Decentralized Wastewater Treatment in Southern Israel

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Water Scarcity in Israel

Population growth

Consumption habits

Economy

Desalination

Reuse wastewater

New irrigation

Water management

Potential Impact

Water Reuse In Southern Israel

+

Limited Access to Sewage Treatment Plants

→

Household Constructed Wetland

Constructed Wetlands

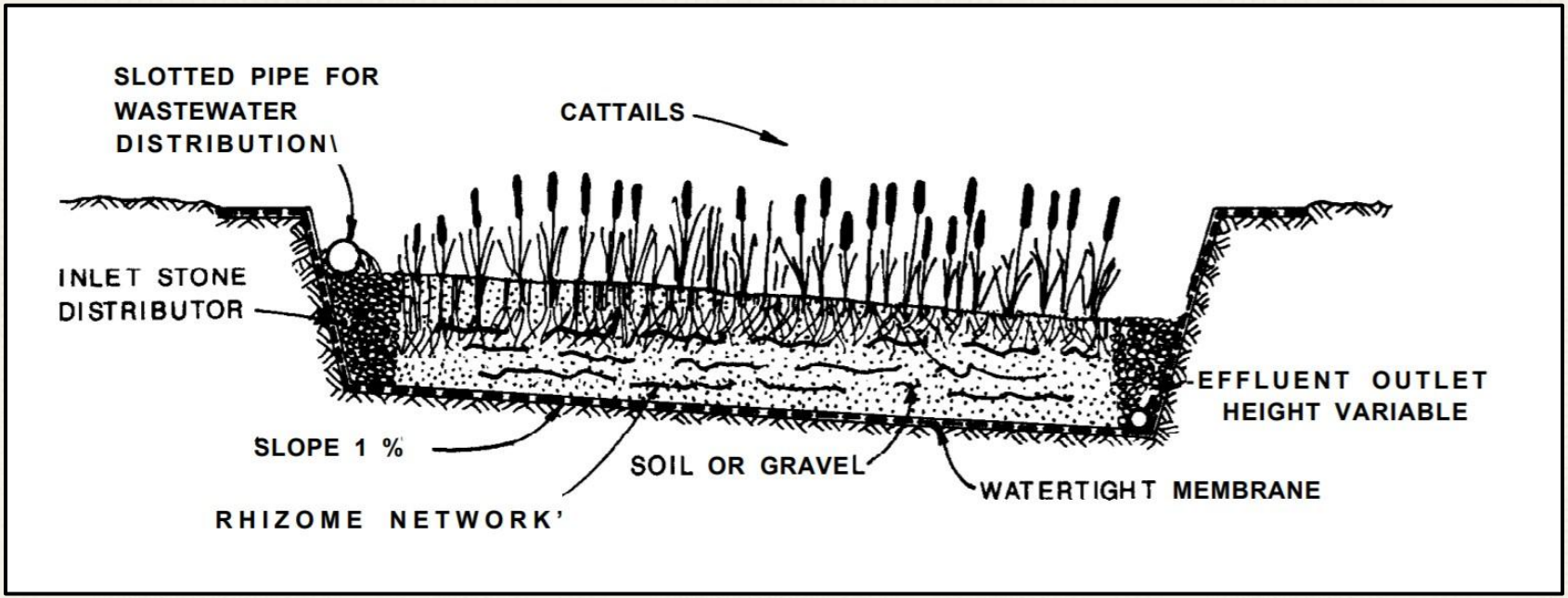
Past Research

- Southern Arava Waste Management plan
- Industrial use
- Reuse for agriculture

Opportunity

- Reduce demand
- Personal water conservation
- Independence from sewage systems

Constructed Wetland (CW)

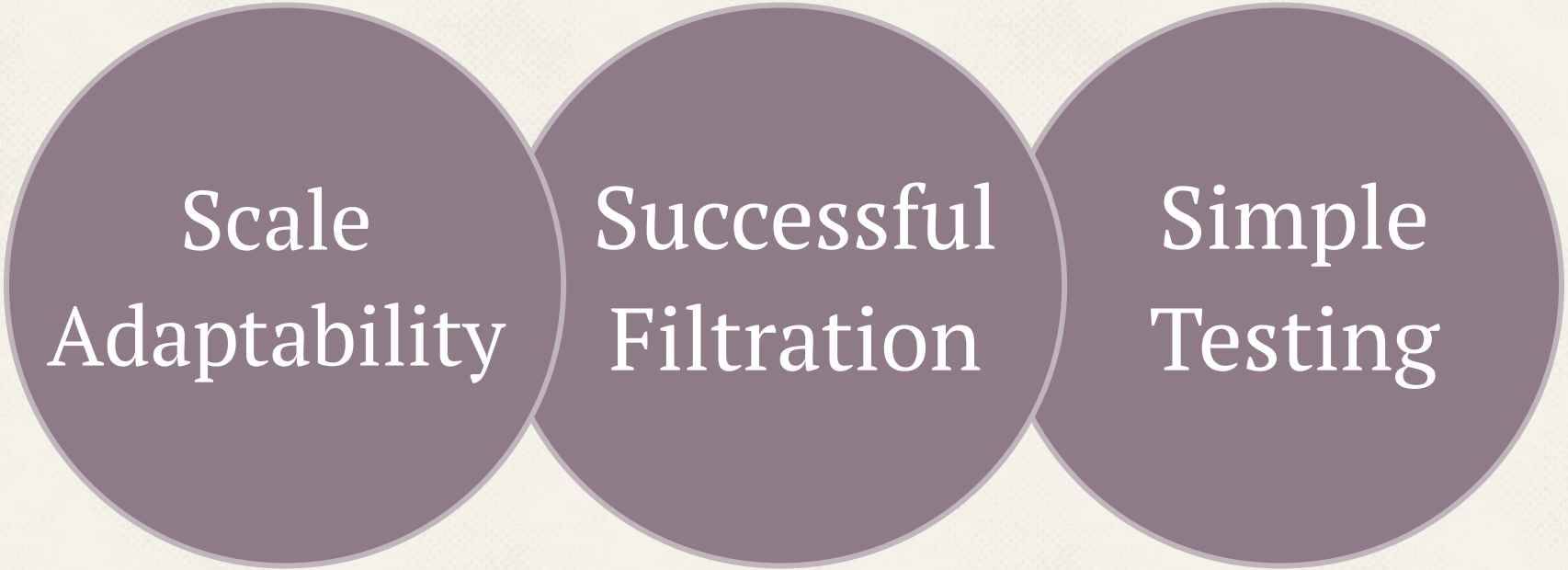


Subsurface Flow Wetland

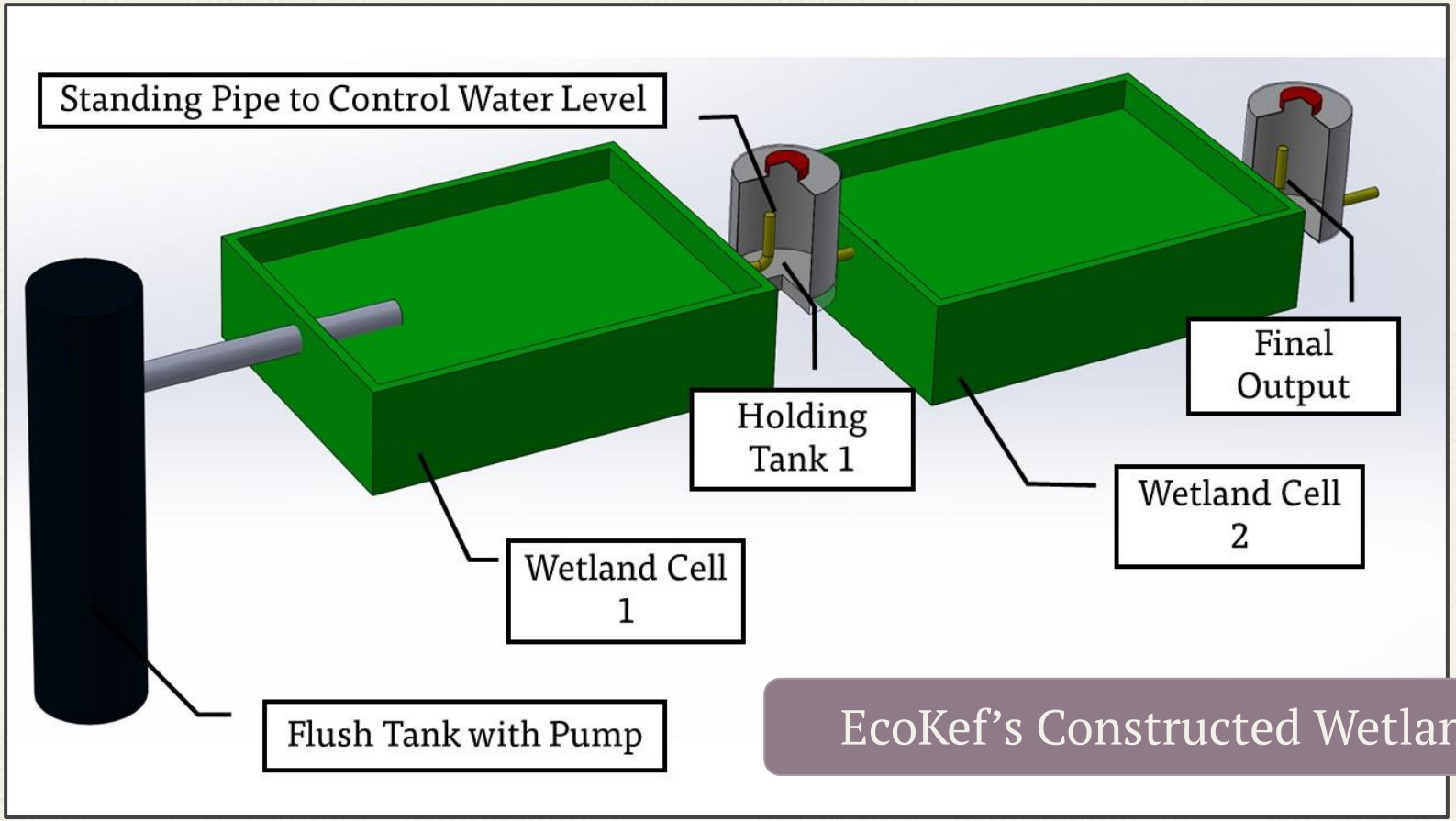
Project Goal

Evaluate a small scale constructed wetland as a reliable option for decentralized household wastewater treatment in Southern Israel.

Requirements for Success



Household Scale

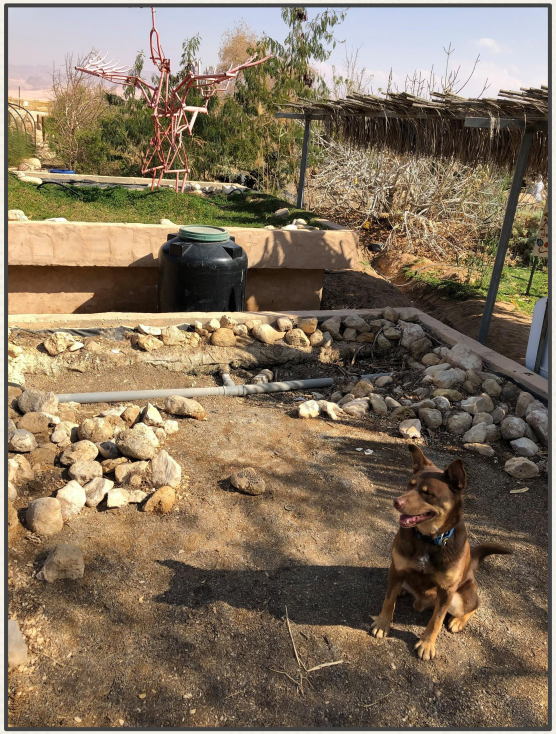


EcoKef's Constructed Wetland

Successful Filtration

Nine-day Test

- Mimic wastewater input for a 2 person household
- 400 L



Expectation

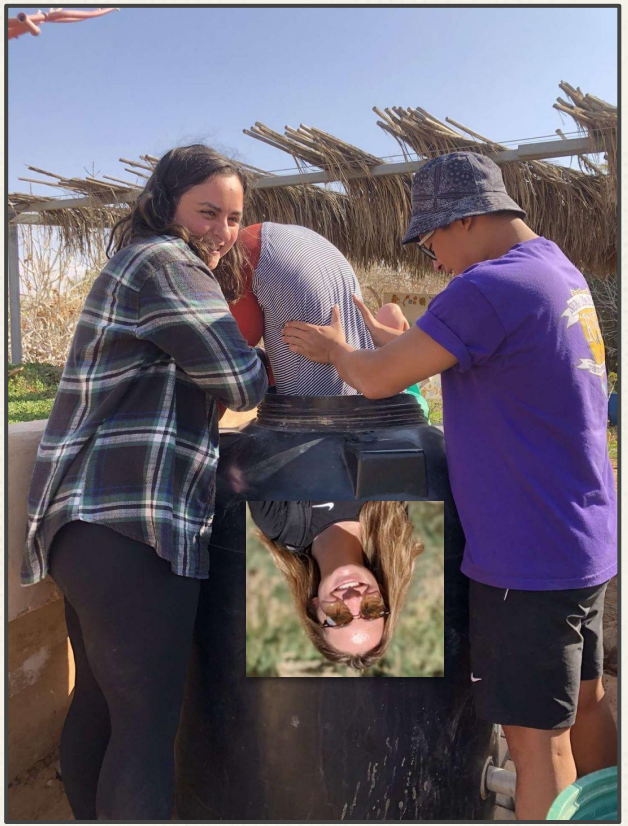
- Proper water flow
- Clear changes in qualitative factors

Limitations of Study

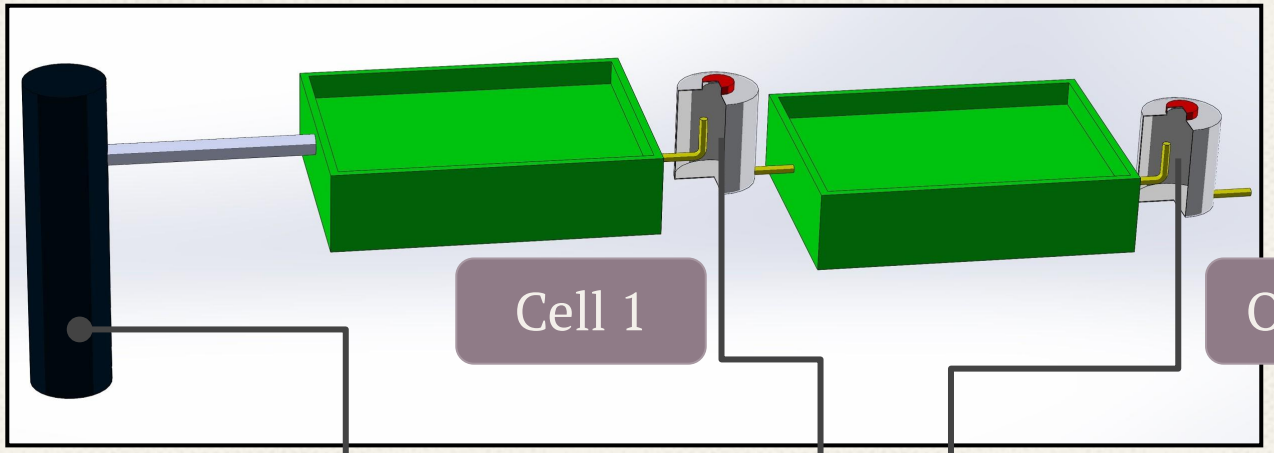
01	Temporary Closure of The Teahouse	Minimal water was put in the system prior to the experiment
02	Spike in Usage	Changed the effectiveness of the system
03	Limited Testing	Timeframe and access limited quantitative testing

Wetland Assessment

Qualitative Testing Plan



Wetland Sampling



Sample from Flush Tank

Water Clarity & Color

Day One

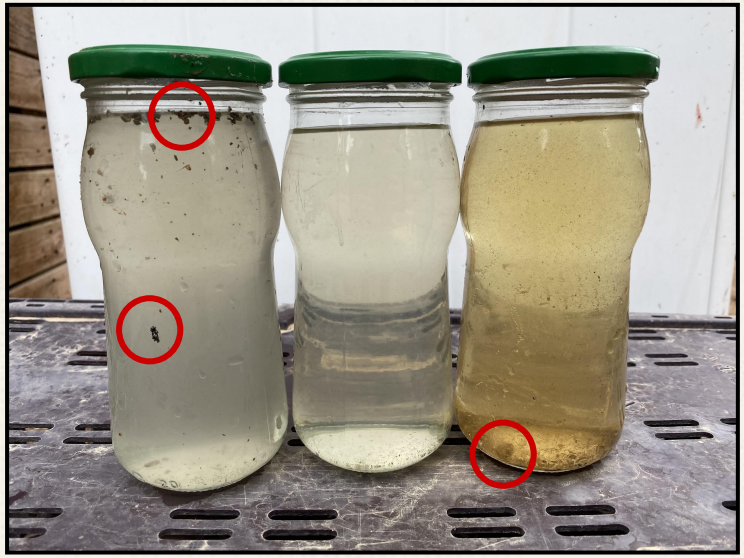
Day Four

Day Nine

Increase in clarity indicates the reduction of organic material.

Yellow color is associated with organic matter decomposition

Suspended Solids



Day Two

Day Eight

Suspended solids were not a reliable qualitative indicator of the constructed wetlands function.

Smell

Signature “Rotten Egg” Smell

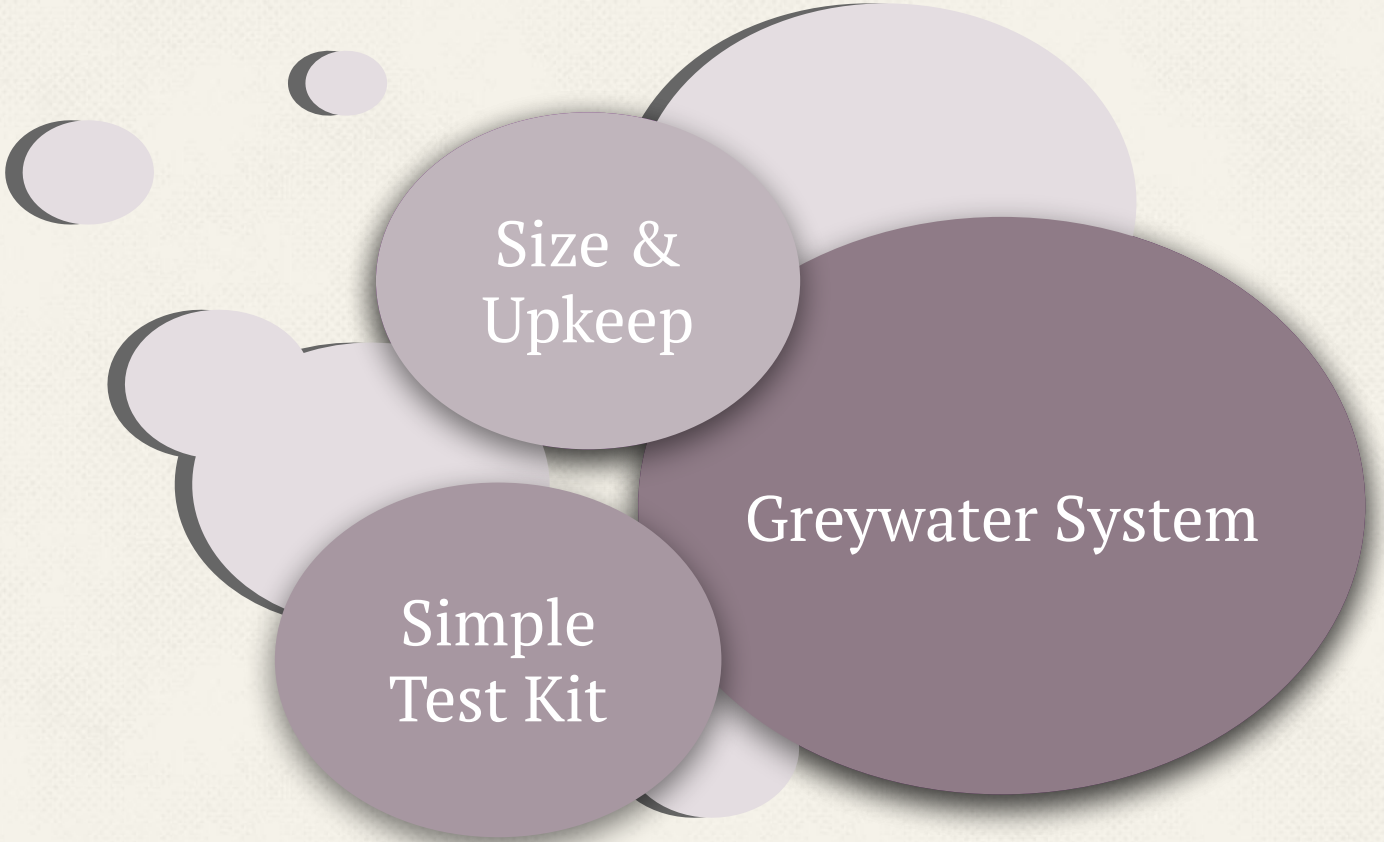
- Sulfur Bacteria
- Hydrogen Sulfide Gas
- Flush Tank (intense)
- Between Filtration Cells (average)
- Final Water (minimal)

Water Level

Cell 1

Cell 2

Household Use



Next Steps

Long Term Study on CW Degradation

Necessary to be considered as sustainable solution

Further Research in Southern Arava

Provide literature for future users

Continue Experiment in Lotan for Reliable Results

Further evaluate the CW with maintenance and testing

Final Thoughts

Constructed wetlands have promise in the Southern Arava Region

Communal wetlands allow groups to reap the benefits and share the constraints

More work to be done to make constructed wetlands accessible at the household level

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Kibbutz Lotan

Where spirit and earth meet

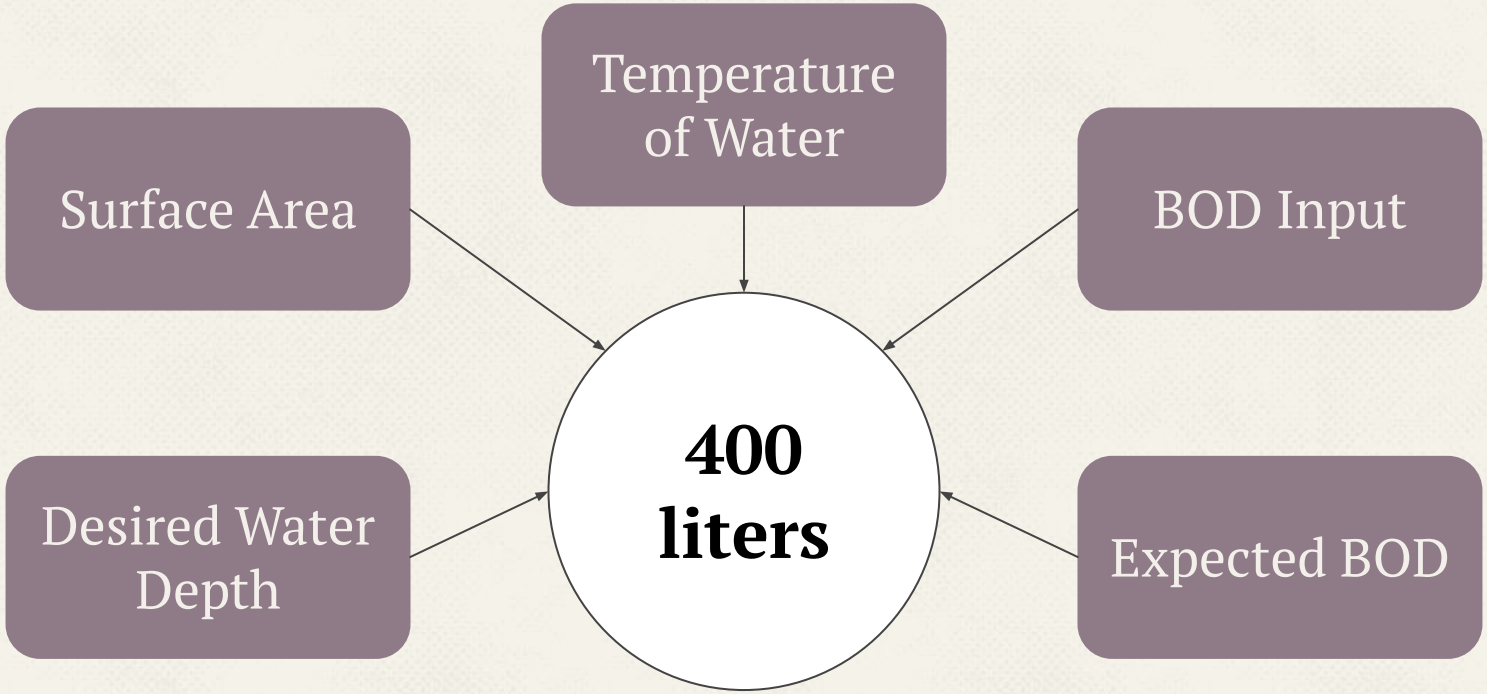
קיבוץ לוטן

מקום בו רוח ואדמה נפגשים

WPI

Additional Information

Water Level


Temperature of Water
Surface Area
BOD Input
400 liters
Desired Water Depth
Expected BOD

Water Level

$$A(s) = [\ Q(\ \ln C_{in} - \ln C_{out}\ )\ ] / (Kt * Depth * Porosity)$$

$$Kt = K20 * (1.1)^{T - 20} = 0.86 * (1.1)^{T - 20}$$

Wastewater Estimation

Type of Wastewater	Number of Times per Day	Total Amount per Day (L)
Showering	1	50
Dish Washing	3	31.5
Clothes Washing	1/week	4
Hand Washing	10	30
Face Washing/Teeth Brushing	2	40
Making Food	3	45

Simple Testing Plan

- Biochemical Oxygen Demand
- Nitrogen
- Total Suspended Solids

Testing of these Quantitative Factors is typically done in Labs

During our time we only found a solution for nitrogen and potential design for BOD testing.

Adaptive Procedure

DO Testing Procedure

Titrate with sodium thiosulfate to a pale straw color. Titrate by slowly dropping titrant solution from a syringe into the bottle, continually stirring

Add 2 mL of the starch solution so a blue color forms.

Continue slowly titrating until the sample turns clear.

The concentration of dissolved oxygen in the sample is equivalent to the number of milliliters of titrant used. Each mL of sodium thiosulfate added equals 1 mg/L dissolved oxygen

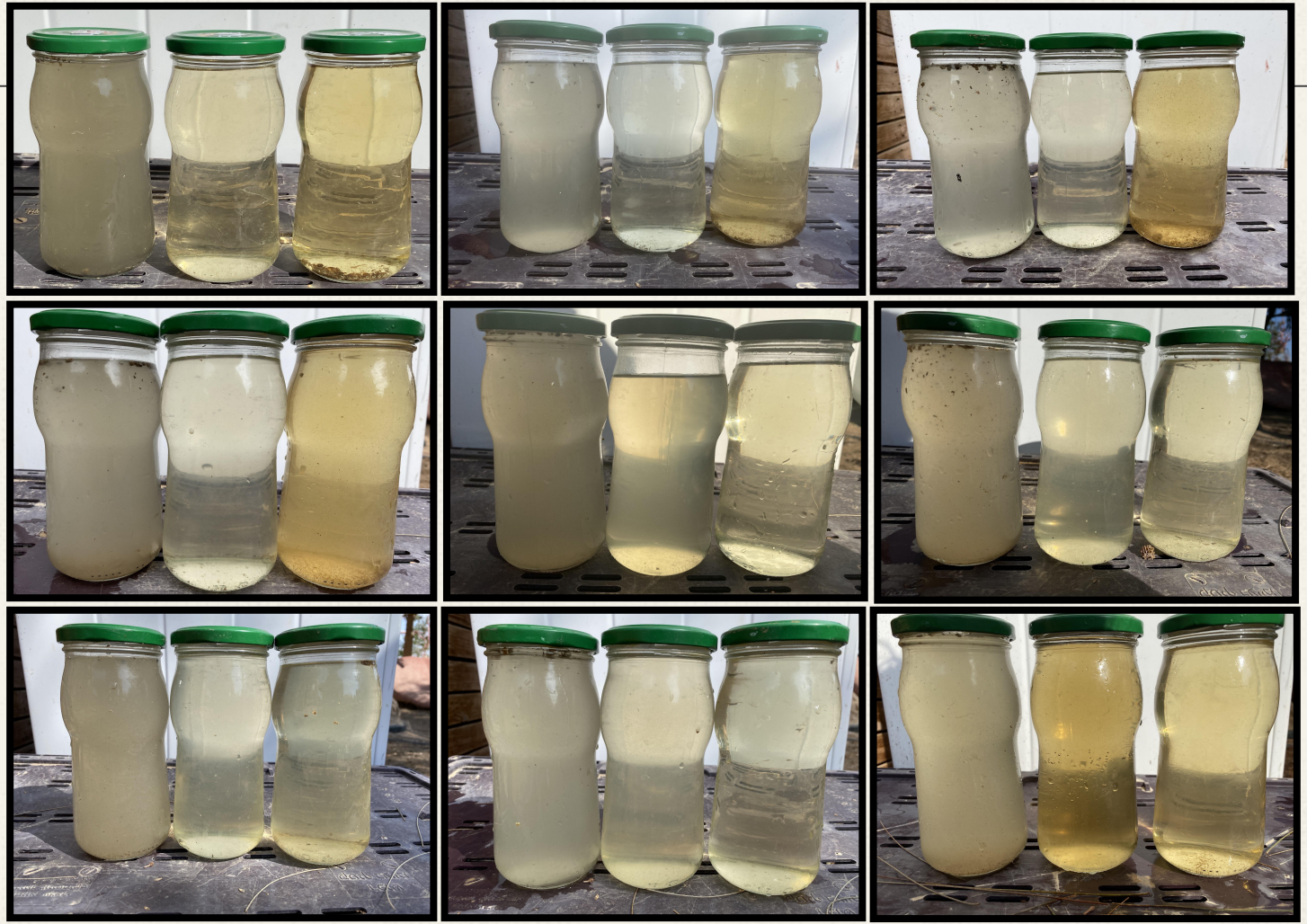
BOD Testing

Upon the original sampling date, take two samples.

BOD Sample should be in airtight jar

Store the duplicate samples at 20-degree Celsius for a 5 day incubation period, stirring often.

After the 5 days come back to repeat the DO test and use the following equation to calculate BOD. $DO_1 - DO_2 = BOD_5$ with mg/l as all of their units.



Land Requirement

- Household Requirement: one square foot per gallon of water used

- 300-600 square feet for the two cells

Typical Maintence

- 6 Month Inspection: remove weeds, replant, and clean out pipes
- Drain the system two to three times a year
- Minimum amount of water at all times.