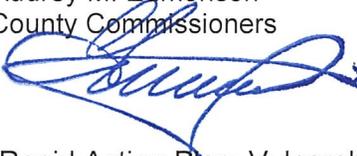


Date: February 11, 2019

To: Honorable Chairwoman Audrey M. Edmonson
and Members, Board of County Commissioners

From: Carlos A. Gimenez
Mayor 

Subject: Report Addressing The Rapid Action Plan: Vulnerability of County Assets to Sea Level Rise and Future Storm Surge - Directive No. 150051

The following report is submitted in response to Resolution No. R-46-15 adopted by the Board of County Commissioners (Board) on January 21, 2015. The Office of Resilience (OOR) worked with a consulting group, Hazen and Sawyer, to conduct a vulnerability assessment of County-owned assets and capital improvement projects. The vulnerability assessment focused on the impacts of sea level rise and future storm surge on both built assets and a sample of future projects. The study found that approximately 46 percent of County-owned assets are vulnerable to impacts from sea level rise and storm surge flooding. The consultants created a Rapid Action Plan that prioritizes projects based on their criticality in terms of emergency management and their vulnerability in terms of exposure to sea level rise and storm surge impacts.

The Office of Resilience is using the information provided by the consultant to meet with each department included in the study to discuss the vulnerabilities to their capital improvement projects. The Office of Resilience will also continue to work with the departments and the Office of Management and Budget to ensure that the marginal costs for resiliency measures is included in capital project budgets to ensure that projects are built to last. The Office of Resilience will also work with the Senior Executive Staff to develop a process to ensure that resiliency is incorporated into capital planning efforts at all departments.

In accordance with Ordinance No. 14-65, this report will be placed in the next available Board meeting agenda.

If you have questions concerning the above, please contact James F. Murley, Chief Resilience Officer, Department of Regulatory and Economic Resources, at 305-375-5593 or at James.Murley@miamidade.gov.

Attachment

c: Abigail Price-Williams, County Attorney
Geri Bonzon-Keenan, First Assistant County Attorney
Jack Osterholt, Deputy Mayor, Office of the Mayor
Lourdes M. Gomez, Deputy Director, Department of Regulatory and Economic Resources
James F. Murley, Chief Resilience Officer, Department of Regulatory and Economic Resources
Yinka Majekodunmi, CPA, Commission Auditor
Eugene Love, Agenda Coordinator
Linda Cave, Acting Director, Clerk of the Board

RAPID ACTION PLAN: VULNERABILITY OF COUNTY ASSETS TO SEA LEVEL RISE AND FUTURE STORM SURGE

January 2019

An update on results from the Rapid Action
Plan in support of Resolution Nos. R-45-15
and R-46-15

Introduction

History and context

In January 2015, the Miami-Dade County Board of County Commissioners (Board) passed Resolution, R-46-15. This resolution directed the Mayor or the Mayor's designee,

"to prepare an action plan and report to accomplish the acceleration of the climate change adaptation planning process by evaluating the engineering and other relevant expertise needed to conduct a comprehensive expert analysis and to develop an enhanced capital plan involving all levels of government to reinvent Miami-Dade County's urban infrastructure in a timely, sequenced manner that includes but is not limited to flood protection, salinity structures, pump stations, and road and bridge designs, and to determine the costs of retaining the experts needed."

To address these mandates to develop an enhanced capital plan, a two-phased approach was recommended by staff in the Office of Resilience in the "[Recommendations for An Enhanced Capital Plan Report](#)" which the Board of Commissioners accepted in November 2016.¹

Based on the recommendations from the 2016 staff report, **the first phase** of the project was to **identify and prioritize projects based on the vulnerabilities of the County's own critical infrastructure and planned capital projects**. For this phase a consulting firm; Hazen & Sawyer; was hired through the Equitable Distribution Program to conduct the vulnerability assessment and create an action plan, named the Rapid Action Plan (RAP). This study was completed in June 2018; it provides an update on the results of this first study, as well as a discussion of next steps. Immediate next steps include meetings with each department to discuss the RAP findings. Department staff can use results from RAP to modify projects if they are critical to County operations and vulnerable to sea level rise and storm surge.

In the coming year, the Office of Resilience will begin **the second phase** of this project that will take a more **comprehensive look at the impact of sea level rise on the broader community and recommend adaptation strategies which address vulnerabilities**. The scope of work will extend beyond County infrastructure, involve significantly more public engagement, and involve more economic analysis of different adaptation measures. At the time of this report, this phase was in procurement.



Vulnerability assessment and the Rapid Action Plan

Process to develop the study

To determine the exposure of Miami-Dade County's current infrastructure and planned capital improvement projects (CIP) to sea level rise and storm surge, this study relied upon both analytical tools and input from key department staff. Additionally, this project developed recommendations to incorporate sea level rise and storm surge risks into the planning process for all capital projects.

The Office of Resilience managed this study which was carried out by the consultant, Hazen and Sawyer, and with the support of multiple County department staff, including representatives from Emergency Management,

¹ "Recommendations for an Enhanced Capital Plan." MDC RER, Office of Resilience. September 2016. <https://www.miamidade.gov/green/library/sea-level-rise-capital-plan.pdf>

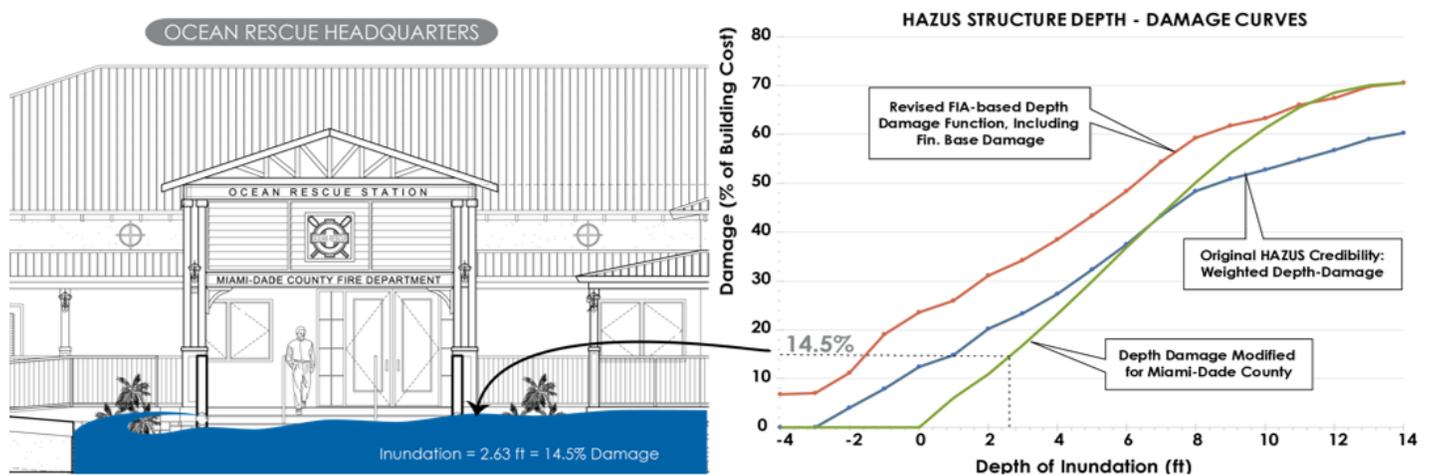
Risk Management, Information Technology, and the other departments. The vulnerability analysis relied heavily on the County’s internal expertise and knowledge of its own systems as well as existing climate data. Departments included in this phase of the assessment were:

- Aviation (MIA)
- Seaport
- Fire Rescue
- Internal Services
- Police
- Parks, Recreation, and Open Spaces
- Public Housing and Community Development
- Solid Waste Management
- Transportation and Public Works

The project team assessed the vulnerability of existing assets and capital improvement projects by County department and then assessed their criticality. Each participating department was provided a map and list of the vulnerability of all their existing facilities, which can now be used to inform their future planning efforts.

Finally, the engineering consultants analyzed the planned capital improvement projects for the participating departments. Many projects did not have sufficient information to allow for adequate analysis, but they were able to review a subset of the planned capital projects and assess their resiliency. The consultants prioritized these capital projects across departments and identified 28 capital projects that were a high priority due to their vulnerability to sea level rise and storm surge and their importance from an emergency management perspective.

Through the course of this study some of these projects were able to be modified to be more resilient. For example, as shown in Figure 1, the Fire Rescue department was able to modify the design of their new ocean rescue facility on Key Biscayne to be less vulnerable to sea level rise. Similarly, the Aviation Department has designed their improvements to the fuel tank area to be built higher and reduce the risk of flooding. Department staff were a key part of this effort and participated in meetings to discuss the preliminary results and provided input on the criticality of their assets to their mission.



Unitized price for new buildings was adjusted to \$300/square foot.

Figure 1. The Ocean Rescue Headquarters on Key Biscayne was elevated during the process of this project. The building was elevated to mitigate flood damage. Now it is expected that only 14.5% of the building will be impacted over the next 50 years.

Methodology

The project team used geospatial data to map sea level rise and storm surge scenarios and to analyze how County assets are impacted now and in the future. From this data, the project team could assign a **vulnerability score** to an asset or project based on its location's exposure to flooding hazards. For example, an existing building located in a low-lying area on a barrier island may be highly exposed to both current and future sea level rise and storm surge based on its location. Therefore, that asset would be assigned a high vulnerability score.

The project team then ranked assets and projects based on an assigned **criticality score**. A high score of five indicated the asset was very critical. For example, the Emergency Operations Center and police and fire stations all had a criticality score of five. A low score indicated that it was not as critical from a life safety perspective. For example, a parcel designated for a mangrove restoration project received a low criticality score because it is not essential during or after an emergency.

The vulnerability and criticality scores were then combined to create a composite score. **Assets with a high vulnerability score and a high criticality score are considered the most at-risk.** It is possible that areas that are highly vulnerable to climate change, such as low-lying parks, did not rank high because they did not have a high criticality score. Assets that are both critical and highly vulnerable are the areas where the County should focus immediate adaptation efforts to most effectively and expediently reduce risks.

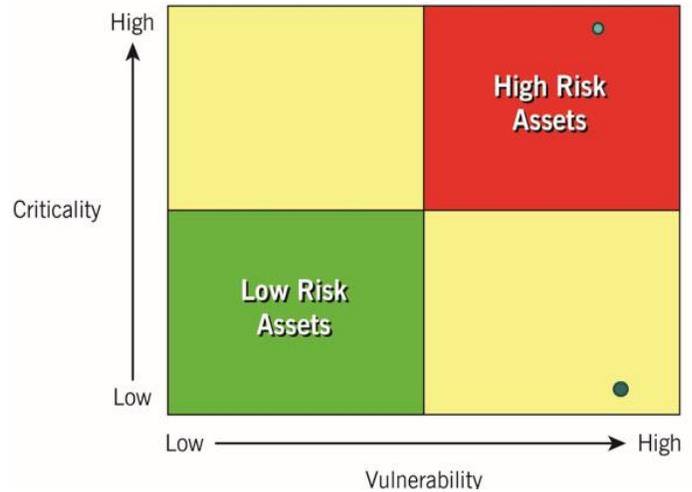


Figure 2. The Rapid Action Plan project team identified low risk assets (low vulnerability and low criticality) and high-risk assets (high vulnerability and high criticality).

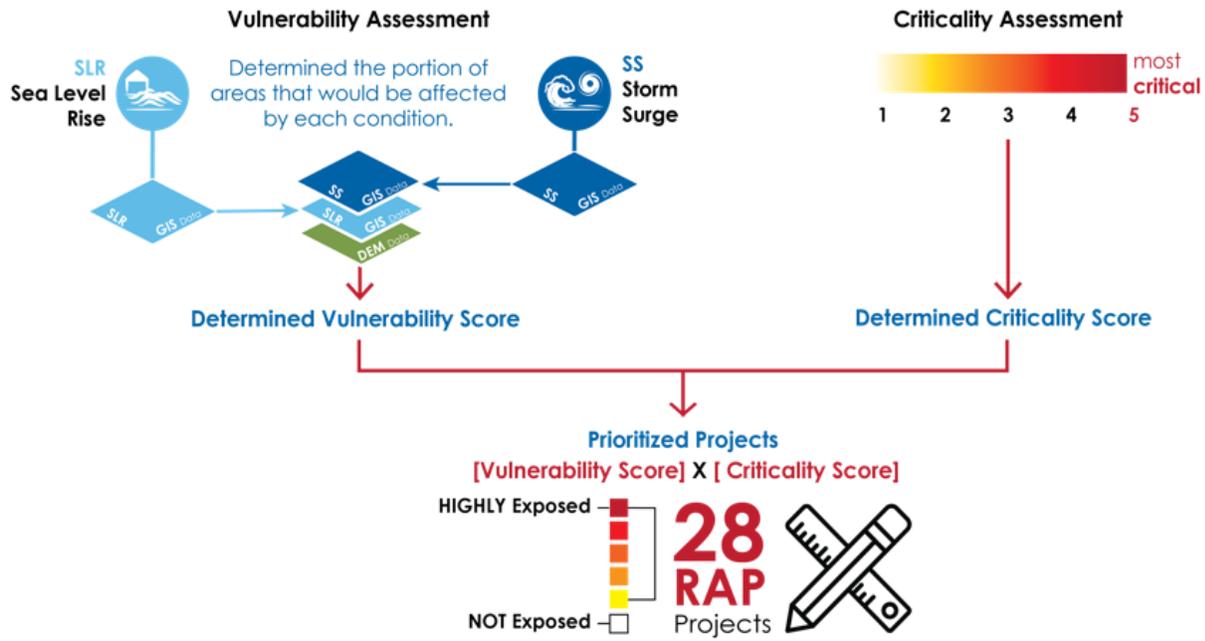
Figure 3. An example of how the vulnerability score was calculated. The location's parcel was selected, and ground elevation was analyzed to identify low-lying areas. The percentage of the parcel exposed to sea level rise was factored in as well as the percentage of the parcel exposed to storm surge to create a vulnerability score.



Facility	% of Property Exposed to SLR		% of Property Exposed to Storm Surge			Vulnerability Score ¹²
	% Exposed between 0.01 ft and 2 ft	% Exposed >= 2 ft	% Exposed between 0.01 ft and 2 ft	% Exposed between 2 ft and 5 ft	% Exposed >= 5 ft	
North Dade Justice Center	44.3%	1.0%	0.1%	0.1%	99.7%	3.46

For the 28 capital improvement projects that could be adequately analyzed, the consultants developed preliminary cost estimates of adapting the projects to protect them from flooding. The consultants also estimated the potential losses that could result from not protecting these projects. A comparison of these two costs can help departments identify the most cost-effective protective measures. This study provides only a preliminary assessment. Project managers will need to do more thorough evaluations of their projects to determine whether potential adaptation measures make sense for their project.

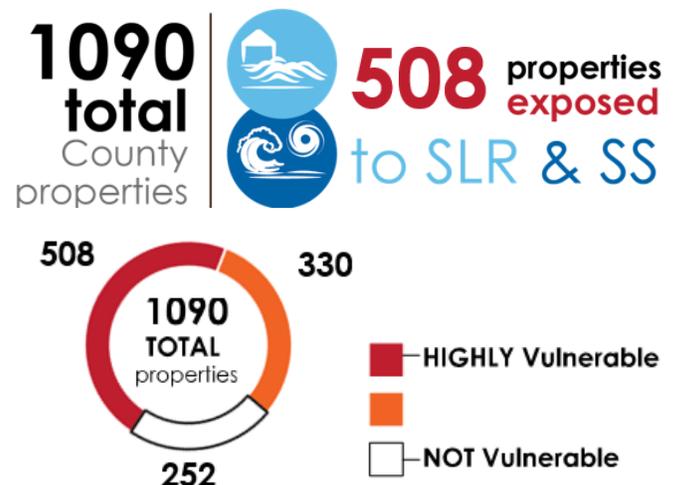
Figure 4. Out of 171 County projects, the top 28 most vulnerable were selected for further analysis.



Results

The 28 most vulnerable projects identified in this study are listed in Appendix 1.² In brief, this study demonstrated that approximately 46% of County-owned assets are vulnerable to significant impacts from sea level rise and storm surge inundation. The project team determined a total of 508 County assets of the 1,090 County assets that were analyzed are vulnerable to sea level rise and storm surge inundation.

Of the 171 County capital improvement projects evaluated, 28 projects were prioritized for further analysis (Figure 4). The consultants estimated the potential losses if no action is taken as well as potential adaptation strategies. The team found that potential losses of the most vulnerable 28 projects exceeds \$24 million. The consultants estimated it would cost about \$6.3 million to revise the 28 project plans to avoid estimated losses. **Based on these preliminary cost estimates, the consultants estimated that potential damages to capital projects could be mitigated with a 4% increase to project budgets.** This is an aggregate estimate and some projects will be more (or less) cost effective to protect. The specific numbers for the 28 projects studied is intended only to show the relative scale of the investment in resilience that is required to reduce damages down the road.



² The full results of this study are available on the Office of Resilience website here: <http://www.miamidade.gov/green/library/sea-level-rise-and-storm-surge-rapid-action-plan.pdf>

Each department with a priority capital project was provided with a vulnerability analysis of the property where the capital project is planned. An example of results shared with the departments is shown in Figure 5. This figure, prepared for the Fire Rescue Department, shows how eight parcels with CIP projects are exposed to future storm surge. The Crandon Park property is highly exposed whereas the Palmetto Bay parcel is only partially exposed. The plans for the ocean rescue headquarters in Crandon Park have been modified by the Fire Rescue Department to reduce these risks. The Office of Resilience is available to assist any department interested in pursuing further protective measures at any of their facilities.

Conclusion and Next Steps

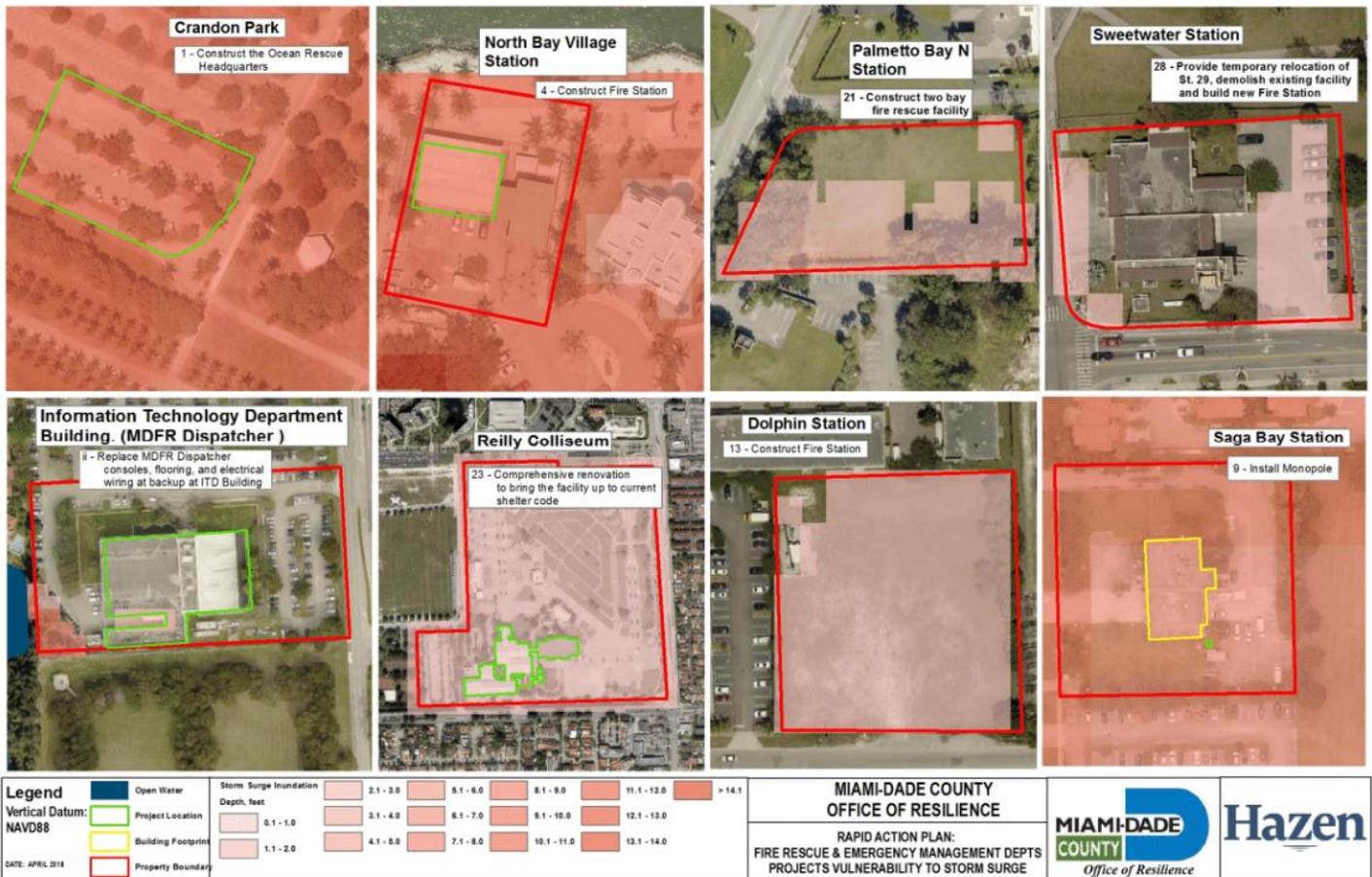


Figure 5. A sample of projects planned by the Fire Department that are vulnerable to storm surge. The Ocean Rescue Headquarters at Crandon Park, one of the most vulnerable projects the Fire Department, is in the upper left corner.

Implementing the RAP and Checklist

Over the next several months, staff from the Office of Resilience will meet with each participating department to discuss the full study results (Appendix 1). Departments are encouraged to look in more detail at their most exposed facilities and identify risk mitigation measures to integrate into future capital improvement plans. Departments are also encouraged to add projects to the Local Mitigation Strategy (LMS) whenever possible to take advantage of state and federal hazard mitigation funds when they become available. This study can help departments improve future proposed projects, improve their position for disaster funding, revise their own CIP to expedite resiliency measures, and help identify overlap between departments. The Office of Resilience will also continue to work with the departments and the Office of Management and Budget to ensure that the marginal costs for resiliency measures is included in capital project budgets to ensure that projects are built to last. The Office of Resilience will also work with the Senior Executive Staff to develop a process to ensure that resiliency is incorporated into capital planning efforts at all departments.

To systematically reduce the vulnerability of County facilities, it is recommended that departments consider flooding risks as early in the planning and design phase as possible (see figure 7). It is typically most cost effective to make alterations to project designs early in the project. As part of this project the engineering consultants recommended using a checklist to help departments plan for future sea level rise and storm surge in their projects. The Office of Resilience has prepared a separate report in response to Resolution R-233-16 outlining the recommended next steps for creating a sea level rise checklist.

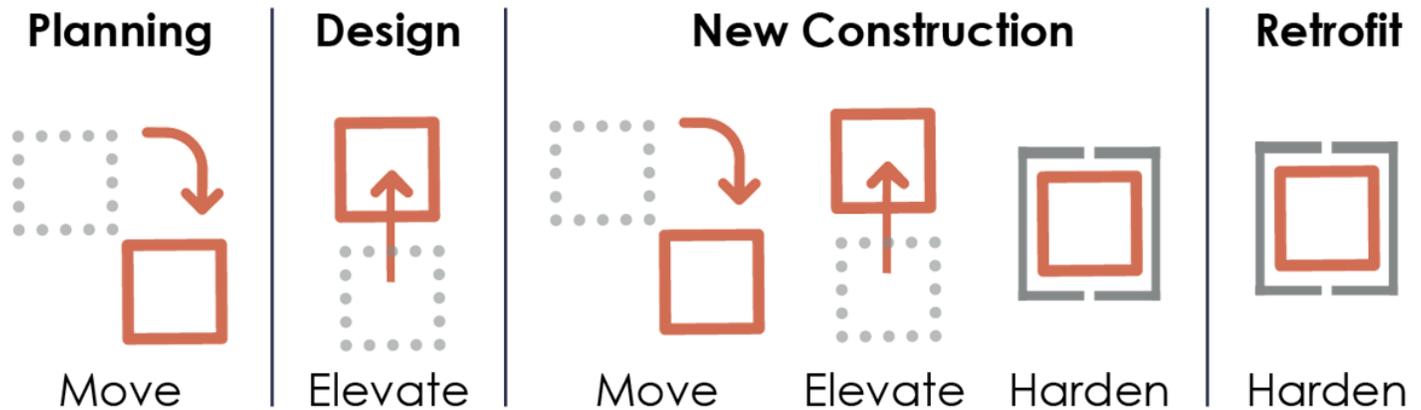


Figure 7. A rendering of how projects could be planned, designed, or constructed to reduce risk from flooding.

Developing the Enhanced Capital Plan

The next phase of this effort will expand the scope of this study beyond the County's facilities and will look more comprehensively at the community's vulnerability to sea level rise. This second phase, which has been called the "Enhanced Capital Plan," will focus on developing adaptation scenarios and evaluating their economic and technical feasibility. This effort will build on several recent studies that have laid the foundation for this work including the recently completed studies by the RAND Corporation and the South Florida Water Management District's work with the Dutch research institute, Deltares.³

Most importantly, completing an enhanced capital plan has the potential to help prioritize and develop consensus around preferred adaptation measures. This will help to ensure that short-term investments are not reacting to short-term issues, such as King Tide flooding, but are instead proactively building the long-term resilience of the community. The FY 2018-2019 Proposed Budget, released in July 2018, highlights efforts to create a more resilient Miami-Dade County through funding to essential assets such as water and sewer infrastructure, fire stations, airports and the seaport.⁴ The Office of Resilience is working directly with these departments to implement modifications to capital improvement projects and discuss which built assets can be retrofitted to prepare for flood impacts. Continued, proactive collaboration with the private sector and local academic institutions will ensure Miami-Dade County's proposed plan is innovative and forward-looking.

³ The RAND Corporation study can be found here: https://www.rand.org/pubs/research_reports/RR1932.html

The Deltares Study can be found here:

ftp://ftp.sfwmd.gov/pub/kkonya/C7_FPLOS_Final_Reports/Risk%20Assessment_of_3_Alternative_Flood_Mitigation_Strategies_for_the_C-7_Basin_in_Miami_Florida%20-%20DELTADES.pdf

⁴ The FY 2018-2019 Proposed Budget can be found here: <https://www.miamidade.gov/budget/library/fy2018-19/proposed/budget-in-brief.pdf>

Appendix 1 Cont'd: RAP projects ranked by criticality and vulnerability

The following 28 projects were ranked highest in terms of criticality and vulnerability. Projects highlighted in yellow have already been modified.

No.	Department	Facility	Project Title	RAP Ranking Based on Vulnerability x Criticality Score	Source	Host Property Value 2016 (As Per Folio)	Project Cost (Dollars in thousands) ¹	Project # ⁴	Nature of Construction	Estimated Loss (Dollars in thousands) ²	Estimated Adaptation Cost (Dollars in thousands)	Project Cost : Adaptation Cost Ratio	Estimated cost of Civil Adaptation, %/ft	Estimated cost of Mech Adaptation	Max Mean Depth	%Hazus	Project Cost to Adaptation Cost Ratio	
1	Fire Rescue	Key Biscayne	Construct Ocean Rescue facility at Crandon Park	1	CIP	38,745,593	\$2,900	376760	NB	\$422	\$114.3	25 : 1	0.50%	1.00%	2.63	14.55	25	
2	ISD	Miami-Dade-County Courthouse	Refurbish existing emergency system and replace generator at the Miami Dade County Courthouse ⁵	2	CIP	43,125,000	\$800	114150	BC	\$408	\$65.0	12 : 1		1.00%	8.13	50.99	12	
3	ISD	Miami-Dade-County Courthouse	Provide emergency capital repairs to the Miami Dade County Courthouse to correct and/or repair hazardous conditions that may affect the life, health, and safety of judges, employees, visitors, and users of the Courthouse ⁵	3	CIP	43,125,000	\$30,000	200000069	BC	\$3,000	\$2,439.1	12 : 1		1.00%	8.13	50.99	12	
4	Fire Rescue	St. 27 North Bay Village**	Replace temporary station at Pelican Harbor	4	CIP	3,474,502	\$2,900	377840	NB	\$1,740	\$114.4	N/A	0.50%	1.00%	2.63	Copied Crandon	25	
5	ISD	North Dade Justice Center	Repair or replace building equipment, refurbish facility ⁵	5	CIP	16,849,014	\$500	114640	BC	\$170	\$41.9	12 : 1	0.50%	1.00%	5.59	34.01	12	
6	Police	Court Services Bureau	Replace obsolete IT system Ct Services Bureau ⁶	6	CIP	88,802,497	\$500	328610	BC	\$110	\$28.7	17 : 1	0.50%	1.00%	3.83	22.04	17	
7	ISD	Richard E. Gerstein Justice Bldg.	Repair HVAC systems ⁵	7	CIP	25,248,569	\$3,900	113820	BC	\$1,149	\$288.5	14 : 1	0.50%	1.00%	4.93	29.47	14	
8	ISD	Hickman Juvenile Center	Repair and refurbish the Bennett H. Brummer Public Defender facility ⁵	8	CIP	23,053,660	\$3,279	118310	BC	\$916	\$231.5	14 : 1	0.50%	1.00%	4.71	27.94	14	
9	Fire Rescue	St. 55 Saga Bay	Install monopole at Station 55 Saga Bay ⁵	9	CIP	883,742	\$100	2000000705	BC	\$29	\$7.3	14 : 1	0.50%	1.00%	4.89	29.20	14	
10	Aviation	MIA Fuel Tank*	Build new MIA fuel tank ⁵	10	CIP		\$500	2000000096	MC	\$44	\$11.9	42 : 1	0.50%	1.00%	1.59	8.81	42	
11	PROS	Pelican Harbor Marina	Sea Wall Replacement and Repair - Pelican Harbor Marina	11	LMS	211,255	\$1,493		MC	\$950	\$235.4	6 : 1	0.50%	1.00%	10.51	63.66	6	
12	PROS	Rickenbacker Causeway	Provide landscape maintenance and improve shoreline beach and road drainage	12	CIP	505,000	\$1,150	608560	MC	\$378	\$31.2	37 : 1	0.50%	0.00%	5.42	32.87	37	
13	Fire Rescue	St. 68 Dolphin*	Construct three bay fire rescue facility	13	CIP	1,525,770	\$4,000	10420	NB	\$129	\$19.5	205 : 1	0.50%	1.00%	0.33	3.23	205	
14	PROS	Homestead Bayfront Park	Construct areawide park improvements including building construction and	14	CIP	4,000,000	\$4,000	937020	MC	\$2,566	\$638.1	6 : 1	0.50%	1.00%	10.63	64.15	6	
15	Aviation	Employee Parking Garage*	Build employee parking garage	15	CIP		\$20,000	2000000096	NB	\$1,894	\$171.4	117 : 1	0.50%	0.00%	1.71	9.47	117	
16	PROS	Crandon Park	Construct improvements including master plan requirements, building construction	16	CIP	38,745,593	\$335	939060	MC	\$217	\$18.1	19 : 1	0.50%	0.00%	10.81	64.84	19	
17	Solid Waste	Home Chemical Collection	58 St Home Chemical Collection Center and Area Drainage Improvements	17	CIP	81,020	\$3,000	507960	BU	\$80	\$7.6	394 : 1	0.50%	1.00%	0.17	2.66	394	
18	PROS	Matheson Hammock Marina	Sea Wall Replacement and Repair	18	LMS	539,000	\$4,243		BC	\$2,906	\$762.0	6 : 1	0.50%	1.00%	11.97	68.50	6	
19	PROS	Haulover Beach	Sea Wall Replacement and Repair	19	LMS	102,388,037	\$2,465		BC	\$501	\$43.9	56 : 1	0.50%	0.00%	3.56	20.31	56	
20	Transportation	Lehman Center/Palmetto Yard	Install five storage tracks, an under floor rail wheel truing machine, rehabilitate and expand emergency exit at the existing	20	CIP	24,664,500	\$38,444	674560	BU	\$1,793	\$397.3	97 : 1	0.50%	1.00%	0.69	4.67	97	
21	Fire Rescue	St. 62 Palmetto Bay*	Construct two bay fire rescue facility	21	CIP	496,256	\$4,776	375681	NB	\$177	\$32.4	148 : 1	0.50%	1.00%	0.45	3.71	148	
22	Solid Waste	North East Regional Transfer Station	Design tipping floor expansion by using a retaining wall and privacy screening for	22	CIP	6,240,422	\$5,600	509100	BU	\$344	\$86.6	65 : 1	0.50%	1.00%	1.03	6.15	65	
23	Emergency Management	Reilly Coliseum	Comprehensive renovation to bring the facility up to current shelter code	23	LMS	8,786,981	\$1,175		BU	\$33	\$3.9	304 : 1	0.50%	1.00%	0.22	2.84	304	
24	Solid Waste	North Dade Landfill	Design and construct an active gas extraction system to the East Cell of the North Dade Landfill including piping and flare retrofit	24	CIP	2,457,069	\$1,800	509280	MC	\$65	\$3.9	463 : 1	0.50%	0.00%	0.43	3.63	463	
25	PROS	Greynolds Park	Construct areawide park improvements including building construction and restoration, pedestrian circulation, natural areas restoration, playground improvements, and landscaping	25	CIP	178,627	\$7,000	936600	MC	\$1,107	\$99.4	70 : 1	0.50%	0.00%	2.84	15.81	70	
26	PROS	Haulover Park	Construct park improvements including building construction and renovation, vehicle and pedestrian circulation, beach area, development of the great lawn, landscaping, and jetty pier	26	CIP	102,388,037	\$7,000	932740	MC	\$1,828	\$155.3	45 : 1	0.50%	0.00%	4.44	26.11	45	
27	PROS	Biscayne Shores And Gardens Park	Construct new community center at Biscayne Shores and Gardens Park	27	CIP	1,451,378	\$1,500	2000000377	NB	\$992	\$251.0	6 : 1	0.50%	1.00%	11.15	66.11	6	
28	Fire Rescue	St. 29 Sweetwater	Provide temporary relocation of Station 29, demolish existing facility and build new Miami-Dade County fire station due to FDOT widening of SW 107 Ave	28	CIP	568,114	\$5,500	5410	NB	\$127	\$5.6	977 : 1	0.50%	1.00%	0.07	2.31	977	
i.1	ISD	Data Processing Ctr ²	Improvements to the Data Processing Center	1	CIP	10,328,894	\$0	115820	BC	N/A	N/A	N/A						
i.2			ITD: Collaboration Room Interior: Expand Vault Room within a portion of an existing 1st Floor space approximately 912 sq. ft. in size ITD NOC: Command Center Interior Refurbishment within a portion of an existing 1st Floor space approximately 2,000 sq. ft. in size															
ii	Fire Rescue Emergency Management	ITD Building ²	Replace MDFR Dispatcher consoles, flooring, and electrical wiring at backup	1	CIP	10,328,894		2000000587	BU	\$0								

SLR Inundation depth exceeding 3 ft indicates the site, or portion thereof, is currently below sea level
¹ Storm Surge projected for a Cat. 5 Hurricane in the future accounting for sea level rise
² These assets/projects were ranked based on their criticality and were not assessed in the same manner as the other
³ Criticality based on input received from MD County Departments
 **FR will lease the property, values
 PROS: Parks, Recreation and Open Spaces Department