

**Are We Certifiable?
Presenting a BOK for
Stream Restoration**

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Gonzaga University***

Multi-disciplinary



- **Professional Certification or Licensure**
 - definitive minimum standard of experience and education for professionals
 - broader recognition as well-educated and experienced and acting in best interest of the public



Stream Restoration

How do we Mature the Profession?

Intl. Encyclopedia of Social Sciences:

*Requirement of formal training
and some mode of validating
adequacy of training and
competence of trained individuals*

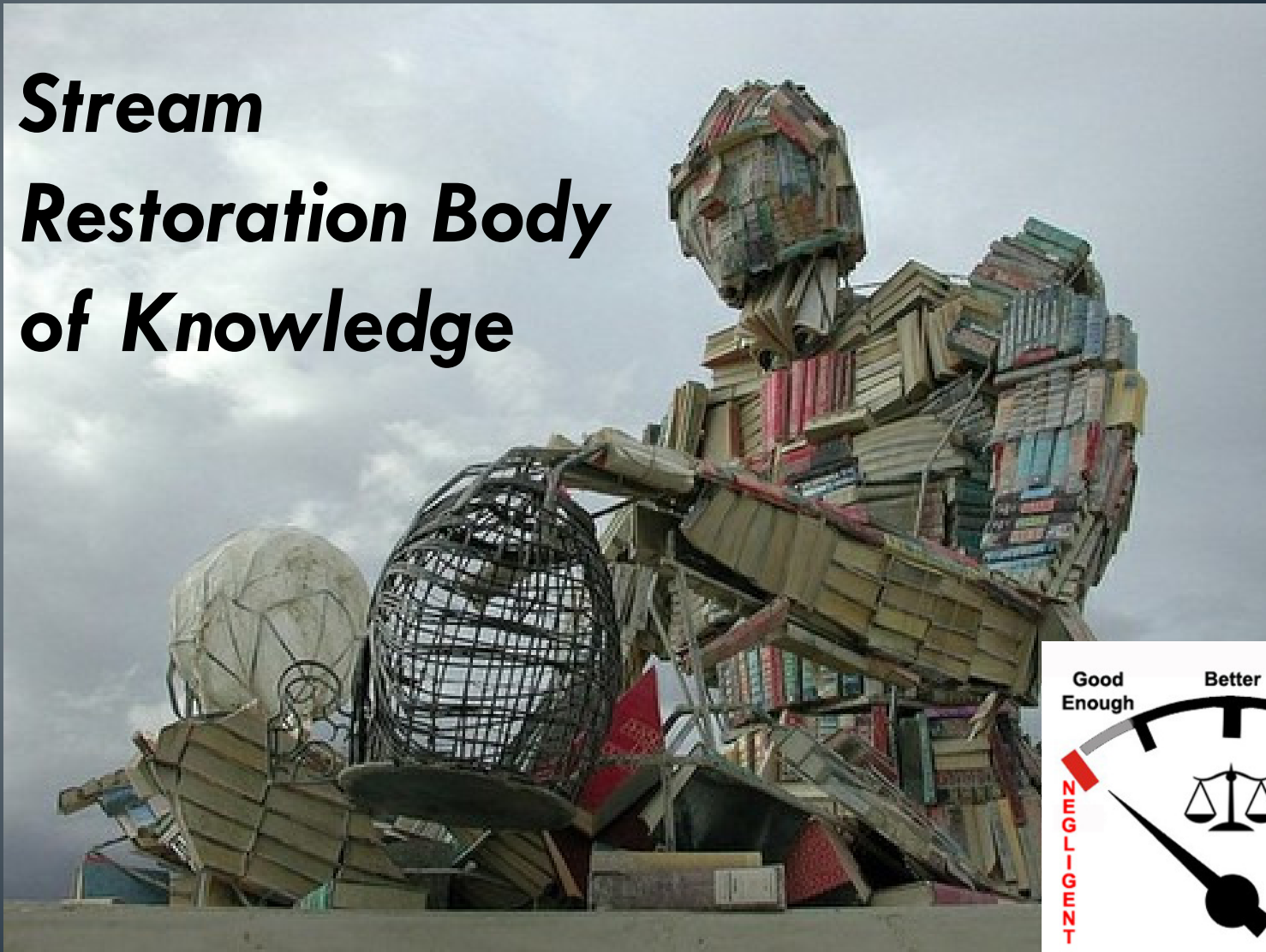


Stream Restoration Educational Materials Committee

- Practitioners, Government, Academics in Fisheries, Geomorphology, Ecology, Engineering
- Active Members:
 - Dan Baker, Janine Castro, Joanna Curran, Sue Niezgodna, Jennifer Muller Price, Doug Shields, John Schwartz, Therese Wynn-Thompson, Peter Wilcock
- Technical Reviewers:
 - Brian Bledsoe, Garey Fox, Will Harman, Rollin Hotchkiss, Greg Jennings, Greg Koonce, Jim MacBroom, Jack Schmidt, Peter Sheydayi, Andrew Simon, Colin Thorne, Desiree Tullos, Vaughan Voller

Committee Goal (Mission)

**Stream
Restoration Body
of Knowledge**



Committee Efforts

Task #1 – Determine current state of restoration education

Task #2 – Determine what is needed by profession

Task #3 – Define SR-BOK

2009 Northwest Stream Restoration Design Symposium

Skamania Lodge, Stevenson, Washington
February 2-5, 2009



2010 SUSTAINING COLORADO WATERSHEDS

Learning from the Past to Protect the Future



Presented by:

Colorado Foundation for Water Education
Colorado Lakes & Reservoir Management Association
Colorado Riparian Association
Colorado Watershed Assembly



Conference Agenda

October 5-7 at the Vail Cascade Resort & Spa



PRRSUM

PARTNERSHIP FOR RIVER RESTORATION AND SCIENCE IN THE UPPER MIDWEST

General Practitioner SR-BOK

- Outcomes - knowledge and skills to acquire
 - Minimum level learning (Blooms Taxonomy)

Bloom's Taxonomy

Identify

Define



KNOWLEDGE



COMPREHENSION



Apply



APPLICATION



Calculate



ANALYSIS



Design



SYNTHESIS



Justify

EVALUATION

***SR-BOK - 21 outcomes with
eight foundational, eight
technical, and five
professional, and identifies the
minimum level of learning
required for each outcome for
a general practitioner***

*Project
Management*

*Monitoring/
Assessment*

*Restoration
Design*

Depth

*Construction
Management*

*Regulatory
Review*

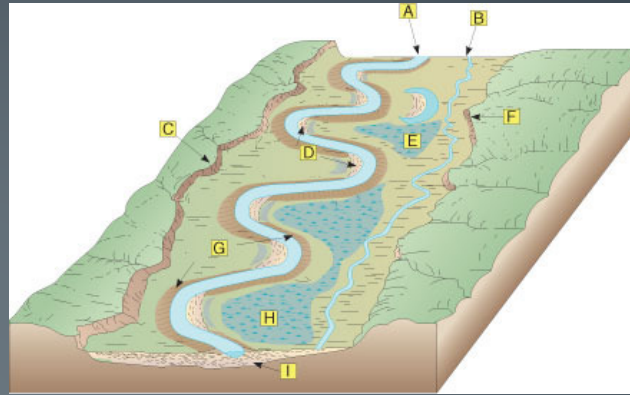
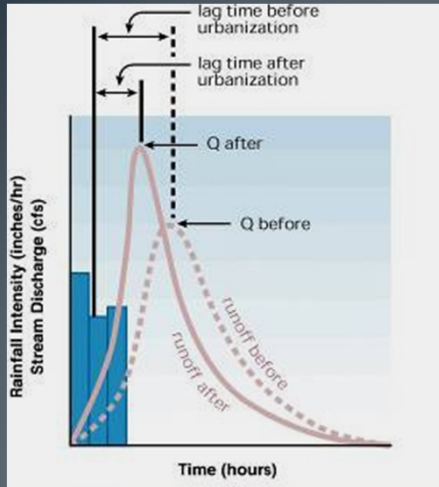
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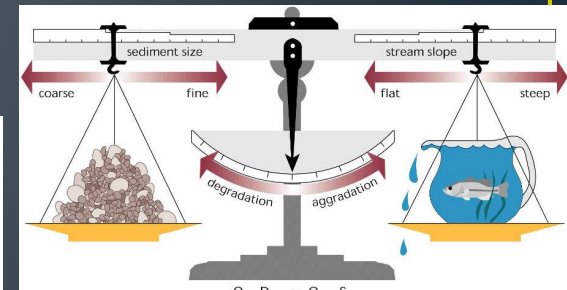
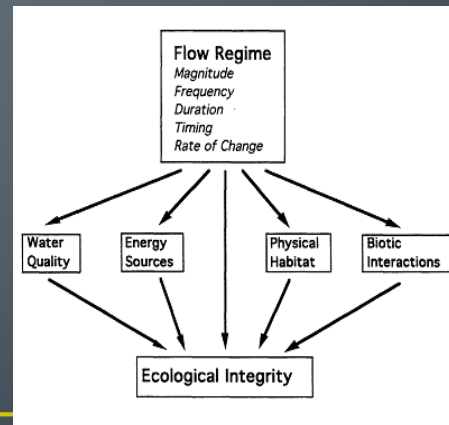
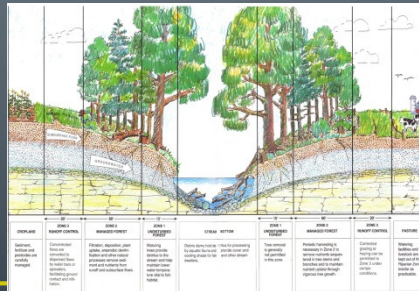
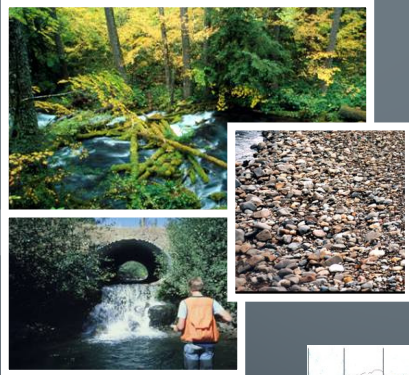
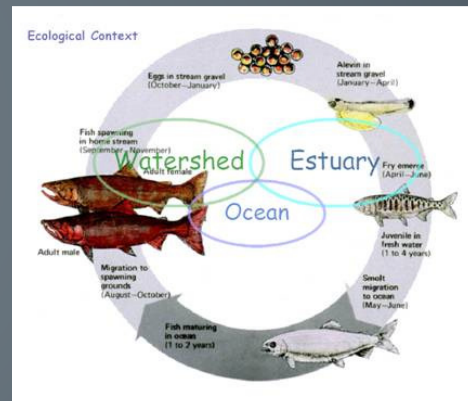
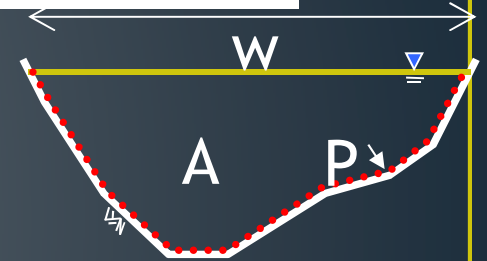
Stream Restoration Body of Knowledge - General Practitioner

Outcome Number and Title	Level of Achievement					
	L1	L2	L3	L4	L5	L6
<i>Foundational</i>						
1. Hydrology						
2. Hydraulics						
3. Fluvial Geomorphology						
4. Sediment Transport						
5. Stream Ecology						
6. Habitat Structure and Function						
7. Fish Biology						
8. Plant Ecology and Riparian Dynamics						
<i>Technical</i>						
9. Surveying/Hydrometry						
10. Watershed Analysis						
11. Geomorphic and Habitat Assessment						
12. Biomonitoring/Bioassessment						
13. Alternatives Analysis						
14. Analytical Techniques						
15. Restoration Design						
16. Uncertainty and Risk						
<i>Professional</i>						
17. Project Development						
18. Restoration Policy (codes and regulations)						
19. Communication and Information Management						
20. Construction Inspection						
21. Professional and Ethical Responsibility						

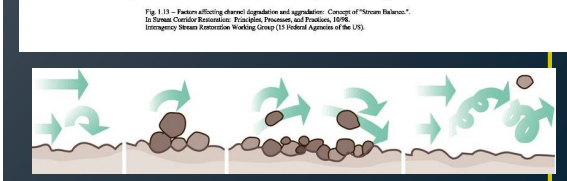
Foundational Outcomes



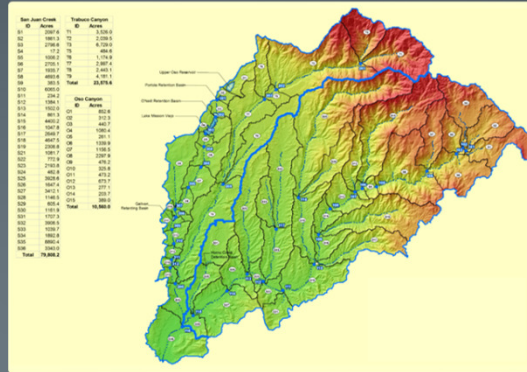
$$Q = \frac{k}{n} AR^{2/3} S_f^{1/2}$$



From Rosgen (1996), from Lane, Proceedings, 1955. Published with the permission of American Society of Civil Engineers.



Technical Outcomes



United States Department of Agriculture
Natural Resources Conservation Service

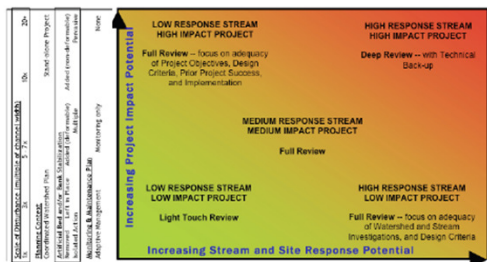
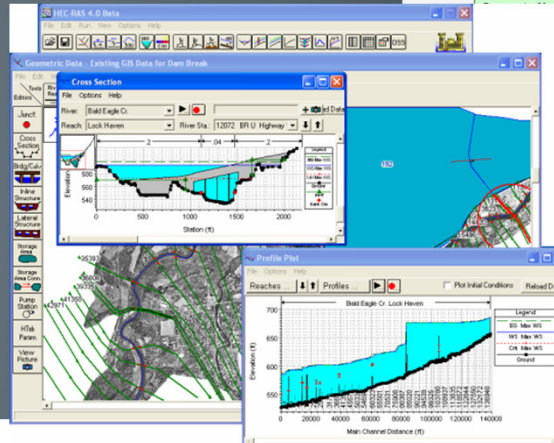
National Water and Climate Center
Technical Note 99-1

Stream Visual Assessment Protocol

Decision Matrix
(scale of 1- 10)

Objective	Website	Blog	LinkedIn	Twitter
Leads	6	3	2	0
Engaging	0	3	7	4
Connections	0	4	6	4
Feedback	5	0	0	1
Quality	10	8	1	0
Quantity	5	6	5	3
Sales	8	10	2	4
Total	10	2	0	0
Total	44	36	23	16

© Multi-Channel Marketing



Project Screening Matrix

Stream Sensitivity / Stream Type	Source (1-10) Slope	Transport (D-10s)	Bedrock	Alluvial	Response (1-20)	Inflow Channel / Alluvial Fan
Continuous/Wide	Semi-continuous/Wide	Discontinuous/Narrow	Urbanized or Lower Confined	Naturally Non-erodible	Erosion Resistant	Highly Erodible, or Retarded
Bed Source Potential	Bedrock/Non-erodible	Erosion Resistant	Highly Erodible, or Retarded	Bed Source Potential	Bedrock/Non-erodible	Erosion Resistant
Bed Source Potential	Bedrock/Non-erodible	Erosion Resistant	Highly Erodible, or Retarded	Bed Source Potential	Bedrock/Non-erodible	Erosion Resistant
Dominant Hydrologic Regime	Spring-fed	Snowmelt	Rain	Rain-de-Snow	Thunderstorm/Monsoon	

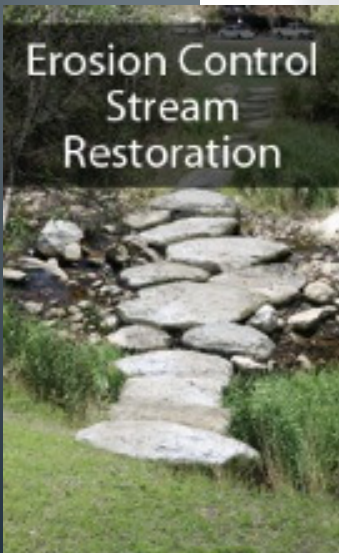
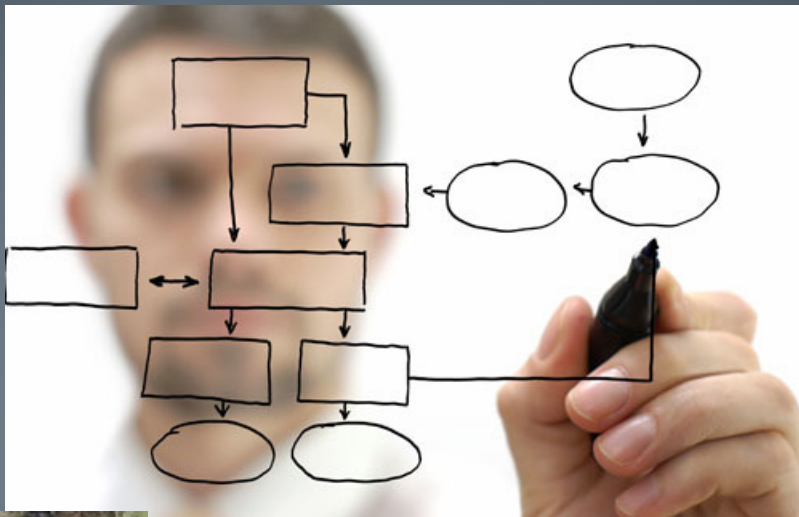
United States Department of Agriculture
Natural Resources Conservation Service

Part 654 Stream Restoration Design National Engineering Handbook

Chapter 9

Alluvial Channel Design

Professional Outcomes



Stream Res

Outcome N

1. Hydrology

2. Hydraulics

3. Fluvial Ge

4. Sediment

5. Stream E

6. Habitat Structure and Function

7. Fish Biology

1) BA, BS, MS, PhD (CE)

2) PE in Wyoming

3) Experience - 3 yrs Consulting

**4) Prof Dev – PSU SR Certificate,
short courses, conferences**

19. Communication and Information Management

20. Construction Inspection

21. Professional and Ethical Responsibility

Where do I stand???

L6

Stream Restoration Body of Knowledge - General Practitioner

Outcome Number and Title	Level of Achievement					
	L1	L2	L3	L4	L5	L6
<i>Foundational</i>						
1. Hydrology	B	B	B	B/M	M	DOC
2. Hydraulics	B	B	B	B/M	M	DOC
3. Fluvial Geomorphology	PD	PD	PD			
4. Sediment Transport	B	M	M	M	M/DOC	DOC
5. Stream Ecology	B	PD	PD			
6. Habitat Structure and Function	PD					
7. Fish Biology	PD	PD				
8. Plant Ecology and Riparian Dynamics	PD	PD				
<i>Technical</i>						
9. Surveying/Hydrometry	B	B	B	B/M	M/DOC	
10. Watershed Analysis	B	B	B	M/E	DOC/E	
11. Geomorphic and Habitat Assessment	PD	PD				
12. Biomonitoring/Bioassessment	PD	PD				
13. Alternatives Analysis	B	B	B	B/M	M/E	DOC/E
14. Analytical Techniques	B	B	M	M/E	DOC/E	DOC/E
15. Restoration Design	E	E	DOC	DOC		
16. Uncertainty and Risk	M	DOC	DOC	DOC	DOC	DOC
<i>Professional</i>						
17. Project Development	E/PD	E/PD				
18. Restoration Policy (codes and regulations)	M	E/PD				
19. Communication and Information Management	E/PD	E/PD				
20. Construction Inspection	E					
21. Professional and Ethical Responsibility	B	B	M	M/E	DOC/E	DOC/E

Stream Restoration Body of Knowledge - General Practitioner

Outcome Number and Title	Level of Achievement					
	L1	L2	L3	L4	L5	L6
<i>Foundational</i>						
1. Hydrology						
2. Hydraulics						
3. Fluvial Geo						
4. Sediment T						
5. Stream Eco						
6. Habitat Str						
7. Fish Biolog						
8. Plant Ecol						
<i>Technical</i>						
9. Surveying/Hydr						
10. Waters						
11. Geomo						
12. Biomor						
13. Alterna						
14. Analyti						
15. Restora						
16. Uncerta						
17. Project						
18. Restoration Policy (codes and regulations)						
19. Communication and Information Management						
20. Construction Inspection						
21. Professional and Ethical Responsibility						

Where do you stand???

Undergrad Degree – BS

Graduate Degrees – MS/Meng/PhD

Continuing Ed Courses – PD

Professional Experience – E

SR-BOK for the General Stream Restoration Practitioner

Foundational Outcomes Number and Title	Minimum Level of Learning						Outcome Definition
	L1	L2	L3	L4	L5	L6	
1. Hydrology							Solve physics problems related to hydrologic processes and apply this knowledge to analyze runoff generation, plant-soil water relations, and coevolution of fluvial geomorphology and hydrologic response.
2. Hydraulics							Solve natural channel free surface flow problems using conservation of mass, momentum, energy and analyze uniform, gradually and rapidly-varied flow, flow resistance, flood routing.
3. Fluvial Geomorphology							Analyze fluvial processes and morphological responses in different environments and types of dynamic rivers including channel response to change and channel patterns. Understand and apply geomorphological approach to river channel management and restoration.
4. Sediment Transport							Understand sediment transport principles and apply strategies of estimating sediment transport in rivers, including incipient motion, mixed size sediments, and alluvial transport. Calculate sediment transport for channel design alternatives, and determine when transport rates are not important.
5. Stream Ecology							Understand basic concepts of river ecology (hydrologic, biogeochemical, biological) to determine structure and function of freshwater lotic ecosystems with an emphasis on solving problems involving stream/habitat/hyporheic restoration of water resources to maintain environmental flows.
6. Habitat Structure and Function							Apply methods to assess stream physical habitat characteristics (e.g., channel roughness, channel structure and pattern, mesohabitat types, velocity, depth, substrate type, riparian vegetation) as they apply to in-stream flow, monitoring, habitat quality, and fish-habitat relationship studies.
7. Fish Biology							Understand the comparative biology of fishes, species traits, and habitat preferences; identify common/economically important species, and apply knowledge to examine the effect of restoration actions on concerned species (i.e., increased in-stream flows, dam removal, and in-channel restoration).
8. Plant Ecology and Riparian Dynamics							Understand plant community dynamics and apply ecological techniques (e.g., riparian habitat mapping, riparian dynamics modeling, plant surveys/monitoring) to examine different restoration scenarios, predict riparian vegetation recruitment, and develop effective revegetation designs.

Technical Outcomes Number and Title	Minimum Level of Learning						Outcome Definition
	L1	L2	L3	L4	L5	L6	
9. Surveying/ Hydrometry							Develop an understanding of river field measurement techniques. Apply techniques and utilize equipment to survey stream morphology and collect water quality and quantity and sediment transport data as it relates to stream stability assessment.
10. Watershed Analysis							Characterize connections between natural landscape properties, human activities, and ecosystem services related to soil, sediment, water resources, and aquatic ecosystems and analyze the main processes that control water quantity, water quality, sediment transport, and aquatic habitat.
11. Geomorphic and Habitat Assessment							Apply rapid geomorphic assessment and rapid habitat assessment to assess stream condition using multiple data types across scales ranging from a single cross section to an entire watershed. Use the results to identify how channel, floodplain and watershed scale stressors effect hydrological processes and alter the physical and ecological structure and habitat values of streams.
12. Biomonitoring/ Bioassessment							Understand rationale for biomonitoring and the use of benthic invertebrates as indicators of water quality and overall stream health. Apply bioassessment methods to identify benthic invertebrates using the visual description of diagnostic characters for sensitive groups (i.e., EPT index).
13. Alternatives Analysis							Analyze scientific information to place stream restoration alternatives in the context of fluvial geomorphology, hydrology, sediment budget, and sediment transport while providing resiliency to stream systems in light of stream processes overlain with biologic goals and human values.
14. Analytical Techniques							Apply analytical tools to characterize flood discharge and stage relationships, sediment budgets, sediment transport conditions, bank mechanics and erosion, and fish habitat and passage (e.g., HEC-HMS, HEC-RAS, BSTEM, BAGGS, River2D, FishXing).
15. Restoration Design							Analyze stream restoration design approaches that integrate geology, soils, and hydrology with hydraulics, sediment transport, and fluvial geomorphology to select an appropriate design approach. Understand the basics of standards, specifications, design notes, and drawings of design features.
16. Uncertainty and Risk							In stream restoration design, understand types and modes of failure, probability of failures, expected failure costs, and uncertainty types. Apply methods to reduce uncertainty.

Professional Outcomes Number and Title	Minimum Level of Learning						Outcome Definition
	L1	L2	L3	L4	L5	L6	
17. Project Development							Apply project and goals management principles to build multi-agency and interdisciplinary teams, set up administrative systems, and create internal and public communication plans.
18. Restoration Policy (codes and regulations)							Understand major laws relevant to stream restoration projects, including federal, state, and county laws, and recognize variable regulatory timeframes and show impacts on project implementation.
19. Communication and Information Management							Prepare and apply a plan that incorporates information distribution, performance reporting and administrative closure and defines how effective communication of information with all involved parties will be accomplished at key stages in the process. Manage and facilitate a process to ensure timely and appropriate generation, collection, dissemination, storage and disposition of information.
20. Construction Inspection							Apply quality assurance testing and engineering surveys and document construction activities to assure that goals of the planned project are realized during construction. Coordinate with the contractor's quality control personnel and maintain the as-built plans.
21. Professional and Ethical Responsibility							Critically evaluate ethical issues that arise in stream restoration, including relationships between ethics and professional life and the particular consequences of ethical considerations within the practitioner's own profession and the professions of others involved with the project.

SR-BOK: Foundation for Certification

Validation of BOK?



The SR-BOK :

- Defines essential knowledge and skills
- Baseline for restoration courses and curricula
- Facilitates a certification based on an agreed-upon standard knowledge and skills
- Provides regulatory agencies and employers with baseline for assessing capabilities of stream restoration practicing professionals

Mature the profession:

***1) Defining a Body of
Knowledge*** 

2) Set a basis for 

National Certification

Are we Certifiable?

