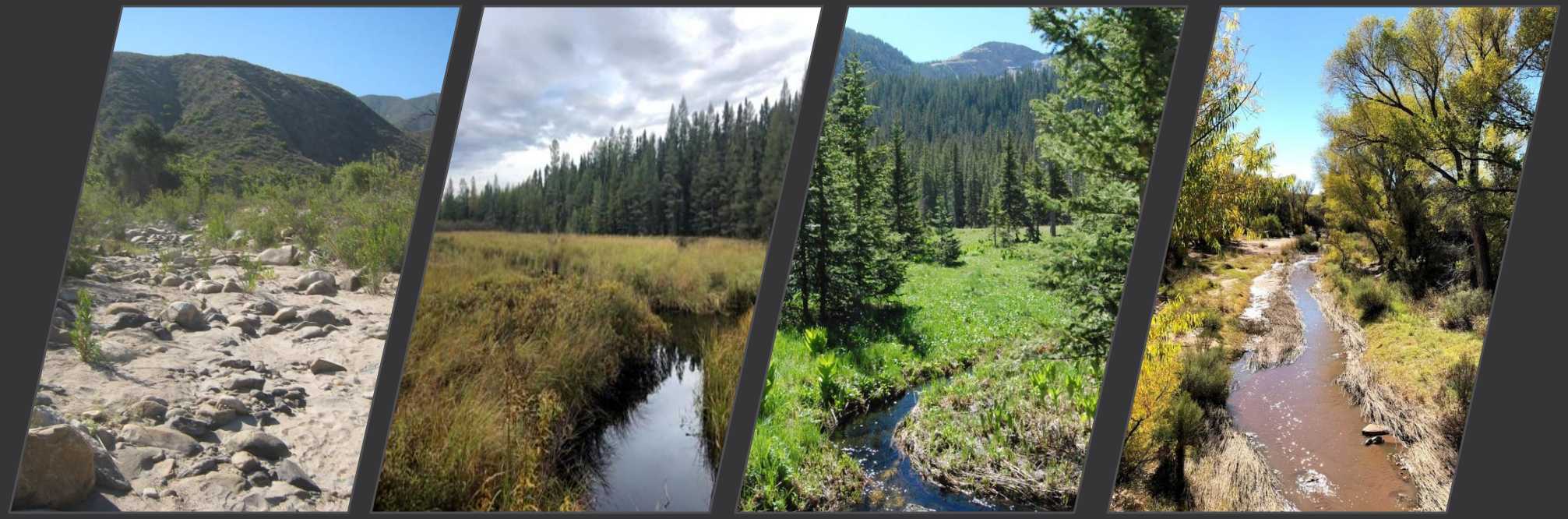
EPA United States Environmental Protection Agency

US Army Corps of Engineers

ERDC

Great Plains Streamflow Duration Assessment Methods: Riffle-pool sequence and Particle size or stream substrate sorting



Video Training

2025

The Great Plains SDAM is based on 8 indicators:

All eight indicators are measured in the **field.**

*Indicators evaluated along the entire length of the assessment reach

In recommended order of data collection:

- Bankfull channel width
- Total aquatic macroinvertebrate abundance
- Number of hydrophytic plant species*
- Presence/absence of rooted upland plants in the streambed*
- Differences in vegetation*
- **Riffle-pool sequence***
- **Particle size or stream substrate sorting***
- Sediment on plants or debris*

Riffle-pool sequence for Great Plains

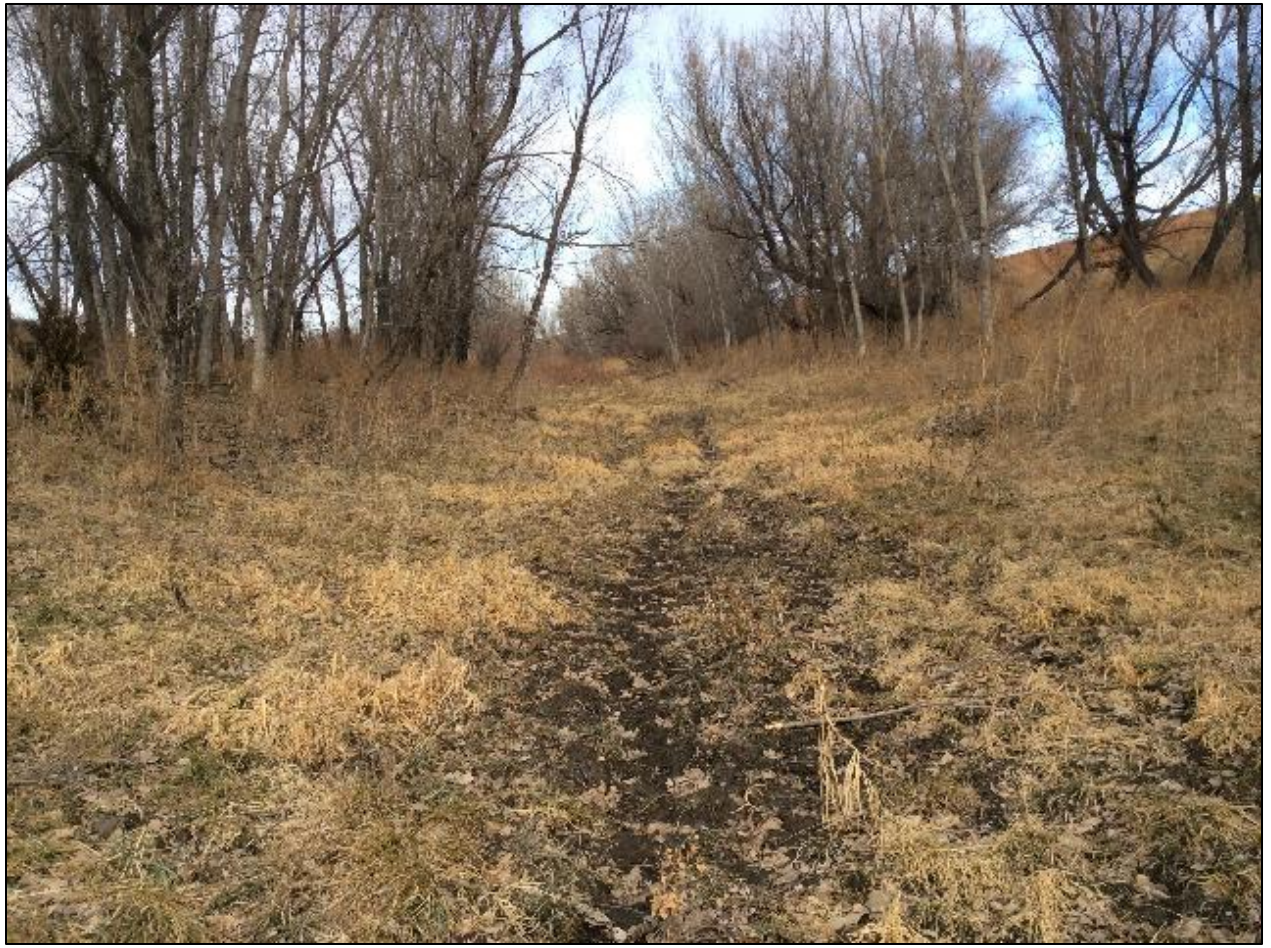
Riffle-pool sequence

- Longer flow durations are associated with larger peak flow magnitudes, which foster the formation of in-stream structures (riffles and pools) and structure sequences.
- Riffles are zones of faster flowing water where the channel gradient is higher and bed material is coarser. Pools are zones of slow-flowing deep water where the channel gradient is lower and bed material is finer.
- Sequence forms can differ based on gradient and bed material; for example, dunes and ripples in sand bed streams.
- Even in a dry reach, these feature sequences can be observed by examining the local profile and patterns of sediment deposition (easier in non-sand bed streams).

Riffle-pool sequence

This indicator is based on a visual estimate of distinction and number of structures (riffles and pools) through the assessment reach scored on an ordinal scale, where half scores are allowed:

- Poor (0): **No riffle-pool sequences observed.**

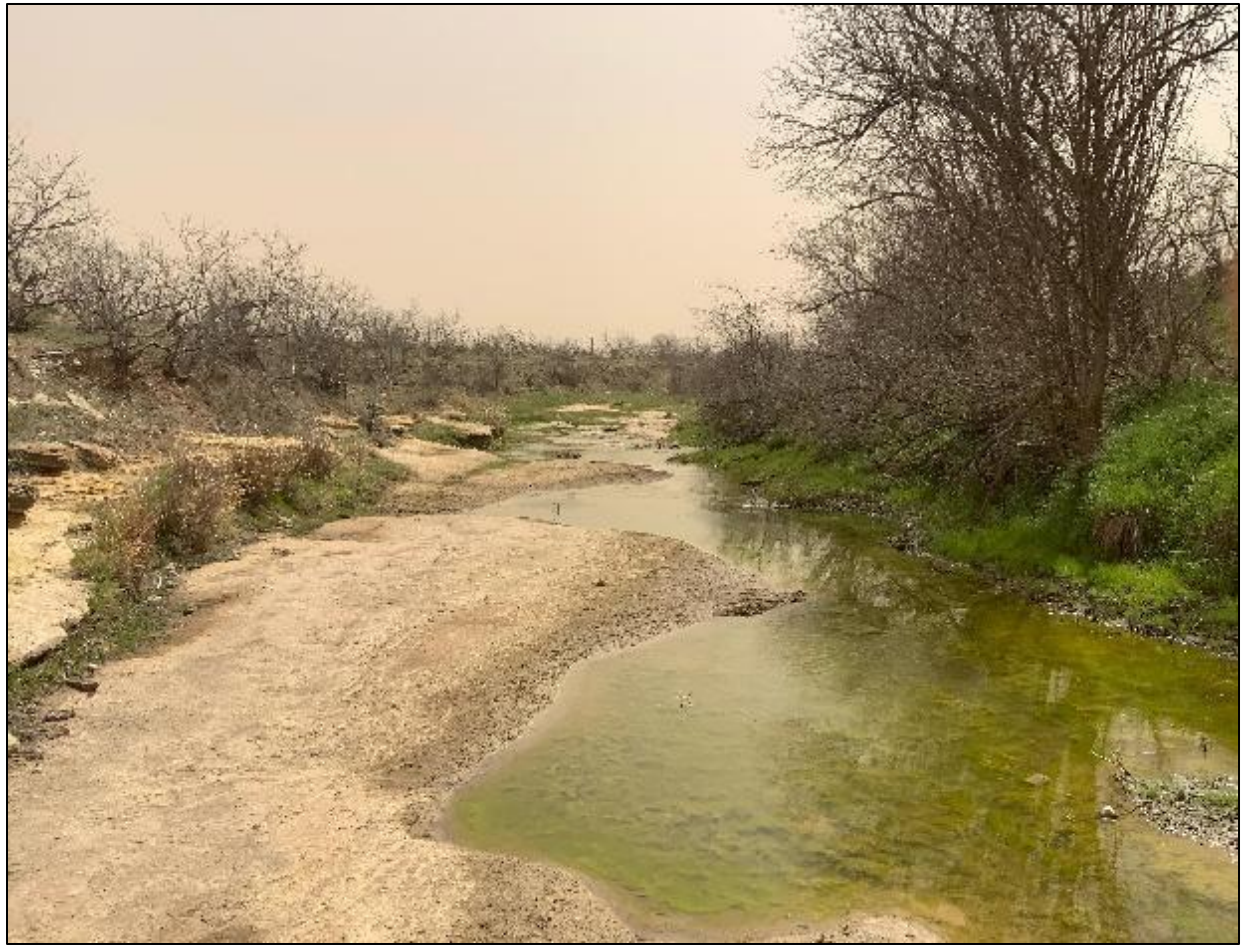


No structural definition is apparent throughout the reach.

Riffle-pool sequence

Indicator is based on a visual estimate of distinction and number of structure sequences (riffles and pools) through the assessment reach scored on an ordinal scale, where half scores are allowed:

- Poor (0): No riffle-pool sequences observed.
- **Weak (1): Mostly has areas of pools or of riffles.**



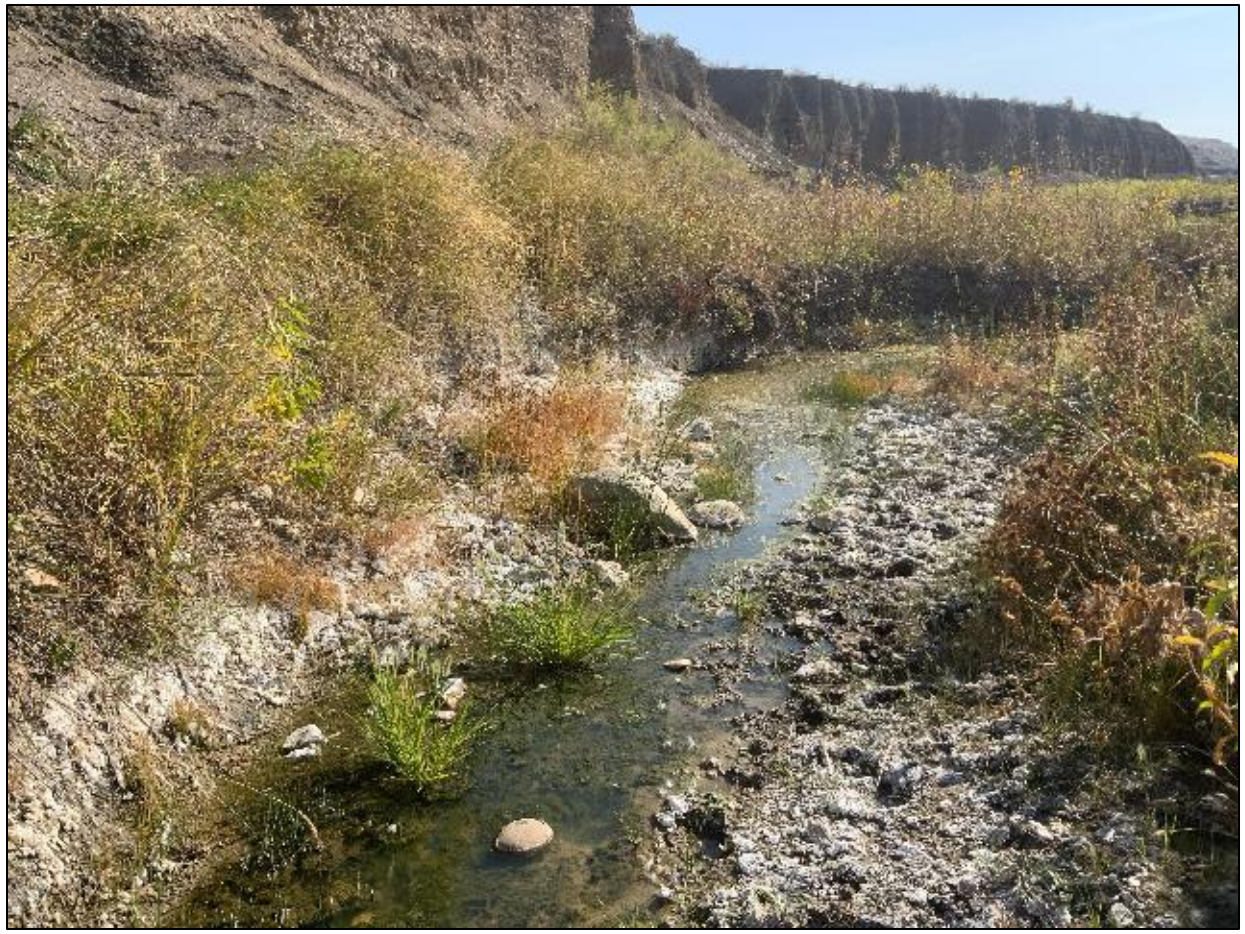
The reach is largely comprised of pools and transitions to other structures are infrequent or not distinct.

MODERATE

Riffle-pool sequence

Indicator is based on a visual estimate of distinction and number of structure sequences (riffles and pools) through the assessment reach scored on an ordinal scale, where half scores are allowed:

- Poor (0): No riffle-pool sequences observed.
- Weak (1): Mostly has areas of pools or of riffles.
- **Moderate (2): Represented by a less frequent number of riffles and pools. Distinguishing the transition between riffles and pools is difficult to observe.**



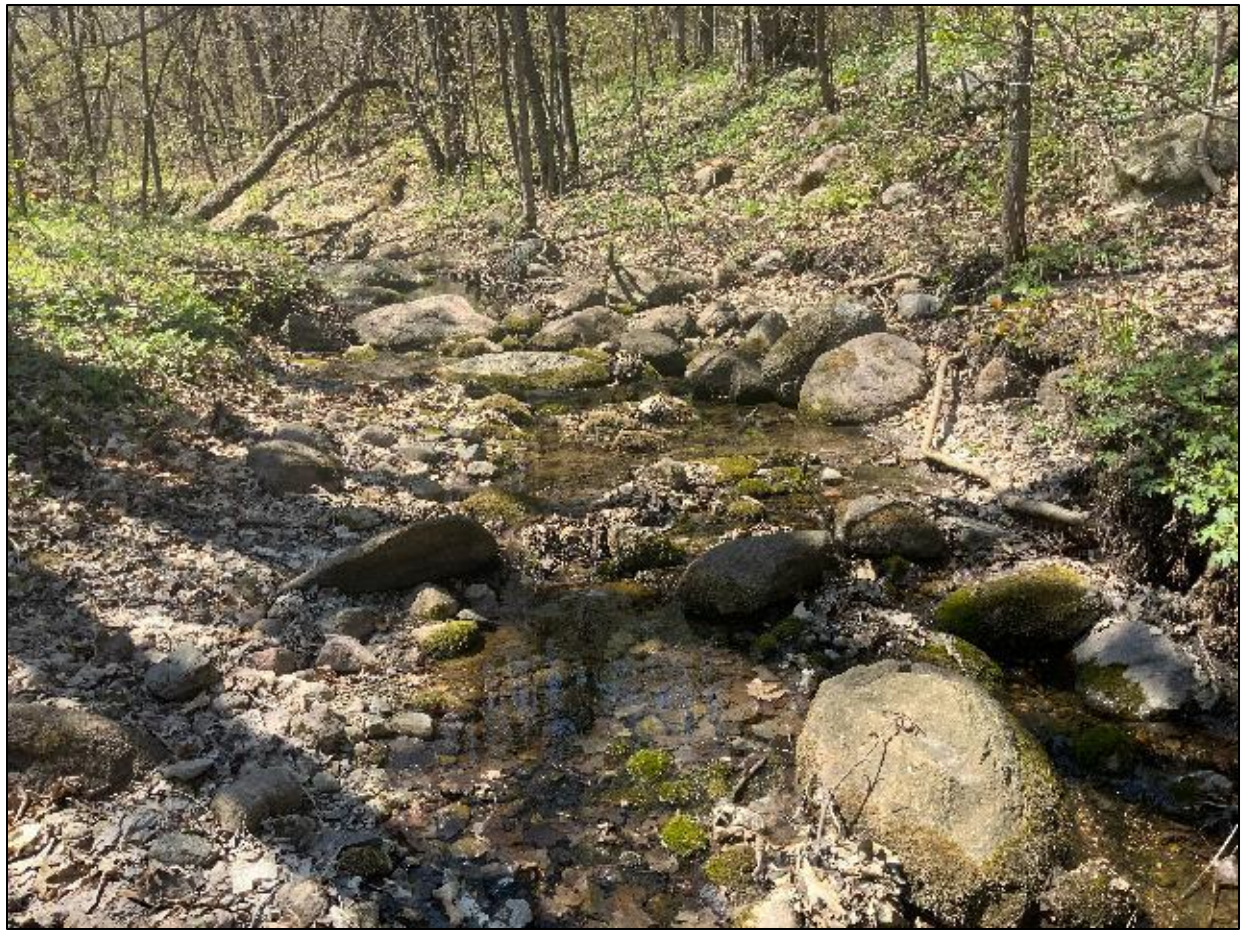
More structural definition is apparent, but distinctions are subtle.

Riffle-pool sequence

STRONG

Indicator is based on a visual estimate of distinction and number of structure sequences (riffles and pools) through the assessment reach scored on an ordinal scale, where half scores are allowed:

- Poor (0): No riffle-pool sequences observed.
- Weak (1): Mostly has areas of pools or of riffles.
- Moderate (2): Represented by a less frequent number of riffles and pools. Distinguishing the transition between riffles and pools is difficult to observe.
- **Strong (3): Demonstrated by a frequent number of structural transitions (e.g., riffles followed by pools) along the entire reach. There is an obvious transition between riffles and pools.**



A sequence of structures is present throughout the reach and transitions between them are obvious.

Record on the field form

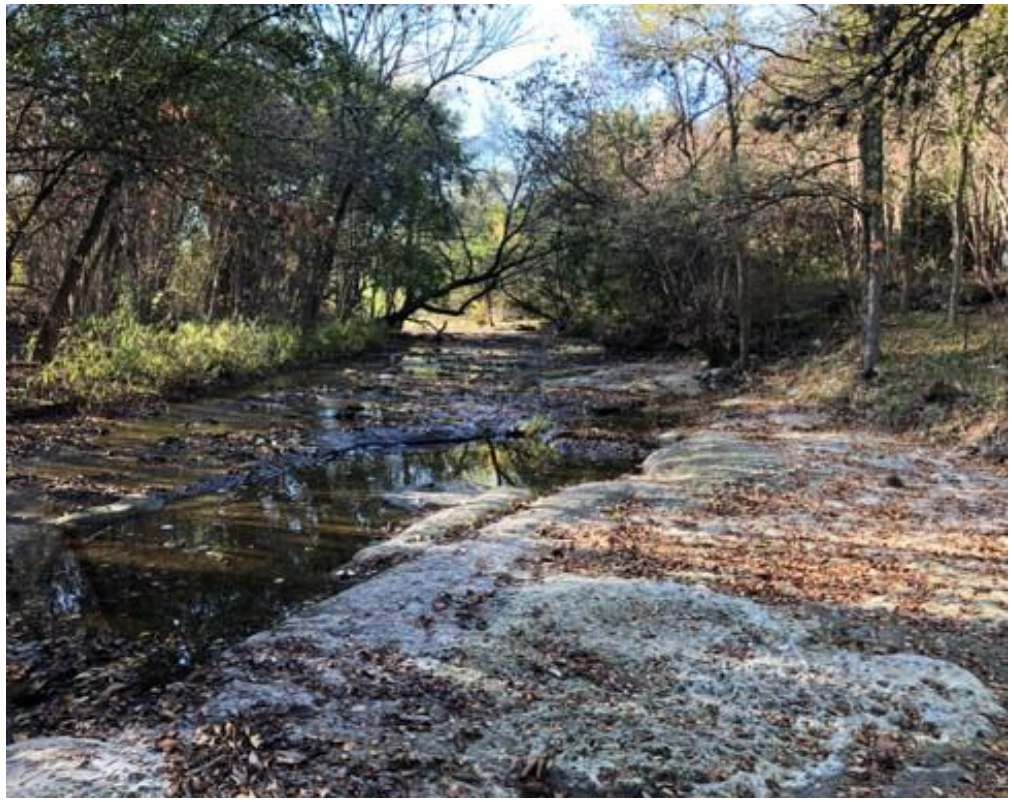
6. Riffle-pool sequence

____ (0-3) *Half scores (0.5, 1.5, 2.5) are allowed.*	Evaluate the prevalence of riffles, pools, and other microhabitats in the streambed. 0. (Poor) No riffle-pool sequences observed. 1. (Weak) Mostly has areas of pools or riffles. 2. (Moderate) Represented by a less frequent number of riffles and pools. Distinguishing the transition between riffles and pools is difficult to observe. 3. (Strong) Demonstrated by a frequent number of structural transitions (e.g., riffles followed by pools) along the entire reach. There is an obvious transition between riffles and pools.
Notes about riffle-pool sequence:	

Riffle-pool sequence for Great Plains

Particle size or stream substrate sorting

- Response to erosional and sediment transport forces that are a result of streamflow. Stronger particle size differentiation and evidence of sorting is associated with longer streamflow duration.
- Two ways to evaluate:
  - Compare particle size/sediment texture between bottom of channel and areas outside the channel. Bedrock counts!
  - Degree of substrate sorting- distribution/variability of particle sizes in channel.
- May be able to visually assess, though some features may require tactile assessment or other tools (pebble count, sand gage reference card).
- May be difficult to assess when channel ice is present.

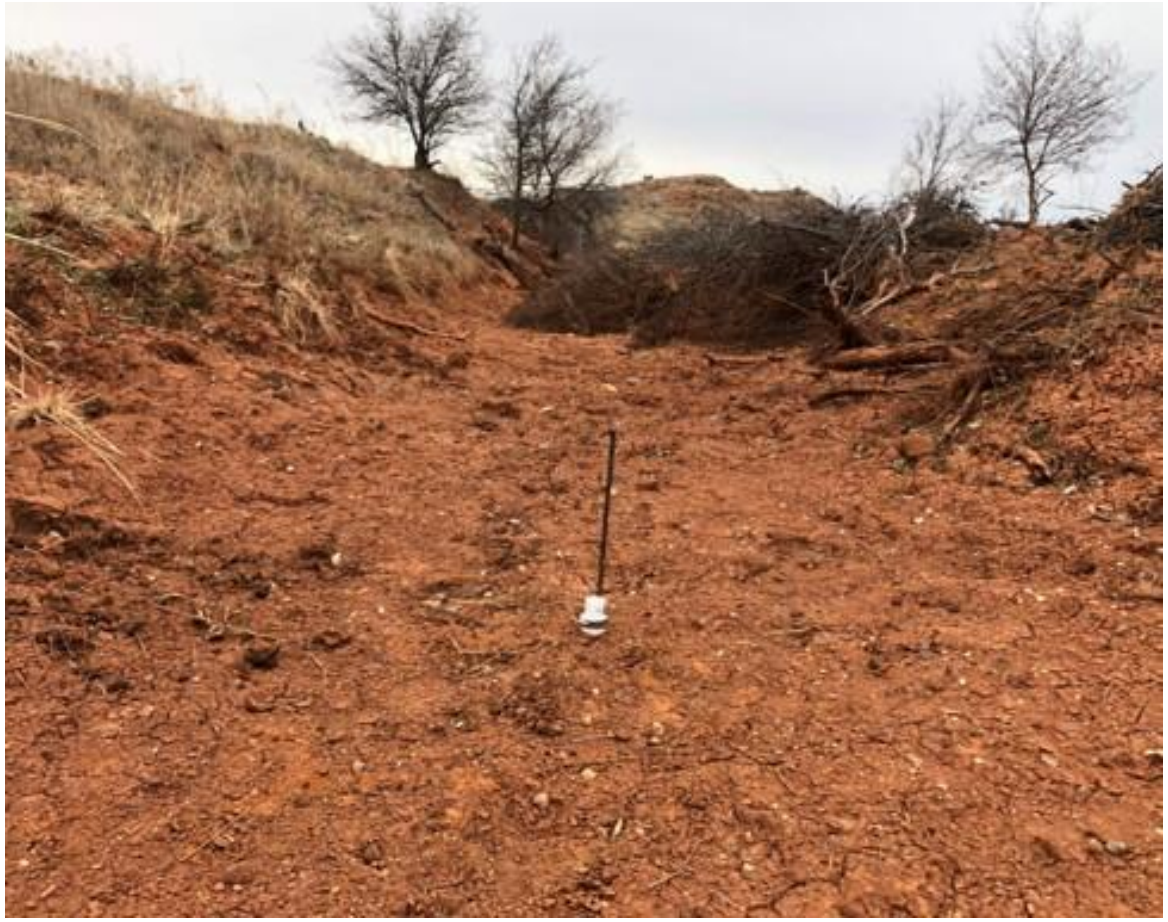


WEAK

Particle size or stream substrate sorting

Indicator is based on comparison of in-channel to out-of-channel sediments and/or degree of substrate sorting in-channel. This indicator is scored on an ordinal scale, where half scores are allowed:

- **Weak (0): Particle sizes in the channel are similar or comparable to particle sizes in areas close to but not in the channel. Substrate sorting is not readily observed in the channel.**



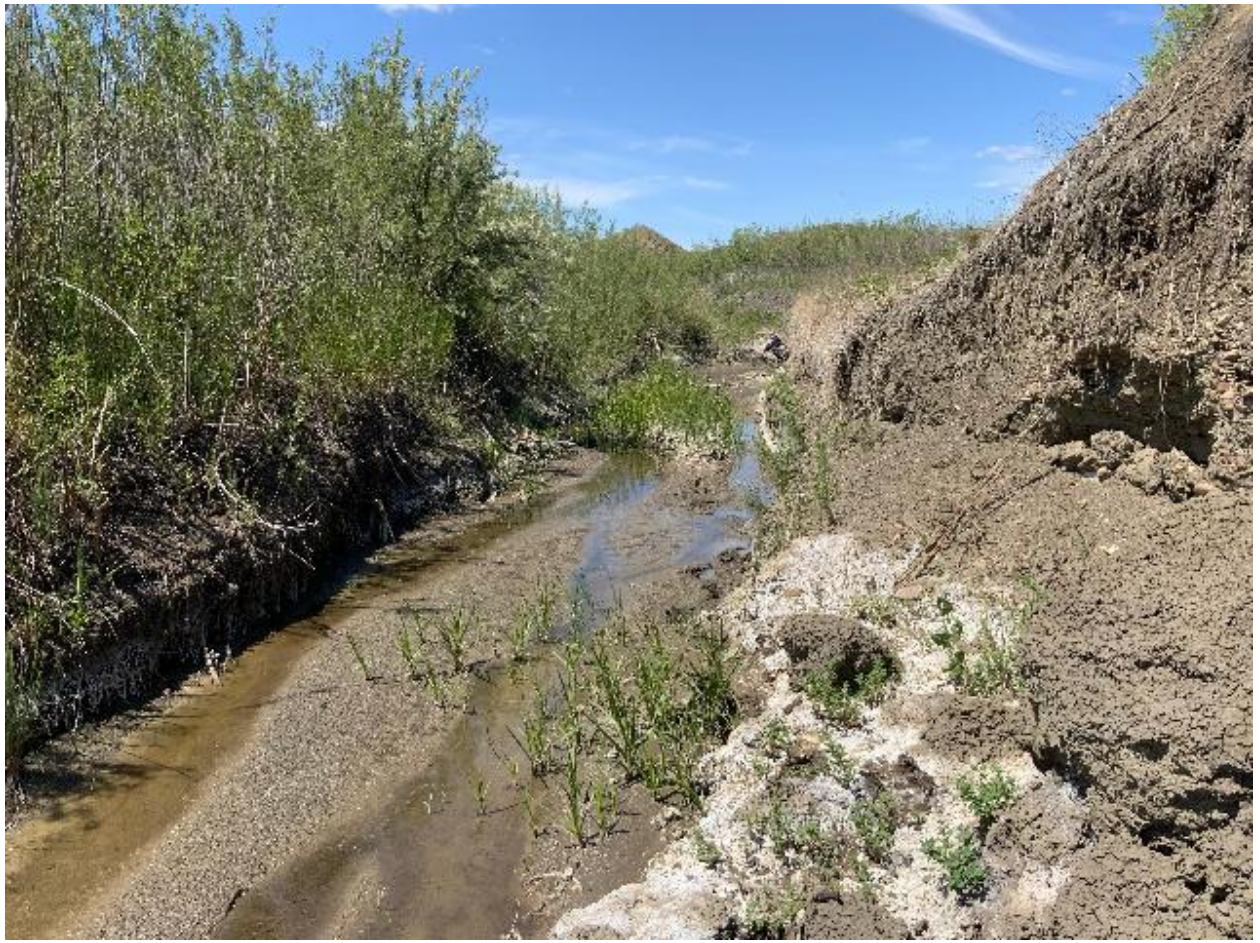
Sediment texture is similar between channel and surrounding uplands; no sorting apparent.

Particle size or stream substrate sorting

MODERATE

Indicator is based on comparison of in-channel to out-of-channel sediments and degree of substrate sorting in-channel. This indicator is scored on an ordinal scale, where half scores are allowed:

- Poor (0): Particle sizes in the channel are similar or comparable to particle sizes in areas close to but not in the channel. Substrate sorting is not readily observed in the channel.
- **Moderate (1.5): Particle sizes in the channel are moderately similar to particle sizes in areas close to but not in the channel. Various sized substrates are present in the channel and are represented by a higher ratio of larger particles (gravel/cobble).**



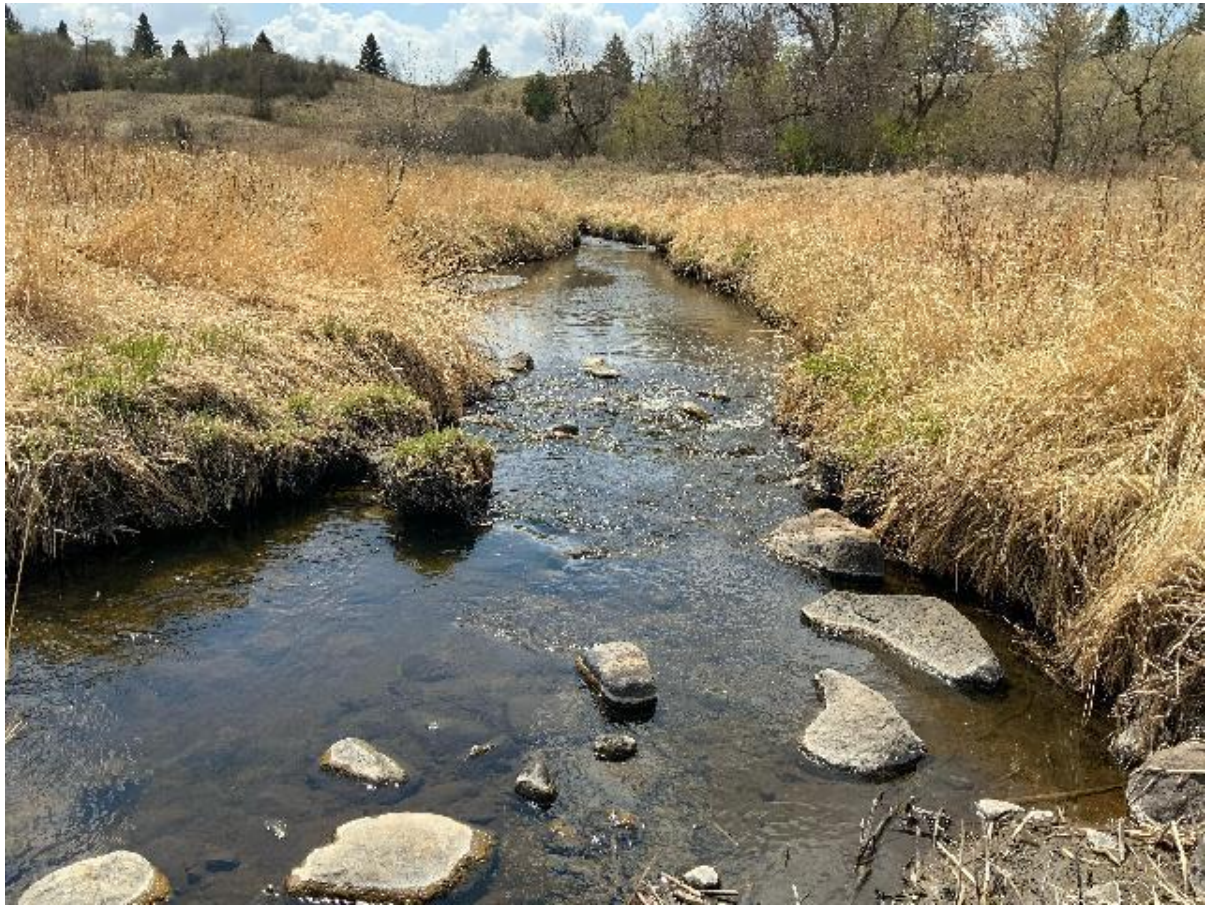
Gravel present in the channel, more differentiation between in-channel and out-of-channel sediments.

Particle size or stream substrate sorting

STRONG

Indicator is based on comparison of in-channel to out-of-channel sediments and degree of substrate sorting in-channel. This indicator is scored on an ordinal scale, where half scores are allowed:

- Poor (0): Particle sizes in the channel are similar or comparable to particle sizes in areas close to but not in the channel. Substrate sorting is not readily observed in the channel.
- Moderate (1.5): Particle sizes in the channel are moderately similar to particle sizes in areas close to but not in the channel. Various sized substrates are present in the channel and are represented by a higher ratio of larger particles (gravel/cobble).
- **Strong (3): Particle sizes in the channel are noticeably different from particle sizes in areas close to but not in the channel. There is a clear distribution of various sized substrates in the channel with finer particles accumulating in the pools, and larger particles accumulating in the riffles/runs.**



High degree of size differentiation between in-channel and out-of-channel particles; sorting apparent in riffle.

Record on the field form

7. Particle Size or Stream Substrate Sorting

____ **Particle Size or Stream Substrate Sorting score (0-3)** *Half-scores are allowed*	Evaluate the extent of substrate sorting. Compare substrate on the channel bed to the banks and adjacent floodplain. Look for sorting within the channel bed (e.g., along bars and islands). Scoring guidance: 0: (Weak) Particle sizes in the channel are similar or comparable to particle sizes in areas close to but not in the channel. Substrate sorting is not readily observed in the channel. 1.5: (Moderate) Particle sizes in the channel are moderately similar to particle sizes in areas close to but not in the channel. Various sized substrates are present in the channel and are represented by a higher ratio of larger particles (gravel/cobble). 3: (Strong) Particle sizes in the channel are noticeably different from particle sizes in areas close to but not in the channel. There is a clear distribution of various sized substrates in the channel with finer particles accumulating in the pools, and larger particles accumulating in the riffles/runs.
Notes:	

Particle size or stream substrate sorting for Great Plains

Knowledge check!

Are riffle-pool sequence and particle size or stream substrate sorting *responses* of streamflow duration?

A. Riffle-pool sequence only is a response
B. Particle size or stream substrate sorting only is a response
C. Both are responses
D. Neither are responses

Knowledge check!

Are riffle-pool sequence and particle size or stream substrate sorting *responses* of streamflow duration?

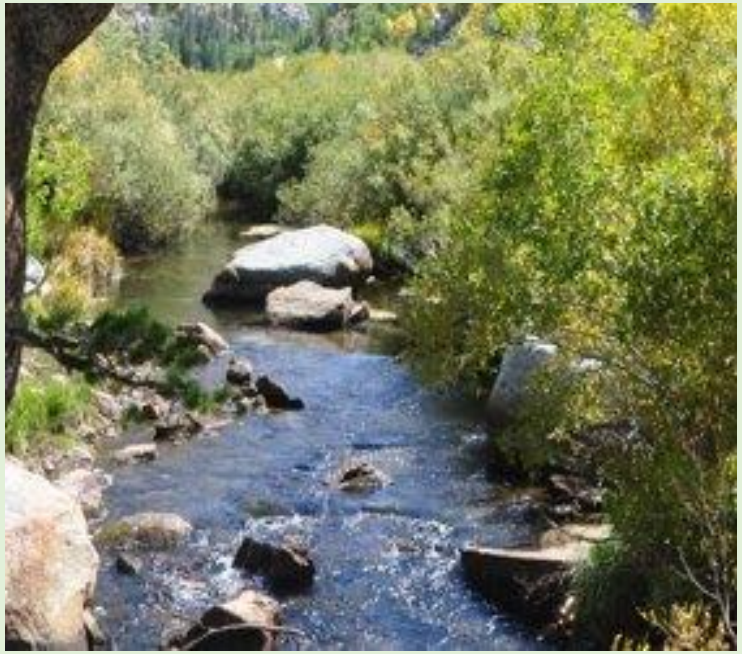
A. Riffle-pool sequence only is a response
B. Particle size or stream substrate sorting only is a response
C. Both are responses
D. Neither are responses

These geomorphological indicators are *associated* with streamflow duration, but not necessarily a response

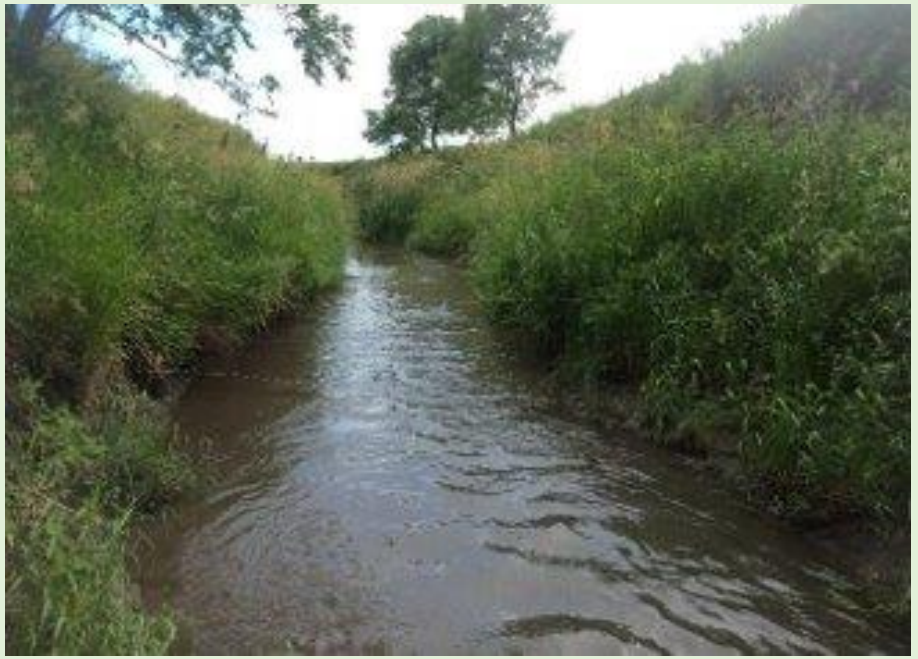
Knowledge check!

What should be the order of these photos, representing poorest to strongest for riffle-pool sequence?

1



2



A. 1, 2

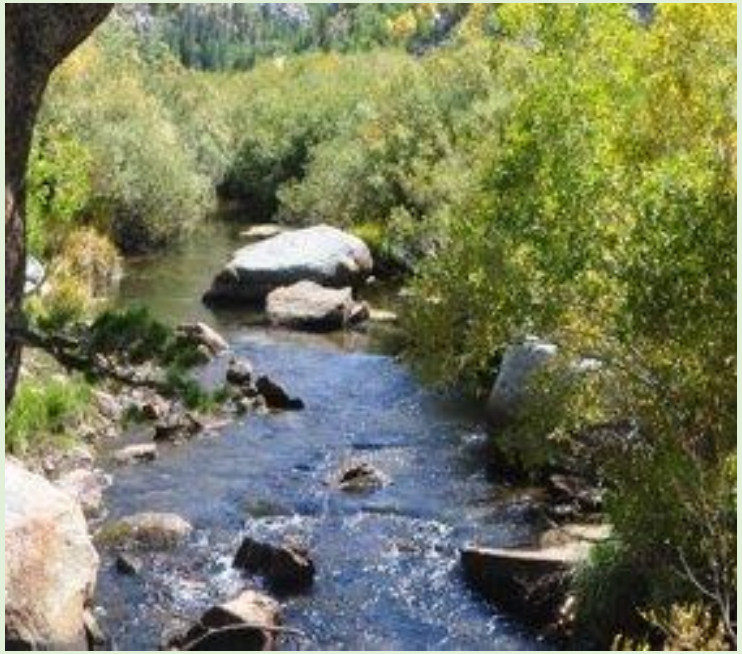
B. 2, 1

C. Roughly equal

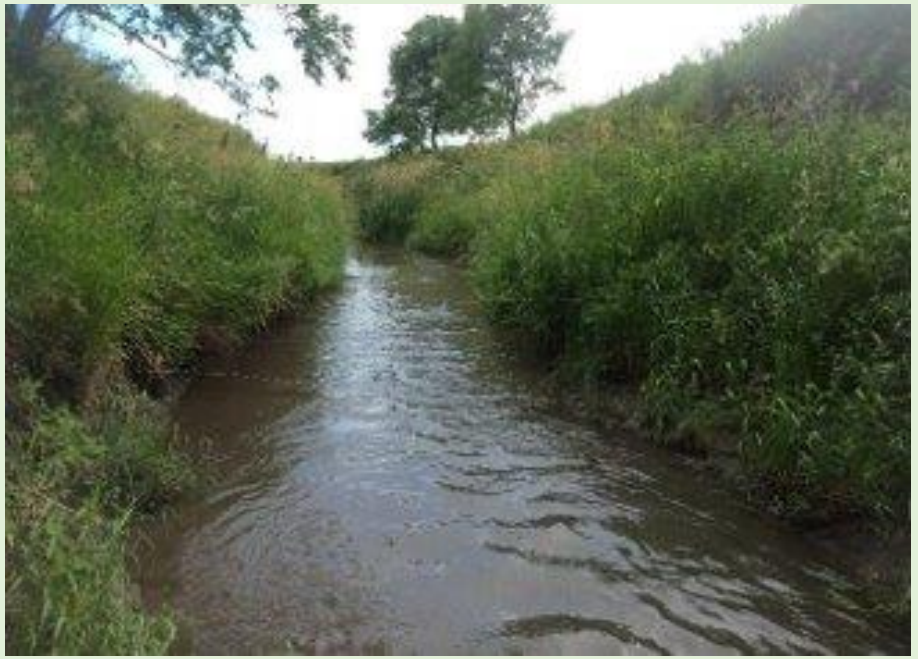
Knowledge check!

What should be the order of these photos, representing poorest to strongest for riffle-pool sequence?

1



2



A. 1, 2

B. 2, 1

C. Roughly equal

Photo 2 does not have an observable riffle-pool sequence, while the reach in photo 1 has some transition from pools to riffles.

For more information about SDAMs:

https://www.epa.gov/streamflow-duration-assessment