

EROSION CONTROL FIELD GUIDE



By Craig Sponholtz & Avery C. Anderson

WORKING WITH NATURE TO HEAL EROSION

Soil loss caused by flowing water diminishes the fertility, productivity and healing capacity of the land. This guide was created to empower landowners and managers to take action and reverse soil erosion at every opportunity. These methods promote harvesting and storing runoff and sediment with structures based on natural forms that initiate long---lasting regenerative processes.

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REGENERATIVE DESIGN PRINCIPLES FOR RESTORING ERODED LAND

- 1. Manage landscapes to enhance ecosystem processes and productivity.**
Regenerative land management must be practiced to maintain ecosystem healing processes that can be employed to stabilize, restore and improve degraded land.
- 2. Protect and expand natural moisture storing areas.**
Areas of abundant moisture are critical reservoirs for regenerative resources. Focusing on these “sweet spots” will yield the greatest return on efforts invested.
- 3. Stabilize active erosion to prevent further incision.**
Active erosion and channel incision cause the direct loss of soil moisture and fertility. It is essential to reverse ongoing erosion to maintain and improve land productivity.
- 4. Restore dispersed flow and increase infiltration at every opportunity.**
Runoff that moves as sheetflow, or that can flow across floodplains adjacent to channels, moves slowly and deposits sediment and infiltrates into the soil readily.
- 5. Cultivate regenerative plant communities to retain and build soil.**
Diverse plant communities initiate long---term healing processes on eroding land. Plants will anchor and build soil and can provide food, fodder, fuel and habitat.

- 6. Harvest runoff in place when possible; use caution when re---directing flows.**
Re---directing runoff is risky and must be carefully evaluated to avoid unintended consequences and damage to previously undisturbed areas.
- 7. Transform sediment and runoff into regenerative resources.**
Turn problems into opportunities by using excess runoff as an energy and moisture source to do regenerative work. Use transported soil to rebuild degraded landforms.
- 8. Create site---specific solutions using natural forms and processes.**
Every degraded site has its own unique opportunities and limitations. Observe and learn from nature to design solutions that promote natural healing processes.
- 9. Anticipate likely failure modes and make adaptive changes.**
Flowing water is a powerful force that, in time, will test every structure and reveal every weakness. Modifications and repairs are often needed to ensure resilience.
- 10. Strive for beauty and inspiration.**
"A thing is right when it tends to preserve the integrity, stability and beauty of the biotic community. It is wrong when it tends otherwise." ---Aldo Leopold

These principles are the result of years of learning and collaboration with Bill Zeedyk, Steve Carson, Van Clothier, Brad Lancaster and Steve Vrooman, as well as many other practitioners, teachers and authors.



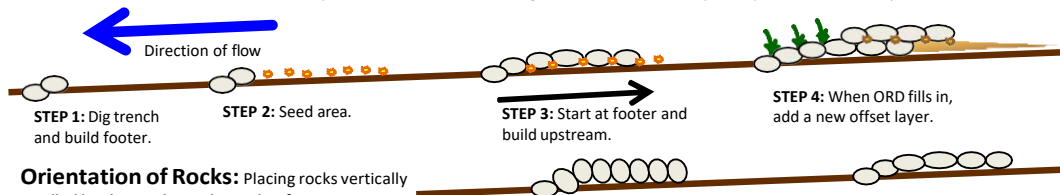
ONE ROCK DAM “ORD”



A low grade control structure built with a single layer of rock on the bed of the channel. ORDs stabilize the bed of the channel by slowing the flow of water, increasing roughness, recruiting vegetation, capturing sediment, and **gradually** raising the bed level over time. ORDs are also passive water harvesting structures. The single layer of rock is an effective rock mulch that increases soil moisture, infiltration, and plant growth. Original concept developed by Bill Zeedyk.

Design & Construction

1. Select area to build the ORD. Dig a shallow footer trench and fill with one or two rows of rock, so that no rock protrudes more than 2 in/5cm above the bed of the channel. This will serve as the **splash apron** for the ORD.
2. Scatter native grass and wildflower seeds in the area where the ORD is to be built.
3. Start building at the footer and continue upstream, laying down one layer of rock, as if you were building a horizontal wall on the bed of the channel.
4. Over time, the ORD will fill with sediment. Once completely filled, another offset layer can be added to the ORD to further raise the bed of the channel and capture more sediment. The original ORD becomes the splash apron for the new layer.



Orientation of Rocks: Placing rocks vertically is called book---stacking. This makes for a very strong structure, especially when using small rocks. It is also a good way to make a slightly taller structure.

Book---stacked rocks are placed vertically



or

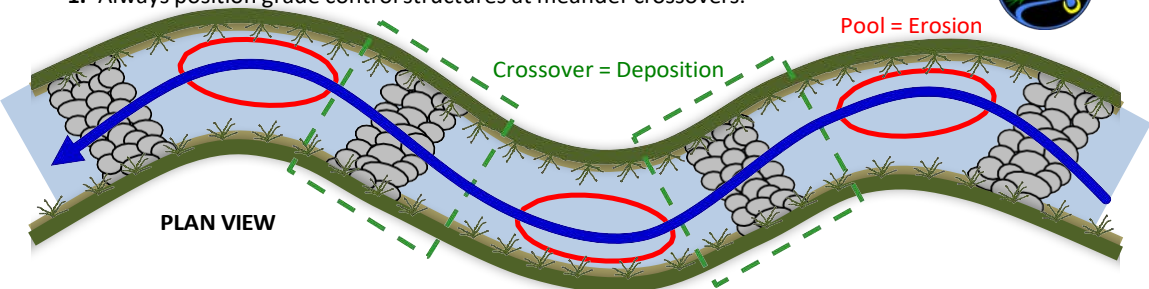
Rocks placed flat



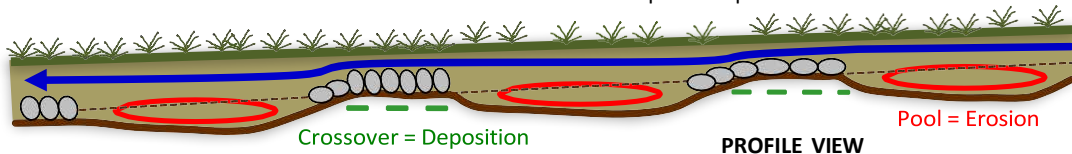
ONE ROCK DAM



1. Always position grade control structures at meander crossovers.



2. Placement at crossovers maintains natural erosion and deposition patterns.



3. Always maintain a low point in the channel cross section to prevent bank erosion.



ROCK MULCH RUNDOWN



A headcut control structure where the face of the headcut has been laid back to a stable angle of repose (minimum of a 3:1 slope), and then covered with a single layer of rock mulch. The mulch serves to slow runoff, increase soil moisture, recruit vegetation, and ultimately prevent the headcut from migrating further up slope. Rock Mulch Rundowns are ONLY to be used on low energy headcuts, like those found in upland rills and gullies with small catchment areas, and where sheetflow collects and enters a channel. Original concept by Craig Sponholtz.

Design & Construction

1. Select a low energy headcut for treatment.
2. Determine the extent of the 3:1 slope. Take care to balance the cutting required to achieve a 3:1 slope vs. the potential disturbance to existing vegetation.
3. Layback the headcut by cutting away soil from the top of the face, and then use the cut material to fill the base of the headcut. Where possible, the Rundown should be the entire width of the channel below the headcut. Narrow headcuts may need to be widened to accommodate the rock work. Adjacent headcuts, separated by uneroded fingers of earth, but leading to the same channel, can be combined into a single Rundown structure. Knock down the uneroded earth between the headcuts, and use it as fill.
4. Compact the fill.
5. Scatter native grass and wildflower seed and rake the surface of the Rundown.
6. Dig a shallow trench on the down slope side of the Rundown and fill with one to two rows of rock, so that no rock protrudes more than 2 in/5cm above the bed of the channel. This will serve as the **splash apron** for the Rundown.
7. Cover the entire surface of the Rundown with a single layer of rock mulch. The center of the Rundown should be the lowest point in the structure so that water will not run around the edges.
8. Continue to lay rock on the surface of the Rundown until you reach the height of the **headcut pour---over**. No rocks should protrude above this level to allow water to flow freely over the structure. It is very important to avoid gaps in the rock work because gaps cause weak points in the structure. Fill gaps with small gravel if needed. To improve durability, you can use a biodegradable geotextile mesh to line the surface of the Rundown prior to laying down rocks.

ROCK MULCH RUNDOWN *

* Use only in *low energy* headcuts (NOT in---channel headcuts!)

headcut pour---over

3:1 slope

1. Layout 3:1 slope over low energy headcut.

2. Layback slope, compact soil, scatter seed.

splash apron

3. Cover new slope with rock mulch.

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4. Time and precipitation will produce plant cover.



ZUNI BOWL

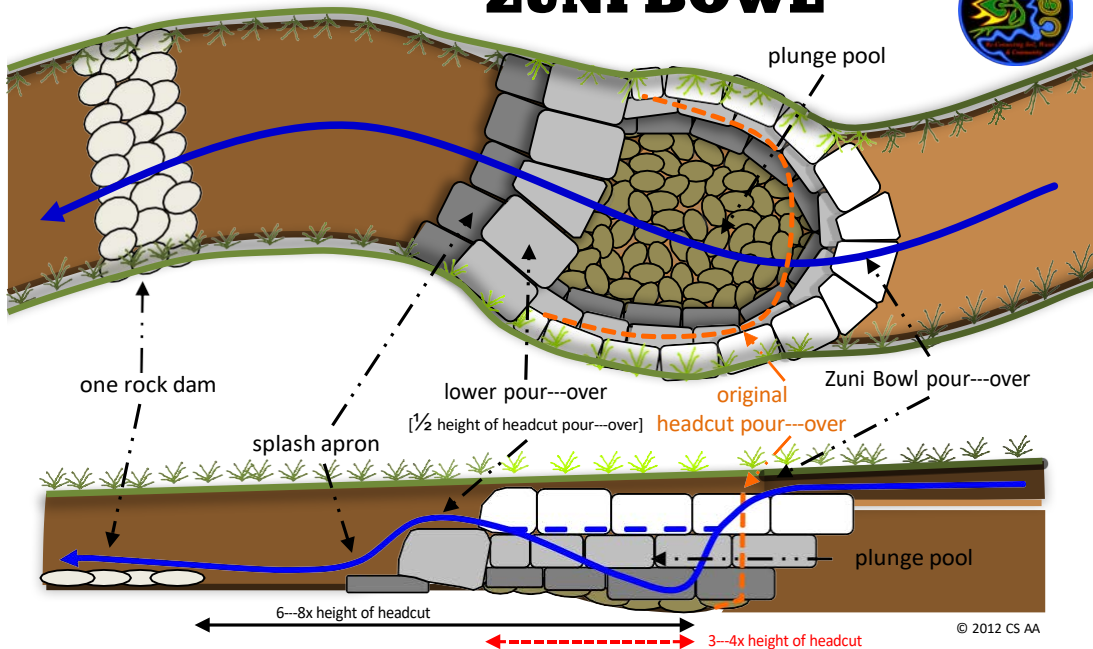


An in---channel headcut control structure composed of rock---lined step falls and plunge pools that prevents headcuts from continuing to migrate upstream. Zuni Bowls stabilize actively eroding headcuts by dissipating the energy of falling water at the headcut pour---over and the bed of the channel. The structure converts the single cascade at an eroding headcut into a series of smaller step falls. Zuni Bowls also serve to maintain soil moisture on the face of the headcut, encouraging the establishment of protective vegetation. Original concept developed by the people of Zuni Pueblo and Bill Zeedyk.

Design & Construction

1. Select a headcut for treatment. Shape and layback the face of the headcut to create a uniform surface on which to build.
2. Determine the height of the headcut. Next measure and mark the location downstream from the face of the headcut that is three to four times (3---4x) the height of the headcut. At this location dig a shallow trench and fill with one to two rows of rock, so that no rock protrudes more than 2 in/5cm above the bed of the channel. This will serve as the **splash apron** for the Zuni Bowl.
3. Scatter native grass and wildflower seeds in the area where the Zuni Bowl is to be built.
4. Gather the largest rocks available, and place them in a row just upstream from, and in contact with, the splash apron. These rocks should sit at an elevation approximately $\frac{1}{2}$ the total height of the headcut. This will serve as the **lower pour---over** of the Zuni Bowl. Use keystones on the pour---over whenever possible.
5. Armor the bottom of the **plunge pool** with a single layer of rocks. Place these rocks at a uniform height to create a stable foundation for the rest of the Zuni Bowl. Smaller rocks may be used for this part of the Zuni Bowl.
6. Starting just upstream from the lower pour---over, lay courses of rock around the face of the headcut. This will form the walls of the bowl. Maintain contact with the shaped surface. The structure will have more integrity if built with layers of off---set rocks that form a sloping wall inside of the headcut, as opposed to merely lining the face with rocks. Improve the durability of the structure by avoiding gaps in the rock work. As an extra precaution, you can use biodegradable geotextile fabric to line the face of the headcut prior to laying down rocks.
7. Continue to lay courses of rock on the face of the headcut until you reach the height of the **original headcut pour---over**. No rocks in the **Zuni Bowl pour---over** should protrude above this level to allow water to flow freely over the structure. Use keystones whenever possible.
8. Construct a **ORD** downstream from the Zuni Bowl. Place the upstream edge of the ORD approximately six to eight times (6---8x) the height of the headcut away from the Zuni Bowl pour---over.

ZUNI BOWL



MEDIA LUNA



There are two types of Media Luna structures – both used to manage sheet flow and prevent erosion. “Sheet flow collectors” (tips DOWN) prevent erosion (small headcuts) at the head of rills and gullies by creating a stable transition from sheet flow to channel flow at the collection point. “Sheet flow spreaders” (tips UP) are used to create a depositional area on relatively flat ground by dispersing erosive channelized flow and reestablishing sheet flow where it once occurred. Original concept developed by Van Clothier.

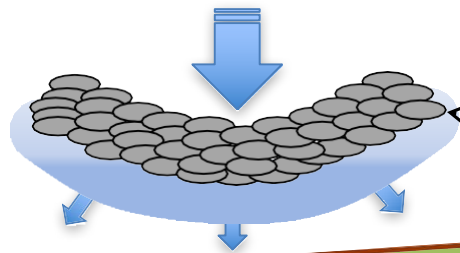
Design & Construction

1. Identify which type of Media Luna (“tips UP” or “tips DOWN”) is appropriate for the treatment site.
2. If the treatment site is at the collection point of a network of rills (< 6 in/15cm deep) or small channels (< 1 ft/30cm deep) then use a **sheet flow collector** (tips DOWN). First lay out the down---slope edge of the structure by selecting two points on the banks of the main channel immediately down slope from where the rills enter. Using a leveling tool, lay out a level arc from bank to bank so that the tips point down slope, and the arc spans all of the rills that you aim to treat.
3. If the treatment site is located where runoff from rills or a shallow channel can easily be spread across relatively flat ground, then use a **sheet flow spreader** (tips UP). First lay out the down---slope edge of the structure by creating a level arc across the flat area with the tips on a slightly higher contour. The tips should be far enough up slope that they prevent water from running around the ends of the structure.
4. Layout the up---slope edge of both types of Media Lunas by tracing a level arc parallel to the down---slope edge to create a band that is at least 3 ft/1m wide. Media Lunas composed of wider bands of rock mulch offer more protection from erosion, improved infiltration and increased plant recruitment.
5. Scatter native grass and wildflower seeds in the area where the Media Luna is to be built.
6. To construct the **splash apron**, start by digging a shallow trench from tip to tip along the down---slope edge. Fill the trench with one to two rows of rock, so that no rock protrudes more than 2 in/5cm above ground level.
7. For both types of Media Lunas, continue construction on the down---slope edge (by the splash apron) and work up slope covering the ground with a single layer of rock mulch to form a band at least 3 ft/1m wide. The tops of the rocks need to be level to ensure proper function of the structure.

MEDIA LUNA

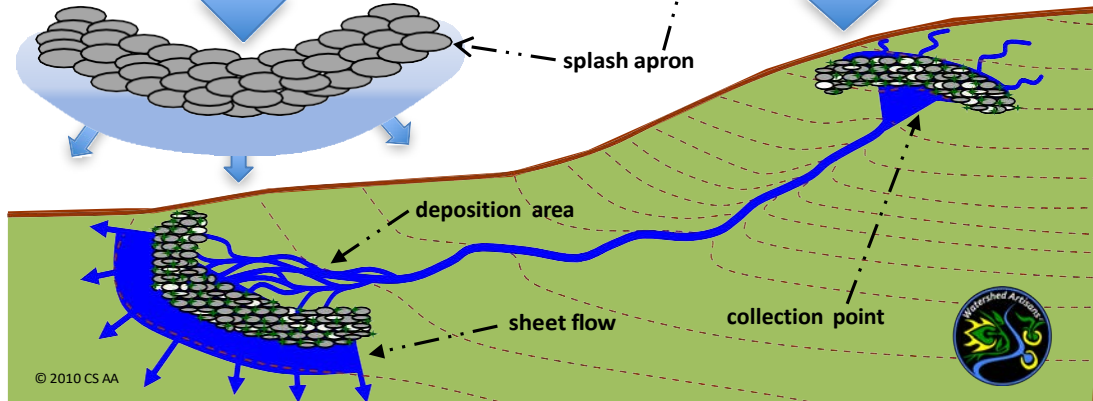
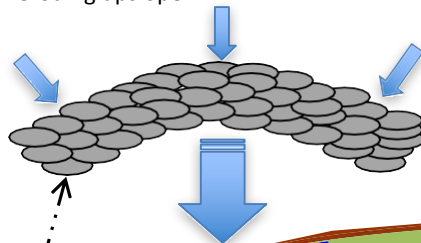
Sheet Flow Spreader (tips UP)

Spreads runoff from channels and initiates sheet flow.



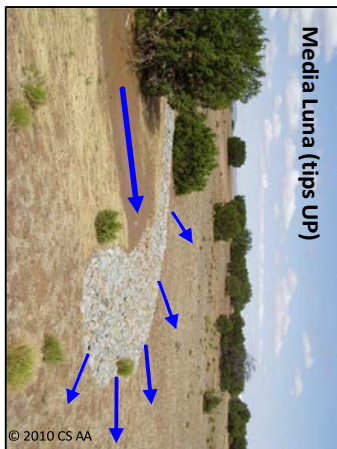
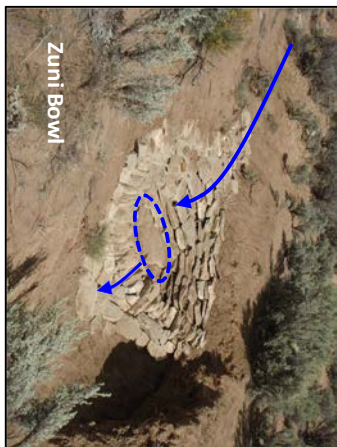
Sheet Flow Collector (tips DOWN)

Prevents developing rills and gullies from eroding upslope.



When possible, use materials available on---site.

NOTE: Many types of rock can be used to build these structures.



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