

HRPDC Sensor Proposal Scope of Work

Scope of Work Narrative

The Hampton Roads Planning District Commission (HRPDC) proposes to expand and improve an existing network of roadway flooding sensors to provide real-time information to drivers about whether area roadways are flooded, develop a platform for local emergency management, transportation operations, and public works agencies to have up-to-date information on flooding impacts, and create a record for use by local decision-makers and researchers.

1. General Requirements

a. Specific problem being solved (not just that flooding exists or may occur in the future).

The Hampton Roads region is a highly interconnected, urbanized region that is home to over 1.7 million people. One of the defining factors of this region is the presence of several major bodies of water with limited crossings, as well as numerous other smaller crossings. This factor, combined with a large percentage of commuters that live in one locality but work in another, creates a need for a large and well-maintained surface transportation network. Unfortunately, the region's coastal location, low topography, and many interior waterways leave the region vulnerable to flooding on the transportation network. Sea level rise and more intense precipitation are increasing the frequency of these occurrences. Roadway flooding causes significant impacts to the region's economy and public safety, as well as operational impacts to the region's military installations and port facilities. Greater awareness of real-time roadway conditions related to flooding will help reduce these impacts.

b. Factors which contribute to the identified problem.

Roadway flooding is predominantly caused by the region's coastal location, but sea level rise and more intense rainfall are exacerbating impacts. In addition, the area is highly urbanized, so many areas rely on storm sewer systems to collect and discharge rain as opposed to infiltration, which can lead to overwhelmed systems during major rain events. Although some efforts have been made to install notification systems, there is a need to expand coverage to more areas and to increase interoperability between the systems.

c. Why the project is needed either locally or regionally.

Many communities utilize reverse 9-1-1 or local emergency notification systems to communicate information during major events. In addition, some communities have used contractors to model flooding and communicate that information to commuters using Waze or other platforms. Although these local systems are helpful, a regional approach is necessary in Hampton Roads because of the extremely high level of commuting between communities. A commuter who lives in one community and works in another may receive warnings from their home locality but not from others

that they drive through or work in. A regional approach will reduce costs for data management, simplify contracting, and expand access and coverage for a larger segment of the population.

d. How the activity decreases the risk to public safety through flood risk reduction.

Risk is a function of the probability of an occurrence and its impacts. Although the proposed project will not reduce how often flooding occurs, it will help reduce the impacts of flooding by enabling drivers to avoid flooded roads. Driving through flooded roads can be very dangerous (e.g. vehicles can be swept away, first responders may have to wade through floodwater to reach stranded drivers), and it can also result in damage to vehicles and adjacent properties. Removing drivers from these streets and directing them to safer routes will mitigate these impacts.

e. How the activity protects or conserves natural resources.

Building a record of surface flooding will give local decision-makers a better understanding of where flooding occurs in areas with complicated hydrologic and hydraulic conditions, which may inform the placement of stormwater or flood management projects, including green infrastructure practices, or help identify areas where restoration or conservation of open space should be prioritized.

f. Who or what is protected.

The proposed project will help protect Hampton Roads residents, commuters, and visitors who use the region's road network.

g. The safety threats, or environmental concerns related to flood risk.

Flooded roadways can strand motorists whose vehicles become trapped, which can lead to potential safety risks for both motorists and first responders. In addition, flooded vehicles can release pollutants into floodwaters, which eventually can reach area waterways.

h. Groups who might directly benefit from this flood risk reduction effort.

Major groups that will directly benefit from this effort include commuters (who will be able to avoid flooded roads) and first responders (who will not have to respond to as many calls regarding vehicles that have become stranded). Others who will benefit include public works personnel and researchers, who will have tools and data to better understand and address flooding patterns.

i. What would happen (or not happen) if the applicant does not receive funding.

In the absence of this funding, commuters will continue to be subjected to roadway flooding without warning in many areas of Hampton Roads. This will, at best, result in those commuters having to turn around and find alternate routes instead of being able to plan for those accommodations from the outset. This will lead to more vehicles being stranded during major flood events and increased need for emergency response. In addition, Hampton Roads localities will continue to lack robust data on the frequency and severity of roadway flooding in their communities.

j. Alternatives analysis of the viability of the project, how selected project reduces risk to populations at risk of flooding. Provide examples current or previous related projects,

data, outcomes etc. that justify the approach chosen. Include how long and how much protection to be achieved.

This project builds on previous efforts by the HRPDC, several Hampton Roads localities, and the Commonwealth to provide real-time information on flooding to those who need it. In particular, this project improves upon an ongoing project by the HRPDC that was initially funded in part by a grant from the U.S. Department of Defense Office of Local Defense Community Cooperation. That project was one of the first to focus specifically on roadway flooding as opposed to water level monitoring. Key improvements that the proposed project will provide will include focusing on ultrasonic sensors that are more reliable and require less maintenance (because they are not exposed directly to water), expanding the coverage from the initial twenty sensors in the pilot project to approximately 50 more sensors, including sensors in additional communities (including Gloucester County, James City County, Suffolk, and York County), establishment of an API to enable better access to the data for researchers and decision-makers, and integration with the Commonwealth's Virginia Flood Monitoring System (managed by the Virginia Department of Emergency Management).

As an alternative to this approach, several Hampton Roads communities and the HRPDC have considered model-based services that provide predictions or estimates of where flooding is occurring based on various inputs. However, in addition to being very costly, these services have not to date been as effective in inland areas where rainfall flooding is a concern, nor do they provide validation to back up the model results. As a result, a robust sensor network continues to be a priority for Hampton Roads communities.

2. Goals and Objectives

a. Goals should be listed as an outcome that solves the problem identified.

The primary goal of this project is to provide information to commuters, decision-makers, and researchers on the presence, severity, and frequency of roadway flooding in Hampton Roads using roadway flooding sensors connected to online data portals and applications. For commuters, making these observations available in real-time will provide them with the information needed to make decisions about which routes to use to access their homes, occupations, children's schools, etc. For decision-makers, this information will potentially be used to inform road closures or other emergency responses. For researchers, this information will be used to document flooding patterns and validate and calibrate predictive models.

b. Objectives must be specific, measurable and timebound.

Specific objectives for this project include final selection of sites in consultation with the contractor and locality representatives, executing agreements with individual localities for various permissions related to sensor installation, installation of sensors, establishment of the data management portal, integration with the Virginia Flood Monitoring System, data analysis and tracking, sensor and dashboard maintenance, and coordination with stakeholders. It is anticipated that all objectives, except maintenance and coordination, will be completed within the first year of

the project. Maintenance will begin after installation is completed and is expected to continue for the duration of the project and for the foreseeable future once the grant ends. Coordination with stakeholders has already begun as part of the development of this proposal and will continue throughout the duration of the project and for the foreseeable future beyond.

c. Objectives be achievable within the agreement period.

Based on discussions with the intended contractor, establishment of the system will be completed within the first 12 months of the project, with the additional 24 months of the agreement period set aside for contingency, maintenance, and ongoing coordination.

3. Work Plan

a. What are the major activities and tasks?

1. HRPDC will schedule and host initial stakeholder meetings, including a large-group kickoff meeting with all localities and state agencies and individual meetings with interested localities
2. HRPDC will finalize the contract with the contractor based on available funding and final costs
3. HRPDC and Contractor will meet with locality representatives to identify potential sites, establish local points of contact, and develop and obtain final agreements
4. Contractor will work directly with locality representatives to finalize sites for sensor installation
5. Contractor will purchase, construct, and test all sensor equipment and hardware prior to installation
6. Contractor will conduct on-site evaluations of each proposed sensor site to determine the optimal installation plan
7. Contractor will complete sensor installation, including obtaining permits, traffic control, elevation surveys, mounting, equipment testing, and other related tasks
8. Contractor will set up cloud services, including integration with the state dashboard and API development
9. Upon completion of installation tasks, Contractor will complete annual maintenance, including regular monitoring of data to identify potential issues to address
10. HRPDC will coordinate with users for feedback on dashboard and API
11. HRPDC will coordinate with Waze to set up automatic alerts for specified flooding thresholds

b. Who is responsible for completing the activities and tasks?

HRPDC staff will be responsible for the following tasks:

- Managing the contract and overall project

- Coordinating with locality representatives, including identifying key points of contact for project implementation

The contractor will be responsible for the following tasks:

- Scheduling and coordinating sensor installation
- Evaluating sites prior to installation to confirm viability
- Supporting local permitting processes by providing necessary documentation
- Constructing and testing all gauge and mount equipment
- Sensor installation
- Managing elevation surveys via a subcontractor
- Organizing traffic control for installation where needed or required via a subcontractor
- Developing the dashboard and API
- Sensor/gauge maintenance
- Communication and coordination with HRPDC and localities

Locality staff will be responsible for the following tasks:

- Determining site ownership
- Selecting specific sites for installation
- Securing necessary permits and/or right of way agreements
- Occasional site checks in case of suspected damage to gauges

c. What is the timeframe for accomplishing activities and tasks?

HRPDC anticipates completing sensor installation and setting up of the dashboard and API in the first year of the project. Other tasks will be completed during the remaining two years of the allowed 36 months.

d. Identify the required partners and where they are represented in the workplan.

Required partners include local government representatives from public works, emergency management, planning, transportation, and other key departments. They will be engaged throughout the process, with various groups directly engaged during key phases (e.g., planning staff during the permitting step). In addition, the HRPDC will also engage with representatives from the Virginia Department of Transportation (VDOT) and Virginia Department of Emergency Management (VDEM) who are working on related efforts to ensure effective integration, identify opportunities for synergy, and avoid duplication of effort.

e. Deliverables

- Installation of approximately 50 sensors
- Partner agreements with localities
- Establishment of dashboard and API for data integration
- Connection with Waze

f. Maintenance plan tied to the identified viability of the project. Plan for sustaining the project after the agreement period (if applicable).

The HRPDC has incorporated lessons learned from previous sensor projects into this proposal. Specifically, this proposal will utilize an existing data management platform and dashboard that is already in use by several local governments and the Virginia Department of Emergency Management instead of establishing a new platform. This will help reduce long-term costs and increase the likelihood of ongoing service. In addition, this proposal will emphasize the use of sensors that are more rugged and less directly exposed to the elements, which should increase longevity and lessen the need for extensive maintenance.

Annual maintenance, including preventive maintenance and the acquisition of spare parts ahead of time, is an integral part of the proposal and has already been discussed with the selected contractor. The cost estimate includes annual maintenance that includes a cloud service/telemetry subscription, planned on-site maintenance, and a spare parts reserve. These projected costs are currently within the annual budget for the HRPDC's Coastal Resilience Program, which should be able to maintain the project for the foreseeable future beyond the two years included in this proposal.

4. Evaluation

a. Indicators of success.

Indicators of success for this project will include:

- Local government and partner agency engagement
- Installation of sensors and data transmission
- Integration with the Virginia Flood Monitoring System and development and use of the API by partner organizations and stakeholders
- Documentation of use cases from local partners

b. Data that will be collected and how the data will be used to measure success.

Engagement will be measured through tracking meetings held and attendance along with specific outcomes, such as agreements, site selections, etc. The contractor will provide regular reports on the status of sensor installations, which will allow the HRPDC to track progress. Similar the contractor and HRPDC will monitor data transmission once it is established to document signal consistency and reliability. The HRPDC and contractor will identify available data metrics to measure use of online tools and will also meet with project partners to obtain feedback.

c. How was cost effectiveness evaluated and measured against the expected outcomes?

The HRPDC has evaluated the cost effectiveness of this proposal by comparing it to its existing pilot network contract and to the available cost estimates for services that model flooding. In both cases, costs were substantially higher than the proposed approach, which takes advantage of existing online infrastructure and local contractors to keep costs down. Documentation of how the

resulting data is used will help to estimate project benefits to inform an assessment of cost effectiveness by the HRPDC, contractor, and project partners.

d. What products, services, meetings, outreach efforts etc. will be conducted and how will success be measured?

The HRPDC has already engaged and will continue engaging several of its existing committees and other stakeholder groups, which provide for public participation and engagement, on this process. These groups include the Coastal Resiliency Committee, Coastal Resiliency Working Group, All Hazards Advisory Committee, and Transportation Operations Committee. In addition, the HRPDC will coordinate specifically with VDOT and VDEM to coordinate outreach and engagement with other stakeholders. The HRPDC will also incorporate this effort into the agency's GetFloodFluent.org regional website and media campaign, which aims to educate Hampton Roads residents about flood risk. Success will be measured by documentation of meeting engagement and attendance and completion of project deliverables.

e. Project progress monitoring plan to ensure project meets the requirements of the agreement and is delivered on time. Outline how delays or other findings may be used to modify or improve outcomes/deliverables.

The HRPDC and contractor will establish a schedule for completing the proposed deliverables on time. The HRPDC will require regular reports from the contractor to monitor progress and identify potential delays. Initial installation and set-up are expected to be completed within the first year of the project, so any delays will not disrupt the overall timeline or ability to complete the project within the required 36 months. In cases where sensor locations are deemed infeasible, the HRPDC and contractor will incorporate sufficient time to work with locality staff to identify alternative sites.