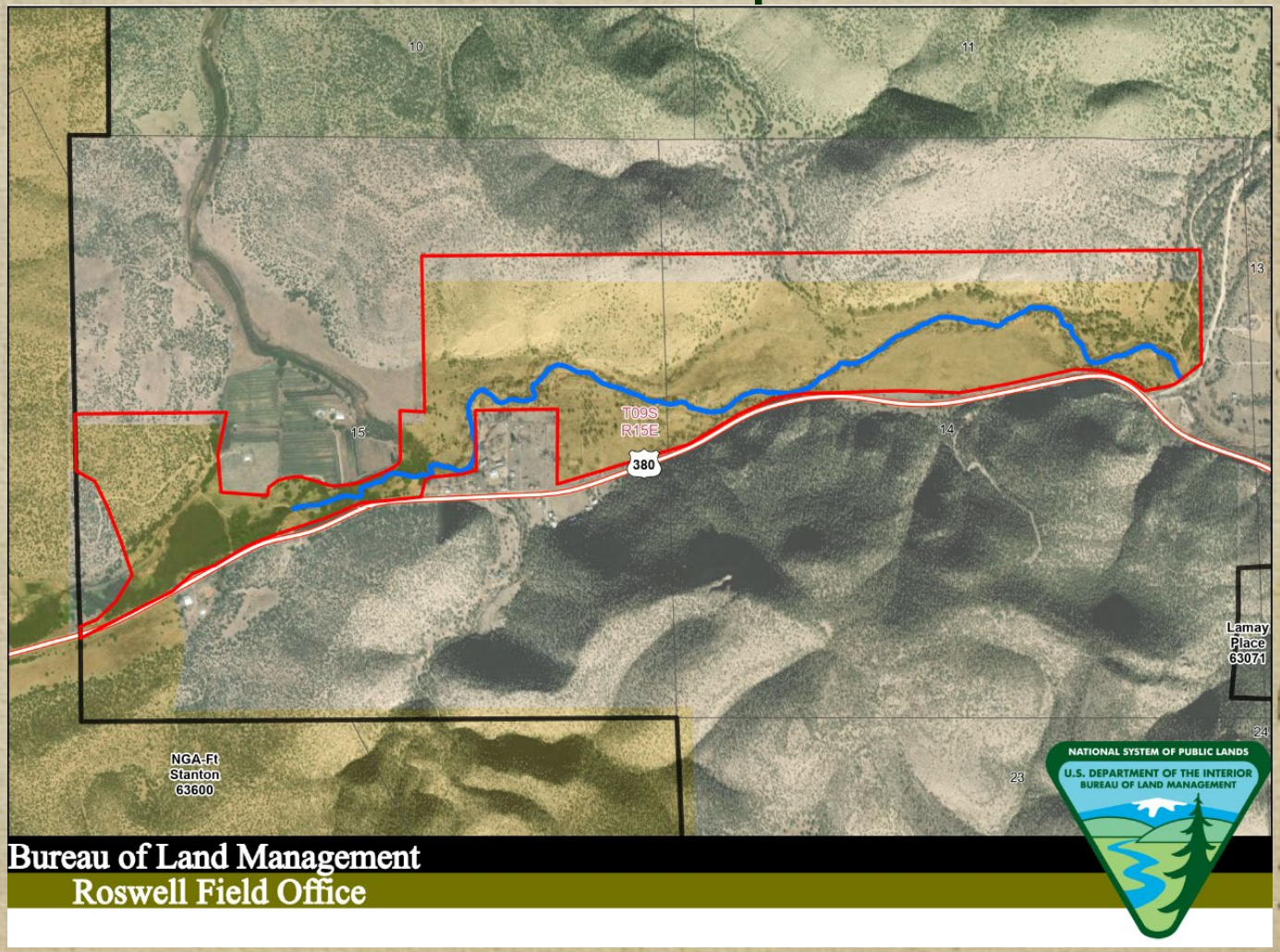
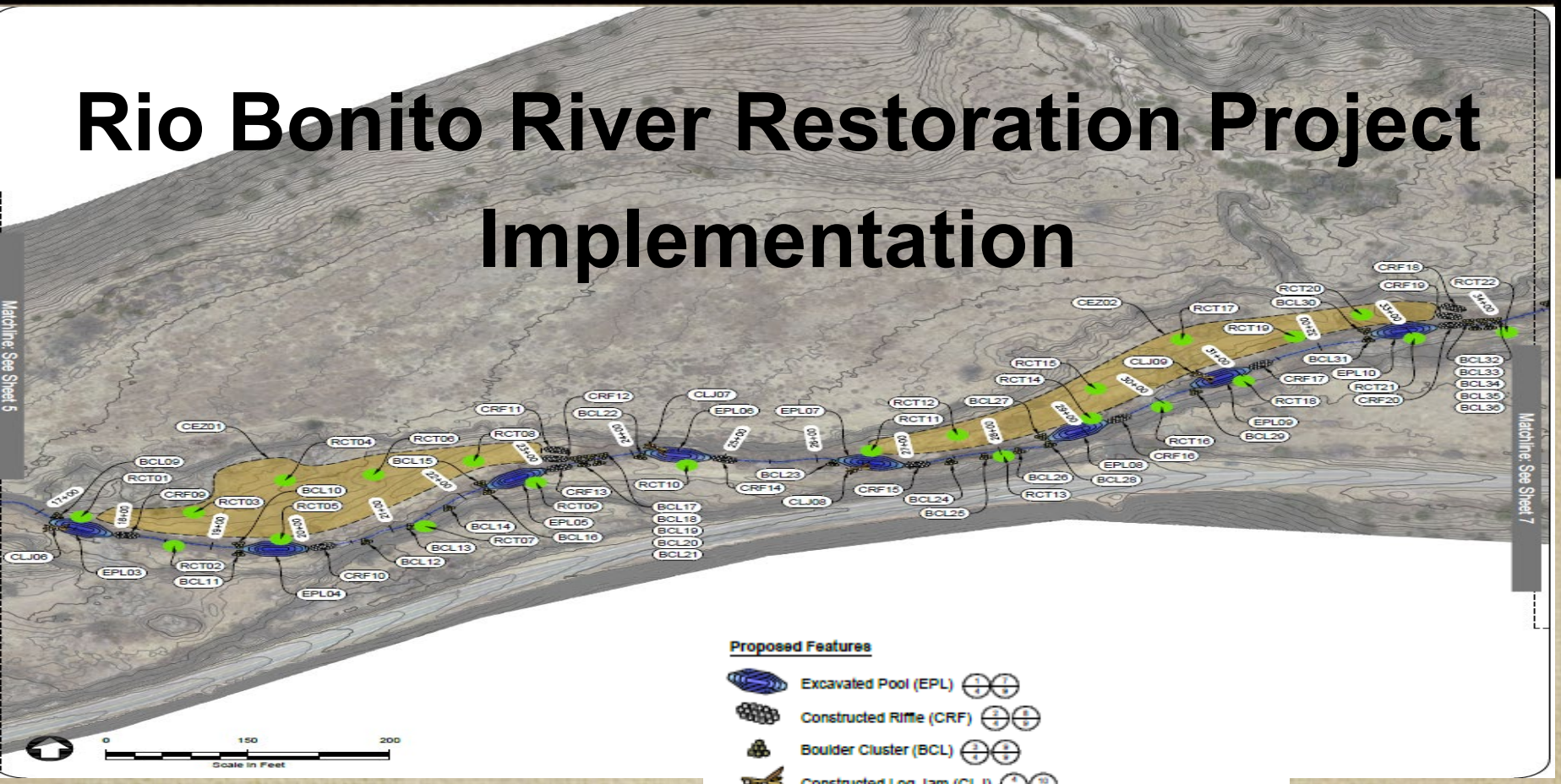
# Rio Bonito River Restoration Project

## Implementation




New Mexico Department of Game & Fish

# Rio Bonito River Restoration Project Implementation




Project over view by OEE


**George Farmer**
**NMDGF**
**george.farmer@dgf.nm.gov**

**Danica Cooke**
**Bureau of Land Management**
**Roswell Field Office**
**dcooke@blm.gov**


New Mexico Department of Game & Fish

# Rio Bonito River Restoration Project Implementation

- For the past 125-150 years the area has been used primarily for intensive farming and grazing, causing channelization of the Rio Bonito.

- Currently, this stretch of the river is basically one large riffle: there are no major changes in velocity. It is also large dominated by willows and is effectively a “willow bowling alley.” Habitat improvements are needed to improve habitat quality for the native fishes, as well as the sportsfish.

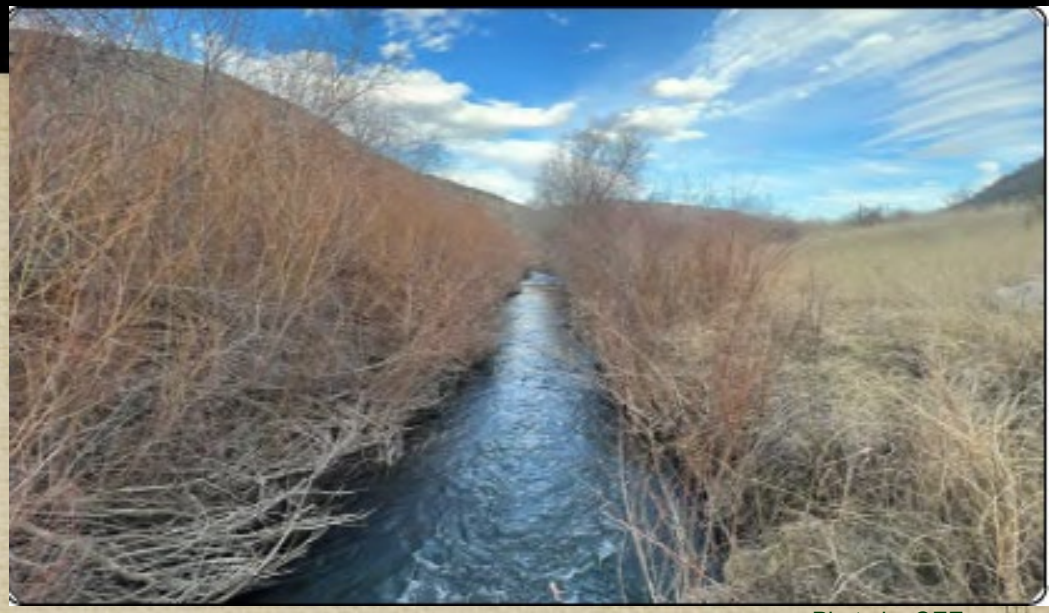
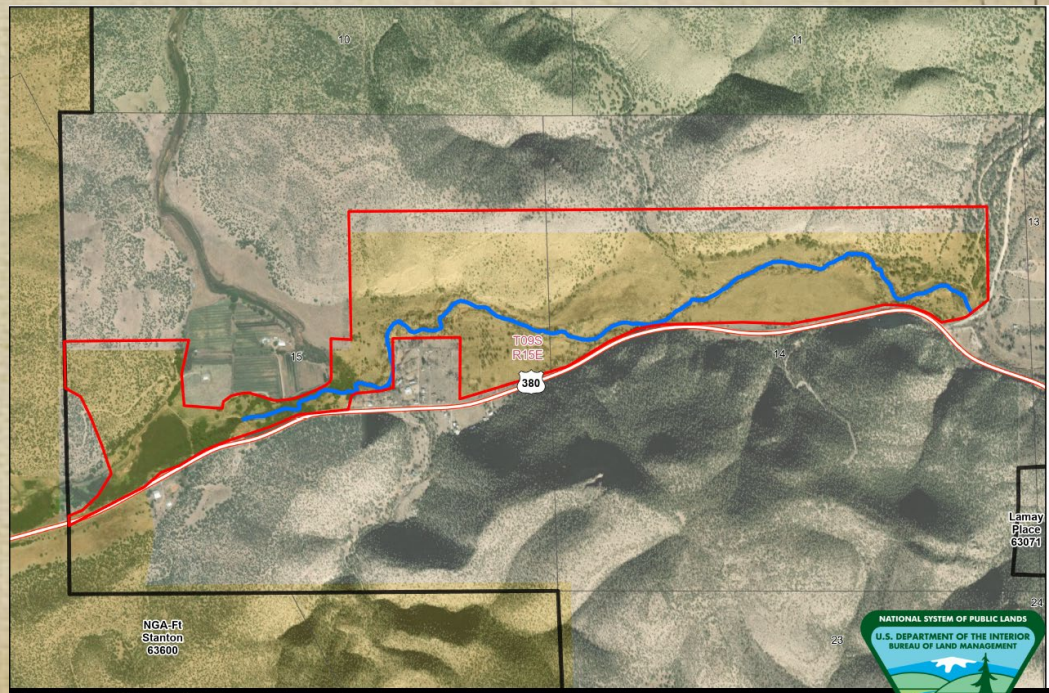
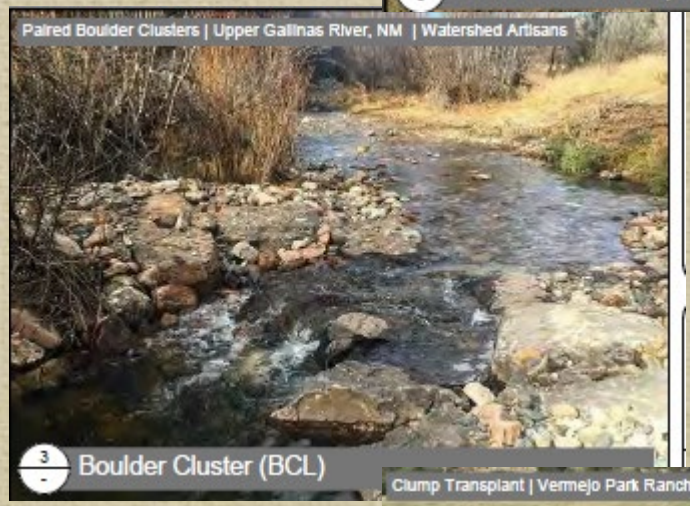


Photo by OEE




Bureau of Land Management
Roswell Field Office

- Last year HSP funded the design phase of the Rio Bonito River Restoration project.
- This implementation phase would be to construct/ install some in-stream structures such as:
  - Excavated pools
  - Constructed Riffles
  - Boulder Clusters
  - Constructed Log Jams
  - Channel Evolution Zones
  - Riparian Clump Transplants
- The Project will help to create a higher water table, reconnect and expand the floodplain; more hyporheic exchange; higher summer base flows; expanded wetlands areas; improved water quality; greater habitat complexity; more diversity and richness in populations of plants, fish, birds, amphibians, reptiles and mammals.


Photos by OEE

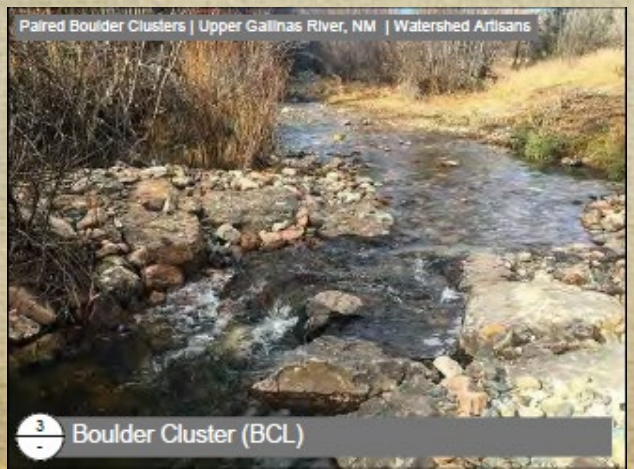

New Mexico Department of Game & Fish

# Summary of Project



Photos by OEE

This project is seeking $550,000
Installing in-stream structures.





New Mexico Department of Game & Fish

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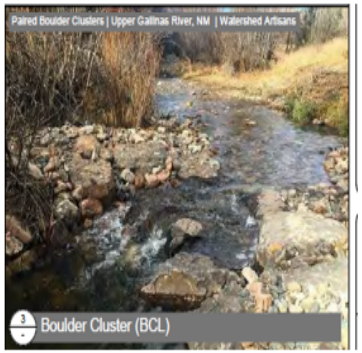
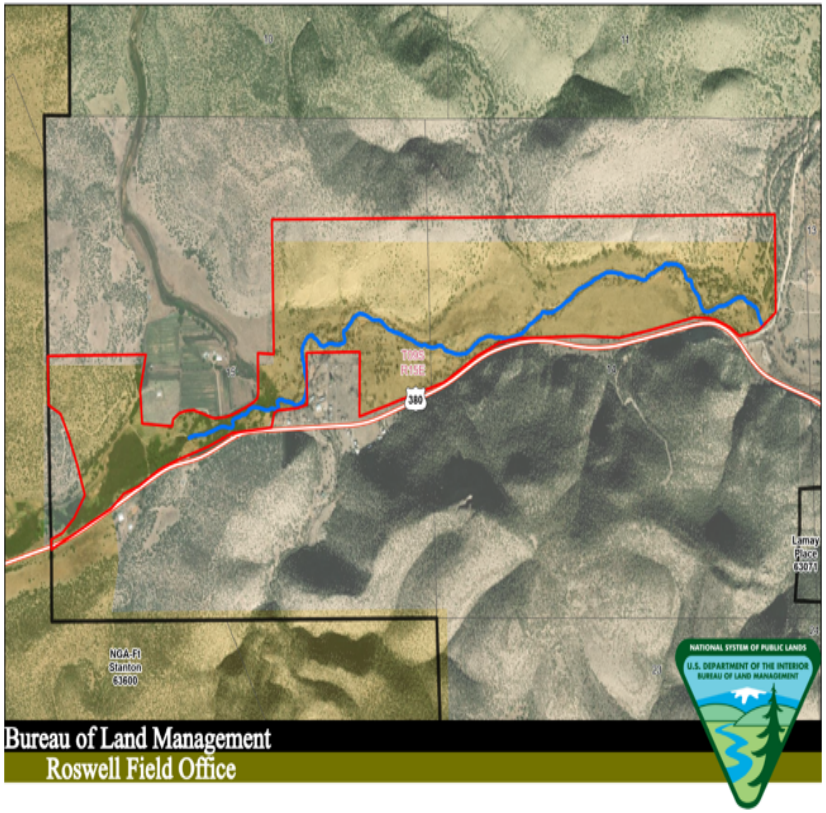



- This tract of land is upstream of Lincoln, NM. Old irrigation canals support black walnut and box elder. Large cottonwood trees and coyote willow line the Rio Bonito which traverse the entire tract.
- Completion of an Environmental Analysis, will be complete next spring.


Roswell Field Office- BLM

Project Contacts: BLM- Danica Cooke dcooke@blm.gov

NMDGF-George Farmer george.farmer@dgf.nm.gov


## Proposed Management Actions

- Initial design has been done.
- Final Designs Expected to be delivered in Fall/Winter 2023, with implementation starting spring/summer 2024
- The Project will help to create a higher water table, reconnect and expand the floodplain; more hyporheic exchange; higher summer base flows; expanded wetlands areas; improved water quality; greater habitat complexity; more diversity and richness in populations of plants, fish, birds, amphibians, reptiles and mammals
- Instream structures could be but not limited to: Excavated pools, Constructed Riffle, Boulder Clusters, Log Jam, and Riparian Clump Transplants.

Estimated Budget for HSP: $550,000.00

**Project Name:** Rio Bonito River Restoration Project (Implementation)

**Project relation to CAC advice or prioties:**

The project represents a great example of producing fish habitat to increase fishing opportunites in Southeastern NM.

**Project Specific Details:**

Oxbow engineering will implement their habitat improvement designs, which include excavated pools, constructed riffles, boulder clusters, constructed log jams, and riparian clump transplants. Locations of these structures were designed based on habitat requirements at various life stages for the native and sportsfish species found within the Rio Bonito.

**Historical Data:**

a. For the past 125-150 years the area has been used primarily for intensive farming and grazing, causing channelization of the Rio Bonito. Habitat improvements are needed to improve habitat quality for the native fishes, as well as the sportsfish.

**Itemized Use of Funds:**

Estimated budget $550,000
Installing in-stream structures.

**Comprehensive Project Analysis:**

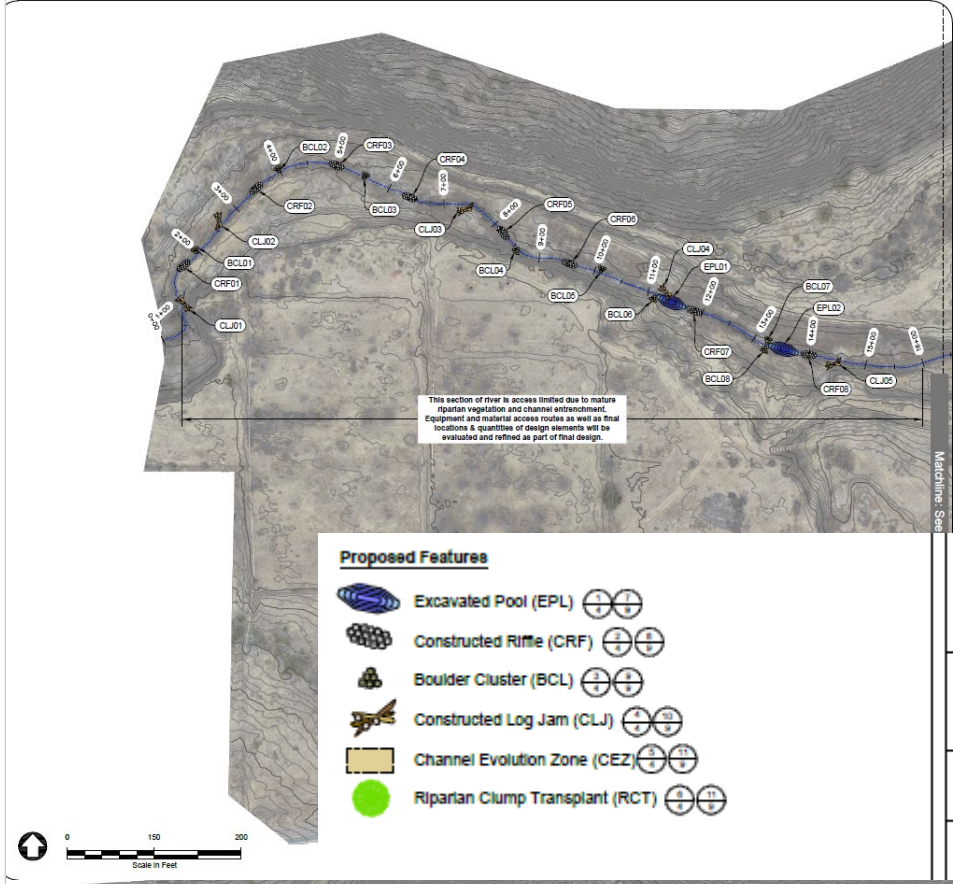
A comprehensive analysis is provided on the summary slide and accompanying presentation. This project is focused on improving water quality, greater habitat complexity and more diversity and richness in populations of fish and plants.

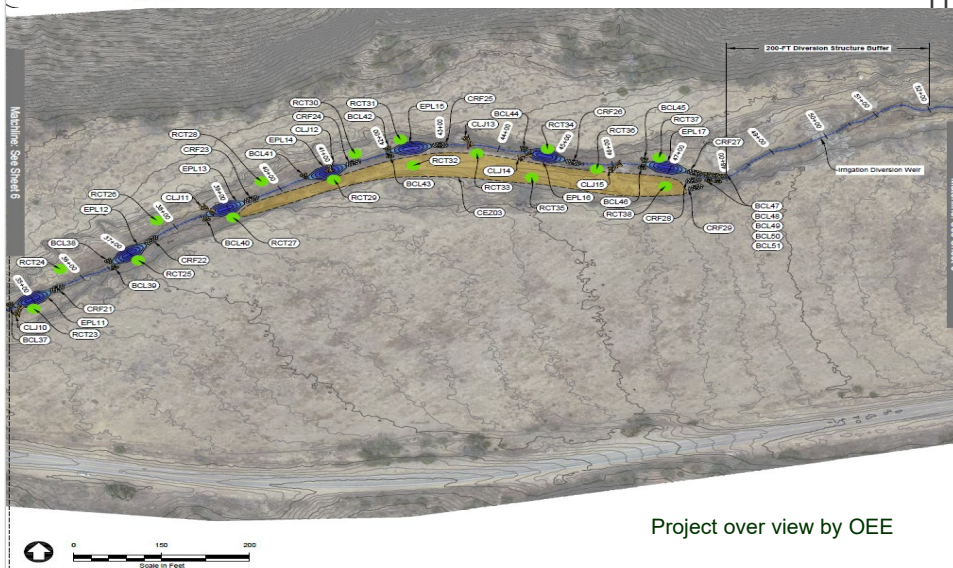
**Monitoring Plan/ Strategy:**

Water Quality and water temperature will be taken prior to implementation of the project. Annual fish monitoring will occur via electroshocking efforts and eDNA analysis by BLM biologists. MIM habitat monitoring will also occur on a biannual basis by BLM biologists. Photo points will be designated prior and then on an annual basis.

**Project Emphasis Species:**

Emphasis species are native fishes (Rio Grande Chub, Rio Grande Sucker, Longnose Dase, and Fathead Minnow) and sports fish such as stocked Rainbow Trout.

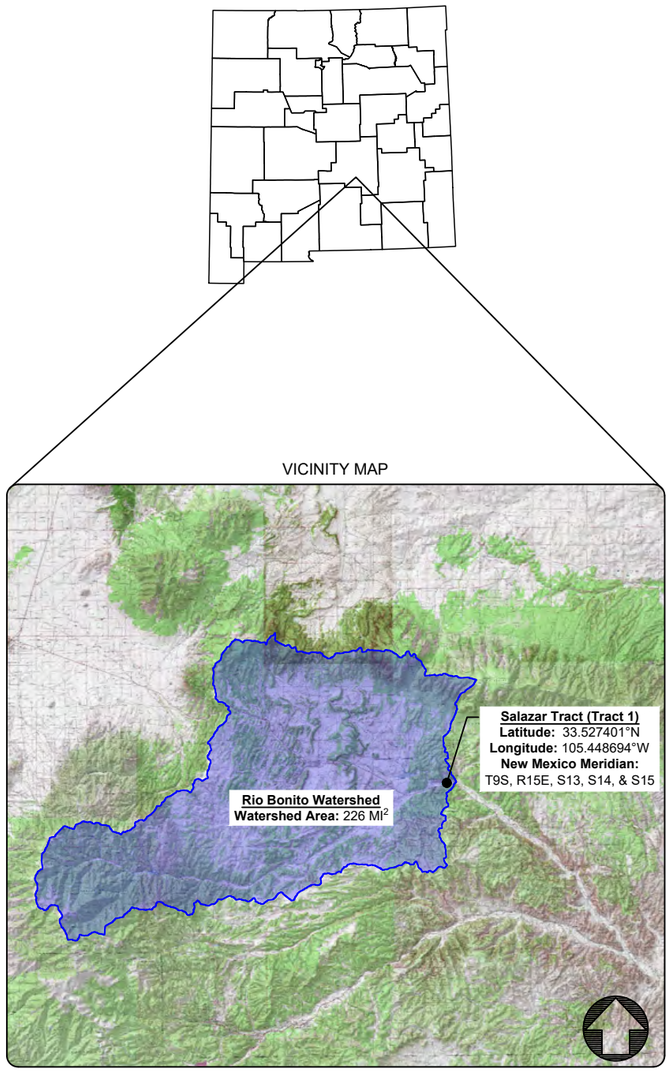



Project over view by OEE

# BLM Rio Bonito Public Lands: Salazar Tract (Tract 1)
# Rio Bonito Habitat Improvement Project
## 30% Design Submittal

Bureau of Land Management (BLM), Roswell Field Office
Lincoln County, New Mexico




VICINITY MAP

Rio Bonito - Photo by OEE, March 8, 2023

### SUBMITTED TO

**CLIENT:**
New Mexico Department of Game & Fish (NMDGF)
1 Wildlife Way
Santa Fe, NM 87507
(505) 476-8000

**PROJECT PARTNER:**
Bureau of Land Management (BLM)
Roswell Field Office
2909 West Second Street
Roswell, NM 88201
(575) 627-0272

### SUBMITTED BY

**CIVIL/ECOLOGICAL PROJECT ENGINEER:**
Oxbow Ecological Engineering, LLC (OEE)
3491 S. Gillenwater Drive
Flagstaff, AZ 86005
(928) 266-6192

**RESTORATION TECHNICAL ADVISOR:**
Watershed Artisans, Inc. (WAI)
1000 Cordova Place, #832
Santa Fe, New Mexico
(505) 577-9625

### SHEET INDEX



### DRAWING REVISIONS

| NUMBER | DATE | BY | REVISION DESCRIPTION |
|---|---|---|---|
| 0 | 4/20/2023 | GFC | 30% Design Submittal |


oxbow ecological engineering, llc
river + riparian + wetland + wildland
3491 S Gillenwater Dr ● Flagstaff, AZ 86005
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Lincoln County, NM

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NMDGF Purchase Order No. 51600-0000084759 (2-1)

PROJECT PHASE:
30% Design Submittal

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(505) 476-8000

DRAWN BY: GFC
DESIGNED BY: GFC & CS
REVIEWED BY: GFC & CS
ENGINEER OF RECORD:

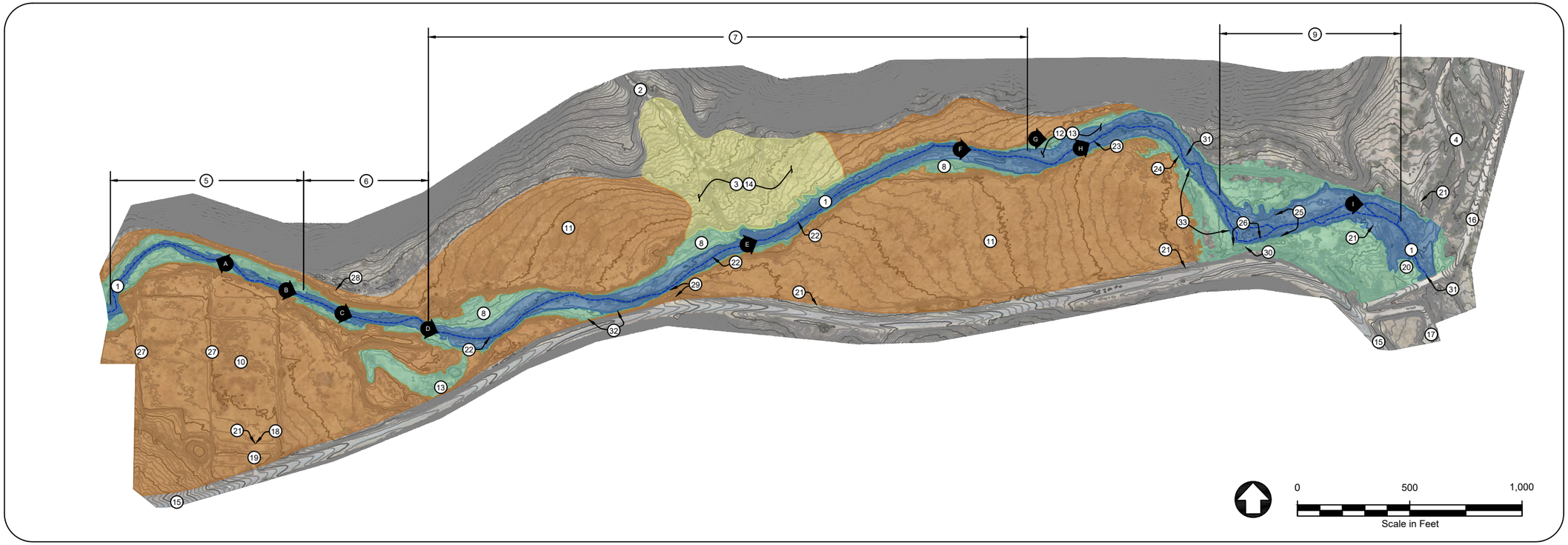
***PRELIMINARY PLAN***

***NOT FOR CONSTRUCTION***



DATE: 04.20.2023
OEE PROJECT #: NM-011-1
DRAWING: Cover Sheet
DRAWING #: CVR01
SHEET #: 1 OF 9
REVISION #: 0

Existing Conditions Map: Project Area




## Existing Conditions: Feature Legend

**General**

- Major Contours [USGS Rio Hondo, NM LIDAR (2014)]
- Minor Contours [USGS Rio Hondo, NM LIDAR (2014)]
- Rio Bonito Channel

**Valley Bottom Geomorphic Units**

- Bankfull/Active Channel
- Floodprone/Active Floodplain
- Alluvial Fan
- Disconnected Floodplain/ Leveled Agricultural Terrace

**Riverscape Features**

1. Rio Bonito
2. Salado Creek
3. Salado Creek Alluvial Fan
4. Salazar Canyon Wash
5. Steeper Channel/Intermittent Step-Pools
6. Entrenched Channel
7. Willow Armored Channel
8. Wider Floodplain Area
9. Flatter Braided Channel/Fine Sediment Deposition
10. Agricultural Terrace: Torres Ranch Orchard
11. Agricultural Terrace: Fallow Fields
12. Evidence of Past Beaver Activity
13. Cottonwood Copse/Clump Planting Donor Site
14. Alkali Sacaton Meadow

**Site Access Features**

15. U.S. Highway 380
16. Forest Service Road 57/County Road 002
17. NMDOT Picnic Area
18. Trailhead
19. Trailhead Parking Area
20. Informal Parking Loop
21. Access Gate/Potential Stocking Access
22. Low Water Crossing/Potential Stocking Area

**Other Site Infrastructure**

23. Irrigation Diversion
24. Irrigation Splitter Box
25. Steel Jetty Structure
26. Concrete Retaining Wall
27. Gated Irrigation Pipe
28. Leaking Pipe Air Vent
29. Highway Culvert & Rip-Rap Chute
30. Buried Irrigation Pipe (Approximate)
31. Culvert Manifold
32. Exposed Pipeline Segment
33. Boulder Piles Along Streambank

**Multimedia**

- On-the-Ground Photos from 3/7/23-3/8/23 (See Photos on Sheet 3)
- Drone Flyover Footage (https://youtu.be/ES6FDWL2U-A)

## Hydro-Geomorphic Data Summary

| Basin Characteristics (StreamStats v4.14.0) | |
|---|---|
| Drainage Area | 226 $MI^2$ |
| Mean Basin Slope | 20% |
| Mean Annual Precipitation | 19.5 IN. |
| Mean Basin Elevation | 7,145 FT |
| Recent Wildfires | Little Bear Fire (2012) |

| Peak Flow Statistics (StreamStats v4.14.0 - Peak 2008 5119 SE Mountain Flood Region 3) | |
|---|---|
| 50-Percent AEP Flood | 1,160 CFS |
| 20-Percent AEP Flood | 3,040 CFS |
| 10-Percent AEP Flood | 5,130 CFS |
| 4-Percent AEP Flood | 9,070 CFS |
| 2-Percent AEP Flood | 13,200 CFS |
| 1-Percent AEP Flood | 18,500 CFS |
| 0.2-Percent AEP Flood | 37,600 CFS |

| Bankfull Characteristics (Regional Relationships for Bankfull Stage [Moody et al. 2003]: Eastern Arizona & New Mexico Sites) | |
|---|---|
| Bankfull Discharge | 422 CFS |
| Bankfull Area | 77 $FT^2$ |
| Bankfull Width | 46 FT |
| Mean Bankfull Depth | 1.7 FT |
| Maximum Bankfull Depth | 2.8 FT |
| Width to Depth Ratio | 27 FT/FT |
| Inner Berm Area | 18-24 $FT^2$ |
| Channel Slope | 0.50% - 1.13% |
| Broad Level Stream Classification | Bc |

## Site Assessment Briefing

**Background**

On March 7-8, 2023 Oxbow Ecological Engineering and Watershed Artisans visited the Tract 1 Rio Bonito Public Lands Site and walked the 7,000-foot long study reach/corridor of Rio Bonito. The goal of this site reconnaissance was to get a preliminary read of the landscape, understand the factors contributing to riverscape impairment and degradation, and to gather data to inform preliminary restoration plans. The information from the field visit was combined with existing topographic information, aerial photos, and literature review to develop a broad-level picture of the watershed context and characteristics and the restoration potential of the this portion of the Rio Bonito riverscape. The following are initial impressions of the site and a brief assessment of the project reach. Follow the link for a video derived from a UAS flyover of the site conducted March 8, 2023: https://youtu.be/ES6FDWL2U-A.

**River Setting**

- The Rio Bonito through Tract 1 was likely relocated, dredged, and straightened to make room for the land-leveled agricultural fields that border both sides of the river.
- Except for an actively irrigated orchard on the west end of the project area, the agricultural fields are now fallow.
- There is still an active irrigation diversion on the lower half of the project area.

**River Character & Behavior**

- Because of these past channel modifications the Rio Bonito channel is currently confined to a 100 to 150-foot wide ravine that is inset 8 to 19-feet deep into the valley floor
- Within the ravine the Rio Bonito flows as single thread channel for most of the reach with a mature inset floodplain, but appears to be in an overall state of arrested degradation.
- There is little diversity in stream profile (few pools and associated runs/glides), pattern (low sinuosity), or dimension (streambanks armored by relatively thin band of willows that have "locked" the straightened channel in place) resulting in poor aquatic habitat quality and complexity.
- Stream substrate throughout is dull and coated with fine sediment and algae indicating reduced movement and turnover of bed material potentially caused by a lack of stream power and hydraulic complexity.
- Woody debris inputs are limited to smaller diameter materials which were likely generated within the tract.
- The lower end of the project has been highly manipulated with mitigation measures and structures installed to protect the nearby highway. These stabilization measures along with cross channel boundary fencelines have likely resulted in deposition of fine sediment and the formation of channel braids.

**Vegetation Community**

- Riparian and wetland vegetation is mostly limited to a 100-150 foot wide buffer along the incised channel corridor, with a few mature cottonwood specimens and copses with younger trees.
- In areas where mature cottonwoods grow along the channel, the willow understory is reduced and the channel appears to be more dynamic.
- The tract is seasonally grazed by cattle and these shaded cottonwood areas also attract cattle and bank trampling is noted in these areas.
- There is evidence of beaver activity in the lower half of the project, with multiple cottonwood stumps showing beaver teeth marks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3491 S Gillenwater Dr ● Flagstaff, AZ 86005
(928) 266-6192 ● www.oxbow-eco-eng.com


PROJECT NAME:
**BLM Rio Bonito Public Lands: Salazar Tract (Tract 1)**
Rio Bonito Habitat Improvement Project

LOCATION:
BLM Rio Bonito Public Lands: Salazar Tract (Tract 1)
Lincoln County, NM

PROJECT NUMBER:
NMDGF Purchase Order No. 51600-0000084759 (2-1)

PROJECT PHASE:
30% Design Submittal

CLIENT:
New Mexico Department of Game & Fish
1 Wildlife Way
Santa Fe, NM 87507
(505) 476-8000

DRAWN BY: GFC
DESIGNED BY: GFC & CS
REVIEWED BY: GFC & CS
ENGINEER OF RECORD:

***PRELIMINARY PLAN***

***NOT FOR CONSTRUCTION***



| DATE: | OEE PROJECT #: |
|---|---|
| 04.20.2023 | NM-011-1 |

DRAWING:
Existing Conditions: Overview & Assessment Briefing

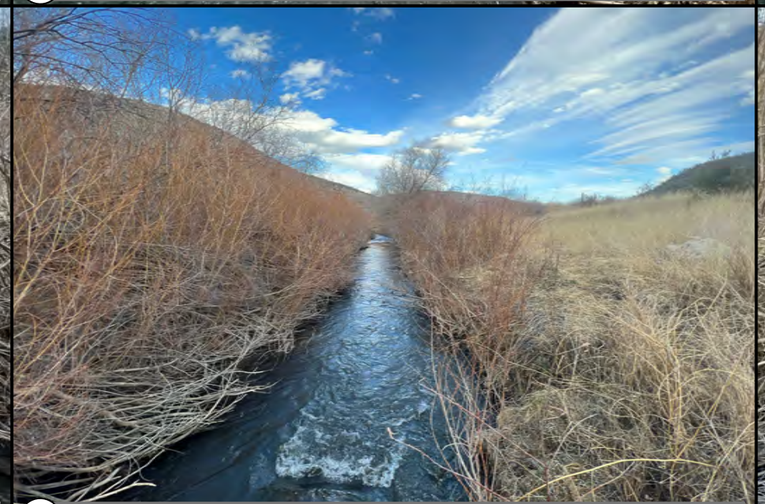
| DRAWING #: | SHEET #: | REVISION #: |
|---|---|---|
| EXC01 | 2 OF 9 | 1 |

A - Typical Channel: Upstream Step-Pool

B - Typical Channel: Upstream Entrenched

C - Typical Channel Substrate - Biofilm/Algae

D - Typical Channel - Upper Middle Willow Armored Channel



E - Typical Channel - Middle Willow Armored Channel

F - Typical Channel - Lower Middle Willow Armored Channel

G - Cottonwood Copse with Beaver Chewed Stumps

H - Irrigation Diversion

I - Typical Channel - Downstream Braided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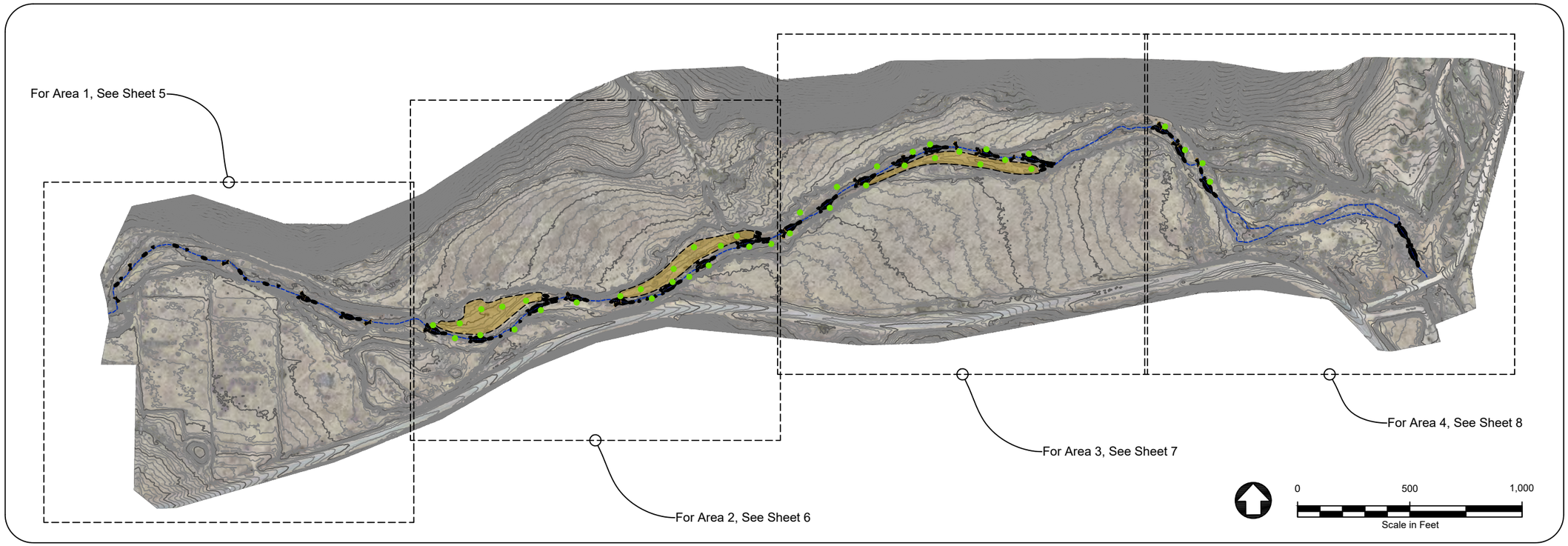
DRAWING:
Existing Conditions: Representative Site Photos

| DRAWING #: | SHEET #: | REVISION #: |
|---|---|---|
| EXC02 | 3 OF 9 | 1 |

Habitat Improvement Plan: Project Area Overview




Habitat Improvement Plan: Objectives & Approach

**Restoration Objectives**

- Increase hydraulic diversity and shelter habitat for trout
- Increase pool frequency and depth throughout the project reach
- Increase frequency of large woody debris jams throughout reach
- Reduce width-to-depth ratio wherever possible
- Increase channel shading with vegetation conducive to a positive angler experience
- Increase overbank flow at lower flood stages and increase system resiliency

**Restoration Approach**

Based on the inventory and assessment for the project, a set of site specific practices was developed that could be used to meet the objectives outlined above. The restoration approach for this reach will include the construction of boulder clusters and log jams to increase hydraulic diversity and improve cover habitat. These structures will be designed to maintain pool scour and increase pool depth. Pools will be excavated to generate fill materials to construct riffles and inner berms that will reduce the channel width to depth ratio and provide grade control. Where there is wider sections of floodplain, re-contour this "Channel Evolution Zone" to allow increased frequency of overbank flows and an opportunity for the channel to evolve/adjust to future conditions including catastrophic wildfires/floods. Strategically placed clump plantings of cottonwoods harvested onsite will be used to cast shade over as much of the project reach as possible.

**Preliminary Design Notes**

1. Location, size, quantity and extent of the preliminary design elements are for baseline guidance/reference.
2. The final improvement plans may vary based off stakeholder input, site assessment findings, final restoration grading and design and modeling, compliance requirements, and/or budget considerations.

**Design Element Summary**

- [22 EA] Excavated Pool (EPL) 1/- 7/9
- [35 EA] Constructed Riffle (CRF) 2/- 8/9
- [59 EA] Boulder Cluster (BCL) 3/- 9/9
- [18 EA] Constructed Log Jam (CLJ) 4/- 10/9
- [3 EA] Channel Evolution Zone (CEZ) 5/- 11/9
- [42 EA] Riparian Clump Transplant (RCT) 6/- 11/9

Habitat Improvement Plan: Design Elements


Excavated Pool | Little Colorado River, AZ | Oxbow Ecological Engineering

1/- Excavated Pool (EPL)


Constructed Riffle | Gallinas River, NM | Watershed Artisans

2/- Constructed Riffle (CRF)


Paired Boulder Clusters | Upper Gallinas River, NM | Watershed Artisans

3/- Boulder Cluster (BCL)


Constructed Log Jam | Upper Gallinas River, NM | Watershed Artisans

4/- Constructed Log Jam (CLJ)


Post-Fire Channel Response/Evolution | Rio Mora NWR, NM | Watershed Artisans

5/- Channel Evolution Zone (CEZ)

Clump Transplant | Vermejo Park Ranch, NM | Oxbow Ecological Engineering

6/- Riparian Clump Transplant (RCT)

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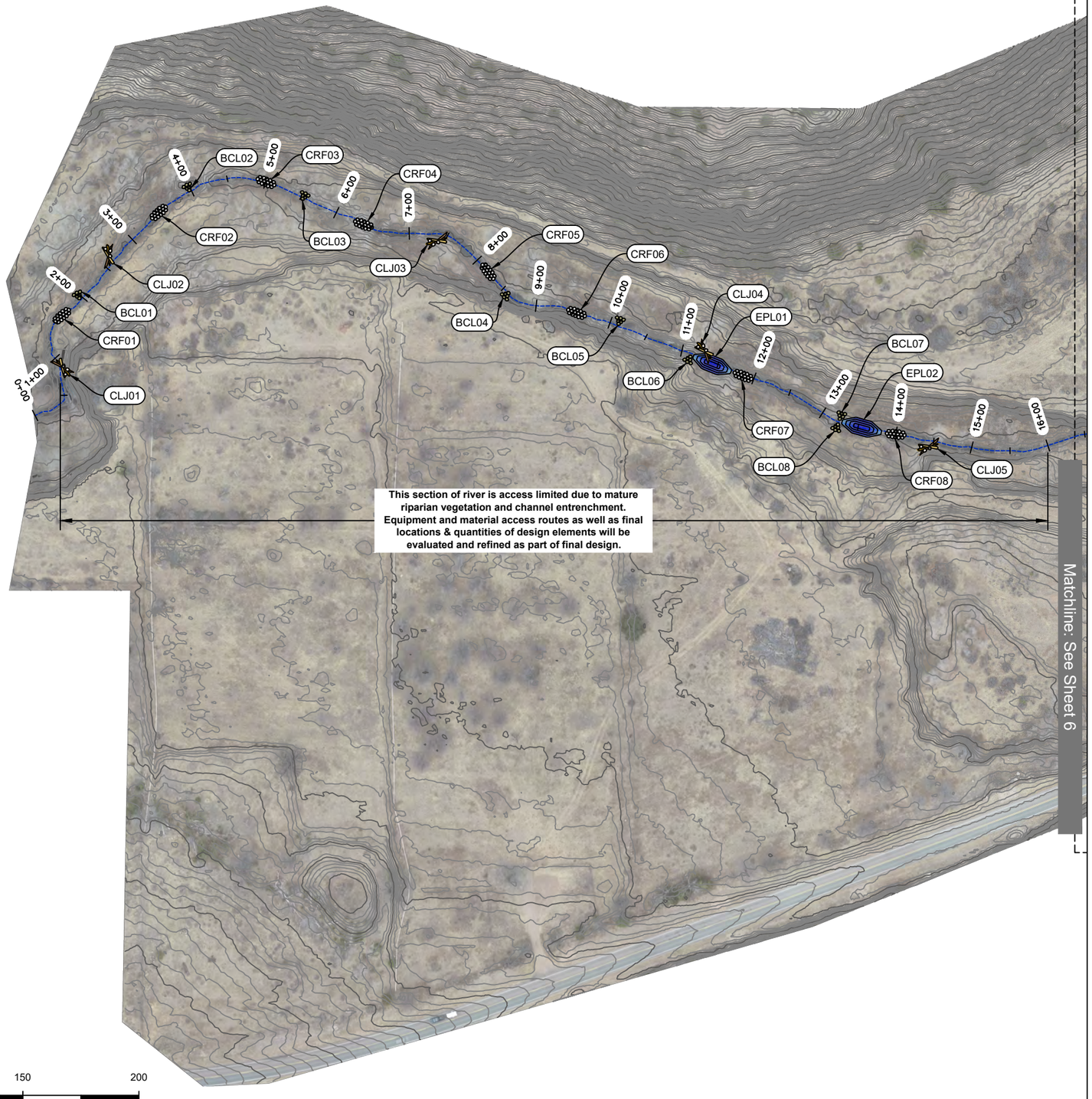
DATE: 04.20.2023
OEE PROJECT #: NM-011-1

DRAWING:
Preliminary Habitat Improvement Plan: Overview & Objectives

DRAWING #: HAB01
SHEET #: 4 OF 9
REVISION #: 0

Habitat Improvement Plan: Area 1




## Legend

**Existing Features**

- Major Contours [USGS Rio Hondo, NM LIDAR (2014)]
- Minor Contours [USGS Rio Hondo, NM LIDAR (2014)]
- Rio Bonito Channel

**Proposed Features**

- Excavated Pool (EPL) 1/4 7/9
- Constructed Riffle (CRF) 2/4 8/9
- Boulder Cluster (BCL) 3/4 9/9
- Constructed Log Jam (CLJ) 4/4 10/9
- Channel Evolution Zone (CEZ) 5/4 11/9
- Riparian Clump Transplant (RCT) 6/4 11/9

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DRAWING: Preliminary Habitat Improvement Plan: Area 1

| DRAWING #: | SHEET #: | REVISION #: |
|---|---|---|
| HAB02 | 5 OF 9 | 1 |

Habitat Improvement Plan: Area 2


## Legend

**Existing Features**

- Major Contours [USGS Rio Hondo, NM LIDAR (2014)]
- Minor Contours [USGS Rio Hondo, NM LIDAR (2014)]
- Rio Bonito Channel

**Proposed Features**

- Excavated Pool (EPL) 1/4 7/9
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(928) 266-6192 ● www.oxbow-eco-eng.com


PROJECT NAME:
**BLM Rio Bonito Public Lands: Salazar Tract (Tract 1)**
Rio Bonito Habitat Improvement Project

LOCATION:
BLM Rio Bonito Public Lands: Salazar Tract (Tract 1)
Lincoln County, NM

PROJECT NUMBER:
NMDGF Purchase Order No. 51600-0000084759 (2-1)

PROJECT PHASE:
30% Design Submittal

CLIENT:
New Mexico Department of Game & Fish
1 Wildlife Way
Santa Fe, NM 87507
(505) 476-8000

DRAWN BY: GFC
DESIGNED BY: GFC & CS
REVIEWED BY: GFC & CS
ENGINEER OF RECORD:

***PRELIMINARY PLAN***

***NOT FOR CONSTRUCTION***



| DATE: | OEE PROJECT #: |
|---|---|
| 04.20.2023 | NM-011-1 |

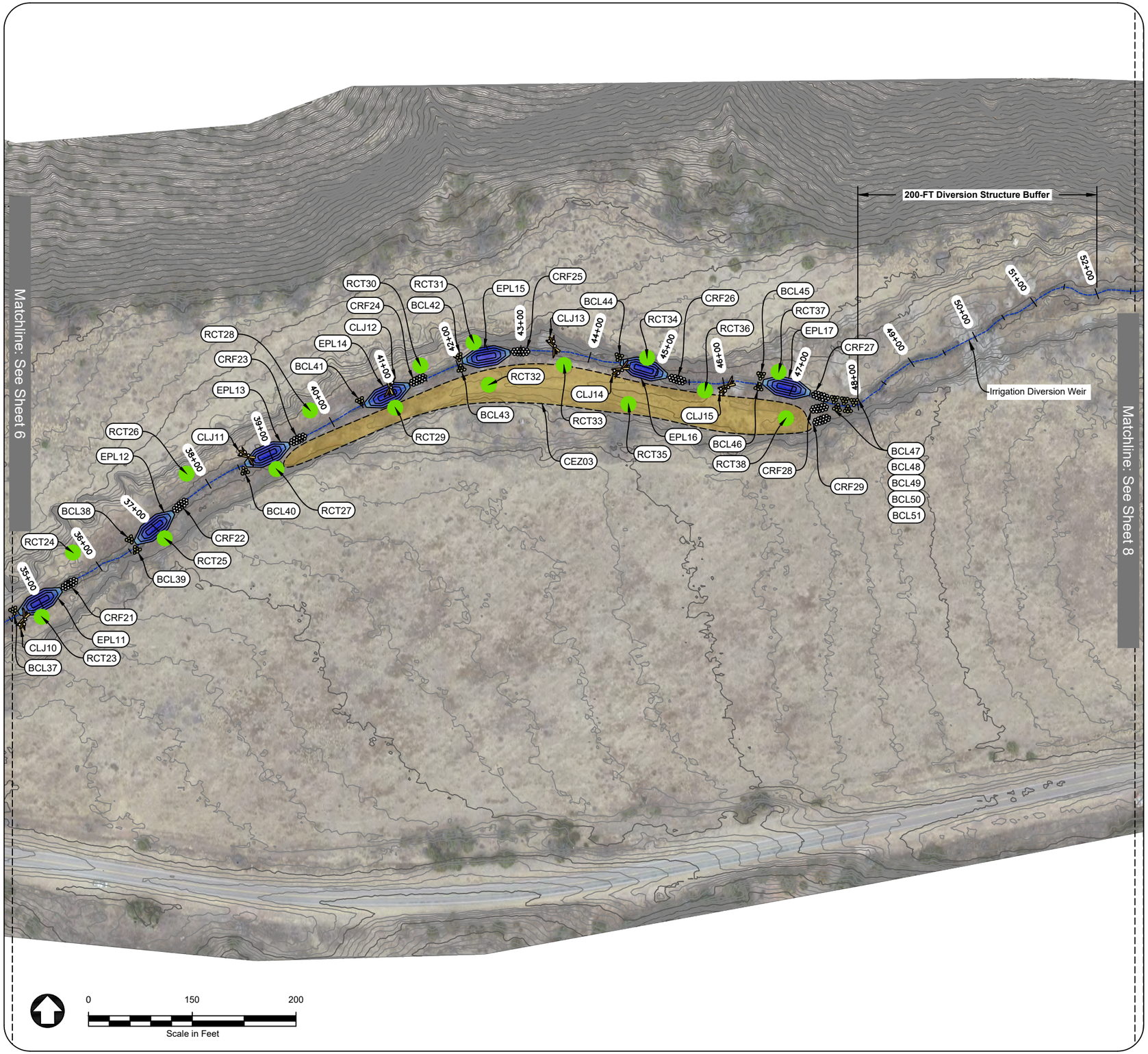
DRAWING:
Preliminary Habitat Improvement Plan: Area 2

| DRAWING #: | SHEET #: | REVISION #: |
|---|---|---|
| HAB03 | 6 OF 9 | 1 |

Habitat Improvement Plan: Area 3

Matchline: See Sheet 6

Matchline: See Sheet 8




## Legend

**Existing Features**

- Major Contours [USGS Rio Hondo, NM LIDAR (2014)]
- Minor Contours [USGS Rio Hondo, NM LIDAR (2014)]
- Rio Bonito Channel

**Proposed Features**

- Excavated Pool (EPL) 1/4 7/9
- Constructed Riffle (CRF) 2/4 8/9
- Boulder Cluster (BCL) 3/4 8/9
- Constructed Log Jam (CLJ) 4/4 10/9
- Channel Evolution Zone (CEZ) 5/4 11/9
- Riparian Clump Transplant (RCT) 6/4 11/9

## Notes

1. Location, size, quantity and extent of the preliminary design elements are for baseline guidance/reference.
2. The final improvement plans may vary based off stakeholder input, site assessment findings, final restoration grading and design and modeling, compliance requirements, and/or budget considerations.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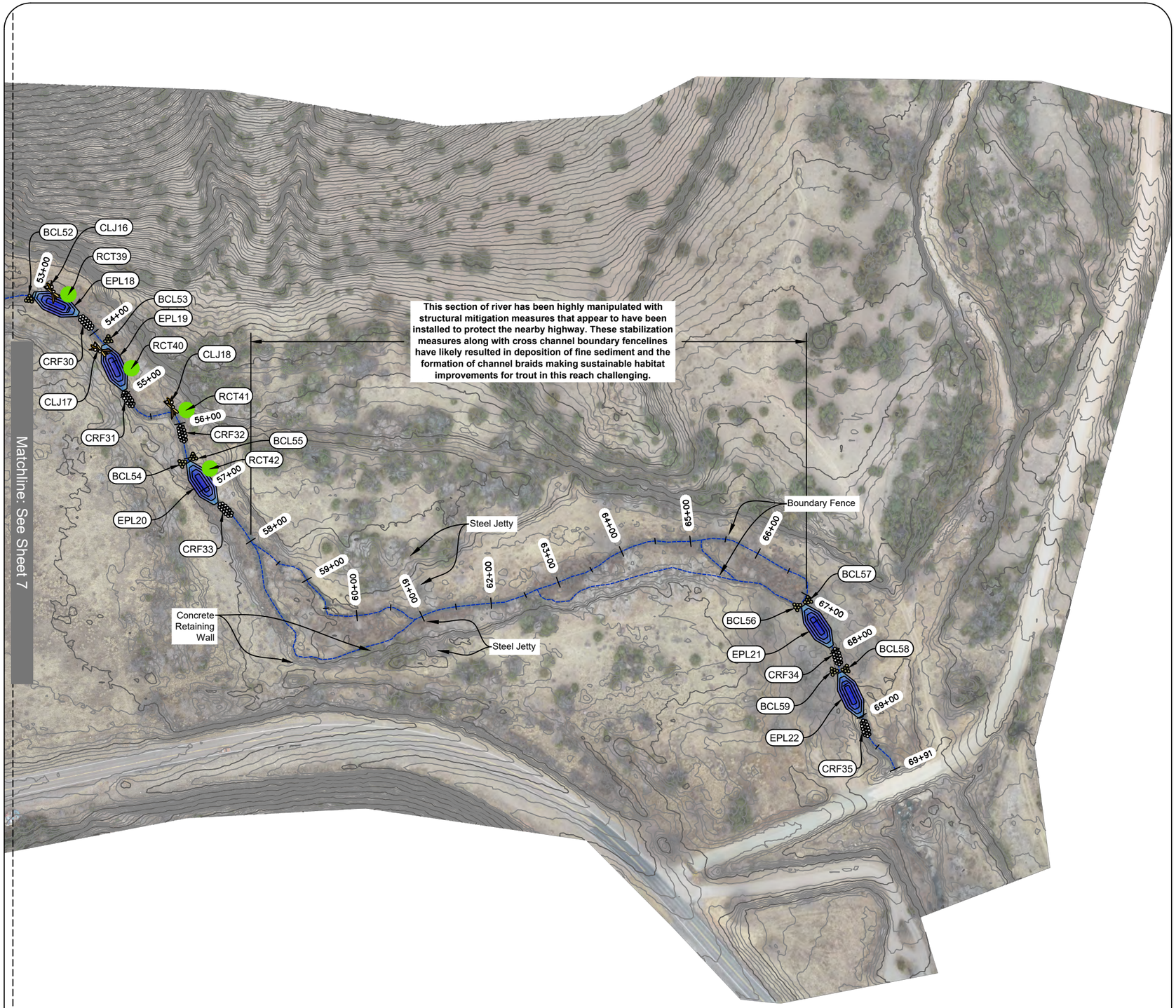
DATE: 04.20.2023
OEE PROJECT #: NM-011-1

DRAWING: Preliminary Habitat Improvement Plan: Area 3

DRAWING #: HAB04
SHEET #: 7 OF 9
REVISION #: 1

Habitat Improvement Plan: Area 4




## Legend

**Existing Features**

- Major Contours [USGS Rio Hondo, NM LIDAR (2014)]
- Minor Contours [USGS Rio Hondo, NM LIDAR (2014)]
- Rio Bonito Channel

**Proposed Features**

- Excavated Pool (EPL) 1/4 7/9
- Constructed Riffle (CRF) 2/4 8/9
- Boulder Cluster (BCL) 3/4 9/9
- Constructed Log Jam (CLJ) 4/4 10/9
- Channel Evolution Zone (CEZ) 5/4 11/9
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## Notes

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New Mexico Department of Game & Fish
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Santa Fe, NM 87507
(505) 476-8000

DRAWN BY: GFC
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REVIEWED BY: GFC & CS

ENGINEER OF RECORD:

***PRELIMINARY PLAN***

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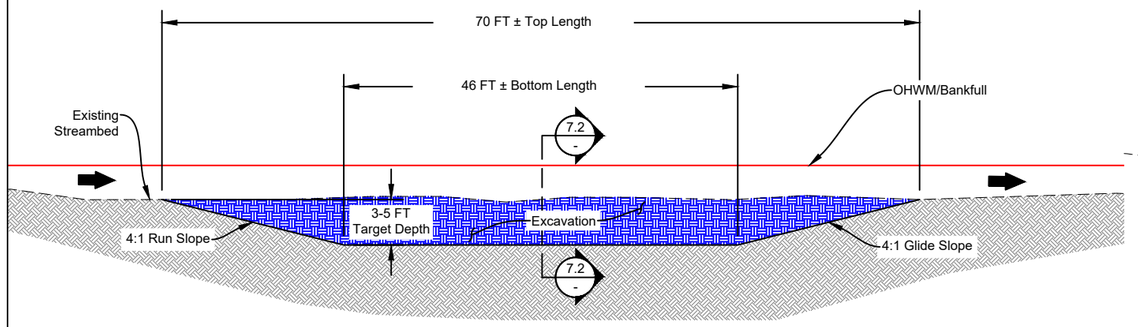
DATE: 04.20.2023
OEE PROJECT #: NM-011-1

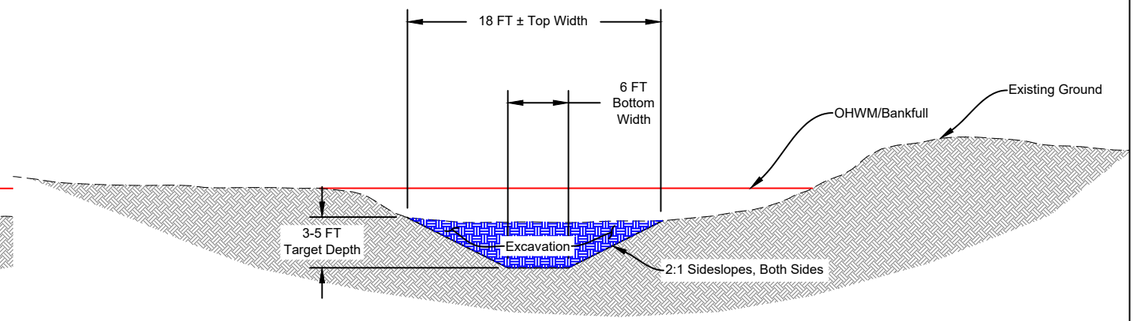
DRAWING:
Preliminary Habitat Improvement Plan: Area 4

DRAWING #: HAB05
SHEET #: 8 OF 9
REVISION #: 1

**Excavate deep pools, with facet slopes, dimensions, & spacing based on functioning reference reach information collected on site and regional reference information. Pools will provide valuable refugia habitat during low flow as well as improved fishing opportunities.**

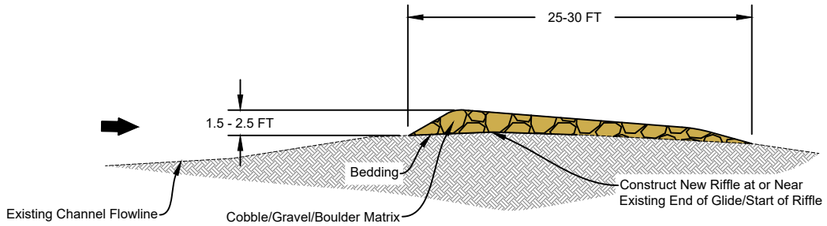



7.1 - Excavated Pool (EPL): Typical Profile



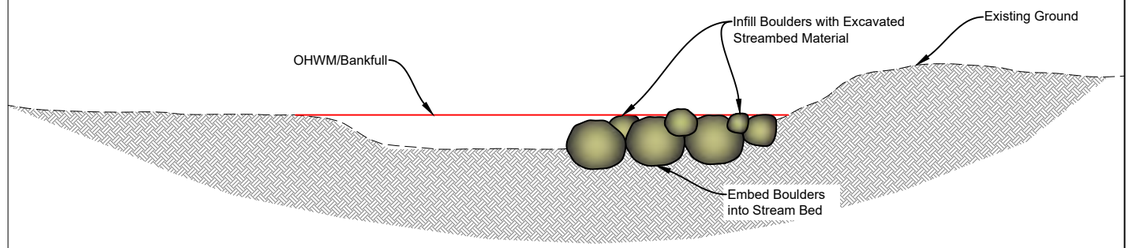

7.2 - Excavated Pool (EPL): Typical Section

**Construct porous grade control structures by placing graded rock, boulders, and streambed material excavated from pools into the streambed to create a hardened riffle section at the tail-out of new and existing pool sections. This armored section is designed to increase the area of inundation of the adjacent pools, while providing grade control for the pool.**



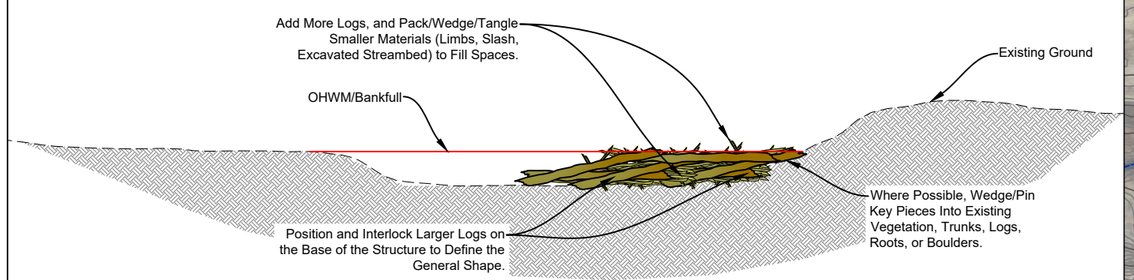

8 - Constructed Riffle (CRF): Typical Profile

**Construct irregular clusters of boulders, sized commensurate with channel size and type, to add roughness and force convergent lateral flow and hydraulic variation. Install boulder clusters into the channel one-third to two thirds of the bankfull width, and tapering in elevation from the bankfull depth at the bank to the low flow water level in the channel.**



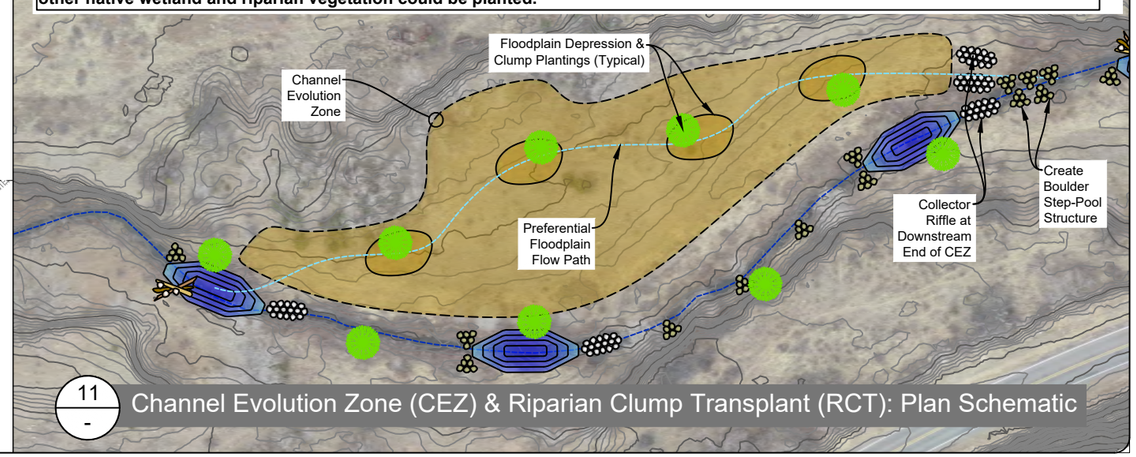

9 - Boulder Cluster (BCL): Typical Section

**Construct irregular spurs from a matrix of woody debris (logs, roots, slash) and boulders, and cobble/gravel material collected on site to add roughness and force convergent lateral flow and hydraulic variation. Install log jams into the channel one-third to two thirds of the bankfull width, and tapering in elevation from the bankfull depth at the bank to the low flow water level in the channel.**




10 - Constructed Log Jam (CLJ): Typical Section

**Re-contour wider sections of floodplain to allow increased frequency of overbank flows and an opportunity for the channel to evolve/adjust to future conditions including catastrophic wildfires/floods. Floodplain re-contouring in the "Channel Evolution Zone" could include the construction of floodplain depressions that create a preferential flow path where riparian clump transplants and other native wetland and riparian vegetation could be planted.**




11 - Channel Evolution Zone (CEZ) & Riparian Clump Transplant (RCT): Plan Schematic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DATE: 04.20.2023
OEE PROJECT #: NM-011-1

DRAWING: Preliminary Habitat Improvement Plan: Typical Details & Sections

DRAWING #: DTL01
SHEET #: 9 OF 9
REVISION #: 0