Presentation of Stormwater Master Plan Update (Phase 1)

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Presentation of Stormwater Master Plan Update (Phase 1)

Presentation in Two Parts

- **Part A – Flooding Due to SLR, King Tides, and Large Storm Events**
  (CPWG's Present Scope of Work – Master Plan Update 2020)

- **Part B – Flooding (Ponding) During Minor Rainfall Events**
  (and Stormwater Management of the same Using Green Infrastructure)

Part A – Flooding Due to SLR, King Tides and Large Rainfall Events

(CPWG's Present Scope of Work for Stormwater Master Plan Update 2020)

Part A - Stormwater Master Plan Update 2020, Phase 1

Scope of Work

Phase 1

- Review past studies since 2012, especially Vulnerability Assessment Study.
- Review on-going CIP projects.
- Recommend a citywide list of projects and/or strategies for Phase 2 evaluation.
- Recommend engineering criteria (Projected MSL in 2050, 100 Year/24 Hour Rainfall, etc.).
- Obtain City's concurrence on which projects to address first from the recommended list in Phase 1.

Phase 2

For the projects agreed upon in Phase 1:

- Review existing stormwater inventory, if readily available
- Conduct field reconnaissance as necessary
- Compute extent of flooding in selected areas to improve resiliency
- Explore funding options
- Prepare final report

Part A - Stormwater Master Plan Update 2020, Phase 1

	Previous Study	Key Summary
1.	2012 SWMP Update	Evaluated 25 Basins for water quantity and quality and recommended prioritized improvements; later confirmed by other studies. (By CPWG)
2.	2018 FDEP Adaptation Planning Guidebook	How to incorporate resiliency measures through consideration of future flood risks from storm surges and **sea level rise in Adaptation Action Plans** through a framework of Context, Vulnerability Assessment, Adaptation Strategies and Implementation Strategies. (By FDEP)
3.	2019 St. Pete Beach Coastal Resiliency Plan	Performed flooding assessment under large storm events with and without projected sea level rise; Used 2015 CSAP projections for **2050 SLR at 1.46 ft. above MSL** today, and developed actionable mitigation policies, strategy, and projects. (By Kimley-Horn)
4.	2019 Tampa Bay CSAP publication for Sea Level Projections	Revised 2015 estimates, **generally upwards,** of low, intermediate, and extreme sea level projections using conditional probabilities of future greenhouse gas emissions, ocean warming and ice sheet loss. Recommended using **intermediate projections for Sea Level Rise**. (By TBCSAP)
5.	2019 St. Pete Beach Sustainable Action Plan Presentation	Clearly depicted acceleration of SLR, showed the City's vulnerability under various stacked events, such as **higher SLR**, large storm events, king tide, etc. Discussed various on-going efforts to mitigate its vulnerability to flooding through neighborhood storm drainage improvement projects, sea wall replacements to a higher elevation (5' above MSL), gave LOS criteria, etc. (By PWD)
6.	2020 Vulnerability Assessment	Provided guidance for adaptive measures to gain resiliency to SLR and Storms on a scale of 1 to 5; provided flood depths at street intersections throughout the City. Discussed CSAP **SLR of 1.44 ft. above MSL in 2050**. (By Kimley-Horn)
7.	2020 USACOE Presentation of Storm Risk in Pinellas County	Confirmed how **MSL Rise of almost 7 inches since 1992.** (By USACOE)

Part A - Stormwater Master Plan Update 2020, Phase 1

2019 CSAP Projections for Intermediate Sea Level Rise		
Year	SLR (ft.)	Incremental Rise in ft.
2030	0.79	
2040	1.08	0.29
2050	1.44	0.36
2060	1.87	0.43
2070	2.33	0.46
2080	2.82	0.49
2090	3.38	0.52
2100	3.90	0.52

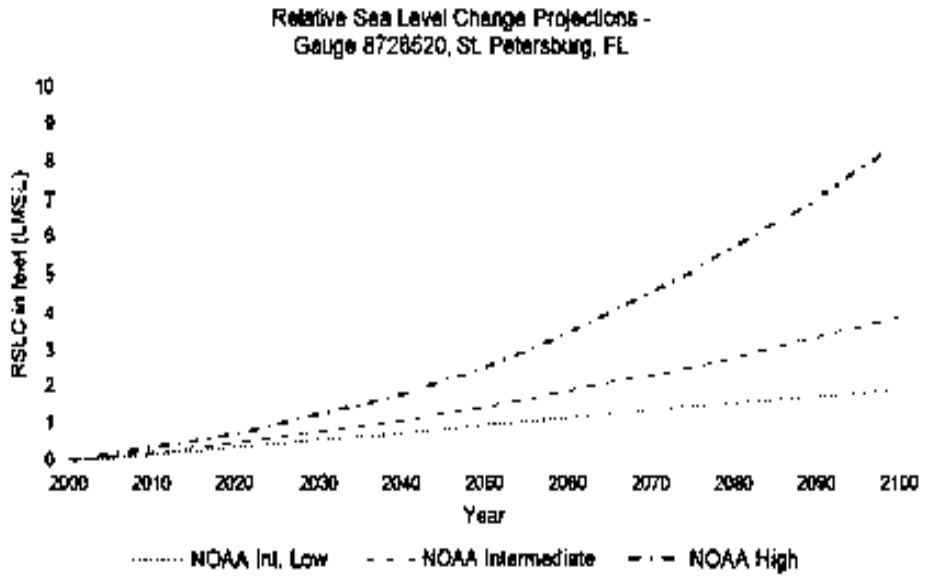


Figure 3. Graphic Relative Sea Level Change (RSLC) Scenarios for St. Petersburg, Florida, as calculated using the regionally corrected NOAA 2017 curves. (USACE 2019)

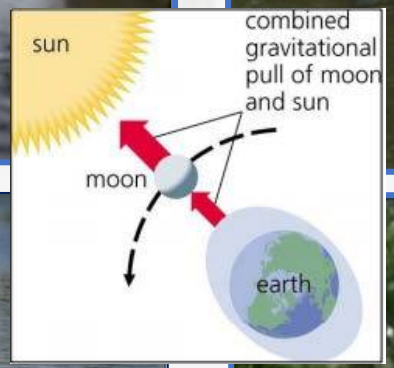
CAUTION: In less than 5 years, projections were revised by TBCSAP upwards. Therefore, what is projected today for 2050 SLR may possibly occur even earlier than 2050.

CSAP Projections for High Sea Level Rise		
Year	2015 SLR (ft)	2019 SLR (ft)
2030	1.00	1.25
2040	1.40	1.77
2050	2.22	2.56
2060	3.00	3.48
2070	3.80	4.56
2080	4.80	5.71
2090	5.75	7.05
2100	6.89	8.50

".....It is predicted that by 2025 three-quarters of the world's population will reside in coastal zones, many of which will be exposed or vulnerable to the impacts of flooding." – Edward Barsley

Part A - Stormwater Master Plan Update 2020, Phase 1

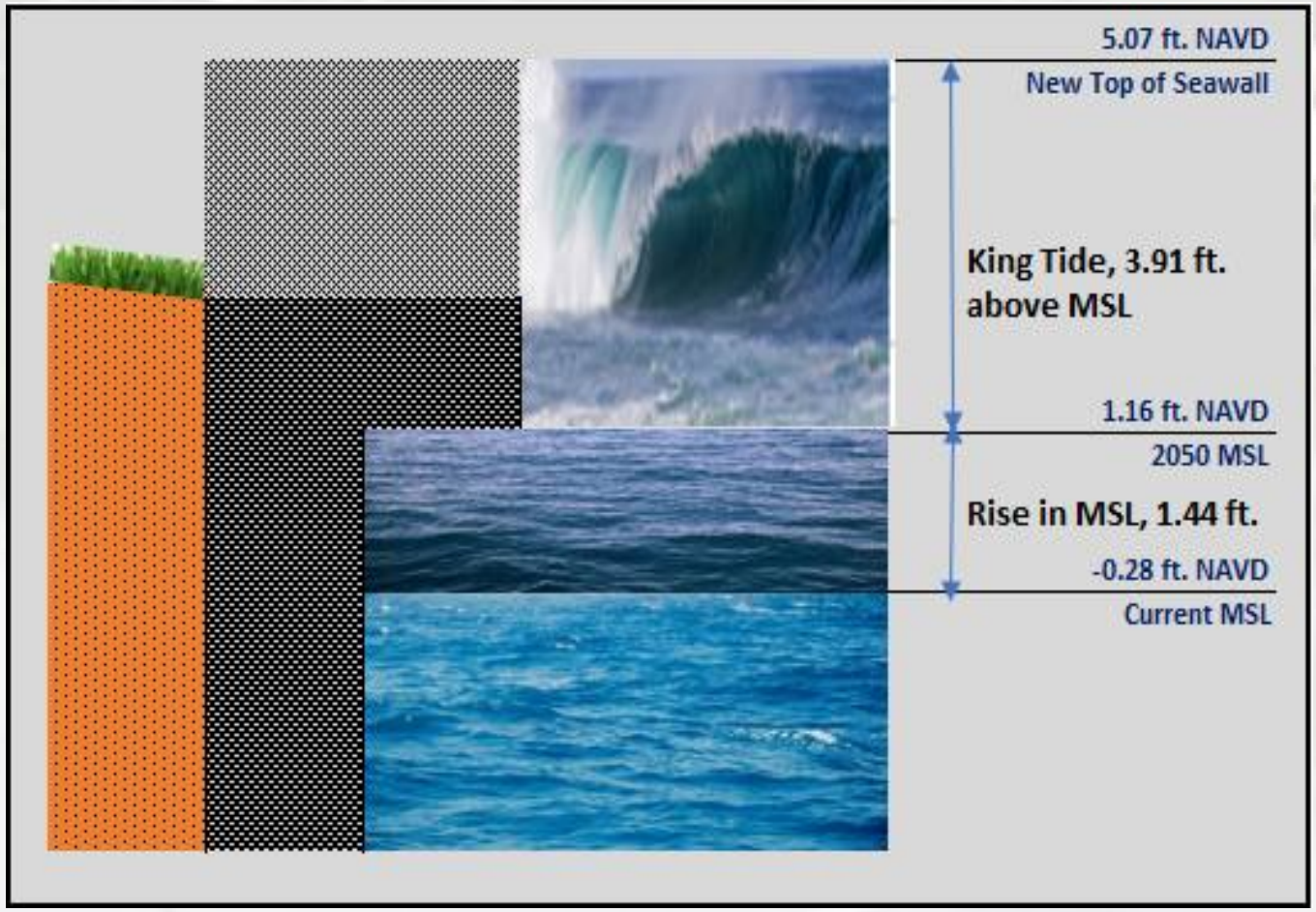
King Tide Flooding in St. Pete Beach in 2017



Part A - Stormwater Master Plan Update 2020, Phase 1

10 Highest Tide Elevations since 2016 at Gauge Station No. 8726520			
	Date	NAVD 1988 Elev.	ft. Above MSL
1.	09/02/2016	3.63	3.91
2.	09/01/2016	3.40	3.68
3.	01/23/2017	3.30	3.58
4.	06/06/2016	3.30	3.58
5.	10/10/2018	3.23	3.51
6.	12/21/2018	3.22	3.50
7.	02/07/2020	3.10	3.38
8.	10/07/2017	2.99	3.27
9.	10/09/2018	2.95	3.23
10.	10/19/2019	2.93	3.21

Raising Seawalls for Protection Against King Tide



Note: 5.35 ft. above current MSL = 5.07 ft. of 1988 NAVD Elevation

Part A - Stormwater Master Plan Update 2020, Phase 1

Data from Presentation for Sustainability Action Plan 2020-2050

Water Threats
St. Pete Beach

Recommended Level of Service
4 Feet Above Current MSL

2 Ft of King Tide: Current Events
+2 FT of Sea Level Rise: 2050

This is an approximate average between the NOAA 2 FT SLR Scenario and the Kimley-Horn Study Group 3 Intermediate Prediction Including the 100 Year Storm for 2050 as our water threats resiliency planning prioritization model for the next 5 fiscal years updated annually.

This sets the standard for development of Adaptation and Implementation Strategies.

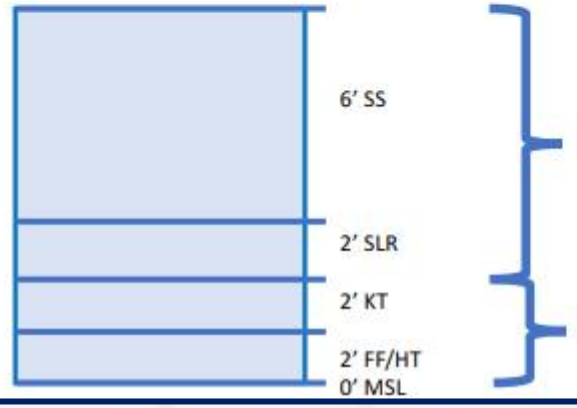
Action Plan

What Are we Planning to Defend Against?

Multiple Water Threats at Multiple Island Locations; Property, Structures and Infrastructure

How do we Plan to Prepare?

City Wide and Localized Approach Incorporating Systems Integration



City Wide Analysis and Planning
City Wide Public Infrastructure and Beach Improvements

Street Systems and Stormwater Drainage Basins
Local Neighborhood Improvements

Note: The above LOS and Action Plan may need to be refined in Phase 2.

Part A - Stormwater Master Plan Update 2020, Phase 1

Adaptive Measure Evaluation Criteria*	
Measure	**Resiliency Rating**
Increase resiliency by hardening infrastructure against future 2050 Extreme SLR and 100-year/24-hour event.	5
Increase resiliency by hardening infrastructure against existing conditions during 100-year/24-hour event.**	4
Increase resiliency or reduce flooding by improving overall functionality of asset.	3
Maintain existing condition and integrity of asset for use or accessibility.	2
Minimal benefit to resiliency	1

* Source: 2020 Vulnerability Assessment Study by Kimley-Horn

** Generally yields results very similar to 25-year/24-hour rain event stacked on top of 2050 Intermediate rise in SLR.

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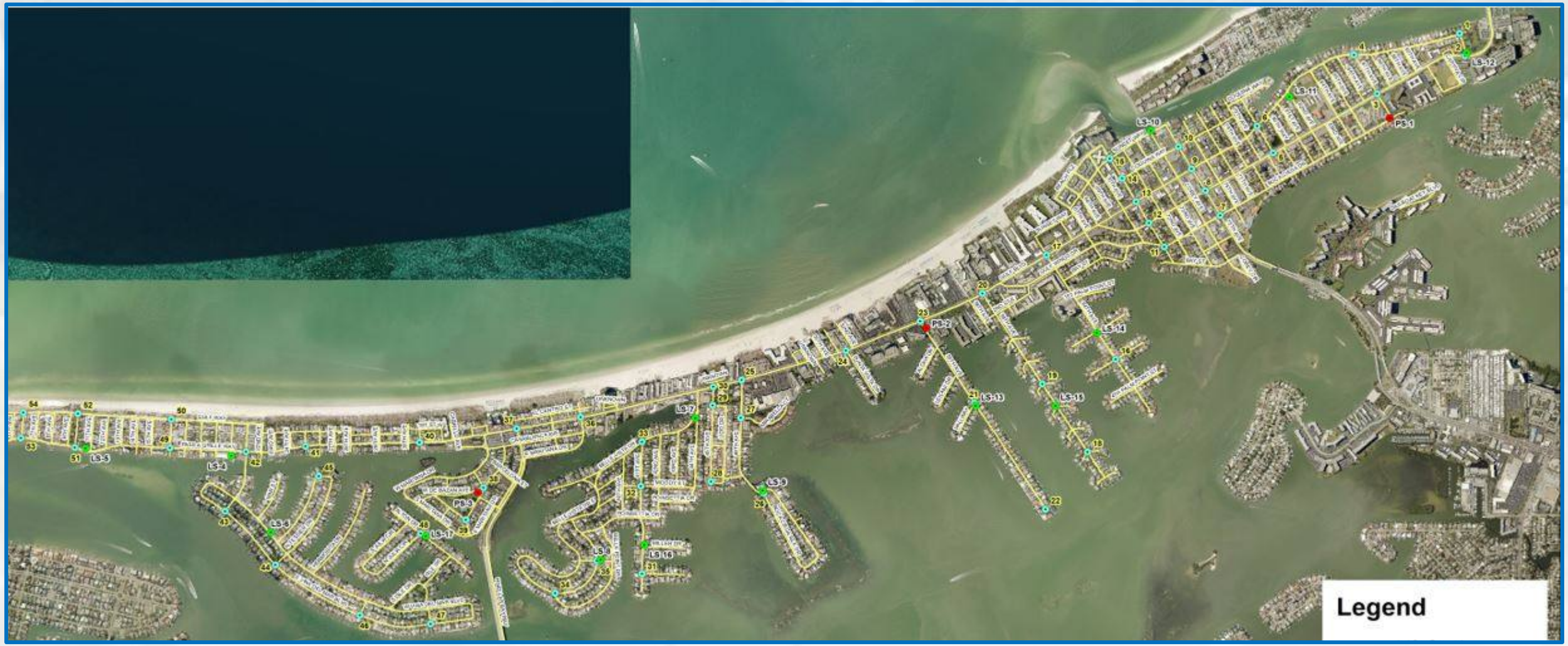
2020 Vulnerability Assessment Study



54 intersections throughout the City for flooding computations under various combinations of SLRs and Rainstorms

Source: Kimley-Horn

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Why consider the study of flooding at intersections as critical?

1. Roadway intersections serve as a proxy for the overall roadway conditions.

2. For a small linear city like St. Pete Beach, roadways reliability is crucial for:

   - Access to governmental institutions
   - Access to residences
   - Access to recreational areas
   - Access to commercial establishments
   - Access to surrounding towns
   - Evacuation in emergencies, such as hurricanes

3. Therefore, flooding at intersections can serve as a guide to determine specific projects for further evaluation in Phase 2.

4. Other infrastructure, such as sewage lift stations, buildings, etc. are important but they are localized and hAvenue relatively easier solutions for flood proofing.

Part A - Stormwater Master Plan Update 2020, Phase 1

Data Included in the Vulnerability Study

Total No. of Intersections included in Vulnerability Study = 54

Total No. of Intersections with No Flooding = 17

Intersections with Some Flooding = 37

Part A - Stormwater Master Plan Update 2020, Phase 1

Project Status Since 2012 Master Plan					
No.	Completed Projects Since 2012 Master Plan Update (w/o consideration of SLR)	No.	CIP Projects Currently in Progress	No.	FDOT Projects
1	Pass A Grille Way & 5th Avenue	8	Belle Vista Drive & 41st Avenue*	16	Gulf Blvd. & 37th Avenue
2	Pass A Grille Way & 10th Avenue	9	Moody Street & 44th Avenue, #9	17	Gulf Blvd. & 44th Avenue
3	Pass A Grille Way & 15th Avenue	10	Boca Ciega Isle Drive & 46th Avenue*	18	Gulf Blvd. & 46th Avenue
4	Pass A Grille Way & 21st Avenue	11	E Debazan Ave. & S Debazan Avenue*	19	Coquina Way & 75th Avenue
5	Pass A Grille Way & 25th Avenue	12	E Debazan Avenue & AlhambraSt.*	20	Gulf Blvd. & 75th Avenue
6	Pass A Grille Way & 30th Avenue	13	Bali Way N & 59th Avenue, #4	21	Gulf Blvd. & 80th Avenue
7	Boca Ciega Drive & 75th Avenue	14	Bahia Honda Way & 59th Avenue*	22	Gulf Blvd. & 87th Avenue
		15	Gulf Blvd. & 93rd Avenue		
			* May need expanding current Genesis projects to include these areas		

Intersections with Some Flooding = 37
Intersections within Above Projects = 22

Intersections within Future Projects = 15

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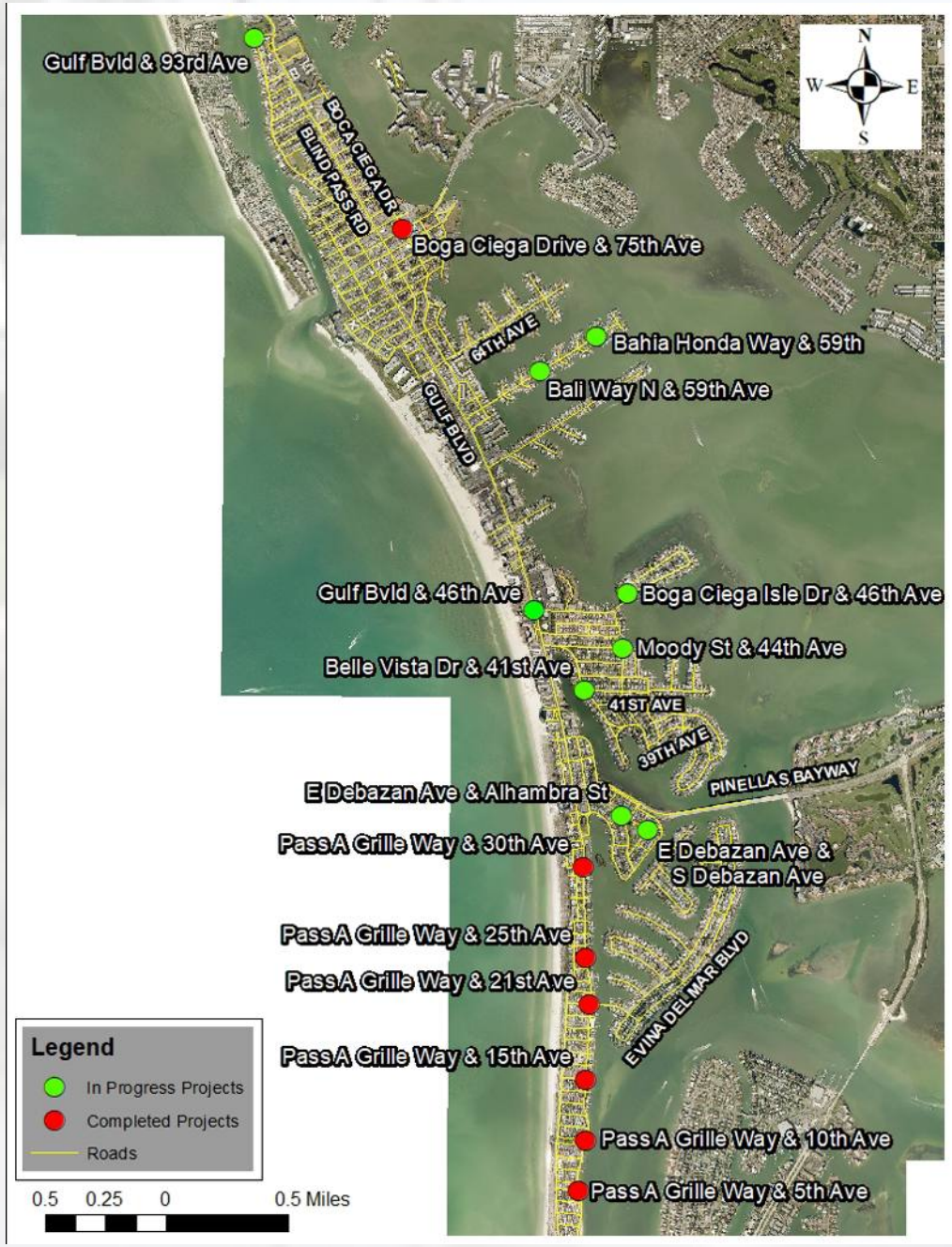

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Partial Data from Vulnerability Assessment Study					
Critical Roadway Intersections		Roadway Crest Elevation (ft.)	NAVD'88 Flood Elevations in ft.		
			100Yr /24H Storm Event	2050 SLR (Intermediate) + 25Yr /24h Storm	2050 SLR (Extreme) + 100Yr/24h Storm
1.	Belle Vista Dr E & 39th Avenue	2.90	3.44	3.43	4.01
2	Belle Vista Dr & 44th Avenue	2.94	-	2.97	4.00
3	Holland Dr & 41st Avenue	3.18	3.46	3.46	4.00
4	E Vina Del Mar Blvd & N Isle D	4.46	5.26	5.26	5.26
5	Boca Ciega Dr & 71st Avenue	3.39	3.44	3.44	4.00
6	Blind Pass Rd & 87th Avenue	3.46	3.36	3.36	4.01
7	Pali Way & 55th Avenue	3.62	-	-	4.00
8	Alton Dr & N Julia Cir	4.58	4.83	4.84	4.84
9	Mirabella Ct & 46th Avenue	3.77	-	-	3.99
10	3rd Palm Point St & 64th Avenue	3.82	-	-	4.01
11	Sunset Way & 71st Avenue	3.88	-	-	4.00
12	End of 55th Avenue	3.92	-	-	4.00
13	Blind Pass Rd & 80th Avenue	3.96	-	-	4.01
14	End of N Tessier Drive	5.33	5.36	5.36	5.36
15	Clearview Way & 39th Avenue	3.32	-	3.40	4.00

Part A - Stormwater Master Plan Update 2020, Phase 1

Priority Rank	Intersection	Inches of Flooding		
		100Y/24H Extreme SLR	100Y/24H without SLR	25Y/24H Intermediate SLR
1	Belle Vista Dr E & 39th Avenue	13.32	6.48	6.36
2	Belle Vista Dr & 44th Avenue	12.72	-	0.36
3	Holland Dr & 41st Avenue	9.84	3.36	3.36
4	E Vina Del Mar Blvd & N Isle Dr	9.60	9.60	9.60
5	Boca Ciega Dr & 71st Avenue	7.32	0.60	0.60
6	Blind Pass Rd & 87th Avenue	6.60	-	-
7	Pali Way & 55th Avenue	4.56	-	-
8	Alton Dr & N Julia Cir	3.12	3.00	3.12
9	Mirabella Ct & 46th Avenue	2.64	-	-
10	3rd Palm Point St & 64th Ave.	2.28	-	-
11	Sunset Way & 71st Avenue	1.44	-	-
12	End of 55th Avenue	0.96	-	-
13	Blind Pass Rd & 80th Avenue	0.60	-	-
14	End of N Tessier Drive	0.36	0.36	0.36
15	Clearview Way & 39th Avenue	8.16	-	0.96

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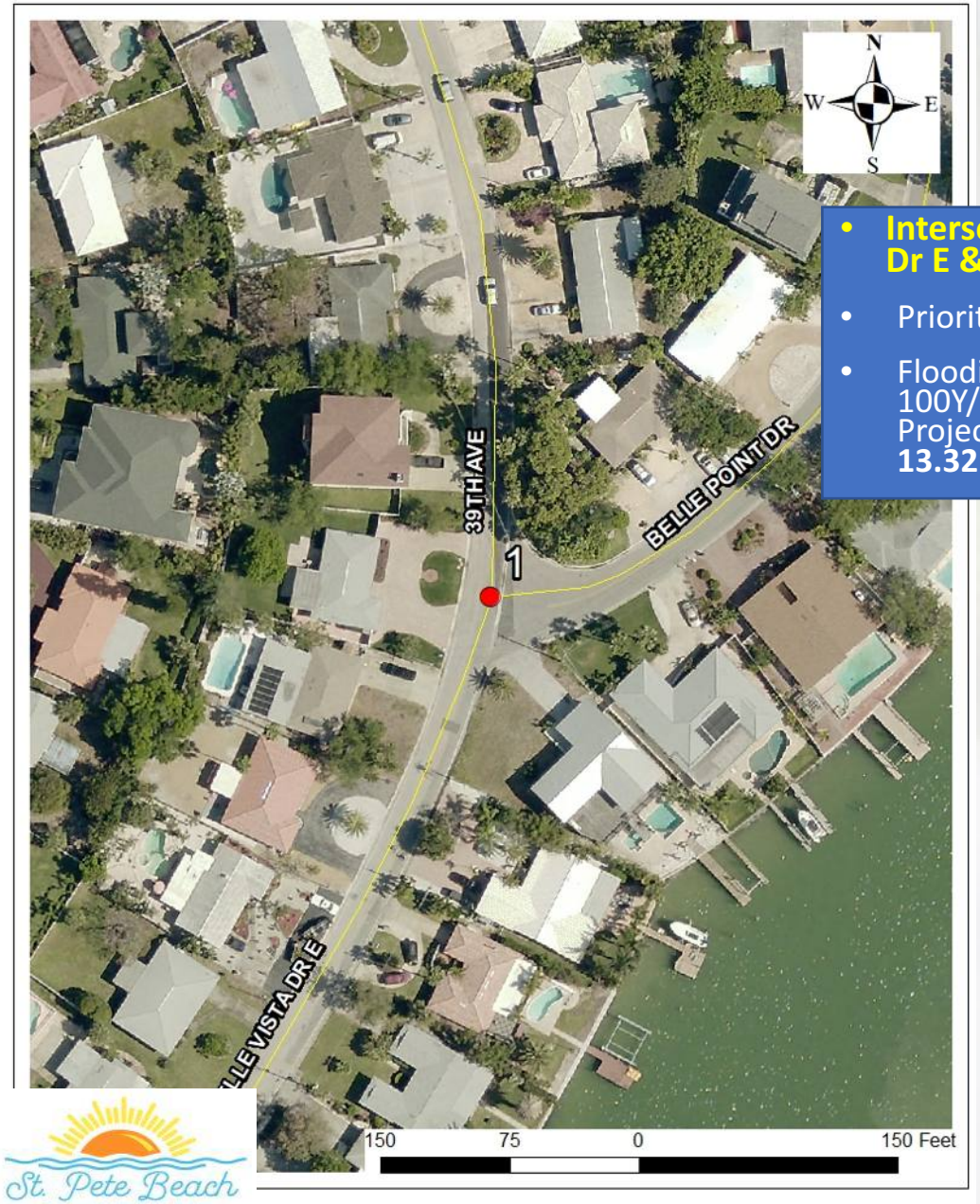
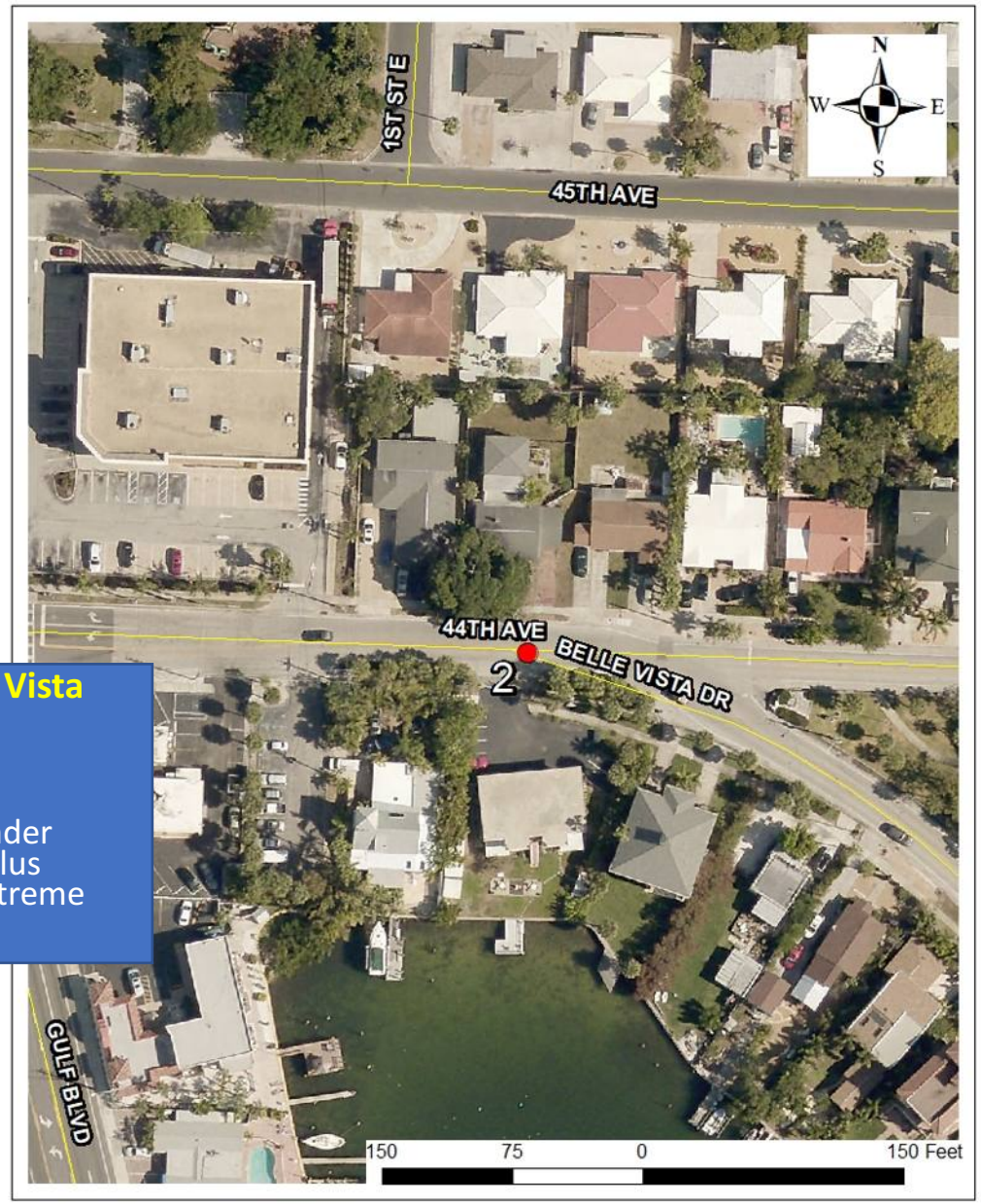


- **Intersection of Belle Vista Dr E & 39th Avenue**
- Priority Rank: **1**
- Flooding Depth under 100Y/24H Storm plus Projected 2020 Extreme SLR: **13.32 inches**

Intersection of Belle Vista Drive & 44th Avenue

- Priority Rank: **2**
- Flooding Depth under 100Y/24H Storm plus Projected 2020 Extreme SLR: **12.72 inches**



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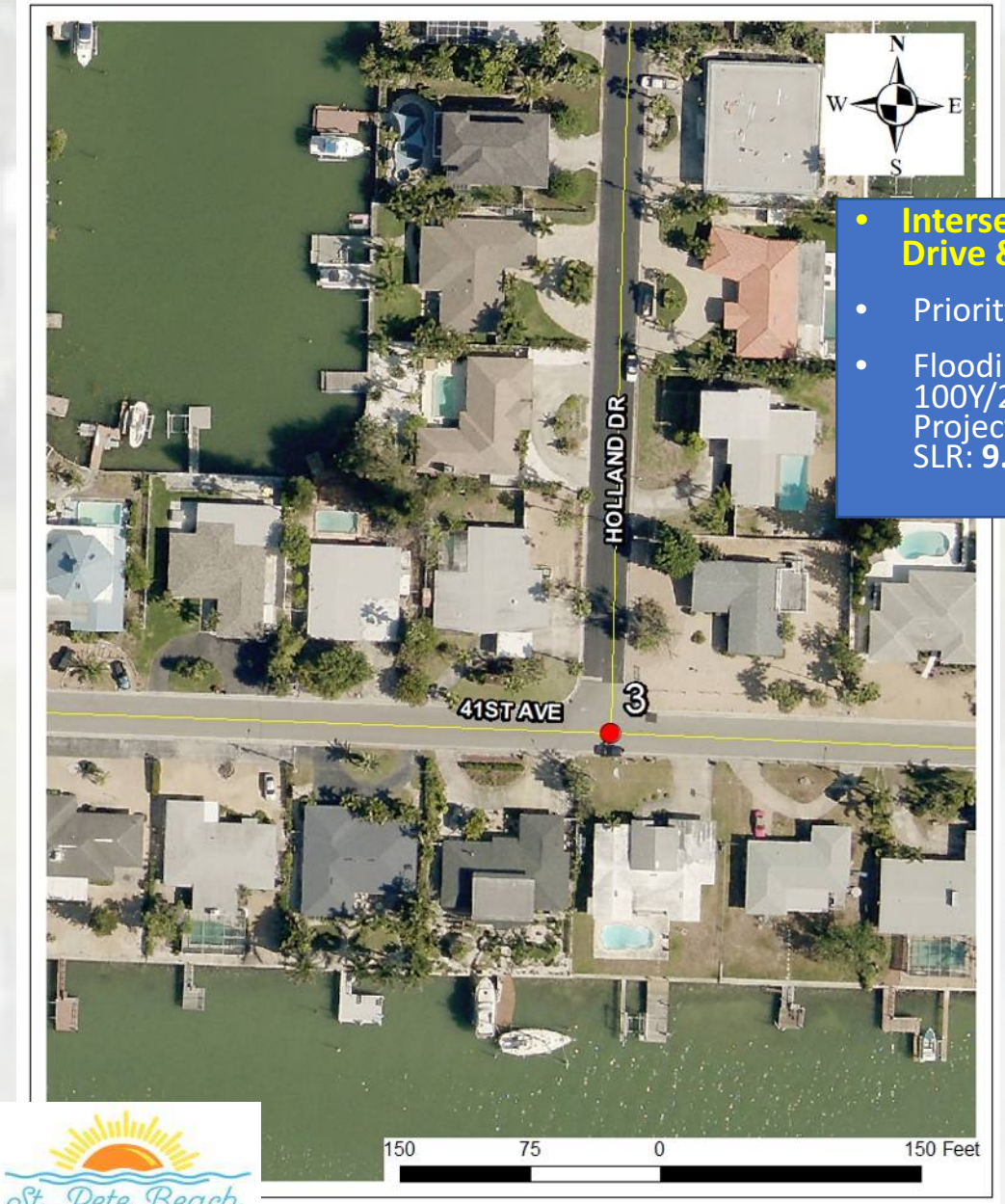
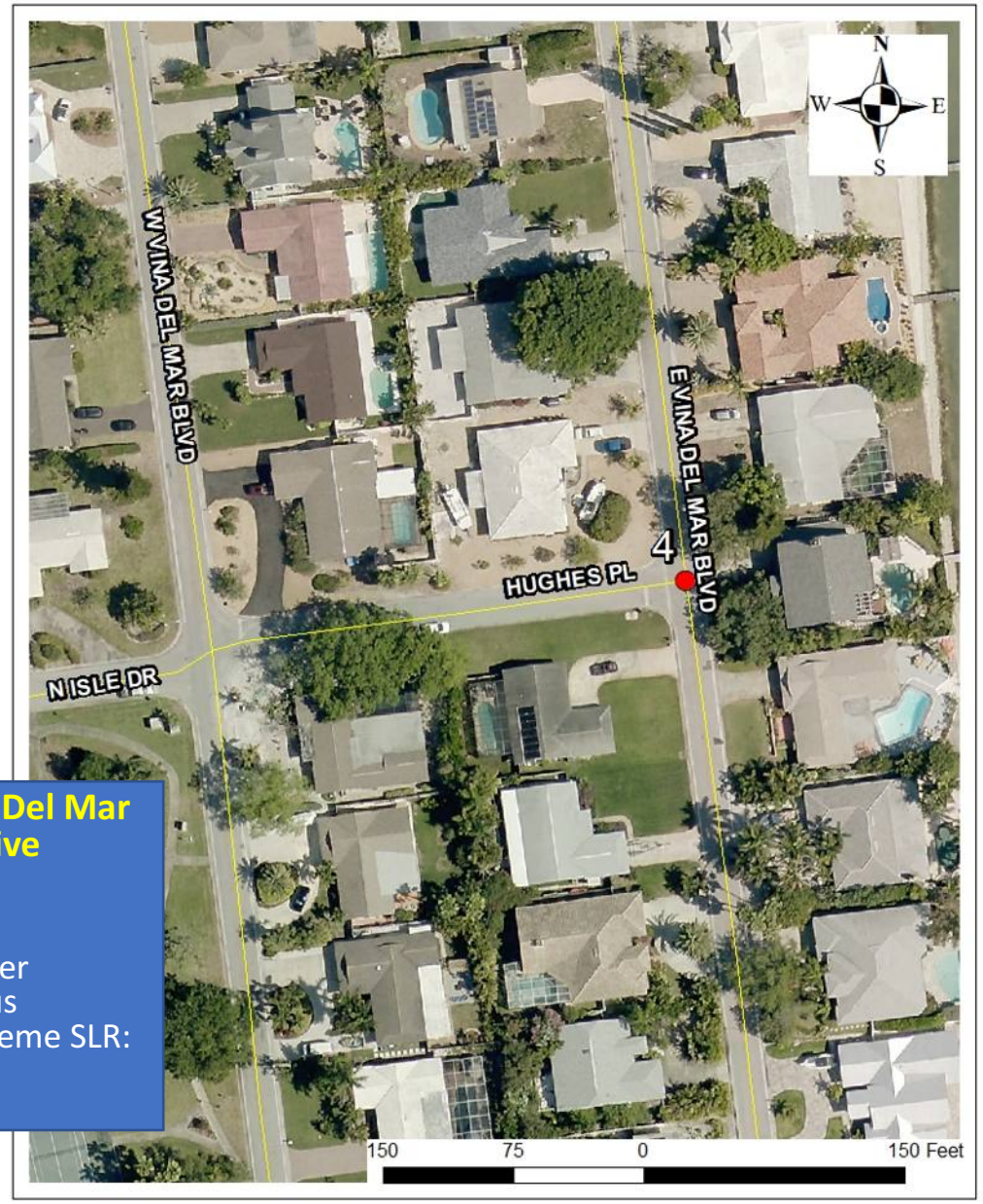


- **Intersection of Holland Drive & 41st Avenue**
- Priority Rank: **3**
- Flooding Depth under 100Y/24H Storm plus Projected 2020 Extreme SLR: **9.84 inches**

Intersection of E Vina Del Mar Boulevard & N Isle Drive

- Priority Rank: **4**
- Flooding Depth under 100Y/24H Storm plus Projected 2020 Extreme SLR: **9.60 inches**



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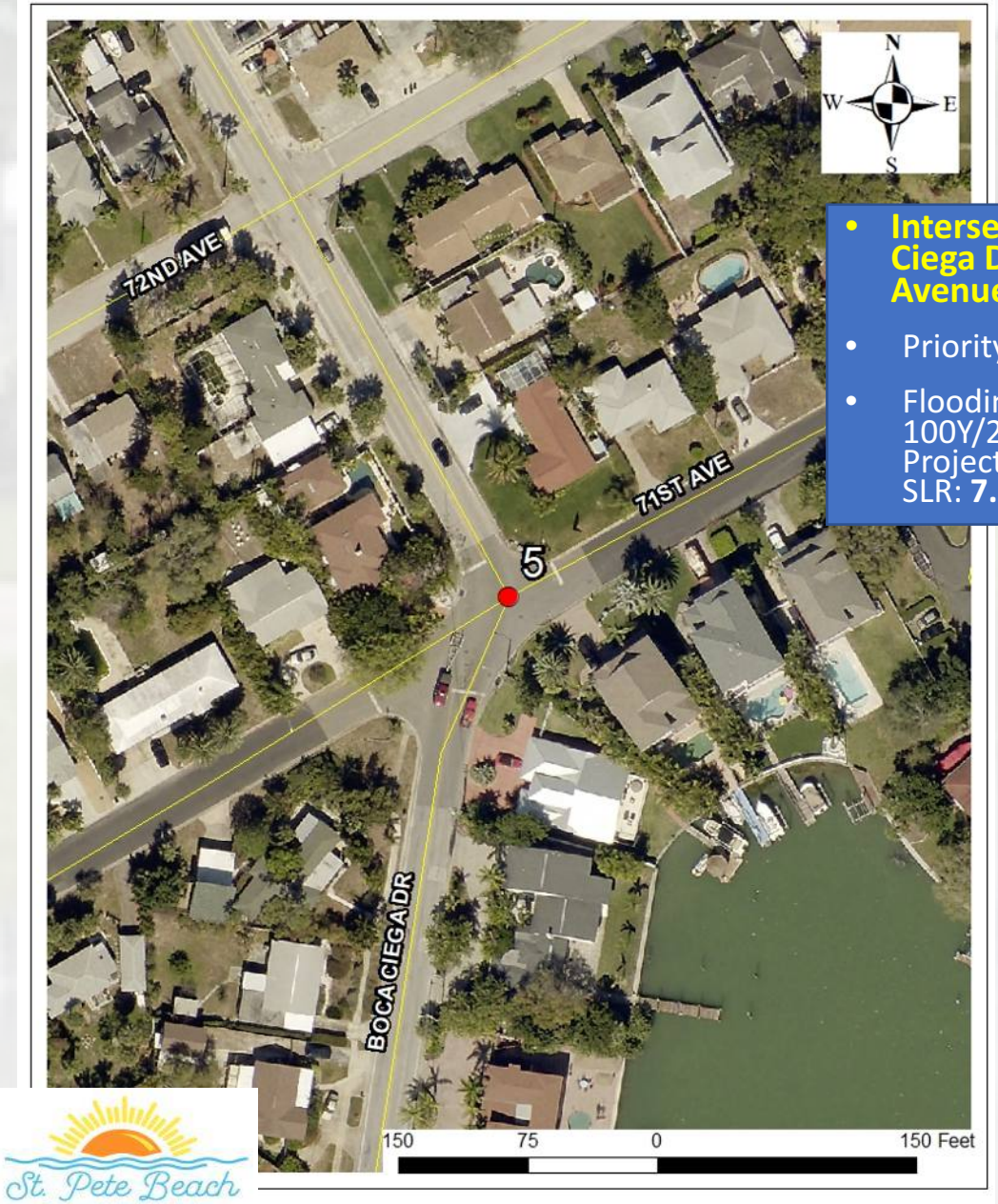
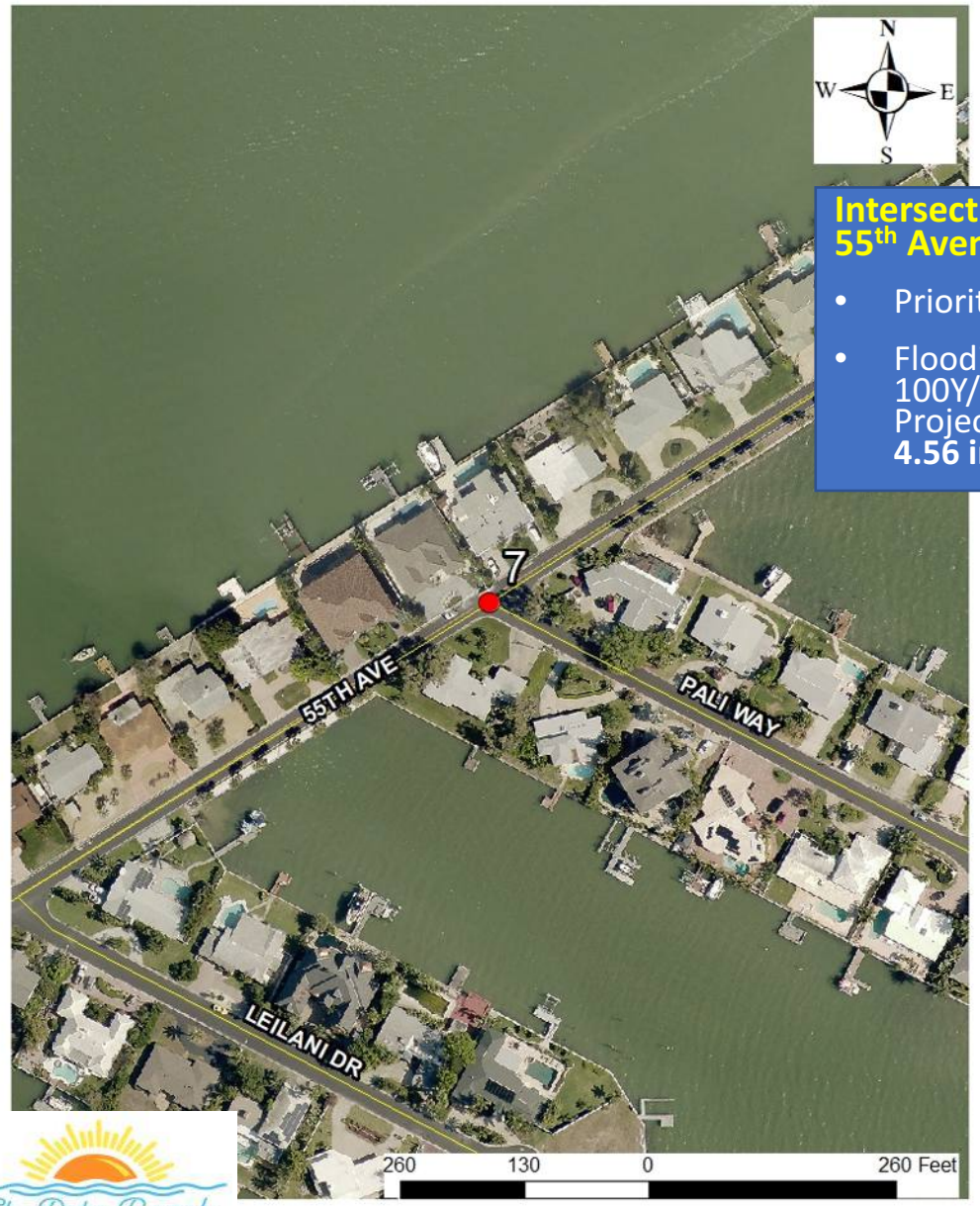


- **Intersection of Boca Ciega Drive & 71st Avenue**
- Priority Rank: **5**
- Flooding Depth under 100Y/24H Storm plus Projected 2020 Extreme SLR: **7.32 inches**

Intersection of Blind Pass Road & 87th Avenue

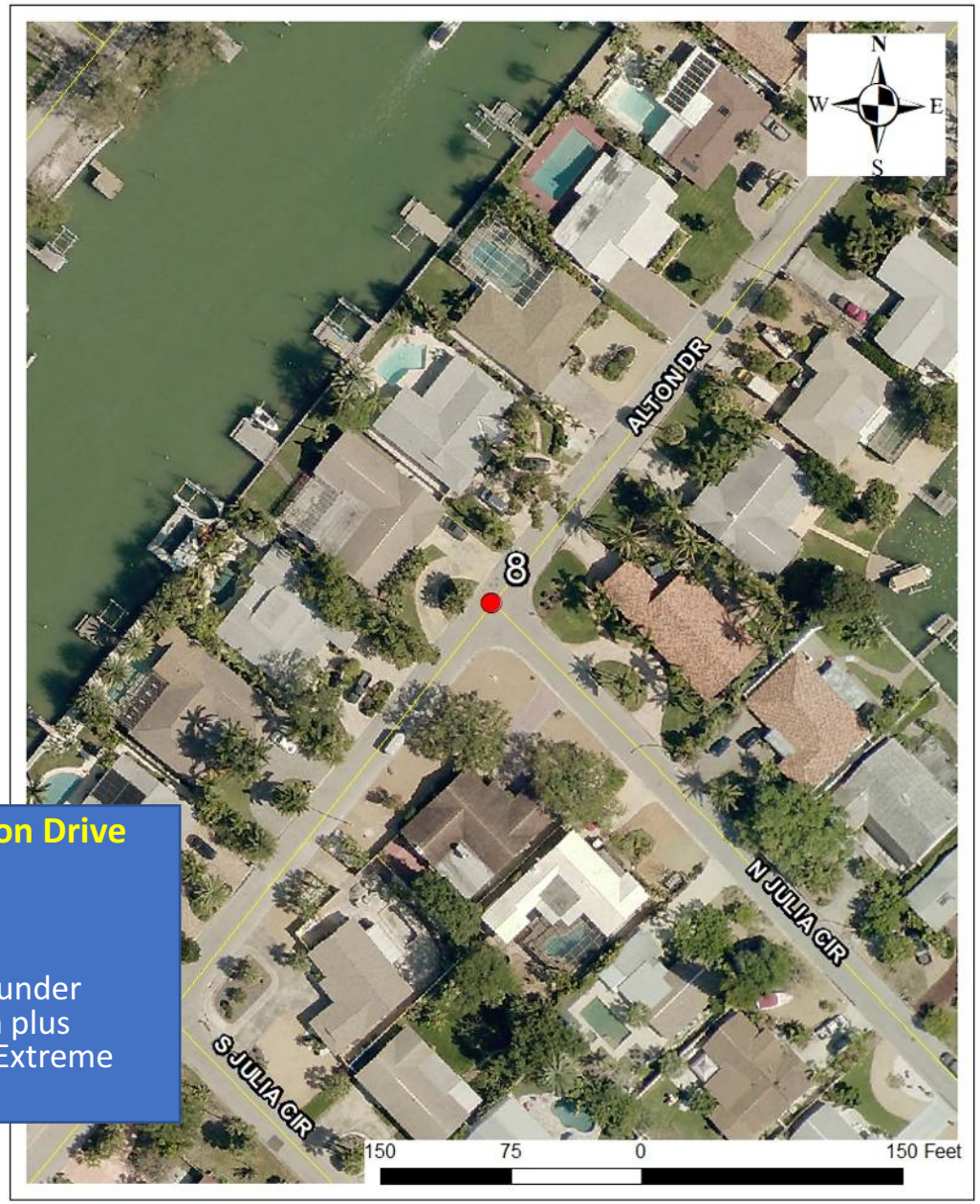
- Priority Rank: **6**
- Flooding Depth under 100Y/24H Storm plus Projected 2020 Extreme SLR: **6.60 inches**

Stormwater Master Plan Update 2020, Phase 1



Intersection of Pali Way & 55th Avenue

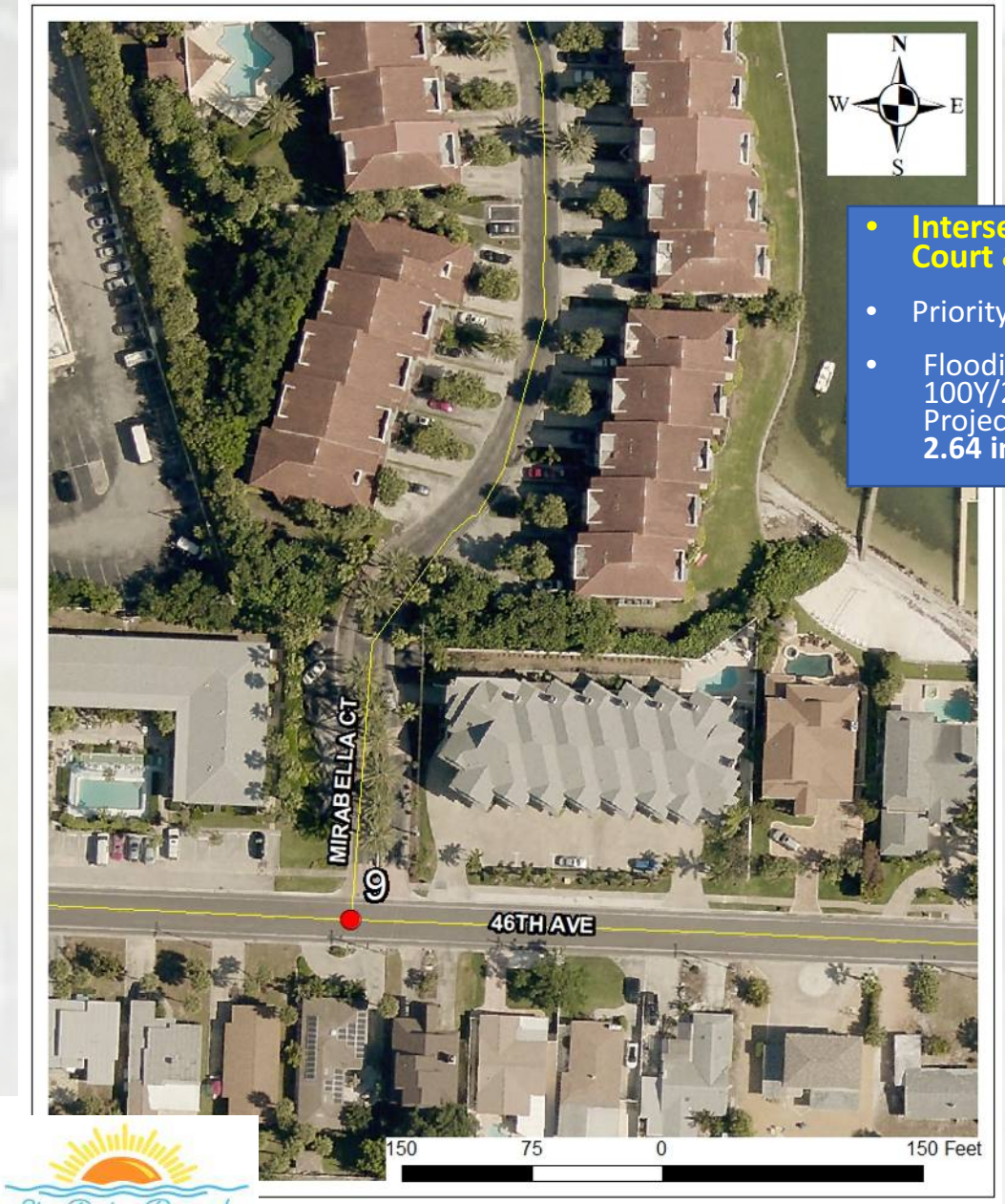
- Priority Rank: **7**
- Flooding Depth under 100Y/24H Storm plus Projected 2020 Extreme SLR: **4.56 inches**



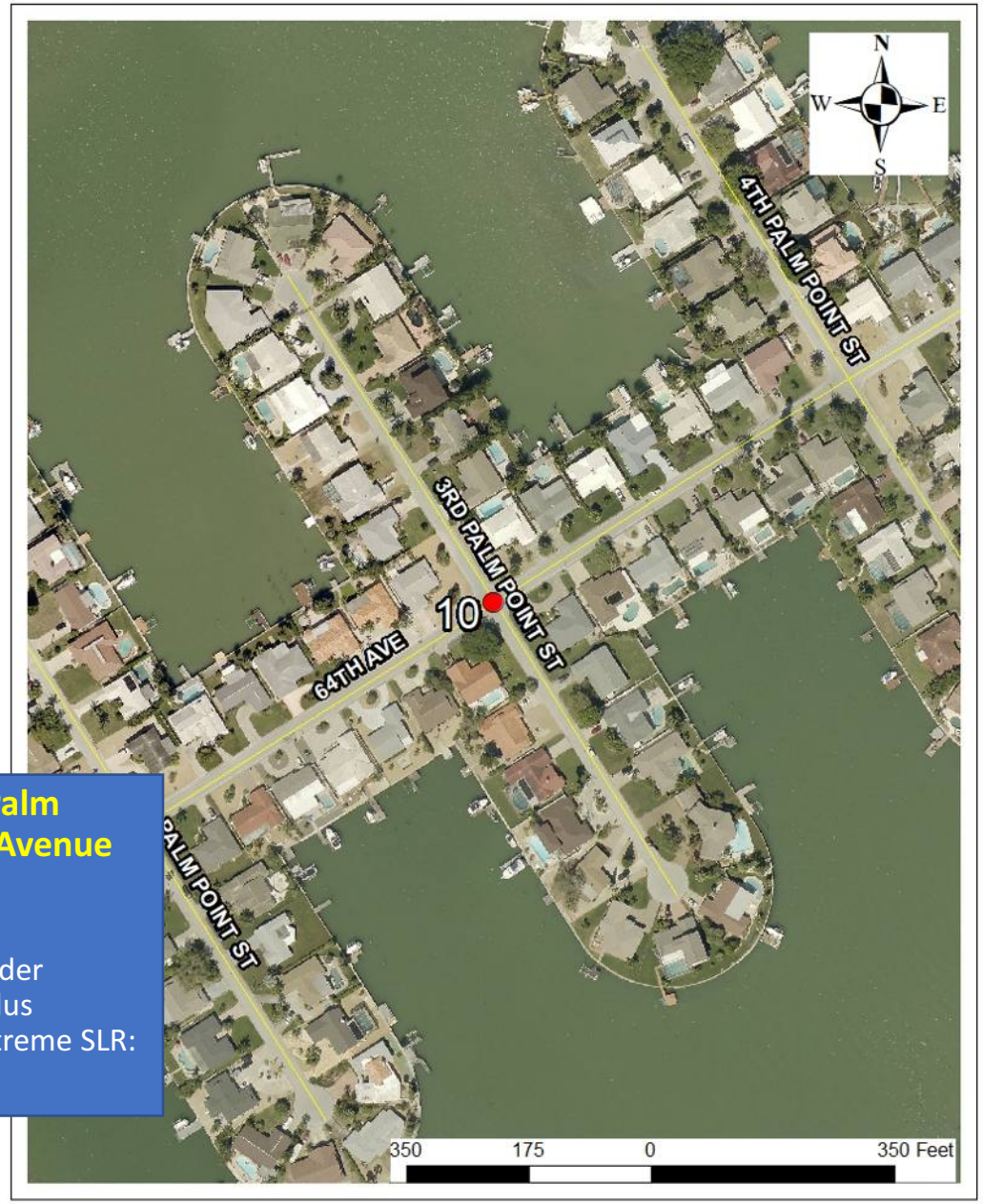
Intersection of Alton Drive & N Julia Circle

- Priority Rank: **8**
- Flooding Depth under 100Y/24H Storm plus Projected 2020 Extreme SLR: **3.12 inches**

Stormwater Master Plan Update 2020, Phase 1



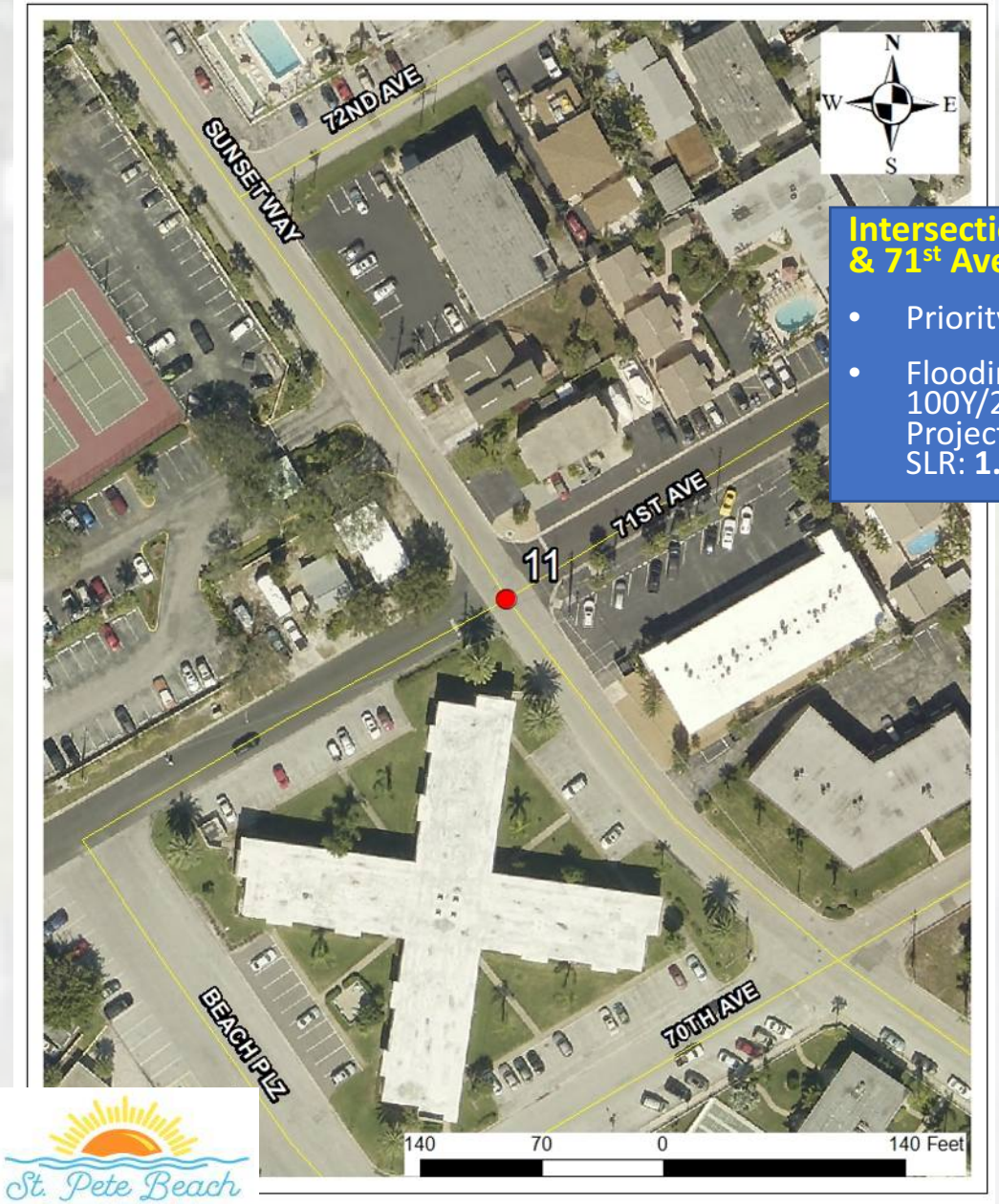
- **Intersection of Mirabella Court & 46th Avenue**
- Priority Rank: **9**
- Flooding Depth under 100Y/24H Storm plus Projected 2020 Extreme SLR: **2.64 inches**



Intersection of 3rd Palm Point Street & 64th Avenue

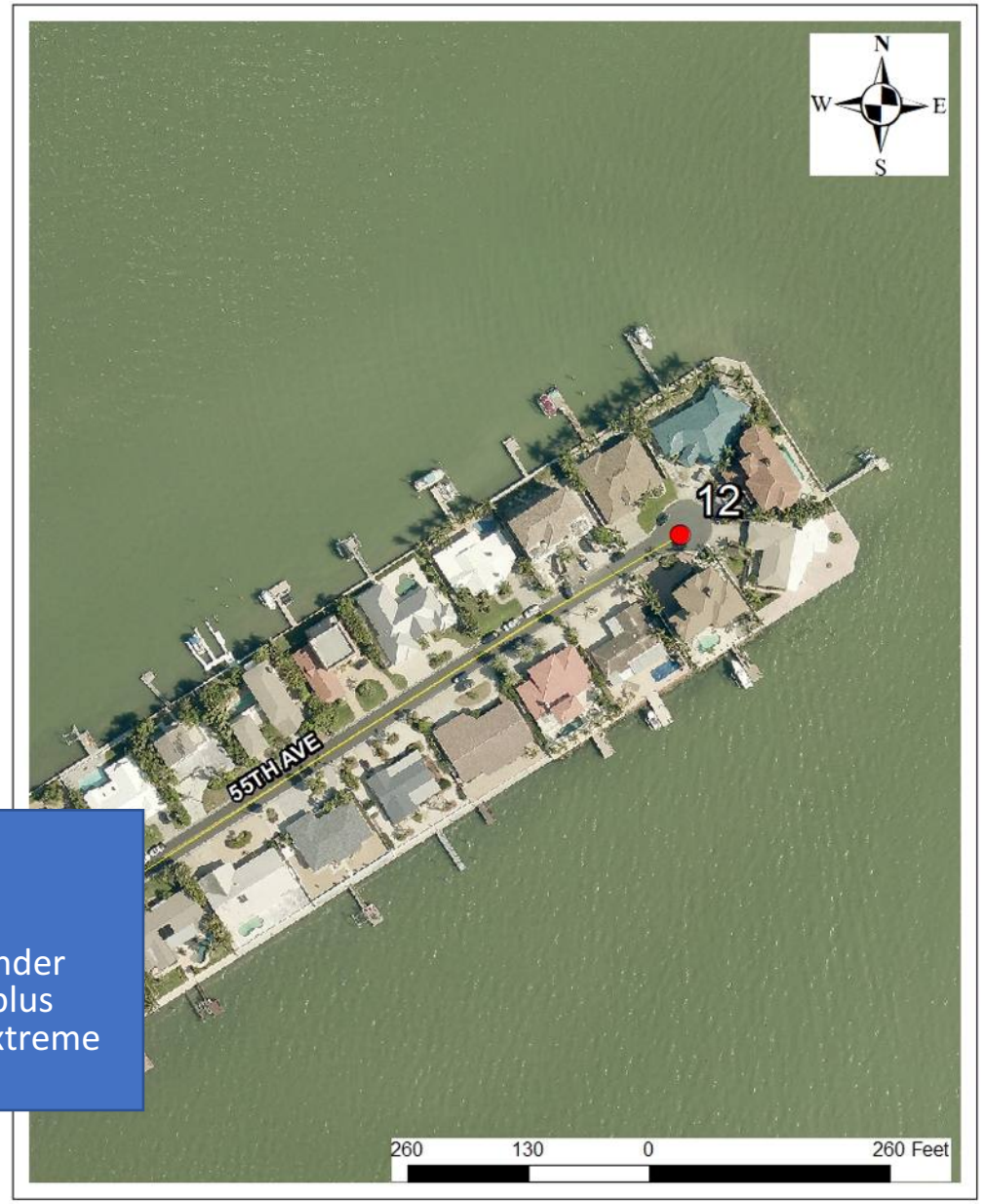
- Priority Rank: **10**
- Flooding Depth under 100Y/24H Storm plus Projected 2020 Extreme SLR: **2.28 inches**

Stormwater Master Plan Update 2020, Phase 1



Intersection of Sunset Way & 71st Avenue

- Priority Rank: **11**
- Flooding Depth under 100Y/24H Storm plus Projected 2020 Extreme SLR: **1.44 inches**



End of 55th Avenue

- Priority Rank: **12**
- Flooding Depth under 100Y/24H Storm plus Projected 2020 Extreme SLR: **0.96 inches**

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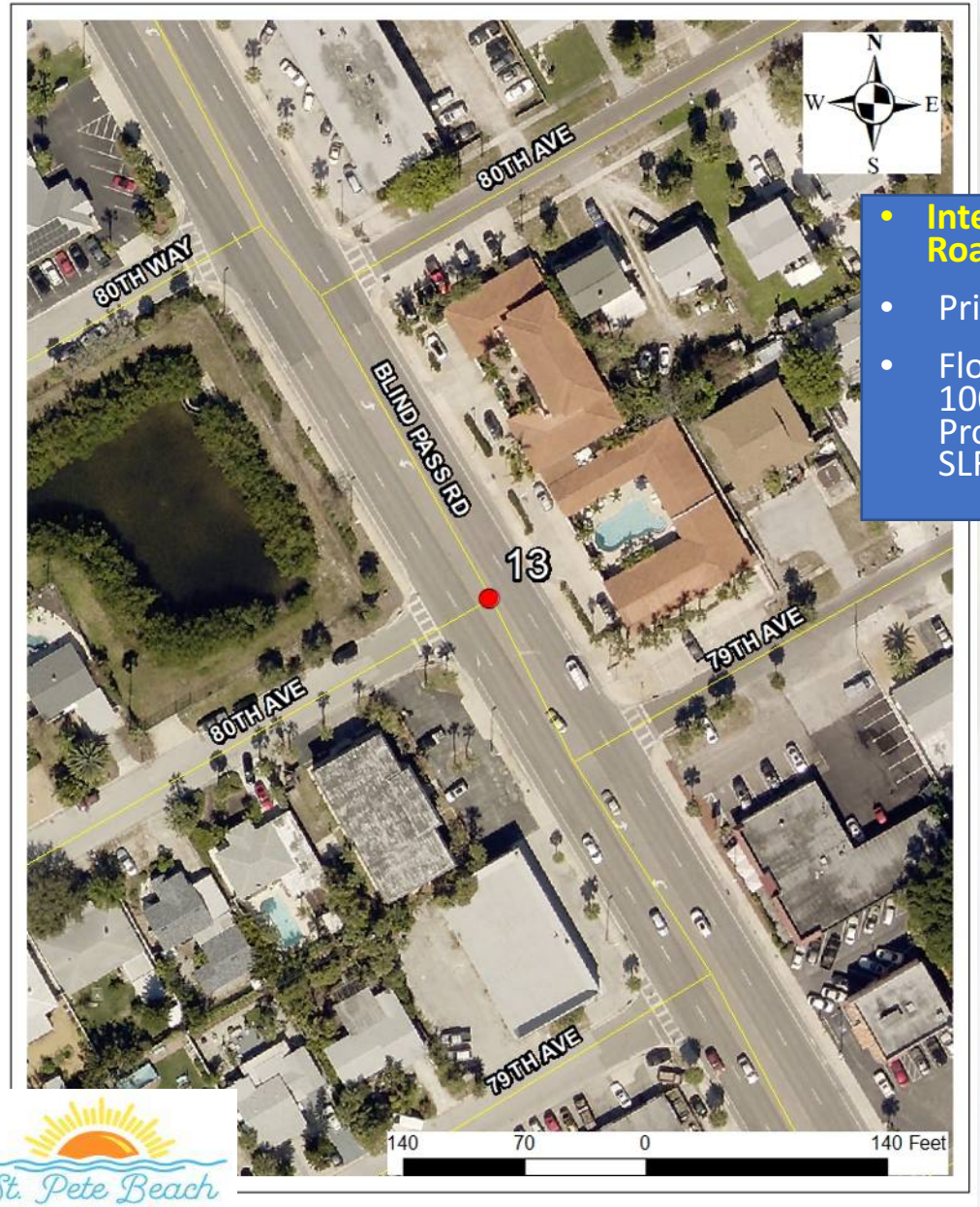
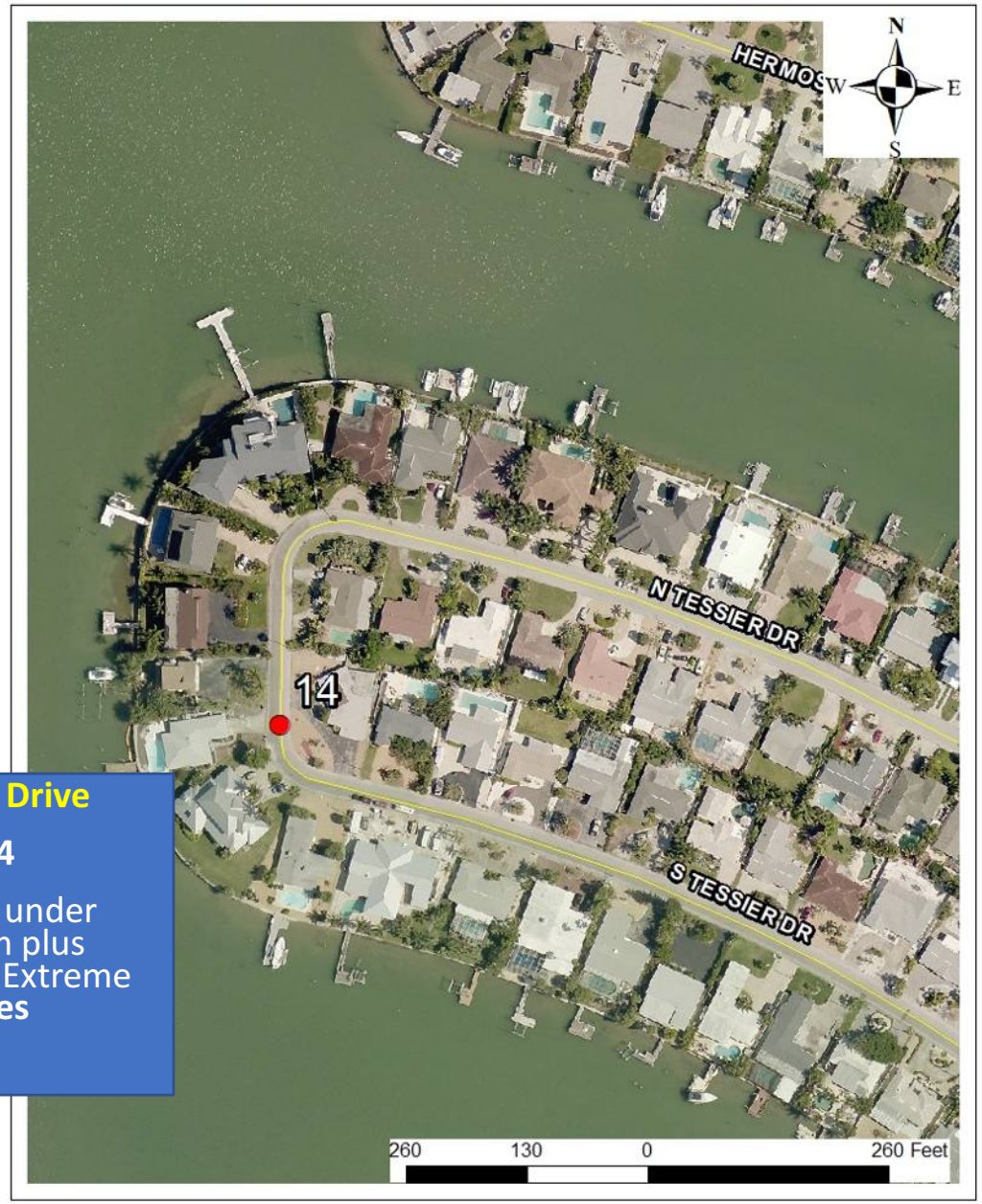
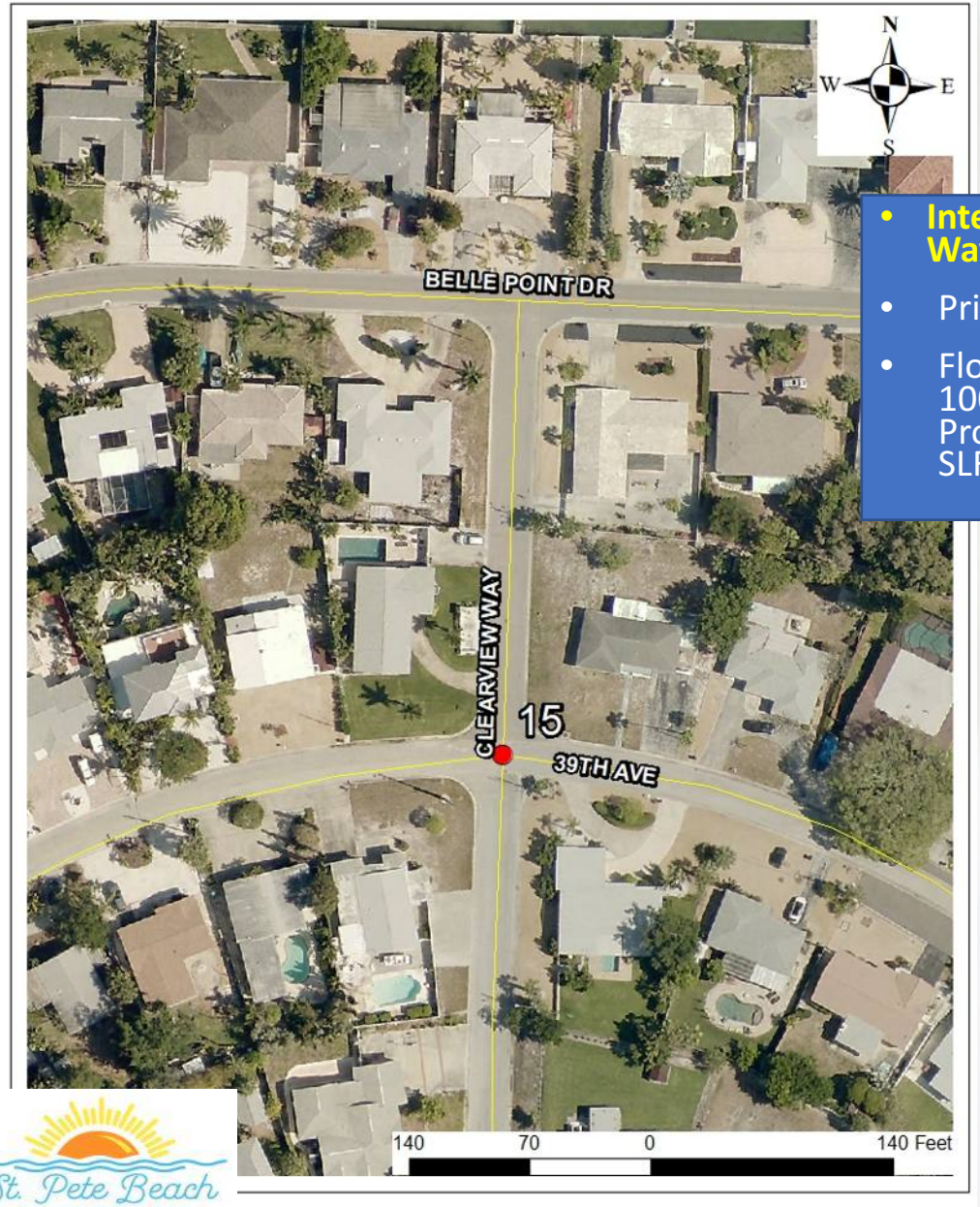


- **Intersection of Blind Pass Road & 80th Avenue**
- Priority Rank: **13**
- Flooding Depth under 100Y/24H Storm plus Projected 2020 Extreme SLR: **0.60 inches**



- **End of N Tessier Drive**
- Priority Rank: **14**
- Flooding Depth under 100Y/24H Storm plus Projected 2020 Extreme SLR: **- 0.36 inches**

Stormwater Master Plan Update 2020, Phase 1



- **Intersection of Clearview Way & 39th Avenue**
- Priority Rank: **15**
- Flooding Depth under 100Y/24H Storm plus Projected 2020 Extreme SLR: **8.16 inches**

Part A - Stormwater Master Plan Update 2020, Phase 1

Conclusions

1. Sea levels are rising at an accelerated rate in the Tampa Bay area.
2. Rising sea levels can create substantial economic damage.
3. Reliability of roadways is of crucial importance. Therefore, intersection flooding depths can be used for project development.
4. City's current CIP projects will achieve a resiliency rating of 3 under present design criteria.
5. All seawalls, public and private, should be raised to about 5+ ft. above current Mean Sea Level.
6. It may not be possible to make a business case for achieving Adaptive Measure of Level 5 resiliency; but achieving a resiliency level of 4 instead should be explored.

Part B – Flooding (Ponding) During Minor Rainfall Events

(and Related Green Infrastructure for Stormwater Management)

Part B- Flooding (Ponding) During Minor Rainfall Events

What is minor flooding (ponding)?

- Flooding that happens during minor rainfall events.
- It is generally short-term accumulation of water in depressions created by the local undulations in topography (manmade or otherwise).
- It is mostly localized even if at multiple locations.
- It is annoying, a source of frustration, and causes a lot inconvenience even when passable.

Part B- Flooding (Ponding) During Minor Rainfall Events

Examples of Localized Flooding in St. Pete Beach

Boca Ciega Dr & 87th Avenue

37th Avenue & E Maritana Drive

18th Avenue, Looking North at Western Alleyway

Part B- Flooding (Ponding) During Minor Rainfall Events

Green Infrastructure Measures for Stormwater Management for Minor Flooding	
Control Measures	Preventive Measures
Rain Gardens	Land Development Regulations
Bio Swales	Source Reduction
Porous Pavements	Parking Lots and Street Cleaning
Under Pavement Storage	Bank Stabilization
Flow-through Devices, French Drains	Buffer zones

Part B- Flooding (Ponding) During Minor Rainfall Events

Examples of Control Measures for Green Infrastructure

A rain garden can be beautiful as well as functional.

Bioswales are essentially rain gardens placed in long narrow spaces such as the space between the sidewalk and the curb.

Permeable pavement is a good example of a practice that catches water where it falls.

Planter boxes are an attractive tool for filtering stormwater as well as reducing the runoff that goes into

Part B- Flooding (Ponding) During Minor Rainfall Events

Examples of Control Measures for Green Infrastructure

Parking lots are a good place to install green infrastructure that can capture stormwater that would usually flow into the sewer system.

Protect coastal areas with living shorelines, buffers, wetlands, and dunes to help reduce coastal erosion and storm impacts.

StormTech

Part B- Flooding (Ponding) During Minor Rainfall Events

Examples of Control Measures for Green Infrastructure

StormTech

Stormwater Master Plan Update Presentation

Recommendations for Way Forward

- Agree that intersections flooding can be used for developing future projects.
  - Determine in consultation with the City which of the areas around the 16 worst intersections are already slated for drainage improvements.
  - Select 5 additional areas from the list of 15 worst in consultation with the City for more detailed evaluation in Phase 2 of this 2020 SWMP Update to achieve a resiliency level of 4.
- Refine LOS criteria.
  - For neighborhood flooding
  - For raising resiliency rating from 3 to 4 or 5
  - For seawalls
- Use 2019 SLR projections by Tampa Bay Climate Science Advisory Panel.
- Use NOAA Atlas 14 precipitation estimates which are slightly higher than those by SWFWMD.
- Encourage Green Infrastructure in the areas of minor flooding or ponding

Stormwater Master Plan Update Presentation

"Flood resilient design should not just be seen as a necessity, but as an opportunity through which to deliver wider benefits such as improved biodiversity and to enhance the quality of placemaking in communities throughout the world."

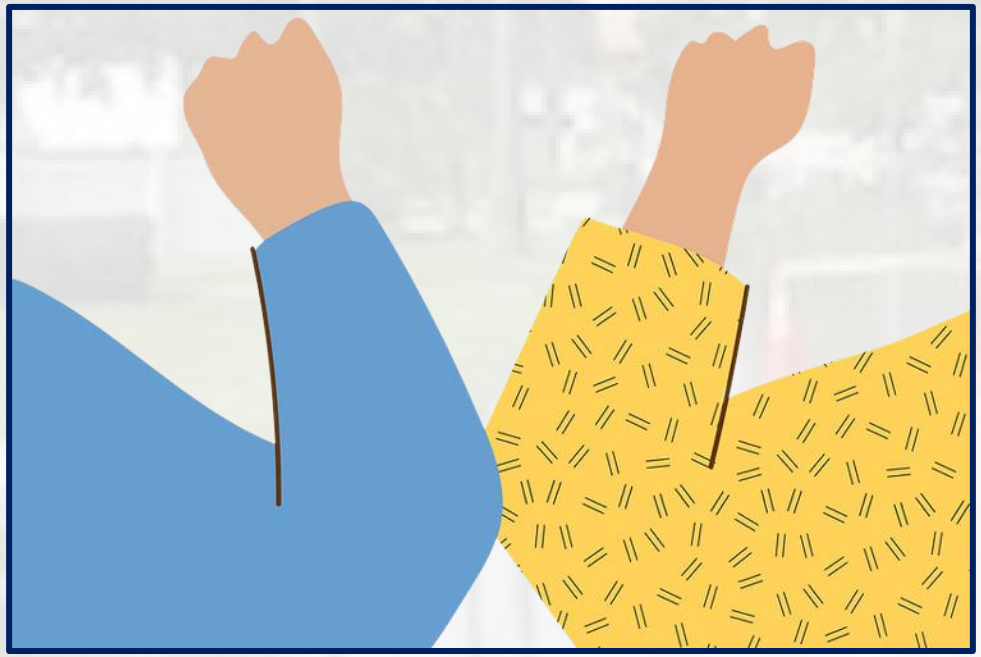
Edward Barsley
in 'Retrofitting for Flood Resilience: A Guide to Building & Community Design'

Six Strategies – Alleviate, Attenuate, Restrict, Realign, Create, Embrace

Stormwater Master Plan Update Presentation

There is always a rainbow after every storm!

Stormwater Master Plan Update Presentation



THANK YOU