Design Team Workgroup Notes

27 February 2017

Attendees: Mike Dixon, Steve Laymon, Robert Stewart, Trevor Morgan, DJ Bandrowski, Dave Gaeuman, Jenny Norris, Phil Fishella (Weaverville); Robert Franklin, Ben Snyder, Justin Alvarez, Josh Boyce, Conor Shea, Fred Meyer, Damon Goodman, Mark Smeltzer, John Bair

Once again, the meeting was jointly held at TRRP in Weaverville and McBain Associates in Arcata due to ongoing traffic controls at the Big French Creek slide. The meeting began with introductions and a stated hope that we could shift the lunch time to accommodate interested parties attending a TRRP-sponsored beaver/climate change film being shown at noon. Alas, this was not meant to be.

A team of USFWS, HVT, YT researchers presented field results from 2016 channel rehabilitation site habitat assessment. Trend was for an initial increase in habitat post-construction followed by some loss; however presented sites (Cableway, Upper Douglas City/Indian Creek) still had higher suitable juvenile rearing habitat in 2016 than pre-construction. There has been evolution of channel morphology due to erosion and deposition of gravels, and a general downward trend in wood storage with impacts to cover availability, bringing up again the potential for large wood augmentation. There was some discussion of side channel designs, including a designed entrance that was functioning as an exit, channels which were designed to be too trapezoidal and too fast (Indian Creek). Summaries of this work have been attached to the end of these notes. Note that all of these findings are draft and should be viewed as such.

D. Goodman et al presented on their draft report regarding 2005-2015 trends in juvenile rearing habitat in the restoration reach. An abstract of this draft report is attached to the end of these notes.There was overwhelmingly positive trends in overall and optimal habitat, though as with the 2016 presentation, there was some loss of habitat over time. There was no significant trend in habitat associated with construction year.

- There were concerns voiced regarding the standard of evaluating habitat at summer base flow (450cfs at the dam). DJ stated that many that many features were not designed to engage at 450 cfs. Robert F. also pointed out that at sites near the dam, juvenile chinook would seldom even see 450 cfs because they would be on their way out of the river by then. It should be noted that the way that the report characterized results was discussed between authors and author agencies prior to the report being presented in its current state.
- There were also concerns that the analytical design's use of GRTS panels for sampling misrepresents the effectiveness of actual sites, because in many cases key areas of channel rehab projects were excluded from analysis because they did not occur within selected GRTS panels. This could lead to those hostile to the program or who don't understand the intricacies of the analysis mischaracterizing the actual amount of habitat at specific locations. There was the suggestion that the analysis should be titled and characterized as a GRTS analysis of constructed features, rather than as an analysis of channel rehab site success.
- The report has been submitted to Jenny N. and has been circulated for internal review which will be followed external review, which will provide an opportunity for these comments to be formally submitted.

The mass grading subgroup provided an overview of their first analysis of areas that have major overburdens of sediment which would have to be removed prior to or as part of any major rehabilitation efforts. They did a GIS analysis of areas that were >5’ above the de-trended 450cfs surface which had either non-native vegetation or rock tailings as a surface, with an additional categorization based on land ownership. This highlighted extensive opportunities for large-scale floodplain lowering.

- DJ and Fred stated that this approach would be very useful as part of a long-term plan to implement designs at Chapman Ranch and elsewhere.
- Phil asked an elaborating question on the overall purpose, leading to further discussion that grading would be undertaken with an intent not to over-excavate, but to facilitate later work. However, this approach might be useful as an end of its own at site revisits, for example.

Trevor M. provided a quick update on the Dutch Creek design with conceptual drawings that incorporate feedback including direction of floodplain grading and a river left low flow channel.

- Jenny asked about design objectives, which are largely unchanged since the last iterations of Dutch Creek.
- Robert F. inquired about all of the past design work that has gone into the site. Trevor said they exist on an external hard drive and that we have been learning over time.
- Brandt inquired about the trespass house which will be an issue when we begin working in the lower Dutch Creek area. This is an area of ongoing conversation with USFS staff.

Brandt provided an overview of the site revisit subgroup’s initial efforts.

- One option is a 1.5’ lowering of the floodplain at Conner Creek to improve revegetation and provide habitat at 4-4.5k cfs. Fred offered that the mass-grading exercise data set could be used to create a rough calculation of volume to be excavated.
- Another is to repair an existing side channel at Upper Junction City that does not engage at low flows because a gravel ramp in front of the ELJ at its head failed and the sediment clogged the entry to the channel. There was a strong spectrum of opinion on whether or not we should conduct corrective revisits to “fix” past sites. Conor also asked how confident we could be that the fix was sustainable. Dave G. believes that it is a relatively straightforward explanation of failure of an otherwise sustainable channel with a very simple fix. This is a topic which will require input from above the WG level due to the potentially precedent setting nature of corrective revisits.
- There is an option to explore building of BDAs within the functioning Lorenz Gulch side channel to create expanded off-channel habitat and raise the water table of adjoining areas. John B. asked whether there was enough drop in the channel to create beaver ponds of appreciable size; Dave G.’s recollection was that there is about 3 vertical feet to work with.
- We could do additional lowering at the downstream side of Hocker Flat to promote slow but flowing water there. Volume of excavation would be large
- Elkhorn – further excavation is possible and likely would be beneficial
- DJ recommended, as a general observation, that a cost-benefit analysis should be conducted to weigh cost, compliance effort, sustainability, created habitat, etc as a step for considering any of these approaches.

DJ and Dave provided an overview of the proposed Deep Gulch/Sheridan Creek project.

- Mike D. was tagged to send out the large wood design. However, it is enormous and cannot be emailed.
- Mark S. asked about how the force balance calculations were done for the engineered wood structures, to which Andreas explained that 9k cfs was used as it just overtops the structures.
- Conor mentioned that many features are reliant on connectivity with the river which can be undermined. Andreas drew attention to the fact that the off channel wetland features are all designed to function with hyporheic connections, though the upstream pond is also supplied through a log jam with surface water.

Fred provided an overview of Chapman Ranch's near-complete design. At present they are waiting on a large wood design from the Yurok Tribe, who are in turn waiting on reassurance that Chapman Ranch will be implementable.

- Wes? asked about the persistence of side channels and what the large side channel might evolve into. Someone commented that the design is replicating a channel that existed in already highly altered topography in 1944 aerial photos (i.e. not necessarily an indicator of what should be there).
- There was discussion started by DJ on the need to start leveraging outside funds to augment TRRP construction budget funding for big projects like this, and so that money isn't left on the table.
- Mike D. mentioned a need to have some conversations with Reclamation staff in and out of the office, including site visits, to help convey that Chapman Ranch and other locations are expensive by necessity due to the sheer volume of work needing to be done in the lower valley section of the river.

Mike D. initiated a conversation about past and future practice to assign and present current conditions assessments for future ESL designs.

- Conor? Brought up the lack of objective measures for geomorphic conditions, which makes it hard to assess current conditions or rehabilitation success following construction.
- There was much discussion of who would like or not like to do which sites and legitimate and other justifications for why. It was agreed that the design groups would submit by COB 01 MAR a ranked list of sites which interest them.
- Following assignment of ESLs and an as-yet-unestablished due date, design groups will present an overview of current conditions at a joint Design Team/IDT meeting to facilitate a broader discussion of limiting factors and possible objectives and concepts.

Follow up: Mike D. will send a doodle poll with dates for a Dutch Creek-specific call in late March, and a separate poll for an in-person meeting late spring or early summer.

Age-0 Chinook and Coho Salmon Rearing Habitat Observations, Cableway Rehabilitation Site, 2008-2016, Upper Trinity River, CA

Participating Agencies: Hoopa Valley Tribal Fisheries, US Fish and Wildlife Service, and Yurok Tribal Fisheries Program

January 30, 2016

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Presented below is a summary of Age-0 Chinook and Coho Salmon rearing habitat during a pre-construction survey, a post-construction survey and a revisit survey conducted eight years after construction at the Cableway rehabilitation site. Dam releases of 8.5, 12.7, 19.8, 34.0 and 56.6 cms are held stable on an annual basis to facilitate surveys. This document is intended to provide a timely update from recent results of habitat studies to be utilized by the Trinity River Design Team as well as other workgroups. For a more detailed description of the methods applied see Goodman et al. (2010). Criteria used for rearing habitat surveys are summarized in Tables 1 and 2.

The Cableway rehabilitation site was constructed during the summer of 2008. Post-construction monitoring in 2009 documented increases in total habitat area ranging from 24% to 165% across the range of flows monitored. In addition, increases in optimal habitat area ranged from 404% to 9%, with the largest increase at 11.1 cms, (393 cfs), and the smallest increase at 52.7cms (1860 cfs).

The Cableway site was revisited in 2016 to document changes that have occurred after the post-construction survey. Total rearing habitat area decreased from 13% to 33% across the range of flows monitored, with the largest decreases occurring at 19.7 cms (696 cfs) (Table 3). Optimal rearing habitat decreased, ranging from 60% to 8%, with the largest decrease at 8.2 cms (290 cfs), and the smallest decrease at 58.2 cms (2055 cfs) (Figure 1). This site experiences winter base flows (~8.5 cms, 300 cfs) for much of the critical rearing period due to proximity to the Lewiston dam.

Before construction in 2008, surface flow was not observed entering the side channel until the dam released approximately 19.3 cms (682 cfs). After construction, in 2009, surface flow entered the side channel at all surveyed flows, resulting in gains at 34.5 cms (1218 cfs) and below. The revisit survey documented a decrease in side channel discharge at low flow, decreasing from 1.33 cms (47 cfs) to 0.89 cms (31 cfs) (Table 4), but remains flowing at winter base flow.

In-water escape cover may have been a driving factor in the overall loss of habitat area observed in the revisit survey, with decreases in escape cover shown at all flows, ranging from 56% at 8.2 cms to 16% at 58.2 cms (Table 5). While all habitat categories associated with escape cover (DV, C and No DV, C) decreased, areas of habitat not associated with escape cover increased at and below ~19 cms (Table 3, Figure 2). High flow events between post-construction survey and the revisit survey may have transported mobile escape cover. Other driving factors may include the transportation of bar material from river-left, lowering the water surface elevation and consequentially causing less inundation of the edges as well as some disconnection of the upper extent of the secondary side channel at 8.2 and 11.1

cms (Figures 3-7). In past summaries, an effort has been made to highlight where change has occurred. However, the changes presented in this summary are spread throughout the site; therefore no localized area provides an explanation of habitat changes.

Literature Cited

Goodman, D., Martin, A., Alvarez, J., Davis, A., and Polos, J. 2010. Assessing Trinity River Salmonid habitat at channel rehabilitation sites, 2007-2008. U.S. Fish and Wildlife Service, Arcata Fish and Wildlife Office, Yurok Tribe, and Hoopa Valley Tribe, Arcata, CA.

Table 1. Guilds and their associated habitat criteria for fish habitat mapping as part of the 2015 Trinity River site assessment.

Habitat Guild	Variable	Criteria
Chinook and Coho Salmon fry (<50 mm)	Depth	>0 to 0.61 m
	Mean column velocity	0 to 0.15 m/sec
	Distance to Cover	0 to 0.61 m
	Cover type	No cover, vegetation or wood
Chinook and Coho Salmon presmolt (50 to 100 mm)	Depth	>0 to 1 m
	Mean column velocity	0 to 0.24 m/sec
	Distance to Cover	0 to 0.61 m
	Cover type	No cover, vegetation or wood

Table 2. Mapped habitat categories with four resulting habitat qualities. Chinook and Coho Salmon total habitat was defined as areas that meet any combination of depth/velocity and cover criteria. Optimal Chinook and Coho Salmon habitat were defined as areas that simultaneously meet depth/velocity and cover criteria.

	Depth and Velocity (DV)	**Outside Depth and Velocity (No DV)**
Cover (C)	DV,C – *Optimal habitat	No DV, C – *Suitable habitat
Outside Cover (No C)	DV, No C – *Suitable habitat	No DV, No C – Unsuitable habitat (not reported)

*Total habitat reported includes optimal habitat + all suitable habitats present

Table 3. Habitat conditions at flows from 8.2 to 58.2 cms (290 to 2,055 cfs) pre-construction (A), after construction (B) and an 8 year post construction revisit (C) at Cableway rehabilitation site. Habitat categories correspond to areas (sq. m) meeting the depth/velocity/cover criteria of rearing habitat for Chinook and Coho Salmon fry (<50 mm FL) and presmolt (50 to 100 mm FL). Habitat density is calculated using a site length of 451 meters.

			Habitat Category								
Evaluation Type	**Life Stage**	**Discharge (cms)**	**DV, C**	**DV, No C**	**No DV, C**	**Total Habitat**	**Habitat Density**	**Change Optimal from A**	**Change Total from A**	**Change Optimal from B**	**Change Total from B**
A	Fry	8.6	1010	1351	392	2753	6.10				
		11.1	454	795	581	1829	4.06				
		19.3	1549	2156	500	4205	9.32				
		34.3	2881	413	2150	5443	12.07				
		57.2	5602	279	3902	9783	21.69				
	Presmolt	8.6	1261	2342	141	3744	8.30				
		11.1	547	1399	488	2433	5.39				
		19.3	1753	2923	296	4972	11.03				
		34.3	3767	1007	1264	6037	13.39				
		57.2	6560	457	2944	9962	22.09				
B	Fry	8.6	1731	2193	843	4767	10.57	71%	73%		
		11.1	2288	1404	1157	4849	10.75	404%	165%		
		19.9	3369	1046	2040	6455	14.31	118%	53%		
		34.5	4181	834	3835	8850	19.62	45%	63%		
		52.7	6084	258	5754	12095	26.82	9%	24%		
	Presmolt	8.6	2029	3732	545	6306	13.98	61%	68%		
		11.1	2619	2681	826	6126	13.58	379%	152%		
		19.9	3964	2036	1446	7446	16.51	126%	50%		
		34.5	5382	1677	2634	9693	21.49	43%	61%		
		52.7	7555	480	4282	12317	27.31	15%	24%		
C	Fry	8.2	722	3029	398	4149	9.20	-28%	51%	-58%	-13%
		12.4	1072	2460	522	4054	8.99	136%	122%	-53%	-16%
		19.7	2018	1601	864	4483	9.94	30%	7%	-40%	-31%
		33.6	3056	966	2239	6261	13.88	6%	15%	-27%	-29%
		58.2	5585	78	4396	10059	22.30	0%	3%	-8%	-17%
	Presmolt	8.2	808	4319	313	5440	12.06	-36%	45%	-60%	-14%
		12.4	1165	3386	429	4980	11.04	113%	105%	-56%	-19%
		19.7	2187	2142	695	5024	11.14	25%	1%	-45%	-33%
		33.6	3512	1549	1784	6844	15.18	-7%	13%	-35%	-29%
		58.2	6455	348	3526	10329	22.90	-2%	4%	-15%	-16%

Table 4. Discharge measurements (cms) for the entire site (total discharge) and side channel.

Evaluation	Total Discharge	Side Channel Discharge
Pre-Construction	8.6	n/a
	11.1	n/a
	19.3	n/a
	34.3	n/a
	57.2	n/a
Post-Construction	8.6	1.33
	11.1	2.00
	19.9	3.21
	34.5	5.01
	52.7	7.09
Revisit	8.2	0.89
	11.1	1.83
	19.3	2.14
	34.3	5.33
	58.2	11.78

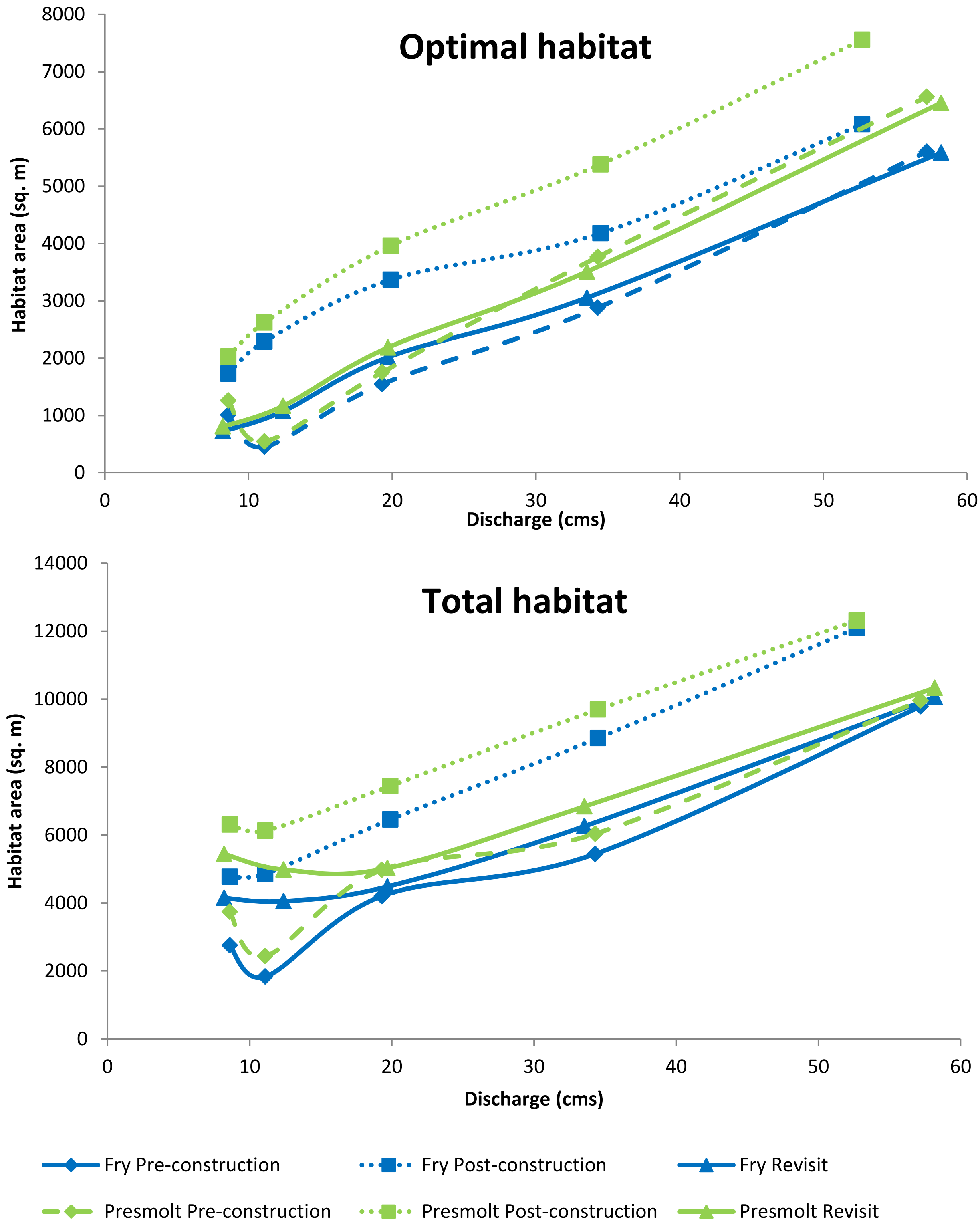

Figure 1. Optimal and total habitat area for Chinook and Coho Salmon fry and presmolt at the Cableway restoration site during pre-construction (2008), post-construction (2009), and revisit (2016). Habitat categories correspond to combinations of depth/velocity (DV) and in-water escape cover (C) criteria.

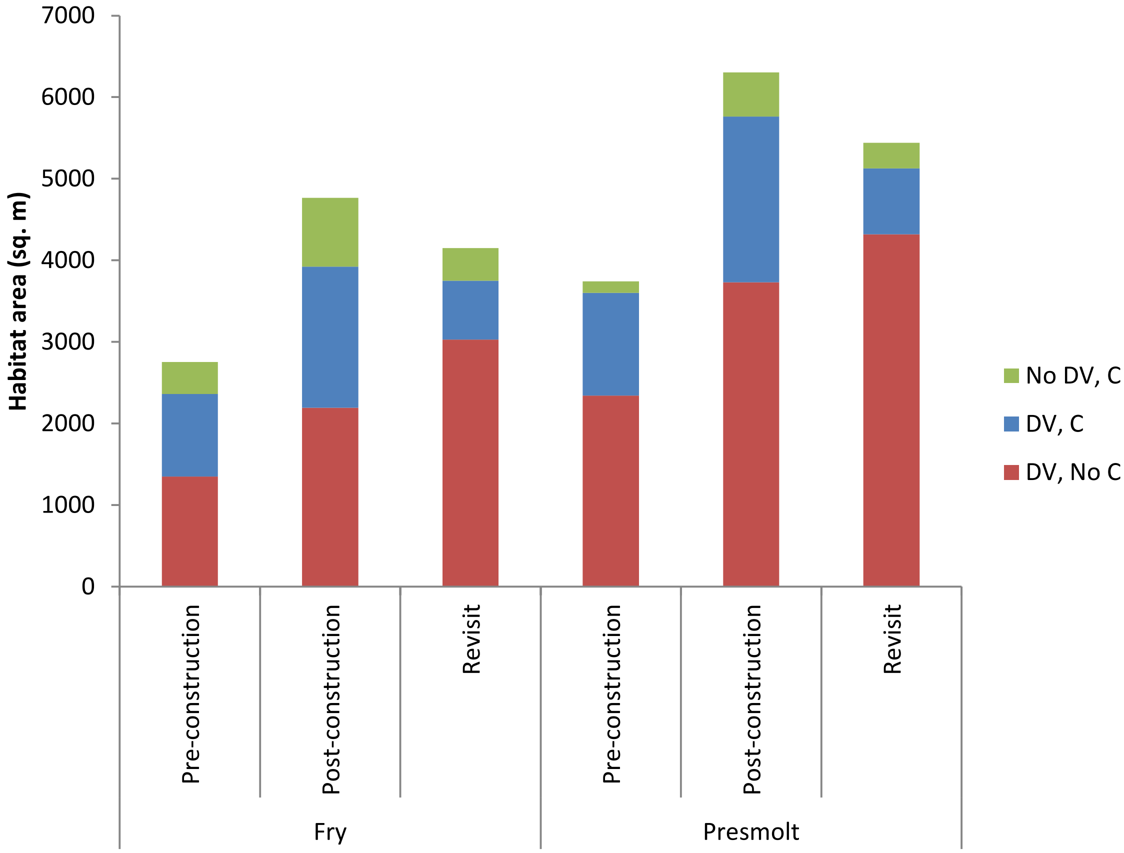

Figure 2. Total area of Chinook and Coho Salmon rearing habitat types at the Cableway restoration site during pre-construction, post-construction, and revisit surveys. Displayed data were collected at approximately 8.5 cms (300 cfs). Habitat categories correspond to combinations of depth/velocity (DV) and in-water escape cover (C) criteria.

Table 5. Total area (sq. m) of Chinook and Coho Salmon in-water escape cover habitat at pre-construction (A), post-construction (B) and an 8 year post construction revisit (C) at Cableway rehabilitation site.

Survey	Flow	Escape cover	% change from A	% change from B
A	8.6	1402		
	11.1	1035		
	19.3	2049		
	34.3	5030		
	57.2	9504		
B	8.6	2574	84%	
	11.1	3445	233%	
	19.9	5410	164%	
	34.5	8016	59%	
	52.7	11837	25%	
C	8.2	1120	-20%	-56%
	12.4	1594	54%	-54%
	19.7	2882	41%	-47%
	33.6	5295	5%	-34%
	58.2	9981	5%	-16%

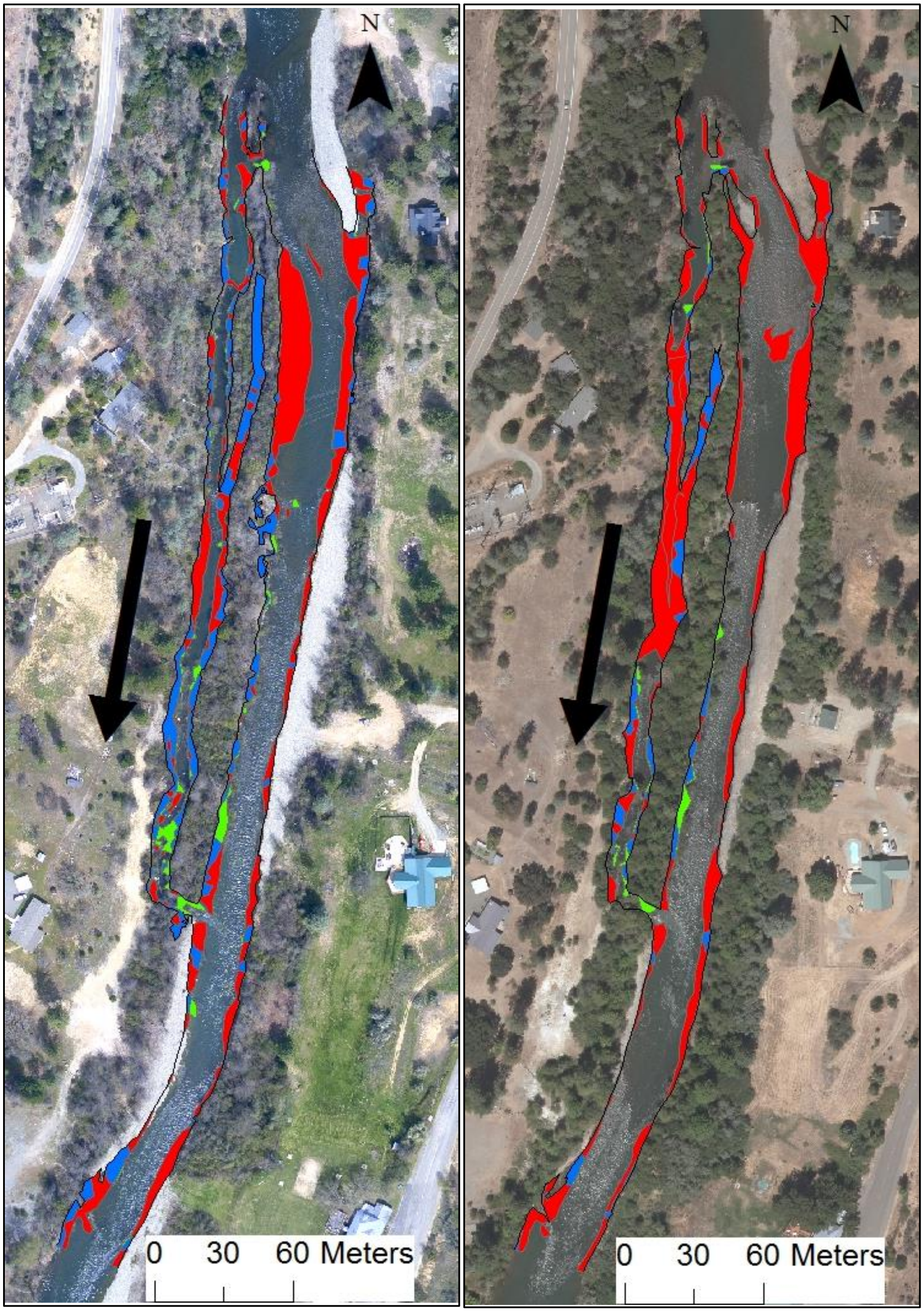

Figure 3. Aerial views of Cableway rehabilitation site post construction (left; 2009) and revisit (right; 2016). Habitat areas were maped at 8.6 and 8.2 cms, respectively. Black lines indicate wetted edge, blue areas indicate optimal presmolt habitat, red and green areas indicate suitable presmolt habitat. The black arrow indicates direction of flow.

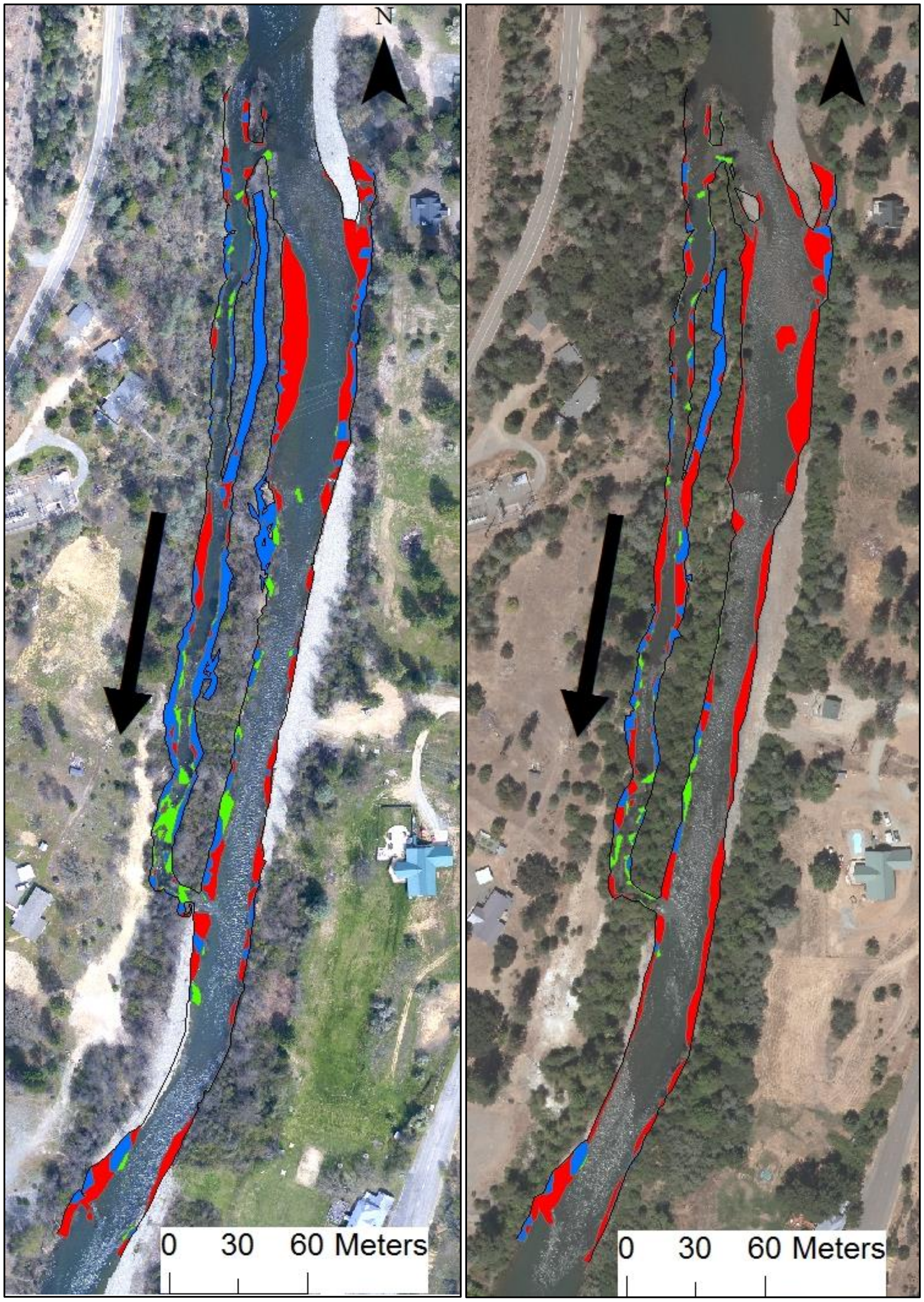

Figure 4. Aerial views of Cableway rehabilitation site post construction (left; 2009) and revisit (right; 2016). Habitat areas were maped at 11.1 cms. Black lines indicate wetted edge, blue areas indicate optimal presmolt habitat, red and green areas indicate suitable presmolt habitat. The black arrow indicates direction of flow.

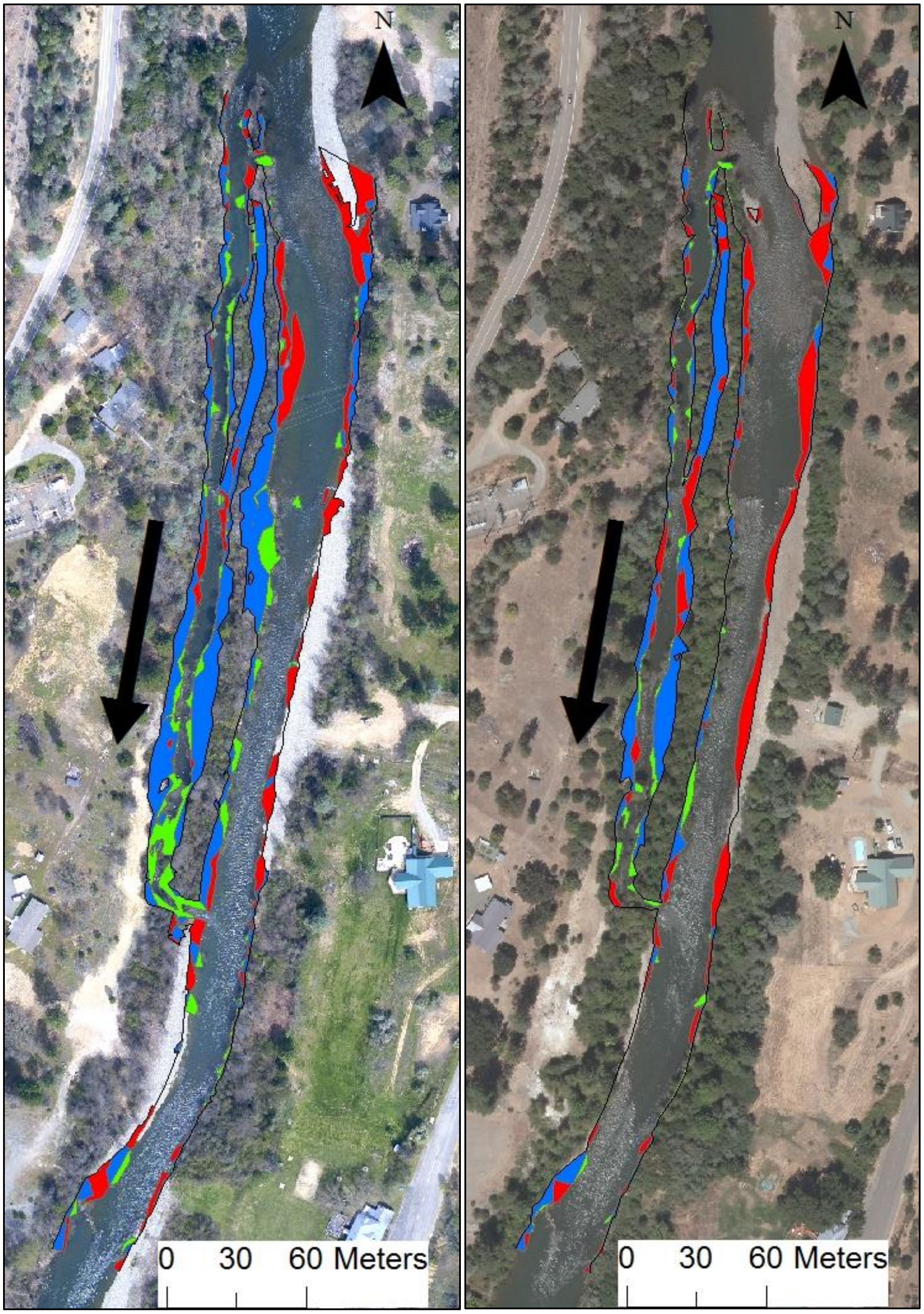

Figure 5. Aerial views of Cableway rehabilitation site post construction (left; 2009) and revisit (right; 2016). Habitat areas were maped at 19.9 and 19.7 cms, respectively. Black lines indicate wetted edge, blue areas indicate optimal presmolt habitat, red and green areas indicate suitable presmolt habitat. The black arrow indicates direction of flow.

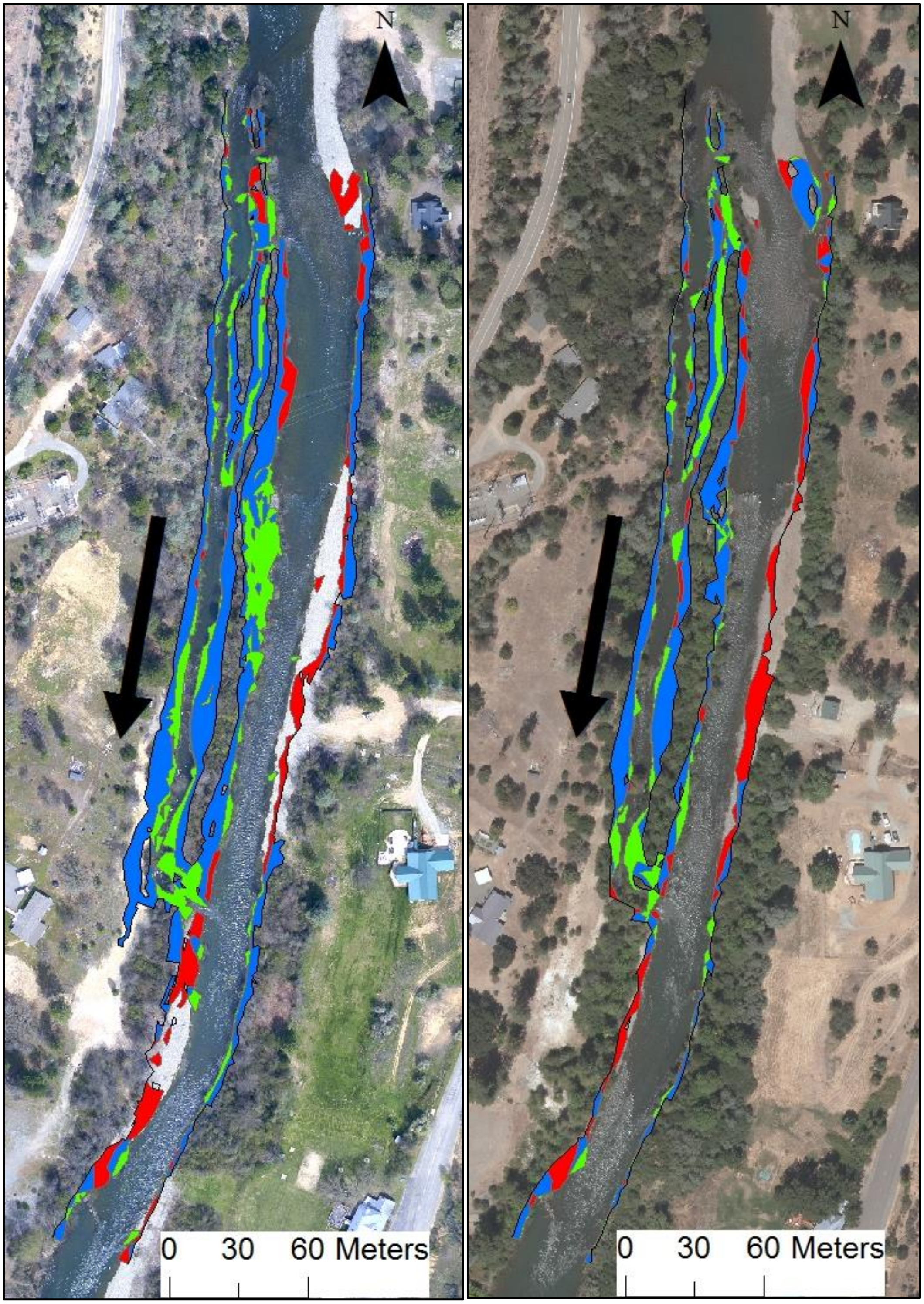

Figure 6. Aerial views of Cableway rehabilitation site post construction (left; 2009) and revisit (right; 2016). Habitat areas were maped at 34.5 and 33.6 cms, respectively. Black lines indicate wetted edge, blue areas indicate optimal presmolt habitat, red and green areas indicate suitable presmolt habitat. The black arrow indicates direction of flow.

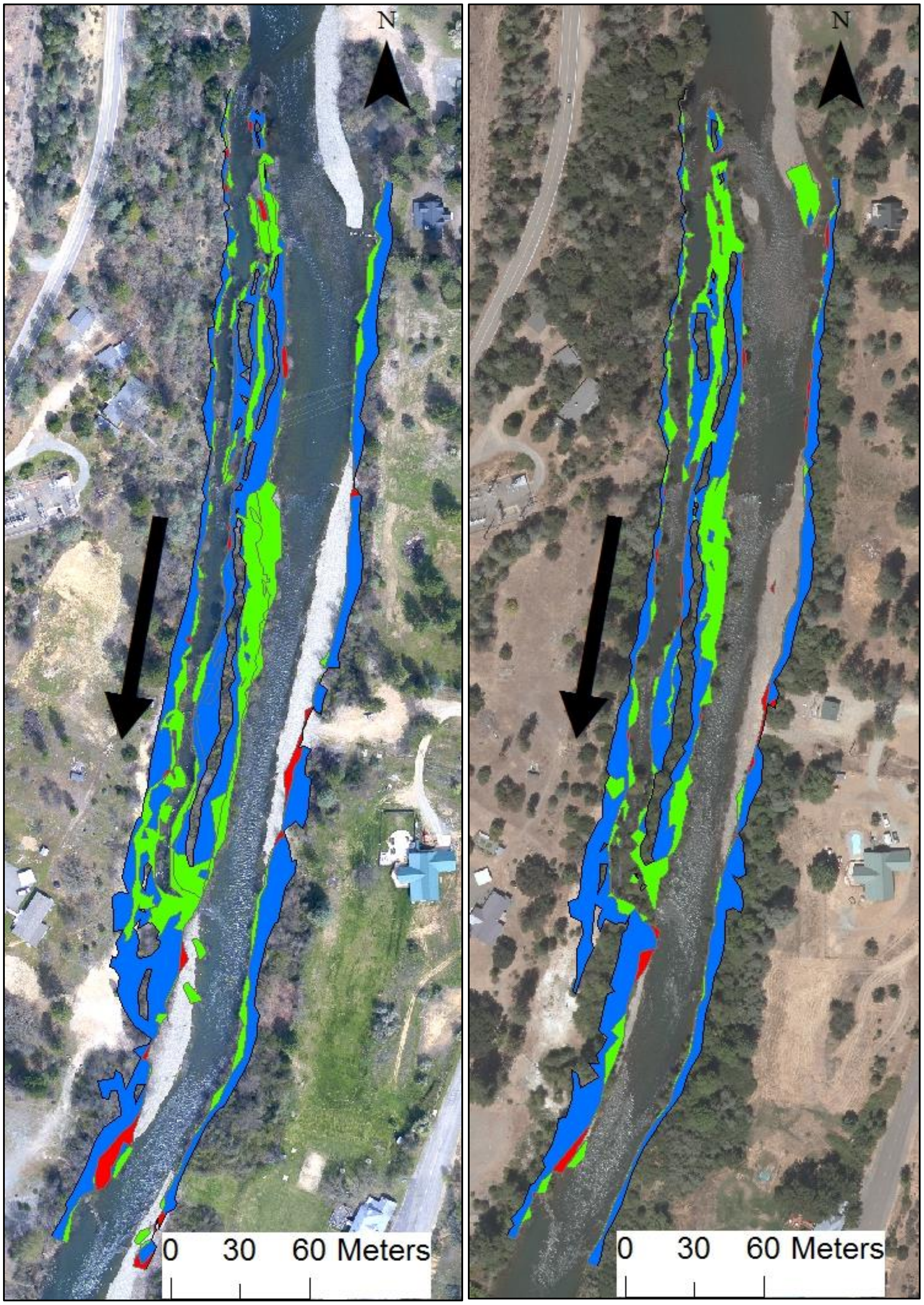

Figure 7. Aerial views of Cableway rehabilitation site post construction (left; 2009) and revisit (right; 2016). Habitat areas were maped at 52.7 and 58.2 cms, respectively. Black lines indicate wetted edge, blue areas indicate optimal presmolt habitat, red and green areas indicate suitable presmolt habitat. The black arrow indicates direction of flow.

Age-0 Chinook and Coho Salmon Rearing Habitat Observations, Upper Douglas City Rehabilitation Site, 2016, Upper Trinity River, CA

Participating Agencies: Hoopa Valley Tribal Fisheries, US Fish and Wildlife Service, and Yurok Tribal Fisheries Program

March 3, 2017

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This document summarizes juvenile salmon rearing habitat present in 2016 at the Upper Douglas City rehabilitation site one year after construction. Rearing habitat was measured at 10.3, 11.5, 20.0, 33.3, and 56.4 cms. A detailed description of the methods used during these surveys can be found in Goodman et al. (2010). The criteria used to evaluate juvenile salmon rearing habitat is summarized in Tables 1 and 2.

Over half of the Upper Douglas City rehabilitation site is superimposed on the Indian Creek Side Channel rehabilitation site, constructed 2009. Prior flow to habitat relationships were documented at Indian Creek Side Channel, but given the difference in boundary extent and depth criteria for presmolt, comparisons are not directly applicable and not presented here. Using prior criteria, which included a 1.52 m depth maximum for presmolt, total habitat densities at Indian Creek Side Channel after construction, in 2009, ranged from 3.61 to 5.47 and 5.48 to 8.89 m^2 habitat/river meter for fry and presmolt, respectively (Goodman et al. 2010). While not directly comparable to the most recent survey, the results are similar enough to confidently infer significant habitat gains as a result of the 2015 construction. The increase in habitat is approximately 68% to 210% for fry depending on flow and 20% to 75% for presmolt.

Optimal habitat area for both fry and presmolt was highest at 10.3 cms. Optimal fry and presmolt habitat area dropped when flows increased to 11.5 cms and again at 20.0 cms. At flows from 20.0-56.4 cms optimal habitat remained relatively steady.

Similarly, total habitat area was highest at 10.3, and dropped as flow increased to 11.5 cms for both fry and presmolt. Fry habitat decreased further at 20.0 cms, slightly increased at 33.3 cms, and then decreased again at 56.4 cms. Presmolt habitat increased from 11.5 to 33.3 cms, then decreased at 56.4 cms (Table 3, Figure 1). The total habitat gain at 33.3 cms resulted from inundation of the high flow side channel at the top of the site on river right, while also maintaining habitat within both alcoves (Figures 2-5). Habitat decreased at 56.6 cms as depths increased in the large alcove on river left, offsetting gains from increased inundation of the banks and high flow side channel (Figure 6).

Side channel discharge measurements were not possible at all surveyed stream flows due to unsafe wading conditions. Additionally, a lack of surface water at measurement location 3 (high flow side channel) was not present under 33.3 cms (Table 4).

Table 1. Guilds and their associated habitat criteria for fish habitat mapping as part of the 2016 Trinity River site assessment.

Habitat Guild	Variable	Criteria
Chinook and Coho Salmon fry (<50 mm)	Depth	>0 to 0.61 m
	Mean column velocity	0 to 0.15 m/sec
	Distance to Cover	0 to 0.61 m
	Cover type	No cover, vegetation or wood
Chinook and Coho Salmon presmolt (50 to 100 mm)	Depth	>0 to 1 m
	Mean column velocity	0 to 0.24 m/sec
	Distance to Cover	0 to 0.61 m
	Cover type	No cover, vegetation or wood

Table 2. Mapped habitat categories with four resulting habitat qualities. Chinook and Coho Salmon total habitat was defined as areas that meet any combination of depth/velocity and cover criteria. Optimal Chinook and Coho Salmon habitat were defined as areas that simultaneously meet depth/velocity and cover criteria.

	Depth and Velocity (DV)	**Outside Depth and Velocity (No DV)**
Cover (C)	DV,C – *Optimal habitat	No DV, C – *Suitable habitat
Outside Cover (No C)	DV, No C – *Suitable habitat	No DV, No C – Unsuitable habitat (not reported)

*Total habitat reported includes optimal habitat + all suitable habitats present

Table 3. Habitat conditions at flows from 10.3 to 56.4 cms after construction at the Upper Douglas City rehabilitation site. Habitat categories correspond to areas (sq. m) meeting the depth/velocity/cover criteria of rearing habitat for Chinook and Coho Salmon fry (<50 mm FL) and presmolt (50 to 100 mm FL). Habitat density is calculated using a site length of 889 meters.

		Habitat category				
Life stage	**Discharge (cms)**	**DV, C**	**DV, No C**	**No DV, C**	**Total habitat**	**Habitat Density**
Fry	10.3	2,739	4,585	865	8,189	9.21
	11.5	2,005	4,808	861	7,674	8.63
	20.0	1,246	4,021	1,595	6,862	7.72
	33.3	1,120	3,119	3,111	7,350	8.27
	56.4	1,397	2,326	3,339	7,062	7.94
Presmolt	10.3	2,995	5,706	609	9,310	10.47
	11.5	2,226	5,743	640	8,609	9.68
	20.0	2,013	5,936	828	8,777	9.87
	33.3	2,047	4,644	2,184	8,875	9.98
	56.4	2,030	3,434	2,707	8,171	9.19

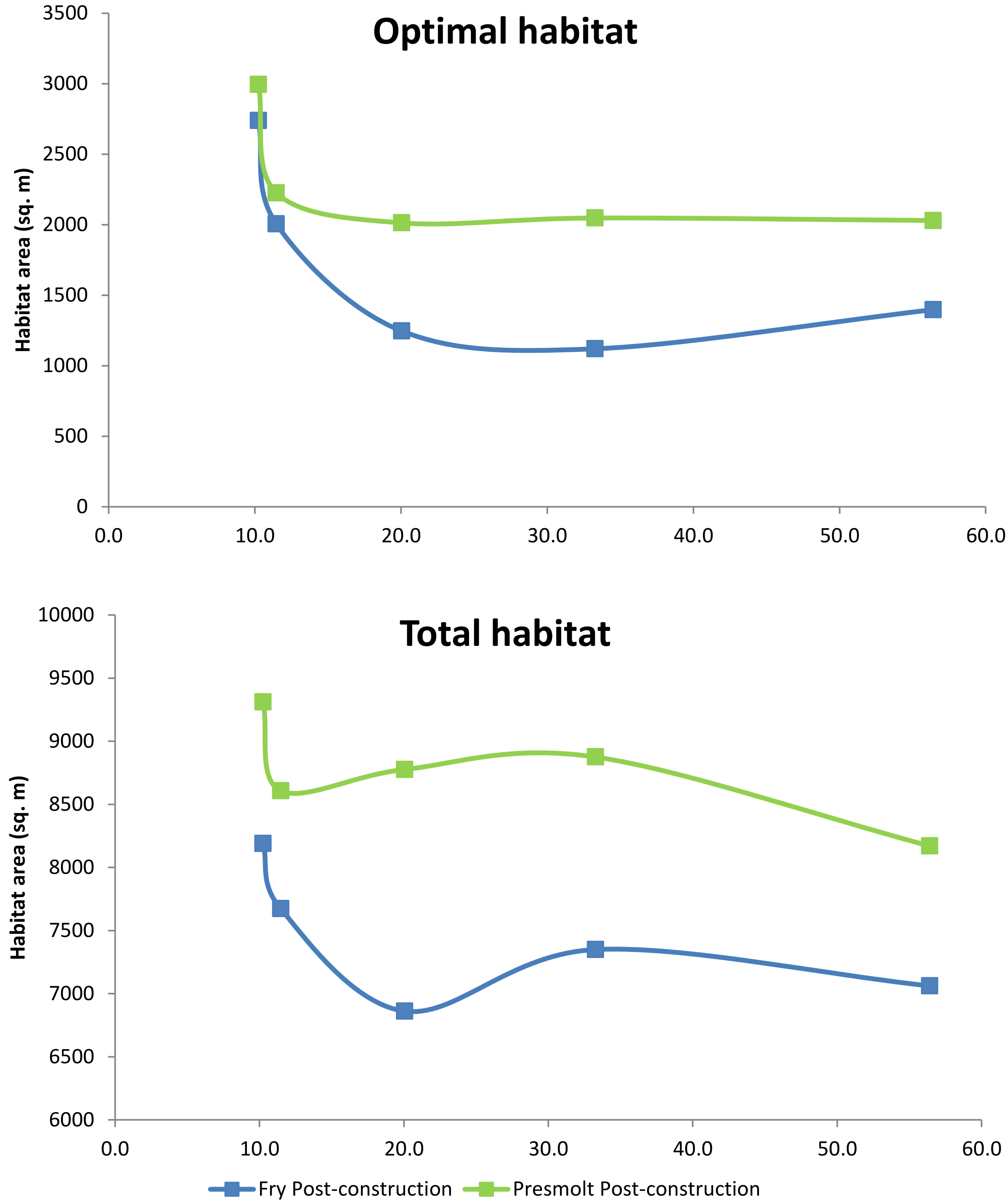

Figure 1. Optimal and total habitat area for Chinook and Coho Salmon fry and presmolt at the Upper Douglas City restoration site one year after construction in 2016. Habitat was measured at 10.3, 11.5, 20.0, 33.3, and 56.4 cms. Habitat categories correspond to combinations of depth/velocity (DV) and in-water escape cover (C) criteria.

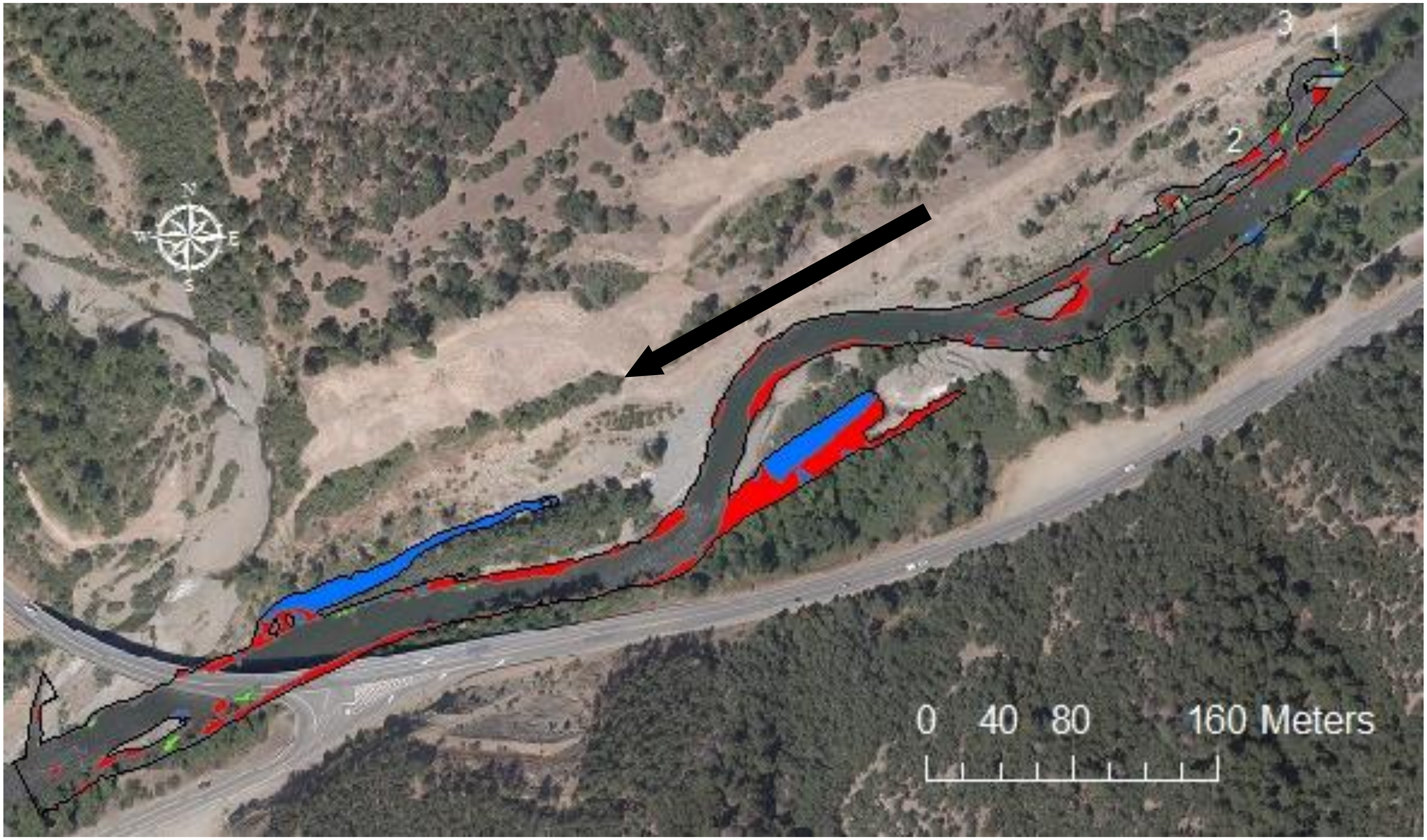

Figure 2. Aerial view of the Upper Douglas City rehabilitation site at 10.3 cms. Black lines indicate wetted edge, blue areas indicate optimal presmolt habitat, red and green areas indicate suitable presmolt habitat. The black arrow indicates direction of flow. White numbers in upper right corner (1-3) indicate side channel discharge measurement locations.

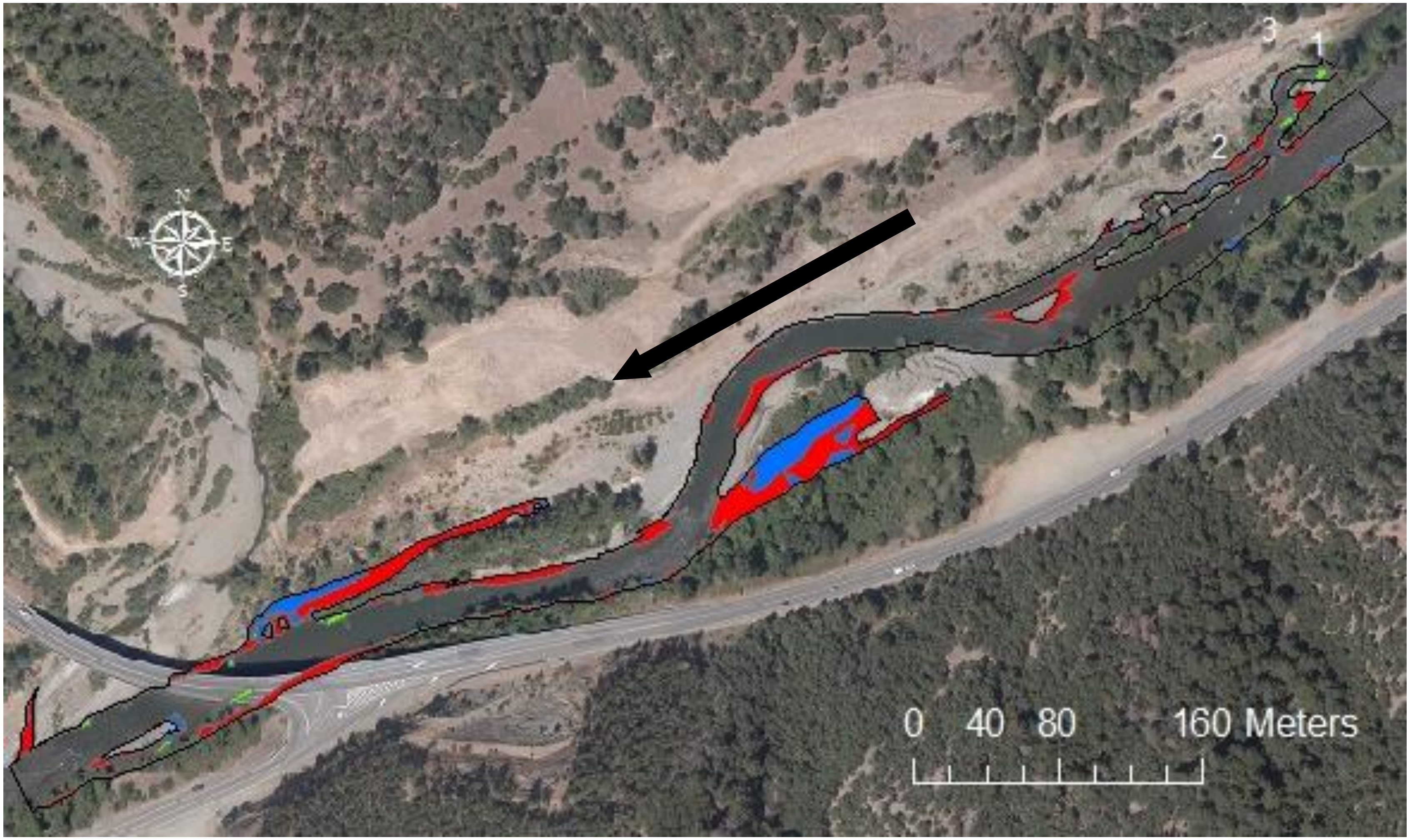

Figure 3. Aerial view of the Upper Douglas City rehabilitation site at 11.5 cms. Black lines indicate wetted edge, blue areas indicate optimal presmolt habitat, red and green areas indicate suitable presmolt habitat. The black arrow indicates direction of flow. White numbers in upper right corner (1-3) indicate side channel discharge measurement locations.

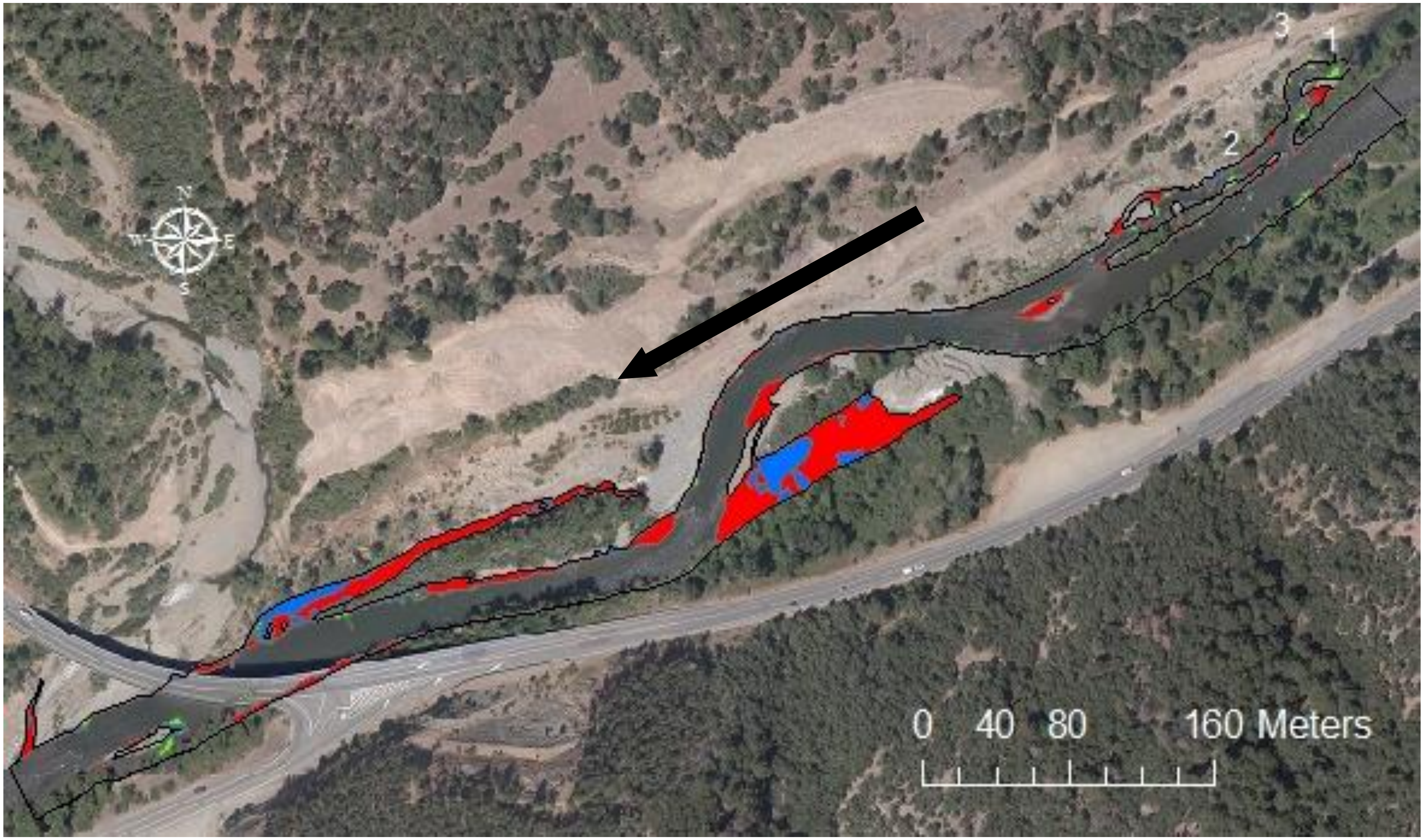

Figure 4. Aerial view of the Upper Douglas City rehabilitation site at 20.0 cms. Black lines indicate wetted edge, blue areas indicate optimal presmolt habitat, red and green areas indicate suitable presmolt habitat. The black arrow indicates direction of flow. White numbers in upper right corner (1-3) indicate side channel discharge measurement locations.

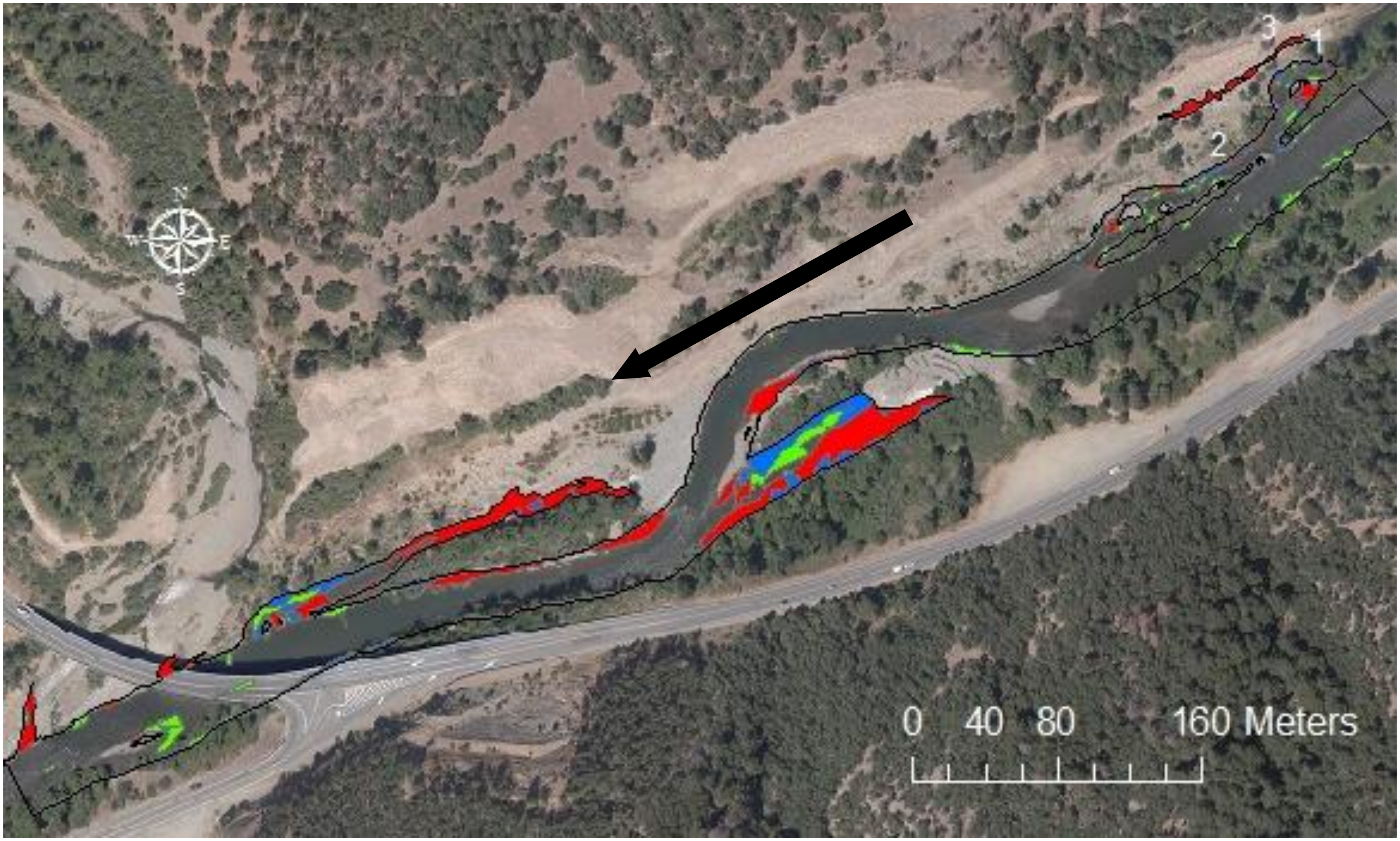

Figure 5. Aerial view of the Upper Douglas City rehabilitation site at 33.3 cms. Black lines indicate wetted edge, blue areas indicate optimal presmolt habitat, red and green areas indicate suitable presmolt habitat. The black arrow indicates direction of flow. White numbers in upper right corner (1-3) indicate side channel discharge measurement locations.

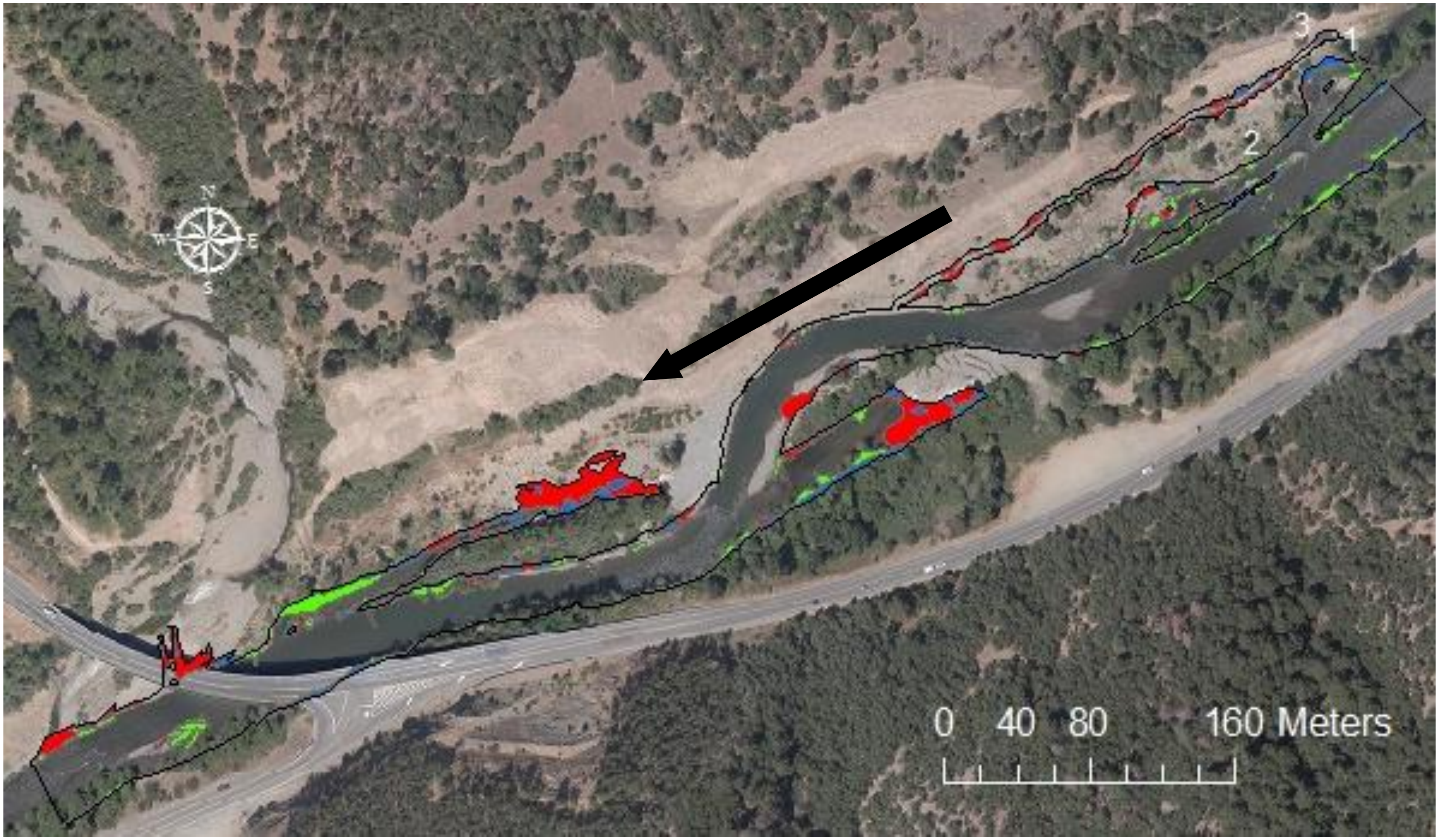

Figure 6. Aerial view of the Upper Douglas City rehabilitation site at 56.4 cms. Black lines indicate wetted edge, blue areas indicate optimal presmolt habitat, red and green areas indicate suitable presmolt habitat. The black arrow indicates direction of flow. White numbers in upper right corner (1-3) indicate side channel discharge measurement locations.

Table 4. Discharge measurements (cms) for the entire site (total discharge) and corresponding side channel discharges.

Total Discharge	Side Channel Discharge 1	Side Channel Discharge 2	Side Channel Discharge 3
10.3	2.0	0.8	NA
11.5	2.3	1.2	NA
20.0	3.7	2.3	NA
33.3	6.4	4.6	0.0
56.4	NA	7.7	0.4

Literature Cited

Goodman, D., Martin, A., Alvarez, J., Davis, A., and Polos, J. 2010. Assessing Trinity River Salmonid habitat at channel rehabilitation sites, 2007-2008. U.S. Fish and Wildlife Service, Arcata Fish and Wildlife Office, Yurok Tribe, and Hoopa Valley Tribe, Arcata, CA.

Long-Term Trend Analysis of the Effects of Restoration on Salmon Rearing Habitat in the Restoration Reach of the Trinity River at Summer Base (12.7 m^3s^{-1}) Streamflow, 2005-2015.

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Abstract.- The Trinity River Restoration Program seeks to enhance the production of naturally spawned salmonids by implementing a suite of restoration actions including streamflow management, gravel augmentation and mechanical channel rehabilitation. Short-term monitoring of select channel rehabilitation sites has documented a direct increase in rearing habitat as a result of channel construction activity; however, a companion study failed to detect substantial improvements between 2009 and 2013 at a 64-km restoration reach scale. Here, we assessed the effect of construction, from 2005-2015, at 13 rehabilitation sites surveyed before and after construction. We also developed a sub-sampling protocol to assess trends in the amount of rearing habitat at a total of 23 rehabilitation sites. All data assessed in this report was collected at a Lewiston dam release of 12.7 m^3s^{-1} and all analyses were applicable to that streamflow. Rearing habitat increased at 12 of 13 sites after construction. One site, Trinity House Gulch, experienced a 23% decrease in optimal presmolt habitat attributable to fluvial processes that occurred before the first post-construction survey. Our sub-sample analysis indicated that the initial benefit from construction was not sustained over longer time periods at many sites. Ten of 19 sites had less total habitat at the most recent survey than they did at the first survey after construction; 1 of those 10, Hocker Flat, had slightly more optimal habitat. The year of construction does not appear to affect the amount of habitat after construction (n=11 sites) or at the most recent survey (n=19 sites). However, six of seven sites had more habitat at the most recent survey than they did at pre-construction. We examined spatiotemporal changes in natural and constructed side channels and alcoves over the same time period to assess the impact these features had on the trends observed at rehabilitation sites. Kaplan-Meier analysis found evidence that natural features have higher survival than constructed features (Log Rank Test; side channels, $p=0.003$; alcoves, $p=0.062$). The information presented in this report is designed to provide feedback on performance of channel rehabilitation sites that can be leveraged to improve future restoration actions as part of an adaptive management process.