Stantec

Iowa River Restoration Toolbox

A Collaborative Approach to Develop Tools to Protect and Enhance Streams for Iowa

George Athanasakes

Overview

- Background on Iowa's Program & Process
- Overview of Practices and Techniques
- Data Collection & Analysis Tool
- Key Drivers & Decision Matrix
- Questions

Why the Need?

- River restoration relatively new in Iowa
- Need for greater consistency
- Use of proven methods
- Establish:
  - Data collection needs
  - Submittal requirements
- Facilitate review

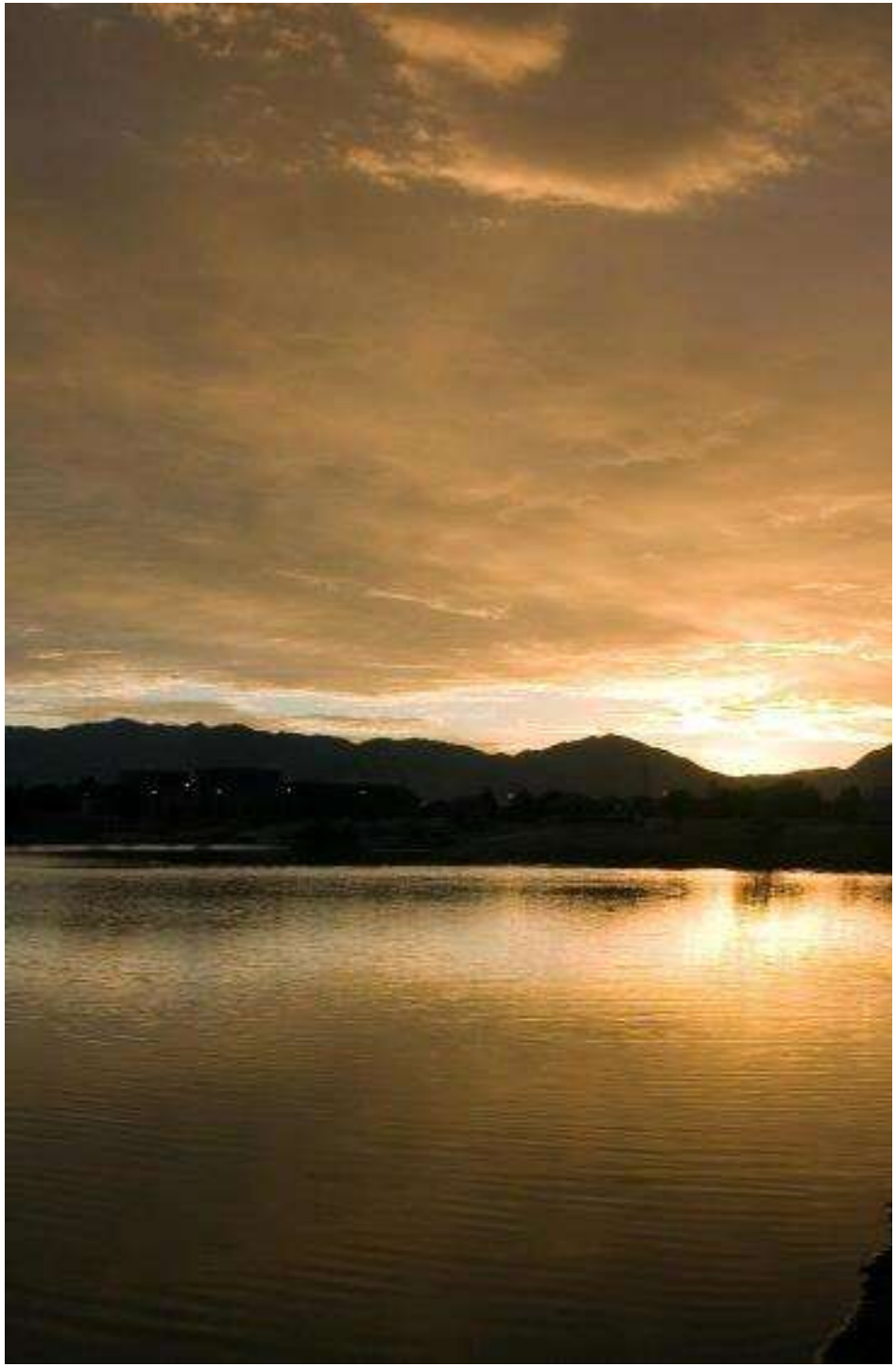
Toolbox Development

Goals included:

- Approaches grounded in understanding conditions in natural rivers
- Alternatives to standard engineering practice for stabilization
- Reduce confusion in review
- Improve project success (from simple stabilization to complex restorations)
- Reduce long-term damage to aquatic and riparian habitats

Recommendations:

- Develop toolbox with holistic, consistent approach for river projects
- Prepare toolbox through a collaborative approach with stakeholders
- Consider riparian corridor and the watershed
- After toolbox, develop monitoring protocols and training
- Required to be eligible for Iowa Clean Water Loan Program



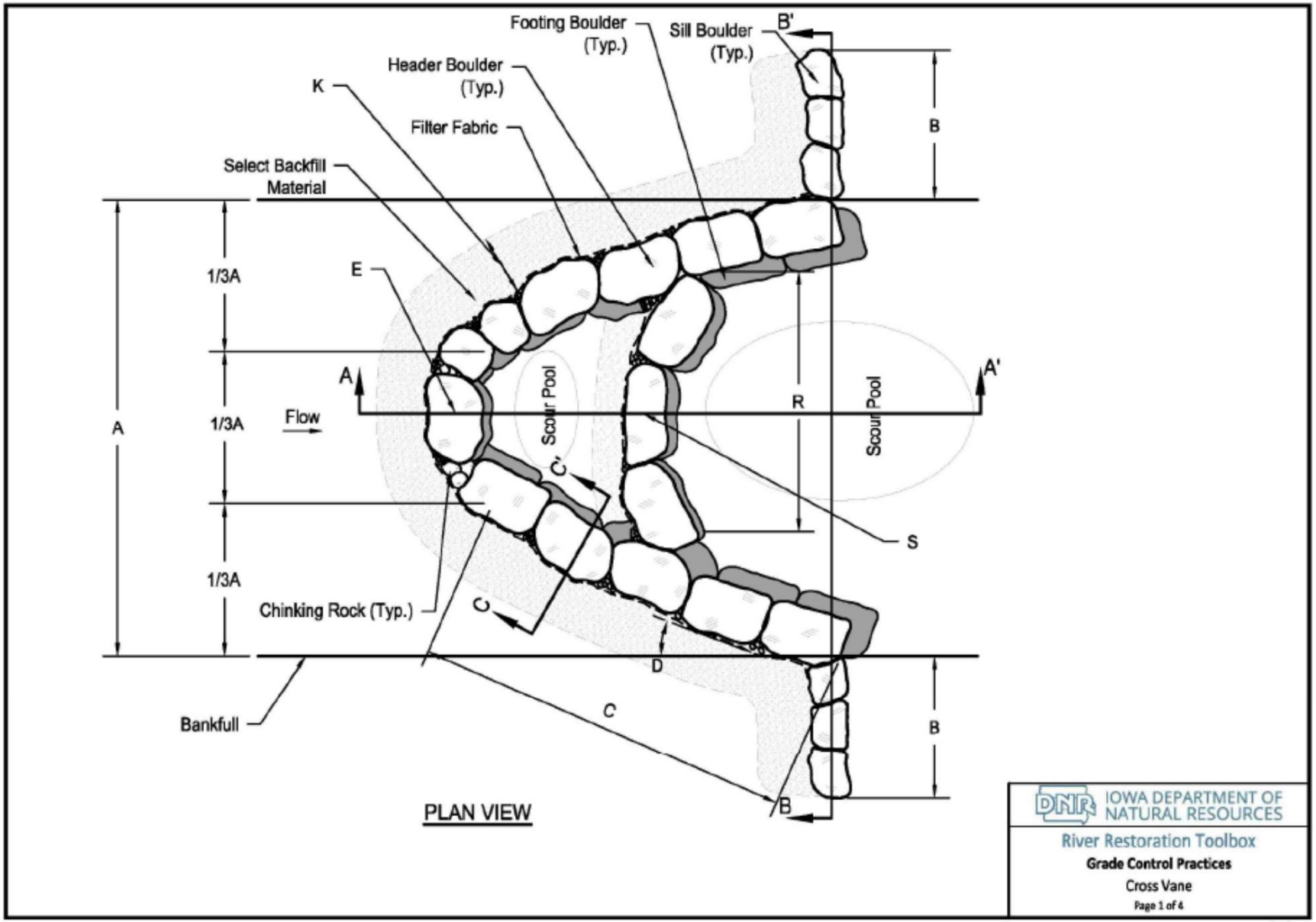
Overview of Practices and Techniques

Overview of Practices

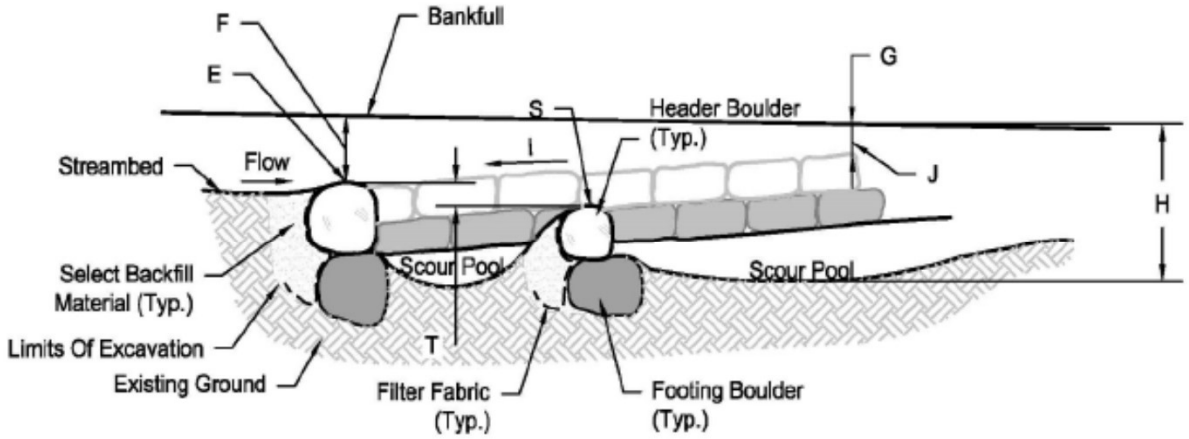
- Grade Control
- Vegetative Restoration
- Riparian Buffers
- Bank and Floodplain Restoration
- Geomorphic Channel Design
- Aquatic Habitat/Cover Features
- Stream Bank Toe Protection/Stabilization
- Channel Definition Structures
- Culvert Adjustment
- Dam Mitigation

1. Grade Control Structures

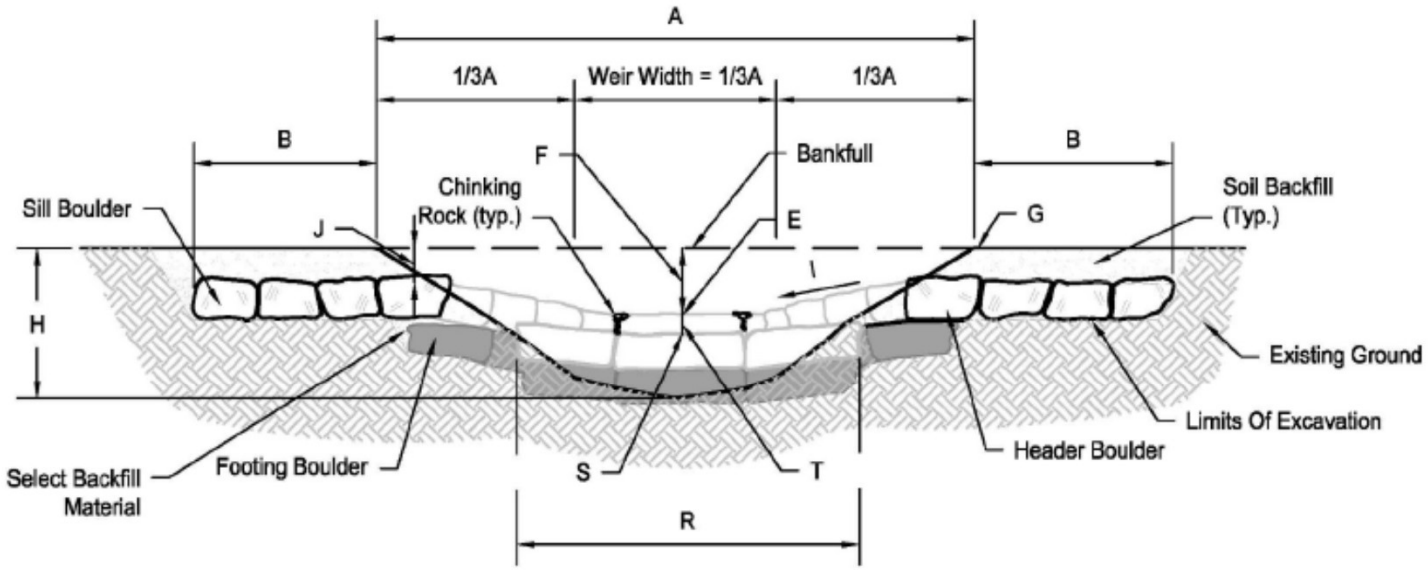
- Rock Arch Rapids
- Cross Vane
- W-Weir
- Constructed Riffle
- Step-Pool Structure
- Rock & Log Riffle
- Grouted Grade Control Structure



Version 1.0 2/17/2017



CROSS SECTION A-A'



CROSS SECTION B-B'

IOWA DEPARTMENT OF NATURAL RESOURCES

River Restoration Toolbox

Grade Control Practices

Cross Vane

Version 1.0 2/17/2017

Dimension[2]	Name	Typical Unit	Guidelines[3]	Description
A	Bankfull width (W_{bkf})	Feet	--	The channel width at bankfull stage, where discharge has filled the channel to the top of its banks and water begins to overflow onto a floodplain.
B	Sill length	Feet	Minimum ½ W_{bkf}	Length of floodplain cutoff sills connecting each vane arm at the point where it intercepts the stream bank. Sills are required to prevent out-of-bank flows from washing around the cross vane.
C	Vane arm length	Feet	--	Based on equations for predicting ratio of vane length/bankfull width as a function of bankfull width, radius of curvature, and departure angle (Rosgen, 2006).
D	Vane arm angle	Degrees	20-30°	Measured upstream from the tangent line where the vane arm intercepts the bank. Angle variation is used to adjust vane arm length and may be asymmetrical to meet certain structure design objectives, such as adjusting to stream pattern (curvature) or bridge abutments or roadway embankments that do not cross the stream at a right angle.
E	Cross vane invert	Feet (NAVD[4])	--	The invert is the elevation on the longitudinal profile of the low point at the head of the structure, often corresponding to the end-of-riffle/beginning-of-run point.
F	Maximum riffle depth	Feet	--	The channel maximum depth above the riffle at bankfull stage, where discharge has filled the channel to the top of its banks and water begins to overflow onto a floodplain.
G	Bankfull elevation	Feet (NAVD[4])	--	Elevation where discharge has filled the channel to the top of its banks and water begins to overflow onto a floodplain.

2. Vegetative Restoration

- Live Staking/Joint Plantings
- Live Fascines
- Bruch Layering
- Erosion Control Matting
- Sod Matting
- Seeding
- Nursery Stock. Bare Root, Vegetative Plug & Transplanting

3. Riparian Buffering

- Riparian Buffers Protected to a Min. of 50 Feet Beyond Belt Width

4. Bank & Floodplain Restoration

- Bank Sloping
- Bankfull Bench
- Levee Removal / Setback
- Two-Stage Channel
- Oxbow Restoration
- Floodplain Assemblages

5. Geomorphic Channel Design Practice

- Alluvial
- Threshold
- Step Pool

6. Aquatic Habitat/ Cover Feature

- Lunkers
- Boulder/Rock Clusters
- Locked Logs
- Large Woody Debris
- Root Wads
- Submerged Crib Wall

7. Stream Bank Toe Protection/Stabilization

- Toe Wood Protection
- Stone Toe Protection
- Fabric Encapulated Soil Lifts
- Log Vane with Boulder Hook
- Single and Double Wing Deflectors

8. Channel Definition Structure

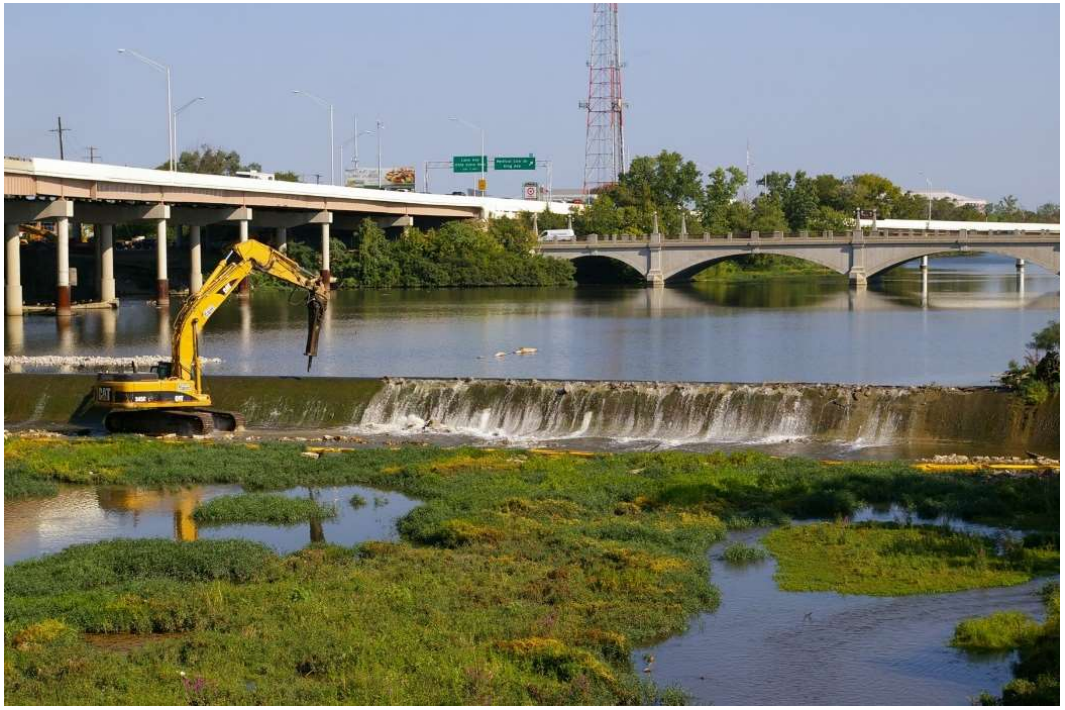
- Cut-off Sills
- Engineered Log Jams
- Longitudinal Peaked Stone Toe
- Bendway Weirs
- Stream Barbs
- J-HookVane/Straight Vane

9. Culvert Adjustment

- Replacement of Culverts with Bridge Spans
- Stream Daylighting
- Sufficiently Sized/Buried Culverts
- Floodplain Bypass Culverts

10. Dam Removal

- Simple Dam Removal
- Stage Dam Removal
- Height Reduction with Fish Passable Grade Control
- Notched Dam w/ Fish-Passable Grade Control Structure
- Replcement of Dam Function w/ Free-Standing Fish-Passable Grade Control Structure



Decision Matrix and Key Drivers for Selection

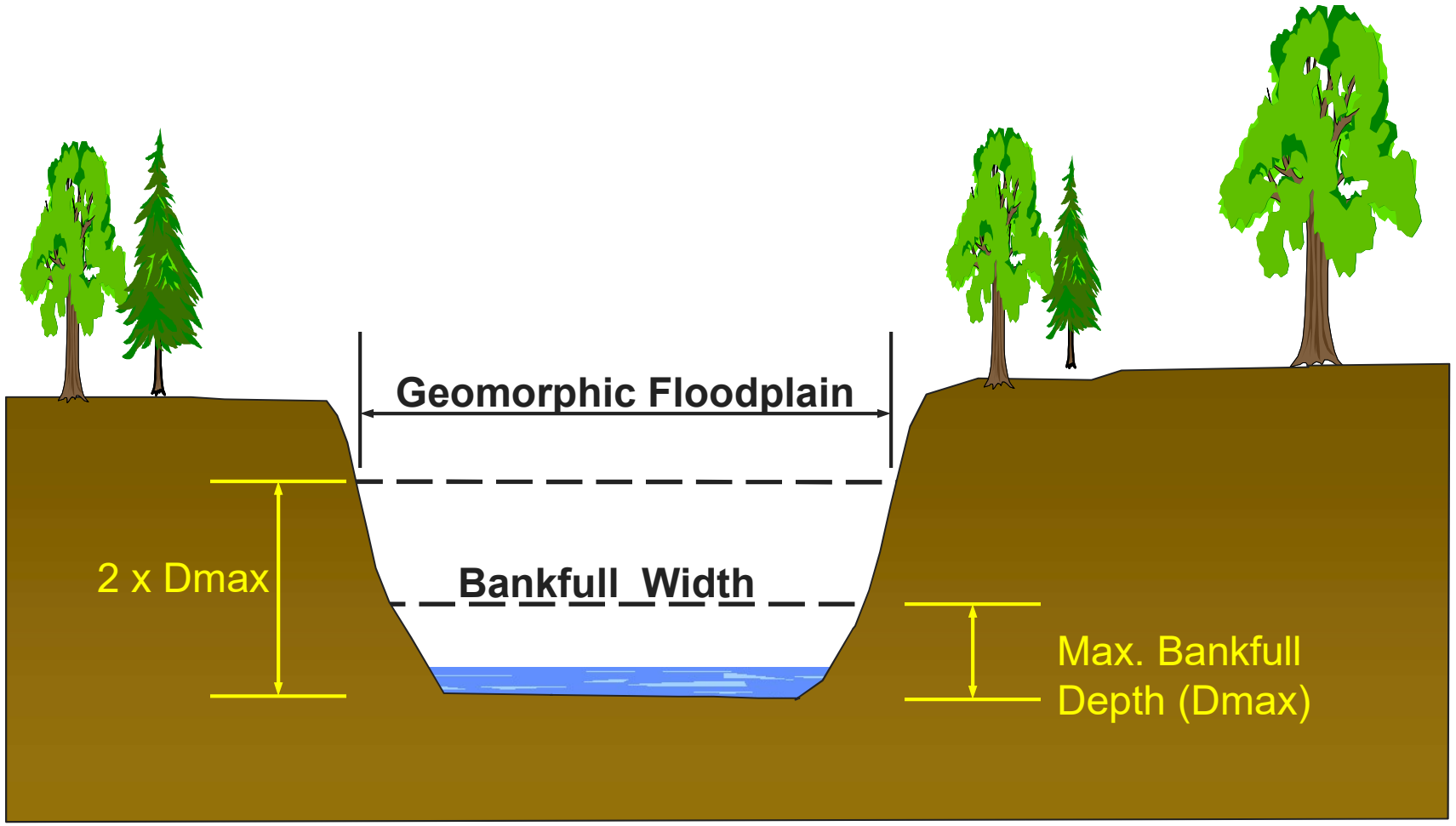
Purpose of Decision Matrix

- Documentation of intuitive knowledge used in stream restoration design
- Establish logic used to determine appropriate practices & techniques
- Note that there are multiple "right answers"

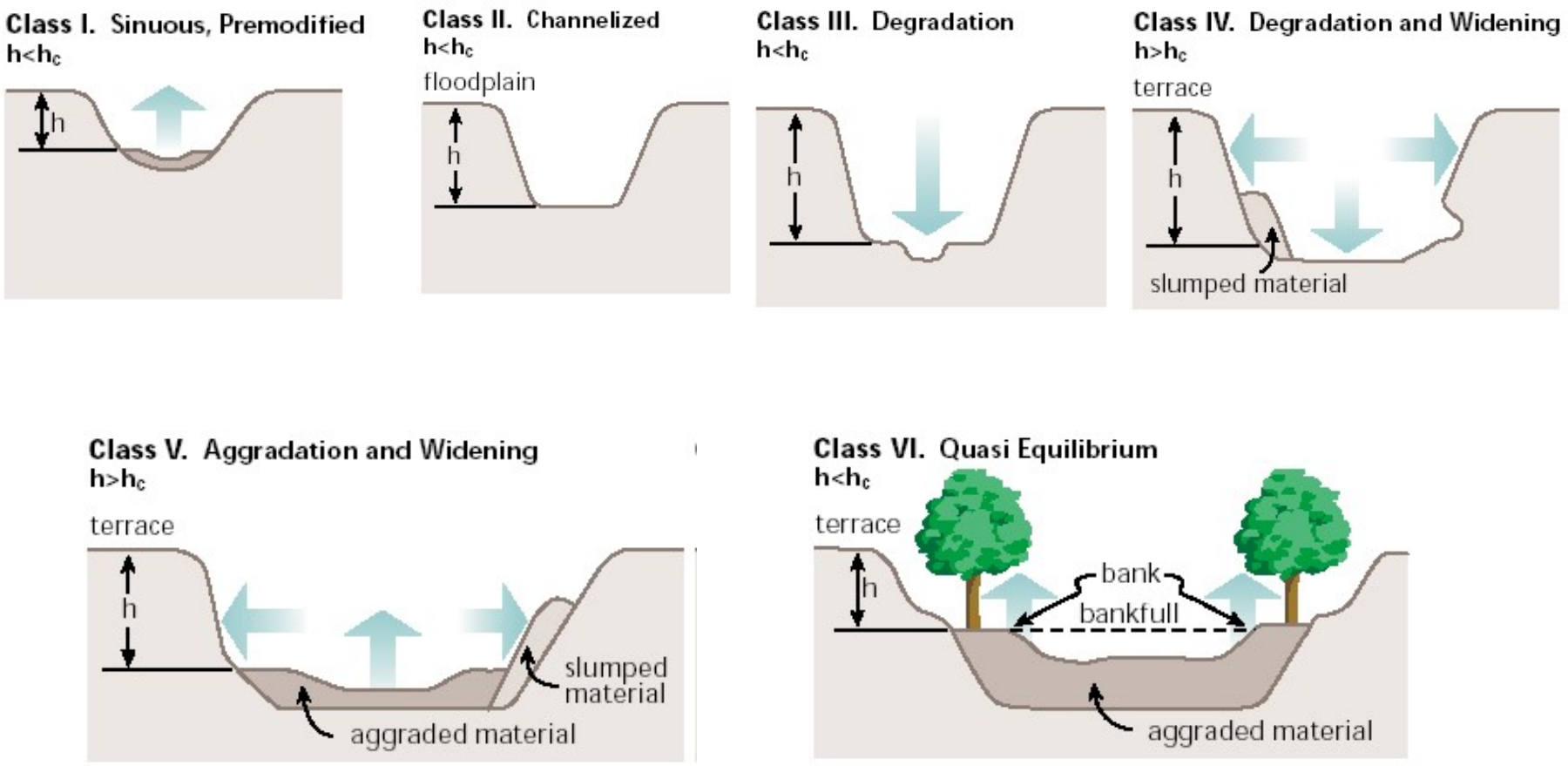
Key Drivers

- Floodplain Access
  - Bank Height Ratio
  - Entrenchment
- Bankfull Properties
  - Area
  - Discharge
  - Width
  - Depth
- Channel Evolution Stage
- Dominant BEHI
- Buffer Width

Entrenched Channel

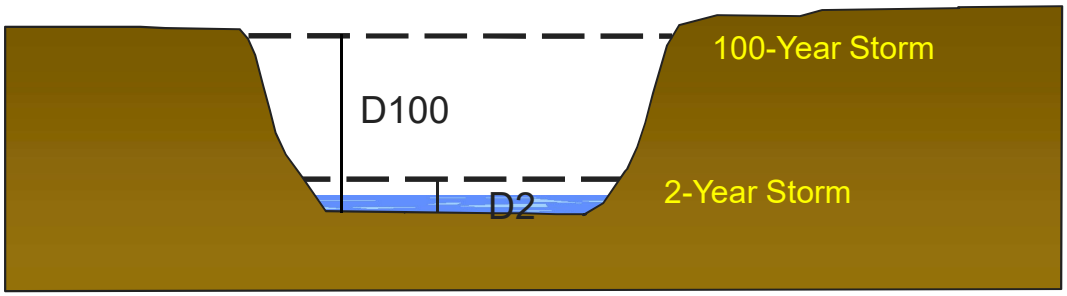


Channel Evolution Model

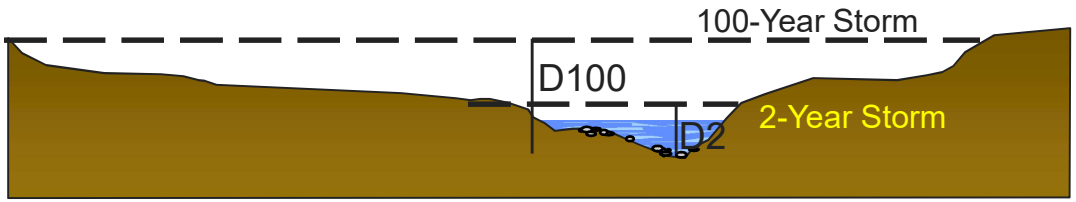


Shear Stresses in Streams

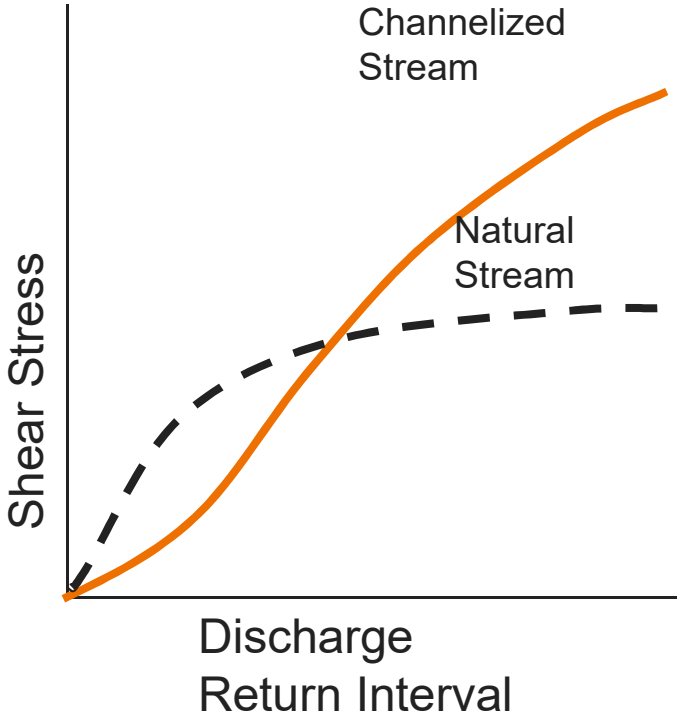
Shear Stress = γ R S



Channelized Stream



Natural Stream



Additional Key Drivers

- Pattern/Geometry
  - Radius of Curvature
  - Meander Width Ratio
  - Pool to Pool Spacing
  - Width to Depth Ratio
  - Channel Length
- Channel Slope
- Stream Type
- Presence of Headcuts/Bed Stability
- Geomorphic Region/Geology
- Sediment Supply/Bed Materials
- Constraints

Decision Matrix - Slope

Slope	<0.1%	0.1-0.5%	0.5-1%	1-2%	2-4%	4-8%	> 8%
Grade Control-Step Pool				Step Pool	Step Pool	Step Pool	Step Pool
Grade Control-RAR					Rock Arch Rapid		
Grade Control-CV		Cross Vane	Cross Vane	Cross Vane	Cross Vane		
Grade Control-Rock&Log Roffle	Rock & Log Riffle	Rock & Log Riffle	Rock & Log Riffle	Rock & Log Riffle	Rock & Log Riffle		
Grade Control-W-weir		W-Weir	W-Weir	W-Weir			
Grade Control-Rock Constructed Riffle	Rock Constructed Riffle	Rock Constructed Riffle	Rock Constructed Riffle	Rock Constructed Riffle	Rock Constructed Riffle		
Grade Control-Grouted Grade Cntrl			Grouted Grade Control	Grouted Grade Control	Grouted Grade Control	Grouted Grade Control	
Geomorphic Channel Design	All	All	All	All	All	All	All
Geomorphic Channel Design					Ab	A	Aa
Geomorphic Channel Design			Bc	Bc	B	Ba	
Geomorphic Channel Design	C	C	C	C	Cb		
Geomorphic Channel Design	DA	D	D	D			
Geomorphic Channel Design	DA	DA					
Geomorphic Channel Design	E	E	E	E			
Toe Protection/Stabilization	Toe wood	Toe wood	Toe wood	Toe wood	Toe wood		
Toe Protection/Stabilization	Stone Toe Protection	Stone Toe Protection	Stone Toe Protection	Stone Toe Protection	Stone Toe Protection	Stone Toe Protection	Stone Toe Protection
Toe Protection/Stabilization	Fabric Encapsulated Soil Lifts	Fabric Encapsulated Soil Lifts	Fabric Encapsulated Soil Lifts	Fabric Encapsulated Soil Lifts	Fabric Encapsulated Soil Lifts	Fabric Encapsulated Soil Lifts	Fabric Encapsulated Soil Li
Toe Protection/Stabilization	Log Vane with Boulder Hook	Log Vane with Boulder Hook	Log Vane with Boulder Hook	Log Vane with Boulder Hook	Log Vane with Boulder Hook		
Toe Protection/Stabilization	Single & Double Wing Deflectors	Single & Double Wing Deflectors	Single & Double Wing Deflectors	Single & Double Wing Deflectors	Single & Double Wing Deflectors		
Aquatic Habitat/Cover Feature	Lunkers	Lunkers	Lunkers	Lunkers	Lunkers		
Aquatic Habitat/Cover Feature	Boulder/Rock Clusters	Boulder/Rock Clusters	Boulder/Rock Clusters	Boulder/Rock Clusters	Boulder/Rock Clusters	Boulder/Rock Clusters	Boulder/Rock Clusters
Aquatic Habitat/Cover Feature	Locked Logs	Locked Logs	Locked Logs	Locked Logs	Locked Logs	Locked Logs	
Aquatic Habitat/Cover Feature	Large Woody Debris	Large Woody Debris	Large Woody Debris	Large Woody Debris	Large Woody Debris		
Aquatic Habitat/Cover Feature	Root Wads	Root Wads	Root Wads	Root Wads	Root Wads		
Aquatic Habitat/Cover Feature	Submerged Crib Wall	Submerged Crib Wall	Submerged Crib Wall	Submerged Crib Wall	Submerged Crib Wall		
Channel Definition Structure	Cut-off Sills	Cut-off Sills	Cut-off Sills	Cut-off Sills	Cut-off Sills		
Channel Definition Structure	Engineered Log Jams	Engineered Log Jams	Engineered Log Jams	Engineered Log Jams	Engineered Log Jams		
Channel Definition Structure	Longitudinal Peaked Stone Toe	Longitudinal Peaked Stone Toe	Longitudinal Peaked Stone Toe	Longitudinal Peaked Stone Toe	Longitudinal Peaked Stone Toe		
Channel Definition Structure	Bendway weirs	Bendway weirs	Bendway weirs	Bendway weirs	Bendway weirs		
Channel Definition Structure	Stream Barbs	Stream Barbs	Stream Barbs	Stream Barbs	Stream Barbs		
Channel Definition Structure	J-Hook Vane/Straight Vane	J-Hook Vane/Straight Vane	J-Hook Vane/Straight Vane	J-Hook Vane/Straight Vane	J-Hook Vane/Straight Vane		
Bank and Floodplain Practices	All	All	All	All	All	All	All
Vegetative Restoration Practice	All	All	All	All	All	All	All
Riparian Buffer Practice	All	All	All	All	All	All	All

Decision Matrix – Bank Height Ratio

Bank Height Ratio	<1	1-1.2	1.2-1.5	>1.5
Grade Control-Step Pool	Step Pool	Step Pool	Step Pool	Step Pool
Grade Control-RAR	Rock Arch Rapid	Rock Arch Rapid	Rock Arch Rapid	Rock Arch Rapid
Grade Control-CV	Cross Vane	Cross Vane	Cross Vane	Cross Vane
Grade Control-Rock&Log Roffle	Rock & Log Riffle	Rock & Log Riffle	Rock & Log Riffle	Rock & Log Riffle
Grade Control-W-Weir	W-Weir	W-Weir	W-Weir	W-Weir
Grade Control-Rock Constructed Riffle	Rock Constructed Riffle	Rock Constructed Riffle	Rock Constructed Riffle	Rock Constructed Riffle
Grade Control-Grouted grade Cntrl	Grouted Grade Control	Grouted Grade Control	Grouted Grade Control	Grouted Grade Control
Toe Protection/Stabilization	(1,3) Toe wood	(3) Toe wood	(3) Toe wood	Toe wood
Toe Protection/Stabilization	Stone Toe Protection	Stone Toe Protection	Stone Toe Protection	Stone Toe Protection
Toe Protection/Stabilization	Fabric Encapsulated Soil Lifts	Fabric Encapsulated Soil Lifts	Fabric Encapsulated Soil Lifts	Fabric Encapsulated Soil Lifts
Toe Protection/Stabilization	Log Vane with Boulder Hook	Log Vane with Boulder Hook	Log Vane with Boulder Hook	Log Vane with Boulder Hook
Toe Protection/Stabilization	Single & Double Wing Deflectors	Single & Double Wing Deflectors	Single & Double Wing Deflectors	Single & Double Wing Deflectors
Bank & Floodplain Restoration	Bank sloping	Bank sloping	Bank sloping	Bank sloping
Bank & Floodplain Restoration		Bankfull bench	Bankfull bench	Bankfull bench
Bank & Floodplain Restoration	Levee removal/setback	Levee removal/setback	Levee removal/setback	Levee removal/setback
Bank & Floodplain Restoration	Two-stage channel	Two-stage channel	Two-stage channel	Two-stage channel
Bank & Floodplain Restoration	Oxbow restoration	Oxbow restoration	Oxbow restoration	Oxbow restoration
Bank & Floodplain Restoration	Floodplain assemblages	Floodplain assemblages	Floodplain assemblages	Floodplain assemblages
Channel Definition Structure	Cut-off Sills	Cut-off Sills	Cut-off Sills	
Channel Definition Structure	Engineered Log Jams	Engineered Log Jams	Engineered Log Jams	
Channel Definition Structure		Longitudinal Peaked Stone Toe	Longitudinal Peaked Stone Toe	Longitudinal Peaked Stone Toe
Channel Definition Structure	Bendway weirs	Bendway weirs	Bendway weirs	
Channel Definition Structure	Stream Barbs	Stream Barbs	Stream Barbs	
Channel Definition Structure	J-Hook Vane/Straight Vane	J-Hook Vane/Straight Vane	J-Hook Vane/Straight Vane	
Aquatic Habitat/Cover Feature	Lunkers	Lunkers	Lunkers	
Aquatic Habitat/Cover Feature	Boulder/Rock Clusters	Boulder/Rock Clusters	Boulder/Rock Clusters	
Aquatic Habitat/Cover Feature	Locked Logs	Locked Logs	Locked Logs	
Aquatic Habitat/Cover Feature	Large Woody Debris	Large Woody Debris	Large Woody Debris	
Aquatic Habitat/Cover Feature	Root Wads	Root Wads	Root Wads	
Aquatic Habitat/Cover Feature	Submerged Crib Wall	Submerged Crib Wall	Submerged Crib Wall	
Geomorphic Channel Design	All	All	All	All
Vegetative Restoration Practice	All	All	All	All
Riparian Buffering Practice	All	All	All	All

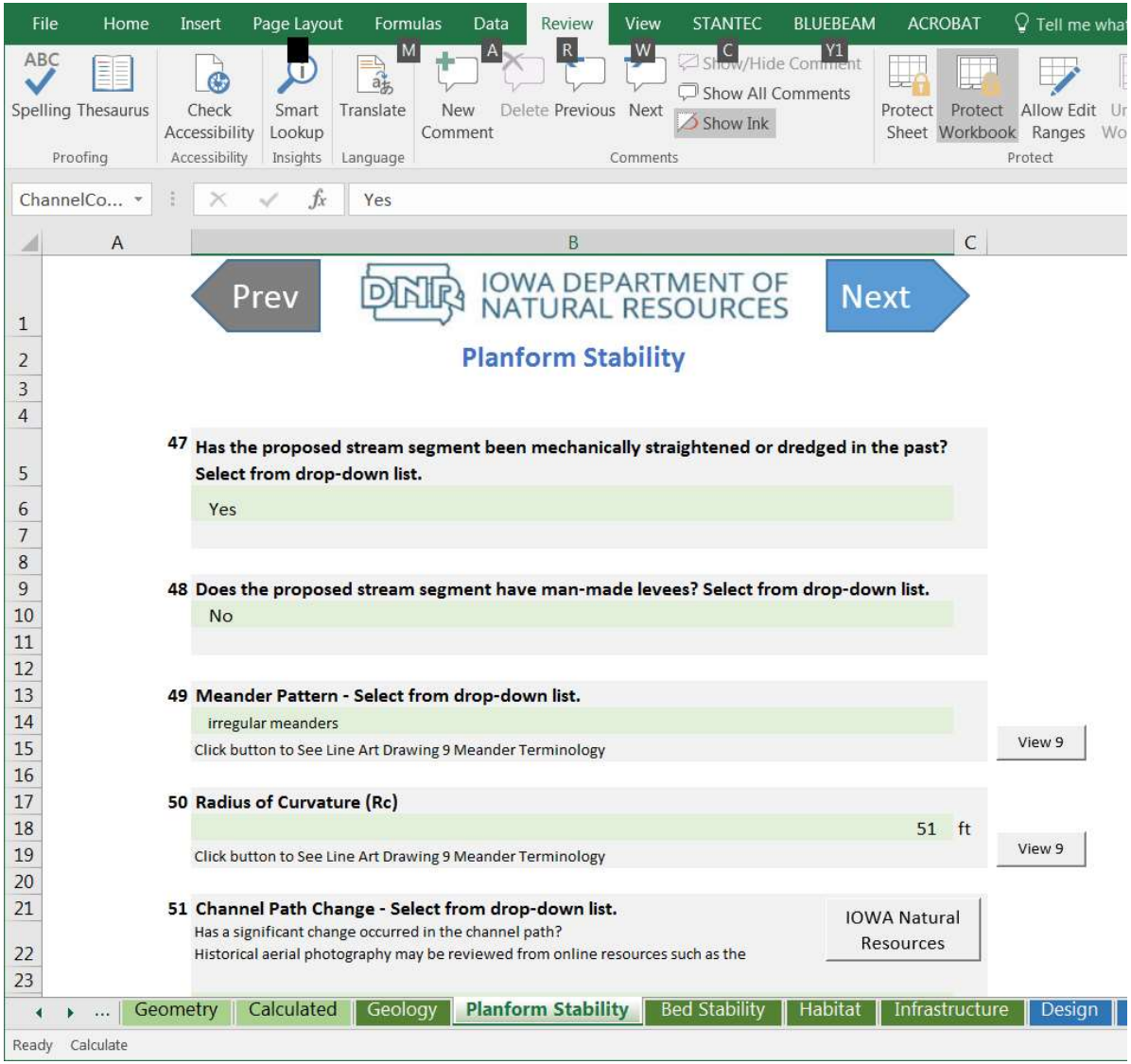
Decision Matrix – Bankfull Width

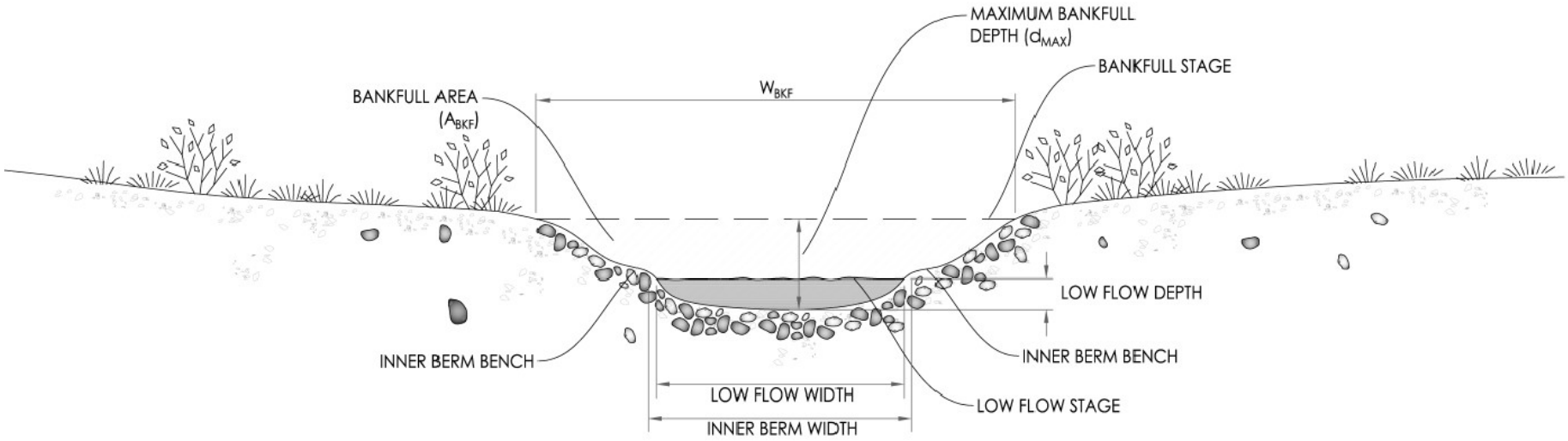
Avg bankfull channel width*	<5	5-15	15-30	30-50	>50
Grade Control	Step Pool	Step Pool	Step Pool	Step Pool	
Grade Control			Rock Arch Rapid	Rock Arch Rapid	Rock Arch Rapid
Grade Control		Cross Vane	Cross Vane	Cross Vane	
Grade Control	Rock & Log Riffle	Rock & Log Riffle	Rock & Log Riffle	Rock & Log Riffle	Rock & Log Riffle
Grade Control			W-Weir	W-Weir	W-Weir
Grade Control	Rock Constructed Riffle	Rock Constructed Riffle	Rock Constructed Riffle	Rock Constructed Riffle	Rock Constructed Riffle
Grade Control	Grouted Grade Control	Grouted Grade Control	Grouted Grade Control	Grouted Grade Control	Grouted Grade Control
Aquatic Habitat/Cover Feature		Lunkers	Lunkers	Lunkers	Lunkers
Aquatic Habitat/Cover Feature		Boulder/Rock Clusters	Boulder/Rock Clusters	Boulder/Rock Clusters	Boulder/Rock Clusters
Aquatic Habitat/Cover Feature	Locked Logs	Locked Logs		Locked Logs	Locked Logs
Aquatic Habitat/Cover Feature	Large Woody Debris	Large Woody Debris	Large Woody Debris	Large Woody Debris	Large Woody Debris
Aquatic Habitat/Cover Feature	Root Wads	Root Wads	Root Wads	Root Wads	Root Wads
Aquatic Habitat/Cover Feature		Submerged Crib Wall	Submerged Crib Wall	Submerged Crib Wall	Submerged Crib Wall
Toe Protection/Stabilization	Toe wood	Toe wood	Toe wood	Toe wood	Toe wood
Toe Protection/Stabilization	Stone Toe Protection	Stone Toe Protection	Stone Toe Protection	Stone Toe Protection	Stone Toe Protection
Toe Protection/Stabilization	Fabric Encapsulated Soil Lifts	Fabric Encapsulated Soil Lifts	Fabric Encapsulated Soil Lifts	Fabric Encapsulated Soil Lifts	Fabric Encapsulated Soil Lifts
Toe Protection/Stabilization		Log Vane with Boulder Hook	Log Vane with Boulder Hook	Log Vane with Boulder Hook	Log Vane with Boulder Hook
Toe Protection/Stabilization		Single & Double Wing Deflectors	Single & Double Wing Deflectors	Single & Double Wing Deflectors	Single & Double Wing Deflectors
Channel Definition Structure		Cut-off Sills	Cut-off Sills	Cut-off Sills	Cut-off Sills
Channel Definition Structure	Engineered Log Jams	Engineered Log Jams	Engineered Log Jams	Engineered Log Jams	Engineered Log Jams
Channel Definition Structure			Longitudinal Peaked Stone Toe	Longitudinal Peaked Stone Toe	Longitudinal Peaked Stone Toe
Channel Definition Structure			Bendway weirs	Bendway weirs	Bendway weirs
Channel Definition Structure			Stream Barbs	Stream Barbs	Stream Barbs
Channel Definition Structure		J-Hook Vane/Straight Vane	J-Hook Vane/Straight Vane	J-Hook Vane/Straight Vane	J-Hook Vane/Straight Vane
Bank and Floodplain Restoration	All	All	All	All	All
Vegetative Restoration Practice	All	All	All	All	All
Riparian Buffering Practice	All	All	All	All	All
Geomorphic Channel Design	All	All	All	All	All

Data Collection and Analysis Tool

Data Collection/ Analysis Tool

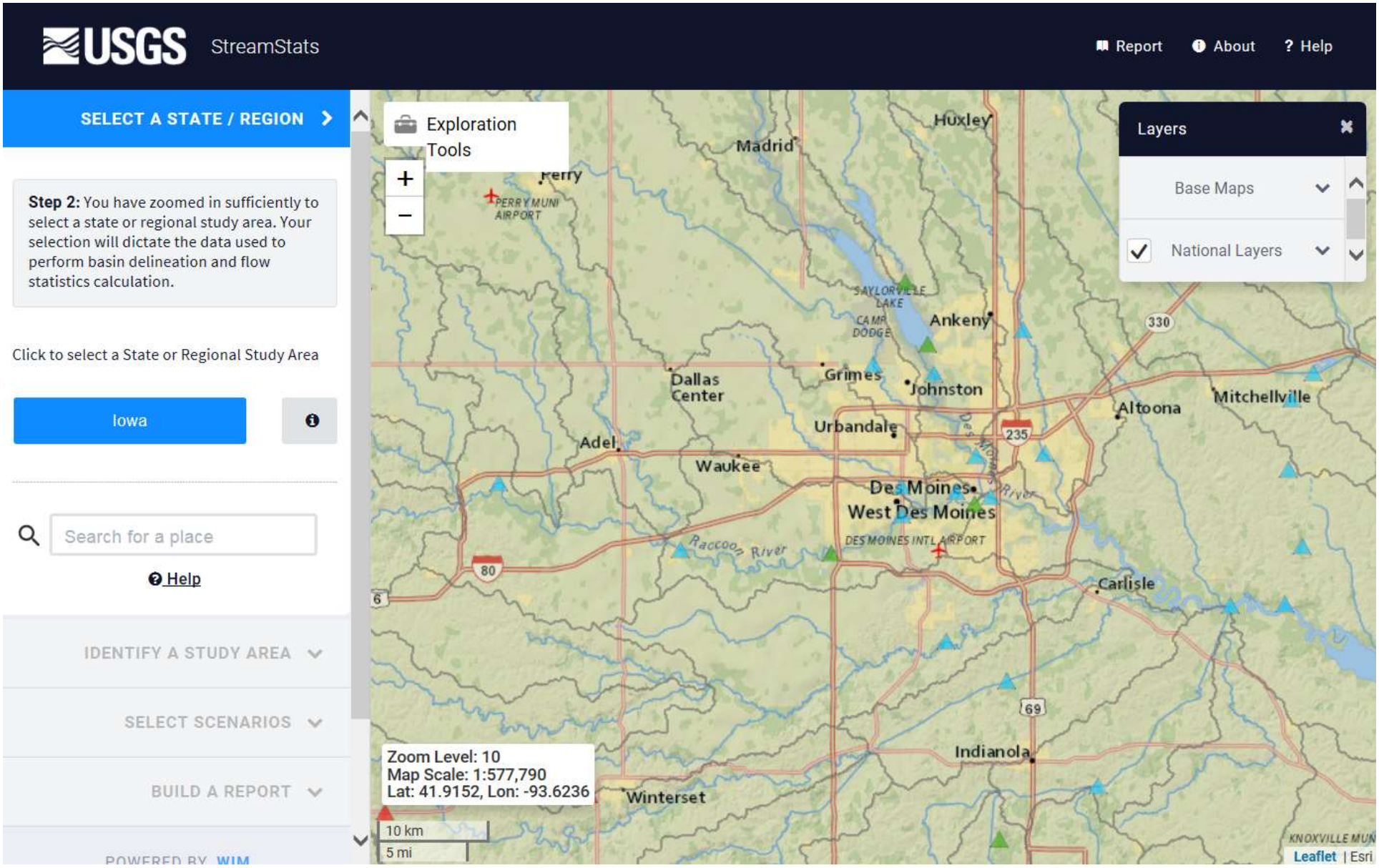
- Divided into Categories
- Drawings
- Links
- Questions Feed Decision Matrix





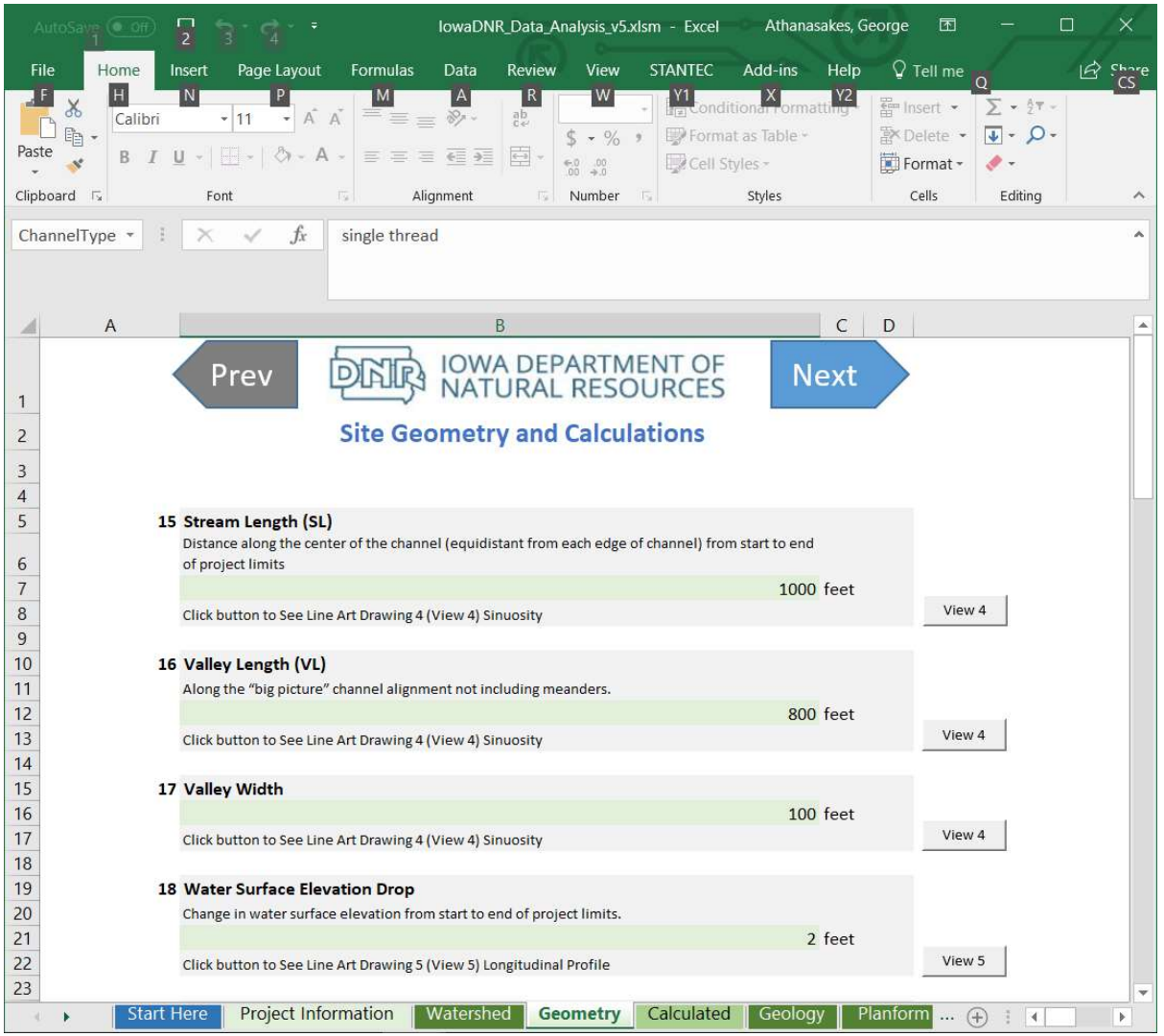
MEAN BANKFULL DEPTH = (BANKFULL AREA)/(BANKFULL WIDTH)

WIDTH-TO-DEPTH RATIO = (BANKFULL WIDTH)/(AVERAGE BANKFULL DEPTH)

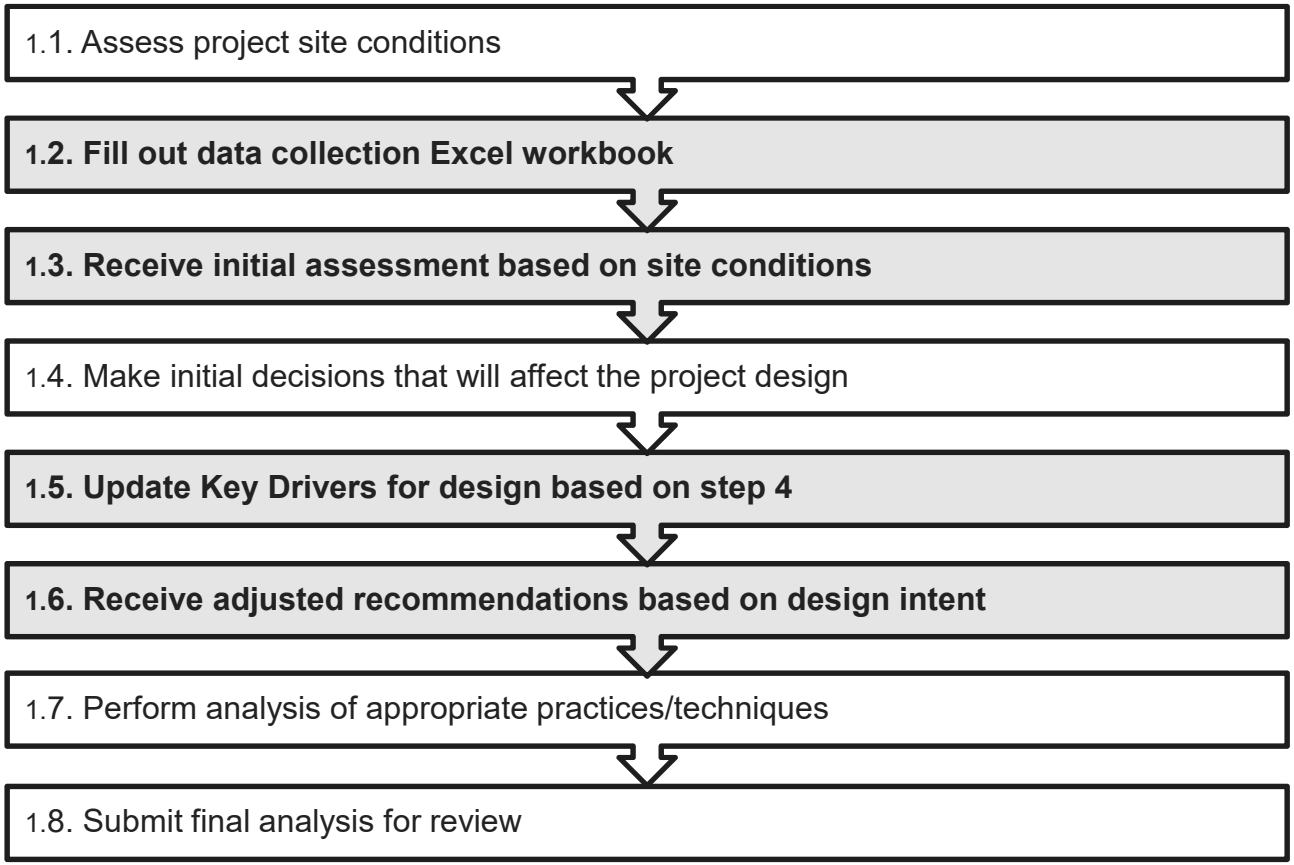

USGS StreamStats
Report
About
Help
SELECT A STATE / REGION
Step 2: You have zoomed in sufficiently to select a state or regional study area. Your selection will dictate the data used to perform basin delineation and flow statistics calculation.
Click to select a State or Regional Study Area
Iowa
Search for a place
Help
IDENTIFY A STUDY AREA
SELECT SCENARIOS
BUILD A REPORT
POWERED BY WIM
Exploration Tools
Layers
Base Maps
National Layers
Huxley
Madrid
Perry
PERRY MUNI AIRPORT
SAYLORVILLE LAKE
CAMP DODGE
Ankeny
330
Dallas Center
Grimes
Johnston
Mitchellville
Altoona
Urbandale
235
Adel
Waukee
Des Moines
West Des Moines
DES MOINES INTL AIRPORT
Raccoon River
80
6
Carlisle
69
Indianola
Winterset
Zoom Level: 10
Map Scale: 1:577,790
Lat: 41.9152, Lon: -93.6236
10 km
5 mi
KNOXVILLE MUN
Leaflet | Esri

Various Tabs

- Project Info
- Watershed
- Channel Geometry
- Calculated Parameters
- Geology
- Planform Stability
- Bed Stability
- Habitat
- Infrastructure
- Design Assessment
- Technique Ranking



The Assessment Process



Functional Status

	This parameter is "Functional" (green); no adjustment is necessary
	Should change this parameter by design to achieve a "Functional" (green) performanace standard
	Should change this parameter by design to achieve a "Functional" (green) or "Functional At-Risk" (orange) performanace standard

Hydraulic Function						
Floodplain Connectivity						
Bank Height Ratio - BHR=Low Bank H	<1	1-1.2	1.2-1.5	>1.5		
#8 Geometry Tab - Top of bank depth; #13 dmbkf						
Entrenchment Ratio* C and E Stream	<2	2-2.2	>2.2			
Entrenchment Ratio* B and Bc Strea	<1.2	1.2-1.4	>1.4			
Geometry Tab - wbkf; Geometry Tab - Wfpa;						
Regional Curve	Q/Qbkf on curve	Q/Qbkf above curve	Q/Qbkf > 2 and d/dbkf > 1.6			
Hydraulic Function						
Flow Dynamics						
Bankfull Velocity (v) C and E Stream T	3-6 fps	6-7 fps	>7 fps			
Bankfull Velocity (v) for Bc Stream Ty	<3 fps	3-5 fps	> 5 fps			
Bankfull Velocity (v) for B Stream Typ	4-6 fps	6-7 fps	>7 fps			
Geomorphic Function						
Channel Evolution						
Channel Evolutionary Stage (Simon a	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
Note: Stage 5 only acceptible if stream is constructing new floodplain at a lower elevation						
Geomorphic Function						
Bank Migration Lateral Stability						
Representative Bank Erosion Hazard	V Low-Low	Moderate	High-V High	Extreme		
Radius of Curvature						
Radius of Curvature/Bankfull width	<2	2-3	>3			
Bankfull Area vs Regional Curve Bankfull Area						
Abkf within % Range of Selected Regiona	<30%	15% - 30%	>15%			
Bankfull Discharge vs Regional Curve Bankfull Discharge						
Qbkf within % Range of Selected Regiona	<30%	15% - 30%	>15%			

Assessment Tab – Functional Evaluation

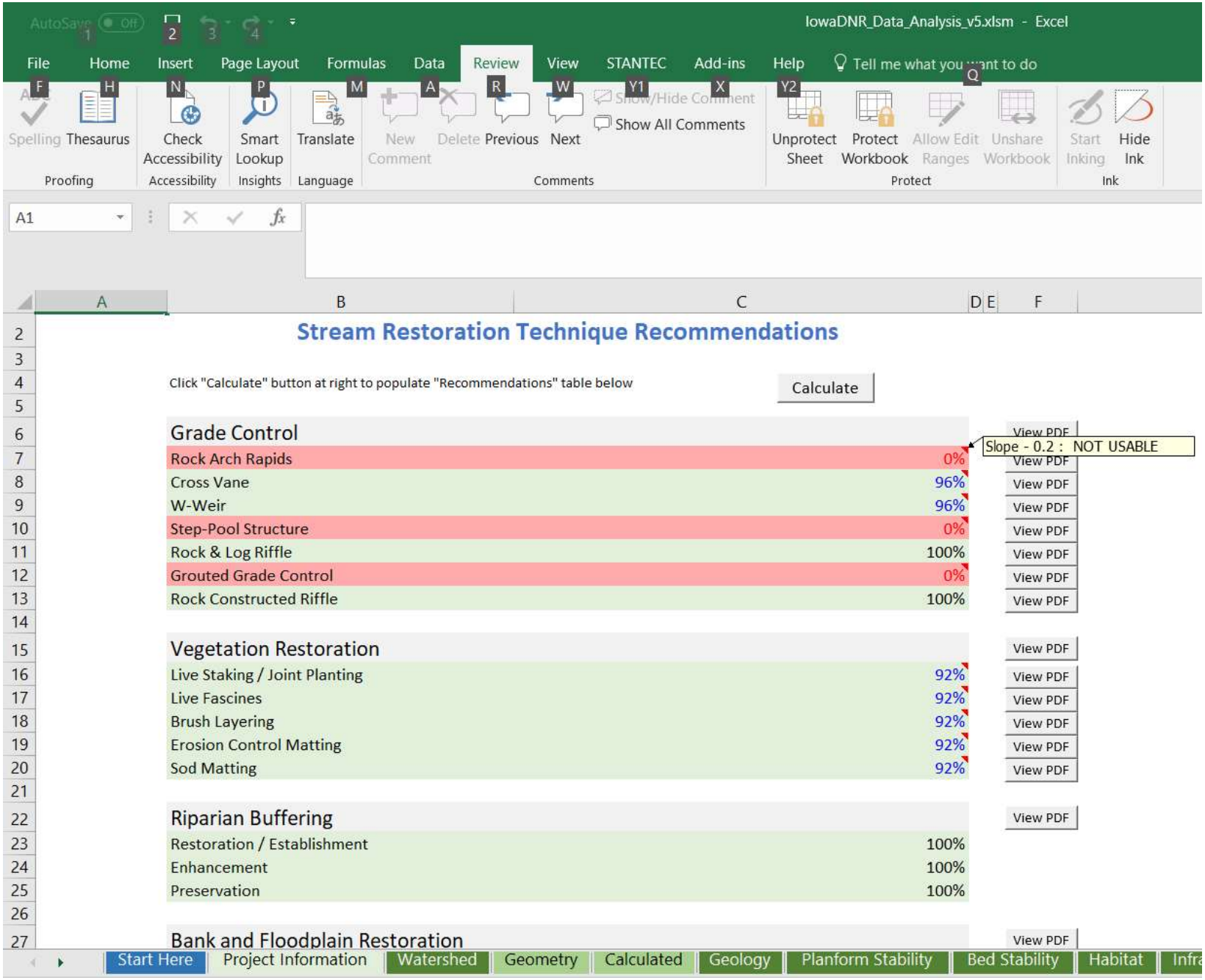
Review Functional Design

Copy Conditions | Clear Conditions | Re-Calculate

Note: Enter most representative value for each parameter.	Existing Conditions	Design Conditions
Bank Height Ratio	1.00	1.00
Entrenchment Ratio	3.33	3.33
Bankfull Cross Sectional Area	54.00	54.00
Bankful Discharge Design	126.00	126.00
Regional Curves - Bankfull Cross Sectional Area	47.89	47.89
Regional Curves - Bankful Discharge	123.47	123.47
Bankful Velocity	2.33	2.33
Schumm Channel Evolution Stage (Select from drop-down list)	Stage IV	Stage I
Dominant Bank Erosion Hazard Index (BEHI) Rating (Select from drop-down list)	high	low
Minimum Buffer Width (Measured from Outside Edge of Belt Width)	40.00	130.00
Bankfull Width	30.00	30.00
Radius of Curvature	57.00	90.00
Meander Width Ratio	3.33	3.33
Pool to Pool Spacing Ratio	2.70	5.10
Pool Maximum Depth Ratio	1.67	1.67
Width to Depth Ratio	16.67	16.67
Water Surface Slope (%)	0.2000	0.2000
Bankfull Max Average Depth	2.00	2.00
Stream Type	C4	C4
Channel Length	1000.00	1000.00
Channel Bed Material (Select from drop-down list)	sand (0.062 mm - <2 mm)	sand (0.062 mm - <2 mm)
Is this stream a single channel or multiple thread channel	single thread	single thread
Presence of Levees (Select from drop-down list)	No	No
Presence of Nearby Infrastructure	3.33	3.33

This parameter is "Functional" (green); no adjustment is necessary	FUNCTIONAL
Should change this parameter by design to achieve a "Functional" (green) performanace standard	FUNCTIONAL - AT RISK
Should change this parameter by design to achieve a	NON - FUNCTIONAL

Project Information | Geometry | Calculated | Watershed | Geology | Planform Stability | Bed Stability | Habitat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Unshare Workbook
Start Inking
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A1
Stream Restoration Technique Recommendations
Click "Calculate" button at right to populate "Recommendations" table below
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Grade Control
Rock Arch Rapids 0%
Cross Vane 96%
W-Weir 96%
Step-Pool Structure 0%
Rock & Log Riffle 100%
Grouted Grade Control 0%
Rock Constructed Riffle 100%
Slope - 0.2 : NOT USABLE
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Vegetation Restoration
Live Staking / Joint Planting 92%
Live Fascines 92%
Brush Layering 92%
Erosion Control Matting 92%
Sod Matting 92%
Riparian Buffering
Restoration / Establishment 100%
Enhancement 100%
Preservation 100%
Bank and Floodplain Restoration
Start Here
Project Information
Watershed
Geometry
Calculated
Geology
Planform Stability
Bed Stability
Habitat


QUESTIONS
Stantec
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Iowa Elevation Tools How to use the tool

Data 3m Posts derived from LiDAR More about the data

Clear | Point Multipoint Polyline | Profile

Profile Data Table

X,Y coordinates are in Web Mercator (srid:3857), d or z units are in feet.

id	x	y	z
1	-10424152.0	5095844.2	809.75

Export CSV

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