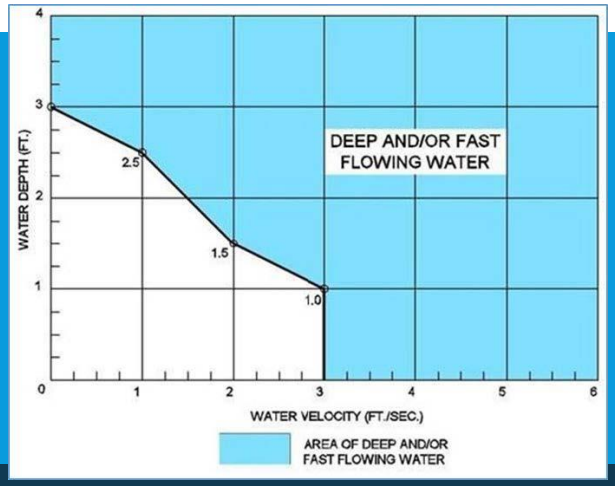
Cooperating Technical Partners Information Exchange

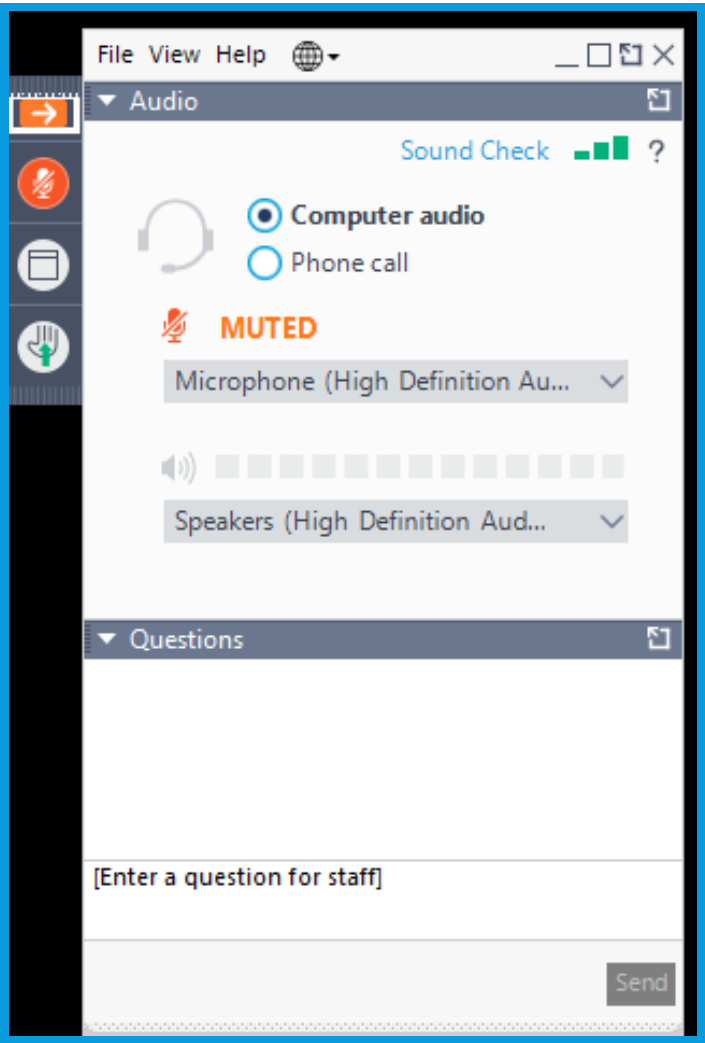
Using a Depth x Velocity Product in Conjunction with Floodways



ASFPM Flood Science Center

October 29, 2020

Audio Settings



- Open and hide your webinar control panel using the orange arrow button at top left corner
- Choose "Computer audio" to use speakers or headphones
- Choose "Phone call" to dial in using the information provided

Submit questions and comments using the "Questions" panel

Webinar Participation

- All lines will be automatically be muted.



Use the "Questions" window in the webinar control panel to submit any questions or comments to the moderator.

- Selected questions will be read to the presenters and answered on the live webinar.

- Submitted questions not asked during the webinar will be answered by the presenters and posted as a document on the webinar event page at floodsciencecenter.org.

Continuing Education Credits

- Certified Floodplain Managers and Certified Planners are eligible for 1 CEC for participating in this webinar.
- You must have registered individually and indicated you are a CFM and/or AICP at time of registration.
- Eligibility for CEC is dependent on your time spent viewing the webinar, as determined by the webinar software.



Attending this webinar in a group setting or only viewing the recording is NOT eligible for CEC.

Additional Logistics

- To suggest future CTP webinar topics, please contact Alan Lulloff at *alan@floods.org* or type a suggested topic into the Questions panel today.



ASFPM CFM CECs will be automatically applied.



Certificates of Attendance will be emailed. Processing will take a few weeks. Please contact *cfm@floods.org* with any certificate issues only after a few weeks have elapsed.

- A follow-up email with link to slides and recording will be sent **in about a week or so.**

Thank You for Joining Us!

ASFPM Mapping and Engineering Standards Committee
Cooperating Technical Partners Subcommittee

Co-chairs:

- Brooke Seymour, P.E., CFM - *bseymour@udfcd.org*
  Colorado's Mile High Flood District
- Darryl Rockfield Jr., CFM - *darryl.rockfield@sema.dps.mo.gov*
  Missouri State Emergency Management Agency

Goals:

- **Identify common concerns**
- **Provide opportunities for information exchange**
- **Identify training needs**
- **Promote and document the value of CTPs**

Presenters

- **Alan Lulloff, P.E., CFM**, Senior Project Manager - ASFPM Flood Science Center
- **Dennis Dixon, CFM**, Floodplain Engineer - Pierce County Planning & Public Works
- **Ataul Hannan, P.E., CFM**, Director, Planning Division - Harris County Flood Control District

Agenda

- **Introduction & Floodway Background** - Alan Lulloff
- **Pierce County, WA: Deep & Fast Flowing** - Dennis Dixon
- **Harris County Flood Control District: Mapping Floodways using DxV** - Ataul Hannan
- **Closing Comments** - Alan Lulloff
- **Questions/Discussion**

Using a Depth x Velocity Product in Conjunction with Floodways

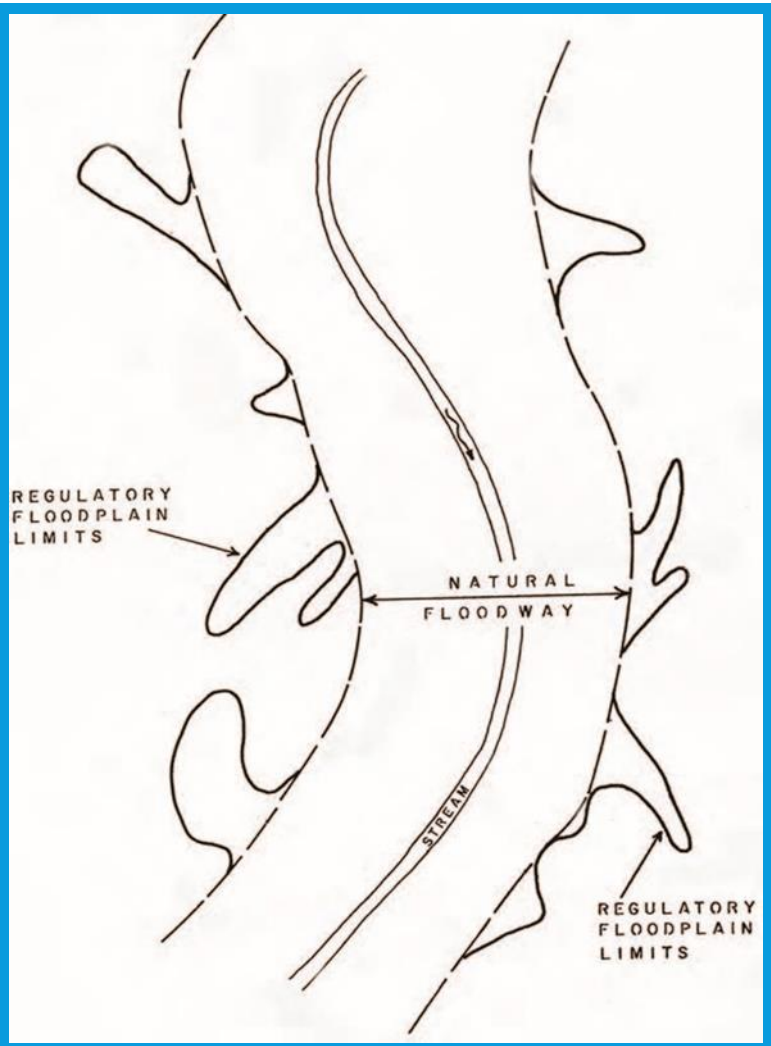
Why was floodway surcharge concept established?

James Goddard
1978 Report:

Origin and Rationale of Criterion Used in Designating Floodways



First consideration for designating floodway



"All the floodplain of the selected flood included, except those shallow areas and embayments … where there was ponding but little, if any flow."

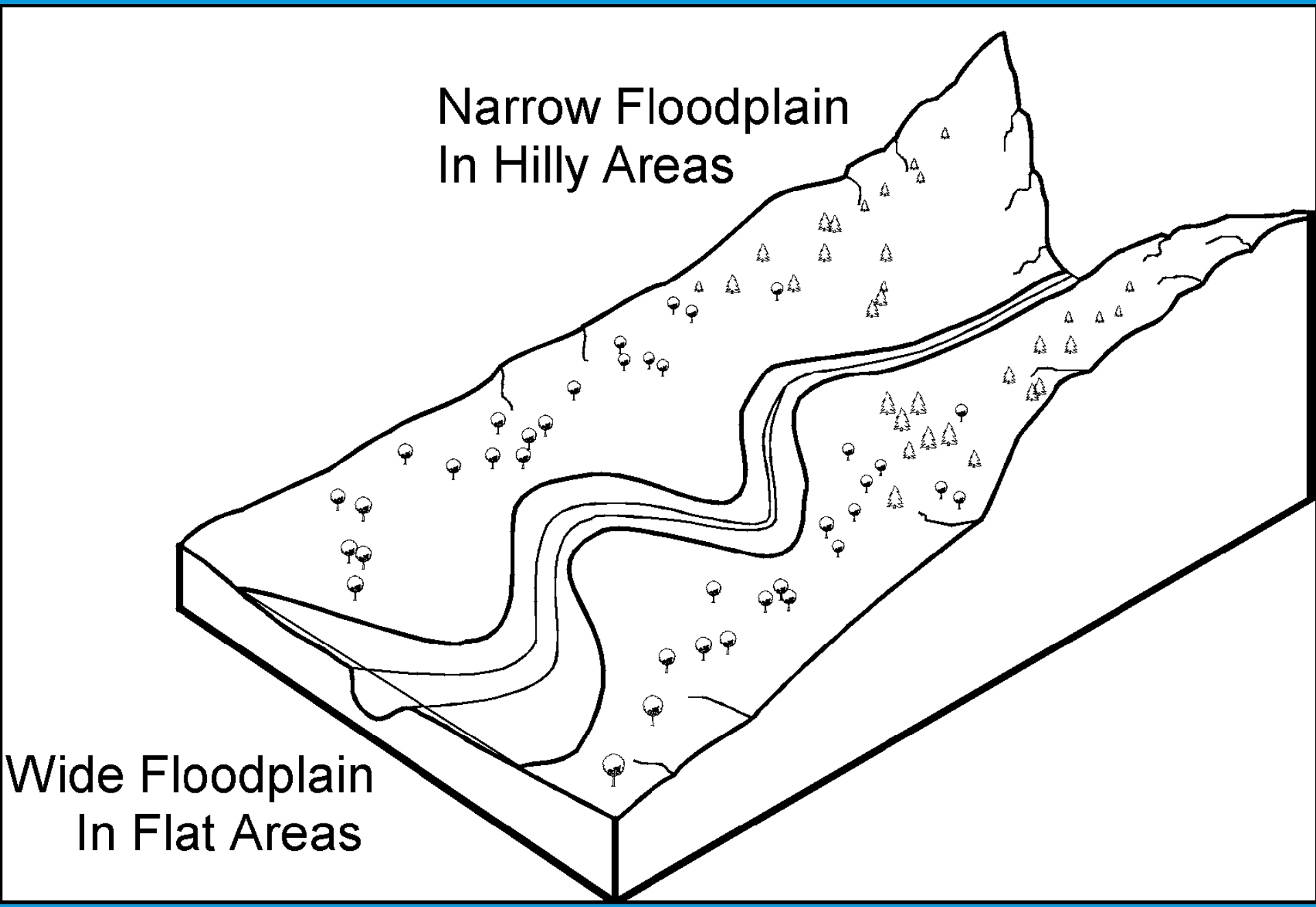
Narrower floodways – a compromise to allow some development

"An approach that allowed encroachment … providing it would not cause an unreasonable increase in flood heights. The criterion evolved as being reasonable amount was no more than one foot."

Why was floodway surcharge concept established?

According to Goddard:

"It was to be a minimum criterion intended as a regional standard, recognizing that there were urbanizing areas …(with) existing development where … a much smaller rise might be appropriately considered."


Narrow Floodplain
In Hilly Areas
Wide Floodplain
In Flat Areas

Is now the federal minimum standard

Title 44 CFR Part 60, Section 59.1

"A floodway is defined as the channel of a river or other watercourse and the adjacent land areas that **must be reserved** in order to discharge the base flood without **cumulatively increasing the water-surface elevation by more than a designated height.**"

Communities can adopt higher standards

Title 44 CFR Part 60, Section 60.3

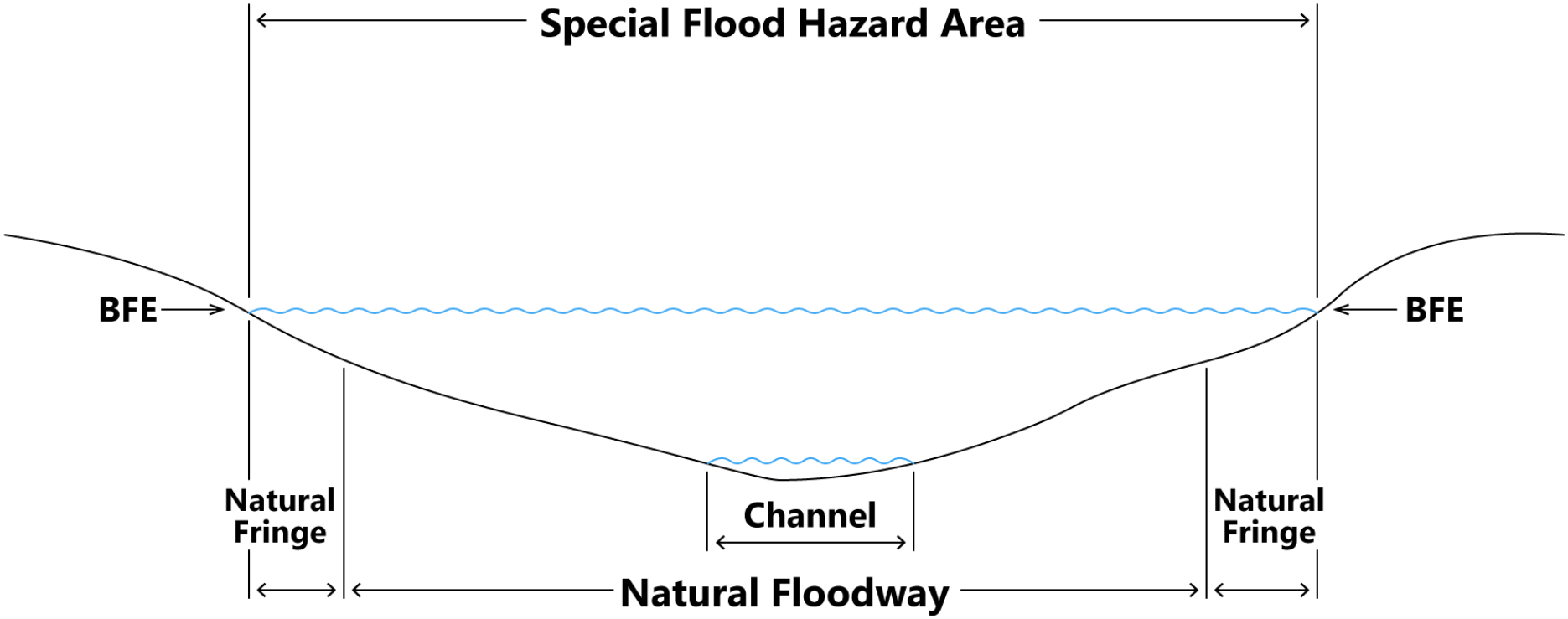
"… the community shall

60.3 (d) (2) **Select** and adopt a regulatory floodway based on the principle that the area chosen for the regulatory floodway must be designed to carry the waters of the base flood, **without increasing the water surface elevation of that flood more than one foot** at any point;"

States that allow less of a surcharge

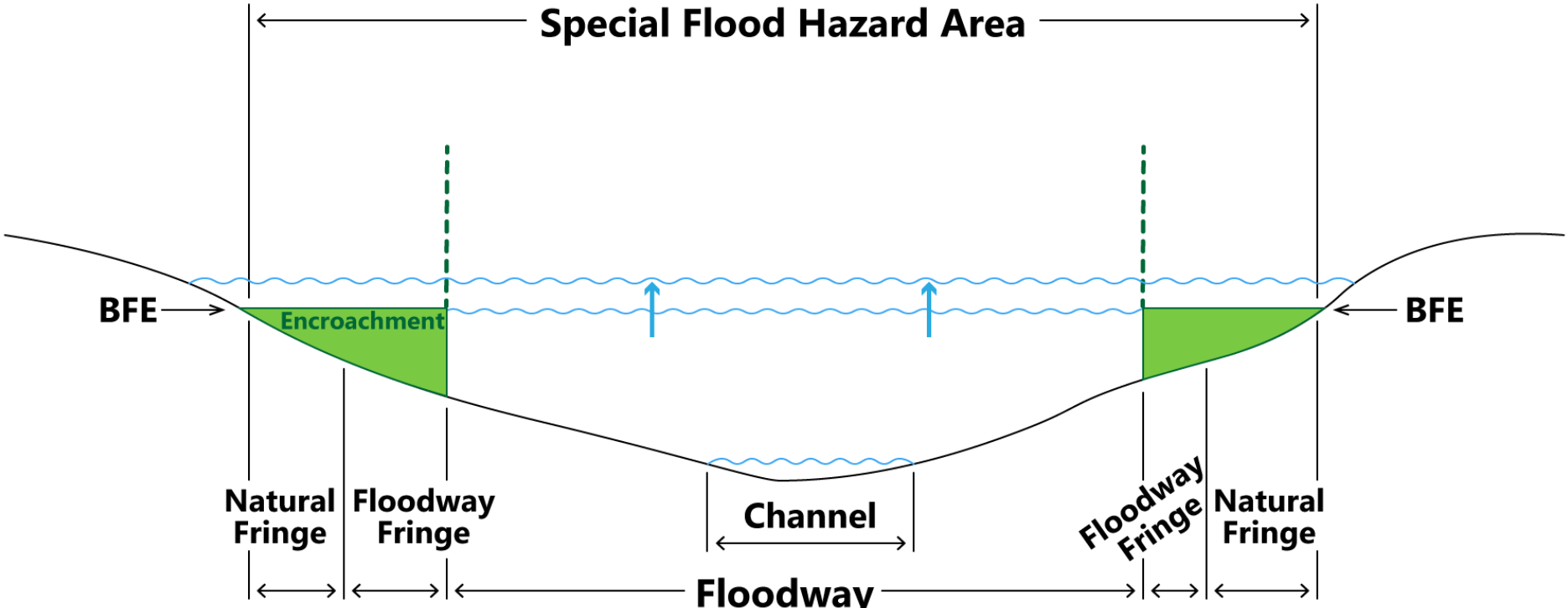
Wisconsin	0.00
Illinois	0.1 (measureable amt.)
Indiana	0.1 (measureable amt.)
Michigan	0.1 (measureable amt.)
New Jersey	0.2
Minnesota	0.5
Montana	0.5
Colorado	0.5

Floodway Encroachment



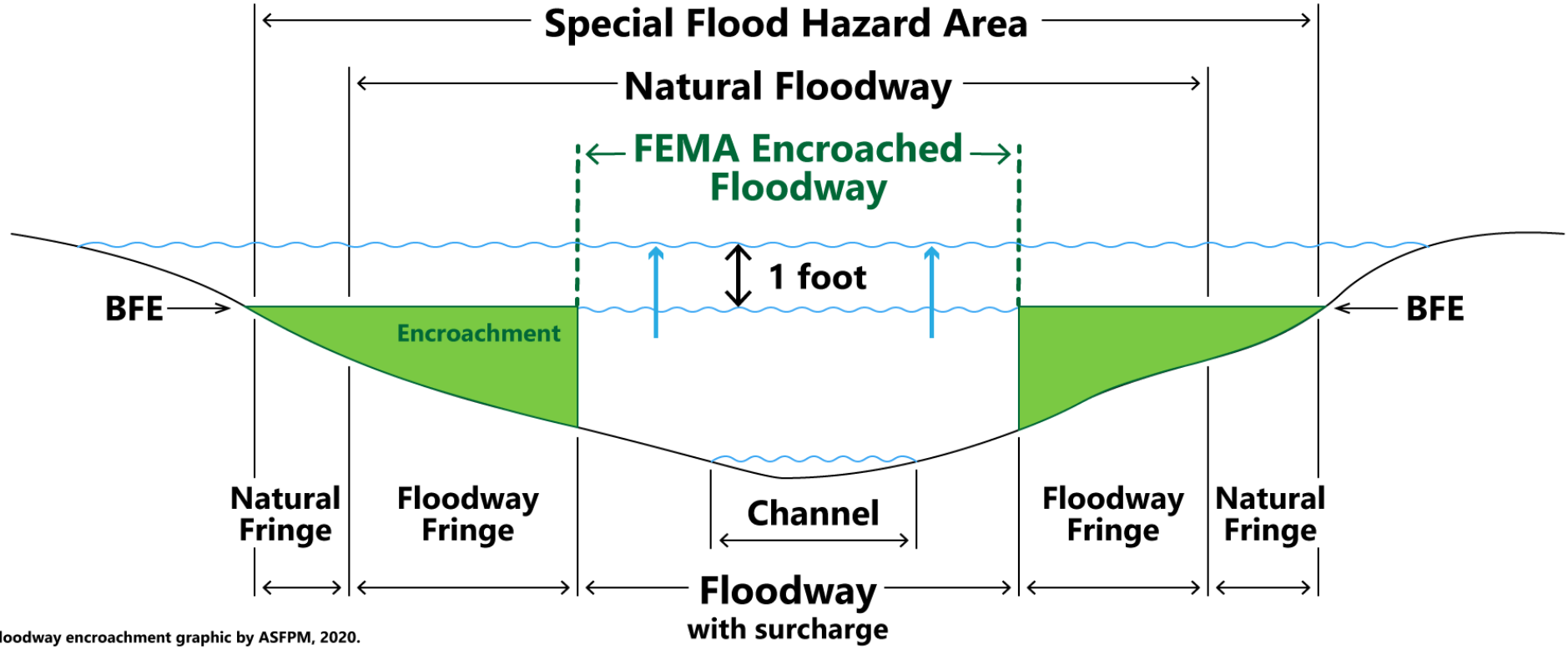
Floodway encroachment graphic by ASFPM, 2020.

Floodway Encroachment



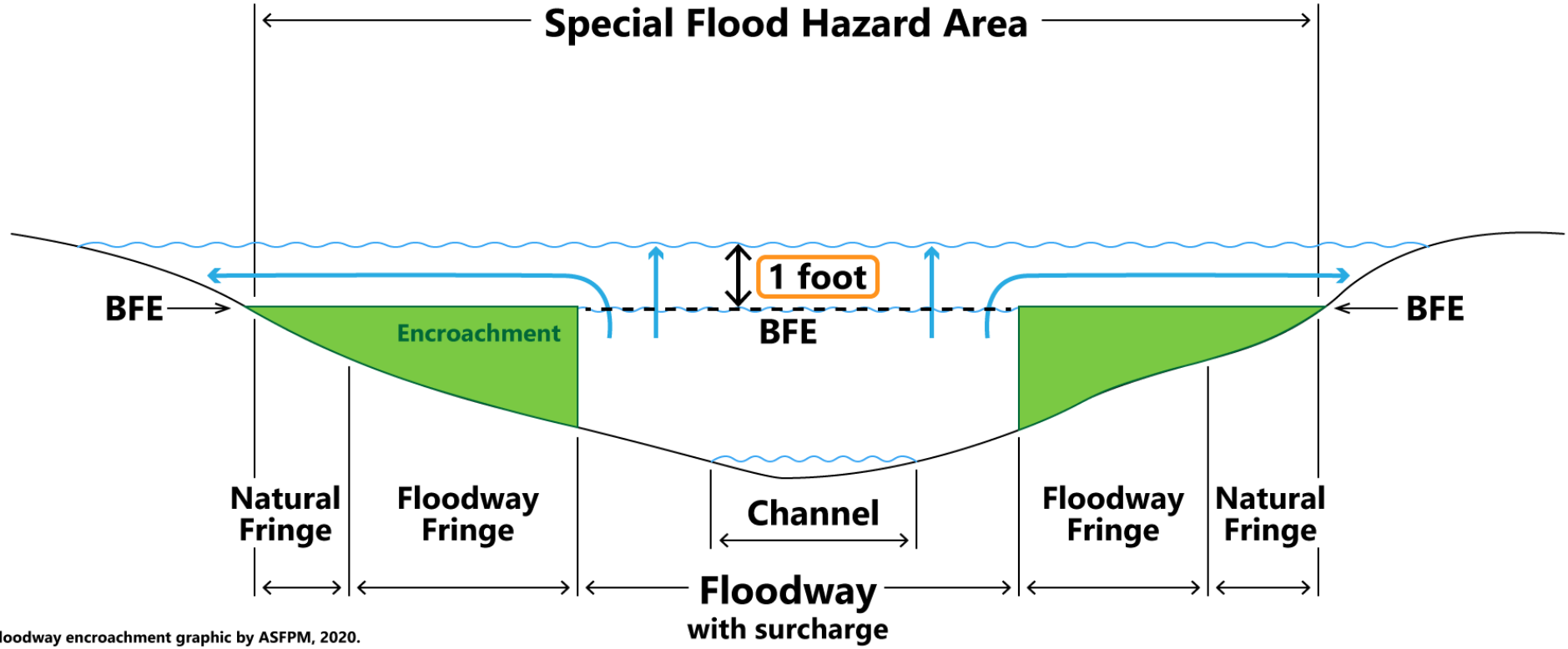
Floodway encroachment graphic by ASFPM, 2020.

Floodway Encroachment



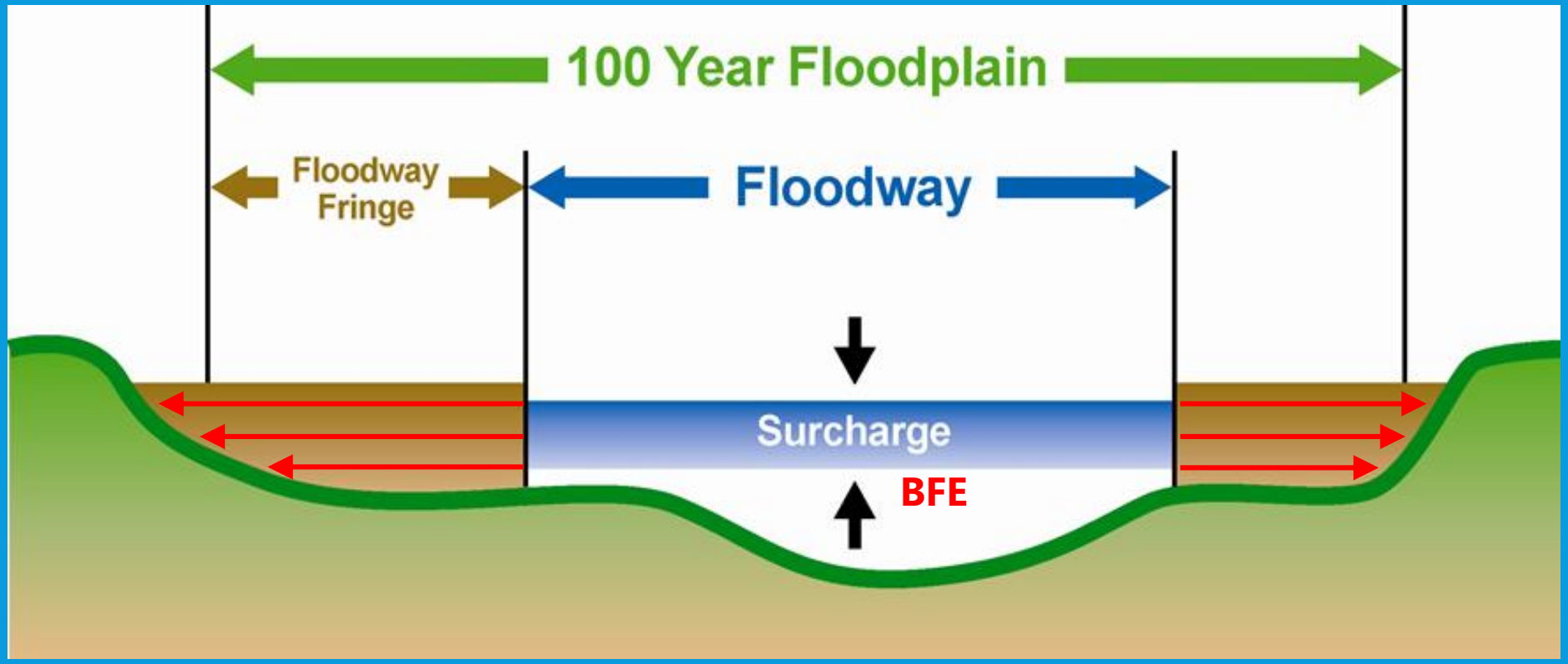
Floodway encroachment graphic by ASFPM, 2020.

Floodway Encroachment



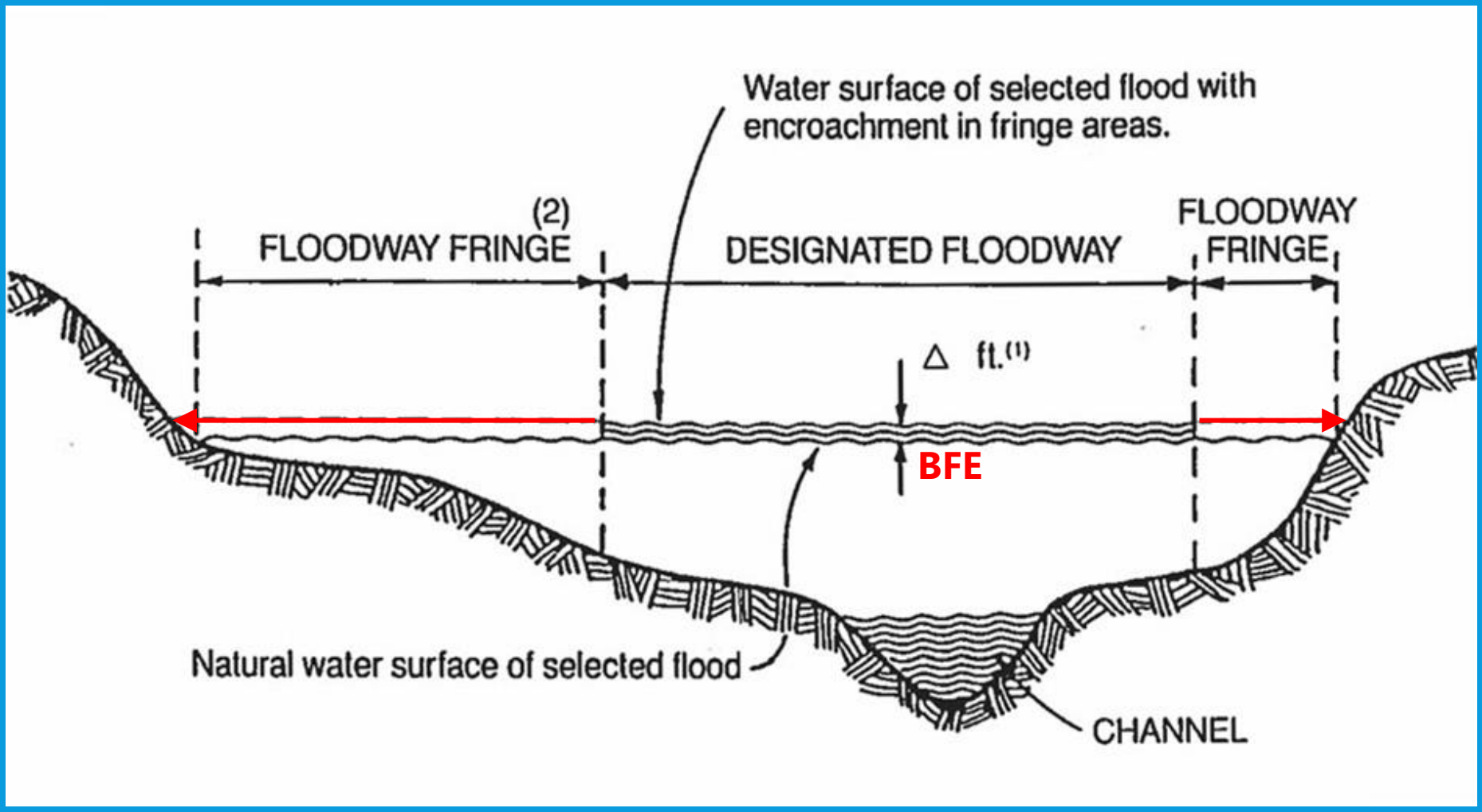
Floodway encroachment graphic by ASFPM, 2020.

Inaccurate Graphic

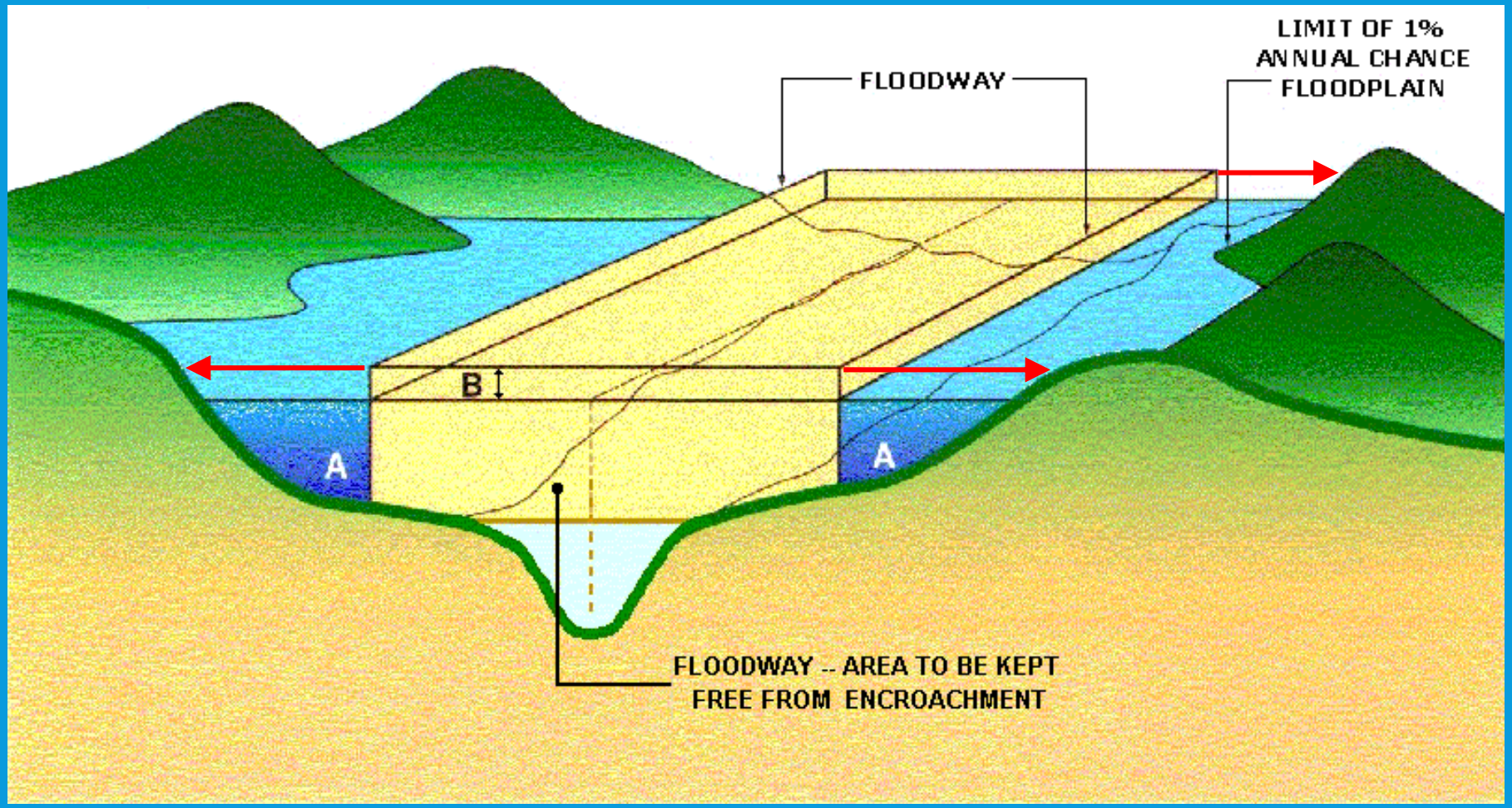


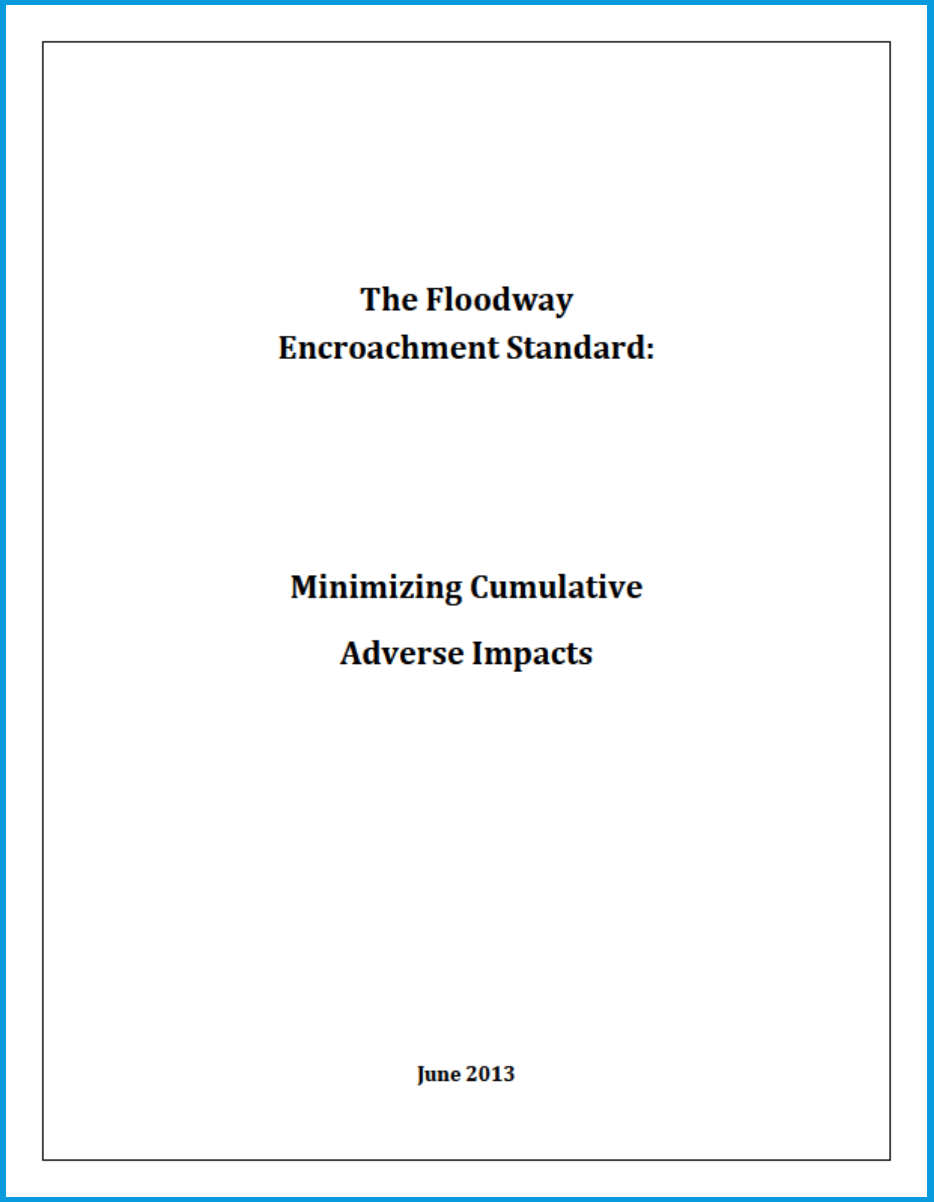
Accurate Graphic

(Source: 1987 USACE Publication prepared for FEMA)

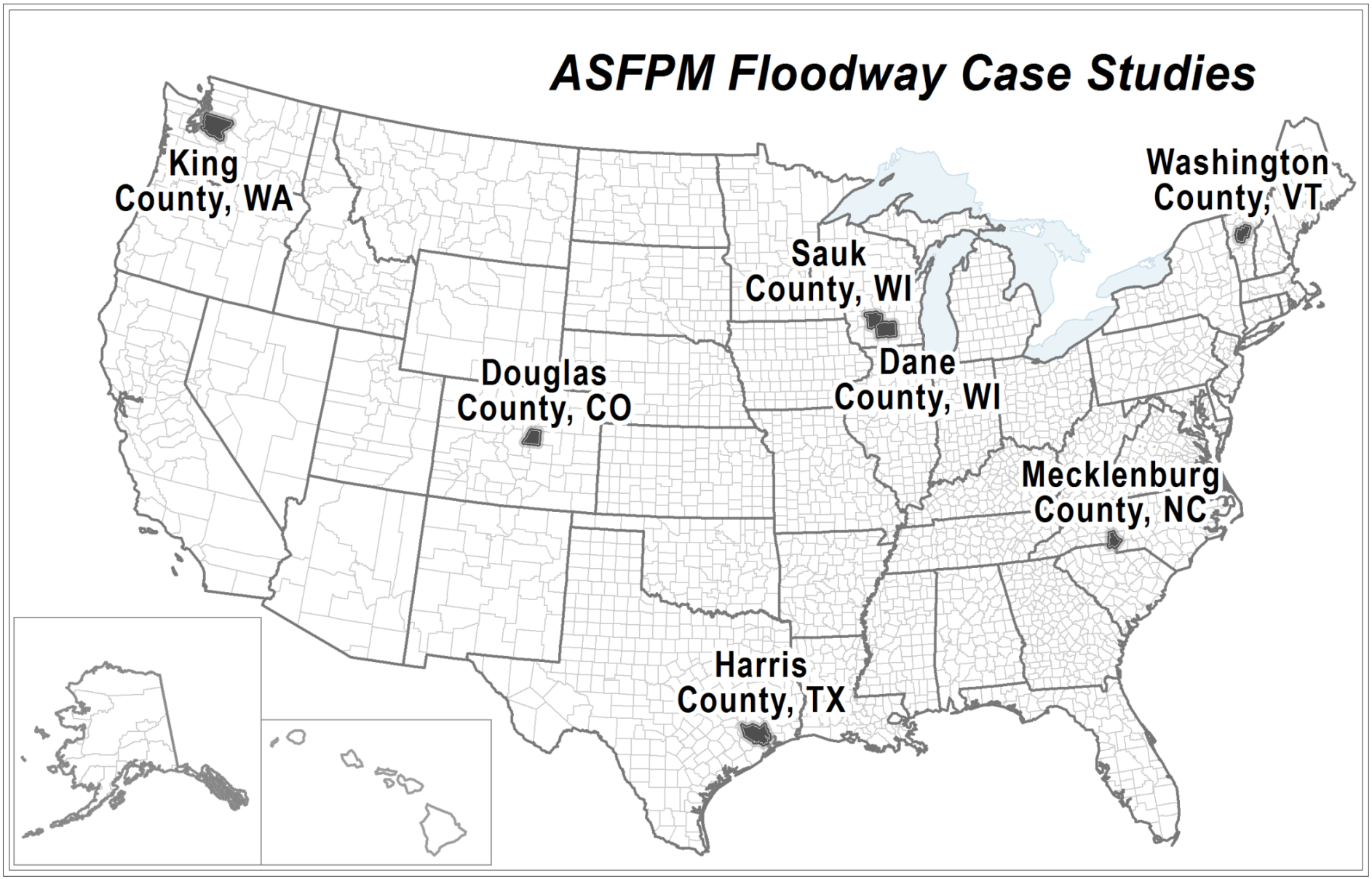


Perspective View





no.floods.org/FloodwayEncroachment

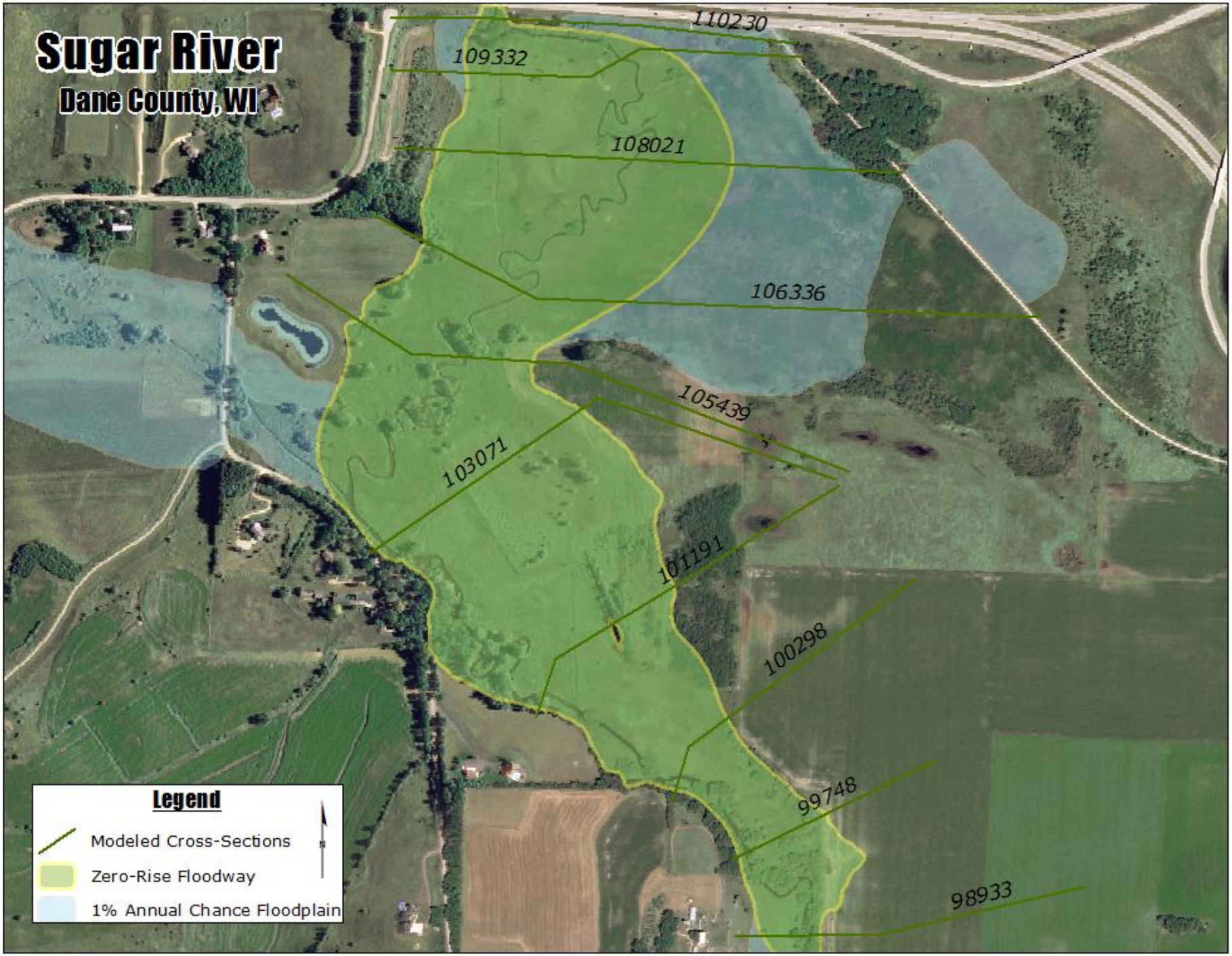

ASFPM Floodway Case Studies
King County, WA
Douglas County, CO
Sauk County, WI
Dane County, WI
Washington County, VT
Mecklenburg County, NC
Harris County, TX

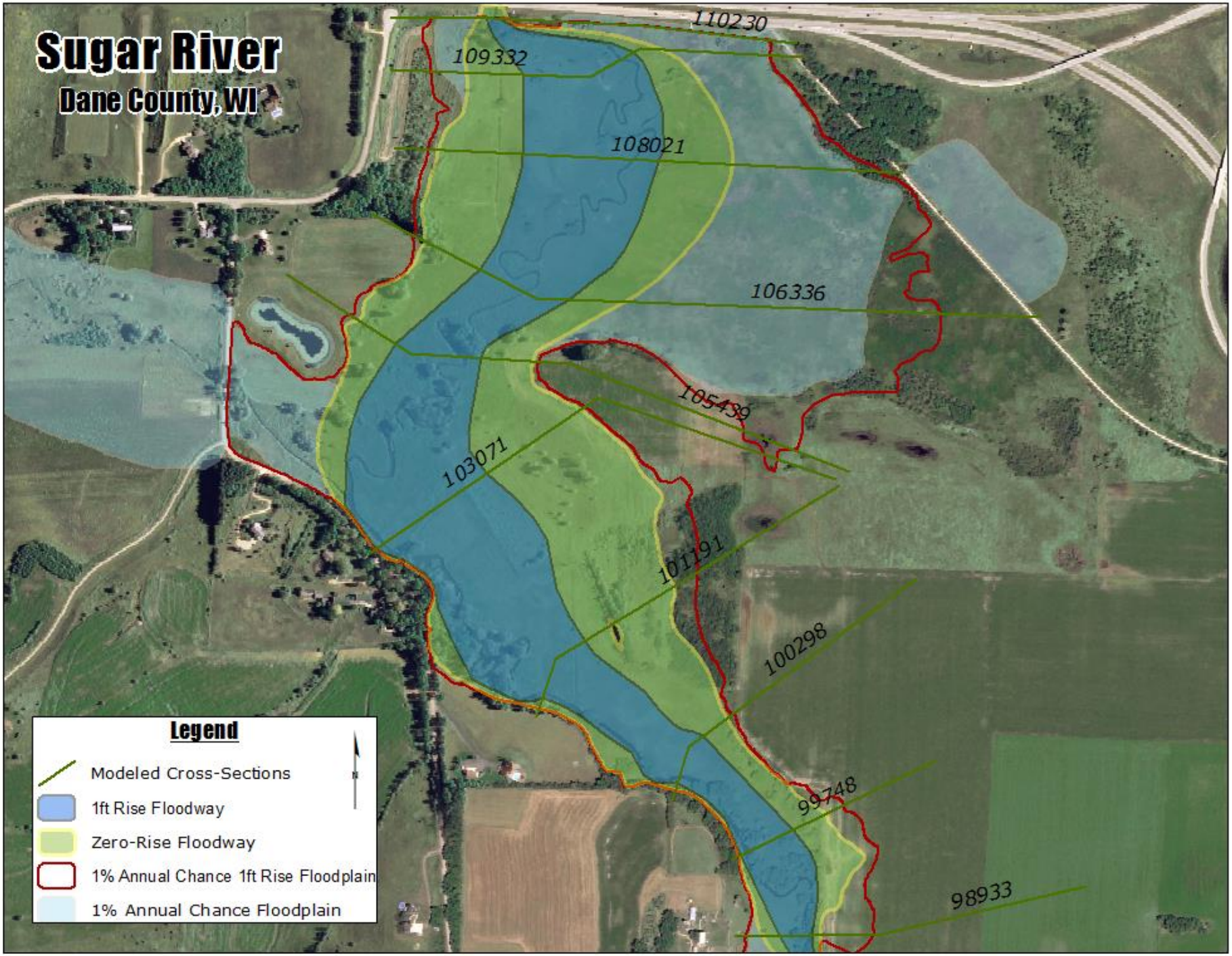
Comparison between 1 ft & 0 surcharge

Stream	Avg. width Decrease (%)	Velocity Increase (ft/sec)	Average Velocity Inc. (%)	Increase floodplain (%)
Pine Creek	59	2.28 to 3.69	62	6
Patterson Creek	68	1.11 to 1.61	45	
Stevens Branch	39	4.98 to 5.82	18	
Sugar River	50	1.57 to 2.07	32	14
Four Mile Creek	43	2.58 to 3.25	26	
Cypress Creek (100)	48	1.92 to 2.46	22	
Cypress Creek (172)	64	1.18 to 1.71	45	
Plum Creek	32	7.15 to 8.31	16	
Avg. all 8 reaches	50	2.85 to 3.62	33	10

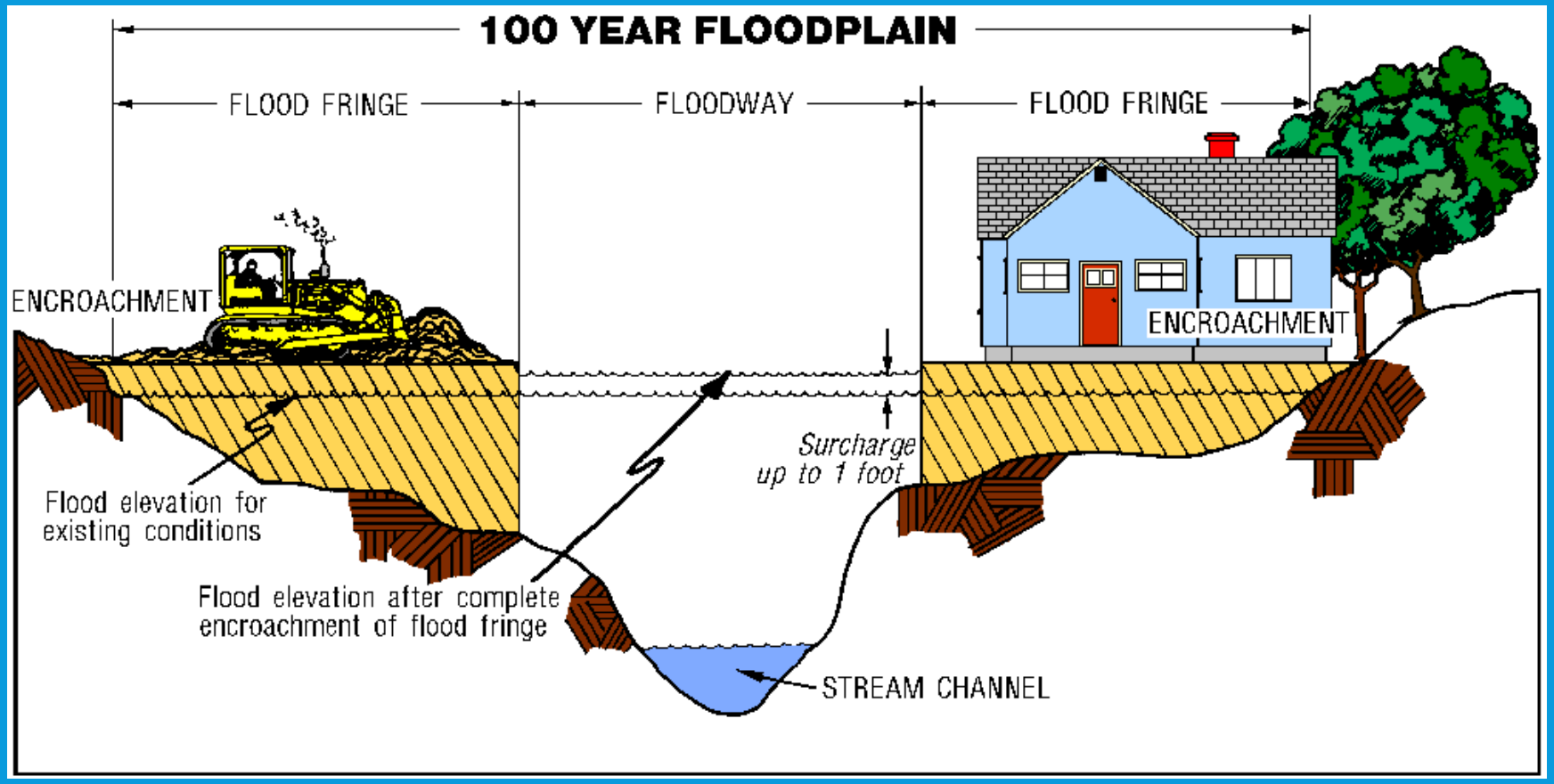
Comparison between 1 ft & 0 surcharge

Stream	Avg. width Decrease (%)	Average Velocity Inc. (%)	Increase floodplain (%)
Avg. all 8 reaches	50	33	10


Sugar River
Dane County, WI
110230
109332
108021
106336
105439
103071
101191
100298
99748
98933
Legend
Modeled Cross-Sections
Zero-Rise Floodway
1% Annual Chance Floodplain


Sugar River
Dane County, WI
110230
109332
108021
106336
105439
103071
101191
100298
99748
98933
Legend
Modeled Cross-Sections
1ft Rise Floodway
Zero-Rise Floodway
1% Annual Chance 1ft Rise Floodplain
1% Annual Chance Floodplain

One-foot surcharge FWs enable filling half the natural FW



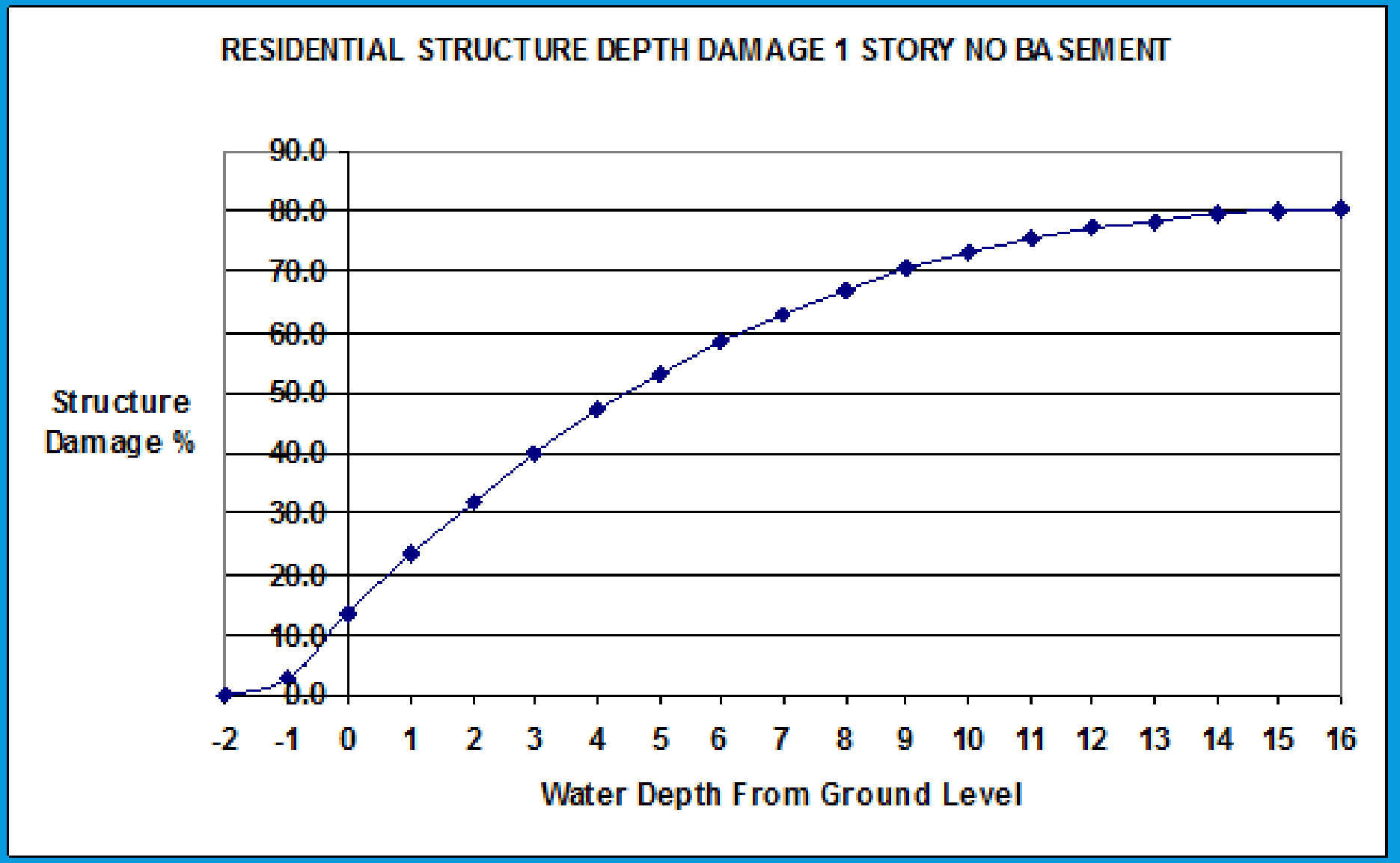
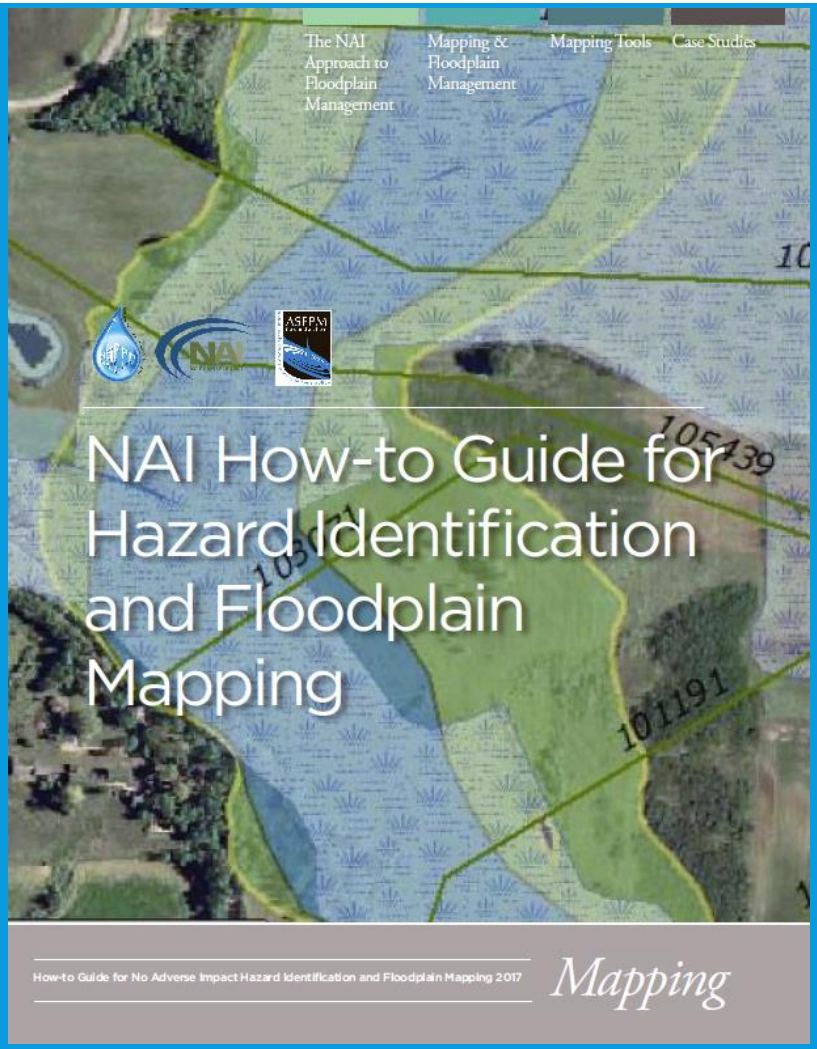


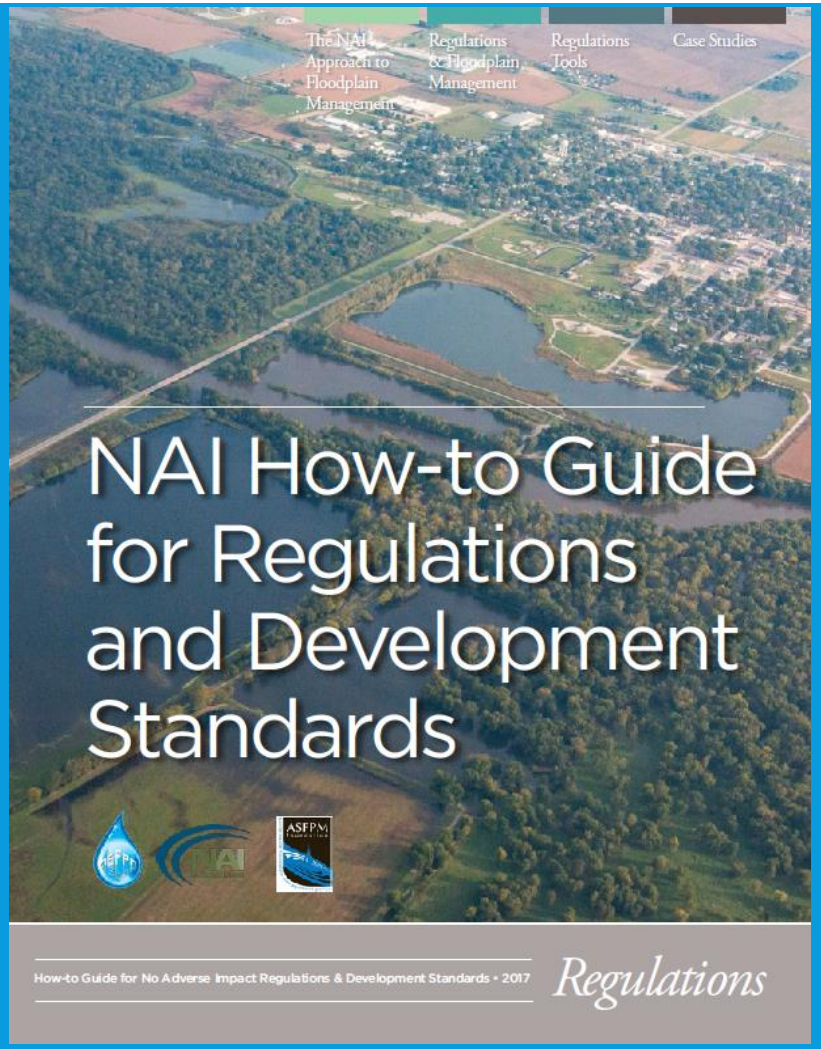
Figure 3 – Flood Depth-Damage Curve for a Single-Story Residential Structure with No Basement at Ground Level. (Source: U.S. Army Corps of Engineers Floodplain Inventory Tool (CEFIT)

ASFPM recommendations

- **Communities be informed of the impacts of floodways with surcharge.**
- **Communities be required to officially acknowledge they are aware that a floodway with surcharge will result increased flooding in their community over time as the floodway fringe is filled.**

ASFPM No Adverse Impact How-to Guides: no.floods.org/NAI





Poll Question

In your opinion, what % of communities would select higher standards floodways if they were aware of the increased flooding associated with one-foot surcharge floodways?

Depth x Velocity Product

Focus on safety vs. impacts of encroachments

- Pierce County, WA – using to supplement FEMA floodway with surcharge
- Harris County Flood Control District – using to establish floodways that meet the one foot surcharge criterion

Pierce County



Cooperating Technical Partners - CTP WEBINAR

OCTOBER 27, 2020

Deep and/or Fast Water Floodway

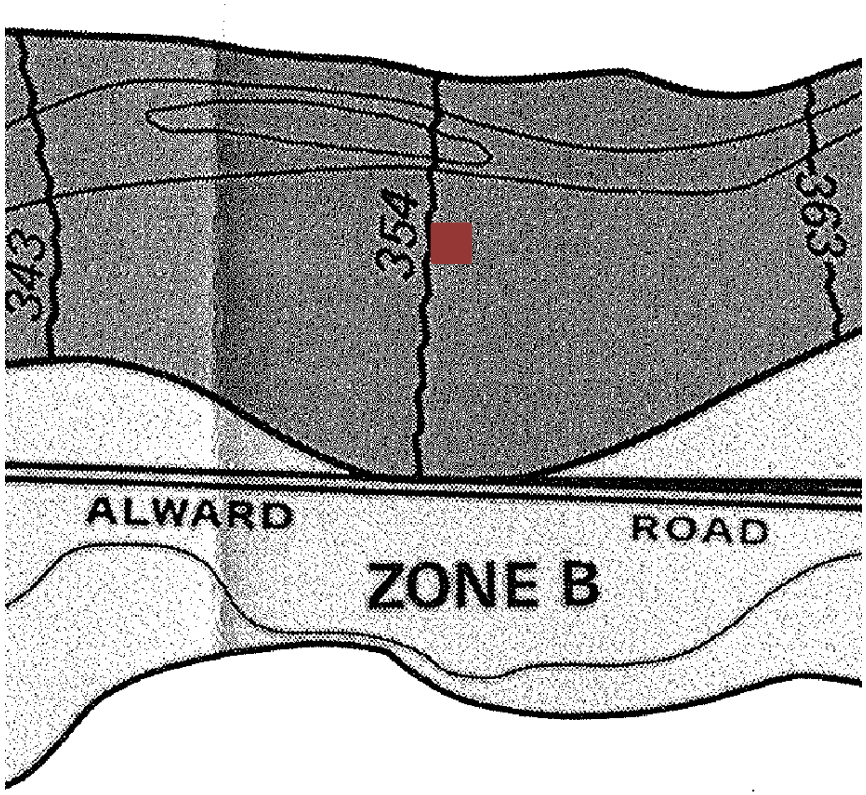
Dennis Dixon, CFM

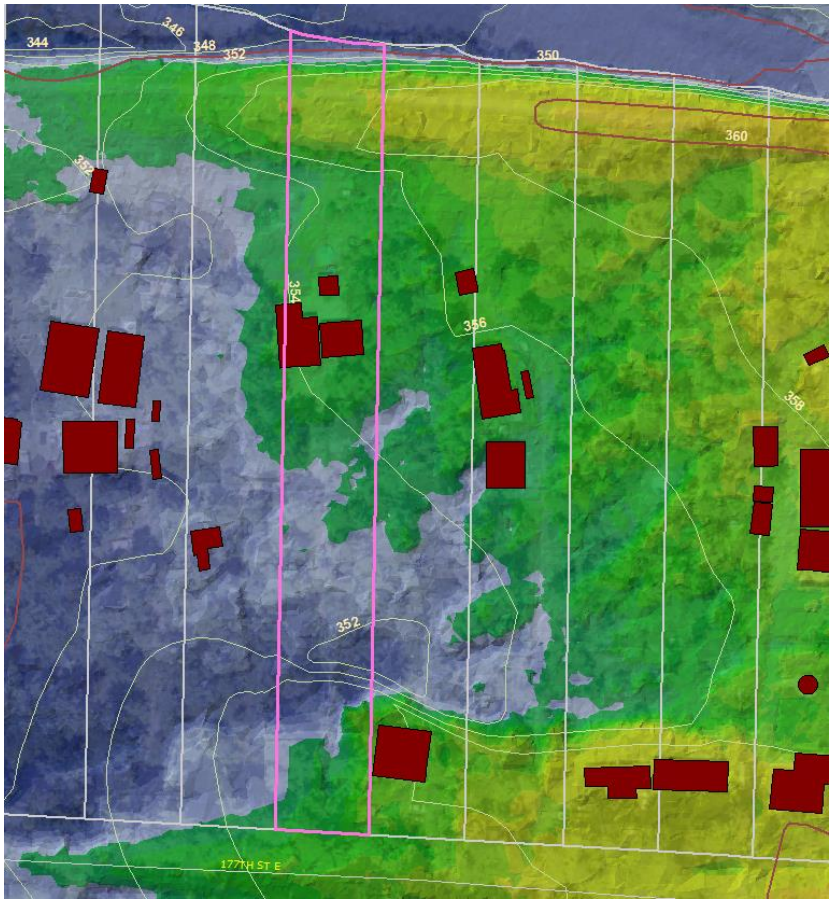
dennis.dixon@piercecountywa.gov – 253 798-3696

Life safety floodway

Pierce County

Carbon River Rescue –Video1





Life safety floodway

Pierce County

Pierce County Code Title 18E.70 – Purpose

- Protect human life and health;
- Minimize expenditure of public money and costly flood control projects;
- Minimize the need for rescue and relief efforts associated with flooding;



Alternative Floodway tools

Pierce County

ACER TECHNICAL MEMORANDUM NO. 11
ASSISTANT COMMISSIONER - ENGINEERING AND RESEARCH
DENVER, COLORADO

DOWNSTREAM HAZARD CLASSIFICATION GUIDELINES

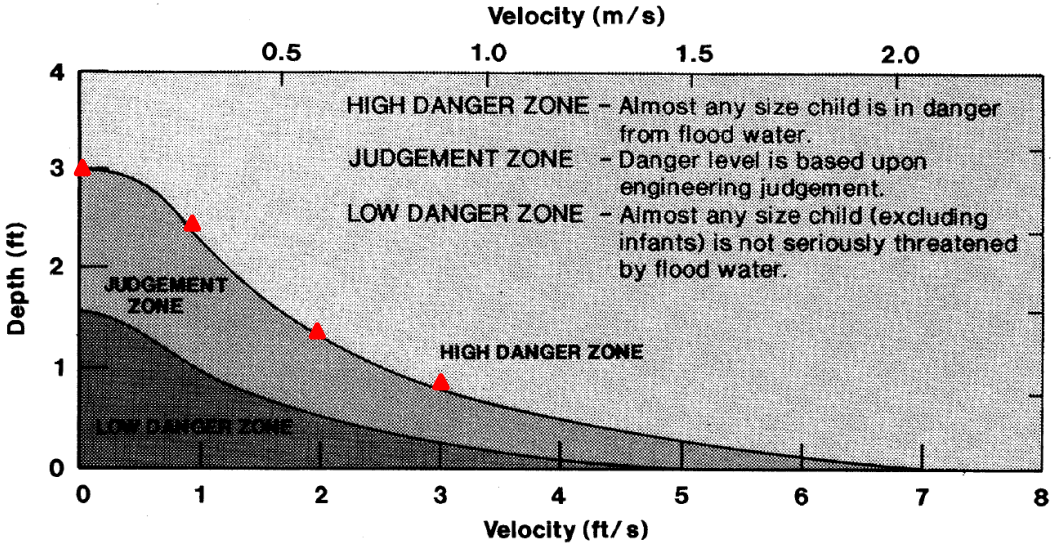
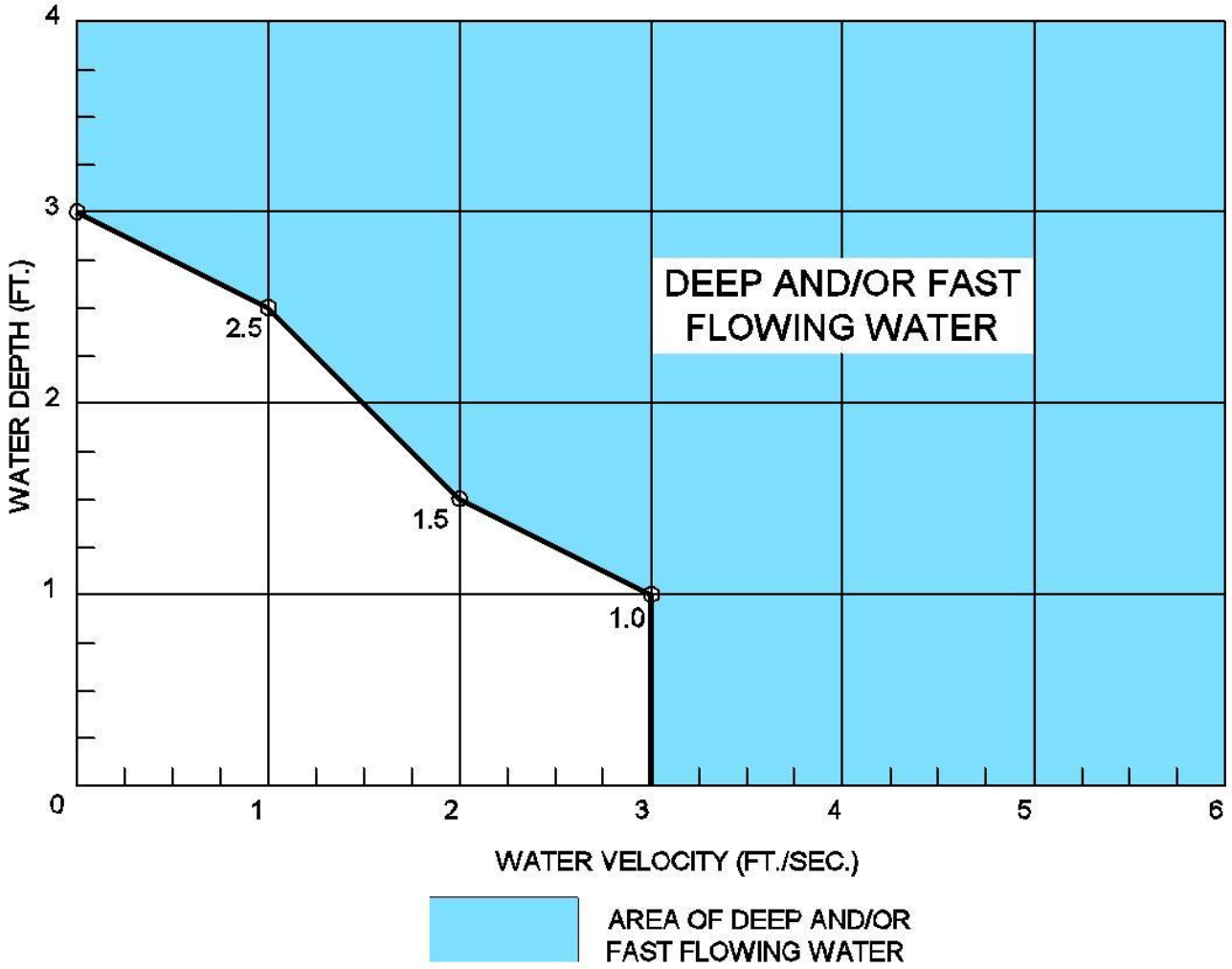


Figure 6. – Depth–velocity flood danger level relationship for children.

U.S. DEPARTMENT OF THE INTERIOR
Bureau of Reclamation
1988

Alternative Floodway tools

Pierce County



Alternative Floodway tools

Pierce County

Deep and/or Fast Flowing Water Floodway

- 3 Feet Depth
- 3 Ft/Sec Velocity
- Combination of both



Poll Question

The Deep and/or Fast Flowing Water Floodway thresholds are set at the danger to _____?

DFF Study Overview

Pierce County

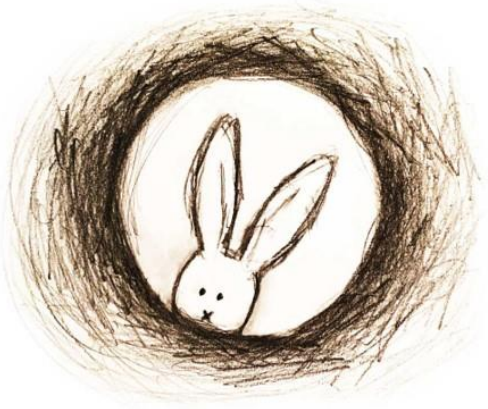
- Used new detailed study models from countywide DFIRM
- Pilot study to verify concept
  - Can we use 1D models to map floodplain velocities with sufficient accuracy?
- Full study to map DFF floodway on over 125 stream miles on 19 rivers and streams
- Work performed by Northwest Hydraulic Consultants – nhc

nhc
northwest hydraulic consultants

Mapping the DFF Floodway

Pierce County

- Starting point
  - HEC-RAS model
  - Floodplain boundary, BFEs, and cross sections in GIS
  - Digital topographic data
- Create depth and velocity grids
- Grid computations to classify floodplain cells as in or out of DFF floodway



2D Model Verification

Pierce County

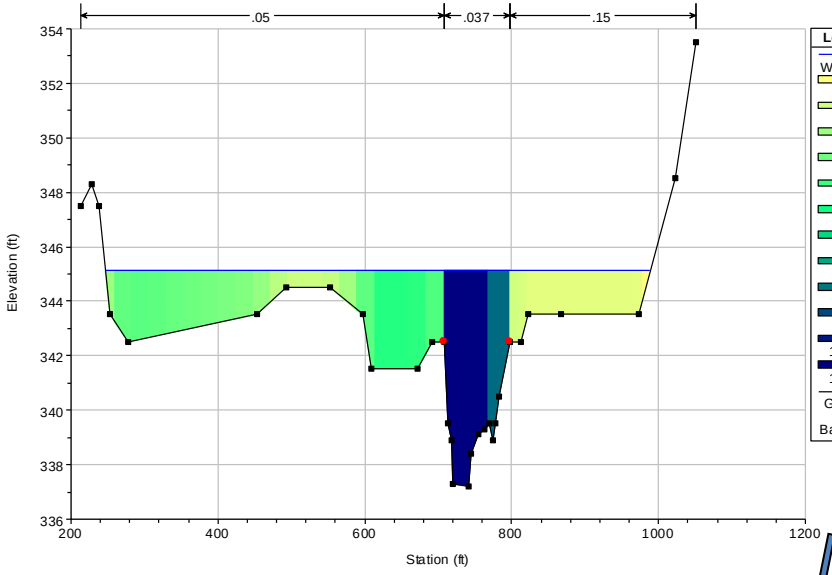


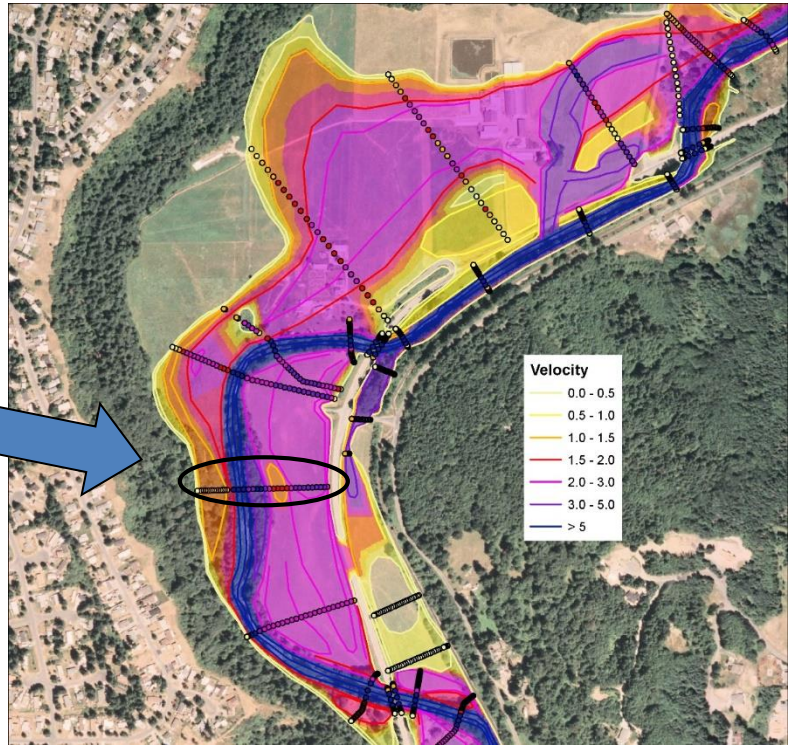
Puyallup River



Swan Creek

Mapping Velocity

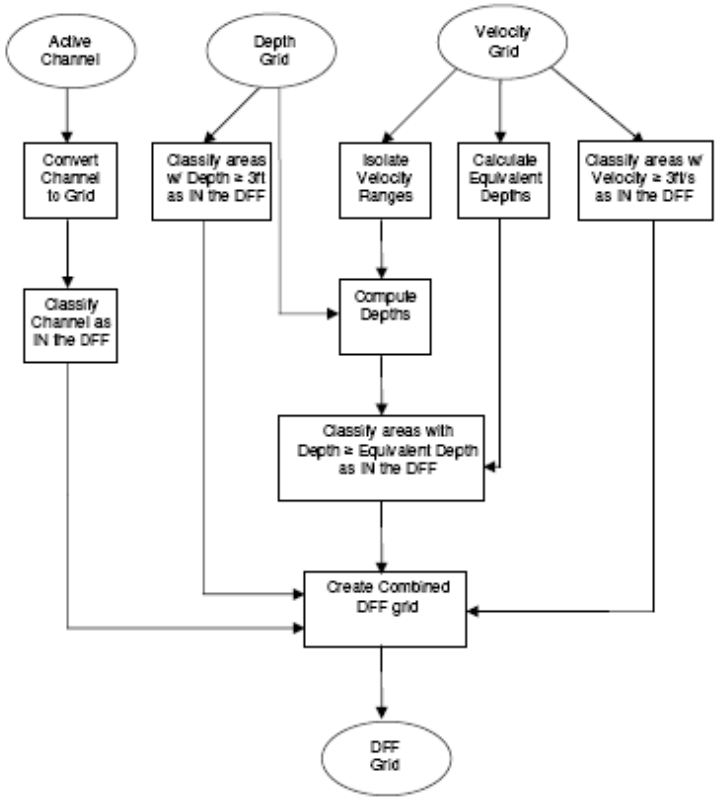




- HEC-RAS velocity points imported to GIS
- Contours must account for depth variation and hydraulic conditions between cross sections

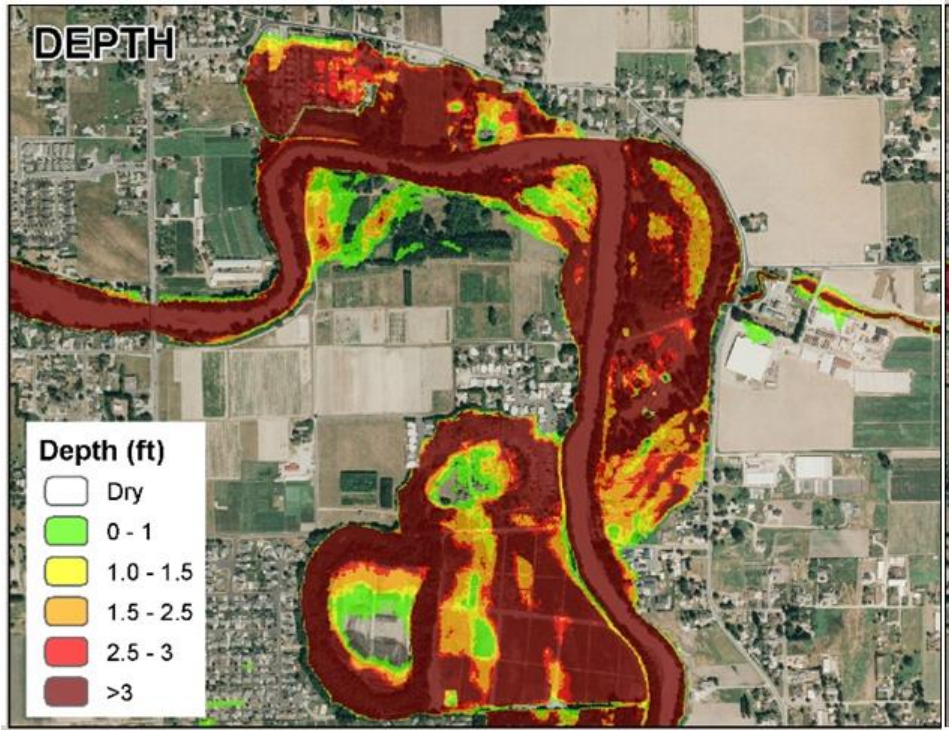
DFF Components

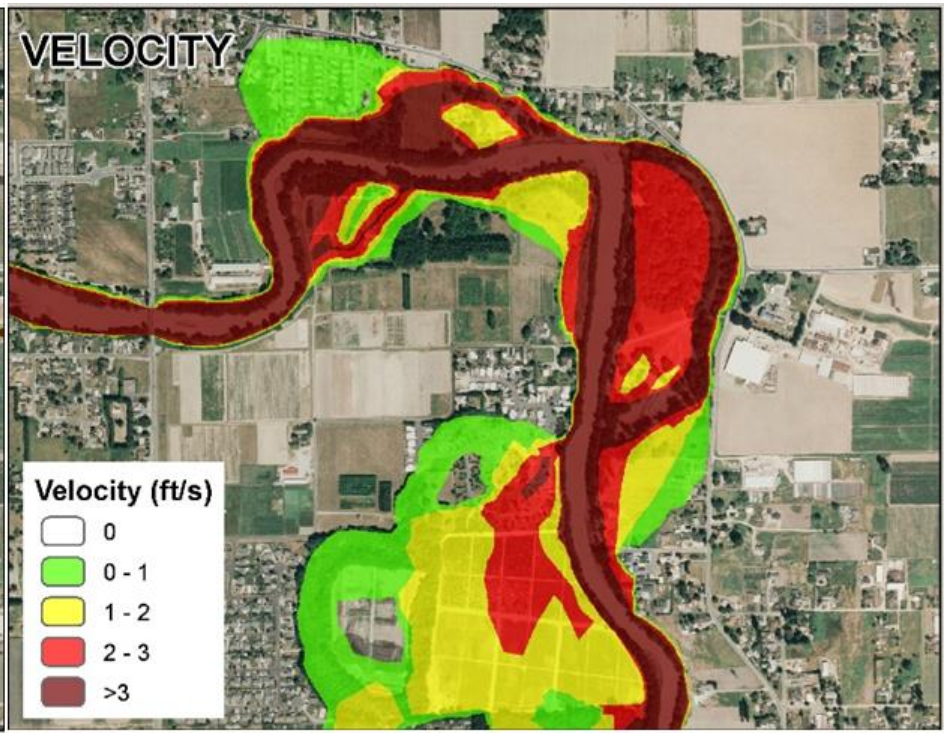
- Active Channel
- Mapped Water Bodies
- Depth > 3 ft
- Velocity > 3 ft/s
- Combined depth and velocity above curve
  - Compare DFF depth threshold for given velocity with water depth
- Post-processing



Depth & Velocity Grids

Pierce County





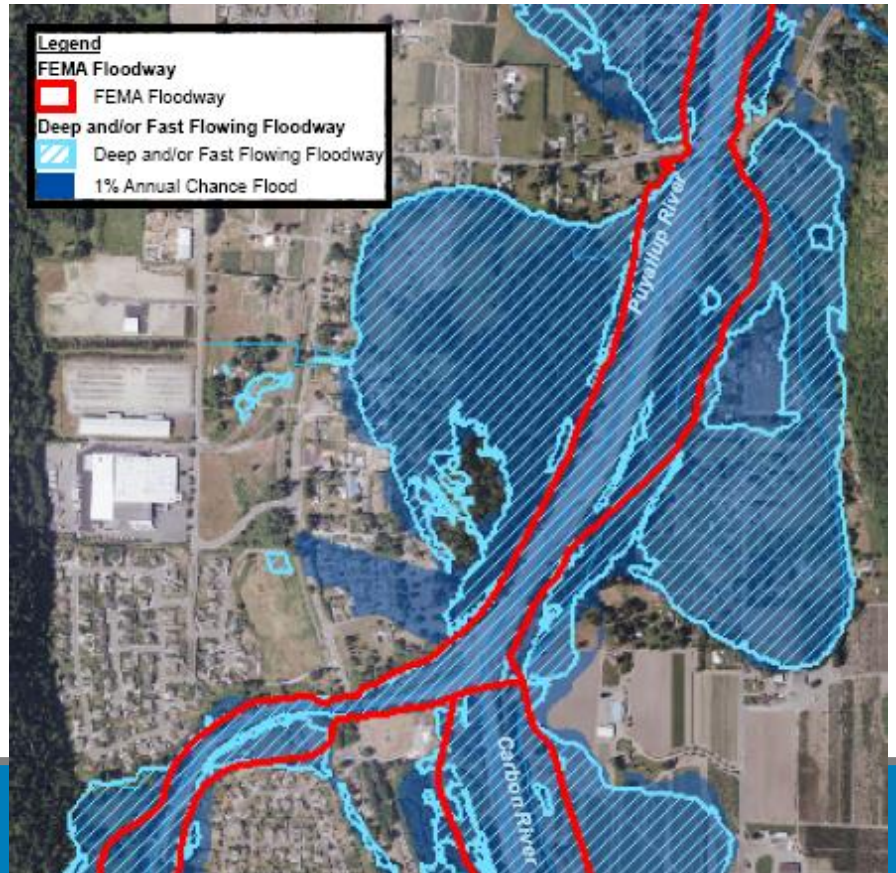
Floodway Comparison

Pierce County

6,500 Acres mapped as DFF Floodway

3,200 acres FEMA Defined Floodway

Doubling the Regulated Floodway



Success out of tragedy

Pierce County

Mobile Home Park Floods

Nov. 2006

- 32 Mobiles Substantially Damaged
- FEMA Provided Individual Assistance
- County Secured Grants to Remove Mobiles
- Only in DFF Floodway
- Pressure To Allow Back In "Cannot Afford To Be Anywhere Else"



Success out of tragedy

Pierce County



Jan 2009 Site Floods Again

- Homes Not Lost – Sites Vacant
- No Grants or Individual Assistance
- No Rescues
- No Lives At Risk or Disrupted
- New business model for RVs

Questions?

Pierce County



Dennis Dixon, CFM
Pierce County
Planning & Public Works

dennis.dixon@piercecountywa.gov | (253) 798-3696

HARRIS COUNTY FLOOD CONTROL DISTRICT

MAAPnext Modeling, Assessment & Awareness Project

Floodway Approach for 1D/2D, 2D & unsteady Models

October 29, 2020

Ataul Hannan, P.E.,CFM,
Planning Division Director – HCFCD

Regulatory Floodway 44 CFR 59.1

… the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height.

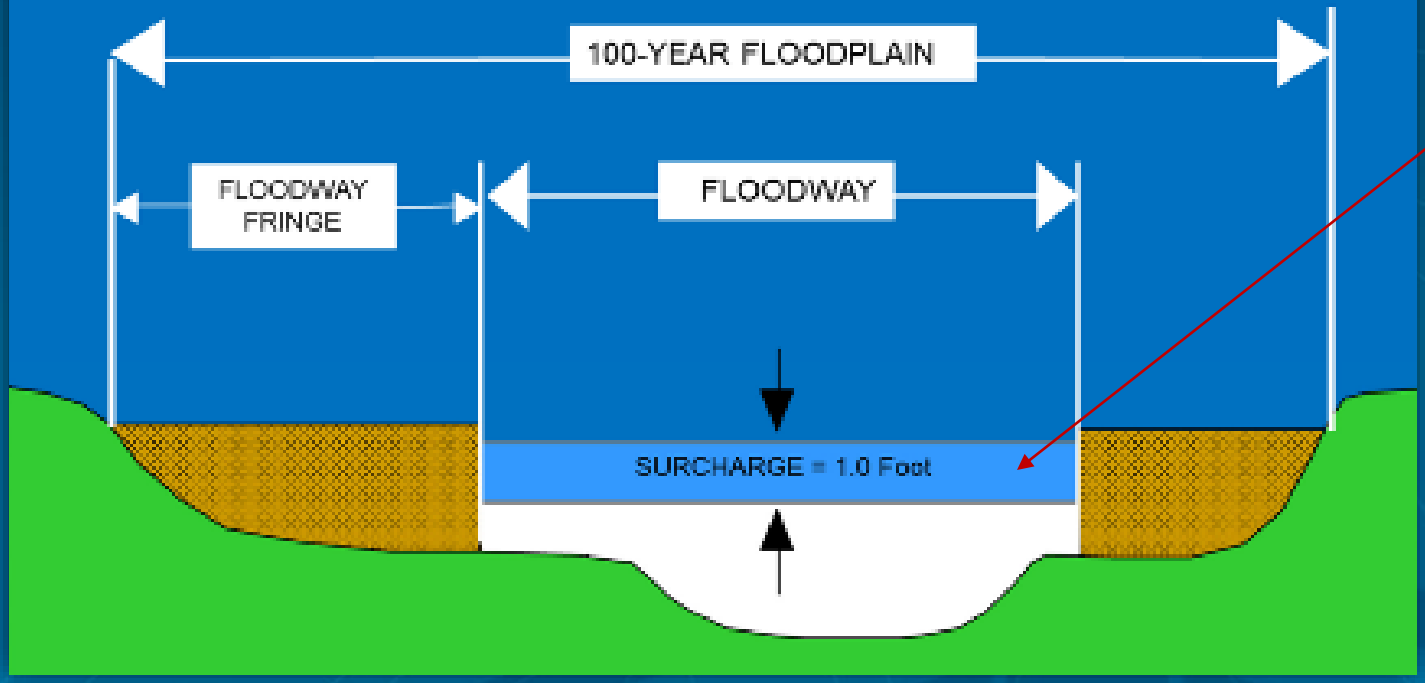
Objective:

Identify the area required to convey the Base Flood discharge without increasing the BFE*

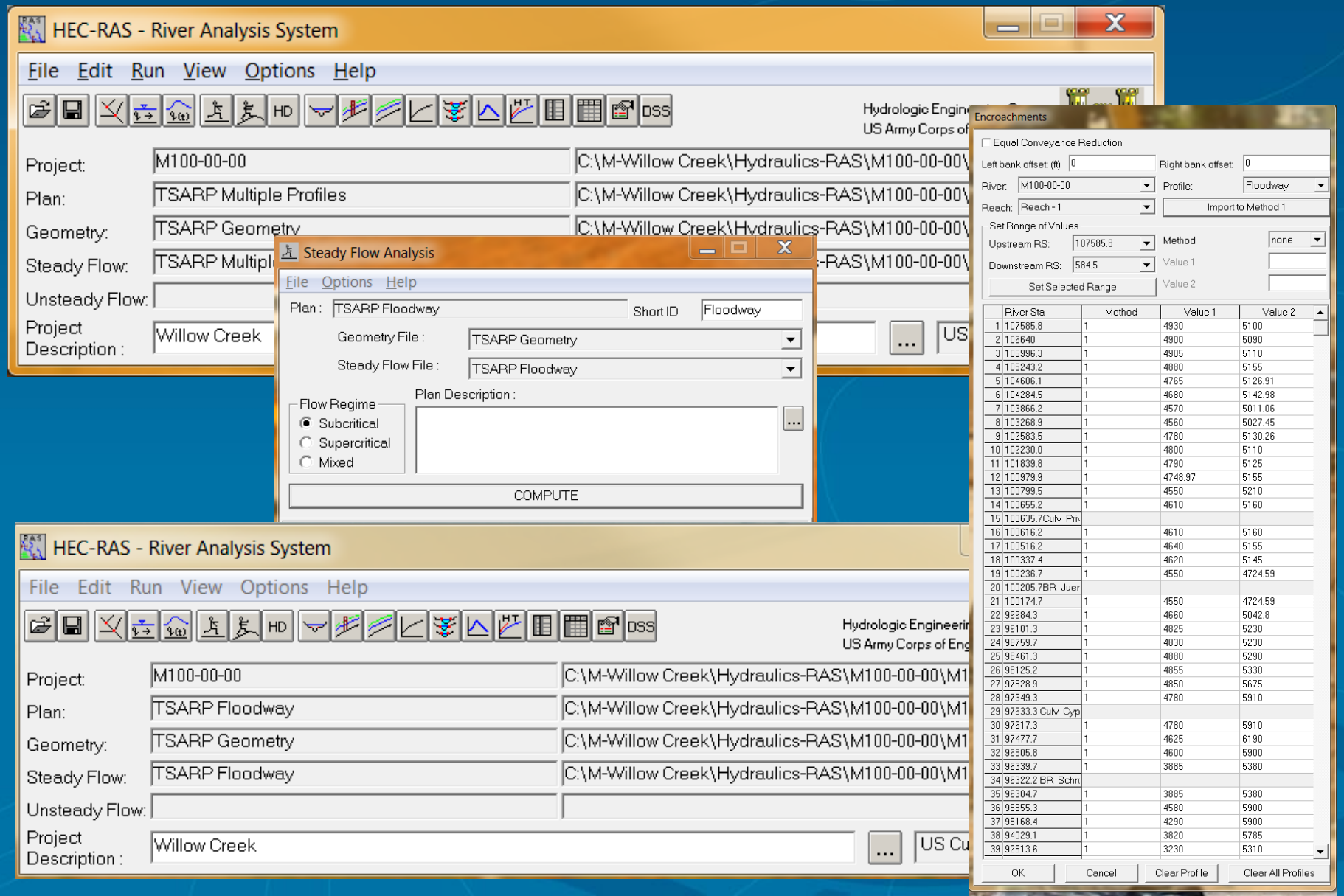
**dependent on local ordinance, no more than 1.0 foot*

Floodway

The channel of a stream and the adjacent area that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height (44 CFR 59.1)

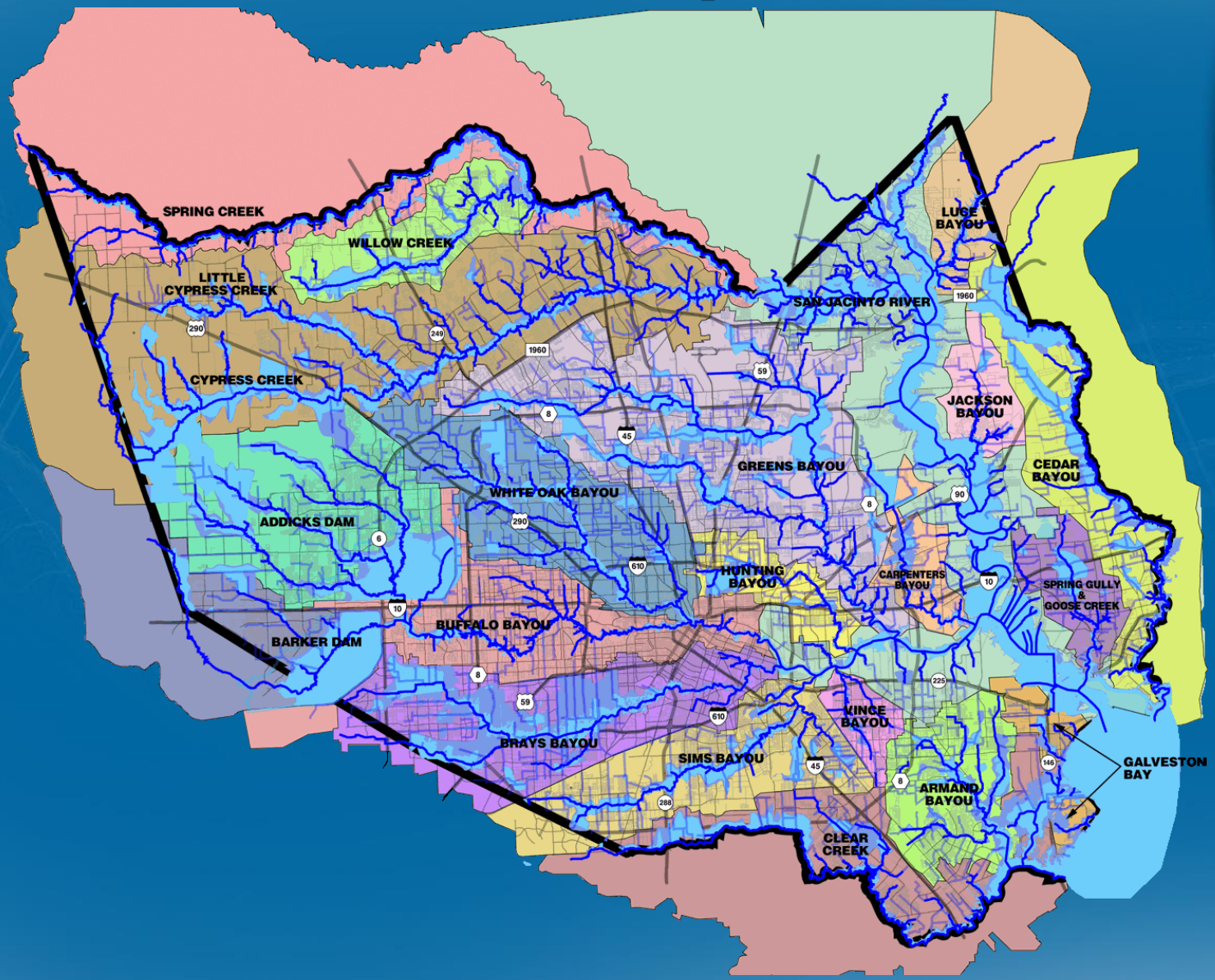


Floodway Modeling

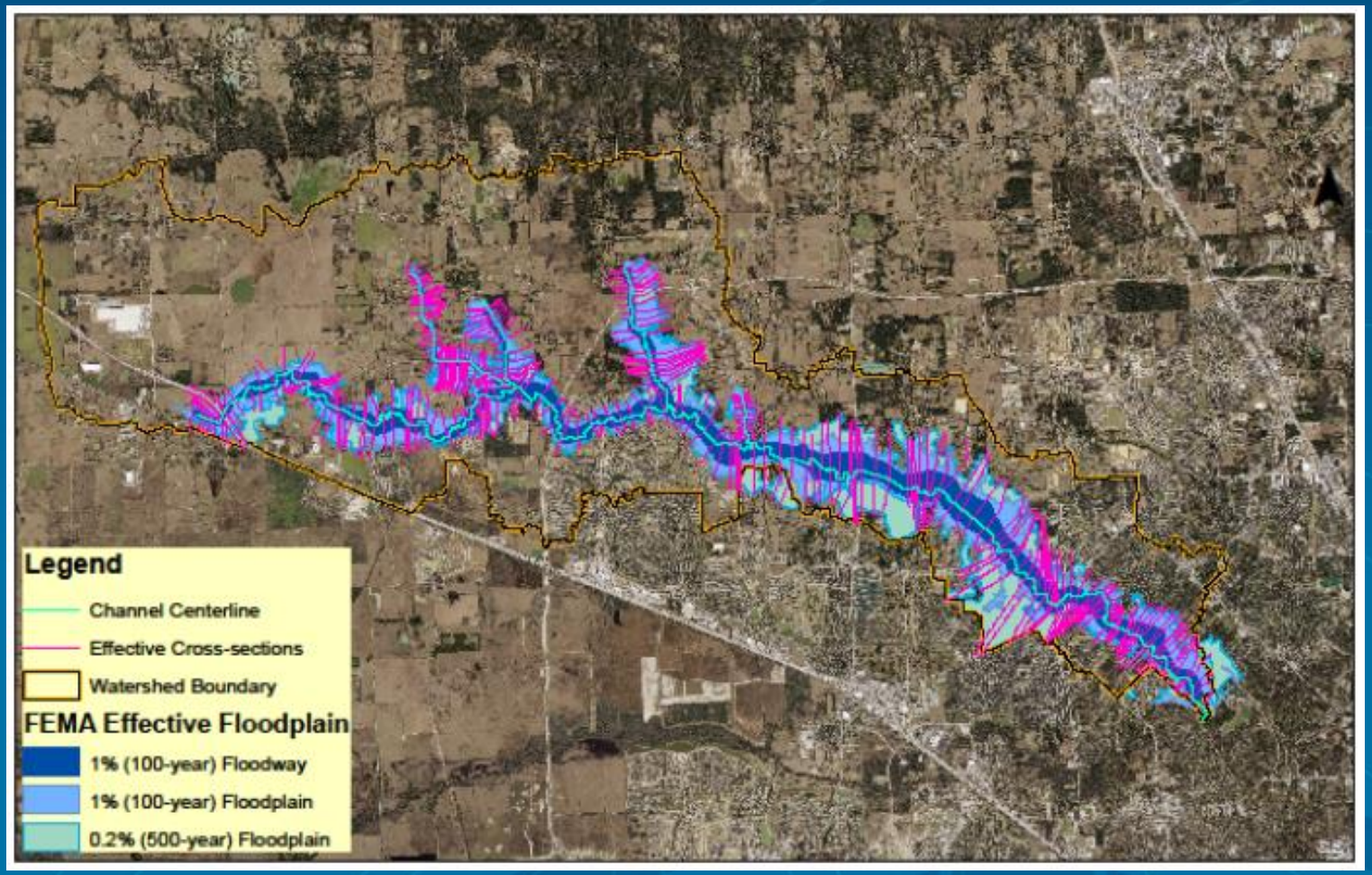


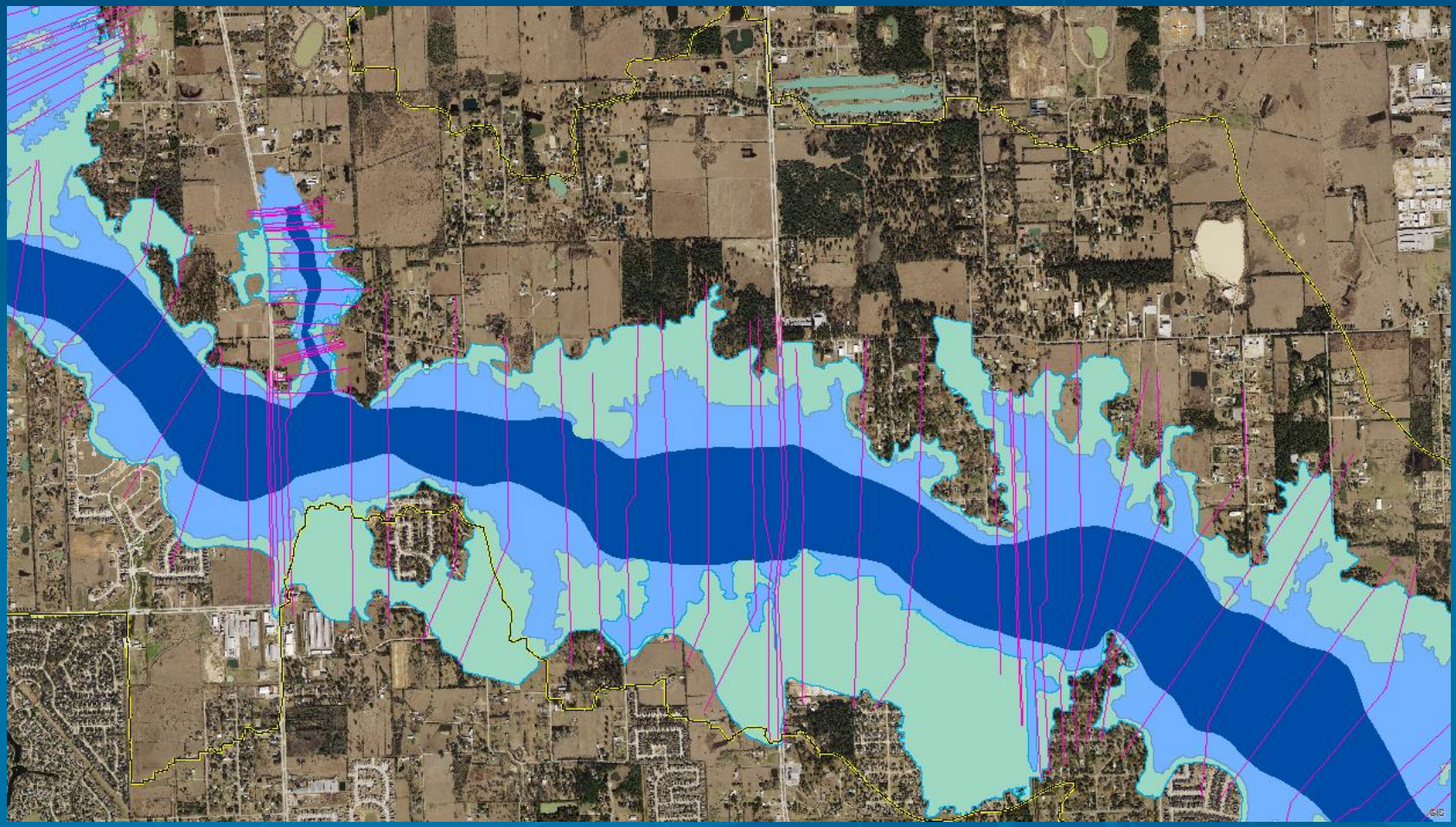
Reach - 1	105243.2		1%	189.48		189.55	778.87	764.13	140.53	512.35		4993.60	5005.88	
Reach - 1	105243.2		Floodway	189.91	0.43	190.06	246.78	437.97	166.92	812.11	4880.00	4993.60	5005.88	5155.00
Reach - 1	104606.1		1%	185.96		186.05	713.99	1241.24	155.47	20.29		4988.10	5017.60	
Reach - 1	104606.1		Floodway	186.58	0.62	186.72	361.91	1084.36	229.15	103.49	4765.00	4988.10	5017.60	5126.91
Reach - 1	104284.5		1%	184.32		184.36	954.21	1288.90	45.49	82.61		4976.80	5005.30	
Reach - 1	104284.5		Floodway	185.31	1.00	185.37	462.98	1062.56	103.38	251.06	4680.00	4976.80	5005.30	5142.98
Reach - 1	103866.2		1%	183.53		183.56	1118.03	1382.86	33.20	0.93		4976.80	5005.90	
Reach - 1	103866.2		Floodway	184.53	1.00	184.60	441.06	1305.79	100.23	10.98	4570.00	4976.80	5005.90	5011.06
Reach - 1	103268.9		1%	182.31		182.34	1027.49	1261.32	130.56	28.12		4980.40	5006.60	
Reach - 1	103268.9		Floodway	183.11	0.81	183.17	467.45	1125.50	213.82	80.68	4560.00	4980.40	5006.60	5027.45
Reach - 1	102583.5		1%	181.08		181.12	780.11	1124.23	220.77	75.00		4990.30	5019.80	
Reach - 1	102583.5		Floodway	182.08	1.00	182.14	350.26	870.61	255.60	293.80	4780.00	4990.30	5019.80	5130.26
Reach - 1	102230.0		1%	180.44		180.46	954.96	1073.68	198.60	147.72		4990.30	5028.50	
Reach - 1	102230.0		Floodway	181.34	0.91	181.42	310.00	601.26	402.93	415.82	4800.00	4990.30	5028.50	5110.00
Reach - 1	101839.8		1%	179.66		179.72	857.81	640.04	393.12	386.84		4990.30	5028.50	
Reach - 1	101839.8		Floodway	179.99	0.33	180.13	335.00	275.01	552.16	592.83	4790.00	4990.30	5028.50	5125.00
Reach - 1	100979.9		1%	178.07		178.10	556.61	332.69	412.27	675.04		4975.60	5028.50	
Reach - 1	100979.9		Floodway	178.13	0.06	178.17	406.03	362.87	432.59	624.54	4748.97	4975.60	5028.50	5155.00
Reach - 1	100799.5		1%	177.77		177.81	801.82	260.69	385.75	773.56		4983.70	5022.10	
Reach - 1	100799.5		Floodway	177.86	0.08	177.89	660.00	280.92	369.34	769.74	4550.00	4983.70	5022.10	5210.00
Reach - 1	100655.2		1%	176.85		177.17	665.37	249.63	806.90	363.47		4985.00	5018.10	
Reach - 1	100655.2		Floodway	177.14	0.29	177.38	550.00	399.09	758.60	262.31	4610.00	4985.00	5018.10	5160.00
Reach - 1	100635.7 Private Access			Culvert										
Reach - 1	100616.2		1%	176.92		177.02	776.18	352.99	558.28	508.73		4985.00	5018.10	
Reach - 1	100616.2		Floodway	177.24	0.32	177.33	550.00	532.18	564.45	323.37	4610.00	4985.00	5018.10	5160.00
Reach - 1	100516.2		1%	176.51		176.60	836.05	205.39	763.49	451.11		4978.00	5027.80	
Reach - 1	100516.2		Floodway	176.91	0.40	176.99	515.00	336.06	766.12	317.82	4640.00	4978.00	5027.80	5155.00
Reach - 1	100337.4		1%	176.11		176.16	964.75	491.78	605.58	322.64		4978.00	5027.80	
Reach - 1	100337.4		Floodway	176.63	0.52	176.66	525.00	679.10	579.20	161.71	4620.00	4978.00	5027.80	5145.00
Reach - 1	100236.7		1%	175.66		175.73	744.39	787.88	627.59	4.53		4677.79	4724.59	
Reach - 1	100236.7		Floodway	175.70	0.04	176.09	174.59	257.05	1162.95	0.00	4550.00	4677.79	4724.59	4724.59
Reach - 1	100205.7 Juergen	BR U	1%	175.62		175.67	637.68	1099.35	320.65			4677.79	4724.59	
Reach - 1	100205.7 Juergen	BR U	Floodway	175.70	0.08	176.10	130.90	732.64	690.61		4550.00	4677.79	4724.59	4724.59
Reach - 1	100205.7 Juergen	BR D	1%	175.05		175.18	452.66	941.76	478.24			4677.79	4724.59	
Reach - 1	100205.7 Juergen	BR D	Floodway	175.70	0.65	176.10	130.90	732.64	690.61		4550.00	4677.79	4724.59	4724.59
Reach - 1	100174.7		1%	174.38		174.88	405.61	416.69	1003.31			4677.79	4724.59	
Reach - 1	100174.7		Floodway	174.45	0.08	175.60	112.48	71.29	1348.71		4550.00	4677.79	4724.59	4724.59
Reach - 1	99984.3		1%	173.23		173.26	1038.20	1063.65	334.48	21.86		4975.06	5042.80	
Reach - 1	99984.3		Floodway	173.83	0.60	173.89	382.80	928.91	491.09		4660.00	4975.06	5042.80	5042.80
Reach - 1	99101.3		1%	170.95		170.99	1653.34	806.34	378.24	235.42		4980.15	5029.20	
Reach - 1	99101.3		Floodway	171.68	0.73	171.75	405.00	561.93	477.96	380.11	4825.00	4980.15	5029.20	5230.00
Reach - 1	98759.7		1%	170.00		170.03	1585.49	872.04	285.48	261.49		4980.52	5029.20	
Reach - 1	98759.7		Floodway	170.80	0.79	170.85	400.00	529.07	426.03	463.90	4830.00	4980.52	5029.20	5230.00
Reach - 1	98461.3		1%	169.68		169.69	1690.78	604.27	197.29	617.44		4975.50	5029.20	
Reach - 1	98461.3		Floodway	170.39	0.71	170.42	410.00	130.53	329.92	958.55	4880.00	4975.50	5029.20	5290.00
Reach - 1	98125.2		1%	169.60		169.60	2973.97	481.63	116.00	821.37		4979.51	5029.20	
Reach - 1	98125.2		Floodway	170.22	0.62	170.23	475.00	281.10	245.82	892.07	4855.00	4979.51	5029.20	5330.00
Reach - 1	97828.9		1%	169.58		169.58	2967.00	219.15	91.35	1108.49		4990.24	5032.80	
Reach - 1	97828.9		Floodway	170.15	0.58	170.16	825.00	185.21	202.26	1031.54	4850.00	4990.24	5032.80	5675.00
Reach - 1	97649.3		1%	169.55		169.56	3305.90	922.61	218.15	2159.24		4990.10	5029.30	
Reach - 1	97649.3		Floodway	170.07	0.52	170.09	1130.00	946.85	425.02	1928.14	4780.00	4990.10	5029.30	5910.00

Floodplain

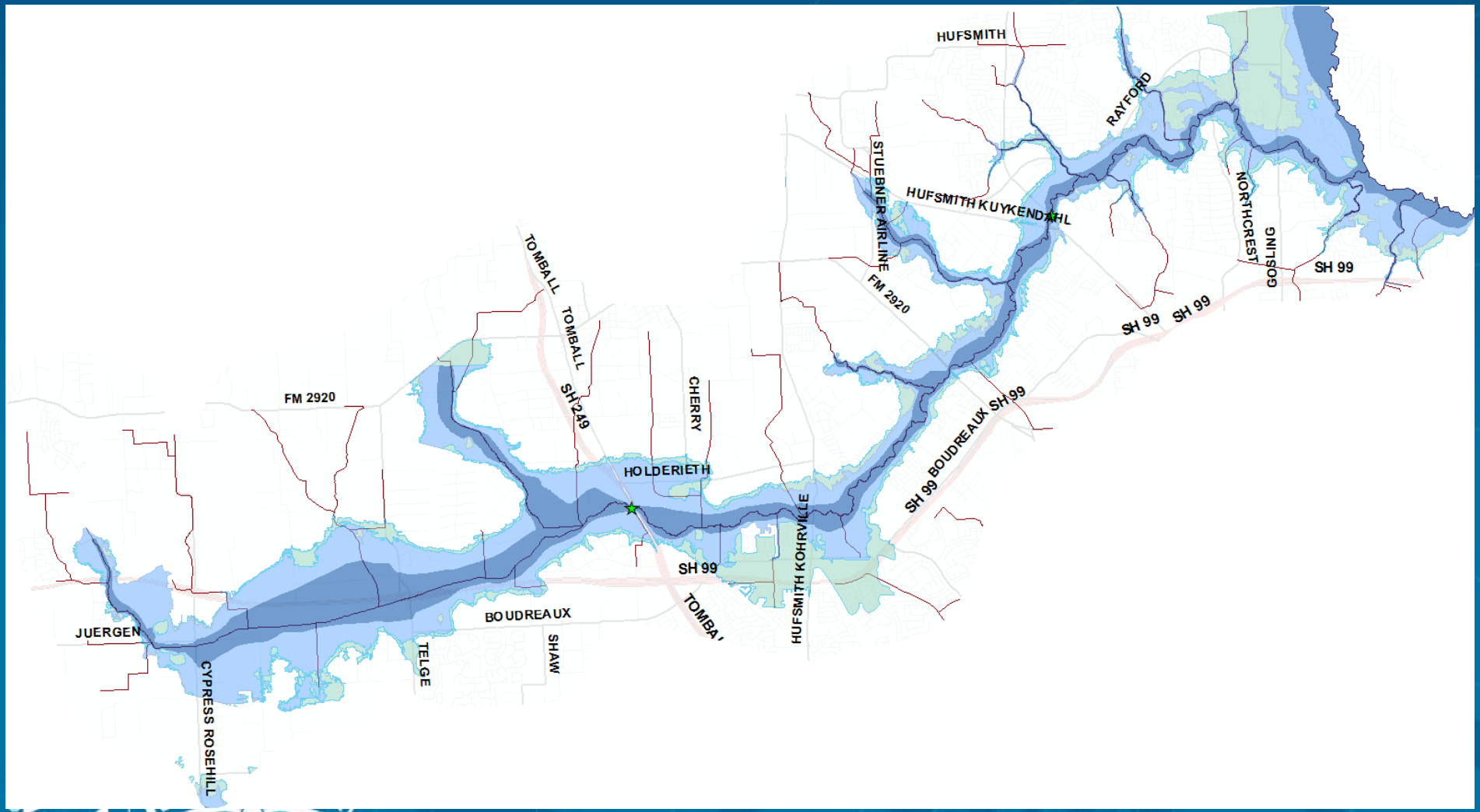


HARRIS COUNTY FLOOD CONTROL DISTRICT

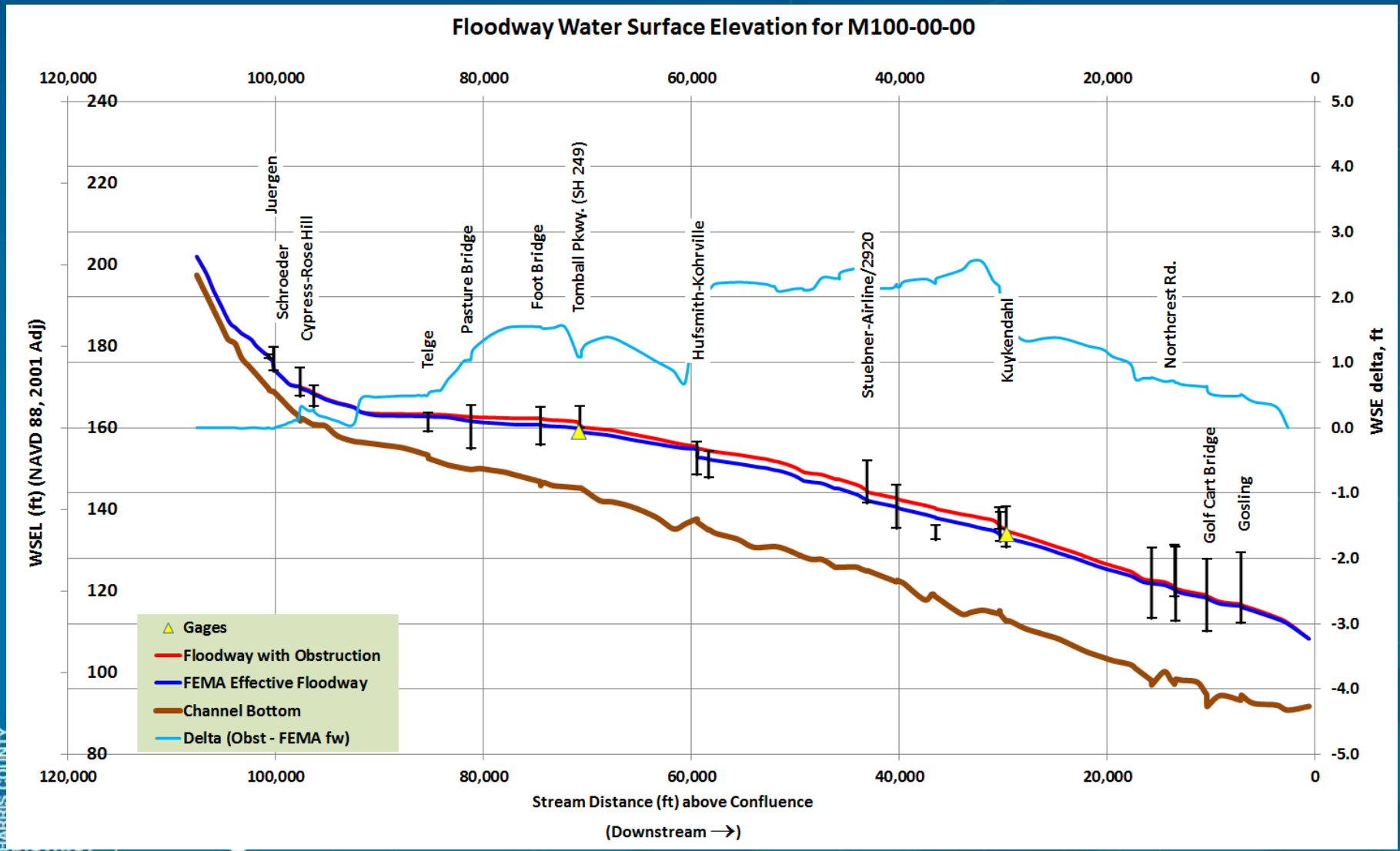

Legend
Channel Centerline
Effective Cross-sections
Watershed Boundary
FEMA Effective Floodplain
1% (100-year) Floodway
1% (100-year) Floodplain
0.2% (500-year) Floodplain



FEMA Effective Floodway



Floodway comparison based on encroachment and block obstruction methods after SVSQ iteration



Challenges & Approaches

Hydrology Inputs

- NOAA Atlas 14
  Texas release 09/2018
- Increases for estimated 24 hour rainfall
  3-4” across Harris County

Urban Environment & Hydrology

Urbanization of Basin

- Basin Development Factor

Ponding/Shallow Flood

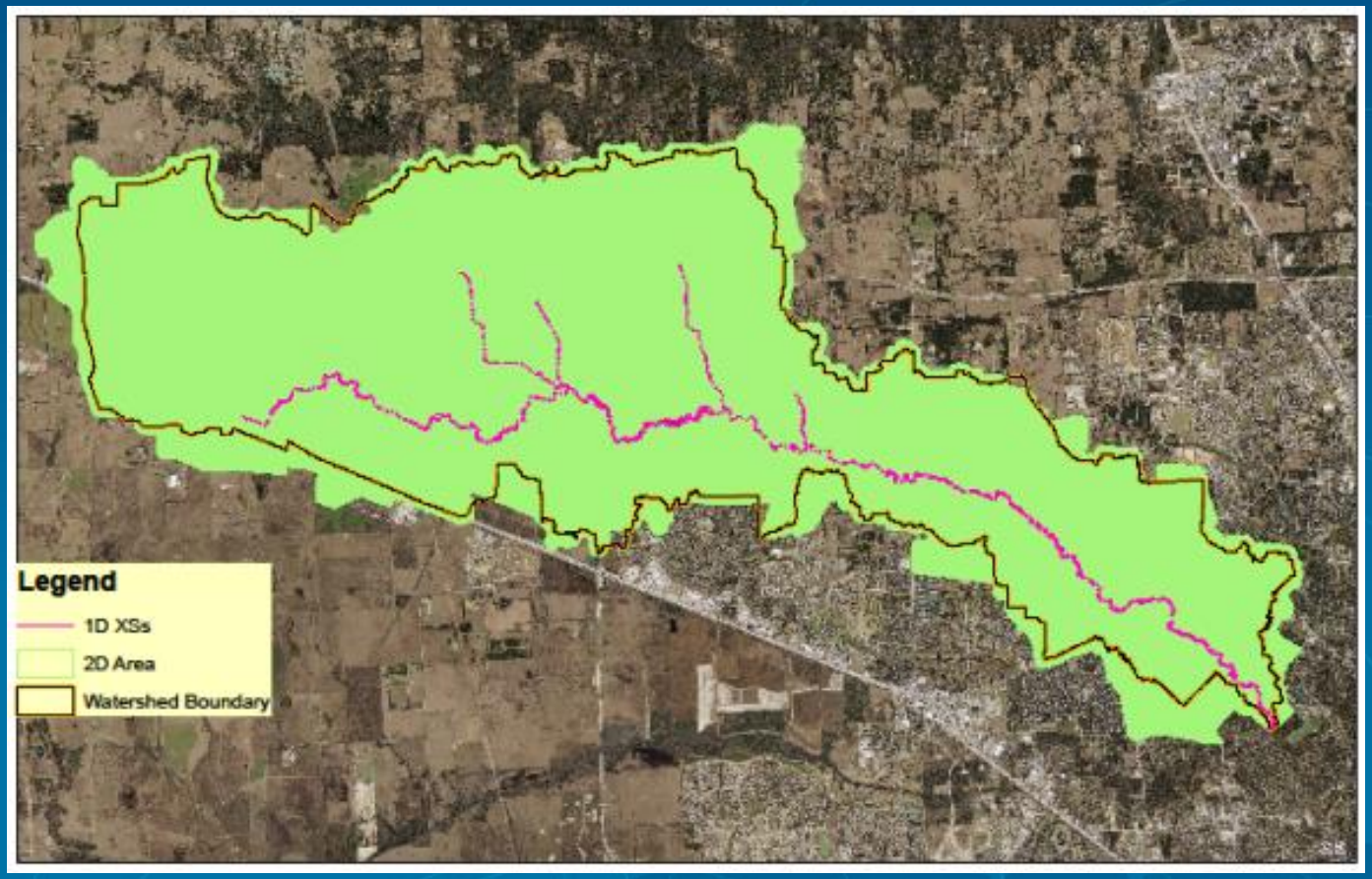
- Rain on Grid

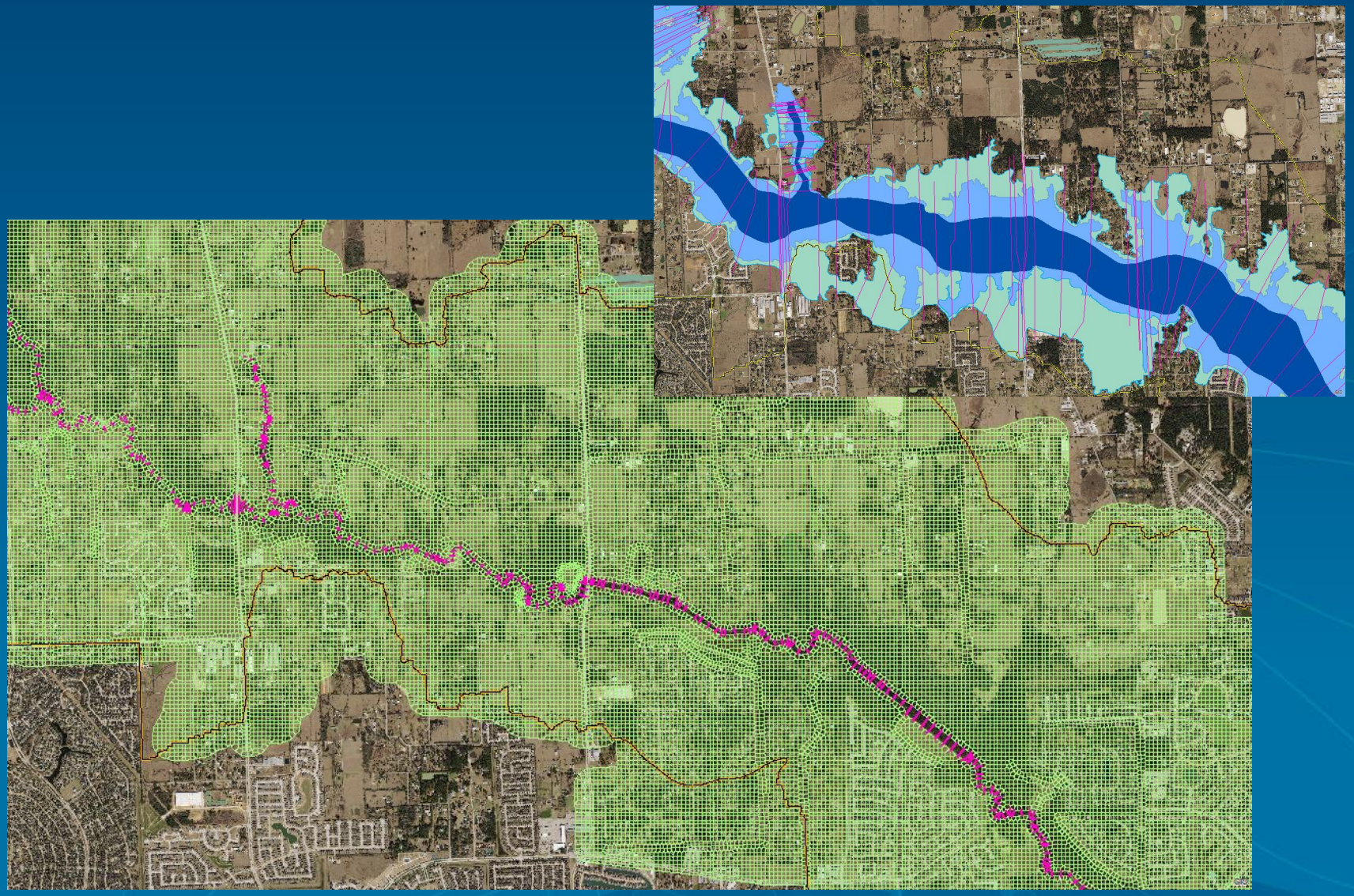
Flood Elevation & Extent

- Unsteady State Model
  (FEMA exception – SID73)
- Coupled 1D-2D Model
  (FEMA exception – SID73)
  Main Channel – 1D
  Floodplains – 2D
- Floodway Delineation with Product Number
  (velocity and depth)
  (FEMA exception – SID69)
  (FEMA exception – SID72)

Support Local Floodplain Management

- Defend Floodway Areas
  Floodway is safety based
  Floodway maintains critical flood capacity/storage areas
- Existing Local Higher Standards
  No Adverse Impact review will have access to data
  Harder for fill placement in critical floodplain storage

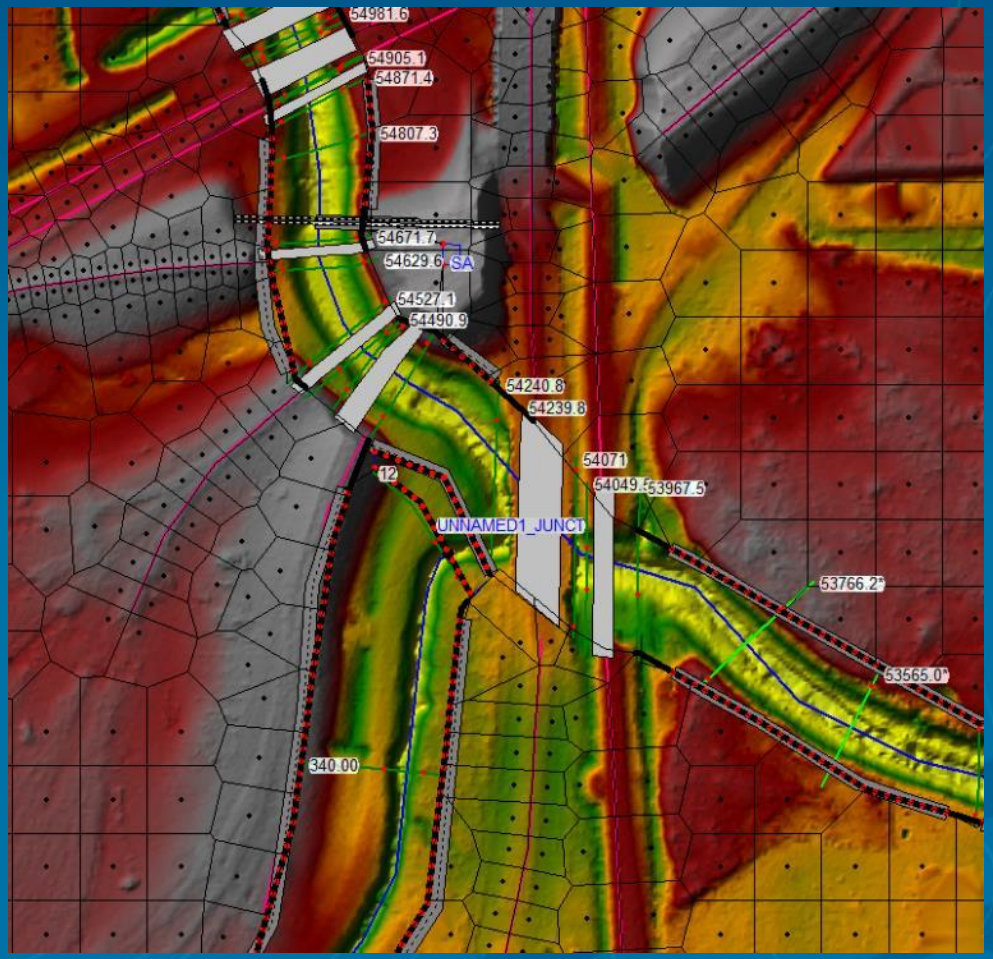

Legend
1D XSs
2D Area
Watershed Boundary



Poll Question

In our current one-dimensional steady state floodway modeling, which factor is assumed to be maintained?

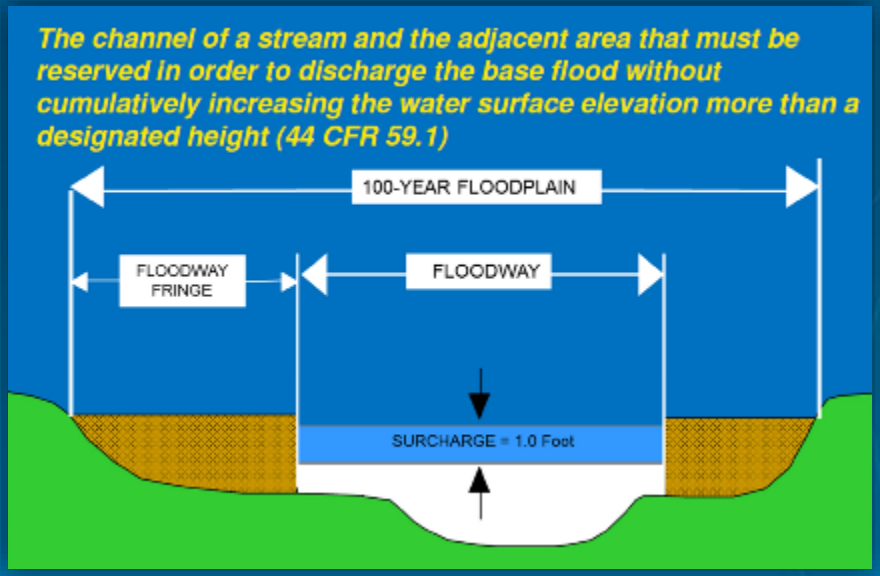
The Floodway Challenge



- Unsteady, coupled model will allow HCFCD to best detail flood hazards
  - 1D for channel/bridge/culvert
  - 2D overbank flow areas
  - Unsteady analysis will still result in determination of peak flows
- This approach will NOT support traditional floodway encroachment methodology

HARRIS COUNTY FLOOD CONTROL DISTRICT

Floodway Challenges (1D/2D)



- Encroachments reduce conveyance AND storage → cause flow increases
- Floodway runs would not be based on the same flows as the 1% annual chance "natural" model

Depth x Velocity Risk Studies

Boulder, Colorado and the U.S. Bureau of Reclamation studies in the 1989s were undertaken to determine the risk of harm for different Depth times Velocity product numbers.

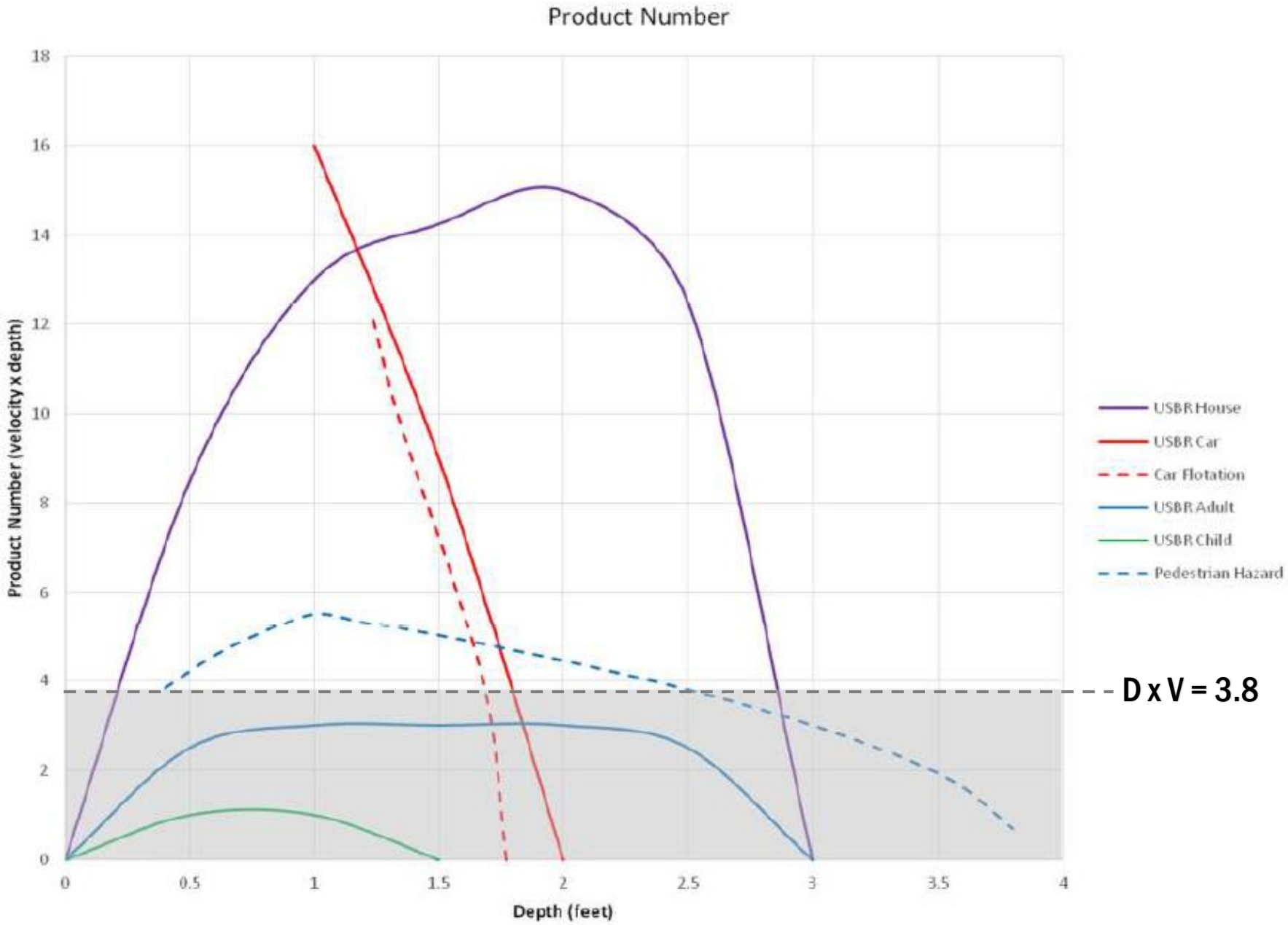
- Risk to structures on foundations
- Risk to mobile home structures
- Risk of car flotation
- Risk to adult pedestrians
- Risk to child pedestrians

Car Floatation Analysis, Simons, Li & Associates, Inc., prepared for City of Boulder, 1984

Analysis of High Hazard Flood Zone, David J. Love & Associated, Inc, prepared for the City of Boulder, 1987

Downstream Hazard Classification Guidelines (ACER Technical Memo No. 11), US Bureau of Reclamation, 1988

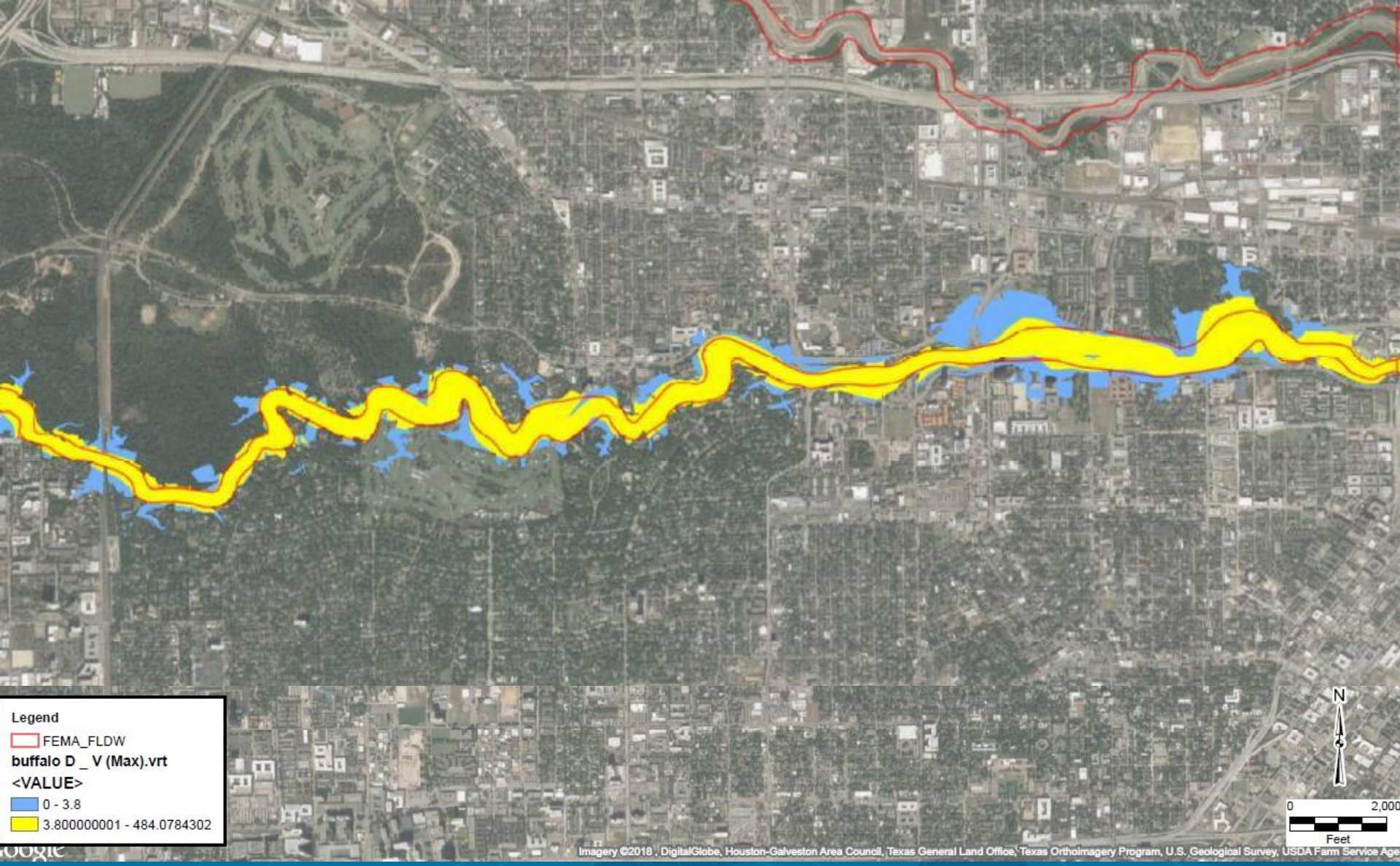
Figure 1: Limiting Product Number for Various Risk Categories (Mobile Homes Excluded)



Proposed Approach (Step-1)

A Product Number equal to depth of water times flow velocity (D x V) be used to define an adequate boundary for the floodway

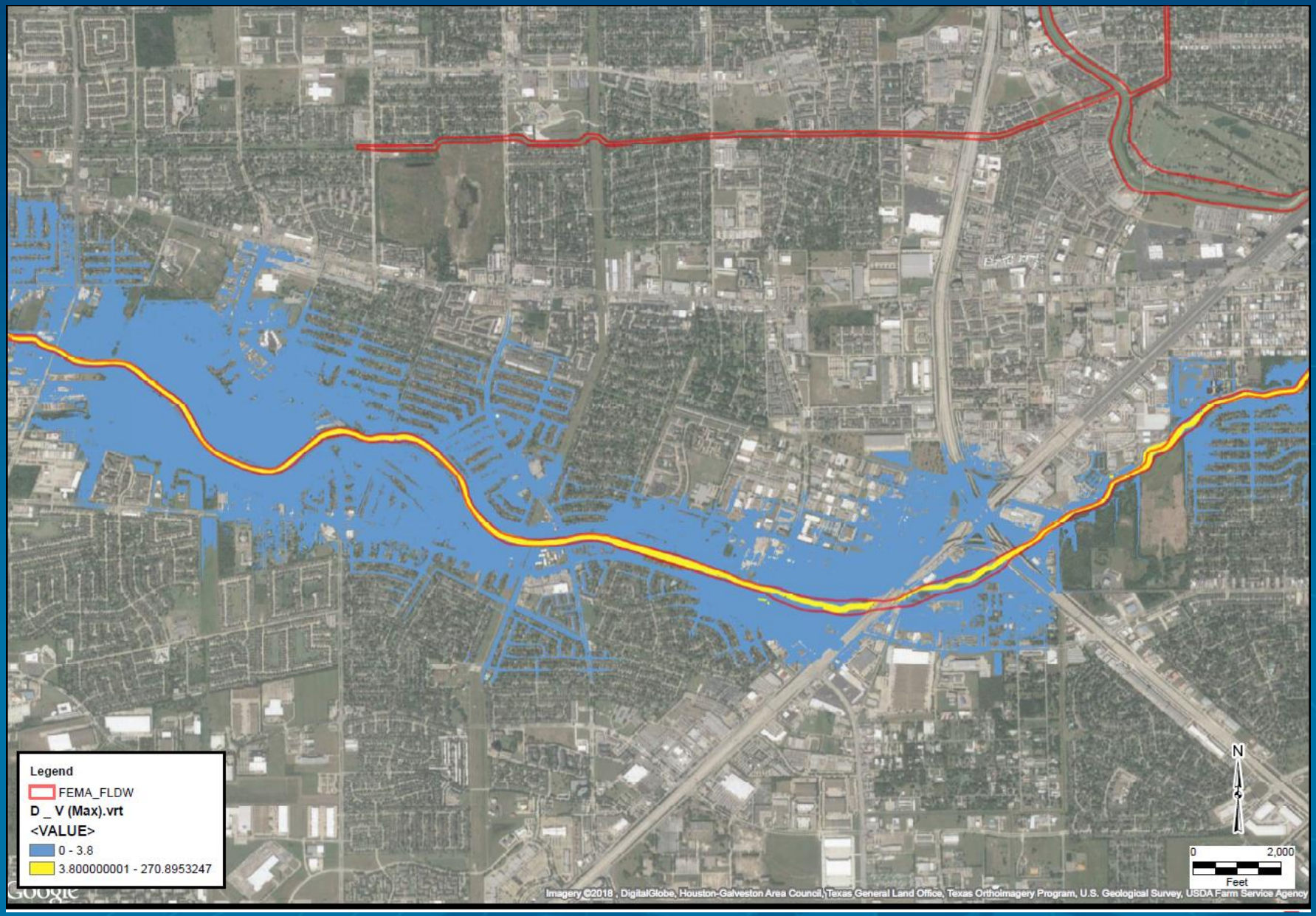
- A product number of 3.8 made physical sense with regard to risk related to the force of water, and produced similar boundaries to the existing floodways
- Harris County already requires that projects have No Adverse Impact (no-rise) to BFEs within the floodplain



Depth x Velocity boundary based on product number of 3.8

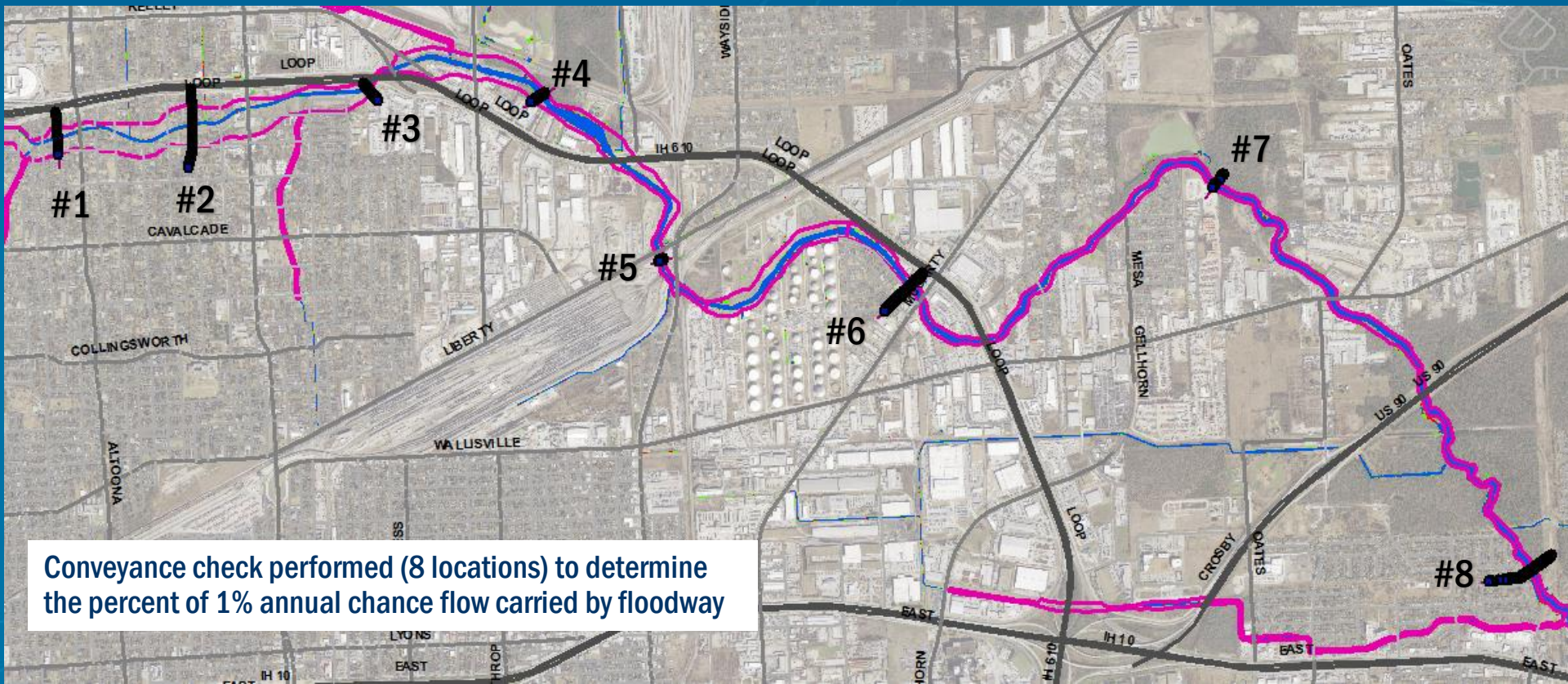
(average sample data from *Analysis of a High Hazard Flood Zone*, David J Love & Associates, 1987)

Yellow is Product Number > 3.8, Blue is Floodplain < 3.8, Red is current Floodway


Legend
FEMA_FLDW
D _ V (Max).vrt
<VALUE>
0 - 3.8
3.800000001 - 270.8953247
N
0
2,000
Feet
Imagery ©2018 , DigitalGlobe, Houston-Galveston Area Council, Texas General Land Office, Texas Orthoimagery Program, U.S. Geological Survey, USDA Farm Service Agency

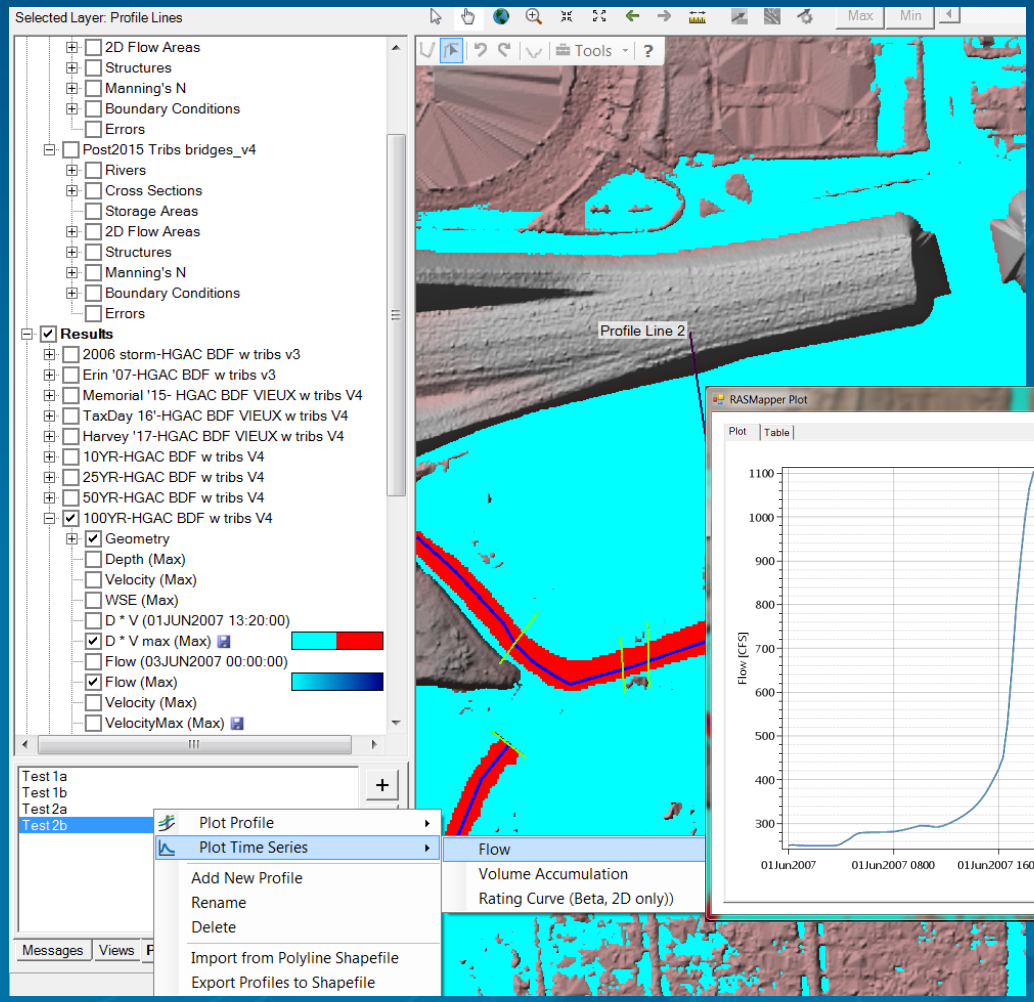
Validation - Conveyance Checks (Step-2)

1. Draw cross section(s)
2. Export to GIS
3. “Extract by Mask”
4. “Raster to Points”
5. Sort & Verify in Excel



Conveyance check performed (8 locations) to determine the percent of 1% annual chance flow carried by floodway

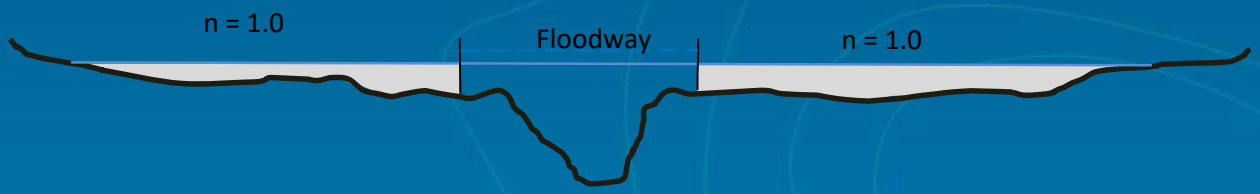
Manual Flow Check

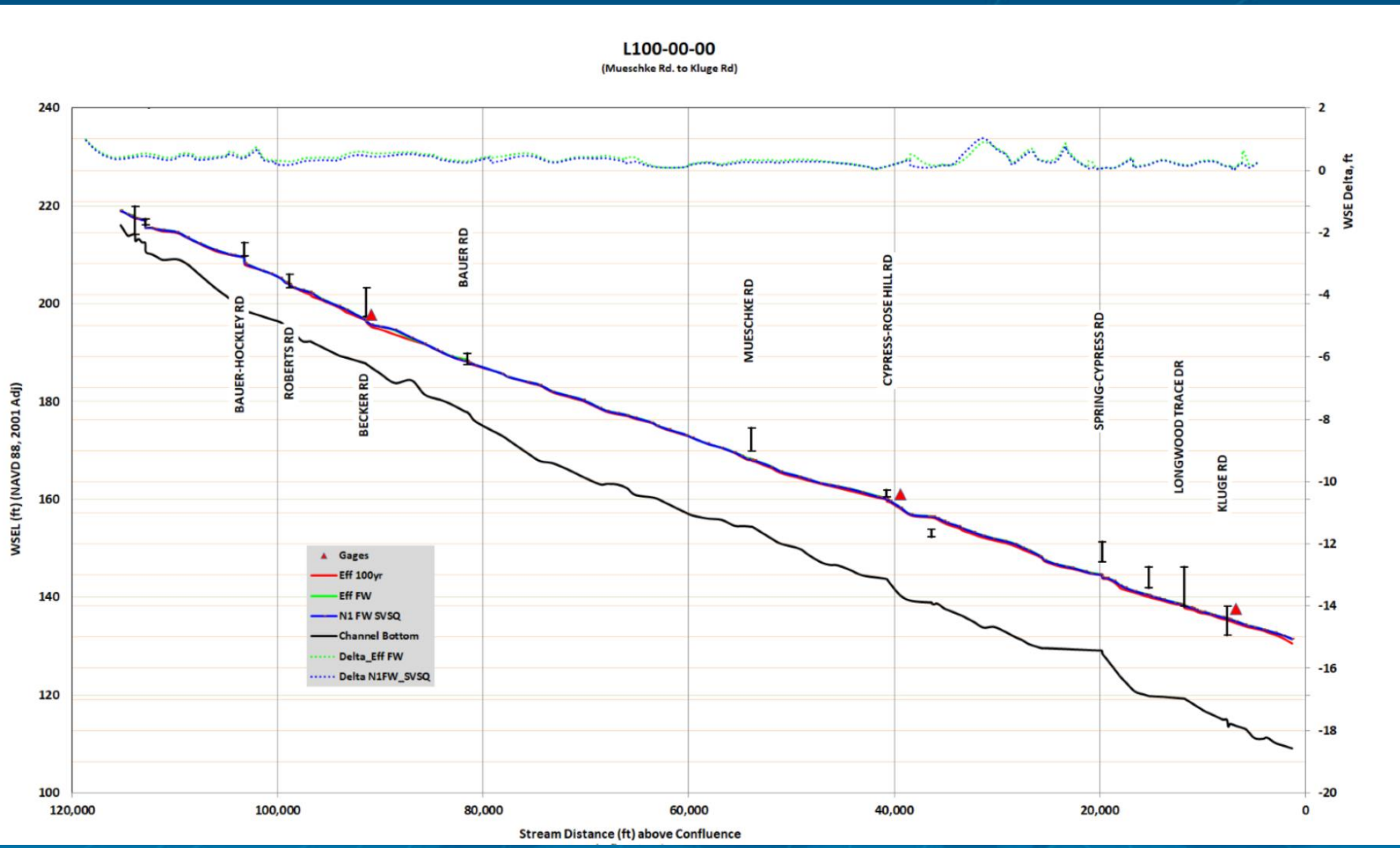


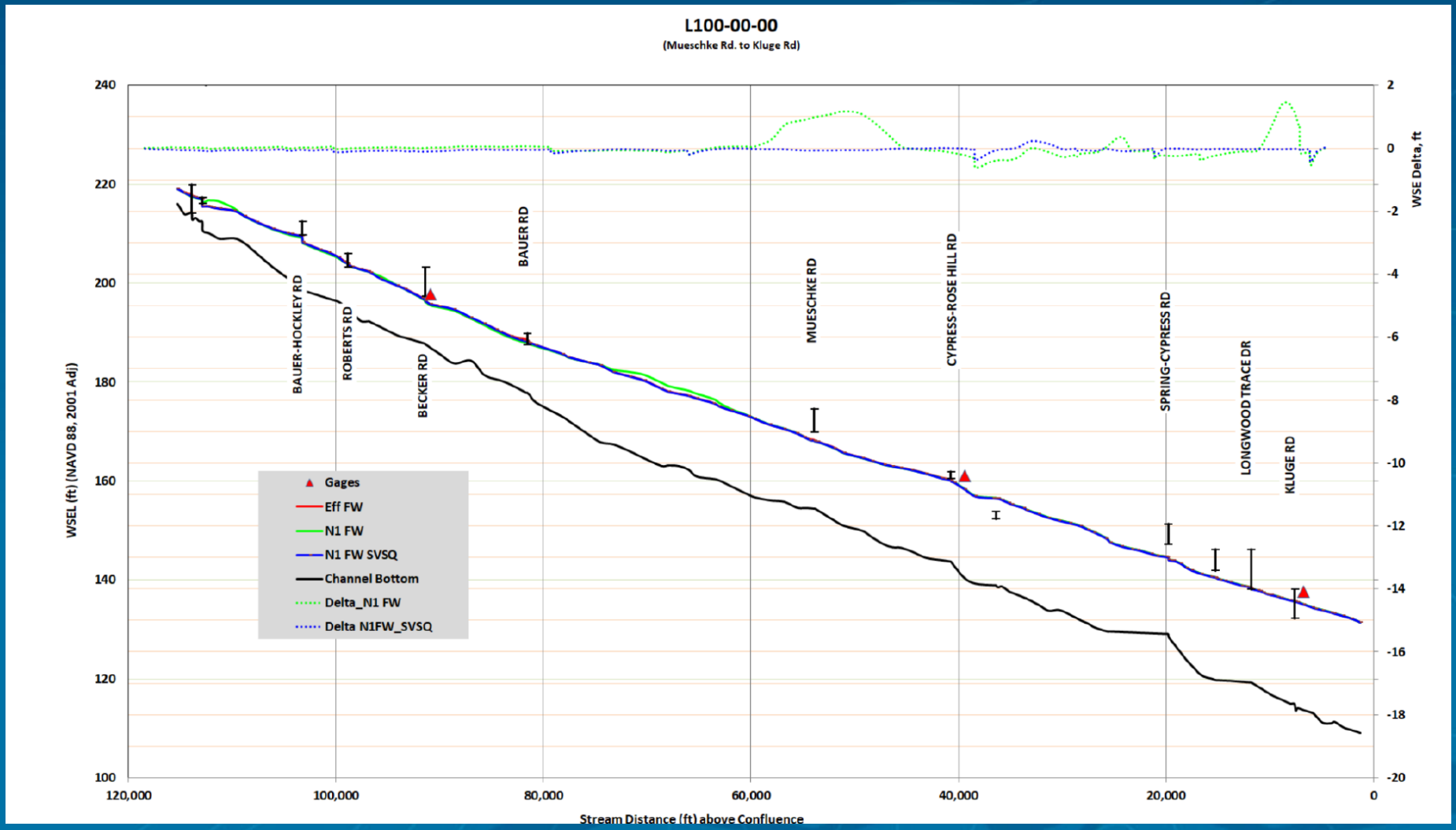
- Draw profile lines across floodplain & across DxV Floodway
- Compare Peak Flows

	FLOW as Measured in RAS Mapper (CFS)		
Testline	All Floodplain	D*V=3	% of flow in D*V =3
1	519	492.2	94.6%
2	1168	1104	94.2%
3	1346	1239	91.4%
4	1550	1448	93.0%
5	2192	2130	97.1%
6	2895	2840	98.1%
7	3296	3295	100.0%
8	3846	3664	95.0%

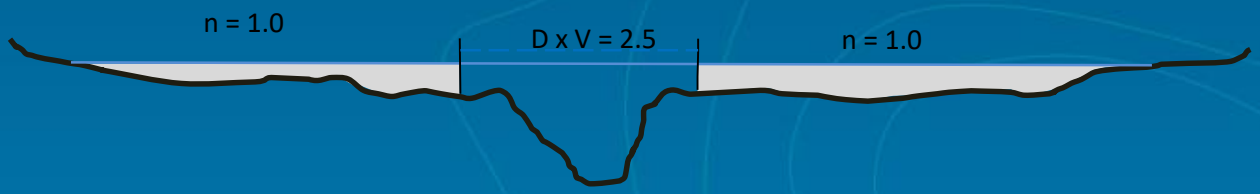
Modeling (Step -3)



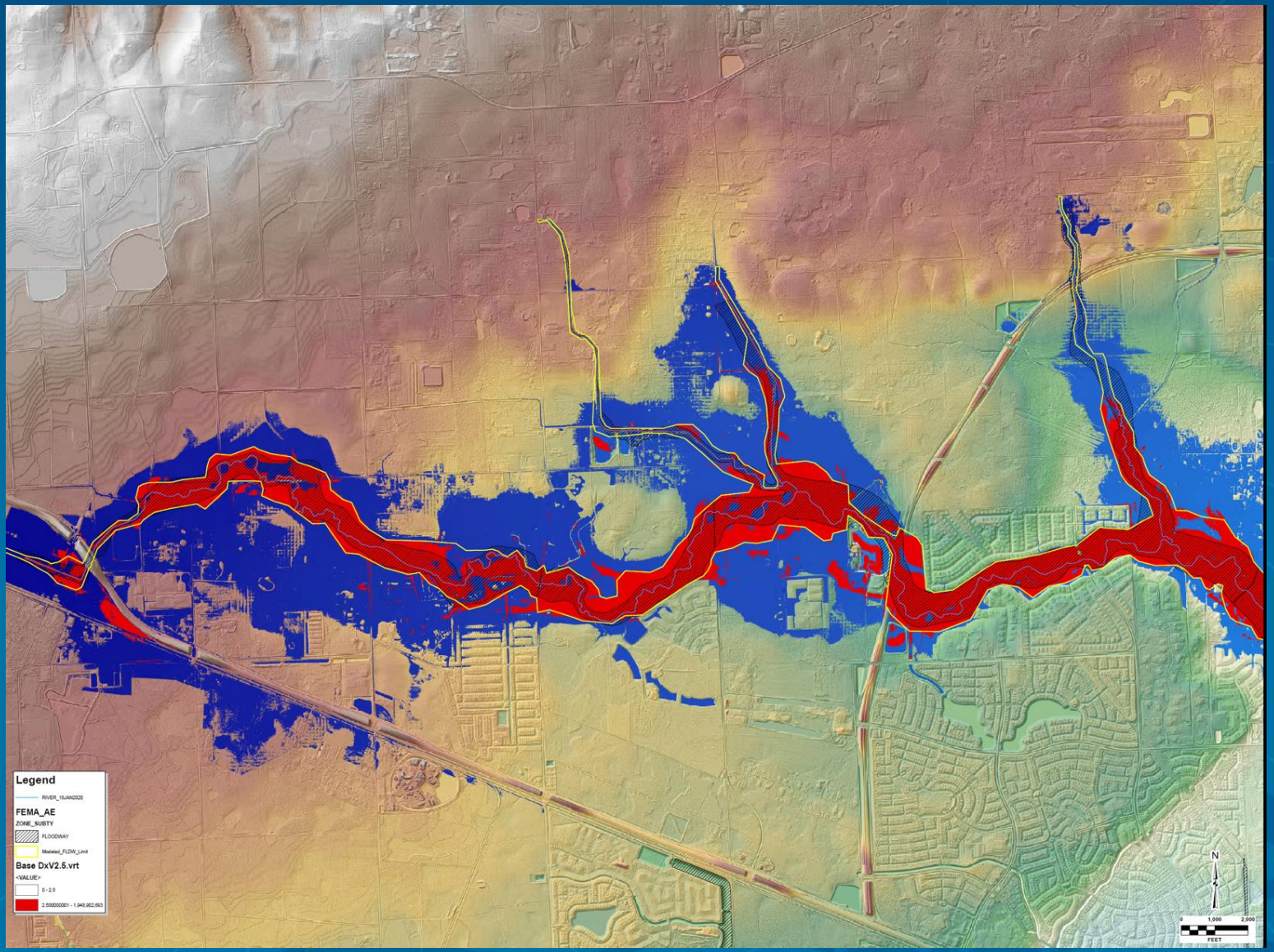

L100-00-00
(Mueschke Rd. to Kluge Rd)
WSEL (ft) (NAVD 88, 2001 Adj)
WSE Delta, ft
Stream Distance (ft) above Confluence
240
220
200
180
160
140
120
100
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
120,000
100,000
80,000
60,000
40,000
20,000
0
BAUER-HOCKLEY RD
ROBERTS RD
BECKER RD
BAUER RD
MUESCHKE RD
CYPRESS-ROSE HILL RD
SPRING-CYPRESS RD
LONGWOOD TRACE DR
KLUGE RD
Gages
Eff 100yr
Eff FW
N1 FW SVSQ
Channel Bottom
Delta_Eff FW
Delta N1FW_SVSQ


L100-00-00
(Mueschke Rd. to Kluge Rd)
WSEL (ft) (NAVD 88, 2001 Adj)
WSE Delta, ft
Stream Distance (ft) above Confluence
240
220
200
180
160
140
120
100
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
120,000
100,000
80,000
60,000
40,000
20,000
0
BAUER-HOCKLEY RD
ROBERTS RD
BECKER RD
BAUER RD
MUESCHKE RD
CYPRESS-ROSE HILL RD
SPRING-CYPRESS RD
LONGWOOD TRACE DR
KLUGE RD
Gages
Eff FW
N1 FW
N1 FW SVSQ
Channel Bottom
Delta_N1 FW
Delta N1FW_SVSQ

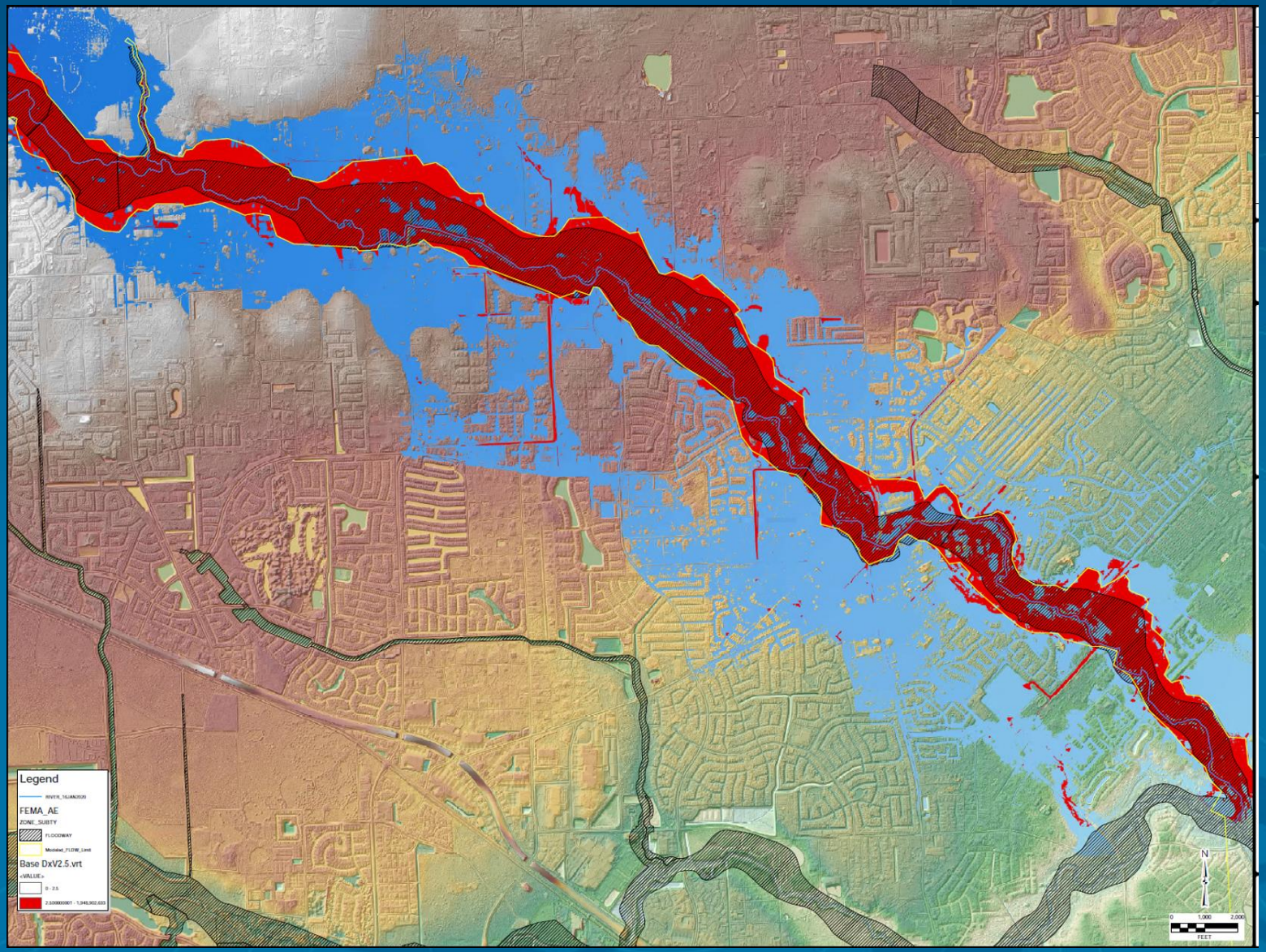
Modeling (Step -3)



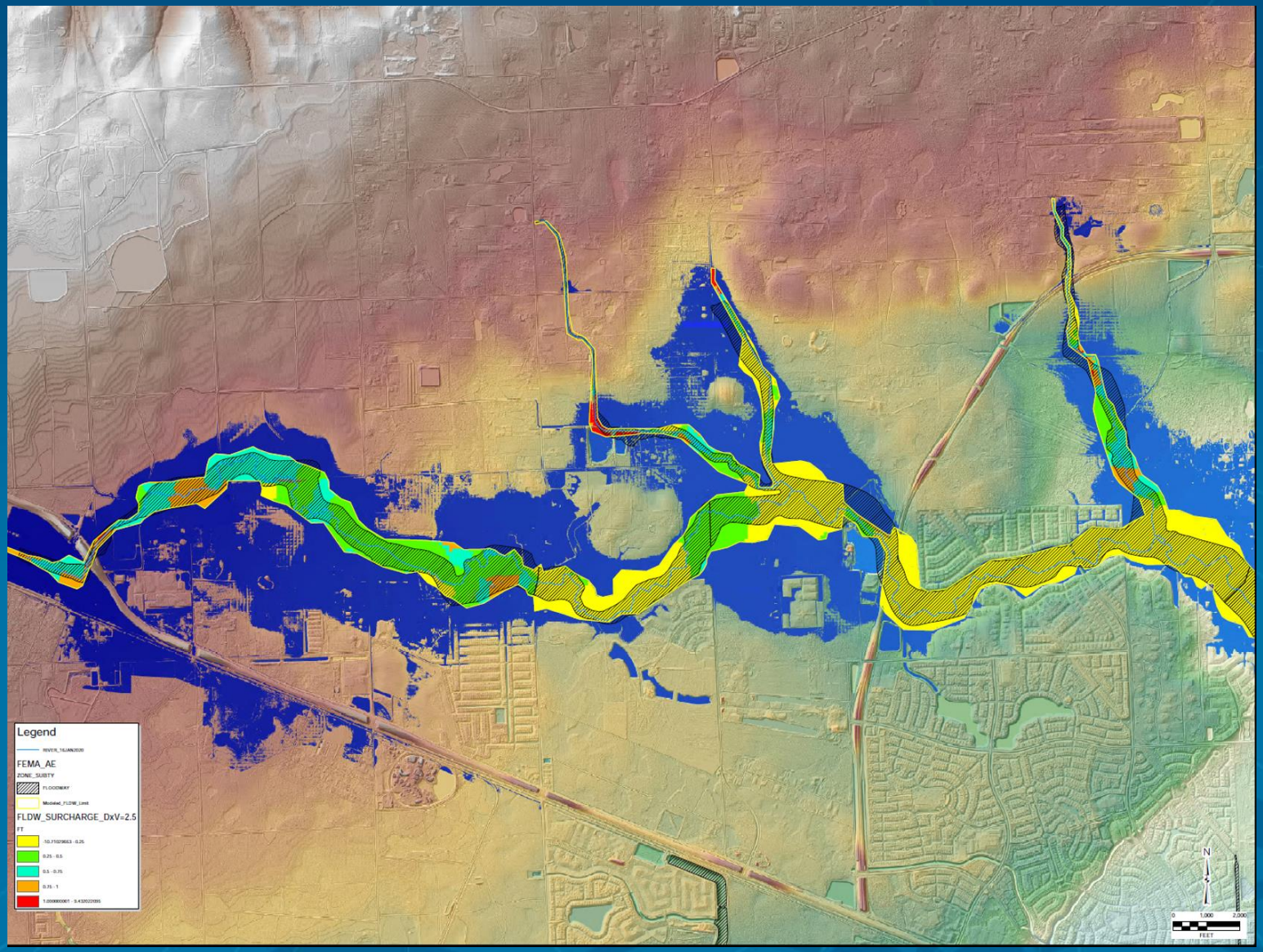
Floodway


Legend
RIVER_16JAN2020
FEMA_AE
ZONE_SUBTY
FLOODWAY
Modeled_FLDW_Limit
Base DxV2.5.vrt
<VALUE>
0 - 2.5
2.500000001 - 1,948,902,593
N
0
1,000
2,000
FEET

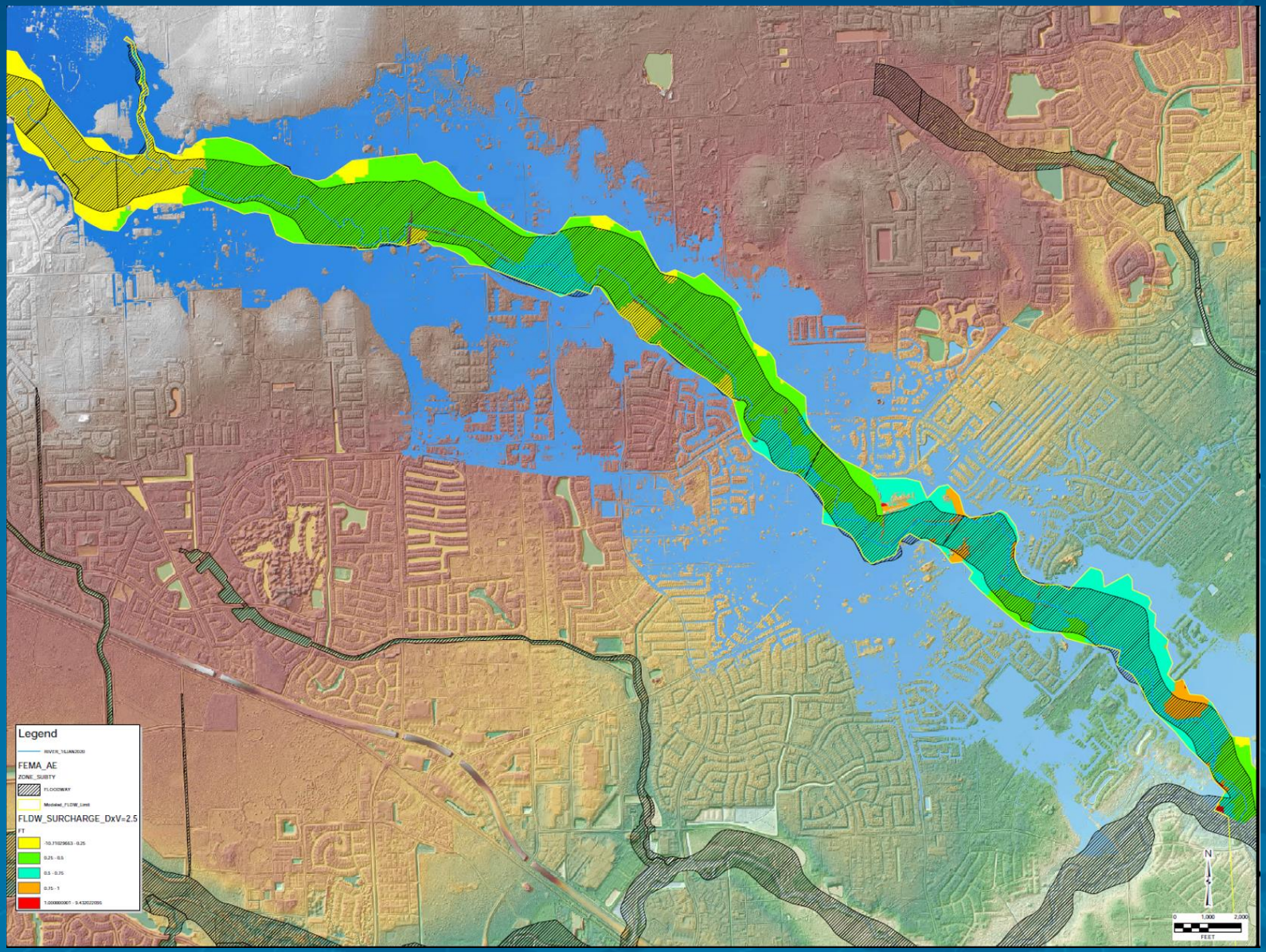
Floodway


Legend
FEMA_AE
ZONE_SUBTY
FLOODWAY
Base DxV2.5.vrt
<VALUE>
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0
1,000
2,000
FEET

Floodway Surcharge



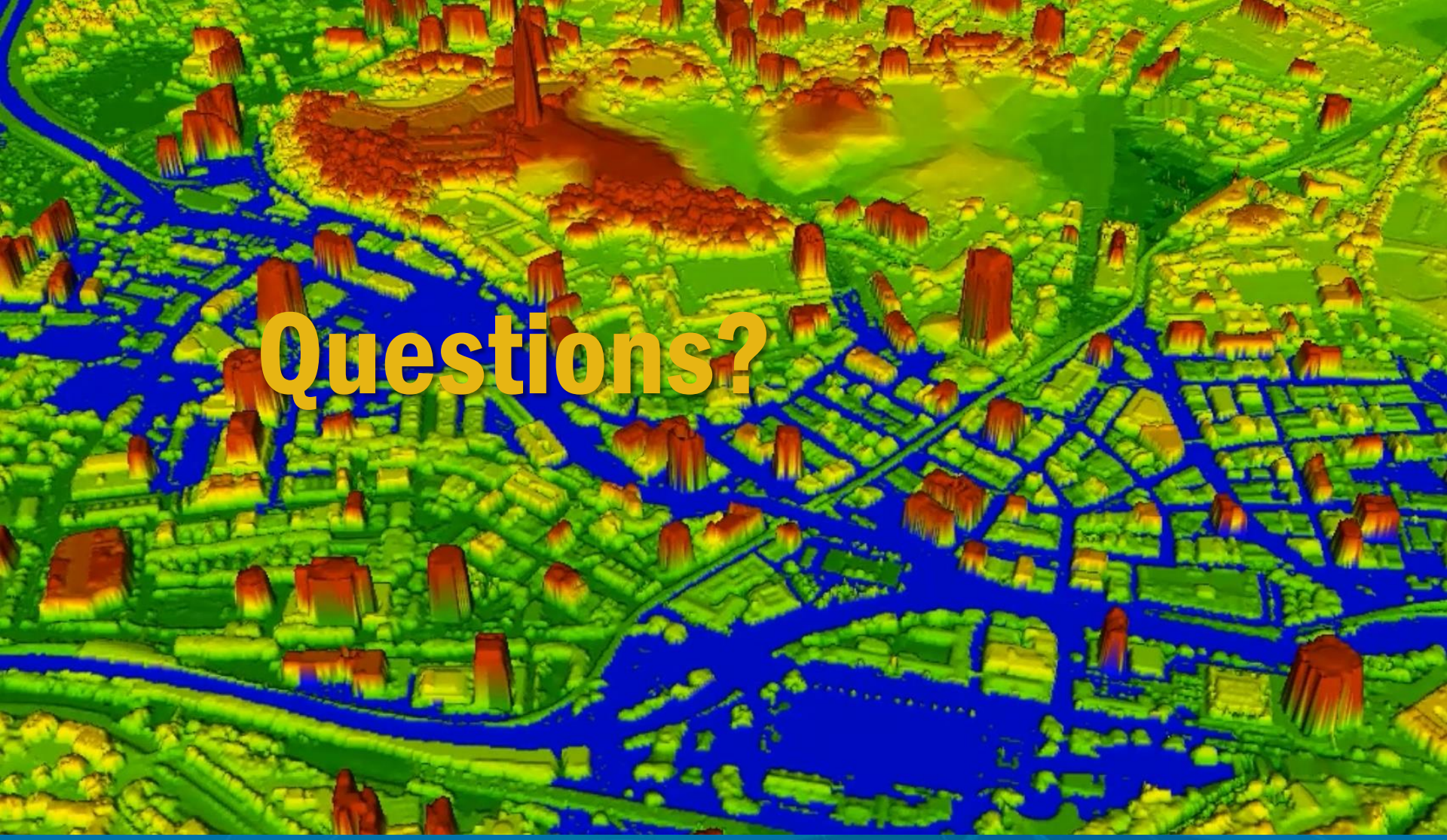
Floodway Surcharge



Conclusion

	Current FEMA	Proposed method
Discharge Q_{100}	✓ 100%	>95%
Surcharge	Max 1 foot	Max 1 foot
Volume	No	Yes
n=1 in Floodway Fringe	Same	Same

This approach can be applied for 1D/2D, 1D and 2D

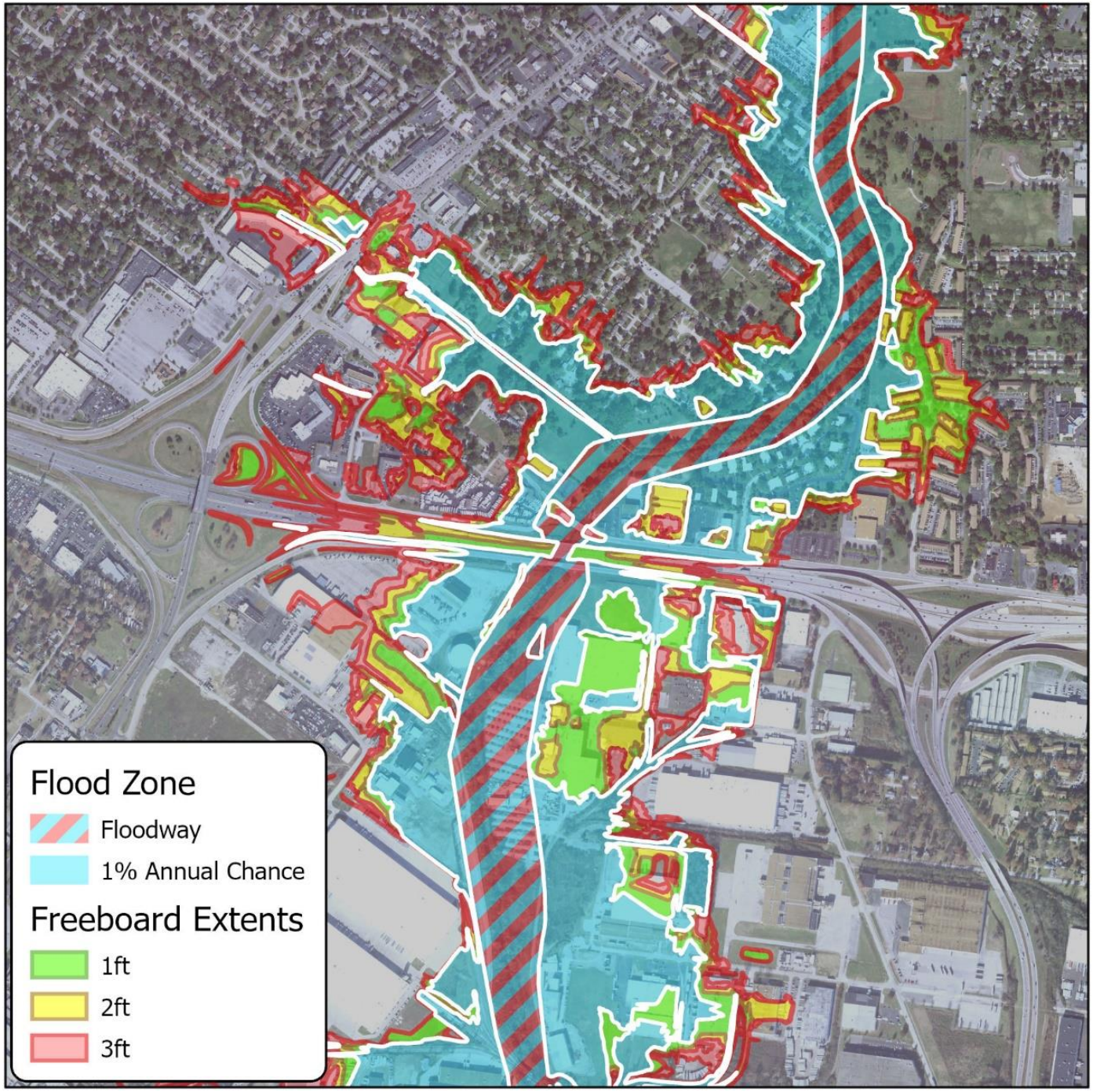


Ataul Hannan, P.E., CFM
Director, Planning Division
Harris County Flood Control District
Email: Ataul.Hannan@hcfcd.hctx.net

Closing Comments: DxV Product

- Can be used to supplement FEMA regulatory floodway
- Can be useful to determine floodway boundaries
- Product < 3 - Can help protect children and people with limited mobility
- Does not address the cumulative impacts assessment required in the CFR

Missouri SEMA Freeboard Mapping

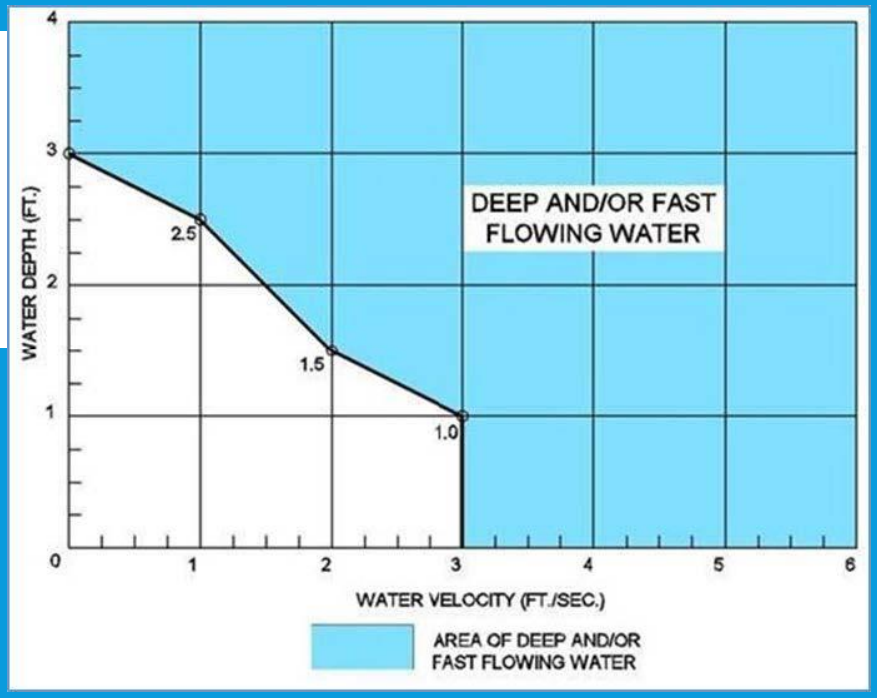


Questions & Discussion

Alan Lulloff, P.E., CFM
ASFPM Flood Science Center
alan@floods.org

Dennis Dixon, CFM
Pierce County Planning & Public Works
dennis.dixon@piercecountywa.gov

Ataul Hannan, P.E., CFM
Harris County Flood Control District
ataul.hannan@hcfcd.hctx.net



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CTP COOPERATING TECHNICAL PARTNERS

Association of State Floodplain Managers

ASFPM Flood Science Center

Poll Question

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- You must have registered individually and indicated you are a CFM and/or AICP at time of registration.
- Eligibility for CEC is dependent on your time spent viewing the webinar, as determined by the webinar software.



Attending this webinar in a group setting or only viewing the recording is NOT eligible for CEC.

Closing Comments

- To suggest future CTP webinar topics, please contact Alan Lulloff at *alan@floods.org* or type a suggested topic into the Questions panel today.



ASFPM CFM CECs will be automatically applied.



Certificates of Attendance will be emailed. Processing will take a few weeks. Please contact *cfm@floods.org* with any certificate issues only after a few weeks have elapsed.

- A follow-up email with link to slides and recording will be sent **in about a week or so.**

Thank You for Joining Us!