PURDUE UNIVERSITY

CAPSTONE/SENIOR DESIGN EXPERIENCE 2019

Village of Hope Haiti Kitchen Garden

Agricultural & Biological ENGINEERING

Cassidy Brown (ENRE), Maddi Jo Duvall (ENRE)

1. Background

- The Village of Hope School is located some 15 miles east of Port au Prince Haiti, in Bonnet
- School provides a mid-day hot meal of beans and rice to about 750 students and faculty
- The school needs a garden design to have crops to supplement this mid-day meal

2. Objectives

- Plants should be nutritious, add variety to the diet, be acceptable to cultural preferences
- Solution should be sustainable for the short and long-term future of the school.
- Garden should be able to be upkept by the students, staff, and volunteers
  - Provide instruction manual

3. Constraints

- Site on a 1/16th acre plot, north facing slope, previously terraced many years ago
- Soil is alkaline
- Water source: 6,000 gal. water tank 150 feet above the garden site
- Low cost as possible

4. Soil Analysis

- Lowering the soil's pH can take 3 - 5 years

Solution

- **Raised Beds:** 3 terraces will have raised beds as a short-term solution for plant growth
- **Cover Crop:** 4th terrace will have a cover crop to fixate nitrogen and lower soil pH as a long-term solution
- **Mulching:** Mulch under & around raised beds to promote soil fertility
- **Composting:** to reduce fertilizer costs & improve organic matter in soil

Sample	Soil pH
Site 1	8.2
Site 2	8.1
Site 3	8.2
Site 4	8.0

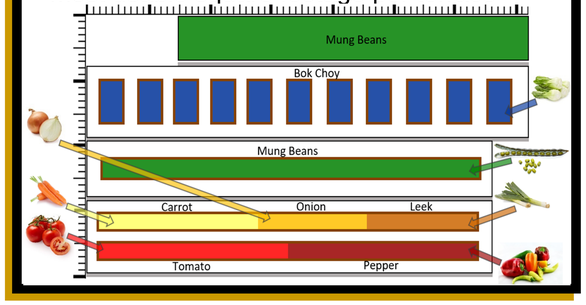
5. Crop Analysis

- Crops chosen based off ability to grow & popularity of crop, vitamin A content, & yield
- Mung Bean later added as a cover crop so crop rotation could be implemented

Plant	Popularity (scale 1-10)	Vitamin A (% DV)	Yield (per 10ft)
Tomato	10	25	17
Carrot	10	428	10
Bok Choy	7	144	42
White Onion	10	0	12
Leek	10	30	5
Bell Pepper	10	11	8
Hot Pepper	10	9	8

6. Crop Placement

- Crop rotation helps prevent erosion, controls pests, diseases, and weeds, uses less chemical fertilizer, making it a more natural solution to aid in plant heath
- Crops will be harvested twice a year to maximize yield
- Raised bed sizing determined to have the most usable square footage per terrace

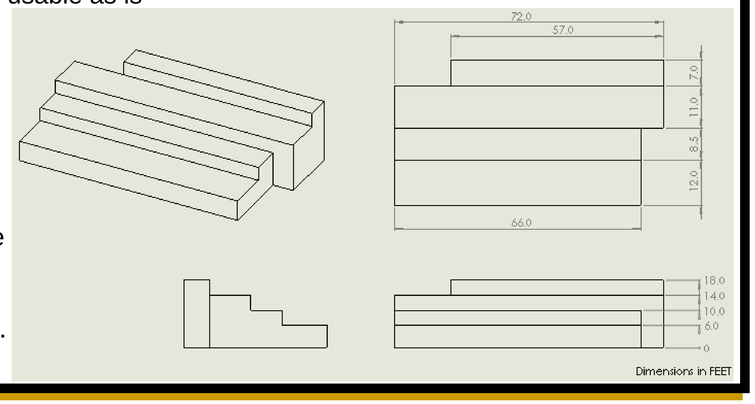


7. Terracing

- Downward slope on the garden site no longer usable as is
- Rocky soil with shrubs and trees
- Need solution that maximizes flat & plantable space & low maintenance once built

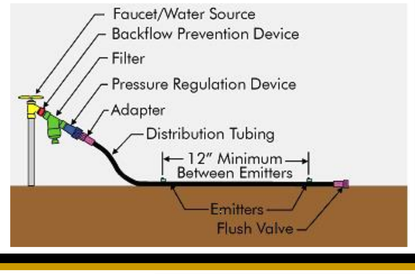
Solution

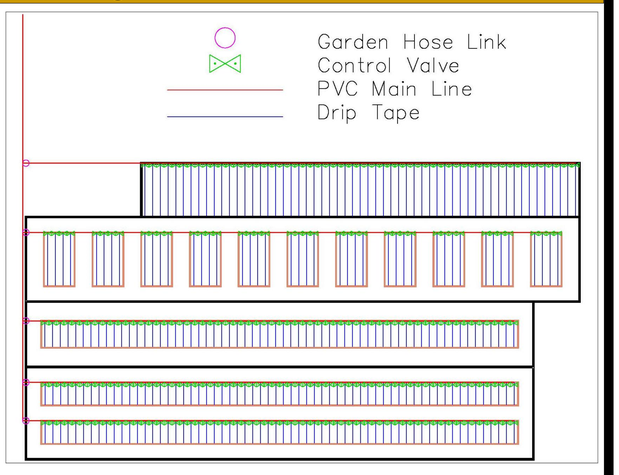
- Terrace design will follow the bones of the current terraces. Less soil will be moved from the site
- Remove large rocks, shrubs & trees, excavate & define terrace levels
- Add retention walls
- Walls made from cement blocks made in Haiti. Held together by concrete & support bars



8. Irrigation Selection, Requirement, Design

- Gravity-fed Drip Irrigation system implemented for increased water efficiency and ease of use.
- Using Climwat and Cropwat, irrigation schedules were created using precipitation data from weather stations in Kenscoff and Mirebalais
- Irrigation design drawn using AutoCAD Civil3D with terraces and raised beds to scale
- Water source provides approximately 86 psi of pressure
- After each Garden Hose link, there will be a Back Flow Prevention Device, Filter, Pressure Regulator as shown is the following diagram
- The Control Valves will be located before the Adapters to allow each drip tape line to be controlled separately





9. Pest Control

- Common pests: Cabbage Root Maggot & Cabbage Moth
- Pesticides/insecticides can't be used because pests lay their eggs deep into plant

Solution

- **Biological controls:** thyme deters these pests & will be planted between bok choy plants
- **Plant Checks:** larvae checks and removal will help eliminate this pest
- **Crop Rotation:** decreases fungal, pest, & weed accumulation by eliminating food source

10. Economic Analysis

Product	Cost
Raised bedding	$7,090
Irrigation	$5,375
Pest control	$20
Terracing	$2,182
Soil fertility	$133
Seeds	$140
Total	$14,940

11. Conclusion

- One meal per person per plant per harvest will be provided
- Kitchen Garden design will provide a learning tool as the soil is remediated
- Garden will provide a sustainable food source in the long-term future
- Future Capstone Projects could include expanding the garden to be able to provide more meals to sustain the school

Sponsor:
Village of Hope Haiti

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Standards:
ASAE S268.6
ASAE S553
NRCS Conservation Practice Standard- Conservation Crop Rotation

VILLAGE OF HOPE HAITI

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Think impact.

Sample	Site 1	Site 2	Site 3	Site 4
Soil pH	8.2	8.1	8.2	8.0

9. Pest Control

- Most prevalent pests in the area are the Cabbage Root Maggot and the Cabbage Moth, which eat leafy greens
- Pesticides or insecticides do not affect either pest because they lay their eggs deep into the plant.

Solution

- **Biological controls:** The herb, Thyme, is a known deterrent for these pests. Thyme will be planted intermittently between bok choy plants
- **Plant Checks:** Diligent larvae checks and eliminate this pest
- **Crop Rotation:** This decreases fungal, pest, and weed accumulation by eliminating the same food source

10. Economic Analysis