

# Urban Farming

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## Introduction

- 80% of the United States population lives in urban areas
- 13.5% of urban households experience food insecurity
- Urban areas have a need for solutions to feed urban populations at low costs

## Objectives

Design and construct:

- a hybrid hydroponic system to grow plants while limiting water usage and losses
- energy generation systems to capture and use environmentally collected energy to power entire hydroponic system

## Water Collection/Storage

- Filters – remove debris from rainwater to ensure potability
- Turbine – rotates using free-falling water from collected rainwater

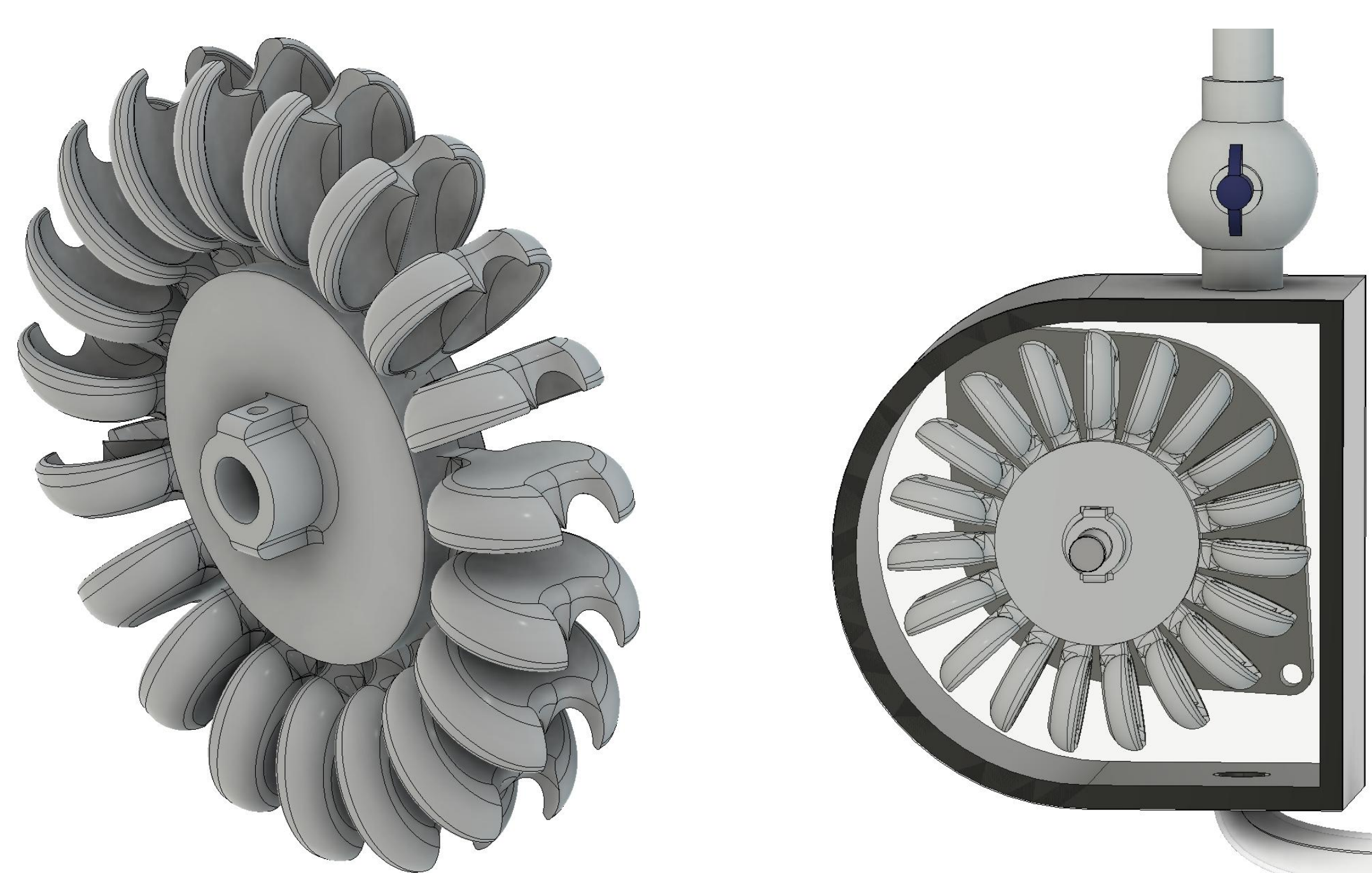


Fig 2. Turbine Model

- Storage Tank – stores potable water
- Nutrient Addition Tank – stores nutrient-filled water to cycle through hydroponic system
- Flexible Tubing – connects system components for water flow

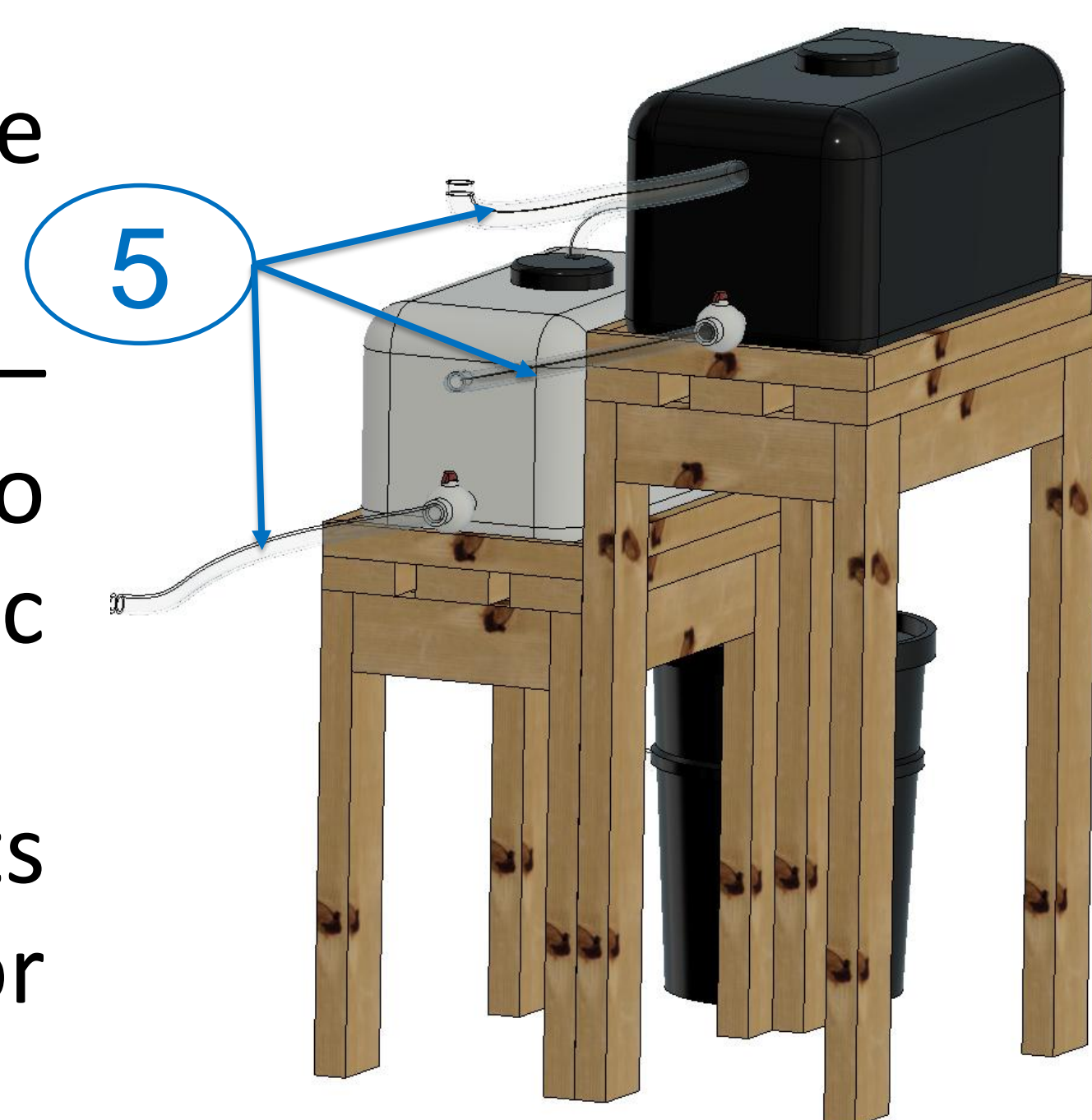


Fig 3. Storage Tank Assembly

## Energy Collection

- Fully self-sustaining
  - 1152 Wh/day power requirement
- Solar Panels – average 454.5 Wh/day each (1818 Wh/day total)
  - Alternator – converts rotational energy from turbine to electrical energy; provides an average of 54 Wh/day (proportional to building volume)

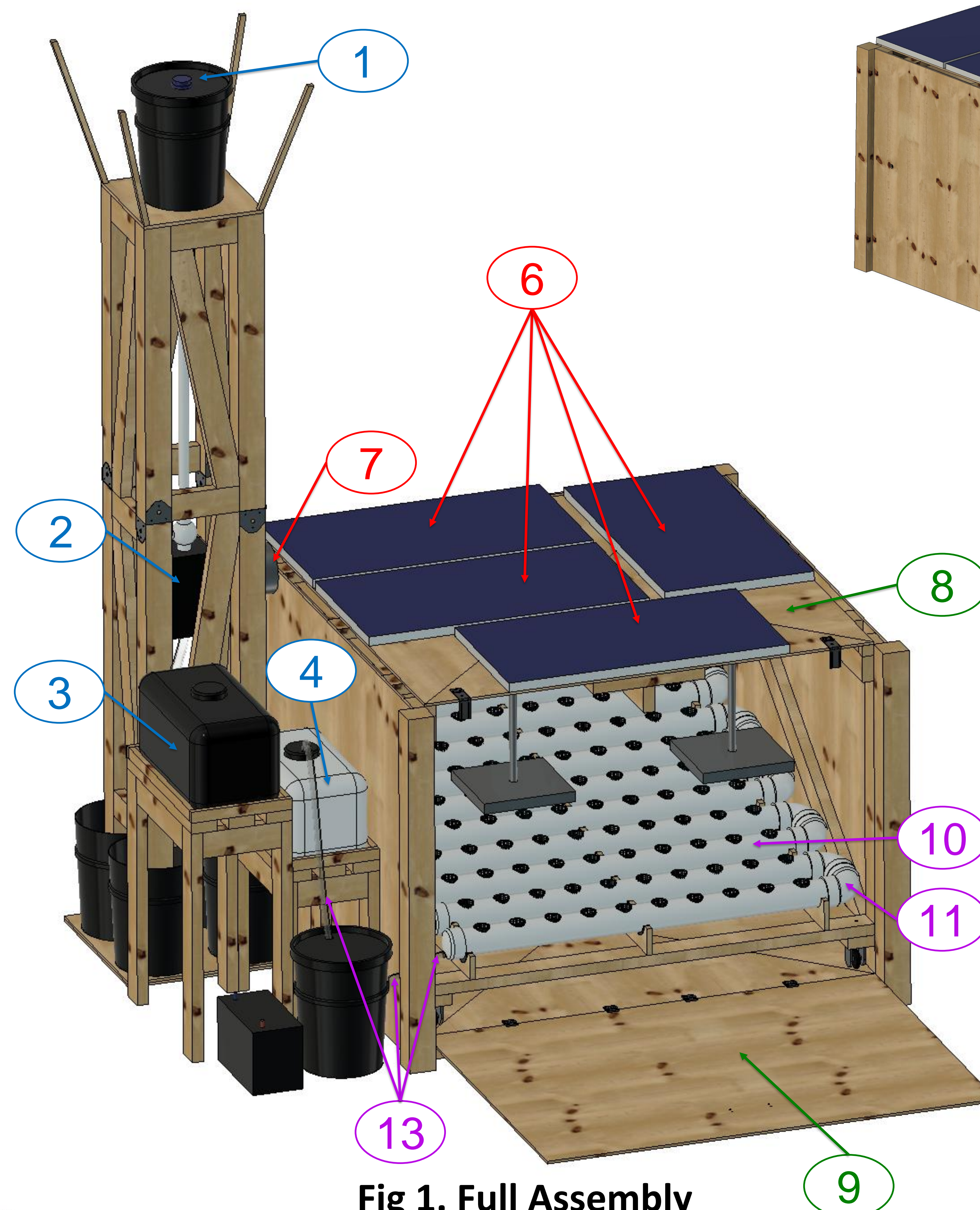


Fig 1. Full Assembly

## Future Work

- Increase solar panel power output by adding solar tracking sensors
- Complete further testing of system with different plant species
- Complete integration and testing of large-scale urban farming in existing urban areas

## Isolation Box

- Warehouse-simulating building containing lights and hydroponic system
- Proof-of-concept to simulate indoor farming
- Roof – holds solar panels
- Door – allows access to hydroponic system and is a table onto which hydroponic system can roll



Fig 4. Isolation Box

## Hydroponics

- Hybrid, gravity-fed system utilizing ebb and flow and nutrient film technique (NFT) to transport nutrient/water solution to plants
- 3-inch PVC Pipes – hold net cups and plants, direct nutrient solution flow
  - Elbows – angled at 10° slope
  - Flow Baffles – maintain constant pipe flow
  - Flexible Tubing – Pump water to nutrient tank for recirculation

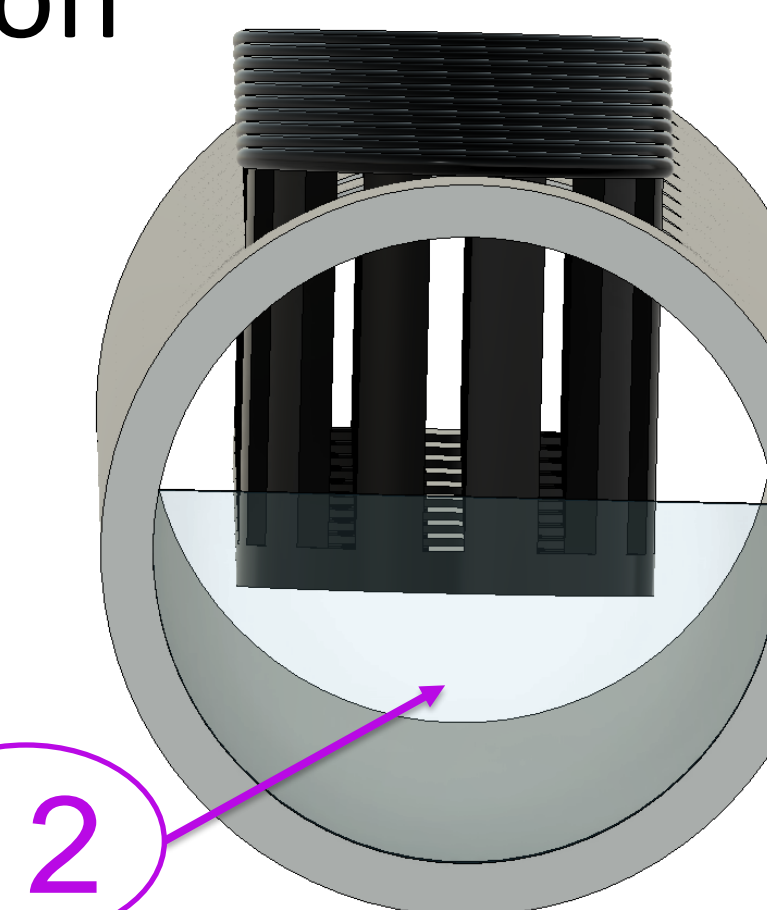


Fig 5. Pipe Cross-Section

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