EWB-USA Sample Evaluation of Completed Projects in Guatemala

2012 Guatemala Program Evaluation Recommendations

January 25, 2013

Engineers Without Borders, USA is currently developing a comprehensive plan to monitor our projects, evaluate their functionality, assess the overall impact of our work in our partner communities and use the resulting data to continue to learn more effective ways to deliver our mission. Our goal in this effort is to incorporate lessons learned from past projects into our current development models to improve our organizational effect in implementing sustainable projects.

In the fall of 2011, an independent review was conducted of a sample of EWB-USA projects in Guatemala. This review was led by a Professional Member of EWB-USA and was performed by a NGO partner in Guatemala with assistance from select staff members who provided completed project reports and summary details of our current review process to the reviewers. This evaluation included EWB-USA projects completed in Guatemala, which represent a relatively small sample size of all of our completed projects. Many of these projects predate the current organizational policies and processes.

Still, valuable information was gained from this review and it will be used as a case study and guide in the EWB-USA organizational effort to develop a Planning, Monitoring, Evaluation and Learning program. As such, we have reviewed each recommendation and are distributing the following lessons learned to the membership with the intent of improving project sustainability within our partner communities.

In total, the report presented eight recommendations to the organization. Elements of the first four recommendations listed below have been incorporated into improvements of the project review and reporting process over the past four years.

1. **Provide Training on Water Pump Maintenance** – Current policies require that chapters use only locally available materials on their projects. This requirement was incorporated after learning that early projects, which allowed pumps and other materials purchased outside of the project country, failed when the local markets could not provide appropriate replacement parts. Additionally, each project requires that the community accepts responsibility for an ongoing operations and maintenance plan for the project, including technical knowledge and funding mechanisms. Technical training is provided by the chapter where expertise is not available locally. If the expertise needed is beyond what can be covered through chapter-led training, the community must identify a funding mechanism to hire technicians with the appropriate expertise to sustain the project.
2. **Ensure a Balance of Benefits for Volunteers and Community** — As a result of communications with some of our partner communities in the past, current policies set the maximum travel team size at 8 people, including Professional Mentors/Technical Leads. This was partly in response to some communities’ inability to host larger travel teams. A smaller team size also forces the project teams to consider taking only those team members who have a contribution to make to the tasks associated with that particular trip. Chapters are informed when the program is approved that their travel team members must be selected based on the value they add to the project, not their interest in travel.

   Additionally, travel teams are encouraged to take a minimum of two assessment trips. With the inherent challenges of doing effective community development work from afar, we maintain that more than one assessment trip is required to begin to establish a productive relationship with the community members and then start a thorough technical assessment of the project. However, taking an excessive number of assessment trips without progress towards implementing a project is not supported by the organization.

3. **Use Circuit Riders for Utilities** — Current policies require that a strong partnership exists between the community and a local entity responsible for ongoing operations and maintenance. In some instances, these roles are filled by “circuit riders” who visit more than one community in a region to provide technical expertise on the implemented system. Where these technical experts are funded at the community level, they prove invaluable assistance. However, we have learned of many projects which failed when the circuit rider is funded by an organization outside of the local community and that funding ceases to exist.

   In addition to project sustainability, this recommendation also highlights the future need for strong in-country representation. EWB-USA staff or strong partners that are from and live in the countries where we work could provide regional perspectives on the most appropriate mechanism for managing the implemented infrastructure. In some cases that management structure might be through a circuit rider program. In others, the management might need to be the responsibility of the local government or a private organization. In-country representation is a program idea we will continue to develop and are seeking funding resources to implement. This in-country representation will assist in the long term maintenance of the programs in addition to the screening of new programs, logistical support, health and safety support, follow-up monitoring and evaluation, etc.

4. **Improve the Project Screening Process** — The current improved project review process includes multiple points of communication with the chapter asking for a “Go – No Go” decision. We continue to emphasize, through review with the project teams, the importance of acknowledging when the project becomes one that is not a good fit for the community, the chapter or the organization as a whole. Chapters should review the “Instructions” documents that accompany each report template located on our website for additional information on the need to continually assess the appropriateness and feasibility of moving forward with a program.
Again, this recommendation emphasizes the need for in-country staff. We are developing this program and are seeking additional funding resources to implement.

The final four recommendations, which are listed below, highlight ongoing needs that we have previously identified in the organization. We have evaluated each recommendation in the context of our organizational resources and have indicated appropriate actions to be taken.

5. **Require a Financial Implementation Plan** – Some of our larger projects face funding challenges for a second or third phase of construction, despite having a thorough plan to raise required funds at the onset of the project. Currently, the project documents require the outlined project budget at each phase.

   **Action** – In the next round of document revisions, we will review the budget tables in the preliminary and final design reports to see how we can get a more detailed plan outlined. Chapters should always think comprehensively about how they will fund the entirety of a project, rather than one phase at a time to avoid leaving projects unfinished or taking too much time to complete their work.

6. **Require a Construction Quality Plan** – Current report templates require a section on the construction plan for implementation. Chapters are encouraged to staff their project teams with experts in project related engineering. Additionally, the project team must identify someone in the local community with applicable construction expertise. If this does not exist at the local level, the chapter is required to have mentorship on construction tasks as well as engineering.

   **Action** – We will implement a Standing Content Committee on Construction Quality to identify ways we can improve in this area. We will also seek additional partnerships with professional construction organizations to broaden our base expertise for chapters seeking qualified mentors with this skills set.

7,8. **Conduct Post-implementation Site Visits and Develop a Plan to Address Issues with Completed Projects** – These two recommendations are specifically addressed by our current efforts to design a comprehensive approach to our organizational Planning, Monitoring, Evaluation and Learning strategies. We are working with an international consultant to develop a robust methodology for incorporating organizational learning from past successes and failures into each step of our project work. We expect that the result of this effort will be not only the capability to report on which of our projects are working, but what overall impact we might have had in our partner communities. This will certainly involve a new way of visiting sample programs in the field and a more definitive approach to addressing issues that arise from completed projects.

   **Action** – New report templates, training for members on community project evaluation and a methodology to compile and report on our impact assessment findings are forthcoming in early 2013.
Chapters can begin to incorporate better metrics for assessing long term impact into their visits to partner communities by reviewing the Instructions documents accompanying each trip report (521, 522, 525, 530 and 531).
Review Objective

In the fall of 2011, a review of projects was conducted for the Engineers Without Borders – USA (EWB-USA) program in Guatemala. Guatemala was selected as it is the second largest program within of EWB-USA projects (Honduras being first) and is one of the oldest programs within EWB-USA. A total of 83 projects have records with EWB-USA in Guatemala spanning from 2005 to 2011.

The objective of the review was to determine “lessons learned” and “best practices” based upon the Guatemala Program. Each phase of the project process was reviewed to determine what is working well and what might need improvement within the EWB-USA process and procedures.

The database was reviewed and after correction for duplicates or miss assigned projects. There were a total of 83 projects classified as in figure 1 below. Projects were classified as; Declined (5%); Canceled (12%); Assessment / Data Gathering (20%); Implementation / Construction (24%); Completed (39%)

Figure 1

![Project Grouping Diagram]
**Program Overview**

The Guatemala Program is dominated by potable water projects which encompass 58% of the program. The next largest discipline of projects is bridges at 19%, followed by education at 11%, sanitation at 8%, energy at 2% and drainage at 1%. Based upon discussions with EWB-USA staff, the project mix is similar to the overall EWB-USA program, which is dominated by potable water projects.

![Pie chart showing distribution of project types.]

**Figure 2**

The year in which the projects were started was also examined. The number of projects started each year is fairly consistent, varying between 10 and 14 between 2007 and 2010. In 2005, nine projects were started despite the fact that EWB-USA was only a fraction of its size compared to 2011. The largest number of projects (19) were started in 2006 which is interesting given the fact that EWB-USA was approximately 20% of its size in 2006 compared to 2011. Only 5 projects were started in 2011. This can be explained by the fact that the database was queried in the fall of 2011 and some projects from 2011 may have not been entered at the time database.

It is difficult to discern why the program in Guatemala has not increased at the same rate as the rest of EWB-USA. Given the close proximity of Guatemala to the USA and the relatively inexpensive airfare compared to other regions of the planet that EWB-USA works, one would expect that the program in Guatemala would have grown at a rate higher than other countries. This maybe partially explained by a moratorium on new programs in by EWB-USA.
A total of 37 chapters have had projects in Guatemala. 27 are student chapters and 10 are professionals. The most active student chapters include Marquette University (7), Milwaukee School of Engineering (8), and University of Wisconsin-Milwaukee (5). The most active professional chapters include the Jacksonville Professionals (5) and the Wisconsin Professional Partners (7).

The project type distribution was similar between the student and professional chapters with potable water projects comprising over 50% of both portfolios. Both student and professional chapters were assigned projects in all technical discipline categories.

It should be noted that 27 (33%) of the projects are assigned to chapters located in Southeast Wisconsin (Marquette University, MSOE, UWM and the Wisconsin Professionals). It is believed that this is because of a long standing program in Guatemala by the Wisconsin Professional Partners and they in turn, mentor many of the student chapter projects in the area.

**Declined Projects**

Only four projects were listed as “declined” within the dataset. In discussions with staff from EWB-USA, it is likely that other projects were declined, but not included in the database. EWB-USA’s Application Review Committee (ARC) task it is to review prospective projects. The ARC may not have logged all incoming projects into the database until recently.
The primary reasons projects were declined were that the project did not meet EWB-USA’s mission and vision. Specifically, the projects were either not engineering in nature or were beyond the scope of resources in which EWB-USA could provide.

It is noted that the EWB-USA Application Review process has been revamped to perform a more complete evaluation. The goal is to benefit future projects by ensuring that projects meet the EWB-USA mission and vision, fully vetting in country NGO partners and screening the scope. This will likely result in more “declined” projects but also prevent more “problem projects” from entering the system.

**Canceled Projects**

Ten projects were listed as canceled in the dataset. Half of the projects were started in 2005 and 2006 when many of the processes and procedures for EWB-USA were not in place. The project classification seems to be similar to the rest of the program with 6 of the canceled projects being potable water, three sanitation and one being an energy project. Two of the canceled projects were assigned to professional chapters and the remaining 8 were student chapter projects.

Several of the projects were canceled when other organizations completed the work. In discussions with the chapters, this was a common occurrence for chapters, especially during the early years of the program. EWB-USA projects typically take several years to work their way through the process. If a project is a high priority to the community, the community will typically seek out additional assistance from other NGO’s.

For example, EWB-USA projects are ill suited for disaster relief or recovery projects. Disaster projects typically require a quick response, assessment and action. NGO’s that have an in-country presence are much better suited to respond quickly to a disaster and implement the projects quickly. Projects that contain a critical component of infrastructure tend to lead to community frustration if they are not implemented quickly.
It was very difficult to get information on half of the canceled projects. The key reason seems to be chapter turnover. This was a problem for both student and professional chapters. Student chapters struggle with key members graduating and project momentum can suffer. Many student chapters have recently addressed this issue with succession planning to ensure continuity on projects despite team member’s graduation. Professional chapters also struggled with Team continuity. Key leaders within the chapter can be transferred to other locations or unavailable due to family situations. When a succession plan is not in place, the project momentum can lag.

It is recommended that additional follow up be conducted on the remaining canceled projects where limited data is available. Specifically, it is recommended that a site visit to the community be conducted to discuss the project and determine the reason for the cancelation from the community perspective.

**Assessment Projects**

Seventeen projects are in the assessment phase. The assessment phase typically consists of data gathering, community communication along with alternative identification and analysis.
The average number of assessment trips taken by a chapter is three before moving on to implementation. The number of assessment trips can vary significantly, with some projects reporting only one assessment trip and others reporting five. This is a significant investment by the organization as each assessment trip to Guatemala typically costs the chapter $10,000 and consists of 8-10 traveling members.

![Assessment Projects by Year](image)

*Figure 7*

Six of the projects are still in the assessment phase after three years. Four of these projects are potable water systems with one bridge and one sanitation project. Each of the chapters (five student and one professional) were contacted to determine the current status of the project. Only one was moving toward implementation soon, while the others were languishing due to several issues. Issues identified by the chapters included a lack of financial resources to advance the project, a project champion from the chapter was no longer involved, or the project champion from the community was no longer involved. All of the chapters expressed a frustration that the project had lost momentum.

It should be noted that obtaining information about these projects was difficult due to changes in the project team. A follow up visit to the communities in Guatemala is advised to obtain their input and perspective on the projects and why they are not moving forward.
Implementation Projects

Twenty projects were identified as in the implementation phase. The implementation phase typically consists of constructing the project and can be accomplished in several phases of work. Based upon a review of EWB-USA projects being reviewed by the Great Lakes Technical Advisory Committee, the average number of implementation trips taken by a chapter is one to two. The number of implementation trips can vary significantly, with some projects reporting only one implementation trip and others reporting five. This is a significant investment by the organization as each implementation trip to Guatemala typically costs the chapter $10,000 for travel alone and consists of 8-10 traveling members.

It is noted that the vast majority (85%) of projects in the implementation phase are water. Water projects can be implemented in phases as a chapter drills a well, builds a distribution tank, installs pipelines by community sector and implements a water treatment system. By comparison, bridge projects are typically implemented in one large construction event as it is difficult to build a bridge in separate and distinct phases.

<table>
<thead>
<tr>
<th>Type of Implementation Projects</th>
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<tr>
<td>Water</td>
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<tr>
<td>Bridge</td>
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<tr>
<td>Education</td>
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<td>Energy</td>
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La Garrucha Community Members digging in water line

Nine of the projects reviewed are still in the implementation phase after three years. The majority (seven) of these projects were water along with one school and one energy project. Each of the chapters (eight student and one professional) were contacted to determine the current status of the project. Only one was moving toward completion soon while the others were languishing due to several
issues. Similar to the assessment phase, issues identified by the chapter included a lack of financial resources to advance the project to completion, a project champion from the chapter was no longer involved, or the project champion from the community was no longer involved. Most of the chapters expressed a frustration that the project had lost momentum.

A few chapters felt that the project was “on track”, although they had no definitive plans to complete the project. Some chapters were concerned that if they completed the project that they would not be allowed to start another project due to the EWB-USA moratorium on new projects.

It should be noted that obtaining information about these projects was difficult due to changes in the project team. A follow up visit to the community in Guatemala is advised to obtain their input and perspective on the projects and why they are not moving forward.
**Completed Projects**

**Overview**

Thirty two projects were identified as being completed or in the monitoring phase. A completed project is one that has submitted the final project paperwork documenting the implementation phase. It should be noted that EWB-USA requires chapters to be committed to work in the same community for five years as part of their program. Therefore, a chapter may still working in the community on another project within the program after a project is completed.

![Completed Projects by Year](image)

**Figure 10**

Approximately two thirds of the projects initiated in 2005, 2006 and 2007 have been completed. Starting in 2008, the completion rate drops significantly to less than 20% indicating a project duration of 4 years from start to completion is common. The project completion rate is nearly the same for projects initiated in 2010 and 2011 as 2009. In discussing this with chapters, it appears that some chapters have a schedule that allows projects to be completed in a year. Bridge projects in particular seem to have a shorter duration than other types of projects. The percentage of bridge projects completed compared to those started is very high (80%) compared to the remaining project types. One explanation for this is that bridge projects do not typically require a utility to be established for maintenance and operations.

Students from Marquette University install a pilot slow sand filter
Figure 11

Water and energy projects require a utility to be established, including a maintenance staff and fee collection. In many cases, the establishment of a utility proves to be more time consuming and difficult than constructing the infrastructure itself.

Figure 12

Fourteen chapters completed projects in Guatemala, three being professional chapters and eleven student. Five of the chapters have completed multiple projects, including the Wisconsin Professional Partners (7), MSOE (5), Marquette University (4) and University of Wisconsin Milwaukee (3). It is noted that 19 of the 32 completed projects (60%) have been completed by chapters in southeast Wisconsin.
is believed that this is because of a long standing program in Guatemala by the Wisconsin Professional Partners and they in turn, mentor many of the student chapter projects in the area.

A site visit was targeted for each community in which a project was listed as “complete”. The site visit was intended to see if the project was functioning, partially functioning or had failed. A project that was servicing more than 50% of the intended benefactors was classified as partially functioning while a project that was servicing less than 50% of the intended benefactors was listed as a failure.

The site visit consists of a half day investigation per site. The project is reviewed with the communities project committee and visually inspected to determine its ability to function. If the project is not functioning, a determination of the cause is attempted. Interviews are conducted with the committee and community members present. The benefits of the project are explored as well as the communities overall satisfaction with the project.

![Percent of Projects Completed by Type](image)

**Figure 13**

It should be noted that the site visits are focused on the technical aspect of the project. Extensive focus group meetings are not held to determine social and economic impacts of the project. It is advised that such interviews be conducted in future reviews.
**Field Review Team**

Agua Para Salud (APS / Water For Health) was selected to perform the field reviews. APS has been a registered NGO in Guatemala for 18 years, working primarily on potable water and sanitation projects. The projects are primarily located in the Departments of Quiche and Solola.

Agua Para Salud was selected due to its in-country presence, long term experience and its field staff capabilities. APS has three circuit riders who have a combined experience of 45 years working in rural communities. Diego Ramirez in Nebaj, Alberto Xoch in Solola and Fermin (Mincho) Ortega in Joyabaj were hired by APS because of their demonstrated long term effort in assisting rural communities; their extensive knowledge in water system design and construction; their respected position in the communities where they work; and a knowledge of the language and history of their respective areas.

Guatemala has recently closed a brutal chapter with the ending of a civil war in 1996 and each of the Circuit Riders suffered from the war and its after effects. Alberto had his baby brother and father killed by the army and Diego was forcibly taken from working in a sugar cane field to serve in the army. Understanding the long term resentments in the rural villages is an important part of being successful. This is not unlike the sentiments from our own US civil war and attempts to rebuild the US south.

The understanding of the history and dynamic of Guatemalan society are important factors to keep in mind when visiting communities new projects. No project will be introduced into an historical or social vacuum.

**Bridge Project Reviews**

A total of twelve bridge projects were listed as complete or monitoring and site visits were conducted at each location. Two of the projects were completed in 2006 and are six years old. The most recent project was completed in the spring of 2011 and was only one year old. Eleven of the bridges service vehicles and one carries pedestrians only.

The size of the structures range from 10’x10’ box culverts up to a 67’ long concrete cast in place girder structures. One of the vehicle bridges consists of a steel beam superstructure with the remaining 10 being cast in place concrete. The one pedestrian bridge is a suspended cable bridge of approximately 100’ length.
All of the bridges except one are fully functioning with improved roadways completed to each end. Six of the bridges have active bus routes established over them. A bus route is a major accomplishment as it provides access to all members of a community to health care, education and markets. Once a reliable source of transportation is provided to a community it is able to plan for activities such as education and planting crops to sell in the market.

Many of the structures have survived the major storm events of Hurricane Agatha (’10) and one was also constructed prior to Hurricane Stan (’06). Three were actually overtopped by Hurricane Agatha. In discussions with the chapter and community, it was determined that the high flow events were caused by debris plugging other upstream structures or landslides that blocked the streams. The water was released once it overtopped the roadway or landslide, creating a flood of water not unlike a dam break.

One structure is not in use due to Hurricane Agatha. Debris plugged the upstream structures as they crossed a roadway and released a flood when the roadway was washed out. The debris field was vast and plugged the entrance to the structure and washed out the roadway approaches. The structure remains, but is badly damaged and the stream has changed its course. This bridge was reconstructed by another EWB-USA chapter in 2012.

None of the bridges are constructed on deep foundations which make them susceptible to a failure by undermining. Stream “headcutting” is common for mountain streams and with time, this will likely be a challenge for all the bridges observed. Several of the bridges had rip rap and erosion repairs done by the community to prevent further damage.

Community Response

One of the structures, the Rio Motagua Bridge near La Garrucha, has become quite famous – being named the “Unbeatable Bridge”. All other bridges across the Rio Motagua, the longest river in Guatemala, were destroyed by Hurricane Agatha. Legend has it that the bridge survived due to the engineers mixing “bulls blood” into the concrete for added strength or a special blessing by a Mayan Shaman. The Chapter
attributes its sustainability to “dumb luck” more than anything else, as the structure was overtopped by a full six feet of water.

The communities all reported a positive impact on their lives. For bridges that now have bus routes over them, the positive impacts seemed to be more extensive. The committee members all mentioned the benefits of the improved access to local markets and the economic benefits it has provided to their communities. Access to health care and education were mentioned to a lesser degree, but focus groups that involved more women in the community may provide different results. One young mother who worked side by side with the EWB-USA volunteers did report that she was the first woman to give birth in the local hospital because of the bridge. She was very thankful that the bridge was in place.

All of the communities reported a pleasant experience working with the EWB-USA chapters.

Lessons Learned

Due to the excessive debris being washed down in large events, the chapters have decided to no longer construct smaller box culverts as they are more susceptible to being plugged. Since it is impossible to predict the size of the high flow event that might hit a bridge due to landslides upstream, all structures should be designed assuming that overtopping is a possibility.

Chapter have also modified their design to address the connection between the bridge and the wingwalls. The abutment and wingwall connection now call for #5 bars at 1’ centers to pin the two structures together to prevent a separation.

Another modification is the use of a 8”x8” curb along the bridge which the handrail posts are attached to. The curb is doweled into the concrete deck with short, 3” #3 bars. Due to the low speeds of vehicles, the vertical curb that is continuous and reinforced provides redirection to any vehicle that might strike it. If the bridge is overtopped with water, debris will get caught in the handrail and remove the curb and handrail system, without creating massive damage to the remaining superstructure.
Water Pumps

A total of four water pumps were listed as complete or monitoring and site visits were conducted at each location. All were completed in 2006 or 2007.

Three of the projects consisted of solar powered water pumps. Unfortunately, two of the installations were classified as “failures” as the pumps were no longer working and one was classified as a “partial” due to flooding of the sump that limited the pumps usage. Upon inspection, the solar units were still functioning, but the pumps needed maintenance and no parts could be found. In discussions with the chapters, it was found that the pumps were brought from the USA and installed in Guatemala with no access to any parts in country. The community had attempted to repair all three pumps, but were unable to do repairs because of a lack of locally available parts. It should be noted that the current EWB-USA policy of only using locally available materials and equipment was not in place when these pumps were installed. New pumps were installed at each location by APS and the systems are performing well.

One of the projects consisted of a displacement pump powered by a water wheel. The pump had a long history of maintenance issues with the lever arm and several welds needing repair. The community indicated that the maintenance was required at least every two weeks. In discussions with the Chapter, it was learned that many components of the pump were not designed. This included the lever arm and the connections to the water wheel. During Hurricane Agatha, the water wheel was destroyed and along with it, the pump. A new solar powered pump was installed at this location.

Community Response

The communities expressed frustration with the pumps and the fact that they could not maintain them and keep them operational.
Lessons Learned

Pump pits need to be designed with more thought towards access for maintenance. This would require a slightly larger pit for access. Also, a curb needs to be added to the cover to prevent water from flooding the pit.

The wiring was found to be generally deficient at two locations. In discussions with the chapters, it was found that the chapters knew that the wiring was not appropriately done, but they could not find the parts needed and had run out of time during the trip to do it correctly. Unfortunately, this is not an uncommon occurrence as chapters are working in areas with limited access to materials and are generally under very tight timeframes during implementation. Many teams also have limited construction experience and lack the knowledge to properly construct the projects designed.

An operations and maintenance manual was not found at any of the sites. In discussions with the chapters, manuals were prepared for two of the installations. The manuals were given to other travelers to deliver to the community months after the project was completed. It is unclear if the manuals actually arrived at the communities or not. It is recommended that all projects deliver and review the manuals with the community and maintenance technician as part of the implementation project to ensure the information is transferred and to provide an opportunity for questions.

Education & Energy

Five projects were identified as Education and Energy. Two of the projects consisted of installing solar energy at a school and subsequently installing laptop computers for the schools use. The solar energy system was operating well, although some poor wiring was found and corrected. The laptop computers had since failed, but the school director had sought out new computers from another NGO and found a local individual who maintains the system.

One of the projects was a fence installation around an existing school. The fence appears to be in good repair and functioning well. The project was constructed by a local mason using a local design method.

Another project provided technical designs to another NGO for homes to be built by volunteers and stoves. The design suggestions were generally being followed for the home construction. The NGO continues to use the designs with the only noted problem being termite damage to the suggested wood sills and posts. The stove designs are not being used due to the cultural concerns of cooking area size.
Unfortunately, the three room school project was a failure. Apparently the chapter started the project by constructing the foundation and some of the walls and was unable to finish the project. EWB-USA hopes to complete the project sometime in the near future.

**Potable Water Projects Supported by Circuit Rider Reviews**

The potable water projects were separated into two categories – those supported by a circuit rider and those that were not. A circuit rider is a water technician that is available to the community to assist them with technical and non technical issues. In the USA, this role is provided by the County, State and the Federal government as they support local townships and Cities with their water issues. In Guatemala, no support typically exists at the Federal, State or Municipality level for water systems in the rural communities. This role can be provided by NGO’s in a geographic region who assign an individual to multiple communities ranging from 20 to 30 for each technician.

A total of five potable water system projects were completed and it was determined that a circuit rider was supporting the communities. All five projects consisted of a spring catchment system, a conduction line, one or more distribution tanks and a distribution system. Two of the projects included a chlorination system while the other water sources were determined to be uncontaminated. The projects were completed two to four years ago.

The communities range in size from 350 to 1500 people and the projects ranged in size from a few kilometers of piping up to 26 kilometers of pipe.

The site visit indicated that all five systems were working well. Water was flowing to all taps within the communities with only one community lacking maintenance on the household taps. All of the distribution tanks were full and functioning as designed. The communities indicated that they had sufficient water in all sectors.

Both chlorinators were working and the residual chlorine in the water was within acceptable limits at all taps tested. The community indicated that they were able to obtain supplies and parts as necessary for the NORWECO chlorinator units.

All five communities have a paid plumber or technician. They are supported by a utility fee that ranges from 10Q to 30Q per family per month. A new tap fee is charged between 300Q to 1000Q for any new homes that are added to the system.
Community Response

The communities were extremely happy with their water systems. Many of the women were very appreciative of the water system and the fact that they no longer needed to carry water for their families.

Focus groups were not conducted in the communities to determine what other social and economic impacts the project might have had. It is recommended that focus group discussions be conducted in the future to determine the impacts on the health, education and welfare of the community.

Lessons Learned

The circuit riders were utilized as much for their non technical expertise as their technical. The technicians were contacted to discuss utility issues including, fee collection, banking, how to discontinue service to a home and how to train a new plumber. The communities were generally looking for best practices from other installations and some confirmation that their plans were on the right track. There appears to be great value of an independent third party to assist the community in its utility operation.

Potable Water Projects Not Supported by Circuit Rider Reviews

A total of six potable water projects were identified as being complete and were found to not have the support of a circuit rider based upon the site visit. Four of them were visited by the review and two were not visited in person.

One project failed due to the group not having enough time to bury the pipeline which was damaged and rendered unusable shortly thereafter. The community was able to get a system constructed using another, larger water source by a different organization.

Utility management was a common concern with all the communities. In general, the ability to enforce the water use for only people and not for animals or crops was a problem. There typically is ample water during the rainy season and immediately after construction. This encourages community members to use water for other purposes. Once this practice is established, it is difficult to break when the population grows and the water source is no longer sufficient.

The utility finances experienced similar issues. Immediately after construction, the needs for repairs were minor and there was pressure to lower the usage fee by the community members. As the system aged, the fee collected was no longer sufficient to cover maintenance costs and it proved to be difficult to raise the amount charged.
Conclusions & Recommendations

Overall, the number of projects that were found to be “Working” was 60%, while 27% were classified as “Failed” and 13% as “Partially Working”. The Bridge and Potable water projects with circuit riders had the highest success rate while water pumps and water projects without circuit riders had the highest rates of failure.

**Number of Projects that are Working, Partially working or Failed**

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<th></th>
<th>Failed</th>
<th>Partial</th>
<th>Working</th>
<th>Total</th>
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<td>Water Pumps</td>
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<tr>
<td>Energy</td>
<td>0</td>
<td>0</td>
<td>11</td>
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**Percentage of Projects that are Working, Partially working or Failed**

- Failed
- Partial
- Working
- Total
The following recommendations are made based upon the Program Review.

**Construction Quality Plan**

EWB-USA has made great strides in designing and implementing a Health and Safety program for all of its projects. A Quality Committee has recently been formed to address the process of improving quality on EWB-USA projects. It appears that the Quality Committee’s efforts have been focused almost exclusively on the design and design review process. It is recommended that construction quality be addressed in the same vigor as design quality.

The quality of construction has several inherent challenges on EWB-USA projects.

- The vast majority of the volunteers have limited or no construction experience.
- It can be very difficult to obtain materials certifications
- In country testing of materials can be difficult
- Obtaining quality materials in sufficient quantity and schedule can be a challenge
- The implementation teams have a limited ability to deal with a change of condition due to the limited travel schedule

A few common issues surfaced when discussing apparent construction defects with chapters.

1. The project team was hoping to have a mentor that had construction experience with the type of installation called for in the design. A travel mentor was found, but an experienced construction mentor was not found and the team had limited or no experience building the design called for.

2. The project team was unable to find or obtain the materials needed during the timeframe of the trip. The team decided to “work with what is available” and implement a solution that they knew might not work.

3. The project team ran out of time during the implementation trip. This was due to conditions that differed from their assumptions or a construction error that the team did not have time to fix. In one instance, the chapter indicated that the formwork was completed before they realized that the reinforcing could not be installed properly without removing the formwork and starting over. The chapter decided to “do the best we could within the time we had”.

As one volunteer put it “Would you hire this crew to wire or plumb your house?”
Require Chapters to have a Financial and Implementation Plan

Unfortunately, many chapters do not have the completion of the project in mind when they begin. A finance section is included in every step of the EWB-USA process, but it seems that it is extremely rare that a project is declined, or an implementation trip is not approved due to a lack of a completion plan.

Chapters (student and professional) tend to focus on the upcoming travel and data gathering needs and may not be thinking about how they would implement the final project. One recent example is a chapter that is building a school, but does not have the in country support to keep the construction program moving between team visits. The chapter was also unable to secure a member to provide the longer term construction support needed. This resulted in an implementation plan that calls for five implementation trips, costing $75,000 in travel to build a $20,000 school over three years.

It is recommended that project implementation not be started until a firm completion plan, including finances are in place. This would require chapters to have all funds secured before beginning construction, or the ability to secure a loan if fund raising does not develop as anticipated.

Improve the project screening process

Although EWB-USA has recently improved the Application Review Committee (ARC) process it is believed that improvement can still be made. Preventing “problem projects” from entering the project process will improve the chance of project success while improving the volunteer’s experience.

One possibility is to have a “Go – No Go” decision point at the completion of the first assessment trip. The chapters indicate that the first assessment trip uncovers many surprises about the project, community and in country partner. Most chapters feel pressure to move forward “at any cost” once the project is assigned to them. By having a defined “Go – No Go” decision point after the first assessment, all the project partners (chapter, community and in country partner) would understand that the project might be declined after the first assessment trip due a variety of reasons.

An in country EWB-USA employee would greatly improve the organizations ability to screen projects and partners before they entered the system. This would require a significant investment by EWB-USA but improving the volunteers experience and success of the projects would clearly benefit the organization.

Circuit Riders for Utilities

The program review indicates that the chances of a potable water system being sustainable is vastly improved if there is an in country, third party resource that can help the community work through technical and non-technical issues.

It is recommended that a strong preference be given to water projects that have a third party in country resource to rely on. One goal should be to convince the local government to provide such a resource to their region to improve the health and welfare of the region.
**Water Pump maintenance and support**

The water pump projects reviewed were not sustainable. The current EWB-USA policy of only using in-country equipment should improve this situation. It is recommended that chapters who utilize water pumps spend a considerable amount of time training the local technician in the use and operation of the pump. Projects that do not have access to a competent technician and or a third party resource (circuit rider) should be reconsidered.

**The need for site visits and obtaining the Community Perspective.**

Only one side of the projects story is obtained by interviewing and discussing the project with the chapter. In many cases, the perspective of the community is vastly different than that of the chapters. This was anticipated and proved to be true during the site visits of the completed projects.

In reviewing the data of the Guatemala Program, it became apparent that the information obtained in the project reports may be skewed or slanted due to a variety of reasons. In some discussions with the chapters, it was not until the chapter knew that a site visit might occur to the community that they were more forthcoming with important information.

To fully determine the impact and effectiveness of the EWB-USA program on the community partners an independent site visit is recommended to project sites during and after implementation. This is especially true for projects that appear to be struggling to move beyond the assessment or implementation phase.

**A policy is needed to address completed projects**

The relative young status of EWB-USA has not required an extensive investment in completed projects. As the organization matures, more and more projects will be completed and a question arises to what extent will EWB-USA continue to support completed projects.

The simple fact that a team is visiting a project post completion brings with it an expectation that the organization will help in addressing any deficiencies. The accountability of these items is unclear as some may be due to neglect while others may be due to poor design or construction. Natural disasters and other “Acts of God” pose another question if there is any moral obligation to return to the community and repair the project.

It needs to be made clear who has what responsibility in cases of projects that are not functioning. Simply holding chapters accountable for past projects may not be sufficient as chapter turnover leads to a lack of interest to accept this responsibility. EWB-USA needs to provide a process to address the communities issues if the chapters are no longer in a position to provide assistance to the community.
**Balance of benefits for volunteers and community.**

EWB-USA has always recognized that a balance must occur between the value provided to its volunteers and the value provided to the community. EWB-USA is supported primarily by the Engineering Consulting Community that receives the benefit of young engineers who have developed leadership, design and teamwork skills through the project process. A tremendous effort has been made to develop a program that provides the volunteer with the best possible experience – and sponsors with the best possible value. One has to question if the same effort has been made to ensure that the community receives its share of benefits.

Unfortunately, it seems that many chapters are focused on the travel experience as the top priority. The EWB-USA project process has checks built in to ensure travel projects are approved for both assessment and implementation trips. In discussions with the EWB-USA project staff, it is very rare (if ever) that a chapter is denied travel status due to non technical reasons. Some chapters have taken advantage of the situation by spending approximately $100,000 in travel (assessment and implementation) to dig a few pit latrines.

EWB-USA should implement a check and balance system to ensure that chapters are not simply “exploiting communities for travel” and a just balance of benefits is achieved.