EXISTING STREAM TO BE REMOVED = 1,096 LF
RELOCATED STREAM = 2,752 LF
TOTAL BUFFER AREA = 299,846 SF
AVERAGE BUFFER = 109 FT
**LOG RIFFLES NOTES**

1. **LOG AND BOULDER RIFFLES ARE GRADE CONTROL AND HABITAT ENHANCEMENT MEASURES THAT ARE USED TO MAINTAIN OR RESTORE UPSTREAM POOLS, DEFINING WATERS, AND HABITAT FOR FISH AND FISHERIES. THESE STRUCTURES ARE TYPICALLY USED IN LOWER GRADIENT STREAMS WITH SLOPES LESS THAN 3%. THE DETAIL CAN BE MODIFIED FOR USE IN HIGHER GRADIENT STREAMS USING LOGS AND BOULDERS, OR A COMBINATION OF BOTH.

2. **BOULDERS AND LOGS Shall BE PLACED AT THE STATIONS, OFFSETS, ELAVATIONS, AND GEOMORPHIC FEATURES INDICATED ON THE STREAM MITIGATION PLAN DATA TABLE IN THE PROJECT PLAN, STREAM MITIGATION PLAN, OR AS DIRECTED BY THE ENGINEER. AT A MINIMUM, THE BASELINE AND MINIMUM LOG AND BOULDER FOR SUBSTRATE RESTORATION SHOULD BE SELECTED AND MAPPED ON THE STREAM MITIGATION PLAN DATA TABLE.

3. **REFER TO D-NSD-37 "SPECIAL NOTES FOR NATURAL STREAM DESIGN"**

4. **LOGS SHALL BE RELATIVELY STRAIGHT, RECENTLY HARVESTED AND DECAY RESISTANT SPECIES SUCH AS CEDAR, WHITE OAK, ETC.**

5. **BOULDERS PRESENT IN THE DESTROYED STREAM MEET THE SPECIFIED TYPE AND SIZE SHOULD BE USED IN THE RESTORED CHANNEL, SEASONAL OR AS DIRECTED BY THE ENGINEER.**

6. **LOCATE LOG OR BOULDER STRUCTURES (RIFFLE LOGS AND BOULDER MINI-VANES) AT EQUALLY SPACED INTERVALS IN THE STRAIGHT SECTIONS OF THE CHANNEL BETWEEN MANAGED SECTIONS (E.G., BETWEEN CONTROL POINTS, CURVATURE, OR AS DIRECTED FOR REGULAR, AND AS HIGH AS THE STREAM MITIGATION PLANS INDICATE).**

7. **THE MAXIMUM AMOUNT OF DROP IN ANY RIFFLE OR BOULDER STRUCTURE SHALL BE NO GREATER THAN 0.3 FT, THE COMBINED AMOUNT OF DROP OVERALL FOR THE RIFFLE OR BOULDER STRUCTURE SHALL NOT EXCEED 0.3 FT. THE MAXIMUM OF THE DROP SHALL BE PLACED IN THE CIRCUMFERENCE OF THE LOG OR BOULDER AND IS CONSIDERED INCIDENTAL TO CONSTRUCTION.**

8. **CONSTRUCT LOG RIFFLE STRUCTURES BY:**
   - **SHAPE THE CHANNEL AND FLOODPLAIN TO THE SPECIFIED GRADES AND DIMENSIONS.**
   - **LOG RIFFLE STRUCTURES ARE BUILT STARTING WITH THE DOWNSTREAM LOG AND PROCEEDING UPSTREAM.**
   - **RIFFLE LOGS SHALL OVERLAP THE CHANNEL BANK WITH THE DOWNSWEEP END OF THE DOWNSTREAM LOG.**
   - **RIFFLE LOGS SHALL OVERLAP THE CHANNEL BANK WITH THE DOWNSWEEP END OF THE DOWNSTREAM LOG.**
   - **ALL BOULDERS ARE TO BE APPROVED BY ENGINEER OR ENGINEER’S ON-SITE CONSTRUCTION OBSERVER.**

9. **SHAPE THE SURFACE OF LOG AND BOULDER RIFFLES TO THE SPECIFIED GRADES AND DIMENSIONS.**

10. **ALL MATERIALS FOR LOG RIFFLE STRUCTURES SHOULD BE CLEAN AND GEOMETRICALLY SHAPED AS SHOWN ON THE TYPICAL CROSS-SECTION DATA AND INSTALL IN THE DEGREE OF COMBINED CURVATURE OF THE LOG OR BOULDER (RIFFLE LOG) AND LOG RIFFLE STRUCTURES SHOWN IN THE STREAM MITIGATION PLAN DATA TABLE.**

11. **LOG AND BOULDER RIFFLES ARE GRADE CONTROL AND HABITAT ENHANCEMENT MEASURES THAT ARE USED TO MAINTAIN OR RESTORE UPSTREAM POOLS, DEFINING WATERS, AND HABITAT FOR FISH AND FISHERIES. THESE STRUCTURES ARE TYPICALLY USED IN LOWER GRADIENT STREAMS WITH SLOPES LESS THAN 3%. THE DETAIL CAN BE MODIFIED FOR USE IN HIGHER GRADIENT STREAMS USING LOGS AND BOULDERS, OR A COMBINATION OF BOTH.

12. **LOGS SHALL BE RELATIVELY STRAIGHT, RECENTLY HARVESTED AND DECAY RESISTANT SPECIES SUCH AS CEDAR, WHITE OAK, ETC.**


14. **REFER TO D-NSD-37 "SPECIAL NOTES FOR NATURAL STREAM DESIGN"**

15. **LOGS SHALL BE RELATIVELY STRAIGHT, RECENTLY HARVESTED AND DECAY RESISTANT SPECIES SUCH AS CEDAR, WHITE OAK, ETC.**


17. **SHAPE THE SURFACE OF LOG AND BOULDER RIFFLES TO THE SPECIFIED GRADES AND DIMENSIONS.**

18. **LOG RIFFLE STRUCTURES ARE BUILT STARTING WITH THE DOWNSTREAM LOG AND PROCEEDING UPSTREAM.**

19. **RIFFLE LOGS SHALL OVERLAP THE CHANNEL BANK WITH THE DOWNSWEEP END OF THE DOWNSTREAM LOG.**

20. **RIFFLE LOGS SHALL OVERLAP THE CHANNEL BANK WITH THE DOWNSWEEP END OF THE DOWNSTREAM LOG.**

21. **ALL BOULDERS ARE TO BE APPROVED BY ENGINEER OR ENGINEER’S ON-SITE CONSTRUCTION OBSERVER.**
CONSTRUCTED ALLUVIAL RIFFLE NOTES

1. Constructed alluvial riffles are grade control and habitat enhancement measures that are used to maintain grade of downstream pools, reconnect habitat, and provide habitat for natural fish, invertebrates, and other organisms. Coarse alluvium or select material can be used for constructing riffles using natural alluvium consisting of boulders, cobbles, and gravel or specified select material.

2. Constructed alluvial riffles should be placed at the stations, offsets, elevations, and geomorphic positions indicated on the stream-mitigation data table in the project plans. Stream-mitigation plans, as designed by the engineer. At a minimum, the bankfull, inner-berm, and low-channel widths, invert elevations at head and bottom of riffle, estimated roughness values, and alluvial riffle select material should be shown in the plans, as indicated on the stream-mitigation data table.

3. Refer to Binder "special notes for stream design".

4. Constructed alluvial riffles are placed in the straight sections of the channel between meander bends (i.e., between upstream point of tangency and downstream point of curvature) as indicated on the stream-mitigation plans.

5. Alluvium or select material for constructed alluvial riffles should consist of coarse substrate (gravel, cobble, and boulder), a mixture of sizes of alluvium or select material as specified on the stream-mitigation data table. Coarse alluvium excavated from the existing streambed, which meets the specified size classification in the stream-mitigation data table, should be used for substrate in riffle and riffle habitats.

6. Constructed alluvial riffles shall be finished to create a smooth profile. Without an abrupt jump/transition between the riffle and the downstream pool, the specified cross section of the riffle material shall generally match the shape and dimensions shown on the riffle typical, section with some variability of the trained location and a result of placement of larger substrate, such as boulders.

7. The end of riffle control point may tie into a drainage structure or other in-stream structure. In this case, the riprap may be extended to create a smooth profile. Without an abrupt jump/transition between the riffle and the downstream pool, the specified cross section of the riffle material shall generally match the shape and dimensions shown on the riffle typical, section with some variability of the trained location and a result of placement of larger substrate, such as boulders.

8. The constructed alluvial riffle material shall be finished to create a smooth profile. Without an abrupt jump/transition between the riffle and the downstream pool, the specified cross section of the riffle material shall generally match the shape and dimensions shown on the riffle typical, section with some variability of the trained location and a result of placement of larger substrate, such as boulders.

9. Constructed alluvial riffles shall be paid for under the following item number:

709-05.81 Rock riffles per lump sum payment shall include all materials, equipment, and labor to construct the alluvial riffle.

CONTRACTED ALLUVIAL RIFFLE