

# Floodplain Fiction

Reconciling Physical Reality with Procedure

# Vision

Coherent FEMA/State/County Procedure

- Consistency
- Predictability
- Repeatability
- Physically real
  - Flexibility

Process | Clarity

# Modeling Sequence:

- **Effective Hydraulic Model**
  - The hydraulic analysis used in the effective FIS
- **Duplicate Effective Hydraulic Model**
  - A copy of the effective model reproduced on the requestors computer
  - Should not be modified – unless required to allow model to run
  - Should reproduce effective profile w/in the appropriate tolerance
    - Within 0.1 foot if the effective model is available and the same modeling program is being used
    - Within 0.5 foot if the effective model is not available
- **Corrected Effective Model**
  - Corrects errors in the duplicate effective
  - Adds cross sections
  - More detailed topography
  - Must NOT reflect man-made changes since the date of the effective model

## – Existing Conditions Model

- Modified version of the Duplicate or Corrected Effective model
- Includes any modifications since the date of the Effective
- If no modifications since the effective, then the Duplicate Effective or Corrected Effective becomes the Existing Conditions

## – Post-Project Conditions Model

- Modified version of the Existing Conditions model
- Includes modifications to reflect the project



**FEMA**

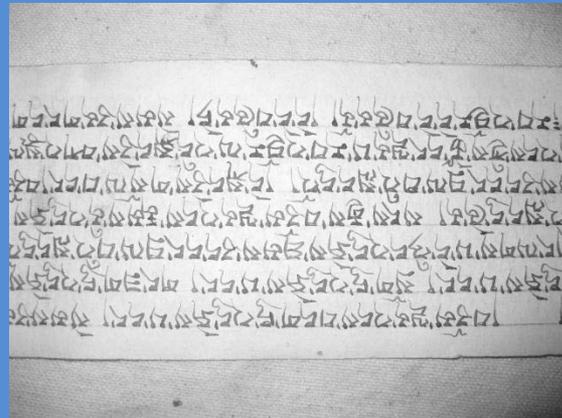
**Baker**

# The Grail: Recreating the Effective Model

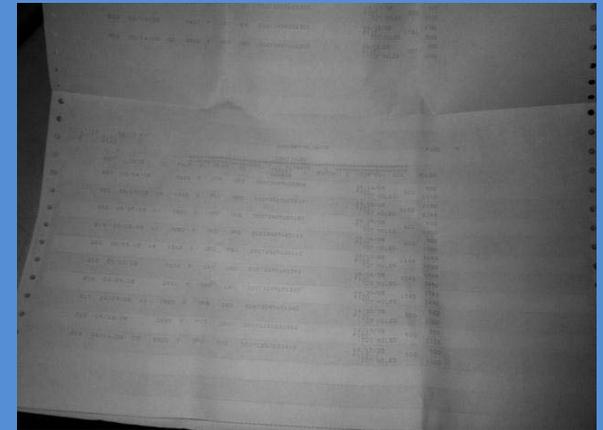
A.



B.

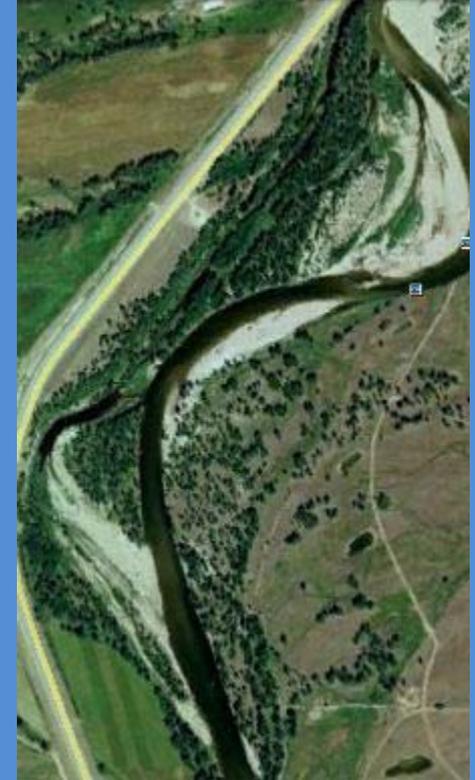


C.



Which is the WSP-2 Effective Model ?

# Channels Change...

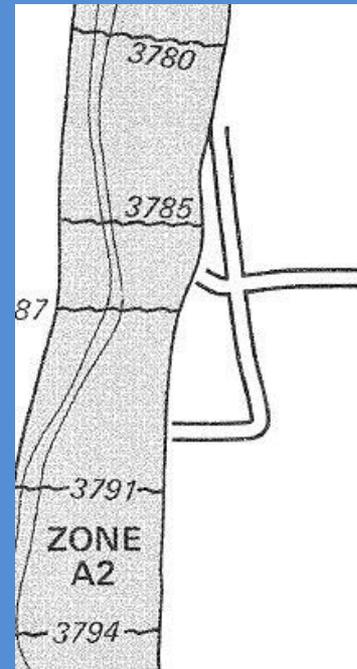
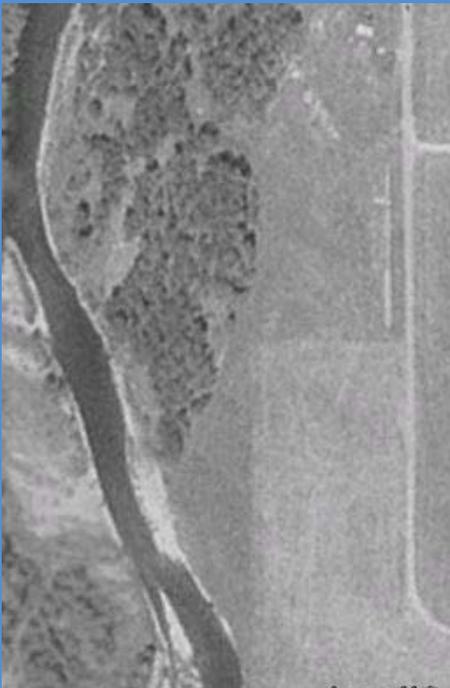


...Effective Cross-sections Don't.

P.S. Why not recreate the effective BFE for analysis of pre-post effects? It's BFE we regulate...not cross sections.

# Providence Smiles: Create Duplicate Effective Model

- A. Match BFE to within 0.1 ft if Effective available
  - B. Match BFE to within 0.5 ft if Effective not available
- Very sensible. Matching BFEs is what we should do!  
Unless the answer is C.



# Published BFEs are not Reality

**Answer C: None of the above - can't match 0.1 ft or 0.5 ft.  
The Effective model is Ineffective.**

- 1) First principles: Published BFEs are approximations.**
- 2) Published BFEs have no tolerances, sensitivity analysis, or associated confidence intervals. Despite uncertainty, BFEs are fixed values.**
- 3) The world is not static. The BFE doesn't care. A plus and a minus.**
- 4) BFEs and effective models: problems of scale, 2D, etc.**

# Another Solution! The Existing Conditions Model!

**Laughing. Maybe. If your client still has any money left.**

- 1) Do you vainly try to replicate the “ineffective” model BFE using your new cross sections, dive into a PMR spanning several FIRM panels, fixing past FEMA woes?
  - 2) So what happens when the observed 10 yr event is 1.5 ft higher than the published BFE?
- P.S. your client has a budget of \$4000 to patch 50 ft of eroding bank.

# What about a subdivision?

## 2011 Flooding



1111 EAST BROADWAY  
MISSOULA, MONTANA 59802  
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FAX: 406-728-2476  
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2011 FLOOD PHOTO WITH LOTS OVERLAY  
STONYBROOK SUBDIVISION  
MISSOULA, MONTANA

REVISIONS:

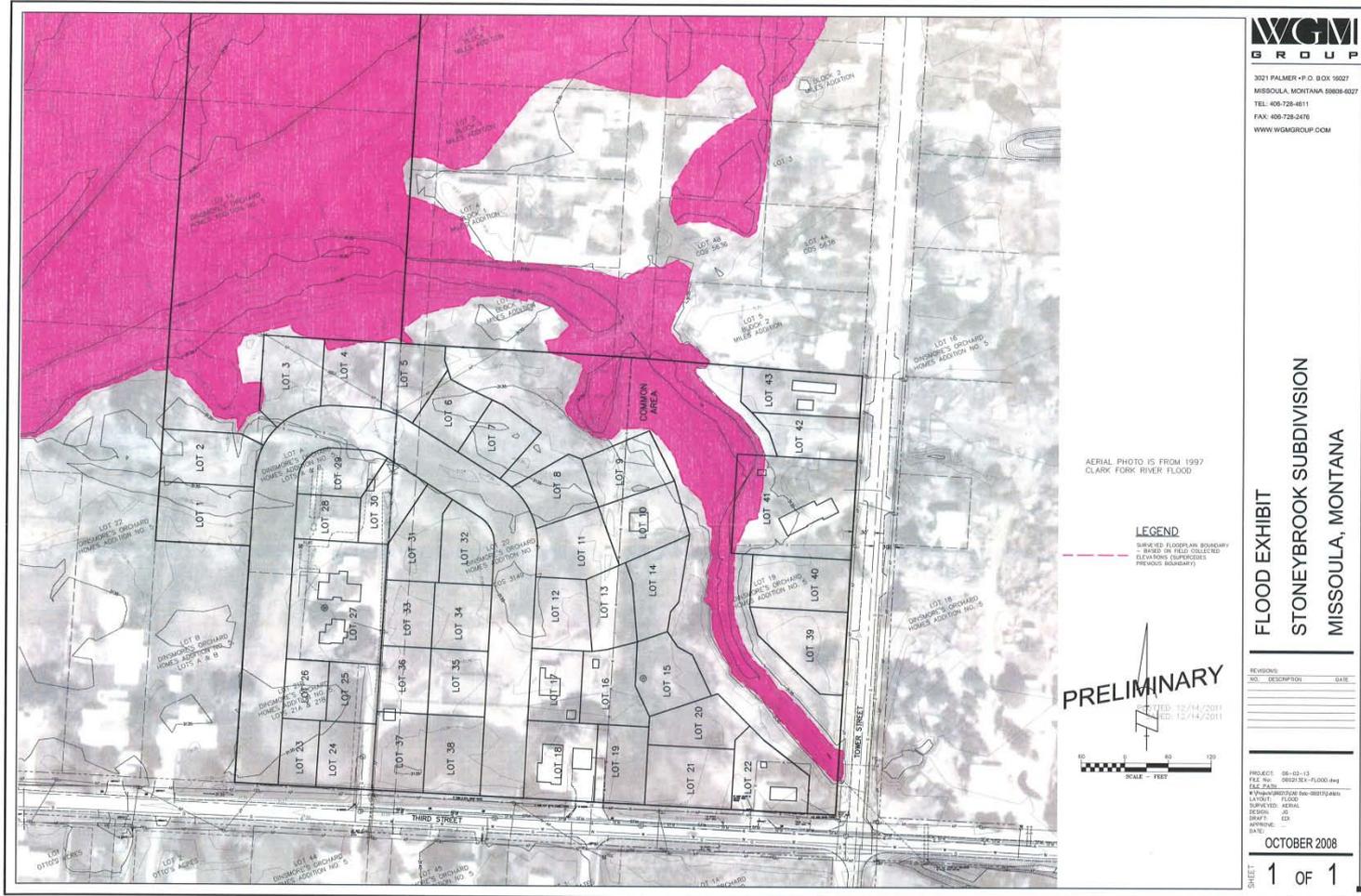
| NO. | DESCRIPTION | DATE |
|-----|-------------|------|
|     |             |      |
|     |             |      |
|     |             |      |
|     |             |      |

PROJECT: 11-09-09  
FILE No: 110909FLOOD-AERIAL3.dwg  
FILE DATE: 12/11/2011  
LAYOUT: PHOTO  
SURVEYED: WGM GROUP  
DESIGN: JCS  
DRAFT: EDI  
APPROVE: \_\_\_\_\_  
DATE: \_\_\_\_\_

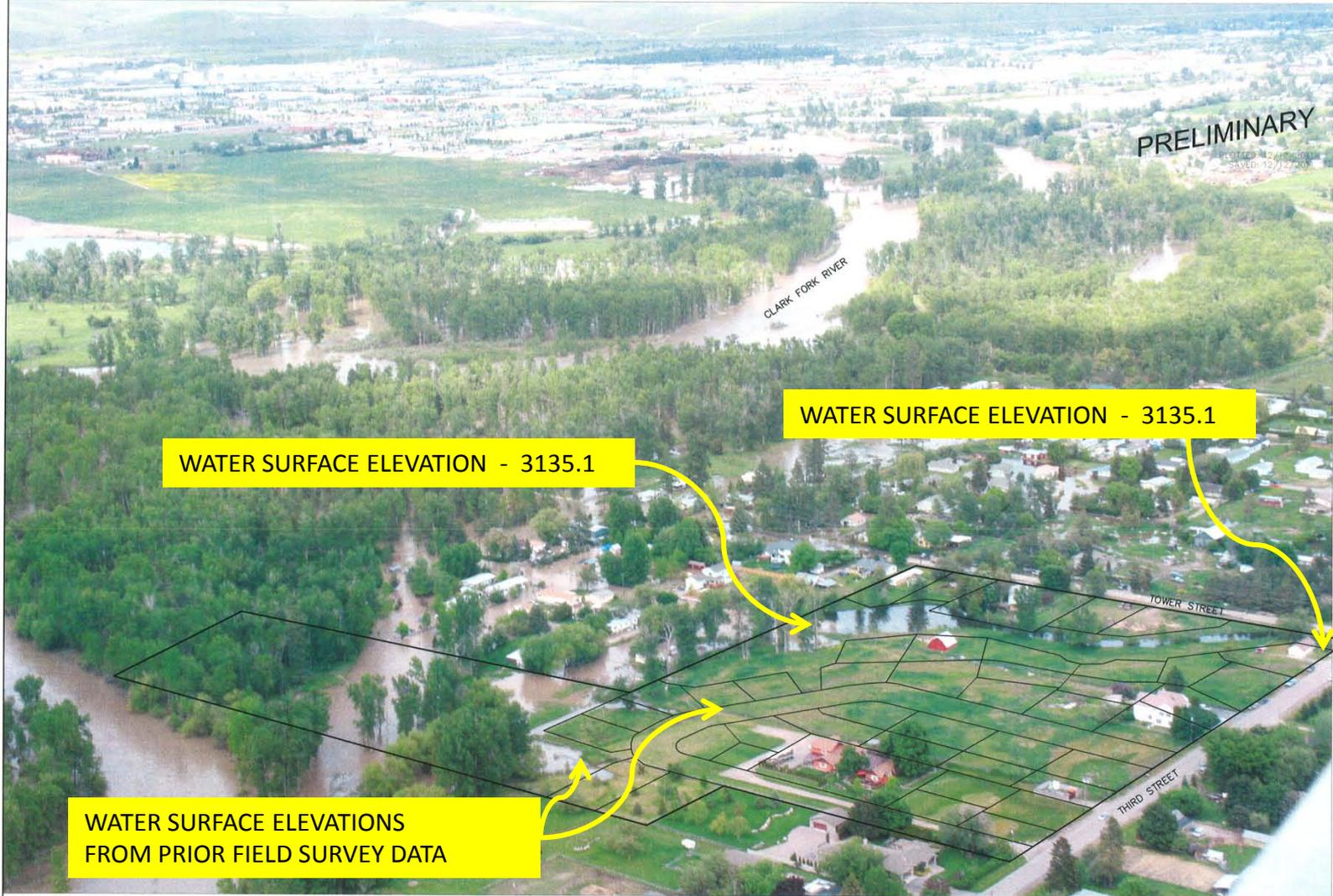
DECEMBER 2011

SHEET 1 OF 1

# 1988 FEMA FIRM REGULATORY FLOODPLAIN



# 2011 WATER ELEVATION SURVEY



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2011 FLOOD PHOTO WITH LOTS OVERLAY  
 STONYBROOK SUBDIVISION  
 MISSOULA, MONTANA

| REVISIONS: |             |      |
|------------|-------------|------|
| NO.        | DESCRIPTION | DATE |
|            |             |      |
|            |             |      |
|            |             |      |

PROJECT: 11-06-09  
 FILE No: 110609FLOOD-AERIAL3.dwg  
 FILE DATE:    
 \*Project: 110609 (AD) 06/16/11  
 LAYOUT: PHOTO  
 SURVEYED: WGM GROUP  
 SERIAL: JCS  
 DRAFT: EDI  
 APPROVE:    
 DATE:  

DECEMBER 2011

# Doing the right thing

- Project beyond jurisdictional floodplain.
- Observed 10 yr event higher than FEMA 10 yr profile by 1.5 ft.
- Observed 10 yr event approached published 100 yr BFE.
- Site-specific fill/floor elevations adjusted to reflect discrepancy.

| LOT # | PREDICTED FLOOD ELEVATIONS |             |                   |
|-------|----------------------------|-------------|-------------------|
|       | 100-YR FEMA                | 500-YR FEMA | 100-YEAR ADJUSTED |
| 3     | 3133.2                     | 3133.8      | 3134.5            |
| 4     | 3133.3                     | 3134.0      | 3134.7            |
| 5     | 3133.5                     | 3134.3      | 3135.0            |
| 6     | 3133.6                     | 3134.3      | 3135.1            |
| 7     | 3133.7                     | 3134.4      | 3135.3            |

What if this project had been located within the floodplain?

# The Yellow Rock

“No-rise” analysis in floodway

- Engineered log jams
- LWD Banks
- Bridge Piers
- Irrigation Diversions
- Fish Passage

Process | Clarity

# LOMR/CLOMR

## When a CLOMR is Required

- Proposed projects that:
  - Encroach upon the floodway and cause an increase > 0.00 ft
  - Encroach upon a floodplain when a floodway has not been established and causes an increase of > 1.00 ft
    - Includes all existing and anticipated development - 60.3(c)(10)
    - Includes Approximate Zone A
      - May require development of a model
- What is an increase
  - Comparison between pre-project (existing conditions) and post project (proposed conditions) model

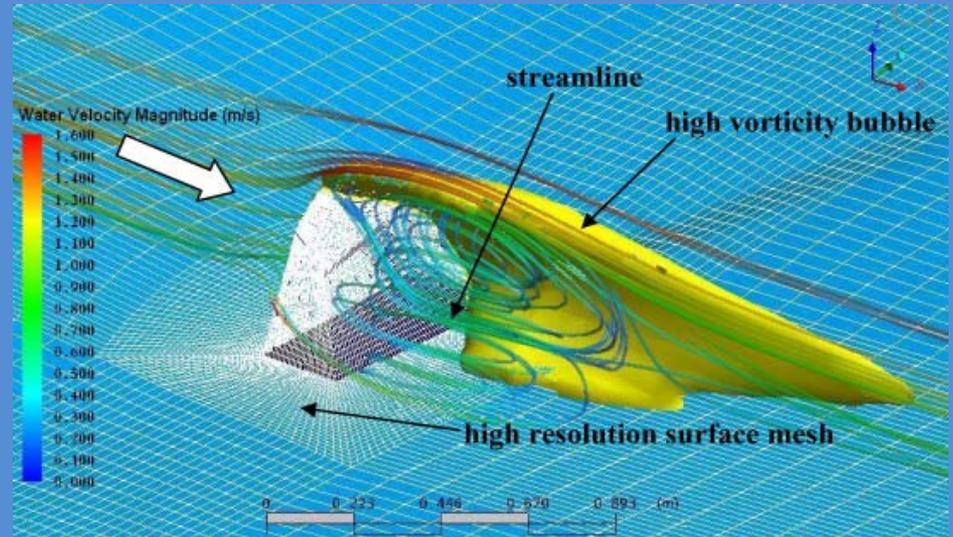
## When is a LOMR Required

- Any change (increases or decreases) in BFE resulting from physical changes.
- Requests involving:
  - Floodway changes
  - Changes or properties in alluvial fan areas
  - Changes in coastal high hazard areas
- A LOMR following an approved CLOMR must be submitted within six months after the project has been completed

# CLOMR /LOMR FEES

| REQUESTS FOR MAP CHANGES REQUIRING SPECIAL TECHNICAL REVIEW                    | FEE     |
|--|---------|
| CLOMR Based on New Hydrology, Bridge, Culvert, Channel, or Combination Thereof | \$4,400 |
| CLOMR Based on Levee, Berm, or Other Structural Measures                       | \$6,050 |
| LOMR/PMR Based on Bridge, Culvert, Channel, or Combination Thereof             | \$5,300 |
| LOMR/PMR Based on Levee, Berm, or Other Structural Measures                    | \$7,150 |
| LOMR Based on As-Built Information (CLOMR previously issued by FEMA)           | \$5,000 |
| LOMR/PMR Based Solely on Submission of More Detailed Data                      | Free    |

# Instream Habitat: $\Delta\text{Floodway} = 0.00\text{ft}$



# Modeling the “no-rise” Yellow Rock

## Channel Geometry

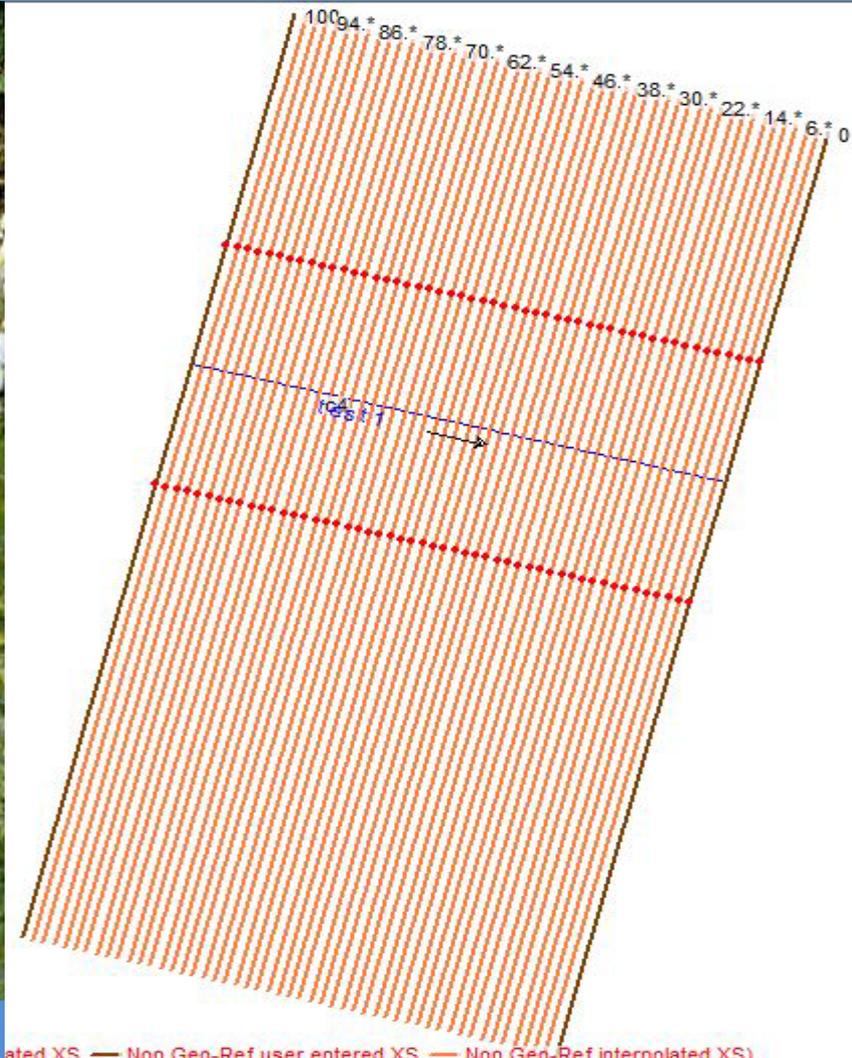
- C4
- $W/D = 25$
- BF width = 50 ft
- BF depth = 2 ft
- $N = 0.032, 0.06$  FP
- Slope = 0.005
- Floodplain width = 150
- 50 cross sections/100 ft

## Pre-Post Channel

- Uniform existing condition model/cross-sections
- Single rock, 2 ft above bed, one cross section.

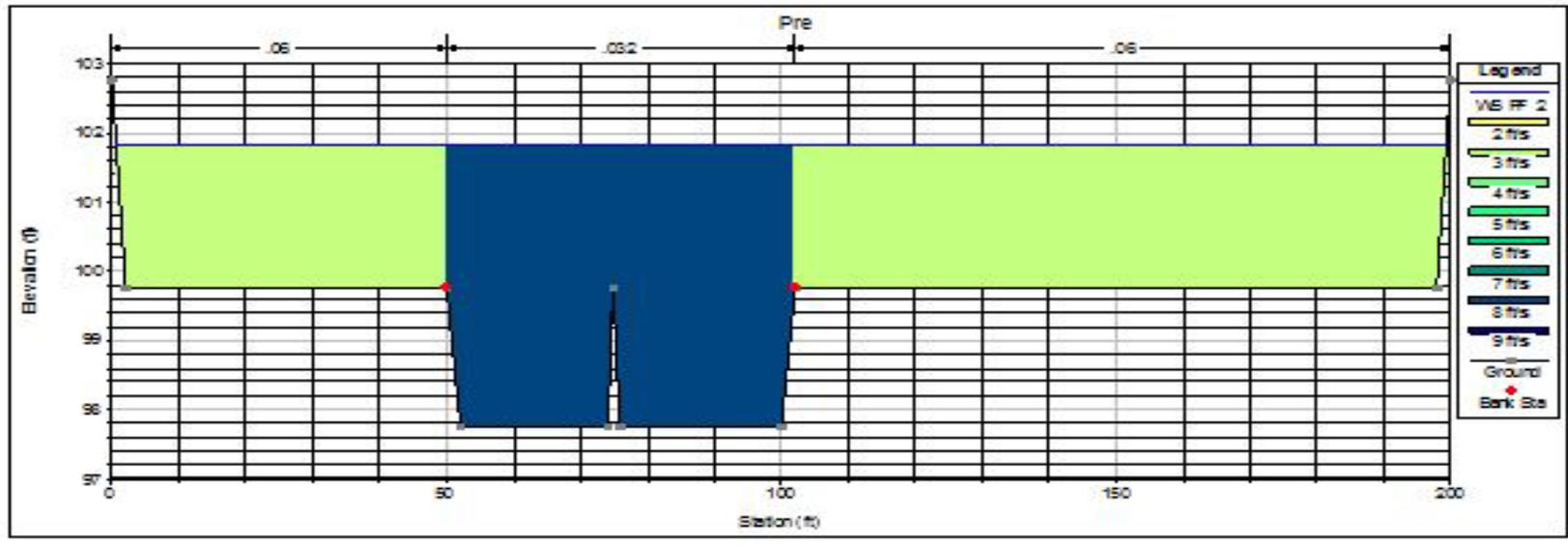
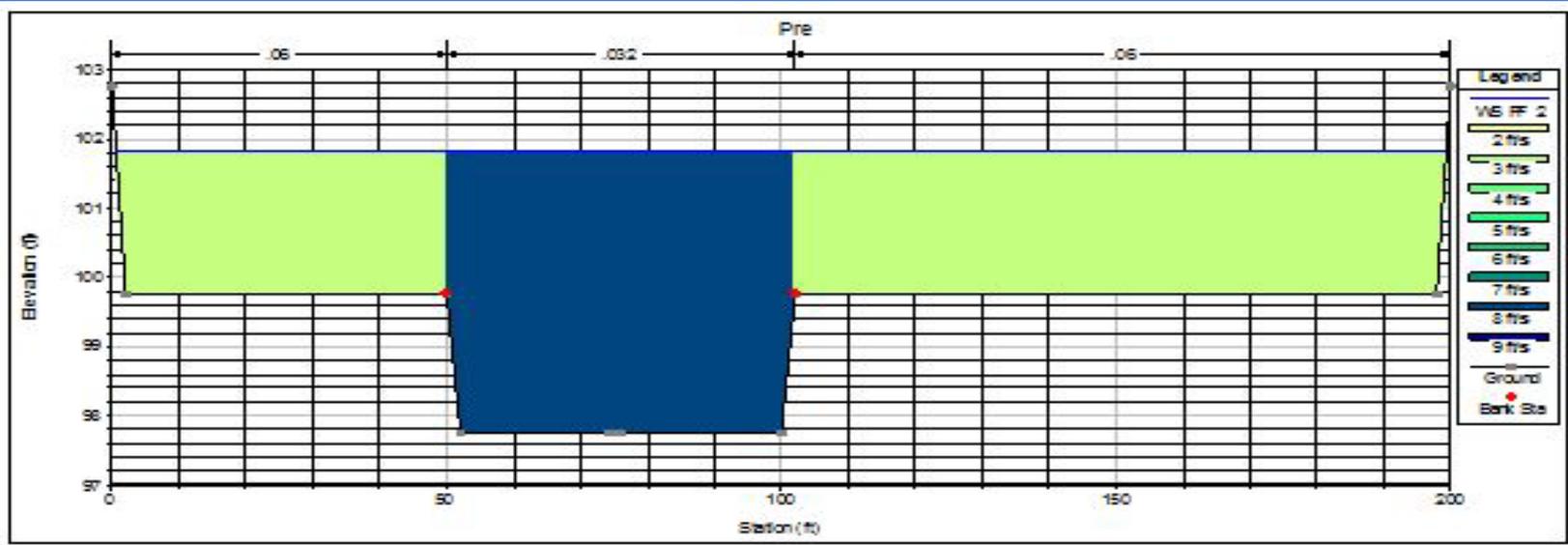


# HEC-RAS Model of Single Rock



Legend: — User entered XS — Non Geo-Ref user entered XS — Non Geo-Ref interpolated XS

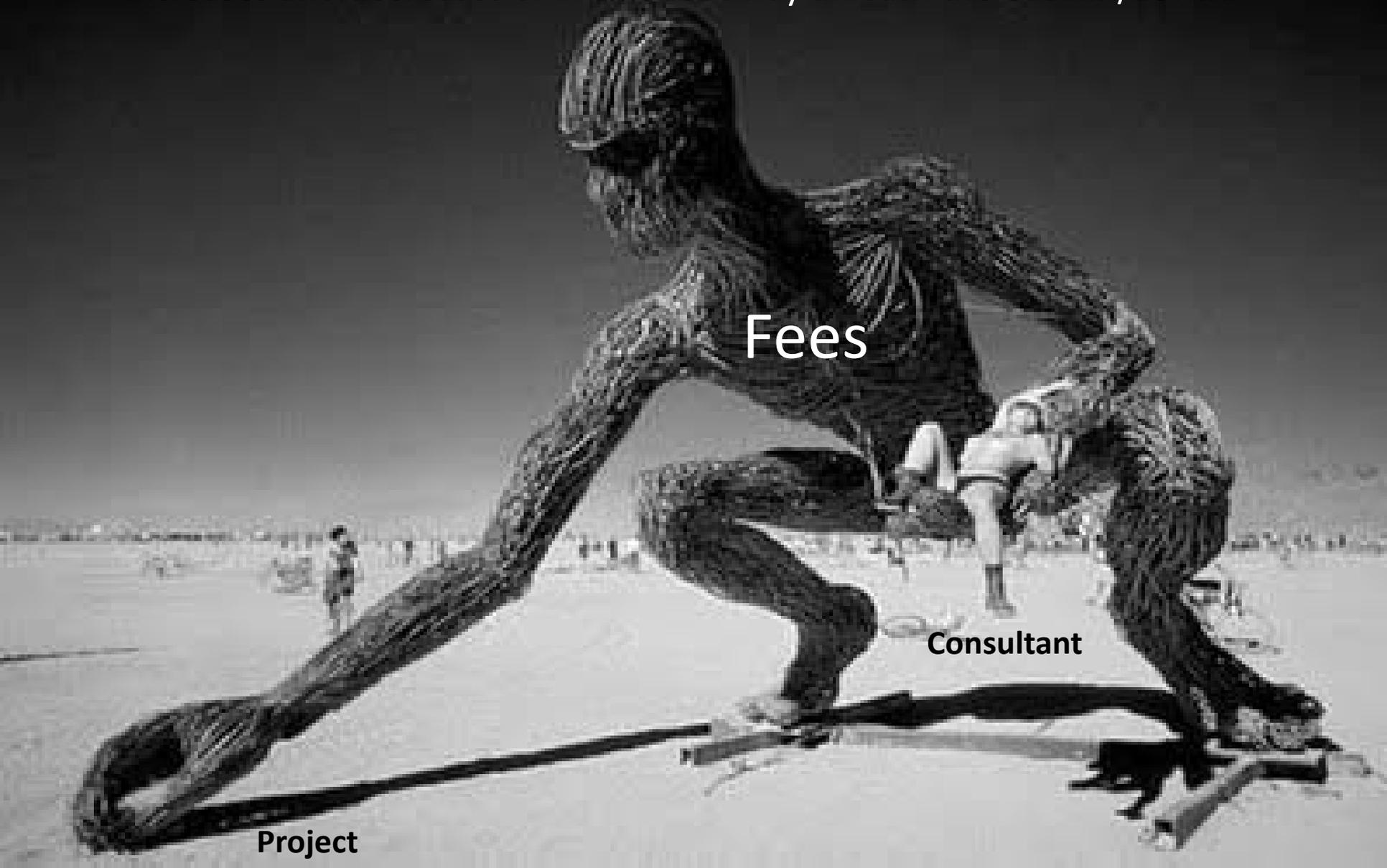
# Existing Conditions vs. Proposed Conditions



## Rise of 0.03 to 0.02 feet upstream of Rock For 100 Yr Flood

| Reach | River Sta | W.S. El. Pre | W.S. El. Post | Delta | Flow Area | Flow Area |
|-------|-----------|--------------|---------------|-------|-----------|-----------|
|       |           |              |               |       |           |           |
| c4    | 100       | 102.05       | 102.07        | 0.02  | 505.25    | 507.75    |
| c4    | 98.*      | 102.04       | 102.06        | 0.02  | 505.25    | 507.78    |
| c4    | 96.*      | 102.03       | 102.05        | 0.02  | 505.25    | 507.8     |
| c4    | 56.*      | 101.83       | 101.85        | 0.02  | 505.24    | 508.41    |
| c4    | 54.*      | 101.82       | 101.84        | 0.02  | 505.24    | 508.45    |
| c4    | 52.*      | 101.81       | 101.83        | 0.02  | 505.23    | 508.47    |
| c4    | 50.*      | 101.8        | 101.83        | 0.03  | 505.23    | 509.01    |
| c4    | 48.*      | 101.79       | 101.79        | 0     | 505.23    | 505.23    |
| c4    | 16.*      | 101.63       | 101.63        | 0     | 505.22    | 505.22    |
| c4    | 0         | 101.55       | 101.55        | 0     | 505.22    | 505.22    |

- Even minor cross section alterations result in altered BFE  $\leftrightarrow$  0.00 ft.
- Increases **and** decreases of BFE in floodway unleash the CLOMR/LOMR.



Tinker with Cross section

Tinker with n

Long fuzzy narrative

Channel "reshaping"

Natural

Variability



0.00 ft



0.00 ft

See Larry...no-rise!

# Closing Thoughts

**Uncertainty:** Effective and existing condition models are approximate. Your model is wrong, too.

**Tools:** Many problems are 2-D, not 1-D HEC-RAS

**Precision:** 0.00 ft exceeds significant digits of model

**Scale:** BFEs vs. project scale.

**Assumptions:** Published BFEs are static; reality is change and variability.

**Plea:** Reasonable expectations and professional judgment, minimize un-useful activities.

**Vision:** Improved floodplain management and stream function



# Perspective

“Master, how do I get to the other side of the river?”

“You **are** on the other side of the river.”