phenomenon
- Establishment of flood and water resources Atlas for enhancing secure development areas
- Preparation of tender documents for proposed projects.
- Construction of hydrologic and hydro-geological maps.
- Consultation of Desalination plants (Construction of withdrawal and injection wells)
- Qualitative Geophysical well logging interpretation and well design
- Supervision of drilling shallow and deep water wells
- Storm water management planning and design in urban areas

