

MIT OpenCourseWare  
<http://ocw.mit.edu>

## 2.500 Desalination and Water Purification

Spring 2009

For information about citing these materials or our Terms of Use, visit: <http://ocw.mit.edu/terms>.

## *Purification of Water in Phaeton and Paulette*

Paulette and Phaeton are two sea-side towns on the north coast of Haiti; the estimated populations are 1750 and 2450, respectively. In both villages, the groundwater has been contaminated with seawater and therefore people use it primarily for washing. Field tests confirmed that the well water is contaminated and has high salinity levels.

Drinking water is supplied to both towns through a diesel-powered pump system that comes from the neighboring town of Ti Kampeche and costs 1 gourde per bucket (~\$0.024); each town has one pump station. Most families use four to five buckets of drinking water per day. Field tests of the pumped water in Paulette gave TDS of 450 ppm; field tests in Phaeton gave 650 ppm. [We believe that the water samples previously collected and distributed to the class may have been drawn from these sources.]

In Phaeton, there is one community well with a broken hand pump, which is now drawn with buckets. (It is unclear whether this breakdown was caused by a lack of regular maintenance or by corrosion related to brackish water.) There are also seven hand-dug, bucket-drawn wells on residential plots, which people are permitted to use free of charge. Field testing of the community well showed TDS of 1200 ppm, and a representative hand-dug well was 3500 ppm. A sample from the latter has been taken and sent for testing.

In Paulette, there are three community wells with hand pumps that are also no longer working and eight hand-dug, bucket-drawn wells. One of the community wells showed 3000 ppm in a field test, and a typical hand-drawn well showed 2300 ppm.

The drinking water from the pumped system in Paulette showed no bacterial contamination. The pumped water in Phaeton showed some contamination, but had significantly lower levels of bacterial contamination than the well water.

Both Paulette and Phaeton are within one hour by car of Cap Hatien and get most of their supplies from there. In Cap Hatien there are many hardware, electronics, and construction supply stores, as well as carpenters, welders, and mechanics. There are also several NGO's and development organizations operating in the area that may be able to provide technical support or help with supply chain issues. Mercy & Sharing, for example, travels to these villages regularly to operate its feeding program; Appropriate Infrastructure Development Group ([www.aidg.org](http://www.aidg.org)) and Sustainable Organic Integrated Livelihood ([www.oursoil.org](http://www.oursoil.org) and see LINK), both have offices in Cap Hatien. We have made a Google Earth map that shows the location of some of these stores, services and organizations (which we will forward when we get access to a better internet connection).

There are no construction or building materials available in the shops in Paulette and Phaeton, but supplies can be brought in by truck from Cap Hatien. The stores in Cap Hatien have a moderate selection, but with limited availability. For example, pipes, glass, plywood, re-bar, cement, angle iron, flat bar, bicycle parts, automotive parts, pumps, PVC pipes and fittings, fans, batteries, inverters, hand tools and some power tools, glue and silicone sealant are all on display, but not necessarily in stock. These materials could be easily transported to Paulette and Phaeton, as most of the route is paved. The last quarter of the journey is on an unpaved road, but is still accessible by most vehicles. In general, the cost of imported items is about 10% - 20% higher than in the United States, though some specialty items could have an even higher mark up.

Few people in these villages have formal employment, especially since the closing of the sisal processing factory several years ago. The surrounding land is ill-suited for subsistence agriculture, so over 50% of the residents depend upon the Mercy and Sharing feeding program to supplement their dietary needs. Income levels are general below \$1 per day, and thus the money spent on water is approximately 10% of their income. A source of free clean water would make a significant impact on the lives of the people in these villages.

*Information compiled by Amy Smith and Kofi Taha, 6 April 2009. Based on field visits.*

### ***Your Task***

You should form teams of two students. Each team is required to develop a written report describing a potential design for a system to provide clean water.

You are required to meet at least once with the highly skilled, but free, consultant Professor Lienhard, before the report is finished. Amy Smith will also come to one of our class meetings in late April or early May to answer your questions.

During class time on May 14th, each group will give a 12 minute oral report. Each group must also submit their written report that day.

The project grade will be 35% of the course grade. The report grade will be based on:

- Originality
- Clarity and organization of the written and oral reports
- Consideration of the requirements created for the specific circumstances
- Assessment of alternatives
- Practicality and potential of the proposed solution
- Appropriateness of supporting calculations

Your report, including appendices, should run 20 pages at most. Details of calculations should go into appendices. Late written reports will be downgraded.