

H2Only

The Sediment Solution

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Client

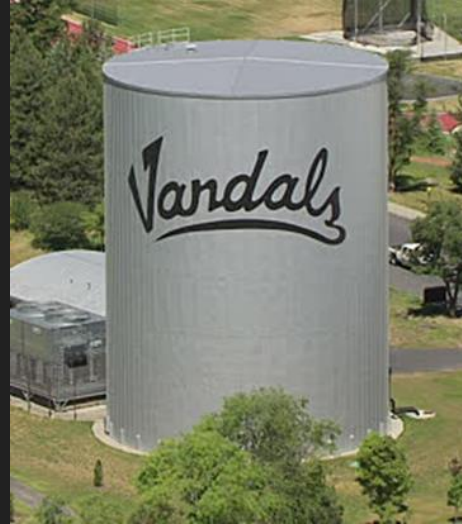
Scott Smith

Sponsor

University of
Idaho Facilities

Problem Statement

The floor of the University of Idaho's chilled water tower accumulates sediment as the water lies stagnant. The current method of sediment removal is very expensive and stops operation of the tank.



Current Sediment Removal Process

Scuba diver inspection

2.5 million gallons drained

Sediment vacuumed out

Tank recharged
With Scuba - \$231,382

In house - \$208,382



Full Scale Specifications

Remove 95% of sediment each time system operates

Continue tank operation while cleaning

External sediment separation and recycle of clean water

Low level of necessary maintenance

Fully automated operation

Prototype Specifications

Scalable to full scale dimensions

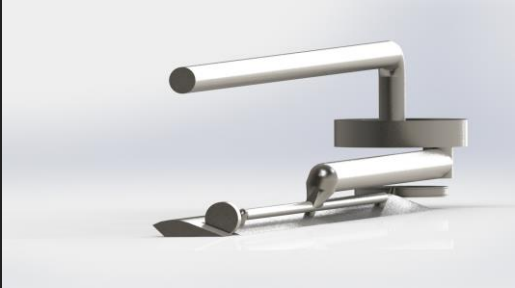
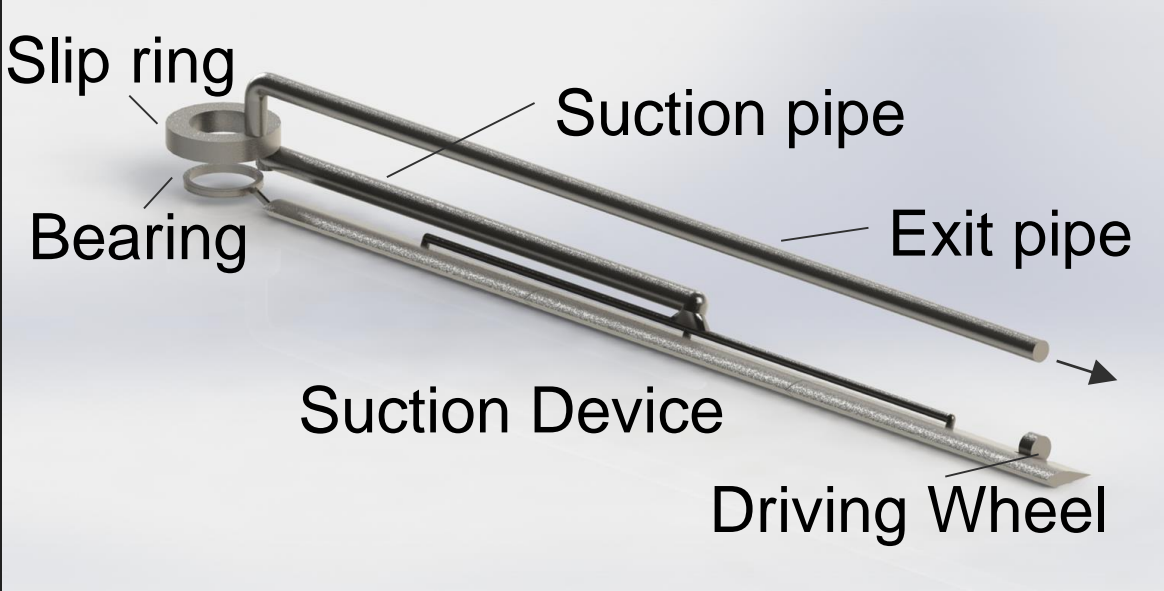
Avoid resuspension

Evenly distributed suction through slit

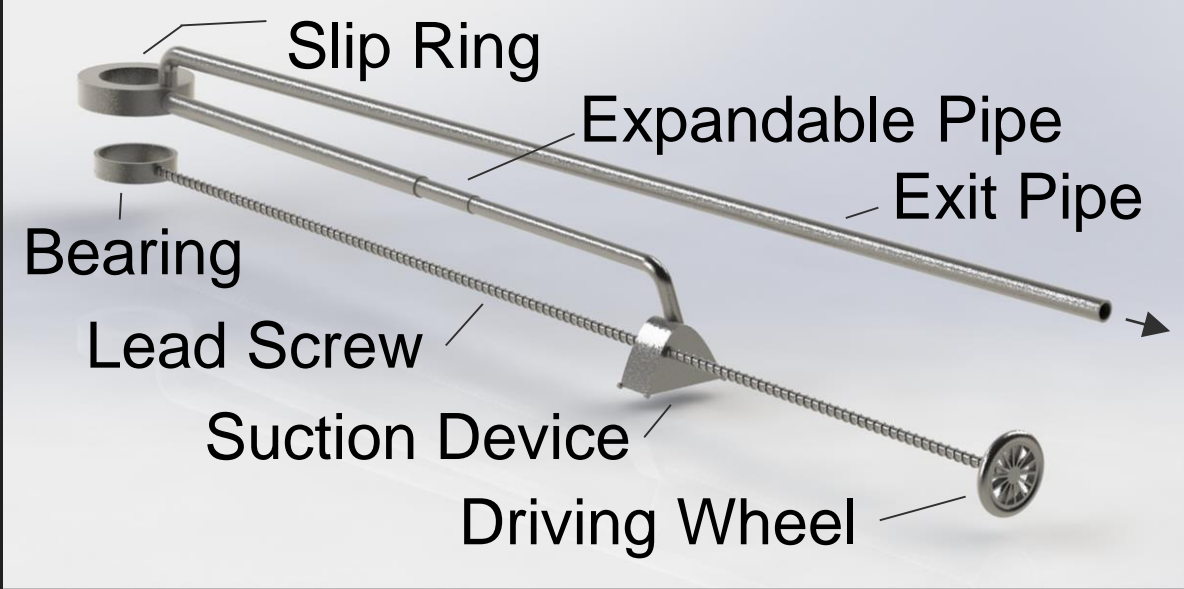
Demonstrate proof of concept



Sweeping Suction Design



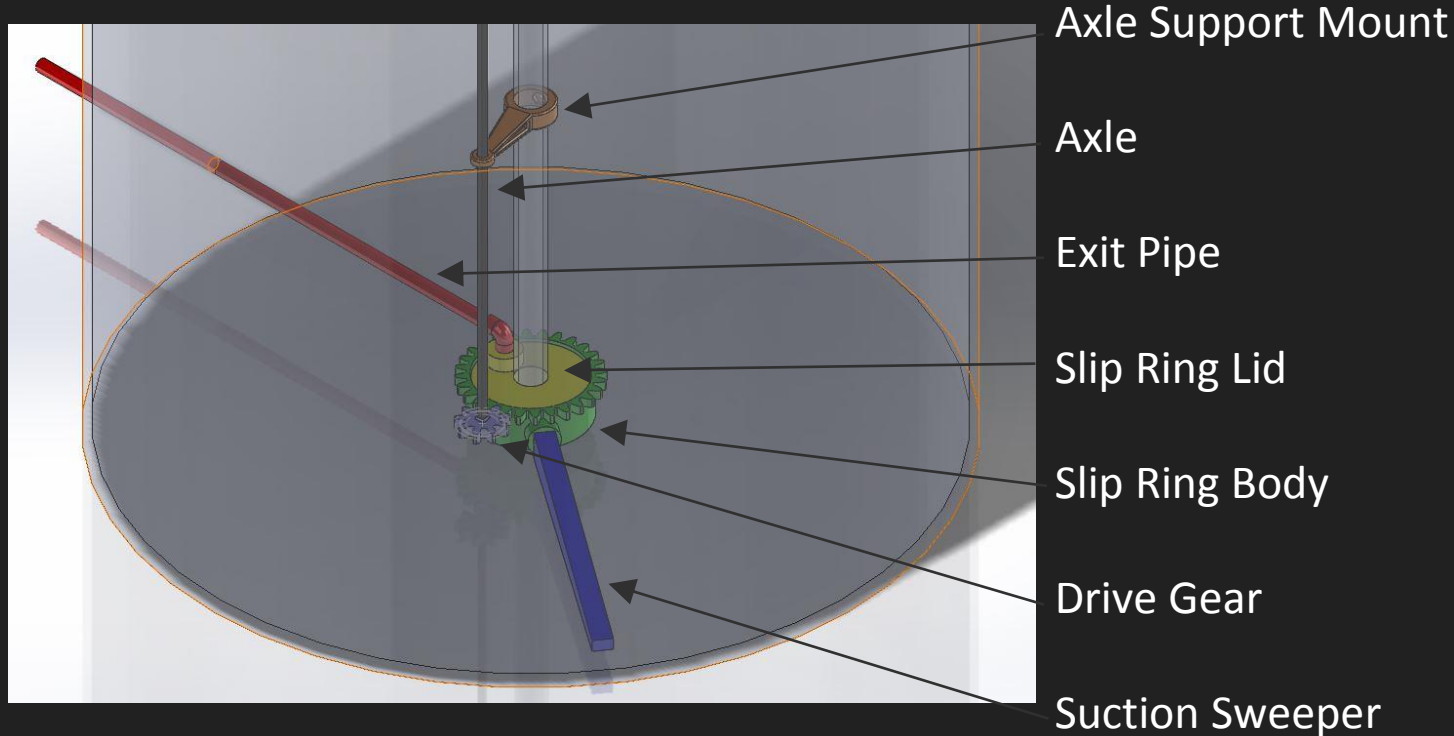
Lead Screw Design



Suction Slit

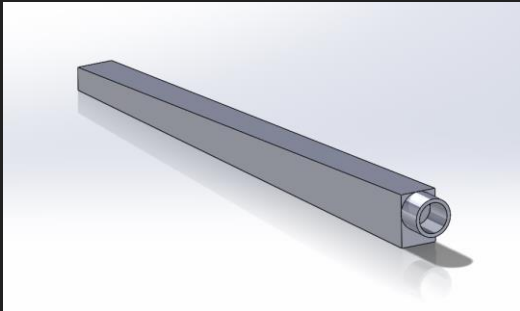


Final Design and 3D Printed Prototype

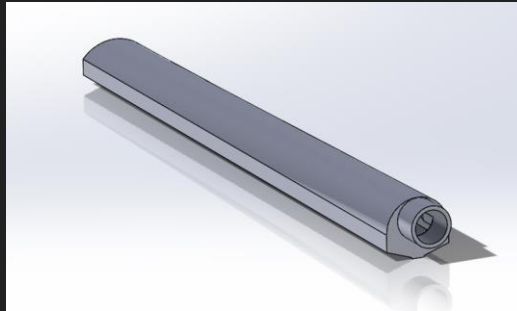


Sweeper Arm Profiles

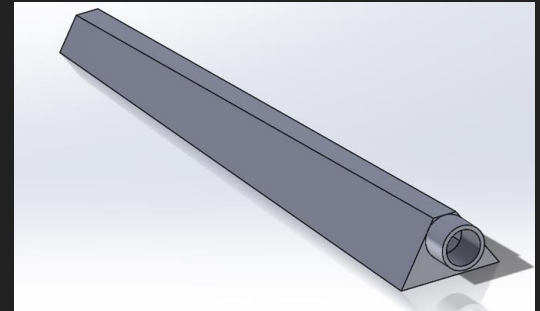
Design 1



Design 2



Design 3



Experiment Setup

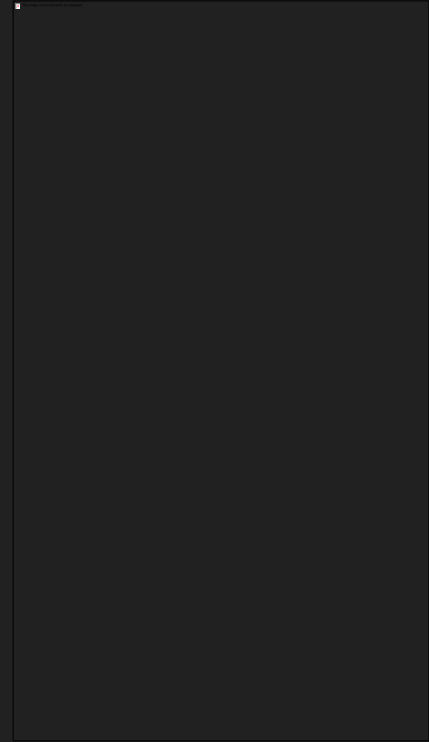
PVC pipe to block light, graduated cylinder holder inside

Lux meter reading of clear water

Lux meter reading before cleaning cycle

Lux meter reading after cleaning cycle

Varying rotational speed and sweeper profile



Results

Design 2 worked the best due to its tapered bottom

The best rotational speed was 0.42 rpm

Majority of sediment was removed by each design

Some clogging occurred from larger particles



Suggestions for Full Scale

Use power from the head to drive the wheel (ie flow against blades)

If using electric motor, install motor on tip of sweeper

Use tapered bottom on sweeper to avoid “shoveling” sediment

Utilize centrifugal hydrodynamics or evaporation to separate sediment

Linearly decrease cross sectional area of sweeper from pivot to tip

A conceptual image featuring a lightbulb with a question mark inside, set against a dark background with several other question marks scattered around. The lightbulb is the central focus, and the question marks are rendered in a light, textured style. The overall theme is inquiry and questioning.

Questions?