

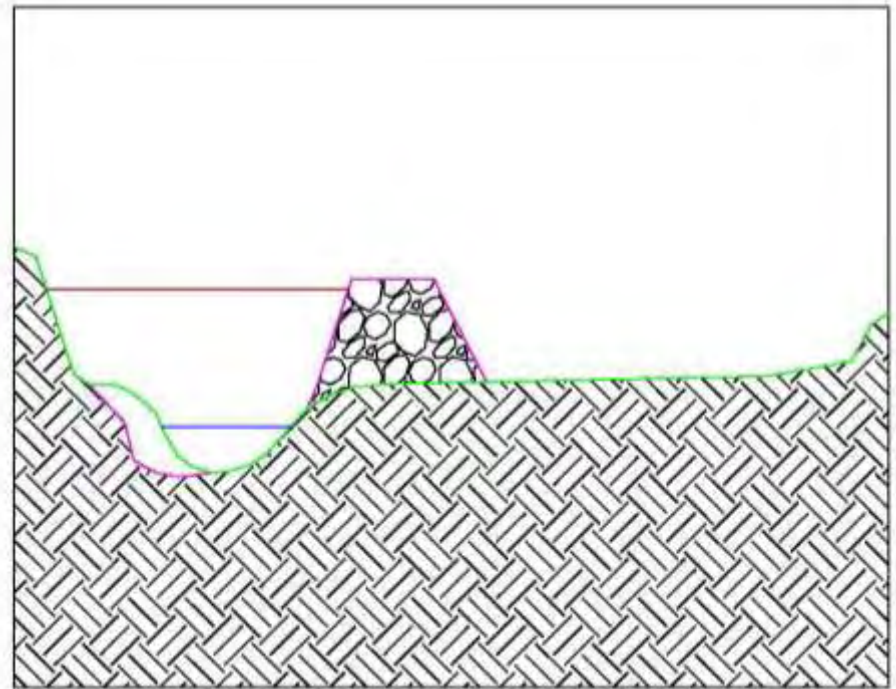
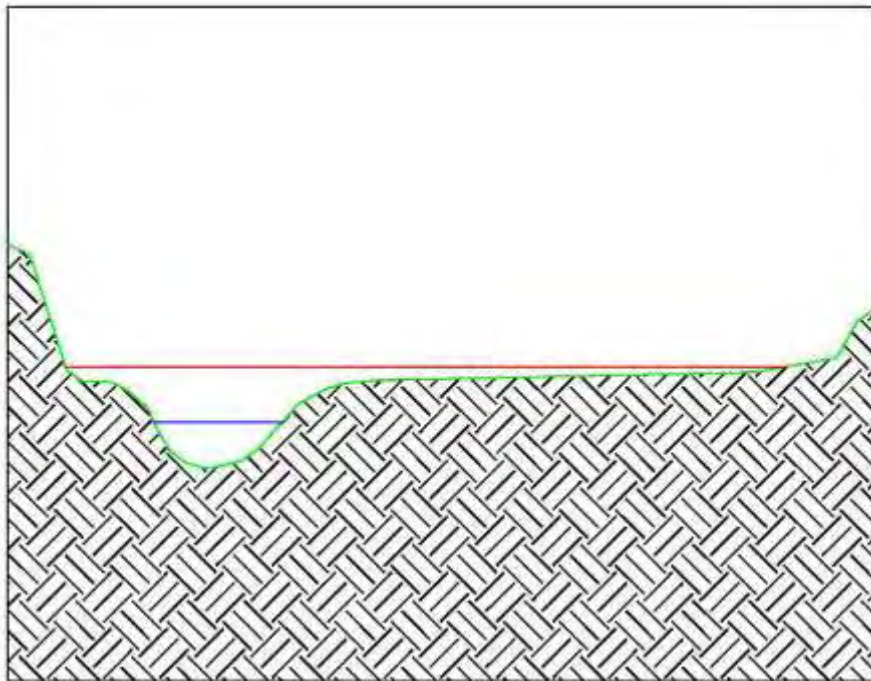
Stream Table

Berms

Floodplain

Berms Definition

An earthen embankment or wall, usually built to provide protection or a result of side casting during stream channel dredging



Berms



Berms



Berms – Failure

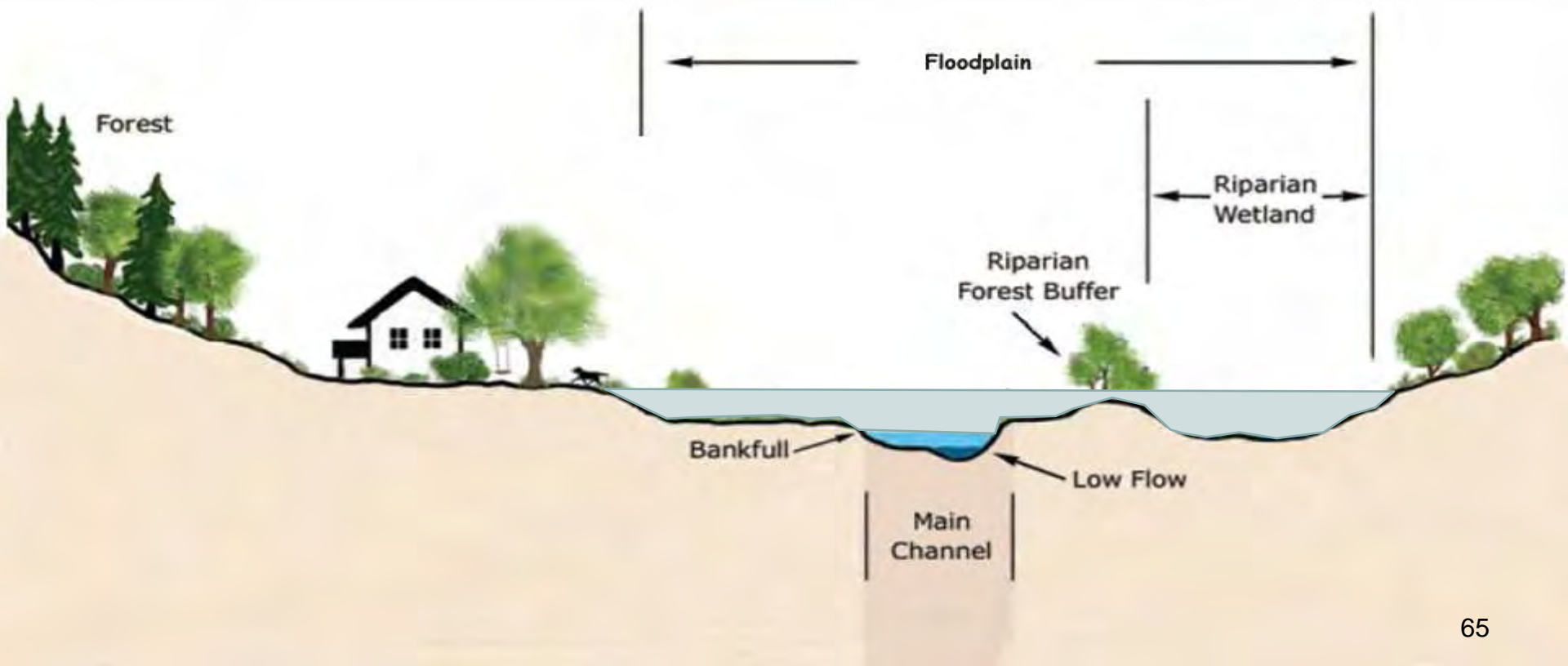


Berms – Failure



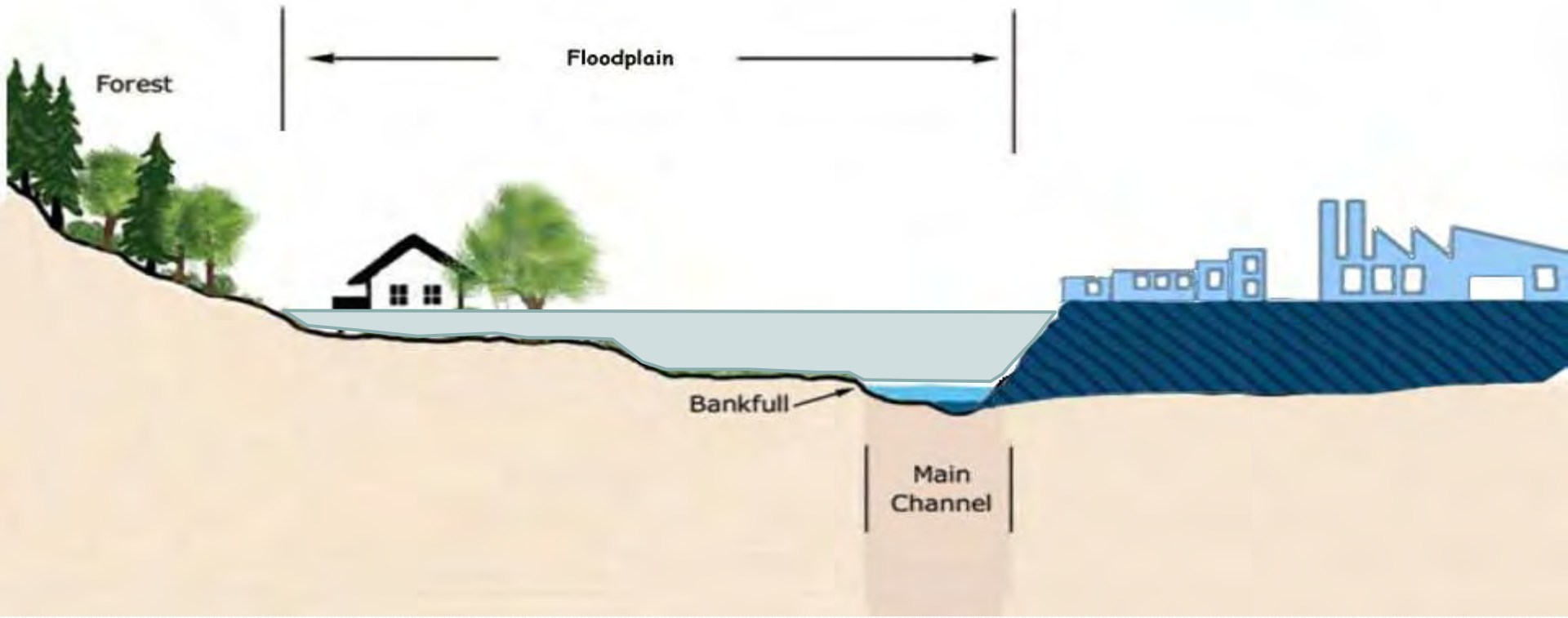
Floodplain

The floodplain is part of the river during storm conditions



Today's floodplains are not necessarily tomorrow's floodplain

If large areas of the floodplain are filled, then there will be an increase in the land area needed to store flood waters. This means your home, farm, or business may be impacted.



When the channel is disconnected from the floodplain...

- Velocity and energy of Stream **increases**
- Erosion **increases**
- **More damage** to infrastructure from debris
- The flood stage is **higher**



Filling in the Floodplain



4 foot of fill in the
Floodplain

09/06/2011

Development on the Floodplain

- Buildings
- Bridge approaches
- Roads
- Parking lots
- Etc.



When the floodplain is developed...

- More threat to life and property
- Velocity and energy increases
- Erosion increases
- More damage to infrastructure
- The flood stage downstream is higher
- Higher cost of flood damage
- Increased flood insurance

Development on the floodplain can lead to significant stream issues including erosion & infrastructure damage





08/28/2011



08/28/2011











Unstable Channels

General Channel Responses to Instabilities

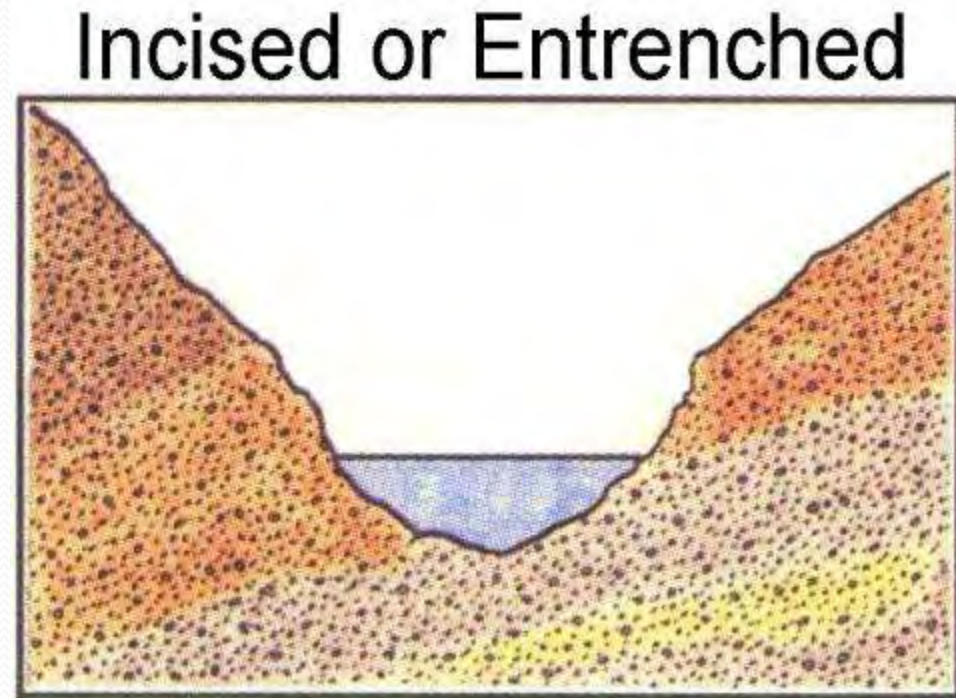
- Instability progresses downstream when there is a change in local sediment supply
 - **Increased supply** (landslide or gravel rich tributary) results in deposition downstream
 - **Decreased supply** (as from a dam or concrete or heavy stone lined channel) results in downstream erosion

General Channel Responses to Instabilities

- Instability progresses upstream when there is a change in local channel form
 - **An incised channel** (dredged or severely down-cut) results in bed erosion upstream
 - ❖ Usually in the form of a head-cut
 - **An aggraded channel** (as from a dam or overly wide) will result in deposition upstream

Incised or Entrenched Channels

- Streams that cannot access their floodplain at the bankfull flow are said to be incised or entrenched
- Incised streams display high velocities & erosive forces during floods
- Incised streams are almost always unstable



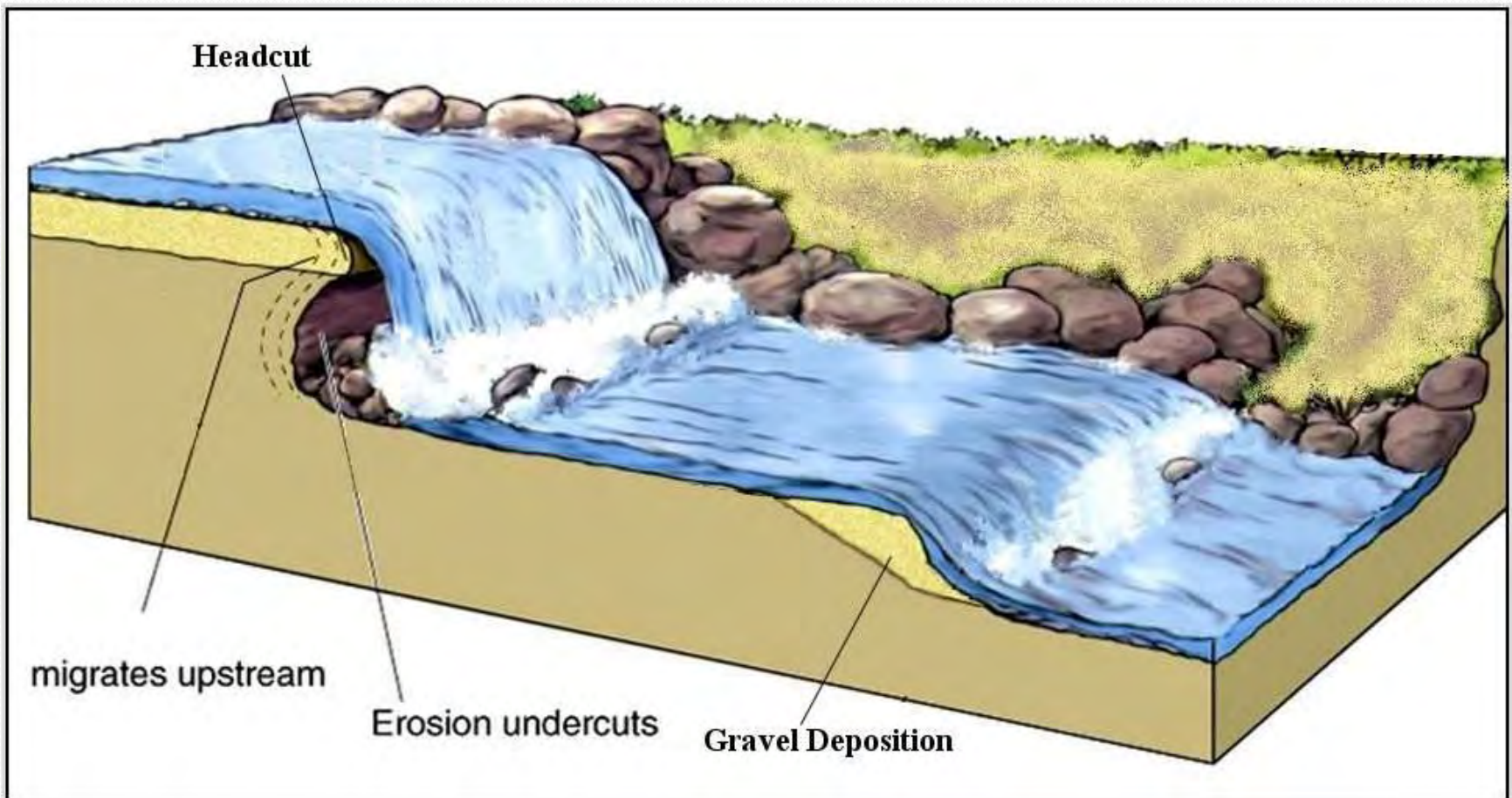
After Rosgen 1996



07-05-07

Headcut Definition

- Instability that progress upstream and downstream from a local disturbance.



Headcut





Avulsion

Avulsions Definition

- *Avulsions are where the stream is no longer in its original channel*
- Is it ...
 - A threat to water quality ?
 - A threat to property?
 - A better alignment?
- Is it possible to work with this new alignment?

Avulsions

- Do **NOT** work if there is no immediate danger to property or necessary infrastructure
- *Notify the municipality and local SWCD that there is an avulsion*

Avulsions

- Do work if property or infrastructure is in danger
- Ask for assistance from local SWCD or NYSDEC office
- If the repair must be made immediately
 - Bring the “new” bank up to the same elevation as the existing ground
 - Armor with large rocks if any are available
 - Notify local SWCD or NYSDEC office of the repair immediately
- *This repair will be temporary and will require careful monitoring*

Platte Kill Avulsion 2009



Platte Kill Avulsion 2011



West Brook Avulsion 2006



West Brook Avulsion 2011 - Realignment



Flood Response

Flood Response

- Immediate Priority Items
- High Priority Items
- Assessment
- Repair
- Documentation and Further Needs

Immediate Priority

- *Immediate priority* items are those facilities and infrastructure which need to be repaired and/or kept open in order that further recovery may be allowed to continue, or to prevent immediate loss of human life.

Immediate Priority Items

- During or right after a flood some things must be done, including, but not necessarily limited to:
 - Opening clogged bridges
 - Opening closed roads
 - Keeping important installations functioning:
 - ❖ Power Plants
 - ❖ Fire Stations
 - ❖ Rescue Centers
 - ❖ Hospitals
 - ❖ Water Wells & Systems
 - ❖ Sewage Treatment Plants & Systems

Flood Repair

“Emergencies” – obvious problems

- Bridges plugged
- Roads severely damaged/closed
- Buildings (especially inhabited buildings) endangered



High Priority Items

- **High priority items** are those items that are necessary for the first part of the cleanup process
- This course concentrates on getting channels back into some acceptable condition
 - Open clogged channels
 - Put avulsed channels back in place
 - Stabilize actively eroding streambanks
 - Stabilize (even if only temporarily) landslides
 - Return the channel to a condition such that the natural processes of streams can begin to return it to its natural state

Assess the Stream Channels

- To decide where to work and where not to work
- To decide where to work first
- To identify the equipment and work force that will be required
- To identify reaches that require technical assistance

Where to Work – Channel Problems

- Actively eroding high banks
 - Eroding bank is heading toward infrastructure or homes
 - High sediment load from eroding bank
 - Another “small flood” would “blow out” the bank
- Channel blocks
- Debris at culverts
- Undermined revetments
- Impaired channel capacity

Actively Eroding High Banks



Channel Block



Debris at a Culvert



Undermined Revetment

- Revetment may become undermined due to:
 - Improper installation depth
 - Stream downcutting



Impaired Channel Capacity



Where Not to Work

- The channel dimensions are ok, or there has been little damage
- Banks are stable
- The channel bottom is imbricated
 - The gravel is “shingled” and is difficult to move
 - Moving the gravel around loosens it and erosion at the reach and deposition downstream

Caution – Steep Streams

- If the slope is over 4% the stream *will* probably be a step-pool system
- If the slope is 2-4% it *could* be a step-pool system
- If debris jam, remove debris
- Don't try and clean the channel except for gravel material or logs at a debris jam

Would you work here?



- Single channel
- Meanders
- Floodplain

Would you work here?



- Single channel
- Some meander
- Stable banks

Is this what you would do here?



8-14-06

The lack of a floodplain will cause the stream to build one to maintain its natural functions.



8-14-06



10-23-06



12-13-06



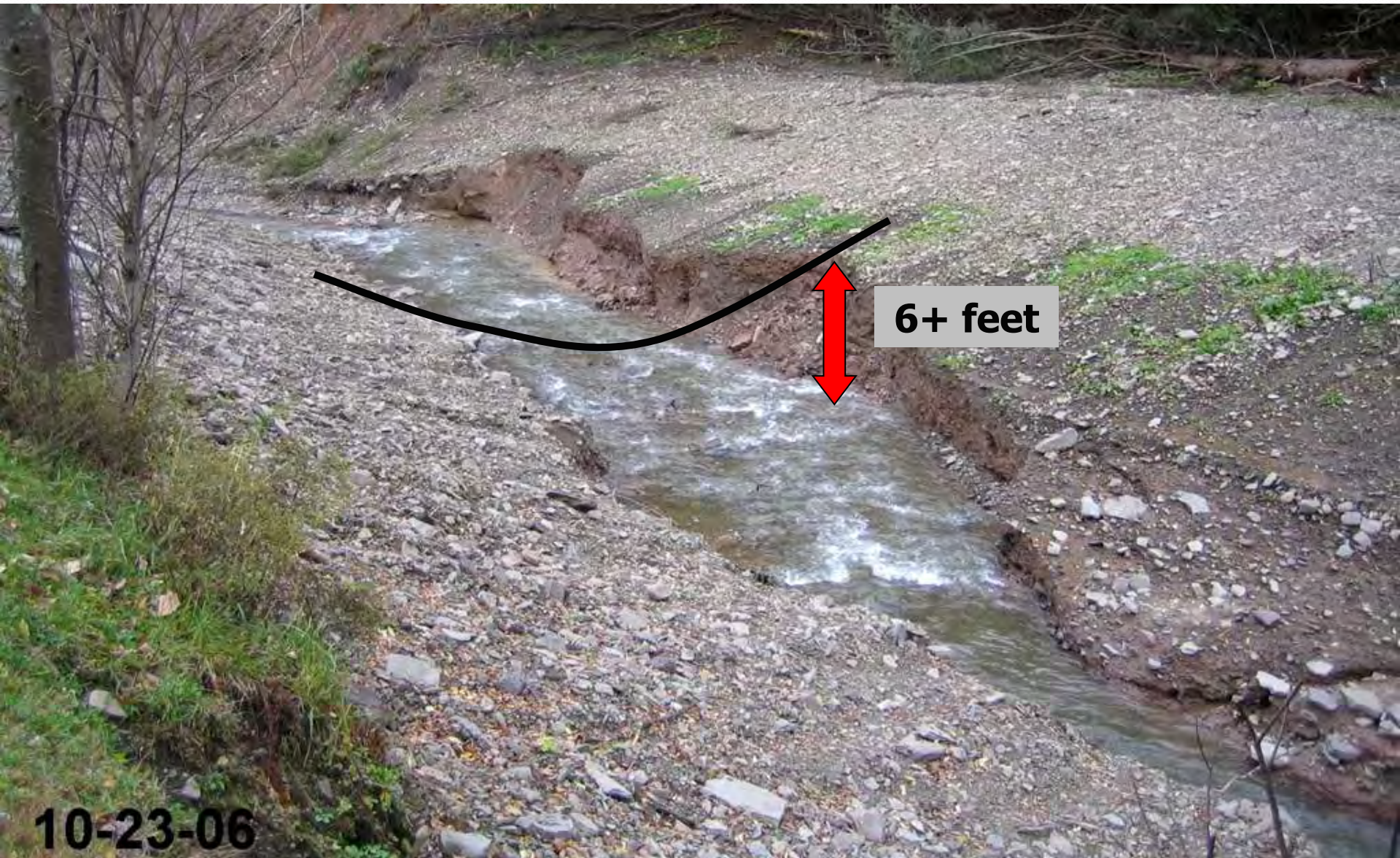
3-06-08

This downstream adjustment created a head-cut upstream...



10-23-06

This slope was actively migrating as the stream continued to lower its bed to adjust its profile. This increased potential risk to those downstream.



10-23-06

Post-Flood Work

- Improper post-flood work can negatively affect:
 - Stream function
 - Stream stability
 - Aquatic habitat
 - Water quality
 - Local resources
- Improper post-flood work can add costs to future repair

Understanding Imbrication

- As storm flows subside bed material overlap and become wedged together like shingles
- Caused by water velocity
- Materials are less mobile



Understanding Imbrication

**Rearranging the bed and banks loosens the material
and makes it more transportable**



Post-Flood Problem Itemization Sheet

- This is located in **Appendix A** in the Training Manual
- It lists problems commonly found after a flood
- Use a sheet for each stream reach
- Check off problems; add any notes/sketches that are necessary
- Customize the sheet to suit your needs
- Photos should be taken during the assessment

Post-Flood Problem Itemization Sheet

- The advantages to using the Itemization Sheet are:
 - Identify the location, number and types of problems on each reach
 - Identify the most severely impacted reaches (keep in mind that some streams or reaches may not be impacted at all)
 - Prioritize work on the most severely impacted reaches
 - Determine manpower & equipment needs
 - Revision of priorities may be required throughout assessment period

Post-Flood Problem Itemization Sheet

- The Itemization Sheet can serve as a record:
 - To document work done for state or federal reimbursement
 - This document can be attached to a permit application as additional information
 - To document work done under an emergency permit

Immediate Post Flood Emergency Stream Intervention Problem Itemization Sheet

Date: 3/16/09

Time: 2:30 PM

Crew: JOEL + GALE

Stream PLATTE RILL
Reach _____

	YES	NO
Debris Jam at Bridge/Culvert		<input checked="" type="checkbox"/>

Bridge / Culvert	
Location	

	YES	NO
Scour at Bridge/Culvert		<input checked="" type="checkbox"/>

Footings exposed	
Undermining	

	YES	NO
Mass Failure		<input checked="" type="checkbox"/>

Estimated height (avg)	
Estimated length (avg)	
Number of failures	

Debris/Log/Gravel Jams	<input checked="" type="checkbox"/>	
-------------------------------	-------------------------------------	--

	YES	NO
Avulsion	<input checked="" type="checkbox"/>	

Estimated length	1200'
Estimated width	40'

Scouring/ Down Cutting		
-------------------------------	--	--

Estimated depth	
-----------------	--

Head Cut		
-----------------	--	--

Estimated depth	
-----------------	--

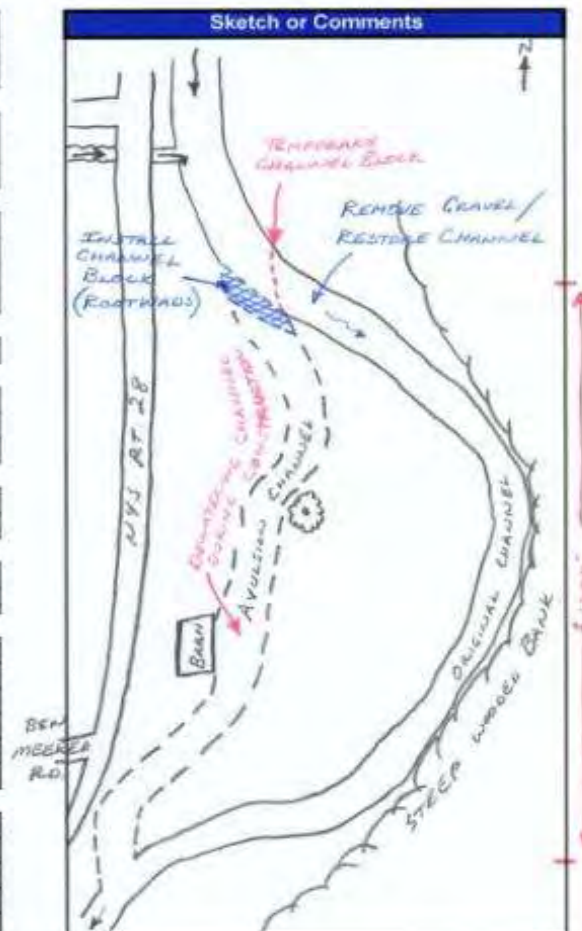
	YES	NO
Gravel Deposits	<input checked="" type="checkbox"/>	

center	<input checked="" type="checkbox"/>
Location - left side	
right side	
Estimated height	3'
Estimated length	75'

Eroded Banks		
---------------------	--	--

Left bank	
Right bank	
Estimated height	
Estimated length	

Sketch or Comments



Further Documentation

- Recommended documentation during construction:
 - Before and After photos
 - Description of the work
 - ❖ Date
 - ❖ Time
 - ❖ Equipment
 - ❖ Material
 - ❖ Labor Force

Further Documentation

- Post Construction Review
 - Was the work performed satisfactorily and completely, and does it meet the needs identified on the Post-Flood Problem Itemization Sheet?
- Contact local SWCD or NYSDEC offices for assistance with:
 - Vegetation
 - Structures
 - Long Term Monitoring

Channel Sizing

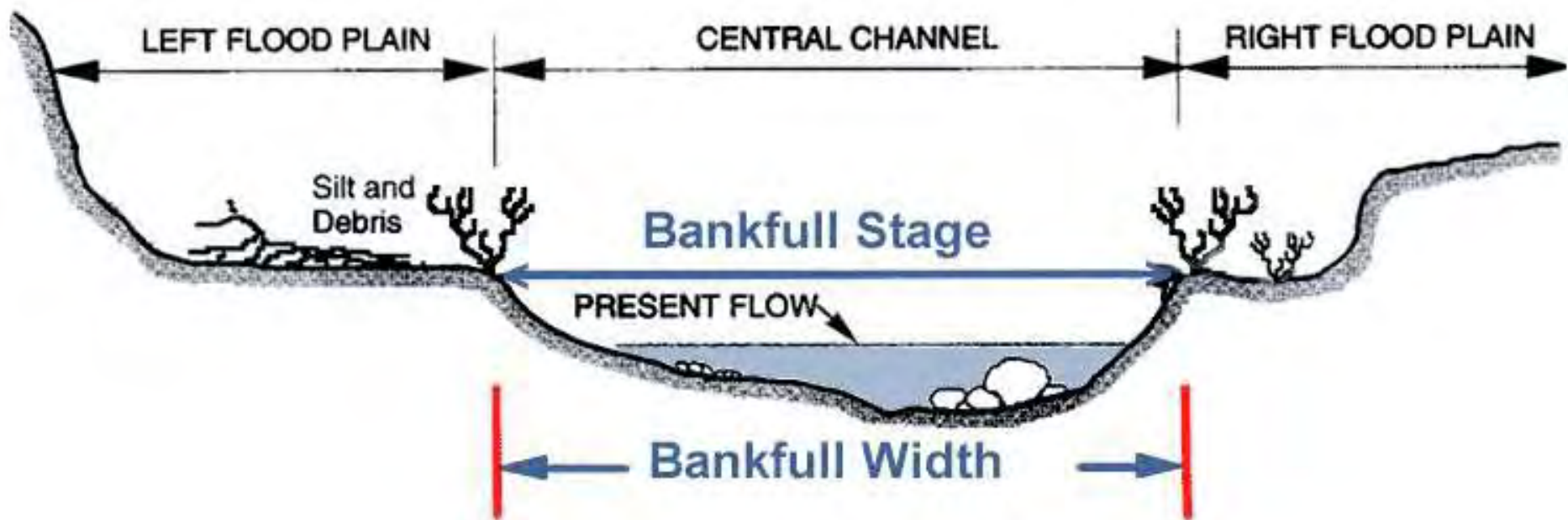
Bankfull Flow

- Bankfull flow is the channel forming discharge

“The bankfull stage corresponds to the discharge at which the channel maintenance is most effective, that is, the discharge at which moving sediment, forming or removing bars, forming or changing bends and meanders, and generally doing the work that results in the average morphologic characteristics of the channel.”

Dunne and Leopold, 1978

Bankfull Flow



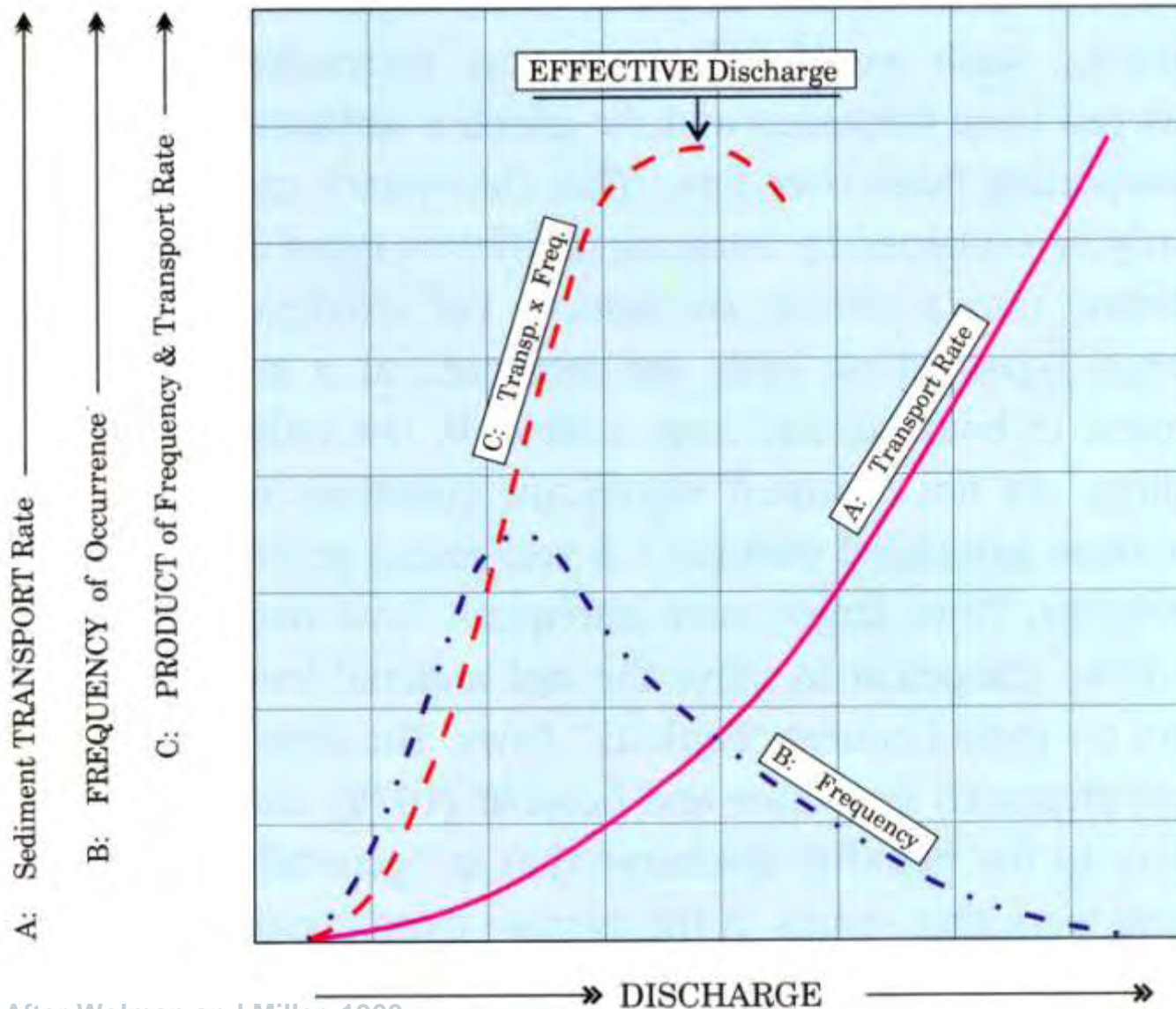


Channel Forming Discharge

- Channel forming discharge, effective discharge, and bankfull all have the same meaning
- In Delaware County the channel forming discharge is approximately equal to the 1.5 year storm
- The regional curves that give information about the size of the channel are based on the bankfull or channel forming discharge

Effective Discharge

How the stream is created and maintained



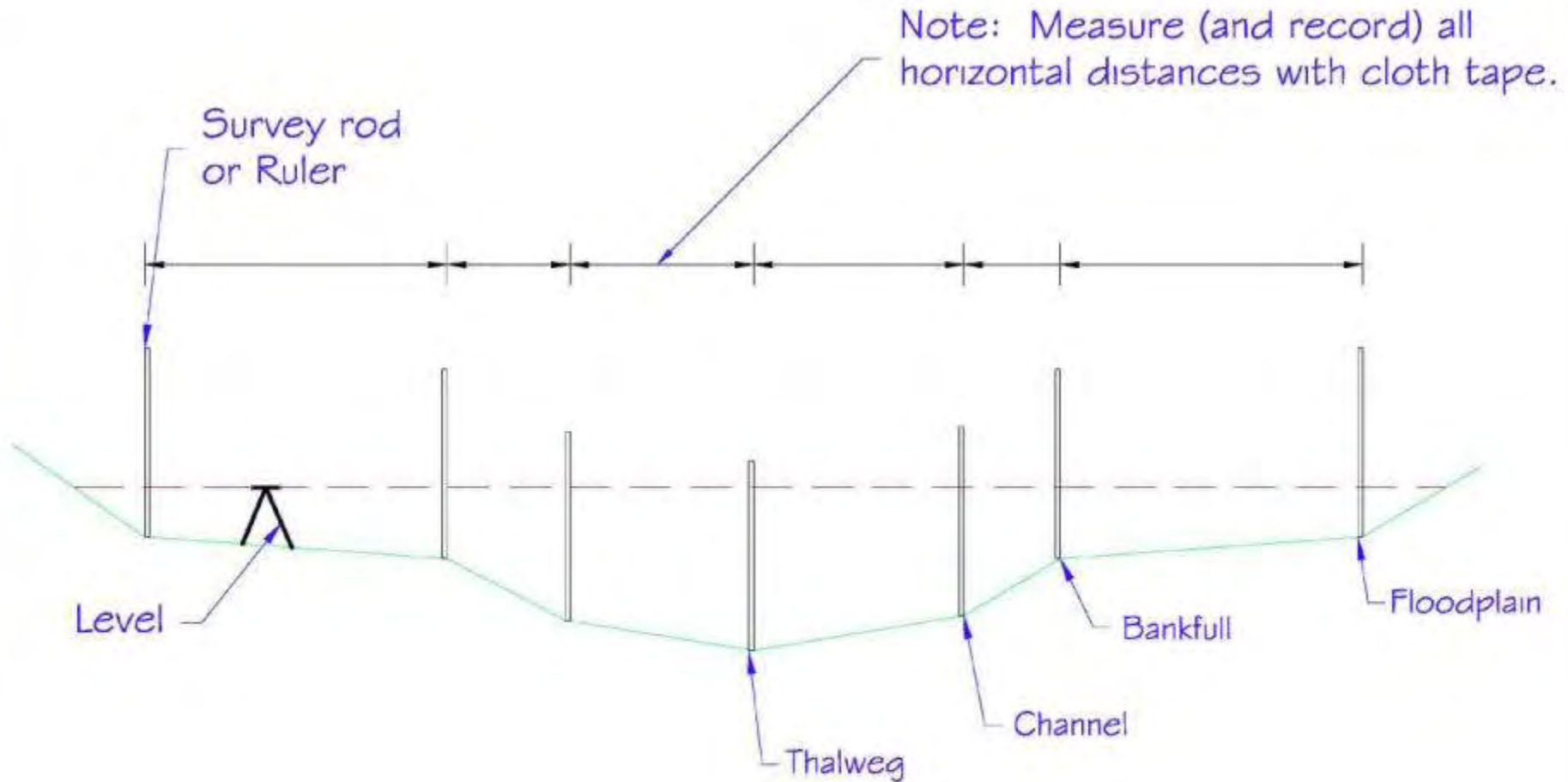
Using an Existing Stable Reach

- Use of the tables may not be required
- A relatively undamaged reach may exist either upstream or downstream
- Measure the undamaged reach **AT A RIFFLE** & duplicate it in the damaged reach (draw a sketch)
 - Bankfull width and depth, floodplain width, bottom width, meander curve radius, and stream slope
- Call your local SWCD or NYSDEC office for assistance



10-27-09 135

Using an Existing Stable Reach



Points to measure on a stable riffle cross section



FP Width

The image shows a stream flowing over a rocky bed in a forest. A green line spans the top of the stream bed, labeled 'FP Width'. A red line spans the width of the water flow, labeled 'BF Width'. A yellow line spans the width of the stream bed at the bottom, labeled 'Bottom Width'. An orange vertical line indicates the depth of the water flow, labeled 'BF Depth'.

BF Width

BF Depth

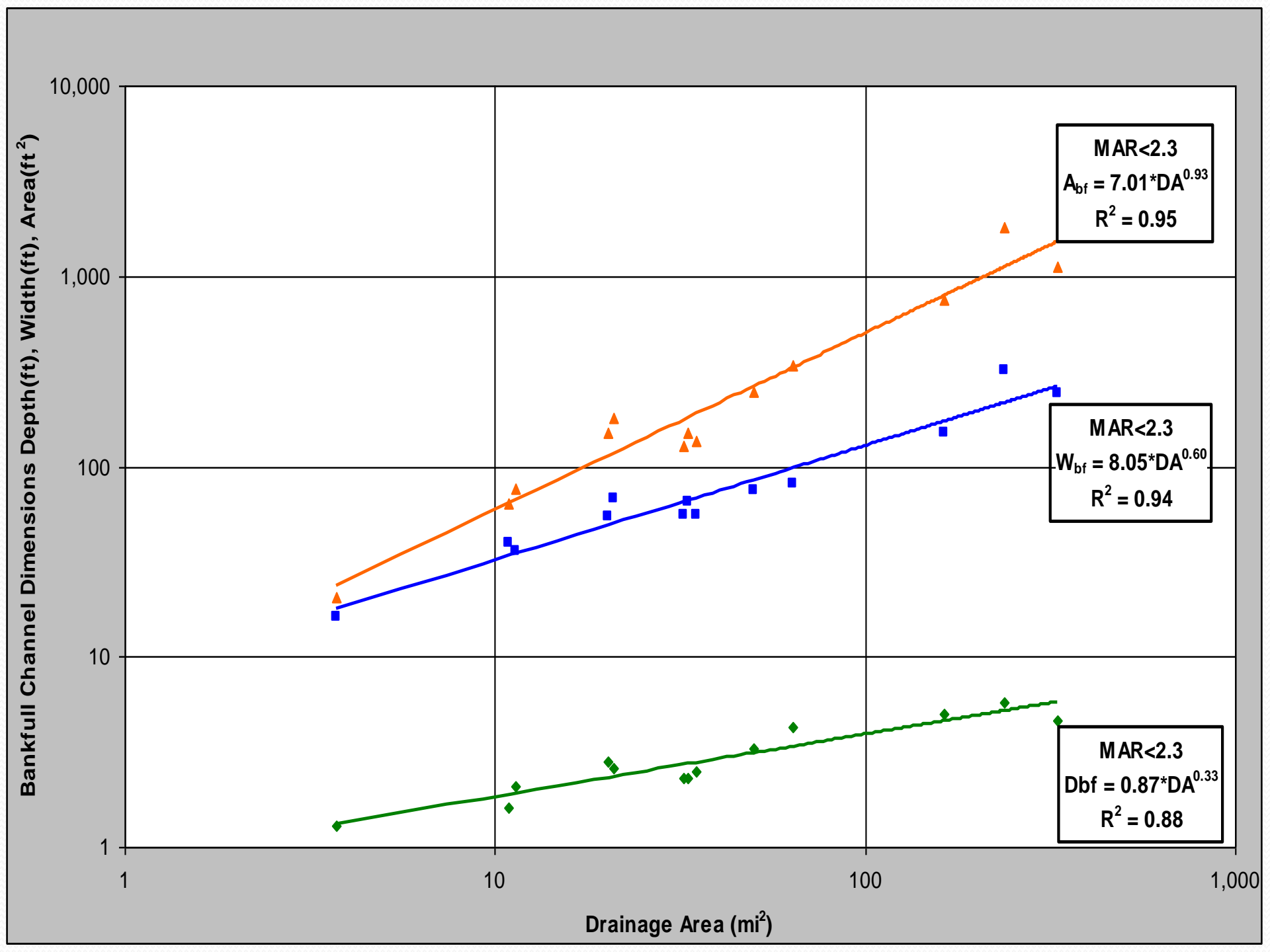
Bottom Width



Meander radius & slope

Regional Curves

- Based on USGS Data
- Information given is based on Drainage Area
- Represents the size & cross section of natural streams in this region
- Dimensions given – Bankfull Dimensions
 - Cross sectional area
 - Bankfull top width
 - Average bankfull depth (mean depth)



Regional Curves

- After a flood the channel dimensions have often been changed – **too big** or **too small**
- Sometimes it is difficult to determine the original size of the stream
- Use the Regional Curves to get reasonable bankfull dimensions

Regional Curves

- Proper width and depth are important
- For hydraulics
 - Sized to carry the bankfull flow
 - Moves the proper size and amount of sediment
 - Avoids erosion
 - Avoids deposition
- For the environment

Regional Curves

- Channel dimensions and aquatic habitat



Proper width and proper depth



Too wide and too shallow

Find Bankfull Channel Dimensions

- Tables have been provided that give the suggested **construction dimensions** in the Training Manual
- You need to know –
 - The drainage area at your site (square miles)
 - What basin you are in

What is a Drainage Area?

The drainage area is the area of the watershed that flows to the point that you are working.



Find Bankfull Channel Dimensions

- Drainage Area can be found:
 - Static maps for New York State are being developed
 - Streamstats New York:
http://water.usgs.gov/osw/streamstats/new_york.html
 - Instructions for use are on the left side of the webpage. Click on State Applications to access New York
 - ❖ See **Appendix D** for the version that is up and running now
 - Streamstats New York will provide regional curve data that can be used with the tables provided to generate construction dimensions