USDA NRCS ENGINEERING INTERNSHIP

Final Report

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Introduction:

This summer I had the opportunity to intern with Tulare County's USDA NRCS engineering team. The NRCS or Natural Resources Conservation Service is a branch of the USDA or United States Department of Agriculture. NRCS services to farmers, ranchers, and forest landowners to assist them in doing their part to conserve our natural resources including water, soil, and air (nrcs.usda.gov). Agriculture is at the heart of the central valley so it's no surprise that the majority of the USDA's jobs in Tulare County are Ag related. Agriculture utilizes and effects natural resources extensively so it's important that we help the industry be efficient and mindful in playing its part. During my time at NRCS there was a variety of projects however, the focus of our projects usually involved the conservation of water. The projects we worked on included, preventing water contamination by implementing concrete slabs under silage piles and improving irrigation efficiency by installing efficient systems. Other smaller projects focused on the conservation of native wildlife and environment.

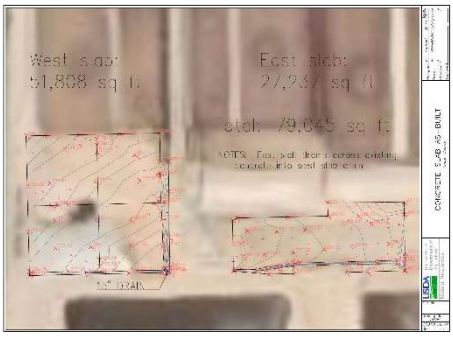
Projects:

Overview of Project Process:

From my experience at NRCS, a job would start with an interested client who has some knowledge of the services and support NRCS provides. The client would meet with a planner in the office and discus a project they have in mind. From the client's description the planners determined whether the project aligns with NRCS's conservation efforts. Plans and profiles were then created for eligible projects. The first step for an engineer would be to survey the locations of these profiles and review the plans to determine if the plan was reasonable and achievable. NRCS engineers do not draw official plans for projects but give the client NRCS's design requirements to be eligible for funding. The client must then submit their official project plans to NRCS for an engineer to review and approve. The customer signs a contract with NRCS to follow these guidelines. Any changes made to a project design must be approved by an NRCS engineer. It is predetermined with the client that during different construction stages of the project an engineer will visit the site to inspect the progress of the project.

Dairy Silage Projects:





Silage piles at dairies, when combined with moisture from rain or the crop itself, release leachate which is harmful to the environment. This leachate runoff has a high nitrate-nitrogen concentration that contaminates ground water and increases its acidity. The photo above and on the left shows runoff from two large piles of silage. This runoff is a sticky tar-like substance that has a strong, undesirable smell. A concrete pad is installed under silage piles to prevent the leachate from contaminating ground water. The concrete pad is designed carefully to direct runoff into a water reservoir that is meant to hold and

keep waste. The photo in the middle above displays the frame for a concrete slab and the reservoir it will dispose to.

For the first inspection of a slab engineers measure the overall height and size of the slab around the edges and at main midpoints before the concrete is poured. The locations of the drain pipes are also verified. Once the concreate is poured a second inspection more accurately verifies the slopes of the slab. This is done with the use of GNSS (Global navigation satellite system) surveying equipment that measures the elevation at a location. Four types of points are taken: edge points are meant to get the dimensions of the slab, gutter points which measure the gutters that direct runoff, slab points which are spread across the slab to get its overall slope, and drainage points specify the measurements around the drains. The data is downloaded into an excel table then transferred into AutoCAD to visually plotted. ArcMap software is used to locate the site's aerial image that can be placed under the plot from AutoCAD and aligned with the points taken. Elevation lines are used to show the slope of the slab. The image above and to the right shows an example of a surveyed slab.

Irrigation Systems:

Design in irrigation systems have become increasingly efficient. Older irrigation systems simply aimed at watering a crop and minimally accounted for efficiency. With more research available, newer irrigation systems can water crops more efficiently. During my time at NRCS we dealt with micro-irrigation systems that drip irrigate. Drip irrigation systems concentrate the water being applied to a crop instead of applying it sporadically. This way the plant can access more of the water emitted.

When reviewing the design plan for an irrigation system an engineer at NRCS will verify that the system meets NRCS requirements. The system requires pipes of different sizes at specific locations to accommodate to the desired water pressures and flow rates. The amount of water in gallons per hour that the system will be handling is calculated both manually and electronically. This is used to determine the thickness and size requirements of the pipes. To operate optimally an irrigation system requires a minimum water pressure. A system has maximum water pressure requirement for safety. An engineer will inspect the pipes onsite before they are covered up to be sure they are the proper sizes and in the proper locations. A second site inspection will verify that the emitters are operating as expected. Emitters are checked by taking pressures and flow rates throughout the field (Picture below and to the left).

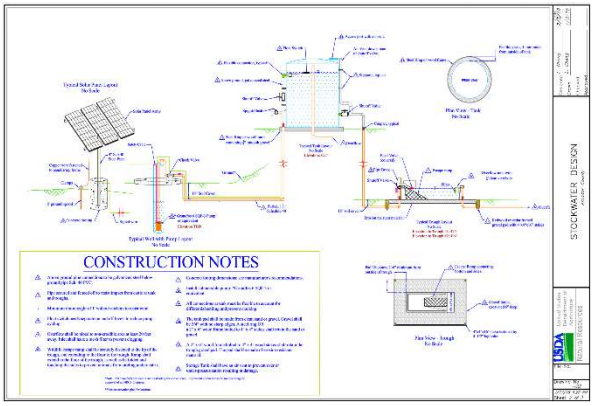



An important part of an irrigation system is the filtration station. The filter station is where water gets filtered before being pumped to the field and includes the chemigation system. NRCS requires that a filter station include pressure release valves in case of emergency, a pressure gauge both upstream and

downstream filtration, a flow meter and a chemigation check valve to prevent chemicals from back flushing into the water source. In the second picture from the left, the filter station was missing a chemigation check valve. The third picture displays a sand media filter station which are popular in the central valley because they can filter finer grains such as silt and clay which is important for drip irrigation. The last picture shows a pressure gauge with and expected psi at the location of the pump of about 40.

Animal Stock Water Projects:

When cows remain in one location for a prolonged period they begin to harm the environment by over grazing and causing erosion. Meanwhile other areas of land could use some grazing. A preventative is to rotate the cattle across sections of land. To achieve this, stock water projects provide water for the cows in various location sections. The stock water projects that I worked on at NRCS utilized a gravity water system so, the tank had to be at a higher elevation than the trough. The slope between the two must allow the water to accumulate enough velocity to fill the trough. During the first planning stage the client proposes a desired location for a tank and trough. The engineer then tries to get as close to that location as possible with the necessary slope. Using the ArcMap software an engineer can view a profile of elevation along a selected path between two locations and measure the actual distance between them. This distance is used to estimate the amount of pipe needed. Below is an example of a plan for a tank connected to two troughs.

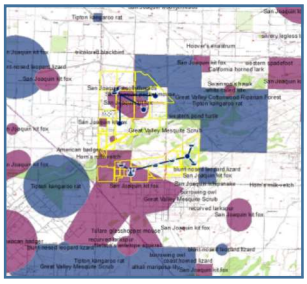


The picture above and to the right is an example of a trough design. Not every trough uses all these features. This design is general and is adjusted to each job. The USDA requires that all troughs have a concrete slab to prevent erosion from livestock and provide support for the structure. Both tank and trough must have an overflow pipe so that overflowing water can be distributed to a non-erodible area and prevent clogging. An escape ramp is required by NRCS so that animals trapped inside the trough can get out.

Irrometer:

NRCS works closely with Irrometer because they provide technology for farmers to understand the moisture levels of their crop. Sensors are placed at different depths throughout a crop field to monitor the moister level. The company recently released an online software where the user can view the status of their crop. To receive funding, NRCS requires that the client install a minimum of 6 soil sensors and that they submit the first annual report.



The picture above is a moisture sensor and a monitor. The sensor is equipped with a pressure gauge which reads the level of water suction on the sensor.

Endangered Species:

I learned that the Central Valley is a “hot spot” for many endangered species. Many habitats in the central valley are unique and cannot be found elsewhere. In Tulare County, some of the most encountered endangered species are the Kangaroo rat, the Blunt-nosed leopard lizard – displayed above, and the Kit Fox. This will affect the work of an engineer at NRCS because it is also the responsibility of the engineer to protect these species and their habitats during construction. The local biologist, Jesse Bahm, informed us about endangered species in the central valley as well as how to protect them. The CNDDB database displayed above and to the right is used to track habitats of endangered species. Often an engineer will need to adjust design or implementation plans to protect these species.

Conclusion:

Working at NRCS as an intern was an excellent learning experience and will be beneficial to any future career I work in. I will continue to use technical skills learned here such as working with various computer programs to complete a job, inspecting job sites, and communicating with various people on a project. I value the knowledge that I gained about the conservation efforts in the central valley as well as the agriculture community. This understanding has given me a sense of greater connectedness to the local community which I think is an important aspect of any job or career that is sometimes overlooked.

This internship has advanced my skills by presenting me with real world experience. An important difference between working on a project at school and working at on a real-world job is the interface between the engineer’s end goals and the end goals of others involved in the project. In school we work in a team who share the same end goal and don’t generally get input from others who want something different. The process of executing a project in the field is different than executing a project in school because from start to finish we have the customer’s requests and needs in mind along with our conservation goal. Jobs that seem strait forward in the field may have unexpected challenges if the customer has different goals. This can sometimes be a barrier and require compromise on behalf of design and implementation. While it is important to accommodate to the customer’s requests, it is equally as important to remain committed to the conservation goals that are the initial reasons for getting involved with the client.

I found this relationship interesting and I plan to use what I learned at NRCS this summer as a basis to continue to learn more and improve upon my collaborative skills. From my experience this summer I feel that I can be a more effective engineer if I am able to accommodate my projects and my goals to the

needs of others. In many cases, my own goals can be improved by those of others just the way our biologist, Jesse was able to expand our knowledge of endangered species conservation efforts and the Irrometer team was able to provide a specialized technology that will make the engineer's job easier and more efficient. While I always worked well in teams I typically preferred to work alone. However, as I realized the benefit and importance of the input of others I have since put efforts into getting out of my comfort zone and working with others. This includes projects, studying, and social activities. I'm grateful to have had the opportunity to work with the NRCS and will continue to grow upon the skills I learned with the engineering team.

AKNOWLEDGMENTS

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