Kendall Hill
UROP Narrative

Evaluation of the Maroon Lot stormwater detention pond: Thermal impact reduction through infiltration

1. Discussion and Summary

The study monitored rainfall events during August and September 2019. The recorded variables include total precipitation, runoff from the M2 Parking Lot, discharge from the M2 Detention Pond, flow in Tischer Creek, and temperatures of all measured flows. Figure 1 shows the hydrograph for stormwater runoff during the rain event on August 26th, 2019; the measured inflow and outflow volumes for the detention pond are 97.3 m^3 and 98.7 m^3 respectively. The difference of 1.4 m^3 is the smallest observed during this study. It is possible that water retained in the detention pond that is discharged later may have caused discrepancies in measured inflow and outflow volumes.

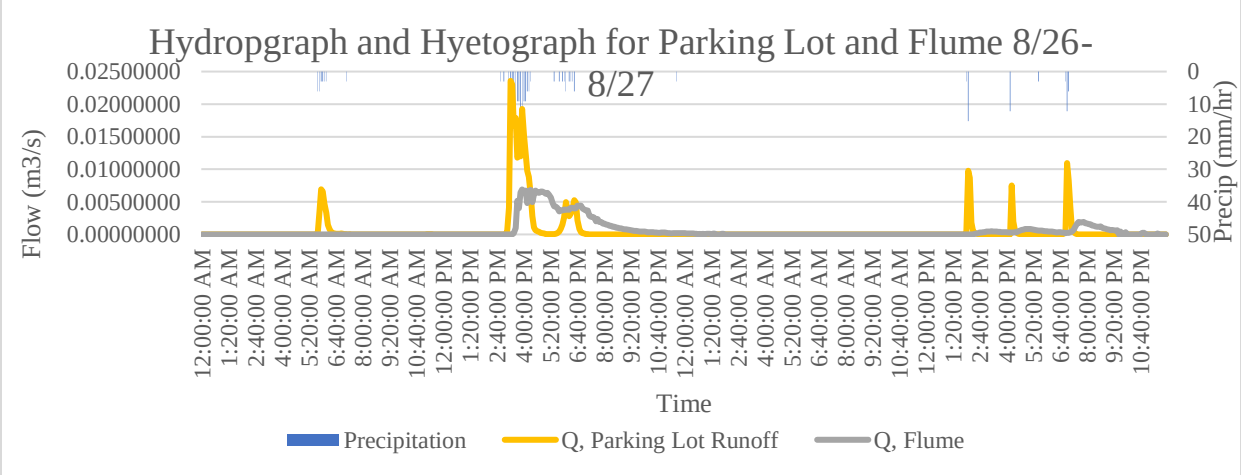

Figure 1: Hydrograph and Hyetograph for the Parking Lot and Flume on August 26th, 2019.

The thermal impact of the detention pond using Equations 1, 2, and 3 turned out to be negligible. The temperature increase from the parking lot runoff and the pond outflow in Tischer Creek is less than .1 ºC for all observed rain events. However, the pond yielded a 1.1 ºC reduction in average runoff temperature for two storm events. An increase in runoff temperature occurred for

two storm events on especially cold days where the sand media of the detention pond still retained significant thermal energy. The value for average flow temperature is obtained by modifying Equations 1 and 2 from the initial proposal methods to determine an average temperature from the parking lot and an average temperature from the pond given by Equation 4.

Average Runoff Temperature: $T = Q_i T_i Q_i$ (Equation 4)

Q_i = Flow at time i

T_i = Temperature at time i

In addition, the study monitored the temperature of the detention pond profile to observe the energy transfer between stormwater and the sand media. Stormwater enters the pond on the edge near the M2 lot and infiltrates directly to the impermeable bottom of the pond and moves horizontally through the media. Thus, the thermal sensors at the bottom of the pond recorded a thermal change before the sensors near the surface. The study also showed significant thermal fluctuations in the top 20cm of the pond media which indicates that this layer of media is most susceptible to thermal radiation. For ponds with adequate storage volume, this top layer could serve as a buffer to insulate the rest of the pond from fluctuations due to solar radiation.