



**California Department of Fish and Wildlife
Sonoma County
Russian River Watershed
Stream Habitat Assessment Reports**

Osborne Creek

Surveyed 2012

Report Completed in 2013



Osborne Creek

STREAM INVENTORY REPORT

Osborne Creek

INTRODUCTION

A stream inventory was conducted 7/18/2012 on Osborne Creek. The survey began at the confluence with Porter Creek and extended upstream 0.4 miles.

The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Osborne Creek.

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

Osborne Creek is located in Sonoma County, California (Map 1). It is a tributary to Porter Creek, which flows into Russian River, which flows into Pacific Ocean. Osborne Creek's legal description at the confluence with Porter Creek is T08N R10W Sec.10. Its location is (38:33:01.0N) 38.5504 north latitude and (122:57:14.0W) 122.954 west longitude, LLID number 1229540385504. Osborne Creek is a first order stream and has approximately 1 miles of blue line stream according to the USGS National Hydrology Dataset (NHD). Osborne Creek drains a watershed of approximately 0.4 square miles. Elevations range from about 482 feet at the mouth of the creek to 1,578 feet in the headwater areas (average elevation of headwaters, not highest point). Evergreen forest dominates the watershed. The watershed is entirely privately owned, which accounts for 100% of the land area. One hundred percent of the land is considered natural. Vehicle access exists via Sweetwater Springs Road located off of county road, Westside Road via South Healdsburg.

METHODS

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

SAMPLING STRATEGY

The inventory uses a method that samples approximately 10% of the habitat units within the

Osborne Creek

survey reach. All habitat units included in the survey are classified according to habitat type and their lengths are measured. All pool units are fully measured. All other habitat unit types encountered for the first time in each reach 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 Osborne Creek to record measurements and observations. There are eleven components to the inventory form.

1. Flow:

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

2. Channel Type:

Channel typing is conducted according to the classification system developed and revised by David Rosgen (1994). This methodology is described in the *California Salmonid Stream Habitat Restoration Manual*. Channel typing is conducted simultaneously with habitat typing and follows a standard form to record measurements and observations. There are five measured parameters used to determine channel type: 1) water slope gradient, 2) entrenchment, 3) width/depth ratio, 4) substrate composition, and 5) sinuosity. Channel characteristics are measured using a 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". Osborne Creek habitat typing used standard basin level measurement criteria. These parameters require that the minimum length of a described habitat unit must be equal to or greater than the stream's mean wetted width. All measurements are in feet to the nearest tenth. Habitat characteristics are measured using a clinometer, hip chain, and stadia rod.

Osborne Creek

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 Osborne Creek, embeddedness was ocularly estimated. The values were recorded using the following ranges: 0 - 25% (value 1), 26 - 50% (value 2), 51 - 75% (value 3) and 76 - 100% (value 4). Additionally, a value of 5 was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate such as 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 Osborne Creek, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the cover. 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 densimeters as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Osborne Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the center of approximately every third unit in addition to every fully-described unit, giving an approximate 30% sub-sample. In addition, the area of canopy was estimated ocularly into percentages of coniferous or hardwood trees.

9. Bank Composition and Vegetation:

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

Osborne Creek

(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 Osborne Creek.

DATA ANALYSIS

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

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

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

Osborne Creek

- 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 7/18/2012, was conducted by C. Neill, D. Dela Vega (WSP). The total length of the stream surveyed was 1,907 feet with an additional 0 feet of side channel.

Stream flow was not measured on Osborne Creek.

Osborne Creek is an A4 channel type for 1,907 feet of the stream surveyed (Reach 1). A4 channels are steep, narrow, cascading, step-pool, high energy debris transporting channels with depositional soils, and gravel-dominant substrates.

Water temperatures taken during the survey period ranged from 47 to 55 degrees Fahrenheit. Air temperatures ranged from 49 to 60 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 39% pool units, 28% riffle units, 26% flatwater units, 7% dry units (Graph 1). Based on total length of Level II habitat types, there were 37% flatwater units, 35% riffle units, 22% pool units, 7% dry units (Graph 2).

Eleven Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were 22% step run units, 22% mid-channel pool units, 15% high gradient riffle units (Graph 3). Based on percent total length the most frequent habitat types were 34% step run units, 24% high gradient riffle units and 9% step pool units.

A total of 18 pools were identified (Table 3). Main channel pools were the most frequently encountered at 72% (Graph 4), and comprised 81% of the total length of all pools (Table 3).

Table 4 is a summary of maximum residual pool depths by pool habitat types. Pool quality for salmonids increases with depth. Two of the 18 pools (11%) had a residual depth of two feet or

Osborne Creek

greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 18 pool tail-outs measured, 12 had a value of 1 (67%), 5 had a value of 2 (28%), 1 had a value of 4 (6%) (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 5, flatwater habitat types had a mean shelter rating of 4, and pool habitats had a mean shelter rating of 21 (Table 1). Of the pool types, the main channel pools had a mean shelter rating of 24, scour pools had a mean shelter rating of 14 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Osborne Creek. Graph 7 describes the pool cover in Osborne Creek. Boulders are the dominant pool cover type, followed by root masses and undercut banks.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Gravel substrate was observed in 72% of pool tail-outs and small cobble substrate was observed in 11% of pool tail-outs.

The mean percent canopy density for the surveyed length of Osborne Creek was 89%. Of the canopy present, the mean percentages of hardwood and coniferous trees were 72% and 28%, respectively. Eleven percent of the canopy was open. Graph 9 describes the mean percent canopy in Osborne Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 76%. The mean percent left bank vegetated was 89% (Table 7). The dominant elements composing the structure of the stream banks consisted of 61% cobble/gravel, 21% bedrock, 16% sand/silt/clay, 2% boulder (Graph 10). Deciduous trees were the dominant vegetation type observed in 66% of the units surveyed. Additionally, 23% of the units surveyed had coniferous trees as the dominant vegetation type, and 11% had brush as the dominant vegetation type (Graph 11).

DISCUSSION

Osborne Creek is an A4 channel type for the entire 1,907 feet of the stream survey. The suitability of A4 channel types for fish habitat improvement structures is as follows: A4 channel types are good for bank-placed boulders and fair for plunge weirs, opposing wing-deflectors and log cover.

The water temperatures recorded on the survey day of July 18th, 2012, ranged from 47 to 55 degrees Fahrenheit. Air temperatures ranged from 49 to 60 degrees Fahrenheit. This is a suitable water temperature range for salmonids. To make any further conclusions, temperatures would need to be monitored throughout the warm summer months, and more extensive

Osborne Creek

biological sampling would need to be conducted.

Flatwater habitat types comprised 37% of the total length of this survey, riffles 35%, and pools 22%. The pools are relatively shallow, with 2 of the 18 (11%) pools having a maximum residual depth greater than two 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.

Seventeen of the 18 pool tail-outs measured had embeddedness ratings of 1 or 2. One of the pool tail-outs had embeddedness ratings of 3 or 4. Zero 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 Osborne Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Fifteen of the 18 pool tail-outs measured had gravel and small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean shelter rating for pools is 21. The shelter rating in the flatwater habitats is 4. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by boulders in Osborne Creek. Boulders are the dominant cover type in pools, followed by root masses and 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 89%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 76% and 89%, 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 RECOMMENDATIONS

Osborne 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

Osborne Creek

remove woody debris from the stream, except under extreme buildup and only under guidance by a fishery professional.

RECOMMENDATIONS

- 1) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover in the pools is from Boulders. Adding high quality complexity with woody cover in the pools is desirable.
- 2) The stream is being impacted from livestock in the riparian zone. Livestock in streams generally inhibit the growth of new trees, exasperate erosion, and reduce summertime survival of juvenile fish by defecating in the water. Alternatives to limit cattle access, control erosion and increase canopy, should be explored with the landowner, and developed if possible.
- 3) There are several log debris accumulations present on Osborne Creek that are retaining large quantities of fine sediment. The modification of these debris accumulations is desirable, but must be done carefully, over time, to avoid excessive sediment loading in downstream reaches.
- 4) Due to the natural high gradient throughout the stream, access for migrating salmonids is an ongoing potential problem. Good water temperature and flow regimes exist in the stream and it offers good conditions for rearing fish. Fish passage should be monitored and improved where possible.
- 5) Inventory and map sources of stream bank erosion and prioritize them according to present and potential sediment yield. Identified sites should then be treated to reduce the amount of fine sediments entering the stream. Active and potential sediment sources related to the road system need to be identified, mapped, and treated according to their potential for sediment yield to the stream and its tributaries.
- 6) Access for migrating salmonids should be assessed at all road crossings and dams. All fish passage assessments should be done according to Part 9 of the California Salmonid Stream Habitat Restoration Manual (Flosi et al, 1998). Where needed, crossings should be replaced or modified to improve fish passage.

COMMENTS AND LANDMARKS

Osborne Creek

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 #	Memo
0	0001.00	Start of Survey at confluence of Porter and Osborne Creek- WP#001 N38.55064 W122.95522
126	0004.00	Cattle have access to creek channel and there is some bank erosion.
199	0006.00	Left Bank Tributary #001 is Dry. Survey crew checked 200ft into Tributary and estimated the slope to be 4-10%. No fish were observed and the tributary is not accessible to fish. After first 50' there is an old decommissioned road on Left bank. The channel is overgrown and inactive. 150' upstream is an old pvc pipe and drip line. WP#002 N38.55093 W122.95501
224	0007.00	Channel Gradient is increasing to 2-4% slope
394	0008.00	Large wood continues upstream into habitat unit 008-010
436	0009.00	Large Wood continues upstream into next habitat unit.
456	0010.00	Large and Small Wood is backing up sediment upstream and creating 4' plunge. Sediment is mostly gravel and sand (40'x4'x90'). Wood covers 90% of habitat unit- WP#003 N38.55138 W122.95544
476	0011.00	Sediment backed up from stack of redwood log that protrude from the left bank. Logs look like they had been cut with a chainsaw and are now nurse logs (roughly 10-20 years old).
545	0014.00	LDA #001 starts at top of habitat unit creating shelter.
559	0015.00	LDA #001 is 52' long, 13' high, and 10' wide, with 7 large pieces, visible gaps, and no water flowing through. It is storing sediment (90'x 5'x 12') of mostly gravel and sand. It may be a potential barrier because it is creating a 7ft plunge. LDA is composed of old redwood logs that parallel channel and protrude into channel from the left bank-WP#004 N38.55180 W122.95531. 30ft into habitat unit is a small spring on the left bank.
677	0018.00	Sediment in channel from decommissioned road/ford crossing
882	0021.00	4' plunge at top of habitat unit

Osborne Creek

Position	Habitat Unit #	Memo
1,013	0026.00	19ft into the habitat unit is left bank Tributary #002; it is Dry. The survey crew checked 100' upstream, and estimated the Slope to be 10%. no fish were observed and the tributary was not accessible to fish. The tributary was moderately entrenched, with dominant substrates of gravel and sand. WP#006 N38.55300 W122.95576
1,099	0027.00	7' plunge at top of habitat unit.
1,151	0028.00	Sediment backed up from plunge in last habitat unit.
1,190	0030.00	At top of the habitat unit is left bank Tributary #003; it is dry. The slope was estimated to be 6%, with a well defined channel with grave and cobble substrate. The survey crew checked 150ft upstream where no fish were observed. The tributary is accessible to fish in higher flows. WP#007 N38.55330 W122.95559
1,190	0030.00	California Giant salamander observed.
1,444	0037.00	Bedrock sheet is a 22ft elevation gain over the habitat unit length of 32ft. the Slope is estimated to be >95% or 43 degree angle.
1,476	0038.00	At top of habitat unit, a bolder is constricting channel and causing water to flow underneath 8ft tall bolder.
1,486	0039.00	64 ft into the habitat unit is right bank tributary #004; it is Dry. Survey crew checked 125ft upstream and estimated the slope to be 6-10% with a well defined open channel, and moderate entrenchment. No fish were observed but the tributary may be accessible to fish in high flows. WP#008 N38.55428 W122.95560
1,673	0043.00	At top of Habitat unit is left bank Tributary #005; it is Dry. The survey crew checked 70ft upstream and estimated the slope to be 6-10%. The 40ft is accessible to fish, and after that a 6-7ft plunge occurs. substrate is gravel and cobble and no fish were observed- WP#010 N38.55458 W122.95570
1,781	0045.00	50' into habitat unit is SWD with lots of drip tape and old tarps.
1,907	0046.00	End of Survey due to large bedrock sheet/waterfall (which is estimated to be 30ft tall). Waterfall is estimated to be about an 80 degree angle with no associated pools. Field crew could not climb above barrier. 431ft downstream is another potential barrier in Habitat unit 37. WP#011 N38.55481 W122.95583

Osborne Creek

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.

Osborne Creek

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 marsh	(MAR)	[9.1]	

Osborne Creek 2012

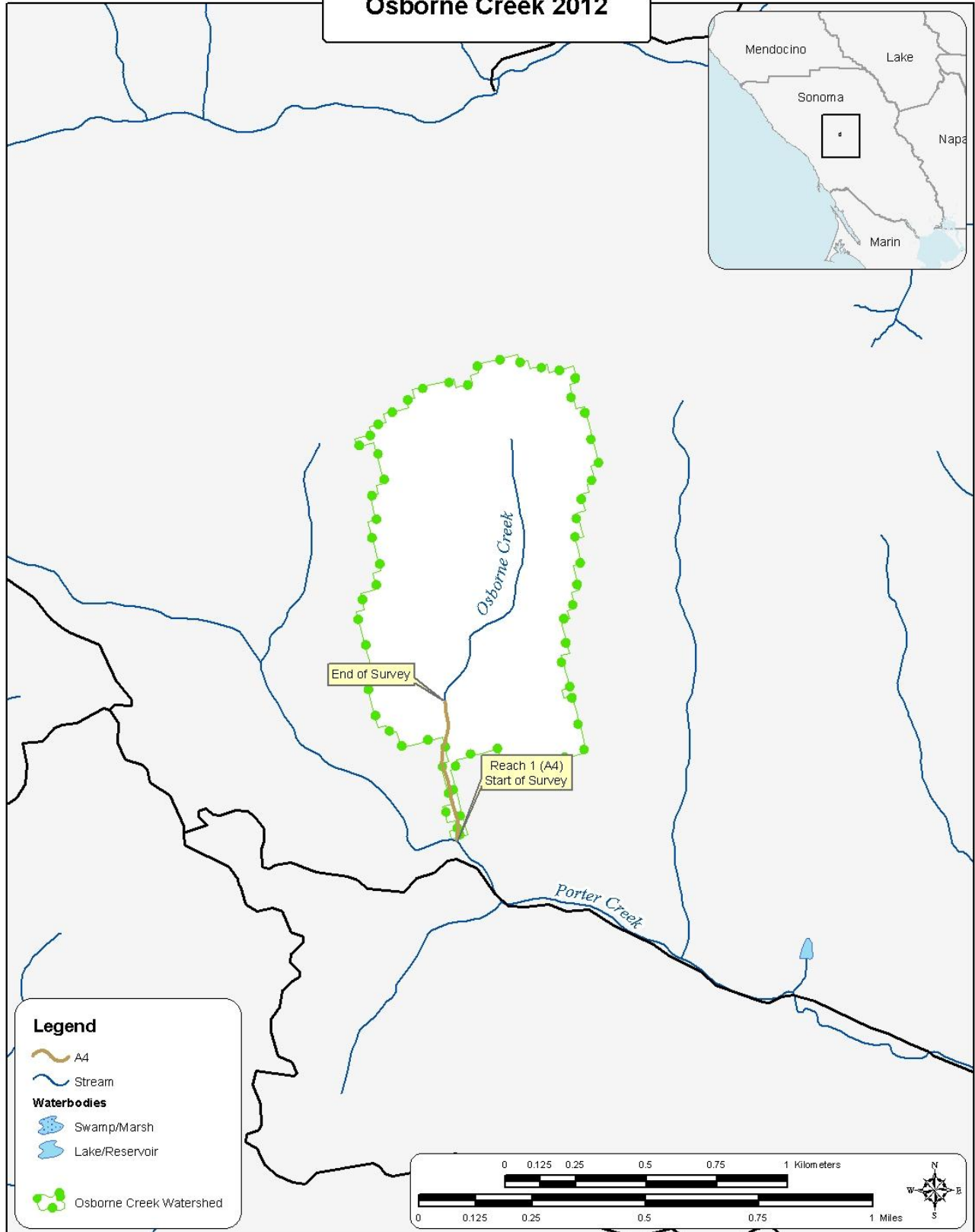


Table 1 - Summary of Riffle, Flatwater, and Pool Habitat Types

Stream Name: Osborne Creek

LLID: 1229540385504

Drainage: Russian River - Lower

Survey Dates: 7/18/2012 to 7/18/2012

Confluence Location: Quad: GUERNEVILLE

Legal Description: T08NR10WS10

Latitude: 38:33:01.0N

Longitude: 122:57:14.0W

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
3	0	DRY	6.5	42	126	6.6									
12	4	FLATWATER	26.1	58	699	36.7	3.0	0.3	0.6	102	1223	25	303		4
18	18	POOL	39.1	23	416	21.8	5.0	0.9	1.4	106	1909	111	1990	99	21
13	6	RIFFLE	28.3	51	666	34.9	3.2	0.3	0.6	141	1827	37	476		5
Total Units	Total Units Fully Measured				Total Length (ft.)						Total Area (sq.ft.)		Total Volume (cu.ft.)		
46	28				1907						4959		2769		

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Osborne Creek

LLID: 1229540385504

Drainage: Russian River - Lower

Survey Dates: 7/18/2012 to 7/18/2012

Confluence Location: Quad: GUERNEVILLE

Legal Description: T08NR10WS10

Latitude: 38:33:01.0N

Longitude: 122:57:14.0W

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 (%)
2	1	LGR	4.3	40	81	4.2	4.0	0.2	0.4	154	308	31	62		5	90
7	3	HGR	15.2	65	454	23.8	3.0	0.3	1.0	191	1335	49	345		5	85
3	1	CAS	6.5	33	99	5.2	4.0	0.4	0.7	90	269	36	108		5	96
1	1	BRS	2.2	32	32	1.7	1.0	0.2	0.5	27	27	5	5		5	76
2	1	RUN	4.3	24	47	2.5	2.0	0.2	0.4	52	104	10	21		0	91
10	3	SRN	21.7	65	652	34.2	3.0	0.3	0.9	119	1185	30	302		5	90
10	10	MCP	21.7	17	167	8.8	5.0	0.8	1.7	70	699	66	664	60	28	89
3	3	STP	6.5	57	172	9.0	5.0	1.1	2.3	246	739	268	803	250	13	92
1	1	CRP	2.2	25	25	1.3	7.0	0.6	1.0	175	175	140	140	105	10	86
4	4	PLP	8.7	13	52	2.7	6.0	1.0	2.0	74	296	96	383	83	15	84
3	0	DRY	6.5	42	126	6.6										96
Total Units	Total Units Fully Measured				Total Length (ft.)						Total Area (sq.ft.)		Total Volume (cu.ft.)			
46	28				1907						5138		2832			

Table 3 - Summary of Pool Habitat Types

Stream Name: Osborne Creek

LLID: 1229540385504

Drainage: Russian River - Lower

Survey Dates: 7/18/2012 to 7/18/2012

Confluence Location: Quad: GUERNEVILLE

Legal Description: T08NR10WS10

Latitude: 38:33:01.0N

Longitude: 122:57:14.0W

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
13	13	MAIN	72	26	339	81	4.7	0.9	111	1438	104	1353	24
5	5	SCOUR	28	15	77	19	5.8	0.9	94	471	87	437	14
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)		Total Volume (cu.ft.)	
18	18				416					1909		1790	

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

Stream Name: Osborne Creek **LLID:** 1229540385504 **Drainage:** Russian River - Lower
Survey Dates: 7/18/2012 to 7/18/2012

Confluence Location: Quad: GUERNEVILLE **Legal Description:** T08NR10WS10 **Latitude:** 38:33:01.0N **Longitude:** 122:57:14.0W

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
10	MCP	56	1	10	9	90	0	0	0	0	0	0
3	STP	17	0	0	2	67	1	33	0	0	0	0
1	CRP	6	0	0	1	100	0	0	0	0	0	0
4	PLP	22	0	0	3	75	1	25	0	0	0	0
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
18			1	6	15	83	2	11	0	0	0	0
Mean Maximum Residual Pool Depth (ft.):			1									

Table 5 - Summary of Mean Percent Cover By Habitat

Stream Name: Osborne Creek **Dry Units:** 3 **LLID:** 1229540385504 **Drainage:** Russian River - Lower

Survey Dates: 7/18/2012 to 7/18/2012

Confluence Location: Quad: GUERNEVILLE **Legal Description:** T08NR10WS10 **Latitude:** 38:33:01.0N **Longitude:** 122:57:14.0W

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
2	1	LGR	0	0	0	0	100	0	0	0	0
7	3	HGR	0	0	33	0	0	0	0	33	0
3	1	CAS	0	20	0	0	0	0	0	80	0
1	1	BRS	0	0	0	0	0	0	0	100	0
13	6	TOTAL RIFFLE	0	3	17	0	17	0	0	47	0
2	1	RUN	0	0	0	0	0	0	0	0	0
10	3	SRN	0	0	0	0	27	0	0	40	0
12	4	TOTAL FLAT	0	0	0	0	20	0	0	30	0
10	10	MCP	14	13	19	14	15	0	0	10	5
3	3	STP	27	13	0	27	0	0	0	33	0
1	1	CRP	0	20	60	0	20	0	0	0	0
4	4	PLP	13	0	0	13	0	0	0	75	0
18	18	TOTAL POOL	15	11	14	15	9	0	0	28	3
46	28	TOTAL	10	8	13	10	13	0	0	32	2

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Osborne Creek **Dry Units:** 3 **LLID:** 1229540385504 **Drainage:** Russian River - Lower
Survey Dates: 7/18/2012 to 7/18/2012

Confluence Location: Quad: GUERNEVILLE **Legal Description:** T08NR10WS10 **Latitude:** 38:33:01.0N **Longitude:** 122:57:14.0W

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
2	1	LGR	0	100	0	0	0	0	0
7	3	HGR	0	0	0	33	67	0	0
3	1	CAS	0	0	0	0	100	0	0
1	1	BRS	0	0	0	0	0	0	100
2	1	RUN	0	0	100	0	0	0	0
10	3	SRN	0	0	33	33	33	0	0
10	10	MCP	0	30	50	10	10	0	0
3	3	STP	0	67	33	0	0	0	0
1	1	CRP	0	0	0	100	0	0	0
4	4	PLP	0	25	50	25	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Osborne Creek

LLID: 1229540385504

Drainage: Russian River - Lower

Survey Dates: 7/18/2012 to 7/18/2012

Confluence Location: Quad: GUERNEVILLE

Legal Description: T08NR10WS10

Latitude: 38:33:01.0N

Longitude: 122:57:14.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
89	28	72	0	76	89

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: Osborne Creek LLID: 1229540385504 Drainage: Russian River - Lower
 Survey Dates: 7/18/2012 to 7/18/2012 Survey Length (ft.): 1907 Main Channel (ft.): 1907 Side Channel (ft.): 0
 Confluence Location: Quad: GUERNEVILLE Legal Description: T08NR10WS10 Latitude: 38:33:01.0N Longitude: 122:57:14.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: A4	Canopy Density (%): 88.5	Pools by Stream Length (%): 21.8
Reach Length (ft.): 1907	Coniferous Component (%): 27.9	Pool Frequency (%): 39.1
Riffle/Flatwater Mean Width (ft.): 3.1	Hardwood Component (%): 72.1	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Hardwood Trees	< 2 Feet Deep: 88.9
Range (ft.): 8.00 to 10.00	Vegetative Cover (%): 82.1	2 to 2.9 Feet Deep: 11.1
Mean (ft.): 9.25	Dominant Shelter: Boulders	3 to 3.9 Feet Deep: 0.0
Std. Dev.: 0.83	Dominant Bank Substrate Type: Cobble/Gravel	>= 4 Feet Deep: 0.0
Base Flow (cfs): 0	Occurrence of LWD (%): 12.5	Mean Max Residual Pool Depth (ft.): 1.38
Water (F): 47 - 55 Air (F): 49 - 60	LWD per 100 ft.:	Mean Pool Shelter Rating: 21
Dry Channel (ft.): 126	Riffles: 0	
	Pools: 2	
	Flat: 0	
Pool Tail Substrate (%): Silt/Clay: 0.0 Sand: 5.6 Gravel: 72.2 Sm Cobble: 11.1 Lg Cobble: 5.6 Boulder: 0.0 Bedrock: 5.6		
Embeddedness Values (%): 1. 66.7 2. 27.8 3. 0.0 4. 5.6 5. 0.0		

Table 9 -Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Osborne Creek **LLID:** 1229540385504 **Drainage:** Russian River - Lower
Survey Dates: 7/18/2012 to 7/18/2012
Confluence Location: Quad: GUERNEVILLE **Legal Description:** T08NR10WS10 **Latitude:** 38:33:01.0N **Longitude:** 122:57:14.0W

Mean Percentage of Dominant Stream Bank Substrate

Dominant Class of Substrate	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percentage (%)
Bedrock	7	5	21.4
Boulder	0	1	1.8
Cobble/Gravel	14	20	60.7
Sand/Silt/Clay	7	2	16.1

Mean Percentage of Dominant Stream Bank Vegetation

Dominant Class of Vegetation	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percentage (%)
Grass	0	0	0.0
Brush	6	0	10.7
Hardwood Trees	16	21	66.1
Coniferous Trees	6	7	23.2
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values: 1

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

Stream Name: Osborne Creek

LLID: 1229540385504

Drainage: Russian River - Lower

Survey Dates: 7/18/2012 to 7/18/2012

Confluence Location: Quad: GUERNEVILLE

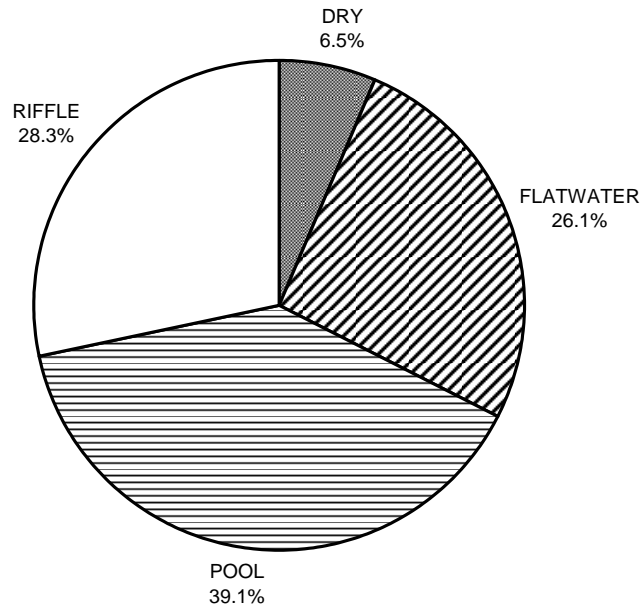
Legal Description: T08NR10WS10

Latitude: 38:33:01.0N

Longitude: 122:57:14.0W

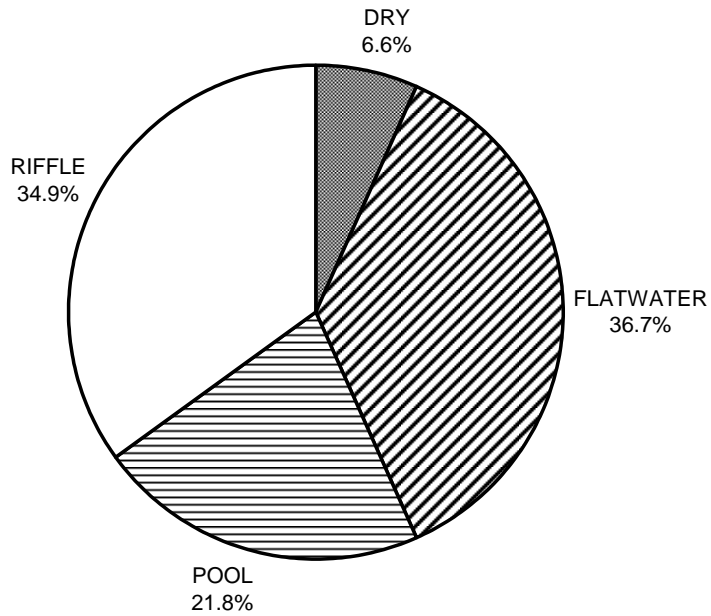
	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	0	15
SMALL WOODY DEBRIS (%)	3	0	11
LARGE WOODY DEBRIS (%)	17	0	14
ROOT MASS (%)	0	0	15
TERRESTRIAL VEGETATION (%)	17	20	9
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	0	0	0
BOULDERS (%)	47	30	28
BEDROCK LEDGES (%)	0	0	3

**OSBORNE CREEK 2012
HABITAT TYPES BY PERCENT OCCURRENCE**



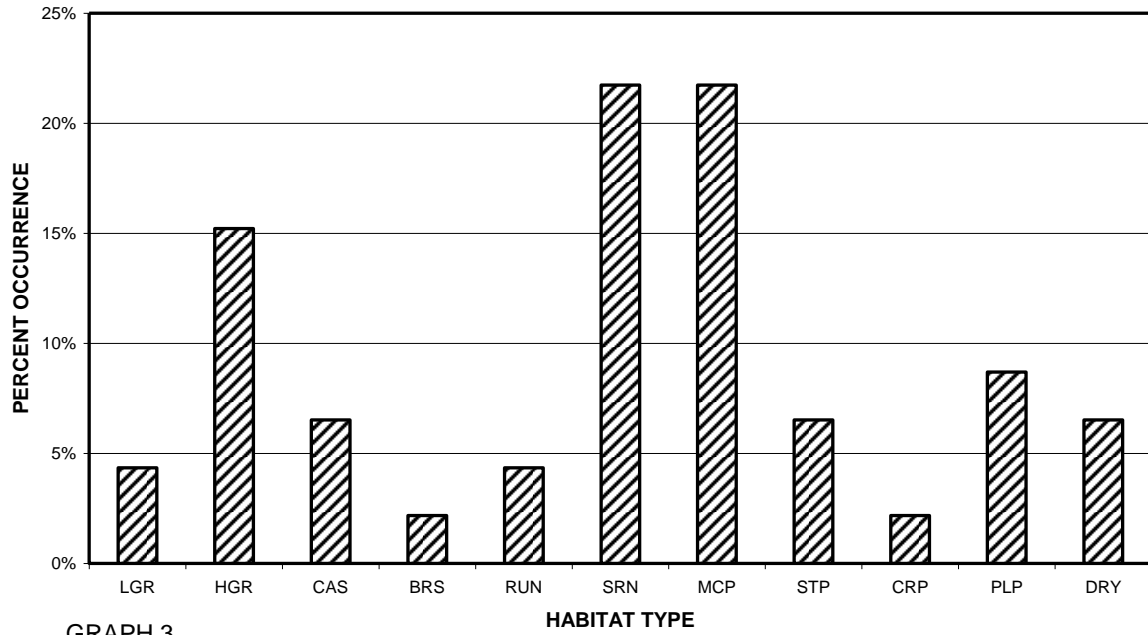
GRAPH 1

**OSBORNE CREEK 2012
HABITAT TYPES BY PERCENT TOTAL LENGTH**



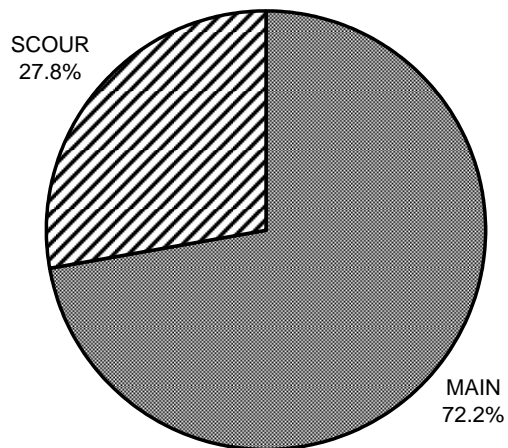
GRAPH 2

**OSBORNE CREEK 2012
HABITAT TYPES BY PERCENT OCCURRENCE**



GRAPH 3

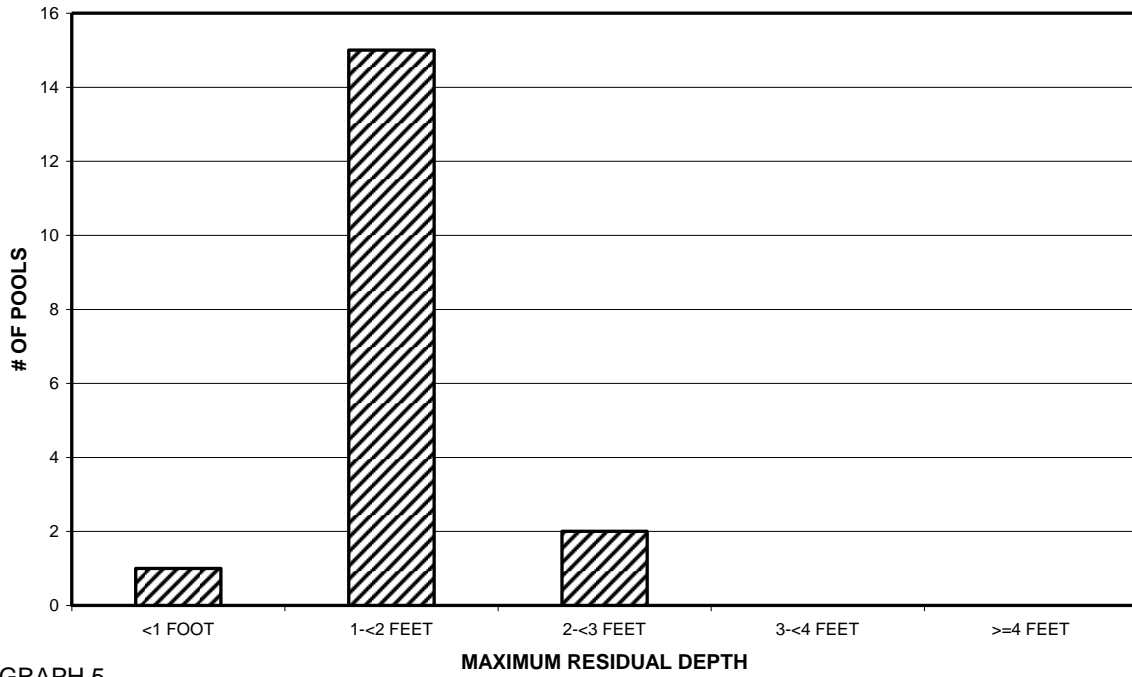
**OSBORNE CREEK 2012
POOL TYPES BY PERCENT OCCURRENCE**



GRAPH 4

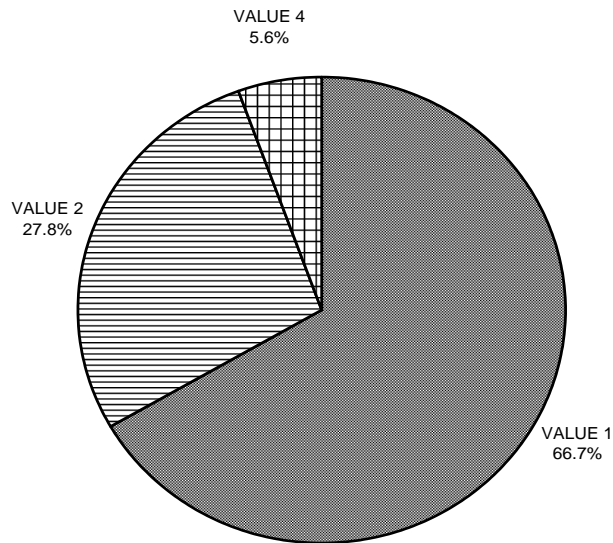
Osborne Creek

OSBORNE CREEK 2012
MAXIMUM DEPTH IN POOLS



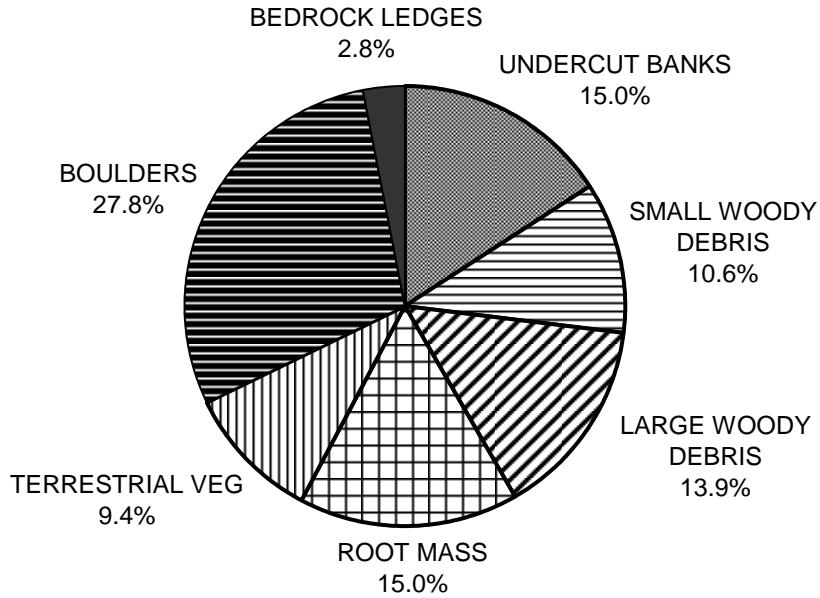
GRAPH 5

OSBORNE CREEK 2012
PERCENT EMBEDDEDNESS



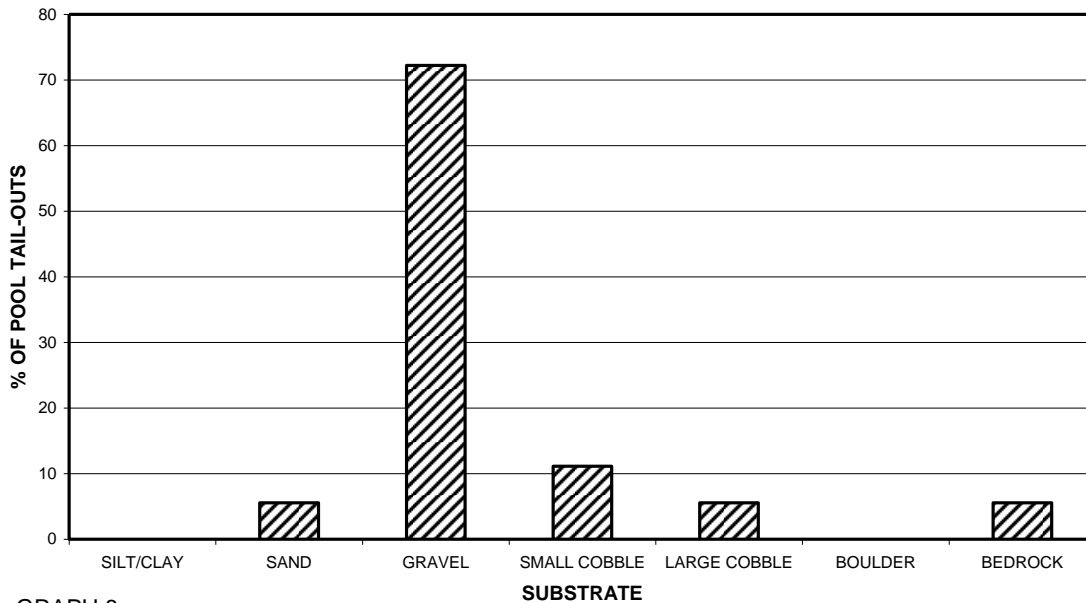
GRAPH 6

OSBORNE CREEK 2012 MEAN PERCENT COVER TYPES IN POOLS



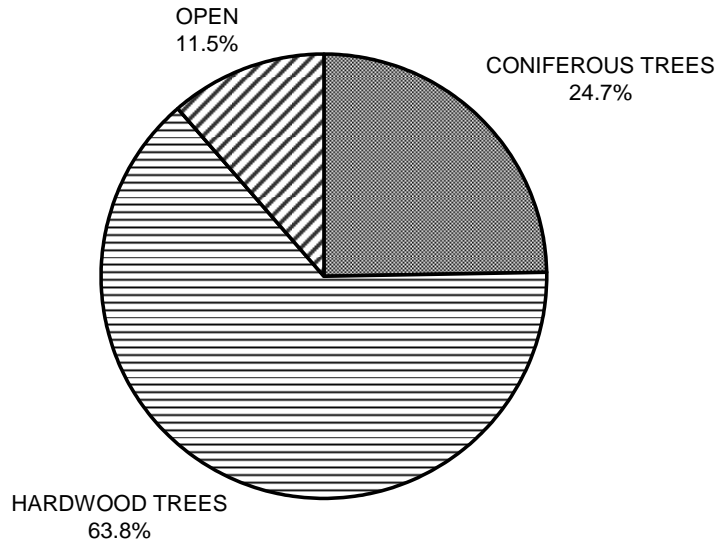
GRAPH 7

OSBORNE CREEK 2012 SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



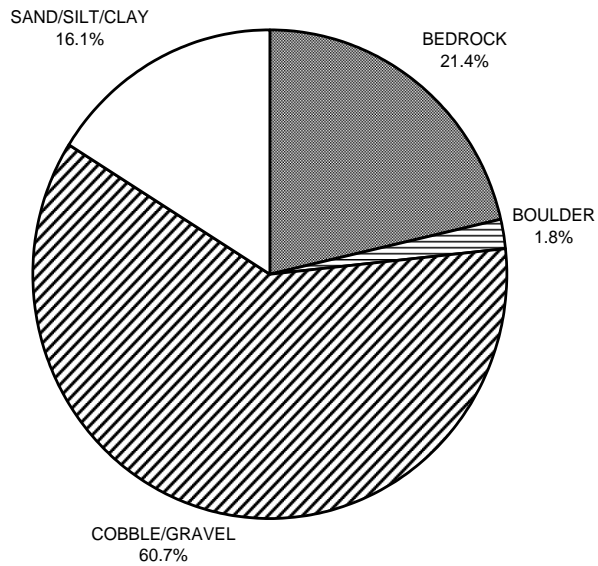
GRAPH 8

**OSBORNE CREEK 2012
MEAN PERCENT CANOPY**



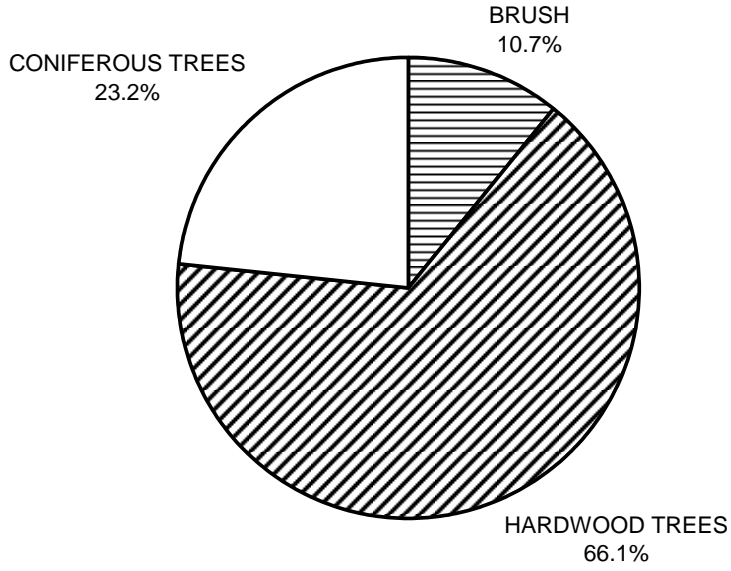
GRAPH 9

**OSBORNE CREEK 2012
DOMINANT BANK COMPOSITION IN SURVEY REACH**



GRAPH 10

**OSBORNE CREEK 2012
DOMINANT BANK VEGETATION IN SURVEY REACH**



GRAPH 11