Providing hydrogeological support to the humanitarian sector

Geraint Burrows

Groundwater Relief's Objective

"To prevent and relieve poverty and sickness and promote the good health of people anywhere in the world by developing their and their water providers capacity to sustainably use and develop groundwater resources."

The Basic Concept

To link groundwater professionals with humanitarian and development projects

Some Facts

- Started providing technical support 3 years ago
- Registered as a UK Charity in June 2016
- Growing membership of 180 groundwater experts
- Have carried out 70 projects and supported over 100 enquiries

Service Provision

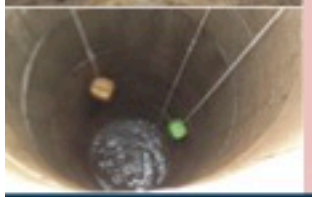
Via our membership we provide:

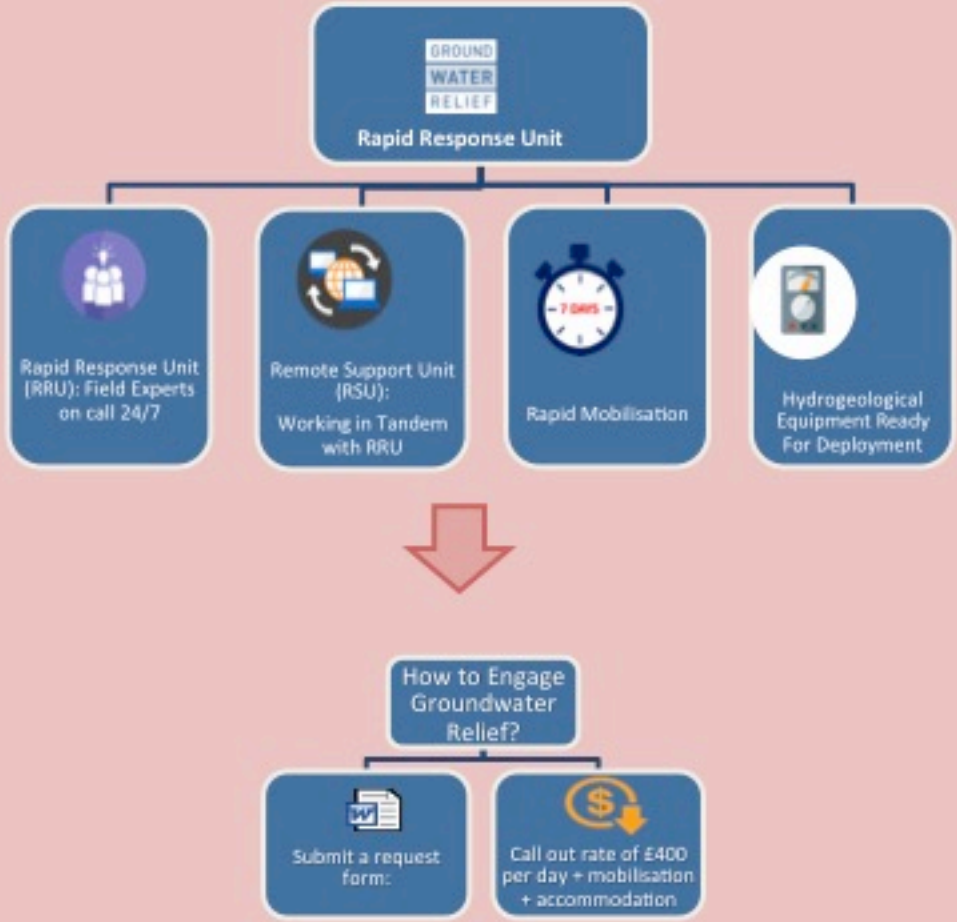
- Remote support (including desk studies, pumping test analysis, contractual support, reviewing other hydrogeological work carried out by local contractors)
- Field support (including borehole siting, drilling supervision, water resource assessments)
- Rapid Response Unit

Rapid Response Unit













For more information contact: help@groundwater-relief.org

Groundwater Relief is a UK registered charity (1167458). Our aim is to alleviate poverty by helping others to sustainably develop and manage groundwater resources. We carry out our work through a membership of groundwater experts.

Feedback

By making people available to go to the field and train our staff 'on-the-job' Groundwater Relief have contributed to increasing greatly the knowledge and capacity of some of our key field staff. This has already proved to be useful in Tanzania and I have no doubt in future interventions as well. We now have some good equipment and some well trained people.
Water and Sanitation Advisor, MSF-OCA

We initially engaged with Groundwater Relief in Sierra Leone during the opening of the GOAL operated 100-bed Ebola Treatment Centre (ETC). Most recently we have engaged Groundwater Relief to provide hydrogeological and geophysical support for GOAL's project in delivering water to 11 hospitals and health centres, including the capacity building of a government geophysics team. We have been consistently impressed with the support, professionalism and responsiveness of Groundwater Relief and see the partnership as one of long term collaboration in delivering technical skills that we do not have within the organisation.
Global WASH Advisor, GOAL

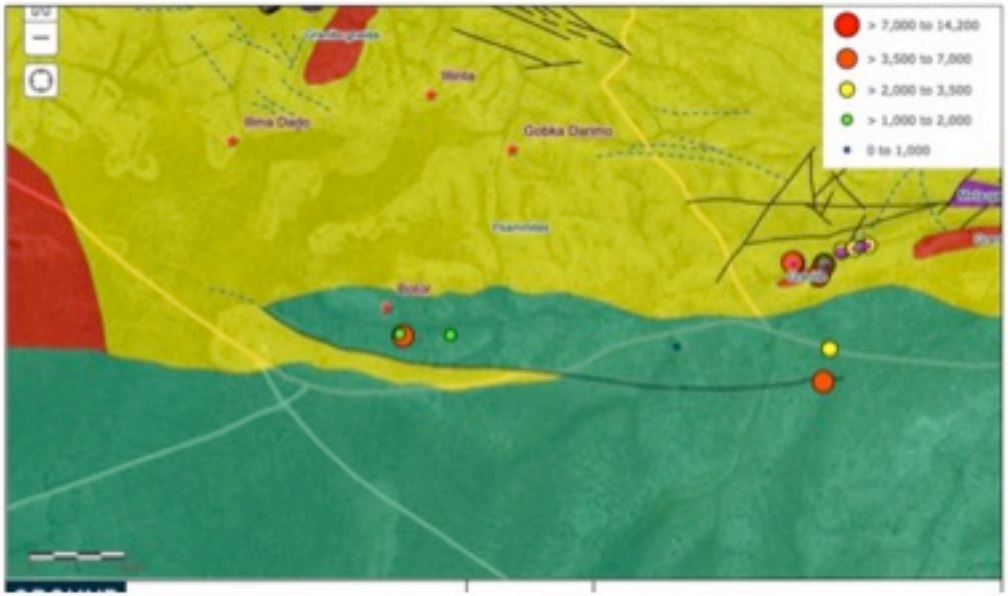
I don't think we would have been able to implement the project properly without the help of Groundwater Relief. Through their input we have removed the need to use drilling rigs which will save many thousands of pounds for every borehole/well and pump installed. As such the service Groundwater Relief provided has been fantastic value for money, and absolutely essential to the successful implementation of this years project and future water-based projects.
Cameroon Catalyst Team

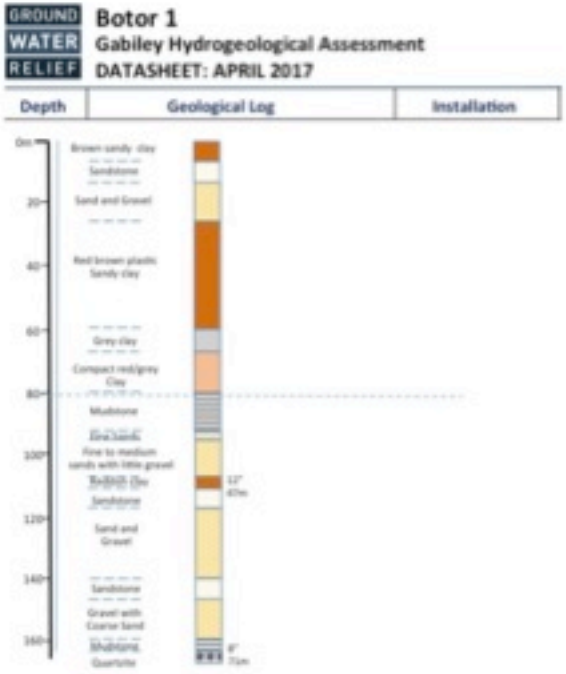
Hydrogeological Investigation for irrigation wells, Gabiley District, Somaliland, Pharo Foundation

6 hydrogeologist team carried out a desk study to assess groundwater potential for irrigation wells

ArcGIS online map produced: https://arcg.is/15aP9b

An aquifer was identified and quotes obtained from two international contractors to carry out geophysical survey to identify extents of aquifer system.



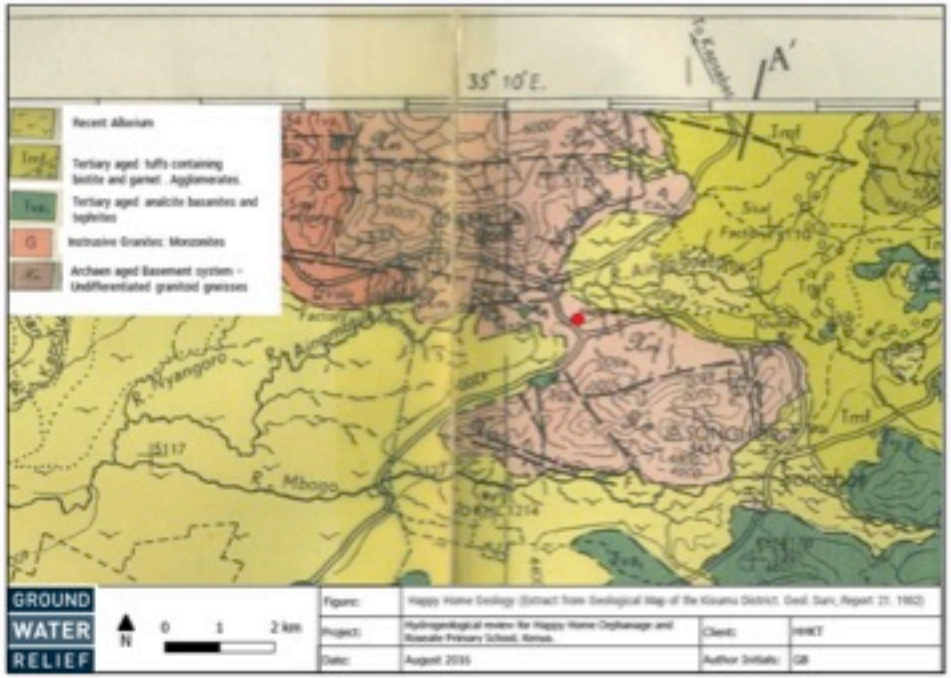


Initial hydrogeological assessment of Happy Home orphanage and Roseate primary school, Kisumu County, Kenya

2 hydrogeologist team carried out initial desk study including a highly experienced Kenyan hydrogeologist

Plan of action developed for next steps including quotes obtained to support Happy Homes with planning

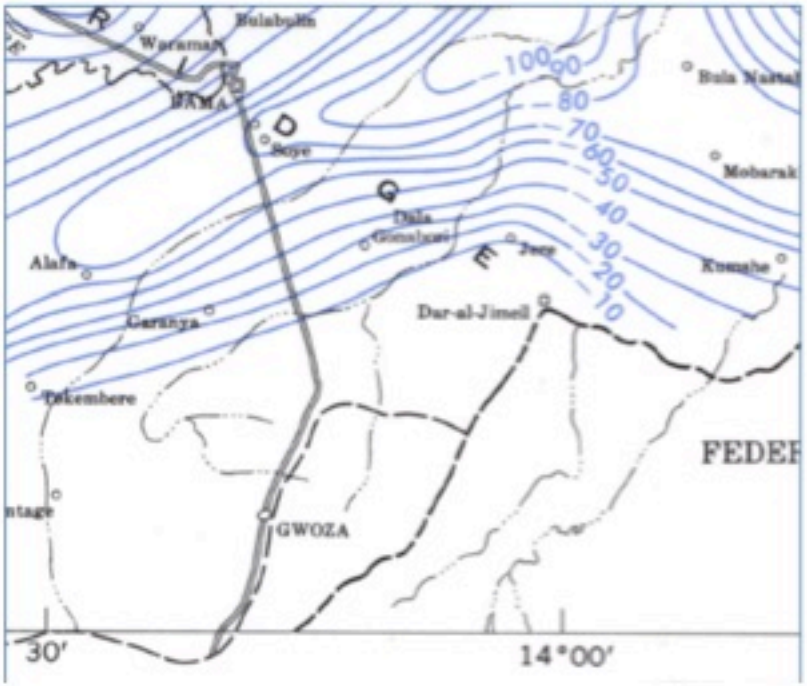
Kenyan team ready to supervise drilling works when funding obtained

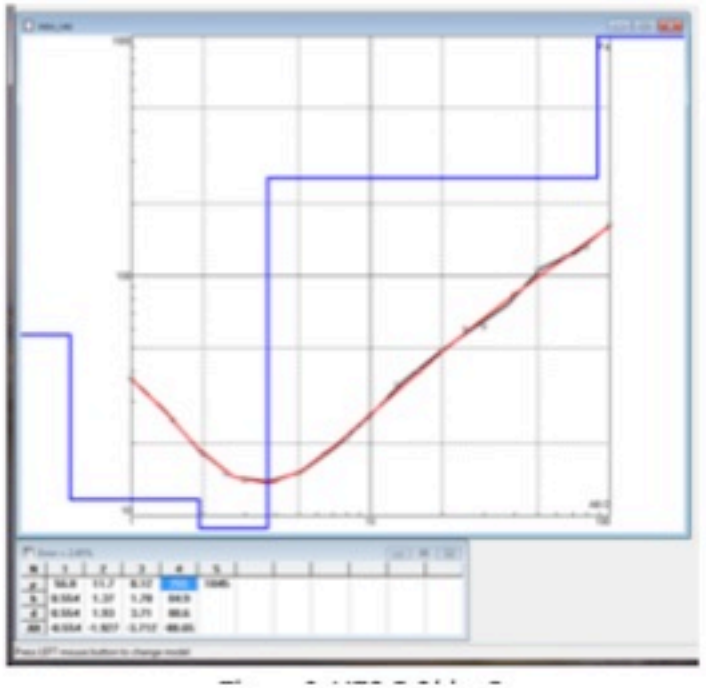


Evaluation of geophysical data to determine groundwater potential of the Pulka Region, Northern Nigeria - Oxfam

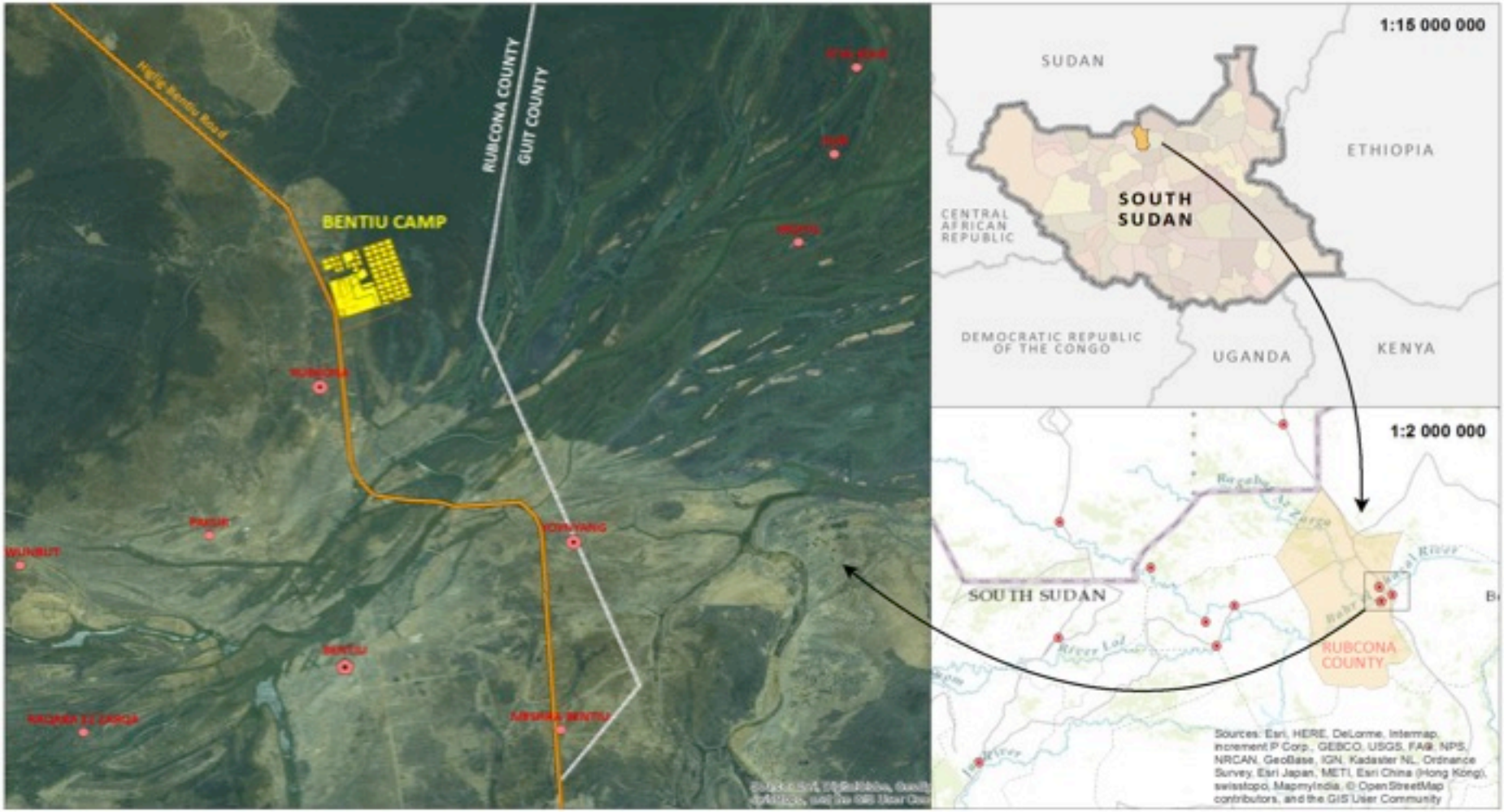
Four hydrogeologist team reviewed geophysical data provided by contractor led by a Professor of Geophysics

Currently supporting identification of targets for further groundwater exploration using remote sensing data





South Sudan – International Organisation for Migration, Bentiu POC



Bentiu POC in March 2016

10 boreholes supplying 125,000 people within the POC.

Camp population receiving under 10l/p/d

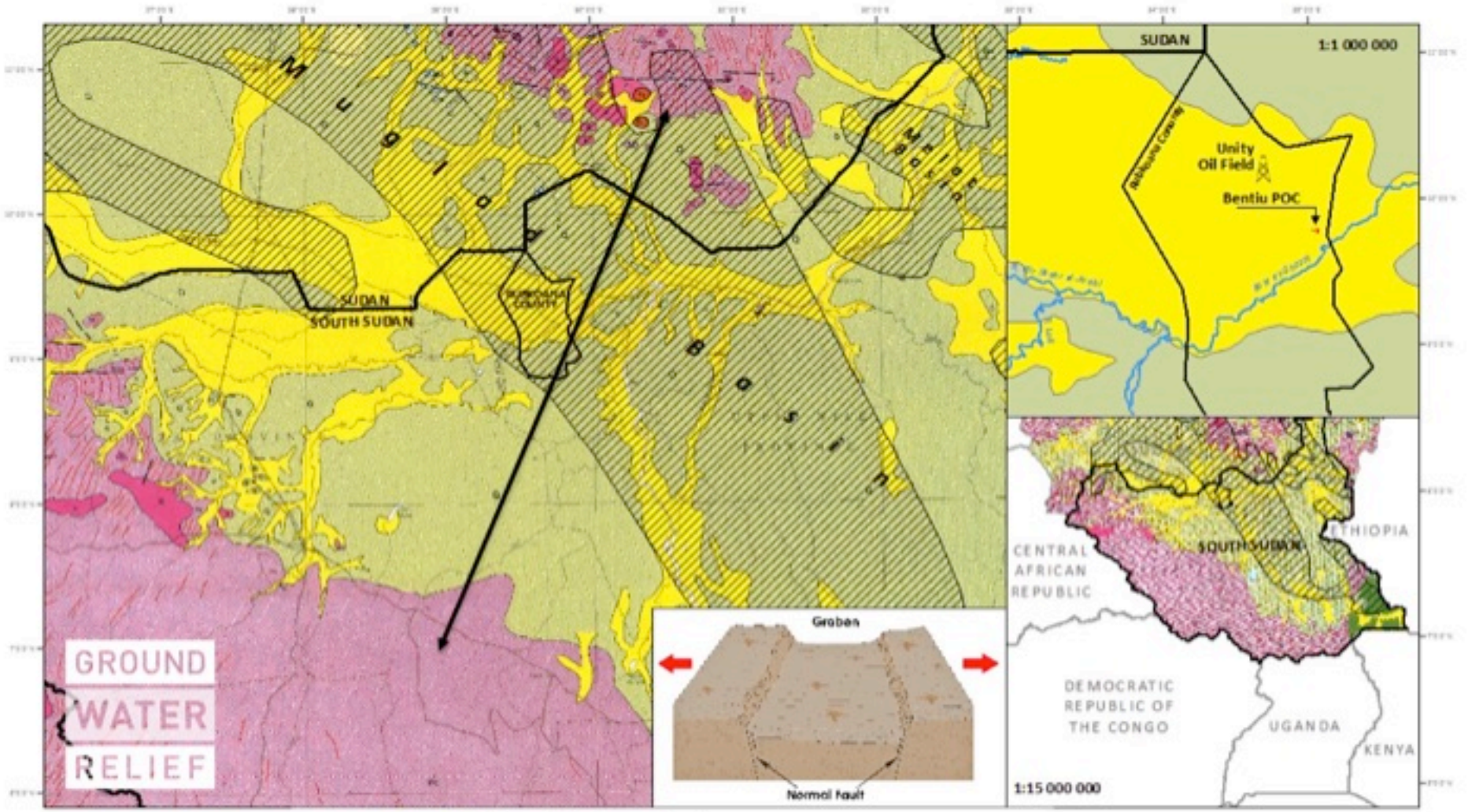
Many of the boreholes poorly performing, inefficient and pumping silt

Concern on groundwater availability

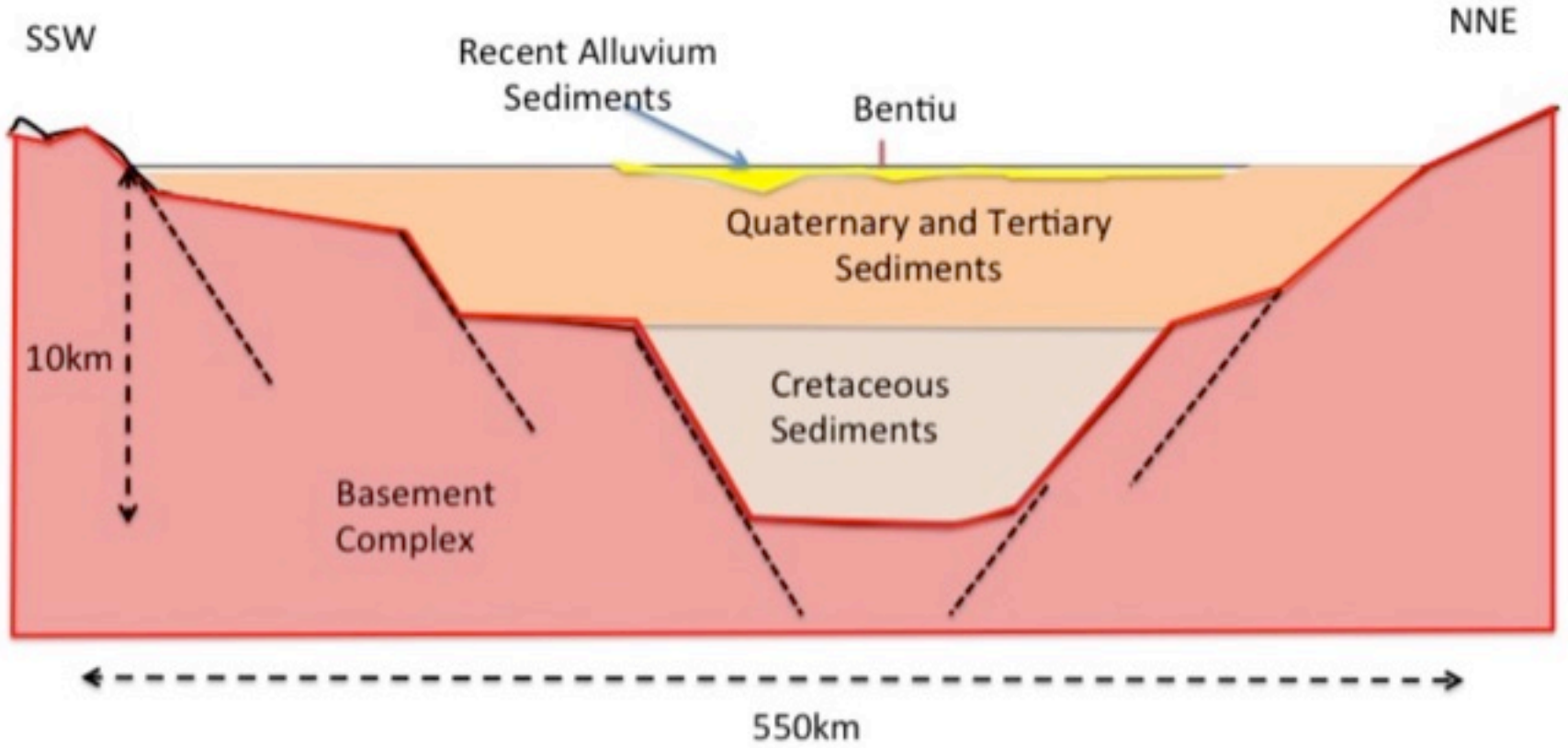
Consideration to construct a pipeline system from river Nile

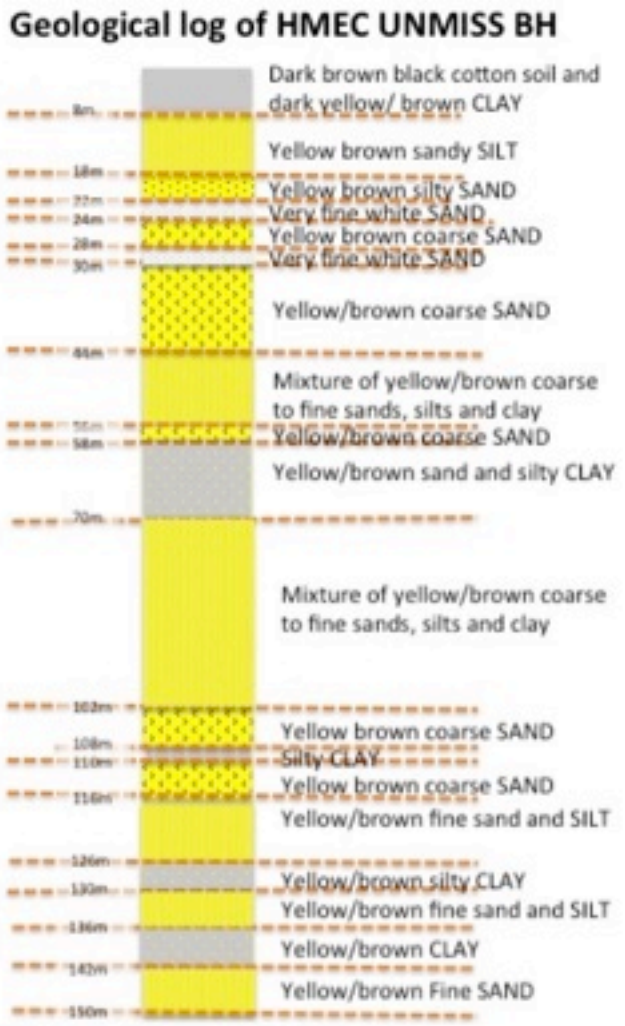
IOM having problems obtaining permission and consensus to drill new boreholes.

Regional Geology



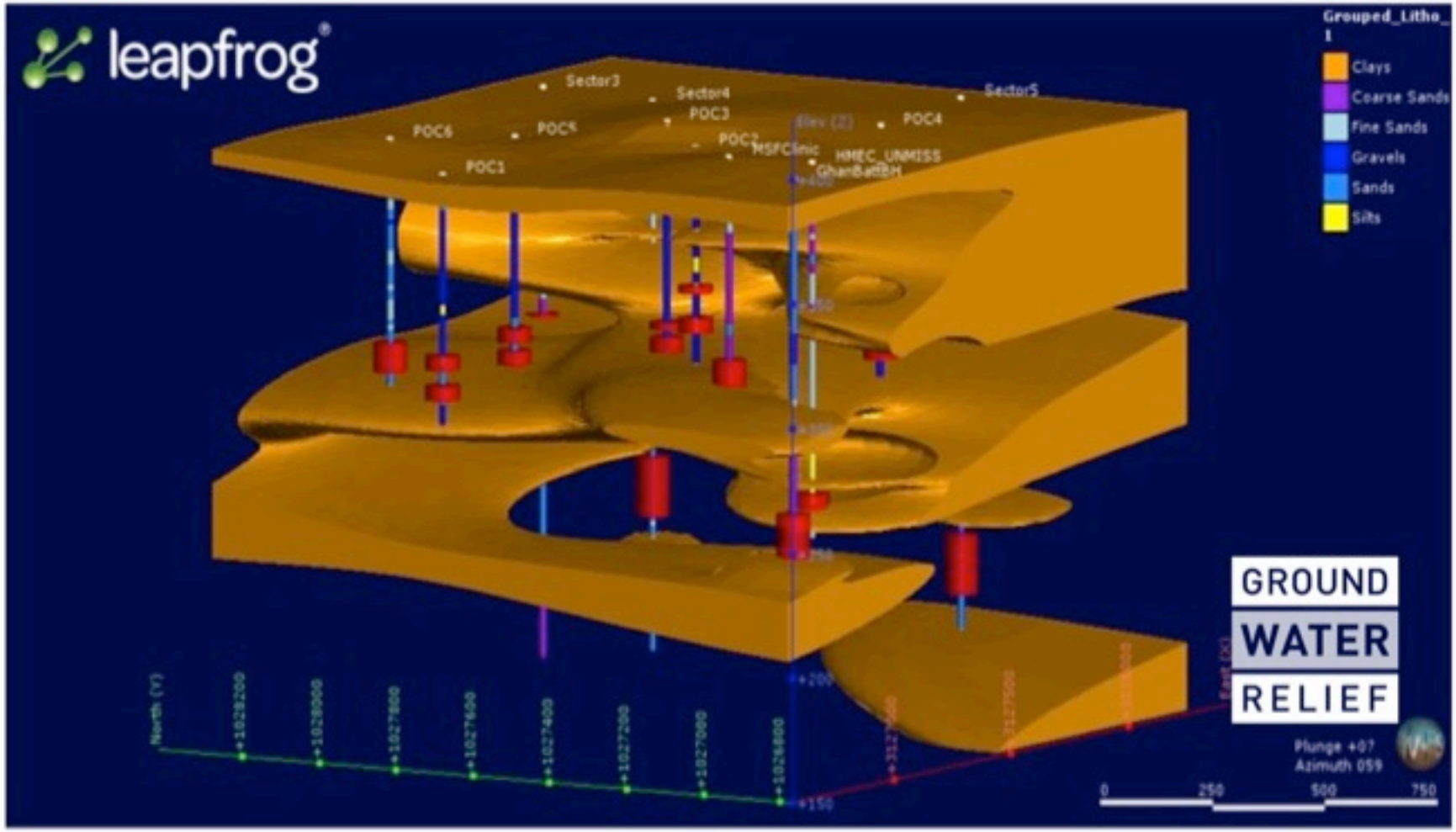
Conceptual Regional model (vertical exaggeration and not drafted using geological logging data)





- No supervision of contractor
- Screen installed in wrong location
- Geology logged in Juba after completion of borehole
- Borehole camera survey revealed inaccuracies in logs in terms of screen placement.
- Contractor enjoying a monopoly at Bentiu charging exhaubatant rates

Local Geology at Bentiu Camp



Field Work Programme – Pumping Tests

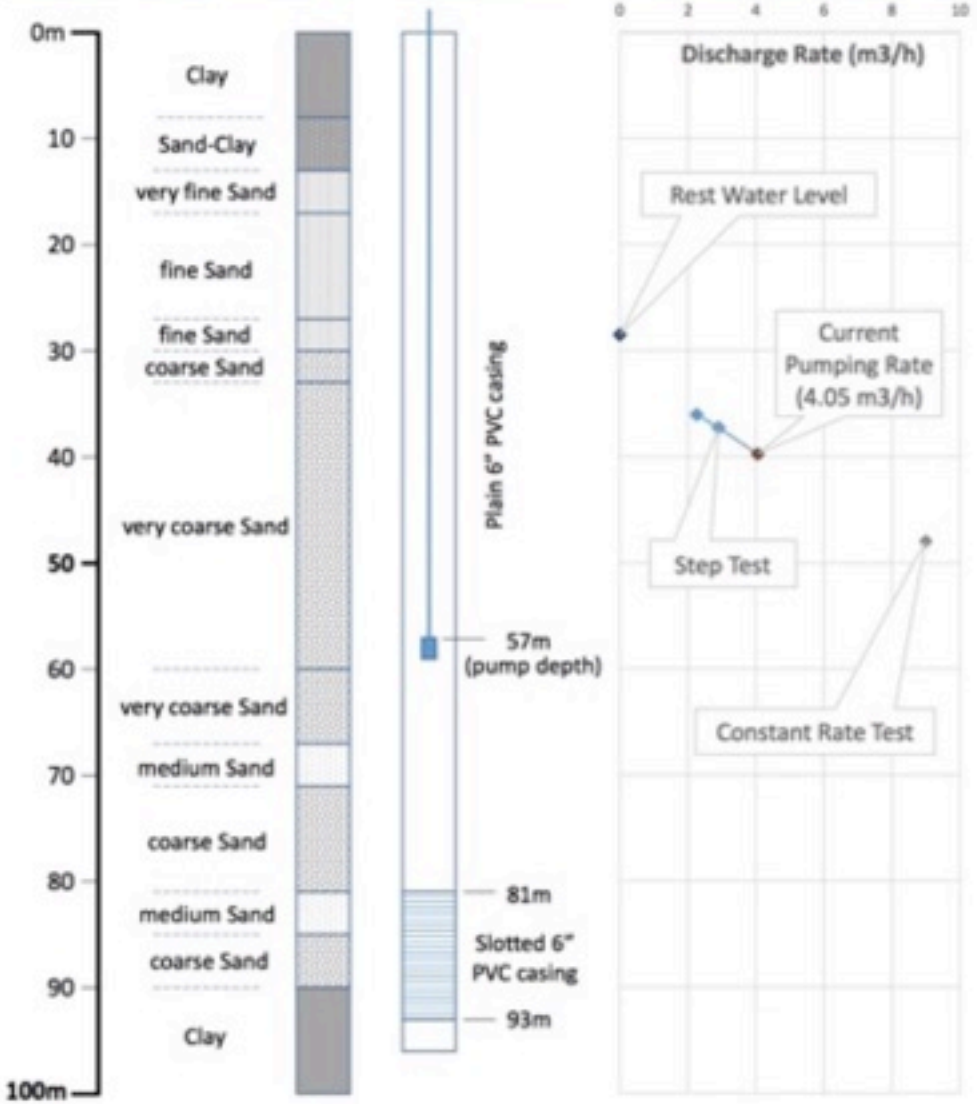
GROUND WATER RELIEF

MSF HOSPITAL PUMPING BOREHOLE

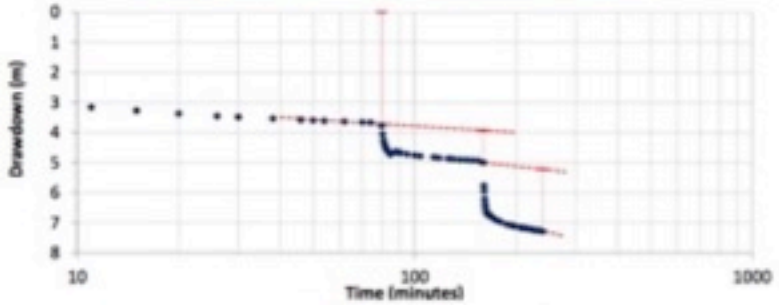
Bentiu PoC

DATA SHEET

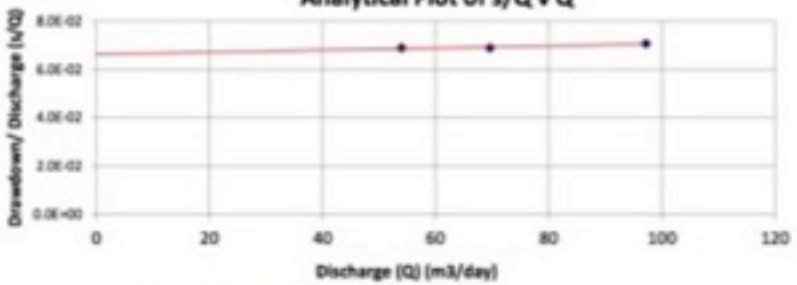
Depth | Geological Log | Installation | Observed Water Levels



Step Discharge Pumping Test Results



Analytical Plot of s/Q v Q



Apparent Well Efficiency = 94% at current pumping rate (4.05 m3/h)

Aquifer Test Results

Analysis indicates that this borehole is installed into a 'leaky' aquifer type

Test Type	Calculated Transmissivity (m2/d)	Analysis Method
Constant Rate Drawdown	**8.12**	Hantush & Jacob (1955)
Constant Rate Recovery	**12.74**	Theis Recovery (1946)

Water Chemistry

Electrical Conductivity = 2220 µS/cm at current pumping rate (4.05 m3/h)

Turbidity = 0 NTU at current pumping rate (4.05 m3/h)

From the pumping test data were able to upgrade some pumps. . .. .

Location of residence	Population	Borehole serving	Current abstraction rate (m^3/h)	Possible new abstraction rate (m3/h) DRAFT	Pumping Time (hours per day)	Estimated daily provision (l/person/day)	Future daily provision DRAFT	Current Shortfall or Excess (m^3/d)	Future shortfall or excess (m3/d) DRAFT
PoC 2	2512	Sector 2 Buffer Zone	2.5	2.0	14	14.0	11.1	-2	-10
PoC 3	7,349	Sector 2 Block 10	4.0	4.0	16	8.7	8.7	-46	-46
PoC 6	3,435	Sector 2 Block 15	2.9	2.9	17	14.4	14.4	-2	-2
Sector 1	10,662	Sector 1 Block 7	7.5	7.5	19	13.4	13.4	-17	-17
Sector 2	7,005	Sector 2 Block 6	4.7	4.7	18	12.1	12.1	-20	-20
Sector 3	35,685	Sector 3 BH	10.8	17.0	20	6.1	9.5	-319	-195
Sector 4	23,094	Sector 4 BH	8.5	17.0	19.5	7.2	14.4	-181	-15
Sector 5	30,597	Sector 5 BH	10.1	20.0	17.5	5.8	11.4	-282	-109
New Arrivals	4,365	MSF*	4.1	9.0	19	8.9	39.2	-27	106
TOTAL Camp Population	**124,704**					**Water shortfall (m^3/d)**		**-897**	**-310**

* Based on MSF distributing half their water supply to the hospital facilities

Decommission some poorly performing boreholes. . . . . .

Location of borehole	Generator Make	Power Rating	Submersible Pump	Litres/day of Fuel	Cost of diesel ($/l)	Fuel Costs ($/day)	Cost of maintaining generators and pumps ($/day)	Staff costs* ($/day)	Volume of water delivered	Total Cost ($)	Cost per m3 ($)
S3 B12	OLYMPIAN	18 Kva	SPA 12	75	3.1	233	34	30	216	297	1.37
S2 B6	OLYMPIAN	13.2 Kva	Grundfos SQS-70	40	3.1	124	34	30	85	188	2.22
S2 B10	OLYMPIAN	13 Kva	Grundfos SQS-70	25	3.1	78	34	30	64	142	2.21
S2 B15	2 KIPPOR	5 Kva	SQF2.5	20	3.1	62	34	30	50	126	2.54
S2 BZ			SQF2.5	20	3.1	62	34	30	35	126	3.60
Sector 2 Total				105	3.1	326	136	120	233	582	2.49
Water Trucking									30	120	4.00

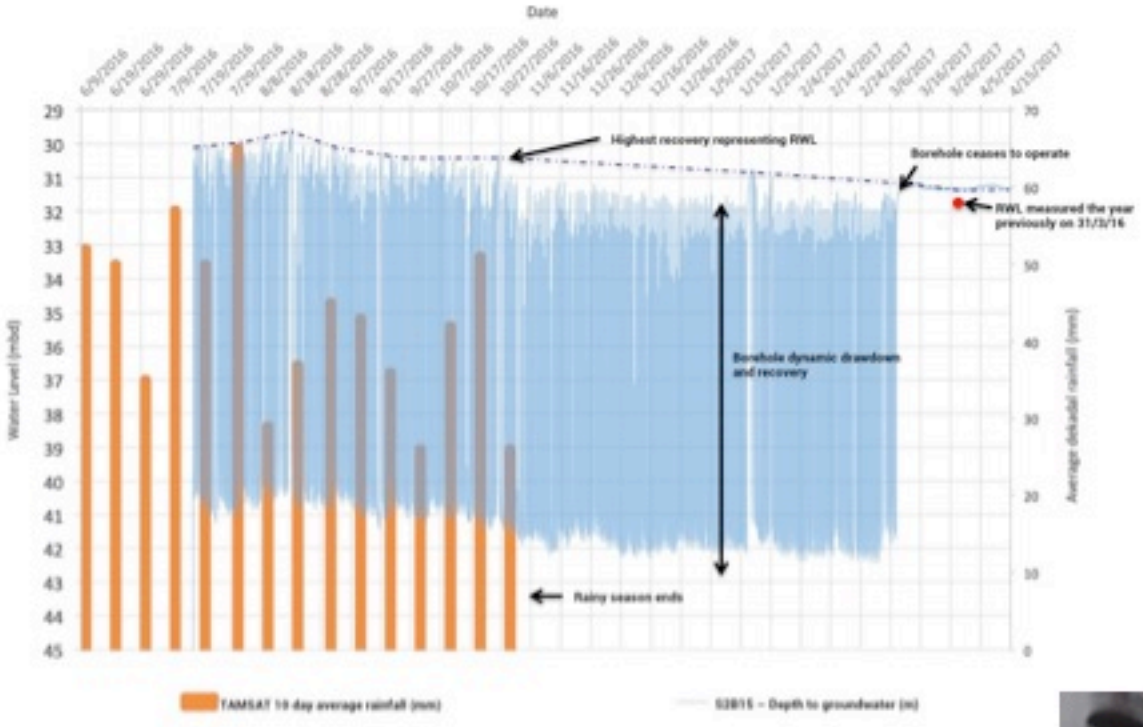
* Based on total IOM staff costs of $4540/month for maintenance of 5 boreholes

** Based on IOM monthly expenditure of $1000/borehole

	Per day ($)	Per year ($)
Cost of Supplying Sector 2		
Current costs	582	212248
Using a borehole equivalent to S3 B12	320	116841
Cost of meeting water deficit of 240m^3/day		
Using a borehole equivalent to S3 B12	329	120247
Water trucking	960	350400

Cost savings of replacing the less efficient boreholes in Sector 2 with a more efficient borehole equivalent to $95,000 per year

Groundwater Monitoring



Drilling Works

Challenges encountered with:

- Politics
- Logistics
- Drilling Practice
- Poor quality casing
- Weather
- Environment

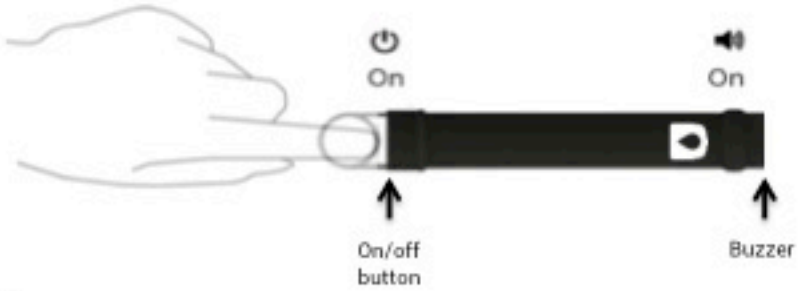
the pocket dipper

Instructions

Step 1
Attach device to surveyor tape using the caribiner snap.

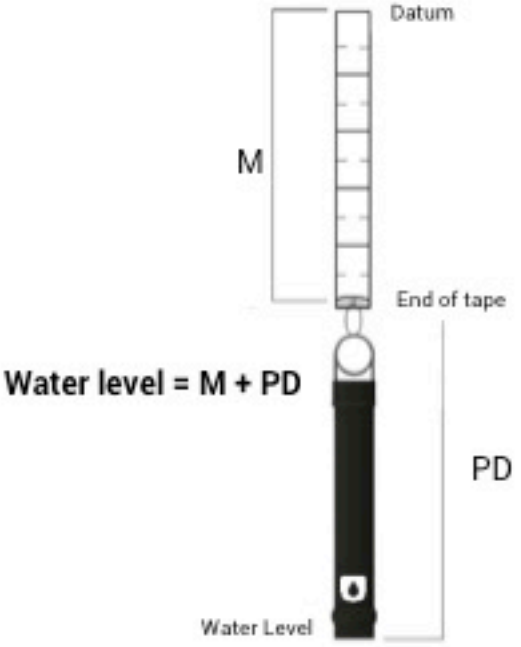
Step 2
Turn the device on by pressing the button at the top of the Pocket Dipper. The device should start emitting a buzzing noise.

Step 3
Lower the Pocket Dipper down the well attached to the surveyor tape. Once the buzzer sound stops pull the Pocket Dipper up a couple of meters until the sound recommences and lower it again this time more slowly. When you are sure of the distance at which the buzzer sound stops record a measurement using a fixed datum at the top of the well.



Step 4
To obtain a true reading of groundwater level you will need to add the distance between the buzzer and the start of the measuring tape to your reading.

If you have connected the surveyor tape to the Pocket Dipper using the caribiner snap then this distance is approximately 18cm.



Specifications

Dimensions: ø 20 mm x 140 mm.
Range: Suitable for measuring shallow water levels (up to about 30m below ground level).
Sound: 82.5 dB
Product Testing: The Pocket Dipper has been tested in water with a maximum exposure of 20 hours under 44 psi of pressure. However it is recommend that the Pocket Dipper is used as a dipping device only and should not be left under water or used as a plumb.