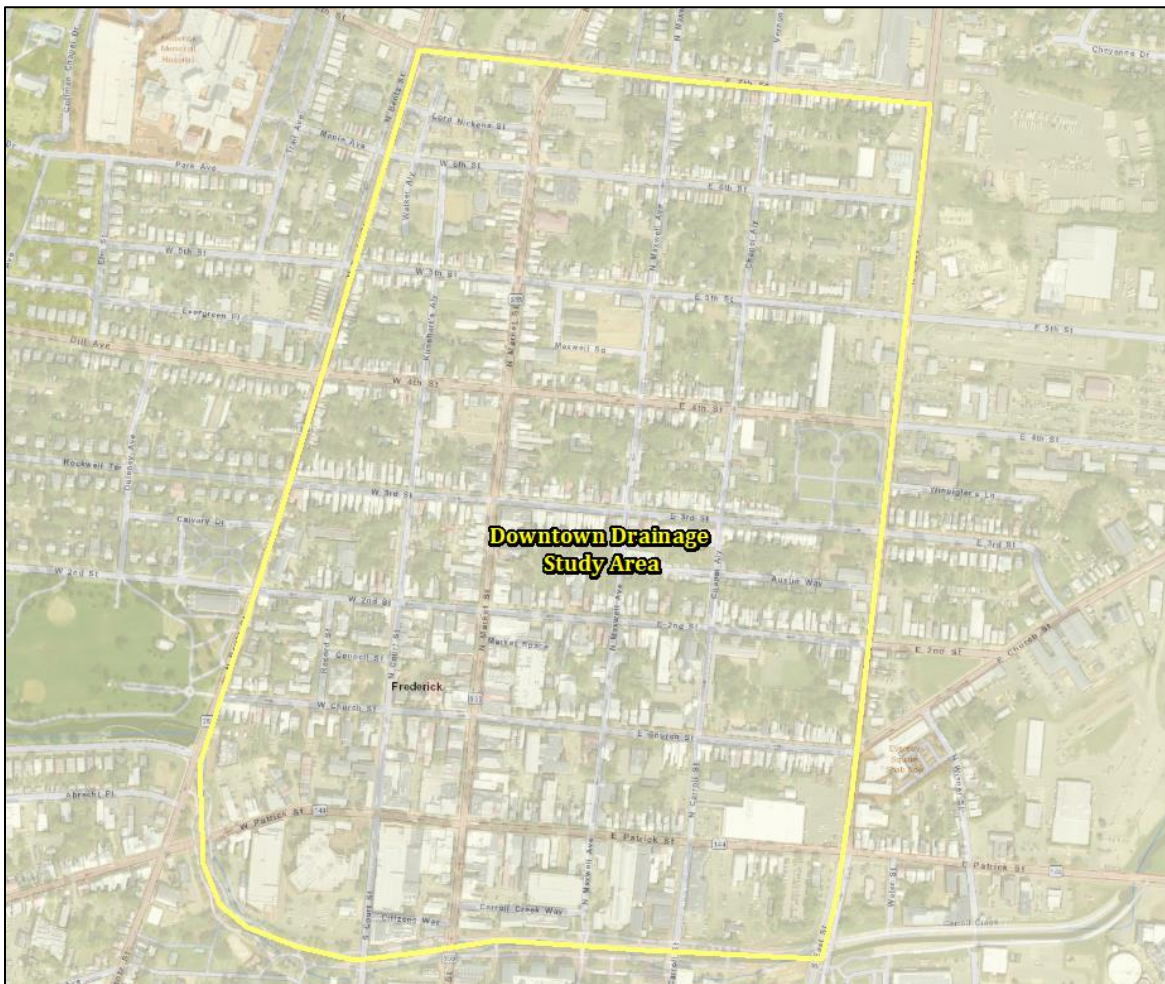


PLAN OF STUDY
Flood Resiliency Study for the City of Frederick
Task 5: Downtown Drainage Area Stormwater Improvements
Draft May 2019

TASK 5: DOWNTOWN DRAINAGE AREA STORMWATER IMPROVEMENTS

The purpose of this task is to provide the City of Frederick data to implement projects for the safe conveyance of stormwater to protect property and infrastructure in the downtown portion of the City of Frederick. The stormwater system in this location, the Downtown Drainage study area, ultimately outfalls to Carroll Creek via several stormwater outfalls. This area is generally bound by East Street on the east, 7th Street on the north, Bentz Street on the west, and Carroll Creek on the south (Figure 1).

Figure 1: Task 5 Study Area (Downtown Drainage)



USACE will complete a study to assess the drainage basin and calculate and analyze impacts of stormwater runoff for the 2, 10 and 100-year storms to the current built environment. Hydrologic and hydraulic analyses will also account for future growth and development within this area and any associated impacts. Areas which may lack sufficient infrastructure to safely convey the 10-year storm shall be identified along with recommended projects to address the potential flooding. Additionally, areas which are likely to experience catastrophic losses from the results of a 100-year storm event shall be identified along with opportunities to minimize those impacts through any combination of additional infrastructure, reduction in impervious area, or potential improvements to private property. In order to achieve these objectives, the following sub-tasks are proposed:

5A: Field Survey of Existing Stormwater System

Prior to the development of this Plan of Study, the City of Frederick has provided all existing data regarding the stormwater system within the study area. This data includes a Geographic Information System (GIS) database of the location of the existing inlets, manholes, and pipes. After review of this data, it was determined that additional field survey is required in order to capture data required for the stormwater modeling in Task 5B. The data absent from the GIS database is critical for the stormwater modeling, and this includes critical elevations of stormwater structures (top of structure, sump, and invert) and pipe slopes and material.

Using the City of Frederick GIS database as a base map, USACE will conduct a survey of the stormwater system within the study area using previous survey protocols for similar studies. Stormwater inlet, manhole, and pipe data will be collected to complete a comprehensive mapping layer(s), in GIS format, of the stormwater conveyance system to meet the objective of this investigation and support future stormwater modeling. The resultant layer(s) would include such stormwater features as inlets (curb, grate, and combination), manholes, headwalls (pipe inlets, pipe outlets, and outfalls), weirs, stormwater riser structures, stormwater pipes/open drainage, and other such features. The physical and conveyance condition of each feature (excluding underground pipes) would also be determined. At each feature, USACE will record the following information: Structure Type (Inlet, Manhole, Weir, Culvert, etc.); Physical and Conveyance Condition; Illicit Discharge; Inlet or Manhole Top Elevation and Sump Elevation; Length, Height, and Type of Grate (or Curb); Headwall Data for Culverts; Pipe Data (Size, Shape, Material, Direction of Flow, etc.). A photograph of all features will also be taken.

Real-Time Kinematic (RTK) Global Positioning System (GPS) technology will be used to collect elevation data to a desired level of accuracy. Top and invert elevations will be collected for all manholes, inlets, culverts, outfalls, and headwalls. Invert elevations will be determined by taking accurate measurements from the rim of the structure to the invert of all pipes. If issues with the equipment arise due to building shadow in the urbanized area, the most recent terrain data would be used to establish the top elevation or traditional differential leveling techniques will be used. USACE personnel will not enter the manholes. All data will be measured from the surface. The data collected in the field will be available as GIS layers to support future tasks in this study. Separate layers will be created for stormwater structures (point files), stormwater pipes/open drainage (line files), and stormwater best management practices (BMPS) (polygon files). All data will be referenced to Maryland State Plane feet horizontal coordinate system and NAVD88 vertical datum.

Based upon the City of Frederick GIS database, it is estimated that no more than 400 structures will be surveyed in this task.

5B: Stormwater Modeling

The objective of this task is to develop stormwater modeling to identify/confirm the existing and future risk of stormwater flooding in the study area. USACE will develop stormwater modeling for the study area using XPSWMM, which is an integrated 1D-2D model that can simulate complex piping networks such as the system in the study area. The SWMM runoff method would be utilized in the hydrologic computation in the model. Input data for the SWMM runoff method includes drainage area, time of concentration, and percent impervious land. Using the best available terrain and land use data, these variables will be computed as part of this task and entered into the model.

The stormwater system data from the field survey outlined in Task 5A will be input into the model and the 1D hydraulic simulation will be completed. The 1D hydraulic model will be linked to the best available terrain data to compute the 2D flood areas as a result of insufficient system capacity. The model will be calibrated to known storm events wherever data exists to do so. This data would include rainfall data, flow rate data from outfalls, and flood area observations. The calibrated model would then be run for synthetic storm events to determine flood areas. It is anticipated that the model will be run for the 2-year, 10-year, and 100-year storms. Additional storms can be run at the request of the City of Frederick.

Once the calibrated existing-conditions model is completed, USACE will also input future growth and development plans in the study area into a future-conditions model to determine the potential impacts to flooding within the study area.

Outputs from the XPSWMM models would include numerical results (tables and reports), flood boundaries and depth grids, stormwater system profiles, and other results. Animations are also available as results from the XPSWMM model. USACE will coordinate with the City of Frederick to deliver the data in a useable format after the completion of the modeling.

5C: Development of Alternatives to Reduce Stormwater Flood Risk

The objective of this task is to develop alternatives for reducing the risk of stormwater related flooding within the study area. The models created in Task 5B will be used to assess the effectiveness of alternatives for improving the stormwater conveyance. Alternatives may include (but not limited to) flow diversions, new stormwater detention/retention facilities, retrofitting existing stormwater facilities, infrastructure improvements, Low Impact Development (LID), pump stations, or a combination thereof.

The alternatives developed may be considered individually or in combination with one another. USACE will develop planning-level conceptual plans and generalized construction cost estimates for the alternatives. The constraints to implementing the alternatives may exist and will be identified. The intent of this task is to provide the City of Frederick with a plan to use as a basis for future actions that are outside the authority of the PAS program. These actions include: designs for the selected recommended improvements including Construction Documents and

Specifications ready for bid; acquisition of required rights-of-way or easements; acquisition of required permits; and construction of selected recommended improvements.

5D: Report

USACE will prepare a technical report describing the methodology used and the results of the study. The report will contain (at a minimum): an introduction to the study area; methodology for the stormwater modeling; results of the analyses; hard-copy flood risk mapping; and description and planning-level drawings/diagrams for alternatives. This task also includes an independent quality control review.

All data will be provided digitally on a project disc. The project disc will contain all data produced in this study, including GIS data, modeling, a digital copy of the report, field notes/sheets, and photographs.

It is anticipated that USACE will provide the City of Frederick a draft report for review and comment. After the City of Frederick's review, USACE will incorporate comments into a final report.

SCHEDULE AND COST

It is estimated that it will take no more than 18 months to complete this effort after the receipt of funds. USACE estimates that the cost of this study will be \$145,000. The Federal portion of the study cost is \$72,500 and the non-Federal portion of the study cost is \$72,500.

ASSUMPTIONS

- The data produced will undergo an independent technical review prior to the issuance of final deliverables. This review will be conducted by an independent, qualified entity. Costs of this review are included in the total cost listed in Section V.
- The alternatives developed in this study are considered planning level. The documents, drawings, and cost-estimates are considered preliminary and further refinements/design will be required prior to implementing any alternatives developed as part of this investigation