APPENDIX A

SHADOW SHADE MODELING

Current Condition and Future Condition

Stream Name	Reach Number	Reach Length (ft)	Aspect NS/45/EW	Stream Order	Wetted Width (ft)	Tree Height (ft)	Shade Density (%)	Comments	% Shade (Curve)	Density Correction	% Shade (Adjusted)	Shade x Length	Shade Wtd by Reach	Wtd Shade Sub Reach	Site Class	Exist/Fut Veg	Fut. Shd Density	Fut. Tree Height	Fut. Shd Value (c)	Density Correction	% Shade (Adjusted)	Shade x Length	Shade Wtd by Reach	Wtd Shade Sub Reach	Recovery Time		Interim Bench Marks Fut. Shd Density	20 + Tree Height	20 + Shade Value (c)	Density Correction	% Shade (Adjusted)	Shade x Length	Shade Wtd by Reach	Wtd Shade Sub Reach
SF Coquille	SFC1	7400	45	4	75	80	60		40	4	36	266400			1	AF/FA	70	180	63	2	61	451400			73		70	120	50	2	48	355200		
(coal)	SFC2	2400	NS	4	65	60	60	ROAD*	40	6	34	81600			2	AF/FA	70	180	70	3	67	160800			78		70	108	57	3	54	129600		
	SFC3	2200	45	4	65	60	40	ROAD*	33	16	17	37400			3	AF/FA	70	180	66	2	64	140800			121		70	94	46	2	44	96800		
	SFC4	2100	NS	4	60	60	60	ROAD*	41	6	35	73500			3	AF/FA	70	180	71	3	68	142800			121		70	94	52	3	49	102900		
	SFC5	1700	NS	4	50	80	60	ROAD*	50	6	44	74800			2	AF/FA	70	180	72	3	69	117300			73		70	120	63	3	60	102000		
	SFC6	5100	NS	4	50	70	60	ROAD*	48	6	42	214200			2	AF/FA	70	180	72	3	69	351900			77		70	113	61	3	58	295800		
	SFC7	3800	45	4	50	50	50	ROAD	28	9	19	72200			2	AF/FA	70	180	71	2	69	262200			83		70	98	55	2	53	201400		
	SFC8	3200	EW	4	40	65	65	TTC, RD*	28	6	22	70400			2	AF/FA	70	180	82	3	79	252800			78		70	110	48	3	45	144000		
	SFC9	2300	EW	4	40	70	70	ROAD	30	3	27	62100			2	AF/FA	70	180	82	3	79	181700			77		70	113	50	3	47	108100		
	SFC10	2900	EW	4	40	50	70	TTC, RD	25	3	22	63800			2	AF/FA	70	180	82	3	79	229100			83		70	98	40	3	37	107300		
	SFC11	2100	45	4	35	40	70	ROAD	25	2	23	48300			2	AF/FA	70	180	75	2	73	153300			86		70	92	57	2	55	115500		
	SFC12	1350	EW	4	35	80	30	ROAD	40	27	13	17550			2	AF/FA	70	180	85	3	82	110700			73		70	120	60	3	57	76950		
	SFC13	4200	NS	4	35	55	30	TTC, RD	48	23	25	105000			2	AF/FA	70	180	77	3	74	310800			81		70	102	63	3	60	252000		
	SFC14	1450	NS	4	40	60	30	ROAD	48	23	25	36250			2	AF/FA	70	180	75	3	72	104400			80		70	108	64	3	61	88450		
	SFC15	1050	NS	4	50	60	30	ROAD	43	23	20	21000			2	AF/FA	70	180	72	3	69	72450			80		70	108	61	3	58	60900		
(johnson)	SFC16	9500	NS	4	30	80	30	ROAD	58	23	35	332500			3	AF/FA	70	180	78	2	76	722000			111		70	110	68	2	66	627000		
	SFC17	3200	45	4	30	80	25	ROAD	55	29	26	83200			3	AF/FA	70	180	77	2	75	240000			111		70	110	67	2	65	208000		
	SFC18	6200	45	4	25	90	60	ROAD	63	4	59	365800		33	3	AF/FA	70	180	78	2	76	471200		72	105		70	116	70	2	68	421600		56
(rock)	SFC19	3100	45	4	25	108	50	ROAD	68	9	59	182900			3	AF/FA	70	180	78	3	75	232500			90		70	130	73	3	70	217000		
	SFC20	7200	EW	4	15	90	70	ROAD	86	3	83	597600			3	AF/FA	70	120	91	2	89	640800			25		70	116	91	2	89	640800		
	SFC21	1900	45	4	15	50	60	ROAD	63	4	59	112100			3	AF/FA	70	120	85	2	83	157700			45		70	90	80	2	78	148200		
	SFC22	3200	45	4	15	90	70	ROAD	80	2	78	249600			3	AF/FA	70	120	85	2	83	265600			25		70	116	82	2	80	256000		
	SFC23	3000	45	4	20	60	70	ROAD	56	2	54	162000			3	AF/FA	70	120	75	2	73	219000			42		70	94	70	2	68	204000		
	SFC24	3600	45	4	25	40	50	PRT,RD, HAR	35	9	26	93600			2	AF/FA	70	120	72	2	70	252000			34		70	92	64	2	62	223200		
	SFC25	3000	45	4	25	30	40	ROAD, HARV	26	16	10	30000			2	AF/FA	70	120	72	2	70	210000			37		70	87	63	2	61	183000		
	SFC26	1050	45	4	25	80	60	ROAD	61	4	57	59850			2	AF/FA	70	120	72	2	70	73500			20		70	120	73	2	71	74550		
	SFC27	1150	EW	4	25	50	20	PRIVATE	28	28	0	0		55	2	AF/FA	70	120	72	3	69	79350		78	31		70	98	62	3	59	67850		73
(panther)	SFC28	3400	45	4	20	80	60	PRIVATE	63	4	59	200600			2	AF/FA	70	120	75	2	73	248200			20		70	120	75	2	73	248200		
	SFC29	2100	45	4	20	80	55	ROAD	63	7	56	117600			2	AF/FA	70	120	75	2	73	153300			20		70	120	75	2	73	153300		
	SFC30	1400	45	4	20	80	60	ROAD	63	4	59	82600			2	AF/FA	70	120	75	2	73	102200			20		70	120	75	2	73	102200		
	SFC31	3500	45	4	20	60	55	TTC, RD	55	7	48	168000			2	AF/FA	70	120	75	2	73	255500			27		70	108	75	2	73	255500		
	SFC32	3600	45	4	20	70	55	ROAD	60	7	53	190800			2	AF/FA	70	120	75	2	73	262800			24		70	113	74	2	72	259200		
(buck)	SFC33	5200	45	4	20	80	60	ROAD	63	4	59	306800		55	2	AF/FA	70	120	75	2	73	379600		73	20		70	120	75	2	73	379600		73
	SFC34	900	45	4	15	70	50	PRIVATE	73	9	64	57600			2	AF/FA	70	120	83	2	81	72900			24		70	113	82	2	80	72000		
	SFC35	4100	NS	4	15	80	65		80	4	76	311600			2	AF/FA	70	120	91	3	88	360800			20		70	120	87	3	84	344400		
	SFC36	1700	45	4	15	60	30	PRIVATE	68	24	44	74800			2	AF/FA	70	120	83	2	81	137700			27		70	108	81	2	79	134300		
	SFC37	1900	45	4	15	80	70		77	2	75	142500			2	AF/FA	70	120	83	2	81	153900			20		70	120	83	2	81	153900		
	SFC38	1100	NS	4	15	70	65	PRIVATE	78	4	74	81400			2	AF/FA	70	120	87	3	84	92400			24		70	113	85	3	82	90200		
	SFC39	900	EW	4	15	70	60	HARV	65	9	56	50400			2	AF/FA	70	120	91	3	88	79200			24		70	113	91	3	88	79200		
	SFC40	4700	45	4	15	70	60	HARV	74	4	70	329000		68	2	AF/FA	70	120	83	2	81	380700		84	24		70	113	82	2	80	376000		82
(wooden r)	SFC41	1500	45	3	15	50	50	HARV	63	9	54	81000			2	AF/FA	70	120	83	2	81	121500			31		70	98	80	2	78	117000		
	SFC42	5100	EW	3	14	70	50	HARV	73	15	58	295800			2	AF/FA	70	120	91	3	88	448800			24		70	113	91	3	88	448800		
(foggy)	SFC43.1	2000	EW	2	14	50	50	TTC	52	15	37	74000		52	2	AF/FA	70	120	91	3	88	176000		87	31		70	98	90	3	87	174000		86
	SFC43.2	1200	EW	2	14	10	5	TTC	0	0	0	0			2	AF/FA	70	120	91	3	88	105600			42		70	60	60	3	57	68400		
(eden br)	SFC44	3800	45	2	12	100	70		83	2	81	307800			2	AF/FA	70	120	85	2	83	315400			11		70	133	87	2	85	323000		
	SFC45.1	4100	45	2	12	100	65	PRIVATE	83	3	80	328000			2	AF/FA	70	120	85	2	83	340300			11		70	133	87	2	85	348500		
	SFC45.2	1600	45	2	10	60	75	TTC	78	1	77	123200			2	AF/FA	70	120	86	2	84	134400			27		70	108	85	2	83	132800		
	SFC46	1500	45	2	10	70	50	PRIVATE	85	9	76	114000			2	AF/FA	70	120	86	2	84	126000			24		70	113	85	2	83	124500		
	SFC47	2200	45	1	8	100	55	HARVEST	87	7	80	176000			3	AF/FA	70	120	87	2	85	187000			18		70	124	98	2	96	211200		
	SFC48	2500	NS	1	6	70	35	HARVEST	87	18	69	172500			3	AF/FA	70	120	87	3	84	210000			38		70	100	88	3	85	212500		
	SFC49	2100	45	1	4	70	45	HARVEST	86	12	74	155400	49	77	3	AF/FA	70	120	90	2	88	184800	77	84	38		70	100	90	2	88	184800	69	86
Coal Cr	COA1	4100	45	3	23	48	75		48	0	48	196800			3	A/A	75	100	65	0	65	266500			30		70	88	65	0	65	266500		
	COA2	3200	45	3	23	50	65		48	3	45	144000			3	A/A	75	100	65	0	65	208000			30		70	90	65	0	65	208000		
	COA3	5300	45	3	20	40	65	HARV	39	3	36	190800			3	AF/F	70	120	75	2	73	386900			50		70	82	63	2	61	323300		
	COA4	1500	45	3	20	40	70	TTC,HARV	40	2	38	57000			3	A/F	70	120	75	2	73	109500			50		70	82	63	2	61	91500		
	COA5	4200	45	3	18	55	70	HARV	55	2	53	222600			3	AF/F	70	120	78	2	76	319200			43		70	92	72	2	70	294000		
	COA6	1900	45	3	14	60	75	HARV	68	0	68	129200			3	F/F	70	120	84	2	82	155800			42		70	94	80	2	78	148200		
	COA7	1700	45	3	12	40	40	TTC,HARV	60	16	44	74800			3	A/F	70	120	84	2	82	139400			50		70	82	80	2	78	132600		
	COA8	4100	45	3	14	60	75	PRVT,HARV	68	0	68	278800			3	AF/F	70	120	84	2	82	336200			47		70	86	82	2	80	328000		
	COA9	2100	NS	2	10	60	75	HARV	80	0	80	168000			3	F/F	70	120	88	3	85	178500			42		70	94	88	3	85	178500		
	COA10	2700	45	2	10	60	75	HARV	76	0	76	205200		54	4	F/F	70	120	86	2	84	226800		76	60		70	84	83	2	81	218700		71
	COA3A	1100	EW	2	6	60	75	HARV	90	0	90	99000			3	AF/F	70	120	97	3	94	103400			42		70	94	96	3	93	102300		
	COA3B.1	2400	45	1	4	50	55	TTC	80	6	74	177600			3	AF/F	70	120	91	2	89	213600			45		70	90	88	2	86	206400		
	COA3B.2	2300	45	1	4	2	2	TTC,HARV	1	0	1	2300			3	AF/F	70	120	91	2	89	204700			65		70	50	78	2	76	174800		
	COA3B.3	3400	45	1	4	60	60	TTC	82	4	78	265200			3	AF/F	70	120	91	2	89	302600			42		70	94	88	2	86	292400		
	COA3C.1	1500	NS	1	4	5	75	TTC,HARV	0	0	0	0		51	3	AF/F	70	120	89	3	86	129000		89	60		70	94	89	3	86	129000		85
	COA3C.2	700	NS	1	4	60	5	TTC	86	6	80	56000			3	AF/F	70	120	89	3	86	60200			65		70	50	83	3	80	56000		
	COA3C.3	1400	NS	1	4	40	60	TTC	80	40	40	56000			3	AF/F	70	120	89	3	86	120400			42		70	94	88	3	85	119000		
	COA3C.4	1700	NS	1	4	5	15	TTC,HARV	0	0	0	0			3	AF/F	70	120	89	3	86	146200			50		70	82	87	3	84	142800		
	COA3C.5	1200	NS	1	4	60	5	TTC	88	4	84	100800			3	AF/F	70	120	89	3	86	103200			65		70	50	83	3	80	96000		
	COA5A	2500	EW	1	4	10	65	TTC,HARV	30	16	14	35000			3	AF/F	70	120	99	3	96	240000			60		70	54	92	3	89	222500		
	COA5B.1	2500	45	1	4	65	70	TTC	84	2	82	205000			3	F/F	70	120	92	2	90	225000			40		70	97	90	2	88	220000		
	COA5B.2	2600	45	1	2	0	0	TTC,HARV	0	0	0	0			3	F/F	70	120	90	2	88	228800			65		70	50	80	2	78	202800		
	COA5C.1	2000	45	1	4	10	40	TTC	30	16	14	28000			3	F/F	70	120	92	2	90	180000			60		70	78	88	2	86	172000		
	COA5C.2	2000	45	1	2	65	70	TTC	92	2	90	180000			3	F/F	70	120	90	2	88	176000			40		70	97	92	2	90	180000		
	COA5D	2000	45	1	4	60	70	TTC,HARV	83	2	81	162000			3	F/F	70	120	91	2	89	178000			42		70	92	91	2	89	178000		
	COA5E	2400	45	1	3	55	60	TTC,HARV	82	4	78	187200	52	50	3	F/F	70	120	91	2	89	213600	82	90	43		70	82	89	2	87	208800	78	87
Johnson Cr	JOH1	5300	45	2	35	80	60		55	4	51	270300			3	F/F	70	120	68	2	66	349800			30		70	120	68	2	66	349800		
	JOH2	4200	EW	2	30	80	65		43	6	37	155400			3	F/F	70	120	68	3	65	273000			30		70	120	68	3	65	273000		
	JOH3	1050	45	2	26	70	50		57	9	48	50400			3	F/F	70	120	75	2	73	76650			38		70	113	72	2	70	73500		
	JOH4	950	EW	2	26	78	70		50	3	47	44650			3	F/F	70	120	75	3	72	68400			32		70	118	75	3	72	68400		
	JOH5	12600	45	1	20	66	75		58	0	58	730800			3	F/F	70	120	76	2	74	932400			40		70	111	74	2	72	907200		
	JOH6	1900	EW	1	15	70	50		72	15	57	108300			3	F/F	70	120	91	3	88	167200			38		70	113	91	3	88	167200		
	JOH7	2400	EW	1	10	80	75	FIRE	89	0	89	213600			3	F/F	70	120	95	3	92	220800			30		70	120	95	3	92	220800		
	JOH8	1050	EW	1	6	80	65	FIRE	94	6	88	92400			3	F/F	70	120	97	3	94	98700			30		70	120	97	3	94	98700		
	JOH9	1500	EW	1	6	40	75	FIRE	70	0	70	105000			3	F/F	70	120	97	3	94	141000			50		70	92	95	3	92	138000		
	JOH10	1150	EW	1	6	40	70	FIRE	70	3	67	77050			3	F/F	70	120	97	3	94	108100			50		70	92	95	3	92	105800		
	JOH11	4600	EW	1	4	90	70	FIRE	95	3	92	423200			3	F/F	70	120	98	3	95	437000			25		70	128	98	3	95	437000		
	JOH12	2300	NS	1	3	60	70	FIRE	89	3	86	197800		63	3	F/F	70	120	88	3	85	195500		79	42		70	108	88	3	85	195500		78
	POV1	4100	45	2	10	110	70		87	2	85	348500			3	F/F	70	120	84	2	82	336200			10		70	140	84	2	82	336200		
	POV2	1050	NS	2	6	110	70		88	3	85	89250			3	F/F	70	120	87	3	84	88200			10		70	140	87	3	84	88200		
	POV3	2100	NS	2	6	40	50	HARV	75	9	66	138600			3	F/F	70	120	87	3	84	176400			50		70	92	87	3	84	176400		
	POV4	2200	NS	2	6	110	70		88	3	85	187000			3	F/F	70	120	87	3	84	184800			10		70	140	87	3	84	184800		
	POV5	2300	NS	2	6	30	45	HARV	68	12	56	128800			3	F/F	70	120	87	3	84	193200			53		70	87	87	3	84	193200		
	POV6	1900	45	2	3	30	60	HARV	65	4	61	115900			3	F/F	70	120	90	2	88	167200			53		70	87	90	2	88	167200		
	POV7	2700	EW	1	3	50	60	HARV	87	9	78	210600		75	3	F/F	70	120	98	3	95	256500		86	45		70	98	98	3	95	256500		86
	SUC1	2100	45	2	15	73	70		74	2	72	151200			3	F/F	70	120	84	2	82	172200			36		70	102	81	2	79	165900		
	SUC2	1400	45	2	15	50	30	SLIDE	63	24	39	54600			3	F/F	70	120	84	2	82	114800			45		70	90	80	2	78	109200		
	SUC3	6300	45	1	10	100	75		85	0	85	535500			3	F/F	70	120	86	2	84	529200			18		70	124	86	2	84	529200		
	SUC4	2200	45	1	8	100	50		87	9	78	171600			4	F/F	70	120	87	2	85	187000			33		70	112	87	2	85	187000		
	SUC5	850	NS	1	6	80	70		86	3	83	70550			4	F/F	70	120	88	3	85	72250			53		70	99	88	3	85	72250		
	SUC6	750	NS	1	6	80	50		86	9	77	57750			3	F/F	70	120	88	3	85	63750			30		70	110	88	3	85	63750		
	SUC7	5400	NS	1	2	80	60		88	6	82	442800		78	4	F/F	70	120	88	3	85	459000		84	53		70	99	88	3	85	459000		83
	NIC1	2000	NS	2	6	60	60		85	6	79	158000			3	F/F	70	120	88	3	85	170000			42		70	94	88	3	85	170000		
	NIC2	1700	EW	1	4	40	20	HARV/SLIDE	80	32	48	81600			3	F/F	70	120	98	3	95	161500			50		70	82	98	3	95	161500		
	NIC3	1100	45	1	4	40	60		76	4	72	79200			3	F/F	70	120	90	2	88	96800			50		70	82	85	2	83	91300		
	NIC4	1500	45	1	4	60	60		80	4	76	114000			3	F/F	70	120	90	2	88	132000			42		70	94	90	2	88	132000		
	NIC5	1100	45	1	2	40	45		77	12	65	71500			3	F/F	70	120	90	2	88	96800			50		70	82	90	2	88	96800		

Stream Name	Reach Number	Reach Length (ft)	Aspect NS/45/EW	Stream Order	Wetted Width (ft)	Tree Height (ft)	Shade Density (%)	Comments	% Shade (Curve)	Density Correction	% Shade (Adjusted)	Shade x Length	Shade Wtd by Reach	Wtd Shade Sub Reach	Site Class	Exist/Fut Veg	Fut. Shd Density	Fut. Tree Height	Fut. Shd Value (c)	Density Correction	% Shade (Adjusted)	Shade x Length	Shade Wtd by Reach	Wtd Shade Sub Reach	Recovery Time		Interim Bench Marks Fut. Shd	20 + Tree	20 + Shade	Density	% Shade	Shade x	Shade Wtd	Wtd Shade
	NIC6	1500	45	1	2	60	60		84	4	80	120000		70	3	F/F	70	120	90	2	88	132000		89	42		70	94	90	2	88	132000		88
	TWO1	950	45	1	3	80	75		90	0	90	85500			3	F/F	70	120	90	2	88	83600			30		70	110	90	2	88	83600		
	TWO2	1300	NS	1	3	40	70		80	3	77	100100			3	F/F	70	120	88	3	85	110500			50		70	82	88	3	85	110500		
	TWO3	1600	NS	1	3	80	65		90	5	85	136000			3	F/F	70	120	88	3	85	136000			30		70	110	88	3	85	136000		
	TWO4	1900	45	1	2	70	55		88	6	82	155800			4	F/F	70	120	90	2	88	167200			63		70	92	90	2	88	167200		
	TWO5	2900	NS	1	2	70	55	FIRE	90	8	82	237800		83	5	F/F	70	120	88	3	85	246500		86	60		70	92	88	3	85	246500		86
	GRA1	2100	EW	1	6	100	70		95	3	92	193200			3	F/F	70	120	98	3	95	199500			18		70	124	98	3	95	199500		
	GRA2	6700	EW	1	4	80	65		95	6	89	596300	72	90	3	F/F	70	120	98	3	95	636500	84	95	30		70	110	98	3	95	636500	83	95
Rock Cr	ROC1	2900	45	3	28	100	50	ROAD	62	9	53	153700			3	F/F	70	180	77	2	75	217500			97		70	124	70	2	68	197200		
	ROC2	6700	45	3	20	60	40	ROAD	50	16	34	227800			3	F/F	70	180	79	2	77	515900			121		70	94	67	2	65	435500		
	ROC3	2700	45	3	20	120	50	ROAD	75	9	66	178200			3	F/F	70	120	76	2	74	199800			0		70	140	76	2	74	199800		
	ROC4	1050	45	3	18	100	60		73	4	69	72450			3	F/F	70	120	77	2	75	78750			18		70	124	77	2	75	78750		
	ROC5	4100	45	3	18	120	65		75	3	72	295200		53	3	F/F	70	120	77	2	75	307500		76	0		70	140	77	2	75	307500		
	ROC6	7300	EW	3	16	120	50		91	15	76	554800			3	F/F	70	120	90	3	87	635100			0		70	140	90	3	87	635100		
	ROC7	450	EW	3	16	20	30	SLIDE	20	20	0	0			4	F/F	70	120	90	3	87	39150			85		70	56	56	3	53	23850		
	ROC8	1900	EW	3	14	100	65		88	6	82	155800			3	F/F	70	120	91	3	88	167200			18		70	124	90	3	87	165300		
	ROC9	2100	NS	2	10	80	50		85	9	76	159600			3	F/F	70	120	88	3	85	178500			30		70	110	88	3	85	178500		
	ROC10	1150	NS	2	10	100	55	HARVEST	82	8	74	85100			3	F/F	70	120	88	3	85	97750			18		70	124	88	3	85	97750		
	ROC11	2500	45	2	10	80	60		82	4	78	195000			3	F/F	70	120	86	2	84	210000			30		70	110	85	2	83	207500		
	ROC12	2200	45	2	10	60	50	HARVEST	75	9	66	145200			3	F/F	70	120	86	2	84	184800			42		70	94	84	2	82	180400		
	ROC13	2100	EW	2	8	45	40		70	21	49	102900			3	F/F	70	120	95	3	92	193200			47		70	86	93	3	90	189000		
	ROC14	2600	45	2	8	45	60	PRIVATE	70	4	66	171600			4	F/F	70	120	87	2	85	221000			78		70	75	83	2	81	210600		
	ROC15	2100	45	1	6	70	70	FIRE?	82	2	80	168000		71	4	F/F	70	120	88	2	86	180600		86	63		70	92	88	2	86	180600		79
	NFK1	2000	NS	2	5	60	50	HARV,SERP	87	9	78	156000			3	F/F	70	120	89	3	86	172000			42		70	94	88	3	85	170000		
	NFK2	7700	45	2	4	70	40	SERP	83	16	67	515900	65	69	3	F/F	70	120	90	2	88	677600	83	88	38		70	100	90	2	88	677600	80	87
Squaw Cr	SQU1	1600	NS	2	12	100	70		87	3	84	134400			3	F/F	70	120	88	3	85	136000			18		70	124	88	3	85	136000		
	SQU2	2100	NS	2	7	56	50	HARV	81	9	72	151200		77	3	F/F	70	120	88	3	85	178500		85	43		70	92	88	3	85	178500		85
	EFK1	6300	45	1	3	50	50	HARV	82	9	73	459900		73	3	F/F	70	120	90	2	88	554400		87	45		70	90	90	2	88	554400		87
	WFK1	4300	NS	1	4	75	70	HARV	88	3	85	365500			3	F/F	70	120	88	3	85	365500			35		70	105	88	3	85	365500		
	WFK2	1250	NS	1	3	15	25	TTC	60	29	31	38750			3	F/F	70	120	88	3	85	106250			57		70	70	88	3	85	106250		
	WFK3	1250	NS	1	3	60	70	TTC	88	3	85	106250	75	75	3	F/F	70	120	88	3	85	106250	86	85	42		70	90	88	3	85	106250	86	85
Panther Cr	PAN1	2100	EW	1	19	60	75	PRIVATE	37	0	37	77700			2	F/F	70	120	83	3	80	168000			27		70	108	77	3	74	155400		
	PAN2	850	45	1	19	90	65		68	3	65	55250			2	F/F	70	120	76	2	74	62900			15		70	128	76	2	74	62900		
	PAN3	3300	45	1	15	100	50		81	9	72	237600			2	F/F	70	120	83	2	81	267300			11		70	133	83	2	81	267300		
	PAN4	3400	45	1	10	100	65		85	3	82	278800			2	F/F	70	120	86	2	84	285600			11		70	133	86	2	84	285600		
	PAN5	1900	45	1	6	26	50		57	9	48	91200			3	F/F	70	120	89	2	87	165300			55		70	73	83	2	81	153900		
	PAN6	2600	EW	1	6	130	70		97	3	94	244400	70		3	F/F	70	120	98	3	95	247000	85		0		70	150	98	3	95	247000	83	
Buck Cr	BUC1	4400	45	1	6	110	70		88	2	86	378400			2	F/F	70	120	89	2	87	382800			6		70	140	89	2	87	382800		
	BUC2	1150	45	1	6	90	70		87	2	85	97750			3	F/F	70	120	89	2	87	100050			25		70	116	89	2	87	100050		
	BUC3	2900	NS	1	6	78	75		87	0	87	252300			3	F/F	70	120	87	3	84	243600			2		70	108	87	3	84	243600		
	BUC4	5000	NS	1	4	110	70		88	3	85	425000	86		3	F/F	70	120	88	3	85	425000	86		10		70	132	88	3	85	425000	86	
Wooden R.	WOO1	850	NS	3	30	80	70		66	3	63	53550			2	F/F	70	120	75	3	72	61200			20		70	120	75	3	72	61200		
	WOO2	3400	NS	3	30	80	70		66	3	63	214200			2	F/F	70	120	75	3	72	244800			20		70	120	75	3	72	244800		
	WOO3	3200	NS	3	25	80	45		68	12	56	179200			2	F/F	70	120	77	3	74	236800			20		70	120	77	3	74	236800		
	WOO4	350	NS	3	22	60	50	TTC	60	9	51	17850			3	F/F	70	120	79	3	76	26600			42		70	94	72	3	69	24150		
	WOO5	1600	NS	3	20	80	65	TTC	72	5	67	107200			3	F/F	70	120	79	3	76	121600			42		70	94	74	3	71	113600		
	WOO6	4200	45	3	20	80	45	TTC	65	12	53	222600			3	F/F	70	120	76	2	74	310800			45		70	90	70	2	68	285600		
	WOO7	2300	45	3	20	80	65		65	3	62	142600			3	F/F	70	120	76	2	74	170200			30		70	110	74	2	72	165600		
	WOO8	3300	NS	2	15	80	70		80	3	77	254100			3	F/F	70	120	87	3	84	277200			30		70	110	85	3	82	270600		
	WOO9	1200	45	2	12	76	60		78	4	74	88800			3	F/F	70	120	85	2	83	99600			34		70	105	83	2	81	97200		
	WOO10	3200	45	2	12	80	60	TTC	80	4	76	243200			3	F/F	70	120	85	2	83	265600			30		70	110	84	2	82	262400		
	WOO11	1800	45	2	12	80	65		80	3	77	138600			3	F/F	70	120	85	2	83	149400			30		70	110	84	2	82	147600		
	WOO12	2100	45	2	10	80	65		81	3	78	163800			3	F/F	70	120	86	2	84	176400			30		70	110	86	2	84	176400		
	WOO13	1400	EW	2	10	80	65		90	6	84	117600			3	F/F	70	120	95	3	92	128800			30		70	110	92	3	89	124600		
	WOO14	1200	45	2	10	70	55	TTC	80	6	74	88800			3	F/F	70	120	85	2	83	99600			38		70	100	85	2	83	99600		
	WOO15	1500	45	2	8	80	70		83	2	81	121500			3	F/F	70	120	87	2	85	127500			30		70	110	87	2	85	127500		
	WOO16	1400	NS	2	8	70	65		84	5	79	110600			3	F/F	70	120	88	3	85	119000			38		70	100	88	3	85	119000		
	WOO17	950	EW	2	8	70	60		88	9	79	75050			3	F/F	70	120	96	3	93	88350			38		70	100	95	3	92	87400		
	WOO18	1450	EW	1	5	60	40		91	21	70	101500			3	F/F	70	120	98	3	95	137750			42		70	94	96	3	93	134850		
	WOO19	1000	45	1	5	60	50		81	9	72	72000			3	F/F	70	120	90	2	88	88000			42		70	94	90	2	88	88000		
	WOO20	2000	45	1	4	40	40	TTC	76	16	60	120000			3	F/F	70	120	90	2	88	176000			50		70	82	87	2	85	170000		
	WOO21	2100	45	1	3	5	10	TTC	20	20	0	0		65	3	F/F	70	120	90	2	88	184800		81	65		70	50	88	2	86	180600		79
	WOO3.1	2900	NS	3	22	60	45	TTC	60	12	48	139200			3	F/F	70	120	76	3	73	211700			42		70	94	76	3	73	211700		
	WOO3.2	1500	NS	3	21	60	70	TTC	66	3	63	94500		53	3	F/F	70	120	80	3	77	115500		74	42		70	94	75	3	72	108000		73
	WOO7A	3400	45	1	4	50	70	TTC	80	2	78	265200			3	F/F	70	120	91	2	89	302600			45		70	90	88	2	86	292400		
	WOO7B	3800	EW	1	4	40	65	TTC	80	5	75	285000			3	F/F	70	120	99	3	96	364800			50		70	82	92	3	89	338200		
	W007C	3300	45	1	2	40	50	TTC	76	9	67	221100	66	73	4	F/F	70	120	93	2	91	300300	83	92	81		70	72	85	2	83	273900	80	86
	CLE1	2700	45	1	4	95	60	PRIVATE	90	4	86	232200			2	F/F	70	120	91	2	89	240300			13		70	130	91	2	89	240300		
	CLE2	4100	NS	1	4	50	50	TTC	82	9	73	299300			2	F/F	70	120	88	3	85	348500			31		70	98	88	3	85	348500		
Clear Cr	CLE3	1200	45	1	3	60	50	TTC	83	9	74	88800			3	F/F	70	120	91	2	89	106800			42		70	94	90	2	88	105600		
	CLE4	1200	NS	1	3	95	70		90	3	87	104400			3	F/F	70	120	90	3	87	104400			22		70	120	90	3	87	104400		
	CLE5	1000	NS	1	3	70	50	TTC	88	9	79	79000			3	F/F	70	120	90	3	87	87000			38		70	100	90	3	87	87000		
	CLE6	2600	45	1	3	50	60	TTC	82	4	78	202800			3	F/F	70	120	91	2	89	231400			45		70	90	88	2	86	223600		
	CLE6.1	500	45	1	40	50	35	TTC, BVR	35	20	15	7500			3	F/F	70	120	65	2	63	31500			45		70	90	55	2	53	26500		
	CLE7	1300	NS	1	3	70	70	TTC	90	3	87	113100	77		4	F/F	70	120	90	3	87	113100	87		63		70	92	89	3	86	111800	85	
	FOG1	600	45	2	12	60	80	TTC	70	1	69	41400			2	F/F	70	120	87	2	85	51000			27		70	108	85	2	83	49800		
	FOG2	550	45	2	12	50	30	TTC	70	24	46	25300			2	F/F	70	120	87	2	85	46750			31		70	98	83	2	81	44550		
Foggy Cr	FOG3	1200	45	2	12	100	80	TTC	82	0	82	98400			2	F/F	70	120	87	2	85	102000			11		70	133	90	2	88	105600		
	FOG4	500	EW	2	12	80	30	TTC	84	27	57	28500			2	F/F	70	120	93	3	90	45000			20		70	87	89	3	86	43000		
	FOG4.1	2400	EW	2	30	10	5	TTC, BVR	0	0	0	0			2	F/F	70	120	65	3	62	148800			45		70	60	30	3	27	64800		
	FOG5	800	45	2	10	140	70		88	2	86	68800			2	F/F	70	120	89	2	87	69600			0		70	168	89	2	87	69600		
	FOG6	3200	NS	2	10	30	25	HARVEST	60	28	32	102400			2	F/F	70	120	88	3	85	272000			37		70	87	86	3	83	265600		
	FOG7	1400	45	1	6	100	65		89	3	86	120400			3	F/F	70	120	89	2	87	121800			1		70	124	89	2	87	121800		
	FOG8	1300	45	1	6	80	75	HARVEST	86	0	86	111800			3	F/F	70	120	89	2	87	113100			80		70	110	89	2	87	113100		
	FOG9	5500	NS	1	4	80	50	HARVEST	88	9	79	434500			3	F/F	70	120	90	3	87	478500			80		70	110	89	3	86	473000		
	FOG10	3200	45	1	3	50	50	HARVEST	80	9	71	227200		61	4	F/F	70	120	91	2	89	284800		84	75		70	78	88	2	86	275200		79
	FOG6A	1400	45	1	4	100	60	FIRE	90	4	86	120400			3	F/F	70	120	91	2	89	124600			18		70	124	91	2	89	124600		
	FOG6B	2900	45	1	4	80	65	FIRE	88	3	85	246500			3	F/F	70	120	91	2	89	258100			30		70	110	90	2	88	255200		
	FOG6C	2300	45	1	3	80	60	FIRE	89	4	85	195500	67	85	4	F/F	70	120	92	2	90	207000	85	89	53		70	99	90	2	88	202400	81	88

Appendix B

NPDES Recreational Suction Dredging

This information is provided to clarify that suction dredge operations that are or will be occurring in the upper South Fork Coquille sub-basin are point sources.

In-stream temperatures were measured during a study conducted jointly by the California Cooperative Fishery Research Unit, the U.S. Fish and Wildlife Service, and Humboldt State University. The study concluded "temperatures above and below dredging sites were virtually identical, indicating no apparent impact in water temperature from dredging." Suction dredge operations are not expected to cause a measurable change in stream temperature and receive zero waste load in the South Fork Coquille sub-basin WQMP/TMDL.

Please see following 0700 general NPDES permit for information regarding management of small scale suction dredge activities.

GENERAL PERMIT

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

WASTE DISCHARGE PERMIT

Department of Environmental Quality
811 SW Sixth Avenue
Portland, OR 97204
Telephone: (503) 229-5279

Issued pursuant to ORS 468B.050 and The Federal Clean Water Act

ISSUED TO:

SOURCES COVERED BY THIS PERMIT:

This permit covers suction dredges, not to exceed 40 horsepower, used for recovering precious metals or minerals from stream bottom sediments.

____
Mike Llewelyn, Administrator
Water Quality Division

____
Date

PERMITTED ACTIVITIES

Until this permit expires or is modified or revoked, the holder of this permit is authorized to operate a suction dredge in public waters in accordance with all the requirements, limitations, and conditions set forth in the attached schedules as follows:

Each other direct and indirect waste discharge to waters of the State is prohibited unless covered by another NPDES or WPCF permit.

SCHEDULE A

Waste Disposal Limitations

1. Dredging is permitted only within the active stream channel where the dredging spoils are relatively clean and will cause minimum turbidity when returned to the stream. This permit does not authorize mining of stream banks (highbanking) or upland areas. Such out-of-stream mining requires a General Permit WPCF 600 or an individual WPCF permit from the Department of Environmental Quality (Department).

2 Dredging shall be done such that in-stream turbidity will be minimized and localized to the general area of the dredging activity. If turbidity is visible 300 feet (90 meters) downstream from one or more working suction dredges, then turbidity exceeds allowable in-stream water quality standard, and dredging must stop. Tailings shall not be discharged into any naturally occurring pool in the work area if it will reduce the volume or depth of the pool.

SCHEDULE D

Special Conditions

OPERATION

1. Harassment of fish in the stream is prohibited by state law. Dredging is not permitted during the periods that fish eggs could be in the gravel at the dredging site. The attached schedule, Timing of In-Water Work To Protect Fish and Wildlife Resources lists the permitted seasonal work periods for dredging activities. If the Oregon Department of Fish and Wildlife (ODFW) has approved working in a stream during periods other than the listed work periods, then a copy of that written approval must be in the possession of the operator, or readily available, during dredging activities.

2. Care shall be taken by the operator during refueling of the dredge to prevent spillage into surface waters or to groundwater. The suction dredge shall be checked for leaks prior to start of operation. Waste oil or other petroleum products may not be disposed of at the site.

3. Removal or disturbance of rooted or embedded woody plants in the stream including trees and shrubs is prohibited.

4. Suction dredging shall be conducted such that undercutting of stream banks and riparian vegetation does not occur.

5. The permittee shall provide a safe passage of fish around and through the active mining area if the stream supports an anadromous fish population.

6. The suction dredging activity shall be conducted such that it will not result in the formation of a dam within the stream or divert a waterway. Construction of check dams or other flow modification or obstruction is not allowed under this permit.

7. Excavating from the stream bank or extending the wet perimeter (the underwater edge of the stream channel) can potentially cause both short and long term adverse impacts to spawning and foraging bases for salmonids. Therefore, mining activities under this permit are restricted to the existing wet perimeter of the stream.

APPLICATION AND FEES

1. To receive this permit, an application must be made on a form provided by the Department.

2. A permit filing fee of $50 is required for dredges equipped with a suction hose having an inside diameter greater than four (4) inches, regardless of the nozzle size. No fee of any kind is required for suction dredges equipped with a suction hose having an inside diameter of four (4) inches or less.

3. <u>Persons covered by this general permit must have a copy of the permit in their possession, or readily available during dredging activities</u>.

OREGON SCENIC WATERWAYS and ESSENTIAL SALMON HABITAT STREAMS

1. Dredging in Oregon Scenic Waterways and Essential Salmon Habitat Streams is restricted to recreational placer mining. Recreational placer mining as defined in Oregon Revised Statutes (ORS) 390.835(17)(b) includes the use of a motorized surface dredge having an intake of four (4) inches or less and a motor no larger than ten (10) horsepower. A map and list of Oregon Scenic Waterways is attached. Maps and a list of essential salmon habitat streams can be obtained from the following Division of State Lands (DSL) offices:

    a. Division of State Lands
    Salem Office
    775 Summer St. NE
    Salem, OR 97310
    Telephone: (503) 378-3805

    b. Division of State Lands
    Bend Office
    20300 Empire Avenue
    Bend, OR 97701
    Telephone: (541) 388-6112

2. Dredging in Oregon Scenic Waterways and Essential Salmon Habitat Streams requires a separate permit from the DSL.

3. Dredging in Oregon Scenic Waterways and Essential Salmon Habitat Streams must follow the regulations and requirements of the Oregon Parks and Recreation Department, the DSL and the Oregon Water Resources Department.

4. No placer mining shall be conducted on federal lands located within the Oregon Scenic Waterways except as allowed by the agencies of the federal government.

WATER QUALITY LIMITED STREAMS*

1. No suction dredging shall be allowed in streams designated by the Department as water quality limited for dissolved oxygen during periods when this limitation is applicable.

2. Suction dredging shall be allowed in streams designated by the Department as water quality limited for temperature, provided that all conditions and limitations of this permit are otherwise met.

3. Dredging activity covered by this general permit is prohibited in streams which are limited for turbidity and toxics. Any person who wishes to conduct suction dredging in these streams must

apply for and obtain an individual NPDES permit in accordance with NPDES procedures set forth in Oregon Administrative Rules (OAR) 340-45-030.

* Maps and a list of water quality limited streams can be obtained from the following Department's regional offices:

a. Northwest Region
2020 SW 4th Avenue
Portland, OR 97201
Tel. No. (503) 229-5263

b. Western Region
750 Front Street NE, #120
Salem, OR 97310
Tel. No. (503) 378-8240

c. Eastern Region
700 SE Emigrant, #330
Pendleton, OR 97838
Tel. No. (541) 276-4063

OTHER REGULATIONS AND REQUIREMENTS

1. This permit does not cover any suction dredging activity that includes construction of check dams, flow modification, or other stream obstructions. A Removal-Fill Permit is required by the Division for any placer mining operation which involves an alteration, removal, or filling of more than fifty (50) cubic yards of material per year in any waterway. Furthermore, a Removal-Fill permit may be required by the DSL for operations involving less than fifty cubic yards per year. Suction dredging that includes construction of check dams or other obstructions, or otherwise meets requirements for DSL fill and removal permit will also be required to obtain an individual NPDES permit from the DEQ. The permittee must contact the DSL and/or DEQ for additional information.

2. Persons who are otherwise eligible for coverage under this general permit but who want an individual NPDES permit, may apply to the Department in accordance with the NPDES permit procedures set forth in OAR 340-45-030.

SCHEDULE F

General Conditions

STANDARD CONDITIONS

1. The dredge owner/operator must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of ORS 468B.025 and is grounds for enforcement action, for permit termination, suspension, or modification; or for denial of a permit renewal application.

2. Dredge operations that result in complaints from downstream users or impairment of other beneficial stream uses may be in violation of the terms and conditions of this permit and the Department may take enforcement action as described in Condition 1.

3. The permittee shall allow the Director, or an authorized representative, upon presentation of credentials to:

   a. Enter upon the permittee's premises where a regulated facility or activity is located or conducted;

b. Inspect at reasonable times any facilities, equipment, practices or operations regulated or required under this permit; and,

c. Sample or monitor at reasonable times, for the purpose of assuring permit compliance or as otherwise authorized by state law, any substances or parameters at any location.

4. If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for permit renewal. The application shall be submitted at least 180 days before the expiration date of this permit. The Director may grant permission to submit an application less than 180 days in advance but no later than permit expiration date.

5. This permit may be modified, suspended, revoked and reissued, or terminated for cause including, but not limited to, the following:

a. Violation of any term, condition, or requirement of this permit, a rule, or a statute;

b. Obtaining this permit by misrepresentation or failure to disclose fully all material facts; or,

c. A change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.

The filing of a request by the permittee for a permit modification or notification of planned changes or anticipated noncompliance, does not stay any permit condition.

6. Except for effluent standards or prohibitions established under Section 307(a) of the Clean Water Act for toxic pollutants and standards for use or disposal of sewage sludge established under Section 405(d) of the Clean Water Act, all rules and statutes referred to in this permit are those in effect on the date this permit is issued.

7. Suction dredge activities allowed under this permit are not expected to cause a measurable change in stream temperature. Therefore, compliance with this permit will be considered to satisfy the requirement for developing and implementing a temperature management plan.

PROPERTY RIGHTS AND TRESPASS

1. The issuance of this permit does not convey any property rights of any sort, or any exclusive privilege.

2. This permit does not authorize trespass on private property or mining claims.

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APPENDIX C

HEAT SOURCE MODELING

PREDICITIVE TEMPERATURE MODELING

Upper South Fork Coquille Stream Temperature Model

DEQ Western Region

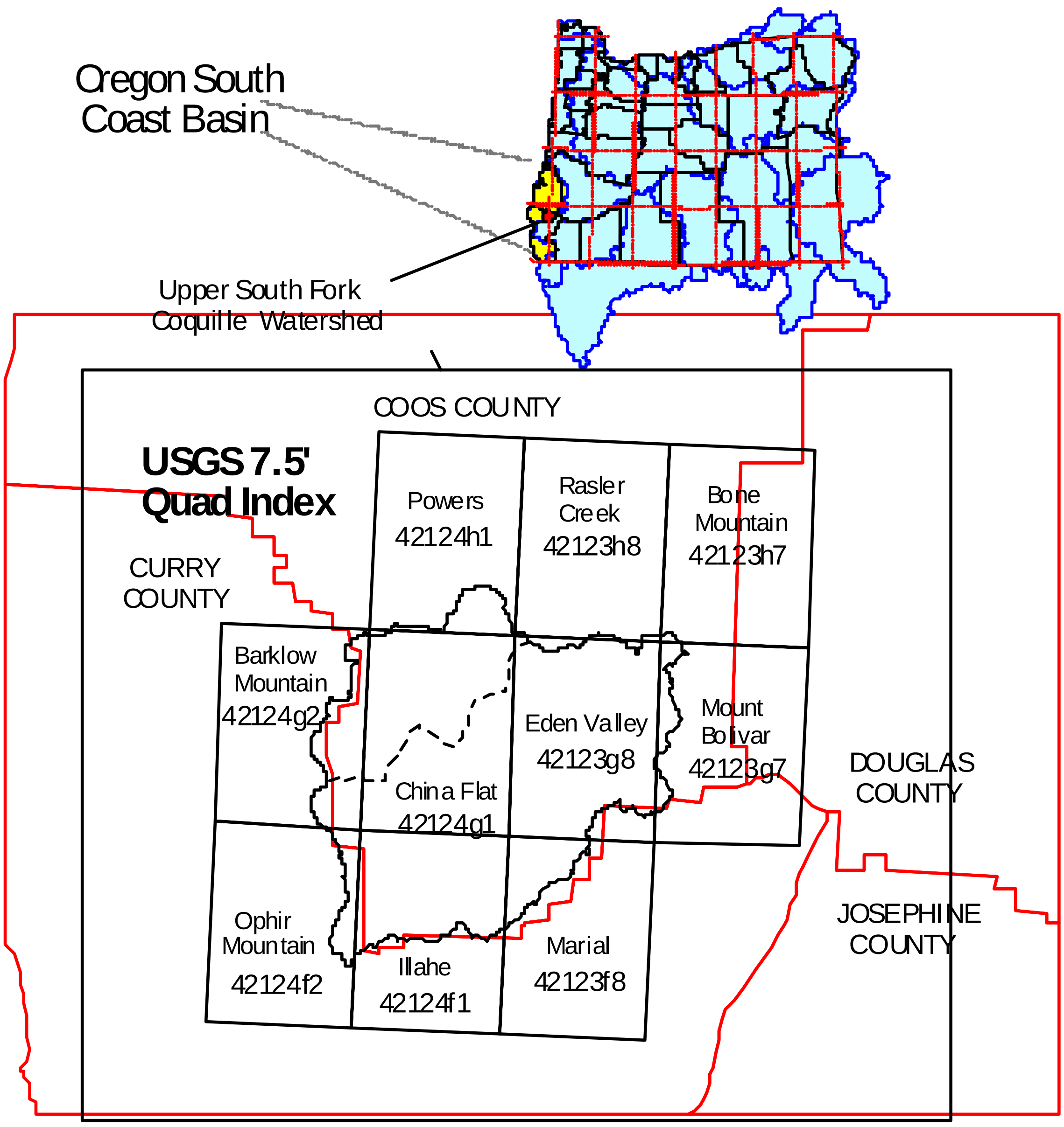
September 2000

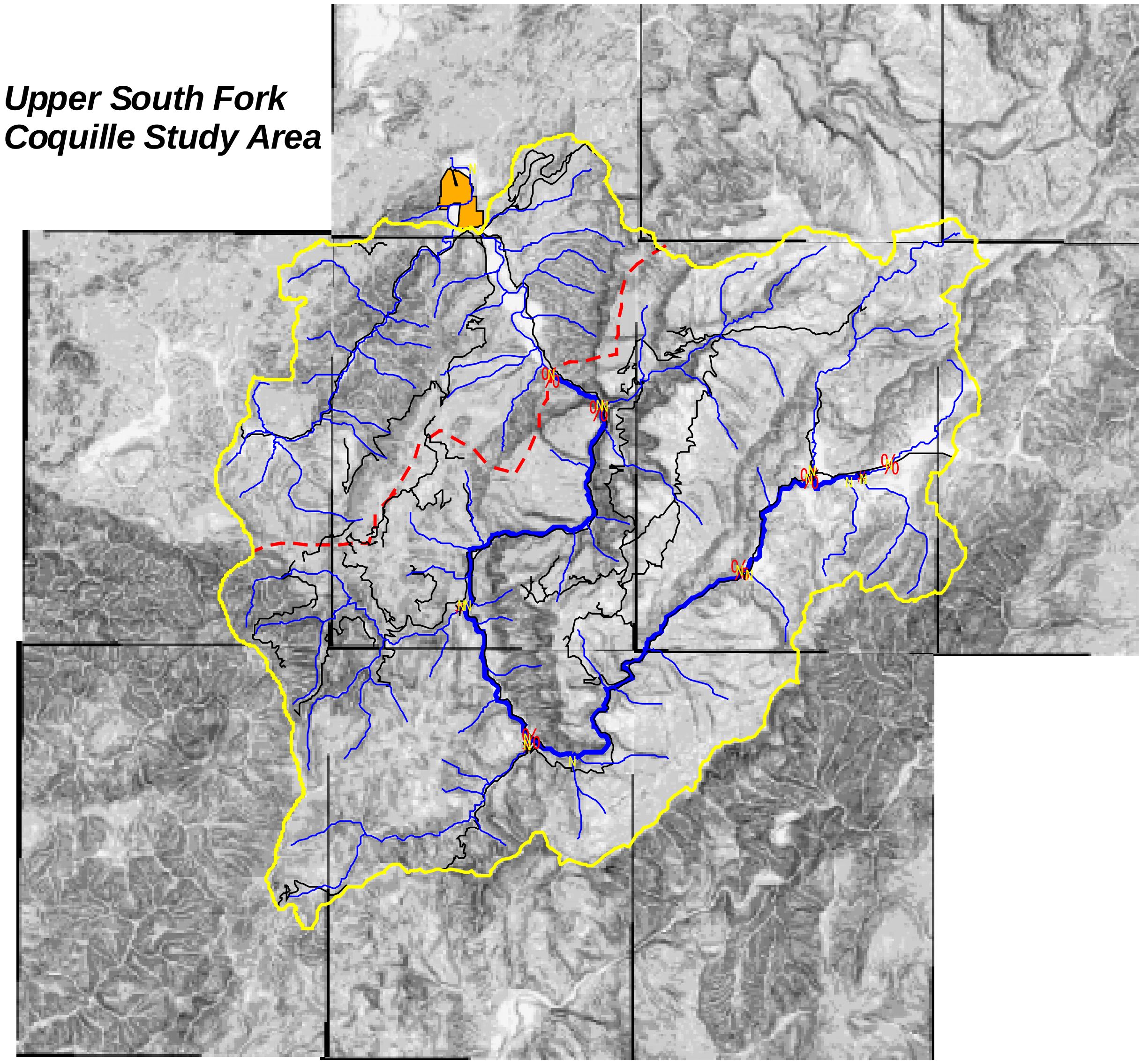
State of Oregon
Department of Environmental Quality

South Fork
Coquille River
Five Miles South of Powers Oregon

Upper South Fork Coquille
Stream Temperature Survey
(HUC 1710030501)

Watershed Location





Watershed Boundary - Yellow Line
Streams - Thin Blue Lines
Study Reach - Thick Blue Line
Discharge Measurements - Yellow x's
Temperature Logger Sites - Red Squares
Trib Temperature Sites - Red Dots
City of Powers - Orange

The Upper South Fork Coquille is located per the USGS national classification system as within:

Region	17	Pacific Northwest
SubRegion	10	Oregon-Washington Coast
Basin	03	Southern Oregon Coast
SubBasin	05	Coquille River
Watershed	01	Upper South Fork Coquille

The Oregon Department of Water Resources identifies this area as within the South Coast Basin
The Oregon Department of Environmental Quality identifies this watershed as within Hydro-Code “14B”.

Physical Watershed
The Upper South Fork Coquille is located just south of the 43rd Latitude and is bisected by the 124th West Longitude. While the upper 5th field HUC of the watershed is about 169 square miles in area, this study simulates conditions in the upper 75% of the delineated watershed (1). Watershed elevations range from an elevation of just over 3900’ down to 400’.

Human Watershed
Total watershed population (1990 census) is 45, or 0.3-people/sq. mi. The watershed is 98% within Coos County with 2% within Curry County. Sixty three percent of the watershed is owned by Federal land managers, 25% is owned by private timber companies and the remaining 12% is owned by non-timber private owners. There are no Public Drinking Water System surface-water intakes within the assessed area. The entire Watershed is classified as a non-aquifer area.

Vegetative Watershed
Ninety eight percent of the watershed is within the Oregon Coast Ecoregion, with 62.5 percent described as a Coastal Sedimentary sub-ecoregion. Fairly uniform stands of Douglas Fir make up 43% of the watershed, mixed stands of Douglas Fir/White Fir/Incense Cedar make up 53% and valley-floor Oak woodlands account for about 3%.

(1) The simulation presented in this paper models the upper ¾ of the watershed. The lower ¼, along with the remainder of the South Fork Coquille (HUC 1710030502) will have water quality/water quantity/shade and weather data collected during the summer of 1999 for similar modeling during the spring/summer of 2000.

Survey Purpose

Field measured data (collected on 7/27/98) was use to calibrate a stream temperature model, *Heat Source 6.0*. Data from late July was used so that a seasonal worst-case condition could be modeled. This assures that stream temperatures during any other time of the year would likely be lower.

The model uses field measurements and model-derived parameters as input to simulate how stream temperatures respond to unique conditions within the watershed. Once the model parameters have been balanced so that the simulation accurately describes the conditions measured in the field (the calibration step), reasonable and obtainable “future conditions” are entered into the model. The model re-summates the amount of energy reaching the stream and re-calculates stream temperatures based on those future condition(s) that are assumed.

Like any model that attempts to “look into the future”, there is a disparity between what is predicted and what will actually come to pass. Our understanding of the processes that determine stream temperature are imperfect, and any predictions using them are similarly imperfect. Any resulting simulation of the future is less a diagram with survey point accuracy than a roadmap that identifies only the most obvious landmarks. Roadmaps, however, are useful for planning a journey and navigating to a destination. While only the broadest suggestions of possible management strategies are suggested by the model, they should point us in the right direction.

Methods for Field Data Collection

Temperature Sets

Hourly instantaneous stream temperatures were taken throughout the summer at six main-stem locations and nine tributary locations (see basin map for locations) using calibrated and audited logging devices. Each data set was reviewed, and it was determined that the data from July 27th (1998) was most suitable to a basin-wide heat source simulation. Each data set, if required, was thinned to the 24 hourly observations taken on July 27th of 1998.

Stream Discharge Measurements

Flow measurements were done in mid-August at each temperature logging location via hand-held current meters. Measurement transects were chosen in areas with wadeable cross-sections and good stream velocities. Each transect consisted of a minimum of 10 individual measurements.

Stream/Shade Conditions

Habitat characteristics relating to riparian shade quality and quantity were measured from aerial photography and on site field measurements. The shading values so calculated were Shade Height, Shade Width, and Shade Density. Values assumed for the “future condition” simulation were based on forest characteristics appropriate to this ecoregion, soil class, species composition and expected tree density. Channel wetted width was also measured via field observations.

Model Inputs

Elevation/Gradient
The test reach is characterized by two low gradient areas connected by a waterfall. The gradients in the upper and lower areas average well below a 2% slope. The falls region loses nearly 1000 feet of elevation within one river mile (which averages out to just under 20% gradient).

Figure 1

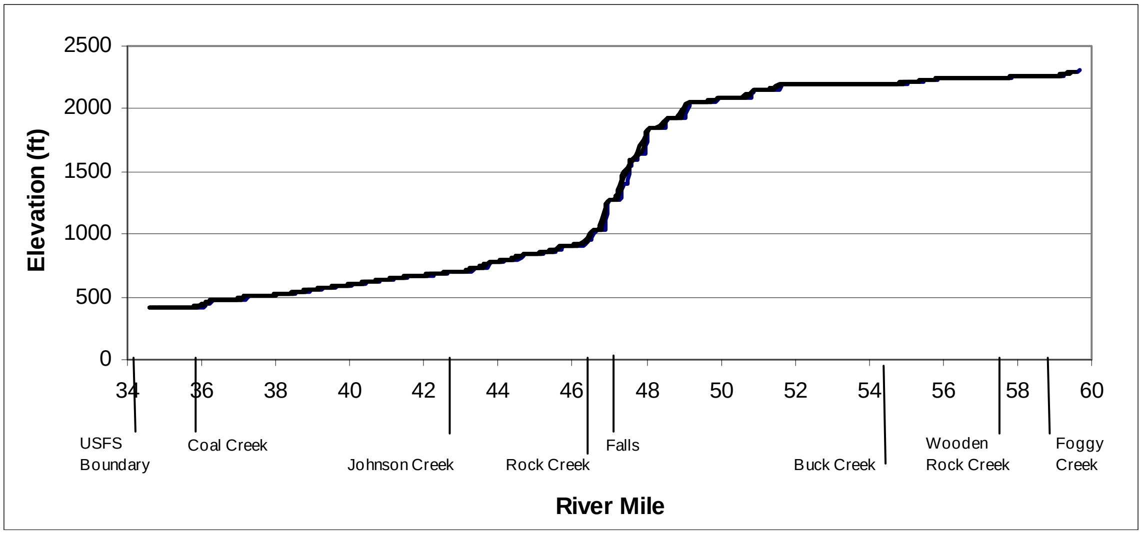
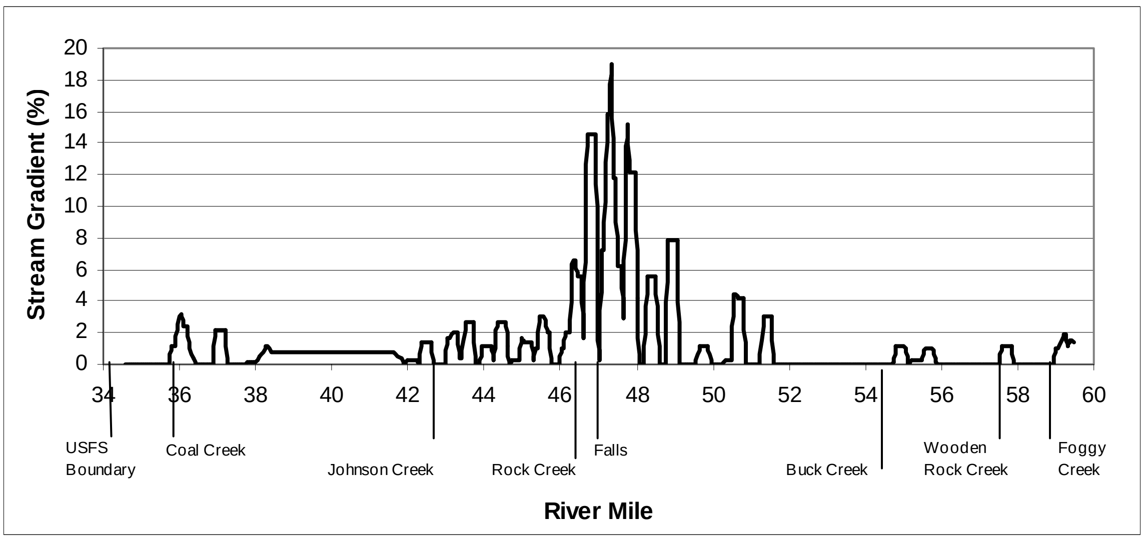


Figure 2



Flow Volume/Velocity/Depth

Flow was measured at the sites shown on the basin map.

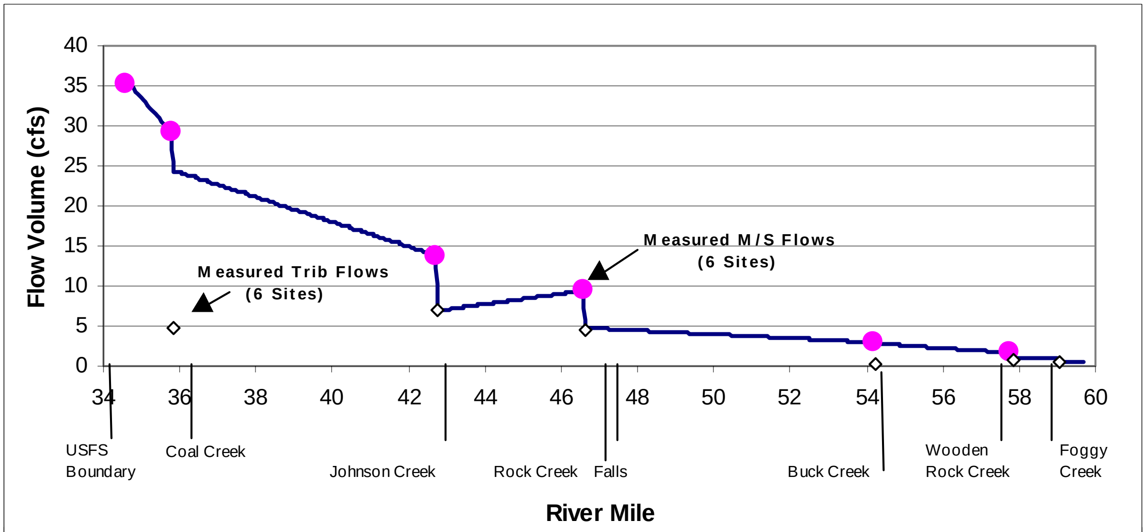
The upper South Fork Coquille is remarkable in that there are no permitted water diversions along the study area. Summer base flows in the modeled reach are as close to natural as exist in the Oregon Coast range.

The temperature sets used in the calibration step were logged on 7/27/98. The stream discharges were measured about three weeks later. In a highly regulated system, with many water withdrawals, this would introduce significant error to flow volume estimates. However, with zero water withdrawals in this part of the Coquille mainstem it was decided that any resulting introduced error would be slight. The error that did occur would likely result in using lower flows for the model than were actually present in July. Therefore, any introduced flow error likely predict a temperature higher than would actually be present. This results in a margin of safety to the analysis.

During the initial data collection in 1998, the flow volume at the USGS gage (#14325000) near the town of Powers was recorded. This gage is about five river miles downstream of the USFS land boundary (also the boundary of the modeled reach). On 7/27/98, the average daily discharge at Powers was 35.3 cfs. An examination of flows at the Powers gage over the last fifty years shows that average daily flows in July/August have been below that 35.3 cfs value 39% of the time.

The flow volume, average velocity and average depth values used for the model are presented in figure 3, 4 and 5. These conditions were the same for the calibration and future condition simulations.

Figure 3



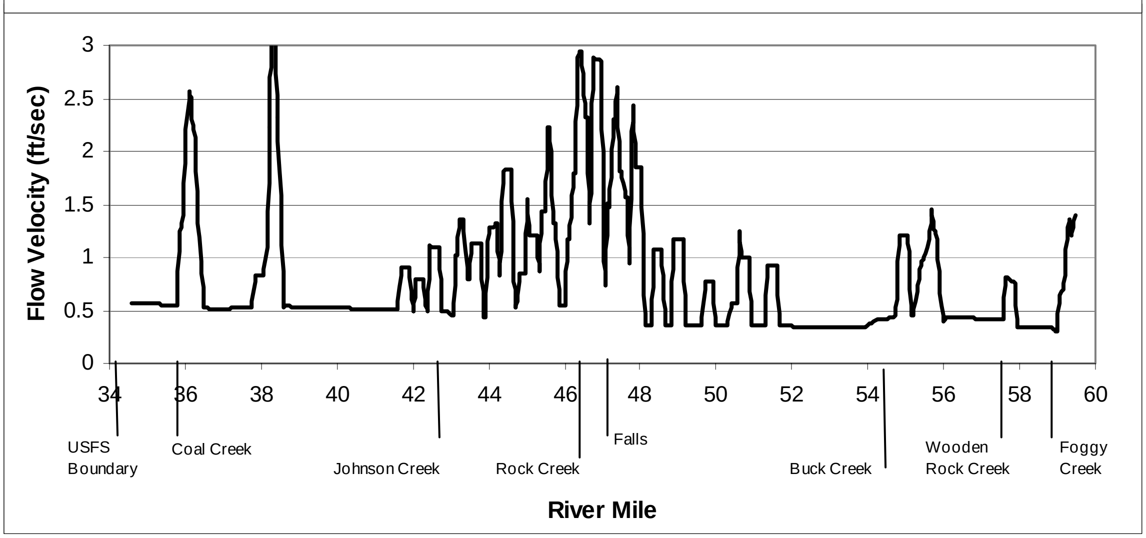
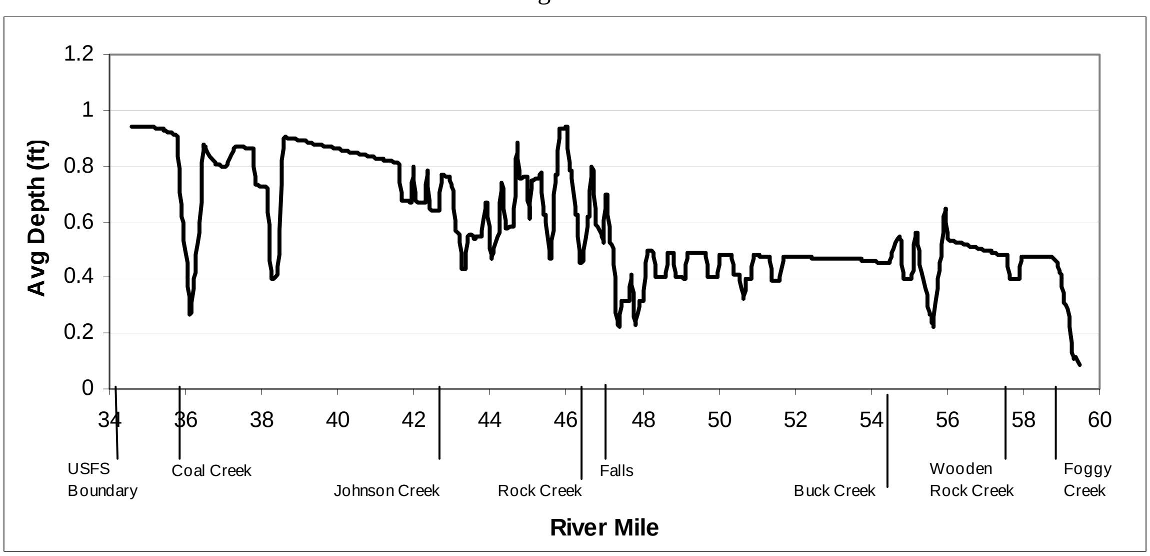


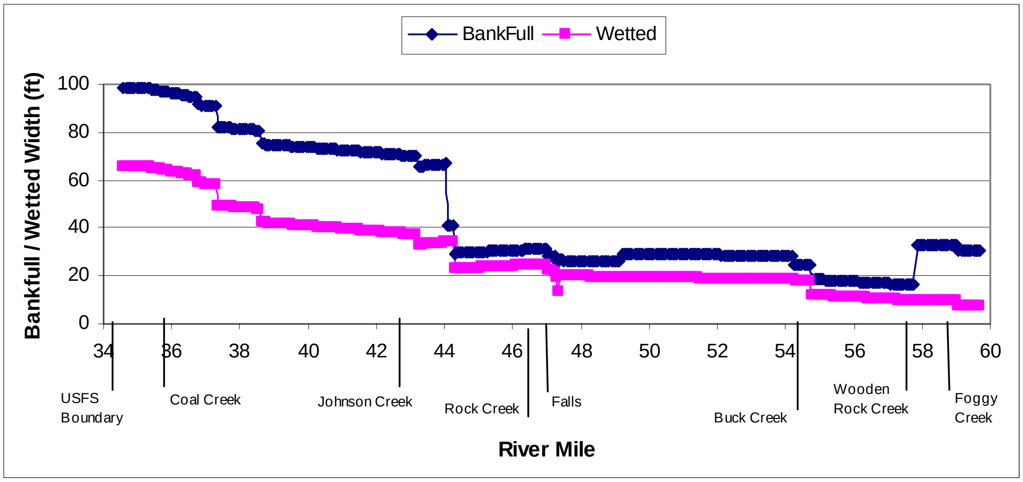
Figure 5



Channel Width

Channel wetted width was determined from field measurements and scaling from aerial photographs. The bankfull widths were measured off of digital photos at 10% of the segment breaks. Bankfull width measurements between the measured locations were interpolated. The values shown in Figure 6 were used in both the calibration and future simulations.

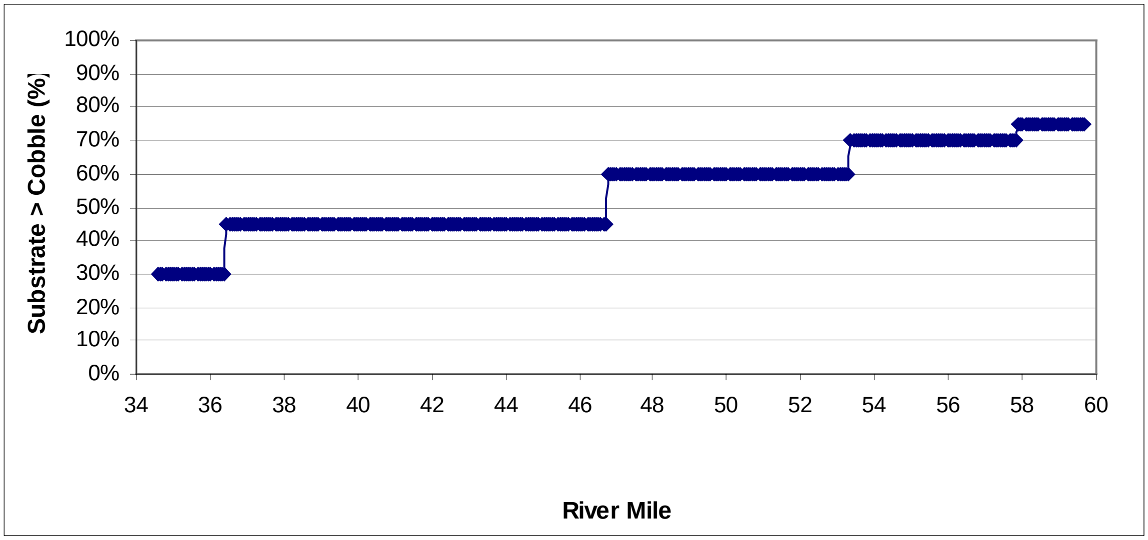
Figure 6



Channel Substrate

Figure 7 shows the "percent bedrock" (channel substrate greater than cobble size) profile used. This parameter was held constant in the calibration and "future condition" scenarios.

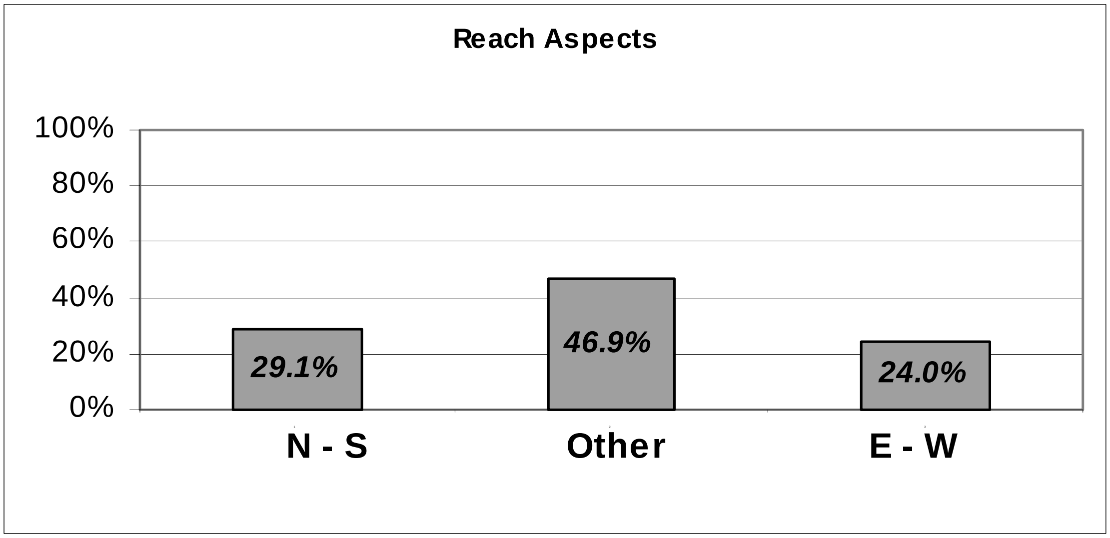
Figure 7



Stream Aspect

Figure 8 shows the relative amount of the study reach headed in these general directions. Aspect is important because North – South streams are less influenced by riparian shading as a means of temperature control while East – West streams are greatly affected by riparian shade. Seventy one percent of the modeled reaches should reduce in temperature in response to increase riparian shade.

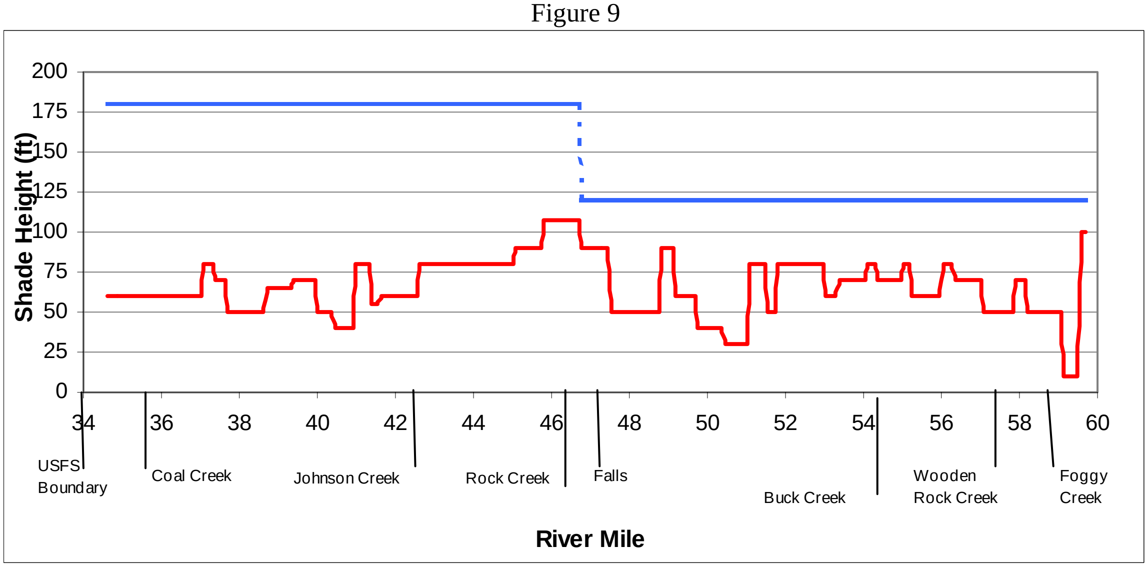
Figure 8



Shade Height

Shade height was one of only two parameters that were changed from the calibration condition to describe the desired future conditions in the Upper South Fork Coquille system. The calibration condition for shade height, based on field measurements, is shown in Figure 9 as the lower line. The assumed future condition for shade height is shown as the upper line.

Figure 9

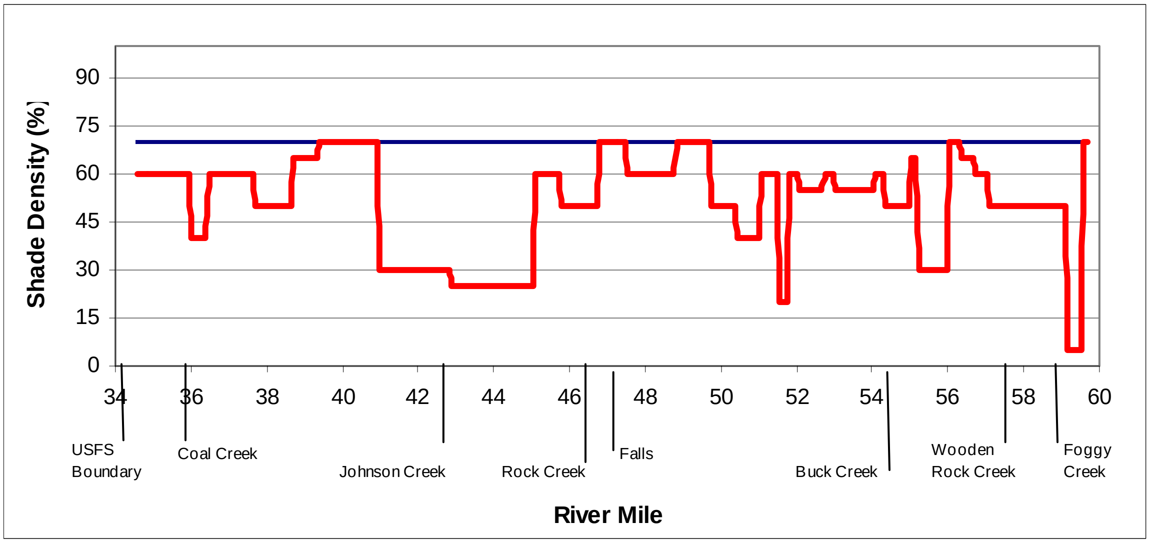


Shade Density

Shade density was the other condition where the future condition is expected to be different from the calibration condition used. The lower line in figure 10 is field measured shade density as it exists today.

The future shade densities (top line in figure 10, centered at the 70% value) are assumed to be uniform. Many future shade densities will likely be higher than 70%, so choosing this value will add a margin of safety to the analysis.

Figure 10



Shade Width

Was held to the same value, 100 feet, in both the calibration and future condition simulations. Federal land managers are presently expected to maintain untouched buffer widths of up to 300 feet. Assuming a width of 100 feet for the future is quite conservative, and provides another margin of safety in the analysis.

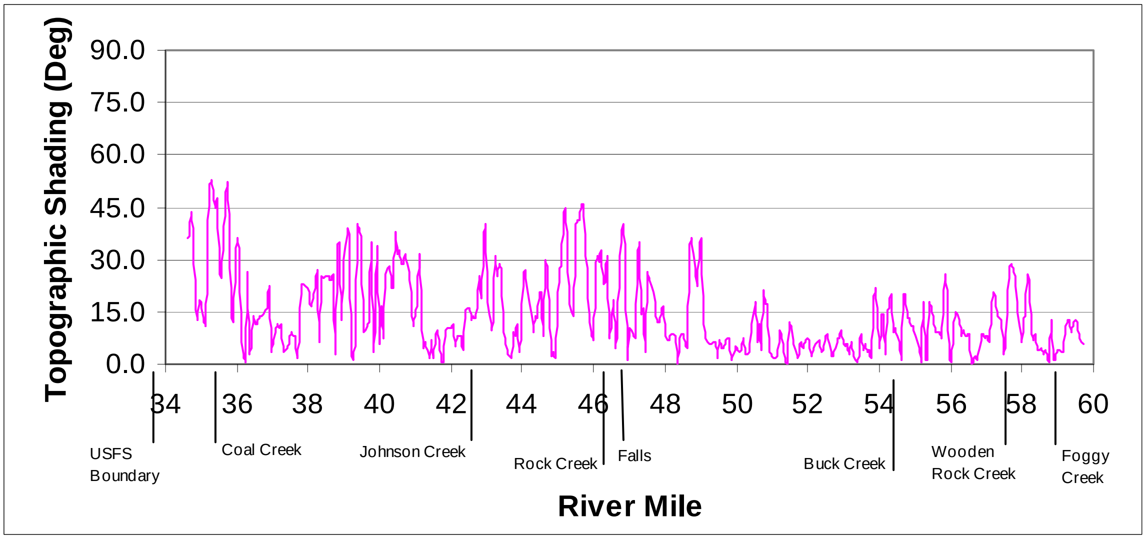
Shade Overhang

Was assumed to be zero in both the calibration and future condition simulation. Again, this is quite conservative and provides additional margin of safety in the analysis.

Topographic Shading

Topographic shading is defined as the shading provided to the stream by ridgelines or hills. It is extremely localized and unique for each system. Figure 11 shows the topographic shading, along the southern horizon, for the South Fork Coquille. Values are high, and are probably responsible for the lower than expected solar energy reaching the South Fork Coquille in the lower 20 miles of the study reach. Figure 12 shows that some areas of the lower system receive solar energy well below the 2500 BTU/square ft expected on a late July day.

Figure 11



Model Input Data Summary

Below is a summary of the model parameters used, how they were derived, and if that parameter was changed between the calibration and the future condition simulations. Parameters in italic type are those used for model calibration.

Data Class	Parameter	Method (measured/calculated)	Source	Future Condition Different from Calibration
Stream	Elevation Gradient Topographic Shade Stream Reach Aspect	Measured Calculated Calculated Calculated	DEM Data GIS Utility GIS Utility GIS Utility	No No No No
Flow	Volume Velocity Depth	Measured Calculated Calculated	Field Measurement *Model calculated* *Model calculated*	No No No
Channel	Bankful Width Wetted Width Channel Substrate	Measured/Calculated (*) Measured/Calculated (*) Estimation	*Field Data/Model Calculation* *Field Data/Model Calculation* Field Estimate	No No No
Shade	Height Width Density Overhang	Measured Measured Measured Measured	Photo Measurement Photo Measurement Photo Measurement Photo Measurement	**Yes** No **Yes** No
Stream Temperature	Main Stem Tributaries	Measured Measured	Field Measurement Field Measurement	--- No
Weather	Humidity Wind Speed Air Temperature	Measured Measured Measured	Field Measurement Field Measurement Field Measurement	No No No

(*) 10% of these values were scaled off of digital photos. Intervening measurements were calculated by the model. Model adjustments were made so that calculated widths agreed with the measured widths.

Model Calibration

All models require some calibration to make the computer simulation match the observed process. For this series of *Heat Source* simulations, the only data changed during the calibration process was average channel width, average channel depth and (in only a couple of reaches) bankfull width. Any data obtained from field measurements or scaled from photos were used as recorded. Adjustments to the three calibration parameters ceased when the simulation output matched the observed field data. None of the calibration parameters were changed during the simulation of future conditions.

Most models are calibrated to one set of conditions. A unique feature of the *Heat Source* model is that it allows calibration simulations to be compared directly to observed stream temperature logged during an entire 24-hour day. This allows calibration to not only daily minimum and maximum values, but also the ability to fit modeled heating and cooling rates to observed data. For this study, the main-stem South Fork Coquille had six data loggers where simulated vs. observed data sets could be compared. A summary of how well the modeled set matched the field measured set is shown below. Each logger summary is based on 24 data pairs (one pair for each hour throughout the day).

Logger Location	Approximate River Mile	"r Squared" Value	Standard Deviation (Deg)	Standard Error (Deg)	
Eden Valley Bridge	59.7	0.987	0.03	0.05	
U/S Wooden Rock Creek	57.8	0.823	2.16	0.73	
D/S buck Creek	54.2	0.407	1.48	0.58	
U/S Rock Creek	46.7	0.721	1.29	0.58	
U/S Coal Creek	35.9	0.738	3.78	0.51	
At USFS Land Boundary	34.6	0.852	1.77	0.33	
	Avg	0.755	1.752	0.46	Deg C
	Avg		0.973	0.26	Deg F

Agreement between the calibration simulation and observed instream temperatures was generally very good to excellent. The most obvious exception was at the D/S Buck Creek site, where the r-squared value was only 0.407. Essentially, the model under predicts cooling at this location with the calibration data used. Based on calibration conditions, the standard error of a *Heat Source* temperature simulation using this data set is just over 0.25 degrees F. Differences between the future/calibration simulations are much more than the average plus-or-minus due to the modeling process. In other words, any uncertainty that might be produced by the model is much less than the changes produced by the future condition assumptions (higher trees and denser shade).

Model Output

Solar Flux

Figure 12 shows the total amount of solar energy available for heating the South Fork Coquille on a late July day (uppermost gray line). This is the total potential energy available to the stream. Note the many dips in total solar energy. Most of this is attributable to topographic shading.

The next line down shows the amount of energy that passed through the riparian vegetation and topographic shading on the day modeled (7/27/98) and actually entered the stream.

The thin line shows the amount of energy that would pass through the riparian vegetation in the **assumed future condition** (average tree heights were increased to those values shown in figure 9 and shade densities shown in figure 10).

The thick straight line at 610 Btu/SqFt-Day shows the target load for the South Fork Coquille as calculated from page 1 of the TMDL Summary and page 16 of the Water Quality Management Plan. Figure 13 shows the distance-weighted amount of the stream receiving more than the target amount presently and in the future.

Figure 12

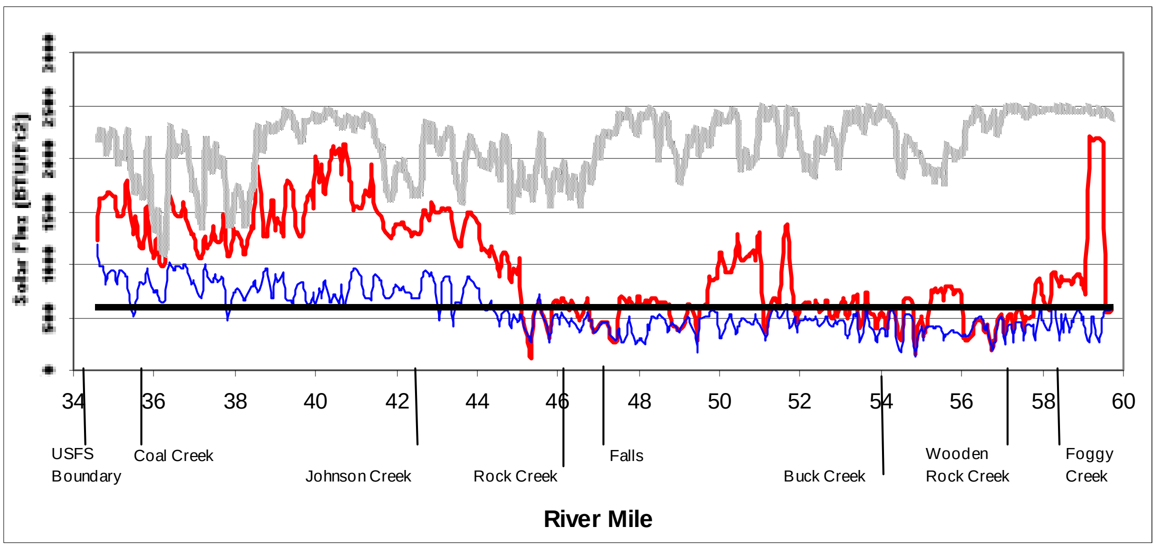
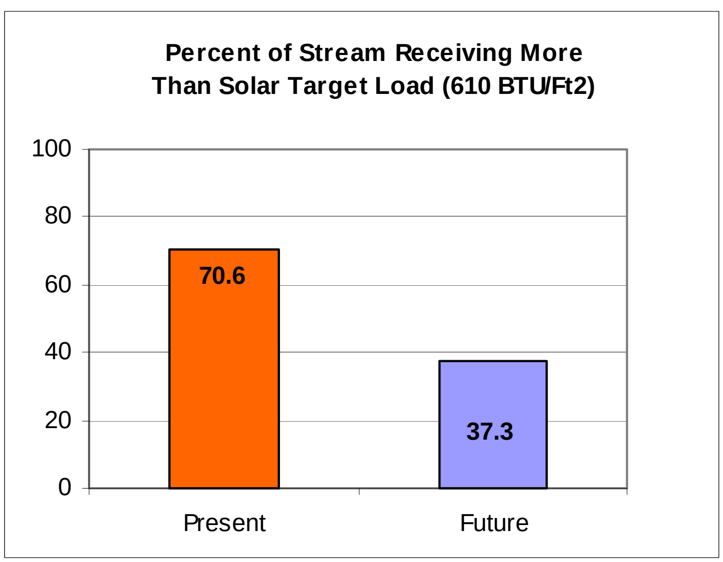


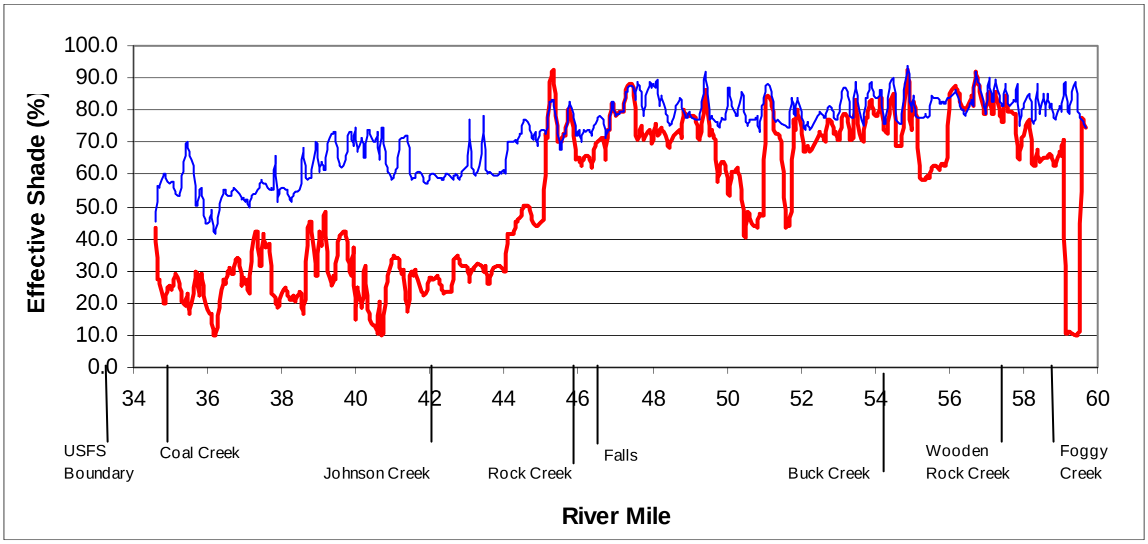
Figure 13



Shade in the Riparian Zone

Figure 14 shows the amount of effective shading provided to the stream by riparian vegetation in the present (lower line) and future (upper line) conditions. Present conditions provide a distance-weighted average of 53% shade to the main stem while future conditions should provide 73% shade (also distance-weighted).

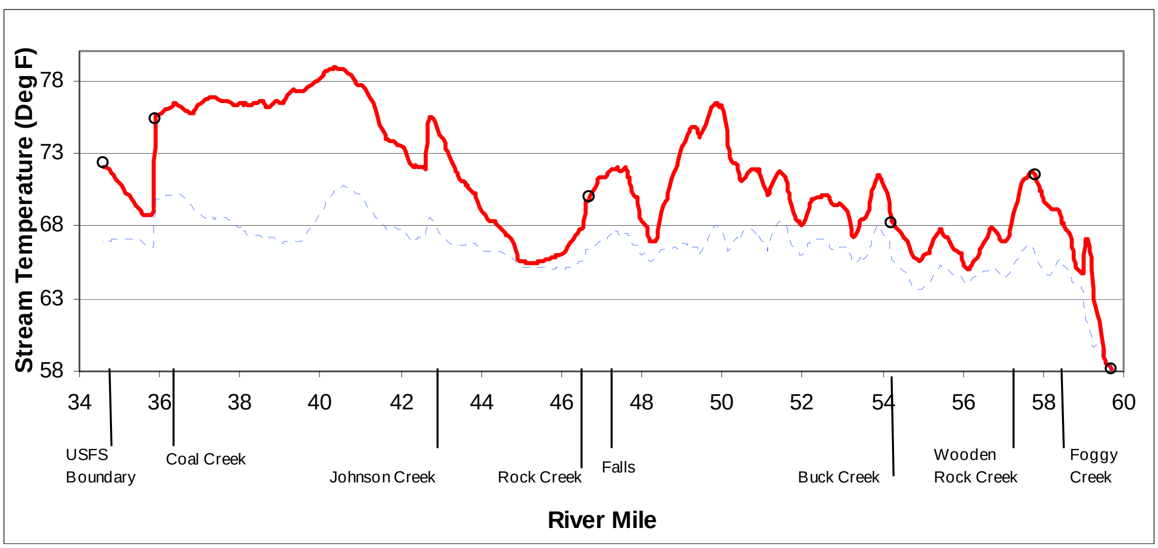
Figure 14



Instream Temperature

Figure 15 shows current (calibration) instream temperature conditions (upper line). The open circles are the corresponding same-day 4:00 PM temperatures recorded by the six data loggers deployed in the main stem. The r squared value of actual vs. simulated temperatures for these six locations (4:00 PM temperatures only, n = 6) was 0.761. The expected future instream temperature conditions (lower dashed line) are based on assumed future conditions. Both lines show instream temperatures at **4:00 PM in the afternoon in late July**. The difference between these two lines shows how much reduction in instream temperature might be expected if the assumed future conditions are achieved.

Figure 15



Both present and future conditions show that tributary temperatures have, and will continue to have, significant bearing on the main stem temperatures. The model simulation for the future condition did not assume any additional cooling in any tributary. **Any additional cooling in any of the tributary sub-watersheds would result in additional cooling in the main stem South Fork Coquille.**

Temperature Distributions

The next two graphs show the same information displayed in two different formats. They show the distribution of temperature levels expected in the future and compare them to those experienced today. These distributions are distance weighted and **reflect conditions at 4:00 PM in late July.**