

State of California – Natural Resources Agency DEPARTMENT OF FISH AND WILDLIFE Coastal Watershed Planning and Assessment Program 1487 Sandy Prairie Court, Suite A Fortuna, CA 95540



## CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE

### STREAM INVENTORY REPORT

#### **Hely Creek**

#### **INTRODUCTION**

A stream inventory was conducted from September 25 to October 4, 2017 on Hely Creek. The survey began at the confluence with Van Duzen River and extended upstream 1.6 miles.

The Hely Creek inventory was conducted in two parts: habitat inventory and biological inventory. The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Hely Creek. The objective of the biological inventory was to document the presence and distribution of juvenile salmonid species.

The objective of this report is to document the current habitat conditions and recommend options for the potential enhancement of habitat for Chinook and coho salmon, and steelhead trout. Recommendations for habitat improvement activities are based upon target habitat values suitable for salmonids in California's North Coast streams.

#### WATERSHED OVERVIEW

Hely Creek, located in Humboldt County, is a tributary to the Van Duzen River, which is a tributary to the Eel River which drains into Pacific Ocean in northern California (Map 1). Hely Creek's legal description at the confluence with Van Duzen River is T01N R02E S05. Its location is 40.2956.0N° north latitude and 123.5834.0W° west longitude, LLID number 1239760404988. Hely Creek is a second order stream and has approximately 3 miles of blue line stream according to the USGS Owl Creek 7.5 minute quadrangle. Hely Creek drains a watershed of approximately 3.65 square miles. Elevations range from about 215 feet at the mouth of the creek to 1,850 feet in the headwater areas (average elevation of headwaters, not highest point). Redwood and Douglas fir forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production. Vehicle access exists via Highway 101 south of Fortuna to Highway 36 east; proceed about 11.5 miles east and turn left onto Redwood House Road.

#### **METHODS**

The habitat inventory conducted in Hely Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The Watershed Stewards Program (WSP) members and California Department of Fish and Wildlife (CDFW) personnel that conducted the inventory were trained in standardized habitat inventory methods by CDFW. This inventory was conducted by a two-person team.

## SAMPLING STRATEGY

The inventory uses a method that samples approximately 10% of the habitat units within the survey reach. All habitat units included in the survey are classified according to habitat type and their lengths are measured. All pool units are measured for maximum depth, depth of pool tail crest (measured in the thalweg), dominant substrate composing the pool tail crest, and embeddedness. Habitat unit types encountered for the first time are measured for all the parameters and characteristics on the field form. Additionally, from the ten habitat units on each field form page, one is randomly selected for complete measurement. Surveyors also take photos to document general habitat conditions (Appendix II).

### HABITAT INVENTORY COMPONENTS

A standardized habitat inventory form has been developed for use in California stream surveys and can be found in the *California Salmonid Stream Habitat Restoration Manual*. This form was used in Hely Creek to record measurements and observations. There are eleven components to the inventory form.

1. Flow:

Flow is measured in cubic feet per second (cfs) near the bottom of the stream survey reach using a Marsh-McBirney Model 2000 flow meter.

2. Channel Type:

Channel typing is conducted according to the classification system developed and revised by David Rosgen (1994). This methodology is described in the *California Salmonid Stream Habitat Restoration Manual*. Channel typing is conducted simultaneously with habitat typing and follows a standard form to record measurements and observations. There are five measured parameters used to determine channel type: 1) water slope gradient, 2) entrenchment, 3) width/depth ratio, 4) substrate composition, and 5) sinuosity. Channel characteristics are measured using a hand level, hip chain, tape measure, and a stadia rod.

3. Temperatures:

Water and air temperatures are measured and recorded at every tenth habitat unit using a handheld thermometer. Both temperatures are taken in degrees (°) Fahrenheit and the time of the measurement is also recorded. Air temperatures are recorded within one foot of the water surface, while water temperatures are recorded (where possible) in flowing water within the habitat unit.

4. Habitat Type:

Habitat typing uses the 24 habitat classification types defined by McCain and others (1990). Habitat units are numbered sequentially and assigned a type identification number selected from a standard list of 24 habitat types. Dewatered units are labeled "dry". Hely Creek habitat typing used standard basin level measurement criteria. These parameters require that the minimum length of a described habitat unit must be equal to or greater than the stream's mean wetted width. All measurements are in feet to the nearest tenth. Habitat characteristics are measured

using a clinometer, hip chain, and stadia rod.

5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out areas is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Hely Creek, embeddedness was ocularly estimated. The values were recorded using the following ranges: 0 - 25% (value 1), 26 - 50% (value 2), 51 - 75% (value 3) and 76 - 100% (value 4). Additionally, a value of 5 was assigned to tail-outs deemed unsuitable for spawning due to inappropriate substrate like bedrock, log sills, boulders or other considerations.

6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide juvenile salmonids protection from predation, reduce water velocities so fish can rest and conserve energy, and allow separation of territorial units to reduce density related competition for prey. Using an overhead view, a quantitative estimate of the percentage of the habitat unit covered is made. All cover is then classified according to a list of nine cover types. In Hely Creek, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the cover. The shelter rating is then calculated by multiplying the qualitative shelter value by the percent of the unit covered. Thus, shelter ratings can range from 0-300 and are expressed as mean values by habitat types within a stream.

7. Substrate Composition:

Substrate composition ranges from silt/clay sized particles to boulders and bedrock elements. In all fully-described habitat units, dominant and sub-dominant substrate elements were ocularly estimated using a list of seven size classes and recorded as a one and two, respectively. In addition, the dominant substrate composing the pool tail-outs is recorded for each pool.

8. Canopy:

Stream canopy density was estimated using modified handheld spherical densiometers as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Hely Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the center of approximately every third unit in addition to every fully-described unit, giving an approximate 30% sub-sample. In addition, the area of canopy was estimated ocularly into percentages of coniferous or hardwood trees.

## 9. Bank Composition and Vegetation:

Bank composition elements range from bedrock to bare soil. However, the stream banks are usually covered with grass, brush, or trees. These factors influence the ability of stream banks to withstand winter flows. In Hely Creek, the dominant composition type and the dominant vegetation type of both the right and left banks for each fully-described unit were selected from the habitat inventory form. Additionally, the percent of each bank covered by vegetation (including downed trees, logs, and rootwads) was estimated and recorded.

## 10. Large Woody Debris Count:

Large woody debris (LWD) is an important component of fish habitat and an element in channel forming processes. In each habitat unit all pieces of LWD partially or entirely below the elevation of bankfull discharge are counted and recorded. The minimum size to be considered is twelve inches in diameter and six feet in length. The LWD count is presented by reach and is expressed as an average per 100 feet.

## 11. Average Bankfull Width:

Bankfull width can vary greatly in the course of a channel type stream reach. This is especially true in very long reaches. Bankfull width can be a factor in habitat components like canopy density, water temperature, and pool depths. Frequent measurements taken at riffle crests (velocity crossovers) are needed to accurately describe reach widths. At the first appropriate velocity crossover that occurs after the beginning of a new stream survey page (ten habitat units), bankfull width is measured and recorded in the appropriate header block of the page. These widths are presented as an average for the channel type reach.

### **BIOLOGICAL INVENTORY**

Biological sampling during the stream inventory is used to determine fish species and their distribution in the stream. Fish presence was observed from the stream banks in Hely Creek. In addition, underwater mask and snorkel observations were made at 15 sites using techniques discussed in the *California Salmonid Stream Habitat Restoration Manual*.

## DATA ANALYSIS

Data from the habitat inventory form are entered into Stream Habitat 2.0.18, a Visual Basic data entry program developed by Karen Wilson, Pacific States Marine Fisheries Commission in conjunction with the California Department of Fish and Wildlife. This program processes and summarizes the data, and produces the following ten tables:

- Riffle, Flatwater, and Pool Habitat Types
- Habitat Types and Measured Parameters
- Pool Types
- Maximum Residual Pool Depths by Habitat Types
- Mean Percent Cover by Habitat Type
- Dominant Substrates by Habitat Type
- Mean Percent Vegetative Cover for Entire Stream
- Fish Habitat Inventory Data Summary by Stream Reach (Table 8)
- Mean Percent Dominant Substrate / Dominant Vegetation Type for Entire Stream
- Mean Percent Shelter Cover Types for Entire Stream

Graphics are produced from the tables using Microsoft Excel. Graphics developed for Hely Creek include:

- Riffle, Flatwater, Pool Habitat Types by Percent Occurrence
- Riffle, Flatwater, Pool Habitat Types by Total Length
- Total Habitat Types by Percent Occurrence

- Pool Types by Percent Occurrence
- Maximum Residual Depth in Pools
- Percent Embeddedness
- Mean Percent Cover Types in Pools
- Substrate Composition in Pool Tail-outs
- Mean Percent Canopy
- Dominant Bank Composition by Composition Type
- Dominant Bank Vegetation by Vegetation Type

## HABITAT INVENTORY RESULTS

\* ALL TABLES AND GRAPHS ARE LOCATED IN APPENDIX I \*

The habitat inventory of September 25 to October 4, 2017, was conducted by Ryan Bernstein, and Kori Roberts (CDFW). The total length of the stream surveyed was 8,626 feet.

Stream flow measurement of 1.4 cfs was recorded on October 9, 2017 near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter.

Hely Creek is a F4 channel type for 7,595 feet of the stream surveyed (Reach 1), a A6 channel type for 1,031 feet of the stream surveyed (Reach 2), F4 channel types are entrenched meandering riffle/pool channels on low gradients with high width/depth ratios, very stable with gravel-dominant substrates. A6 channels are steep, narrow, cascading, step-pool, high energy debris transporting channels associated with depositional soils and silt/clay-dominant substrates.

Water temperatures taken during the survey period ranged from  $50^{\circ}$  to  $56^{\circ}$  Fahrenheit. Air temperatures ranged from  $54^{\circ}$  to  $66^{\circ}$  Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 34% riffle units, 33% flatwater units, and 33% pool units, (Graph 1). Based on total length of Level II habitat types there were 48% flatwater units, 28% riffle units, 23% pool units (Graph 2).

Six Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were low gradient riffle units, 34%; mid-channel pool units, 31%; and run units, 29% (Graph 3). Based on percent total length, run units made up 37%, low gradient riffle units 28%, and mid-channel pool unit 22%.

A total of 79 pools were identified (Table 3). Main channel pools were the most frequently encountered at 95% (Graph 4), and comprised 96% of the total length of all pools (Table 3).

Table 4 is a summary of maximum residual pool depths by pool habitat types. Pool quality for salmonids increases with depth. Fifteen of the 79 pools (19%) had a residual depth of two feet or greater (Graph 5

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 79 pool tail-outs measured, 7 had a value of 1 ((8.9%)); 17 had a value of 2 ((21.5%)); 41 had a value of 3 ((51.9%)); 8 had a value of 4 ((10.1%)); 6 had a value of 5 ((7.6%)); (Graph 6). On this scale, a value of 1

indicates the highest quality of spawning substrate. Additionally, a value of 5 was assigned to tail-outs deemed unsuitable for spawning due to inappropriate substrate such as bedrock, log sills, boulders, or other considerations

A shelter rating was calculated for each habitat unit and expressed as a mean value for each habitat type within the survey using a scale of 0-300. Riffle habitat types had a mean shelter rating of 4, flatwater habitat types had a mean shelter rating of 23, and pool habitats had a mean shelter rating of 31 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating of 76. Main channel pools had a mean shelter rating of 29 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Small Woody Debris is the dominant cover type in Hely Creek. Graph 7 describes the pool cover in Hely Creek. Small woody debris is the dominant pool cover type followed by undercut banks.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Gravel was the dominant substrate observed in 78% of the pool tail-outs. Boulders were the next most frequent observed dominate substrate type and occurred in 6% of the pool tail-outs.

The mean percent canopy density for the surveyed length of Hely Creek was 97. Three percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 74% and 26%, respectively. Graph 9 describes the mean percent canopy in Hely Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 100%. The mean percent left bank vegetated was 100%. The dominant elements composing the structure of the stream banks consisted of 95% sand/silt/clay, 4% bedrock, and 1% boulders (Graph 10). Hardwood trees were the dominant vegetation type observed in 71.5% of the units surveyed. Additionally, 25.1% of the units surveyed had coniferous trees as the dominant vegetation type.

## BIOLOGICAL INVENTORY RESULTS

Survey teams conducted a mask and snorkel survey at 15 sites for species composition and distribution in Hely Creek on October 5, 2017 (Table A). The sites were sampled by Ryan Bernstein (CDFW) and Kori Roberts (CDFW).

In Reach 1, which comprised the first 7,595 feet of stream, 12 sites were sampled. The reach sites yielded 5 young-of-the-year (YOY) coho salmon, 166 YOY steelhead trout (SH), 7 age 1+ SH, 4 age 2+ SH, and 2 Sacramento pikeminnow (SPM).

In Reach 2, 3 sites were sampled starting approximately 6,932 feet from the confluence with the Van Duzen River and continuing upstream 1,619 feet. The reach sites yielded 4 young-of-the-year (YOY).

During the survey, the upstream-most observation of coho salmon occurred at 40.50417° north latitude, -123.97145° west longitude, approximately 2,878 feet upstream from the confluence with the Van Duzen River (Map 1). Steelhead YOY were observed throughout the reach up to the last pool surveyed 8,591 feet upstream of the confluence of the Van Duzen River.

Date	Survey	Habitat	Habitat	Approx. Dist. from	Steell	nead Ti	rout	Coh Salm	io ion	Additional Aquatic Species
	Site #	Unit #	Туре	mouth (ft.)	YOY	1+	2+	YOY	1+	Observed
Reach 1: F	4 Channel	Туре								
10/05/17	1	15	Pool	552	20	4	1	0	0	
	2	19	Pool	668	3	0	0	5	0	
	3	30	Pool	984	30	0	0	0	0	
	4	34	Pool	1,026	5	0	0	0	0	
	5	36	Pool	1,058	2	1	1	0	0	
	6	42	Pool	1,266	0	0	0	0	0	
	7	48	Pool	1,545	20	2	1	0	0	
	8	61	Pool	2,238	13	0	0	0	0	
	9	66	Pool	2,449	7	0	0	0	0	
	10	75	Pool	2,810	20	2	2	0	0	
	11	77	Pool	2,843	40	0	0	0	0	2 SPM
	12	79	Pool	2,900	6	0	0	0	0	
Reach 2: A	6 Channel	Туре								
10/05/17	13	202	Pool	6,932	2	0	0	0	0	
	14	237	Pool	8,426	1	0	0	0	0	
	15	239	Pool	8,551	1	0	0	0	0	

Table A. Summary of results for a fish composition and distribution survey within Hely Creek, October 5, 2017.

Species abbreviations: SPM = Sacramento pikeminnow

### DISCUSSION

Hely Creek is a F4 channel type for the first 7,595 feet of stream surveyed, and an A6 channel type for the next 1,031 feet. The suitability of F4 and A6 channel types for fish habitat improvement structures is as follows: F4 channels are good for bank-placed boulders and fair for plunge weirs, single and opposing wing-deflectors, channel constrictors, and log cover. A6 channels are generally not suitable for fish habitat improvement projects.

The water temperatures recorded on the survey days September 25 to October 4, 2017, ranged from 50  $^{\circ}$  to 56  $^{\circ}$  Fahrenheit. Air temperatures ranged from 54 $^{\circ}$  to 66 $^{\circ}$  Fahrenheit. This is a suitable water temperature range for salmonids. To make any further conclusions, temperatures need to be monitored throughout the warm summer months, and more extensive biological sampling needs to be conducted.

Flatwater habitat types comprised 48% of the total length of this survey, riffles 28%, and pools 31%. 15 of the 79 (19%) pools had a maximum residual depth greater than 2 feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In first and second order streams, a primary pool is defined to

have a maximum residual depth of at least two feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width. Installing structures that will increase or deepen pool habitat is recommended.

Twenty-four of the 79 pool tail-outs measured had embeddedness ratings of 1 or 2. 49 of the pool tail-outs had embeddedness ratings of 3 or 4. 6 of the pool tail-outs had a rating of 5, which is considered unsuitable for spawning. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead. Sediment sources in Hely Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Sixty-four of the 79 pool tail-outs measured had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean shelter rating for pools is 31. The shelter rating in the flatwater habitats is 23. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by small woody debris in Hely Creek. Small woody debris is the dominant cover type in pools followed by undercut banks. Log and rootwad cover structures in the pool and flatwater habitats would enhance both summer and winter salmonid habitat. Log cover structure provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

The mean percent canopy density for the stream was 97%. Reach 1 had a canopy density of 96.3%, Reach 2 had a canopy density of 99%, in general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 100%. In areas of stream bank erosion or where bank vegetation is sparse, planting endemic species of coniferous and hardwood trees, in conjunction with bank stabilization, is recommended.

### RECOMMENDATIONS

Hely Creek should be managed as an anadromous, natural production stream. Recommendations for potential habitat improvement activities are based on target habitat values suitable for salmonids in California's north coast streams. Considering the results from this stream habitat inventory, factors that affect salmonid productivity and CDFW's professional judgment, the following list prioritizes habitat improvement activities in Hely Creek. Keep in mind, watershed and stream ecosystem processes, land use alterations, changes in land ownership, and other factors could potentially change the order of these recommendations or create the need to remove/add recommendations in the future.

- 1) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover in the pools is from Small Woody Debris. Adding high quality complexity with woody cover in the pools is desirable.
- 3) Inventory and map sources of stream bank erosion and prioritize them according to present and potential sediment yield. Identified sites should then be treated to reduce the amount of fine sediments entering the stream.

- 4) Active and potential sediment sources related to the road system need to be identified, mapped, and treated according to their potential for sediment yield to the stream and its tributaries.
- 5) Suitable size spawning substrate on Hely Creek is limited to relatively few reaches. Projects should be designed at suitable sites to trap and sort spawning gravel.
- 7) Where feasible, design and engineer pool enhancement structures to increase the number of pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.
- 8) There are several log debris accumulations present on Hely Creek that are retaining large quantities of fine sediment. The modification of these debris accumulations is desirable, but must be done carefully, over time, to avoid excessive sediment loading in downstream reaches.

#### COMMENTS AND LANDMARKS

The following landmarks and possible problem sites were noted. All distances are approximate and taken from the beginning of the survey reach.

Position (ft):	Habitat unit #:	Comments:
0	0001.00	Start of survey at the confluence with the Van Duzen River.
464	0011.00	The creek is out of the influence of the confluence with Van Duzen River.
551	0015.00	Bridge #1 is the crossing for Hwy36, and is a Road Crossing high 34' wide x 14.5' long. It is an automobile bridge made of cement and is/is not a barrier to salmonids. With artwork underneath bridge.
599	0017.00	Rip rap on banks.
1634	0050.00	Downed trees in creek.
2389	0065.00	Large debris accumulation (LDA) #1 is 7' high, 22' wide, 17' long and contains 4 pieces of large woody debris (LWD). Water flows through the LDA and there are visible gaps in it. Sediment is being retained in the approximate dimensions of 12' wide, 11' long and 2 ' deep. The sediment ranges in size from silt to sand. The LDA is not a possible barrier to salmonids as Fish were observed above the LDA.
2972	0082.00	LDA #2 is 9' high, 12' wide, 12' long and contains 1 piece of LWD. Water flows through the LDA and there are visible gaps in it. Sediment is being retained in the approximate dimensions of 12' wide, 10' long

and 2' deep. The sediment ranges in size from silt to sand. The LDA is not a possible barrier to salmonids as fish were observed above the LDA.

- 3012 0085.00 LDA #3 is 5' high, 11' wide, 18' long and contains 6 pieces of LWD. Water flows through the LDA and there are visible gaps in it. Sediment is being retained in the approximate dimensions of 11' wide, 4' long and 1' deep. Gravel sediment is present. The LDA is not a possible barrier to salmonids as fish were observed above the LDA.
- 3137 0089.00 LDA #4 is 6' high, 38' wide, 26' long and contains 6 pieces of LWD. Water flows through the LDA and there are visible gaps in it. Sediment is being retained in the approximate dimensions of 11' wide, 4' long and 1' deep. Sediment ranges in size from silt to gravel. The LDA is not a possible barrier to salmonids as fish were observed above the LDA.
- 3339 0095.00 LDA #5 is 21' high, 24' wide, 24' long and contains 4 pieces of LWD. Water flows through the LDA and there are visible gaps in it. Sediment is being retained. The sediment contains gravel. The LDA is not a possible barrier to salmonids as fish were observed above the LDA. Five-foot plunge over wood into three-foot pool after LDA.
- 3486 0099.00 +1 observed.
- 3657 0104.00 Landslide on left bank 40' long. Trees down in creek.
- 3725 0107.00 One-foot plunge over wood into two-foot pool.
- 4235 0125.00 LDA #7 is 8' high, 20' wide, 20' long and contains 5 pieces of LWD. Water flows through the LDA and there are visible gaps in it. Sediment is being retained in the approximate dimensions of 17' wide x 15' long x 1' deep. The sediment ranges in size from silt to clay. The LDA is not a possible barrier to salmonids as fish were observed above the LDA.
- 4485 0135.00 Channel change gravel to wider channel.
- 5011 0148.00 LDA #8 is 10' high x 31' wide x 50' long and contains 10 pieces of LWD. Water flows through the LDA and there are visible gaps in it. Sediment is being retained in the approximate dimensions of 31' wide, 12' long and 4' deep. The sediment ranges in size from silt to clay. The LDA is not a possible barrier to salmonids but no fish were observed above the LDA.

- 5344 0160.00 LDA #9 is 6.5' high, 28' wide, 32' long and contains 7 pieces of LWD. Water flows through the LDA and there are visible gaps in it. Sediment is being retained in the approximate dimensions of 20' wide, 20' long and 4' deep. The sediment ranges in size from silt to gravel. The LDA is not a possible barrier to salmonids as fish were above the LDA. This could be a possible barrier during low flows.
- 5487 0165.00 Landslide on left bank 30 x 30 active gravel and silt.
- 5855 0175.00 YOY observed.
- 6243 0187.00 Three foot drop over wood into 3.4 foot pool.
- 6296 0189.00 LDA #10 is 8' high, 15' wide, 50' long and contains 8 pieces of LWD. Water flows through the LDA and there are visible gaps in it. Sediment is being retained in the approximate dimensions of 12' wide, 5' long and 2' deep. The sediment ranges in size from silt to gravel. The LDA is not a possible barrier to salmonids.
- 6675 0200.00 Canopy 3X per page.
- 6920 0202.00 YOY observed just below L.B. Trib. #1.
- 6946 0203.00 Tributary #1 enters on the left bank. It contributes to approximately 25% of Hely Creek's flow. The water temperature of the tributary was 53° Fahrenheit, the water temperature downstream of the confluence was 52° Fahrenheit, and the water temperature upstream of the confluence was 51° Fahrenheit. The slope of the tributary is 3%. The tributary may not be accessible to salmonids due to as no fish were observed in the tributary.
- 7313 0214.00 Tributary #2 enters on the Right bank. It contributes to approximately 40% of Hely Creek's flow. The water temperature of the tributary was 54° Fahrenheit, the water temperature downstream of the confluence was 54° Fahrenheit, and the water temperature upstream of the confluence was 53° Fahrenheit. The slope of the tributary is 1%. The tributary may not be accessible to salmonids as fish were not observed in the tributary.
- 7595 0221.00 LDA #11 is 8' high, 18' wide, 177' long and contains 7 pieces of LWD. Water flows through the LDA and there are visible gaps in it. Sediment is being retained in the approximate dimensions of 12' wide, 10' long and 4' deep. The sediment ranges in size from silt to gravel. The LDA is a possible barrier to salmonids as fish were not observed above the LDA.

- 7901 0225.00 Bedrock and canyon wall on left bank.
- 7933 0226.00 Bedrock and canyon wall on left bank.
- 7960 0227.00 Bedrock and canyon wall on left bank.
- 8120 0233.00 1.5' plunge over wood into 1.8' pool.
- 8132 0234.00 LDA #12 is 8' high, 36' wide, 85' long and contains 6 pieces of LWD. Water flows through the LDA and there are visible gaps in it. Sediment is being retained in the approximate dimensions of 18' wide, 24' long and 2' deep. The sediment ranges in size from silt to gravel. The LDA is a possible barrier to salmonids as no fish were observed above the LDA.
- 8242 0235.00 Tributary #3 enters on the Left bank. It contributes to approximately 40% of Hely Creek's flow. The water temperature of the tributary was 53° Fahrenheit, the water temperature downstream of the confluence was 53° Fahrenheit, and the water temperature upstream of the confluence was 53° Fahrenheit. The slope of the tributary is 1%. The tributary may not be accessible to salmonids as fish were not observed in the tributary.
- 8414 0237.00 Three YOY observed.
- 8539 0239.00 YOY observed.
- 8579 0240.00 End of survey for Hely creek at Hab. Unit #240. Survey ended at 8,638 feet or 1.6 miles. Ended because it was taking surveyor two hours to hike in to where we left off. There was not a road, thus the hike was a hard two hour through an overgrown, silty bottom, highly erosive creek. Steelhead were seen all the way to the last pool, which was in a few units below where survey ended. The creek was flowing fast from the mouth to the end of the survey. Overall the creek was entrenched, full of silt, and highly erosive.

## **REFERENCES**

Flosi, G., Downie, S., Hopelain, J., Bird, M., Coey, R., and Collins, B. 1998. *California Salmonid Stream Habitat Restoration Manual*, 3rd edition. California Department of Fish and Game, Sacramento, California.

## **REPORT CONTACT INFORMATION**

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## LEVEL III and LEVEL IV HABITAT TYPES

RIFFLE Low Gradient Riffle High Gradient Riffle	(LGR) (HGR)	[1.1] [1.2]	$\left\{\begin{array}{c}1\\2\end{array}\right\}$
CASCADE Cascade Bedrock Sheet	(CAS) (BRS)	[2.1] [2.2]	{ 3 } {24}
FLATWATER Pocket Water Glide Run Step Run Edgewater	(POW) (GLD) (RUN) (SRN) (EDW)	[3.1] [3.2] [3.3] [3.4] [3.5]	{21} {14} {15} {16} {18}
MAIN CHANNEL POOLS Trench Pool Mid-Channel Pool Channel Confluence Pool Step Pool	(TRP) (MCP) (CCP) (STP)	[4.1] [4.2] [4.3] [4.4]	{ 8 } {17} {19} {23}
SCOUR POOLS Corner Pool Lateral Scour Pool - Log Enhanced Lateral Scour Pool - Rootwad Enhanced Lateral Scour Pool - Bedrock Formed Lateral Scour Pool - Boulder Formed Plunge Pool	(CRP) (LSL) (LSR) (LSBk) (LSBo) (PLP)	[5.1] [5.2] [5.3] [5.4] [5.5] [5.6]	<pre>{22} {10} {10} {11} {12} {20} {9}</pre>
BACKWATER POOLS Secondary Channel Pool Backwater Pool - Boulder Formed Backwater Pool - Rootwad Formed Backwater Pool - Log Formed Dammed Pool	(SCP) (BPB) (BPR) (BPL) (DPL)	[6.1] [6.2] [6.3] [6.4] [6.5]	{ 4 } { 5 } { 6 } { 7 } { 13 }
ADDITIONAL UNIT DESIGNATIONS Dry Culvert Not Surveyed Not Surveyed due to a marsh	(DRY) (CUL) (NS) (MAR)	[7.0] [8.0] [9.0] [9.1]	





Coordinate System: NAD 1983 California Teale Albers Data Sources: CDFW, USGS, CalWater 2.21, CDF 24k \*River M

\*River Mile indicates distance from confluence with Van Duzen River

# **APPENDIX I**

# **TABLES AND GRAPHS**

#### Table 1 - Summary of Riffle, Flatwater, and Pool Habitat Types

POOL

RIFFLE

32.9

34.2

26

30

2021

2429

79

82

78

6

Stream Name: Hely Creek LLID: 1239760404988 Drainage: Van Duzen River Survey Dates: 9/25/2017 to 10/4/2017 Confluence Location: Quad: OWL CREEK Legal Description: T01NR02ES05 Latitude: 40:29:56.0N Longitude: 123:58:34.0 Habitat Units Fully Habitat Habitat Mean Total Total Mean Mean Mean Mean Estimated Mean Estimated Units Measured Туре Occurrence Length Length Length Width Depth Total Area Total Max Area Volume (%) (ft.) (ft.) (%) (ft.) (ft.) Depth (sq.ft.) (sq.ft.) (cu.ft.) Volume (cu.ft.) (ft.) FLATWATER 32.9 0.8 320 25254 79 4 53 4176 48.4 10.0 0.5 162 9618

23.4

28.2

Total	Total Units	Total Length	Total Area	Total Volume	
Units	Fully Measured	(π.)	(sq.ft.)	(cu.ft.)	
240	88	8626	64771	35370	

11.0

10.0

0.6

0.3

1.9

0.6

290

202

Mean

Residual

Pool Vol

(cu.ft.)

181

19732

6019

22926

16591

253

73

Mean

Shelter

Rating

23

31

4

#### Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Hely Creek

Survey Dates: 9/25/2017 to 10/4/2017

Confluence Location: Quad: OWL CREEK Legal Description: T01NR02ES05 Latitude: 40:29:56.0N Longitude: 123:58:34.0W

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Depth (ft.)	Max Depth (ft.)	Mean Area (sq.ft.)	Estimated Total Area (sq.ft.)	Mean Volume (cu.ft.)	Estimated Total Volume (cu.ft.)	Mean Residual Pool Vol (cu.ft.)	Mean Shelter Rating	Mean Canopy (%)
82	6	LGR	34.2	30	2429	28.2	10	0.3	0.8	202	16591	73	6019		4	99
69	3	RUN	28.8	47	3210	37.2	6	0.4	0.8	147	10166	88	4066		23	91
10	1	SRN	4.2	97	966	11.2	11	0.6	0.9	517	5170	310	3102		25	99
1	1	TRP	0.4	15	15	0.2	14	0.5	1.3	210	210	147	147	105	25	100
74	73	MCP	30.8	26	1923	22.3	11	0.6	19.7	290	21435	248	18123	175	29	96
4	4	PLP	1.7	21	83	1.0	11	1.0	3.2	248	991	364	1457	299	76	99

LLID: 1239760404988

Drainage: Van Duzen River

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)	
240	88	8626	54563	32915	

#### Table 3 - Summary of Pool Types

Stream Name: Hely Creek

Survey Dates: 9/25/2017 to 10/4/2017

Confluence Location: Quad: OWL CREEK Legal Description: T01NR02ES05 Latitude: 40:29:56.0N Longitude: 123:58:34.0W

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Residual Depth (ft.)	Mean Area (sq.ft.)	Estimated Total Area (sq.ft.)	Mean Residual Pool Vol (cu.ft.)	Estimated Total Resid.Vol. (cu.ft.)	Mean Shelter Rating	
75	74	MAIN	95	26	1938	96	11.0	0.6	289	21644	174	12895	29	
4	4	SCOUR	5	21	83	4	11.3	1.0	248	991	299	1195	76	

LLID: 1239760404988

Drainage: Van Duzen River

Total	Total Units	Total Length	Total Area	Total Volume	
Units	Fully Measured	(ft.)	(sq.ft.)	(cu.ft.)	
79	78	2021	22635	14091	

#### Table 4 - Summary of Maximum Residual Pool Depths By Pool Habitat Types

Stream Name: Hely Creek

LLID: 1239760404988 Drainage: Van Duzen River

Survey Dates: 9/25/2017 to 10/4/2017

Confluen	ce Location	n: Quad: OV	VL CREEK	Legal	Description:	T01NR02ES05	Latitude:	40:29:56.0N	Longitude:	123:58:34.0W		
Habitat Units	Habitat Type	Habitat Occurrence (%)	< 1 Foot Maximum Residual Depth	< 1 Foot Percent Occurrence	1 < 2 Feet Maximum Residual Depth	1 < 2 Feet Percent Occurrence	2 < 3 Feet Maximum Residual Depth	2 < 3 Feet Percent Occurrence	3 < 4 Feet Maximum Residual Depth	3 < 4 Feet Percent Occurrence	>= 4 Feet Maximum Residual Depth	>= 4 Feet Percent Occurrence
1	TRP	1	0	0	1	100	0	0	0	0	0	0
74	MCP	94	12	16	49	66	10	14	0	0	3	4
4	PLP	5	0	0	2	50	1	25	1	25	0	0

Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total
Units	< 1 Foot	< 1 Foot	1< 2 Foot	1< 2 Foot	2< 3 Foot	2< 3 Foot	3< 4 Foot	3< 4 Foot	>= 4 Foot	>= 4 Foot
	Max Resid.	% Occurrence								
	Depth		Depth		Depth		Depth		Depth	
79	12	15	52	66	11	14	1	1	3	4

Mean Maximum Residual Pool Depth (ft.): 1.9

#### Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Hely Creek LLID: 1239760404988 Drainage: Van Duzen River

Survey Dates: 9/25/2017 to 10/4/2017 Dry Units: 0

Confluence Location:		Quad: OWL CREEK		Legal Description: T01NR02ES05			Latitude	e:40:29:56.0N	Longitude:	123:58:34.0W	
Habitat Units	Units Fully Measured	Habitat Type	Mean % Undercut Banks	Mean % SWD	Mean % LWD	Mean % Root Mass	Mean % Terr. Vegetation	Mean % Aquatic Vegetation	Mean % White Water	Mean % Boulders	Mean % Bedrock Ledges
82	5	LGR	0	0	0	0	0	0	0	100	0
82	5	TOTAL RIFFLE	0	0	0	0	0	0	0	100	0
69	2	RUN	50	50	0	0	0	0	0	0	0
10	1	SRN	0	0	0	0	0	0	0	100	0
79	3	TOTAL FLAT	33	33	0	0	0	0	0	33	0
1	1	TRP	0	100	0	0	0	0	0	0	0
74	72	MCP	17	64	6	0	0	0	1	4	7
4	4	PLP	0	0	0	0	0	0	0	0	0
79	77	TOTAL POOL	16	64	6	0	0	0	3	5	6
240	85	TOTAL	17	62	6	0	0	0	2	6	6

#### Table 6 - Summary of Dominant Substrates By Habitat Type

Stream N	Name: Hely C	reek				LLID:	1239760404988	Drainage:	Van Duzen River
Survey D	Dates: 9/25/2	017 to 10/4/2	2017	Dry Units:	0				
Confluer	nce Location:	Quad: O	WL CREEK	Legal Des	cription: T01N	IR02ES05 Latitu	ide: 40:29:56.0N	Longitude:	123:58:34.0W
Habitat Units	Units Fully Measured	Habitat Type	% Total Silt/Clay Dominant	% Total Sand Dominant	% Total Gravel Dominant	% Total Small Cobble Dominant	% Total Large Cobble Dominant	% Total Boulder Dominant	% Total Bedrock Dominant
82	6	LGR	50	0	33	0	0	17	0
69	1	RUN	100	0	0	0	0	0	0
10	1	SRN	100	0	0	0	0	0	0
1	1	TRP	0	0	100	0	0	0	0
74	73	MCP	68	1	29	1	0	0	0
4	4	PLP	50	0	50	0	0	0	0

#### Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Hely Creek						LLID: 1239760404988	Drainage:	Van Duzen River
Survey Dates:	9/25/2017 to 10	/4/2017						
Confluence Loca	ation: Quad:	OWL CREEK	Legal	Description:	T01NR02ES05	Latitude: 40:29:56.0N	Longitude:	123:58:34.0W
Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover			
97	26	74	0	100	100			

Note: Mean percent conifer and hardwood for the entire reach are means of canopy components from units with canopy values greater than zero.

Open units represent habitat units with zero canopy cover.

#### Table 8 - Fish Habitat Inventory Data Summary

Stream Name: Hely Creek		LLID: 1239760404988	Drainage: Van Duzen River
Survey Dates: 9/25/2017 to 10/4/2017	Survey Length (ft.): 8626	Main Channel (ft.): 8626	Side Channel (ft.): 0
Confluence Location: Quad: OWL CREEK	Legal Description: T01NR02E	S05 Latitude: 40:29:56.0N	Longitude: 123:58:34.0W

#### Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1		
Channel Type: F4	Canopy Density (%): 96.3	Pools by Stream Length (%): 23.1
Reach Length (ft.): 7595	Coniferous Component (%): 27.6	Pool Frequency (%): 32.7
Riffle/Flatwater Mean Width (ft.): 9.9	Hardwood Component (%): 72.4	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Hardwood Trees	< 2 Feet Deep: 82
Range (ft.): 14 to 33	Vegetative Cover (%): 100.0	2 to 2.9 Feet Deep: 13
Mean (ft.): 19	Dominant Shelter: Small Woody Debris	3 to 3.9 Feet Deep: 1
Std. Dev.: 5	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 4
Base Flow (cfs.): 1.4	Occurrence of LWD (%): 6	Mean Max Residual Pool Depth (ft.): 1.9
Water (F): 50 - 56 Air (F): 54 - 66	LWD per 100 ft.:	Mean Pool Shelter Rating: 31
Dry Channel (ft): 0	Riffles: 1	
	Pools: 7	
	Flat: 2	
Pool Tail Substrate (%): Silt/Clav: 4 San	d: 4 Gravel: 79 Sm Cobble: 3 Lg Cobble: 3	Boulder: 7 Bedrock: 0
Embeddedness Values (%): 1 97 2	22.2 3 52.8 4 8.3 5 6.9	
STREAM REACH: 2		
STREAM REACH: 2 Channel Type: A6	Canopy Density (%): 99.0	Pools by Stream Length (%): 25.8
STREAM REACH: 2 Channel Type: A6 Reach Length (ft.): 1031	Canopy Density (%): 99.0 Coniferous Component (%): 10.0	Pools by Stream Length (%): 25.8 Pool Frequency (%): 35.0
STREAM REACH: 2 Channel Type: A6 Reach Length (ft.): 1031 Riffle/Flatwater Mean Width (ft.): 11.0	Canopy Density (%): 99.0 Coniferous Component (%): 10.0 Hardwood Component (%): 90.0	Pools by Stream Length (%): 25.8 Pool Frequency (%): 35.0 Residual Pool Depth (%):
STREAM REACH: 2 Channel Type: A6 Reach Length (ft.): 1031 Riffle/Flatwater Mean Width (ft.): 11.0 BFW:	Canopy Density (%): 99.0 Coniferous Component (%): 10.0 Hardwood Component (%): 90.0 Dominant Bank Vegetation: Hardwood Trees	Pools by Stream Length (%): 25.8 Pool Frequency (%): 35.0 Residual Pool Depth (%): < 2 Feet Deep: 71
STREAM REACH: 2 Channel Type: A6 Reach Length (ft.): 1031 Riffle/Flatwater Mean Width (ft.): 11.0 BFW: Range (ft.): 16 to 16	Canopy Density (%): 99.0 Coniferous Component (%): 10.0 Hardwood Component (%): 90.0 Dominant Bank Vegetation: Hardwood Trees Vegetative Cover (%): 100.0	Pools by Stream Length (%): 25.8 Pool Frequency (%): 35.0 Residual Pool Depth (%): < 2 Feet Deep: 71 2 to 2.9 Feet Deep: 29
STREAM REACH: 2Channel Type:A6Reach Length (ft.):1031Riffle/Flatwater Mean Width (ft.):11.0BFW:Range (ft.):16Mean (ft.):16	Canopy Density (%): 99.0 Coniferous Component (%): 10.0 Hardwood Component (%): 90.0 Dominant Bank Vegetation: Hardwood Trees Vegetative Cover (%): 100.0 Dominant Shelter: Small Woody Debris	Pools by Stream Length (%): 25.8 Pool Frequency (%): 35.0 Residual Pool Depth (%): < 2 Feet Deep: 71 2 to 2.9 Feet Deep: 29 3 to 3.9 Feet Deep: 0
STREAM REACH: 2Channel Type:A6Reach Length (ft.):1031Riffle/Flatwater Mean Width (ft.):11.0BFW:Range (ft.):16Mean (ft.):16Std. Dev.:0	Canopy Density (%): 99.0 Coniferous Component (%): 10.0 Hardwood Component (%): 90.0 Dominant Bank Vegetation: Hardwood Trees Vegetative Cover (%): 100.0 Dominant Shelter: Small Woody Debris Dominant Bank Substrate Type: Sand/Silt/Clay	Pools by Stream Length (%): 25.8 Pool Frequency (%): 35.0 Residual Pool Depth (%): < 2 Feet Deep: 71 2 to 2.9 Feet Deep: 29 3 to 3.9 Feet Deep: 0 >= 4 Feet Deep: 0
STREAM REACH:2Channel Type:A6Reach Length (ft.):1031Riffle/Flatwater Mean Width (ft.):11.0BFW:Range (ft.):16Mean (ft.):16Std. Dev.:0Base Flow (cfs.):1.4	Canopy Density (%): 99.0 Coniferous Component (%): 10.0 Hardwood Component (%): 90.0 Dominant Bank Vegetation: Hardwood Trees Vegetative Cover (%): 100.0 Dominant Shelter: Small Woody Debris Dominant Bank Substrate Type: Sand/Silt/Clay Occurrence of LWD (%): 6	Pools by Stream Length (%): 25.8 Pool Frequency (%): 35.0 Residual Pool Depth (%): < 2 Feet Deep: 71 2 to 2.9 Feet Deep: 29 3 to 3.9 Feet Deep: 0 >= 4 Feet Deep: 0 Mean Max Residual Pool Depth (ft.): 1.7
STREAM REACH: 2Channel Type:A6Reach Length (ft.):1031Riffle/Flatwater Mean Width (ft.):11.0BFW:Range (ft.):16Mean (ft.):16Std. Dev.:0Base Flow (cfs.):1.4Water (F):51 - 52Air (F):56 - 58	Canopy Density (%): 99.0 Coniferous Component (%): 10.0 Hardwood Component (%): 90.0 Dominant Bank Vegetation: Hardwood Trees Vegetative Cover (%): 100.0 Dominant Shelter: Small Woody Debris Dominant Bank Substrate Type: Sand/Silt/Clay Occurrence of LWD (%): 6 LWD per 100 ft.:	Pools by Stream Length (%): 25.8 Pool Frequency (%): 35.0 Residual Pool Depth (%): < 2 Feet Deep: 71 2 to 2.9 Feet Deep: 29 3 to 3.9 Feet Deep: 0 >= 4 Feet Deep: 0 Mean Max Residual Pool Depth (ft.): 1.7 Mean Pool Shelter Rating: 37
STREAM REACH: 2 Channel Type: A6 Reach Length (ft.): 1031 Riffle/Flatwater Mean Width (ft.): 11.0 BFW: Range (ft.): 16 to 16 Mean (ft.): 16 Std. Dev.: 0 Base Flow (cfs.): 1.4 Water (F): 51 - 52 Air (F): 56 - 58 Dry Channel (ft): 0	Canopy Density (%): 99.0 Coniferous Component (%): 10.0 Hardwood Component (%): 90.0 Dominant Bank Vegetation: Hardwood Trees Vegetative Cover (%): 100.0 Dominant Shelter: Small Woody Debris Dominant Bank Substrate Type: Sand/Silt/Clay Occurrence of LWD (%): 6 LWD per 100 ft.: Riffles: 0	Pools by Stream Length (%): 25.8 Pool Frequency (%): $35.0$ Residual Pool Depth (%): < 2 Feet Deep: 71 2 to 2.9 Feet Deep: 29 3 to 3.9 Feet Deep: 0 >= 4 Feet Deep: 0 Mean Max Residual Pool Depth (ft.): 1.7 Mean Pool Shelter Rating: 37
STREAM REACH: 2         Channel Type:       A6         Reach Length (ft.):       1031         Riffle/Flatwater Mean Width (ft.):       11.0         BFW:       Range (ft.):       16         Mean (ft.):       16         Std. Dev.:       0         Base Flow (cfs.):       1.4         Water (F):       51 - 52       Air (F):       56 - 58         Dry Channel (ft):       0	Canopy Density (%): 99.0 Coniferous Component (%): 10.0 Hardwood Component (%): 90.0 Dominant Bank Vegetation: Hardwood Trees Vegetative Cover (%): 100.0 Dominant Shelter: Small Woody Debris Dominant Bank Substrate Type: Sand/Silt/Clay Occurrence of LWD (%): 6 LWD per 100 ft.: Riffles: 0 Pools: 4	Pools by Stream Length (%): 25.8 Pool Frequency (%): 35.0 Residual Pool Depth (%): < 2 Feet Deep: 71 2 to 2.9 Feet Deep: 29 3 to 3.9 Feet Deep: 0 >= 4 Feet Deep: 0 Mean Max Residual Pool Depth (ft.): 1.7 Mean Pool Shelter Rating: 37
STREAM REACH: 2 Channel Type: A6 Reach Length (ft.): 1031 Riffle/Flatwater Mean Width (ft.): 11.0 BFW: Range (ft.): 16 to 16 Mean (ft.): 16 Std. Dev.: 0 Base Flow (cfs.): 1.4 Water (F): 51 - 52 Air (F): 56 - 58 Dry Channel (ft): 0	Canopy Density (%): 99.0 Coniferous Component (%): 10.0 Hardwood Component (%): 90.0 Dominant Bank Vegetation: Hardwood Trees Vegetative Cover (%): 100.0 Dominant Shelter: Small Woody Debris Dominant Bank Substrate Type: Sand/Silt/Clay Occurrence of LWD (%): 6 LWD per 100 ft.: Riffles: 0 Pools: 4 Flat: 2	Pools by Stream Length (%): 25.8 Pool Frequency (%): 35.0 Residual Pool Depth (%): < 2 Feet Deep: 71 2 to 2.9 Feet Deep: 29 3 to 3.9 Feet Deep: 0 >= 4 Feet Deep: 0 Mean Max Residual Pool Depth (ft.): 1.7 Mean Pool Shelter Rating: 37
STREAM REACH: 2 Channel Type: A6 Reach Length (ft.): 1031 Riffle/Flatwater Mean Width (ft.): 11.0 BFW: Range (ft.): 16 to 16 Mean (ft.): 16 Std. Dev.: 0 Base Flow (cfs.): 1.4 Water (F): 51 - 52 Air (F): 56 - 58 Dry Channel (ft): 0 Pool Tail Substrate (%): Silt/Clay: 14 San	Canopy Density (%): 99.0 Coniferous Component (%): 10.0 Hardwood Component (%): 90.0 Dominant Bank Vegetation: Hardwood Trees Vegetative Cover (%): 100.0 Dominant Shelter: Small Woody Debris Dominant Bank Substrate Type: Sand/Silt/Clay Occurrence of LWD (%): 6 LWD per 100 ft.: Riffles: 0 Pools: 4 Flat: 2 d: 0 Gravel: 71 Sm Cobble: 0 Lg Cobble: 14	Pools by Stream Length (%): 25.8 Pool Frequency (%): 35.0 Residual Pool Depth (%): < 2 Feet Deep: 71 2 to 2.9 Feet Deep: 29 3 to 3.9 Feet Deep: 0 >= 4 Feet Deep: 0 Mean Max Residual Pool Depth (ft.): 1.7 Mean Pool Shelter Rating: 37 Boulder: 0 Bedrock: 0
STREAM REACH: 2         Channel Type:       A6         Reach Length (ft.):       1031         Riffle/Flatwater Mean Width (ft.):       11.0         BFW:       Range (ft.):       16         Mean (ft.):       16       16         Mean (ft.):       16       5td. Dev.:         Base Flow (cfs.):       1.4         Water (F):       51 - 52       Air (F):       56 - 58         Dry Channel (ft):       0         Pool Tail Substrate (%):       Silt/Clay:       14         Silt Substrate (%):       Silt/Clay:       14	Canopy Density (%): 99.0 Coniferous Component (%): 10.0 Hardwood Component (%): 90.0 Dominant Bank Vegetation: Hardwood Trees Vegetative Cover (%): 100.0 Dominant Shelter: Small Woody Debris Dominant Bank Substrate Type: Sand/Silt/Clay Occurrence of LWD (%): 6 LWD per 100 ft.: Riffles: 0 Pools: 4 Flat: 2 d: 0 Gravel: 71 Sm Cobble: 0 Lg Cobble: 14 14.3 3. 42.9 4. 28.6 5. 14.3	Pools by Stream Length (%): 25.8 Pool Frequency (%): 35.0 Residual Pool Depth (%): < 2 Feet Deep: 71 2 to 2.9 Feet Deep: 29 3 to 3.9 Feet Deep: 0 >= 4 Feet Deep: 0 Mean Max Residual Pool Depth (ft.): 1.7 Mean Pool Shelter Rating: 37

#### Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name:	: Hely Creek					LLID: 1239	760404988	Drainage:	Van Duzen River
Survey Dates:	9/25/20	17 to 10	/4/2017						
Confluence Loc	ation:	Quad:	OWL CREEK	Legal Description:	T01NR02ES05	Latitude: 4	40:29:56.0N	Longitude:	123:58:34.0W

#### Mean Percentage of Dominant Stream Bank Substrate

Dominant Class of Substrate	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percent (%)
Bedrock	2	5	4.0
Boulder	1	1	1.1
Cobble / Gravel	0	0	0.0
Sand / Silt / Clay	84	81	94.8

#### Mean Percentage of Dominant Stream Bank Vegetation

Dominant Class of Vegetation	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percent (%)
Grass	0	0	0.0
Brush	0	0	0.0
Hardwood Trees	72	71	82.2
Coniferous Trees	15	16	17.8
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values:

3

#### Table 10 - Mean Percent of Shelter Cover Types For Entire Stream

StreamName: Hely Creek

Drainage: Van Duzen River LLID: 1239760404988

Survey Dates: 9/25/2017 to 10/4/2017

Confluence Location: Quad: OWL CREEK

Legal Description: T01NR02ES05 Latitude: 40:29:56.0N Longitude: 123:58:34.0W

	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	33	16
SMALL WOODY DEBRIS (%)	0	33	63
LARGE WOODY DEBRIS (%)	0	0	6
ROOT MASS (%)	0	0	0
TERRESTRIAL VEGETATION (%)	0	0	0
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	0	0	3
BOULDERS (%)	100	33	5
BEDROCK LEDGES (%)	0	0	6





## HELY CREEK 2017 HABITAT TYPES BY PERCENT TOTAL LENGTH



## HELY CREEK 2017 HABITAT TYPES BY PERCENT OCCURRENCE



## HELY CREEK 2017 POOL TYPES BY PERCENT OCCURRENCE



## HELY CREEK 2017 MAXIMUM DEPTH IN POOLS



## HELY CREEK 2017 PERCENT EMBEDDEDNESS







## HELY CREEK 2017 SUBSTRATE COMPOSITION IN POOL TAIL-OUTS





## HELY CREEK 2017 DOMINANT BANK COMPOSITION IN SURVEY REACH



## HELY CREEK 2017 DOMINANT BANK VEGETATION IN SURVEY REACH



# **APPENDIX II**

# **STREAM INVENTORY PHOTOS**



Photo 1: Landslide at unknown distance from start of survey. (Photo taken 9/25/17)



Photo 2: Run unit at unknown distance from start of survey. (Photo taken 9/25/17)