

Appendix A

Riprap Condition Report

MUIR WOODS NATIONAL MONUMENT

**2016 REDWOOD CREEK
RIPRAP ASSESSMENT**

Prepared for

National Park Service
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INTRODUCTION

The National Park Services (NPS) is considering an environmental restoration project on Redwood Creek in Muir Woods National Monument. The project area is a roughly one-mile stretch of creek bed between the vicinity of the monument entrance plaza and Bridge 4. Redwood Creek has approximately 3,500 feet of rock bank armor installed to prevent erosion and meandering. Commonly referred to as riprap, the bank armor was installed by the Civilian Conservation Corps in the 1930s (within the Period of Significance). Although specific characteristics vary, the bank armor is not like typical modern riprap installed for bank protection. Although sloped in most places to follow the shape of the creek bank, in other respects it resembles traditional dry-laid stone walls with irregularly-shaped stones carefully placed and tightly fitted together. The riprap interferes with habitat for the local Coho salmon and steelhead trout populations by preventing natural processes such as channel meandering, floodplain formation, and pool scour. In order to improve riparian habitat for these fish and the overall ecological condition of Redwood Creek, NPS proposes removing between 13 and 18 sections of riprap within the project area. Of the roughly 3570 linear feet of existing historic stone revetment, between 1280 and 2286 feet are targeted for removal. Figures 1 through 3 show visibility of existing riprap (based on data provided by NPS), and which segments are proposed for removal under different project alternatives.



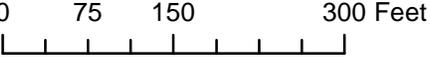
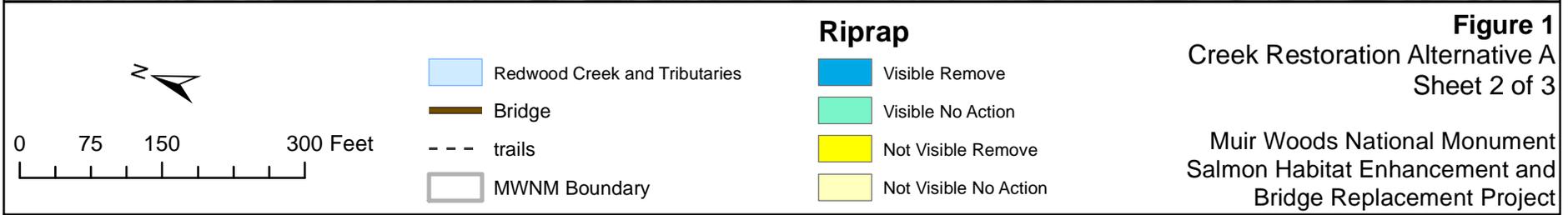
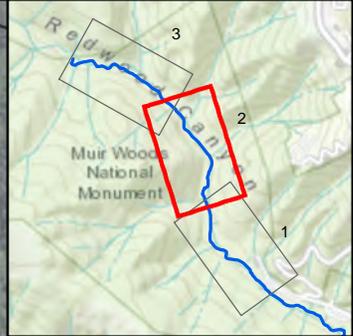
	 Redwood Creek and Tributaries	Riprap	 Visible Remove
	 Bridge	 Visible No Action	 Not Visible Remove
	 trails	 Not Visible No Action	
	 MWNM Boundary		

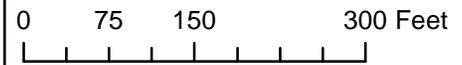
Figure 1
Creek Restoration Alternative A
Sheet 1 of 3

Muir Woods National Monument
Salmon Habitat Enhancement and
Bridge Replacement Project





	<p> Redwood Creek and Tributaries</p> <p> Bridge</p> <p> trails</p> <p> MWNM Boundary</p>	<p>Riprap</p> <p> Visible Remove</p> <p> Visible No Action</p> <p> Not Visible Remove</p> <p> Not Visible No Action</p>	<p>Figure 1 Creek Restoration Alternative A Sheet 3 of 3</p> <p>Muir Woods National Monument Salmon Habitat Enhancement and Bridge Replacement Project</p>
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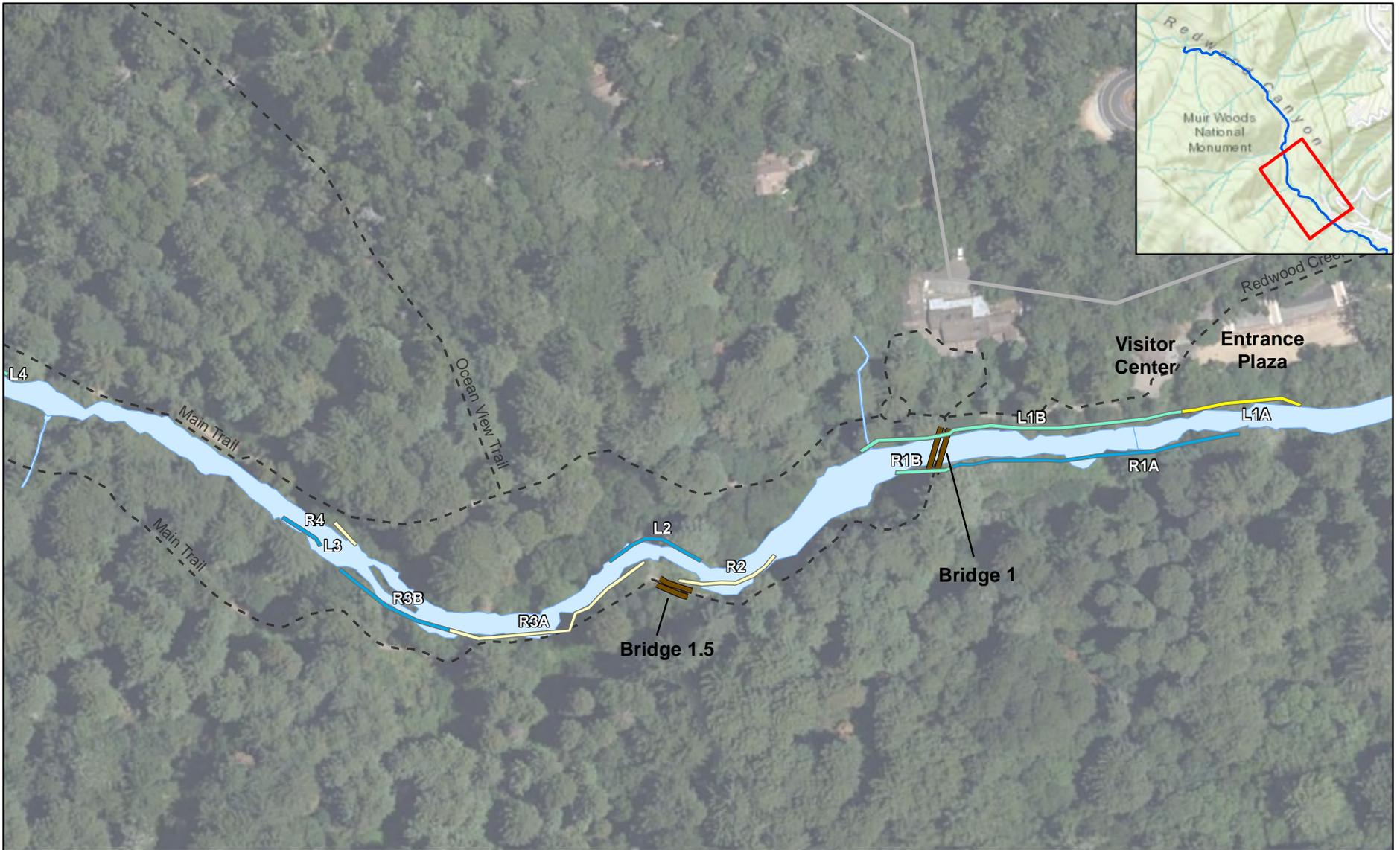


Figure 2
Creek Restoration Alternatives B and C

Muir Woods National Monument
Salmon Habitat Enhancement and
Bridge Replacement Project

	Redwood Creek and Tributaries	Riprap	Visible Remove
	Bridge	Visible No Action	Not Visible Remove
	trails	Not Visible No Action	
	MWNM Boundary		



		<p>Figure 3 Creek Restoration Alternatives D and E Sheet 1 of 3</p>	
<p>0 75 150 300 Feet</p>	<p> Redwood Creek and Tributaries</p> <p> Bridge</p> <p> trails</p> <p> MWNM Boundary</p>	<p>Riprap</p> <p> Visible Remove</p> <p> Visible No Action</p> <p> Not Visible Remove</p> <p> Not Visible No Action</p>	<p>Muir Woods National Monument Salmon Habitat Enhancement and Bridge Replacement Project</p>



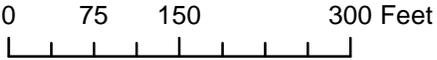
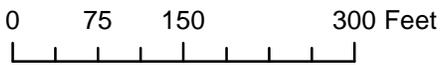
 	 Redwood Creek and Tributaries	 Visible Remove
	 Bridge	 Visible No Action
 trails	 Not Visible Remove	 Not Visible No Action
 MWNM Boundary		

Figure 3
 Creek Restoration Alternatives D and E
 Sheet 2 of 3

Muir Woods National Monument
 Salmon Habitat Enhancement and
 Bridge Replacement Project



 	 Redwood Creek and Tributaries	 Visible Remove	<p>Figure 3 Creek Restoration Alternatives D and E Sheet 3 of 3</p> <p>Muir Woods National Monument Salmon Habitat Enhancement and Bridge Replacement Project</p>
	 Bridge	 Visible No Action	
 trails	 Not Visible Remove	 Not Visible No Action	
 MWNM Boundary			

RIPRAP ASSESSMENTS

Horizon Water and Environment Architectural Historian Kara Brunzell performed a field visit to document historic riprap along Redwood Creek on November 10, 2016. Horizon Water and Environmental personnel performed two subsequent field visits in December 2016. Golden Gate National Recreation Area Historical Landscape Architect Amy Hoke walked the Redwood Creek Trail with Kara in order to point out significant features of the cultural landscape along the creek. Kara documented each numbered section of riprap, taking detailed notes on condition and photographs from the creek bank or creek bed as necessary to provide multiple views of the resources.

Letter grades for condition were assigned in the field to each numbered section (where a variety of conditions were present within a single numbered section, multiple grades were utilized). A narrative description of each numbered section is provided below, with condition assessment grades on maps. The sections are described in order, beginning at those closest to the visitor center and working upstream. Photographs with captions illustrate the text and map. Table 1 summarizes visibility, condition, proposed removal, and potential geomorphic and biological effects of removal.

Condition Assessment Key

A – excellent condition: Intentionally placed, tightly fitted rocks, few or no missing rocks, appears stable.

B – good condition: Intentionally placed rocks range from loosely to tightly fitted, some missing rocks or apparently unstable areas, overall appears stable.

B-/C+ – fair condition: intentionally but loosely stacked rocks or tightly stacked with missing rocks.

C – poor condition: Rocks appear jumbled or randomly stacked, portions missing or fallen into the creek, areas appear unstable.

D – not present or not visible: Section has either fallen away completely or is hidden under vegetation or fully embedded in creek bank.

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Table 1. Riprap segment ratings, with anticipated geomorphic and salmonids effects

Riprap Section	Condition	Visibility	Removal					Approximate Length (LF)	Geomorphic Effects	Effects on Salmonids
			Creek Restoration Alternative 1	Creek Restoration Alternative 2	Creek Restoration Alternative 3	Creek Restoration Alternative 4	Creek Restoration Alternative 5			
<i>Condition A/B, Visible</i>										
R1A	B-	Visible	no	yes ¹	yes ¹	yes ¹	yes ¹	344	Removing bank armor would allow lateral migration and width adjustment and encourage riffle-pool formation. Due to existing trail on left bank, channel would likely migrate into an area with little woody vegetation. Because of straight reach, channel response anticipated to be minimal.	Small scour pool beneficial to salmonids
R1B	B-	Visible	no	no	no	no	no	66	Removing bank armor would allow lateral migration and width adjustment and encourage riffle-pool formation. Due to existing trail on left bank, channel would likely migrate into an area with little woody vegetation. Because of straight reach, channel response anticipated to be minimal.	None, not being removed.
L2	B	Visible	yes	yes	yes	yes	yes	128	Would allow active meander migration into tree stand with large root masses. High potential for large wood recruitment. Likely to promote deep pool development and undercut banks.	Scour pool and bank erosion beneficial to salmonids.
R5	A	Visible	no	no	no	no	no	135	Active meander migration into tree stands with large root masses. Potential for large wood recruitment. Would create deep pool and undercut banks.	None, not being removed.
R6	A-	Visible	yes	yes	yes	yes	yes	128	Would allow meander migration and channel adjustment. Would create more natural banks and exposed roots. Some potential for large wood recruitment.	Natural banks, exposed roots, and potential LWD recruitment would be beneficial for salmonids.
L7	B-/B	Visible	yes	yes	yes	yes	yes	141	Would allow lateral migration or widening of creek. Limited geomorphic response expected due to straight channel alignment. May undercut trail (6-15 feet laterally from creek) (trail would be removed). Opposite of tributary which may accelerate erosion.	Lateral migration or widening of creek would be beneficial to salmonids. Accelerated erosion would cause downstream water quality issues for salmonids.
R7	A-	Visible	yes	yes	yes	yes	yes	118	May allow sinuosity in a currently straight reach. Would allow lateral migration or widening into a bank with several large root masses. Erosion would expose roots and create overhanging banks. High potential for large wood recruitment.	Overhanging banks and LWD recruitment would be beneficial for salmonids.
L10	B+	Visible	yes	yes	yes	yes	yes	131	Would allow meander migration into a tree stand with large root masses. May create overhanging banks with cover and complexity. High potential for large wood recruitment	Overhanging banks and LWD recruitment would be beneficial for salmonids.
R8	A	Visible	yes	yes	yes	yes	yes	108	Lateral migration or widening would expose roots and create overhanging banks. High potential for large wood recruitment	Overhanging banks and LWD recruitment would be beneficial for salmonids.
L11B	B	Visible	no	no	no	no	no	26	Would allow active meander migration into tree stands with limited root masses. Likely to create deep pool with shaded overhanging banks. Potential for large wood recruitment on downstream end.	None, not being removed.

Riprap Section	Condition	Visibility	Removal					Approximate Length (LF)	Geomorphic Effects	Effects on Salmonids
			Creek Restoration Alternative 1	Creek Restoration Alternative 2	Creek Restoration Alternative 3	Creek Restoration Alternative 4	Creek Restoration Alternative 5			
R9	A-	Visible	yes	yes	yes	yes	yes	82	High potential for channel to migrate or widen into large tree stand, creating overhanging banks, exposed roots and large wood recruitment. Well connected to adjacent floodplain.	Overhanging banks and LWD recruitment would be beneficial for salmonids.
R12B	B-	Visible	no	no	no	no	no	26	Reactive confluence scour and deposition processes. High potential for large wood recruitment. Potential erosion near bridge.	None, not being removed.
L13	B+	Visible	yes	yes	yes	yes	yes	62	Would immediately allow active channel migration into tree stand with large root mass. High potential for large wood recruitment.	
R11	B	Visible	no	no	no	no	no	49	Would allow active meander migration. May create overhanging banks. May reactivate historic landslide with little large wood. Risk of introducing large volumes of fine sediment with little compensating coarse sediment or wood.	None, not being removed.
Condition B-/C, Visible										
L1B	C+	Slightly Visible	no	no	no	no	no	397	Removing bank armor would allow lateral migration and width adjustment and encourage riffle-pool formation. Due to existing trail on left bank, channel would likely migrate into an area with little woody vegetation. Because of straight reach, channel response is expected to be minimal.	None, not being removed.
R3B	C+	Visible	yes	yes	yes	yes	yes	151	Riprap may be preventing avulsion around log jam – removal may allow process to proceed. Removal would create undercut natural banks with moderate exposure of large tree roots. Removal would disturb existing log jam and pool complex, and riparian area on adjacent bank.	Small scour pool beneficial to salmonids
R4	C	Visible	yes	yes	yes	yes	yes	13	Would allow lateral migration or widening of channel. Would allow more natural, undercut banks.	
L4	C-	Visible	no	no	no	no	no	46	Limited benefit for removal since riprap is part of the Bridge 2 abutment and would expose footings of bridge.	None, not being removed.
L5	B-	Visible	no	no	no	no	no	79	Would allow lateral migration or widening. Very limited large wood recruitment or shade due to presence of trail in migration zone.	None, not being removed.
L6	C-	Visible	no	no	no	no	no	23	Inside of meander bend so limited erosion potential. Limited root mass to expose and limited potential for wood recruitment.	None, not being removed.
L11A	C-	Visible	yes	yes	yes	yes	yes	59	Would allow active meander migration into tree stands with limited root masses. Likely to create deep pool with shaded overhanging banks. Potential for large wood recruitment on downstream end. May undercut trail at upstream end.	
R12A	C	Visible	yes	yes	yes	yes	yes	39	Reactive confluence scour and deposition processes. High potential for large wood recruitment. Potential erosion near bridge.	LWD recruitment would be beneficial for salmonid habitat.
L16	C+	Visible	no	no	no	no	no	72	If removed, limited migration potential due to bridge across Fern Creek.	None, not being removed.

Riprap Section	Condition	Visibility	Removal					Approximate Length (LF)	Geomorphic Effects	Effects on Salmonids
			Creek Restoration Alternative 1	Creek Restoration Alternative 2	Creek Restoration Alternative 3	Creek Restoration Alternative 4	Creek Restoration Alternative 5			
<i>Condition A/C, Not Visible</i>										
R2	A-	Not Visible	no	no	no	yes	yes	51	Would allow meander migration and natural bank formation. Presence of trail results in no large wood to recruit or tree roots to expose. Could generate large volumes of fine sediment with little benefit.	Removal of trail associate with removal of this section would allow for natural bank formation. Release of fine sediment could have adverse effects downstream.
R3A	B+	Not Visible	no	no	no	yes	yes	253	Riprap may be preventing avulsion around log jam – removal would allow process to proceed. Removal would create undercut natural banks with moderate exposure of large tree roots. Removal would disturb existing log jam and pool complex, and riparian area on adjacent bank.	Small scour pool beneficial to salmonids
L3	C-	Not Visible	no	no	no	no	no	39	If removed, limited lateral migration due to straight alignment and wide channel. Lower potential for large wood recruitment.	None, not being removed.
L8	C+	Not Visible	no	no	no	no	no	55	If removed, would allow for lateral migration towards a large tree stand. Improve connectivity with unnamed tributary. If log weir integrated into riprap is removed, 1-2 feet of local bed incision is likely. 23 feet from trail at most likely migration area. May need to smooth tributary transition or rebuild grade control to prevent incision migrating up tributary.	None, not being removed.
L9	C+	Not Visible	no	no	no	no	no	23	If removed, would allow for lateral migration towards a large tree stand. Improve connectivity with unnamed tributary. If log weir integrated into riprap is removed, 1-2 feet of local bed incision is likely. 23 feet from trail at most likely migration area. May need to smooth tributary transition or rebuild grade control to prevent incision migrating up tributary.	None, not being removed.
L12	A-	Not Visible	no	no	no	yes	yes	104	May allow meander migration in an otherwise straight reach. High potential for root exposure and large wood recruitment. Some potential for migration into trail (40 feet from existing bank).	Root exposure and LWD recruitment would create beneficial habitat for salmonids.
R10	A-	Not Visible	yes	yes	yes	yes	yes	104	High potential for migration or widening into tree stand. Likely to create undercut banks with exposed roots. Limited potential for large wood recruitment. Riprap section is opposite of the Fern Creek confluence, which may promote erosion of bank.	Undercut banks with root exposure would create beneficial habitat for salmonids.
L14	C-	Not Visible	no	no	no	no	no	79	If removed, would allow meander migration to occur. Good potential for more natural overhanging banks. Proximity to floodplain terrace reduces migration potential. Low potential for exposed roots and wood recruitment due to presence of trail immediately above bank. Trail is within 3 feet of riprap and likely to be undermined by erosion or bank slumping under no action.	None, not being removed.

Riprap Section	Condition	Visibility	Removal					Approximate Length (LF)	Geomorphic Effects	Effects on Salmonids
			Creek Restoration Alternative 1	Creek Restoration Alternative 2	Creek Restoration Alternative 3	Creek Restoration Alternative 4	Creek Restoration Alternative 5			
L14.5	B-	Not Visible	no	no	no	no	no	20	If removed, would allow meander migration to occur. Good potential for more natural overhanging banks. Proximity to floodplain terrace reduces migration potential. Low potential for exposed roots and wood recruitment due to presence of trail immediately above bank. Trail is within 3 feet of riprap and likely to be undermined by erosion or bank slumping under no action.	None, not being removed.
Nonexistent Or Very Poor Condition, Not Visible										
L1A	C-	Not Visible	no	yes ²	yes ²	yes ²	yes ²	151	Would allow lateral migration and width adjustment and encourage riffle-pool formation. Due to existing trail on left bank, channel would likely migrate into an area with little woody vegetation. Because of straight reach, channel response is expected to be minimal.	Riffle-pool formation beneficial to salmonids
L8.5	D	Not Visible	no	no	no	no	no	49	If removed, would allow lateral migration towards a large tree stand. Improve connectivity with unnamed tributary. If log weir integrated into riprap is removed, 1-2 feet of local bed incision is likely. 23 feet from trail at most likely migration area. May need to smooth tributary transition or rebuild grade control to prevent incision migrating up tributary.	None, not being removed.
Not Documented (outside of Project Area)										
L15	NA	NA	no	no	no	no	no	131	If removed, high potential for exposed roots and large wood recruitment. Lower potential for channel migration in the short-term since large root masses are adjacent to riprap	None, not being removed.
¹ Approximately 112 feet would be removed from the downstream end of this segment ² Approximately 98 feet would be removed from this segment										

Riprap Illustration Key

This illustration key provides the symbology used in the following figures. Please note that the removal of some riprap segments has changed since the development of these figures. Table 1 has the correct segments to be removed under each Creek Restoration Alternative.



Section L1A

Section L1A is located immediately southwest of the Visitor Center and Entrance Plaza (Figure 4). It was previously measured at about 150 feet long and 6 feet high (NHE 2016). In 2000, it was recorded as a well-stacked embedded wall of medium-sized boulders (Peterson 2000). It is not visible from park trails or the Visitor Center. Little of the section was visible from the creek banks and creek bed during the November 2016 field visit. There are medium-sized boulders partially obscured by heavy vegetation in the roughly 30-foot stretch west of center, but plant cover made condition difficult to ascertain (Figure 5). The balance of this Section L1A (a 30 foot stretch to the west and a roughly 90 foot stretch to the east) appears to have been completely engulfed in vegetation and woody debris, although it may have fallen away. The overall condition of Section L1A is poor or not visible. Note: this segment would be removed under alternatives B, C, D, and E.

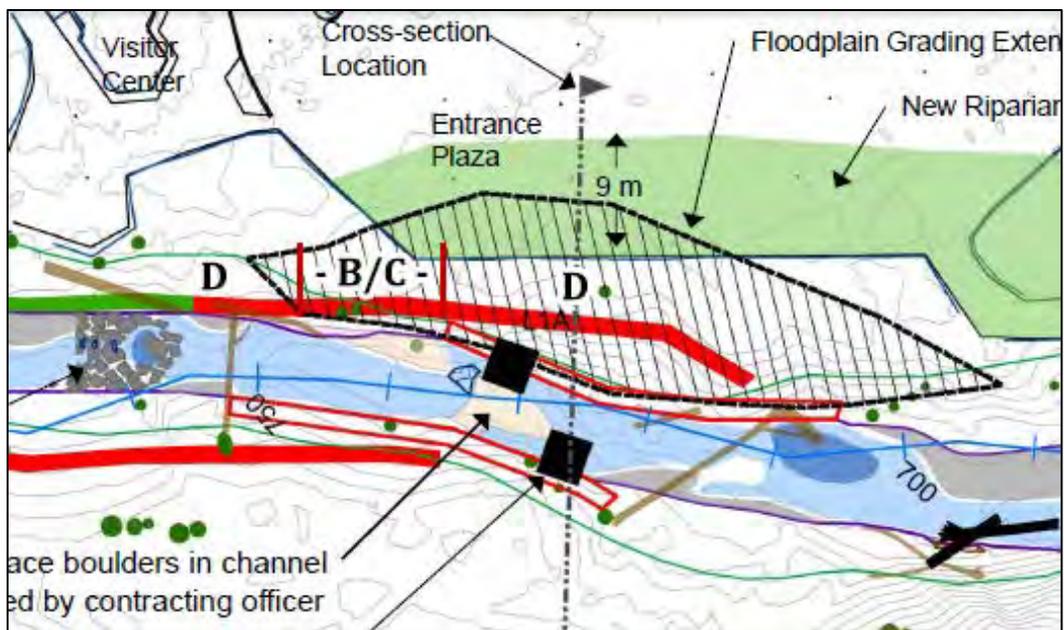


Figure 4. Section L1A Condition Assessment



Figure 5. Section L1A, center stretch view north-northeast from creek bed, showing tightly placed medium sized rock revetment in fair-good condition behind tree trunks and vegetation

Section R1A

Section R1A stretches from across the creek from the Entrance Plaza and Section L1A nearly to Bridge 1 (Figure 6). It has been measured at 344 feet long and almost 7 feet high (NHE 2016), consistent with observed conditions in November 2016. In 2000, it was documented as consisting of well-stacked large boulders (Peterson 2000). The section is visible from the Boardwalk. Although the location of this section is observable from the Boardwalk, the creek bank is heavily overgrown with ferns and seasonal vegetation, and only small stretches of its rocks were visible from the creek bank and creek bed in November 2016. The uniform shape of the creek bank, however, indicates the presence of rock retaining walls in fair to good condition (Figures 7-8). The roughly 40-foot eastern stretch slightly more visible and in better condition (Figure 9). Although heavily overgrown, the overall condition of Section R1A is fair to good. Note: this segment would be removed under alternatives B, C, D, and E.

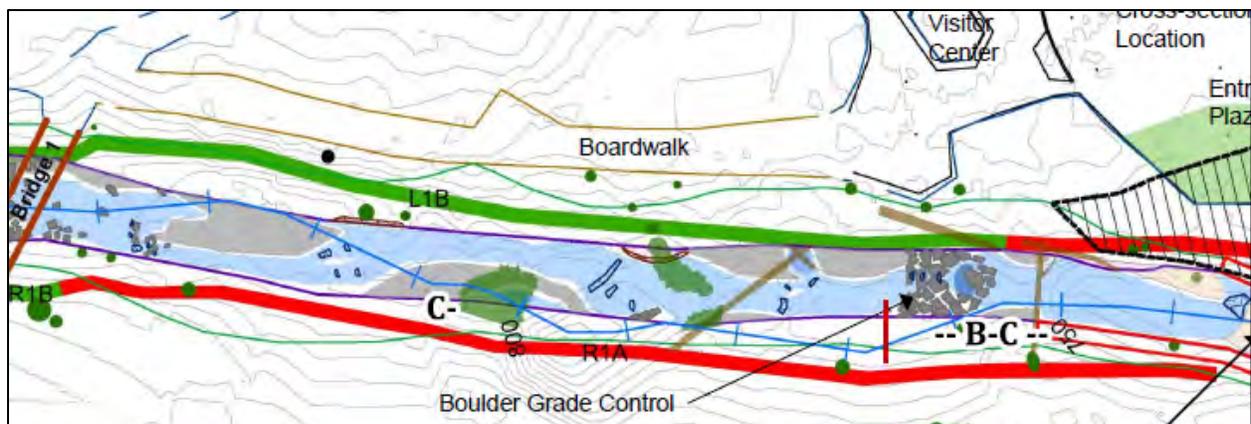


Figure 6. Section R1A Condition Assessment



Figure 7. Center-west stretch of Section R1A, view south-southwest from creek bed, showing riprap of medium-sized rocks in good condition beneath vegetation and with trees growing from some areas



Figure 8. Center-west stretch of Section R1A, view south from creek bed, showing riprap in good condition beneath vegetation and with trees growing from some areas



Figure 9. Eastern stretch of Section R1A, view south from creek bed, showing larger rocks, some of which are out of place

Section L1B

Section L1B is located directly adjacent to Section L1A to the northwest and continues upstream under and past Bridge 1, across the stream from most of R1A and all of R1B (Figure 10). It has been measured at roughly 245 feet long and 5.5 feet high (NHE 2016). In 2000, it was documented as consisting largely of boulders that were buried in the bank and not visible (Peterson 2000). These measurements were generally consistent with its observed condition in December 2016, especially toward the west end, which is mostly obscured by vegetation (Figure 11). Very little of the section is visible from park trails. The stretches that are not obscured by vegetation consist of large- and medium-sized rocks and are in relatively good condition (Figure 9~~12~~). Section L1B is in fair to poor condition overall.

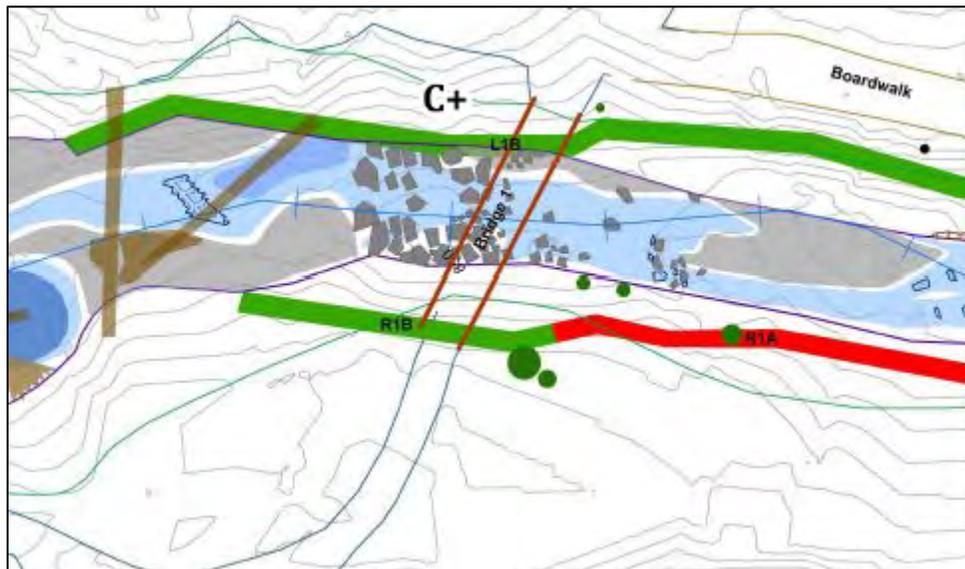


Figure 10. Section L1B Condition Assessment.



Figure 11. Stretch of L1B obscured by vegetation, view northwest from right bank, with large loosely-stacked stones visible left of frame



Figure 12. Section L1B and boardwalk, view east from right bank, stretch with medium rocks in fair to good condition center frame

Section R1B

Section R1B is located across the stream from the northwest end of Section L1B and is continuous with Section R1A, running under and a small distance past Bridge 1 (Figure 13). It has been measured at about 65 feet long (NHE 2016). In 2000, it was documented as being nonexistent and consisting only of exposed soil (Peterson 2000). The December 2016 visit, however, found that, while obscured by vegetation toward the east end, the section consisted of loosely stacked rocks of variable size (Figures 14-15). It is partially visible from park trails. Section R1B is in good condition under and upstream of Bridge 1 (Figure 16) but the downstream (east) end is in poor condition and verging on not visible. Section R1B is in fair to good condition overall.

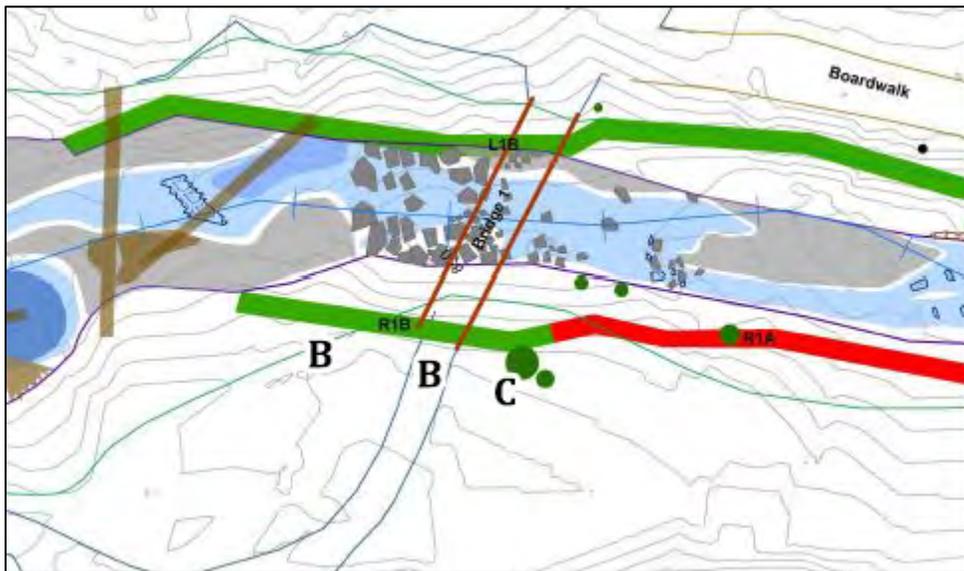


Figure 13. Section R1B Condition Assessment



Figure 14. Section R1B and Bridge 1, view southwest from left bank, showing riprap in good condition under bridge and obscured by trees and ferns to the east



Figure 15. Detail, Section R1B downstream from Bridge 1, view southwest from left bank



Figure 16. Western stretch of Section R1B upstream of Bridge 1, view southwest from Bridge 1, showing riprap in fair condition partially obscured by a tree and other vegetation

Section R2

Section R2 wraps around a bend in the creek upstream of Bridge 1 and ends adjacent to Bridge 1.5 to the east (Figure 17). It has been measured at about 165 feet long and 6.5 feet high (NHE 2016). In 2000, it was documented as consisting of a combination of small and large loosely stacked boulders (Peterson 2000). The measurements recorded are mostly consistent with its observed condition in December 2016, although it appears to be more tightly stacked than described in 2000. It is not visible from park trails. Its downstream half is in good condition and consists of tightly-placed medium-sized rocks (Figure 18). Upstream, it is in excellent condition and is also tightly stacked, but is made up of larger boulders (Figure 19). Overall, Section R2 is in very good condition. Note: this segment would be removed under alternatives D, and E.

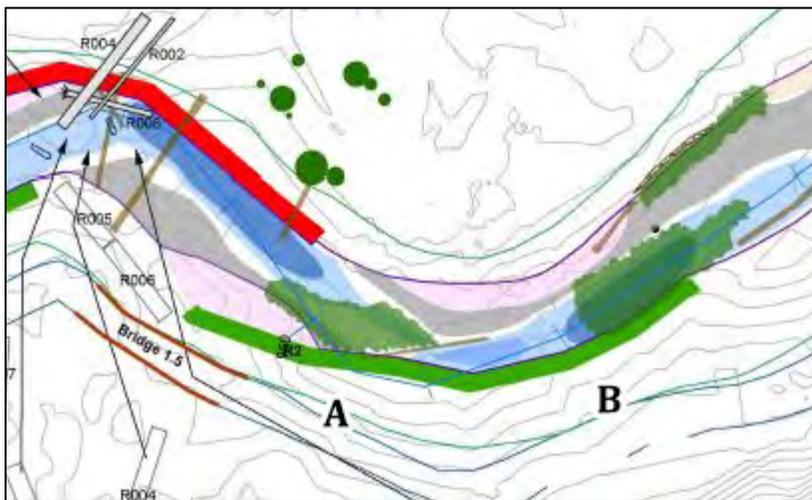


Figure 17. Section R2 Condition Assessment



Figure 18. Section R2 viewed from left bank, camera facing southwest, showing tightly placed medium-sized rocks in good condition

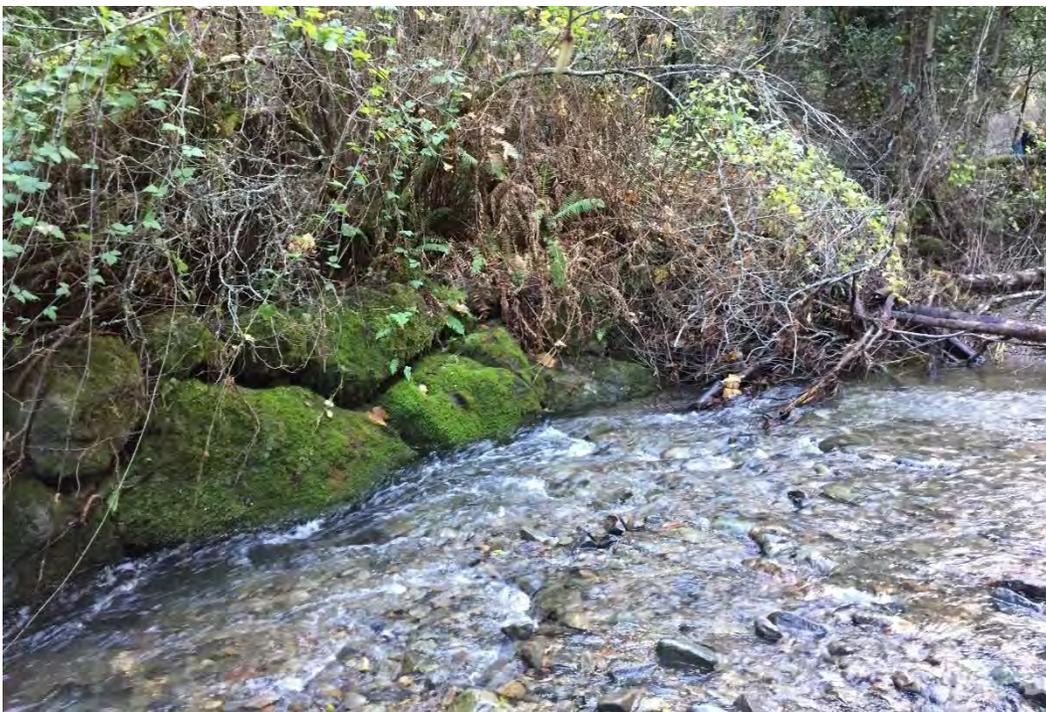


Figure 19. Section R2 viewed from left bank, camera facing west, showing upstream stretch with larger boulders in excellent condition

Section L2

Section L2 is located at a bend in the creek immediately northwest and upstream of Bridge 1.5 (Figure 20). The U-shaped section has been measured at roughly 128 feet long and 6.5 feet high (NHE 2016). In 2000, it was documented as consisting of large, loosely-stacked boulders, some of which had fallen into the creek (Peterson 2000). The measurements recorded are consistent with its observed condition in November 2016. Its location is visible from park trails. Although its location is visible from park trails, live vegetation on the bank and dry brush and fallen trees in the creek bed make some stretches hard to see, but careful observation shows that the entire section is extant. The 30-foot central stretch is in excellent condition, with intentionally placed large- and medium-sized rocks (Figure 21). The 45-foot stretch upstream of the creek bend is in good condition, while the 45-foot stretch downstream is in fair to poor condition (Figures 22-23). Overall, Section L2 is in good condition.

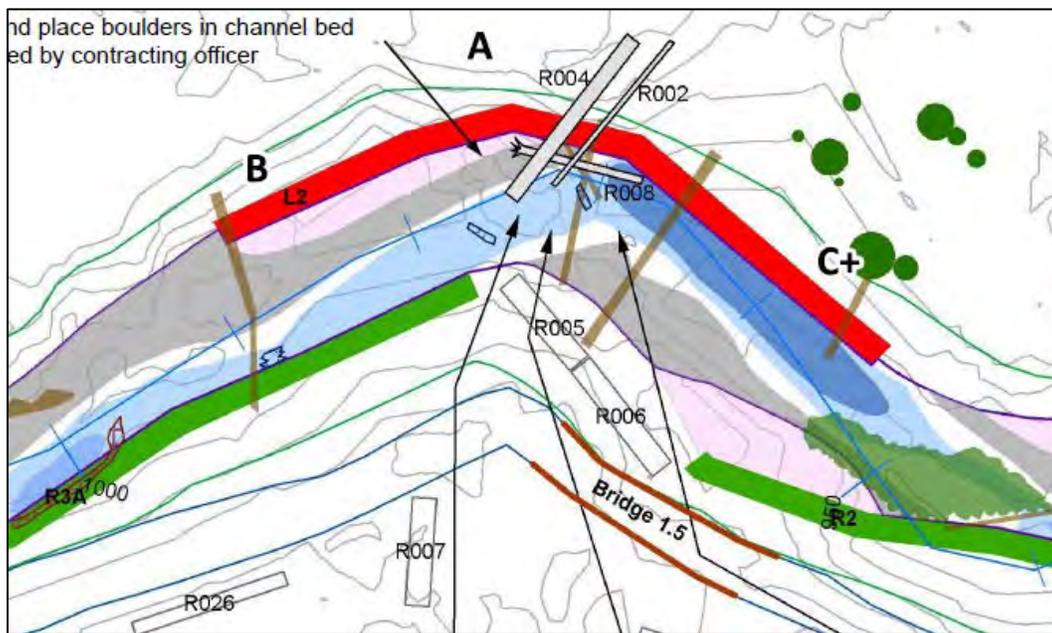


Figure 20. Section L2 Condition Assessment



Figure 21. Central stretch of Section L2, view northwest from right bank, showing riprap in excellent condition beneath ferns and other vegetation



Figure 22. Northwest (upstream) stretch of Section L2, view north from right bank, showing riprap under vegetation and woody debris



Figure 23. Poor condition downstream stretch of Section L2, view east from right bank, showing deteriorating riprap with woody debris, ferns, and other vegetation

Section R3A

Section R3A begins just north of Bridge 1.5 and continues upstream as far as the part of the right bank across from the Pinchot and Emerson trees (Figures 24-25). It has been measured at about 253 feet long and 4 feet tall (NHE 2016). In 2000, it was documented as a well secured, “embedded wall” of medium-sized boulders (Peterson 2000), which is consistent with observed conditions in December 2016 (Figures 26-27). Vegetation and a log jam at the west end obscured part of the section at the time of the visit (Figure 28). It is not visible from park trails. It consists generally of 4-5 courses, except at the east end. Section R3A is overall in very good condition. Note: this segment would be removed under alternatives D and E.

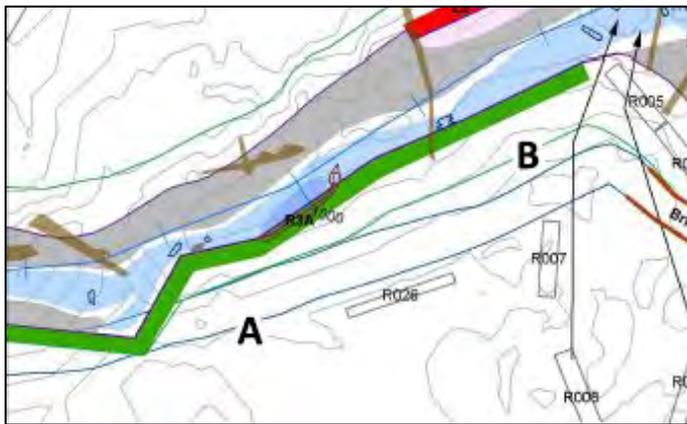


Figure 24. Section R3A Condition Assessment (east portion)

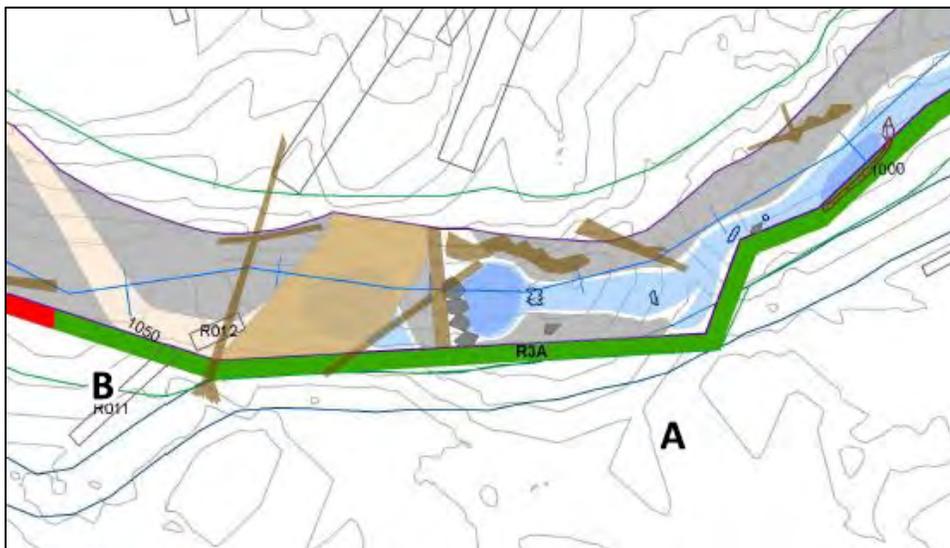


Figure 25. Section R3A Condition Assessment (west portion)



Figure 26. Section R3A from left bank, camera facing east, showing east stretch with 2-4 course riprap in excellent condition



Figure 27. Section R3A from left bank with path visible in background, camera facing southwest, showing center-west stretch with 4-5 course riprap in excellent condition with minimal vegetation



Figure 28. West stretch of Section R3A obscured by log jam viewed from left bank, camera facing west, riprap is in good condition beneath vegetation and woody debris

Section R3B

Section R3B is located just across the creek to the west from the Pinchot and Emerson trees (Figure 29). It has been measured at 150 feet long and about 2.5 feet tall (NHE 2016), consistent with observed conditions in November 2016. In 2000, it was documented as disassembled, “non-embedded”, and consisting of a single course of small boulders (Peterson 2000). The section is visible from park trails and the Emerson Tree area. Although the area is visible, heavy seasonal vegetation and woody debris make observation of the section, especially the north stretch, difficult, but there appears to be at least one course of boulders present throughout (Figures 30-31). R3A, which is adjacent to the south and supports the trail, is more visible and consists of at least 2 courses. The overall condition of Section R3B is fair to poor, and it consists of only 1-2 courses in contrast to most sections which have 3 or more courses.

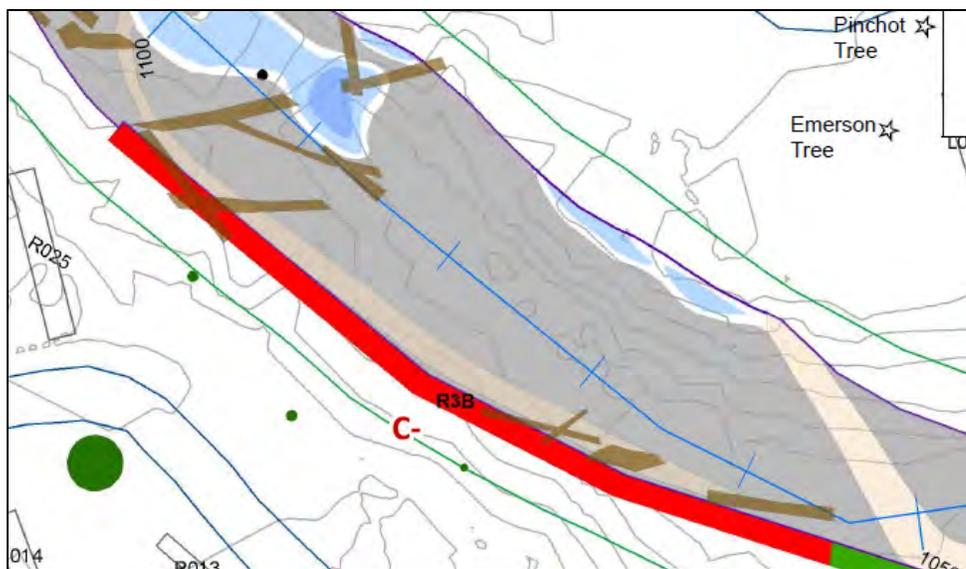


Figure 29. Section R3B Condition Assessment



Figure 30. South stretch of Section R3B, view south from creek bed, showing low riprap obscured by ferns and woody debris



Figure 31. Detail, Section R3B low rock wall is visible behind woody debris

Section L3

Section L3 is located between Sections R3B and R4, across the creek to the east (Figure 32). It is west of the fork of the Canopy View Trail and Redwood Creek Trail. Section L3 has been measured at about 39 feet long and 4 feet high (NHE 2016). In 2000, it was recorded as a combination of a disassembled, “non-embedded wall,” embedded rocks that did not make up a wall, and rocks fallen into the creek (Peterson 2000). These measurements are consistent with observed conditions in December 2016 (Figures 33-34). The location of Section L3 is not visible from park trails. It is in generally poor condition and much of it is obscured by debris and vegetation or has fallen away.

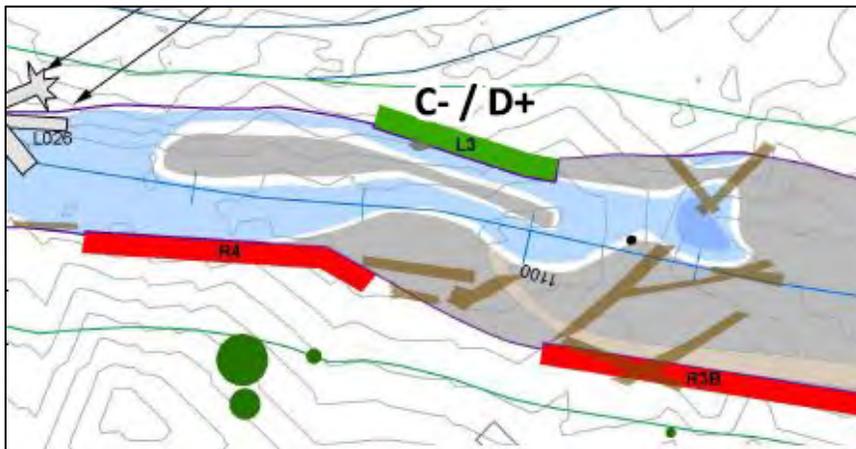


Figure 32. Section L3 Condition Assessment



Figure 33. Section L3 seen from right bank, camera facing northeast, showing occasional rocks beneath moss, ferns, and other vegetation. The shape of the bank suggests riprap is in poor condition



Figure 34. Overview of Section L3, camera facing east, showing area slightly to the east of Figure 30 which is also obscured by vegetation but appears to be in fair to poor condition

Section R4

Section R4 is located just upstream of R3B and across the creek to the west of where the Canopy View Trail diverges from the main Redwood Creek Trail (Figure 35). This portion of the creek runs north-south in contrast to the general west-east direction. Section R4 has been measured at about 13 feet long and 2.5 feet high (NHE 2016). In 2000, it was recorded as a well-stacked wall of small boulders buried under the bank and not visible (Peterson 2000). However, it appears to be currently visible from park trails as well as the creek bed. The height and length recorded are consistent with observed conditions in November 2016. Section R4's small boulders are now easily visible, and are no longer stacked, but appear piled at random (Figures 36-37). It is completely dry, and at least 20 feet from the current water in the creek. The overall condition of Section R4 is poor.

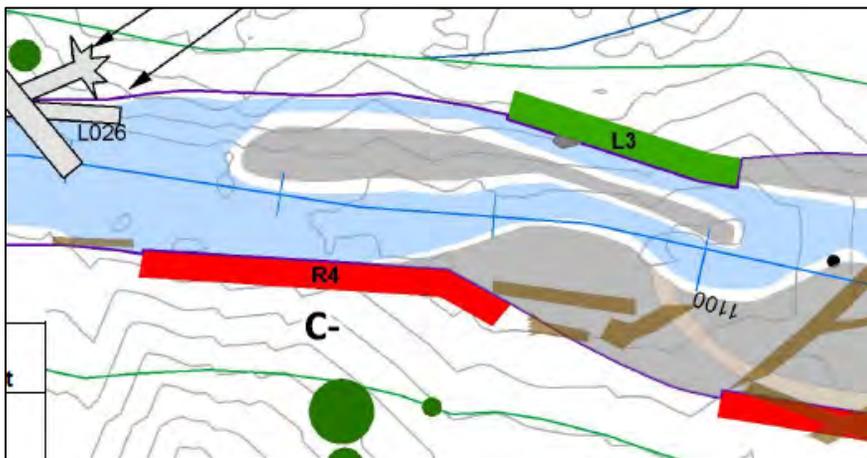


Figure 35. Section R4 Condition Assessment



Figure 36. Overview of Section R4, view west, showing displaced riprap beneath fallen logs



Figure 37. Detail, Section R4, view south, showing riprap in fair condition with ferns and a tree growing out of it

Section L4

Section L4 is located directly under and at either end of Bridge 2 (Figure 38). It has been measured at roughly 46 feet long and 4 feet tall (NHE 2016). In 2000, it was documented as loosely-stacked, disassembled, and “non-embedded,” (Peterson 2000). Measurements are mostly consistent with observed conditions in December 2016. It consists of rocks that, while mostly small, are variable in size and loosely stacked, and is in poor condition overall (Figures 39-40). It is visible from Bridge 2 and the right bank trail.

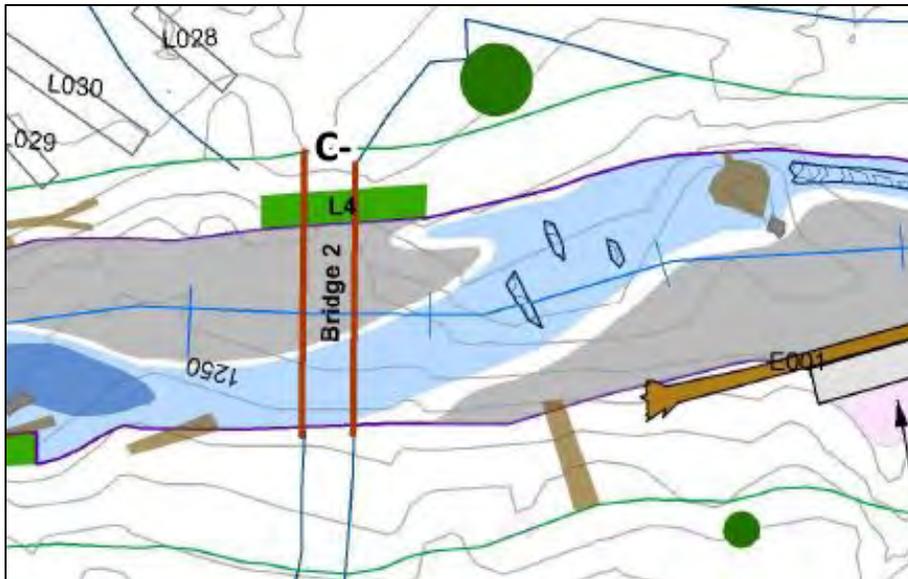


Figure 38. Section L4 Condition Assessment



Figure 39. View of Section L4 from right bank, camera facing northeast, showing variable-sized displace rocks



Figure 40. View of Section L4 from right bank, camera facing north, with little intact riprap in place

Section R5

Section R5 is located northwest of Bridge 2 and runs along the curve of the creek upstream from the bridge, ending directly west from the start of Section L5 (Figure 41). It has been measured at roughly 135 feet long and just under 7 feet tall (NHE 2016). In 2000, it was documented as a loosely stacked and fallen wall of large boulders (Peterson 2000). However, it appeared tightly stacked and in excellent condition and consisted of small- to medium-sized boulders at the time of the December 2016 field visit (Figures 42-43). The measurements recorded are consistent with field observations in December 2016. It is visible from park trails and in excellent condition overall.

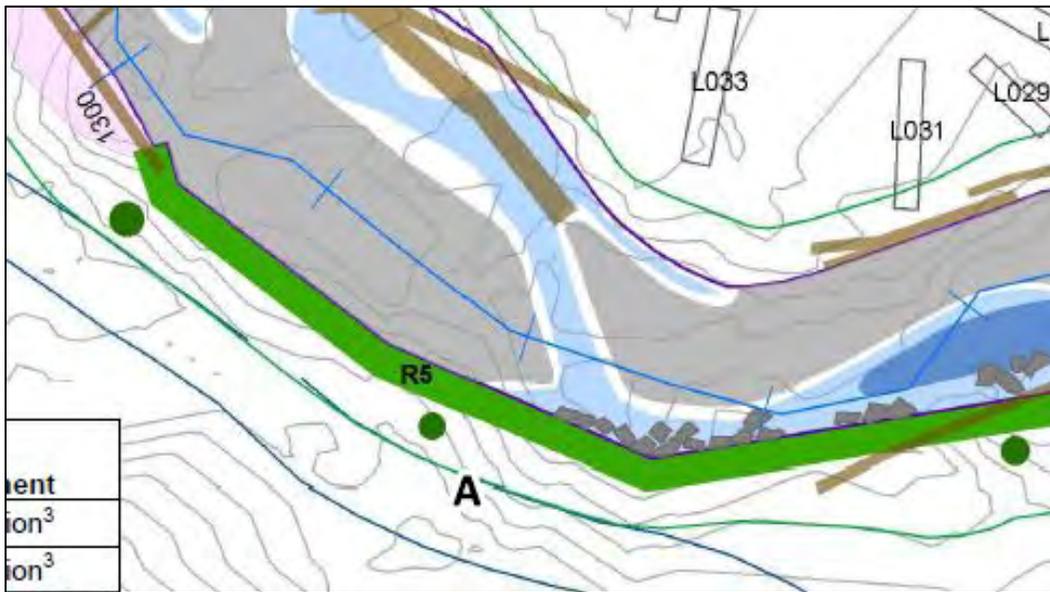


Figure 41. Section R5 Condition Assessment



Figure 42. View of Section R4 with trail in background from left bank, camera facing northwest, showing medium-sized rocks in excellent condition with some light fern growth above



Figure 43. View of Section R4, camera facing southwest, large- and medium-sized rocks in excellent condition below fern growth

Section L5

Section L5 wraps around the curve where the creek turns and flows north-south upstream of Bridge 2 (Figure 44). It has been measured at roughly 79 feet long and just under 6 feet tall (NHE 2016). In 2000, it was documented as a loosely stacked and “disassembled wall” of medium-sized boulders (Peterson 2000). At the time of the December 2016 visit, parts of the section were obscured by seasonal vegetation and more durable woody debris (Figures 45-46), but visible stretches were consistent with recorded observations. Section L5 is visible from park trails. It is in good condition in the middle and poor condition at the ends (Figure 47). The section overall is in fair to good condition.

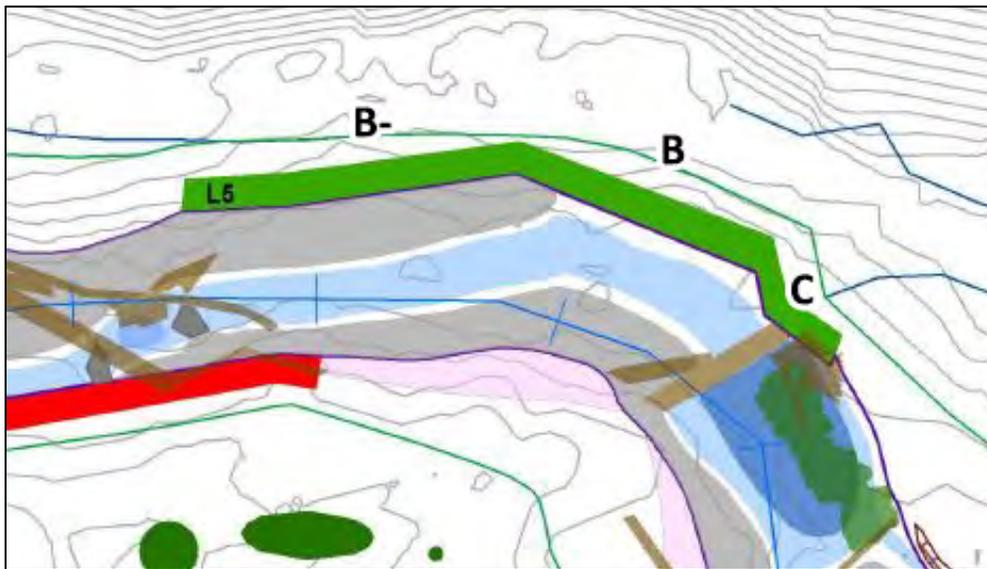


Figure 44. Section L5 Condition Assessment



Figure 45. Portion of Section L5 mostly obscured by woody debris, camera facing north



Figure 46. Section L5, from right bank, camera facing northeast, showing woody debris, ferns, and seasonal vegetation with small areas of rock revetment visible left of frame and at center



Figure 47. East end of Section L5 and trail, camera facing east, showing rocks displaced by tree and falling away

Section R6

Section R6 is located roughly halfway between Bridge 2 and Bridge 3 along the portion of the creek that runs north-south (Figure 48). It has been measured at roughly 128 feet long and slightly over 7 feet tall (NHE 2016). In 2000, it was documented as a loosely-stacked and fallen wall of large boulders (Peterson 2000). Although there are ferns and trees growing on the top of Section R6, most of the vegetation does not cover the face of the rock wall. It is highly visible from the main Redwood Creek Trail, which is very close to the creek in this area. The measurements recorded are consistent with field observations in November 2016. However its condition is much better than suggested by the previous documentation. The south stretch, about 65 feet long, is in excellent condition (Figure 49). Boulders of varying size are stacked fairly tightly, and are 3-5 courses high. Vegetation obscures some of the center stretch, but it also appears to be in very good condition (Figures 50-51). The north stretch of about 50 feet is in good condition, except for small areas (5-10 feet) where a few boulders have fallen out of place (Figure 52). Section R6 overall is in very good condition. Its condition and craftsmanship are better than many of the other sections targeted for removal.

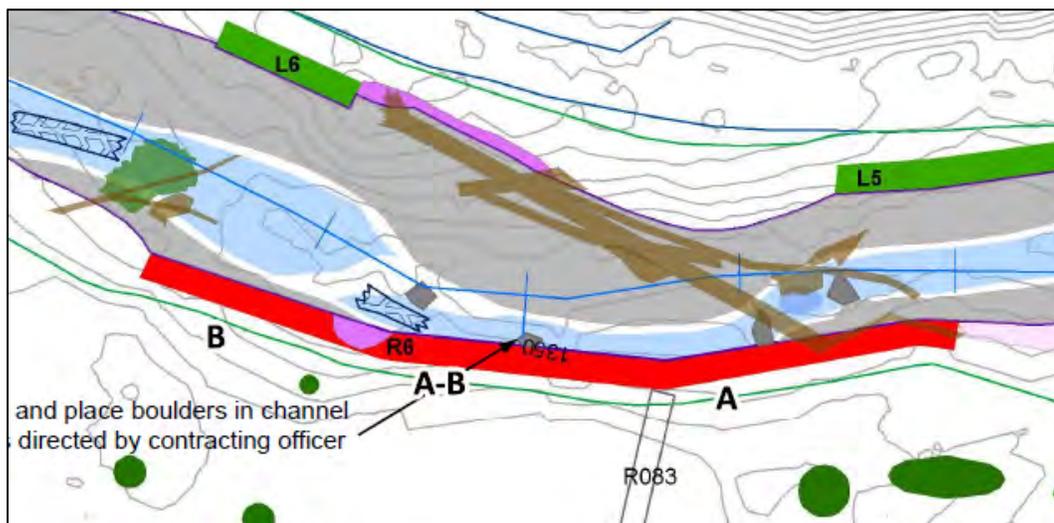


Figure 48. Section R6 Condition Assessment



Figure 49. South stretch of Section R6, view west from trail showing riprap in excellent condition with some woody debris around it and trees and ferns on top of the bank



Figure 50. Center-south stretch of Section R6, view west-southwest showing riprap in clearly visible and in excellent condition with ferns above



Figure 51. Center-north stretch of Section R6, showing riprap in good condition to south with area obscured by ferns and other vegetation to north

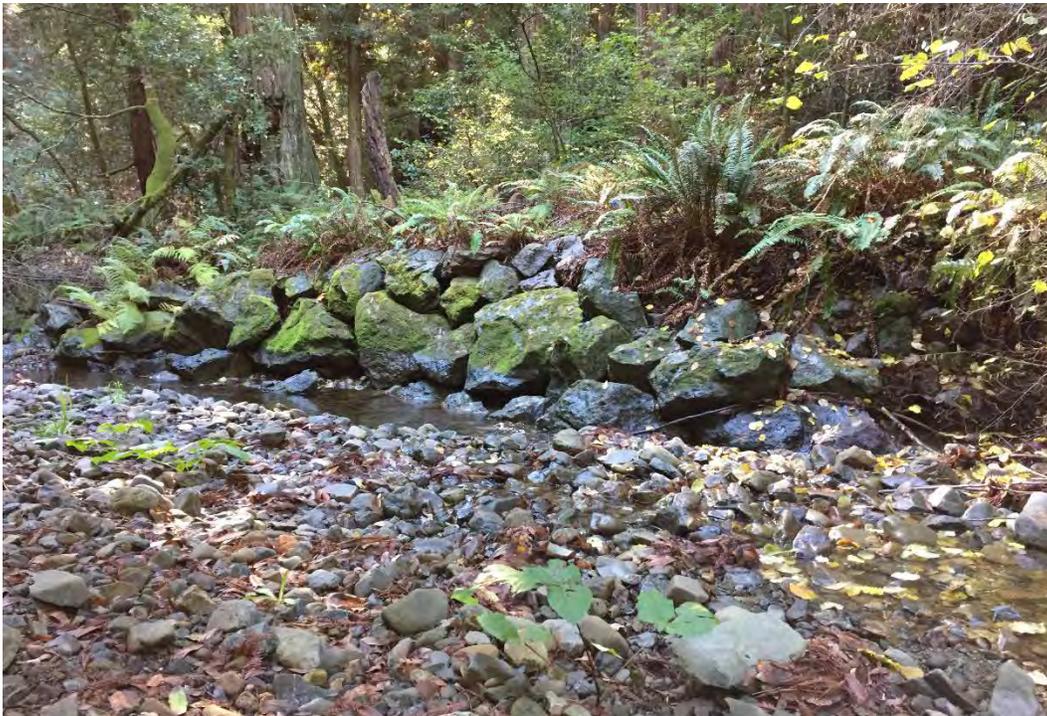


Figure 52. North stretch of Section R6, view west showing riprap in very good condition with small areas of deteriorated or obscured by vegetation at either end

Section L6

Section L6 is located directly across the creek from the north end of Section R6 (Figure 53). It has been measured at roughly 23 feet long and just over 7 feet tall (NHE 2016). In 2000, it was documented as a loosely stacked wall of large rocks (Peterson 2000). These measurements were consistent with its observed condition in December 2016; at the time of the field visit, it was partially obscured by woody debris and seasonal vegetation and largely disassembled (Figure 54). Section L6 is visible from park trails. It consists of about 2 courses and is in poor condition.

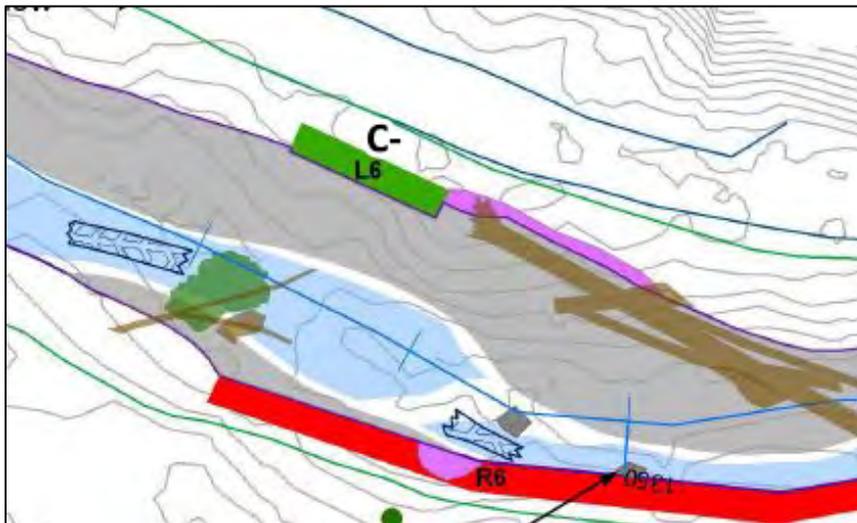


Figure 53. Section L6 Condition Assessment



Figure 54. Section L6 from right bank, camera facing northeast, showing riprap in poor condition center frame and otherwise obscured by vegetation

Section L7

Section L7 is located adjacent to Cathedral Grove and supports the western arm of the trail that splits off from Redwood Creek Trail before the grove (Figure 55). It has been measured at about 141 feet long and 5 feet high (NHE 2016). Observed conditions in November 2016 revealed a roughly 110-foot by 5-foot wall. In 2000, it was documented as consisting of medium boulders. The 2000 report called out loosely-stacked, well-stacked, buried, and “embedded non-wall” conditions in the section (Peterson 2000). Although these different conditions must have been observed in different stretches, no details about their specific locations were recorded. The section is visible from the Hillside Trail, although ferns and woody debris partially obscure much of the upper course. Section L7 consists of boulders of variable size with the largest forming the lower course. This results in a wall that is more tapered from bottom to top than most other sections. Roughly 110 feet of its west stretch is in fair to good condition (although rocks are not as carefully fit together as in the most finely wrought sections). Roughly 15 feet at the west end of the section is in fair to poor condition (Figure 56), while the 95 feet at the center are in good condition, with boulders that are clearly stacked intentionally (Figures 57-58). The east 30 feet, as recorded in 2000, has either fallen away or is obscured by vegetation (Figures 59-61). Overall Section L7 is in fair to good condition.

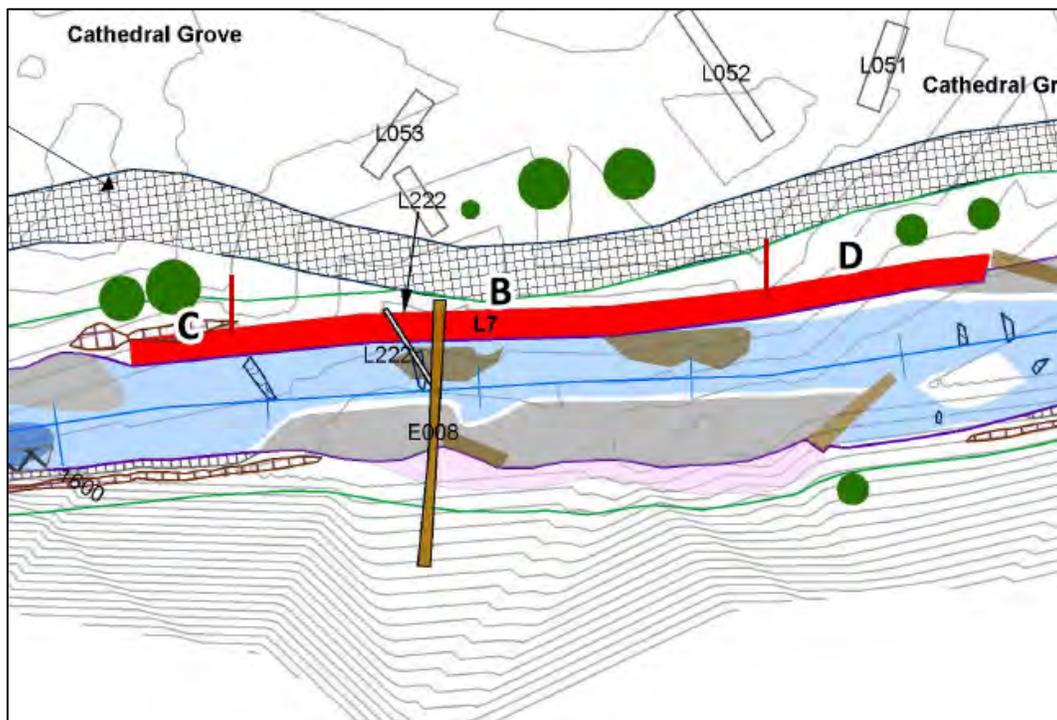


Figure 55. Section L7 Condition Assessment



Figure 56. West stretch showing poor condition/obscured stretch left of frame, view northwest from creek bed



Figure 57. Center section, view north-northeast from creek bed, showing well-stacked boulders beneath tree stump, ferns, and the trail



Figure 58. Center-east section, view northeast from creek bed showing well-stacked boulders beneath tree stump, ferns, and the trail



Figure 59. Overview, east stretch, view east from creek bed, showing riprap in good condition partially obscured by ferns and young trees



Figure 60. Overview, view east from creek bed at east end of Section L7, riprap clearly visible below ferns



Figure 61. Detail, eastern stretch where wall has either fallen away or been engulfed in vegetation

Section L8

Section L8 is located just past the curve in the creek northwest of Cathedral Grove (Figure 62). It has been measured at almost 56 feet long and just under 7 feet tall (NHE 2016). In 2000, it was documented as a combination of loosely stacked wall and “disassembled non-wall,” made of medium-sized boulders that had partly fallen into the creek (Peterson 2000). Previous measurements were consistent with observed conditions at the time of the December 2016 field visit. It consists of loosely-stacked medium-sized boulders (Figures 63-64). The section is not visible from park trails. No disassembled areas were observed. Section L8 is overall in fair condition.

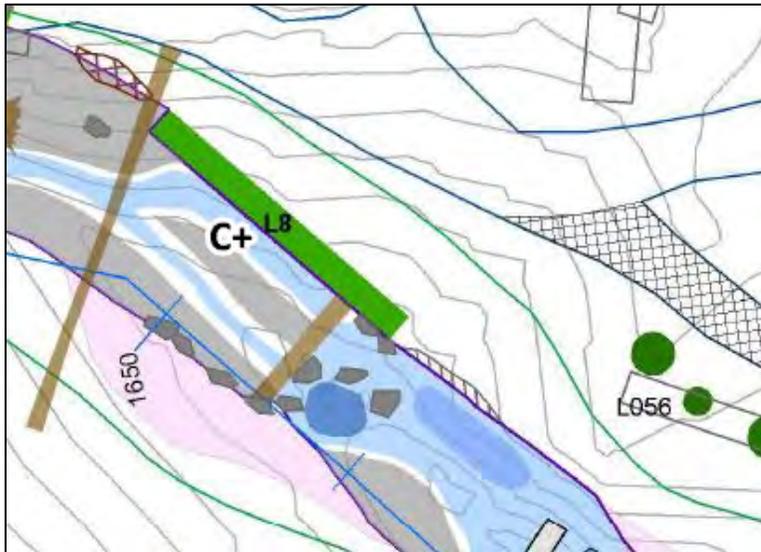


Figure 62. Section L8 Condition Assessment



Figure 63. Section L8, view north from creek bed, showing riprap in good condition with ferns above and some woody debris



Figure 64. Section L8 looking east from creek bed, showing medium-sized boulders in good condition with some areas covered by ferns

Section L8.5

Section L8.5 is located along where the creek curves towards the east-west and to the north of Section L8 (Figure 65). It has been measured at about 49 feet long (NHE 2016). In 2000, it was documented as consisting of very small boulders, and its categorization as riprap was questioned (Peterson 2000). Its location is not visible from park trails. Very little or no riprap was observed at the time of the December 2016 field visit, although it may be present under heavy fern growth and other vegetation (Figure 66). A tributary was flowing into the creek from the north. Section L8.5 is overall not visible or has fallen away.

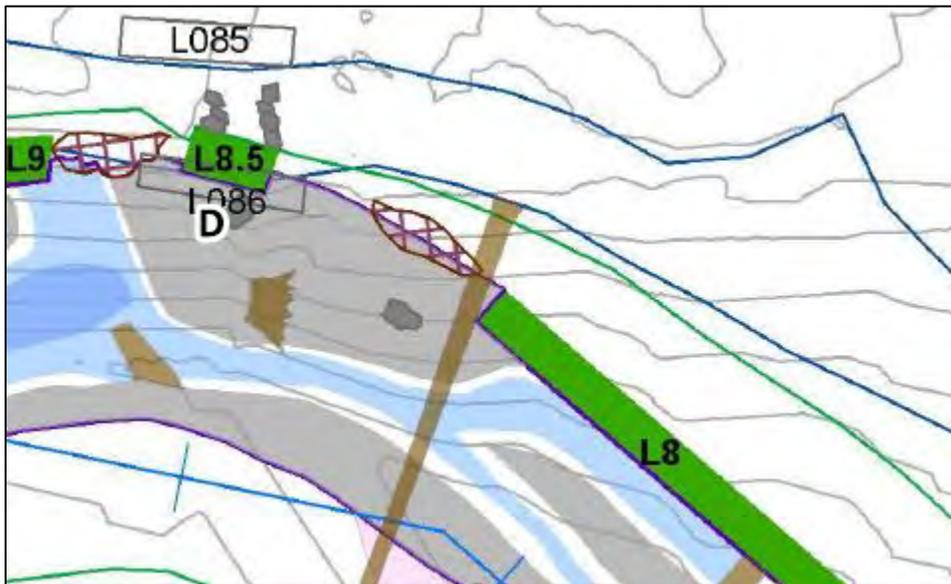


Figure 65. Section L8.5 Condition Assessment



Figure 66. Section L8.5, view north from creek bed, showing heavy seasonal vegetation with what appears to be riprap fallen away in the creek

Section L9

Section L9 is located immediately upstream from Section L8.5 (Figure 67). It has been measured at almost 23 feet long and almost 10 feet tall (NHE 2016). In 2000, it was documented as consisting of a combination of loosely stacked wall and “disassembled non-wall” made of medium-sized boulders (Peterson 2000). Measurements were consistent with observed conditions at the time of the December 2016 field visit. Although individual rocks were not directly visible, close inspection of the bank reveals that it consists of small boulders embedded in dirt or covered with moss (Figures 68-69). L9 is much less vertical than other sections, and may have shifted into a more horizontal position over the decades, or may originally have been designed differently than most sections. Its location is not visible from park trails. The section is in fair to poor condition overall.

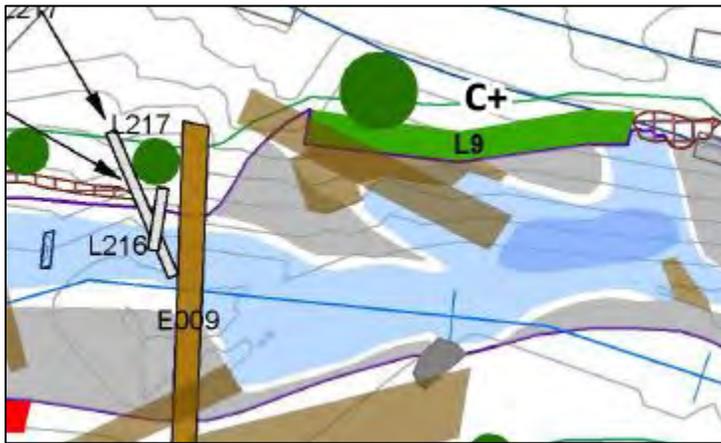


Figure 67. Section L9 Condition Assessment



Figure 68. Section L9, view north from creek bed, showing nearly horizontal riprap of small rocks under moss below a vertical creek bank supporting ferns and tree roots



Figure 69. Section L9, view southwest from left bank, showing nearly horizontal riprap of small rocks under moss in foreground

Section R7

Section R7 is located across the creek and roughly 150 feet upstream of Cathedral Grove (Figure 70). It was previously measured at about 115 feet long and just under 4 feet high (NHE 2016). The length is consistent with observed dimensions in November 2016, although most of its visible stretches are no more than about 3 feet high. It was documented as a loosely-stacked wall of medium-sized boulders in 2000 (Peterson 2000). The section is visible from the Redwood Creek Trail. Its roughly 60-foot northwest stretch is in very good condition, and consists of 2-3 courses of tightly stacked boulders of variable size (Figures 71-72). The 55-foot southeast stretch is largely obscured by vegetation, but, where visible, consists of carefully placed medium-sized boulders (Figure 73). Overall Section R7 is a low wall in good to very good condition.

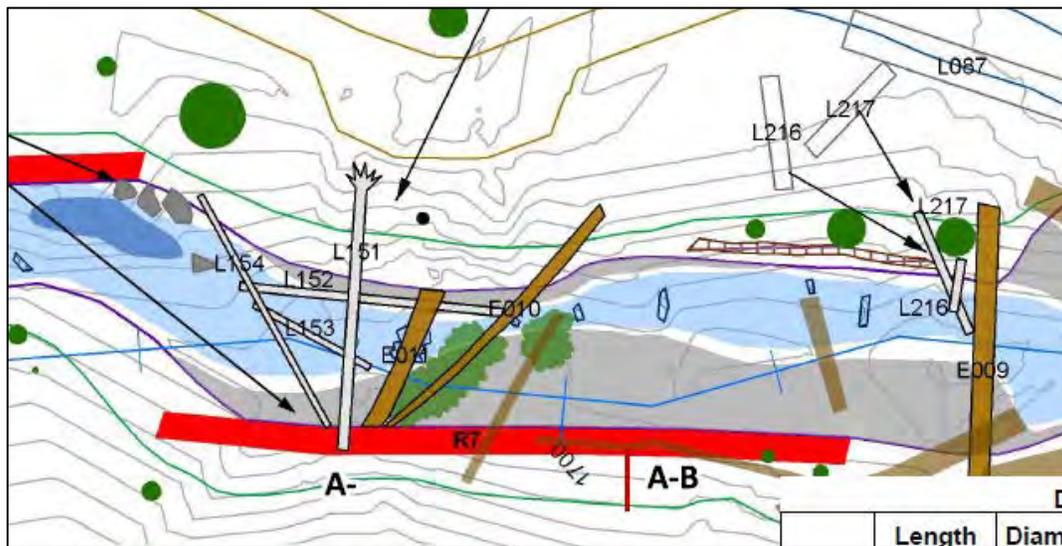


Figure 70. Section R7 Condition Assessment



Figure 71. Overview, northwest stretch of Section R7, view south-southeast from creek bed, showing 2-3 courses of tightly stacked boulders of variable size with ferns and trees above



Figure 72. Detail, northwest stretch, showing 2-3 courses of tightly stacked boulders of variable size with ferns and small amounts of woody debris



Figure 73. Southeast stretch, view southeast from creek bed, well-stacked wall visible center frame behind ferns, small trees, and seasonal vegetation

Section L10

Section L10 is just across the creek and upstream from Section R7 (Figure 74). It has been measured at about 130 feet long and 5.5 feet tall (NHE 2016), consistent with observed conditions in November 2016. In 2000, it was documented as a well-stacked wall of large boulders (Peterson 2000). Its location is visible from the Hillside Trail. Although partially overgrown with ferns and other vegetation, it remains in excellent condition, with large boulders intentionally placed in 3-4 courses (Figures 75-76). A 30-foot stretch at its eastern end is in poor to fair condition (Figures 77-78). Overall, Section L10 is in good condition. Its condition and craftsmanship make it one of the better sections targeted for removal.

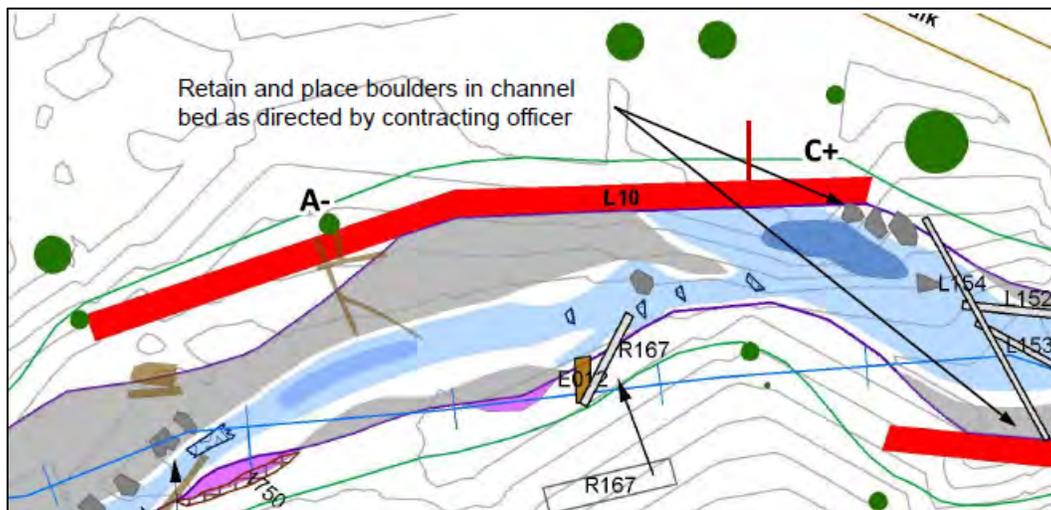


Figure 74. Section L10 Condition Assessment



Figure 75. West stretch, view north from creek bed, showing riprap in fair condition beneath vegetation



Figure 76. Center stretch, view east from creek bed, showing ferns and small tree grown atop riprap in good condition



Figure 77. Center-east stretch, view east-northeast from creek bed, showing riprap in good condition



Figure 78. East end showing some displaced boulders with most riprap in good condition beneath light vegetation growth

Section R8

Section R8 is located across the creek and upstream from Section L10 (Figure 79). It has been measured at about 110 feet long and 3.5 feet tall (NHE 2016), consistent with observed conditions in November 2016. It was documented in 2000 as a loosely stacked wall of medium boulders. Roughly 80 feet at its west stretch consists of carefully placed and tightly stacked boulders (Peterson 2000). The location of the section is visible from the Redwood Creek Trail. The majority of the section consists of medium-sized boulders, with smaller rocks fit in to form a relatively solid wall of 3-4 courses (Figures 80-82). A small area (roughly 5 feet long) at the east end is in poor condition, with a 15-foot stretch center-east in good condition (Figure 83). The overall condition of Section R8 is excellent. Its condition and craftsmanship make it one of the finest sections targeted for removal.

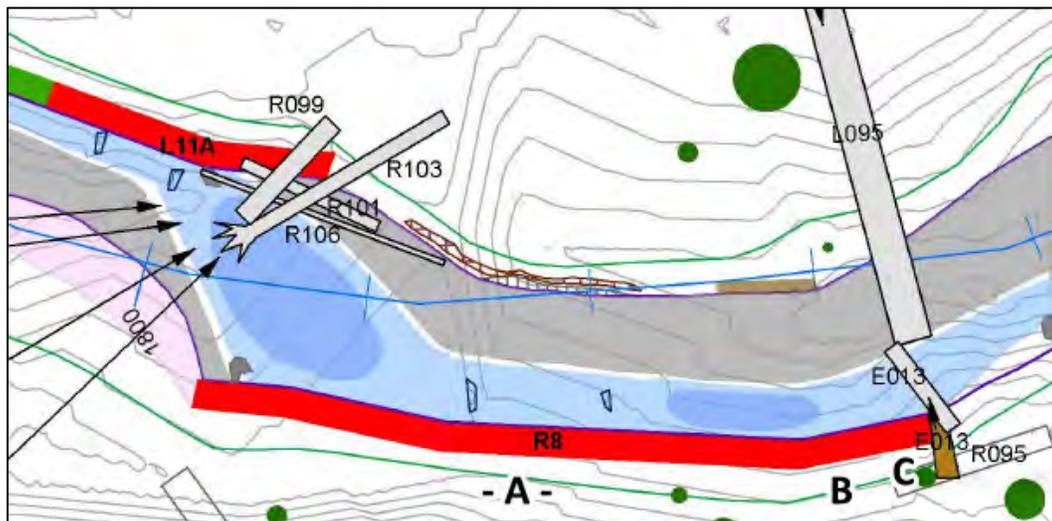


Figure 79. Section R8 Condition Assessment

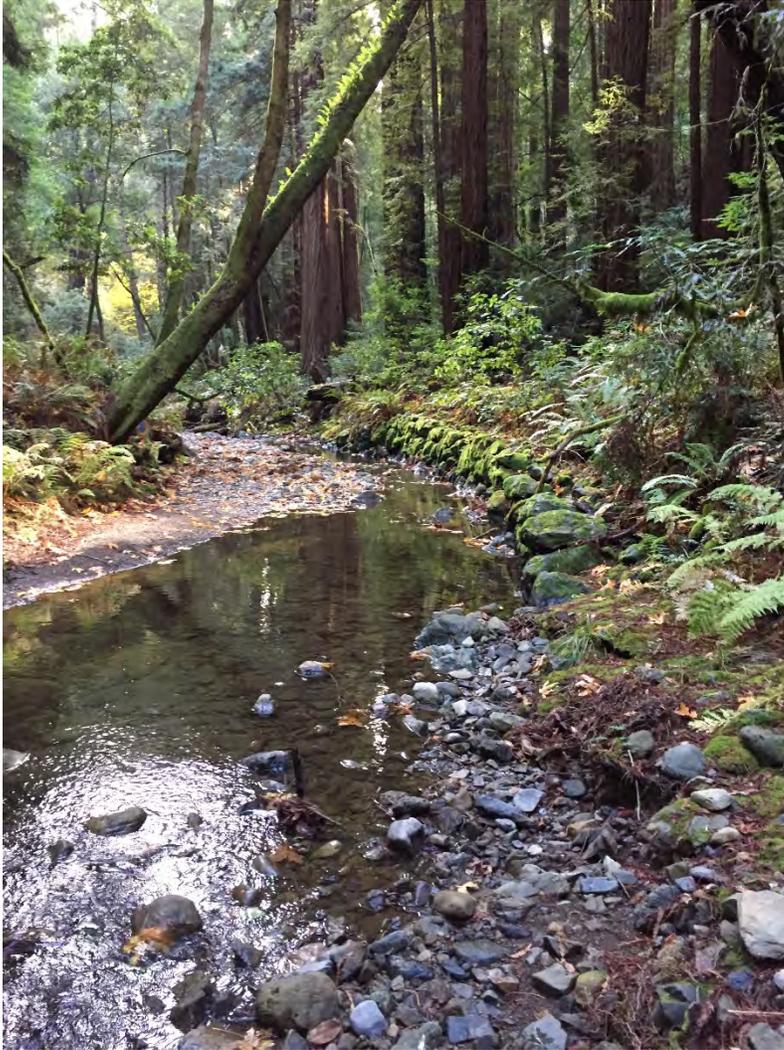


Figure 80. Section R8 overview, view west from creek bed showing riprap of medium-sized boulders, with smaller rocks fit in to form a relatively solid wall of 3-4 courses, in excellent condition



Figure 81. Detail, west stretch, showing riprap in excellent condition with ferns above



Figure 82. Detail, center-west stretch showing riprap in excellent condition with ferns above



Figure 83. Detail showing good-fair condition of east stretch with ferns and vegetation partially obscuring riprap

Section L11A

Section L11A is located across the creek and just upstream from Section R8. It is connected at its west end to Section L11B, which is not slated for removal (Figure 84). It is about 25 feet long, while the adjacent Section L11B is close to 60 feet (NHE 2016). It is just under 6 feet tall (NHE 2016). In 2000, Section L11 was documented as loosely-stacked and “embedded non-wall” of medium-sized rocks (Peterson 2000). No details were recorded to differentiate the west and east stretches of L11. It is visible from the Hillside Trail. The dimensions are consistent with those observed in November 2016, but it is difficult to discern the exact dividing line between L11A and L11B. What appears to be L11A’s west stretch is in fair-poor condition (Figure 85), while the east stretch (about 15 feet long) is completely missing and/or in poor condition (Figure 86). The overall condition of Section L11A is poor.

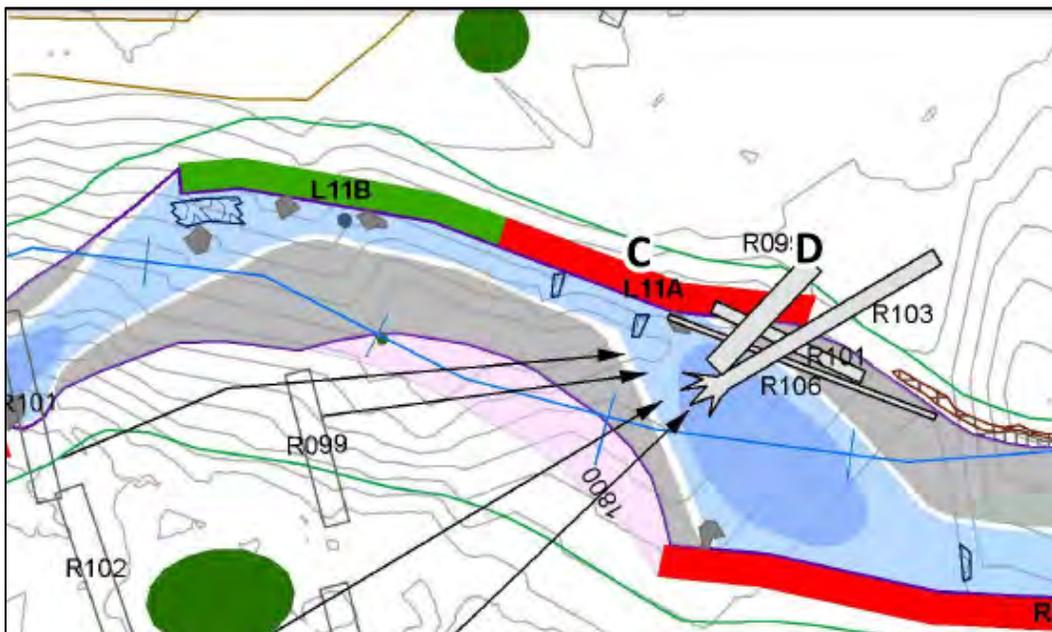


Figure 84. Section 11A Condition Assessment



Figure 85. West stretch, view north from creek bed, showing riprap in fair-poor condition with ferns partially obscuring



Figure 86. East stretch, view north from creek bed, where riprap is missing or completely obscured by ferns and other vegetation

Section L11B

Section L11B is directly adjacent to and northwest of Section L11A (Figure 87). It has been measured at about 26 feet long and just over 8 feet tall (NHE 2016). In 2000, it was documented as a loosely stacked wall (Peterson 2000). Its length appeared generally consistent with observed conditions at the time of the December 2016 field visit, although it appeared to be only about 5 feet tall. Its location is visible from the Hillside Trail. Its downstream stretch is in very good condition, with tightly stacked medium-sized rocks (Figures 88-89). The upstream stretch may also be in good condition based on the shape of the bank, but it is less visible due to moss, ferns, and seasonal vegetation (Figure 90). Section L11B is in overall good condition.

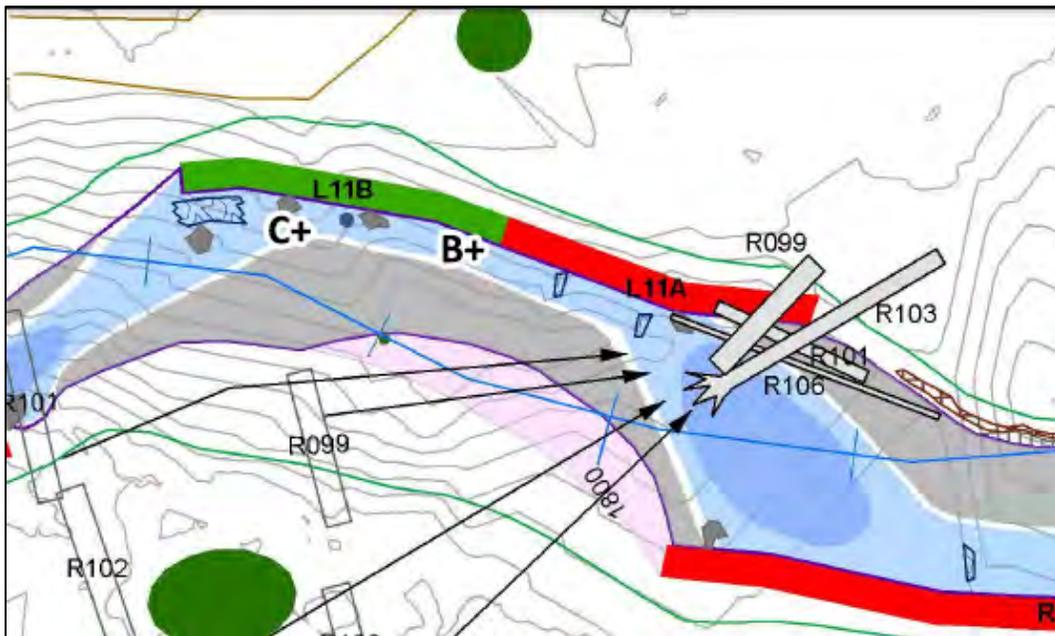


Figure 87. Section L11B Condition Assessment



Figure 88. Downstream stretch of Section L11B looking east from creek bed, showing riprap in very good condition, with tightly stacked medium-sized rocks below fern growth



Figure 89. Center stretch of Section L11B, view northeast from creek bed, showing riprap in good condition with some woody debris and heavy moss growth



Figure 90. Upstream stretch of Section L11B, view north from right bank, showing riprap not visible possibly due to profusion of moss, ferns, and seasonal vegetation

Section R9

Section R9 is located just across the creek and upstream from Section L11 (Figure 91). It has been measured at roughly 80 feet long and about 6.5 feet tall (NHE 2016). The length is consistent with its observed condition in November 2016, but it appears to be only about 3 feet high. In 2000, the section was documented in two parts, with small and medium boulders recorded in a variety of conditions (Peterson 2000). Its location is visible from the Redwood Creek Trail. Its small and medium boulders are tightly stacked into 3 to 4 courses that form a nearly upright wall (Figure 92). Its roughly 60-foot west stretch is in excellent condition (Figure 93), with some collapsing on the east stretch due to tree root interference (Figure 94). Small areas are obscured by fern growth and seasonal vegetation. The overall condition of Section R9 is excellent. Although small, it is one of the better sections targeted for removal.

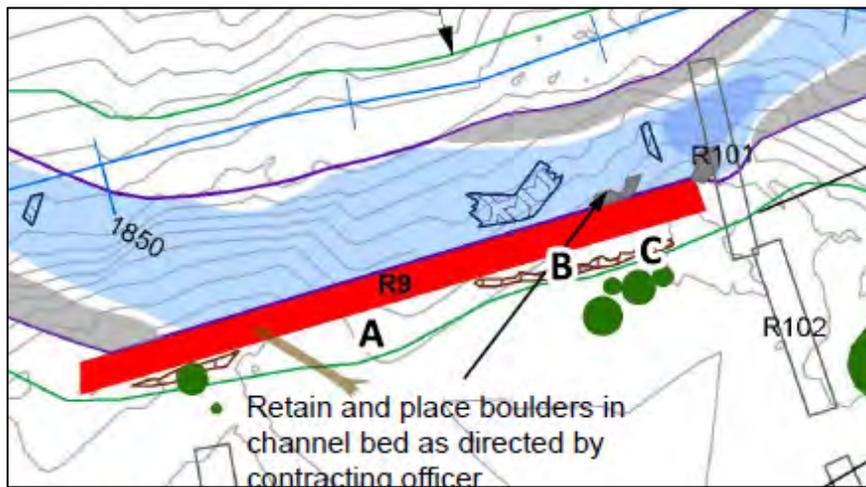


Figure 91. Section R9 Condition Assessment



Figure 92. Overview of Section R9, view southeast from creek bed, showing riprap tightly stacked into 3 to 4 courses that form a nearly upright wall beneath trees, ferns, and other vegetation



Figure 93. Detail, west stretch view south, showing riprap in excellent condition



Figure 94. Detail, east stretch view southeast, showing riprap excellent condition with small collapsed area left of frame and ferns growing above

Section L12

Section L12 is located along the creek to the south of where Fern Creek Trail diverges from the Redwood Creek Trail (Figure 95). It has been measured at almost 105 feet long and about 5 feet tall (NHE 2016). In 2000, it was documented as an embedded wall made of medium and large boulders that was well-secured at some parts (Peterson 2000). Its measured dimensions were consistent with those observed at the time of the December 2016 field visit. Its location is not visible from park trails. It consists of a loosely stacked stretch of medium-large to large boulders at the roughly 30-foot upstream (west) stretch. There is a roughly 6-foot wide strip of embedded toe material in front of this stretch that appears to have been installed along with the riprap (Figure 94). The rocks in the downstream 2/3 of the stretch are the same size range but are tightly-stacked and in excellent condition (Figures 97-98). There is no toe material in front of the 75-foot downstream stretch. Overall Section L12 is in very good condition. Note: this segment would be removed under alternatives D and E.

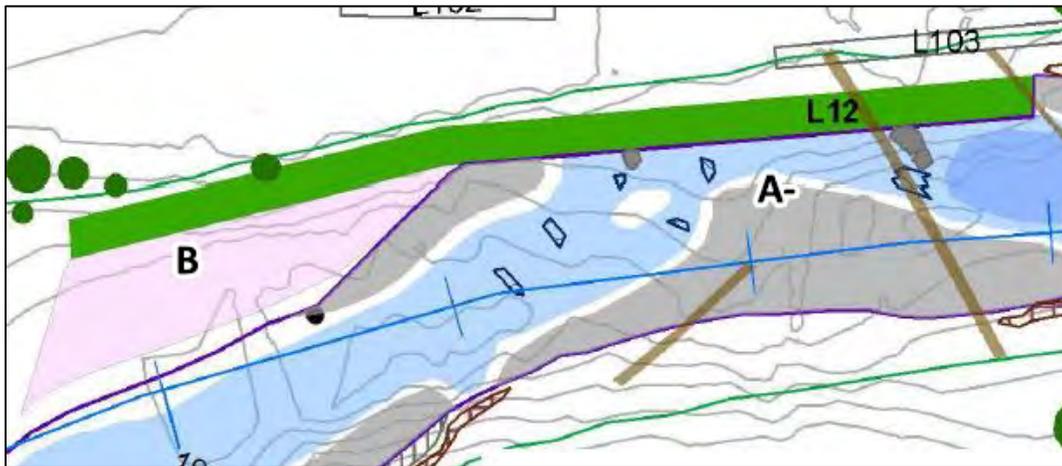


Figure 95. Section L12 Condition Assessment



Figure 96. Upstream (west) stretch of Section L12 with toe material below riprap wall in good condition, view northeast from creek bed



Figure 97. Center stretch of Section L12, view west from creek bed, showing riprap tightly-stacked and in excellent condition



Figure 98. Downstream stretch of Section L12, view west from creek bed, showing riprap tightly-stacked and in excellent condition

Section R10

Section R10 is located across the creek from where the Fern Creek Trail diverges from the Redwood Creek Trail (Figure 99). It was measured at roughly 100 feet long and nearly 6 feet tall (NHE 2016), consistent with observed 2016 conditions. In 2000, it was documented as a well-stacked wall of large boulders, and also documented as “fallen” (Peterson 2000). It is not known what where the fallen section was observed. Section R10 is in a location that is not visible from park trails. Its west 25 feet are difficult to see due to heavy fern growth, but close inspection reveals that it appears to be in good condition (Figure 100). The 75-foot east stretch is in excellent condition, except for about 20 feet of good condition at its center (Figure 101). Rocks vary in size, and are tightly fitted into 5 to 6 courses, with the larger boulders on the lowest course. Its eastern 50 feet have a large amount of toe material or a check dam consisting of large boulders in the creek bed adjacent to the section (Figures 102-103). The overall condition of Section R10 is excellent to very good despite being obscured by seasonal and more permanent woody vegetation.

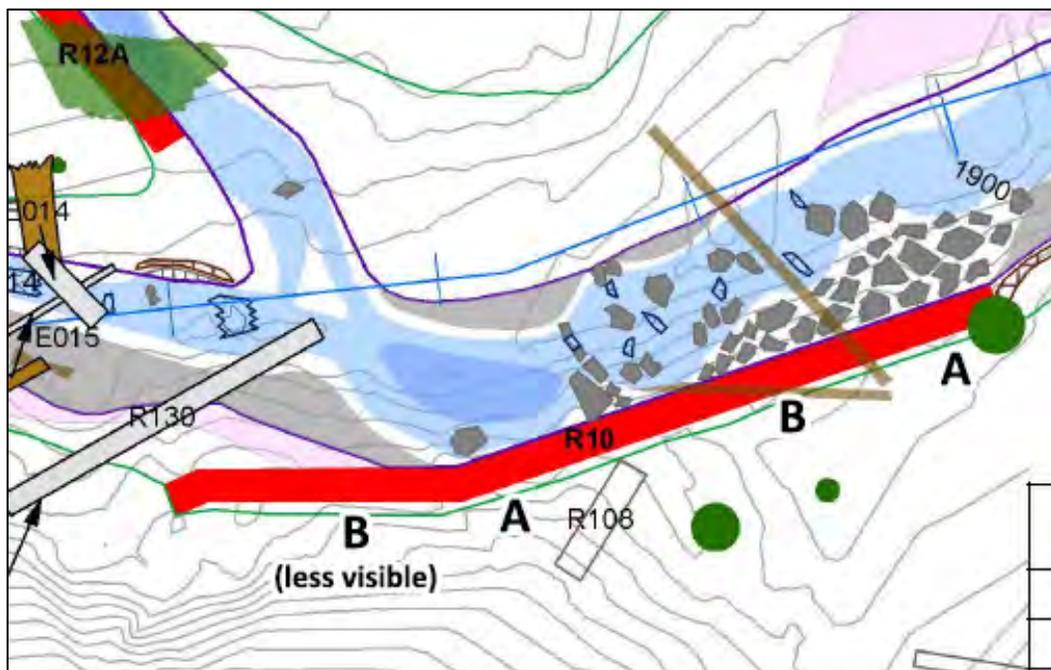


Figure 99. Section R10 Condition Assessment



Figure 100. Western stretch, view southwest from creek bed with riprap in good condition behind ferns



Figure 101. Detail, east stretch, showing tightly stacked wall in excellent condition beneath ferns and some woody debris



Figure 102. Central stretch, view south showing heavy toe material with ferns and woody debris covering riprap that is in excellent condition



Figure 103. View west toward east stretch with large boulder riprap and toe material/check dam

Section R12A

Section R12A is located on Fern Creek just upstream from its confluence with Redwood Creek (Figure 104). It was measured at about 40 feet long and 4 feet high (NHE 2016), consistent with observed conditions in November 2016. In 2000, Section R12A was documented as well- and loosely-stacked large and small rocks (Peterson 2000). It is adjacent to R12B, and the exact dividing line between the sections is difficult to discern. Section R12A is visible from the Redwood Creek Trail. Its north stretch (adjacent to R12B) is in fair condition, but tree roots have apparently destroyed all but this roughly 10-foot stretch (Figure 105). The south stretch is missing or in poor condition. The overall condition of Section R12A is poor.

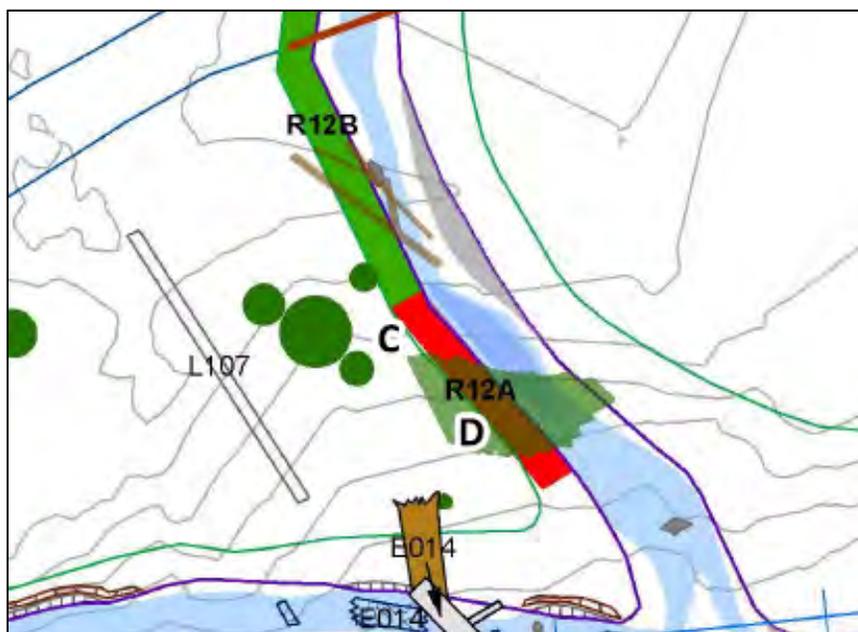


Figure 104. Section R12A Condition Assessment



Figure 105. Section R12A left of frame, camera view west from creek bed

Section R12B

Section R12B is located on Fern Creek, north of where it meets Redwood Creek and connected at its south end to Section R12A (Figure 106). It has been measured at almost 43 feet long and just over 4.5 feet tall (NHE 2016). In 2000, it was recorded as a combination of loosely stacked and embedded wall made of small and large boulders, consistent with its observed condition in December 2016 (Figures 107-108) (Peterson 2000). It is visible from park trails. Although difficult to see the rocks because of the bridge over its north end and ferns along the bank, careful inspection shows they are well stacked and medium-sized. Section R12B is in good condition overall.

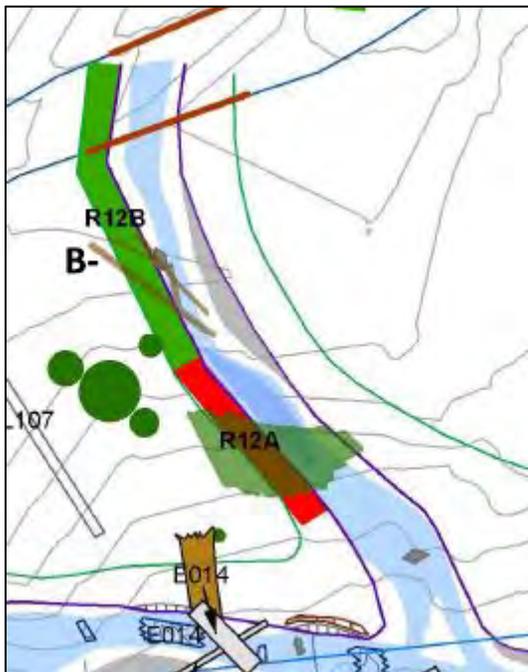


Figure 106. Section R12B Condition Assessment



Figure 107. Section R12B, camera facing southwest



Figure 108. Section R12B, camera facing west



Figure 109. Section R12B, camera facing southwest

Section L16

Section L16 is located immediately adjacent, to the northwest, of the fork where Fern Creek Trail splits from the Redwood Creek Trail (Figure 110). It has been measured at roughly 72 feet long and just over 5 feet tall (NHE 2016), consistent with its observed condition in December 2016. In 2000, it was documented as well-secured and embedded, made of a variety of small and large boulders (Peterson 2000). At the time of the December 2016 field visit, it consists of loosely stacked boulders of variable size (Figures 111-112). The eastern stretch is in very poor condition and essentially nonexistent, while the western end is in fair condition. It is visible from park trails and is in overall fair condition.

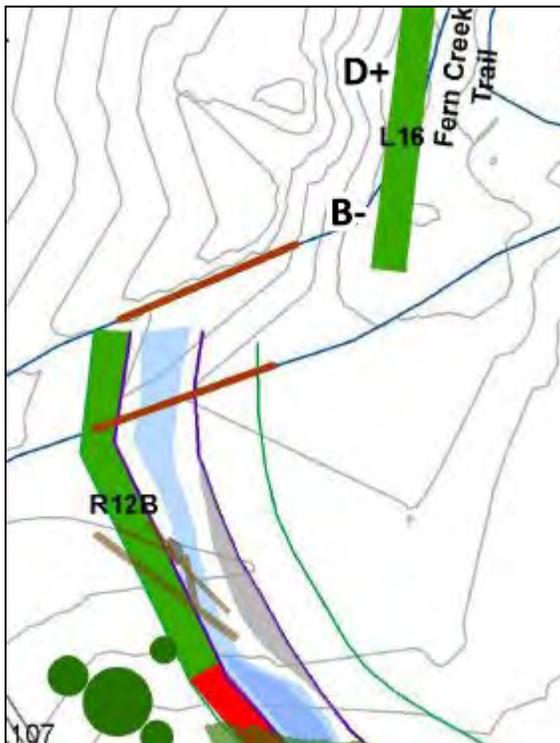


Figure 110. Section L16 Condition Assessment



Figure 111. View upstream with Section L16 at right of frame, camera facing northeast



Figure 112. Section L16 and Redwood Creek Trail, camera facing east

Section L13

Section L13 is located just southeast of the intersection between Camp Eastwood Trail and Redwood Creek Trail (Figure 113). It was measured at roughly 60 feet long and 5 feet high (NHE 2016), consistent with its observed condition in November 2016. When it was documented in 2000, it was recorded as a loosely stacked wall of medium-sized boulders that had fallen into the creek (Peterson 2000). Overall, the section is a well-stacked wall of medium-sized boulders that have clearly been intentionally placed. The roughly 25-foot western stretch is in excellent condition (Figures 114-115). The 15-foot central section, where tree roots have pushed rocks into the creek, is in poor condition, and the under layer of smaller rocks is visible (Figure 114). The 20-foot eastern stretch is in good condition (Figures 117-118). The overall condition of Section L13 is good. It is visible from Hillside Trail. Its condition and craftsmanship make it one of the finest sections targeted for removal despite the small area of deterioration at its center.

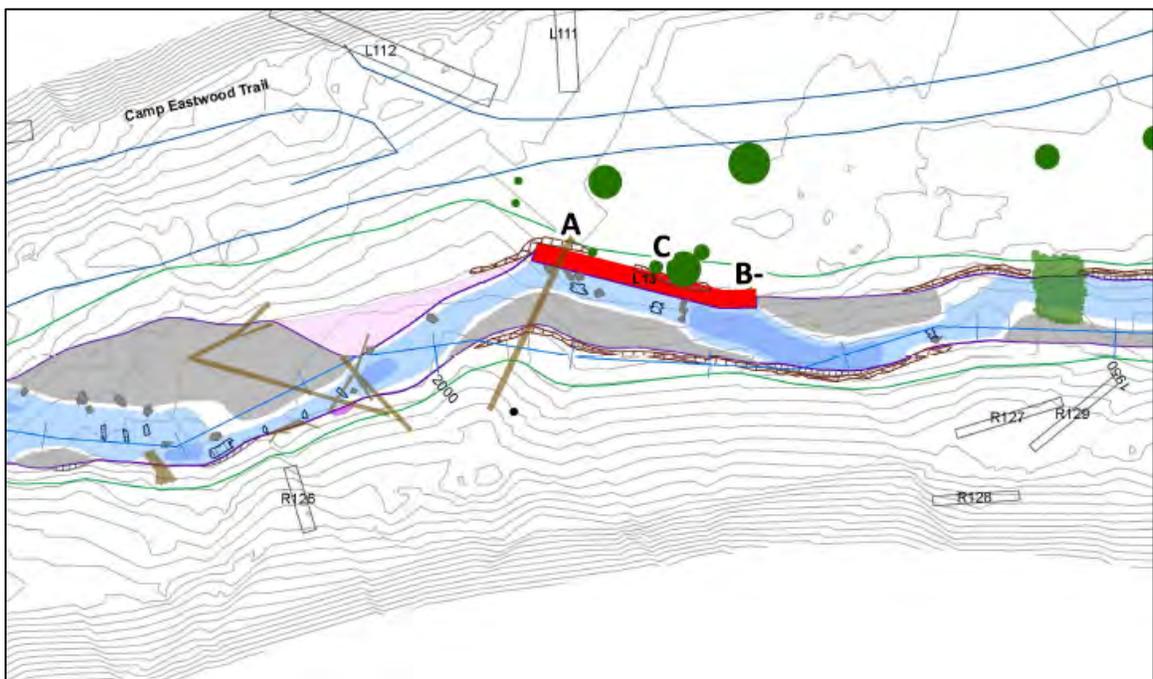


Figure 113. Section L13 Condition Assessment



Figure 114. Overview, Section L13, view east from creek bed, well-stacked western stretch left of frame



Figure 115. Western stretch, view northeast from creek bed



Figure 116. Central stretch showing large rocks pushed out by tree roots and smaller rocks used for backfill exposed



Figure 117. Eastern stretch, view east from creek bed



Figure 118. Eastern stretch of Section L13, view west from left bank

Section L14

Section L14 is located west of the start of Camp Eastwood Trail, just east of a bend in the creek (Figures 119-120). It has been measured at almost 79 feet long and around 6 feet high (NHE 2016). In 2000, it was documented as a combination of well-secured embedded wall, loosely stacked wall, “embedded non-wall”, and boulders fallen into the creek, composed of a variety of sizes of boulders ranging from very small to medium (Peterson 2000). It is not visible from park trails and could not be accessed at the time of the December 2016 field visit. However, one photograph of its center stretch was discovered in a 2014 report, which shows jumbled boulders of varying size (ESA 2014) (Figure 121). The larger boulders have fallen into the creek, while some of the smaller stones used for backfill is visible still embedded in the bank. The overall condition of Section L14 appears to be very poor and somewhat unstable.

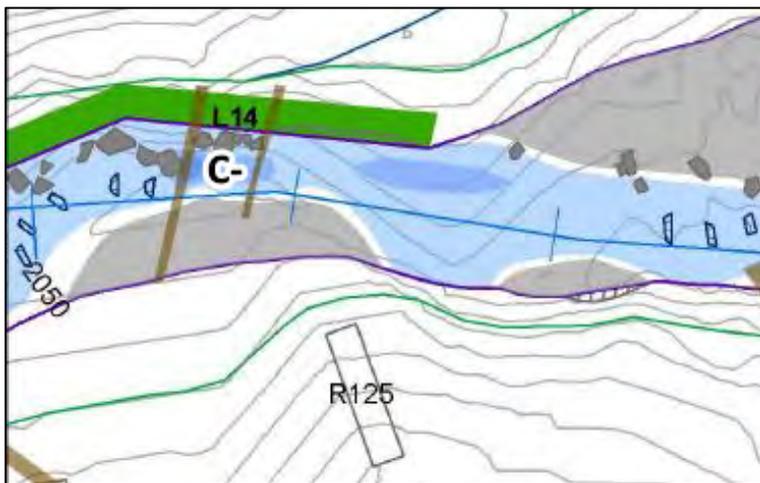


Figure 119. Section L14 Condition Assessment (east portion)

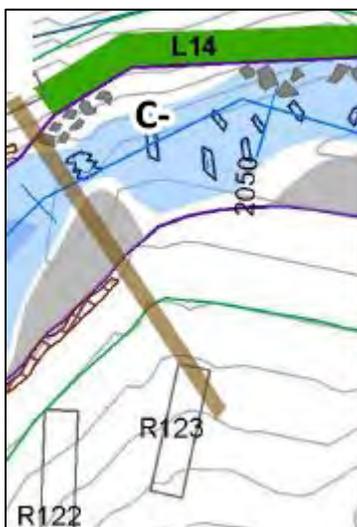


Figure 120. Section L14 Condition Assessment (west portion)



Figure 121. Center stretch, Section L14, view northeast from creek bank (photo ESA 2014)

Section R11

Section R11 begins to the southwest of the end of Section L14 and runs alongside most of the short northeast-southwest segment at this part of the creek (Figure 122). It has been measured at roughly 49 feet long (NHE 2016). In 2000, it was documented as a well-secured, “embedded wall” composed of medium-sized and large boulders. These measurements were consistent with the observed condition at the time of the December 2016 field visit (Figures 123-124). It is visible from park trails. The east end is more covered by seasonal and woody vegetation and in worse condition, while the west end is more visible and contains larger rocks. The overall condition of the section is good.

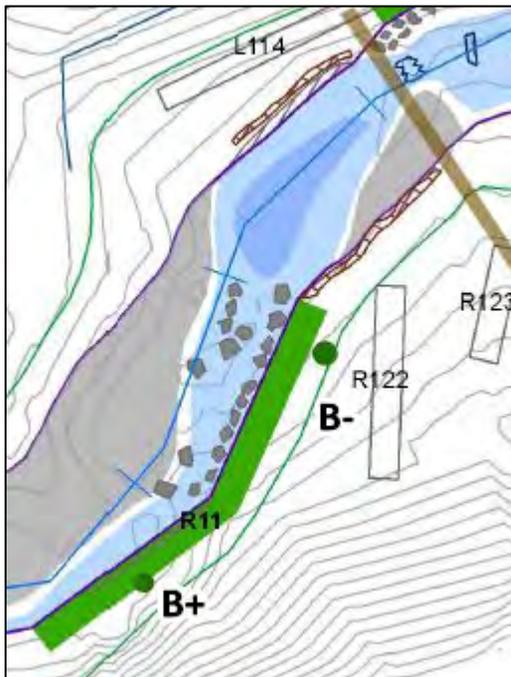


Figure 122. Section R11 Condition Assessment



Figure 123. Section R11, camera facing southeast



Figure 124. Section R11, camera facing east

Section L14.5

Section L14.5 is located northeast of Bridge 4 at a curve in the creek (Figure 125). It has been measured at just under 20 feet long (NHE 2016), which was consistent with observed conditions at the time of the December 2016 visit. It is not visible from park trails and consists of loosely stacked rocks of variable size that range from large to medium (Figure 126). It is in fair condition.

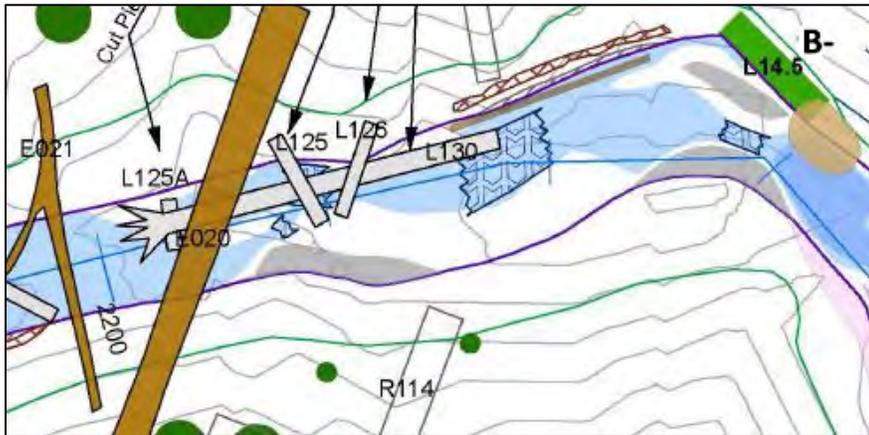


Figure 125. Section L14.5 Condition Assessment



Figure 126. Section L14.5 and trail, camera facing northeast

REFERENCES

- Auwaerter, J. and J. Sears. 2006. Historic Resource Study for Muir Woods National Monument: Golden Gate National Recreation Area.
- Environmental Science Associates & Mark Thomas & Company. 2014. Muir Woods National Monument: Redwood Creek Riprap Removal, Channel Migration, and Bridge Replacement Survey.
- Petersen, B., Rahman, J., Semion, J. Paulson, H., Thurman, S., Xiong, J. and Shoulders, C. 2000. Redwood Creek Riprap Assessment.
- Northern Hydrology & Engineering. 2016. Muir Woods Preliminary Conceptual Design.

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Appendix B

CEQA Checklist

Appendix B.

CEQA ENVIRONMENTAL CHECKLIST

This appendix assesses the environmental impacts of the Salmon Habitat Enhancement and Bridge Replacement at MWNM. The environmental impact analysis is based on the environmental checklist provided in Appendix G of the California Environmental Quality Act (CEQA) Guidelines. This checklist has been prepared to support any necessary evaluation of the project pursuant to the California Environmental Quality Act by relevant lead and responsible agencies with discretionary approval authority over some or all of the project. The conclusions in the checklist are supported by information in the body of the Environmental Assessment.

Environmental Factors Potentially Affected

The environmental factors checked below would potentially be affected by the Proposed Project, as indicated by the checklist on the following pages.

- | | |
|---|---|
| <input type="checkbox"/> Aesthetics | <input type="checkbox"/> Land Use/Planning |
| <input type="checkbox"/> Agriculture and Forestry Resources | <input type="checkbox"/> Mineral Resources |
| <input type="checkbox"/> Air Quality | <input type="checkbox"/> Noise |
| <input type="checkbox"/> Biological Resources | <input type="checkbox"/> Population/Housing |
| <input type="checkbox"/> Cultural Resources | <input type="checkbox"/> Public Services |
| <input type="checkbox"/> Geology/Soils | <input type="checkbox"/> Recreation |
| <input type="checkbox"/> Greenhouse Gas Emissions | <input type="checkbox"/> Transportation/Traffic |
| <input type="checkbox"/> Hazards and Hazardous Materials | <input type="checkbox"/> Tribal Cultural Resources |
| <input type="checkbox"/> Hydrology/Water Quality | <input type="checkbox"/> Utilities/Service Systems |
| <input type="checkbox"/> Land Use/Planning | <input type="checkbox"/> Mandatory Findings of Significance |

1.1 Aesthetics

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
Would the Project:				
a. Have a substantial adverse effect on a scenic vista?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b. Substantially damage scenic resources, including, but not limited to trees, rock outcroppings, and historic buildings within a state scenic highway?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c. Substantially degrade the existing visual character or quality of the site and its surroundings?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
d. Create a new source of substantial light or glare that would adversely affect daytime or nighttime views in the area?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

1.2 Agriculture and Forestry Resources

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
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In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Dept. of Conservation as an optional model to use in assessing impacts on agriculture and farmland. In determining whether impacts to forest resources, including timberland, are significant environmental effects, lead agencies may refer to information compiled by the California Department of Forestry and Fire Protection regarding the state's inventory of forest land, including the Forest and Range Assessment Project and the Forest Legacy Assessment Project; and forest carbon measurement methodology provided in Forest Protocols adopted by the California Air Resources Board. Would the Project:

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
a. Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program (FMMP) of the California Resources Agency, to nonagricultural use?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b. Conflict with existing zoning for agricultural use, or a Williamson Act contract?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c. Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Pub. Res. Code section 12220(g)), timberland (as defined by Pub. Res. Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104(g))?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
d. Result in the loss of forest land or conversion of forest land to non-forest use?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
e. Involve other changes in the existing environment, which, due to their location or nature, could result in conversion of Farmland to nonagricultural use or conversion of forest land to non-forest use?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

1.3 Air Quality

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
When available, the significance criteria established by the applicable air quality management or air pollution control district may be relied upon to make the following determinations. Would the project:				
a. Conflict with or obstruct implementation of the applicable air quality plan?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b. Violate any air quality standard or contribute substantially to an existing or projected air quality violation?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
c. Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is a nonattainment area for an applicable federal or state ambient air quality standard (including releasing emissions that exceed quantitative thresholds for ozone precursors)?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
d. Expose sensitive receptors to substantial pollutant concentrations?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
e. Create objectionable odors affecting a substantial number of people?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

1.4 Biological Resources

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
Would the Project:				
a. Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the CDFW or USFWS?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
b. Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations, or by the DFG or USFWS?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
c. Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the CWA (including marshes, vernal pools, and coastal wetlands) through direct removal, filling, hydrological interruption, or other means?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
d. Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
e. Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
f. Conflict with the provisions of an adopted habitat conservation plan (HCP); natural community conservation plan; or other approved local, regional, or state HCP?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

1.5 Cultural Resources

	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
Would the project:				
a. Cause a substantial adverse change in the significance of a historical resource as defined in Section 15064.5?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
b. Cause a substantial adverse change in the significance of an archaeological resource as defined in Section 15064.5?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
c. Directly or indirectly destroy a unique paleontological resource or site or unique geological feature?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
d. Disturb any human remains, including those interred outside of dedicated cemeteries?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

1.6 Geology, Soils, and Seismicity

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
Would the Project:				
a. Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:				
i. Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
ii. Strong seismic ground shaking?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
iii. Seismic-related ground failure, including liquefaction?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
iv. Landslides?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
b. Result in substantial soil erosion or the loss of topsoil?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
c. Be located on a geologic unit or soil that is unstable or that would become unstable as a result of the Project and potentially result in an on-site or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
d. Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
e. Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems in areas where sewers are not available for the disposal of wastewater?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

1.7 Greenhouse Gas Emissions

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
Would the Project:				
a. Generate a net increase in greenhouse gas emissions which may have a significant impact on the environment?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
b. Conflict with a county-adopted climate action plan or another applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

1.8 Hazards and Hazardous Materials

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
Would the Project:				
a. Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
b. Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
c. Emit hazardous emissions or involve handling hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
d. Be located on a site that is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, create a significant hazard to the public or the environment?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
e. Be located within an airport land use plan area or, where such a plan has not been adopted, be within 2 miles of a public airport or public use airport and result in a safety hazard for people residing or working in the study area?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
f. Be located within the vicinity of a private airstrip and result in a safety hazard for people residing or working in the study area?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
g. Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
h. Expose people or structures to a significant risk of loss, injury, or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

1.9 Hydrology and Water Quality

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
Would the Project:				
a. Violate any water quality standards or waste discharge requirements?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
b. Substantially deplete groundwater supplies or interfere substantially with groundwater recharge, resulting in a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level that would not support existing land uses or planned uses for which permits have been granted)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
c. Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion or siltation on site or off site?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
d. Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding on-site or off-site?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
e. Create or contribute runoff water that would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
f. Otherwise substantially degrade water quality?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
g. Place housing within a 100-year flood hazard area, as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
h. Place within a 100-year flood hazard area structures that would impede or redirect floodflows?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
i. Expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
j. Contribute to inundation by seiche, tsunami, or mudflow?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

1.10 Land Use and Planning

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
Would the Project:				
a. Physically divide an established community?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b. Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including a general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c. Conflict with any applicable habitat conservation plan or natural community conservation plan?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

1.11 Mineral Resources

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
Would the Project:				
a. Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b. Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

1.12 Noise

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
Would the Project result in:				
a. Exposure of persons to or generation of noise levels in excess of standards established in a local general plan or noise ordinance or applicable standards of other agencies?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
b. Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
c. A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
d. A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
e. For a project located within an airport land use plan area, or, where such a plan has not been adopted, within 2 miles of a public airport or public-use airport, would the project expose people residing or working in the project site to excessive noise levels?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
f. For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project site to excessive noise levels?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

1.13 Population and Housing

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
Would the Project:				
a. Induce substantial population growth in an area, either directly (e.g., by proposing new homes and businesses) or indirectly (e.g., through extension of roads or other infrastructure)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b. Displace a substantial number of existing housing units, necessitating the construction of replacement housing elsewhere?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c. Displace a substantial number of people, necessitating the construction of replacement housing elsewhere?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

1.14 Public Services

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
Would the Project:				
a. Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities or a need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any of the following public services:				
i. Fire protection?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
ii. Police protection?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
iii. Schools?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
iv. Parks?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
v. Other public facilities?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

1.15 Recreation

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
Would the Project:				
a. Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b. Include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

1.16 Transportation/Traffic

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
Would the Project:				
a. Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
b. Conflict with an applicable congestion management program, including, but not limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
c. Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
d. Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
e. Result in inadequate emergency access?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
f. Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

1.17 Tribal Cultural Resources

	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
Would the Project cause a substantial adverse change in the significance of a tribal cultural resource, defined in Pub. Res. Code section 21074 as either a site, feature, place, cultural landscape that is geographically defined in terms of the size and scope of the landscape, sacred place, or object with cultural value to a California Native American tribe, and that is:				
a. Listed or eligible for listing in the California Register of Historical Resources, or in a local	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

register of historical resources as defined in Public Resource Code Section 5020.l(k), or

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|---|--------------------------|--------------------------|--------------------------|-------------------------------------|
| <p>b. A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Public Resource Code Section 5024.1. In applying the criteria set forth in subdivision (c) of Public Resource Code Section 5024.1. the lead agency shall consider the significance of the resource to a California Native American tribe.</p> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
|---|--------------------------|--------------------------|--------------------------|-------------------------------------|

1.18 Utilities and Service Systems

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
Would the Project:				
a. Exceed wastewater treatment requirements of the applicable RWQCB?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
b. Require or result in the construction of new water or wastewater treatment facilities or an expansion of existing facilities, the construction of which could cause significant environmental effects?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c. Require or result in the construction of new stormwater drainage facilities or an expansion of existing facilities, the construction of which could cause significant environmental effects?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
d. Have sufficient water supplies available to serve the Project from existing entitlements and resources, or would new or expanded entitlements be needed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
e. Result in a determination by the wastewater treatment provider that serves or may serve the Project that it has inadequate capacity to serve the Project's projected demand in addition to the provider's existing commitments?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
f. Be served by a landfill with insufficient permitted capacity to accommodate the Project's solid waste disposal needs?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
g. Comply with federal, state, and local statutes and regulations related to solid waste?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
h. Encourage activities that resulted in the use of substantial amounts of fuel or energy, or used these resources in a wasteful manner?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

1.19 Mandatory Findings of Significance

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
a. Does the Project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, substantially reduce the number or restrict the range of a rare or endangered plant or animal, or eliminate important examples of the major periods of California history or prehistory?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
b. Does the Project have impacts that are individually limited but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.)	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
c. Does the Project have environmental effects that will cause substantial adverse effects on human beings, either directly or indirectly?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

