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Design

The Design Team facilitates communication between the research teams, the field engineers, and other AguaClara partners.

The design team is the publishing end of AguaClara.

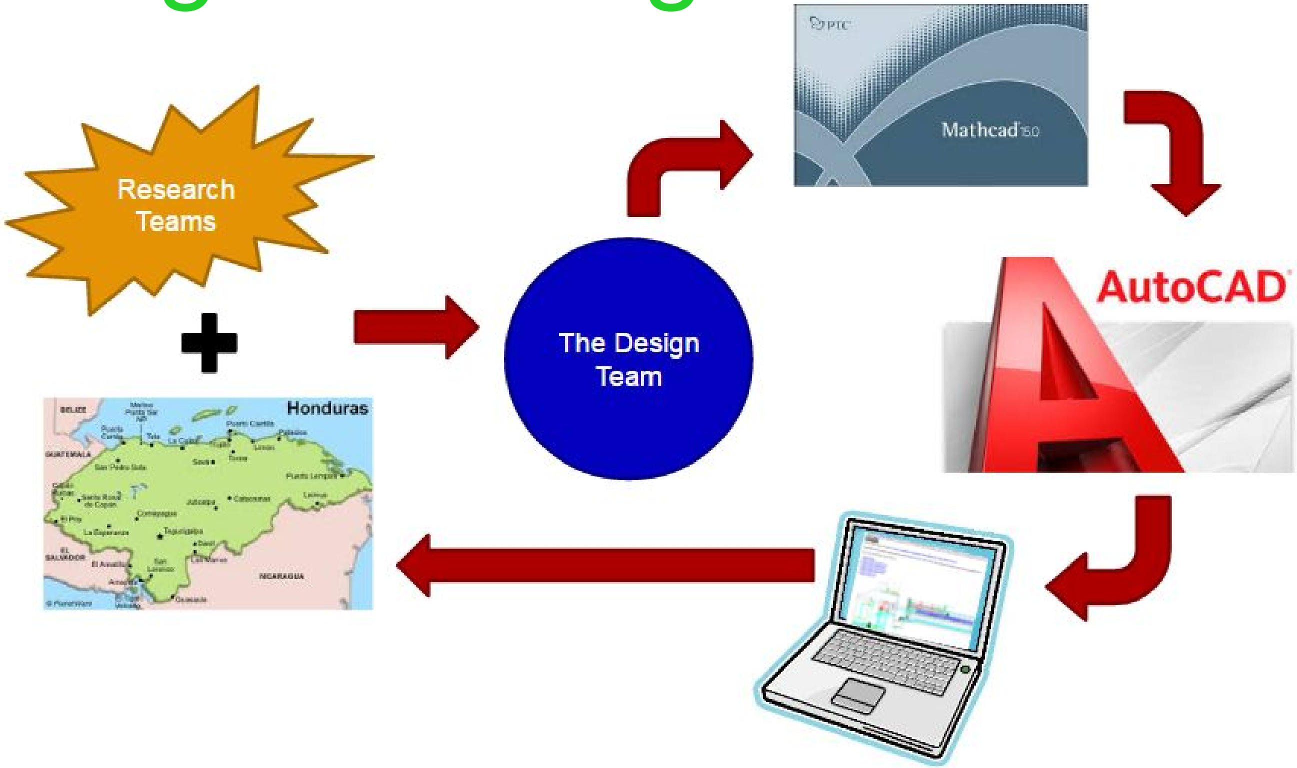

Figure 1: General design team process

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High Flow Plant

The drawing for a two train ‘high flow’ plant is under construction this semester.

The standard plant design works well for flows from 16 to 60 Lps.

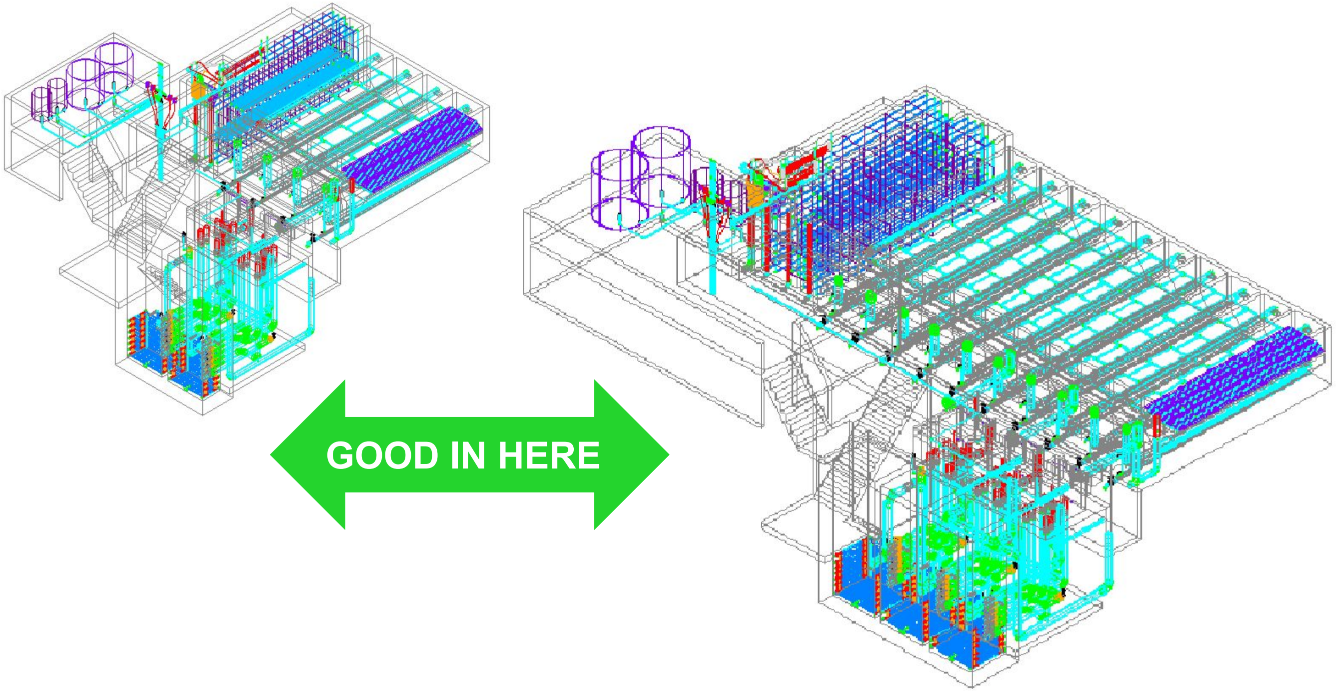

Figure 2: Standard Design Tool Output

Above 60 Lps, the sed tank inlet channel gets funky.

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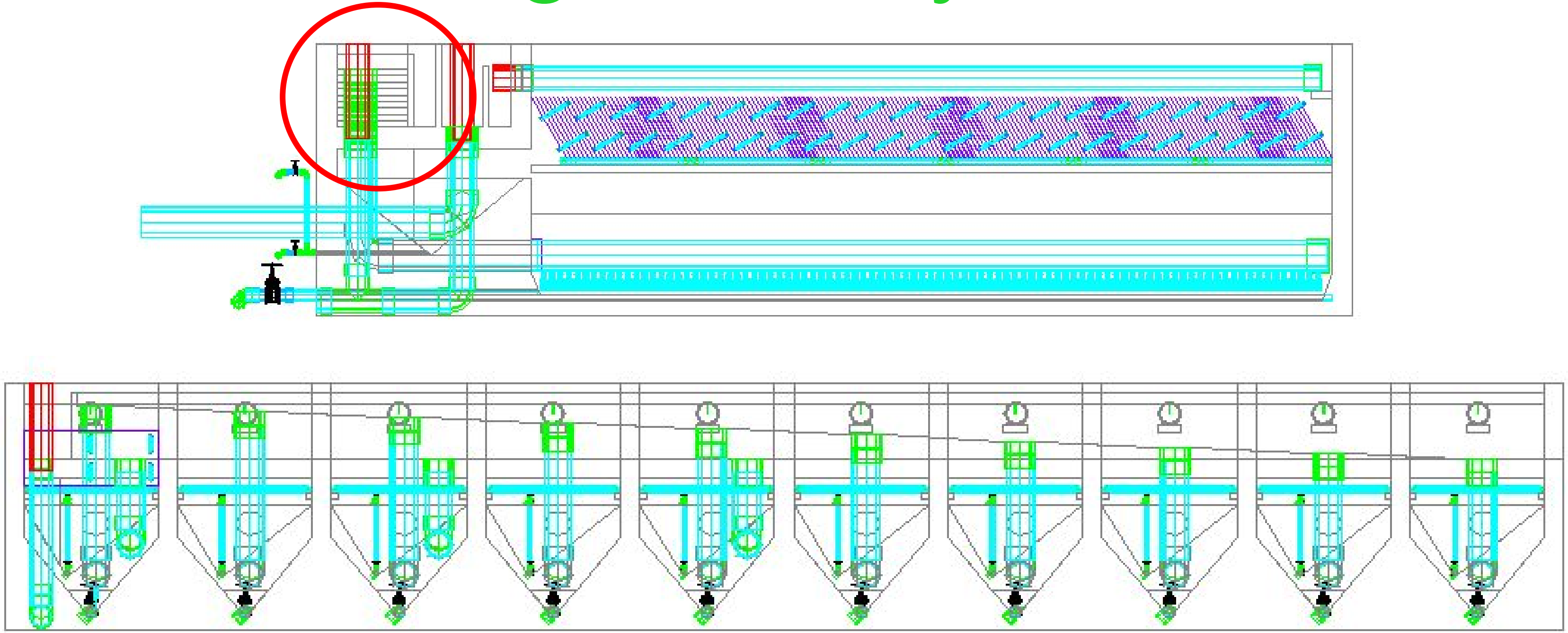

Figure 3: the 60 Lps sed tank inlet channel becomes too wide and too shallow to accommodate flow distribution to 10 sed tanks

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The 2-train design is similar to the standard design.

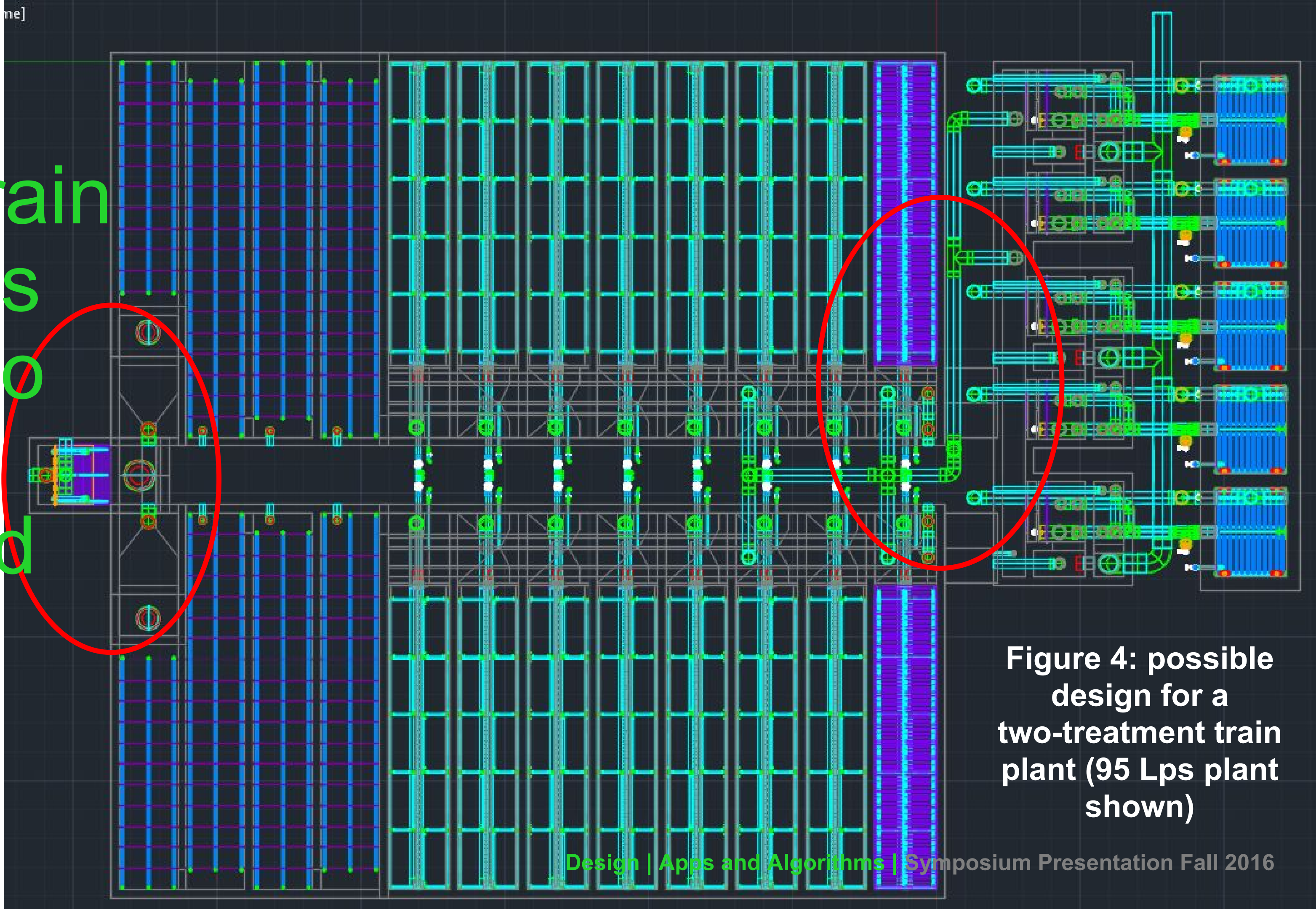
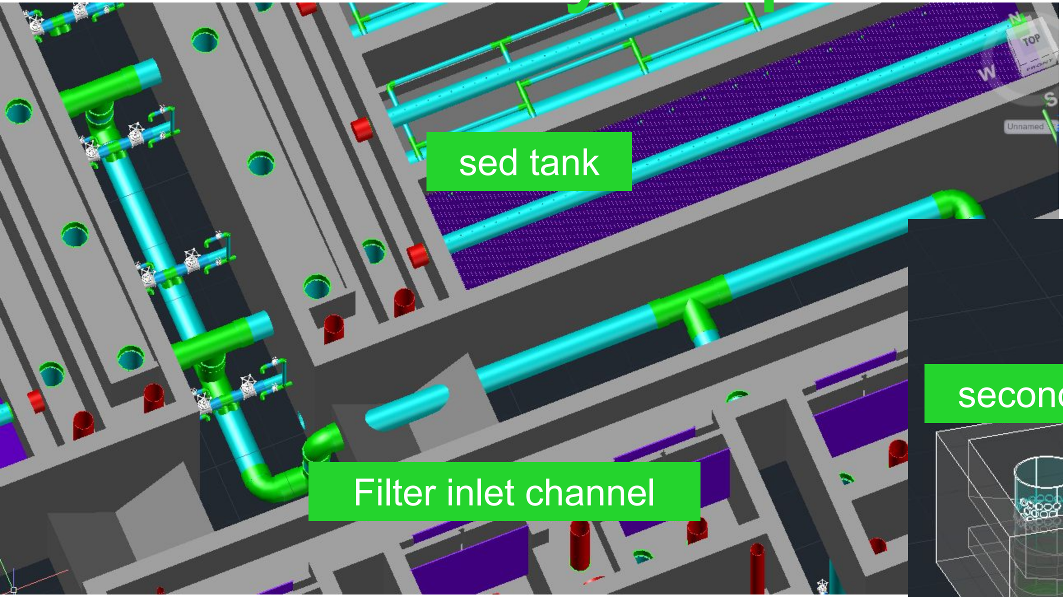


Figure 4: possible design for a two-treatment train plant (95 Lps plant shown)

The new designs have been reviewed by experts.



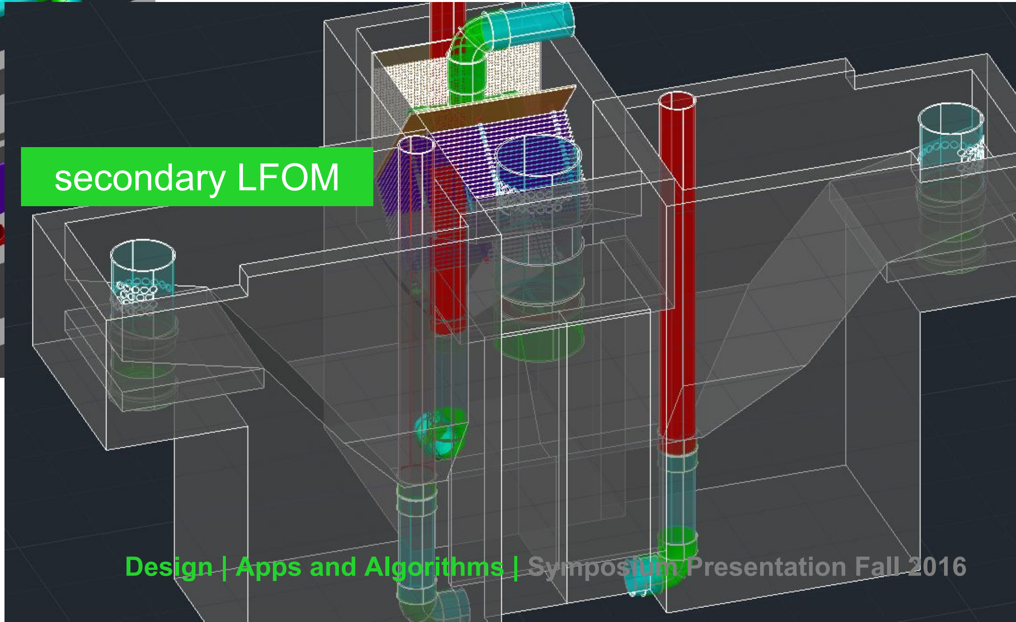


Figure 5: the entrance tank and sed-to-fi connection plumbing for a high flow plant.

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Low Flow Plant

The drawing for a low flow plant needs to be revised to accommodate new revelations about transition rates.

Current designs transition into low flow code when flow rates are less than 6Lps.

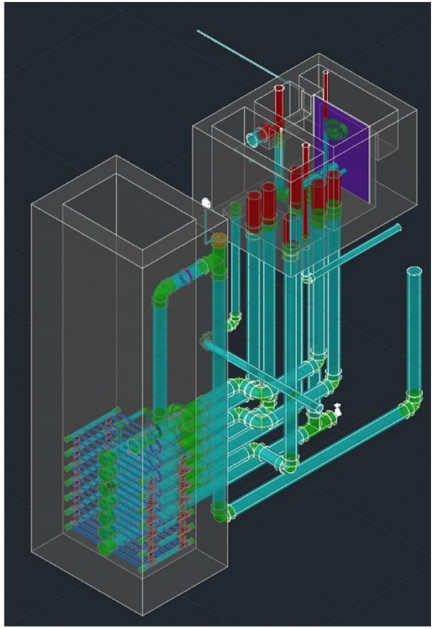

Figure 6: OStaRS filter

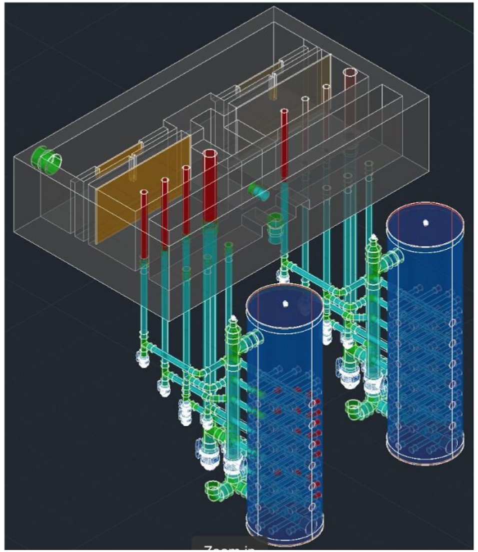

Figure 7: EStaRS filter

Last semester, Paroma found that the optimal transition rate should actually be 16Lps.

Description	Upper Constraint	Min Q L/s	Max Q L/s
Pre-fab plants	Number of pre-fab plants needed, beyond 4.9 L/s, use EStaRs design with sed tanks	1	4.9
2 EStaRS 1 sed tank with room for more sed tanks (include sed inlet and outlet channels when building)	A bigger sed tank (inlet manifold length of 3.5m) could be used at 7.5 L/s	5	<7.5
2 EStaRS or more 2 sed tanks	The masonry needed for the filter box for OStaRs gets too difficult (too small for a normal sized person to maneuver) below 16 L/s.	7.5	16
2 or more OStaRS	Due to a 24in LFOM (biggest pipe size in database)	16<	150
Multiple treatment trains (multiple chemical dosing, entrance tanks, flocculators)		150	1000

Figure 8: Results of Paroma's research from Spring 2016

In updating this design, the team must consider the optimal number of sedimentation tanks how their connections to the EStaRS filters are affected as this number changes.

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Future low flow code will likely integrate the 1Lps plant design at flow rates that are incredibly small (probably somewhere around *5Lps or less).

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LFOM

The 3D model for the LFOM needs to be updated to reflect the 2D layout.

Last semester an LFOM Template was made and added to the ADT.

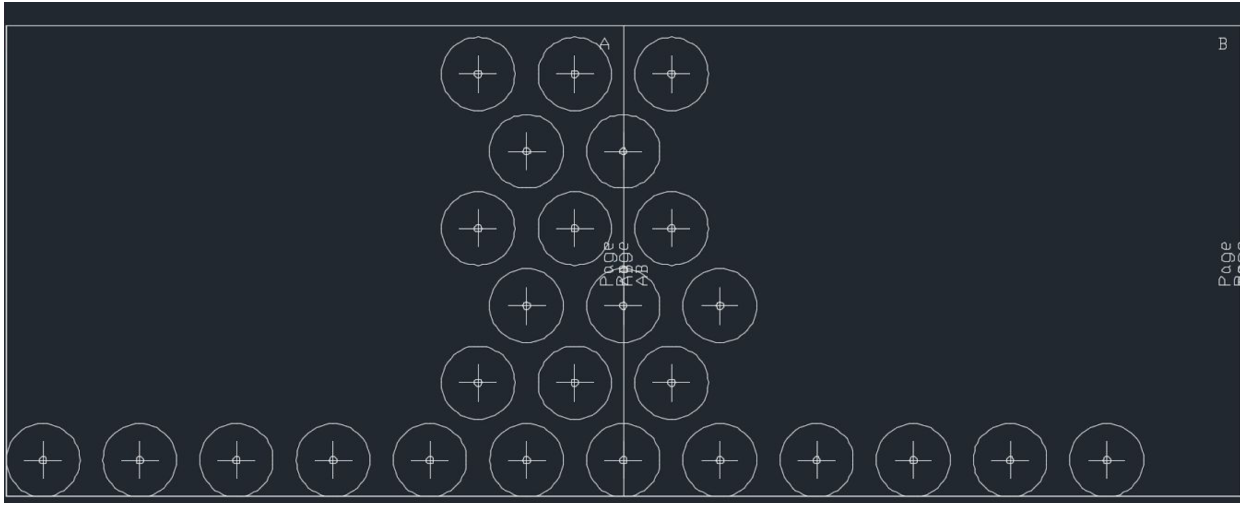
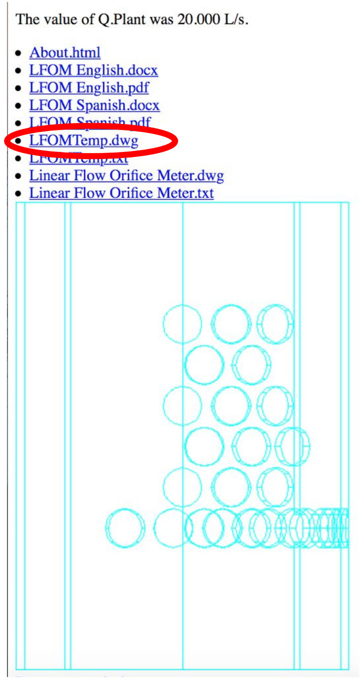


Figure 10: LFOM template produced by ADT



We first had to adjust the spacing between orifices.

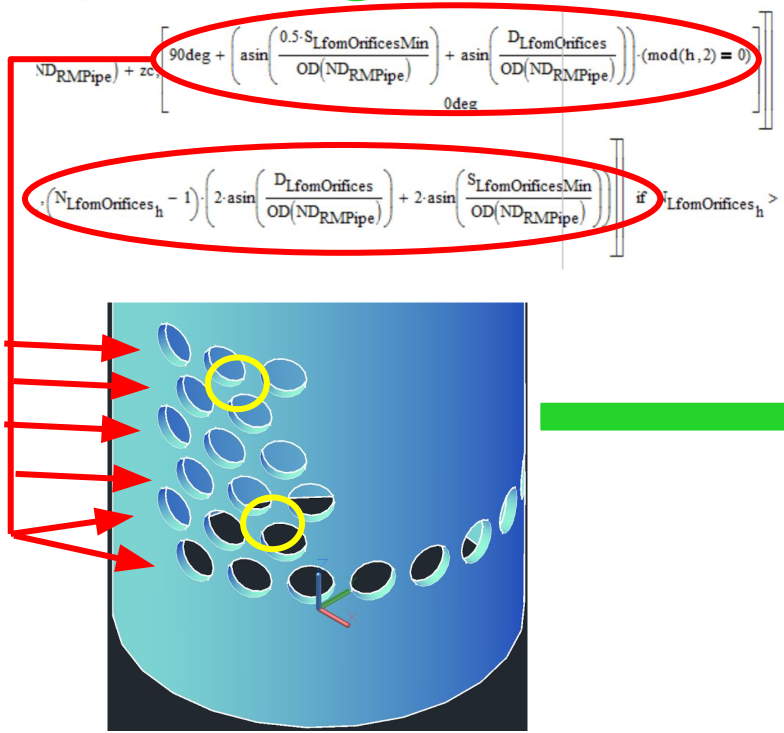


Figure 12: Different sized spaces on the LFOM

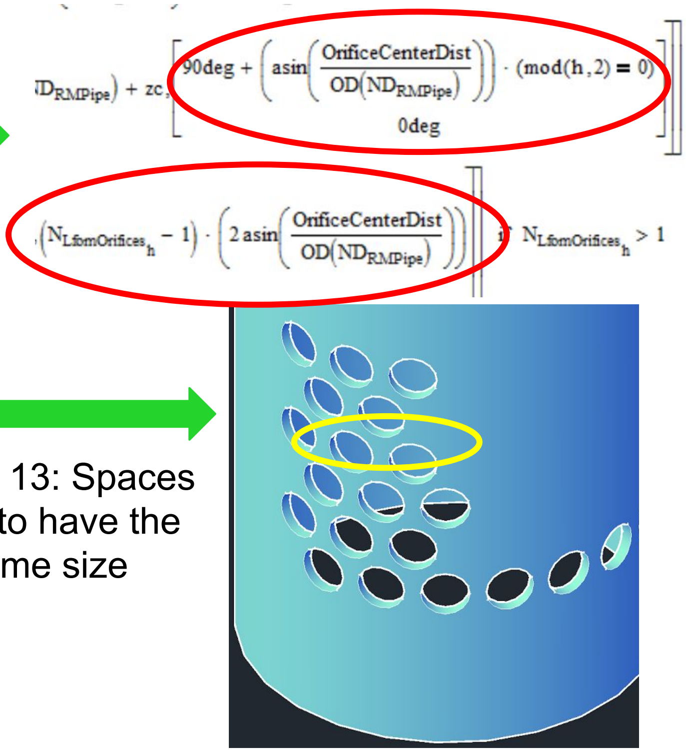
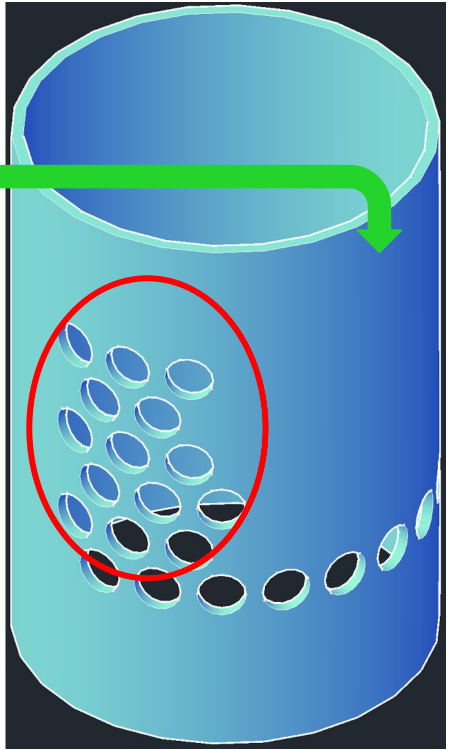


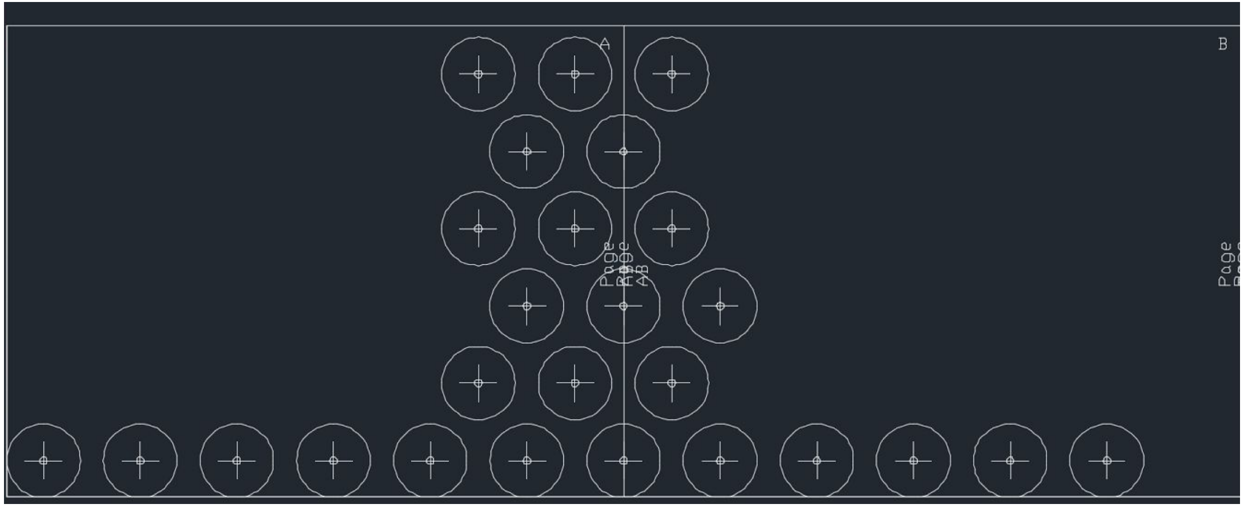
Figure 13: Spaces fixed to have the same size

The cluster of orifices needs to be rotated to match reality and the template.

Figure 14: Desired location of orifices



We need it around here



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Fusion 360

The Design Team has been approached by AutoDesk to implement Fusion 360 as an alternative CAD program

Fusion 360 is currently being used as a learning tool.

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Pages

Blog

SPACE SHORTCUTS

- Home
- Research
- Research Archive
- Team Resources
- Site Map
- Creative Commons License

PAGE TREE

- Research
- AguaClara White Paper - Technical M
- How-to articles
- Project Sites
- Public Relations
- 20 L/s Plant Model
- Archive
- Research Archive
- CDC Calendar
- Trash Pages
- Design Fall 2015
- Safety

Links for Team Members

- Assignments
- Calendar
- Challenges
- Safety
- Slack
- Syllabi
- Team Roster
- Research
- Expert Resources
- Student Leadership
- How-To's and Troubleshooting
- Design Team
- Publications
- Job Opportunities
- Summer Program 2016

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- AguaClara Course Descriptions
- AguaClara Engineers

More About AguaClara

- Real-Time Plant Performance Data
  - Wash4all data
  - POST app data
- Project Sites
- 20 L/s Plant Model
- Sign up for the AguaClara newsletter
- AguaClara FAQ
- Design Philosophy
- Research Philosophy
- AguaClara White Paper - Technical Materials

AguaClara at Cornell is a center for **Research** and **Design** of sustainable engineered processes to provide clean drinking water for communities everywhere. As opposed to point of use devices that provide water to individuals, AguaClara systems provide drinking water at the municipal scale. Cornell student research teams focus on Researching, Inventing, and Designing using state of the art process control to automate parametric testing. Experimental automation makes it possible to explore a wider parameter space per unit time, allowing student teams to thoroughly test their ideas and to quickly adapt their hypotheses to respond to new results. The research teams generate new knowledge that is used to improve AguaClara designs and create new treatment processes. An important incentive to students in AguaClara research teams is that they get to see the results of their work built and used to benefit people. **Click here to see student reflections from the most recent trip to Honduras.**

The AguaClara Difference

Despite functioning on the same basic process, there are major differences in design between what is effective in the developed world and what is feasible in the Global South. Almost all of the plants in the developed world rely on large amounts of electricity to monitor and operate. However, in the developing world, access to a reliable source of electricity is both doubtful and prohibitively expensive. AguaClara plants use gravity instead of pumps, and mechanical devices instead of electrical monitors, to run the plant. Since the plants are designed to be constructed using almost exclusively locally-available materials and labor, AguaClara communities also avoid the risks of failure or shut-down that plague other projects dependent upon overseas expertise and supplies. Up-to-date plant designs are freely available and customizable using the **open-source AguaClara Automated Design Tool, accessible via our online interface**.

How Water Flows Through the Plant

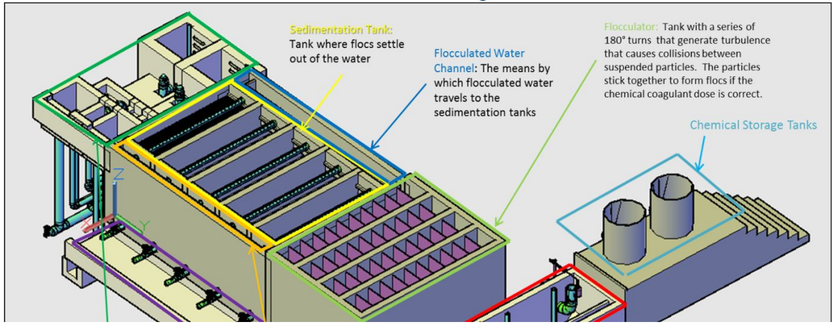


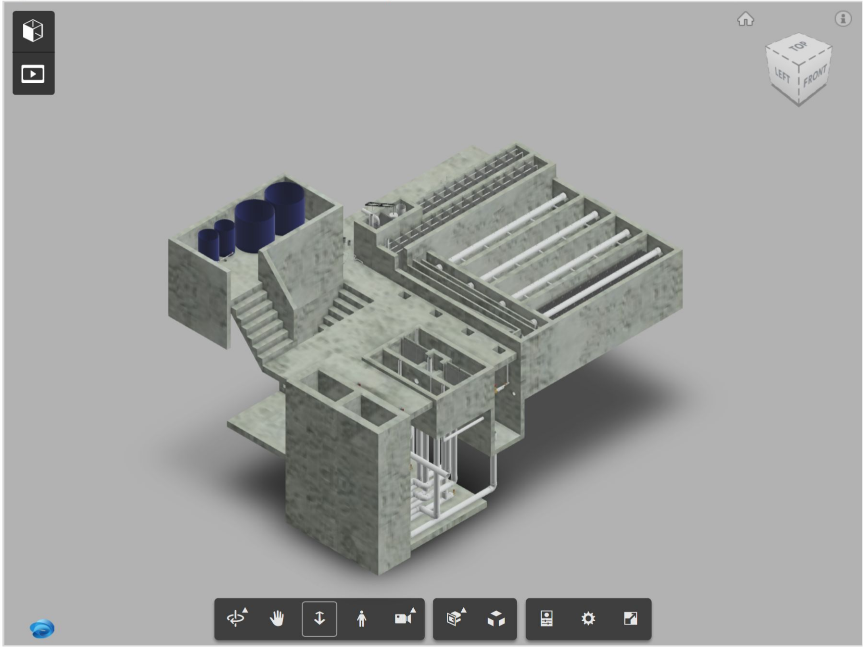
Figure 15: Wiki homepage with a link to the interactive model

Fusion models are more interactive and more realistic.

20 L/s Plant Model

Created by Kevin Juan, last modified on Oct 11, 2016

To get a downloadable Fusion 360 file of the 20 L/s Plant, visit this link: http://a360.co/2e0MtZK



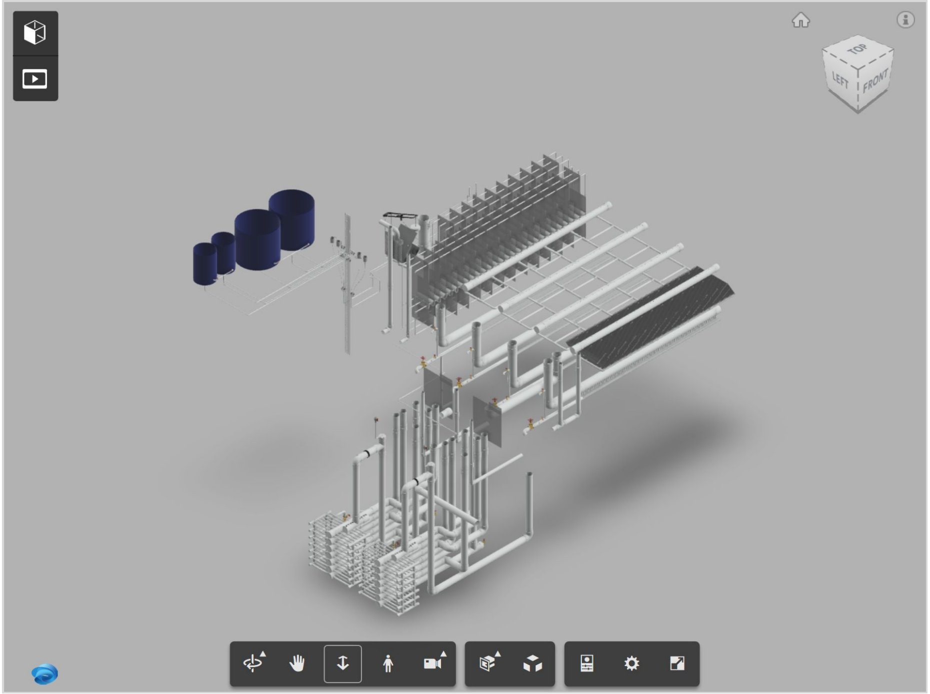


Figure 16: Embedded interactive models with and without concrete

A transition into Fusion 360 would making communicating designs with partners much easier.

Fusion can only interact with Python, JavaScript, or C++.

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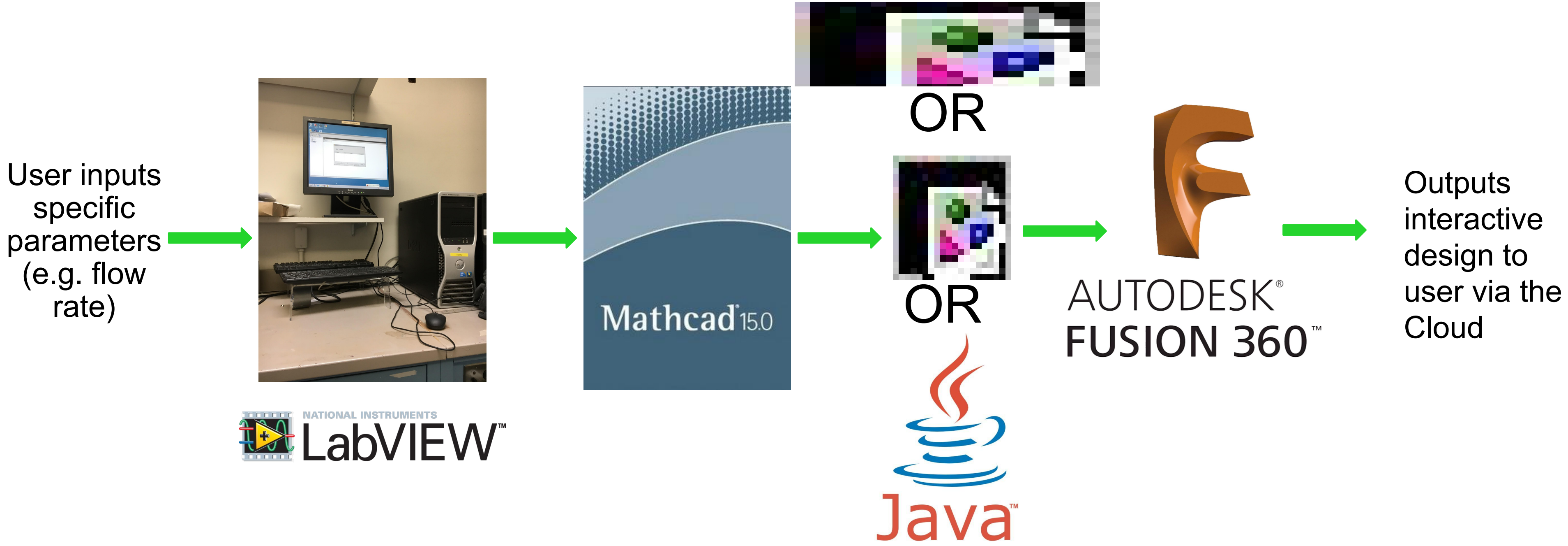

Figure 19: Proposed schematic to incorporate Fusion 360

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Backwash Recycling

A system is being designed to divert water from backwash

The backwash lagoon is designed for “wastewater” from backwash.

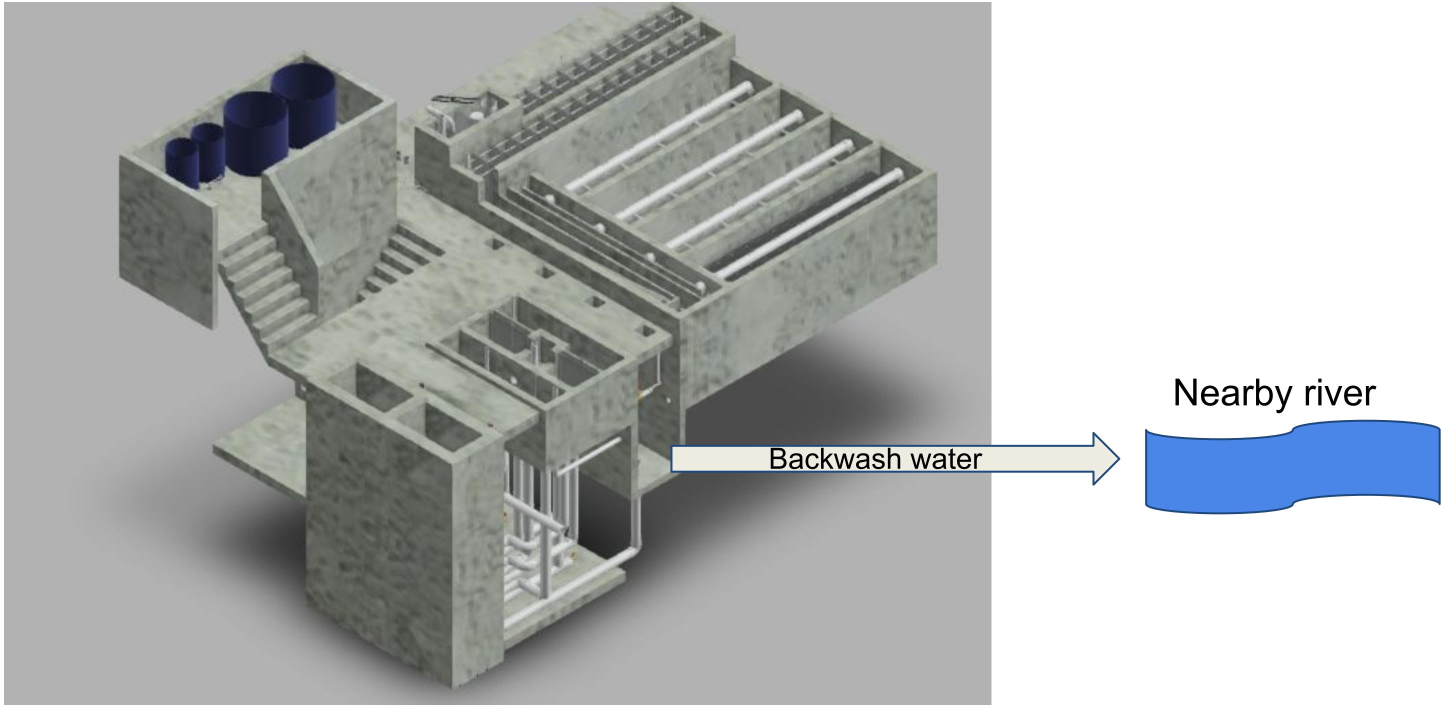


Figure 20: 20 L/s Plant Model

We are designing the pumping system in this way.

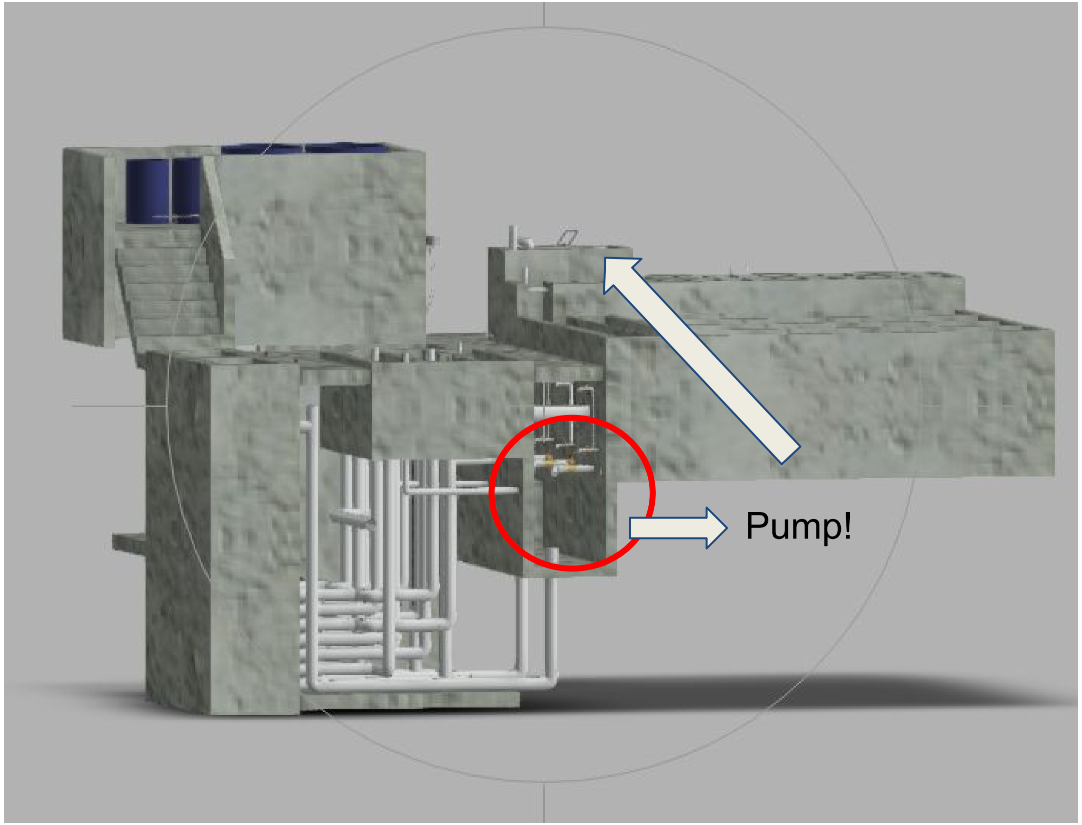


Figure 21: 20 L/s Plant Model

Directly pumping water from backwash is a possible configuration.

For the San Matias case:

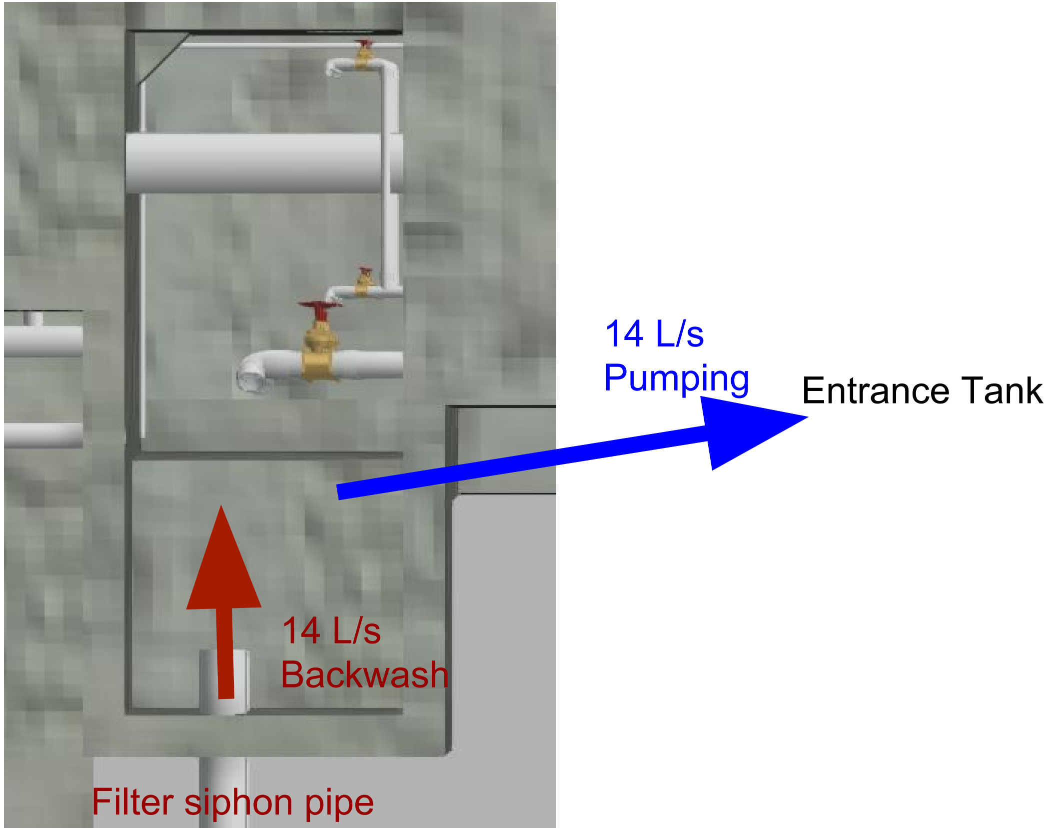
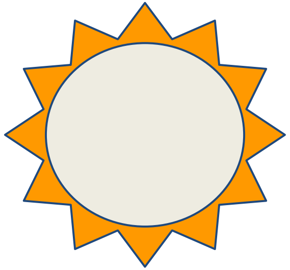


Figure 22: Filter siphon pipe entering drain channel

We plan to use solar pumps.



Length of day and less cloud cover

Available anywhere / in rural areas

<2 L/s
Pumping

We can pump slower with an intermediate storage tank.

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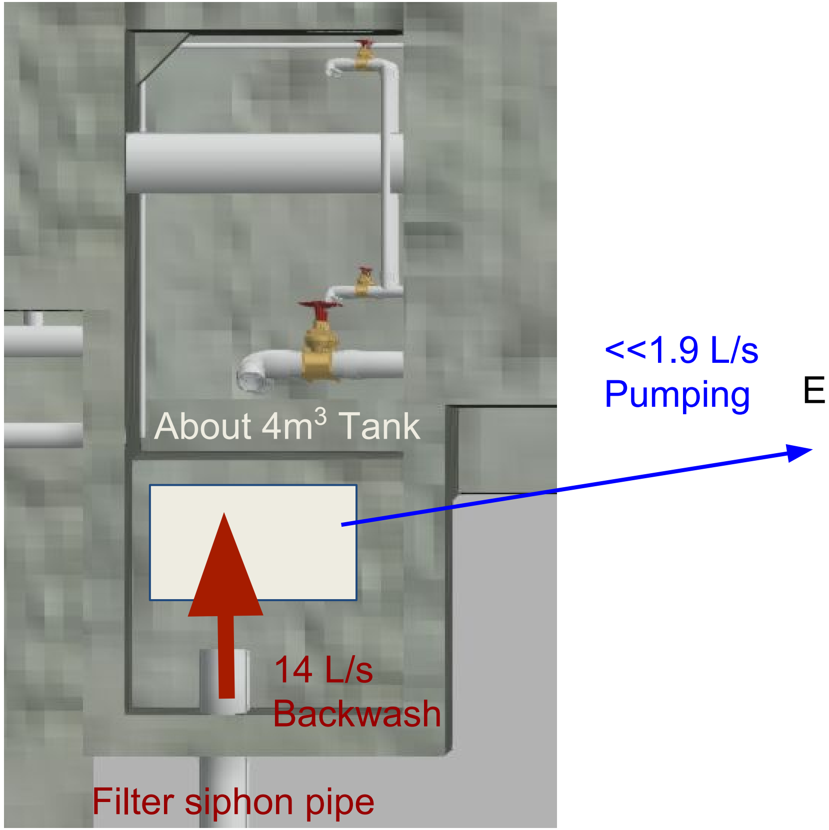
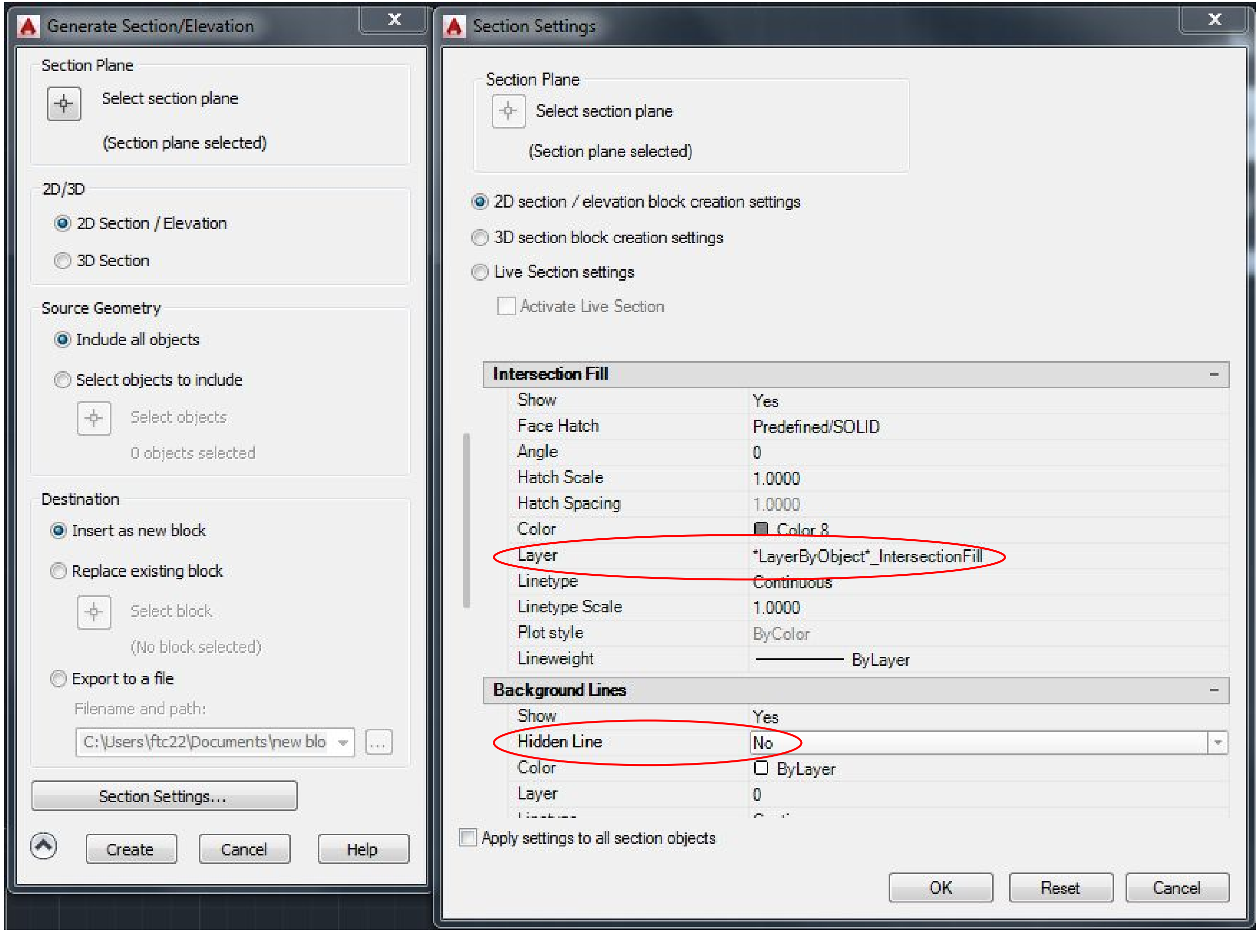


Figure 23: Filter siphon pipe entering drain channel

Section Cuts

We are working with AutoDesk to automate section cuts using Mathcad code



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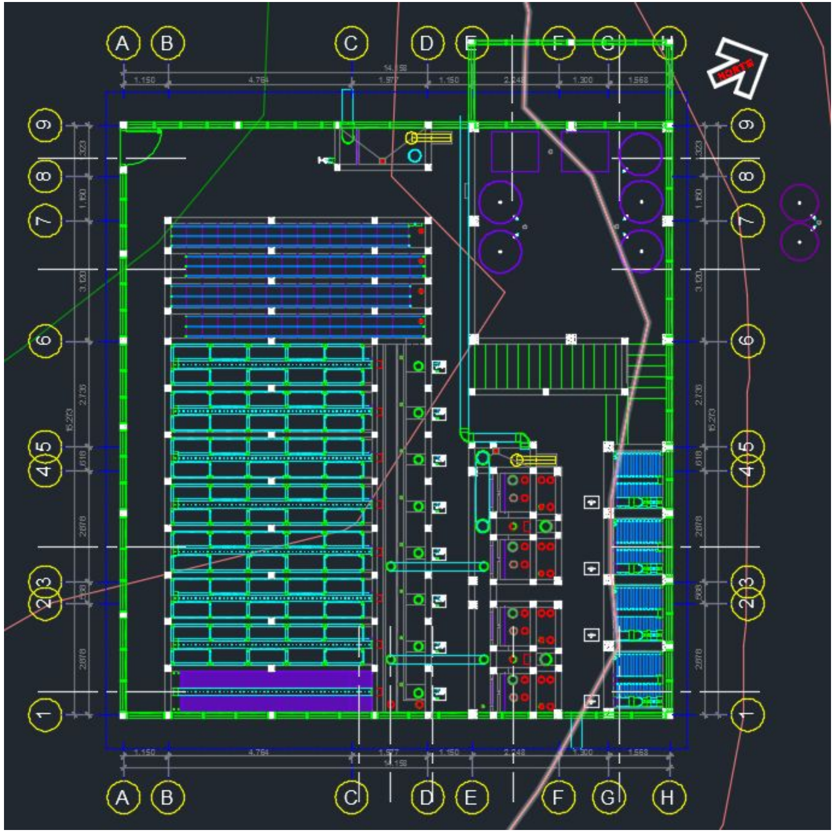
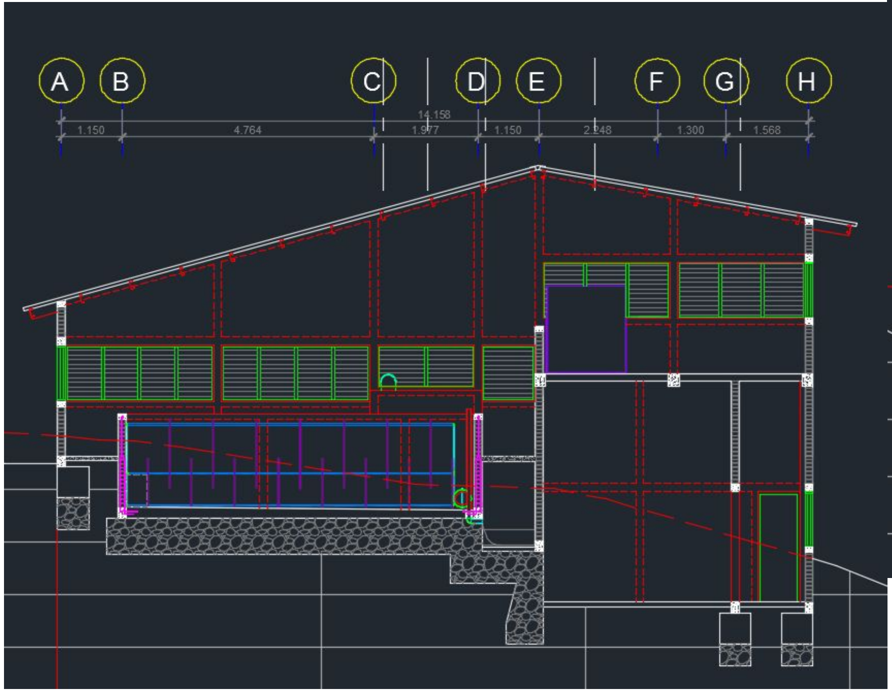
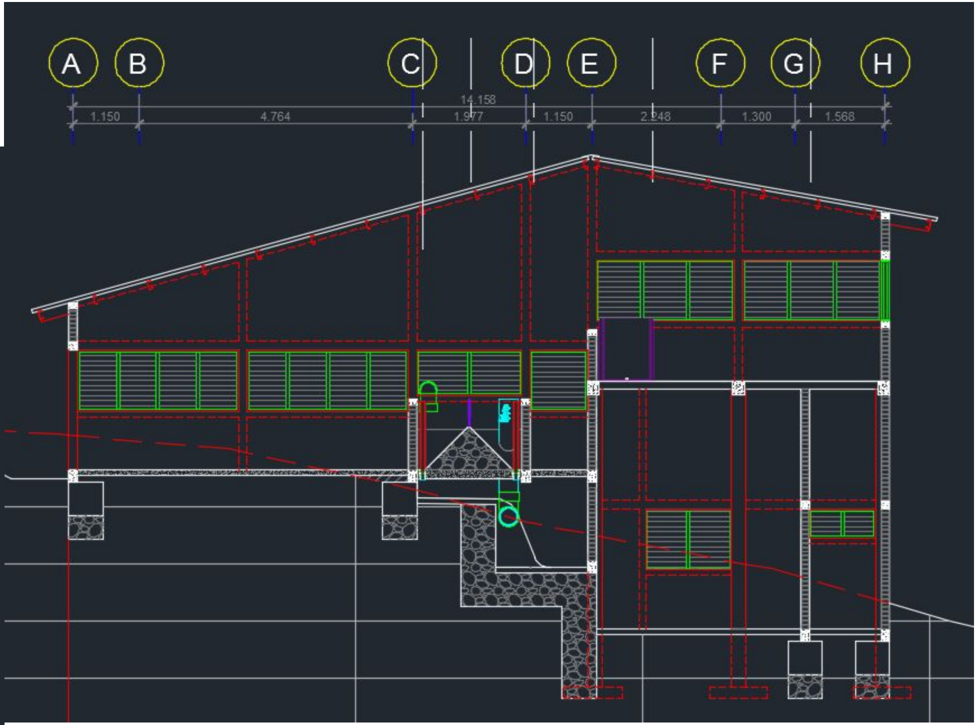
The dialogue box makes us unable to code this command in Mathcad.

We obtained ideal final results from Honduras.

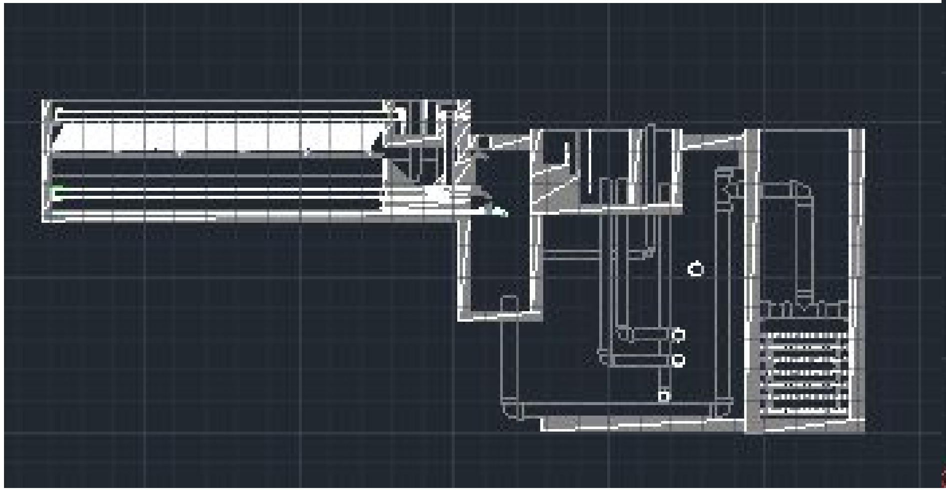


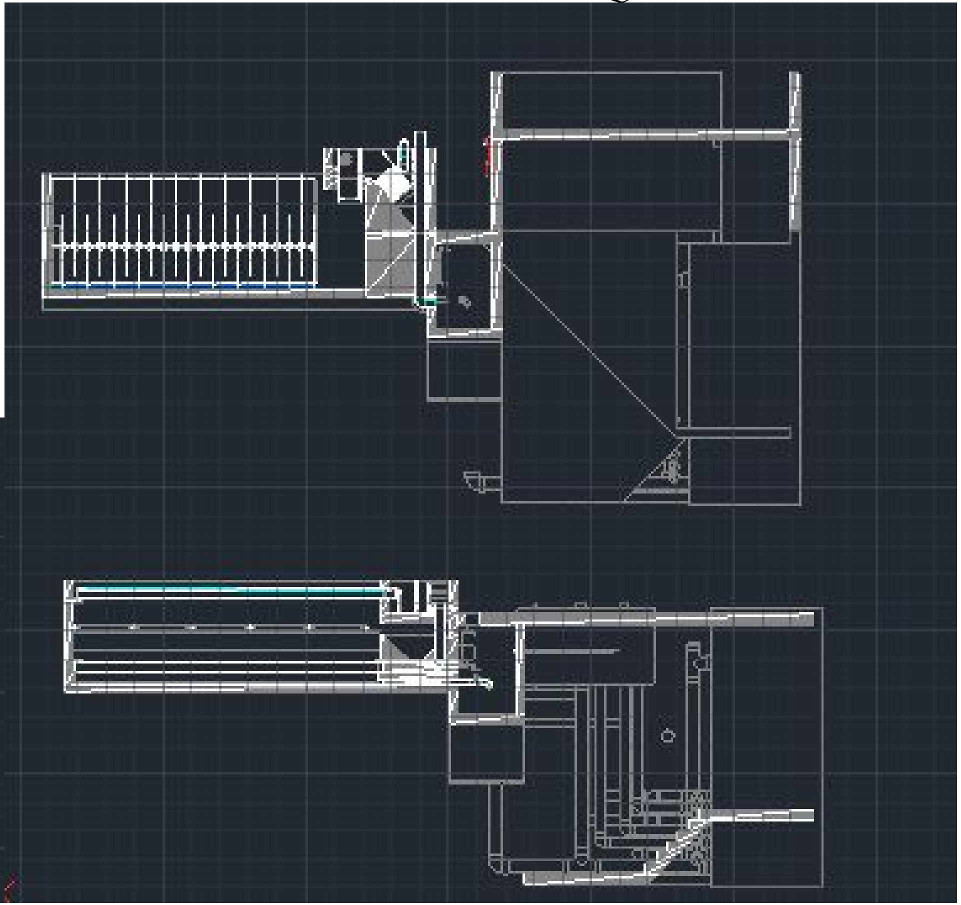
A section cut should be made at each hydraulic component.





After working in AutoCAD, we got these results ourselves.





The next step is to communicate these results to AutoDesk.

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Max Head Loss

The max had loss constraint is not being properly followed in the design code

Maximum head loss was made a user input, but it isn't being followed properly

$$HL_{FlocMax} := 40cm$$

$$HL_{Floc} := K_{FlocBaffle} \cdot \frac{{V_{Floc}}^2}{2g} \cdot N_{FlocExpansions} = 0.422\,m$$

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Questions and Recommendations

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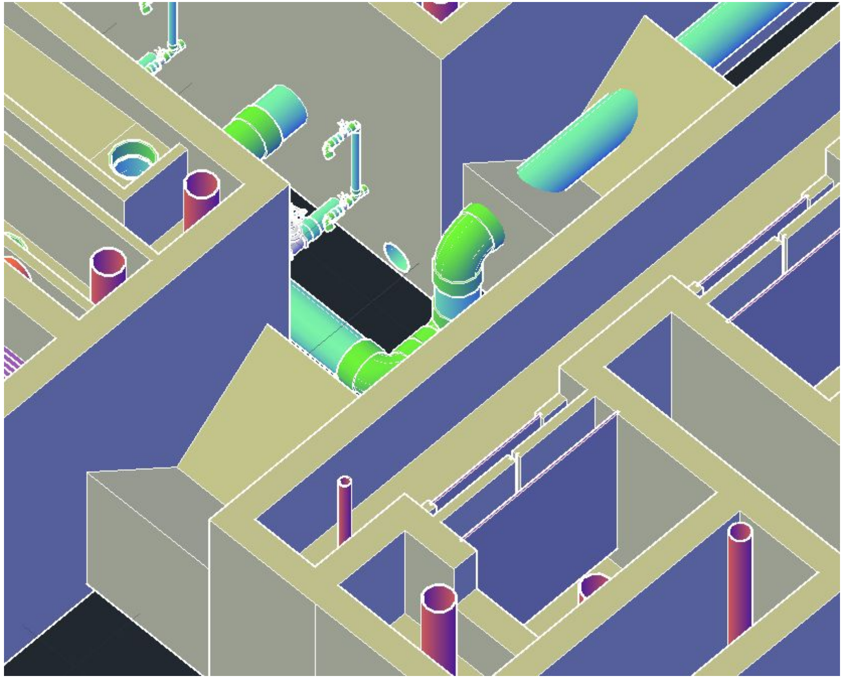
Appendix Slides

There are strange errors with the high flow code.



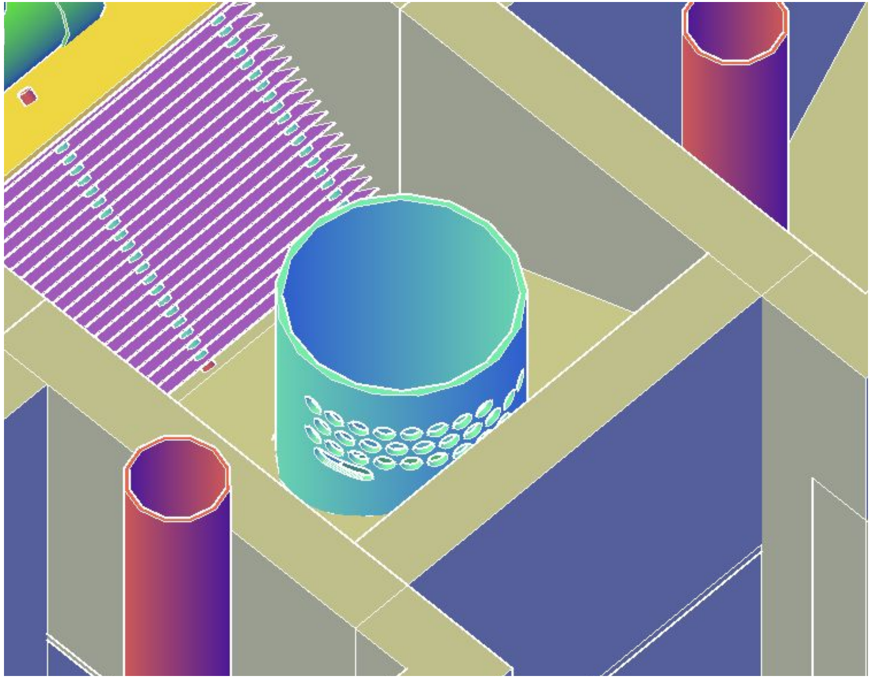


Figure X: errors with the LFOM above 100 LPS and with the sed tanks!

Sludge-water from the sedimentation tank is also passing the drain channel. This water still needs to be able to exit the plant after the backwash recycling modification

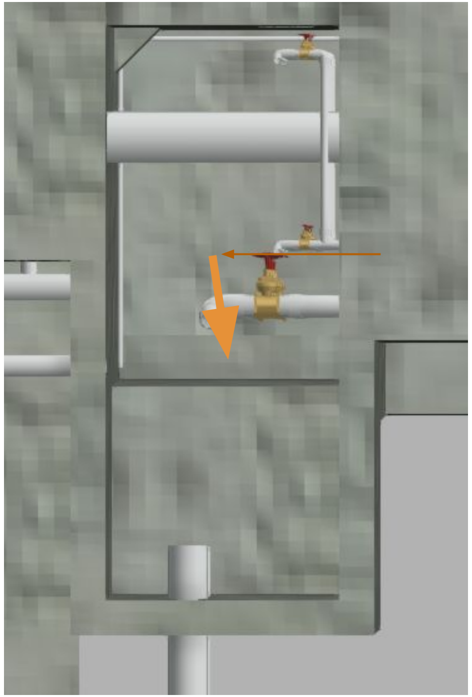


Figure X: Drain Channel

Sections cuts still need a lot of work.

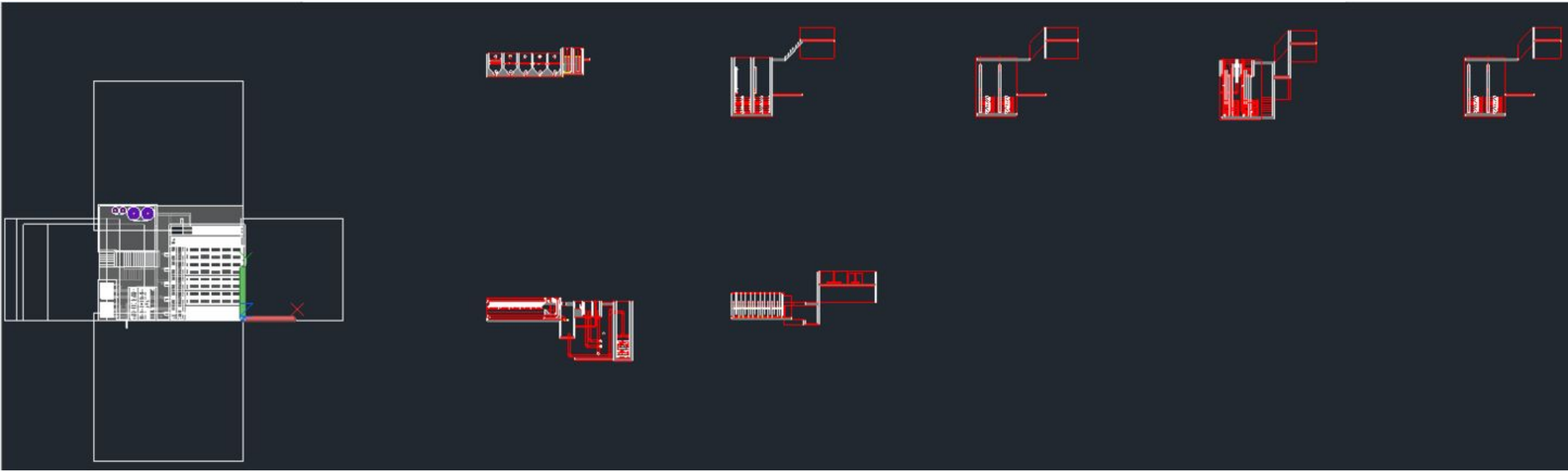


Figure X: Current section cut layout.