

Lehi City Irrigation Asian Clam Eradication Project ID: CEEn_2018CPST_010

by

LOS HERMANOS

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A Capstone Project 30% Completion Report

Submitted to

Dave Norman Lehi City Water Department

Department of Civil and Environmental Engineering Brigham Young University



December 11, 2018 Executive Summary

PROJECT TITLE:Asian clam eradicationPROJECT ID:CEEn_2018CPST_010PROJECT SPONSOR:Lehi City Water DepartmentTEAM NAME:Los Hermanos

The Lehi City Asian Clam Eradication project will propose a plan to manage the Asian clam population found in Lehi's irrigation water distribution system. The objective is to find the most effective chemical treatment or a combination of different types of treatments (e.g. copper treatment and a periodically flushing of the system). This will limit the damage done in the system and control the spread of the Asian clam population while maintaining system operation. In addition, the BYU capstone team has taken into consideration the research that was done by different sources, and the most feasible solutions were selected from them. These two different sources of solutions will be used to arrive to a conclusion throughout the project.

The BYU capstone team in conjunction with the Water Department from Lehi City will set up a laboratory located at Lehi city headquarters. The laboratory will be used to test the different chemical treatments such as Virkon, Earth Tech, and copper. In addition, identification of the Asian clams larvae will be done in the laboratory. This two objectives will help to identify of treatments are effective over the juvenile and adult of Asian clam population. Finally, the BYU Capstone team selected one possible solution from the research that was conducted before which are finding an adequate filtration system for the regions in which water enters the city system. This filtration system will be selected after a study program is set up. The filter system will be design according the results of the study program.

The final proposal report is expected to be complete by April 2019. It is anticipated that 30% of the project will be completed by the end of December 2018. This first part includes setting up the laboratory , locating where the clams are most concentrated in the system, and identifying and testing the different methods to control the population of clams. The second part of the project will be completed by April 2019. This will include an analysis of cost, practicality and effectiveness of the chosen methods. and the design of an appropriate filter system.



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Introduction

The city of Lehi has been experiencing problems with the invasive species of Asian clams in the pressure irrigation distribution system. The Asian clam is capable of self-fertilization and one clam can lay up to 70,000 eggs a year. The presence of the Asian clam being in the pressure irrigation system can cause problems such as decrease in water pressure throughout the system due to clogging, damage to the pipes, and damage to the pipe outlets. The city of Lehi has been managing the population of Asian clams by injecting chlorine into the system and flushing the system. However, there is no data most of the flushing is done during the winter since low demand of the pressure irrigation system is used. The city of Lehi can not turn off the pressure irrigation system due to the fact that the fire hydrants are connected to the irrigation system.

The BYU Capstone team has been working with the City of Lehi to find a way to control the population of the Asian clams. The BYU capstone team will create a small model of the pressure irrigation system to reflect the residue of the different chemicals. The residual of the selected chemical will be analyse to find a correlation with the asian clam mortality. Figure 2 resembles the different parts of the model. Chemical treatment chosen will be EarthTec, Virkon, and Chlorine. In summary, this experiment is to find the minimum chemical residual for the different treatments that maximizes the mortality rate of the Asian Clams.

Figure 4 lays out where Asian clams have reported to appear in the United States. This map is especially helpful in finding cities that are in a similar issue to Lehi's and finding solution that have worked for those cities.



<u>Schedule</u>

An important team's quintessential goal is to complete all the tasks within the allotted time frame. One way to make sure deadlines are met is by establishing "soft" deadlines. Thus, every week, at 5 pm on Fridays, the team evaluates progress on the project. This also encourages a weekly team meeting and accounting. Figure 1 outlines the deadlines that will need to be met to collect the data for the best results at controlling the population of Asian clams.



Lehi City Asian Clam Eradication

Figure 1 Capstone Project Schedule



Assumptions & Limitations

The proposed project counts with limitations and assumptions. The assumptions help to simplify the view of the problem, but overall the limitation and assumptions will have a high impact on the future results of the project.

The main limitation to the project has is the connection between the culinary and the hydrant system. It is not possible to isolate the whole system during the winter to treat the Asian clams because that will leave the hydrant system inactive as well.

Another important limitation of the project is that there is not a specific treatment that can eradicate the population of Asian clams on open or closed water systems. Many treatments have been proposed over the years, but none has shown total effectivity over the clam population. In addition, the resources for the design of the filter system are limited; therefore, it can not be designed for all extreme cases that can arise.

Finally, one of the main assumptions made is that the testing environment inside the laboratory can simulate the real conditions such as flow, and chemical residuals. The BYU capstone team will assume that the flow will be steady in the open water sources such as open reservoirs. It will also assume the chemical residuals will last long enough in the open water resources even though water is leaving the system through the culinary system.



Design, Analysis & Results

The Capstone project will be heavily involved with Zone 1 where Mill Pond is infested with Asian Clams. Figure 2 shows the entire city limits of Lehi, Utah. The map was divided up into 9 zones. The team's point of interest is in zone 1 where the majority of the clam population is predicted to reside.



Figure 2 Map Of Lehi Divided Up Into Zones

The design of the model will take into account continuous flow by pumping water from the Mill Creek reservoir to the 40 gallons containers. The last 20 gallon container will have a orifice for water to go to to the residual container to avoid overflowing. In addition, two hoses will be connected to the middle of the two parallel containers from both sides in order to simulate the system pipes of the culinary system. The chemicals will be added periodically to the system in the first container. There it will spread and flow into the second container. The model will have checkpoints from the reservoirs to measure the residual of the selected chemical treatments. This will further help to know the concentration need to eliminate the majority of clams and possibly algae. Figure 3a describe how the model will emulate water passing through the different facilities.



Figure 3a Experimental Model Outline Top View



Lessons Learned

A lot of research about the mortality rate of clams have already been done, especially with chlorine. Many reports compare the effectiveness of different chemicals including chlorine and copper sulfate in killing clams. By reading several study articles, the team gain new perspective of the problem caused by the infestation of the Asian Clam. This effectively saved the team several hours and gain a level of knowledge to make better judgements.

The team later learned that Lehi's lack of a backup for fire hydrant is a unique problem. Although other cities in Utah are also exposed to Asian Clams, each of these cities can simply drain out their systems and let the clams die out. But since the fire system is connected to it, Lehi's system has to be on. The team quickly learned that water treatments would be one of the best solutions to managing the calms. The team is still open to the idea of mechanical devices that can help like filters, but the direction of the project will be more involved with chemicals and the biology of the clams.

In the beginning there was a lack of direction where to take the project. In fact, there is still some ambiguity. Yet this was mostly solved by attending meetings with Lehi's city staff and asking the right people to provide valuable information.

Other issues that have occurred was the difficulty in reaching certain people and miscommunication with others outside of the team. Both challenges are still being worked on and currently the best method is to keep asking others for helpful contacts



Conclusions

The BYU capstone team have concluded that the total eradication of the population of clams is not feasible. However, it is possible to control the population of Asian clams inside the culinary system. This is the result from the combined treatment of chemical solutions and filters that were designed to keep the population from entering the system. It can be conclude that Asian clams have a higher resistance than other invasive mussels, but it is possible to decrease their population to a certain number and maintain such population.



Recommendations

After researching different chemicals and ways to treat Asian clams. It is the BYU capstone teams recommendation that EarthTec is to be tested in a model representing Lehi's City's irrigation system while a certain amount of EarthTec is put into the system. From the model, data will be collected regarding the amount of residue that will be needed to have a maximum amount of mortality of Asian clams. From the data that will be collected from the experiment, a more specific recommendation will be given to treat and control the the infestation of Asian Clams in the irrigation distribution system.



<u>Appendix A</u>

Eduardo Helam Hernandez

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Education

BS, Civil Engineering, Brigham Young University, GPA: 3.40.

AA, Pre-Professional Engineering, Hutchinson Community College, GPA: 3.45.

Related Course Work

Surveying and GIS, CAD Design, VBA Coding, Sustainability, Transpiration Engineering, Dynamics, Statics, Calculus, and Differential Equations.

Graduation 2019

2012 - 2014

Work Experience

Civil Engined	ering Internship; Spanish Fork City, Work under the direction of the city engineer to mee and work with different city departments.	6/1/2018 - Present t deadlines. Communicate
Server; Appl	ebee's, Communicate with guests and co-workers to give the team environment to meet restaurant standards.	8/1/2017 – Present e best service. Work in a
Assembler; E	<i>Excel Industries,</i> Assembled the main gear box for the Hustler Raptor followed blueprints to ensure parts were properly ass	6/1/2014 - 1/15/2015 lawn mower. Read and sembled and placed.
Assistant Ma	nager; Comfort Inn and Suites, Planned and oversaw the daily work for housekeeper both housekeepers and front desk clerks. Planned we desk clerks.	6/1/2012 - 1/15/2015 rs. Calculated payroll for eakly schedule for front
Leadership Experience		
Missionary; Ok	The Church of Jesus Christ of Latter-Day Saints, Iahoma City, Oklahoma, Worked with missionaries to develop teaching, organ skills.	2015-2017
Collegian Tr	ack Athlete; Hutchinson Community College	2012-2014

Hutchinson, Ks,

Led the 4by8 Team to a third-place finish at the NJCAA Nationals.

Isaac Gomez

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EDUCATION

Brigham Young University - Provo

AUG 2015 - JUN 2019

B.S. in Civil and Environmental Engineering

GPA 3.12

RESEARCH PROJECTS

Lehi Clty Irrigation Asian Clam Eradication

AUG 2018 - APR 2019

Working with the City of Lehi to minimize the clam population found in Lehi's piping system. Being in charge of communicating with Lehi city officials and BYU professors. The purpose is to make an economically-feasible solution to manage the damaging population of Asian clams

ASCE Steel Bridge Competition

AUG 2017- JUN 2019

Allowing freedom to construct a steel bridge under the ASCE rulebook and being able to place 1st in Rocky Mountain. Being able to organize the team and delegate the responsibility to each of the members. Other notable roles is designing and testing loading factors on the bridge with spreadsheets and structural software.

WORK EXPERIENCE

Water Resource Technician- Aquaveo, Provo, UT

2017 - 2018

Helping clients understanding using the water modeling software. Being in charge of ensuring quality customer service by providing adequate knowledge of the softwares. Replicating the client's model and addressing their issues. Providing technical knowledge of both the physics of water and software modeling.

Electrician - The Premier Group Midvale, UT

2011 - Present

Providing craftsmanship and learning national regulation in electrical components. Working hard to give power sources to many infrastructure in Utah County. Most notably, this includes: BYU Engineering Building, Tanner's Building and Richard's Building, UVU Woodbury School Of Business, Orem High School Seminary Building and Springville Llbrary

SPECIAL MEETING

Meeting the President of Mexico for my exceptional ability in playing chess.

Elkin G. Romero

800 N 60 W Provo, UT 84601 (801) 427-8727 gio.busrom@gmail.com

EDUCATION

Brigham Young University

Undergraduate Student of Civil Engineering

- GPA: 3.7/4.00 •
- Engineering Transportation Research Assistant •
- Engineering Transportation Teaching Assistant

Brigham Young University-Idaho

Undergraduate Student of Civil Engineering

- Math Tutor volunteer •
- Academic Scholarship

SKILLS

Used Software:

- **SAP 2000** .
- **GEOSLOPE 2012** .
- AUTOCAD 2014 .
- SOLIDWORKS 2012 .
- WMS (Watershed Solutions) •
- C++
- VBA .
- ADOBE ILLUSTRATOR CS6
- ADOBE PHOTOSHOP CS6 •
- ADOBE INDESIGN CS6
- ADOBE DREAMWEAVER CS6

ENGINEERING EXPERIENCE

Jordan Valley Water Conservancy District (JVWCD) Engineer Assistant using Geo-technical Software

- Read and analyze engineering drawing weekly in order to present reports to the local city municipality.
- Hire and supervise contractors for maintenance and design in the different JVWCD facilities. •
- Design modifications to existing pipe systems in deep wells and treatments water plants, •
- Analyze data from the SCADA system for different levels of manganese in the treated water.

TAURO S.A,

Engineer Assistant using Geotechnical Software

- Read and analyze engineering drawing weekly in order to present reports to the local city municipality.
- Apply the geotechnical software, Geoslope, for 10 hrs. weekly. to prevent failure in the building slope during construction.
- Organize different geotechnical studies in the proposed structure in order to find optimal reinforcements for the slope at failure such as anchors, pins, and geofabrics.
- Watch and supervise the volume of excavations for the footings to prevent any possibility of heaving for 5 hrs. every week

Naboo Constructions S.R.L

Engineering Assistant at Different Tasks

- Develop the budget for a national project proposal that involved the construction of 500 houses in undeveloped rural areas. •
- Submit proposals to the local entity for a single housing weekly for two months. •
- Find suppliers for the different construction materials and negotiate the price for 500 houses.

Provo, September 2017 - Present

> Rexburg, Jan 2001 - Apr 2014

West Jordan, Utah

Jun 2017-August 2017

La Paz, Bolivia

Jun 2017-August 2017

La Paz, Bolivia

October 2014-February 2015

- Survey the land of the proposed project and help the local people to understand the need of surveying before construction.
- Set up different meetings with the local population to explain the work schedule and their duties.

Elkin G. Romero

800 N 60 W Provo, UT 84601 (801) 427-8727 gio.busrom@gmail.com

RESEARCH EXPERIENCE

Brigham Young University Engineering Transportation Research Assistant Research Involved:

• Driver Compliance at different types of Crosswalks (RGS)

- Developing a methodology to determine the compliance rates after choosing four significant pedestrian crossing enhancements in Utah.
- Read and analyze over 20 research journals by organizing the related data in tables in order to build a literary review.
- Collect data by installing one video camera in each of the four selected intersections and determining the statistically significant sample size for the collected data.
- Pedestrian Walking Speed at Signalized Intersections
 - Determine four or more signalize crosswalks that have different types of pedestrian with a wide range of speeds for one month.
 - Read and analyze over 20 research journals by organizing the related data in tables in order to build a literary review.
 - Collect data by installing one video camera in each of the four selected intersections and determining and average pedestrian walking speed for signal timing design in Utah

GROUP MANAGEMENT EXPERIENCE

CECASEM (NGO)

Consultant Project Manager

- Conduct and plan Meetings with the different area managers of the institution once a week to analyze the institutional results.
- Plan two capacitation meetings every month for each area of the institution to ensure monthly and quarterly planning requirements are met
- Develop and internal institutional strategic plan (IPS) for the 2017-2019 period that put emphasis in the alliances between NGO's and business for funding and the transition form the NGO to a social business that funds its project.

RESTAURANT "COME RICO"

Manager

- Found the food catering service "Come Rico" with 14 people earning around \$1000 in local currency in the first month.
- Manage and invest the amount of money that the company was earning in marketing and social networking.
- Use of social media for branding to increase the number of customers by 5% every week.
- Coordinate the food deliver schedule in order to meet the customer deadlines.

SERVICE

Volunteer Representative

March 2015 – March 2017

The Church of Jesus Christ of Latter Day Saints, Asuncion, Paraguay

- Conduct multiple large group trainings of 60+ representatives in setting and achieving higher goals of measured performance, resulting in increased goal reaching attitudes of 200 representatives
- Develop the annual capacitation plan for the entire number of volunteers.

Provo, UT Jan 2018-Sep 2018

La Paz, Bolivia June 2017-September 2017

La Paz, Bolivia

June 2017-September 2017

Edbert **Bourdeau**

Education

B.S. Civil Engineering

Brigham Young University

Skills

- AutoCAD Civil3D
- ArcGIS Pro
- Trimble GPS Survey

Engineering Experience

Civil Engineering Intern

City of Orem

- Led a few small projects in collaboration with contractors to design and build roads, buildings, sewer and storm drain systems etc.
- Assembled technical designs using AutoCAD Civil3D in anticipation of city-sponsored construction projects
- Surveyed sites throughout the city to determine measurements relative to projects as well as precise locations of easements, utilities etc.
- Performed documentation, coordinated meetings, kept track of reports, contracts and agreements, and inspected projects for adherence to specifications

Other Experience

Technical Support Agent

ModusLink

- Troubleshoot cell phone issues for Republic Wireless
- Gather information to quickly identify needs and provide solutions or alternatives
- Manage large volume of email correspondences in a timely manner
- Adapt communication style and keep customer satisfaction by consistently exceeding expectation

ESL and Haitian Creole Teacher

Missionary Training Center

- Mentored young men and women from all over the world while teaching them a new language in 6 weeks
- Created daily lesson plans based on the needs and progress of a small group of missionaries
- Coordinated plans and progress with a co-teacher.

Volunteer

Full-Time Representative

Church of Jesus Christ of Latter Day Saints

- Recorded a book of over 400 pages into an audio book to make it accessible to illiterate individuals •
- Planned, organized and held a weekly English Class for a group of approximately 25 individuals •
- Led a group of 30+ representatives in setting and achieving performance goals.
- Gather and analyze reported performance data and provide monthly trainings to reach and exceed these performance goals

Aug 2011 – Apr 2019 Provo, UT

- Proficiency in Microsoft Office
- Fluency in English, French and Haitian Creole

Jan - Aug 2018 Orem, UT

Jul 2018 - Present Orem, UT

Feb - Dec 2017

Provo, UT

Boston, MA

Jan 2013 - Jan 2015