Alternative Backwash with Slotted Pipes
Fall 2014

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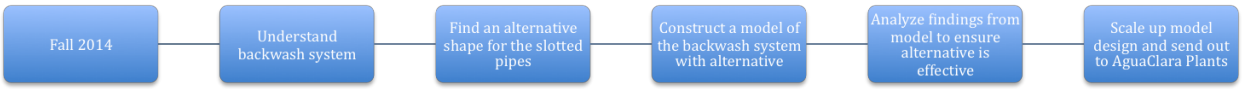
September 27, 2014

Task List

Task Map



Task Details

1. **Understanding the current Backwash system** - *Jorge, Ainhoa, and Alberto*

To be completed by: *September 24**

In order to further our endeavors with our main goal of finding an alternative to the slotted pipes in the backwash system, we must all have a mutual and strong understanding of how the backwash system actually works, either through a lab demonstration or a meet up with our research advisor or perhaps a meet up with Professor Monroe. Also, by understanding the backwash system we strive to determine the after effects of removing the slotted pipes from the system as a whole, the paths which the sand and water take within the backwash system can be further understood and thus lead to ideas on alternative ideas to the slotted pipes.

2. **Determining the effects of changing the shape of the pipe** - *Alberto*

To be completed by: *October 9**

Perhaps the problem may be that the current shape of the pipe is more prone to clogs than others. For example, instead of using the full, cylindrical shape with slots for the pipes, we could try to incorporate the use a pipe that has the same cylindrical shape but with no slots and that

has a relative “U” shape instead of the usual “O” shape. We hope to find a way to not allow for the sand moving with the water in the pipes to clog the pipes. Though the “U” shaped pipe was a suggestion made by Professor Monroe, we hope to look at different shapes for pipes that may also not allow for sand to build up. We will test these different shapes by building models of the pipes and implementing them into our model to be built in the future.

3. **Build a model of a Backwash System without Slotted Pipes** -*Led by Alberto, with help from Jorge and Ainhoa*

To be completed by**:** *October 31**

Once research has been complete regarding a new design for the slotted pipes, we hope to build a small-scale model of the system to visually see how the water flows in the system. All research regarding materials to be used for the model, along with model specifications, will be collected and organized by Alberto and each of the team members, with the help of the Shop in the basement of Hollister Hall, will construct a small-scale model. In order to have the specifications, Jorge will work with dimensional analysis in reference to the large-scale backwash system to ensure that the small-scale model will be indicative of the behavior of the actual system. Based on the findings of the small-scale model, we will be able to determine how to scale it up if the findings provide feedback regarding our design to be an alternative to the current design.

4. **Scale up model and implement design**-*Alberto, Ainhoa, Jorge*

To be completed by: *November 26**

Once a successful alternative for the slotted pipes has been found, we hope to scale up our small-scale model and create a design to be implemented in the water treatment plants in Honduras and India. We will determine which materials need to be changed, along with how to have these designs constructed easily with current resources in each country.

* Dates are tentative and are subject change.

Team Roles

Jorge Guevara: *Team Coordinator*

- Keep track of the progress the sub team has made with their tasks.
- Arrange meetings to be held outside of designated time weekly.
- Maintain communication with team members and our research advisor.
- Edit any reports that will be submitted.

Ainhoa Arribas Llona: *Head of Research*

- Ensure the validity of resources used for research.

- Organize research found by other team members and create a Word Document containing the research, the name of the team member who found it, the date when the team member found, and a detailed summary of findings that can be used from the found research.

Alberto Arnedo: *Head of Design*

- Lead the construction of any models required for the sub team by finalizing the materials needed for the model, the sketch of the model, and a tentative construction schedule.

In addition to the responsibilities assigned with each role, each member of the ABSP sub-team must follow the subsequent set of responsibilities:

- Maintain communication through the use of email and the phone app “WhatsApp”
- Submit research summaries and information to the Head of Research
- Update each other with findings that will have an impact on the project

Literature Review

In the beginning steps of the Alternative Backwash with Slotted Pipes sub team, we found ourselves at standstill with regards to how the Backwash system worked and the reason why our sub-team was created. As time passed and our questions continued to be answered, we found a purpose to our team: we will work to find the most effective and easy to manufacture alternative to the slotted pipes in the current backwash system in order to reduce the number of clogs in the current system.

Introduction

The Alternative Backwash with Slotted Pipes sub team has begun its first semester with AguaClara project team in response to multiple problems arising from the use of slotted pipes in the backwash system. With the tools currently available at the AguaClara filtration sites in India and Honduras, the problem has risen regarding the fabrication of the tiny slots on the pipes. In India, the people working on building the filtration plants are using handsaws to create the slots in the pipes. In addition to manufacturing issues, the slotted pipes have been prone to clogging up with sand. Some of the filtration plants have attempted to clean up pipes in order to remove the clogs (see this movie showing , however this is not an ideal situation given the size of these pipes, approximately *2-3* inches in diameter. By finding a successful alternative to the slotted pipes, both the processes of construction and maintenance of the AguaClara filtration plants will be made more efficient by allowing for an easier fabrication process and reducing the amount of time and effort spent cleaning up the clogged slotted pipes. You can see a purge valve in use on one of the OStaRS filters at San Nicolas in this video.

Methods

In order to gain insight into the backwash system of the AguaClara filtration plants, we first strived to learn through visuals and videos of the backwash system, more specifically a video on the AguaClara YouTube page showing the backwash system actually implemented in one of the Honduras sites. Though helpful in understanding the actual size of the system, our team hoped to gain more insight with regards to the actual steps the backwash system takes to complete filtration.

Our next step was to look to our research advisor, William Pennock, and Professor Monroe for more insight regarding the process. These conversations gave us the knowledge regarding our research in altering the shape of the object, specifically incorporating the use of a pipe with an inverse U shape to both let the water enter and to avoid sand infiltration and settling. This new inverse “U” shape has thus become the center of our research and we immediately invested our time in creating of a model of the backwash system containing the alternative pipes. In order to touch base and understand what the model should look like, our Head of Research, Ainhoa, began creating an AutoCAD drawing of the model and the result can be seen below.

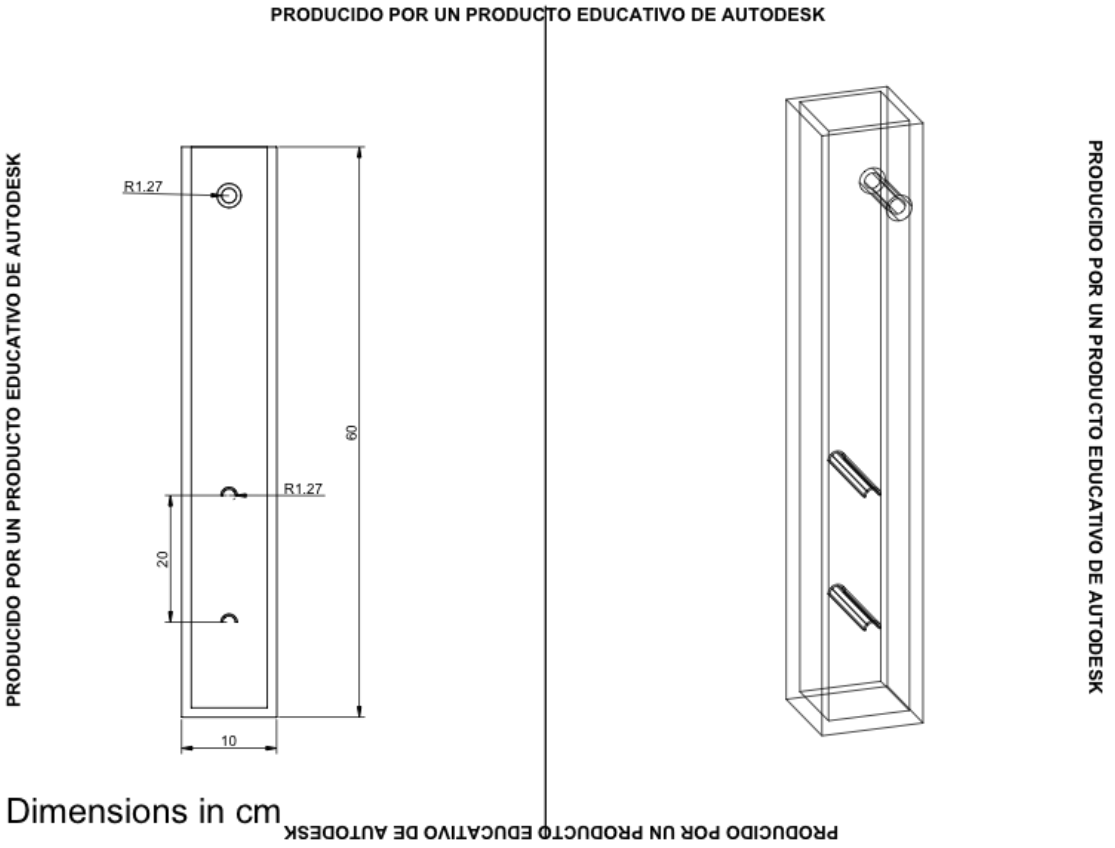


Figure 1: AutoCAD Drawing of Backwash Model with Alternative Pipe with Dimensions in cm

Following the completion of the AutoCAD model, we summarized the design specifications of the model. We will build a sandbox of 10x10x60 cm that will be full of sand up to 40 cm and the extra 20 cm of the model will be the freeboard for the fluidization of sand. We will start by using pipes of 1'' diameter, which will be subject to increase dependent on the effects noted after each experiment run. The pipes' shape will also be open to change in order to evaluate a variety of alternatives with different fabrication and effectiveness. Also, gate valves will be used to close the outlet pipes when the backwash process starts.

Analysis

Since our team is still in its beginning steps of attempting to retrieve data, we are still in the process of calculating numbers. What we expect to get out of the model is information solidifying the assumption that sand will not occupy the space where the water is supposed to flow through the pipes. If our assumptions are correct and all works well with our model, we will find results that show that both gravity and the inverse U shape of pipes, after fluidization of sand during backwash, sand will settle again and will allow for a free space for the water inlet.

Conclusions

We learned the basic knowledge of the backwash systems through informational power point presentations and insightful conversations with our research advisor and Professor Monroe. Furthermore, our team began to learn each other's strengths and weaknesses in order to solidify the path for a successful project sub team. We learned that through precise thinking and planning for our model that we really knew why our project team was created.

Future Work

In the coming weeks, we hope to finish the construction of our model of the backwash system and experiment with the inverse "U" shaped tube. We hope to find information that helps solidify our predictions with regards to the manipulation of the shape and gravity in the system in order to see if we could use the alternative in the backwash systems in the filtration plants in Honduras and India.

References