Acknowledgments
The Project Leads and Mentor Team acknowledge that:

- The chapter reviewed the accompanying 526 – Post-Implementation Report Instructions for accurate completion of this report.
- The PMEL lead updated, the 901B – Program Impact and Monitoring Report and it is submitted as a separate document with this report.
- The PMEL lead completed the 905 – Program Logic Framework and included it as an appendix to the 901B report.
- The team has included the Signed 903 – Implementation Agreement as an appendix to this report.
- The most current contact information is updated in this report and all other reports included with this submittal.
- If there were any health and safety incidents during the trip, a completed 612 - Incident Report document is included as a separate document with this report.
We, the project team leadership confirm that the above information and tasks have been completed and that this report accurately reflects our chapter’s implementation activities during the implementation trip.

Judy Jiang 2/20/2016
Project Lead Printed Name Project Lead Signature Date

Jeff Randall 2/20/2016
Mentor Printed Name Mentor Signature Date

Or

Faculty Advisor Printed Name Faculty Advisor Signature Date

It is the responsibility of the Responsible Engineer In Charge (REIC) to ensure that the team’s Post-Assessment report meets the typical engineering standard of care. I have reviewed the subject project. I am qualified by education and experience to design and oversee construction for this type of project. In my best engineering judgement, the implementation carried out on this Implementation trip followed the design approved by the Technical Advisory Committee. The construction quality met the normal standard of care for a facility of this type.

Jeff Randall 2/20/2016
REIC Printed Name REIC Signature Date
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### Part I – Administrative Information

#### 1.0 Contact Information

<table>
<thead>
<tr>
<th>Project Title</th>
<th>Travel</th>
<th>Name</th>
<th>Email</th>
<th>Phone</th>
<th>Chapter Name or Organization Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Lead</td>
<td>No</td>
<td>Judy Jiang</td>
<td><a href="mailto:kenya@ewb-osu.org">kenya@ewb-osu.org</a></td>
<td>(503)851-8060</td>
<td>EWB-OSU</td>
</tr>
<tr>
<td>Additional Project Lead (if applicable)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>President</td>
<td>No</td>
<td>Adrian Hinkle</td>
<td><a href="mailto:president@ewb-osu.org">president@ewb-osu.org</a></td>
<td>(503)915-8644</td>
<td>EWB-OSU</td>
</tr>
<tr>
<td>Responsible Engineer in Charge</td>
<td>No</td>
<td>Jeff Randall</td>
<td><a href="mailto:Jrandall.hydro@gmail.com">Jrandall.hydro@gmail.com</a></td>
<td>(206)295-0800</td>
<td>EWB-OSU</td>
</tr>
<tr>
<td>Traveling Mentor</td>
<td>Yes</td>
<td>Anthony Mahinda</td>
<td><a href="mailto:mhuni@alumni.stanford.edu">mhuni@alumni.stanford.edu</a></td>
<td>+(254)-787-481-349</td>
<td>EWB-SFP</td>
</tr>
<tr>
<td>Faculty Advisor (if applicable)</td>
<td>No</td>
<td>Lewis Semprini</td>
<td><a href="mailto:Lewis.semprini@oregonstate.edu">Lewis.semprini@oregonstate.edu</a></td>
<td>(541)737-6895</td>
<td>EWB-OSU</td>
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<tr>
<td>Planning, Monitoring, Evaluation and Learning (PMEL) Lead</td>
<td>No</td>
<td>Elizabeth Byron</td>
<td><a href="mailto:byrone@oregonstate.edu">byrone@oregonstate.edu</a></td>
<td>(406)839-5009</td>
<td>EWB-OSU</td>
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2.0 **Budget**

2.1 **Project Budget**

<table>
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<td>EWB-USA Chapter Name ::</td>
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<td>Project Name ::</td>
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<tr>
<td>Type of Trip ::</td>
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NOTE: The fees associated with each trip type will auto-populate the EWB-USA HQ section.

Lines with an asterisk are automatically calculated.

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<td><strong>Sub-Total</strong>*</td>
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<td>In-Country Logistical Support</td>
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<td>Well Materials &amp; Well Permit - Okello</td>
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<td>Service Description</td>
<td>Cost at EWB-USA</td>
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<tr>
<td>----------------------------------------------------------</td>
<td>------------------</td>
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<tr>
<td>Well Drilling and Construction - Midland</td>
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<td>Well Apron and Handpump - Okello</td>
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<td>Water Quality Testing</td>
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<td>Hydrogeological survey</td>
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**IN-KIND CONTRIBUTIONS**

Community In-Kind Contributions to Project Costs

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<th>Cost at EWB-USA</th>
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<td><strong>TOTAL IN-KIND CONTRIBUTIONS</strong></td>
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**Funds Raised**

Cash from community (EWB-USA requires a minimum 5% contribution) $182

Total $ in Project Fund at EWB-USA HQ $5,000

Total $ in Project Fund at University $0

Boeing Grant $4,000

**Total** $5,000

**Funds Raised for Chapter**

Total $ in Chapter General Fund at EWB-USA HQ $9,259

Total $ in Chapter General Fund at University $27,079
2.2 Professional Mentor Team Hours

<table>
<thead>
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<th>Name(s) of Professional Mentor(s)</th>
<th>Pre-trip hours</th>
<th>During trip hours</th>
<th>Post-trip hours</th>
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<tr>
<td>1. Jeff Randall</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>120</td>
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<tr>
<td>2. Anthony Mahinda</td>
<td>0</td>
<td>24</td>
<td>0</td>
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</table>

3.0 Project Discipline(s)

**Water Supply**
- X Source Development
- X Water Storage
- Water Distribution
- Water Treatment
- X Water Pump

**Sanitation**
- Latrine
- Gray Water System
- Black Water System
- Solid Waste Management

**Structures**
- Bridge
- Building
- Retaining Wall

**Civil Works**
- Roads
- Drainage
- Dams

**Energy**
- Fuel
- Electricity

**Agriculture**
- Irrigation Pump
- Irrigation Line
- Water Storage
- Soil Improvement
- Fish Farm
- Crop Processing Equipment

4.0 Project Snapshot for Publicity

4.1 Problem Identification
Lela, Kenya lacks a clean potable water supply within the community which forces many community members to use unclean sources for water or walk up to an hour to access clean water.

4.2 Project Goal
This project seeks to provide year-round potable water to the community and the primary school. Specifically, EWB-OSU goals are to provide 15 lpcd of water to all community members, 3 lpcd of drinking water for students at the primary school, a sustainable water source within 750 m for 95% of households, less than 500 people per well, and safe water quality meeting World Health Organization (WHO) standards.

4.3 Project Status
During the 2015 implementation trip, EWB-OSU, in partnership with EWB-SFP, constructed a third well in the community of Lela, Kenya to help fulfill the project's goal of access to clean drinking water. This well services a sector of the community that previously had to travel long
distances for water. The third well will also likely decrease overcrowding at the existing two wells and increase the overall community’s access to water. The Kenya Program is now closer to achieving the goal of 15 lpcd for all community members. Immediate next steps include discussing the transfer of the program to EWB-SFP.
Part II – Pre-Assessment Report

1.0 Executive Summary

The Oregon State University student chapter of Engineers without Borders (EWB-OSU), in partnership with the Engineers without Borders San Francisco Professional chapter (EWB-SFP), sent a travel team consisting of in-country professionals to Lela, Kenya between July and November 2015. EWB-SFP members comprised the travel team while EWB-OSU funded and generally supported the project in all aspects. This was the third implementation in Lela, each of which included the construction of a borehole water well. The trip was a continuation of the Lela Community Water Project (EWB-USA Project #5091). The project’s primary purpose is to provide a sustainable and dependable water source for domestic use in Lela, Kenya. The resident in-country team traveled to the community between July 15th, 2015 and November 25th, 2015.

The scope and goals of the program are grounded in providing adequate quantity and quality of potable water to the people of Lela. EWB-OSU re-assessed the program’s goals in spring 2015, and they are as follows: (1) provide 15 lpcd of drinking water for community members, (2) provide 3 lpcd of drinking water for students at the Lela Primary School (currently via a rainwater catchment system), (3) have no more than 500 users per well, (4) establish a clean, year-round water source within 750 m for 95% of households, and (5) ensure access to water that meets WHO water quality standards.

Lela is a rural agrarian community in southwestern Kenya. The population is estimated to be 2,000 people, distributed throughout a 5 to 7 km² area. Since implementation of the first two wells, Lela’s population has associated into community subgroups based on their proximity to a specific well. For example, the area containing users of the Lela A well has been dubbed “Lela A,” and likewise, the region surrounding the Lela B well has been dubbed “Lela B.” In anticipation of another well, a third group organized itself during 2014; they now call this area “Lela C.” A fourth, fifth, and sixth group have organized into regions called Lela D, E, and F in anticipation of future wells. However, no hydrogeological work has been done in D, E, and F to support whether or not a well would be successful in those regions. To avoid confusion in this document, care will be taken to differentiate between the names of the regions and their respective wells. All three current wells are managed by the community water board: the Lela Women’s Water Committee (LWWC). The 903 Implementation Agreement (Appendix A) was signed by all parties in mid-April 2015 and a final, updated version is now included. There were no incidents to be filled via the 612 Incident Report, as stated in Appendix B.

The Kenya Program was adopted by EWB-OSU in 2009. There have been no other projects within the program besides the Lela Community Water Project. Assessment trips were carried out in 2009 and 2011. During the first implementation trip in 2012, Lela A was constructed and a rainwater catchment system—four 10,000L tanks—was installed at the Lela Primary School. Lela B, the second well, was drilled in 2013. A monitoring and evaluation trip occurred in 2014. The sixth trip to the community and the third well implementation occurred in 2015.

Calculations and drawings pertaining to the well design were based on the field conditions encountered and as-built details of the Lela A and B wells. A full set of drawings, which includes a community map (Figure 1), a well site plan (Figure 2), a plan and cross-sectional drawing of the wellhead/apron (Figure 3), and well cross-section drawing (Figure 4), has been included in
Appendix C. Note, all final vertical well dimensions including total depth and screen depths and lengths were determined in the field based on actual site conditions. Lela C was drilled to a depth of 100 m by Midland Construction Co Ltd. The location of the proposed well was determined by the community and the recommendation of the Kenya program’s REIC, Dr. Jeff Randall. Subsequently, the proposed location was confirmed by a hydrogeological survey (including a vertical electrical resistivity survey) conducted during the 2014 monitoring & evaluation trip. During drilling, the first significant groundwater was encountered at about 35 m, a depth similar to wells Lela A and B. Drilling continued to 100 m. The casing and screen assembly was then lowered into the borehole and sand pack installed to about 8 m below the ground surface. A sanitary concrete seal was then installed above the sand pack to the ground surface. A pumping yield test was conducted with an electric test pump and water quality samples were collected. Water quality results are summarized in Appendix D. The well head/apron was then constructed and the Afridev hand pump installed.

Major deviations from the original design include borehole depth, borehole diameter, and casing/screen diameters. The changes were driven by the selection of the new drilling contractor, Midland, and availability of local materials. None of the changes affected the utility or sustainability of the completed well.

Overall construction and testing spanned several weeks but was fully completed on December 3rd, 2015 and the well was operational on December 9th, 2015. The community plans to construct fencing and place a lock around Lela C in February 2016. A LWWC member has been placed at Lela C for fee collection, in the meanwhile. Fencing around Lela A and B will also be re-done. Workshops regarding water, health, gender, and chlorine were conducted February 3rd-5th, 2016 and will follow the installation of a chlorine dispenser by a separate, local NGO.

Calculations have been made based on current average well yields (16.4 lpm) against the community’s needs, accounting for a population of 2,000, the current goal of 15 lpcd, and under certain assumptions such as well operating hours (8 hours). Currently, the three wells at Lela produce a yield of 10.62 lpcd when accounting for these assumptions and including 10% spillage. These calculations, including data on water quality from 2014 and 2015, are included in Appendices D, E, and F. It should be noted that data pertaining to wells Lela A and Lela B were obtained during June-August (dry season) whereas data from Lela C was primarily obtained during December (wet season).

### 2.0 Trip Description

The implementation of Lela C was the joint efforts of EWB-OSU and EWB-SFP. The EWB-SFP travel team members, in-country residents of Kenya at the time, provided on-the-ground contact and field work while EWB-OSU funded, technically supported, and generally prepared all other aspects of implementation. The partnership came about from EWB-OSU’s inability to send a student travel team due to safety concerns expressed by Oregon State University.

Melchizedeck Okello—a local water well expert who was the general contractor on the permitting, construction, and testing of Lela A and Lela B—and his team were scheduled to commence drilling in mid-July. Initial materials were purchased and a drilling rig scheduled; however, delays were experienced. Due to miscommunication and Mr. Okello’s inability to meet agreements due to a
family emergency, EWB-OSU changed drilling contractors in early August and extended the implementation trip’s dates. Delays were encountered again due to permitting issues, but construction ultimately began in mid-November with EWB-OSU’s new drilling contractor Midland Construction Co Ltd. Midland is a large and reputable company based in Kakamega, Kenya and has drilled for the World Bank and the Salvation Army. EWB-OSU contacted Midland via an in-country referral (Jaynie Whinnery). Communication was eventually re-established with Mr. Okello who directed the construction of the apron and hand pump installation.

Additionally, water quality at the new well was tested and community updates such as a bank statement and changes in the organizational structure of LWWC, such as on the committee’s newly formed sub-committees, were received by the project team.

3.0 Project Summary

3.1 Project Description
The purpose of this trip was to implement a third water well equipped with an Afridev hand pump to contribute towards the Lela Community Water Project’s goals. Specifically, this well contributed towards providing year-round access to an improved water source for all members of the community. This well, as with the existing two wells, is available to all community members for domestic purposes. Specifically, Lela C provides clean water to about 18% of community members who previously lacked year-round access to an improved water source.

Additionally, continued efforts were made to ensure maintenance and sustainability of all the previously implemented systems and the management of those systems by the LWWC.

3.2 Summary
Construction of the Lela C well commenced on November 14th, 2015 at 1°06' 49.1" S 34°23' 59.8" E. Borehole drilling was finished a day later on the 15th at a depth of approximately 100 m (328 ft) with a nominal diameter of 9 in. The static water table was measured at 21.9 m below the ground surface. The casing and screen assembly was installed the next day consisting of 6 in nominal PVC flush threaded casing and screen (see Appendix C). The screen sections had machined cut slots that were about 1 mm wide. Screen sections were installed at the following depths, as measured from the ground surface: 32.6 to 47.5 m, 56.2 to 59.1 m, 65.0 to 70.9 m, 76.8 to 82.7 m, and 88.6 to 94.4 m. Over the next two days, the well was developed by airlift pumping using the drilling rig. The gravel pack, 2 to 5 mm diameter, non-rounded was then installed to about 8 m below the ground surface.

An unanticipated mistake in construction occurred when the drilling contractor pulled the temporary surface casing and then left the borehole open overnight. Heavy rain overnight caused the shallow soil to collapse around the upper well casing and let surface water runoff enter the borehole. The collapsed soil was removed, excess soil and water was pumped out, and installation of the sanitary seal proceeded after pouring about 8 L of bleach down the borehole annulus to try to disinfect the surface water and soil that had entered the well. A 24 hour pumping yield test was conducted on December 19th with an electric submersible test pump. Water quality results from the pump test and testing done at an in-country laboratory are included in Appendix
D. The wellhead/apron was constructed on November 26th and an Afridev hand pump was installed on December 3rd. The well was operational on December 9th after a short delay due to a missing part on the hand pump.

The Lela C well and wellhead/apron design were based on the as-built details of the two existing wells in the program. The location of Lela C is also consistent with the locational guidelines listed in Schneider’s “Water Supply Well Guidelines for use in Developing Countries” (2014), as are the Lela A and B wells. Specifically:

- At least 30m (98’) from concentrated areas of human waste disposal
- At least 15m (49’) from concentrated areas of food or wastewater disposal
- At least 30m (98’) from areas related to confining, housing, or feeding animals

The design of the wellhead/apron is also consistent with the recommended guidelines in Schneider (2014):

- The apron should extend no less than one meter in all directions
- The well casing should be placed in the center of the apron to collect spill water
- All surfaces should be sloped towards the drainage channel, away (and down slope) from the pump to prevent well contamination
- Proper reinforcement (steel wire) should be used to prevent cracking, which can lead to well contamination
- The drainage channel should be sufficiently long to convey excess water away from the well head to prevent well contamination
- The construction of the apron should not take place until the soil surrounding the well head, which will be disturbed during construction, has consolidated

The Afridev hand pump (also installed in Lela A and B) is the preferred pump for this project and is consistent with UNICEF (2010) guidelines for hand pump selection. This includes factors such as corrosion resistance, ease of repair, pumping lift, number of users, and user preference. The Afridev hand pump is resistant to corrosion and is simple to repair due to its design (Deep Well Pumps, 2010). The standard lift for an Afridev hand pump is 45 m, which is within the estimated water table depth in Lela. Lastly, the pump is familiar to the people of Lela, as it is used at both the Lela A and B wells. The specific hand pump has been repaired several times by the community.
3.3 Difference Between Planned and Actual Implementation

Table 1 and Table 2 below summarize components of the planned well and the as-built well as described in section 3.2:

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<th>As-Built Component</th>
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<td>Drilling method</td>
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<td>Drilling method</td>
<td>Air Rotary</td>
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<td>Borehole diameter (nominal)</td>
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<tr>
<td>Screen</td>
<td>5 inch PVC with 1mm wide slots (40 slot)</td>
<td>Screen</td>
<td>6 inch PVC with 1mm wide slots</td>
</tr>
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<td>2-4 mm diameter rounded (non-crushed)</td>
<td>Grave pack</td>
<td>2-5 mm diameter non-rounded</td>
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<td>26 feet (8 meters)</td>
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<td>Hand pump</td>
<td>Afridev</td>
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Table 1 Planned component designs of Lela C    Table 2 As-built component designs of Lela C

Major deviations from the original design include borehole depth and borehole and casing/screen diameters. The total depth of the Lela C well was to be determined based on in-field conditions with a maximum depth of 80 m. For reference, wells Lela A and B were drilled to depths of 60 m and 70 m respectively. The final 100 m well depth of Lela C was decided by the travel team, the REIC, and the drilling contractor Midland. Midland’s policy includes a minimum drilling depth of 100 m to ensure complete groundwater access and a productive well. Second, the initial casing and screen design diameter was 5 in PVC flush threaded, but 6 in PVC flush threaded casing and screen was installed instead due to local material availability. Also the nominal borehole diameter was increased from 8 in to 9 in to accommodate the larger diameter casing and screen.

EWB-OSU believes that the utility and sustainability of the new well is not affected by these deviations in design/construction and materials.
One of the most significant differences regarding the implementation was the unanticipated change in drilling contractors. Originally, Melchizedeck Okello was contracted to obtain the permits (including required government studies), to hire the driller, and to oversee all construction and testing activities for Lela C in July 2015. However, due to Mr. Okello’s family emergency and inability for consistent communication, EWB-OSU hired the construction company Midland in August to construct Lela C. Midland completed the drilling and casing installation. Communication and relations with Mr. Okello were eventually resolved, and he and his team returned to construct the wellhead/apron and install the hand pump. Mr. Okello also stayed on during construction as a consultant.

A significant construction related problem involved the sanitary seal. The drilling contractor pulled the temporary surface casing and then left the borehole open overnight. A heavy rain caused the shallow soil to collapse around the well casing and let surface water runoff enter the borehole. The collapsed soil was removed, excess soil and water were pumped out, and installation of the sanitary seal proceeded after pouring about 8 L of bleach down the borehole annulus to try to disinfect the surface water and soil that entered the well. However, the effects of the collapse were apparently not fully mitigated by the bleach as subsequent testing of the groundwater found total coliform (soil coliform not enteric animal feces e-coli form) counts of 150 total coliform per 100m, indicative of surface water contamination. EWB-OSU believes that the aerobic total coliform bacteria and other shallow soil bacteria that entered the well will die off as the oxygen and food sources will be cut off in the deeper groundwater. A similar situation (initial high total coliform) occurred at Lela B caused by shallow surface soil erosion during sand pack installation. The total coliform counts at Lela B are now zero, and EWB-OSU expects the same for Lela C in the future.

Lela C is currently in use and will be further monitored in the future. Additionally, the planned installation of a chlorine dispenser at the well in February 2016 will help ensure adequate disinfection.

To address pre-implementation TAC comments, EWB-OSU prepared an operations & maintenance manual for the wells that was left with the community in summer 2015. Additionally, re-establishing relations with Mr. Okello was vital in ensuring the community had a local source to receive future training from.

3.4 Post Trip Follow-Up/Update
Notable activities followed completion of Lela C. Firstly, the community plans to construct fencing around Lela C and improve fencing around Lela A and Lela B in February 2016. Lela C is currently being used with fees collected by a committee member. Secondly, installation of a chlorine dispenser at the well is planned as extra precaution for ensuring the bio-quality of the water. Existing chlorine dispensers, one at each well and other popular local water sources, were installed by the NGO Evidence Action in early 2014, independent from EWB-OSU. As of early February 2016, Evidence Action had run out of chlorine dispensers but will be installing one at Lela C when their supply re-stocks.

Community members trained by Evidence Action as representatives and representatives from the NGO hosted a workshop at Lela C. The LWWC also arranged for workshops from the Ministry of
Water, Gender, and Health. These workshops occurred on February 3rd to 5th, were about two hours long, and incorporated a visit to the well site. All four workshops had been performed in Lela before. The workshops were positively received and the community hopes to regularly host workshops in the future.

Additionally, committee elections will be taking place in spring 2016. The Ministry of Gender plans on sending a representative during this time to oversee elections. The Ministry of Water also sent an engineer named Ojango who offered to regularly visit the Lela wells and provide assistance. Ojango’s assistance was appreciated, and his contact information was left with community members.

3.5 As-Built Drawings
Drawings are included in Appendix C. Because the EWB-SFP travel team was not present during wellhead/apron construction, as-built details were not collected. The drawing presented in Appendix C is a copy of the 2013 Lela B wellhead/apron as constructed by Mr. Okello and his team in 2013. Mr. Okello has confirmed that the Lela C wellhead/apron was constructed the same as Lela B.

3.6 Operation and Maintenance
The LWWC is familiar with use, operation, and maintenance of water wells with Afridev hand pumps. Twice in 2014, pump-chamber O rings were broken on Lela B well, and the LWWC independently hired a repairman to successfully repair the pump. Recently, the pivot bearings on the Lela B nylon pump handle had become worn and squeaky due to heavy use and made the pump hard to use. The LWWC hired a repairman to fix the issue. Examples such as these show the capacity that the LWWC has for maintaining the wells. Ultimately, Lela C should not see as heavy of use as Lela B and, like Lela A, should not have as many operational and maintenance problems. Furthermore, the implementation of Lela C will lessen the usage of Lela B which should reduce the need for frequent repairs of Lela B.

The LWWC was provided with an operation and maintenance manual in summer 2015 and was trained on operating and maintaining the wells. Furthermore, the community has a good relationship with local well expert, Mr. Okello. Mr. Okello visits the community and assists in maintenance as well as purchasing of parts, such as o-rings, which are not readily available in the community. Mr. Okello’s continued presence in the community is important.

The LWWC charges users either 20 KES per month or 5 KES per 20 L bucket. The former is for registered members and the latter for non-registered members. These O&M fees have provided the committee with sufficient funds for maintenance, and the fund’s bank account in Migori has a balance of about $378. This amount has so far been sufficient for O&M costs.

The LWWC has also contacted Evidence Action, another local NGO, to install a chlorine dispenser at Lela C. The dispenser deposits a drop of chlorine into buckets as an additional sanitation measure, and have already been installed at the previous two wells. Local community members were trained by Evidence Action as representatives on the usage and importance of the chlorine dispensers to teach the rest of the community.
3.7 Sustainability

Observations by the travel team on the wells constructed in 2012 and 2013 occurred on this trip. It was observed that the LWWC was sustainably maintaining and operating these two wells. From these observations, EWB-OSU team believes that Lela C will also be sustainable in the long run. Most important in the long-term sustainability of the project is the LWWC’s strong leadership and transfer of knowledge. EWB-OSU has observed regular elections for the committee. The LWWC has been successful in raising funds, hiring repairmen, and operating the wells such that users are satisfied—important in that users continue using and supporting the committee—as evident by surveys conducted in 2014. The organizational sustainability of the LWWC and of the program is therefore satisfactory and is likely to remain so.

Specific strategies for financial and technical sustainability include collecting sufficient maintenance funds, training on the water systems, and successful transfer of pertinent knowledge in the committee. All of these metrics have been observed in the committee by EWB-OSU. Financially, the fee structure has successfully provided the committee with $378 which is a 451% increase from the previous year. The committee has also taken its own independent initiative on pump repairs. The O&M manual provided to the committee in summer 2015 should also help maintain technical sustainability. The continued support from Mr. Okello, as mentioned in section 3.6, also ensures technical sustainability.

4.0 Photo Documentation

Photo 1: EWB-SFP member and traveler Jaynie Whinnery meets with members of the LWWC including the presiding Chairman Pastor Sam and Village Elder Charles Olang’o.
Photo 2: Well rig at project site Lela C.
Photo 3: Lela C under operation of local children.
5.0 Lessons Learned

Construction: All aspects of the design and construction for the implementation must be discussed with the contractor/driller on-site before construction begins.

Construction: Receipts for supplies and materials should be carefully recorded.

Health & Safety: Coordination with a Village Elder should be made before construction begins in order to ensure the safety of spectators during all construction activities. Crowd control is especially important in regards to children.

Travel: Meet up times and locations should be clearly communicated and upheld by both travel team members and in-country contacts.

Travel/Community Engagement: Repeat travelers assisted in the success of the Kenya Program. Early on in the Kenya Program, this helped establish a better relationship between Lela and EWB-OSU and should be considered when selecting travel teams for future programs.

Community Engagement: The most critical key in the Kenya Program successes was the buy-in from the community as fostered by travel teams staying in the community and participating in community member’s daily lives. Building this close relationship between the community and a chapter should be high on the list of priorities for future programs.

6.0 Project Phase

<table>
<thead>
<tr>
<th>Project Type</th>
<th>Implementation Continues</th>
<th>Monitoring &amp; Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Supply</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

7.0 EWB-USA Project Monitoring

7.1 EWB-USA Project Status Table

No projects have been completed at this time. However, components of the Lela Community Water Project were constructed to completion in 2012, 2013, and 2015

<table>
<thead>
<tr>
<th>Project ID</th>
<th>Project Type</th>
<th>Project Discipline(s) (list all in one cell)</th>
<th>Date of Completion (mm/dd/yy)</th>
<th>Functionality (check one range per project)</th>
<th>Periodic Maintenance (yes or no)</th>
<th>Demonstration of Community Capacity (yes or no)</th>
</tr>
</thead>
<tbody>
<tr>
<td>#5091</td>
<td>Water Supply</td>
<td>Source Development, Water Storage, Water Pump</td>
<td></td>
<td>0-50%</td>
<td>51-75%</td>
<td>76-100%</td>
</tr>
</tbody>
</table>

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### 7.2 EWB-USA Project Functionality Indicators

<table>
<thead>
<tr>
<th>Project ID</th>
<th>Project Type</th>
<th>Project Functionality Indicator (select from document 906)</th>
<th>Monitoring Result (include baseline data where applicable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>#5091</td>
<td>Water Supply</td>
<td>Quality of the water at water point</td>
<td>Water samples taken at all three wells and the three available water tanks yielded safe results as defined by WHO and Kenya governmental standards. Additionally, coliform testing was done and the results are listed below:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lela A: Total count of 0 total coliform</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lela B: Total count of 0 total coliform</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lela C: Total count of 150 non e.coli coliform per 100mL</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>The high total coliform count at Lela C is likely because the drilling company did not properly comply with recommended construction standards, resulting in the borehole temporarily collapsing and soil bacteria contaminating the well. Bleach was added to the borehole annulus as a precaution after the collapse but was not totally effective. A similar issue was observed in the Lela B well with soil bacteria present after drilling but which has now subsided. EWB-OSU believes the soil bacteria in Lela C will also subside once the bacteria die off from lack of oxygen and food.</td>
</tr>
<tr>
<td>Time to collect water</td>
<td>In 2014:</td>
<td></td>
<td>83% of well users surveyed could reach a well within 30 min.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lela A: average queue time = 18 min</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lela B: average queue time = 147 min</td>
</tr>
</tbody>
</table>
Percentage of houses within certain distance of access point

In 2014:
- 84% of the houses surveyed are within 1 km of Lela A or B.
- 45% of the houses surveyed are within 500 m of Lela A or B.

In 2015:
- EWB-OSU believes that 97% of houses will be within 1km of Lela A, B, or C.
- EWB-OSU believes 60% of houses will be within 500m of Lela A, B, or C.

7.3 Periodic Maintenance Indicators

<table>
<thead>
<tr>
<th>Project ID</th>
<th>Project Type</th>
<th>Periodic Maintenance Indicator</th>
<th>Monitoring Result (include baseline data where applicable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>#5091</td>
<td>Water Supply</td>
<td>Existence of broken components</td>
<td>No broken parts were found during the examination of the wells during the trip. However, the Lela B hand pump was squeaky and pumping with difficulty. This issue was resolved by the LWWC and Mr. Okello. However, tank four at the primary school has been out of operation due to a broken tap for the past year. The other three tanks, though, have been adequately meeting the school’s daily needs thus far. There have been no urgent complaints.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Level of cleanliness of water storage tanks</td>
<td>Water from all tanks at the school and all three wells were tested and comply with WHO standards.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Observed evidence of routine maintenance on the system done accurately without EWB-USA</td>
<td>Twice in 2014 a worn-out O-ring on the Lela B well was fixed by a repairman hired by the LWWC. In summer 2015, the Lela B hand pump was squeaky and pumping with difficulty but has since been resolved by the LWWC and Mr. Okello.</td>
</tr>
</tbody>
</table>
Currently, the committee plans to construct/improve the fencing surrounding all three wells and have discussed constructing shelters for users while they wait. So far, no major issue has been found that the LWWC did not fix independently and in a timely manner. These examples are encouraging and support the opinion that the LWWC have the capacity to manage the program.

### 7.4 Periodic Maintenance Indicators

<table>
<thead>
<tr>
<th>Project ID</th>
<th>Project Type</th>
<th>Community Capacity Indicator (select from document 906)</th>
<th>Monitoring Result (include baseline data where applicable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>#5091</td>
<td>Water Supply</td>
<td>Balance available in maintenance fund</td>
<td>A bank statement from the LWWC account was obtained in late December 2015. The LWWC has approximately $386 (38,622 KES) in their account for maintenance of their three wells. This is a 451% increase in funds from a balance obtained in the summer of 2014 showing $96 (8,563 KES). Very little money is available for maintaining the rainwater catchment system. The system is managed by a school board. Any money raised is often use for other expenses.</td>
</tr>
</tbody>
</table>
|            |              | Observed method of community members’ storage of water   | During household surveys in 2014, the travel team visually inspected all drinking water containers:  
  - 68% looked clean  
  - 21% displayed light mildew |
### Cost of Water to User

| Remaining water containers displayed heavy mildew or were not available for observation |
| Cost of water to user |
| For all wells: |
| • 20 KES (~$.025) per month for registered well users |
| • 5 KES (~$.05) per bucket for non-registered well users |
| The rainwater catchment system is free for use intended for students and teachers. |
| Note, the LWWC is currently considering implementing new membership fees in 2016. |

#### 7.5 Additional Monitoring Information

EWB-OSU has no additional monitoring information to report.

#### 8.0 Next Phase of the Program

The transfer of the Lela, Kenya program from EWB-OSU to EWB-SFP will continue as detailed in the “Memorandum of Understanding Between Engineers Without Borders Oregon State University and Engineers Without Borders San Francisco Professionals Chapter”. Specifically EWB-OSU and EWB-SFP are currently discussing details of the potential transfer. The success of the program in meeting its goals and the program’s feasibility are being re-evaluated by both EWB-OSU and EWB-SFP. In general, adoption of the program by EWB-SFP will include evaluation of the continuation of the water supply project, the prospect of starting another project within the community, or a final monitoring and evaluation trip.
Appendices

Appendix A – Signed Final 903 – Implementation Agreement

Note: The 903 Implementation Agreement below is still awaiting final signatures. The complete 903 will be sent to EWB-USA as soon as possible.

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**Document 903**

**IMPLEMENTATION AGREEMENT**

EWB-USA projects are most successful when there is a three-way partnership between each of the entities listed below. Each partner has specific skills and expertise, which together, contribute to a more sustainable project over the long-term.

- Lela, Kenya and the Lela Women’s Water Committee
- Midland Construction Co. Ltd (primary construction company / drilling company)
- Melchizedeck Okello & Co (secondary construction company)
- Engineers Without Borders: Oregon State University Chapter
- Engineers Without Borders: San Francisco Professional Chapter

This contract is between the Oregon State University (OSU) chapter and the San Francisco Professional chapter of Engineers Without Borders, USA, the Lela Women’s Water Committee (LWWC) as representative of the Lela, Kenya community, Midland Construction Co. Ltd, Melchizedeck Okello & Co for the purpose of setting guidelines for the Lela Community Water Project – Third Implementation. The specific conditions listed below must be included in the standard EWB-USA Implementation Agreement. Additional roles and responsibilities identified by any party to the agreement may be added at the discretion of all parties to the agreement. This document must be signed by all parties in order to begin construction of the Lela Community Water Project – Third Implementation. The roles and responsibilities agreed to in the previously-signed Project Agreement remain in effect in addition to the commitments outlined below.
PRE-CONSTRUCTION PHASE

LWWC responsibilities:
- Provide 17,000 KSH of the capital construction cost in cash before construction begins.
- Provide written confirmation that the land required for the project implementation has been properly donated to the community for the intended use.
- Provide written confirmation that it has the legal right to use the water supply that is being developed in this project. Provide the names of the committee’s most current executive board.
- Contribute to construction discussions and provide program guidance from community-perspective.
- Provide a bank statement demonstrating progress on fee collection over the past year.
- Agree that the goal of the Lela Community Water Project is to improve the quality of life of everyone in the community, not just those who can afford to pay a tax/fee. Therefore, considerations will be made for those who are unable to pay for and/or physically retrieve water.

Midland Construction Co. Ltd responsibilities:
- Drill, construct, and develop a water well.
- Provide and/or utilize the following list of equipment and tools required for construction, if necessary:
  - Wooden platform (1)
  - Drill pipe (1)
  - Joints for drill pipe (1)
  - Auger (1)
  - Sant auger (1)
  - Handle - Afridev (1)
  - Plastic pipe for casing (150-250 ft)
  - Plastic pipe with slots for screen (150-250 ft)
  - Plug for screen (1)
- Provide and/or utilize the following materials for construction:
  - Cement mix
  - Sealing material
  - Gravel pack

Melchizedeck Okello & Co. responsibilities:
- Construct a well apron
- Install a hand pump
- Provide and/or utilize the following list of equipment and tools required for construction, if necessary:
  - Wooden platform (1)
o Drill pipe (1)
o Joints for drill pipe (1)
o Auger (1)
o Sant auger (1)
o Handle - Afridev (1)
o Plastic pipe for casing (150-250 ft)
o Plastic pipe with slots for screen (150-250 ft)
o Plug for screen (1)

- Provide and/or utilize the following materials for construction:
  o Cement mix
  o Sealing material
  o Gravel pack

- Provide appropriate technical training for community members.
- Provide contacts for ongoing maintenance.

**OSU chapter of EWB-USA responsibilities:**
- Provide remaining funds needed for construction (beyond the community contribution).
- Communicate the requirements of site preparation to the community/in-country contacts prior to the travel team’s arrival.

**San Francisco chapter of EWB-USA responsibilities:**
- Provide qualified representatives of the design team during construction for observation and oversight. Representatives will be knowledgeable about the previously implemented systems, the Lela Community Water Project’s background, the circumstances of the 2015 implementation, as well as any supplementary knowledge that will benefit the program.

**POST-CONSTRUCTION/OPERATIONS AND MAINTENANCE PHASE**

**LWWC responsibilities:**
- Plan and oversee the construction of protection around the well (fencing).
- Pay for 100% of the costs to operate and maintain the wells. This cost is estimated to be 17,000 KSH per year.
- Monetary resources will be collected from the community for operations and repairs as per the following: 20 KSH will be collected from registered users at the beginning of each month.
- 5 KSH per bucket will be collected from non-registered users.
- Identifying maintenance needs, specifically the committee members overseeing daily well operation (Margaret Achieng & Daniel Arua)
- If the committee does not have the required knowledge to perform the necessary repairs, they are responsible for acquiring outside help (repairman).
• Electing committee members on a regular basis. Each position will be held for one term by the elected individual.

Melchizedeck Okello & Co. responsibilities:
• Provide ongoing support to Lela for a minimum of 3 years after construction is complete, as needed.
• Assist with additional monitoring activities (well inspection) as identified by the OSU chapter of EWB-USA as long as the program is in collaboration with the EWB chapter.

OSU chapter of EWB-USA responsibilities:
• Develop a detailed operation and maintenance manual for the community (including applicable photos and local language, as appropriate). The manual will include a maintenance schedule and anticipated costs.
• Perform and fund repairs to the project that are the result of errors in the design

San Francisco chapter of EWB-USA responsibilities:
• Provide and relay monitoring and evaluation of the Lela Community Water Project to EWB-USA as long as the program is active.

ADDITIONAL RESPONSIBILITIES
• Coordination of transportation for travel team members of the SFP chapter of EWBUSA will be provided by the OSU chapter of EWB-USA.
• Coordination of translation services for travel team members of the SFP chapter of EWB-USA will be provided by the LWWC.
• Procurement of construction materials before the OSU chapter of EWB-USA arrives for construction will be provided by the Midland Construction Co. Ltd and Melchizedeck Okello.
• Transportation of materials will be funded by the OSU chapter of EWB-USA.
On behalf of, and acting with the authority of the residents of Lela, Kenya, Midland Construction Co Ltd, Melchizedeck Okello & Co, OSU chapter of EWB-USA, and SFP chapter of EWB-USA, the under-signed agree to abide by the above conditions.

Signature
Judy Jiang

Printed Name
Kenya Program Coordinator

Position in EWB-OSU chapter of EWB-USA

Signature

Date

Printed Name

Position in EWB-SFP chapter of EWB-USA

Signature

Date

Printed Name

Position in Community-Based Organization: CHAIRMAN.

Signature

Date

Printed Name

Position in Primary Construction Company (Midland)

Signature

Date

Printed Name
Appendix B – 612 – Incident Report

No incidents occurred on this trip.
Appendix C – As-Built Drawing
Figure 1
Plan View

Cross Sectional View

Allen Dysart | Lela C Apron | US Feet
---|---|---
EWB - OSU | 11/14/15 - 12/3/15 | Figure 3
See Well Site Figure (Fig. 2)
Bore-hole Ø = 0.25 m

8 m

2 m

21.9 m

32.6 m - 47.5 m

56.2 m - 59.1 m

65.0 m - 70.9 m

76.8 m - 82.7 m

88.6 m - 94.4 m

Sump (94.4m - 99.9m)

Bore-hole Ø = 0.25 m

Concrete Sanitary Seal (cement, sand, gravel pack)

Drilling Fines

Gravel Pack (Angular to Sub-Angular 2-5mm Ø)

Static Water Level (21.9m)

Sceen

Machine slotted ~3m long with 265 slots per row x5 rows
slot width 1mm

Casing and Screen Ø = 17cm

(flush threaded, no bell ends)

Anular Width = 0.04 m

Allen Dysart

Lela C Well

Not to Scale

EWB - OSU

11/14/15 - 12/3/15

Figure 4

See Well Site Figure (Fig. 2)
Appendix D – Water Quality Results Summarized

<table>
<thead>
<tr>
<th></th>
<th>Lela A</th>
<th>Lela B</th>
<th>Lela C</th>
<th>Tank 1</th>
<th>Tank 2</th>
<th>Tank 3</th>
<th>KEBS Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>7.5</td>
<td>7.505</td>
<td>7.6</td>
<td>7.595</td>
<td>7.6495</td>
<td>7.805</td>
<td>6.5-8.5</td>
</tr>
<tr>
<td>Turbidity (NTU)</td>
<td>27.8</td>
<td>4.46</td>
<td>3.84</td>
<td>0.09</td>
<td>0.95</td>
<td>0.68</td>
<td>5</td>
</tr>
<tr>
<td>Conductivity (umhos/cm)</td>
<td>372ppm</td>
<td>400.25</td>
<td>373.5ppm</td>
<td>8</td>
<td>9.8</td>
<td>9.415</td>
<td>2000</td>
</tr>
<tr>
<td>Total Alkalinity (mgCaCo3/l)</td>
<td>148</td>
<td>158.5</td>
<td>147</td>
<td>14.095</td>
<td>14.3</td>
<td>14.41</td>
<td>500</td>
</tr>
<tr>
<td>Total Hardness (mgCaCo3/l)</td>
<td>162</td>
<td>146</td>
<td>148</td>
<td>14.25</td>
<td>12</td>
<td>9.975</td>
<td>500</td>
</tr>
<tr>
<td>Total Dissolved solids (mg/l)</td>
<td>246ppm</td>
<td>266.25</td>
<td>247ppm</td>
<td>3.3</td>
<td>6.4</td>
<td>6.2005</td>
<td>1200</td>
</tr>
<tr>
<td>Calcium (mg/L)</td>
<td>8.1</td>
<td>9.1</td>
<td>8.3</td>
<td>4.8</td>
<td>2.6</td>
<td>3.2</td>
<td>250</td>
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<tr>
<td>Iron (mg/L)</td>
<td>0.1</td>
<td>0.1</td>
<td>0.09005</td>
<td>0</td>
<td>0</td>
<td>0.3005</td>
<td>0.3</td>
</tr>
<tr>
<td>Chloride (mg/L)</td>
<td>23</td>
<td>11</td>
<td>21.005</td>
<td>1</td>
<td>4</td>
<td>3</td>
<td>250</td>
</tr>
<tr>
<td>Fluoride (Mg/L)</td>
<td>0.3</td>
<td>0.05</td>
<td>0.8</td>
<td>0</td>
<td>0</td>
<td>0.01</td>
<td>1.5</td>
</tr>
<tr>
<td>Magnesium (mg/L)</td>
<td>3.9</td>
<td>4.865</td>
<td>4.365</td>
<td>0.99</td>
<td>0.4575</td>
<td>0.67</td>
<td>100</td>
</tr>
<tr>
<td>Nitrate (Mg/L)</td>
<td>0.9</td>
<td>0.2305</td>
<td>1.52</td>
<td>0</td>
<td>0</td>
<td>0.02</td>
<td>10</td>
</tr>
<tr>
<td>Nitrites (Mg/L)</td>
<td>0.7</td>
<td>0.01</td>
<td>0.05295</td>
<td>0.02</td>
<td>0.00695</td>
<td>0.046</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 3. Water quality of Lela A, B, & C and rainwater catchment tanks

Lela A:
- Total count of 0 total coliform

Lela B:
- Total count of 0 total coliform

Lela C:
- Total count of 150 non E.coli coliform per 100mL

Samples of total coliform bacteria were found in Lela C likely due to a partial collapse of the borehole during construction. The borehole was reopened and bleach was poured down the hole. EWB-OSU believes the bacteria will die off due to a lack of oxygen and food and that no further action is needed. A similar occurrence of bacteria was found in Lela B in 2013 and a similar outcome followed. Additionally, community members are encouraged to use the chlorine dispensers installed by the wells. Dispensers issue one drop per bucket and have individuals trained by the nonprofit organization Evidence Action to facilitate the use of the chlorine dispensers. Evidence Action and EWB-OSU have no formal relationship. Additionally, the tanks on the Primary School are cleaned using the chlorine solution Water Guard during breaks when the system is not in use by the schoolchildren.
Appendix E – Water Quantity Estimates

<table>
<thead>
<tr>
<th>Water Quantity</th>
<th>2014</th>
<th>2015</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lela A (2012 well):</td>
<td>13.3 lpm</td>
<td>20 lpm</td>
<td>16.65 lpm</td>
</tr>
<tr>
<td>Lela B (2013 well):</td>
<td>13.3 lpm</td>
<td>12 lpm</td>
<td>12.65 lpm</td>
</tr>
<tr>
<td>Lela C (2015 well):</td>
<td>N/A</td>
<td>20 lpm</td>
<td>20 lpm</td>
</tr>
<tr>
<td><strong>Overall Average</strong></td>
<td></td>
<td></td>
<td><strong>16.4 lpm</strong></td>
</tr>
</tbody>
</table>

*Table 4 Water quantity, Lela A, B, & C*

<table>
<thead>
<tr>
<th>Number of wells</th>
<th>Lpd</th>
<th>Lpcd</th>
<th>Lpd (10% spillage)</th>
<th>Lpcd (10% spillage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>One well</td>
<td>7,872</td>
<td>3.93</td>
<td>7,084</td>
<td>3.54</td>
</tr>
<tr>
<td>Two wells</td>
<td>15,744</td>
<td>7.87</td>
<td>14,16</td>
<td>7.08</td>
</tr>
<tr>
<td>Three wells</td>
<td>23,616</td>
<td>11.80</td>
<td>21,254</td>
<td>10.62</td>
</tr>
<tr>
<td>Four wells</td>
<td>31,488</td>
<td>15.74</td>
<td>28,339</td>
<td>14.16</td>
</tr>
<tr>
<td>Five wells</td>
<td>39,360</td>
<td>19.68</td>
<td>35,424</td>
<td>17.71</td>
</tr>
</tbody>
</table>

*Table 5 Water quantity, One - Five wells*

Table 5, an estimate of lpcd with increasing wells, shows water quantity calculations in more general terms as calculated per the average flow rate from Table 4 (16.4 lpm) under the assumptions of 8 hours of operation. Realistically, these numbers are high because inconsistent pumping and spillage occur. Reed in “Minimum water quantity needed for domestic uses” uses a figure of 10% for spillage. Liters per capita daily are calculated using the assumed 2,000 population. Note that this figure is also an underestimate as population growth has occurred.

It is important to note that WHO standards for water supply are 7.5 – 15 lpcd. The goals of this water supply project, based off of WHO standards, are currently 15 lpcd.
Appendix F – Supply and Demand Calculations
The map in Appendix F indicates surveyed households that currently use Lela A (magenta) and Lela B (yellow), and households not currently using a well that would use Lela C (dark green). The pale green are too far from Lela A, Lela B, and Lela C. A portion of households currently using Lela B will be able to use Lela C after its implementation, lessening demand on the overcrowded Lela B; see calculation table below. Community input via phone calls after the construction of Lela C support this claim.

<table>
<thead>
<tr>
<th></th>
<th>Lela A</th>
<th>Lela B</th>
<th>Lela C</th>
<th>Current Lela B that will likely become Lela C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satisfaction (out of 10)</td>
<td>7.8</td>
<td>6.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of households (out of 62)</td>
<td>18</td>
<td>31</td>
<td>11</td>
<td>7</td>
</tr>
<tr>
<td>% of households</td>
<td>29%</td>
<td>50%</td>
<td>18%</td>
<td>11%</td>
</tr>
<tr>
<td>Estimated users per well</td>
<td>581</td>
<td>1000</td>
<td>355</td>
<td>226</td>
</tr>
</tbody>
</table>

*Table 6 Supply & Demand, including Lela C*

Based on 2014 household survey and estimated community population of 2,000. Lela B is currently overcrowded (and received a much lower satisfaction rating with a difference of 1.8); however, after Lela C is implemented, the roughly 23% of Lela B’s population (11% of Lela’s population) that is roughly equidistant between Lela B and Lela C will likely migrate to Lela C, reducing crowding at Lela B. Lela A, which is far from Lela C, will not be significantly affected.

<table>
<thead>
<tr>
<th>Estimated Breakdown After Implementation of Lela C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of households</td>
</tr>
<tr>
<td>18</td>
</tr>
<tr>
<td>% of households</td>
</tr>
<tr>
<td>29%</td>
</tr>
<tr>
<td>Estimated users per well</td>
</tr>
<tr>
<td>581</td>
</tr>
</tbody>
</table>

*Table 7 Supply & Demand, including Lela C*

Estimated breakdown of usage after implementation of Lela C. Notice the decrease in overcrowding at Lela B.
Appendix G – References


