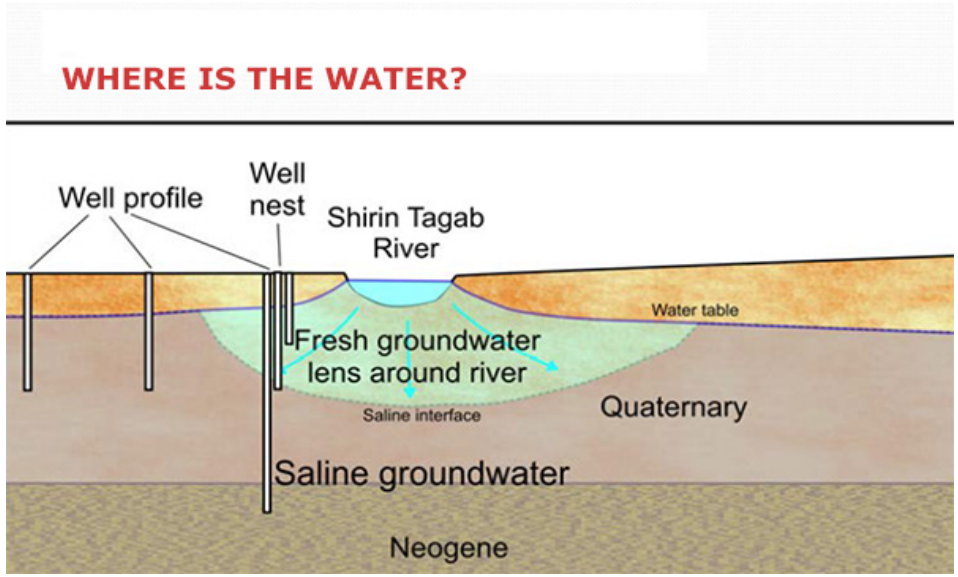
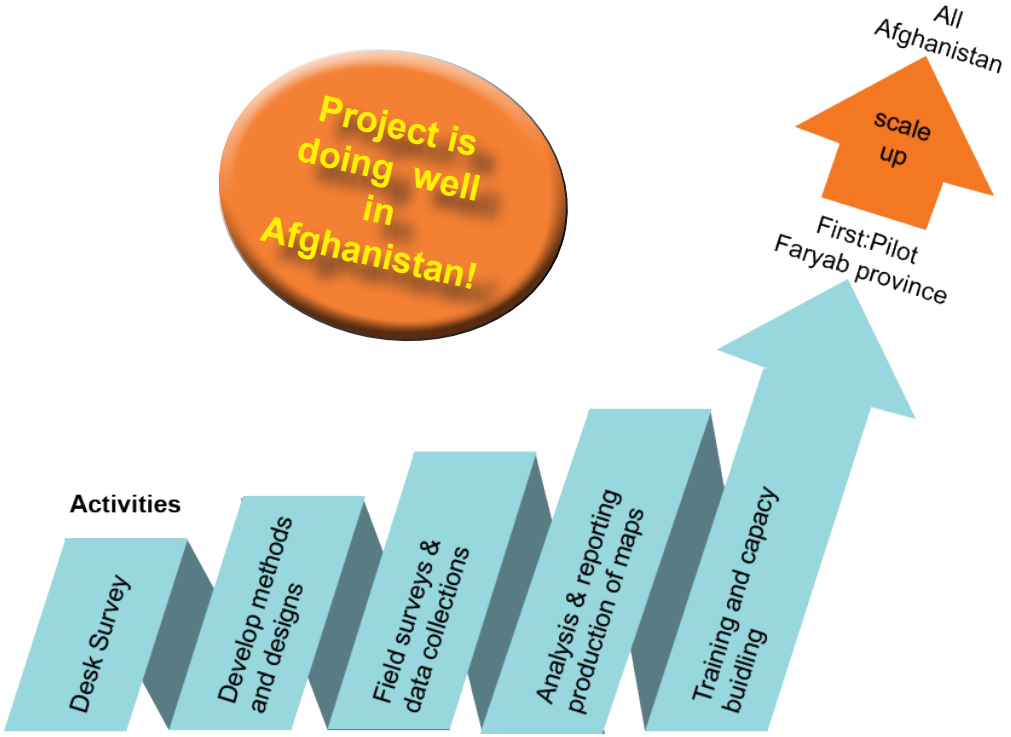
MRRD
RuWatSIP

MAPPING GROUNDWATER RESOURCES AND CAPACITY BUILDING.

- So that Afghanistan can locate, quantify, develop, utilise and sustainably manage its groundwater resources for the benefit of ALL Afghans in accordance with prioritised needs.





Capacity building and institutional development in the field of hydrogeology, with Faryab as a pilot province

Project Status, 24TH APRIL 2015,

Funded by: Norad

NORPLAN DACAAR

Abbreviations:

Sector organisations:

ANSA	Afghanistan National Standards Authority
AGS	Afghanistan Geological Survey (MoM)
AUWSSC	Afghanistan Urban Water Supply and Sewerage Corporation.
DACAAR	Danish Afghan Relief Organization
FAO	UN Food and Agriculture Organization
MRRD	Ministry Rural Rehabilitation and Development
GIZ	German International Cooperation Organization.
RuWatSIP	Rural Water Supply, Sanitation and Irrigation Program (MRRD)
JICA	Japan International Cooperation Agency
KFW	German Development Bank
MAIL	Ministry of Agriculture, Irrigation and Livestock
MEW	Ministry of Energy and Water
MoM	Ministry of Mines
MUDA	Ministry of Urban Development and Holusing
NCA	Norwegian Church Aid
NORAD	Norwegian Development organization
UMB	University of Life Sciences, Oslo, Norway
UNEP	UN Environmental Program
UNICEF	UN Children Fund
USAID	US AID
USGS	US Geological Survey
WSG	Water and Sanitation Coordination Committee.

CONTENT

HOW AND WHERE CAN WE FIND SAFE WATER TO SERVE ALL, - NOT JUST FOR ONE DAY BUT EVERY DAY?

WHY THE PROJECT?

18 million people in rural areas still without safe water!

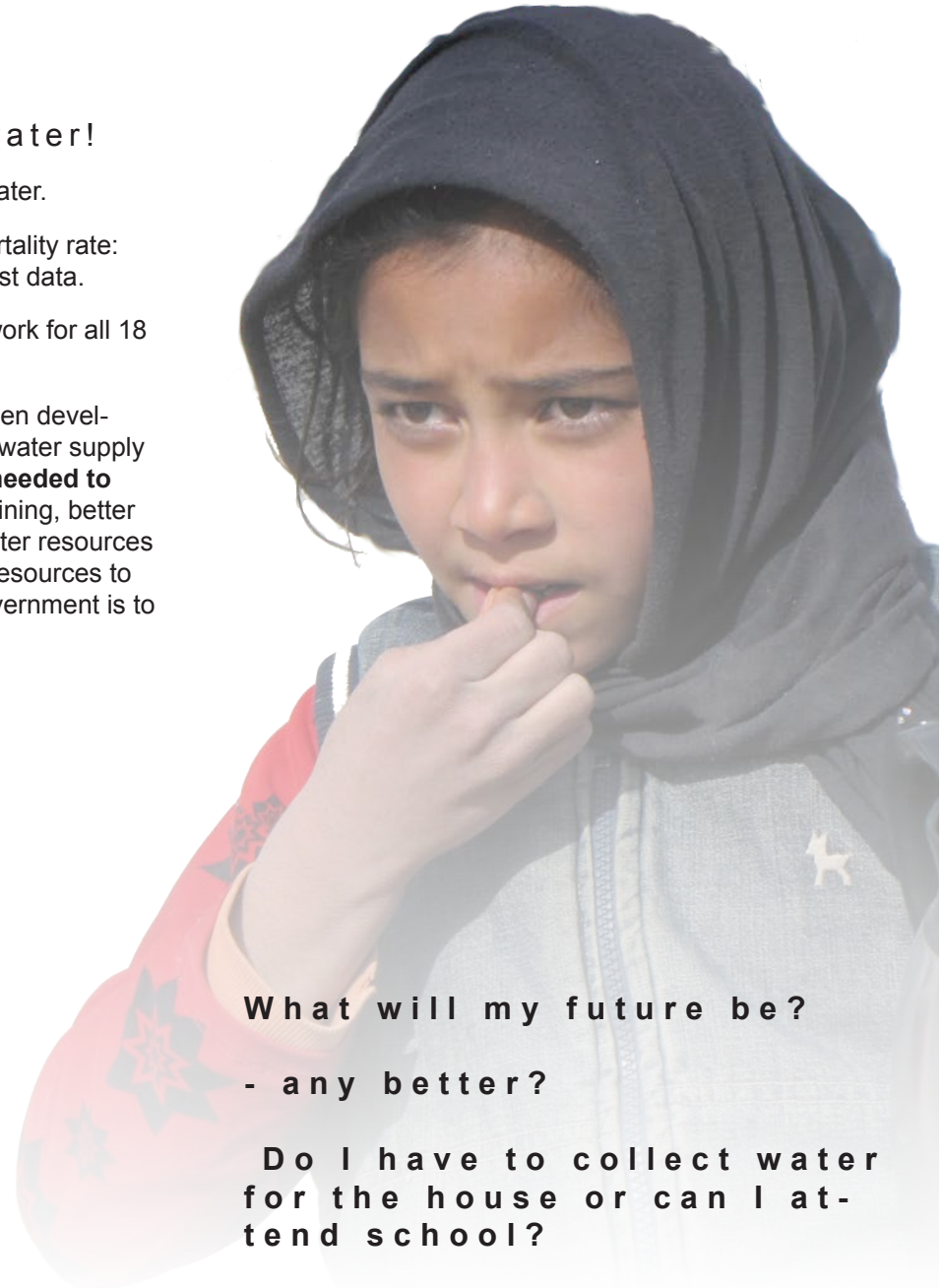
Of the 29 million Afghans living in rural areas, barely 40% have access to safe drinking water.

Safe drinking water is closely linked to public health, and Afghanistan has a very high mortality rate: approximately one in ten children dying before the age of 5 according to World Bank latest data.

MRRD is responsible for rural water supply and sanitation. This means that MRRD work for all 18 million to have access to safe drinking water.

The problem may now be that most of the easily available water sources have already been developed and it is becoming difficult to find water. **Groundwater is the main source** of safe water supply for rural areas. With ground water being increasingly difficult to find, **more expertise is needed to find and map groundwater availability**. This means that technical staff need better training, better equipment and effective institutional arrangements for handing of information. Groundwater resources need to be mapped so that all Afghans can have adequate safe water supply. For water resources to be sustainable, good regulation and monitoring of this vital resource is essential if the government is to manage all water resources in the best national interests.

Water must be available and
Safe to drink



What will my future be?

- any better?

Do I have to collect water for the house or can I attend school?

THE PROJECT

The project covers mapping, capacity building and institutional cooperation in the field of hydrogeology for the province of Faryab. It includes the following goals:.

Develop methoddologies for hydrogeological surveys.

- Develop methodologies for mapping groundwater resources in Afghanistan using Faryab as a Pilot Province.
- Design and develop methods for communicating information effectively to water sector staff (especially MRRD staff) to allow upscaling of mapping methodologies to all provinces in the country.

Test and demonstrate methodologies via a provincial survey in Faryab

- Using developed methods, collect data for Faryab, conduct additional surveys and prepare a hydro-geological rep developed methods, collect data for Faryab; conduct additional surveys and prepare a hydro- geological 'Atlas' for Faryab Province, showing distribution of groundwater resources, water quality, and potential quantity in different areas.

Design and develop GIS/ data management for visualization of hydrogeological maps and data.

- Plan data management and GIS solutions so as to prepare hydrogeological maps providing information to hydrogeologists, water engineers and others in need of water sector information.

Apply hydrogeological data to the design of water supply in 3 villages

- The project should use information from the survey in Faryab to prepare a plan for water supply for three villages (of less than 5000 population)

Training and capacity-building, (50 courses, 800 persons)

- Develop capacity empowering MRRD, RuWatSIP, MEW to continue mapping groundwater resources across Afghanistan.Coordinate capacity building with MEW, MoM, AGS and other key sector stakeholders including DACAAR, GIZ, UNICEF etc.

Funding: NORAD

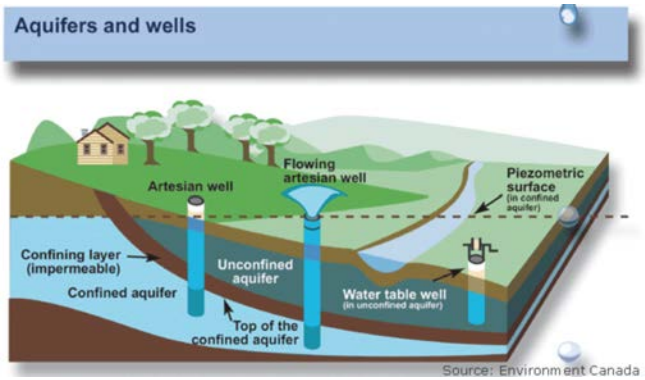
Project owner: MRRD

Project duration: 2012-2015

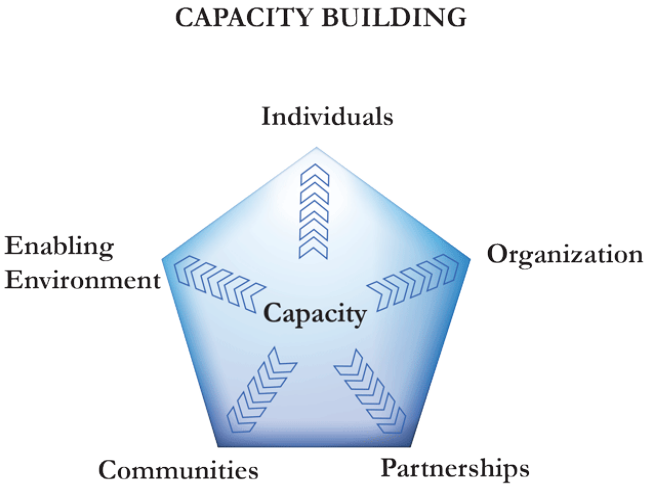
Implementation arrangement:

The Norwegian consultant, NORPLAN was awarded the assignment to implement the project under MRRD. It was agreed by NORAD that DACAAR should be the local partner for the project.

Map showing main project areas. One province complete, 33 remaining before whole country is covered



How to conduct groundwater mapping in Afghanistan using Faryab as pilot province



Sustainability and up-scaling is based on developing local capacities to continue work nationwide

RUWATSIP, MRRD

NORPLAN DACAAR

DEVELOPMENT OF METHODS	PROJECT ACTIVITIES	TRAINING & CAPACITY BUILDING	OUTPUTS
Design hydrogeological methods	Collect data about ground water resources, desk study, field survey	**About 25 short courses run twice** practical/theoretical 3 geophysical investigations 8 hydrogeology	200 - 400 persons trained Provincial hydrogeological survey methodology developed
Design Database / GIS-MIS system	Data analysis, make GIS & Web ground water user maps	5 GIS -database software 2 data capture/managem	Hydrogeological survey for Faryab province (pilot) Database for hydrogeological data set GIS Hydrogeological mapping system for pc and paper maps Web "Water Use Atlas"
Prepare methods for use of hydrogeo data in water supply planning and design	Use maps to plan/ design good rural water supplies	3 Plan. WS using maps 5 WS technology & design 2 O&M, managem, social	Capacity building in MRRD RuWatSIP and sector agencies Survey and prelim design WS for 3 towns

NORAD Support to MRRD, RUWatSIP for Capacity-Building and Institutional Cooperation in the Field of Hydrogeology for Faryab Province, Project

HOW MUCH GROUNDWATER IS THERE FOR US TO SHARE?

- Should water be shared?
- How can we share if we don't know what we have and where we can find it?
- How are groundwater systems replenished?
- GROUND WATER MAPPING IS NEEDED
- Government to set the priority for use?
- What about regulation and enforcement?

MANY SMALL USERS

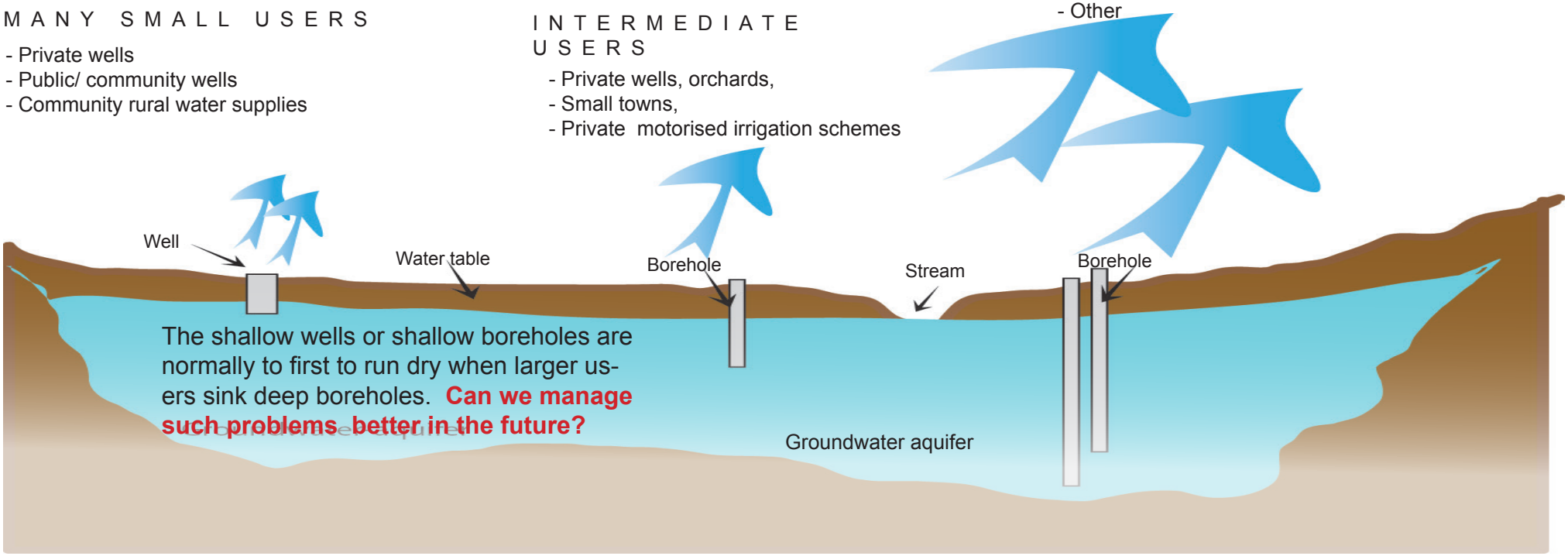
- Private wells
- Public/ community wells
- Community rural water supplies

INTERMEDIATE USERS

- Private wells, orchards,
- Small towns,
- Private motorised irrigation schemes

LARGE USERS

- Irrigation schemes
- Large private users
- Larger public/ private water supply
- Industry
- Other



PROJECT PHASES

INCEPTION

Hon. Minister MRRD, and Norwegian Ambassador at the Inception and project launch.

All Norplan team and local partners with Director Qader in MRRD
February 2012.

PLANNING

Annual Meeting MRRD - NORAD at MRRD, Dir.. Qader, and Hon. Deputy Minister Ismati Tariq.

Bridging workshop and MRRD.
Nov 2013.

IMPLEMENTATION

Annual Meeting MRRD - NORAD Kabul, Mr. K. Kristmoen, NORAD, Hon. Deputy Minister Ismati Tariq and Dir. Qader, Nov. 2014

Midterm review/workshop and MRRD;
Feb. 2014

KEY LOCAL RESOURCE PERSONS PARTICIPATING AS TRAINERS OR CO-TRAINERS.

- important local resources enabling continuity and future water sector capacity-building.

Good local expertise for use in continue training

NO	Name
	University training expert resources

Prof. Naim Eqrar. Professor at Kabul University. National Training expert. Presenter and co-presenter in most Norplan training courses.

Prof. S. Zarinkhail. GIS expert to handle data management and preparation of databases, ArcGIS maps, and training coordinator for GIS-MIS activities under the project.

Prof. Noor Ahmad Akhundzadah. Dean at Env. dept. at Kabul university. Co-trainer in hydrogeology and geophysics courses

Prof. M. Najaf. Professor at Kabul Polytechnic University. Presenter of training course in hydrogeology.

Assoc. Prof. Shekeb Shamal is DACAAR WET Centre part time trainer who is responsible for facilitation of Social Organization and O&M of Rural Water Supply training workshops (Kabul University)

Eng Pervaiz A. Maseri. Presenter in training course for use of total station surveying equipment. Associate Professor at Kabul Polytechnic University.

NO	Name

Lecturer M. Iqbal, GIS expert and trainer in GIS courses. Lecturer at Maiwand University

Dr. Barat. GIS expert, lecturer at Maiwand University. Presenter at several training courses at the project.

Eng. Atta. Presenter in training courses in data management covering Excel.

Ministry experts and resource persons

Eng. Jalil. Senior hydrogeologist at MRRD, RuWatSIP. Attending and participating in training courses. Provided expert support in hydrogeological and geophysical training courses

Eng. Yousuf. Vice dean of Hydrogeology department in MEW. Partly presenter and co-trainer for training course in well drilling methods and provided demonstration of soil testing in MEW soil lab (sieving analysis)

Abdul Munir. Very experienced expert in MIS/ GIS. Used to work in MRRD, now in MAIL. Backstopping institutional adviser and support to GIS training courses.

Eng. Ali Poya. Senior hydrogeologist at MRRD providing support as co-trainer for many of the hydrogeological courses presented by Andrea de Jong.

NO	Name
	NGO experts, resource persons ,consultants

Eng. Naqibullah Abrar. Deputy team leader, in NORPLAN, providing logistical and technical support for courses. Directly involved in Quality Control training courses as co-trainer

Eng. M. Hassan. An experienced senior hydrogeologist from DACAAR.Supervisor of data collection in the field for hydrogeological surveys, Presenter and co-presenter in hydrogeology, GPS, Water Quality courses.

Eng. Jawid. Working in DACAAR and working closely with Eng Hassan. Support in training courses, demonstrating water quality testing using field kits. Support for analysis of geophysical data in courses and for Water Atlas.

Eng. Azim Barat is DACAAR WET Centre part time trainer who is facilitator and trainer at DACAAR courses run for NORPLAN

Eng. Ehsan Bayat. Working at NCA. Senior hydrogeologist. Participated and co-trainer in one course in hydrogeology.

Key professional staff involved in the project

Rev. 5th March 2015

MRRD, Ru-WatSIP

DIR. G. QADER
Client & project owner

M.AFZAL SAFI
Proj.Coordinator

M. NAEEM
Sen. Water Eng.

ENG A.JALIL
Sen. hydrogeologist

ENG.MIRWAIS
Dir. PRRD, Faryab

E.A. POYA
Sen. hydrogeologist

S. JAMALUDDIN
Section head. hydrogeology

A.AHMADI
MIS-GIS officer

N.DAREEZ
Training Coord.

NORPLAN
Consulting Engineers and Planners

S.STOVELAND
Team leader

D. BANKS
Sen. Hydrogeologist

A. DE JONG
Sen. hydrogeologist/ Trainer

A.NORBØ
trainer

N.ABRAR
Deputy Team leader

T.G. ØVERLI
MIS/GIS/It

F.R. HAUGAN
MIS/GIS/It

S.R. BERGHEIM
MIS/GIS/It

PROF. N.EQRAR
Nat. Training expert

PROF.ZARINKHAIL
MIS/GIS/It

G.GREÅSTAD
Sen. Hydrogeologist

E.EIKAAS
Gender expert

K.T.ELLEFSEN
HQ Adm/Inst expert

M. MUNIR
MIS/GIS/It

M.NASIR
Trainning logistics

M. HABIBULLAH
Security/ logistics

B.HULTMAN
HQ Security/Adm.fin

R.YOUSOFI
Adm.fin. Kabul

DACAAR

SHAH WALI
Head of program,

L. VIJSELAAR
Wash Adviser

M. HASSAN
Sen. Hydreogeologist

A. BARAT
WETC Manager

A. JAWID
Hydrogeo.+ MIS/GIS

M. HADI
Hydrogeologist ; Faryab

M. FAISAL
Security officer

B.BHANDARI
Proj. Coordinator 2014

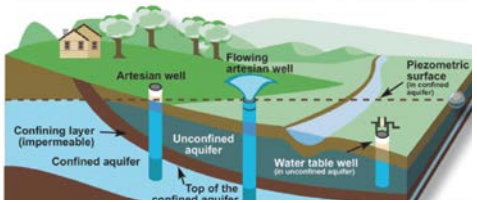
HYDROGEOLOGY

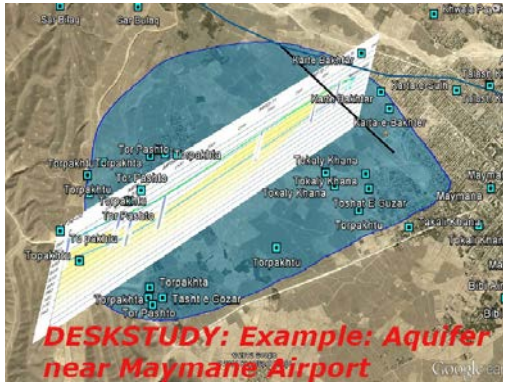
What is Hydrogeology?: Hydrogeology covers the occurrence , distribution, movement and exploitation of groundwater.

Technical assignment for hydrogeological mapping:

This project utilizes hydrogeological expertise to develop methodologies for finding and mapping groundwater resources in the pilot province of Faryab. The component activities are indicated by the photos below.

Using the data acquisition techniques and methodologies developed for Faryab, the project could be up-scaled to facilitate groundwater mapping covering all the provinces in Afghanistan. For this to happen, capacity building in MRRD and MEW is necessary.

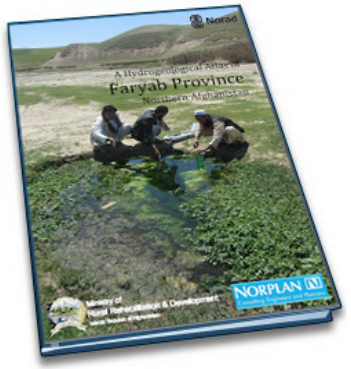




Desk study

Field sampling and surveys

Exploratory drilling



Data analysis and reporting

A textbook showing how to analyse and present result

Spring, Rainwater and Soil Sampling in Faryab

Geophysical Investigations

Exploratory Drilling

Management of Field Operations, Data Collection and interpretation

OUTPUT : WATER ATLAS FOR FARYAB

The NORPLAN project has strongly suggested that the key factor in promoting an understanding of groundwater in Afghanistan is :

- The curation of hydrogeological data in the public domain

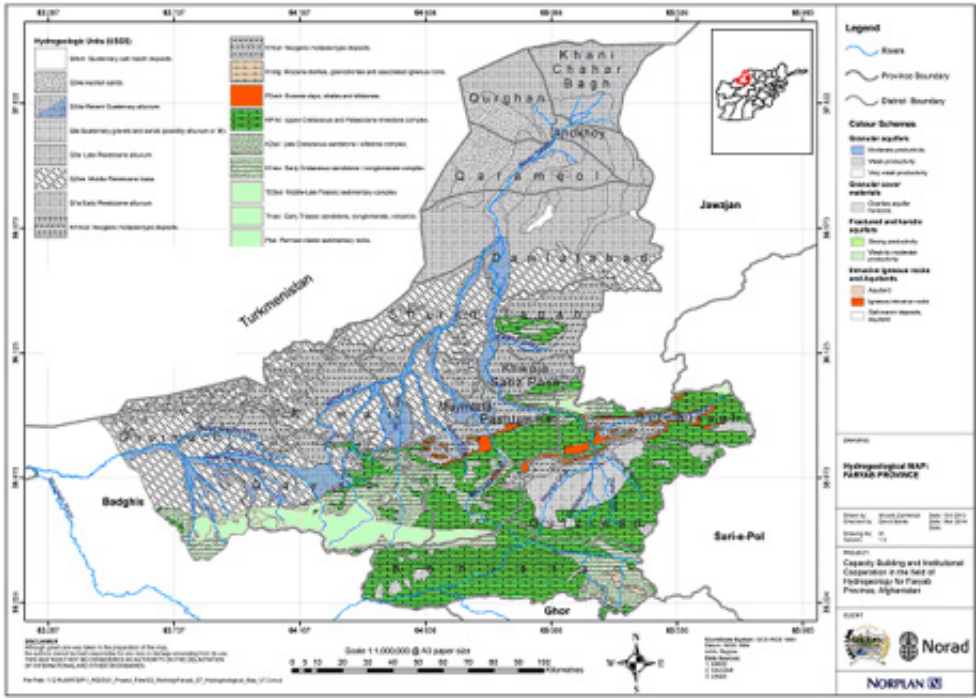
Data on geological outcrops, river and spring flows and borehole logs has progressively been made available to the general public via the Internet. Examples include

- A fruitful collaboration between the Afghan Geological Survey and the US Geological Survey (http://afghanistan.cr.usgs.gov/)
- NORPLAN's own incorporation of borehole data, previously curated by organisations such as DACAAR, into a WebGIS environment (http://www.norplan.af/Page_GIS_Web_maps.html)

In addition, NORPLAN has developed a hydrogeological map of Faryab Province, utilising the International Association of Hydrogeologists' standard legend.

HYDROGEOLOGICAL MAP OF FARYAB PROVINCE

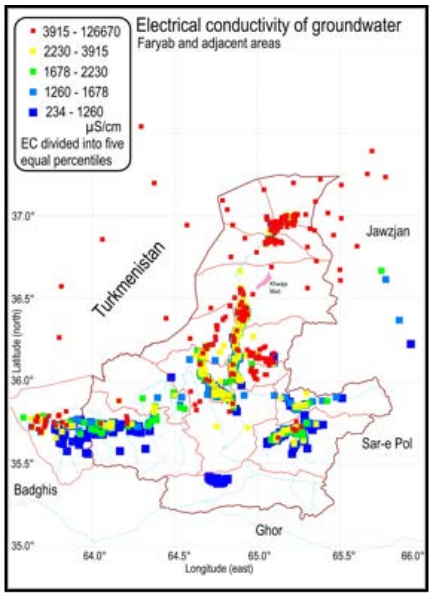
NORPLAN has also produced a Hydrogeological Atlas of Faryab Province. The Atlas is designed to be



- An accompaniment to the Hydrogeological Map,
- A commentary to the raw data made available on the Internet,
- A summary of our current conceptual understanding of groundwater in Faryab (and its interaction with surface water systems).

The Atlas comprises twelve Chapters, dealing with the history, physiography and topography of Faryab, its meteorology, its surface waters, its geology and hydrogeological units, its wells, springs and boreholes, its groundwater chemistry and stable isotopes and its thermogeology and geothermal potential. The Atlas concludes with a section on the estimation of groundwater recharge and the sustainability of groundwater exploitation in Faryab. It discusses possible limitations and solutions to water supply issues in Faryab.

Faryab shares many topographic and geological features with Afghanistan in general, making it a highly suitable area for a pilot hydrogeological mapping project. Faryab exhibits stark contrasts in climate, topography and recharge.



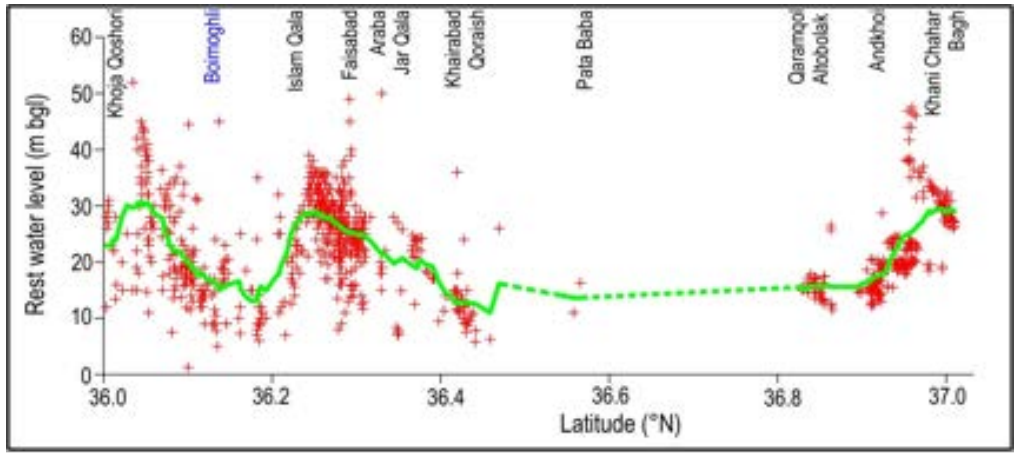
The electrical conductivity of groundwater in Faryab. Electrical conductivity is roughly proportional to salinity.

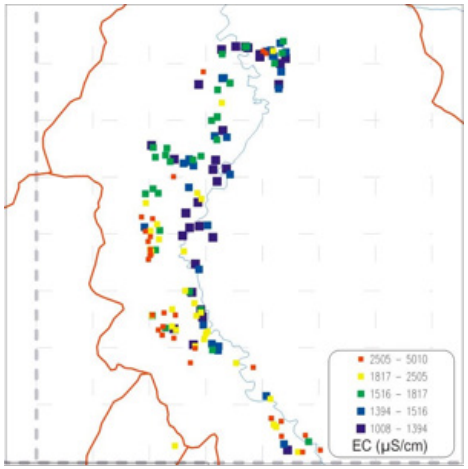
Towards the north, recharge decreases and water resources become scarcer. The ground and surface waters become progressively more saline.

NORPLAN's hydrogeological mapping has revealed a number of important factors, which are summarised in the Hydrogeological Atlas.

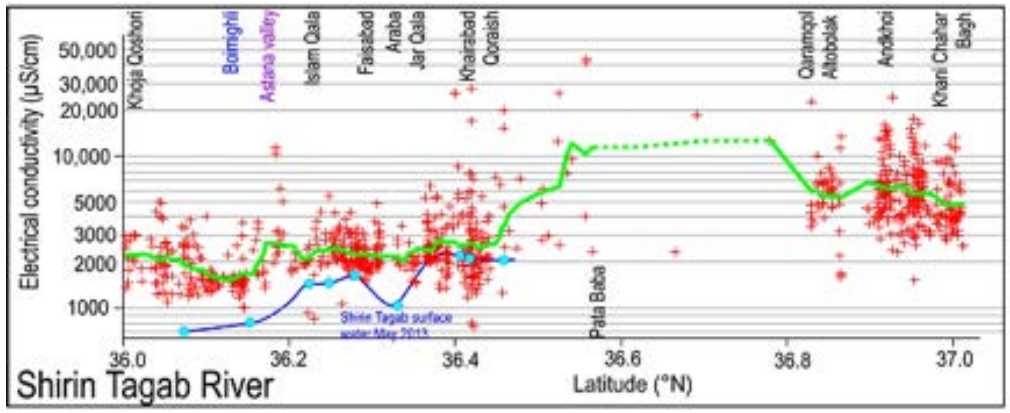
- Along the main river valleys (Shirin Tagab, Maimana and Chechaktu) in the central parts of Faryab, groundwater levels are typically 10-30 m below ground level, indicating that there is potential for the river water to provide indirect recharge to alluvial aquifers. In certain locations, in the vicinity of major springs, groundwater levels approach the surface, suggesting constrictions in subsurface flow channels.

Groundwater level (m below ground level) and groundwater salinity profiles along the valley of the Shirin Tagab River (blue line shows salinity of Shirin



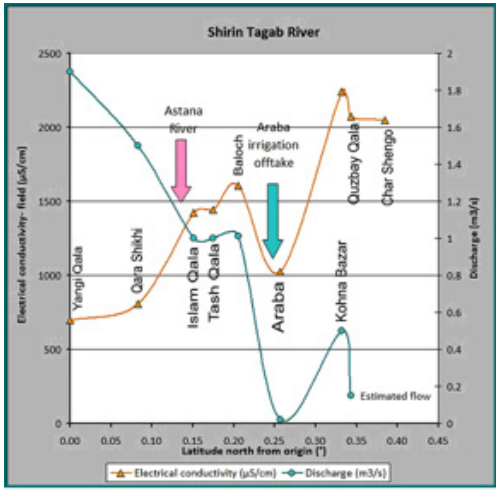


The electrical conductivity (salinity) of groundwater near the Islam Qala area of Shirin Tagab District. Fresher groundwaters are found immediately adjacent to the Shirin Tagab River (blue line).

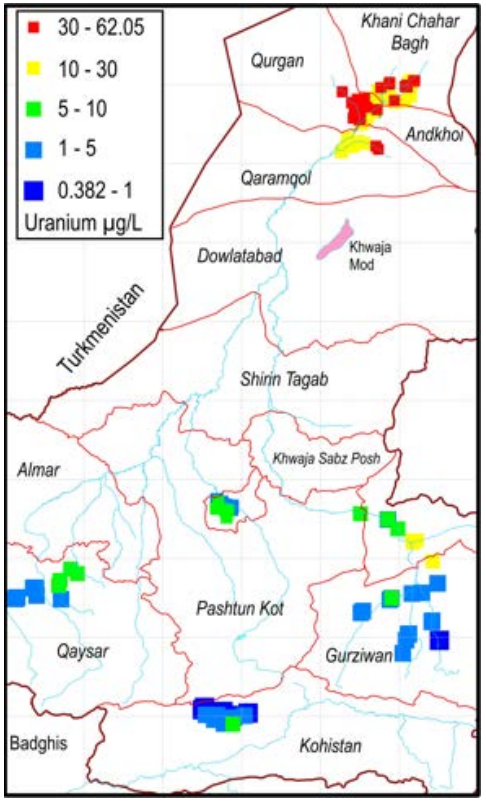


Tagab River in May 2013).

- Along these main river valley aquifers, river water is typically less saline than groundwater, suggesting that indirect groundwater recharge from rivers could be identified by zones of lower groundwater salinity adjacent to river channels.



River flow and electrical conductivity of the Shirin Tagab River, Faryab Province (spring 2013) This suggests a strong influence of evapotranspiration on water flows and quality



Map of dissolved uranium concentrations of groundwater from Faryab. The WHO suggests a provisional guideline concentration of <30 µg/L

GEOPHYSICAL BOREHOLE LOGGER

Under the project equipment has been procured to a fully-equipped geophysical borehole logging vehicle. This equipment will help us to collect information on groundwater and geological conditions in boreholes.

WHAT IS THE PURPOSE OF GEOPHYSICAL BOREHOLE LOGGING?

GEOLOGICAL MAPPING

- Identification of lithology
- Measurement of lithological parameters.
- Stratigraphic correlation between boreholes.
- Identification of aquifer units.
- Identification of fractures & secondary porosity.

GROUND WATER QUALITY

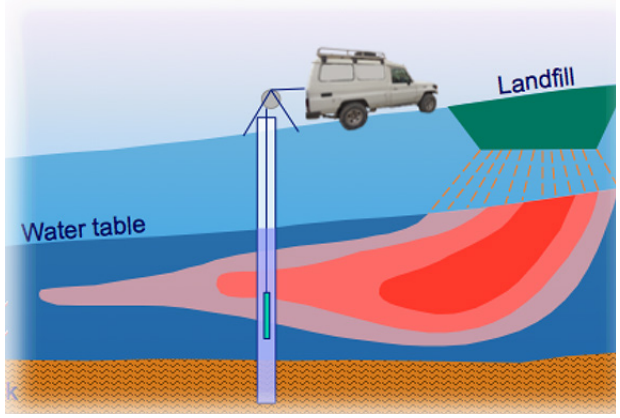
- Determination of groundwater quality. E.g. EC
- Identifying saline intrusion & contaminant plumes.

WELL INSPECTION

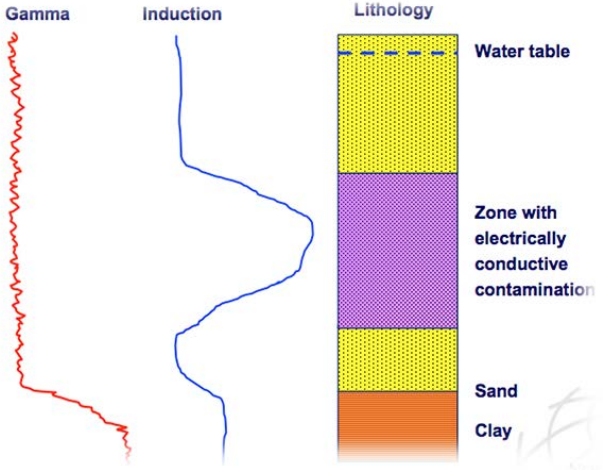
- Verifying well construction.
- Determining status of old water wells.
- Plan fishing operations.
- Pre & post well rehabilitation surveys.

LOGGING ARRANGEMENTS:

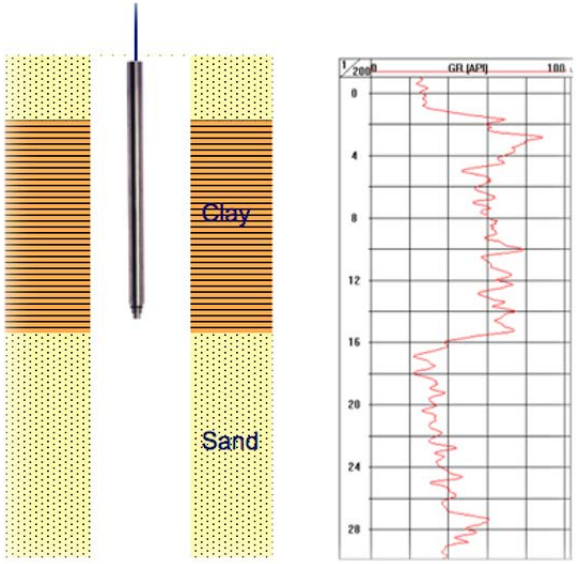
To illustrate the use and value of the logger an illustration is shown (below)where the water pollution from a landfill is investigated by logging the water quality.



The information collected can look like the diagram show below. The data collected require a certain level of training and experience to allow efficient interpretation.



Natural gamma for lithology identification



Using the camera a lot can be learnt about the well construction. It can be used for checking and inspecting new and old boreholes, verifying screen location or locating leaks.

Start with sinking a camera into the borehole: then check for leaks

struction. The seat and the tables must be arranged so operators can work comfortably. Storage must be provided for equipment: delicate equipment must be secured firmly during travel to avoid damage.

The first photo shows the re-fitting of the seating to allow enough legroom for the operators.

or check the screens where water is collected:

Below the supervising team inspects the completed vehicle installation.

Well logger construction

Andreas has all the time insisted that the people who are going to use the logger vehicle must be part of the design and supervision during con-

The photos above shows the well logger vehicle – a customized Land Cruiser - completely fitted with equipment. The fitting was designed and supervised by Norplan and a team of hydro-geologists and geophysicists from RuWatSIP , while the fitting was performed byToyota in Kabul.

A new great tool.
It works!!

MANAGEMENT OF HYDROGEOLOGICAL DATA

GIS AND MIS - DATA MANAGEMENT

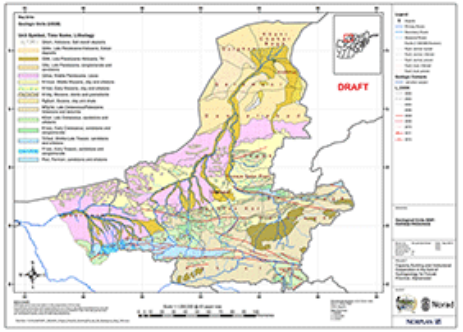
Definition GIS: Geographic information system. This is a system designed to capture, store, manipulate, analyse, manage, and present all types of spatial or geographical data.

Assignment under project:
Following the collection of huge amounts of data, the information should be curated and used for the development of the country. The data also needs to be quality-controlled so that the final outputs can be trusted.

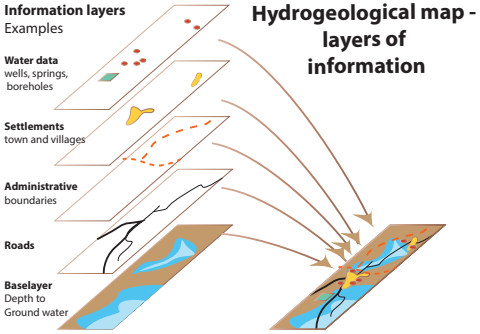
All hydrogeological data has been collected, screened, cleaned and assessed before entering into the designed database, and before producing paper and online maps.

Data collection

Data screening, and processing



Design and production of hydrogeological maps (paper)



Design and production of hydrogeological online web maps.

Data Collection

Data have been collated from many sources, but always starting with available and existing data. The data can be obtained from:

- Existing databases
- Drillers' borehole logs
- Geological maps
- Hydrogeological surveys and reports
- GIS maps
- Other data

Most of the existing data has been obtained from existing databases as WSG and DACAAR, with additional data from MRRD, MEW, and with maps from AGS and USGS and some others. Hopefully, in the future, data sharing and national databases can make things easier. Hydrogeological maps were also found in archives in Russia.

New data and surveys will have to be well planned and organised. In the case of Faryab, existing data was first collected and reviewed, then additional surveys for collection and analysis of field data, water and soil samples were planned and implemented.

Much of the data is collected in excel sheets, while borehole logs are shown in the figure "Borehole log Report." These logs are very useful for hydrogeologists to evaluate subsurface conditions.

Data processing.

The data has to be processed, cleaned, and quality controlled before being analysed. The preliminary analysis is done using EXCEL and ACCESS spreadsheet and database soft- ware. Once checked, the data is transported to ArcGIS software for production of desktop maps or for printing of maps.

The data management process is illustrated in the diagram to the right.

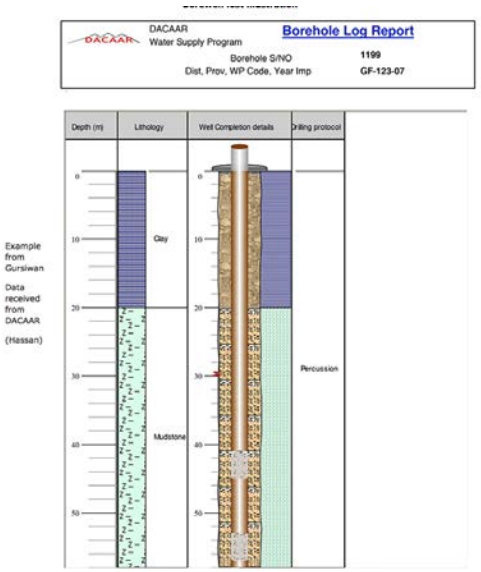
The type of data collected will be reflected in the type of information on the hydrogeological maps. Information of importance include:

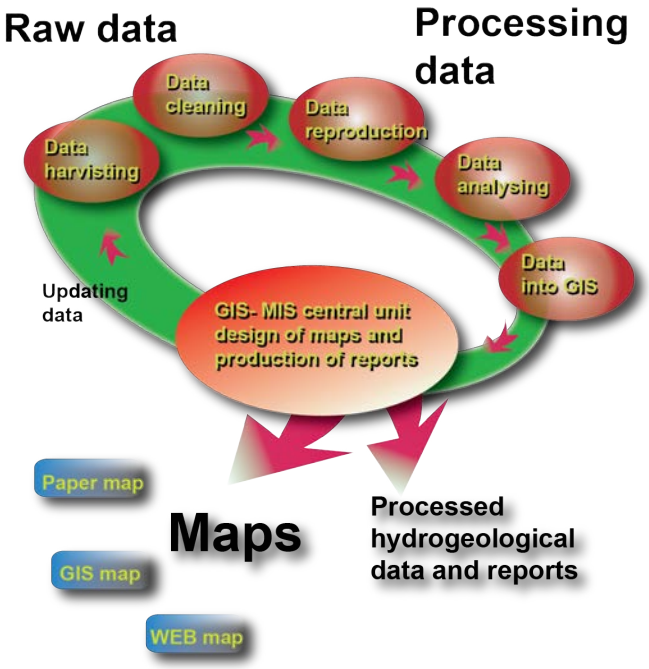
- Borehole / water point coordinates
- Altitude above sea level
- Depth to water level below ground
- Construction details, inclusive/ dates
- Yield and capacity of well
- Funding and responsible agency,
- Water quality (salinity)
- Water productivity
- Geological details
- Administrative boundaries
- Other info.

Design of hydrogeological Maps.

Six or seven different templates for hydrogeological maps have been prepared.

Borehole log sheet





This makes it easy to view maps on the desktop computer or to print out a paper copy of the different maps. See the following pages for examples of such maps.

On-line web maps.

A new software facility – ArcGIS Online Utility - has been applied for preparing online maps. The use of this facility is free as long as the information is public domain (and not for commercial use)

Many people have been trained to use this: with only a few days training, most people can manage to upload information without problems. In the webmap environment, it is possible to zoom in and view the location of groundwater locations on very good satellite or aerial images. Every house and street in Afghanistan can be seen and so can the location of the water facilities. This is excellent for the communication of groundwater information, for efficient planning and for verifying who seems to be served and who is not! An example of information which can be seen or downloaded is the individual borehole log sheets. Just click and view when online.

DACAAR recently implemented a functionality survey for water supplies and the system was tested for Faryab. Straight away, it is possible to see which of the registered facilities works which does not. Great!.

All information is available on the project web page. (http://norplan.af/Page_GIS_Web_maps.html)

If this concept is extended to other Provinces, Afghanistan could be the first country in the region to have extensive coverage by online hydrogeological maps.

Developed maps are shown below:

HYDROGEOLOGICAL MAPS: (Desktop or paper versions)

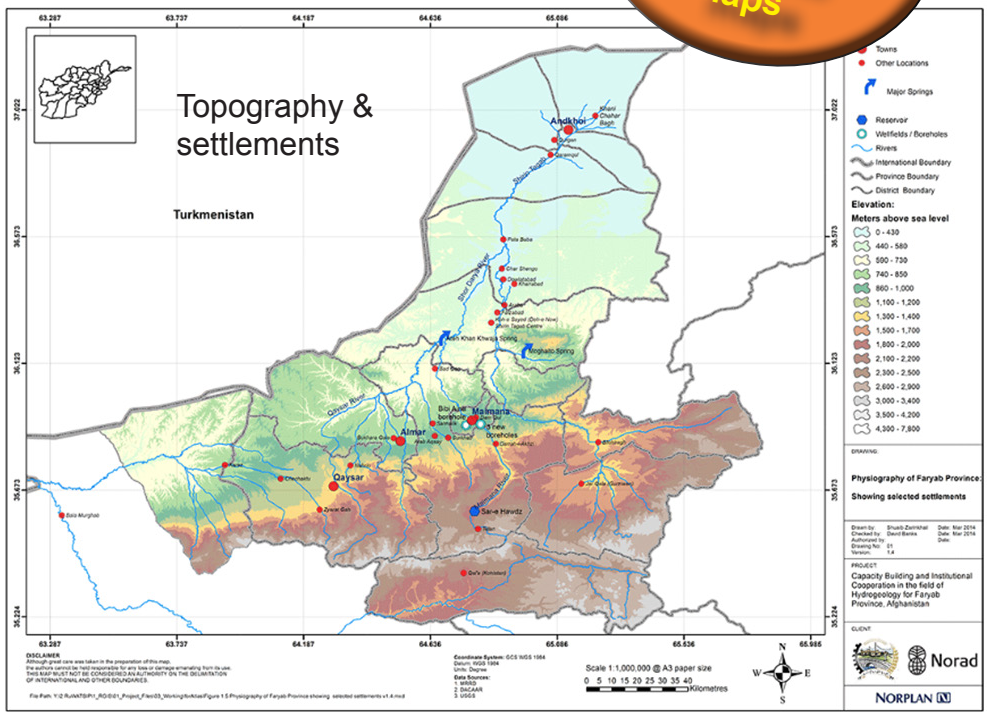
Design and capacity to make maps

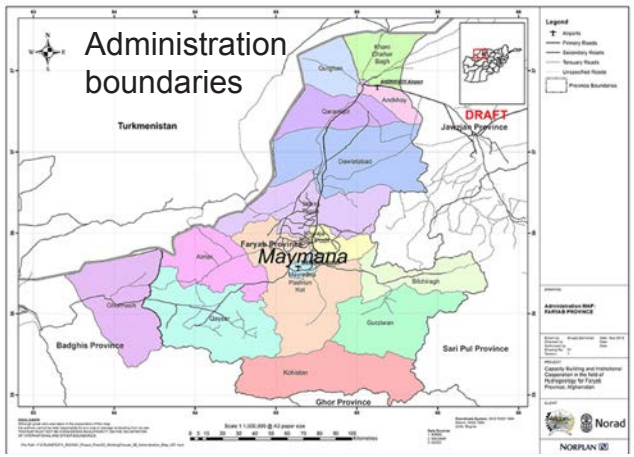
Formats for maps have been designed by project staff and discussed with key stakeholders. Templates for formats are shown below. Colour schemes for different types of information have been tested and discussed with key stakeholders.

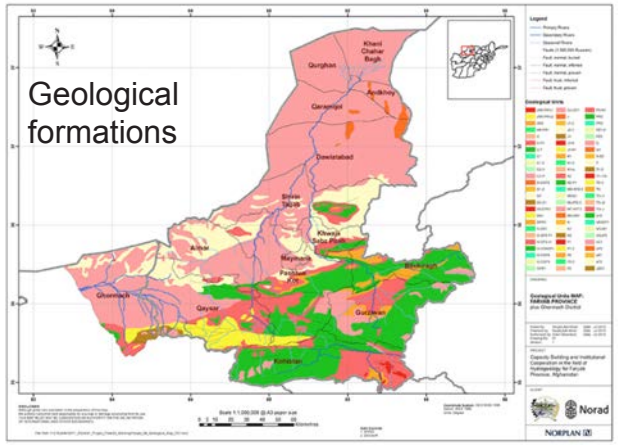
As far as possible, the formats used have been compatible with international con- ventions for hydrogeological maps (International Association of Hydroge- ologists).

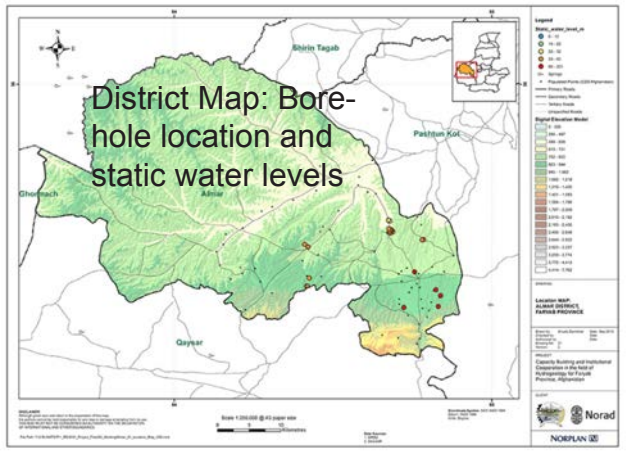
With the formats designed and tested, the GIS map system can be easily applied to other provinces as soon as the raw data is available. The maps can be viewed on a computer or printed, as shown in the examples here.

See examples of different themes of information from the hydrogeological maps devel- oped;







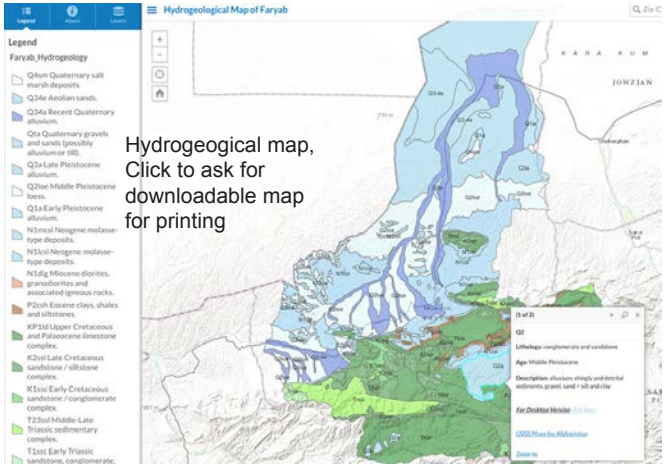


ONLINE WEB MAPS:

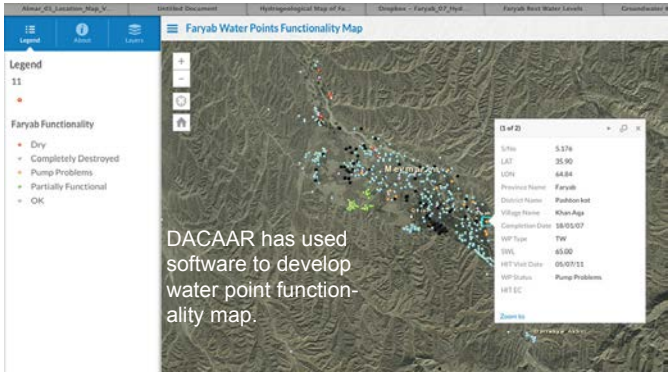
Examples of the online web maps. Just log to the web, click on the map with the information wanted and ZOOM in. New information is available in a most impressive manner and detail.

The maps are freely available anywhere, and accessible wherever the internet is working or where the mobile telephone works.

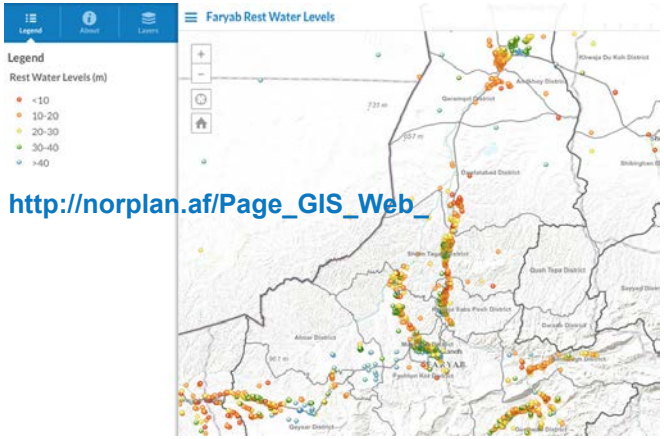
Potential users have been trained and this is just a powerful tool for sharing information.



Hydrogeogical map, Click to ask for downloadable map for printing

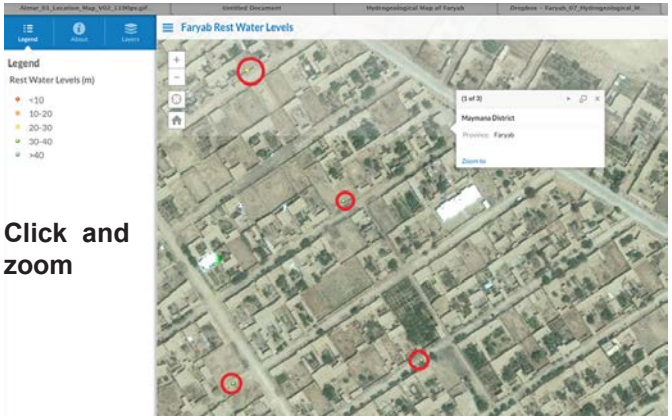


DACAAR has used software to develop water point functionality map.

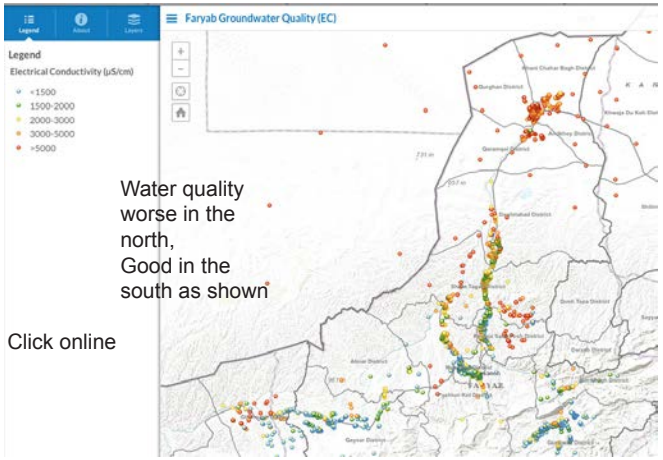


http://norplan.af/Page_GIS_Web_

Click and zoom

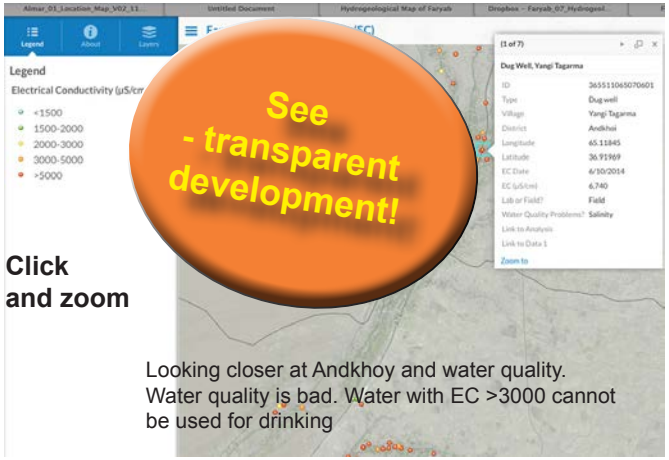


Click and zoom



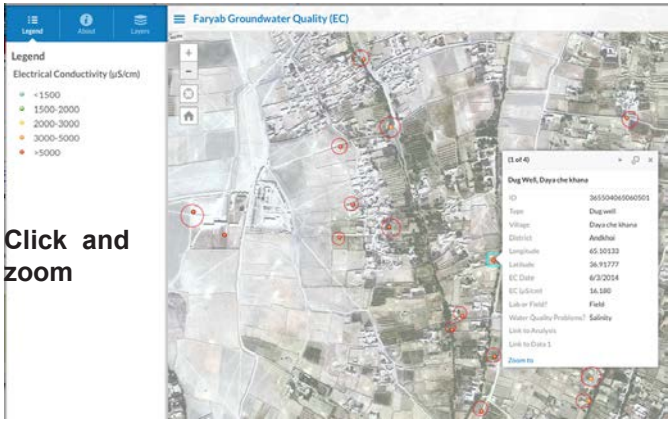
Water quality worse in the north, Good in the south as shown

Click online



Click and zoom

Looking closer at Andkhoy and water quality. Water quality is bad. Water with EC >3000 cannot be used for drinking

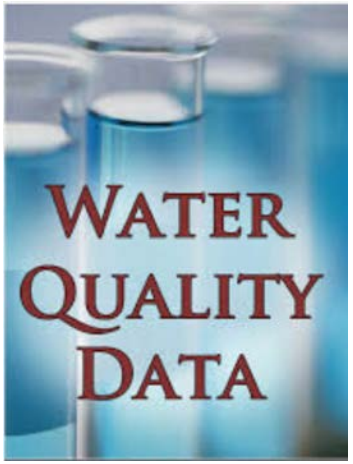


Click and zoom

Water supply design

I the terms of reference it was envisaged that three towns should be identified for survey and planning for rural water supply. We have not managed to move far on water supply development but as water engineers have addressed the challenges with poor quality control of water testing laboratories.

CAN THE RESULTS FROM THE LABS TODAY BE TRUSTED? - NO.



CAN THIS BE FIXED? - YES.

WE HAVE STARTED SEEKING LONG TERM SOLUTIONS.

Evaluations of water testing labs in Kabul before the sample analysis Faryab revealed that we had a problem. QA samples were given to some Kabul labs two to three times to check if the results were comparable with results obtained from international accred- ited water testing laborato- ries. For the project we required trustworthy results for our hydrogeological survey in Faryab so we sent 200 samples for analysis abroad (BGS lab in UK.)

We also observed that that, in the Kabul labs, some analysis types were reliable and some were not. However, we could not pick and choose which analyses to trust and which to reject.

So we decided to take some initial steps to rectifying this situation, by encouraging Kabul labs to instigate more rigorous quality assurance schemes.

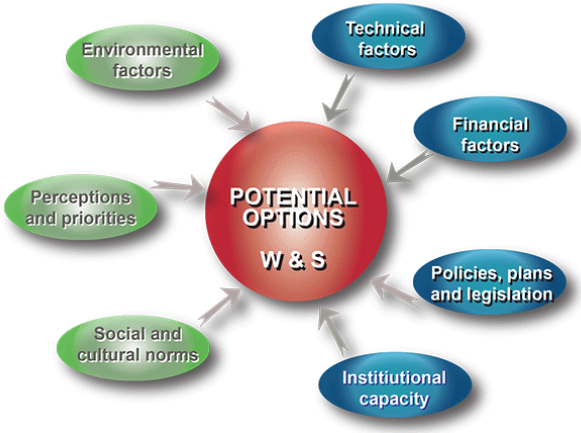
We contacted ANSA, responsible for coordinating standards for drinking water in Afghanistan. Now ANSA is the focal point for quality control systems check reliability of results.

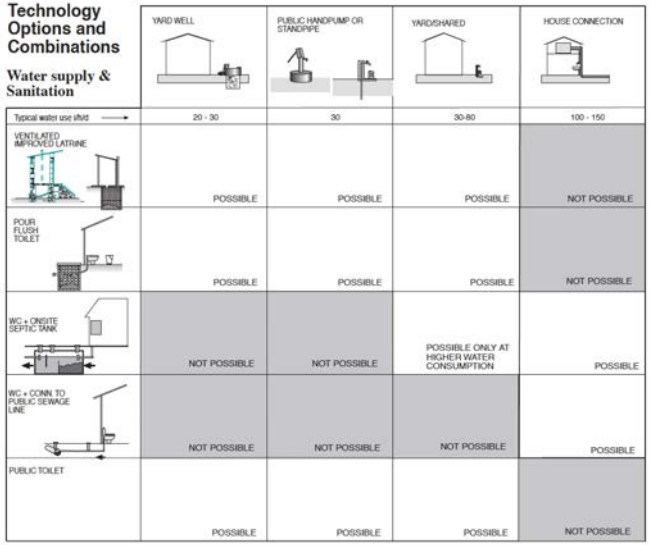
ANSA meeting:

During the last year, 4 meetings have been held with water testing laboratory owners, ANSA, Ministries, UNICEF, DACAAR and others to develop a framework for a quality assurance system in Afghanistan. Three workshops have also been held with laboratory staff to generate awareness that quality matters. It was apparent that none of the labs has adequate standards for checking results, nor instructions for calibration of equipment. Procedures and checklists have now been planned and developed, as well at inter-laboratory calibration work.

Conceptual water supply design,

Conceptual design of water supplies has been delayed. However, training will continue to cover the use of hydrogeological data to plan water supplies based on user needs, and sustainable solutions. There are also important issues of linking water supply and sanitation together. Potential health benefits must also be weighed against costs. (see diagrams next.)





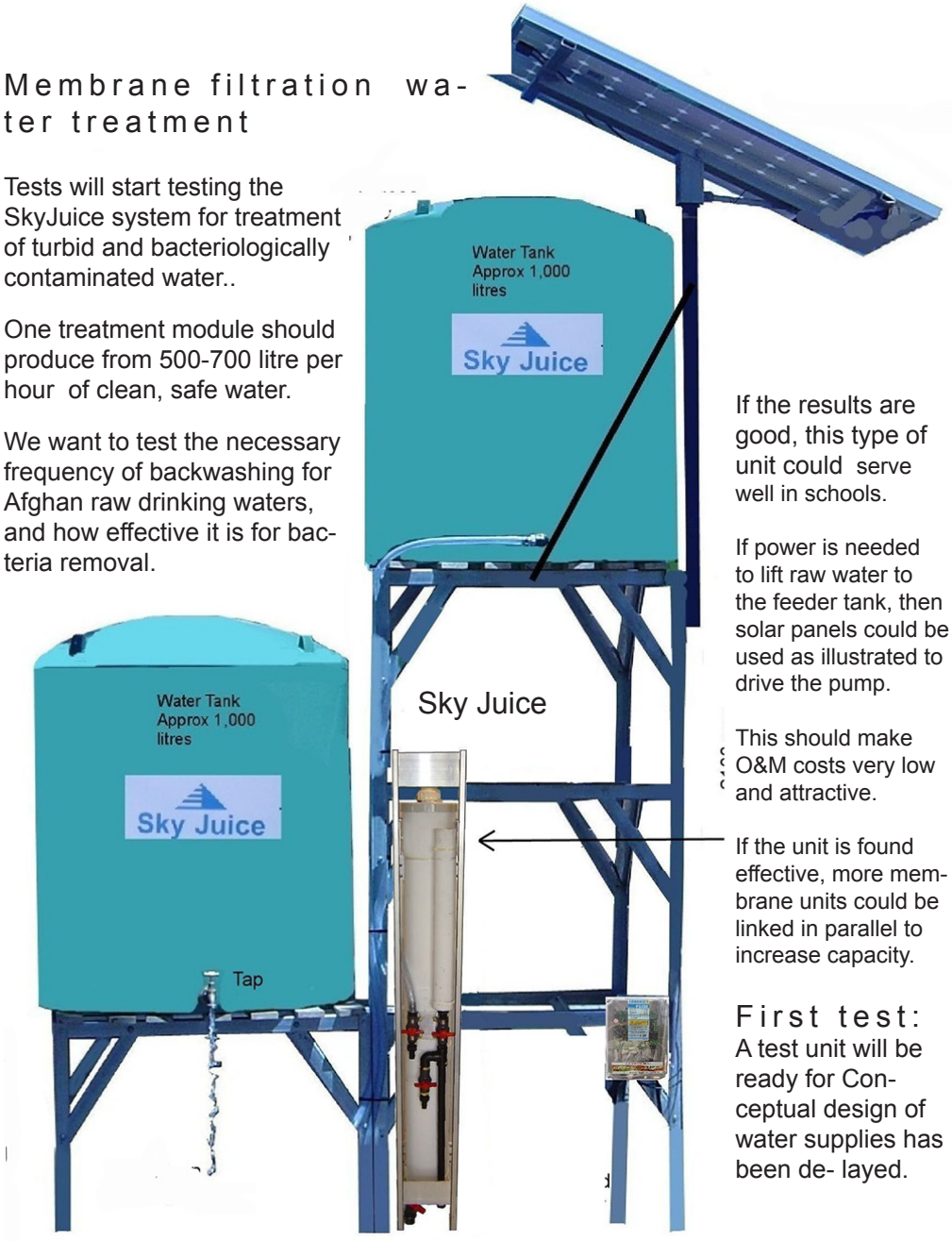
Testing water treatment technology.

Membrane filtration water treatment

Tests will start testing the SkyJuice system for treatment of turbid and bacteriologically contaminated water..

One treatment module should produce from 500-700 litre per hour of clean, safe water.

We want to test the necessary frequency of backwashing for Afghan raw drinking waters, and how effective it is for bacteria removal.



If the results are good, this type of unit could serve well in schools.

If power is needed to lift raw water to the feeder tank, then solar panels could be used as illustrated to drive the pump.

This should make O&M costs very low and attractive.

If the unit is found effective, more membrane units could be linked in parallel to increase capacity.

First test:

A test unit will be ready for Conceptual design of water supplies has been de- layed.

Sky Juice model:

Sky Juice membrane filtration units are manufactured in Australia by an NGO using recycled membranes.

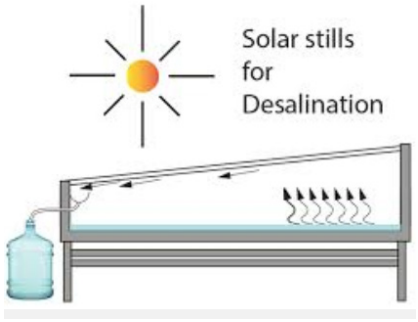
They claim that the membrane unit should last for up to 10 years without need for replacement parts and all the cleaning of the unit is done manually. It has been extensively used in refugee camps and for emergency situations, but we want to test it here in Afghanistan where it may find application in schools, rural communities or for emergency water supply systems.

Desalination of water using solar stills.

MRRD is working with NCA to develop and test the possible application of solar stills for remote rural areas where raw water may be saline or otherwise undrinkable.

This is especially suited to impoverished, remote rural locations living in salinized areas, where no conventional water supply systems are feasible.

The diagram show below how it works concept works in the case of the simplest



models. Last year an M.Sc. student from the University of Life Sciences (UMB) , Norway, came to Kabul to construct and test some units to see how much water they would or could yield. The results were positive and a unit of about 1 m2 producing 3-4 litres desalinated water per day. This is not much but the resulting water is cheap and safe to drink and that may make some difference for some.

Work will now continue to find local solution for constructing units at a low cost to permit mass production. The test will also cover water quality, and users' perceptions of these facilities. NCA will host the test, but MRRD and NORPLAN will participate in the testing.

TRAINING AND CAPACITY BUILDING:

During the project inception period, a training program was planned in 2012. This program has been followed but adapted as required to tailor to observed needs.

Key focus:

- Short courses, (1-7 days)
- Focus on learning skills,
- Interpretation of data,
- Learn to use existing equipment

Achievements: (planned 800 participants)

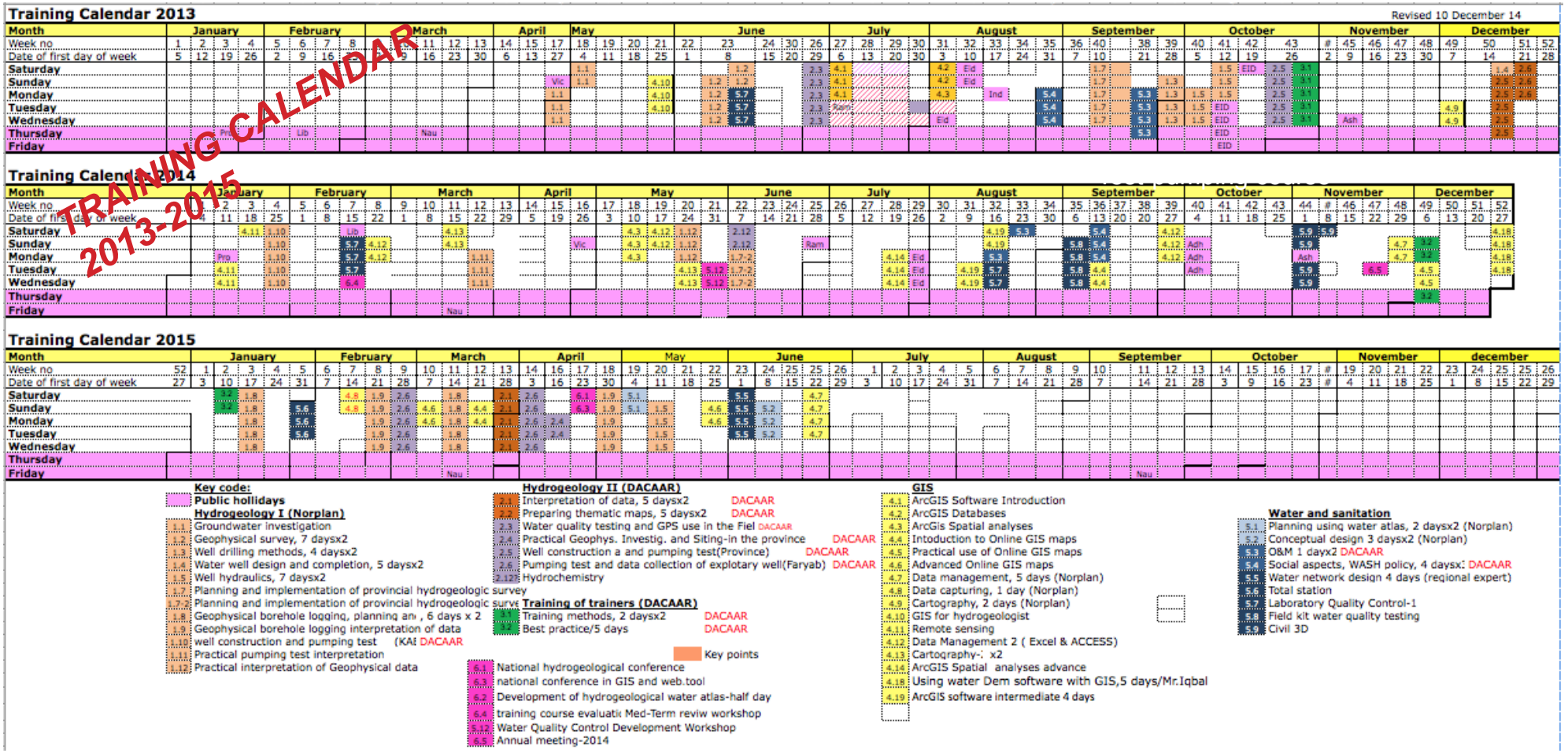
- 42 short courses completed.
- 771 course participants trained
- 347 different persons attended
- 42 different water organizations participated.
- 13% female participants

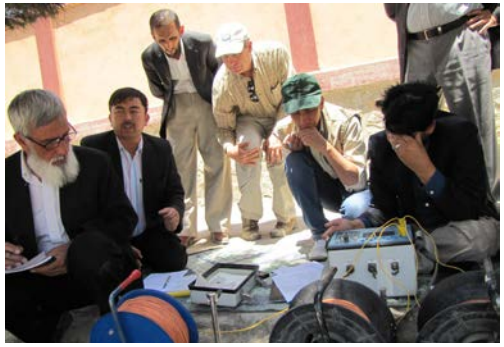
Method of implementation:

Course presenters were international and local staff. When international staff presented, they were accompanied by local expert, - typically a university professor, senior hydrogeologists, local data expert from MRRD, MEW, DACAAR, NCA or other organisation. This would facilitate local in repeating the course delivery following NORPLAN project closure. The co-presenters also ensured that course was presented in local language.

For sustainability:

All training material is available for free download on the internet. Presentations, tutorials can be used by other trainers, local co-trainers or resource persons at universities, polytechnics, at Ministries or other sector organizations.






Test-pumping course


Well Design

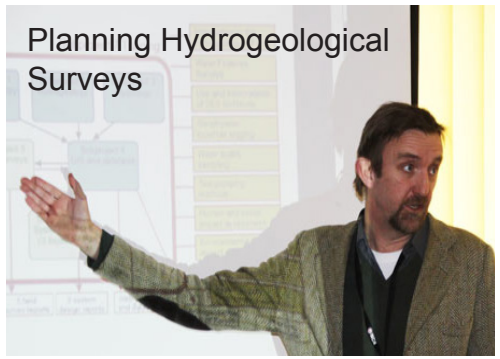

Cartography course


Groundwater
Investigations


Sieving analysis at
MEW lab


Drilling methods


GIS - Online
mapping course

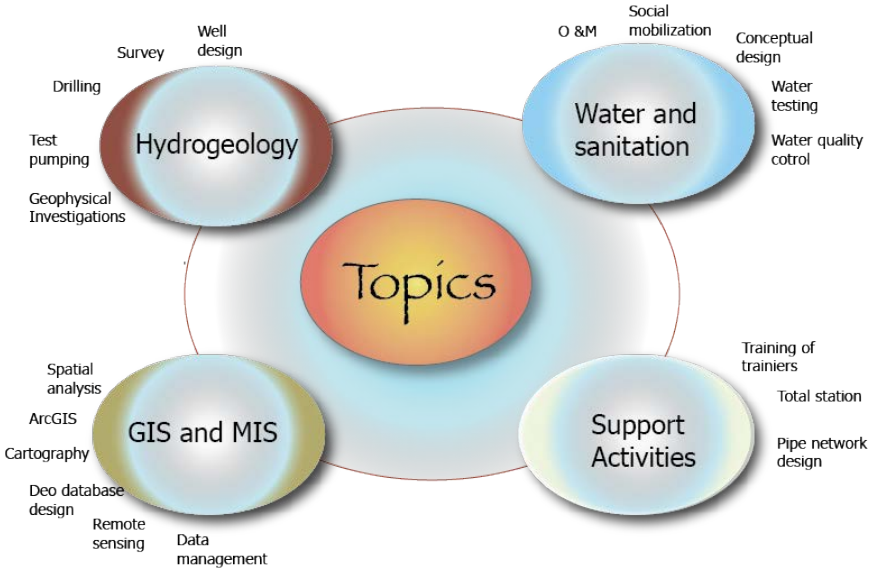

Planning Hydrogeological
Surveys


Water Quality Testing


Test-pumping course


Water Quality Testing

TRAINING OUTPUTS:



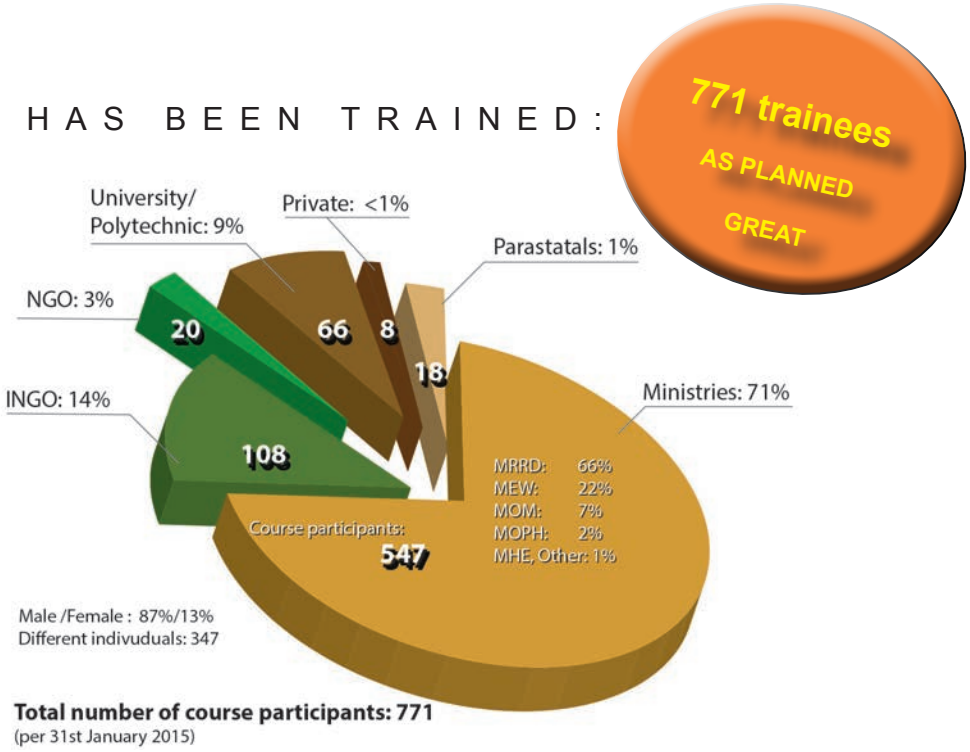
Some facts:

- 771 course participants trained
- 42 training courses completed
- 347 different persons attended trained training
- 42 different organizations attended

Course focus:

- Short courses with focus on practical skills training
- All training with local co-trainer
- Small groups for effective training and good interactive training

WHO HAS BEEN TRAINED:



TOPICS

The diagram to the left shows the main category of courses for training which is:

- Hydrogeology / geophysics
- GIS- MIS (Data management)
- Water supply (use of data)
- Other courses

The complete list of courses is shown in the tables (right.).

About 25 courses were described during the inception phase at the beginning of the project which should be run twice. As the training proceeded modifications had to be made and more and different courses has to be tailored to fit better the training needs of the course participants. So far 42 courses has been run out of a total 50 courses.

DURATION

Courses were short, from 1 to 7 days, depending on the topic. The training is specifically focussed on practical training and how to adapt technology to practical use. It was also important to tailor the training to people working in the ministries.

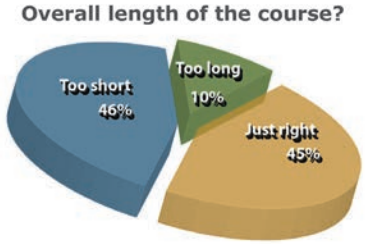
EVALUATIONS

All course evaluations made have been made available online on the project web, and the summaries are shown in the adjacent pie charts.

Much of the feedback is positive. In cases where participants were not wholly satisfied, it was often the case that the participant's background was unsuitable for the course, suggesting the need for better pre-course screening of participants on future occasions.

ADDED COURSES

Courses were added particularly in data management.



NO	Name
	HYDROGEOLOGY COURSES:
1.1.1	Groundwater investigations
1.2.1	Geophysical Surveys
1.3.1	Well drilling methods
1.4.1	Water well design
1.5.1	Well hydraulics
1.6.1	Hydrochemistry, interpretation of data
1.7.1	Planning and implementation of Provincial hydrogeological surveys
1.7.2	Planning and implementation of Provincial hydrogeological surveys
1.8.1	Geophysical borehole logging, planning and operating equipment
1.9.1	Geophysical borehole logging interpretation of data
1.10.1	Well construction and pumping tests
1.11.1	Practical Pumping Test Interpretations
1.12.1	Practical Geophysical interpretations (Working on Faryab Data)
1.13.1	Advanced topics in hydrogeology
2.3.1	GPS reading and Water Quality Testing, -in the province
2.4.1	Geophysical Investigation and Siting; practical-in the province
2.5.1	Drilling methods and Well Construction -in the province
2.6.1	Test Pumping and Data Collection -in the province (Mazaar)
2.6.2	Test Pumping and Data Collection -in the province (Faryab)
	TRAINING METHODS
3.1.1	Training of trainers methods
	GIS- & DATA MANAGEMENT
4.1.1	ArcGIS Software Introduction
4.2.1	ArcGIS Databases
4.3.1	ArcGis Spatial analyses
4.4.1	Introduction to online GIS maps

NO	Name
4.5.1	Practical Use of Online Maps
4.6.1	Advanced online GIS Maps
4.7.1	Data Management 2, (Excel & ACCESS, Summary of 4.12/4.17)
4.8.1	Data Capture
4.9.1	Introduction to Cartography
4.10.1	Introduction to GIS for Hydrogeologists
4.11.1	GIS - Remote Sensing
4.12.1	Data Management 2
4.13.1	Cartography II
4.14.1	ArcGIS Spatial analysis II
4.17.1	Data Management MS ACCESS,
4.19.1	ArcGIS Software Intermediate
	WATER SUPPLY - ENGINEERING
5.1.1	Planning water supply using water atlas
5.2.1	Conceptual design for of sustainable water supplies
5.3.1	Planning and implementation of O&M for rural water supplies
5.3.2	Planning and implementation of O&M for rural water supplies
5.4.1	Social aspects of Water and Sanitation, WASH policy, gender issues
5.4.2	Social aspects of Water and Sanitation, WASH policy, gender issues
5.6.1	Training in use of total-station for water/wastewater, network survey
5.7.1	Laboratory Quality Control
5.8.1	Water Testing using field kits
5.9.1	Autocad Civil 3D
5.10.1	Quality Control for Water labs
5.10.2	Quality Control for Water labs.
Key:	Black : completed courses Blue: courses to be completed in 2015

NEED FOR COORDINATION

Many Stakeholders:

The diagram to the right attempts to illustrate the many stakeholders involved ground water resources.

Groundwater resource management:

MEW: Responsible and have jurisdiction for management of ground water resources.

Users:

MRRD: Responsible for developing rural water supplies for the rural population. Need to know where/ how to find water.

MAIL: Use water for irrigation, including ground water.

AUWSSC: Responsible for Urban water supply.

NGOS: Many organizations are involved in support, development and capacity building involving use and knowledge of development of ground water resources.

Universities / polytechnics:

Involved in training and capacity -building.

Coordination under Capacity building-project:

The capacity-building project for groundwater mapping, data collection and management impinges on the interests of many organizations. In the terms of reference for the project, it was clearly stated that coordination should be undertaken with other key stakeholders, such as MEW; GIZ and other actors.

This is so important because:

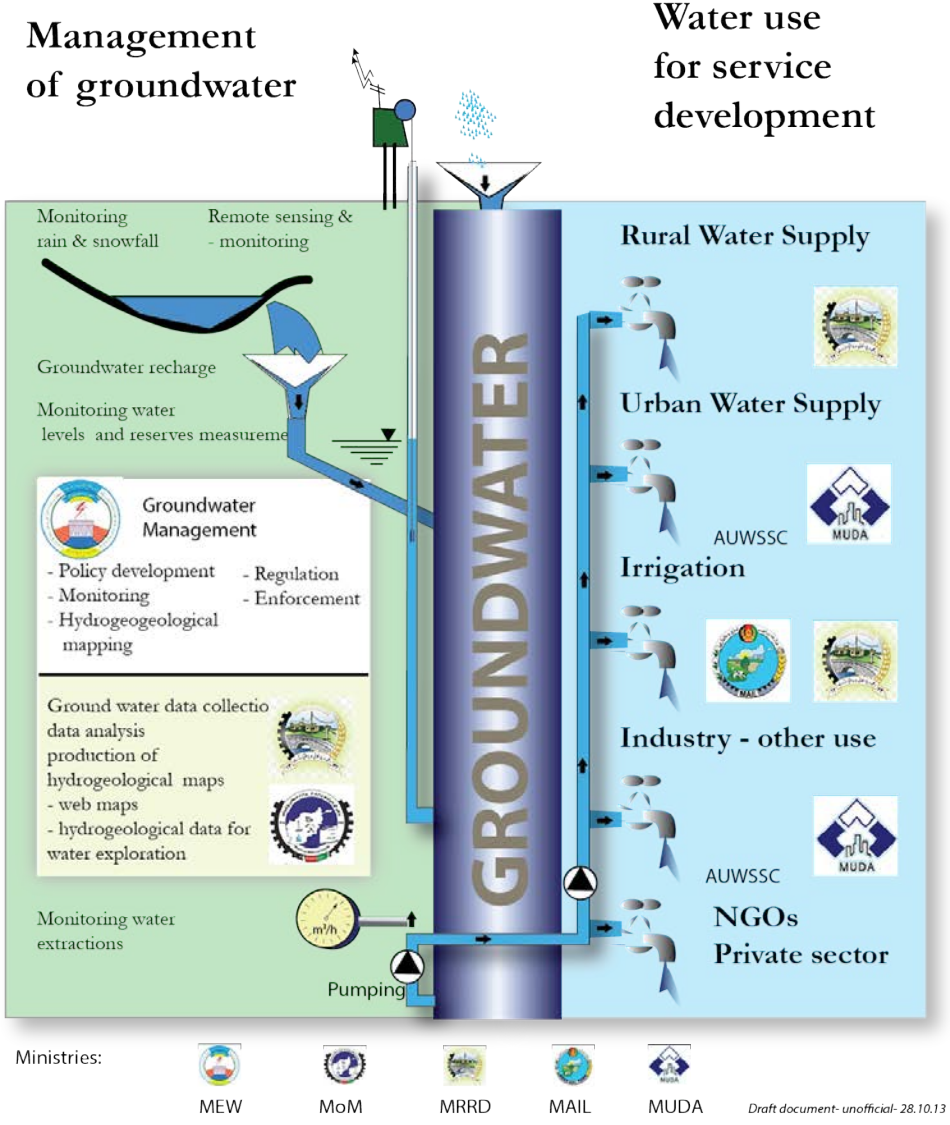
- Many organizations curate information about ground water
- Many organizations or users want to make use of groundwater resources and wish to know how and where to find safe water
- Government have to define and monitor the use of groundwater resources in order to provide services to its people, farmers and industry.
- Training institutions need to know what type of training is required.

Why coordinate?

This may sound like a rhetorical question, but in a fragile and competitive environment, sharing information is like a private company giving away commercial secrets. We have therefore endeavoured to generate trust and confidence about the project and its objectives, purpose and benefits:

Groundwater resources

Users and producers of important information of government ministries and organizations.



- The project is short term and, when it ends, others should continue activities
- All information is shared and transparent.
- Focus is not organizations but sustainable development of one of Afghanistan´s vital resources.
- Focus on respect for personnel, institutions and institutional framework.
- Support what works
- Share data, training materials, manuals, documents and other relevant information.

How to coordinate:/ where:

- Share information though training courses (over 350 different persons attended)
- Though updating Project web
- Though coordination meetings at MRRD, MEW, UN, donor meetings, provincial offices.
- Though lectures at University directly or though university professors conveying information from the project to students,
- Lectures to civil society, (Afghanistan Engineering Association)
- Conferences
-

Enough work for all so we should work together.

MEW: Manage and map all water resources. Huge work, need support , expertise and resources.

MRRD Develop water supply services for 18 million people currently unnerved. Need more support.

AUESSU Most urban areas are waiting for water and wastewater services and institutions for service deliveries. Huge task for identifying water sources and resources.

NGOs Need to continue capacity building and support for nationwide service provisions.

Training institutions:

Much needed for practical training, equipment, hands-on training

Examples of coordination fora:

Project review meeting at MRRD

Strategic meeting in MEW on ground water mapping

Key Stakeholders:

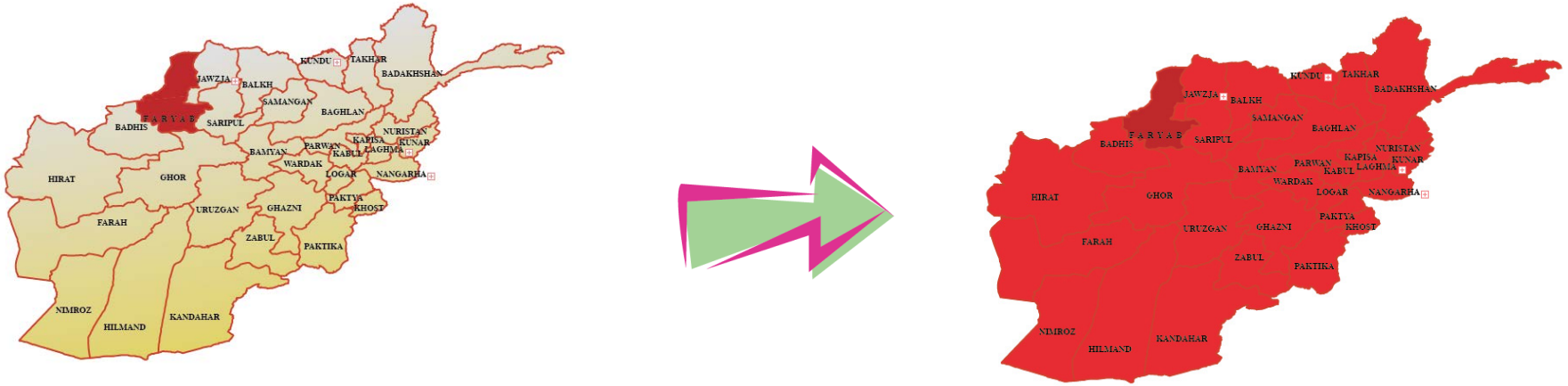
Lecturing at Kabul University informing about ground water mapping

Participating in Annual meeting in UNICEF for rural water supply

Lecture and information to Afghanistan Engineering Association. (3 evening lectures)

FOR PROJECT JUSTIFICATION:

SCALE UP FROM 1 PROVINCE TO COVER WHOLE OF AFGHANISTAN



What does this mean for this project?

We always have to return to the basic question: what are we trying to achieve?

We can say that our project development is sustainable if the hydrogeological mapping is scaled up so that, in the foreseeable future, Afghanistan will have mapped its groundwater resources at Provincial scale throughout the country. This facilitates the management of groundwater resources and allows priorities to be defined and followed.

If the above is attained, we will have succeeded, but there will be more to do. We may have the maps, but we will still need institutions and expertise to ensure that the maps are “alive” and continuously updated. This is a challenge which will require commitment from the government to ensure that resources are allocated to attain this goal.

How will sustainability be attained:

Training/ capacity building

- **Provide training** for Afghan nationals to have knowledge to continue work in MRRD, RuWatSIP, MEW and in stakeholder organizations.
- Training of trainers/ lecturers.

In the project, 5 of the trainers or co-trainers come from universities/ and will be able to continue as trainers after the end of the project. They will have access to all training materials for all the courses as necessary. Some of the professors have already been giving training not only by integrating the NORPLAN materials into student curricula but also by acting as consultant trainers at other ministries than MRRD. (See list of local resource persons for use in future training)

Though good coordination

- **Coordinate** with sector stakeholders so that all can make use of materials. It will strengthen sustainability of most organisations follow the same approach facilitating data and information exchange.

Support to institutional development in Ministry

- Support **institutional development** in MRRD and MEW to continue work.

Work closely with ministry staff to see that they are in position to handle the work.

In this project some of the assignments have been organised by involving MRRD staff for hydrogeological surveys after training. Exploratory drilling is also undertaken by MRRD staff with daily consultation and data interpretation with Norplan experts and staff.

Test methodology on other provinces.

The methods for data collection and production of hydrogeological maps was developed for Faryab and tested there. In order to assess the challenges with scaling up the project, two other provinces have been selected to test the methodology, These provinces are Balkh and Nangahar. The work is in progress, but this will help us assess resource requirements for all the 33 provinces in Afghanistan yet to be covered with hydrogeological maps.

Share information with all sector stakeholders.

In a country under development, many institutions are only semi-permanent. It makes sense to train local staff from many institutions, to develop a continuity of knowledge and experience irrespective of organization rearrangement. Hydrogeological experts (MRRD, AGS, MEW) should be able to meet professionally outside the ministerial framework for exchange of data and information.

Project web page fully transparent.

The project web page has set an example of how things can be done and how information can be exchanged. We have noticed that about 2000 persons visit the project web page monthly. They view photos and news, collect documents and review hydrogeological maps. From all the users we have met, the web page has been appreciated.

All training material available for all.

All the training documents, power-point presentations, tutorials, training videos, course agendas, list of participants, course reports, and participants evaluations are available on the web for anybody to review and use.

We are now also mapping the presentations available in English and Dari languages so we trust this may strengthen sustainability , by allowing future training.

COMMUNICATION - MAKING INFORMATION AVAILABLE FOR ALL

How can water sector staff in Afghanistan benefit from this project?

This project is aimed at capacity-building in MRRD but also within other sector agencies. A number of organizations are concerned with the mapping, management and development of groundwater resources.

Use Internet for communication

The project is one of few projects which has developed a project web page for communication, exchange of data, maps and training materials. All information collected should be made available to all sector stakeholders in Afghanistan to facilitate service provision and rational resource development. All such development requires reliable and readily available information.

ALL information from this information is available for review or downloading on the internet. We are also making information available in both English and in Dari languages. Training material can be downloaded and used for future training courses in MRRD, other ministries, University/ Polytechnics orby NGOs. What- ever, for serving development in Afghanistan.

On the adjacent diagram, a listing of available documents is shown, together with their location on the internet.

www.norplan.af.

Communication during training courses

During each training course information was provided to participants: documents, practical exercises and presentations in hard copy or on digital media.

LIST OF MAIN DOCUMENTS AVAILABLE FOR ALL TO READ

HYDROGEOLOGY DOCUMENTS

- Water Atlas for Faryab
- Field survey methods (English/ Dari)
- List of equipment
- Design and use of Well Logger

GIS - MIS

- Hydrogeological PDF Maps
- ArcGIS electronic hydrogeological Maps for Faryab
- How to prepare hydrogeological maps for a province
- Data Management Procedures
- GIS solutions for planners and water engineers
- GIS training material and manuals

WATER SUPPLY

- Quality control for water testing labs
- Water testing labsHow to prepare hydrogeologcal maps for a province
- Conceptual design for water supply and sanitation services
- Testing water technology
  solar stills
  Low pressure membrane filtration

CAPACITY BUILDING - TRAINING

- List of Afghan resource experts/trainers
- Training videos, course photographs
- Training course material, lectures, presentations, tutorials
- Powerpoint presentations
- Reference books
- Course evaluations

PROJECT MANAGEMENT

- Terms of Reference
- Progress reporting
- Work schedule
- Project and sector staff
- Training courses lists and reports
- Outputs, incl web pages
- List of procured equpment and softwater
- Achievements

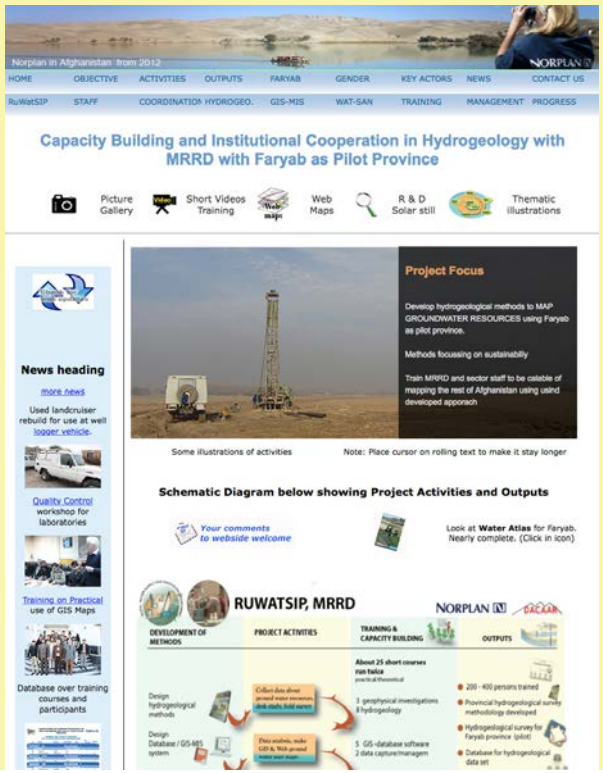
Snapshots of electronic information from project (ON WEB)

This page illustrates some of the infor-mation derived from project activity, which is freely available for all to use.

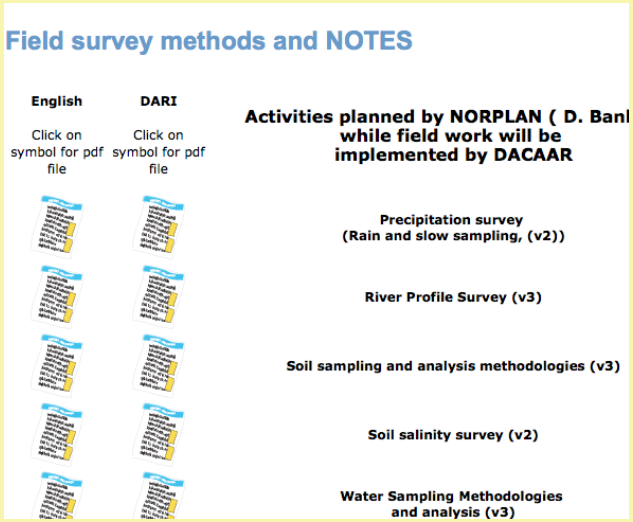
The Project's website welcome page menu directs users to Objectives, Activities, Staff, Co- ordination, Hydrogeology, GIS-MIS, WatSan, Training, Management and Progress. This web page is updated as the project progresses

The overview and project history is easy followed under the NEWS menu item.

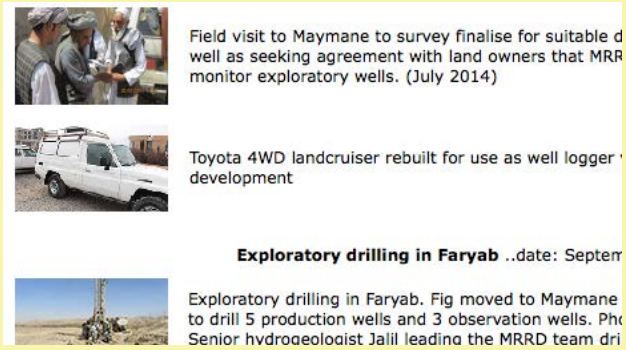
Web Page www.norplan.af



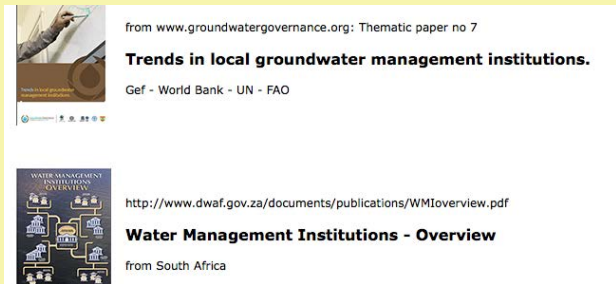
Field survey method.



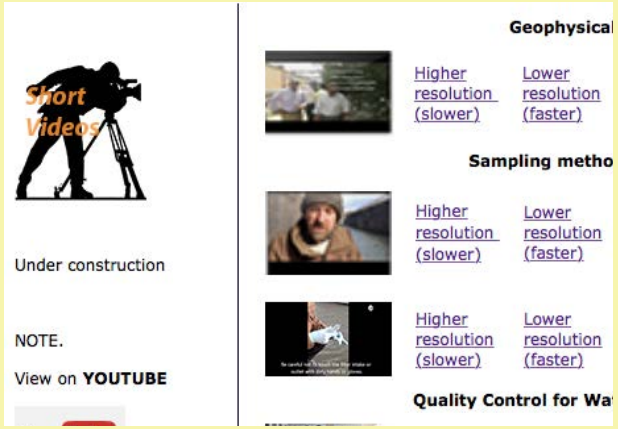
Photographs from activities.



Reference books and documents

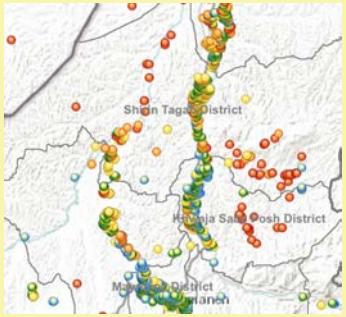


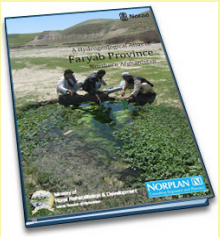
Training videos



Project outputs:

Water Atlas for Faryab and example of
Online hydrogeological map showing water quality from sources in Faryab.





And More

Here we have tried to show how Project information is stored and can be found. You'll find over 100 web pages of information here about groundwater mapping in Afghanistan. We hope that you, as users, will be able to employ the information and training materials that we have provided.

Happy viewing.

Will this project make any difference to us?

(Kabul boy)

It MUST.

Next steps: Map groundwater in ALL provinces

then provide safe drinking water to the whole nation - rich and poor, him and her! All.

This can make a better future for 18 million rural people still waiting for safedrinking water!

Want to know more?

Contact **Dr. Svein Stoveland**, team leader, Norplan
sst@asplanviak.no, tel + 47 91571225
or **Eng. Naqibullah Abrar**, Deputy team leader Norplan, Kabul
tel + 93 776782054,email: naqib.380@gmail.com
or see www.norplan.af, or www.norplan.com

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