

Oyster Creek Stabilization Project
Post-construction Monitoring Report – Year 3



Prepared for:
El Dorado Irrigation District

Prepared by:
Horizon Water and Environment
Contact: Robin Hunter
(510) 986-1854
robin@horizonh2o.com

August 2022



1. INTRODUCTION

The El Dorado Irrigation District (EID) completed construction of the Oyster Creek Stabilization Project (Project) in October 2019. The Project used biotechnical techniques to stabilize a portion of Oyster Creek and its North Tributary.

The Project site is located in eastern El Dorado County, California (**Figure 1**). **Figure 2** provides an overview of the Project area. The Project includes two sites, the Oyster Creek and North Tributary restoration sites. Five years of post-construction monitoring are required by the Oyster Creek Monitoring Maintenance and Reporting Plan (MMRP) (EID 2014). This *Year-3 Monitoring Report* documents conditions at the Project sites, including plant survival, vegetation cover, erosion, and photographic documentation during the summer of 2022. The monitoring activities comply with the requirements of the MMRP. Monitoring activities were canceled in 2021 (Year-2) due to the road closures and dangerous conditions related to the Caldor Fire.

2. METHODS

Year-3 monitoring activities were conducted on June 8, 2022 by Horizon Water and Environment (Horizon) biologist Brian Piontek. Post-construction monitoring was conducted per the Oyster Creek Monitoring Maintenance and Reporting Plan (EID 2014). Reference sites were established in 2019 near the restoration sites (Figure 2).

2.1 VEGETATION ASSESSMENT

Plant survival was recorded within the Oyster Creek and North Tributary restoration sites for each willow cutting and container plant. Vegetation cover was recorded by strata (i.e., herbaceous cover and shrub/tree cover) at both the restoration sites and reference sites.

2.2 EROSION ASSESSMENT

Monitoring included measurement of erosion pins placed in the banks of Oyster Creek in 2019 at the restoration and reference sites. If restoration sites experience similar erosion rates as reference sites or less (within 25 percent), the restoration will be considered successful. The stability of the three head cuts in the North Tributary were measured and visually assessed, and compared to the reference site head cut. The bases of the head cuts were marked in 2019 and compared to 2022 conditions.

2.3 PHOTO-DOCUMENTATION

Photographs were taken from representative point locations established during Project implementation. The photographs document and compare annual vegetative growth and conditions at each site. Photo point locations are shown on Figures 2. Photographs are provided in **Appendix A**.

C:\Users\GIS\Documents\ArcGIS\PROJECTS\16018_EID_OysterCreek\mxd\Welland\Definition\Fig1_ProjectLocation.mxd PG. 8/30/2016

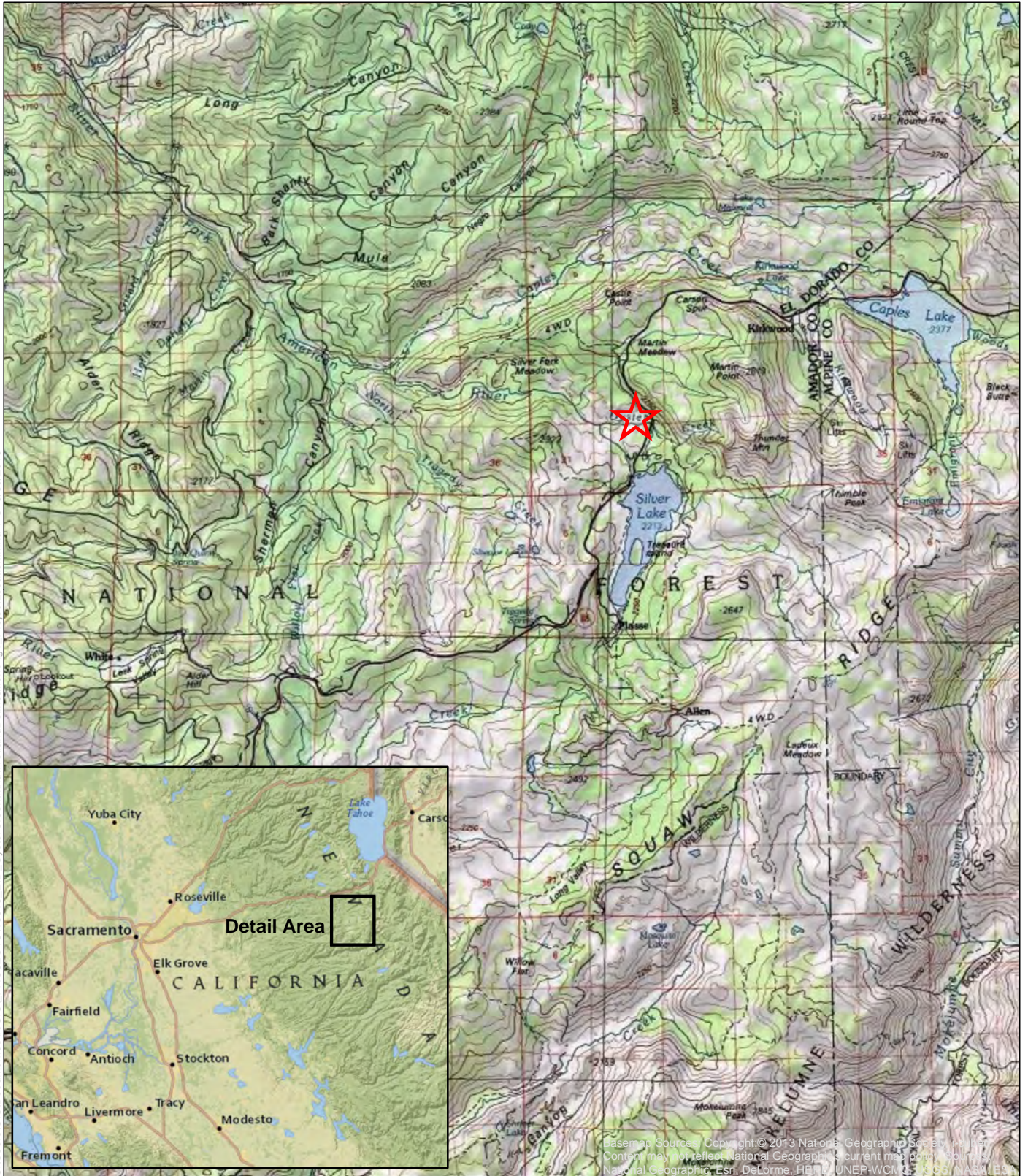
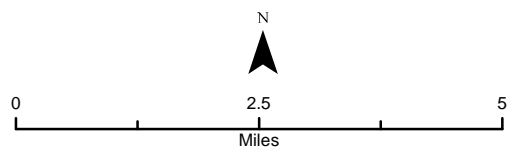


Figure 1
Project Location

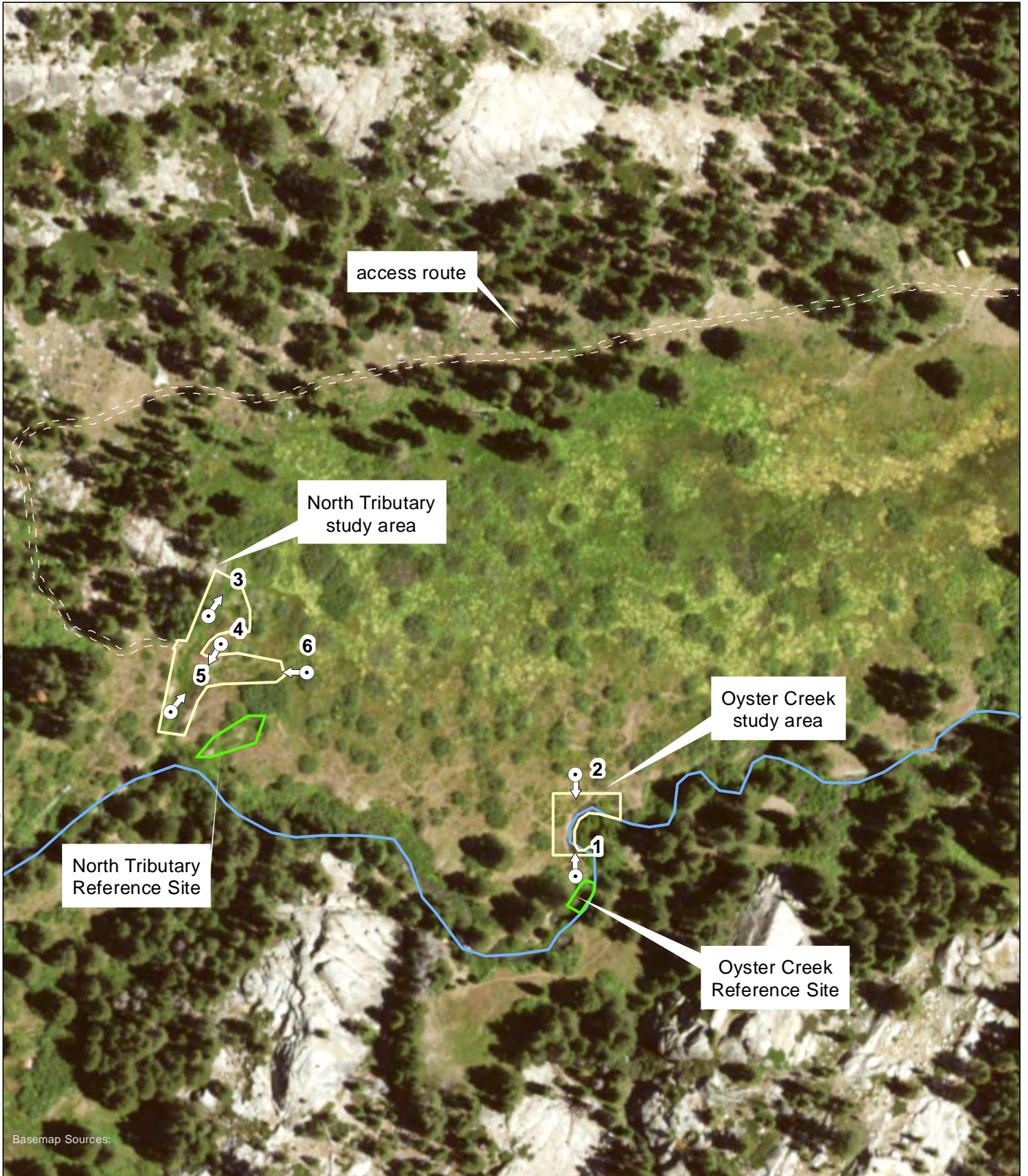


 Project Location

Oyster Creek
Stabilization Project



\\PROJECTS\16018_EID_OysterCreek\WetlandDelineation\Fig2_ProjectOverview_Monitoring.mxd RH 12/2/2020



Basemap Sources:

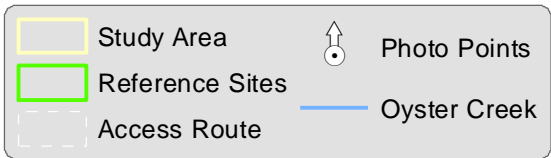
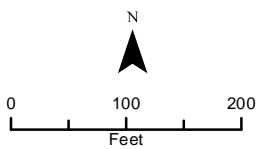


Figure 2
Project Overview

Oyster Creek
Stabilization Project

3. RESULTS

3.1 VEGETATION ASSESSMENT

Oyster Creek

Revegetation of the Oyster Creek restoration site included planting of locally-harvested Lemmon’s willow (*Salix lemmonii*) poles and mountain alder (*Alnus incana* spp. *tenuifolia*) container plants. A diverse assemblage of naturally recruited herbaceous species also contributes to plant cover. **Table 1** shows the vegetation percent cover at the Oyster Creek restoration and reference sites, according to stratum. **Table 2** lists the species installed in 2019 and the number of living plants observed in Year-1 and Year-3 monitoring events.

Table 1. Vegetation percent cover within Oyster Creek restoration and reference sites.

Stratum	Performance Standard (Percent Cover)	Year-1 (Percent Cover)			Year-3 (Percent Cover)		
		Restoration	Reference	Restoration Compared to Reference	Restoration	Reference	Restoration Compared to Reference
Herbaceous	Restoration +/- 25% Reference	25	30	-5	15	5	10
Shrub/Tree		5	20	-15	1	20	-19
Total		30	50	-20	16	25	-9

Table 2. Plant species and abundance at the Oyster Creek restoration site.

Species	Performance Standard	Number Installed	Number of Living Plants (Year-1)	Number of Living Plants (Year-3)
Mountain Alder <i>Alnus incana</i> spp. <i>tenuifolia</i>	60% survival	10	8	1
Lemmon’s Willow <i>Salix lemmonii</i>		121	107	69
Total		131	115	70
Percent Survival			88%	53%

Vegetation cover at the reference site as shown in Table 1 is mainly due the presence of a mature pine tree at the northern edge of the site, raising the overall shrub/tree stratum cover. The herbaceous cover at the reference site also decreased significantly as compared to Year-1. The site is meeting the performance standard for percent vegetative cover.

Where visible, planted mountain alder and Lemmon’s willow are currently surviving well at the Oyster Creek restoration site. However, the recent calving of the overhanging vegetation and top of bank has

buried portions of the coir log toe and many willow stakes along the mid- and lower bank. For this reason, the Oyster Creek site is not meeting the performance standards for plant survivorship.

North Tributary

Revegetation of the North Tributary restoration site included planting Lemmon’s willow poles, mountain alder container plants, and quaking aspen (*Populus tremuloides*) seedlings harvested from adjacent to the restoration site. A diverse assemblage of naturally recruited herbaceous species also contribute to plant cover. **Table 3** shows the vegetation percent cover at the North Tributary restoration and reference sites, according to stratum. **Table 4** lists the species installed in 2019 and the number of living plants observed in Year-1 and Year-3 monitoring events.

Table 3. Vegetation percent cover within North Tributary restoration and reference sites.

Stratum	Performance Standard (Percent Cover)	Year-1 (Percent Cover)		Year-3 (Percent Cover)		
		Restoration	Reference	Restoration	Reference	Restoration Compared to Reference
Herbaceous	Restoration +/- 25% Reference	70	70	70	60	10
Shrub/Tree		15	10	20	10	10
Total		85	80	90	70	+20

Table 4. Plant species and abundance at the North Tributary restoration site

Species	Performance Standard	Number Installed	Number of Living Plants (Year-1)	Number of Living Plants (Year-3)
Mountain Alder <i>Alnus incana</i> spp. <i>tenuifolia</i>	60% survival	5	1	1
Lemmon’s Willow (poles) <i>Salix lemmonii</i>		111	87	42
Quaking Aspen <i>Populus tremuloides</i>		7	2	35
Total		123	90	78
Percent Survival			73%	63%

At the North Tributary restoration site, vegetation in the herbaceous stratum is dominated by various grasses and sedges, as well as corn lily (*Veratrum californicum*). Vegetation in the shrub/tree stratum is dominated by Lemmon’s willow and quaking aspen. Vegetation composition in the reference site is similar, although quaking aspen is not present at this site. Overall, the North Tributary restoration site supported dense herbaceous growth that was 10 percent greater than at the reference site and is meeting the vegetation cover performance standard.

Where visible, planted Lemmon’s willow poles and fascines are currently surviving well at the North Tributary restoration site. Willows installed in the brush pack (rocked channel) appeared most vigorous (see Appendix A, Photo 3c). However, significant sedimentation has occurred behind several fascines and directly downstream of the rocked channel. These features are performing as designed by creating sediment sinks and aggrading the channel thus creating a more gradual bed slope. However, this aggradation has buried significant portions of the willow fascines. In general, these areas are densely vegetated with herbaceous species, but the aggradation unintentionally lowers the survivorship of woody species. Natural recruitment has significantly expanded the aspen stand on the right bank near the rocked channel (see Appendix A, Photos 4c and 5c). Dozens of shoots and saplings were detected along the top of the right bank down to near the toe of the channel. The surviving willow cuttings together with the natural aspen recruitment along the North Tributary restoration site result in this site currently meeting its percent survival performance standard.

3.2 EROSION ASSESSMENT

Oyster Creek Erosion Pin Monitoring

Erosion pins were installed at various bank elevations in 2019 at the Oyster Creek restoration and reference sites. The erosion pins were measured to determine the rate of erosion at the reference and restoration sites. If restoration sites experience similar erosion rates as reference sites or less (within 25 percent), the restoration will be considered successful. Table 5 provides results from Year-1 and Year-3 erosion pin monitoring. Erosion pin numbers are from upstream to downstream. Photo 7B in Appendix A shows a reference site erosion pin.

Table 5. Oyster Creek Erosion Pins

	Length at Installation (Inches)	Year-1	Year-3	Change from Installation (inches)
		Length (Inches)	Length (Inches)	
Restoration Site				
Erosion Pin 1	5.75	--*	--*	-5.75*
Erosion Pin 2	5.00	5.25	9.50	+4.50
Erosion Pin 3	6.10	4.00	--*	-6.10*
Erosion Pin 4	6.00	5.00	3.50	-2.50
Average				-2.46
Reference Site				
Erosion Pin 5	6.00	4.00	4.50	-1.50
Erosion Pin 6	6.00	5.00	5.50	-0.50
Average				-1.00
*These erosion pins appear to have been buried by slumping of the upper portion of the bank.				

The streambank along the Oyster Creek restoration site appears to be naturally adjusting laterally as the site is evolving to a more stable condition (see Appendix A, Photos 1c and 2c). This is supported by visual evidence that portions of undercut, hanging vegetation along the upper edge of the bank has fallen into the channel, on top of the reinforced coir log toe, or is laying between the top of bank and the coir log. The coir roll has remained in place. It is collecting material on its upslope side, and herbaceous vegetation has colonized this area. This has resulted in a more gradual, stable bank slope in areas that were previously steepened and undercut. The lateral adjustment of the upper bank is moving the restoration site to a more stable equilibrium.

Erosion pins 1 and 3 were not able to be located during Year 3 monitoring. It appears that slumping of the upper portion of the bank in that location has buried the pins such that they are not visible. Movement of unconsolidated material from the upper portions of the banks to lower portions of the banks has resulted in less of erosion pins 4 being exposed, which would not be considered erosion. Erosion did occur at erosion pin 2. The average length of exposed erosion pins decreased more at the restoration site, compared to the reference site. The restoration site is currently meeting the performance standard, as on average no erosion occurred.

North Tributary Headcut Monitoring

Table 6 shows Year 1 and 2 monitoring results for the base of the three North Tributary headcuts, and the reference site headcut.

Table 6. North Tributary Headcuts

Headcut Location	Performance Standard	Headcut Advancement	
		Year-1 (inches)	Year-3 (inches)
Restoration Site			
Main Portion North Tributary (Brush Pack)	Headcuts do not advance more than 24 inches	0	0
Upstream Tributary		6	6
Downstream Tributary		12	8
Reference Site			
Reference		12	14

No upstream advancement has occurred in the headcut in the main portion of the North Tributary, where the brush pack was installed. The brush pack has remained stabled and sediment aggradation is visible (Photos 3c and 4c in Appendix A). The smaller headcuts in the upstream and downstream tributaries have not advanced since Year-1. The biotechnical stabilization methods used in these portions of the North Tributary do not provide as much immediate erosion control as the brush pack does, as the root systems of plantings are still becoming established. The reference site headcut has advanced by 2 inches since Year-1. North Tributary headcuts are meeting the performance standard, and headcut advancement is less than or equal to headcut advancement at the reference headcut.

4. DISCUSSION AND RECOMENDATIONS

This section discusses the results of the monitoring in the context of the performance standards and conditions listed in the MMRP.

VEGETATION ASSESSMENT

The MMRP stipulates a 60 percent survivability target for plantings throughout the five-year monitoring period. It also stipulates that the restoration sites shall provide similar vegetative cover as the reference sites (+/- 25 percent). If the survival and/or cover requirements are not achieving these goals, adaptive management techniques (e.g., replacement plantings, additional watering) may be necessary to meet the success criteria.

Oyster Creek Restoration Site

The Oyster Creek restoration site is not meeting the performance standards for plant survivorship. This is directly attributed to the lateral bank adjustment and recent calving of the overhanging vegetation and top of bank that has buried portions of the coir log toe and many willow stakes along the mid- and lower bank. Additional willows cuttings will need to be installed in order to meet the planting survivorship target. Longer willow stakes, up to 3-4 feet in length, are also suggested to minimize burial as the overhanging bank stabilizes while also increasing the likelihood that stakes are in contact with ample groundwater supplies.

Steps to increase percent vegetative cover may include manually cutting undercut vegetation at the top of bank into blocks of sod and placing the blocks on the mid- and lower slopes above the coir log. The intent of this action is to control the loss of densely vegetated overhanging sections that may otherwise naturally shear off and drop into the creek channel where they become buried or wash away. The blocks should be as large as feasible in order to increase the likelihood vegetation would survive and thereby increase the herbaceous percent vegetative cover at the restoration site.

North Tributary Restoration Site

The North Tributary restoration site is meeting the success criteria for plant survivorship and vegetative cover. However, many willows have been buried due to channel aggradation behind the willow fascines. Additionally, some plantings in the downstream portions of the North Tributary restoration site showed signs of drought stress and limited growth.

Additional willows cuttings may be considered in order to increase the likelihood the site meets the planting survivorship. Willow stakes up to 3-4 feet in length are also suggested at this site to increase contact with groundwater supplies.

Monthly supplemental watering during the summer months is also recommended to improve soil moisture conditions for plantings and thus improve survivorship chances.

Tree cages were installed on approximately half of the installed willow poles in 2019 to protect against herbivore browsing. Many of these cages have been lost, damaged, or removed. Tree cages should be installed to protect small plantings, repositioned to reduce the chances for binding plant growth, and/or removed completely where damaged or failed to prevent material from leaving the site during storm events.

EROSION ASSESSMENT

Erosion rates at the restoration site are currently meeting the performance standard.

Some slumping of the top of bank has occurred at the Oyster Creek restoration site. However, the toe of the bank has remained stable. Sediment is accumulating behind the coir log at the toe of the slope. Overall, the coir logs installed during initial construction have performed relatively well at resisting erosion at the toe while the site naturally adjusts. To further stabilize the toe, EID may consider installing additional coir log(s) along the lower and/or mid-bank. Additional coir logs have the potential to create lateral steps across the bank with the intent of holding material at intermediate levels while reducing material losses to the creek. It is assumed that two of the erosion pins along the site have become buried as the bank adjusts. It is also assumed other erosion pins may become buried in the future due to similar processes.

The performance standard for erosion at the North Tributary is that headcuts do not advance headward (upstream) by more than two feet into the meadow following completion the Project. The brush pack in the main portion of the North Tributary is stable and has prevented any movement of the main headcut upstream. The two smaller headcuts are currently meeting the performance standard, and headcut advancement is less than or equal to headcut advancement at the reference headcut.

SUMMARY OF YEAR-3 FINDINGS AND RECOMMENDATIONS:

- Additional willow stakes are required at the Oyster Creek restoration site in order to meet standards for plant survival and vegetative cover.
- Cutting and placing sod blocks at the Oyster Creek restoration site is recommended.
- Installing additional coir log(s) at the Oyster Creek restoration site may be considered.
- Additional willow stakes are recommended at the North Tributary restoration site to increase the probability the site meets plant survival standards.
- Monthly watering of the plantings in the North Tributary in July, August, and September is recommended.
- Oyster Creek is currently meeting erosion standards.
- The North Tributary is meeting erosion standards.

REFERENCES

El Dorado Irrigation District. 2014. Oyster Creek Monitoring Maintenance and Reporting Plan. December.

Appendix A

Photographs

Appendix A: Photographs







Photo No. 1A	Photo No. 1B	Photo No. 1C
Date: 10/24/2019	Date: 8/28/2020	Date: 6/8/2022
Description: Oyster Creek post-construction, facing north.	Description: Oyster Creek during Year-1 Monitoring, facing north.	Description: Oyster Creek at Year-3. The bank appears to be evolving to a more gradual slope.
		

Photo No. 2A	Photo No. 2B	Photo No. 2C
Date: 10/24/2019	Date: 8/28/2020	Date: 6/8/2022
Description: Oyster Creek post-construction, facing south.	Description: Oyster Creek during Year-1 Monitoring, facing south.	Description: Oyster Creek at Year-3. The bank toe appears to be in a similar position as Year-0.
		

Appendix A: Photographs






Photo No. 3A	Photo No. 3B	Photo No. 3C
Date: 10/24/2019	Date: 8/28/2020	Date: 6/8/2022
Description: North tributary, main head cut, post-construction. Facing northeast.	Description: North tributary, main head cut during Year-1 monitoring. Facing northeast.	Description: The main head cut on the north tributary remains stable at Year-3.
		

Photo No. 4A	Photo No. 4B	Photo No. 4C
Date: 10/24/2019	Date: 8/28/2020	Date: 6/8/2022
Description: North tributary, pre-construction, facing southeast.	Description: North tributary, during Year-1, facing southeast.	Description: North tributary in Year-3. Dense vegetation covers both banks.
		

Appendix A: Photographs

Photo No. 5A	Photo No. 5B	Photo No. 5C
Date: 10/24/2019	Date: 8/28/2020	Date: 6/8/2022
Description: North tributary, pre-construction, downstream extent of project, facing upstream.	Description: North tributary during Year-1 at the downstream extent of project, facing upstream.	Description: North tributary in Year-3. An aspen stand is actively expanding on the right bank.
		

Photo No. 6A	Photo No. 6B	Photo No. 6C
Date: 10/24/2019	Date: 8/28/2020	Date: 6/8/2022
Description: North tributary, post-construction, facing east.	Description: North tributary during Year-1, facing east.	Description: North tributary during Year-3. The site is densely vegetated with grasses and herbs.
		

Appendix A: Photographs

Photo No. 7A	Photo No. 7B
Date: 8/28/2020	Date: 6/8/2022
Description: Oyster Creek reference site. Erosion control pin location is circled in red.	Description: Conditions at the reference site appear relatively unchanged in Year-3 as compared to Year-0.
