# Groundwater mapping
# Project ID: CEEn_2018CPST-DR-01

**by**

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**A Capstone Project 30% Completion Report**

**Submitted to**

**Fidel Perez**
**INDRHI-Instituto Nacional de Recursos Hidráulicos**

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**Brigham Young University**

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# Executive Summary

**PROJECT TITLE:** Groundwater mapping
**PROJECT ID:** CEEn_2018CPST_01
**PROJECT SPONSOR:** INDRHI
**TEAM NAME:** SEA

The objective of this project is to create a groundwater mapping application for the country of the Dominican Republic which can be used as a reliable data source for the engineers, planners, and citizens of the country. This will be completed by formatting and importing given groundwater data into a Groundwater Mapping application being developed by Steve Evans at Brigham Young University. Although efforts will be made to report on the water quality of the wells, it is important to note that the deliverable is being developed by student engineers and does not reflect the work nor professional opinions of a licensed professional engineer. As such, some measurements used to indicate water quality might not be absolute parameters in determining the actual quality of the water.

Efforts have been, and continue to be, made to communicate effectively with our sponsors, namely INDRHI and INAPA in the acquisition of data. A large amount of data has now been received from INAPA through INDRHI and the team is now waiting on more data and is starting the next phase of the project, which is formatting, analyzing, and importing the data for use.

The schedule will continue to be executed according to the detailed schedule listed under the Schedule section of this document. The application will be completed and ready for review and comment in the beginning of April 2019. Successful completion of this project will result in a Groundwater Mapping application, with menu options specific to the Dominican Republic.

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# Introduction

This document will outline the completed capstone project for Brigham Young University's Capstone Groundwater Mapping project in the Dominican Republic. The work schedule used will be given, as well as the assumptions and limitations of the project as perceived by the capstone team. This report will also outline the design, analysis, and results of the project, along with lessons learned, conclusions, and recommendations. Development of a well database and animated maps of an area in the Dominican Republic will be created in the Tethys software, a groundwater mapping application being developed by Steve Evans. The overall objective of this project is to develop a useful database of current well and groundwater data in the Dominican Republic.

As the project team is not a team of licensed engineers, the expected performance standards for the Groundwater Mapping project are also outlined in this document. It should be noted that project results cannot be construed as work performed by licensed professionals and cannot be used as "stamped deliverables" without first being reviewed, approved and stamped by a qualified and relevant licensed professional engineer.

# Schedule

The schedule for the past months, from the beginning of the project in October up to the submittal of this report, has been as follows:

October 8 - November 4
Have weekly meetings every Monday
Translate and summarize reports sent to team by Dominican Republic team
Explore and familiarize the team with Tethys
Research the geology and hydrogeology of the Dominican Republic
Submit regular status reports

November 5 - December 2
Have weekly meetings every Monday
Research the geology and hydrogeology of the Dominican Republic
Collect well and aquifer data
Review collected data
Submit regular status reports
Meet with Fidel Perez about the project requirements
Translate the Statement of Work into Spanish

December 3 - December 16
Have weekly meetings every Monday
Import data to groundwater mapping application
Submit 30% Completion Report

The schedule for the rest of the project is given below:

January 7 - January 24
Have weekly meetings every Monday
Analyze data in groundwater mapping application for errors
Submit regular status reports

January 25 - February 3
Visit the Dominican Republic site to gather extra data and pictures

February 4 - March 3
Have weekly meetings every Monday
Develop well database and animated maps
Submit regular status reports

March 4 - March 31
Have weekly meetings every Monday
Finalize well database and animated maps
Write final report and conclusions on database and animated maps
Submit regular status reports

April 1 - April 17
Have weekly meetings every Monday
Finalize final report
Create project poster
Present capstone project
Submit regular status reports

# Assumptions & Limitations

Due to the nature of the project, there are no assumptions used in design. The greatest limitation in the project has been access to the sponsor and the sponsor's well data. Since the sponsor is in the Dominican Republic, communication has been limited to email, as have data transfers. Explanations for project details were unclear until the team met with Fidel Perez, the sponsor representative, at Brigham Young University while he visited the United States. Most assumptions on what the sponsor expects is based on that meeting.

# Design, Analysis & Results

The design aspect of the project includes formatting the data in Excel to be compatible for the Groundwater Mapping application and then importing said data into the application for use. There are to be two spreadsheets for the project: one titled "WellLocations" which has a column each for well ID, x and y coordinates and the zone. The second spreadsheet titled "TimeSeries" has columns for the well ID, time stamp, well measurement, zone and water quality. Once the data has been formatted in Excel, the team will begin analysis on the data to eliminate outliers and bad data points. After the analysis is complete, Steve Evans will assist the team in importing the data to the Groundwater Mapping application and adding menu options for the Dominican Republic.

Once the application has been completed, the team can begin to receive feedback on the results and further improve the application.

# Lessons Learned

One of the greatest challenges encountered by the project team was communication. Communication with the sponsor, with the mentor, and between team members was difficult, mostly due to language barriers. Not all of the project team speaks Spanish, and the project mentor does not speak Spanish either. Most of the communication with the project sponsors, INAPA and INDHRI, is in Spanish, as well is most of the data that is sent from them to the project team. Due to the language barriers, the project team has had to learn to communicate together as a team with the project mentor to make sure that information is being shared accurately and completely.

Particularly when documents are sent to the project team from the sponsors in Spanish, the documents have to be translated and explained to the project mentor and the members of the team that do not speak Spanish. It was difficult at first to know how all members of the team could participate. One the lessons that has been learned through this process is that every team member has something to contribute. Some members are able to translate and others contribute in other ways such as writing or preparing a schedule or organizing team meetings. In this way, the team is able to be efficient and everyone is able to contribute to the process.

# Conclusions

At this point in the project, there are no conclusions that can be made about the results. As mentioned previously, the project team is waiting for data from the sponsors. After the data is sorted and uploaded to Tethys, conclusions can be drawn.

# Recommendations

Recommendations for the implementation of this project will be included in the final project report, to be submitted in April.

# Appendix A

<Click to add a one-page resume for each team member with each resume on a new page by itself. Add other Appendices as necessary for data, numerical results and result summary tables, software/app source code & sample software/app execution, etc.>