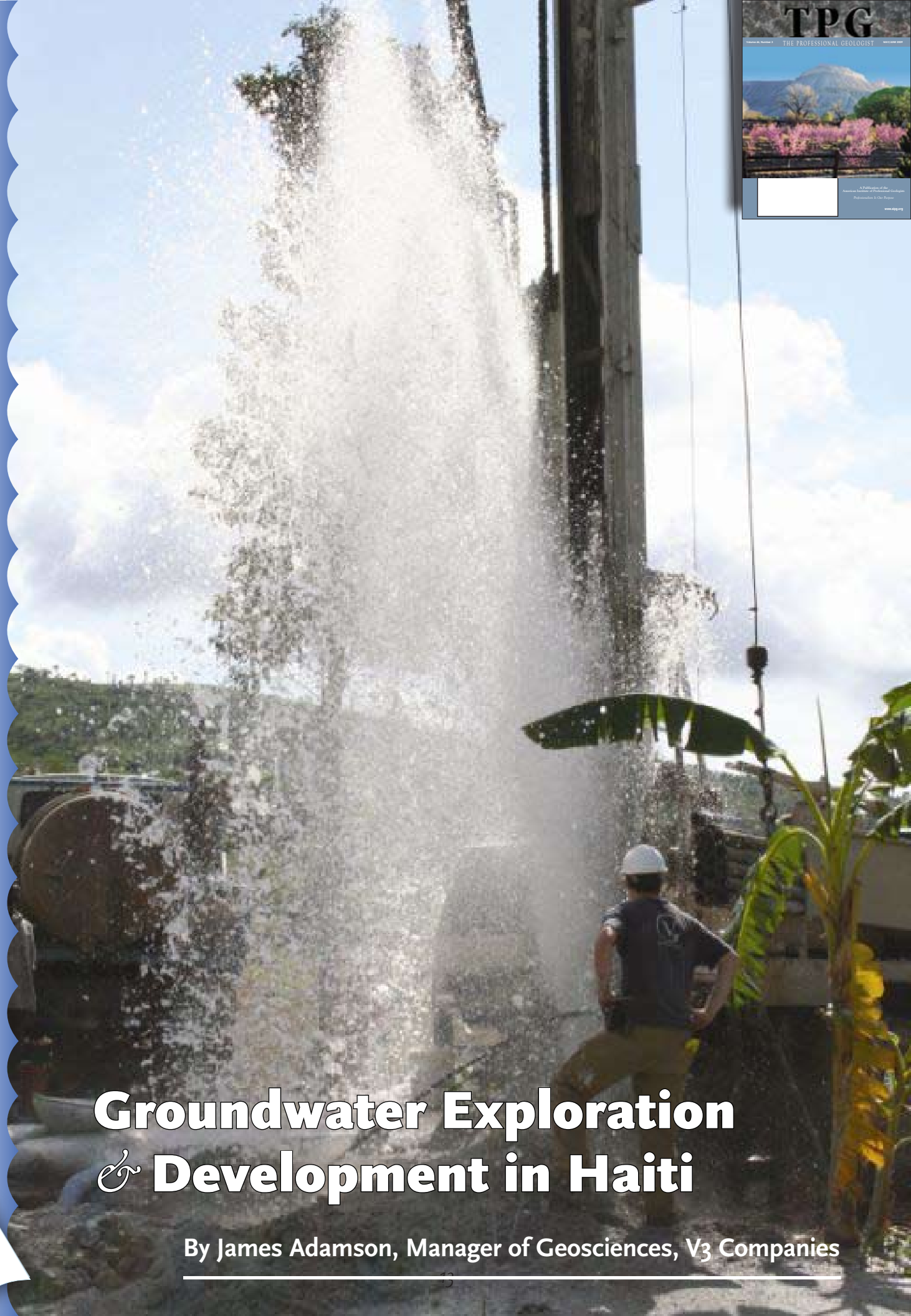


colorado ground-water association
NEWSLETTER





FEATURE ARTICLE



Groundwater Exploration & Development in Haiti

By James Adamson, Manager of Geosciences, V3 Companies

Nouveau Kiskeya has become synonymous with the words “hope” and “change” in northwest Haiti. Nouveau Kiskeya, meaning “new Haiti” in Creole, is an innovative mixed use land-development project underway on the north coast of Haiti. The key to Nouveau Kiskeya’s success was clean water, which was needed for the development and the people of the area.

In May of 2007, we found that water – clear, clean and plentiful – and it was accomplished in spite of many who doubted it could be done. The discovery has instantly delivered pride to the people of northwest Haiti and is propelling the project forward.

Haiti shares the island of Hispaniola with its much larger neighbor to the east, the Dominican Republic. Haiti was once considered the jewel of the Caribbean, but now is viewed by many as a hopeless case with one of the worst water availability indices in the world. The best word to describe northwest Haiti is poor; there is little economic activity, no utility or sanitation services and no infrastructure. Disease is rampant, infant mortality is high and modern sanitation is nearly non-existent. Clean water is at a premium, especially in northwest Haiti, considered to be one of the driest areas of the country.

We were brought into the project with one objective, to find clean water, enough to supply the development and the local communities. We conducted months of geologic research, including a visit to the USGS library and hundreds of phone calls with Caribbean and Haitian geology authorities. We also tasked satellites to obtain high resolution imagery of the area to analyze the landscape for geologic features. The research left us with mixed emotions; we were optimistic about groundwater prospects based on our research but many of the

experts we contacted wished us luck but dismissed the idea of finding quality groundwater. We were also discouraged by the reports and stories full of horror about the living conditions and poverty that blanket Haiti. Everything we read encouraged us to think that Haiti was an awful place, with a hopeless outlook and a dispirited population.

We packed up all of our field equipment, dusted off our Brunton compasses and rock hammers, and headed to Haiti to start our field work. We arrived only to find a beautiful country with people who radiate happiness and hospitality despite their impoverished conditions. All the people we met were open and welcoming and gave us complete freedom to wander their land. Grasping what we were trying to do, they appeared to be truly honored to work with us and be part of the search.

We spent nearly six weeks performing a geologic survey of an area greater than 200 square kilometers. We conducted geologic transects, observed springs, rock outcrops, faults and stream cuts. Road limitations provided us with about 150 km of rugged hiking in heat that often exceeded 100 degrees. Whenever we stopped to rest, the local people would offer what they had to eat and race to bring us hand woven chairs. When it rained, they would scramble to offer us cover. Ultimately, this special treatment made us uncomfortable, as the Haitians we met were unfailingly gracious despite their living conditions.

Work continued in the office analyzing all of our geologic maps and field data to target some drilling locations. The geology of the area is complex; the northwest of Haiti is one of the most tectonically active areas of the Caribbean. Faults strike through the landscape exposing confusing unconformities, folds had to be interpreted, sills and dikes had

to be delineated and the varying rock formations had to be characterized and understood.

From all of our research and field data we developed cross sections and a conceptual geologic model of the area. We determined that a steeply dipping Eocene fractured limestone was the most likely stratum to contain water. It is positioned above relatively impermeable layers of Cretaceous andesite and conglomerate. Further, the nature of some regional faulting and intrusive dikes hinted that groundwater could be trapped from immediately discharging to the ocean.

There was another challenge to finding water; a very thick unit of clayey marl above our target aquifer. The marl was deposited unconformably over a steeply dipping limestone with a highly irregular upper surface, impeding our ability to estimate the depth to the limestone. Our data indicated that horizontal differences of 100 feet could attribute to an extra 300 – 500 feet of drilling length to reach the aquifer. We only had 320 feet of drill stem, so we had to carefully and precisely choose a location. There were very few locations that met our criteria; all of them required a road be built for drill rig access.

We took a deep breath and chose our one drill site, as we were constrained by project schedules and budgets. We suddenly felt the pressure when the team starting building the road and the well site property was purchased. It took three days for the drill rig to reach the site and the driller thought we were crazy and told us we would not find water here. His reason was justifiable for an uninvolved observer, as we were very high on the landscape in a location that even made us think. We were going in, trusting all of our interpretations, rock measurements and extrapolations for what was beneath us. We were nervous but confident.



It took three days to drill the well. Every day we attracted a crowd reaching up to 100 people that circled the drill rig. Enterprising women set up a food vending area where they made and sold coffee, fried bananas, bread and spicy peanut brittle. During the drilling, the locals would constantly study

our facial expressions and try to interpret whether things were promising or discouraging.

After about 300 feet of nerve-racking drilling, things started changing. We had encountered our targeted limestone unit and were very excited. Suddenly, we

lost circulation of the drilling mud as we had hit a crack in the limestone below. We had found the water!

We soon began airlifting the water from the borehole; the crowd could not believe that it was groundwater. Some thought it was just

water that we used for the drilling, but water kept coming and coming. Rivulets gathered to form a small stream that flowed into the fields around the well. The celebration exploded upon our initial smiles and acknowledgment of success.

Women danced and chanted in Creole, people clapped while others watched in awe as water shot from the well. The drilling-team director, a 20 year veteran of such work in Haiti, said it was the best well he had drilled. Turning to us he said, "We have changed northwest Haiti forever." The news of the discovery had reached out within minutes to people all over Haiti and the U.S.

Locals anxiously diverted the flowing water to their fields; women and children immediately collected their buckets and jugs to replenish their supply. People started washing their faces in the flowing water. It was clear that the celebration was more than the promise of a better way of life. There was a deep sense of pride that water was found in their area. The celebration went on and on,

the experience was of the richest for us and unforgettable to everyone present that day.

The completed test well is a small diameter well, and although it just penetrates the aquifer, yields 620 gallons per minute. The test well came to represent much more as the project proceeded. Even though it was intended to be exploratory, it required significant investment and risk to complete. It became a verdict of whether we had done our job.

The work is just beginning, we now have a 26 gpm pump installed and have constructed a 6,000 gallon reservoir to provide water to approximately 1,000 locals near the well. The aquifer is carefully being studied to determine sustainable yields and a 15 km pipeline is planned to deliver water to Nouveau Kiskeya and the local communities along the way.

Nouveau Kiskeya has large hurdles ahead but the promise of a changing Haiti is there. The project's backbone is a beautiful country and people, and now there is

some water to contribute to the success of the project, the country and people of northwest Haiti.

The Nouveau Kiskeya work has led us to many other groundwater exploration projects in Haiti and we spend up to two months every year in Haiti helping non-profit and for-profit organizations develop water supply systems.

**James Adamson
V3 Companies**

James Adamson (jadamson@v3co.com) is a Sr. Hydrogeologist with V3 Companies, Ltd. This project was recently awarded a 2009 Engineering Excellence Honor Award and a National Recognition Award by ACEC (American Council of Engineering Companies). V3's groundwater exploration and development team now spends up to two months every year in Haiti helping non-profit and profit organizations discover and develop water supply systems. James has traveled and studied the geology throughout most of the country and has a professional and personal passion for helping Haiti become a developed country.

DOTY & ASSOCIATES
ENVIRONMENTAL, GROUND-WATER AND WASTE MANAGEMENT ENGINEERS

- Site Investigations
- Flow and Contaminant Transport Modeling
- Conceptual and Final Remedial Design
- Construction Supervision and Management
- Performance Monitoring

1440 BRICKYARD RD., SUITE 1, GOLDEN, CO 80403
TELEPHONE: (303) 279-9181

www.dotyeng.com
FAX: (303) 279-9186

**Downhole Flow Control Valves
for Aquifer Storage & Recovery**

- Cavitation free, sand resistant performance
- 2 to 12 inch and larger pump column pipe sizes

Inflatable Packers

- Standard & Custom for all applications
- 100 to 7,000 psi; 1-1/2 to 60 inch holes



Baski Inc. www.baski.com info@baski.com
Ph. 303 789-1200 or 800 552-2754 Fx. 303 789-0900
1586 South Robb Way, Denver, CO 80232 USA



DYNOTEK
FLUID LEVEL MANAGEMENT

FLUID LEVEL MANAGEMENT

FLUID LEVEL MEASUREMENT PRODUCTS

- Submersible Pressure Transducers
featuring stainless steel transducer cable
- Data Loggers
- Level Displays

APPLICATIONS

- Pump Control
- Pump Tests
- Long Term Monitoring



SALES AND RENTALS
675 Reed St., Lakewood, CO 80214
303-234-1409
Data Sheets at www.dynotekflm.com