ILS L'ONT FAIT

ADEME
Agence de l'Environnement et de la Maîtrise de l'Energie
Club ADEME International

altereo

NAMWATER
Namibia Water Corporation Ltd

Namibia

Intervention time
2018 – 2020

Total cost
745 000 € HT

Engaged workforce
20 man-months. 10 profiles mobilised: project manager; remote management/ data processing expert; civil engineering/ process expert; works expert; pipeline expert; GIS expert; design/ planning expert; hydraulic engineers; project coordinator

Thematic

Prestations provided

Engineering

Namibia Water Corporation Ltd (NamWater)

Feasibility study and detailed design to secure the drinking water production and transfer system for the Naute-Keetmanshoop area

The project took shape in 2016 following the visit to France of Namibia's President, Dr. Hage Geingob, which brought together the Namibian authorities, the French Embassy in Namibia and Altereo to discuss the urgent water-related issues in the country including the networks ageing and the resurgence of leaks.

Several prospective missions were conducted by Altereo in Namibia in order to identify high-priority areas namely the Karas region and its capital, Keetmanshoop.

It was therefore decided to include in the Keetmanshoop municipality project:

- *the technical rehabilitation studies of the conveyance pipeline from Naute dam*
- *the diagnosis of the distribution system involving significative improvement of the network, creation of a geographic information system (GIS), leak detection campaigns and an asset replacement program*
- *a master plan defining the works to be implemented up to year 2040*

French partners :

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Mission A: Diagnosis of the conveyance system

Replacement of the conveyance pipeline : Data collection was carried out through GPS and drone surveys to locate the 109 manholes and produce a high precision aerial photographic report (100 m wide) along the 45 km of existing pipeline as well as a Digital Terrain Model. Since 2009, 68 leaks have been recorded on this pipeline. A leak record form was created with the KIS® Collect mobile application. A tender was prepared and delivered to the client to renew the pipeline: technical drawings, phasing of works, costs, etc.

Diagnosis of the conveyance facilities: treatment plant, pumping stations and reservoirs : A panel of experts was involved in auditing the existing facilities, establishing detailed diagnoses and providing suggestions through costed rehabilitation works taking into consideration the 2040 master plan for the municipality

Optimisation of remote management of conveyance structures : A global analysis was undertaken on the existing monitoring equipment: SCADA, level sensors, pressure gauge, flowmeters, etc. Costed suggestions were provided to upgrade and ease the management of the existing facilities.

Mission B: Diagnosis of the Keetmanshoop distribution system and preparation of a Master Plan

Installation of an asset management unit : Original drawings of the water network were converted and transfered to KIS, Altereo's geographical information system before being updated with the field investigations. A leak form was also created on the KIS Collect application and implemented within the municipality.

Diagnosis of the water distribution system: metrology, hydraulic modeling, night flow : A measurement campaign was perfomed on the Keetmanshoop water network via the analysis of bulk meters, pressure loggers and level sensors. Night flow follow up enabled the estimation of the leaks and orientate localized and precise leak detection campaigns. A hydraulic model was also constructed and calibrated to support the diagnosis and test the envisaged developments.

Optimised network replacement strategy with Altereo's HpO® AI : Leak records were analysed with the HpO® expert system which uses artificial intelligence to identify the risks of leaks for each pipe of the network. An optimised replacement program, taking into account this risk criteria and a few others, was built with HpO®.

Master plan 2040 : : The 2040 drinkable water master plan was established with the help of the diagnosis, the hydraulic model results and the optimized renewal program. It integrates the demographic growth and future water demand and aims to sustainably improve the service to the subscribers and preserve the water resource for the next 20 years.

Post-realization results

Mission A : Diagnosis of the conveyance system

Overall, at least 6,994,000.00 € ex. VAT (~$N 112,839,000 ex. VAT) will be necessary for the renewal of the coveyance pipeline between Naute dam and the Keetmanshoop municipality. And 1,857,000 € ex. VAT (~ $N 29,950,000 Ex. VAT) for the rehabilitation of the treatment plant and the different reservoirs on the conveyance scheme (treatment plant reservoir, pumping stations reservoirs and Terminal resevoirs).

Mission B : Diagnosis of the Keetmanshoop distribution system and preparation of a Master Plan

- **State of the network at the beginning of the study :** The yield was estimated to 50% on the municipal network. Taking into consideration the water purchases from NamWater, it represented in 2018, 120m³/h of leaks and a net loss of 1 million € ex. VAT ($N 16,000,000 ex. VAT) for the municipality.
- **Improvement of the network knowledge and Non-Revenue Water :** Before Altereo's intervention, about 22 km of pipes were unknown from the water services (material, diameter, depth, etc.) Today, the entire network is known and integrated in the GIS KIS®. Moreover, following the installation of district meters on the water network and the execution of different measurement campaigns with the municipal teams, a reduction of more than 16% of the minimal night flow was observed between the beginning and the end of the study. It represents about 300,000 m3/year and therefore an annual economy of 280,000.00 € ex. VAT ($N 4,500,000.00 ex. VAT). The master plan complements the operational improvement via better organisation of the services, training and assets replacement plan, etc. Before Altereo's intervention, about 22 km of pipes were unknown from the water services (material, diameter, depth, etc.) Today, the entire network is known and integrated in the GIS KIS®. Moreover, following the installation of district meters on the water network and the execution of different measurement campaigns with the municipal teams, a reduction of more than 16% of the minimal night flow was observed between the beginning and the end of the study. It represents about 300,000 m3/year and therefore an annual economy of 280,000.00 € ex. VAT ($N 4,500,000.00 ex. VAT). The master plan complements the operational improvement via better organisation of the services, training and assets replacement plan, etc.
- **Network replacement optimisation though targeting with the HpO® AI and 2040 master plan :** HpO® analysed 260 leaks (881 pipes, 150 km). The HpO® IA was calibrated with leaks data over 4 year (2014-2017) and validated with 2 years of leaks data (2018-2019).

The failure risk forecast curve created by HpO®, shows that replacing 15% of the pipes would avoid almost 70% of the failures. This strategic renewal will save hundreds of thousands of euros to the municipality by 2040.

Overall, at least 6,500,000,00 € ex. VAT will be necessary to implement the master plan: current and future network consolidation, replacement program and training programs.

Environmental impact

The project aims to significantly reduce the loss of drinking water from the supply pipe and the urban network. The ecological impact is undeniable, both in terms of water resource preservation and energy savings in treatment and pumping. The approach of intelligent network renewal via HpO® is virtuous in the sense that it should improve the efficiency of the drinking water supply network in a sustainable manner.

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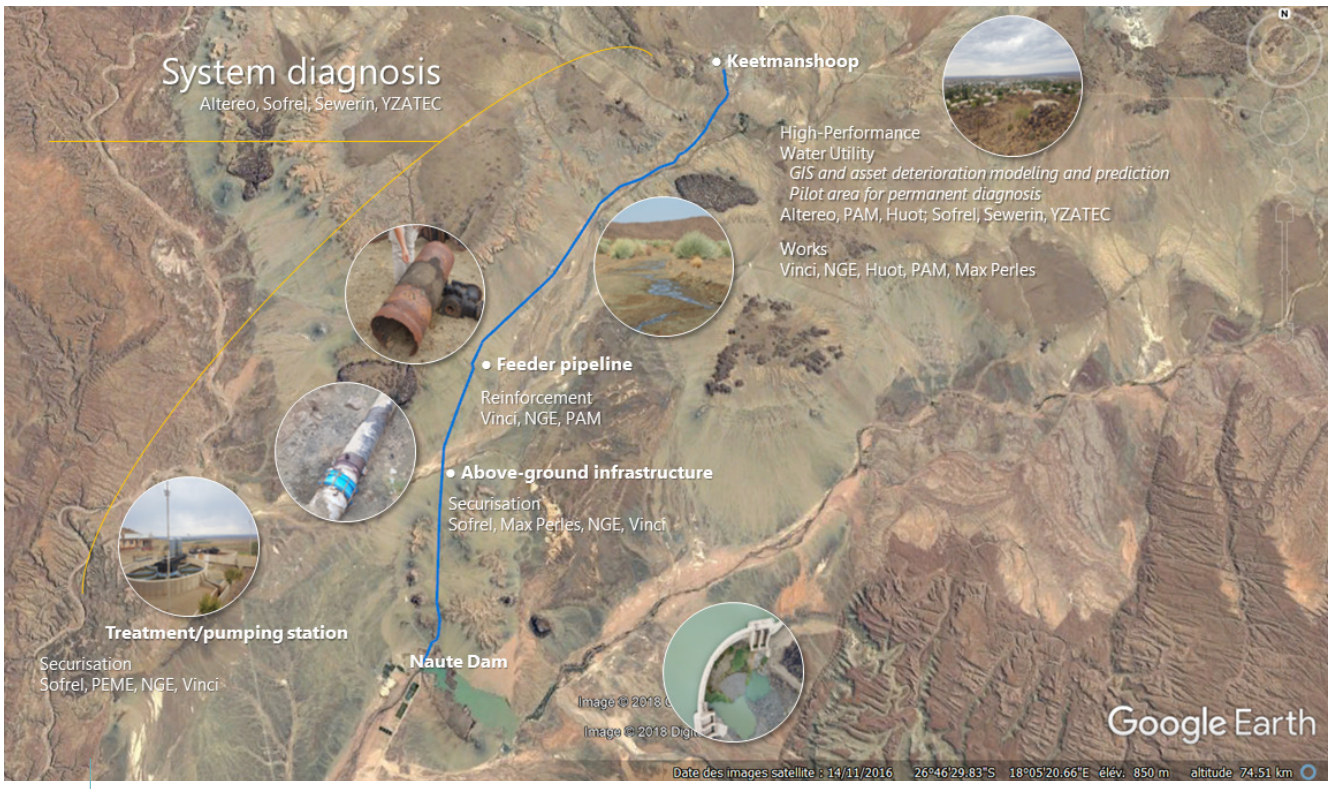
Repercussions for France

Demonstration of the know-how of French companies combining engineering technologies and computer systems. First application of the HpO® IA on the African continent. Prospecting support for development in Namibia, South Africa and neighbouring countries. Downstream supply contracts for project partners.

Repercussions for Namibia

Securing the drinking water supply in the Naute-Keetmanshoop region. Potential for replication in other drinking water supply systems.



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With more than 130 members, the Club ADEME International assists the SMEs in its network in the development of innovative projects and international partnerships. The objective is to participate in the dissemination of French knowledge, by supporting the private and public sector in the ecological and energy transition sector in order to meet global environmental and climate challenges.

More information : www.clubinternational.ademe.fr