

Response to Request for Qualifications for Key West Comprehensive Adaptation and Resilience Implementation Plan



January 11, 2023



TETRA TECH

Table of Contents

1	Cover Letter.....	1
2	Information	2
3	Organization Chart	3
4	Company Information.....	4
5	Methodology, Approach and Timeline.....	7
5.1	Grant Goals and Tasks (Task 0)	7
5.2	Mobile LiDAR Data Acquisition (Task 1)	7
5.3	Climate Vulnerability Assessment (CVA) (Task 2)	8
5.4	Adaptation Plan (Tasks 3 through 10).....	12
5.4.1	Identify a Catalog of Strategies	13
5.4.2	Develop Prioritization Framework for Chapters and Planning Efforts	14
5.4.3	Develop Strategy Metrics/Targets for Chapters and Planning Efforts.....	14
5.5	Final Adaptation Plan (Task 11).....	15
5.6	Interactive Mapping	16
5.7	Public Engagement Plan.....	16
5.8	Project Deliverable Timelines.....	18
6	Personnel	18
6.1	Key Personnel	18
6.2	Technical Leads	20
7	Qualifications	23
8	Representative Vulnerability Assessment and Adaptation Plan Experience and Client References	29

List of Exhibits

Exhibit 3-1.	Proposed Team Organization.....	3
Exhibit 5-1.	Team Interactive Map Examples	16
Exhibit 5-2.	Schedule	18

1 Cover Letter

January 11, 2023

City Clerk, City of Key West
1300 White Street
Key West, FL 33040

**Subject: Qualifications for Key West Comprehensive Adaptation and Resilience Implementation Plan,
RFQ #22-001**

Dear City Clerk,

Tetra Tech, Inc. (Tetra Tech) is pleased to submit the enclosed response to your request for Qualifications for the City of Key West Comprehensive Adaptation and Resilience Implementation Plan, RFQ #22-001. Tetra Tech offers a full suite of services and subject matter experts to mitigate hazard risk, adapt to the changing climate, fund adaptation response and build community resilience—subject matter experts with deep experience on vulnerability in the Keys. Working collaboratively with our partners, we employ a holistic resilience planning approach that considers socioeconomic concerns, integrates nature-based solutions, and builds capacity and capability to ensure programmatic success. Our experts are committed to a people-first focus, from conducting scientific and policy assessments to reducing greenhouse gas emissions and not only planning but implementing effective adaptation and mitigation solutions.

The Tetra Tech Team has extensive experience in conducting vulnerability assessments and adaptation planning specific to the Florida Keys and our engineering staff have been working for the City directly through the Environmental Engineering Contract since 2016 on over 60 task orders. Tetra Tech's broad engineering experience related to climate adaptation and resiliency includes waterfront facilities and seawalls, infrastructure adaptation, power and water adaptation as well as extensive experience in Florida ecology and nature-based solutions. For this important project, we have strategically teamed with firms we have worked successfully with in the past on vulnerability and resiliency planning and water resource projects. This provides a knowledgeable, experienced and familiar Team that has partnered in the past, providing a high level of competence and experience with the City's unique challenges and opportunities. Our Team is not only completing these projects and work in the Keys, but we are working on adaptation and resiliency planning projects all over the state for large and small local governments, east and west coasts, from the Keys to the Panhandle. Our Team's resiliency planning experience is unparalleled in the State. Our Team includes:

Erin L Deady, PA – land use and code adaptation, policy and Resilient Florida compliance and development of vulnerability assessments

Clearview Geographic – ArcGIS resiliency inundation mapping and interactive dashboards

Stantec Engineering – infrastructure and adaptation


SEARCH, Inc – historic and cultural preservation

Balmoral Group – evaluation of economic return on investment analysis related to adaptation measures and economic development initiatives

Brizaga, Inc. – public outreach and engagement and housing and shelter adaptation

We appreciate the opportunity to submit our qualifications and look forward to working with the City on this important project. I can be reached at Brian.Proctor@tetratech.com, by phone at 772.341.0432.

Sincerely,



Brian Proctor
Vice-President, Southeast Operations
Tetra Tech, Inc.

2 Information

Project Name: City of Key West Comprehensive Adaptation and Resilience Implementation Plan

Name of Vendor (Prime): Tetra Tech, Inc.

Contact Information (Project Manager):

Georgia Vince, Project Manager
759 S. Federal Highway, Suite 314, Stuart, FL 34994
Phone 561-236-8692/Fax 772-781-3411
Email georgia.vince@tetrattech.com

Contact Information (Authorized Representative)

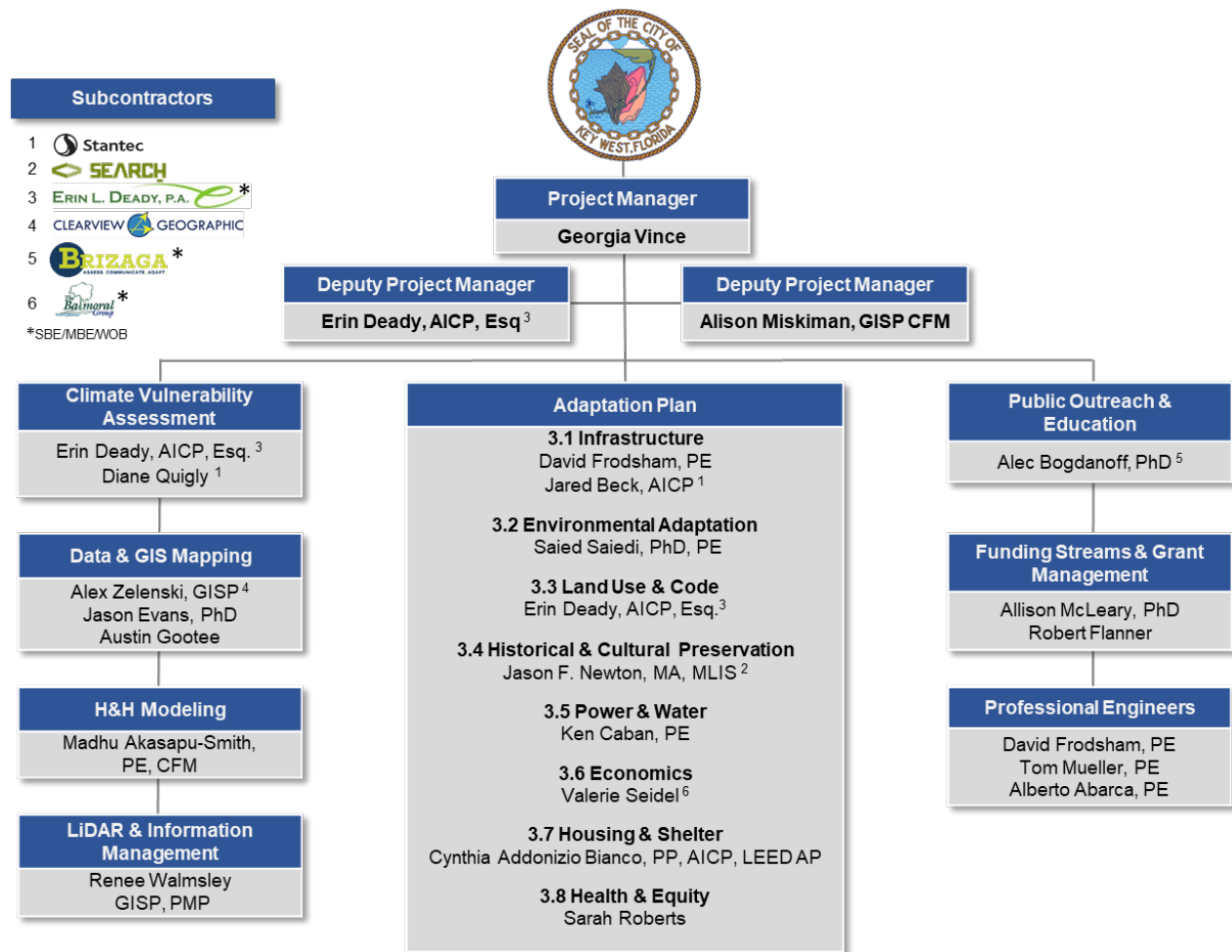
Brian Proctor, Vice President Southeast Operations
Address 759 S. Federal Highway, Suite 314, Stuart, FL 34994
Phone 772-341-0432/Fax 772-781-3411
Brian.Proctor@tetrattech.com

3 Organization Chart

Our proposed project team is shown in Exhibit 3-1. Tetra Tech, led by Project Manager Georgia Vince, will be the primary point of contact for the City and will ensure the project is executed on time, within budget, and successfully achieves the City of Key West’s objectives for the project. Georgia will be supported by Deputy Project Manager Erin Deady, AICP, Esq., who will oversee implementation of the Climate Vulnerability Assessment (CVA) and Deputy Project Manager Alison Miskiman, GISP CFM, who will oversee the implementation of the Adaptation Plan. We have a pool of professional engineers who will be available to assist with adaptation strategies, conceptual design, cost estimates, and construction schedules for future projects.

Additional information on Tetra Tech and our team subcontractors is provided in Section 4. Location of Key Personnel is included in Section 6.

Exhibit 3-1. Proposed Team Organization



4 Company Information

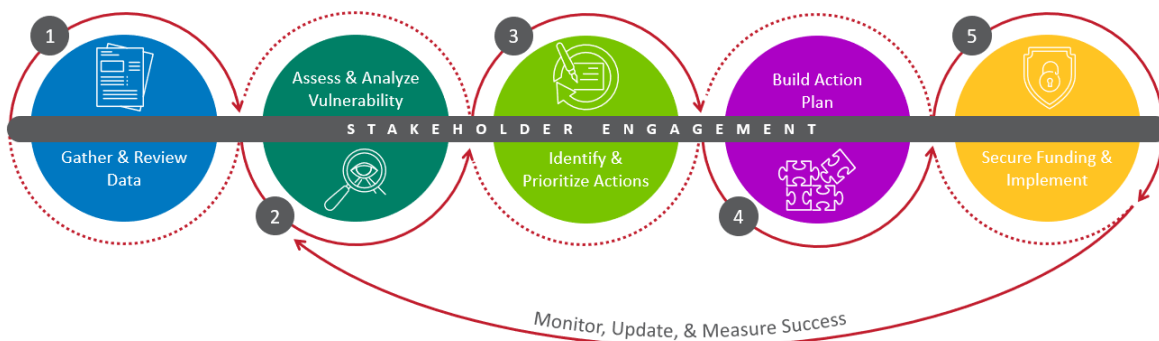
Tetra Tech is a leading provider of consulting, engineering, and technical services. We are a diverse company, including individuals with expertise in science, engineering, construction, and research. Our strength is in collectively providing integrated services, delivering the best solutions to meet our clients' needs. Formed in 1966, Tetra Tech is respected for our excellent business practices and outstanding reputation in science and engineering. We are consistently ranked by *Engineering News-Record* (ENR) as among the leaders in our field. Tetra Tech's 2022 ENR national rankings include number 1 in Water for the 19th year in a row, as well as a number 1 ranking in Environmental Management and number 2 rankings in Consulting Studies and Environmental Science.

Our team has the most extensive experience developing Vulnerability Assessments (VA) and Adaptation Plans in Florida and nationally, conducting tidal and storm flood water modeling, and evaluating options for structure hardening (or gray) and non-structural (or blue and green) adaptation projects. Our interdisciplinary teams of scientists, engineers, planners, and policy analysts use our *Leading with Science*® approach, which employs our **Tetra Tech Delta**, a suite of proprietary technologies and analytical tools, to assess climate risk, develop strategies to mitigate greenhouse gas emissions, and help communities adapt to and build resilience from the impacts of climate change while improving the carbon footprint.

Our expertise spans the continuum of resilience—helping communities prepare for, withstand, respond, and adapt to climate change through tangible and achievable implementation strategies. While Tetra Tech is uniquely experienced and has a highly qualified team to support this work, we are first and foremost committed to listening to the input of stakeholders, bringing forth local knowledge and expertise from within the community, applying what we learn in planning, and providing focused technical support as needed.

Tetra Tech Differentiators

- Significant (over 30 completed or in progress) Statewide Climate Change Adaptation & Mitigation Planning Experience
- Extensive Resilient Florida and CDBG Experience with program implementation and grants
- Extensive Experience in the Florida Keys and Key West with planning and capital project implementation
- Application of Artificial Intelligence and Advanced Data Analytics
- Approaches have secured more than \$1B in grant funding



Tetra Tech Delta combines our deep subject matter expertise in science and engineering with understanding our clients' needs and implementing analytics, tools, and smart approaches to create transformational digital solutions that meet your goals.

We will support the City of Key West to optimize and transform your processes—from smart data collection and advanced analytics that support decision-making to automated intelligent processes and secure cloud solutions that modernize operations and implement solutions. **Tetra Tech Delta** represents more than 50 years of research and industry-leading, technology-driven applications that serve as the foundation for the solutions we provide our clients today. We are *Leading with Science*® to create sustainable solutions that extend the impact of investment, optimize performance, maximize resources, and minimize future maintenance.

Tetra Tech is at the leading edge of climate change and resiliency analysis, providing our clients with the data they need to make informed decisions about their future. We use predictive analytics to simulate and forecast how climate change and flooding will impact the behavior of physical, biological, and chemical components of natural and manmade systems. Tetra Tech also supports our clients in reducing Green House Gas (GHG) emissions through developing low-carbon and zero-carbon strategies, optimizing existing and new structures, making operational shifts to lower energy use, and developing renewable and alternative energy technologies. Our hazard mitigation and resilience planners support enhanced adaptation planning, incorporating the effects of sea level rise, changing rainfall patterns, and climate change into strategies that increase community resilience. Our engineers, planners, and scientists design adaptation solutions to restore critical habitat, reduce flood risk, and support long-term resilience in all environments.

Tetra Tech offers a full suite of services and subject-matter experts across our team members to prepare VAs and Adaptation Plans, mitigate hazard risk, plan for changing climate conditions, and build community resilience in Florida. We offer more than the typical technical team by including partners well-experienced in vulnerability, adaptation, and resiliency planning, including policy, planning, legal, communications, and outreach specific to South Florida and Monroe County.

We work collaboratively with local governments to design programs to achieve long-term resilience. All planning starts with a technically sound VA. The Tetra Tech team uses a holistic resilience planning approach that considers socioeconomic concerns, integrates nature-based solutions, and builds capacity and capability to ensure programmatic success.



Stantec

Included on our team is **Stantec** to support the infrastructure resilience planning and coordinate directly on the Duval Street Revitalization and Resilience Project recently awarded by the City. We feel that coordination on this iconic corridor is integral to these resiliency and adaptation planning efforts and will enhance the plan for a resilient City of Key West.

Stantec assesses what the community needs are and connects with the necessary expertise appreciating the nuances and envisioning how to bring together solutions with diverse perspectives toward a shared success. Stantec includes planners, engineers, scientists, and project managers, innovating together at the intersection of community, creativity, and client relationships. Balancing these priorities results in projects that advance the quality of life in communities across the globe.

The Stantec community unites more than 26,000 employees working in over 400 locations across 6 continents. Since 1954, over 68 years, they have collaborated across disciplines and industries to bring buildings, energy and resource, and infrastructure projects to life.



CLEARVIEW
—GEOGRAPHIC—

Clearview Geographic, LLC (Clearview) has performed the geographic information system (GIS) VA modeling for the required projections on behalf of numerous counties and municipalities throughout Florida, from the Panhandle to the Keys, which will expedite the development of the Resilient Florida VA for the City of Key West. Clearview supported the development of the Monroe County VA Update completed in 2021, which included the identification of adaptation action areas, data gap analysis, and sea level rise (SLR) projections for 2040, 2070 and 2100 planning horizons. Clearview also performed the habitat change modeling with the Sea Level Affecting Marshes Model (SLAMM), unique to any VAs conducted in the state, and lasting virtual public outreach via a production StoryMap.

Women and Minority Owned Businesses

Tetra Tech is not a certified minority, disabled, small, or veteran business enterprise as defined by Florida Statute. However, our team includes four small business subcontractors:

- **Erin Deady, PA** is a law firm and land use planning consulting practice certified by the State of Florida and US. Small Business Administration as a woman-owned and economically disadvantaged woman-owned business.

- **Southeastern Archaeological Research, Inc. (SEARCH)** is a woman-owned business and woman-owned small business certified by the Women's Business Enterprise National Council.
- **Brizaga, Inc.** is a Small Business Enterprise in accordance with Broward County office of Economic and Small Business Development.
- **Balmoral Group** is a consulting practice certified by the Small Business Administration as a woman-owned business.



We have teamed with **Erin L. Deady, PA, (ELDPA)**, a Delray Beach-based firm that has completed numerous planning, code, and resilience projects within Monroe County and has provided input and guidance to the Florida Department of Environmental Protection (DEP) for the Resilient Florida Program. The addition of Erin on the team provides a necessary and critical level of legal risk analysis for vulnerability and resiliency planning to help local governments navigate the complexity of prioritization of adaptation response. ELDPA continues to coordinate directly with agency staff on rule interpretation on several key aspects of the program. ELDPA has led the development of numerous vulnerability assessment statewide including numerous aspects of the policy implementation approach for resiliency in Monroe County, Martin County, and many municipalities throughout the State of Florida. Currently, ELDPA is leading vulnerability assessments (or updates) in Islamorada, Pensacola, West Palm Beach, Martin County and Lynn Haven. ELDPA led the development, with Clearview Geographic, of all of the vulnerability planning conducted in Monroe County in 2015 and 2021 and is a subconsultant on the Countywide Roads Adaptation planning. She has written over 20 successful grants in the Keys related to resiliency and vulnerability planning and project work. She recently authored a successful grant for the City of Key West awarded by the Division of Emergency Management to conduct a Watershed Management Plan under the NFIP CRS program.



We have teamed with **Brizaga, Inc. (Brizaga)**, a firm with extensive experience in resilience planning, including a public engagement role for ten resilience planning efforts, to assimilate technical information in an easy-to-understand way. Brizaga recognizes that public engagement increases the visibility of a planning effort and is key to the successful implementation of any plan. The community must support the City's efforts to develop policy and implementation strategies to address the risks we now see on a routine basis from flooding and SLR. The collective team has successfully implemented multitudes of in-person and online workshop-style meetings coupled with available tools and technology to gather valuable input and achieve "buy-in" from the public and stakeholders.



The **Balmoral Group's** unique combination of Natural Resource Economics and Engineering sets them apart for providing services on these contracts. Founded in 2004, The Balmoral Group has been in the forefront of coastal resiliency planning since completing the state of Florida's first contract in 2011, which developed strategies for Okaloosa and Martin Counties. The Balmoral Group includes Florida's leaders in resilience work, including Dr. Dourte, who leads the DEP Statewide Resilience Mapping project currently for The Balmoral Group. The firm also completed a resiliency plan for FDOT District One and evaluated all (state-owned) coastal assets for vulnerability to SLR. The Plan prioritized vulnerability actions by decade based on planning-level numerical modeling, estimated costs and fiscal implications of minor and major resiliency enhancements, and offered updated tailwater conditions and other policy guidance. The Balmoral Group has worked with Tetra Tech in the past for a Comprehensive Wastewater Treatment Plan for Leon County Engineering Services and with Erin Deady on Martin County's VA and Resiliency Plan. The Balmoral Group will be on the team to conduct Monroe County's Natural Resource Adaptation planning grant set to launch soon, with that successful grant being authored by ELDPA.



Since 2012, SEARCH has provided cultural and historical resource support services to Tetra Tech, including Phase I, II, and III investigations, National Register nominations, maritime surveys, architectural history surveys, and more. SEARCH's reciprocal

teaming with Tetra Tech spans 10 U.S. States in the Southeast, Midwest, Pacific, the entire Atlantic Coast, and various offshore locations. With nearly 90 projects successfully completed or underway to date, valued at nearly \$26M, the SEARCH-Tetra Tech team is a go-to provider for timely service and quality products. SEARCH is currently providing maritime and terrestrial services on several Tetra Tech projects in the Mid-Atlantic and Southeast, plus locations offshore. In Key West, SEARCH performed a Phase I investigation for the Last Mile Amenities LAP project.

5 Methodology, Approach and Timeline

Our methodology, approach and timeline follow the structure of the Statement of Work (SOW) and are mindful of the key components, including the Climate Vulnerability Assessment (CVA), the Adaptation Plan, Interactive Mapping, and Public Engagement Plan, which fall within the structure of the Grant Goals and Tasks funded by different grant awards. Understanding the relationships between these grant requirements, timelines, and deliverables in ADA-compliant formatting and reporting requirements is complicated and will require the experience of a Team versed in both the Community Development Block Grant (CDBG) and Resilient Florida grant structures as well as how to conduct such planning efforts. Given our Team's strong experience in both of these grant programs, we know how to phase tasks in a way to avoid duplicated data requests, analyses and other project elements that can add inefficiencies and time lags in the process.

Most importantly, our Team has a head start on data collection because we have such long and integrated experience working in the City and Monroe County overall. Similarly conducting data requests from the utility service providers, for example, gives us a unique perspective on the strengths and weaknesses in existing data and the development of the required metadata that will be required for electronic data as part of the Resilient Florida grant deliverables. Similarly, over 7 years of capital project, coastal engineering, and infrastructure projects through our 60+ task orders give us an inside understanding of the City's infrastructure and existing data. We also have the capabilities to run stormwater modeling such as Interconnected Channel and Pond Routing (ICPR) and/or glean that data from the recent Stormwater Master Plan development. All of this experience with the City's data gives us a reality check on the information we have to work with to conduct these planning efforts, allowing us to focus on filling necessary data gaps.

5.1 Grant Goals and Tasks (Task 0)

The Project will start with a **Kick-off Meeting (Task 0.1)** with the City to review project schedule and deliverables. Tetra Tech will work with the City to organize the Steering Committee, including members from various departments, elected officials, and community leaders. Once the City finalizes the **Steering Committee (Task 0.2)**, Tetra Tech will coordinate and schedule the quantity, dates, times and locations for the **Steering Committee Meetings (Task 0.3)** based on critical decision points. Data collection efforts and resources will also be discussed in the Kick-Off Meeting to manage the expectations on that level of effort both from the Team and City staffing perspectives.

5.2 Mobile LiDAR Data Acquisition (Task 1)

Tetra Tech will work with the City to determine the best methods to acquire LiDAR data as it relates to the Monroe County Mobile LiDAR. Our Team is well versed in merging LiDAR data from different sources to conduct additional needed analyses. Our Team is also already familiar with this dataset having already worked with many of its attributes in the County's Vulnerability Assessment conducted in 2021 and this will save time in the data collection effort. Tetra Tech also owns LiDAR collecting equipment including Mobile LiDAR, drones, boat-mounted LiDAR, and multibeam sonar equipment that can be quickly deployed as needed to fill any data gaps in the LiDAR for development of needed maps and models. Filling data gaps is one of the key areas where our equipment and knowledge of data needs are applied to ensure project success.

5.3 Climate Vulnerability Assessment (CVA) (Task 2)

The Tetra Tech Team is extremely familiar with the Resilient Florida Program requirements, including experience performing the statutorily required GIS analysis, identifying the critical asset inventory, the sensitivity and exposure analysis and focus area mapping with required metadata. Tetra Tech has teamed with **ELDPA** and **Clearview** to provide analysis and modeling specific to the Resilient Florida Program. That team of ELDPA and Clearview has performed and prepared these scenarios for several municipalities and counties including Monroe County, and now currently Islamorada, and our team will be able to apply our experience to expedite and streamline the components of this effort.

Tetra Tech will also conduct the kick-off meetings with each of the CVA Working Groups (organized by the City) to provide guidance and recommendations and review study deliverables (**Task 2.1**). We will schedule a **Public Meeting #1 (Task 2.2)** early to inform the public about the CVA project, obtain input from the communities and identify and track their concerns.

Acquire Background Data and Perform Gap Analysis (Task 2.3). Tetra Tech will work closely with the City to identify critical assets under the four categories in Section 380.093(3), F.S., and prepare a GIS-compatible inventory list that is comprehensive and compliant with mapping and metadata requirements in Section 380.093 F.S. We will start with a data checklist that we have used for other CVA projects to assist with data collection across City Departments, public utilities and other stakeholders. To the extent that we can collect that data, or already have it due to our extensive work with the City, we will save time and effort on the part of the City's resources to collect it. Once data collection is complete, we will also perform a data gap analysis to evaluate the completeness of the dataset. If needed, Tetra Tech can support data collection to cover identified critical data gaps using drone and artificial intelligence technology.

Data collection efforts will focus on available federal, state, regional, county, and local data in the areas of hazard and event data, asset/inventory data, vulnerability data, and planning data based on the requirements defined in Section 380.093 F.S. Tetra Tech will review other existing studies, reports, and technical information; the Comprehensive Plan and Code of Ordinances; emergency management and operation plans; the Local Mitigation Strategy; soil surveys; census data; local flood maps; survey data; light detection and ranging (LiDAR) and digital elevation model (DEM) data; and county and local GIS data.

Once data are collected, Tetra Tech will finalize a technical approach and methodology to address existing data gaps based on the Section 380.093 F.S. requirements. We will identify those existing data gaps, where missing data or low-quality information may limit the CVA's extent or reduce the accuracy of the results and address those gaps through data collection or other means.

Tetra Tech will develop a technical report to outline the data compiled and findings of the gap analysis; this summary report will include recommendations to address the identified data gaps and actions taken to rectify them, if applicable (Technical/Summary Report 2.3). Additionally, Tetra Tech will prepare an inventory of relevant literature and data on historic impacts, current threats, and future impact projections of the City. We will also compile geographic and narrative data on assets that relate to community lifelines and are consistent with relevant state requirements and recommendations, assess data quality and usability, and prioritize asset data to be used for further analysis.

Exposure Analysis (Task 2.4). The exposure mapping will be completed in accordance with the minimum requirements of Section 380.093(3), F.S. and the rules (Chapter 62S-8, F.A.C.) and guidelines of DEP and will examine:

- Depth of tidal flooding, including future high tide flooding, using thresholds published or provided by DEP (currently based on NOAA's High Tide Flooding Outlook). This analysis will also include the number of high tide flooding days expected for each scenario and planning horizon.
- Depth of current and future storm surge flooding using publicly available FEMA or NOAA data (to be decided with the City and Steering Committee). The initial storm surge event must exceed the current

100-year flood event to comply with state statute. A second higher than 100-year storm frequency storm surge event will also be analyzed.

- Depth of rainfall-induced flooding, in conjunction with existing H&H modeling, which will include modified future boundary conditions to consider SLR and future high tide conditions. The scenarios evaluated will include the 100-year and 500-year storm events.

This team has performed exposure analysis and mapping for dozens of local governments across Florida, and has standard methodologies that have been accepted by DEP.

Sensitivity Analysis (Task 2.5). In conjunction with the exposure analysis, the Tetra Tech Team will perform a sensitivity analysis on critical assets examining the required scenarios listed in Task 2. In addition to sensitivity, criticality and adaptive capacity values will be assigned and the level of risk-based on percentages of land area inundated and number of critical assets affected will be included. In this task, demographic and socioeconomic overlays will be developed that can be used during the Asset Prioritization task. Before the completion of this task, a meeting with key staff will be held to review the results of the exposure analysis and allow for feedback on selected criticality and adaptive capacity scores.

Tetra Tech will provide the City with a draft CVA report that provides details on the findings of the exposure analysis and the sensitivity analysis. The report will include a visual presentation of the data via maps and tables, based on the statutorily required scenarios and standards. The report will also include an initial list of critical and regionally significant assets that are impacted by flooding. The list of assets will be prioritized by area or immediate need and will identify which flood scenario(s) impacts each asset.

Public Outreach Meeting (Task 2.6). Upon completion of the draft CVA report, Tetra Tech will conduct a public meeting to present results from the analysis and obtain community-specific input on the results to be used to refine the CVA results and get input from the public on how best to prioritize focus areas and flooding, and critical assets for the Adaptation Plan.

Identify Focus Areas (Task 2.7). The Focus Areas can be developed with input from both the Team, City staff, Working Groups, and other feedback based on the results of the exposure and sensitivity analysis. At the early stages of the project and throughout the modeling effort, criteria or thresholds for the Focus Areas can be developed and refined based on parameters important for the project such as aggregations of impacted critical facilities, locational criteria, population density and other socioeconomic characteristics that are important, which is why one of the Team's map layers will include output from the CDC Social Vulnerability Index most recently updated in 2022. Feedback from the community will be particularly important for this Task. For implementation of a response within the Focus Areas, the Team may propose establishing these Adaptation Action Areas, Priority Planning Areas or other designation support by the eight Adaptation Chapters. Depending on the final structure of the Focus Areas and their criteria, project-level adaptation strategies or policy-level adaptation strategies will be crafted to capture the unique attributes of how to address that Focus Area.

The Team will produce a separate Report for Task 2.7 that summarizes the Focus Area methodology (structured to reflect the Chapter headings), Tables listing the Focus Area and affected critical assets to the extent that relationship exists (for instance the Land Use and Code "Focus Area" may not specifically have critical assets, but policy issues may be more appropriate). Maps related to the Focus Areas and the relevant critical assets within them should they exist and all associated GIS and metadata for that map series will be provided. Further discussion with the City on this component may be warranted to fully integrate the City's Chapter approach with the Focus Area designations as contemplated by the Adaptation Planning Guidebook.

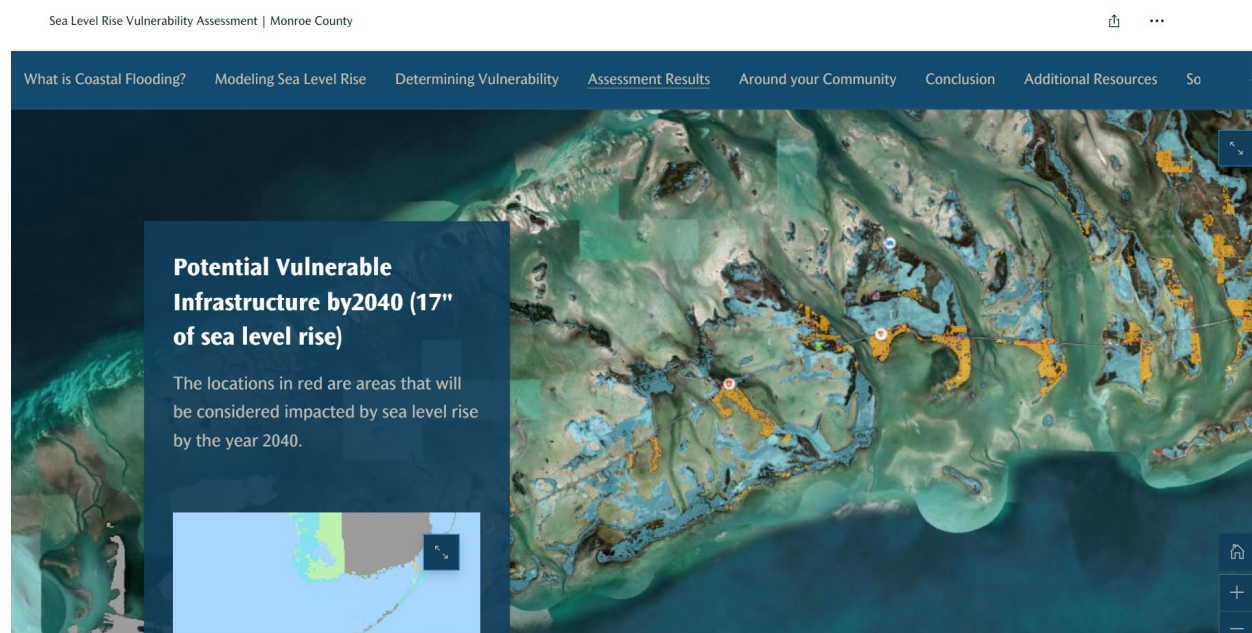
Final CVA Report, Maps and Tables (Task 2.8). The Resilient Florida CVA will include the results from the analysis, a summary of identified risks, a map series to visually highlight inundation levels across the landscape, and those assets that will be impacted by the flooding scenarios. All data will be compliant with the Resilient Florida Program's GIS metadata standards. Once the analyses are conducted, Tetra Tech will develop a draft and final CVA. This will include all results from the exposure and sensitivity analyses and will provide a summary

of identified risks to the City using tables and maps. The assessment will also include a list of critical and regionally significant assets that are impacted by flooding and sea-level rise, specifying the scenarios for each asset. The report will also include the prioritized project and policy recommendations to help address the identified risks and vulnerabilities for key assets. The FDEP VA Compliance Checklist will be a guiding structure for the CVA from its inception as well as the requirements of Chapter 380.093, F.S. and Chapter 62S-8, F.A.C.

The Tetra Tech Team understands how the Resilient Florida program will evaluate and rank future capital project submittals that will be included in a Statewide Flooding and Sea Level Rise Resilience Plan or through other available funding sources. The modeling and analysis for the CVA will be designed to ensure the City is in compliance with state requirements in Section 380.093, F.S. allowing the City's future projects to be identified and ranked successfully according to Chapter 62S-8, F.A.C. The goal is to structure the CVA around the statutory and rule requirements related to the Resilient Florida program so that the City's CVA is deemed in compliance with the criteria, which will position the City's projects for higher ranking in future funding cycles. Our experience with how the FDEP not only reviews Vulnerability Assessments but also employs the criteria in Chapter 62S-8, F.A.C. to rank future projects can help inform the content and scope of the CVA to best position the City for future project grant awards both within and outside of the Resilient Florida program.

Public Presentation (Task 2.9). Tetra Tech will present the final CVA results to the City Commission and will be prepared to discuss future project funding. The Tetra Tech Team will prepare all social media notifications, meeting invitations, meeting materials, presentations, and graphics used during the meeting. The presentation will include recommended actions for adaptation strategies and will inform the public of the results and future risk of SLR and increased flooding, as well as encourage community participation when identifying mitigation strategies to address the flooding vulnerabilities. All grant deliverables for the meeting will be developed and organized for submittal to FDEP

Develop a Public Online Interactive Tool (Task 2.10). The Tetra Tech Team has developed numerous different types of interactive tools for the public. Interactive maps and dashboards are an important communication tool and can also be used to solicit community input through the entire adaptation process. Our team has used interactive maps as a tool to collect flood risk data, adaptation ranking, and community concerns. This allows residents to include input early in the decision process, building greater public will for action.



Monroe County Sea Level Rise Vulnerability Assessment StoryMap: Erin Deady, PA and Clearview Geographic

Modeling Approach to Support Task 2.4 and 2.5. Tetra Tech has unparalleled qualifications in two- and three-dimensional watershed modeling and we are considered industry experts in all aspects of modeling, including hydrologic, hydraulic, hydrogeologic, water quality, sediment transport, lake and estuarine circulation, reservoir routing, flood prediction, wetland retention, and fate and transport modeling of nutrients and contaminants. Tetra Tech has one of the largest groups of experienced watershed and water quality modelers among consulting firms; successfully applied models for more than 7,500 waterbodies in over 45 states and for all pollutant, source, and waterbody types; developed numerous watershed and water quality models and project-specific model interfaces; performed numerous projects involving linked watershed, water quality, and/or hydrodynamic models; provided training in modeling in all 10 U.S. Environmental Protection Agency (USEPA) regions and numerous states; developed materials and provided training in water quality modeling principles and application; and developed the Environmental Fluid Dynamics Code (EFDC) model, USEPA's Better Assessment Science Integrating Point and Nonpoint Sources (BASINS) modeling system, and USEPA's Modeling Toolbox.

We will work with the City to identify the most appropriate modeling tool(s) for the CVA based on the engineering problems, potential solutions, level of detail required, available data, and ease of use. We understand that the City is currently completing a Stormwater Master Plan that is based on the ICPR model. Tetra Tech frequently uses the ICPR model (version 3 or 4) for surface water hydrologic and hydraulic (H&H) modeling, especially when analyzing the cost effectiveness of various alternatives to improve the level of service in public roadways, canals, and stormwater facilities. Tetra Tech has a dozen engineers that are highly competent in performing H&H modeling using ICPR and many of our stormwater and watershed master plans have used ICPR as the primary modeling tool. We have experience both developing new ICPR models and building upon existing models and we will be able to easily use the Stormwater Master Plan model, including the model data, to run any additional scenarios necessary for the CVA or Adaptation Plan's development, if the ICPR model is the City's preferred tool. The Tetra Tech Team brings a wealth of experience in selecting the right analytical tools to provide an actionable plan while meeting the state's Section 380.093, F.S. requirements.

Tetra Tech will use the ICPR model and its output from the Stormwater Master Plan to the extent necessary along with the GIS database created for the CVA to evaluate hydrology, areas of flooding, depth of flooding for tides, surge, rainfall, sea level rise, and water quality hotspots. The ultimate modeling approach and tools include evaluating tidal flooding, including future high tide flooding; current and future storm surge flooding using publicly available NOAA or FEMA storm surge data; rainfall-induced flooding; and compound flooding. The NOAA Sea level rise projections will be used for the years 2040, 2070, and 2100. We propose adding the 2100 condition to this effort due to linkages with CRS requirements and to coordinate that output with the City's efforts to develop an Activity 452.b CRS-compliant Watershed Management Plan under its DEM grant.

The data used in the model approach and results from various scenario runs will be summarized in a report to the City. The model files will be transferred to the City and Tetra Tech will also provide training on how to use the model for future efforts. The model results will also be used to identify and prioritize projects in the CVA.

To align the project's modeling effort with Section 380.093(3), F.S., the CVA will leverage the functionality within the best available software to:

- 1) Map potential future regular tidal inundation using a modified bathtub approach that attempts to account for local and regional tidal variability and is used by the NOAA Office for Coastal Management to map SLR;
- 2) Map potential high tide flooding based on NOAA's Coastal High Tide Flooding methodology ;
- 3) Map potential storm surge events using a combination of presently available data from both NOAA and FEMA and leverage readily available software methodologies to project multiple sea-level-adjusted designed storm events (particularly the 25-, 50-, 100- and 500-year events);
- 4) Map likely areas of pluvial flooding using a H&H rain-on-grid model approach and coupled with potential storm surge and/or sea-level rise impacts for designed storm events (particularly the 25-, 50-, 100, and 500-year events); and

- 5) Map likely areas of flooding due to adverse tailwater conditions at salinity control structures that limit or prevent discharges during storm surge and/or sea-level rise conditions.

Additionally, to build a more comprehensive CVA, enrich the overall resilience data community and improve community engagement, we will:

- 1) Provide a detailed infrastructure specific map series organized first by planning horizon (2040, 2070, and 2100) then by type (such as stormwater, potable, emergency management, land use, etc.) depicting key assets, areas, and infrastructure that may be vulnerable to various model conditions;
- 2) Assess the quality of geospatial datasets in terms of resiliency planning and disaster response within the gap analysis and provide recommendations for improving data quality;
- 3) Map vulnerable populations using the CDC's Social Vulnerability Index;
- 4) Map potential impacts of long-term SLR on wetlands and shoreline habitat using Warren Pinnacle Consulting's Sea Levee Affecting Marsh Model (SLAMM) model;
- 5) Identify listed threatened and endangered species that may be especially vulnerable to the impacts of SLR and climate change;
- 6) Analyze readily available LiDAR point clouds provided by the United States Geological Survey and satellite imagery to identify shoreline type (i.e., natural, hardened, riprap, etc..) to develop data to be used in concert with CVA; and
- 7) Create an ArcGIS StoryMap summarizing key project highlights which may include but are not limited to the SLR projections.

To meet the requirements of Section 380.093, F.S., an effort will be taken to build upon the tidal inundation projected for the 2017 NOAA intermediate-low and intermediate high SLR projections and will include the planning horizons for the years 2040, 2070 and 2100. Local tidal variability reported from the closest or regionally significant NOAA tide gauge will be employed with NOAA's VDATUM utility.

All avenues for assessing flood risk, briefly outlined above, will be included in a spatiotemporal analysis to determine what key assets and infrastructure within a community are vulnerable to various climate-induced stressors and when that vulnerability may appear along the planning horizon timeline.

5.4 Adaptation Plan (Tasks 3 through 10)

The City's resilience goals will shape and focus the identification and prioritization of structural and nonstructural adaptation strategies that will be identified for all **eight Adaptation Chapters** outlined in the RFQ. The strategies (blue, green and gray) will prioritize all potential adaptive measures based on their potential to reduce vulnerability, the ability and feasibility of implementation, cost/benefit ratio, and other criteria established by that Chapter's Working Group and the selected consultant. They will also address the urgency needed in taking certain actions and reflect existing short- and long-term goals established in existing policies and plans. We will work to identify robust Adaptation Plan goals after our data/plan review is complete and feedback is received from the City, stakeholder groups and the community.

The approach to the Chapters requested by the City is similar to each one but there may be individualized additional activities based on the uniqueness of that Chapter. The Team has been structured with specific expertise in each of the Chapter headings with experience in adaptation planning relative to that subject matter. Each Chapter will include the following general activities and required deliverables:

1. Coordination with a Chapter-specific Working Group
2. Development of a Focus Area and GIS layer
3. Proposed Adaptation Options
4. 10-year Budget
5. Summary of how the Chapter integrates into existing plans with proposed policy/implementation language or strategy
6. Complete Chapter narrative

Summary of Strategy Development Process






1. Update Goals
2. Identify Strategies
3. Prioritize Strategies
4. Establish Implementation Steps

All grant deliverables for the Adaptation Chapters shall be developed and organized for easy submittal for grant compliance. Relevant deliverables include information about each Working Group member, meeting summaries online or in person, a prioritization analysis of the relevant adaption options (using STAPLEE, SWOT, HARC Guidelines, etc.). At a minimum, the Chapters shall meet the requested project development thresholds as listed below.

- | | |
|--|---|
| • Infrastructure Adaptation Chapter | Prioritized Project List of 25 projects |
| • Environmental Adaptation Chapter | Prioritized Project List of 15 projects |
| • Land Use & Code Adaptation Chapter | Prioritized Project List of 15 projects |
| • Historic and Cultural Adaptation Chapter | Prioritized Project List of 15 projects |
| • Power and Water Adaptation Chapter | Prioritized Project List of 15 projects |
| • Economic Adaptation Chapter | Prioritized Project List of 15 projects |
| • Housing and Shelter Adaptation Chapter | Prioritized Project List of 15 projects |
| • Health and Equity Adaptation Chapter | Prioritized Project List of 15 projects |

Presentation and input from the Working Groups and City Commission Summary report presentations will be organized to maximize time and meeting efficiency.

With input from the eight Adaptation Chapters, Tetra Tech will develop a city-wide cost-effective and achievable Final Adaptation Plan (**Task 11 below**) that will track resilience metrics and targets with an implementation strategy and Master Financing List consisting of all Chapter across all 10 Budget years to meet those targets including available programs and strategies to fund and/or finance their implementation which may include federal and state funding sources, best practices with respect to special taxing districts, revolving loan funds, public-private partnerships, innovative insurance tools, and other practices. The Adaptation Plan will include climate adaptation strategies with an effort to identify potential funding sources up front. Tetra Tech will work with the City to support the specific analysis needs and identify the appropriate long-term plan to achieve this goal. The Adaptation Plan will be informed by and will include results from the Resilient Florida CVA, including mitigation strategies for the list of priority projects for critical assets. Not only will the Team develop a planning level cost estimate for comparison with estimated costs of the impacts to the assets, but we will also compare the costs were no adaptation strategies implemented (cost/benefit ratio).

Category	Metric	Category Weight	Maximum Score
	Total Costs	100%	25
	Total Costs	100%	25
	Flood Reduction	45%	15.75
	Water Quality	30%	10.50
	Ecosystem/Habitat	25%	8.75
Total Benefits		100%	35
	Health and Safety	40%	6
	Reduced Flooding Risk	40%	6
	Future Adaptability	20%	3
Total Risk and Vulnerability		100%	15
	Program Synergies	30%	3
	Municipal Dependencies	30%	3
	Critical Infrastructure	20%	2
	Leveraged Funds	20%	2
Total Synergies		100%	10
	Improved Quality of Life	33%	5
	Cultural Heritage Preservation	33%	5
	Education Opportunities	33%	5
Total Social Resiliency		100%	15
MAXIMUM PRIORITIZATION SCORE			100

*Example Prioritization Metrics and Scoring from
Tetra Tech's Living with the Bay*

The Adaptation Plan will include an Executive Summary with Capacity Section and assemble a final summary of all plan integration factors across the Chapters identifying linkages and synchronization elements. The Team will develop an on-line dashboard for the Adaptation Plan that will be used to communicate the results of the project and will be easily for the City to manage and update.

5.4.1 Identify a Catalog of Strategies

Our Team will use the CVA results, input from the stakeholders, the Working Groups, and the public, as well as existing plans/studies (e.g., Monroe County VA, Duval Street Redevelopment and Resilience Project), and our extensive knowledge of mitigation strategies, adaptation measures, best practices, funding alternatives and national trends to assemble a catalog of potential alternatives to address short- and long-range planning activities and investments with respect to resilience for all eight Adaptation Chapters (Task X.1).

Focus Areas will identify adaptation and mitigation resilience projects that address the greatest risk in the next 10 years with emphasis on low-moderate and socially vulnerable populations. These projects should have the greatest potential to reduce future risk from climate change, linking back to the CVA, and can be designed to meet other community development and economic revitalization needs. In addition to short- and long-term projects, alternatives may also include recommendations for plan integration, update of codes/standards/regulatory frameworks, as well as projects that advance other system needs such as equity and environmental justice and climate change and sustainability. In accordance with the requirements of the Biden Administration's Justice 40 Executive Order, equity will be a central factor in strategy and project identification (Task X.2).

The catalog will be prepared for each of the eight chapters and will include a brief summary paragraph for each potential alternative strategy describing the risk(s) identified and the potential alternative. The descriptions will be drafted for a non-technical audience to be used in the proposed workshops described further below. The draft catalog will be provided to the City for review in an Excel matrix for comment prior to the City's prioritization and proposed outreach meetings (Task X.3). To fully engage stakeholders about the impacts of climate change and to develop pathways to resilience based on sound science, the Tetra Tech team will collaborate with Adaptation Plan as described below.

5.4.2 Develop Prioritization Framework for Chapters and Planning Efforts

The Tetra Tech Team will draft a comprehensive and standardized prioritization framework to evaluate and rank adaptation and mitigation strategies. The prioritization framework will be designed to align with the identified adaptation and mitigation goals, with the results to inform a collection of highly ranked transformative strategies to increase resiliency through implementation giving priority to benefitting underserved populations.

A set of standardized questions, metrics, and associated weights and scoring will be used to prioritize each strategy. Each project will have a score and ultimately a total project ranking. Our team will leverage existing quantified results from the CVA and previous planning efforts to support the prioritization; when not available, qualitative ratings will be used.

Example criteria that may be integrated into the prioritization framework are listed below.

- Benefits – Avoided losses to include risk reduction; environmental benefits
- Cost – Existing adaptation measure costs will be leveraged; if not available qualitative ratings will be used with corresponding cost thresholds
- Climate Resiliency – Reduction in climate risk or level of protection of the adaptation strategy, and future adaptability to changing conditions
- Social Resiliency – Inclusive of social and cultural benefits, social equity, and community input
- Integration and Capacity – Alignment with existing programs/policies, dependencies, adaptive capacity to implement and maintain, funding availability
- Timeline – Sense of urgency to implement the adaptation measure/project

Our team will meet with the City to review and finalize the draft framework and update the criteria selection, weights, and scoring.

Using the final prioritization framework, the Tetra Tech Team will conduct the first round of strategy prioritization and organize the strategies for each chapter. This draft will be presented to the City staff and Working Group for one round of consolidated feedback. The goal is to reduce the catalog of projects and identify the top projects by Chapter to develop metrics and targets for inclusion in the Adaptation Plan (Task X.4).

5.4.3 Develop Strategy Metrics/Targets for Chapters and Planning Efforts

After the prioritization is complete, our team, in collaboration with the City, will identify key information to be assembled for each prioritized strategy (i.e., metrics and targets for the implementation plan). The following list summarizes example attributes that may be included. Our team will populate this information drawing upon our subject matter expertise and long-standing history of developing action plans that successfully access funding

to support implementation. The detailed projects will be included in the Adaptation Plan to enable funding. Example attributes include:

- Problem/solution including targeted populations, facilities, infrastructures being serviced
- Hazard(s) addressed
- Potential funding sources
- Potential limitations or complications
- Implementation timeframe (short, medium, long)
- Cost of inaction – bulleted qualitative statements
- Summary of benefits and co-benefits
- Planning-level cost estimate (high/medium/low)
- Lead implementation entity
- Implementation priority (high, medium, low)
- Action type (people, infrastructure/ services, education, and mitigation)

PRIORITIZATION RANKING BREAKDOWN							PRIORITIZATION RANKING BREAKDOWN (CONTINUED)								
ID	PROJECT NAME	Costs	Benefits	Risk & Vulnerability	Syner-gies	Social Resil-ient	Total Project Rating	ID	PROJECT NAME	Costs	Benefits	Risk & Vulnerability	Syner-gies	Social Resil-ient	Total Project Rating
V	Coastal Marsh Restoration	0.0	32.4	8.2	3.3	6.6	50.5	GG	Hendrickson Avenue	24.0	1.9	3.0	4.8	0.0	33.9
B	Horsebrook Drain West Branch Recharge Basin	7.0	25.3	11.4	1.9	0.8	46.4	I	Lakeview Avenue	24.0	0.0	2.4	4.9	0.0	32.9
DD	Hempstead High School Creek Restoration	23.9	7.4	2.2	5.7	5.8	45.0	OO	Waldo Avenue	24.8	1.2	3.9	3.0	0.0	32.9
II	Cooper Square	19.8	14.7	2.3	6.1	0.0	42.9	AA	Beverly Road	24.5	1.6	2.9	3.6	0.0	32.6
M	East Rockaway High School/Lister Park	10.3	13.8	6.0	4.9	7.8	42.8	K	Peninsula Boulevard Greenway	24.3	0.0	2.4	4.3	0.0	32.6
H	Malverne High School	18.0	11.3	2.1	4.8	6.2	42.4	Y	Maple Avenue and Long Beach Road Intersection	24.3	0.1	2.7	5.2	0.0	32.3
F	Malverne Green Streets	12.1	19.6	3.8	5.3	0.4	41.2	LL	Halls Pond Study	24.5	0.0	2.5	4.9	0.0	31.9
A	Hempstead Lake State Park	0.0	13.6	11.3	5.3	10.7	40.9	Q	Williamson Street	22.5	3.4	4.4	1.3	0.0	31.6
L	Smith Pond	12.8	9.1	4.7	5.7	7.4	39.7	T	Lawson Boulevard	11.8	9.5	7.1	2.4	0.0	30.8
C	Hempstead Housing Authority	20.0	8.2	7.2	3.6	0.2	39.2	S	East Rockaway Long Island Railroad Station	23.5	1.2	1.7	3.6	0.0	30.4
N	Forest Avenue	22.5	4.9	4.8	6.1	0.4	38.7	R	Bay County Park	23.6	1.1	2.5	1.4	0.0	29.6
								FF	Mill River Storm Surge Barrier	0.0	15.8	10.2	3.5	0.0	29.5

Example catalog of prioritized projects and associated metrics and ranking from Living with the Bay

The final Adaptation Chapter will include the 10-year, budget and recommended policy changes and a final presentation to the City Commission (Task X.5) to receive feedback and input. A summary report will be provided to the City that will integrate the Adaptation Plan recommendations into existing plans including the Comprehensive Plan, Code of Ordinances, Local Mitigation Strategy, post disaster plans, stormwater master plans, etc. (Task X.6)

5.5 Final Adaptation Plan (Task 11)

Tetra Tech understands that the information and adaptation strategies from the eight Adaptation Chapters will be consolidated into one Final Adaptation Plan for the City and that all data will be part of the interactive dashboard so that the information can be easily accessed by the public and stakeholders. The Final Adaptation Plan will be an integration of plans across all Chapters and will include metrics for tracking successful implementation of the Plan. Tetra Tech's Baseline Assessment ToolSM (commonly referred to as the BAToolSM) transforms the way a community manages their Adaptation Plans. This intuitive program streamlines the tracking of actions and projects from identification through implementation across multiple jurisdictions, departments, and partners to support the following:

1. Project status reports and action plan maintenance
2. Local plan roll-up for local mitigation strategy
3. Community Rating System (CRS) annual reports
4. Project identification and alignment with grant-funding opportunities
5. Documentation and tracking of resilience and adaptation investments and funding sources
6. Immediate access to projects for re-prioritization and selection to fund post-disaster
7. Enhanced communication and transparency between jurisdictions

5.6 Interactive Mapping

Tetra Tech's employs a High Security ArcGIS Enterprise environment. Geospatial data and results utilized and developed during the project term can be shared with the City via GIS collaboration that can share geo-spatial data. Model and analytical results can also be published and made available to the Tetra Tech Team, the City, and the public. Interactive tools can be published to visualize items such as SLR and the potential impacts to structures, community and infrastructure at a variety of storm events and flood stages. This information can also be embedded in a "Story Map" with detailed narratives, maps and illustrations to tell the project story.

Firm	Project Name	Link
Tetra Tech	USEPA EnviroAtlas	https://www.epa.gov/enviroatlas
Tetra Tech	USEPA Freshwater Explorer	https://www.epa.gov/water-research/freshwater-explorer
Tetra Tech	FEMA RecoveryTrac	https://www.tetratech.com/en/markets/disaster-recovery/disaster-response-and-recovery-solutions/disaster-response-technology-solutions
Tetra Tech	Lower LA River Recovery Revitalization Plan	https://lowerlariver.org/the-plan/
Tetra Tech	Chesapeake Bay Program Communications Workgroup Infographics	Watershed Implementation Plan Engagement Action Team (chesapeakebay.net)
Tetra Tech	NYS Fisheries Technical Working Group (NYSERDA FTWG)	Lease Map - New York State Fisheries Technical Working Group (nyftwg.com)
Tetra Tech	Patriot Renewables Western Maine Renewable Energy	WESTERN MAINE RENEWABLE ENERGY (arcgis.com)
The Balmoral Group	Agricultural Water Demand Projections, FL Energy Equity, Highway Construction Cost Analysis	Microsoft Power BI
Clearview Geographic	City of Pensacola: Sea Level Rise Vulnerability Assessment	Sea Level Rise Vulnerability Assessment Pensacola, FL (arcgis.com)
Clearview Geographic	Monroe County: Sea Level Rise Vulnerability Assessment	Sea Level Rise Vulnerability Assessment Monroe County (arcgis.com)
Clearview Geographic	City of New Smyrna Beach: Resilient New Symrna Beach	Resilient New Smyrna Beach (arcgis.com)
Clearview Geographic	Martin County, FL: King Tide Season Photo Submission Form	Martin County - King Tide Season Photo Submission (arcgis.com)

Tetra Tech Team member Brizaga will support development of the Public Engagement Plan identified in the RFQ. Our goal is to communicate science-based information that engages the public, community leaders, and subject matter experts, regardless of education and technical background. Our Team will use a variety of methods and multi-media tools in a collaborative and meaningful way to help the community understand the science and technical information behind the CVA and proposed projects, taking knowledgeable actions to

protect quality of life and the health of the community. Our team has deep and unparalleled experience engaging communities on the complicated topics of resilience and adaptation.

Our team believes that engagement must be entrained in the entire project and when convenient for stakeholders. This is why we develop a 24-7 engagement approach that allows residents, businesses, visitors, and other stakeholders to engage when is convenient for them. We recommend a project informational website from the beginning to share information and gather feedback electronically such as a flood reporting tool that allows residents to upload photos and location information with an easy-to-use form. We do not just do standard public meetings, but interactive media-first engagements that educate and deeply build the public will for action. We also conduct mobile “pop-up” opportunities for public involvement with project materials to give the community a first-hand look at the work as its being conducted for early and often feedback. We can also conduct both mobile in person involvement opportunities as well as online. Recognizing the strong community engagement in the City, and the multitude of year-round community events, our approach will capitalize on these opportunities to deliver information and gain feedback through different methods.

The Tetra Tech Team will work with the City to develop a public Engagement Plan including community outreach analysis to strategize the dissemination of public announcements and educational materials throughout designated websites, calendars, email lists, newsletters, in-person and mobile charette, and social media platforms. Our outreach tools and materials may include combinations of:

- Mailchimp email templates for newsletters and email distribution
- Graphic designed social media standard posts
- Graphic designed educational materials with ADA compliance (e.g., one-pagers, executive summaries, citizens’ guides, and brochures for best management practices)
- Video-editing of promotional and educational videos
- Personalized copy for a website with ADA compliance
- Facilitated live hybrid meetings and webinars through virtual conferencing tools, such as Zoom and Teams, including a personalized registration page and facilitated break-out rooms, polls, and other interactive tools to create a safe space for feedback and collaboration
- SurveyMonkey surveying and comment cards with alternatives to submit via email or physical copy (paper) during and after the initial engagement
- Hybrid dotted map exercise (physical and digital reporting dotting boards) to identify areas of concern and flooding severity (Our team uses digital mapping tools that easily allow residents to provide feedback any time that is convenient for them [part of our 24-7 engagement approach])
- Public-adaptation prioritization exercise that uses both quantitative and qualitative analyses
- Live in-person, mobile charette and event-driven opportunities for engagement

We focus on meeting people where they are, which means being flexible to accommodate what works best for each community. This could be by using their preferred platforms, implementing or even innovating new methods. We understand that to build strong and resilient communities, equity must be at the front of what we do. We help implement the arrangements necessary for a genuinely equitable outreach engagement. This may include translating meetings or materials, meeting after regular business hours, or other accommodations to encourage public participation. We want everyone to feel welcome and able to participate.

The Tetra Tech Team will support the City in scheduling an initial public outreach meeting so that the public and stakeholders can provide input during the initial project stages to discuss preferred methodologies, data for analyzing potential SLR impacts and/or flooding, guiding factors to consider, and critical assets important to the community. The Tetra Tech Team will prepare all social media notifications, meeting invitations, meeting materials, presentations, and graphics used during the meeting, based on prior approval from the City. Additional public meetings will be held at key points throughout the process and before the Adaptation Plan is finalized. After each public interaction, our Team will provide the City with a comment-response document to note the comments

received and a response, including how the plan forward was modified, if applicable. By creating a process that allows the public to ask questions and provide input prior to the assessment, the City of Key West will be able to create a CVA and Adaptation Plan that addresses the needs and demands and has strong community support—built from the ground up by meeting people where they are, and being honest and authentic communicators.

5.8 Project Deliverable Timelines

Our Project Manager, Georgia Vince, who has managed similarly complex projects throughout Florida, will ensure that deliverables and final products are provided to Key West on time and meet the project objectives. Our team will hold regular coordination calls with the City throughout the project to provide updates on task status and obtain feedback on project tasks, which will allow for City input as the project is developed to save time in review of each task deliverable. Georgia has managed several complex planning projects over \$2 million that were delivered on time and within budget.

Tetra Tech understands the coordination and organization required to maintain a complex schedule. Schedules often have overlapping tasks, which use various personnel and require experience in coordinating subconsultants to preserve multiple critical paths. For highly complex projects such as this, we prepare advanced schedules in Primavera P6. Resource-loaded schedules can provide resource balancing and integration with our labor forecast tool. A 30-Day Look Ahead Schedule can be provided with monthly reports. Tetra Tech has used these tools to meet project deadlines on large complex projects.

An estimate of our proposed Project Schedule is shown in Exhibit 5-2. The schedule is based on our standard implementation timeframes for Resilient Florida VAs we have completed and assuming approximately 6 months to evaluate each Chapter of the Adaptation Plan. As the project progresses, we will reevaluate and take advantage of every opportunity to start tasks or chapters earlier, overlap similar tasks that can be completed simultaneously and to compress the schedule and complete the project ahead of schedule.

Exhibit 5-2. Schedule

	2023												2024												2025			
Description	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR			
Kickoff																												
Public Engagement Plan																												
Steering Committee Meeting																												
Mobile LiDAR Data																												
Acquire Background Data																												
Public Outreach Meeting #1																												
Exposure Analysis																												
Sensitivity Analysis & Draft VA																												
Public Outreach Meeting #2																												
Infrastructure Adaptation Plan (CH 1)																												
Historical and Cultural Adaptation Plan (CH 4)																												
Final Vulnerability Assessment Report																												
Public Presentation																												
Environmental Adaptation Plan (CH 2)																												
Land Use & Code Adaptation Plan (CH 3)																												
Power & Water Adaptation Plan (CH 5)																												
Economics Adaptation Plan (CH 6)																												
Housing & Shelter Adaptation Plan(CH 7)																												
Health & Equity Adaptation Plan (CH 8)																												
Final Assimilation (DEO Deliverable 7)																												

6 Personnel

6.1 Key Personnel

Our project management team comprises Project Manager Georgia Vince, and Deputy Project Managers Alison Miskiman and Erin Deady. The project management team will coordinate with the City, oversee the project and task administration, and ensure that the project meets deadlines, budgets, and goals. Georgia will be the main point of contact for the City and will work with Alison and Erin to assign personnel and resources, oversee all work activities, and provide QA/QC of project deliverables in accordance with the project schedule and deliverable deadlines.

Georgia Vince

Project Manager

Years of Experience: 23

Education: BS,
Oceanography

Location: Palm Beach
Gardens, FL



Georgia has 23 years of experience with environmental programs and 12 years with project management. She has managed projects of all sizes with budgets of over \$2 million. She recently was project manager for the St. Lucie County VA completed in 2021. Her background in regulatory and permitting programs for state, federal, and local levels of government has provided her with a detailed understating of Florida's regulation system. Georgia has extensive experience in public speaking and coordinating with stakeholders on sensitive environmental issues. She is well known for her abilities to meet project schedules and stay within budget with a high level of client satisfaction.

Relevant Project Experience

- St Lucie County VA
- Comprehensive Everglades Restoration Projects throughout south Florida including nutrient removal technologies, feasibility studies, engineering design, permitting, and construction management.
- Projects in process, recently launched or awarded: City of Hollywood Vulnerability Assessment, Palm Beach County Vulnerability Assessment and Resilience Action Plan

Erin Deady

PA

Deputy Project Manager

Years of Experience: 26

Education: MA Public
Administration, MA
Environmental Growth
Management, Juris

Location: Delray Beach, FL



Erin Deady has helped local governments throughout Florida undertake resiliency and climate planning efforts and is a subject matter expert in navigating the legal risk associated with flooding and climate change. Her planning and legal practice have focused on formulating strategies to address climate and SLR through new policy initiatives, comprehensive plans, and codes. She has written numerous publications on the legal issues addressing tort and negligence liability for local governments in adaptation planning and response.

Relevant Project Experience

- Monroe County VA (2015, 2021)
- Completed Vulnerability Assessments: Martin County, Pensacola, St. Lucie County
- Roadway Vulnerability Assessment and Capital Plan, Monroe County (subcontractor)
- Monroe County Comprehensive Plan Update 2010 (subcontractor); Peril of Flood Amendments 2020; Adaptation Action Areas 2021
- In process Vulnerability Assessments: Islamorada, City of West Palm Beach, Lynn Haven
- Resilient Shoreline Ordinance: Tampa Bay Regional Planning Council (completed), City of St. Augustine (in process)
- Peril of Flood Comprehensive Plan Amendments: West Palm Beach, Briny Breezes, Delray Beach and Pensacola
- Adaptation Action Areas: Coastal Resources Partnership (7 Cities in Palm Beach County)

Alison M. Miskiman
GISP, CFM
Deputy Project Manager
Years of Experience: 31
Education: BS, Engineering
Location: Elizabeth, NJ



Alison Miskiman leads Tetra Tech's Risk and Resilience sub-practice as part of our Emergency Management Community Resilience program. She specializes in risk-informed planning and working in partnership with clients to maximize funding to increase resilience to natural hazard events and the changing climate. She is a Certified Floodplain Manager (CFM) and a Certified Geographic Information Systems Professional (GISP). Alison leads our geospatial team conducting detailed and customized risk and VAs.

Relevant Project Experience

- Resilient NJ, Regional Planning for a Stronger New Jersey; NJ Department of Environmental Protection

6.2 Technical Leads

Our technical leads have decades of experience in public outreach, data analysis and modeling, critical asset evaluation, CVAs, and adaptation planning. Summaries are provided below for each of our technical leads. Supporting the technical leads are experienced technical staff with the expertise and knowledge to successfully implement the VARAP tasks.

David Frodsham
PE
Civil Engineering and Infrastructure
Years of Experience: 26
Education: MS, Engineering Management; BS, Civil Engineering
Location: Stuart, FL

David Frodsham has experience in civil engineering, coastal engineering, municipal engineering, civil site design, environmental permitting, and construction management. He is currently the Project Manager for the Environmental, Coastal, and Remediation Engineering contract with the City of Key West. This has included more than 63 task orders including seawall repair/replacement, waterfront planning, structural and waterfront assessments, and civil, structural, and utility engineering design.

Relevant Project Experience

- City of Key West, Aquarium Basin Seawall, Half Shell Raw Bar Seawall, Schooner Wharf to Conch Republic Seawall
- Harbour Ridge Yacht & Country Club, Shoreline Hardening and Restoration, Palm City

 **Stantec**
Jared Beck
AICP
Civil Engineering and Infrastructure
Years of Experience: 20
Education: BS, Landscape Architecture
Location: Miami, FL

Jared Beck brings a blended background as an urban planner that also includes past professional roles as an Executive Director of a merchant driven business district within a National Register Commercial District and as a Principal Preservation Planner managing both National and Local Historic Districts. Having spent much of the last 20 years with a career focused on redevelopment and community-based revitalization, his past roles and projects demonstrate his commitment to building successful communities for the future. He is also one of Stantec's public engagement specialists and has been heavily involved in numerous public projects in that capacity.

Relevant Project Experience

- Past Principal Preservation Planner, City of Fort Meyers
- Duval Street Redevelopment and Resilience, City of Key West

Saied Saiedi

PhD, PE

Environmental Adaptation

Years of Experience: 33

Education: PhD, Civil Engineering
(Hydraulics and Coastal)

Location: Boynton Beach, FL

Saied is a civil engineer with 32 years of engineering and academic experience. His hydrotechnical experience includes coastal structures and processes, floating offshore structures, submarine pipelines, free surface flow (hydraulic structures, sediment transport, hydropower dams, river engineering, water tunnels), hydrodynamics (cavitation, gates, pressurized flow in pipes and tunnels), surface hydrology and flood studies.

Relevant Project Experience

- City of Miami, Brickell Bay Drive Seawall & Resiliency Improvements
- Miami-Dade County, Sea Level Rise Mitigation Feasibility Study



Jason Newton

Historical & Cultural Preservation

Years of Experience: 13

Education: MA, History

Location: Jacksonville, FL

Jason Newton has experience with architectural history and cultural resource management. Jason has experience conducting historic resource evaluation, National Register of Historic Places (NRHP) nominations, Section 106 Review, and architectural survey throughout Florida, particularly central and south Florida. His qualifications exceed those set forth by the Secretary of the Interior's *Standards and Guidelines for Architectural History and History* (36 CFR Part 61).

Relevant Project Experience

- Last Mile Amenities LAP, Key West FL

Ken Caban

PE

Power & Water

Years of Experience: 27

Education: MS, Environmental
Engineering

Location: Miami, FL

Ken Caban has managed local resiliency and infrastructure improvement projects in the Miami area for over 20 years. His local understanding and proven abilities managing multi-discipline teams make him an ideal project manager for this project. Most recently, his work has included climate change and SLR adaptation and resiliency projects within the Miami-Dade and Tri-County area, as part of the Southeast Florida Regional Compact on Climate Change, where he served as a member of the Built Environment Work Group. As a member of the Work Group, Ken's mission was to develop focused recommendations pertaining to regional climate mitigation and adaptation issues in the built environment as part of a regional action plan.

Relevant Project Experience

- Stormwater Infrastructure Program, City of Hollywood
- Water Main Replacement Program, City of Hollywood



Valeri Seidel

Economics

Years of Experience: 37

Education: Master of Commerce in
Economics

Location: Winter Park, FL

Valeri Seidel's economics experience focuses on infrastructure and natural resource valuation, GIS and statistical models of resource allocation and optimization, and cost-benefit analysis. She has expertise in data synthesis of numerous data types ranging from sea level rise VAs to economic development. Her completed projects include researching the economic impacts of public policies to application of economic methods.

Relevant Project Experience

- VA Phase I and II, Nassau County
- Coastal Resiliency Management Alternatives, Cost-Benefit Analysis, Martin and Okaloosa Counties

Cynthia Bianco
PP, AICP, CFM, LEED AP BD+C
Housing and Shelter
Years of Experience: 31
Education: BS, Engineering
Location: Parsippany, NJ

Cynthia Bianco is involved in the management and performance of community reconstruction plans, resiliency projects, and local hazard mitigation planning projects regulated under the Disaster Mitigation Act of 2000. Her experience includes the development and management of a wide range of implementation-focused resilience and mitigation projects in accordance with HUD, FEMA, and state requirements. These proactive plans form the basis for climate adaptation measures and mitigation strategies to reduce the vulnerability of hazards.

Relevant Project Experience

- Hillsborough County Resilience Plan, FL
- FEMA Hazard Mitigation Technical Assistance Program

Sarah Roberts
Health & Equity
Years of Experience: 24
Education: MSEM Disaster and
Emergency Management, BS Human
Services
Location: Maitland, FL

Sarah Roberts is a seasoned emergency specialist with more than 20 years of multidisciplinary emergency management and public health emergency response and recovery experience at all levels of government, local, state and federal emergency operations. She is currently Tetra Tech's National Director of Public Health and Diversity Equity and Inclusion supporting a diverse group of public health, healthcare, and emergency management clients. She has successfully managed project teams for a diverse group of emergency management and public health clients in both rural and metropolitan environments.

Relevant Project Experience

- Arlington County, VA Emergency Support Function After Action Report
- New York City DOHMH Monkeypox After Action Report


Alex Zelenski
GISP
GIS Consultant
Years of Experience: 10
Education: BS, Env. Sci. & Geography
Location: Deltona, FL

Alex Zelenski has significant GIS and environmental consulting experience on numerous projects including resiliency, sustainability, VAs, and public engagement to support local government planning initiatives both within and outside of Florida. He has experience creating climate-risk models to serve as the basis for VAs and Adaptation Plans and has leveraged them to identify priority planning areas and adaptation action areas.

Madhu Akasapu-Smith
PE, CFM
H&H Modeling
Years of Experience: 12
Education: MS, Water Resources
Engineering, BS, Civil Engineering
Location: Atlanta, GA

Madhu Akasapu-Smith is a Water Resources Engineer with 12 years of experience specializing in watershed modeling, receiving water modeling and analysis, and results interpretation and presentation. She has experience with watershed hydrology and water quality modeling using Loading Simulation Program in C++ (LSPC), receiving water modeling using EFDC and Water Quality Analysis Simulation Program, surface water—groundwater modeling in ICPR4, H&H modeling using HEC-RAS and hydrologic modeling system, culvert hydraulics using the HY-8 Culvert Hydraulic Analysis Program and mixing zone modeling using Cornell Mixing Zone Expert System.

Relevant Project Experience

- Coastal Flood Inundation Mapping, Village of Key Biscayne
- Coastal Hazard Assessment and Mapping Program (CHAMP) City of Sanibel

Renee Walmsley
PMP, GISP
LiDAR & Information Management
Years of Experience: 22
Education: BA, Environmental
Science, BA, Geography, MBA
Management
Location: Denver CO

Renee Walmsley leads the Geomatic Technologies Group and is the Director for Remote Sensing. She is a certified GISP, FAA UAS remote pilot and PMP and has been a project manager for 18 years. Her experience includes using remote sensing technology as a part of various job requirements at locations throughout the U.S. and overseas. Through these projects, she has managed many aspects of remote sensing, LiDAR, photogrammetry and GIS, mobile mapping, including data development and analysis, image classification and new sensor technologies. She has also used ArcGIS software to support information management and decision-making.

Relevant Project Experience

- Program Manager, NOAA Sea Level Rise Viewer Updates



Alec Bogdanoff
PhD
Public Outreach
Years of Experience: 20
Education: PhD, Physical
Oceanography; MS, Meteorology
Location: Hollywood, FL

Alec Bogdanoff is a policy-trained oceanographer and meteorologist and has experience with simplifying and effectively communicating complex scientific processes. He is intimately familiar with leading the outreach and education for the Southeast Palm Beach County Coastal Resilience Partnership VA. He has worked on numerous VA and adaptation plans. He has a unique understanding of state statute on VAs and deftly navigates grant requirements and project vision between community, elected officials, staff, and other key stakeholders.

Allison McLeary
PhD
Grant Management
Years of Experience: 18
Education: PhD, Civil Law
Location: Pensacola, FL

Allison McLeary is an experienced emergency response and recovery executive with a demonstrated history of building meaningful relationships across all levels of government. As former Recovery Bureau Chief of the Florida Division of Emergency Management, she offers more than 3 years of direct experience administering grant programming throughout Florida. She also served as Recovery Counsel for the Louisiana Governor's Office of Homeland Security and Emergency Preparedness. She is a steadfast advisor in planning for, responding to, and recovering from challenges and disasters.

Relevant Project Experience

- Florida Division of Emergency Management, Recovery Bureau Chief

7 Qualifications

Vulnerability Assessments and Adaptation Plans. Representative Vulnerability Assessments and Adaptation Planning projects the team has recently completed are summarized in Section 8.

The Tetra Tech team (and including partners for this CVA) has supported several local governments with their VAs, public outreach, and related studies including:

- St. Lucie County VA – 2021 (Tetra Tech, ELDPA, and Clearview Geographic)
- Hillsborough County Resilience Plan – 2020 (Tetra Tech)
- Martin County Resilience and Watershed Management Plan – 2021 (ELDPA and Clearview Geographic)
- Monroe County VA – 2021 (ELDPA and Clearview Geographic)
- City of Pensacola VA – 2021 (ELDPA and Clearview Geographic)
- Peril of Flood Comprehensive Plan Amendments for Monroe County, the Cities of Pensacola and West Palm Beach, and the Town of Briny Breezes – 2019-Present (ELDPA)
- Southeast Palm Beach County Coastal Resilience Partnership VA, seven municipalities and Palm Beach County – 2021 (ELDPA, Brizaga, CMA)
- Briny Breezes Community Adaptation Plan – 2021 (ELDPA and Brizaga)

- Indian River Lagoon VA (Balmoral Group)
- Nassau County VA (Balmoral Group)
- St. Johns County, FL, Action Plan – 2020 (Tetra Tech)
- U.S. Virgin Islands Action Plan – 2021 (Tetra Tech)
- Lexington County, SC, Action Plan – 2021 (Tetra Tech)
- Richland County, SC, Action Plan – 2019 (Tetra Tech)

Engineering Services. Tetra Tech has provided engineering services to help our clients and the communities they serve improve and protect assets and resources for over 55 years. Our engineering staff is versed in appropriate technologies, regulatory matters, and project management to address all forms of infrastructure projects that may occur in Key West. We are currently providing engineering services to the City through our Environmental Engineering Contract. Our expertise includes coastal engineering in Key West from numerous seawalls, marinas and coastal structures to throughout Florida addressing coastal development and coastal protection with science that begins with modeling, environmental surveys and design.

Tetra Tech staff has developed a solid working rapport with City staff and is committed to seeing the City through to its goals for general engineering initiatives. We understand the value of responsiveness and strive to be as communicative and accessible to the City as possible. Tetra Tech has a proven record of advocating for the City's interests, obtaining timely jurisdictional authorizations for City projects, and keeping our deliverables on schedule. We are also pleased to report that a substantial percentage of our projects have been delivered under budget.

Civil Engineering. Tetra Tech maintains a deep roster of widely skilled engineers and environmental scientists that are equipped to address a wide variety of civil engineering projects including hardscape engineering for the City of Key West. Tetra Tech has been ranked #1 in Water by *Engineering News-Record* magazine for 19 years in a row. Tetra Tech helps provide access to safe, abundant water supplies; effective treatment of stormwater and wastewater; flood control and restoration tools; and innovative watershed protection approaches to assess, protect, and restore our water bodies. Our potable water services help protect public health and improve quality of life. Tetra Tech is involved in all phases of the water cycle, combining state-of-the-art techniques and demonstrated best practices. Tetra Tech assists numerous municipalities and government agencies to identify and evaluate water resources. As industry leaders in potable and non-potable reuse, desalination, utility resiliency, and green infrastructure, Tetra Tech guides and supports efficient, effective total water management for communities. Many of our staff are former regulatory employees who intimately understand the nuances and complexities of successful regulatory permitting. We are versed in all forms of civil site design, including conceptual design, site remediation, stormwater engineering, utility installation and upgrades, wastewater treatment plant services, coastal engineering projects, construction management, and project close-out.

Water Utility Engineering. Tetra Tech's drinking water services help clients protect the public health and quality of life in their communities. Whether our clients are maintaining or improving existing water supply infrastructure, planning new construction to expand capacity or enhance water quality, or seeking to minimize life-cycle costs, Tetra Tech provides sustainable solutions to complex water treatment challenges. Our engineers and scientists have been helping local governments and municipal utilities provide safe and secure drinking water for decades. Our approach to water resources management and innovative water treatment practices helps our clients create a reliable 21st century roadmap for their water systems. Our team has extensive experience designing treatment facilities throughout the U.S. including the state of Florida. We have experience designing expansions to existing treatment facilities, as well as designing new treatment facilities at greenfield sites and/or at the site of existing water utility infrastructure. For the past 19 years, Tetra Tech has been ranked Number 1 by *Engineering News-Record* for Water and Number 1 for Water Treatment and Desalination due to our volume of work in this practice area. Based on the number of treatment facilities that our Team has delivered; we have developed close working relationships with manufacturers and specialists.

Power Utilities. Tetra Tech has provided multidisciplinary detailed design and project management services for numerous overhead and underground electrical systems pertaining to capital projects, identification of vulnerabilities, and recommendations for adaptation measures to ensure resource resiliency through

redundancy and has a strong background in distribution protection measures. Examples of our efforts include relocation to underground distribution, upgrade of existing overhead switching to include remote operated SCADA switches for Smart Grid initiatives, pole replacement and reframing to current standards. Standardization projects include upgrade of transformers, switches, conductors and other components for improved reliability and reduction of procurement/inventory costs. The services include adaptation planning, public relations support, outage management, design, permitting, construction support and close-out.

Historic Preservation and Resilience. Tetra Tech understands that flood risk has long been a major challenge for many historic properties and local, state, and national landmark districts. Changing weather patterns, stronger hurricanes and other extreme weather events, SLR, increased nuisance flooding, and king tides are some of the factors increasing the risk of flooding events, both in terms of their frequency and magnitude. Some historic properties that have never flooded before may now be exposed to this risk, and those that flooded infrequently in the past may experience more instances of flooding or of water reaching higher levels than before. These challenges have become a significant concern for many local municipalities, notwithstanding the size and scale of their historic districts, as they are faced with ever increasing coastal environmental issues related to recurring storm damage and shoreline retreat.

Tetra Tech is familiar with and has implemented the Guidelines on Flood Adaptation for Rehabilitating Historic Buildings which provides guidance on how to adapt historic buildings that need to be more resilient to flooding risk in a manner that will preserve their historic character. Our team has a proven track record of successful delivery of planning, assessment and rehabilitation design services for historic structures, towns, cities and landscapes, and the related cultural resources consulting services that will be needed for this project. We have extensive experience with federal, state and local regulations or consultation processes that may apply, along with an understanding of many of the minor differences in the details of the process that arise among different State Historic Preservation Offices (SHPOs) and different consulting agencies.

Our work will be informed by our extensive expertise in projects of similar scale and scope, in addition to our familiarity with the National Park Services Secretary of the Interior Standards for Historic Preservation processes, design standards, and submission requirements. We understand the nuances of the historical, political, social and economic contexts that shape interventions on the existing building fabric, and the unique challenges of developing strategies for the long-term stewardship of the built heritage, particularly when attempting flood adaptation interventions in challenging geographic, topographic or infrastructure contexts.

Our effective, and inclusive approach seeks to create consensus between the multitude of stakeholders and governmental entities involved in the process, informed by a thorough - and practical - knowledge of relevant codes and standards, and latest technological innovations. We will work closely with the Historic Florida Keys Foundation and the State Historic Preservation office to ensure that proposed resilience plans extend the life of these threatened resources in a manner consistent with the Foundation's mission for emergency preparedness actions related to future storm events and potential increases in water surface elevations, while meeting appropriate Secretary of the Interior Standards, and other relevant state or local historic preservation standards and regulations.

Nature Based Solutions. As communities adapt to and respond to more frequent and extreme flooding and sea level rise, there is an increased need for nature-based solutions. Nature based solutions provide social economic and environmental benefits by increasing green space, protecting infrastructure and providing ecosystem enhancement. Our teams weave natural features and processes in an engineered capacity to create customized and sustainable solutions for resilient coastlines and shorelines.

The City will benefit from our understanding of project goals and objectives, expected quality of work and performance standards and the desire to incorporate nature-based resilience elements into engineering design components of each project as they are identified for the Adaptation Plan. We provide the engineering, modeling, environmental, regulatory, survey, and public relations needed to deliver nature-based solutions that will meet the City's objectives. We bring a successful record of accomplishment of performing technical studies, environmental modeling and habitat characterization, coastal engineering design and agency permitting

coordination that will meet the City's functional requirements, while optimizing costs, schedule, and consideration of significant environmental and resilience attributes of projects.

The Tetra Tech team is fully prepared to support the City with nature-based solutions and green infrastructure projects. Our highly qualified team includes coastal and marine engineers, modelers, environmental/biological scientists, permitting experts, GIS professionals, marine survey, resilience, and archeological professionals with proven success as well as extensive local knowledge and experience to help manage and enhance the City's coastal attributes and natural resources. We have successfully designed and implemented living shoreline projects in Florida, Massachusetts, New York, and Louisiana as well as riverfront structural flood barrier and wave and current attenuation projects as nature-based solutions to support resilient coastlines and provide environmental benefits.



Fort Pierce Storm Protection Island, Tetra Tech

Community Adaptation (Housing, Health and Wellness). Tetra Tech applies intersecting VAs to connect climate change-related hazards to impacts on populations that are more susceptible to adverse health impacts associated with climate-related exposures.

- **Assessing climate change exposure risks.** These are defined as contact between people and stressors, which could include biological (e.g., vector-borne diseases, mold), behavioral health, extreme weather (e.g., extreme heat and seasonal hurricanes), or physical circumstances impacted by climate change (e.g., access to housing). Often, multiple simultaneous stressors are generated by climate hazards.
- **Social vulnerabilities.** The degree to which people and communities are directly affected by climate change is directly related to community-based characteristics that place a person at greater risk of a negative health outcome if exposed.
- **Adaptive capacity.** Heavily influenced by social determinants of health such as education, social norms, and economic resources. The concept of capacity is directly related to how these elements of vulnerability overlap and compound each other for certain communities, exacerbating the extent to which people are at risk for negative health outcomes and impacting the implementation of adaptation strategies.

Tetra Tech uses three distinct tools to provide the necessary depth and breadth of the islands residents, these include the Centers for Disease Control and Prevention (CDC) - Agency for Toxic Substances and Disease Registry (**CDC/ATSDR**) **Social Vulnerability Index** which provides data from 16 U.S. census variables that identifies community populations the negative effects caused by external stressors on human health by natural or technological disasters or disease outbreaks The second tool is the U.S. Environmental Protection Agency's (EPA) **EJScreen: Environmental Justice Screening and Mapping Tool** which identifies high-risk communities by environmental markers, historic data, as well as income and other demographic markers. The third is Tetra Tech's proprietary **Diversity, Equity, Inclusion, and Accessibility (DEIA) Program Assessment Tool**. This DEIA tool assesses 10 areas including communication, outreach, policies, and plans in organizations. Tetra Tech's team will synthesize findings to develop adaptive strategies to enhance benefits and services to underserved communities that are disproportionately impacted by climate change. Tetra Tech will leverage information presented in the *Health Impact Assessment of the Southeast Florida Regional Climate Compact's Regional Climate Action Plan* and other studies that have been completed as a basis for this chapter of the Adaptation Plan.

The challenge of housing affordability is much bigger than Key West, but the community has an opportunity to lead and innovate. This Adaptation Plan will provide the ability to focus on how climate change will impact frontline communities first and hardest – and how we respond to the challenge. This is not just about developing more housing in more resilient areas, but also ensuring existing housing is resilient. Beyond life and safety, it's about people and our economy – thriving through a storm or situation – and getting back to the Key West way of life as quickly as possible.

Our team has deployed flood protection solutions for a variety of clients, from some of the largest developers in South Florida, to historic structures, like Vizcaya Museum and Gardens in Miami. In addition, Brizaga is currently leading the development of Miami Beach's Private Property Adaptation Program. This first-of-its-kind program will provide assessment, adaptation solutions, and a grant from the City to implement the solutions. This is just an example of the type of program that could be implemented in Key West – and this team has the experience to do just that.

In terms of new development, team members Brizaga and Erin Deady are both intimately familiar with the development process, and the Brizaga team has been a national leader in resilience and adaption associated with housing affordability. Both have extensive experience developing resilience policy across South Florida and beyond and have worked together on multiple projects look at building standards, resilience updates, and priority planning areas.

Brizaga is also deeply familiar with working with affordable housing owners to enhance resilience standards. Through their Keep Safe Miami initiative, Enterprise Community Partners retained Brizaga to assist with their private property assessment program, designed to provide property owners of multi-family properties in low-income areas with a resource for improving the resiliency and sustainability of their properties. Brizaga provides direct assistance to individual property owners and managers by walking them through the intake process, which presents users with a 66-question survey to ascertain the specific conditions of the property relative to flooding, extreme heat, extreme wind, unhealthy housing, and operations and community. Our team reviews the responses to the survey questions as a quality control for property owners who may be unsure of their responses and consults with individuals following the completion of the assessment to help develop a longer-range plan for property resilience.

Brizaga is also leading at the state-level, working on resilience financing legislation that would provide opportunities for innovative financing. Along with Erin Deady, Brizaga team members understand the new state laws and grants available and have supported over 100 applications.

And while there is a need to evacuate sometimes, allowing people to shelter in place when possible is better for residents, first responders, the community, and the economy. Through our team's experience, we can assist Key West, through a stakeholder led process, understand what a shelter in place standard could look like for the community and include this in your Adaptation Plan.

Policy and Comprehensive Plans. The Keys have unique planning laws governed by Florida statute which could potentially affect adaptation planning. Section 380.0552(9)(a)2., Florida Statutes, requires that the Keys maintain a hurricane evacuation clearance time for permanent residents of no more than 24 hours. This requirement has had a key role in the approval of development permits under the County's Rate of Growth Ordinance – which in turn affects development at Key West, which is at the end of U.S. 1 and requires the most time to implement hurricane clearance.

The City of Key West authorizes new residential development through its Building Permit Allocation System (BPAS), i.e., the City's Rate of Growth Ordinance. The City is designated as an Area of Critical State Concern, and of the State's original allocation of units countywide, fewer than 100 units had remained available for the City. However, the updated (2012) Hurricane Evacuation Clearance Time MOU by Monroe County and the cities provided Key West with an additional 91 units per year through July 2023. These units may be used for market-rate, affordable, and transient housing. Since 2013 the City's Land Development Regulations emphasize sustainable building practices and reflect consideration of sea level rise. As a result of determinations by the Florida Administration Commission, in 2019 the City amended its comprehensive plan to include a new category of allocation: the "Affordable - Early Evacuation Pool" that provides 300 workforce-affordable building permit allocations (and any additional allocations authorized by the Florida Administration Commission or transferred to the City that were accepted by other Keys municipalities or the County). The Team understands the unique nature of Comprehensive Planning in the Keys and this experience will make the project more efficient with the development of policy recommendations that reflect this unique growth management system.

Our team understands the gravity of resiliency planning for local governments and the ultimate decisions to prioritize projects. This has both a policy and legal component to ensure that projects do not unintentionally physically impact property owners, but that there is a sound technically driven and transparent process to develop the overall Vulnerability Assessment and Adaptation Plan. For this reason, our Team includes ELDPA an urban planner and attorney who advises local governments across the state on how to approach these decisions in a way that creates a sound record for decision-making mindful of the legal and policy implications for adaptation response. An example to consider is antiquated language in Comprehensive Plans that may create a legal obligation for a local government to deliver a particular level of service that may not be achievable with increased inundation and future tidal flooding risk. Our approach to the policy component of this project will be based on the latest litigation, Comprehensive Plan requirements (and flexibility within those requirements) to simply identify legal risk for a community they may not have thought of prior to the planning effort. Erin is a thought leader in this space throughout the state publishing numerous legal journal articles and performing such liability analysis currently for Monroe County in the Countywide Roads Adaptation Planning process. The bottom line is that people may not all be supportive of the adaptation priorities of the City or its funding strategies to implement the program. The addition of Erin on the team provides a necessary and critical level of review to vulnerability and resiliency planning. This is unparalleled and local experience that is unique and extremely important to the City's efforts.

Public Facilitation, Outreach, and Education. From our direct work with communities following disasters, Tetra Tech understands the importance of creating an equitable platform and equitable investments in our communities. We understand that disasters and climate change impacts continue to disproportionately affect underserved and historically marginalized communities. As a society, we must actively work to ensure that all are treated in a fair and equitable manner before, during and after a disaster.

The Tetra Tech team has worked on similar planning efforts throughout the state and has been successful involving the public in the process and facilitating the transfer of information to keep the public informed of project activities, while still maintaining the goals and objectives and keeping to the project schedule. We will prepare a Public Engagement Plan and will work with City staff to organize and facilitate the public meetings. The goal of these meetings will be to engage local residents in the planning process, obtain area-specific information that will help guide plan development, and ensure that all voices are heard during the meetings. During the last few years, we have gained extensive experience in holding virtual public meetings due to COVID-19 restrictions using various platforms such as Microsoft Teams, Zoom, and GoTo Meeting.

Tetra Tech recently led two planning processes with significant public engagement for South Florida Water Management District. Georgia Vince, our proposed Project Manager for this effort, was the Project Manager for the Everglades Agricultural Area Feasibility Study-Post Authorization Change Report (PACR) and the C-43 Reservoir Water Quality Feasibility Study (C-43 WQFS). For the PACR, which affected western Palm Beach County, parallel public meetings were held at the SFWMD headquarters in West Palm Beach as well as communities in western Palm Beach County. The planning process included an alternatives analysis for the reservoir location and configuration. Along with standard meeting notifications, the public meetings were advertised in local newspapers to ensure awareness. Ten public meetings were held for this project.

The C-43 WQFS also had a significant public engagement component, including meetings throughout southwest Florida. The project team consisted of a committee of local municipality representatives. The committee provided input to the study, which evaluated and ranked 30 water quality treatment technologies. Due to the pandemic, many of the public meetings for this project were held virtually, via Teams or Zoom. In order to capture public input, the Tetra Tech team used the "Menti" program, which can be accessed using any web browser including from a smart phone. Menti allows participants to respond to predetermined questions to show preferences or allows questions to be submitted during audience polling. All responses are displayed on the screen.

Alongside ELDPA, Brizaga worked on assessments for Briny Breezes and the micro-regional Southeast Palm Beach County Coastal Resilience Partnership. Brizaga led the landmark regional Business Case for Resilience for Southeast Florida, covering Miami-Dade, Broward, and Monroe Counties, and was on the team for Miami Beach's Business Case Analysis for their Stormwater Resiliency Program. All of these projects required careful and consistent

messaging to build stakeholder buy-in across the entire community. Our team focuses on ensuring all voices have a seat at the table. Brizaga creates engagement approaches that fit the community and its residents. In Briny Breezes, a seasonal and older community, Brizaga led the outreach and engagement as part of an overall Adaptation Plan. Outreach and engagement was one-on-one and included phone calls and person emails. As a community that is less reliant on technology than most, all digital outreach was also performed in-person, or analog.

Grant Funding. Our team also has an exceptional track record securing funding and providing grant management services to successfully usher projects through to completion. Our team is specifically experienced in the implementation of the Resilient Florida program and has an incredible track record in navigating, securing, and managing grants in that program. Brizaga and ELDPA have authored more than 100 Resilient Florida grant applications to date. Tetra Tech team members have decades of experience working within the U.S. Department of Housing and Urban Development's (HUD's) CDBG program eligibility framework, successfully leveraging public funds and working with local communities to develop action plans, complete applications, and identify, evaluate, and prioritize recovery projects, focusing on HUD eligibility, including back-end grant management. The Tetra Tech team has worked with communities across the nation to ensure that HUD-funded recovery programs are launched and implemented with long-term sustainability, risk reduction and elimination, and community safety and resilience in mind and Tetra Tech has secured over \$1 billion in grant funding for our clients. Our knowledge of grant management will alleviate the burden on the City and assist with grant reporting and other grant requirements for management of budget and deliverables given our in-depth knowledge of both programs.

8 Representative Vulnerability Assessment and Adaptation Plan Experience and Client References

St. Lucie County VA, St. Lucie County Environmental Resource Department, FL

Tetra Tech teamed with ELDPA and Clearview to prepare the St. Lucie County VA as a product of Resilience Planning Grant R2133. The VA addresses (1) flood related impacts under various sea level rise scenarios and tidal flooding, (2) critical buildings and infrastructure, (3) natural resources, and (4) at-risk populations. The analysis forms the foundation of an evidence-based, strategic resilience plan that systematically prioritizes and develops adaptive strategies to address areas of vulnerability. Development of the key findings and data analysis for the VA was led by ELDPA and Clearview Geographic. Based on the project's results, the County and its partners will integrate resilience and adaptive strategies into their respective planning documents within the various disciplines and agencies of their governments.

Reference

Sandra Bogan, Resilience Navigator
Environmental Resources Dept
772.785.5835
Bogans@stlucieco.org
Contract Value: \$75,000
Date: 2019 – 2021

Highlights/Services:

- Stakeholder engagement
- Data gap analysis
- 2040, 2070, and 2100 planning horizons

Hillsborough County Resiliency Plan, Hillsborough County, FL

Tetra Tech supported the development of a resiliency plan for the County's new Office of Innovation and Resiliency through a cooperative process that included internal and external stakeholders. The resiliency plan provides an organizational roadmap to build interagency cooperation within the county and to enable a synergistic approach to addressing climate change. Tetra Tech developed this plan to provide a sustainable framework to support an effective and innovative Office of Innovation and Resiliency. The plan identifies the shocks and stressors impacting the county, its population, infrastructure, and economy and presents an organizational structure to guide

Reference

Barton T. Weiss, Chief Officer, Innovation and Resiliency
WeissT@HillsboroughCounty.org
Contract Value: \$83,000
Date: 2019 – 2020

Number FTEs: 3

Highlights/Services:

- Resilience planning
- Interagency cooperation
- Prioritize projects

leadership in implementing focused programs, actions, and administration and implementation of resilience strategies and projects. The plan provides a framework to enable the office to coordinate priorities and clearly communicate the similarities and important differences between sustainability and resiliency, including roles and responsibilities.

Village of Key Biscayne Flood Mapping, FL

Tetra Tech developed a Coastal Hazard Analysis Modeling Program (CHAMP v2.0) using the Flood Insurance Study transect data for three flood sources and the 100-year and 500-year flood magnitude events for a total of six scenarios. The results from the model were used to develop high-resolution inundation maps of the Village for the six scenarios using LiDAR and DEM data. The maps allowed homeowners and developers to quickly determine the expected inundation depth for properties throughout the Village. The results were also used to delineate Coastal A zone from the Atlantic Ocean side.

Reference

Sergio Ascunce, CFM, Director of Building, Planning, and Zoning, 305.365.5512

Contract Value: \$12,000

Date: 2017

Highlights/Services:

- Coastal flood modeling
- CHAMP modeling

Brickell Bay Drive Improvements for Sea Level Rise, City of Miami, FL

Tetra Tech is working with the City of Miami to provide interdisciplinary services. The urban, engineering, and architectural design alternatives designed for the project will have inherent environmental consequences. Therefore, factors relating to tidal and storm surge, drainage, ecosystem of Biscayne Bay, transportation, cultural resources, urban design/visual aspects, open space and recreation, and topography are being considered. This project will serve as a demonstration project for protection from storm surge and sea level rise while also providing waterfront connectivity, public open space, and natural ecosystems for a long-term and resilient public asset. While climate change and sea level rise are long-term issues, the area faces the threat of a hurricane every year potentially bringing destructive wind and rain and storm surge. This project will help to face both immediate and long-term challenges.

Reference

Jose Lago, PE, Project Manager

City of Miami, 305.416.1252

jlago@miamigov.com

Contract Value: \$946,000

Date: 2021 – Present

Highlights/Services:

- Demonstration project for protection from storm surge and sea level rise
- Designed resilient infrastructure using a holistic approach

Martin County Resilience and Watershed Management Plan

ELDPA and Clearview have been working with Martin County since 2018 on various climate and resiliency issues, including grants, VA development, and outreach. ELDPA has secured three planning grants for the County (more are pending) and supported the County with modeling initiatives to secure another five capital planning grants through the Resilient Florida program. Work products were completed pursuant to an initial Resilient Planning Grant and a subsequent one to develop the County's Resilient and Watershed Management Plan document served as a basis for the creation of the Sea Level Rise Report.

ELDPA and Clearview collected all data, developed an extensive GIS mapping dataset and metadata files provided to FDEP in compliance with all grant requirements. As the County's efforts converged with the creation of the Resilient Florida program, the County's work to date places them far ahead of the curve having already completed numerous analyses to finalize a comprehensive VA consistent with new state criteria.

Reference

Jessica Garland, Martin County, Board of County Commissioners, 772.288.5429

Contract Value: \$200,000

Date: 2021

Highlights:

- Sea level rise analysis
- County wide resilience planning
- Public outreach

Martin County Vulnerability Assessment and Resiliency Plan

As part of Resilient Martin, The Balmoral Group estimated the business impacts of climate change - wages and revenues at risk of losses due to inundation – and how to mitigate economic harm from future hazards. Analysis of water depths, business locations and wage and employment data were used to develop planning

recommendations. The Balmoral Group participated in significant public outreach and stakeholder engagement with Erin Deady Law to ensure that plans and recommendations were fully vetted and easily understood by policymakers and the public.

Vulnerability Assessment, Monroe County, FL

ELDPA has led the County's resilience planning efforts since 2013 and developed the Resilience Planning Grant R2111 awarded to Monroe County to update its original VA conducted in 2015. For this 2020-2021 work, ELDPA led the team, which also included Clearview, performing habitat analysis (one of the only VAs to perform that analysis to date). Using a baseline GIS database containing building elevation certificates, planning-grade sea level adjusted floodplains, and local sea-level-rise tide projections, the team identified multiple climate-driven vulnerabilities and provided visualizations of potentially flooded infrastructure in 2040, 2070, and 2100. To help communicate the severity of sea level risk inundation, the team created a fly-over-style animation of the southern portions of unincorporated Monroe County, Florida. The team conducted the GIS analysis to identify potential vulnerabilities with consideration of natural areas, assets, and infrastructure, as well as the social fabric of the community. Modeling change in habitat and mangrove encroachment, the team identified habitats that are especially vulnerable to rising sea levels. These data served as a foundational component for identifying the county's adaptation action areas.

Reference

Rhonda Haag, 305.453.8774
Haag-Rhonda@monroecounty-fl.gov

Contract Value: \$1.8M

Date: 2021

Highlights/Services:

- Sea level rise analysis
- Legal risk analysis
- Grant funding

Roadway Vulnerability Assessment and Capital Plan, Monroe County, FL

As a subcontractor, ELDPA's role on the Roadway VA was to develop legal and policy strategy related to level of service determinations, identify potential special assessment methodologies, and advise the project team and county attorney's office on potential legal liability issues related to tort and takings actions against the county related to the outcomes of the prioritization of road and stormwater projects. ELDPA conducted significant legal analysis for the project, unique within Florida, which shaped the transparency and communications with the public about the project as well as the final methodology to prioritize the projects. ELDPA also secured two grants to implement projects to date and submitted grant applications for 15 more roads elevation projects in 2022.

Reference

Rhonda Haag, 305.453.8774
Haag-Rhonda@monroecounty-fl.gov

Contract Value: \$92,000

Date: 2021

Highlights:

- Sea level rise analysis
- County-wide resilience planning
- Public outreach

City of Pensacola Vulnerability Assessment, FL

ELDPA and Clearview prepared the VA for the City of Pensacola through Resilience Planning Grant R2116. The VA presents an updated analysis of the City of Pensacola's vulnerabilities, with a particular focus on ecological and social vulnerabilities to guide future planning efforts. The project team developed stormwater project recommendations for the city, both to guide adaptation measures based on the VA and to improve the quality of future assessments. Clearview developed several map books and corresponding GIS data detailing the NOAA sea level rise projections. Using a 2040, 2070, and 2100 planning horizon and the NOAA Intermediate High and Intermediate Low flood projections in an analytical model that assigned a ranked priority based on timeline to impact and estimated water depth for the critical assets, areas, and infrastructure. Additionally, Clearview identified Priority Planning Areas and a stormwater project priorities list for retrofitting outfalls with tide valves.

Reference

Cynthia Cannon, AICP, 850.435.1670
ccannon@cityofpensacola.com

Contract Value: \$85,000

Date: 2021

Highlights/Services:

- Sea level rise analysis
- Grant funding

Briny Breezes Community Adaptation Plan

Brizaga and team member ELDPA led the development of a first-of-its-kind community-wide adaptation plan, with a focus on flooding and the impacts of climate change, including sea level rise, for the Town of Briny Breezes. The team performed a VA for at-risk assets and produced a comprehensive community adaptation plan proposing actions to adapt the community over time. The analysis was conducted utilizing Brizaga's Adaptation Prioritization Exercise, or APEx, which includes impacts and threats that may occur to infrastructure and the community. In May 2021, Brizaga delivered a detailed adaptation plan that embodies the unique needs of Briny Breezes and proposed innovative solutions to alleviate the effects of flooding and sea level rise. In addition, ELDPA continues work on code revisions that will allow more resilient redevelopment options within the Town as well as previously completing the Town's Peril of Flood Comprehensive Plan amendments which have been adopted.

Reference

Michael Gallacher, General Manager
561.767.0115, brinybreezesgm@gmail.com

Contract Value: \$29,780

Date: 2020 – 2021

Highlights/Services:

- Assess and identify top risk factors and vulnerabilities to create a prioritized list of at-risk assets with input from stakeholders.
- Devise a roadmap for adaptation.

Hallandale Beach Sea Level Rise and Critical Infrastructure Analysis, Hallandale Beach, FL

Stantec conducted a Vulnerability Assessment and Adaptation Plan for the City of Hallandale Beach. The goal was to assist the City in pro-actively identifying the effects of sea-level rise on their community with the understanding that the adverse impacts of sea-level rise pose economic, social, environmental, and public health and safety challenges to the City. Our Vulnerability Assessment considered the City's "at-risk" critical assets and infrastructure, including stormwater infrastructure as well as public works and public utility infrastructure, consistent with the intent of Florida Statutes 380.093. The Vulnerability Assessment focused on stormwater infrastructure; evaluating stormwater infrastructure components in multiple sea-level rise scenarios. An Adaptation Plan was developed, which considered the output of the work completed in the initial assessment. Included in the Adaptation Plan were outlines of Geographic Information System (GIS) and engineering methodologies utilized throughout the project, including digital elevation modeling, GPS field verification, geodatabase development, the creation of raster mosaics and proposed engineered solutions. The Adaptation Plan provided recommendations for capital improvement projects to address several sea-level rise scenarios. Additionally, the Adaptation Plan provided strategies and potential modifications to future zoning and development codes to strengthen existing and future infrastructure from the effects of sea-level rise.

Reference

Ryan Thomas, Emergency Manager
604.485.2260

Contract Value: \$60,000

Date: 2017 – 2018

Highlights/Services:

- Assessment of storm surge, sea level rise, and coastal erosion
- Numerical modeling of storm surge

Angela Street Reconstruction, Key West, FL

Stantec was asked to provide surveying, design, and permitting assistance services for the conversion of this dead-end, minimal access road into a one-way exit to the Truman Waterfront. The road served as an access point to several residences and an old utility building. The conversion to an exit from the Truman Waterfront parking lot will greatly assist with traffic flow and access in the area and enhance an underutilized portion of road. A new sidewalk on the north side along with new ADA ramps will greatly assist with safe pedestrian travel through the corridor. Existing trees were avoided as much as possible to preserve the existing tree canopy.

Reference

Gary Volenec, 305.809.3967
Gvolenec@Cityofkeywest-FL.Gov

Date: 2016 – 2017

Highlights/Services:

- Surveying
- Design
- Permitting

Vulnerability Assessment of the Indian River Lagoon

The Balmoral Group completed this assessment for the IRL Council, coordinating with representatives of five counties (Volusia, Brevard, Indian River, St Lucie and Martin). Staff assessed the impacts of climate change on the IRL National Estuary Program's Comprehensive Conservation and Management Plan (CCMP). Each risk was ranked and prioritized based upon: (1) magnitude of consequence, (2) likelihood, (3) spatial scale, and (4) time horizon. Results were developed through stakeholder input in a variety of formats including personal interviews, meetings, and real-time polling.

Nassau County Vulnerability Assessment

The Balmoral Group completed an FDEP-funded VA for this coastal North Florida county. The Balmoral Group prepared GIS maps and technical report outlining current demographics, vulnerable populations and neighborhoods (low- and moderate-income), attributes of existing infrastructure, planned development change, and related variables to identify potential conflicts with future vulnerability to coastal changes and comprehensive land use plans. Staff prepared exhibits for public meetings and led public discussion at multiple workshops and County Commission meeting.

Maui Beach Park VA, County of Maui Department of Parks and Recreation, HI

Tetra Tech conducted a VA of Maui's beach parks. The purpose was to conduct a detailed analysis of the vulnerability of the county's beach parks and develop recommendations to address short- and long-term impacts of coastal hazards, climate change, and other threats. A compendium of adaptation strategies was prepared to guide planning and capital improvement programs. An interactive GIS database was developed to help county staff access and use the results of the assessment for decision-making.

Statewide Guidance for Integrating Resilience to Coastal Hazards and Sea Level Rise in County Planning Frameworks and for Disaster Recovery Preparedness, HI

Tetra Tech is currently developing statewide guidance for integrating resilience to coastal hazards and sea level rise in state, county, and community plans funded by a NOAA Regional Coastal Resilience Grant administered through the Hawaii Sea Grant College Program in partnership with the Hawaii State Office of Planning and Department of Land and Natural Resources. Tetra Tech is leading two of the three subprojects under this grant: (1) develop *Guidance for Integrating Coastal Hazards and Sea Level Rise into County Planning Frameworks* (SLR Planning Guidance) and (2) develop *Guidance for Disaster Recovery Preparedness* (DRP Guidance). Tetra Tech is also major contributor of data layers on the impacts of sea level rise to the third subproject, the Hawaii Sea Level Rise Viewer. The SLR Planning Guidance is being developed to support transformative land use and development to address coastal hazards with sea level rise, focusing on long range planning at county and community levels.

Coastal Hazard Risk Assessment Powell River Regional District (PRRD), British Columbia

Tetra Tech supported the PRRD in securing the funding for this study. The study characterizes coastal hazards (storm surge, sea level rise, and coastal erosion) and quantifies consequences and risk. It included extensive data gathering and reviewing about historical events, climate, population, and infrastructure at risk; numerical modeling of storm surges; assessment of shoreline erosion potential; review of a previous tsunamis study; and assessment of consequences in a GIS-based risk model. The study provides risk levels along the shorelines, prioritizes areas that require more detailed assessment, and outlines steps to address identified risks and uncertainties.