2019 GLISA Small Grant White Paper

Preparing Erie, Pennsylvania for Extreme Weather - What to Do and Where to Start

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Acknowledgments

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Background and Approach

BACKGROUND

Erie County, Pennsylvania, which includes 76 miles of Lake Erie shoreline, Presque Isle State Park, the City of Erie, and nine coastal municipalities, is becoming increasingly vulnerable to both the short and long-term impacts of extreme weather and climate variability. Recent examples of these extremes have included record rain and snowfall events, tornados, ice storms, and more frequent high wind events. Each of these extreme weather events has resulted in costs to economic prosperity, personal property, the health and welfare of individuals, and the sense of certainty and safety in local communities. Overcoming these events and rising above them in the aftermath has become the 'new normal' for residents as they repair damage to homes and businesses, deal with loss of revenue, and try to address coastal damage caused by accelerated erosion.

Pennsylvania Sea Grant (PASG) collaborates closely with the Community Resilience Action Network of Erie (CRANE), a coalition of agencies and organizations with a vested interest in building climate resilience in Erie County. Current CRANE members include Pennsylvania Sea Grant, the Erie County Department of Planning, the City of Erie Sustainability Office, The Pennsylvania Department of Conservation and Natural Resources, The Pennsylvania Department of Environmental Protection, Penn Future, The Erie County Department of Health, The Erie County Conservation District, The Pennsylvania Lake Erie Watershed Association, and SCS Engineers, Environmental Consultants and Contractors. CRANE's mission is to engage with the Erie community through science-based education, outreach, and collaboration to identify climate vulnerabilities and implement proactive responses that preserve a vibrant and resilient region. In this context, resilience can be defined as strengthening the ability of human and non-human systems to withstand and respond to changes in the earth's climate. To help fulfill this mission, CRANE identified the following goals:

- Engage the public and stakeholders with accurate, local, up-to-date information on climate impacts, data, and projections.
- Provide technical assistance to communities in planning for and preparing for extreme weather events and other coastal hazards.
- Develop, support, and implement climate resilience strategies and actions for Erie County.

To better meet these goals and assist decision-makers in planning and preparing for extreme weather, PASG hosted a focus group in 2015 that asked community leaders, local businesses, and other community members to identify barriers that have impeded their ability to implement resilience and adaptation planning. Common responses included limited resources, lack of knowledge about local impacts, the lack of local climate leadership, and a disconnect on what tools and resources are available to them. The identification of these barriers helped PASG and CRANE to develop a 5-year strategic planning process with the goals of helping communities overcome these barriers and facilitate the incorporation of adaptation and resilience strategies into existing planning processes.

SUMMARY

Pennsylvania Sea Grant in partnership with CRANE submitted a project proposal to GLISA to develop a community strategy for building climate resilience in Erie following the steps outlined in the U.S. Climate Resilience Toolkit. These steps included:

- **Step 1: Explore Hazards**
  PASG proposed to explore Erie's hazards by working with GLISA to obtain Erie-specific climate data and hosting community engagement workshops to determine the most relevant community assets and concerns. Due to restrictions from Covid-19, the engagement workshops were reworked to include a community-wide survey and a document was developed to highlight the results of the survey and highlight relevant climate data. PASG also worked with Penn State to develop hazard visualization models to help garner discussion of potential lake level and flooding threats.
- **Step 2: Assess Vulnerability and Risk**
  This step involved identifying Erie's vulnerabilities by gauging how prepared Erie County municipalities are for severe weather hazards. The planning team adapted existing vulnerability assessment tools and met with shoreline municipalities to complete the assessment. The results helped to identify vulnerabilities and priorities to focus on for additional steps in the process.

- **Step 3: Investigate Options**
  In this step, PASG, GLISA, and CRANE held a workshop to customize and explore scenarios that would help municipal officials plan for a future with weather and climate conditions that look different than what has been experienced in the past. This provided a platform for discussion and consideration of the vulnerabilities and themes identified in Step 2. Participants then brainstormed resilience strategies that could be implemented to build resilience.

- **Step 4: Prioritize and Plan**
  Part of the prioritization process for municipalities took place during the scenario planning workshop; however, additional prioritization took place through a partnership with the Erie County Hazard Mitigation Plan update process through a survey allowing municipalities to rank projects they felt would be most beneficial to building resilience in their communities. For example, municipalities felt it was more important to plant trees to prevent erosion than it was to elevate structures prone to flooding. PASG and CRANE decided to conduct a similar survey for community groups to identify prioritized action strategies that could be prioritized and implemented at the community level.

- **Step 5: Take Action**
  Implementation involves compiling the prioritized action strategies and recommendations and incorporating them into existing planning processes, such as the Erie Hazard Mitigation 5-year update, and other community-wide planning initiatives. PASG hopes to be able to support the implementation of these strategies with future grants and funding opportunities.

PROJECT TEAM COMPOSITION

Primary Investigator: Sara Stahlman, Pennsylvania Sea Grant

Community Resilience Action Network of Erie (CRANE) project team:

- Shelby Clark, Pennsylvania Department of Environmental Protection
- Anne Desarro, Pennsylvania Department of Conservation and Natural Resources
- Joy Fronzoli, Erie County Department of Planning and Community Development
- David George, SCS Field Services
- Joseph Hudson, Erie County Conservation District
- Nikki Jackson, Pennsylvania Sea Grant
- Sam Mason, Penn State Erie, the Behrend College
- Sarah Peelman, City of Erie
- Jesse Stiles, Erie County Department of Health
- Jenny Tomkins, Penn Future

Relationships

PASG-GLISA RELATIONSHIP

This was the first GLISA small grant PASG has received and there was no prior relationship or partnership. GLISA provided immense support to the project and was vital to its success. PASG and CRANE worked with GLISA to obtain the necessary climatic data described in Step 1, and GLISA packaged this information in multiple ways to fit the needs of the project team. For example, a large document with all data and information was developed, but GLISA also provided a smaller summarized document that could be used on the CRANE website, and a summary handout that was distributed to participants of the scenario planning workshop. GLISA also assisted with the review of the framing document, the CRI tool, and with developing benchmark climate scenarios. GLISA was

especially helpful with facilitating the Step 3 scenario planning workshop. This is not an area where PASG had prior experience, so having GLISA take the lead provided a conduit to success. At all phases of the project, GLISA participated in CRANE monthly project calls and was a source of information and support whenever needed. The project team will continue to see GLISA as an important source of information and potential partnership on future projects.

Mary Austerman, a previous GLISA small grant recipient from New York Sea Grant was an integral partner in the success of this project. Mary shared resources, tools, and information from a similar project implemented in New York, including New York's Great Lakes CRI tool, and information, agendas, and lessons learned from New York's scenario planning workshops. Mary acted as a mentor and helped advise the process as well as reviewed materials whenever needed.

MUNICIPAL CONNECTIONS

In September 2021, PASG was invited to speak at a quarterly meeting of the Erie County Zoning and Code Enforcement Officials Association (ECZCEOA) to present on CRANE, the GLISA project, and to request participation from municipalities on the project and in the CRI meetings. Representatives from 12 local municipalities were in attendance, including Harborcreek Township, Summit Township, Girard Township, Erie County Planning, North East Township, City of Corry, Borough of Edinboro, Greene Township, Fairview Township, and the City of Erie. Through this initial connection, municipalities became familiarized with the project and were asking for more information on how they could participate. Connections with municipalities continued through the Erie County Hazard Mitigation 5-year update team. PASG and CRANE were invited to present at the initial "kick-off" meeting in June 2022, where 35 municipal stakeholders were in attendance. The relationship built through partnership with the hazard mitigation planning team was also extremely valuable. Thirteen new connections were made during the vulnerability assessment process, where PASG and CRANE met zoning officers, planners, emergency management staff, public works, and borough managers in seven municipalities to complete the CRI tool. Many of these same contacts also participated in the scenario planning workshop; however, ten additional contacts that previously had not been part of the process attended the workshop. Some municipal connections, such as Dale Robinson, Erie County's Emergency Management Coordinator followed up after the scenario planning workshop to have PASG and CRANE present at an Emergency Management meeting to present on the project. Dale organized the theme of this meeting to be about climate change to share information with additional emergency management staff. In total, PASG estimates connections with 45-50 municipal contacts because of this project.

COMMUNITY CONNECTIONS

Through this effort, PASG and CRANE have connected with several community partners, residents, business owners, and students. Through the implementation of community-wide surveys, these stakeholders were able to share their feelings, perceptions, and stories with CRANE to help inform and support the process. There are currently 115 respondents to the Erie Extreme Weather Survey, and 68 responded to the Community Resilience Project Survey, which was distributed in April 2023. In addition, PASG and CRANE have participated in presentations and community events, such as the Lake Erie Environmental Forum (60-70) participants, and the World-Wide Climate teach-in (40-50 participants) to engage the community and share information about CRANE's work and the GLISA project. This process was also supported by other CRANE members not listed above in this white paper, including those who helped to plan meetings, review materials, and provide feedback and input where needed. These members include the Pennsylvania Department of Environmental Protection, the Department of Conservation and Natural Resources, the Erie County Conservation District, and SCS engineers.

PARTNERSHIP WITH THE ERIE COUNTY HAZARD MITIGATION 5-YEAR UPDATE TEAM

During the project period, Erie County was undergoing an update of its 5-year Hazard Mitigation Plan. Recognizing that this initiative was following a similar process as the GLISA project, PASG, CRANE, and the Hazard Mitigation planning team decided to join efforts to collectively work on incorporating GLISA project results into the hazard mitigation plan. CRANE was invited to present at municipal meetings, provide input on plan content and structure, and participate in the review of the plan update. This project provided a context for data, feedback, and recommendations to be incorporated into existing planning efforts. The contractor leading the project shared this testimonial about PASG and CRANE's participating in the process:

"PA Sea Grant and CRANE were valuable partners in the 2023 update cycle for Erie County's hazard mitigation plan. The doctrine governing mitigation plans requires communities to both identify and integrate consistent, compatible planning efforts into the process, and the community risk assessment and scenario planning workshops were particularly relevant. Through the community risk assessment, the mitigation team was able to use survey data on the extreme weather hazards that most concern Erie County's residents. CRANE's survey data allowed the mitigation planning team to poll the public about a different, often-overlooked aspect of mitigation planning - risk reduction projects.

Additionally, workshops geared toward anticipating the impacts from scenarios engaged stakeholders in problem-solving that indirectly informed their municipal mitigation action plans. State and federal reviewers commented positively on the number of municipalities with multiple mitigation actions. Data available through CRANE, such as the Resilient Erie Story Map, also allowed for evidence of green infrastructure and low-impact development to appear in the mitigation plan.

Finally, individual CRANE members were engaged throughout the 2023 update. They provided comments on document drafts, and since several members were subject matter experts on some of the hazards appearing in the plan, hazard profiles are more accurate and locally specific than they would have been without CRANE's involvement."

- JH Consulting, Emergency Preparedness and Safety Consulting

Use of Climate Information and Services

Based on feedback from a previous focus group; the lack of Erie-specific climate information was a consistent barrier to resilience and adaptation planning. Therefore, obtaining these data and making it available to Erie stakeholders was a top priority.

In the project proposal, PASG requested that GLISA provide localized historical and future climate and weather data for Erie County, focusing on variables such as temperature and extreme heat, precipitation, flooding and drought, winter storms, ice cover for Lake Erie, and winter weather events. The planning team anticipated this information to be shared on the CRANE website and that it would help inform scenarios of concern for Erie County.

GLISA provided climate-specific information for Erie County, as requested. This information was added to the pacrane.org website, and weather "snapshots" were created, such as the extreme temperatures infographic. This data was also used to inform the development of the framing document, CRI tool, and climate scenarios for the scenario planning workshop. The project team used the climate information as expected.

Outcomes and Outputs

Erie, Pennsylvania Climate Data

Pennsylvania Sea Grant worked with GLISA to identify weather variables important to the region where historic/baseline data and future climate projections were needed. These weather variables included temperature, precipitation, lake levels, lake surface temperatures, ice cover, and winds. Temperature and precipitation data included annual and 10-year running averages, seasonal patterns, and monthly trends. Lake data included monthly, annual, and decadal lake levels, daily, seasonal, and annual lake temperatures, monthly average and annual maximum ice cover, and a look at potential changes in peak wind speeds by the end of

the century. This data was used to update and inform the PACrane.org website and develop the weather snapshots (Figure 1) for Erie County. This document is being held internally in CRANE's Google Drive folder as a reference material.

Climate Factsheet handout for Erie PA

GLISA prepared this handout to summarize relevant climate data in a 1-pager that is shared on the pacrane.org website and was used during the scenario planning workshop as a reference document.

Erie's New Normal Temperature Infographic

Erie's New Normal Temperature Infographic (Figure 1) was created to highlighting temperature data provided by GLISA into a document that could be printed and shared on the pacrane.org website. The intention is to eventually create infographics for all the climatic categories that GLISA provided data on.

Preparing for Extreme Weather in Erie, Pennsylvania – Community Survey

The Erie Extreme Weather survey was designed to gauge the Erie community's perceptions, experiences, and concerns surrounding extreme weather events. The results of this survey helped to shape the content and focus of the Erie Hazardous Weather Vulnerability Assessment (Step 2) by identifying key weather impacts and capturing anecdotal accounts of how extreme weather is directly impacting Erie's residents. The results of the survey represent input from respondents living or working within the Erie region. Respondents encompassed stakeholders from industries such as agriculture, marinas, transportation, grocery stores and businesses, municipalities, natural resources, and residents of the area. To date, 115 people have taken the survey; however, it remains open as an ongoing way to collect quantitative and qualitative information about how residents and business owners are experiencing climate impacts. Summary data from the survey identified the top five weather risks as current and future concerns for the Erie Region:

- Extreme temperatures
- Heavy rain
- High winds
- Coastal and inland flooding
- Blizzards

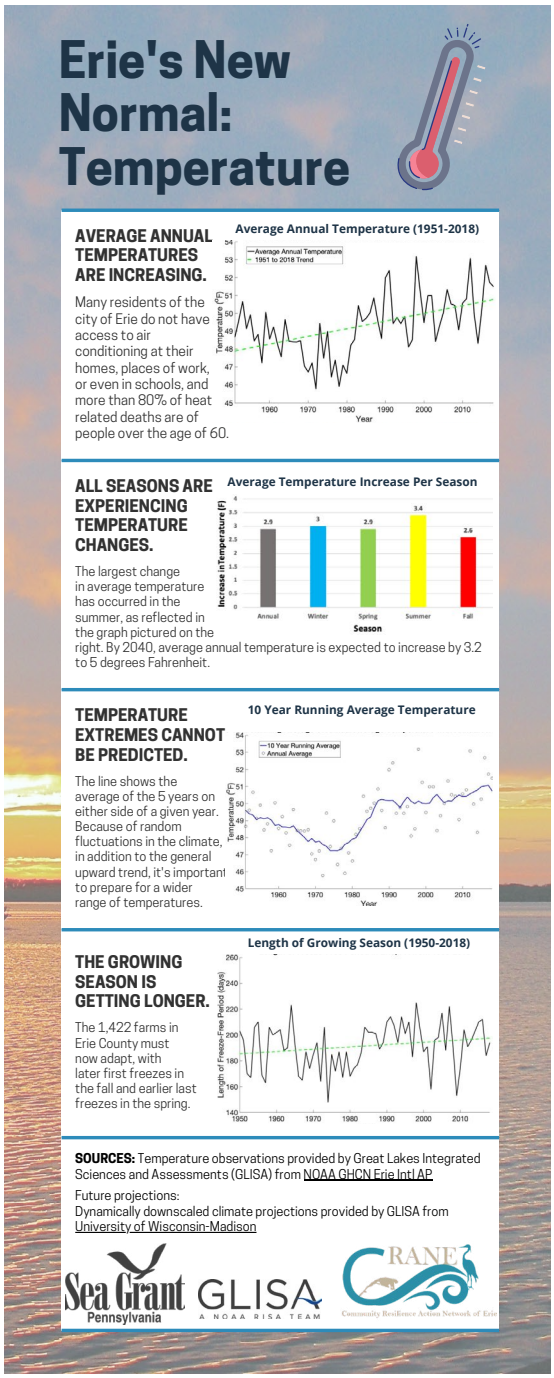

Figure 1. Erie's New Normal Infographic

Over 60 percent of survey respondents indicated that they have been directly impacted by hazardous weather in the past 10 years and 47 percent have needed to implement modifications to homes or businesses to account for these weather risks. Respondents reported impacts such as structural damage to homes and businesses, power outages resulting in loss of food and produce, hail damage, freezing water lines, basement flooding, and fear for personal safety. The survey also revealed collective experiences and loss due to hazardous weather. Multiple years of record high lake levels on the shores of Lake Erie resulted in damage to coastal infrastructure and shorefront businesses, decreased opportunities for outdoor recreation and fishing, and severe erosion, causing loss of bluff and the increased need for sand replenishment at beaches. Trust in the USDA hardiness zones and past weather patterns has dwindled as local farmers attempt to plan for their growing seasons and experience crop losses from extreme temperatures and frost. Respondents expressed that their greatest concerns for future impacts included ecological damage to Presque Isle State Park, infrastructure and energy concerns, and worry about future damage to homes and businesses.

Understanding Erie's Level of Preparedness for Coastal Flooding other Weather Disasters: A Community Vulnerability Assessment

This framing document was developed as a tool to summarize historical and projected climate information and highlight results from the Erie Extreme Weather Survey. The purpose of this document was to help set the stage for additional steps in the Steps to Resilience process. It provides background information on the project and project location, summarizes data from the survey, and includes five weather disaster narratives reflecting the five top weather risks identified in the survey. Each of the weather disaster narratives includes an introduction, a "benchmark" weather scenario, and a "credible worst-case scenario." The benchmark scenario indicates a historical baseline event that occurred at some point in Erie County's history. The credible worst-case scenario indicates an event that hasn't yet taken place, but that is plausible given climate projection and weather data. These examples were researched and developed by members of CRANE with data and expertise taken from sources such as New York's Coastal Resilience Index and Community Self-Assessment the National Weather Service, Federal Emergency Management Agency (FEMA), the Northwest Regional Climate Center, and others. These scenarios were used as discussion points to frame the vulnerability assessment conducted in Step 2 below, but are separate from the scenario planning process.

Erie Hazard Visualizations

PASG partnered with Penn State Department of Landscape Architecture to create hazard visualizations using climate data and lake-level data (Figure 2). These visualizations will be used to help identify areas where resilience projects could be implemented to provide the greatest benefit to the community and will be used in future discussions for resilience and adaptation planning, for example, a feasibility analysis of roofs in Erie that would be suitable for green roofs (Figure 3). It was intended for these visualizations to be developed before the CRI meeting and scenario planning workshop, however, delays with the development team prevented completion until the end of the project. These visualizations will be used at future meetings and in future materials used to identify resilience projects and action strategies. Funding from NOAA's Water Equity funding will also support additional green infrastructure visualizations of projects in vulnerable communities.

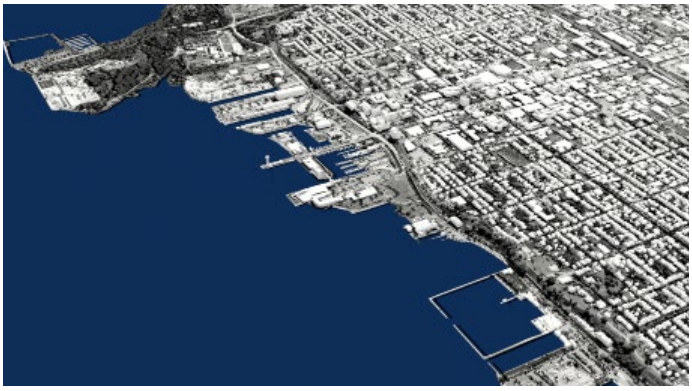

Figure 2. Lake Level visualizations of Erie's Bayfront

Figure 3. Suitability analysis for green roofs in the City of Erie

Erie County Coastal Resilience Index (CRI) Tool

Pennsylvania Sea Grant partnered with New York Sea Grant to adapt New York's Coastal Resilience Index (CRI) tool. Using this template, Pennsylvania Sea Grant and CRANE developed the "Erie County Coastal Resilience Index." This tool provides community leaders with a simple and inexpensive method of predicting if their community will reach and maintain an acceptable level of functioning after weather disasters. The Erie County CRI consists of six sections, including critical infrastructure and facilities, transportation, community plans and agreements, mitigation measures, business plans, and social systems. Critical infrastructure represented things like wastewater treatment systems and power grid infrastructure; critical facilities included emergency medical services and police stations; transportation included bridge and road blockages and availability of public transportation; community plans and agreements included emergency management plans and early warning systems; mitigation measures included shoreline restoration in eroding areas and weatherproofing of homes and businesses; business plans included agreements and coordination with local retail stores; and social systems included faith-based networks and community centers. Each section is meant to be completed using the baseline and worst-case weather narratives identified in the framing document in Step 1. Upon completion of each section, a resilience index score is calculated, allowing the sectors to be classified with low, medium, or high resilience.

Preparing Erie for Extreme Weather Webinar

On April 27, 2022, PASG hosted a webinar for local planners, engineers, code enforcement officers, floodplain managers, emergency management staff, administrators, and any other municipal official that would participate in the vulnerability assessment process. The webinar provided important background information on the steps in the project, the weather scenarios identified in the framing document, and instructions for using the CRI tool. The webinar brought in 26 participants.

CRI Data and Municipal Scores

PASG and CRANE met individually with seven Erie County shoreline municipalities to facilitate the completion of the CRI: The City of Erie, Fairview Township, Girard Township, Harborcreek Township, Millcreek Township, North East Borough, and Springfield Township (Figure 4). Themes that arose from the meetings included a generally low resilience score for critical infrastructure during heavy rains and high winds (over 78% of municipalities shared these concerns), and critical facilities during blizzards (57% of municipalities shared this concern). Another theme that arose during the CRI assessment was specific concern over Erie's power grid and aging power infrastructure. Transportation issues, including any impacts or disruption to roads, bridges, evacuation routes, and snowplows, as well as the physical capacity to move residents in times of emergencies were also top concerns. Another theme that arose was the lack of coordination with local retailers. No municipalities consulted had existing response plans or agreements in place with local stores to provide supplies or food during emergencies. These results and themes were used to help inform the scenario planning workshop discussed in Step 3.

Figure 4. Municipalities in Erie County that participated in the Erie County Coastal Resilience Index sessions

Scenario Planning Workshop and Summary Document

To help foster thoughtful consideration and discussion about extreme weather needs and recommendations, PASG partnered with GLISA to hold a scenario planning workshop for municipal staff. The workshop was held on October 12, 2022, at the Millcreek Township Municipal Building in Erie, PA, and was attended by 14 borough employees, township supervisors, environmental health and planning, public safety officials, and other municipal leaders from 10 different Erie municipalities. The goal of this workshop was to develop scenarios to help plan for a future with weather and climate conditions that will likely look different than what has been experienced in the past.

GLISA developed two physically plausible climate scenarios that included events and impacts from the five climate hazards identified as the greatest concern for the communities (A summer scenario involving sustained heat and storms, and a winter scenario involving blizzards, deep snow, and massive melting). These scenarios were informed by climate projections, historical trends, and the physical properties of the Great Lakes system.

Participants considered these climate scenarios in two focus areas, transportation, and power and water utilities, which were chosen based on results and feedback from the CRI assessments.

Participants were broken out into four groups, each charged with working through the scenario planning exercises with a different climate scenario and a different focus. Participants were given a problem statement to define the main challenges, or problem areas that each of the scenarios should address:

Extreme weather is becoming more frequent and more severe in Erie County.

Municipalities are facing numerous challenges, including temperature extremes, heavy rain and flooding, and impacts surrounding heavy snow and blizzards.

Solutions are needed to help build resilience in Erie.

Each breakout group worked together to build upon and customize the GLISA scenarios and discuss the potential actions they would take in response. Each group identified recommended actions that would help address the problem statement for each weather scenario in their respective community sector. At the end of the workshop, all breakout groups summarized the outcomes of the activities and recommended actions. This provided participants with a chance to learn about all scenarios and focus areas, beyond their breakouts, and share their thoughts in a full group discussion.

This workshop provided the opportunity for local municipalities to gauge their level of preparedness for pre-determined severe weather scenarios. It created a dialogue to identify where current needs and gaps exist, what ideal responses would look like, and what realistic recommendations could be made.

Feedback from participants was positive with over 90% of participants reporting they now have a better understanding of the scenario planning process and that they learned valuable information that will inform their future management planning and actions.

PA Sea Grant, GLISA, and CRANE summarized the scenario planning workshop in a report published on the GLISA website.

Erie Community Resilience Projects Survey:

The focus of this project has centered mostly around gathering feedback from municipalities, and recommendations have been on the municipal level. To gather feedback on resilience actions at the community level, PASG and CRANE developed a complimentary community survey to identify and prioritize actions that the citizen of Erie County feel are most beneficial for building resilience to extreme weather at the community level. This survey was distributed in April 2023 and was completed by 68 community members from throughout Erie County. Fifteen projects were ranked on a scale from 1-4 according to level of importance and top five projects were identified. Top priority projects included planting trees to prevent erosion and promote cooler microclimates, promoting the collection and reuse of rainwater through rain gardens, green roofs, and downspout planters, and providing community shelters for tornados and other severe weather events.

Challenges and Lessons Learned

The greatest challenge the team faced during the project period was the Covid-19 pandemic and needing to adjust the scope of work and timeline to reflect the inability to hold in-person engagement sessions and meetings. In some cases, readjusting the plan resulted in benefits to the project; for example, deciding to conduct community-wide surveys allowed the project team to collect significantly more data than what would have been collected from in-person engagement sessions. In other cases, such as the scenario planning workshop and the CRI meetings, the importance of having face-to-face interactions and discussions about complex topics was of high priority. Therefore, postponing and receiving a no-cost extension helped the team to conduct the project to the full level of benefit that was intended in the initial proposal. These challenges highlight the importance of knowing the difference between what can be done remotely and through surveys, and what should happen at a more personal and connected level.

Next Steps

While all the tasks outlined in the "Steps to Resilience" framework have been accomplished, the project team will continue working on this project by engaging with community members to incorporate results into new and existing planning processes and working to implement specific action strategies identified during this process. For example, CRANE would like to continue working with municipalities to provide resources and support for projects such as creating debris removal plans, creating MOUs with neighboring municipalities or big box business stores to provide support during emergencies, or implementing green infrastructure, tree planting,

or erosion control projects. In addition, the team would like to compile all recommendations at the municipal, community, and individual levels into a guidance document that will help provide further resilience guidance for the Erie Community moving forward. This was initially part of the plan for this project; however, with Covid-19 delays and timing, it wasn't realistic to include within this time frame.