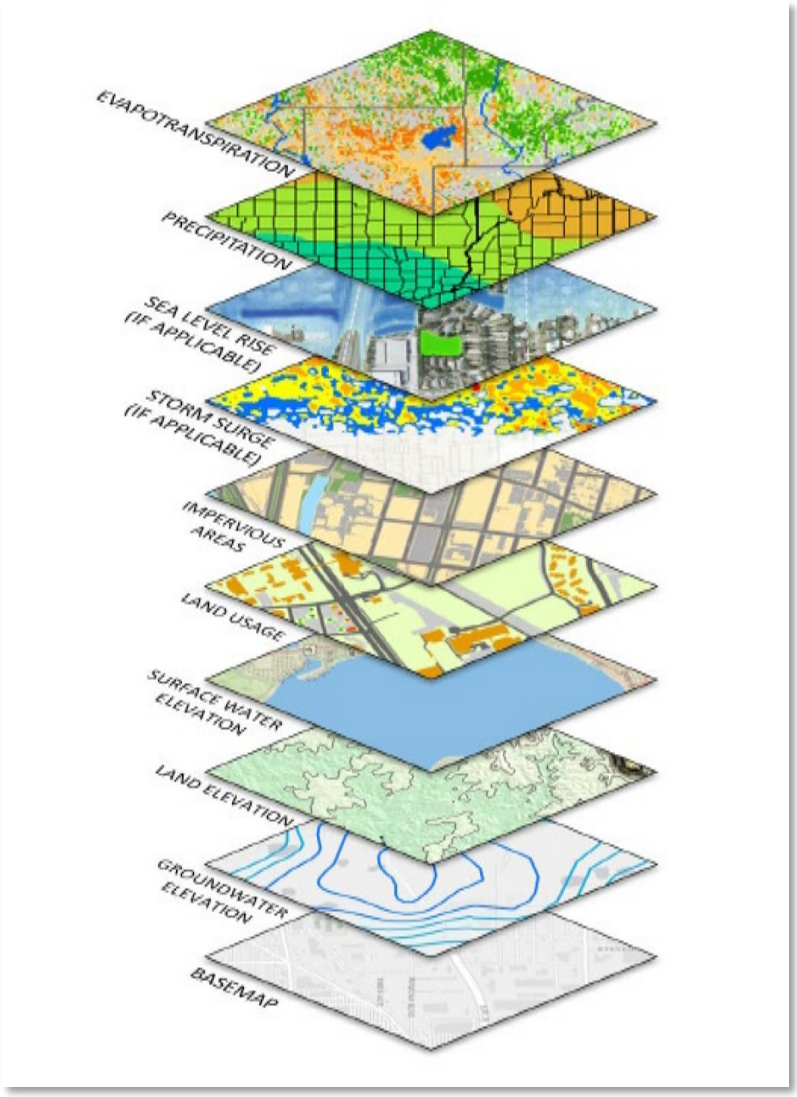
Standardized Vulnerability Assessment: Scope of Work Guidance



Example Input Data Schematic for Flood Simulation Models (Esri, 2020; FDEP, 2017; HPRCC, 2022; Jean-Paul Rodrigue, 2015; NOAA, 2022; NOAA, 2018; USGS 2021; USGS, 2018)

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Introduction

1. Purpose

This document is provided to ensure state-funded Vulnerability Assessments (VAs) are standardized to meet the requirements of the statute, s. 380.093, F.S., and to maximize funding for the Florida Department of Environmental Protection's (the Department) Resilient Florida Program grant awardees. The standardized scope of work guidance (the "guidance") is designed to assist local governments, both coastal and noncoastal, in developing the project, project cost estimates, and assist communicating requirements to consultants, when applicable, in the preparation of a statutorily compliant VA. Additionally, a minimum standard for locally performed VAs are necessary to provide a common framework for the development of a statewide assessment. This guidance will refer to the "project team" which represents either the local government and/or any contracted third parties including consultants, project managers, GIS professionals, engineers, hydrologists, etc. This guidance includes, but may not be limited to, minimum tasks, required data, standards, scenarios, methodologies, and example deliverables of a VA. Example deliverables that illustrate best practices excerpted from previous state-funded VAs are included throughout.

2. Application

The guidance is organized with **recommended** and **required** minimum required tasks which include statutorily required data, standards, elements, methodologies for VAs in coastal and noncoastal communities. The guidance also includes example deliverables for each task. The **recommended** tasks are meant to serve as best practices and reinforce concepts from the Florida Adaptation Planning Guidebook to include in the scope of work which can be tailored to meet the needs of each community. Local governments are encouraged to add more location specific detail, as well as standard formats, specifications, and legal requirements required by their organization. Appendix A provides generalized cost estimates for each task based on previously conducted VAs around the state. The purpose of the generalized costs is to provide a framework for estimating the overall cost of preparing a vulnerability assessment depending upon selected tasks and deliverables. These generalized estimates can be used when determining appropriate funding sources and fiscal resources necessary to complete the VA. Appendix B contains notes from focus groups held on conducting noncoastal assessments. Appendix C contains the Department's GIS Standards. Appendix D and E relate to the Vulnerability Assessment Checklist and contain Exhibit I which will be included in all grant agreements and the checklist to be submitted to the Department at the conclusion of the assessment.

Standard Scope of Work Tasks

1. Kick off meeting (recommended)

After a notice-to-proceed is issued, the project team should meet to develop an overall project management plan and to address initial actions. Meeting attendees should discuss the project scope, project goals, schedule, key milestones, and deliverables - to develop a consistent project approach. The kick-off meeting should be hosted by the local government and should identify potential representatives to serve on the project steering committee. Prior to the meeting, the project team should prepare the sign-in sheet, draft project schedule and other meeting materials as necessary.

The project team should prepare a draft list of representatives to serve on the project Steering Committee based on discussions with the local government. It is recommended that the Committee be limited to no more than 10 representatives to better manage meeting outcomes.

Recommended representatives for the Steering Committee are (NOAA, 2021):

- Public Safety – emergency planning officials, hazard mitigation planners, state, and/or local floodplain manager
- Transportation – local transit authorities, highway planning and maintenance officials, metropolitan planning organization, ports authority
- Utilities – public and private utilities
- Building and Housing – building regulation and inspection officials, public housing authorities, local developers/builders associations, local realtors associations, local engineering/architects associations
- Community and Economic Development – local community development and economic development officials, nonprofit community development organizations, chamber of commerce, major business interests
- Education – local colleges and universities, school district officials, nonprofit education and advocacy organizations, extension agents
- Environment – environmental planning and management officials, coastal planning and management officials, sustainability planning officials, land conservation organizations, nonprofit organizations
- Planning – local and regional planning officials, zoning and codes, nonprofit planning organizations, land development
- Parks and Recreation and Cultural Resources – local recreation and cultural resource officials, nonprofit recreation groups and organizations, cultural resource groups
- Human and Social Services – health care and mental health organizations, social service providers, elderly and child advocacy organizations, neighborhood and community associations, religious and charitable organizations
- Local Elected Officials
- Community Leaders or Champions – Cultural groups with diverse and socio-economic backgrounds
- Researchers and Scientists – State science officer, local weather forecast office, climate researchers
- State and Federal Governments, NGOs – Sea Grant Agent, State Coastal Management Program, National Association of Counties Representative (NACo), National Estuarine Research Reserves (NERR), National Fish and Wildlife Federation (NFWF), U.S. Geological Survey (USGS), Environmental Protection Agency, U.S. Army Corps of Engineers (USACE),

University of Florida's Institute of Food and Agricultural Sciences (UF/IFAS) representative, state agencies, water management district representative

Example Deliverables: Draft list of Steering Committee members for consideration by the local government/project team. Minutes prepared by the project team, for review and approval by the local government, which documents all decisions and agreed upon outcomes of the meeting. The project team should prepare a draft email detailing the project purpose, goals, schedule, project meeting dates and locations, and overall desired outcomes to potential steering committee members, requesting their participation on the committee.

2. Assemble steering committee, and conduct public outreach (recommended)

2.1. Assemble steering committee

After reviewing and approving the steering committee list, the project team should distribute the draft email prepared in Task 1 requesting steering committee participation and confirmation of the potential committee member's acceptance or denial.

Example Deliverables: A list of local representatives that have confirmed participation on the steering committee for final approval by the local government.

2.2. Conduct Steering Committee Meetings

The project team should coordinate with the local government in determining the number, dates, times, and locations for the steering committee meetings, based on critical decision points in the project process. The goal of the steering committee meetings is to assist in reviewing the goals of the project, review draft materials, provide input for study direction, assist in identifying geographic context, appropriate modeling methodologies, assist in identifying available data and resources, identify relevant assets, and review project findings and recommendations. A minimum of 2 steering committee meetings is recommended, at the beginning and end of the project, however, more may be necessary to provide guidance at critical decision points throughout the project process. Additional guidelines and recommendations for stakeholders to include can be found in Chapter 1 of the Florida Adaptation Planning Guidebook.

Example Deliverables: Meeting agendas indicating location, date, and time of meeting; sign-in sheets specifying attendees; presentation(s) from the meeting; summary report of committee recommendations and guidance including attendee input, meeting outcomes, methodologies selected, appropriate resources and data, relevant assets and review study deliverables for accuracy and applicability.

Table 1 Example of a Deliverable Listing Steering Committee Members, Affiliation, and Meeting Participation, Orange County (Amec Foster Wheeler, 2017)

Member Name	Affiliation	Meeting Date					
		10/24/16	11/30/16	1/19/17	3/23/17	8/7/17	12/18/17
Jason Taylor	Orange County	✓	✓	✓			
Luis Martinez	Orange County					✓	
Daniel Negron	Orange County	✓	✓	✓	✓	✓	
Amy Bradbury	Orange County	✓	✓	✓	✓	✓	
Gregory Golgowski	Orange County						
Nadia Vanderhoof	Orange County						
Kelsie Davis	Red Cross	✓	✓	✓			
Bill Graf	SFWMD	✓	✓		✓		
Michelle Cechowski	ECFRPC	✓					

2.3. Public Outreach Meeting #1

The project team should, in coordination with the local government when applicable, conduct at a minimum, two public outreach meetings during the course of the project. The purpose of this initial meeting is to allow the public to provide input during the initial data collection stages, preferred methodologies, and data for analyzing potential sea level rise impacts and/or flooding, guiding factors to consider, and critical assets important to the community. The project team should be responsible for preparing all social media notifications, meeting invitations, meeting materials, presentations, and graphics utilized during the meeting, based on prior approval from the local government when necessary.

Public outreach should be conducted during the data collection stages of the project. Stakeholder groups (from the list above) not included in the steering committee should be invited to attend public outreach meetings. Including public outreach early in the project can influence critical asset inventories, particularly when it comes to determining the community's cultural assets. It is recommended that a video or audio recording of public outreach meeting(s) be uploaded on a publicly accessible webpage to allow citizens to be involved who could not attend.

Additional guidelines and recommendations can be found in, s. 380.093, F.S., and Chapters 1 and 2 of the Florida Adaptation Planning Guidebook.

Example Deliverables: Meeting agenda indicating location, date, and time of meeting; sign-in sheets identifying the number of citizens, steering committee attendees, and county/municipality staff attendees; presentation(s) from the meeting; video or audio recording from the meeting posted to public webpage, if available; summary report including attendee input and meeting outcomes. Copies of any social media posts, announcements, presentations, and graphics utilized during the conduct of the meetings should be provided.

3. Acquire Background Data (required)

The project team, in coordination with the local government when applicable, should research and compile the data needed to perform the VA, based on the requirements as defined in s. 380.093, F.S. Three main categories of data are required to perform a VA:

1. Critical/regionally significant assets
2. Topographic data
3. Flood scenario-related data

Examples of required data and data sources for the development of a VA in each of the three categories listed include:

3.1. Critical/Regionally Significant Assets Inventory

The inventory should include:

Transportation assets and evacuation routes, including airports, bridges, bus terminals, ports, major roadways, marinas, rail facilities, and railroad bridges.

Critical infrastructure, including wastewater treatment facilities and lift stations, stormwater treatment facilities and pump stations, drinking water facilities, solid and hazardous waste facilities, military installations, communications facilities, and disaster debris management sites.

Critical community and emergency facilities, including schools, colleges, universities, community centers, correctional facilities, disaster recovery centers, emergency medical service facilities, emergency operation centers, fire stations, health care facilities, hospitals, law enforcement facilities, local government facilities, logistical staging areas, affordable public housing, risk shelter inventory, and state government facilities.

Natural, cultural, and historical resources, including conservation lands, parks, shorelines, surface waters, wetlands, and historical and cultural assets.

Potential Data Sources include but are not limited to:

- Property/parcel geo-referenced data (public, historic, natural resources, land use) – sourced from Florida Geospatial Open Data, local water management districts – Florida Land Use, Cover, and Forms Classification System (FLUCCS), Florida Master Site File – Division of Historical Resources, locally sourced county and municipality data.
- Critical Facilities – sourced from Florida Division of Emergency Management (FDEM) Critical Facilities Inventory, USGS Geographic Names Information System, FEMA/Dept. of Homeland Security, locally sourced county and municipality data
- Flood Elevation Certificates – sourced from FDEM Elevation Certificates, locally sourced county and municipality data
- Roadway/Transportation Network data – sourced from USGS The National Map transportation layer, U.S. Department of Homeland Security Homeland Infrastructure

Foundation-Level Data, OpenStreetMap, Florida Department of Transportation (FDOT) Open Data Hub, NavTeq/HERE roads database.

- Building Footprints – sourced from Microsoft/Esri, Google, locally sourced county and municipality property appraiser data.

3.2. Topographic Data

- Survey data – sourced from FDEM Florida Elevation Certificates, locally sourced county and municipality data of Finished First Floor Elevations (FFEs) and roadway crests for selected critical assets

- LiDAR, Digital Elevation Model (DEM) data – sourced from National Oceanic and Atmospheric Administration's (NOAA) National Centers for Environmental Information (NCEI) DEM, U.S. Interagency Elevation Inventory, USGS National Elevation Dataset, Florida Geospatial Open Data, local water management district GIS hubs, locally sourced county and municipality data

    - DEM used for state-funded vulnerability assessments should be 3-meter cell size at a minimum.

3.3. Flood Scenario-Related Data

As applicable, the following flooding scenario-related data should be included.

- Precipitation data – currently sourced from NOAA Atlas 14, local water management district, USGS, Florida Flood Hub (when available). The USGS is developing a change factor that would be applied to NOAA Atlas 14 rainfall distribution curves to account for future climate variability in South and Central Florida. The USGS Geo Data Portal and National Hydrologic Model (NHM) Infrastructure are valuable sources for climate data (USGS, 2022; USGS, 2020). The Hydrologic & Hydraulic (H&H) modeling team should account for any uncertainties associated with the future climate data projections used in the study. Precipitation projection data should include the 100-year, 24-hour rainfall event at a minimum.

- Groundwater level data – groundwater flooding can be prevalent in low elevation karst areas and coastal communities where sea-level rise (SLR) has raised the groundwater level in the topmost aquifer. Groundwater levels determine aquifer storage capacity and can also significantly influence soil infiltration rates under shallow water table conditions. Therefore, groundwater levels throughout the study area should be known, especially in areas where shallow water table conditions exist. The groundwater level data could be sourced from the Department. Generalized Well Information System (GWIS), one of the five Water Management District, potentiometric surface maps developed by the USGS (FDEP, 2016).

- Sea level rise (SLR) projections – sourced from NOAA's most recent intermediate-high and intermediate-low SLR projections for 2040 and 2070 at a minimum, and optionally, other projections available from NOAA Digital Coast website, Florida Flood Hub.

- Tidal datums and tidal flooding – sourced from NOAA Tides and Currents website, NOAA Digital Coast SLR viewer, Florida Flood Hub.

- Storm surge – sourced from Federal Emergency Management Agency (FEMA) flood depth grids and water surface elevation grids (which are non-regulatory products provided to local municipalities), National Hurricane Center's Sea, Lake, and Overland Surges from Hurricanes (SLOSH) model, USACE Coastal Hazards System South Atlantic Coastal Study (SACS).

  Hydro stratigraphic Information (if applicable, with justification) – geology exerts significant control over the hydrologic response of a study area because of its control over the water table location. Across most of Florida, the Intermediate Aquifer System provides varying degrees of confinement to the underlying Floridan Aquifer System and controls the depth to the water table in the topmost aquifer. Each Water Management District maintains data related to the hydro stratigraphic units within its jurisdiction.

- River channel cross-section (if applicable) – accurate data on river or stream cross sections, top of bank elevation, overbanks, and seasonal high-water stages are important in areas with major rivers and streams. Channel cross-section data should be collected at a resolution to define the conveyance volume available at the channel accurately.

- Land use data – how the municipalities manage their land would lead to future land use changes resulting in increased or decreased flooding. Therefore, studies should account for potential future land use changes and, most importantly, the spatial extent of total impervious area (TIA) and directly connected impervious area (DCIA). The UF GeoPlan Center has collaborated with the FDOT to produce future land cover data for the entire state, which is updated annually as more data become available from various municipalities. Florida 2060 and Florida 2070 projects produced alternative land use scenarios based on varying degrees of potential urban area development in the state (UF GeoPlan Center, 2022). Land use data are also maintained by the local water management districts, counties, and municipalities. Recently Southwest Florida Water Management District has started acquiring GIS shapefile defining the extent of the impervious areas alongside their LiDAR data. Municipalities should reach out to their respective water management district to see if similar impervious area extent data exists for their study area.

- Evapotranspiration data – evapotranspiration (ET) losses constitute the second largest term in the water budget equation of any watershed in Florida. ET losses significantly influence flood peaks due to its control over antecedent soil moisture content preceding any rain event. Grid-based ET data for the entire state can be obtained from the USGS.

An example schematic of flood scenario-related input data used for flood simulation models is shown in the figure below.

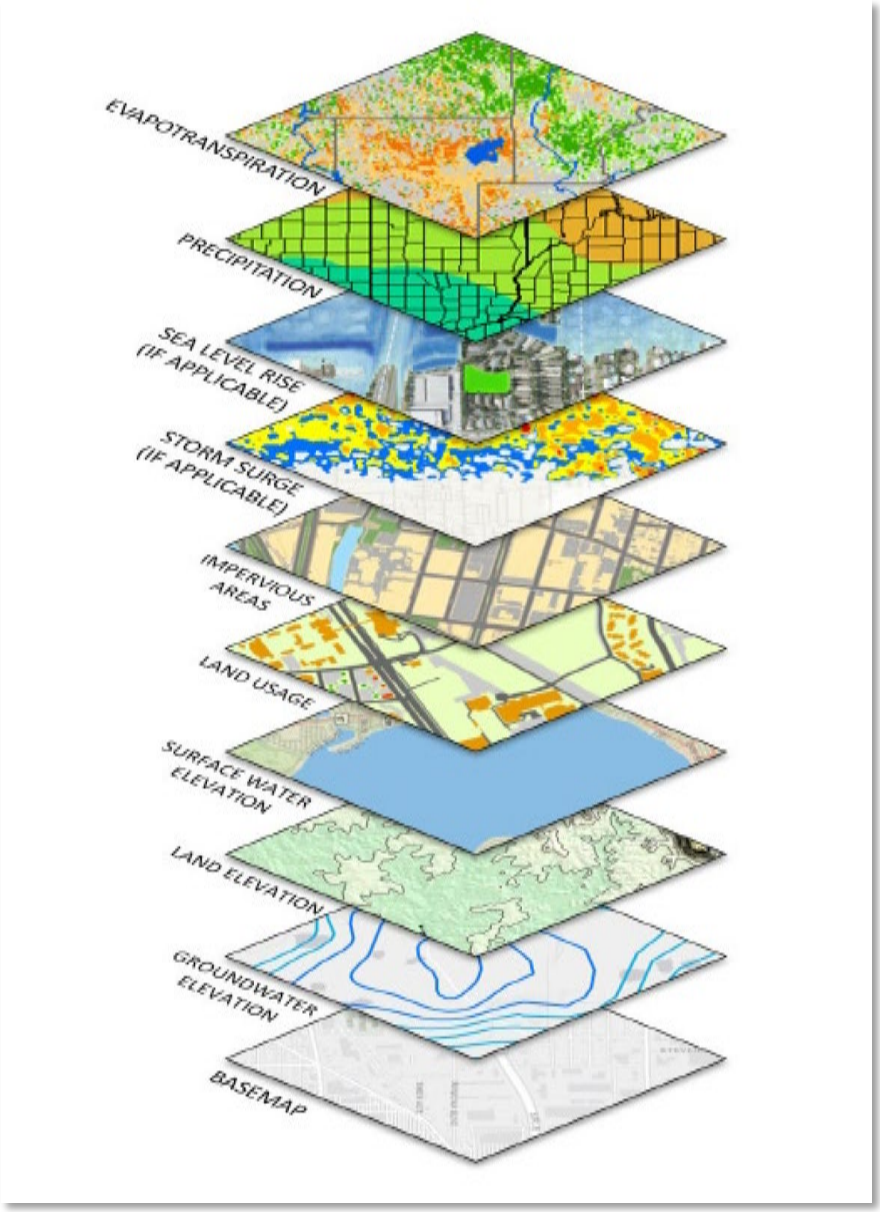


Figure 1 Example Input Data Schematic for Flood Simulation Models (Esri, 2020; FDEP, 2017; HPRCC, 2022; Jean-Paul Rodrigue, 2015; NOAA, 2022; NOAA, 2018; USGS 2021; USGS, 2018)

GIS metadata should incorporate a layer for each of the four asset types as defined in s. 380.093(2) 1-4, F.S.:

1. Transportation assets and evacuation routes
2. Critical infrastructure
3. Critical community and emergency facilities
4. Natural/cultural/historic assets

GIS files and associated metadata must adhere to the Department's GIS Data and Metadata Standards, and raw data sources should be defined within the associated metadata (see Appendix C).

Sea level rise projection data should include NOAA's most recent intermediate-high and intermediate-low projections for 2040, 2070 at a minimum. Other projections can be used at the community's discretion. Storm surge data used must be equal to or exceed the 100-year return period (1% annual chance) flood event.

In the process of researching background data, the consultant should identify data gaps, where missing data or low-quality information may limit the Vulnerability Assessment's extent or reduce the accuracy of the Vulnerability Assessment's results. The consultant should rectify any gaps of necessary data if funding is available.

Example Deliverables: A technical report should be prepared outlining the data compiled and findings of the gap analysis; a summary of recommendations to address the identified data gaps and actions taken to rectify them, if applicable; GIS files with appropriate metadata of the data compiled, to include locations of critical assets owned or maintained by the county/municipality and regionally significant assets, classified as defined in s. 380.093(2) 1-4, F.S.:

Table 2 Example of a Deliverable Summarizing Asset Data from FDEP Grant #R2132, City of North Miami (NEMAC+Fernleaf, Brizaga, Inc., & Collective Water Resources, LLC, 2021)

Asset Theme	Dataset	Source	Data Type
Commercial Properties	Miami-Dade County Parcels	Miami-Dade County GIS Hub	Polygons (GIS)
	Esri Business Locations	Esri Business Analyst program	Points (GIS)
Critical Facilities and Government-owned Properties	Miami-Dade County Parcels	Miami-Dade County GIS Hub	Polygons (GIS)
	City Facilities	City of North Miami	List of Addresses
	State HAZUS Essential Facilities Inventory	FL Department of Emergency Management	Database

Table 3 Example of a Deliverable Summarizing Precipitation Projections from FDEP Grant #R1910, City of Naples (Molloy, 2020)

	Baseline	RCP 4.5 (mid-century stabilization)			RCP 8.5 (rapid economic growth "business as usual")		
		2030	2060	2100	2030	2060	2100
Average Total Annual Precipitation (inches)	49.1	+0.2	+0.7	-0.9	+0.8	+0.5	-4.5
1-year, 24-hour Storm (inches)	4.0	+0.0	+0.0	+0.0	+0.0	+0.1	+0.0
10-year 24-hour Storm (inches)	7.0	-0.1	+0.1	+0.5	+0.3	+0.4	+0.2
100-year 24-hour Storm (inches)	11.0	+0.1	+0.7	+2.4	+1.0	+1.3	+1.6

4. Draft Vulnerability Assessment

4.1. Exposure Analysis (required)

The project team should perform an exposure analysis. The purpose of this task is to identify the depth of water caused by each sea level rise, storm surge, rainfall, and/or compound flood scenario.

Per Chapter 2 of the Florida Adaptation Planning Guidebook:

Exposure Analysis: Performed to identify the depth of water caused by various flooding and, if appropriate, sea-level rise.

As defined in s. 380.093, F.S., the water surface depths (i.e., flood scenarios) used to evaluate assets should include the following data:

- Tidal flooding, if applicable, including future high tide flooding, which must use thresholds published and provided by the Department. The analysis should also geographically display the number of tidal flood days expected for each scenario and planning horizon (as applicable/practicable).
- Current and future storm surge flooding, if applicable, using publicly available NOAA or FEMA storm surge data. The initial storm surge event used must equal or exceed the current 100-year flood event. Higher frequency storm events may be analyzed to understand the exposure of all critical assets.
- Rainfall-induced flooding using spatiotemporal analysis or existing hydrologic and hydraulic modeling results. Future boundary conditions should be modified to consider sea-level rise and high tide conditions (as applicable/practicable).
- Compound flooding or the combination of tidal, storm surge, and rainfall-induced flooding (as applicable/practicable).

As defined in s. 380.093, F.S., the following scenarios and standards should be used for the exposure analysis:

- All analyses performed in North American Vertical Datum of 1988 (NAVD88).
- If applicable, at least two local sea-level rise scenarios, including the 2017 NOAA Intermediate-Low and Intermediate-High sea-level rise projections.
- At least two planning horizons that include planning horizons for the years 2040 and 2070.
- If applicable, local sea level data that has been interpolated between the two closest NOAA tide gauges. Local sea level data may be taken from one such gauge if the gauge has higher mean sea level. Data taken from an alternate gauge may be used with appropriate rationale and Department approval if it is publicly available or submitted to the Department.
- Encompassing entire municipality/county and including all critical assets owned or maintained by the municipality/county.
- The exposure analysis should use the most recent publicly available DEM which meets the defined minimum standard of 3-meter cell size. The minimum standard modeling technique for the exposure analysis is the "Modified Bathtub Model," which identifies all

areas under a target elevation as potentially flooded with a hydrologic connectivity filter applied to remove isolated inundated areas not connected to a major waterway. A more detailed explanation of the Modified Bathtub approach is outlined in the 2017 NOAA publication *Detailed Method for Mapping Sea Level Rise Inundation* (NOAA, 2017).

Example Deliverables: The project team should provide a draft VA documenting the modeling process, type of models utilized and resulting tables and maps illustrating flood depths for each flood scenario; GIS files with results of exposure analysis for each flood scenario, with appropriate metadata identifying the methods used to create the flood layers. GIS files and associated metadata must adhere to Resilient Florida's GIS Data and Metadata Standards (see Appendix C).

Table 4 Example of a Deliverable Illustrating Flood Depths at Each Flood Scenario for Chosen Assets from FDEP Grant #R1927, City of St. Pete Beach
(Kimley Horn & Associates, 2020)

Exposure Level	City Lift Stations	City Buildings	City Roadways
	Flood Levels		
High	Exceeds station electrical controls	Exceeds Finished Floor Elevation	Greater than 6-inches above centerline of roadway
Medium	Less than 8-inches below station electrical controls	6-inches or less from Finished Floor Elevation	Up to 6-inches above centerline of roadway
Low	Above wet well top slab elevation	6-inches to 12-inches from Finished Floor Elevation	Above the shoulder of the roadway

City Buildings		Finished Floor Elevation (ft)	Flood Level Elevations (ft)								
Building Description	Address		100 Year/ 24 Hour	25 Year/ 24 Hour	2050 SLR (Intermediate)	2050 SLR (Intermediate) + 25 Year/24 Hour	2050 SLR (Extreme)	2050 SLR (Extreme) + 100 Year/24 Hour	Category 1 Hurricane	King Tide	King Tide 2050 SL (Intermedi
St. Pete Beach Public Library	375 73rd Ave	7.65	-	-	-	-	-	-	8.011	-	-
Don Vista Center	3300 Gulf Blvd.	5.57	-	-	-	-	-	-	8.015	-	-
Fire Department	1950 Pass A Grille	4.98	-	-	-	-	-	3.996	8.041	-	4.39
Fire Department Bay	1950 Pass A Grille	4.40	-	-	-	-	-	3.996	8.041	-	4.39
Community Center	1500 Pass A Grille	3.84	3.278	3.278	-	3.278	2.95	3.996	8.05	3.39	4.39
Paradise Grill	900 Gulf Way	7.74	2.261	2.042	-	-	2.95	3.99	8.02	-	-
Bathroom	9300 Blind Pass	4.70	3.608	3.607	-	3.61	-	4.005	8.023	-	4.39

4.2. Sensitivity Analysis (required)

The project team should perform the sensitivity analysis. The purpose of this analysis is to measure the impact of flooding on assets, applying the data from the exposure analysis to the inventory of critical assets created in the previous task. The analysis should include an evaluation of the impact of flood severity on each asset type at each flood scenario and assign a risk level based on percentages of land area inundated and number of critical assets affected. Additional guidelines and recommendations can be found in, s. 380.093, F.S., and Chapter 2 of the Florida Adaptation Planning Guidebook.

Example Deliverables: The project team should provide a draft VA report detailing the findings of the exposure analysis and the sensitivity analysis, including visual presentation of the data via maps and tables, based on the statutory scenarios and standards; an initial list of critical and regionally significant assets that are impacted by flooding, prioritized by area or immediate need, specifying for each asset which flood scenario(s) it was impacted by. Table 6 illustrates example results from a sensitivity analysis. Accompanying maps and tables should use the terminology and color coding from Table 6 to illustrate the extent of flooding. A statutory requirement of the VA is to provide a list of critical and regionally significant assets that are impacted by flooding and sea-level rise, specifying each asset and the associated flood scenario(s) impacting the asset.

Table 5 Example of a Deliverable Illustrating Risk Level Based on Percentages of Land Area Inundated and Number of Critical Assets Affected from FDEP Grant #R21ST1, Sarasota County
(Taylor Engineering, 2021)

Percentage of Barrier Island Inundated at each of the Coastal Flood Scenarios					
Sarasota County Gulf-Fronting Coastal Areas in Resilience Study	1.5 ft SLR	3.0 ft SLR	2% Annual Chance Flood	1.5 ft SLR + 2% Annual Chance	3.0 ft SLR + 2% Annual Chance
Town Of Longboat Key	3%	8%	72%	88%	96%
City of Sarasota (Lido Key)	11%	26%	66%	88%	97%
Siesta Key	6%	24%	86%	95%	98%
Casey Key	6%	14%	32%	51%	67%
City of Venice (Island)	0%	3%	10%	15%	23%
Manasota Key	11%	21%	60%	76%	87%

Sarasota County Areas in Resilience Study	Number of Critical Facilities Inundated at each of the Coastal Flood Scenarios						
		Total of Critical Facilities Evaluated	1.5 ft SLR	3.0 ft SLR	2% Annual Chance Flood	1.5 ft SLR + 2% Annual Chance	3.0 ft SLR + 2% Annual Chance
Town of Longboat Key	PUBLIC SAFETY (Law Enforcement, Fire)	1					1
	UTILITIES (Stormwater, Freshwater, Sanitary Sewer)	19		2	17	18	19
	HEALTH (Assisted Living Facilities, Hospital)	0					
	PUBLIC FACILITIES	0					
City of Sarasota (Lido Key)	PUBLIC SAFETY (Law Enforcement, Fire)	1		1	1	1	1
	UTILITIES (Stormwater, Freshwater, Sanitary Sewer)	8	1	3	8	8	8
	HEALTH (Assisted Living Facilities, Hospital)	2			2	2	2
	PUBLIC FACILITIES	0					
Siesta Key	PUBLIC SAFETY (Law Enforcement, Fire)	1			1	1	1
	UTILITIES (Stormwater, Freshwater, Sanitary Sewer)	58	1	14	53	57	58
	HEALTH (Assisted Living Facilities, Hospital)	0					
	PUBLIC FACILITIES	0					

Table 6 Flood Inundation Damage and Risk Assessment Percentages

Overall Risk Assessment	Land Area Inundated (% of census tract or neighborhood)	Critical Assets Affected (percentage of total assets or within each asset category)
None	0%	0%
Low	<25%	<25%
Medium	25 – 50%	25 – 50%
High	50 – 75%	50 – 75%
Extreme	>75%	>75%

4.3. Public Outreach Meeting #2 (recommended)

The project team, in coordination with the local government when applicable, should conduct a second public meeting to present the results from the exposure analysis, sensitivity analysis, and draft Vulnerability Assessment. The purpose of this meeting is to allow the public to provide community-specific input on the results of the analysis and to reconsider methodologies and assumptions used in the analysis for refinement. Additionally, during this meeting, the consultants should conduct exercises to encourage the public to prioritize focus areas of flooding, and the critical assets in preparation for the development of adaptation strategies and project development. Criteria should be established to guide the public's input for the selection of focus areas. The project team should be responsible for preparing all social media notifications, meeting invitations, meeting materials, presentations and graphics utilized during the meeting, based on prior approval from the local government when necessary. Additional guidelines and recommendations can be found in Chapter 1 and 2 of the Florida Adaptation Planning Guidebook.

Example Deliverables: The project team should provide meeting agenda indicating location, date, and time of meeting; sign-in sheets identifying the number of citizens, steering committee attendees, and county/municipality staff attendees; presentation(s) from the meeting; video or audio recording from the meeting posted to public webpage, if available; summary report including attendee input and meeting outcomes, to include defining focus areas recommended by the community. Copies of any social media posts, announcements, presentations, and graphics utilized during the conduct of the meetings should be provided.

4.4. Identify Focus Areas (recommended)

Based on the results of the second Public Workshop and input from the Steering Committee, the project team is encouraged to identify critical focus areas, following the guidelines in Chapter 2 of the Florida Adaptation Planning Guidebook. Based on the exposure and sensitivity analyses, a community may assign focus areas to locations or assets that are particularly vulnerable and require the development of adaptation strategies.

Example Deliverables: A report summarizing the areas identified as focus areas, with justification for choosing each area; tables listing each focus area with any critical assets that are contained inside the focus area; maps illustrating the location of each focus area compared to the location of all critical assets within the geographic extent of the study, and GIS files illustrating geographic boundaries of the identified focus areas.

5. Final Vulnerability Assessment

5.1. Report, Maps, and Tables (required)

Based upon input from the Steering Committee and Public Outreach efforts, as well as the local government, the project team should further develop, refine, and finalize the VA per the guidelines in s. 380.093, F.S., including identification of focus areas when applicable.

The final VA should include all results from the exposure and sensitivity analyses, as well as a summary of identified risks and assigned focus areas. It should contain a list of critical and regionally significant assets that are impacted by flooding and sea-level rise, specifying for each asset the flood scenario(s) impacting the asset. The project team should provide the VA Compliance Checklist (See Appendix E) In accordance with statute, the project team should submit at a minimum:

- A report detailing the findings of the assessment.
- All electronic mapping data used to illustrate flooding and sea level rise impacts identified in the assessment in a format suitable for input to the Department's mapping tool.
- GIS data that has been incorporated into the appropriate Florida State Plan Coordinate System and suitable for the Department's mapping tool.
- Metadata using standards prescribed by the Department.
- A list of critical assets, including regionally significant assets, that are impacted by flooding and sea level rise.

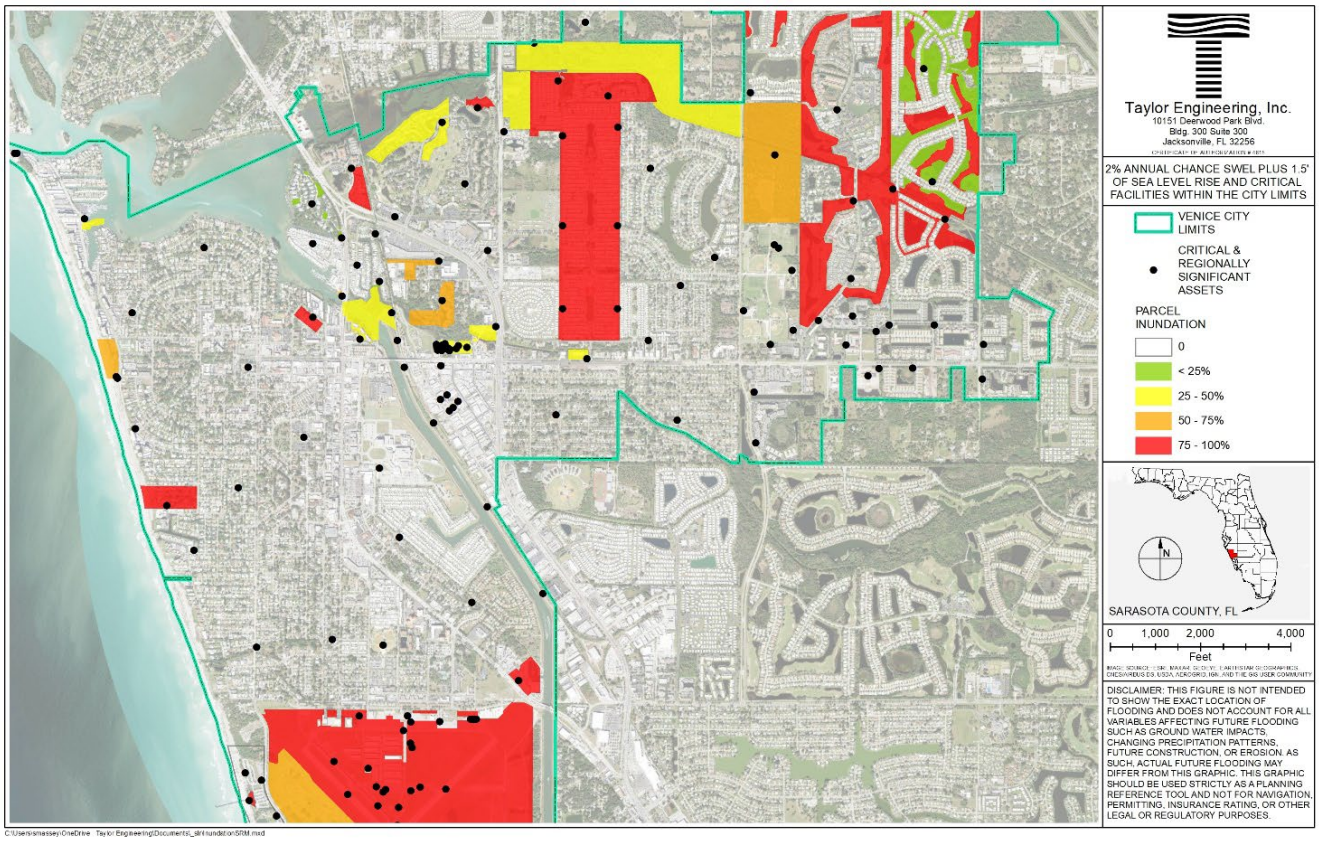
Example Deliverables: Final Vulnerability Assessment Report detailing the findings, including illustrations via maps and tables, based on the statutory scenarios and standards outlined in the Technical Standards Guidance; a final list of critical and regionally significant assets that are impacted by flooding, prioritized by area or immediate need, specifying for each asset which flood scenario(s) it was impacted by. An example table of the number of assets and parcels of land inundated by each flooding scenario and the associated risk level is shown in Table 7.

Table 7 Percentage of Critical Structures and Parcels Inundated by Each Flood Scenario

	Total Number of Assets Evaluated	1.5 ft SLR	3.0 ft SLR	2% Annual Chance Flood	1% Annual Chance Flood	1.5 ft SLR + 2% Annual Chance	1.5 ft SLR + 1% Annual Chance	3.0 ft SLR + 2% Annual Chance	3.0 ft SLR + 1% Annual Chance
Critical Structures	258	0%	2%	10%	15%	17%	23%	24%	31%
Parcel Inundation	149	1%	1%	4%	6%	6%	8%	8%	10%

An example map of parcel inundation and the associated risk level for the 2% annual chance plus 1.5 feet of sea level rise flooding scenario is shown in Figure 2.

Figure 1 Flood Inundation Damage and Risk Assessment Map for 2% Annual Chance SWEL + 1.5' of SLR



5.2. Public Presentation(s) (recommended)

The project team should present the final VA results to local governing boards, technical committees, or other appropriate officers or elected officials. The purpose of these presentations is to share the findings from the final VA and recommend actions for adaptation strategies and project funding. The presentation will also inform the public of the results and the future risk of sea level rise and increased flooding and encourage community participation when identifying mitigation strategies to address the flooding vulnerabilities. Chapter 2 and 3 of the Florida Adaptation Planning Guidebook. The project team should be responsible for preparing all social media notifications, meeting invitations, meeting materials, presentations and graphics utilized during the meeting, based on prior approval from the local government.

Example Deliverables: Meeting agenda indicating location, date, and time of meeting; sign-in sheets identifying the number of citizens, steering committee attendees, and county/municipality staff attendees; presentation(s) from the meeting; video or audio recording from the meeting posted to public webpage, if available; summary report including attendee input and meeting outcomes.

6. Peril of Flood Compliance (required if applicable)

Update the comprehensive plan coastal management element language to comply with the Peril of Flood requirements in s. 163.3178(2)(f), F.S.

Example Deliverables: Draft comprehensive plan coastal management element language in strike-through and underlined format that satisfies the Peril of Flood requirements in s. 163.3178(2)(f), F.S. The draft comprehensive plan will include the following:

1. Examples of strategies, principles, and related engineering solutions that reduce flood risk in coastal areas when resulting from high-tide events, storm surge, flash floods, stormwater runoff, and the related impacts of sea-level rise;
2. Use of best practices development and redevelopment principles, strategies, and engineering solutions that will result in the removal of coastal real property from flood zone designations established by the Federal Emergency Management Agency;
3. Site development techniques and best practices that may reduce losses due to flooding and claims made under flood insurance policies issued in this state;
4. A requirement that development or redevelopment within the coastal areas be consistent with, or more stringent than, the flood-resistant construction requirements in the Florida Building Code and applicable flood plain management regulations set forth in 44 C.F.R. Part 60;
5. A requirement that any construction activities seaward of the coastal construction control lines established pursuant to Section 161.053, Florida Statutes, be consistent with Chapter 161, Florida Statutes; and
6. Encouragement of local governments to participate in the National Flood Insurance Program Community Rating System administered by the Federal Emergency Management Agency to achieve flood insurance premium discounts for their residents.

Technical Guidance: Based on the analysis performed, draft comprehensive plan amendments must address the requirements of s. 163.3178(2)(f), F.S., Peril of Flood, if the county or municipality is subject to such requirements. The municipality will draft the comprehensive plan coastal management element language in strike-through and underlined format that satisfies the Peril of Flood requirements in s. 163.3178(2)(f), F.S. The Department's grant manager will provide the deliverable to the Department of Economic Opportunity (DEO) for preliminary review to ensure compliance with s. 163.3178(2)(f), F.S. DEO will have ten (10) working days to review and provide its comment(s) to the Department's Grant Manager. This review is to provide preliminary feedback only and does not constitute the state agency review required under s. 163.3178(2)(f), F.S.

7. Local Mitigation Strategy (LMS) (recommended)

The results of the VA can be used to inform a Local Mitigation Strategy as required by the Florida Division of Emergency Management.

Work with Local Mitigation Strategy Working Group (LMSWG) to ensure Vulnerability Assessment Report is in alignment with existing county LMS Plan and is utilized during the planning process of future county LMS Plan updates.

Example Deliverables: Submit a letter to the Department and FDEM Mitigation Bureau Planning Unit, signed by the LMSWG Chair, or Designee, stating the following:

1. Vulnerability Assessment Report will be incorporated as a reference in updating the next iteration of the LMS Plan, i.e., utilized in the next five-year update.
2. Vulnerability Assessment Report will be included as an appendix to the next iteration of the LMS Plan.
3. Entity/entities that composed the VA report will participate in the LMSWG through any of the following:
    a. At a minimum, be added to the Working Group Contact List
    b. Attend meetings
    c. Participate in the planning process of the next major update
    d. Adopting the LMS plan
    e. Submit projects to the working group to be included on LMS Prioritized Project List

Technical Guidance: The LMS is usually developed at the county level and serves to reduce the risks associated with natural and man-made disasters, including sea level rise.

Example References

Amec Foster Wheeler Environment & Infrastructure, Inc., 2017. "Orange County Flood Management Plan Draft." Orange County, FL.

Florida Department of Environmental Protection (FDEP), 2021. Resilient Florida Planning Grants GIS Data Standards. Florida Resilient Coastlines Program, Tallahassee, FL.

Florida Department of Environmental Protection (FDEP), 2018. Florida Adaptation Planning Guidebook. Florida Resilient Coastlines Program, Tallahassee, FL.

Hazen and Sawyer, 2020. "City of Oakland Park Flood Vulnerability Assessment Report." Oakland Park, FL.

Kimley Horn & Associates, 2020. "St. Pete Beach Phase 2 Vulnerability Assessment." St. Pete Beach, FL.

Molloy, S., 2020. "City of Naples Climate Change Vulnerability Assessment." Naples, FL.

National Oceanic and Atmospheric Administration (NOAA), 2017. Detailed Method for Mapping Sea Level Rise Inundation. NOAA Office for Coastal Management, Charleston, SC.

National Oceanic and Atmospheric Administration (NOAA), 2021. Participants Checklist for Risk and Vulnerability Assessment. Office for Coastal Management DigitalCoast. https://coast.noaa.gov/digitalcoast/training/checklist-risk-vulnerability.html

NEMAC+Fernleaf, Brizaga, Inc., Collective Water Resources, LLC., 2021. "Climate Change Vulnerability Assessment and Adaptation Planning." North Miami, FL.

Statewide Flooding and Sea Level Rise Resilience Plan, 2021. Section 380.093, Florida Statutes.

Taylor Engineering, 2021. "Sarasota County Coastal Resilience – Baseline Coastal Analysis." Sarasota County, FL.

Appendix A: Scope of Work Summary of Cost Estimates

(Note: estimations based on past funding awarded for a single community assessment)

Task Title	Task Amount
Kick off meeting, 4 Steering committee meetings, and 2 Public outreach meetings, Public Presentation(s)	$5,000 - $20,000
Acquire Background Data	$5,000 - $20,000
Draft Vulnerability Assessment (including sensitivity and exposure analysis completion and results)	$20,000 - $150,000
Final Vulnerability Assessment	Combined with Task 3
Local Mitigation Strategy	No separate data available
Peril of Flood Compliance (if applicable)	$5,000 - $10,000
Total	**$35,000 - $200,000**

Appendix B: Summary of noncoastal community focus groups discussion

Some of the recommendations made in this guidance document are based on a review of several existing inland flooding vulnerabilities studies completed across the State of Florida, and a series of focus group discussions held on March 28-29, 2022, in which several experts from government agencies, academic institutions, and private consulting firms provided their expert opinion on what should define a minimum standard practice in flooding vulnerability studies.

Key points from the focus group discussions:

• The inland (also applicable to coastal) flood studies should account for the non-stationarity introduced by the future variability in land use, sea-level, groundwater level, and climate conditions across the state.

• Studies that plan to include any data with future projections should also consider addressing the bias and uncertainties present in the analysis due to these future projections.

• Common metrics should be established for modeling inland flooding include precipitation, groundwater levels, future land use changes, soil storage capacity and soil moisture, riverine flooding, and upstream flows.

• At the minimum, the hydrologic response must be simulated for a 100-year, 24-hour design storm event. However, some agencies such as FDOT and Water Management Districts use a suite of multiple design storms with varying storm volume, temporal distribution, and return period for flood modeling.

• Common H&H modeling tools used for flood simulation are ICPR, HECRAS, SWMM (XPSWMM, PCSWMM, EPASWMM), Flo 2D, MIKE SHE/MIKE HYDRO, XPSWMM in combination with Delft3D, and HSPF in combination with SWMM/EFDC/HEC-RAS. The selection of an appropriate H&H model depends on the study area characteristics, data requirement/availability, and preference of the H&H modeling team. A flexible framework is preferred where municipalities can use their preferred modeling platform depending on their specific needs.

• The distinction between coastal and non-coastal flooding is difficult due to complex interactions between several non-linear processes. Since the majority of counties/municipalities in Florida lie in an area that requires a compound flooding analysis, a unified model for the entire state could be created to run coastal models coupled with inland models.

Appendix C: GIS Data Standards

Pursuant to section 380.093 (3)(c), Florida Statutes, grantees who receive funding to complete a vulnerability assessment must submit a series of items to the Florida Department of Environmental Protection (the "Department") in the required formats below.

Section 380.093 (3)(c)(2), F.S., shown below provides the basis of the items that must be provided.

> Section 380.093 (3)(c)(2), F.S.:
> Upon completion of a vulnerability assessment, the county or municipality shall submit to the Department the following:
>
> a. A report detailing the findings of the assessment.
> b. All electronic mapping data used to illustrate flooding and sea level rise impacts identified in the assessment. When submitting such data, the county or municipality shall include:
> i. Geospatial data in an electronic file format suitable for input to the department's mapping tool.
> ii. Geographic information system data that has been projected into the appropriate Florida State Plane Coordinate System and that is suitable for the Department's mapping tool. The county or municipality must also submit metadata using standards prescribed by the Department.
> c. A list of critical assets, including regionally significant assets, that are impacted by flooding and sea

The highlighted text must meet the Department standards which have been outlined below.

- Acceptable electronic Geospatial file formats are:
  - File Geodatabases (.gdb) – Geodatabase containing Feature Classes of the datasets. This file format is exclusive to the Environmental Systems Research Institute (ESRI) software.
  - Project Packages (.ppkx) – Package file containing the project, geodatabase, and symbology of the datasets. This file format is exclusive to the ESRI ArcGIS Pro software.
  - Shapefiles (.shp) – Shapefiles are a collection of location, shape, and attributes files of a dataset.
- Geospatial data should be projected into the appropriate Florida State Plane Coordinate System.
- Reference datums to be used are:
  - Horizontal Datum: North American Datum of 1983 with 1990 Adjustments (NAD83/90), or later.
  - Vertical Datum: North American Vertical Datum of 1988 (NAVD88).
- For Metadata standards, the standards defined by the Federal Geospatial Data Committee (FGDC) must be followed. The metadata standards may vary based on the dataset type; however, the Department requires the following items regardless of dataset type:
  - Title – Name for the dataset.
  - Summary – Short summary of what the dataset represents.
  - Description – Basic information about the dataset and its purpose.
  - Process Summary – Steps in creating the dataset or layer.
  - Dates of Data Collection
  - Date of Publication
  - Contact name for the originator of the dataset
  - Credits – Person or entity responsible for the collection/development of the dataset.
  - Use Limitation – Restrictions or legal prerequisites to using the dataset.

Additional Supporting References

- File Geodatabases and Feature Classes:
    - File geodatabases—ArcGIS Pro | Documentation
    - Feature classes—ArcGIS Pro | Documentation
- Project Packages
    - Share a project package—ArcGIS Pro | Documentation
    - Package Project (Data Management)—ArcGIS Pro | Documentation
- Shapefiles
    - Shapefiles in ArcGIS Pro—ArcGIS Pro | Documentation
- Metadata
    - FGDC Content Standard for Digital Geospatial Metadata: https://www.fgdc.gov/metadata/csdgm-standard
    - Content Standard for Digital Geospatial Metadata Workbook: https://www.fgdc.gov/metadata/documents/workbook_0501_bmk.pdf
    - Metadata Quick Guide: https://www.fgdc.gov/metadata/documents/MetadataQuickGuide.pdf
    - Other tools for Metadata: https://geology.usgs.gov/tools/metadata

Appendix D: Vulnerability Assessment Certification for Grant Agreement

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
RESILIENT FLORIDA GRANT PROGRAM
VULNERABILITY ASSESSMENT COMPLIANCE CHECKLIST CERTIFICATION

Exhibit I

Required for all grant agreements.

DEP Agreement Number: _____

Project Title: _____

Grantee: _____

By signing this Vulnerability Assessment Compliance Checklist Certification (hereinafter "Checklist Certification") the Grantee certifies that, upon execution of the Agreement, it will have reviewed the statutory requirements for vulnerability assessments in subsection 380.093(3), F.S., and provided this signed Checklist Certification to the Department, which gives the Department *partial* assurance that any and all vulnerability assessments the Grantee may utilize for its individual project will adhere to the relevant statutory requirements in subsection 380.093(3), F.S., regardless of the party actually completing the work (e.g., subcontractors).

To give the Department the remaining assurance it requires, the Grantee also certifies that it will deliver a fully completed and signed Vulnerability Assessment Compliance Checklist to the Department, in the form included in this exhibit, at a yet-to-be-determined time mutually agreed upon by both parties to this Agreement but prior to close out of the Grantee's individual project. The completed Vulnerability Assessment Compliance Checklist and this Checklist Certification will be joined and attached to the Agreement together as a single "Exhibit I."

By signing below, I certify on behalf of the Grantee that the Grantee or its designee(s) will have reviewed the statutory requirements in subsection 380.093(3), F.S., prior to execution of the Agreement. I further certify on behalf of the Grantee that, prior to close out of the grant, either myself or the Grantee's designated grant manager will provide to the Department a Vulnerability Assessment Compliance Checklist form that has been fully completed in the manner described in this Checklist Certification.

_____
Grantee's Grant Manager Signature

_____
Print Name

_____
Date

Appendix E: Vulnerability Assessment Compliance Checklist

In accordance with Section 380.093 (3) the following components, scenarios, data, and information are required for a comprehensive Vulnerability Assessment. This checklist and the deliverables identified below will be executed and provided to the Department upon completion of the grant.

Vulnerability Assessment Review Checklist Specific Part 1 [380.093(3)(c)2., F.S.]

		Page Reference in VA (if applicable)
☐	Report detailing the findings of the assessment provided	
	All electronic mapping data used to illustrate flooding and sea level rise impacts are identified in the assessment, to include the following:	
GIS	☐ Geospatial Data in electronic file format suitable for input to dept.'s mapping tool	
GIS	☐ GIS data that has been projected into the appropriate FL State Plane Coordinate System, suitable for dept.'s mapping tool	
GIS	☐ Metadata using standards prescribed by the dept.	
☐	List of critical assets for each jurisdiction, including regionally significant assets, that are impacted by flooding and sea level rise	

Vulnerability Assessment Review Checklist Specific Part 2 – [380.093(3)(d)1. and 380.093(3)(d)2., F.S.]

		Page Reference in VA (if applicable)
☐	Peril of Flood Comp. Plan amendments developed that address s. 163.3178(2)(f), if applicable ☐ Not applicable or already in compliance *(departmental verification attached)*	
☐	Assessment includes depth of Tidal flooding, including future high tide flooding using thresholds published and provided by the dept.	
	☐ Assessment includes to extent practical an analysis displaying geographically the number of tidal flood days expected for each scenario and planning horizon *(optional)*	
☐	Assessment includes depth of current and future storm surge flooding using publicly available NOAA or FEMA storm surge data (*check one*): ☐Uses NOAA data ☐Uses FEMA data	
	☐ Initial storm surge event used in assessment equals or exceeds current 100-year flood event	
	☐ Assessment includes higher frequency storm analyzed for critical asset *(optional, if so, provide detail below)*	
☐	To the extent practicable, assessment includes rainfall-induced flooding using spatiotemporal analysis or existing hydrologic and hydraulic modeling results. *(optional)*	
	☐ If provided, future boundary condition has been modified to consider sea level rise and high tide	
	☐ Rainfall-induced flooding analysis or modeling not provided with assessment *(optional for coastal, required for noncoastal communities)*	

	☐ Assessment includes depth of rainfall-induced flooding for 100-year storm and 500-year storm *(required for noncoastal communities)*	
☐	To the extent practicable, assessment includes compound flooding or the combination of tidal, storm surge, and rainfall-induced flooding *(optional)*	

Vulnerability Assessment Review Checklist Specific Part 3 – [380.093(3)(d)3., F.S.]

		Page Reference in VA (if applicable)
☐	Assessment performed all analyses in North American Vertical Datum of 1988	
☐	Assessment Includes 2017 NOAA intermediate-low and intermediate-high sea level rise projections	
☐	Assessment includes at least two planning horizons that includes years 2040 and 2070	
☐	Assessment utilized local sea level data used that has been interpolated between the two closest NOAA tide gauges	
	☐ Local sea level data was taken from one such gauge with higher mean sea level *(departmental approval attached)*	

I certify that, to the Grantee's knowledge, all information contained in this completed Vulnerability Assessment Compliance Checklist is true and accurate as of the date of signature below.

Grantee's Grant Manager Signature

Print Name

Date