General Information Aligned with Grand Canyon High School Master Drainage Study Background

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February 1st, 2018

CENE 476C - 001

Senior Capstone Course for Civil and Environmental Engineering - Design for Practice

NORTHERN ARIZONA UNIVERSITY

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Nomenclature

Acronyms:

GCHS: Grand Canyon High School

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1.0 Description of Technical Aspect

Every Project, goal, or plan has technical aspects that are needed to ensure the quality and completion of the job. Technical aspects for a master drainage sites includes the expertise of environmental, civil, and sometimes geotechnical engineers. Pre-existing conditions, hydrology, hydraulics, and surveying are the background technical aspects needed.

1.1 Pre-Existing Conditions

Initial conditions of the site and project are needed to gain a complete understanding of the full task. Depending on the solution needed, a fix, a repair, or a complete new design idea are applicable. For future drainage study work, the research will include the following conditions [3, 5, 6]:

1. Location and contour maps of the area
2. Location and design of current system
3. Plats from city records displaying property boundaries and utility location
4. FEMA 100-year flood data
5. USGS previously determined drainage areas
6. Areas of concern observed by client
7. Rainfall data, intensity, frequency, etc.
8. Every inlet and outlet of local streams, rivers, tributaries, etc.
9. Locations of infrastructure or bridges, dams, levees, etc.

1.2 Hydrology Application

Hydrology is directly concerned with the properties of water and how it interacts with land. This can include surface runoff, infiltration, evapotranspiration, etc. What goes in, must come out, and knowing its form or state is important to the water cycle and analysis. EPA standards must be followed for runoff and discharge from the site and its vicinity. Regulations can be found online at epa.gov. Quality testing will be done to ensure no contaminants from the new system are leaching into the water and traveling downstream. Because there is little to no treatment in storm water drainage, typical screen and basin percolation is commonly practiced [3,4]. Storm water detention sites, basins, and other structures will need to be identified and evaluated for volume and retention time. Continuous testing should be done to ensure safety of downstream consumers, if applicable.

1.3 Hydraulics Application

Hydraulics concerns using a mechanical force to convey water through pressurized pipes, open channels, and unpressurized pipes. Common practices of this include potable, non-potable, sanitary, and sewer systems. Most drainage studies require a hydraulic study to remove the water from the problem areas and safely transport it from the site into the requested place. A proper hydraulic system will safely transport the required flow expected without failure. Safety factors, friction losses, total energy and cavitation problems are analyzed for each system independently during the design phase. Furthermore, analysis of discharge and velocity will dictate choice of pumps and dimension of pipe required throughout system [1, 4]. Microsoft excel will aid in the analysis of pump selection, and placement, i.e. in series or parallel. Some of the equations that will be utilized are Darcy Weisbach, Hazen - Williams, and the energy equation.

1.4 Surveying

An accurate survey greatly aides in the creation of accurate models and maps. Some of these maps include topographic, vicinity, county, problem areas, and just general location data of the site. New survey technology allows for aerial mapping with lidar that can create digital terrain models [2, 5]. Surveying in general can make or break a project. Information being created off of a poor survey can lead to unnecessary excavation, elevation issues, or boundary disputes [1, 3, 5]. A total station or auto level are the equipment of choice for an accurate survey. Without surveying, nothing would have coordinates, a place, or direction. Information and data gathered in the field will be implemented into Civil 3D for the creation of maps.

2.0 Additional Data

Being well versed and educated within your project and field before you begin is expected. Regulations, laws, and acts govern and dictate the design and implementation process of urban infrastructure. Computer software and tools are used to analyze and create a sustainable working product based on regulations and needs of the client.

2.1 Regulations

This project needs to acquire knowledge of the county, city, state, federal, and any other regulations that the GCHS follows. Discharge laws, acts, and compliances will guide the project design and implementation. The client will be helpful in determining which regulation is required for this project after initial research for clarification. Regulations can be found online and within the correct housing offices [3, 6].

2.2 Computer Software

Computer software that may be used to design the master drainage will be beneficial in selecting pipes, designing channels, and mapping the area. Software also aids in data collection, tabulation, and simulation scenario analysis. Tools can be the most accurate form of data collection when used in accordance with codes and proper instruction. The software and tools that may be utilized include:

1. AutoCAD [3,4] - AutoCAD will be used to design a drainage system that would help to design the needed inlets and outlets of the entire way.
2. Civil 3D [3,4] - Civil 3D will be used to create the needed topographic of the entire area after collecting the needed data from surveying and designing the water's pathway in the entire area.
3. HEC-RAS [3] - HEC-RAS will be used to design the channels of the storm water, designing pipes, and selecting the needed pipes throw the entire pathway.
4. 4. Microsoft Excel [3] - Microsoft excel is used in complex and simple analysis of rainfall data, water transport systems, and ensures quality results.
5. Auto Level - An Auto level is a piece of surveying equipment that reads or establishes points of interest along one plane. A base shot is used as reference when taking the rest of the survey.
6. Total Station - A total station is a form of surveying equipment that incorporates an electronic theodolite with an electronic distance reader. These report back information about slopes, distances, elevations, and are extremely important.

3.0 Conclusion and recommendations

Different projects and goals have very different technical aspects. Building a skyscraper in California is a completely different skillset than in New York. Engineers must be well versed and educated within their field of practice. A substantial knowledge in surveying, hydraulics, and hydrology are needed to ensure the completion of the GCHS project. A visit to the client's site and exploration of exact details is heavily needed to further analysis and the project.

4.0 References

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[4] L. North star Hydro, "Final Drainage Design Report," FST, Inc., Route 302, Fryeburg – Bridgton, Maine, April, 2014

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