



Fast, Accurate Benefit-Cost Analysis: A Cloud-Based Evaluation of Stormwater Projects

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Joseph Amoah, PhD, PE; Tracy Dayton, PE, CFM, ENV SP; Khansith Boupha, PE, GISP;
David Jones, PE, GISP

Introduction

- BCA improvements were needed
- BCA Process was automated
- Tools and web application were developed
- Extended use as project planning tool was discovered



Better Projects

- More focused and directed (Where they are most needed)
- More beneficial projects (the “right project”)
- More cost-effective projects



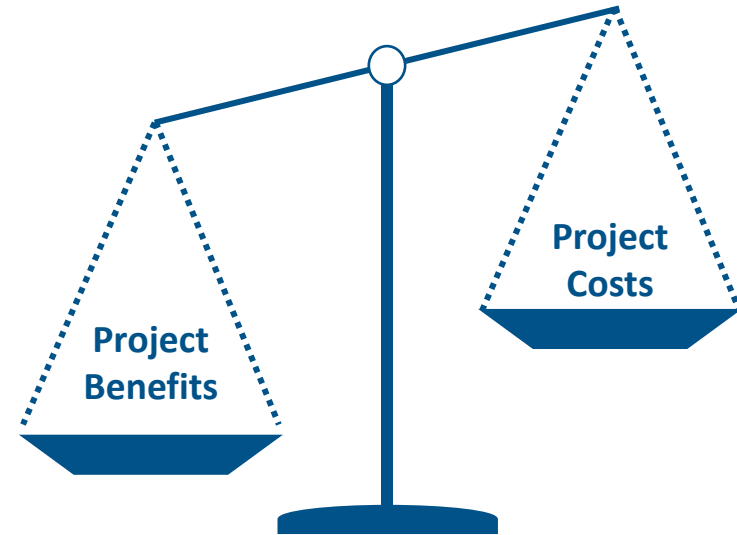
Agenda

- What is a BCA?
- Automating BCA Process
- Tools and web application
- Use as BMP decision support system



Benefit-Cost Analysis (BCA)

- Cost-effectiveness of project
- Future flood risk reduction benefits
- Calculate **Flood Damages** Twice
 1. Before Project ("as-is")
 2. After Project
- $\text{Benefits} = \text{Before} - \text{After}$
- Compare benefits to costs
- Ratio: Benefits/Costs

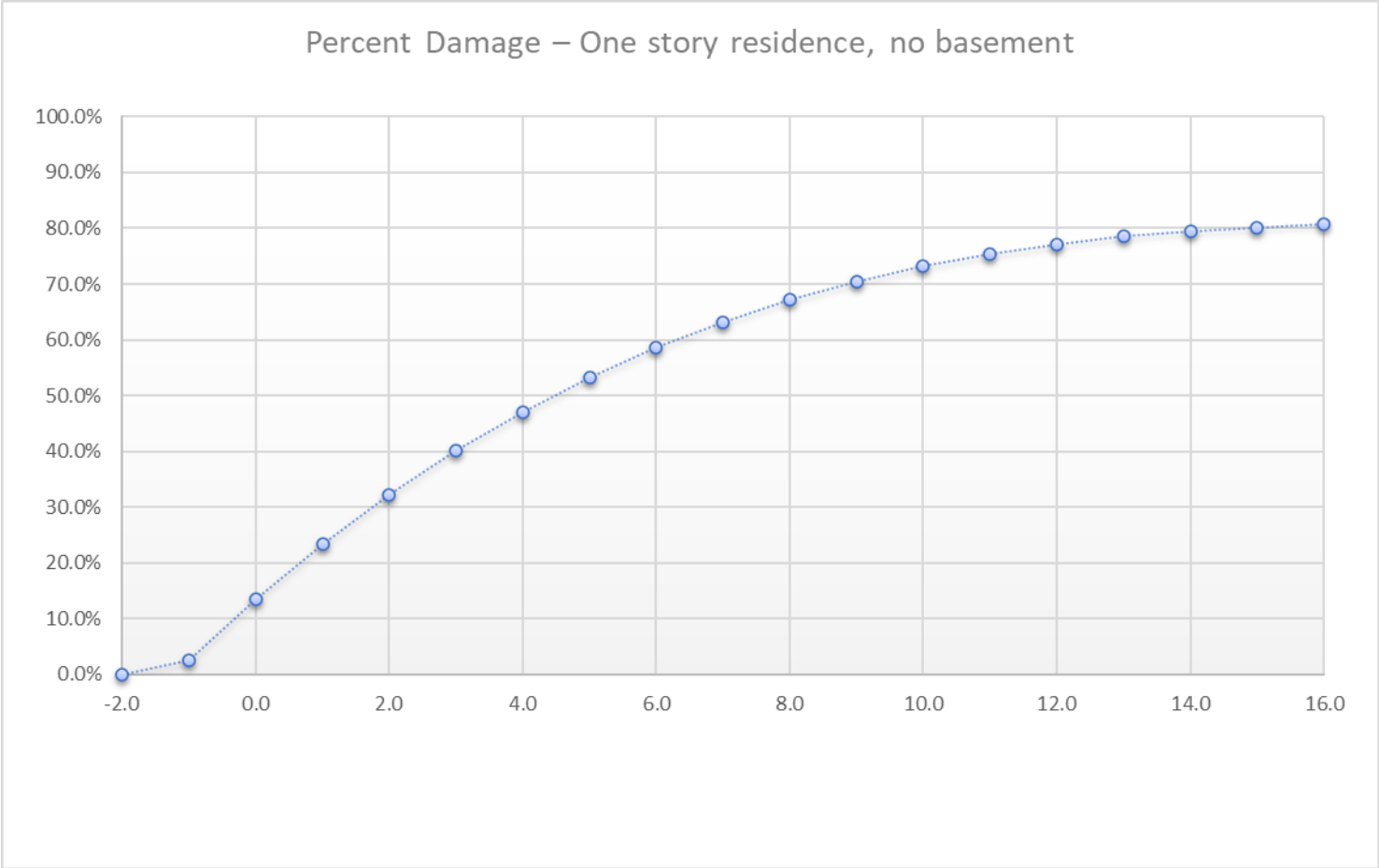


Expected Annual Flood Damages

- Structures
- Roads
- Flood Depth/Damage
- Probability-based
- Damages Annualized

Storm	Annual Probability	Damages
1-year	100%	\$
2.33-year	43%	\$\$
5-year	20%	\$\$\$
10-year	10%	\$\$\$\$
25-year	4%	\$\$\$\$\$
50-year	2%	\$\$\$\$\$\$
100-year	1%	\$\$\$\$\$\$\$

Example Depth-Damage Curve



Flood Damage Components



Structures:

- Structure
- Contents
- Displacement
- Vehicle



Roadway:

- Delay
- Repair



Flood Damages - Components and Variables

Structures



- Structure
 - Flood Depth, FF
 - Type (Depth-Damage Curve)
 - Assigned Structure Value
- Contents (residential only)
 - Flood Depth, FF
 - Depth-Damage Curve
 - Assigned Structure Value
- Displacement (residential only)
 - Flood Depth, FF
 - Time Displaced
 - Square Feet
- Vehicle (residential only)
 - Flood Depth, Driveway
 - Type (Depth-Damage Curve)
 - Vehicle Value



Flood Damages - Components and Variables

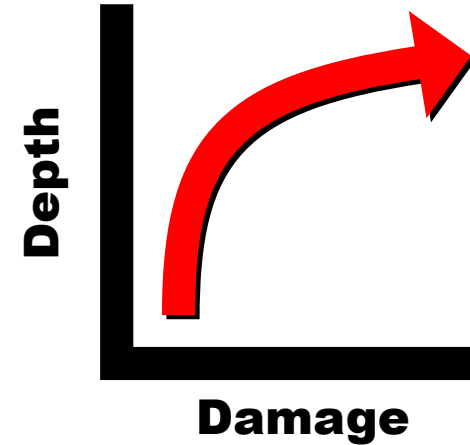
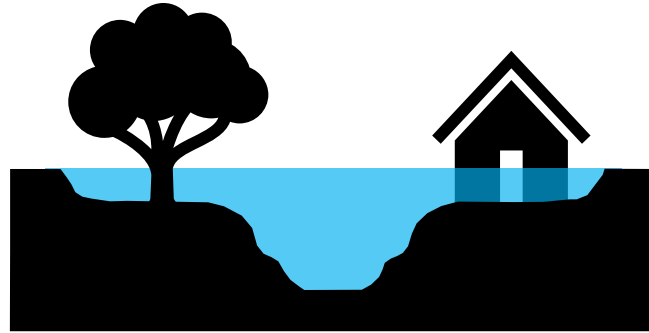
Roadway

- Repair
 - Wet (yes or no)
 - Length
 - Number of Lanes
 - Type of Road
- Delay
 - Flood Duration (time impassable)
 - AADT
 - Detour Time
 - \$/vehicle/hour

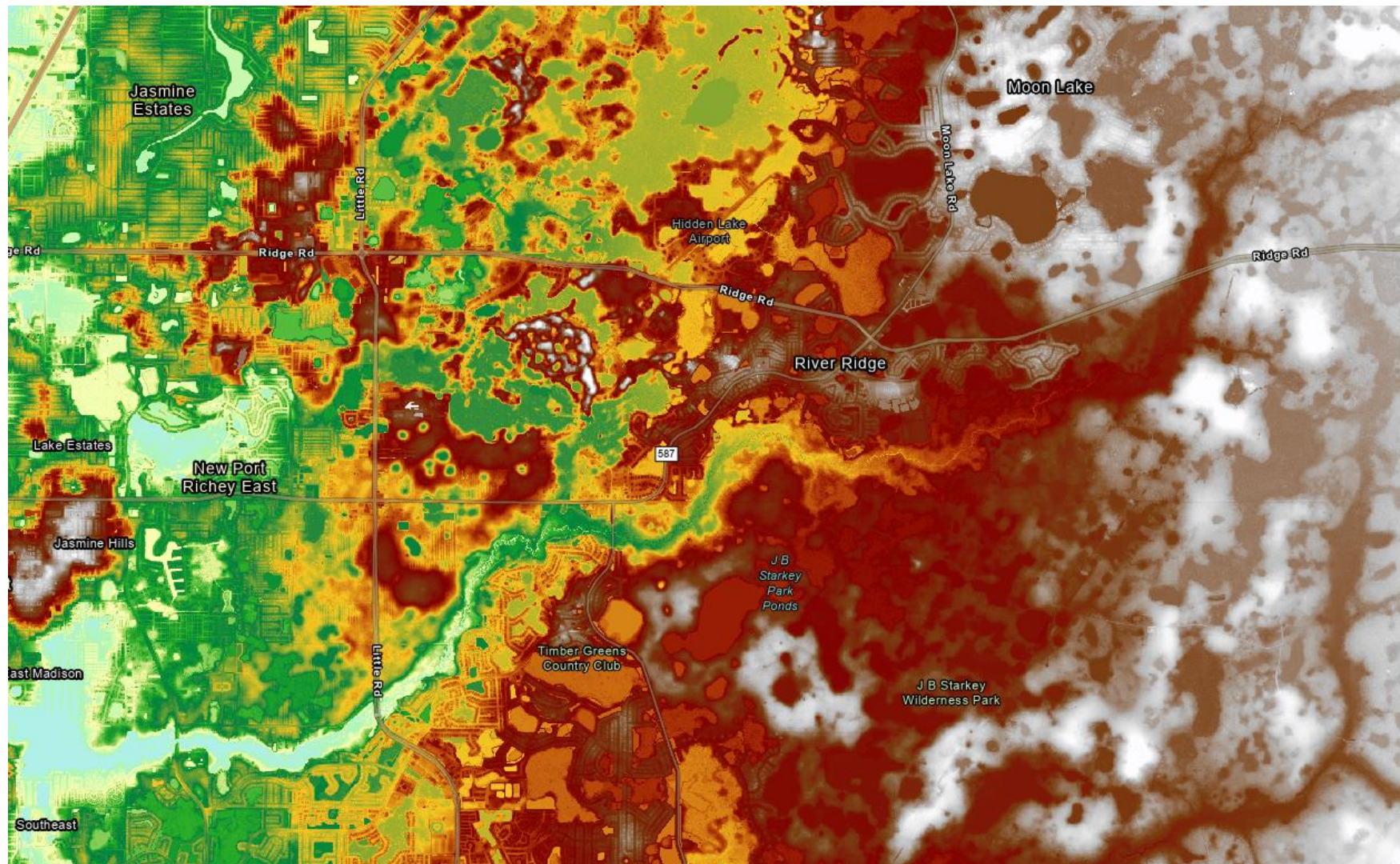


Flood Damages (\$)

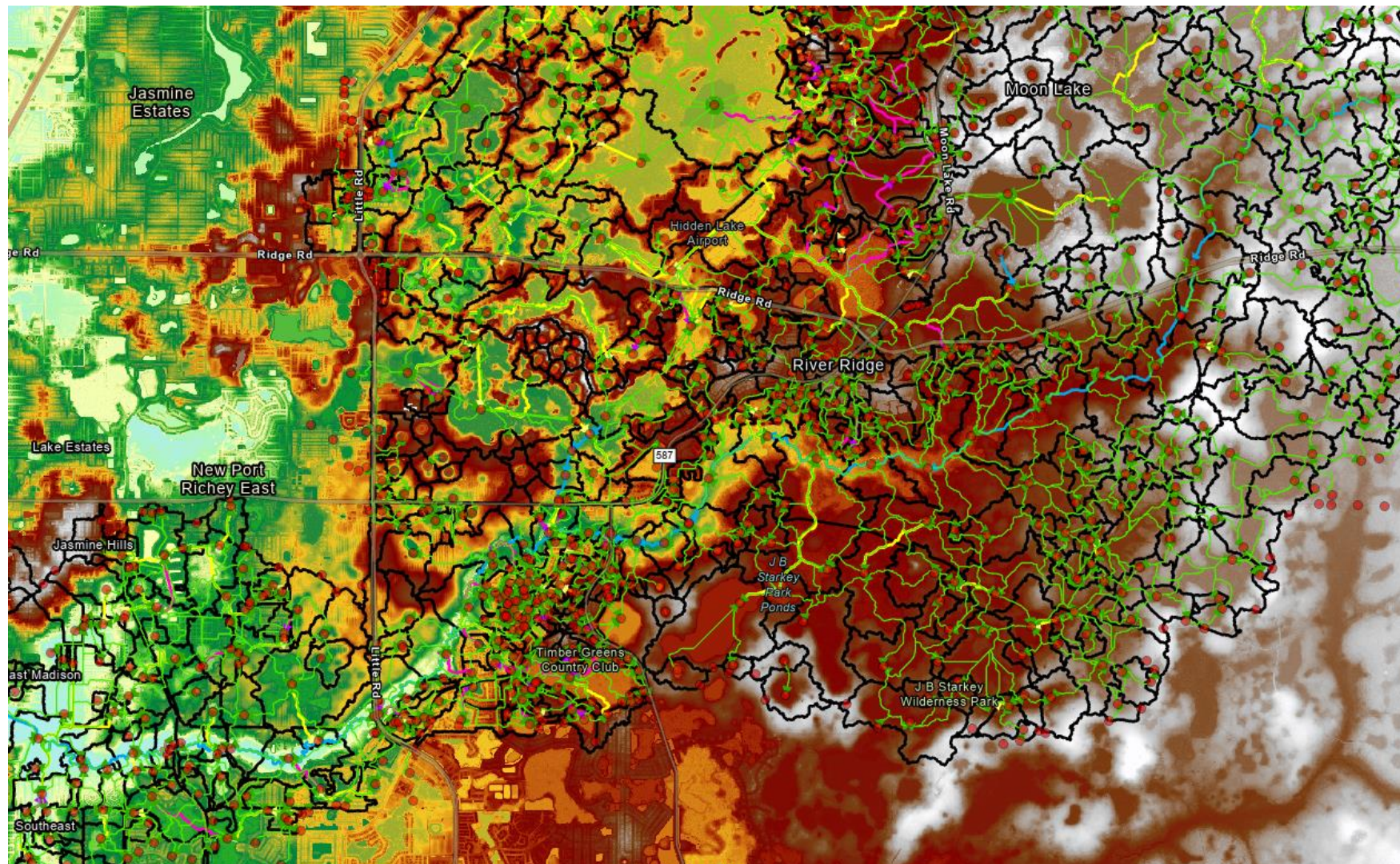
- Per Asset/Feature
 - Structures
 - Roads
- Flood Depth/Damage
- Summarize for area of interest



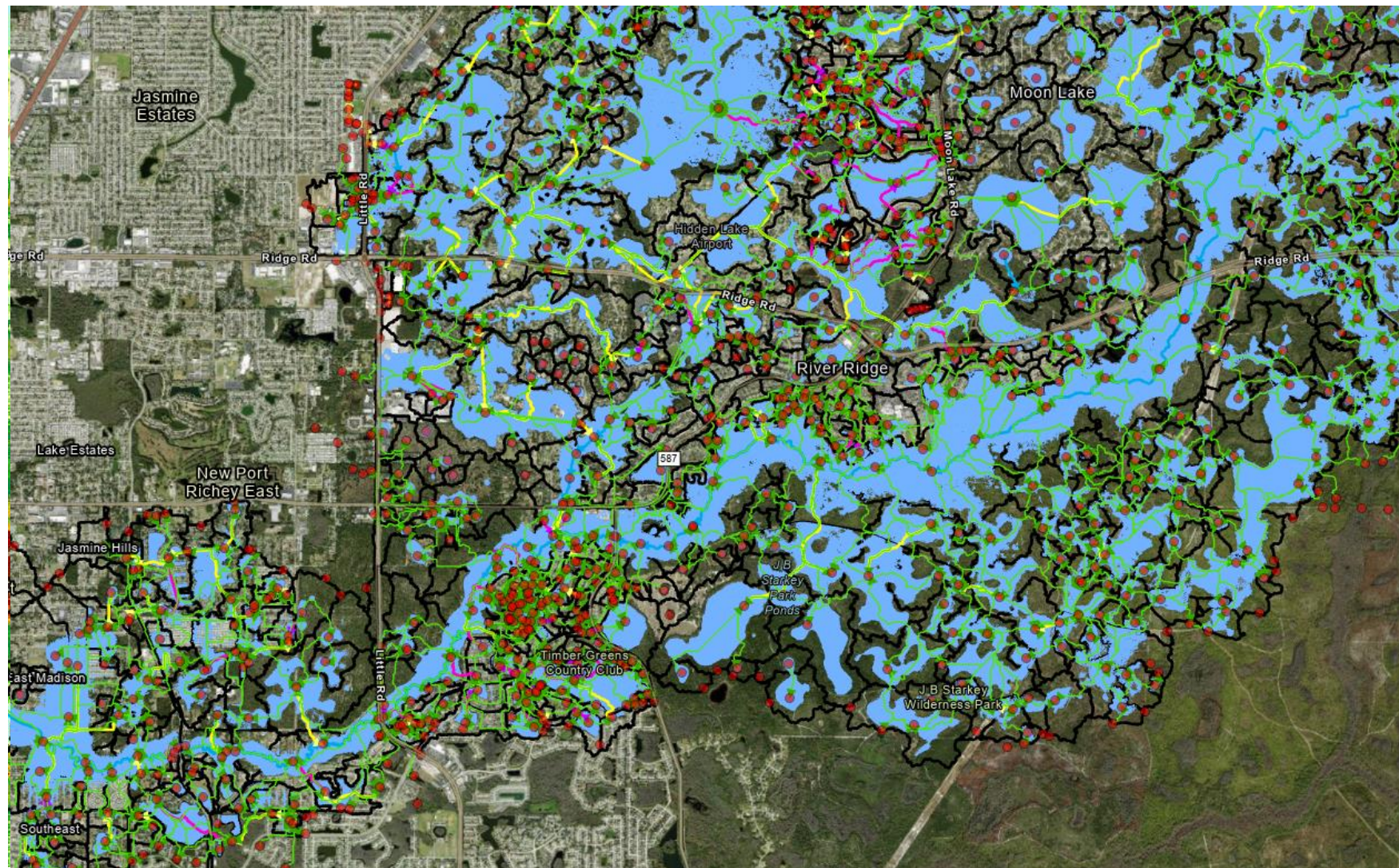
Automating Flood Damage Calculations



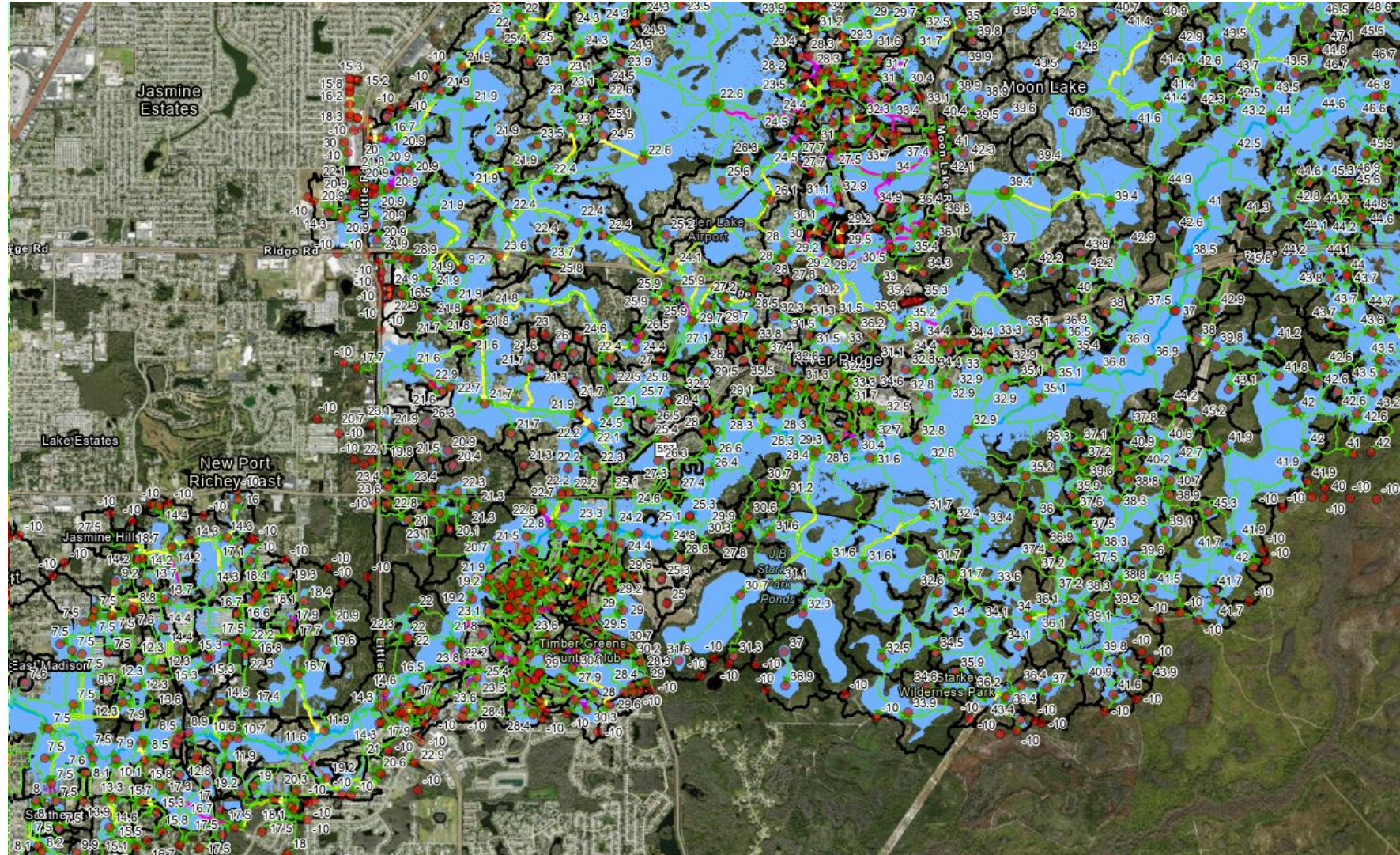
Automating Flood Damage Calculations



Automating Flood Damage Calculations

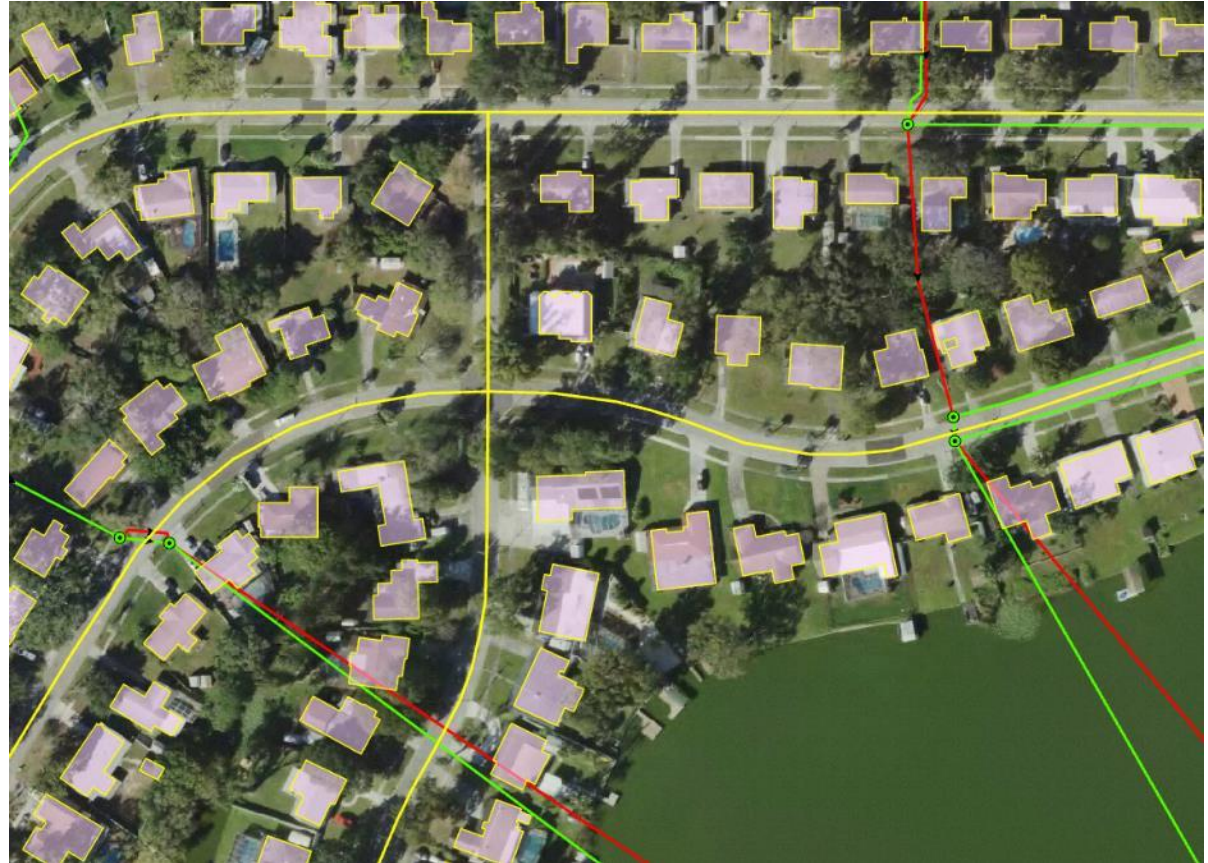


Automating Flood Damage Calculations



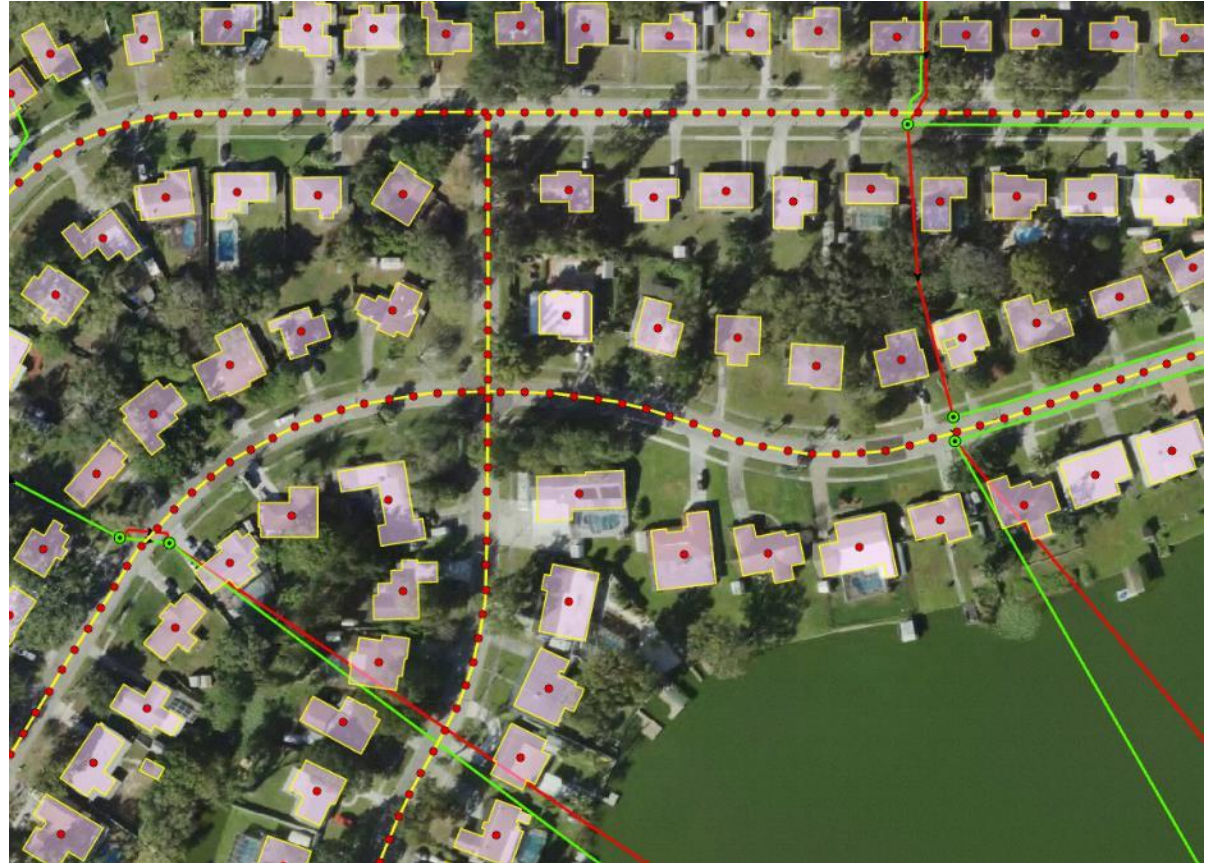
Automating Flood Damage Calculations

- Countywide Datasets
 - Structures w/ estimated FF
 - 3D Roads
 - Parcel Mappings
- Models – Node locations and model results
- Flood Damages



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Depth-Damage Curve Types

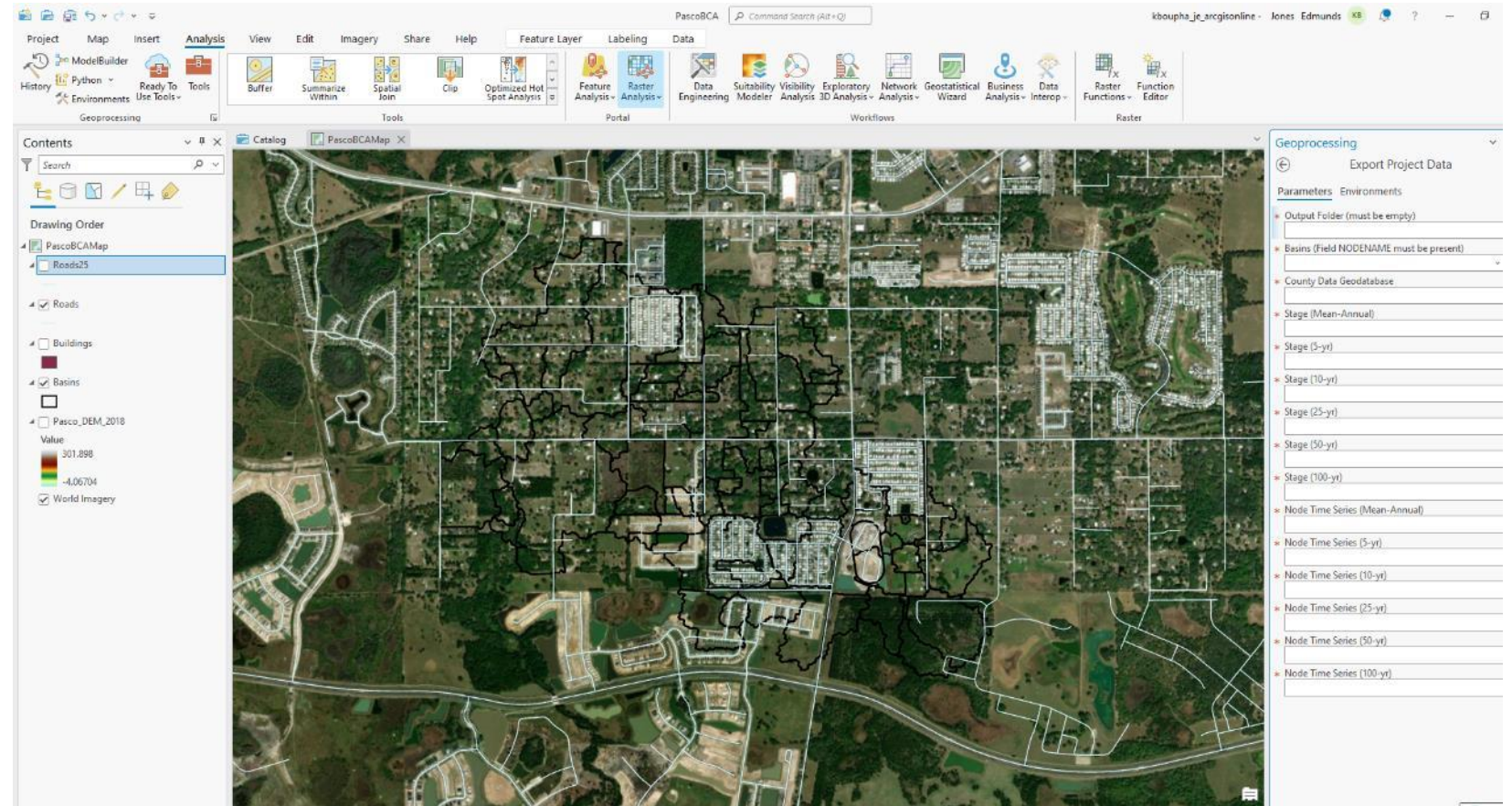
ID	Description	ID	Description
1	No Structure	17	Private Golf Course, structure
2	Average Agriculture, structure	18	Average Heavy Industrial, Structure
3	Airport, structure	19	Hospital, structure
4	Auto Dealer Big, structure	20	Clinic Eng
5	Average/Unknown	21	Industrial Light Eng
6	Bowling Alley, structure	22	Lumber, structure
7	Churches	23	Average Light Industrial, structure
8	Organization Hall, structure	24	Average Metals/Minerals processing, structure
9	Average College/University, structure	25	Gas/Butane Supply, structure
10	Condominium, living area on multi	26	Mobile Home
11	Average Government Services, structure	27	Cemetery, structure
12	Retail Clothing	28	Motel Unit, structure
13	Drive-In Theater, structure	29	Apartments, Structure
14	Bank, structure	30	Municipal Storage Warehouse, structure
15	Florist, structure	31	Private Club, structure
16	Recreation Facilities, structure	32	Nursing Home, structure

Depth-Damage Curve Types

ID	Description	ID	Description
33	Big Office Commercial, structure	50	Average Wholesale, Structure
34	Office 1 Story	51	Garage, structure
35	Office Building, structure	52	Drug, Super, structure
36	Average School, structure	53	Warehouse
37	Fast Food	54	Medical Clinic, structure
38	Non-Fast Food	55	Boat Sales/Service, structure
39	Service Station, structure	56	Car Wash, structure
40	Average Personal and Repair Services, structure	57	Auto Repair, structure, composite water and duration
41	Sewage Treatment, structure		
42	One Story, no basement	58	Auto Junk Yard, structure
43	Two or More Stories, no basement	59	Food Processor, structure
44	Split Level, no basement	60	Warehouse, structure
45	Average Retail, Structure	61	Metal Recycling, structure
46	Supermarket, structure	62	Heavy Equipment Storage, structure
47	Average Theatre, structure	63	Private Day Care, structure
48	Average Entertainment/Recreation, structure	64	Funeral Home, structure
49	Utility Company, structure	65	Cemetery, structure
		66	Physical Fitness, structure

Tools and Web Application

- GIS Processing Tool
- Web Application



Tools and Web Application

BCA Tool

Projects

Alternatives

Inundation

PASCOCOUNTY FLORIDA

OPEN SPACES. PRISTINE PLACES.

Copy

Excel

CSV

PDF

Print

ID	Name	Date	Structure Value Multiplier
423	Outfall Improvements	5/29/2025	1
310	LaSalle Avenue Drianage	8/14/2023	1
196	Drainage Improvements	5/16/2023	1

Showing 1 to 3 of 3 entries

Inundation

Damages

Benefit-Cost

Application Constants

New Project

Project Data

Project Name

Discount Rate

7

%

Model Nodes File

Choose file

No file chosen

Select model nodes .csv file

Model Peak Results File

Choose file

No file chosen

Select model peak stage results .csv file

Model Time-Series Results File

Choose file

No file chosen

Select model time series results .csv file

Time Series Increment (hours)

Structure Data

Roadway Data

Cancel

Restore Defaults

Save

Project: Outfall Improvements

Search:

	Maximum Driveable Limit (ft)	Discount Rate (%)	Time Step (hr)
	0.5	7	0.25
	0.5	7	0.25
	0.5	7	0.125

Previous

1

Next

Tools and Web Application

BCA ToolProjectsAlternativesInundationDamagesBenefit-CostApplication Constants

PASCCOUNTY FLORIDAOpen Spaces. Vibrant Places.

Project:

Outfall Improvements

Property - Existing

Roadway - Existing

CopyExcelCSVPDFPrint

Search:

ID	Parcel ID	Address	Description	Square Footage	Structure Value	Vehicle	Finished Floor Elevation	Driveway Elevation	Storm	Flood Depth (Structure)	Flood Depth (Vehicle)
1200	19-26-21-0050-00000-4900	3110 PINEY BARK DRIVE, WESLEY CHAPEL, 33543	Mobile Home	1,681	\$42,178	Sedan	76.37	75.7	100-year	0.5	1.2
1203	19-26-21-0040-00000-0780	3114 PINEY BARK DRIVE, WESLEY CHAPEL, 33543	Mobile Home	2,315	\$56,135	Sedan	76.29	75.9	50-year	0.5	0.9
1026	19-26-21-0040-00000-0970	34230 COUNTRY BREEZE AVENUE, WESLEY CHAPEL, 33543	Mobile Home	2,426	\$51,384	Sedan	77.51	76.2	100-year	0.4	1.8
		34413 COUNTRY									

Tools and Web Application

BCA ToolProjectsAlternativesInundationDamagesBenefit-CostApplication Constants

PASC

COUNTY FLORIDA

OPEN SPACES. LIBRARY PLACES.

Project:
Outfall Improvements

Property - Existing

Roadway - Existing

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Search:

RDSEgid	Name	Storm	Length Flooded (ft)	Hours Impassible
10292	SHADY CREEK DRIVE	25-year	196	38.0
11398	COUNTRY BREEZE AVENUE	5-year	125	37.8
9918	HICKORY DRIVE	10-year	250	37.5
11771	TIMBERLAND BOULEVARD	10-year	423	36.8
32842	BRIDGE HAVEN DRIVE	100-year	375	36.8
32850	ACKEE LANE	100-year	205	36.5
6803	ROAD RUNNER ROAD	50-year	587	35.5
10297	PINEY BARK DRIVE	100-year	649	35.5
11487	LODGE DRIVE	100-year	275	35.5
11395	BROWN BAYOU	25-year	211	35.0
11775	PINEY BARK DRIVE	100-year	178	34.8
33338	FLOWERING MOSS RUN	100-year	346	34.8

Showing 181 to 192 of 1,185 entries

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...

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Tools and Web Application

BCA Tool

Projects

Alternatives

Inundation ▾

Damages ▾

Benefit-Cost

Application Constants

PASC
COUNTY FLORIDA
OPEN SPACES. LIBRARY PLACES.

Project:
Outfall Improvements

Summary

Property Detail

Roadway Detail

By Storm

Existing Annual Damages: \$3,093,846

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CSV

PDF

Print

Search:

Item	2.33-year	5-year	10-year	25-year	50-year	100-year
Property-related	\$313,835	\$384,457	\$778,837	\$1,144,269	\$1,450,104	\$1,750,186
Roadway-related	\$2,940,918	\$3,525,157	\$5,635,671	\$7,103,878	\$7,964,363	\$9,086,780
Total	\$3,254,753	\$3,909,614	\$6,414,508	\$8,248,147	\$9,414,467	\$10,836,966

Showing 1 to 3 of 3 entries

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Tools and Web Application

The screenshot displays a web application interface for a 'Benefit-Cost' analysis. The main navigation bar includes 'Projects', 'Alternatives', 'Inundation', 'Damages', 'Benefit-Cost' (selected), and 'Application Constants'. A user profile icon is visible in the top right. The background shows a project titled 'Drainage Improvements' with a 'Benefit/Cost' ratio of 1.18. A modal window titled 'Alternative 2' is open, displaying a table of values for various items. The table includes 'Annual Damage Without Project' (\$175,924), 'Annual Damage With Project' (\$4,468), 'Annual Damage Benefit' (\$171,456), 'Discount Rate (%)' (7), 'Project Useful Life' (50), 'Present Value of Future Benefits' (\$2,366,223), 'Project Cost' (\$2,000,000), and 'Benefit/Cost Ratio' (1.18). A 'Close' button is located at the bottom right of the modal.

Item	Value
Annual Damage Without Project	\$175,924
Annual Damage With Project	\$4,468
Annual Damage Benefit	\$171,456
Discount Rate (%)	7
Project Useful Life	50
Present Value of Future Benefits	\$2,366,223
Project Cost	\$2,000,000
Benefit/Cost Ratio	1.18

Because it is Automated...

- Easily apply to entire watershed or jurisdiction
- Use the flood damage calculations to identify and rank needs
- Point us to locations where BMPs are needed - impacts to people
- Support decision making
- Improve flooding conditions
- Social equity



Questions