



WILDLANDS
ENGINEERING

Evolution of the Constructed Riffle

Shawn D. Wilkerson

Wildlands Engineering, Inc.



Shawn D. Wilkerson

- President of Wildlands Engineering, Inc.
- Masters Degree in Civil Engineering
- NC Real Estate Broker
- Rosgen Levels I-IV
- Specializes in hydrologic science, watershed planning, land acquisition, and project management
- 13 years of experience implementing environmental restoration projects
- Board Member of North Carolina Environmental Restoration Association (NCERA)



Creating ecological solutions through innovative engineering

- Founded in 2007
- Offices in Charlotte, Raleigh, and Charlottesville

Major services provided include:

- Stream, Wetland, and Habitat Mitigation
- Stream and Wetland Restoration
- Water Quality Management and Mitigation
- Watershed and Environmental Planning



Project Team Experience

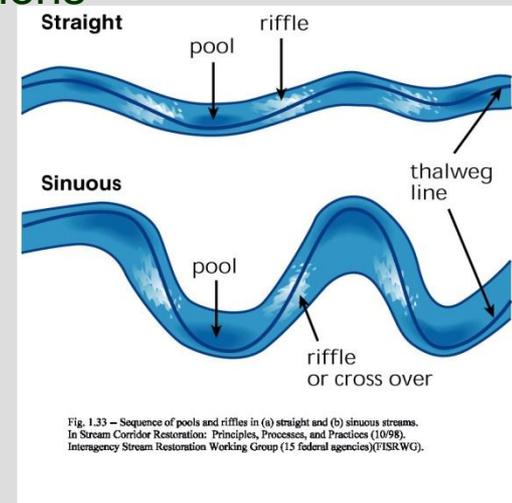
- 200 miles of stability and functional **assessment**
- 175,000 LF of urban and rural **design** work
- 75,000 LF of restoration and enhancement **construction**
- 1,700 acres of **wetland** restoration and enhancement





Background, Definitions and Limitations

- The point of the presentation is to take a look at the evolution of grade control/stability structures that have been placed in the cross over area between pool sections of a stream.
- Riffle: the generally rocky area of a creek or river, where steeper bed slopes and fast currents are found.
- Evolution: the process of formation, growth and development.
- Dates are approximate and only for enhancing the ideas of the progression of the constructed riffle as a useful structure in Natural Channel Design.
- Pictures come from many sources and projects and are not the sole property of Wildlands nor all from Wildlands projects.



Evolution of the Constructed Riffle

AN ILLUSTRATIVE TIMELINE

PRE-RIFFLE PERIOD

AKA ~ THE DARK AGES

Before Dave

1998

Concrete
Weirs Extinct

Boulder Era

Emergence of
the Constructed
Riffle Species

2005

POST-RIFFLE PERIOD

Riffle Transition Age

Riffle/J-hook
Merge

Rock & Roll
Riffle Appears

2008

Riffle Enlightenment Age

Cluster Sills Occur

Woody Riffle &
Other Mutation
Appear In
Isolated Areas



WILDLANDS
ENGINEERING



Pre-Riffle Period

Time Before Dave (before 1998)-These were the dark ages of grade control's most basic species consisting of concrete weirs and rip-rap check dams.

- These structures provided grade control, aeration and pool development
- Often caused bank erosion and caused upstream sedimentation
- Little habitat value
- Expensive





Pre-Riffle Period

Boulder Era (1998-2005) - New, more thoughtful species develop such as cross-vanes and double wing deflectors. Still pre-riffle in nature, thought toward habitat and bank stability begins to emerge.

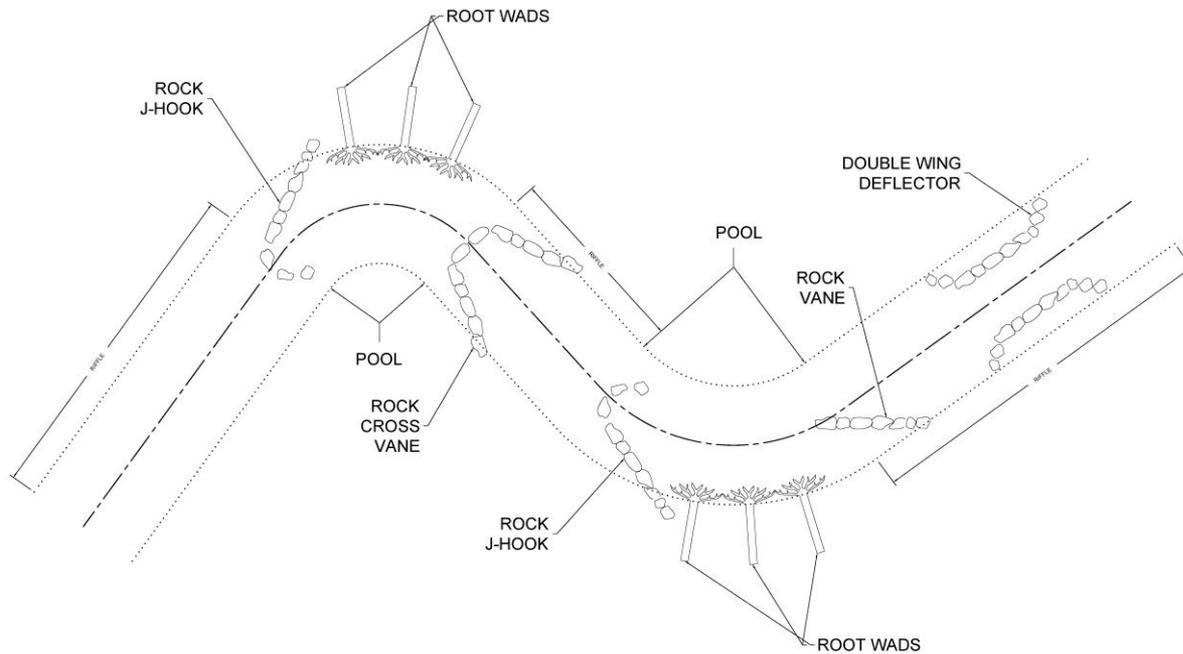
- Still lack macro-invertebrate habitat function, mostly pool habitat
- Still encourages importation of large quarried boulders into the riffle area or stream
- Not very natural for most meandering stream types
- Expensive





Pre-Riffle Period Boulder Era (1998-2003)

TYPICAL STRUCTURE PLACEMENT ≈2002





WILDLANDS
ENGINEERING

Pre-Riffle Period

Boulder Era (1998-2005)





Riffle Period (aka, Age of Naturalization)

Riffle Transition Era (2005-2008) - Turbulent (ha, ha) period of fits and starts for riffles as dominance over boulder structures is hard fought. Evolution includes dropping unneeded sills and developing more mobile substrate.





WILDLANDS
ENGINEERING

Riffle Period

Riffle Transition Era (2005-2008)





WILDLANDS
ENGINEERING

Riffle Period

Riffle Transition Era (2005-2008)





Riffle Period

Riffle Enlightenment Age (2008-present) - Riffles begin rapid development of newly formed attributes such as wood substrate, integrates wood and rock step features, and the merging with J-hook vanes. Several distinct species of riffles begin to form.

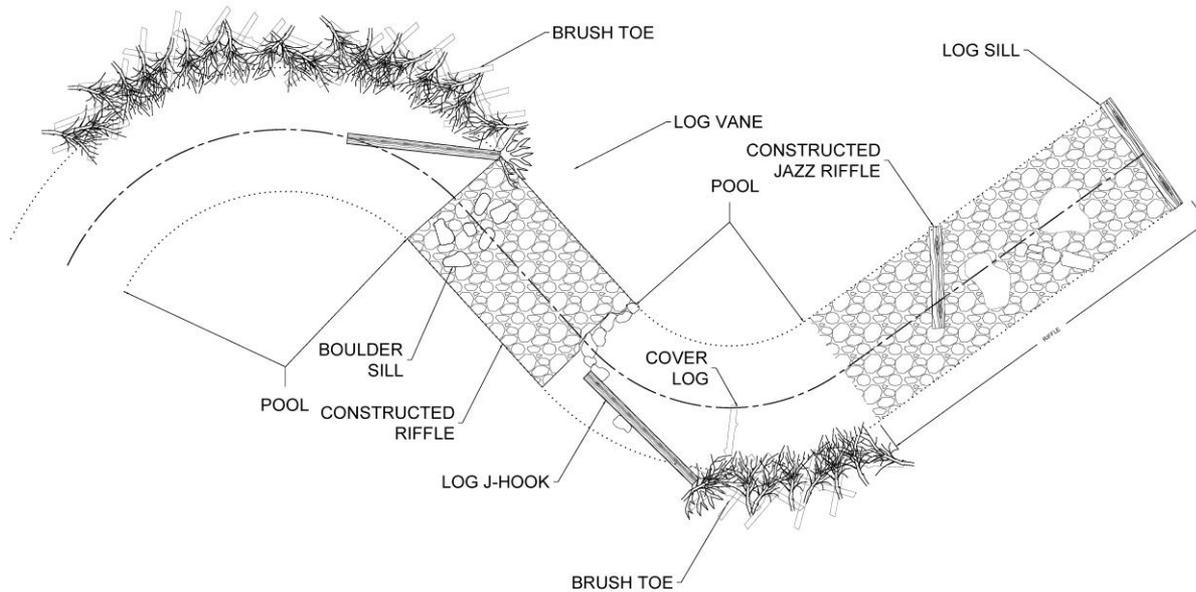




Riffle Period

Riffle Enlightenment Age (2008-present)

TYPICAL STRUCTURE PLACEMENT 2010





WILDLANDS
ENGINEERING

Riffle Period

Riffle Enlightenment Age (2008-present)





WILDLANDS
ENGINEERING

Riffle Period (aka, Age of Naturalization)

Riffle Enlightenment Age (2008-present)





WILDLANDS
ENGINEERING

Riffle Period

Riffle Enlightenment Age (2008-present)





Summary and Conclusions

- In a fairly short period of time (12-15 years), constructed riffles have emerged as the preferred method to stabilize and add habitat to the cross-over section of restored streams.
- While weirs, cross-vanes, and double wing deflectors still have their uses, construction riffles are a more natural feature in most stream restoration projects.
- Constructed riffles should be designed in numerous different ways to reflect diversity and site specific goals.
- Constructed riffles save money on projects especially using natural substrate instead of quarries.



Questions?

