

DGLVR Webinar



Bankfull Technical Bulletin Update

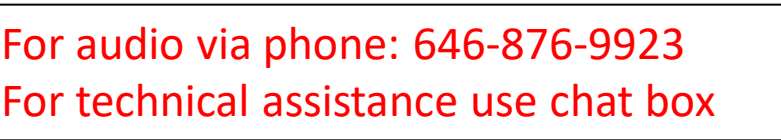
4/9/20

Starts at 9am

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Big Picture

- CDGRS/TU have started on a series of technical bulletins related to stream crossing replacements
- This webinar is the first in an eventual series of webinars debuting new technical bulletins

Big Picture

- **Bankfull Guidance**
- **Structure Selection**
- **Slope and Longitudinal Profile**
- **Grade Control**
- **Substrate / Bed Material**
- **DGLVR Grant App Procedure**
- **Contracting, engineering, cost estimates**
- **Design Requirements**
- **Construction Oversight**

Bankfull Technical Bulletin:

- Expands on existing 1-page guide
- Tries to clear up common misconceptions
- Provides more picture examples of streams, bankfull indicators, and more.
- Get final feedback

Special Thanks to Trout Unlimited for their work on the Bankfull Technical Bulletin and for many of the pictures and slides used in this webinar.



Bankfull flow sets stream characteristics:

- pool width and depth
- channel shape
- substrate size
- width-depth ratios

This is useful because it has hydrologic and morphologic significance which can be used for **crossing design and will ensure sediment and aquatic passage.**



Benefits of sizing structures for bankfull:

- ✓ Hydraulic capacity for the 100-year storm (Q100)
- ✓ Reduces flooding
- ✓ Minimize maintenance needs
- ✓ Maximize useful life of structure
- ✓ Passage of aquatic species
- ✓ Maintain channel processes
- ✓ Meets DGLVR policy

Bankfull Determination

- Because the bankfull flow does the greatest amount of work forming the channel, the bankfull stage is *identifiable in the field.*
- There is no single universal indicator. You must look for clues and the combination of clues identifies bankfull.





Bankfull Updates:

- Policy Overview
- Evaluation Form
- Updated Technical Bulletin

Stream Crossing Replacement Policy

Section 7.1 of the Administrative Manual



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Policy for replacing culverts and bridges applies to both D&G and LVR projects.

- Goal of the policy

- Limits replacements to areas where structure is causing problem with stream.
- Existing structures must be undersized and causing stream instabilities in relation to the bankfull width of the stream
- New structures must be sized to properly accommodate stream flow, bed load, and aquatic organisms (bankfull width)

When does the Stream Crossing Policy Apply?

- Applies to situations where streams, including intermittent channels, with identified bed and banks are flowing into the road or uphill ditch
- Contact the Commission for questionable circumstances
- In order for exemptions on “questionable stream” channels, Districts must obtain written approval from the Commission prior to contracting the project.

Use of Round Pipes

- Round pipes over 3 feet in diameter are **NOT** permitted to be funded for use in stream crossing replacements.

Existing Stream crossing structures with an opening of more than 13 ft² (equivalent to 48" diameter round pipe)

In order to be eligible for replacement, EXISTING structures must:

1. Have a structure to bankfull width ratio of 75% or less.
2. Show signs of streambank erosion.
3. Show signs of streambed erosion/aggradation.

Existing Stream crossing structures with an opening of more than 13 ft² (equivalent to 48" diameter round pipe)

In order to be eligible for replacement, EXISTING structures must:

1. Have a structure to bankfull width ratio of 75 % or less.
2. Show signs of streambank erosion.
3. Show signs of streambed erosion/aggradation.

The NEW REPLACEMENT structure must (*all four*):

1. Have a structure width at least equal to bankfull width (100% ratio).
2. Be properly aligned with the channel.
3. Consider additional floodplain connectivity when possible.
4. Be designed and constructed to accommodate the passage of aquatic organisms through the structure.

Existing Stream crossing structures with an opening **equal to or less** than 13 ft² (equivalent to 48" diameter round pipe) automatically qualify

~~In order to be eligible for replacement, EXISTING structures must:~~

- ~~1. Have a structure to bankfull width ratio of 75% or less.~~
- ~~2. Show signs of streambank erosion.~~
- ~~3. Show signs of streambed erosion/aggradation.~~

The NEW REPLACEMENT structure must (all four):

1. Have a structure width at least equal to bankfull width (100% ratio).
2. Be properly aligned with the channel.
3. Consider additional floodplain connectivity when possible.
4. Be designed and constructed to accommodate the passage of aquatic organisms through the structure.

Multiple pipes

- Existing stream crossings consisting of multiple pipes are eligible for replacement regardless of their relationship to the bankfull measurement (multiple pipes only, not multi-cell bridges)
- Installation of multiple pipe structures is NOT permitted with Program funds
- Must be replaced with a single opening structure of at least bankfull width.



Crossings that are not eligible for replacement

- Program funds can **NOT** be used to replace the structure. This includes any materials, equipment, labor, engineering / consulting, etc.
- Maintenance is not an eligible expense. Including lining of existing crossings, bridge deck repair, etc.
- Can do work on road and stream around existing structure.
 - Divert ditches from directly impacting the stream
 - Drainage and base improvements on the road around the structure
 - Streambank Stabilization
 - Headwalls or endwalls on existing structure

All necessary permits must be obtained before work can begin.

Remember:

All permit conditions must be followed appropriately. DGLVR Projects are not exempt from any permits conditions or DEP regulations.



Bankfull Updates:


- Policy Overview
- Evaluation Form
- Updated Technical Bulletin


PA Dirt Gravel and Low Volume Road Program—Stream Crossing Evaluation Form


Reviewer Information: Site Information


Date: _____
Reviewer: _____
Entity: _____


Existing Structure (circle):


round

oval

bottomless arch

box culvert

box bridge

multiple openings

Other : _____
(describe/draw)

County _____ Township _____
Road Owning Entity _____
Structure Owning Entity _____
Road Name _____
Stream Name _____
Latitude _____ N Longitude _____ W
Site notes: _____

Existing Conditions: quantitative assessment

required

Measuring Bankfull Channel Width: Since stream conditions vary, these guidelines are flexible, and the goal is to determine bankfull width of an unaltered "reference reach" of the stream. Look upstream if possible, trying to find an undisturbed "reference reach" of stream free from influences that may affect the width of the "area of influence" from the structure to be collected. Subsequent bankfull width measurements should be taken at a distance of at least 100 feet upstream and downstream of the structure to avoid channel obstruction.

Bankfull width _____ ft

A. Avg. Reference bankfull width _____ ft

If it is impossible to obtain reference bankfull widths upstream of the structure, downstream widths can be used if they are taken out of the structure influence area.

B. Existing structure width _____ ft

Width of structure at narrowest point.

C. Structure / Bankfull ratio _____ %

Structure width divided by average bankfull width. (Line B divided by line A)

Existing Conditions: qualitative assessment

D. Stream Bank Erosion	upstream	none	slight	moderate	high	severe
Erosion of banks immediately upstream and downstream of structure	downstream	none	slight	moderate	high	severe
E. Stream Bank Erosion						severe
Evidence of headcut or plunging						severe
F. Stream Bank Erosion						severe
Evidence of headcut or plunging						severe
G. Bank Armoring		unknown	none	intact	failing	

Eligibility for Crossing Structural Replacement with Program Funds

Is the existing structure eligible for replacement with program funds?
Note that for larger structures, the structure must be in good condition and have a minimum span of 10 feet.

For larger structures, the structure must be in good condition and have a minimum span of 10 feet.

Existing structure is in good condition and has a minimum span of 10 feet.

Show signs of streambank erosion. Is streambank erosion present (line D above): YES NO

Show signs of streambed erosion/aggradation. Is streambed erosion/aggradation present (line H&J above): YES NO

Is this stream crossing eligible for replacement with Program funds? YES NO

Note that ALL new structures paid for with Program funds are required to span the bankfull channel with a single opening.

PA Dirt Gravel and Low Volume Road Program—Stream Crossing Evaluation Form

Reviewer Information:

Site Information

Date: _____

County _____ Township _____

Reviewer: _____

Road Owning Entity _____

Entity: _____

Structure O _____


Road Name _____


Stream Name _____


Latitude _____ N Longitude _____ W


Site notes: _____


Existing Structure (circle):


round

oval

bottomless arch

box culvert

retaining bridge

multiple openings

Other: _____
(describe/draw)

Existing Conditions: quantitative assessment

Measuring Bankfull Channel Width: Since stream conditions vary, these guidelines are flexible, and the goal is to determine bankfull width of an unaltered "reference reach" of the stream. Look upstream if possible, trying to find an undisturbed "reference reach" of stream free from influences that are outside of the "area of influence" from the structure to be collected. Subsequent bankfull width measurements should be taken at the same location. Care to avoid channel obstructions.

required

Bankfull width _____ ft

A. Avg. Reference bankfull width _____ ft

if it is impossible to obtain reference bankfull widths upstream of the structure, downstream widths can be used if they are taken out of the structure influence area.

B. Existing structure width _____ ft

Width of structure at narrowest point.

C. Structure / Bankfull ratio _____ %

Structure width divided by average bankfull width. (Line B divided by line A)

Existing Conditions: qualitative assessment

D. Stream Bank Erosion	upstream	none	slight	moderate	high	severe
Erosion of banks immediately upstream and downstream of structure	downstream	none	slight	moderate	high	severe
E. Stream Bank Erosion						severe
Evidence of stream bank erosion						severe
F. Stream Bank Erosion						severe
Evidence of stream bank erosion						severe
G. Bank Armoring		unknown	none	intact	failing	

Eligibility for Crossing Structural Replacement with Program Funds

Is the existing structure ES-Eligible?

Note that for larger structures, existing stream bank erosion is stream bank erosion present (line D above):

Show signs of streambed erosion/aggradation. Is streambed erosion/aggradation present (line H&J above):

Is this stream crossing eligible for replacement with Program funds? YES NO

Note that ALL new structures paid for with Program funds are required to span the bankfull channel with a single opening.

PA Dirt Gravel and Low Volume Road Program—Stream Crossing Evaluation Form

Reviewer Information: Site Information

Date: _____

Reviewer: _____

Entity: _____

County _____ Township _____

Road Owning Entity _____

Structure Owning Entity _____

Road Name _____

Stream Name _____
"UNT" for unnamed tributary to

Latitude _____ N Longitude _____ W

Site notes: _____

Existing Structure (circle):



round



oval



bottomless
arch



box
culvert



footers &
bridge



multiple
openings

Other :
(describe/draw)

Existing Structure (circle):



round



oval



bottomless
arch



box
culvert



footers &
bridge



multiple
openings

Other :
(describe/draw)

PA Dirt Gravel and Low Volume Road Program—Stream Crossing Evaluation Form

Reviewer Information:

Site Information

Date: _____

County _____ Township _____


Reviewer: _____


Road Owning Entity _____


Entity: _____


Structure On _____


Existing Structure (circle):


round

oval

bottomless arch

box culvert

multiple bridge

multiple openings

Other: _____
(describe here)

Road Name _____

Stream Name _____
"UNT" for unnamed tributary to _____

Latitude _____ N Longitude _____ W

Site notes: _____

Existing Conditions: quantitative assessment

Measuring Bankfull Channel Width: Since stream conditions vary, these guidelines are flexible, and the goal is to determine bankfull width of an unaltered "reference reach" of the stream. Look upstream if possible, trying to find an undisturbed "reference reach" of stream free from influences that of influence" from the structure to be collected. Subsequent bank channel obstructions are required to avoid

Bankfull width _____ ft

A. Avg. Reference bankfull width _____ ft
If it is impossible to obtain reference bankfull widths upstream of the structure, downstream widths can be used if they are taken out of the structure influence area.

B. Existing structure width _____ ft
Width of structure at narrowest point.

C. Structure / Bankfull ratio _____ %
Structure width divided by average bankfull width. (Line B divided by line A)

Existing Conditions: qualitative assessment

D. Stream Bank Erosion	upstream	none	slight	moderate	high	severe
Erosion of banks immediately upstream and downstream of structure	downstream	none	slight	moderate	high	severe
E. Stream Bank Evidence of						severe
F. Stream Bank Evidence of						severe
G. Bank Armoring		unknown	none	intact	failing	

Eligibility for Crossing Structural Replacement with Program Funds

Is the existing structure eligible for replacement with program funds? _____%
Note that for larger structures, the structure must be replaced with a structure of equal or greater capacity.

For larger structures, the structure must be replaced with a structure of equal or greater capacity.

Existing structure is in good condition. _____%
Show signs of streambed erosion/aggradation. Is streambed erosion/aggradation present (line B above)?

Show signs of streambed erosion/aggradation. Is streambed erosion/aggradation present (line H&J above): YES NO

Is this stream crossing eligible for replacement with Program funds? YES NO

Note that ALL new structures paid for with Program funds are required to span the bankfull channel with a single opening.

Existing Conditions: quantitative assessment

required

Measuring Bankfull Channel Width: Since stream conditions vary, these guidelines are flexible, and the goal is to determine bankfull width of an unaltered “reference reach” of the stream. Look upstream if possible, trying to find an undisturbed “reference reach” of stream free from influences that may impact cross section (such as debris jams, floodplain obstructions, bedrock outcrops, etc.). In order to get out of the “area of influence” from the structure, roughly estimate the bankfull channel width, then go at least 5 times that distance away from the structure to begin taking bankfull measurements. Additional bankfull widths should be measured so that at least three (with 5 preferred) are collected. Subsequent bankfull width measurement should be collected at least 1/2 bankfull width away from the first measurement, taking care to avoid channel obstructions and bends. Additional bankfull determination guidance on reverse.

Bankfull width measurements: 1)_____ft 2)_____ft 3)_____ft 4)_____ft 5)_____ft

A. Avg. Reference bankfull width	_____ft	If it is impossible to obtain reference bankfull widths upstream of the structure, downstream widths can be used if they are taken out of the structure influence area.
B. Existing structure width	_____ft	Width of structure at narrowest point.
C. Structure / Bankfull ratio	_____%	Structure width divided by average bankfull width. (Line B divided by line A)

Existing Conditions: quantitative assessment

required

Measuring Bankfull Channel Width: Since stream conditions vary, these guidelines are flexible, and the goal is to determine bankfull width of an unaltered “reference reach” of the stream. Look upstream if possible, trying to find an undisturbed “reference reach” of stream free from influences that may impact cross section (such as debris jams, floodplain obstructions, bedrock outcrops, etc.). In order to get out of the “area of influence” from the structure, roughly estimate the bankfull channel width, then go at least 5 times that distance away from the structure to begin taking bankfull measurements. Additional bankfull widths should be measured so that at least three (with 5 preferred) are collected. Subsequent bankfull width measurement should be collected at least 1/2 bankfull width away from the first measurement, taking care to avoid channel obstructions and bends. Additional bankfull determination guidance on reverse.

Bankfull width measurements: 1) 18 ft 2) 19 ft 3) 19.5 ft 4) 17 ft 5) 16.5 ft

A. Avg. Reference bankfull width 18 ft If it is impossible to obtain reference bankfull widths upstream of the structure, downstream widths can be used if they are taken out of the structure influence area.

B. Existing structure width _____ ft Width of structure at narrowest point.

C. Structure / Bankfull ratio _____ % Structure width divided by average bankfull width. (Line B divided by line A)

Existing Conditions: quantitative assessment

required

Measuring Bankfull Channel Width: Since stream conditions vary, these guidelines are flexible, and the goal is to determine bankfull width of an unaltered “reference reach” of the stream. Look upstream if possible, trying to find an undisturbed “reference reach” of stream free from influences that may impact cross section (such as debris jams, floodplain obstructions, bedrock outcrops, etc.). In order to get out of the “area of influence” from the structure, roughly estimate the bankfull channel width, then go at least 5 times that distance away from the structure to begin taking bankfull measurements. Additional bankfull widths should be measured so that at least three (with 5 preferred) are collected. Subsequent bankfull width measurement should be collected at least 1/2 bankfull width away from the first measurement, taking care to avoid channel obstructions and bends. Additional bankfull determination guidance on reverse.

Bankfull width measurements: 1) 18 ft 2) 19 ft 3) 19.5 ft 4) 17 ft 5) 16.5 ft

A. Avg. Reference bankfull width	<u>18</u> ft	If it is impossible to obtain reference bankfull widths upstream of the structure, downstream widths can be used if they are taken out of the structure influence area.
B. Existing structure width	<u>6</u> ft	Width of structure at narrowest point.
C. Structure / Bankfull ratio	<u>33</u> %	Structure width divided by average bankfull width. (Line B divided by line A)

PA Dirt Gravel and Low Volume Road Program—Stream Crossing Evaluation Form


County _____ Township _____


State _____


Reviewer _____


Entity _____


Existing Structure (circle):



round


oval


bottomless arch


box culvert


bottomless bridge


multiple openings

Other: _____
(describe/draw)

Site Information

County _____ Township _____

Road Owner _____

Structure Owner _____

Road Name _____

Stream Name _____ *"UNT" for unnamed tributary to _____

Latitude _____ N Longitude _____ W

Site notes: _____

Existing Conditions: quantitative assessment

Measuring Bankfull Channel Width: Since stream conditions vary, these guidelines are flexible, and the goal is to determine bankfull width of an unaltered "reference" stream channel free from any structure influence that may be present. The "reference" channel should be free from any structure influence that may be present. The "reference" channel should be free from any structure influence that may be present. The "reference" channel should be free from any structure influence that may be present.

Site Evaluation: width considerations

Bankfull width _____ ft

A. Avg. Reference bankfull width _____ ft If it is impossible to obtain reference bankfull widths upstream of the structure, downstream widths can be used if they are taken out of the structure influence area.

B. Existing structure width _____ ft Width of structure at narrowest point.

C. Structure / Bankfull ratio _____ % Structure width divided by average bankfull width. (Line B divided by line A)

Existing Conditions: qualitative assessment

D. Stream Bank Erosion	upstream	none	slight	moderate	high	severe
Erosion of banks immediately upstream and downstream of structure						severe
E. Stream Bank Erosion						severe
Evidence of streambank erosion/plunging						severe
F. Stream Bank Erosion						severe
Evidence of gravel bar formation downstream		none	slight	moderate	high	severe
G. Bank Armoring		unknown	none	intact	failing	

Site Evaluation: erosion considerations

Eligibility for Crossing Structural Replacement with Program Funds

Is the existing structure eligible for replacement with program funds? **YES** **NO**

Note that for larger structures, the existing structure to be replaced must be a "single opening" structure.

Is this stream crossing eligible for replacement with Program funds? **YES** **NO**

Note that ALL new structures paid for with Program funds are required to span the bankfull channel with a single opening.

ES-Eligible **YES** **NO**

are. **YES** **NO**

Existing Conditions: qualitative assessment

D. Stream Bank Erosion Erosion of banks immediately upstream and downstream of structure	upstream	none	slight	moderate	high	severe
	downstream	none	slight	moderate	high	severe
E. Stream Bed Erosion Evidence of head-cutting at inlet or plunge pool scour at outlet	upstream	none	slight	moderate	high	severe
	downstream	none	slight	moderate	high	severe
F. Stream Bed Deposition Evidence of gavel bar formation	upstream	none	slight	moderate	high	severe
	downstream	none	slight	moderate	high	severe
G. Bank Armoring		unknown	none	intact	failing	

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Existing Conditions: qualitative assessment

D. Stream Bank Erosion Erosion of banks immediately upstream and downstream of structure	upstream	none	slight	moderate	high	severe
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E. Stream Bed Erosion Evidence of head-cutting at inlet or plunge pool scour at outlet	upstream	none	slight	moderate	high	severe
	downstream	none	slight	moderate	high	severe
F. Stream Bed Deposition Evidence of gavel bar formation	upstream	none	slight	moderate	high	severe
	downstream	none	slight	moderate	high	severe
G. Bank Armoring		unknown	none	intact	failing	

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Eligibility for Crossing Structural Replacement with Program Funds

Is the existing structure opening equal to or less than 13 square feet (equivalent to a 48" diameter round pipe). **NO-see below** YES-Eligible

Note that multiple-pipes are automatically eligible for replacement, but must be replaced with a single bankfull-width structure.

For larger structures, all three criteria below must be met in order to be eligible for replacement with Program funds:

Existing structure to bankfull width ratio of 75% or less. What is the existing structure to bankfull ratio (line C above): **33** %

Show signs of streambank erosion. Is stream bank erosion present (line D above): **YES** NO

Show signs of streambed erosion/aggradation. Is streambed erosion/aggradation present (line H&J above): **YES** NO

Is this stream crossing eligible for replacement with Program funds? **YES** NO

Note that ALL new structures paid for with Program funds are required to span the bankfull channel with a single opening.

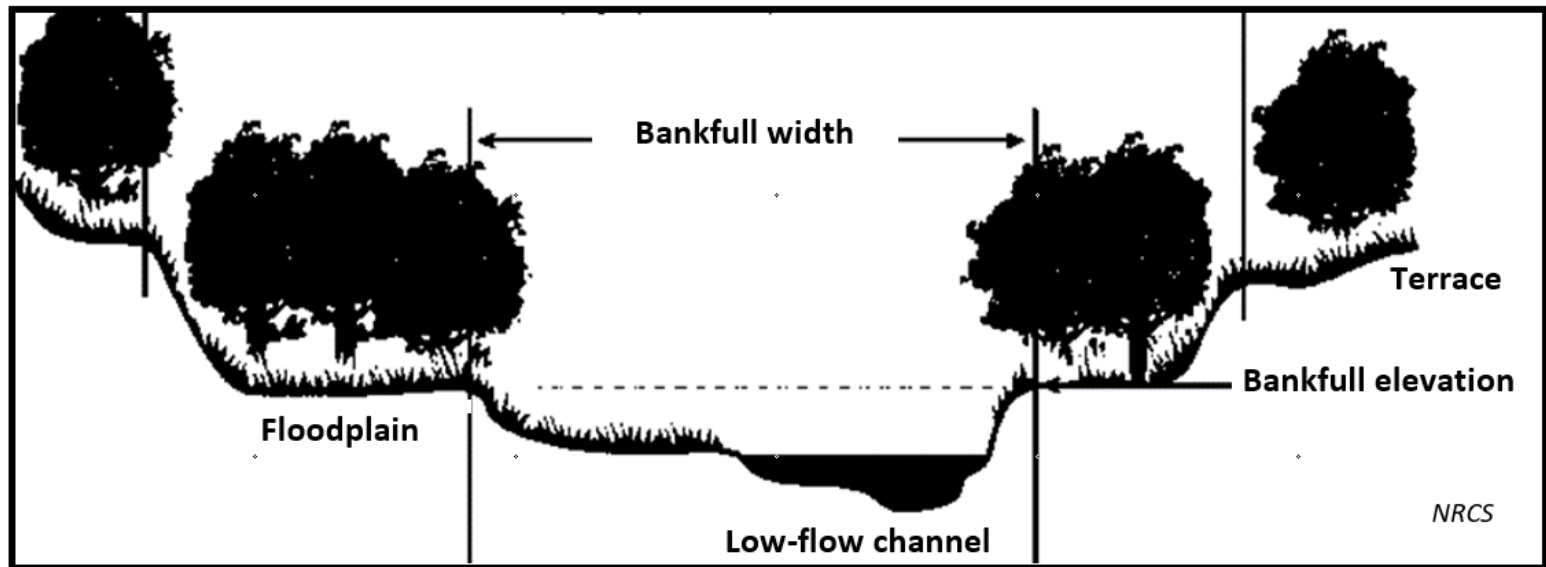


Bankfull Updates:

- Policy Overview
- Evaluation Form
- Updated Technical Bulletin

Updated Bankfull guidance to assist in completion of the Stream Crossing Replacement Evaluation

Bankfull Width – The average width of the channel at the bankfull elevation.



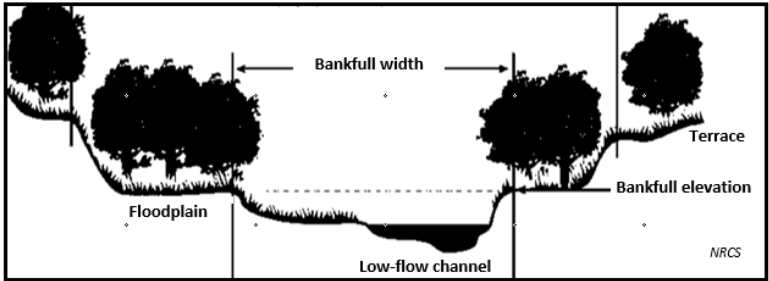
Guidance in Determining Bankfull Stream Width in Pennsylvania

Bankfull Flow (stage or elevation):

This flow stage is determined by the elevation point at which the stream accesses the floodplain. This point is typically indicated by deposits of sand or silt, a break in stream bank slope, perennial vegetation limit, rock discoloration, and/or a change in stream bank composition. Bankfull flow is also known as the channel-forming discharge, which is the discharge that occurs most frequently over time and is the most effective in shaping and maintaining the natural channel. Bankfull flow roughly corresponds to a 1.5-2 year recurrence interval.

Bankfull Definition

Bankfull Width – The average width of the channel at the bankfull elevation.



Finding the Natural Channel of a Stream:

Because stream channels are often altered by human activity, it is important to find the natural channel. To find an area of natural channel, sometimes measurements are taken at various points along the stream that are unnatural. The measurement of the natural channel is important for determining the bankfull width.

Finding the Measurement Location

Procedure for Determining Bankfull Width Near a Road / Stream Crossing Structure:

Location: Start at a location away from the influence of any culvert or bridge, since they often impact channel width. To do this, roughly estimate bankfull channel width, then go at least 5 times that distance away from the structure. Looking upstream is preferred, but downstream reaches can be used if necessary (see locations to avoid below).

Procedure for determining Bankfull

Determine Bankfull: To determine the bankfull width, first determine the bankfull stage. Once the bankfull stage is determined, then work down the stream to find the best bankfull indicators and measure the bankfull width. Stand at your bankfull mark(s), noting that the tape should be level, to measure the bankfull channel width. Continue moving upstream or downstream, taking successive measurements that are at least 1/2 bankfull width apart (for example, if the first bankfull measurement is 16 feet, move at least 8 feet away before taking another measurement). Collect at least 5 measurements and average them together. More than 5 bankfull measurements can be used to obtain a better average if needed. This is only a general guide, note the "locations to avoid" section that follows.

Be flexible and think logically in choosing the best indicators for your bankfull measurement locations.

Field Indicators of Bankfull Flow: (listed in order from most to least reliable indicators)

1. **Change in Bank Slope:** Bankfull flows are often associated with "benches" or the top of the stream bank, unless the stream is entrenched or has been altered in the past.
2. **Depositional Features:** The mid-channel bars are often indicators of the bankfull flow elevation. Use benches on each bank at the same elevation.
3. **Changes in Particle Size:** Accessing their floodplain. A Change in particle size along a stream bank indicates bankfull elevation.
4. **Vegetation Changes:** Although not as reliable, changes in vegetation can indicate bankfull elevation.
5. **Scour Features:** Erosion and scour lines can be used if other features cannot be located.

Bankfull Indicators



Locations to Avoid in Determining Bankfull Flow: (if possible)

Logjams or Fallen Trees: These structures tend to increase the bankfull width in their immediate vicinity.

Manmade Impacts: Avoid locations with the influence of man-made impacts on the stream width.

Bedrock Outcrops: These can narrow the channel and affect the bankfull width.

Braided Channels: These channels are difficult to measure and should be avoided if possible.

Tributaries/Springs: Measure bankfull between road crossing and any incoming flows that may increase width.

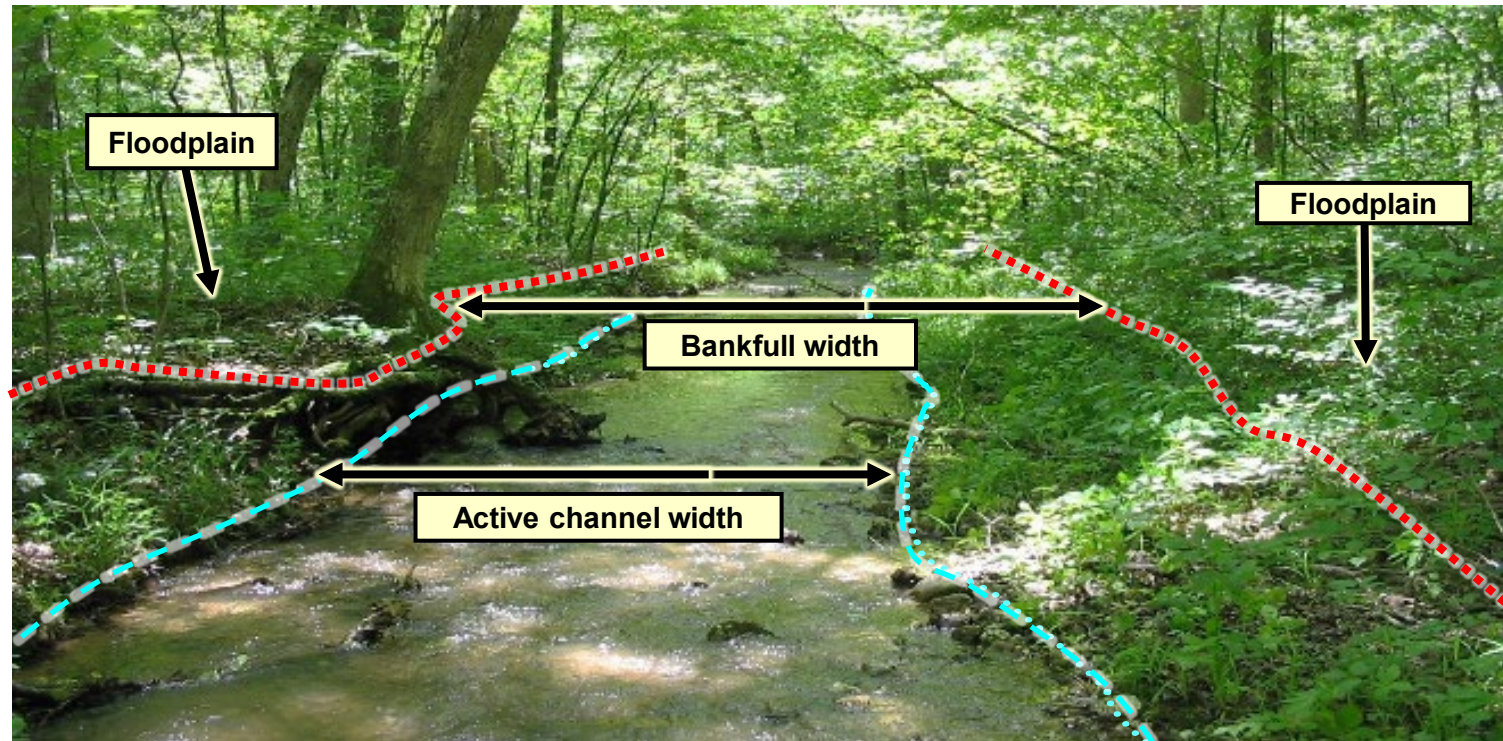
Hard Meander bends: Hard bends make it difficult to find good indicators since the stream is moving laterally.

Locations to Avoid

Additional Bankfull Determination Tips:

- Bankfull flows will be level across the channel, so make sure your tape is level when measuring bankfull widths. If you find strong indicators on one bank but not the other, you can stretch your tape level across the stream to get your width.
- When looking for indicators, consider the stream's history. Does it make sense that the points you are looking at are indicators?
- On entrenched channels (or channels with significant man-made impacts), bankfull elevation is often below the elevation of the "top of stream bank" due to many years of man-made impacts.
- Note that tree roots and other vegetation can exist below the bankfull elevation, especially in dry years.
- Measuring bankfull is often easier during Spring and Fall when vegetation is dormant.
- **Be flexible in your measurement locations to find the best representation of the natural channel.**

Additional Tips



Bankfull elevation: The elevation point where water fills the channel just before accessing floodplain.

Bankfull width: Average width of the channel at bankfull elevation.

Bankfull Technical Bulletin

Procedure for Determining Bankfull Width Near a Road / Stream Crossing Structure:

Location: Start at a location away from the influence of any culvert or bridge, since they often impact channel width. **To do this, roughly estimate bankfull channel width, then go at least 5 times that distance away from the structure.** Looking upstream is preferred, but downstream reaches can be used if necessary (see locations to avoid below).



Bankfull Technical Bulletin

Determine Bankfull: Begin by looking up in the floodplain and then work down toward the stream. Using both sides of the channel find the elevation of the best bankfull indicators and **mark those locations**, using flags if necessary. Stretch a measuring tape across the stream at your bankfull mark(s), noting that the tape should be level, to measure the bankfull channel width. Continue moving upstream or downstream, **taking successive measurements that are at least 1/2 bankfull width apart. Collect at least 5 measurements and average them together. Be flexible and think logically in choosing the best indicators for your bankfull measurement locations.**

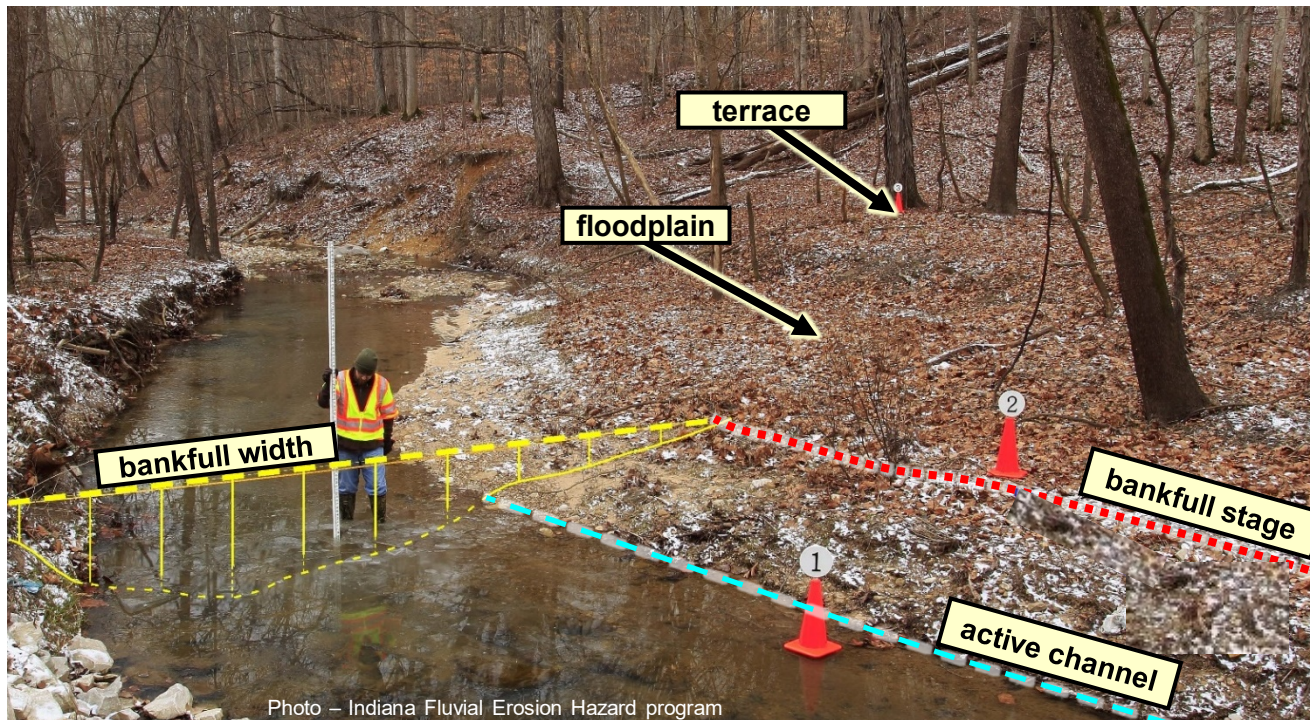
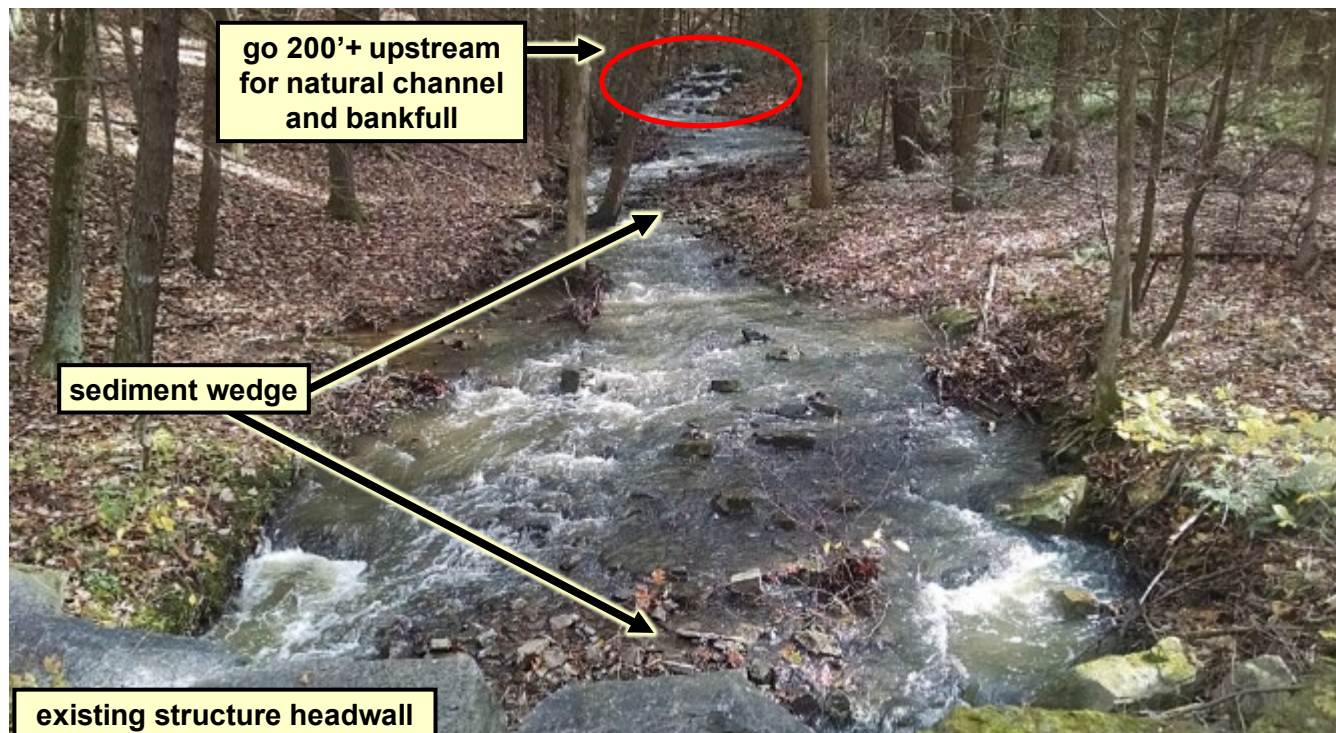


Photo – Indiana Fluvial Erosion Hazard program

Finding the Natural Channel of a Stream:

Because streams vary widely in composition, slope, and manmade impacts, it is impossible to create a set of “instructions” for determining bankfull that will work on every channel. The goal when determining bankfull flow is to find an area that represents natural channel conditions either upstream or downstream of the crossing. This sometimes means moving further upstream or downstream away from the structure, or skipping sections of stream that are unnaturally widened or constricted.

Be flexible and think logically in choosing your bankfull measurement stream section in order to get the best representation of the natural channel.



Bankfull Technical Bulletin

Field Indicators of Bankfull Flow: *(listed in order from most to least reliable indicators)*

1. **Change in Bank Slope:** Bankfull flows are often associated with “benches” or the top of the stream bank, unless the stream is entrenched or has been altered in the past.
2. **Depositional Features:** The top of features such as point bars and mid-channel bars are often indicators of the bankfull flow elevation. Use these elevations to look for additional clues on each bank at the same elevation.
3. **Changes in Particle Size:** Streams drop sediment when they start accessing their floodplain. A Change in particle size along a stream bank (from gravelly, to silty or sandy) often indicates bankfull elevation.
4. **Vegetation Changes:** Although not as reliable, changes in vegetation can indicate bankfull elevation.
5. **Scour Features:** Erosion and scour lines can be used if other features cannot be located.



Bankfull Technical Bulletin

Locations to Avoid in Determining Bankfull Flow: *(if possible)*

Logjams or Fallen Trees: These structures tend to increase the bankfull width in their immediate vicinity.

Manmade Impacts: Avoid locations with wall, weirs, dams, rip-rap, pipes. etc.

Bedrock Outcroppings: Bedrock can hide indicators of bankfull flow and alter channel width.

Braided Channels: Measure upstream or downstream of any braided channels if at all possible.

Tributaries/Springs: Measure bankfull between road crossing and any incoming flows that may increase width.

Hard Meander bends: Hard bends make it difficult to find good indicators since the stream is moving laterally.



Bankfull Technical Bulletin

Additional Bankfull Determination Tips:

- Bankfull flows **will be level across the channel**, so make sure your tape is level when measuring bankfull. If you find strong indicators on one bank, you can stretch the tape level across the stream to get bankfull.
- When looking for bankfull indicators, **think logically about a 1.5-2 year recurrence interval**. Does it make sense that the points you are measuring as bankfull will see flow with that frequency?
- Surveys of **cross sections can be used to verify changes in slope** as an indicator of bankfull.
- On entrenched streams, or streams with historically high sediment impacts (legacy sediments), **bankfull elevation can be below the elevation of the “top of stream bank”** due to many years of impacts.
- Note that **tree roots and other vegetation can exist below the bankfull elevation**, especially in dry years.
- Measuring bankfull is often **easier during Spring and Fall** when vegetation is dormant.

Be flexible in your measurement locations to find the best representation of the natural channel.



Looking to finalize TB next week:

- Comments, corrections, questions, additional clarifications needed, better pictures?
 - Eric Chase: ehc111@psu.edu

QUESTIONS?

