

# Appendix

The development of the CCAP began in Autumn 2016 with the seating of a Task Force composed of individuals from The Ohio State University's Byrd Polar and Climate Research Center (BPCRC), Columbus city government, and MORPC. A list of these individuals is provided in the Acknowledgments section of this document.

To guide city government, non-profit organizations, businesses, and individuals in accomplishing the recommended actions, the Task Force was charged with:

1. soliciting input and feedback from important community stakeholders and technical experts.
2. drafting a list of prioritized actions that could be taken to address climate change risks and vulnerabilities.
3. providing an accessible, written report, with sufficient background information and connections to existing initiatives.

This largely followed recommendations provided by the Climate and Energy Working Group of the Columbus Green Team in Spring 2016 and a framework from the U.S. Climate Resilience Toolkit.<sup>1</sup> In total, more than 90 people were directly involved in the development of the CCAP, including Task Force members, stakeholders and technical experts.

The work of the Task Force was informed by a number of assumptions.

1. Many climate change impacts are complex phenomena involving people, places, and events well outside city boundaries and the control of city government, but the city is the level

of government with which individuals are mostly likely to interact. Therefore, the City has an important role to play in preparing the local community for climate impacts.

2. City government is one player in the local landscape of climate resilience. Therefore, efforts should build capacity with local businesses, non-profits, and individuals while also sharing information gathered to regional and statewide government agencies.
3. There are some prior local efforts to address risks and vulnerabilities associated with climate change. Likewise, a number of other local initiatives could be made more resilient through receipt of critical information. Therefore, efforts should build on successful past projects and take advantage of existing opportunities rather than focus on constructing brand new initiatives.
4. Resources available in both the public and private sectors are limited. Therefore, actions that have the lowest barriers to implementation and provide the maximum return on investment should be prioritized.
5. Populations within the city should not face undue harm from climate change impacts because of circumstances outside of their control. Therefore, the city has a responsibility to work proactively to protect vulnerable populations from climate change impacts.

A timeline of steps and critical milestones in the development of the CCAP is included below. In Autumn 2016, the Task Force identified the relevant departments, organizations, and technical backgrounds that would play a role in the creation, refinement, and prioritization of actions to address the vulnerabilities from the *Climate Change in Columbus, Ohio* report.<sup>2</sup> A database of community stakeholders and technical experts was created, with additions being made throughout the life of the project, that served to extend the expertise of the Task Force.

In Winter 2017, a first stakeholder meeting was held at The STEAM Factory in Franklinton. This meeting was facilitated by the Task Force members, and it involved 34 stakeholders. The stakeholders were divided into 7 groups based on their backgrounds and expertise. The 7 groups were Air and Water, Business, Community Health, Community Housing, Community Neighborhoods, Infrastructure, and Natural Systems. During the meeting, each group was asked to draft a series of action items that would address 6-7 of the priority vulnerabilities. The purpose of this process was to collect as many ideas as possible, regardless of cost or feasibility. By the end of the meeting, 412 action items had been proposed.

During Winter 2017, the list of 412 action items was reviewed and refined by the team at BPCRC. Through a process of eliminating duplicates, collapsing or combining overlapping actions, and splitting complex actions, the list was reduced to a manageable size. As the list evolved, the Task Force members reviewed the statements and refined the language, and the list was pared down to 68 action statements. The Task Force ensured that all of the statements fell within the scope of the City, and were feasible based on current science and technology, clearly written, and were sufficiently discrete in their objectives.

The 68 actions statements were divided into 14 categories for review by technical experts with backgrounds in fields that corresponded with each category. In Spring 2017, digital surveys for each of the 14 categories were distributed, and 45 technical experts provided feedback on the proposed action statements. Each category garnered responses from at least two technical experts, with most categories receiving at least three or more reviews. Within the survey, the experts were asked to indicate the level of (1) potential positive impact of each proposed statement, (2) feasibility of implementing each proposed statement, and (3) their technical knowledge on each proposed statement. Feasibility of implementation was parsed from three separate questions that asked experts to indicate the relative costs associated with implementation, the amount of local knowledge and resources that would facilitate implementation, and the political will and expected constituent support. Possible answers for the impact and feasibility questions ranged from “strongly disagree” to “strongly agree”, and answers for the expertise question ranged from “no expertise” to “significant expertise”. The experts were also given the opportunity to provide additional comments for each statement. An example survey question is provided at the end of this Appendix A (Figure A1).

After the surveys were returned, the responses were assigned a score of 1-4 for each question; a score of 1 corresponded with “strongly disagree” or “no expertise” answers, while a score of 4 corresponded with “strongly agree” or “significant expertise” answers. The final impact and feasibility scores from each technical reviewer were weighted by the stated expertise of the reviewer for each statement, respectively. By doing so, an index score was calculated for each action statement that gave more weight to those with greater expertise in each subject. Actions considered to have high impact and high feasibility received high index scores, while low

index scores were given to actions that experts thought would either have a low overall impact or would be difficult to implement.

The 68 action statements were ranked based on their index scores and categorized as either Necessary, Aspirational, or Not for Inclusion (see table on page 120). This prioritized list was

reviewed at a second stakeholder meeting held in Summer 2017, which was attended by 30 stakeholders. Stakeholders were divided into 7 groups based on their professional backgrounds. The groups included Air Quality/Energy Use and Infrastructure, Business, Ecosystems, Extreme Heat, Flooding/Runoff, Vulnerable Populations/Public Safety, and Water Use/Drinking Water. The review process involved confirming whether each action statement was correctly placed within the three bins (Necessary, Aspirational, or Not for Inclusion) based on the professional expertise of the stakeholders. To facilitate this review, stakeholders were provided with details of the index scores that were generated from the technical experts feedback. Most important was ensuring that the Necessary and Aspirational categories contained all actions that would be included in the final report. Final decisions regarding the movement of actions were made by the Task Force in a subsequent meeting. Twelve statements changed bins or were split (nine moved to a higher priority bin, one moved to a lower priority bin, and two were split with one portion moving to a lower priority bin). By the end of this process, 43 action statements were deemed either Necessary or Aspirational and were included in the final document for more detailed examination. During the Summer 2017 meeting, it was also determined that greater input was needed from the business community, which was subsequently sought out by the Task Force. Despite a concerted effort to coalesce a set of actions directly pertinent to community businesses, a lack of representation by Columbus business leaders resulted in the inability to effectively map specific actions to the needs of the business community.

From Autumn 2017 through Winter 2018, Task Force members at BPCRC drafted the CCAP document. The final list of 43 Necessary and Aspirational actions were divided between 8 technical chapters, each one corresponding to a major climate impact or a sector that would

**Instructions**

The following action has been proposed to enhance climate resilience in Columbus. Based on your technical expertise, respond to the following statements.

**Action (Statement):**

"Implement educational programs on environmental hazard (air quality, extreme heat, flooding, contaminated drinking water) preparedness to reach diverse and vulnerable populations." #2

**Impact of this action: \***

	Strongly Disagree	Disagree	Agree	Strongly Agree
This action will have a significant positive impact on Columbus. (number of people reached, extent of the impact, length of the impact, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Feasibility of implementing this action: \***

	Strongly Disagree	Disagree	Agree	Strongly Agree
The city is currently willing to take this action. (political support of elected city officials; constituent support; consistency with regional, state, and federal laws and priorities; etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The city currently has the knowledge, staff, and infrastructure in place to take this action.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Additional costs associated with this action are low.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Technical Expertise \***

	No Expertise	Little Expertise	Some Expertise	Significant Expertise
Your level of technical expertise regarding this action:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Optional Feedback**

Your answer \_\_\_\_\_

**Figure A1.** An example survey question provided to technical experts in Spring 2017.

be heavily affected by climate change. The chapters were reviewed by the other members of the Task Force, as well as some technical experts, for content, style, and tone. Three additional outside reviewers, who do not have technical backgrounds in any of the subjects discussed in the plan, provided a final review for style and grammar. The first draft of the document was made available for public comment from February 1, 2018 through March 9, 2018. All comments were reviewed by the Task Force, and revisions were made to the original document by BPCRC and the City of Columbus where deemed appropriate.

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- <sup>1</sup> “Meet the Challenges of a Changing Climate.” U.S. Climate Resilience Toolkit. w. (Accessed Oct. 2018).
  - <sup>2</sup> Great Lakes Integrated Sciences and Assessment (GLISA) and the University of Michigan Climate Center. *Climate Change in Columbus Ohio: An assessment of Columbus’ Key Climate Changes, Impacts, and Vulnerabilities of Concern*. March 2016. [http://research.bpcrc.osu.edu/education/greenteam/FINAL\\_ColumbusFinalReport\\_3.0.pdf](http://research.bpcrc.osu.edu/education/greenteam/FINAL_ColumbusFinalReport_3.0.pdf). (Accessed Dec. 2017).

# Preliminary Climate Adaptations for Columbus

Index Score	Statement
3.87958	Adopt and enforce building codes to reduce localized flooding and basement/sewage backups.
3.46773	Continue upgrades to water and sewage treatment infrastructure to reduce sewage contamination of waterways.
2.64994	Understand the types of events, likelihood of occurrences, and ranges of severity that adversely impact drinking water availability.
2.34626	Use GIS to map fixed critical assets and vulnerable populations susceptible to environmental hazards.
2.14181	Implement education campaign for individuals and businesses on proper treatment and use of contaminated drinking water.
2.11936	Create long-term management plan for entire watershed serving Columbus that ensures sufficient drinking water.
2.11089	Evaluate capacity to clean up, restore services, and care for citizens following environmental hazard emergencies.
1.8071	Reduce impacts of stormwater runoff and promote infiltration in new development and redevelopment.
1.77721	Identify representative advocacy organizations for diverse and vulnerable populations.
1.77644	Ensure diverse modes of communication during environmental hazard emergencies to reach diverse and vulnerable populations.
1.68908	Develop a public-private partnership to manage food and water access for vulnerable populations during environmental hazard emergencies.
1.61662	Establish extreme heat education campaign and health advisories for those running summer programs. (Enveloped #32, make sure to include working conditions in new phrasing.)
1.58453	Implement education campaign to reduce water use.
1.34861	Promote sustainable landscaping practices for residential, commercial, and industrial properties.
1.06522	Review inter-agency and city-wide training and response to environmental hazard emergencies.
0.96028	Establish a network of cooling centers and draft clear guidelines for network members.

	<b>Index Score</b>	<b>Statement</b>
	0.80456	Facilitate cross cultural dialogue, offer training for service providers, and share best practices.
	0.79673	Assess and ensure adequate transportation and logistics for critical resources.
	0.76734	Develop emergency transportation plan that can be implemented during a flood.
	0.5556	Implement educational programs on environmental hazard preparedness to reach diverse and vulnerable populations.
	0.40793	Collaborate with organizations, agencies, and private landowners to support holistic, long-term ecosystem health – promoting education campaign.
	-0.1617	Modernize electric grid for greater resiliency and more efficient distribution.
	-0.3134	Implement idling reduction education campaign (specify fuel types).
	-0.5667	Implement program for individuals and businesses to reduce energy usage during peak demand.
	—	Continue upgrades to water and sewage treatment infrastructure to reduce harmful algal bloom toxins in drinking water. <i>(Split from other statement; no index score.)</i>
	1.24559	Create method of measuring and reporting water used from streams and rivers for irrigation.
	0.84745	Track and communicate costs associated with preparing for and responding to environmental hazards.
	0.55833	Develop event-based water use criteria.
	0.48952	Require or incentivize monthly utility costs for rental properties be reported to potential tenants.
	0.46305	Improve data collection to anticipate and respond to harmful algal blooms.
	0.40793	Collaborate with organizations, agencies, and private landowners to support holistic, long-term ecosystem health – identifying green space, urban canopy, urban farms.
	0.40621	Develop policies on application of fertilizers, herbicides, pesticides and animal waste.
	0.33544	Collaborate with landscaping and fertilizer companies to improve products and their application.
	0.26151	Develop new app or integrate with existing app for environmental hazard alerts.
	0.24701	Create community health action teams for environmental hazards.

	<b>Index Score</b>	<b>Statement</b>
	0.19417	Implement education campaign on energy audits and renewable energy to reduce emissions for residential and business users.
	0.13395	Provide programs to distribute fans, air conditioners, and water to vulnerable populations.
	0.0881	Internalize climate resilience practices in city planning to reduce the urban heat island.
	0.081978	Improve irrigation through changes in infrastructure and practices that more efficiently use water.
	0.05121	Require disclosure of known property problems for sale or rental of property.
	0.05121	Implement education campaign for landowner66s to promote responsible use of fertilizers, herbicides, and pesticides.
	-0.1563	Update building code to require more efficient water use.
	-0.2134	Improve efficiency of water use in city fountains, pools, splash pads, and ponds.
	-0.2721	Lobby state and federal government to implement policies that reduce erosion and runoff and promote infiltration.
	-0.3606	Retrofit flood gates or backflow preventers on stormwater infrastructure.
	-0.3996	Establish contingency contracts so that sufficient resources are available in case of environmental hazard emergencies.
	-0.562	Implement education campaign to inform the public about insurance and other shared risk programs available for environmental hazards.
	-0.5989	Increase number of air quality monitoring stations and pollutants monitored (specify collecting baseline data in statement text?).
	-0.8669	Increase investment in and/or purchase of renewable energy.
	-2.6799	Use data and best practices to adapt transportation modes and inform economics of transportation. (e.g., reduce single occupancy, lower polluting fuels, lower emissions vehicles, incentives or requirements to provide EV charging stations, expand transportation options and times to reduce overall transportation pollution).
	0.079	Implement education campaign for small business continuity planning.
	-0.8532	Develop tool that allows Columbus residents and business owners to access flood risk data in an intuitive, graphical interface.
	-1.2217	Utilize climate projections and hydrologic models to revise floodplain maps and re-evaluate locations of buildings in floodplains and use of flood control measures.

Index Score	Statement
■	-1.2403 Aggregate real-time environmental hazard data from multiple agencies and sensors platforms for display on a dashboard.
■	-1.2858 Provide financial instruments for vulnerable populations that have insufficient cooling measures.
■	-1.2911 Incentivize relocation or retrofit of residential and commercial properties and critical transportation routes to create greater resilience.
■	-1.3387 Collaboration with coroner to identify underlying factors impacting death related to extreme heat.
■	-1.4589 Provide transportation to or create portable/mobile cooling centers.
■	-1.547 Lobby state to accept new building code, energy efficiency code, and appliance/equipment standards.
■	-1.6377 Establish regional data hub for sharing information on natural resources.
■	-2.3699 Require energy usage and other measures of externalities (i.e. CO <sub>2</sub> , sulfates, etc.) in bidding projects and proposing policy changes.
■	-2.3984 Reassess permitting process for larger water users.
■	-2.8771 Increase use of residential and commercial water storage.
■	-3.5503 Promote on-site water treatment, water restoration, and greywater recycling within new and retrofitted buildings to increase efficient water use.
■	-4.0781 Inventory air conditioning capability of buildings and housing stock.
■	-4.6124 Require emissions testing for motor vehicles.
■	-4.6698 Create a water trading system for use during intense droughts.