Tools to Prioritize Flood Mitigation Projects

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Tom Amstadt – 12-1-2021

Introduction

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- Limited Resources
- Three Tools (Metrics)
  - Level of Service
  - Flood Damage Estimate
  - Benefit Cost Analysis

Level of Service

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- Level of Service (LOS)
  - A qualitative measure of how well a system performs
  - Objective and repeatable metric to identify and compare severity of flooding problems

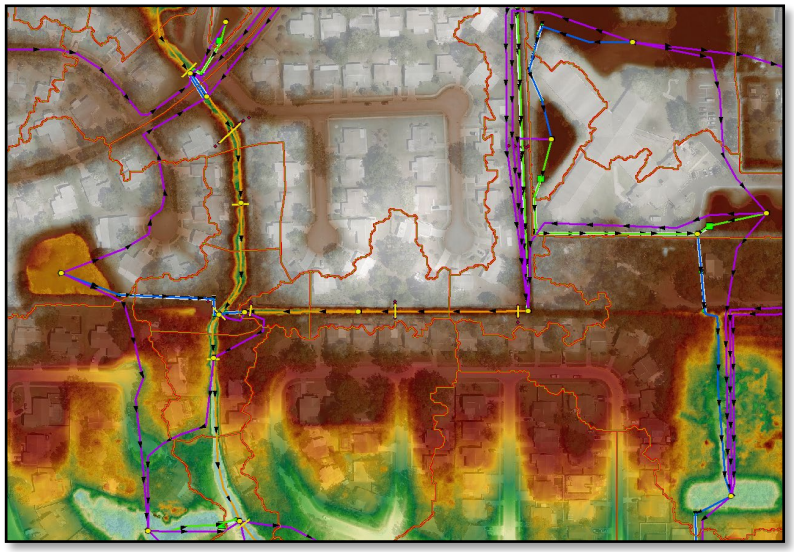
Level of Service

- Approach – Establish Criteria
  - Pass/Fail or A, B, C, D, E
  - Design Storm Model Results vs. Asset Classification vs. Landmark Elevations

Source: Bass Slough Basin Study, Osceola County, Inwood, 2003.

Level of Service

- Approach – Gather and Develop Base Data
  - Topographic Data
  - H&H Model of Area of Interest
  - Establish Flood Elevations
    - Roads Data
      - Centerlines
      - Lane Widths
      - Classification
    - Structures Data
      - Footprints
      - Finished Floor Elevations
      - Structure Type
    - Other Locations



Level of Service

- Example #1 – Highlands County Carter Creek Watershed

Roads

Roadway Type	Flood Depth[1]	2.33-Year (0.429 chance)	5-Year (0.2 chance)	10-Year (0.1 chance)	25-Year (0.04 chance)	50-Year (0.02 chance)	100-Year (0.01 chance)
Private/other Road	< 0	A	A	A	A	A	A
	0 to 0.17	D	C	B	B	A	A
	0.17 to 0.33	F	D	C	B	B	A
	0.33 to 0.5	F	F	D	C	B	B
	> 0.5	F	F	F	D	C	C
Local Road	< 0	A	A	A	A	A	A
	0 to 0.17	D	C	B	B	A	A
	0.17 to 0.33	F	D	C	B	B	A
	0.33 to 0.5	F	F	D	C	B	B
	> 0.5	F	F	F	D	C	C
Minor Collector Road	< -0.5	A	A	A	A	A	A
	-0.5 to 0	D	D	C	B	B	A
	0 to 0.17	F	F	D	C	B	B
	0.17 to 0.5	F	F	F	D	C	B
	> 0.5	F	F	F	F	D	C
Major Collector Road	< -0.5	A	A	A	A	A	A
	-0.5 to 0	D	D	D	C	B	B
	0 to 0.17	F	F	F	D	C	B
	0.17 to 0.5	F	F	F	F	D	C
	> 0.5	F	F	F	F	F	D
Minor Arterial	< -0.5	A	A	A	A	A	A
	-0.5 to 0	D	D	D	C	C	C
	0 to 0.17	F	F	D	D	D	D
	> 0.17	F	F	F	F	F	F
Evacuation Route/Principle Arterial	< -2	A	A	A	A	A	A
	-2 to -0.5	D	D	D	C	C	B
	-0.5 to 0	F	F	D	D	D	C
	0 to 0.17	F	F	F	F	F	F
	> 0.17	F	F	F	F	F	F

Structures

Structure Type	Flood Depth[1]	100-Year (0.01 chance)
Emergency Shelter / Essential Services	< -2	A
	-2 to -1	B
	-1 to 0	C
	0 to 0.5	D
	> 0.5	F
Employment Service Center	< -1	A
	-1 to -0.5	B
	-0.5 to 0	C
	0 to 0.5	D
	> 0.5	F
Mobile Home	< -1	A
	-1 to -0.5	B
	-0.5 to 0	C
	0 to 0.5	D
	> 0.5	F
Permanent Habitable Structures	< -1	A
	-1 to -0.5	B
	-0.5 to 0	C
	0 to 0.5	D
	> 0.5	F

A: Excellent, Flow and stages contained within drainage system.
B: Very Good, Flow and stages contained within drainage system.
C: Adequate, Minor road inundation during ideal LOS design storm.
D: Substandard, Flow exceeds capacity of drainage structure.
F: Unacceptable, Flow exceeds capacity of drainage structure.

Level of Service

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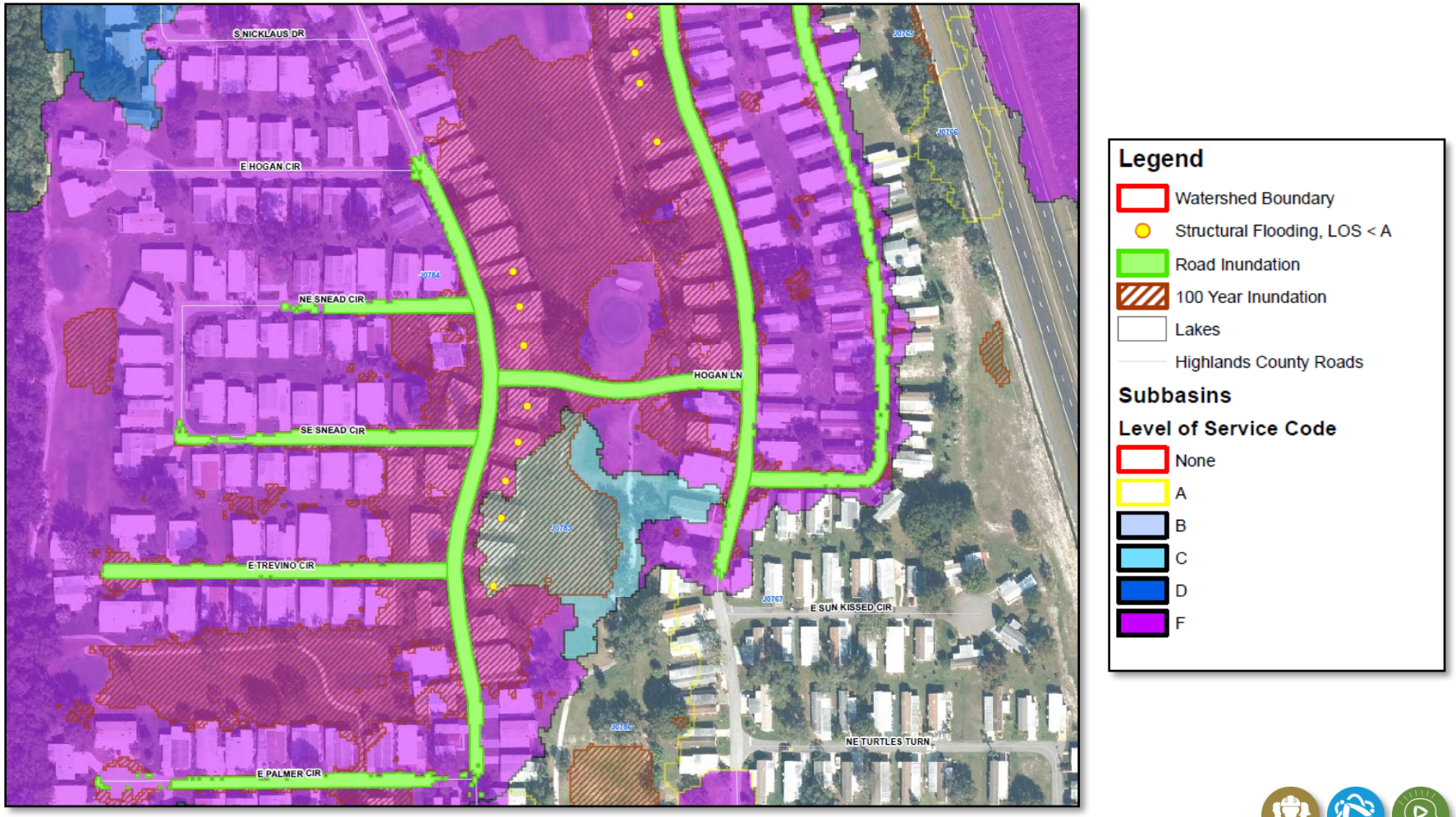
- Example #1 – Highlands County Carter Creek Watershed



Level of Service

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- Example #2 – Pasco County Club Wildwood Watershed

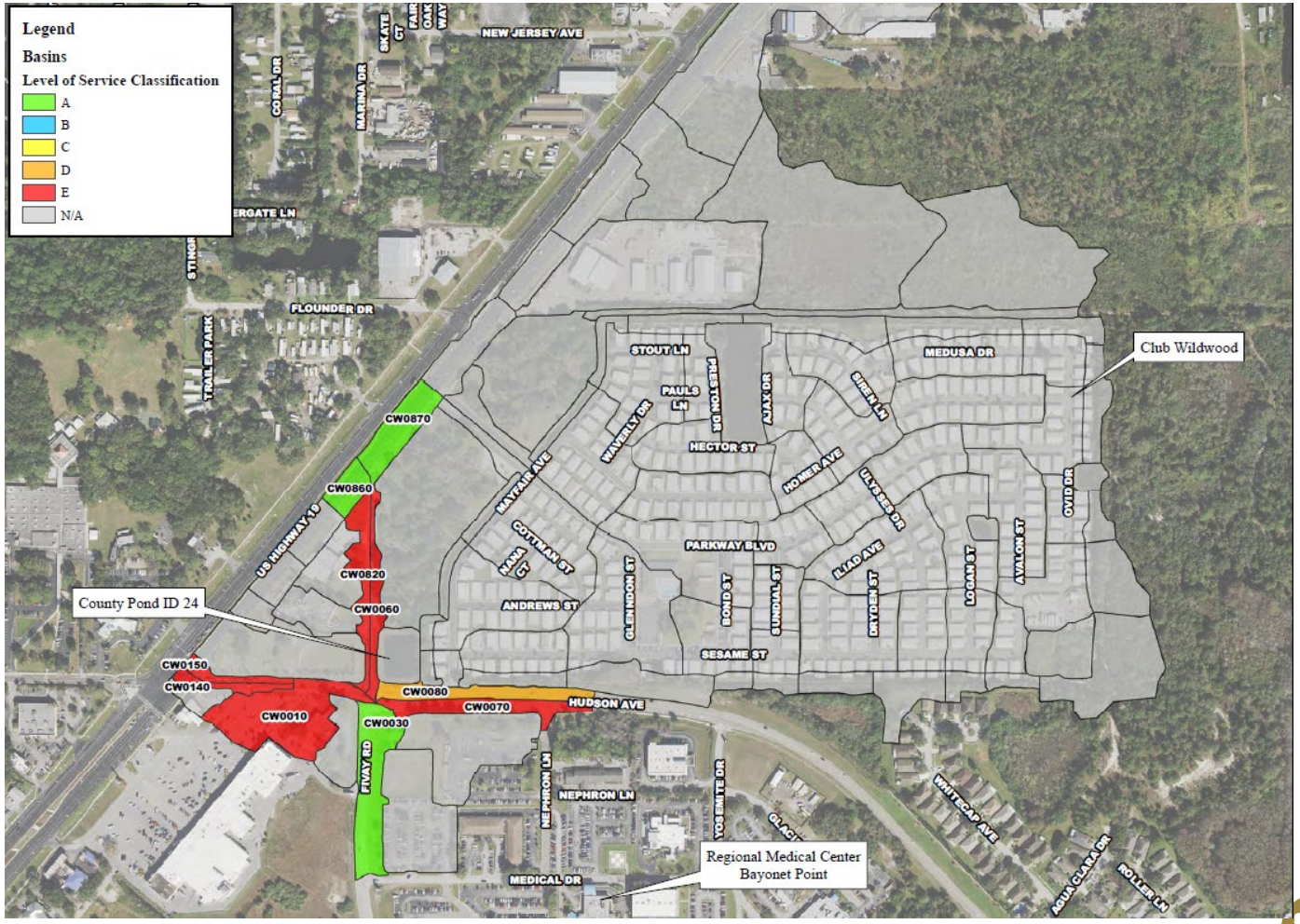
Table 2-1: Flooding LOS Classification for Roads

Approach to Assessing Level-of-Service, Surface Water Resources, and Best Management Practice Alternatives for Watersheds in Pasco County, Florida

	Roads LOS Classification				
Event	Evacuation Roads	Arterial Roads	Collector Roads	Local Roads	
				Major	Minor
100-Year (0.01 chance)	E	E	D	C	B
50-Year (0.02 chance)	E	E	E	D	C
25-Year (0.04 chance)	E	E	E	E	D
10-Year (0.1 chance)	E	E	E	E	E
5-Year (0.2 chance)	E	E	E	E	E
2.33-Year (0.43 chance)	E	E	E	E	E

Level of Service

- Example #2 – Pasco County Club Wildwood Watershed

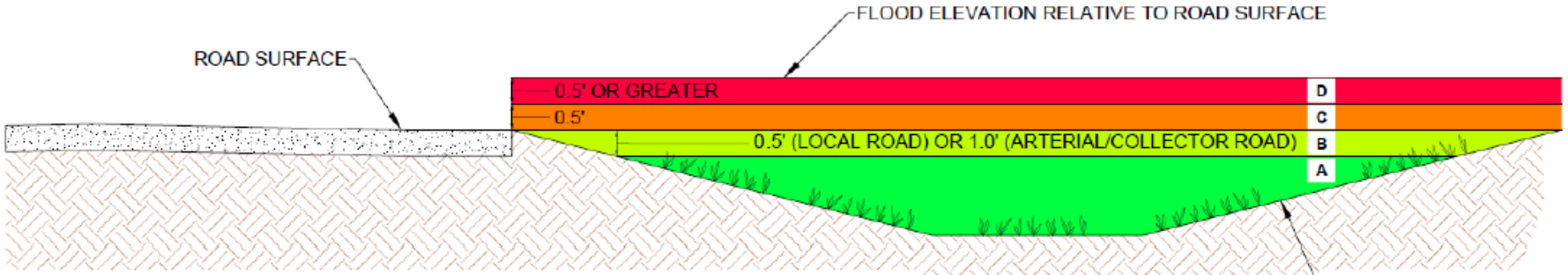


Level of Service

- Example #3 – Seminole County Lake Harney Watershed

Flood Depth (feet)	Road LOS Classification (Design Storm)		
	Evacuation Route (100-yr / 96-hr)	Arterial / Collector Street (10-yr / 24-hr)	Local Street (10-yr /24-hr)
≤ -1.0	A	A	A
-1.0 to -0.5	A	B	A
-0.5 to 0	A	B	B
0 to 0.5	C	C	C
>0.5	D	D	D

Lowest Storm Event that Causes Flooding	Structural LOS Classification			
	Emergency Shelter/Essential Services	Permanent Habitable Structures	Mobile Home/ Manufactured Home	Employment Service Center
No Flooding in Listed Design Storm Events	A	A	A	A
100 Year (0.01 chance)	D	B	B	B
50 Year (0.02 chance)	D	C	B	B
25 Year (0.04 chance)	D	D	C	C
10 Year (0.1 chance)	D	D	D	C
MA (0.43 chance)	D	D	D	D

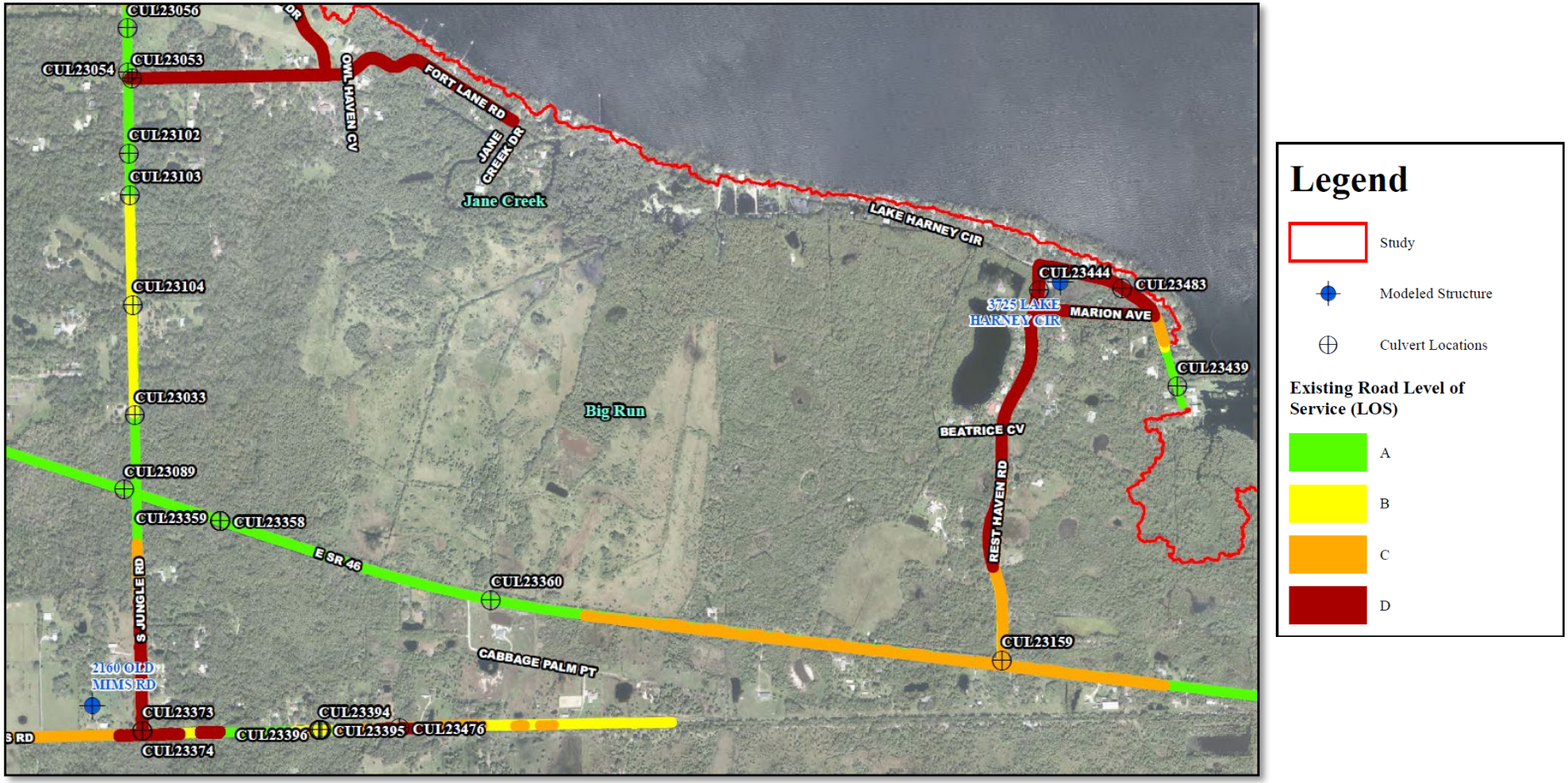


SUMMARY OF LEVEL OF SERVICE GRADES

- A - FLOOD ELEVATION IS MORE THAN 0.5 FEET BELOW THE ROAD SURFACE FOR LOCAL ROADS OR MORE THAN 1.0 FOOT BELOW THE ROAD SURFACE FOR ARTERIAL/COLLECTOR ROADS.
- B - FLOOD ELEVATION IS GREATER THAN GRADE 'A' BUT STILL BELOW THE ROAD SURFACE.
- C - FLOOD ELEVATION IS 0.5 FEET OR LESS ABOVE THE ROAD SURFACE.
- D - FLOOD ELEVATION IS 0.5 FEET OR GREATER ABOVE THE ROAD SURFACE.

Level of Service

- Example #3 – Seminole County Lake Harney Watershed



Level of Service

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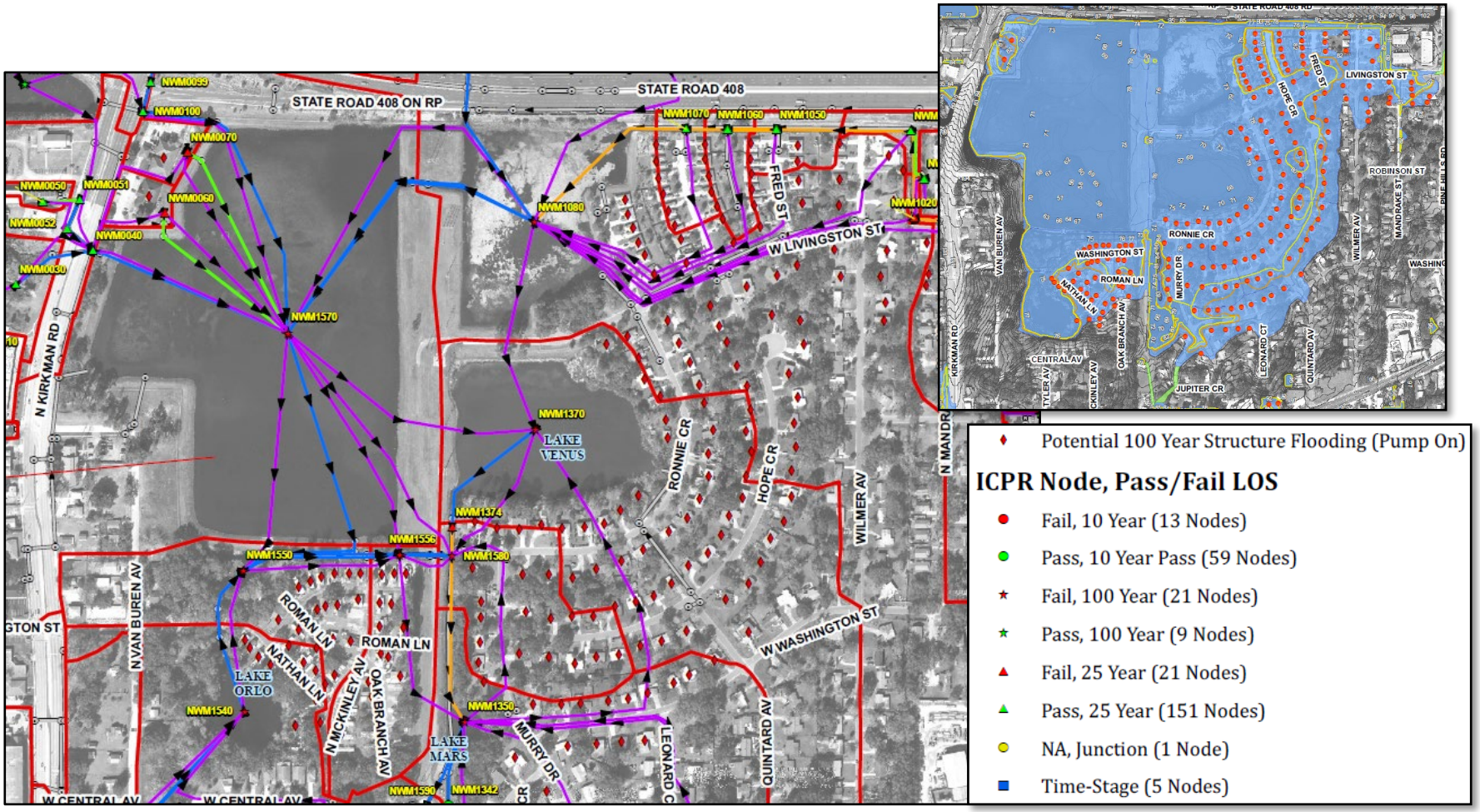
- Example #4 – Orange County Orlo Vista Watershed



Flood Damage Estimates

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- Road Damages
  - Structural Damages (i.e., pavement, subbase, etc.)
    - Road Classification, Flood Length, Number of Lanes
  - Traffic Delays
    - Duration of Flooding, Flood Depth, Traffic Count

Flood Damage Estimates

- Structure Damages
  - Structural Damages
  - Content Damages
  - Other Damages (i.e., displacement, loss of business, vehicles, livestock, etc.)
- Depth Damage Functions (DDF), USACE and others
  - Flood Depth Vs. Finished Floor

Flood Damage Estimates

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- Difficult to Quantify Damages
  - Human Life
  - Psychological Effects
  - Social Impacts
  - Public Perception / Acceptance

JIM CARCHIDI

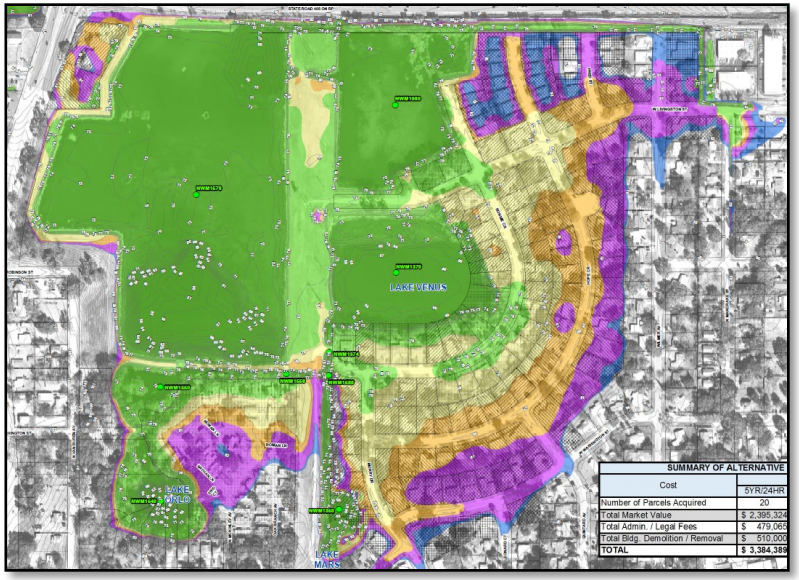
A night of heavy rain left several neighborhoods flooded.

Flood Damage Estimates

- Example #1 – Orange County Orlo Vista Hurricane Irma Flooding

Flood Damage Estimates

- Example #1 – Orange County Orlo Vista Hurricane Irma Flooding
- Damages include
  - Building damages
  - Content damages
  - Displacement costs
  - Road closures cost (delay time)
  - Rescue costs
  - Flood insurance claims
  - Stressed residents



- Damages data provided to FDEM to support HMGP grant application

Flood Damage Estimates

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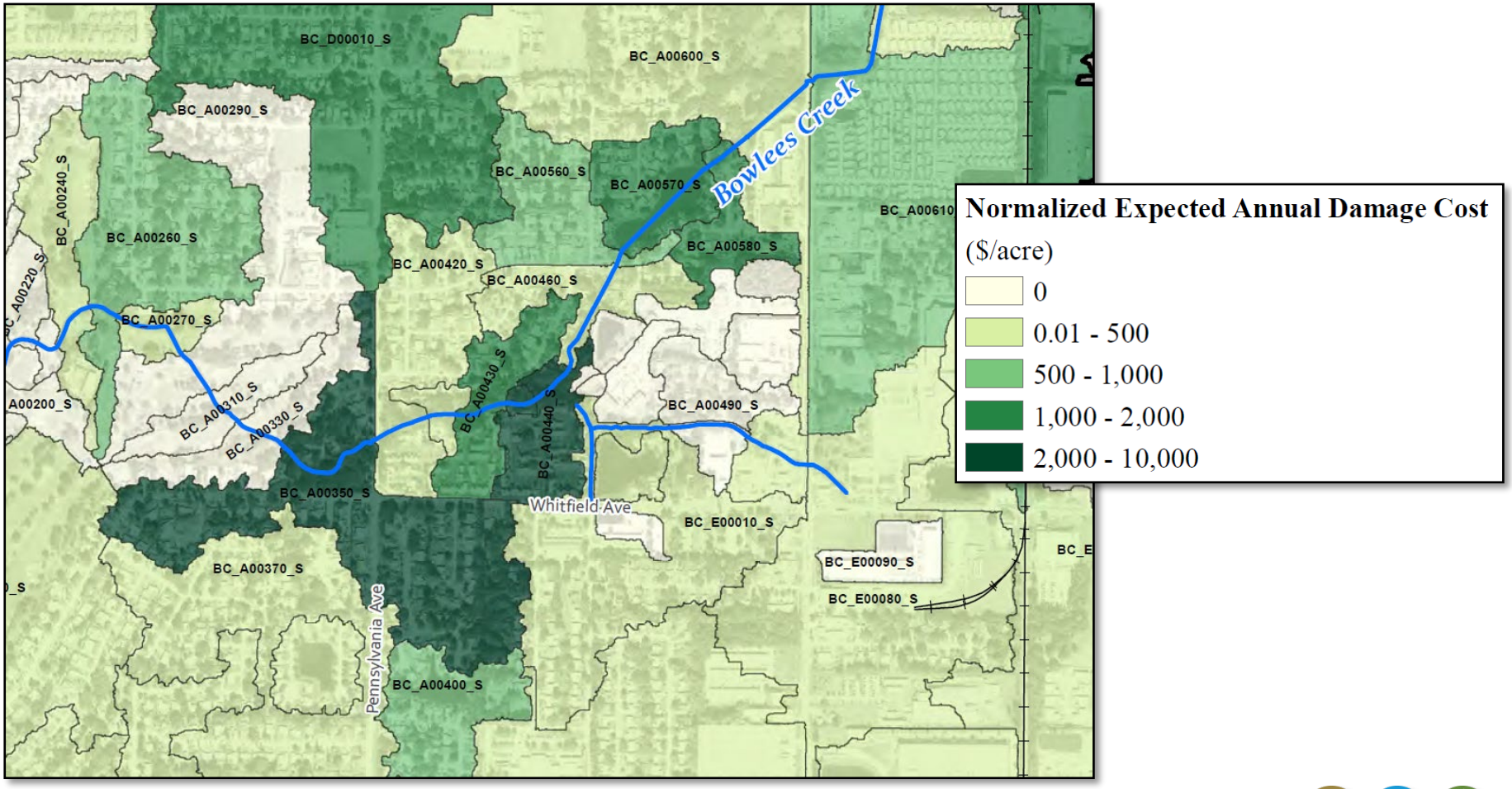
- Example #2 – Manatee County Bowlees Creek Watershed



Benefit-Cost Analysis

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- Additional Data Needs
  - Alternative Design Concept
  - Alternative Conditions H&H Model

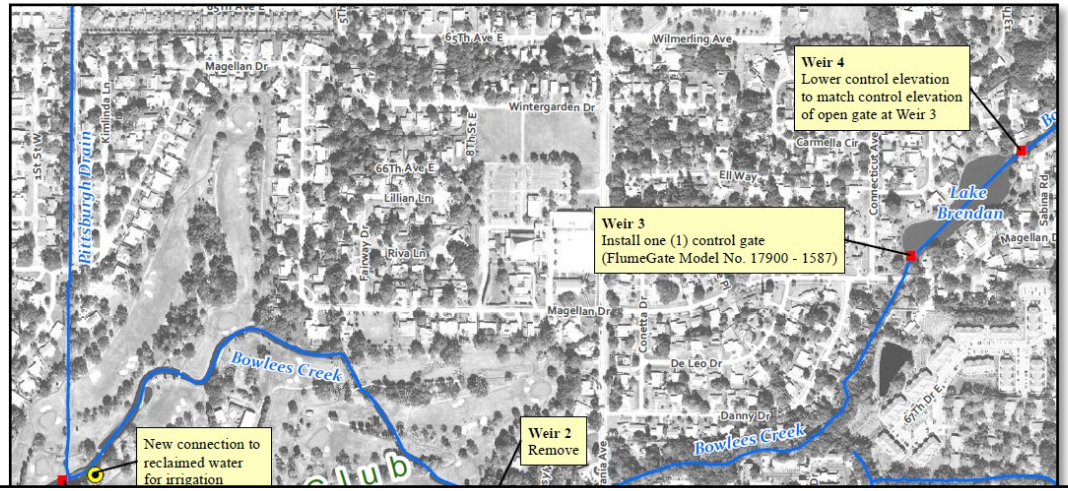
- Benefits (Avoided Flood Damages) = Existing – Alternative
- Costs = Implementation Cost + O & M Cost
- Service Life and Interest Rate to Calculate Present Value

$$BC = \frac{Damages\ before\ - Damages\ after}{Project\ Cost}$$

BCR > 1 = Cost Effective Project

Benefit-Cost Analysis

- Example #1 – Manatee County Bowlees Creek Cooperative Funding Initiative (CFI) Assistance
  - Remove and Modify Weirs in Bowlees Creek



Scenario	Estimated Flood Damages			Benefit (A)	Benefit (P)	Cost (P)	BCR
	Building (A)	Roadway (A)	Total (A)				
Ex. Cond.	$510,774	$1,621,902	$2,132,676	-	-	-	-
Alt. 1	$448,795	$1,526,776	$1,975,571	$157,104	$1,949,516	$467,736	4.2

(A) – cost/benefit is expressed as an annual payment.
(P) – cost/benefit is expressed as the present value of a single payment.

Benefit-Cost Analysis

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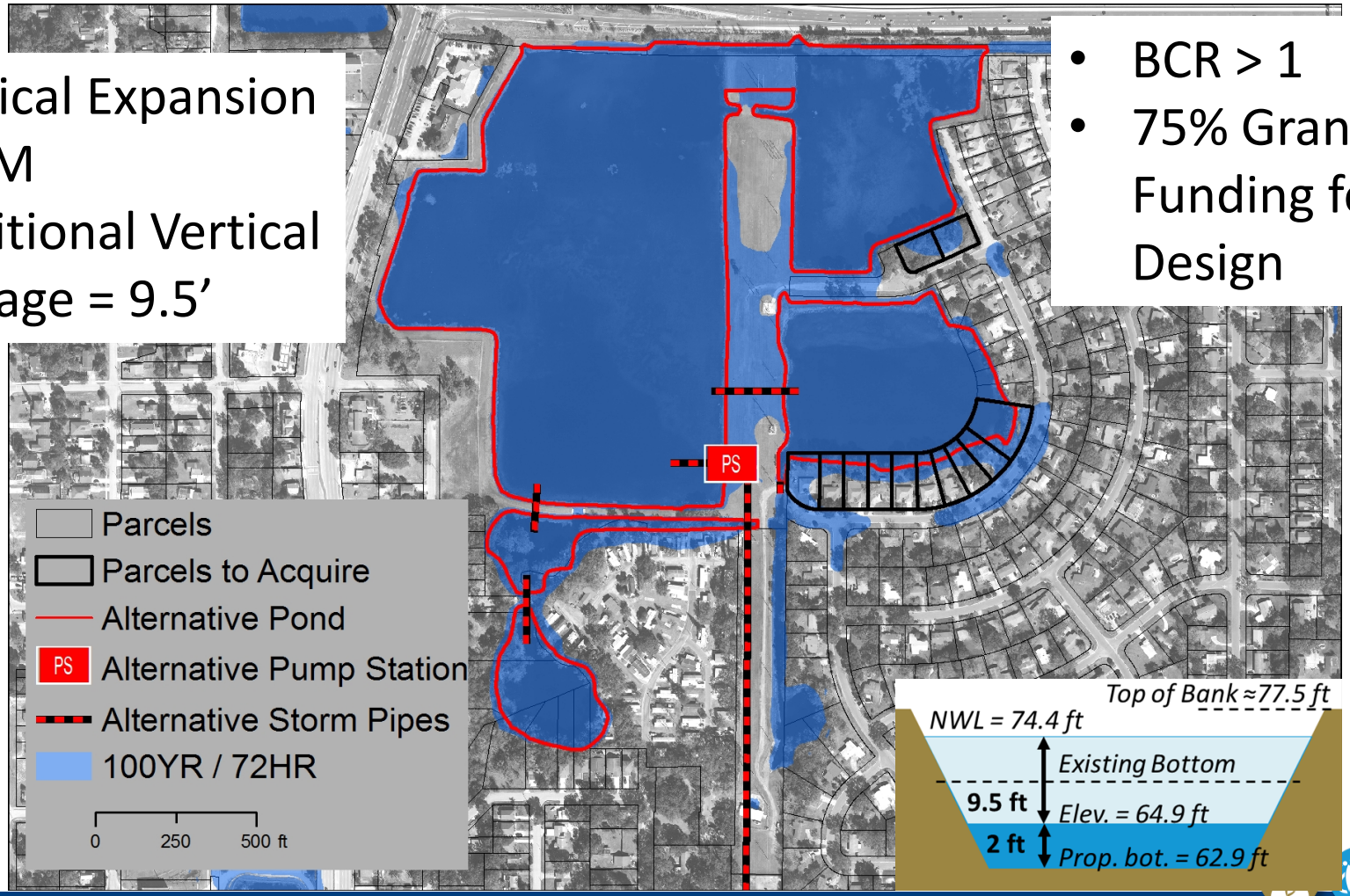
- Example #2 – Orange County Orlo Vista Drawdown Alternative

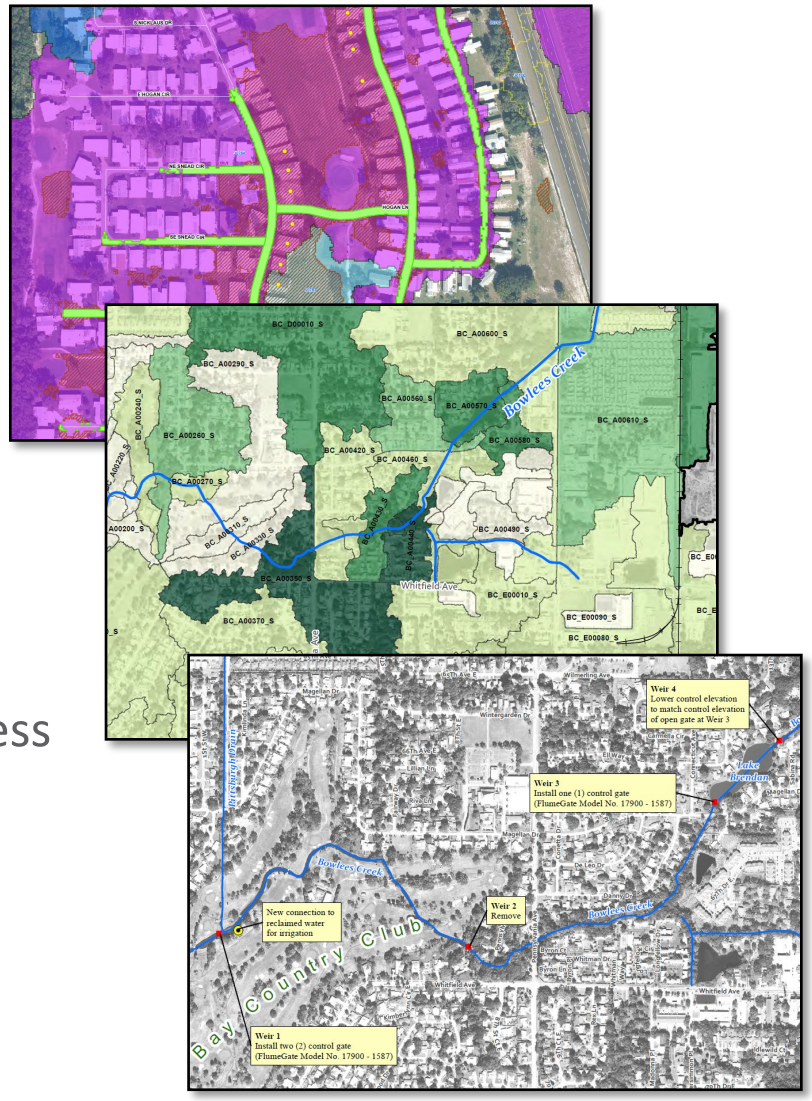
Vertical Expansion
$10M
Additional Vertical Storage = 9.5’

- BCR > 1
- 75% Grant Funding for Design



Summary & Conclusions

- Three Metrics
  - Level of Service
    - Identify Problem Areas
    - Compare Severity of Flooding
  - Flood Damage Estimates
    - Quantify Projected Damages
    - Prioritize and Rank
  - Benefit-Cost Analysis
    - Evaluate Project Cost Effectiveness
    - Identify Funding Opportunities



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Thank You!