CALIFORNIA DEPARTMENT OF FISH AND GAME
STREAM INVENTORY REPORT
Norton Slough
Report Completed March 20, 2007
Assessment Completed 2006

INTRODUCTION

A stream inventory was conducted during 8/15/2006 to 8/17/2006 on Norton Slough. The survey began at the confluence with Foss Creek and extended upstream 1.7 miles. The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Norton Slough.

The objective of this report is to document the current habitat conditions and recommend options for the potential enhancement of habitat for chinook salmon, 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

Norton Slough is a tributary to West Slough, a tributary to Dry Creek, a tributary to the Russian River, a tributary to the Pacific Ocean, and is located in Sonoma County, California (Map 1). Norton Slough's legal description at the confluence with Foss Creek is T09N R09W S20. Its location is 38°36'49.0" north latitude and 122°52'19.0" west longitude, LLID number 1228677386035. Norton Slough is a second order stream and has approximately 2.4 miles of blue line stream according to the USGS Jimtown and Healdsburg 7.5 minute quadrangles. Elevations range from about 100 feet at the mouth of the creek to 190 feet in the headwater areas. Mixed hardwood forest dominates the watershed. The watershed is primarily privately owned and urban. Vehicle access exists via Hwy 101 to Dry Creek Rd. to Healdsburg Ave. in Healdsburg, California.

METHODS

The habitat inventory conducted in Norton Slough follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The California Conservation Corps (CCC) Technical Advisors and Watershed Stewards Project/AmeriCorps (WSP) Members that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). 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.

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 Norton Slough 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 clinometer, hand level, hip chain, tape measure, and a stadia rod.

3. Temperatures:

Both water and air temperatures are measured and recorded at every tenth habitat unit. The time of the measurement is also recorded. Both temperatures are taken in degrees Fahrenheit at the middle of the habitat unit and within one foot of the water surface.

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". Norton Slough 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 Norton Slough, 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 unsuited 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. The shelter rating is calculated for each fully-described habitat unit by multiplying shelter value and percent cover. 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 Norton Slough, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the cover. 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 Norton Slough, 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 Norton Slough, 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 Norton Slough. In addition, One site was electrofished using a Smith-Root Model 12 electrofisher. These sampling techniques are 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 Game. 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 Norton Slough 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 AT THE END OF THE REPORT *

The habitat inventory of 8/15/2006 to 8/17/2006 was conducted by H. Fett, K. McIntosh, and R. Spangler (WSP). The total length of the stream surveyed was 9,220 feet.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.05 cfs on 8/15/2006.

Norton Slough is an F6 channel type for all 9,220 feet of the stream surveyed (Reach 1). F6 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and sand and silt-dominant substrates.

Water temperatures taken during the survey period ranged from 59 to 70 degrees Fahrenheit. Air temperatures ranged from 55 to 72 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 50% flatwater units, 28% riffle units, 11% pool units, 5% culvert units, 4% nosurvey units, and 2% nosurvey_marsh units (Graph 1). Based on total length of Level II habitat types there were 65% flatwater units, 9% riffle units, 4% pool units, 3% culvert units, 5% nosurvey units, and 14% nosurvey_marsh units (Graph 2).

Four Level IV habitat types were identified with three additional habitat types found (Table 2). The most frequent habitat types by percent occurrence were 11% Run units, 28% Low Gradient Riffle units, 40% Glide units, and 11% Mid-Channel Pool units (Graph 3). Based on percent total length there were 9% Run units, 9% Low Gradient Riffle units, 56% Glide units, and 14% "not surveyed due to a marsh" units.

A total of 9 pools were identified (Table 3). All pools identified were main channel pools and comprised 100% of the total length of all pools (Graph 4).

Table 4 is a summary of maximum residual pool depths by pool habitat types. Pool quality for salmonids increases with depth. Eight of the 9 pools (89%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 9 pool tail-outs measured, 2 had a value of 1 (22%); 2 had a value of 2 (22%); 2 had a value of 3 (22%); and 3 had a value of 4 (34%) (Graph 6). On this scale, a value of 1 indicates the best spawning conditions and a value of 4 the worst. Additionally, a value of 5 was assigned to tail-outs deemed

unsuited 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 0 , flatwater habitat types had a mean shelter rating of 50, and pool habitats had a mean shelter rating of 22 (Table 1). Of the pool types, the main channel pools had a mean shelter rating of 22 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Terrestrial Vegetation is the dominant cover types in Norton Slough. Graph 7 describes the pool cover in Norton Slough. Terrestrial Vegetation 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. A silt/clay substrate type was observed in 44% of pool tail-outs, and gravel substrate was observed in 56%.

The mean percent canopy density for the surveyed length of Norton Slough was 65%. The mean percentages of hardwood and coniferous trees were 100% and 0%, respectively. Thirty-five percent of the canopy was open. Graph 9 describes the mean percent canopy in Norton Slough.

For the stream reach surveyed, the mean percent right bank vegetated was 85%. The mean percent left bank vegetated was 88%. The dominant elements composing the structure of the stream banks consisted of 100% sand/silt/clay (Graph 10). Brush was the dominant vegetation type observed in 55% of the units surveyed. Additionally, 45% of the units surveyed had hardwood trees as the dominant vegetation type (Graph 11).

HABITAT INVENTORY RESULTS FOR CHIQUITA CREEK

Chiquita Creek, a tributary to Norton Slough, was surveyed on August 17, 2006. The entire length of the surveyed stream, approximately 3700 feet, was dry.

BIOLOGICAL INVENTORY RESULTS

One site was electrofished for species composition and distribution in Norton Slough on September 28, 2006. The site was located near Simi Winery. Water temperatures taken during the electrofishing period 12:50 – 14:00 ranged from 59 to 62 degrees Fahrenheit. Air temperatures ranged from 63 to 65 degrees Fahrenheit. The sites were sampled by Mitsuko Terry (DFG) and Henning Fett (DFG).

Table 1. Biological sampling data for Norton Slough.

Species	Minimum Number Observed
larval roach	342
roach	161
sculpin	38
crayfish	24
red eared slider	1

DISCUSSION

Norton Slough is an F6 channel type for the entire 9,220 feet of stream surveyed. According to the California Salmonid Stream Habitat Restoration Manual, the suitability of F6 channel types for fish habitat improvement structures is graded as good for bank-placed boulders. F6 channel types are also graded fair for plunge weirs, boulder clusters, single and opposing wing deflectors and log cover.

The water temperatures recorded on the survey days 8/15/2006 to 8/17/2006 ranged from 59 to 70 degrees Fahrenheit. Air temperatures ranged from 55 to 72 degrees Fahrenheit. To make any further conclusions, temperatures would need to be monitored throughout the warm summer months, and more extensive biological sampling would need to be conducted.

Flatwater habitat types comprised 65% of the total length of this survey, riffles 9%, and pools 4%. Although the pools are relatively deep, with 8 of the 9 (89%) pools having a maximum residual depth greater than 2 feet, they were fairly infrequent. 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 for locations where their installation will not be threatened by high stream energy, or where their installation will not conflict with the modification of the numerous log debris accumulations (LDA's) in the stream.

Four of the 9 pool tail-outs measured had embeddedness ratings of 1 or 2 and five of the pool tail-outs had embeddedness ratings of 3 or 4. None 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 Norton Slough should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Five of the 9 pool tail-outs measured had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids. The other 4 of the 9 pool tail-outs had silt or sand as the dominant substrate, which is generally considered unsuitable for spawning salmonids.

The mean shelter rating for pools was 22. The shelter rating in the flatwater habitats was 50. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by Terrestrial Vegetation in Norton Slough. Terrestrial Vegetation is the dominant cover type in pools followed by undercut banks. Log and root wad 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 65%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was relatively high at 85% and 88%, respectively. 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.

GENERAL MANAGEMENT RECOMMENDATIONS

Norton Slough should be managed as an anadromous, natural production stream.

Winter storms often bring down large trees and other woody debris into the stream, which increases the number and quality of pools. This woody debris, if left undisturbed, will provide fish shelter and rearing habitat, and offset channel incision. Landowners should be sensitive about the natural and positive role woody debris plays in the system, and encouraged not to remove woody debris from the stream, except under extreme buildup and only under guidance by a fishery professional.

RECOMMENDATIONS

1. Access for migrating salmonids should be assessed at all road crossings and culverts. Where needed crossings and culverts should be replaced or modified to improve fish passage.

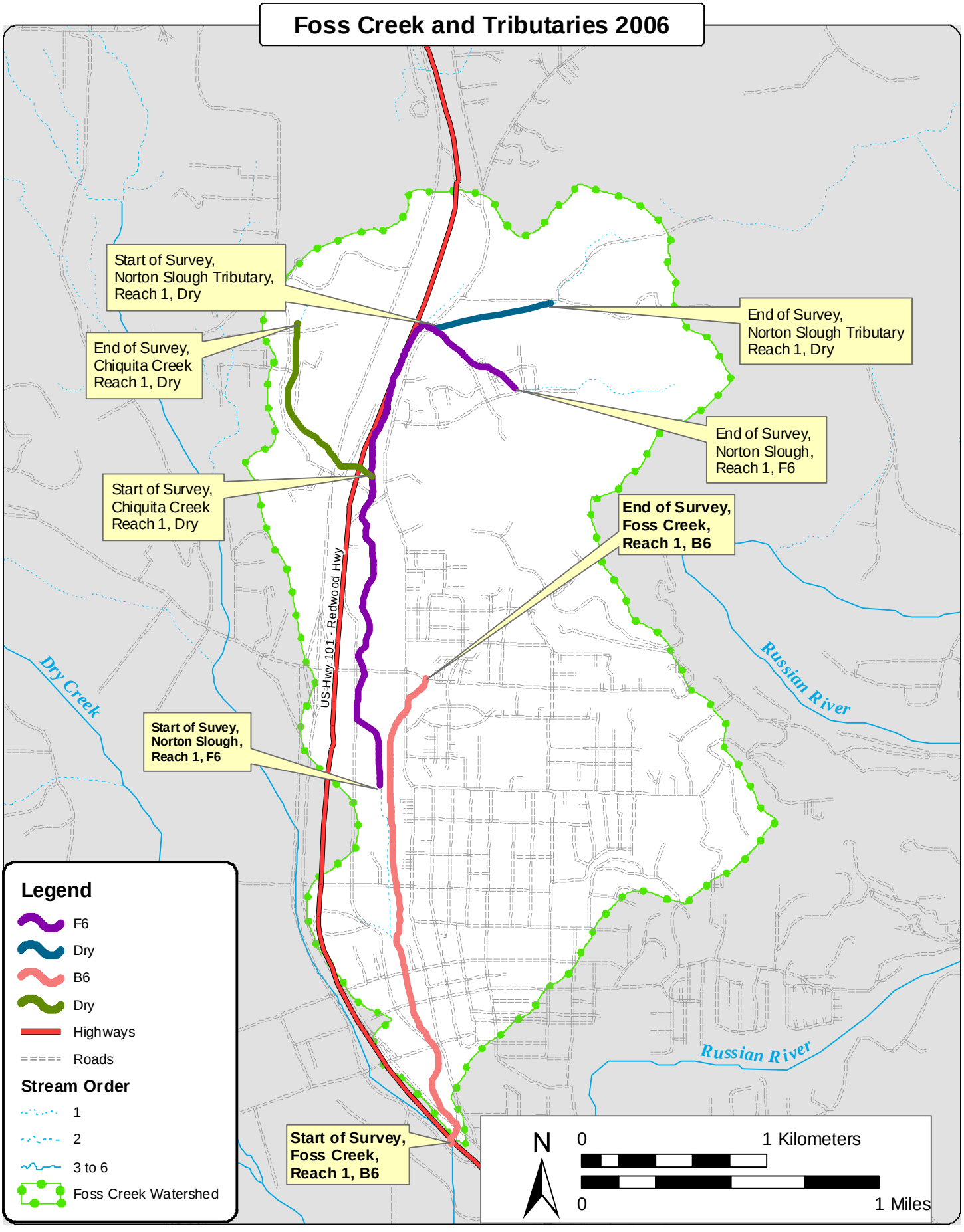
2. Norton Slough would benefit from utilizing bio-technical vegetative techniques for bank stabilization and to re-establish floodplain benches and a defined low flow channel. This would discourage lateral migration of the base flow channel and decrease bank erosion.

3. 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.

4. Increase woody cover in the pools and flatwater habitat units. Most of the existing cover in the pools is from Terrestrial Vegetation. Adding high quality complexity with woody cover in the pools is desirable.

5. Increase the canopy on Norton Slough by planting appropriate native vegetation like willow, alder, redwood, and Douglas fir along the stream where shade canopy is not at acceptable levels. The reaches above this survey section should be inventoried and treated as well, since the water flowing here is affected from upstream. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.

6. The limited water temperature data available suggest that maximum temperatures are above the acceptable range for juvenile salmonids. To establish more complete and meaningful temperature regime information, 24-hour monitoring during the May through October temperature extreme period should be performed for 2 to 3 years.



L:\mondo3\data\stream-maps\foss.mxd

Prepared by: Dan Resnik, March 21, 2007

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	Habitat Unit #	Comments
0	0001.00	Survey began at the confluence of Foss creek
553	0013.00	General Comment: Retaining walls at top of unit Many Roach and several unidentified fish 3" - 5" in length
553	0013.00	Structures: Bridge #1, Driveway 325' into unit
1533	0017.00	Structures: Culvert #1, Dry Creek Road L66 W9 H5 No down cutting, Not retaining gravel
1944	0024.00	Structures: Bridge #2, Private H6.5 W17 L20
2678	0033.00	General Comment: 36" culvert on right bank at 123' into unit
3030	0035.00	General Comment: 30" culvert on right bank at 79' into unit
3174	0036.00	Structures: Bridge #3, Private H8.5 W56 L18
3767	0042.00	Structures: Bridge #4, Private H7.3 W60 L21
3872	0045.00	General Comment: Seven shopping carts piled across creek at top of unit 2 culverts flowing into creek, right bank pipe is 36", left bank pipe is 24", both have gravel and silt build up
3980	0046.00	Culvert #2: Grove street L63 W12 H6.3 Not down cutting, not retaining gravel
4189	0048.00	General Comment: Dry ditch on right bank, possible trib?
4197	0049.00	General Comment: At top of unit on right bank, severely eroded bank
5203	0059.00	Structures: Bridge #5, Railroad H9.3 W12 L12
5739	0064.00	General Comment: smells like sewage
5849	0066.00	General Comment: Right bank is covered by Rock, left bank by Ivy

Position	Habitat Unit #	Comments
5849	0066.00	Structures: Bridge #6, Private H6.4 W10 L9 Not down cutting, not retaining gravel Ivy curtain on upstream side
6006	0067.00	General Comment: Artificially created channel, rock placed on both banks and in stream Building on left bank 5' from waters edge
6266	0068.00	General Comment: Large pieces of concrete laying on right bank
6750	0076.00	General Comment: Broken fence (wooden) in creek below culvert
6750	0076.00	Structures: Culvert #3, Private 260' into unit on right bank L?? W4 H4 Down cutting 3.7' 3.7' from water to lip Not retaining gravel There is a bend in pipe, unable to measure length
7240	0077.00	Structures: Culvert #4, Healdsburg Avenue L49 W17 H4.9 No down cutting Retaining gravel
7289	0078.00	General Comment: Cable across creek at beginning of unit There are to sources of in-flow on right bank, one is 105'L x 5'W and goes underground into a culvert that is 24" in diameter. The other is a man made spillway that is 475'L x 25'W and is overflow for a drainage basin. Both are very shallow and warm, more like a marsh than a stream
8204	0081.00	Structures: Culvert #5, Storm water pond L60 W12 H12 No down cutting Not retaining gravel
8264	0082.00	Structures: Bridge #7, Bridle Path H3.7 W22 L66
9175	0083.00	General Comment: Large concrete slab in creek After the glide in Unit #83 the creek goes dry under bridge #8 and stays dry
9175	0083.00	Structures: Bridge #8, Parkland Farms Boulevard H4.2 W22 L66

Position Habitat Unit # Comments

9220 0083.00 End of Survey: EOS after bridge #8

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.

McCain, M., D. Fuller, L. Decker and K. Overton. 1990. Stream habitat classification and inventory procedures for northern California. FHC Currents. No.1. U.S. Department of Agriculture. Forest Service, Pacific Southwest Region.

Rosgen, D.L., 1994. A Classification of Natural Rivers. Catena, Vol 22: 169-199, Elsevier Science, B. V. Amsterdam.

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

Stream Name: Norton Slough **LLID:** 1228677386035 **Drainage:** Russian River - Middle

Survey Dates: 8/15/2006 to 8/17/2006

Confluence Location: **Quad:** HEALDSBURG **Legal Description:** T09N R09W S20 **Latitude:** 38:36:13.0N **Longitude:** 122:52:04.0W

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Depth (ft.)	Mean 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
4	3	CULVERT	4.8	60	238	2.6	12.7	0.9	1.4	728	2911	675	2700		
42	42	FLATWATER	50.6	144	6048	65.6	6.3	1.2	2.1	946	39737	1496	62843		50
3	0	NOSURVEY	3.6	143	428	4.6									
2	0	NOSURVEY_ MARSH	2.4	639	1278	13.9									
9	9	POOL	10.8	42	380	4.1	8.2	1.9	3.0	358	3219	735	6612	667	22
23	23	RIFFLE	27.7	37	848	9.2	3.9	0.2	0.5	112	2582	30	679		0

Total Units	Total Units Fully Meassured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
83	77	9220	48449	72834

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Norton Slough **LLID:** 1228677386035 **Drainage:** Russian River - Middle

Survey Dates: 8/15/2006 to 8/17/2006

Confluence Location: Quad: HEALDSBURG **Legal Description:** T09N R09W S20 **Latitude:** 38:36:13.0N **Longitude:** 122:52:04.0W

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Depth (ft.)	Mean 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 (%)
23	23	LGR	27.7	37	848	9.2	4.0	0.2	0.8	112	2582	30	679		0	67
33	33	GLD	39.8	158	5202	56.4	7.0	1.4	5.0	1129	37244	1845	60883		68	57
9	9	RUN	10.8	94	846	9.2	4.0	0.5	2.1	277	2494	218	1960		20	60
9	9	MCP	10.8	42	380	4.1	8.0	1.9	4.6	358	3219	735	6612	667	22	78
4	3	CUL	4.8	60	238	2.6	13.0	0.9	1.9	728	2911	675	2700			
3	0	NS	3.6	143	428	4.6										
2	0	MAR	2.4	639	1278	13.9										

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
83	77	9220	48449	72834

Table 3 - Summary of Pool Types

Stream Name: Norton Slough **LLID:** 1228677386035 **Drainage:** Russian River - Middle

Survey Dates: 8/15/2006 to 8/17/2006

Confluence Location: **Quad:** HEALDSBURG **Legal Description:** T09N R09W S20 **Latitude:** 38:36:13.0N **Longitude:** 122:52:04.0W

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
9	9	MAIN	100	42	380	100	8.2	1.9	358	3219	667	6007	22

Total Units	Total Units Fully Meassured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
9	9	380	3219	6007

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

Stream Name: Norton Slough **LLID:** 1228677386035 **Drainage:** Russian River - Middle

Survey Dates: 8/15/2006 to 8/17/2006

Confluence Location: **Quad:** HEALDSBURG **Legal Description:** T09N R09W S20 **Latitude:** 38:36:13.0N **Longitude:** 122:52:04.0W

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 Occurence	3 < 4 Feet Maximum Residual Depth	3 < 4 Feet Percent Occurrence	>= 4 Feet Maximum Residual Depth	>= 4 Feet Percent Occurrence
9	MCP	100	0	0	1	11	5	56	1	11	2	22

Total Units	Total < 1 Foot Max Resid. Depth	Total < 1 Foot % Occurrence	Total 1< 2 Feet Max Resid. Depth	Total 1< 2 Feet % Occurrence	Total 2< 3 Feet Max Resid. Depth	Total 2< 3 Feet % Occurrence	Total 3< 4 Feet Max Resid. Depth	Total 3< 4 Feet % Occurrence	Total >= 4 Feet Max Resid. Depth	Total >= 4 Feet % Occurrence
9	0	0	1	11	5	56	1	11	2	22

Mean Maximum Residual Pool Depth (ft.): 3

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Norton Slough **LLID:** 1228677386035 **Drainage:** Russian River - Middle

Survey Dates: 8/15/2006 to 8/17/2006

Confluence Location: **Quad:** HEALDSBURG **Legal Description:** T09N R09W S20 **Latitude:** 38:36:13.0N **Longitude:** 122:52:04.0W

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
23	2	LGR	0	0	0	0	0	0	0	0	0
33	5	GLD	18	17	1	13	31	0	0	0	0
9	3	RUN	3	3	0	0	40	0	0	20	0
9	9	MCP	13	11	6	11	26	7	0	4	0
4	0	CUL									
3	0	NS									
2	0	MAR									

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Norton Slough **LLID:** 1228677386035 **Drainage:** Russian River - Middle

Survey Dates: 8/15/2006 to 8/17/2006

Confluence Location: **Quad:** HEALDSBURG **Legal Description:** T09N R09W S20 **Latitude:** 38:36:13.0N **Longitude:** 122:52:04.0W

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
23	2	LGR	0	0	100	0	0	0	0
33	5	GLD	80	0	20	0	0	0	0
9	4	RUN	75	25	0	0	0	0	0
9	9	MCP	78	0	22	0	0	0	0
4	0	CUL	0	0	0	0	0	0	0
3	0	NS	0	0	0	0	0	0	0
2	0	MAR	0	0	0	0	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Norton Slough **LLID:** 1228677386035 **Drainage:** Russian River - Middle

Survey Dates: 8/15/2006 to 8/17/2006

Confluence Location: **Quad:** HEALDSBURG **Legal Description:** T09N R09W S20 **Latitude:** 38:36:13.0N **Longitude:** 122:52:04.0W

Habitat Units	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
65	0	100	0	85	88

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: Norton Slough LLID: 1228677386035 Drainage: Russian River - Middle
Survey Dates: 8/15/2006 to 8/17/2006 Survey Length (ft.): 9220 Main Channel (ft.): 9220 Side Channel (ft.): 0
Confluence Location: Quad: HEALDSBURG Legal Description: T09N R09W S20 Latitude: 38:36:13.0N Longitude: 122:52:04.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: F6
Reach Length (ft.): 9220
Riffle/Flatwater Mean Width (ft.): 5.4
BFW:
Range (ft.): 4 to 21
Mean (ft.): 13.6144578313253
Std. Dev.: 5.99966128622497
Base Flow (cfs): 0.05
Water (F): 59 - 70 Air (F): 55 - 72
Dry Channel (ft.): 0

Canopy Density (%): 64.5
Coniferous Component (%): 0.0
Hardwood Component (%): 100.0
Dominant Bank Vegetation: Brush
Vegetative Cover (%): 86.4
Dominant Shelter: Terrestrial Veg.
Dominant Bank Substrate Type: Sand/Silt/Clay
Occurrence of LWD (%): 2.9
LWD per 100 ft.:
Riffles: 0
Pools: 1
Flat: 0

Pools by Stream Length (%): 4.1
Pool Frequency (%): 10.8
Residual Pool Depth (%):
< 2 Feet Deep: 11.1
2 to 2.9 Feet Deep: 55.6
3 to 3.9 Feet Deep: 11.1
>= 4 Feet Deep: 22.2
Mean Max Residual Pool Depth (ft.): 3.02
Mean Pool Shelter Rating: 22

Pool Tail Substrate (%): Silt/Clay: 44.4 Sand: 0.0 Gravel: 55.6 Sm Cobble: 0.0 Lg Cobble: 0.0 Boulder: 0.0 Bedrock: 0.0
Embeddedness Values (%): 1. 22.2 2. 22.2 3. 22.2 4. 33.3 5. 0.0

Table 9 -Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Norton Slough **LLID:** 1228677386035 **Drainage:** Russian River - Middle

Survey Dates: 8/15/2006 to 8/17/2006

Confluence Location: **Quad:** HEALDSBURG **Legal Description:** T09N R09W S20 **Latitude:** 38:36:13.0N **Longitude:** 122:52:04.0W

Mean Percentage of Dominant Stream Bank

Dominant Class of Substrate	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percentage (%)
Bedrock	0	0	0.0
Boulder	0	0	0.0
Cobble/Gravel	0	0	0.0
Sand/Silt/Clay	20	20	100.0

Mean Percentage of Dominant Stream Bank

Dominant Class of Vegetation	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percentage (%)
Grass	0	0	0.0
Brush	12	10	55.0
Hardwood Trees	8	10	45.0
Coniferous Trees	0	0	0.0
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness 3

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

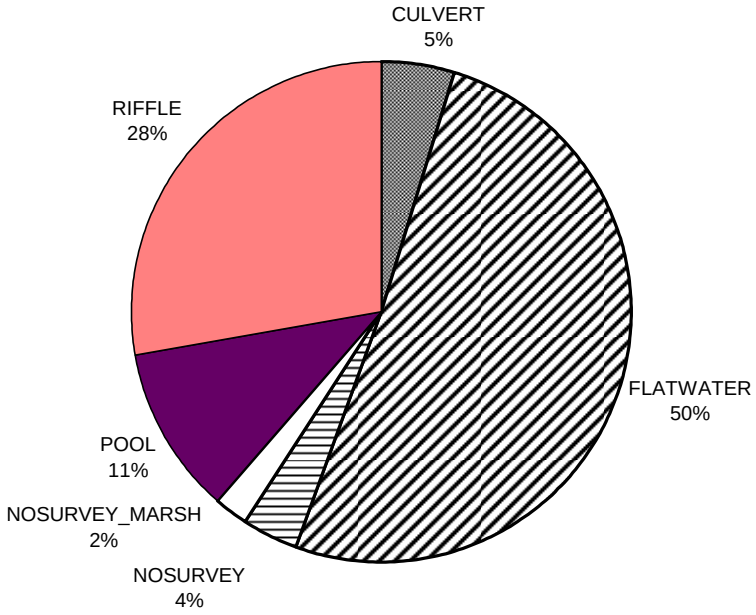
Stream Name: Norton Slough **LLID:** 1228677386035 **Drainage:** Russian River - Middle

Survey Dates: 8/15/2006 to 8/17/2006

Confluence Location: Quad: HEALDSBURG **Legal Description:** T09N R09W S20 **Latitude:** 38:36:13.0N **Longitude:** 122:52:04.0W

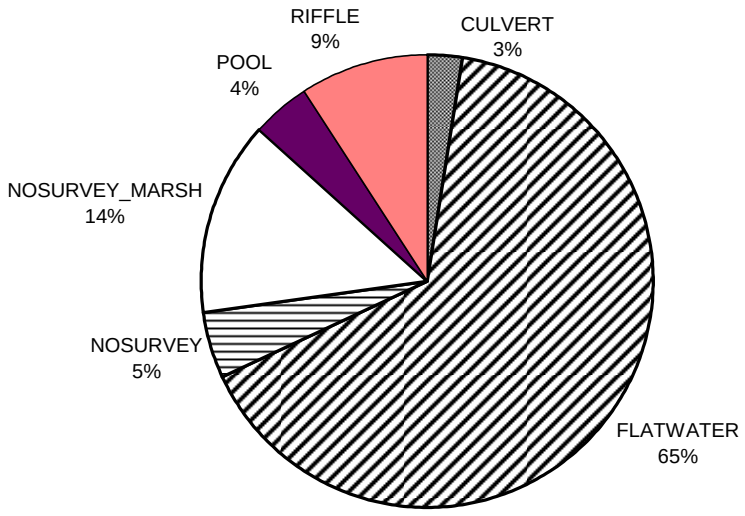
	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	13	13
SMALL WOODY DEBRIS (%)	0	12	11
LARGE WOODY DEBRIS (%)	0	1	6
ROOT MASS (%)	0	8	11
TERRESTRIAL VEGETATION (%)	0	34	26
AQUATIC VEGETATION (%)	0	0	7
WHITEWATER (%)	0	0	0
BOULDERS (%)	0	8	4
BEDROCK LEDGES (%)	0	0	0

NORTON SLOUGH 2006
HABITAT TYPES BY PERCENT OCCURRENCE



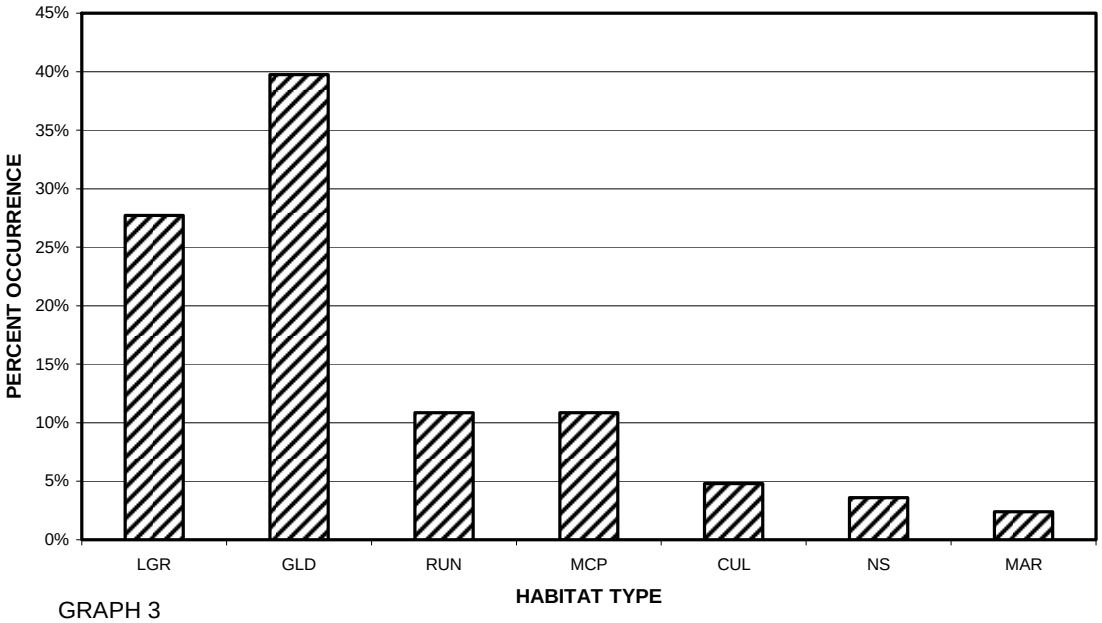
GRAPH 1

NORTON SLOUGH 2006
HABITAT TYPES BY PERCENT TOTAL LENGTH



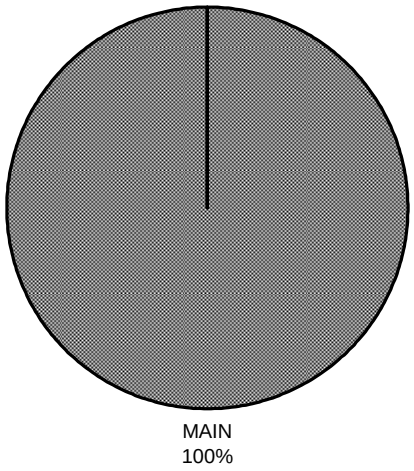
GRAPH 2

NORTON SLOUGH 2006
HABITAT TYPES BY PERCENT OCCURRENCE



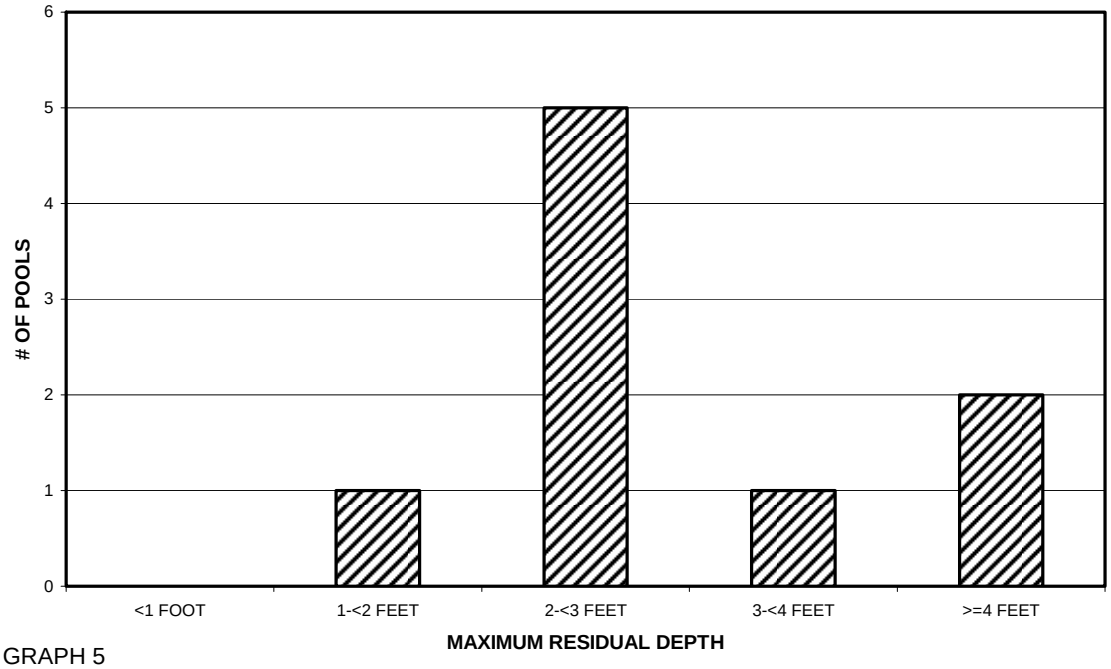
GRAPH 3

NORTON SLOUGH 2006
POOL TYPES BY PERCENT OCCURRENCE



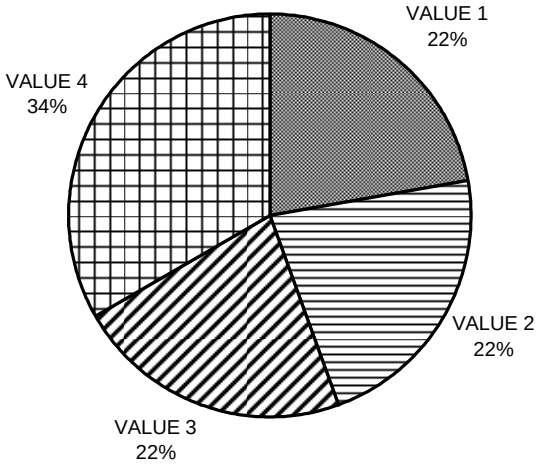
GRAPH 4

NORTON SLOUGH 2006
MAXIMUM DEPTH IN POOLS



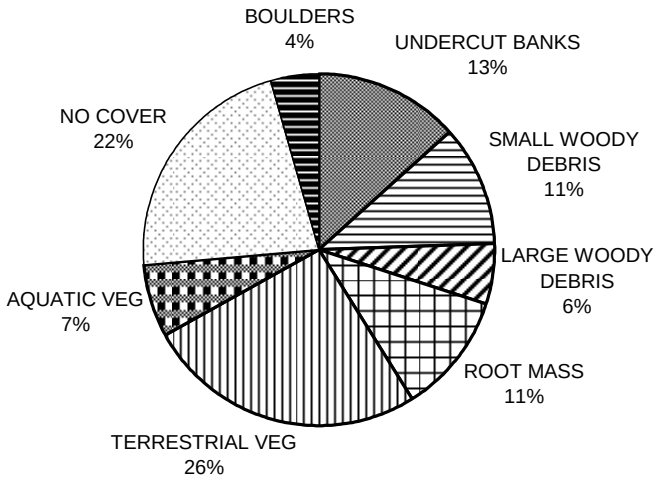
GRAPH 5

NORTON SLOUGH 2006
PERCENT EMBEDDEDNESS



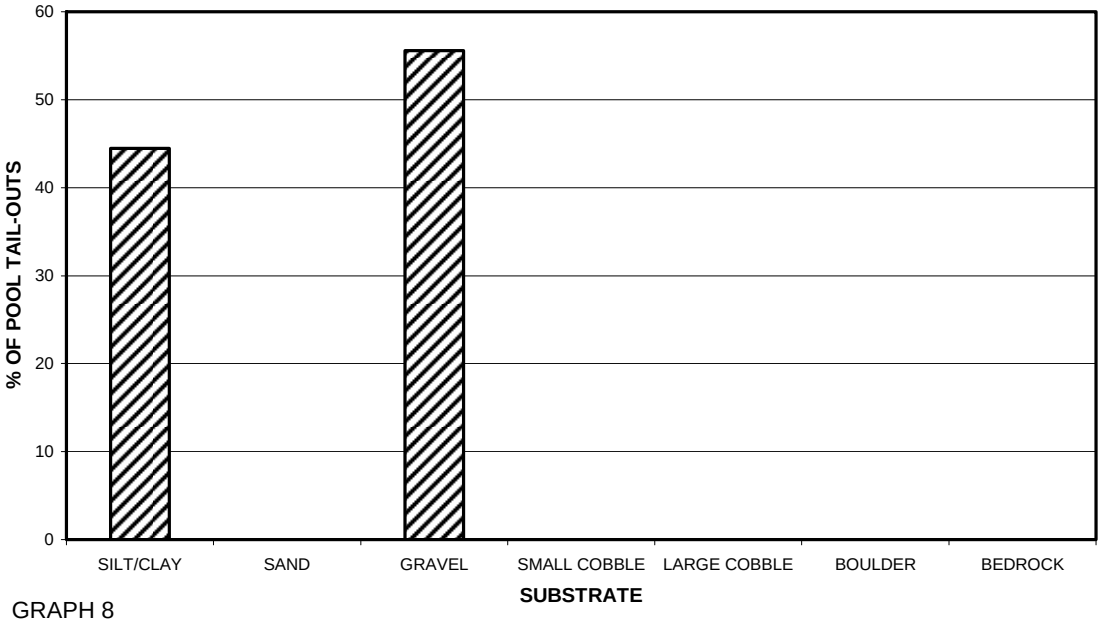
GRAPH 6

NORTON SLOUGH 2006
MEAN PERCENT COVER TYPES IN POOLS



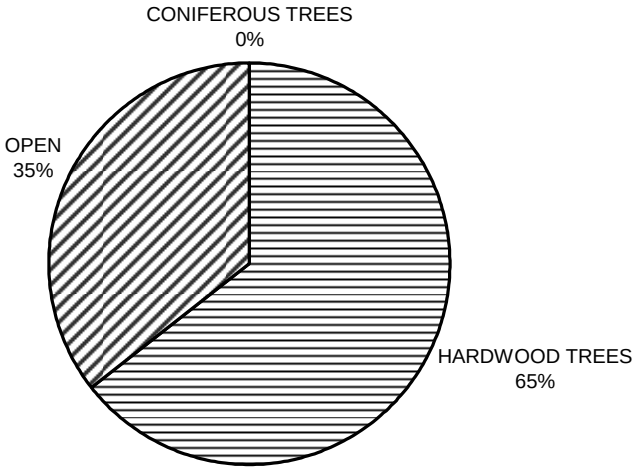
GRAPH 7

NORTON SLOUGH 2006
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



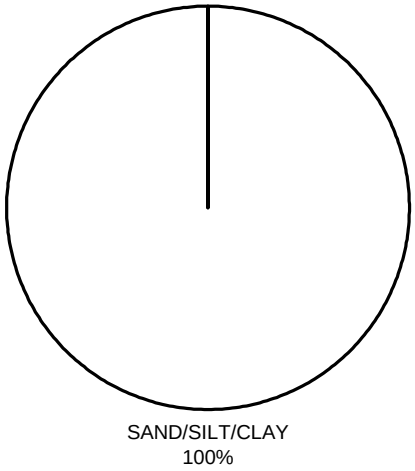
GRAPH 8

NORTON SLOUGH 2006
MEAN PERCENT CANOPY



GRAPH 9

NORTON SLOUGH 2006
DOMINANT BANK COMPOSITION IN SURVEY REACH



GRAPH 10

NORTON SLOUGH 2006
DOMINANT BANK VEGETATION IN SURVEY REACH

GRAPH 11

LEVEL III and LEVEL IV HABITAT TYPES

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