Clean water for Nepal

July 23 2015, by Dave Zobel

Gordon Treweek and Nauman Javed walking through a rice field near the Bimal Dhara spring site; they are being led by Namsaling Community Development Center engineer Birendra Paudal and translator/guide Prakash Ghimire. Credit: EWB-Caltech

On the steep, tea-covered hillsides of Ilam in eastern Nepal, where 25 percent of households live below the poverty level and electricity is scarce, clean running water is scarcer still. What comes out of the region's centralized distribution systems is unfiltered, untreated, and teeming with nitrates, viruses, and E. coli. Purifying it is the consumer's

responsibility.

But wood and yak dung, the only available fuels for boiling water, are precious, and purification tablets impart an unpleasant chlorine taste. The result? During the rainy season, local hospitals overflow with typhoid and gastrointestinal cases, mostly involving children and tainted runoff.

That may change, thanks to a gravity flow and slow-sand filtration system designed by Caltech undergraduates. They represent EWB-Caltech, one of the newest chapters of Engineers Without Borders USA, a nongovernmental organization (NGO) whose mission is to design and implement sustainable engineering projects in underprivileged communities.

Founded in 2012 by Sarah Wright (BS '13, bioengineering), EWB-Caltech already has about 30 members. This summer, a half dozen of the chapter's members are traveling to Ilam, where they are staying with local villagers while helping to oversee and implement the system's construction. The hillside will be partly excavated and then reconstructed. Layers of rock, gravel, sand, polyethylene sheeting, and soil will soak up rainfall, filtering and purifying it as it trickles into underground water. Pipes tapping into the underground water will run downhill to a small communal enclosure made of poured concrete, providing a reliable supply of clean water for about 100 households, with another 200 indirectly affected.

Webster Guan testing for the presence of nitrates and other contaminants in the Bimal Dhara water. Credit: EWB-Caltech

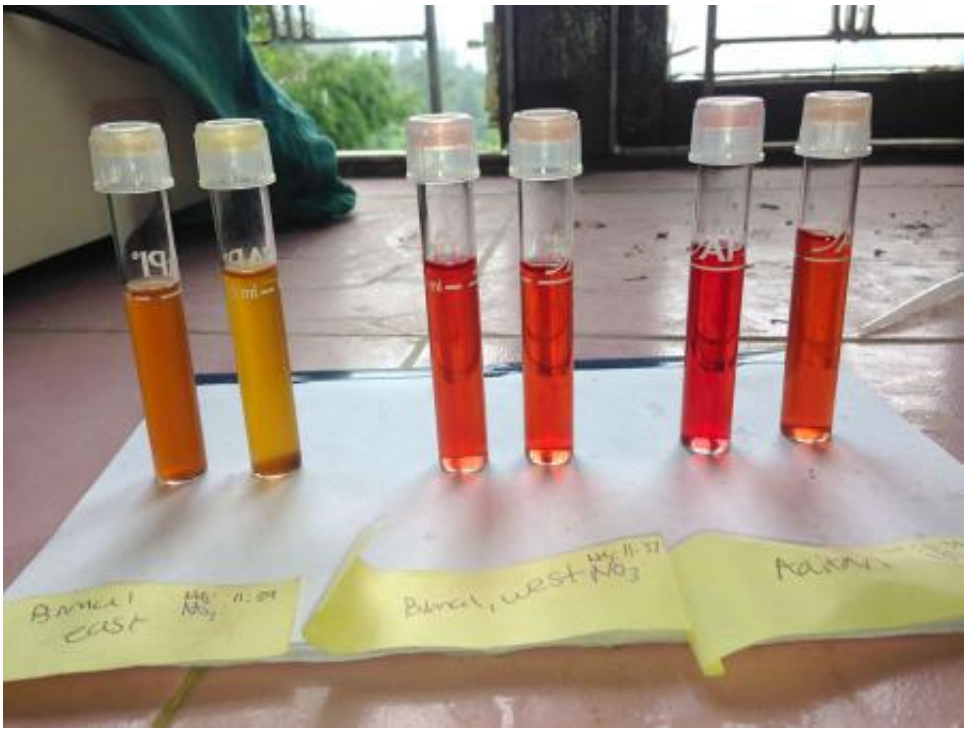
The students will not be working alone, says their mentor, environmental engineering consultant Gordon Treweek (MS '71, PhD '75) who is partnering with Caltech engineering students for the first time. "All

EWB projects are community-driven, with the local workforce providing much of the labor. And we've received tremendous logistical support, including interpreters, from the Namsaling Community Development Center, an NGO in Ilam that had previously worked with an EWB chapter from the University of Colorado, Boulder."

According to EWB requirements the Nepalese must contribute 5 percent of the project's budget. EWB-Caltech copresidents Jihoon Lee (a senior in bioengineering) and Nauman Javed (a senior in physics) acknowledge that successfully coming up with the remainder—over $20,000—involved nearly continuous fund-raising. "We've been applying for grants, soliciting private donations, partnering with companies, especially water-related and environmental corporations, and we held a benefit dinner in January that was largely attended by Caltech faculty and friends," says Lee.

Both a 10-day on-site assessment trip last summer and this summer's trip were covered by individual donations and grants. The assessment trip took Treweek, Javed, and fellow Caltech senior Webster Guan (chemical engineering) to Ilam to meet with the NGO; to survey the local community of about 100 families to ascertain their needs and willingness to assist in the construction and ongoing maintenance of the water tap stand; and to gather predesign data for planning construction and estimating costs.

"The support we have received from Caltech alumni directly and through their networks of contacts at Northrop Grumman and Boeing has been invaluable in helping to keep this project moving forward," Treweek says.



Samples of water from various spring sources around Ilam. The deep red color suggests an unsafe level of nitrates. Credit: EWB-Caltech

After the assessment trip, the students spent the 2014–15 school year preparing detailed engineering documents using computer-aided design techniques. In this, they were assisted by the water-resource engineering firms Carollo Engineers and Montgomery Watson Harza, whose pro bono involvement did not surprise Treweek. "Consulting engineering firms frequently donate resources for projects like this," he says. "It's socially responsible, and it gives them a chance to observe future engineers addressing the four traditional phases of engineering: planning, design, fund-raising, and construction."

With preventable infectious diseases a leading component of Ilam's one-in-three infant mortality rate, the project includes a public-education component. "Besides training the local villagers who will maintain our

spring-water source protection system," says Javed, "we plan to visit local schools, demonstrate how the system works, teach a little germ theory."

But no amount of careful planning can guarantee success. Similar projects have failed due to engineering problems, misaligned long-term governance strategies, eleventh-hour reprioritizations by the community, even simple miscommunication. "We've drafted plenty of contingency plans," affirms Lee, "with great support from EWB-USA. Their stringent review procedures covered every engineering and social aspect of the project, and they've given us detailed feedback on our drawings, schedules, and rationales."

After the implementation phase—which ends just one week before classes resume back in Pasadena—EWB-Caltech will continue to monitor the site for five to six years. By then the current members will have moved on and a new group of student leaders will have taken over this project. But for now, they are spending their summer trying to build a better world, drop by drop.

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