SPRINGVILLE IRRIGATION CANAL BREACH MITIGATION
PROJECT ID: CEEN_2018CPST_012

by

Centilium Engineering
Max Barnes
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A Capstone Project 30% Completion Report

Submitted to

Brad Stapley
City of Springville

Department of Civil and Environmental Engineering
Brigham Young University

December 10, 2018

Executive Summary

PROJECT TITLE: SPRINGVILLE IRRIGATION CANAL MITIGATION
PROJECT ID: CEEn_2018CPST_012
PROJECT SPONSOR: City of Springville
TEAM NAME: Centilium Engineering

The canal located near Hobble Creek in Springville City, Utah, is experiencing breaching south of the Wayne Bartholomew Family Park. The Springville City and Springville Irrigation Company operate and maintain the open canal. Currently the canal has been shut off, and very little water is flowing through the canal. The canal spans approximately 2,000ft with an adjacent paved walking-trail and residential dwellings.

Centilium Engineering Capstone (CEC) has been selected by the City of Springville to analyze and model different options for mitigating the breached ditch and considering different options of altering the current Strawberry water configuration. To do this, CEC will identify and evaluate the possible causes and solutions of the breach. CEC will also consider configurations of Strawberry water to improve pond water circulation and quality.

To be able to evaluate current conditions of the ditch, CEC has gathered soil samples and elevation data from various locations along the ditch. The soil samples are currently being analyzed with the hopes that flow nets can be created. Additionally, the elevation and other GIS data will be verified for validity and input into a model so the flow of the canal can be calculated.

The bulk of the analysis and modeling will occur during the Winter 2019 Semester. Final outcomes of this analysis will directly affect proposed solutions. Solutions will be further assessed for validity and quality based on parameters such as cost, convenience, time, and other environmental or public effects.

Final objectives and deliverables for this project include cost analyses of possible solutions, as well as a written proposal. A presentation will also be given to members of the City Council and other stakeholders. The deadline for this project is March 1, 2019.

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Introduction

The origins of this project date back to 2010 when the Rivers subdivision was constructed, with several homes built on parcels along the canal. During the construction process, the Springville Irrigation Company insisted that the canal be piped to reduce the liability should the canal breach and flow downhill through the new subdivision.

The City Council voted to keep the canal open to preserve the natural beauty of the open water source, especially since it had the trail running parallel to it. In some locations there are trees on both sides of the open canal. Eventually homes were constructed on parcels that are downhill of the open canal. In some cases, homeowners have cut into the hillside just below the trail and open canal and installed unreinforced rock walls.

In addition to the problems with the breach, the city has found that water in the retaining pond at Wayne Bartholomew Family park is not circulating well. The main source of water from the Strawberry Reservoir enters the pond close to the outlet for the canal and short-cuts directly to the outlet rather than traveling throughout the entire pond. Centillium Engineering Capstone has looked at several solutions and is currently evaluating the best and most economical way to circulate the water through the pond.

The city of Springville has tasked Centillium Engineering Capstone with evaluating several solutions for the breach along the canal flowing from Wayne Bartholomew Family park as well as finding a better way to circulate the water flowing in from Strawberry Reservoir through the pond. To this point the team has proposed and is currently analyzing several solutions. Data about the creek has also been collected using professional tools and procedures. Based on the team's best analysis and calculations more than thirty percent of the project has been completed.

Schedule

The following table contains the important milestones, accomplishments, and challenges faced thus far in the project by CEC

Table 1: Important Milestones, Accomplishments, and challenges

Date	Important Milestone, Accomplishment, Challenge
September 21, 2018	Meeting with Dr. Lee regarding project options and received powerpoint information on project
September 24, 2018	Meeting with sponsor and mentor to discuss scope of project
September 25, 2018	Scope of project was further defined: Cost-benefit analysis of canal mitigation options with a minimum of 20 cfs flow and cost benefit analysis of piping Strawberry water to the east of pond for water circulation
September 28, 2018	First canal site visit with Dr. Hotchkiss, learned about canal history in Springville, discussed property boundaries, NIMBY ideologies, and how these might affect the project
October 1, 2018	Received address of canal breach location, obtained permission to wade canal to obtain canal dimensions, gained access to survey data and online GIS maps from Byron
October 6, 2018	Discussed different breach mitigation options and possible additional options as a team. Options include: Reline ditch, pipe ditch, cut off wall beside ditch, Cut off wall beside ditch with strawberry water piped back up to canal, Cut off wall beside ditch with majority of water in canal being piped and strawberry water piped back up to canal, install rocky drain beside canal and install water feature to transport strawberry water to pond, pipe canal and strawberry water under the neighborhood street
October 15, 2018	Finished statement of work document and received additional Strawberry water information from Byron such as pipe diameter
October 20, 2018	Waded canal and obtained canal measurements and soil samples
November 1, 2018	Sent Statement of work document to Byron for feedback. Byron indicated that CEC needed to describe more of the work the group will be doing in the introduction and that the Centilium Engineering Capstone group has been selected to perform a cost-benefit analysis of the canal and research additional options of piping strawberry water into pond. Byron also indicated to check cost estimates with Brad's when CEC starts cost estimates.

November 2, 2018	Meeting with Dr. Hotchkiss to discuss fluid modeling and progress on project.Updated statement of work document to include suggestions from Byron and sent it to both Dr. Hotchkiss and Byron for additional feedback
November 3, 2018	Began soil analysis, soil separated and washed to prepare for Atterberg Limits
November 5, 2018	Received contact information of Springville City Aborist to gain additional information on how CEC might be able to keep trees around canal alive
November 6, 2018	Atterberg limits performed on soil sample
November 10, 2018	Additional soil sample collected
November 13, 2018	Attended the waterboard council meeting, learned that: trees might be large enough to have reached ground water supply, there is a two way pipe running strawberry water into pond, there is a pressure irrigation pipe running to the east side of the pond where CEC wants Strawberry water to run. Received contact information for Albert Harmer (Springville Irrigation), Martin Boyer (Springville Irrigation), Pattie Anderson (Springville Irrigation Front Desk), and Shawn Baker (Springville City Water)
November 19, 2018	Downloaded Hydraulic Toolbox and learned to use the software to begin 3D modeling
November 24, 2018	Canal survey data collected
December 3, 2018	Atterberg Limits performed on second soil sample and conversion of survey data into elevations started
December 10, 2018	30% completion report completed

Tasks that still need to be performed:

- Obtain bids on materials
- Obtain bids on labor
- Create fluid flow models
- Combine fluid flow and soil analysis results
- Create flow net
- Create canal cross sections for each project option
- Environmental impact analysis of all options
- Public opinion analysis of all options
- Create plan views
- Cost analysis for all options

- Write final report
- Present findings to faculty and students in final seminar
- Present findings to mayor and representatives from City of Springville and Springville Irrigation Company

Assumptions & Limitations

At this point in the project, not many assumptions have been made due to the fact that much of the analysis and calculations have not been completed; however, CEC have come across several limitations. One of the main limitations found during the project is those caused by not being licensed professionals. CEC are all students whom have not performed much in-depth engineering work before. Therefore, before any suggested solutions are put into place they must be checked by a licensed professional engineer.

Other than limitations in experience, the project has many limitations that must be taken into consideration. Some of the project limitations encountered are public opinion, cost, property boundaries, and space. Any solution that is presented must be subject to the public's opinion. Some public opinions that CEC has been encouraged to work around is ensuring that the trees live and that the canal is not piped for aesthetics. These limitations are taken into account in some of the project designs but ignored in others to find the best quality solution. Cost is a large limitation on the project as well. Many of the current project designs that could fix the breach exceed the desired project expense and are thus inadequate in the view of the city. There are also several private property boundaries that include the canal that could prevent solutions being cared out in these sections. Due to properties being owned on either side of the canal, there is a limited amount of space in which solutions can be implemented.

Design, Analysis & Results

The first step in the analysis was to visually inspect the canal and take pictures. Over 50 high resolution photos were taken of the canal, including photos of the junction at the end of the canal and the mouth of the canal at the initial site visit on September 28. Photos were also taken where Strawberry Reservoir water enters the pond. Included are photos of where the breach occurred and the mouth of the canal.

Figure 1: Location of breach

Figure 2: Mouth of canal

In the next step of the analysis process, width measurements were taken along the canal. These measurements will be used to supplement the elevation data that was obtained later and will assist in modeling the canal. The condition of the canal was also recorded at various points. Included is the sample from the measurement data sorted by address.

Table 2: Canal Measurements

Locations	Top Width	Bottom Width	Notes
Culvert	12	4	D=3
2745 E (East)	27	16	Some Vegetation
2745 E (Center)		16	Some Vegetation
2745 E (West)	18	11	Some Vegetation
2727 E			Not a lot of vegetation, Couldn't get into canal.
2709 E	16.5	11.5	Height: 3
2677 E (West)	11	12	Choke Point

Two soil samples were obtained, and tests were performed by Centillium Engineering staff in the Brigham Young University soils laboratory. The first soil sample was taken from the site of the breach and the second from further up the canal to assess whether the breached soil was significantly different in composition. The soil was sampled eight inches below the surface from the wall of the canal and was taken with a square-nosed shovel to minimize bias in sampling. The soil was tested for Atterberg limits and a full gradation was performed using ASTM standard sieves. Data from the soil analyses are still being processed but included are graphs of the particle size from each sample.

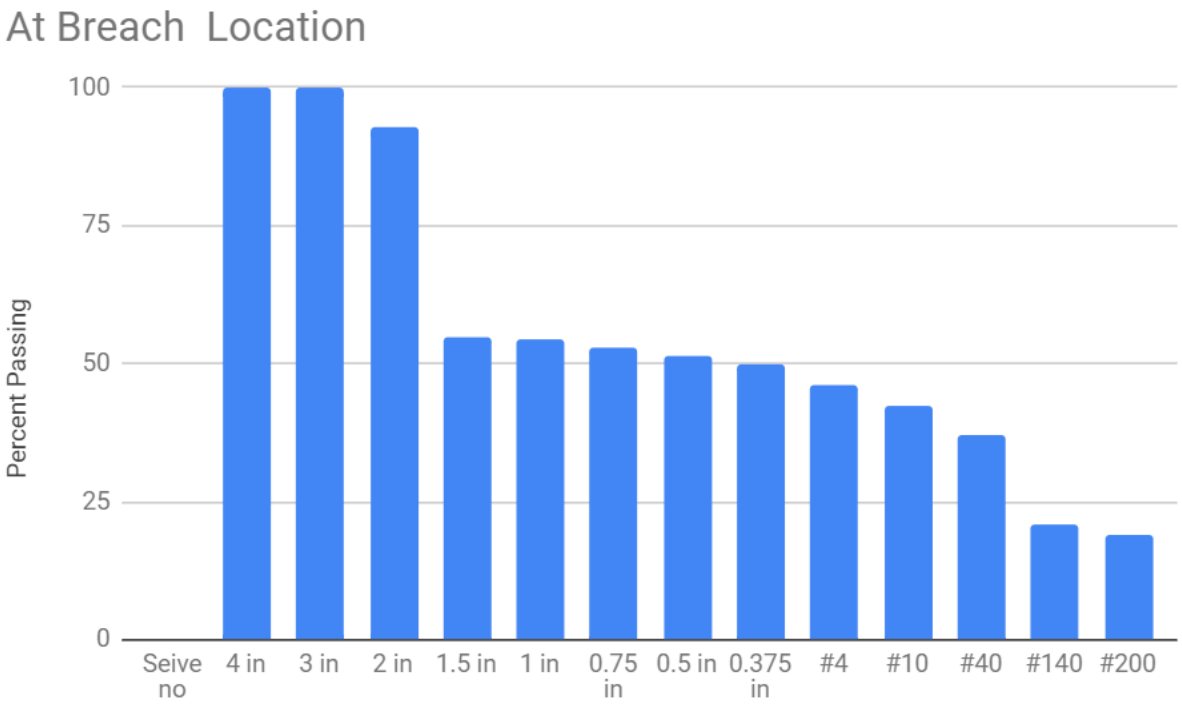

Figure 3: Soil gradation at breach location

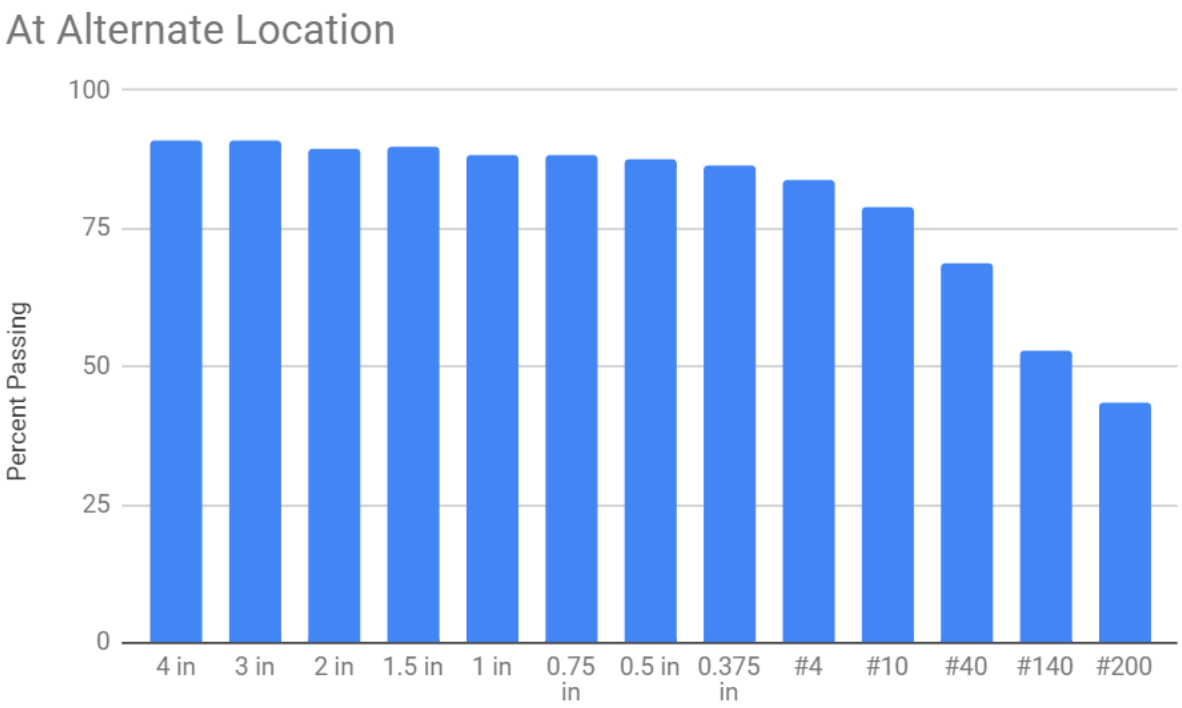

Figure 4: Soil gradation at alternate location

Lastly, a surveyor's level was used to collect elevation data at key points along the canal. These data will be the primary resource in creating a computer model of the canal. These data are also being synthesized currently.

Lessons Learned

CEC encountered several challenges throughout the initial phases of this project. Many of these challenges were noted in status reports and required additional effort to overcome. Initial challenges such as identifying the location of the breach and orientation of other locations and becoming familiar with the project were overcome by visiting the site and photographing key areas.

All of the encountered challenges thus far in the project were easily overcome through teamwork. Each challenge was approached differently. The lessons learned from these challenges are valuable, as they can be adapted to help CEC overcome future challenges. It is interesting to note that because the members of CEC knew each other prior to the capstone experience, little to no challenges have arisen as far as working relationships are involved.

Defining the scope of the project was a difficult challenge for CEC to overcome, because none of the members of CEC have had prior experience working on projects such as this capstone experience. It was difficult to learn what components make up a scope, as well as what questions should be asked when trying to find information. CEC wanted all questions to be well evaluated and thought out so that we could gain as much information as possible from answers received.

CEC also learned the importance of conducting sample analysis as quickly as possible after returning from the field. This allows team members to be on the same page as far as who is responsible for what. It also allows the samples to remain in the same areas and not become lost or damaged by others.

Other challenges included finding access to portions of the canal that are fenced off, analyzing clayey soil, learning to use new software, learning to use surveying equipment and obtaining basic data. These challenges were overcome by asking, Dr. Hotchkiss for input and recommendations, and by using google to learn the basics of the new software. A demo was also done by the CEEN Department at BYU to help CEC learn how to use a digital level for surveying.

One other significant challenge that CEC encountered was scheduling conflicts. It was difficult to find times when team members were available due to busy school schedules. Often, CEC met on weekends or late in the evening in order to progress through this project. This has perhaps been one of the biggest challenges because school schedules change weekly according to other group projects, assignments and midterm exams.

Conclusions

After doing the research and data analysis mentioned throughout this paper, the cause of the breach is being better understood. Understanding the breach will help find the best solution that will solve the problem as opposed to pushing the problem back a couple of years. Due to the nature of this project, if the correct solution is not implemented then this could be a recurring problem that will need to be dealt with again in the future.

Current conclusions that have been drawn are that the soil was not permeable enough to cause the breach and that what probably happened is the water slowly eroded the soil away from around tree roots and made its way to the retaining wall that way. A soil analysis was performed to make this conclusion through gradation tests and atterberg limit analyses. It is inconclusive as to whether or not the breach is fed by canal water or spring water, so the final designs will take one or both options into account.

Recommendations

Based on incomplete analysis, no options are recommended as of this date.

Appendix A

REED **REIMSCHUSSEL**

495 East Center, Pleasant Grove, Utah, 84062 · (801)616-6583
Reimschusseler912@gmail.com

EDUCATION

2012-PRESENT
DEGREE IN PROGRESS , BRIGHAM YOUNG UNIVERSITY
Area of Study: Civil Engineering- 113.5 Credit Hours Completed
Relevant Courses may include: Engineering Mechanics-Statics; Engineering Mechanics: Dynamics; Elementary Linear Algebra; Calculus of Several Variables, Elementary Differential equations, Engineering Drafting w/ CAD applications; Mechanics of Materials; CE EN 270 Computer Methods, Hydraulics and Fluid Flow Theory, Structural Analysis, Elementary Soil Mechanics.

MAY 2012
HIGH SCHOOL DIPOLMA, PLEASANT GROVE HIGH SCHOOL

EXPERIENCE

AUGUST 2017 – PRESENT
RESEARCH ASSITANT, DR. KEVIN FRANKE
Assistant in the Next Generation Liquefaction project, data entry and management in generating a liquefaction potential curve for Davis, Weber and Salt Lake counties. General assistance in data entry, management and analysis.

APRIL 2018 – AUGUST 2018
FIELD TECHNICIAN, RB&G ENGINEERING
Duties: Quality assurance and Quality Control testing and field testing. Conducted concrete testing both on site and compressive strength tests. Soils testing such as gradations and proctor testing.

APRIL 2017 – AUGUST 2017
BUILDING SECURITY OFFICER, BRIGHAM YOUNG UNIVERSITY
Duties: Building Security Checks, Writing Building Security Reports, and Patron Surveillance

SKILLS

- Proficient with Microsoft Excel and Visual Basic
- Have conducted many Proctor tests and gradations.
- Familiar with AutoCAD and Revit
- Construction Experience
- Experience Driving Forklifts and Box Trucks

Delila Lasson

669 E 800 N S304 | Provo, Ut | (615)992-4776 | lila@lassons.net
LinkedIn Profile: https://www.linkedin.com/in/delila-lila-lasson-92b652123/

OBJECTIVE

I am seeking a promising career as a Civil Engineer position providing me the opportunity to apply and enhance my current Engineering skills while, contributing constructively towards the growth of the company.

SUMMARY

I will be completing my bachelor's degree in civil engineering from Brigham Young University in April 2019. I have been working on building the Next Generation Liquefaction database since I began my junior year in the program. I am also working with Intermountain GeoEnvironmental Services to test and verify building site preparation and suitability for their clients.

EDUCATION

Bachelors, Civil Engineering, Brigham Young University, Provo, UT, anticipated graduation April 2019

- Active participant in: Women in Engineering BYU chapter and American Society of Civil Engineers BYU chapter
- Pursuing an emphasis in Geotechnical Engineering

WORK EXPERIENCE

Engineer Intern, Intermountain GeoEnvironmental Services Inc., 12429 S. 300 E., Ste. 100, Draper, Utah, 8/2018-present

- Performed excavation observations to verify if the site was suitable to build on
- Digitized raw field data for various SPT test holes

Earthquake Research Assistant, Brigham Young University, Provo, UT, 09/2017-present

- Reached out to various Geotechnical firms to gather data
- Processed raw earthquake damage data for the 2011 Tohoku, Japan earthquake for Dr. Jonathan Stewart (UCLA) to be placed in the Next Generation Liquefaction database
- Coordinated with another university to accomplish tasks relevant to the Next Generation Liquefaction database and other projects

OTHER EXPERIENCE

Volunteer Representative, The Church of Jesus Christ of Latter-day Saints, Billings, Montana, June/2013 – December/2014

- Provided training for 5 volunteer representatives as they began their volunteer work
- Developed leadership, teaching, interpersonal, and communication skills
- Provided any service to those in need. Spent approximately 5 hours a week performing service the entire 18 months totaling 390 service hours
- Provided training for 3 of my leaders

SKILLS

Computer

- Familiar with Microsoft office programs
- Familiar with ArcGIS programs such as ArcMap
- Familiar with AutoCAD and Revit
- Quick learner when it comes to computer programs

Max Barnes

www.linkedin.com/in/mbarnes7
(801) 361-0910 • barnesmaxmax@gmail.com

EDUCATION

Brigham Young University — Expected Dec 2019
B.S. Civil and Environmental Engineering — Provo, Utah
Minor in Scandinavian Studies – Swedish Emphasis

- 3.38/4.00 GPA
- Relevant Coursework: Mechanics of Materials, Dynamics, Fluid Mechanics, Principles of Transportation, Geotechnical Engineering
- Phi Eta Sigma National Scholarship, Loftur Bjarnason Scholarship – (*Merit Based*)

ENGINEERING EXPERIENCE

City of St. George Public Works — Jul 2018 – Present
Intern — St. George, Utah

- Draft site plans for future development using AutoCAD, allowing continuous growth to City services
- Calculate 1600+ equivalent residential unit drainage values regaining $100,000+ of monthly revenue
- Create geospatial database using ArcGIS Pro to track permeable surface area, aiding in answering billing inquiries
- Streamline processes for maintaining and archiving drawings and other records saving 2 hours weekly

American Society of Civil Engineers Rocky Mountain Region (ASCE) — Apr 2018
Pre-Design Team Captain — Rapid City, South Dakota

- Coordinated design and building of system which delivered water to multiple locations for competition
- Competed in regional Pre-Design competition taking 2nd place overall
- Secured $1000+ in funding for the 2019 BYU Concrete Canoe Team by reaching out to sponsors

Technical Skills

- Geosystems – ArcMap, ArcGIS Pro, Total Station
- Autodesk/CAD Apps – Fusion 360, AutoCAD 2018, AutoCAD Civil 3D 2018, Revit Design

OTHER EXPERIENCE

Missionary Training Center of the Church of Jesus Christ of Latter-day Saints — Dec 2017 – Jul 2018
Shuttle Driver — Provo, Utah

- Assisted 20+ patrons/day to safely board and exit vehicle during transport in the greater Salt Lake City area
- Maintained a zero-incident record over course of employment
- Remained vigilantly aware of surrounding traffic and changing weather conditions
- Identified methods to improve safety while loading and unloading patrons from large 12-passenger vans

SERVICE

Phi Eta Sigma Honor Society — Apr 2017 – Present
President — Provo, Utah

- Plan and execute monthly club activities designed to encourage participation in club and community activities
- Guide efforts to increase attendance at activities from 60-80+ using principles of 4DX
- Communicate with Advisor and Executive Committee at weekly meetings about upcoming workshops and events

The Church of Jesus Christ of Latter-day Saints — Aug 2013 – Aug 2015
Volunteer — Stockholm, Sweden

- Provided 100+ hours of community service over a 24-month period in various non-profit organizations and community events in the Stockholm and greater Copenhagen areas
- Increased effectiveness of volunteers by conducting 70+ personalized one-on-one 24-hour trainings designed to uplift, motivate and inspire missionaries to attain goals in a 12-month period
- Led, conducted and planned 6+ monthly training meetings for a team of 10+ volunteers, designed to accomplish group goals, and increase effectivity

Meghann Morgan

www.linkedin.com/in/meghann-morgan
meghannmorgan16@gmail.com
(208) 703-6836

Education

Brigham Young University – Provo, Utah — December 2019

- Civil Engineering Major
- GPA: 3.82

Relevant Classwork

- Fluid Dynamics — Winter 2018
- Elementary Soil Mechanics — Winter 2018
- Technical Communication — Summer 2018
- Structural Analysis — Fall 2018
- Metals, Woods, and Composites — Fall 2018
- Concrete, Masonry, and Asphalt — Fall 2018
- Transportation Engineering — Fall 2018

Skills

- Relevant Software: Revit, AutoCAD, Microsoft Excel (advanced)
- Programing Languages: VBA
- Foreign Languages: Spanish

Professional Experience

College of Civil and Environmental Engineering – Provo, Utah — September 2018-Present
Fluid Dynamics Lab Teaching Assistant

- Lead and prepare student lab experiences

BYU Math Lab – Provo, Utah — August 2017-August 2018
Upper Division Math Tutor

- Helped students understand concepts for linear algebra, differential equations, and multivariable calculus

BYU Physical Facilities – Provo, Utah
Groundskeeper — May 2016-August 2017

- Beautified and landscaped in a team

Custodian — November 2015 -April 2016

- Cleaned, organized, and disinfected assigned areas in a team

J. Weil Foodservice: Office Executive Secretary – Boise, Idaho — June 2012-January 2014

- *Accounts Receivable* – processed customer payments and managed customer accounts
- *Accounts Payable* – reviewed and processed vender invoices and prepared invoices for payment
- *Customer Service* –responded promptly to customer inquiries and complaints
- *Receptionist* – answered phone, screened and directed calls, took and relayed messages, received customer payment, organized office area, sorted and filed invoices

Volunteer Experience

Habitat for Humanity – Provo, Utah — November 4, 2017
Volunteer

Utah Community Academy of Science, UCAS – Orem, Utah — March 4, 2016
Balsawood Bridge Competition

Geneva Elementary School – Provo, Utah — 8 October 2015, 3 February 2016, 4 February 2016
Spanish Translator

- Translated during parent teacher conferences for Spanish speaking parents and teachers

Appendix B

Wayne Lee wlee@byu.edu via gmail.com
to Reed, Max, Lila, me, Rollin

Wed, Sep 19, 12:09 PM

All,

Attached is the PowerPoint (converted to pdf) Presentation referred to by the project description. I am sending the pdf because the PPT is about 6 times larger in file size and BYU may not handle it well.

This is a great project that involves all aspect of a real world project including technical (engineering), politics (government, residents, etc.), and some challenges that may require engineers to think outside the box.

It would be best if I can sit down with you all to describe/explain/clarify some of the background information not intuitively obvious in the Presentation file, as this was presented by the Director of Public Work to the City Council and Mayor of Springville. Both presenter and audience are intimately familiar with Springville so a lot of the explanations and details are omitted in the presentation. I suggest that we meet and discuss this before the kick-off meeting next Monday so that you can go into the kick-off knowing the background information for this project.

Please let me know when would be good for us to meet, if you all so desired.

Thanks,

Dr. Lee

Wayne Y. Lee, Ph.D., P.E. (AZ & WA)
Director, Capstone Program
Department of Civil & Environmental Engineering
Brigham Young University
Provo, UT 84602
Landline: (520) 647-9861
Cell: (520) 300-6706
E-Mail: WLee@byu.edu

Meeting Minutes with Dr. Lee:

Information about project that will be useful to know

- The canal, trail, and trees predate all of the homes that have been built in the area
- The homeowners often complain about how many people use the walking trail even though they knew there was a trail when they purchased their homes
- Leakage developed along the trail about a year ago. The irrigation company (who owns the canal) came forward and said that they wanted to pipe the canal because they were liable for damages caused by the leak. The city and residents said no, and now the city is liable for damages. If we pipe the canal, all of the trees die unless other provisions are made.
- There is concern about the pond to the north which is being fed from multiple places--the water quality is bad in drought years like this year because of algae. The pond directly feeds the canal. On a good year, the canal could overtop the dike and flood homes which were built at a lower elevation near the canal. We need to figure out how to be sure the pond always has adequate water for good water quality.
- One solution is to pipe water into the pond (strawberry could be a good source)
- Is there a compromise on the problem of pedestrians
- Main issues are the water quality an the major flooding
- The city and public haven't liked any of the proposed solutions which is why they asked us to solve this for them.
- They hope that our different perspective will help solve the problem in a better way--we see things that they don't see
- There are a few requirements:
    - It must be economical--keeping costs down. Must be cheap solution
    - There must be solutions that please many people, project needs to make sense--appeal to their logic
    - be able to do it quickly--they want to have quality water
    - Is there a combination of solutions that could work
- This is a different project because we are dealing with people, the government, and the irrigation company

- Springville wants to do it right so that they don't' have the liability problem in the future
- We won't be able to please everybody
- What if the leak isn't actually from the canal??? Because of this, We don't know if any of the proposed solutions will actually fix the problem
- There will be A LOT OF OPPOSITION FROM EVERYONE about choosing the piping solution
- At the end of the year, they want US to go and present our findings to all the big important people from the city of springville
- The strawberry water issue is big
- Option 4 has a lot of negatives--try and find the positives in the problem, but also list reasons why it is a bad idea
- Solution 3 build a wall, doesn't' solve overtopping problem--build a short wall to prevent overtopping
- The best water source is strawberry. Get that water source into the pond so it will flow down
- If they are worried about the trees dying, they could install irrigation so that the trees don't die. Make it an appealing area rather than covering the pipe with concrete--turn the negatives into positives--keep in mind that we don't actually know where the leak is coming from

Advice from Dr. Lee about how to work with clients:

- Never give them one option. Always provide 2 or more options--we have these options what do you think? They will ask which one we recommend, and we need to provide reasons to backup the option that we recommend, always lead them to ask you questions so you can tell them what you know they need to know. If we get them to ask us questions that we already know the answer to, everyone will feel smart. Them for asking us questions and us for being able to answer the questions we go there mto ask. Minimize the random questions.
- If you can turn a negative into a positive people will love you. Be able to turn failure into an opportunity, or anything else at that matter--continually negotiate projects as you work on projects
- Don't be afraid to share ideas--focus on being open not defensive. Turn everything into an opportunity. If you are creative you can always find projects--in 15 years down the road we can be a hot commodity on the market. The difference between average and outstanding is that the person who is outstanding pays attention and comes up with solutions for the customer--help the customer win
- Modifying their ideas is perfectly acceptable
- Justify all the reasons why something isn't a good idea

Questions for capstone

1. Can we pipe strawberry water before it reaches pump system so that it doesn't have to pump upstream?
2. What's the change in elevation from the pump station to the pond
3. Natural spring water - is piping feasible? Will it fix the problem?
4. Irrigating for trees after piping canal?
5. Min depth needed in pond to ensure water quality
6. Lining temporarily
7. Build small retaining wall on side of canal to prevent flooding.

Max Barnes <barnesmaxmax@gmail.com> Mon, Sep 24, 5:33 PM
to bhaslam, me, Reed, Lila

Byron,

Here is a copy of the template for the Scope (Statement of Work) form that we are going to fill in and return to the City for approval before October 8th. Please let us know if there is anything specific that needs to be included in this form from your side.

We are going to meet Dr. Hotchkiss at the Wayne Bartholemew Family Park parking lot at 5 pm on Friday, September 28. Please come if you are able.

Thanks,
Max Barnes
Centilium Engineering Capstone

Byron Haslam <Bhaslam@springville.org> Tue, Sep 25, 10:58 AM
to Max, me, Reed, Lila

Centilium Engineering Capstone Team,

I have talked over the project with Brad Stapley. I wanted to give you some follow up information for your scope you are working on. First, Brad would like you to keep piping the strawberry Water to the east of pond as an option. He feels like it would be good to have you continue looking at this option. Second, we wanted to let you know that we have talked with the irrigation company and it has been decided that the stream needs to carry a minimum of 20 cfs. Lastly, we do not have any time sensitive deadlines. Let me know if you have any other questions.

Thank you,

BYRON HASLAM P.E.
Staff Engineer
bhaslam@springville.org
801.491.7863
springville.org

springville ENGINEERING

Max Barnes <barnesmaxmax@gmail.com> Mon, Oct 1, 10:34 AM
to bhaslam, me, Reed, Lila

Byron,

After our site visit last Friday, we have several questions:

1. Which houses did the breach occur at?
2. Dr. Hotchkiss mentioned a meeting on Tuesday, October 9 at 6:30 am about water in Springville. Could two representatives from our capstone group attend?
3. We are thinking about wading the canal to get a better feel for its current condition. Do you know who we would need to talk with to get permission to do that?
4. We also thought about trying to talk briefly with the homeowners along the canal. Would that be a problem?
5. Do you know what the current flow rate in the canal is? It was very slow, however, there was some flow. What water source is currently feeding the canal?
6. Do you know how we can get the bury depths for the utilities under E 1100 S as well as the dirt intersection where the canal disappears (the dirt road possibly going into Goldberry farms near the horse enclosure)?

Thanks,
Max Barnes
Centilium Engineering Capstone

Byron Haslam <Bhaslam@springville.org> Mon, Oct 1, 4:24 PM
to Max, me, Reed, Lila

Max,

Please see my response below in BLUE.

Thank you,

BYRON HASLAM P.E.
Staff Engineer
bhaslam@springville.org
801.491.7863
springville.org

springville ENGINEERING

Byron,

After our site visit last Friday, we have several questions:

1. Which houses did the breach occur at? The Breach happened at 2611 E 1100 S.
2. Dr. Hotchkiss mentioned a meeting on Tuesday, October 9 at 6:30 am about water in Springville. Could two representatives from our capstone group attend? If you would like to you can attend the meeting you can. They will not be discussing Ditch #1 but you could see if they will discuss it since you are there.
3. We are thinking about wading the canal to get a better feel for its current condition. Do you know who we would need to talk with to get permission to do that? The ditch is currently dry so you can walk it if you would like.
4. We also thought about trying to talk briefly with the homeowners along the canal. Would that be a problem? The City prefers that you not talk to the residents on your own. People may be frustrated about the ditch and we do not want them to take it out on you. If you think this would be critical to your project, we can look into the city doing a public meeting where you attend. That way the City is running it.
5. Do you know what the current flow rate in the canal is? It was very slow, however, there was some flow. What water source is currently feeding the canal? The water feeding the canal is Hobble Creek. The agreement with the Irrigation Company is to be able to flow 20 cfs.
6. Do you know how we can get the bury depths for the utilities under E 1100 S as well as the dirt intersection where the canal disappears (the dirt road possibly going into Goldberry farms near the horse enclosure)? I have attached some survey points. Also, Our online GIS has depths on Sewer.

1332	7223380.607	1622514.195	4782.271	EOC
1333	7223308.752	1622507.812	4777.887	IRRIG BOX
1334	7223306.954	1622531.177	4778.599	EOA
1335	7223272.779	1622628.305	4779.9	EOA
1336	7223278.462	1622629.577	4780.412	EOA
1337	7223269.232	1622625.173	4778.044	NG
1338	7223266.491	1622625.478	4774.64	NG
1339	7223237.246	1622803.003	4782.573	EOA
1340	7223231.904	1622800.656	4782.278	EOA
1341	7223225.298	1622798.041	4782.006	NG
1342	7223222.594	1622796.282	4776.843	NG
1343	7223221.685	1622800.6	4781.552	NG
1344	7223189.651	1623606.083	4783.907	IRRIG DTICH FL
1345	7223190.052	1623611.25	4783.856	IRRIG DTICH FL
1347	7223191.876	1623540.948	4783.817	IRRIG DTICH FL
1348	7223309.61	1623921.435	4785.684	IRRIG DTICH FL
1349	7223312.216	1623925.903	4792.089	IRRIG MANHOLE
1350	7223309.574	1623921.76	4785.616	IRRIG PIPE 48 FL

Max Barnes <barnesmaxmax@gmail.com> Mon, Oct 15, 10:46 AM
to bhaslam, me, Lila, Reed

Byron,

We have spent some time looking at a solution for moving the Strawberry water to encourage better circulation and increased water quality in the pond. We have come up with a few ideas, but need some information about the water.

1. What is the maximum amount of water in cfs taken from strawberry?
2. What is the average flow in cfs taken from strawberry?
3. Does the City of Springville or the Springville Irrigation Company have geotechnical reports about the area where the breach occured? If so, we would like access to these reports so that we can better evaluate possible problems and solutions
4. If these geotechnical reports are not available, could we take a soil sample in the area? We would provide fill dirt for the area where the sample is taken from
5. We noticed that the park has permitted parking stalls. We are curious to see if we could get 1-2 parking passes for the parking lot for use during this project

Thanks,
Max Barnes
Centilium Engineering Capstone

Byron Haslam <Bhaslam@springville.org> Mon, Oct 15, 2:13 PM
to Max, me, Lila, Reed

See below.

Thank you,

BYRON HASLAM P.E.
Staff Engineer
bhaslam@springville.org
801 491 7863
springville.org

springville ENGINEERING

Byron,

We have spent some time looking at a solution for moving the Strawberry water to encourage better circulation and increased water quality in the pond. We have come up with a few ideas, but need some information about the water.

1. What is the maximum amount of water in cfs taken from strawberry? I do not know the max cfs from strawberry. Currently it comes down a 30" pipe. Jeff's thought was to tie a 24" pipe to the strawberry outlet structure and push as much water as we could back to the Bartholomew pond.
2. What is the average flow in cfs taken from strawberry? See above.
3. Does the City of Springville or the Springville Irrigation Company have geotechnical reports about the area where the breach occured? If so, we would like access to these reports so that we can better evaluate possible problems and solutions We do not have a geotechnical report for that area but you can go take a sample if you would like to.
4. If these geotechnical reports are not available, could we take a soil sample in the area? We would provide fill dirt for the area where the sample is taken from See above.
5. We noticed that the park has permitted parking stalls. We are curious to see if we could get 1-2 parking passes for the parking lot for use during this project. Let me reach out to our building and grounds to see if they can get us permit.

Max Barnes <barnesmaxmax@gmail.com> Fri, Nov 2, 12:58 PM
to Rollin, me, Lila, Reed

Dr. Hotchkiss,

We appreciate your attendance at our meeting this afternoon. The information and knowledge you share with us is always welcome and very much appreciated.

Attached you will find the most current version of our Statement of Work. Please look over this and feel free to provide any feedback you have.

We did have a one follow up question from our conversation. If we know the flow, cross-section, and canal elevations, can we determine the interface elevation at each cross-section at the known flow?

Respectfully,
Max Barnes

Max Barnes <barnesmaxmax@gmail.com> Thu, Nov 1, 12:44 PM
to bhaslam, me, Reed, Lila

Byron,

Attached you will find our drafted SOW. Please take a few minutes to look over the document. We would appreciate any feedback the City has, as well as any additional information or changes that need to be made.

You can click here to view our most recent progress reports. Were currently working with the soil samples we gathered, and are going to begin further analysis for the project.

Thanks,
Max Barnes
Centilium Engineering Capstone

Byron Haslam <Bhaslam@springville.org> Nov 1, 2018, 1:14 PM
to Max, me, Reed, Lila

Max,

I have a few thoughts looking over the SOW. I would describe more of the work you will be doing in the introduction. Give maybe a paragraph to the introduction saying you have been selected by Springville City to look at options of fixing the ditch and aa option of piping Strawberry water back to the Bartholomew pond. Also, the City Surveyor might have elevations to go along with your GIS Map elevations. Lastly, when you get doing estimates, it might be a good idea to use the total cost estimates from Brad's presentation to double check yourselves.

Thank you,

BYRON HASLAM P.E.
Staff Engineer
bhaslam@springville.org
801 491 7863
springville.org

springville ENGINEERING

Max Barnes Nov 5, 2018, 10:18 AM
to Bhaslam, me, Reed, Lila

Byron,

Attached you will find an updated version of our SOW. Do you happen to have the contact information for the city surveyor and the city arborist (or a local arborist)?

Would you like us to continue contacting just you, or should we begin including Brad Stapley?

Thanks,
Max Barnes
Centilium Engineering Capstone

Waterboard Council Meeting Minutes:
Water Meeting Questions:

Q. How valuable is the plant life around the canal? We understand that it is important, however we are concerned that one of our solutions may cause some loss to plant life along the canal, mainly the trees along the south side of the canal.

A. Very important to the people who live there, the people who pay for the water don't carea about the tree. It comes bac to dollars. Who is going to pay for it

Decided not to pipe it originally because of the older hertigage trees. People might not choose to wawter it. And the trees "could" die

Q. How can we mitigate use of the canal during construction and in the future? Especially privately used sections.

A. We should have access and rights, that is something that we don't need to worry about, there are no water rights for animal use, so manure man has to deal with it.

Q. At the junction where the canal ends, where does the water go? Where can we get elevations and pipe capacities? Are there plans for the junction?

A. There won't be any issues with the junction, we don't need to worry about it

Q. What purpose does the irrigation pipe running under 1100 S/River Bottom Rd currently serve? Logistically, is there a possibility of running a second irrigation pipe under 1100 S/River Bottom Rd to connect to the junction, bypassing the canal?

A. Expensive, 36 inch PI pipe that runs both directions (some of them like this idea), they talked a lot about springs or leakage causing water in the canal right now, then talked more about the trees. Didn't throw the idea out it's just going to be more expensive

Q. We want to get your thoughts, ideas, and concerns about finding a solution to cause more water circulation in the pond. Options that we have come up with thus far include:
a. Water feature (similar to lazy river near city library in St. George, Utah, or that of City Creek Mall in Salt Lake City)
b. Underwater wall
c. Piping a small portion of strawberry water to other end of pond
A. There is a pipe that goes along where we thought to put the river, open box under concrete that would have to be changed. PI pipe makes a left hand turn when the water demand is high and doesn't go into the pond--valving issue. Be imaginative

Contact Information

1. Albert Harmer--Springville Irrigation, (801) 310-2344
2. Marlin Boyer--Springville Irrigation, (801) 361-8075
3. Patti Anderson--Springville Irrigation Front Desk, (801) 491-2985
4. Shawn Barker --Springville City Water, (801) 420-0421, sbarker@springville.org