



HOW TO IMPROVE ROADWAY SAFETY DURING HIGH WATER EVENTS

Every year, roadway flooding results in death and serious injury. The costs of infrastructure damage and demands on first responders can also put a serious strain on communities.

Proactive, well-placed safety solutions can mitigate these dangers and protect lives.

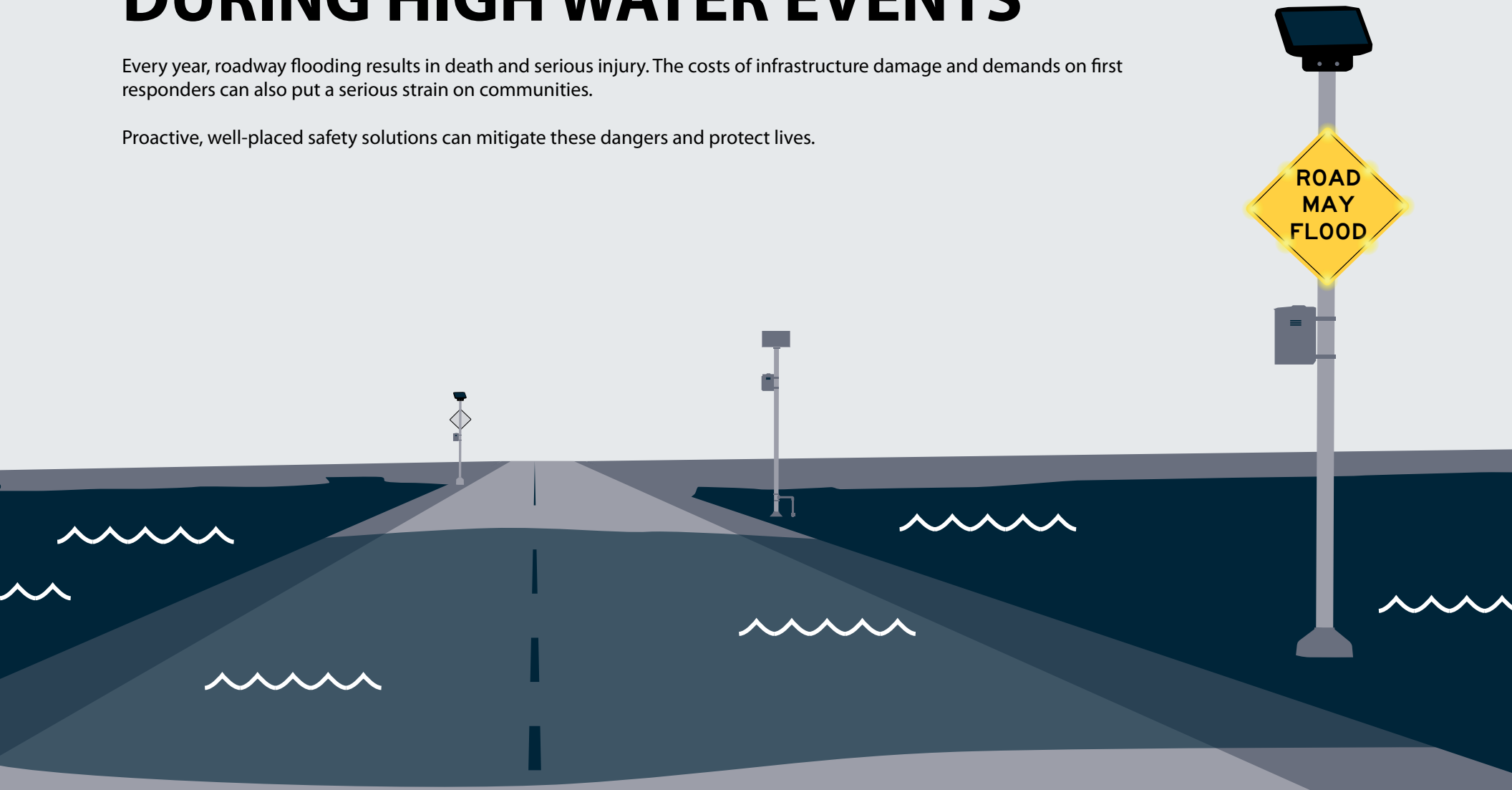




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FATAL FLOODING

Flooded roadways can be lethal, and mitigating that risk is easier said than done.

When water covers a road, it can be incredibly difficult to tell if it's an inch or a foot deep — or even more. Just a few inches of water on a road can be dangerous, and six inches is all it takes to reach the bottom of most cars and cause a loss of control.¹

Flash floods are especially hazardous, killing 127 people in the United States each year. Half of those deaths are vehicle-related.²

Flooded roads also reduce mobility for all road users. Businesses can be cut off from customers, students in school cut off from their homes and first responders cut off from those in need.

Redirecting traffic from flooded roads, however, requires manpower, expense and time to execute. Plus, that redirection can unexpectedly increase traffic on neighboring roads.



ROAD
MAY
FLOOD

THE IMPACT OF CLIMATE CHANGE

Many communities are dealing with increasingly erratic and severe weather patterns due to climate change, and that includes more flooding.

According to the Environmental Protection Agency, “Climate change is projected to concentrate rainfall into more intense storms. Heavy rains may result in flooding, which could disrupt traffic, delay construction activities, and weaken or wash out the soil and culverts that support roads, tunnels, and bridges.”³

Increased flooding puts more lives at risk, and it can decimate budgets for many communities and states. For example, in 2020, roadway floods in Maryland caused over \$15 million in economic losses.⁴

Hundreds of miles to the south, Florida is facing a two-foot sea level rise by mid-century, which the Florida Department of Transportation estimates would jeopardize over five percent – 250-plus miles – of the state’s most heavily traveled highways. Protecting those highways could “easily cost several billion dollars.”⁵



WHERE FLOODED ROADS ARE MOST LIKELY TO OCCUR

There are six types of areas that are at the highest risk for dangerous roadway flooding.



Underpasses and tunnels



Causeways



Barrier islands



Areas with unreliable or inadequate drainage



Areas near bodies of water, such as oceans, rivers, lakes and reservoirs



Any low-lying area

THE COST OF FLOODED ROADS

Roadway flooding increases costs in a few areas in particular.

Trying to prevent and react to disabled vehicles stuck in or carried away by flood waters comes with expenses:



Traffic cones and barricades



Law enforcement's time and associated costs



Manual and automated gate systems



Repairs to infrastructure struck by vehicles



High water warning systems



EMS' time and associated costs



Higher insurance rates

Cities have been sued because someone got injured or their car got stuck in flood waters.

- Eric Deike, Director of Public Works for Hagerstown, MD



SAFETY COUNTERMEASURES

There are three types of safety countermeasures that can help during a high water event.

TEMPORARY TRAFFIC CONTROL DEVICES

[Traffic cones](#) and [barricades](#) are temporary traffic control devices often used to demarcate a flooded road, preventing vehicles from moving forward without driving over them.

While they are always a handy tool for transportation professionals to have around, they require public works personnel to be aware of a flooded road, travel to it and place the cones and barricades themselves, taking precious time and exposing them to hazardous high water events.

INSTALLED TRAFFIC CONTROL DEVICES

Because [manual](#) and [automated gate systems](#) can block or partially block flooded roadways quickly, they remain a popular installed traffic control device during high water events. Smaller gates that only partially block flooded roadways also enable first responders to get around them and reach disabled vehicles, mitigating the concern that fully blocking a road cuts off first responders from those in need.

For high-risk areas, gates can be a very worthwhile investment. However, not all roadway configurations allow for their installation.

HIGH WATER WARNING SYSTEMS

A more proactive safety countermeasure is also available. **Providing drivers and other road users with real-time warning of a flooded road ahead can significantly reduce the likelihood of an injury-causing or even life-ending disaster.** [High water warning systems](#) make this possible.

They work by using a combination of sensors to detect rising water levels. When the water exceeds a pre-determined threshold, the system notifies road operators of the high water and activates flashing LED warning alerts, so road users know there is a flooded road ahead and can take an alternate route.

Most systems can include either a single pole that includes both sensors and warning alerts – ideal for infrequently traveled roads with low to moderate flooding problems – or multiple poles with sensors and warning alerts placed separately, which is ideal for higher risk areas.

For very large areas, some vendors like TAPCO offer systems with zones; when water is detected in a specific zone, all alerts in that zone automatically activate.

These systems can also include an automated gate system that lowers upon system activation.

DID YOU KNOW?

The majority of flash flood victims are men.

According to [weather.gov](https://www.weather.gov)

Customization

Because every roadway has its own unique configuration and challenges, having a system customized to each location is key. Look for a vendor offering a high water warning system with:

- An adjustable water level threshold
- Multiple sensor technologies to match the application
- Radio communication for multi-pole systems that enables alert poles to be placed far enough ahead to allow for alternate routes
- The ability to operate in salt and fresh water
- Remote activation and monitoring available through event management software
- Camera options for remote visual confirmation of events and local conditions
- The option to integrate automated gate systems

Price

The price of a high water warning system, which usually starts at just a few thousand dollars, is most significantly influenced by how many customizable features are included. However, those features can also increase the effectiveness of the system, increasing the overall value and safety it provides long-term.

In addition, a high water warning system can pay for itself in a single day during a high water event by reducing the need for traffic control devices, law enforcement and EMS's time and associated costs, repairs to infrastructure and more.

We might not have any barriers in place for awhile, but drivers do get a flashing warning immediately and in real time now. We've done what's reasonable to warn the public of a dangerous situation, so it helps them stay safe and reduces our liability.

- Eric Deike, Director of Public Works for Hagerstown, MD

Alert Options

There are two common types of high water warning system alerts:



LED-Enhanced Signs:

[LED-enhanced signs](#) feature long-lasting, amber LEDs embedded into the perimeter of the sign face that only flash when high water is detected, making them ideal for emergency situations.

Signs can be single-sided or double-sided. Look for MUTCD-compliant signs engineered to withstand the harshest environmental conditions, and make sure they come with LEDs that automatically dim based on ambient light.



LED Beacons:

[LED beacons](#) are round beacons frequently used in pairs that feature a large, amber LED that only flashes when high water is detected, warning drivers of high water in real time. They are commonly eight or 12 inches in diameter.

Beacons can come in a variety of configurations, including single, side by side (dual horizontal) or stacked on top of each other (dual vertical). Look for MUTCD-compliant ones engineered to withstand the harshest environmental conditions, and make sure they come with LEDs that automatically dim based on ambient light as well.

Power Options

Most high water warning systems can be operated with solar or AC power.



Solar Power

Solar-powered systems are ideal if:

1. The installation location is too far from an AC power grid
2. The costs of connecting to an AC power grid – trenching and metering, for example – are prohibitive
3. Long-term power usage is a concern due to cost or the environment

TAPCO can design high water warning systems to fit any location's power needs, offering solar panels with varying wattage and battery capacities, as well as self-contained, top-of-pole solar cabinet options.



AC Power

AC-powered systems are ideal if:

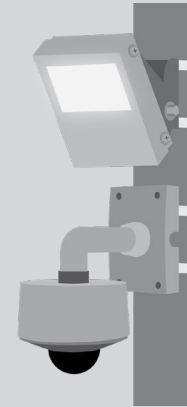
1. The locations have lower light levels due to tree shading, heavy cloud coverage, or regional sunlight conditions
2. An AC power grid is readily available

The TAPCO High Water Warning System can use 120VAC or streetlight power, enabling agencies to tap into existing infrastructure for power.

System Enhancement Options

Camera with an Illuminator

Some vendors like TAPCO offer systems with high-definition cameras that capture images and/or video of local conditions and high water warning system activations, enabling authorities to visually confirm a road has flooded and monitor the roadway. The cameras are paired with an illuminator to ensure images and video are of sufficient quality at night.



BlinkLink® Event Management Software

The TAPCO High Water Warning System can be enhanced with [BlinkLink®](#), an easy-to-use, cloud-based software application for agencies to remotely activate, manage and monitor high water warning systems and other Intelligent Warning Systems. The software enables automated notifications to facilitate an immediate response from traffic management centers, law enforcement and EMS personnel.

Connected Vehicle Interface

Forward-looking government agencies can add another layer of safety with a [Connected Vehicle Interface](#), which communicates information about flooded roads ahead and other hazards via connected vehicle roadside units, delivering in-vehicle alerts to drivers of connected vehicles.





LOCATION, LOCATION, LOCATION

To optimize the effectiveness of a high water warning system, it is important to consider unique topography and environmental factors.

Detection Poles

Detection poles house the sensors that detect when water exceeds a pre-determined threshold. Pole locations are customizable, depending on your needs and environment. For example, detection poles can be placed right by a roadway or in a remote area where there is water that can rise, such as a culvert, bridge or underpass near a river.

Alert Poles

Alert poles feature high water warning signs and alerts, and the quantity of these poles will vary by vendor. TAPCO's system, for example, allows for up to 15 additional alert poles.

Pole locations are customizable as well. For example, if an intersection is prone to flooding, it is wise to place at least four alert poles in the area — one on each road ahead of the intersection. This will warn drivers of the flooded road in time to re-route.

You can also provide more advanced warning by deploying additional alert poles further away from the hazard. This prevents a high volume of vehicles from re-routing at the same time to the same place.



PREVENTATIVE MAINTENANCE

Preventative maintenance is absolutely critical for maximizing high water warning system performance, accuracy and longevity.

Experts recommend conducting preventative maintenance every quarter and especially after a high water event.

Maintenance should include:

- Mechanical status testing
- Electrical status testing
- Activation / detection checks
- Cleaning / maintenance / testing of sensor(s)
- Video / communication / alerting checks, if applicable

If this preventative maintenance cannot be provided with community resources, a [service agreement](#) can help.

TAPCO offers service agreements that enable agencies to outsource preventative maintenance entirely, and the agreements even come with extended system warranties, guaranteed regulatory compliance, discounted software subscriptions and detailed records after every maintenance visit.

Proactively improving roadway safety during flooding is both possible and cost-effective with a well-placed high water warning system.

[Get started by learning more about the TAPCO High Water Warning System today >](#)

1: https://www.weather.gov/tsa/hydro_tadd

2: https://www.weather.gov/shv/awarenessweek_severe_flashflood

3: https://19january2017snapshot.epa.gov/climate-impacts/climate-impacts-transportation_.html

4: <https://www.marylandmatters.org/2021/09/22/roadway-floods-in-maryland-caused-more-than-15m-in-economic-losses-last-year-these-projects-could-help/>

5: <https://www.sun-sentinel.com/news/environment/fl-ne-sea-level-rise-threatens-florida-roads-20210319-lcheqk6p4rcb5ivprpzfgg3wfg-story.html>