United Nations
Educational, Scientific and
Cultural Organization

International
Hydrological
Programme

Governance of Groundwater Resources in Transboundary Aquifers (GGRETA)

The GGRETA Information Management System (IMS)

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Agency for Development and Cooperation SDC

igrac
International Groundwater Resources Assessment Centre

IUCN

The GGRETA project

Many groundwater systems around the world (or 'aquifers', as exploitable groundwater reservoirs are called) are transboundary, which means that they either extend over two or more administrative units inside a country or are crossed by international boundaries. The latter condition adds special challenges to groundwater governance and management. Moreover, governance of such transboundary aquifers (TBAs) requires building trust and fostering greater cooperation between states. In order to ensure the sustainable use of the mutual groundwater resources, various authorities in charge of groundwater should conduct information exchange and data harmonization across the national borders, based on transparency and benefit sharing. Accordingly, an appropriate assessment is necessary to improve their governance and management in order to prevent or mitigate conflicts over groundwater use.

The GGRETA project ("*Governance of Groundwater Resources in Transboundary Aquifers*") aims at gaining first-hand experience in this respect, on the basis of three pilot studies of transboundary aquifer systems in different parts of the world: the Trifinio in Central America, the Stampriet in Southern Africa and the Pretashkent in Central Asia. These three pilot case studies were selected to represent different major aquifer types and different transboundary contexts.

GGRETA is part of the *Water Diplomacy and Governance in Key Transboundary Hot Spots Programme* financed by the Swiss Agency for Development and Cooperation (SDC) and is implemented by the UNESCO International Hydrological Programme (UNESCO-IHP) in close cooperation with the International Union for Conservation of Nature (IUCN), the UNESCO International Groundwater Resources Assessment Centre (IGRAC) and national counterparts in all 3 case studies.

The first phase of GGRETA (2013-2015) was designed as an assessment phase, with three major objectives:

- Focusing the attention of the international community on transboundary aquifers, and providing examples of their assessment and diagnostics,
- Multi-disciplinary assessment of the transboundary aquifers and their context for the three pilot cases (Trifinio, Stampriet and Pretashkent),
- Fostering recognition of the shared nature of the groundwater resource and facilitating cross-border dialogue and technical exchanges.

The project responds to the pressing need of increasing the knowledge on the physical and socio-economic characteristics of transboundary aquifers. The project is an integral component of the UNESCO's International Shared Aquifer Resource Management (ISARM) Initiative and the Transboundary Waters Assessment Programme (TWAP).

The GGRETA Project conducted in-depth assessments of the three selected case studies

- Trifinio Aquifer (Guatemala, El Salvador, Honduras) (see next section)
- Stampriet Aquifer (Botswana, Namibia, South Africa)
- Pretashkent Aquifer (Kazakhstan, Uzbekistan)

Project outcomes also include the development of a common Information Management System (IMS). The GGRETA IMS is a crucial tool to provide efficiency and effectiveness of strategic decision-making, to facilitate and promote knowledge management and sharing within the groundwater community at regional and global scale. It is an easily accessible on-line platform developed to collect, store, visualise and share structured information in order to support the governance of the TBAs groundwater resources both at domestic and transboundary level. The GGRETA IMS is accessible via https://ggis.un-igrac.org

The GGRETA Information Management System (IMS)

The case studies

Trifinio Aquifer

GGRETA results indicate that the original "Trifinio Aquifer" actually consists of two individual aquifers: the 'Esquipulas' in Guatemala and the 'Ocotepeque-Citala' shared by Honduras and El Salvador. The aquifers are connected by the River Lempa, which contributes to the discharge and recharge of the aquifers.

Stampriet Aquifer

The Stampriet Transboundary Aquifer System is a large aquifer system situated in the southern part of the Kalahari desert and it is shared between Botswana, Namibia and South Africa. The aquifer system is well representative of groundwater resources in hot-semi arid regions of Africa, where groundwater is the primary source of water.

Pretashkent Aquifer

The Pretashkent Aquifer is an artesian transboundary aquifer shared by Kazakhstan and Uzbekistan. A constant lowering of groundwater heads has been observed, caused by overexploitation. The insignificant recharge of the Pretashkent Aquifer makes it practically non-renewable. This situation calls for further improvement of transboundary cooperation to enable sustainable use of the aquifer.

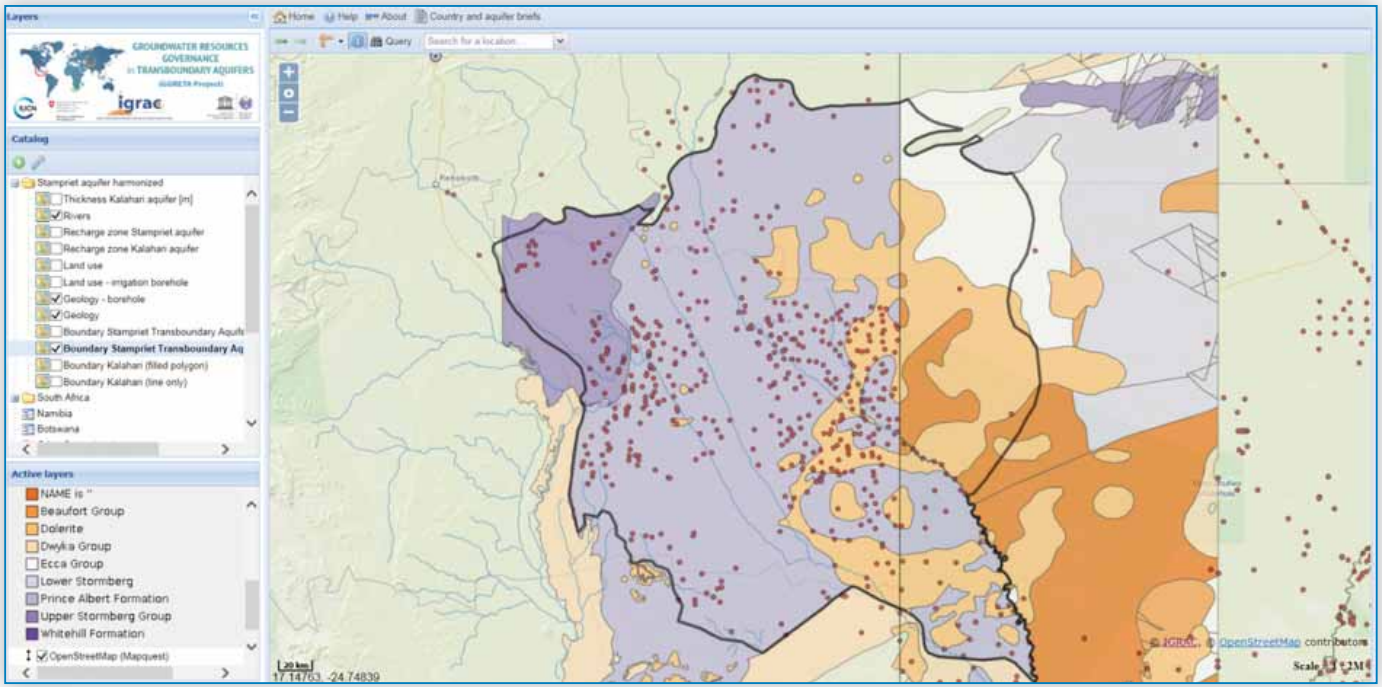
The GGRETA IMS has three project-specific dedicated workspaces.

With the advent of the application of geographic information systems (GIS) to facilitate decision-making, groundwater databases are becoming increasingly geo-referenced, thus enabling mapping of indicators for groundwater resources assessment.

The GGRETA IMS is a modern online GIS-based application that was developed by UNESCO-IHP and IGRAC to support decision makers and stakeholders involved in the governance of transboundary aquifers. It allows users to integrate, store, edit, analyse, share, and display spatial and geographic information (e.g. maps, tables, pictures) that result from the assessment activities conducted in the framework of the GGRETA project. Users can also create interactive queries (user-created searches), analyze spatial information, edit data in maps, and present the results of all these operations. Through regular updates, the GGRETA IMS will enable periodic monitoring of groundwater resources which is crucial for the sustainable management of transboundary aquifers.

General objective of the GGRETA IMS

The main objective of the GGRETA IMS is to provide stakeholders with an online platform to consistently collect, organise, regularly analyse and disseminate the information collected during the assessment of transboundary aquifers. The availability of a common information system facilitates cooperation between aquifer states and provides a tool to all stakeholders involved in the sustainable governance of the transboundary aquifer.

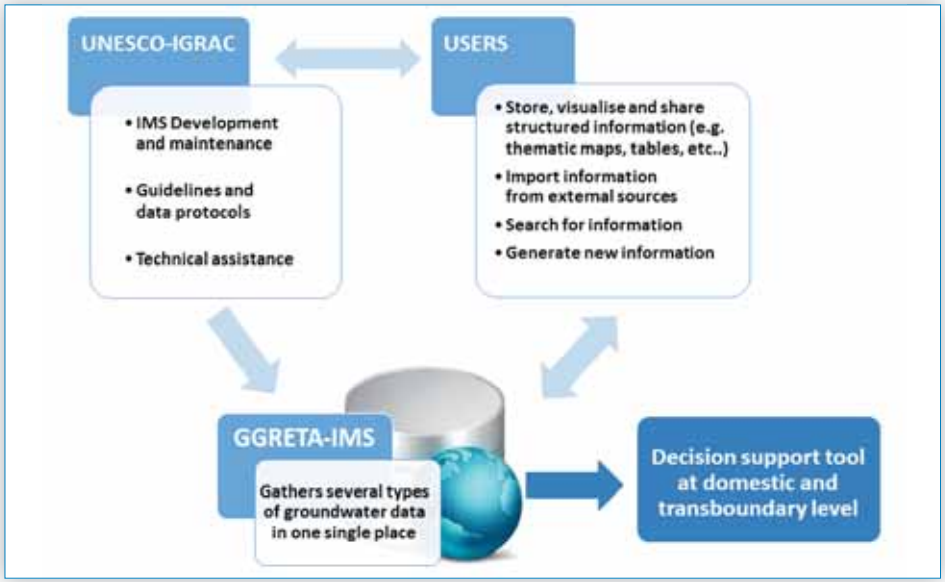


Other elements that contribute to the foundations of good groundwater governance are provisions for structural acquisition and management of data and information, awareness raising programmes and mechanisms for effective stakeholder involvement. A general condition for effective governance is that sufficient data, information and knowledge should be available and accessible to all. In order to optimally develop, manage and protect groundwater resources, reliable information is required. Information includes snapshots of static features collected during assessment studies, as well as time-dependent features collected by monitoring activities. Information needs to be converted to knowledge in order to enable stakeholders to take informed management decisions. Information

Role of the IMS in groundwater governance at domestic and transboundary level

"Groundwater governance comprises the promotion of responsible collective action to ensure control, protection and socially-sustainable utilisation of groundwater resources and aquifer systems for the benefit of humankind and dependent ecosystems. This action is facilitated by an enabling framework and guiding principles" (www.groundwatergovernance.org).

The first step towards improved governance is creation of an adequate information basis. This starts with diagnosing the current groundwater governance conditions in the area concerned. This diagnostic step helps defining which governance improvements are most relevant and how they may be adapted to local conditions and challenges. Critical in all cases is leadership, usually vested in a dedicated government organization, and political commitment.



management systems facilitate the presentation of analyses in a form that makes the messages understandable for those addressed. Information systems can also help achieving an effective and low-cost sharing of results among all involved stakeholders. Finally, useful knowledge can be interactively disseminated in the form of tailor-made messages for the general public.

Description of the GGRETA IMS

The GGRETA IMS is part of a larger information system that provides data on groundwater resources at the global, transboundary, regional and local scale: the Global Groundwater Information System (GGIS). The Global Groundwater Information System (GGIS) is an interactive, web-based portal to groundwater-related information and knowledge. The main purpose of the system is to assist in collection and analysis of information on groundwater resources and its sharing among water experts, decision makers and public. The GGIS uses open and extendable state of the art technology, which makes it possible to connect to more and more varied external data sources and systems on the internet

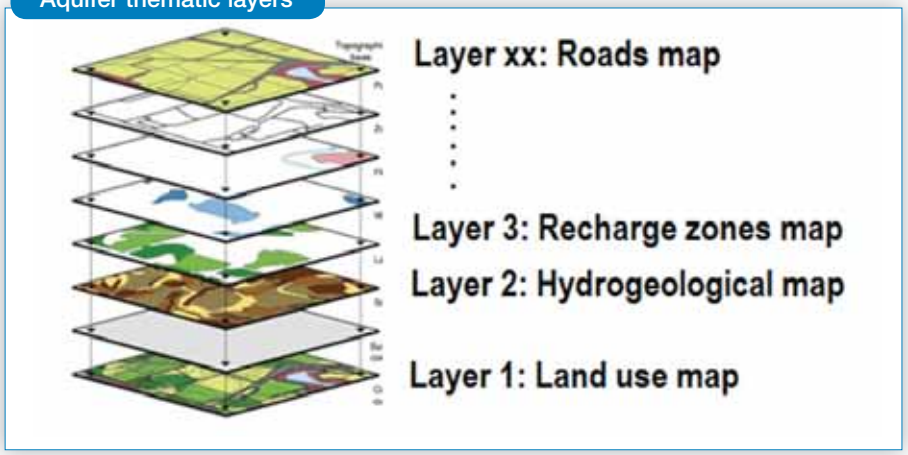
The GGRETA IMS

Is not just a database to store information. It is developed to assist in various ways the assessment, management and governance of the project transboundary aquifers. The IMS can be used to share and discuss preliminary results using the password protected environment (see next section). In its final form it is meant to store interpreted and processes data from the assessment of the groundwater resources in order to be used as a tool to support decision makers and relevantstakeholders actions.

What users can do in the GGRETA IMS

1. Store and visualize geospatial data and information, thematic maps, documents and images in a systematic way
2. Share and analyse results in a protected environment before making it publically available (see “Viewing modes”)
3. Add map layers from external sources via web map services (WMS)
4. Generate new pieces of information by creating overlays of thematic maps (see “Aquifer thematic layers”)
5. Build advanced queries (user-created searches) on attributes table

Aquifer thematic layers



The GGRETA IMS Viewer

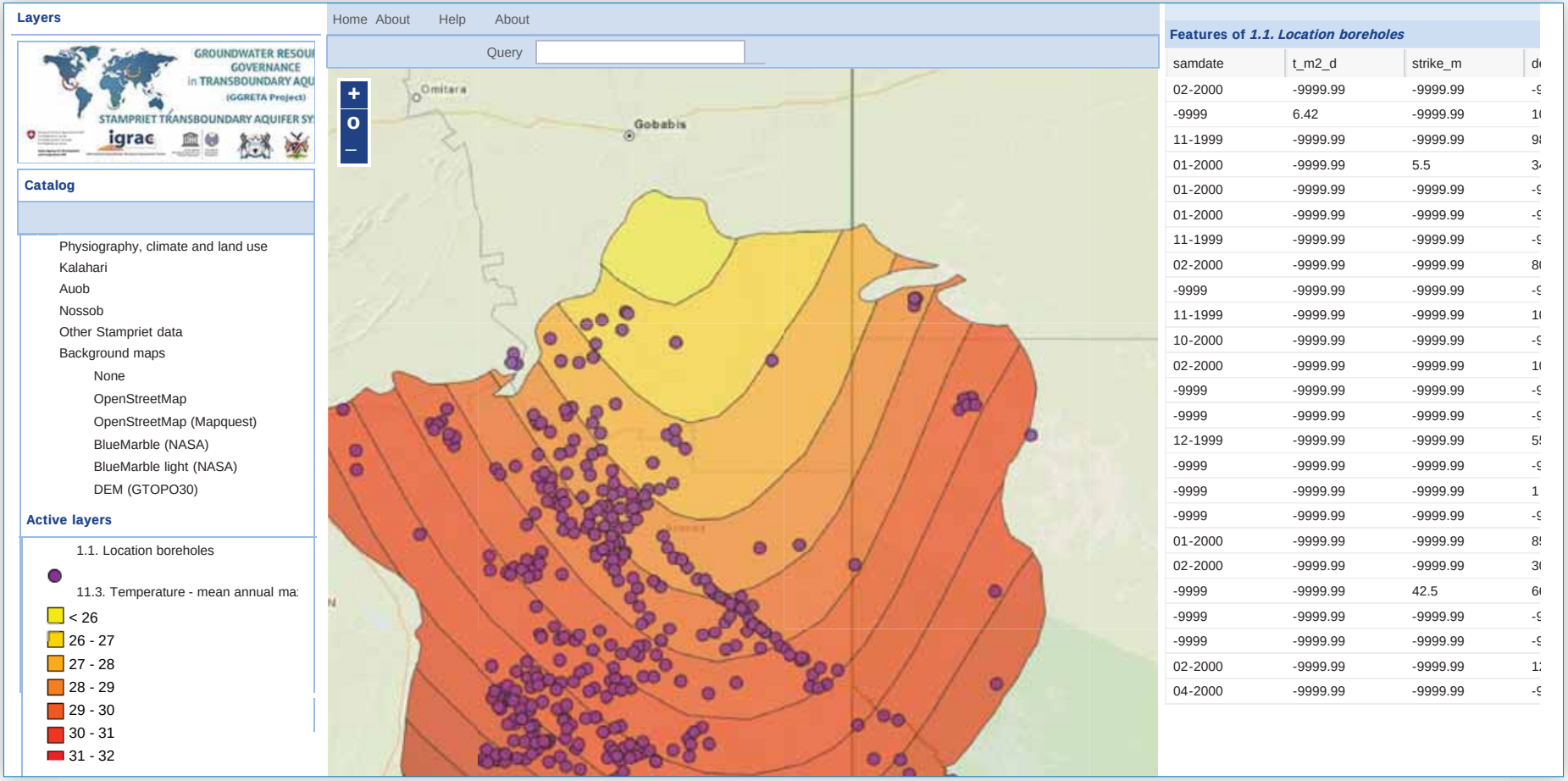
The GGRETA IMS Viewer interface contains:

1. A catalogue containing all map layers with data structured in a systematic way
2. Main menu and tools
3. A map view to visualise data and information on a geographic location
4. A features panel providing tabular output of the data

Viewing modes

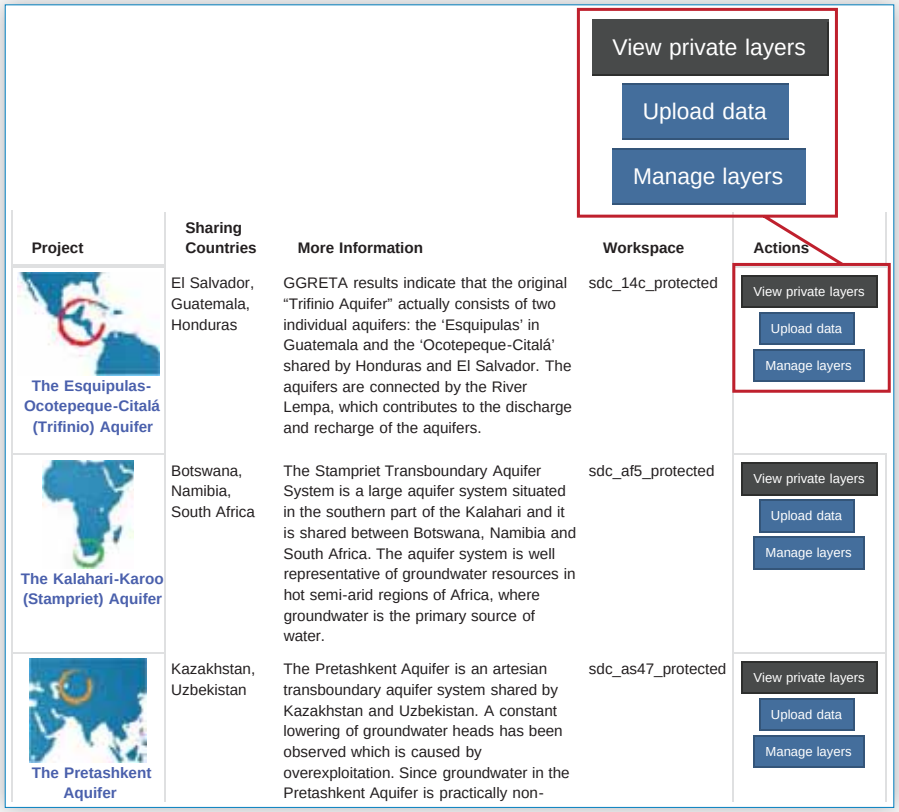
The GGRETA IMS has two different workspaces: the public viewer, freely accessible to anyone with internet access, and the protected workspace, which is a password protected and exclusively available to registered and authorized GGRETA users.

The *Protected aquifer workspace* is only accessible for registered GGRETA. In the protected workspace, registered users have access to a password protected environment where they can visualize, edit or manage the groundwater information related to the aquifer or region they are



related to within the project framework. The Protected workspace has two main functionalities: 1) it allows registered users to upload / update data themselves (map information and documents) and 2) it allows registered users to share, visualise, analyse and discuss results before making the data publicly available. In the current set-up it, administrators nominated by Countries have the authority to move data and maps from the protected workspace to the public view.

In the *Public view mode*, users are able to navigate through a map view and search for information related to the transboundary aquifer by clicking directly on the geographical units of interest. Information such as aggregated values or spatially distributed data of parameters and indicators values derived from the assessment is displayed in an interactive map view. All meta-information (i.e. "data about data") is accessible to facilitate interpretation of the assessment results. In addition, a query tool allows selecting/filtering geographical units based on parameter and/or indicator values. Data can also be downloaded as excel files. When administrators will give permission, data will be also available for download in shape-file format.



Project	Sharing Countries	More Information	Workspace	Actions
The Esquipulas-Ocotepeque-Citalá (Trifinio) Aquifer	El Salvador, Guatemala, Honduras	GGRETA results indicate that the original "Trifinio Aquifer" actually consists of two individual aquifers: the 'Esquipulas' in Guatemala and the 'Ocotepeque-Citalá' shared by Honduras and El Salvador. The aquifers are connected by the River Lempa, which contributes to the discharge and recharge of the aquifers.	sdc_14c_protected	View private layers / Upload data / Manage layers
The Kalahari-Karoo (Stampriet) Aquifer	Botswana, Namibia, South Africa	The Stampriet Transboundary Aquifer System is a large aquifer system situated in the southern part of the Kalahari and it is shared between Botswana, Namibia and South Africa. The aquifer system is well representative of groundwater resources in hot semi-arid regions of Africa, where groundwater is the primary source of water.	sdc_af5_protected	View private layers / Upload data / Manage layers
The Pretashkent Aquifer	Kazakhstan, Uzbekistan	The Pretashkent Aquifer is an artesian transboundary aquifer system shared by Kazakhstan and Uzbekistan. A constant lowering of groundwater heads has been observed which is caused by overexploitation. Since groundwater in the Pretashkent Aquifer is practically non-	sdc_as47_protected	View private layers / Upload data / Manage layers

Ownership

All uploaded data is safely stored in a server under the supervision of UNESCO-IHP and IGRAC, and is constantly accessible to the working group of a specific project. The data ownership remains with the data providers, namely the aquifer states and their national assessment teams, who decide which data can be should be in the private and public workspace.

System support

IGRAC provide technical support to their GGIS users. Online availability of data and assessments results - also after completion of the project - are therefore guaranteed.

Available online!

The GGRETA IMS is designed, implemented and maintained by IGRAC under supervision of UNESCO-IHP and is accessible via: https://ggis.un-igrac.org

For any further questions, comments or suggestions, please contact: IGRAC: info@un-igrac.org

This project is executed by the UNESCO-IHP within the framework of the Swiss Agency for Development and Cooperation (SDC) “Global Programme Water Initiatives (GPWI) – Water Diplomacy” activities.

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