



City of Harrisonburg, Virginia
Federal Emergency Management Agency
Cooperating Technical Community
Mapping Activity Statement

Agreement CTC00-1- Hydrologic and Hydraulic Analyses and Floodplain Mapping

In accordance with the Cooperating Technical Community (CTC) Memorandum of Agreement dated _____ between the City of Harrisonburg, Virginia and the Federal Emergency Management Agency (FEMA), Agreement CTC00-1 is as follows:

- 1. Objective and Scope:** The objective of this Mapping Activity is to develop detailed hydrologic and hydraulic analyses and floodplain and floodway mapping. Hydrologic analyses will be completed by the Norfolk District of the Corps of Engineers for approximately 30 square miles of drainage area under a separate FEMA contract. Final flows for use in hydraulic analysis will be based upon the Corps hydrologic study, subject to review and acceptance by FEMA and the City. Hydraulic analysis and floodplain mapping will be completed for approximately 21 linear miles of stream, including the following flooding sources: Blacks Run, Tributaries 1, 2, 3 & 4 of Blacks Run, Sunset Height Branch and West Fork Sunset Heights Branch. Hydraulic models will be prepared from improved information available at the City and existing FEMA models will be referenced. Letters of Map Revision (LOMR) will be prepared as identified problems can be resolved.

The expected result from the grant amount and community contribution established below at a minimum is to create hydraulics models from improved information, resolve ambiguities between these models. This is defined in more detail under *Milestone 3*. The completion of LOMRs leading to Physical Map Revisions (PMR) is the ultimate goal of this project but may require resources and time beyond the one-year scope of this agreement. Subsequent agreements will be considered pending the availability of FEMA funding and City resources.

GIS-based mapping techniques will be applied to develop digital GIS data sets in support of the floodplain mapping.

- 2. Period of Performance:** This Mapping Activity will begin on _____ and will proceed as defined herein under "Schedule and Milestones". This Mapping Activity may be terminated at the option of FEMA or The City of Harrisonburg in accordance with the provisions of the above referenced CTC Memorandum of Agreement.
- 3. Funding/Cost-Sharing:** For this Mapping Activity Statement, FEMA will provide funding in the amount of \$10,000 and City of Harrisonburg will provide professional services equal to the amount of \$10,000.
- 4. Standards:** The following standards and documents are relevant to this Mapping Activity:
 - Detailed hydrologic and hydraulic analyses and floodplain mapping will follow the standards set forth in FEMA 37, *Guidelines and Specifications for Study Contractors*

(January 1995) and Title 44 of the Code of Federal Regulations (CFR), Part 65. FEMA 37 is available at FEMA's web site at http://www.fema.gov/mit/tsd/EN_reg.htm.

- Computer models used for hydrologic and/or hydraulic analyses will meet the requirements of 44 CFR 65.6(a)(6) and be on FEMA's *Numerical Models Accepted by FEMA for NFIP Usage* (http://www.fema.gov/mit/tsd/EN_modl.htm).
 - Topographic mapping used to delineate floodplain and floodway boundaries will be of adequate scale and topographic definition to provide reasonable accuracy. Planimetric features will be compatible with the base map (with respect to horizontal accuracy) to be used by FEMA for Digital FIRM production. Topographic mapping taken from aerial photogrammetry or surveys will comply with the requirements of Appendix 4 of FEMA 37. The selection of the topographic mapping source to be used will be coordinated with the FEMA Project Officer prior to analysis and mapping.
 - Any levee or dike systems to be shown on the community's FIRM as providing protection from the 1% annual chance flood will comply with the requirements of 44 CFR 65.10. Chapter 7 of FEMA 37 provides guidelines for evaluating levee systems.
 - Flood elevations and floodplain and floodway boundaries will reasonably tie in to non-revised information in accordance with 44 CFR 65.6(a)(6).
 - The floodway will be established in accordance with 44 CFR 65.7, as well as any applicable state requirements.
 - Digital mapping will comply with the requirements of Chapter 9 and Appendix 7 of FEMA 37.
 - Automated data processing and modeling algorithms for GIS-based modeling and mapping will be documented and provided to ensure they are consistent with the standards outlined above. Digital data sets (such as elevation, basin, or land use data) will be documented and provided to FEMA for approval prior to performing the analysis to ensure they meet minimum requirements. If non-commercial (i.e., custom developed) software is used for the analysis, then full user documentation, technical algorithm documentation, and the software will be provided to FEMA for review prior to performing the scope of work.
 - Digital Elevation Models (DEMs) and field survey data will meet vertical accuracy requirements contained in Appendix 4 of FEMA 37.
5. **Products:** The City of Harrisonburg will make available items outlined in Chapter 11 of FEMA 37 in the Technical Support Data Notebook (TSDN) format. These include:
- Digital 1% and 0.2 % annual chance floodplain and floodway boundaries;
 - Digital profiles of the 10%, 2%, 1%, and 0.2% annual chance water surface elevations representing existing conditions;
 - Suggested Revisions to the Flood Insurance Study (FIS) report;
 - Floodway data tables;
 - Digital copies of all hydraulic modeling (input and output files); and
 - All back-up data used in the analyses or mapping.

For GIS-based modeling and mapping, the City of Harrisonburg will deliver all digital input and output data, intermediate data processing products, GIS data layers, and final products in the format of the DFIRM database structure.

6. Schedule and Milestones:

Milestone 1 (Scoping Phase): Upon completion, products for the first milestone will be provided to the FEMA Project Officer. These include:

- Annotated copies of effective FIRMs depicting limits of proposed study.
- Documentation of the proposed source of topographic data, including: scale; contour interval; source/methodology; date of survey/data collection; vertical and horizontal datums; and comparison of planimetric features with the Digital FIRM base map planned for use by FEMA.
- A written summary of the initial data research; proposed analysis methodologies; and a work plan.
- Documentation of digital data sets to be used (such as elevation, basin, and land use data). Full user documentation; technical description of methodologies and algorithms; and a copy of the source codes and custom-developed software applications for GIS-based modeling will also be provided.
- Copies of topographic maps depicting proposed cross section locations.

Milestone 2 (Hydrology Phase- Norfolk District, Corps of Engineers): Upon completion, products for the second milestone will be provided to the FEMA Project Officer. This includes draft hydrologic analyses in accordance with the TSDN format.

Milestone 3 (Hydraulics Phase): Upon completion, products for the third milestone will be provided to the FEMA Project Officer. These include the hydraulic models and sample floodplain mapping in accordance with TSDN format.

Year 1 Tasks:

- Compile all FEMA Flood Insurance Study hydraulic models and all accepted and submitted Letter of Map Revision Applications along with all applicable information available from the City
- Prepare HEC-RAS models of the available information noting and resolving ambiguities discovered and noting areas where significant information is needed, Lower Section of Black's Run, from southern corporate to just upstream of the crossing at US Route 11 (Main St) is the City's identified priority for year one, being approximately 4.5 miles.
- Develop a plan to acquire the needed information to improve the model
- Obtain additional information by way of field survey and other means to improve the hydraulic model for Lower Section of Black's Run.
- Evaluate the effects of the Norfolk District hydrology study on the hydraulic model for Lower Section of Black's Run
- Use the model to address identified problem areas of the effective Flood Insurance Study and Flood Insurance Rate Map for Lower Section of Black's Run and prepare Letters of

Map Revision application where necessary in anticipation of a future Flood Insurance Study.

- Draft map revisions sufficient for submittal with LOMRs for Lower Section of Black's Run

In Following Years:

- Obtain additional information by way of field survey and other means to improve the hydraulic models for the other identified streams.
- Evaluate the effects of the Norfolk District hydrology study on the improved hydraulic models for the other identified streams
- Use the model to address identified problem areas for the other identified streams of the effective Flood Insurance Study and Flood Insurance Rate Map and prepare Letters of Map Revision application where necessary in anticipation of a future Flood Insurance Study.
- Draft map revisions sufficient for submittal with LOMRs for the other identified streams

Milestone 4 (Final Products): Upon completion, final products will be provided to the FEMA Project Officer. These include:

- The completed TSDN and accompanying data containing the information outlined in Section 5 of this Mapping Activity Statement.
- A QA/QC report documenting the results of the independent review of all computational and data processing procedures.

Final products will be made available in accordance with the Period of Performance described in Section 2 of this Mapping Activity Statement.

- 7. Certification:** The following certifications apply to this Mapping Activity (as appropriate):

 - Hydrologic and/or hydraulic analyses and data will be certified by a registered professional engineer or licensed land surveyor in accordance with 44 CFR 65.6(f).
 - Topographic information will be certified by a registered professional engineer or licensed land surveyor in accordance with 44 CFR 65.5(c).
 - If fill is to be considered in the mapping to raise land areas above the 1% annual chance flood elevation, certification of the fill will be provided in accordance with 44 CFR 65.5(a)(6) by the community's NFIP permit official, a registered professional engineer, or a licensed land surveyor.
 - Any levee systems to be accredited as discussed in Section 4 of this Mapping Activity Statement will be certified in accordance with 44 CFR 65.10(e).
- 8. Technical Assistance and Resources:** The City of Harrisonburg may obtain copies of LOMCs, archived engineering back-up data, and data collected as part of the Five-Year Mapping Needs Assessment from FEMA's Mapping Coordination Contractor (MCC)/Technical Evaluation Contractor (TEC) as part of the initial data research. Copies of FEMA's rule-based engineering software packages such as CHECK-2 to evaluate HEC-2 models and FISPLOT, an automated flood profile plotting software package, may also be obtained through the MCC/TEC. The MCC/TEC may be contacted at 1-877-FEMA-MAP (336-2627). General technical and programmatic information can be downloaded from

FEMA's Flood Hazard Mapping web site (www.fema.gov/mit/tsd). Specific technical and programmatic support may be provided through FEMA's MCC/TEC; such assistance should be requested through the FEMA Project Officer specified in Section 12 of this Mapping Activity Statement.

The City of Harrisonburg may also consult with the FEMA Project Officer to request support in the areas of: recommended data sources, recommended digital data accuracy standards, assessing vertical data accuracy, data collection methods or sub-contractors, GIS-based engineering and modeling training.

9. Subcontractors: Not Applicable

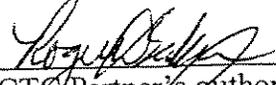
10. Quality Assurance/Quality Control (QA/QC) Procedures: The QA/QC procedures outlined in Chapter 10 of the *Guidelines and Specifications for Study Contractors* should be followed during the development of the hydrologic and hydraulic analyses and floodplain mapping. Analyses and mapping should be independently reviewed for compliance with the standards defined in Section 4 of this Mapping Activity Statement. Dewberry & Davis will conduct this independent review.

For GIS-based, automated modeling, QA/QC activities should ensure automated calculations are reasonable and in compliance with standard flood modeling and mapping approaches. The City of Harrisonburg will document internal QA/QC procedures to FEMA to ensure all calculations and data processing were reviewed.

11. Reporting: Reporting requirements will be in accordance with Agreement Articles V & VI.

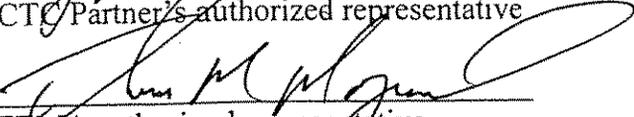
12. Points of Contact: The FEMA Project Officer is Jon Janowicz and the CTC's Project Manager is Daniel Rublee, or subsequent personnel of comparable experience who are appointed to fulfill these responsibilities.

Each party has caused this Mapping Activity Statement to be executed by its duly authorized representatives.



CTC Partner's authorized representative

Sept. 14, 2000
date



FEMA authorized representative

9/20/00
date

State representative*

date

* In States where statutory and/or regulatory requirements require the State's review and/or approval of new flood hazard data, the State will be a signatory to a community's Mapping Activity Statement.