**Pullman Flood Protection Memo**

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TO:

FROM:

DATE:

SUBJECT: Pullman Flood Protection Memo

**Introduction**

Increasing urban development creates the challenge of controlling flooding after a rainfall event. Urban development increases the area covered by impervious surfaces, which increases the volume that requires runoff surfaces and it reduces the infiltration volumes. Thus, in urban areas, there is need to install storm sewers and to realign and channel natural streams resulting in rapid transmission of runoff from impervious surfaces. Where control is lacking, it is likely that downstream areas will flood following a rainfall event due to higher peak discharge rate, which is an inevitable consequence.

The engineering question that this memo seeks to answer relates to the effect that rainfall variability has in creating flash floods in light of such other significant variables as surface properties of urban land such as management infrastructure for storm water, the current network of storm drainage, and the soil moisture. The study will seek to evaluate the storm event response in Downtown Pullman in Washington State, which is particularly vulnerable to flash floods.

**Site and Event Description**

The project area is the Pullman area in Whitman County in the Washington State. Pullman flooded twice in 2019 after about one hour of rain, and the problem is most severe in Downtown Pullman, which is particularly vulnerable to flooding. Braun (2017) traces the history of flooding in Pullman to 1910, when Downtown Pullman suffered a severe flood. Pullman covers an area of 25.59 square kilometers of land. This memo proposes a hydrologic response suited for a storm event. A hydrologic response refers to the reaction of a catchment area when subjected to a rainfall event. The goal of the hydrologic response is peak management of storm events.

**Methods**

The study will use the Gridded Surface Subsurface Hydrologic Analysis (GSSHA), which is a “gridded, distributed, and physically based hydrologic model” (Yang, Smith, Baeck, and Zhang, 2016, 4572). The model has been employed effectively in studies of urban flooding over numerous settings. The model gives the capability to use 2-D representation of overland flow and 1-D routing of hydraulic streamflow routing in drainage and grid-based infiltration systems (Yang et al., 2016). The study will also use the HEC-HMS model, which will help in simulating a storm event and a rainfall-runoff and it will help to generate broad ranging options (Borah, 2011).

The study will need data from the Pullman and Wichita County administrative offices. Some of the data needed will include engineering design drawings of the infrastructure in Downtown Pullman designed to handle storm water including the drainage system and the water detention basins. Sharif, Al-Zahrani, and Hassan (2017) show that GSSHA is superior to HEC-HMS in evaluating effect that structures for flood control have in stream discharge and in simulating extreme events using standard parameters

**Expected results**

The study hopes to establish the rainfall-off relationship between the hourly rate of rainfall and the peak discharge of the Pullman area. The study will also look at the efficiency of storm drainage networks. The analysis hopes to determine whether there are capacity constraints in the Pullman area, especially the Downtown Pullman area

**Timeline and Work Plan**

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| Activity | Timeline  | Goal |
| * Data collection
* Hydrometereological
* Parameters GSSHA Model
 | February – March 2020 | * Collecting appropriate data from the various sources is critical to running credible simulations
* The paramaters serve as indicators that will ensure that the study meets its objectives
* Calibration of the model
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| * Data analysis
 | March – April 2020 | * Performing the simulations based on data and reporting on results
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| * Final report
 | April – May 2020 | * Presenting the final comprehensive report including problem statement, methodology, results, and recommendations
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References

Borah, D. K. (2011). Hydrologic procedures of storm event watershed models: a comprehensive review and comparison. *Hydrological Processes, 25*(22), 3472–3489. doi:10.1002/hyp.8075

Braun, M. (2017). History of downtown Pullman. *The Daily Evergreen*. Retrieved from <https://dailyevergreen.com/5729/mint/history-of-downtown-pullman/>

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