San Pablo Water Management Team

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Introduction

- Potable Water for San Pablo
  - Assessment
  - Preliminary Design
- Outline

Outline

- Background
- Future conditions
- Criteria and Constraints
- Range of Options
- Assessment
- Selection
- Preliminary Design
- Implementation Strategies
- Acknowledgements
- Questions
- Trivia

Background

- Location
- Current Situation
- Water Source
- Water Quality

Current Situation

- Cistern
  - 2600 Gallon
- Pump
  - Centrifugal Pump
  - Gas powered
Water Source

- Swasey River
  - Perennial River
  - Fluctuating Flow
- Ruled out
  - Groundwater
  - Rainwater catchments

Water Quality

- Tested by Jon Stoddard – Sept. 2001
- Fecal Contamination
  - High levels
  - Exceeds Drinking water standards
  - Exceeds Wastewater Effluent standards
- Unknowns
  - TOC, ALK, pH, Temp, Turbidity, etc.

Future Conditions

- Procurement Graph
- Projected Domestic Water Demand
- Treatment Goals

Projected Domestic Water Demand

<table>
<thead>
<tr>
<th></th>
<th>2001</th>
<th>2006</th>
<th>2011</th>
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<tbody>
<tr>
<td>Population</td>
<td>250</td>
<td>319</td>
<td>407</td>
</tr>
<tr>
<td>Domestic Water per Villager (GPD)</td>
<td>14.5</td>
<td>14.5</td>
<td>14.5</td>
</tr>
<tr>
<td>Total Domestic (GPD)</td>
<td>4005</td>
<td>5066</td>
<td>6414</td>
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Treatment Goals

1: Reduce incidence of cholera and other causes of diarrhea and dehydration; reduce overall public health risk of current drinking water.
2: Provide a system that can be managed and owned successfully by the people of San Pablo.
3: Maintain taste, color, and texture of drinking water in its present form in San Pablo to the best of our ability.
4: Do not compromise the culture of San Pablo and the history of its people.
5: Minimize economic costs and impacts on the village.

Criteria and Constraints

- Sustainability
  - Economic
  - Environmental
  - Social
  - Disaster
- Performance
  - Pathogen Removal
  - Design Life
  - Operation
  - Pesticide Removal
- Weighted Score
- Design Matrix
Range of Options
- Settling – Sedimentation Basis
- Filtration
  - Standard and Deep-bed
  - Pulse-bed
  - Multi-media
  - Declining rate
  - Bank filtration
  - Membrane processes
- Disinfection
  - Ozone
  - UV Disinfection
  - UV Pasteurization
  - Iodine
  - At-Home Chlorine Disinfection

Assessment
- Centralized Chlorine Disinfection
  - Centralized
  - Home
- Slow Sand Filtration
  - Centralized
  - Home
- Ceramic Filtration lined with Bacteriostatic
  - Filtrón

Centralized Chlorine Disinfection
- Pros
  - Superior Pathogen Removal
  - Inexpensive
  - Relatively Simple
  - Residual
  - Easy to Monitor
- Cons
  - Rejection - Change in Taste
  - Handling/Education concerns
  - Susceptible to Downtime and Damage
  - DBP’s

Slow Sand Filtration
- Centralized
  - Local Materials
  - Quality of treated water
  - Ease of operation
  - Gravity Driven
  - No change in taste or odor
  - Cons
    - Unfamiliar Responsibility
    - Initial Capital
  - Home
    - Pros
      - Gravity driven
      - Ownership
      - No change in taste or odor
    - Cons
      - Cannot meet daily demand
      - Dependant on individual usage
      - Non-local materials

Filtrón
- Pros
  - Simple
  - Socially Acceptable
  - Low Cost
  - Micro-enterprise
  - Many backups
  - No electricity dependence
  - Performance
- Cons
  - Clay
  - Market?
  - CS solution

Design Matrix by Train

<table>
<thead>
<tr>
<th>Train</th>
<th>No. Interv.</th>
<th>SSF Central</th>
<th>SSF Home</th>
<th>Chlorine (Central)</th>
<th>Filtrón</th>
<th>SSF Central &amp; Chlorine</th>
<th>SSF Home &amp; Filtrón</th>
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<tbody>
<tr>
<td>Scores</td>
<td>3.21</td>
<td>7.51</td>
<td>7.45</td>
<td>5.87</td>
<td>7.66</td>
<td>5.72</td>
<td>7.78</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6.23</td>
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Recommendation

- Centralized SSF in combination with Home Filtrón
  - Together can meet demand
  - No residual
  - Backup
  - Increase performance
  - Increase design life for Filtrón
  - Less Cleaning time for Filtrón

Preliminary Design: SSF

- Scope
  - Sizing
  - Materials & Quantities
  - Cost Estimates
- Proposed Schematics
- Basis for Design: Design Manuals

Scope

- Sizing

<table>
<thead>
<tr>
<th>Item</th>
<th>meters</th>
<th>feet</th>
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<tr>
<td>Freeboard</td>
<td>0.25</td>
<td>0.82</td>
</tr>
<tr>
<td>Head water</td>
<td>1.00</td>
<td>3.28</td>
</tr>
<tr>
<td>Filter media (sand)</td>
<td>1.1</td>
<td>3.61</td>
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<tr>
<td>Support gravel</td>
<td>0.4</td>
<td>1.31</td>
</tr>
<tr>
<td>Minimum depth (sand)</td>
<td>0.5</td>
<td>1.64</td>
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Schematic 1

Cost, Materials, and Quantities

- Concrete – 52 cu. yd - $162/cu. yd
- PVC Plumbing - $600
- Total Cost = $11,000
Recommended Implementation

Strategy: SSF

Filtrón Cost

- Immediate relief
  - $1000

- Workshop Establishment
  - $15,000 - $20,000 (all inclusive)

Acknowledgements

- Dr. Angela Bielefeldt
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- Water For People
- UROP
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- PFP
- Daniele Lantagne, MIT Lecturer and Alethia Environmental
- Richard Kraiser – photos

¿Preguntas?