NAPA RIVER FISHERIES STUDY:
THE RUTHERFORD DUST SOCIETY RESTORATION REACH
NAPA COUNTY, CALIFORNIA

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PREPARED BY

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SUMMARY
Chinook salmon (*Oncorhynchus tshawytscha*) have been sporadically reported in the Napa River since the 1980's; however no data on run size, timing, or origin have been collected. In 2003 and 2004, significant numbers of fall-run Chinook salmon were documented in the Napa River and several tributaries. In 2004, the spawning period began immediately following the first storm outflow in early November, peaked in early December, and was over by the end of December.

To better estimate the size and distribution of the run, we conducted redd counts and carcass surveys along a 3.6 mile stretch of the mainstem Napa River. Biweekly surveys in November and December, 2004 documented 62 redds and 102 live Chinook salmon spawning and holding. Two recovered carcasses had adipose fin clips. The snouts of three adipose fin clipped carcasses were removed for coded wire tag analysis by the Department of Fish & Game; only one tag was recovered. The recovered tag showed the fish to be a 2002 spring-run Chinook salmon from the Feather River Hatchery released in Benicia in 2003. It is not clear what proportion of the entire run were of hatchery origin or wild stock.

Regardless of origin, it is possible that a self sustaining population of fall run Chinook salmon is developing in the Napa River. Similar runs have been established in other tributaries to the San Francisco Bay including the Guadalupe River and Coyote Creek (Moyle 2002). This scenario is further bolstered by the fact that a relatively long section of the river is owned by concerned landowners that have formed a voluntary stewardship group: *The Rutherford Dust Society*. Initial funding has been secured to plan and implement broad-based restoration to create favorable salmonid and native riparian habitat along 4.5 contiguous miles of the river between the Oakville Crossroad and Zinfandel Lane.

In order to monitor channel function before and after the proposed restoration we installed scour chains and conducted gravel permeability measurements, pebble counts, cross-sectional surveys, and a thalweg profile in fall of 2004. Our preliminary gravel permeability results suggest relatively high predicted egg mortality in most of the study reach. These results are consistent with data collected by Stillwater Sciences as part of the Limiting Factors Analysis, 2002. Scour chain data will be analyzed following a bankfull storm event and during the summer of 2005 to examine depth and frequency of bed scour.

I. SALMONID SPAWNER SURVEYS

Methods
Surveys were conducted following California Department of Fish & Game protocols as described in the California Salmonid Stream Habitat Restoration Manual (Appendix A).

Results and Discussion

The results of the spawner surveys are given in Table SP-1.

A salmon carcass survey was conducted by Jonathan Koehler and Paul Blank of the NCRCD on 11/19/04. The survey documented 102 live Chinook salmon in the ~3.6 mile Rutherford reach. The location and size of 27 redds, many of which had fish on them, were recorded using a handheld GPS. Most redds were upstream of the Rutherford Crossroad with a large number just below the Zinfandel Lane Bridge. Stream flow during the survey was not adequate to allow passage over the bridge apron. Two carcasses were recovered, one of which had an adipose fin clip. The snout of the ad-fin clipped fish was removed and sent to DFG for coded-wire-tag (CWT) analysis. One CWT (#062760) was recovered, and the fish was determined to be a 2002 Spring-run Chinook salmon from the Feather River Hatchery, one of 54,357 released by the hatchery on 4/28/03 in Benicia.

On 12/3/04, a follow-up survey of the 3.6 mile Rutherford reach was conducted by Jonathan Koehler and Chad Edwards of the NCRCD. The crew counted 93 live Chinook salmon spawning and holding. An additional 34 new redds were mapped, m.any of which were below the Rutherford Crossroad. Sixteen carcasses and 12 skeletons were recovered; none had fin clips. Most carcasses were between 85-100 cm FL (33-39 inches).

A final survey of the reach was conducted on 12/21/04. A total of 21 live Chinook salmon were observed, mostly holding and hiding near redds. Most fish appeared worn with visible signs of physiological deterioration. Stream flow was considerably higher than previous surveys, which hindered identification of new redds. We mapped 1 new redd bringing the total to 62 for the reach. Twenty-six carcasses and 15 skeletons were recovered; none had fin clips. The mean fork length of the carcasses was 75 cm.

Survey Date	19-Nov-2004	3-Dec-2004	22-Dec-2004	Total
Survey distance (ft)	19,108 ft	19,129 ft	19,173 ft	
Water temp	11.5˚ C	8˚ C	8˚ C	
Air temp	11˚ C	14˚ C	20˚ C	
Live salmon observed	102	93	21	**216***
Carcasses	4	16	26	**46**
Mean fork length (cm)	68	80	75	
Range fork length (cm)	54 - 84	62 - 100	55-95	
Adipose fin clip	2	0	0	**2**
Skeletons	3	12	15	**30**
Redd count	27	34	1	**62**

Table SP-1. Summarized salmon spawner/redd surveys of the Rutherford reach in 2004.

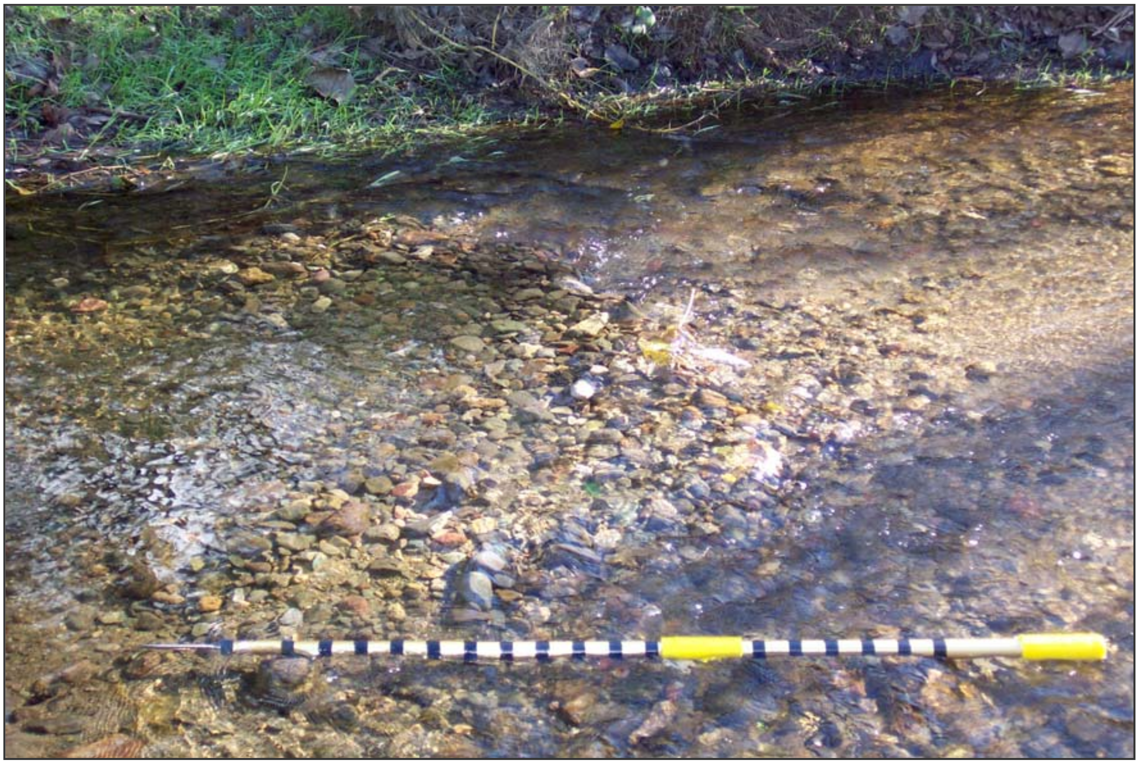
*Total count of live salmon may include fish counted multiple times in subsequent surveys and is therefore not an accurate estimate of total reach density.

It is not known what proportion of the Chinook salmon observed in the Napa River were of direct hatchery origin or Napa River stock. State and federal hatcheries release surplus Chinook smolts into the Carquinez Straits and San Pablo Bay each year to supplement the declining salmon populations from the Sacramento and San Joaquin River systems. The Mokelumne and Feather River hatcheries released a combined 8 – 10 million Chinook smolts (≥ 30/lb.) into the San Pablo bay in 2002 (Mokelumne River Hatchery pers. comm., 2002).

Of all Pacific salmon, Chinook have the highest rates of straying from their natal streams (Moyle 2002). The relatively recent surge in salmon returns to the Napa River may be attributed either to an increase in the number of hatchery strays entering the basin, or an increase in the number of fish that have successfully spawned in the river, the offspring of which are now returning. Another hypothesis is that the bulk of the run consists of Napa River spawned salmon that have led other ambiguous fish into the Napa River basin, thus increasing the size of the run with each subsequent year. Chinook spawning was successful last year; we captured and released several Chinook smolts (50-60 mm) in the river in the spring of 2004. A quantitative assessment of survival is needed to achieve smolt production and adult return estimates.

School of approximately 30 Chinook salmon holding in a deep pool in the Napa River near the Rutherford Crossroad (November 19, 2004).

Chinook salmon (female) migrating upstream in a shallow riffle of the Napa River (November 19, 2004).

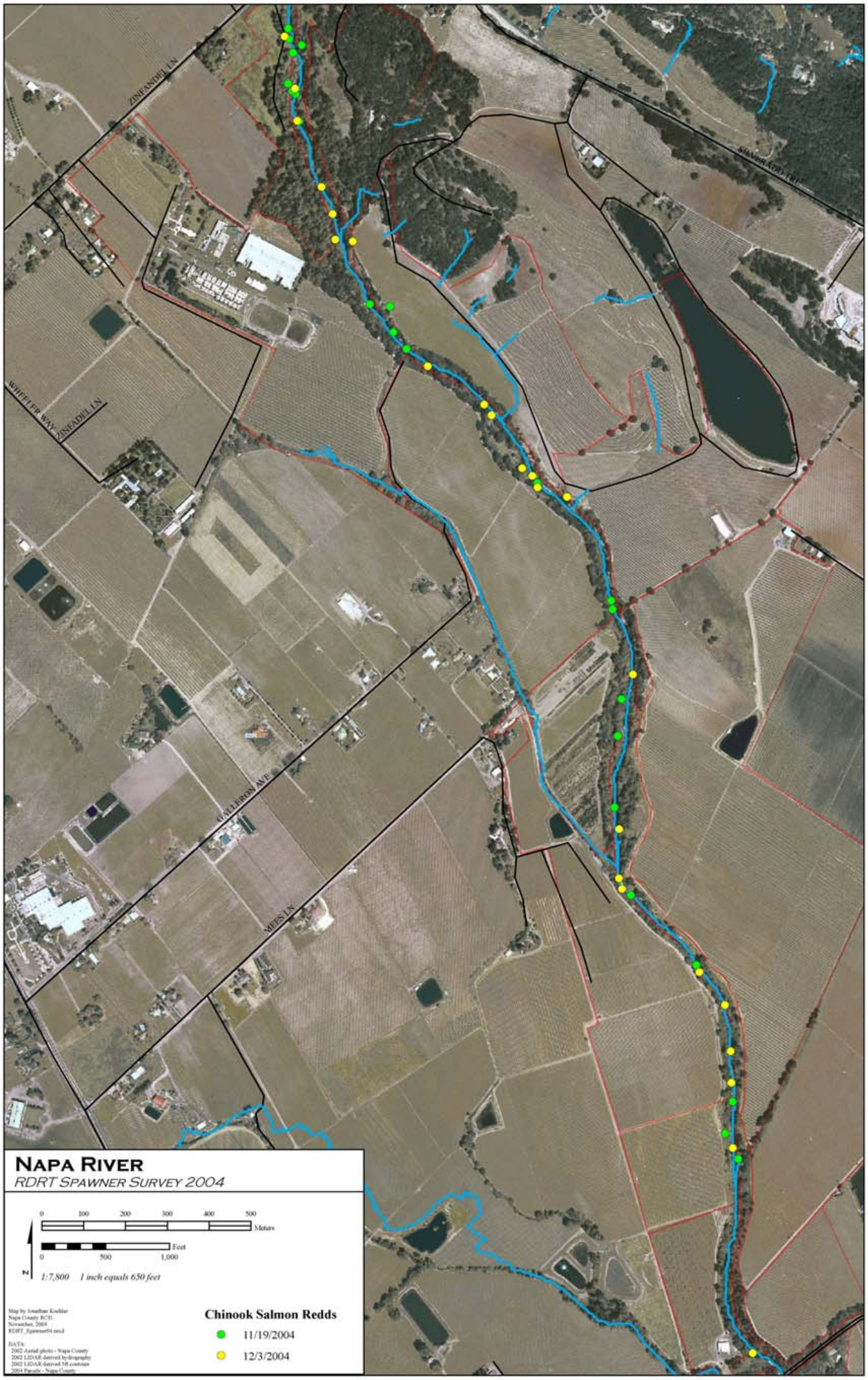


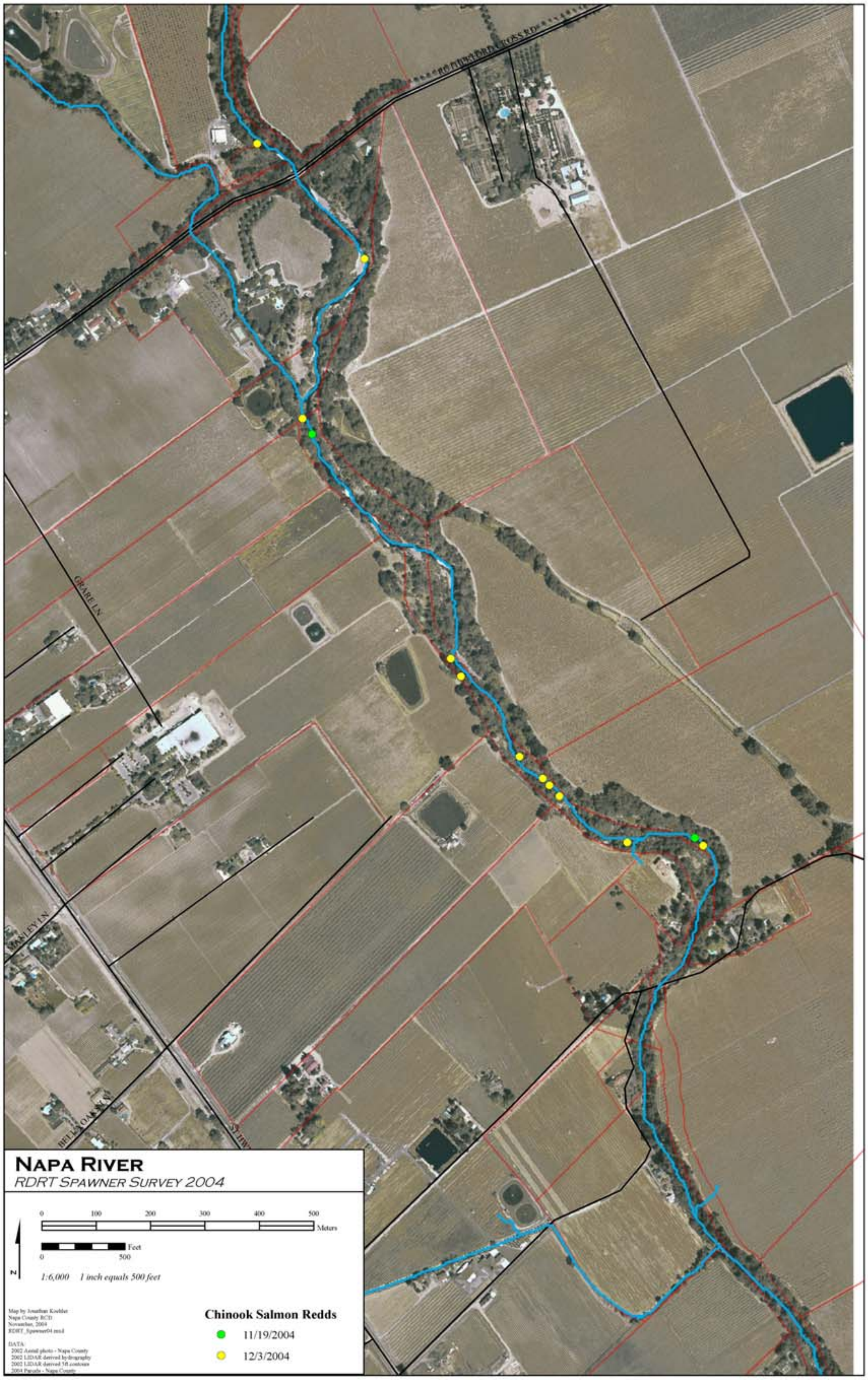
Chinook salmon redd in the Napa River. Gaff hook in photo is 1.25 meters long (November 19, 2004).

Chinook salmon (female) excavating a redd in the Napa River near Zinfandel Lane (November 19, 2004).

Chinook salmon carcass recovered in the Napa River (December 22, 2004).

Chinook salmon (male) carcasses stranded by low flow over the Zinfandel Lane Bridge apron (November 19, 2004).


ZINFANDEL LN
WHEELER WAY
ZINFANDEL LN
GALLERON AVE
MEES LN
NAPA RIVER
RDRT SPAWNER SURVEY 2004
0 100 200 300 400 500 Meters
0 500 1,000 Feet
N
1:7,800 1 inch equals 650 feet
Chinook Salmon Redds
11/19/2004
12/3/2004


NAPA RIVER
RDRT SPAWNER SURVEY 2004
0 100 200 300 400 500 Meters
Feet
0 500
N
1:6,000 1 inch equals 500 feet
Chinook Salmon Redds
11/19/2004
12/3/2004

II. SPAWNING GRAVEL PERMEABILITY

Methods

Gravel permeability was measured at each cross-section using methods developed and used by Stillwater Sciences during the Napa River Watershed Limiting Factors Analysis in 2002. These methods are summarized here and described in detailed in Appendix B.

To determine the quality of spawning gravels in the mainstem Napa River for Chinook salmon egg incubation and early rearing, substrate permeability was measured using a modified Mark IV standpipe (Terhune 1958, Barnard and McBain 1994). The recharge rate (the rate at which water moves through the substrate) derived from these measurements was converted to permeability using a rating table with a temperature and viscosity correction from Barnard and McBain (1994).

For consistency, we used the same analysis methods as those used in the Napa River Watershed Limiting Factors Analysis by Stillwater Sciences. The calculations are based on relationships between survival-to-emergence and permeability from two data sets (McCuddin 1977, Taggart 1976). We used the following simple linear regression on the combined data sets to estimate survival based on our permeability measurements:

$$\text{Survival} = 0.1488 * \ln(\text{Permeability}) - 0.8253$$

where permeability is in units of cm/hr and:

$$\text{Mortality Index} = (1 - \text{Survival})*100$$

Results and Discussion

The summarized results of the permeability analysis and the mortality index calculation are given in Table GP-1. The complete results are given in Appendix B.

DATE	GPS	X-SEC	MEDIAN A (cm/hr)	MEDIAN B (cm/hr)	SITE PERM (cm/hr)	SURVIVAL INDEX	RANK
11/23/2004	13	xs-9.6us	3000	1581	2290.5	33%	poor
11/23/2004	15	xs-9.2us	2544	3936	3240	38%	fair
11/23/2004	14	xs-8.6us	11618	6967	9292.5	53%	good
11/30/2004	3	xs-4.0us	6794	3183	4988.5	44%	fair
11/30/2004	2	xs-3.7us	5112	5304	5208	45%	fair
11/30/2004	7	xs+3.2ds	2465	3171	2818	36%	fair
12/1/2004	8	xs+3.3ds	2518	1640	2079	31%	poor
12/1/2004	9	xs+3.8ds	1288	1636	1462	26%	poor
12/1/2004	10	xs+4.2ds	2058	4351	3204.5	38%	fair
12/1/2004	11	xs+4.4ds	2809	2755	2782	35%	poor

Table GP-1. Aggregated gravel permeability results with calculated survival rates and qualitative ranking. Sites are listed in downstream order.

Spawning gravel is manually cleaned to a depth of 0.95 feet prior to driving in the standpipe to simulate the cleaning effect of redd construction.

Standpipe driven into the bed of the Napa River.

III. BED MOBILITY (SCOUR CHAINS)

Methods

A total of 40 scour chains were installed in the Rutherford reach by Jonathan Koehler (NCRCD), Chad Edwards (NCRCD), and Mike Napolitano (RWQCB) to monitor the depth of bed scour during high flows. Within each cross-section site, the most suitable potential spawning patch was identified based on substrate size, hydraulic conditions, and other significant features. A total of four scour chains were driven into the streambed surrounding the patch; one upstream, one downstream, and one on either side. The chains were four feet in length and constructed by Pina Vineyard Management based on designs from literature (Nawa and Frissel, 1993). Chains were driven into the substrate with a steel pipe to a depth of approximately three feet. The pipe was then removed, leaving the chain buried vertically in the stream bed. The exposed chain length was measured with a stadia rod and recorded along with location details in a field book. Finally, a metal tag with a unique number was attached to the end of the chain with steel wire. Photographs were taken of each site upon completion.

Results

Scour chains from all ten cross-section sites will be recovered in summer of 2005 once flows recede. Reconnaissance surveys to relocate the chains during the winter proved impossible due to high water velocity (~100 cfs) and turbidity. Scour chain data will be incorporated into this report as they become available.

Scour chain being placed into the steel installation pipe

Installed scour chain after being driven into the streambed.

Measuring the scour chain's exposed length from the substrate with a stadia rod.

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APPENDICES

APPENDIX A: SALMON SPAWNER SURVEYS

CALIFORNIA SALMONID STREAM HABITAT RESTORATION MANUAL
FISH SAMPLING METHODS IV-7
California Dept. of Fish & Game

Salmon spawner surveys (also called salmon carcass surveys) are stream bank or above-water surveys. Surveyors usually walk along the stream bank and record the number of spawned salmon carcasses, redds, and live adults. This information is useful to:

- Determine if adults are returning to and spawning within a stream reach or basin area;
- Determine which species or races are utilizing the sample area;
- Determine relative abundance and distribution of carcasses, redds or live fish within a sample area;
- Recover and record marked fish for mark studies;
- Identify preferred spawning habitat area.

Stream flow conditions can alter the timing and distribution of spawning activity from one year to the next. For annual *comparison of data it is recommended that weekly surveys be conducted throughout the entire potential time range of spawning activity.
Descriptions of spawning distribution within a basin should not rely on carcass counts conducted only during the assumed week of peak spawning. Spawner distribution within a stream system may be different for early versus late spawners.

The typical method for conducting spawner surveys is to walk along the stream bank or wade in the stream counting and recording all carcasses, redds and live fish observed. Carcasses are examined to determine species, sex, and/or missing fins. The fork lengths (FL) of fish are measured from the tip of the snout to middle of the tail to the nearest centimeter (cm). Counted carcasses are either cut in half or marked with a hog ring to eliminate being counted in subsequent surveys. With prior DFG approval, the heads of carcasses with missing adipose (Ad) fins, will be removed and retained for coded-wire-tag (CWT) extraction by DFG. All data is recorded on the Daily Salmon Spawning Stock Survey Field Form as indicated below.

Tools and Supplies Needed

- Thermometer
- Gaff hook, handle marked. in centimeters
- Waders with non-slip soles
- Pencils
- Waterproof field record form
- Waterproof ID tags_ for fish heads (Figure 11)

 Plastic "Ziploc" bags for fish heads
 Machete – and file or hog-ring-pliers and hog rings
 Vest or day pack'
 Polarized glasses
 Stream map to indicate location of spawning activity
 Drinking water and food

Instructions for Completing Daily Salmon Spawning. Stock Survey Field Form
1) **Stream -** Print the stream name.
2) **T-R-S -** Enter the township, section and range from the USGS quadrangle.
3) **Lat -** Latitude of the confluence of the stream determined from a 7.5-minute USGS quadrangle.
4) **Long -** Longitude of the confluence of the stream determined from a 7.5-minute USGS quadrangle.
5) **Quad** - Name of the USGS 7.5-minute quadrangle containing the confluence of the stream.
6) **Drainage -** Print the drainage name.
7) **County -** Enter the county in which the stream. is located
8) **Starting location -** Enter the starting point of the survey; for example, the confluence with another stream, a highway mileage marker, a bridge, etc.
9) **Lat and Long of the starting location -** Taken from a 7.5-minutes USGS quadrangle.
10) **Ending Location -** Enter the ending point of the survey; for example, the confluence with another stream, a highway mileage marker, a bridge, etc.
11) **Lat and Long of the ending location** - Taken from the 7.5-minute USGS quadrangle.
12) **Feet/miles surveyed -** Determine the distance of the survey using a map measurement device and a 7.5-minute USGS quadrangle. If the distance surveyed was measured using a hip chain, enter the distance in feet.
13) **Date of survey** - Enter the day's date: nm/dd/yy.
14) **Weather,-** Make a check mark to indicate weather conditions: clear, overcast, rain. If weather conditions chancre during the survey, note this in the remarks section at the end of the page.
15) **Water clarity** -Estimate water clarity at the beginning of the survey. If water clarity changes during the survey, note this in the remarks section at the end of the page.
16) **Water temperature** -Water temperature is taken in degrees Fahrenheit at the beginning of the survey.
17) **Air temperature** - Air temperature is to be taken in degrees Fahrenheit- at the beginning of the survey.
18) **Time -** Time when temperatures were taken.
19) **Crew** - Enter the names of the persons doing the survey.
20) **Number of live fish observed -** Enter the number of live chinook adults, chinook jacks (< 55 cm FL), coho, and steelhead observed. Identification of live fish can be very difficult. If positive identification is not possible, record the fish as an unknown.
21) **Number of carcasses examined** - Identify all carcasses to species and sex. Measure fork length in centimeters and record on the form. Examine all carcasses for adipose fin clips or any other fin clip. Mark all the carcasses using hog rings or cut carcasses in half after examination.
22) **Tag number of adipose-clipped fish and snout recoveries** - All carcasses must be examined for adipose fin clips. If the adipose fin is missing, the carcass may contain a CWT and the snout must be cut off and retained. Remove the snout by cutting across the head in the vicinity of the eyes; cut straight down from the eyes through the upper jaw and into the mouth cavity. Remove the snout in one piece. If unsure of the removal procedure; take the entire head. It is important not to lose the tag due to an improper cut. The project name, the recovery location, the species, length and sex of the fish, date and other relevant information must be recorded on a tag and wired to the snout. The project name will be recorded on the tag for later reference. The

snout or head must be frozen in a zip-lock bag and taken to DFG, where the coded-wire tags will be excised and decoded. Snouts must be individually bagged.
23) **Other fin clips observed** - Record any fin clips observed other than adipose fins.
24) **Number of skeletons observed** - Any fish that cannot be measured, or any identifiable parts of fish found are considered skeletons.- If it is possible to identify the species, record it appropriately; if not, record it as unknown.
25) **Number of redds observed** - Record the number and location of observed redds. This can be difficult in areas of heavy spawning due to multiple redds and superimposition of redds.
26) **Remarks** - Add any, information discovered during the. survey such as barriers, landslides, etc. Include any information necessary to clarify other entries on the field form.

Salmon CWT Recovery Tag			
Tag No.			
Project			
Location:			
Lat			
Long			
Species			
Race	Fall	Win	Spr
Sex	M	F	U
Recovery method			
Date			

APPENDIX B: SPAWNING GRAVEL PERMEABILITY

NAPA RIVER WATERSHED LIMITING FACTORS ANALYSIS
APPENDIX 8: PERMEABILITY
Stillwater Sciences

To determine the quality of streambed gravels for salmonid egg incubation and larval (alevin) rearing, substrate permeability was measured using a modified Mark IV standpipe (Terhune 1958, Barnard and McBain 1994). Gravels at potential spawning sites were mixed to a depth of 0.95 feet to simulate mixing and sorting conditions that would occur during redd construction by a spawning salmonid (see Kondolf and Wolman 1993 for more information on this topic).

The standpipe used was 46.5 inches (118 cm) long, with a 1.0 inch (2.5 cm) inside diameter and a 1.25 inch (3.8 cm) outside diameter. The standpipe had a 2.75 inch-long band of perforations and was driven into the substrate so that the band of perforations extended in depth from approximately 0.64 to 0.86 feet below the bed surface. To reduce the potential for water 'slippage' down the pipe, the standpipe was held, but not forced in any direction, during the driving process.

Permeability was measured by using a Thomas vacuum pump (Model 107CDC20, powered by a 12-volt rechargeable battery) to siphon water out of the standpipe to maintain the water level inside the standpipe exactly one-inch lower than the surrounding water. By measuring the volume of water siphoned out of the standpipe over a measured time interval, it was thus possible to determine the recharge rate of the water level in the standpipe under a standard one-inch pressure head. At each spawning patch assessed, the standpipe was driven in twice and at least five consecutive permeability measurements were taken.

The recharge rate (units of volume per time) data measured in the field were converted into permeability (units of length per time) using an empirically derived rating table (Barnard and McBain 1994) and adjusted with a correction factor that accounts for temperature related changes in water viscosity that can affect permeability results (Barnard and McBain 1994).

Date	Time	Stream	Site	Rep	Water Temp (C)	Start Height (cm)	End Height (cm)	Time (s)	Inflow (ml/s)	Unadjusted Permeability (cm/hr)	Viscosity Correction	Adjusted Permeability (cm/hr)
11/23/04	12:15	Mainstem Napa River (Rutherford)	GPS13a	1	10	2	17	32.93	28.3	2930	1.007	2950
			XS-9.6 US	2	10	2	17	32.06	29.0	3000	1.007	3020
				3	10	2	17	32.47	28.7	2970	1.007	2990
				4	10	4	19	32.35	28.8	2980	1.007	3000
				5	10	3	18	32.06	29.0	3000	1.007	3020
											mean	**2996**
											median	**3000**
11/23/04	12:00	Mainstem Napa River (Rutherford)	GPS13b	1	10	2	17	61.97	15.0	1500	1.007	1510
			XS-9.6 US	2	10	2	17	59.43	15.7	1570	1.007	1581
				3	10	2	17	58.96	15.8	1580	1.007	1591
				4	10	2	17	59.72	15.6	1560	1.007	1571
				5	10	2	17	57.56	16.2	1620	1.007	1631
											mean	**1577**
											median	**1581**
11/23/04	10:30	Mainstem Napa River (Rutherford)	GPS15a	1	10.5	4	24	50.4	24.6	2560	0.994	2544
			XS-9.2 US	2	10.5	4	24	49.91	24.9	2590	0.994	2574
				3	10.5	5	25	49.62	25.0	2600	0.994	2584
				4	10.5	5	25	51.75	24.0	2500	0.994	2485
				5	10.5	5	25	51.75	24.0	2500	0.994	2485
											mean	**2534**
											median	**2544**
11/23/04	11:00	Mainstem Napa River (Rutherford)	GPS15b	1	10.5	5	25	36.7	33.8	3960	0.994	3936
			XS-9.2 US	2	10.5	7	27	34.12	36.4	4480	0.994	4452
				3	10.5	7	27	37.24	33.3	3860	0.994	3836

				4	10.5	10	30	36.52	34.0	4000	0.994	3975
				5	10.5	11	31	36.9	33.6	3920	0.994	3896
											mean	**4019**
											median	**3936**
11/23/04	9:45	Mainstem Napa River (Rutherford)	GPS14a	1	10	2	22	20.24	61.3	10790	1.007	10863
			XS-8.6 US	2	10	4	24	20.62	60.2	10400	1.007	10471
				3	10	4	24	18.81	66.0	12400	1.007	12484
				4	10	4	29	24.41	63.6	11480	1.007	11558
				5	10	3	28	22.37	69.4	13780	1.007	13874
				6	10	4	29	24.24	64.0	11600	1.007	11679
											mean	**11821**
											median	**11618**
11/23/04	10:00	Mainstem Napa River (Rutherford)	GPS14b	1	10	5	25	24.87	49.9	6780	1.007	6826
				2	10	9	29	24.28	51.1	7130	1.007	7178
				3	10	11	31	23.87	52.0	7400	1.007	7450
				4	10	4	24	24.66	50.3	6890	1.007	6937
				5	10	5	25	24.65	50.4	6920	1.007	6967
											mean	**7072**
											median	**6967**
11/30/04	11:20	Mainstem Napa River (Rutherford)	GPS3a	1	8	5	25	26.55	46.8	5860	1.072	6280
			XS-4.0 US	2	8	11	29	22.37	49.9	6780	1.072	7265
				3	8	5	25	24.97	49.7	6700	1.072	7180
				4	8	9	29	25.44	48.8	6340	1.072	6794
				5	8	5	25	26.06	47.6	5920	1.072	6344
											mean	**6773**
											median	**6794**
11/30/04	11:35	Mainstem Napa River (Rutherford)	GPS3b	1	8	4	24	43.47	28.6	2960	1.072	3172
			XS-4.0 US	2	8	5	25	44.06	28.2	2920	1.072	3129
				3	8	4	24	42.8	29.0	3000	1.072	3215

				4	8	5	25	41.02	30.3	3160	1.072	3386
				5	8	5	25	43.28	28.7	2970	1.072	3183
											mean	**3217**
											median	**3183**
11/30/04	10:40	Mainstem Napa River (Rutherford)	GPS2a	1	8	5	25	32.82	37.8	4680	1.072	5015
			XS-3.7 US	2	8	5	25	32.87	37.8	4680	1.072	5015
				3	8	5	25	33.1	37.5	4650	1.072	4983
				4	8	5	25	32.06	38.7	4770	1.072	5112
				5	8	9	29	30.27	41.0	5100	1.072	5465
				6	8	5	25	30.57	40.6	4960	1.072	5315
											mean	**5178**
											median	**5112**
11/30/04	10:55	Mainstem Napa River (Rutherford)	GPS2b	1	8	7	27	60.72	20.4	2140	1.072	2293
			XS-3.7 US	2	8	5	25	30.32	40.9	4990	1.072	5347
				3	8	5	25	30.63	40.5	4950	1.072	5304
				4	8	5	25	30.82	40.3	4930	1.072	5283
				5	8	7	27	30.63	40.5	4950	1.072	5304
											mean	**4706**
											median	**5304**
11/30/04	14:25	Mainstem Napa River (Rutherford)	GPS7a	1	9.5	3	23	52.2	23.8	2480	1.023	2537
			XS+3.2 DS	2	9.5	3	23	53.73	23.1	2410	1.023	2465
				3	9.5	4	24	53.73	23.1	2410	1.023	2465
				4	9.5	5	25	53.13	23.4	2440	1.023	2496
				5	9.5	5	25	54.23	22.9	2390	1.023	2445
											mean	**2482**
											median	**2465**
11/30/04	14:40	Mainstem Napa River (Rutherford)	GPS7b	1	9.5	3	23	42.47	29.2	3020	1.023	3089
			XS+3.2 DS	2	9.5	5	25	41.21	30.1	3120	1.023	3192
				3	9.5	5	25	41.83	29.7	3070	1.023	3141

				4	9.5	5	25	40.26	30.8	3260	1.023	3335
				5	9.5	3	24	43.49	30.0	3100	1.023	3171
											mean	**3186**
											median	**3171**
12/01/04	13:40	Mainstem Napa River (Rutherford)	GPS8a	1	8	4	24	53.08	23.4	2440	1.072	2615
			XS+3.3 DS	2	8	4	24	56.2	22.1	2310	1.072	2475
				3	8	5	25	58.04	21.4	2240	1.072	2400
				4	8	5	25	47.53	26.1	2710	1.072	2904
				5	8	4	24	55.18	22.5	2350	1.072	2518
											mean	**2583**
											median	**2518**
12/01/04	13:55	Mainstem Napa River (Rutherford)	GPS8b	1	8	4	24	69.67	17.8	1780	1.072	1907
			XS+3.3 DS	2	8	4	24	83.4	14.9	1490	1.072	1597
				3	8	2	12	45.32	13.7	1370	1.072	1468
				4	8	3	18	51.69	18.0	1800	1.072	1929
				5	8	2	12	40.53	15.3	1530	1.072	1640
											mean	**1708**
											median	**1640**
12/01/04	12:45	Mainstem Napa River (Rutherford)	GPS9a	1	8.5	1	11	54	11.5	1150	1.055	1214
			XS+3.8 DS	2	8.5	1	11	45.89	13.5	1350	1.055	1425
				3	8.5	1	11	50.84	12.2	1220	1.055	1288
				4	8.5	1	11	49.79	12.5	1250	1.055	1319
				5	8.5	1	11	51.04	12.2	1220	1.055	1288
											mean	**1307**
											median	**1288**
12/01/04	13:00	Mainstem Napa River (Rutherford)	GPS9b	1	8.5	2	12	39.24	15.8	1580	1.055	1668
			XS+3.8 DS	2	8.5	5	20	51.17	18.2	1820	1.055	1921
				3	8.5	5	15	38.09	16.3	1630	1.055	1720
				4	8.5	3	13	42.27	14.7	1470	1.055	1551

				5	8.5	2	12	47.85	13.0	1300	1.055	1372
				6	8.5	3	13	40.97	15.2	1520	1.055	1604
											mean	**1639**
											median	**1636**
12/01/04	9:50	Mainstem Napa River (Rutherford)	GPS10a	1	7.5	4	24	67.71	18.3	1830	1.089	1993
			XS+4.2 DS	2	7.5	4	24	65.62	18.9	1890	1.089	2058
				3	7.5	3	23	65.44	19.0	1900	1.089	2069
				4	7.5	3	23	64.77	19.2	1930	1.089	2102
				5	7.5	3	23	66.12	18.8	1880	1.089	2047
											mean	**2054**
											median	**2058**
12/01/04	10:05	Mainstem Napa River (Rutherford)	GPS10b	1	8	4	24	37.67	33.0	3800	1.072	4072
			XS+4.2 DS	2	8	4	24	35.92	34.6	4120	1.072	4415
				3	8	4	24	35.06	35.4	4280	1.072	4586
				4	8	4	24	37.71	32.9	3780	1.072	4051
				5	8	5	25	36.15	34.3	4060	1.072	4351
											mean	**4295**
											median	**4351**
12/01/04	8:50	Mainstem Napa River (Rutherford)	GPS11a	1	7.5	4	24	51.14	24.3	2530	1.089	2755
			XS+4.4 DS	2	7.5	5	25	50.89	24.4	2540	1.089	2766
				3	7.5	5	25	49.57	25.0	2600	1.089	2831
				4	7.5	5	25	49.99	24.8	2580	1.089	2809
				5	7.5	4	24	49.13	25.3	2630	1.089	2864
											mean	**2805**
											median	**2809**
12/01/04	9:05	Mainstem Napa River (Rutherford)	GPS11b	1	7.5	3	23	50.99	24.3	2530	1.089	2755
			XS+4.4 DS	2	7.5	4	24	50.81	24.4	2540	1.089	2766
				3	7.5	4	24	52.46	23.7	2470	1.089	2690
				4	7.5	3	23	50.53	24.6	2560	1.089	2788

5	7.5	5	25	52.88	23.5	2450	1.089	2668
							mean	**2733**
							median	**2755**