

# A Framework for Identifying and Verifying Bankfull in Diverse Landscapes and Watershed Conditions

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# Many Assessment Methods Use Bankfull

- BLM's Assessment, Inventory and Monitoring Strategy (AIM)
- EPA's National Rivers & Stream Assessment (NRSA)
- EPA's Rapid Bioassessment Protocol (RBP)
- Stream Quantification Tool (SQT)
- Stream Function Assessment Method (SFAM)
- USGS's National Water-Quality Assessment Program

# Many Design Approaches Use or Refer to Bankfull

- Natural Channel Design (NCD)
- Low-Tech Process-Based Restoration of Riverscapes
- Let The Water Do The Work
- Analytical Approaches

NCD and Process-Based Approaches Use Bankfull in Some Way.

# Bankfull Challenges

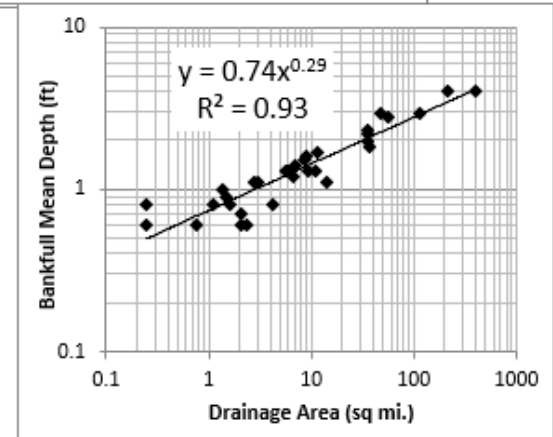
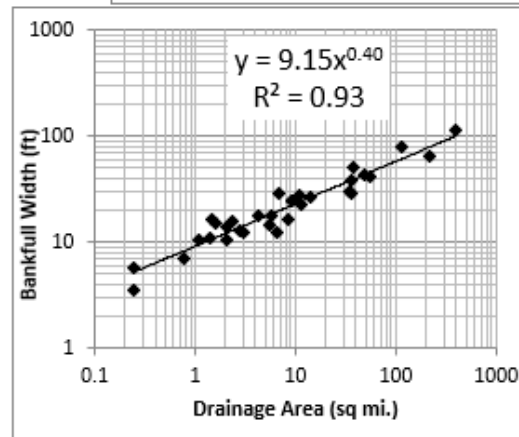
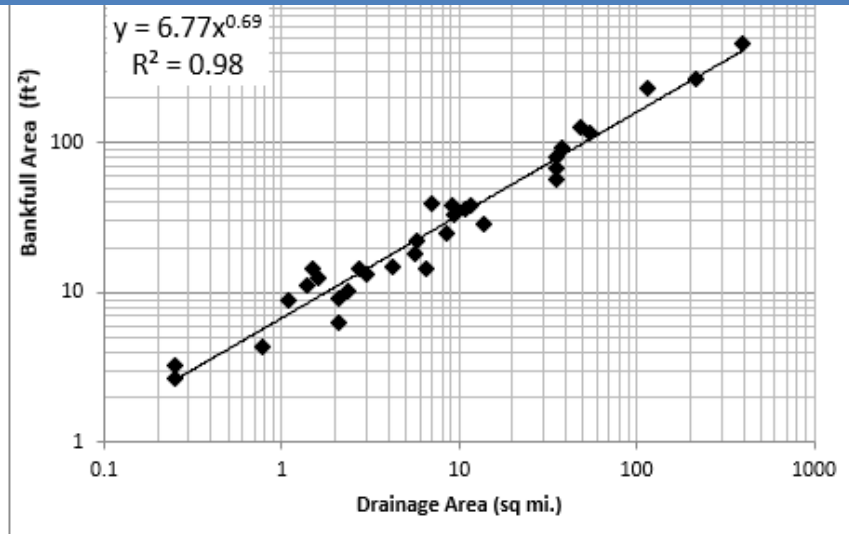
- Lack of experience identifying and verifying bankfull.
  - Leads to repeatability issues.
- Challenges in disturbed streams.
- Challenges in regulated watersheds.
- What about anastomosed and ephemeral channels?
- What if bankfull does not apply?

We have more tools than guidance

We simply say that regional curves can be used as an aid in finding bankfull.

<b>Physiographic Division:</b>	Intermontane Plateaus, Pacific Mountain System, Pacific Mountain	<b>Stream Types:</b>	Aa+, B3, B3a, B4a, B4c, C3b, C4, C4b,
<b>Physiographic Province:</b>	Western Alaska, Alaska-Aleutian, Northern Plateaus, Coastal Trough	<b>Sample size:</b>	32
<b>Physiographic Section:</b>	Alaska Range, Northern Foothills, Tanana-Kuskokwim Lowland, Yukon-Tanana Upland, Broad Pass Depression, Clearwater Mountains, Talkeetna Mountains		

### Bankfull Regional Curves



# Framework

- Phase 1: Watershed Assessment
- Phase 2: Regional Curve Acquisition, Review, and Creation
- Phase 3: Bankfull / Geomorphic Feature Identification
- Phase 4: Bankfull Verification

**Primary purpose is to improve the repeatability of assessment methods that use Bankfull!**

# Phase 1: Watershed Assessment

- Watershed Delineation and Drainage Area Calculation
- Precipitation / Runoff Relationships



# Phase 1: Watershed Assessment

- Hydrologic Alteration



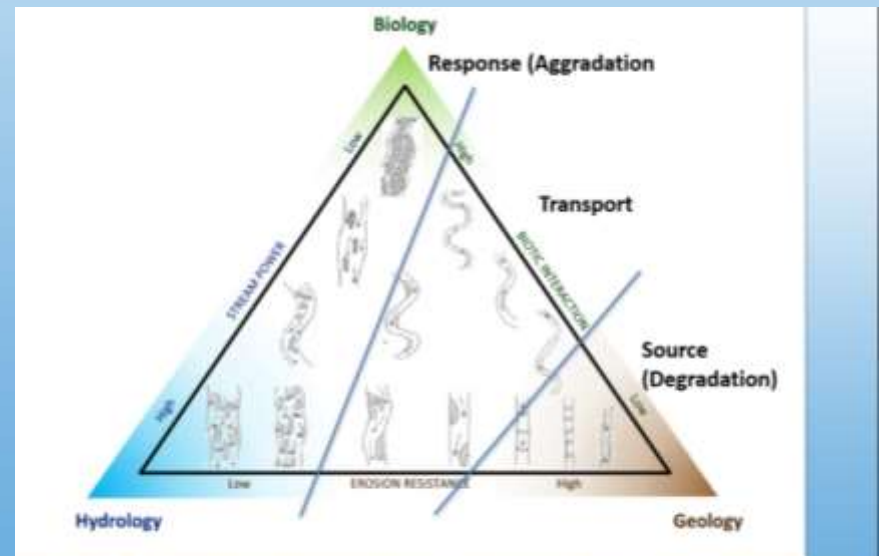


## Phase 2: Regional Curve Acquisition, Review, and Creation

- **Acquire** existing regional curves that apply to the project watershed.
- **Review** and verify that the curves are appropriate.
- **Create** watershed-specific regional curves as needed.
  - Critical in areas with flow regulation.

# What about Anastomosed Streams?

- Bankfull probably spans all channels.
- Need regional curves from anastomosed systems.
  - Response versus transport curves and single versus multi-thread.



# What About Tiny Ephemeral Channels?

- Bankfull ***might not*** apply to channels that were historically not channels.
  - Valley bottoms, swales.
  - Drain ditch (does not apply) versus channelized stream (does apply)



# What About Wetlands?

- Bankfull represents a break in channel-forming processes and floodplain processes.
- Bankfull does not apply to wetlands that do not have a channel.



# Key Regional Curve Points

- Take care to ensure that regional curves only include bankfull features and not inner berms and terraces.
  - Best if bankfull is top of bank.
- Separate curves for each hydro-physiographic region.
  - Also by Rosgen stream type and response/transport.
- Watershed-specific curves are often needed in areas with significant flow alteration and heterogeneity.

## Phase 3: Bankfull / Geomorphic Feature Identification

- Look for Geomorphic Indicators Throughout Reach
  - Inner Berm
  - Bankfull (Floodplain)
  - Terrace (Abandoned Floodplain)
- Measure the Bankfull Cross Sectional Area at a Representative Riffle

**Many of the assessment methods only include this phase, but without identifying multiple features.**





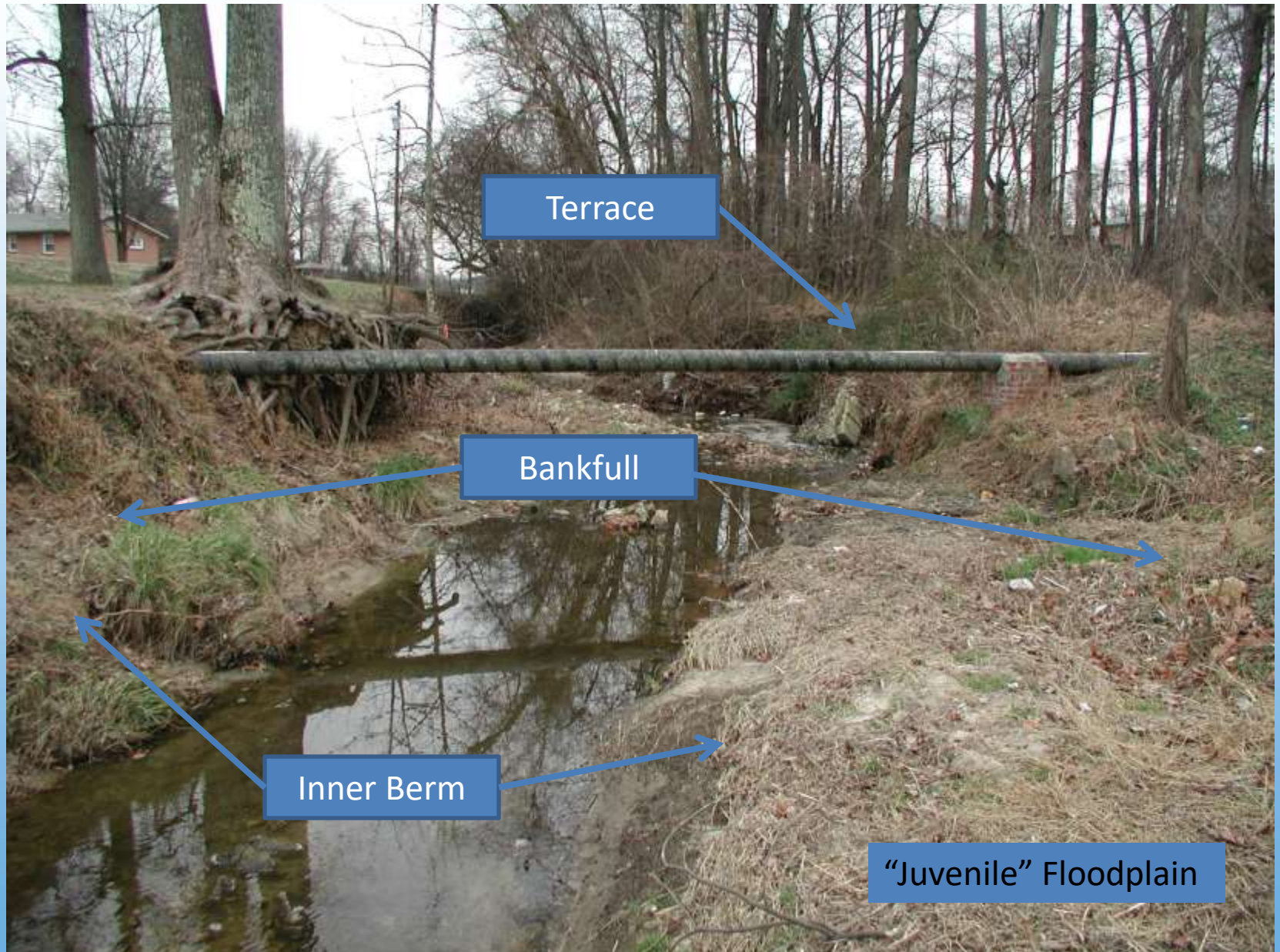




Terrace

Bankfull

Inner Berm





# Measure Cross Sectional Area

Also helpful to measure  
slope and bed material  
so  $Q_{bkf}$  can be  
estimated.

Rapid / Coarse

Detailed

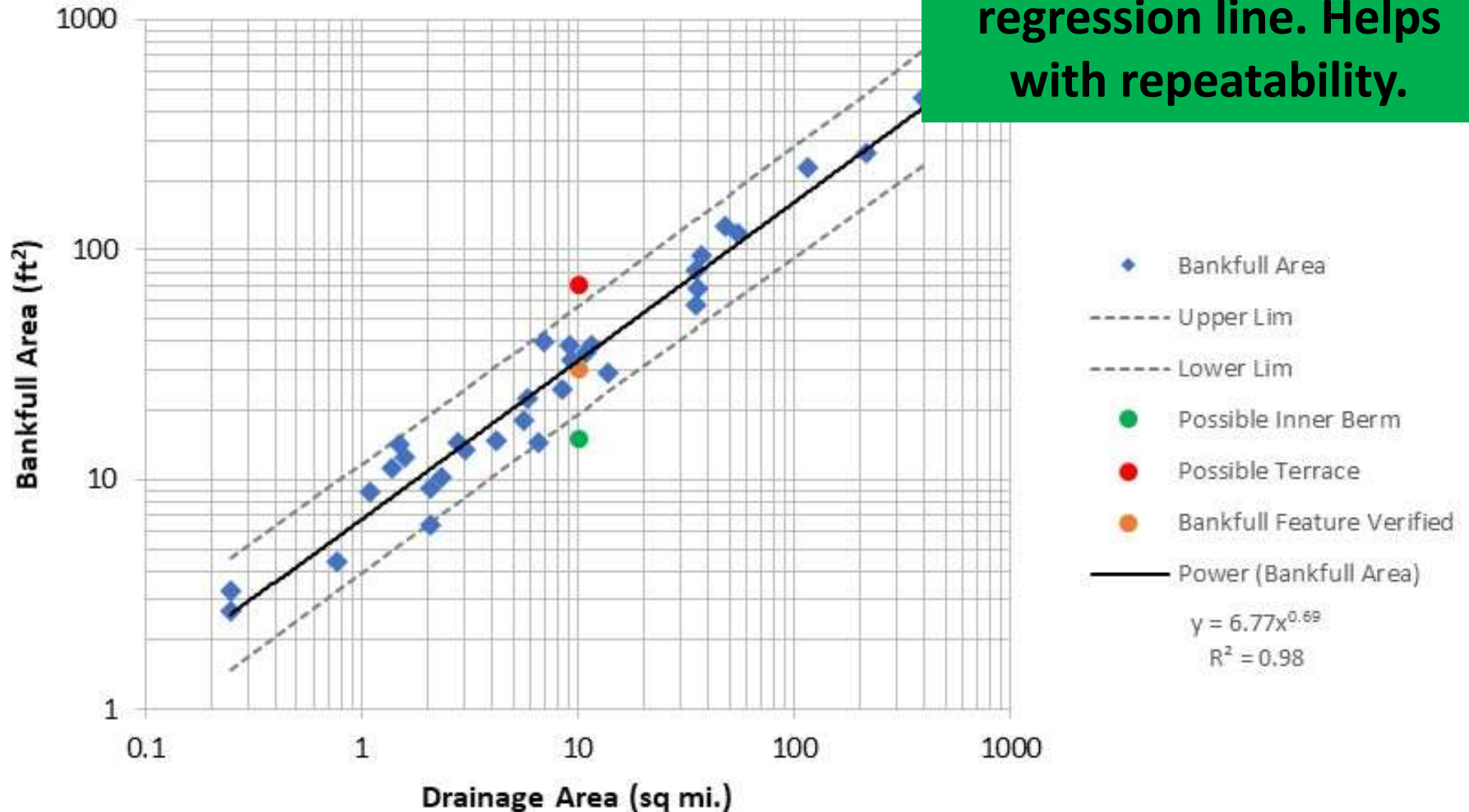


## Phase 4: Bankfull Verification

- Compare Cross Sectional Area to Regional Curve with Confidence Intervals.
- Below CI = Inner Berm
- Above CI = Terrace
- Between CI's = Bankfull



If more than one feature falls between the confidence limits, pick the one closest to the regression line. Helps with repeatability.

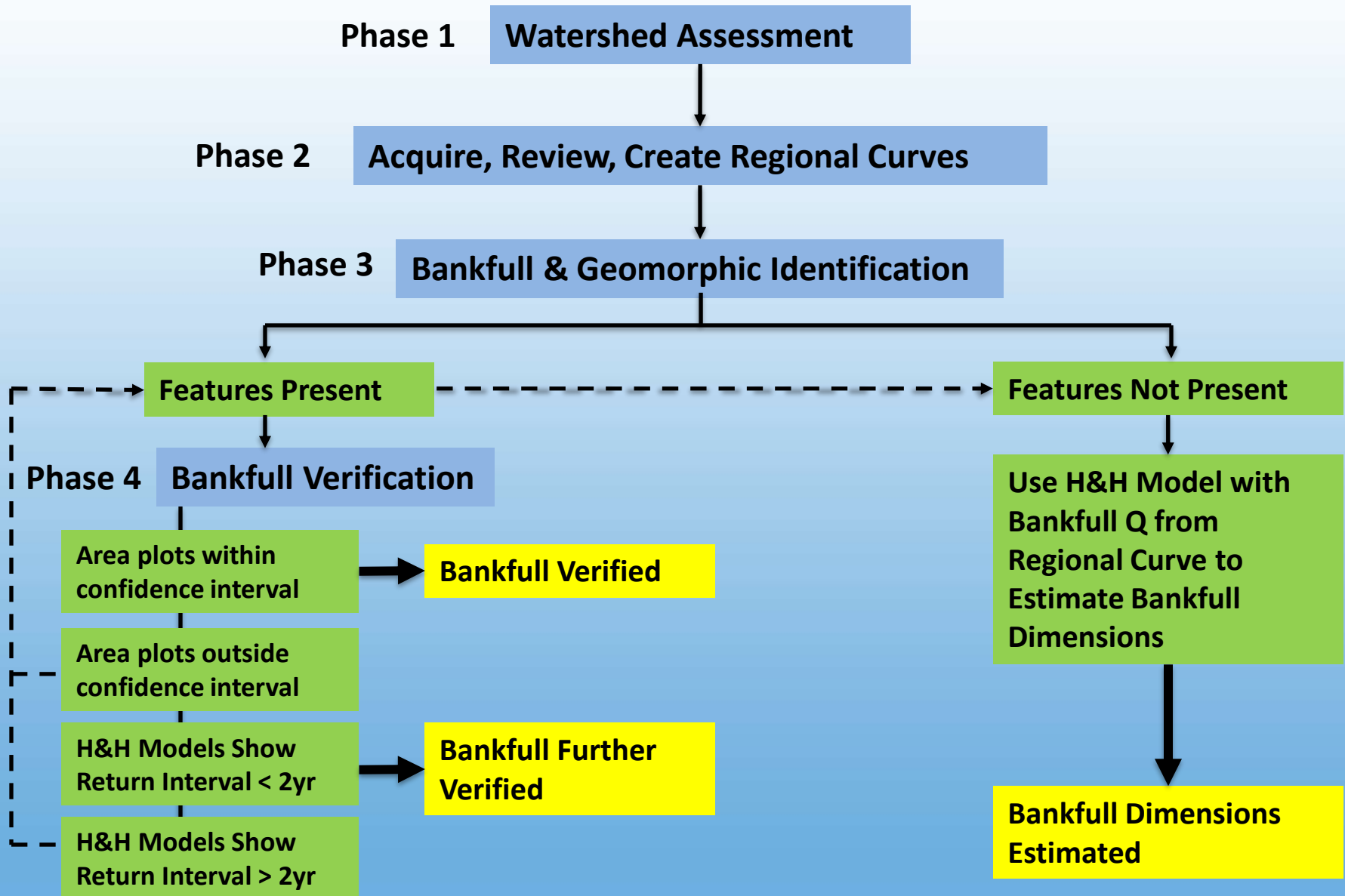


# Hydrology and Hydraulic Models can Play a Great Supporting Role

Use Hydrology and Hydraulic models to further  
verify the bankfull stage.

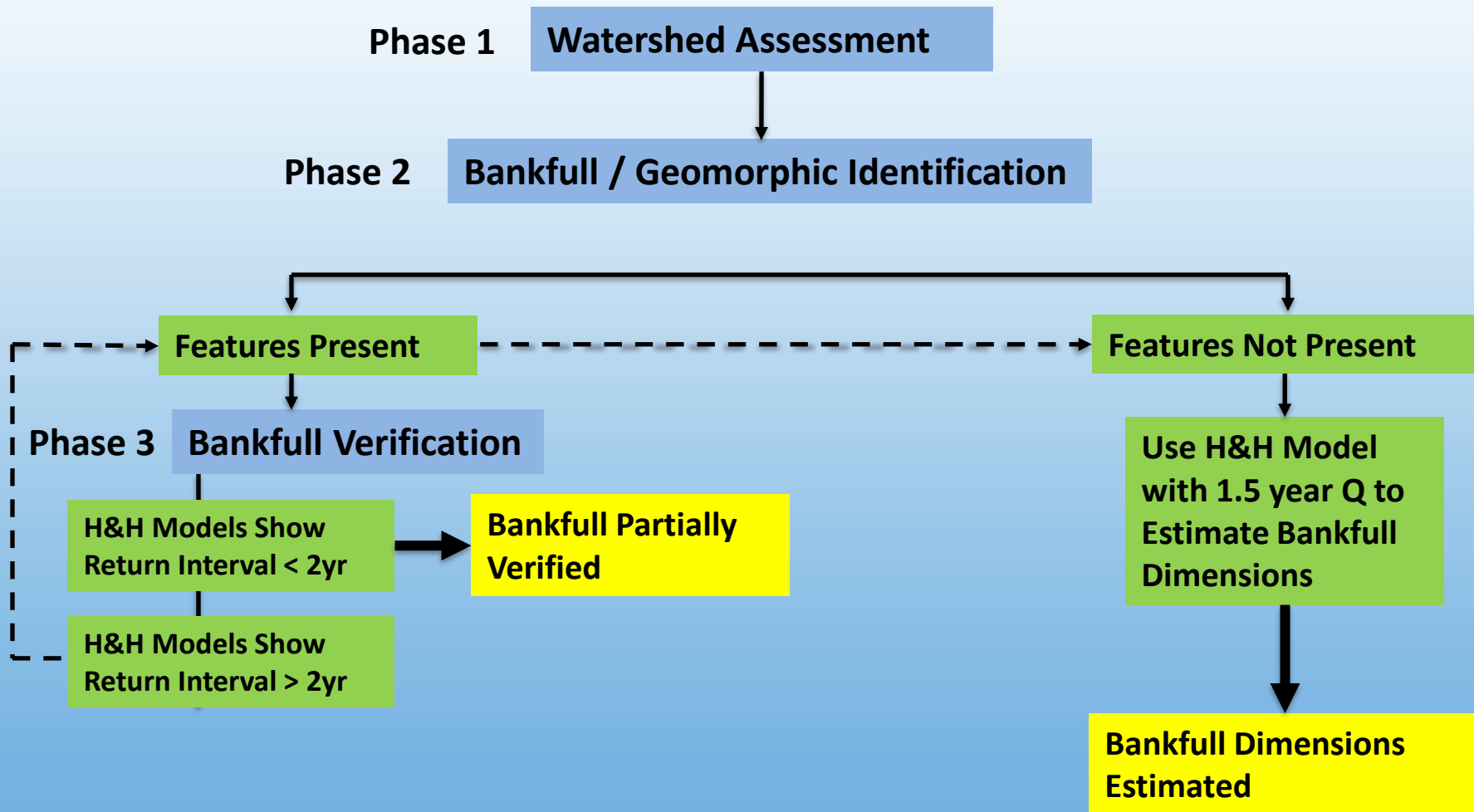


# Scenario 1: Regional Curves Can Be Acquired.





## Scenario 2: Regional Curves Cannot Be Acquired.



# Summary

If experienced people follow the process and use good regional curves, identifying bankfull is applicable and repeatable in most cases.