



January 19, 2024

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SUBJECT: Invoice for Project Management (PM) Task A: Global Outreach Services for WV Flood Tool; FY22 CTP Project Management (PM) Grant.

Dear Tim,

In accordance with the FY22 CTP Service Agreement signed October 2021, this invoice in the amount of **\$155,000.00** is for Global Outreach Services (Task A) for the WV Flood Tool (www.mapwv.gov/Flood). See the scope of work as outlined in the amended 2022-23 (FY22) CTP Project Management (PM) plan dated July 2022, and authorized under a WV-48 service agreement between the WVEMD and WV GIS Technical Center, West Virginia University. Refer to the WVEMD [Statement of Work](#) documents for more details about the specific tasks.

Invoice #	Services Rendered	Amount
01192024	TASK 1: [GLOBAL OUTREACH SERVICES FOR WV FLOOD TOOL] Provide statewide global outreach services that process and integrate new flood and reference GIS layers, tool enhancements, flood risk information, etc. for the WV Flood Tool (www.mapwv.gov/Flood). Services include computer programming, geoprocessing, customized mapping, public awareness/outreach, training, and Community Rating System credits for communities.	\$155,000
Time Period 10/1/2022 to 9/30/2023	Task A ACTIVITIES SUMMARY: Updated new flood layers (flood zones, depth/WSEL grids, cross-sections, BFE lines, LOMAs/LOMRs, flood profiles, panel index, FEMA map and HEC-RAS model downloadable links, etc.) and building risk assessment layers to the WV Flood Tool. Upgraded flood zone query programming logic and cartography to support new FEMA Flood Risk products for Approximate A Zones that include unlabeled cross-sections and HEC-RAS models. Updated WV Flood Tool with elevation certificates and buyout properties. Updated reference layers (parcels, addresses, leaf-off imagery, legal boundaries, etc.) on WV Flood Tool. Migrated WV Flood Tool to new hardware and software network system. Provided outreach, training, and technical services in support of WV Flood Tool. Performed a structure-depth analysis of upgrading Approximate A Zones to Detailed AE Zones for the state and more detailed analysis for Kanawha River Basin, Gauley River/New River watersheds. Created 3D visuals of mitigated closed and open foundations for display on Flood Tool. <i>Through collaboration with Local, State, and Federal entities, the WV Flood Tool delivers quality data that increases public awareness and leads to actions that reduce risk to life and property.</i>	

	<p><i>To manage the wealth of available data and better communicate flood risk, the WV Flood Tool has maintained a public facing outreach tool for the public, communities, engineering/surveying companies, and others (Insurance companies, lending institutions, real estate companies) that has provided effective floodplain models, supporting datasets, water-surface elevations, floodplain boundaries, and additional enhanced flood risk information. During the past decade, the functionality and quality of data layers of the WV Flood Tool have progressed, resulting in an increased use of the application. Over time the WV Flood Tool has become more than just a flood determination tool, and today is routinely used by floodplain managers for building permit applications, floodplain regulations enforcement, pre- and post-disaster assessments, Community Rating System discounts, and flood risk planning. For risk assessment and planning, the RiskMAP View includes structure-level risk assessments and mitigated properties to aid in flood reduction efforts. This CTP activity enables the website and the WV Flood Tool's global outreach program to adapt and remain relevant as both the datasets and technology continue to evolve.</i></p> <p>Specific tasks under <i>global outreach services</i> in support of the WV Flood Tool included:</p> <p><u>New Flood Map Products:</u></p> <p>Incorporated new FEMA flood map products into the WV Flood Tool. These flood products included both regulatory National Flood Hazard Layers and non-regulatory flood hazard layers (e.g., Advisory Flood Heights) into the WV Flood Tool. All the flood layers, query layers, geoprocessing layers, models, and attributes were published according to standardized procedures and cartographic design. Map products and data layers are listed below.</p> <ul style="list-style-type: none"> • Flood Study Status Graphics <ul style="list-style-type: none"> ○ Active Flood Studies ○ Advisory Flood Heights (A major priority of the WV State Business Plan is to obtain model-backed WSEL and Depth grids for all Approximate A Zones.) ○ FEMA R3 FIRM Active Project Status • Effective and Preliminary National Flood Hazard Layers (e.g., Countywide RiskMAP Studies, 2016 Flood Physical Map Revision (PRM) Reaches in Southeastern WV) from flood studies. <ul style="list-style-type: none"> ○ Effective or Draft/Preliminary NFHL, WSEL, and Flood Depth. See Table PM-A-1. ○ Advisory Flood Heights and Base Flood Elevations ○ For Preliminary NFHL Flood Heights, in Flood Query Results Panel, link to FEMA's Map Changes Viewer • Floodplain Boundary, WSEL, Depth Layers <ul style="list-style-type: none"> ○ Floodplain Boundary: Regulatory and Non-Regulatory Advisory Zones (Updated AE or Advisory A Zones) ○ WSEL Grid: Restudy, Advisory Updated Zone AE (Redelineation), Advisory Flood Heights (AFH) Zone A ○ Depth Grid: Model-Backed (HEC-RAS) Advisory A Depth Grids • Other Flood or Flood-Related Layers <ul style="list-style-type: none"> ○ Cross-Sections ○ BFE Lines ○ Panel Index (GeoIndex) ○ LOMAs, LOMRs (including Location-Verified LOMAs to correct parcel or structure) ○ Flood Study Profiles for Detailed AE Zones ○ Flood Query Results Layers: Flood Zone Designation, Stream Name/Flood Source, HEC-RAS Engineering Model Download ○ USGS High Water Marks and Stream Gages 	
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- H&H Hydrologic/Hydraulic Downloadable Models
- Structure (bridges, culverts, etc.)
- Mitigated Buyout Properties
- [Elevation Certificates](#)
- Flood Manager List on WV Flood Tool
- Cartography, Map Labels, Map Symbols
 - Upgraded cartography to support new FEMA Flood Risk products for Approximate A Zones that include unlabeled cross-sections and HEC-RAS models.
- 3D Flood Visualizations. Created 3D visuals of non-mitigated and mitigated structures (closed and open foundations) for display on Flood Tool.

Table PM-A-1. New flood studies updated to WV Flood Tool. Studies include Effective, Draft/Preliminary National Flood Hazard Layers, and Advisory Flood Heights (AFH) submitted for 12 study areas.

ADVISORY FLOOD HEIGHTS	DRAFT NFHL	PRELIMINARY NFHL	EFFECTIVE NFHL
Randolph	Hampshire	Hardy	Greenbrier countywide
Upshur	Pocahontas	Monroe	Kanawha Elk River
		Summers	Nicholas Cherry River
			Pendleton (countywide, except Franklin)
			Webster Gauley River

Model-Backed Studies: Added new model-backed base flood heights and depth grids to the WV Flood Tool. This included making HEC-RAS engineering models available for download. In addition, published new model-backed Base Flood Height values for the Flood Query Results Panel and for processing LiDAR LOMAs using the Print Function of the WV Flood Tool.

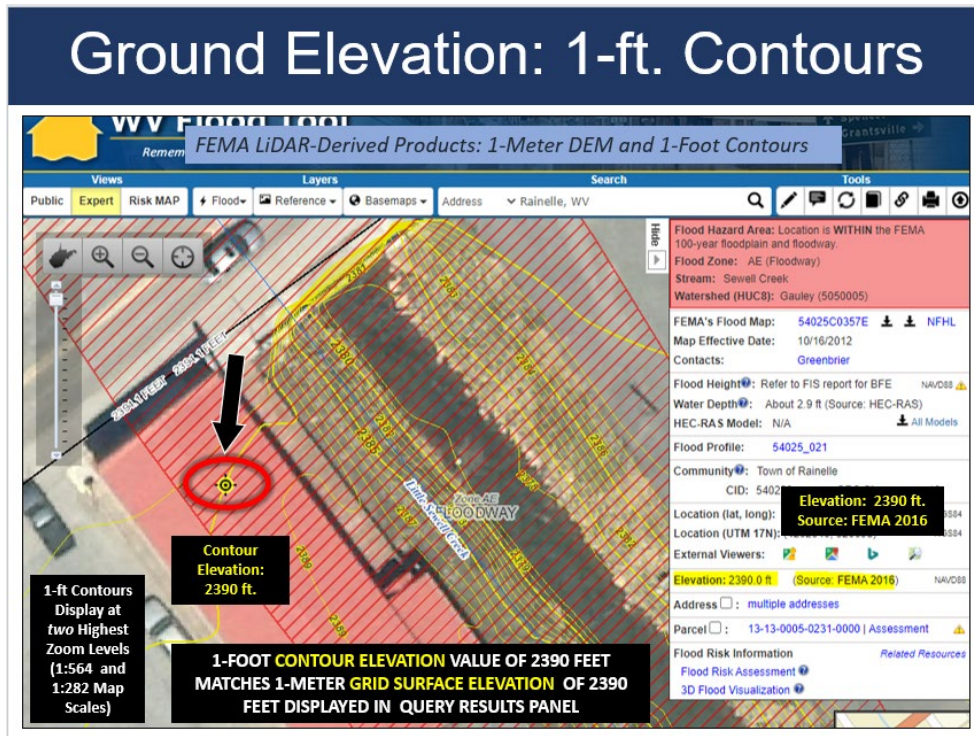
Structure-Depth Analyses: Performed a [structure-depth analysis](#) of upgrading Approximate A Zones to Detailed AE Zones for the state and a more [detailed analysis](#) for the Kanawha River Basin, Gauley River/New River watersheds. Potential mapping errors from anomalous building level risk assessments were forwarded to Region 3 for CNMS problem area tracking. Provided FEMA Discovery information for Zone A Building Cluster Analysis to identify streams for Zone AE Detailed Mapping.

Reference Data Layers:

Key reference data sets are ground elevation, parcels/assessment records, E-911 addresses, and aerial imagery. Data processing included caching aerial imagery and elevation contours at 15 levels from 1: 4,622,324 to 1:282 map scales. The new county aerial imagery of 4-inch resolution as well as the FEMA-purchased LiDAR and derived elevation products are quite large in file size and require extensive computer processing and quality control checks before being published to the WV Flood Tool. Aerial imagery and contours required caching to the highest zoom level of 1:282 Map Scale. The caching is necessary to improve the rendering performance of the aerial imagery and contours on the WV Flood Tool. Besides the WV Flood Tool, there are no FEMA web applications or other web services in the Nation that allow users to view aerial imagery and 1-foot contours for West Virginia at the largest map scale of 1:282.

	<ul style="list-style-type: none"> • GROUND ELEVATION: Maintained Statewide Elevation Products for Flood Tool: <ul style="list-style-type: none"> ○ 1- or 2-foot contours (published to the highest zoom level 1:282 on Flood Tool) ○ 1-meter DEM (1 meter DEM elevation sources) ○ 1-meter Hillshade (1 meter DEM elevation sources) <p><i>Accurate, high-resolution LiDAR-derived elevation products such as one-foot contours and one-meter DEMs that are incorporated into the WV Flood Tool are beneficial for floodplain determinations, LOMAs, LAGs, water depth flood visualizations, flood risk studies, etc.</i></p> • PROPERTY PARCELS AND ASSESSMENT RECORDS: Published Tax Year 2023 parcel geometry and assessment attributes (1.4 million records) to WV Flood Tool. <ul style="list-style-type: none"> ○ Master surface parcel file and standardized assessment attributes ○ Sketch diagrams for building identification of residential properties ○ Parcel history (19 years) to search previous owners or deed book numbers. Important for improving positional accuracy of LOMAs and Buyout Properties. ○ Intersected statewide parcels/assessment records with flood hazard zones for display on the WV Flood Tool. Associating flood risk information with property parcels allows users to perform queries of parcels by the degree of flood risk using the WV Property Search Tool (Advanced Search Option). <p><i>Accurate and current parcels and assessment attributes are essential to identifying flood risk structures in the WV Flood Tool</i></p> • E-911 ADDRESSES: Performed quarterly updates of E-911 site (1 million address points) and street addressing layers and address matching geocoding services for Flood Tool. <p><i>Accurate and current E-911 site addresses are essential to identifying flood risk structures in the Flood Tool.</i></p> • AERIAL PHOTOGRAPHY: <ul style="list-style-type: none"> ○ County aerial imagery. Added new 2023 leaf-off, high-resolution (4-inch or 3-inch) aerial imagery for 13 counties to Flood Tool. <ul style="list-style-type: none"> ▪ Berkeley ▪ Cabell ▪ Doddridge ▪ Harrison ▪ Jefferson ▪ Monongalia ▪ Ohio ▪ Putnam ▪ Ritchie ▪ Taylor ▪ Tyler ▪ Wood ○ 2020 NAIP. Obtained and geocached uncompressed TIFF files of 2020 NAIP at higher zoom-in levels. ○ 2022 NAIP. Consumed USDA web map service for NAIP 2022. Added to WV Flood Tool as new base map layer. <div data-bbox="769 1304 1313 1463" style="border: 1px solid black; padding: 10px; margin-top: 20px;"> <p><i>Accurate and current leaf-off aerial photography is essential to identifying flood risk structures in the WV Flood Tool.</i></p> </div>	
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<< Hi-Resolution Elevation Contours and Aerial Imagery Cached to 1:282 Map Scale >>



Application Programming Development:

Provided software programming updates for desktop and mobile versions. Modified programming code of JavaScript application (www.mapwv.gov/flood) to enhance tool functions, messages, data layers, and cartography. Updated flood risk information to the WV Property Search Tool, a companion product of the WV Flood Tool, to allow users to identify, for example, new structures built in flood zones or mitigated buyout properties. Made other tool enhancements based on requests from WV NFIP Coordinator.

Desktop Version: <https://www.mapwv.gov/flood>

Mobile Version: <https://www.mapwv.gov/flood/mmap>

Property Search and Report: <https://www.mapwv.gov/property>

- **Data Integrity between FEMA Flood Products and WV Flood Tool:** Where necessary consumed or synchronized FEMA's National Flood Hazard Layer (NFHL) web services and FEMA Map Store products for WV Flood Tool. Evaluated consuming NFHL web services with performance testing and other suitability measures. Programmed failover protocols for external web map services consumed by the Flood Tool.
- **RiskMAP View:** Further enhanced the WV Flood Tool to leverage the statewide building-level flood risk assessments first generated from the TEIF/TEAL Hazard Mitigation Grant.
- **Flood Query Results Panel:** Maintained all functions and support for Flood Query Results Panel to include updating flood zone query logic for countywide studies. Followed standard operating procedures for incorporating floodplain layers, water surface elevation and depth grids. Updated and published all the flood layers, query layers (flood zone, stream name, HEC-RAS model) and geoprocessing layers (WSEL, Depth). Ensured the proper flood regulatory and flood risk attribute values were

displayed properly in the Flood Query Results Panel. Upgraded flood zone query programming logic to support new FEMA Flood Risk products for Approximate A Zones that include unlabeled cross-sections and HEC-RAS models.

<< Flood Query Results Panel >>

Flood Query Results Panel

#	Each Location Query Answers:
1	In Flood Hazard Area? Flood Zone? Floodway?
2	Stream & Watershed names?
3	FEMA Issued Flood Map / NFHL links?
4	Floodplain Manager Contact?
5	Flood Height value & Vertical Datum?
6	Water Depth value and source?
7	HEC-RAS Model available?
8	Flood Profile available?
9	CRS community information?
10	Coordinate x,y location?
11	External Map Viewer Links?
12	Ground elevation value and source?
13	E-911 Address (link to address info)
14	Parcel ID (link to property info)
15	Flood risk assessment info?
16	3D flood visualization?

Map Data:

- Address: 7170 QUEEN ST, KEARNEYSVILLE, WV
- Flood Hazard Area: Location is WITHIN the FEMA 100-year floodplain and floodway.
- Flood Zone: AE (Floodway)
- Stream: Turkey Run
- Watershed (HUC8): Conococheague-Opequon (2070004)
- FEMA's Flood Map: 54037C0115E
- Map Effective Date: 12/18/2009
- Contacts: Jefferson
- Flood Height: 495.6 ft (BFE - Non-Restudy)
- Water Depth: About 2.4 ft (Source: HEC-RAS)
- HEC-RAS Model: N/A
- Flood Profile: 54037_028
- Community: Jefferson County
- CID: 540065
- CRS Class: 6
- Location (lat, long): (39.302764, -77.983755)
- Location (UTM 17N): (4354713, 760089)
- Elevation: 493.1 ft (Source: FEMA 2012)
- Address: 54 KING ST, Kearneysville, WV, 25430
- Parcel: 19-07-022B-0022-0000 | Assessment
- Flood Risk Information: Flood Risk Assessment, 3D Flood Visualization

Parcel ID Web Link: <https://www.mapwv.gov/flood/map/?v=1&pid=19-07-022B-0021-0000>

Dam Inundation Zones:

- Created [WV Dam Inundation Viewer](#) of 168 High Risk Dams from the WV Conservation Agency
- USACE dam inundation zones can be viewed and downloaded from the USACE [National Inventory of Dams Viewer](#):

System Administration: Finished migrating WV Flood Tool to new hardware and software network system. Maintained backups of critical systems and data.

Outreach Services:

Performed outreach and training services to include developing print and online educational materials, delivering presentations, administering email listserv, and participating in Flood Tool coordination meetings and data exchange with State CTP Mapping Grants Coordinator, State NFIP Coordinator, FEMA, USACE, NRCS, and other cooperators. Provided technical support to the Flood Hazard community like AFH specifications for contracts and other technical queries associated with flood and reference data. Enhanced the WV Flood Tool to effectively increase flood risk communications for the public and communities. Educated and outreached to counties about submitting their locally produced address, parcel, imagery, and elevation data for inclusion in the Flood Tool.

- Presented at WV Floodplain Managers Conference and for FEMA Region III events.

	<ul style="list-style-type: none"> Flood Map Datasets Published to State Data Clearinghouse with Summary Metadata <ul style="list-style-type: none"> Flood Maps: Statewide Floodplain Polygons WV Hazard Mitigation Buyout Properties Vertical Datum Conversions NGVD29 County Map NAVD 88 to NGVD 29 Conversion Factors by County NGVD 29 to NAVD 88 Conversion Factors by County Launch Page Updates <ul style="list-style-type: none"> Resources (Glossary) Page: http://mapwv.gov/flood/resources.html Updated Floodplain Mangers Contact List and ListServ: <ul style="list-style-type: none"> FPM Contact List: https://www.mapwv.gov/flood/content/wvCountyFloodplainManagersList.htm FPM ListServ: WVFlood@LISTSERV.WVU.EDU Coordination meetings and project scoping in support of WV Flood Tool. 	
Grand Total	Total invoice amount:	\$155,000

Please use the following information for paying electronically:

Payment Transfer Information:

OASIS: 4187 111 1463 1463 6909 H514

WVU Acct: 11. 110530213. 11303179. 4108501. 999. 99999999

If you have any questions, or need clarifications, please do not hesitate to call.

Sincerely,



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CC: WVU Revenue Services - RevenueServices@mail.wvu.edu