

Tool: Hydrologic and Hydraulic (H&H) Modeling of the Stormwater System

A representation of watersheds within Wake County capable of predicting the water quantity response of local streams/rivers for existing and future land-use conditions and for various design storm events (1-yr, 2-yr, 10-yr, 25-yr, and 100-yr, 24-hr design storms).

What is a potential Task Force recommendation for implementation of the H&H modeling tool at the conclusion of this process?

Ultimately, a hydrologic and hydraulic model of each 14-digit Hydrologic Unit Code (HUC) boundary within the County would be developed for the purpose of establishing changes in the 100-year floodplain (elevations and depth of flow), evaluating the service levels at critical stream crossings (rate and volume of flow), determining the erosion potential of local streams (volume and velocity of flow), and identifying capital improvement projects that will maximize the existing system's capacity and conveyance capabilities. Areas to model will be prioritized based on existing and future growth pressures, public health and safety hazard potential, and environmental impact potential. The following two basins have been selected for the first round of study: 1) Richlands Creek and 2) Middle Creek (see attached for map of 14-digit HUC basins in Wake County).

Model Platform and Features - Existing modeling efforts within Wake County and its jurisdictions rely almost exclusively on HEC-HMS for hydrologic modeling and HEC-RAS for hydraulic modeling. Therefore, the proposed models will be developed using the HEC products to allow for seamless coordination with past modeling efforts.

Data Collection - The models will include detailed field surveys augmented with existing County GIS and LIDAR information to record topographic data and stream crossing characteristics. It may also be possible to coordinate survey data collection within these basins as local utilities extend water and sewer lines into the area. Survey data will include stream profiles and cross sections, floodplain delineations and information regarding stream crossings.

Modeling Scenarios - Each model will include an analysis of the following design storm events: 1-yr, 2-yr, 10-yr, 25-yr, and 100-yr, 24-hr design storms. The models will include existing and future, build-out conditions. Existing conditions will be determined from GIS data, planimetric maps and aerial photographs. Future, build-out conditions will be determined from parcel data, land use data and zoning data (see stakeholder section below for more information). In addition, modeling will consider future build-out with and without stormwater detention requirements.

Model Calibration - Temporary rainfall and stream gages will be installed in each basin where existing monitoring devices are not available in order to collection storm event information to be used for calibration of the models.

Model Updates – Each model will be updated at intervals to be determined with as-built and stormwater inventory information in order to maintain an accurate prediction of existing and future land use conditions as development occurs.

Model Application – The Task Force participated in a voting exercise during Meeting #9 to consider potential applications for the proposed models. The results from the voting exercise indicated that a majority of Task Force members prefer that models be used to review and approve proposed development projects (see stakeholders section below for more information). Other options for model applications included the following:

- Develop capital improvement plan of infrastructure capacity needs
- Use to develop future conditions floodplain maps for entire county, including areas previously unmapped by the FEMA floodplain program
- Identify areas prime to streambank erosion

Additional Stakeholders Process – Due to the complicated nature of some of the modeling decisions, an additional stakeholders process will be convened to provide decision making on the following items:

1. Land Use Assumptions and Scenarios for “Build-Out” Conditions
2. Potential Application of Model in Development Review Process
3. Impact of Modeling Output on Decisions Regarding Post Construction Runoff Controls (see Recommendation #2 for more information on Task Force post construction suggestions)

What problems identified by the Task Force (Objectives) does this tool address?

Used to address a wide variety of concerns (10 of the 14 Task Force objectives), including structural/roadway flooding, nuisance flooding, and sedimentation issues.

What is the minimum regulatory requirement, if any, for this tool?

As a function of their NPDES Phase I permit, the City of Raleigh is the only jurisdiction in Wake County required to develop H&H models. No such requirement exists for the remaining jurisdictions.

How is the H&H modeling tool currently applied within Wake County?

The City of Raleigh, Town of Holly Springs and the Town of Cary have developed H&H models for portions of their jurisdiction. In each case, the models are used primarily to predict existing and future flood impacts and potential streambank erosion issues (see

attached for map of completed studies). In addition, the NC Floodplain Mapping program has developed models to map existing and future condition floodplains in the County (see attached for mapping locations).

Is there an opportunity for collaboration on the implementation of this tool?

All jurisdictions may participate collaboratively on the development of this tool. The collaborative benefits include economies of scale in the cost of developing the models and the understanding of watershed conditions across political boundaries.

What is the expected outcome of this potential recommendation?

An asset management tool capable of identifying existing and future capital needs for stormwater. It will also provide the communities with a tool to assess the impacts of future projects and development as they relate to flooding (elevation and extent of floodplain), streambank erosion, and water quality conditions. In addition, the modeling will assist the development of risk assessments for the maintenance activities identified in Recommendation #5. Lastly, the tool can be used to test potential management scenarios/practices to assess their relative benefits/drawbacks.