



Engineers for a Sustainable World
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Gashora Irrigation Project DEA Presentation

Global Team for Irrigation in Africa
Purdue University

National University of Rwanda

Presenters: Tim Bond, T. Reid Gray, Jeremy Koehler,
Erin Potrzebowski, Tyler Williams

Presentation Overview

- Introduction of ESW
- Project Overview & Organization
- Technology in Use
- Customer Specifications
- Assessment Trip Review
- Looking Forward





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INTRODUCTION

Engineers for a Sustainable World

- USA-based, international non-profit network
- Founded in 2002
- Currently comprised of 2,000+ students, university faculty and professionals
- “We believe engineers can be a vital part of the solutions needed to meet global human needs while providing sustainable access to the world's resources for current and future generations”
- For more information: esustainableworld.org



ESW Purdue University Chapter

- ESW-Purdue founded in Summer 2008
 - Dan Hirleman, Advisor
 - Tyler Williams, President
 - University Chapter of ESW-USA (20 total)
 - Purdue University Student Organization
- Organization's Mission:
 - To engage engineers in reducing poverty by improving environmental, social, and economic sustainability worldwide.



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Tyler Williams
2/20/2009 - 7

ESW National University of Rwanda

- ESW-NUR currently in process of being formed
 - Dr. Ir Karambizi Sylvestre , Advisor
 - Aimable Pierre Iyamukuru, President
 - 5 members total
- Chapter Application Submitted on 02.18.2009





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PROJECT OVERVIEW & ORGANIZATION

Inaugural Project



- Global Team for Irrigation in Africa (GTIA)
 - Pronounced 'gee-tee-ya'
- Focus: Irrigation in the Gashora Sector of Rwanda
- Partnership between National University of Rwanda and Purdue University
- Capstone Design Project (ME463) for 5 of the members



Project Team Members

- Purdue GTIA Team:
 - Dan Hirleman
 - Advisor
 - Tyler Williams
 - ESW-Purdue President
 - Erin Potrzebowski
 - Overall Project Lead
 - T. Reid Gray
 - Technical Lead
 - Jeremy Koehler
 - Sustainability Lead
 - Tim Bond
 - Information Lead
- Total Undergraduate Students:
8 Purdue & 2 NUR
- ESW-Purdue Supporting Members:
 - Jerad Cole
 - Mechanical Engineering Student
 - Mike Baird
 - Agriculture-Economics Student
 - John Mazunda
 - Agriculture-Economics Student
- NUR GTIA Team:
 - Dr. Ir Karambizi Sylvestre
 - Dean of Applied Sciences
 - Jean de Dieu “Jado” Iyamuremye
 - Civil Engineering Student
 - Aimable Pierre Iyamukuru
 - Civil Engineering Student



Brief Project History

August
2008

- Dr. Hirleman visits Rwanda
- Meets with Dean of Applied Sciences and Agriculture
- Agrees to move forward on joint student project

Fall 2008

- NUR Students and Faculty develop and prioritize potential projects

December
2008

- Agree on irrigation project in Bugesera Region
- Begin planning for team building & project assessment trip

January
2009

- Dr. Hirleman and 4 ESW-Purdue members visit Rwanda to develop project guidelines and meet with NUR team



Gashora Irrigation Project Overview

- Irrigation using naturally-available water resource in Bugesera is a national priority for Rwanda
- Selected farm is located on Lake Mirayi in the Bugesera Region, Gashora Sector of Rwanda
- 3 Seasons: A (Sep-Dec), B (Jan-May), C (June-Aug)
- Normal crops are maize and beans (intercropped) and are planted during Seasons A and B only
- 4 Hectares (10 acres) of farmland



Our mission is to “develop an agricultural irrigation system to aid in reducing poverty in the Gashora Sector of Rwanda using environmentally, socially, and economically sustainable design practices.”







Project Timeline

Spring
2009

- GTIA works to develop options for irrigation system and evaluate feasibility and sustainability of project

May
2009

- Evaluate goal of deployment in June
- Begin purchasing of equipment

May-June
2009

- Purdue implementation team travels to Rwanda
- Begin deployment and installation

Fall
2009

- Evaluate initial design's effectiveness and sustainability
- Potentially develop new system for another farm in region



GTIA Delegation of Responsibilities

- Purdue Team

- Ensure that we collaborate as a team throughout the entire design process
- Update GlobalHUB to make data and documents continuously available to NUR students
- Commit project as a sustainable design for Rwanda that will bridge US and African engineering and economies
- Design irrigation system and evaluate feasibility as Senior Capstone Project



GTIA Delegation of Responsibilities

- NUR Team
 - Form NUR Chapter of ESW
 - Participate in weekly Global Design Team meetings
 - Create a detailed topographical map of farming region (preferred resolution of 3m)
 - Provide or obtain meteorological data (rainfall, solar intensity, humidity)
 - Interact with farmers and local suppliers as needed





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Global teaming presents many challenges. GTIA is trying to overcome some of these challenges by embracing the use of new and existing technologies in our design process.

TECHNOLOGY IN USE



- Online global collaboration and teaming website
- Acts as the public face of ESW-Purdue and GTIA
 - <http://globalhub.org/groups/eswpurdue>
- Serves as the central share point for all research, scheduling, and other information generated by the project.
 - Goal: easy access to all project information no matter where you are in the world





- Livescribe Pulse Smartpen and Dot Paper Notebooks are being used in place of traditional design notebooks for 3 members
- Uses “Dot Positioning System,” to record both handwriting and audio.
- Allows team members to easily digitize notes to share with global teammates or search at a later date.

MEETING: 1/21/2009
MAILING LIST PASSWORD: j
LIST: eswpurdue@lists.purdue.edu

- Multiple file uploads
- VIEW FILE LIST ON WIKI PAGE

MISSION STATEMENT:
TO DEVELOP AN AGRICULTURAL IRRIGATION SYSTEM
TO AID IN REDUCING POVERTY IN THE GASHORA REGION
OR @ RWANDA USING ENVIRONMENTALLY, SOCIALLY,
AND ECONOMICALLY SUSTAINABLE DESIGN PRACTICES.

PROJECT NAME: GTIA - GLOBAL TEAM FOR IRRIGATION
IN AFRICA

ROLES:

INFORMATION LEAD: GLOBAL HUB, PULSE PEN
↳ TIM BOND - COMPANY TEMPLATES
DATA MANAGEMENT
COMMUNICATIONS MANAGEMENT

PROJECT LEAD: MANAGING SCHEDULES/MEETINGS
SET DEADLINES
↳ ERIN - FINAL SAY ON ADMIN. ISSUES
DELEGATING/ASSIGNING TASKS

TECH LEAD: COORDINATES DESIGN EFFORT
FINAL SAY ON DESIGN ISSUES
↳ REID - DELEGATES DESIGN RESPON.

SUSTAIN. LEAD: LEADS/COORD. EVALUATION
↳ JER - OF PROJECTS' SUSTAINABILITY

TYLER = ESU - PRESIDENT
NUR - LIAISON
FUNDRAISING / PROPOSALS
MEETINGS W/ HIRLEMAN
RESOURCING



Team Communications

- Currently using Google Talk™ chat features built into GMail™ to hold weekly meetings between team members in Rwanda and at Purdue
 - All communications are logged and posted to GlobalHUB
- Teleconferencing used when necessary
- Working towards using Google Talk™ or Skype™ to teleconference or video conference weekly
- Goal: Global delivery of final presentation via video conference and Adobe® Acrobat Connect™ (formerly Breeze™) presentation





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CUSTOMER SPECIFICATIONS & ENGINEERING REQUIREMENTS

Customer Specifications

- System will primarily be used during dry season
 - June-August; nothing currently planted during this time
 - Must be expandable to other two growing seasons
- Watering should be focused to morning and early evening
- System must be both profitable and sustainable



Customer Specifications

- System should be scalable to other farms in region
- Must be easy to operate and maintain
 - All products must have end-user maintenance
- Cannot interfere with other two planting seasons
 - Includes any soil recovery time
- Labor is widely available and should be utilized if possible

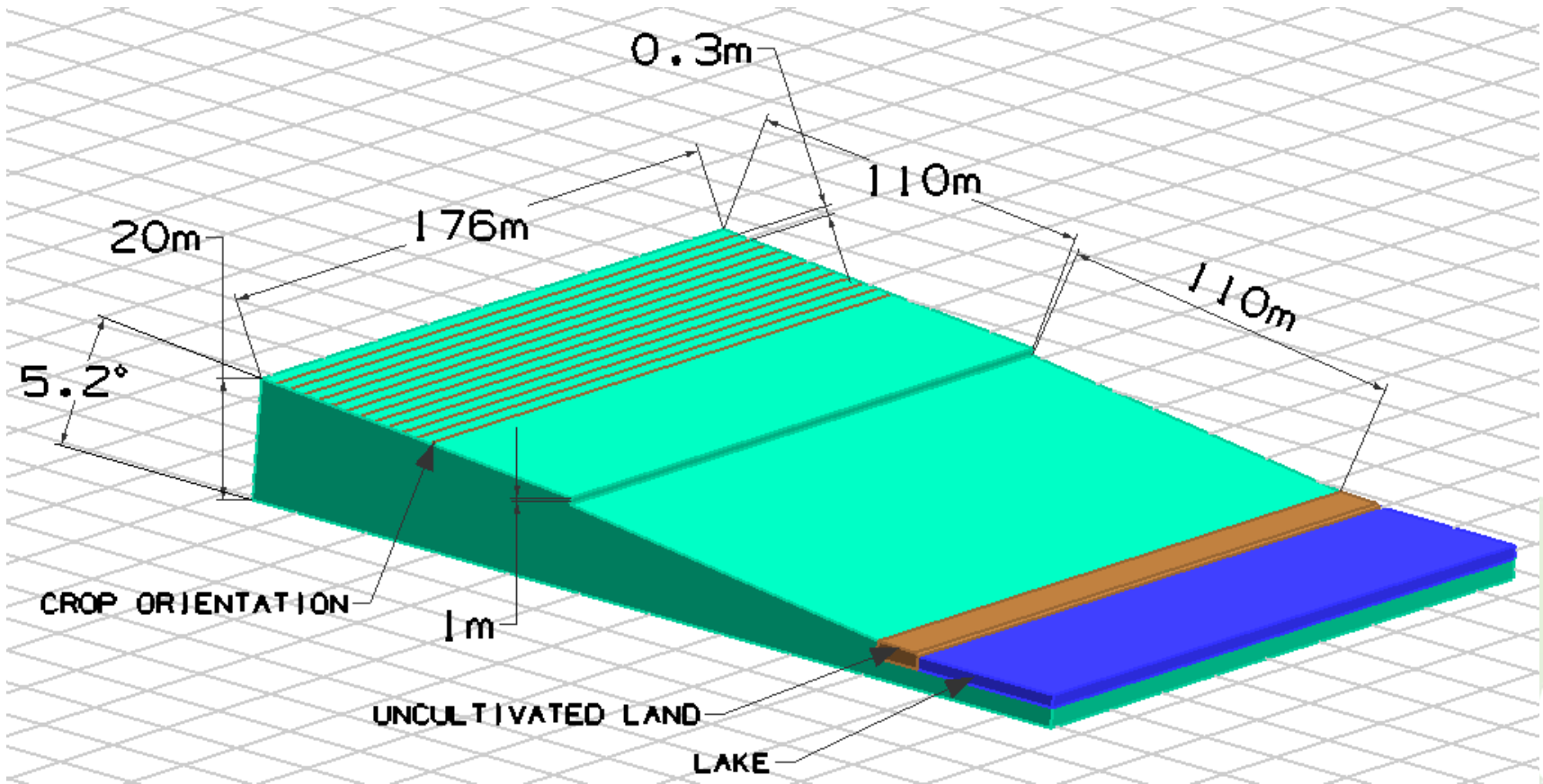


Agricultural Details

- Irrigating during Season C (June, July, August)
- Average seasonal rainfall: 0mm
- Average seasonal temperature: 32°C (90°F)
- Planting maize and beans (inter-cropped)
- Soil type: Sandy loam
- Current farming methods:
 - Hand tilled, planted and harvested (about 10 people)
 - No tractors / self-propelled farm implements
 - No fertilization
- Livestock on farm: None



Field Diagram



*Note: this map is a first order approximation, a more detailed resolution map will be generated by NUR students if funding for equipment can be secured.



Engineering Requirements

- Irrigate 175 m by 226 m (4 ha or 8 football fields)
- Capacity of 250m³ of water per day
- Overcome maximum 26m elevation change
- Water delivery rate not to exceed 40mm/hr^{E3}
- Daily operation costs not to exceed 6050rwf (\$11)
- Must be securable (security guard / shack)
- Materials must be obtainable from within region
- Minimize loss of arable land due to system





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ASSESSMENT TRIP

Assessment and Global Team Building Trip

- *Who:* National University of Rwanda and Purdue University students
- *When:* January 5 – 14, 2009
- *Where:* Kigali, Rwanda;
Butare, Rwanda;
Gashora Sector, Bugesera Region, Rwanda
- *Objective:* To assess Gashora Sector irrigation project and to complete global team building activities



Tasks Accomplished

- Met NUR teammates and established team expectations
- Met with Bugesera farmers and identified initial customer requirements
- Visited local suppliers and evaluated materials available in Rwanda
- Created preliminary budget, task list, and timeline
- Met with NUR officials, USAID representatives, and Government officials
- Established long-term strategic plan





















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LOOKING FORWARD

Pending Research

- Upcoming meetings with:
 - Rabi H. Mohtar
Professor of Environmental and Natural Resources Engineering,
Department of Agricultural and Biological Engineering,
Purdue University
 - Gebisa Ejeta
Professor of Sorghum Genetics and Breeding
Department of Agronomy
Purdue University
- Awaiting response from:
 - Simon Allen regarding solar array sizing and pricing
 - Rwandan pump supplier regarding pricing of European pumps
- Detailed AutoCAD model of field
 - Currently pending a new source of funding for NUR students
- NUR counterparts' research and notes from meeting with Masters of Irrigation students.



Looking Forward

- Preliminary Design Review
- Detailed System Analysis
- Critical Design Review
- Implementation Analysis
- Final Design Presentation and Report
- Implementation Trip
- Possible Continuation/Expansion of Project





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QUESTIONS?