

Treatment Effectiveness and Maintenance and Safety Monitoring for erosion control sites on Lake Chelan: Prince Creek (Site 55), Corral Creek (Site 11), Deer Point (Site 58) and Mitchell Creek (Site 59)

INTRODUCTION

Lake Chelan Hydroelectric Project FERC Project No. 637 ARTICLE 401(a) Condition Appendix A, Articles 1(a)1, 1(a)2 and 1(a)3 required Chelan PUD to complete and submit an Erosion Control Implementation Plan, Site-Specific Erosion Control Plans, and an Erosion Monitoring and Maintenance Plan respectively. These plans provide a comprehensive approach to address shoreline erosion associated with the operation of this project. A number of erosion control sites described in the aforementioned plans have been treated to inhibit shoreline erosion on Forest Service lands on Lake Chelan.

This report details 'Treatment Effectiveness Monitoring' of erosion control sites which includes both Implementation Monitoring at years 1, 3, and 5 after treatments and 'Maintenance and Safety Monitoring' every 5 years starting at year 10 after treatments. Although not required until year 10, this report includes information on 'Maintenance and Safety Monitoring' at year 5 as it was easy to collect this data while on site. The erosion control sites were treated with rock armoring, large woody debris consisting of logs (LWD), geotextile, wattles, and other means approved in site specific plans.

The erosion control sites described in this report, which are located at lakeside campgrounds, have been monitored by Okanogan Wenatchee National Forest (National Forest) boat operators and resource personnel since the projects were completed. The sites are located next to popular shoreline recreation sites and are visited frequently for recreation infrastructure operation and maintenance from May through October on an annual basis. These visits constitute monitoring for years 1 and 3. On May 12, 2015 representatives of the Public Utility District No. 1 of Chelan County (Gene Yow) and the Okanogan-Wenatchee National Forest (Paul Willard and Lori McAllister) completed a formal 'Treatment Effectiveness Monitoring'. A monitoring form was created to capture site specific information for the 'Treatment Effectiveness Monitoring' and 'Maintenance and Safety Monitoring' objectives. The following sites were monitored: Prince Creek (Site 55), Corral Creek (Site 11), Deer Point (Site 58) and Mitchell Creek (Site 59). The site specific reports follow.

EROSION CONTROL SITE MONITORING

PRINCE CREEK - SITE 55

Prince Creek erosion control work commenced in November, 2009 by LKE Corporation and was completed in March, 2010. Treatment was completed on 610 linear feet of shoreline. The site contained 14 Treatment Zones which included Single Row Rock Placement, Double Row Rock Placement, Enhanced Rock Placement (re-armor crib wall), Gabion Basket Installation, plantings and Large Woody Debris (LWD) placement. Several treatments included wattles and fabric cloth. LWD were placed and anchored with steel wire attached to 3 boulders per log.

On May 12, 2015 Gene Yow, Paul Willard and Lori McAllister (Monitoring Team) visited the site. Previous cursory inspections by Forest Service personnel found that the treatments appeared to be very effective. The Monitoring Team found the treatments at the Prince Creek site to be very successful at this time. A few rocks had rolled after their initial placement in treatment Zones A and C1 but were determined to be of very limited consequence to the overall stability and effectiveness of the treatment. These rocks will potentially be moved back into the treatment zone when the Prince Creek Dock is replaced (2016). Overall, treatment is effective; all LWD is in place and stable. No new erosion was found and the old erosion scars above the treatments are stabilizing and naturally revegetating.



Erosion Control Monitoring and Maintenance: Field Data Sheet
2015

Lake Chelan Hydroelectric Project
FERC Project No. 637

Erosion Site #: Prince Creek – Site 55 Initial Treatment Date (YR completed): 2010

Monitoring Date: May 12, 2015

Monitoring Personnel: Yow, Willard, McAllister

Implementation Monitoring Yrs 1-5 only

1 Year

3 Years

X 5 Years

1. Slope Stabilization Objective: 90% success rate in treated areas
Observed Success Rate: 95-99% Comments: No new erosion above treatments
2. Vegetation Cover Ratio Objective*: Similar to that found nearby on undisturbed slopes on 90% of the treated area: Native grasses are established.
80% Cover on undisturbed slope **40%** Cover on treated site

3. Noxious Weed Objective: Do not introduce noxious weeds through treatments. **No new noxious weeds introduced.**

Y/N Presence of noxious weeds before treatment. Species of weed(s): Crupina, Knapweed, Cheat grass

Y/N Current presence of noxious weeds. If yes, give species of weed(s): Crupina, Knapweed, Cheat grass

4. LWD objective: Ensuring LWD is stable. Y/N Yes, LWD is stable. If no, then provide comment:

Maintenance and Safety Monitoring Yrs 10+ @ 5 year intervals

1. Inspection of LWD systems and recommended repairs.
Safety Comments: None
Stability Comments: # 7 log - 1 of 3 cables have failed, # 8 log - 1 of 3 cables have failed, # 9 log - 1 of 3 cables have failed. However, logs are stable and in the same positions as when placed in 2009-2010.
2. Repair conducted on LWD systems
Safety Repairs: None at this time
Stability Repairs: None Needed
3. Toe Rock Stability
Linear feet of toe rock needing maintenance: <5 individual rocks Comments: Limited rock rolling in Areas A-C1 only.
4. Inspection of vegetation (planted and naturally occurring).
Are additional actions needed: None

Corral Creek - Site 11

Corral Creek erosion control work commenced in November, 2009 by LKE Corporation and was completed in March, 2010. Treatment was completed on 230 linear feet of shoreline. The site contained 3 Treatment Zones which included Single Row Rock Placement, Double Row Rock Placement, Enhanced Rock Placement (re-armor crib wall), plantings and Large Woody Debris (LWD) placement. Treatments included wattles and geotextile. A total of 4 LWD were placed and anchored with steel wire attached to 3 boulders per log.

On May 12, 2015 Gene Yow, Paul Willard and Lori McAllister (Monitoring Team) visited the site. Previous cursory inspections by Forest Service personnel found that the treatments appeared to be very effective. The Monitoring Team found the treatments at the Corral Creek to site to be very successful at this time. Overall, treatment is effective and all LWD is in place. No new erosion was found and the old erosion scars above the treatments appear to be stabilizing but natural revegetation is occurring at a slow pace.



Erosion Control Monitoring and Maintenance: Field Data Sheet
2015

Lake Chelan Hydroelectric Project
FERC Project No. 637

Erosion Site #: Corral Creek – Site 11 Initial Treatment Date (YR Completed) 2010

Monitoring Date: May 12, 2015

Monitoring Personnel: Yow, Willard, McAllister

Implementation Monitoring Yrs 1-5 only 1 Year 3 Years **X** 5 Years

1. Slope Stabilization Objective: 90% success rate in treated areas
Observed Success Rate: 95% Comments: No new erosion above treatments
2. Vegetation Cover Ratio Objective*: Similar to that found nearby on undisturbed slopes on 90% of the treated area:
90 % Cover on undisturbed slope 20% Cover on treated site
3. Noxious Weed Objective: Do not introduce noxious weeds through treatments. **No new noxious weeds introduced.**

Y/N Presence of noxious weeds before treatment. Species of weed(s):

Y/N Current presence of noxious weeds. If yes, give species of weed(s):

4. LWD objective: Ensuring LWD is stable. Y/N Yes, LWD is in place and are secure. If no, then provide comment:

Maintenance and Safety Monitoring Yrs 10+ @ 5 year intervals

1. Inspection of LWD systems and recommended repairs.
Safety Comments: None
Stability Comments: None
2. Repair conducted on LWD systems
Safety Repairs: None at this time
Stability Repairs: None, all is good.
3. Toe Rock Stability
Linear feet of toe rock needing maintenance: None Comments: None
4. Inspection of vegetation (planted and naturally occurring).
Are additional actions needed: None at this time. Trend is positive but growth rate appears limited. Continue to monitor.

Deer Point – Site 58

Deer Point erosion control work commenced in September, 2008 by LKE Corporation and was completed in March, 2009. Treatment was completed on 360 linear feet of shoreline. The site contained 11 Treatment Zones which included Single Row Rock Placement, Steps, Enhanced Rock Placement, plantings and Large Woody Debris (LWD) placement. Several treatments included wattles and geotextile. A total of 15 LWD were placed and anchored with steel wire attached to 3 boulders per log.

On May 12, 2015 Gene Yow, Paul Willard and Lori McAllister (Monitoring Team) visited the site. Previous cursory inspections by Forest Service personnel found that the treatments appeared to be very effective. In 2010 LWD was repaired with additional cables. The Monitoring Team found the repair work done at the Deer Point site to be acceptable. All repaired LWD are in place and others have been added with naturally occurring LWD. Native vegetation looks good. The treatment tended to terminate at the top of the cut slopes, so there were very limited eroded sections above the treatment. Therefore, very limited areas were available to establish additional vegetation. No new erosion was found and the old erosion scars above the treatments are stabilizing and naturally revegetating.



Erosion Site #: Deer Point – Site 58 Initial Treatment Date (YR completed) 2009, Repairs in 2010

Monitoring Date: May 12, 2015 Monitoring Personnel: Yow, Willard, McAllister

Implementation Monitoring Yrs 1-5 only 1 Year 3 Years **X 5 Years**

1. Slope Stabilization Objective: 90% success rate in treated areas
Observed Success Rate: 100% Comments: No new erosion above treatments
2. Vegetation Cover Ratio Objective*: Similar to that found nearby on undisturbed slopes on 90% of the treated area:
80% Cover on undisturbed slope **10%** Cover on treated site
(As noted above: The rock treatment tended to terminate at the top of the cut slopes, so there were very limited eroded sections above the treatment, and limited availability to establish additional vegetation)
3. Noxious Weed Objective: Do not introduce noxious weeds through treatments. **No new noxious weeds introduced.**

Y/N Presence of noxious weeds before treatment. Species of weed(s): Knapweed, Cheat grass
Y/N Current presence of noxious weeds. If yes, give species of weed(s): Knapweed, Cheat grass
4. LWD objective: Ensuring LWD is stable. Y/N Yes, All LWD is in place and more added naturally.
If no, then provide comment:

Maintenance and Safety Monitoring Yrs 10+ @ 5 year intervals

1. Inspection of LWD systems and recommended repairs.
Safety Comments: None
Stability Comments: None
2. Repair conducted on LWD systems
Safety Repairs: None at this time
Stability Repairs: None.
3. Toe Rock Stability
Linear feet of toe rock needing maintenance: None Comments: None
4. Inspection of vegetation (planted and naturally occurring).
Are additional actions needed: No

Mitchell Creek – Site 59

Mitchell Creek erosion control work commenced in *September, 2008* by LKE Construction and was completed in March, 2009. Treatment was completed on 496 linear feet of shoreline. The site contained 16 Treatment Zones which included Single Row Rock Placement, Double Rock Placement, Steps, Enhanced Rock Placement over Crib Wall, plantings and Large Woody Debris (LWD) placement. Several treatments included wattles and geotextile. A total of 16 LWD were placed and anchored with steel wire attached to 3 boulders per log.

On May 12, 2015 Gene Yow, Paul Willard and Lori McAllister (Monitoring Team) visited the site. Previous cursory inspections by Forest Service personnel found that the treatments appeared to be very effective. This site has been repaired once in 2010 by repairing cables on LWD. The Monitoring Team found the repair work done at the Mitchell Creek site to be acceptable. Natural LWD recruitment and lacustrine deposits on top of LWD made it difficult to discern every placed LWD log. However, the site has more LWD than prior to treatment. It appears that the LWD introduced at the site helps retain naturally occurring LWD near the ordinary high water line. Several of the remaining logs have broken cables but are stable. Native vegetation looks good. The rock treatment tended to terminate at the top of the cut slopes, so there were very limited eroded sections above the treatment. Therefore, very limited areas were available to establish additional vegetation. No new erosion was found and the old erosion scars above the treatments are stable and naturally revegetating.





Erosion Control Monitoring and Maintenance: Field Data Sheet
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Erosion Site #: Mitchell Creek – Site 59 Initial Treatment Date (YR completed) 2009 Repair in 2010

Monitoring Date: May 12, 2015 Monitoring Personnel: Yow, Willard, McAllister

Implementation Monitoring Yrs 1-5 only 1 Year 3 Years 5 Years

1. Slope Stabilization Objective: 90% success rate in treated areas

Observed Success Rate: 95-99%

Comments: No new erosion above treatments

2. Vegetation Cover Ratio Objective*: Similar to that found nearby on undisturbed slopes on 90% of the treated area: Native grasses are established.
80% Cover on undisturbed slope **10%** Cover on treated site
(As noted above: The rock treatment tended to terminate at the top of the cut slopes, so there were very limited eroded sections above the treatment, and limited availability to establish additional vegetation)
3. Noxious Weed Objective: Do not introduce noxious weeds through treatments. **No new noxious weeds introduced.**

Y/N Presence of noxious weeds before treatment. Species of weed(s): Knapweed, Cheat grass
Y/N Current presence of noxious weeds. If yes, give species of weed(s): Knapweed, Cheat grass
4. LWD objective: Ensuring LWD is stable. Y/N Yes If no, then provide comment: 30% no longer attached but are buried in lacustrine deposits and/or have been replaced with natural logs.

Maintenance and Safety Monitoring Yrs 10+ @ 5 year intervals

1. Inspection of LWD systems and recommended repairs.
Safety Comments: None
Stability Comments: The monitoring team was unable to specifically identify LWD #2, #3, #4, #8, and #10. Additional natural LWD recruitment and lacustrine deposits on top of LWD made it difficult to discern every placed LWD log. However, due to natural recruitment the site has more LWD than prior to treatment. The cables on LWD #9 were broken but the log is stable due to naturally improved lacustrine deposits and additional natural LWD on-site.
2. Repair conducted on LWD systems
Safety Repairs: None at this time
Stability Repairs: None Needed
3. Toe Rock Stability
Linear feet of toe rock needing maintenance: None Comments: None
4. Inspection of vegetation (planted and naturally occurring).
Are additional actions needed: No

**Vegetation Cover Ratio Objective derived from USDA Forest Service Erosion Control Implementation and Erosion Monitoring and Maintenance Plan, 3.1 Treatment Effectiveness Monitoring. Implementation monitoring. 2.*

EROSION CONTROL SITE MONITORING SUMMARY COMMENTS

The monitoring team expected to see successful treatments at the sites monitored for this report. Forest Service boat operators had frequently conducted informal inspections of the sites after treatments were completed and continually through the spring-fall seasons. However, the results of the inspection and monitoring proved that the treatments have been very successful for meeting the primary objective of slope stability. This objective was met via rock armoring treatments, functional LWD, and vegetation recovery.

Slope stability was highly successful with slopes above the treatments being 95-100% stable as measured by inspecting existing head cuts and associated soil movement. Soil movement observed throughout the treatments was insignificant. The rock armoring exhibited minimal movement characterized by a small number of rocks that have rolled out of the armoring. This rock movement had negligible effect on the effectiveness of the current treatment. The LWD placed at the sites has for the most part stayed intact. The monitoring team found that it was hard to discern every piece of LWD that was placed during the original treatment due to new lacustrine deposits in the treatment zone and the recruitment of additional natural LWD in Lake Chelan. It appears that the artificially placed LWD that is anchored may be serving as the mechanism to retain the natural LWD in the treatment zone. So, overall the LWD portions of the treatments are clearly functioning quite well. The vegetation is also recovering in many of the eroded areas but at a slow pace. The trajectory for vegetation recovery at many sites is expected to slowly trend towards a percentage of vegetation equal to that found nearby on 90% undisturbed slopes in the treated area. The loss of topsoil and organic matter in the eroded head cuts does not provide an ideal area for vegetation recovery. However, the stabilized slopes will aid in vegetation recovery.