



Emergency Preparedness

Actions

N15

Use GIS to map fixed critical assets, transportation routes, and vulnerable populations susceptible to environmental hazards.

N16

Evaluate city preparedness and response during and after environmental hazard emergencies.

A17

Track and communicate costs associated with preparing for and responding to environmental hazards.

A18

Establish contingency contracts so that sufficient resources are available in case of environmental hazard emergencies.

A19

Develop new app or integrate with existing app for environmental hazard alerts.

A20

Implement educational campaign to inform the public about insurance and other shared risk programs available for environmental hazards.

Background

In previous chapters, impacts from specific symptoms of climate change have been addressed. These environmental hazards – floods, heat waves, droughts, and deteriorated air and water quality – have the potential to lead to a greater number of natural disasters in our community when confronting poorly-prepared infrastructure and systems. In addition to the changing climate, increases in urbanization, population, and poverty compound disaster risk. It is necessary to ensure that the Columbus community is best prepared to handle the immediate and long-term effects of the potential disasters that may result from local climate changes.

This chapter contains two necessary (N) and four aspirational (A) actions that support preparedness as the best way to manage the effects of a natural disaster. The best-

prepared communities not only limit damage from disasters, but they also ensure that the recovery process is timely and efficient. The proposed necessary actions cover three main phases that lead to a resilient community: (1) understanding who and what infrastructure will be most affected, and developing strategies that will protect them, (2) educating and training everyone that is involved in disaster response, and (3) ensuring a swift and effective recovery plan. The aspirational actions focus on providing resources both before and during environmental disasters. Whether it is through new hazard-alert tools or increasing public awareness regarding the costs associated with environmental hazards, it is critical that everyone in the community play a role. Through these actions, we can ensure that Columbus will be best situated to deal with potential hazards projected to affect our community.

N15

Use GIS to map fixed critical assets, transportation routes, and vulnerable populations susceptible to environmental hazards.

Columbus should develop GIS tools that tag critical assets, transportation routes, and vulnerable populations, and this information should be used for planning, queried during emergencies, and shared with appropriate stakeholders. GIS resources should be used to identify both critical assets (e.g., hospitals, fire stations, shelters, distribution centers, substations, pipelines, dams, drinking water sources), transportation routes (e.g., primary and secondary routes and alternates), and vulnerable populations. GIS staff knowledgeable in the tools that have been developed should be available during the entirety of an emergency to provide information to decision makers and emergency services and in addition to being able to generate updated maps to share with the public.

While some of the data can and should be made available to the public, others are sensitive and should only be available to vetted individuals within emergency management and public safety. Therefore, data should be tagged with a classification scheme that remains with the data to clearly articulate with whom the data may be shared. The Ohio State University (OSU) implemented a similar *system for institutional data classification* that includes public, internal, private, and restricted levels.¹ Likewise, contracts or partners outside City government should include access to classified information when necessary. Subsequent training should be provided to ensure that individuals, both within and outside of City government, understand and comply with the classification system.

Some facets of the GIS tool to map fixed critical assets and vulnerable populations have already been created by Franklin County Emergency Management and Homeland Security (FCEM

& HS), and the Franklin County Emergency Operations Center staffs a GIS position for generation of real-time maps. Since this agency already handles emergency preparedness and response for Columbus and other jurisdictions, it makes sense to determine what partnership between the City of Columbus or FCEM & HS can best fulfill various parts of this effort, how information can flow between the City and county, and how duplication of services can be avoided.

Critical Assets

American Electric Power (AEP) currently prioritizes facilities, such as hospitals, for re-establishment of service when there is an outage. A tool identifying critical city facilities, such as fire stations and shelters, would allow utilities to also prioritize these locations. Once developed, utilities could be invited to review the GIS tool and provide feedback about facilities and routes based on their knowledge of the surrounding infrastructure.

Key natural resources that could be damaged or contaminated during environmental hazards should also be included. For instance, in July 2016, Columbus issued a warning for high nitrates in drinking water in a portion of the region.² The City was able to quickly post a map to its website, which was subsequently distributed to media outlets, showing the affected properties. The ability to efficiently generate such products, both for emergency responders and the public, is underpinned by robust GIS tools.

Transportation Routes

In addition to major arteries, the critical routes identified with this tool should include roads in close proximity to hospitals, or those that serve as solitary routes between shelters and

emergency services. This need was highlighted during the windstorm of 2008 resulting from the remnants of Hurricane Ike, when Columbus experienced significant electrical service outages and road closures due to downed trees.³ Transportation routes, including some major arteries, were unusable for days after the storm.

The proposed tool should identify neighborhoods that are likely to be isolated under various scenarios, flooding being the easiest to anticipate. During major disaster events, such as floods, it may become necessary to protect citizens by moving or relocating them from areas that are threatened to areas that are more secure. These types of evacuations are directed by Columbus' Fire and Police Departments, and they are supported by the Franklin County Engineer's Office, the Central Ohio Transit Authority (COTA), FCEM & HS, and other agencies and transportation industry entities, through Emergency Support Function 1 (ESF1) Transportation of the Franklin County Emergency Operations Plan.⁴ ESF1 also includes the *City of Columbus Downtown Evacuation Plan* and the Mid-Ohio Regional Planning Commission (MORPC) *Evacuation Framework*.⁵ ⁶ COTA should be engaged in planning as many of their assets are critical to moving people. For example, similar COTA arrangements have provided free transportation to the public when the city is under certain levels of *snow emergency*.⁷

In addition to moving people, plans should be in place to provide transportation and logistics for critical resources, such as medical supplies and bottled water. In the case of a large-scale, regional event, plans should make considerations for procurement of supplies from outside the region via reliable transportation routes. Knowledge of these prioritized transportation routes could inform subsequent city investment in infrastructure such as LED street lights and traffic controls with battery backup.

The Ohio Department of Transportation (ODOT) *Infrastructure Resiliency Plan* recently identified transportation infrastructure that is most at risk due to climate change; information from this report relevant to transportation in Columbus should be included within the City's GIS tool.⁸

Vulnerable Populations

Particularly vulnerable populations, such as those in close proximity to a floodplain or unlikely to relocate due to inaccessibility, should be identified on the GIS tool. This would permit efficient transportation to be arranged if the impacts of the environmental hazard overlap with the vulnerable population. Data on vulnerable populations, as identified by various characteristics, was recently made available via the Populations at Risk tool by Headwaters Economics; data within the tool is derived from well-established, federal data sets and can be easily imported into any GIS tool for immediate use.⁹ The next chapter of this plan focuses exclusively on vulnerable populations.

N16

Evaluate city preparedness and response during and after environmental hazard emergencies.

According to the FCEM & HS *Risk Assessment for Franklin County 2016*, all of the environmental hazards noted in this adaptation plan are among the 19 threats and hazards that have been evaluated for Franklin County.¹⁰ City preparedness and response to these threats require an assessment of risk based not only on current climate trends but also future projections. Environmental hazard emergencies currently prompt responses from various agencies.

FCEM & HS, in conjunction with OEMA, offers extensive preparedness training and response

Agencies that Respond to Environmental Hazard Emergencies

<i>Air Quality</i>	MORPC and Ohio Environmental Protection Agency (OEPA)
<i>Drought</i>	Ohio Emergency Management Agency (OEMA) and Columbus Division of Water
<i>Flood</i>	National Weather Service (NWS) and OEMA
<i>Heat Waves</i>	NWS and Ohio Department of Health (ODH)
<i>Water Quality</i>	Columbus Division of Water and Franklin County Public Health (FCPH)

tools for environmental hazard emergencies. All efforts of the City should integrate with and build upon resources that have already been developed by these agencies. Plans should be developed, and training should be completed well in advance of an emergency, especially considering the timeline of onset varies by hazard. For example, air quality and drought have relatively long onsets, floods and heat waves have relatively short onsets, and water quality has a relatively long onset that can manifest as an acute problem with a harmful algal bloom (HAB).

FCEM & HS currently maintains a **Training and Exercise Plan** for environmental hazard emergencies.¹¹ This training should be revised to incorporate risks magnified by climate change and disseminated to a broader audience. Drawing on training already articulated in county plans brings greater awareness to the threat of environmental hazards, reduces the likelihood of training being neglected, and allows this training to be incorporated with other programs already in place. Likewise, FCPH manages the **Medical Reserve Corps**, and FCEM & HS manages the **Community Emergency Response Team (FC**

CERT).^{12, 13} Each of these groups have trained volunteers, many with technical knowledge, that are willing and able to serve during emergencies.

Severe floods, heat waves, and water quality issues might necessitate local emergency services and deployment of the Ohio National Guard by the Ohio Governor's Office. Coordination between City departments and external agencies is encouraged. During an event, incident management structure should be established between City leadership to facilitate communication and decision-making. FCEM & HS already serves as the emergency management agency for the City of Columbus and 41 other jurisdictions in Franklin County, streamlining communication between local municipalities and state agencies.

Mutual Aid Agreements can be prepared and signed ahead of time. The Columbus Department of Public Utilities (DPU) is currently a member of **Ohio WARN** (Water/Wastewater Emergency Response Network) and can request specialized assistance from other public utilities in the state.¹⁴ They can also work with OEMA to request responses from National WARN members.

Additionally, DPU is also a member of the AMP Ohio (American Municipal Power) *Mutual Aid Program* that provides emergency response in the aftermath of disasters.¹⁵

Once the emergency has ended and basic services have been restored, much of the long-term work of clean up, restoring services, and caring for citizens falls to the city. In the case of particularly damaging events, a disaster declaration at the state or federal level can bring additional long-term support. Services such as, but not limited to, debris removal, food and water distribution, and establishment of temporary shelters are coordinated through the Franklin County Emergency Operations Center as written in the Franklin County Emergency Operations Plan.⁴

With regard to flooding, postmortem analyses of the emergency response and post event actions taken by *Nashville in 2010* and *Houston in 2017* could inform planning.^{16, 17, 18} Likewise, *Chicago in 1995* and *Toledo in 2014* are cases to examine for emergency response to heat and water quality, respectively.^{19, 20, 21} Chicago is a case of how planning and decision making broke down and led to tragic consequences.

A17

Track and communicate costs associated with preparing for and responding to environmental hazards.

While failure to mitigate and adapt to climate change may be devoid of upfront costs, individuals working in the climate resilience community know that expenses are paid over the long-term. Without an appreciation for the number and magnitude of changes, it is easy to discount the inevitable cost to communities and individuals. In order to understand the full costs of responding to environmental hazards, expenses associated with both preparing for and responding to these events should be tracked.

Knowing these expenses allows policy makers and planners to better understand long-term costs associated with the decisions they are making. As additional cost information is collected over time, policies and plans, in addition to funding allocations, can be adjusted accordingly.

In a budgetary sense, costs within specific departments of City government should have options of being tagged as associated with responding to particular threats, of which climate change is one. During reporting periods, department and City leadership would be able to examine costs not just by department but by tagged themes that extend between multiple departments. Similarly, if all planning for climate change adaptation was paid by one budget allocation that needed to be divided among a number of departments, portions could then be tracked to provide accountability.

Expenses for responding to emergencies would be a bit more complex, with the necessary step of rating various emergencies and disasters as being fully or partly attributable to climate change. The City could elect to also track metrics, like costs incurred by the private sector and the percentage of those that were insured versus uninsured. If the City is unable to track costs associated with preparing for and responding to environmental hazards, weather hazards could be substituted as these are likely to be more readily tracked in both the public and private sectors. FCEM & HS has a procedure and federal forms that are required for tracking costs related with events that rise to the level of a disaster. For significant events, these procedures and documents could be used to estimate costs. For smaller events, the procedures and documents might provide the City with guidance on what could be efficiently tracked.

The DPU Work Asset Management (WAM) system provides the costs associated with all response

and recovery work assignments that result from weather-related incidents (flooding, ice/wind storms, tornado, etc.). Activities and resources tracked in WAM include personnel time, contractors, use of equipment, materials, and damaged infrastructure and large assets. Additionally, DPU can track all claims resulting from the incident. Although DPU is the only department that uses WAM, other departments use similar systems to track costs for work assignments. The City has a “Crystal” management system that is able to extract this data from the different systems within City departments.

Examples of costs that could be tracked include the City’s *contingency contract for \$1 million* for reagents, and \$3 million for upgrades, to a water treatment facility to address taste associated with algal blooms.²² These blooms are expected to become more common under a warming climate.²³ In addition, we have seen neighborhood flooding associated with increasingly common intense rainfall events, such as the *event that struck near OSU in July 2017* and resulted in the flooding of High Street and stranding of vehicles.²⁴ In this case, the costs fell on stranded motorists and businesses along High Street. Additional cost information regarding projects needing to be completed due to flooding and environmental vulnerabilities might become available upon completion of the DPU Hazard Vulnerability Assessment.

An interesting measure of costs borne by individuals would be the portion of current and future insurance costs, such as homeowners insurance, attributable to climate impacts. In order to make these hidden costs more transparent to citizens, Columbus in partnership with other cities or regional and state government could work to gather this information from the insurance industry and share it with broader community. It is likely that these estimates are already available in coastal

communities. If they are available for the Midwest in general and Ohio specifically, it is uncertain whether the insurance industry would be willing to share either specific or detailed information about how climate impacts factor into their rates.

Costs associated with preparing for and responding to environmental hazard emergencies should be communicated with the public to maintain transparency and capitalize on an opportunity to educate individuals, business, and organizations about planning for resilience. Sharing this information could also help dispel the misunderstanding that inaction on climate change comes at no cost. Information could be shared online, curated for inclusion in an annual report, or embedded on signage installed as part of capital improvement projects.

A18

Establish contingency contracts so that sufficient resources are available in case of environmental hazard emergencies.

Based on the capacity to clean up, restore services, and care for citizens following environmental emergencies, contingency contracts should be established for services and assets that the city might need but otherwise might not be readily available. These contracts have pre-negotiated costs for procurement of particular services or assets, with included delivery schedules. In many cases, there are primary and secondary suppliers to hedge against disruptions to supply chains. Examples of contracts appropriate for environmental hazard emergencies include, but are not limited to: sandbags, bottled water, generators, environmental-cleanup contractors, and technical services for repair of HVAC (heating, ventilation, and air conditioning) and pumping systems. Each environmental hazard plan should account for services and assets that will be needed so that contracts can be established well in advance of an emergency.

With emergencies for which the City will seek reimbursement from the Federal Emergency Management Agency (FEMA), it is important to remember that **procurement rules from FEMA** must be followed.²⁵ Under these rules, pre-negotiated contracts may be utilized during an emergency (with justification of the emergency), but regular procurement procedures must be reverted to once the emergency has ended. Regular procurement procedures also require that the most restrictive procurement process be followed, regardless of whether it is at the local or federal level. FCEM & HS and OEMA have extensive knowledge of assets available from state and federal agencies and experience with planning and procurement for emergencies.

A19

Develop new app or integrate with existing app for environmental hazard alerts.

Digital tools allow individuals to receive timely and customizable information during emergencies and provide updates to emergency services, streamlining the flow of information in both directions. Over the past few years, mobile applications have gained popularity for such tasks as neighborhood communication and real-time traffic alerts. During the 2017 flooding in Houston, mobile applications emerged as novel communication vehicles between citizens and first responders when traditional communications vehicles (e.g., phone and emergency alerts) broke down. With cellular phone access at 95% and smartphone access at 77% in the United States, and the resilience of the cellular network being demonstrated in circumstances such as Hurricane Harvey, mobile apps can serve as a robust communication tool during emergencies.²⁶

The City of Columbus currently has a mobile application, **MyColumbus**, designed to provide information (non-emergency) to residents and serve as a conduit to submit 311 requests.²⁷ For

emergency- and hazard-related information, FCEM & HS developed the **ALERT Franklin County** app, which is already available to all Franklin County residents.²⁹ Columbus has collaborated with FCEM & HS in deploying ALERT. Rather than create another mobile application for hazard alerts, the City should continue to use MyColumbus for non-emergency information but utilize ALERT for emergency communications. Columbus needs to carefully consider the role of its websites during emergencies. City websites and the MyColumbus app could all include a header to point visitors seeking out emergency information to the website of FCEM & HS and ALERT Franklin County app. The roles and limitations of the ALERT app, MyColumbus app, and websites should be clearly understood and articulated. All three platforms should work in tandem to ensure that residents receive vital information in a timely manner.

Any digital solutions will require regular maintenance and updating of features to remain secure and relevant. Likewise, similar to GIS services, staff needs to be on call during an emergency to assist with content curation and note areas for improvement. FCEM & HS is best positioned to deliver these continually evolving services. Since not everyone has access to a smartphone, especially among some vulnerable populations, more traditional methods of communication (television, radio, text alerts, etc.) will still need to be maintained for the foreseeable future. Thus, mobile applications are not a panacea for emergency communication. For those with landlines, FCEM & HS, through the Everbridge Notification System, has the ability to send out a Reverse 911 message to any area in their designated region. Although the program is managed by FCEM & HS, the City of Columbus has access to use the Everbridge database and notification capability for their employees.

The social science research community has

Improving Emergency Communications

While there have been considerable improvements to emergency communication during disasters in the United States over the past decade, additional changes that have been requested by emergency managers and have been deployed elsewhere in the world have yet to become standard in the United States. For instance, the Federal Communications Commission (FCC) does not require wireless carriers to direct wireless emergency alerts to specific, geographically targeted recipients. This is particularly important when individuals in two adjacent locations need to be given different instructions, such as individuals in one location needing to shelter in place while individuals in an adjacent location need to evacuate. Likewise, wireless emergency alerts do not allow inclusion of images, such as photographs or maps, that might be useful to recipients.²³ While mobile carriers were able to stage fuel for backup generators, portable cell sites, and additional assets during Hurricane Harvey, individuals that called 911 often received busy signals or long hold times as there was not sufficient capacity to answer calls. While this was an improvement from Hurricane Katrina, when much of the cellular network was incapacitated, overloaded 911 call centers could be alleviated by allowing excess calls to be distributed to other locations, potentially outside disaster zones, where additional infrastructure and staffing are present to absorb the demand.³³

demonstrated that during disaster situations, such as hurricanes and flash floods, individuals do not respond to emergency notifications in expected ways.^{29, 30} Therefore, effective communication should take into account how people receive and respond to these messages. For instance, during the *flash floods in California in January 2018*, only 10-15% of residents in Santa Barbara County evacuated when told to do so, suggesting that there was a disconnect between the messaging and the desired behavior.³¹

A20

Implement educational campaign to inform the public about insurance and other shared risk programs available for environmental hazards.

The public is likely not fully aware of risks associated with deteriorated air and water quality, floods, heat waves, and droughts, or ways to insure themselves for personal, business, and organizational losses. Probably the best known program for shared risk is the *National Flood Insurance Program (NFIP)*.³⁴ Depending on the type of loan sought by a homeowner and the home's location relative to an established floodplain, lenders require homeowners to purchase a policy from the NFIP. But, the current program is underfunded, not all property owners understand its limitations, and the nature of the program often incentivizes property owners rebuilding on the same site following a flood without significant design changes. With climate change increasing the frequency and intensity of extreme rainfall, events are occurring more often than expected by historical probability.³⁵ While

there has been a recent effort to update floodplain maps to better reflect the best available science, the process is costly and contentious. Without access to updated information, property owners are therefore bound to make decisions based on understated risk. Likewise, costs associated with supplemental insurance and trends in rate structures must be considered when accounting for comprehensive long-term costs.

Each of these environmental hazards impact individuals, business, and organizations in different ways. Therefore, an educational campaign needs to target a variety of audiences, communicate information in formats tailored to those audiences, and offer solutions appropriate to audience needs. For instance, deteriorated air quality is a cost borne by individuals and hospitals. Costs associated with poor air quality that result in an increase in visits by individuals to emergency departments are paid through health insurance. Individuals without health insurance

personally bear the costs or transfer the costs to hospitals through unpaid or underpaid bills.

Heat waves, droughts, and deteriorated water quality can be risks to businesses. For instance, a heatwave or drought may increase costs for plant nurseries. A regional water quality emergency may result in the temporary closure of food processors, restaurants, and businesses associated with tourism. In each of these cases, individuals and groups need to take steps to understand, reduce, and pool their particular risks. For large companies, experts can be hired to analyze risk in more sophisticated ways, reduce risk where possible, and distribute the remaining risk over the entire company. Smaller companies and individuals may require external expertise, purchase additional insurance coverage in traditional or novel marketplaces, and/or participate in public-private partnerships. An educational campaign needs to be delivered by a trusted source that has deep knowledge of both the problem and options available.

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