



# Skagit River Flood Insurance Study

Overview, Significance, & Direction

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# Presentation Outline

- National Flood Insurance Program
  - What and Why
  - Map Modernization
- FEMA Policies
  - 100-yr flood
  - Risk
  - Levees
  - Floodways
- Skagit River Flood Insurance Study
  - Key Issues
  - Modeling
  - Comparison old and new maps
- Thoughts & Direction



# National Flood Insurance Program

## Problem

- Flood damages were rising rapidly
- Costs of recovery borne by all taxpayers even those that do not live in floodplains
- Private Insurance too expensive to afford

# National Flood Insurance Program

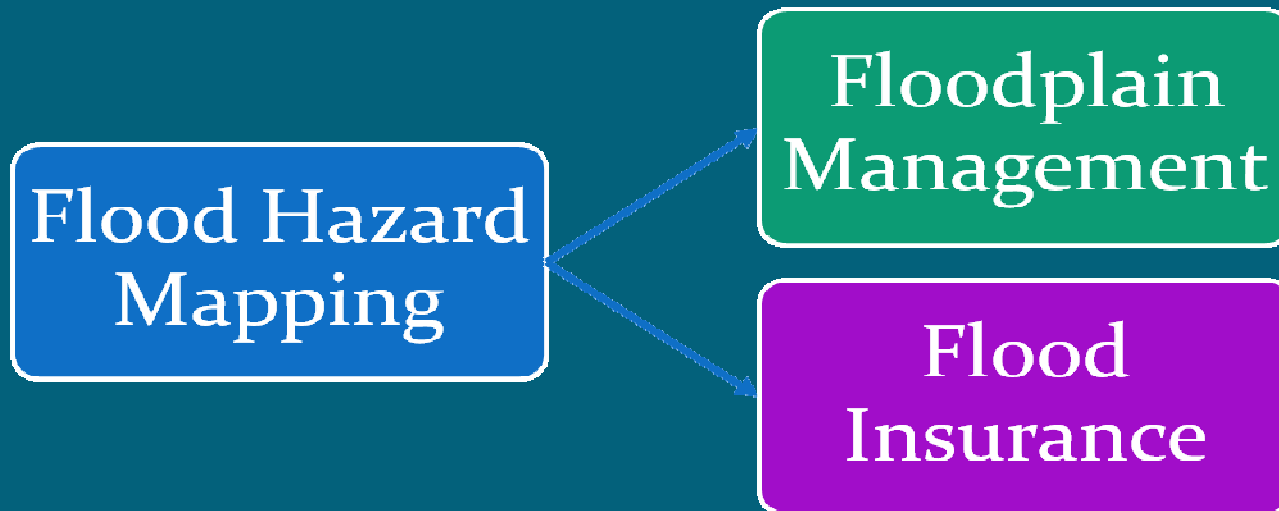
## Solution – The National Flood Insurance Program (NFIP)

- Purpose
  - Provide protection for property owners against flooding, while promoting wise floodplain management to reduce future flood damages
- Implementation
  - Create NFIP fund to insure property owners, while requiring communities to adopt floodplain regulations to ensure flood damages would be reduced in the future
  - Require flood insurance for all federally backed mortgages

# National Flood Insurance Program

## The Tool – Flood Hazard Maps

- Used by local communities to promote wise floodplain development – they are a “minimum” standard
- Used by mortgage companies to determine if flood insurance is needed



# FEMA Map Modernization

- National Program to Improve Accuracy of Flood Maps

## Consequences of Inaccurate Maps

- *Maps that under predict risk*
  - Higher Insurance Premiums -- NFIP
    - Note -- 25% of NFIP claims from unmapped areas
  - Everyone pays -- Tax \$ spent for federal emergency declarations
  - New structures built with inadequate flood protection
  - False sense of security for residents
- *Maps that are too conservative*
  - Can limit growth, reduce property values, & restrict development

# Map Modernization

- Reasons Existing Maps need to be Updated
  - Better Hydrology – Flood Discharges and Volumes
    - Longer period of record (USGS)
    - Watershed changes
      - Dam flood control operations
      - Land use & development
    - Climate change
    - New statistical methods and tools



# Map Modernization

- Reasons Existing Maps need to be Updated
  - New Hydraulic Conditions
    - Natural changes – lateral migration, scour, erosion...
    - Man made changes-- floodplain development, levees, roads, bridges
  - New Data and Better Tools
    - Better Topography – LiDAR imagery
    - Improved hydraulic models – more accurate, eliminate assumptions



# Mapping Process

- FEMA is very specific how mapping will be done
  - Set Policies
  - Detailed Study Contractor Guidelines

# FEMA Policies – The 100-yr Flood

- 1 in 100 chance every year
- Policy Decision
  - Balancing of costs of implementation vs. risk avoidance



- Probability of a given flood occurring

		Number of Years			
Flood Size	Annual Chance	10	30	50	100
10 year	10.0%	65.1%	95.8%	99.5%	100.0%
100 year	1.0%	9.6%	26.0%	39.5%	63.4%
500 year	0.2%	2.0%	5.8%	9.5%	18.1%

# Consider the Skagit

## Skagit River Peak Discharges -- I-5 Corridor

This is an illustration only – numbers listed below represent a “ball park range” based upon a review of published reports. Currently there is considerable debate as to what the numbers should be.

- 50-year 170,000 to 190,000 cfs
- 100-year 200,000 to 225,000 cfs
- 500-year 300,000 to 350,000 cfs
- **Assume** levees can contain ... 150,000 cfs

(assumes: 1) no freeboard, 2) levees are structurally sound, and 3) there is no uncertainty in flood levels)

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# FEMA Policies – Current vs Future Risk

- FEMA maps address current risk -- not future  
*But it is the future that you need to plan for....*

- Future risk may increase or decrease

- Hydrology may change
  - Better and more data
  - Climate Change
  - More Reservoir Regulation
- Flood protection features may be constructed



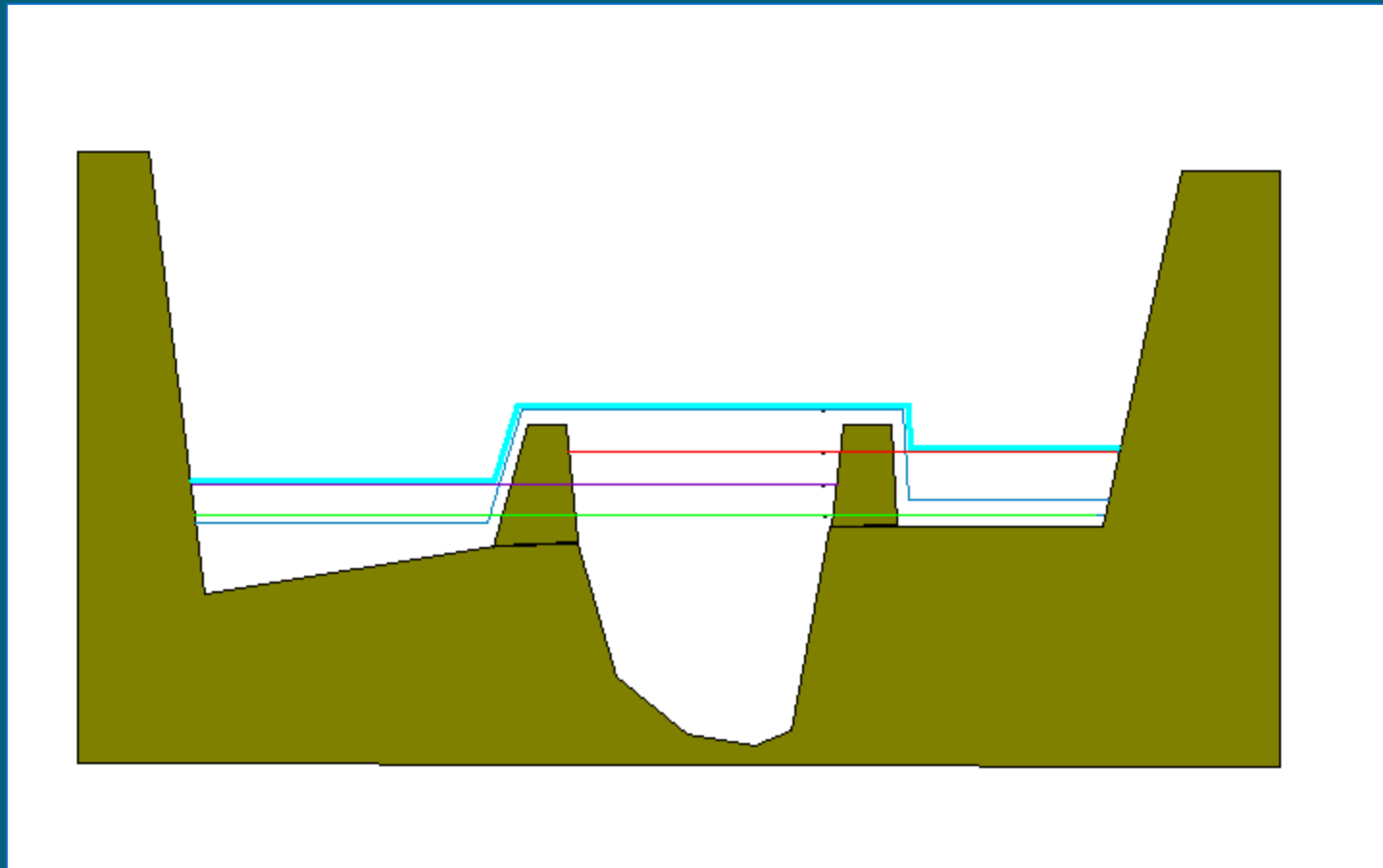
# FEMA Policies - Levees

- Certified
  - Contain the 100-yr flood
  - Meets freeboard, structural and other standards
- Not Certified
  - Assume levee segment does not exist



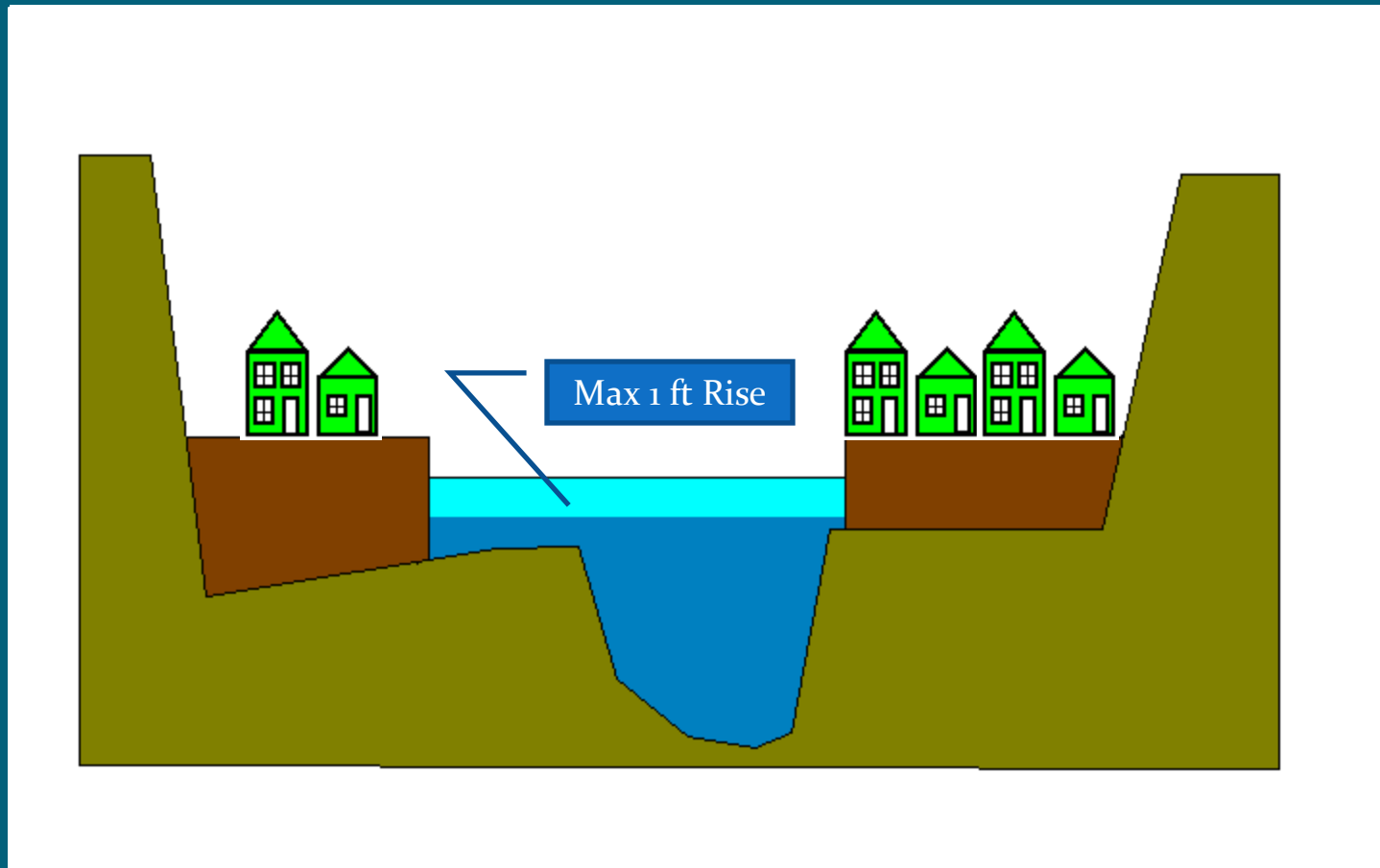
# FEMA Policies - Levees

## “Failure” Scenarios



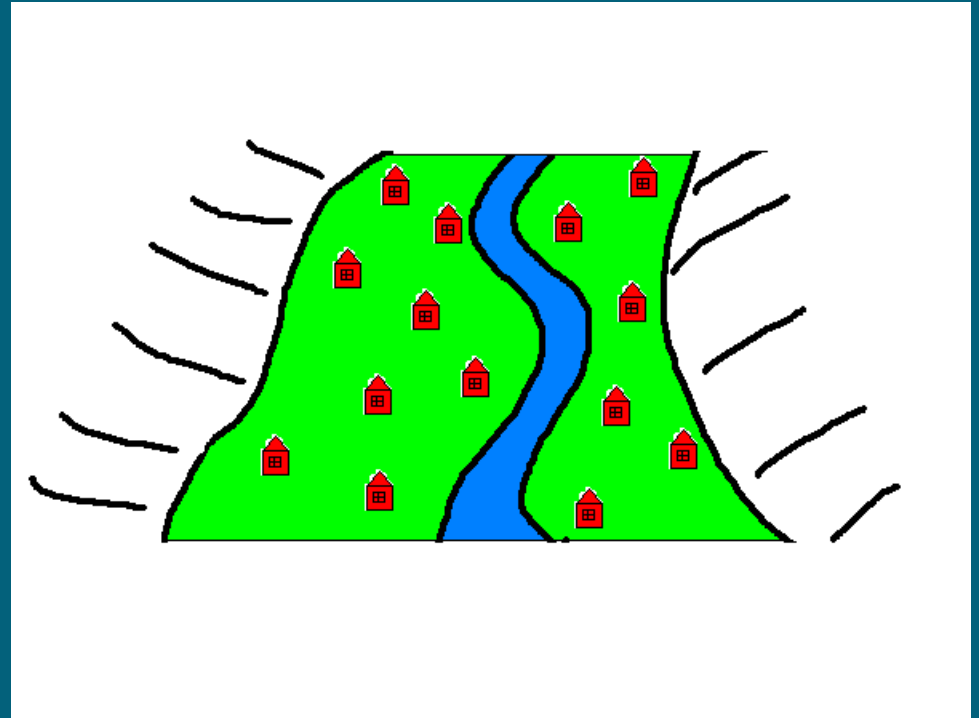
# FEMA Policies - Floodway

- Floodway: The channel and adjacent floodplain that must be kept open so that the cumulative impacts of floodplain development do not cause more than a one foot rise in the 100-yr flood



# FEMA Policies - Floodway

- Floodway Options
  - Standard Floodway
    - Nationwide Usage
  - Split Floodways
    - City of Snoqualmie
    - Pierce County
  - Density Fringe Floodway
    - (Technically you have one)





# Skagit River FIS – Key Issues

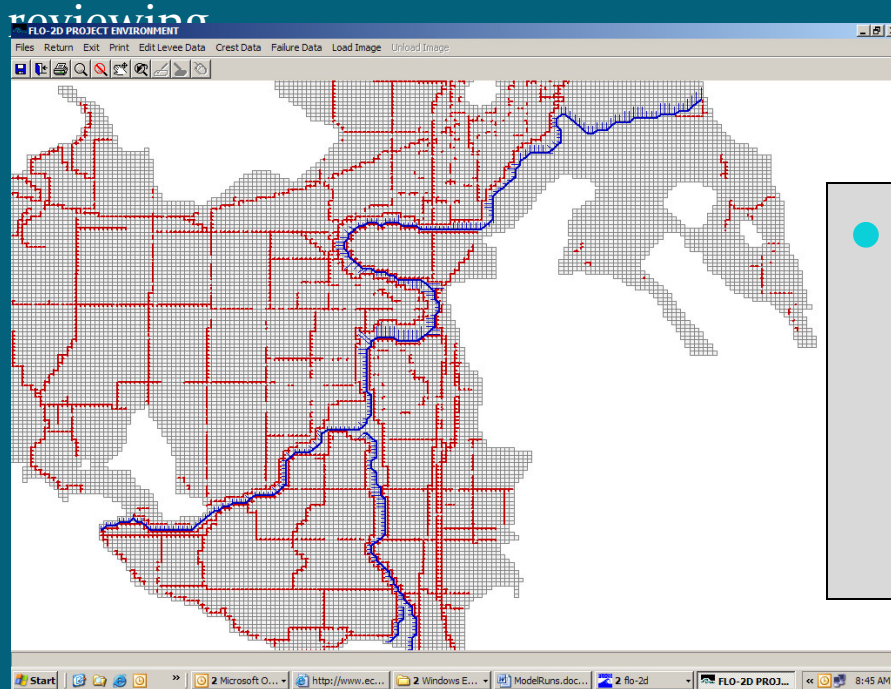
## Hydrology

- Controversy
  - COE/FEMA discharges and hydrographs
    - Some believe they are too conservative
  - PIE discharges and hydrographs
    - Agencies believe are too low and not defensible
- County Situation
  - Has re-established good working relationships with key federal agencies – FEMA, COE, USGS – this is critical
  - Desires to know the “right answer”

# Skagit River FIS – Key Issues

## Hydraulics -- Flo2D Model

- FEMA has invested far more than is usual because of the importance and significance to “get it right”
- Models are only tools. They require considerable judgment – nhc currently

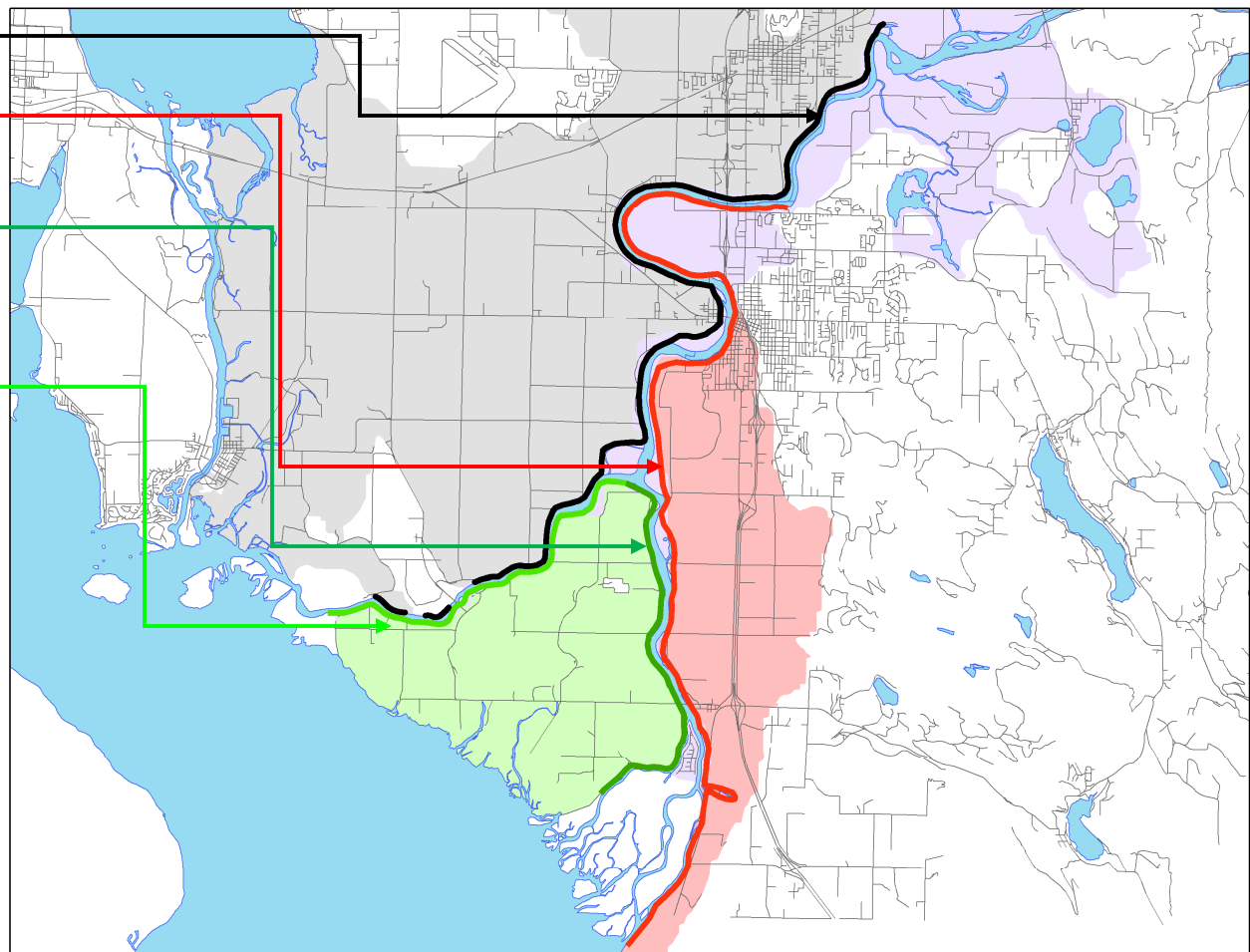


- Key Model Components
  - Channel Cross Sections
  - Floodplain Topography
  - Levee Crest Elevations

# Skagit River FIS – Key Issues

## Skagit River Levee Scenarios

- Right Bank
- Left Bank
- SF Right Bank  
(Fir Island)
- NF Left Bank  
(Fir Island)



# FEMA Policies - Levees

## Observed Levee Breach Widths on Large Rivers

River	Location	Year	Breach Width (ft)	Area Flooded (acres)	River Flow (cfs)
Snohomish	Marshland	1995	900		132,000
Mississippi	Mounds Landing	1927	4000	10,000,000	2,500,000
Yangtze	Lizhou Polder	1998	1280	17300	420,000+
Sacramento	Middle R	2004	300		
Po	Cambio Nuovo	1994	660		406,000

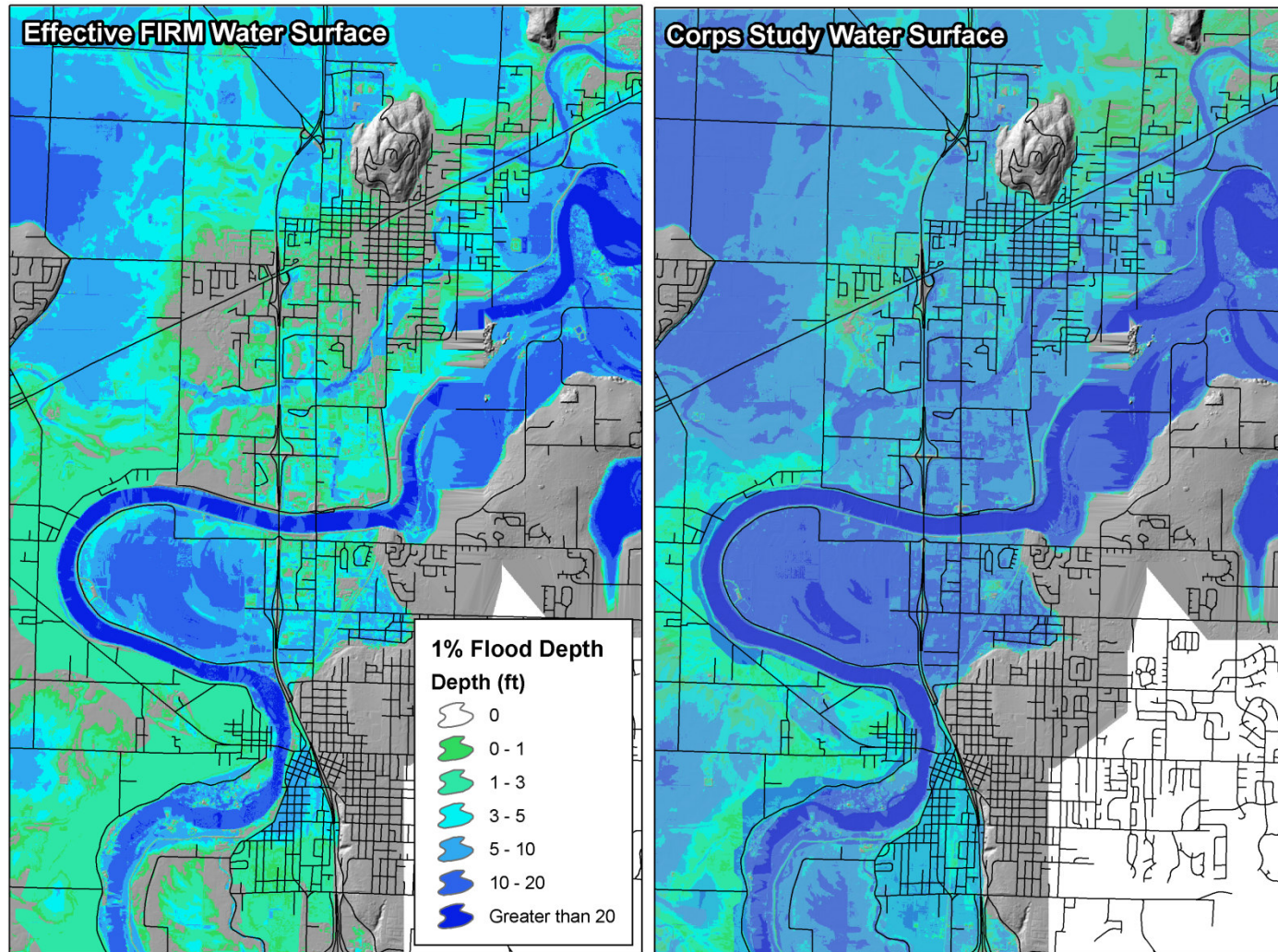
## Skagit River FIS Right Bank Levee Removed

Skagit			75,000		235,000
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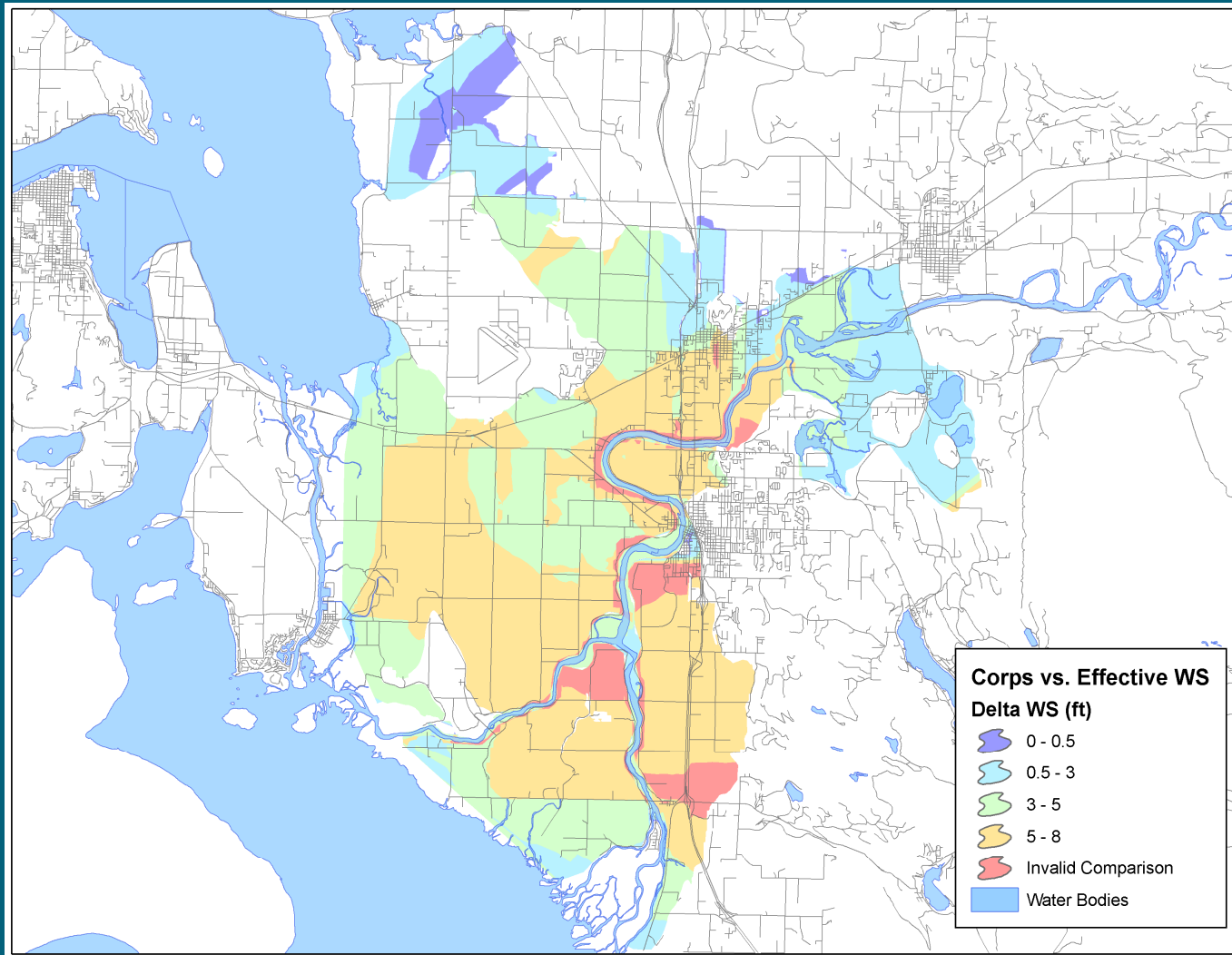
• Uncertain where levee will fail thus assume entire segment does not exist

We haven't yet explored the significance of this issue

# Old and New FEMA Maps



# Change in Depth Old vs New Maps



# New vs Old Maps

- Why are they different?
  - Hydrology ~
    - Peaks about same

	1984 FIS	2006 Draft FIS
Q <sub>100</sub> @ Sedro-Wooley (cfs)	240,000	234,800

- Hydrographs now considered (Unsteady hydraulic analysis)
  - Volume of water stored in floodplain may have significant impact on water depths and levels.

# New vs Old Maps

- Why are they different?
  - Hydraulics ~
    - Models substantially different – today's tools are much better
    - 1984 Study – very simple assumptions (i.e. fewer assumptions required today)
    - Improved definition of floodplain topography
    - Considerable floodplain development

We are currently examining the Flo2D model



# New vs Old Maps

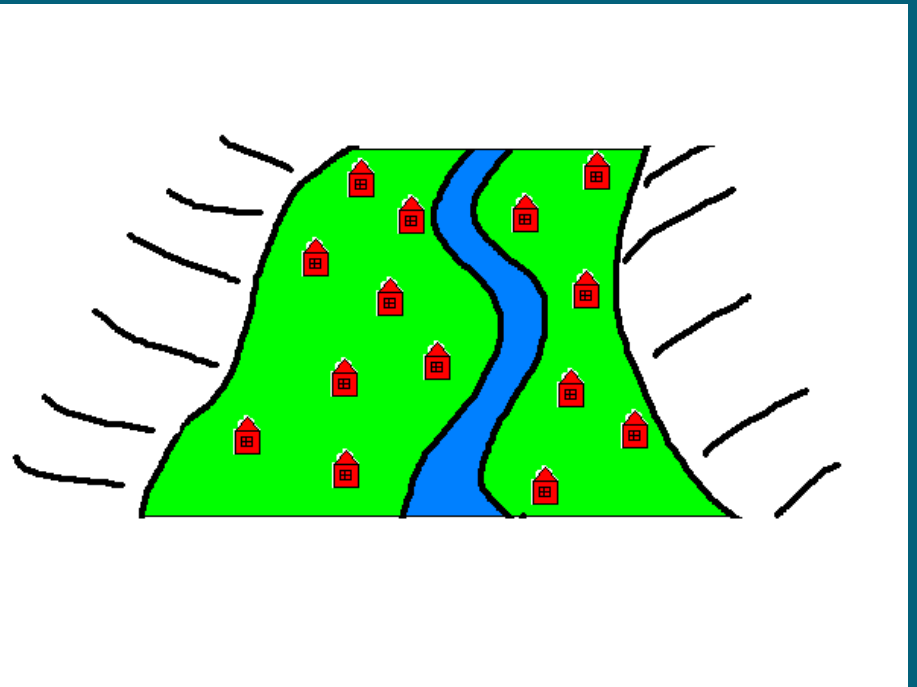
- Why are they different?
  - Levee Policies ~
    - New Policy -- Assume entire levee segments do not exist due to uncertainty in security

We will come back to this



# New vs Old Maps

- Floodways ~
  - ALERT -- They are coming
  - Perception that the 1984 floodway has been ignored and that development has proceeded in spite of flood risk. 20+ years later much larger number of structures at risk



# nhc Thoughts

- Hydrology

- May be conservative ... may not...

- People have raised excellent questions regarding the accuracy of the “Stewart” estimates of historical peak flows
    - All parties seem to be somewhat selective. Inclusion of some data, exclusion of other. In-depth investigations of some items, relative disregard for others. There is an amazing story to be told but ...
    - FEMA and COE are going to rely upon published USGS data
    - USGS Paleo study may reveal critical information, but could be a double edged sword – may reveal that higher discharges should be used... may not ...

One thing is clear – there is uncertainty

# nhc Thoughts

- Hydraulics

- Appropriate Model -- Flo2D
  - (FEMA/COE have done far more than is typical)
- Complex – Considerable and careful work by COE
  - We are currently examining the Flo2D model
  - Plan to conduct sensitivity analysis of BFEs to flood peak and volume

# nhc Thoughts

- Floodway
  - Possible flexibility in floodway methods but ....
  - FEMA likely to take relatively hard stance due to past history of relative disregard

# nhc Thoughts

- Levee Policy

- National FEMA Policy – assume entire levee does not exist if it can not be certified
  - Careful consideration by FEMA (at a national level) to identify defensible levee “failure” scenarios for the Skagit
- Not yet sure of the impact that this assumption has on BFEs
  - We plan to test sensitivity

# nhc Thoughts

- Levee Policy – Complete Levee Failure
  - Not a realistic assumption ... but it is national “Policy”
  - These scenarios will never happen
  - No credit for existing flood protection
    - Significant flood protection features in place
    - Active Diking Districts
    - Active community flood fighting support

# nhc Thoughts

- Levee Policy

What level of protection do you have today?

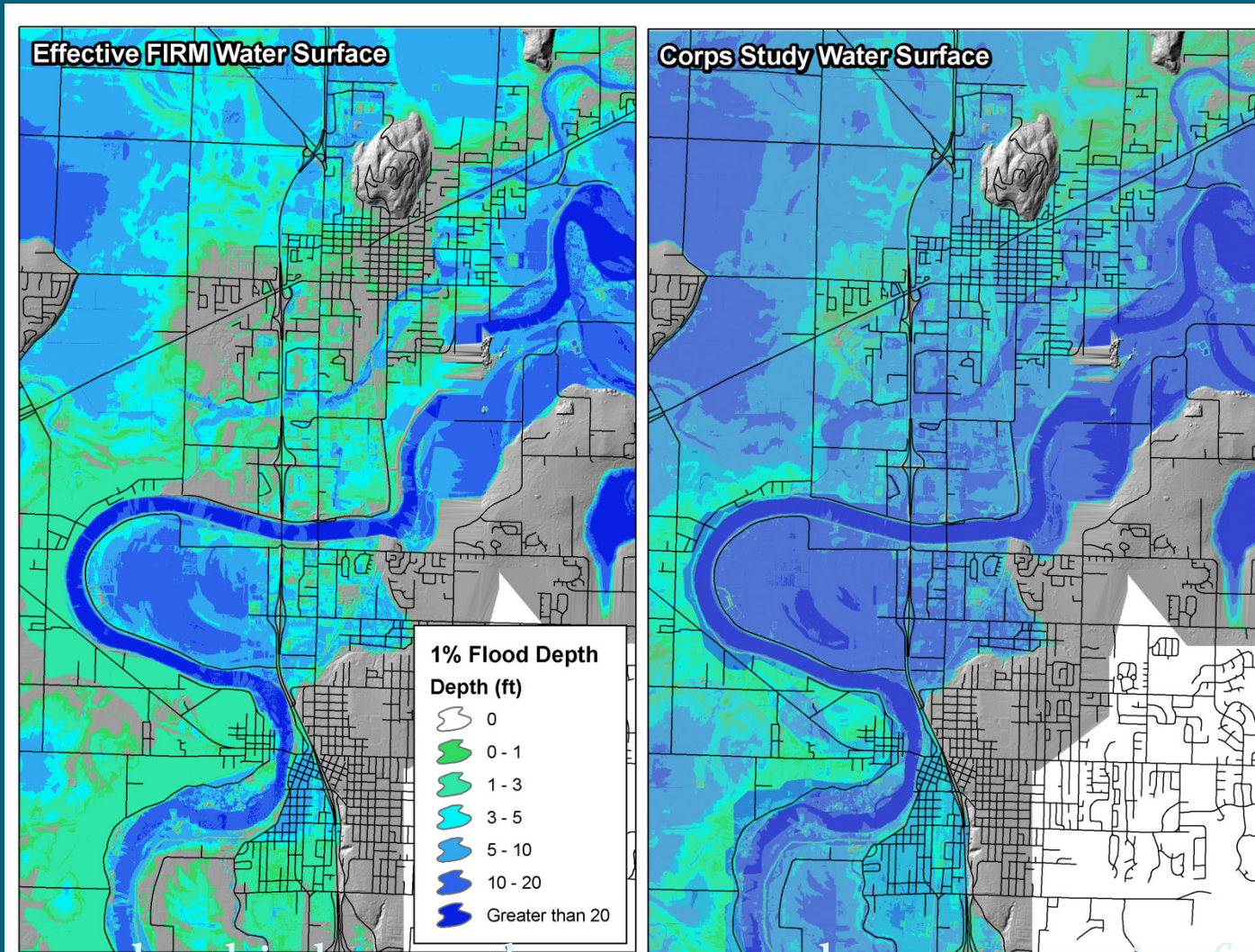
Where is the Existing Condition Assessment?

Example Pierce County – Lower Puyallup River

- Hydrology
- Hydraulics
- Sediment Transport and Geomorphology
- Levee Stability – Geotech assessment
  - Are the levees structurally secure? (Thought levees were “Junk”)
  - What truly is likely to happen during a major flood?
- Economic Benefits & Costs



# Old and New FEMA Maps



You need a third map, then you can have a meaningful discussion