VIII. CUMULATIVE EFFECTS

1. INTRODUCTION

Cumulative effects are defined in the California Environmental Quality Act (CEQA) Guidelines as "… two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts" (14 CCR § 15355). The individual effects may arise from the proposed project, or may be the additive result of interactions between the proposed project and other closely "related past, present, and reasonably foreseeable probable future projects" taking place over time (14 CCR § 15355). EIRs must discuss significant cumulative effects that are, in part, attributable to the project and need not discuss those significant cumulative impacts that are caused solely by other projects [14 CCR 15130(a)(1)]. The lead agency should describe its basis for determining a project's incremental effects are not cumulatively considerable, or significant. In addition, the lead agency may determine that a project's contribution to a cumulative impact will be less than significant through the implementation of mitigation measures.

This draft EIR is programmatic, considering a series of potential future projects that are geographically similar, carried out under the same authority, and having roughly the same environmental effects which can be mitigated in similar ways (14 CCR § 15168). A programmatic EIR has the advantage of providing the opportunity for a more exhaustive examination of environmental effects, both individual and cumulative, than would be practical in a project-by-project analysis. However, where there is uncertainty about the specific potential impacts of future projects under the DFMP that tier to this EIR, it may be necessary to provide additional analysis of cumulative (and individual) impacts at the project level. For timber harvesting conducted under the DFMP, additional analysis of cumulative impacts will be routine as a part of the THPs that will be prepared and that will be tiered to this EIR.

In addition to timber harvesting and its THP processes, it is important to keep in mind that, many other activities conducted under this EIR—particularly for those with the greatest environmental impact potential, such as road building—project-level CEQA assessments (e.g., Negative Declarations or EIRs) will result in additional cumulative effects assessment based on the best information available at that time. For example, as CDF's plans for expanding the Learning Center at Camp 20 are formulated, it may become necessary to consider the impacts associated with that expansion along with the existing uses in the Camp 20 area, including the mobile home park and the nearby Conservation Camp. Since the expansion of the Learning Center is speculative at this time, it would be premature to conduct such an analysis in this EIR. Where non-THP CEQA documents (e.g., Negative Declarations) tiered to this EIR find potentially significant impacts following proposed mitigation, a project level EIR may be required.

Most if not all future CEQA assessments related to DFMP implementation and JDSF management, including THPs, will tier to this EIR, resulting in a critical analytical connection between the most recent project-level information and the broader

cumulative effects assessment subject matter addressed here. Landowners outside of JDSF but within the watershed cumulative effects assessment area also are likely to tier the CEQA assessments for their proposed projects to this EIR.

The resource areas for which cumulative effects are specifically considered here include the categories of Watershed (with subcategories of Flow Effects, Water Temperature Effects, Nutrient Effects, Large Wood and Organic Debris Effects, and Sediment Effects), Hazardous Materials, Soil Productivity, Biological Resources (with subcategories of Aquatic Resources, Wildlife and Wildlife Habitat, and Botanical Resources), Recreation, Aesthetics, Noise, Traffic, Air Quality, and Heritage Resources.

A substantial amount of cumulative impact assessment has already been presented in section VII Resource Specific Analysis. The purpose of this section is to introduce additional information that is relevant specifically to cumulative effects and to synthesize and recap, rather than repeat in detail, information that is found in other parts of this EIR. Therefore, the following discussion of cumulative impacts relies in part on the more detailed descriptions that are included in other sections of this EIR. References are provided to lead the reader to appropriate sections in the EIR and to other materials supporting points that are not described elsewhere in the EIR. For resource areas that were identified as areas of substantial public concern during the scoping process, and for areas that were identified of substantial concern during the EIR analysis process, greater amounts of assessment and summary of information presented earlier are provided here. For resource areas of lesser concern, the presentation is briefer and simply referential to appropriate earlier sections that adequately address cumulative effects issues. [1]

It is important to recognize that, since assessment of cumulative effects by definition and law requires consideration of future projects and their potential effects, the cumulative effects assessment process is dynamic. Since the “list” of future projects is in flux the CEQA Guidelines suggest that lead agencies “draw a line” and include in their analysis those probable future projects that were planned or had an application submitted at a particular point in time. While efforts were made to incorporate in this EIR all reasonably foreseeable future projects, the list of such projects may change tomorrow. The Board’s analysis of cumulative effects is based for the most part on known projects as of December 31, 2004. If subsequent projects are planned, or applications are submitted to a public agency, which may contribute in some way to additional cumulative effects they may be addressed in the final EIR, where their impacts do not trigger the requirement to prepare a subsequent or supplemental EIR (14 CCR § 16162) .

[1] CEQA case law supports a lead agency discussing cumulative impacts throughout an EIR; all cumulative effects discussion does not need to be found in one section.

2. SETTING

The individual sections for the various resource analysis topics in section VII Resource Specific Analysis provide the bulk of the setting for cumulative effects. Further, section VII.10.2 Regional and Project Watershed Setting and Figure V.3 define a watershed cumulative effects assessment area that is used for many of the past and future projects and the impact analyses below. The relevant cumulative effects assessment area for each impact type is described in each respective section below.

3. PAST, PRESENT, AND FUTURE PROJECTS

The definition for “project” found in the CEQA Guidelines states:

> (a) "Project" means the whole of an action, which has a potential for resulting in either a direct physical change in the environment, or a reasonably foreseeable indirect physical change in the environment, and that is any of the following:
>
> > (1) An activity directly undertaken by any public agency including but not limited to public works construction and related activities clearing or grading of land, improvements to existing public structures, enactment and amendment of zoning ordinances, and the adoption and amendment of local General Plans or elements thereof pursuant to Government Code Sections 65100-65700.
> >
> > (2) An activity undertaken by a person which is supported in whole or in part through public agency contracts, grants, subsidies, loans, or other forms of assistance from one or more public agencies.
> >
> > (3) An activity involving the issuance to a person of a lease, permit, license, certificate, or other entitlement for use by one or more public agencies. (14 CCR § 15378)

Projects do not include activities requiring no public agency approval or funding, that are carried out by private parties outside of JDSF or any actions that occur outside of the specific resources’ assessment area.

The CEQA Guidelines describes the “list” method of addressing cumulative impacts wherein the assessment must include a listing of all relevant past, present, and reasonably probable foreseeable future projects. These project categories are presented below. Project types and locations are discussed where the impacts are similar to, and may interact with the potential impacts of the proposed project (i.e., the DFMP). Where the impact is not cumulatively considerable or where the impact does not arise, in part, from the proposed project, the lead agency need not consider the impact significant

3.1 Past Projects

In theory, the outcome of past projects are incorporated into the project's "Environmental Setting", discussed in each of the resource sections of this EIR. For example, the timber stands found on JDSF today are the result of all timber harvesting and stand management that has occurred in the past, including those permitted and carried out by CDF since the inception of the Forest Practices Act, and as such, would be reflected in a description of the timber stands that exist at JDSF today. However, the results of some recent projects, either on or off of JDSF may not be reflected in the environmental setting and, as such, must be listed as a past project. While CEQA does not state a specific time period for past projects, the rule of thumb is generally all projects that have been approved within the past ten years. Approved projects include those that were found to be exempt from further CEQA review.

Timber Management

Timber management has been the most pervasive land management activity occurring throughout the cumulative watershed effects assessment area (see, e.g., the land use breakdown for the cumulative effects assessment area presented in Table VII.11.2, which shows that over 81% of this area is classified as Forest Land by Mendocino County). Tables VIII.1 through VIII.6 and Figures VIII.1 and VIII.2 summarize past timber harvesting projects occurring from 1986 through 2004 in the cumulative watershed impacts assessment area.[2] The earliest comprehensive, electronically available THP information for the entire cumulative effects assessment area dates to 1986, hence information is presented back to this date. This period provides a reasonable scope of past timber harvesting projects for cumulative effects assessment, given the rates at which environmental factors and processes typically recover from timber harvesting conducted in the fashion permitted during the period under the Forest Practice Rules. For example, the research and models presented in section VII.10 Hydrology and Water Quality and Appendix 10 indicate that in Northern California, peak flow recovery from timber harvesting effects occurs within 11 years. Since some instream sediment effects are tied to peak flows, these particular sediment effects also will decay within a similar period (see section VII.10.4.2). Most surface erosion from timber operations has been found to occur within two years of land disturbing activities (Megahan 1972). Reduced root strength effects on landsliding following harvest are expected to last 3 to 15 years for non-sprouting species (Sidle and Wu 2001) and is less for redwood, which maintain some live roots that are supported by sprouts (Ziemer and Lewis 1984). Sediment transport also can be initiated from instream sources, such as bank erosion and remobilization of stored sediment, with recovery times that are yet to be determined. For example, Keppeler et al. (2003) state that "Recent data analysis suggests that sediment loads in North Fork [Caspar Creek] tributaries remain elevated through water year 2002, more than a decade after harvest."

[2] Appendix 14 provides a very detailed review of the 1986 through 2004 harvest history of the watershed cumulative effects assessment area, including THP number, watershed units, and acres by silvicultural system class and yarding system.

Table VIII.1. Summary of Past Timber Harvesting in the Cumulative Effects Assessment Area, 1986 through 2004.

	Silvicultural System Class (acres)					Silvicultural System Class (percent)					Yarding System (acres)			
Watershed Name	**A**	**B**	**C**	**Other**	**Total**	**A**	**B**	**C**	**Total**	**Sub-Basin Total**	**Heli-copter**	**Cable**	**Tractor**	**Other**
Noyo Headwaters (35,392 ac)	1,868	16,330	10,073		28,271	7	58	36	100	80	1,348	5,972	20,950	
Middle Noyo (14,144 ac)	4,352	2,416	4,814		11,582	38	21	42	100	82		4,676	6,812	
South Fork Noyo River (17,536 ac)	2,656	1,194	8,650		12,501	21	10	69	100	71	498	7,177	4,825	
Lower Noyo River (5,248 ac)	756	567	1,019		2,342	32	24	44	100	45		654	1,687	
NOYO RIVER WATERSHEDS SUM (72,320 ac)	**9,633**	**20,507**	**24,556**		**54,696**	**18**	**37**	**45**	**100**	**75**	**1,847**	**18,480**	**34,275**	
Big River Headwaters (20,992 ac)	1,226	8,394	7,137		16,758	7	50	43	100	80	765	1,836	14,157	
North Fork Big River (27,840 ac)	355	7,952	3,141		11,448	3	69	27	100	41	3	1,170	10,275	
South Fork Big River (34,880 ac)	861	6,535	9,949	39	17,385	5	38	57	100	50	1,480	3,492	12,375	37
Lower Big River (32,256 ac)	6,532	7,574	11,012		25,118	26	30	44	100	78	377	8,102	16,640	
BIG RIVER WATERSHEDS SUM (115,968 ac)	**8,975**	**30,455**	**31,240**	**39**	**70,673**	**13**	**43**	**44**	**100**	**61**	**2,625**	**14,600**	**53,446**	**37**
COASTAL WATERSHEDS SUM (25,216 ac)	**1,464**	**679**	**4,492**		**6,634**	**22**	**10**	**68**	**100**	**26**	**106**	**2,858**	**3,669**	
ASSESSMENT AREA SUM (213,504 ac)	**20,071**	**51,640**	**60,287**	**39**	**132,003**	**15**	**39**	**46**	**100**	**62**	**4,578**	**35,938**	**91,391**	**37**

Table VIII.2. Silviculture Classifications System.	
Class A	
Clearcut	Powerline Right of Way
Conversion from timberland to pasture	Rehab Understocked
Diameter Limit Cut	River High Grade
Diameter Limit Cut >42"	Shelterwood Seed Cut
Diameter Limit Cut >36"	Structure Tree Cut*
Diameter Limit Cut >30"	Seed Tree Seed Cut
Diameter Limit Cut >24"	Variable Retention
Class B	
Alternative Prescription	Diameter Limit Cut >15"
Diameter Limit Cut >23"	Diameter Limit Cut >14"
Diameter Limit Cut >22"	Shelterwood Preparation Cut
Diameter Limit Cut >21"	Shelterwood Removal Cut
Diameter Limit Cut >20"	
Class C	
Commercial Thin	Sanitation Salvage
Group Selection with Commercial thin between groups	Single Tree Selection
Group Selection	Seed Tree Removal Cut
Group Selection and or Group Selection with Single Tree Selection between groups	Transition
*Similar to a Seed Tree Seed Step or Shelterwood Seed Step in which additional trees were left to provide wildlife habitat structure.	

Table VIII.3. Acres Harvested, by Watershed Unit and Silvicultural Class, for Cumulative Watershed Effects Assessment Area, 1986-94 and 1995-2004.

Basin and Planning Watershed		Acres Harvested by Period and Silvicultural Class						Total 1986-2004
		1986-1994			1995-2004			
Name	Area (acres)	A	B	C	A	B	C	
Noyo River								
Brandon Gulch	6,445	29	2	677	46		2,439	3,193
JDSF	6,244	0	0	645	0		2,429	3,075
Non JDSF	201	29	2	32	46		9	119
Duffy Gulch	5,733	1,432	187	1,602	297	219	1,023	4,760
JDSF	1		0				0	0
Non JDSF	5,732	1,432	187	1,602	297	219	1,023	4,760
Hayworth Ck	7,106	338	1,960	721	227	385	881	4,512
Kass Ck	3,530	1,005	697	364	195	19	1,350	3,629
JDSF	1,532	169	451	76	38	0	674	1,409
Non JDSF	1,998	835	246	287	156	19	676	2,220
Little N Fk Noyo River	8,431	2,277	1,939	1,062	346	71	1,128	6,822
JDSF	12	0		0	1			2

Table VIII.3. Acres Harvested, by Watershed Unit and Silvicultural Class, for Cumulative Watershed Effects Assessment Area, 1986-94 and 1995-2004.

Basin and Planning Watershed		Acres Harvested by Period and Silvicultural Class						Total 1986-2004
		1986-1994			1995-2004			
Name	Area (acres)	A	B	C	A	B	C	
Non JDSF	8,419	2,277	1,939	1,062	344	71	1,128	6,821
McMullen Ck	7,065		1,466	980	73	572	1,148	4,239
Middle Fk N Fk Noyo River	4,566		4,290	116	386	462	324	5,576
Mouth of Noyo River	5,220	620	557	439	136	10	579	2,342
JDSF	22							
Non JDSF	5,198	620	557	439	136	10	579	2,342
N Fk Noyo River	6,516	137	1,708	788	139	239	1,599	4,609
JDSF	175						0	0
Non JDSF	6,341	137	1,708	788	139	239	1,598	4,609
Olds Ck	6,964		1,971	1,436	294	643	1,779	6,124
JDSF	41		0	0		0		0
Non JDSF	6,923		1,971	1,436	294	643	1,779	6,124
Parlin Ck	7,573	627	248	1,919	757	228	1,903	5,682
JDSF	6,058	547		1,189	714	0	1,711	4,161
Non JDSF	1,515	80	248	731	43	228	191	1,522
Redwood Ck	3,361		1,547	88	275	1,086	211	3,208
Total Noyo River	**72,510**	**6,465**	**16,571**	**10,193**	**3,170**	**3,934**	**14,363**	**54,696**
JDSF	**14,085**	**717**	**451**	**1,910**	**754**	**0**	**4,815**	**8,646**
Non JDSF	**58,425**	**5,748**	**16,120**	**8,283**	**2,416**	**3,934**	**9,548**	**46,050**
Big River								
Berry Gulch	7,994	1,258	284	726	286	199	912	3,666
JDSF	5,020	616	54	145	95		315	1,225
Non JDSF	2,974	642	230	582	191	199	597	2,441
Chamberlain Ck	7,863		0	0	2		47	50
JDSF	7,792				2		8	9
Non JDSF	71		0	0	1		39	41
Dark Gulch	7,151		391	325	16	800	916	2,448
East Brch N Fk Big River	5,156	108	3,947	50		206	373	4,684
JDSF	169		0					0
Non JDSF	4,987	108	3,947	50		206	373	4,684
James Ck	4,455	4	422	14	2	113	768	1,323
JDSF	3,207	4	0	0	0		0	4
Non JDSF	1,248		422	14	2	113	768	1,319
Laguna Ck	3,244	360	535	1,712	419	32	1,126	4,184
Leonaro Lake	5,325	16	389		41		43	489
Lower N Fork Big River	4,949	202	558	237	20	30	643	1,689
JDSF	2,789	70	0				0	70
Non JDSF	2,160	132	558	237	20	30	643	1,619
Martin Ck	5,940	168	2,633	1,257	267	365	1,664	6,355
Mettick Ck	11,724	227	514	1,653	96	460	1,818	4,768
Mouth of Big River	9,542	1,287	2,163	1,213	776	80	2,172	7,691
JDSF	1,649	0		0	0		204	205
Non JDSF	7,893	1,287	2,163	1,213	776	80	1,967	7,486
Rice Ck	8,033	86	2,038	756	229	50	1,375	4,534
Russell Brook	7,011	358	3,133	853	120	175	1,231	5,870

Table VIII.3. Acres Harvested, by Watershed Unit and Silvicultural Class, for Cumulative Watershed Effects Assessment Area, 1986-94 and 1995-2004.

Basin and Planning Watershed		Acres Harvested by Period and Silvicultural Class						Total 1986-2004
		1986-1994			1995-2004			
Name	Area (acres)	A	B	C	A	B	C	
South Daugherty Ck	10,659	255	3,430	1,240	210	551	3,956	9,642
Two Log Ck	11,425	1,259	3,071	939	886	1,210	2,211	9,577
JDSF	544	20		0			0	20
Non JDSF	10,881	1,239	3,071	939	886	1,210	2,211	9,557
Upper N Fk Big River	5,415	17	2,430	375		246	636	3,703
JDSF	1,428		0					0
Non JDSF	3,987	17	2,429	375		246	636	3,703
Total Big River	**115,886**	**5,605**	**25,939**	**11,352**	**3,370**	**4,517**	**19,890**	**70,673**
JDSF	**22,598**	**710**	**55**	**145**	**97**		**527**	**1,534**
Non JDSF	**93,288**	**4,896**	**25,883**	**11,207**	**3,273**	**4,517**	**19,363**	**69,139**
Coastal Drainages								
Hare Ck	6,180	284	139	1,194	285		1,783	3,686
JDSF	4,078	275	93	947	265		1,551	3,132
Non JDSF	2,102	9	46	248	20		232	554
Mitchell Ck	6,551	59	31	20	59	14	61	244
JDSF	1,743			0			3	4
Non JDSF	4,808	59	31	20	59	14	57	240
Caspar Ck	5,356	762	404	808	1	22	308	2,305
JDSF	4,838	581	385	787			212	1,965
Non JDSF	518	181	20	20	1	22	95	340
Russian Gulch	7,090	13	68	49			269	399
JDSF	1,311	0	0	13			66	80
Non JDSF	5,779	13	68	36			203	320
Total Coastal Drainages	**25,177**	**1,118**	**642**	**2,071**	**345**	**36**	**2,420**	**6,634**
JDSF	**11,970**	**856**	**478**	**1,748**	**265**		**1,833**	**5,180**
Non JDSF	**13,207**	**262**	**164**	**324**	**80**	**36**	**587**	**1,454**
Grand Total	**213,573**	**13,188**	**43,152**	**23,616**	**6,886**	**8,487**	**36,673**	**132,003**
JDSF	**48,653**	**2,282**	**984**	**3,802**	**1,116**	**0**	**7,175**	**15,360**
Non JDSF	**164,920**	**10,906**	**42,168**	**19,814**	**5,770**	**8,487**	**29,498**	**116,642**

Note: See Table VIII.2 for key to the A, B, C silviculture classes.

The "Area (acres)" field is inclusive of all land and vegetation types in each watershed unit, not just timberland.

Where no listing as "Non JDSF" or "JDSF" is shown in the "Name" field, the entire watershed unit is outside JDSF boundaries.

Table VIII.4. Percentage of Watershed Area Harvested, by Watershed Unit and Silvicultural Class, for Cumulative Watershed Effects Assessment Area, 1986-94 & 1995-2004.

Basin and Planning Watershed		Percentage of Watershed Unit Harvested by Period and Silvicultural Class								Total
		1986-1994				1995-2004				1986 - 2004
Name	Area (acres)	A	B	C	Period Total	A	B	C	Period Total	
Noyo River										
Brandon Gulch	6,445			11	11	1		38	39	50
JDSF	6,244			10	10			39	39	49
Non JDSF	201	14	1	16	31	23		5	28	59
Duffy Gulch	5,733	25	3	28	56	5	4	18	27	83
JDSF	1		1		1			8	8	9
Non JDSF	5,732	25	3	28	56	5	4	18	27	83
Hayworth Ck	7,106	5	28	10	43	3	5	12	20	63
Kass Ck	3,530	28	20	10	58	6	1	38	45	103
JDSF	1,532	11	29	5	45	3		44	47	92
Non JDSF	1,998	42	12	14	68	8	1	34	43	111
Little N Fk Noyo River	8,431	27	23	13	63	4	1	13	18	81
JDSF	12					12			12	13
Non JDSF	8,419	27	23	13	63	4	1	13	18	81
McMullen Ck	7,065		21	14	35	1	8	16	25	60
Middle Fk N Fk Noyo River	4,566		94	3	97	8	10	7	25	122
Mouth of Noyo River	5,220	12	11	8	31	3		11	14	45
JDSF	22									
Non JDSF	5,198	12	11	8	31	3		11	14	45
N Fk Noyo River	6,516	2	26	12	40	2	4	25	31	71
JDSF	175									
Non JDSF	6,341	2	27	12	41	2	4	25	31	73
Olds Ck	6,964		28	21	49	4	9	26	39	88
JDSF	41									
Non JDSF	6,923		28	21	49	4	9	26	39	88
Parlin Ck	7,573	8	3	25	36	10	3	25	38	75
JDSF	6,058	9		20	29	12		28	40	69
Non JDSF	1,515	5	16	48	69	3	15	13	31	100
Redwood Ck	3,361		46	3	49	8	32	6	46	95
Total Noyo River	**72,510**	**9**	**23**	**14**	46	**4**	**5**	**20**	29	**75**
JDSF	**14,085**	**5**	**3**	**14**	22	**5**		**34**	39	**61**
Non JDSF	**58,425**	**10**	**28**	**14**	52	**4**	**7**	**16**	27	**79**
Big River										
Berry Gulch	7,994	16	4	9	29	4	2	11	17	46
JDSF	5,020	12	1	3	16	2		6	8	24
Non JDSF	2,974	22	8	20	50	6	7	20	33	82
Chamberlain Ck	7,863							1	1	1
JDSF	7,792									
Non JDSF	71		1		1	1		55	56	57
Dark Gulch	7,151		5	5	10		11	13	24	34
East Brch N Fk Big River	5,156	2	77	1	80		4	7	11	91
JDSF	169									
Non JDSF	4,987	2	79	1	82		4	7	11	94
James Ck	4,455		9		9		3	17	20	30
JDSF	3,207									

Table VIII.4. Percentage of Watershed Area Harvested, by Watershed Unit and Silvicultural Class, for Cumulative Watershed Effects Assessment Area, 1986-94 & 1995-2004.

Basin and Planning Watershed		Percentage of Watershed Unit Harvested by Period and Silvicultural Class								Total
		1986-1994				1995-2004				
Name	Area (acres)	A	B	C	Period Total	A	B	C	Period Total	1986 - 2004
Non JDSF	1,248		34	1	35		9	62	71	106
Laguna Ck	3,244	11	16	53	80	13	1	35	49	129
Leonaro Lake	5,325		7		7	1		1	2	9
Lower N Fork Big River	4,949	4	11	5	20		1	13	14	34
JDSF	2,789	3			3					3
Non JDSF	2,160	6	26	11	43	1	1	30	32	75
Martin Ck	5,940	3	44	21	68	4	6	28	38	107
Mettick Ck	11,724	2	4	14	20	1	4	16	21	41
Mouth of Big River	9,542	13	23	13	49	8	1	23	32	81
JDSF	1,649							12	12	12
Non JDSF	7,893	16	27	15	58	10	1	25	36	95
Rice Ck	8,033	1	25	9	35	3	1	17	21	56
Russell Brook	7,011	5	45	12	62	2	3	18	23	84
South Daugherty Ck	10,659	2	32	12	46	2	5	37	44	90
Two Log Ck	11,425	11	27	8	46	8	11	19	38	84
JDSF	544	4			4					4
Non JDSF	10,881	11	28	9	48	8	11	20	39	88
Upper N Fk Big River	5,415		45	7	52		5	12	17	68
JDSF	1,428									
Non JDSF	3,987		61	9	70		6	16	22	93
Total Big River	**115,886**	**5**	**22**	**10**	37	**3**	**4**	**17**	24	**61**
JDSF	**22,598**	**3**		**1**	4			**2**	2	**7**
Non JDSF	**93,288**	**5**	**28**	**12**	45	**4**	**5**	**21**	30	**74**
Coastal Drainages										
Hare Ck	6,180	5	2	19	26	5		29	34	60
JDSF	4,078	7	2	23	32	7		38	45	77
Non JDSF	2,102		2	12	14	1		11	12	26
Mitchell Ck	6,551	1			1	1		1	2	4
JDSF	1,743									
Non JDSF	4,808	1	1		2	1		1	2	5
Caspar Ck	5,356	14	8	15	37			6	6	43
JDSF	4,838	12	8	16	36			4	4	41
Non JDSF	518	35	4	4	43		4	18	22	66
Russian Gulch	7,090		1	1	2			4	4	6
JDSF	1,311			1	1			5	5	6
Non JDSF	5,779		1	1	2			4	4	6
Total Coastal Drainages	**25,177**	**4**	**3**	**8**	15	**1**		**10**	11	**26**
JDSF	**11,970**	**7**	**4**	**15**	26	**2**		**15**	17	**43**
Non JDSF	**13,207**	**2**	**1**	**2**	5	**1**		**4**	5	**11**
Grand Total	**213,573**	**6**	**20**	**11**	37	**3**	**4**	**17**	24	**62**
JDSF	**48,653**	**5**	**2**	**8**	15	**2**		**15**	17	**32**
Non JDSF	**164,920**	**7**	**26**	**12**	45	**3**	**5**	**18**	26	**71**

Note: See Table VIII.2 for key to the A, B, C silviculture classes.

The "Area (acres)" field is inclusive of all land and vegetation types in each watershed unit, not just timberland.

Where no listing as "Non JDSF" or "JDSF" is shown in the "Name" field, the entire watershed unit is outside JDSF boundaries.

Table VIII.5. Summary of Cumulative Effects Assessment Area Harvest by Acres and Percent.

	Ownership	Period and Silvicultural System Class*							
		1986 - 1994				1995 - 2004			
		A	B	C	Total	A	B	C	Total
By Acres	JDSF	2,282	984	3,802	7,069	1,116	0	7,175	**8,291**
	Non JDSF	10,906	42,168	19,814	72,887	5,770	8,487	29,498	**43,755**
	Total	**13,188**	**43,152**	**23,616**	**79,956**	**6,886**	**8,487**	**36,673**	**52,046**
By Percent of Area Harvested	JDSF	32%	14%	54%	100%	13%	0%	87%	**100%**
	Non JDSF	15%	58%	27%	100%	13%	19%	68%	**100%**
	Total	**16%**	**54%**	**30%**	**100%**	**13%**	**16%**	**70%**	**100%**

***See Table VIII.2 for definition of silvicultural system classes.

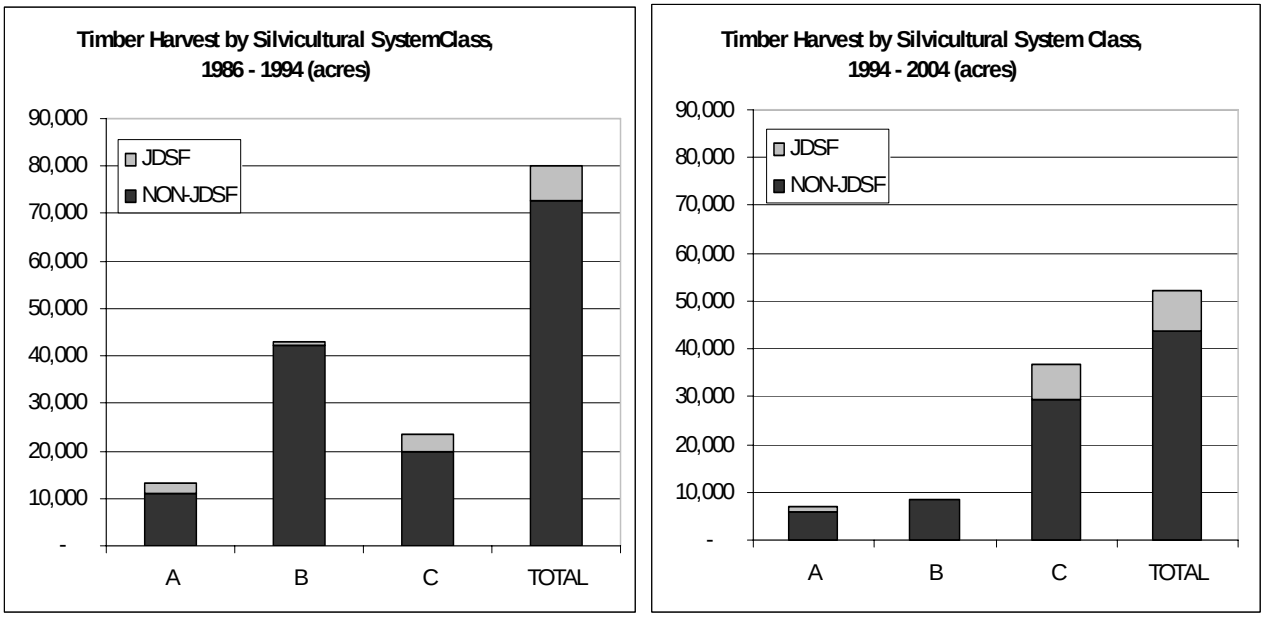

Figure VIII.1. Bar Graph of Harvest Acres by Silvicultural Class, Period, and Ownership. (See Table VIII.2 for definition of silvicultural system classes).

Table VIII.6. Summary of Cumulative Effects Assessment Area Yarding by Acres and Percent.

		Period and Yarding System							
		1986 - 1994				1995 - 2004			
	Ownership	Tractor	Cable Susp.	Heli-copter	Total	Tractor	Cable Susp.	Heli-copter	Total
By Acres	JDSF	3,309	3,653	106	7,069	2,529	5,264	498	**8,291**
	Non JDSF	56,148	14,735	2,005	72,887	29,409	12,378	1,968	**43,755**
	Total	**59,457**	**18,388**	**2,112**	**79,956**	**31,938**	**17,642**	**2,466**	**52,046**
By Percent of Area Harvested	JDSF	4%	5%	0%	9%	5%	10%	1%	**16%**
	Non JDSF	70%	18%	3%	91%	57%	24%	4%	**84%**
	Total	**74%**	**23%**	**3%**	**100%**	**61%**	**34%**	**5%**	**100%**

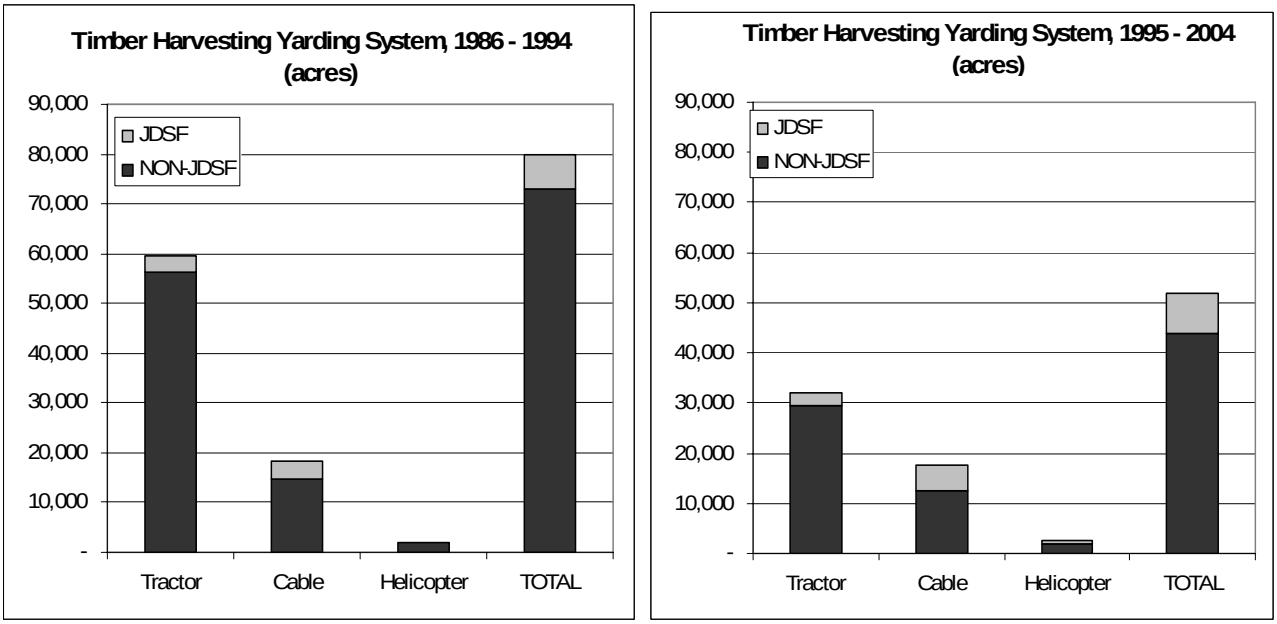

Figure VIII.2. Bar Graph of Area Yarded by Yarding System, Period, and Ownership.

The silvicultural treatments applied in these harvests are grouped into three basic classes of treatments with similar levels of vegetation removals and other site disturbance. As shown in Table VIII.2, class A includes clearcutting, variable retention, and other primary evenaged management treatments, plus large-tree diameter limit cuts and conversions. Class B includes alternative prescriptions, secondary evenaged management treatments (e.g., shelterwood removal), and smaller tree diameter limit cuts. Class C includes commercial thinning and unevenaged management treatments.

Tables VIII.3 through VIII.6 break the nineteen year period into a nine-year (1986-1994) and a ten-year period (1995-2004). This breakpoint is convenient both because it splits

the overall period into roughly equal portions and because the break also falls at a time when the Board of Forestry and Fire Protection enacted significant changes to the Forest Practice Rules that provided greater protections to streams, as well as increased requirements for the achievement of maximum sustained production of timber products. The locations and general silvicultural and yarding systems for timber harvesting plan projects are shown in Map Figures G-I. Appendix 14 provides a very detailed listing of harvesting activities by individual THP and planning watershed for the 19-year assessment period.

During the nineteen-year period of timber harvesting displayed in Table VIII.1, a total of 132,003 acres was harvested at varying levels of intensity, an area equivalent to 62 percent of the assessment area. Where a given area was harvested more than once within this period, the acres were counted each time. Of the area harvested, 20,071 acres (15%) were in silvicultural class A, 51,640 (39%) in class B, 60,278 (46%) in class C, and 39 acres (0.03%) in other treatments. Most of the yarding was by tractor or ground-based systems (91,391 acres or 69%), with the next largest amount by cable (35,938 acres or 27%), followed by helicopter (4,578 acres or 3%). These yarding systems rank, in order of most to least disturbance of vegetation and soil, from tractor to cable to helicopter.

At a finer scale at the subbasin level, the percentages of subbasin area with silvicultural treatments over the 19-year period varied substantially. Several of the subbasins had 80 percent or more of their area harvested (Noyo headwaters, Middle Noyo, Big River headwaters), while the coastal watersheds subbasin had only 26 percent of its area harvested (Table VIII.1).

Tables VIII.3 and VIII.4 present data at the planning watershed level and broader for two subsets of the 19-year period. These tables also break out activity on JDSF lands versus other ownerships. Thus, these tables allow for a very detailed look at the location, nature, and intensity of past harvesting activity within the cumulative effects assessment area. Given the large amount of data presented in these tables, only a few key factors and trends indicated by the data are described here.

As would be expected from the disaggregation of data, the percentages of planning watershed area harvested over the 19-year period varies more substantially than at the subbasin level. Some planning watersheds had 100 percent or more of their area under THP treatments during the period, indicating that some areas were treated more than once: Kass Creek, 103%; Martin Creek, 107%; Middle Fork of the North Fork Noyo River, 122%; Laguna Creek, 129%. Other planning watersheds saw relatively little harvest activity over the period: Chamberlain Creek, 1%; Mitchell Creek, 4%; Russian Gulch, 6%; Leonaro Lake 9%. At the larger basin levels, 61% of the Big River and 75% of the Noyo River watershed areas were harvested during the 19-year period. On the entire cumulative effects assessment area, 62% of the area was harvested.

Where planning watersheds had substantial portions of both JDSF and other ownership, the harvest activity was typically more extensive on the non-JDSF portions during the

period of time examined, due to variable stand conditions, stand management history, and management philosophy: Parlin Creek, 69% of JDSF acres harvested/100% of non-JDSF acres harvested; Berry Gulch, 24%/82%; James Creek, 0%/106%; Kass Creek, 92%/111%; Lower North Fork Big River, 3%/75%; Two Log Creek, 4%/88%; Upper North Fork Big River, 0%/93%; Caspar Creek, 41%/66%. Only the Hare Creek planning watershed had the reverse relationship, 77%/26%. Making the same comparison at the level of the larger watershed units show the following: Big River, 7% of JDSF acres harvested/74% of non-JDSF acres harvested; Noyo River, 61%/79%; coastal drainages, 43%/11%; entire cumulative effects assessment area, 32%/71%.

Table VIII.5 and Figure VIII.1 compare the kinds of silvicultural prescriptions applied on the cumulative effects assessment area. The data show that, in general, private landowners within parts of the assessment area have tended to utilize more even-aged stand management techniques than has JDSF over this time period. They also show that between the two periods, both JDSF and non JDSF owners made a significant shift toward relatively greater use of less intensive silviculture (class C) and less use of more intensive silviculture (classes A and B).

Table VIII.5 and Figure VIII.1 also show that the amount or rate of harvesting dropped significantly between the two periods. Area-wide, 79,956 acres were harvested from 1986 through 1994 (8,884 acres/year) and 52,046 acres from 1995-2004 (5,205 acres/year). This change represents a decrease in harvest rate (acres/year) of 41%. Looking at harvest on non JDSF lands alone, the rate of harvest dropped from 8,099 acres/year to 4,376 acres/year, or a decline of 46%. On JDSF lands, the rate of harvest between the two periods increased from 785 acres/year to 829 acres/year, or an increase of 6%.

Shifting from silviculture to yarding, Table VIII.6 and Figure VIII.2 summarize yarding methods by acres and percent of area harvested. Tractor yarding generally results in more ground and vegetation disturbance than do cable suspension and helicopter yarding. In general, ground-based systems such as tractor are utilized on less steep slopes, where less excavation is required for safe operation of the equipment. This is especially true today, due partially to rules which restrict the use of heavy equipment on steep slopes. In decades past (prior to 1970s), few cable yarders were utilized in this area. The data show that, in general, non JDSF landowners tend to use tractor yarding for a relatively high proportion of their harvest area. In the 1986-1994 period, JDSF used tractor and cable yarding in about equal proportions. In the 1995-2004 period, JDSF used cable and helicopter yarding about twice as much as tractor yarding. Non JDSF landowners used tractor yarding at about three times the rate of cable and helicopter yarding during the earlier period and at about twice the rate during the later period. Both JDSF and non JDSF landowners increased their relative use of cable and helicopter yarding between the two periods. Increased reliance on these less disruptive methods of yarding will contribute to reduced soil and sediment impacts.

There has been a significant change in ownership of industrial timberland within the cumulative watershed effects assessment area within the past ten years. Both of the

major industrial forestland ownerships have changed hands. The lands currently owned by the Campbell Group and managed by Hawthorne Timber Company were acquired from Georgia-Pacific Corporation in 1999. The lands currently managed by Mendocino Redwood Company (about 54,000 acres or 25% of the assessment area) were acquired from Louisiana-Pacific Corporation in 1998. As documented in discussions of restoration activities, below, Mendocino Redwood Company has taken an aggressive stance toward environmentally sound forestry practices, included certification of their operations under both the Forest Stewardship Council and the Sustainable Forestry Initiative. More recently, the Campbell Group transferred ownership of 7,334 acres of industrial forestland to the Department of Parks and Recreation to create the Big River Unit of the Mendocino Headlands State Park. This change in ownership permanently removed this area from commercial timber management.

Forest Roads

The existing forest road network found through much of the cumulative watershed effects assessment area represents an accumulation of road construction and maintenance over a long period of time. The bulk of the roads within the assessment area are associated with timber management, however some are residential roads and others (e.g., State Highways 20 and 1) are part of the main transportation infrastructure. Roads represent an ongoing source of environmental impacts across the cumulative watershed effects assessment area. As discussed in section VII.7 Geology and Soils, VII.10 Hydrology and Water Quality, VII.6.1 Aquatic Resources, and Appendix 11, roads are a significant, ongoing source of environmental impacts, particularly as related to sediment generation. The discussion in the noted sections documents that, within the watershed cumulative effects assessment area, roads are the greatest source of anthropogenic sediment, as is typically the case for forested watersheds in California. These sections document the extent of the road network, provide estimates of its sediment generation potential, and discuss the effects of sediment on water quality and aquatic species and habitat.

Table VII.7.1 summarizes modeled road characteristics and estimated road surface sediment production at the planning watershed level for the watershed cumulative effects assessment area. Table VIII.6B, below, summarizes the overall information from this modeling exercise. In addition to information on road miles and densities, it shows that for the entire assessment area and all ownerships, the estimated average road sediment rate is 110.2 tons per square mile per year (t/mi.^{2}/year). Outside of JDSF, the rate is 114.2 t/mi.^{2}/year; inside JDSF the rate is 96.7 t/mi.^{2}/year. These numbers represent a modeled estimate of the cumulative annual road sedimentation rate for the assessment area. Figure VII.7.1 illustrates the model-estimated road surface sediment rates at the planning watershed level for the watershed cumulative effects assessment area.

Table VIII.6B. Summary of Road Sediment Modeling.

	Drainage Area (mi^2)	Road Miles	Road Density (mi/mi^2)	Miles of Riparian Roads	Riparian Road Density	Road Sediment Rate ($t/mi^2/yr$)
Outside of JDSF	257.9	1,813.6	7.0	690.4	2.7	114.2
Inside JDSF	75.6	457.1	6.0	220.1	2.9	96.7
Entire Assessment Area	333.5	2,270.7	6.8	910.5	5.6	110.2

(Information extracted from Table VII.7.1.)

Where roads cross streams, there is the potential for sedimentation effects, as well as for blockage of fish passage where culverts have failed or were not installed with fish passage in mind. Table VII.7.2 presents information on the number of road/stream crossings at the planning watershed level for the watershed cumulative effects assessment area. In summary, this information shows that, across the watershed cumulative effects assessment area, the average density of crossings per stream mile is 2.71. For JDSF lands on the Big River the density of crossings per stream mile is near the assessment-area-wide average (2.61), but for JDSF lands on the Noyo it is far below the average (1.07). For areas outside JDSF the density of crossings per stream mile is above the assessment area wide average for lands on both the Big (2.88) and Noyo (2.95) Rivers.

JDSF began a program of road decommissioning in the mid-1990s, and has removed about 15 miles of roadway since, resulting in a very substantial level of long-term sediment savings and habitat restoration (e.g. Road 600, Road 630, and Road 340). While the soil disturbance inherent in road removal may initially result in temporarily increased sedimentation levels, long-term sediment reduction is eliminated or substantially reduced.

Stream Alteration, Restoration, and Sediment Reduction Activities

The Department of Fish and Game provided information on projects within the cumulative effects assessment area that were conducted under Streambed Alteration Agreements. This information, which included Project Descriptions and Conditions information, came from a DFG database extending back approximately 3 years. The exercise identified 26 projects within the cumulative effects assessment area. The bulk of these projects were efforts to reduce sediment or otherwise improve instream habitat for fish. Additionally, DFG provided a database and GIS coverage of stream improvement projects that they had funded within the cumulative effects assessment area since 1995. A third source, the Natural Resources Project Inventory (http://endeavor.des.ucdavis.edu/nrpi) identified a number of additional relevant projects. Project information extended back as far as 1990. However, this list is by no means complete (e.g., DFG Project Descriptions and Conditions database information was available only for the last 3 years), thus it likely significantly understates the level of

sediment reduction and fish habitat restoration activities that have occurred within the watershed cumulative effects assessment area over this period.

Projects from these three information sources were combined into Table VIII.7, which identifies 126 projects, 99 (79%) of which were conducted to reduce stream sedimentation. Twenty-eight (22%) of the projects were intended to improve fish passage or habitat, and a few (5 or 4%) to restore riparian areas. Three of the projects involved watershed planning. Out of the 126 projects, 21 (17%) were conducted on JDSF. The on-the-ground projects listed in Table VIII.7 also are displayed in Map Figure Y. While it is uncertain, some of the projects in the table that involved “barrier removal” or “barrier modification” circa 1990 or 1991 may have removed large wood that fisheries biologists would today consider to be desirable. However, taken as a whole, the projects identified in Table VIII.7 should contribute to improved stream conditions and fishery habitat within the watershed cumulative effects assessment area. Again, the available information presented here understates the actual magnitude of efforts within the watershed cumulative effects assessment area to reduce sediment and improve fish habitat.

Road Maintenance and Improvement

CALTRANS conducts a significant amount of road maintenance and improvement activities within the cumulative effects assessment area. The past 10 years of CALTRANS projects in the assessment area are summarized in Table VIII.8. Sediment impacts are the primary concern regarding potential cumulative effects interactions between CALTRANS projects and activities proposed in the DFMP.

Road projects conducted by Mendocino County are described in EIR section VII.15.1 (Traffic and Transportation). Major Caltrans projects (Table VIII.8) include: Replacement of the Highway 1 bridge over the Noyo River; curve realignment to improve safety with standard radius curves and full-width lanes and shoulders along a 0.6 mile stretch of Highway 20; and proposed culvert and drainage structure rehabilitation, removal and replacement at a variety of sites. The most likely cumulative impact interaction between County or Caltrans roads projects and the JDSF management alternatives assessed in this EIR are related to the generation of sediment and related impacts to the beneficial uses of water. The County or Caltrans conducted CEQA-required environmental review of all of these projects and mitigated all adverse impacts to the level of no significant effect. As a part of this EIR, these projects and their CEQA documents were reviewed and a determination made that there was no reasonable potential for their remaining less-than-significant impacts—particularly as related to sediment generation—to combine with the potential impacts from activities contemplated in the DFMP or other alternatives resulting in a significant adverse cumulative impact.

Table VIII.7. Watershed Restoration Projects in the Cumulative Effects Assessment Area, 1990 through 2004.

Watershed Unit	Type of Project	Purpose	Year	JDSF	Location
BIG RIVER (general)					
	Barrier Removal; decrease erosion; fish passage	sediment reduction, fish passage	1991		Big River (river mile 32.29-123.69)
	Replaced log stringer bridge with railcar bridge	sediment reduction	1999		Camp A Creek
	Remove 18” CMP crossing	sediment reduction	2003		Comptche Quad
	Decommissioned 800' of road	sediment reduction	1999		Camp A Gulch
	Decommissioned 2,800' of road	sediment reduction	2000		Jeep Trail
BIG RIVER HEADWATERS					
Martin Creek	Replace an existing bridge		2002		Tributary to Martin Creek
Rice Creek	Decommissioned 800' road/landings	sediment reduction	2001		Stingle Gulch
	Barrier Removal	fish habitat	1990		
	Installed dips, rocking, riprapped outfalls	sediment reduction	2001		Stingle Gulch
Russell Brook	Slide repair. Placed 100 yds riprap.	sediment reduction	1998		M&M Road @ 10.8 mile
	Rocked one mile road	sediment reduction	1998		Russell Brook Road
	Replaced log stringer bridge with railcar bridge (#1)	sediment reduction	1999		Russell Brook Road
	Replaced log stringer bridge with railcar bridge (#2)	sediment reduction	1999		Russell Brook Road
	4.1 miles surfacing and rocking roads. Inc. EB WH Road @ 4 mi	sediment reduction	1998		East Branch/Russell Brook
	Installed double 89' railcar bridges	sediment reduction	1998		McDuffy Opening
	Rocked 0.19 miles road	sediment reduction	1999		Smith Gulch Road
	Decommissioned 5,760' road/landings	sediment reduction	2000		Smith Gulch
	Pulled up fill, outsloped, dips, rocking, riprapped outfalls	sediment reduction	2000		Smith Gulch
	Replaced 2-Class II CMP with 30" and 60" CMPs	sediment reduction	2001		Unknown Gulch

Table VIII.7. Watershed Restoration Projects in the Cumulative Effects Assessment Area, 1990 through 2004.

Watershed Unit	Type of Project	Purpose	Year	JDSF	Location
	Pull fill 3.6 miles road, installed dips, rocking, riprapped outfalls, pull pipe	sediment reduction	2001		Unknown Gulch
	Removal of barriers, add logs to stream	fish habitat	1995		39.29,-123.47
	Watershed assessment projects (roads, hillslope)	watershed planning	2001		39.3,-123.49
	Two slide repairs. Placed 100 yds riprap.	sediment reduction	1999		Firebox Road @ 7 mile, Firebox Creek
	Rocked 0.38 miles road. Inc. McDuffy WH Road	sediment reduction	1999		Wildhorse Shortcut @ 11 mile
NORTH FORK BIG RIVER					
	Decommissioned 1,300' road/landings	sediment reduction	2001		The Pits
	Rocked 150' of road	sediment reduction	1999		Waterhole Rd @ 2mile
Upper North Fork Big River	Remove culvert, road fill, and stream sediment, remove mass wasting, upgrade crossing	sediment reduction	2004		Frykman Gulch
	Barrier Modification	Fish passage	1996	**X**	NF Big River (at end of Rd 911)
	Watershed assessment projects (roads, hillslope)	watershed planning	2002		39.48,-123.54
East Branch North Fork Big	Replaced log stringer bridge with railcar bridge	sediment reduction	2001		EBNFBR Bridge @ 4 mile
	Slide repair. Placed 100 yds riprap.	sediment reduction	1998		Firebox Bridge @ 6 mile
	Rocked 100' of road	sediment reduction	2001		Waterhole Rd @ 6.4mile
Lower North Fork Big River	Installed dips, rocking, riprapped outfalls, pull 17 pipes	sediment reduction	2001		Entrance
	Slide repair. Placed 80 yds riprap.	sediment reduction	1998		Dunlap @ 2.25 mile
	Rocked 0.47 miles road	sediment reduction	2001		Dunlap Road
	Pulled up fill, outsloped, dipped 3 miles of road	sediment reduction	1999		Dunlap Road
	Decommissioned 600' road/landing	sediment reduction	2001		Entrance /Dunlap Gulch
	Decommissioned 2,000' of road	sediment reduction	2000		Steam Donkey Gulch

Table VIII.7. Watershed Restoration Projects in the Cumulative Effects Assessment Area, 1990 through 2004.

Watershed Unit	Type of Project	Purpose	Year	JDSF	Location
SOUTH FORK BIG RIVER					
Dark Gulch	Install railcar bridges and rock-armored fords remove mass wasting	sediment reduction	2002		Montgomery Creek
	Barrier Removal, upgrade culverts	fish passage, sediment reduction	1995		39.25,-123.41
South Daugherty Creek	Crossing upgrades, pulled perched road edge, outsloping of road, upgraded crossings	sediment reduction	2000		Main Line
	Create pools, improve cover and structure	fish habitat	1998		39.22,-123.45
	Add large woody debris, create pools	fish habitat	1996		39.20,-123.43
	Soda Creek improvements to fish passage	fish passage	1996		
	Stabilize stream bank	sediment reduction	1995		39.20,-123.42
	Removed large slide, end haul materials, reshaped road, removal of perched material	sediment reduction	2000		North Side Road
Mettick Creek	Remove 8 culverts on a unused forest road	sediment reduction	2002		
	Removed 8 culverts, installed 8 dips, riprap one dip, installed Hewitt Ramp and decommissioned 3,000' of road in Mettick Creek. Removed 36" CMP and installed 60" CMP at No Name Gulch.	sediment reduction	2002		Mettick Creek and No Name Gulch
	Rocked 0.14 miles road	sediment reduction	2002		Mettick Creek Road
	Decommissioned 3,500' roads/landings	sediment reduction	2002		Mettick-Clark
	Pull fill, installed 18 dips, rocking, riprapped outfalls	sediment reduction	2002		Mettick-Clark
	Rocked 0.2 miles road	sediment reduction	2000		L&M Road .75-4 mile
	Rocked 0.25 miles of road.	sediment reduction	2000		L&M Road @ 2 mile
	Outsloped and dipped road on 2.25 miles road	sediment reduction	2001		M&M Road @ 8-10.25 mi
	Decommissioned 1,000' of road	sediment reduction	2000		Kelly Gulch
	Rocked 0.34 miles road	sediment reduction	1999		Kelly Gulch
	Install 16 dips, 11 of these are rocked dips	sediment reduction	2000		Kelly Gulch
	Rocked 0.18 miles road	sediment reduction	2002		Poverty Gulch Road

Table VIII.7. Watershed Restoration Projects in the Cumulative Effects Assessment Area, 1990 through 2004.

Watershed Unit	Type of Project	Purpose	Year	JDSF	Location
	Pull fill, installed dips, rocking, riprapped outfalls	sediment reduction	2002		Poverty Gulch
	Rocked 0.17 miles road	sediment reduction	2002		Sky Ranch Gate @ 18 mi
	New 48" CMP/Class II	sediment reduction	1998		Slide Camp
	Rocked 150' WH Road	sediment reduction	1998		Clark Opening WH Road
	Improve fish passage	fish passage	1996		39.26,-123.52
	Add large woody debris to stream channel	sediment reduction	1997		Mettick, Russell Brook, Ramon Creek
LOWER BIG RIVER					
Berry Gulch	Road decommissioning	sediment reduction, restoration of riparian zone	1999	x	Berry Gulch Road 552
	Removal of 2 18" culverts	sediment reduction	2003		Manly Gulch
Two Log Creek	Replaced log stringer bridge with railcar bridge	sediment reduction	2001		Two Log Bridge
	Remove crossings and install a temporary bridge	sediment reduction	2003		Kidwell Gulch
	Remove and upgrade 6 culverts	sediment reduction	2002		Tributary to Big River
	24 sites for salmonid habitat improvement, add large wood	fish habitat	2003		
	Removal of 2 culverts and add old logs (large wood) to stream, upgrade crossing	sediment reduction, fish habitat	2001		
	Removal of 18" culvert	sediment reduction	2003		Big River
	Replaced log stringer bridge with railcar bridge	sediment reduction	1998		Docker Gulch
	Rocked 0.08 miles road	sediment reduction	1999		Docker Gulch 4000' Rd
	Replaced 3-Class III CMP with 2 30" and 36" CMP	sediment reduction	1999		Docker Gulch
	Rocked 0.12 miles road	sediment reduction	1999		Lower Docker Gulch Rd
	Rocked 0.37 miles road	sediment reduction	1999		Upper Docker Gulch Road
Mouth of Big River	Fish passage, road decommissioning, riparian habitat	sediment reduction, fish habitat	2002		Big River Estuary

Table VIII.7. Watershed Restoration Projects in the Cumulative Effects Assessment Area, 1990 through 2004.

Watershed Unit	Type of Project	Purpose	Year	JDSF	Location
NOYO (general)					
	Road improvement on 4 miles of Fort Bragg-Sherwood road	sediment reduction	2003		along Upper and Middle Noyo ridge
	Barrier modification	fish habitat	1990		not specific
	Remove crossings, upgrade culverts, and rocked a section of road in a WLPZ	sediment reduction	2004		Non-specific
NOYO HEADWATERS					
Hayworth Creek	Upgrade watercourse crossings	sediment reduction	2001		Confluence
	Removed 11 CMPs, installed 11 rocked dips, installed 13 riprapped outfalls, installed 2 non-rocked dips, repaired slide damaged road, outsloped roads and rocked 100' of EEZ road.	sediment reduction	2002		Hay U
	Decommission roads	sediment reduction	2001		Hayworth Creek
	Remove culverts; install 2 bridges	sediment reduction, fish passage	2002		Hayworth Creek
	Upgrade watercourse crossings, rock road, re-shape road	sediment reduction	2001		Hayworth Creek
	Decommissioning & stormproofing roads, crossing upgrades.	sediment reduction	2003		Noyo River
McMullen Creek	Barrier Modification	fish passage	1990		McMullen Creek
	Barrier Modification	fish passage	1990		McMullen Creek
	Install portable bridges	sediment reduction			Burbeck and Noyo
North Fork Noyo River	Upgrade watercourse crossings	sediment reduction	2001		Marble Gulch
	Upgrade watercourse crossings, rock road, re-shape road	sediment reduction	2001		North Fork Noyo
	Upgrade watercourse crossings, storm proof	sediment reduction	1999		River Road
	Rocking of rolling dips.	sediment reduction	1999		Marble Creek
	New bridge installation.	sediment reduction	1998		North Spur, Beatty

Table VIII.7. Watershed Restoration Projects in the Cumulative Effects Assessment Area, 1990 through 2004.

Watershed Unit	Type of Project	Purpose	Year	JDSF	Location
Olds Creek	Installed rock weir in Class I watercourse, repaired slide damaged road, removed 3 CMP's, installed 2 rocked dips, installed 2 non-rocked dips, installed 4 riprapped outfalls, outsloped roads and rocked 0.25 miles Class I WLPZ road.	sediment reduction	2002		Twitchell
	Barrier modification	fish passage	1990		Olds Creek
	Replace railcar bridge		2003		
	Upgrade watercourse crossings, storm proof	sediment reduction	1999		River road
	New bridge installation.	sediment reduction	2000		Irmulco
Redwood Creek	Install bridge, upgrade watercourse crossings, rock road, re-shape road	sediment reduction	2001		Redwood Creek
	Add large woody debris to stream	sediment reduction, fish habitat	1995		39.5,-123.61
	Add large wood debris to stream	Improve fish passage	1995		39.51,-123.61
	Add large wood debris to stream; 14 log structures.	Improve fish habitat	1999		39.78,-123.75
	Replace railcar bridge		2003		
	Upgrade watercourse crossings, storm proof	sediment reduction	1999		River road
SOUTH FORK NOYO RIVER					
Brandon Gulch	Brandon Gulch Rd 360 Culvert Removal	sediment reduction, fish passage	1995	x	Brandon Gulch Rd 360
	Barrier modification, placement of logs	fish habitat	1990	x	NF of the SF of the Noyo
	Culvert Removal	sediment reduction	1995	x	Brandon Gulch Rd 360
Kass Creek	Culvert Removal	sediment reduction	1997	x	Boundary Creek Rd 390
	Culvert Installation	open Boundary Creek to fish Passage	1997	x	Road 300 Boundary Creek
	Road decommissioning	Sediment reduction, restoration of riparian zone	1998	x	Boundary Creek Road 390

Table VIII.7. Watershed Restoration Projects in the Cumulative Effects Assessment Area, 1990 through 2004.

Watershed Unit	Type of Project	Purpose	Year	JDSF	Location
Parlin Creek	Large Woody Debris Placement	fish habitat	1996	x	Parlin Creek
	Road decommissioning	sediment reduction, restoration of riparian zone	1996	x	Parlin Creek Road 340
LOWER NOYO RIVER					
Mouth of Noyo River	Dredge Noyo harbor to remove 31,000 cubic yds of sediment	sediment reduction	2002		Noyo River Estuary
COASTAL					
Caspar Creek	Large wood placement	fish habitat	1998	x	Caspar Creek
	Culvert installation	fish passage	1995	x	Road 600 Blue Gum Creek
	Road decommissioning (road 630); 3.5 mi inner gorge road; crossing removal	sediment reduction	2005	x	
	Road decommissioning	sediment reduction, restoration of riparian zone	1998	x	SF Caspar Creek Road 600
	Replace dilapidated fishways in experimental watershed areas	fish passage	2006	x	NF and SF Caspar Creek
Russian Gulch	Assessment of road, channel, and hillslope condition, with recommendation for restoration projects	watershed planning	2002	x	39.633,-123.78
Hare Creek	Large Woody Debris Placement	fish habitat	1998	x	Hare Creek
	Culvert Removal	sediment reduction	1996	x	Rd 445
	Spur road culvert removal	sediment reduction	1998	x	Road 450
	Spur road culvert removal	sediment reduction	1998	x	Road 450
	Spur decommissioning	sediment reduction, restoration of riparian zone	1998	x	SF Hare Creek Road 450

Note: CMP = corrugated metal pipe, i.e., culverts.

Table VIII.8. Caltrans Projects Summary, 1994-2004.

ENVIRONMENTAL ANALYSIS ID NUMBER	CONTRACT NUMBER	COUNTY-ROUTE-POST MILE NUMBER	PROJECT DESCRIPTION	JOB COMPLETION DATE	SOIL GENERATED YARDS
142750		MEN-1-002.5/057.4	Two Paved CHP Commercial Truck Inspection Stops - 200' south of Jug Handle creek on flat ground	2005	600
139320		MEN-1-004.9/053.5	Storm Drain - upgrades on numerous road drains	1999	negligible
137272		MEN-1-009.9/078.7	Restore Roadway - surface maintenance along 69 mile stretch, mostly outside of CWE assessment area	1998	0
142590		MEN-1-018.5/080.6	Treat Bridge Deck - maintenance of decking on bridges, potential for waste intrusion to watercourses	2001	0
135040		MEN-1-048.2/059.7	Resurface - ground asphalt placed on shoulder greater than 100' from culvert	1999	0
137481	01-322004	MEN-1-050.2	Remove Timber Piles - subsurface in river, hydraulic chainsaw	2004	10
132200		MEN-1-050.2/050.3	Seismic Retrofit - strengthening existing structure	1995	0
137270		MEN-1-051.5/078.5	Storm Damage Repair - numerous individual small repairs	1997	negligible
133020	01-330204	MEN-1-051.9/082.9	Seismic Retrofit - strengthening existing structure	1996	30
133021	01-330214	MEN-1-052.6/059.7	Seismic Retrofit - strengthening existing structure	1997	1,300
134780		MEN-1-054.5/054.7	Widen & Channelize - widen the running surface, mostly w/I existing road prism, modify lane stripes	1997	negligible
140100		MEN-1-054.7/055.5	Highway Planting	1999	0
131940		MEN-1-056.7	Bridge Deck Restoration - replace joint seals	1994	0
131570	01-315704	MEN-1-057.0/057.4	Create Left Turn Lanes - widen roadway, restripe the highway	1994	600
137800		MEN-1-060.2	Replace Noyo River Bridge - see discussion in text	2005	7,300
139640		MEN-20-000.0/000.5	Resurface Roadway - periodic maintenance	1999	0
129200		MEN-20-000.3/002.4	Construct 2-Way Left Turn Lane - mostly w/I existing road prism	2008	0
	01-345114	MEN-20-000.4	Unknown	2002	40
145280		MEN-20-000.5/004.4	Resurface Roadway - periodic maintenance	2004	0

Table VIII.8. Caltrans Projects Summary, 1994-2004.

ENVIRONMENTAL ANALYSIS ID NUMBER	CONTRACT NUMBER	COUNTY-ROUTE-POST MILE NUMBER	PROJECT DESCRIPTION	JOB COMPLETION DATE	SOIL GENERATED YARDS
139300		MEN-20-000.9/001.1	Culvert Installation	1998	unknown
141680		MEN-20-002.6/004.7	Centerline Rumble Strip - install bumps in-between east and west bound lanes	2000	0
136430		MEN-20-004.4/032.8	Proposed Culvert Restoration - 77 culverts - see discussion in text	12/06	7
142850		MEN-20-006.0/007.0	Resurface Roadway - periodic maintenance	2001	0
142851		MEN-20-006.0/007.0	Repair Roadway - minor surface repair, associated with EA 142850 resurfacing	2002	0
143940		MEN-20-006.5/013.6	Widen Passing Lanes - mostly w/I existing road prism	2011	< 10,000
141440		MEN-20-007.2/007.5	Widen Shoulder - mostly w/I existing road prism	2000	0
138230	01-382304	MEN-20-008.6/008.9	Realign Roadway	1999	103,000
136870		MEN-20-008.8	Repair Slipout	1997	unknown
138231		MEN-20-008.8	Install Bailey Bridge - part of MEN-020-008.6/008.9 road realignment	1998	0
136871		MEN-20-008.8/009.4	Restore Roadbed - part of MEN-20-008.8 slipout repair	1997	negligible
131800	01-318004	MEN-20-008.8/019.6	Construct Turnouts	1996	1,200
141650		MEN-20-011.3/011.5	Resurface Roadway and Widen Shoulders - mostly w/I existing road prism	2001	0
137920		MEN-20-012.6/026.8	Resurface Roadway - periodic maintenance	1998	0
140470		MEN-20-012.9/013.6	Resurface Roadway - periodic maintenance	1999	0
	01-382304	MEN-20-013.9/014.3	Unknown	1998	102,000
138930		MEN-20-015.4/015.5	Remove Slide & Place Rock Buttress	1998	unknown
136590		MEN-20-015.5/018.0	Culvert Installation	1999	unknown
142080		MEN-20-017.3/031.6	Resurface Roadway - periodic maintenance	2002	0
140180		MEN-20-017.5/031.9	Proposed Culvert Restoration - mostly maintenance	2002	30
133190		MEN-20-018.7/65 019.6	Drainage Corrections	1995	unknown
138390		MEN-20-020.2/20.3	Remove Slide	1998	unknown

Table VIII.8. Caltrans Projects Summary, 1994-2004.

ENVIRONMENTAL ANALYSIS ID NUMBER	CONTRACT NUMBER	COUNTY-ROUTE-POST MILE NUMBER	PROJECT DESCRIPTION	JOB COMPLETION DATE	SOIL GENERATED YARDS
141760		MEN-20-020.5/20.6	Guardrail - Install guardrail	2000	0
141640		MEN-20-023.5/023.9	Resurface Roadway - periodic maintenance	2000	0
138220		MEN-20-025.9/026.0	Repair Slipout	1998	unknown
141940		MEN-20-025.9/026.1	Embankment Restoration	2001	unknown
134340		MEN-20-025.9/028.5	Storm Damage Repair - several individual small repairs	1997	negligible
141180		MEN-20-026.0/027.0	Curve Realignment - see discussion in text	2008	260,000
138250		MEN-20-026.2	Restore Slope	1998	unknown

Table notes: Volumes of soil generated include material excavated or brought in for fill. Where numbers are available, most came from a Caltrans database for volume basis of payment to contractor, but a few were estimated in scoping reports. “Unknown,” “Negligible” and “0” did not show in the Caltrans list. “Unknown” implies no record was found, “Negligible” and “0” indicate Caltrans engineer verbal statement about a specific project.

Water Quality Permits
The North Coast Regional Water Quality Control Board (NCRWQCB) issues permits for a wide range of pollution-generating activities within its area of jurisdiction. NCRWQCB staff provided a listing of all active permits within Mendocino County (Wright-Shacklett 2004, pers. comm.). This 78-page list identified about 380 permitted projects or facilities. This permit information was reviewed for projects within the JDSF cumulative effects assessment area that had a potential to result in cumulative adverse impacts as a result of interaction with the kinds of impacts likely to result from the management proposed under the DFMP. The NCRWQCB list was reviewed in particular for projects or facilities that would produce sediment, alter flows, or result in water temperature impacts.

Relevant projects that were already identified from other information sources, particularly THPs and CALTRANS projects, and otherwise addressed in the EIR are not discussed in this section. Review of remaining projects or facilities resulted in the identification of no projects with a potential for adverse cumulative impact interactions with the proposed JDSF management activities.

Section VII.7.3 discusses the regulatory framework for water quality that the NCRWQCB is implementing. To summarize this framework with respect to sediment sources, the NCRWQCB is implementing General Waste Discharge Requirements (or, in some cases, waivers may be granted) for timber harvest activities on nonfederal lands. This two-pronged program to reduce sediment discharges to watercourses seeks to prevent or minimize new sediment sources and to mitigate existing sediment sources through Erosion Control Plans that timberland owners will be required to develop and implement. As this program is implemented by the NCRWQCB and landowners, the amount of sediment inputs to streams should decrease over time, resulting in an improvement of water quality and aquatic habitat conditions.

Development Activities
As documented in section VII.11 and Table VII.11.2, developed land uses comprise a minimal amount of the cumulative watershed effects assessment area. Developed land use categories (Commercial, Commercial Residential Mixed, Industrial, and Residential) total only 1,730 acres or less than 1 percent of the area. There are no meaningful cumulative effects interactions between proposed JDSF management and these lands.

Rural residential areas, which are low density rural or semi-rural areas, comprise 11,657 acres or 5.4 percent of the assessment area. Some of these lands are immediately adjacent to JDSF. The main potential cumulative effects interactions of concern between these lands and proposed JDSF management are related to rural residential roads as sediment sources, wildlife habitat impacts, aesthetic impacts, recreation impacts, traffic, and noise impacts. Roads as sediment sources within the cumulative effects assessment area have been addressed through the road sediment modeling portion of section VIII.7 Geology and Soils and Table VII.7.1.

Recent development projects in the EIR assessment area include new housing and commercial development, primarily in and near towns located west of JDSF and potential future development of an 18 hole golf course located along Highway 20 about two miles inland from the coast.

Shifts in Land Use

Land use within the cumulative effects assessment area has been relatively stable in past years. One major change that took place in 2002 was the creation of the Big River unit of the Mendocino Headlands State Park. This land use change shifted over 7,300 acres of estuary and former industrial timberland into a state park. Study and planning for the restoration, recreational development, and management of this Park unit are underway. The Big River unit was acquired to achieve the following objectives:

1. To preserve and protect the property's estuarine, wetlands, aquatic and other fish and wildlife resources;
2. To support late seral forest characteristics and associated natural functions that maximize benefits to salmonid species and wildlife; and
3. To provide public access consistent with the protection and enhancement of natural resources.[3]

The resulting shift in management and the Park's implementation of projects to restore and preserve natural systems will result in long-term reductions in sediment inputs, improvements in instream habitat, and increases in the size and density of forest vegetation.

Other Past Projects

The Noyo Harbor District conducted Noyo Harbor dredging in 2002; the Army Corps of Engineers dredged the lower Noyo River in 2000; and CDF conducts periodic (approximately every five years) cleanout of the two Caspar Creek weir ponds on JDSF, most recently the South Fork pond in 2003.

VIII.2.2 Current Projects

Current projects within the watershed cumulative effects assessment area include ongoing land uses [such as agriculture, rangeland, residential, commercial, public facilities, parks, and transportation facilities such as roads and operation of the California Western Railroad (also known as the Skunk Train)], periodic activities such as THPs identified above that have not yet been completed, CALTRANS projects identified above that have not yet been completed, and ongoing NCRWQCB permits. The discussion in the various parts of section VII Resource Specific Analysis, combined with ongoing projects from section VIII.2.2 Past Projects, adequately identifies their current potentials for contributing to significant adverse cumulative effects in conjunction with

[3] From Executive Summary of the "Big River Preliminary Plan: Resource Assessment and Recommendations," p. xi (http://www.mendocinolandtrust.org/download/brimp/BRPP/BRPP_Exec_Summary.pdf).

the proposed JDSF management activities and other reasonably foreseeable future projects.

Tables VIII.9 and VIII.10, although characterized as anticipated future timber harvests, in part also represent current harvesting, since all open THPs and NTMPs are included in the table. Specific progress on any of these THPs (other than those on JDSF, which are not currently active) is not known. Once work completion reports are filed for THPs, CDF's database is updated to reflect that completion status, and such THPs would at that point be considered past projects.

VIII.2.3 Future Projects

An agency's consideration of cumulative effects is required to include "reasonable foreseeable probable future projects" (14 § CCR 15355). Probable future projects includes those that have an application on file with a public agency at a specific point in time (generally when the NOP is filed); projects that are identified in a plan (i.e., the DFMP); projects that are later phases of an earlier approved project; and/or budgeted public agency projects. Future projects include those under review by the lead agency as well as other agencies; projects that may be found to be exempt by a public agency from further CEQA review; and includes projects that may never be carried out.

Timber Harvesting

Possible future timber harvesting projects have been identified by review of current and past THPs and Nonindustrial Timber Management Plans (NTMPs) located within the EIR assessment area, as indicated in the proposed JDSF Management Plan, from information supplied by local foresters, and from "Option A" sustained yield documents filed with CDF by landowners. These timber harvesting related projects are summarized in Tables VIII.9 and 10. Other projects related to timber operations include pest control treatments and road rehabilitation work by private timberland owners that is not part of a THP.

Table VIII.9 identifies 122 anticipated future projects or project components related to timberland management. The available acreage information totals to 17,885 acres. To the extent information is available, 93 of the 122 projects involves timber harvest of some form, even if simply described as "habitat development." Of the timber harvesting projects, 21 (23%) involve some form of evenaged management; the remainder involves unevenaged management.

Some of the projects identified in Table VIII.9 are expected to be completed within a specified period; others are ongoing projects. A substantial portion (52 out of 122) of the future projects are NTMPs, which may or may not be operated on in any given year or even decade. NTMPs established for ownerships within the cumulative effects assessment area are classified as ongoing, because an owner may file a Notice of Timber Operations (NTO) at any time and commence harvest activities without any additional permit review. Requirements are imposed on NTMPs that tend to reduce potential for significant environmental effects, such as restricted silvicultural treatments

Table VIII.9. Anticipated Future Timber Management within the Watershed Cumulative Effects Assessment Area for the next Five-Ten Years.

Ownership	Planning Watershed	Project Type	Project ID	Project Size (ac)	Project Activities/Note	Project Period	Source
MRC	unknown	Closure	NS	8	Wood waste disposal site clean closure	2005	10/20/04 memo
Hawthorne	Berry Gulch	THP	Two Log Crossing	27	Non-regen. and regeneraton step	by 2008	THP 1-03-021
Hawthorne	Berry Gulch	THPs	NS	33	Uneven aged harvesting	by 2008	THP 1-01-290
Hawthorne	Berry Gulch	THPs	NS	138	Uneven aged harvesting	by 2008	THP 1-01-290
Hawthorne	Berry Gulch	THP	Two Log Crossing	302	Non-regen. and regeneraton step	by 2008	THP 1-03-021
Hinsch	Berry Gulch	NTMP	Old Mill Farm	NS	Uneven aged harvesting	on-going	NTMP 1-02-001
JDSF	Berry Gulch	THP	Berry Flat	50	Even-aged regeneration	5 years	JDSF DFMP
JDSF	Berry Gulch	THP	Thompson Gulch	250	Habitat development	5 years	JDSF DFMP
JDSF	Berry Gulch	THP	S. Whiskey Springs	300	Commercial thin	5 years	JDSF DFMP
JDSF	Berry Gulch	THP	14 Gulch North	400	Group selection	5 years	JDSF DFMP
JDSF	Berry Gulch	THP	West Berry Gulch	400	Commercial thin	5 years	JDSF DFMP
JDSF	Brandon Gulch	THP	Camp 3	366	Selection	5 years	JDSF DFMP
JDSF	Brandon Gulch	THP	Volcano #2	500	Group Selection	5 years	JDSF DFMP
JDSF	Brandon Gulch	THP	Brandon	540	Selection	5 years	JDSF DFMP
JDSF	Brandon Gulch	THP	Northfork Spur	600	Selection	5 years	JDSF DFMP
JDSF	Brandon Gulch	THP	Riley Ridge	600	Group selection	5 years	JDSF DFMP
JDSF	Caspar Ck.	THP	Orchard	500	Selection/group selection	5 years	JDSF DFMP
Powers	Caspar Ck.	None	NS	0	No plans for future harvesting	5 years	THP 1-03-206
JDSF	Chamberlain Ck.	THP	Park Gulch	300	Group selection	5 years	JDSF DFMP
JDSF	Chamberlain Ck.	THP	Water Gulch #1	300	Commercial thin	5 years	JDSF DFMP
JDSF	Chamberlain Ck.	THP	Water Gulch #2	450	Commercial thin	5 years	JDSF DFMP
JDSF	Chamberlain Ck.	THP	West Chamberlain	650	Commercial thin	5 years	JDSF DFMP
Leonard Trust	Dark Gulch	NTMP	Leonard NTMP	NS	Uneven aged harvesting	on-going	NTMP 1-00-062
Orrs Sp. Prop.	Dark Gulch	NTMP	Orrs Spring NTMP	NS	Uneven aged harvesting	on-going	NTMP 1-04-008
Smith	Dark Gulch	NTMP	Smith NTMP	NS	Uneven aged harvesting	on-going	NTMP 1-00-063
Weger et al	Dark Gulch	NTMP	Weger NTMP	NS	Uneven aged harvesting	on-going	NTMP 1-02-019
Weger Ltd	Dark Gulch	NTMP	Weger Ranch	NS	Uneven aged harvesting	on-going	NTMP 1-01-005

Table VIII.9. Anticipated Future Timber Management within the Watershed Cumulative Effects Assessment Area for the next Five-Ten Years.

Ownership	Planning Watershed	Project Type	Project ID	Project Size (ac)	Project Activities/Note	Project Period	Source
MRC	Daugherty Ck.	THP	NS	large	None Specified	2007	THP 1-04-073
MRC	Daugherty Ck.	THP	NS	large	None Specified	2007	THP 1-04-073
Other	Daugherty Ck.	Agric.	NS	NS	None Specified	on-going	THP 1-04-073
Other	Daugherty Ck.	Grazing	NS	NS	None Specified	on-going	THP 1-04-073
Apsley et al	Hare Ck.	NTMP	Noyo Hill NTMP	NS	Uneven aged harvesting	on-going	NTMP 1-03-009
Babcock	Hare Ck.	NTMP	Babcock NTMP	NS	Uneven aged harvesting	on-going	NTMP 1-94-003
JDSF	Hare Ck.	THP	Tunnel	54	Even-aged regeneration/selection	5 years	JDSF DFMP
JDSF	Hare Ck.	THP	Upper Hare Ck.	100	Selection	5 years	JDSF DFMP
JDSF	Hare Ck.	THP	Walton Gulch #2	100	Even-aged regeneration	5 years	JDSF DFMP
JDSF	Hare Ck.	THP	Hare Ck. GHIJK	250	Selection	5 years	JDSF DFMP
MRC	Hayworth Ck.	THPs	NS	175	None Specified	by 2005	THP 1-01-437
Hawthorne	Kass Ck.	THP	Noyo Hill	193	Uneven aged harvesting	by 2005	THP 1-00-458
Apsley et al	Kass Ck.	NTMP	Noyo Hill NTMP	NS	Uneven aged harvesting	on-going	NTMP 1-03-009
Hawthorne	Kass Ck.	THP	Duck Pond	<800	Even aged and uneven aged harvesting	2008	THP 1-04-010
Hawthorne	Kass Ck.	THP	NS	NS	Area similar to "Duck Pond" above	10 years	THP 1-03-063
JDSF	Kass Ck.	THP	Pleiades #4	50	Selection	5 years	JDSF DFMP
Booth	Laguna Ck.	NTMP	Booth NTMP	NS	Uneven aged harvesting	on-going	NTMP 1-97-009
Drinkwater	Laguna Ck.	NTMP	Drinkwater NTMP	NS	None Specified	on-going	NTMP 1-95-004
Hawthorne	Laguna Ck.	THP	Laguna Round	NS	None Specified	5 years	THP 1-04-043
Hawthorne	Laguna Ck.	THP	Hatch Gulch	NS	None Specified	5 years	THP 1-04-043
Hawthorne	Laguna Ck.	THP	Tunzi East 40	NS	None Specified	5 years	THP 1-04-043
Hawthorne	Laguna Ck.	THP	Creek Thin	NS	None Specified	5 years	THP 1-04-043
Other	Laguna Ck.	NTMP	NS	NS	None Specified	on-going	THP 1-04-043
Other	Laguna Ck.	NTMP	NS	NS	None Specified	on-going	THP 1-04-043
Other	Laguna Ck.	NTMP	NS	NS	None Specified	on-going	THP 1-04-043
Runner	Laguna Ck.	NTMP	Runner NTMP	NS	Uneven aged harvesting	on-going	NTMP 1-00-061
Tunzi	Laguna Ck.	NTMP	Tunzi Ranch	3,240	Uneven aged harvesting	on-going	NTMP 1-93-003

Table VIII.9. Anticipated Future Timber Management within the Watershed Cumulative Effects Assessment Area for the next Five-Ten Years.

Ownership	Planning Watershed	Project Type	Project ID	Project Size (ac)	Project Activities/Note	Project Period	Source
Weger et al	Leonaro Lake	NTMP	Weger NTMP	NS	Uneven aged harvesting	on-going	NTMP 1-02-019
Weger Ltd	Leonaro Lake	NTMP	Weger Ranch	NS	Uneven aged harvesting	on-going	NTMP 1-01-005
Jameson	Little NF Noyo	NTMP	Jameson NTMP	NS	Uneven aged harvesting	on-going	NTMP 1-94-004
JDSF	Lower NF Big River	THP	Dunlap North	300	Commercial thin	5 years	JDSF DFMP
MRC	Lower NF Big River	THPs	NS	300	Favor all-aged management	10 years	THP 1-01-134
Hawthorne	Lower Noyo	THP	Noyo Hill	25	Even aged harvesting	by 2005	THP 1-00-458
MRC	McMullen Ck.	THP	NS	NS	No future plans identified	10 years	THP 1-02-259
Urban	McMullen Ck.	NTMP	Urban NTMP	NS	Uneven aged harvesting	on-going	NTMP 1-01-040
Whittaker	McMullen Ck.	NTMP	Whittaker NTMP	NS	Uneven aged harvesting	on-going	NTMP 1-97-023
Island	Mettick Ck.	NTMP	Island NTMP	NS	Uneven aged harvesting	on-going	NTMP 1-00-058
MRC	Mettick Ck.	THP	Goddard Gulch	350	Favor all-aged management	10 years	THP 1-03-214
MRC	Mettick Ck.	THP	Halfway House	in above	Favor all-aged management	10 years	THP 1-03-214
MRC	Mettick Ck.	THPs	Kelley Gulch	1,400	Includes area from THP 1-03-214	10 years	THP 1-01-257
MRC	Mettick Ck.	THP	Bowman Gulch	NS	See THP 1-03-214	10 years	THP 1-02-067
MRC	Mettick Ck.	THP	NS	200	Partial cut, minor road con. & recon.	2 to 10	THP 1-04-071
MRC	Mettick Ck.	Road wk.	NS	NS	Road cons, recons, maintenance	on-going	THP 1-04-071
Orrs Sp. Prop.	Mettick Ck.	NTMP	Orrs Spring NTMP	NS	Uneven aged harvesting	on-going	NTMP 1-04-008
Other	Mettick Ck.	Road wk.	NS	NS	Road cons., recons., maintenance	on-going	THP 1-03-214
Other	Mettick Ck.	Agric.	NS	NS	None Specified	on-going	THP 1-04-071
Other	Mettick Ck.	grazing	NS	NS	None Specified	on-going	THP 1-04-071
MRC	MFNF Noyo	THP	NS	NS	No future plans (after 1-03-2003)	10 years	THP 1-02-232
JDSF	Mitchell Ck.	THP	Mitchell	635	Selection/group selection	5 years	JDSF DFMP
JDSF	Mouth Big River	THP	Helms	250	Selection and group selection	5 years	JDSF DFMP
Ketchum	Mouth of Big River	NTMP	Ketchum NTMP	NS	Uneven aged harvesting	on-going	NTMP 1-95-017
The Timber Co.	Mouth of Big River	THPs	NS	510	Most now owned by State Parks	by 2005	THP 1-99-355
Yager&Pittman	Mouth of Big River	NTMP	Yager NTMP	NS	Uneven aged harvesting	on-going	NTMP 1-96-017
Balassi et al	Mouth of Noyo	NTMP	Balassi NTMP	NS	Uneven aged harvesting	on-going	NTMP 1-97-022

Table VIII.9. Anticipated Future Timber Management within the Watershed Cumulative Effects Assessment Area for the next Five-Ten Years.

Ownership	Planning Watershed	Project Type	Project ID	Project Size (ac)	Project Activities/Note	Project Period	Source
Smith	Mouth of Noyo	NTMP	Smith NTMP	NS	Uneven aged harvesting	on-going	NTMP 1-93-007
B&GC of SF	North Fork Noyo	NTMP	Boys & Girls Clubs	NS	Uneven aged harvesting	on-going	NTMP 1-03-007
Bello	North Fork Noyo	NTMP	Bello NTMP	NS	Uneven aged harvesting	on-going	NTMP 1-97-021
Doll & Ballard	North Fork Noyo	NTMP	Doll & Ballard NTMP	NS	Uneven aged harvesting	on-going	NTMP 1-03-001
Herr et al Trust	North Fork Noyo	NTMP	Herr et al NTMP	NS	Uneven aged harvesting	on-going	NTMP 1-03-003
MRC	North Fork Noyo	THPs	NS	187	Even aged and uneven aged harvesting	by 2005	THP 1-01-250
Boone	Olds Ck.	NTMP	Boone NTMP	NS	Uneven aged harvesting	on-going	NTMP 1-01-058
MRC	Olds Ck.	None	NS	0	No plans for future harvesting	10 years	THP 1-03-141
Other	Olds Ck.	Agric.	NS	NS	None Specified	on-going	THP 1-03-141
Other	Olds Ck.	Road wk.	NS	NS	Road cons, recons, maintenance	on-going	THP 1-03-141
Whittaker	Olds Ck.	NTMP	Whittaker NTMP	NS	Uneven aged harvesting	on-going	NTMP 1-97-023
Hawthorne	Parlin Ck.	THP	NS	NS	None Specified	2005	Notice
JDSF	Parlin Ck.	THP	Scissors #2	100	Even-aged regeneration	5 years	JDSF DFMP
JDSF	Parlin Ck.	THP	Waldo	150	Even-aged regeneration	5 years	JDSF DFMP
JDSF	Parlin Ck.	THP	Frolic #2	200	Even-aged regeneration	5 years	JDSF DFMP
JDSF	Parlin Ck.	THP	Road 80	200	Even-aged regeneration	5 years	JDSF DFMP
JDSF	Parlin Ck.	THP	Upper Parlin	251	Commercial thin/alternative prescription	5 years	JDSF DFMP
JDSF	Parlin Ck.	THP	Upper Parlin Ck.	110	Even aged and uneven aged harvesting	by 2008	THP 1-02-020
Soper-Wheeler	Parlin Ck.	NTMP	NS	342	Uneven aged harvesting	on-going	NTMP 1-02-020
MRC	Redwood Ck.	None	NS	0	No plans for future harvesting	5 years	THP 1-04-011
MRC	Redwood Ck.	Road wk.	NS	NS	Road cons, recons, maintenance	on-going	THP 1-04-011
Orrs Sp. Prop.	Rice Ck.	NTMP	Orrs Spring NTMP	NS	Uneven aged harvesting	on-going	NTMP 1-04-008
MRC	Russell Brook	THPs	NS	1500	Even aged and uneven aged harvesting	10 years	THP 1-01-302
Orrs Sp. Prop.	Russell Brook	NTMP	Orrs Spring NTMP	NS	Uneven aged harvesting	on-going	NTMP 1-04-008
Johnson	S. Daugherty Ck	NTMP	Johnson NTMP	NS	None Specified	on-going	NTMP 1-00-040
Weger Ltd	S. Daugherty Ck.	NTMP	Weger Ranch	NS	Uneven aged harvesting	on-going	NTMP 1-01-005
Hawthorne	Two Log Ck.	THP	NS	NS	None Specified	2005	Notice

Table VIII.9. Anticipated Future Timber Management within the Watershed Cumulative Effects Assessment Area for the next Five-Ten Years.

Ownership	Planning Watershed	Project Type	Project ID	Project Size (ac)	Project Activities/Note	Project Period	Source
Hawthorne	Two Log Ck.	THP	NS	7	ST Removal	10 years	THP 1-04-049
Hawthorne	Two Log Ck.	THP	NS	28	ST Seed Step	10 years	THP 1-04-049
Hawthorne	Two Log Ck.	THP	NS	46	Shelterwood Removal	10 years	THP 1-04-049
Hawthorne	Two Log Ck.	THP	NS	112	Selection	10 years	THP 1-04-049
Hawthorne	Two Log Ck.	THP	NS	306	Clearcut	10 years	THP 1-04-049
Hawthorne	Two Log Ck.	THP	Ridgebound	47	Even aged harvesting	by 2008	THP 1-02-020
Hawthorne	Two Log Ck.	THP	Unnamed	162	Even aged and uneven aged harvesting	by 2008	THP 1-02-020
Hawthorne	Two Log Ck.	THP	Two Log Crossing	170	Non-regen. and regeneraton step	by 2008	THP 1-03-021
Hawthorne	Two Log Ck.	THP	Two Log North	234	Even aged and uneven aged harvesting	by 2008	THP 1-02-020
JDSF	Two Log Ck.	THP	Dunlap South	350	Group selection	5 years	JDSF DFMP
MRC	Two Log Ck.	THPs	NS	433	Evenaged harvesting	by 2008	THP 1-00-393
MRC	Two Log Ck.	THPs	NS	1,184	Uneven aged harvesting	by 2008	THP 1-00-393
Spring	Two Log Ck.	NTMP	Spring NTMP	NS	uneven aged harvesting	on-going	NTMP 1-01-016
Young	Two Log Ck.	NTMP	Young NTMP	NS	Uneven aged harvesting	on-going	NTMP 1-97-040

Note: NS = not specified in available information.

(e.g., only unevenaged management is permitted); thus, operations conducted under NTMPs should have minimal environmental impacts. Foresters who prepare the NTO are required to identify any new potential sources of significant impacts, including disclosure of any new listed species in the area which could be affected by operation of the NTMP.

Table VIII.10 summarizes those anticipated future timber harvesting projects in Table VIII.9 for which acreage is available. The information was gathered from the DFMP and from CDF THP and NTMP records and represents the publicly available information about likely timber harvest activities over the next five to ten years. The summary is at the planning watershed level, breaks out evenaged and unevenaged management, and also considers anticipated future activities separately for on and off JDSF. The last column of the table repeats information from Table VIII.4.

Table VIII.10 provides an opportunity to consider the anticipated future rate of timber harvest on a planning watershed basis. Rate of harvest is often raised in the context of sediment environmental impacts in particular. The scientific and analytical dimensions of this issue are considered below in section VIII.3.5 Sediment Effects. Here, we merely report the rate of harvest information.

The planning watersheds with the highest percentages of anticipated future harvesting over the next 5-10 years are Brandon Gulch (40.4%), Kass Creek (35.2%), Two Log Creek (26.9%), Berry Gulch (23.8%), Chamberlain Creek (21.6%), Russell Brook (21.4%), Parlin Creek (17.9%), and Mettick Creek (16.6%). The anticipated harvesting in each of these planning watersheds is briefly reviewed below.

In Brandon Gulch, all of the anticipated harvesting is uneven-aged management on JDSF under the DFMP. In the Kass Creek planning watershed, the anticipated harvesting is predominantly by private landowners and in about a 2:3 ratio of unevenaged to evenaged harvests. In Two Log Creek most of the anticipated harvesting is on private lands, with unevenaged management outweighing evenaged management. Two Log Creek also has two NTMPs in place for which future harvest information is not known; however, since it is an NTMP, unevenaged silviculture must be used. In Berry Gulch, most of the harvesting is unevenaged management proposed in the DFMP. In the Chamberlain Creek planning watershed, all of the anticipated harvesting is on JDSF under the DFMP. In Russell Brook, all of the anticipated harvesting is on private lands and is evenly split between evenaged and unevenaged. For the Parlin Creek planning watershed, most of the anticipated harvesting is on JDSF under the DFMP, with over half of it being evenaged management on JDSF. In the Mettick Creek planning watershed, all of the anticipated harvesting is unevenaged and on private lands.

Table VIII.10. Summarized Anticipated Future Harvests within the Watershed Cumulative Effects Assessment Area for the Next Five-Ten Years.

Planning Watershed Name and (Acreage)	Future Harvest Area (Acres)	Total Future Harvest Area as % of Planning Watershed Area	JDSF Future Harvest Area (Acres)	JDSF Future Harvest Area as % of Planning Watershed Area	Other Owners' Future Harvest Area (Acres)	Other Owners' Future Harvest Area as a % of Planning Watershed Area	1995-2004 Harvest as a % of Planning Watershed Area
Berry Gulch (7,999)	1,900	23.8%	1,400	17.5%	500	6.3%	17%
Evenaged	379	4.7%	50	0.6%	329	4.1%	6%
Unevenaged	1,521	19.0%	1,350	16.9%	171	2.1%	11%
Brandon Gulch (6,449)	2,606	40.4%	2,606	40.4%	-	0.0%	39%
Evenaged	-	0.0%	-	0.0%	-	0.0%	1%
Unevenaged	2,606	40.4%	2,606	40.4%	-	0.0%	38%
Caspar Ck. (5,360)	500	9.3%	500	9.3%	-	0.0%	6%
Evenaged	-	0.0%	-	0.0%	-	0.0%	0%
Unevenaged	500	9.3%	500	9.3%	-	0.0%	6%
Chamberlain Ck. (7,868)	1,700	21.6%	1,700	21.6%	-	0.0%	1%
Evenaged	-	0.0%	-	0.0%	-	0.0%	0%
Unevenaged	1,700	21.6%	1,700	21.6%	-	0.0%	1%
Hare Ck. (6,184)	504	8.2%	504	8.2%	-	0.0%	34%
Evenaged	154	2.5%	154	2.5%	-	0.0%	5%
Unevenaged	350	5.7%	350	5.7%	-	0.0%	29%
Hayworth Ck.(7,112)	175	2.5%	-	0.0%	175	2.5%	20%
Kass Ck. (3,533)	1,243	35.2%	50	1.4%	1,193	33.8%	47%
Evenaged	500	14.2%	-	0.0%	500	14.2%	3%
Unevenaged	743	21.0%	50	1.4%	693	19.6%	44%
Lower NF Big River (4,953)	600	12.1%	300	6.1%	300	6.1%	14%
Evenaged	0	0.0%	-	0.0%	-	0.0%	1%
Unevenaged	600	12.1%	300	6.1%	300	6.1%	13%
Mettick Ck. (11,733)	1,950	16.6%	-	0.0%	1,950	16.6%	21%
Evenaged		0.0%	-	0.0%	-	0.0%	5%
Unevenaged	1,950	16.6%	-	0.0%	1,950	16.6%	16%
Mitchell Ck. (6,555)	635	9.7%	635	9.7%	-	0.0%	2%
Evenaged	-	0.0%	-	0.0%	-	0.0%	1%
Unevenaged	635	9.7%	635	9.7%	-	0.0%	1%
Mouth of Big River (9,549)	760	8.0%	250	2.6%	510	5.3%	32%

Table VIII.10. Summarized Anticipated Future Harvests within the Watershed Cumulative Effects Assessment Area for the Next Five-Ten Years.

Planning Watershed Name and (Acreage)	Future Harvest Area (Acres)	Total Future Harvest Area as % of Planning Watershed Area	JDSF Future Harvest Area (Acres)	JDSF Future Harvest Area as % of Planning Watershed Area	Other Owners' Future Harvest Area (Acres)	Other Owners' Future Harvest Area as a % of Planning Watershed Area	1995-2004 Harvest as a % of Planning Watershed Area
Evenaged	-	0.0%	-	0.0%	-	0.0%	9%
Unevenaged	760	8.0%	250	2.6%	510	5.3%	23%
Mouth of Noyo (5,223)	25	0.5%	-	0.0%	25	0.5%	14%
North Fork Noyo (6,521)	187	2.9%	-	0.0%	187	2.9%	31%
Parlin Ck. (7,578)	1,353	17.9%	1,011	13.3%	342	4.5%	38%
Evenaged	705	9.3%	705	9.3%	-	0.0%	13%
Unevenaged	648	8.6%	306	4.0%	342	4.5%	25%
Russell Brook (7,017)	1,500	21.4%	-	0.0%	1,500	21.4%	23%
Evenaged	750	10.7%	-	0.0%	750	10.7%	5%
Unevenaged	750	10.7%	-	0.0%	750	10.7%	18%
Two Log Ck. (11,433)	3,079	26.9%	350	3.1%	2,729	23.9%	39%
Evenaged	1,150	10.1%	-	0.0%	1,150	10.1%	19%
Unevenaged	1,929	16.9%	350	3.1%	1,579	13.8%	19%

Note: Table summarizes future harvesting information from Table VII.9, to the extent that harvest acreages are available in that table. Future harvest acres are generally not available for NTMPs, though NTMPs are listed since they permit harvesting at any time with the filing of a Notice of Timber Operations, after which harvest activities may commence without any additional permit review. By law, NTMPs are restricted to unevenaged management.

While the proposed JDSF management plan discloses significant information about planned future management activities on that public Forest, private timberland owners generally disclose little or no information about their future management plans or policies. Mendocino Redwood Company, which owns about 25% of the cumulative effects assessment area, has made a significant amount of information about its management plans public via its website, http://www.mrc.com. The company presents extensive information about its management policies and practices, as well as its 2000 management plan. According to MRC's website, "Annually, the percentage of acres harvested using even-aged silviculture is 45% and the percentage of acres using uneven-aged silviculture is 55%. Once tanoak-dominated stands are restored to redwood and Douglas-fir dominated stands, the need for even-aged silviculture will be replaced with uneven-aged management across MRC's property" (http://www.mrc.com/issues/silviculture_harvesting.html). Further, since the company is certified by both the Forest Stewardship Council and the Sustainable Forestry Initiative, information about the standards the company must meet to satisfy certification requirements, as well as periodic audit reports of certification compliance, are also publicly available. No such information is publicly available about the management of

the other large industrial timberland owner within the cumulative effects assessment area, Hawthorne Timber Company.

Roads

The Road Management Plan is a key component of the DFMP. The Accelerated Road Management Plan Management Measure introduced in this EIR would speed up implementation of this process to evaluate road conditions, prioritize critical sediment sources for repair or problematic road segments for decommissioning, and then implement these priority projects. In addition to being described in the DFMP, the Road Management Plan is discussed in sections VII.6.1 Aquatic Resources, VII.7 Geology and Soils, and VII.10 Hydrology and Water Quality.

Implementation of the Road Management Plan on JDSF is expected to reduce sediment inputs to streams over time. While there may be short-term sediment increases as a result of the implementation of some road improvement projects (e.g., replacement of an undersized culvert), the overall effect is anticipated to be significant, long-term reduction of sediment inputs.

The short-term (5-10 years) DFMP harvest schedule for JDSF, contained in Table VIII.9, includes anticipated forest management in areas that currently have, or have had, roads constructed in close proximity for timber harvest and other forest management purposes. In many cases, these older roads, constructed between 1950 and 1975, are located on steep slopes and/or very near streams, and involve a relatively high frequency of watercourse crossings. Roads of this type have a strong potential to be significant sediment producers. In the long-term, through implementation of the Road Management Plan over time, it is anticipated that 50-100 miles or 10-20% of JDSF's roads will be decommissioned.

As planning is conducted for timber harvest under the DFMP, and new road construction will take into account slope steepness, potential slope instability, yarding restrictions, watercourse crossings, and proximity to other areas of environmental concern. New roads will be planned and constructed according to the provisions of the Road Management Plan. In general, road construction will be limited to the minimum length necessary to enable environmentally sound yarding practices, and will be located primarily on gentle to moderate slopes near ridges and will avoid new watercourse crossings to the extent feasible.

Following completion of the Forest-wide road inventory, selected roads will be decommissioned to reduce potential for sedimentation and slope failure. These old roadways, constructed on steep slopes near watercourses, will be removed and replacement roadways, when needed, will be planned and located upslope in locations that involve greatly reduced risk to watershed resources, utilizing modern construction and erosion control techniques.

Under the short-term DFMP harvest schedule for JDSF (contained in Table VIII.9), it is anticipated that about 20 miles of roads will be decommissioned and about 24 miles of

new roads constructed. In some cases (e.g., Upper Parlin, Camp 3, Brandon Gulch, North Fork Spur, West Chamberlain, Mitchell Creek), the proposed locations of new roads are known. In each case, road location and construction are subject to multi-disciplinary environmental assessment at the project level. When expected construction and anticipated decommissioning are considered together, there is an anticipated positive net long-term effect as a result of greatly reducing potential sedimentation and slope instability, while locating and constructing new roads to current standards.

As discussed above in section VIII.2.1 Past Projects, other major landowners within the cumulative watershed effects assessment area have been upgrading and decommissioning roads in order to reduce their sediment inputs. It is anticipated that these landowners will continue this work for some time into the future.

For all forestland owners in the cumulative watershed effects assessment area, regulatory processes are expected to continue to pressure improvements in road systems to reduce current or potential sediment impacts. These regulatory elements include (a) Forest Practice Rule requirements that new and reconstructed crossings will handle 100-year flow events (including passage or water, wood, and sediment) and (b) the NCRWQCB General Waste Discharge Requirements program, which has a two-pronged approach to reduce significant sediment input to watercourses: (1) prevention/minimization of new sediment sources, and (2) development and implementation of a program to mitigate existing sediment source areas through an Erosion Control Plan (see section VII.10.8 for details).

Development

Most of the land base within the cumulative effects assessment area—171,130 acres or 79% (see section VII.11 Land Use)—is zoned for timber production (TPZ), so minimum parcel size and parcel splits are limited, thus reducing the potential for a significant increase in home construction, residential access roads, and related soil disturbance. Another 25,739 acres, or 12% of the area, are in Public Facilities, Rangeland-Williamson Act, or state parks, and thus are also unlikely to see development within the next decade.[4] Thus, 19,799 acres, or only 9% of the cumulative effects assessment area, are in land classes with some likelihood of more intensive development in the reasonably foreseeable future.

The County does not have any growth management ordinances in place; though some sewer and water districts have had temporary moratoria on new connections due to problems with infrastructure or water supply (Housing Element Technical Appendix, Mendocino County General Plan, December 14, 2004, p. 3-19; http://www.co.mendocino.ca.us/planning/GenPlan/Housing/3-Housing%20Constraints%20and%20Opportunities%2012142004.pdf). The County notes:

[4] Both TPZ and Williamson Act acreage require a ten-year rollout period to shift to another land use class without the payment of tax penalties.

> In order to preserve agricultural uses and a rural environment, the County has generally designated areas in towns or near incorporated cities for higher density residential development, while outlying areas have been typically zoned for low-density and low-impact development. Despite the agricultural constraints, the County has an adequate supply of developable residential land, as discussed in Section 4.0 – Housing Resources. (Housing Element Technical Appendix, Mendocino County General Plan, December 14, 2004, p. 3-39; http://www.co.mendocino.ca.us/planning/GenPlan/Housing/3-Housing%20Constraints%20and%20Opportunities%2012142004.pdf)

Because of their ongoing nature, a significant portion of the NCRWQCB permits identified in the Past Projects section, above, also can be considered future projects. As indicated above, these permitted activities to not appear to pose a significant cumulative effect potential. Some of the Caltrans projects identified in Table VIII.8 will not be completed for several years and can thus be considered to constitute future projects.

3. WATERSHED CUMULATIVE EFFECTS

Watersheds are formed from combined drainage areas and, therefore, integrate the effects of upstream activities. Watershed products that can be affected by management activities and influence on-site and downstream beneficial uses of water include: stream flow, water temperature, nutrient concentrations, chemical contamination, large wood (LWD) and organic debris, and sediment. The potential for each of these watershed products to create or add to significant, adverse cumulative impacts is described below.

Figure V.3 shows the assessment area for watershed cumulative effects. This assessment area is used for each of the five cumulative effects topics in this section. The planning watersheds included in the cumulative watershed impacts assessment area are described in section VII.10.2 Regional and Project Watershed Setting and are shown in Figure V.3. The characteristics of these watersheds are summarized in Table VII.10.2. Criteria and findings for impact significance are summarized in EIR sections VII.10.8 and VII.10.9 (Hydrology and Water Quality) and VII.7.5 and VII.7.6 (Geology and Soils). Forest management activities, including timber management, road design, road construction, and road maintenance, are the most extensive source of potential watershed effects within the assessment area.

3.1 Flow Effects

Activities that remove vegetation or create compacted or impervious surfaces have the potential to increase peak flows, summer low flows, and water yields. The mechanisms and potential magnitude of these effects are described in sections VII.10.3 and VII.10.4 (Hydrology and Water Quality) and in Appendix 10.

Moderate increases in summer low flows and water yields resulting from vegetation removal, as described in section VII.10 Hydrology and Water Quality, help maintain or reduce water temperature and will provide additional water for downstream uses during drier months (Keppeler 1998). The percentage increase in flow tends to be greatest in streams immediately below harvested areas, and is expected to diminish with distance below harvested areas as streamflow is added from unharvested areas. This additional water is expected to have positive effects on fish and other beneficial uses in the short term and return to pre-harvest levels within less than 10 years. **Therefore, none of the alternatives are expected to result in significant adverse cumulative impacts from increased summer flows or water yields at onsite or downstream locations.**

The analysis of peak flow effects described in Appendix 10 shows that the largest increase in an individual planning watershed from past harvesting combined with any of the proposed harvesting alternatives will be less than 2.3 percent, which is less than the typical error of streamflow measurement, and that the magnitude of peak flow changes diminish with increasing watershed size.[5] Studies in Caspar Creek and elsewhere have determined that flow increases of this size do not substantially modify channel morphology or downstream habitats (see section VII.10.3.2 (Hydrology and Water Quality) and Appendix 10). **As a result, the predicted increases in peak flows from any of the alternatives are unlikely to be detectable at the planning watershed scale and are not expected to result in significant adverse cumulative impacts to downstream beneficial uses of water.**

Further, Impacts 4 and 5 in section VII.10.9 and Table VII.10.5 address flow related issues that reflect cumulative impacts:

Impact 4: ***Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding on- or off-site*. (Less than Significant)**

Impact 5: ***Create or contribute runoff water that would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff.* (No Impact)**

[5] Increases in small headwater tributaries that are clearcut can increase 2-yr return interval peak flows under average soil wetness approximately 30% (ranging from approximately 10 to 80% depending on soil wetness at the start of the storm) (Lewis et al 2001). This could potentially increase gully development and bank erosion in small headwater streams. However, little clearcutting is expected to be used under the proposed JDSF Management Plan and the anticipated use of medium to long rotation ages (60 to 150 years) will help to mitigate this potential impact. Additionally, use of broadcast burning on JDSF is greatly reduced under the DFMP. The tables and discussion above in section VIII.2.1 indicate that evenaged management is decreasing in the watershed cumulative effects assessment area. Mendocino Redwood Company, which owns and manages 25% of the cumulative effects assessment area, has indicated that they will not use traditional clearcutting practices, that 45% of acres harvested will be evenaged management, and that this percentage will decrease as hardwood stands are restored to conifer stands (http://www.mrc.com/issues/silviculture_harvesting.html).

No potential for significant impacts is found for either of these two impact areas for any of the seven EIR alternatives.

3.2 Water Temperature Effects

Cumulative impacts to water temperature can be caused by management activities that lead to progressively higher water temperature along one stream or that increase water temperature in tributary watersheds that combine to increase downstream water temperature. The North Coast Regional Water Quality Control Board's listing of the Big River as temperature impaired (see section VII.10 Hydrology and Water Quality) is a per se indicator that this water body currently has a significant adverse temperature impact. The Big River watershed comprises 54% of the watershed cumulative effects assessment area. For JDSF, 46% of the Forest area is in the Big River watershed.

Timber harvesting can raise water temperature by removing near-stream vegetation, which may increase solar exposure and, to a lesser extent, by changing local microclimate. A detailed description of factors affecting water temperature and the relationship of water temperature to beneficial uses is provided in sections VII.6.1.3 through VII.6.1.6 (Aquatic Resources) and in Appendix 12. Some of these factors are summarized below.

The initial, historic logging on JDSF and surrounding ownerships cleared nearly all trees from the riparian zone. Streamside vegetation is still recovering from this first round of logging and from subsequent removals of second growth timber. However, stream temperature measurements on JDSF and resulting Maximum Weekly Average Temperature (MWAT) calculations show that most streams within JDSF are currently below critical water temperature thresholds for coho salmon and other fish. In fact, measurements on Big River show that water is cooler after passing through JDSF. Exceptions include parts of Parlin Creek, Chamberlain Creek and James Creek that have occasionally exceeded the MWAT threshold temperature and will require continued canopy development and water temperature monitoring. Other factors observed within JDSF that can lead to continued recovery from high water temperature include recruitment of large wood (LWD) to stream channels, and the narrowing and deepening of the channel as old sediment deposits are moved downstream by high stream flows.

To meet current Forest Practice Rule requirements, all alternatives for timber harvesting proposed in the JDSF EIR must retain a 150 feet wide WLPZ along Class I watercourses [14 CCR § 916.9(f)] and a 50 to 100 feet wide WLPZ along Class II watercourses (14 CCR § 916.5). The FPRs also require an additional 25 to 50 foot wide special operating zone along Class I watercourses where understory and mid-story trees must be retained adjacent to even-aged harvest units [14 CCR § 916.9(c)]. In addition to the Forest Practice Rules, the DFMP (alternative C1) includes additional requirements for vegetation retention and further restricts harvesting in areas adjacent to watercourses, as described in sections VII.6.1.3 and VII.6.1.5 (Aquatic Resources)

and Table VI.1. Alternatives C2 through F also include riparian canopy protection measures that go beyond the Forest Practice Rules (see Table VI.1 and section VII.6.1.7). Alternative B relies solely on the Forest Practice Rules for canopy protection and alternative A would not directly disturb any riparian canopy, since it does not include any harvesting activity.

In addition to the Forest Practice Rules, Mendocino Redwood Company (which owns about 25% of the cumulative watershed effects assessment area) applies the following measures in its management that are relevant to potential water temperature effects (http://www.mrc.com/issues/streamside_buffers.html):

1. At least 70% absolute canopy cover within the watercourse and lake protection zones (WLPZ) will be retained or recruited;

2. Where watershed analysis indicates there is high or moderate in-stream large woody debris (LWD) demand, any harvest activity in the WLPZ will recruit and permanently retain:

    - 20 trees per 330 feet of lineal Class I watercourse (10 per side) and

    - 10 trees per 330 feet of lineal Class II watercourse (5 each side) that have the greatest potential for LWD input. (Greatest potential for LWD is defined by the tree disposition (likelihood to fall in the watercourse), distance to the stream, size and species).

    - Priority will be given to the largest 20% diameter trees within 60' of the watercourse;

3. Sanitation salvage logging will not be conducted in WLPZ or equipment limitation zones (ELZ) buffer areas; . . .

7. Any current or future livestock leases will include mitigation measures to protect streamsides and avoid riparian damage. These retention standards will be held constant so long as scientific research indicates that the policy is necessary.

Section VII.6.1.7 and Table VII.6.1.22 consider water temperature impacts in the context of potential impacts to listed species:

Project Impact 1: *Potential to have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive or special status species in local or regional plans, policies, or regulations, or by the CDFG or U.S. Fish and Wildlife Service.*

Impact 1a: *Increases in Water Temperature* (Beneficial)

Since this impact is from a habitat perspective and ambient water temperature is a measurement of cumulative temperature effects, this impact addresses water

temperature cumulative effects. The analysis in section VII.6.1.7 finds that the combined effect of FPR requirements, DFMP (alternative C1) provisions, Additional Management Measures, and provisions of alternatives A and C1 through F will prevent removal of riparian vegetation and shade canopy needed to maintain water temperature in adjacent streams. The analysis finds that these six alternatives would result in beneficial temperature effects over time. The analysis also indicates that alternative B would result in a less than significant impact to stream temperature impacts.

With stream temperatures within an acceptable range in most areas of JDSF and riparian vegetation continuing to recover from past logging throughout the cumulative watershed effects assessment area (as documented in Appendix 12), the limitations on harvesting adjacent to watercourses specified in the Forest Practice Rules, the DFMP (alternative C1) and other alternatives will promote continued recovery and ensure that water temperature is not increased by activities proposed in any of the JDSF EIR alternatives. Lack of water temperature changes at individual sites adjacent to harvesting activities will also preclude accumulation of downstream effects either along individual watercourses or at stream intersections.

Given the discussion in this section, in section VII.6.1, and Appendix 12 it is concluded that timber management operations proposed in the JDSF EIR alternatives are not expected to cause or contribute to significant, adverse cumulative impacts to water temperature. As further discussed, alternatives A and C1 (DFMP) through F would have a beneficial cumulative effect on water temperature.

Management activities on JDSF other than timber harvesting are not anticipated to disturb riparian vegetation in any way that would affect stream temperature. There is a potential, under alternatives B through F, that specific research projects or recreation facilities projects could be proposed that might result in a more substantial disturbance of streamside vegetation (compared to anticipated timber management activities) such that canopy removal and subsequent stream temperature effects could be of concern. However, no such projects, at either a general or specific level are contemplated at this time. Thus the potential cumulative temperature impacts of such projects cannot be assessed here because they are presently speculative. In the event such projects are proposed, any potential effects of such projects would be assessed as a part of CEQA environmental documentation that would be required at the project level.

3.3 Nutrient Effects

Cumulative impacts of nutrients on beneficial uses of water can be caused by management activities that lead to changes in nutrient concentrations along one stream or in tributary watersheds that combine to increase downstream nutrient concentrations. Effects of harvesting on nutrient leaching and stream water concentrations are discussed in section VII.10.4.4 (Hydrology and Water Quality). In general, timber harvesting has been shown to increase levels of nitrate and other nutrients in adjacent stream water, but these concentrations are reduced and return to background levels

downstream. As described in sections VII.10.4.2 and VII.10.4.4, increased light, water temperature, and/or nutrients in the North Fork of Caspar Creek did not lead to adverse changes in stream biology after clearcutting nearly half of the upstream watershed in 3 years. This level of harvest is much more intense than any activities contemplated in the DFMP or any of the other alternatives examined in this EIR. It also is more intensive than the timber management expected on other ownerships within the watershed cumulative effects assessment area.

Reasons for reduction in nutrient concentrations downstream from logging operations include utilization by aquatic organisms and dilution by water from unharvested areas. The lower harvesting rates, residual vegetation, and dispersal of harvesting activities proposed in the JDSF EIR harvesting alternatives (B through F) will both reduce on-site release of nutrients and increase the opportunity for dilution when compared to the Caspar Creek Study findings (Dahlgren 1998). Further, outside of JDSF but within the watershed cumulative effects assessment area, current landowner management practices and Forest Practice and Water Quality regulatory programs are not likely to allow levels of harvest similar to the Caspar Creek study. **As a result, the proposed JDSF EIR harvesting alternatives are not expected to produce downstream accumulations of nutrients that could cause or add to significant adverse cumulative impacts to beneficial uses of water.**

None of the activities contemplated under alternative A are expected to result in any nutrient effects. None of the non-harvest activities contemplated under alternatives B through F is expected to result in any significant nutrient effects.

3.4 Large Wood and Organic Debris Effects

Large wood (LWD) is a critical component of stream channels in the JDSF EIR assessment area, where it provides structure for pool formation, cover and food sources for young fish, and sediment retention sites. The functions of LWD and its history, current status, and sources in the JDSF assessment area are described in section VII.6.1 (Aquatic Resources). Cumulative impacts from changes in LWD can occur when large wood is directly removed from watercourses or when timber operations remove trees or large woody debris that would otherwise provide the source of future LWD recruitment to watercourse channels.

Most of the past management of LWD in local coastal watersheds has, unfortunately been focused on removing wood from streams. This was done during early logging operations to clear smaller channels for yarding, to remove obstructions from larger streams so accumulated logs could be floated to downstream sawmills, and to clear the way for railroad lines that were built in and adjacent to stream channels. More recent stream clearance work has been conducted in a misguided effort to provide access to spawning habitat for anadromous fish (Holman and Evans 1964). As a result, most of the larger stream channels in the EIR assessment area lack sufficient LWD to provide needed pool habitat, cover, and rearing habitat for potential populations of juvenile

salmon and steelhead. This condition is recognized as an existing, on-going cumulative impact of past management activities.

As described in section VII.6.1 (Aquatic Resources), current sources of LWD include streamside trees that topple into a channel, often in association with undermining or instability caused by bank erosion; tree stems and tops that fall into or bridge the channel from the near-stream areas beyond the channel banks; trees carried into the channel by landslides; and old logging debris. Studies in the JDSF assessment area (Benda 2004, Reid and Hilton 1998) indicate that the great majority of LWD in larger channels is produced by bank erosion and that wind breakage and blowdown from WLPZs can be a major, short term source of wood in smaller streams following logging. Based on these studies and other research summarized in section VII.6.1 (Aquatic Resources), for streams without substantial landslide inputs, more than 90 percent of LWD is expected to be produced from trees located within less than 50 feet of the stream edge, with most of this coming from near the streambank (Benda et al. 2002). In less stable terrain, significant amounts of LWD can be carried to the stream by landslides, but the majority of LWD still comes from within 75 to 100 feet of the channel (Benda et al. 2002, McDade et al. 1990).

All timberland owners in the cumulative effects assessment area are subject to the current Forest Practice Rules, which require retaining the 10 largest trees per 330 feet of a Class I watercourse channel within 50 feet of the watercourse transition line [14 CCR § 916.9(i)], retaining of 85 percent overstory canopy cover within 75 feet of the watercourse transition line, and leaving 65 percent canopy cover in the remainder of the WLPZ width (14 CCR § 916.9(g)). These requirements apply to all timberland ownerships in the JDSF EIR Assessment Area. Results of CDF's Modified Completion Report Monitoring Program (Brandow 2004), using data collected from 2001 to 2004, show that average total canopy in the Coast Region is approximately 85 percent in unharvested areas and 82 to 83 percent in harvested Class I and II WLPZs, indicating that few trees are available to be removed and that little harvesting is currently occurring in these streamside areas.

In addition to current Forest Practice Rules, the JSDF DFMP includes mitigation measures for vegetation retention described in the above discussion of "Water Temperature Effects" and the following measures to help retain trees for recruitment of future LWD:

- No harvesting within the inner 25 feet of WLPZs along Class I and Class II watercourses.
- Retaining native hardwoods in the WLPZ, except for treatments to deal with a species imbalance.
- Keeping at least 240 sq. ft. of conifer basal area following any harvesting activity in the WLPZ.
- Protecting old-growth and residual trees in the WLPZ as part of the JDSF old-growth conservation strategy.

- No salvage of dead and dying trees in the WLPZ, except in response to large scale fire, insect attack, or windthrow events or where infrastructure is threatened.
- Retaining all LWD within the WLPZ, unless it presents an imminent threat to drainage structures.

Further CDF has developed an Additional Management Measure for Large Woody Debris Survey, Recruitment, and Placement for application as part of the DFMP. The specifics of this measure, which is intended to contribute toward a more rapid recovery of aquatic habitat features and functions related to LWD, are described in section VII.6.1.5.

Additionally, CDF has placed large wood directly into stream channels as part of past habitat restoration actions or experiments in the Brandon Gulch, Parlin Creek, Hare Creek, and Caspar Creek planning watersheds, and future studies will be conducted to assess the potential for placing large wood in other Class I channels. Table VIII.7 also identifies other landowners' projects to add LWD to Russell Brook, South Daugherty Creek, Two Log Creek (2 projects), and Redwood Creek (3 projects). A total of 11 LWD placement projects were identified. It is likely that there were other LWD placement projects that were not identified.

In addition to the Forest Practice Rules, MRC (owns about 25% of the cumulative watershed effects assessment area) applies the following measures in its management that are relevant to large wood retention and recruitment (http://www.mrc.com/issues/streamside_buffers.html):

1. At least 70% absolute canopy cover within the watercourse and lake protection zones (WLPZ) will be retained or recruited;

2. Where watershed analysis indicates there is high or moderate in-stream large woody debris (LWD) demand, any harvest activity in the WLPZ will recruit and permanently retain:

    - 20 trees per 330 feet of lineal Class I watercourse (10 per side) and

    - 10 trees per 330 feet of lineal Class II watercourse (5 each side) that have the greatest potential for LWD input. (Greatest potential for LWD is defined by the tree disposition (likelihood to fall in the watercourse), distance to the stream, size and species).

    - Priority will be given to the largest 20% diameter trees within 60' of the watercourse;

3. Sanitation salvage logging will not be conducted in WLPZ or equipment limitation zones (ELZ) buffer areas;

4. All LWD in the watercourse and WLPZ will be retained. No salvage logging of LWD.

5. Foresters are encouraged to look for guidance from biologists, for ways to put more LWD into the stream channel; . . .

7. Any current or future livestock leases will include mitigation measures to protect streamsides and avoid riparian damage. These retention standards will be held constant so long as scientific research indicates that the policy is necessary.

Given the foregoing Forest Practice Rule regulatory measures that apply to all timberland owners, DFMP measures, Additional Management Measure for Large Woody Debris Survey, and MRC LWD management measures, it is anticipated that LWD within the cumulative watershed effects assessment area will increase over time, resulting in improved aquatic habitat conditions.

Section VII.6.1.7 considers the following impact regarding large wood:

Project Impact 1: *Potential to have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive or special status species in local or regional plans, policies, or regulations, or by the CDFG or U.S. Fish and Wildlife Service.*

Impact 1c: *Reduction in LWD Recruitment* (Beneficial)

Since this is a habitat-based impact, it is reflective of cumulative effect considerations.

Section VII.6.1 and the discussion above detail the requirements of the Forest Practice Rules and the measures proposed under the various alternatives to protect or increase levels of large wood recruitment. The Forest Practice Rules apply to all timberlands in the cumulative effects assessment area. Further, MRC has in place additional measures, described above, to increase LWD recruitment beyond the levels required in the Rules.

In the context of these management and regulatory measures and the current situation of inadequate levels of LWD throughout much of the cumulative effects assessment area, the analysis of this impact presented in section VII.6.1.7 found that alternative A, alternatives C1 and C2 with the Large Woody Debris Survey, Recruitment, and Placement management measure, and alternatives D through F would have a beneficial impact on LWD levels, as a result of management measures to recruit LWD or to place it directly into streams. No mitigations would be necessary for these alternatives.

Alternative B provides only the LWD protections required under the FPRs. FPR retention standards are designed to protect LWD recruitment potential on a THP-by-THP basis. Additional mitigation is necessary, such as that included in the Large Woody Debris Survey, Recruitment, and Placement management measure. Application of this mitigation will result in increased LWD recruitment over time, resulting in improved instream habitat conditions, which constitutes a beneficial effect.

Smaller organic debris also can affect beneficial uses of water. Fine organic materials provide food and host sites for benthic macroinvertebrates and microbes. However, decomposition of large amounts of fine organic matter may lead to oxygen depletion that can kill fish and other oxygen-requiring aquatic organisms and can release undesirable chemical compounds and odors. The Forest Practice Rules prohibit the deposition of slash or other fine organic materials in Class I or II waters, and require prompt removal if deposition occurs [14 CCR §§ 916.3, 916.3(a), 916.3(b)]. Inventories of Forest Practice Rule implementation and effectiveness related to water quality (Cafferata and Munn 2002) have not found compliance problems with these rule requirements, and the low level of timber operations in Class I and II WLPZs indicates that there are few opportunities for deposition of fine organic materials into these watercourses. **Therefore, deposition of small organic debris in streams as a result of timber operations under any of the alternatives is not expected to have significant adverse cumulative impacts on beneficial uses of water.**

3.5 Sediment Effects

Sediment induced cumulative impacts are described in the Forest Practice Rules as occurring when earth materials from surface erosion or mass wasting enter a stream or a stream system at separate locations and are then combined at a downstream location to produce a change in water quality or channel condition. The eroded materials can originate from the same or different projects or sources unrelated to projects (14 CCR § 912.9, Technical Rule Addendum No. 2). As section VII.7 Geology and Soils and Appendix 11 make clear, sediment has both natural and anthropogenic sources. Assessment of cumulative impacts must consider how one or both of these sources may combine to result in a significant adverse impact.

The North Coast Regional Water Quality Control Board's listing of the Big River and Noyo River watersheds as sediment impaired (see section VII.10 Hydrology and Water Quality) is a per se indicator that these two water bodies currently have significant adverse sediment cumulative impacts. Combined, the Big and Noyo watersheds comprise 88% of the cumulative watershed effects assessment area. For JDSF, 75% of the Forest lies within these two watersheds.

Past road and railroad construction and timber operations in the JDSF EIR cumulative effects assessment area (particularly prior to the 1973 Z'berg-Nejedly Forest Practice Act and subsequent Forest Practice Rules) were a major source of sediment and created a legacy of accumulated channel deposits, road conditions, and erosion sites that continue to contribute sediment to streams in the assessment area. Mixing these legacy effects from past projects with natural sediment sources and future sediment production from proposed operations could create new or add to existing significant adverse cumulative impacts to on-site and downstream beneficial uses of water.

Current timber management related sediment sources include roads, skid trails, landings, harvest areas, and related cuts, fills, and watercourse crossings. Non-timber management sediment sources include railroad maintenance, residential development,

recreational facilities such as trails and campgrounds, land use conversions from timberland to other uses, grazing, and state and local highway construction and maintenance. Sediment also is produced from natural surface erosion and mass wasting features and in channels from bank erosion and re-mobilization of previously stored deposits under the influence of high flows. Processes that can initiate and move sediment to streams include sheet and rill erosion, gully erosion, crossing failures, debris flows, landslides, and other types of mass movements. These multiple erosion processes acting on different source areas under the influence of precipitation and flow regimes that exhibit wide variations in space and time greatly complicate the analysis of both individual and cumulative impacts.

Erosion processes and sediment sources (natural and anthropogenic) are described in section VII.7.2.4 (Geology and Soils), and earlier sediment production estimates for watersheds in the EIR cumulative effects assessment area are described and summarized in Appendix 11, where the summary of methods and sediment yields given in Tables 1 and 2 illustrate the difficulty of arriving at consistent sediment production values and a lack of uniformity in the assessment and reporting of sediment yields. In addition, research information described in Appendix 11 indicates that long term erosion rates (over thousands of years) are approximately two times larger than estimates of current sediment yields and that sediment originating from natural mass wasting features, channel bank erosion, and re-mobilization of in-channel deposits is responsible for much of the sediment that has been previously attributed to current timber operations.

There is general agreement that erosion from roads is now the largest source of sediment from timber operations and other management activities [Cafferata and Spittler 1998, Bawcom 2005, section VII.7.2.4 (Geology and Soils), and Appendix 11]. As described in Appendix 11, the importance of road, skid trail, and landing location and construction methods is demonstrated by the large reduction in sediment yield resulting from timber harvesting operations in the North Fork of Caspar Creek, when compared to sediment generated by earlier logging in the South Fork (Ziemer 1998). Surface erosion and mass wasting from skid trails has been effectively reduced on both JDSF and other timberland ownerships in the EIR assessment area by application of the Forest Practice Rules (Cafferata and Munn 2002). As shown in Appendix 11, Table 2, skid trails are now a relatively small source of stream sediment. Section VIII.2.1, above, discusses how Caltrans and County road projects were evaluated and not found to pose a sediment cumulative impact risk.

Section VII.7. 2.4 and Table VII.7.1 show the results of the modeling of road sediment production within the watershed cumulative effects assessment area. The results indicate that the estimated road sediment is less for JDSF, 96.7 tons/square mile/year, than for the rest of the assessment area, 114.2 tons/square mile/year. This relationship holds looking only at the Big River watershed, where the JDSF and non-JDSF sediment rates are 83.5 and 131.2 tons/square mile/year, respectively. This relationship reverses on the Noyo watershed, where the JDSF and Non-JDSF road sediment rates are 110.6 and 103.5 tons/square mile/year, respectively. The differences in estimated sediment

production rates between the various assessment units is the result of differences in factors such as slope, road surface and design, road proximity to watercourses, numbers and types of stream crossings, road age, and rainfall.

Table VIII.6 and Figure VIII.2, above, illustrate how yarding practices within the cumulative effects assessment area have shifted away from the more disruptive use of tractor yarding to increased use of less disruptive cable yarding. Further, as shown in latter table figure, the area subject to harvest and related soil disturbance has declined in recent years.

Hillslope mass wasting also has been identified as a source of stream sediment that can be initiated by timber harvesting and by the excavations and concentration of water associated with roads, landings, and skid trails. As described in Appendix 11, identification and avoidance of high-risk sites have effectively reduced the incidence of management related hillslope failures, which prevents significant increases in sediment from mass wasting on harvesting units.

Above, Tables VIII.1 through VIII.6, Table VIII.9, Table VIII.10, and the accompanying discussion, presented information on past, current, and future timber harvesting rates within the watershed cumulative effects assessment area. Rate of harvest, expressed as the percentage of a watershed or other assessment unit harvested over a given period such as a year or a decade, is often sometimes looked to by agencies or the public as a meaningful measure of environmental impacts, particularly to water quality, aquatic habitat, and fisheries. However, rate of harvest alone generally is not considered by scientists to be highly predictive of rates of environmental impacts.

Beschta and others (1995) state that limiting timber harvest levels as a surrogate for impacts (limiting harvest to a certain percent of the basin per year to keep average annual sediment levels below a set level) “is a simplistic approach that does not account for regional or watershed variability, harvest location, yarding system, roading, etc., and assumes a direct causal mechanism between timber harvest and magnitude of impact. In most cases, it is not the fact that trees were harvested, but how they were harvested, where on the landscape, the methods of roading and yarding, the degree of riparian protection, and other factors that ultimately determine the impact of a forest practice operation.”

The Scientific Review Panel (1999) reported that a reasonable “red flag” percentage value for concern over rate of harvest would likely range from 30% to 50% per decade, but will depend on numerous factors including geology, harvest prescriptions, past disturbance, etc. The Panel suggested that a blue ribbon panel be formed to investigate this issue further, however this step has not yet been taken.

A very intensive level of timber management in the North Fork of Caspar Creek—clearcut harvesting about 45% of the watershed area in 3 years—did not cause large changes in watershed physical or biological variables in a moderately stable geologic formation (Ziemer 1998, Lewis 1998, Cafferata and Spittler 1998, Nakamoto 1998, Bottorff and Knight 1996). While Table VIII.10 does not indicate anticipated future

harvesting at this level of intensity, it also must be noted that the concern in this section of the EIR is cumulative impacts. With cumulative impacts, theoretically, it may take only a very small amount of additional environmental impact, on top of existing impact levels, to result in a significant adverse impact.

While there is some evidence that increased annual rates of timber harvest and roading increase chronic turbidity levels at the watershed scale (Klein 2003), it is apparent that there is high variability in erosion sensitivity found in North Coast watersheds, and that insufficient work has been completed to determine what rate of harvest would cause an adverse cumulative watershed effect related to turbidity for JDSF EIR assessment area basins.

Although limited by the number of sites assessed (eight), Klein (2003) concluded that land use variables, particularly road density and annual rate of timber harvest, appear to be the dominant controls on the gross differences in chronic turbidity observed among the study streams. It has been stated that Klein's (2003) report on turbidity associated with logging and roading suggests that there should be thresholds of harvested acres/roading—beyond which additional harvesting and roading will cause large water quality problems. Klein states in his report that that while turbidity levels might be decreased by reducing the density of roads in a watershed and limiting the annual rate of timber harvest, his "*results should be considered preliminary and not be used alone for policy decisions or regulatory standards"* (italics added). He also wrote that while his study argues for quantitative limits on annual harvest rates, they should be "*perhaps customized to accommodate the variability in erosional sensitivity found within the northcoast*. *But a stronger analysis, one that includes a greater sample size of northcoast streams, is needed to establish defensible harvest rates that ensure protection of beneficial uses*" (italics added).

It has been argued that hydrologically associated erosion (i.e., erosion due to increased net precipitation due to reduced interception losses and erosion due to increased peak flows), along with landslide rates associated with differing silvicultural systems and road-related erosion, can be used to determine acceptable rates of harvest for North Coast watersheds (Lisle and others 2000). Lewis (1998) reported that much of the increased sediment load in the North Fork tributaries was related to increased storm flow volumes. In a detailed review of Lisle and others (2000), Munn (2000) found that the results of the North Fork Caspar Creek study reported by Lewis (1998) do not support the model developed by Reid (2000) for calculating limits on the rate of timber harvesting. In Munn (2000), it was stated that the Caspar Creek results clearly show that downstream water quality impacts of hydrologic changes resulting from timber operations are small in magnitude and that major sources of sediment production can be prevented by the application of mitigation measures contained in the California Forest Practice Rules.

Finally, with respect to rate of harvest providing some proxy for rate of sediment generation, one of the conclusions from Appendix 11, Overview of Existing Sediment Studies Relevant to JDSF EIR, noted:

> Sediment budgets prepared for Noyo and Big River watershed assessments show that road-related sediment (both from road surface erosion and road-related landslides) is a dominant source of sediment from current management activities, while in-unit hillslope erosion is a much smaller contributor.

While road construction, maintenance, and usage associated with timber harvests constitute important sediment sources, it also should be noted that most harvesting operations in the North Coast today include significant work to upgrade roads to reduce their sediment generation potential.

Given the information available in the scientific literature, it is reasonable to state that insufficient work has been completed in western Mendocino County watersheds to determine that exceeding a particular threshold harvesting rate in one decade would necessarily cause a significant adverse cumulative watershed effect related to turbidity. However, harvesting rates do have some use as a sort of cautionary indicator. Hence, in the discussion in section VIII.2.3 Future Projects above, planning watersheds with anticipated future harvest rates above about 17% over a 5-10 year period were singled out.

In the face of this kind of uncertainty about standard thresholds, watershed analysis is often considered to be the best tool for addressing cumulative watershed effects (CDF 1999, SRP 1999). Watershed analysis was conducted for a significant part (99,526 acres or 47 percent) of the current JDSF EIR watershed cumulative effects assessment area in 1999. The watershed analysis process conducted as part of the Draft JDSF HCP/SYP planning process was a type of cumulative effects assessment method designed to identify appropriate management practices to avoid significant adverse impacts to resources of concern. Important principles learned from the draft JDSF HCP/SYP and suggested management practices have been incorporated in the JDSF Draft Management Plan.

MRC, which owns about 25% of the watershed cumulative effects assessment area, has been systematically moving through its ownership and completing watershed assessments. It has completed assessments for both the Noyo and Big River watersheds. Hawthorne Timber Company has routinely conducted watershed assessments on its timberlands, though the results were not available.

Table VIII.7, above, identifies 99 sediment reduction projects conducted within the watershed cumulative effects assessment area since 1991. This tally does not account for all sediment source reduction activities that have been conducted in the assessment area during this period.

The combined use of (1) prevention/minimization of new sediment sources, and (2) a program to mitigate existing sediment source areas is now required by the North Coast Regional Water Quality Control Board for General Waste Discharge Requirements

related to timber operations (North Coast Regional Water Quality Control Board Order No. R1-204-0030) (see discussion above in section VII.7.3). Implementation and enforcement of these requirements will contribute to a reduction of sediment sources and impacts over time.

The proposed DFMP (alternative C1) is subject to or contains a number of measures to prevent, avoid, or reduce sediment generation and the potential for significant adverse sediment cumulative effects. These measures and their potentials to avoid or reduce sediment generation are discussed in detail in sections VII.6.1.3-6.1.4, VII.6.1.6, and Table VII.6.1.22 (Aquatic Resources); sections VII.7.4, VII.7.6, and Table VII.7.7 (Geology and Soils); and sections VII.10.6-VII.10.9, and Table VII.10.5 (Hydrology and Water Quality). To summarize, these measures include:

- Current Forest Practice Rules;
- NCRWQCB waste discharge requirements;
- Past efforts to improve road systems to reduce their sediment generation;
- DFMP Road Management Plan and the Additional Management Measure for an Accelerated Road Management Plan;
- Hillslope Management Guidelines;
- Use of a Certified Engineering Geologist in the development and review of projects;
- Enhanced WLPZ protection;
- Increased use of skyline yarding systems and reduced reliance on tractor yarding;
- Designation and protection of Special Concern Areas; and
- Procedures to identify and avoid unstable areas.

With respect to management activities by other major forest landowners within the EIR cumulative effects assessment area [i.e., Hawthorne Timber Company (HTC) and Mendocino Redwood Company (MRC)], a number of factors point toward reduced sediment production on these lands over time:

- Current Forest Practice Rules;
- NCRWQCB waste discharge requirements;
- Past and anticipated future landowner efforts to improve road systems to reduce their sediment generation; and
- Levels of harvesting activity anticipated per publicly available information {such as HTC and MRC Option A documents where they demonstrate how they will attain FPR requirements for “maximum sustained production of high quality timber products,” [14 CCR § 913.11(a)] and MRC management plan information}.

As noted, the other major landowners in the JDSF EIR Assessment Area also are working to improve their road networks to reduce sediment inputs to watercourses, both voluntarily and in response to new water quality requirements. These mitigation

measures are in addition to the improved road and riparian zone protection practices that are now required throughout the assessment area by the Threatened and Impaired Watersheds Forest Practice Rules (14 CCR § 916.9). Since roads have been identified as the largest anthropogenic sediment source within the watershed cumulative effects assessment area (see discussion above), the amount of attention and action the major forest landowners in the assessment area are devoting to reducing road sediment sources is expected to contribute significantly to reducing anthropogenic sediment sources in the assessment area.

Applied across JDSF and industrial timberland ownerships within the watershed cumulative effects assessment area, it is anticipated that these various measures combined will result in significant improvements in sediment-related water quality over time within this assessment area. Note that HTC (approximately 29,000 acres) and MRC (approximately 54,000 acres) combined own 83,000 acres or 39% of the cumulative watershed effects assessment area; adding in JDSF's 48,653 acres and State Park's 11,286 acres accounts for a total of 67% of the assessment area where great care is/will be taken to protect water quality from sediment related impacts. An additional portion of the watershed cumulative effects assessment area is under NTMPs, which also require significant measures to reduce sediment impacts to water quality.

MRC's website provides information on various management practices that they apply beyond the specifics of the Forest Practice Rules. The sediment policy MRC (which owns about 25% of the watershed cumulative effects assessment area) follows is:

> MRC is committed to forest management practices that will minimize movement of sediment. In particular:
>
> - MRC is investing a significant amount of resources into the redesign, relocation, rehabilitation and repair of its road system (see Roads in the issue inventory). Roads are the leading source of sediments to streams, and MRC is investing in its road system to reduce sediments from roads across its landscape.
> - MRC is primarily employing cable yarding when it removes logs from the woods, in place of more traditional tractor logging. This harvest system disturbs soils to a lesser degree than tractor yarding. It also minimizes soil compaction, which can ultimately lead to serious erosion problems. Cable yarding relies on a crane and wire pulley system to lift logs from the woods and bring them to a landing where they can be loaded for transport.
> - MRC is carefully managing around its stream zones. MRC has high tree retention standards along streams, and equipment limitations for streamside areas.

- MRC has substantially limited any harvest activities in the winter (see Winter Harvesting)

(Source: http://www.mrc.com/issues/turbidity.html)

With respect to winter harvesting, which can tend to cause erosion and sedimentation under certain circumstances, MRC's policy is as follows:

> In general, MRC will avoid winter operations when there is risk of sediment movement and road damage. Sediment movement and road damage may occur when hauling logs across wet road surfaces during periods of precipitation. Through the THP process, MRC, along with various government agencies, established significant limitations and precautions for any winter harvesting activity.
>
> Here are the guidelines MRC uses for considering any winter activities:
>
> - Cable yarding on rocked landings may be conducted if sediment movement can be avoided.
> - Loading and hauling on rocked roads and landings will not be conducted during periods of rainfall or when roadside ditches are flowing with surface runoff, or when roads are saturated and cannot support the heavy loads. At first sign of measurable rain, trucks in the woods will make their final trip out and trucks not yet in the woods will be asked to return home for the day.
> - Operations during extended periods of dry weather (prior to two inches of seasonal rainfall) might include tractor logging and hauling on non rocked roads.
> - Falling operations are acceptable if precautions are taken to protect against road damage and falling in the WLPZs is precluded.
>
> (Source: http://www.mrc.com/issues/winter_harvesting.html)

In summary, background sediment production from natural mass wasting and surface erosion, bank erosion, and channel deposits will not be increased by the proposed DFMP. In addition, sediment produced from harvesting units, including skid trails, will be held to a minimum by practices included in current Forest Practice Rules that apply to all proposed timber operations in the EIR cumulative effects assessment area, the JDSF Management Plan, and this EIR to avoid and mitigate activities on sensitive sites and to increase protection of areas adjacent to watercourses. Sediment produced from roads and watercourse crossings will be further reduced by application of measures in the JDSF Road Management Plan to reduce erosion from new road construction, while identifying opportunities for decommissioning unnecessary roads and repairing existing

road problems.[6] As described above, MRC has a number of policies in place to contribute to the prevention and reduction of sedimentation.

The combination of current Forest Practice Rule requirements, DFMP requirements, Additional Management Measures, and avoidance of unstable and sensitive areas as specified in the JDSF Management Plan and Hillslope Management Guidelines, and fixing existing problems with roads and crossings as described in the Road Management Plan will substantially reduce potential sediment production from timber operations within the EIR assessment area and prevent the proposed DFMP from creating or adding to adverse cumulative sediment impacts, while providing an opportunity to reduce current levels of sediment production from roads and crossings. This reduction in sediment impacts from JDSF can assist the long-term reduction of in-stream sediment levels and contribute to the recovery of the beneficial uses of water.

Taken together, the anticipated forest management activities on JDSF under the proposed DFMP and on other timberlands in the EIR cumulative effects assessment area are expected to result in a reduction in sediment generation and stream sediment loads over time, and thus reduce impacts over time. This positive trend, in combination with natural recovery processes, will prevent proposed timber operations and other land management activities from creating new or adding to existing cumulative impacts.

This conclusion of improving sediment conditions is supported in part by results of the North Fork Caspar Creek study, as described in Appendix 11, despite study treatments that included clearcutting nearly half of the watershed in 3 years, the use of hot, broadcast burns in some of the harvesting units, and use of less restrictive Forest Practice Rules. These silvicultural treatments were more severe and extensive than any operations proposed in the JDSF EIR alternatives, and current Forest Practice Rules contain additional requirements for watercourse protection and erosion control that will further reduce sediment production. In addition, LWD retention requirements included in the current Forest Practice Rules and specified in the DFMP, Additional Management Measures, this EIR, and MRC management policies will, over time, provide additional sediment retention capacity to help regulate the transport of sediment that does enter the stream system.

Section VII.10 assesses water quality issues related to the DFMP. In section VII.10.9 Project Impacts and Table VII.10.5, Impact 1 addresses ambient water quality standards, which are a cumulative impact measure of all pollutants found in a stream at a given point in time and space:

[6] It is recognized that site disturbance associated with road and crossing repair or removal activities can result in short term increases in sediment production (Klein 2003). However, these measures are also expected to prevent catastrophic failures and to reduce total sediment yield over time (Madej 2001). Such projects are typically subject to further CEQA analysis at the project level, even when tiered to a programmatic EIR, where these short-term impacts can be properly assessed and mitigated if needed.

Impact 1: *Violate any water quality standards or waste discharge requirements*. (Less than Significant)

The analysis for this impact finds there would be less than significant impacts for all alternatives. This analysis specifically addresses sediment and turbidity issues.

Alternatives C2 through F contain many of the same sediment prevention and reduction measures as the DFMP (alternative C1), as well as having, in some cases, additional levels of watercourse buffer protection that may further contribute to keeping sediment out of streams. Further, alternatives D through F propose lower levels of timber management than the other alternatives, which also may contribute to reduced sediment generation over time. Based on these considerations and the analysis above, it is concluded that timber management under alternatives C2 through F will result in a decrease in the current level of adverse sediment cumulative impacts over time.

Alternatives A and B do not provide the same levels of sediment prevention and reduction measures as do the other five EIR alternatives. The analyses in sections VII.6.1 (Aquatic Resources) and VII.7 (Geology and Soils) both indicated that mitigations were needed to address erosion and sedimentation effects. These mitigations, found necessary at the individual impact level, will be even more important at the cumulative effects level. Potential mitigations identified included a Road Management Plan and Hillslope Management Guidelines. With these mitigations, and other factors described above, sediment generation under these two alternatives would decrease over time and current levels of adverse sediment cumulative impacts would be reduced over time.

Section VII.6.1 addresses potential impacts to aquatic resources, including impacts related to sediment. Section VII.6.1.7 and Table VII.6.1.22 specifically assess Impact 1 and 1b regarding sediment impacts to listed species:

Project Impact 1: *Potential to have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive or special status species in local or regional plans, policies, or regulations, or by the CDFG or U.S. Fish and Wildlife Service.*

Impact 1b*: Increases in Sedimentation* (Less than Significant)

Since the impact and analysis are habitat-based, this impact reflects sediment cumulative impacts. The analysis presented in section VII.6.1.7 finds that the DFMP (alternative C1) and alternatives C2 through F, given their management approaches and their incorporated measures to address sediment, would result in a less than significant impact. The analysis finds that alternatives A and B would need to be mitigated to keep potential adverse impacts less than significant.

Management activities on JDSF other than roads and timber harvesting are not anticipated to result in any sizeable sediment discharges. In particular, they are generally not expected to be large enough to offset the reductions in sediment discharges that are anticipated per the discussion above. Further, managers of most of the other forestland in the watershed cumulative effects assessment area are also working to reduce their levels of sediment generation. However, there is a potential, under active management alternatives B through F, that specific research projects or recreation facilities projects could be proposed that might have the potential to result in more substantial sediment generation, such that stream sedimentation effects could be of concern. With one exception, no such projects, at either a general or specific level are under contemplation at this time; thus the potential adverse cumulative sediment impacts of such projects cannot be assessed here. However, any such potential effects would be assessed as a part of CEQA environmental documentation that would be required at the project level. The noted exception is the periodic cleaning out of sediment from Caspar pond, which is conducted approximately every five years.

4. Hazardous Materials

Adverse cumulative effects from hazardous materials can occur from the accumulation of such materials from repeated application or spills over time at a given site, or from the movement of hazardous materials from one or more sites of application or spills to another site or waterbody where they accumulate. Movement of hazardous materials from one site to another may occur through the air, water, or soil. Aerial application of herbicides is not known to occur in the project area, nor is aerial distribution of other hazardous materials. Thus, the aerial movement mechanism of accumulation of hazardous materials is not relevant to the proposed project. Since the hazardous material movement and accumulation process with the largest scope is via water, the watershed cumulative effects assessment area (see Figure V.3) is used as the assessment area for hazardous materials.

The types, application, and threats of toxic materials that might be used to implement the proposed JDSF Management Plan are described in EIR sections VII.8.2.1 through VII.8.2.4 and are summarized in Table VII.8.6. Appendix 13 provides further description of herbicides expected to be used on JDSF. These hazardous materials include fuels and lubricants used by equipment employed for timber operations and herbicides used for vegetation control. The amounts of herbicides anticipated to be used on JDSF range from low (alternative B) to minimal (alternatives A, C1, C2, F) to none (alternatives D and E). Aerial application of herbicides would not be used under any of the alternatives. Specific measures to prevent and control accidental discharges are described in EIR section VII.8.2.3.

Section VII.8.2.3 discusses the pesticide-related regulations that must be followed by all pesticide users within the watershed cumulative effects assessment area. These include federal, state, and county regulations that address many aspects of pesticide

storage, handling, and application for the protection of both human health and environmental values.

Mendocino Redwood Company (MRC), an industrial timberland owner, owns about 54,000 acres or 25% of the cumulative effects assessment area. MRC has been following a policy of reducing its use of herbicides (http://www.mrc.com/issues/herbicide.html). This policy is one element of its forest management certification by the Forest Stewardship Council. Between 2000 and 2003, MRC reduced its herbicide use by over 48%. As MRC brings more of the hardwood competition in its land under control, it expects to further reduce the use of herbicides. Specific information was not available about herbicide use by other landowners in the cumulative effects assessment area.

As shown in Table VII.8.5 in section VII.8.2, use of pesticides on timber land constitutes only about 0.7 percent of all pesticide use in Mendocino County. Agriculture is largest use of pesticides in Mendocino County; however, the cumulative effects assessment area has less than one percent of its area in agriculture (see Table VII.11.2). Thus, there appears to be no significant opportunity for cumulative effects to occur due to the combination of agricultural and forest management use of pesticides within the cumulative effects assessment area.

Section VII.8.3 and Table VII.8.6 document conclusions that potentially significant individual impacts related to the application of pesticides on JDSF are not expected under any of the seven alternatives, including the project alternative, C1.

Section VII.8.3 and Table VII.8.6 examine three potential impacts related to the use of hazardous materials and document conclusions that potentially significant individual impacts related to the application of pesticides on JDSF are not expected under any of the seven alternatives, including the project alternative, C1. Only one of these potential impacts is relevant in the cumulative impacts context:

Impact 3: *Adoption of the DFMP has a less than significant potential to cause a hazard to the public or the environment through the routine transport, use or disposal of hazardous materials, or through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment* (Less Than Significant).

The routine transport of hazardous materials does not appear to provide an opportunity for cumulative impacts, since it does not typically result in the release of any hazardous materials, except under accidental circumstances, which are discussed below.

Given the existing regulatory measures that must be complied with by all parties handling hazardous materials throughout the watershed cumulative effects assessment area, the DFMP-incorporated measures related to the routine storage and disposal of hazardous materials and the planned compliance with these requirements under the

DFMP and other alternatives (see section VII.8.2.3), a significant adverse cumulative effect from routine storage and disposal of hazardous materials is not anticipated.

Accidental release of hazardous materials such as fuels or herbicides occurs only rarely and according to no particular spatial distribution. Such spills are generally quickly controlled and cleaned up. As described in section VII.8.2.3, the DFMP incorporates a Spill Prevention and Control and Countermeasure Plan that incorporates Federal Clean Water Act requirements; the DFMP also incorporates Forest Practice Rule requirements for safe handling of hazardous materials and County requirements for pesticides. Other regulatory restrictions are also described in section VII.8.2.3. Given these circumstances, a significant adverse cumulative impact from an *accidental* release of hazardous materials, while theoretically possible, is not anticipated to occur as a result of the DFMP (alternative C1) or any of the other six alternatives, which incorporate the same measures or, in the case of alternatives D and E, which prohibit the use of herbicides.

The hazardous material impact issue that has raised the greatest public concern is related to the routine use of forest management herbicides. The discussion of Impact 3 in section VII.8.3 notes the findings of the CDF report titled *Environmental Effects of Herbicide Related to Timber Harvesting* (Hill and Wickizer 2002): (1) "The effects are generally not cumulative impacts because uses related to different Timber Harvesting Plans (THPs) are separated in time and distance so that their individual effects rarely reinforce or interact with each other." And (2) "the plan (THP) submitter is bound by State and Federal law to use herbicides only in accordance with their label restrictions: CDF finds that there is no significant adverse effect that will result from this plan related to herbicide use."

Based on the discussion above and the information presented in section VII.8, Hazards and Hazardous Materials, and Appendix 13, Brief Description of Herbicides Considered for Use on Jackson Demonstration State Forest, the proposed JDSF EIR alternatives are not expected to produce significant adverse cumulative impacts from the use of hazardous materials.

5. SOIL PRODUCTIVITY EFFECTS

As described in the Forest Practice Rules (14 CCR § 912.9, Technical Rule Addendum No. 2), cumulative impacts to soil productivity can occur when the effects of two or more activities, from the same or different projects, combine to produce a significant decrease in the biomass production potential of the soil on a site.

Factors influencing soil productivity that can be affected by timber operations include: organic matter loss, surface soil loss, soil compaction, and growing space loss. Recovery from these impacts is often slow, so mitigation measures must focus on prevention and limits on the extent of impact.

Past timber operations typically were conducted with little concern for soil productivity impacts. Old growth logging often involved pre-burning to improve access to the harvest area, excavation of layouts for falling large trees, and post-falling burning of slash to remove yarding obstacles. These activities removed much of the surface organic material and left slopes exposed to erosion. Later tractor logging resulted in large numbers of excavated skid trails, landings, and roads with little erosion control, often directly filling watercourse channels; deeply excavated layouts; extensive slash removal and site preparation by tractors with large amounts of soil movement; and the continued use of hot, broadcast burning for slash removal and site preparation. Through the 1960s, erosion control was rarely provided for roads and skid trails after use and before winter rainfall. This phase of tractor logging resulted in the removal of much organic matter, large amounts of soil disturbance and displacement, the creation of large areas of compacted surfaces, and greatly accelerated surface erosion, gully erosion, and mass wasting.

Organic matter loss can occur by displacement of surface organic materials during skidding, mechanical site preparation, and other land disturbing timber operations and from erosion, burning, or oxidation of exposed fine organic material. Soil productivity is affected by the loss of nutrients stored in organic matter, surface exposure that results in higher temperatures and increased evaporation during the dry season, and reductions in soil porosity from loss of soil organic matter. These impacts are can be avoided or reduced by promoting re-use of existing skid trails, reduced reliance on clearcut harvesting, minimizing the use of broadcast burning for slash control and site preparation, and greater use of cable and helicopter systems that reduce or eliminate yarding disturbance on steep slopes. In particular, skyline and helicopter yarding systems are generally preferred on slopes greater than 40 percent depending upon local site conditions.

Soil loss occurs from mechanical displacement (scalping) during roading, harvesting, or site preparation and by surface erosion or mass wasting on harvest units. Removing the surface soil has a disproportionate effect on soil productivity because the upper layers of soil are the storehouse of organic matter and nutrients that have accumulated from decomposing plant materials and atmospheric sources. As described in Appendix 11, loss of soil by surface erosion from harvesting units is generally small for timber operations conducted under current Forest Practice Rules, and mass wasting (above background rates) from timber operations is prevented by identifying and placing limits on operations in unstable areas. Implementation of the DFMP's Hillslope Management approach is a key part of the proposed methods to reduce and avoid soil disturbance and mass wasting. Surface soil erosion is further minimized by the reduced emphasis on use of broadcast burning and other intensive site preparation methods in the JDSF Management Plan. Loss of surface soil by mechanical displacement is avoided or reduced by re-use of existing skid trails, use of yarding systems that reduce or eliminate excavation on steep slopes, and reduced use of mechanical site preparation to remove logging slash. Dispersing harvest units through space and time also helps to spread out potential impacts and to allow recovery.

Management practices used by other timberland owners in the EIR assessment area have also been modified in ways that reduce soil loss. As Table VIII.5 shows, the use of the more intensive silvicultural methods (classes A and B) across the non-JDSF portions of the cumulative effects assessment area has declined from 67 percent of the harvest area in the 1986-94 period to just 27 percent in the 1995-2004 period. In particular, Mendocino Redwood Company "…no longer uses traditional clearcutting as a harvesting method. All harvested stands retain elements that provide perpetual, multi-aged stand structure, and maintain critical ecological refugia (e.g., clumps of standing trees, snags, downed woody debris, undisturbed soil, etc.)," (http://www.mrc.com/issues/silviculture_harvesting.html). In addition, over 7,000 acres of privately owned timberlands within the assessment area recently have been put into a state park, where soil disturbance will be minimal and restoration activities to reduce sediment generation are anticipated (see the Big River Preliminary Plan, April 2005, at http://www.mendocinolandtrust.org/projects/brpp.shtml).

Soil compaction leads to loss of soil productivity by reducing pore space for water storage, movement of water, and for the exchange of oxygen, carbon dioxide, and other gases that are required and produced by roots and soil organisms. Compaction also increases soil density and strength, which impedes root penetration. Measures designed to limit compaction produced by timber operations include controlling the location and amount of ground disturbance by ground-based equipment. This is accomplished by greater reliance on cable and helicopter yarding systems, re-use of existing skid trails in areas that are tractor logged, minimizing the construction of new roads and landings, and reduced use of site preparation to remove logging slash. Table VIII.6 shows that the use of less disturbing yarding methods has increased in the cumulative effects assessment area between the two periods examined.

Growing space loss reduces site productivity by decreasing the area available for production. It is reduced by minimizing the number of roads, landings, and skid trails used for timber operations and by re-use of existing landings and skid trails. The Caspar Creek watershed study provides an example of how practices related to growing space have improved over the past two to three decades. When the South Fork was logged selectively with crawler tractors from 1971 to 1973, approximately 15% of the watershed was compacted through the creation of roads, skid trails and landings (Rice et al. 1979). When the North Fork was logged from 1985 through 1991, only about 3% of the basin was found to be compacted by creating new roads, skid trails and landings (Henry 1998). Since practices have continued to improve, this level of impact to growing space can be anticipated to continue or decline further. Under the DFMP, recovery of some growing space will be accomplished by re-growth on unused roads and skid trails and by road decommissioning conducted as part of the JDSF Road Management Plan and on other ownerships in the EIR assessment area.

Section VII.7.6 and Table VII.7.7 discuss soil erosion or loss of top soil potential impacts. It describes the various measures included in the DFMP to avoid or reduce these impacts, including the Road Management Plan, Hillslope Management

Guidelines, watercourse and riparian protections, etc. Section VII.7.6 considers the following impact with respect to individual and cumulative impacts to soil productivity:

Impact 5: *Soil Erosion or Loss of Topsoil will Result in a Significant Individual or Cumulative Impact*: (Less than Significant)

The analysis of this impact finds that individual and cumulative impacts related to soil erosion or loss of topsoil are less than significant for alternatives C1 through F. The analysis in section VII.7.6 also indicates that mitigation is needed to address potential soil erosion or loss of topsoil impacts for alternatives A and B. Mitigation via a Road Management Plan is recommended for both of these alternatives. Additionally, since alternative B includes timber management activities, further mitigation with Hillslope Management Guidelines, Certified Engineering Geologist involvement in project design and field review is recommended. With these modifications, these alternatives would have a less than significant impact on soil erosion or loss of topsoil, when viewed from the soil productivity perspective.

Measures described above that reduce the extent and degree of surface disturbance are often complementary in helping to reduce or prevent potential impacts of timber operations on organic matter loss, soil loss, soil compaction, and growing space loss. **Taken together, these measures are expected to prevent timber operations included in the JDSF Management Plan alternatives from creating or adding to significant, adverse cumulative impacts on soil productivity**.

Activities other than timber management and associated roads anticipated on JDSF or other portions of the cumulative effects area are not expected to result in disturbance of any sizable areas of soil, such that soil productivity might be adversely affected on either an individual or cumulative effects basis. This conclusion applies to all of the alternatives considered in the EIR.

6. BIOLOGICAL RESOURCES

The sections of this EIR addressing biological effects, VII.6.1 Aquatic Resources and VII.6.6 Wildlife and Wildlife Habitat, address cumulative impacts in these two resource areas to a substantial degree. Some additional cumulative effects assessment is presented below. Note also that much of the discussion in the watershed cumulative effects section VIII.3, above, addresses a number of the key cumulative effects factors for aquatic resources, i.e., flow, water temperature, LWD, sediment, and nutrients. Table VIII.14 at the end of section VIII also presents a summary of cumulative impacts for biological resources.

Section VII.6.2 Botanical Resources also discusses cumulative effects issues. Key portions of this section are recapped below.

6.1 Aquatic Resources

The following section addresses the potential cumulative effects of forest practices on aquatic species habitat. This section addresses some of the same topics discussed under watershed cumulative effects, such as stream temperature, large wood, and sediment; however, it discusses these topics in a more integrative fashion that is more focused on overall aquatic health than on each of the component elements thereof.

The first part of this section describes two geographic information system (GIS) based models that were developed to evaluate, in an integrated fashion, factors related to aquatic system health and disturbance due to land management. The Big River is then used as a case study to evaluate the impact of historic forest practices on aquatic resources. Based on this case study, a determination is made that historic logging and log transport practices have had a negative direct and cumulative effect on the presence and recruitment of large wood, stream sediment and temperature regime, and channel geomorphology.

Model 1: GIS Evaluation of Cumulative Watershed Effects and Recovery Potential

Methods

Techniques that describe habitat conditions at scales that exceed individual stream reaches, and encompass entire watersheds can improve an assessment of cumulative effects of forest practices on aquatic species habitat (Dunne et al. 2001). The use of larger spatial units for analysis is somewhat speculative, but is intended to provide a better understanding of how the conditions along an individual stream reach reflect more complex interactions between hillslope processes and the riparian zone. Using a map-based approach, a GIS model was developed to address potential linkages between hillslope processes and stream channel response. Aggregating measures of stream channel condition from individual stream reaches to sub-basins provides a consistent framework to conduct a watershed assessment. The baseline data resulting from the assessment can be used to evaluate cumulative land use practices and can assist in developing restoration strategies.

The model was designed using spatially explicit data that were gathered to conduct the JDSF EIR. To provide a consistent interpretation, each variable in the model needed to exist as complete or comprehensive dataset across the entire cumulative effects assessment area. As a result some data layers were not used in the model. In particular, this meant leaving out a landslide potential layer that was developed by CGS for only a portion of the assessment area. In addition, peak flow data were excluded from the model. However, the results from the peak flow analysis (see Appendix 10) indicated that changes in peak flows were not found to substantially modify channel morphology or downstream habitats.

In total 8 criteria were used to evaluate both current riparian conditions and to represent potential disturbance from management related activities. Each criterion was evaluated

separately. The results were then transformed to ordinal scores with values ranging from one to four. These individual ratings were then combined to produce a composite score for both the overall riparian habitat conditions and an overall disturbance potential rating. A 3 x 3 matrix was then constructed to combine habitat ratings with disturbance ratings (Table VIII.11). The composite score reflects the relative recovery potential for a planning watershed. For example, planning watersheds with a low riparian habitat rating and high disturbance rating would require a longer time frame for recovery of riparian habitat (canopy cover, LWD recruitment…) and channel conditions (pool formation…). Conversely, planning watersheds with a high riparian habitat score and a low or moderate sediment rating may require less in terms of restoration effort and have a much shorter recovery time.

Table VIII.11. Synthesis of Riparian Habitat and Disturbance Ratings.

		Anthropogenic Disturbance Level		
		Low	*Medium*	*High*
Riparian Habitat Indicators	*Poor*	**A** Low disturbance potential, but requires long term restoration of riparian habitat.	**B** Requires long term restoration of riparian habitat and sediment reduction.	**C** Requires long term restoration of riparian habitat and sediment reduction.
	Adequate	**D** Near term recovery possible with improved riparian habitat	**E** Near term restoration possible with reductions in sediment and improved riparian habitat	**F** Requires long term sediment reduction and riparian habitat improvements
	Good	**G** Good habitat conditions and low disturbance	**H** Short term recovery possible with sediment reduction.	**I** Good habitat conditions coupled with high disturbance.

Assessment Criteria

The following criteria were used to represent management related disturbance. For each variable quartiles were used to divide the data into four equal parts. The first quartile, the lower 25% of the distribution, was assigned a value of one, the second quartile (25% - 50%) was assigned a value of two. Data in the third quartile (50% - 75%) were assigned a value of three, and the fourth quartile (75% to 100%) was assigned a value of four.

Criterion 1: Road Sediment

This criterion is based on predictions of surface erosion from SEDMODL v.2 (see section VII.7 Geology and Soils). The estimated surface erosion was originally calculated for individual road segments. The data were summarized by planning

watershed to represent a rate (tons/mi^2/yr). The ordinal ratings (1–4) are on a relative scale. They are interpreted as the lower the rating the lower the sediment rate.

Criterion 2: Density of Road and Stream Crossings
The density of road and stream crossings within a planning watershed was used to represent the potential for road related failures that have the potential to deliver sediment directly to stream channels. Higher densities represent a greater potential for disturbance and result in a higher disturbance rating.

Criterion 3: Riparian Road Density
The density of roads within the riparian zone represents the portion of the road system that is most likely to deliver sediment to a stream channel.

Criterion 4: Stream Temperature
Stream temperature was evaluated using the maximum MWAT recorded in a planning watershed (see section VII.6.1 Aquatic Resources and Appendix 12, Water Temperature). The recorded stream temperature data cover a time period from 1995 – 2004. In many cases there are multiple locations where stream temperature data have been collected within a single planning watershed. However, only the single highest MWAT was chosen to represent potential disturbance.

Criterion 5: Timber Harvesting
This criterion represents the extent of timber harvesting within a planning watersheds from 1986–2004. The data are recorded as the percentage of the watershed area where timber harvesting has occurred. See section VIII.2.1, above.

The following criteria were used to represent riparian habitat conditions:

Criterion 1: Structure of Riparian Forest Stands
This criterion was chosen to represent the potential for streamside forest stands to contribute large wood to stream channels. Using estimated tree size from the available vegetation maps that cover the assessment area, the vegetation data were classified into small (less than 12” dbh), medium (12” – 24” dbh), and large trees (greater than 24” dbh). For each planning watershed the tree size was summarized using a 200-foot riparian buffer. Then the percentage of that area that was occupied by large forest stands was recorded. The data were converted to an ordinal score using the method previously described. A value of four represents a greater proportion of large trees within the riparian buffer and a value of one represents a lower proportion of large trees within the riparian buffer.

Criterion 2: Riparian Shade
Riparian shade was previously collected on planning watersheds within and adjacent to JDSF in support of a draft Habitat Conservation Plan (CDF 1999). The assessment method used both photo interpretation and some field validation to estimate the amount of riparian shade over stream channels. The data were collected in 1996. In most

areas, riparian shade has likely increased over time since 1996, given the application of increasingly stringent riparian protection standards by landowners and regulatory agencies, and by the natural regrowth of vegetation.

Criterion 3: Channel Characteristics
This criterion identifies the extent of source, transport, and depositional stream reaches based on channel gradient and confinement, as modeled in GIS. The data are summarized by planning watersheds and recorded as the percentage of the stream network that is occupied by response reaches.

Model Results
The model results are presented in Figure VIII.3 and Table VIII.12. The results from this model are not definitive. There has been no field validation of the model results. Given those limitations, however, the model does provide a synthetic indication of the influence that historical management practices have had on current habitat conditions for aquatics.

Most of the planning watersheds composed primarily of JDSF lands received ratings that indicate good or moderate habitat conditions with low or moderate disturbance ratings. This outcome suggests that in the context of the assessment area, these planning watersheds may represent a lower relative priority for restoration. In addition, the expected recovery time for these healthier planning watersheds is less than for the more heavily impacted planning watersheds. Also, the restoration actions proposed as part of the JDSF management plan should accelerate natural recovery processes. However, JDSF is only part of two larger river basins. Both Noyo and Big River headwaters have fairly high disturbance ratings that are coupled with low or moderate riparian habitat ratings. The resulting impacts, such as sediment or warm water are transported downstream. Thus, recovery of downstream watersheds is likely to be influenced by disturbance from historic management practices upstream. Recent studies indicate that the lag time between sediment generation and downstream transport (i.e., channel storage) can be quite long (Kohler et al. 2001).

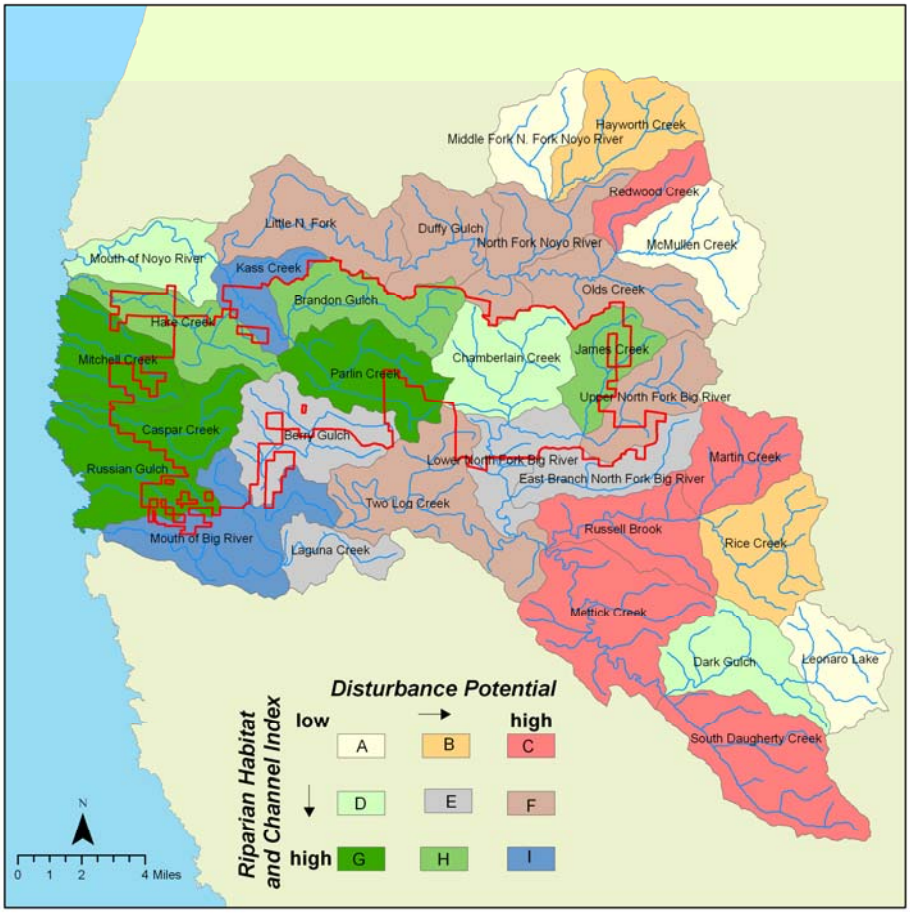

Figure VIII.3. Recovery Potential of Planning Watersheds Across the JDSF EIR Cumulative Effects Assessment Area. Recovery is interpreted through relative levels of anthropogenic watershed disturbance and riparian habitat conditions. Watersheds shown in shades of green generally have favorable habitat conditions combined with low or moderate disturbance ratings. Watersheds in orange, red, and brown have high disturbance ratings that are coupled with low riparian habitat ratings.

Table VIII.13. Habitat Ratings and Scores for Model Variables.

Waterbody	Drainage Area (mi^2)	Riparian	Shade Index	Stream Response	Cross -ings	Road Sediment	Stream Temp.	Peak Flow	Harvest Index	Hazard Score	Recovery Score
NOYO HEADWATERS	**55.3**										
Hayworth Creek	11.1	1		1	3	1	3	2	2	9	B
McMullen Creek	11.0	1		1	2	1	2	2	3	8	A
Middle Fork N. Fork Noyo	7.1	1		2	4	1	1	3	2	8	A
North Fork Noyo River	9.9	2		2	4	1	4	3	3	12	F
Olds Creek	10.8	4		2	3	3	3	3	4	13	F
Redwood Creek	5.3	1	4	1	2	3	3	4	4	12	C
MIDDLE NOYO	**22.1**										
Duffy Gulch	9.0	4		1	3	4	4	3	3	14	F
Little North Fork	13.2	2		2	2	4	3	4	2	11	F
SOUTH FORK NOYO RIVER	**27.4**										
Brandon Gulch	10.1	4	4	3	1	4	2	2	4	11	H
Kass Creek	5.5	4	3	4	4	3	2	4	4	13	I
Parlin Creek	11.8	4	2	3	1	1	2	4	4	8	G
LOWER NOYO RIVER	**8.2**										
Mouth of Noyo River	8.2	2	4	3	2	1	3	2	1	7	D
NOYO RIVER WATERSHED	**113.0**										
BIG RIVER HEADWATERS	**32.8**										
Martin Creek	9.3	2		1	4	3	3	4	4	14	C
Rice Creek	12.6	2	1	1	3	3	1	4	3	10	B
Russell Brook	11.0	1	4	2	4	4	4	3	2	14	C
NORTH FORK BIG RIVER	**43.5**										
Chamberlain Creek	12.3	2	3	3	1	2	2	1	1	6	D
East Branch North Fork Big	8.1	3	2	3	3	3	3	3	1	10	E

Table VIII.13. Habitat Ratings and Scores for Model Variables.

Waterbody	Drainage Area (mi^2)	Riparian	Shade Index	Stream Response	Cross -ings	Road Sediment	Stream Temp.	Peak Flow	Harvest Index	Hazard Score	Recovery Score
James Creek	7.0	4	2	4	4	2	2	1	2	10	H
Lower North Fork Big River	7.7	2	1	4	4	2	4	1	1	11	E
Upper North Fork Big River	8.5	2		3	4	4	3	4	2	13	F
SOUTH FORK BIG RIVER	**54.5**										
Dark Gulch	11.2	3		1	2	2	1	1	2	7	D
Daugherty Creek	16.7	1		2	1	4	4	2	4	13	C
Leonaro Lake	8.3	2		1	1	2	1	1	1	5	A
Mettick Creek	18.3	1	4	2	3	4	4	1	3	14	C
LOWER BIG RIVER	**50.4**										
Berry Gulch	12.5	3	4	3	2	3	2	2	2	9	E
Laguna Creek	5.1	3		2	2	2	1	4	4	9	E
Mouth of Big River (Estuary)	14.9	3	1	4	3	2	4	3	3	12	I
Two Log Creek	17.9	1		4	4	4	4	3	4	16	F
BIG RIVER WATERSHED	**181.2**										
COASTAL WATERSHEDS	**39.4**										
Caspar Creek	**8.4**	4	3	4	1	3	1	2	1	6	G
Hare Creek	**9.7**	4	4	4	2	2	2	2	3	9	H
Mitchell Creek	**10.2**	3	4	4	3	1	1	1	1	6	G
Russian Gulch	**11.1**	3	4	3	2	1	1	1	1	5	G

See text above for explanation of quartile-based rating system.

Model 2: Fish and Game In-Stream Channel Surveys and Ecological Management Decision Support System

In stream surveys have been conducted across many of the streams in the JDSF EIR assessment area by the Department of Fish Game, JDSF staff, Mendocino Redwood Company and Hawthorne Timber Company. Much of this stream habitat data has been collated and made available through the KRIS Big River project (www.krisweb.com) or from DFG directly. The in-stream measurements represent current channel conditions and support an assessment of cumulative watershed effects on aquatic resources. Stream survey data include a broad range of environmental parameters: riparian vegetation, water temperature, stream flow, and in-channel habitat conditions (i.e., large woody debris and pool habitat). The JDSF EIR evaluated the following stream channel measurements: riparian canopy, embeddedness, pool quality, and pool shelter.

Methods

The field data were collected between 1995 and 1999 using Department of Fish and Game stream survey protocols (Flosi et al. 1998). Pools are important habitat for juvenile coho salmon and steelhead trout. Consequently, pool frequency is an indicator of habitat quality and lack of pools is a potentially limiting factor. The ***pool shelter*** rating is used as a relative measure of the quantity and composition of LWD, root wads, boulders, undercut banks, and submersed or overhanging vegetation that serves as in-stream habitat, creates areas of diverse velocity, provides protection from predation, and separation of territorial units to reduce density related competition. ***Pool quality*** is used as a measure of pool depth and pool shelter complexity. Pool tail ***embeddedness*** is an indicator of substrate composition which is used as a suitability measure of pool tail sediments for survival of eggs to the emergence of fry. The percent embeddedness is an indicator of the quality of spawning gravels. Optimal spawning values are considered to be less than 25%. ***Canopy density*** is the percent of stream influenced by tree canopy measured with a spherical densiometer from the center of a stream habitat unit.

The instream habitat data were used in conjunction with the Ecological Management Decision Support (EMDS) computer model to support the evaluation of cumulative effects on aquatics. The knowledge base modeling software in EMDS requires scientists to identify and evaluate specific environmental factors which contribute to the formation of anadromous salmonid habitats. The spatial nature of EMDS makes it particularly useful for evaluating and portraying watershed and stream conditions. The EMDS stream reach model was originally developed to support watershed assessments under the North Coast Watershed Assessment Program (NCWAP). A detailed discussion of the EMDS model can be found in the NCWAP Methods Manual, Appendix G (Bleier et al. 2003; available on line at: http://www.ncwatershed.ca.gov/pdf/NCWAP_Methods_Manual_Final.pdf).

Results

The EMDS results for canopy cover indicate a deficiency in stream shade throughout the mainstem of the Noyo and Big Rivers, but show most tributaries providing adequate

shade (Figure VIII.4). The analysis of stream temperature data also consistently found lower MWAT values along tributaries, but the measurements of MWAT along the

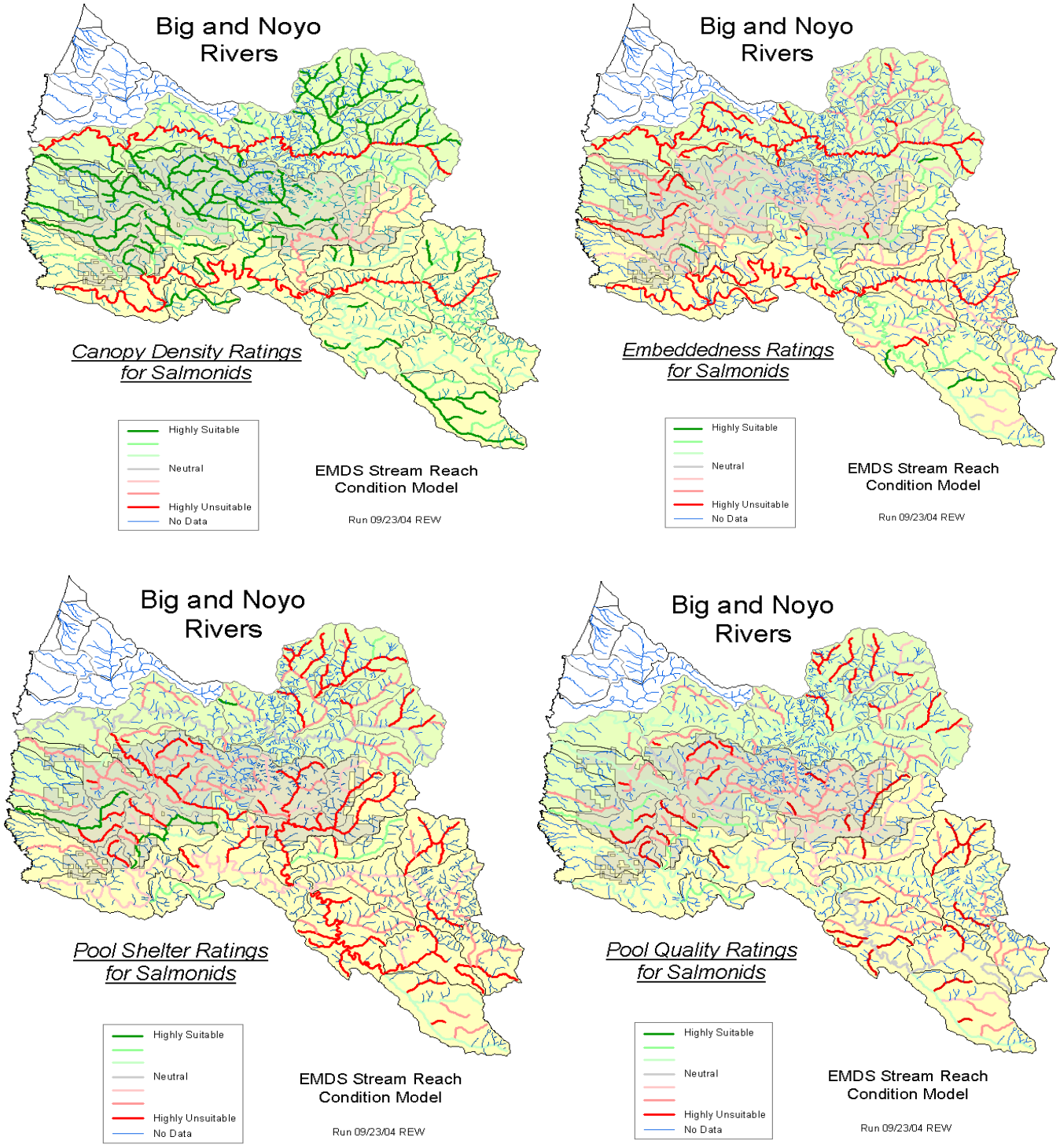

Figure VIII.4. EMDS In-Stream Channel Survey Model Results.

mainstem of the Noyo and Big Rivers had much higher variability then what is predicted from EMDS. Pool tail embeddedness was highly unsuitable across the mainstem of the Big and Noyo Rivers and poor across much of the JDSF ownership. With the exception of Caspar Creek, the measures of pool shelter and pool quality were generally poor across the JDSF ownership and much of the assessment area. The mainstem of the Big and Noyo rivers however, are shown to have adequate pool shelter and pool quality ratings.

Big River Case Study: Historical Context as a Basis for the Assessment of Cumulative Effects

The Institute for Fisheries Resources (IFR) was retained by the California Department of Forestry and Fire Protection (CDF) to acquire, integrate, and interpret watershed information in the Fort Bragg area (Noyo, Ten Mile and Big River watersheds) prior to the inception of the State's North Coast Watershed Assessment Program (NCWAP). The resulting KRIS Big River compilation of watershed information (http://www.krisweb.com/krisbigriver/krisdb/html/krisweb/index.htm) provides historical and contemporary information useful for a land use cumulative effects assessment and is summarized below.

Fish Numbers and Splash Dams

Historical forest management on the Big River dates back to the 1850s. The methods for harvesting and transporting logs to the mill are well documented (KRIS Big River 2000) and likely produced cumulative impacts that persist to varying degrees today. Early fish counts on Big River (circa 1900) do not exist although newspaper accounts of abundant salmon resources and anecdotal recollections are numerous. The frequency of these qualitative expressions of salmon numbers decrease as the use of ***splash dams*** as a means of moving logs to the coast increased. Splash dams were used extensively throughout the Big River watershed to transport logs down stream. A total of twenty-seven dams have been identified on the Big River that operated between 1860 and 1940 (Jackson 1991) (Figure VIII.5 and Table VIII.13). There were more logging dams on Big River than on any other stream in the Redwood region. The upper-most dam on the Big River was 48 miles upstream of the mouth and logs were rafted this entire length. Timing of dam releases was tightly scheduled to coordinate flows as log rafts reached various areas along their route. Construction of these dams began in about 1860 and continued through 1924. Some remained in use through 1943.

The impacts of log drives were long lasting. Log drives removed spawning gravels, large wood and any trees encroaching on the stream that might impede log movement. Log drives occurred as frequently as four times a year, and little of the Big River watershed was not affected by this practice. These stream reaches generally exhibit a low level of instream habitat complexity and diminished carrying capacity for juvenile salmonids. Log drives continued on the North Fork Big River through 1943. Many subwatersheds still exhibit the effects of early logging and wood transport with splash dams. Pool frequency is low and pools are generally shallow.

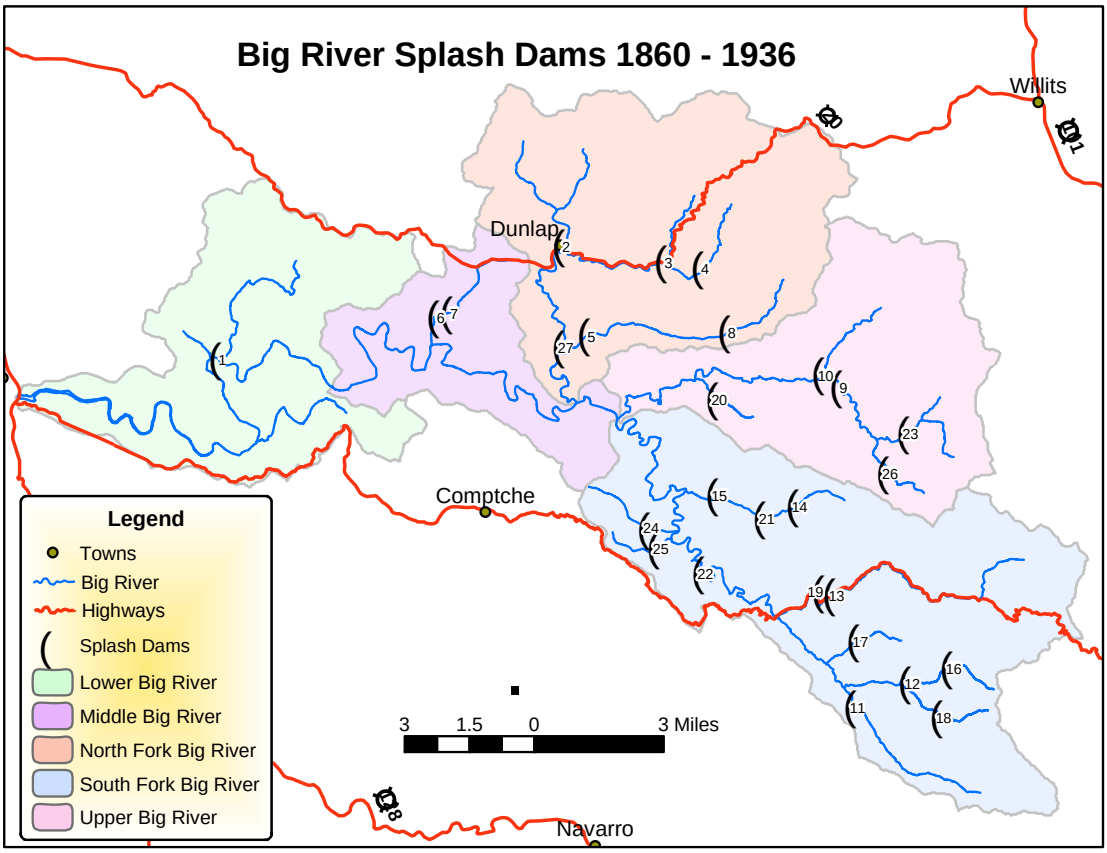

Figure VIII.5. Location of Splash Dams on the Big River (Rutland 2003 adapted from Jackson 1991).

Table VIII.13. Splash Dams on the Big River (Rutland 2003 adapted from Jackson 1991).

Dam Number	Name	Construction Date	Dam Number	Name	Construction Date
1	Little Northfork	1860	15	North Fork Ramon Creek	1880s
2	Chamberlain Creek	1860s	16	Upper Gates Creek	1892
3	James Creek	1860s	17	Soda Creek	1892
4	Milliken	1860s	18	Horsethief Creek	1893
5	Lower East Branch	1860s	19	Johnston Creek	1900
6	Lower Two Log Creek	1860s	20	Russell Brook	1907
7	Upper Two Log Creek	1870s	21	Lower Ramon Creek	1909
8	Upper East Branch	1870s	22	Hellsgate	1913
9	36-Mile	1880s	23	Johnston	1914
10	Martin Creek	1883	24	Mettick Creek	1915
11	Dougherty Creek	1885	25	Anderson Gulch	1917
12	Lower Gates Creek	1886	26	Valentine Creek	1919
13	Handley Halfway	1887	27	Big Northfork	1924
14	Upper Ramon Creek	1888			

The cumulative watershed effects on aquatic species habitat from this practice—called by some to be the most profound and lasting impact to fish habitat in the watershed—include loss of in stream habitat, simplification of channel morphology, harvest of large conifers in the riparian zone and associated reduction in the recruitment of large wood to stream channels, increased levels of sediment input to stream channels, and likely increases in water temperature from more open or absent forest canopies.

Taylor (1978) estimated that the Big River had an adult coho population of 6,000 and a steelhead population of 12,000. No field data were collected and his estimate was based on weir counts at the Noyo River Egg Taking Station. However, salmon numbers generated from that site are variable given timing of egg station operation and personnel available to operate the site. The actual carrying capacity of the Big River may have been less than the Noyo River at that time because of extensive logging in the 1930s and 1940s in the North Fork Big River, Little North Fork and Laguna Creek. Department of Fish and Game reports in the 1950s and 1960s document very poor stream habitat conditions and sparse fish numbers in many Big River sub-basins and attribute those findings to stream damage from logging activity at that time and earlier.

Daugherty Creek and the South Fork Big River, however, were logged in an earlier period and had recovered to where they harbored coho CDFG (1959b, 1966c). Elwell (CDFG 1966c) surveyed the South Fork Big River and found coho salmon and steelhead very numerous and in almost equal proportions. Coho juveniles were estimated at 250/100 feet and steelhead at 300/100 feet. Morehouse (CDFG 1959) notes that Daugherty Creek was "the most important tributary of the South Fork of the Big River for the production of steelhead and silver salmon (coho)."

Fisheries data collected since 1944 by the CDFG and more recently by the Mendocino Redwood Company and Hawthorne Timber Company suggest that coho are at remnant levels or absent in much of the basin. The diminished range of coho in the Big River basin and sub-optimal conditions in sub-basins where they exist suggest very limited carrying capacity. Consequently, it is likely that the coho population today is down by an order of magnitude from 1960s estimates.

Causative Elements

Instream Large Wood Supply

From the 1950s through the 1980s instream wood removal commonly occurred on streams throughout both the Big and Noyo Rivers (Figure VIII.6). Ironically, this activity was promoted and encouraged by the Department of Fish and Game in an effort to improve aquatic habitat. It was thought at the time that large debris jams represented barriers to spawning salmonids, and that the sediment impoundments were preventing the development of riffle habitats. Large woody debris was removed from stream reaches in planning watersheds within and adjacent to JDSF. Additional information on stream clearance can be found through the KRIS Big River project (www.krisweb.com).

"One of the working hypotheses concerning coho salmon ecology and management in Mendocino County streams is that large woody debris (LWD), and the rearing habitat that it provides, may currently be the most important factor limiting coho populations. The well-documented role of LWD in coho salmon ecology, combined with the observation that the recent decline of coho salmon in California appears to be somewhat coincident with large-scale LWD removal programs led quite naturally to this hypothesis." (CDF 1999).

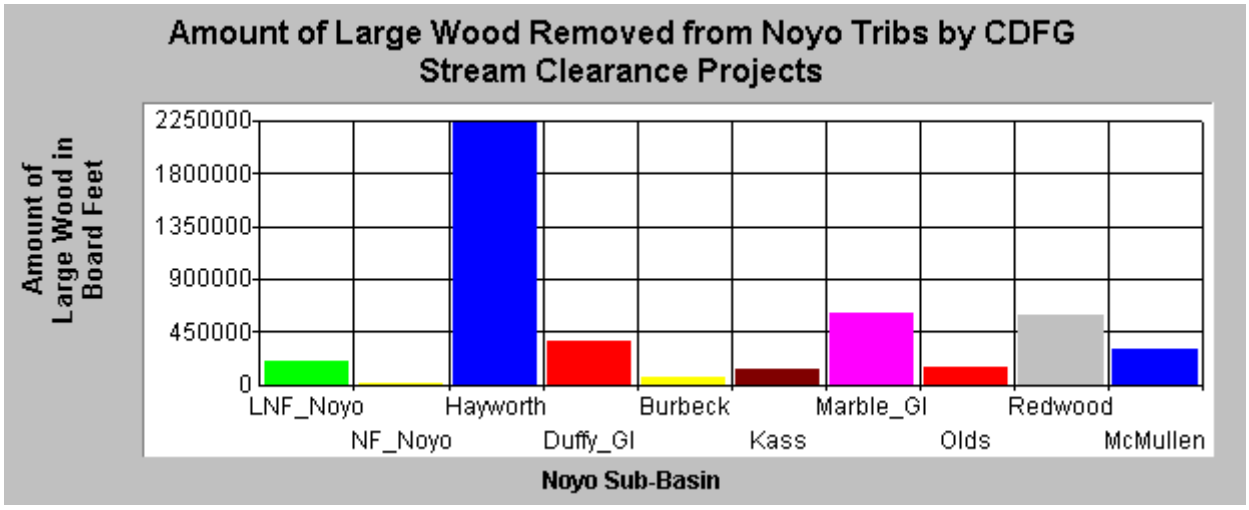

Figure VIII.6. Large Wood Removal from Noyo River Tributaries by DFG, 1950s through 1980s.

Large wood as an instream habitat element is particularly important in streams of unconsolidated geology for its role in helping create and maintain fish habitat diversity, storing and metering excess sediment supply (Kelley et al. 1995), and pool formation for rearing and cover. The addition of large wood to streams has been shown to increase pool frequency and coho salmon production (Cedarholm et al. 1997). An analysis of habitat typing data and remnant distribution of coho salmon in the Ten Mile River basin (the next basin to the north of the Noyo River basin) revealed that the streams where coho persist could be predicted by levels of scour pool habitat formed by large wood (Mangelsdorf and Clyde 2000).

O'Connor and Ziemer (1989) found that large wood supply in the North Fork Caspar Creek reflected timber harvest activities from 100 years prior. The average density of large wood in the bank-full channel was measured at 339 m^3/ha, or 24.3 m^3/100m. This density, in a second-growth channel, is 21% of the average reported for twelve reaches in Redwood National Park, and 47% of the average reported for twenty-eight pre-harvest streams in coastal Washington (Shott 2000). A predominance of fir and alder in the North Fork Caspar Creek is likely the result of early succession of harvested riparian zones, and O'Connor and Ziemer suggest that large wood supply may actually

decrease over time due to a century-long delay in recruitment of decay resistant redwood. The authors noted that only 7% of all large wood in the bank-full channel was associated with pool habitat, but redwood root-wads left after harvesting were conspicuously important in that function.

Surfleet and Ziemer (1996) returned to the North Fork Caspar Creek after half of that basin was clear-cut around riparian buffers in 1992, and comparatively studied the South Fork Caspar Creek where the basin was selectively cut without riparian buffers, and where stream-cleaning activities occurred 25 years earlier. The study supports the importance of riparian buffer strips for providing the recruitment of large wood to streams, but further documents the wood supply deficit from historic logging and large woody debris removal as a part of stream restoration efforts prior to about 1990.

Existing large wood supplies within streams of the Big River area are very low, as recorded by Mendocino Redwood Company surveys of 28 streams in the Big River basin, and CDFG surveys of Hare Creek (1999) and Caspar Creek (1999). Hare Creek was subject to wood removal in the 1960s, and the wood supply in Hare Creek is conspicuously lower than that in Caspar Creek.

The Mendocino Redwood Company surveyed reaches of the Big River watershed, North Fork, and South Fork of the Big River and found they had no key pieces of large wood or wood which could individually contribute to pool formation. Moderate-sized tributaries, such Two Log Creek, East Branch of the North Fork, Upper Big River, Daugherty Creek, and Ramon Creek, each averaged less than 5 cubic yards/100 meters of wood in the key piece category. Habitat data for the Big River basin have not been analyzed with regard to scour pool frequency or wood-formed pool frequency, but the readily available attributes of maximum pool depth and overall pool frequency show that pool habitat in most streams in the area would be rated as poor or fair.

Sediment Inputs and Salmonid Survival Rates

The Big River is recognized as impaired with regard to sediment under section 303d of the Clean Water Act and a *Big River Total Maximum Daily Load for Sediment* (U.S. EPA 2001) has been prepared. The report states that: "The primary adverse impacts associated with excessive sediment in the Big River pertain to the anadromous salmonid fishery. The water quality conditions do not adequately support several anadromous salmonid species present in the Big River and its tributaries, which has contributed to severe population declines." Those findings are consistent with other data showing that levels of fine sediment in gravels are over thresholds for optimal coho and steelhead egg and alevin survival, and that rearing habitat quality is also limiting.

Barnard and McBain (1994) note that gravel permeability, dissolved oxygen, and gravel particle size composition are substrate parameters affecting the survival of incubating salmonid embryos. Less permeable gravels had lower survival rates. The California Department of Fish and Game (Flosi 1998) has characterized good spawning substrate as less than 25% embedded.

Mendocino Redwood Company has collected Big River gravel samples and permeability data at five locations. Permeability at some MRC Big River monitoring locations indicates low egg and alevin survival. Gravel samples from MRC are dry sieve and samples from Daugherty Creek show high levels of sand and fine gravel (<5.6 mm). Three of four sites exceeded 30% in 2000. This level of fine sediment is generally recognized as an impairment to salmonid survival (Kondolf 2000; U.S. EPA 2001).

Kondolf (2000) surveyed the literature, averaged the data from ten studies and found 50% egg and alevin mortality in salmon redds when sand sized particles (< 6.4 mm) comprise 30% of the stream bed. These studies are consistent with a 14% target for fine sediment <0.85mm and 30% target for 6.4 mm set by regional TMDL studies, such as was done for the Garcia River (US EPA 1998). However, Kondolf also found that spawning salmonids are capable of reducing the level of fine sediment from within the egg pockets as they are excavated.

High embeddedness in the Big River suggests that spawning habitat quality is low. Most locations show little habitat with less than 25% embeddedness. Pool frequency is low and there are few pools over three feet in depth, both indicators that sediment is limiting salmonid rearing habitat. Matthews and Associates (2001) performed a preliminary sediment budget for the Big River which shows episodic waves of sediment related to land management since 1952. Their report shows a recent increase following a period of widespread land use activity since 1985, which included extensive timber harvest and associated road construction in the watershed.

Excessive sediment may also reduce pool volume and frequency, potentially reducing the survival of coho salmon which use pools as rearing habitat. CDFG (1998) characterized streams with greater than 40% pool frequency as being healthy salmonid habitat. Murphy et al. (1984) found pool frequencies of 39-67% in undisturbed streams. Brown et al. (1994) noted the importance of having pools deeper than a meter (39 inches) for coho juvenile rearing, and stated that loss of pools was a principal cause for loss of coho salmon in northwestern California.

Water Temperature: Big River

JDSF predominately influences water temperature along the North Fork of the Big River, and to a lesser extent, along the Little North Fork of the Big River. Water temperature data along the mainstem of Big River consistently exceeds the 16.8°C MWAT threshold. The Big River is listed as temperature impaired per Section 303(d) of the federal Clean Water Act. Thus, management practices that have the potential to elevate stream temperatures are of concern. Water temperature data were assessed by the NCRWQCB staff under the NCWAP watershed assessment program and a summary of the data is provided in Appendix 12 (see Aquatics section). However, a more general discussion of water temperature issues is presented here for completeness of known water temperature issues.

Some of the warmest stream temperatures on JDSF have been recorded along the lower reaches of Chamberlain and James Creek. Chamberlain and James Creek are the eastern most watersheds that are predominately managed by JDSF. As interior

watersheds, they can be influenced by very warm air temperatures throughout the summer months. Both watersheds have a history of intensive land management, but have had very little (none on JDSF lands) timber harvesting over the last 20 years. The maximum value for MWAT ranged from 13.8 to 18.9 °C, based on water temperature data collected from 1996 through 2003.

Stream temperatures are very similar at the mouth of James and Chamberlain Creeks. Chamberlain Creek is a larger watershed (7,868 acres) than James Creek (4,459 acres), but both have a similar north-south orientation. Both creeks exhibit a distinct increase in stream temperatures in the downstream direction. Based upon a limited data record, stream temperatures increased by 2.5 °C in the downstream direction on Chamberlain and 3.5°C on James Creek. Unlike the South Fork Noyo, there has been virtually no timber harvesting in Chamberlain Creek since 1985, and only two recent harvest units in James Creek off of JDSF land. As such, canopy conditions are likely to have improved as a result of canopy development along both channels, where relatively young forest has re-grown to replace the old forest that existed prior to the 1940s and 1950s.

Stream temperature data have been collected at four locations along the North Fork of Big River. Stream temperature appears to be much higher upstream of the JDSF boundary, cooling as it passes through JDSF, and then increasing below the JDSF boundary (NCWAP 2004, Appendix B). Stream temperature data loggers have recorded higher temperatures at the station above the confluence of James Creek than at downstream locations within JDSF. Stream temperatures do not appear to increase as water flows past the entrances of James and Chamberlain Creeks. Water temperatures recorded on the mainstem of the North Fork of the Big River are consistently higher than water temperatures recorded along the lower reaches of James and Chamberlain Creeks. The computed MWAT on the North Fork of the Big River upstream of Chamberlain is a full degree (Celsius) higher than the MWAT recorded from the station on Chamberlain Creek just above its confluence with Big River. As such, the conditions within JDSF appear to have a moderating temperature effect upon water flowing into the state forest. As canopy continues to develop adjacent to these stream reaches in the future, the cooling trend is likely to continue and to improve.

Cumulative Effect Matrices and Determination of Cumulative Effects

The Institute for Fisheries Resources (IFR), as input to the State's North Coast Watershed Assessment Program (NCWAP), compiled watershed information as part of the KRIS Big River Project (see URL above) and developed several matrices that illustrate the variety of pathways along which cumulative watershed effects could impact certain salmonid life history stages. Links to these matrices are listed below.

Eggs and alevin: http://www.krisweb.com/watershd/cwe1.htm

Juvenile salmonids: http://www.krisweb.com/watershd/cwe2.htm

Adult salmonids: http://www.krisweb.com/watershd/cwe3.htm

It is highly likely that salmonids, amphibians, and other aquatic values within the Big River watershed have experienced significant adverse cumulative effects. Historic logging and log transport practices had a negative direct and cumulative effect on the presence and recruitment of large wood, stream sediment and temperature regime, and channel geomorphology. Negative cumulative effects on salmonids and amphibians likely continued to accumulate until passage of the modern Forest Practice Act in the early 1970s, increased recognition of fish and amphibian habitat needs through research and monitoring, promulgation of additional Forest Practice Rules by the Board of Forestry and Fire Protection to enhance habitat protections, and formal listings under both State and federal Endangered Species Acts.

Current Trajectory of Habitat Condition

Improving canopy and channel conditions indicate that a recovery process has started and continues with a positive trend that is leading to improved habitat conditions. Recent mapping of channel characteristics in the Big River watershed was done as part of a watershed assessment conducted by the North Coast Watershed Assessment Program (NCWAP). The mapping was based on two photo dates, 1984 and 2000. Channel features that were associated with disturbance, termed “Negative Channel Features” are shown in green (Figure VIII.7). The general findings of this watershed assessment documented far fewer disturbance features in the 2000 photo date than those noted in 1984. This study identified habitat improvement and recovery of channel morphology between the two photo dates. The lower Big River however, is the one exception where the extent of negative (i.e., disturbance related) channel features increased. The upper mainstem, South Fork, and Dougherty Creek all contained more negative features in 1984 and fewer features in 2000, thus they all appear to have improved overall. The North Fork of the Big River contained fewer “negative” in-channel features than the mainstem or South Fork channels in both photo years (NCWAP 2003).

Watershed Restoration and Planning

The goals of watershed restoration are to reestablish the structure and function of an ecosystem, including its natural diversity, and a comprehensive, long-term program to return watershed health, riparian ecosystems, and fish habitats to a close approximation of their condition prior to human disturbance. The Big and Noyo Rivers are rural river basins with a long history of timber harvesting. The main impacts to the watershed are related to water quality: excess sediment and controlling or minimizing the likelihood of high water temperatures. There are also potential impacts from changes in forest condition on wildlife habitat for threatened and endangered species.

The lack of reference sites within the assessment area makes it difficult to precisely define a desired future condition that represents a goal or target for watershed restoration. It is generally recognized that sediment reductions are needed, along with maintenance and enhancement of stream canopy. This need is reflected in the types of restorations projects that are currently being implemented across the assessment area. While restoration goals and priorities are not specifically stated in them, water quality

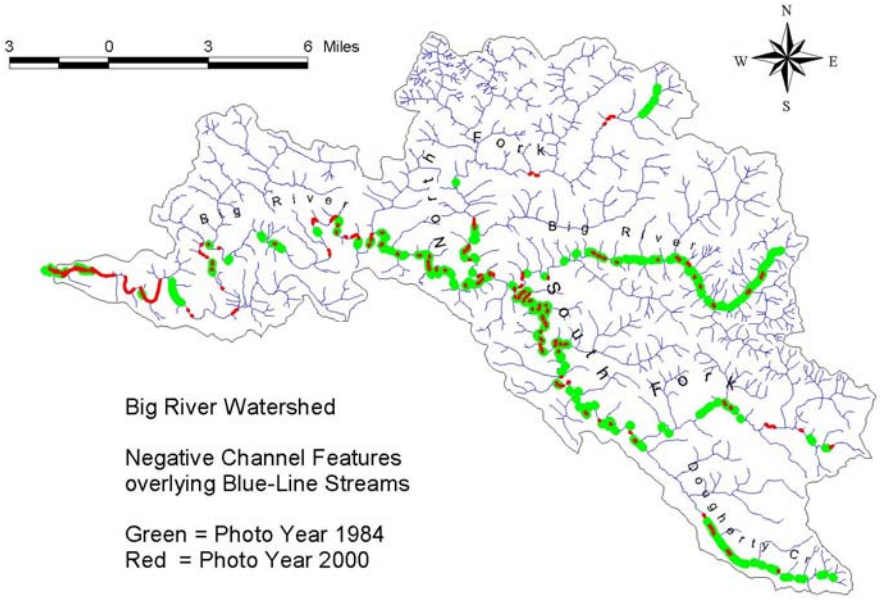

Figure VIII.7. Channel disturbance in major channels within the Big River watershed including the mainstem and North and South Forks of Big River and Dougherty Creek (a tributary to the South Fork).

control plans implemented through the North Coast Regional Water Quality Control Board (NCRWQCB) provide numeric targets for meeting water quality objectives that are designed to support beneficial uses. In the Big and Noyo River watersheds, cold water fisheries are deemed to be the most sensitive among the beneficial uses that the watershed supports (NCRWQCB). The beneficial uses are related to the Big River watershed's coldwater fishery are:

- Commercial and sport fishing (COMM);
- Cold freshwater habitat (COLD);
- Migration of aquatic organisms (MIGR);
- Spawning, reproduction, and early development (SPWN); and
- Estuarine habitat (EST).

The over-arching goal of demonstrating sustainable forestry will provide for a broad range of forest habitat conditions (p. 51, JDSF DFMP). With regard to watershed values, riparian and stream ecosystems will be protected or restored by managing forest stands in WLPZs to promote their ecological succession to late seral forest conditions (p. 76, JDSF DFMP).

Some specific elements include:

- Increase the abundance and distribution of key pieces of LWD.

- Maintain streamside overstory to avoid or minimize impacts to stream temperatures.
- Promote bank stability through retaining streamside vegetation and the use of equipment exclusion zones (EEZs) or equipment limitation zones (ELZs).

Watershed restoration in riparian areas is also promoted by restrictions to forest management in WLPZs as stated in the Forest Practice Rules and the adherence to the BOF Threatened and Impaired Watersheds rules.

Watershed restoration also is addressed in the JDSF management plan through timber operations and road maintenance. The JDSF management plan attempts to minimize the input of management related sediment to streams by identifying and limiting management activities on potentially unstable areas. In addition, the implementation of the JDSF road management plan is expected to promote watershed restoration by reducing the input of road-related sediment to stream channels (p.78, JDSF DFMP). Specific elements of the Road Management Plan are designed to reduce the delivery of sediment to streams which would lead to reductions in turbidity and suspended sediment (p.80, JDSF DFMP). These elements include: hydrologically disconnecting inside ditchlines along road segments from watercourses and other road upgrading actions, reducing winter hauling on wet roads, properly decommissioning roads located near watercourses, and use of annual inspections of roads to improve road maintenance. In addition to road management actions, improvements associated with hillslope operations will reduce sediment entry into watercourses. These practices include reduced tractor logging on steeper slopes, better recognition and mitigation measures for unstable slopes and inner gorge areas, and use of wider equipment exclusion zones, keeping ground disturbing activities further away from stream channels. In following these approaches, the DFMP is expected to make significant contributions to watershed restoration and recovery.

Similar land management policies are being implemented by surrounding landowners to further improve the generally nascent but positive trajectory of habitat conditions and salmonid and amphibian populations. Monitoring efforts are needed to confirm and quantify expected improvements. Recent acquisition of the lower portion of the Big River watershed by the Department of Parks and Recreation will--given time anticipated restoration activities, and the dynamics of forest and stream ecosystem succession--result in improved conditions for salmonids, amphibians and other aquatic life. This portion of the Big River watershed continues to exhibit many of the effects of past and contemporary management as watershed level impacts work their way through the stream system to the ocean. In addition, the Mendocino Redwood Company has developed a number of aquatic policies designed to guide their land management decision making (see www.mrc.com for a detailed discussion). These include:

- Increasing the baseline survey data for species such as coho salmon, Chinook salmon, steelhead trout, aquatic amphibians, and macroinvertebrates
- To control the flow of fine and coarse sediment into streams, MRC restricts operations in unstable areas, restricts winter harvesting, covers bare mineral soil,

and most importantly reconstructs and de-activates roads with high potential for sediment input or failure.

- Implementation of a road management plan will be developed to cover ongoing monitoring and maintenance for temporary, seasonal, and permanent roads.
- A long-term road management plan will be developed to cover ongoing monitoring and maintenance for temporary, seasonal, and permanent roads.
- To improve recruitment of LWD in streams, MRC permanently retains larger trees near stream channels and restricts removal of downed logs in stream zones.
- Any current or future livestock leases will include mitigation measures to protect streamsides and avoid riparian damage.

Restoration Projects

Over the last several years there have been an extensive number of restoration projects throughout the JDSF EIR assessment area (Table VIII.7). The vast majority of these restoration projects are done for the purpose of sediment reduction. They include road repairs, resurfacing dirt roads to gravel, repairing culverts, and road decommissioning. A smaller number of projects have been conducted to address fish passage barriers and to improve fish habitat by adding large woody debris to stream channels. Restoration projects are widespread across the assessment area (Map Figure Y). Most all planning watersheds have some type of restoration project being conducted in them. The long-term cumulative effect of these projects should result in improved water quality through a reduction in sediment sources and improved riparian habitat conditions.

Recapping Aquatic Resources Cumulative Impacts Analyses from Earlier Sections

Section VIII.3 Watershed Cumulative Effects, above, reiterated a number of impact analyses from earlier sections of the EIR that relate to aquatic resources cumulative impacts (e.g., water temperature and sediment). This section briefly reiterates some additional earlier cumulative impact analyses related to aquatic resources, as presented in section VII.6.1 Aquatic Resources.

The following two impact discussions are excerpted from section VII.6.1.7, project impacts on aquatic resources:

Project Impact 1: ***Potential to have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive or special status species in local or regional plans, policies, or regulations, or by the CDFG or U.S. Fish and Wildlife Service.***

Impact 1e: *Channel Geomorphology* (Less than Significant)

Channel geomorphology is affected by a number of factors. These include geology, channel gradient and confinement, rainfall patterns and hydrology, LWD and sediment inputs, and the cumulative effect of anthropogenic activities upstream and at a given site. The other factors affecting geomorphology are discussed in the section VII.7 Geology and Soils and VII.10 Hydrology and Water Quality.

As detailed in Section VII.6.1 and also above, the DFMP (alternative C1) and alternative C2 include Hillslope Management Guidelines, WLPZ retention standards, use of CEGs on projects, and an Accelerated Road Management Plan that will reduce the potential for impacts to channel geomorphology. Further, the Large Woody Debris Survey, Recruitment, and Placement additional management measure will provide adequate levels of instream LWD to ensure properly functioning channel geomorphology. The resulting impacts on channel geomorphology will be less than significant. No mitigation was found necessary for alternatives C1 and C2.

Under alternative A, there will be no timber harvest and associated potential effects that can alter channel geomorphology. However, there could be increased sediment from non-maintained roads that could fill pools and gravel interstices and reduce channel capacity. These potential impacts could be mitigated to less than significant though the adoption of a Road Management Plan.

Alternative B provides no special protections for channel geomorphology beyond the FPRs. Increased sediment delivery from roads that are not upgraded or decommissioned could fill pools and gravel interstices and reduce channel capacity. Potential road sediment impacts could be mitigated through the adoption of a Road Management Plan. Potential hillslope sediment impacts could be mitigated through the Hillslope Management Guidelines developed in the DFMP. Mitigation with a measure such as Large Woody Debris Survey, Recruitment, and Placement would ensure adequate instream LWD to address channel geomorphology processes and to reduce overall impacts to less than significant.

For alternatives D through F, enhanced riparian zone protections, Road Management Plan, Hillslope Management Guidelines, and use of CEGs on THPs should reduce sediment delivery below current conditions and not result in further degradation of channel geomorphology. Thus, there would be a less than significant impact under these alternatives.

Project Impact 3: *Potential to have a substantial effect on any riparian habitat.*

Impact 3c: *Instream Habitat and Streambank Stability* (Beneficial)

As an instream habitat-based impact, this impact represents a potential cumulative impact issue, since instream habitat at any one point integrates both on-site and

upstream aquatic habitat factors. Section VII.6.1 and the section above discuss instream habitat factors in detail, as well as the various land use, regulatory, and management measures that are relevant to this topic, in terms of both the range of EIR alternatives for JDSF as well as for other land managers within the cumulative effects assessment area.

The analysis in section VII.6.1.7 concludes that, taken as a whole, the measures in the alternatives C1 and C2 would result in beneficial improvements to instream habitat and streambank stability. No mitigation was identified as needed to prevent significant adverse impacts.

Alternative A does not permit any harvesting, thus maintaining all the benefits that current riparian vegetation provides to instream habitat quality and streambank stability. Further, without harvest, these vegetation values will increase over time as trees get larger and forest canopy denser. This alternative would benefit instream habitat and streambank stability over time.

Under alternative B, application of the FPRs may not affect instream large wood and habitat in some reaches. However, riparian silviculture may reduce large wood recruitment potential in watercourses where instream wood loads are low, thereby affecting instream habitat. Mitigation regarding WLPZ outer zone harvesting is needed, such as the Large Woody Debris Survey, Recruitment, and Placement management measure. With this mitigation, the impact would be less than significant.

Alternatives D, E, and F have measures including no-cut zones and wide stream buffers where they promote the development of late successional riparian habitat and will likely lead to beneficial improvements in instream habitat quality and streambank stability.

Project Impact 5: *Causes a fish or amphibian population to drop below self-sustaining levels or threaten to eliminate an aquatic community.* (Beneficial)

Section VIII.6.1 discusses the management practices the various alternatives would follow with respect to fish and amphibian population levels. As discussed above, other large industrial landowners within the watershed cumulative effects assessment area also are implementing measures to improve aquatic habitats, particularly MRC, which manages 25% of the assessment area, and State Parks, which manages 5% of the assessment area. An additional portion of the assessment area is under NTMPs, which have their own set of special requirements for protecting and enhancing water quality.

Fish and amphibian populations can be extirpated from watercourses and watersheds if conditions degrade to a point that populations are no longer self-sustainable. This loss represents a cumulative impact. Fish and amphibian populations are not expected to drop below self-sustaining levels under the DFMP (alternative C1), alternative C2, or alternatives D through F. Similarly, no aquatic community will be eliminated. In general, conditions for aquatic species are expected to show continued improvement over time, given current aquatic habitat conditions, the management practices

incorporated in these alternatives, and the anticipated management practices of other landowners within the cumulative effects assessment area.

For alternative A, lack of a Road Management Plan could result in increased sedimentation, alter flow and channel geomorphology, and restrict fish movement and access to spawning areas, potentially resulting in significant adverse impacts. Implementation of a Road Management Plan as a mitigation would reduce the potential for these impacts and would likely reduce sedimentation over time, which would be beneficial. This mitigation would result in less than significant impacts.

Alternative B also lacks a Road Management Plan and, because it includes timber harvest, lack of Hillslope Management Guidelines also is of concern regarding potential sedimentation. WLPZ harvest activity and its potential impact on large wood recruitment could be mitigated with the Large Woody Debris Survey, Recruitment, and Placement management measure. Promotion of late seral habitat conditions within WLPZs and added protections of Class III/headwater streams in addition to the Road Management Plan, as well as application of Hillslope Management Guidelines, could further reduce risk of sedimentation, restriction of fish movement and altered channel geomorphology, and increase large wood recruitment to stream systems generally lacking this attribute. With these mitigations, alternative B would have a less than significant impact.

Project Impact 6: *Reduce the number or restrict the range of a rare or endangered aquatic plant or animal.* (Beneficial)

This impact represents a cumulative impact since significant reductions in the number of or restrictions to the range of aquatic animals typically occur as the result of a cumulative impact, rather than just a single impact from one project. There are no known rare or endangered aquatic plants on JDSF. Coho salmon and steelhead trout occurring on JDSF are listed as “threatened” under the federal ESA and coho are listed as “endangered” under the California ESA. Existing habitat impairments—resulting for the most part from cumulative impacts—for these fish species have been discussed extensively above. The number and range of salmonids were reduced on the JDSF cumulative effects assessment area in part from the effects of timber operations prior to the introduction of the modern Forest Practice Rules.

Like aquatic animals, sediment impacts can have negative effects on aquatic plants. The effects relative to aquatic plants should be similar for aquatic animals.

The definition of Aquatic plants includes plants that are growing under, in or on water and rooted in bottom sediment or floating (Hickman,1993). The scoping process described in the Botanical section did not identify any floating aquatic plants. Many of the Plants of Special Concern (Table VII.6.2.1.) have bog, or swamp listed in their habitat descriptions, and could be considered aquatic by Hickman’s definition. These plants were analyzed as part of the “Wet Areas Functional Group” in table VII.6.2.3.

Discussion of this functional group noted that watercourse and lake zones would provide protections for these species.

Under the DMFP (alternative C1), alternative C2, and alternatives D through F, the proposed management practices (as described in section VII.6.1), in combination with existing conditions and the anticipated management practices of significant additional ownerships in the cumulative effects assessment area, would have a beneficial effect on the number or range of threatened or endangered fish.

For alternative A, lack of a Road Management Plan could result in increased sedimentation, alter flow and channel geomorphology, and restrict fish movement and access to spawning areas, potentially resulting in significant adverse impacts on the number or range of salmonids. Implementation of the Road Management Plan as a mitigation would reduce risk of these potential impacts. It would likely reduce sediment levels over time. This mitigation would result in less than significant impacts.

Alternative B also lacks a Road Management Plan and, because it includes timber harvest, lack of Hillslope Management Guidelines also is of concern regarding potential sedimentation and its impacts on salmonid numbers. WLPZ harvest activity and its potential impact on large wood recruitment could be addressed with application of the Large Woody Debris Survey, Recruitment, and Placement management measure. Additional mitigations for promotion of late seral habitat conditions within WLPZs and added protections of Class III/headwater streams in addition to a Road Management Plan, as well as application of Hillslope Management Guidelines, would further reduce potential impacts to salmonid numbers and range. With these mitigations, alternative B would have a less than significant impact.

VIII.6.2 Wildlife and Wildlife Habitat

Section VII.6.6 Wildlife and Wildlife Habitat provides a substantial level of cumulative effects analysis for this topic because it is largely habitat based and examines habitat and its wildlife implications across the entire assessment area. Key highlights of that section are recapped here to stress the important potential significant impacts to wildlife and their habitat. However, the reader is referred to section VII.6.6, particularly sections VII.6.6.3 and VII.6.6.6 through VIII.6.6.9, as well as Table VII.6.6.34.

The impact summary tables at the end of Section VII.6.6 address a large number of species and habitat issues. The issues that have received that greatest amount of concern from the public, wildlife biologists, and others, or indicated the potential for significant adverse cumulative impacts for the DFMP (alternative C1) are:

- late succession/old-growth forest
- snags and down wood
- riparian habitat
- unique/special habitats and features

- wildlife communities and habitat values
- Southern Torrent Salamander and Tailed Frog
- Marbled Murrelet
- Northern Spotted Owl
- Vaux's Swift and Purple Martin
- Sonoma red tree vole
- reduction in the number or range of an endangered species
- interfere with movement, migration, or use of nursery areas
- cause a wildlife population to drop below self-sustaining levels

The analysis results for these issues are summarized in Table VIII.14. For more details on these factors and other wildlife and species cumulative effects, see section VII.6.6 Wildlife and Wildlife Habitat. The analysis find that--in some cases after mitigation, in other cases without additional mitigation—there would be no significant adverse cumulative impacts associated with the proposed DFMP (alternative C1), or any of the other alternatives. In a number of cases, C1 and other alternatives would result in beneficial cumulative impacts, for example for riparian habitat or for Marbled Murrelet habitat.

VIII.6.3 Botanical Resources

Section VII.6.2 discusses botanical resources and various regulatory and management measures to protect botanical resources, with section VII.6.2.6 specifically discussing potential impacts to botanical resources from the seven EIR alternatives. Here we recap impacts from section VII.6.2.6 that have cumulative impacts implications.

Several of the botanical resource impacts identified in section VII.6.2.6 have at least partially a cumulative impacts nature. These are listed here with the finding for the project alternative (C1), and the reader is referred to section VII.6.2.6 for the analyses and results for all seven alternatives:

Impact 1: *The project has the potential to threaten to eliminate a plant community*. (Less than Significant)

Impact 2: *The project has the potential to threaten to reduce the number of an endangered, rare, or threatened species.* (Less than Significant)

Impact 3: *Have substantial adverse effects, either directly or indirectly through habitat modifications, on any species identified as a candidate, sensitive, or special status plant species in local or regional plans, policies, or regulations, or by the CDFG or USFWS.* (Less than Significant)

Impact 4: *The project has the potential to threaten to restrict the range of an endangered, rare, or threatened species.* (Less than Significant)

Impact 7: Forest management activity impacts to the Mushroom Corners area could cause adverse impacts to the type localities for 26 fungi species with a resulting loss of scientific value. **(Less than significant)**

Impact 6 is specifically a cumulative effects impact:

Impact 6: ***Cumulative effects resulting in a reduction in the range of a species, or local extirpation of a plant species on a spatial scale that includes the larger analysis area. This threshold includes changes in the environment caused by the interaction of ecological processes and multiple effects.*** **(Less than Significant**)

This cumulative impact is assessed at length in section VII.6.2.6, particularly for the project alternative, C1 (the DFMP). The assessment finds that there would be a less than significant impact for C1. Given the minimal Forest management that would occur under alternative A, the overall cumulative impact on plants is expected to be less than significant.

Alternative B is identified as needing mitigation to ensure that significant adverse cumulative impacts do not occur. Mitigations similar to the management measures provided under alternative C1 are identified as appropriate for mitigating these potential impacts to a less than significant level.

Alternatives C2 through F are identified as requiring a mitigation (Supplemental Mitigation 1, section VII.6.2.8) to ensure that significant adverse cumulative impacts do not occur. Potential significant impacts are identified due to lesser use of even-aged timber management, the narrow range of patch sizes, and the different mixes of seral types as compared to C1.

7. RECREATION EFFECTS

Sections VII.14.3.1 through VII.14.3.3 detail the DFMP's goals, objectives, and specific management actions regarding recreation, so these are not repeated in depth here. However, key features of these DFMP elements are summarized below.

The DFMP calls for compliance with Board of Forestry and Fire Protection policies regarding recreational improvements. JDSF recreational facilities generally will be maintained to provide a rustic and informal experience. A defined recreational corridor will be established, the width of which is to be determined by aesthetic considerations from points of concern (DFMP page 76).

A defined 300-foot wide recreation corridor has been established around campgrounds and day-use areas by the plan, and mitigation provided to increase the level of protection beyond that specified by the existing management plan. Future needs of the recreation program will be determined by implementing user and county-wide surveys at least every planning period. Once the user survey has been completed, the Recreation

Corridor will be defined explicitly where possible to provide for integrating the Recreation program with timber management, resource protection, demonstration and education, and the neighboring community. If the recreational plan is determined to represent a significant change in management, the amended plan will be presented to the Board for review and approval.

The proposed DFMP provides for an increase in the level of environmental protection over that which currently exists. For example, native vegetation may be planted where necessary to provide an increase in privacy and a decrease in the level of soil compaction associated with use of the facilities. Regular maintenance will be provided, and heavily used access roads will be surfaced with rock to reduce erosion and sedimentation.

Section VII.14 Recreation provided a significant exploration of cumulative effects issues through its in-depth look at coast redwood forest recreational opportunities at the levels of the entire redwood region, the North Coast Region, and Mendocino County. It examined the scale and recreational role of JDSF within each of these levels. Several potential impact elements in section VII.14.5 assessed potential cumulative impacts and are abstracted below:

Impact 2b: *Cumulatively over time, use of the JDSF roads and trails for recreation would be substantially reduced or eliminated if roads and trails are not maintained, if roads and trails are abandoned, or sanctioned trails are not reconstructed after a timber harvest operation*. (Less than Significant)

The analysis for recreation Impact 2b concluded that no significant adverse cumulative impact potential exists for any of the seven EIR alternatives except for alternative A. It found that, under the minimal level of road and trail maintenance under this alternative, there is a potential for increasing levels of road and trail closures over time, resulting in a significant adverse impact to road and trail recreational opportunities. The potential significant cumulative adverse impacts identified for alternative A could be mitigated through increasing the level of maintenance provided to roads and trails.

Impact 6: *The DFMP will create individual or cumulative impacts associated with construction and use of new or expanded recreational improvements.* (Less than Significant)

Relative to recreation Impact 6, the DFMP proposes to increase the level of environmental protection associated with existing recreational facilities. Only modest improvements to the recreational system are suggested to enhance environmental conditions and to improve recreation opportunities, and these are not planned to occur until after a recreation user-needs survey is conducted. New user-need surveys will be conducted periodically to update available information on user needs. Any subsequent construction and use of additional facilities is considered speculative at this time, and would require a CEQA analysis of potential incremental and cumulative effects at the time actual facilities are planned. No significant cumulative adverse impacts related to construction and use of new or expanded recreational improvements would result given

these provisions. As such, no mitigation is required at this time for the DFMP (alternative C1).

Under alternative A, there would be no expansion of recreational facilities over time. Under alternative B there would be only a low level of recreation facility development. Alternative C2 proposes the same approach as the DFMP (alternative C1). Under alternative E, low impact recreational opportunities would be expanded where they do not pose significant risk to fish and wildlife resources. Alternative F is similar to C1, plus it contains additional considerations for certain potentially sensitive recreation resources. Based on these considerations, no significant cumulative adverse impacts related to construction and use of new or expanded recreational improvements are anticipated for alternatives A, B, C2, E, or F.

Alternative D calls for increased emphasis on recreation including development of new and improved trails. This expansion of recreational facilities might require mitigation to ensure that impacts remain less than significant. However, any subsequent construction and use of additional facilities is considered speculative at this time, and would require a CEQA analysis of potential incremental and cumulative effects at the time actual facilities are planned. As such, no mitigation is required at this time.

The remainder of the discussion in this section looks at potential recreation cumulative impacts more generally.

Future additions and major improvements to recreation facilities are speculative at this time. As such, an assessment (tiered to the program EIR for the DFMP) of cumulative effects associated with future improvements or additions should be conducted at such time as the user-survey is complete and preliminary plans are in place.

Given the current level of recreational activities on JDSF, the minimal level of additional activities anticipated under the DFMP (alternative C1), the protections included in the DFMP, and the additional CEQA review that will take place for any new recreation facilities on JDSF, we find that the DFMP's potential adverse cumulative impacts on recreation will be less than significant. Through the improvement of roads over time, such as the road surfacing discussed above and the implementation of the Road Management Plan, there will be a long-term improvement in recreational access, resulting in a beneficial cumulative effect. Similar outcomes would result for alternatives C2, D, E, and F. Alternative B also would have a similar outcome with respect to adverse cumulative effects; since it does not explicitly provide for road improvements that could increase recreational access, no long-term beneficial cumulative effects are anticipated. Other than the potential cumulative impact discussed under Impact 2b, above, alternative A, with its minimal management provisions, would not result in a significant adverse cumulative effect on recreation opportunities, not would it provide long-term beneficial cumulative effects.

8. AESTHETIC EFFECTS

Section VII.2 Aesthetic Resources provides an in depth discussion of the setting for these resources and the potential for impacts to them as a result of the proposed project. Section VII.2.1 describes the setting for aesthetic resources and identifies that impact to aesthetics is important for JDSF given its location in a popular tourist area. However, it also is noted that JDSF is not visible from Highway 1 or from the popular tourist-destination towns of Mendocino and Fort Bragg. Natural large landscape vistas are not common in this area.

Intensively managed landscapes such as vineyards, pastures, small towns, and cities are a part of the region's scenic resources. Despite the overall scenic nature of JDSF, Mendocino County, and the redwood forest region in general, human disturbance is a common, familiar site, both within and around JDSF. Within the cumulative effects assessment area, 79% of the area (171,130 acres) is zoned by the county as Forest Land—Timber Production Zone (TPZ). Land use in a TPZ district is restricted to growing and harvesting timber as well as certain other compatible uses, and establishes a presumption that timber harvesting will occur on such lands (Government Code § 51115.1).

Cumulative aesthetic impacts may result from:

- The effects to the viewer of multiple disruptions of natural vegetation viewed within JDSF from a given viewpoint at a given time;
- The effects to the viewer of multiple disruptions of natural vegetation viewed within JDSF from a number of viewpoints within a short period of time;
- The effects to the viewer of multiple disruptions of natural vegetation viewed within JDSF and outside JDSF from a given viewpoint at a given time;
- The effects to the viewer of multiple disruptions of natural vegetation viewed within JDSF and outside JDSF from a number of viewpoints within a short period of time.

Thus, the area of assessment for aesthetic cumulative effects is the envelope of points from which views as described above may occur. Because of its size and topographic conditions, visitors do not view JDSF as a whole; rather, only portions of the Forest are visible at any one time. Middleground vistas are viewed from relatively few ridgeline vantage points, and these views are filtered by standing trees. More typical are limited foreground views from roads, trails, campgrounds, day use recreation areas, and adjacent residences. Given the complexity of these "viewshed" elements, we can not precisely define the aesthetic resources cumulative effects assessment area on the ground; however, it is something smaller than the watershed cumulative effects assessment area defined in section VII.10.2 Regional and Project Watershed Setting and shown in Figure V.3.

Section VII.2.6 provided a detailed discussion of aesthetic cumulative effects. It identified the provisions of the DFMP that prevent or reduce the potential for cumulative

aesthetic effects and addressed three questions to identify and guide development of mitigations for potential significant adverse impacts to aesthetic resources. The cited section considered the potential cumulative effect:

Cumulative Impact 1: Timber harvesting, timber sale road construction, and/or Road Management Plan implementation would substantially degrade scenic vistas in a cumulative manner. **(Less than Significant with Mitigation)**

The section concluded that, for the DFMP (alternative C1), there would be a less than significant cumulative impact with the application of the described mitigation. The section found that there would be no potential for significant adverse cumulative effects under alternative A since it would entail no timber harvesting or road construction. It found that alternatives B and C2 both had the potential to cause significant cumulative impacts which could be mitigated through the application of the described mitigation. Finally, it found that while alternatives D through F had a lesser potential to result in significant adverse cumulative aesthetic impacts, these alternatives still involve harvesting and Road Management Plan implementation, and thus have some potential to result in significant cumulative effects. As a result, application of the described mitigation also was called for these three alternatives.

9. NOISE EFFECTS

Potential impacts related to noise from proposed project activities are described in section VII.12, Noise. That section discusses several potential anthropogenic noise sources, including vehicle traffic, recreation, residences and businesses, construction, timber harvesting, and air traffic. Potential timber harvest related noise impacts receive particular attention. Timber harvest noise sources include yarding (tractor, cable, and helicopter), loading equipment, log trucks, water trucks, and chainsaws. Noise impacts occur only if the noise is heard or felt by a receptor. Sensitive human receptor concerns given particular consideration in section VII.12 are recreation areas, within and adjacent to JDSF, and residential areas. Wildlife also can be a sensitive noise receptor, particularly during the reproduction season.

The steep forested character of JDSF and the surrounding areas creates an environment in which most noise is dampened by geographic features. Since noise does not travel far in this setting and given the nature of activities that are anticipated to occur on JDSF, the cumulative effects assessment area for noise is limited to JDSF and the area immediately outside of it.

An important regulatory factor related to significance thresholds for noise cumulative impacts is the Mendocino County General Plan Noise Element, which states among its goals and policies, “Lumbering and agriculture are basic to the economy of Mendocino County and necessary noise associated with them must be tolerated; however residential buyers should be informed of the noise potential of sites affected by these industries.”

The proposed DFMP contains a number of measures to prevent noise impacts. These measures are detailed in section VII.12.7 of the EIR and include:

- A Special Concern Area buffer adjacent to non-industrial timberland owner neighbors;
- Consideration of helicopter noise and disturbance on nest sites and neighbors;
- Considerations regarding timber management activities adjacent to campgrounds.

The Forest Practice Rules restricts disturbances—including noise—to nest sites of numerous bird species, including eagles, Northern Spotted Owl, Osprey, marbled Murrelet, Northern Goshawk, and Cooper's Hawk (14 CCR §§ 919.2-919.3). These protections apply to all timberlands within the cumulative effects assessment area.

Section VII.12.9 of the EIR also discusses potential noise-related cumulative effects. The occurrence of noise related cumulative effects under the DFMP would require that projects on JDSF add to existing ambient noise levels to cause a significant adverse impact, or that noise from two or more individual projects combines to create such an impact. Noise could combine from sources entirely within JDSF or from sources both within and outside of the Forest. Standards for what constitutes a significant cumulative noise impact in a forested setting are not well defined. Impacts would occur only where the cumulative noise is heard or felt.

Section VII.12.9 discusses the following potential adverse cumulative effect:

Impact 6: *A temporary or permanent accumulation of noise over space and time from two or more sources resulting in an impact on sensitive human receptors.* (Less than Significant with Mitigation.)

The most likely sensitive receptors would be recreational users within JDSF or adjacent state parks, or residents on the rural residential interface boundary of JDSF. JDSF projects are generally separated by time and space, and thus do not tend to accumulate near adjacent properties or recreation sites. Most of the high-use recreational sites within or adjacent to JDSF are buffered by distance from adjacent land uses, and therefore have a low potential to result in significant cumulative effects.

The most likely sources of noise with potential to accumulate include gunfire, chainsaws, logging and road maintenance equipment, trucks, and helicopter use.

The potential of the seven alternatives to result in significant cumulative noise impacts varies. Alternative A, with its minimal level of management activity, is not expected to result in such impacts. Alternatives B, C1 and C2, with their higher timber harvest levels, have a relatively higher potential to result in significant cumulative noise impacts. Alternatives D, E, and F are intermediate.

While the EIR and DFMP offer specific mitigation measures to lessen or avoid noise impacts from one source, sources can combine to create a significant cumulative effect. Section VII.12.9 provides a mitigation (Mitigation 3) for potential adverse cumulative noise impacts. The mitigation requires that noise-generating management activities be assessed for cumulative adverse noise effects, and that JDSF incorporate mitigation measures to minimize them. Examples of mitigation that can be applied to projects include alteration of project methods, timing, location, scope, and duration. Trees have potential to buffer ambient (chronic) highway and residential noise, and site-specific retention should be considered to reduce potential impacts to residents or recreationalists.

Target shooting and chainsaws (firewood cutting) are identified as generally the noisiest recreational activities, with potential individual and cumulative noise impact that may not be mitigated by distance. JDSF controls firewood cutting through the use of permits, so firewood collection locations can be controlled. Recreational shooting is not a controlled activity on the State Forest. For harvesting and construction activities, mitigating noise to a level that is less than significant is accomplished by limiting days and hours of operation, as well as providing buffering distance, taking advantage of topographic features, and time between noise-creating activity and nearby sensitive receptors, and using equipment that makes less noise.

A precise estimate of noise produced in future projects is not possible, however noise can be predicted, mitigated, and monitored on projects as they are designed and implemented.

With the DFMP noise protection measures and the three EIR mitigations in place, noise generated by project activities included in the JDSF management plan alternatives are not expected to create or add to known cumulative impacts.

10. TRAFFIC EFFECTS

The setting, proposed management measures, impacts, and mitigations related to traffic generated by proposed project activities are described in section VII.15, with the analysis of traffic thresholds and impacts included in sections VII.15.4 through 15.7. As identified in section 15.1.2, no potential air traffic issues have been identified, leaving vehicular traffic as the sole area of traffic concern for the proposed project. The primary vehicular uses associated with JDSF are for log trucks and for recreationists driving cars or light trucks. Traffic related to research and demonstration is very minimal. Cumulative traffic impacts are already discussed to some extent as a part of Impacts 1, 2, and 5 in section 15.5 and in Table VII.15.2.

Cumulative traffic impacts would occur if traffic from projects on JDSF either makes existing traffic problems significantly worse or is combined with existing traffic to create a significant adverse impact. There is no indication that there are currently any existing traffic cumulative impacts within the assessment area. The assessment area includes

all roads on JDSF, as well as all other roads that are used to move materials and people to and from JDSF. Specific roads of potential concern for impacts are identified in section VII.15, Transportation and Traffic, particularly sections 15.1.1 and 15.1.5.

Log truck traffic in the project area has declined in recent years proportionately with the decline in timber harvesting activity (see Tables VIII.3 and VIII.5 and surrounding discussion), however log hauls are now longer due to the recent closures of the Georgia-Pacific and Mendocino Redwood Company mills in Ft. Bragg. These closures have increased the amount of log truck traffic traveling on highways leading away from the Ft. Bragg area, including north- and south-bound Highway 1 and east-bound Highway 20.

The log truck traffic levels resulting from implementation of the DFMP or any of the other six alternatives will vary with the alternative and also will vary over time and space and seasonally. However, none of the alternatives would result in significant ongoing increases in log truck traffic beyond the historic levels that have resulted from management of JDSF and other timberlands in Mendocino County, such as those managed by Hawthorne Timber Company and MRC.

Further, sources of traffic growth in the area are minimal, resulting in little or no traffic growth over time. The evaluation of traffic impacts in section VII.15 considered the overall effect of traffic increases from proposed JDSF project activities on existing traffic levels, and concluded that there were no substantial impacts, including either individually or cumulatively exceeding a level of service standard established by the county congestion management agency for designated roads or highways. Therefore, proposed project alternatives will not add to or create significant, adverse cumulative impacts to traffic.

Recreation related traffic is primarily comprised of autos and light trucks, plus the occasional bus. As discussed in section VII.14 Recreation, the available information about recreation use on the forest is limited.

Section VII.15.5 considers three key potential traffic impacts that have a cumulative impacts nature and finds that, for the proposed project (alternative C1) all three would have a less than significant impact:

Impact 1*:* ***An increase in traffic, which is substantial in relation to existing traffic load and capacity of the street system*****. (Less than Significant)**

Impact 2: *Exceed, either individually or cumulatively, a level of service standard established by the county congestion management agency for designated roads or highways* (Less than Significant)

Impact 5: *Would the project significantly affect parking capacity?* (Less than Significant)

See the discussion in section VII.15.5 and Table VII.15.2 for the discussion of these impacts and the findings of less than significant impact. For all three of this potential impacts, section VII.15.5 finds that there would be a less than significant adverse cumulative impact and that there would be no beneficial cumulative impact for alternatives B through F.

Alternative A would have no impact with respect to Impacts 1 and 2, above, since there would be no logging related traffic. Further, since recreational facilities and use levels are not anticipated to change from current levels under this alternative, there would be no impacts related to increased levels of recreational traffic, either. For alternatives B through F, each would result in some level of logging and recreation traffic to varying degrees that remain well below the significance thresholds.

For Impact 5, Alternative A could have a significant adverse cumulative impact in the absence of management activity. For example, unauthorized and unsafe parking could increase. Feasible mitigation would consist of signing, enforcement, and permits for special events. For all of the other alternatives, potential adverse cumulative impacts would be less than significant. Special events will have appropriate and adequate parking and staging.

11. AIR QUALITY

Air quality is discussed in section VII.5 of the EIR. In particular, section VII.5.5 discusses potential individual and cumulative impacts of the proposed project on air quality. Since air quality impacts and regulations are largely based on ambient air quality standards meant to address both short-term and long-term effects of pollutants on humans, animals, and materials, most of the impacts discussed in section VII.5 address potential air quality cumulative effects of the proposed project.

Air quality cumulative effects is an important CEQA issue; however, during the scoping process, it was not identified as an issue of substantial public concern with respect to the proposed management of JDSF. The issue was thoroughly addressed from a cumulative effects perspective in section VII.5. Hence, here we simply reiterate that none of the seven EIR alternatives was found to pose a potential significant adverse impact for any of the air quality impacts addressed. The reader is referred to section VII.5 for details.

12. LAND USE

JDSF is primarily surrounded by industrial and nonindustrial timberland (see Map Figure X). The potential for land use conflicts between JDSF management and neighbors' enjoyment of their parcels is greatest where the neighboring parcel is residential. The DFMP provides a 200-foot buffer with restricted harvesting practices adjacent to

residential parcels. Further, county land use regulations dictate that timber management on lands zoned TPZ, as is JDSF, shall not be construed a nuisance.

Section VII.11 addresses land use issues relevant to the DFMP. This section specifically addresses the following cumulative impact:

Impact 3: *Would implementation of the Management Plan result in adverse cumulative impacts to adjacent landowners in the form of reduced enjoyment in the use of their property or a loss of property values* (Less than Significant).

The county land use statute that timber management on TPZ shall not be construed a nuisance provides a strong presumption that there will be no land use related cumulative impacts for the proposed project (alternative C1). The potential for cumulative nuisance effects is further reduced by the 200-foot residential neighbor buffer provided by the DFMP. Given these measures, the cumulative land use impacts to adjacent owners are anticipated to be less than significant for alternative C1.

Because of the minimal management activity permitted under alternative A, potential cumulative impacts would be less than significant under this alternative. Given provisions similar to C1 for alternatives C2 and D, prohibitions on harvest adjacent to non-timberland owners in alternative E, and the minimal amounts of even-aged management that would be permitted under Alternative F, there is less than significant potential for significant adverse cumulative effects for any of these five alternatives.

Alternative B provides less protection to neighbors than the other alternatives. While it would comply with Forest Practice Rules (e.g., notification of neighboring landowners within 300 feet of proposed harvest operations), it provides no neighbor buffers. Alternative B makes greater use of intensive evenaged harvest prescriptions than any of the other alternatives. While harvest operations on TPZ are statutorily defined as not constituting a nuisance, repeated intensive harvests adjacent to non-timberland ownerships could impact the adjacent landowner's enjoyment of his/her property and reduce land values. This impact could be mitigated to less than significant through the use of a 200-foot neighbor buffer.

13. HERITAGE RESOURCES

Section VII.9, Heritage Resources, explicitly addressed the potential of the proposed project and other EIR alternatives to result in a significant adverse cumulative effect on heritage resources. The reader is referred to that section for details. To summarize here, there are a number of potential impacts for which mitigations are found necessary to prevent significant adverse cumulative impacts. These potential impacts relate to management activities such as timber management; fire protection and prescribed burns; maintenance of existing roads and appurtenant structures; recreation and public uses, and maintenance of existing facilities; and interpretation, demonstration, and research

programs. Mitigations were found necessary for almost all of the alternatives under all of the impact areas. The reader is referred to section VII.9 for details.

14. CUMULATIVE IMPACTS SUMMARY AND COMPARISON TABLE

Table VIII.14 provides a summary comparison of how the seven EIR alternatives have been assessed for both significant adverse and beneficial cumulative impacts. The format is loosely adapted from the cumulative impacts checklist found in the Forest Practice Rules at 14 CCR § 912.9.

Table VIII.14. Summary of Potential Adverse and Beneficial Potential Cumulative Effects.

	Cumulative Effects Potential for the Various EIR Alternatives*					
	Potential for Significant ***Adverse*** Cumulative Effects			Potential for Significant ***Beneficial*** Cumulative Effects		
Resource Area	Yes after mitigation (a)	No after mitigation (b)	No reasonably potential significant adverse effects (c)	Yes without mitigation (a)	Yes after mitigation (b)	No reasonably potential significant beneficial effects (c)
Watershed						
Flow			A-F			A-F
Water Temperature			A-F	A, C1-F		B
Nutrients			A-F			A-F
Large Woody Debris		B	A, C1-F	A, D-F	B, C1, C2	
Organic Debris			A-F			A-F
Sediment						
Violate WQ Standards		A, B	C1-F	C1-F	A, B	
Aquatic Habitat/Species		A, B	C1-F			A-F
Hazardous Materials			A-F			A-F
Soil Productivity						
Organic Matter Loss			A-F			A-F
Surface Soil Loss		A, B	C1-F			A-F
Soil Compaction			A-F			A-F
Growing Space Loss			A-F			A-F
Biological Resources						
Aquatic Resources						
Channel Geomorphology		A, B	C1-F			A-F
Instream Habitat/Bank Stability		B	A, C1-F	A, C1-F	B	
Fish/Amphibian Populations		A, B	C1-F	C1-F	A, B	
Number/Range Rare or Endangered Species		A, B	C1-F	C1-F		A, B

Table VIII.14. Summary of Potential Adverse and Beneficial Potential Cumulative Effects.						
	Cumulative Effects Potential for the Various EIR Alternatives*					
	Potential for Significant ***Adverse*** Cumulative Effects			Potential for Significant ***Beneficial*** Cumulative Effects		
Resource Area	Yes after mitigation (a)	No after mitigation (b)	No reasonably potential significant adverse effects (c)	Yes without mitigation (a)	Yes after mitigation (b)	No reasonably potential significant beneficial effects (c)
Wildlife and Wildlife Habitat						
Late Succession/Old-Growth Forest			A-F	E, F		A-D
Snags and Down Wood		B-D	A, E, F	E, F		A-D
Riparian Habitat		B	A, C1-F	C1-F		A, B
Unique/Special Habitats and Features		B-C2	A, D-F	D-F	C1, C2	A, B
Wildlife Communities and Habitat Values			A-F	A, D-F		B-C2
Southern Torrent Salamander and Tailed Frog		B	A, C1-F	D-F		A-C2
Marbled Murrelet		B, D	A, C1, C2, E, F	E, F	C1-D	B
Northern Spotted Owl			A-F	E, F		A-C2
Vaux's Swift and Purple Martin		B-C2	A, D-F	D-F		A-C2
Sonoma Red Tree Vole			A-F	A, D-F		B, C1, C2
Reduction in the Number or Range of an Endangered Species		B-C2	A, D-F	E, F		A-D
Interfere with Movement, Migration, or Use of Nursery Areas		C1-C2	A, B, D-F	E, F	C1, C2	A, B, D
Cause a Wildlife Population to Drop Below Self-Sustaining Levels		B, D	A, C1, C2, E, F	A, C1, C2, E, F	D	B
Botanical Resources						
Threaten/Eliminate Community		B	A, C1-F			A-F
Reduce No. of Rare, Threatened, or Endangered Species		B	A, C1-F			A-F
Impacts to Candidate, Sensitive, or		B	A, C1-F			A-F

Table VIII.14. Summary of Potential Adverse and Beneficial Potential Cumulative Effects.

	Cumulative Effects Potential for the Various EIR Alternatives*					
	Potential for Significant ***Adverse*** Cumulative Effects			Potential for Significant ***Beneficial*** Cumulative Effects		
Resource Area	Yes after mitigation (a)	No after mitigation (b)	No reasonably potential significant adverse effects (c)	Yes without mitigation (a)	Yes after mitigation (b)	No reasonably potential significant beneficial effects (c)
Special Status Species						
Restrict Range of Rare, Threatened, or Endangered Species		B	A, C1-F			A-F
Impact Mushroom Corners		A, C1, C2	B, D-F			A-F
Reduction of Range or Extirpation of Species		B	A, C1-F			
Recreation						
Loss of Roads and Trails		A	B-F			A-F
New or Expanded Facilities			A-F			A-F
General Recreation-Related Effects			A-F	C1-F		A, B
Aesthetics						
Degradation of Scenic Vistas		B-F	A			A-F
Noise						
Temporary or Permanent Accumulation		B-F	A			A-F
Nesting Birds			A-F			A-F
Traffic						
Substantial Increase in Traffic			A-F			A-F
Exceed Level of Service			A-F			
Parking Capacity		A	A-F			A-F
Air Quality			A-F			A-F
Land Use		B	A, C1-F			A-F

Table VIII.14. Summary of Potential Adverse and Beneficial Potential Cumulative Effects.

	Cumulative Effects Potential for the Various EIR Alternatives*					
	Potential for Significant ***Adverse*** Cumulative Effects			Potential for Significant ***Beneficial*** Cumulative Effects		
Resource Area	Yes after mitigation (a)	No after mitigation (b)	No reasonably potential significant adverse effects (c)	Yes without mitigation (a)	Yes after mitigation (b)	No reasonably potential significant beneficial effects (c)
Heritage Resources See sections VIII.13 and VII.9.7 for details.		A-F				A-F

*This table format is adapted from the Forest Practice Rules cumulative impact assessment table found at 14 CCR § 912.9.

(a) Yes, means that potential significant adverse/beneficial cumulative impacts are left after application of existing laws and regulations (e.g. Forest Practice Rules) and proposed mitigations or alternatives.

(b) No after mitigation means that any potential for the proposed project to cause or add to significant adverse cumulative impacts by itself or in combination with other projects has been reduced to insignificance or avoided by application of existing laws and regulations and by mitigation measures or alternatives proposed in the JDSF Management Plan and EIR.

c) No reasonably potential significant cumulative effects means that the proposed actions do not have a reasonable potential to join with the impacts of any other project to cause, add to, or constitute significant adverse cumulative impacts.