



Technical Cooperation Project between Namibia (MAWF)
and Germany (BGR) „Groundwatermanagement in the North of Namibia“

*„Water in the Kalahari Sands! From Investigation to
sustainable management of the Ohangwena
Aquifer System, CEB“*

CAAWG November 2014



Outline of presentation



1. Introducing the project
2. Investigation Approach
3. Preliminary findings
4. Outlook / Recommendations



Project Partners / History of project



- Funded by BMZ
- Co- Funded by DWAF (MAWF)
- NamWater
- EU-GIZ funded IWRM Project
- CuveWaters (BMBF funded)
- SASSCAL (BMBF funded)





Project Partners / Training



➤ University of Namibia



➤ Polytechnic of Namibia



POLYTECHNIC OF NAMIBIA

✓ 6 full time bursaries for junior staff (BSc, BSc (Hons), MSc)

✓ Over 25 student contracts

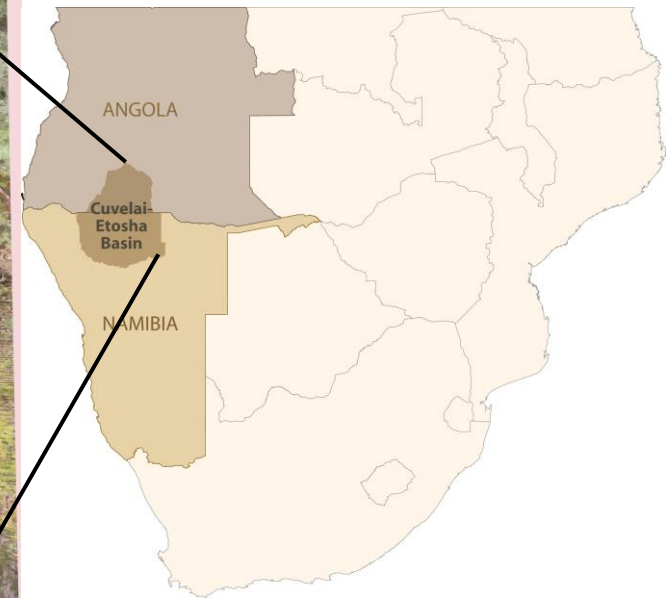
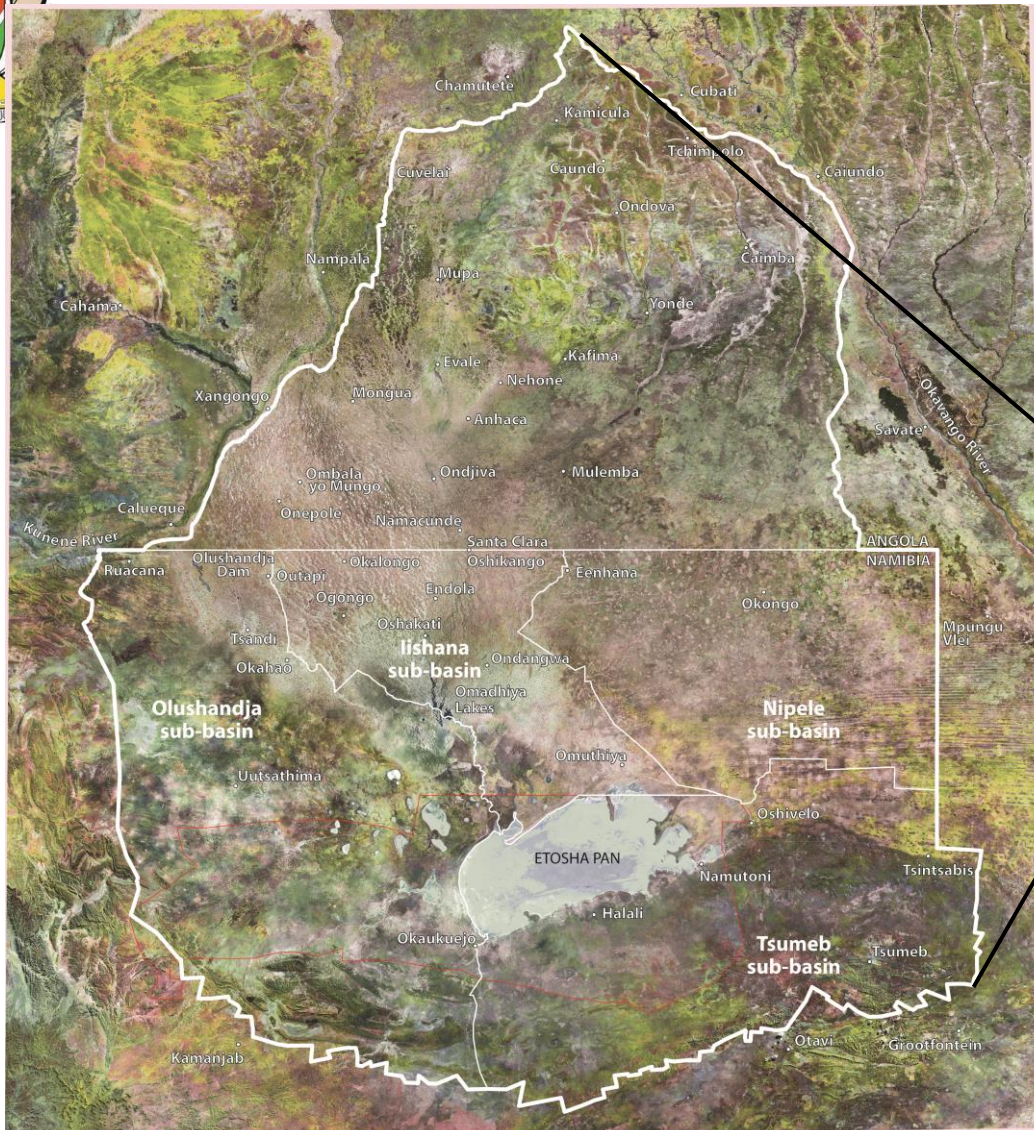
✓ Several BSc thesis and internships



DWAF NAMIBIA Resource Management Directorate		
	Female	Male
Directors and Deputy Directors	100%	0%
Professionals (Geohydrology)	62.5%	37.5%
Namibian UNESCO TBA Team	80%	20%

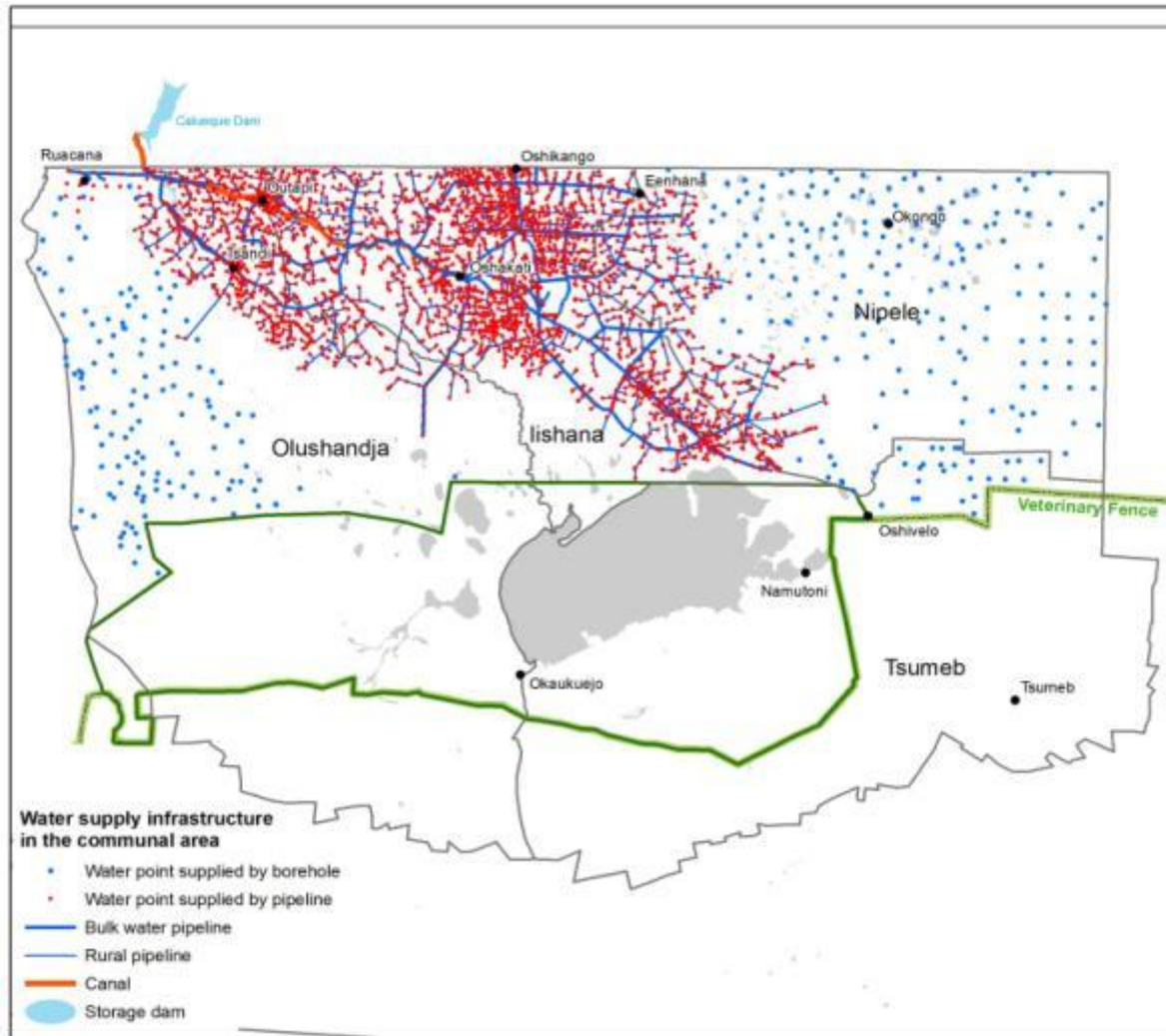


Study Area CEB



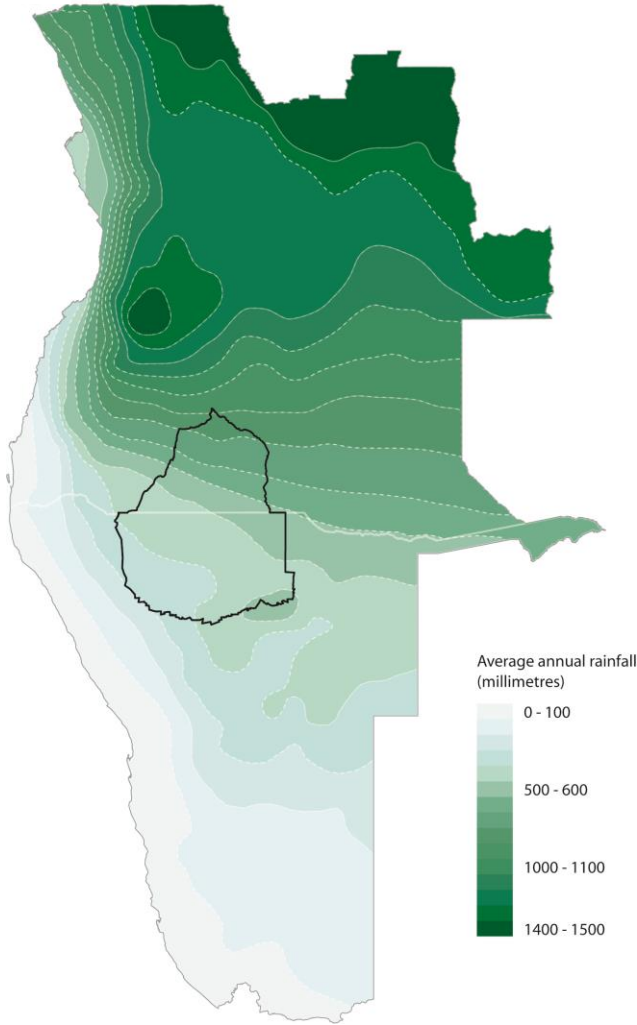


Current water supply of northern CEB

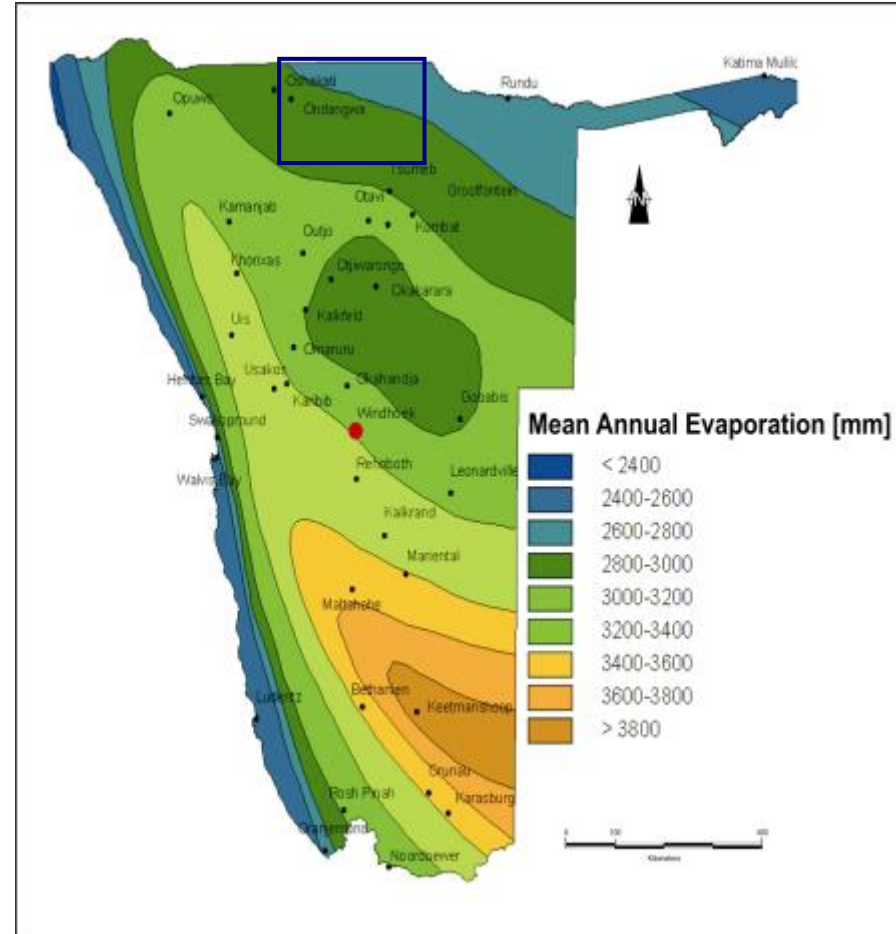




Precipitation



Potential Evaporation





Expected results:

- Defining boundaries of different groundwater bodies in the CEB
- Elaboration of recommendations
 - + drinking water supply (freshwater)
 - + water supply for livestock and irrigation (freshwater and/or brackish water)
 - + back- up supply for other areas
- Improved Database
- Sustainable IWRM using well founded groundwater information based on a Decision Support System (DSS)



Investigation Approach



1. Desktop Study
2. Hydrocensus / Sampling campaign
3. Geophysical Investigations
4. Drilling of boreholes, Hydrogeological and Geophysical tests, Hydrochemical sampling campaign.
5. Monitoring, Protection Guidelines
6. Evaluate and disseminate information, elaborate abstraction volumes

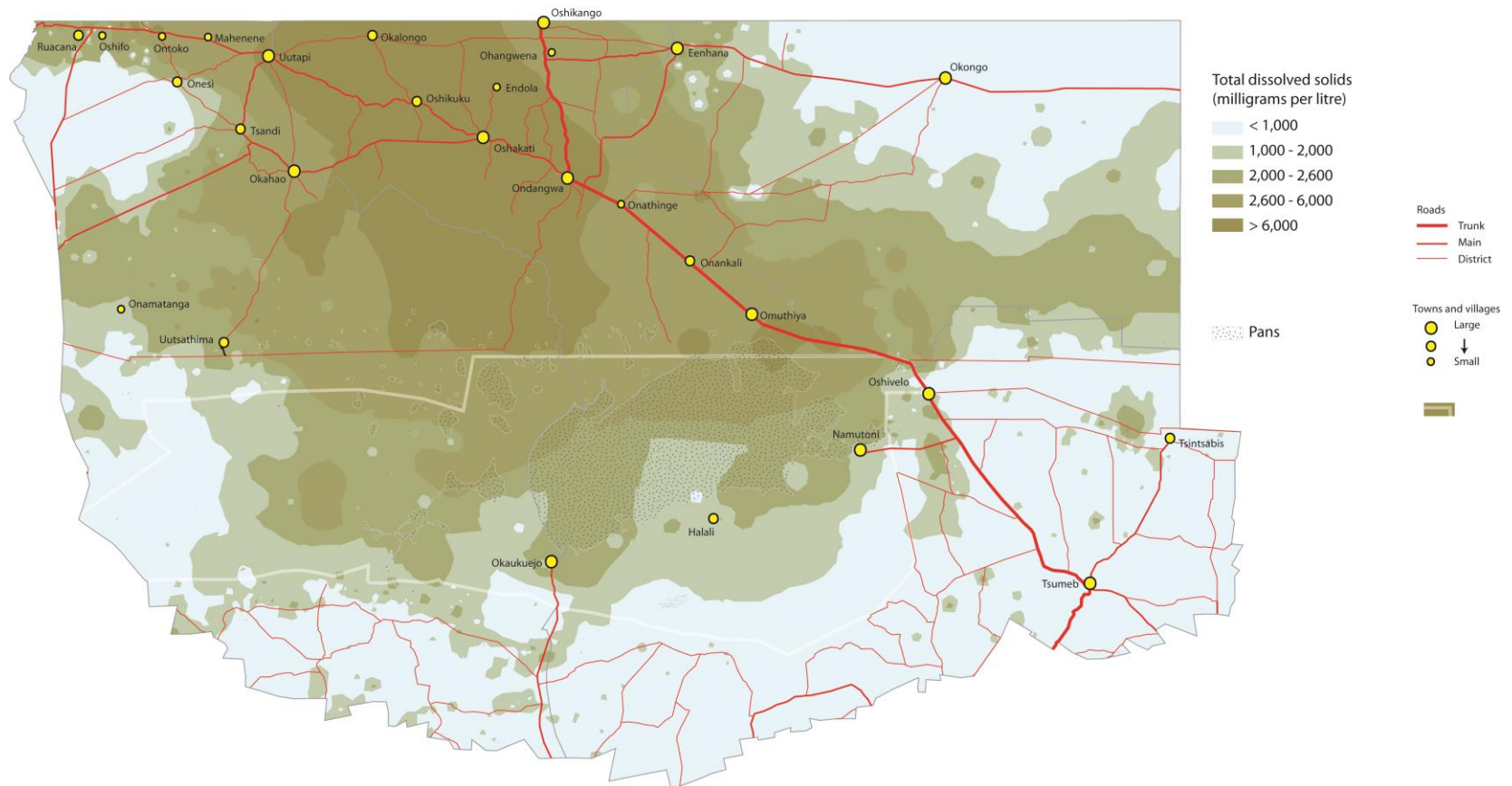


Hydrocensus: visited boreholes



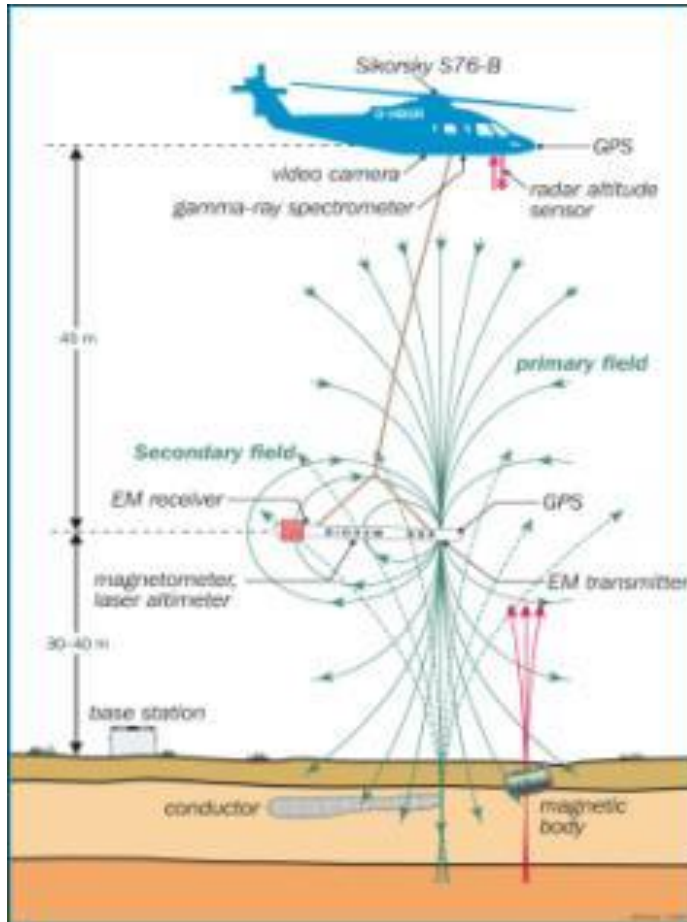


Hydrocensus: Water quality TDS



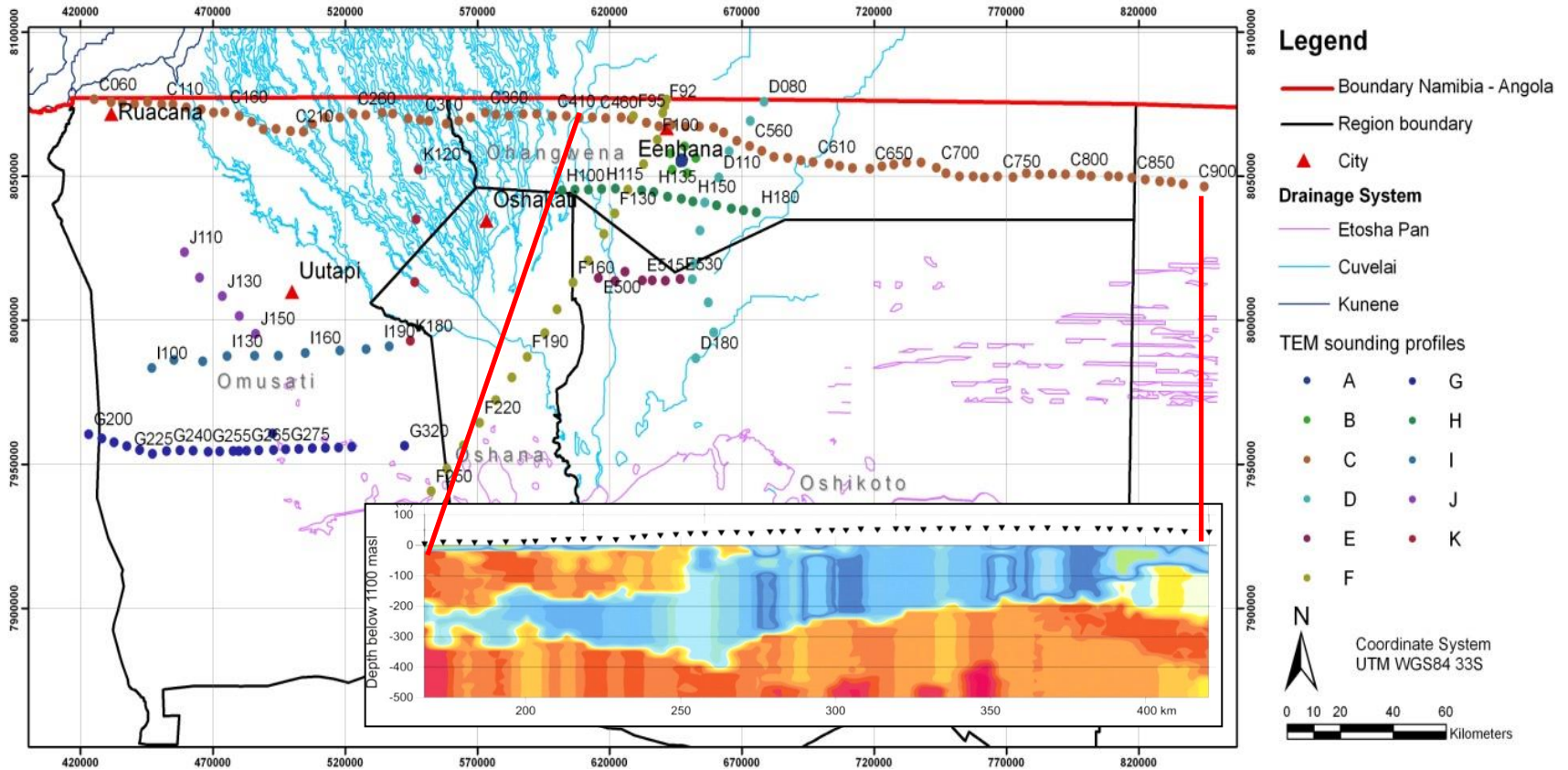


Indirect geophysical investigation (TEM)





Indirect (geophysical) investigation: Example Ohangwena



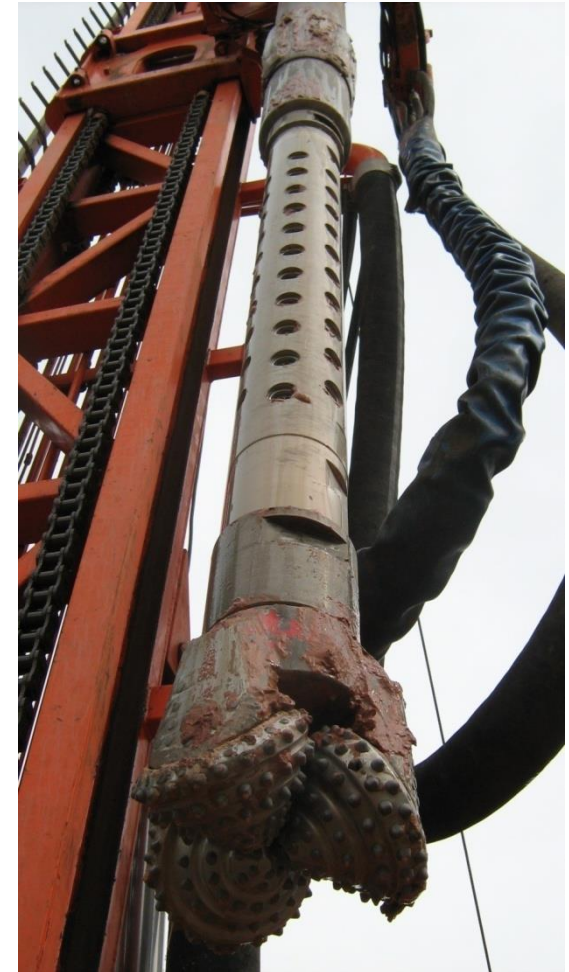


Direct investigation: Drilling of investigation and monitoring boreholes



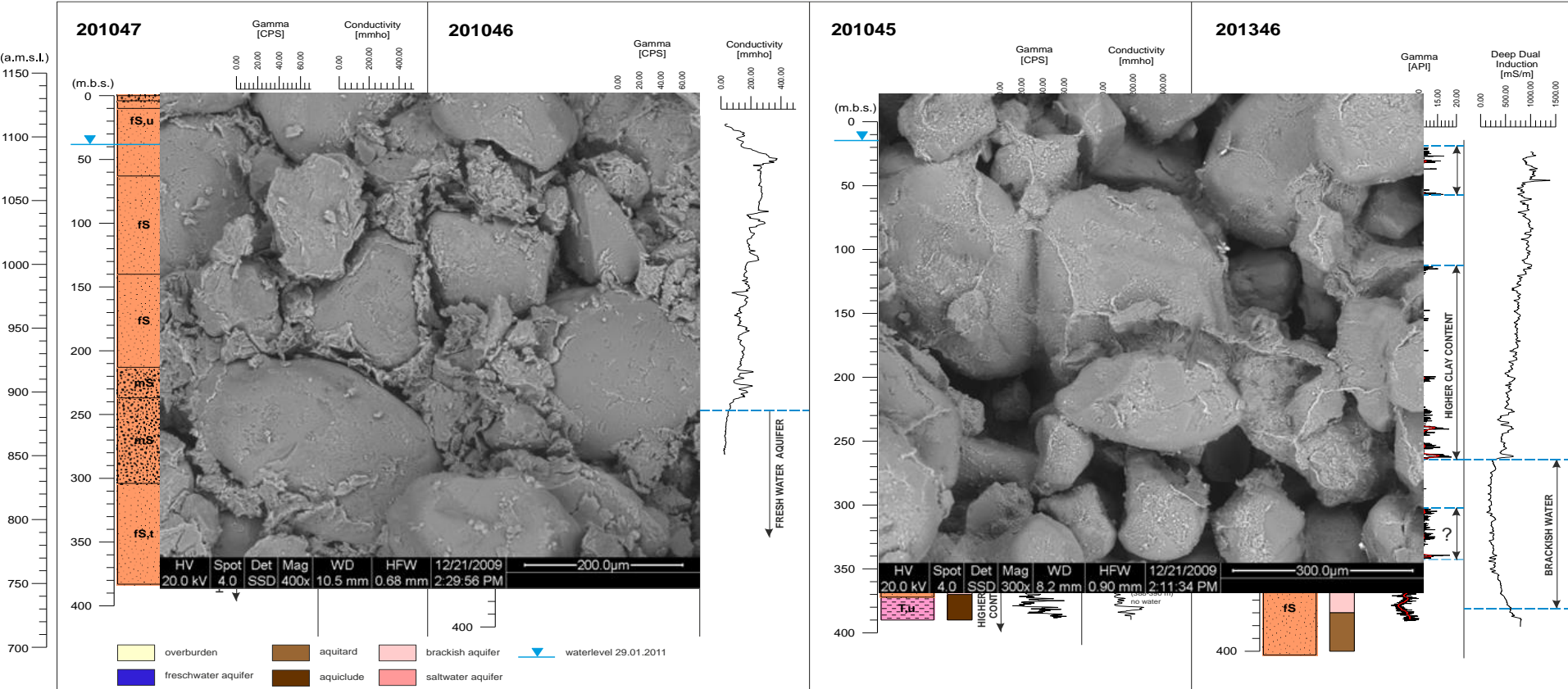
- ✓ „Insight“ to calibrate and verify indirect investigation measures.
- ✓ First assessment of yield.
- ✓ Assess quality of the water.
- ✓ Monitor the development of water resources while being used (quantity and quality)





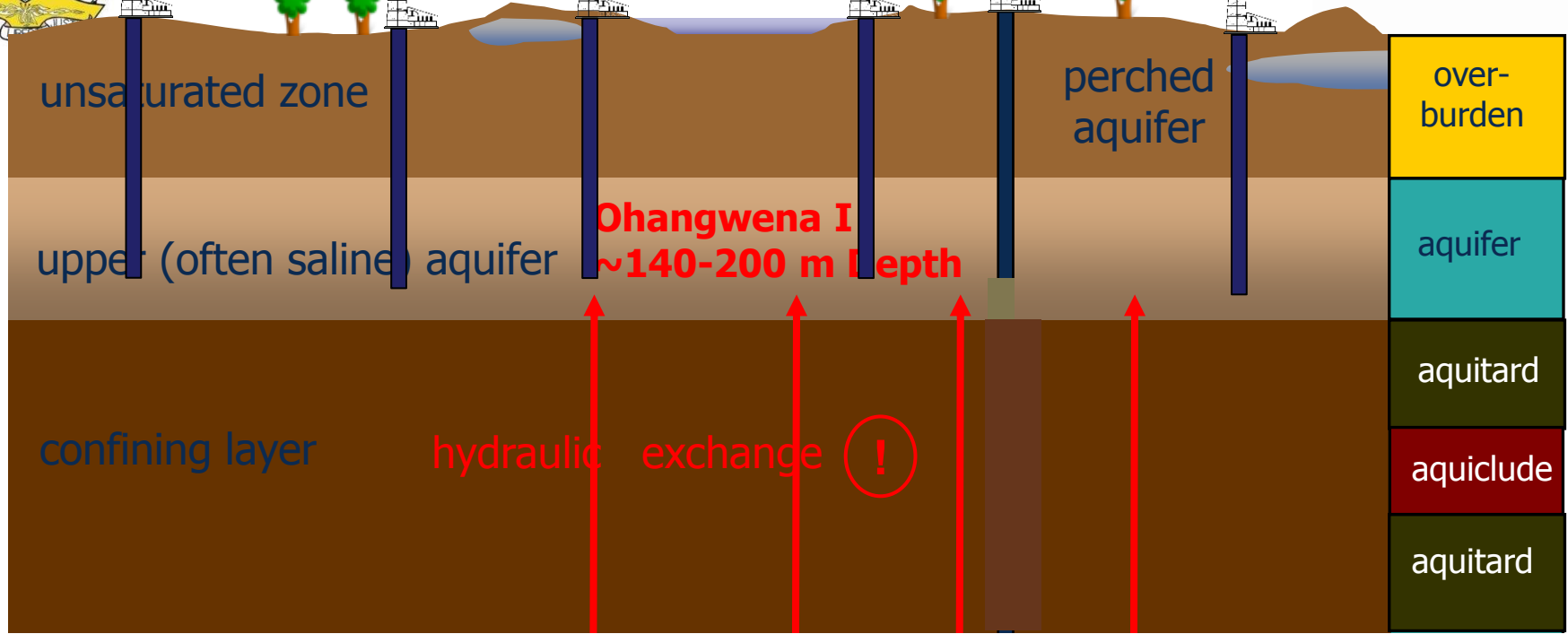


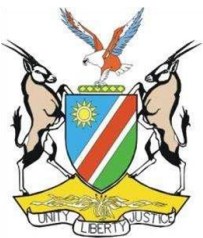
Correlation of BH- logs





Oshana

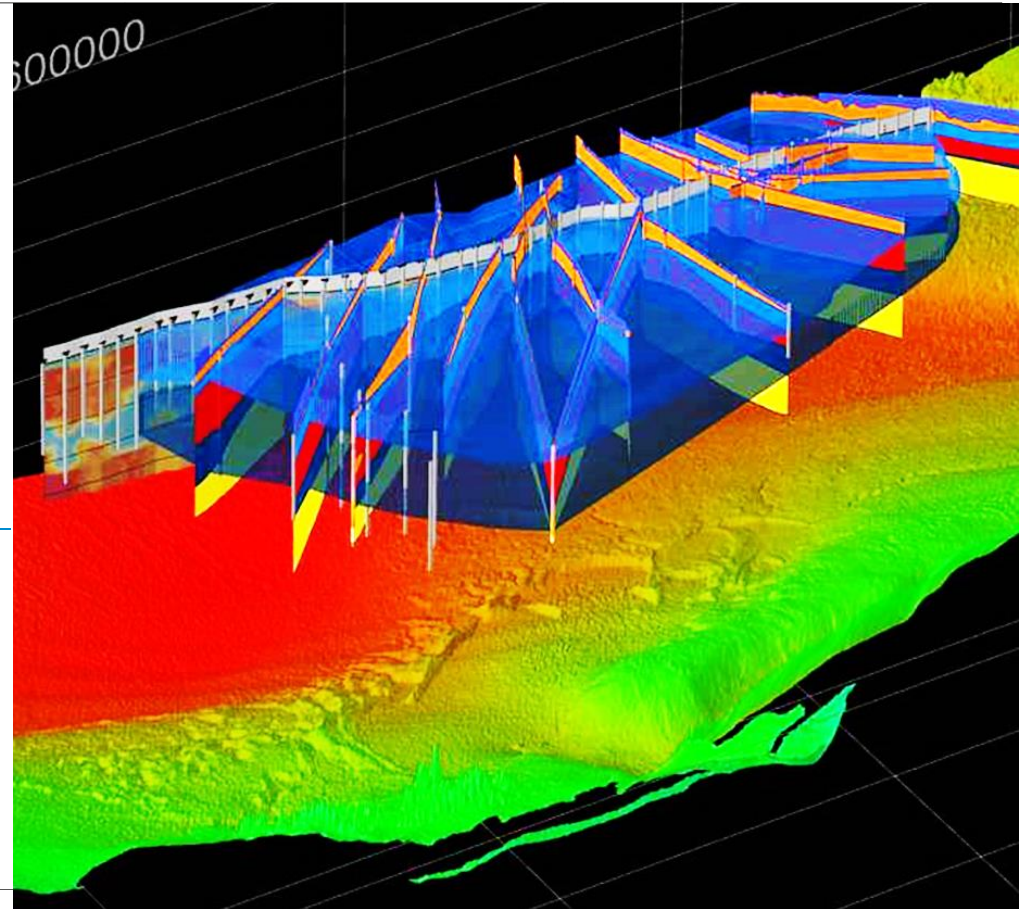
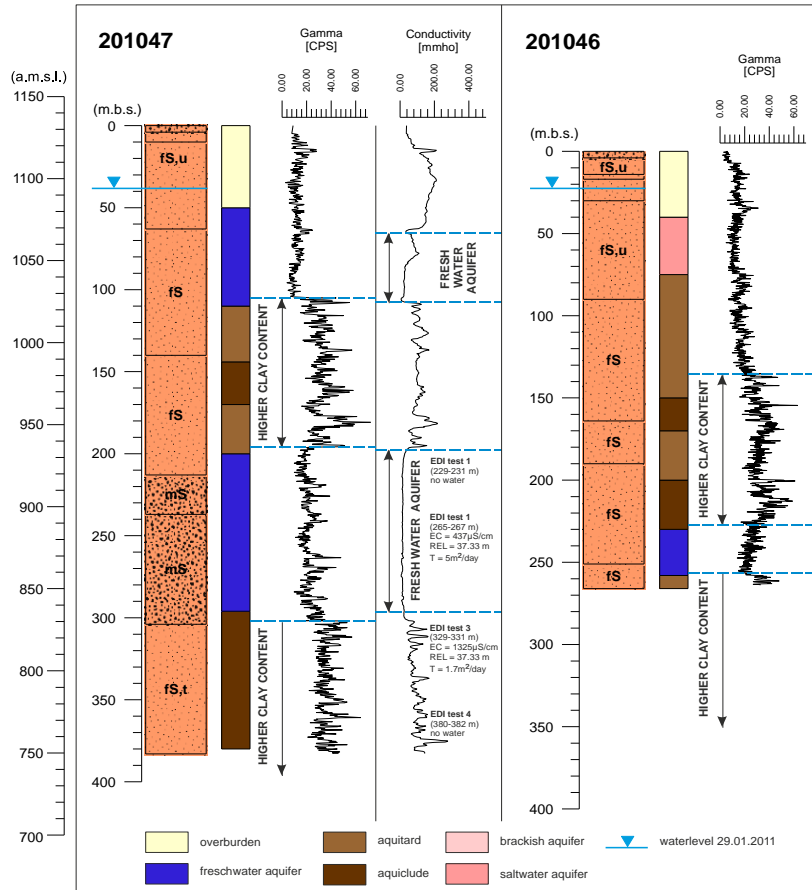




Modelling



- A first conceptual and numerical Model is developed.
- A Weap Model as part of the Information-Management was created for the whole CEB





Groundwater quality evaluation





Investigations on Groundwater Resources in the CEB



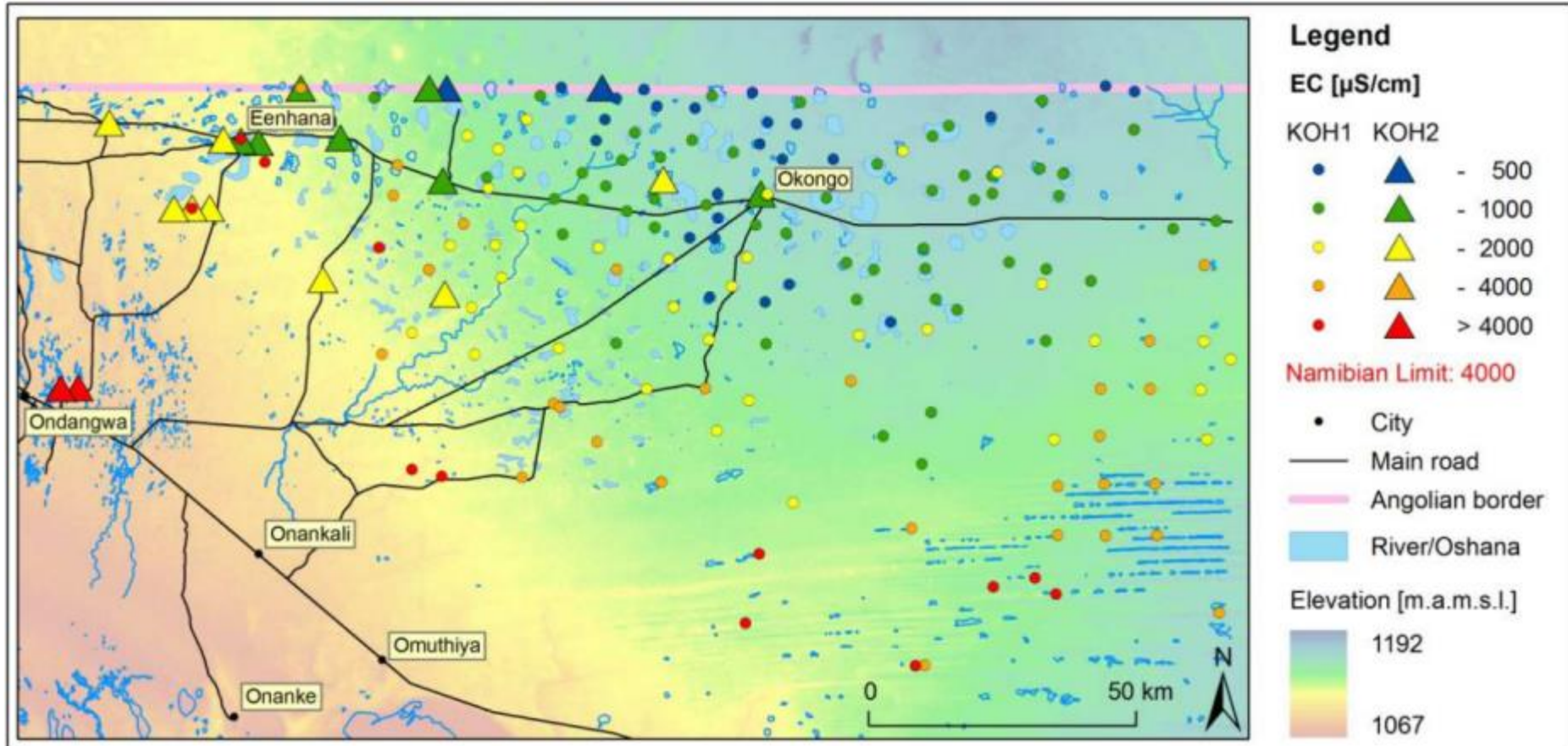
7 Groundwater Sampling campaigns in the Ohangwena Region were conducted :

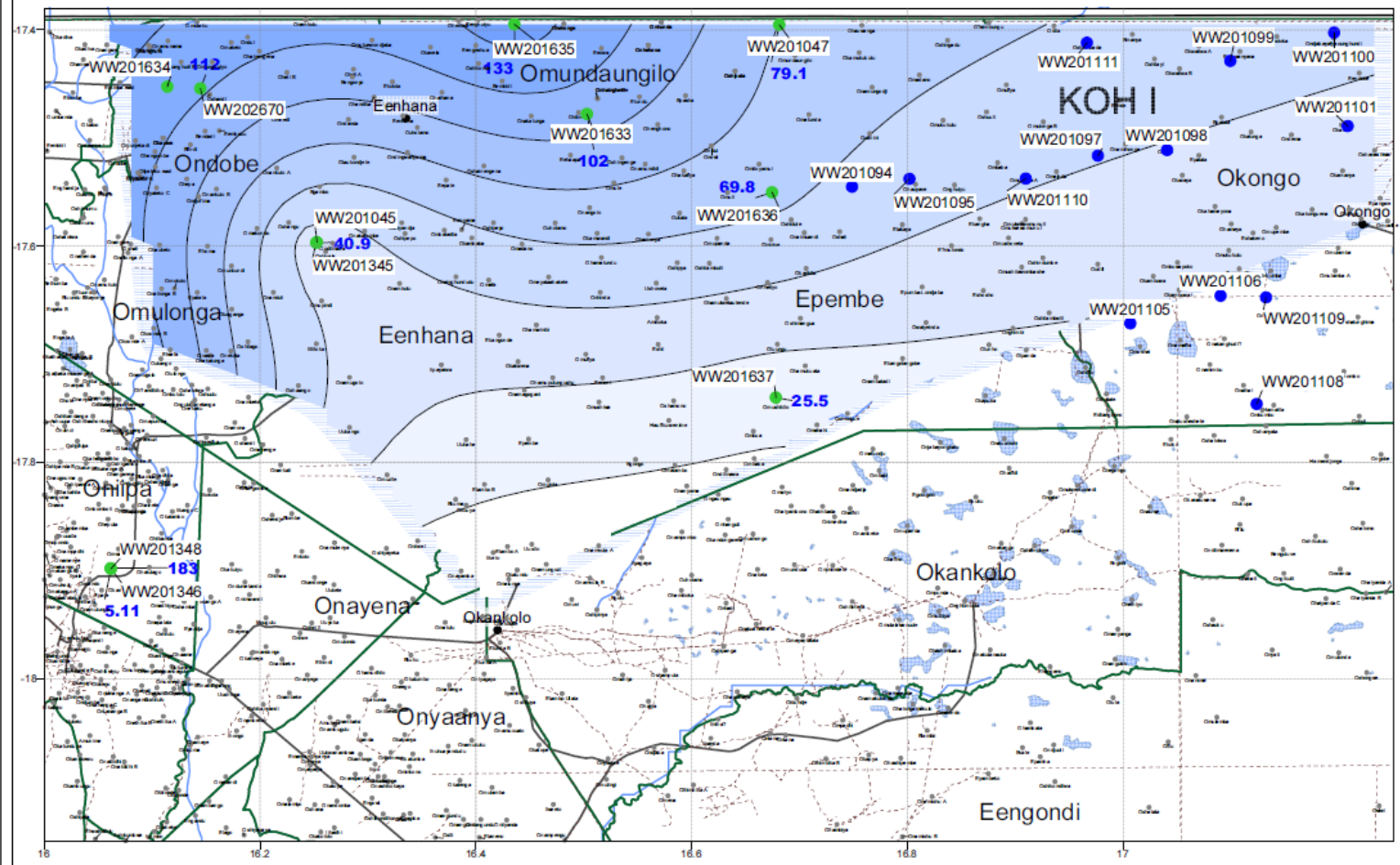
- **Water Quality Sampling, general composition, rare earth elements, stable isotopes, radio isotopes (C-14), Fluoride Studies**
- **20 boreholes are installed with water level monitoring devices. Continuous measuring**
- **Cooperation with Unam, IAEA, Sassoc established**





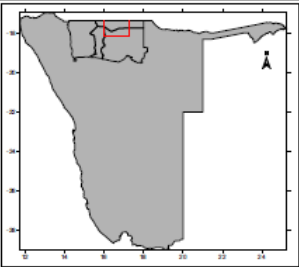
Electric conductivity in the Ohangwena region





<p>Project: Groundwater for the North of Namibia</p>		
<p>Title: Transmissivity KOH 2 (m³/h per m drawdown); Ohangwena Region; Cuvelai-Etoshia Basin, Namibia</p>		
Date: August 2014	Source: Directorate of Environmental Affairs / NNEP, Atlas of Namibia 2002; Hydrogeological Map of Namibia 2001; Technical Co-operation Project DWAV-BGR Groundwater for In North of Namibia 2013	Compiled by: Christoph Lohr (BGR) / Federal Institute for Geosciences and Natural Resources

●	Boreholes KOH I		Interpolation of Transmissivity Values (m ² /d) for KOH II
●	Boreholes KOH II		
●	Cities		
⊕	Villages		
⊕	Tracks		
⊕	Border of Constituency		
⊕	Roads		Known extend of the Ohangwena II (KOH II), Kalahari freshwater yielding deep Aquifer





Recharge?

Quality during usage?

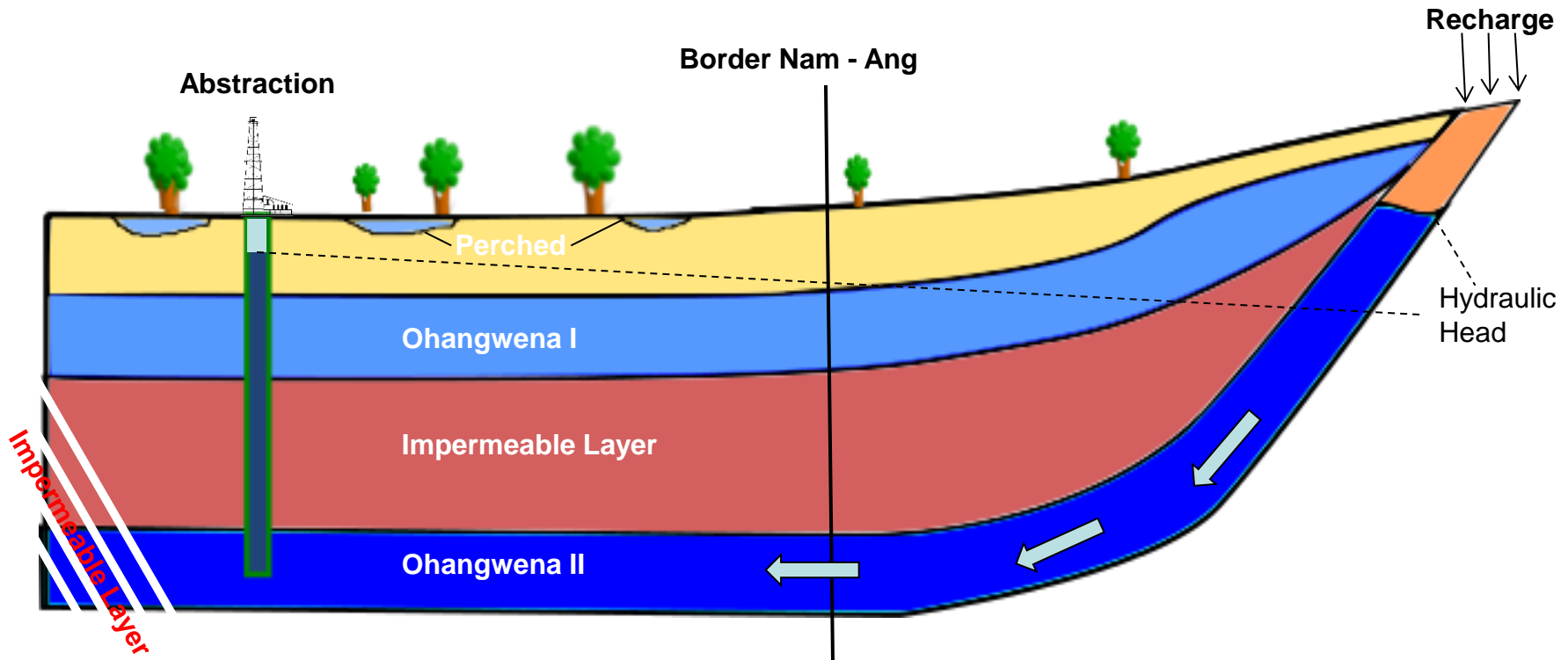


Recharge Principle (not to scale)



S

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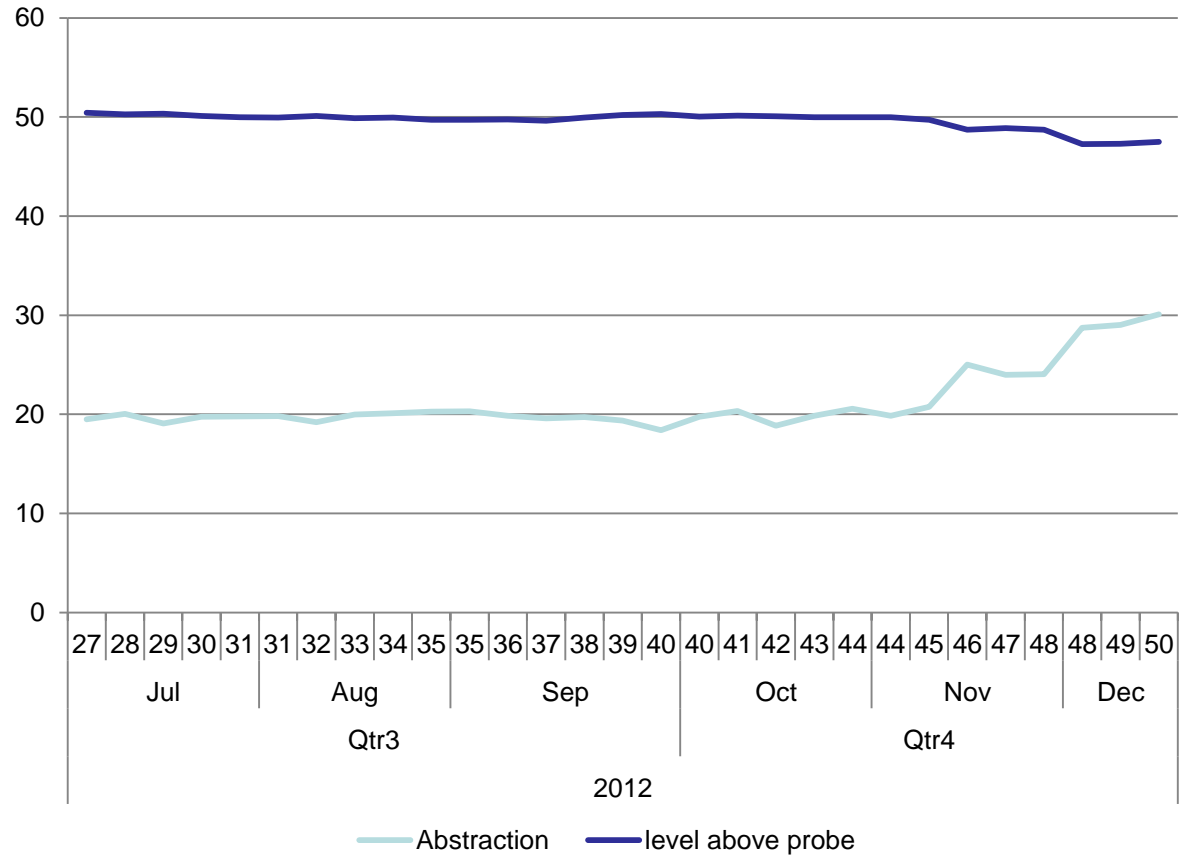


Namibia

Angola



Long-term test pumping Eenhana





Key Figures KOH II

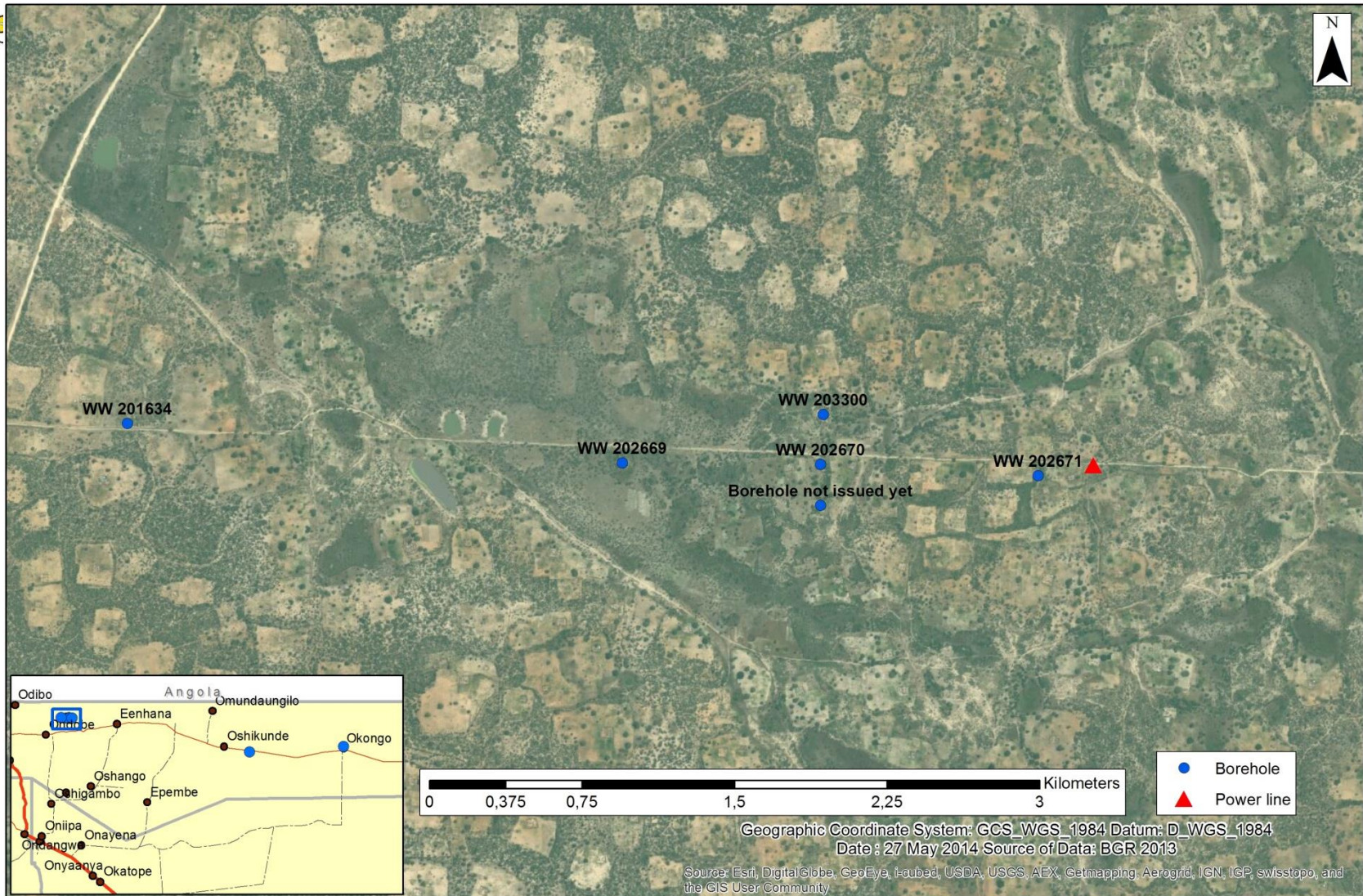


Parameter	Values presented in 2013	Current Status Values
Area covered Namibia	2500 km ²	5170 km ²
Stored volume	5 billion m ³	20 billion m ³
Actual recharge 2011/2012	???	635,000m ³
Potential recharge	???	???
Average depth to top of aquifer	250 m	235 m (189 – 331)
Average thickness	60	65 m (33 – 97)
Average rest water level below ground	20 m	17 m (9 – 29)
Average Transmissivity	???	74 m ² /day (5 – 240)
Average specific yield per m draw down	???	1,4 m ³ /h (0.28 – 5.29)



Detailed Map of Drilled Boreholes in Ondobe Constituency - 2013

IN ARBEIT



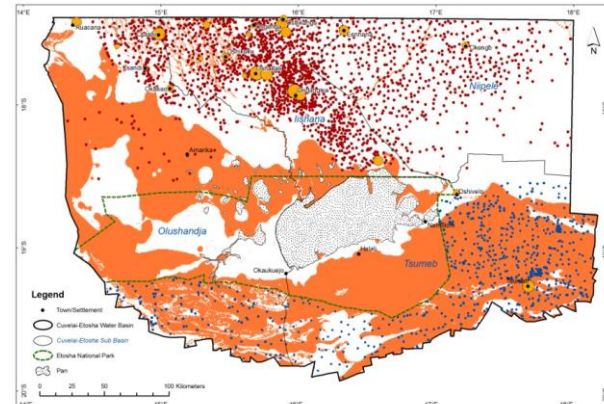
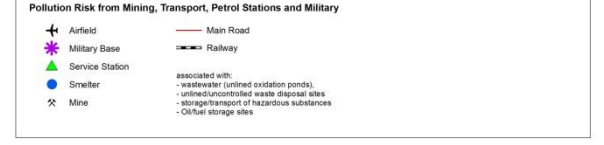
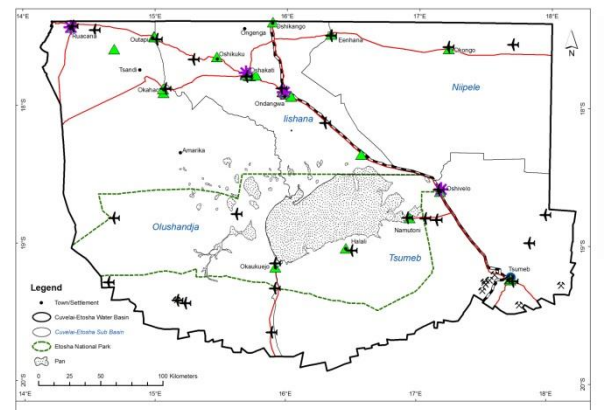
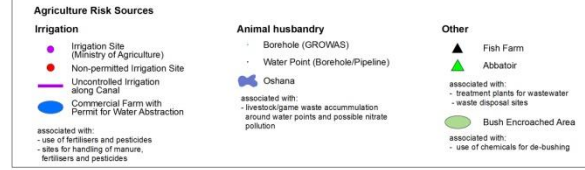
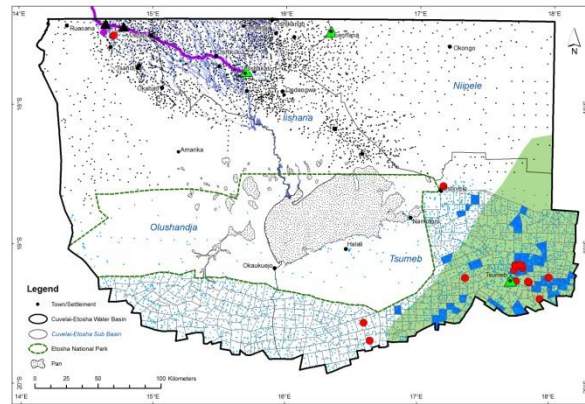
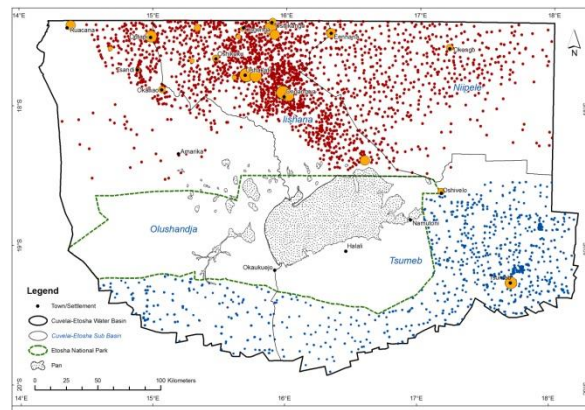
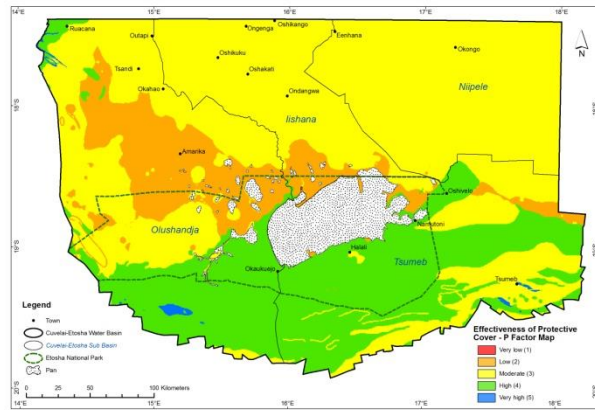
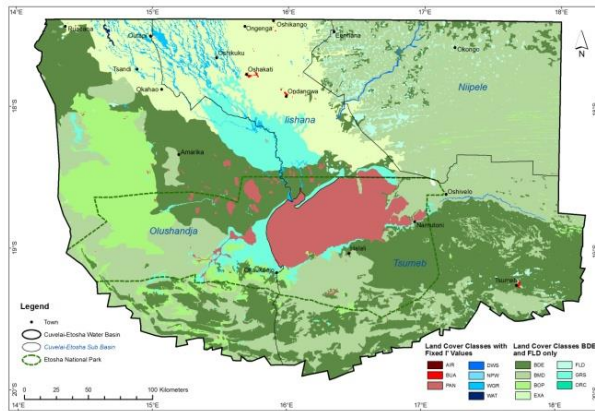
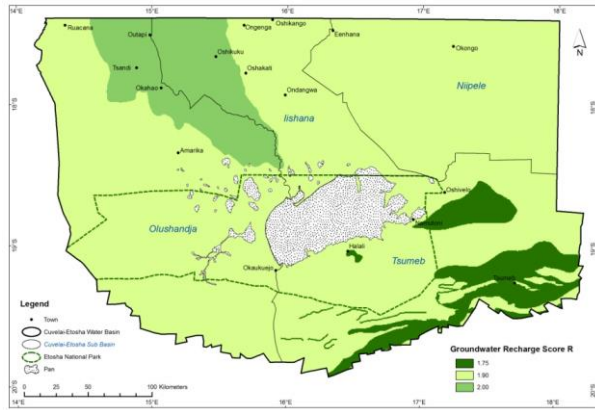


Stakeholder Participation (Communication)



- From the start all stakeholder groups were informed and involved
- Cooperation with traditional leaders and local political decision makers is essential
- The newly established Basin Management Committees (BMC) proved to be an ideal platform to apply IWRM principles.
- On the job-training with more than more than 40 water experts and students from Ministries and Universities, preferably from the region
- Awareness campaigns in schools sensitizes the next generation on the importance of clean water
- Without stakeholder involvement, it is impossible to secure compliance with regulations in Namibia!







GROWAS II Modules



GROWAS II: V3.7.0 ODBC



Map View Locations Master Data Time Series Hydro chemistry Borehole logs Licensing

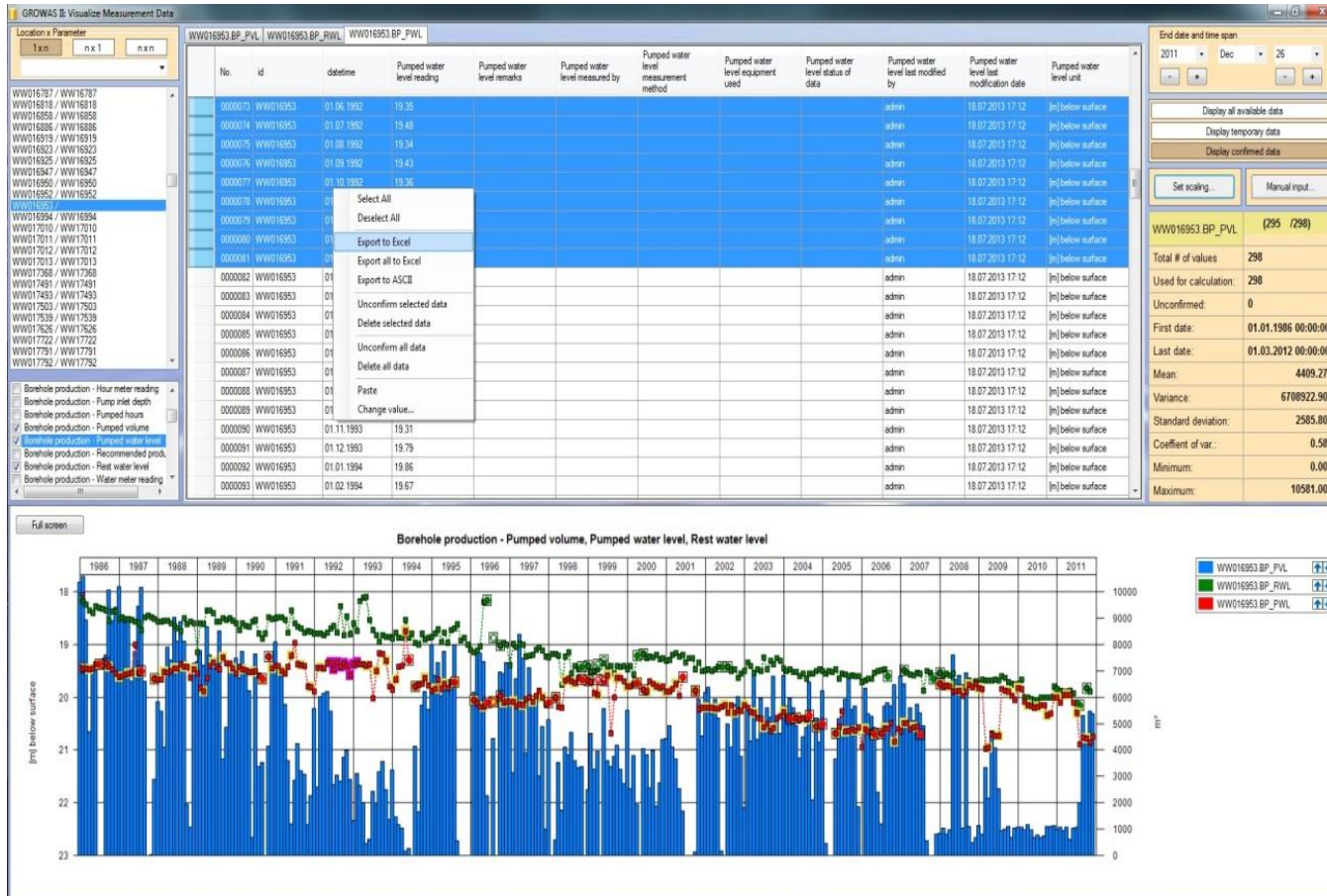
Import Export Report Profiles Configuration Info EXIT

Ministry of Agriculture, Water and Forestry
Department of Water Affairs and Forestry
BGR
Federal Institute for Geosciences and Natural Resources

nam09 admin DBAdmin New Profile Selected IDs (0)



GROWAS II monitoring data





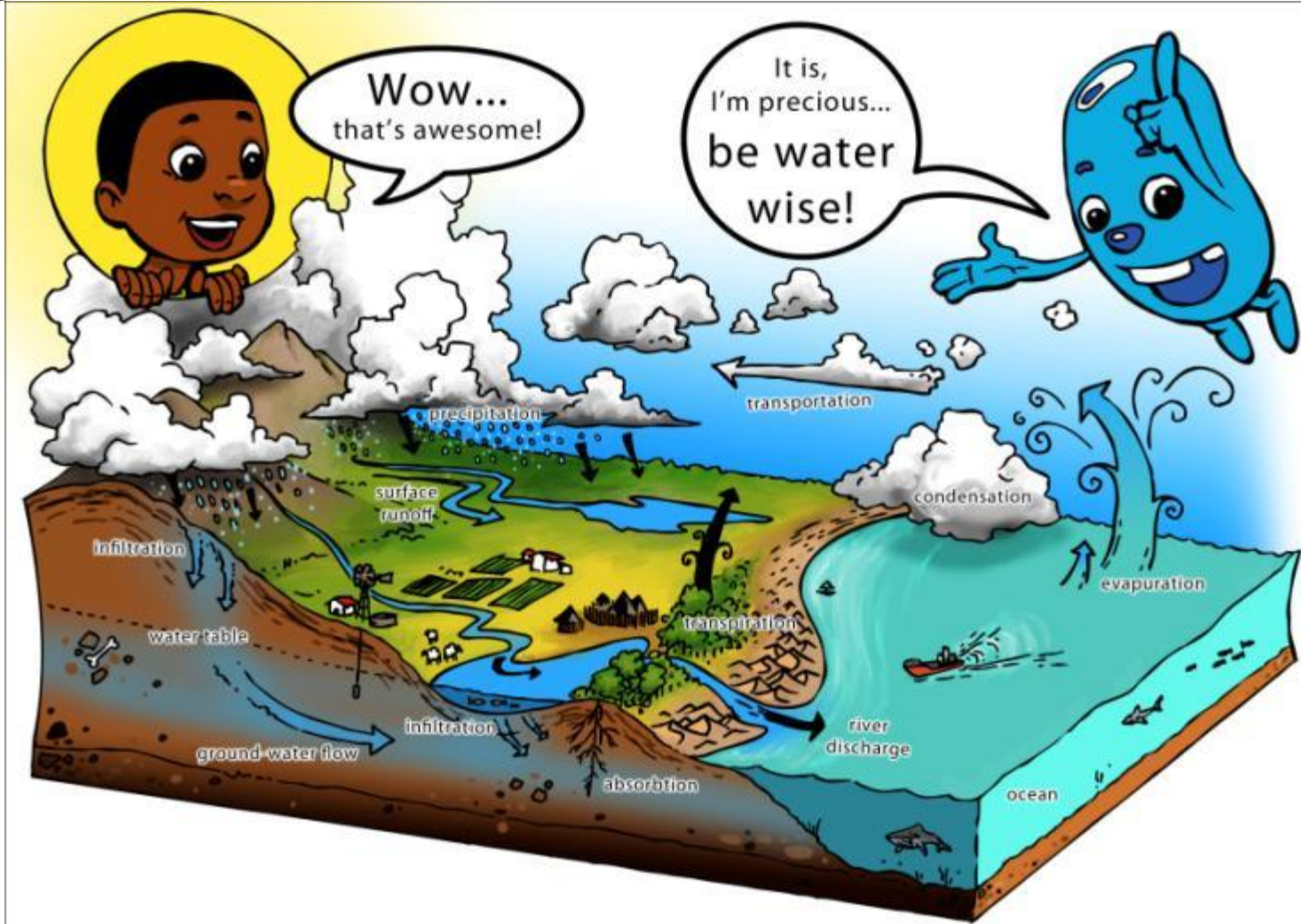
Conclusion



- The Ohangwena II Aquifer can be considered as a secure back- up supply option for the region if developed accordingly.
- To assess the option for sustainable long- term exploitation further investigations are fundamental! (minimum time frame 3 years)
- For testing purposes the aquifer should be used (long term test pumping), but reducing the supply must be an option if the results indicate insufficient recharge or negative development. (*with NamWater, DWSSC*)
- A sound legal framework must be in place to control any development of the system! (*with D- Law + Admin*)



Awareness water cycle: for the future generation



Thank You

