Final WREP Report

Flood Discharge Analysis

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Over the last six months the goal of the Flagstaff flood discharge project was to monitor, build and model crest stage gauges around Flagstaff. These crest stage gauges measured the maximum height for flood occurrences around Flagstaff from mid-July to Early December 2011. This project was a continuation of a previous endeavor which began earlier in January 2011 when two of my fellow geography undergraduate classmates built an initial system of six crest stage gauges around Flagstaff (Appendix A: Previously Built Gauges). A large portion of my job for this project was to monitor and maintenance these 6 crest stage gauges. This would include collecting flood height measurements from the gauges after every significant precipitation occurrence during the project period specified above (Appendix B).

The measuring process was simple. Each crest gauge contained a wooden dowel and granulated cork. When the crest gauges flooded the cork would stick to the wooden dowel making a distinct line at the maximum height of the flood. This dowel would be removed and then measured from the bottom to the cork line. This measurement would then be recorded as the maximum height of the most recent flood to occur around that specific gauge. Once the measuring process was completed the gauge was refilled with cork and the cork from the previous measurement was wiped off of the dowel. The gauge would then be checked for stability and all debris which could potentially prevent water from entering the gauge was removed. This was done several times over the duration of the project.

Once funding was received in October the new system of 4 gauges was built over 2 months (Appendix A: Gauges Built For Grant). The first step in building the gauges was finding proper locations for their construction. The factors that went into finding suitable locations for the gauges were accessibility, the existence of a culvert, flooding potential and the feasibility of constructing the gauge on the culvert. Pictures were taken of potential gauge locations all over Flagstaff from far west route 66 to a few miles up the 180. Once data was collected I met with my project mentor Dr. Schiefer and the

four locations were chosen one by one over a series of weeks. Once the proper tools and materials were purchased the gauges could be constructed. Two of the gauges could be simply drilled into the culvers, but the other two needed a wood spacing system to be created in order for the gauges to be implemented correctly. Once the design of the culverts and spacing system had been created construction could be completed. Caps for the gauges were then drilled and dowels were cut to size. Once these last components were implemented and cork was added the gauges were ready for future measurements.

The last component of my project was modeling the crest gauges using GIS. Point shapefiles were created for former crest gauges used by the USGS around Flagstaff as well as shapefiles of more advanced flood gauges currently placed around Flagstaff by the USGS. The historical data of flood measurements from these gauges were added to the shapefiles as well. Shapefiles were also created for the six gauges I monitored over the course of the project and the four gauges I built. The six gauges I monitored have the measurement data implemented, but the four new gauges have no information associated with them because they have just been recently built and have not been monitored.

The information gathered in the project will be used to analyze flooding patterns in Flagstaff. Because there is so little data no conclusions or analysis can be done as for now. Once a few years of data has been collected an analysis will be appropriate. Correlations between precipitation and flooding conditions for certain crest gauge areas can then be made. The shapefiles created can be used to visually represent these analyses and spatial statistics can further help the conclusions made by this project.

In conclusion this project has monitored and expanded the crest gauge system of west side Flagstaff's watershed system as was the outset of the project. The hazards and importance of Flagstaff's flooding episodes are both great. The knowledge gained from using these monitoring tools will help

prevent damage and maintain harmony between humans and their local water ways. The entire scope of the larger Flagstaff discharge analysis project has really just begun. More gauges need to be built and many more seasons of monitoring must be completed. I hope in the future other geography students like myself could continue this endeavor and get a chance at taking part in such a comprehensive project. I hope that WREP will choose to support the student who will take the reins of this project next year for the NAU Geography Department. I look forward to presenting my work at the undergraduate research conference this spring at NAU and thank WREP for their funding which has given me a chance to get valuable hands on experience in applied physical geography.

Appendix

A.

Previously Built Gauges Monitored For Grant	**LAT**	**LON**
Rio de Flag at Hidden Hollow	35° 14’ 31.01” N	111° 41’ 04.21” W
Schultz Creek	35° 13’ 07.06” N	111° 39’ 31.54” W
Rio de Flag at Crescent	35° 13’ 18.67” N	111° 39’ 25.77” W
Rio de Flag at Benton	35° 11’ 41.15” N	111° 38’ 59.99” W
Bow and Arrow Wash	35° 10’ 44.63” N	111° 39’ 28.50” W
Sinclair Wash	35° 10’ 05.60” N	111° 38’ 45.62” W
Gauges Built For Grant	**LAT**	**LON**
Longview and Green Briar	35° 11’ 28.68” N	111° 40’ 07.58” W
Rio de Flag at San Fran and Butler	35° 11’ 34.91” N	111° 39’ 00.44” W
Rio de Flag at Cherry and Kendrick	35° 11’ 05.44” N	111° 40’ 07.58” W
Rio de Flag at Boldt and Fremont	35° 11’ 14.39” N	111° 40’ 07.58” W

B.

Flood Measures (cm)						
Date	**Hidden Hollow**	**Shultz Creek**	**Crescent**	**Benton**	**Bow and Arrow Wash**	**Sinclare Wash**
7/16/2011	3.3	1.6	0	43.3	N/A	N/A
7/22/2011	1.2	2.8	0	49.8	26.1	5.2
7/31/2011	0	0	0	33.6	94.4	1.2
8/7/2011	0	5.4	0	33.2	44.2	0
8/19/2011	1	3.4	0	104.1	75.1	22.5
9/19/2011	3.1	3.2	0	68.1	87.2	37
10/29/2011	0	0	0	40.8	81	4.6
12/14/2011	0	0	0	32.7	62.2	0