CALIFORNIA DEPARTMENT OF FISH AND GAME
STREAM INVENTORY REPORT
McDonald Creek
Report Revised April 14, 2006
Report Completed 2005
Assessment Completed 2002

INTRODUCTION

A stream inventory was conducted during the summer of 2002 on McDonald Creek, a stream in the Russian River basin. The inventory was conducted in two parts: habitat inventory and biological inventory. The objective of the habitat inventory was to document the amount and condition of available habitat to fish, and other aquatic species with an emphasis on anadromous salmonids in McDonald Creek. The objective of the biological inventory was to document the salmonid and other aquatic species present and their distribution.

The objective of this report is to document the current habitat conditions and, after analyzing historical and recent data, 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

McDonald Creek is located in Mendocino County, California, a tributary of Cummiskey Creek, which is a tributary to the Russian River (see McDonald Creek map, APPENDIX A). The legal description at the confluence with Cummiskey Creek is T12N, R11W, S9. Its location is 38°54'02.83"N latitude and 123°05'15.93"W longitude. Access to McDonald Creek exists from Mountain House Road between the historic 1913 bridge over Cummiskey Creek and Hwy 128, approximately 2.3 miles south of the bridge.

McDonald Creek and its tributaries drain a basin of approximately 1445.9 acres (2.3 square miles). McDonald Creek is a maximum second order stream and has approximately 11072.8 feet (2.10 miles) of blue line stream, according to the USGS "Hopland" 7.5 minute quadrangles. McDonald has three minor, unnamed tributaries which were not surveyed. Elevations range from about 541 feet at the mouth of the creek to 1893 feet in the headwaters. The vegetation is primarily herbaceous (45%), hardwood (36%) and mixed conifer/hardwood (18%) with minor amounts of conifer forest (1%). None of the watershed is agricultural or urban. The watershed is 100% privately owned and is managed as rangeland. The creek is also influenced by Mountain House Road and its culverts which run along the entire upper left bank. Salmonid fish species historically present include steelhead trout.

METHODS

The habitat inventory conducted in McDonald Creek follows the methodology presented in the California Salmonid Stream Habitat Restoration Manual (Flosi, et al., 1998). The Americorp Volunteers and the California Department of Fish and Game (DFG) field crew that conducted the inventory was trained in standardized habitat inventory methods by DFG. This inventory was conducted by two person teams and was supervised by Derek Acomb, Russian River Planner (DFG).

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 McDonald Creek to record measurements and observations. There are nine components to the inventory form: flow, channel type, air and water temperatures, habitat type, embeddedness, shelter rating, substrate composition, canopy, and bank composition.

1. Flow:

Flow is measured in cubic feet per second (cfs) at the bottom of the stream survey reach using standard flow measuring equipment, if available. In some cases flows are estimated. Flows were also measured or estimated at major tributary confluences.

2. Channel Type:

Channel typing is conducted according to the classification system developed and revised by David Rosgen (1985 rev. 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:

Water and air temperatures, and time, are measured by crew members with hand held thermometers and recorded at each tenth unit typed. Temperatures are measured in 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 (1988). 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. McDonald 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 were in feet to the nearest tenth. All measurements are in feet to the nearest tenth. Habitat characteristics are measured using a hip chain, and stadia rod.

5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out reaches is measured by the percent of the cobble that is surrounded or buried by fine sediment. In McDonald Creek, embeddedness was visually estimated. The values were recorded using the following ranges: 0 - 25% (value 1), 26 - 50% (value 2), 51 - 75% (value 3), 76 - 100% (value 4). Additionally, a rating of "not suitable" (value 5) was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate particle size, having a bedrock tail-out, or other considerations.

6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide 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. Using an overhead view, a quantitative estimate of the percentage of the habitat unit covered is made. All shelter is then classified according to a list of nine shelter types. In McDonald Creek, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the shelter. The shelter rating is calculated for each habitat unit by multiplying shelter value and percent 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 measured habitat units, dominant and sub-dominant substrate elements were visually estimated using a list of seven size classes which are defined in the California Salmonid Stream Habitat Restoration Manual.

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 McDonald Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the top 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 visually into percentages of evergreen or deciduous 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 McDonald Creek, the dominant composition type and the dominant vegetation type of both the right and left banks for each fully measured 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.

BIOLOGICAL INVENTORY

Biological sampling during stream inventory is used to determine fish species and their distribution in the stream. Biological inventory is conducted using one or more of three basic methods: 1) stream bank observation, 2) underwater observation, 3) electro fishing. These sampling techniques are discussed in the California Salmonid Stream Habitat Restoration Manual.

IMPACT INVENTORY & ANALYSIS

Problems such as migration barriers, streambed erosion, poor water quality or temperatures are noted in the comments and landmarks section. In some cases measurements are taken, an analysis of what caused the problem is made and restoration potential and alternatives are recommended.

DATA ANALYSIS

Data from the habitat inventory form are entered into Habitat for data storage and analysis. Habitat is a Visual Basic extension to Microsoft Access, developed by Zebulon Young, University of California, Berkeley. This program processes and summarizes the data, and produces the following tables and appendices:

- Summary of riffle, flatwater, and pool habitat types
- Summary of habitat types and measured parameters
- Summary of pool types
- Summary of maximum pool depths by pool habitat types
- Summary of shelter by habitat types
- Summary of dominant substrates by habitat types
- Summary of fish habitat elements by stream reach

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

- Level II habitat types by % occurrence
- Level II habitat types by % total length
- Level IV habitat types by % occurrence
- Level I pool habitat types by % occurrence
- Maximum depth in pools
- Percent embeddedness estimated in pool tail-outs
- Mean percent cover types in pools
- Substrate composition in pool tail-outs
- Mean percent canopy

- Dominant bank composition in survey reach
- Dominant bank vegetation in survey reach

HISTORICAL STREAM SURVEYS:

The Department of Fish and Game had not conducted previous surveys of McDonald Creek.

HABITAT INVENTORY RESULTS FOR MCDONALD CREEK

* ALL TABLES AND GRAPHS ARE LOCATED AT THE END OF THE REPORT *

The habitat inventory of McDonald Creek, 7/11/2002, was conducted by Jake Newell (DFG) and Cassie Simons (Americorps) with supervision and analysis by California Department of Fish and Game (DFG). The survey began at the confluence with Cummiskey Creek and extended up McDonald Creek to a 60' rock falls after a long dry stretch. The total length of stream surveyed was 8409 feet, with an additional 22 feet of side channel.

Flows were not measured on McDonald Creek.

This section of McDonald Creek has four reaches with two distinct channel types: from the mouth to 3386 feet a B3, 907 feet a A2, 950 feet a B3 and 3166 feet a A2.

B3 channel types are moderately entrenched, moderate gradient (2-4%), riffle dominated channels, with infrequently spaced pools, a very stable plan and profile, stable banks and have a predominantly cobble substrate.

A2 channel types are steep (4-10%), narrow, cascading, step-pool streams with a high energy/debris transport associated with depositional soils and a predominantly boulder substrate.

Water temperatures ranged from 64ºF to 77ºF. Air temperatures ranged from 72ºF to 97ºF.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 42% dry units, 31% pool units, 27% flatwater units, (Graph 1). Based on total length of Level II habitat types there were 78% dry units, 5% pool units, 17% flatwater units, (Graph 2).

Ten Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were 42% Dry units, 6% Lateral Scour Pool - Bedrock Formed units, 17% Step Run units, 8% Glide units, 4% Plunge Pool units, 13% Mid-Channel Pool units, 4% Lateral Scour Pool - Boulder Formed units, 2% Run units, 2% Step Pool units, 2% Lateral Scour Pool - Root Wad Enhanced units, (Graph 3). Based on percent total length, 78% Dry units, 1% Lateral Scour Pool - Bedrock Formed units, 16% Step Run units, 1% Glide units, 1% Mid-Channel Pool units, 1% Run units, 2% Step Pool units.

A total of 16 pools were identified (Table 3). Scour pools were the most frequently encountered, at

50%, and comprised 29% 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. Three of the 14 pools (21%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 13 pool tail-outs measured, one had a value of 1 (7.7%); seven had a value of 2 (53.8%); five had a value of 5 (38.5%); (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 like bedrock, log sills, boulders.

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 , flatwater habitat types had a mean shelter rating of 8 , and pool habitats had a mean shelter rating of 19 (Table 1). Of the pool types, the Scour pools had a mean shelter rating of 14, Main Channel pools had a mean shelter rating of 23, (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover types in McDonald Creek. Graph 7 describes the pool cover in McDonald Creek. Boulders is the dominant pool cover type followed by bedrock ledges.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Gravel was observed in 43% of pool tail-outs and boulders were observed in 36% of pool tail-outs.

The mean percent canopy density for the surveyed length of McDonald Creek was 59%. The mean percentages of hardwood and coniferous trees were 39% and 61%, respectively. Forty-one percent of the canopy was open. Graph 9 describes the mean percent canopy in McDonald Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 14%. The mean percent left bank vegetated was 18%. The dominant elements composing the structure of the stream banks consisted of 18% bedrock, 47% boulder, 35% cobble/gravel, (Graph 10). Grass and brush were the dominant vegetation type observed in 6% of the units surveyed. Additionally, 21% of the units surveyed had hardwood trees as the dominant vegetation type, and 65% had coniferous trees as the dominant vegetation (Graph 11).

BIOLOGICAL INVENTORY

JUVENILE SURVEYS:

Department of Fish and Game has not conducted previous biological inventories of McDonald Creek nor are there any records of hatchery releases or fish rescues in the McDonald Creek watershed. A biological inventory was not conducted in 2002. However, during the stream habitat inventory, surveyors observed steelhead 0+, California roach, newts, frogs and deer.

DISCUSSION FOR MCDONALD CREEK

McDonald Creek has four reaches: 3386 feet a B3, 907 feet a A2, 950 feet a B3 and 3166 feet a A2. Many site specific projects can be designed within the B channel type, especially to increase pool frequency, volume and shelter.

According to the DFG Salmonid Stream Habitat Restoration Manual, B3 channel types are excellent for low-stage plunge weirs, boulder clusters, bank placed boulders, single and opposing wing-deflectors and log cover. They are also good for medium-stage plunge weirs. These channel types have suitable gradients and the stable stream banks that are necessary for the installation of instream structures designed to increase pool habitat, trap spawning gravels, and provide protective shelter for fish.

The high energy, steep gradient A2 channel types have stable stream banks and poor gravel retention capabilities and are generally not suitable for instream enhancement structures.

The water temperatures recorded on the survey day, 7/11/2002, ranged from 64ºF to 77ºF. Air temperatures ranged from 72ºF to 97ºF. The warmest water temperatures were recorded in Reach 4. Water temperatures above 65°F, if sustained, are above the threshold stress level for salmonids.

Flatwater habitat types comprised 17% of the total length of this survey and pools 5%. The pools are relatively shallow, with only three of the fourteen (21%) pools having 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 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.

Eight of the 13 pool tail-outs measured had embeddedness ratings of 1 or 2. None of the pool tail-outs had embeddedness ratings of 3 or 4. Five 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 McDonald Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Seven of the 14 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 was 19. The shelter rating in the flatwater habitats was 8. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by Boulders in McDonald Creek. Boulders are the dominant cover type in pools followed by bedrock ledges . 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 59%. Reach 1 had a canopy density of 61.5%, Reach 2 had a canopy density of 62.5%, Reach 3 had a canopy density of 37.5%, Reach 4 had a canopy density of 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 low at 14% and 18%, 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

McDonald Creek 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.

PRIORITY FISHERY ENHANCEMENT OPPORTUNITIES

1. Access for migrating salmonids is an ongoing potential problem, therefore, fish passage should be monitored, and improved where possible.

2. Increase the canopy on McDonald Creek by planting willow, alder, redwood, and Douglas fir along the stream where shade canopy is not at acceptable levels. The reach above the survey section should be assessed for planting and treated as well, since water temperatures throughout are effected from upstream. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.

3. McDonald Creek would benefit from utilizing bio-technical vegetative techniques 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.

4. In McDonald Creek, active and potential sediment sources related to the road system need to be mapped and treated according to their potential for sediment yield to the stream and its tributaries.

5. Map sources of upslope and in-channel 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. Near-stream riparian planting along any portion of the stream should be encouraged to provide bank stability and a buffering against agricultural, grazing and urban runoff.

6. Where feasible, increase woody cover in the pool and flatwater habitat units along the entire stream. Most of the existing shelter is from vegetation and undercut banks. Adding high quality complexity with larger woody cover is desirable. Combination cover/scour structures constructed with boulders and woody debris would be effective in many flatwater and pool locations in the upper reaches. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion. In some areas the material is at hand.

7. Where feasible, design and engineer pool enhancement structures to increase the number of pools in the upper reaches. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.

8. If riparian areas are not improved, temperatures in McDonald Creek, should be monitored to determine if they are having a deleterious effect upon juvenile salmonids. To achieve this, biological sampling is also required.

COMMENTS AND LANDMARKS

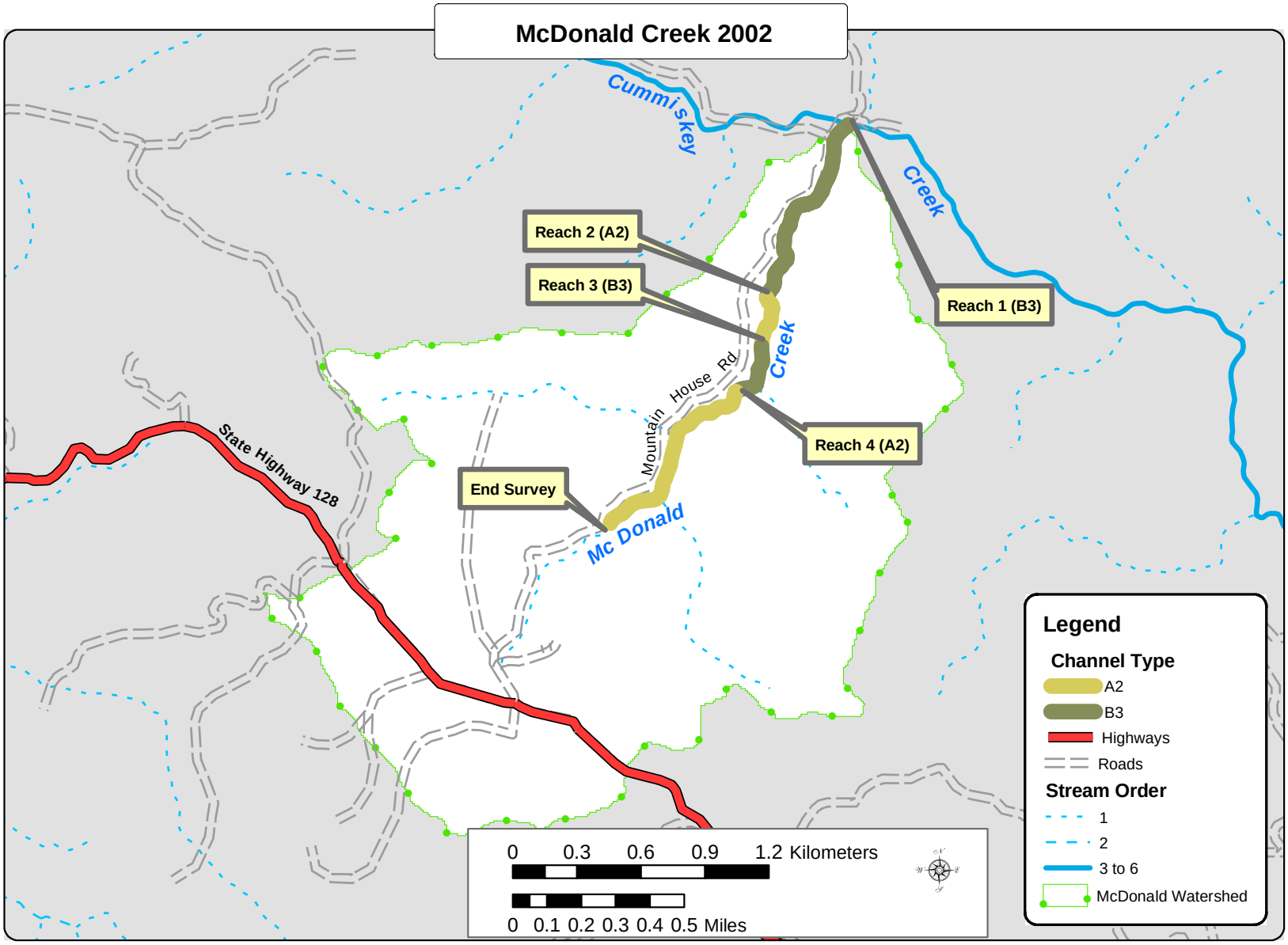
The following landmarks and possible problem sites were noted. All distances are approximate and taken from the beginning of the survey.

0' Good spawning habitat but poor rearing habitat.
600' Increase in gradient, more boulders.
610' Isolated small pools. DEBRIS ACCUMULATION, dimensions: 2.5'L x 3.5'H x 19'W, retaining 2.3' of gravel, not downcutting, scour hole formed beneath log accumulation, fish observed upstream. Accumulation consists of long, narrow dead trees spanning entire channel width and is causing erosion on the right bank (RB).
890' Steelhead 0+ observed throughout the creek from 890’ to 4668’.
1113' Active EROSION RB, dimensions: 30'D x 80'L x 100'W, high flow influenced, not debris influenced, significant sediment source (photo).
1313' Habitat units 12-15 display A2 channel characteristics Messy bedrock/boulder cluster in steep, 10% grade, causing major erosion along RB (photo #3, roll 2).
1949' CULVERT on left bank (LB), Mountain House Road, dimensions: 80'L x 2'W x 3'H, downcutting, not retaining gravel. Culvert should be checked periodically because it is causing erosion. Active bank EROSION on LB, dimensions: 7'D x 60'H x 60'W, upslope, high flow influenced, but not debris influenced, and is a sediment source.
3386' Channel change to an A2
3541' Active EROSION on RB, dimensions: 180'D x 40'L x 50'W, high flow influenced, not debris influenced.
4293' Channel changes to a B3
4668' Run is intermittent
4907' Road crossing. RB wet tributary, water temperature: tributary 71°F, confluence 79°F, upstream 82°F.
5243' Channel change back to an A2

6239' RB tributary @ 1300' into unit. CULVERT- LB, Mountain House Road, dimensions: 30'+L x 2.5'W x 12'H, downcutting, retaining gravel, causing erosion. GULLY- LB, active, dimensions: 8'D x 100'L x 8'W, upslope, high flow influenced, not debris influenced. Gully is caused by a culvert from Mountain House Road which has been downcut. Dry stream for 2000'. END OF SURVEY: 60' steep (>100%) bedrock cluster (photo 5).

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.



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Prepared by: Ann-Marie Osterback, May 14, 2003

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

Stream Name: McDonald Creek

LLID: 1230878389008

Drainage: Russian River - Upper

Survey Dates: 7/11/2002 to 7/11/2002

Confluence Location: Quad: HOPLAND Legal Description: T12NR11WS09 Latitude: 38:54:03.0N Longitude: 123:05:16.0W

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
22	0	DRY	42.3	298	6567	77.9									0
14	4	FLATWATER	26.9	102	1433	17.0	4.0	0.3	0.9	290	4063	121	1691		8
16	16	POOL	30.8	27	431	5.1	7.7	1.0	1.6	201	3208	275	3572	253	19

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
52	20	8431	7271	5264

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: McDonald Creek

LLID: 1230878389008

Drainage: Russian River - Upper

Survey Dates: 7/11/2002 to 7/11/2002

Confluence Location: Quad: HOPLAND Legal Description: T12NR11WS09 Latitude: 38:54:03.0N Longitude: 123:05:16.0W

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 (%)
4	1	GLD	7.7	17	67	0.8	5	0.3	0.7	28	112	8	34		5	45
1	0	RUN	1.9	50	50	0.6										60
9	3	SRN	17.3	146	1316	15.6	4	0.3	1.7	378	3398	158	1424		8	54
7	7	MCP	13.5	17	118	1.4	7	1.0	2	124	869	126	885	109	24	64
1	1	STP	1.9	190	190	2.3	8	1.3	1.9	1368	1368	1915	1915	1778	20	60
1	1	LSR	1.9	17	17	0.2	6			102	102				5	50
3	3	LSBk	5.8	20	61	0.7	5	0.9	2.2	126	379	191	383	178	12	70
2	2	LSBo	3.8	9	18	0.2	12	0.8	1.6	18	36	25	25	25	23	85
2	2	PLP	3.8	14	27	0.3	10	1.3	2.7	127	253	182	365	182	15	80
22	0	DRY	42.3	298	6567	77.9									0	54

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
52	20	8431	6518	5031

Table 3 - Summary of Pool Types

Stream Name: McDonald Creek LLID: 1230878389008 Drainage: Russian River - Upper

Survey Dates: 7/11/2002 to 7/11/2002

Confluence Location: Quad: HOPLAND Legal Description: T12NR11WS09 Latitude: 38:54:03.0N Longitude: 123:05:16.0W

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
8	8	MAIN	50	39	308	71	7.2	1.0	280	2237	317	2540	23
8	8	SCOUR	50	15	123	29	8.3	1.0	96	770	149	746	14

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
16	16	431	3008	3285

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

Stream Name: McDonald Creek LLID: 1230878389008 Drainage: Russian River - Upper

Survey Dates: 7/11/2002 to 7/11/2002

Confluence Location: Quad: HOPLAND Legal Description: T12NR11WS09 Latitude: 38:54:03.0N Longitude: 123:05:16.0W

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
7	MCP	50	0	0	6	86	1	14	0	0	0	0
1	STP	7	0	0	1	100	0	0	0	0	0	0
2	LSBk	14	0	0	1	50	1	50	0	0	0	0
2	LSBo	14	0	0	2	100	0	0	0	0	0	0
2	PLP	14	0	0	1	50	1	50	0	0	0	0

Total Units	Total < 1 Foot Max Resid. Depth	Total < 1 Foot % Occurrence	Total 1< 2 Foot Max Resid. Depth	Total 1< 2 Foot % Occurrence	Total 2< 3 Foot Max Resid. Depth	Total 2< 3 Foot % Occurrence	Total 3< 4 Foot Max Resid. Depth	Total 3< 4 Foot % Occurrence	Total >= 4 Foot Max Resid. Depth	Total >= 4 Foot % Occurrence
14	0	0	11	79	3	21	0	0	0	0

Mean Maximum Residual Pool Depth (ft.): 1.6

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: McDonald Creek LLID: 1230878389008 Drainage: Russian River - Upper

Survey Dates: 7/11/2002 to 7/11/2002 Dry Units: 22

Confluence Location: Quad: HOPLAND Legal Description: T12NR11WS09 Latitude: 38:54:03.0N Longitude: 123:05:16.0W

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
0	0	TOTAL RIFFLE									
4	1	GLD	0	0	0	0	0	0	0	100	0
1	0	RUN									
9	3	SRN	0	0	0	0	0	0	0	67	0
14	4	TOTAL FLAT	0	0	0	0	0	0	0	75	0
7	7	MCP	0	0	0	0	0	0	0	86	0
1	1	STP	0	0	0	0	0	0	0	100	0
1	1	LSR	0	100	0	0	0	0	0	0	0
3	3	LSBk	0	2	0	0	0	0	0	45	53
2	2	LSBo	0	3	0	0	0	0	0	98	0
2	2	PLP	0	0	0	8	0	0	0	68	25
16	16	TOTAL POOL	0	7	0	1	0	0	0	73	13
52	24	TOTAL	0	5	0	1	0	0	0	61	9

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: McDonald Creek LLID: 1230878389008 Drainage: Russian River - Upper

Survey Dates: 7/11/2002 to 7/11/2002 Dry Units: 22

Confluence Location: Quad: HOPLAND Legal Description: T12NR11WS09 Latitude: 38:54:03.0N Longitude: 123:05:16.0W

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
4	1	GLD	0	0	0	0	0	100	0
1	0	RUN	0	0	0	0	0	0	0
9	3	SRN	0	0	33	33	0	33	0
7	2	MCP	0	0	50	0	0	50	0
1	1	STP	0	0	0	0	0	100	0
1	1	LSR	0	0	100	0	0	0	0
3	2	LSBk	0	0	50	50	0	0	0
2	1	LSBo	0	0	0	0	0	100	0
2	2	PLP	0	0	0	0	0	50	50

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: McDonald Creek LLID: 1230878389008 Drainage: Russian River - Upper

Survey Dates: 7/11/2002 to 7/11/2002

Confluence Location: Quad: HOPLAND Legal Description: T12NR11WS09 Latitude: 38:54:03.0N Longitude: 123:05:16.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
59	61	39	0	14	18

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 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: McDonald Creek LLID: 1230878389008 Drainage: Russian River - Upper

Survey Dates: 7/11/2002 to 7/11/2002

Confluence Location: Quad: HOPLAND Legal Description: T12NR11WS09 Latitude: 38:54:03.0N Longitude: 123:05:16.0W

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	3	3	17.6
Boulder	8	8	47.1
Cobble / Gravel	6	6	35.3
Sand / Silt / Clay	0	0	0.0

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	1	1	5.9
Brush	0	2	5.9
Hardwood Trees	2	5	20.6
Coniferous Trees	13	9	64.7
No Vegetation	1	0	2.9

Total Stream Cobble Embeddedness Values: 3

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

StreamName: McDonald Creek LLID: 1230878389008 Drainage: Russian River - Upper

Survey Dates: 7/11/2002 to 7/11/2002

Confluence Location: Quad: HOPLAND Legal Description: T12NR11WS09 Latitude: 38:54:03.0N Longitude: 123:05:16.0W

	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)		0	0
SMALL WOODY DEBRIS (%)		0	7
LARGE WOODY DEBRIS (%)		0	0
ROOT MASS (%)		0	1
TERRESTRIAL VEGETATION (%)		0	0
AQUATIC VEGETATION (%)		0	0
WHITEWATER (%)		0	0
BOULDERS (%)		75	73
BEDROCK LEDGES (%)		0	13

Appendix C - Fish Habitat Inventory Data Summary

Stream Name: McDonald Creek LLID: 1230878389008 Drainage: Russian River -
Survey Dates: 7/11/2002 to 7/11/2002 Survey Length (ft.): 8431 Main Channel (ft.): 8409 Side Channel (ft.): 22
Confluence Location: Quad: HOPLAND Legal Description: T12NR11WS09 Latitude: 38:54:03.0N Longitude: 123:05:16.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: B3
Reach Length (ft.): 3386
Riffle/Flatwater Mean Width (ft.): 4.2
BFW:
Range (ft.): to
Mean (ft.):
Std. Dev.:
Base Flow (cfs): 0
Water (F): 64 - 69 Air (F): 72 - 90
Dry Channel (ft.): 2781

Canopy Density (%): 61.5
Coniferous Component (%): 65.0
Hardwood Component (%): 35.0
Dominant Bank Vegetation: Coniferous Trees
Vegetative Cover (%): 14.5
Dominant Shelter: Boulders
Dominant Bank Substrate Type: Boulder
Occurrence of LWD (%): 0.0
LWD per 100 ft.:
Riffles:
Pools:
Flat:

Pools by Stream Length (%): 4.3
Pool Frequency (%): 27.3
Residual Pool Depth (%):
< 2 Feet Deep: 75.0
2 to 2.9 Feet Deep: 25.0
3 to 3.9 Feet Deep: 0.0
>= 4 Feet Deep: 0.0
Mean Max Residual Pool Depth (ft.): 1.5
Mean Pool Shelter Rating: 20

Pool Tail Substrate (%): Silt/Clay: 0.0 Sand: 0.0 Gravel: 37.5 Sm Cobble: 12.5 Lg Cobble: 0.0 Boulder: 50.0 Bedrock: 0.0
Embeddedness Values (%): 1. 12.5 2. 37.5 3. 0.0 4. 0.0 5. 50.0

STREAM REACH: 2

Channel Type: A2
Reach Length (ft.): 907
Riffle/Flatwater Mean Width (ft.):
BFW:
Range (ft.): to
Mean (ft.):
Std. Dev.:
Base Flow (cfs): 0
Water (F): 69 - 69 Air (F): 90 - 90
Dry Channel (ft.): 0

Canopy Density (%): 62.5
Coniferous Component (%): 62.5
Hardwood Component (%): 37.5
Dominant Bank Vegetation: Hardwood Trees
Vegetative Cover (%): 20.0
Dominant Shelter: Boulders
Dominant Bank Substrate Type: Boulder
Occurrence of LWD (%): 0.0
LWD per 100 ft.:
Riffles:
Pools:
Flat:

Pools by Stream Length (%): 22.8
Pool Frequency (%): 33.3
Residual Pool Depth (%):
< 2 Feet Deep: 100.0
2 to 2.9 Feet Deep: 0.0
3 to 3.9 Feet Deep: 0.0
>= 4 Feet Deep: 0.0
Mean Max Residual Pool Depth (ft.): 1.65
Mean Pool Shelter Rating: 15

Pool Tail Substrate (%): Silt/Clay: 0.0 Sand: 0.0 Gravel: 50.0 Sm Cobble: 0.0 Lg Cobble: 50.0 Boulder: 0.0 Bedrock: 0.0
Embeddedness Values (%): 1. 0.0 2. 100.0 3. 0.0 4. 0.0 5. 0.0

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 3

Channel Type: B3
Reach Length (ft.): 950
Riffle/Flatwater Mean Width (ft.): 3.5
BFW:
Range (ft.): to
Mean (ft.):
Std. Dev.:
Base Flow (cfs): 0
Water (F): 77 - 77 Air (F): 97 - 97
Dry Channel (ft.): 661

Canopy Density (%): 37.5
Coniferous Component (%): 50.0
Hardwood Component (%): 50.0
Dominant Bank Vegetation: Coniferous Trees
Vegetative Cover (%): 20.8
Dominant Shelter: Small Woody Debris
Dominant Bank Substrate Type: Cobble/Gravel
Occurrence of LWD (%): 0.0
LWD per 100 ft.:
Riffles:
Pools:
Flat:

Pools by Stream Length (%): 1.8
Pool Frequency (%): 16.7
Residual Pool Depth (%):
< 2 Feet Deep:
2 to 2.9 Feet Deep:
3 to 3.9 Feet Deep:
>= 4 Feet Deep:
Mean Max Residual Pool Depth (ft.):
Mean Pool Shelter Rating: 5

Pool Tail Substrate (%):	Silt/Clay:	Sand:	Gravel:	Sm Cobble:	Lg Cobble:	Boulder:	Bedrock:

Embeddedness Values (%):	1.	2.	3.	4.	5.
					0.0

STREAM REACH: 4

Channel Type: A2
Reach Length (ft.): 3166
Riffle/Flatwater Mean Width (ft.):
BFW:
Range (ft.): to
Mean (ft.):
Std. Dev.:
Base Flow (cfs): 0
Water (F): 67 - 77 Air (F): 90 - 97
Dry Channel (ft.): 3125

Canopy Density (%): 65.0
Coniferous Component (%): 45.0
Hardwood Component (%): 55.0
Dominant Bank Vegetation: Coniferous Trees
Vegetative Cover (%): 12.5
Dominant Shelter: Boulders
Dominant Bank Substrate Type: Bedrock
Occurrence of LWD (%): 0.0
LWD per 100 ft.:
Riffles:
Pools:
Flat:

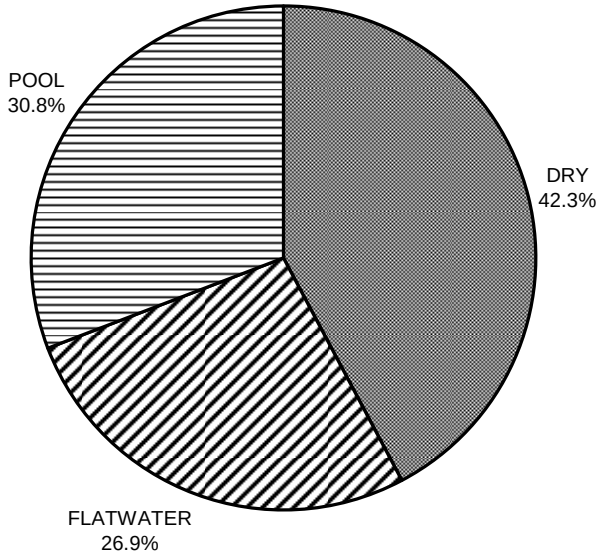
Pools by Stream Length (%): 1.3
Pool Frequency (%): 50.0
Residual Pool Depth (%):
< 2 Feet Deep: 66.7
2 to 2.9 Feet Deep: 33.3
3 to 3.9 Feet Deep: 0.0
>= 4 Feet Deep: 0.0
Mean Max Residual Pool Depth (ft.): 2.1
Mean Pool Shelter Rating: 23

Pool Tail Substrate (%):	Silt/Clay:	Sand:	Gravel:	Sm Cobble:	Lg Cobble:	Boulder:	Bedrock:
	0.0	0.0	66.7	0.0	0.0	0.0	33.3

Embeddedness Values (%):	1.	2.	3.	4.	5.
	0.0	66.7	0.0	0.0	33.3

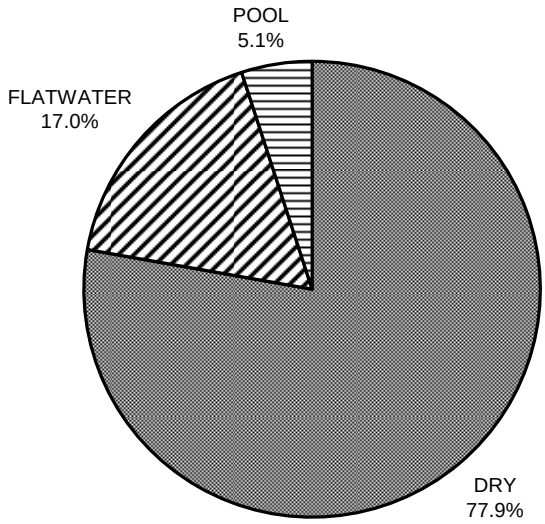
APPENDIX D: GRAPHS

MCDONALD CREEK 2002
HABITAT TYPES BY PERCENT OCCURRENCE



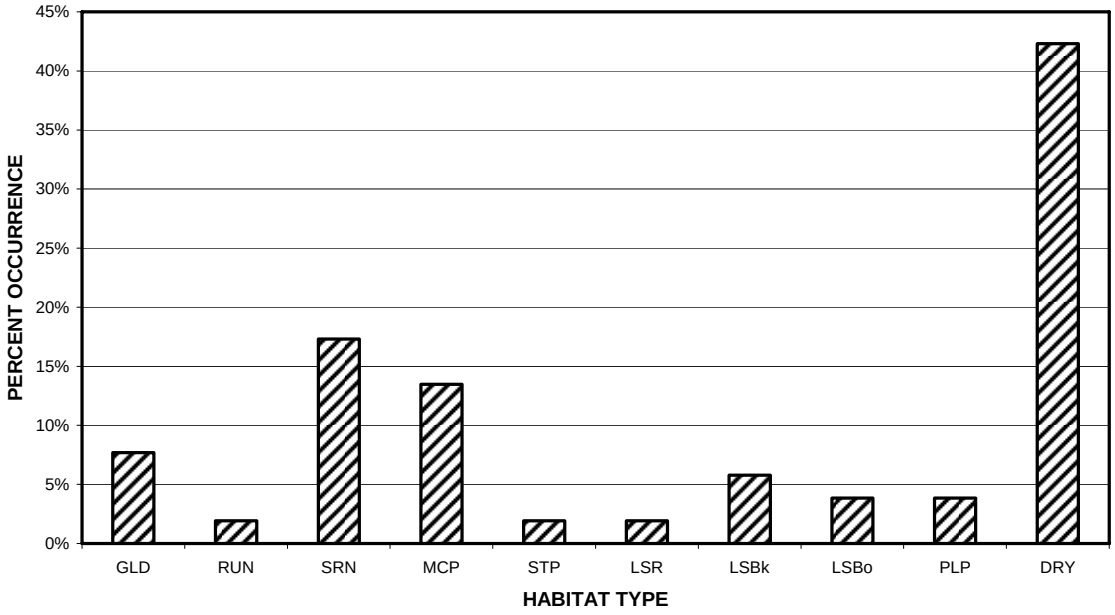
GRAPH 1: Level II habitat types by percent occurrence

MCDONALD CREEK 2002
HABITAT TYPES BY PERCENT TOTAL LENGTH



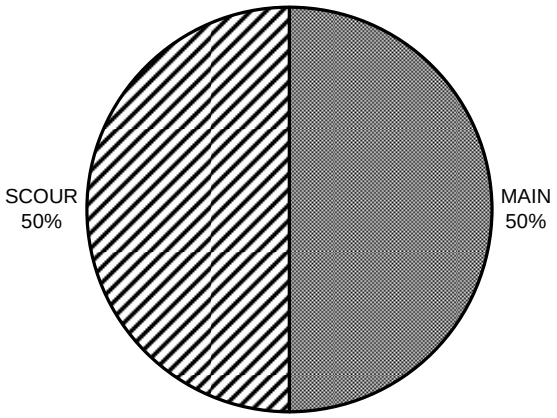
GRAPH 2: Level II habitat types by percent total length

MCDONALD CREEK 2002
HABITAT TYPES BY PERCENT OCCURRENCE



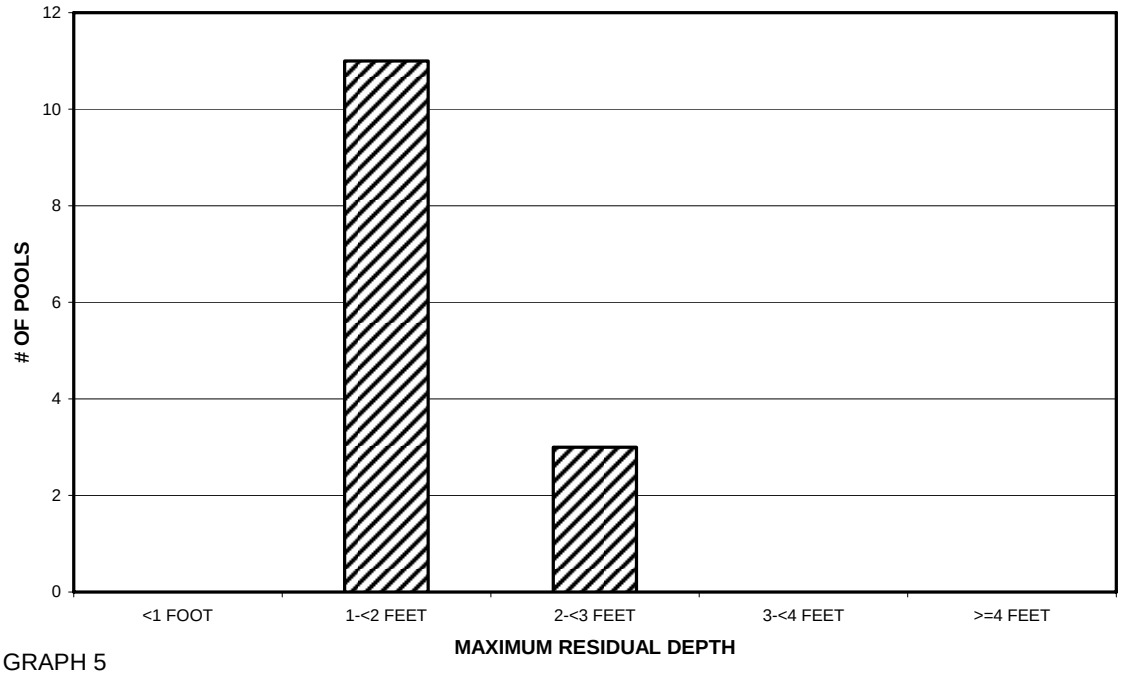
GRAPH 3: Level IV habitat types by percent occurrence

MCDONALD CREEK 2002
POOL TYPES BY PERCENT OCCURRENCE



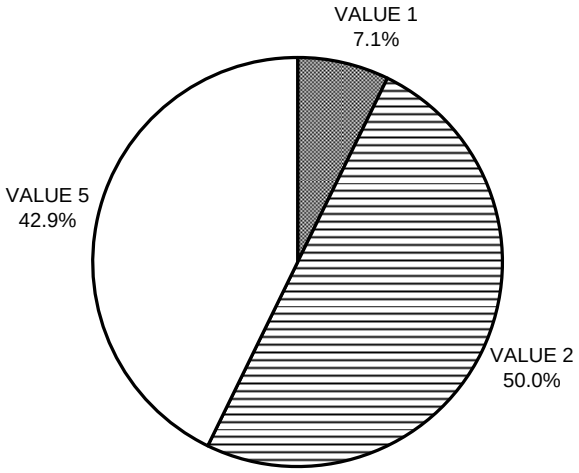
GRAPH 4: Level I pool types by percent occurrence

MCDONALD CREEK 2002
MAXIMUM DEPTH IN POOLS



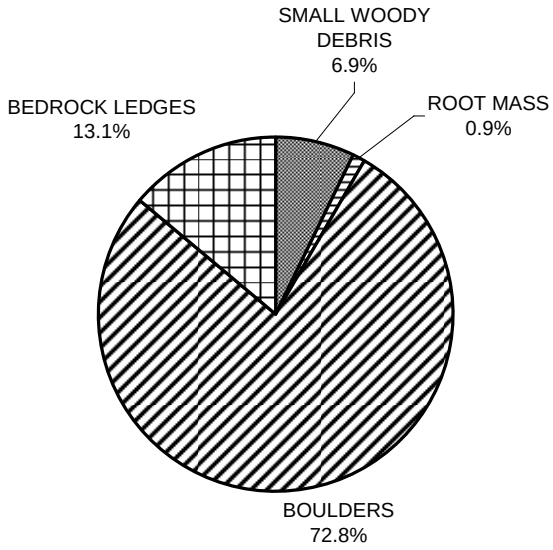
GRAPH 5

MCDONALD CREEK 2002
PERCENT EMBEDDEDNESS



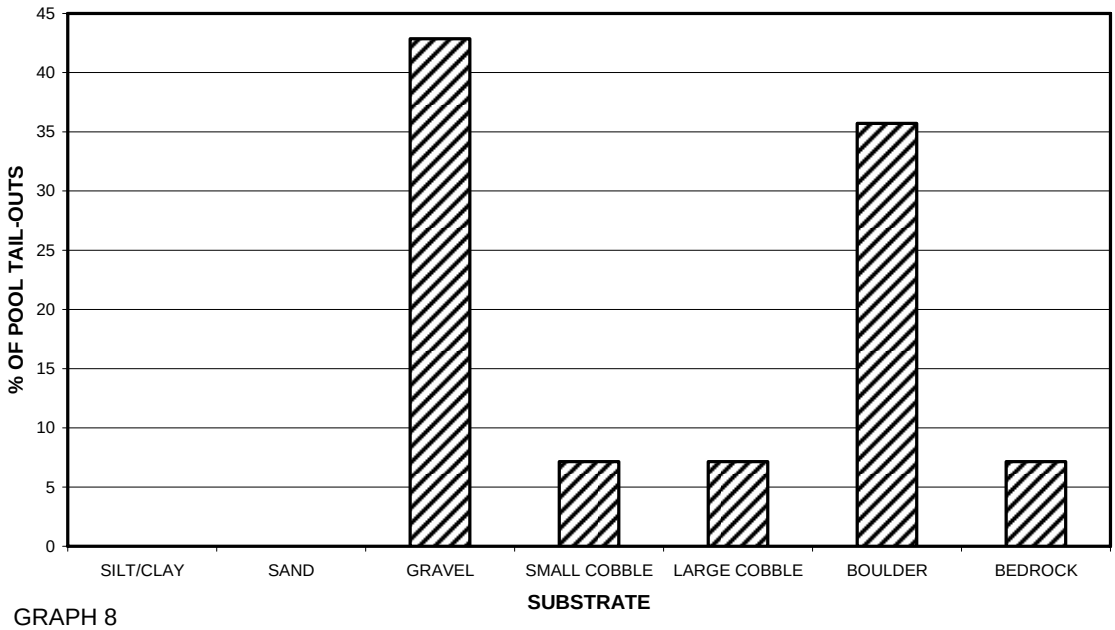
GRAPH 6

MCDONALD CREEK 2002
MEAN PERCENT COVER TYPES IN POOLS



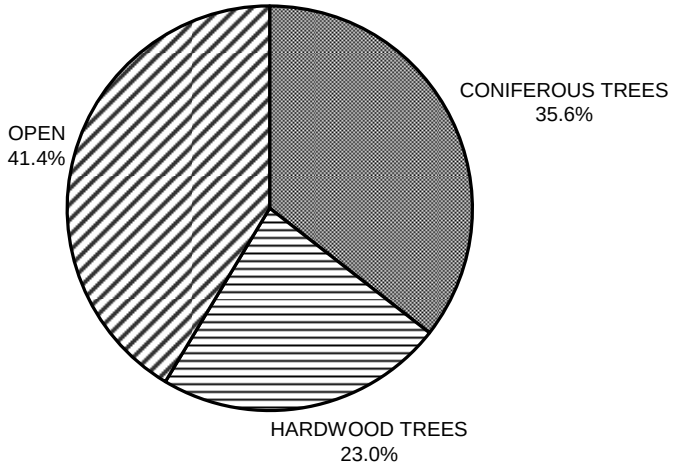
GRAPH 7

MCDONALD CREEK 2002
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



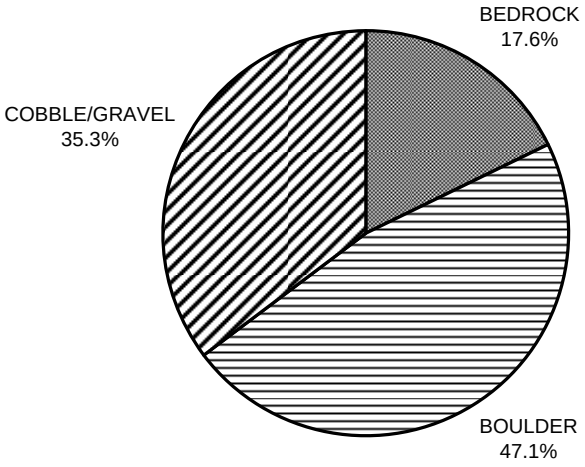
GRAPH 8

MCDONALD CREEK 2002
MEAN PERCENT CANOPY



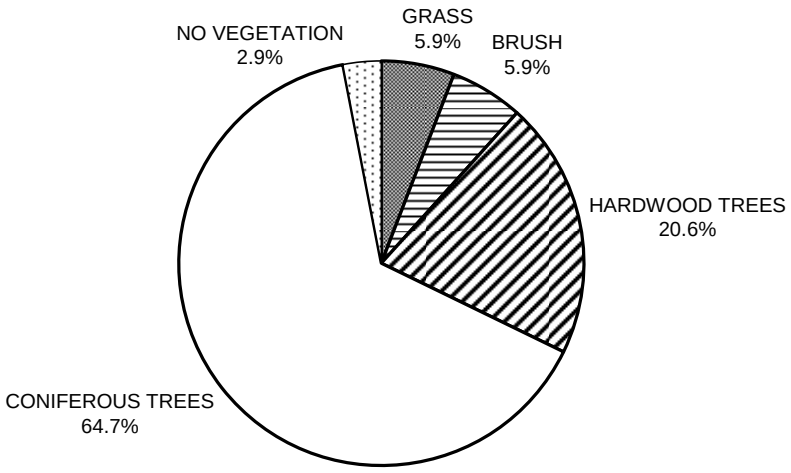
GRAPH 9

MCDONALD CREEK 2002
DOMINANT BANK COMPOSITION IN SURVEY REACH



GRAPH 10

MCDONALD CREEK 2002
DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11