INITIAL APPRAISAL REPORT FOR THE

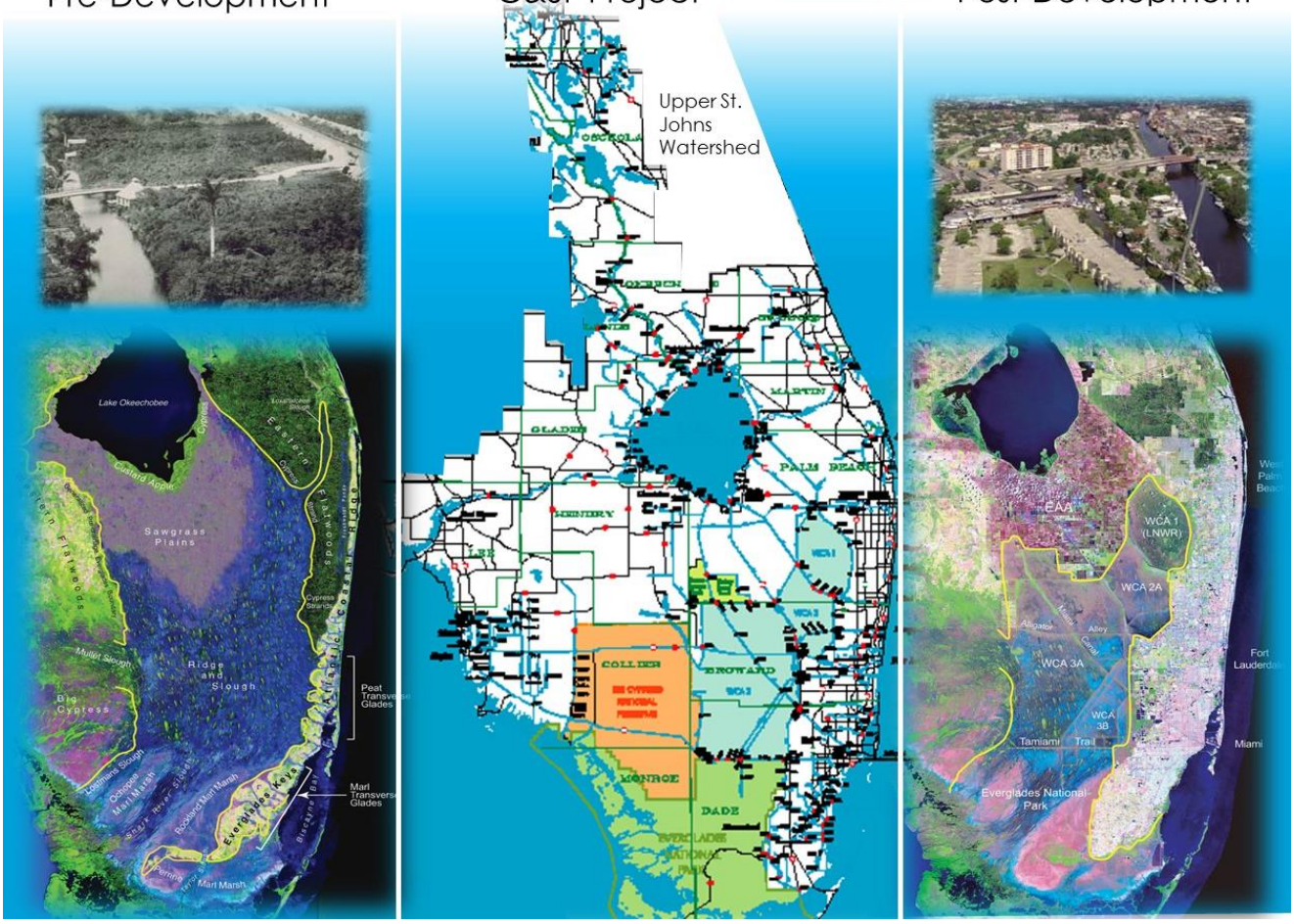
CENTRAL AND SOUTHERN FLORIDA PROJECT

Conducted under Section 216 of the Flood Control Act of 1970, as amended

Before 1900s – Pre-Development

1948 – 1965 C&SF Project

After 2000s – Post-Development



March 2020

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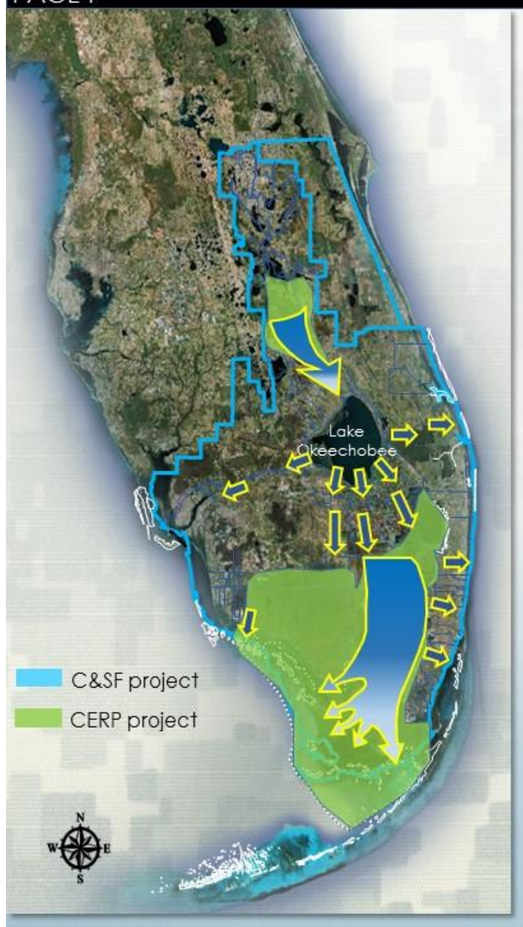


BACKGROUND

The Central & Southern Florida (C&SF) Project extends in the area shown and even into the upper St. Johns. The Comprehensive Everglades Restoration Plan (CERP) is encompassed within the C&SF project. C&SF history includes:

- Authorized in 1948, after the 1947 flood
- Flood Control Act of 1954 established that Chief of Engineers had discretionary authority to modify the plan
- One of the world's largest and most complex water management systems
- Jointly operated by USACE and South Florida Water Management District
- Spans 18 counties
- Covers 18,000 square miles
- C&SF serves multi-purposes and provides
  - Flood protection
  - Water supply/control (agriculture, municipal & industrial, Everglades National Park)
  - Navigation
  - Prevention of salinity intrusion
  - Protection of fish and wildlife
- CERP was authorized under WRDA 2000,
  - To restore, preserve and protect ecosystem while maintaining C&SF project purposes

STUDY PURPOSE & EXISTING CONDITIONS

A large extent of Florida is facing extraordinary changes which are challenging the original project purposes of the authorized C&SF project. The main drivers of change can be largely grouped into categories of population growth, increased development of land, temperature increase, and sea level change trends. There are already increasing problems in terms of flood vulnerabilities, water supply, and coastal flooding. In the next 50 to 200 years, the effects of the existing problems will become more extreme. This report shows that the risk of no-action is too large to ignore, and that there is an opportunity to address these problems now with phased approaches through the use of two different holistic studies.

RECOMMENDATIONS

This Section 216 Initial Appraisal Report determines there is Federal interest in further investigation of improvements to the C&SF Project due to significant changed conditions since the time the C&SF project was constructed. A C&SF Project Update Feasibility Study is recommended under the authority of Section 216 of the Flood Control Act of 1970, as amended.

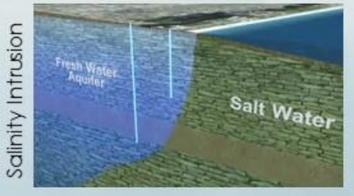
This Section 216 Initial Appraisal Report also determines there is a Federal interest in working with the State of Florida through its Department of Environmental Protection and in cooperation with its five Water Management Districts on five coordinated watershed planning studies. The purpose would be to develop a multi-generational long-term Adaptive Risk Management (ARM) Strategy as a framework for interagency coordination and planning for cost effective adaptation actions to address future sea level changes of more than 2-3 feet above 1992 datum levels.

C&SF PROJECT PURPOSES INCLUDING CERP

Flood Protection

Water Supply/Control

Prevention of Salinity Intrusion



Ecosystem Restoration, Preservation, Protection

GRAPHIC EXECUTIVE SUMMARY – PAGE 2

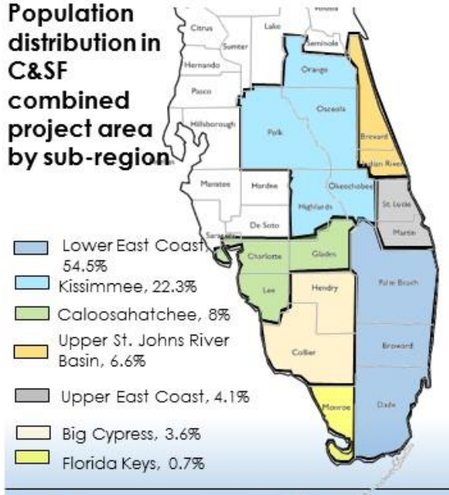
THE CENTRAL AND SOUTHERN FLORIDA PROJECT
FOUR CHANGES THAT WARRANT AN UPDATE TO THE ORIGINALLY AUTHORIZED PROJECT

1 Population Growth

Impacts to: water supply

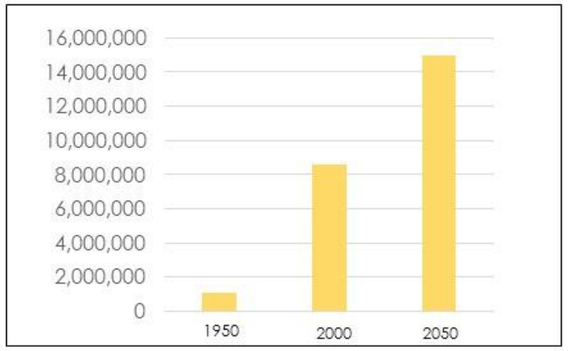
Population increases over the past 70 years have changed where the water supply needs are and how much water supply is needed.

Population distribution in C&SF combined project area by sub-region



- Lower East Coast, 54.5%
- Kissimmee, 22.3%
- Caloosahatchee, 8%
- Upper St. Johns River Basin, 6.6%
- Upper East Coast, 4.1%
- Big Cypress, 3.6%
- Florida Keys, 0.7%

HISTORIC POPULATION GROWTH & FORECAST IN SOUTH FLORIDA IN THE COMBINED C&SF PROJECT AREA

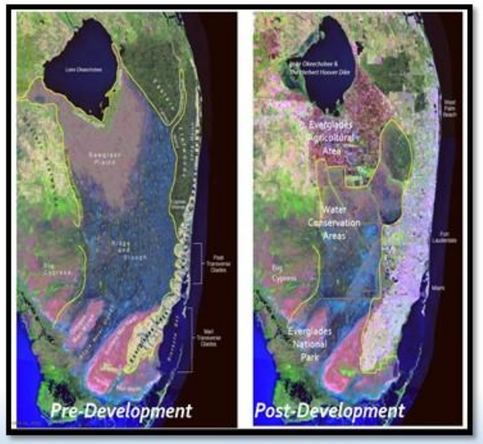


C&SF was designed based on projected population growth of 2 million in the Lower East Coast by 2000. The actual population in the Lower East Coast in 2000 was approximately 5 million.

2 Increased Development of Land

Impacts to: flood risk reduction

There has been a drastic increase in land development over the past 70 years. This has reduced the amount of natural surface for runoff during storm events, leading to increases in flooding.



MIAMI CANAL- Pre and Post-Development

3 Hydrologic Changes

Impacts to: flood risk reduction & water supply

Extreme weather is becoming more prevalent due to rising temperatures, leading to longer periods of drought and less frequent but more intense periods of rainfall. This means that there will need to be more of a focus on adequate water supply during times of drought, as well as capturing intense rainfall for future water supply and to reduce immediate flooding.

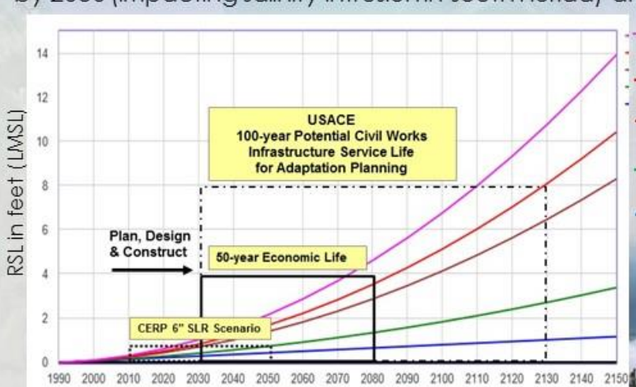
LAKE OKEECHOBEE DROUGHT

INTENSE RAINFALL

4 Sea Level Change

Impacts to: flood risk reduction, water supply, prevention of salinity intrusion, ecosystem

The original C&SF project did not address sea level rise (SLR). The Comprehensive Everglades Restoration Project (CERP) projected an increase of 0.5 feet of SLR. Current predictions under USACE guidance show SLR on an accelerated track reached 2 feet by 2050 (impacting salinity intrusion in south Florida) and 5.1 feet by 2100.



Sea level rise impacts can lead to coastal flooding impacts, salinity intrusion of fresh water supplies through porous limestone, and long term planning for inland areas.

1 STUDY OVERVIEW

Reference the Graphic Executive Summary for an overall project map, background, and key highlights from this report.

1.1 STUDY PURPOSE

The purpose of this report is to provide an overview of the significant changes influencing the Central and Southern Florida (C&SF) Project since its inception in 1948, and if appropriate, to make recommendations regarding potential future studies. This Initial Appraisal is authorized by Section 216 of the Flood Control Act of 1970 (33 USC 426 et seq) as amended, which reads:

"The Secretary of the Army, acting through the Chief of Engineers, is authorized to review the operation of projects the construction of which has been completed and which were constructed by the Corps of Engineers in the interest of navigation, flood control, water supply, and related purposes, when found advisable due to significantly changed physical or economic conditions, and to report thereon to Congress with recommendations on the advisability of modifying the structures or their operation, and for improving the quality of the environment in the overall public interest."

The importance of this study is demonstrated in a letter (see Appendix B-1) submitted by Senator Rubio, Senator Scott, Representative Steube, Representative Mast, Representative Rooney, Representative Hastings and Representative Diaz-Balart in June 2019. The letter emphasizes the urgency of assessing the full extent of South Florida's aging flood control system, under sea level rise and higher water tables conditions, to improve the resilience of South Florida communities. In addition, individual letters were submitted by the mayors of four South Florida counties: Palm Beach County, Broward County, Miami-Dade County and Monroe County. The letters, represented in Appendix B-2 by the Palm Beach County letter, aim to: 1) highlight the importance of the south Florida economy to the nation, 2) stress the limitations of the 70-year old Central and South Florida Flood Control Project (C&SF Project), and 3) expresses the risk of no holistic action to the resilience of the existing infrastructure in terms of flood vulnerabilities, water supply, coastal flooding, and surge protection given the significant changes to population, land use, weather patterns and sea level rise trends. Back in 2018, a letter from Senator Rubio, also included in Appendix B-3, reinforced the existing limitations of the region's water management system and describes significant impacts occurred during Hurricane Irma. Finally, on March 2020, the Governing Board Members of the project's non-

federal sponsor – South Florida Water Management District – passed a resolution to approve a letter of endorsement, supporting the U.S. Army Corps of Engineers (USACE) seeking federal funding to initiate the Central and Southern Florida Flood Resiliency Study (see Appendix B-4).

This report offers a brief analysis of the existing C&SF project and explains existing external changes to the Florida landscape and consequential problems to the surrounding shared environment, threatening the project purposes of the originally authorized C&SF project. In the next 50 to 200 years, the effects of the existing problems will become more extreme. This report shows that the risk of no-action is too large to ignore, and that there is an opportunity to address these problems now with a phased approach. The Central and Southern Florida Flood Resiliency Study will focus on the project features which can reduce the most immediate risk to changing conditions, and the resilience aspects of such infrastructure in terms of flood vulnerabilities, based on an overall assessment of the entire C&SF system and the recommendation of areas for further evaluation. The selection of the most critical project features to be included at the study will be defined in coordination with South Florida Management District, non-federal project sponsor. The results of the study will allow the immediate authorization of construction to update components that need immediate attention to provide the expected C&SF level of service and approve continuing investigations of the remaining structures.

1.2 LOCATION

The Central and Southern Florida (C&SF) Project is generally located within the southeastern 18 counties of Florida, covering an area of about 18,000 square miles (Reference the Graphic Executive Summary, page 1). It is comprised of the Upper St. Johns River Basin in the northeastern section of the project, Kissimmee River Basin in the central section, the Lake Okeechobee-Everglades area in the central and southwestern section, and the east coast area in the southeastern section.

1.3 EXISTING AUTHORIZED PROJECT

The C&SF Project was initially authorized by the Flood Control Act of 1948 and is a large, multipurpose water resources project designed and constructed by the U.S. Army Corps of Engineers (USACE) in cooperation with the local sponsor. The C&SF project is jointly operated by USACE and the primary local sponsor, the South Florida Water Management District.

1.4 AUTHORIZATIONS AND PROJECT PURPOSES

In 1948, the Department of the Army submitted to Congress the *Comprehensive Report on Central and Southern Florida for Flood Control and Other Purposes* (House Document 80-643). The C&SF Comprehensive Plan described how water stored in the Water Conservation Areas would provide water for use on the east coast agricultural lands, raise the groundwater table and improve water supply for the east coast communities, and improve problems of saltwater intrusion in the coastal water supply wellfields. Spillways and culverts were to be constructed

in the Water Conservation Area levees to provide water to east coast areas for use during the dry season. Lake Okeechobee would serve as a multiple-use reservoir with flood control, navigation, and water-conservation functions. Lake Okeechobee was considered to be the heart of any plan for flood control and water conservation in South Florida. The benefits of the C&SF Comprehensive Plan for salinity control and municipal and industrial (M&I) water supply were described in House Document 80-643.

The Flood Control Act of 1954 authorized the remainder of the C&SF Project proposed in House Document 80-643, and, in addition, established that the Chief of Engineers had the discretionary authority to modify the plan. The C&SF Project was expected to improve the water supply for domestic, industrial, and agricultural use throughout the project area. USACE concluded that from the standpoint of the project as a whole, these water supply benefits contributed to the increased land use benefits, which served as a basis for the local contribution. In order to obtain the full benefits of the Federal project, the local interests would also be required to provide a system of secondary works.

The compelling reason for Federal participation in the C&SF Project was its function of reducing flood damages. The importance of drainage and water control and the resulting benefits from increased land use made it analogous to a project for reclamation of western lands. In the Water Resources Development Act (WRDA) of 2000, the Comprehensive Everglades Restoration Plan (CERP) was approved as a framework for the modifications and operational changes to the Central and Southern Florida Project that are needed to restore, preserve, and protect the South Florida ecosystem while providing for other water-related needs of the region, including water supply and flood protection.

A summary of the C&SF authorized project purpose and the applicable authorizations, including a series of Flood Control Acts and Water Resources Development Acts is provided in Appendix A and in **Table 1**.

Table 1. Central and Southern Florida Project – Authorized Project Purposes.

YEAR	1948	1954	1958	1960	1962	1965	1968	1970	1970	1983	1988	1989	1992	1996	2000	2007	2014	2017	2018
PURPOSE	PL 80-858	PL 83-780	PL 85-500	PL 86-645	PL 87-874	PL 89-298	PL 90-483	PL 91-282	HD 91-394	PL 98-181	PL 100-676	PL 101-229	PL 102-580	PL 104-303	PL 104-303	PL 110-114	PL 113-121	PL 114-322	PL 115-270
Flood Control	X	X	X	X	X	X	X			X		X		X	X	X	X	X	X
Drainage/Water Control	X	X	X	X	X	X	X								X	X	X		
Groundwater Recharge	X	X			X	X									X	X	X	X	
Salinity Intrusion	X	X			X		X								X		X	X	
Everglades National Park Water Supply	X	X					X	X		X		X		X	X		X	X	X
Fish/Wildlife Preservation	X	X	X		X		X								X	X	X	X	X
Navigation	X	X					X		X										X
Water Supply	X	X					X								X	X	X	X	X
Environmental Protection/ Restoration											X	X	X	X	X	X	X	X	X
Recreation	X				X		X								X		X	X	X
Irrigation							X								X		X		X
Hydrologic Ecosystem Model											X								

PL 80-858 - Flood Control Act of 1948
PL 83-780 - Flood Control Act of 1954
PL 85-500 - Flood Control Act of 1958
PL 86-645 - Flood Control Act of 1960
PL 87-874 - Flood Control Act of 1962
PL 89-298 - Flood Control Act of 1965
PL 90-483 - Flood Control Act of 1968
PL 91-282 - River Basin Monetary Authorization and Miscellaneous Civil Works Amendments Act of 1970
HD 91-394 - Central and Southern Florida Small-Boat Navigation (Authorized under Section 201 of the Flood Control Act of 1965)
PL 98-181 - Supplemental Appropriations Act, 1984
PL 100-676 - Water Resources Development Act of 1988
PL 101-229 - Everglades National Park Protection and Expansion Act of 1989
PL 102-580 - Water Resources Development Act of 1992 modifications to the project.
PL 104-303 – Water Resources Development Act of 1996.
PL 106-541-Water Resources Development Act of 2000
PL 110-114 Water Resources Development Act of 2007
PL 113-121 Water Resources Reform and Development Act of 2014
PL 114-322 Water Resources Development Act of 2016 as part of the Water Infrastructure Improvements for the Nation Act of 2016
PL 115-270 Water Resources Development Act of 2018 - America's Water Infrastructure Act

2 REVIEW OF CHANGED CONDITIONS

A large extent of Florida is facing extraordinary changes which are challenging the original project purposes of the authorized C&SF project. The main drivers of change can be largely grouped into categories of population growth, increased development of land, temperature increase, and sea level rise trends. A roughly tenfold increase in the study area population and change in land use over time has significantly changed the demand for C&SF project benefits. The C&SF project was to provide flood protection for urban and agricultural areas, water supply for agricultural, municipal, industrial, and Everglades National Park (ENP) uses, and prevent saltwater intrusion risks to the coastal water supply. These changes directly negatively affect the intended purposes of the C&SF project, as listed below:

- Population growth – water supply
- Increased development of land – flood risk reduction
- Extreme Weather – water supply and flood risk reduction
- Sea level change – flood risk reduction, water supply, prevention of salinity intrusion, ecosystem restoration, preservation and protection

2.1 POPULATION GROWTH

Impact to the originally authorized C&SF project purposes: Water supply (both needs and location of the water supply) is most greatly impacted by this change.

The C&SF Project encompasses either all or part of roughly 18 counties in the state of Florida. Counties within the study area grouped by physiographic sub region are as follows:

- Lower East Coast - (Palm Beach, Broward, Miami-Dade)
- Florida Keys - (Monroe)
- Big Cypress - (Collier, Hendry)
- Caloosahatchee - (Lee, Glades, Charlotte)
- Upper East Coast - (Martin, St. Lucie)
- Kissimmee - (Highlands, Okeechobee, Osceola, Polk, Orange)
- Upper St Johns River Basin - (Brevard, Indian River)

Since the project was authorized, the population of these counties has changed significantly over time. C&SF was designed based on projected population growth of 2 million in the Lower East Coast (Palm Beach, Broward and Miami-Dade Counties) by 2000 (Reference 1951 C&SF Project Partial Definite Report Part I). The actual population in the Lower East Coast in 2000 was approximately 5 million. Analysis of the data below suggest that the C&SF study

area population is growing and spreading far beyond what was originally anticipated during the early authorization of C&SF over 70 years ago.

The total population of the study area increased at a combined annual growth rate (CAGR) of 3.2% per year from 1.1 million in 1950 to over 9.2 million as of 2017. According to University of Florida Bureau of Economic and Business Research (UF BEBR) projections, the study area population is anticipated to grow to nearly 12.5 million over the next 30 years (**Figure 1**). Reference the Graphic Executive Summary Page 2, Quadrant 1, for the visual illustration on the spatial distribution associated **Figure 2** and **Table 2**, below.

Figure 1. Total Population of C&SF Project Area

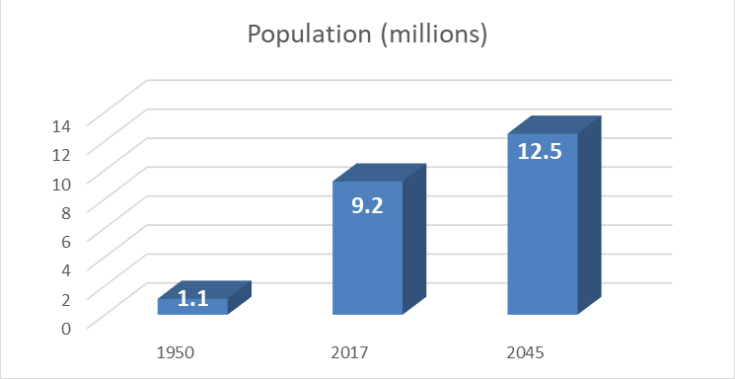


Table 2. Total Population of the C&SF Project Area (Past, Present, & Projected)*

	Year	Low	Medium	High
Population of the counties in the C&SF Project.	1950		1,080,591	
	1970		2,941,450	
	1990		5,750,815	
	2000		7,229,399	
	2017		9,183,296	
	2020		9,609,562	
	2025	9,473,669	10,284,211	11,124,561
	2030	9,719,281	10,866,238	12,093,551
	2035	9,892,728	11,384,254	13,017,630
	2040	10,010,113	11,851,249	13,926,632
[1]	2045	10,068,735	12,280,936	14,823,260

1. SFWMD shares calculated with 2010 census block results, based on the % of the County areas within the C&SF Project. 100% of population from Indian River and Brevard counties were included.
2. 1950 data source: 1950 census of population preliminary counts, U.S. Department of Commerce (SFWMD shares not applied).
3. 1970 data source: Revised estimates of Florida Population by County, ISSN 0071-6030, Census April 1, 1970.
4. 1990 data source: BEBR report: Revised annual population estimates by county in Florida, 1980 - 1990, with components of growth.
5. 2000 data source: BEBR report: Revised annual population estimates by county in Florida, 2000 - 2010, with components of growth.
6. 2017 data sources: BEBR report (January 2018): Projections of Florida population by county, 2020 - 2045, with estimates for 2017
7. 2020-2045 data sources: BEBR report (April 2017): Projections of Florida population by county, 2020 - 2045, with estimates for 2016

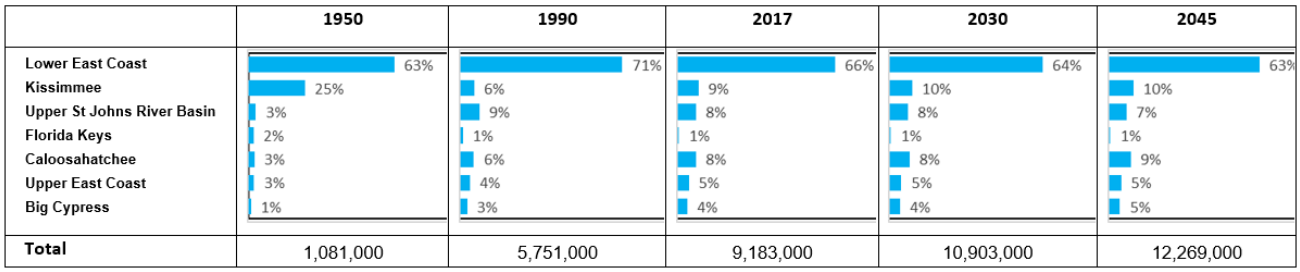
Table 3 provides detail on the current distribution of study area population by county and physiographic sub-region. **Figure 2** provides detail on the past, present and projected population distribution by sub-region.

Table 3. Distribution of Study Area Population

Sub Region	County	2017 Population*	Percentage
Lower East Coast	Broward	1,873,970	20.4%
	Palm Beach	1,414,144	15.4%
	Miami-Dade	2,743,095	29.9%
Kissimmee	Okeechobee	40,075	0.4%
	Orange	368,943	4.0%
	Osceola	335,898	3.7%
	Highlands	8,847	0.1%
	Polk	37,057	0.4%
Upper St Johns River Basin	Indian River	148,962	1.6%
	Brevard	575,211	6.3%
Florida Keys	Monroe	76,889	0.8%
Caloosahatchee	Glades	13,087	0.1%
	Charlotte	1,467	0.0%
	Lee	698,468	7.6%
Upper East Coast	Martin	153,022	1.7%
	St. Lucie	297,634	3.2%
Big Cypress	Hendry	39,057	0.4%
	Collier	357,470	3.9%

*Estimates taken from BEBR 2017 publication. The population for SFWMD are adjusted for SFWMD share (ref).

Figure 2. Distribution of Population over Time by Sub-region.



The two most populous sub-regions (Lower East Coast and Kissimmee) accounted for 88% of the population at the beginning of the project fell to around 75% based on current estimates (2017). The remaining five sub-regions which accounted for 12% of the study area population grew to around 25% based on 2017 US Census and UF BEBR population estimates. Population has increased far beyond what C&SF was designed for and will continue to put a strain on how much water supply will be needed as well as where the water needs will be required.

2.2 INCREASED DEVELOPMENT OF LAND

Impact to the originally authorized C&SF project purposes: Flood risk reduction is most greatly impacted by this change.

In addition to population changes, demand for project outputs for agricultural relative to urban uses is also changing in South Florida, leading to less value placed on land for agricultural use and more value placed on land for development.

As development continues, areas that once provided natural cover for absorption and larger runoff of storm flows is now being replaced by hard surfaces, with large populations in very close proximity. This has had the dramatic effect of flooding in relatively small storm events, and even days after storm events (sometimes known as sunny-day flooding).

Between the mid-1990s, and 2012, agriculture yields have shown a significant decline. **Figure 3** and **Figure 4** provides illustrations of the magnitude of change in land use development for urban use over time.

These problems of flooding are also echoed in the letter submitted by four south Florida counties and adjacent vicinities, where the residents who live in the communities and the shared environment have begun to experience real damages in their infrastructure, economic and environmental arenas.

Figure 3. Changes in land use from rural land to highly developed over the past 70 years.

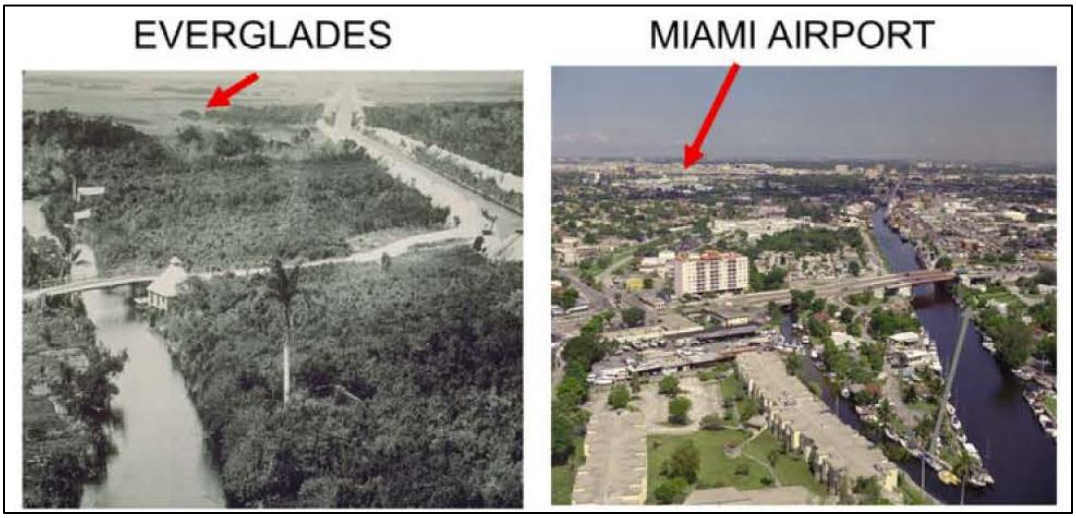
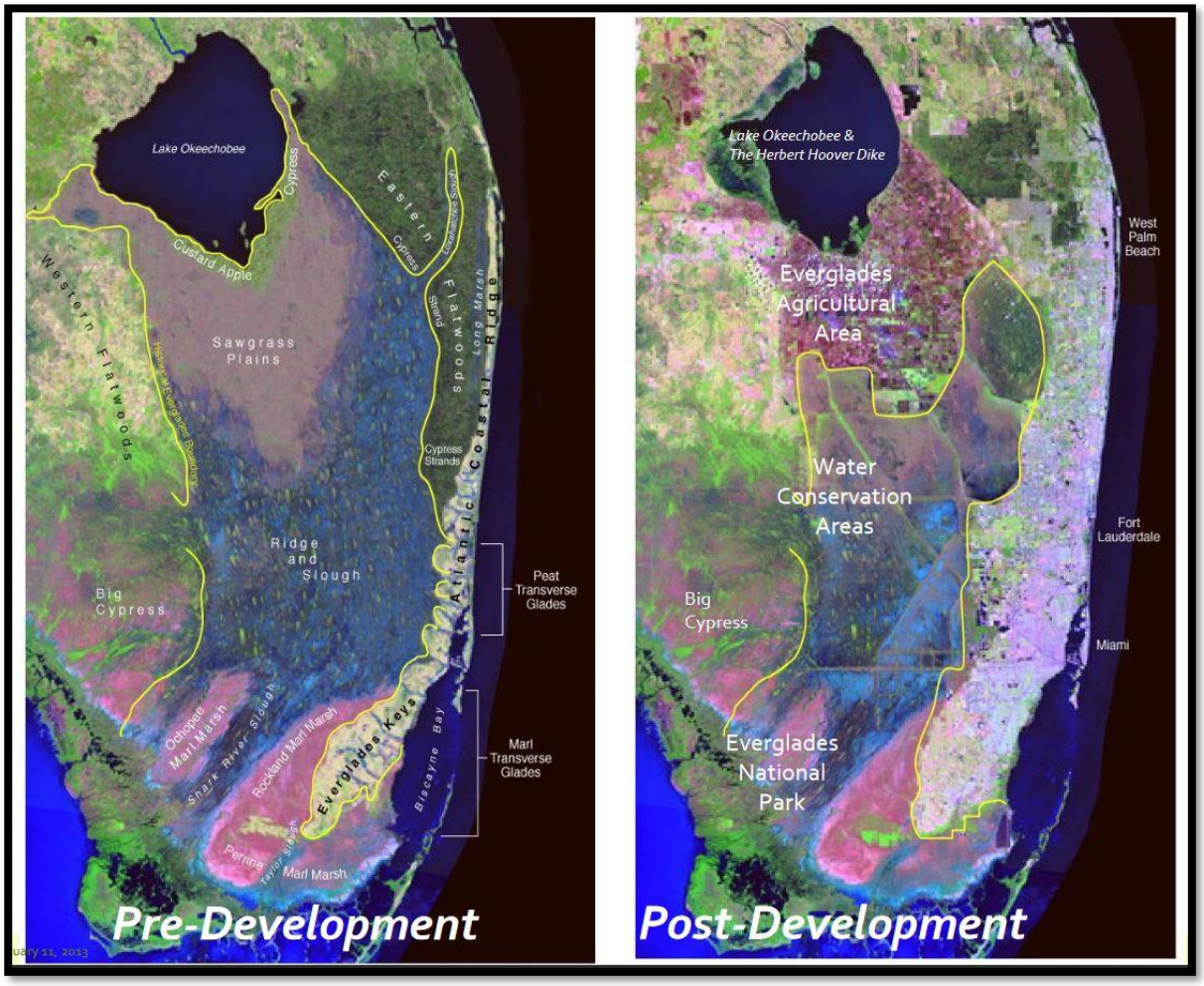


Figure 4: Changes in land use in the C&SF project area showing South Florida development and reduction of undeveloped areas for storm runoff storage, which can increase local flood risks.



Pre-drainage Everglades 1850 satellite image simulation McVoy (2011)

1994 satellite image McVoy (2011)

2.3 CLIMATE-RELATED HYDROLOGIC CHANGES

Impact to the originally authorized C&SF project purposes: Water supply and flood risk reduction are most greatly impacted by this change.

Extreme weather is becoming more prevalent due to rising temperatures, leading to longer periods of drought and more intense periods of rainfall. This means that there will need to be more of a focus on adequate water supply during times of drought, as well as capturing intense rainfall for future water supply and to reduce immediate flooding.

A series of extreme rainfall occurrences have been documented in the recent past in South Florida, as exemplified in Figure 5, showing rainfall driven flooding events in North Miami, Loxahatchee and Wellington areas, and the major storm event that closed the Sawgrass Mall in Sunrise, for 3 days in June 2017.

Figure 5. Rainfall Driven Flooding Occurrences in South Florida

USACE now requires consideration of potential climate-related changes in historic hydrologic patterns. That includes, but is not limited to, changes in the frequency, intensity, duration and seasonal timing of rainfall, and related impacts on required water management, water storage and flood damage reduction systems.

ECB 2018-14 *Guidance for Incorporating Climate Change Impacts to Inland Hydrology in Civil Works Studies, Designs, and Projects, 10 Sep 2018 requires* consideration of both past (observed) changes as well as potential future (projected) changes to relevant hydrologic

inputs as part of a first-order statistical analysis of the potential impacts to particular hydrologic elements of the study. This analysis can be very useful in considering future without project conditions (FWOP) and the potential direction of climate change.

2.4 SEA LEVEL CHANGE

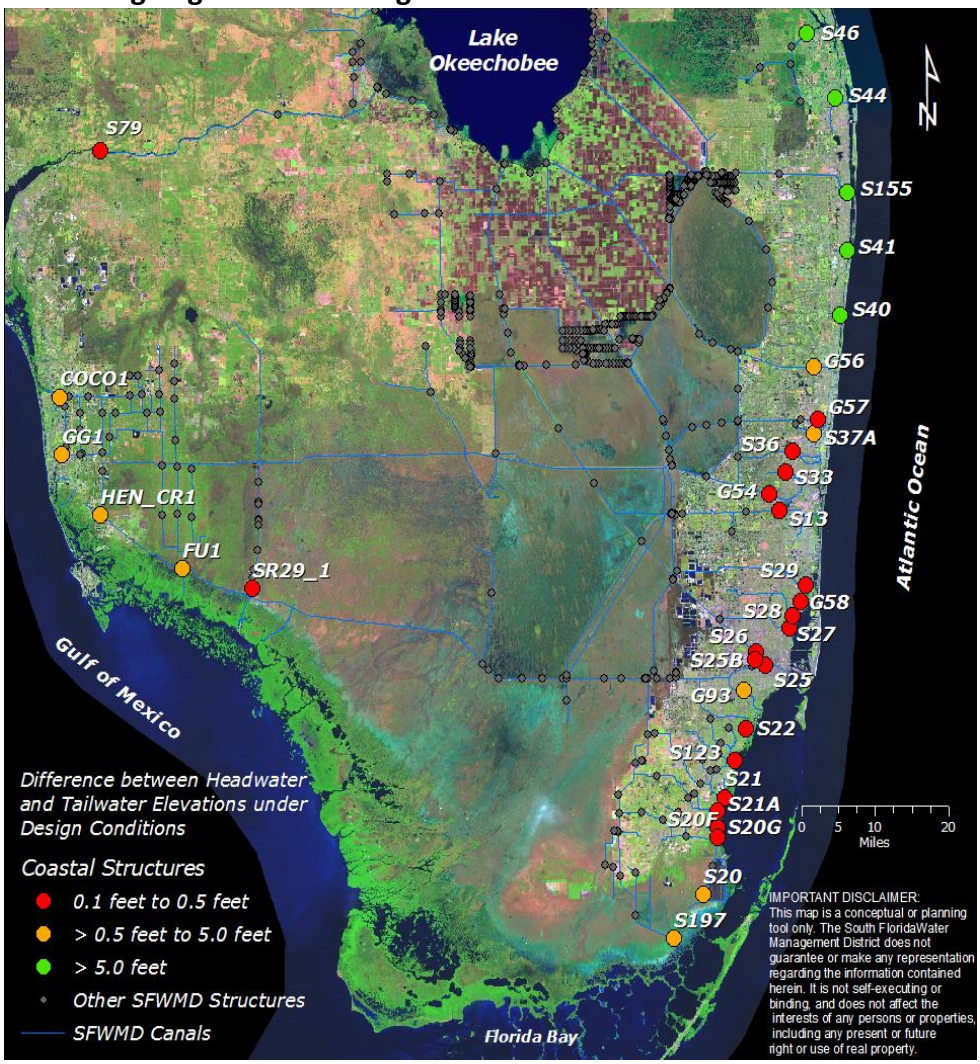
Impact to the originally authorized C&SF project purposes: Flood risk reduction, water supply, prevention of salinity intrusion, and the ecosystem are most greatly impacted by this change.

Sea level rise plays a significant role in the future of Florida's shared environment – perhaps the most significant of all the drivers discussed to this point. USACE policy recommends analyzing sea level trends using three curves – a low (baseline, based on historical trends), medium, and high. Data from the Sea Level Rise Update for SFWMD Board, 12 Apr 2018 shows that trends have been on the order of tracking the high level curve, on the order of 2-3 feet in the next 50 years, and as much as 15 feet in the next 100 years. Sea level rise is influenced by temperature increases, on the order of 15 feet for every 2 degrees of Celsius increase. As sea level increases, especially on the order mentioned above, not only is coastal infrastructure at risk, but also water supply features, inland flooding, salt water intrusion, and in general the entire shared environment (human, ecosystem, and economic) in which we all live.

As noted earlier, the C&SF Project began with the Congressional authorization of 1948. Early C&SF Project design and construction documents did not address potential future sea level change. Most flood damage reduction measures for coastal areas relied on canals and structures designed for gravity drainage to tide, and general guidelines were for these canals and structures to provide design flood discharge flows with the canal stage at either +6 inches or +9 inches above the local Mean High Water (MHW) (i.e,. average high tide) elevation. These canal stages and tide elevations may have been developed, in part, after consideration of pre-existing locally developed flood drainage canal systems and local land development practices. Unfortunately, the relatively small difference between design flood discharge canal stages and average high tide elevations make the flood drainage system performance, and related community developments vulnerable to the unrecognized risk of slowly rising sea levels. **Figure 6** shows a SFWMD map of their many, mostly C&SF Project built, gravity discharge water management structures whose flood discharge performance is being negatively impacted by ongoing sea level change. In most cases, current MHW elevations are around +6 inches or more above original design conditions. The map shown in Figure 6 does not represent, necessarily, the most critical structures that will be prioritized in the proposed Study's phased approach. The selection of the most critical project features to be included at

the study will be defined based on an overall assessment of the entire C&SF system and the recommendation of areas for further evaluation, during the scoping stage, in coordination with South Florida Management District, non-federal project sponsor.

Figure 6. SFWMD coastal water management structures which are losing discharge flow capacity due to ongoing sea level change.



Note: Some of the earliest C&SF design documents were prepared with reference to the Mean Sea Level datum, a national survey datum which preceded the National Geodetic Vertical Datum of 1929 which may not have been widely implemented until some years after the Great Depression and World War II. Appropriate adjustments will be needed to convert historic elevations into the North Atlantic Vertical Datum of 1988 (NAVD88) which is the required datum for all USACE SLC-related studies.)

The Central and Southern Florida Project Comprehensive Review Study dated April 1999, aka the Comprehensive Everglades Restoration Plan (CERP), did consider potential future sea level change in accordance with then current national guidance from EPA. Based on this guidance and discussions with higher authorities, it was determined that future sea level rise of more than +6 inches by 2050 was very unlikely. Subsequently, a future scenario with +6 inches of SLC by 2050 was modeled as discussed in CERP, Appendix B, pages B-77 to B-78, and also in other areas of the report. Some of the major findings presented in CERP, Appendix B include:

- *For the Lower East Coast, water use cutbacks increased significantly with sea level rise, particularly in LECSA1 and LECSA2* (Lower East Coast Service Areas 1&2) *where the number of months of cutbacks more than doubled.*
- *Water supply deliveries increased significantly in order to maintain canals* (in these areas) *at higher stages.*
- *Mean groundwater levels and peak stages were increased in the Lower East Coast flood protection area indicating a potential increase in flood risk with sea level rise.*

USACE Engineering Regulation (ER) 1100-2-8162, *Incorporating Sea Level Change in Civil Works Programs,* dated 31 Dec 2013, now requires all USACE Civil Works projects to consider potential impacts across the project life cycle for the entire range of possible future rates of SLC identified in this guidance. These SLC scenarios represent potential low (historic), intermediate and high rates of future SLC based on local historic rates of SLC and two alternative future rates based on National Research Council guidance. USACE guidance also requires that historic rates of SLC be determined based on a continuous 40-year or longer tide data record from a NOAA tide station or other approved tide stations. **Figure 7** below shows the NOAA tide stations around Florida which have a 40-year period of record and are accepted for use in developing USACE SLC scenarios. A quick review of the tide station data and USACE SLC projections for this group of tide stations indicate future ranges of SLC are generally similar all-around Florida.

For this report SLC scenarios for Key West, FL will be considered roughly representative of SLC scenarios all around Florida. **Table 4** below presents numeric values for USACE (2013) and NOAA (2012) sea level change scenarios for South Florida through 2100 and beyond. **Figure 8** provides the USACE and NOAA SLC curves developed from the data in Table 4. **Figure 9** and **Figure 10** present USACE SLC curves for Key West plus 19-year and 5-year midpoint moving averages for the tide data. These moving averages show the multi-decadal variations in SLC which is believed linked to variations in ocean dynamics. **Figure 9** shows 30 years of tide data, and the 5-year midpoint moving average seems to suggest a potential significant future increase in local long-term SLC rates. **Figure 10** shows the tide data full period of record which reveals that short term increases in SLC have happened in the past without necessarily producing a sharp increase in long-term SLC trends (See Appendix C for additional Sea Level Change Graphs in Florida).

Figure 7. NOAA tide stations around Florida. Compliant stations have a continuous 40-year or longer data record for use in calculating USACE and NOAA sea level change projections.

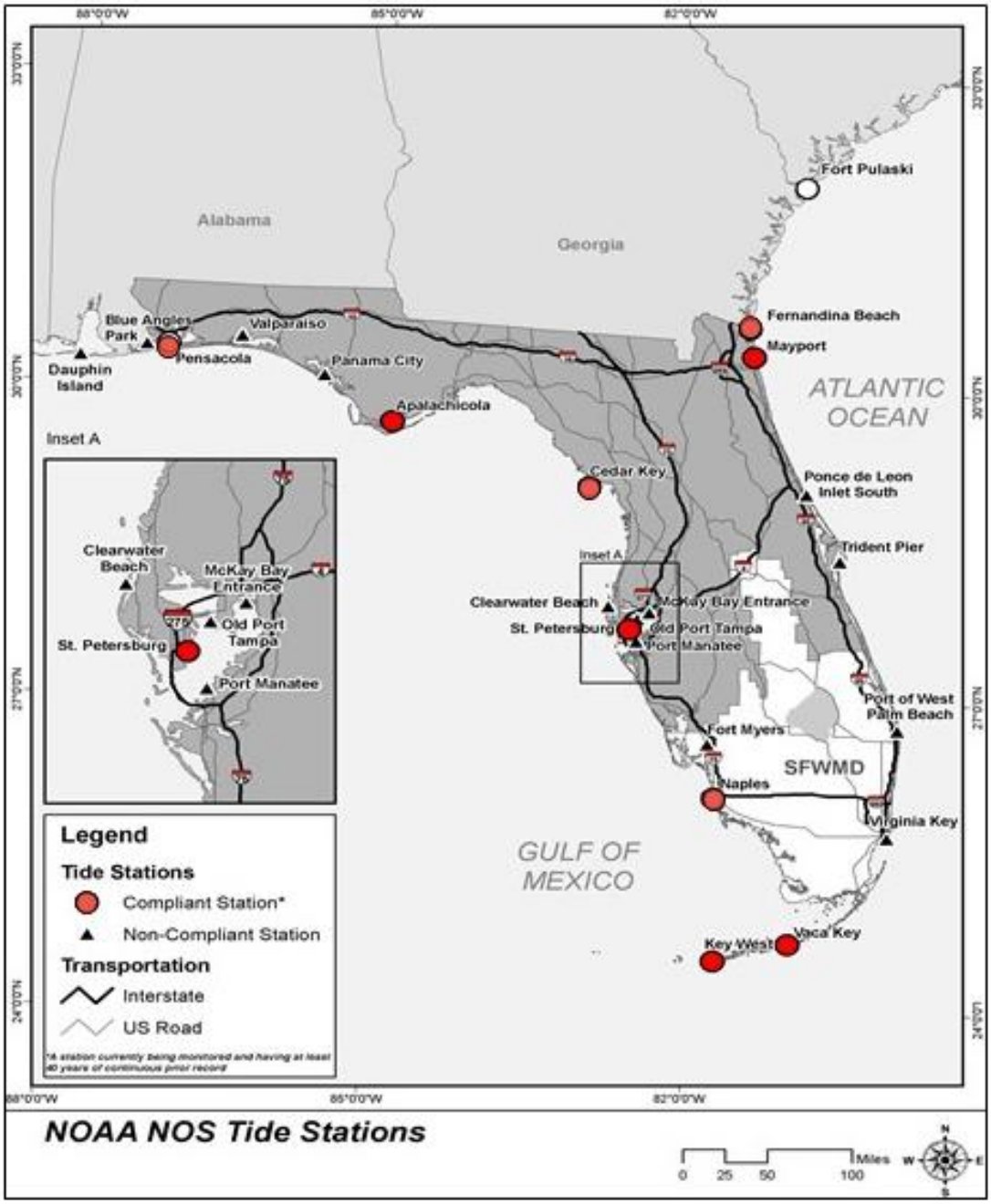


Table 4. USACE 2013 and NOAA 2012 Sea Level Change Scenarios for Key West, FL. USACE guidance does not currently address SLC projections far beyond 2100.

Year	USACE Low	USACE Intermediate		USACE High	
	NOAA Low	NOAA Inter. Low	NOAA Inter. High		NOAA High
1992	0.00	0.00	0.00	0.00	0.00
2000	0.06	0.06	0.08	0.08	0.09
2010	0.13	0.16	0.23	0.25	0.3
2020	0.21	0.28	0.43	0.5	0.61
2030	0.28	0.41	0.69	0.82	1.02
2040	0.35	0.56	1.01	1.21	1.53
2050	0.43	0.73	1.39	1.67	2.15
2060	0.5	0.91	1.82	2.21	2.86
2070	0.57	1.11	2.31	2.83	3.68
2080	0.65	1.34	2.86	3.52	4.6
2090	0.72	1.57	3.47	4.28	5.63
2100	0.79	1.83	4.13	5.12	6.75
2110	0.87	2.11	4.85	6.03	7.98
2120	0.94	2.4	5.62	7.02	9.31
2130	1.01	2.71	6.46	8.07	10.74
2140	1.09	3.04	7.35	9.21	12.28
2150	1.16	3.38	8.3	10.42	13.91
2160	1.24	3.74	9.3	11.7	15.65
2170	1.31	4.13	10.36	13.05	17.49
2180	1.38	4.52	11.48	14.49	19.44
2190	1.46	4.94	12.66	15.99	21.48
2200	1.53	5.38	13.89	17.57	23.63

Saltwater intrusion from three feet of SLR will force closure of many water supply wells in South Florida.

Figure 8. USACE 2013 and NOAA 2012 SLC curves.

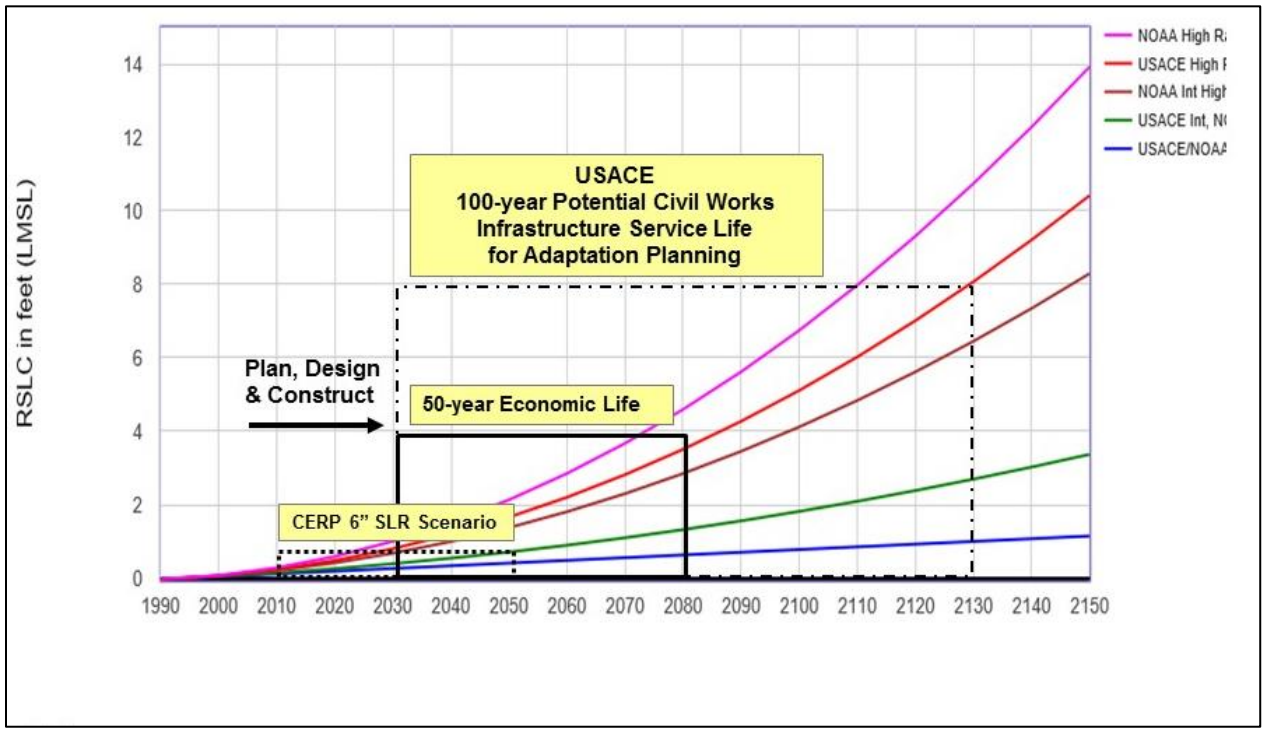


Figure 9. USACE SLC curves for Key West over 105 years from January 1913 to June 2018.

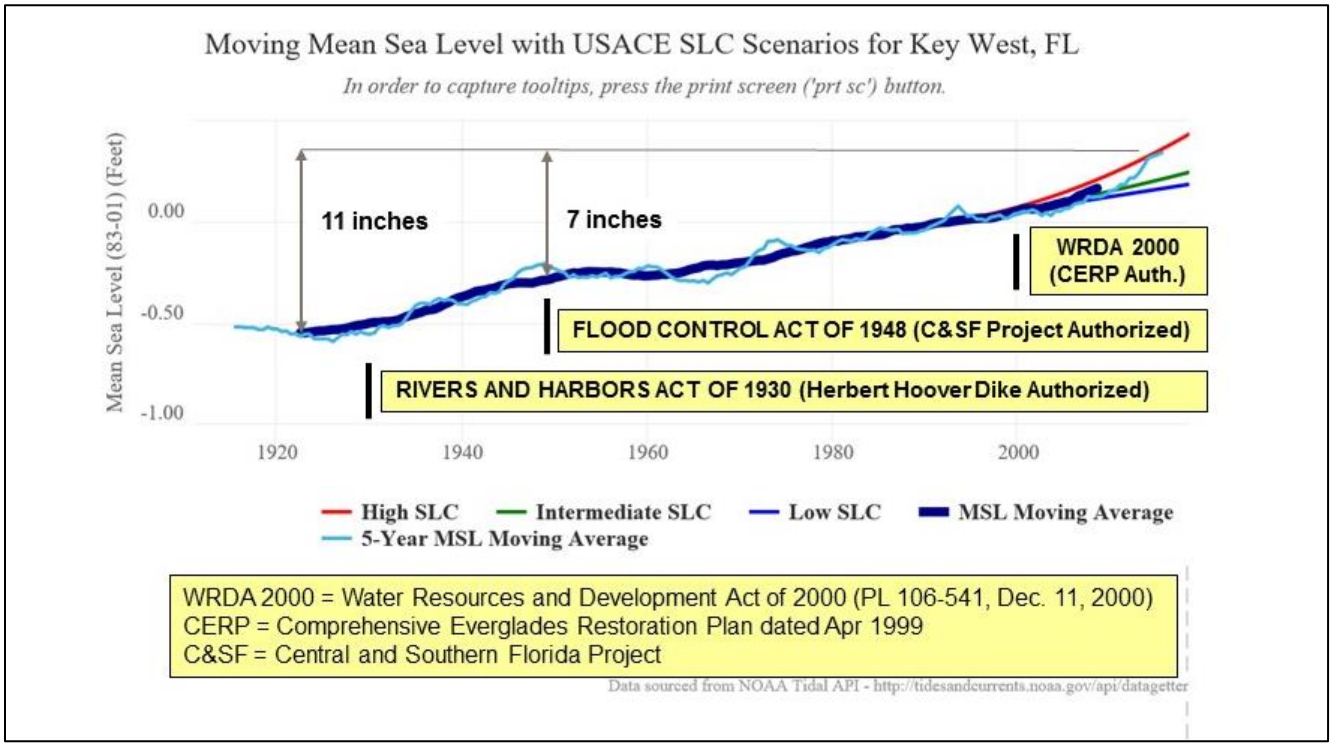
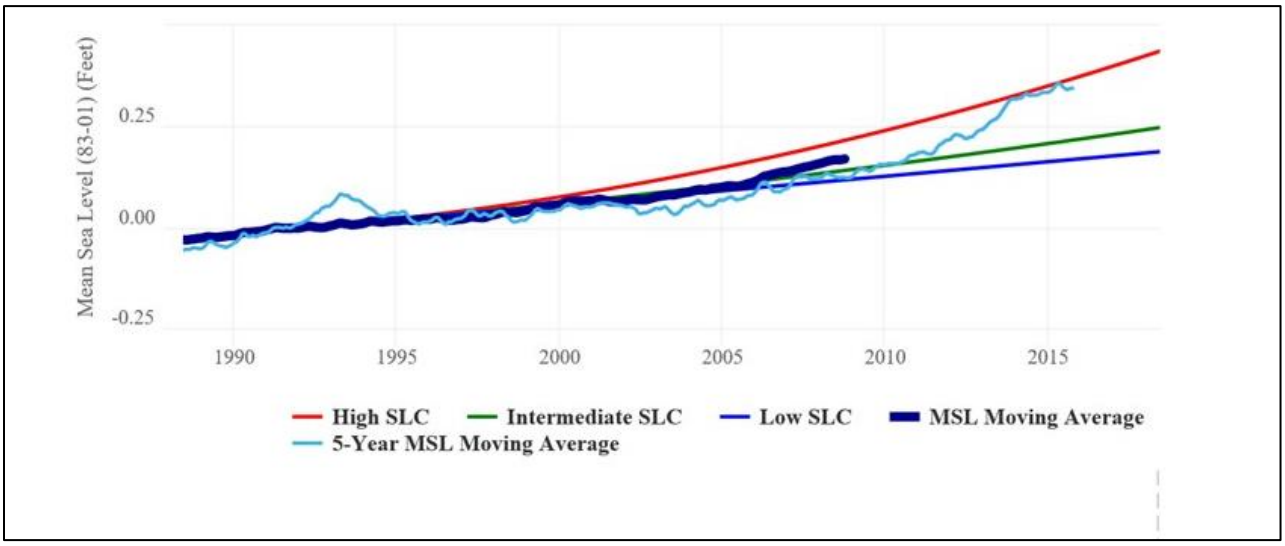
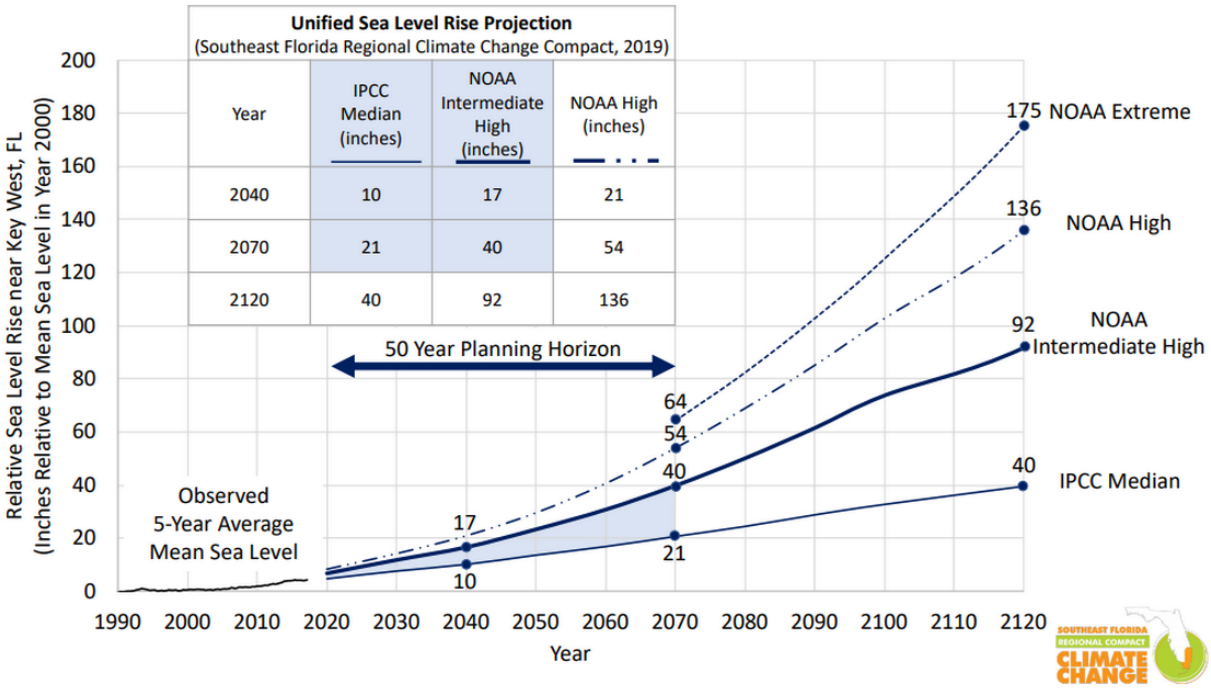


Figure 10. USACE SLC curves for Key West over 30 years from June 1988 to June 2018.



In addition, a Regionally Unified Sea Level Rise Projection has been produced every 4 years, since 2011, by the Southeast Florida Regional Climate Compact to aid in understanding of vulnerabilities and to provide a basis for adaptation strategies, policies, and infrastructure design in the Southeast Florida region. **Figure 11** shows the Compact's 2019 Unified Sea Level Rise Projection.

Figure 11. Southeast Florida Regional Climate Compact's 2019 Unified Sea Level Rise Projection



For long-term planning, sea level change is forecast to accelerate in coming decades and to continue well past 2100, and very likely well past 2200. Table 4 provides NOAA and USACE SLC scenarios to 2200 even though USACE guidance does not (yet) address SLC scenarios far beyond 2100. This is an area of great interest for current global research.

For current knowledge on the potential amount of multi-generational sea level change (but not the future rate of very long-term SLC) which may result from ongoing global warming trends, readers may consider the paper by Levermann A, Clark P, Marzeion B, et al (2013), *The multi-millennial sea-level commitment of global warming* as published in the Proceedings of the National Academy of Sciences (doi:10.1073/pnas.1219414110). It indicates that for each +1 degree Celsius increase in average global temperatures, global sea levels may be expected to rise about +2.3 meters (about +8.0 feet) over a time frame that will span multiple human generations.

Current global efforts seek to limit the ongoing increase in average global temperatures to +2.0 degrees Celsius or less by 2100, but there is a risk that global temperatures may exceed that target. From a risk management perspective, it may be wise for Florida's planners to consider lands up to 16-20 feet or more above current MSL as potential long-term SLC adaptation action areas, and to develop regional watershed or statewide strategies that will provide infrastructure and incentives to strongly encourage most future new development to voluntarily locate in lower-risk inland areas.

Just a few feet of sea level rise has the potential to cause drastic and prolonged effects, shown in the case study of what 1.0 meter (3.28 feet) of sea level rise would look like in Hollywood, Florida shown in **Figure 12**.

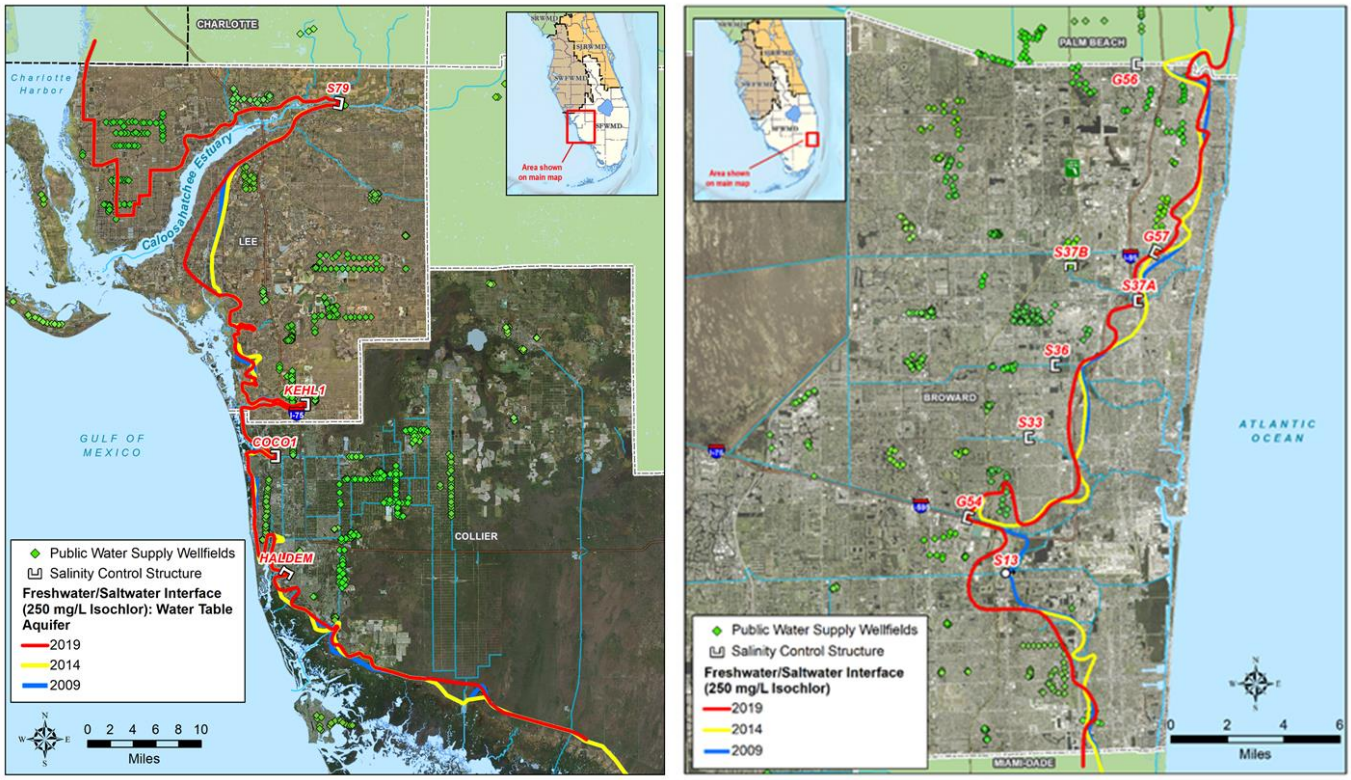
Figure 12: Effect of 3.28 feet (1 meter) of sea level rise in Hollywood Florida.

Among observed impacts in the region, a series of high tide flooding events have been documented, as illustrated by **Figure 13** showing "Sunny Day Flooding" occurrences in Miami Beach, Pompano Beach, Delray Beach and Lantana. These events are projected to increase in frequency as a result of sea level rise.

Figure 13. High Tide Flooding Occurrances in South Florida

Another observed impact is the acceleration of saltwater intrusion in highly porous Biscayne Aquifer, which is the region's major source of drinking water. As illustrated in **Figure 14**, inland movement of the saltwater intrusion has been observed in the past years in both East and West Coasts in South Florida. In the past years, a total of 26 wellfields were relocated inland as a result of saltwater intrusion vulnerability. SFWMD is actively monitoring and mapping the location of the Saltwater interface on a five-year cycle, to identify movement, and therefore risk to water supply.

Figure 14. Movement of the Saltwater Interface in the East and West Coasts of South Florida



3 FEDERAL INTEREST

Based upon the discussion in this initial appraisal report concerning significant changes which affect the C&SF project purposes, there is Federal interest in proceeding to the feasibility phase of this study to further analyze and evaluate improvements to the C&SF project.

4 RECOMMENDATIONS

4.1 RISK AND UNCERTAINTY

Risk may be thought of as the probability of an event times the consequences of the event. It is clear that the long-term consequences of ongoing sea level change and other related change, plus inappropriate development, could be very costly, even catastrophic, for people, buildings and communities unless they take actions in advance to reduce potential damages.

It is uncertain when and how fast local sea levels and other extreme weather conditions in Florida may change in the coming years. Ongoing regional scale sea level change has begun accelerating significantly in the past two decades, and there is a risk that the rate of change could accelerate more in the future. Risk management actions are needed to (1) minimize potential impacts in existing natural and developed areas, and to (2) concurrently plan and implement new infrastructure and encourage developments that will increase Florida's climate preparedness and resilience.

4.2 PROPOSED PATH FORWARD

The most cost-effective way for Florida to build resilience to anticipated future climate-related changes, and to sustain economic prosperity, is to develop a long-term vision and strategic plan to encourage most future growth in areas that are sustainable through 2200. In simple terms, the strategic plan will encourage new growth to locate in low risk areas and support efforts for gradual transition of existing high-risk coastal developments to lower-risk areas. To help with this process, it is proposed that the USACE and local cost-sharing partners, undertake the following three efforts:

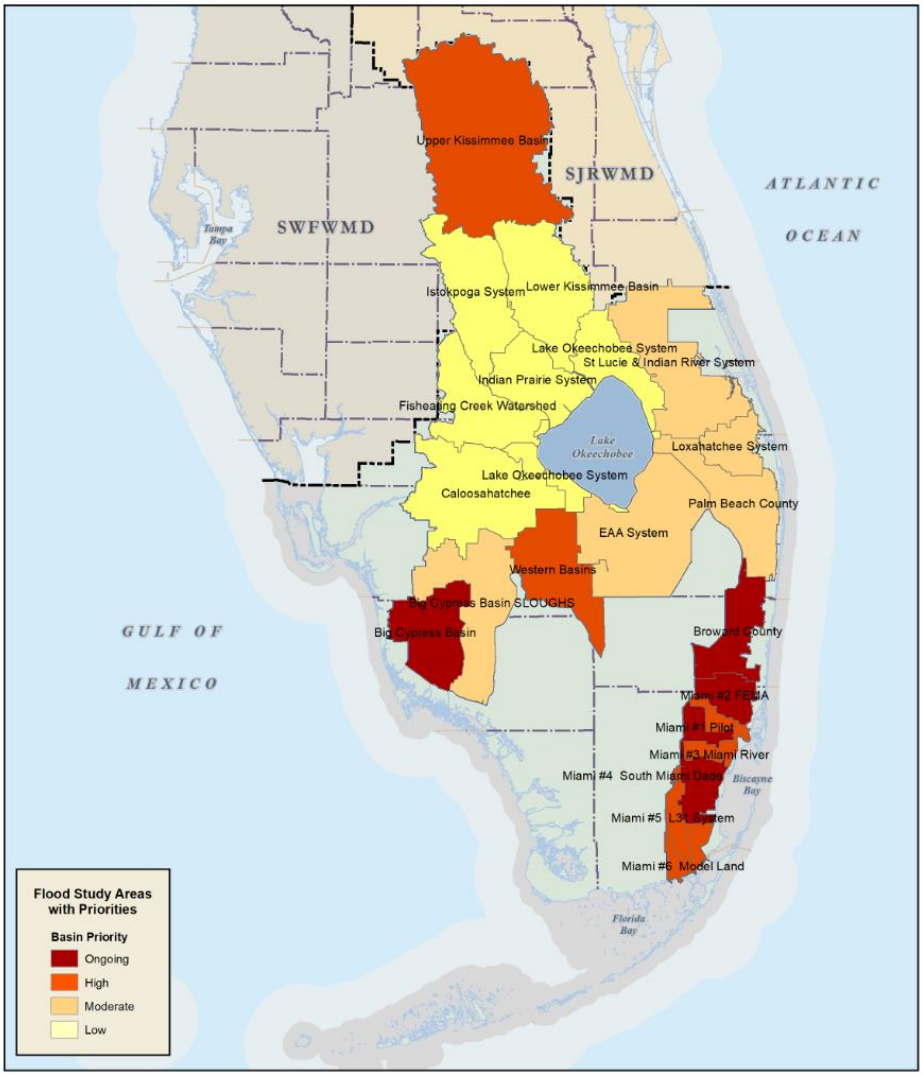
(1) In FY20, continue to develop **enhanced C&SF project water management models**, plus other tools, data and alternative operating rules for sea level change up to +3 feet above the 1992 datum used for NAVD88 elevations. Existing CERP and C&SF authorities and funding could support these efforts. This is work that is already needed to prepare for a CERP Modification Study[1] to address changing future conditions as required by the CERP Programmatic Regulations. The same model development work and related efforts would be required to conduct a C&SF project update study, so this effort could help accelerate those proposed future efforts.

Since 2015, South Florida Water Management District, the C&SF Project non-federal sponsor, has been implementing the Flood Protection Level of Service Program (FPLOS) to develop enhanced water management modelling tools to evaluate the C&SF operations, under changed current and future conditions, to assess alternative mitigation selections, and to anticipate impacts of changed

[1]The need for a CERP Modification Study might be eliminated by a decision to conduct a larger Section 216 C&SF project update study. Selected CERP projects could continue to be implemented and considered as part of existing conditions for future studies much like the CERP plan formulation efforts considered the then ongoing C-111 and MWD projects as part of existing future conditions. A decision to proceed with this work would require support from the SFWMD which is the existing cost-sharing partner for the C&SF and CERP projects.

conditions in selected basins. The mission of the FPLOS program is to identify and prioritize long-term infrastructure improvement needs, and to develop an implementation strategy to assure that each basin can maintain and improve its designated FPLOS. The SFWMD is implementing the FPLOS program at a regional and local scale, according to a prioritization of basins to study (**Figure 15**), a methodology and suite of tools for evaluating structures and canals in selected watersheds, and a framework for establishing the level of service. The FPLOS effort has already identified C&SF structures in Miami Dade County that no longer provide the same level of service and exhibit real urgency for adaptation.

Figure 15: Basin Priorities for Flood Protection Level of Service in SFWMD



In addition, the Southeast Florida Regional Climate Change Compact's Counties have been investing in technical assessment of vulnerabilities and resilience needs, under current and future changed conditions, and the evaluation of local and regional mitigation and adaptation strategies and their dependency on the performance of the C&SF system (Appendix D). Therefore, the proposed C&SF Project Flood Resiliency Study will be informing both County's and SFMWD's efforts and, at the same time, be provided with robust technical analyses being advanced in the project area.

(2) In FY21, initiate a **Section 216 C&SF Project Update Study** under the existing authority of the Flood Control Act of 1970. This 4-year study would identify recommended modifications that would allow the C&SF Project to continue to provide project benefits where possible for future conditions with sea level change up +3 feet above 1992 datum elevations. Sea levels in South Florida are currently about +6 inches above the 1992 datum elevations and NOAA tide station data show the rate of SLC is between current USACE intermediate and high rate SLC projections, so this study is expected to address flood damage reduction, water supply and related water resources concerns which could occur the coming 50 years (2020-2070) if the USACE high rate SLC scenario happens. Potential 50/50 cost-sharing partners would be the SFWMD and the SJRWMD. (Note. This SLC scenario is consistent with regionally coordinated efforts of south Florida counties already underway to further SLC adaptation planning.)

The Study would focus on the project features which can reduce the most immediate risk to changing conditions, and the resilience aspects of such infrastructure in terms of flood vulnerabilities, based on an overall assessment of the entire C&SF system and the recommendation of areas for further evaluation. The results of the study should allow the immediate authorization of construction to update components that need immediate attention to provide the expected C&SF level of service and approve continuing investigations of the remaining structures.

(3) In FY21, if authorized, initiate **Regional Watershed Planning Studies** in each of the five Florida Water Management Districts CONCURRENT with the above Section 216 study. The purpose would be to develop coordinated statewide strategic plans to address future sea level change of +3 feet and more (based on the 2200 planning horizon and appropriate SLC scenarios). These studies are expected to develop a coordinated vision and framework for planning and policy decisions regarding major new infrastructure investments (water resources, transportation, and utility systems, etc.) for sustainable growth in Florida through 2200 much like early C&SF plans helped shape current South Florida

development. These studies would also identify public/private partnership opportunities to encourage long-term development and population shifts away from high risk coastal areas to lower risk inland locations. Potential 50/50 cost-sharing sponsor could be FDEP, potentially in partnership with FDOT.

4.3 SECTION 216 FEASIBILITY STUDY

This Section 216 Initial Appraisal Report determines there is Federal interest in further investigation of improvements to the C&SF project. Population, land use, hydrology and sea level change have been a significant driver of change with respect to the need for and Improvement of the C&SF project. A C&SF project update/feasibility study is recommended under the authority of Section 216 of the Flood Control Act of 1970 as amended.

It is proposed that the recommended **Section 216 C&SF Project Update Study** (feasibility study) consider improvements to the existing C&SF project which are economically justified to minimize saltwater intrusion into local water supply wells and help maintain C&SF project water supply and flood damage reduction drainage benefits while accommodating up to +3 feet of sea level change above 1992 datum levels, which is predicted to occur within the next 50 years or more. Target flood damage reduction levels of service are to be the same as year 2000 levels (canal stages and flood water removal capacity) agreed to for the CERP Interim Targets (where available), except that relocation assistance may be provided to willing sellers of properties within C&SF project service areas unavoidably impacted as sea level rises and groundwater/canal stages are raised to prevent saltwater intrusion into local water supply wells.

4.4 FLORIDA COORDINATED REGION AL WATERSHED STUDIES

This Section 216 Initial Appraisal Report also determines there is a Federal interest in working concurrently with the State of Florida through its Department of Environmental Protection (FDEP) and in cooperation with its five Water Management Districts (Reference Page 1 of the Graphic Executive Summary) on five **Coordinated Regional Watershed Planning Studies**. The purpose would be to develop a multi-generational Adaptive Risk Management (ARM) Strategy for Florida as a framework for long range interagency coordination and planning of cost-effective adaptation actions to address future sea level changes of +3 feet to +10 feet or more (as appropriate for a planning horizon of 2200). It is expected that the Florida ARM Strategy will recommend future local, state, tribal and Federal government policies, infrastructure investments, private investment incentives, and public/private partnership opportunities that could strongly encourage voluntary and cost-effective adaptation to greatly increase Florida's climate preparedness and resilience. The ARM Strategy is also expected to gradually and substantially reduce future economic risks to the National Flood Insurance Program and other taxpayer funded programs which already are, or will be, negatively impacted by ongoing sea level change and other related impacts.

APPENDIX A
AUTHORIZATIONS

APPENDIX A - AUTHORIZATIONS
INITIAL APPRAISAL

In 1948, the Department of the Army submitted to Congress the *Comprehensive Report on Central and Southern Florida for Flood Control and Other Purposes*. This Comprehensive Plan was published by Congress in House Document 80-643. In the Comprehensive Report, Chief of Engineers General R.A. Wheeler wrote,

> "*The district engineer has prepared a comprehensive plan of improvement for flood protection, water control, and allied purposes. Development of the comprehensive plan of improvement would afford a high degree of flood protection throughout the area; it would provide for removal of excess waters in wet seasons, and for their control, storage, and use in maintain water levels during dry periods. Adequate control of water levels is essential for agricultural use of lands in this area and for maintenance of municipal water supplies. The plan as whole and each of its major features are multiple-purpose in concept and design. Accordingly, each feature of the plan contributes to the realization of the primary benefits through flood protection, drainage, and control of water.*"

The C&SF Comprehensive Plan described how water stored in the Water Conservation Areas would provide water for use on the east coast agricultural lands, raise the groundwater table and improve water supply for the east coast communities, and ameliorate saltwater intrusion in the coastal water supply wellfields. Spillways and culverts were to be constructed in the Water Conservation Area levees to provide water to east coast areas for use during the dry season. Lake Okeechobee would serve as a multiple-use reservoir with flood control, navigation, and water-conservation functions. Lake Okeechobee was considered to be the heart of any plan for flood control and water conservation in South Florida. The benefits of the C&SF Comprehensive Plan for salinity control and municipal and industrial M&I water supply were described in House Document 80-643:

> *"66. Estimated benefits. – The flood protection and water control that would be afforded by the proposed improvements would result in large benefits from the prevention of flood damages and from increased or higher use of land throughout the area. In addition, the project would produce other substantial benefits from navigation, preservation of fish and wildlife, improved water supply, reduction of salt-water intrusion in coastal areas, and from improvement of sanitary conditions.*
> *(d) <u>Salinity Control</u>: It is recognized that control of salinity is one of the urgent problems to be met by the comprehensive plan of improvement. No attempt has been made to evaluate the extensive benefits claimed by local interests by virtue of excluding salt water from exiting canals and by maintaining higher ground-water tables, thereby*

restricting saltwater intrusion. This benefits are real and extensive as indicated by the proposed construction of a lock and dam for salinity control in Miami River by local interests at an estimated cost of $700,000; the continued drilling of Miami water-supply wells further inland from the east coast resulting in long expensive pipe lines; and the creation of water conservation areas by Dade, Broward, and Palm Beach Counties. Benefits due to prevention of damages due to salt-water intrusion in the Homestead-Perrine area are included under flood-control benefits.

(e) Water Supply: Establishment and operation of conservation areas would aid materially in recharging underground fresh-water reservoirs of the east-coast areas, thereby maintaining and improving present water supplies of cities and towns of that area. While this is a real benefit anticipated from the development, it has not yet been evaluated in monetary terms because of the extended and costly surveys which would be necessary to establish the full extent of this beneficial effect. In addition, the more complete control of Lake Okeechobee contemplated under the comprehensive plan makes it adaptable to future development as a water supply for east-coast cities in the event of large population increases."

The Flood Control Act of 1954 authorized the remainder of the C&SF Project proposed in House Document 80-643, and, in addition, established that the Chief of Engineers had the discretionary authority to modify the plan. The C&SF Project was expected to improve the water supply for domestic, industrial, and agricultural use throughout the project area. The Corps of Engineers concluded that from the standpoint of the project as a whole, these water supply benefits contributed to the increased land use benefits, which served as a basis for the local contribution. In order to obtain the full benefits of the Federal project, the local interests would also be required to provide a system of secondary works. The compelling reason for Federal participation in the C&SF Project was its function of reducing flood damages. The importance of drainage and water control and the resulting benefits from increased land use made it analogous to a project for reclamation of western lands.

House Document 186 described the role of water supply in the C&SF Project as follows:

"94. Water supply. – The Florida project will improve the water supply for domestic, industrial, and agricultural use throughout the project area. This feature was pointed out in the original project document [H.Doc 643]. Water supply for domestic and industrial use has in the past been a non-Federal responsibility, resting largely upon lower governmental levels such as municipalities.

95. The water supply value of the project was not evaluated in monetary terms in the House Document No. 643, on which authorization was based. At that time the effect of the project on domestic and industrial supply did not arise from providing direct withdrawal of water for those purposes. The water-supply values result incidentally

from maintenance of ground-water tables, recharge of ground waters, and abatement of salt-water intrusion accomplished by facilities provided under the project for other purposes. Such area wide effects and resulting benefits cannot be assigned with certainty to a specific beneficiary such as a city, town, or industry. From the standpoint of the project as a whole, these effects and improvement of agricultural water supply, contributed to the increased-land-use benefits which served as a basis for the total local contribution.

96. It is considered, therefore, that there should be no specific contribution for general improvement of water supply in the area, over and above the general local contribution to the project. In the event such features can be added to the project, or operating arrangements made, which would permit specific communities or industries to obtain rights to an assured water supply, those features or arrangements should be paid for by water users under separate agreements with the Federal Government and the local Flood-Control District."

House Document 85-186 stated that the water-supply values result incidentally from the maintenance of ground-water tables, the recharge of ground waters, and the abatement of salt-water intrusion accomplished by facilities provided under the project for other purposes. The Corps' authority under the 1948 Flood Control Act, and subsequent Acts, to make releases from the C&SF Project for M&I water supply is not an "incidental benefit" that might accrue from releases for other authorized purposes. Whether the releases are made for groundwater recharge, prevention of saltwater intrusion, or for M&I water supply is immaterial, as those purposes are interrelated in the multipurpose design and operation of the C&SF Project. The authorizing language, through the incorporated Comprehensive Plan published in House Document 80-643 made clear that M&I water supply was intended to be a project purpose. In the Hearings of the U.S. House Committee of Public Works on the Flood Control Act of 1968, the Florida Secretary of State Tom Adams testified that,

"The vital flood control project designed 20 years ago needs to be reengineered and updated to take full advantage of all water conservation aspects and provide maximum multipurpose benefits in a region that has more than quadrupled in population and tripled in industrial development during these two decades since the project was authorized. Modification of the project is essential to Florida because all the water that can be saved is needed."

In the Water Resources Development Act (WRDA) of 2000, the Comprehensive Everglades Restoration Plan (CERP) was approved as a framework for the modifications and operational changes to the Central and Southern Florida Project that are needed to restore, preserve, and protect the South Florida ecosystem while providing for other water-related needs of the region, including water supply and flood protection. The 22 June 1999 Chief's Report on

CERP discussed M&I Water supply. According to the Chief's Report,

> *"The C&SF Project, first authorized by the Congress in 1948, is a multipurpose project that provides flood control; water supply for municipal, industrial, and agricultural uses; prevention of salt water intrusion; water supply for Everglades National Park (ENP); and protection of fish and wildlife resources. Today, the C&SF Project is the backbone of south Florida's system of water management. It provides flood protection and supplies water to more than six million people and almost one million acres of agricultural lands. The Restudy reexamined the C&SF Project to determine the feasibility of modifying the project to restore the south Florida ecosystem and to provide for other water-related needs of the region. Specifically, as required by the authorizing legislation, the study investigated making structural and operational modifications to the C&SF Project for improving the quality of the environment and protecting natural resources; protecting water quality in the south Florida ecosystem; improving protection of the aquifer; improving the integrity, capability, and conservation of urban and agricultural water supplies; flood protection and improving other water-related purposes. For close to 50 years, the C&SF Project has performed its authorized functions well. However, the project also has had unintended adverse effects on the unique natural environment that constitutes the Everglades and Florida Bay ecosystems."*

APPENDIX B
LOCAL INTEREST

Figure 1: Statement of Need from Congressmen (Pt 1)

Congress of the United States
Washington, DC 20515

June 25, 2019

The Honorable R.D. James
Assistant Secretary of the Army—Civil Works
Department of the Army
108 Army Pentagon
Washington, D.C. 20310-0108

Dear Assistant Secretary James:

Following passage and signing into law of the *Additional Supplemental Appropriations for Disaster Relief Act, 2019*, Congress has now provided the U.S. Army Corps of Engineers (USACE) with $35 million in investigation funding and $740 million in construction funding for flood and storm damage reduction projects in states and territories impacted by hurricanes and typhoons in 2018, including Florida. As your office begins work with all three levels of the USACE to identify, evaluate, and take action on studies and projects eligible for this new supplemental disaster funding, I urge you to strongly consider funding a restudy of the aging flood control system created as a result of the Central and Southern Florida (C&SF) Project.

The C&SF Project was authorized by Congress in 1948 and has served as an invaluable contributor to the development and economic success of South Florida. The most recently completed restudy in 1999 served as a template for the Comprehensive Everglades Restoration Plan (CERP), with the goal of restoring the region's hydrological connectivity and ensuring the sustainability of South Florida's water resources for people and the environment. A new restudy of the C&SF Project is overdue to ensure the cost-effectiveness and resilience of the region's flood control system.

Specifically, a new C&SF Project Flood Control Restudy would assess the full extent of South Florida's aging water management infrastructure. Building off the USACE's concurrent efforts in the region through CERP and the South Atlantic Coastal Study, the restudy should also integrate the potential impacts of sea level rise and generally higher water tables into the engineering and design of improved flood control features. Importantly, the restudy should focus on maintaining current levels of flood control service throughout the region, including by proposing new projects as necessary, such as a South Dade Flood Protection Project to ensure comprehensive seepage management west of Krome Avenue in Miami-Dade County.

Facing dynamic new pressures on the existing flood control system, the USACE, working in concert with the South Florida Water Management District, now has a critical opportunity to improve the resilience of South Florida communities for decades to come. In accordance with all applicable rules and regulations, we encourage you to seize this opportunity to dedicate supplemental disaster funding to restudy the C&SF Project flood control system.

Sincerely,

Figure 1 (continued): Statement of Need from Congressmen (Pt 2)

Marco Rubio
U.S. Senator

Rick Scott
U.S. Senator

W. Gregory Steube (FL-17)
Member of Congress

Brian Mast (FL-18)
Member of Congress

Francis Rooney (FL-19)
Member of Congress

Alcee L. Hastings (FL-20)
Member of Congress

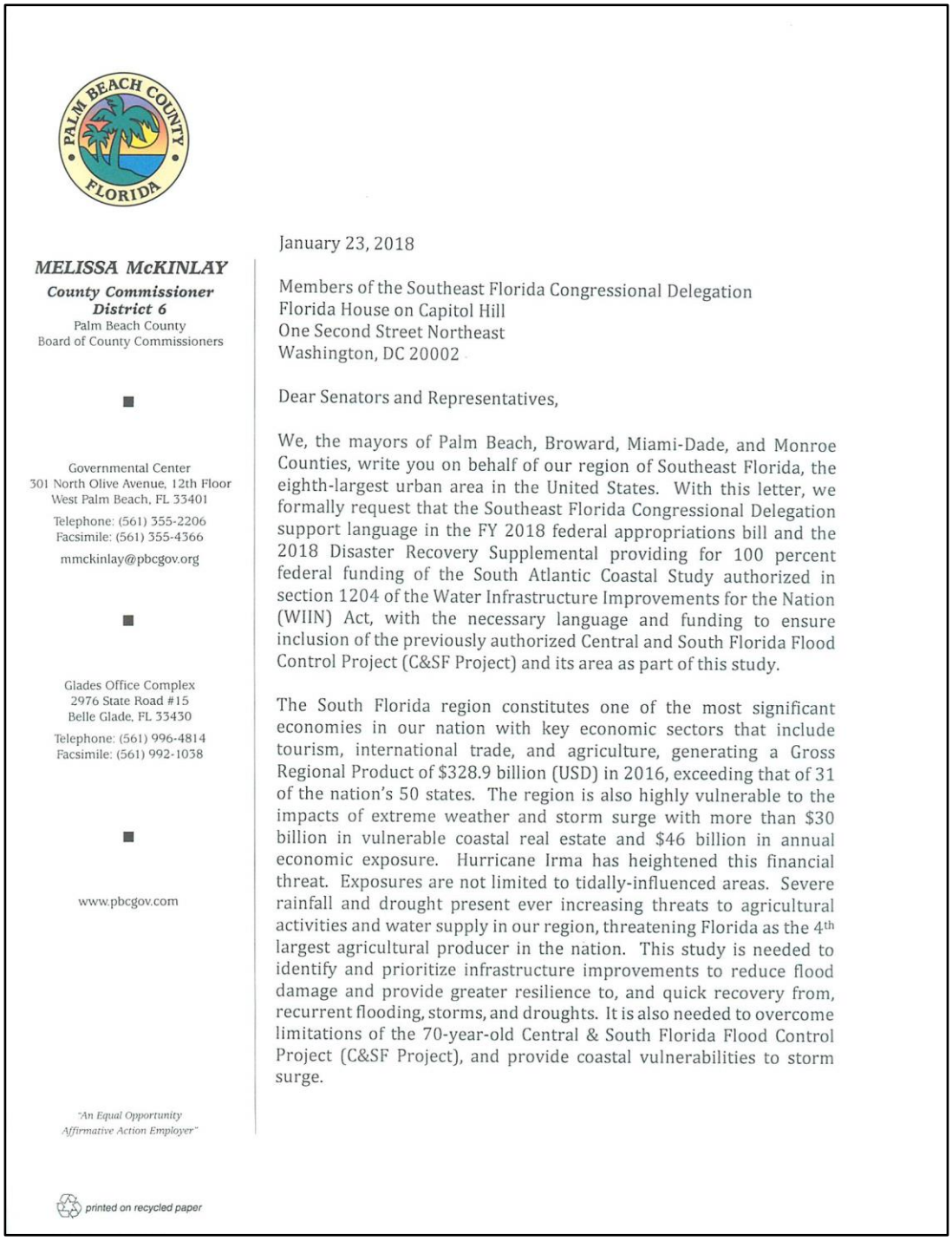
Mario Diaz-Balart (FL-25)
Member of Congress

cc: LTG Todd T. Semonite
Commanding General and Chief of Engineers
Headquarters
U.S. Army Corps of Engineers
441 G Street NW
Washington, D.C. 20314-1000

BG Diana M. Holland
Commander
South Atlantic Division
U.S. Army Corps of Engineers
60 Forsyth Street SW, Room 10M15
Atlanta, GA 30303-8801

COL Andrew Kelly
District Commander
Jacksonville District
U.S. Army Corps of Engineers
701 San Marco Boulevard
Jacksonville, FL 32207-8175

Figure 2: Statement of Need on behalf of Four Counties (Pt 1)



PALM BEACH COUNTY FLORIDA

MELISSA McKINLAY
County Commissioner
District 6
Palm Beach County
Board of County Commissioners

Governmental Center
301 North Olive Avenue, 12th Floor
West Palm Beach, FL 33401
Telephone: (561) 355-2206
Facsimile: (561) 355-4366
mmckinlay@pbcgov.org

Glades Office Complex
2976 State Road #15
Belle Glade, FL 33430
Telephone: (561) 996-4814
Facsimile: (561) 992-1038

www.pbcgov.com

January 23, 2018

Members of the Southeast Florida Congressional Delegation
Florida House on Capitol Hill
One Second Street Northeast
Washington, DC 20002

Dear Senators and Representatives,

We, the mayors of Palm Beach, Broward, Miami-Dade, and Monroe Counties, write you on behalf of our region of Southeast Florida, the eighth-largest urban area in the United States. With this letter, we formally request that the Southeast Florida Congressional Delegation support language in the FY 2018 federal appropriations bill and the 2018 Disaster Recovery Supplemental providing for 100 percent federal funding of the South Atlantic Coastal Study authorized in section 1204 of the Water Infrastructure Improvements for the Nation (WIIN) Act, with the necessary language and funding to ensure inclusion of the previously authorized Central and South Florida Flood Control Project (C&SF Project) and its area as part of this study.

The South Florida region constitutes one of the most significant economies in our nation with key economic sectors that include tourism, international trade, and agriculture, generating a Gross Regional Product of $328.9 billion (USD) in 2016, exceeding that of 31 of the nation's 50 states. The region is also highly vulnerable to the impacts of extreme weather and storm surge with more than $30 billion in vulnerable coastal real estate and $46 billion in annual economic exposure. Hurricane Irma has heightened this financial threat. Exposures are not limited to tidally-influenced areas. Severe rainfall and drought present ever increasing threats to agricultural activities and water supply in our region, threatening Florida as the 4th largest agricultural producer in the nation. This study is needed to identify and prioritize infrastructure improvements to reduce flood damage and provide greater resilience to, and quick recovery from, recurrent flooding, storms, and droughts. It is also needed to overcome limitations of the 70-year-old Central & South Florida Flood Control Project (C&SF Project), and provide coastal vulnerabilities to storm surge.

Figure 2 (Continued): Statement of Need on behalf of Four Counties (Pt 2)

The four counties recently held our Ninth Annual Leadership Summit with a focus on flood risk, severe weather, and economic resilience, attended by elected and business leadership from across our region. We were pleased to include several members of the Florida Congressional Delegation, state legislators, and federal agency partners in our Summit program. Many discussions at the conference highlighted southeast Florida's increased exposure to the impacts of tidal-, surge-, and storm-induced flooding, and the associated, escalating economic losses which threaten domestic commerce, international trade, and public health and safety.

Our local communities are already acting to face these threats: updating drainage systems and flood standards, installing pumps, upgrading stormwater systems, and raising seawalls, but these investments will be overwhelmed without a comprehensive strategy for addressing the regional flood control system and infrastructure upon which our local systems depend. This regional infrastructure is under the purview of the federal government, via the U.S. Army Corps of Engineers (USACE), and intersects with federally authorized C&SF Project and Everglades restoration.

Parts of our region suffered nearly unimaginable devastation from Hurricane Irma. What Irma revealed (and Sandy, five years earlier) is that it is urgent that we move from discussion of risk into action. We know that studies, plans, and projects take time and that this time has been exhausted.

We further know the federal government and the U.S. Army Corps of Engineers recognize the importance of investing in critical infrastructure and commerce in our region. We appreciate that the USACE continues to pursue studies of future flood risk, which will benefit our region. However, there has been no regional assessment of flood vulnerabilities, nor a holistic plan for improved inland flooding, water supply, coastal flooding, and surge protection for the region, especially in the face of increasingly severe weather.

We note that the Water Resources Development Act of 2014 authorized a comprehensive study of the coastline within the South Atlantic Division of the USACE. Today, we request your support in ensuring that the Supplemental Funding Bill providing for disaster relief includes evaluation of the C&SF Project and necessary funding as part of the appropriations for the South Atlantic Coastal Study.

Time is truly of the essence. We respectfully urge you to prioritize authorization and funding of the South Atlantic Coastal Study and inclusion of the C&SF Project in this analysis. This study can then serve

Figure 2 (Continued): Statement of Need on behalf of Four Counties (Pt 3)

as the basis for a plan of action focused on immediate and long-term flood risk and infrastructure improvements needed to protect the people, economy, infrastructure, and natural resources of our region.

We thank you in advance for swift consideration of this request and stand ready to assist you however we can.

Sincerely,

Melissa McKinlay, Mayor
Board of County Commissioners
District 6

CC: Brigadier General Diana Holland, Commander, South Atlantic Division, USACE
Palm Beach County Board of County Commissioners
Verdenia Baker, Palm Beach County Administrator

Figure 3: Statement of Need from Senator Rubio's Office (Pt 1)

MARCO RUBIO
FLORIDA

United States Senate
WASHINGTON, DC 20510

COMMITTEES:
APPROPRIATIONS
FOREIGN RELATIONS
SELECT COMMITTEE ON INTELLIGENCE
SMALL BUSINESS AND ENTREPRENEURSHIP
SPECIAL COMMITTEE ON AGING

March 20, 2018

The Honorable R. D. James
Assistant Secretary of the Army – Civil Works
Department of the Army
108 Army Pentagon
Washington, D.C. 20310-0108

Dear Assistant Secretary James:

I write to draw your attention to the urgent need to study, design, and construct a comprehensive seepage management solution along the boundary of the eastern Everglades in Miami-Dade County, independent from ongoing Comprehensive Everglades Restoration Plan program efforts. As your office continues to work with all three levels of the U.S. Army Corps of Engineers to identify, evaluate, and take action on flood and storm damage reduction projects in 2017 hurricane-impacted states eligible for supplemental disaster funding, I urge you to include this important flood protection measure.

Above-normal summer rainfall and Hurricane Irma combined to expose flood risks throughout this area last year. The Corps was even forced to excavate a section of the L-359 levee bordering the 8.5 square mile area to drain rising flood waters into the C-111 North detention area in Hurricane Irma's immediate aftermath. This incident has increased concerns held by the South Florida Water Management District that existing flood mitigation features may not be adequate. Additionally, enhancing flood protection for agricultural areas adjacent to Everglades National Park in southwestern Miami-Dade County remains an unaddressed concern from the perspective of many of the region's growers.

In my role on the Senate Appropriations Committee, I worked diligently to write and pass a disaster supplemental appropriations package that would provide all necessary funding to secure the repair of federal flood control and Everglades infrastructure in Florida that had been damaged by Hurricane Irma. Signed into law on February 9, 2018 as part of the Bipartisan Budget Act, this legislation provides sufficient funding to also address key flood risk management priorities for Floridians across the state, including:

- expedited rehabilitation of the Herbert Hoover Dike at full federal cost;
- beach renourishment for degraded shore protection and beach erosion control projects;
- the capability to conduct the South Atlantic Coast Comprehensive Study that I championed in the Water Infrastructure Improvements for the Nation Act of 2016; and
- emergency authority to develop new, innovative projects that secure long term flood mitigation and protection benefits.

I urge you to utilize this emergency authority as granted in division B, title IV of the Bipartisan Budget Act of 2018 to work with the South Florida Water Management District to study, design, and

Figure 3 (continued): Statement of Need from Senator Rubio's Office (Pt 2)

construct a new flood and storm damage reduction project that addresses seepage and flood risks along the boundary of the eastern Everglades in Miami-Dade County. Comprehensive seepage management is desperately needed to protect private property and to mitigate flooding concerns for South Dade farmers. Additionally, improved seepage management would also benefit the broader Corps mission in South Florida by helping sustain the broad public support for implementing the Modified Water Deliveries to Everglades National Park project and realizing the full potential of the Central Everglades Planning Project in restoring the hydrological connections between the northern Everglades and Florida Bay.

Thank you for your attention to this request.

Sincerely,

Marco Rubio
U.S. Senator

cc: Mr. Ernie Marks
Executive Director
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, Florida 33406

LTG Todd T. Semonite
Commanding General and Chief of Engineers
Headquarters
U.S. Army Corps of Engineers
441 G Street NW
Washington, D.C. 20314-1000

BG Diana M. Holland
Commander
South Atlantic Division
U.S. Army Corps of Engineers
60 Forsyth Street SW, Room 10M15
Atlanta, GA 30303-8801

COL Jason A. Kirk
District Commander
Jacksonville District
U.S. Army Corps of Engineers
701 San Marco Boulevard
Jacksonville, FL 32207-8175

Figure 4: Letter of Endorsement from South Florida Water Management District – Non-Federal Sponsor (Pt 1)

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

March 12, 2020

Eric P. Summa
Chief, Planning and Environmental Policy Jacksonville District
U.S Army Corps of Engineers
Jacksonville District
701 San Marco Boulevard
Jacksonville, Florida 32207

Subject: Central and South Florida Flood Risk Management Infrastructure Resiliency Plan

Dear Mr. Summa,

The South Florida Water Management District (District), as the non-federal sponsor of the Central and Southern Florida (C&SF) Project endorses the U.S. Army Corps of Engineers' (USACE) funding request, through a 216 Initial Appraisal, to reevaluate the C&SF Project to address flooding and other related risks due to changed conditions, including sea level rise, climate change, land development and population growth. The C&SF Flood Resiliency Study request is for a focused segment of a comprehensive study to assess the resiliency of the system's most critical infrastructure and related water resources concerns. The study would also provide recommended areas for further evaluation and study.

The District's current efforts to implement the Flood Protection Level of Service Program (FPLOS) includes the development of enhanced water management models to evaluate the C&SF operations under changed current and future conditions, and recommendations for priority infrastructure investments in critical locations within the District's boundaries. The FPLOS effort has already identified C&SF structures in Miami Dade County that exhibit an opportunity for adaptation.

It is our understanding that this 216 Study will further evaluate specific components of the C&SF system that need to be updated and adapted to continue to provide service given the changes in land development and climatic conditions. The District supports the Corps initiating this evaluation, and also strongly encourages the study scope to allow the immediate authorization of construction to update components that need immediate attention to provide the expected C&SF level of service.

The District is pleased to join forces with the USACE in recognizing the urgency of addressing the limitations of the 72-year old C&SF system, through a focused feasibility

3301 Gun Club Road, West Palm Beach, Florida 33416 • (561) 686-8800 • 1-800-432-2045 • www.sfwmd.gov

Figure 4: Letter of Endorsement from South Florida Water Management District – Non-Federal Sponsor (Pt 2)

Eric P. Summa
March 12, 2020
Page 2

study and identification of priority investments. We understand that we will cost share 50% in the Section 216 Study once funded, and we would have significant participation in the Study, from the scope development through its final completion.

We look forward to working together with the USACE on the Section 216 Central and Southern Florida Project Update Study - Central and Southern Florida Flood Risk Management Infrastructure Resiliency Plan, under the existing authority of the Flood Control Act of 1970.

Enclosed please find a copy of the resolution approved by our Governing Board on March 12, 2020.

Sincerely,

Drew Bartlett
Executive Director

Enclosure

Figure 4: Letter of Endorsement from South Florida Water Management District – Non-Federal Sponsor (Pt 3)

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

Resolution No. 2020 - 0317

A Resolution of the Governing Board of the South Florida Water Management District to approve a letter of endorsement, supporting the U.S. Army Corps of Engineers (USACE) seeking federal funding to initiate the Central and Southern Florida Flood Resiliency Study; providing an effective date.

WHEREAS, South Florida Water Management District (District) is the non-federal sponsor of the Central and Southern Florida (C&SF) Project authorized by the Flood Control Act of 1948.

WHEREAS, the C&SF Project was authorized for the purposes of flood control, water supply, navigation, prevention of saltwater intrusion, and protection of fish and wildlife resources, and projected to serve a population of 2 million people.

WHEREAS, a C&SF Project Comprehensive Review Study was initiated in 1992 and authorized in 2000 as the Comprehensive Everglades Restoration Plan.

WHEREAS, the District is strongly committed to address the impacts of sea level rise and changing climate as part of our core mission of protecting and restoring ecosystems, protecting communities from flooding and ensuring adequate water supply for all of South Florida's needs.

WHEREAS, a new review study is needed to reevaluate the C&SF Project to address flooding, water supply and other related risks to vulnerable communities due to changed conditions, including sea level rise, weather patterns, land development and population growth.

WHEREAS, the new review study request is made pursuant to Section 216 of the Flood Control Act to assess the infrastructure at highest risk and the resilience aspects of such infrastructure in terms of flood vulnerabilities, water supply, coastal flooding, surge protection and related water resource concerns, and to recommend areas for further evaluation.

WHEREAS, the new review study will further evaluate specific components of the C&SF system that need to be updated and adapted to continue to provide service and allow the immediate authorization of construction to update components that are currently not providing the expected C&SF level of service.

WHEREAS, the District will cost share 50% in the Section 216 review study once funded and will have significant participation in its development, from elaborating the scope of work through its final completion.

Page 1 of 2

Figure 4: Letter of Endorsement from South Florida Water Management District – Non-Federal Sponsor (Pt 4)

Resolution No. 2020 - 0317

NOW THEREFORE, BE IT RESOLVED BY THE GOVERNING BOARD OF THE SOUTH FLORIDA WATER MANAGEMENT DISTRICT:

Section 1. The Governing Board of the South Florida Water Management District hereby approves a letter of endorsement, supporting USACE seeking federal funding to initiate the Central and Southern Florida Flood Resiliency Study.

Section 2. This Resolution shall take effect immediately upon adoption.

PASSED and **ADOPTED** on this 12th day of March, 2020.

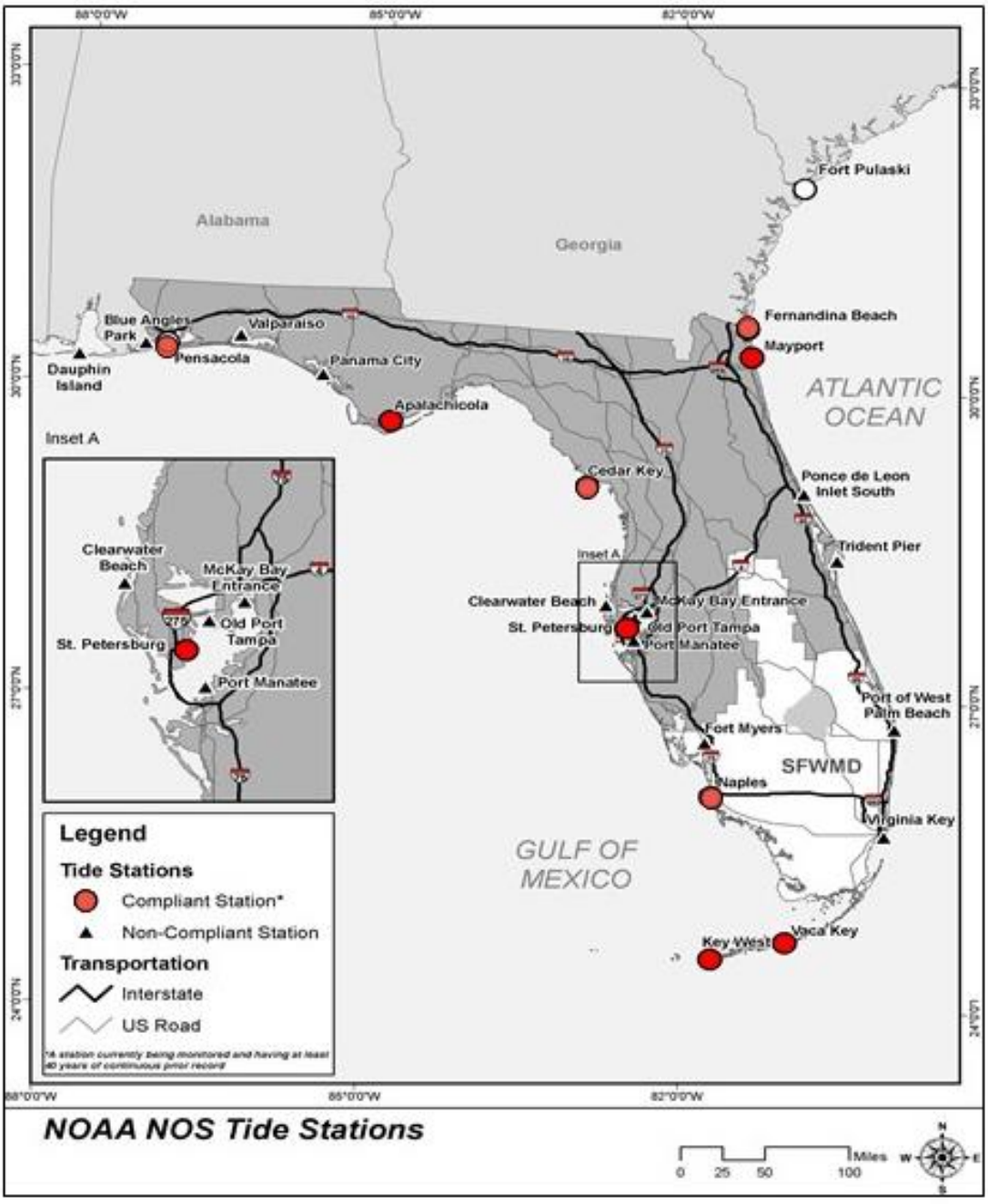
SOUTH FLORIDA WATER MANAGEMENT DISTRICT, BY ITS GOVERNING BOARD
By:
Chauncey P. Goss, II
Chairman

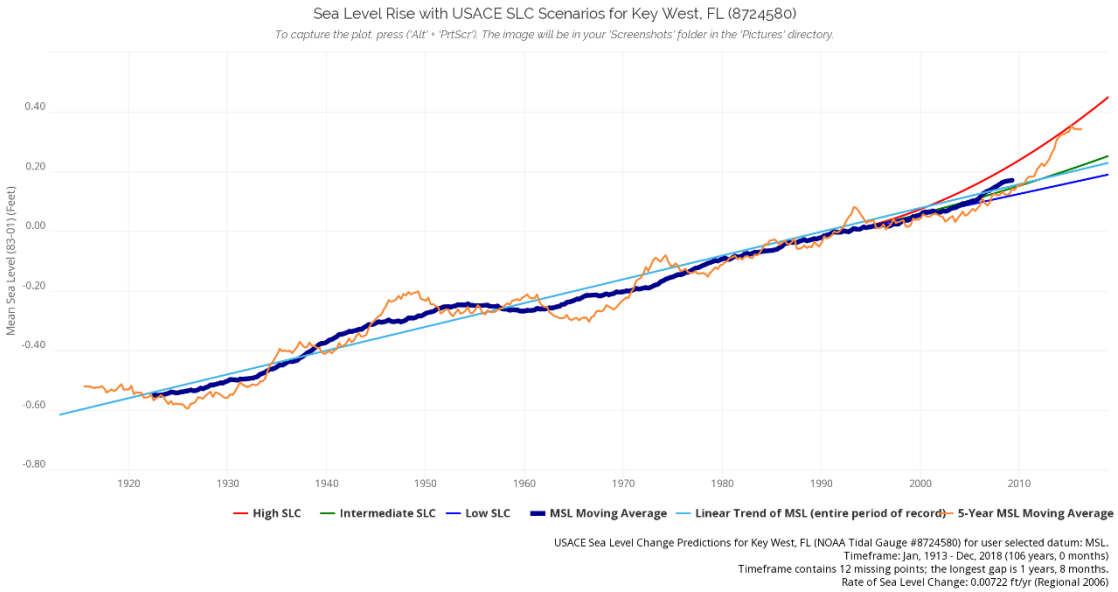
Attest:
District Clerk/Secretary

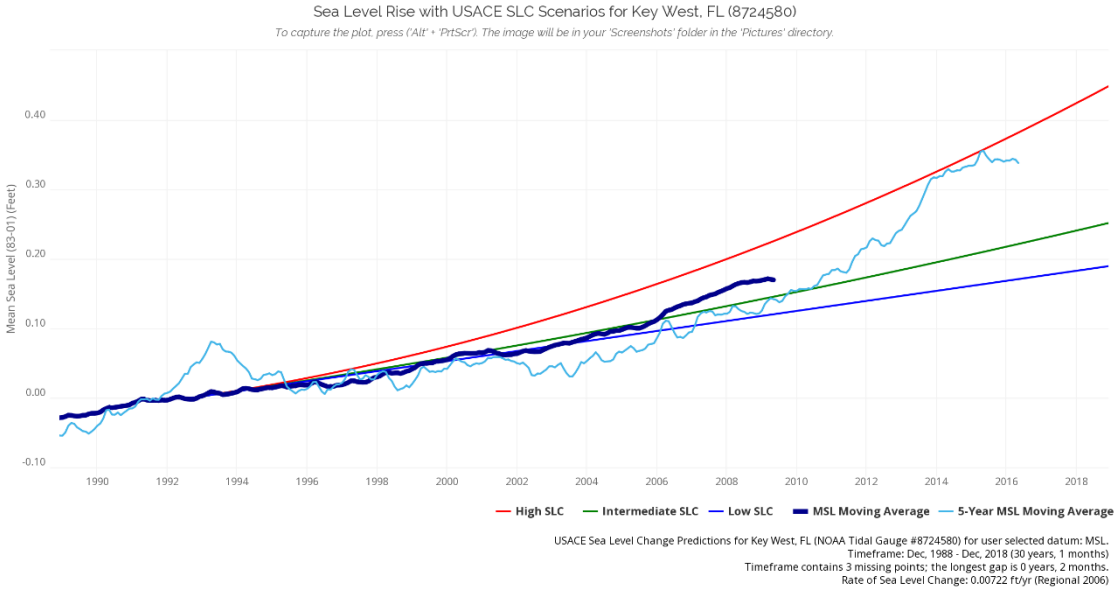
Legal form approved:
By:
Office of Counsel

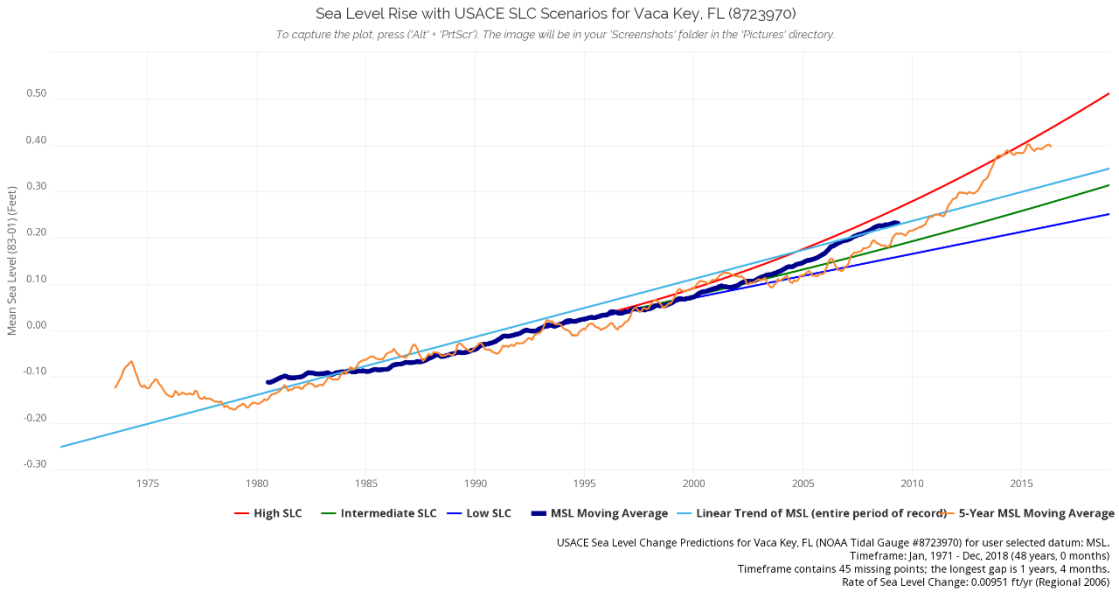
Print name:
JUDITH LEVINE

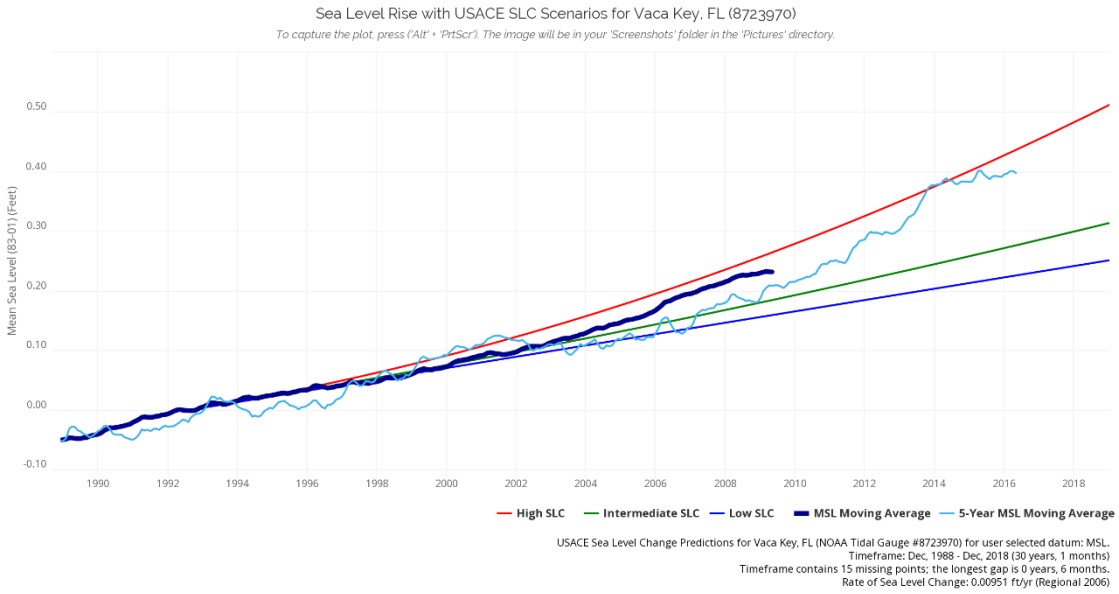
APPENDIX C
Pertinent Sea Level Change Graphs in Florida

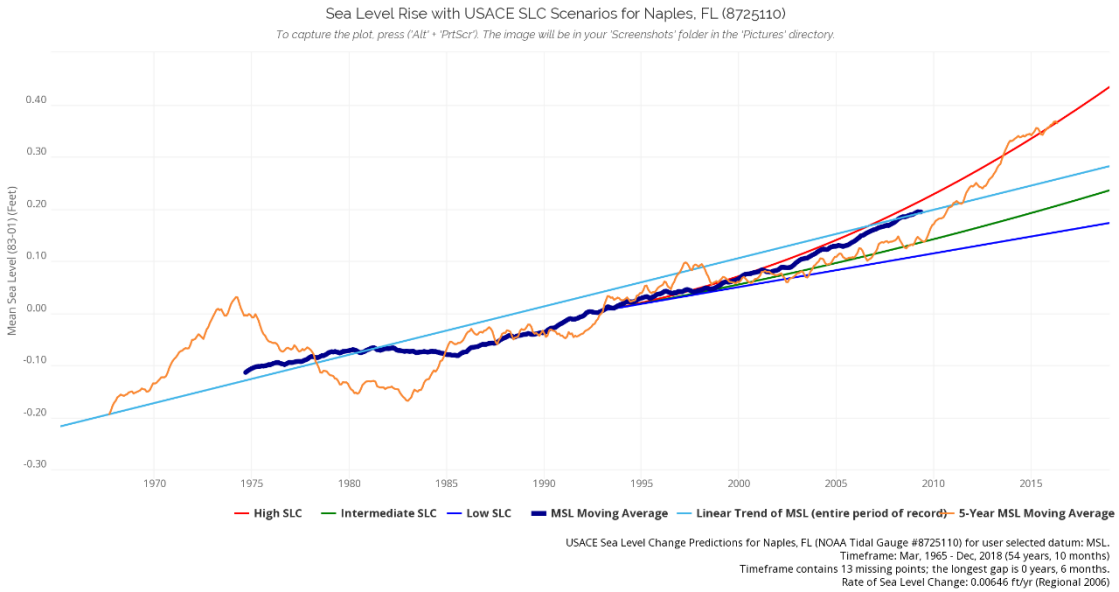

88°0'0"W
85°0'0"W
82°0'0"W
30°0'0"N
27°0'0"N
24°0'0"N
Alabama
Georgia
Fort Pulaski
Fernandina Beach
Mayport
Blue Angles Park
Valparaiso
Pensacola
Dauphin Island
Panama City
Apalachicola
ATLANTIC OCEAN
Inset A
Cedar Key
Ponce de Leon Inlet South
Trident Pier
Clearwater Beach
McKay Bay Entrance
St. Petersburg
Old Port Tampa
Port Manatee
Port of West Palm Beach
Fort Myers
SFWMD
Naples
Virginia Key
GULF OF MEXICO
Key West
Vaca Key
Legend
Tide Stations
Compliant Station*
Non-Compliant Station
Transportation
Interstate
US Road
*A station currently being monitored and having at least 40 years of continuous prior record
NOAA NOS Tide Stations
0 25 50 100 Miles
N
S
E
W


Sea Level Rise with USACE SLC Scenarios for Key West, FL (8724580)
To capture the plot, press ('Alt' + 'PrtScr'). The image will be in your 'Screenshots' folder in the 'Pictures' directory.
Mean Sea Level (83-01) (Feet)
0.40
0.20
0.00
-0.20
-0.40
-0.60
-0.80
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
High SLC
Intermediate SLC
Low SLC
MSL Moving Average
Linear Trend of MSL (entire period of record)
5-Year MSL Moving Average
USACE Sea Level Change Predictions for Key West, FL (NOAA Tidal Gauge #8724580) for user selected datum: MSL.
Timeframe: Jan, 1913 - Dec, 2018 (106 years, 0 months)
Timeframe contains 12 missing points; the longest gap is 1 years, 8 months.
Rate of Sea Level Change: 0.00722 ft/yr (Regional 2006)

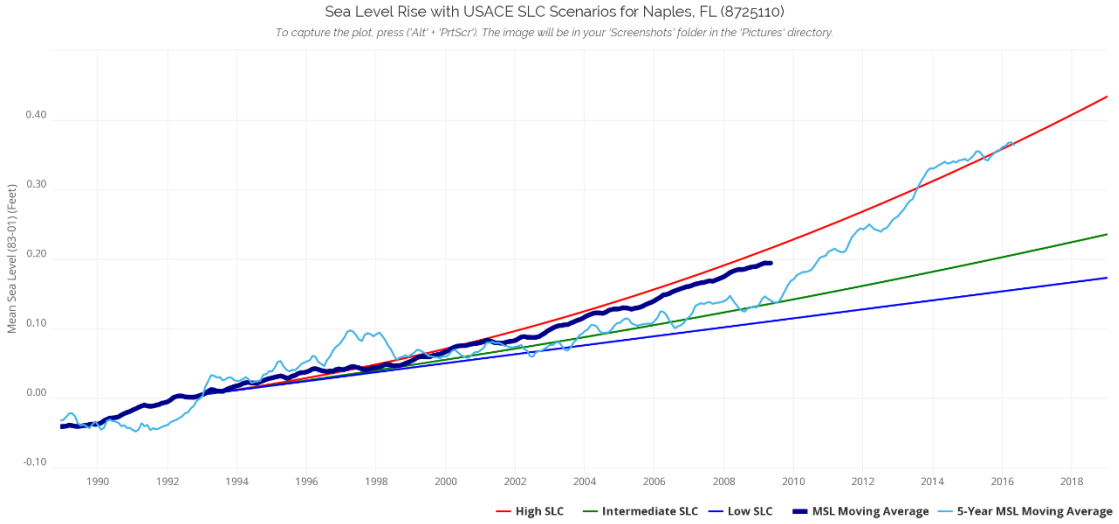

Sea Level Rise with USACE SLC Scenarios for Key West, FL (8724580)
To capture the plot, press ('Alt' + 'PrtScr'). The image will be in your 'Screenshots' folder in the 'Pictures' directory.
Mean Sea Level (83-01) (Feet)
0.40
0.30
0.20
0.10
0.00
-0.10
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
High SLC
Intermediate SLC
Low SLC
MSL Moving Average
5-Year MSL Moving Average
USACE Sea Level Change Predictions for Key West, FL (NOAA Tidal Gauge #8724580) for user selected datum: MSL.
Timeframe: Dec, 1988 - Dec, 2018 (30 years, 1 months)
Timeframe contains 3 missing points; the longest gap is 0 years, 2 months.
Rate of Sea Level Change: 0.00722 ft/yr (Regional 2006)


Sea Level Rise with USACE SLC Scenarios for Vaca Key, FL (8723970)
To capture the plot, press ('Alt' + 'PrtScr'). The image will be in your 'Screenshots' folder in the 'Pictures' directory.
Mean Sea Level (83-01) (Feet)
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
1975
1980
1985
1990
1995
2000
2005
2010
2015
High SLC
Intermediate SLC
Low SLC
MSL Moving Average
Linear Trend of MSL (entire period of record)
5-Year MSL Moving Average
USACE Sea Level Change Predictions for Vaca Key, FL (NOAA Tidal Gauge #8723970) for user selected datum: MSL.
Timeframe: Jan, 1971 - Dec, 2018 (48 years, 0 months)
Timeframe contains 45 missing points; the longest gap is 1 years, 4 months.
Rate of Sea Level Change: 0.00951 ft/yr (Regional 2006)

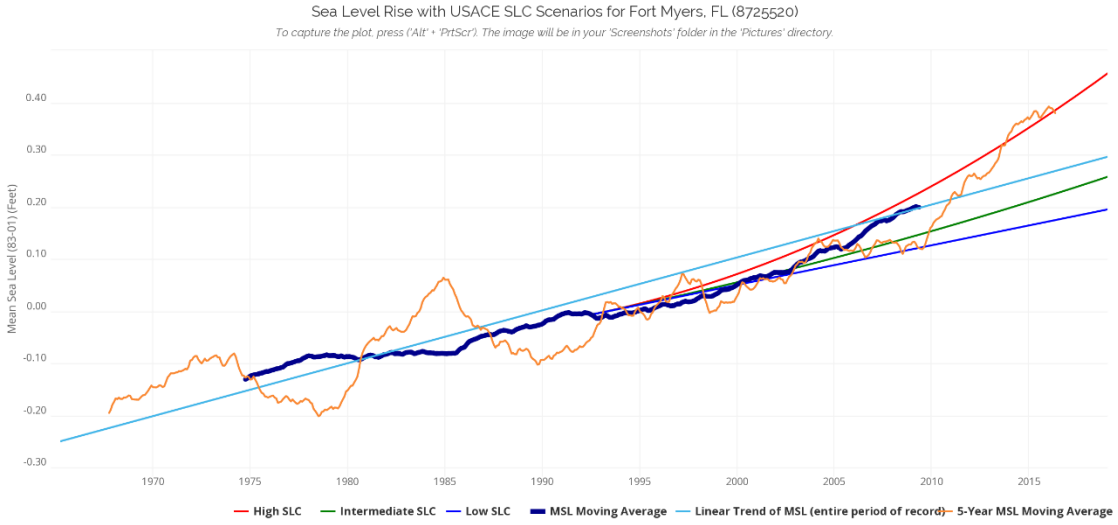

Sea Level Rise with USACE SLC Scenarios for Vaca Key, FL (8723970)
To capture the plot, press ('Alt' + 'PrtScr'). The image will be in your 'Screenshots' folder in the 'Pictures' directory.
Mean Sea Level (83-01) (Feet)
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
High SLC
Intermediate SLC
Low SLC
MSL Moving Average
5-Year MSL Moving Average
USACE Sea Level Change Predictions for Vaca Key, FL (NOAA Tidal Gauge #8723970) for user selected datum: MSL.
Timeframe: Dec, 1988 - Dec, 2018 (30 years, 1 months)
Timeframe contains 15 missing points; the longest gap is 0 years, 6 months.
Rate of Sea Level Change: 0.00951 ft/yr (Regional 2006)



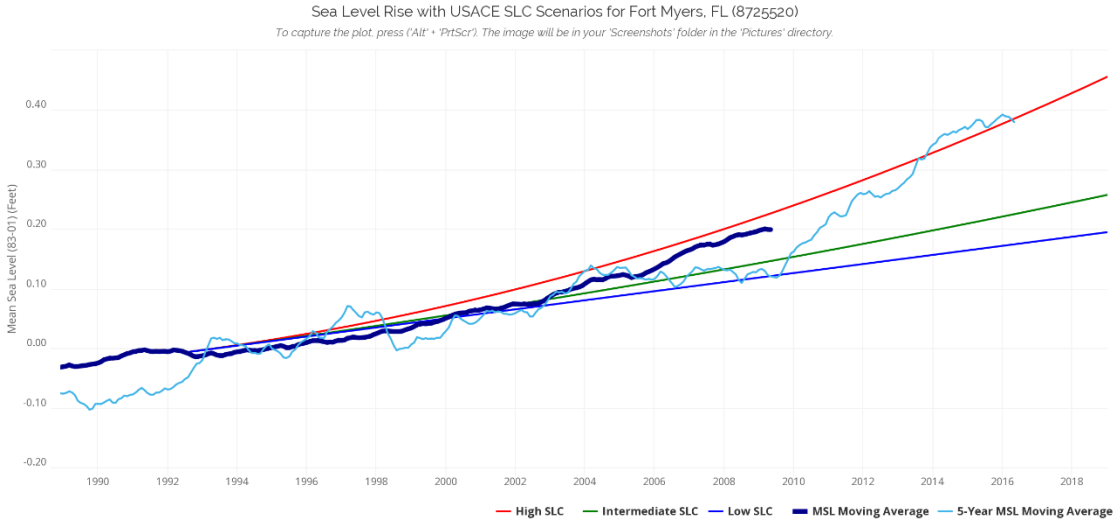
USACE Sea Level Change Predictions for Naples, FL (NOAA Tidal Gauge #8725110) for user selected datum: MSL.
Timeframe: Mar, 1965 - Dec, 2018 (54 years, 10 months)
Timeframe contains 13 missing points; the longest gap is 0 years, 6 months.
Rate of Sea Level Change: 0.00646 ft/yr (Regional 2006)



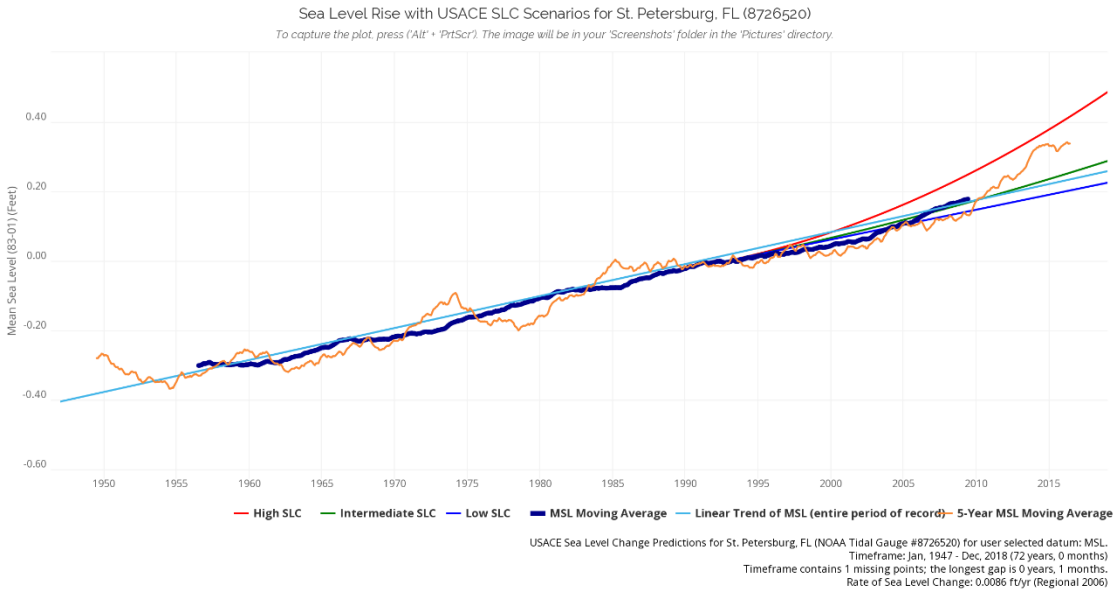
USACE Sea Level Change Predictions for Naples, FL (NOAA Tidal Gauge #8725110) for user selected datum: MSL.
Timeframe: Dec, 1988 - Dec, 2018 (30 years, 1 months)
Timeframe contains 5 missing points; the longest gap is 0 years, 2 months.
Rate of Sea Level Change: 0.00646 ft/yr (Regional 2006)

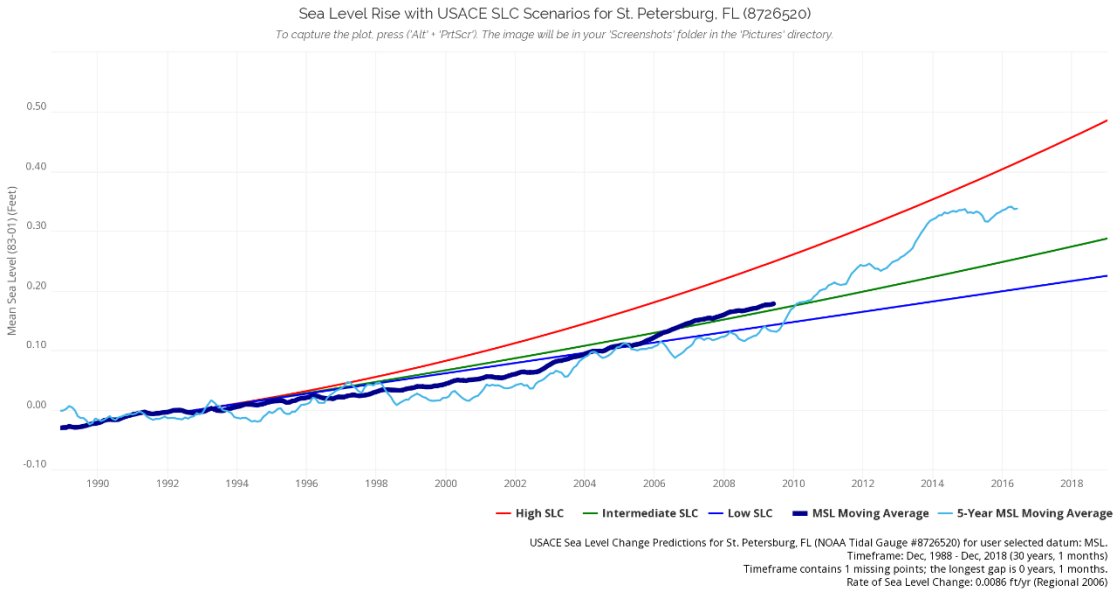


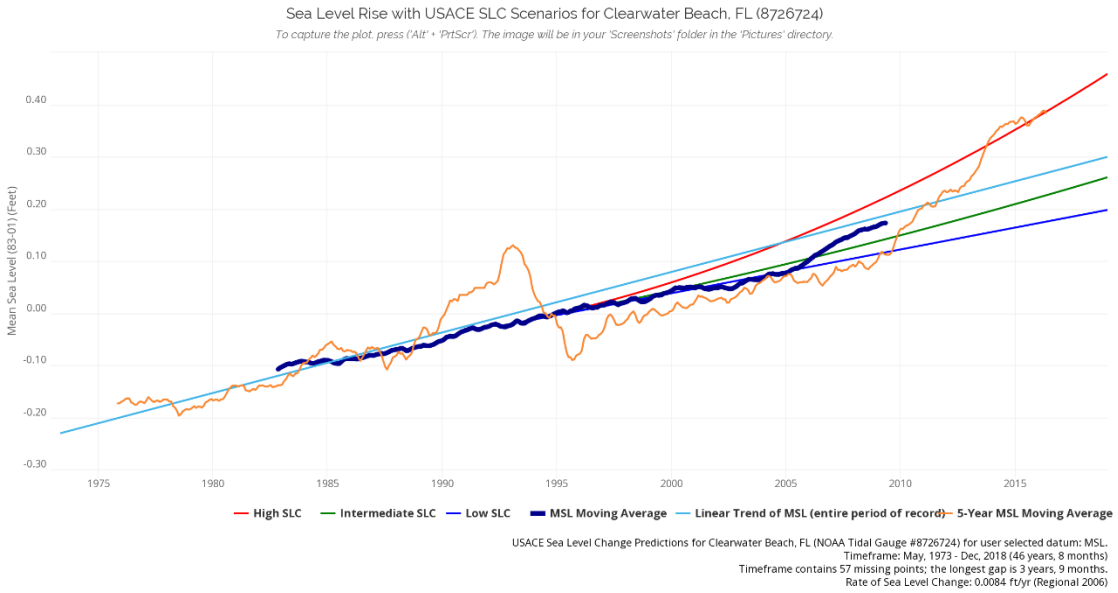
USACE Sea Level Change Predictions for Fort Myers, FL (NOAA Tidal Gauge #8725520) for user selected datum: MSL.
Timeframe: Apr, 1965 - Dec, 2018 (54 years, 9 months)
Timeframe contains 14 missing points; the longest gap is 1 years, 7 months.
Rate of Sea Level Change: 0.00761 ft/yr (Regional 2006)



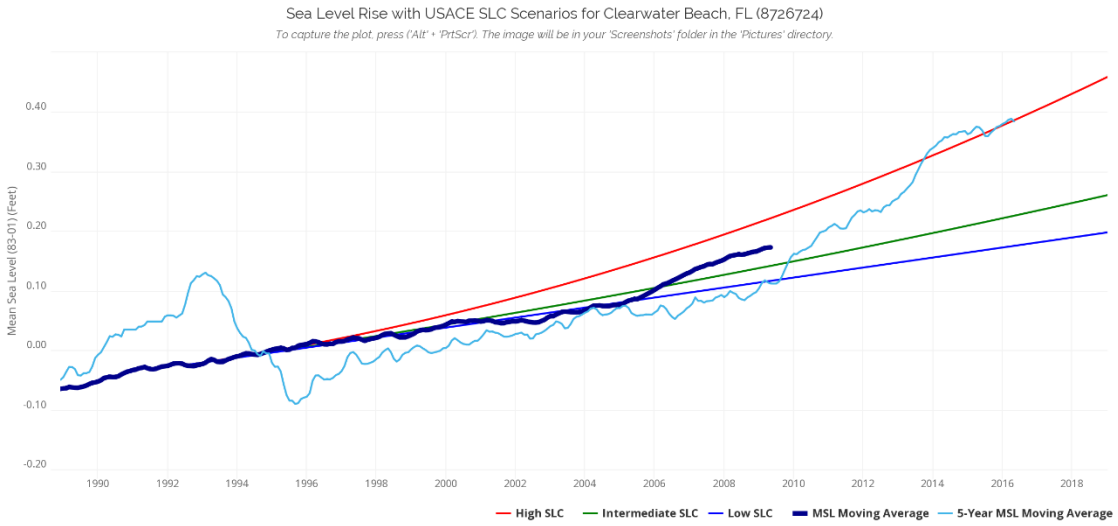
USACE Sea Level Change Predictions for Fort Myers, FL (NOAA Tidal Gauge #8725520) for user selected datum: MSL.
Timeframe: Dec, 1988 - Dec, 2018 (30 years, 1 months)
Timeframe contains 14 missing points; the longest gap is 1 years, 7 months.
Rate of Sea Level Change: 0.00761 ft/yr (Regional 2006)


Sea Level Rise with USACE SLC Scenarios for St. Petersburg, FL (8726520)
To capture the plot, press ('Alt' + 'PrtScr'). The image will be in your 'Screenshots' folder in the 'Pictures' directory.
Mean Sea Level (83-01) (Feet)
0.40
0.20
0.00
-0.20
-0.40
-0.60
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
High SLC
Intermediate SLC
Low SLC
MSL Moving Average
Linear Trend of MSL (entire period of record)
5-Year MSL Moving Average
USACE Sea Level Change Predictions for St. Petersburg, FL (NOAA Tidal Gauge #8726520) for user selected datum: MSL.
Timeframe: Jan, 1947 - Dec, 2018 (72 years, 0 months)
Timeframe contains 1 missing points; the longest gap is 0 years, 1 months.
Rate of Sea Level Change: 0.0086 ft/yr (Regional 2006)

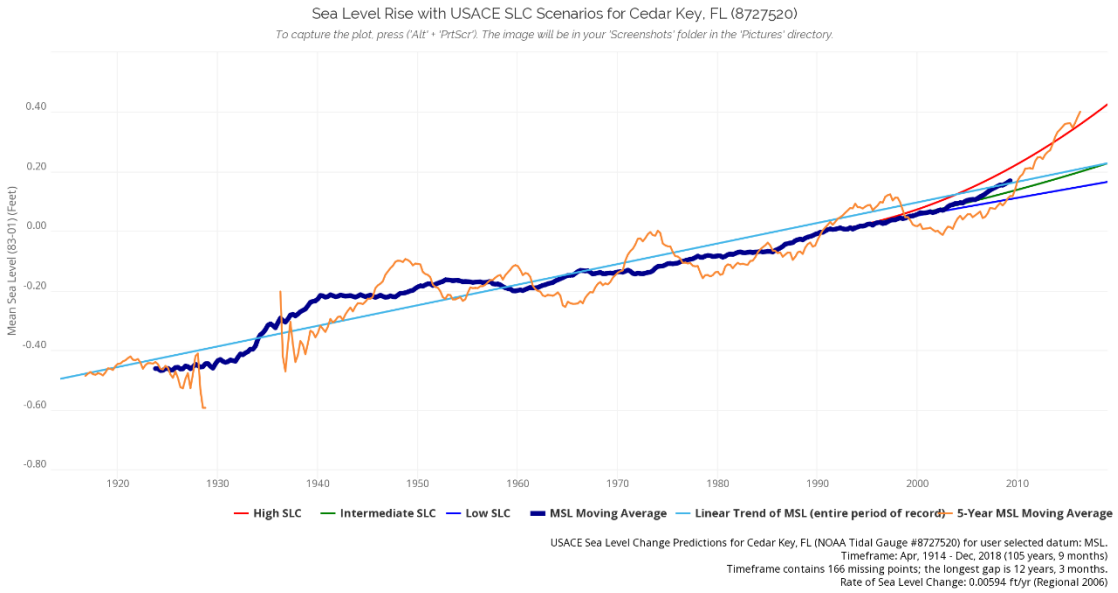

Sea Level Rise with USACE SLC Scenarios for St. Petersburg, FL (8726520)
To capture the plot, press ('Alt' + 'PrtScr'). The image will be in your 'Screenshots' folder in the 'Pictures' directory.
Mean Sea Level (83-01) (Feet)
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
High SLC
Intermediate SLC
Low SLC
MSL Moving Average
5-Year MSL Moving Average
USACE Sea Level Change Predictions for St. Petersburg, FL (NOAA Tidal Gauge #8726520) for user selected datum: MSL.
Timeframe: Dec, 1988 - Dec, 2018 (30 years, 1 months)
Timeframe contains 1 missing points; the longest gap is 0 years, 1 months.
Rate of Sea Level Change: 0.0086 ft/yr (Regional 2006)



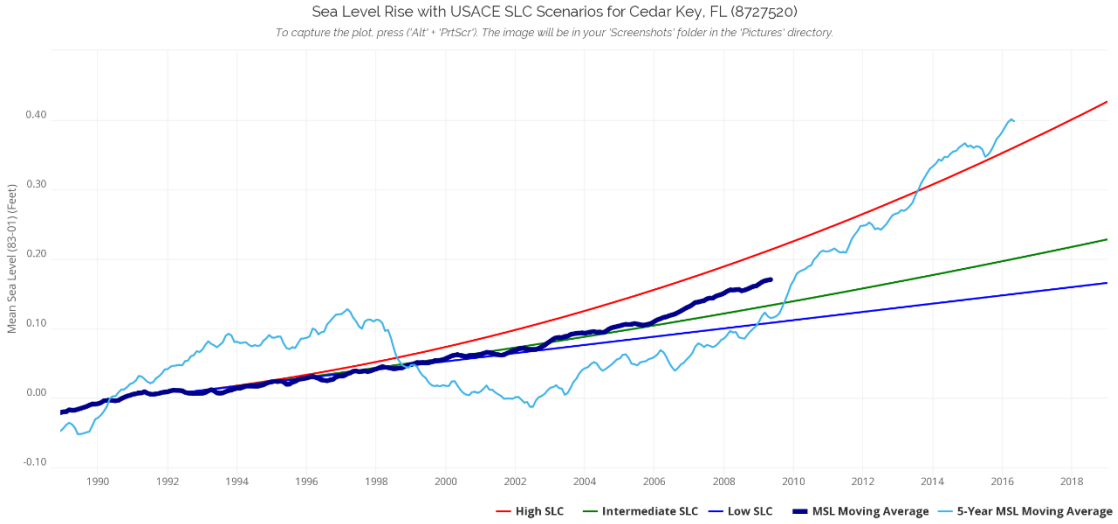
USACE Sea Level Change Predictions for Clearwater Beach, FL (NOAA Tidal Gauge #8726724) for user selected datum: MSL.
Timeframe: May, 1973 - Dec, 2018 (46 years, 8 months)
Timeframe contains 57 missing points; the longest gap is 3 years, 9 months.
Rate of Sea Level Change: 0.0084 ft/yr (Regional 2006)



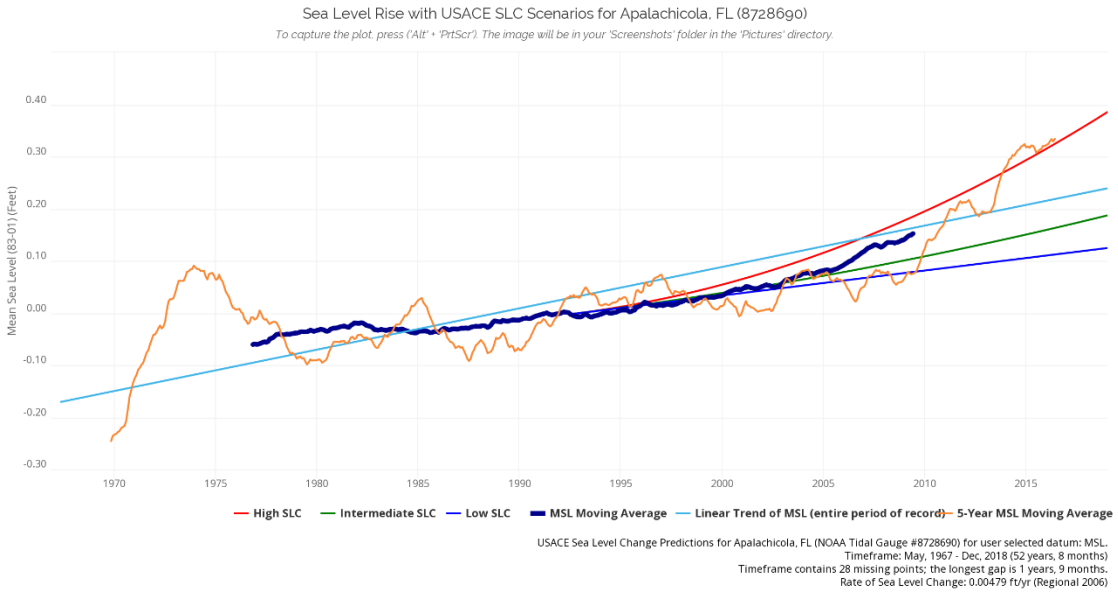
USACE Sea Level Change Predictions for Clearwater Beach, FL (NOAA Tidal Gauge #8726724) for user selected datum: MSL.
Timeframe: Dec, 1988 - Dec, 2018 (30 years, 1 months)
Timeframe contains 51 missing points; the longest gap is 3 years, 9 months.
Rate of Sea Level Change: 0.0084 ft/yr (Regional 2006)



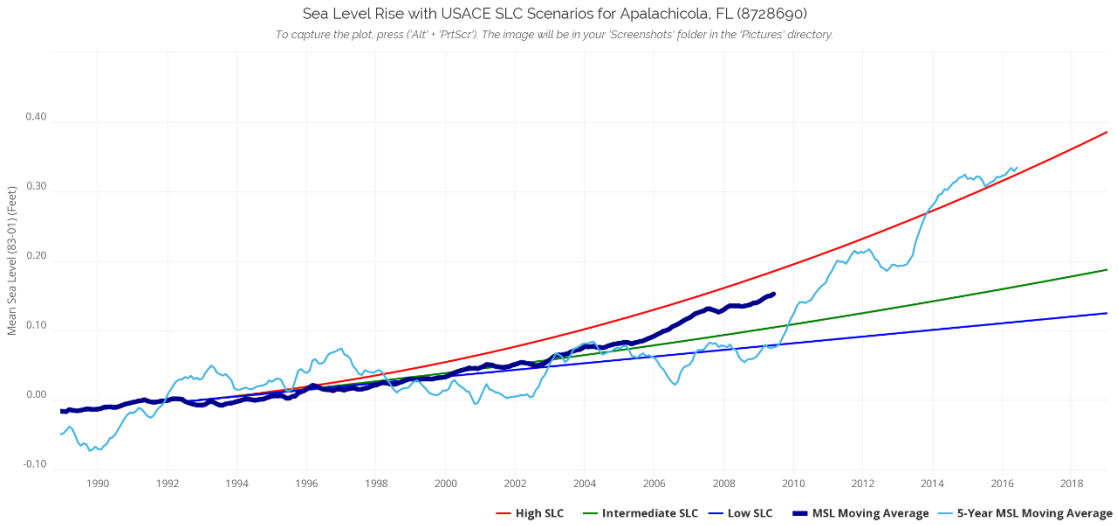
USACE Sea Level Change Predictions for Cedar Key, FL (NOAA Tidal Gauge #8727520) for user selected datum: MSL.
Timeframe: Apr, 1914 - Dec, 2018 (105 years, 9 months)
Timeframe contains 166 missing points; the longest gap is 12 years, 3 months.
Rate of Sea Level Change: 0.00594 ft/yr (Regional 2006)



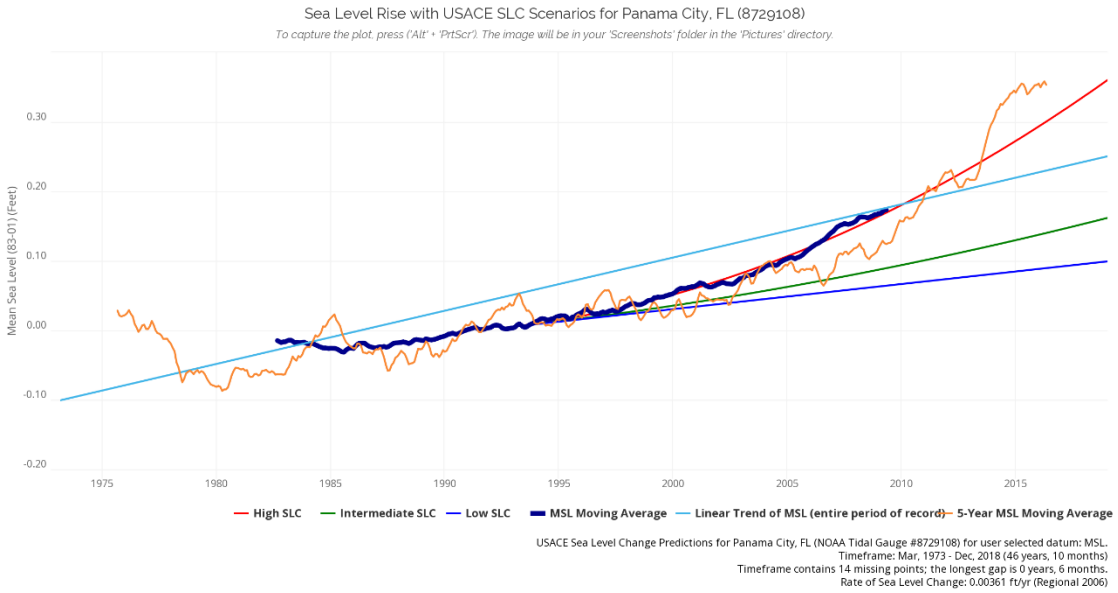
USACE Sea Level Change Predictions for Cedar Key, FL (NOAA Tidal Gauge #8727520) for user selected datum: MSL.
Timeframe: Dec, 1988 - Dec, 2018 (30 years, 1 months)
Timeframe contains 11 missing points; the longest gap is 1 years, 8 months.
Rate of Sea Level Change: 0.00594 ft/yr (Regional 2006)

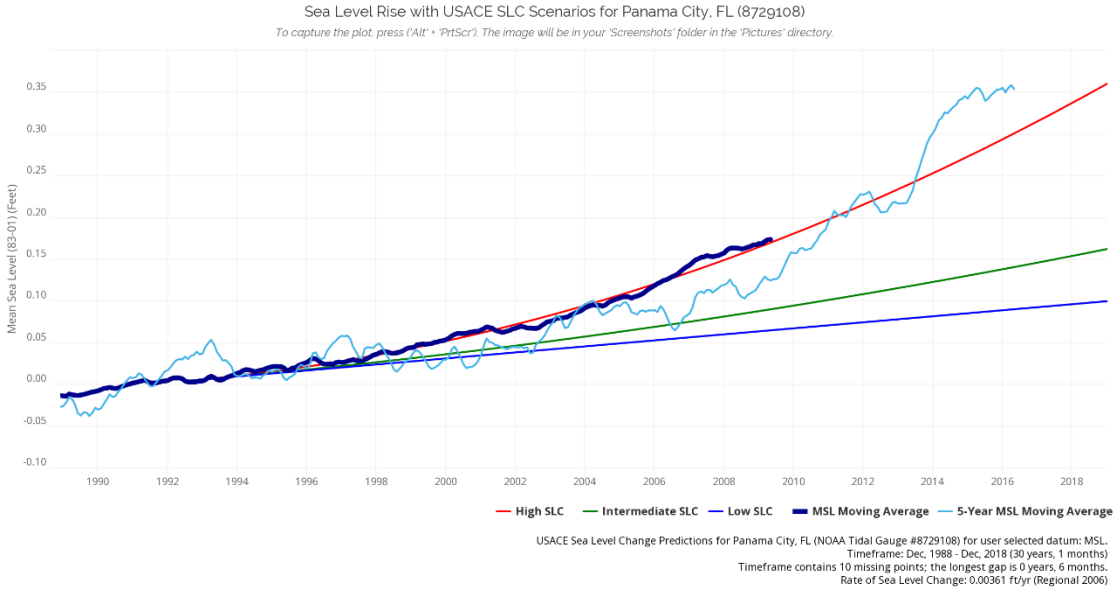


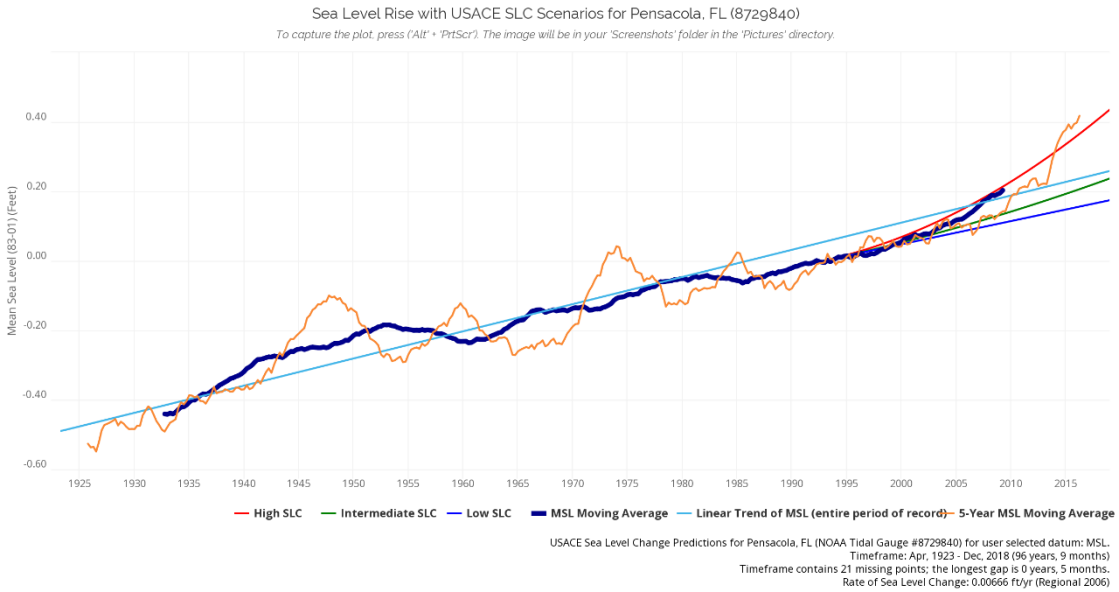
USACE Sea Level Change Predictions for Apalachicola, FL (NOAA Tidal Gauge #8728690) for user selected datum: MSL.
Timeframe: May, 1967 - Dec, 2018 (52 years, 8 months)
Timeframe contains 28 missing points; the longest gap is 1 years, 9 months.
Rate of Sea Level Change: 0.00479 ft/yr (Regional 2006)



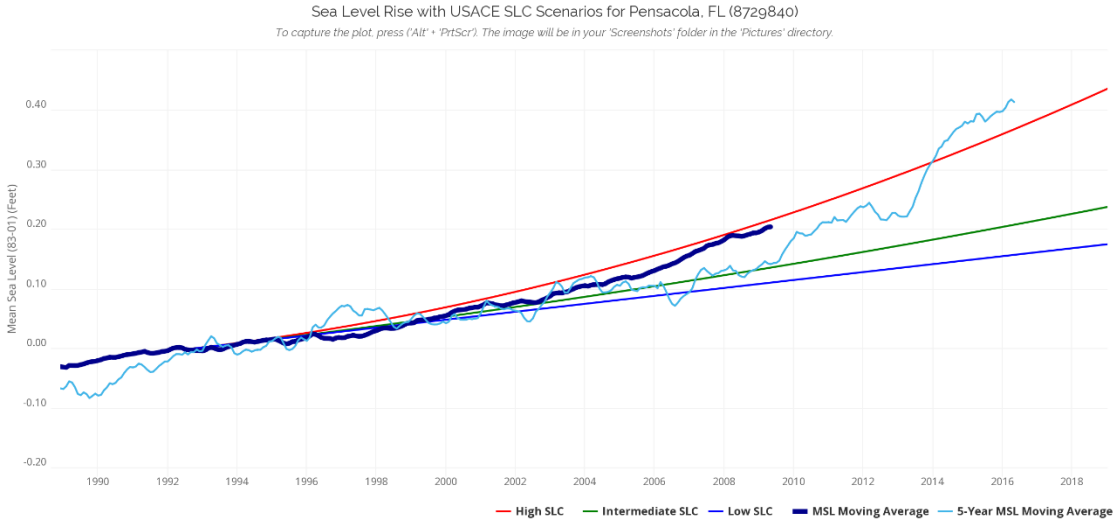
USACE Sea Level Change Predictions for Apalachicola, FL (NOAA Tidal Gauge #8728690) for user selected datum: MSL.
Timeframe: Dec, 1988 - Dec, 2018 (30 years, 1 months)
Timeframe contains 2 missing points; the longest gap is 0 years, 2 months.
Rate of Sea Level Change: 0.00479 ft/yr (Regional 2006)


Sea Level Rise with USACE SLC Scenarios for Panama City, FL (8729108)
To capture the plot, press ('Alt' + 'PrtScr'). The image will be in your 'Screenshots' folder in the 'Pictures' directory.
Mean Sea Level (83-01) (Feet)
0.30
0.20
0.10
0.00
-0.10
-0.20
1975
1980
1985
1990
1995
2000
2005
2010
2015
High SLC
Intermediate SLC
Low SLC
MSL Moving Average
Linear Trend of MSL (entire period of record)
5-Year MSL Moving Average
USACE Sea Level Change Predictions for Panama City, FL (NOAA Tidal Gauge #8729108) for user selected datum: MSL.
Timeframe: Mar, 1973 - Dec, 2018 (46 years, 10 months)
Timeframe contains 14 missing points; the longest gap is 0 years, 6 months.
Rate of Sea Level Change: 0.00361 ft/yr (Regional 2006)

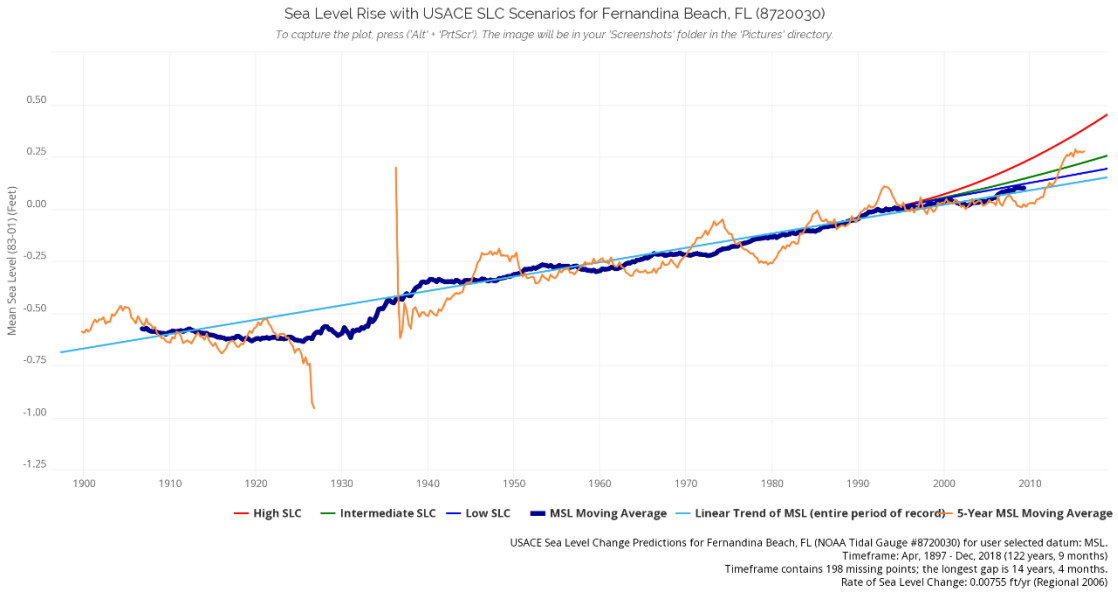

Sea Level Rise with USACE SLC Scenarios for Panama City, FL (8729108)
To capture the plot, press ('Alt' + 'PrtScr'). The image will be in your 'Screenshots' folder in the 'Pictures' directory.
Mean Sea Level (83-01) (Feet)
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
-0.05
-0.10
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
High SLC
Intermediate SLC
Low SLC
MSL Moving Average
5-Year MSL Moving Average
USACE Sea Level Change Predictions for Panama City, FL (NOAA Tidal Gauge #8729108) for user selected datum: MSL.
Timeframe: Dec, 1988 - Dec, 2018 (30 years, 1 months)
Timeframe contains 10 missing points; the longest gap is 0 years, 6 months.
Rate of Sea Level Change: 0.00361 ft/yr (Regional 2006)



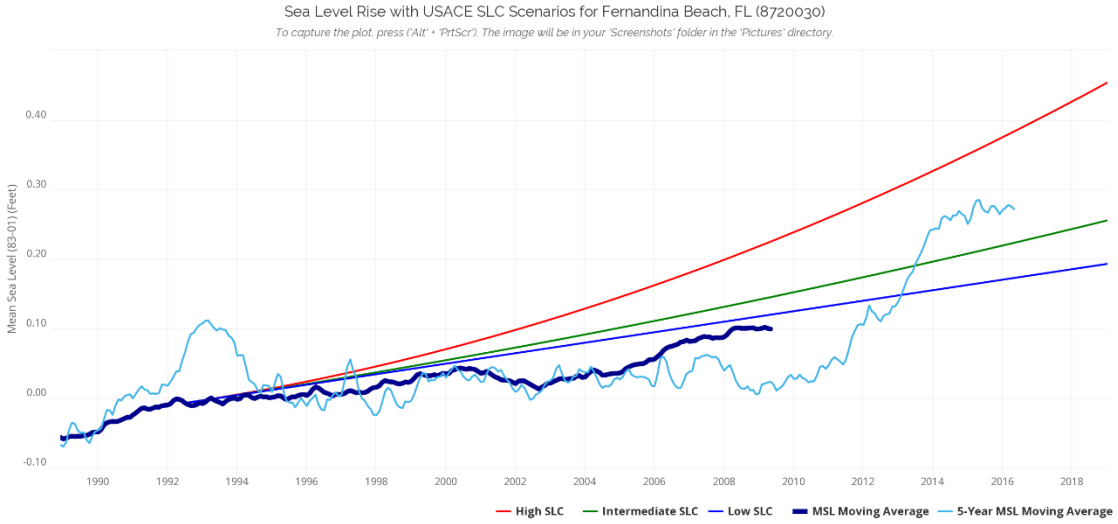
USACE Sea Level Change Predictions for Pensacola, FL (NOAA Tidal Gauge #8729840) for user selected datum: MSL.
Timeframe: Apr, 1923 - Dec, 2018 (96 years, 9 months)
Timeframe contains 21 missing points; the longest gap is 0 years, 5 months.
Rate of Sea Level Change: 0.00666 ft/yr (Regional 2006)



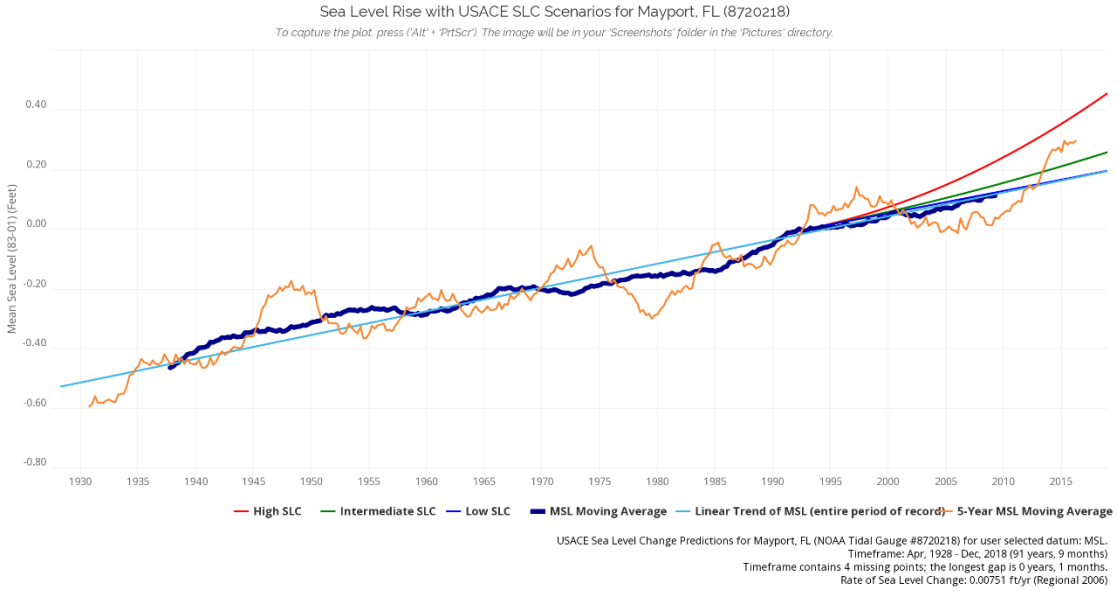
USACE Sea Level Change Predictions for Pensacola, FL (NOAA Tidal Gauge #8729840) for user selected datum: MSL.
Timeframe: Dec, 1988 - Dec, 2018 (30 years, 1 months)
Timeframe contains 14 missing points; the longest gap is 0 years, 5 months.
Rate of Sea Level Change: 0.00666 ft/yr (Regional 2006)



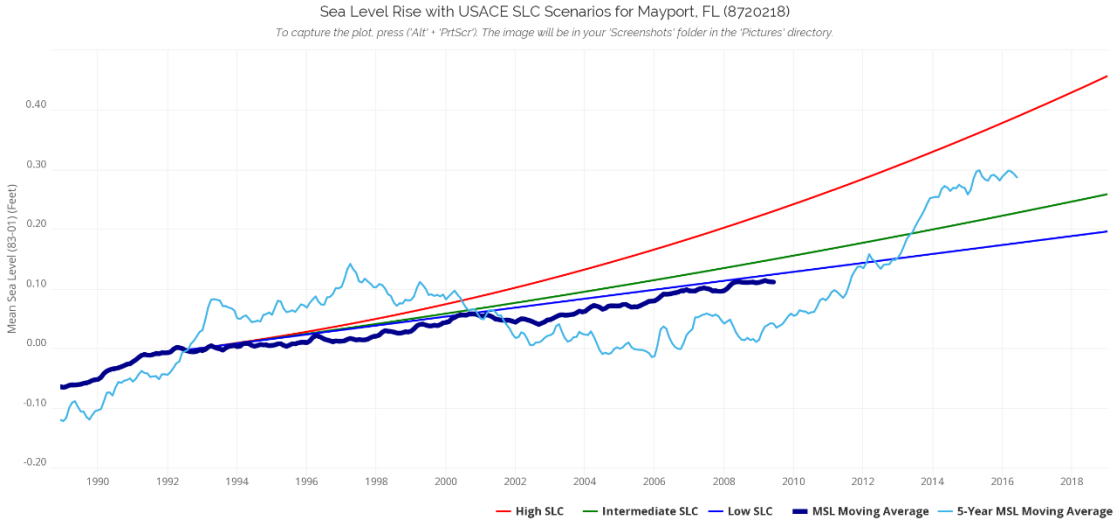
USACE Sea Level Change Predictions for Fernandina Beach, FL (NOAA Tidal Gauge #8720030) for user selected datum: MSL.
Timeframe: Apr, 1897 - Dec, 2018 (122 years, 9 months)
Timeframe contains 198 missing points; the longest gap is 14 years, 4 months.
Rate of Sea Level Change: 0.00755 ft/yr (Regional 2006)



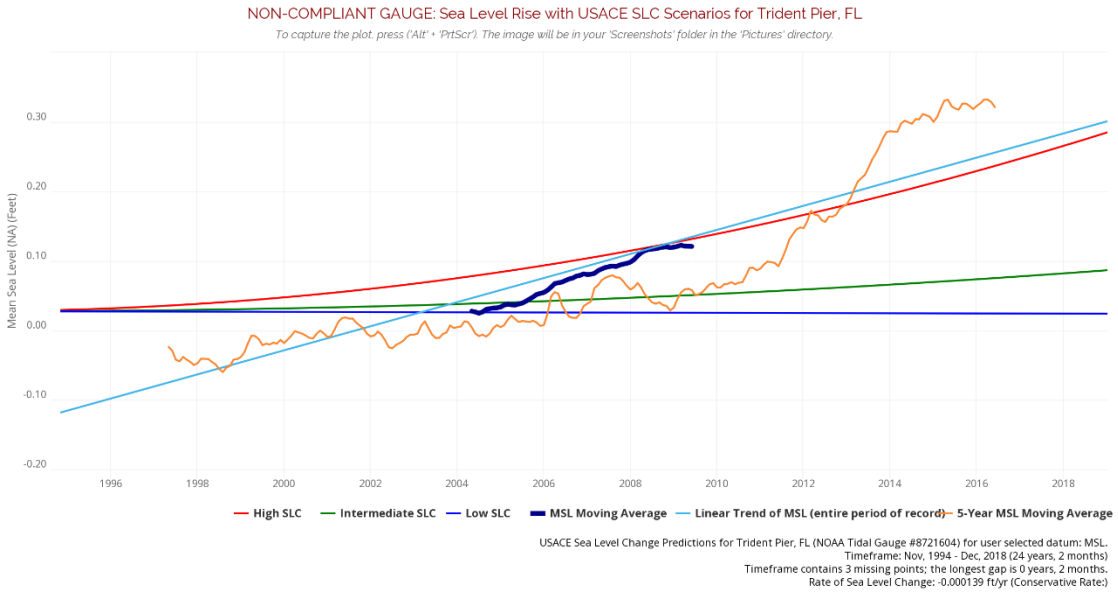
USACE Sea Level Change Predictions for Fernandina Beach, FL (NOAA Tidal Gauge #8720030) for user selected datum: MSL.
Timeframe: Dec, 1988 - Dec, 2018 (30 years, 1 months)
Timeframe contains 17 missing points; the longest gap is 1 years, 8 months.
Rate of Sea Level Change: 0.00755 ft/yr (Regional 2006)

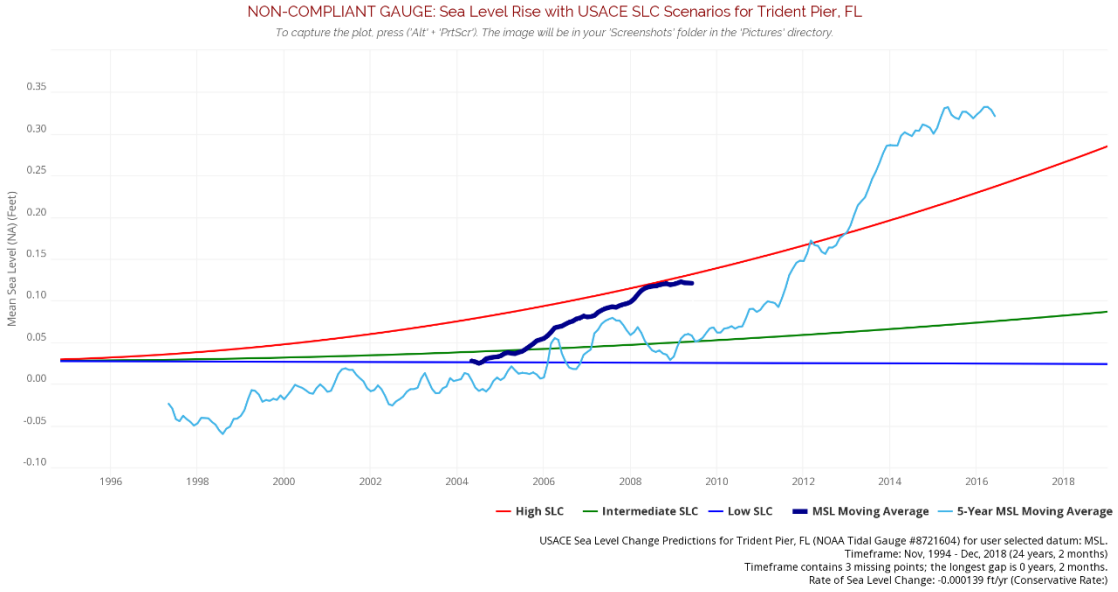


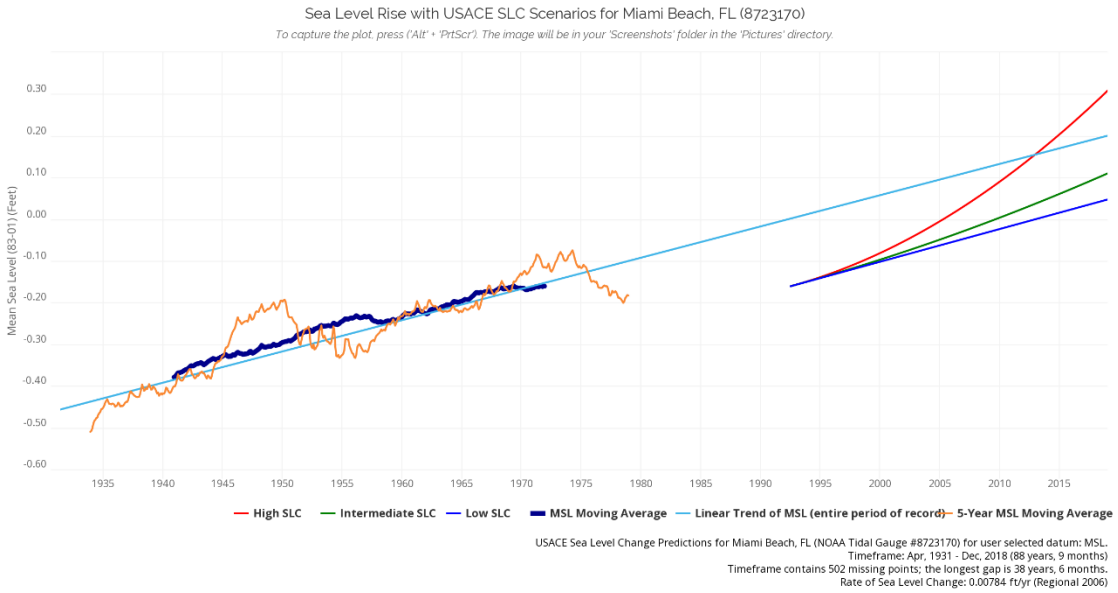
USACE Sea Level Change Predictions for Mayport, FL (NOAA Tidal Gauge #8720218) for user selected datum: MSL.
Timeframe: Apr, 1928 - Dec, 2018 (91 years, 9 months)
Timeframe contains 4 missing points; the longest gap is 0 years, 1 months.
Rate of Sea Level Change: 0.00751 ft/yr (Regional 2006)



USACE Sea Level Change Predictions for Mayport, FL (NOAA Tidal Gauge #8720218) for user selected datum: MSL.
Timeframe: Dec, 1988 - Dec, 2018 (30 years, 1 months)
Timeframe contains 2 missing points; the longest gap is 0 years, 1 months.
Rate of Sea Level Change: 0.00751 ft/yr (Regional 2006)


NON-COMPLIANT GAUGE: Sea Level Rise with USACE SLC Scenarios for Trident Pier, FL
To capture the plot, press ('Alt' + 'PrtScr'). The image will be in your 'Screenshots' folder in the 'Pictures' directory.
Mean Sea Level (NA) (Feet)
0.30
0.20
0.10
0.00
-0.10
-0.20
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
High SLC
Intermediate SLC
Low SLC
MSL Moving Average
Linear Trend of MSL (entire period of record)
5-Year MSL Moving Average
USACE Sea Level Change Predictions for Trident Pier, FL (NOAA Tidal Gauge #8721604) for user selected datum: MSL.
Timeframe: Nov, 1994 - Dec, 2018 (24 years, 2 months)
Timeframe contains 3 missing points; the longest gap is 0 years, 2 months.
Rate of Sea Level Change: -0.000139 ft/yr (Conservative Rate:)


NON-COMPLIANT GAUGE: Sea Level Rise with USACE SLC Scenarios for Trident Pier, FL
To capture the plot, press ('Alt' + 'PrtScr'). The image will be in your 'Screenshots' folder in the 'Pictures' directory.
Mean Sea Level (NA) (Feet)
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
-0.05
-0.10
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
High SLC
Intermediate SLC
Low SLC
MSL Moving Average
5-Year MSL Moving Average
USACE Sea Level Change Predictions for Trident Pier, FL (NOAA Tidal Gauge #8721604) for user selected datum: MSL.
Timeframe: Nov, 1994 - Dec, 2018 (24 years, 2 months)
Timeframe contains 3 missing points; the longest gap is 0 years, 2 months.
Rate of Sea Level Change: -0.000139 ft/yr (Conservative Rate:)


Sea Level Rise with USACE SLC Scenarios for Miami Beach, FL (8723170)
To capture the plot, press ('Alt' + 'PrtScr'). The image will be in your 'Screenshots' folder in the 'Pictures' directory.
Mean Sea Level (83-01) (Feet)
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
1935
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
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1995
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2010
2015
High SLC
Intermediate SLC
Low SLC
MSL Moving Average
Linear Trend of MSL (entire period of record)
5-Year MSL Moving Average
USACE Sea Level Change Predictions for Miami Beach, FL (NOAA Tidal Gauge #8723170) for user selected datum: MSL.
Timeframe: Apr, 1931 - Dec, 2018 (88 years, 9 months)
Timeframe contains 502 missing points; the longest gap is 38 years, 6 months.
Rate of Sea Level Change: 0.00784 ft/yr (Regional 2006)

APPENDIX D

Southeast Florida Regional Climate Change Compact's Future Conditions Adaptation and Flood Mitigation Initiatives

Future Conditions Adaptation and Flood Mitigation Initiatives

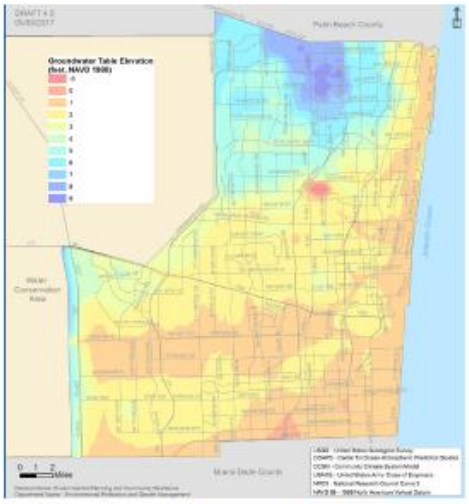
Broward, Miami-Dade, Monroe, and Palm Beach counties have collaborated since 2009 to advance comprehensive initiatives to contend with regional flood risk and prepare for future conditions through the Southeast Florida Regional Climate Change Compact (The Compact). Theses policies and projects mitigate risk at the individual property-scale, support local government planning and investment in critical infrastructure, and guide development decisions. Despite the robustness of local government action to date, **the effectiveness of these efforts is dependent upon adaptation of the Central and South Florida Flood Control Project to account for changes in the landscape and future conditions.**

Regional Initiatives: In addition to the extensive and ongoing activities advanced individually by each county, the Compact has similarly invested in multiple efforts to allow the region to prepare for sea level rise (SLR) and recurrent flooding, inclusive of a **Regional Climate Action Plan**, covering 12 chapters and 142 recommendations for coordinated action; a regionally **Unified Sea Level Rise Projection** to support planning and decision-making; and a regional **Vulnerability Assessment**. The Compact is currently advancing a **Business Case for Resilience** to ascertain the return on investment of adaptation initiatives across the region. Finally, significant staff resources across the four counties are being devoted to addressing the risks of sea level rise. Staff span a number of departments with a focus on water and sewer systems, environmental resources, urban planning, and resilience.

BROWARD COUNTY

FUTURE CONDITIONS GROUNDWATER TABLE MAP (2015-2019): Policy requires drainage infrastructure for major development and redevelopment projects to be designed for year 2070 conditions when sea level rise will have reduced the amount of rainfall that can be stored in the topsoil. Policy based on coupled groundwater and surface water modeling.

Expenditure: $1.5M



Average wet-season groundwater elevation map (2017)

REGIONAL RESILIENCE STANDARD FOR TIDAL FLOOD BARRIERS (2016-2019): Broward County Land Use Plan policy and code sets a minimum top elevation requirement of 5 feet NAVD by 2050 for all tidally influenced waterfront property owners. This standard was informed by a study undertaken in collaboration with the USACE and will reduce neighborhood flooding as a result of high tides and rising sea levels.

Expenditure: $480,000

Seawall overtopped during September 2019 high tide, Mola Avenue, Fort Lauderdale

October 2019

BROWARD 100-YEAR FLOOD ELEVATION MAP (2018-2020): Policy requires the finished floor elevations of buildings to be higher than the flood elevations predicted for a 100-year return interval storm based on community hydrologic modeling under future conditions. An update of this map is underway to include flood projections considering future rainfall and sea level rise.

Expenditure: $1M

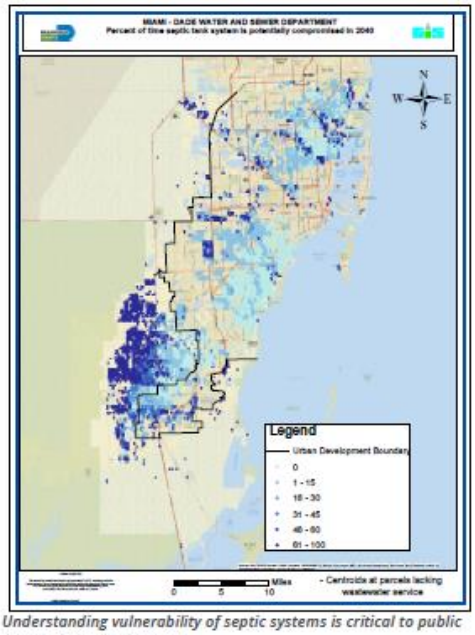
RESILIENT INFRASTRUCTURE PLAN (2020-2022): A basin-level economic risk assessment and identification of infrastructure improvements needed to mitigate future flood risk and impacts of future flood conditions. This assessment will serve as the foundation for a county-wide resilient infrastructure improvement plan.

Expenditure: $3M

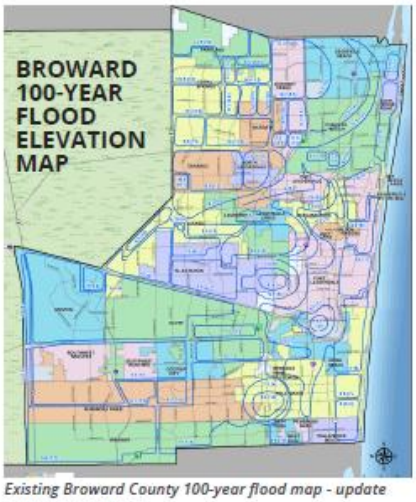
MIAMI-DADE COUNTY

RESILIENCY STUDIES ON SEPTIC SYSTEMS VULNERABLE TO SLR (2017 – present): Analyzing the potential impacts to the functionality of septic systems as a result of current and projected groundwater water levels. County Staff are prioritizing short and medium-term actions to mitigate the potential risks posed by sea level rise upon the most vulnerable septic systems.

Expenditure: significant staff time



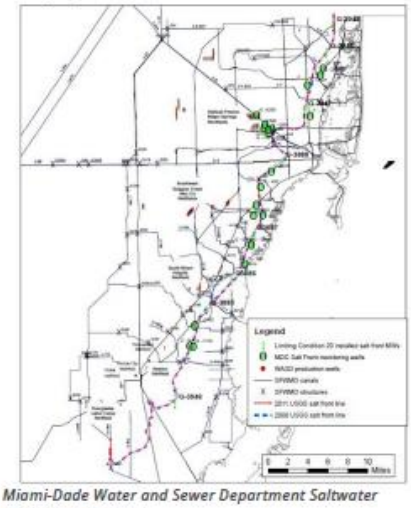
Understanding vulnerability of septic systems is critical to public and environmental health



Existing Broward County 100-year flood map - update currently underway

RESILIENCY STUDIES AND IMPROVEMENTS FOR WATER AND WASTEWATER ASSETS (on-going): Multiple efforts to assess how water and wastewater systems will be affected by sea level rise and storm surges, inclusive of a series of engineering studies to identify future conditions, exposure of assets, appropriate design elevations, and costs. On-going studies are monitoring and modeling saltwater intrusion of aquifer. The County is also incurring a marginal cost increase to elevate or protect their facilities as they are investing in capital improvements as part of the Ocean Outfall and Consent Decree programs.

Expenditures: Approximately $9M in discrete studies and monitoring efforts. Approximately 5% increase in costs for all capital improvements related to Ocean Outfall and Consent Decree programs



Miami-Dade Water and Sewer Department Saltwater Monitoring Network

SEA LEVEL RISE STRATEGY (2018-2020): Consulting team led by Arcadis Inc. is providing guidance on how the County can address sea level rise comprehensively—identifying implementable, financially-feasible adaptation strategies for the short, medium, and long-term. This study is also assessing the economic implications of multiple adaptation approaches to identify cost-effective investments.

Expenditure: $600,000

ROAD ELEVATION AND DRAINAGE IMPROVEMENTS (2017 – 2018): Construction of drainage and roadway improvement to include a berm to reduce the effects of King Tide Flooding and Elevation of Dade Boulevard.

Expenditure: more than $3M

RESILIENCY STUDIES AND IMPROVEMENTS AT COUNTY PARKS (2017 – present): Investment in vulnerability studies, engineering studies, and protective projects to address the flooding within County Parks. In 2017-2018 these projects included a Sea Level Rise Feasibility Study for Matheson Hammock, flood panels at doors and openings to fortify the Deering Estate (a historic structure), Crandon Park Marina Northern shoreline stabilization with mangroves and riprap, and Canal Bank Stabilization to stabilize new roadway at Black Point Marina against tidal erosion.

Expenditure: approximately $1.3M

ADAPTATION ACTION AREA FOR THE ARCH CREEK BASIN (2016 – 2018): The County's pilot Adaptation Action Area was the Arch Creek Basin. Urban Land Institute (ULI) hosted an advisory services panel providing recommendations for the area's flood challenges and hosted a subsequent 'Resilient Redesign' charrette aimed at enhancing the resilience within the Arch Creek basin. With support from the Knight Foundation, the County partnered with Citymart to launch a Flood Resilience Challenge to identify solutions for the area.

Expenditure: approximately $108,000

RAPID ACTION PLAN (2017-2018): Assessed the vulnerability of more than 1,000 County-owned assets (i.e. properties, facilities, and planned projects) to changing flood risks, due to sea level rise and stronger storms, and evaluated their criticality to departmental operations and emergency management, as well as more than 300 projects in the multi-year Capital Improvement Program. Assets were then ranked based on their vulnerability and criticality scores, allowing each department to prioritize hardening of their existing critical facilities and infrastructure.

Expenditure: $200,000

ON-GOING PROGRAMS THAT BENEFIT FLOOD RISK MITIGATION (on-going): Several on-going programs help with broader SLR adaptation efforts, including County capital improvements to manage stormwater and mitigate flood damage, the master plan of County capital improvements to manage stormwater and mitigate flood damage, mangrove restoration which enhances coastal resiliency and storm protection for inland communities. Additionally beach nourishment and land acquisition program (Environmentally Endangered Lands Program) help provide a key buffer from the impacts of sea level rise.

Expenditure budgeted for FY2017 and 2018: $51M

MONROE COUNTY

PILOT ROADS ELEVATION PROJECT (2018 – present): Project includes pilot roadway elevation and stormwater construction for neighborhoods in Big Pine and Key Largo, to reduce impacts due to seasonal flooding and includes sea level rise assumptions for the useful life of the project.

Expenditure: Pilot $5M; full cost of project TBD

A closer look at the low elevation roads in the Twin Lakes community on Key Largo. Monroe County plans to spend almost a million dollars to elevate a third of a mile of Shaw Drive, marked in red.

SEPTIC TO SEWER CONVERSION (2005 – present): Seven wastewater operators have converted virtually all of the County's 77,000 residents to central sewer systems.

Expenditure: ~$1B invested by the County, the wastewater system operators, and individual residents and businesses.

WATERSHED MANAGEMENT PLAN: Plan integrates stormwater risk identification with watershed management planning requirements as identified in FEMA's Community Rating System (CRS), inclusive of updated database of stormwater infrastructure analysis. The Plan was adopted in August 2019 and has been deemed in compliance with CRS requirements by FEMA.

COUNTYWIDE ROADS AND STORMWATER ANALYSIS (Spring 2019 – present): Analysis to develop a short, medium and long-term capital plan of road and stormwater adaptation projects. Process will also include level of service and funding options for countywide road elevation.

Expenditure: $1.89M

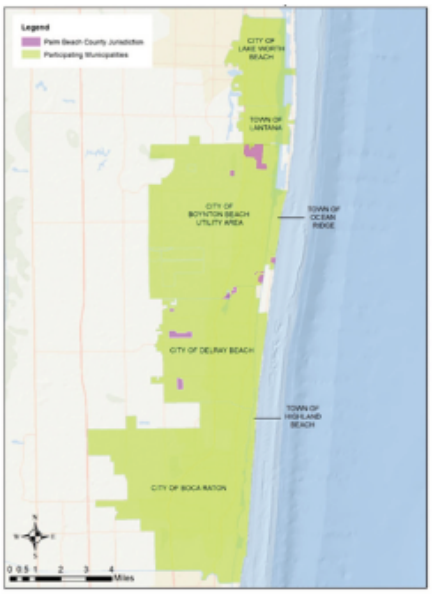
COMPREHENSIVE PLAN UPDATES (2019 – present): Integration of County's GreenKeys adaptation and vulnerability planning into multiple elements of the County's Comprehensive Plan, including but not limited to the Peril of Flood Amendments in the Conservation and Coastal Management Element.

PALM BEACH COUNTY

CAPITAL IMPROVEMENT PROJECTS POLICY AND PROCEDURE MANUAL (2019 – present): Development of a Policy and Procedure Manual to incorporate resilience and sustainability into the planning phase of capital improvement projects performed by the County, requiring SLR to be considered in planning and documenting integration of green infrastructure and other resiliency efforts into facilities and infrastructure projects.

COASTAL RESILIENCE PARTNERSHIP (2018 – 2020): Collaboration among seven municipalities to address climate vulnerability in the southern coastal region of the County, inclusive of a joint climate change vulnerability assessment and advancement of collaborative adaptation strategies.

STORMWATER INFRASTRUCTURE MAPPING (2019 – present): Embarking on data collection services to begin the process of mapping a comprehensive Stormwater GIS inventory for County stormwater infrastructure. Adequate information on the County's stormwater infrastructure will allow the County to better understand existing water quality impacts, and evaluate and implement water quality improvement projects.



Map of the Coastal Resilience Partnership