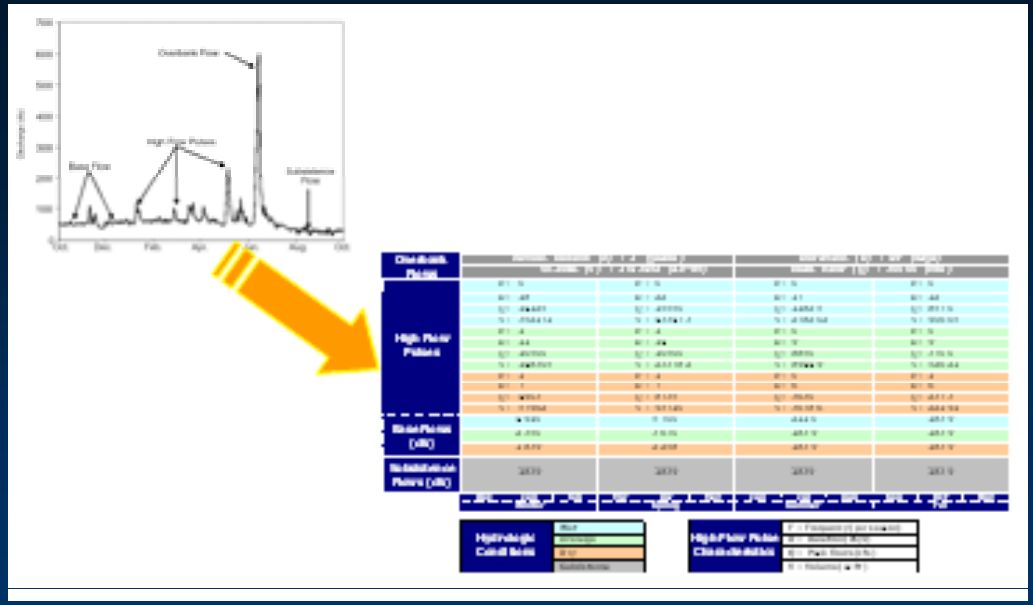
# ~ HEFR ~



# An Overview, with Emphasis on the Most Important Decision Points

Dan Opdyke

Presentation to SB3 Sabine-Neches BBEST

April 28, 2009

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# HEFR Basic Approach

(1) Select Flow Gage

↓

(2) Select Period of Record

↓

(3) Separate (parse) Hydrograph

↓

(4) Generate Statistical Summaries in HEFR .xla Excel add-in

- Uses hydrologic data
- Computations are rapid
- Populates a flow regime matrix

**A hydrological tool for an ecological purpose**

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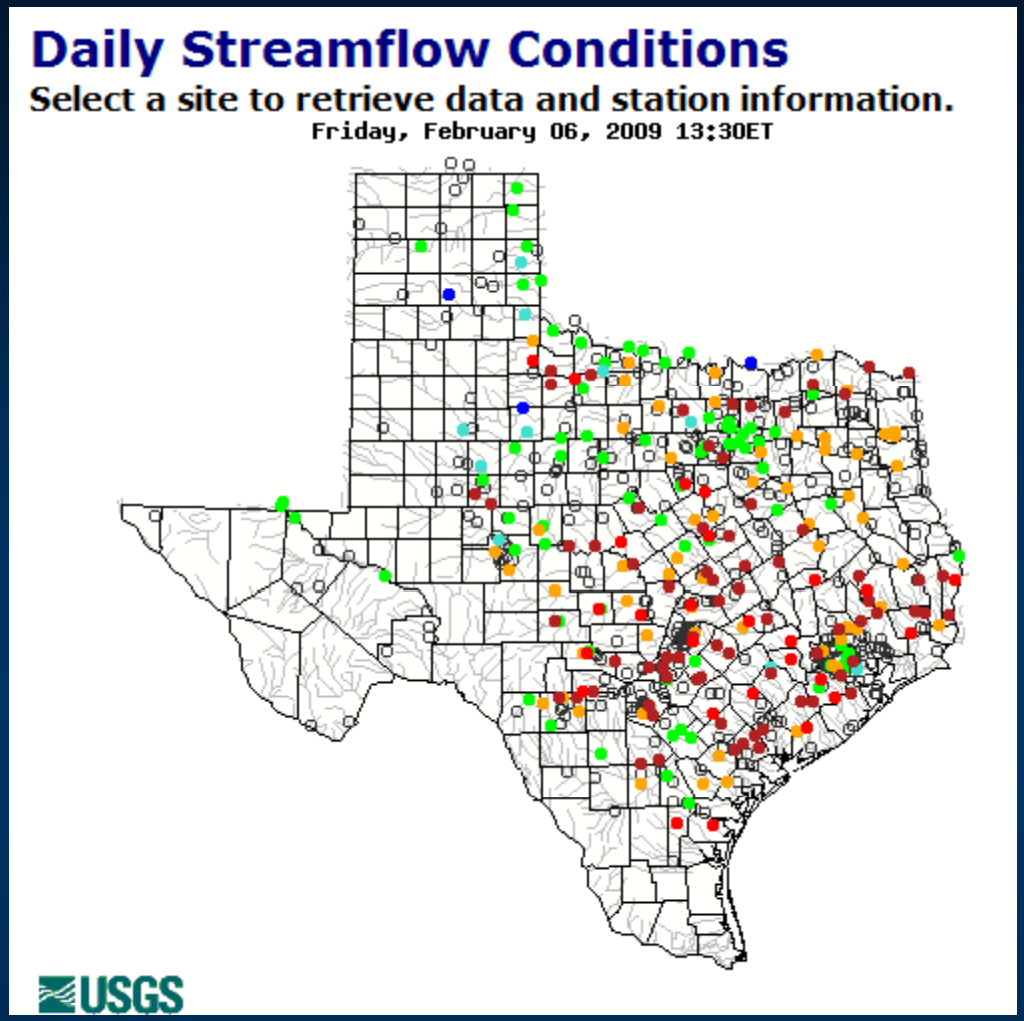
# (1) Select Flow Gage




http://waterdata.usgs.gov/tx/nwis/rt

- Many to choose from
- SAC released guidance
- BBEST subcommittee has recommended 12

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# (2) Select Period of Record

- May vary by gage
- Some discussion in Section 4 of Hydrologic Methods document
- Also LCRA-SAWS Water Project (Aquatic Habitat Final Report, pg 64)

# (3) Separate (Parse) Hydrograph

- Traditional Hydrographic (Baseflow) Separation Objective
  - Identify source of water (e.g., groundwater, surface runoff)
- SB3/HEFR *Ecological* Hydrographic Separation Objective
  - Identify flow components with desired ecological roles/benefits (§2.2 Hydro Methods Doc)
- Two Methodologies Available:

IHA/EFC MBFIT

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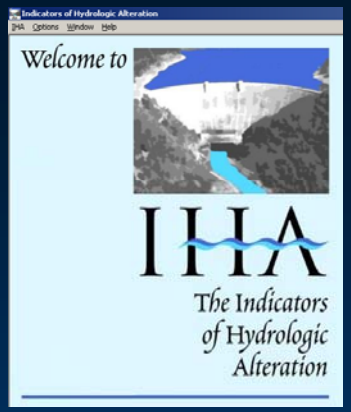


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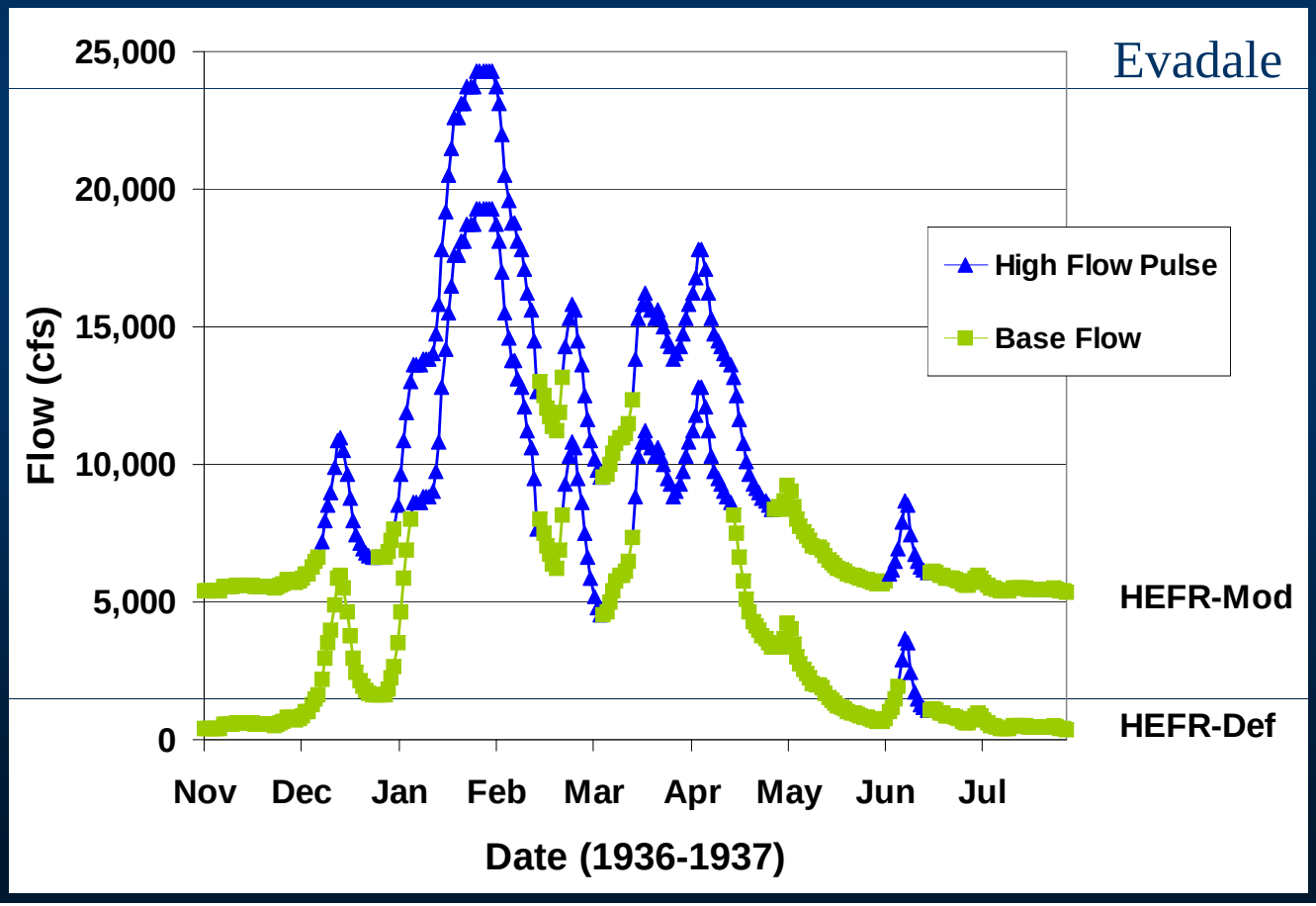
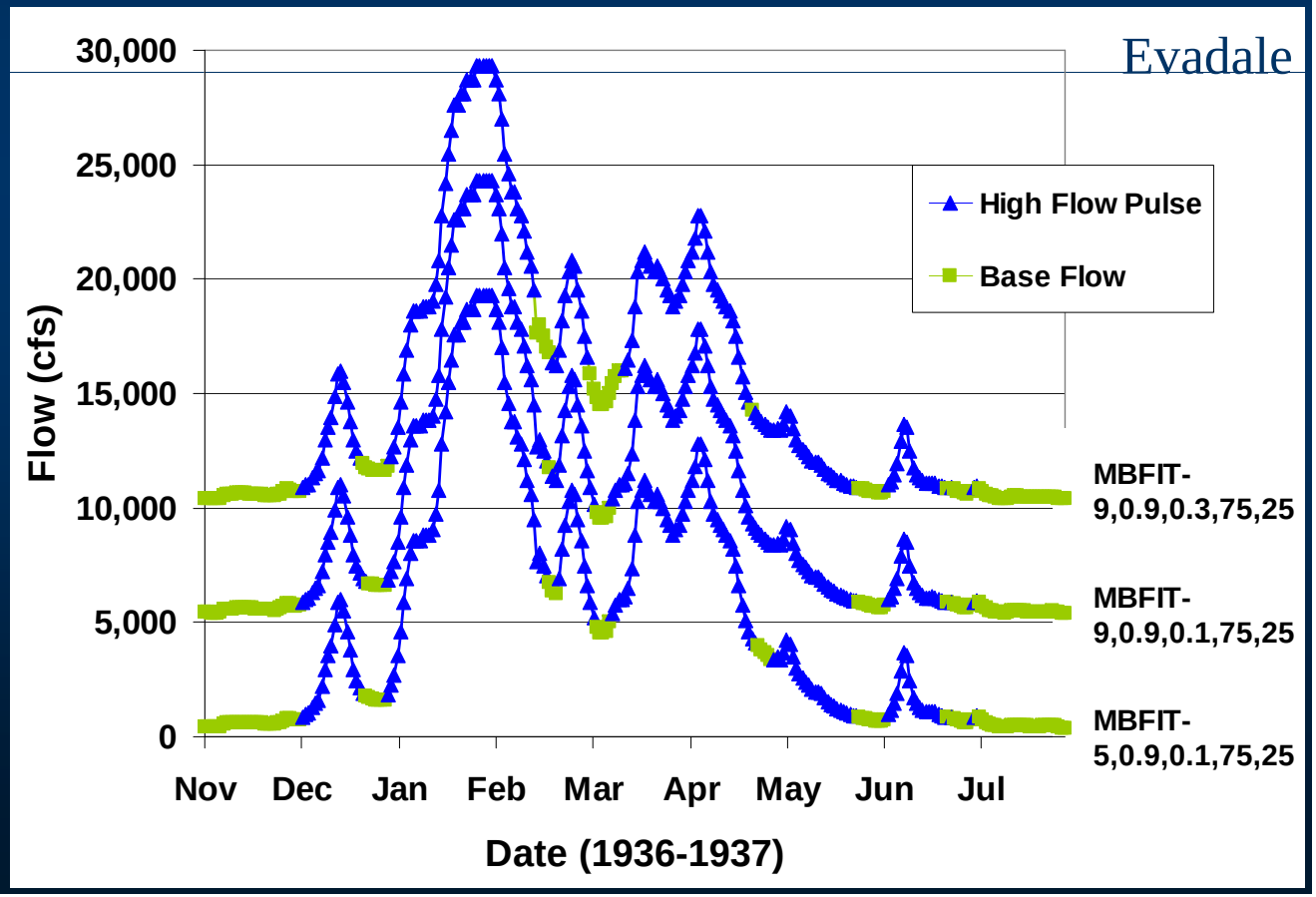
# IHA/EFC

- 7 parameters
- Decide what to look for

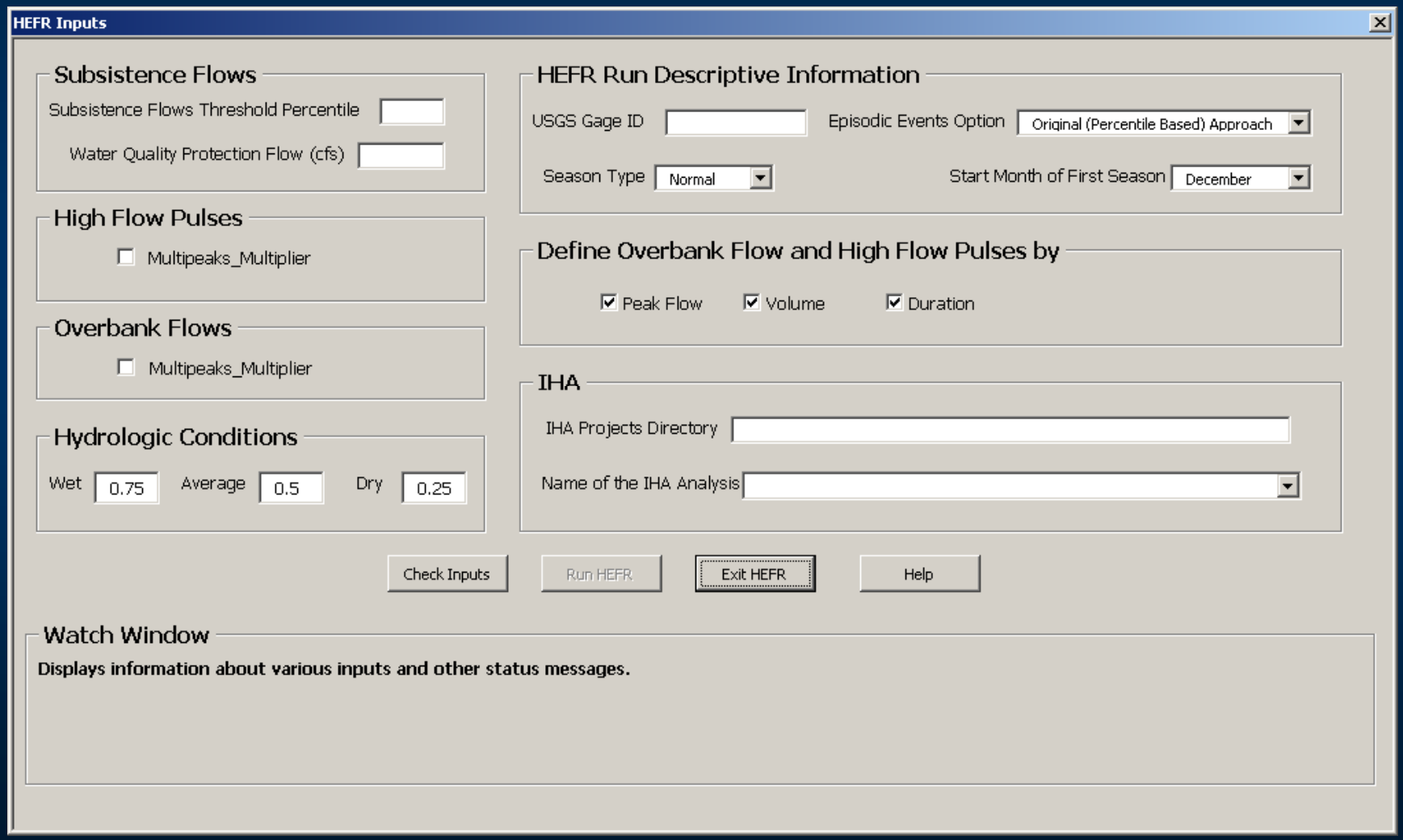


# MBFIT

- ***M***odified (George Ward) ***B***ase ***F***low ***I***ndex (US Bur Rec) with ***T***hreshold (Joe Trungale)
- 8 parameters

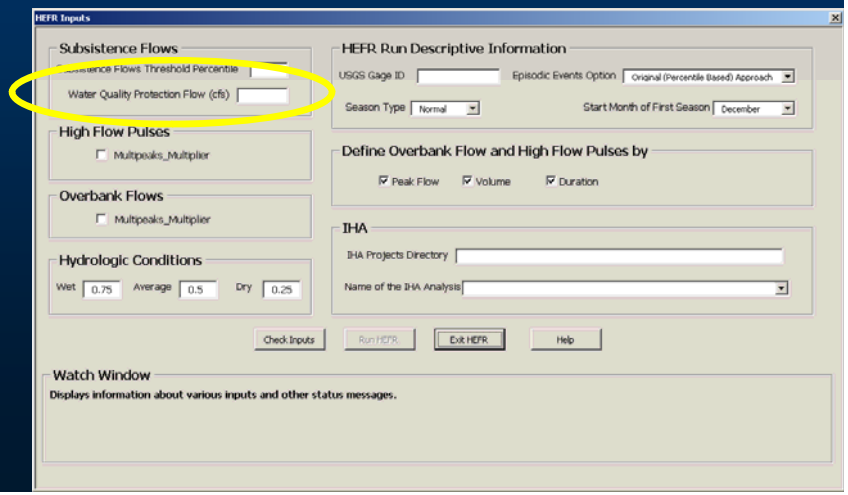


# (4) HEFR Screen Shot



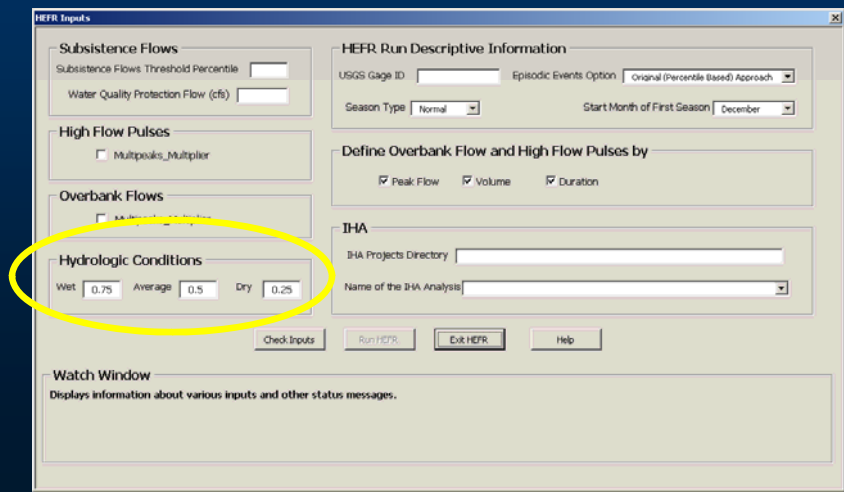
# Water Quality Protection Flow

- Minimum flow expected to protect water quality
- Default Suggestion: Published 7Q2, especially if assimilative capacity of reach is exhausted



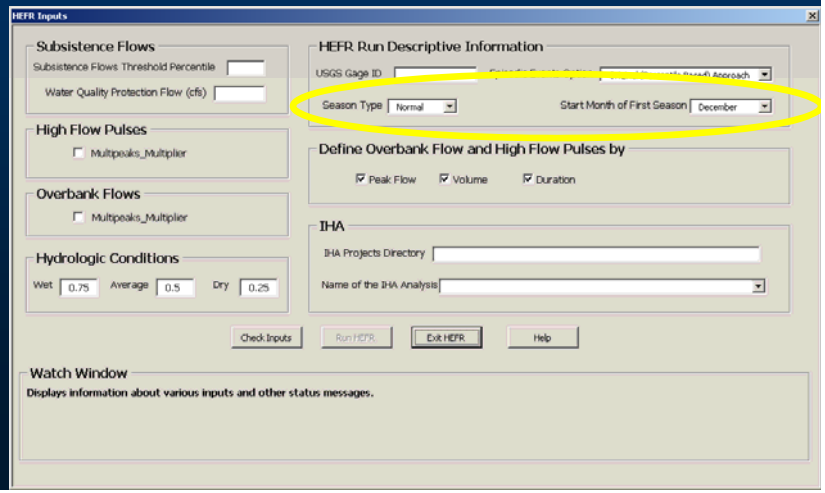
# Hydrologic Condition Percentiles

- Dry, Average, and Wet defaults: 25th, 50th, and 75th percentiles
- Should be in line with recommended frequency of occurrence



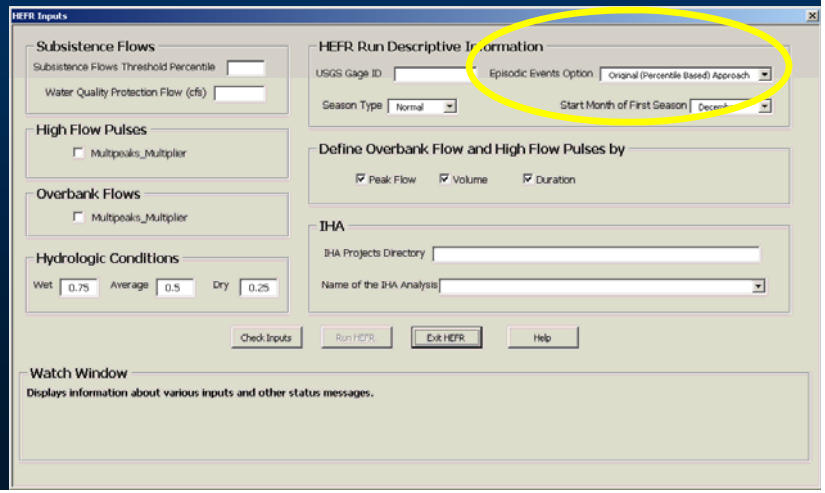
# Seasonality

- Number and length of seasons
  - Primarily based on biology, maybe water quality



# Episodic Events Option

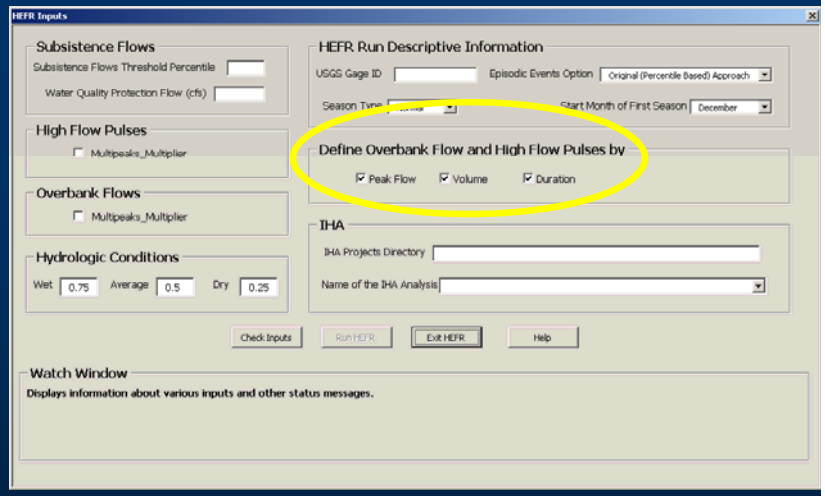
- Two Options
  - “Original (Percentile-Based) Approach”
  - “Alternate (Frequency-Based) Approach”



# Episodic Events

## "Original (Percentile-Based) Approach"

- Select characteristics to define qualifying HFPs and Overbanks (default is all three):
  - Peak Flow (cfs),
  - Volume (ac-ft), and/or
  - Duration (days)
  - Based on biology and geomorphology

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# Example Output

| Overbank Flows | Return Period (R) : 2.7 (years) | | Duration (D) : 49 (days) | |
|---|---|---|---|---|
| | Volume (V) : 1743452 (ac-ft) | | Peak Flow (Q) : 30000 (cfs) | |
| High Flow Pulses | F: 0 | F: 0 | F: 0 | F: 0 |
| | D: 18 | D: 22 | D: 17 | D: 12 |
| | Q: 14125 | Q: 15550 | Q: 11825 | Q: 8570 |
| | V: 352171 | V: 433473 | V: 278202 | V: 90605 |
| | F: 1 | F: 1 | F: 1 | F: 1 |
| | D: 11 | D: 14 | D: 9 | D: 9 |
| | Q: 10500 | Q: 10500 | Q: 8850 | Q: 3700 |
| | V: 148305 | V: 233782 | V: 89449 | V: 52621 |
| | F: 2 | F: 1 | F: 1 | F: 1 |
| | D: 7 | D: 7 | D: 6 | D: 6 |
| | Q: 4903 | Q: 8735 | Q: 3630 | Q: 2373 |
| | V: 57962 | V: 93710 | V: 36786 | V: 22191 |
| Base Flows (cfs) | 4910 | 5700 | 2110 | 1839 |
| | 2350 | 3670 | 1839 | 1839 |
| | 1839 | 2258 | 1839 | 1839 |
| Subsistence Flows (cfs) | 1839 | 1839 | 1839 | 1839 |
| | Dec, Jan, Feb | Mar, Apr, May | Jun, Jul, Aug | Sep, Oct, Nov |
| | Winter | Spring | Summer | Fall |

| Hydrologic Conditions | |
|---|---|
| | Wet (75th %ile) |
| | Average (50th %ile) |
| | Dry (25th %ile) |
| | Subsistence |

| High Flow Pulse Characteristics | |
|---|---|
| | F = Frequency (per season) |
| | D = Duration (days) |
| | Q = Peak Flows (cfs) |
| | V = Volume (ac-ft) |

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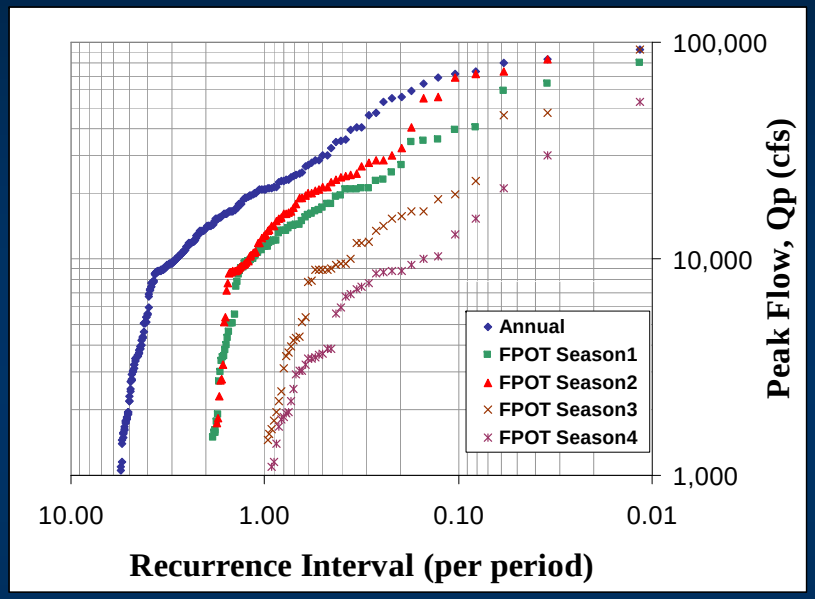
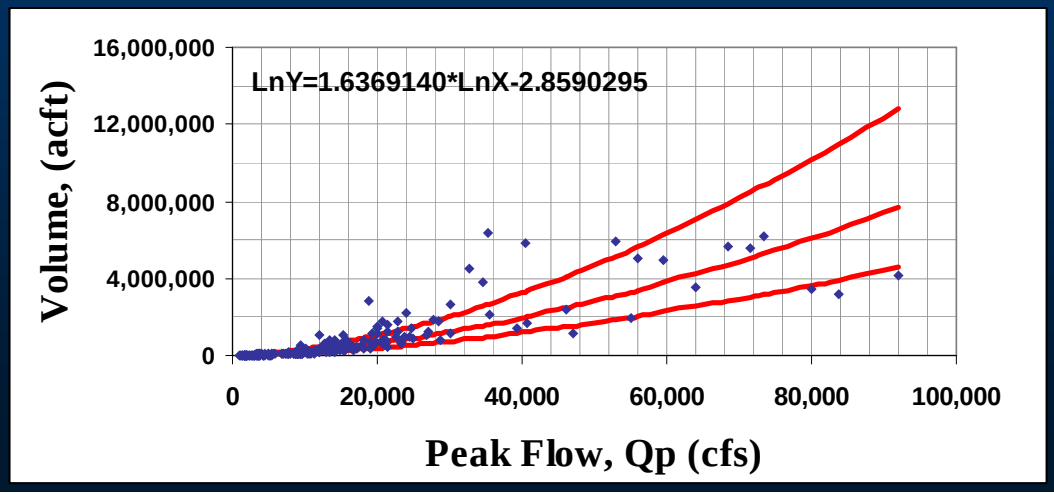
# Episodic Events

## "Alternate (Frequency-Based) Approach"

- Select flow levels and seasonality – based on biology and geomorphology
- HEFR provides regressions against volume and duration



# Example Output

| | | | | |
|---|---|---|---|---|
| Overbank Flows | Qp: 56,000 cfs of Recurring Frequency 1 per 5 years<br>Volumes is 2,849,465 to 4,136,063 (3,492,764)<br>Duration is 33 to 96 (57) | | | |
| High Flow Pulses | Qp: 30,000 cfs of Recurring Frequency 1 per 2 years<br>Volumes is 1,162,659 to 2,432,039 (1,797,349)<br>Duration is 21 to 59 (35) | | | |
| | Qp: 14,100 cfs of Recurring Frequency 2 per year<br>Volumes is 16,234 to 1,282,821 (649,527)<br>Duration is 11 to 33 (19) | | | |
| | Qp: 11,400 cfs of Recurring Frequency 1 per season<br>Volumes is #N/A to 1,120,857 (428,063)<br>Duration is 10 to 29 (17) | Qp: 12,800 cfs of Recurring Frequency 1 per season<br>Volumes is #N/A to 1,103,878 (478,316)<br>Duration is 10 to 30 (17) | | |
| Base Flows (cfs) | 4910 | 5700 | 2110 | 1839 |
| | 2350 | 3670 | 1839 | 1839 |
| | 1839 | 2258 | 1839 | 1839 |
| Subsistence Flows (cfs) | 1839 | 1839 | 1839 | 1839 |
| | Dec, Jan, Feb<br>Winter | Mar, Apr, May<br>Spring | Jun, Jul, Aug<br>Summer | Sep, Oct, Nov<br>Fall |

| Hydrologic Conditions | |
|---|---|
| | Wet (75th %ile) |
| | Average (50th %ile) |
| | Dry (25th %ile) |
| | Subsistence |

| High Flow Pulse Characteristics | |
|---|---|
| | F = Frequency (per season) |
| | D = Duration (days) |
| | Q = Peak Flows (cfs) |
| | V = Volume (ac-ft) |

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# Summary

- Flexibility = Decisions Required
- Need to keep ecological goals front and center
- Some decisions may be uniform across locations
  - BBEST should identify these and make decisions
  - Should include some site specific oversight to confirm that uniform decision is appropriate at each site
- Some decisions may vary by location
  - BBEST should identify these and establish decision process
- BBEST should establish a course of action for assessing draft HEFR outputs

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