When creating an evacuation model for an area there are a few general aspects needing to be addressed. They range from vital details directly affecting the design of the evacuation model to other aspects that should be considered in the event of an actual evacuation. While the latter may not be affected by the model, it’s still important to understand and use the output of the study to help address them. However, in some cases the output of the model can help give insight into planning an evacuation.

The problem attempting to be solved is the balance of flow through a network, including such aspects as traffic flow, density, and speed (Shirke et al., 1982). Through the use of GIS software, keeping track of these metrics is easier and more effective. More importantly, being able to understand this information ahead of time allows for planning instead of waiting for a crisis event to establish evacuation zones or other safe areas (Murray-Tuite et al., 2013; Ma et al., 2012).

The area of focus is the Pocket area of Sacramento as well as the road network leading into and out of the area. The study site was limited to a couple hundred feet west of Interstate 5 allowing estimation of traffic flow out of the area. The natural border of the river levee provides the remaining boundary of the study area. The Sacramento River levee contains the neighborhood like a bowl. This forces all evacuation in an eastward direction towards Interstate 5 and the area of south Sacramento. For the flood model, a break on the northern edge of the levee, about halfway across, will be taken into account. The lack of elevation change in the Pocket area allows flooding to cover a large amount of area in a short amount of time.

There are 10,945 individual residential locations and 27,975 vehicles. This is significantly larger due to apartment complexes accounting for hundreds of vehicles at a single “residential location.”

To create and run an evacuation model, ESRI ArcGIS software was utilized along with CASPER’s evacuation model software (Shahabi et al., 2014). To model the hypothetical evacuation in the Pocket Area – the decision to focus on an in-vehicle type of transportation was made since this neighborhood is mostly residential. Also, the study assumes all families will follow the “one car per family” rule (Bow and Cutter, 1998). To track how many vehicles will be utilizing the network, a recent dataset showing each parcel of residential property was collected from the Sacramento County Tax Assessor. Within this parcel data is a field called “units” which details the amount of individual living spaces, this was utilized to calculate the number of vehicles at each parcel.

To measure the amount of time it takes flooding to spread a Sacramento County hypothetical flood depth map was utilized and is shown in Figure 4. This map contains three “stages” of flooding across certain intervals of time showing the spread of water. By digitizing these, one can compare the amount of time it takes to evacuate against how long it takes flooding to reach them.

To keep the road network as accurate as possible, an ESRI generated United States Streets dataset was obtained. There were nine total safe zones created for the study:
1) Southbound I-5 from the southern edge of the Pocket area,
2) Pocket Road,
3) Florin Road,
4) 43rd Avenue,
5) Northbound I-5 from the northern edge of the Pocket area,
6) Riverside Boulevard,
7) Gloria Drive,
8) 56th Avenue, and
9) South Land Park Drive. These routes were chosen because they are all through streets leading directly out of the Pocket area.

After running the evacuation model, consideration of “cost” is achieved through a spatial join between the cost of each route taken and the overall time it takes for flood inundation to occur. After this, subtracting the evacuation time from flooding time shows which locations are able to evacuate. If this result is negative, then the location would not be able to leave the area in the allotted time.