

HEC-HMS is a computer model which is a mathematical representation of the physical world. The ability of that model to accurately represent the real world depends on the parameters used in the model. One important parameter used in the model is the curve number which describes the relationship between rainfall and subsequent runoff in both timing of runoff and runoff volume.

Ascenté claims in their application that no additional soil will be imported in the project area. They also claim that the soils on site consist of mostly D soils with some C soils intermixed. However, in determining the curve number for subbasins, they show quite a bit of C soils with some A soils and B soils. Assigning these more permeable soils to the subbasins results in a lower overall curve number for those basins which results in the model predicting more lag time in runoff and less overall runoff from any given storm event. Ascenté determined composite curve number for all of their subbasins which is allowable in the Truckee Meadows Drainage Manual; however, they did not assign any of the area to impermeable surfaces. Model guidance says if streets and associated impermeable surfaces such as sidewalks and driveways are directly connected to a storm water drainage system that percentage of the subbasin should be assigned to impermeable surface. The unconnected impermeable surface such as roofs and patio area is dealt with by proportionally assigning the curve number associated with developed urban areas.

#### Detention Basins

North detention basins 1 and 2 drain to north detention basin 3, they only act as a delaying mechanism. In the model north detention basin 3, the main storage basin for the Sierra and Tioga subdivisions, the outlet is set at 6 feet below land surface. They also set initial outflow equal to inflow. How does setting these parameters in the model effect the prediction of capacity and peak discharge from this detention basin? In the real world outflow only occurs over the spillway which is set at the proper elevation in the model.

In the Conceptual Drainage Report, Ascenté states that outflow from North Detention Basin 3 flows directly onto Cedarwood Drive. The Basin features a 3 foot diameter outflow pipe for minor flow events and a 90 foot wide broad crested weir for major storm events. They also state that existing flow from this area flow through an “existing network of drainage channels and pipes towards Galena Creek. In reality the “Existing Network” is very poorly defined. Prior to the Estates at Mount Rose being developed there was little runoff from this area. Shortly after the roads, drainage system and detention basins for the Estates At Mount Rose were completed in the mid 2000's, several of the detentions basins overflowed and caused wide spread flooding in Callahan Ranch from Callahan Road to the base of the Steamboat Hills. Washoe County with taxpayer's dollars installed a storm water drainage system on Callahan road which delivered storm water from the western detention basin of Estates at Mount Rose to Jones Creek. Washoe County also made some repairs to storm water drains near the Steamboat hills, However, they could not fix drainage problems on private property even though these problems did not exist prior to the Estates of Mount Rose being developed. Now storm water from The Estates at Mount Rose south-eastern basin combined with storm water drainage from the flats south of Fawn Lane cause storm water drainage problems at the base of the Steamboat Hills. Reviewing historic images on Goggle Earth shows how runoff from the flat area South of Fawn Lane has been concentrated and directed to

Cedarwood Drive by off road drivers climbing the hill to the area where the proposed Tioga subdivisions is located. This concentrated flow has cause problems since the mid-2000. The poorly defined “existing drainage network” is already at capacity.

For example during mid-October of this year we received what amounts to a 5 year storm. See the chart below. During this event I took photos of runoff from this event at several locations along this poorly defined network of drainage.

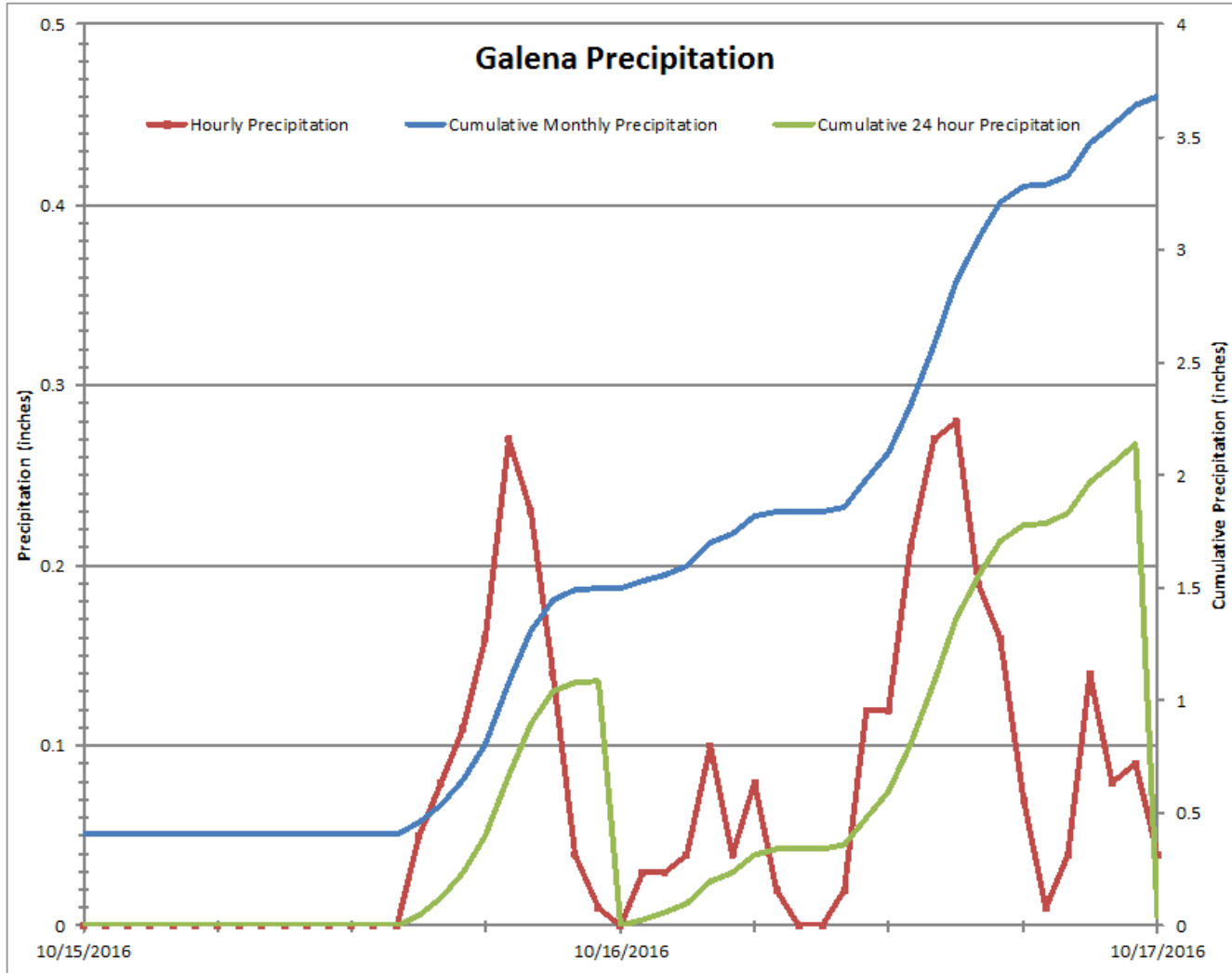


Figure 1 Precipitation from the Galena RAWS station. (Source; Western Regional Climate Center)

The first photography was taken at the outflow from the flats at the south end of Fawn Lane onto Cedarwood Drive. This photo was taken at 8:27 in the morning on the 16<sup>th</sup> of October after about 1.4 inches rain.



Photograph 1 Cedarwood Drive 10/16/2016 08:27. Detention Basin 3 will be located in the background towards the left side of the photograph

The next Photograph was taken at 1:38 P.M. where storm water drains from private property into a newly installed storm water drain system on Shawna Lane. This photo was taken after 2.2 inches of rain



Photograph 2 October 16, 2016 1:58P.M. Storm water Drainage on private property adjacent to Shawna Lane from the flats south of Fawn Lane.

The next photograph was taken at the same location and the same time looking toward the west where drainage goes under the driveway. Storm water then goes under Shawna Lane to the drainage ditch along the east side of Millie Lane.



Photograph 3. Storm water drainage on Shawna Lane. Photograph Taken on 10/16/2016 2:01 P.M.

The next two Photographs were taken from the same place as the preceding two photographs at 5:30 that evening after 2.64 inches of precipitation. This was the peak discharge observed at this site from this precipitation event. It can be seen in the plot of precipitation that the intensity of precipitation started dropping off in late afternoon on the 16<sup>th</sup> of October.



Photograph 4 10/16/2016 5:30 P.M.



Photograph 5 10/16/2016 5:30 P.M. Note that the culvert under the driveway is complete filled.

This photograph shows that the drainage system is at capacity in this area. Any additional runoff will flow on the surface across Shawna Lane and then flood several yards of houses on Millie Lane.

The last Photograph is taken 20 feet upstream of Photographs 2 and 4 also taken at 5:30 P.M. This photograph shows flooding on private property from this storm event.



Photograph 6 10/16/2016 5:30 P.M.

With these photographs I tried to illustrate one area where the storm water drainage system is inadequate to accommodate additional flow from storm water. There are many more properties that are affected by storm water drainage from this area and will be greatly affected if the concentrated storm water runoff from Ascenté is dumped on to Cedarwood drive. In addition during this storm event the detention basin at the south east corner of the Estates at Mount Rose did not fill and overflow as it sometimes does during winter months.

I hope I also illustrated that the HEC-HMS model did not accurately represent model outflow from a 5 year event. The existing modeled scenario predicts that during a 5 year event, discharge from the flats at the south end of Fawn Lane should produce 21.3 cfs. From Photograph 4 it can be clearly seen that this event produced something on the order of 2 cfs or less.

The final fate of storm water that drains from the detention pond at the south east corner of the Estates at Mount Rose and the flats at the south end of Fawn Lane is an unidentified detention basin at the end of Millie Lane. This detention basin has a very large capacity, however it is very old. If it was not there this storm water discharge would flood an additional two properties prior to entering Galena Creek.



In figures C3.0 thru C3.3 Ascenté claims that snow storage areas will be the detentions basins and common open space. If snow is stored in the detention basins there will be no storage capacity for storm water flows. This proposed development is located between 5470 ft. and 5760 ft. elevation. We do get snow here that often can persist throughout the winter. Snow removal and storage is an issue with this project. Currently Washoe County most often uses a sanding truck with a plow affixed to the front. They have a difficult time plowing cul-de-sacs, I know since I live on one. Often they make a straight plowing approach and push snow between driveways. They occasionally come back several days after the storm with an articulating loader to clean up the cul-de-sacs. I have never seen the county come in with a loader and dump truck like they would have to do in the Ascenté subdivision with their numerous cul-de-sacs, high density housing with no snow storage adjacent to the roads. The county will need to spend the entire road impact fee of 1.2 million on new equipment just to remove snow from the Ascenté subdivision.

In conclusion I hope that Washoe County engineers take a very careful look at the rainfall/runoff model that ascent constructed to estimate runoff from the existing conditions as well as the proposed subdivision. It would also be useful to do a sensitivity analyses of some of the more critical parameters used in the model such as the composite curve number and impermeable surface. Ascenté should be responsible to create a drainage system through the existing subdivision to mitigate future flooding that this subdivision will cause. Ascenté needs to designate snow storage areas in the subdivision.

One other word on roads. Ascenté proposes using existing subdivision roads for egress. The Matera Ridge Overlay District was approved with the idea that they would build the road from Thomas Creek for their egress. The roads in question, Fawn Lane, Shawna Lane, Cherrywood, Goldenrod Drive, Cedarwood Drive, Wildwood Drive, and Tannerwood Drive, were not built with this density of development, when they were built there was a 1 acre minimum zoning in place. With the addition of these 281 homes the design of these roads is inadequate. There are no sidewalks, no school bus loading zones. These roads were not designed for this type of use. If Washoe County approves this tentative subdivision the developer should be required to install a drainage system on these roads and provide at a minimum of gravel walkways where the storm water drainage ditches now exist. Although this will reduce groundwater recharge and increase storm water runoff, it will at least provide some pedestrian safety for the existing residents.