ADDITIONAL EXHIBITS FOR THE FOLLOWING CDP APPLICATION NUMBERS:

1-09-005 (EUREKA READY MIX – ITEM Th6c)

1-09-006 (EUREKA READY MIX – ITEM Th6d)

1-09-011 (HANSEN – ITEM Th6e)

1-09-022 (MERCER-FRASER CO. – ITEM Th6f)

EXHIBITS A - F

Analysis of Eel River Cross Sections at Gravel Mining Sites, 1997-2007

County of Humboldt Extraction Review Team (CHERT)
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EXHIBIT NO. **A**

APPLICATION NOS.
1-09-005 (Eureka Ready Mix)
1-09-006 (Eureka Ready Mix)
1-09-011 (Hansen)
1-09-022 (Mercer-Fraser Co.)
CHERT ANALYSIS, 1997-2007

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Introduction

Gravel extraction, or mining, from Humboldt County rivers has been used to supply aggregate to various users for decades. Because of concerns surrounding potential impacts to river infrastructure (bridges, municipal water facilities, etc.) and river-dependent animals and plants, it is important to monitor the river corridor to detect potential impacts.

In July, 1997, the Humboldt County Board of Supervisors adopted the *Interim Monitoring Program and Adaptive Management Practices for Gravel Removal from the Lower Eel and Van Duzen Rivers (IMP)*, which required monitoring, formally established the County of Humboldt Extraction Review Team (CHERT) and extended the team's scope to include the Eel River system. Monitoring requirements for gravel operators include annual river cross section surveys to track changes in river channels near mining operations. These cross sections are used to evaluate river conditions annually as part of the process by which each year's proposed mining operations are reviewed and often revised to reduce or eliminate impacts.

Eel River cross section data have accumulated since about 1997 and have been used in the annual mining review process. ; no longer-term analysis of them has taken place until now. As part of the pending renewal of federal and state permits, a longer-term analysis of cross sections was deemed necessary to support impact evaluation and protection/mitigation strategies. This report provides analysis of river physical trends that will be considered along with other information in the permit renewal process.

Geomorphic issues of concern differ between the Mad and Eel rivers. When the gravel mining review process began on the Mad River in 1992, there were serious concerns about the relationship between gravel mining and channel bed lowering (aka, bed degradation) that was adversely affecting fish habitat, threatening bridge stability and impacting performance of municipal water supply facilities. To our knowledge, the only location in the Eel River system which had a similar issue was in the lower Van Duzen River, where three bridges cross the river just upstream of the delta at the confluence with the Eel River. Several years ago, the US Highway 101 bridge was retrofit to make it less vulnerable to pier scour. The status of the third bridge, supporting railroad tracks owned by North Coast Railroad Authority, is unknown.

Although flood history and gravel recruitment (gravel transported during floods) characteristics differ between the Mad and Eel river systems, the main difference between these systems with respect to gravel mining centers on the relative volumes of mining and recruitment. Historical mining volumes on the Mad River were high relative to recruitment, leading to the river infrastructure and fish habitat problems that triggered controversy and heightened regulatory controls in the early 1990s. Since then, Mad River mining volumes have been reduced to levels that are consistent with the current estimate of mean annual recruitment (MAR) and the problems perceived in the 1990s seem to have subsided.

At present there is no estimate of MAR for the Eel River system, but it is almost certainly substantially greater than present mining levels. While certain methods of mining and locally excessive volumes can affect instream habitat in the short term, the river does not appear to suffer from long term or broad scale channel bed degradation from gravel mining. Furthermore, the CHERT adaptive management program authorized by the IMP specifically addresses preventing local over-extraction and avoids/minimizes mining methods that cause aquatic and riparian habitat damage.

Although there is a perception that Eel River gravel mining is generally not causing excessive channel bed degradation, the cross section analysis here provides a tool for examining the issue. But unlike the Mad River, Eel River gravel extraction sites are clustered in several river reaches that are far apart from one another. This precludes a system-wide analytical approach, limiting the analysis to a more localized scope that cannot link geomorphic processes occurring, for example, in the South Fork Eel River with those in the lower Eel River.

Eel River Gravel Mining

Table 1 describes the gravel mining sites in the Eel River, which are primarily concentrated in four river reaches, with three isolated sites far removed from others. Because the isolated sites are far removed from other extractions and only intermittently extracted, the likelihood of cumulative geomorphic impacts is small. Consequently, this analysis is limited to just the four primary river reaches described below.

Table 1. Description of gravel mining reaches in the Humboldt County portion of the Eel River watershed.

Approximate Length (miles)	Mining Reaches in the Eel River
8	**Lower Eel River:** The Lower Eel River Reach extends approximately eight miles downstream from the mouth of the Van Duzen River to just downstream of Fernbridge. This reach is within the Coastal Zone, thus Coastal Development Permits are required for gravel extraction.
5	**Lower Van Duzen River:** The Lower Van Duzen River Reach extends upstream approximately five miles from the mouth of the Van Duzen River. Only the lower portion of one site lies within the Coastal Zone (Leland Rock).
26	**Middle Reach of Eel River:** The Middle Reach of the Eel River extends upstream from Scotia (River mile 20) for approximately 26 miles to River Mile 46. These sites are extracted intermittently by Humboldt Redwoods Co..
17	**South Fork Eel River:** The South Fork Reach extends from Garberville (River mile 33) upstream to Cooks Valley near the Mendocino County line (River mile 50). There is a considerable distance (about 20 river miles) between the Randall and Wallan & Johnson sites near Garberville and Cooks Valley at the Humboldt/Mendocino county line.
	Isolated Sites: Three extraction sites are geographically isolated from the rest. These are the *Satterlee Bar* on the main stem of the Eel river at Fort Seward, the *PL Bar* on the Van Duzen River, and the *Charles Bar* on Larabee Creek.

Eleven gravel mining operators extract gravel from 23 sites within the four reaches, as shown in Table 2. Many of the sites listed in Table 2 are not mined every year. In the Lower Eel, Singley, Worswick, Drake and Hansen Bars are extracted intermittently. In the Middle Reach Eel River, Humboldt Redwoods Co. (formerly Pacific Lumber Co.) has special permit constraints that limit the frequency of extraction from specific bars. Mined volumes vary widely from year-to-year, and volumes actually extracted are typically much less than the volumes approved by regulatory agencies (Table 3). An average of 665,000 cubic yards (cy) of gravel were approved for extraction annually since 1997, of which about 442,000 cy, or about two-thirds of that approved, were actually extracted. No Middle Reach Eel River bars were mined from 2004 through 2006. Annual extraction volumes on a site-by-site basis can be found in the annual CHERT post-extraction reports at: http://co.humboldt.ca.us/planning/smara/default.asp?inc=slm

Table 2. Gravel mining operators and sites in the Eel River (listed by reach in upstream order; excludes isolated sites).

Operator	Site
Lower Eel River	
Eureka Ready Mix	Singley Bar
Humboldt County	Worswick Bar
Mallard Pond	Drake Bar
Mercer Fraser	Sandy Prairie Plant B
Mercer Fraser	Sandy Prairie Plant A
Hansen Trucking	Hansen Bar (currently unpermitted)
Eureka Ready Mix	Hauck Bar
Van Duzen River	
Rock and Gadbury	Leland Rock Bar
Jack & Mary Noble	Van Duzen River Ranch Bars
Tom Bess	Bess East & West Bars
Middle Reach Eel River	
Humboldt Redwoods Company	Lower Scotia Bar
Humboldt Redwoods Company	Scotia Dam Bar
Humboldt Redwoods Company	Lower & Upper Truck Shop Bars
Humboldt Redwoods Company	Dinner Creek Bar
Humboldt Redwoods Company	Three Mile Bar
Humboldt Redwoods Company	Elinor Bar
Humboldt Redwoods Company	Holmes/Larabee Bar
Humboldt Redwoods Company	South Fork Bar
Humboldt Redwoods Company	Bowlby Bar
Humboldt Redwoods Company	Vroman Bar
Humboldt Redwoods Company	Maynard Bar
South Fork Eel	
Wallan &Johnson	Wallan Bar
Randal Sand & Gravel	Home Bar
Randal Sand & Gravel	Twooby Park Bar
Randal Sand & Gravel	County Bar
Mercer Fraser	Cooks Valley Bar (Humboldt County)
Mercer Fraser	Cooks Valley Bar (Mendocino County)

Table 3. Approved and extracted gravel mining volumes in the Eel River since 1997 (excludes isolated sites).

Lower Eel River			
Year	Approved Volume (cubic yards)	Extracted Volume (cubic yards)	Percent
1997	561,700	326,500	58%
1998	399,100	273,000	68%
1999	471,400	290,500	62%
2000	291,300	208,600	72%
2001	389,900	119,300	31%
2002	387,300	220,000	57%
2003	318,300	163,900	51%
2004	188,840	120,305	64%
2005	199,370	166,280	83%
2006	235,495	208,240	88%
2007	243,097	177,334	73%
Totals	**3,685,802**	**2,273,959**	**62%**
Years	**11**	**11**	**---**
Averages	**335,073**	**206,724**	**62%**

Middle Eel River			
Year	Approved Volume (cubic yards)	Extracted Volume (cubic yards)	Percent
1997	147,300	84,900	58%
1998	157,900	99,400	63%
1999	134,900	124,900	93%
2000	160,100	131,000	82%
2001	116,100	64,000	55%
2002	132,767	121,608	92%
2003	74,030	54,060	73%
2004	0	0	n/a
2005	0	0	n/a
2006	0	0	n/a
2007	89,990	64,424	72%
Totals	**1,013,087**	**744,292**	**73%**
Years	**11**	**11**	**---**
Averages	**92,099**	**67,663**	**73%**

South Fork Eel River			
Year	Approved Volume (cubic yards)	Extracted Volume (cubic yards)	Percent
1997	67,700	74,700	110%
1998	75,400	70,100	93%
1999	85,400	75,900	89%
2000	75,700	53,700	71%
2001	66,000	43,100	65%
2002	58,163	48,122	83%
2003	87,060	54,660	63%
2004	80,730	50,745	63%
2005	82,770	36,480	44%
2006	92,000	35,075	38%
2007	90,737	73,956	82%
Totals	**861,660**	**616,538**	**72%**
Years	**11**	**11**	**---**
Averages	**78,333**	**56,049**	**72%**

Van Duzen River			
Year	Approved Volume (cubic yards)	Extracted Volume (cubic yards)	Percent
1997	120,000	81,600	68%
1998	119,100	103,700	87%
1999	159,900	108,800	68%
2000	194,800	121,300	62%
2001	161,700	85,600	53%
2002	202,500	167,400	83%
2003	175,100	123,000	70%
2004	179,045	92,610	52%
2005	159,090	123,170	77%
2006	134,910	104,750	78%
2007	152,773	113,184	74%
Totals	**1,758,918**	**1,225,114**	**70%**
Years	**11**	**11**	**---**
Averages	**159,902**	**111,374**	**70%**

Analysis Methods

Channel Cross Section Data

Channel cross section surveys yield topographic information across a slice of a river channel perpendicular (or nearly so) to the longitudinal centerline of the high flow channel. By comparing one year's survey with another, changes over the intervening time span can be quantified. We were provided cross section survey data in spreadsheet format by the Eel River operators or their consultants. It was first necessary to review the cross section (XS) data to: 1) ensure elevations were based on a consistent vertical datum (we presently use the North American Vertical Datum of 1988, or NAVD88, in all surveys); 2) adjust horizontal positioning as needed so the left and/or right endpoints align; and 3) add data from earlier or later surveys to either or, in some cases, both ends to create a full channel data set for analysis.

Making these adjustments to the data is a time intensive process and results were needed in early 2009. To expedite the analysis, it was agreed by all concerned that using a sampling of the full set of XS (from one to five from each site) and analyzing XS surveys from the beginning, middle and end of the monitoring period would suffice. Using this strategy, we reviewed air photos from recent mining submittals and selected XS from each site that provided reasonable river reach coverage. The years of 1997, 2002, and 2007 were targeted to evaluate temporal changes. Table 4 shows the selected XS and years used in this analysis. In cases where a particular survey year's data were not available or useable, the closest year with useable data was substituted, as shown in Table 4. The "XS#" in Table 4 denotes the codes for identifying cross sections in graphs throughout this report.

Table 4. Eel River cross sections used in this analysis.

Cross sections Analyzed			Survey Years Analyzed [1]		
Operator	Site	XS#	First	Second	Third
Lower Eel River					
Eureka Ready Mix	Singley Bar	SIN 12	1997	2003	2007
Eureka Ready Mix	Singley Bar	SIN 6	1997	2003	2007
Eureka Ready Mix	Singley Bar	SIN 1	1997	2003	2007
Humboldt County	Worswick Bar	WOR 5	1998	2002	2007
Humboldt County	Worswick Bar	WOR 1	1997	2002	2007
Mallard Pond	Drake Bar	DRA 9	1997	2002	2007
Mallard Pond	Drake Bar	DRA 3	1997	2002	2007
Mercer Fraser Co.	Sandy Prairie	SAN 11R	1998	2002	2007
Mercer Fraser Co.	Sandy Prairie	SAN 7	1998	2002	2007
Mercer Fraser Co.	Sandy Prairie	SAN 1	1999	2002	2007
Hansen Trucking	Hansen Bar	HAN 13	1997	2001	2007
Hansen Trucking	Hansen Bar	HAN 0	1997	2002	2007
Eureka Ready Mix	Hauck Bar	HAU 25	1997	2002	2007
Eureka Ready Mix	Hauck Bar	HAU 13	1997	2002	2007
Eureka Ready Mix	Hauck Bar	HAU -3	1997	2002	2007
Van Duzen River					
Leland Rock	Lower Rock Bar	ROC 27	1997	2002	2007
Leland Rock	Lower Rock Bar	ROC 23	1997	2002	2007
Leland Rock	Upper Rock Bar	ROC 17	1997	2002	2007
Leland Rock	Upper Rock Bar	ROC 10	1997	2002	2007
Leland Rock	Upper Rock Bar	ROC 4	1997	2002	2007
Van Duzen River Ranch	Noble Bar	NOB 10	1997	2002	2007
Van Duzen River Ranch	Noble Bar	NOB 7	1997	2002	2007
Van Duzen River Ranch	Noble Bar	NOB 2	1997	2003	2007
Tom Bess	Bess West Bar	BES 14	1997	2002	2007
Tom Bess	Bess West Bar	BES 2	1997	2002	2007
Tom Bess	Bess East Bar	BES 8	1998	2002	2007
Tom Bess	Bess East Bar	BES 4	1998	2002	2007
[1] red font denotes substituted year					

Table 4. Eel River cross sections used in this analysis (continued).

Cross sections Analyzed			Survey Years Analyzed [1]		
Operator	Site	XS#	First	Second	Third
Middle Reach Eel River					
Humboldt Redwoods Co.	Lower Scotia Bar	SCO 0	1997	2002	2007
Humboldt Redwoods Co.	Lower Scotia Bar	SCO 2	1997	2002	2007
Humboldt Redwoods Co.	Scotia Dam Bar	SCO 3	1997	2002	2007
Humboldt Redwoods Co.	Scotia Dam Bar	SCO 5	1997	2002	2007
Humboldt Redwoods Co.	Truck Shop Bar	TRU 6	1997	2002	2007
Humboldt Redwoods Co.	Truck Shop Bar	TRU 10	1997	2002	2007
Humboldt Redwoods Co.	Dinner Creek Bar	DIN 13	1997	2002	2007
Humboldt Redwoods Co.	Three Mile Bar	THR 15	1997	2002	2007
Humboldt Redwoods Co.	Three Mile Bar	THR 18	1997	2002	2007
Humboldt Redwoods Co.	Elinor Bar	ELI 8	1997	2002	2007
Humboldt Redwoods Co.	Elinor Bar	ELI 2	1997	2002	2007
Humboldt Redwoods Co.	Holmes/Larabee Bar	HOL 2	1997	2002	2007
Humboldt Redwoods Co.	South Fork Bar	SOU 3	1997	2002	2007
Humboldt Redwoods Co.	Bowlby Bar	BOW 6	1997	2002	2007
Humboldt Redwoods Co.	Bowlby Bar	BOW 1	1997	2002	2007
Humboldt Redwoods Co.	Vroman Bar	VRO 6	1997	2002	2007
Humboldt Redwoods Co.	Vroman Bar	VRO 1	1997	2002	2007
Humboldt Redwoods Co.	Maynard Bar	MAY 2	1997	2002	2007
South Fork Eel River					
Wallan and Johnson	Wallan Bar	WAL 5	1997	2002	2007
Wallan and Johnson	Wallan Bar	WAL 2	1997	2002	2007
Randall Sand and Gravel	Randall Site	RAN 10	1999	2002	2007
Randall Sand and Gravel	Randall Site	RAN 8	1999	2002	2007
Randall Sand and Gravel	Randall Site	RAN 3	1999	2002	2007
Randall Sand and Gravel	Randall Site	RAN 1	1999	2002	2007
Mercer Fraser Co.	Cooks Valley	CVA 12	1998	2002	2007
Mercer Fraser Co.	Cooks Valley	CVA 11	1998	2002	2007
Mercer Fraser Co.	Cooks Valley	CVA 8	1998	2002	2007
Mercer Fraser Co.	Cooks Valley	CVA 3	1998	2002	2007
[1] red font denotes substituted year					

Data Extraction Procedure

Data extraction from each cross-section involved six steps:

1) **Estimation of ground-surface elevations at 1-foot intervals:** Ground-surface elevations were estimated at 1-foot intervals across the width of the cross-section by linear interpolation of elevations between adjacent survey points using the Excel macro Lintrp 1.4 (Lehre, 1995).

2) **Selection of reference elevation:** For each cross-section, a *reference elevation* was selected by overlaying the XS for all years on the same graph and choosing an elevation below which lay all significant yearly flow or man-caused changes in bed, bars, and banks. The reference elevation controls which data points are used in computation of mean elevation and cross-sectional area (see Fig. 1 below).

3) **XS computation width limits:** For each year the width of the cross-section *at the reference elevation* (Fig. 1) is determined by inspection of the interpolated elevation values. The ends of the reference line are chosen at those distances whose elevations most closely correspond to the reference elevation. Only XS data within these horizontal limits was used in computations.

4) **Computation of mean elevation of XS:** Mean elevation of the cross-section in each year is computed as the *average* of all the interpolated points included between the right and left ends of the reference elevation line.

5) **Computation of XS area:** The cross-sectional area lying between the reference elevation and the ground surface (see Fig. 1) is computed from the interpolated data by subtracting the ground elevation at each point from the reference elevation and adding all these up (each point represents one-foot of XS width). This XS area has no significance other than for comparing repetitive surveys at a cross section.

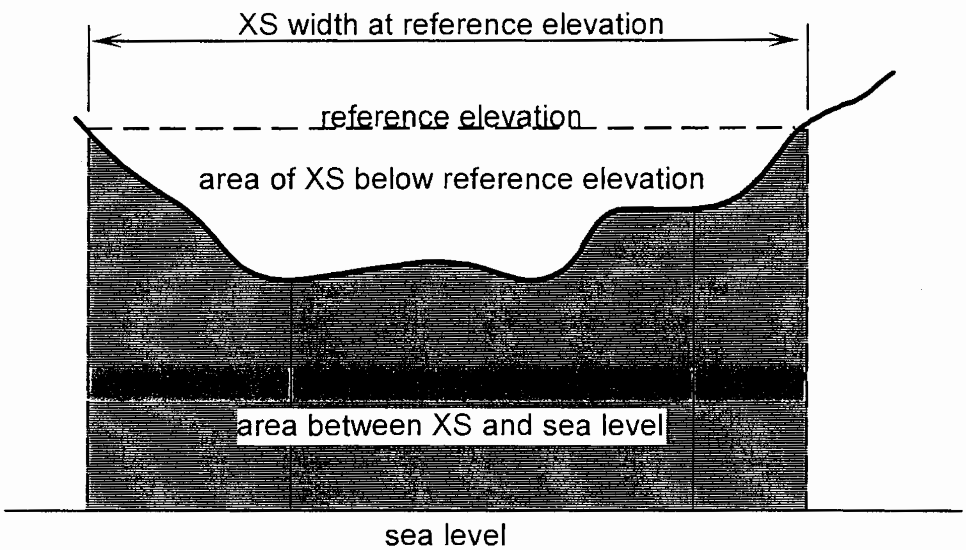


Figure 1. Definition sketch for determination of XS area and mean elevation.

6) **Determination of thalweg elevation:** Thalweg elevation is taken as the minimum elevation in the channel portion of the cross-section. Off-channel excavations (terrace trenches or wetland pits) are excluded since they are not part of the channel, even though they may contain the minimum elevation in the XS.

The resulting data were tabulated by year for each cross-section and are available electronically in the Excel spreadsheet *Eel R XSS Data Summary*.

Mean Bed Elevation, Thalweg Elevation, and Channel Scour and Fill

Mean bed elevation: The *mean bed elevation* of a cross-section is the arithmetic average of all the interpolated elevation points lying between the ends of the reference elevation line (see Fig. 3). This includes all parts of the cross section which have undergone significant elevation changes, due either to stream processes or to gravel extraction. Thus it encompasses not only the low-water and active-channel areas, but also those parts of the floodplain and lower terraces that have experienced erosion, deposition, or extraction.

Thalweg elevation: The *thalweg* is the line of maximum depth of the river. The *thalweg elevation* is thus the lowest channel-related elevation (as opposed to an off-channel or excavation-related elevation) in the cross-section.

Channel scour and fill: Scour represents a loss of gravel from a river bar or channel and will appear on XS as a lowering of elevation at a particular point. Fill represents a gain of gravel. Both scour and fill can occur between any two surveys of a XS. The change in XS area between two surveys being compared is a mathematical summation of scour and fill.

Results

Results from Eel River cross section analyses are summarized for all reaches in Table 5 and in a series of bar graphs for specific to each river reach that show changes between the survey years selected and the net change over the entire period. We also included a line graph with net changes in thalweg and mean bed elevations from 1997 to 2007 (or the closest years to those that were suitable for analysis) for each reach to provide a clearer means to evaluate longitudinal trends.

Reach-averaged trends

Table 5 has reach-averaged thalweg, mean bed, and scour/fill results for the 1997-2007 period. Lower Eel River thalweg elevations decreased while mean bed elevations increased, possibly indicating improved low flow channel confinement. Net scour/fill was positive, consistent with mean bed elevation increase. On the other three reaches, both thalweg and mean bed elevations decreased and net scour/fill was negative, indicating that the three upstream reaches are likely in a degradational phase.

Table 5. Reach-averaged thalweg and mean channel bed elevation changes and net scour/fill for the Eel River, 1997-2007.

River Reach	Thalweg Elev. Change (feet)	Med Bed Elev. Change (feet)	Net Scour/Fill (sq. ft.)
Lower Eel River	-0.44	0.71	418
Middle Reach Eel	-1.23	-0.80	-520
South Fork Eel	-1.33	-0.84	-303
Van Duzen River	-0.07	-0.27	-1386

Lower Eel River

Figures 2 and 3 show incremental and net changes in thalweg and mean bed elevations, respectively. Thalweg elevations generally decreased between 1997 and 2007 in the upstream portion from Hauck Bar to Sandy Prairie, with little net change at the Hansen site in between. Over the same period, mean bed elevations experienced a modest increase, suggesting bar growth coincident with channel deepening, a process that indicates improved fish habitat conditions. In the downstream portion, thalweg elevations increased at most XS along with increases in mean bed elevations, suggesting this sub-reach experienced bed aggradation affecting the full channel width over the decade beginning in 1997. We note that the left (south) bank immediately upstream of Fernbridge has experienced heavy erosion, approaching hundreds of feet laterally, since the 1990s.

Figure 4, depicting channel scour and fill, shows mixed results along the lower Eel River, with alternating scour and fill through the eight mile reach. Little net scour or fill occurred at the upstream end (Hauck Bar), with the highest fill at the Hansen Bar, the highest scour at Sandy Prairie, with small change at the Drake and upper Worswick Bars, and net fill on either side of Fernbridge (lower Worswick and lower Singley Bars). Although there were too few XS used to allow reliable computation of reach-wide gravel volume changes, reach-averaged mean bed elevations rose by about 0.7 feet. Reach-averaged thalweg elevations decreased by about 0.4 feet over the same period (Table 5).

Figure 2. Lower Eel River Thalweg Elevation Change, 1997-2007

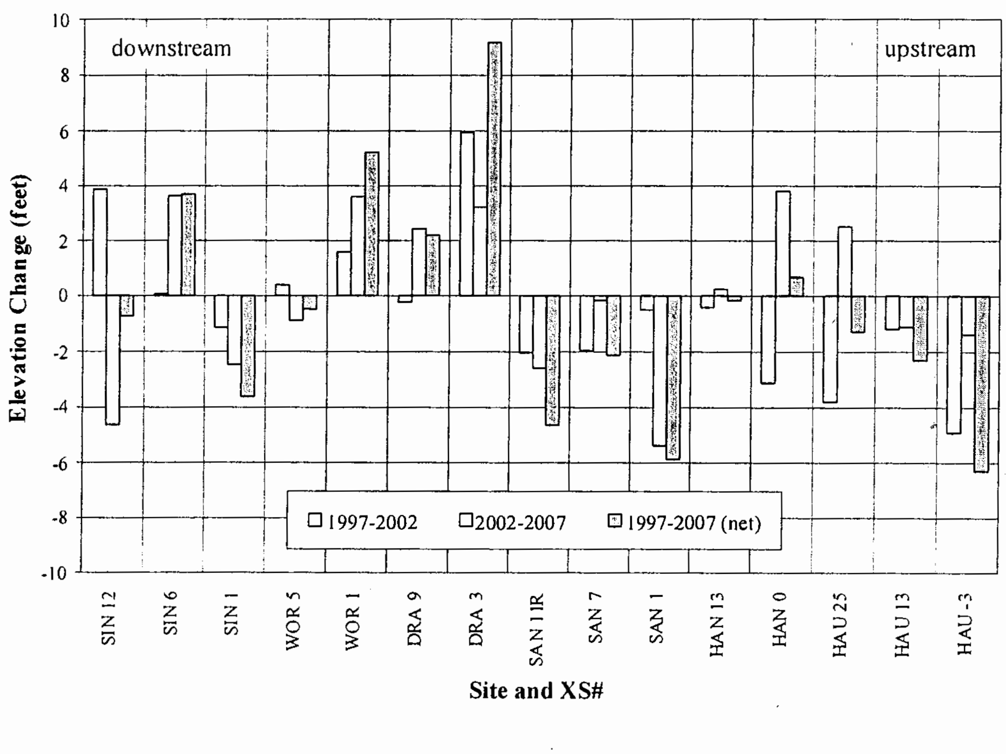


Figure 3. Lower Eel River Mean Bed Elevation Change, 1997-2007

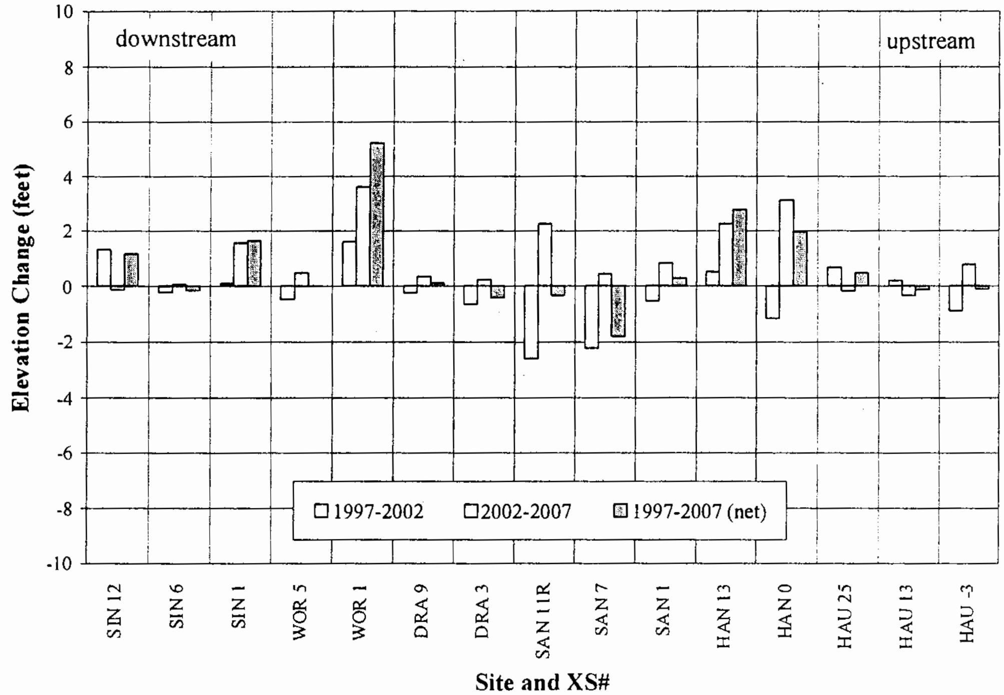


Figure 4. Lower Eel River Channel Bed Scour and Fill, 1997-2007

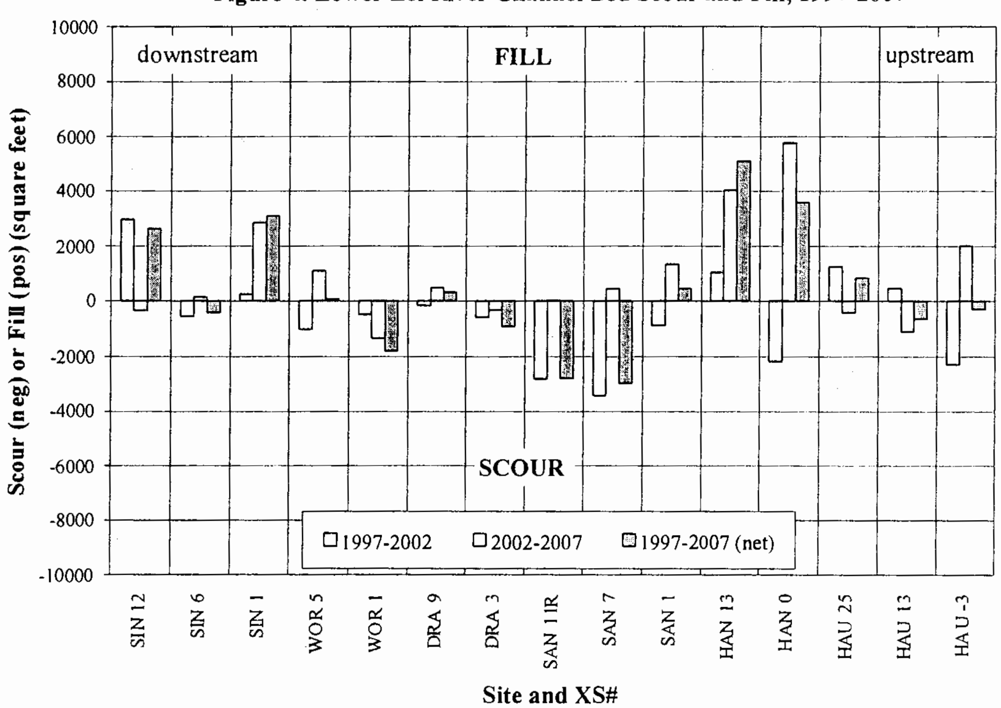


Figure 5. Lower Eel River Thalweg and Mean Bed Elevation Net Change, 1997-2007

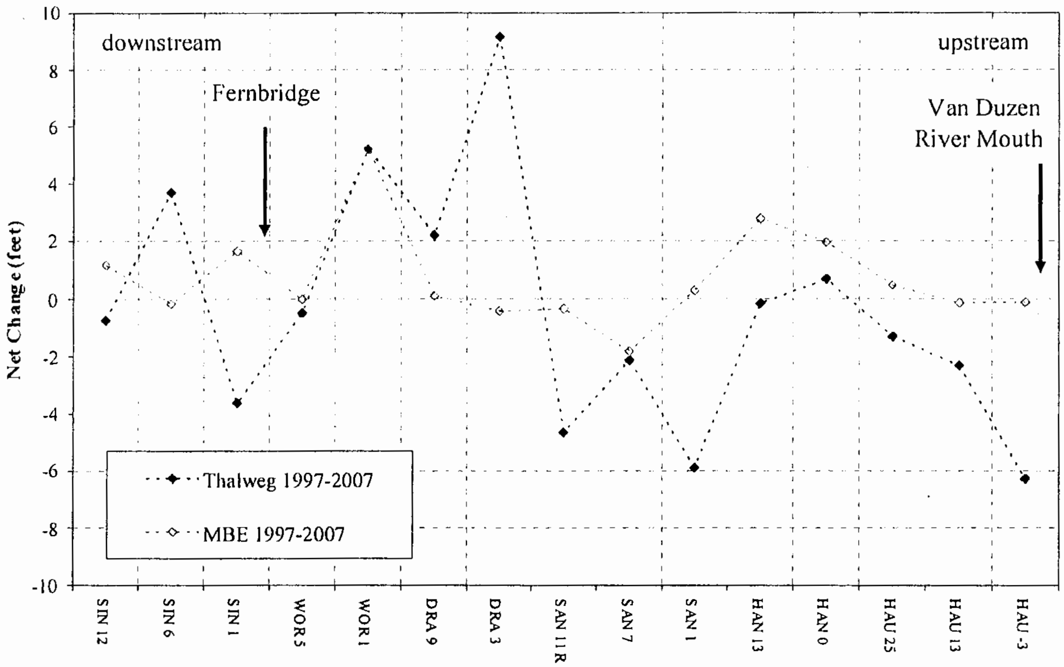


Figure 5 plots thalweg and mean bed elevation changes from 1997 to 2007 as longitudinal lines. Although these are the same data as plotted separately in Figures 2 and 3, associations can be more clearly seen when plotted together. Changes in either of these variables can be due to gravel volume gains or losses, or simply due to movement of channel features such as bars and pools. For example, XS DRA3 (Fig. 5) showed a dramatic increase in thalweg elevation as the pool formerly along the right bank migrated upstream (B. Brown, pers. comm.. 2008).

Van Duzen River

As with the Lower Eel, the Van Duzen mining reach exhibited mixed results (Figs. 6-9). Thalweg elevations increased and decreased over time at many XS, but the net changes for 1997-2007 were generally increases in thalweg elevations at the upstream sites (Bess and Noble), and decreases at the downstream site (Leland Rock), both above and below the Highway 101 and railroad bridges. Mean bed elevations mostly mirrored thalweg elevations, with decreases at the downstream (Leland Rock) site ranging from about 1 to four feet and increases up to four feet at the middle site (Noble). Reach-averaged results (Table 5) showed minimal thalweg elevation change, reflecting the substantial longitudinal differences that averaging cancelled out.

Channel scour and fill were relatively small at the upstream sites, with XS NOB2 a notable exception. Channel avulsion (sudden realignment) monitored by this cross section produced a large amount of scour between 1997 and 2003, followed by large fill from 2003 to 2007 as the old channel and adjacent terrain filled in. Thalweg and mean bed elevations varied together in the Van Duzen, as illustrated in Figure 9, with the exception of XS ROC4, where the thalweg increased in elevation while the mean bed elevation decreased, suggesting a flattening of the channel cross section and possibly a reduction in low flow channel confinement.

Figure 6. Van Duzen River Thalweg Elevation Change, 1997-2007

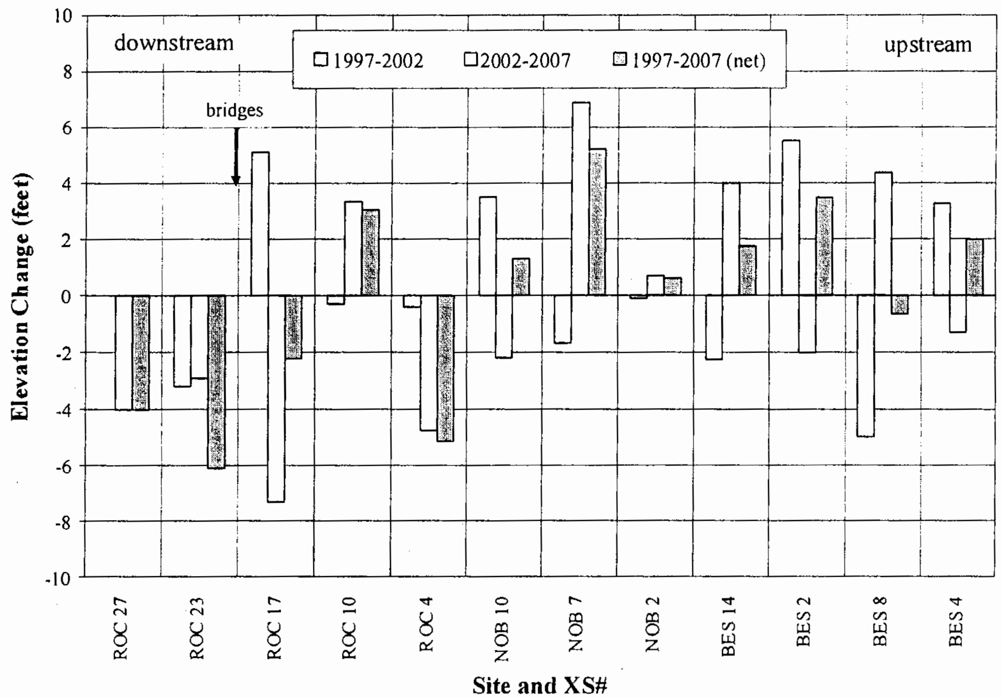


Figure 7. Van Duzen River Mean Bed Elevation Change, 1997-2007

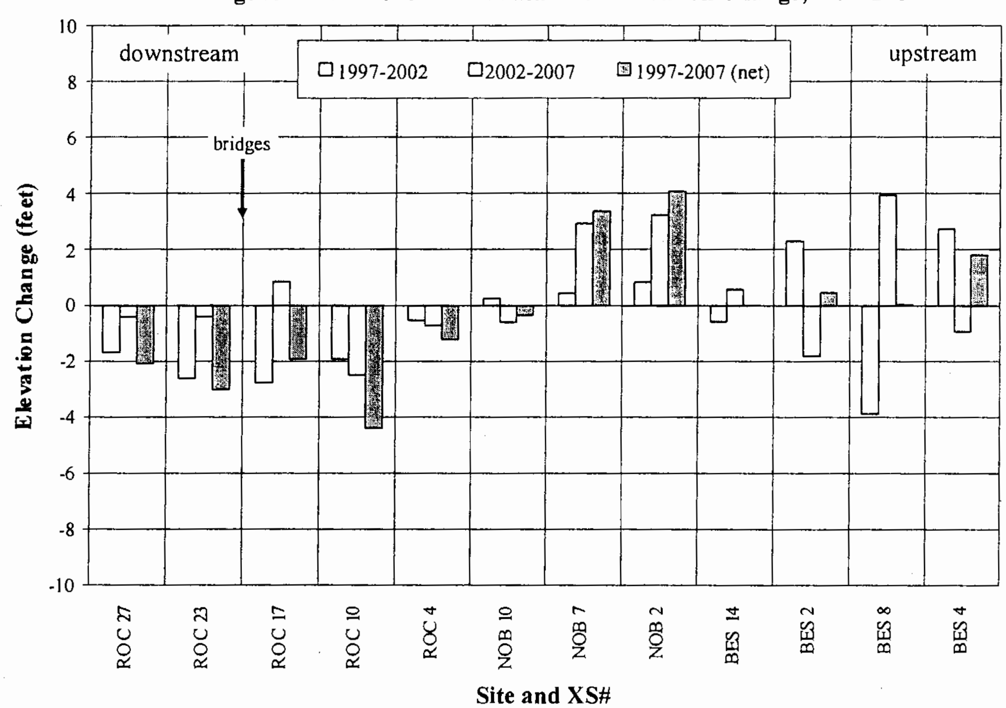


Figure 8. Van Duzen River Channel Bed Scour and Fill, 1997-2007

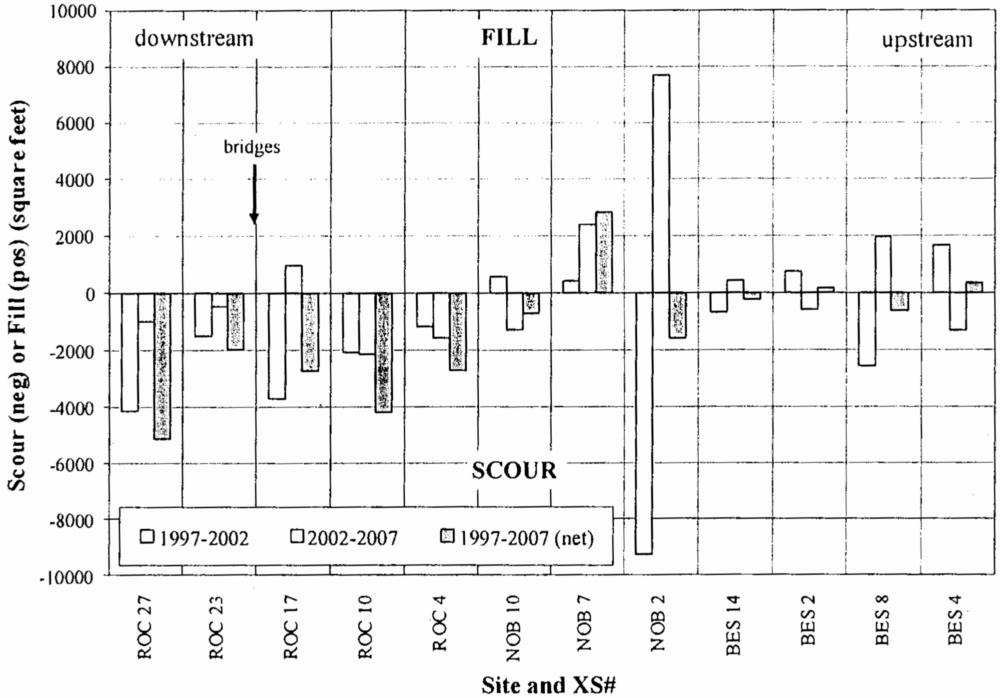
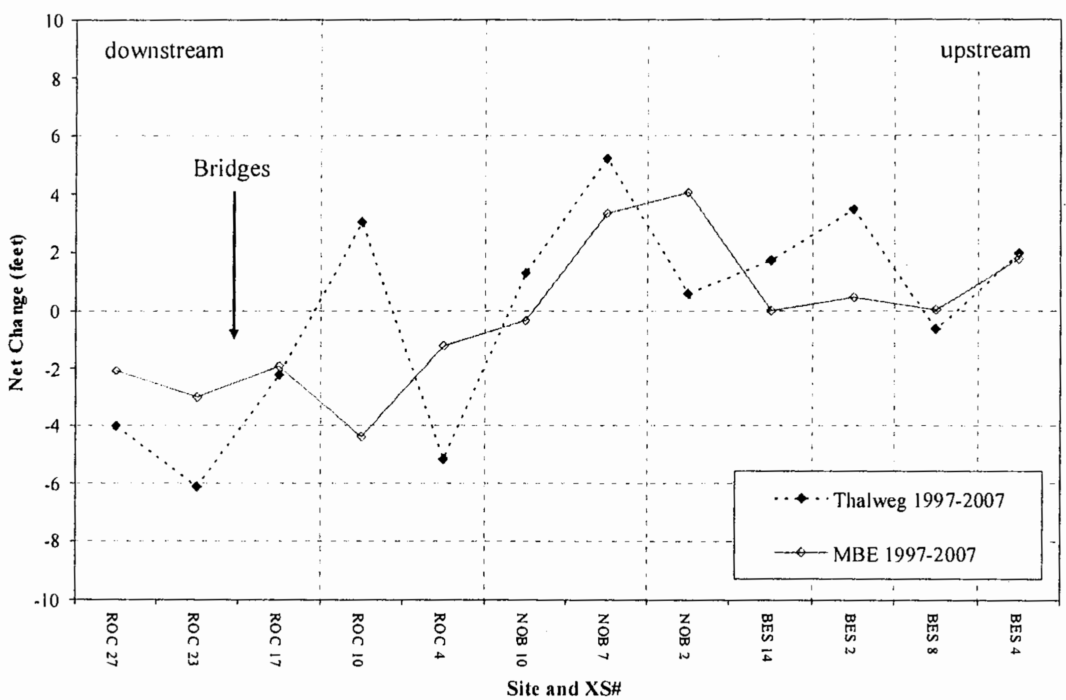


Figure 9. Van Duzen River Thalweg and Mean Bed Elevation Net Change, 1997-2007



Middle Reach Eel River

Channel changes were more subdued and consistent among sites in the Middle Reach Eel than in the Lower Eel. Figures 10-12 show results of thalweg and mean bed elevations and scour/fill with the same vertical scaling as those for the Lower Eel. Consistent with Table 5, the Middle Eel River XS almost exclusively exhibited decreases in thalweg and mean bed elevations. A few XS showed minor increases over the 1997-2002 period, but net decreases for 1997-2007. Increases in mean bed elevation were limited to South Fork and Holmes/Larabee Bars. Figure 13 corroborates this and shows that at most XS, thalweg elevations decreased in concert with mean bed elevations.

Figure 10. Middle Eel River Thalweg Elevation Change, 1997-2007

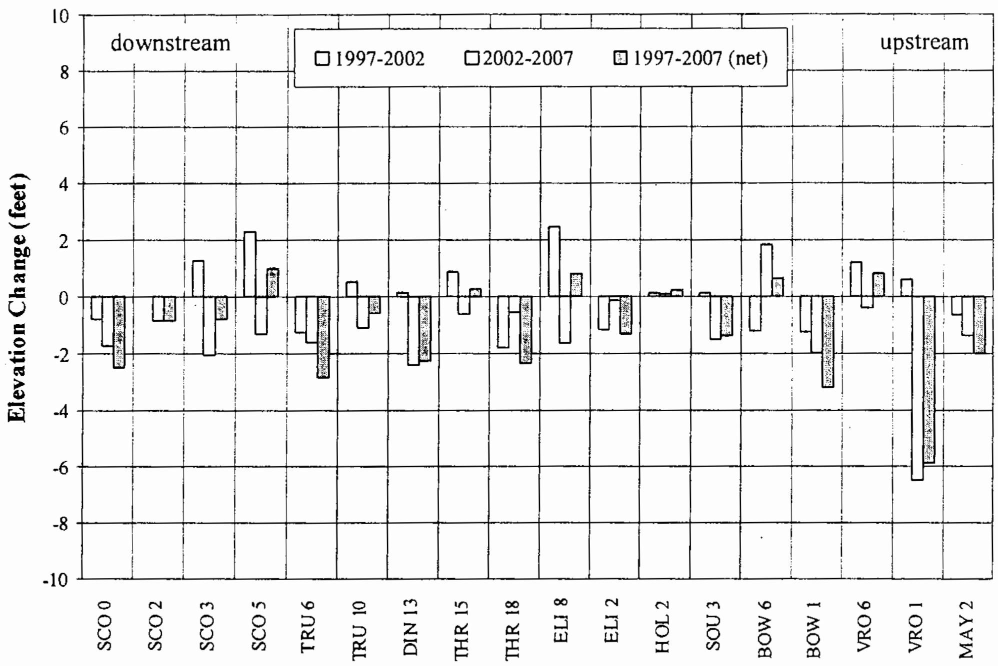


Figure 11. Middle Eel River Mean Bed Elevation Change, 1997-2007

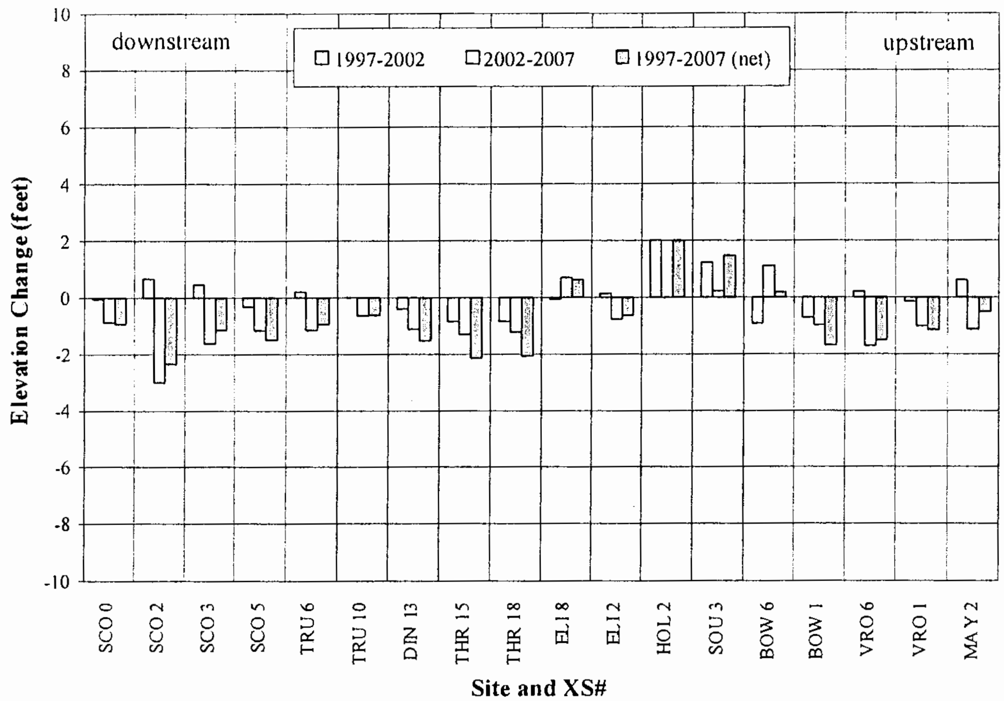


Figure 12. Middle Eel River Channel Bed Scour and Fill, 1997-2007

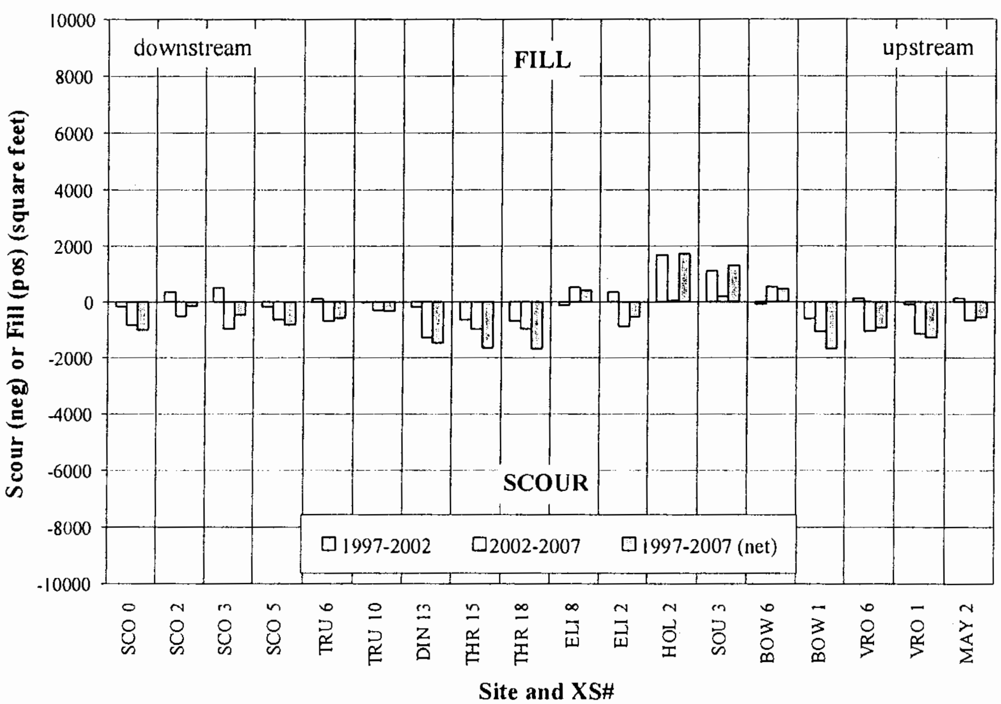
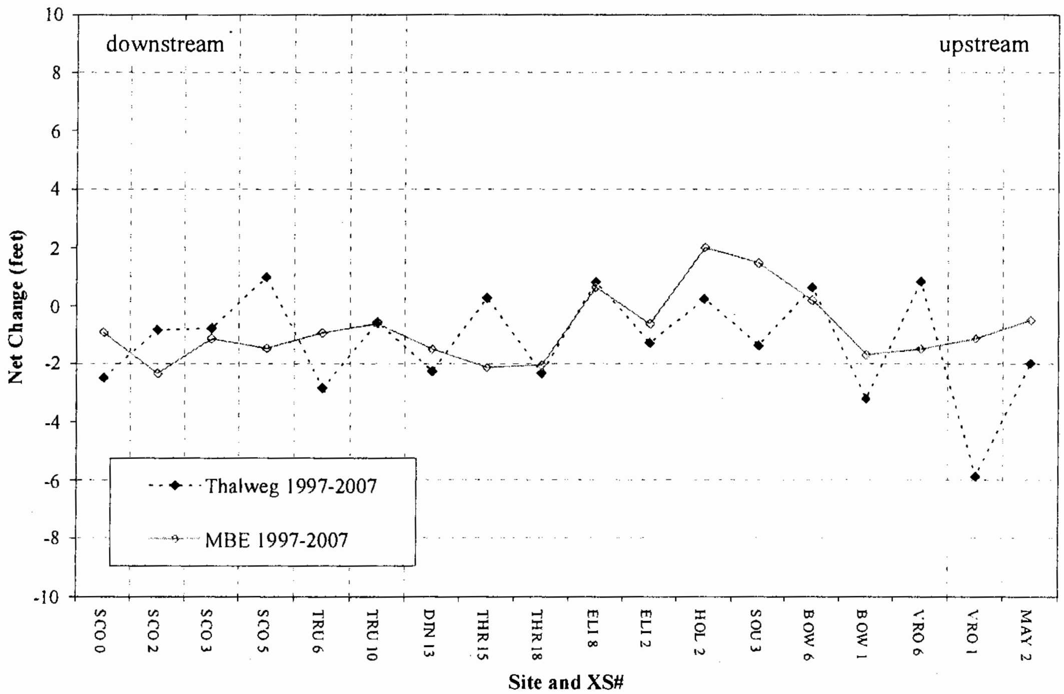


Figure 13. Middle Eel River Thalweg and Mean Bed Elevation Net Change, 1997-2007



South Fork Eel River

Results for the South Fork Eel River were quite similar to those for the Middle Eel. Channel changes were relatively subdued and consistent among sites in the South Fork Eel than in the Lower Eel. Figures 14-16 show results of thalweg and mean bed elevations and scour/fill with the same vertical scaling as those for the Lower Eel. Consistent with Table 5, the South Fork Eel River XS almost exclusively exhibited decreases in thalweg and mean bed elevations. A few XS showed minor increases over the 1997-2002 period, but net decreases were most common during the 1997-2007 period as a whole. Increases in mean bed elevation were limited to the Wallan & Johnson and Randall sites, and were very small. Decreases in thalweg and mean bed elevations ranged to almost four feet at Cooks Valley (CVA, Figures 14-17). Figure 17 corroborates this and shows that at most XS, thalweg elevations decreased in concert with mean bed elevations.

Figure 14. South Fork Eel River Thalweg Elevation Change, 1997-2007

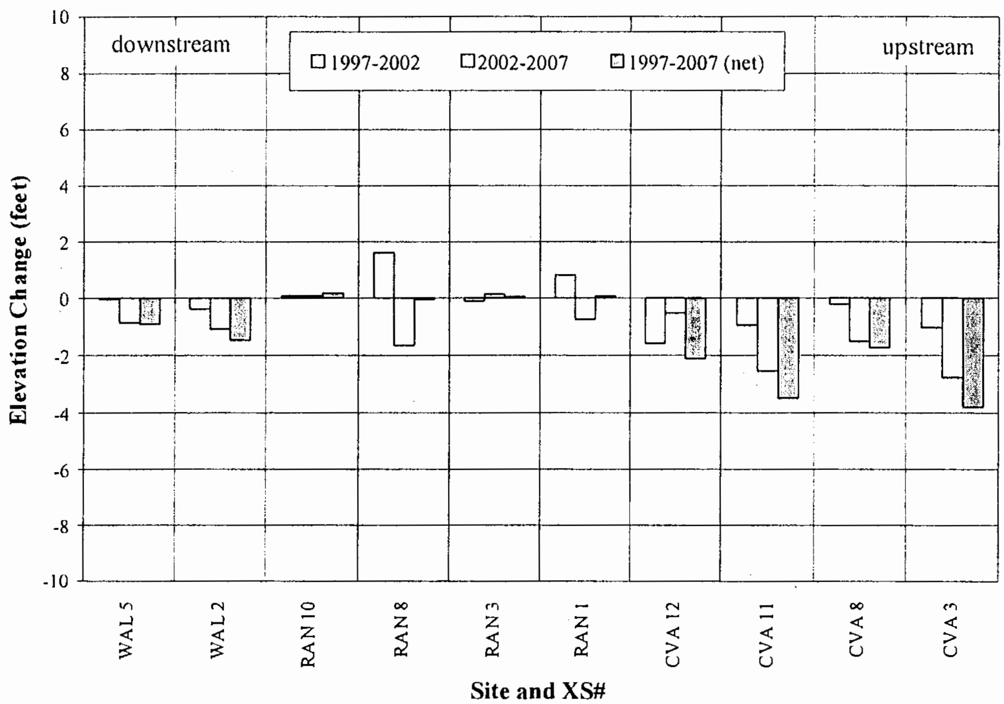


Figure 15. South Fork Eel River Mean Bed Elevation Change, 1997-2007

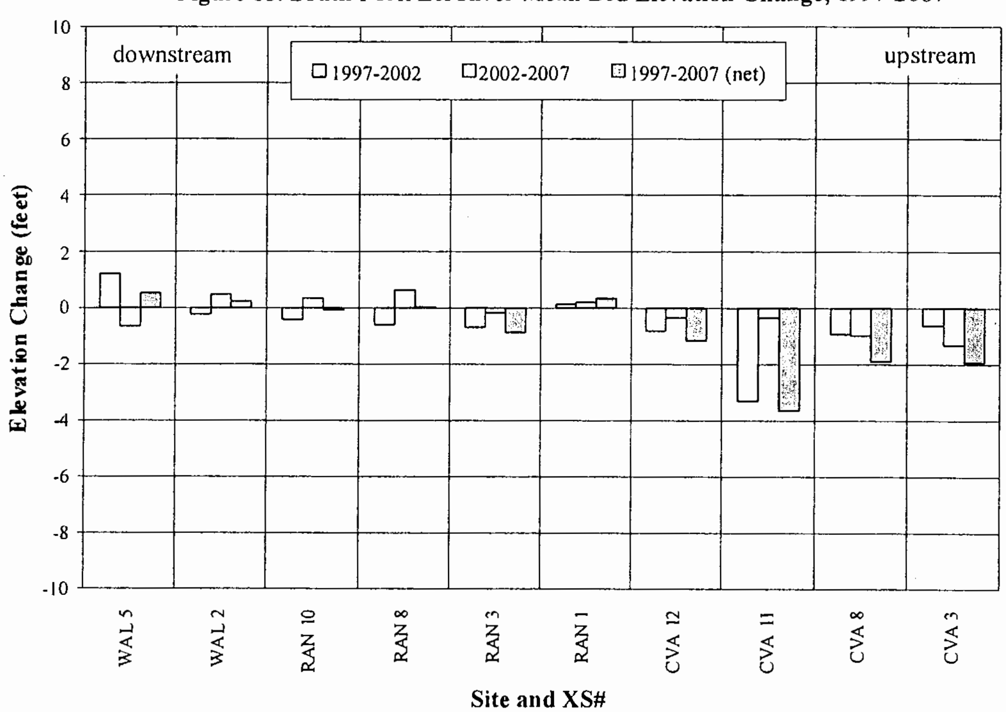


Figure 16. South Fork Eel River Channel Bed Scour and Fill, 1997-2007

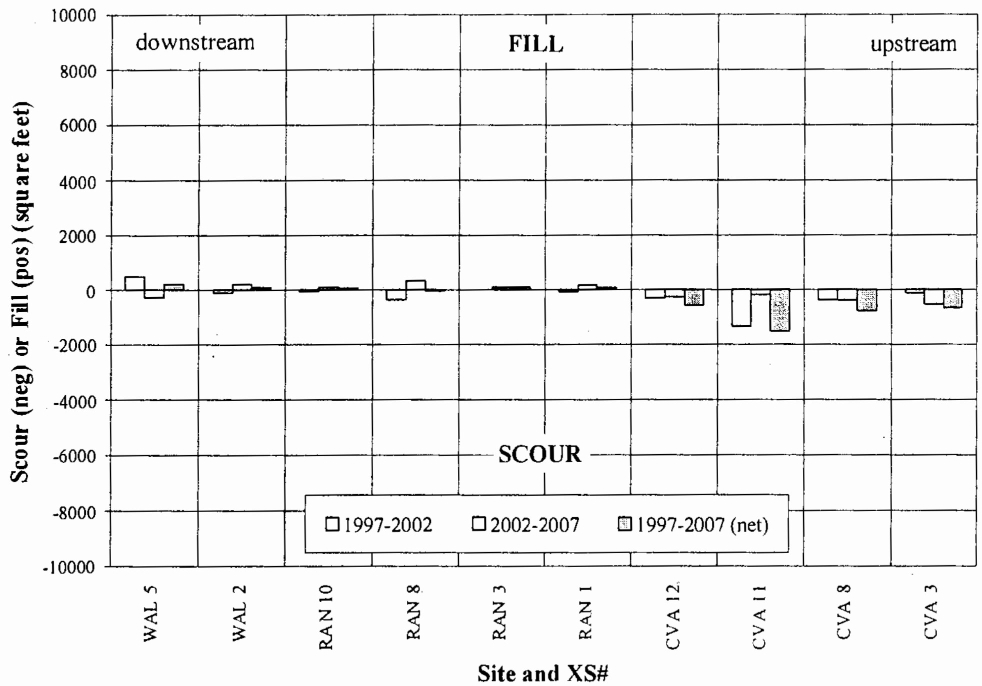
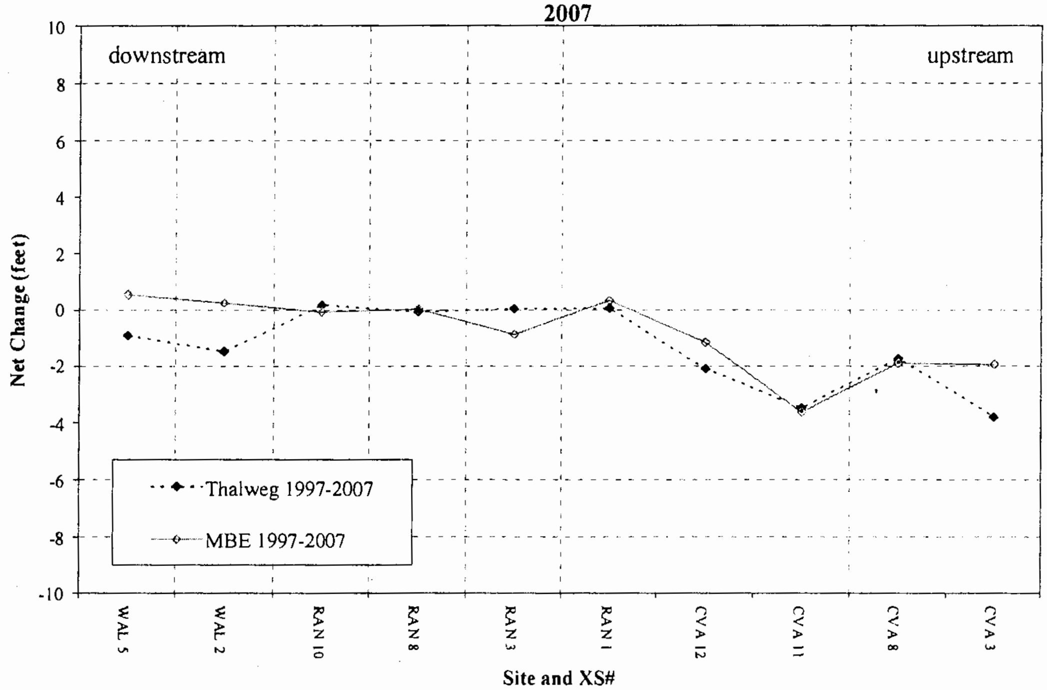


Figure 17. South Fork Eel River Thalweg and Mean Bed Elevation Net Change, 1997-2007



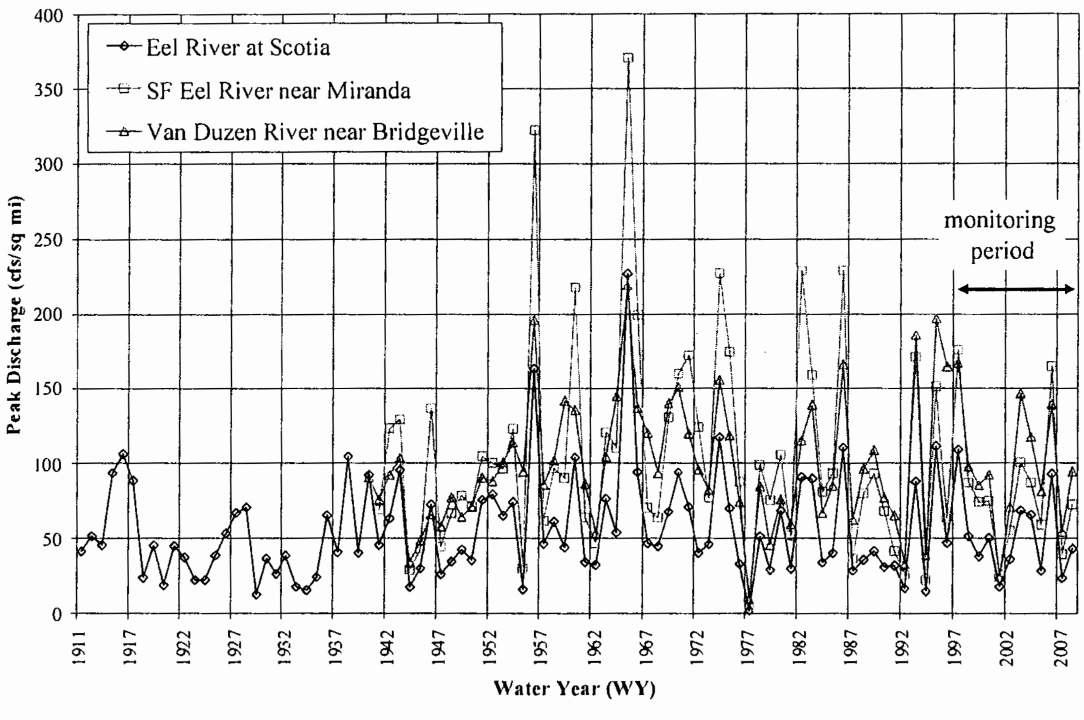
Flood History

Floods are the drivers of channel change, so the history of floods, especially large ones, provides an important context for evaluating changes in river channels. Three USGS stream gaging stations are used as reference sites for river discharge in the Eel River:

Eel River at Scotia (USGS Sta. No. 11477000, drainage area = 3,313 sq. mi.)
South Fork Eel River near Miranda (USGS Sta. No. 11476500, drainage area = 537 sq. mi.)
Van Duzen River near Bridgeville (USGS Sta. No. 11476500, drainage area = 222 sq. mi.)

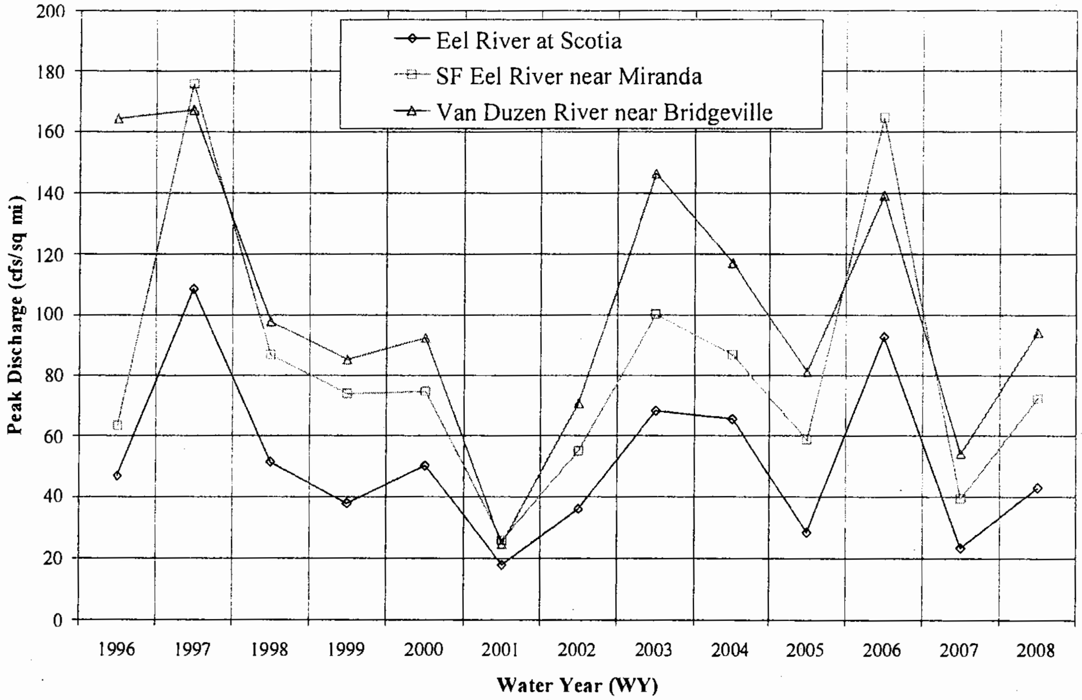
Figure 18 shows the annual maximum instantaneous peak discharges over the period of record (1911-2008), while Figure 19 shows just the peak discharges for the XS monitoring period. Data are expressed on a unit drainage area basis (cfs/sq. mi.) for comparison. By far, the largest floods of record occurred in water years (WY, October-September) 1956 (Dec., 1955) and 1965 (Dec., 1964). Other large floods occurred in WY 1960, 1974, 1982, and 1986. During the monitoring period (1997-2007), several large floods occurred, but all were substantially smaller than these six earlier floods.

Figure 18. Annual maximum peak discharges, Eel River Basin, 1911-2008.



As shown in Figure 19, during the 1997-2007 XS monitoring period, the largest floods occurred WY 1997 (Jan., 1997) and 2006 (Dec., 2005) in the South Fork and Lower Eel rivers. In the Van Duzen, the 2003 (Dec., 2002) flood was slightly larger that that in WY2006. Although smaller than record historical floods, these events were quite capable of transporting large volumes of gravel.

Figure 19. Annual maximum peak discharges, Eel River Basin, 1996-2008.



Discussion

The Eel River channel network spans a very large geographical area from the Pacific Ocean south to the Willits area in Mendocino County. Gravel mining sites participating in Humboldt's adaptive management program span a fair portion of that, all the way to from Fernbridge to the Humboldt-Mendocino County line. Unlike the Mad River, where mining sites and monitoring are concentrated in an eight-mile reach, mining sites in the Eel are clustered in four areas, with those in closest proximity to one another located in the Lower Eel and Van Duzen rivers. Consequently, a sediment budget-derived estimate of mean annual recruitment (MAR) for the Eel River would be based on relatively scant existing information on channel bed sediment supply, storage and changes, and so would have large uncertainty. Should derivation of a reliable estimate of MAR become a high priority, as it would if permits for new, large mining operations are sought, then filling of data gaps would be a necessary first step.

As demonstrated for the Redwood Creek watershed by Madej and Ozaki (1996), transport of channel bed sediment slows as it works its way downstream over the decades following large erosion and sediment delivery events such as the 1964 flood. In a basin the size of the Eel River (3,313 sq. mi. at Scotia), export of coarse sediment would be expected to take much longer than in the much smaller Redwood Creek watershed (287 sq. mi. at Orick). Thus historical floods and massive sedimentation in the 1950s through 1970s in the Eel River system certainly influence contemporary channel form and process.

This cross section analysis showed generally that channel changes were greatest on the Lower Eel and Van Duzen rivers, but that there was no consistent trend among sites in these reaches. Both exhibited areas of elevation increase and decrease. More consistent results came from XS analysis of the other two reaches, Middle Reach and South Fork Eel River, where elevations decreased and scour occurred. Individual sites in these two reaches showed little change or net gravel storage loss.

Comparing observed channel changes with mining rates is the obvious and most simplistic approach to exploring causal relationships, and one would expect channel degradation to exist, or be greatest, where mining volumes were highest. However, the opposite seems to be the case: channel bed elevation decreases and scour were highest where mining volumes were lowest (Middle Reach and South Fork Eel, see Tables 3 and 5). Where gravel mining volumes have been the greatest, mixed results were documented: both gravel accumulation (e.g., increases in mean bed elevation) and loss occurred in the lower Eel and Van Duzen rivers. Within these two reaches, the Leland Rock site stands out as an area of reduced bed elevations and net gravel loss. Whether this was from excessive mining volumes, recovery from aggradation caused by historical floods and sediment delivery to channels, effects from channel constriction imposed by the abutments of the three bridges, or processes unique to the deltaic setting cannot be determined with this analysis.

In a study which was completed about the time XS data first became available for the Eel River, Klein (1998) assembled and reviewed available XS data for the Van Duzen River. His general conclusions stated:

> *"Although the data presented herein is of limited use in making reliable inferences about channel responses in the main stem Van Duzen River, recent changes suggest that mean bed elevations increased in response to the 1965 flood, became even higher following floods in the 1970's, and have been generally lowering in recent years."*

This suggests that the Van Duzen is indeed exporting gravel as channel recovery proceeds. Whether bed lowering at the Leland Rock site is due in part or exclusively to channel and watershed recovery processes is unknown.

As a general conclusion, and based on this abbreviated analysis, we did not discern any large scale, persistent effects of Eel River gravel mining on channel thalweg elevations, mean bed elevations, or scour. It is possible that using only a sampling of XS and survey years caused us to miss something significant, but we doubt it. Gravel mining effects in the Eel River are probably limited to short term, localized effects which the adaptive management program and federal and state oversight attempt to avoid or minimize. Refinement of project-scale minimization measures will continue to be a fundamental component of the adaptive management process, as will instream habitat improvement projects associated with gravel extraction operations.

Literature Cited

Klein, R.D. 1998. Recent and historical changes in channel cross sections at selected sites in the Van Duzen River basin. Report prepared for Tetra Tech, Inc., for Environmental Protections Agency. 23 p.

Lehre, A.K. 1995. Lintrp 1.4, an Excel macro for linear interpolation. Humboldt State University, Geology Department website: http://www.humboldt.edu/~geology/courses/geology550/550_macros_templates_index.html

Madej, M.A., and V. Ozaki. 1996. Channel response to sediment wave propagation and movement, Redwood Creek, California, USA. Earth Surface Processes and Landforms. V. 21. Pp. 911-927.

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Lower Eel River
Gravel Mining and Extraction Activities
Biological Assessment
(Western Snowy Plover)

March 12, 2009

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Lower Eel River Gravel Operators

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EXHIBIT NO. **B**

APPLICATION NOS.

1-09-005 (Eureka Ready Mix)
1-09-006 (Eureka Ready Mix)
1-09-011 (Hansen)
1-09-022 (Mercer-Fraser Co.)

WESTERN SNOWY PLOVER BIOLOGICAL ASSESSMENT

I. INTRODUCTION

The purpose of this biological assessment (BA) is to review the proposed Lower Eel River (LER) gravel mining and extraction activities in sufficient detail to determine to what extent the proposed action may affect the Federal threatened coastal populations of the Western Snowy Plover (*Charadrius alexandrinus nivosus*) and designated critical habitat listed below. In addition, the following information is provided to comply with statutory requirements to use the best scientific and commercial information available when assessing the risks posed to listed and/or proposed species and designated and/or proposed critical habitat by proposed federal actions. This initiation package is prepared in accordance with legal requirements set forth under regulations implementing Section 7 of the Endangered Species Act (50 CFR 402; 16 U.S.C. 1536 (c)).

Threatened, Endangered, Proposed Threatened or Proposed Endangered Species

The following listed species may be affected by the proposed action:

- Pacific coast Western Snowy Plover (*Charadrius alexandrius nivosus*) Threatened (58 FR 12864-12874; March 5, 1993);
- Western Yellow-billed Cuckoo (*Coccyzus americanus*) Candidate;
- Southern Oregon/Northern California Coasts (SONCC) coho salmon (*Oncorhynchus kisutch*); listed under the ESA as threatened (62 FR 24588; May 6, 1997);
- California Coastal (CC) Chinook salmon (*O. tshawytscha*); listed under the ESA as threatened 64 FR 50394 (September 16, 1999);
- Northern California (NC) steelhead (*O. mykiss*); listed under the ESA as threatened (65 FR 36094; June 7, 2000).

The salmonids are being treated under a separate cover. The cuckoo is listed as casual in northwestern California with no known breeding records (Harris, 2005), although recent evidence suggests that LER riparian on Cock Robin Island, may have hosted a nesting pair in the summer of 2008 (McAllister, 2008, Rogers, et al., 2009). Mature riparian habitat required by cuckoos for breeding is not expected to be impacted by the extraction activities described herein. None of the above species except the Snowy Plover are being treated under this Biological Assessment.

Critical Habitat

Critical Habitat was finalized by the U.S. Fish & Wildlife Service (FWS) for the Pacific coast Western Snowy Plover (WSP) effective September 29, 2005 (70 FR 56970-57119). The Lower Eel River (LER), from the confluence of the Van Duzen River to the Eel River mouth, is included

included within the area designated as critical habitat.

The action addressed within this document also falls within critical habitat for the following species:

- Southern Oregon/Northern California Coasts (SONCC) coho salmon (*Oncorhynchus kisutch*); Designated critical habitat (64 FR 24049; May 5, 1999);
- California Coastal (CC) Chinook salmon (*O. tshawytscha*); designated critical habitat (70 FR 52488; Sept. 2, 2005);
- Northern California (NC) steelhead (*O. mykiss*); designated critical habitat (70 FR 52488; Sept. 2, 2005).

Critical habitat for the above species except the Snowy Plover, are being treated under a separate Biological Assessment.

II. CONSULTATION TO DATE

Consultation under the ESA consists of discussions between the action agency, the applicant (if any), and the FWS and National Marine Fisheries Service (NMFS). Consultation includes the sharing of information between all parties about the proposed action and related actions, the species and environments affected, and means of achieving project purposes while conserving the species and their habitats. Under the ESA, there can be both formal and informal consultation. The consultation process in each is similar, but formal consultation has statutory timeframes and other requirements (such as the submission of the information in this package). Informal consultation typically concludes after the action agency makes a determination that the action "***may affect, but is not likely to adversely affect***" listed species or critical habitat and FWS and/or NMFS concur with this determination in writing. Formal consultation typically occurs when the action agency makes a determination of "***may affect, likely to adversely affect***" and concludes when FWS and/or NMFS issue a biological opinion. Alternatively, formal consultation can also lead to incorporation of additional protective measures that render the project "not likely to adversely affect" listed species or designated critical habitat.

Summaries of the history of WSP consultation that has occurred thus far are presented in an earlier Biological Assessment (Mad River Biologists [MRB], 2002, Appendix A) and a FWS Biological Opinion [BO] (FWS, 2005, Appendix B). Since 2005, technical assistance from FWS has been provided to the operators (Leland Rock, Eureka Ready Mix, Granite Construction, Mercer Fraser and County of Humboldt) or their representatives in January 2009. At that meeting, procedures to provide pre-extraction survey notification to the U.S. Army Corps of Engineers (USACE) prior to agency site visits was requested. Additional technical assistance from FWS was provided to Paul Kraus of Eureka Ready Mix on January 6, 2009, and to Winzler & Kelly on January 23, 2009, with additional electronic correspondence provided from FWS on February 13, 2009.

III. CURRENT MANAGEMENT DIRECTION

In summary, from the MRB (2002) BA:

In accordance with Title 33 CFR 325.2(e) published in the Federal Register, November 13, 1986, the USACE has adopted a Letter of Permission (LOP) procedure for the authorization of work herein. The original LOP (96-1) has been extended until December 2002 although a new LOP (02-1) has been drafted. Gravel extraction in Humboldt County is cooperatively regulated by the USACE, Humboldt County Planning Department, the California Department of Fish & Game (DFG), *and others. Because Endangered Species Act listed species and their habitats are present, the National Marine Fisheries Service and FWS were consulted.*

The purpose of the LOP procedure is to streamline the Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899 authorizations for gravel mining and extraction activities in Humboldt County that do not pose significant adverse individual or cumulative impacts.

LOP (02-1) was issued with FWS provided recommendations that in addition to seasonal operating restrictions, buffer zones and specific monitoring guidance, included additional details such as speed limits and time of day restrictions. LOP 2004-1 was issued by the USACE, with a request to the FWS on April 28, 2004, for formal consultation under Section 7(a)(2). In response, the FWS prepared a BO (Formal Consultation [8-14-2005-2730] on Proposed Gravel Operations in Humboldt County, California: Letter of Permission, Procedure 2004-1, attached in Appendix B). The LOP 2004-1 was in effect for 5 years. The current LOP 2009-1 is presently in draft and is the incentive for this BA.

IV. DESCRIPTION OF THE PROPOSED ACTION

The proposed action is the intent to extract gravel for commercial purposes from the LER gravel bars. The applicants are the LER gravel operators. The federal action is issuance of a Section 404 permit. Thus, the USACE would be authorizing the activity and is the action agency. Gravel may be extracted by excavation by various means for example-horseshoe pits, trenches, alcoves and wetland pits, or by skimming the surface of the gravel bar. A description of the numerous extraction methods is provided below.

Activity related to gravel removal, generally occurs within the limits defined by the Ordinary High Water (OHW) mark. Operations consist of excavation, grading, loading, and transport of sand and gravel from dry gravel bars to processing plants. The primary method of excavation is skimming with a variety of heavy equipment including bulldozers, excavators, belly scrapers, front-end loaders, large haul trucks, dump trucks and similar types of machinery. The proposed projects are situated reaches that exhibit varied channel morphology, elevation, vegetation patterns, aquatic habitats, and aggregate deposits. This variation in physical and biological characteristics makes it appropriate to employ an innovative site-specific planning approach rather than a one-size-fits-all methodology.

For these applications, a variety of aggregate extraction and non-extraction activities are being considered that may be applied on a site-specific basis depending on bar and discharge characteristics and proximity to sensitive habitats. Full descriptions of the extraction methods and restoration activities are described in detail below. The proposed activities are sorted into four groups according to their objectives. The groups are:

- Pre-extraction activities,
- Extraction methods with impact minimization measures,
- Extraction methods with a restorative component, and
- Optional restoration actions.

Pre-extraction activities

Pre-extraction activities are those whose primary objective is to survey gravel bar cross-sections, site visits to evaluate extraction materials plan, survey for nesting WSP and conduct agency pre-extraction site visits.

Extraction with impact minimization measures

Extraction methods with impact minimization measures are those whose primary objective is to extract commercial quantities of aggregate. These methods include narrow skims, horseshoe skims, inboard skims, traditional skims, and other options developed by the applicants, CHERT, the USACE, DFG and NMFS that will allow for both economical operations and aquatic resource protection. Identification of specific extraction methods will occur during the pre-extraction planning process and will depend on site conditions at that time. The standard impact minimization measures associated with these methods include, but are not limited to; the 35% exceedence flow elevation buffer from the low flow channel, head of bar buffer; riparian vegetation avoidance, large woody debris retention, and post-extraction bar surface reclamation.

Narrow Skim

Narrow skims of active bar surfaces shall· be limited to widths no greater than one-third the exposed bar width as measured at the widest point of the bar. Narrow skims may extend into the traditional head-of-bar buffer, tapering gradually as a function of decreasing bar width.

Horseshoe Skim

This method would harvest gravel from the downstream two-thirds of gravel bars. A lateral edge-of water buffer is maintained along the low flow channel. The upper third of the bar will be left in an undisturbed state as an upper bar buffer. The finished grade of the extraction area will have a downstream gradient equal to the river and the floor will follow the low flow water table. Cut-slopes will be left 'at a 2: 1 (horizontal: vertical) slope except along the upstream side at the head-of-bar buffer where a 10:1 slope will be established. There will be at least a 15-foot offset buffer from the bank. The extraction surface shall daylight along the downstream 1/5 of the bar to facilitate drainage following high runoff events. Due to less frequent flow inundation, horseshoe shaped skims may take larger flow events to replenish than traditional skim designs, depending on the unaltered bar height between the excavation and the stream.

Inboard Skim

This method is similar to the horseshoe except that it maintains a wider horizontal offset from the low flow channel where warranted. These areas would be excavated to a depth no lower than the water surface elevation offset, with a 0-0.5% cross slope, steeper (1:1) slopes on the sides, and gentle (10: 1) slopes at the head of the excavation. The horizontal and vertical offsets are intended to remove the excavation area away from zones of frequent flow inundation. There would be a 15-foot offset buffer from the bank. The excavation may extend into the upper one third of the head-of-bar buffer if sufficient rationale is provided to show that protection of the upstream riffle would be maintained. .

Traditional Skim

A traditional skim allows extraction surfaces that exceed one-third of the bar width as measured at the widest point of the bar. This method does not extend beyond the upper one-third head of bar buffer, maintains the 35% exceedence flow elevation offset from the low flow water surface, and includes other standard protection measures.

Wet Floodplain Pit

Wet floodplain pits are irregularly shaped excavations (to avoid excavating riparian vegetation) located on the l-to-3 year floodplain surface. An excavator digs out the sediment below the water table and leaves the sides of the pit sloped. Wet pits are typically shallow and allow for gravel extraction away from frequently inundated gravel bar surfaces. Wet pits will fill with sediment only during high flow events, on the order of every 1-to-3 years, and typically over a multi-year period. Wet pits may have vegetation, either existing or planted, around their perimeter, and may contain some type of cover elements, such as woody debris. These features may also fill in with fine sediment that would create a seedbed in which native riparian vegetation could become established. Pit extractions have not been a widely utilized extraction method within the Lower Eel River project reach,

Dry Floodplain Pits

Dry floodplain pits are irregularly shaped excavations (to avoid excavating riparian vegetation) located on the 2-to-5 year floodplain surface away and may or may not be connected to the low flow channel by any secondary channels. An excavator digs out the sediment and leaves the sides of the pit sloped. The floor of the pit does not extend into the groundwater table. Dry pits allow for gravel extraction away from frequently inundated gravel bar surfaces. Dry pits will only fill with sediment during high flow events, on the order of every 2-to-5 years, and typically over a multi-

multi-year period. Dry pits may have vegetation, either existing or planted, around their perimeter. These features may also fill in with fine sediment that would create a seedbed in which native riparian vegetation could become established. Pit extractions have not been a widely utilized extraction method within the Lower Eel River project reach.

Oxbows

Narrow (average low-flow channel or less), linear, off-channel excavations along historic channel locations, typically defined on aerial photographs by curvilinear vegetation colonization, muted secondary channels, or as the toe of a moderate to high terrace or valley margin. Extraction shall be located where a future channel would be desired in contrast to present channel pattern. Features should be located in downstream half of bar to minimize channel capture and should not be excavated deeper than the adjacent thalweg. Oxbows will have willow vegetation and large woody debris placed in them to enhance their cover habitat. Oxbow extractions have not been a widely utilized extraction method within the Lower Eel River project reach.

Alcoves

Alcove extractions are located on the downstream end of gravel bars, where naturally occurring alcoves form. Alcove extractions are irregularly shaped to avoid disturbance of riparian vegetation, and are open to the low flow channel on the downstream end. Alcoves are extracted to a depth either above or below the water table, and are small in area and volume extracted, relative to other extraction methods.

Secondary Channel Skims

These extractions are elongate, shallow skims in the area of dry, secondary channels, designed to be free-draining and open at either end. The skim floor elevation shall be at least one foot above the riffle crest of the secondary channel. Secondary channel riffle crest elevations shall be shown on the spring aerial photograph and included as extraction floor reference points in the pre-extraction proposal. The upstream riffle crest, or elevation control of secondary channels shall not be affected by extraction proposals.

Migration Channel Excavation

Migration channels may be excavated in those locations where upstream fish passage into tributary channels is impeded by sediment deposits. These channels are constructed to connect mainstem channels to tributaries at lower discharges than would be required in the pre-project condition, thus allowing easier access for upstream migrating adult salmonids.

High Terrace Skim

This method extracts gravel from the 10-year or greater floodplain that is located at the downstream end of the lower bar. This area is to be excavated to the 1- year flood elevation (below bankfull elevation) and in such a way as to promote backwatering and fine sediment deposition at higher flows. This extraction is expected to foster riparian vegetation development by creating a suitable seed bed that is at a low enough elevation so seedling roots can gain access to summer groundwater. The intent is to utilize this method only one time during the permit period, primarily when instream sources are not sufficient to meet volume requirements.

Action Area

The ***action area*** is defined as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." The action area is not based simply on the Federal action and should not be limited to the location of the Federal action. The purpose of identifying this area is to provide a boundary around the area(s) in which the ***effects of the action*** will be felt. In this area, the physical, chemical, and biological changes resulting from the proposed action and any interrelated and interdependent actions are considered in context of existing conditions and activities to determine the resulting consequence to species and critical habitat. The action area is defined by measurable or detectable changes in land, air and water, or other measurable factors that result from the proposed action and interrelated or interdependent actions.

The action area as described by USDI FWS (2005b) is to include the Lower Eel River, downstream of the Van Duzen River and including the following gravel bars: Leland Rock (upstream on the Van Duzen River to river mile 1.7), Hauck Bar (Eureka Ready Mix operator), Hansen Bar, Sandy Prairie (Mercer-Fraser Company, operator), Canevari (Mercer-Fraser Company, operator), Drake Bar (Drake Materials, operator), Worswick (County of Humboldt, operator) and Singley Bar (Eureka Ready Mix, operator). An action area map is provided of an aerial photograph with the bar (reach) locations provided is attached following this page (Lower Eel River Projects Snowy Plover Consultation Reaches) as well as the following site descriptions.

Project Description

Leland Rock

The Leland Rock site (Assessor's Parcel Numbers [APN's] 205-121-001,002, 003, 205-151-001, 003, 004, 205-191-001; Sections 23, 24, 25 & 26, Township 2 N, Range 1 W, Humboldt Base Meridian (HBM), 40° 32' 22" N, 124° 08' 49" W) is located off of Highway 101, approximately 1,500 feet north of the Van Duzen River bridge, south of the City of Fortuna. The operator has maintained commercial gravel mining operations at this site (Leland Rock ownership) since 1966. The total project area is approximately 161 acres in size, approximately 34 of which may be disturbed annually, but reclaimed each year. The project area is generally within Ordinary High Water and therefore within Corps jurisdiction.

The operation is permitted by the County of Humboldt (SP-05-94) and CUP-28-94) to extract a maximum of 100,000 cubic yards annually. The 404 permit application proposes that a maximum extraction volume of 100,000 cubic yards be allocated on an annual basis, which corresponds to a maximum of 1,000,000 cubic yards allocation for the ten year term of the permit. This proposed allocation is based upon Leland Rocks' historical extraction rates and fall within the range of MAR as allocated by the CHERT committee.

Hauck Bar

Eureka Ready Mix proposes to continue to extract aggregate from the Hauck Bar, located on the Eel River at river mile ~14, downstream of the Van Duzen River confluence. The lead agency permit for the site allows for annual excavation of up 150,000 cubic yards of aggregate during the extraction season, occurring between the dates of July 22 and October 15.

The project area consists of those areas of the subject parcels west of Sandy Prairie Levee (APN's 106-221-001, 201-261-006 & 201-221-009) in portions of Sections 14, 15, 22, 23 & 24, T2N, R1W, HBM. The Hauck property is leased and has been operated by Eureka Ready Mix since 1981. The average annual extraction volume during the period from 1993 to 2008 is 48,236 cubic yards and during the term of the 2004 USACE) Individual Permit (27725N) was 53,660 cubic yards.

Operations are permitted by the local lead agency through Conditional Use Permit (CUP-29-92), Coastal Development Permit (CDP-59-92) and Reclamation Plan (SMR-08-92).

Hansen Bar

The Charlie Hansen Sand & Gravel (Hansen) Project involves the continued gravel extraction activity on the lower Eel River gravel bar (River Mile 13.5), that occurs annually between June 1st and November 1st. The Hansen Project is permitted under a Vested Rights (SMR-03-912), (RP-02-912) authorized by the County of Humboldt for removal of up to 100,000 cubic yards (yd^3). However, the proposed action is for an annual volume not to exceed 50,000-yd^3, which corresponds to a maximum 500,000-yd^3 in a ten-year period.

The Project property is solely owned by the Hansen family (APN 201-211-003) and is situated within Section 14, T2N, R1W, HBM. The project site is located 5-miles south of Fortuna, California, on the west side of Sandy Prairie Road, ¼ mile north of the intersection of Highway 101 and 36. The property is approximately 108 acres, with 49 acres being agricultural land (pasture). A portion of the site (13 acres) is utilized for processing and stockpiling of aggregate from the adjacent bar. Most of the surrounding land use is industrial, agricultural, rural, and rural-improved. The river channel is defined by 15-25 foot vertical banks cut through agricultural lands with some residences nearby. The upper terraces are covered with a mixture of vegetation. Groundwater is at river level except during winter when it raises due to seasonal rainfall. The climate is temperate and rainfall in the area averages 30-40 inches per years. The subject gravel bar is essentially an open active bar without topsoil or significant amounts of vegetation. Of the 108 acres included in the site, rarely are more than 17 acres disturbed annually within the bank-full channel by the Project. Natural bedload transport processes will be the major factor that will accomplish yearly reclamation with the advent of annual of annual high velocity flows over the bar and reshaping and replenishing gravel and vegetation. However, annual site reclamation activities consist of finish grading gravel bars following extraction of sand and gravel to leave them shaped in a configuration consistent with permitted design criteria imposed by the USACE, DFG, North Coast Regional Water Quality Control Board, and NOAA Fisheries. It should be noted that extraction volume might fluctuate in response to annual replenishment and operational conditions affecting habitat protection goals.

Sandy Prairie

The Sandy Prairie site (APN's 106-041-015, 016, 106-091-030, 040, 044, 200-352-002, 003, 200-361-002, 003, 200-362-011, 005, Sections 2 & 3. T2N, R1W, Sections 33 & 34, T3N, R1W, HBM, latitude 40, 35.2', 74" N, longitude 124 09' 34.2" W) is located on both sides (north and south) of the Fortuna wastewater treatment plant, at the general location of the confluence of Strongs Creek with the Eel River (river mile 10.5). The Sandy Prairie site is comprised of two separately permitted sites as the Pedrazzini site and the Canevari site. The operator has maintained commercial gravel mining operations at the Pedrazzini site dating back to the 1940's and is a vested rights ops site (Mercer-Fraser Sandy Prairie Bar). The total project area is approximately 995 acres in size, approximately 38 of which may be disturbed annually, but reclaimed each year. The project area is generally within the limits of Ordinary High Water and therefore with USACE jurisdiction. The operation is permitted by the County of Humboldt (SP-07-88, CIUP-57-912) to extract a maximum of 270,000 cubic yards annually. The 404 permit application proposes that a maximum extraction volume of 270,000 cubic yards be allocated on an annual basis, which corresponds to a maximum of 2,700,000 cubic yards allocation for the ten-year term of the permit. This proposed allocation is based upon Mercer-Frasers' historic extraction rates and fall within the range of MAR as calculated by the CHERT committee.

Drake Bar

This site is owned by Shamrock Materials and is currently leased to Eureka Ready Mix. It is located between the Mercer-Fraser Canevari site and the County Worswick Bar, approximately at the Palmer Creek confluence.

The Drake bar (S1/2 Sec. 34, T3N, R1W, H.B.M., on the lower Eel River, northwest of the City of Fortuna, Humboldt County. 200-331-02; 200-332-06; 200-341-06, latitude 40, 36', 11" N, longitude 124 10' 43" W) extraction areas are located at the downstream end of Sandy Prairie, on the west side the processing plant, just upstream of the confluence of Palmer Creek with the Eel River (river mile 10). The site is accessed via the Palmer Creek/Highway 101 interchange. The operator has maintained commercial gravel mining operations at the Drake bar dating back to the 1950's and is a vested rights site. The total project area is approximately 120 acres in size, approximately 30 of which may be disturbed annually, but reclaimed each year. One hundred acres of the project area is within the limits of Ordinary High Water and therefore with USACE jurisdiction.

The operation is permitted by the County of Humboldt (SMP-08-93, RP-01-93) to extract a maximum of 250,000 cubic yards annually, which corresponds to a maximum of 2,500,000 cubic yards allocation for the ten-year term of the permit. Skimming is the preferred extraction method for the bar, although alternative extraction methods (e.g. trenching) have also be used. Equipment utilized typically includes excavator, front-end loaders, bulldozers and haul trucks. A bridge crossing is currently required to access the extraction area. Excavated rock is transported to a permanent crushing and stockpile site adjacent to the bar, above ordinary high water. Work period is between June 1 and November 1. Reclamation is ongoing and is completed immediately after extraction is complete.

Worswick Bar

The Worswick Gravel Bar is on the LER at river mile seven, immediately upstream of Fernbridge (Highway 211). The bar is on Assessor Parcel Number 200-321-11, and is located in Sections 28 and 29 Township 3 North, Range 1 West, HBM (40° 36.7' N, 124° 11.8' W). Access to the bar is from Fernbridge Drive, just north of the entrance ramp to southbound Highway 101. The bar is 227 acres in size, although the average area of each extraction is approximately 10 acres. Humboldt County Department of Public Works (HCPW) has a vested right to extract up to 200,000 cubic yards of gravel annually (#SP 73-87). However, the proposed action is extraction of up to 25,000 cubic yards, as frequently as annually.

Skimming is the preferred extraction method for the bar, although alternative extraction methods (e.g. trenching) may also be used. Equipment utilized includes a bulldozer, excavator, front-end loader, and haul trucks. Excavated rock is transported to a permanent crushing and stockpile site adjacent to the bar, above ordinary high water. Work period is between June 1 and November 1. Reclamation is ongoing and is completed immediately after extraction is complete. As historical extraction areas and methods have been restricted to low-volume skims of limited area, no historical restorative activities have been performed on the Worswick Bar (other than post-extraction reclamation grading).

Singley Bar

Eureka Ready Mix proposes to obtain permits for extraction of aggregate from the Singley Bar, located on the LER at River mile ~6, one-half mile downstream of Fernbridge, Highway 211, crossing. The project site is near the upstream end of low-flow tidal influence. The lead agency permit for the site allows for annual extraction of up to 150,000 cubic yards of aggregate during the extraction season, occurring between the dates of July 22 and October 15.

The project area consists of those areas of the subject parcels generally within the boundary of OHW (APN's 106-011-011, 012, 023, 024, 106-031-001, 309-271-001, & 002) in portions of Sections 24 and 25, T3N, R2W, and portions of Sections 19 and 30, T3N, R1N, HBM. The Singley property is leased by Eureka Ready Mix and has not seen operations since 1995.

Operations are permitted by the local lead agency through Conditional Use and Coastal Permit (CUP-38-912) and Reclamation Plan (SMR-06-912). Renewal of the lead agency Conditional Use Permit and Reclamation Plan are pending.

Public access to the Singley Bar is gained from the Substation Road, which terminates near the south approach to Fernbridge. Restriction access at the Singley site is problematic due to multiple property ownerships and the historic nature and scope of the recreational activities that take place during the summer and fall months. Recreational activity is confined to the left bank bar area when the river levels are high. Once the LER receeds to summer lows, off-road vehicle access to the right bank can occur and is difficult to control.

V. STATUS OF THE SPECIES AND CRITICAL HABITAT IN THE ACTION AREA

Pacific Coast Western Snowy Plover (*Charadrius alexandrius nivosus*)

The Pacific coast population of the western snowy plover was Federally listed as threatened on March 5, 1993 (USDI Fish and Wildlife Service 1993). In California, the western snowy plover has been classified by the California Department of Fish and Game as a "species of special concern" throughout all of California since 1978 (DFG, 2001).

Critical habitat was designated on December 7, 1999 (USDI Fish and Wildlife Service 1999). On June 19, 2003, the U.S. District Court of the District of Oregon found that critical habitat designation was not consistent with the requirements of Section 4(b)(2) of the Act and remanded the designation to FWS; the Court partially vacated the 1999 critical habitat designation. On December 17, 2004, FWS published a proposed rule to re-designate critical habitat along the coasts of California, Oregon, and Washington (USDI Fish and Wildlife Service 2004b). A final rule for critical habitat was published September 29, 2005 (USDI FWS, 2005). The critical habitat designated on the LER (Van Duzen river mile 0 to Eel River mile 0) occurs seasonally when river flows recede to expose gravel bars, as evidenced by WSP seen on gravel bars April-early September (MRB, 2002).

WSP species status, including taxonomy, life history, wintering habitat and numbers, conservation needs and strategy, current conditions both range wide and within Recovery Unit 2 (including LER) and breeding conditions within the LER has been recently described in USDI FWS (2005b), is provided in its' entirety in Appendix B.

Following summary of LER survey data are results based on the contemporary Colwell, et al. 2005-2008 surveys:

2005: Breeding plovers were only sighted on 4 (33 percent) of the 12 breeding sites in Recovery Unit 2 identified as important for recovery in the draft recovery plan. The four sites are Big Lagoon, Clam Beach/Little River, Eel River gravel bars and Eel River south spit. The 2005 number of breeding birds at only one of the 12 sites (Clam Beach/Little River) met or exceeded the draft recovery plan's management goal (Colwell, et al. 2005).

In 2005, males breeding in Recovery Unit 2 fledged 0.94± 1.1 chicks (Colwell, et al., 2005). In one of the past five years, animal reproductive success for Recovery Unit 2 exceeded 1.3 fledged chicks per male (200l, 1.7± 1.4) (Colwell et al. 2004), which is the target for an increasing population assuming adult survival of at least 76 percent and juvenile survival of 50 percent (Nur et al. 1999). The 5-year (2001-2005) average productivity for Recovery Unit 2 has been 1.2 chicks fledged per male. Over the past 5 years, males that nested on the Eel River gravel bars fledged proportionately significantly more chicks, in 2005 gravel bar males fledged 1.25± 1.16 chicks while males breeding on ocean beaches fledged 0.87± 1.22 chicks (Colwell, et al. 2005). In 2004 and 2005, productivity on the gravel bars has declined, so it is likely that future overall productivity for the recovery unit may also decline.

In 2005, a total of 71 chicks hatched in Recovery Unit 2 and 27 of these chicks survived to 28 days (Colwell, et al. 2005). The majority (74 percent) of the chicks fledged from Clam Beach and the Eel River gravel bars. On beaches, 39 percent of 59 chicks successfully fledged, whereas 83 percent of 12 chicks fledged on the gravel bars (Colwell, et al. 2005).

In 2005, the number of breeding males (32) in Recovery Unit 2 was well below the recovery target of 75 males (population target of 150 and assuming a 1:1 sex ratio). Therefore, in addition to producing fewer chicks per male, the recovery unit had a low number of males.

2006: Breeding plovers were only sighted on 5 (42 percent) of the 12 breeding sites in Recovery Unit 2 identified as important for recovery in the draft recovery plan. The five sites were Clam Beach/Little River, Mad River Mouth and Beach, Humboldt Bay south spit, Eel River gravel bars and Eel River south spit. The 2006 number of breeding birds at only one of the 12 sites (Clam Beach/Little River) met or exceeded the draft recovery plan's management goal (Colwell, et al. 2006).

In 2006, males breeding in Recovery Unit 2 fledged 0.65± 0.91 chicks (Colwell, et al., 2006). In one of the past six years, animal reproductive success for Recovery Unit 2 exceeded 1.3 fledged chicks per male (200l, 1.7± 1.4) (Colwell et al. 2004). The 6-year (2001-2006) average productivity for Recovery Unit 2 has been 1.1 chicks fledged per male. Over the past 6 years, males that nested on the Eel River gravel bars fledged proportionately significantly more chicks, in 2006 gravel bar males fledged 1.11± 1.27 chicks while males breeding on ocean beaches fledged 0.45± 0.67 chicks (Colwell, et al. 2006). Since 2004, productivity on the gravel bars has declined, so it is likely that future overall productivity for the recovery unit may also decline.

In 2006, a total of 55 chicks hatched in Recovery Unit 2 and 20 of these chicks survived to 28 days (Colwell, et al. 2006). The majority (80 percent) of the chicks fledged from Clam Beach and the Eel River gravel bars. On beaches, 24 percent of 41 chicks successfully fledged, whereas 71 percent of 14 chicks fledged on the gravel bars (Colwell et al. 2006).

In 2006, the number of breeding males (28) in Recovery Unit 2 was well below the recovery target of 75 males (population target of 150 and assuming a 1:1 sex ratio). Therefore, in addition to producing fewer chicks per male, the recovery unit had a low number of males.

2007: Breeding plovers were only sighted on 5 (42 percent) of the 12 breeding sites in Recovery Unit 2 identified as important for recovery in the draft recovery plan. The five sites were Big Lagoon, Clam Beach/Little River, Mad River Mouth and Beach, Humboldt Bay south spit, Eel River gravel bars and Eel River south spit. The 2007 number of breeding birds at only one of the

12 sites (Clam Beach/Little River) met or exceeded the draft recovery plan's management goal (Colwell, et al. 2007).

In 2007, males breeding in Recovery Unit 2 fledged 0.69± 0.95 chicks (Colwell, et al., 2007). In one of the past six years, animal reproductive success for Recovery Unit 2 exceeded 1.3 fledged chicks per male (2001, 1.7± 1.4) (Colwell et al. 2004). The 7-year (2001-2007) average productivity for Recovery Unit 2 has been 1.01 chicks fledged per male. Over the past 7 years, males that nested on the Eel River gravel bars fledged proportionally significantly more chicks, in 2007 gravel bar males fledged 1.67± 0.58 chicks while males breeding on ocean beaches fledged 0.46± 0.88 chicks (Colwell, et al. 2007). Since 2004, productivity on the gravel bars has declined, so it is likely that future overall productivity for the recovery unit may also decline.

In 2007, a total of 21 chicks hatched in Recovery Unit 2 and 11 of these chicks survived to 28 days (Colwell, et al. 2007). The majority (64 percent) of the chicks fledged from Clam Beach and the Eel River gravel bars. On beaches, 37 percent of 13 chicks successfully fledged, whereas 63 percent of 8 chicks fledged on the gravel bars (Colwell et al. 2007).

In 2007, the number of breeding males (16) in Recovery Unit 2 was well below the recovery target of 75 males (population target of 150 and assuming a 1:1 sex ratio). Therefore, in addition to producing fewer chicks per male, the recovery unit had a low number of males.

2008: Breeding plovers were only sighted on 5 (42 percent) of the 12 breeding sites in Recovery Unit 2 identified as important for recovery in the draft recovery plan. The five sites were Big Lagoon, Clam Beach/Little River, Mad River Mouth and Beach, Humboldt Bay north spit, Eel River gravel bars and Eel River south spit. The 2008 number of breeding birds at only one of the 12 sites (Clam Beach/Little River) met or exceeded the draft recovery plan's management goal (Colwell, et al. 2008).

In 2008, males breeding in Recovery Unit 2 fledged 0.50± 1.03 chicks (Colwell, et al., 2008). This was the lowest fledging rate recorded in 8 years (Colwell, et al., 2008). In one of the past six years, animal reproductive success for Recovery Unit 2 exceeded 1.3 fledged chicks per male (2001, 1.7± 1.4) (Colwell et al. 2004). The 8-year (2001-2008) average productivity for Recovery Unit 2 has been 0.95 chicks fledged per male. Over the past 8 years, males that nested on the Eel River gravel bars fledged proportionally significantly more chicks, in 2008 gravel bar males fledged 2.00± 1.41 chicks while males breeding on ocean beaches fledged 0.27± 0.80 chicks (Colwell, et al. 2008). Since 2004, productivity on the gravel bars has declined, so it is likely that future overall productivity for the recovery unit may also decline as noted in the low fledging rate in 2008.

In 2008, a total of 15 chicks hatched in Recovery Unit 2 and 8 of these chicks survived to 28 days (Colwell, et al. 2008). For the first time, 100 percent of the chicks fledged from South Spit, Eel River Wildlife Area and the Eel River gravel bars (none on Clam Beach). On beaches, 44 percent of 9 chicks successfully fledged, whereas 67 percent of 6 chicks fledged on the gravel bars (Colwell, et al. 2008).

In 2008, the number of breeding males (18) in Recovery Unit 2 was well below the recovery target of 75 males (population target of 150 and assuming a 1:1 sex ratio). Therefore, in addition to producing fewer chicks per male, the recovery unit had a low number of males. Increasing the current population size will require relatively high productivity, juvenile survival, and adult survival. To achieve this objective, intensive management of nesting areas will be required. It is the conclusion of Colwell, et al. 2008, that the northern California population of WSP is maintained by immigration of birds from more productive populations elsewhere (Oregon and Monterey County, CA).

In summary, overall population numbers, nests and fledged chicks for WSP in the Recovery Unit 2 are dropping. Compared to 2006 high totals of 50 birds and 44 nests on Humboldt County beaches and 18 birds with 13 nests on the LER gravel bars there were 35 birds and 47 nests on the beaches and 4 birds with 2 nests on the LER in 2008. Results from surveys upstream from Worswick Bar conducted by LBJ (2009) from Leland to Sandy Prairie bars from 2005 to 2008 resulted in no WSP detected. There appears to be a shift from the 2001 high of 39 birds and 39 nests on the LER to a preference for the local beaches for breeding (Colwell, et. al. 2008).

VI. ENVIRONMENTAL BASELINE (in the Action Area)

Regulations implementing the Act (50 CFR 402.02) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities in the action area. As stated earlier, the action area includes the Lower Eel River, downstream of the Van Duzen River mouth. Also as stated earlier, the action area is the exposed gravel bars once high water has receded (providing nesting habitat for WSP). The environmental baseline is described in detail in the attached (Appendix B) USDI FWS (2005b).

VII. PROJECT MITIGATION MEASURES

The following conditions and limitations (in standard text) were provided in the FWS Biological Opinion (USDI FWS, 2005) and have been accepted by the LER operators as workable mitigation measures to protect the WSP occurring on the gravel bars.

Evidence supporting the 1,000 foot buffer for vehicle use from active nests and/or suitable habitat is provided in on-site observations of an operating bulldozer on a LER gravel bar within approximately 1,000 feet of a nesting WSP and there were no discernable reactions from the bird (MRB, 2002).

Evidence supporting the night driving restriction can be found in an unpublished paper by MRB (2005) indicating significant WSP disturbance to on-coming vehicle headlights in comparison to daylight vehicle approaches.

Proposed new measures (#s 8-10, in bold text below) are expected for the upcoming LOP 2009:

Measure 8 requires that gravel bar access roads be properly gated during off hours to protect against unauthorized recreational vehicle entry during the WSP breeding season. Evidence of such need for Measure 8 is found in recent WSP survey results. In 2005, 9 WSP nests were lost to unauthorized recreational vehicle access, mostly on Worswick Bar (Colwell, et. al., 2005). In 2006, 2 nests were lost on Worswick to vehicles (Colwell, et. al., 2006). In 2007, 2 nests were lost to vehicles on Singley Bar (Colwell, et. al., 2007). No recorded lost of nests were noted in 2008 although only 2 nests total were recorded throughout the LER (Colwell, et. al., 2008). The County of Humboldt minimizes vehicular access to the Worswick bar from Fernbridge Drive by locking the gate and blocking the access road during plover nesting season. However, vehicles are able to access the Worswick bar from the Singley bar by crossing the low flow channel in summer, which may account for the possibility of nest loss due to vehicle activities. Additionally, the proposed Cal Trans construction of a new Highway 101/36 interchange is removing an existing Leland Rock access gate. There is no clear replacement or vehicle access control being established at that point of entry. The proposed Measure 8 mitigation gate exemption as written applies to commercial gravel operators.

Measure 9 requires that the USACE Arcata Field Office receives confirmation from Service approved-surveyors that WSP surveys have been conducted before pre-extraction agency site visits. Confirmation can be provided in written form, and as proposed here, verbally (in-person or by phone) at the facility gate.

Measure 10 requires the submission of an annual WSP survey report to the FWS Arcata Field Office, to document the pre-extraction WSP survey results.

1. Operators shall make an attempt to initiate all extraction related activities after September 15 each year to avoid direct effects to plovers.

2. All pre-extraction activities within plover habitat that occur between March 1 and August 22 require a Service-approved surveyor to minimize potential harm to plovers. To be effective, plover surveyors must have the authority to direct the activities of workers to avoid nests and other plover life stages, and require that activity be rescheduled until technical assistance from the Service is received regarding avoidance or minimization measures. Vehicle use within plover habitat should be restricted to those occasions where the activity cannot be completed otherwise.

3. Initiate extraction activities within plover habitat after July 22. If a plover nest is present within 1,000 feet of a planned extraction site, extraction activities would not commence until the nest had hatched or the fate of the nest has otherwise been determined and the Service has provided its approval. Service approval (verbal or written) will be provided when the Service has concurred with the nest fate determination and the Service has completed a query to determine if: 1) take occurred, 2) take was attributed to the Federal action, and 3) the take was authorized (i.e. incidental).

4. Between July 22 and September 15, initiate extraction activities within plover habitat after three consecutive days of surveys have determined that no plovers (adults or chicks) or

or nests are within 1,000 feet of the proposed extraction site. The three consecutive days of surveys must be completed by a Service approved surveyor, would not begin before July 20, and would occur only on days of acceptable weather conditions. The surveys must be conducted during a period when plover and nest detections are at their best, i.e. generally mornings, not during period of low light, high winds, or when heat waves distort observations.

5. Between July 21 and September 15, survey areas in the vicinity of the targeted extraction site for plovers and nests to determine the likelihood of chicks, juveniles, and adults moving into areas where they could be affected by operations (i.e. within 1,000 feet). "Vicinity" refers to all suitable plover habitat contiguous with the gravel extraction site. Because gravel bars and the riverine system on the Eel River are dynamic, the Service would provide technical assistance regarding annual determinations of what constitutes contiguous habitat.

6. Between July 21 and September 15, operators of extraction sites that have nests or plovers within 1,000 feet, or in the vicinity, shall complete the following: a) daily plover surveys by a Service approved surveyor to determine the status of plovers and nests within the extractions site vicinity: b) if plovers are within 1000 feet of the extraction site, operations may not commence until the plovers move to a distance greater than 1,000 feet away (hazing is not authorized): c) operators must ensure that extraction activities do not occur when plovers or nests are within 1,000 feet of the extraction site: and d) all extraction onsite personnel shall receive training regarding the identification of adult and immature plovers, their behaviors, and the ramifications to the conditions of the LOP and the Terms and Conditions in this biological opinion. Training shall be provided by a Service approved biologist.

7. Between July 21 and September 15, prohibit night driving (0.5 hour after sunset to 0.5 hour before sunrise) for extraction-related activities within suitable plover habitat. Authorized daytime driving shall be minimized to those trips essential to complete authorized work. Car-pooling is encouraged. Parking, staging, and maintenance of vehicles and equipment shall occur at least 1,000 feet away from suitable habitat. Vehicle speeds in suitable plover habitat should not exceed 10 miles per hour (mph), unless on an established access/haul road where speeds shall not exceed 30 mph. The first three vehicle trips on haul/haul roads in suitable habitat each day shall not exceed 10 mph.

8. **Access roads owned, controlled, or utilized by commercial gravel operators shall be gated and locked when no active extraction and hauling is occurring (including at night). This will help prevent recreational vehicles from impacting western snowy plovers on gravel bars. Vehicle access to the Worswick bar from Fernbridge Drive will be closed starting March 15 and re-opened on September 15 (or earlier, if monitoring data confirm that all chicks have fledged).**

9. **For Worswick, Leland Rock, Hauck, Sandy Prairie, Drakes, Singley and Hansen**

bars, the Corps will not participate in on-site pre-extraction reviews until after September 15 or after the plover biologist provides the Corps written or verbal confirmation that the pre-extraction surveys have been completed in accordance with USFWS Biological Opinion, (No. 2730) dated August 14, 2005, and Appendix E of the LOP.

10. **WSP survey annual reports, if conducted for Worswick, Leland Rock, Hauck, Sandy Prairie, Drakes, Singley and Hansen bars documenting pre-extraction site WSP surveys, shall be submitted to the Arcata FWS Field Office by October 15 following each WSP breeding season.**

VIII. EFFECTS OF THE ACTION

The potential impacts the proposed action will have the possibility of direct and indirect impacts to the WSP and/or the designated LER critical habitat. There is no expected gravel extraction change in project description therefore the following is from the USDI FWS (2005b) BO, with additional subsequent references added from Colwell, et al., 2005-2008):

Habitat Modification

Proposed gravel mining activities will physically modify suitable western snowy plover nesting habitat. Snowy plovers are visually oriented. They rely on their eyesight to detect food items and potential predators. Proposed gravel extracting activities that will physically modify suitable habitat resulting in flat or gently sloped bars, and the removal or maintenance of areas devoid of vegetation and debris, have been considered by some as a benefit to nesting plovers (Mad River Biologists 2002). Conversely, snowy plover chicks are known to hide near debris items or vegetation when threatened. As a result, removing debris or herbaceous vegetation through gravel extraction could put chicks at an increased risk to predation (Mad River Biologists 2002). Scraping, as an extraction methodology, could modify gravel bars to potentially enhance nesting habitat by providing low gradient, topographically uniform bars that lack debris and dense vegetation (Mad River Biologists 2002). At some locations, extraction has resulted in low terraces, or shelves, that break up the bar's topography and consequently restrict plovers field of view. These 'terraces' could restrict an incubating plover's ability to detect an approaching mammalian predator (Mad River Biologists 2002).

Trenching, as an extraction method will physically modify suitable habitat. After gravel extraction any berms are breached and the trench is connected to the river. Trenches could result in injury or death as described below. However, trenches should not impair the plovers' ability to detect predators or food items because neither plovers nor their predators are likely to use the trenches. On an annual basis, trenches are likely to be filled in with gravel after the breeding season by over-winter flows; Trenching potentially affects less surface area, thereby reducing the amount of habitat disturbed. This is especially true when a low water year follows extraction, and gravel recruitment is therefore low.

Plovers continue to use mined and unmined gravel bars habitats with no apparent difference in *nest or chick survivorship (Mad River Biologists 2001a). Where as plover nesting was concentrated on the upper gravel bars near the Van Duzen River in the late 1990's and early 2000, there has been a shift to the Worswick bar (Fernbridge) and unmined gravel bars downstream, where gravel mining does not occur (Colwell, et al., 2004,* and Colwell, et al., 2005, Colwell, et al., 2006, Colwell, et. al., 2007, Colwell, et al., 2008).

In summary, it is unclear if gravel mining activities that physically modify suitable habitat are beneficial or adverse to the species. The affects to habitat largely depend on the technique utilized, quantities extracted, and the timing of the activities.

Harassment

The proposed activities will require the use of personnel, heavy equipment, and vehicles, all of which introduce high levels of noise and human activity into the environment. Disturbance from human presence or activities during the breeding season may potentially disrupt the species essential breeding behaviors by causing: 1) abandonment of the breeding effort by failure to initiate nesting or to complete incubation; 2) separation of adults from their broods; and 3) deterring adults and broods from utilizing favored, foraging areas. The potential effects of disturbance will depend on the frequency, timing, location, and intensity of activities. There is a single observation of a bulldozer operating ~approximately 1,000 feet from an active plover nest on an Eel River gravel bar. The incubating plover showed no apparent sign of distress (Mad River Biologists 2002). Based on this observation, disturbance from noise and activity associated with gravel mining is not likely to be adverse if the activity is greater than 1,000 feet from plovers.

Injury or Mortality

The draft recovery plan (U.S. Fish and Wildlife Service 2001) summarizes potential ways activities may cause mortality of plovers. Plover chicks and eggs are highly cryptic, making them difficult to see, even at close range. Many species that predate on plover chicks are visual predators. When in the presence of danger, snowy plover chicks tend to 'freeze' in place and rely on their cryptic plumage for safety from these visual predators. Pedestrians, vehicles, and heavy equipment may crush highly cryptic eggs or chicks and flush adult plovers off their nests.

Separation of plover adults from their nests and broods can cause mortality through exposure of eggs or chicks to heat, cold, blowing sand, and or predators. Repeated disturbances may cause plovers to nest in marginal habitat where their chances of reproductive success are reduced. Vehicle and heavy equipment traffic presents a very real threat to the survival of plover eggs and chicks. Circumstantial evidence indicates that vehicles crushed nests at Clam Beach Little River in 1998 and 2002. A vehicle crushed an active nest on the Eel River gravel bar in 2002 (U.S. Fish and Wildlife Service unpublished data), {additionally 9 Eel River nests in 2005, 2 nests in 2006 and 2 nests in 2007, were lost to recreational vehicles, Colwell, et al, 2005, 2006, 2007}. *Vehicles crushed adult plovers at Vandenberg Air Force Base and Ocean Dunes State Vehicular Recreation Area in 1994 arid 1998, respectively. A snowy plover chick was stepped on during the 1998 nesting season by a pedestrian at Ocean Dunes State Vehicular Recreation Area, in a portion of the park closed to vehicle use (U.S. Fish and Wildlife Service unpublished data).*

Trenching, as an extraction method, may entrap flightless chicks. Trenches may be as deep as the reach of the equipment. If a flightless chick becomes entrapped in a trench, it could be more vulnerable to predation or may die due to starvation. In summary, injury or mortality of adults, chicks, or eggs could occur from gravel mining activities as described above. Trenches are generally are hydrologically connected at the downstream end which would possibly allow one way exit opportunities for flightless chicks.

IX. ANALYSIS OF PROJECT EFFECTS

Taken from USDI FWS (2005):

Likelihood of Species Presence

Potentially suitable nesting habitat exists on all gravel bars in the action area. In July 2005,

three nests were located on the Worswick Bar {annual Colwell, et al. 2005, 2006, 2007, 2008 summaries recorded a total of 13 nests on the LER in 2005 and 2006, 4 nests in 2006 and 2 nests in 2008}. *In the past, plovers have nested at the Hauck Bar site on the Eel River approximately 0.25 to 0.5 miles downstream from the confluence with the Van Duzen River. As many as 39 breeding plovers have been documented along the Eel River. An estimated 27 plovers nested on the Eel River gravel bars in 2004. Habitat suitability fluctuates annually along the Eel River. In high water years many gravel bars may still be submerged early in the nesting season, while in low water years, more gravel bars will be exposed. However, in low water years vegetation may become established earlier in the year and reduce the overall amount of available habitat (Mad River Biologists 2002). The quantity of gravel that is deposited every year is variable depending upon flows.*

Habitat Modification

Modification of suitable plover nesting habitat will occur on the gravel bars annually as a result of gravel operations. Gravel mining activities are likely to alter topography of the natural gravel bars. An estimated 1,190 acres of gravel bars could be modified during each year of the LOP period. Mad River Biologists (2002) estimate 806 acres of suitable nesting habitat could potentially be modified annually {current estimates are approximately 120 acres}. We do not anticipate the snowy plovers will be adversely affected due to habitat modification for the following reasons: 1) plovers along the Eel River have nested successfully in areas mined for gravel in the previous year (Mad River Biologists 2002, Colwell, et al. 2004); 2) gravel extraction does not appear to adversely affect nesting habitat or success down stream from the action area; and 3) during all but a low water year, it is expected that water levels during the winter will redeposit gravel throughout the action area.

4.2.3 Harassment

Project, generated noise and activities, including the presence of workers and the use of vehicles and heavy equipment, may disturb adults and/or chicks. Repeated auditory or visual disturbances

disturbances can interrupt brooding, incubating, and foraging of adults and cause chicks to be separated from their parents.

The proposed action includes measures to reduce impacts. Among other restrictions, operators must ensure that extraction activities do not occur when plovers or nests are within 1,000 feet of an extraction site. However, due to cryptic nature of plover nests, active nests could be missed. Or plovers could wander into a work area after surveys are complete. We anticipate that the level of activity associated with the proposed action will likely result in adverse affects due to harassment to an unknown number of plover adults or chicks in the action area during the LOP period.

4.2.4 Injury or Mortality

Mortality of adults, chicks, and eggs may occur as a result of collisions with extraction equipment and/or workers. Plover eggs in the gravel bar environment are especially difficult to detect. It is possible that chicks from an undetected nest or adults may enter the extraction areas during extraction and after daily surveys. Undetected nests, chicks, or adults in the extraction areas will be highly vulnerable to injury or mortality from crushing or entrapment. The likelihood of injury or mortality will be minimized by the protective measures described the project description of this BO. It is unlikely that more than one nest would be established within the action area during the LOP period that would be missed during surveys because surveyors are well trained, and pre-approved by the Service. The typical plover clutch size is three. Therefore, we expect that three eggs associated with one nest could be lost either directly or indirectly due to proposed gravel extraction activities. It is unlikely that more than one flightless chick would wander into the area after surveys are complete. Therefore we expect that no more than one chick would be lost due to proposed gravel extraction activities.

Effects on Numbers

The proposed action could affect the number of snowy plovers by disturbing reproductive efforts and by injury or mortality. The Eel River is identified in the draft {final} *recovery plan as a breeding location important for recovery. Current plover use (27 breeding adults in 2004 (Colwell, et al. 2004)) along the Eel River is below the draft recovery plan's population target of 40 breeding adults for recovery. The proposed action will not likely prevent achievement of the draft recovery plan's population target for the following reasons: 1) the likelihood of adverse affects to plovers will be minimized through project minimization measures, and 2) during the LOP period, we anticipate, at most, harm of one nest (three eggs) and one chick due to implementation of the Corps' action.*

Effects on Distribution

The draft recovery plan identifies 12 breeding sites in Recovery Unit 2 that are important for recovery. For the past three years, nesting has only occurred ~at four of these locations (Clam Beach, Little River, Eel River Wildlife Area, Humboldt Bay south spit, and Eel River gravel bars) {since 2005, nesting has additionally been documented on Centerville Beach, Mad River Beach &

& Humboldt Bay, north spit}. The proposed action will affect plovers at only one of these breeding sites, and is not expected to eliminate plover use of the Eel River gravel bars. Therefore, it is unlikely that the proposed action will influence the long-term distribution of breeding plovers along the Eel River or within Recovery Unit 2.

Effects on Reproduction

In 2002, 47 percent of the nests (14 of 30) along the Eel River did not successfully hatch and 50 percent (20 of 40) of the hatched chicks failed to fledge (Colwell, et al. 2002). The cause of most of the clutch failures is unknown; however, predation is suspected to be the cause in most cases, and vehicles in three (Colwell, et al. 2002). Results during the 2004 breeding season indicated that 52 percent of the nests hatched along the gravel bars (13 of 25), with 19 chicks fledging (Colwell, et al. 2004).

In 2002, 87 percent (20 of 23) of the chicks fledged in Humboldt County came from nests on the Eel River gravel bars (Colwell, et al. 2002). Males on the Eel River fledged 1.46±1.13 chicks in 2002 (Colwell, et al. 2002) and 1.6±1.6 chicks in 2001 (Colwell, et al. 2001). This represents a 2-year average productivity of 1.5 fledged chicks per male along the Eel River. The draft recovery plan indicates that a productivity of 1.2 or more chicks fledged per male should increase population size at a moderate rate. The delisting criteria is to maintain a 5-year average productivity of at least 1.0 fledged chicks per male. This level of productivity should result in a stable population. {Since 2004, although number of fledged chicks remained relatively high (average of 1.36) on the gravel bars, numbers of adults (17 to 4) and nests (13 to 2) have declined}.

We do not anticipate that the potential loss of one nest (three eggs) during the four years of gravel extraction will hinder the long-term attainment of the draft recovery plan's target for productivity. Since plovers are known to re-nest after loss of their eggs, it is possible that if a nest is destroyed the adults may still be successful at fledging chicks that year. The 2-year average productivity for male plovers along the Eel River, during 2001 and 2002, was 1.5 fledged chicks. If one additional nest had failed in one of these two years the average productivity level would still have been above the level (1.0 fledged chicks per male) necessary to maintain a stable population. Therefore, assuming that the productivity during the four year extraction period is similar to the rates in 2001 and 2002, the potential loss of one additional nest is not expected to hinder, the long term attainment of the plan's target for productivity on the Eel River.

X. CUMULATIVE EFFECTS

Colwell, et al. 2008 have noted, from the 2001 high of 39 birds and 39 nests on the LER to only 4 birds and 2 nests in 2008, that local WSP have shifted to the adjacent beaches for breeding. Although the reason for this shift is not understood, clearly losses of nests due to river flood (high spring flows) have occurred in 2003 and 2005 (Colwell, et al. 2008).

Nest losses have been recorded, since 2005 of up to 13 nests, from unauthorized vehicle use on LER river bars (Colwell, et al. 2005-2008), which maybe leading to nesting declines on the LER. As stated by MRB (2002) and Colwell, et al, 2004-2008), vehicles are incompatible to nesting WSP and their chicks. Although implied but not provided, Colwell, et al, (2008) stated that a significant percentage of Eel River nests lost to vehicles in 8 years of monitoring (*accounted for __% of failed nests,* not clarified by authors). In the past 4 years, based on Colwell, et al. (2005-2008) data, 41% of Eel River nest failures were directly attributed to recreational vehicles. Unknown reasons have caused WSP to concentrate nesting activities outside of the LER, but losing suitable available habitat to recreational vehicle use can possibly attribute to this change in preference. This poses a dilemma to the Lower Eel River operators and FWS that have developed increased protective measures to support nesting WSP, whereas recreational vehicle users do not recognize those measures. The added gate mitigation in the expected LOP-2009 is included in an effort to stem the negative influence by unauthorized recreational vehicle use. Additional associated impacts due to recreational vehicle access such as target practice, unrestrained dogs, illegal camping and littering could be lessened. Public access being promoted by the California Coastal Commission or individual prescriptive rights being invoked on LER may undermine any controlled access benefits and contribute to cumulative effects.

XI. DETERMINATION

Due to the presence of suitable available nesting habitat, typical annual replenishment of fresh gravels, returning or immigrating breeding WSP and adherence to mitigation measures designed to protect nesting plovers, the described actions may affect but are not likely to adversely affect the WSP.

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APPENDIX A

Eel River Gravel Mining and Extraction Activities Biological Assessment (Western Snowy Plover) 2002, Mad River Biologists

APPENDIX B
USDI FWS Biological Opinion on Proposed Gravel Operations in Humboldt County, California 2005

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COASTAL COMMISSION

Biological Assessment for The U.S. Army Corps of Engineers LOP 2009 Aggregate Extraction Operations Lower Eel River and Van Duzen River, Humboldt County, California

Prepared for
County of Humboldt
Drake Materials
Eureka Ready-Mix
Hanson Sand & Gravel
Van Duzen River Ranch
Mercer-Fraser Company
Rock and Gadberry Sand and Gravel
Thomas R. Bess Asphalt, Sand and Gravel

EXHIBIT NO. C
APPLICATION NOS.
1-09-005 (Eureka Ready Mix)
1-09-006 (Eureka Ready Mix)
1-09-011 (Hansen)
1-09-022 (Mercer-Fraser Co.)
SALMONID BIOLOGICAL ASSESSMENT

Prepared by
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May 6, 2009

Suggested citation: Berg, A. 2009. Biological Assessment for the U.S. Army Corps of Engineers LOP 2009 Authorizing Aggregate Extraction Operations in The Lower Eel River and Van Duzen River, Humboldt County, California. Draft BA prepared by Alice Berg & Associates for County of Humboldt, Drake Materials, Eureka Ready-Mix, Hanson Sand & Gravel, Van Duzen River Ranch, Mercer-Fraser Company, Rock and Gadberry Sand and Gravel, Thomas R. Bess Asphalt, Sand and Gravel

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1 INTRODUCTION

The Army Corps of Engineers (ACOE) has proposed Procedures for Issuing Letters of Permission for Gravel Extraction in Humboldt County (LOP 2009) that may permit or authorize ongoing commercial extraction of river-run sand and gravel in Humboldt County, California. A Letter of Permission is a type of Standard Permit issued by the ACOE through an abbreviated processing procedure and public interest evaluation. LOP 2009 is a permitting procedure that is specifically proposed to permit gravel extraction in Humboldt County, and each activity authorized under LOP 2009 shall be a part of a single and complete project.

The purpose of this biological assessment (BA) is to determine the potential effects of LOP 2009 (the Project), which authorizes instream gravel extraction operations for the following operations: County of Humboldt, Drake Materials, Eureka Ready-Mix, Hanson Sand & Gravel, Jack and Mary Noble-Van Duzen River Ranch, Mercer-Fraser Company, Rock and Gadberry Sand and Gravel and Thomas R. Bess Asphalt, Sand and Gravel. The BA will determine potential effects of LOP 2009 on Pacific salmonids listed under the Endangered Species Act (ESA).

The project area is the Lower Eel River from River Mile (RM) 6.0 to RM 13.5, and on the Van Duzen River from RM 0 to RM 16.7, Humboldt County, California. The following federally listed species and their designated critical habitat occur in the project vicinity:

- Southern Oregon/Northern California Coasts (SONCC) coho salmon (*Oncorhynchus kisutch*); listed under the ESA as threatened (62 FR 24588; May 6, 1997). Designated critical habitat (64 FR 24049; May 5, 1999);
- California Coastal (CC) Chinook salmon (*O.tshawytscha*); listed under the ESA as threatened 64 FR 50394 (September 16, 1999); Designated critical habitat (70 FR 52488; Sept. 2, 2005)
- Northern California (NC) steelhead (*O. mykiss*); listed under the ESA as threatened (65 FR 36094; June 7, 2000); Designated critical habitat (70 FR 52488; Sept. 2, 2005)

In addition to critical habitat designations for listed Pacific salmonids, Essential Fish Habitat (EFH) provisions of the Magnuson-Stevens Act (MSA) require heightened consideration of habitat for commercial species in resource management decisions, including EFH for SONCC coho salmon and CC Chinook salmon. EFH is defined in section 3 of the MSA as "those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity." The National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS) interprets EFH to include aquatic areas and their associated physical, chemical and biological properties used by fish that are necessary to support a sustainable fishery and the contribution of the managed species to a healthy ecosystem. The MSA and its implementing regulations at 50 CFR 600.92(j) require that before a federal agency may authorize, fund or carry out any action that may adversely effect EFH, it must consult with NMFS. The purpose of the consultation is to develop conservation recommendations that address reasonably foreseeable adverse effects to EFH. Freshwater EFH for Pacific salmonids includes all those streams, lakes, ponds, wetlands, and other water bodies currently, or historically, accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable man-made barriers, and long-standing impassable natural barriers. The BA's analysis of effects to Pacific salmonid habitat includes, by definition, an analysis of effects to EFH.

2 CONSULTATION BACKGROUND

Gravel extraction has been previously permitted by the Army Corps of Engineers (ACOE) under LOP 96-1, and LOP 96-1 extensions. NMFS section 7 consultation on LOP 96-1 and all extensions as described below (NMFS 1997; NMFS 2000; NMFS 2001; NMFS 2002; NMFS 2003).

On July 17, 1997, NMFS issued a biological opinion (BO) on LOP 96-1 for gravel mining and extraction activities within Humboldt County. NMFS' (1997) BO determined that implementation of LOP 96-1 was not likely to jeopardize the continued existence of SONCC coho salmon.

Several ESA listing actions occurred subsequent to the issuance of NMFS' 1997 BO: critical habitat for SONCC coho salmon was designated on May 5, 1999 (64 FR 24049); CC Chinook salmon was listed as threatened under the ESA on September 16, 1999 (64 FR 50394); critical habitat was designated for CC Chinook salmon on February 16, 2000 (65 FR 7764); and, NC steelhead was proposed for listing under the ESA on February 11, 2000 (65 FR 6960). NMFS issued a second BO and conference opinion on LOP 96-1 (which included terms and conditions contained in the NMFS' 1997 BO) on May 1, 2000, in response to a letter from the ACOE requesting reinitiation of section 7 consultation due to the above listing actions. NMFS 2000 BO concluded that gravel mining under LOP 96-1 for mining year 2000 was not likely to jeopardize the continued existence of SONCC coho salmon, CC Chinook salmon, or NC steelhead, and was not likely to destroy or adversely modify SONCC coho salmon or CC Chinook salmon designated critical habitat. Subsequent to NMFS' 2000 BO, NC steelhead were listed as threatened under the ESA (June 7, 2000; 65 FR 36094).

On September 6, 2000, NMFS issued an amendment to the 2000 BO on LOP 96-1. NMFS' September 2000 BO amendment contained an amended Incidental Take Statement (ITS) including modifications to the NMFS' May 2000 BO Reasonable and Prudent Measures (RPMs).

On July 5, 2001, NMFS issued a second amendment to their 2000 BO. The ACOE requested the amendment for purposes of extending the duration of LOP 96-1 and 2000 BO to cover 2001 gravel extractions, and to add two gravel sites. LOP 96-1 expired on August 19, 2001, and the ACOE extended it to October 31, 2001. NMFS' second amendment determined that "no significant new information has been revealed on the effects of the action, as described in the Opinion, that may affect listed species in a manner, or to an extent not previously considered" and "there have been no significant changes to the Federal action which would alter the content of the May 1, 2000, Opinion. Therefore, this letter adopts the May 1, 2000, Conference Opinion as the Biological Opinion for the NC steelhead ESU." NMFS concluded that "LOP 96-1 for gravel mining operations during 2001 is still not likely to jeopardize the continued existence of SONCC coho salmon, CC Chinook salmon, or NC steelhead, or destroy or adversely modify SONCC coho salmon or CC Chinook salmon designated critical habitat." NMFS included that "though NMFS had assumed that a new LOP procedure for gravel mining activities would be in place for 2001, the continuation of the proposed action for one additional mining season changes the project description only in extent of duration, and does not appreciably change the effects of the action as analyzed in the Opinion." NMFS' second amendment (NMFS 2001) contained an analysis of effects and an amended ITS specific to implementation of LOP 96-1 for gravel extractions in 2001. NMFS' second amendment letter described the modified terms and conditions/additional monitoring requirements imposed as "minor changes to the proposed action."

In April of 2002, the critical habitat designation for CC Chinook salmon and NC steelhead was remanded by court order, but has since been redesignated.

On August 5, 2002, NMFS issued a third amendment to its May 1, 2000, BO for LOP 96-1. The amendment (NMFS 2002) informed the ACOE that NMFS would not consult on another 1-year extension of LOP 96-1 and directed the ACOE to issue a 5-year proposed action before the 2003 mining season to address long term effects of gravel mining. NMFS (2002) also stated that it was refining an analysis of the 1-foot vertical offset (a mitigation measure required to protect the low flow channel. NMFS (2002) concluded that a one season extension of LOP 96-1 (for the 2002 mining season) "is still not likely to jeopardize the continued existence of Southern Oregon/Northern California (SONCC) coho salmon, Central California (CC) Chinook salmon, or Northern California (NC) Steelhead, or destroy or adversely modify SONCC coho salmon designated critical habitat." Additional monitoring requirements, reporting requirements and project design features were included as terms and conditions of the amended ITS.

On November 26, 2002 the ACOE issued a Public Notice for the proposed LOP 2003-1. On December 26, 2002, NMFS received a request for ESA section 7 consultation from the ACOE on the proposed Letter of Permission procedure for gravel mining (LOP 2003-1) in the streams and rivers of Humboldt County, California. The request for consultation concerns the effects of the proposed LOP 2003-1 on Pacific salmonids and designated coho salmon critical habitat. The ACOE also requested consultation on EFH pursuant to the Magnuson-Stevens Fishery Conservation and Management Act. On June 12, 2003, NMFS issued their draft biological opinion. In that opinion, NMFS concluded that "...gravel mining under LOP 2003-1 for the next five years is likely to jeopardize the continued existence of threatened SONCC coho salmon, NC steelhead, and threatened CC Chinook salmon, and is likely to adversely modify SONCC coho salmon critical habitat." A period of vigorous public comment and debate ensued soon thereafter.

Through public and various inter-agency meetings, a variety of issues came to light about data accessibility, formatting, and analysis. It was realized by all parties involved that a 6 to 8 month period of time was needed to get cross-section databases for a rigorous and systematic analysis. Understanding that the extraction season would close prior to completion of the analysis, NMFS worked with Humboldt County and the ACOE to extend LOP 96-1 for one additional year, with modifications to the proposed action that reduced the effects to threatened salmonid species. This modification and extension of LOP 96-1 was to provide additional time for the cross-section study to be completed before proposal of a five-year LOP or issuance of individual permits to mine on the Mad River. On August 29, 2003, NMFS completed the biological opinion for the LOP 96-1 extension. In that document, NMFS concluded that "gravel mining under the modified LOP 96-1 procedure for the 2003 mining season, ending December 31, 2003, is not likely to jeopardize the continued existence of threatened SONCC coho salmon, NC steelhead, and threatened CC Chinook salmon, and is not likely to adversely modify or destroy SONCC coho salmon critical habitat."

On April 14, 2008, the ACOE, NMFS and the Humboldt County gravel operators met to discuss the completed 2007 extraction season, the upcoming LOP and Mad River individual permit renewals, and other issues related to the gravel management program.

On December 2, 2008, the ACOE held a meeting of all the Humboldt County gravel operators and regulatory agency representatives to discuss the upcoming renewal of the LOP 2004 and Mad River individual permits. A number of issues were discussed including permitting timelines, development of biological assessment, improvements to the LOP, and the potential for a one-year extension of LOP 2004. A follow-up meeting was held on December 11, 2008, to continue the discussions. Individual break-out meetings with gravel operators on specific river reaches were held in subsequent weeks.

3 MANAGEMENT DIRECTION

Commercial aggregate extraction is a land use conducted on privately held and public lands within the jurisdiction of and regulated by local, state and federal agencies. In Humboldt County, removal of mineral and natural materials, including construction materials to be used for commercial purposes, shall be allowed in any zone with a use permit (Section 316-17, Humboldt County Code, Title III, Land Use Development). Aggregate miners must obtain a Conditional Use Permit (CUP) and/or vested right to mine and have an approved Reclamation Plan.
When Humboldt County issues a CUP, it has typically established the maximum volume that may be extracted in any given year and the time, place and manner in which the extraction and reclamation plans will be implemented. The local lead agency's issuance of permits and approval of reclamation plans is subject to the California Environmental Quality Act (CEQA), the California Surface Mining and Reclamation Act (SMARA), and other state and local laws.

In 1991, at the request of Mad River operators, the California Resources Agency, California Department of Fish and Game (CDFG), other state agencies, and Mad River operators entered into a memorandum of understanding (MOU) to utilize a Scientific Review and Design Committee (SRDC). The committee was comprised of faculty from Humboldt State University and others with skills in hydrology, fluvial geomorphology, fisheries, wildlife biology and botany. Humboldt County has since retained the SRDC, changed its name to County of Humboldt Extraction Review Team (CHERT), and directed it to conduct annual reviews of various commercial and government agency aggregate extractions.

NMFS (1996) issued a National Gravel Extraction Policy describing general policies, procedures and the recommendations of NMFS National Habitat Program pertaining to any gravel extractions within or near current or historic anadromous fish habitat. The intent of NMFS gravel policy is to strengthen NMFS efforts in conserving anadromous fish habitat and to foster consistency at the national level, while maintaining regional flexibility. The gravel policy provides guidance and recommendations to regional field offices, and is intended to "streamline government and foster predictability for the intra- and interstate operations of gravel miners." NMFS gravel policy contains a description of potential effects to anadromous habitat and recommendations to minimize effects, and outlines a "simple management scenario for gravel extraction operations" that includes establishment and implementation of pre-extraction surveys to establish baseline environmental data and a monitoring program to verify environmental safeguards.

The ESA requires the ACOE to consult with the USFWS and/or NMFS for issuance of permits, and applicants (gravel operators) may be involved in the consultation process. Pursuant to section 7(a)(2) of the ESA, the ACOE is required to ensure that any action authorized, funded or carried out is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. In fulfilling this requirement, the ACOE must use the best scientific and commercial data available to complete a biological assessment of its proposed action.

The California Coastal Act (CCA) of 1976 requires coastal development permits for commercial aggregate mining in the coastal zone (PRC Section 30600(a)). The CCA includes grading, removing, dredging, mining or extraction of any materials in their definition of "development." Operations on the Mad River are outside of the Coastal Commission jurisdiction.

Pursuant to Section 10 of the Rivers and Harbors Act of 1899, the ACOE regulates any work in navigable waters of the United States (33 U.S.C. 403), and pursuant to Section 404 of the Clean Water Act, the ACOE regulates any work involving the discharge of dredged or fill material into waters of the United States (33 U.S.C. 1344). The ACOE San Francisco District has used the LOP process to streamline permits for commercial and public works aggregate extraction. Since 1996, the ongoing (as proposed in this BA) gravel extraction operations have operated under the ACOE's LOP 96-1, LOP 2004-1 and individual CWA 404 permits. Under LOP 96-1, LOP 2004-1, and individual CWA 404 permits, the permittees submitted complete applications to the ACOE for review and determination as to whether the activity qualified under the permit procedures. The ACOE required CHERT review and recommendations for each application, but maintained final decision making authority. Annual monitoring data and reports were required to be submitted on an annual basis to ensure compliance with the LOP and individual 404 permit conditions.

The 2009 LOP terms are included below and have been incorporated into the proposed action for all operators subject to this BA. The ACOE is required to ensure that any action it authorizes, funds or carries out is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. To fulfill this requirement, the ACOE must use the best scientific and commercial data available to complete a biological assessment of its proposed action. The ACOE makes a determination as to whether consultation pursuant to section 7(a)(2) of the ESA is required. If so, the ACOE must consult with the Services prior to issuance of permits and the Services develop a biological opinion for the project. The Services biological opinion analyzes the effects the project may have on listed species, makes a determination regarding the effects of the action on listed species, issues reasonable and prudent measures to lessen the effect, and contains an incidental take statement that allows for take of listed species during the course of otherwise lawful activities.

4 PROPOSED ACTION

LOP 2009 authorizes continued annual gravel extraction and temporary crossing construction activity for the sites listed and described below, which are located on the Lower Eel River between RM 6.0 and RM 13.5 (Table 4-1 and Figure 1). LOP 2009 also authorizes continued annual gravel extraction and temporary crossing construction activity for the sites listed and described below, which are located on the Van Duzen River from RM 0 to 16.7 (Table 4-1 and Figure 2):

Table 4-1. Gravel operations to be covered under LOP 2009 in the lower Eel River and Van Duzen River.

River	Operator	Gravel bar name and location (rivermile)
Lower Eel River	Eureka Sand & Gravel	Hauck Bar (RM 14.0) and Singley Bar (RM 6.0)
	Hansen Truck Stop	Hansen Bar (RM 13.5)
	Mercer-Fraser Company	Sandy Prairie Bar complex (RM 10.5)
	Mallard Pond	Drake Bar (RM 8.0)
	County of Humboldt	Worswick Bar (RM 7.0)
Van Duzen River	County of Humboldt	Pacific Lumber Bar (RM 16.7)
	Thomas R. Bess Asphalt Sand and Gravel	Bess Bar (RM 5.4)
	Jack and Mary Noble	Van Duzen River Ranch Bar (RM 3.3)
	Rock and Gadberry Sand and Gravel	Leland Rock Bar (RM 0.3)

The LOP 2009 permit period is from June of 2009 through December 31, 2014. All extraction and reclamation activities are restricted to occur between June 1 and October 15 of each year, although work extensions may be granted by regulatory agencies on a case-by-case basis up until November 1. All temporary crossing activities are restricted to occur between June 30 and October 15 of each year, unless an approved river flow monitoring plan is enacted and a time extension (up to November 1) is granted.

Certain habitat enhancement activities, such as riparian planting projects, may be conducted outside the normal extraction operating season. For example, riparian planting efforts tend to have a higher rate of success when cuttings are collected and installed during the plant's dormant season (late fall/winter months).

The actions authorized by this LOP are expected to include certain activities within permitted gravel extraction sites, during extraction seasons, that will enhance habitat for salmonids and other riverine species. The specific details of such habitat enhancement activities shall be determined during, and follow, the same multi-agency pre-extraction design review process that is used for gravel extraction operations. Many of the habitat enhancement activities shall be consistent in scope, size and cost impact as restoration activities that have occurred in the past under LOP-2004. These activities included, but were not limited to, trenching designed to improve salmon migration, alcove construction, placement of edge water large woody debris, and construction of wetland pits to improve aquatic and riparian habitat. Some habitat enhancement activities will be new to this LOP, including, but not limited to, riparian planting and strategic placement of instream large wood and boulders.

This BA provides a more detailed description of activities and assessment of effects of habitat enhancement activities (as well as gravel extraction activities). The extent of habitat enhancement activities is estimated based, in part, on accomplishments under the previous LOP 2004-1 permit period, as well as operational feasibility during the upcoming LOP 2009 implementation period. In determining a general target for enhancement activities, this BA lists and quantifies habitat improvement activities that were accomplished under LOP 2004, and describes additional, voluntary reach-specific habitat improvement activities that are planned to occur under LOP 2009. LOP 2009 authorizes habitat improvement projects of like kind, nature and quantity and assumes projects of like kind would occur in the future. See LOP 2009 Appendix A for typical habitat improvement activities.

The LOP 2009 permit period will run from June 2009 through 31 December 2014.

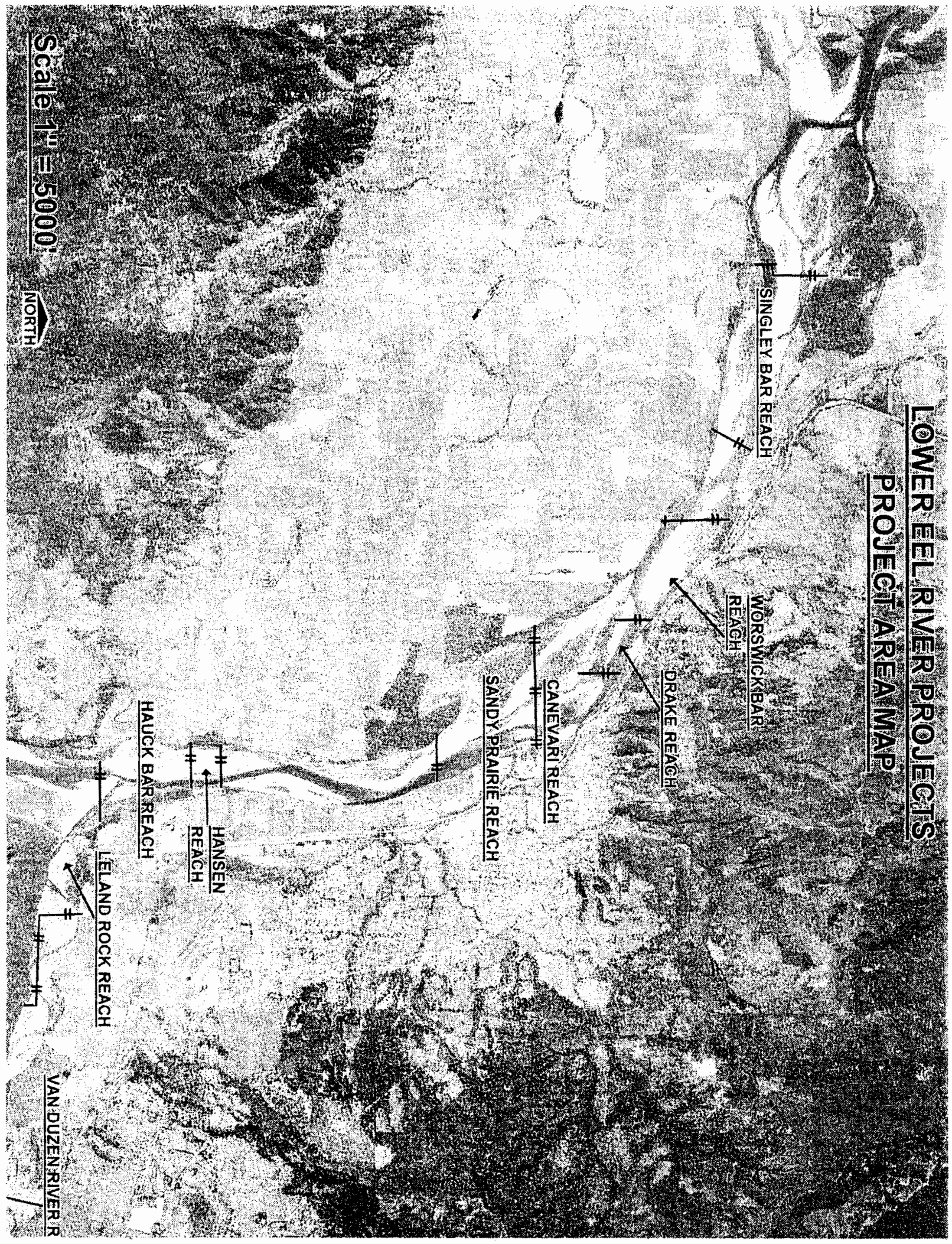


Figure 1. Lower Eel River Aggregate Extraction Operations.

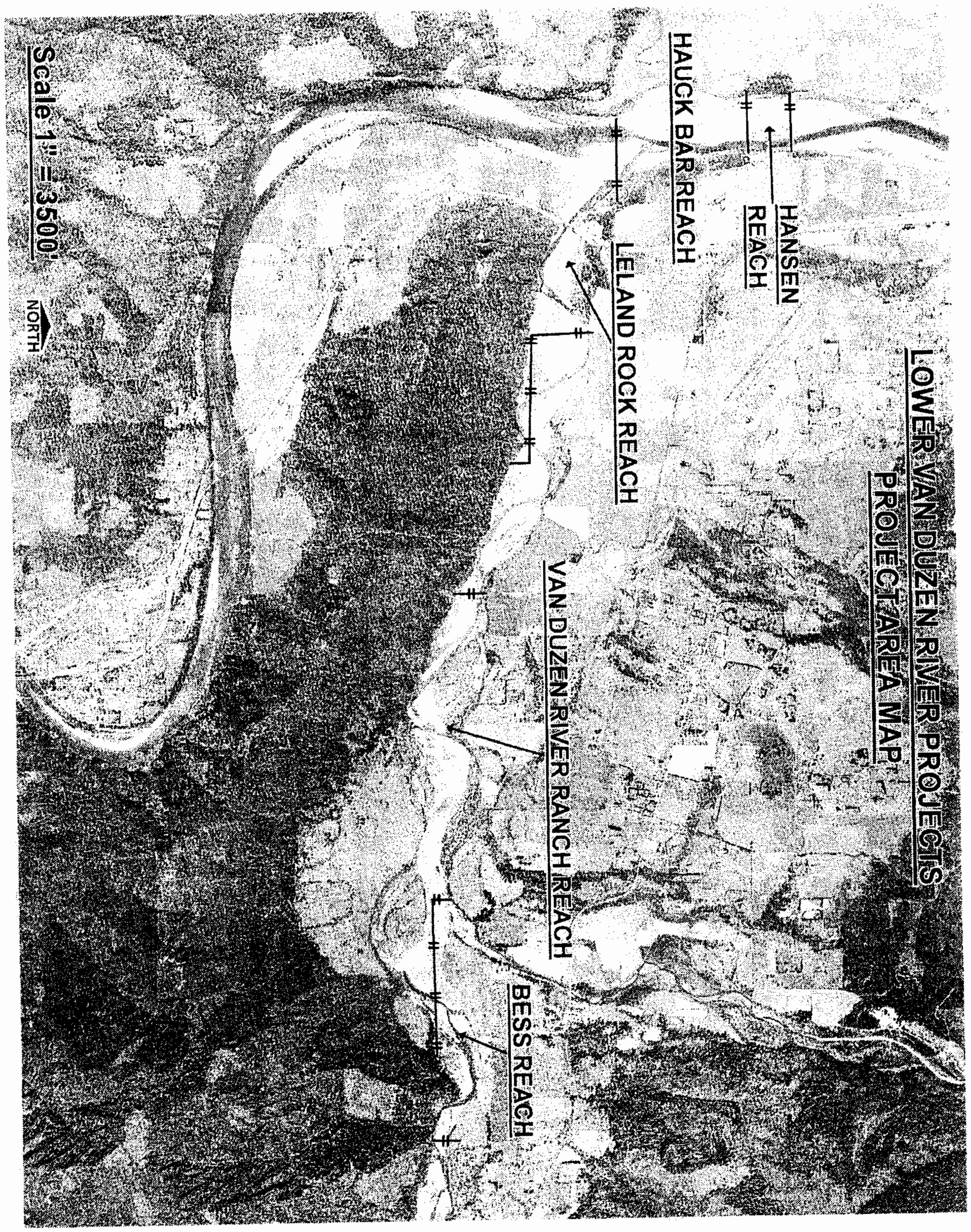


Figure 2. Lower Van Duzen River Aggregate Extraction Operations.

4.1 Extraction Methods

Activity related to gravel removal generally occurs within the limits defined by the Ordinary High Water (OHW) mark. Further, the majority of gravel extraction occurs below the mean annual flood zone. Operations consist of excavation, grading, loading, and transport of sand and gravel from dry gravel bars to processing plants or existing, adjacent stockpile sites located at or above the 100-year floodplain. Heavy equipment including bulldozers, excavators, belly scrapers, front-end loaders and similar types of machinery is utilized to achieve site-specific gravel extraction and habitat protection goals. The proposed projects are situated in reaches that exhibit varied channel morphology, elevation, vegetation patterns, aquatic habitats, and aggregate deposits. This variation in physical and biological characteristics makes it appropriate to employ an innovative, site-specific planning approach rather than a one-size-fits-all methodology.

For these applications, a variety of aggregate extraction and non-extraction activities are being considered that may be applied on a site-specific basis depending on bar and discharge characteristics and proximity to sensitive habitats. Descriptions of the extraction methods and restoration activities are provided below, and are generally categorized into: (1) standard gravel extraction methods, (2) gravel extraction methods with habitat improvement components, and (3) optional habitat improvement actions. One or all of these categories may be utilized at each extraction site based on annual designs that are developed on a site-specific basis with input from regulatory agencies and CHERT.

The extraction season is defined by LOP 2009 (see Protective Measures in Section 4.1.8 below), which specifies generally that gravel extraction shall cease by 15 October each year. Extraction season start dates generally occur in June. Requests for time extensions are reviewed by regulatory agencies on a case-by-case basis.

There are a number of operational conditions, limitations, and criteria specific to gravel mining on rivers covered in the proposed action (see Table 4-1). These special operational parameters have been established for these rivers due to specific reach characteristics relating to channel morphology, hydrological patterns, and salmonid use. See Section 4.2 for additional details.

4.1.1 Standard gravel extraction methods

The primary objective of standard extraction methods is to extract commercial quantities of aggregate. These methods include narrow skims, horseshoe skims, inboard skims, traditional skims, and other options developed by the applicants and NMFS that will allow for both economical operations and aquatic resource protection. Identification of specific extraction methods will occur during the pre-extraction planning process and will depend on site conditions at that time. The standard protective measures associated with these methods include, but are not limited to, the 35-percent exceedance flow elevation buffer (except for the horseshoe method) from the low-flow channel, head-of-bar buffer, riparian vegetation and large woody debris retention, and post-extraction bar surface grooming.

These methods are generally used when there are sufficient aggregate deposits in easily accessible locations, such as exposed gravel bar surfaces. This usually occurs following a winter that resulted in good gravel recruitment to extraction bars. These methods typically cost less than extraction techniques with habitat improvement components.

It must be noted that CHERT utilizes the same extraction types as described below, but calls several of them by different names. A nomenclature comparison between the ACOE's and CHERT's extraction method terminology is provided in Table 4-2.

Table 4-2. ACOE and CHERT extraction method terminology comparison.

ACOE terminology	CHERT terminology
Narrow skim	Narrow shoreline skim
Horseshoe skim	Wide offset skim
Traditional skim	Wide shoreline skim
Secondary channel skim	Overflow channel skim

Traditional skim

A traditional skim allows extraction surfaces that typically do not exceed one-half of the bar width as measured at the widest point of the bar. This method does not extend beyond the upper one-third head-of-bar buffer, maintains the 35-percent exceedance flow elevation offset from the low-flow water surface, and includes other standard protection measures. CHERT calls this technique a wide shoreline skim.

4.1.1.1 Narrow skim

Narrow skims are no more than one-third of the bar width, follow the shape of the bar feature, maintain the point of maximum height of the bar, and trend in the general direction of stream flow. These skims maintain a vertical offset corresponding to the flow at 35-percent exceedance flow elevation. Finished skims are free-draining and slope either toward the low-flow channel or in a downstream direction. Furthermore, these skims avoid the head of the bar, defined as the upstream one-third of the exposed bar surface. This buffer may be decreased on a case-by-case basis provided that the extraction area narrows and tapers smoothly to a point, and remains below the upstream cross-over riffle. CHERT calls this technique a narrow shoreline skim.

4.1.1.2 Inboard skim

This method is similar to the horseshoe except that it maintains a wider horizontal offset from the low flow channel where warranted. These areas would be excavated to a depth no lower than the water surface elevation offset, with a 0–0.5% cross slope, steeper (1:1) slopes on the sides, and gentle (10:1) slopes at the head of the excavation. The horizontal and minimum skim floor elevation of the water surface elevation of the 35% exceedence flow vertical offsets are intended to remove the excavation area away from zones of frequent flow inundation. There would be a 15-foot offset buffer from the bank. The excavation may extend into the upper one-third of the head-of-bar buffer if sufficient rationale is provided to show that protection of the upstream riffle would be maintained.

4.1.1.3 Horseshoe skim

Horseshoe skims harvest gravel from the downstream two-thirds of gravel bars. A lateral edge-of-water buffer is maintained along the low-flow channel. The upper one-third of the bar will be left in an undisturbed state as an upper bar buffer. The finished grade of the extraction area will have a downstream gradient equal to the river, a flat cross slope, and will be no lower than 1-foot above the low-flow water surface elevation as identified during the pre-extraction review. Cut-slopes will be left at a 2:1 (horizontal:vertical) slope except along the upstream side at the head-of-bar buffer where a 6:1 slope will be established. There will be at least a 15-foot offset buffer from the bank. The extraction surface will daylight along the downstream one-third to one-fifth of the bar to facilitate drainage following high runoff events. The horizontal and vertical offsets are intended to remove the excavation area away from the low-flow channel and minimize effects on listed salmonid species by disconnecting the mined surface from frequent flow inundation. Due to less frequent flow inundation, horseshoe-shaped skims may take larger flow events to replenish than traditional skim designs, depending on the unaltered bar height between the excavation and the stream. CHERT calls this technique a wide offset skim.

4.1.1.4 Secondary channel skims

These extractions are elongate, shallow skims in the area of dry, secondary channels and are designed to be free-draining and open at either end so as to not impede fish passage/migration and to prevent any potential fish stranding. The upstream riffle crest or elevation control of secondary channels shall not be affected by extraction proposals. The skim floor of these excavations shall be set at the 35-percent exceedance flow elevation. With proper design, secondary channel skims have a restorative function, as described in Section 4.1.2.3. CHERT calls this technique an overflow channel skim.

4.1.1.5 Trench

A trench is generally a long, narrow excavation adjacent to, but outside of, the wetted perimeter of the channel. This type of extraction may be considered a standard and/or restorative method depending on design and objectives. For example, a trench may be the least impactive method to achieve extraction goals while helping to promote channel narrowing by concentrating mining adjacent to the channel, thereby allowing for adjacent bar height to continue building. It may also be used to trap sediment that might have been transported to and deposited in an already aggraded reach. In some cases (e.g., 2008 trenches in the Lower Eel River), adult salmonids may use these locations as holding and resting pools following migration through a riffle.

Wet trenching
The wet trenching method of extraction is used to excavate sediment directly from portions of the channel, after the stream flow has been diverted to a secondary channel location. The wet trenching method of extraction will only be used when there is the additional objective of improving instream salmonid habitat by the limited use of sediment removal, and where the diversion of the low flow channel into a secondary channel that provides salmonid habitat is possible. Fish relocation may be required for wet trenching, and NMFS specifications for fish relocation will be followed.

Dry trenching
The dry trenching method of extraction may be both shallow and stay above the water table, or deep and extend below the water table. The dry trenching method involves gravel bar excavation on the exposed (dry) bar surface. A gravel berm may be constructed with materials on site to isolate the trench from the channel, or the trench may be far enough from the low flow channel to not require a berm to separate it. Material is then excavated from inside the trench to a depth that is limited by the reach of the equipment, and by the annual, site-specific recommendations provided by CHERT. After excavation, and when the sediment in the trench has settled, the berm is breached on the downstream end, and the trench is connected to the river to prevent fish stranding. Alternatively, the berm may be constructed to be naturally breached during normal storm runoff in the fall.

4.1.1.6 Other

As stated above, other extraction methods may be developed depending on site conditions that do not fall within the methodologies described above. These new options would be developed in consultation with regulatory agencies and CHERT.

4.1.2 Gravel extraction methods with habitat improvement components

Extraction methods with habitat improvement components are those that allow for harvesting of commercial quantities of aggregate, but also have a primary or secondary objective of providing a habitat restoration function. These methods include wet and dry floodplain pit excavations, restorative secondary channel skims, oxbow and alcove development, migration channel extractions, restorative trenches, and high terrace skims. Other options may be developed by the applicants in coordination with regulatory agencies and CHERT that will allow for both extraction of commercial quantities of aggregate and aquatic habitat restoration. Identification of specific restorative extraction methods will occur during the pre-extraction planning process and will depend on site conditions at that time. Site-specific restorative gravel extraction methods utilized in the past are described in Section 4.2. This BA anticipates that similar types and amounts of restorative gravel extraction techniques will be implemented in the future.

Each extraction site is unique morphologically and adjacent to different habitat types, which dictates the need for site-specific designs relative to habitat protection and restoration goals. In general, the design and implementation of restorative extraction methods are based on improving or creating adult salmonid holding and migration habitat, edgewater habitat for salmonid fry, and mainstem and off-channel juvenile rearing habitat.

The goals of these types of projects in the Lower Eel River include:

- increasing riparian habitat
- increasing channel confinement to improve adult salmonid holding and migration habitat

The goals of these types of projects in the Van Duzen River include:

- silt sequestration and erosion control
- encouragement of a single thread channel
- increasing riparian vegetation
- encouraging the thalweg to move toward riparian vegetation
- increasing channel confinement to improve adult salmonid holding and migration habitat

4.1.2.1 Wet floodplain pits

Wet floodplain pits are irregularly shaped excavations (to avoid excavating riparian vegetation) located on the floodplain surface. An excavator digs out the sediment below the water table and leaves the sides of the pit sloped. Wet pits are typically shallow and allow for gravel extraction away from frequently inundated gravel bar surfaces and most salmonid habitat features. Wet pits will fill with sediment only during high-flow events, and are typically located on the 2-5 year floodplain. Wet pits may have existing or planted vegetation around their perimeter, and may contain some type of cover elements such as woody debris. These features may also fill in with fine sediment, creating a seedbed in which native riparian vegetation could become established.

Lower elevation wet pits will have a connection to the low-flow channel, or other frequently inundated secondary channel, to allow for seasonal salmonid use and reduce salmonid entrapment potential. The pits will be monitored for salmonid stranding after high flows have receded. The pre-extraction plan will include a monitoring plan that assesses the risk of salmonid stranding and includes a fish rescue plan. Pre-extraction proposals for wet floodplain pits will include some type of verification of the inundation frequency, either by mapping flows on air photos or by HEC-RAS modeling

4.1.2.2 Dry floodplain pits

Dry floodplain pits are irregularly shaped excavations (to avoid excavating riparian vegetation) located on the three- to five-year return interval floodplain surface and should not have a secondary channel inlet. However, there should be an outlet connection to a secondary channel to reduce entrapment potential and provide very high-flow habitat for fish. An excavator digs out the sediment and leaves the sides of the pit sloped. The floor of the pit does not extend into the groundwater table. Dry pits allow for gravel extraction away from frequently inundated gravel bar surfaces and most salmonid habitat features. Dry pits will only fill with sediment during very high-flow events, on the order of every three to five years, and typically over a multi-year period. Dry pits may have existing or planted vegetation around their perimeter, and may also fill in with fine sediment that creates a seedbed in which native riparian vegetation could become established. The pits will be monitored for salmonid stranding after high flows have receded. The pre-extraction plan will include a monitoring plan that assesses the risk of salmonid stranding, and includes a fish rescue plan.

4.1.2.3 Restorative secondary channel skims

Secondary channel skims are described in Section 4.1.1.4. With proper design (i.e., variable topography, small side alcoves, introduction of anchored woody debris, etc.), these extractions can be used to create or improve high-flow habitat for salmonids. These channels could also be used as upstream adult salmonid migration corridors when water velocities in the main channel are high.

4.1.2.4 Oxbows

Oxbow extractions are narrow (average low-flow channel or less), linear, off-channel excavations along historical channel locations, typically defined on aerial photographs by curvilinear vegetation colonization, muted secondary channels, or as the toe of a moderate to high terrace or valley margin. Features should be located within the downstream half of the bar to minimize channel capture, and can potentially be excavated deeper than the adjacent thalweg. Oxbows that intercept hyporheic flow have historically been utilized by juvenile salmonids for rearing with good success. Oxbows could have willow vegetation and LWD placed in them to enhance their cover habitat.

4.1.2.5 Alcoves

Alcove extractions are typically located on the downstream end of gravel bars, where naturally occurring alcoves form and may provide velocity refuge for juvenile salmonids during high flows, and potential thermal refuge for juvenile salmonids during the summer season. Alcove extractions are irregularly shaped to avoid disturbance of riparian vegetation, and are open to the low-flow channel on the downstream end to avoid stranding salmonids. Alcoves are extracted to a depth either above or below the water table, and are small in area and volume extracted relative to other extraction methods.

4.1.2.6 Migration channel excavation

Migration channels may be excavated in those locations where upstream fish passage into tributary channels is impeded by sediment deposits and intermittent flow. These channels are constructed to connect mainstem channels to tributaries at lower discharges than would be required in the pre-project condition, thus allowing easier access for upstream migrating adult salmonids.

4.1.2.7 Restorative trench

A restorative trench is generally a long, narrow excavation adjacent to, but outside of, the wetted perimeter of the channel. As described above, this type of extraction may be considered a standard and/or restorative method depending on design and objectives. Trenches have been utilized to enhance adult salmonid migration and holding and resting areas. Trenches will be designed based on site-specific objectives and connected to the wetted channel at the upstream and downstream ends (after sediment has settled out) to prevent entrapment of fish. In addition, trenches will not be used where they could affect nearby spawning habitat.

4.1.2.8 High terrace skim

High terrace skims extract gravel from the 10-year or greater floodplain that is located at the downstream end of the lower bar. This area is excavated to the 35-percent exceedance flow elevation (below bankfull elevation) in such a way as to promote backwatering and fine sediment deposition at higher flows. This extraction is expected to foster riparian vegetation development by creating a suitable seedbed that is at a low enough elevation so seedling roots can gain access to summer groundwater. Riparian vegetation establishment may also be enhanced by direct planting. The extraction may be phased over a number of seasons to cover the planned area. However, once a surface has been extracted, the subsequent riparian vegetation growth will preclude the site's use as an active extraction area well into the future.

4.1.2.9 Other

Other restorative extraction methods may be developed depending on site conditions that do not fall within the methodologies described above. These new options will be developed in consultation with regulatory agencies and CHERT.

4.1.3 Completed historical habitat improvement extractions

A number of habitat improvement extraction activities have been completed in the last five years through a cooperative partnership with NMFS, CDFG, and the gravel operators. It is anticipated that at least an equal number of these types of activities will be implemented during the next permit period depending on annual site characteristics. Habitat improvement extractions conducted by each operator in the past are detailed in Section 4.2.

4.1.4 Optional habitat improvement actions

Optional habitat improvement actions may be developed in coordination with regulatory agencies and CHERT that do not fall within the methodologies described above. In addition, other habitat improvement activities that enhance habitat conditions for salmonids, have been implemented in the last five years through a cooperative partnership with NMFS, CDFG, and a number of Humboldt County gravel operators. Projects have included streambank erosion control, riparian planting, LWD placement, and placing cut willow vegetation in isolated oxbow pools to provide overhead cover. These projects have not been a required component of extraction operations, but have been implemented on a voluntary basis. The proposed action includes continuing to implement these types of projects and on a voluntary basis. This BA anticipates that at least an equal number of these types of activities will be implemented during the LOP 2009 permit period.

Optional restoration actions are intended to be goal-based and developed on a site-specific basis. Restoration goals for these types of actions in the Lower Eel River include:

- increasing riparian habitat
- increasing channel confinement to improve adult salmonid holding and migration habitat

Restoration goals for the Van Duzen River sites include:

- silt sequestration and erosion control
- encouragement of a single thread channel
- increasing riparian vegetation
- encouraging the thalweg to move toward riparian vegetation
- increasing channel confinement to improve adult salmonid holding and migration habitat

Several operators have identified potential future habitat improvement activities that might be implemented during the next permit period. Potential future activities are detailed in Section 4.2 below each operator's individual site description.

4.1.5 Annual plan development process

The proposed projects intend to reduce environmental impacts by site-specific planning of extraction activities on the proposed bars that takes into account unique landforms, vegetation patterns, salmonid spawning and rearing habitat, tributary stream locations, bedload transport, and other factors.

Primary components of the gravel extraction projects' planning and impact minimization measures are the continuation of monitoring programs that assess river resource trends over time, and adaptive management that results from these monitoring data. Planning and impact minimization of the proposed gravel extraction activities is accomplished through a combination of river monitoring activities. These involve annual biological monitoring activities along with evaluation and comparison of aerial photographs coupled with comparison of recent and historical full-channel cross-sections, which identify hydrological and morphological alterations. Gravel and sand extraction methods are developed in consideration of local and reach-wide geomorphic processes, and protection of bedforms important for sediment transport continuity, changes in local reach hydraulics, and sediment transport characteristics.

Pre-extraction cross-section surveys are typically conducted during the months of May and June. The applicants and/or their consultants will use the cross-sections to help identify potential extraction areas containing commercial quantities of aggregate within the project boundaries. Several other factors are considered during extraction planning including:

- Site-specific determinations of replenishment since the previous season;

- Locations of gravel deposits;
- Morphological changes caused by high flows and changes in sediment deposition patterns from the previous season;
- Assessment of how extraction of selected features will potentially affect surrounding morphology when flows increase again;
- How the extraction can be tailored and blend to surrounding natural contours to minimize extraction-induced depressions and initiation of nickpoint erosion;
- Avoidance of riparian vegetation as per the established protection measure; and
- Use of alternative extraction methods to improve instream or floodplain habitat features.

A decision matrix (see example in appendix A) is then developed that rates extraction options in relation to their ability to minimize adverse habitat and achieve project goals. Once the proposed options are developed, the operator will delineate the extraction plan on aerial photographs and gravel bar, describe in detail the various operational and protective aspects of the extraction, calculate potential harvestable volume, and identify temporary crossing locations, if any. The proposed extraction plan is then submitted to the ACOE, CHERT, CDFG, and NMFS. A field review is conducted, at the request of the operators, to describe the proposed plan, solicit comments or recommendations, and make any final modifications. The plan is then resubmitted to CHERT and NMFS for their final review and recommendation. The ACOE makes the final determination whether or not to approve the extraction plan. Extraction designs are implemented by marking mining areas, which may include grade staking, similar to the process utilized in road construction. The heavy equipment operator is provided with temporary stakes and/or hubs in or around the area of extraction indicating the boundaries and grades determined during the extraction plan review process. Typically, final surfaces are designed to be: (1) free-draining toward the river channel; (2) sloped downstream, parallel to the river, and/or (3) complementary to surrounding natural contours. This design strategy can reduce potential channel shifting, ponding, fish stranding, and nickpoint erosion caused by moderate to high-flow inundation.

4.1.6 Monitoring

During the extraction season and following cessation of seasonal operations, the site will be visited and reviewed by CHERT and regulatory agency representatives to document compliance with the approved extraction plans. The operator will do additional monitoring or reclamation/grading of the site if so determined necessary during the post-extraction visit. Any measures that were proposed as part of the operator's annual extraction plan would also be analyzed for compliance during the post-extraction visits. Post-extraction cross-sections will be surveyed to determine compliance with the extraction plan.

Physical monitoring of the project reach will be conducted through the use of several surveying techniques including:

- Pre-extraction cross sections
- Post-extraction cross sections
- Monitoring cross sections
- Identification of the elevation and location of the 35% exceedence water surface
- High water elevation and location from the previous winter

Details of the physical monitoring program can be found in Appendix C of LOP 2009 (ACOE 2009).

The biological monitoring component is intended to complement the physical monitoring described above. For each site, habitat data will be collected that describes the distribution and characteristics of three principal habitat types (pools, flatwater, and riffles) as described by the California Department of Fish and Game (Flosi et al. 1998), with the addition of an alcove habitat type. This habitat identification effort will be applied at each site, and at a minimum, will extend one half of a meander sequence above and below a given extraction site. Additionally, a habitat mapping component will be incorporated that delineates more specific micro-habitat features based upon relevant life history stages of concern for each reach.

This effort will be conducted annually, except for the "isolated sites" listed in the 2004 biological opinion for LOP 2004-1 (NMFS 2004a). For the isolated sites, the habitat data will be collected the year of extraction and at the conclusion of the permit period. If no extraction occurs at an isolated site, a minimum of one habitat survey will be conducted at the conclusion of the 5-year LOP permit period.

The intent of the habitat monitoring effort is two-fold. The first is to maintain continuity from past habitat mapping efforts and record the distribution and characteristics of habitat units that provide fish habitat value. To this end, the monitoring will be similar to that conducted in the past. The second intent of the monitoring is to provide the means to capture more qualitative biological observations than is possible using the physical monitoring protocols described in the previous section. Habitat units should be recorded on the current aerial photograph for the site(s) and be linked to both the cross-section and habitat data forms. At a minimum, the habitat data forms should record the depth and area of individual habitat units, the extent and type of cover available, and any additional observations (e.g., cold water seeps, undercut banks, overhanging vegetation, LWD, spawning and holding habitat, coho salmon rearing habitat) that provide useful information on the value of available habitat. We note that the utility of these more qualitative observations depend heavily on having the same person(s) conducting the monitoring from year to year.

In order to minimize observer subjectivity in the habitat mapping process, two approaches are used. First, pools should be defined based on a variety of characteristics that include substrate composition (sand and small gravel), bottom morphology (concave), maximum depth and velocity (<1 fps and smooth surface). The second approach is to coordinate with NMFS staff during at least the first year of implementation to ensure that habitat units are consistent and meet the intent of the biological monitoring. Should multiple biologists conduct the monitoring, each biologist will coordinate with NMFS staff.

Annual data submissions should include the aerial photographs with the habitat units clearly delineated, summary tables including descriptions of the proportional area of each habitat type, the distribution of habitat measurements (e.g., pool depths), and a narrative describing the habitat conditions in the reach.

4.1.7 Adaptive management strategy

Primary components of the gravel extraction projects' planning and impact minimization measures are the continuation of monitoring programs that assess river resource trends over time, and adaptive management that results from analyses of these monitoring data. During the course of the permit period, there may be flow events that alter the shape, location, or sediment depositional characteristics of the gravel bars and associated salmonid habitat elements. Such changes may justify review and adaptation of extraction locations, methods, and techniques in order to provide a consistent level of habitat and species protection and extractable volume. A collaborative site review and extraction design development process involving the individual operators, Humboldt County, CHERT, ACOE, NMFS, and CDFG will be utilized during the permit period to assess site conditions and develop annual extraction plans that are responsive to changing site conditions. This adaptive management strategy involves a multi-step process.

Prior to extraction, individual operators and/or their consultants will identify potential extraction sites in relation to the river channel and sensitive areas. Extraction locations and methods will be considered with respect to protection of habitat elements, sensitivity of the site with regard to potential significance of effects upon habitat elements and species utilization, effects on habitat elements by extraction method implementation, potential site response to the proposed extraction method(s), and annual replenishment and gravel availability. In addition, the operators will utilize cross-sections to help develop the pre-extraction plans.

Once potential extraction methods and locations are identified for a given year's operational bars, a set of proposed plans along with the pre-extraction monitoring data will be submitted to CHERT, ACOE, NMFS, and CDFG. As part of the review process, the individual operators and the interested agencies will conduct a field review of each operational bar. The agencies will review the plans to see if they comply with the terms and conditions of the permits, submit recommendations back to the operators for development of final operational plans, or make a determination that the plans are in compliance with the various permits.

Ongoing monitoring of river planform (from aerial photographs) and topography (from cross sections), coupled with on-site review by operators and regulatory personnel, will help in the assessment of channel response to specific extraction methodologies. The results of these assessments will enable the operators and the agencies to modify future extraction techniques, if necessary, prior to the upcoming extraction season. Therefore, adaptive management for extraction planning purposes is based on feedback of information based on monitoring data, field assessments, and agency review and recommendations. This adaptive management process is designed to minimize effects to channel form and function.

4.1.8 Effects minimization measures

Gravel extraction from the Lower Eel River and Van Duzen River will adhere to the Terms described in LOP 2009 (ACOE 2009) to minimize adverse effects to salmonids and their habitat including the following:

4.1.8.1 CHERT process

All operators shall use the CHERT process. CHERT is a critical part of the gravel extraction planning, implementation, compliance and monitoring program. In addition to making recommendations to the operators, CHERT also provides the Corps and NMFS with a summary of its rationale supporting the preferred extraction alternatives. Gravel extraction proposals shall include a summary of the rationale supporting how the CHERT recommendation does not increase channel braiding, promotes channel confinement, does not increase the risk of adult salmonid stranding, or decrease riffle and redd stability. CHERT also conducts field visits and analyzes pre- and post-extraction physical monitoring data and aerial photographs to determine compliance with approved extraction plans and assess effects of gravel operations on the form and function of the river.

4.1.8.2 Operating season

The operating season for extraction operations extend from June 1 through October 15, with potential for a Corps-approved extension until November 1. Bridge construction and use is limited to June 30 through October 15. Bridge use extensions can be granted until November 1 with Corps approval. Regrading, if necessary, shall be completed prior to October 15 each year.

Requests for a time extension will be reviewed on a case-by-case basis. The applicant, however, must have regraded the site before an extension can be authorized. Requests for an extension must include an approved CDFG Stream Alteration Agreement (SAA) extension or exemption. The ACOE will coordinate with CHERT and NMFS before a decision is made on the time extension.

The reason for establishing an operating season is to limit the potential for direct impacts and other interactions between extraction activities and various salmonid life history stages that occupy (seasonally or year around) the extraction reaches. It is expected that the bulk of the adult runs would be absent from the project reach during the operating season. In addition, most of the downstream smolt migration would be complete by June 1, with only a few stragglers remaining by the June 30 bridge installation date. Most steelhead fry that occupy edgewater habitats during the first weeks of their lives would be expected to have grown to a larger size and have moved into deeper and faster water by June 30.

4.1.8.3 Minimum head of bar buffer

The upstream end of the bar (head of bar) shall not be mined or otherwise altered by the proposed action (with the exception of trenching or other alternative designs as discussed below). The minimum head of the bar shall be defined as that portion of the bar that extends from at least the upper third of the bar to the upstream end of the bar that is exposed at summer low flow. Therefore, the upstream one-third portion of the bar as exposed at summer low flow is provided as the minimum head of bar buffer. The intent of the head of bar buffer is to provide protection of the natural stream flow steering effect provided by an undisturbed bar.

Some alternative extraction techniques, such as longer and much narrower skims adjacent to the low flow channel, have specific geomorphic objectives that may require extraction on a portion of the head of bar buffer. Variances to the minimum head of bar buffer may be considered on a case-by-case basis, if the proposed alternative provides equal or greater protection. NMFS will inform the ACOE and CHERT if a proposed variance does not comply with the terms of the Incidental Take Statement. The specific nature of the proposed variance must be described, along with sufficient biological, hydrological, and sediment transport rationale to support the recommended alternative. For example, any modification in the default head-of-bar buffer dimensions should, at a minimum, provide for protection of the adjacent cross-over riffle, by limiting extraction to the area downstream of the riffle. In addition, NMFS may impose special requirements, including additional monitoring on approved variances to the minimum head of bar buffer, to insure there is no take beyond what is allowed in the Incidental Take Statement of the biological opinion.

4.1.8.4 Minimum skim floor elevation

The minimum skim floor elevation shall be the elevation of the water surface at the 35% exceedence flow for each site, on an annual basis. Instructions for determining, marking and reporting the water surface elevation of the 35% exceedence flow are available from NMFS.

Additionally, the water surface elevation of the 35% exceedence flow shall be marked on the gravel bar and indicated on the cross section survey data.

The intent of the 35-percent exceedance flow elevation buffer is to allow for confinement of the low-flow channel, help route sediment around the post-extraction bar at relatively low to moderate flows, and ensure that the river is already transporting fine sediment from other sources when the bar is overtopped.

To aid compliance with these setbacks, the area of extraction shall be clearly flagged, painted, or staked. Excavated material shall be skimmed off the surface. Other methods of excavation, such as trenching, may be approved by the ACOE, however, these alternative designs will be discussed with other resource agencies (e.g., NMFS, CDFG) and CHERT prior to submitting the extraction plans in the spring.

4.1.8.5 Temporary channel crossings

Design and construction

The location, construction and removal of all temporary channel crossings must be reviewed by CHERT for conformance with these guidelines and described in the CHERT recommendation. Crossings will be designed and installed to minimize turbidity and geomorphic impacts from bridge construction, bridge use and bridge removal. Factors to consider include habitat quality, channel width, length of available bridges, required bridge width, water depth and velocity, amount of fine sediment in the native gravel and the availability of washed rock.

- Main channels must be spanned to the maximum length practicable using either a flatcar or bridge span. Appropriate culverts may be approved for use in secondary channels on a case-by-case basis.
- Heavy equipment passes across the wetted channel during temporary channel crossing construction and removal will be kept to an absolute minimum and described in the CHERT recommendation. Heavy equipment passes shall be limited to two passes per bridge construction and two passes per removal.
- Native gravel can be used for bridge approaches and abutments if the bridge will completely span the wetted channel, and the abutment materials are removed and regraded onto approved sites upon bridge removal.
- Use of brow logs, concrete blocks, concrete K-rails or other suitable materials shall be used in temporary abutments to minimize the amount of sediment required for abutments or approach ramps.
- If encroachment into the low flow channel is necessary to span the wetted channel, then approach ramps shall be constructed using techniques that will reduce the input of fine sediment into the channel. These techniques could include a base of washed rock or cobbles on the access side of the stream. The base shall extend from the bed of the stream to six inches above the water surface at construction time. This base can be topped with native gravel. Alternatively, if washed rock is not readily available, native gravel used in wetted approaches and abutments may be lined with filter fabric and surrounded with K-rails. Other methods that would provide equal or superior protection from turbidity impacts may be suggested by the operator and presented for review and recommendation by CHERT and NMFS. Other methods may be approved if they meet the objective of minimizing sediment delivery to the low-flow channel.
- Upon bridge removal, the original channel configuration shall be restored to the fullest extent feasible.

Timing
Temporary crossings shall be placed after June 30 only. All crossings and associated fills must be removed after excavation ceases, but before October 15. The ACOE shall provide NMFS a copy of any request for a time extension for bridge construction or removal for its review before the time extension may be authorized by the ACOE, due to the sensitivity of working directly within the wetted channel. Requests for a time extension will be reviewed on a case-by-case basis. Requests for an extension must include an approved CDFG Stream Alteration Agreement (SAA) extension or exemption. The ACOE will coordinate with CHERT and NMFS before a decision is made on the time extension.

To minimize the potential for adverse impacts to adult salmonids any operator who requests an extension to the November 1 bridge removal date will agree to the following conditions and will coordinate closely with regulatory agencies on the following:

1. The operator will monitor the National Weather Service (NWS) Eureka website on a daily basis after October 15. The purpose of the monitoring will be to determine if a weather system is approaching the area that has the potential to deliver at least one inch of rainfall. If the NWS predicts one inch of rain then the bridge will be removed immediately.

2. The operator will inspect the bridge site on a daily basis to determine if fish are attracted to the site by the change in water depth, velocity, overhead cover, etc. The bridge will be immediately removed if adult salmonids are observed at the site. The operator will inspect the bridge site on a daily basis to determine if adult salmonids are using the location for spawning. The bridge will be removed immediately if adult salmonids are observed at the site.

3. The operator will insure the extraction site is in a post-extraction groomed condition at the end of each day following October 15. This will allow for immediate removal of the bridge, if necessary, and preclude the necessity of waiting for reclamation activities to be completed.

Location
Bridge locations shall avoid known spawning areas. The middle of riffles may provide the best location for temporary crossings since the bridge may be able to span the entire wetted channel. Where bridges are not able to span the entire wetted channel, the crossing location shall be determined on a site-specific basis. The proposed location, and rationale used to determine how the crossing location minimizes effects to salmonids, shall be included in the CHERT recommendation. Haul roads shall follow the shortest route possible while avoiding sensitive areas such as riparian vegetation. If excessive compaction is identified, the roads shall be scarified after extraction is complete.

4.1.8.6 Storage and stockpiles

Temporary storage of excavated material may occur on the gravel bar, but must be removed by October 1. Temporary stockpiling of gravel on bars that are on rivers listed under the Wild and Scenic Rivers Act (see Appendix B in LOP 2009) may occur during the active work week, Monday through Friday, but must be removed before Saturday of each weekend.

In order to minimize the turbidity associated with excavating wet sediment, all wet excavated sediment must be stockpiled on the gravel bar away from the low flow channel and allowed to drain prior to hauling across the temporary channel crossing.

The intent of this protective measure is to minimize the potential for the production of turbid water should early rainfall increase river levels to the point where the river flows over the extraction surface and erodes the stockpile. In addition, once it has been loaded onto a dump truck (or other piece of hauling equipment), undrained, wet sediment has the potential to release turbid water into the river as it is being hauled over a bridge and potentially affect aquatic habitat. Draining of wet sediment in a temporary stockpile will minimize this impact

4.1.8.7 Vegetation and wetlands

All riparian woody vegetation and wetlands must be avoided to the maximum extent possible. Any riparian vegetation or wetland that is to be disturbed must be clearly identified by mapping. Woody vegetation that is part of a contiguous 1/8-acre complex or is at least 2 inches diameter that is disturbed must be mitigated. Impacts to other woody vegetation must be described and submitted to the ACOE and CHERT with the gravel extraction plans. These impacts may require mitigation at the discretion of the ACOE and mitigation requirements would be assessed on a case by case basis. Impacted areas that must be mapped consist of riparian vegetation that have drip lines within 25 feet of excavation activities (excavation, stockpiling, parking, etc.) or wetlands, which are filled, excavated or drained. Mitigation for impacts to woody vegetation shall not be required for pre-existing haul roads, stockpile areas and facilities (see discussion under Required Mitigation).

The purpose of this protective measure is to maintain and restore riparian vegetation, assist in bar stabilization, and provide for low- and high-flow salmonid habitat.

4.1.8.8 Structure setbacks

Gravel removal must remain a minimum distance of 500 feet from any structure (i.e. bridge, water intake, dam, etc.) in the river. For bridges, the minimum setback distance is the length of the bridge or 500 feet, whichever is greater. Gravel removal may encroach within this setback if written approval is given by owners of these structures and approved by the ACOE. A copy of written approvals shall be provided to the ACOE. The purpose of this protective measure is to limit any potential for extraction-related undercutting of the structure

4.1.8.9 Regrading

The project area must be regraded, if necessary, before the water levels rise in the rainy season. Grading must be completed by October 15 each year. Regrading includes filling in depressions, grading the construction/excavation site according to the approved configuration, leaving the area in a free-draining configuration (no depressions and sloping toward the low flow channel), and removing all temporary fills from the project area. Regrading may not be necessary if extraction operations leave the extraction area free of depressions and temporary fills and meet the approved mining configuration.

4.1.8.10 Wild and Scenic Rivers

Sections of the upper Eel River (outside of the project area) and Lower Van Duzen rivers (from the Powerline above Little Larabee Creek to the confluence with the Eel River) in Humboldt County are designated recreational and scenic. For a complete list of these recreational and scenic river sections see Appendix B of LOP 2009. Temporary stockpiling of gravel on bars that are on rivers listed under the Wild and Scenic Rivers Act may occur during the active work week, Monday through Friday, but must be removed before Saturday of each weekend.

4.1.8.11 Special status species

All applicants shall submit, as part of the application, a written assessment by a qualified biologist describing the potential effects of the project on state and federally listed threatened, endangered, or proposed species. Relative to potential impacts to SONCC coho salmon, CC Chinook salmon and NC steelhead, Appendix M of Lop 2009 contains the Incidental Take Statement from the BO from NMFS, dated August 13, 2004. The Reasonable and Prudent Measures contain restrictions which are mandatory conditions of LOP 2009.

4.1.8.12 Large woody debris retention

Large woody debris (LWD) in the wetted channel and on floodplains and terraces is an important component of aquatic and riparian habitat. However, it is common practice for LWD to be gathered by local residents for firewood and other uses. To reduce the adverse effects of this longstanding practice, educational signing regarding the importance of LWD for salmonids shall be placed at access roads owned, controlled, or utilized by the gravel operators. In addition, in order to protect LWD deposited on mined gravel bars, all access roads owned or controlled by commercial gravel operators shall be gated and locked to reduce access. Operators should consult with NMFS for suggestions on the wording and design of this sign.

4.1.8.13 Habitat enhancement and protection

The actions authorized by the LOP are expected to include certain activities at gravel extraction sites, during extraction seasons, that will enhance habitat for salmonids and other riverine species. The specific details of such habitat enhancement activities shall be determined during, and follow, the same multi-agency pre-extraction design review process that is used for gravel extraction operations. Many of the habitat enhancement activities shall be consistent in scope, size, and cost as restoration activities that have occurred in the past under LOP-2004. These activities included, but were not limited to, trenching designed to improve salmon migration, alcove construction, placement of edge water large woody debris, and construction of wetland pits to improve aquatic and riparian habitat. Some habitat enhancement activities will be new to LOP 2009, including, but not limited to, riparian planting and strategic placement of large wood and boulders in the stream.

This procedure assumes and authorizes habitat improvement projects of like kind, nature, and quantity would occur in the future. Please see the LOP 2009 for river-specific instream habitat concerns that could help direct habitat improvement activities.

Although the habitat improvement activities (HIA) may provide substantial benefits to the salmonids and other aquatic organisms, the HIA are incidental to the extraction activities and shall not be made a condition of a permit or annual approval.

4.1.8.14 Lower Eel River conditions, limitations and criteria

The Lower Eel River, from the confluence with the Van Duzen River downstream, is important nesting and rearing habitat for western snowy plovers (refer to LOP 2009) as well as migration and rearing habitat for coho and Chinook salmon, and steelhead. The ACOE and NMFS believe that this reach of river could be improved with increased riparian vegetation and channel confinement. For these reasons, the Lower Eel River contains extra conditions to further limit adverse impacts.

1. Alternative extraction techniques shall be preferred over traditional skimming (bar scalping). These alternative techniques may include, but are not limited to horseshoe extractions, alcoves, wetland pits, trenches and dry-trenches, as described in LOP 2009 Appendix L.

2. In addition to the alternative extraction techniques listed above, narrow skims that are adjacent to the low flow channel but provide for protection of the adjacent cross-over riffle by limiting extraction to the areas away from the entire riffle will also be considered for the Lower Eel River on a case-by-case basis. These narrow skims may have a minimum vertical offset of 2 feet above the water surface elevation of the low flow channel. Narrow skim widths will be determined on a site specific basis, but narrow skims must: (1) not increase channel braiding; (2) not lower the elevation at which flows enter secondary channels; (3) avoid the higher portions of the annually inundated bar surface; and (4) must promote channel confinement. The CHERT recommendation shall include a summary of the reasoning, along with sufficient biological, hydrological, and sediment transport rationale to support the recommended width.

4.1.8.15 Van Duzen River conditions, limitations and criteria

The mouth of the Van Duzen River channel is broad and generally shallow. In conjunction with the aggraded conditions, the river may flow subsurface in the late summer and early autumn. The situation has caused stranding and mortality of Chinook salmon in recent years. The ACOE' and NMFS' goals include silt sequestration, encouraging a single-thread channel and more riparian vegetation, and/or encouraging the thalweg adjacent to the existing riparian vegetation. The Van Duzen River is especially appropriate for trenching. Extraction proposals in the lower two miles of the Van Duzen River shall be limited to alternative extraction designs, such as trenching, alcoves, horseshoe pits, very narrow skims, etc. In particular, trenching is recommended in some locations in the Lower Van Duzen, especially when very close to the wetted channel.

"Very Narrow Skims" on the lower two miles of the Van Duzen River (from the confluence to River Mile 2) shall be limited to 90 feet total width, as measured across the top of the extraction. This width provides for confinement of typical early season (November/December) peak flows of 1,000 cfs and maintains a depth of one foot within the narrow skim area, which shall also be above the water surface elevation of the 35% exceedence flow, so that impairment of adult passage is reduced. Extraction proposals shall include a justification describing how the proposal will prevent increases in the width:depth ratio and not increase the likelihood of salmon stranding.

4.2 Gravel Extraction Areas

The six subject gravel extraction sites on the Lower Eel River are within an eight mile reach from near the confluence of the Van Duzen River to just downstream of Fernbridge. Three of the four extraction sites on the Lower Van Duzen River Reach are within the lower five miles, and the County of Humboldt's Pacific Lumber Bar is located at Rivermile 16.7. Information on combined total permitted and extracted amounts, CHERT approved volumes in past years and actual extracted volumes in past years is given in Section 6.0 below (Environmental Baseline).

4.2.1 Lower Eel River

4.2.1.1 Eureka Ready Mix – Hauck Bar

Eureka Ready Mix proposes to continue extraction of aggregate from the Hauck Bar, located on the Lower Eel River at River Mile 14±, downstream of the Van Duzen River confluence. Activity related to gravel removal generally occurs within the limits defined by the Ordinary High Water (OHW) mark. The project area consists of those areas of the subject parcels west of the Sandy Prairie Levee (APN's 106-221-001, 201-261-001, 201-261-006 & 201-221-009) in portions of Sections 14, 15, 22, 23 & 24, T2N, R1W, H.B. & M. The Hauck property is leased and has been operated by Eureka Ready Mix since 1981. Operations are permitted by the local lead agency through a Conditional Use Permit (CUP) (CUP-29-92), CDP (CDP-59-92) and Reclamation Plan (SMR-08-92).

The CUP for the site allows for annual excavation of up to 150,000 cubic yards of aggregate during the extraction season. The average annual extraction volume during the period from 1993 to 2008 was 48,236 cubic yards, and during the term of the 2004 ACOE Individual Permit (27725N) was 53,660 cubic yards.

Habitat adjacent to the Hauck Bar consists primarily of flatwater units with several small age 2+ steelhead habitat units and one adult holding pool just downstream of the confluence of the Van Duzen River. The primary habitat goal is to enhance upstream salmonid migration habitat through development or maintenance of a fish passage channel through the Van Duzen River delta. The over-all objective is to improve the success of upstream salmonid migration through the extraction site to the Van Duzen River watershed.

Table 4-3. Number and type of extraction methods employed at the Eureka Ready Mix site between 2004 and 2008.

Extraction Method	Types of extraction methods used per year				
	2004	2005	2006	2007	2008
Alcove	-	-	-	-	1
Trench	1	1	1	1	-
Narrow skim	1	-	1	1	-
Traditional skim	-	1	1	1	-
Total Volume Extracted	75,720	56,300	37,695	32,743	65,881

This site utilizes two existing roads to access the annual extraction sites and transport aggregate materials to their upland stockpile areas and processing facilities. Temporary roads are established in various locations within the dry portion of the channel in any given year and physical channel conditions such as vegetation presence. The low flow channel location can govern road placement on the active gravel bar surface, but will generally be established in a manner that reaches the extraction area in the shortest possible route, thereby reducing disturbance. These temporary roads are re-graded following operations to re-contour outside berms back into the road surface. This site may also require the use of temporary crossings to provide access to the Van Duzen River delta and Hauck Bar.

Historical habitat improvement extraction activities

Since 2002, the primary means of extraction at the Hauck Bar has contained a salmonid habitat improvement, or restorative component. This project has been a collaborative effort between Leland Rock and Eureka Ready Mix since the designed fish migration channel spans both sites. The majority of the effort has been for the benefit of upstream salmonid migration by development of a fish passage channel through the Van Duzen River delta. A designed fish migration channel, or combination of an alcove trench and fish channel have been implemented every season since 2002. The fish channel project has been instrumental in improving the success of upstream salmonid migration to the Van Duzen River watershed. The annual multi-agency/operator coordinated project benefits both the fish and the site operator. Extraction design documents show that since 2002, 65% of the Hauck Bar extraction volume has come from the Van Duzen River fish channel project. It is proposed to continue the fish channel project as necessary to maintain salmonid migration to the Van Duzen River system. Other extractions occurring under the latest permit period include: skims of the mid-channel bar, narrow skims of the upstream right-bank bar and a trench parallel to the Eel River upstream of the Van Duzen River confluence (Table 4-3). Eureka Ready Mix proposes to conduct similar operations as in the past and consistent with methods described herein.

4.2.1.2 Hansen Bar

Hansen Truck Stop (Hansen) proposes to continue gravel extraction activities at the Hanson Truck Stop Bar on the Lower Eel River at RM 13.5. Gravel operations occur annually during the extraction season. The property is solely owned by the Hansen family (APN 201-211-003) and is situated within Section 14, T2N, R1W, H.B. & M. The project site is located 5-miles south of Fortuna, California, on the west side of Sandy Prairie Road, ¼ mile north of the intersection of

Highway 101 and 36. The entire property is approximately 108 acres, with 49 acres in agricultural lands. A portion of the site (13 acres) is utilized for processing and stockpiling of aggregate from the adjacent bar. Most of the surrounding land use is industrial, agricultural, rural, and rural-improved.

The Hansen operation is permitted under a Vested Rights (SMR-03-912), (RP-02-912) authorized by the County of Humboldt for removal of up to 100,000 cubic yards. However, the proposed action is for an annual volume up to 50,000 cubic yards. This site did not experience any gravel extraction during the LOP 2004 permit period. This application is for the continuance of an existing activity under the strict regulation of numerous existing local, State and Federal agency programs. No significant change or cumulative augmentations of this activity are proposed.

Extraction methods appropriate for this site will be identified through the planning process. As stated in Appendix H of the LOP 2009, alternative extraction techniques shall be preferred over traditional skimming. This site utilizes one existing road to access the extraction sites and to transport aggregate materials to their upland stockpile areas and processing facilities. Temporary roads are established in various locations dependent on physical channel conditions and location of vegetation. Roads will be located such that extraction areas can be accessed in the shortest possible route to reduce disturbance, and are re-graded following operations to recontour outside berms back into the road surface. The low flow channel location also determines whether a summer bridge is needed. A temporary crossing is usually necessary to access sediment deposits on the bar.

The river channel at this site is defined by 15-25 foot vertical banks cut through agricultural lands with some residences nearby. The upper terraces are covered with a mixture of vegetation. The subject gravel bar is essentially an open active bar without topsoil or significant amounts of vegetation. Of the 108 acres included in the site, rarely are more than 17 acres disturbed within the bank-full channel by gravel extraction.

Annual site reclamation activities consist of finish grading gravel bars following extraction of sand and gravel to leave them shaped in a configuration consistent with permitted design criteria imposed by the ACOE, CDFG, North Coast Regional Water Quality Control Board, and NMFS. Extraction volumes may fluctuate in response to annual replenishment and operational conditions affecting habitat protection goals.

A primary habitat enhancement goal at this site is to expand riparian habitat on the east bank of the Eel River at the extraction site to improve riparian function including sediment control and soil stabilization. A second habitat goal is to restore or maintain a single thread channel to maintain channel confinement through the extraction reach. A plan is being developed to expand the riparian corridor along the east side of the river (from the river towards the stockpile/processing area). Historical photos suggest that intrusion into the established riparian buffer has occurred in the past in an effort to increase the stockpiling/processing area. Expansion of riparian growth would be accomplished by first pulling the stockpiles away from the riverbank then defining and establishing a work zone and off limit zone in the area of concern. This effort will consist of posting "Riparian Zone" signage at the edge of the riparian corridor between the yard and riverbank. The established boundary will minimize the chance of material inadvertently being off-loaded within the riparian zone or material being pushed into the riparian area.

4.2.1.3 Sandy Prairie Bar

The Sandy Prairie Bar complex includes the Mercer-Fraser Pedrazzini and Canevari sites. The Mercer-Fraser Sandy Prairie Bar (APN's 106-041-15,16; 200-352-02, 03; 200-361-02, 03; 200-362-11: Sections 2&3, Township 2 North, Range 1 West, & 33, 34 Township 3 North, Range 1 West, H.B.&M. Latitude: 40 Degrees, 35.2', 74" N, Longitude: 124 Degrees, 09', 34.2" W) Pedrazzini and Canevari sites are located on both sides (north and south) of the Fortuna sewage treatment plant, at the general location of the confluence of Strongs Creek with the Eel River (RM 10.5). The Canevari Site is located downstream of the Fortuna Sewage treatment plant at RM 10. The main low flow channel typically alternates location to the east and west side of a relatively large island with mature riparian vegetation, known as Canevari Island. The active channel of the Eel River is about 4,600 feet wide within this depositional reach and has multiple braids. The operator has maintained commercial gravel mining operations at the Pedrazzini site dating back to the 1940's and this is a vested rights site (Mercer-Fraser Sandy Prairie bar). The total project area is approximately 995 acres in size, approximately 38 of which may be disturbed annually, but reclaimed each year. The project area is generally within the limits of OHW and, therefore, within ACOE jurisdiction.

The Canevari site is granted aggregate extraction entitlements under a CUP and an approved Surface Mining and Reclamation Plan covering the annual entitlement of 200,000 cubic yards. Mercer-Fraser has operated the Canevari site as well as the Petrazzini site, and actual extraction volumes have been reported as combined volumes for these two operations. The Petrazzini site is permitted at a maximum extraction volume of 70,000 cubic yards. The annual ACOE letter of modification that is provided incorporates both sites as one permit with a maximum extraction of 270,000 cubic yards combined.

An existing levee, constructed following the 1964 flood, extends downstream from the town of Alton along the right bank of the river for approximately 2.5 miles. Thus, the low flow channel location has been fairly static relative to location due to annual scour that occurs along the levee. The upstream reach, which is adjacent to the Riverwalk Conference Center (12^{th} Street pool), contains a small patch of age 2+ steelhead habitat and an extensive adult holding pool (13.4 feet deep in 2007) that is associated with scour along the levee. The middle reach, adjacent to the stockpile and processing area, has a few small age 2+ steelhead habitat units, but is mostly flatwater. The downstream-most reach, near the Highway 101 and Main Street off ramp, has two adult holding pools and a few age 2+ steelhead habitat units. The entire site does not have any mapped spawning habitat. The primary habitat goals at this site are to maintain adult holding and migration habitat and improve juvenile salmonids rearing habitat.

Extraction locations and methods vary each year depending on annual river conditions (Table 4-4). As stated in Appendix H of the LOP 2009, alternative extraction techniques shall be preferred over traditional skimming at these sites. These alternative techniques include, but are not limited to, horseshoe extractions, wet and dry trenches, wetland pits, and alcoves. Narrow skims may also be used, but rational needs to be provided to show this method will: (1) not increase channel braiding; (2) not lower the elevation at which flows enter secondary channels; and (3) avoid the higher portions of the annually inundated bar surface; and (4) promote channel confinement. Extraction techniques for both Mercer-Fraser sites are similar in nature, and in some cases individual extractions may extend from one site to the other.

Table 4-4. Number and type of extraction methods employed at the Mercer-Fraser sites between 2004 and 2008.

Extraction Method	Types of extraction methods used per year				
	2004	2005	2006	2007	2008
Alcove	-	-	1	1	-
Trench	1 (wet)	1	2	3	4
Narrow skim	2	4	-	1	1
Secondary channel skim	1	5	3	3	-
Traditional skim	-	1	3	1	-
Total Volume Extracted	44,585	109,980	153,025	144,591	113,283

Seasonal crossings are typically installed over low flow river channels to access aggregate deposits and transport material to the processing plant. Crossing installation is conducted as per the requirements of the LOP 2009. The operation utilizes three existing roads to access extraction sites and to transport aggregate materials to upland stockpile areas and associated processing facilities. Temporary roads are established in various locations within the active channel in any given year. Physical channel conditions, vegetation presence and low flow channel location determine road location. The low flow channel location also determines the need for summer bridge installations. Up to two bridges may be used during the extraction season to access the bar. Roads will be established in a manner that reaches extraction areas in the shortest possible route to minimize disturbance, and are ripped and re-graded following operations to re-contour outside berms back into the road surface.

Historical habitat improvement extraction activities
Alternative extraction techniques are preferred at this site. Trenches have been historically implemented within either the abandoned secondary channels on either side of Canevari Island or alongside the active channel (where historical trenching techniques were implemented). Trenches that are located alongside the active low flow channel, such as those extracted in 2008, are designed with a horizontal offset to prohibit suspended sediment from infiltrating into the active channel. The widths and depths of the trenches are limited by the reach of an excavator. Typically, trenches would be approximately 50 to 90 feet wide with a depth of 12-17 feet. Trenches do not encroach into the active channel due to their horizontal buffers, but are only connected to the active channel after any suspended sediment has been allowed to settle (the downstream end is opened). Trenching has been utilized to deepen the channel and provide a fish migration passage thru the site.

Future habitat enhancement activities have been discussed with regulatory agencies specific to this site including riparian planting and encouraging a single thread channel through carefully designed trenching. These activities may be implemented in the future.

4.2.1.4 Drake Bar

Mallard Pond's Drake Bar is part of a 120-acre property (Sec. 33 & 34, Township 3 North, Range 1 West; APNs 200-331-02, 200-332-06-200-341-06) and are comprised of three parcels that extend from the railroad right-of-way across the river to and including the gravel bar and overflow channel on the river's southwest side. Along this part of the river, the bed of the river is approximately 2,100 feet wide and contains a low flow channel that is approximately 400 feet wide during the dry season. Of this total acreage, approximately 20 acres is generally used for gravel extraction unless alternatives are proposed.

The Drake Bar operation has been ongoing for approximately 50 years and has a County approved vested right/reclamation plan (1988) for a maximum extraction volume of up to 250,000 cubic yards on an annual basis. The project is subject to the approval of a number of permits, agreements, or authorizations from different local, state, and federal agencies (Humboldt Co.: MSP-08-93, RP-01-93; Coastal Commission: 1-94-79; State Lands Commission Lease PRC 6705; Army Corps of Engineers LOP 96-1, 211190). There has been no extraction on this bar during the LOP 2004 period.

In most years, the channel adjacent to this site consists of a single long pool that can be up to 15 feet deep and contain a large amount of adult holding habitat. However, for the past two years sediment deposition into the pool has resulted in a shift from pool to flatwater habitat and a loss of adult salmonids holding area. In terms of utilization, this area has typically provided adult and juvenile migration habitat. The primary habitat goal is to maintain and improve adult salmonid holding and migration through the extraction reach.

As stated in Appendix H of the LOP 2009, alternative extraction techniques shall be preferred over traditional skimming at this site. These alternative techniques include, but are not limited to, horseshoe extractions, wet and dry trenches, wetland pits, and alcoves. Narrow skims may also be used, but LOP 2009 requires rational to show this method will: (1) not increase channel braiding; (2) not lower the elevation at which flows enter secondary channels; and (3) avoid the higher portions of the annually inundated bar surface; and (4) promote channel confinement.

Future habitat enhancement activities have been discussed with regulatory agencies specific to this site including riparian planting and encouraging a single thread channel through carefully designed trenching. These activities may be implemented in the future.

This site utilizes existing roads to access the extraction sites and to transport aggregate materials to an upland stockpile area or to haul material off-site for processing. No processing facilities are associated with this site. Temporary roads are established in various locations within the active channel in any given year and physical channel configurations along with vegetation presence and location of low flow channel determine road locations. Up to three temporary crossings may be needed to access extraction sites. The actual number and locations of crossings will be dependent on the location of the active low flow channel.

4.2.1.5 Worswick Bar

The Worswick Gravel Bar is on the Lower Eel River immediately upstream of Fernbridge (Highway 211) at RM 7. The bar is on Assessor Parcel Number 200-321-11 and is located in Sections 28 and 29 Township 3 North, Range 1 West, HB&M (40° 36.7' N, 124° 11.8' W). Access to the bar is from Fernbridge Drive, just north of the entrance ramp to southbound

Highway 101. The bar is 227 acres in size, although the average area of each extraction is approximately 10 acres.

Humboldt County Department of Public Works (HCDPW) has a vested right to extract up to 200,000 cubic yards of gravel annually (#SP 73-87). This bar was extracted a single time during the LOP 2004 period. However, the proposed action is extraction of up to 25,000 cubic yards on as frequently as annually.

Instream habitat adjacent to this site consists mainly of shallow flatwater units with a few critical riffles (riffles that may be impassable to adult salmonids at certain low flows). Habitat goals include maintaining and protecting adult and juvenile migration habitat at this site.

Due to bar size and small volume extracted, traditional skimming has typically been used in the past. This extraction method has been approved by agencies and may be used again. Alternative methods as described in this BA may also be used. Equipment utilized includes a bulldozer, excavator, front-end loader, and haul trucks. Excavated rock is transported to a permanent crushing and stockpile site adjacent to the bar, above ordinary high water. Annual reclamation is completed immediately after extraction is concluded.

As historical extraction areas and methods have been restricted to low-volume skims of limited area, no historical restorative activities have been performed on the Worswick Bar (other than post-extraction reclamation grading). While no future restoration actions have been identified, restoration activities may be undertaken during the LOP 2009 period if such opportunities are identified.

This site utilizes an existing road to access the extraction site and to transport aggregate materials to an upland stockpile area or to haul material off-site for processing. No processing facilities are associated with this site. No bridges are proposed for this site.

4.2.1.6 Singley Bar

Eureka Ready Mix proposes extraction of aggregate from the Singley Bar, located on the Eel River at River Mile 6.0±, one-half mile downstream of the Fernbridge, Highway 211 crossing. The project site is near the upstream end of low-flow tidal influence.

The project area consists of those areas of the subject parcels generally within the boundary of OHW (APN's 106-011-011, 106-011-012, 106-011-023, 106-011-024, 106-031-001, 309-271-001 and -002) in portions of Sections 24 & 25, T3N, R2W and portions of Sections 19 & 30, T3N, R1N, H.B. & M. The Singley property is leased by Eureka Ready Mix and has not seen active operations since 1995. This bar is used extensively for public recreation.

Operations are permitted by the County through a CUP and CDP (CUP-38-912), and Reclamation Plan (SMR-06-912). Renewal of the lead agency CUP and Reclamation Plan are pending. The lead agency permit for the site allows for annual excavation of up to 150,000 cubic yards of aggregate during the extraction season.

Habitat adjacent to the Singley Bar consists of primarily long shallow flatwater units with one quality adult holding pool under/adjacent to Fernbridge. In addition, there is a small alcove on the right bank just upstream of Fernbridge. Habitat goals include maintaining adult and juvenile migration and holding habitat.

Extraction methods consistent with methods described above and in Appendix H of LOP 2009 will be used. Operations consist of excavation, grading, loading, and transport of sand and gravel from the exposed gravel bars to processing plants. The primary method of excavation utilizes a variety of heavy equipment including bulldozers, excavators, belly scrapers, front-end loaders and similar types of machinery.

Eureka Ready Mix proposes to implement a variety of extraction methods at the site as appropriate considering salmonid habitat elements and potential for improvement or enhancement, bar topography, riparian vegetation boundaries and public safety consistent with methods described herein and in LOP 2009. It is anticipated that appropriate extractions would include narrow skims, alcoves, trenches and secondary channel skims and horseshoe skims. Temporary crossings are not proposed with this project. The channel has remained relatively stable within the project reach with the main channel located along the right bank since 1992.

This site utilizes one existing road to access the extraction sites and to transport aggregate materials to an upland stockpile area or to haul material off-site for processing. No processing facilities are associated with this site. Temporary roads are established in various locations within the active channel in any given year and physical channel configurations along with vegetation presence and location of low flow channel determine road locations. No bridges are proposed for this site.

Public access to the Singley Bar is gained from Substation Road, which terminates near the south approach to Fernbridge. Restricting access at the Singley site is problematic due to multiple property ownership and the historic nature and scope of the recreational activities that take place during the summer and fall months. Recreational activity is confined to the left-bank bar area.

Restorative extraction activities may include alcove excavations along the left bank at the downstream end of the bar. A backwater area might also be an appropriate excavation objective along the right bank. While no specific future restoration actions have currently been identified, restoration activities may be undertaken in the future if such opportunities are identified.

4.2.2 Van Duzen River

4.2.2.1 Pacific Lumber Bar

The Pacific Lumber Gravel Bar is on the Van Duzen River, approximately 8.5 miles east of Carlotta on State Highway 36. This site/operation is considered an "isolated site" under LOP 2009. The bar is on Assessor Parcel Number 209-201-01, and is located in Sections 9 and 16, Township 1 North, Range 2 East, HB&M (40° 28.4'N, 123° 57.6'W). Access to the bar is immediately south of Highway 36 Bridge #4-94 (highway post mile 13.5). The bar is approximately 18 acres in size. The average area of each extraction is approximately 5 acres.

Humboldt County Department of Public Works (HCPW) has a surface mining permit to extract up to 3,000 cubic yards of gravel annually (permit #CUP-37-86/SMR-03-86). This bar was last extracted in 1996. However, the proposed action is for extraction of up to 3,000 cubic yards as frequently as annually. It is unlikely that extraction would occur at this site frequently (e.g. annually). However, if river conditions change, or under unusual circumstances (e.g. especially high winter flows or increased landslide activity across from or upstream of the bar), gravel extraction may occur in consecutive years.

Instream habitat goals for this site include maintain and protect adult salmonids spawning habitat, migration passage, and juvenile rearing habitat adjacent to the site.

The Pacific Lumber bar was not included in the 1992 PEIR for the Lower Eel River and Van Duzen River. CEQA compliance for this bar consists of an Initial Study and Negative Declaration (Humboldt County 1986), and a draft Addended Initial Study and Mitigated Negative Declaration submitted to the County Planning Division with SMARA permit renewal application in 2007.

Bar skimming is the preferred extraction method, although alternative extraction methods consistent with those described herein and in LOP 2009 may also be used. Equipment utilized includes a bulldozer, excavator, front-end loader, and haul trucks. Excavated rock is transported off-site to permanent crushing and stockpile sites in upland locations. Reclamation is ongoing and is completed immediately after extraction is concluded.

The site utilizes pre-existing permanent roads to access extraction sites and to transport aggregate materials. Temporary roads will be established on the bar based on extraction location and design. The gravel bar and extraction sites are on the north side of the river and do not require temporary crossings.

Historical extraction areas and methods have been restricted to low-volume skims of limited area. No restorative activities have been performed on the Pacific Lumber Bar (other than post-extraction reclamation grading). While no future restoration actions have currently been identified for the Pacific Lumber Bar, restoration activities may be undertaken in the future if such opportunities present themselves.

Because this operation occurs at an isolated site, the County of Humboldt is proposing to conduct biological monitoring consistent with "isolated sites" as described in Appendix D of LOP 2009. Specifically, since this site is used infrequently, habitat mapping would only occur during the year of extraction and cross section monitoring would occur as described in LOP 2009 for isolated sites.

4.2.2.2 Bess Site

The Thomas R. Bess Asphalt Sand and Gravel site (APN 204-072-003: NE ¼ Section 27, Township 2 North, Range 1 East, H.B.&M. Latitude: 40 Degrees, 31', 48.7" N, Longitude: 124 Degrees, 03', 8.9" W) is located approximately 5.4 miles upstream from the mouth of the Van Duzen River. The operator has maintained commercial gravel mining operations at this site (Thomas Bess ownership) since the 1940's and conditionally permitted in 1986. The total project area is approximately 93 acres in size, approximately 15 of which may be disturbed annually, but reclaimed each year. The project area is generally within the limits of OHW and therefore within ACOE jurisdiction.

The operation is permitted by the County of Humboldt (CUP-122-85) to extract up to 20,000 cubic yards annually. The proposed action is for extraction of up to 20,000 cubic yards on an annual basis. This proposed allocation is based upon Tom Bess' historical extraction rates and fall with the range of MAR as calculated by the CHERT committee.

The project reach is located where the more confined channel of the Van Duzen River (upstream) begins to open up to a broad valley floor and a broad alluvial terrace begins. The right bank adjacent to, and extending downstream of, the processing plant is protected by riprap and has a rock deflector that was constructed to reduce bank erosion. This structure extends out into the active channel, reduces the channel width, and has scours a deep pool. The constriction also reduces high flow water velocities on its downstream side, which encouraged deposition of aggregate and helps to alleviate bank erosion along the adjacent pasturelands. The forested slopes adjacent to the left bank along this reach have numerous rotational/translational slides, debris slides, and debris torrents.

Flatwater units are the dominate habitat type at this site with some adult holding pools and riffles, and one spawning habitat unit. In terms of salmonid utilization, adult holding is the primary use followed by age 2+ steelhead habitat and limited spawning. Goals include maintaining or enhancing adult holding habitat adjacent to the site through excavation design, enhancing created habitat through placing brush or other cover in excavated trenches, and implementing bank stabilization actions (this is a voluntary action dependent on funding availability).

The proposed action is the continued gravel extraction consistent with methods described herein and in LOP 2009. Trench excavations have been utilized at this site and have been designed to create adult salmonid holding habitat (~60 ft wide ~12-15 ft deep). The applicant proposes to implement similar actions and to potentially expand excavation of trenches as appropriate.

The site utilize existing roads to access extraction sites and to transport aggregate materials. Temporary roads are established in various locations within the active channel in any given year and physical channel conditions such as vegetation presence and low flow channel location can govern road location. The low flow channel location also determines whether a summer bridge is needed. Up to two summer bridge crossings may be required at this site. Roads will generally be established in a manner that reaches the extraction area in the shortest possible route to reduce disturbance, and are re-graded following operations to re-contour outside berms back into the road surface.

Streambanks at the Bess site have been subject to scour and erosion to the extent that the operator has lost from 40-50 acres of pastureland to eroding streambanks. Thus, the applicant is proposing to implement stream bank stabilization (that may include riparian planting) depending on available funds for planning and implementation. The applicant is also proposing to place brush and other cover elements in trenches to provide overhead cover for juvenile salmonids.

4.2.2.3 Van Duzen River Ranch

The Van Duzen River Ranch project is a cooperative commercial gravel extraction project located in 14 parcels between RM 3.2 and 6.0 (NE ¼ Sec 27, 28, 29, Township 2 North, Range 1E/~5; 204-072-06, 204-071-07, 204-071-09, 204-101-24, 204-076-06, 204-062-11, 204-071-05, 204-062-01, 204-063-14, 204-111-11, 204-111-05, 204-111-09, 204-101-26, 204-111-06, 204-063-13). Primary access to the site is via River Bar Road off of Highway 36, west of Hydesville. The proposed project consists of instream river-run aggregate extraction from exposed gravel bars along the Van Duzen and downstream of the mouth of Yager Creek.

Area of bankfull channel along this site is approximately 322 acres, and the project area contains approximately 100 acres of exposed gravel bars located between the low-flow channel and areas of periodic high flow inundation that are above the OHW. Aggradation has been identified as a threat to ranch resources and gravel extraction was identified in the Van Duzen River Ranch SEIR (Jager 1997a) as necessary to increase channel flood capacity and reduce bank erosion impacts. The operation is permitted by the County of Humboldt (CUP) to extract up to 100,000 cubic yards annually. Storm runoff from Yager Creek also adds a significant amount of discharge and sediment to the Van Duzen in this area. The Van Duzen River Ranch extends along 2.8 miles of the Van Duzen River, and Kelsey estimated that this portion of the river may contain 830,000 cubic yards of material that has aggraded relative to pre-1964 conditions (Resource Design Technology, Inc. 1999).

High sediment deposition at this site has resulted in flooding and aggradation, and the risk of channel avulsion is high. The over-all goal is to reduce storage at this site and the risk of significant channel erosion (as identified by Jager 1997a). Streambank protection/erosion control through bioengineered designs have been implemented along a significant portion of the ranch. Implementation of excavation designs that improve the success of erosion control/bank protection measures are desired outcomes of gravel extraction. Habitat goals for this project include maintaining and protecting adult salmonids migration passage, improving juvenile rearing habitat, increasing riparian vegetation, and stabilizing eroding banks.

Habitat along the ranch includes relatively good quality adult holding habitat along the left bank riprap that is located downstream of the mouth of Yager Creek. This streambank protection has been in place for many years and includes overhanging and partially submerged riparian vegetation. Age 2+ steelhead habitat is located in isolated places, particularly at the head of pools. Spawning habitat is in low supply.

The Van Duzen River Ranch SEIR (Jager 1997) described various methods to be used at these sites and included bar skimming, trenches, pits and "other environmentally sound methods that are consistent with the objectives of the project and authorized under Department of Fish and Game agreements will be used." Skimming is the preferred extraction method, although alternative extraction methods (e.g. trenching) consistent with methods described herein and in LOP 2009 may also be used (no more than 50 acres of exposed gravel bar would be disturbed during any one year).

The Van Duzen River Ranch Reclamation Plan (Jager 1997a) described extraction reaches as "the instream gravel extraction operation is confined to recent, unconsolidated quaternary alluvium located on exposed gravel bars between the banks of the Lower Van Duzen River and at the mouth of Yager Creek. Stockpiles are located on adjacent less recent alluvium and terraces. The extraction sites are in a major aggraded sediment deposition area, which is influenced by significant features in the lower six miles of the Van Duzen River. Just upstream of the project area the river loses sediment transport capacity as it exits from a narrow canyon and spreads out adjacent to the upper Poverty Flat land form. The resulting sediment deposition adds to the flooding and aggradation problems in this reach, and the risk of channel avulsion is high."

The site utilizes existing roads to access extraction sites and to transport aggregate materials. Temporary roads are established in various locations within the active channel in any given year and physical channel conditions such as vegetation presence and low flow channel location can govern road location. The low flow channel location also determines whether a summer bridge is needed. Roads will generally be established in a manner that reaches the extraction area in the shortest possible route to reduce disturbance, and are re-graded following operations to re-contour outside berms back into the road surface. A single bridge is usually constructed to access that portion of the ranch across the river, however, up to four summer bridge crossings are proposed in the event that they are needed. A single bridge is typically used to haul gravel to the stockpile area. The largest bar is located on the north side of the river and does not require bridge access.

Historical habitat improvement extraction activities

The operator has and will continue to use a variety of bio-engineering methods, hard points and revegetation to enhance stream habitat and reduce the risk of significant channel erosion (Jager 1997a). Past restoration work has included replanting vegetation along groins (next to stockpile) and it is proposed to continue similar actions. In addition to these actions, excavation in the overflow channel to allow a bank stabilization project (along the left bank) to become established, and to slow velocity in the river bend (to slow erosion into timber lands on left bank), has been recommended at this site and thus is included in the suite of voluntary restoration projects that may occur. These actions are dependent on available funding.

4.2.2.4 Leland Rock

The Leland Rock site (APN's 205-121-01, 02, 03; 205-151-01, 03, 04; 205-191-01: Sections 23, 24, 25, & 26, Township 2 North, Range 1 West, H.B.&M. Latitude: 40 Degrees, 32', 22" N, Longitude: 124 Degrees, 08', 49" W) is located south of the City of Fortuna, off of Highway 101 in the vicinity of the Van Duzen River/Highway 101 bridge. The operator has maintained commercial gravel mining operations at this site (Leland Rock ownership) since 1996. The total project area is approximately 161 acres in size, approximately 34 of which may be disturbed annually, but reclaimed each year. The operation is permitted by the County of Humboldt (SP-05-94 and CUP-28-94) to extract a maximum of 100,000 cubic yards annually. Actual extraction amounts vary and are based on site-specific annual planning and design.

Habitat upstream of the Highway 101 Bridge at this site consists of primarily flatwater units, no spawning habitat, three pools that provide adult holding habitat, and three age 2+ steelhead units. The majority of extraction operations occur downstream of the Highway 101 Bridge (a wetland pit was excavated above the Highway 101 Bridge above the mean annual flood zone in the past) where there is a barrier to adult migration associated with channel aggradation. Habitat goals at this site include restoring adult migration habitat, protecting streambanks from severe erosion, and enhancing or creating habitat through placement of LWD downstream of the 101 Bridge.

Leland Rock is proposing to continue the migration barrier modification project (fish channel) at the confluence with the Eel River, LWD installation, alcoves, and off-channel trenching. This project is a collaborative effort between Leland Rock and Eureka Ready Mix (Hauck Bar) since the designed channel spans both sites. Narrow skims can be utilized in this reach, but will be limited to a maximum width of 90 feet. Alternative extraction methods (e.g., trenching) consistent with methods described herein and in LOP 2009 may also be used.

The site utilizes existing roads to access extraction areas and to transport aggregate materials to the processing area. Temporary roads are established in various locations within the active channel in any given year and physical channel conditions such as vegetation presence and low flow channel location can govern road location. The low flow channel location also determines whether summer bridges are needed. Up to three summer bridges may be necessary. Roads will generally be established in a manner that reaches the extraction area in the shortest possible route to reduce disturbance, and are re-graded following operations to re-contour outside berms back into the road surface. Extraction operations typically required the use of two temporary bridges to access deposits. Temporary roads are re-graded following operations to re-contour outside berms back into the road surface.

Historical habitat improvement extraction activities

Leland Rock has implemented a salmonid migration barrier modification project (fish channel) at the confluence with the Eel River, LWD installation, alcoves, and off-channel trenching. This work has been implemented as part of a collaborative effort between Leland Rock and Eureka Ready Mix (Hauck Bar). Similar actions may be implemented in the future.

5 SPECIES AND CRITICAL HABITAT

The Lower Eel River and Van Duzen River provide habitat for the following salmonids listed under the ESA:

- Southern Oregon/Northern California Coasts (SONCC) coho salmon (*Oncorhynchus kisutch*) ESU
- California Coastal (CC) Chinook salmon (*O. tshawytscha*) ESU
- Northern California (NC) steelhead (*O. mykiss*) DPS

5.1 Designated Critical Habitat

The project area contains designated critical habitat for SONCC coho salmon, CC Chinook salmon and NC steelhead. Designated critical habitat for SONCC coho salmon encompasses accessible reaches of all rivers (including the Klamath River basin, estuarine areas and tributaries) between the Mattole River in California and the Elk River in Oregon, inclusive. Designated critical habitat for CC Chinook salmon encompasses accessible reaches of all rivers and tributaries south of the Klamath River (exclusive), and north of the Russian River (inclusive), not including those reaches excluded from critical habitat (as described in 70 FR 52488; Sept. 2, 2005). Designated critical habitat for NC steelhead encompasses accessible reaches of all rivers and tributaries between Redwood Creek (in Humboldt County) and the Gualala River in Mendocino County, not including those reaches excluded from critical habitat (as described in 70 FR 52488; Sept. 2, 2005).

5.2 Essential Fish Habitat

In addition to critical habitat designations for listed Pacific salmonids, Essential Fish Habitat (EFH) provisions of the Magnuson-Stevens Act (MSA) require heightened consideration of habitat for commercial species in resource management decisions, including EFH for SONCC coho salmon and CC Chinook salmon. EFH is defined in section 3 of the MSA as "those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity." NMFS interprets EFH to include aquatic areas and their associated physical, chemical and biological properties used by fish that are necessary to support a sustainable fishery and the contribution of the managed species to a healthy ecosystem. The MSA and its implementing regulations at 50 CFR 600.92(j) require that before a federal agency may authorize, fund or carry out any action that may adversely effect EFH, it must consult with NMFS. The purpose of the consultation is to develop conservation recommendations that address reasonably foreseeable adverse effects to EFH. Freshwater EFH for Pacific salmonids includes all those streams, lakes, ponds, wetlands, and other water bodies currently, or historically, accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable man-made barriers, and long-standing impassable natural barriers. The BA's analysis of effects to Pacific salmonid habitat includes, by definition, an analysis of effects to EFH.

5.3 Steelhead

Winter-run steelhead enter fresh water between November and April in the Pacific Northwest (Busby et al. 1996; Nickelson et al. 1992), migrate to spawning areas, and then spawn, generally in April and May (Barnhart 1986). Some adults, however, do not enter some coastal streams until spring, just before spawning (Meehan 1991). Summer steelhead enter freshwater in the spring and summer months, hold in the mainstem river and large tributaries, and then spawn in fall.

Steelhead require a minimum depth of 0.18 m and a maximum velocity of 2.44 m/s for active upstream migration (Smith 1973). Spawning and initial rearing of juvenile steelhead generally take place in small, moderate-gradient (generally 3-5 percent) tributary streams (Nickelson et al. 1992). A minimum depth of 0.18 m, water velocity of 0.30-0.91 m/s (Smith 1973), and clean substrate 0.6-10.2 cm (Nickelson et al. 1992) are required for spawning. Steelhead spawn in 3.9-9.4°C water (Bell 1991). Depending on water temperature, steelhead eggs may incubate for 1.5 to 4 months (August 9, 1996, 61 FR 41542) before hatching, generally between February and June (Bell 1991). After two to three weeks, in late spring, and following yolk sac absorption, alevins emerge from the gravel and begin actively feeding. After emerging from the gravel, fry usually inhabit shallow water along banks of perennial streams. Fry occupy stream margins (Nickelson et al. 1992). Summer rearing takes place primarily in the faster parts of pools, although young-of-the-year are abundant in glides and riffles. Winter rearing occurs more uniformly at lower densities across a wide range of fast and slow habitat types. Productive steelhead habitat is characterized by complexity, primarily in the form of large and small wood. Some older juveniles move downstream to rear in larger tributaries and mainstem rivers (Nickelson et al. 1992). Steelhead prefer water temperatures ranging from 12-15°C (Reeves et al. 1987). Juveniles live in freshwater from one to four years (usually two years in the California ESU), then smolt and migrate to the ocean in March and April (Barnhart 1986). Winter steelhead populations generally smolt after two years in fresh water (Busby et al. 1996).

5.4 Chinook Salmon

NMFS' (Meyers et al. 1998) status review of Chinook salmon contains information on the biological requirements of Chinook salmon. In summary, Chinook salmon mature between 2 and 6+ years of age (Myers et al. 1998). Fall-run Chinook salmon enter freshwater at an advanced stage of maturity, move rapidly to their spawning areas on the mainstem or lower tributaries of the rivers, and spawn within a few days or weeks of freshwater entry (Healey 1991). Post-emergent fry seek out shallow, near-shore areas with slow current and good cover, and begin feeding on small terrestrial and aquatic insects and aquatic crustaceans. The optimum temperature range for rearing Chinook salmon fry is 10°C to 12.8°C (Rich 1997, Seymour 1956) and for fingerlings is 12.8°C to 15.5°C (Rich 1997). In preparation for their entry into a saline environment, juvenile salmon undergo physiological transformations known as smoltification that adapt them for their transition to salt water. The optimal thermal range for Chinook during smoltification and seaward migration is 10°C to 12.8°C (Rich 1997). Chinook salmon addressed in this document exhibit an ocean-type life history, and smolts out-migrate predominantly as subyearlings, generally during April through July. Chinook salmon spend between 2 and 5 years in the ocean (Bell 1991; Healey 1991), before returning to freshwater to spawn. Some Chinook salmon return from the ocean to spawn one or more years before full-sized adults return, and are referred to as jacks (males) and jills (females).

NMFS (2007) assigned a Recovery Priority of 3 to CC Chinook salmon "based on a high degree of threat, a low-to-moderate recovery potential, and anticipated conflict with development projects or other activity." Population trends in the Eel River and throughout most of the ESU appear to be negative, and some local populations may have been extirpated.

5.5 Coho Salmon

General life history information and biological requirements of SONCC coho salmon have been described in various documents (Shapovalov 1954; Hassler 1987; Sandercock 1991; Weitkamp et al. 1995) as well as NMFS' final rule listing SONCC coho salmon (May 6, 1997; 62 FR 24588).

Adult coho salmon typically enter rivers between September and February. Spawning occurs from November to January (Hassler 1987), but occasionally as late as February or March (Weitkamp et al. 1995). Generally, coho spawn in smaller streams than those used by Chinook. Preferred gravel sizes range from 0.5 to 4.0 in. Adults die within 10–14 days following spawning. Coho salmon eggs incubate for 35-50 days between November and March. Successful incubation depends on several factors including dissolved oxygen levels, temperature, substrate size, amount of fine sediment, and water velocity. Fry start emerging from the gravel two to three weeks after hatching and move into shallow areas with vegetative or other cover. As fry grow larger, they disperse up or downstream. In summer, coho salmon fry prefer pools or other slower velocity areas such as alcoves, with woody debris or overhanging vegetation. Juvenile coho salmon over-winter in slow water habitat with cover as well. Juveniles may rear in fresh water for up to 15 months then migrate to the ocean as "smolts" from March to June (Weitkamp et al. 1995).

In preparation for their entry into a saline environment, juvenile salmon undergo physiological transformations known as smoltification to adapt them for their transition to salt water. Coho salmon adults typically spend two years in the ocean before returning to their natal streams to spawn as three-year olds.

Available historical data and coho salmon abundance for California are summarized by NMFS status reviews and update s (NMFS Southwest Fisheries Science Center 2001). The number of streams with coho salmon present within the SONCC ESU was found to have declined from 1989-2000. In the CC ESU the number of streams identified as having historical coho salmon presence generally ranged between 44 to 48 percent from 1989-2000. The decline of SONCC coho salmon is not the result of one single factor, but rather a number of natural and anthropogenic factors that include dam construction, instream flow alterations, and land use activities coupled with large flood events, fish harvest, and hatchery effects. Historical data and abundance for California are also summarized in Good et al. 2005. Coho salmon populations continue to be depressed relative to historical numbers and there is strong indications that breeding groups have been lost from a significant percentage of streams within their historical range (Good et al. 2005). The 2001 brood year appears to be one of the strongest perhaps of the last decade, and it followed a number of relatively weak years (Good et al. 2005). Risk factors include severe declines from historical run sizes, frequency of local extinctions, long-term downward trends, degraded freshwater habitat, reduction of carrying capacity and presence of Sacramento pikeminnow (*Ptychocheilus grandis*) in the Eel River basin. A Recovery Priority Number of 1 was assigned to SONCC coho salmon "based on a high magnitude of threat, a high potential for recovery, and anticipated conflict with current and future land disturbance and water-associated development" (NMFS 2007).

5.6 Tidewater Goby

Tidewater goby (*Eucyclogobius newberryi*) are listed as endangered under the ESA by USFWS. Tidewater goby are also state listed as "fully protected." Critical habitat was designated in November 2000, but did not include Humboldt County. However, and a new proposal for critical habitat is undergoing review that includes the Eel River delta (proposed at 50CFR 17: Vol 71 FR pp 68914-68995). The Tidewater goby is a small fish that inhabits coastal brackish water habitats entirely within California ranging from the Smith River to northern San Diego County. Tidewater gobies are uniquely adapted to coastal lagoons and the uppermost brackish zone of larger estuaries, rarely invading marine or freshwater habitats. The species is typically found in water less than 1 meter deep and salinities of less than 12 parts per thousand. However, gobies have a wide tolerance for varied salinity, oxygenation and temperature, especially for short periods. Principal threats include loss and modification of habitat, water diversions, predatory and competitive introduced species, habitat channelization and degraded water quality.

6 ENVIRONMENTAL BASELINE

The environmental baseline is an analysis of the effects of past and ongoing human and natural factors leading to the current status of Pacific salmonids and their habitat within the project area. A review of historic channel conditions and trends is included. The environmental baseline also represents the cumulative effects of past and ongoing actions, as well as floods and other watershed processes that have occurred in the watershed over time.

6.1 Lower Eel River

The mainstem Eel River watershed covers approximately 1,477 square miles spanning Glenn, Lake, Mendocino, and Humboldt Counties, California. The headwaters of the Eel River originate in Mendocino, Lake and Glenn Counties and are dammed by Lake Pillsbury in northern Lake County. Headwaters flow west approximately 10.5 miles from Lake Pillsbury to Van Arsdale Reservoir where a portion of Eel River flows are pumped south into the Russian River basin.

In addition to the gravel operations described herein on the Lower Eel River, gravel extraction occurs at Fort Seward on the mainstem of the Eel River (RM 65-66), on gravel bars along the middle mainstem Eel River from river mile 15.8 to 49.6, on Charles Bar in Larabee Creek (a tributary to the Eel River), and at three operations along a 17-mi reach of the South Fork Eel River.

The Eel River is California's third largest drainage basin with an area (at Scotia) of 3113 mi^2 . Precipitation averages 40 inches per year in the coastal lowlands, and 80-100 inches per year at higher elevations. Average annual run-off (1900-1959) is estimated at 6,808,000 acre feet. The Eel River basin is one of the wettest, accounting for 9% of California's annual run-off (from only 2% of the state's drainage area). Flows near the mouth of the Eel River have ranged from 12 cfs to 752,000 cfs in the historic record (NMFS 2000). The Eel River basin landscape varies from mountainous redwood and Douglas fir forest to grassland and oak woodlands. The geology of the Eel River watershed is naturally unstable and is considered one of the highest sediment producing rivers in the world, carrying 15 times as much sediment as the Mississippi River (Brown and Ritter 1971). Land uses include grazing, timber management, rural and residential development, recreation, gravel extraction, infrastructure, and specialty crop agriculture.

Water diversions have occurred historically and currently in the Eel River including Cape Horn Dam, on the upper mainstem, which was constructed in 1907. Improvements to fish passage facilities were made in 1962 and 1987. Approximately 219 cfs (average) is diverted at Cape Horn Dam to the Russian River basin. Scott Dam is located 12 miles upstream of Cape Horn Dam and was constructed in 1912, without providing for fish passage. Benbow Dam is located in the South Fork Eel River near Garberville, and was first constructed in 1937. This dam historically was operated from July to October to provide a seasonal recreation lake. Currently, State Parks is analyzing the economic and environmental issues associated with the Benbow Dam to develop a future management scenario.

The mainstem Eel River was listed as water quality limited due to sediment and temperature by the State of California and a Total Maximum Daily Load (TMDL) analysis was completed under Section 303(d) of the Federal Clean Water Act (EPA 1999). Summer water temperatures are a limiting factor for salmonids in the upper mainstem Eel River. The Lower Eel River TMDL was completed in December 2007 (EPA 2007).

The Lower Eel River from Rio Dell downstream to the estuary is a depositional reach bordered by open pastures and some urban development. Summer fog influences water temperatures in the Lower Eel River, however the average channel width is 1,900 ft. Riparian vegetation has been reduced as a result of land uses including the construction of the Sandy Prairie Levee in 1959. EPA (2007) concluded that sediment input volume has decreased over time while storage volume has increased and that increases in storage volume has likely contributed to channel widening, and resulted in less shading over the channel (also refer to discussion of CHERT 2009 below).

The Eel River estuary has decreased in size and function relative to historic accounts (Ames 1983). The Eel River estuary has decreased in size and function relative to historic accounts (Ames 1983). CDFG (1977) reported a trend of estuary filling that has extended upstream in recent years and resulted in filling in and narrowing of formerly persistent deep pools such as the Singley Hole below Fernbridge and the Box-Car Hole at the upstream end of Drake Sand and Gravel. More recently, CHERT (2009) conducted a cross section analysis and reported "....net fill on either side of Fernbridge (lower Worswick and lower Singley Bars)."

Shoreline monitoring near Humboldt Bay entrance has been conducted by Moffat and Nichol (1996). Shoreline sediment volume within six miles either side of the Humboldt Bay entrance was found to have increased. The study indicated that sediment outflow from the Eel River was a contributing factor for this growth and may imply that the river maintained an unquantified but positive production of sediment (ACOE 1999).

Tributaries to the Eel River have steep gradients and side slopes and drain areas with unstable conditions. Some of the most unstable geology is located in the middle and lower portions of the basin just above Scotia station. Major earthflows are common in some areas. Due to the basin's recent general uplift and consistent contribution of large amounts of landsliding, channels are narrow and deep in relationship to peak flows. As discharge increases, depth and velocity increase rapidly while width increases only slightly. The 1964 flood, in one week period, contributed 46% of the total suspended sediment in a 10 year period, or 4.6 times the average annual suspended sediment discharge.

6.1.1 Channel Conditions

The Eel River PEIR (Humboldt County 1992) contains information on changes in river bed elevation and channel morphology over time. Based on testimonies of "old timers" given at a public hearing in 1937 on a flood control project, it appears that the channel in much of the Lower Eel extraction reaches was deeper in the 1860 through 1890 period than in 1937.

Between 1924 to 1935 channel gradient between the Van Duzen River bridge and Fernbridge was 5.28 feet per mile. Following the 1964 flood, gradients increased to 6.95 feet per mile. In December of 1991, gradients were measured at 4.44 feet per mile. The PEIR (Humboldt County 1992) reported that the distances between riffles in December 1940 versus December 1991 was not great. The PEIR (Humboldt County 1992) reported on comparative cross sections and photos and reported that little change in the river bed elevation at Fernbridge between 1911 and 1991 has occurred. Highway 101 at Rio Dell cross sections showed a bed lowering trend between 1972 and 1991. Further upstream at Stafford and at the South Fork Eel confluence, the channel bed elevations changed very little.

Sand and gravel mining has occurred on the Eel River since 1911 when Fernbridge was constructed, and later when roads began to be resurfaced with gravel around 1915. The Eel River PEIR (Humboldt County 1992) reported that the low-flow river bed morphology appears visually similar to that which existed in 1940.

Physical channel changes including aggradation, degradation, channel shifting, and width variations have occurred and are part of natural processes in the evolution of alluvial floodplains that evolve simultaneously towards self-stabilization and which are directly influenced by factors such as sediment load, sediment size, gradient and discharge (ACOE 1999). The ACOE (1999) attempted to determine whether any of these changes have been accentuated by the influence of sand and gravel mining or if they are the result of ongoing natural processes.

The ACOE's (1999) analysis was based on a comparison of the most recent cross sections and aerial photographs at the time of their analysis. Six "representative" cross sections were used for comparison purposes, located from Rio Dell to Fernbridge. The ACOE (1999) reported that the overall channel geometry has changed little over the years. Some sections showed aggradation in the vicinity of steep banks, but overall measurements indicate that four out of six cross sections displayed minor to moderate net degradation ranging from 0.5 to 3.2 feet. Depth and velocity tend to increase rapidly with increasing discharge along this reach, however no channel switching was observed because this reach flows mostly confined in one channel at most stages and at some locations its steep banks are not subject to overflow (ACOE 1999).

Gravel extraction projects located in the Lower Eel River are along a broad alluvial flood plain known as the Eel River Delta and on the Sandy Prairie landform. The Lower Eel River was used historically for commercial shipping by shallow draft boats. Thus, it is evident that the Lower Eel River is currently filled with bedload and is shallower and wider that in the mid-1800s. The PEIR (Humboldt County 1992) described widening and filling of the Lower Eel River and the Sandy Prairie landform from a map showing the original river banks as they occurred in 1857. The channel in much of the project area (Lower Eel River extraction sites) was much deeper in the 1860 through 1890 period.

The PEIR (Humboldt County 1992) also described stream bed gradient and riffle locations. From 1924 to 1935 between the Van Duzen River and Fernbridge the channel gradient was 5.28 ft per mile, and following the 1964 flood gradient increased to 6.95 ft per mile. In 1991, the gradient was 4.44 ft per mile. These flat gradients of around one foot per thousand feet are fairly representative of a drowned river valley. The differences in distances between riffles in December 1940 compared to December 1991 is not great. All of the evidence indicates that the Lower Eel River is in an aggraded condition relative to historic conditions.

Longitudinal thalweg profiles surveyed in 1962 by the ACOE and resurveyed have been compared and show no significant degradation of the thalweg or riverbed (Humboldt County 1992; Rising Sun Enterprises 1995). Local scour at flood control levees occurred. Comparisons of cross-sections and photographs were done for the PEIR (Humboldt County 1992), which reported that "there has been very little net change in the riverbed elevation over the past 80 years at Fernbridge. The low flow riverbed morphology appears visually similar to that which existed in 1940." Aerial photos and other evidence document that the river is in an aggraded condition (oral histories and historical summaries can be found in the Eel River PEIR). Gravel operators also described the Lower Eel River as having much deeper pools, and as being navigable by large boats during the last half of the 19th century and the first half of the 20th century.

Longitudinal profiles analyses, aerial photos, and anecdotal information all support the findings in the PEIR and substantiate claims by operators that the channel bed has maintained its elevation even during periods of intensive mining that corresponded with local and regional construction needs.

Changes in thalweg and bed surface elevations have occurred in relation to flood events and at specific locations. For example, the bed levels of the Van Duzen at Highway 101 bridge, Eel River at Fernbridge, and the Eel River at Cock Robin Island bridge had changes related to flood events. The bed at Cock Robin Island bridge aggraded from 2 to 14 feet during the 1972 flood (Humboldt County 1992).

The Eel River at the Van Duzen confluence is aggraded to the point that, in some years (1994, 2001), salmonids holding in the Lower Eel River cannot migrate upstream in late fall due to subsurface flows. This same situation has occurred just below the Twelfth Street levee. In the past, CDFG has requested operators to open up the channels to allow for fish passage.

Bank protection and levee structures placed in the Lower Eel River have limited the river's ability to migrate and overflow its banks. The construction of the Sandy Prairie levee in 1959 and the Grizzly Bluff levee following the 1964 flood, plus the cutting of the old original channel sometime in the 1860's at Fernbridge has changed the meandering ability of the river during high flow. The flood control features influence the location of the low flow channel (generally cause it to be against the existing levees and rock slope protections). Historically during floods much of the river overflowed into the Salt River channel. On the east side high flows reached the railroad grade adjacent to Fortuna. Essentially, through the project area from the mouth of the Van Duzen to Fernbridge, the high flow morphology of the river has been changed through flood control and erosion control efforts such as the construction of levees and rip rap along banks. Levees separate potential overflow areas from the main channel and concentrate the high flow energy of floods to a narrower part of the river bed, thereby moving more bedload material through the project area. When available sediment exceeds the channel carrying capacity sediment deposition (channel aggradation) occurs. The bed fills in and the low flow channel becomes unconfined, wide and shallow. Channel braiding would likely occur at low flows and bank erosion will increase at higher flows. The braided section (between river mile 10.5 and 13.1) contains the largest available area to store bedload during the 50 to 100 year flows.

The Sandy Prairie landform was produced by deposition of large quantities of aggregate materials in the main and overflow channels of the Lower Eel River, and has persisted as such since at least 1916. This landform is a transition in the channel slope that occurs at river mile 10 and continues at a low gradient (0.02%) to the ocean. The decreased slope influences velocity and a corresponding decrease in bedload carrying capacity occurs, which resulted in the creation of this large depositional feature. The zone of tidal influence is just upstream of Fernbridge, which is the lower end of the landform. Tidal action influences discharge characteristics here by backing up flows and increasing deposition in the project area. Bankfull channel width increases from 1,800 ft upstream to approximately 4,300 ft at the mid point of the landform. Downstream of the landform the channel narrows to 1,800 ft (Drake Bar). As the river widens at the landform, bedload is deposited and stored. The Canevari SEIR (Humboldt County 1993) shows five distinct channels at the main body of the landform, each of which become active at different discharges. At low flow there is a single channel, and upstream and downstream of the landform the Eel River flows in a single channel at discharges up to bankfull.

EPA (2007) assessed (historical aerial photos and field reconnaissance) channel changes and concluded that in the Lower Eel River "sediment input volume has decreased over time while storage volume has increased; in other words, more sediment is stored in the channel area today than in the past" and "these increases in storage volume likely contributed to channel widening, (Appendix C of EPA 2007), thereby resulting in less shading over the channel, which can contribute to increases in stream temperature."

The ACOE (1999) estimated average annual suspended sediment load and bedload for the Eel River basin and reported the following:

> "The USGS collected and analyzed suspended sediment data for the Eel River at Scotia's station between 1959 and 1980. Analyses indicate that the average annual suspended load is nearly 23 million tons, or approximately 13 million cubic yards. Assuming that bedload is 5% of suspended load, then 650,000 cubic yards can be estimated as bedload. According to Rosgen (1996), for rivers like the Eel and Van Duzen, bedload estimates that are in the general range of 5 to 10 percent of measured suspended loads are believed to be conservative estimates."

A study of sediment loading rates directly after the 1964 flood estimated that the Eel River had the highest average suspended sediment yield for any basin in the United States, and that the majority of the suspended sediment from the basin originates upstream from Eel Rock (approximately 9 river miles downstream of Fort Seward) (Brown and Ritter 1971, EPA 2005). For the two year period of record, suspended sediment discharge was 29,210,000 tons, or approximately 56 percent of that recorded at Scotia for the same period (Brown and Ritter 1971). Collins and Dunne (1990) reported bedload is generally 8–16 percent of suspended load in mountainous basins. Using the Collins and Dunne (1990) range the average annual bedload at Scotia would range from 2,336,800 to 4,673,600 cubic yards.

To address potential cumulative impacts of gravel extraction, CHERT and regulatory agencies constrain the total volume of gravel removed within estimates of gravel recruitment to avoid exceeding amounts needed for maintenance of channel form and function and downstream beneficial uses. Implementation of site-specific minimization measures and extraction designs, establishment of extraction baseline elevations and operational restrictions, implementation of physical monitoring and an adaptive management process as proposed, using a technical-based planning process that involves annual review and input from regulatory agencies and CHERT, minimizes or avoids significant adverse cumulative effects.

The combined total of permitted extraction amounts on the Lower Eel River is 1,120,000 cubic yards. Actual extracted volumes have been less. During LOP 2004, the CHERT approved volumes did not exceed 235,495 cubic yards (Table 6-1). The actual extraction volume during LOP 2004 was even less than the approved amount and didn't exceed 208,240 cubic yards (Table 6-1). Therefore, actual extraction volumes for the LOP 2004 period were significantly less than either the MAR and maximum permitted amounts. This was due to each operator's actual extraction volume fluctuating in response to site-specific designs, annual replenishment, extraction season length, and habitat protection goals.

Table 6-1. 2004 through 2008 CHERT approved and actual extracted gravel volumes for the Lower Eel River (CHERT 2004, 2005, and 2006-2008 unpublished data tables).

Operator	2004		2005		2006		2007		2008	
	CHERT Approved (yd^3)	Actual Extracted (yd^3)	CHERT Approved (yd^3)	Actual Extracted (yd^3)	CHERT Approved (yd^3)	Actual Extracted (yd^3)	CHERT Approved (yd^3)	Actual Extracted (yd^3)	CHERT Approved (yd^3)	Actu Extra d (yd
ERM[1]	87,025	75,720	69,560	56,300	40,760	37,695	33,089	32,743	70,310	65,8[illegible]
Hansen	0	0	0	0	0	0	0	0	0	0
M-F[2]	91,815	44,585	125,810	109,980	169,755	153,025	210,008	144,591	167,645	126,4
Mallard	0	0	0	0	0	0	0	0	0	0
County	0	0	0	0	24,980	17,520	0	0	0	0
Total	**178,840**	**120,305**	**195,370**	**166,280**	**235,495**	**208,240**	**243,097**	**177,334**	**237,955**	**192,3**

1-Eureka Ready Mix
2-Mercer-Fraser

Chert (2009) also provided extracted volumes for the past 10 years of operations in the Eel River Basin and Figure 19 from CHERT (2009) shows annual peak discharges for corresponding years (refer to CHERT 2009 for further information):

Table 6-2. Approved and extracted gravel mining volumes in the Eel River since 1997 (excludes isolated sites).

Lower Eel River			
Year	Approved Volume (cubic yards)	Extracted Volume (cubic yards)	Percent
1997	561,700	326,500	58%
1998	399,100	273,000	68%
1999	471,400	290,500	62%
2000	291,300	208,600	72%
2001	389,900	119,300	31%
2002	387,300	220,000	57%
2003	318,300	163,900	51%
2004	188,840	120,305	64%
2005	199,370	166,280	83%
2006	235,495	208,240	88%
2007	243,097	177,334	73%
Totals	**3,685,802**	**2,273,959**	**62%**
Years	**11**	**11**	---
Averages	**335,073**	**206,724**	**62%**

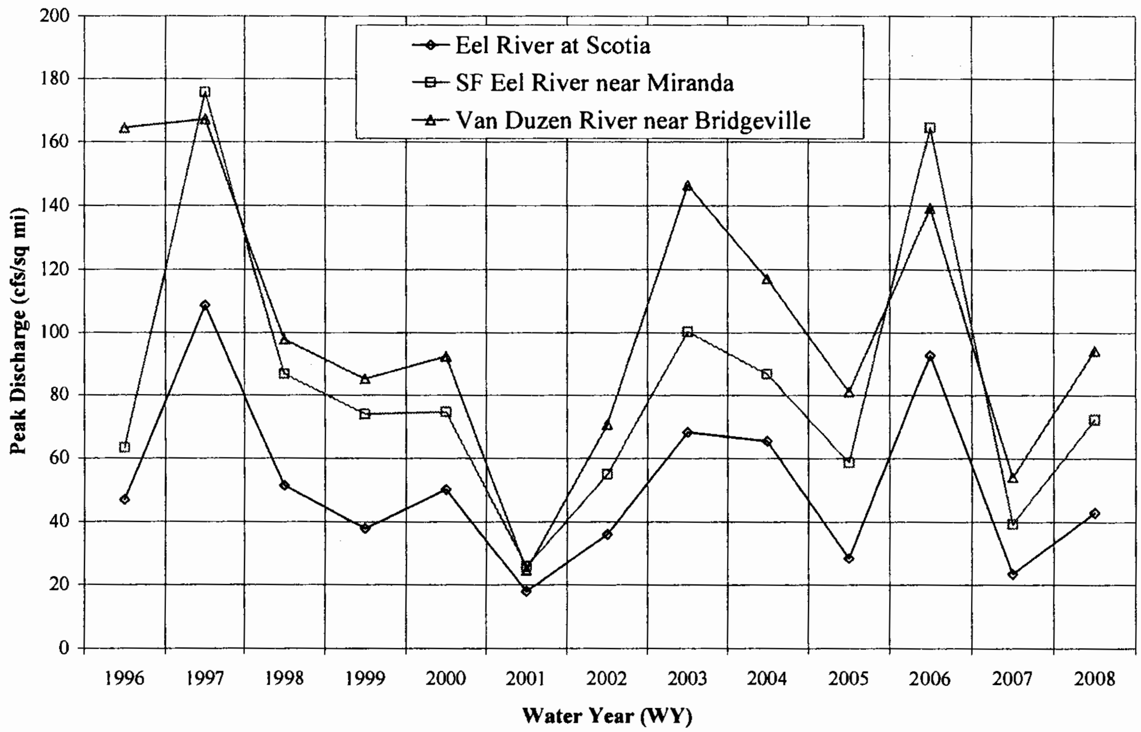
Middle Eel River			
Year	Approved Volume (cubic yards)	Extracted Volume (cubic yards)	Percent
1997	147,300	84,900	58%
1998	157,900	99,400	63%
1999	134,900	124,900	93%
2000	160,100	131,000	82%
2001	116,100	64,000	55%
2002	132,767	121,608	92%
2003	74,030	54,060	73%
2004	0	0	n/a
2005	0	0	n/a
2006	0	0	n/a
2007	89,990	64,424	72%
Totals	**1,013,087**	**744,292**	**73%**
Years	**11**	**11**	---
Averages	**92,099**	**67,663**	**73%**

South Fork Eel River			
Year	Approved Volume (cubic yards)	Extracted Volume (cubic yards)	Percent
1997	67,700	74,700	110%
1998	75,400	70,100	93%
1999	85,400	75,900	89%
2000	75,700	53,700	71%
2001	66,000	43,100	65%
2002	58,163	48,122	83%
2003	87,060	54,660	63%
2004	80,730	50,745	63%
2005	82,770	36,480	44%
2006	92,000	35,075	38%
2007	90,737	73,956	82%
Totals	**861,660**	**616,538**	**72%**
Years	**11**	**11**	---
Averages	**78,333**	**56,049**	**72%**

Van Duzen River			
Year	Approved Volume (cubic yards)	Extracted Volume (cubic yards)	Percent
1997	120,000	81,600	68%
1998	119,100	103,700	87%
1999	159,900	108,800	68%
2000	194,800	121,300	62%
2001	161,700	85,600	53%
2002	202,500	167,400	83%
2003	175,100	123,000	70%
2004	179,045	92,610	52%
2005	159,090	123,170	77%
2006	134,910	104,750	78%
2007	152,773	113,184	74%
Totals	**1,758,918**	**1,225,114**	**70%**
Years	**11**	**11**	---
Averages	**159,902**	**111,374**	**70%**

As shown in Figure 19 (from CHERT 2009), during the 1997-2007 cross section monitoring period, the largest floods occurred in Water Year 1997 (Jan., 1997) and 2006 (Dec., 2005) in the South Fork and Lower Eel rivers. In the Van Duzen, the 2003 (Dec., 2002) flood was slightly larger than that in Water Year 2006. Although smaller than record historical floods, these events were quite capable of transporting large volumes of gravel.

Figure 19. Annual maximum peak discharges, Eel River Basin, 1996-2008.



An understanding of the channel aggradation and degradation trends is one of the most critical elements used in assessing baseline conditions in the context of gravel extraction. The cross section analysis recently completed by CHERT (2009) provides another tool for examining aggradation/degradation. The following information was excerpted or summarized from CHERT (2009):

Table 6-4 has reach-averaged thalweg, mean bed, and scour/fill results for the 1997-2007 period. Lower Eel River thalweg elevations decreased while mean bed elevations increased, possibly indicating improved low flow channel confinement. Net scour/fill was positive, consistent with mean bed elevation increase. On the other three reaches, both thalweg and mean bed elevations decreased and net scour/fill was negative, indicating that the three upstream reaches are likely in a degradational phase.

Table 6-4. Reach-averaged thalweg and mean channel bed elevation changes and net scour/fill for the Lower Eel River, 1997-2007.

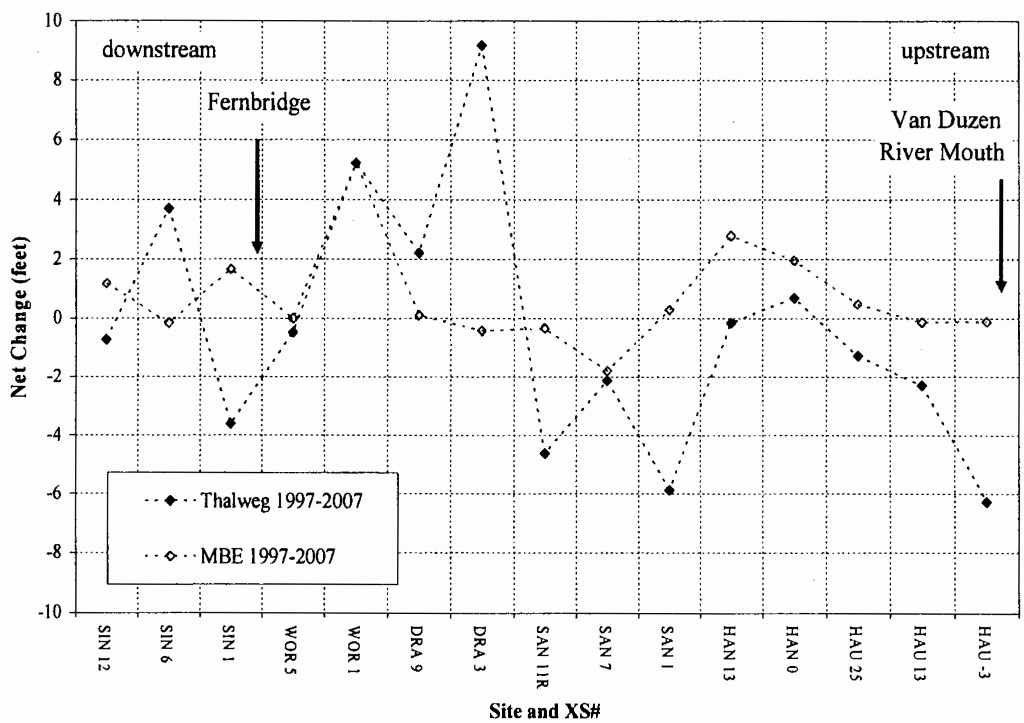
	Thalweg Elev. Change (ft.)	Mean Bed Elev. Change (ft.)	Net Scour/Fill (sq. ft.)
Lower Eel River	-0.44	0.71	418

Figures 2 and 3 in CHERT (2009) show incremental and net changes in thalweg and mean bed elevations, respectively. Thalweg elevations generally decreased between 1997 and 2007 in the upstream portion from Hauck Bar to Sandy Prairie, with little net change at the Hansen site in between. Over the same period, mean bed elevations experienced a modest increase, suggesting bar growth coincident with channel deepening, a process that indicates improved fish habitat conditions. In the downstream portion, thalweg elevations increased at most XS along with increases in mean bed elevations, suggesting this sub-reach experienced bed aggradation affecting the full channel width over the decade beginning in 1997. We note that the left (south) bank immediately upstream of Fernbridge has experienced heavy erosion, approaching hundreds of feet laterally, since the 1990s.

Figure 4 in CHERT (2009) depicts channel scour and fill, and shows mixed results along the Lower Eel River, with alternating scour and fill through the eight mile reach. Little net scour or fill occurred at the upstream end (Hauck Bar), with the highest fill at the Hansen Bar, the highest scour at Sandy Prairie, with small change at the Drake and upper Worswick Bars, and net fill on either side of Fernbridge (lower Worswick and lower Singley Bars). Although there were too few XS used to allow reliable computation of reach-wide gravel volume changes, reach-averaged mean bed elevations rose by about 0.7 feet. Reach-averaged thalweg elevations decreased by about 0.4 feet over the same period.

Figure 5 (shown below, from CHERT 2009) plots thalweg and mean bed elevation changes from 1997 to 2007 as longitudinal lines. Changes in either of these variables can be due to gravel volume gains or losses, or simply due to movement of channel features such as bars and pools.

Figure 5. Lower Eel River Thalweg and Mean Bed Elevation Net Change, 1997-2007



6.1.2 Salmonid Habitat

The Lower Eel River is utilized primarily as a migratory corridor for adult salmonids migrating upstream in the fall and winter, and downstream migrations of juveniles/smolts, which peak in April (steelhead) and May (coho and Chinook). However, limited numbers of juvenile steelhead have been observed rearing during the summer and fall months in this reach (Dennis Halligan, Stillwater Sciences, personal communication, 2008).

Stream temperature directly governs almost every aspect of the survival of Pacific salmonids (Berman 1998) including metabolism, food requirements, growth rates, timing of adult migration upstream, timing of juvenile migration downstream, sensitivity to disease, and direct lethal effects (Spence et al. 1996). The most sensitive period in the Lower Eel River is the summer, when stream temperatures are hottest and young salmonids would be rearing before migrating to the ocean. EPA (2007) summarized stream temperature data for the Lower Eel River using the maximum value of the 7-day running average (max7daat) of all recorded summer temperatures. EPA (2007) summarized the condition of streams for steelhead summer rearing based on the max7daat and compiled literature reviews. In addition, changes to shade and flow were examined as well as their modeled effects to stream temperatures. EPA (2007) reported that most stream monitoring locations along the main channel have summer stream temperatures categorized as stressful, which is a fairly wide range (19-24°C). Tributaries examined exhibited much wider variability. Larabee Creek had max7daats in the marginal to stressful ranges, while tributaries to Larabee Creek are generally in the good to fair categories. Other tributaries draining directly to the Lower Eel River have max7daats in the fair to marginal categories. The creeks draining to the Salt River show the most variability among tributary subbasins, with max7daats ranging from 14.5-18°C (good to marginal). EPA also funded airborn Thermal Infrared Remote Sensing (TIR) and gathered one-time (August 12, 2005) surface water temperatures over the entire length of the main channel. From the South Fork (river mile 40) to the estuary, most of the main channel is 23-24°C, which is just below the lethal category. There are pockets of warmer and cooler temperatures throughout the main channel. The Lower Eel River TMDL concluded that "while current summer temperatures may be slightly higher than historical temperatures, even the historical temperatures were so warm (in the lethal range for salmonids) that returning to historical conditions would not improve conditions for salmonids." In addition, shade modeling on the main channel of the Lower Eel River indicated that "changes in riparian vegetation do not result in significant changes in shade, which would suggest that current temperatures are only incrementally warmer than historic temperatures, and in only a small number of stream segments." Thus, EPA concluded that a temperature TMDL is not needed for the main channel of the Lower Eel River. However, the EPA concluded that tributary streams do not meet water quality standards for temperature and established temperature TMDLs to achieve those standards. The EPA (2007) also concluded that neither shade nor flow alterations are altering natural stream temperatures in the range that adversely affects beneficial uses in the main channel.

Instream habitat for Pacific salmonids adjacent to extraction sites has been recently characterized by Jenson (2000) and Stillwater Sciences (2008). In 1999, a total of 34,000 feet of the mainstem Eel River and 12,700 feet of side channel between the mouth of the Van Duzen River and Fernbridge were habitat mapped (Jensen 2000). Flatwaters, riffles, and pools comprised 50%, 28%, and 22% of the stream length, respectively. Pool structural complexity was in the form of boulders, willows, and riprap. Mean and maximum pool depths averaged 5.3 and 20 feet, respectively. Substrate embeddedness ranged from 70-80% and appeared unsuitable for spawning.

The 2007 survey of the Lower Eel River totaled 29,071 ft in length, and the 2007 report (Stillwater Sciences 2008) assessed changes between 2005, 2006 and 2007 survey data. The combined pool:riffle:flatwater percentages for the Eureka Ready Mix (ERM), Mercer-Fraser (M-F), Drake, and Worswick reaches were 16:8:76. The percentage of the survey reach consisting of pool habitat appeared to decrease between 2006 and 2007. However, the 2007 pool lengths were roughly the same as in 2005. The amount of riffle habitat was relatively consistent from 2005 to 2007. Flatwater percentages appeared to be inversely related to pool percentages.

Table 6-5. Lower Eel River pool:riffle:flatwater lengths and percentages for 2005-2007, from the mouth of the Van Duzen River to Fernbridge.

Operator/Bar	Pools (ft)			Riffles (ft)			Flatwaters (ft)		
	2005	2006	2007	2005	2006	2007	2005	2006	2007
ERM/Hauck	1,180	2,307	655	290	1,008	1,013	1,595	1,365	4,098
M-F/Sandy Prairie	2,195	4,877	4,004	995	1,045	1,246	6,380	5,994	6,772
Shamrock/Drake	840	2,310	0	0	209	0	3,330	1,375	4,157
Humboldt Co./Worswick	0	0	0	105	176	0	8,255	5,565	7,126
Total	**4,215**	**9,494**	**4,659**	**1,390**	**2,438**	**2,259**	**19,560**	**14,299**	**22,153**
P:R:F %	17	36	16	5	9	8	78	55	76

Note: There was no requirement to collect pool:riffle:flatwater length data in 2004.

The 2007 residual pool depths throughout the survey reach ranged from 4.3 to 11.4 ft and were on average about 0.6 ft shallower than in 2006. However, 2007 residual pool depths were deeper than those in 2004 and 2005. The number of pools within the survey reach decreased from eight in 2004 to four in 2007. Some of this pool loss may be attributed to sediment deposition and channel migration. For example, the loss of the Drake pool could be the result of deposition of bedload carried by the large secondary channel that is present on the west side of Sandy Prairie Island. In addition, one of the Sandy Prairie pools became an alcove when the upstream bar developed, which pushed the thalweg to the west.

The 2007 adult-holding, spawning, Age 2+ steelhead, and alcove habitat areas within the extraction reaches covered 473,351 $ft.^2$, 0 ft^2, 81,903 $ft.^2$, and 91,417 $ft.^2$, respectively (See Appendix B of the 2007 Monitoring Report for delineated aerial photographs). Between 2005 and 2007, there appeared to be a decrease in adult-holding habitat. The decrease in adult-holding habitat could be attributed to the loss of pools in the Sandy Prairie and Drake reaches. In addition, even though the new Drake flatwater was greater than 3 ft deep, the low-water velocity (<0.5 fps) precluded it from being called adult-holding habitat. The lack of spawning habitat indicated that the Lower Eel River is not used by salmonids for spawning. Even if spawning were to occur, the large amount of high flow bedload movement through the reach would result very low to non-existent redd survival. The Age 2+ steelhead habitat area was fairly consistent with what was recorded in 2006 and much greater than what was present in 2005. Alcove habitat area showed relative consistency between 2005 and 2006, but was reduced during 2007. The loss of alcove habitat area during 2007 was caused by the downstream growth of the Worswick Bar, which pushed the alcove entrance below Fernbridge and outside of the survey reach. No juvenile coho habitat was observed.

There may be errors associated with the habitat mapping effort caused by the different discharges between the dates when aerial photographs were flown and when the mapping was conducted. For example, the 2005, 2006, and 2007 aerial photographs were taken when the river discharges at Scotia were 1,640, 1,090, and 1,870 cfs, respectively. Discharges for the 2005, 2006, and 2007 mapping efforts were 204 cfs, 113 cfs, and 74 cfs, respectively. This resulted in estimating edges of habitat polygons in relation to morphological features that were submerged on the aerial photographs.

Table 6-6. Lower Eel River pool depths for 2004-2007, from the mouth of the Van Duzen River to Fernbridge.

Operator/Bar	Maximum Depth (ft)				Riffle Crest Depth (ft)				Residual Pool Depth (ft)			
	2004	2005	2006	2007	2004	2005	2006	2007	2004	2005	2006	2007
ERM/Hauck	7.7	6.5	7.4	7.5	0.9	1.3	0.7	1.1	6.8	5.2	6.7	6.4
	2.1	3	5.2	-	0.4	0.8	0.8	-	1.7	2.2	4.4	-
M-F/Sandy Prairie	12.6	9	12.4	11.6	0.5	1.4	0.7	0.9	12.1	7.6	11.7	10.7
	4.3	3.5	-	4.7	0.3	0.8	-	0.4	4	2.7	-	4.3
	8.6	11.5	-	-	0.6	1	-	-	8	10.5	-	-
	10.4	-	12.1	13.4	0.5	-	0.6	2	9.9	-	11.5	11.4
Shamrock/Drake	15.5	6.8	10.3	-	1.1	1.2	0.6	-	14.4	5.6	9.7	-
Humboldt Co./Worswick	6.2	-	-	-	0.4	-	-	-	5.8	-	-	-
Average Depth	**8.4**	**6.7**	**9.5**	**9.3**	**0.6**	**1.1**	**0.7**	**1.1**	**7.8**	**5.6**	**8.8**	**8.2**

Notes: "-" indicates pools were not present even though the entire reach was surveyed. Pools do not necessarily occur in the same number or place every year. Therefore, the data can only be used for general comparative purposes and not to compare the depth of an individual pool through the years.

Table 6-7. Lower Eel River mapped habitat unit areas for 2005-2007, from the mouth of the Van Duzen River to Fernbridge.

Operator/Bar	Adult Holding (ft²)			Spawning (ft²)			2+ Steelhead (ft²)			Alcove (ft²)		
	2005	2006	2007	2005	2006	2007	2005	2006	2007	2005	2006	2007
ERM/Hauck	65,106	128,971	39,521	8,464	0	0	21,206	21,787	29,049	0	28,107	13,883
M-F/Sandy Prairie	331,762	1,076,295	433,830	0	0	0	0	72,448	52,854	44,578	23,292	77,534
Shamrock/Drake	100,080	375,000	0	0	0	0	0	0	0	45,600	0	0
Humboldt Co./Worswick	15,120	0	0	0	0	0	0	0	0	94,770	126,787	0
Total	**512,068**	**1,580,266**	**473,351**	**8,464**	**0**	**0**	**21,206**	**94,235**	**81,903**	**184,948**	**178,186**	**91,417**

The Eel River estuary provides habitat for salmonids and tidewater goby and is a nursery area for Dungeness crab and other marine invertebrates. Juveniles may utilize the estuary through much of the year: juvenile Chinook salmon and steelhead have been observed in fall, winter and spring months (Humboldt County 1992). The estuary has decreased in areal extent and volume substantially since 1880 due to the diking off of several thousand acres of salt marsh habitat within the tidal prism, and to massive amounts of sediment that have moved into the Lower Eel River since the 1955 and 1964 floods.

A current assessment of riparian vegetation on the Lower Eel River is in progress but was not available for this assessment. Reynolds et al. (1981 *in* Downie et al. 2007) reported that riparian vegetation has been reduced throughout the Lower Eel River Basin due to clearing for agriculture.

6.1.3 Riparian Vegetation

McBain and Trush (2009) mapped approximately 2,090 acres of channelbed and associated riparian vegetation on the Eel River and approximately 723 acres on the Van Duzen River. The objectives of the study were to: (1) classify the vegetated and unvegetated areas within the active riparian corridor of the lower Van Duzen and Eel rivers into five broad categories based on the plant and substrate composition and height above the late summer baseflow similar to the classification developed for the Mad River, (2) use the classification to map the active riparian corridor in three different years since the beginning of CHERT oversight, and (3) present the changes in acreage of mapped riparian categories between the three different years. The results were to assist CHERT in evaluating whether gravel mining has changed the amount of woody riparian vegetation and/or interfered with depositional processes. The following results were reported (McBain and Trush 2009):

> "Overall, Open Channelbed increased and Active Channelbed decreased on both rivers from 1995 to 2008 (Figures 6 and 7, Table 3). However, the combined percentage of Open and Active Channelbeds remained approximately the same on the Eel and Van Duzen rivers from 1995 to 2008 (Figures 6 and 7), suggesting that the increase in Open Channelbed was directly related to the decrease in Active Channelbed (e.g., the "lost" Active Channelbed was scoured to become Open Channelbed). The high flows during the January 1, 1997, storm probably re-worked the Active Channel surfaces and converted them to Open Channelbed. Further decreases in Active Channelbed may have been caused by gravel extraction through the conversion (i.e., lowering) of these features into Open Channelbed. However, the specific effects of gravel extraction versus natural channelbed processes cannot be easily distinguished using the five mapping categories. Using a separate channelbed category for gravel mining might help address questions in changes due to mining activities.
>
> The combined percentages of Floodplain, Woodland, and Terrace remained approximately the same for both the Eel and Van Duzen rivers from 1995 to 2008 (Figures 6 and 7, Table 3). However, the patterns were less straightforward for these riparian categories than Open and Active Channelbeds. For instance, Floodplain decreased on the Eel River (Figure 6) but there was no net change on the Van Duzen River (Figure 7) between 1995 and 2008 (Table 3). Woodland increased on the Eel River (Figure 6) but slightly decreased overall on the Van Duzen River (Figure 7) between 1995 and 2008 (Table 3). Terrace increased on the Eel River (Figure 6) but there was no net change on the Van Duzen River (Figure 7) between 1995 and 2008 (Table 3).
>
> The relative stability between the combined percent acreages of the open riparian categories (e.g., Open Channelbed and Active Channelbed) and the vegetated riparian categories (e.g., Floodplain, Woodland, and Terrace) suggests that gravel extraction and other potential influencing factors within the study area have not had a detectable effect on overall woody riparian vegetation acreage during the study period (Figures 6 and 7). The size of the study area, however, may mask local changes in riparian vegetation cover attributable to gravel extraction and other factors. For instance, gravel was extracted from 20.9 acres in the Lower Eel River study area in 2004 (CHERT 2006), which is 1% of the total mapped area. Total extraction area on the Lower Eel River in 2004 was two orders of magnitude smaller than the study area (20.9 acres extracted compared to 2,090 acres mapped). Any changes in riparian vegetation acreage due to gravel extraction are likely to be undetectable over such a large study area. Future efforts may need to focus on specific localized reaches of river where gravel extraction is occurring or be conducted at a scale to match the scale of gravel extraction (e.g., study area is 209 acres if extraction area is 20.9 acres) to estimate the effects of extraction more accurately.

Some areas that were initially mapped as Floodplain in 1995 evolved into Terrace over the 13 year study period from 1995-2008 (Figure 8a-e). There are four large areas of Floodplain with smaller patches of Woodland located to the southwest of the main channel in the 1995 photo (Figure 8a, the areas shaded mauve and pink slightly above the center of the photo). By 2000, the acreage of Floodplain was reduced substantially, with a corresponding increase in Woodland. Some portions of 1995 Woodland converted into Terrace. By 2008, almost all Floodplain had evolved into Woodland, and a considerable acreage of Woodland had evolved into Terrace."

6.1.4 Eel River Estuary

The estuary subbasin of the Lower Eel River Basin includes approximately 7 miles of the mainstem from the mouth of the Eel River to Fernbridge, and about 40 miles of tidally driven sloughs (Downie et al. 2007). Agricultural lands now dominate what was once forested riparian and wetland habitat. Tideland reclamation and the construction of dikes and levees for agricultural purposes have changed the natural function of the Eel River estuary. In 1870, the Eel River estuary was estimated to be 6,525 acres (USDA 1989) and is now 40% of this size. The reduction in estuarine size has been due to tideland reclamation including installation of tide gates, levees and berms. Slough and creek channels that once meandered throughout the delta are now confined by levees, sufficiently slowing flow to a point the many have become filled with sediment. Remnant channels are visible throughout the delta. Flow has been altered throughout the estuary due to levees and tidegates and excessive sedimentation within the Eel River Basin has resulted in loss of rearing and feeding habitat for salmonids. It is generally accepted that the estuary and tidal prism has been reduced by over half of its original size. However, the estuary still provides critical rearing habitat.

The most comprehensive studies of the estuary were year-long investigations conducted in 1951, 1977 and 1995 (Downie et al. 2007). These studies indicate presence of juvenile Chinook salmon from March through November, coho salmon from spring through summer and year-round presence of steelhead. Adult Chinook and steelhead hold in the estuary until sufficient flows allow upstream migration in the fall. Tidewater goby have been collected by the USFWS in an unnamed slough of the estuary near Cannibal Island in August 2004.

Historical accounts of the recreational fishery in the Eel River estuary describe excellent conditions for salmon and steelhead fishing over the entire delta (Downie et al. 2007). The commercial salmon fishery was eliminated in 1926 and the recreational fishery has been significantly reduced and is now catch and release.

6.1.5 Species Status in the Project Area

As described above, the Lower Eel River Basin provides habitat for SONCC coho salmon, CC Chinook salmon and NC steelhead and other non listed fish species. Coho salmon have been documented in 13 tributaries across the Lower Eel River Basin (including the Lower Van Duzen River) and Chinook salmon in six tributaries. Steelhead have been documented in 21 tributaries. These species utilize the mainstem Lower Eel River and estuary as critical migration routes and may use the estuary for rearing habitat (Downie et al. 2007).

Limiting factors in the Lower Eel River Basin for salmonids are summarized from Downie et al. (2007) and include the following:

- Loss of estuary habitat and alteration of flow throughout the estuary due to tidegates and levees.
- Low summer flows.
- High levels of fine sediment in streams including high turbidity during winter rains, which correspond to spawning seasons.
- Excessive sedimentation and deposition results in an overall loss of rearing and feeding habitat for salmonids.
- Water temperatures are unsuitable in the mainstem for salmonids during summer months.
- Quality pools are lacking.
- Areas of suitable spawning habitat are limited.
- Decreased channel capacity.
- Competition with Sacramento pikeminnow.

The first adult salmonids begin to enter the estuary in late August and September and the Lower Eel River (up to the large pool adjacent to and downstream of Fernbridge) around mid-September (Jensen 2000; Halligan 1997, 1998). Prior to that salmon and steelhead hold in the Eel River estuary until the first rains of the season. Upon entering habitat near proposed extraction areas, Chinook and steelhead appear to hold primarily in the Boxcars pool (between the Drake and Mercer-Fraser processing plant) and 12^th^ Street hole (adjacent to the Riverwalk Conference Center) while waiting for enough runoff to initiate further upstream migration. A secondary holding location is the lateral scour pool along the Hansen bar. Both of these locations have water depths ranging from 6-15 feet deep. However, entry to the Hansen pool appears to be dependent on the depth of water at the riffle at the upstream end of the Sandy Prairie bar. In some years this riffle is too shallow to allow passage except for perhaps half-pounder sized fish (Halligan, personal communication, March 2002).

Based on information contained in Halligan (1997, 1998) and Jensen (2000) adult migration timing appears to be slightly different from year to year, although this may be an artifact of survey intervals and runoff regimes. In 1996, very few fish entered the extraction areas until mid-October. By the end of October, 1996 over 1,500 Chinook salmon and only a few steelhead were observed holding at the Boxcars and 12^th^ Street hole and boxcars. Very few fish were observed upstream of those locations. In 1997, nothing but steelhead were observed until the end of October when Chinook appeared. In 1999, Halligan observed approximately 40 times more steelhead than Chinook during his fisheries surveys.

The historical estimate of steelhead in the entire Eel River Basin is 82,000 adults (NMFS 2005). Adult steelhead data is sparse, but steelhead populations were known to be at least 4,000 in the 1930s-1950s (EPA 2007). Busby *et al.* (1996) reported on estimates of NC steelhead abundance prior to 1960 from dam counts in the upper Eel River (Cape Horn Dam annual average of 4,400 adult steelhead in the 1930s), the South Fork Eel River (Benbow Dam annual average of 19,000 adult steelhead in the 1940s), and the Mad River (Sweasey Dam annual average of 3,800 adult steelhead in the 1940s). Busby *et al.* (1996) reported that the only current run-size estimates for this ESU are counts at Cape Horn Dam on the Eel River where an average of 115 total and 30 wild adults were reported.

The distribution of juvenile steelhead is of interest for this BA and is influenced greatly during the gravel extraction season by summer water temperatures. In the Lower Eel River, juvenile steelhead are widely distributed in tributaries but not the main channel (EPA 2007). However, a small number of juvenile steelhead have been observed rearing at isolated location in the Lower Eel River (Dennis Halligan, Stillwater Sciences, personal communication, 2009). NMFS (2007) summarized the conservation value of the Ferndale and Scotia HSAs as medium and the Larabee Creek HSA as high. A Recovery Priority Number of 5 was assigned to the NC steelhead DPS "based on a moderate degree of threat, a high recovery potential, and anticipated conflict with development projects or other economic activity" (NMFS 2007). Concerns included a lack of data, particularly for winter run, and abundance and productivity.

Summer steelhead have been observed in the Lower Eel River during surveys conducted under LOP 96-1 (Table 6-8). The primary holding area is the lateral scour pool along the Hansen Bar. This pool has the overhead cover, depth, and flow (at least at the head of pool) steelhead prefer. Summer steelhead have also been commonly observed holding in the pool and flatwater units off the mouth of the Van Duzen River (Dennis Halligan, Stillwater Sciences, personal communication 2009). It is possible the summer steelhead holding here are late-running Van Duzen River fish. They are unable to enter the Van Duzen due to the intermittent flow characteristics in the lower reach.

Table 6-8. Summary of Eel River summer steelhead survey results, 1996-2001.

Year	Naturally Spawned	Hatchery	Half-pounders
1996	0	0	0
1997	11	7	0
1998	1	0	4
1999	8	0	0
2000	18	0	33
2001	20	0	36

Adult coho salmon could potentially migrate into the project area from the ocean when heavy rains commence and increase instream flows, typically from October through February, with peak migration during mid-November to mid-December. Coho salmon typically select smaller coastal streams for spawning relative to Chinook salmon. Preferred spawning habitat may include lower gradient reaches, with dense riparian corridors, narrow and shallow channels with overhanging banks, small substrates and an abundance of large woody debris. Egg incubation periods are dependent on water temperature but fry typically emerge from February to late June. Juveniles may spend a year rearing in freshwater and estuaries before emigrating to the ocean. Juveniles would be expected to emigrate from May through mid-July. Habitat in the project area is not suitable for spawning or rearing coho salmon, but provides migration habitat during high flow periods.

Historically, the entire Eel River basin was thought to have had around 14,000 adult coho salmon (NMFS 2005). Among coastal California rivers, the Eel River basin has the highest amount of habitat for coho salmon, but ranks second in production (Hassler 1992). Most of the coho salmon production in the Eel River basin is in the South Fork Eel River (EPA 2007). CDFG surveys documented the presence of coho salmon in Carson Creek (tributary to Larabee Creek), Chadd Creek, and Bear Creek. Coho salmon utilize the Lower Eel River as a migration route to spawning and rearing tributaries in Outlet Creek and the South Fork Eel River, among other areas. Coho were observed in Francis Creek (tributary to Salt River) in 2006.

Historically, the Eel River basin had much greater abundance of Chinook salmon than nearby watersheds (NMFS 2005). Specifically, in 1965, 55,000 Chinook salmon were estimated to be in the Eel River, based on habitat conditions and professional opinion. The estimate of 55,000 adults in 1965 declined to 17,000 adults in 1987 (NMFS 2005). NMFS (2005) estimated that seventy-seven out of 417 total stream miles (or 18%) are estimated to be currently used by Chinook salmon. Chinook salmon are reported in Howe, Strongs, Chadd, Bear, and Monument Creeks, which drain directly into the Lower Eel River as well as Larabee Creek (up to Smith Creek), Carson, and Newman creeks (Hart Crowser 2005).

Despite habitat loss, tidewater gobies have been reported from an unnamed slough in the Eel River estuary (Greg Goldsmith, USFWS, personal communication, 2005). No intensive systematic surveys have been conducted in the Eel River estuary and sloughs. The recent recovery of tidewater gobies during a limited sampling effort may indicate that other elevated brackish water sloughs also provide suitable habitat for the tidewater goby, and that distribution is more widespread in the Eel River estuary than previously reported. Tidewater goby do not occur in the action area (Lower Eel River mainstem), but may occur downstream of Fernbridge in estuary/slough habitat.

6.2 Van Duzen River

The Van Duzen River is the most northern tributary to the Eel River in California's North Coast Range, and enters the Eel River south of Fortuna, California. The watershed drains an area of 429 square miles: 366 square miles are in Humboldt County and 63 square miles are in Trinity County. Elevations range from 5,906 ft. at its headwaters at Red Lassic Peak to 62 ft. at its confluence with the Eel River. The Van Duzen River is 73.5 miles long ,has no major dams, thus is one of the few remaining free flowing rivers in California. Its headwaters drop quickly from higher elevations through moderately sloping grasslands in the upper and middle portions of the basin to low gradient reaches near Bridgeville, and then through alluvial reaches bordered by redwood forests in the lower basin. Bank erosion and sliding are common characteristics of the Van Duzen River. Major tributaries to the Van Duzen include South Fork Little Van Duzen, Cummings Creek, Hely Creek, Grizzly Creek, Stevens Creek, Root Creek, Yager Creek and Fish Creek. State Highway 36 parallels the mainstem from Carlotta to Bridgeville. Based on data from 1950-2000, mean daily streamflow at the Van Duzen River near Bridgeville gage ranges from 4.4 to 33,900 cfs, with an average value of 872 cfs (Steppen 2001). The largest event recorded in this time period was 48,000 cfs on December 22, 1964, and the lowest annual peak on record was 2,140 cfs during the 1977 water year.

The Van Duzen River flows over Yager and Franciscan formations in the upper portion of the watershed. Gradients are greater and the river is more confined in these upper reaches. Where the Van Duzen flows over the Wildcat group, sand and cobble are dominant substrate with gravel sub-dominant. The lower mainstem Van Duzen consists of low gradient alluvial reaches, with meandering pool/riffle morphology. High magnitude aggradation has occurred in these reaches in response to high sediment loads. LWD plays a minor role in channel morphology, however LWD jams that have been abandoned by the river play a role in formation and maintenance of mid channel and other bar deposits, although effects may be transient (Benda et al. 2001). The channel migration zone is large in some areas and identifiable through meander and flooding patterns in historical aerial photos and field surveys. The mainstem, low gradient reaches have high potential for sediment storage and bed elevation changes (aggradation and degradation), high sinuosity with large point and mid-channel bar deposits. High bank erosion along the edges of meander bends, and act as transport reaches for LWD with little opportunity to create semi-persistent channel-spanning log jams that would impede fluvial transport of wood. Below Goat Rock, a reach is impinged by the toe of a Franciscan-Melange earthflow complex, and large boulders have been transported downhill and have been exhumed by the river, creating large boulder deposits that dominate channel morphology.

In addition, an extremely large unstable feature emanating from Goat Rock, directly feeds large volumes of colluvium to the system from the left bank. The hillslope processes associated with this unstable feature are very dynamic, combining a large translational/rotational feature with rock avalanches, debris slides, and rock falls directly from the Goat Rock formation commonly termed a "floater" comprised of more resilient geologic parent material than that of the surrounding Franciscan Melange (Benda et al. 2001).

During the course of field work for various land management activities and throughout the Van Duzen River Basin during a period dating from 1994 to 2001 numerous large mass wasting features have been encountered (Keith Hess, DWR Consulting, personal communication, 2002). Many of these features/events corresponded with storms of 1996 and 1997. The numerous instabilities observed were primarily within the reach above the confluence of Cuddeback Creek however, several large translational/rotational slides and debris torrents directly enter the Van Duzen during winter months. An example is the large translational/rotational slide within the Leland Rock project reach that contributed large volumes of bedload and suspended sediment over the last five years.

The focus of this section is the lower basin of the Van Duzen River, an area encompassing approximately 129 square miles including the lower Van Duzen River from the confluence with the Eel River to the confluence with Grizzley Creek as well as lower Yager Creek, including Lawrence Creek. Geology in the lower basin is dominated by relatively stable sandstone, interspersed with pockets of potentially unstable sandstone along steep streamsides and with stable mélange in the lower floodplains. Streams in the lower basin are naturally more capable of supporting anadromous fish than the rest of the basin because of lower gradients and aquatic habitat conditions that are more suitable for salmonids (EPA 1999).

6.2.1 Channel Conditions

The Van Duzen's sediment transport mechanisms encompass a range of channel types including depositional reaches (alluvial, low gradient, low confinement, meandering), transport reaches (weakly or non-alluvial, steeper gradient, more confined, coarse sediment), and source reaches (step headwater areas).

The extraction sites are located in the lower river, which is characterized as braided or meandering trunk streams in lower floodplains, with low to moderate gradient tributaries available for fish spawning, and smaller steep gradient headwater transport reaches. The Van Duzen River basin is in the process of broad scale erosional and depositional fluvial adjustment. Cross sectional surveys done at two locations in 1968 and 1998 in the lower river indicated net aggradation of 1.7 feet and 2.7 feet. Channel switching and width changes are common geomorphic characteristics in the lower Van Duzen, and have been cyclical in occurrence. Channel width variability was summarized by the ACOE (1999) based on historical aerial photos from 1941, 1954, 1966, 1981, 1994 and 1995 in an area that encompasses most of the 1.7 mile reach at the Leland Rock site. The ACOE (1999) reported that "measurements across the active channels confirmed that width changes on this reach of the river are cyclical in nature and, like erosion and replenishment cycles, are common geomorphic characteristics, which tend to repeat in time." Also, it was determined that unlike erosion of the steeper left banks, the relatively flat areas to the right do experience longer periods of deposition and replenishment during which time riparian vegetation is permitted to grow undisturbed in a natural ongoing process (ACOE 1999).

An aerial photo series extending beyond the confluence of Yager Creek shows occasional small and large scale agricultural conversion and loss of riparian vegetation. Loss of riparian vegetation and conversion to agricultural lands has increased the potential for bank scour. The aerial photo sequence depicts the riparian corridor has been relatively consistent as far as the overall habitat in acreage with although fragmentation differs in spatial distribution. Baseline conditions, preceding settlement are somewhat unclear as far as species distribution and extent along the alluvial floodplain. A certain amount of supposition could easily ascertain the succesional development of shrub to hardwood species present. However, the extent and distribution of the coniferous component is unknown and journal entries from early explorers have conflicting descriptions.

Kelsey (1977) reports that the channel widths in the Lower Van Duzen have increased from 13% to 643% between 1872 and 1974, and he attributed much of this widening to long term, gradual changes between 1872 and 1964. Greater sediment production without proportionally greater peak streamflow resulted in aggradation of stream channels in the downstream portion of the basin, which in turn resulted in greater flood inundation hazard and broadening of the active fluvial channels due to greater lateral erosion of alluvial streambanks (ACOE 1980).

The ACOE (1999) described the meandering pattern of the Van Duzen River delta area near the confluence with the Eel River as "here too, this whole sector looked like a network of interconnected channels where, through time, flowing water has left an enduring mark." Mitch Swanson, a consulting hydrologist-geomorphologist, noted that the constriction imposed by the Van Duzen bridges (HWY 101 bridges) results in deposition above and below the bridges (control points) and scour at the bridges, and he described the properties of flows leaving the area constricted by the bridge as similar to turning on a unmanned fire hose. Morphology of the delta is further complicated by flow regimes within the Eel River, which also affect the delta area. Jager (1995) reported "basic to the situation is the channel constriction caused by the three bridges at this location. The bank erosion at the base of the north railroad fill is creating an immediate threat to the railroad. This bridge constriction has contributed significantly to the flooding, channel aggradation and bank erosion we continue to see along the Lower Van Duzen River valley upstream of the bridges. The historical left-bank (Dwelley property) erosion downstream of the bridges is primarily due to the nozzle-like constriction in the channel. While channel widening appears to be episodic in nature and primarily related to episodic high water events, it appears to be more pervasive within some reaches (e.g. the starvation flat area)."

In addition to channel widening that was observed in historical aerial photos (1941, 1948, 1954, 1963, 1966, 1974, 1981, 1988, 1992,1995) channel braiding can be observed throughout the lower reaches. These braided reaches appear more prevalent throughout the Van Duzen River Ranch reach below the confluence of Yager Creek as well as above and below the Hwy 101 bridges and railroad bridge near the Van Duzen River delta.

The following information was excerpted or summarized from the *Draft Supplemental Environmental Impact Report to the 1992 Program Environmental Impact Report on Gravel Removal from the Lower Eel River* (Jager 1996).

> The Van Duzen River Ranch contains approximately 900 acres and three miles of the Van Duzen and Yager Creek flow through the ranch. Following the 1955 and more recent floods the Van Duzen and Yager Creek became highly aggraded (Kelsey 1977; Kelsey 1980; DWR 1975). This aggradation, which continues today (Humboldt County 1992) has adversely impacted the distribution of riparian vegetation, increased channel width and reduced channel depth, limited fish passage and spawning, reduced channel capacity, increased bank erosion, and increased the threat of flooding on the ranch and neighboring property. Gravel extraction is planned to reduce the adverse effects of aggradation.

> The riverine portion of the ranch contains 210 acres, within which are 100 acres of exposed gravel bars. The remaining 110 acres of riparian area is occupied by grass, brush and trees. About 2 miles upstream of the project area (river mile 7.0) the Van Duzen leaves the confinement of a relatively narrow canyon and spreads out onto an alluvial depositional area, and downstream at river mile 3.2 the channel narrows again. Backwater from this constriction contributes to deposition, as does backwater from the entrance to Yager Creek at river mile 5.0. Thus, between river mile 3.2 and 7.0 there is a major depositional area we call the Van Duzen River Ranch land form. The project area is located on this alluvial deposition. Much of the river bed is rather course, containing a large proportion of exposed gravel and cobbles. The channel is very wide, shallow and unstable during the winter and the risk of avulsion is high in this reach. During the summer, much of the flow is subsurface because of the aggraded channel.

The Van Duzen River is well recognized as having marked channel aggradation. Much of this aggradation dates to the December 1964 flood, with additional recruitment over subsequent years (Resource Design Technology, Inc., 1999). Kelsey (1980) estimated that within the 22 miles of the lower watershed (excluding the South Fork Van Duzen River), over 5.3 million cubic yards (7,190,000 metric tons) had aggraded by 1975, as compared to the conditions of the river in 1975. Tetra Tech, Inc. (1997) notes this aggradation resulted in a thalweg 12 feet higher than the pre-1964 condition at Pepperwood Falls, and an additional 9.5 feet above the previous condition near Bridgeville. The ACOE completed a comparative analyses of historical cross sections surveyed within the Leland Rock site (identified as VD-2 and VD-4) and reported that the data, which was obtained from surveys done in 1968 and in 1998, shows that there are no unusual geomorphic changes present at the riverbed and flood plain as it appears that the sections have experienced equal shares of both sediment gain and loss. Overall, both cross-sections displayed net aggradation of 1.7 feet (VD-2) and 2.7 feet (VD-4) respectively (ACOE 1999). Extraction volumes during this period of time (1993-1996) were significantly less than the figures addressed within the PEIR which was partially a function of demand but also due to the fact that the CEQA document had addressed future foreseeable projects that had not yet acquired permit approvals. Given the well-documented aggraded nature of these reaches, extraction rates and activities proceeded without CHERT involvement up until 1996.

The Eel River PEIR (Humboldt County 1992) estimated historical extraction volumes and analyzed them relative to replenishment rates calculated by Kelsey 1977. Historical volumes varied widely as a function of demand, however, no marked degradation within the system could be discerned even when extraction rates were (estimated to be) in excess of replenishment rates.

Since the Eel River PEIR (Humboldt County 1992) several estimates for bedload replenishment have been generated for purpose of analyzing allowable levels of extraction. The Eel River PEIR (Humboldt County 1992) generated figures based upon data collected within Kelsey's (1980) thesis. The figures generated were calculated using the assumption that bedload represented 15% of the suspended load. This assumption is on the high end of values used by Collins and Dunn (1990) – they reported that bedload generally accounts for 8–16 percent of suspended load in mountainous basins. The calculated bedload passing Bridgeville on the Van Duzen River equaled 123,800 cubic yards. The location at Bridgeville for which the calculation was generated only represents approximately half (222 mi^2) of the total watershed area (429 mi^2). Kelsey (1977) reported that during the 35-year period, from 1941 to 1975, an estimated 50,310,000 tons of suspended sediment flowed past the Bridgeville gauging station, for a mean annual suspended sediment discharge of 6,500 tons per square mile. Kelsey assumed bedload discharge at 0.12, for an average bedload transport of 780 tons per square mile per year.

USDA (1970) estimated the average annual total suspended load for the entire basin at 10,600 tons per square mile per year and a Qb/Qss of 0.15. This would produce an average annual bedload rate for the entire basin of approximately 1,590 tons per square mile per year or about 680,000 tons per year (Jager 1995).

In the Addendum to Cumulative Impact Evaluation Response to Comments prepared by CHERT for the Van Duzen River Ranch Final Supplemental Impact Report (1997) a range of mean annual recruitment was generated utilizing sediment yield estimates by Kelsey (1977). While Kelsey recommended utilizing a Qb of 9%, the range of MAR was calculated based upon a Qb of 5-10% and a ratio of 1.4 tons to the cubic yard. Thus, by converting these figures, the range of MAR was presented as 135,000-202,000 cubic yards per year, with a median value of 168,500 cubic yards per year.

During LOP 2004, the CHERT maximum approved volume did not exceed 209,136 cubic yards (Table 6-9). The actual extraction volume during LOP 2004 was even less than the approved amount and didn't exceed 137,850 cubic yards (Table 6-9). Therefore, actual extraction volumes for the LOP 2004 period were significantly less than either the MAR and maximum permitted amounts. This was due to each operator's actual extraction volume fluctuating in response to annual replenishment, extraction season length, market and operational goals, and habitat protection goals.

Table 6-9. 2004 through 2008 CHERT approved and actual extracted gravel volumes for the Van Duzen River (CHERT 2004, 2005, and 2006-2008 unpublished data tables).

Operator	2004		2005		2006		2007		2008	
	CHERT Approved (yd³)	Actual Extracted (yd³)	CHERT Approved (yd³)	Actual Extracted (yd³)	CHERT Approved (yd³)	Actual Extracted (yd³)	CHERT Approved (yd³)	Actual Extracted (yd³)	CHERT Approved (yd³)	Actual Extracted (yd³)
Bess	19,000	13,215	17,010	14,620	20,000	18,765	18,360	18,473	17,009	13,568
Noble	63,435	8,440	72,850	35,110	23,890	1,355	40,400	1,000	99,012	42,376
L. Rock	96,610	70,955	69,230	73,440	87,598	84,627	94,013	93,711	93,115	81,906
Total	**179,045**	**92,610**	**159,090**	**123,170**	**131,488**	**104,747**	**152,773**	**113,184**	**209,136**	**137,850**

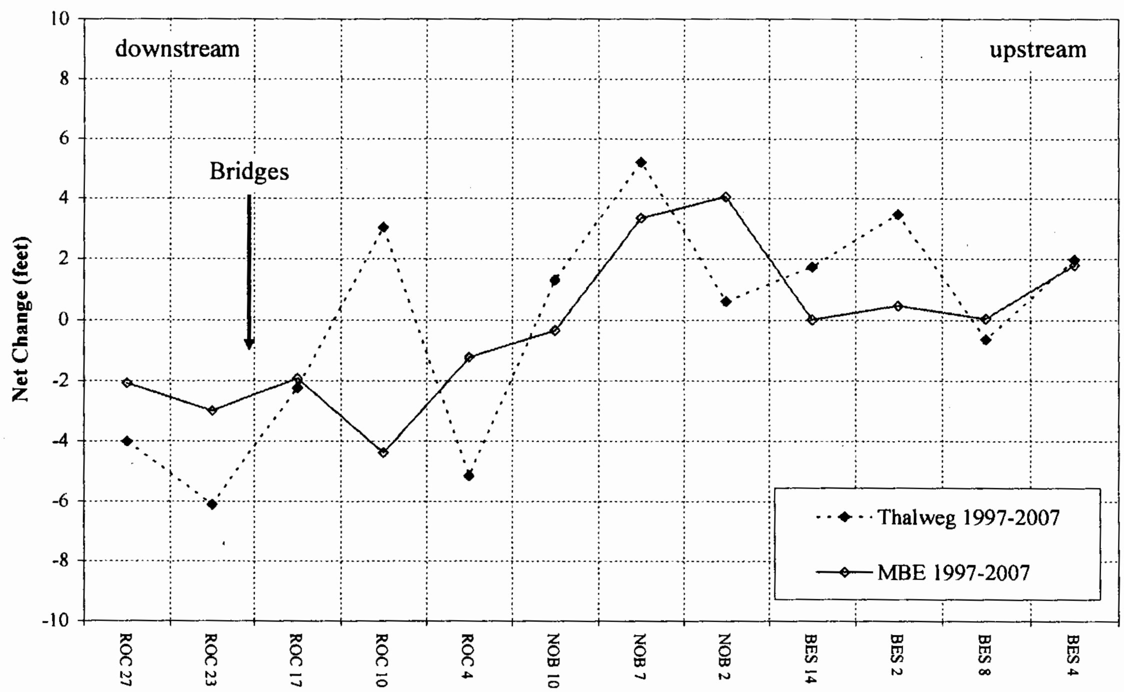
River channel dimensions and form reflect the prevailing flow and sediment transport regime and recent geomorphic history, including the effects of human activities. Channel morphology, as shaped by fluvial geomorphic processes of erosion and sediment transport, is dependent upon the balance of stream flow and sediment supply, which are variables subject to change as a result of anthropogenic influences such as road construction and other land use in the basin. Land uses can induce changes in cross-sectional width and depth, substrate characteristics, channel pattern or planform, and channel slope (Kondolf 1994), with important implications for river management planning.

An understanding of the channel aggradation and degradation trends is one of the most critical elements used in assessing baseline conditions in the context of gravel extraction. A cross section analysis completed by CHERT (2009) provides a tool for examining channel changes. The following information was excerpted from CHERT (2009):

The following information was excerpted or summarized from CHERT (2009):

As with the Lower Eel River, the Van Duzen mining reach exhibited mixed results (Figs. 6-9 in CHERT 2009). Thalweg elevations increased and decreased over time at many XS, but the net changes for 1997-2007 were generally increases in thalweg elevations at the upstream sites (Bess and Noble), and decreases at the downstream site (Leland Rock), both above and below the Highway 101 and railroad bridges. Mean bed elevations mostly mirrored thalweg elevations, with decreases at the downstream (Leland Rock) site ranging from about 1 to four feet and increases up to four feet at the middle site (Noble). Reach-averaged results showed minimal thalweg elevation change, reflecting the substantial longitudinal differences that averaging cancelled out.

Figure 9. Van Duzen River Thalweg and Mean Bed Elevation Net Change, 1997-2007



6.2.2 Salmonid Habitat

The Van Duzen is characterized by having low holding pool frequency, high fall mainstem temperatures, and subsurface flows as a result of excessive sedimentation and deposition. Historic habitat trends are evident in CDFG survey records. Habitat quality has been degraded by both anthropogenic and natural events. The 1964 flood aggraded stream channels in the Van Duzen with 3-9 feet of new sediment (Kelsey 1974). Land use prior to the 1970s has been linked to subsequent instream impacts (Kelsey 1980) and include timber harvest, road construction and grazing. Recent large floods and landsliding in the watershed have also had an impact on salmonid habitat conditions and trends. The high amount of bedload that moved during the 1955 and 1964 floods filled pools in the mainstem Van Duzen and aggraded its tributaries. Aggradation and loss of pools is a limiting factor in the Van Duzen River, and has reduced holding and rearing habitat. Moderate to high fine sediment fractions in substrates were observed in almost all survey reaches (surveys included tributaries; Hadley 2001). Increased width to depth ratios and reduced riparian canopy contribute to high summer water temperatures that often exceed stressful levels for juvenile salmonids (Hadley 2001). Anecdotal information includes observation of fish kills in the Van Duzen mainstem during low flows and hot summers. Severe aggradation has also occurred at the confluence of the Van Duzen and the Eel Rivers (Hadley 2001). The Van Duzen flows subsurface for more than 500 feet upstream from the confluence during the low flow period of June through September. During low rainfall years, this delays upstream migration and has resulted in mortality of adults. This phenomena has been consistently occurring on an annual basis from 1995 to 2001 and the first documentation of this trend that could be located in association with the literature search for this document was found in 1977. The Humboldt Beacon on September 8, 1977 contains a picture of the confluence of the Van Duzen River with the Eel River titled "Van Duzen River Dries Up Before Joining Eel". Many individuals believe that the historic drag line operating just below the highway helped offset this occurrence through nick point scour because historic drag line operations dug deep holes that would scour and migrate upstream. While the direct effects of this operation are unclear, it is definitive that this operation existed and the 1963 aerial photos clearly depict this operation. Other tributaries have also been affected by excessive sediment deposition at their mouths. During summer months, floodplain reaches of tributaries may have intermittent flows; high fines and low pool frequencies, are unconfined and have gradients of 1% or less. These reaches have aggraded in response to increases in supply of course sediment. Tributaries entering the Van Duzen floodplain commonly are oriented downstream and parallel the river for hundreds to thousands of meters due to natural flood-formed levees (refer to Benda et al. 2001). Floodplain tributaries are bounded by shallow terraces or by active floodplains. Flow may go subsurface in the large alluvial sediment reservoir of the mainstem (Benda et al. 2001). Rearing habitat is poor given the lack of cover, and spawning gravels were embedded (Hadley 2001).

In 1996, a total of 10,715 ft of main channel and 1,875 ft of side channels were mapped in the Van Duzen River, from the mouth to the Noble site (Halligan 1996). Approximately 47.8% of the reach was flatwater habitat (mean depth was 1.1 ft and maximum depth was 2.3 ft), with an average active channel width of 1,200 ft, and a mean wetted width of 76 ft. Riffles accounted for 33.3% of the survey reach, with mean depths at 0.4 ft and maximum depth of 1.1 ft, and mean wetted width of 50 ft. Pool habitat comprised 18.8% of the survey reach, with mean depths of 2.6 ft and maximum depths ranging from 3-8 ft. Temperatures were recorded at Leland Rock and held at 21.9-23.9°C for prolonged periods during the summer.

A total of 4,700 ft of river at the Bess Site was mapped on June 25, 1997. The reach surveyed was comprised of the following: 32% comprised of two scour pools (maximum depths ranging from 6-15 ft), 59.5% comprised of flatwater habitat (maximum depths averaged 2.3 ft), and 8.5% comprised of low gradient riffles.

Six thermographs recorded temperatures at the Bess, Noble and Rock extraction sites in 1997. The maximum sustained water temperatures within the Lower Van Duzen River was 21.9-25°C for prolonged periods. The single highest temperature 26.7°C (80°F) was recorded at the bottom of a 15' deep lateral scour pool adjacent to the Bess site. The coolest temperatures were at the bottom of a 6' deep lateral scour pool near the Noble site. This pool was thermally stratified and temperatures ranged from 13°C to 17°C from mid-July to October, 1997. In general, water temperatures were warmest in the most inland or upstream locations and progressive cooling occurred in a downstream direction.

In 1998, temperature monitoring occurred in the Van Duzen at Bess, Noble and Leland Rock operations. The maximum sustained temperatures was 20-23.9°C for a prolonged period in the summer. No summer steelhead were observed in any of the reaches. No migration surveys were conducted in 1998 and no redds were observed because the mouth of the Van Duzen was impassable to salmonids during the survey period and once the mouth opened, waters were too turbid to survey.

In 1999, a total of 21,955 ft of main channel and 1,600 ft of side channel was mapped within the Bess, Noble and Leland Rock reaches. Pools comprised 49% of habitat units with mean depth of 2.29 ft and maximum depth 10 ft. Substrate embeddedness ranged from 45-80%. Flatwaters comprised 23% of the monitoring reach length. Mean and maximum depths were 1.13 and 3.5 ft respectively and mean widths were 105 ft. Riffles comprised 28% of the reach, cobble was the dominant substrate, mean depth was 0.42 ft and maximum depth was 1.2 ft, mean widths were 110 ft. Edgewater habitat was present along stream margins throughout the survey reaches. The maximum sustained water temperature was from 66-75° F. No dives were conducted on the Van Duzen in 1999 because the mouth presented a barrier to migrating salmonids.

The 2007 Van Duzen River survey reach totaled 11,442 ft in length and covered the Tom Bess (Carlotta) and Leland Rock (Alton) operations (Stillwater Sciences 2008). The combined pool:riffle:flatwater percentages for the two reaches were 18:11:71 (Table 6-10). The pool:riffle:flatwater percentages remained fairly consistent between 2005 and 2006, but the proportion of the survey length made up of pools decreased from 2006 to 2007. The decrease in the 2007 pool percentage may have been due to (1) observed sediment intrusion into pools at Tom Bess' operation, (2) lack of Noble pool data that typically accounts for about half the pool length in the gravel mining reaches, and (3) channel avulsion at the upstream end of the Leland Rock operation.

Table 6-10. Van Duzen River pool:riffle:flatwater lengths and percentages 2005-2007.

Operator/Bar	Pools (ft)			Riffles (ft)			Flatwaters (ft)		
	2005	2006	2007	2005	2006	2007	2005	2006	2007
Tom Bess/Bess	1,281	1,296	1,410	809	640	605	3,449	4,860	4,632
Noble/Noble	2,176	2,567	ns	988	1,426	ns	5,589	4,729	ns
Leland Rock/Rock	1,595	1,349	883	1,500	883	595	2,281	2,471	3,317
Total	**5,052**	**5,212**	**2,293**	**3,297**	**2,949**	**1,200**	**11,319**	**12,060**	**7,949**
P:R:F %	26	26	18	17	15	11	57	60	71

Note: "ns" indicates no survey occurred. Differences in total length between 2006 and 2007 were due mainly to a lack of Noble data (~8,700 ft).

The 2007 residual depths throughout the survey reach ranged from 3.5 to 10.0 ft and were on average about 0.7 ft shallower than in 2006. The Van Duzen River extraction reaches appear to have experienced a significant decrease in pool depth since 2004. Much of the loss in the average residual pool depth stems from the deposition of sediment into the two deepest pools on the Bess property. The number of pools within the Bess and Rock reaches stayed fairly consistent between 2005 and 2007.

The 2007 adult-holding, spawning, Age 2+ steelhead, and alcove habitat areas within the extraction reaches covered 33,505 ft^2, 1,817 ft^2, 11,540 ft^2, and 5,134 ft^2, respectively (see Appendix D in Stillwater (2008) the delineated 2007 aerial photographs). Between 2006 and 2007, there were significant decreases in adult-holding, Age 2+ steelhead, and alcove habitats. The reduction in the quantity of adult-holding areas appeared to be due to sediment deposition into pools, which resulted in shallowing and shortening of these habitat types. In addition, because no monitoring was conducted at the Noble site, significant amounts of adult-holding habitat data were not collected. Similarly, the perceived loss of Age 2+ steelhead habitat may have been due to a lack of Noble monitoring data. The bulk of the alcove loss was caused by the filling in of a single unit on Leland Rock's operation and lack of data collection at the Noble site.

There may be errors associated with the habitat mapping effort caused by the different discharges between the dates when aerial photographs were flown and when the mapping was conducted. For example, the 2006 and 2007 aerial photographs were taken when the river discharges at Bridgeville were 570 and 218 cfs, respectively. Discharges for the 2006 and 2007 mapping efforts were 8 cfs, and 7 cfs, respectively. This resulted in estimating edges of habitat polygons in relation to morphological features that were submerged on the aerial photographs.

Habitat at the Pacific Lumber bar was surveyed in October 2003. Residual pool depths ranged from 0.5 to 7.5 feet. Other data could not be readily summarized for this BA.

The Van Duzen River supports all life stages of salmon and steelhead. However, the majority of salmonid habitat utilization (spawning and rearing) in the basin occurs upstream of the project reach. The project reach is a critical migration route for adult and smolting salmonids and is utilized to a lesser extent for spawning and rearing salmonids. CDFG does not collect redd/spawning data on the main stem, only on specific tributaries (pers. comm. S. Downie April 27, 2009).

Table 6-11. Van Duzen River pool depths for 2004-2007.

Operator/Bar	Maximum Depth (ft)				Riffle Crest Depth (ft)				Residual Pool Depth (ft)			
	2004	2005	2006	2007	2004	2005	2006	2007	2004	2005	2006	2007
Ton Bess/Bess	5.2	6.1	9	6.3	0.4	0.2	0.4	0.3	4.8	5.9	8.6	6.0
	16.5	7.9	5.2	4.7	0.2	0	0.4	0.9	16.3	7.9	4.8	4.3
	15.3	11	9.1	6.4	0.1	0.3	0.2	0.3	15.2	10.7	8.9	6.1
	-	-	9.1	10.2	-	-	0.2	0.5	-	-	8.9	10.0
Noble/Noble	-	7.8	7.1	-	-	0.5	0.4	-	-	7.3	6.7	-
	-	4.5	7.6	-	-	0.4	0.3	-	-	4.1	7.3	-
	-	9.9	5.9	-	-	0.5	0.2	-	-	9.4	5.7	-
Leland Rock/Rock	2	5.6	6.8	3.9	0.3	0.3	0.3	0.4	1.7	5.3	6.5	3.5
	3.6	5.3	3	7.5	0.3	0.3	0.4	0.3	3.2	5	2.6	7.2
	6.8	6	4.7	5	0.3	1.2	0.6	0.4	6.5	4.8	4.1	4.6
	-	5.8	-	4.2	-	0.7	-	0.4	-	5.1	-	3.8
Average Depth	**8.2**	**7.0**	**6.8**	**6.0**	**0.3**	**0.4**	**0.3**	**0.4**	**8.0**	**6.6**	**6.4**	**5.7**

Note: "-" indicates pools were not present even though the entire reach was surveyed. Pools do not necessarily occur in the same number or place every year. Therefore, the data can only be used for general comparative purposes and not to compare the depth of an individual pool through the years.

Table 6-12. Lower Van Duzen River mapped habitat unit areas for 2006-2007.

Operator/Bar	Adult Holding (ft^2)		Spawning (ft^2)		2+ Steelhead (ft^2)		Alcoves (ft^2)	
	2006	2007	2006	2007	2006	2007	2006	2007
Tom Bess/Bess	35,062	24,454	0	1,817	6,036	5,115	10,749	5,134
Noble	103,228	nd	0	nd	4,961	nd	27,562	nd
Leland Rock/Rock	34,507	9,051	0	0	5,691	6,425	46,305	0
Total	**172,797**	**33,505**	**0**	**1,817**	**16,688**	**11,540**	**84,616**	**5,134**

Note: "ns" indicates no survey occurred.

6.2.3 Species Status in the Project Area

The Van Duzen also provides habitat for CC Chinook salmon, SONCC coho salmon, NC steelhead, coastal cutthroat trout, resident rainbow trout, Pacific lamprey, West Coast three-spine stickleback, Sacramento sucker, Coast Range sculpin, prickly sculpin, California roach (introduced), speckled dace (introduced) and Sacramento pikeminnow (introduced). Pacific salmonids may be limited to the lower one-third of the watershed. Eaton Rough Falls, a barrier to upstream migration, is at river mile 47. Steelhead are the most abundant species and can utilize smaller tributaries with steeper gradients. Two distinct runs of steelhead utilize the Van Duzen, including winter-run and summer-run steelhead. Winter-run are the most numerous and widespread.

Table 6-13. Salmonid species life stage and habitat use in the Van Duzen River.

Species	Life Stage	Period of Use	Habitat
Coho and Chinook	Adult	Fall/winter	Pools / spawning
Winter steelhead	Adult	Fall/winter	Pools / spawning
Summer steelhead	Adult	Summer/fall	Pools
Chinook	Fry/juveniles	Spring/summer	Edgewater / pools
Coho	Fry/juveniles	Spring/summer	Edgewater / pools
Steelhead	Fry/juveniles / smolts	Year round	Edgewater / pools / fast water

Downie et al. (2007) summarized limiting factors for the Lower Van Duzen River as follows:

- Sediment levels in streams are high and create a multitude of problems including pool filling, substrate embeddedness and aggradation.
- Accessibility to habitat is blocked at various points in the basin including at the mouth of the Van Duzen, at log debris accumulations in tributaries, at culverts, at rock dams and at the confluences of some tributaries.
- Water temperatures are stressful to salmonids in the mainstem Van Duzen and are unsuitable in some tributaries.

Very little quantitative information exists regarding historic levels of anadromous and resident fish in the Van Duzen River. A CDFG (1951) survey identified a few tributaries in the Van Duzen River (Copper Creek, Mill Creek, Cummings Creek, Grizzley Creek, and Hely Creek) as supporting up to 500 young-of-the-year coho salmon. A spawning survey of Chinook salmon by USFWS in 1959 indicated that the basin had the capability to support 7,000 Chinook salmon and reported 1,500 redds (EPA 1999). No current estimates for Chinook are available. Summer steelhead generally hold in deep pools between Bridgeville (river mile 31) and the confluence of the South Fork Van Duzen (river mile 45). These pools range from 6 to 20 feet deep. Spawning and rearing occurs primarily in the South Fork Van Duzen River (Hadley 2001). Mainstem Chinook spawning occurs in riffles up to river mile 31 at Bridgeville. CDFG surveys document Chinook spawning in many of the larger tributaries of the lower watershed including Yager Creek, Hely Creek, Cummings Creek, Root Creek, and Grizzley Creek. Following the floods of

1955 and 1964, CDFG estimated that the annual run numbered 2,500 fish. Historically, coho salmon did not represent a large run in the Van Duzen River. The CDFG (1964) reported an estimated run size of 500 adult fish.

There have been no hatcheries on the Van Duzen River, however, CDFG stocking records indicated that 3,000 steelhead of Little Lost Man Creek origin were released in Stevens Creek in 1985. The Yager Creek hatchery was operated since its construction in 1977 through 2002 and has historically planted steelhead, coho salmon, and Chinook salmon. The steelhead stock have been documented in three Humboldt Beacon articles as originating from the Mad River and Iron Gate hatcheries. Although the historical data for the hatchery releases from 1977 to 1990 have not been reviewed and summarized to date and the newspaper articles discussed the arrival of 50,000 to 100,000 fish for rearing at this hatchery (no released numbers were documented). PALCO records dating back to 1990 were summarized by the total number of steelhead, Chinook salmon, and coho salmon released from the Yager Creek hatchery from the time between 1990 and 2002 as follows: steelhead trout 90,257; Chinook salmon 306,927; and, coho salmon 6,500. Prior to 1977 the actual number of hatchery reared fish released into the Van Duzen River is vague and complete records were not found. Documentation that has been collected spans from the period between 1898 and 1914 when a hatchery was established at Price Creek in response to public and commercial fisheries concerns over the depleted stocks. The review of historical newspaper references, compiled by Susie Van Kirk, dating from 1854 to 1995 documents the release of 61,036,107 Chinook salmon and 17, 720,000 steelhead into the Eel River and its tributaries. The hatchery stocks were documented as initially originating predominantly from the Battle Creek and McCloud hatcheries initially. These figures were generated from newspaper articles referencing releases between 1898 and 1914 and yet millions of eggs and fish were discussed for years where release numbers were not given. The majority of these articles refer to the release of fish within the Eel River system, but others provided more detail, specifically naming the Van Duzen River among other tributaries within the system. After 1914 the Price Creek hatchery was closed due to geologic instabilities that continually compromised the water impoundment necessary for hatchery operations. A new hatchery site was chosen at Fort Seward at which point historical records become even more obscure as to numbers and locations of hatchery releases. While no concise historical record of hatchery releases exists for the Van Duzen River, examples such as the CDFG stocking records indicated that 3,000 steelhead of Little Lost Man Creek origin were released in Stevens Creek in 1985 exist. Even though actual numbers of fish released per year are relatively sparse, the historical record does demonstrate that the system had introduced stock as early as the 1880's.

Although precise population estimates for each salmonid species are not available, CDFG (1996) along with local accounts, indicate the most serious decline in population occurred in response to the 1964 flood. In general, lower basin tributaries are naturally more capable of supporting anadromous fish production due to stream gradients, riparian vegetation, temperatures than the middle and upper basin.

Halligan (1996, 1997, 1998) conducted fisheries monitoring for gravel operators as required under LOP 96-1. No summer steelhead were observed in 1996 at any of the sites. No fish were observed and poor visibility was reported for the first migration survey on October 30, 1996. On November 4, 1996, 115 Chinook, 4 steelhead and 23 jacks were observed as follows: 7 Chinook along the Noble reach; 110 Chinook, 4 steelhead and 4 jacks along the Leland Rock reach. 303 Chinook, 5 steelhead, 1 chum salmon, and 22 jacks were observed on November 15, 1996, and all fish were along the Leland Rock reach. No spawning activity or redds was observed in any of the surveyed reaches.

Summer steelhead surveys were conducted in the Van Duzen River at the Bess, Noble and Leland Rock sites in 1997. No summer steelhead were observed. However, Tom Bess has frequently reported seeing summer steelhead migrating thought his extraction reach in late-May and June.

The mouth of the Van Duzen has typically remained impassable to adult salmonids until the second week of October or the first significant rainfall event. In years past, many Chinook salmon entered the Van Duzen River after the first rainfall but were caught by anglers soon after CDFG opened the fishing season. Holding Chinook were subject to intense fishing pressure during the season openings. In 1997, the first appearance of adult salmonids was on October 14, 1997, when 44 Chinook, 1 steelhead and 3 jacks were observed as follows: 23 Chinook and steelhead at Bess site; 7 Chinook and 2 jacks near the Noble site; 14 Chinook and 1 jack at Leland Rock. On October 22, 1997, 94 Chinook, 2 steelhead and 6 jacks were observed as follows: 27 Chinook and 2 steelhead were observed in the Bess reach; 17 Chinook and 1 jack were observed in the Noble reach; >50 Chinook and 5 jacks were observed in the Leland Rock reach. Visibility prevented surveys after October 22, 1997. No redds were observed at any of the sites in 1997.

7 EFFECTS OF THE PROPOSED ACTION

This section of the BA assesses potential indirect, direct, and cumulative effects of the proposed action on SONCC coho salmon, CC Chinook salmon and NC steelhead and their critical habitat. Effects to tidewater goby are described below in Section 7.3. The proposed action addresses potential effects of aggregate extraction through experience gained from past operations, scientific review, mitigation measures contained in the CWA 404 application, NMFS' Sediment Removal Guidelines (2004), Biological Assessments (Berg et al. 2002; Halligan 2004; Stillwater Sciences 2009), instream habitat monitoring (Stillwater Sciences 2008) and NMFS' Biological Opinions for gravel extraction operations listed earlier in this BA.

The potential effects on aquatic resources are addressed by: (1) minimizing localized site-specific effects through implementation of extraction methods and mitigation measures that are designed to avoid or minimize effects at each site combined with annual monitoring and scientific reviews and (2) avoiding or reducing cumulative effects at the reach scale through long-term monitoring and extraction volumes that are constrained by estimates of mean annual recruitment and annual replenishment above a flow-based, vertical buffer, and, (3) implementation of a physical and biological monitoring program that provides data to an adaptive management strategy. In addition, extraction methods with a restorative component as either a primary or secondary objective are planned to be implemented at the same or greater level than in the previous permit period. The intent of these restorative extraction projects is to improve aquatic habitat at the site scale while providing economical aggregate volumes for the operator.

7.1 Direct Effects

Direct effects are those that may be caused by or result immediately from the proposed action. Potential direct effects of the proposed action include hydrocarbon contamination of aquatic habitat, crushing of eggs or individuals during bridge construction or removal, and interference with salmonid migration (Table 7-1). Each of these effects and protection measures are discussed in more detail in the following sections.

Table 7-1. Project activities with associated potential direct effects and protection measures.

Proposed Activity	Potential Direct Effects	Protection Measures
Fuel storage and fueling operations	Contamination of groundwater and aquatic habitat	Fuel storage and equipment servicing outside of bankfull channel; use of Best Management Practices
Skimming and other extraction methods	Injury or mortality of salmonids	Head of bar and edge of water buffers
	Inhibition of migration runs	Seasonal operating restrictions
Temporary bridge/crossing construction	Injury or mortality of salmonids	Minimal channel encroachment; seasonal operating restrictions; heavy equipment wet crossings during crossing installation or removal only
	Inhibition of migration runs	Seasonal operating restrictions; use of bridges and/or properly sized and placed culverts
	Hydraulic attraction for spawning adults	Seasonal operating restrictions: Placement of crossing to avoid spawning habitat to the extent possible

7.1.1 Hydrocarbon contamination of aquatic habitat

Hydrocarbon contamination of aquatic habitats could potentially occur during extraction operations. Contamination could result from leaking fuel or hydraulic lines on heavy equipment, improper fuel handling practices, or spills during refueling or lubrication operations. All operators are required to ensure that all fuel and hydraulic lines on heavy equipment are in good working order and are not leaking. All operators are required to conduct fueling and lubrication operations off-site at processing plants and to use Best Management Practices when doing so. There are no fuel storage facilities at the extraction bars. All equipment is serviced on an "as needed" basis with the necessary daily or weekly fueling and lubrication conducted at processing plants prior to the start of work. Accidents, such as a breaking of a hydraulic line, require immediate notification of appropriate agencies and clean-up of the area, which will be completed well before the onset of high-flow conditions. Barring an unforeseen accident, aquatic habitat is not expected to be impacted by hydrocarbon contamination.

7.1.2 Crushing of eggs or juveniles

Wet crossing of the river channel by heavy equipment and the disruption of wetted substrate associated with seasonal bridge/culvert crossing construction has the potential to harm or destroy salmonid eggs that may be contained in redds. In addition, juvenile salmonids that may occupy the area or seek refuge within substrate interstitial spaces in response to disturbance may be harmed by bridge construction or heavy equipment crossings.

There may be a maximum of 8 summer bridges needed on the Lower Eel River (Hauck Bar-2; Hanson Bar-1; Mercer-Fraser-2; Drake Bar-3). There may be a maximum of 9 summer bridges needed on the Van Duzen River (Bess Bar-2; Van Duzen River Ranch-4; Leland-3). Only the Bess site has a spawning habitat unit, which is located at the downstream end of the site. Due to avoidance of spawning habitat and a lack of spawning habitat in the project area, and because crossing construction will commence on or after June 30 when fry would have emerged from gravel, the potential for direct effects to eggs is very low and the potential for impacts to SONCC coho, CC Chinook, and NC steelhead populations is very low.

In these rivers, the majority of age 0+ Chinook salmon will have migrated downstream by the time bridge construction commences on 30 June. Any remaining individuals would likely be rearing in pools or deep runs by this time of year, which are not desirable for bridge crossings. Age-0 coho salmon, which are by and large excluded from these extraction reaches during the operation period due to warm water temperatures, also rear in pool habitats. Therefore, the potential for direct impact on juvenile Chinook and coho is likely to be very small.

Juvenile steelhead may be rearing in the project area during the extraction season, although the extent of habitat use is low due to low flows high water temperatures. Steelhead fry tend to inhabit edgewater habitats once they emerge from the gravel. As they grow larger, they move to more swiftly moving deeper water contained in higher gradient runs and riffles. These locations provide high dissolved oxygen and food concentrations that these fish need to survive high water temperatures. It is expected that by 30 June juvenile steelhead will be of a size that allows them to inhabit deeper water and that juveniles would not be in potential bridge installation areas. Thus, the seasonal restriction on crossing installation is expected to minimize if not eliminate the potential for impact to juvenile salmonids.

Temporary bridge placement will be planned to avoid riffle crests, head of pool, and pooltail locations. Encroachment of bridge abutments into the channel will occur on the sides only and not enter the channel thalweg. Only washed material will be utilized within the wetted area of the approaches. Heavy equipment will not be used in the wetted channel except for crossing installation and removal activities. If bridge construction does need to occur in riffle or flatwater habitats, then there may be a low level of harm, harassment, or mortality to juvenile steelhead. However, due to the proposed impact minimization measures (low maximum number of bridges, seasonal restrictions, channel encroachment mitigation) and Age 0+ growth rates, and juvenile steelhead habitat preferences in the project area, impacts to NC steelhead populations from bridge construction and removal are expected to be minimal.

Crushing of salmonids could occur during unregulated extraction operations. However, operators will be heavily regulated and do not propose to conduct any extraction operations in the wetted channel unless it is for habitat enhancement such as alcove development. Operators will maintain head-of-bar and edge-of-water buffers along all extraction surfaces to avoid direct contact with salmonids by heavy equipment. A minimal amount of contact with habitat that could possibly contain salmonids may occur during "daylighting" operations for skimmed areas. However, the streamside edge of the daylight location will be created by "backblading", which will minimize deposition of material into the channel that could possibly come in contact with a fish.

Alcoves can be constructed by an excavator positioned on the streambank and, therefore, construction doesn't require wheels or tracks to enter the wetted channel. Alcove construction will occur on dry gravel beginning at the upstream end of the site, possibly extend below the groundwater surface elevation, and move progressively downstream. Actual entry into the wetted river channel will only occur where the constructed alcove joins the wetted channel. Therefore, potential crushing of juveniles during alcove construction is expected to be minimal to nonexistent. All the other extraction types carry little or no risk of crushing eggs or juveniles.

7.1.3 Interference with adult and juvenile salmonid migration

The first adult salmonids begin to enter the Eel River estuary in late August and September and the Lower Eel River (at Fernbridge) around mid-September. Depending on flow conditions, there are critical riffles just upstream of Fernbridge that are typically low flow barriers to migration until after the first significant rains. In some dry years, this reach has intermittent flows. If these critical riffles are passable, Chinook and steelhead appear to hold primarily at the Boxcars hole (lower Sandy Prairie) while waiting for enough runoff to initiate further upstream migration. A secondary holding location is the lateral scour pool along the Hansen bar. Both of these locations have water depths ranging from 9-15 feet deep. There would be no adult salmonids migrating upstream during summer months when bridges are proposed to be installed (in general, after June 30, and in the Eel River installation is later due to Western Snowy Plover restrictions) and likely none in the fall (bridges can be in place until October 15, unless an extension is granted) until after bridges are removed..

Upstream migration and holding of adult salmonids could potentially be affected during installation and removal of bridge crossings. Installation and removal of crossings could cause short-term (several hours) disturbance and increased turbidity, which may result in some adult fish temporarily abandoning preferred holding habitats that may be in close proximity during heavy equipment operations. However, these effects are expected to be minimal for a number of reasons. The mandated seasonal-use period for bridge installation of 30 June through 15 October (or 1 November if an extension is granted) is timed to minimize exposure for migrating adult salmonids. Temporary bridge placement will be planned to avoid pool locations (where adult salmonids hold) to the greatest extent practicable.

Juvenile outmigration is not expected to be affected during bridge construction. Sparkman (2002) found that in the Mad River, the great majority of juvenile salmonid downstream migration is complete by the June 30 bridge construction start date. The portion of bridge construction that may include filling or crossing the channel takes about 3 to 5 hours. This small amount of time will have little effect on downstream migration considering it is occurring at the tail end of the run that has spanned several months. In addition, the Lower Eel River operators are subject to snowy plover seasonal restrictions, which results in operations beginning extraction operations on July 22 at the earliest and September 15 at the latest. This restricted start date would minimize any potential impacts to downstream migrating steelhead that may be associated with bridge construction activities.

Juvenile steelhead (YOY, age 1+, and age 2+) and a lesser number of juvenile Chinook and coho salmon may rear year-round in extraction reaches. Although they do not actively migrate downstream like smolts, these fish do move from place to place during the course of their rearing and some individuals may come into contact with bridge structures. These bridges typically clear span the channel and are a few feet above the water surface. The channel may be constricted to some degree between bridge abutments, which would result in somewhat deeper and faster water under the bridge. However, increased water velocities should pose no passage problem for fish moving upstream because their cruise and burst speeds range from 6–12 ft per second, which is great enough to allow for upstream migration through these higher-velocity reaches. Therefore, temporary bridges are not likely to affect juvenile fish movement.

7.1.4 Hydraulic attraction of bridges for spawning adults

As mentioned above, bridge construction can result in a constriction of the channel and increased water depth and velocities. In addition, on occasion and only when absolutely necessary, bridges are placed in close proximity to suitable spawning gravel. The changes in water depth and velocities may attract adult salmonids to the spawning gravel near bridges. It is possible, if conditions are right that salmon could spawn at these locations prior to bridge removal. Bridge removal could then pose a risk to the newly formed redd and the eggs within it. This potential direct effect only applies to Chinook salmon, which are the only species that could potentially spawn in mainstem extraction reaches before 15 October.

In general, there is very little spawning habitat available in the Lower Eel River. If spawning did occur downstream of the Van Duzen River, there is a high likelihood that the redds would be destroyed due to bedload movement during high water events. The potential for bridges to create attractive spawning locations is low due to lack of other suitable habitat elements. In the Van Duzen River, however, bridges may actually be placed in the vicinity of spawning habitat. In this case, bridges are usually removed by October 15 and generally prior to the arrival of runoff events that would allow for adult salmonid passage over the Van Duzen River delta. Therefore, the potential for a hydraulic attraction being created is very low. However, if an extension is granted to allow the bridge to stay in place until November 1, then there may be potential that fish could be attracted to bridges for spawning.

To minimize the potential for adverse impact on adult salmonids, any operator who requests an extension to the 15 October bridge removal date will agree to the following conditions:

1. The operator will monitor the National Weather Service (NWS) Eureka website on a daily basis after 15 October. The purpose of the monitoring will be to determine if a weather system is approaching the area that has the potential to deliver at least 1 inch of rainfall. If the NWS predicts 1 inch of rain, then the bridge will be removed immediately.
2. The operator will inspect the bridge site on a daily basis to determine if fish are attracted to the site by the change in water depth, velocity, overhead cover, or any other factor. The bridge will be immediately removed if adult salmonids are observed at the site.
3. The operator will inspect the bridge site on a daily basis to determine if adult salmonids are using the location for spawning. The bridge will be removed immediately if adult salmonids are observed at the site.
4. The operator will ensure that the extraction site accessed via the bridge is in a post-extraction groomed condition at the end of each day following 15 October. This will allow for immediate removal of the bridge, if necessary, and preclude the necessity of waiting for reclamation activities to be completed.

It is expected that implementation of these conditions, and the low probability that salmonids would spawn prior to arrival of fall rains in the rivers as discussed above, will minimize the potential for this effect to occur.

7.2 Indirect Effects

Indirect effects are those that are caused by, or will result from, the proposed action and are later in time, but are still reasonably certain to occur. Potential indirect effects for this project include stranding of individual salmonids on the extraction surface, reduction in channel substrate size, reduction in pool depth and area, decrease in riparian vegetation, intrusion of fine sediment into spawning gravel, increased water temperatures, loss of velocity refugia, and increase in channel instability (Table 7-2). Each of these effects and protection measures are discussed in more detail in the following sections.

Table 7-2. Project activities with associated potential indirect effects and protection measures.

Proposed activity	Potential indirect effects	Protection measures
Gravel bar skimming (horseshoes, secondary channel skims, traditional skims)	Stranding of salmonids	Post-extraction grooming to a free-draining configuration; daylight the lower portion of bar to insure free-draining surface
	Reduction in channel substrate size; reduction in pool habitats	Maintenance of head-of-bar and edge-of-water buffers
	Decrease in riparian vegetation	Riparian retention/transplanting measures
		Head-of-bar and edge-of-water buffers
	Intrusion of fine sediment into redds	Elevational offsets from water surface
		Head-of-bar and edge-of-water buffers
	Increase in water temperatures	Head-of-bar and edge-of-water buffers
		Riparian retention measures
	Loss of velocity refugia	Riparian retention measures
		Head-of-bar and edge-of-water buffers
Trenches and pits (parallel trenches, oxbows, alcoves, wet and dry pits)	Stranding of salmonids	Connection with low-flow channel
	Decrease in riparian vegetation	Riparian retention measures
	Improved summer rearing potential (positive impact)	Site-specific planning and consultation with regulatory agencies
	Improved migration passage	Site-specific planning and consultation with regulatory agencies; openings at upstream and downstream ends
	Loss of velocity refugia	Site-specific planning that could improve high-flow velocity refugia

7.2.1 Stranding of adult and juvenile salmonids

Stranding is a natural phenomenon, which can be exacerbated by unregulated gravel extraction, and is one of the risks that migrating salmon and steelhead face as they move up or downstream. Stranding primarily occurs after the river stage rises and allows fish to move into newly inundated areas. As flows recede, fish can become trapped on the substrate or in isolated pools and depressions that were formed from old channels, flow around vegetation or large woody debris, and other features. Unless water levels increase or the depressions are fed by sub-surface flow, fish will desiccate or become easy prey for a variety of predators. Unregulated gravel skimming can leave depressions or holes in the finished bar surface that can trap salmonids once flows increase and subsequently fall.

Gravel bar skimming (narrow, traditional, horseshoe skims) would result in the post-extraction bar surfaces being subject to inundation at flows lower than required to cover non-extraction surfaces, thereby increasing the potential for stranding. The proposed action will include post-extraction grading, if necessary, that eliminates depressions and maintains downstream slopes to facilitate uniform draining.

Trenches have the potential to trap salmonids, especially those constructed perpendicular to the channel due to the potential for sediment to deposit and form a berm along the river side. The project does not proposed to utilize perpendicular trenches due to the heightened stranding risk.

Parallel trenches that are adjacent to the low flow water's edge have less potential for stranding salmonids due to being inundated at very low flows and having the upstream and downstream ends open the to wetted channel. Although these trenches are intended to facilitate fish passage and avoid stranding of either adults or juveniles, observations indicate that fish may become isolated in the trenches when unpredicted shifts in channel form occur and unexpectedly close off the trench and subsequent streamflows are insufficient to re-open the trench to salmonid migration. Where this occurs, salmonids may perish due to lack of flowing water. Even with suitable flow infiltrating through the gravels, adults may perish due to their limited lifespan dictated by reproductive needs. Therefore, trenches will be monitored (as access allows) following high-flow events to determine if fish are being stranded. If fish are observed trapped then the operator will contact the permitting agencies and initiate a recommended course of action.

Trenches are not proposed to be utilized in areas where spawning habitat is located, but may be used in reaches where migration passage improvement is desirable. Any trench proposed will be designed to provide an overall benefit in terms of fish migratory conditions and deeper holding habitat. Trenches could have woody debris and other elements of cover added where deemed appropriate and necessary by the reviewing agencies. Any stranding that may occur would be a result of unanticipated river changes and would not be a result of trench design.

Alcoves are open at the downstream end and do not have an entrapment risk. Oxbows could strand fish, but are also inundated infrequently. In addition, they will be dug deep enough to remain wet due to hyporheic flow throughout the low-flow months, which would allow for successful rearing of salmonids, much like natural isolated oxbows.

Wet and dry floodplain pits do have the potential to entrap salmonids. However, a number of studies (Morley et al. 2005, Swales and Levings 1989, Brown and Hartman 1988) have concluded off-channel habitats (ponds, wetlands, secondary channels, etc.) can improve winter growth rates and survivability of juvenile coho salmon. Koski (2009) stated the following "Creation of winter habitat in streams will help in the recovery of depressed coho populations by providing critical habitat for stream rearing, and for nomadic coho returning to freshwater to overwinter. Koski and Lorenz (1999) developed overwinter habitat in Duck Creek by building a stream channel that meandered through created wetlands containing deep pools. Several hundred coho nomads migrated from the stream-estuary ecotone into these wetlands for overwintering annually during 2004–2007 (Koski, unpublished data). In many larger river systems, side channels, natural ponds, and beaver ponds provide important winter habitat. Cederholm et al. (1988) developed methodology for creating pond habitat in the Clearwater River, Washington that successfully allowed juvenile coho to overwinter. Small ponds or alcoves excavated adjacent to the stream channel increased juvenile coho salmon densities and overwinter survival in Oregon streams (Nickelson et al. 1992).

Lower elevation wet and dry floodplain pits proposed by the operators will have connections to the low-flow channel or other frequently inundated secondary channel to allow for seasonal salmonid use and reduce entrapment potential. Based on literature given above, it is possible that juvenile salmonids that successfully rear in wet and dry pits during winter high-flow periods will have a greater survival rate than those in the main channel. The pits will be monitored for salmonid stranding after high flows have receded. The pre-extraction plan will include a monitoring plan that assesses salmonid stranding and include a fish rescue plan.

The potential for stranding of salmonids on extractions surfaces is likely to be minimal if the above mitigation measures are followed. Nonetheless, the effect cannot be completely eliminated on post-extraction surfaces that may become inundated during high-flow events. Therefore, some effect, however minor, could occur that may contribute to injury and possible mortality of a small number of individuals.

7.2.2 Reduction of channel substrate size

Bar skimming removes surface substrate from bars, which may cause changes in bed mobility, gradual "fining" of substrates, alteration of spawning habitat, and loss of velocity refuge on bars. Legasse et al. (1980) reported that the stability of rivers depends on armoring of bars with relatively coarse gravel material. The armor layer reduces the mobility of bed sediment, making the bar head and channel bottom resistant to high-flow stresses and provides stability to the channel during high flows (NOAA 2004). Skimming operations on mature bars can remove patches of coarser material, exposing smaller substrates and potentially influencing the "steering" effect of the gravel bar and channel stability. By removing most of the gravel bar above the water level, the confinement of the low-water channel is reduced or eliminated, changing the patterns of flow and sediment transport through the reach (Kondolf 1994). To minimize adverse effects on channel stability, the inboard, horseshoe, and narrow skim extractions will leave the upper bar intact and employ an edge-of-water buffer. These buffer areas will help maintain riffle and channel stability and route bedload around the extraction site at less than the effective discharge flows.

Skimming has been found to enhance deposition of fine sediment on previously mined surfaces (Pauley et al. 1989) and may cause part of the river's fine sediment load to deposit and be temporarily stored within the river rather than be transported out of the system, leading to "fining" of bar surface substrates. It is possible that some extraction techniques currently being proposed (horseshoes, inboard skims) may encourage fine sediment deposition on finished surfaces, which could result in a net decrease in fines to areas downstream. A net reduction in the quantity of fines transported downstream may be beneficial since fine sediment can fill substrate interstices, decrease the availability of cover for juvenile salmonids, affect the rate of water interchange between water and redds, and alter primary production and invertebrate abundance.

Substrate that is of suitable size for spawning (2–15 cm) does deposit on extraction surfaces and may be removed during skimming operations. Under unmanaged conditions, these potential spawning gravel deposits are in dynamic long-term storage and would eventually be transported downstream if eroded in a high enough flood. Extraction of these deposits has the potential to reduce the amount of suitably sized substrate that may sooner or later be available for spawning areas downstream of the extraction bar. Natural particle abrasion and decreasing hydraulic energy in a downstream direction also results in a gradual fining of substrates in a downstream direction.

Effective minimization and mitigation measures include leaving the one-third upper bar buffer and a minimum vertical offset at the 35-percent exceedance flow elevation or 2 ft above the low-flow water surface elevation. These buffers will help route bedload around the extraction site at less than the effective discharge flows. Only when discharges are high enough to carry spawning-sized particles over those buffers will deposition on extraction surfaces occur. The head-of-bar buffers will also help maintain the upstream riffle and its associated spawning habitat stability.

The Lower Eel River and Van Duzen River sites do not have suitable spawning habitat, with the exception of the Bess site (one spawning habitat unit is present at the lower end). Thus, although extraction activities have the potential to alter spawning gravel composition in the active channel, few to no salmonids spawn in these lower rivers. However, protection measures (upper-bar and edge-of-water buffers as well as alternative extraction designs) are proposed to avoid or minimize potential adverse impacts. Even though protection measures will be implemented, and spawning habitat is absent at most sites or limited at one site, minor effects could occur.

7.2.3 Reduction in pool habitats

Unregulated instream gravel extraction has the potential to affect pool length and depth. Until bars are replenished, gravel bar skimming can result in hydraulic flow fields that are less constricted than they would be under natural conditions. High flows would pass over a wider cross-sectional area, thereby reducing velocity in the thalweg and increasing velocity over the bar. This reduction in thalweg velocity could reduce pool scour and increase deposition, reducing the length and depth of pool habitats. Pool formation is also related to the intensity and duration of high-flow events. High flows over a long period will tend to result in increased pool habitat due to the ability of the flow to scour sediment. By contrast, low-duration runoff events may not have the time to scour pools, and may even result in excessive deposition of sediment. Reductions in pool length and depth could affect salmonids by reducing adult holding areas, winter rearing habitat, and downstream juvenile migration habitat.

Vertical and horizontal offsets and head-of-bar buffers generally prevent flows from spreading out across skimmed surfaces during low to moderate flows; however, large increases in flow could cause the water to overtop the skimmed area and spread out onto the skimmed surface. Thus, loss of high-flow confinement in the context of gravel bar skimming is a concern because there may be a reduction in stream power in the low-flow channel relative to an undisturbed or narrower channel. In addition, altered hydraulics at moderate to high flows can affect pool and riffle formation and maintenance. The extent to which this potential alteration of high-flow channel confinement translates into a measurable effect on channel processes is unknown, and especially difficult to separate from other natural and anthropogenic influences within the watershed. Hydraulic effects would be limited to that period of time when high flows overtop vertical offsets, which may be temporally and spatially variable by site. The potential effect begins to diminish once gravel recruitment onto the extraction surface commences and flows are once again confined by elevated bar surfaces.

The 2007 residual pool depths throughout the Lower Eel River survey reach ranged from 4.3 to 11.4 ft and were on average about 0.6 ft shallower than in 2006. However, 2007 residual pool depths were deeper than those in 2004 and 2005. The number of pools within the survey reach decreased from eight in 2004 to four in 2007. Some of this pool loss may be attributed to sediment deposition and channel migration. For example, the loss of the Drake pool could be the result of deposition of bedload carried by the large secondary channel that is present on the west side of Sandy Prairie Island. In addition, one of the Sandy Prairie pools became an alcove when the upstream bar developed, which pushed the thalweg to the west. Between 2005 and 2007, there appeared to be a decrease in adult-holding habitat. The decrease in adult-holding habitat could be attributed to the loss of pools in the Sandy Prairie and Drake reaches. Alcove habitat area showed relative consistency between 2005 and 2006, but was reduced during 2007. The loss of alcove habitat area during 2007 was caused by the downstream growth of the Worswick Bar, which pushed the alcove entrance below Fernbridge and outside of the survey reach (see the description of potential errors associated with habitat mapping and differing discharges in the Environmental Baseline Section of the BA).

The proposed narrow bar-skimming techniques are designed to maintain channel-forming processes and channel confinement during periods of low to moderate flow. No-entry buffers will be established on the upper one-third of the gravel bars, which when combined with the elevational offsets should maintain the "steering" effect, constrict the moderate stream stage, and help minimize the reduction in pool-forming scour. The use of narrow skims and alternative extraction techniques will also help maintain pool forming scour. Therefore, the degree of influence that the proposed extraction activities may have on channel adjustments and ability of the river to form and maintain pools is likely to be minor. Nonetheless, some effect from bar skimming, however minor, may occur and could contribute to some change in channel morphology and pool formation.

Floodplain pits, alcoves, and oxbows would be located well away from the low flow channel and would have minimal effect on pool formation. However, pool formation and maintenance could be adversely affected if the river is captured by either a floodplain pit or oxbow and the former low flow channel is abandoned. Therefore, these extraction methods may also entail some minimal risk of affecting localized pool formation and maintenance downstream of these features.

Trenches could have an effect on pool formation, especially if one captured the river thalweg. It is possible that sediment that might be routed downstream would be deposited in the trench and reduce deposition in a pool downstream. In addition, the trench itself could become a pool if it was not filled with sediment during the next winter's high flows. A shift in the thalweg could also result in modification of existing pool morphology either upstream or downstream. Therefore, trench extraction may result in localized beneficial or detrimental impacts to pool formation and maintenance.

7.2.4 Decrease in riparian vegetation

Riparian vegetation generally occupies areas immediately adjacent to that area of the channel subject to gravel scour and deposition on a relatively frequent basis, and within the meander belt or zone of contemporary and channel migration (Laird et al. 2000). Gradual changes over time, driven by peak flows have, throughout the years, resulted in channel migration and erosion of some established riparian vegetation. Colonization of floodplain areas, including gravel bars, occurs between significant flood years. Infrastructure improvements (e.g., bridges, rock slope protection) may change instream flows and patterns of colonization by riparian vegetation.

Instream skimming operations disturb surfaces of gravel bars and may inhibit or prevent colonization of riparian vegetation. However, extraction activities can also be designed to encourage riparian vegetation establishment. Where undisturbed gravel bars are more than 1 meter above low water, the bars may remain largely unvegetated because seedlings that become established there are likely to die from desiccation because of the depth to water table during the dry summer and fall (Kondolf 1994). Some areas that are too low may have adequate water, but may be scoured by the hydraulic force and bedload transport. By lowering the top of the bar away from the zone of scour, skimming may create shallower water table conditions in which willows can establish (Kondolf 1994).

Reynolds (in Downie et al. 2007) reported that there has been a loss of riparian vegetation in the Lower Eel River Basin due to agriculture and urban development. Information on riparian vegetation associated with the subject extraction sites is being assessed, but was not available for this BA. In general, the significance of extraction-related effects depends on the type of extraction, the size of disturbance area, type of channel being operated in, and location of the project within a river's planform.

Extraction activities may also encourage riparian vegetation establishment by creating seedbeds that are closer to groundwater level. Where undisturbed gravel bars are more than 3 ft above low-water, the bars may remain largely unvegetated because seedlings that become established there are likely to die from desiccation because the depth above the water table during dry summer and fall periods is too great (Kondolf 1998). Some areas that are low enough in elevation to have adequate water may be scoured by the hydraulic force and bedload transport. By lowering the top of the bar away from the zone of scour, skimming may create shallow water table conditions in which willows can establish (Kondolf 1998).

Riparian improvement extraction methods include wet and dry floodplain pits and high terrace skims. It is expected that silts and sands would deposit in these project areas and create high-quality seedbeds that would allow for riparian recolonization.

Several of the operations are proposing voluntary riparian vegetation enhancement. Opportunities exist for accelerating native riparian recolonization and successional development on higher elevation areas that are either currently devoid of vegetation or are occupied by non-native annual grasses and coyote brush. Extraction activities conducted in off-channel areas could be used to promote riparian development. Vegetation colonization might be fairly rapid in these off-channel areas because natural seed deposition would occur on the lower extracted elevations allowing seedling roots to reach the summer water table. Vegetation could also become established in buffer areas and in infrequently extracted locations located in areas outside of high-scouring flows.

7.2.5 Intrusion of fine sediment into spawning gravel

The potential for this effect is low due to lack of spawning habitat in the project area. However, because there is limited spawning habitat in the Van Duzen River, effect mechanisms are described below.

Removal of coarse particles on the surface of gravel bars during bar skimming operations can create post-skimmed surfaces that have a higher proportion of fine-grained materials than undisturbed bars. These surfaces are then inundated at lower flows than undisturbed bars and may release a portion of this finer material into the channel. Some of this material may eventually intrude into spawning gravel. However, the significance of this fine sediment contribution depends on the finished configuration of the extraction bars, rainfall patterns, hydrograph timing, and in-channel fine sediment storage and transport. Understanding the timing of the hydrograph, channel response, and sediment mobilization is critical to determining the potential impact on spawning substrate from fines transported off extraction surfaces.

Not all of the fine sediment remaining on skimmed bars is available for transport downstream. The first fall rains do not tend to create much runoff, as the dry ground absorbs much of the precipitation prior to becoming saturated. These early rains generally cause a significant portion of the exposed sand and fine sediment to infiltrate down into the post-extraction bar surface, leaving a layer of gravel. This gravel helps stabilize the post-extraction surface and reduces the transport of fines from the bar during subsequent runoff events that overtop the buffers.

Beschta and Jackson (1979) found that most intrusion of fine sediment into gravel occurred quickly, during the first 1520 minutes of experimental sediment transport events. Therefore, by the time there is enough discharge to inundate extraction surfaces and mobilize its sand and fine sediment deposits, any infiltration into spawning substrate, by fines stored in the low flow channel, is mostly complete.

Skimmed gravel bars with intact edge-of-water buffers (35-percent exceedance flow elevation, head-of-bar, and horizontal offsets) route highly turbid runoff around the post-extraction surfaces. As river stage increases, turbid water enters the bar surface either from the downstream daylighted area or as a thin sheet once the 35-percent exceedance flow elevation is overtopped. During this period, some of the fine sediment flushed from the pools and low flow channel margins is deposited on the bar surface due to the exceedingly low water velocities typically associated with backwaters and edgewaters. As flows increase, the upper bar areas begin to be overtopped, but the pool of water on the bar surface creates a velocity sink, decreasing the river's sediment transport ability at that location and causing more sediment to settle out. At this stage, the main channel continues to have high water velocity, which carries a tremendous amount of fine sediment. Eventually there may be sufficient flow over the extraction surface to entrain a significant amount of fines for transport downstream; however, these sediments would largely be those that were originally deposited on the rising limb of the hydrograph rather than fine sediment exposed by the extraction process. The turbidity and suspended sediment sampling data contained in Appendix B of the *2009 Batched Biological Assessment for Aggregate Extraction Operations in the Lower Mad River* (Stillwater Sciences 2009) appear to support the scenario described above.

Beschta and Jackson (1979) found that most sediment intrusion into gravel occurred quickly, during the first 15–20 minutes of experimental fine sediment input events. Therefore, by the time there is enough flow to enter extraction surfaces and mobilize its sand and fine sediment, the infiltration in spawning substrate by fines stored in the low-flow channel is mostly complete. The concentration of fines in spawning substrate can change as a female salmonid digs a redd. This is due to sand and fine sediment being flushed from the gravel by flowing water as the substrate is being worked and moved by the female salmonid.

Late fall/early winter storm events are likely to occur during the height of the Chinook spawning season, but spawning activity is not dependent on increased stormflow and may continue into January. Subsequent and more intense storms in December through February are likely to flush some of the fine sediment from spawning gravel when fry would begin to emerge from redds made in November. Therefore, while any fine sediment intrusion into redds may be ephemeral, the timing and duration is likely to be coincident with the incubation of embryos.

Fine sediment delivery from floodplain skims and oxbows to spawning habitat is likely to be very low. These extractions are located at higher elevations and well away from the low-flow channel and as such are subject to infrequent through flow.

Extraction-induced sediment delivery to redds is likely to be limited and occur after suspended sediment loads are already high and natural intrusion from low-flow channel storage has already taken place. In addition, early winter storms will likely flush redds of some fines prior to or during emergence of the fry, thereby further limiting adverse effects of extraction surface fines. The proposed extraction bars will have head-of-bar and edge-of-water buffers that will route low to moderate flows around the bars. These buffers will delay water from flowing over the extraction surfaces until after flows in the channel have mobilized the sand and fines already stored in pools and tributaries are flowing. The effect from extraction operations is likely to be minimal due to very limited spawning habitat in extraction reaches in addition to use of site-specific designs that protect habitat.

7.2.6 Increased water temperatures

Increasing water temperature in a downstream direction has been identified in streams and rivers throughout the world, except where the watercourses become influenced by coastal weather conditions (fog, wind, humidity) that can result in a cooling pattern, such as for some extraction sites in the Lower Eel River. The general tendency for incremental increases in temperature has been attributed to increasing channel width reducing the effectiveness of shading from riparian vegetation, increasing air temperature, increasing stream depth, and decreasing proportion of cooling groundwater inflow (Sullivan et al. 1990). As the bankfull channel widens, air temperature and solar radiation play an increasingly greater role on controlling water temperatures in the relatively narrow wetted channel. The greater water surface area absorbs more incoming short-wave solar radiation and water temperatures rise. Furthermore, incoming summer solar radiation that penetrates the relatively clear, shallow water in the riffles and flatwaters warms the substrate. The substrate releases long-wave radiation during the day and also helps maintain warm water temperatures into the evening hours. However, once the substrate has released its heat load, the wide, shallow portions of the wetted channel cool relatively rapidly.

Salmonids are essentially coldwater species and as such are sensitive to changes in water temperatures. Temperature increases can affect fish physiologically and behaviorally. As temperatures increase, fish will seek cooler environments (e.g., deep stratified pools, shade, and cool water seeps) to minimize physiological stress. However, intermittent flow conditions and/or physical or thermal barriers may block movement. Those fish unable to move to refugia are subjected to temperature-induced stress. As water temperatures increase, the amount of dissolved oxygen in the water decreases. A fish has to increase its breathing rate to compensate for the low oxygen. The increased breathing rate, in turn, increases the oxygen and energy demands of the fish. Lethal conditions result when fish metabolic demands exceed a stream's capacity to provide adequate oxygen.

As described in the Section 6.0 of this BA, stream temperature directly governs almost every aspect of the survival of Pacific salmonids (Berman 1998) including metabolism, food requirements, growth rates, timing of adult migration upstream, timing of juvenile migration downstream, sensitivity to disease, and direct lethal effects (Spence et al. 1996). The most sensitive period in the Lower Eel River is the summer, when stream temperatures are hottest and young salmonids would be rearing before migrating to the ocean. EPA (2007) summarized stream temperature data for the Lower Eel River using the maximum value of the 7-day running average (max7daat) of all recorded summer temperatures. EPA (2007) summarized the condition of streams for steelhead summer rearing based on the max7daat and compiled literature reviews. In addition, changes to shade and flow were examined as well as their modeled effects to stream temperatures. EPA (2007) reported that most stream monitoring locations along the main channel have summer stream temperatures categorized as stressful, which is a fairly wide range (19-24°C). Tributaries examined exhibited much wider variability. Larabee Creek had max7daats in the marginal to stressful ranges, while tributaries to Larabee Creek are generally in the good to fair categories. Other tributaries draining directly to the Lower Eel River have max7daats in the fair to marginal categories. The creeks draining to the Salt River showed the most variability among tributary subbasins, with max7daats ranging from 14.5-18°C (good to marginal). EPA also funded airborn Thermal Infrared Remote Sensing (TIR) and gathered one-time (August 12, 2005) surface water temperatures over the entire length of the main channel. From the South Fork (river mile 40) to the estuary, most of the main channel is 23-24°C, which is just below the lethal category. There are pockets of warmer and cooler temperatures throughout the main channel. The Lower Eel River TMDL concluded that "while current summer temperatures may be slightly higher than historical temperatures, even the historical temperatures were so warm (in the lethal range for salmonids) that returning to historical conditions would not improve conditions for salmonids." In addition, shade modeling on the main channel of the Lower Eel River indicated that "changes in riparian vegetation do not result in significant changes in shade, which would suggest that current temperatures are only incrementally warmer than historic temperatures, and in only a small number of stream segments." Thus, EPA concluded that a temperature TMDL is not needed for the main channel of the Lower Eel River. However, the EPA concluded that tributary streams do not meet water quality standards for temperature and established temperature TMDLs to achieve those standards. The EPA (2007) also concluded that neither shade nor flow alterations are altering natural stream temperatures in the range that adversely affects beneficial uses in the main channel. There is no canopy cover over the low-flow channel in the Lower Eel and Van Duzen rivers. This is because riparian vegetation is located in a relatively narrow band along the edge of the relatively wide active channels. Thus, ambient air temperatures have a greater influence on water temperatures. The project areas are located in the zone of marine influence and as such are subject to fog, low clouds, and cool air temperatures during summer months.

Depending on location, gravel bar skimming could create a less confined, wider channel. The greater water surface area absorbs more incoming short-wave solar radiation and water temperatures rise. However, the elevational and edge-of-water offsets would prevent water from spreading over the extraction surfaces during this time of year. Further, alternative extraction designs and narrow skims minimizes the potential for this effect.

The proposed effect minimization measures will require avoidance of native woody riparian vegetation within the extraction areas to the greatest extent practicable. The effect of extraction operations on water temperatures is likely to be insignificant based on EPA's (2007) findings that changes in riparian vegetation do not result in significant changes to shade on these rivers, however establishment of head-of-bar and edge-of-water buffers and the retention of riparian vegetation in extraction areas is proposed as impact minimization measures. Further, the effect of extraction operations on water temperatures is likely to be insignificant due to extraction surface elevational offsets, lack of riparian shade due to the wide channel, impact minimization measures that preserve vegetation, use of site-specific extraction designs and the cooling effect of the coastal marine layer.

7.2.7 Loss of velocity refugia

Geomorphic features and vegetative structure both provide hydraulic boundary roughness associated with areas of lower water velocity. These low-velocity zones provide refuge to juvenile salmonids during high-flow periods both within the low-flow channel and in areas periodically inundated by flood waters. Reduced opportunities to escape from high flows decreases overwinter survival. Favorable overwinter cover elements therefore represent an important feature allowing salmonids to complete their lifecycles.

The proposed project may reduce the hydraulic boundary roughness associated with geomorphic features by reducing bar height and the size of surface particles in extraction areas. The result could be an increase in water velocities during flood flows within the extraction area until the bars replenish. However, areas adjacent to the extraction surfaces will not be affected and will continue to provide suitable roughness and geomorphic diversity. In addition, all bars retain a one-third head-of-bar buffer, which provides velocity cover elements.

Methods for minimizing for this potential effect include leaving the upper one-third of the bar intact, creating riparian and LWD retention standards, and retaining the natural topographic and vegetative characteristics in non-extraction areas. The extraction options that include alcove, oxbow, and wet and dry pit extraction methods will also provide winter refugia habitat. Very little, if any, existing woody vegetation within that area will be removed by the proposed action. Large woody debris that deposits on the extraction surface will be placed within buffer areas to allow redistribution downstream at the next high flow. Any loss of refugia is small compared with what currently exists on the outer banks, non-extraction bars, head-of-bar buffers, and edge-of-water buffers.

The changes in high-flow refugia habitat will be limited in extent. Site-specific designs that create desirable habitat attributes such as alcoves improve winter habitat. Therefore, adverse changes to velocity refuge habitat and salmonid survivability are expected to be minor.

8 EFFECTS TO TIDEWATER GOBY

Coastal development projects that modify or destroy coastal brackish-water habitat are the major factor adversely affecting the tidewater goby. Coastal lagoons and marshes have been drained and reclaimed for agricultural, residential and industrial developments. Waterways have been dredged for navigation and harbors, or filled due to sedimentation, resulting in direct losses of wetland habitats as well as indirect losses due to associated changes in salinity. Gravel extraction operations are remote (the closest site is 5-7 miles upstream) from potential habitat that would be utilized by tidewater goby in the Eel River estuary. Potential impacts at each site and at the reach scale will be minimized through the proposed effects minimization measures and through constraining volumes by estimates of replenishment. LOP 2009 will have no effect on tidewater goby.

9 CUMULATIVE EFFECTS

Cumulative impacts to salmonid fisheries resources within the lower Eel and Van Duzen rivers have been occurring due to a variety of natural and anthropogenic reasons. Natural conditions that add incrementally to cumulative effects include the following:

- The Basin is very seismically active, resulting in extensive surface erosion, uplift and landslides.
- The highly erodible Franciscan geology produces prodigious quantities of sand and gravel that is transported by the high annual rainfall.
- Basin has undergone considerable sedimentation and deposition resulting in loss of estuary habitat, loss of spawning areas due to siltation, and intermittent and dry reaches during summer low flows (Downie et al. 2007).
- The Lower Eel River Basin is subject to large seasonal storm events resulting in flooding and stream channel modification.
- The Pacific Decadal Oscillation and El Niño events influence ocean productivity conditions and ultimately salmonid survival rates.
- Marine mammal predation can have a significant impact on salmonids during certain times of the year when the fish are concentrated near river mouths and are more susceptible to predation.

Historic and current land use has altered watershed processes and conditions:

- Agricultural lands now dominate what was historically forested riparian, and wetland habitat throughout the Lower Eel River Basin (Downie et al. 2007).
- There has been an overall change in species of grass for livestock grazing, which reduces root strength of prairie vegetation, increasing bank slumping and livestock has unrestricted access to streams in some areas causing bank erosion and riparian vegetation damage.
- Filling, draining and diking of streams has occurred.
- Streams near urban areas are subject to polluted storm runoff.
- Historic timber management activities has introduced sediment into area watercourses from accelerated areas of landslides and surface and stream channel erosion.
- Forest and ranch roads have been sediment sources in these watersheds. Roads are significant contributors of fine sediment that can affect spawning and rearing habitat quality. Road construction and use can alter the upslope hydrologic patterns by increasing peak flows through interception of ground and surface water runoff.

- Streambank erosion has caused loss of pasture, and the use of rock slope protection (riprap) in other areas inhibits the ability of the stream to meander and reduces riparian successional processes.

Rural and residential development has impacted salmonid populations and habitat in a number of ways:

- Development within and outside the watershed increases the demand for the aggregate and timber products necessary to support it. The extraction of these natural resource products inherently results in some level of impact to aquatic and terrestrial resources.

- The development of rural road systems for subdivisions decreases the ability of the ground to absorb rainfall. Compacted surface runoff and drainage via inboard ditches results in increased peak flows, which may increase downcutting in tributary streams and wash away spawning locations. Roads are also significant contributors of fine sediment that can affect spawning and rearing habitat quality.

- Sewage treatment plants have affected water quality for beneficial uses when out of compliance with permits, or when subject to flooding.

- Recreational sportfishing and poaching activities for adult salmonids result in direct injury or mortality to these fish during their ocean residency and spawning migration.

The Eel River estuary receives sediment loads, turbidity and other water quality stresses from the entire basin and thus is susceptible to cumulative watershed effects. Excessive sediment accumulations have been documented in the estuary (Downie et al. 2007) and water temperatures in the upper estuary are above desired levels. In the past, the estuary was more complex and diverse.

The removal of gravel from the project area, when combined with other land uses in the watershed, add incrementally to effects on salmonid habitat. In particular, cumulative impacts could occur if the total volume of gravel removed exceeds that needed for maintenance of channel form and function and downstream beneficial uses. Implementation of site-specific minimization measures and extraction designs and operational restrictions, implementation of physical monitoring and an adaptive management process as proposed, using a technical-based planning process that involves annual review and input from regulatory agencies and CHERT, will minimize or avoid significant adverse cumulative effects. Potential adverse effects of gravel extraction will be addressed through the annual review and design process and would prevent any potential long-term impacts from occurring prior to subsequent environmental assessments pursuant to possible future permits. Site-specific restorative extraction designs and other restoration actions will be used to provide benefits to salmonids, for example through creation of migration channels, expansion of alcoves and oxbows. Therefore, cumulative impacts to salmonids and their habitat are not expected to be significant.

10 DETERMINATION

Based on the above discussions, the proposed project may result in a minor level of direct, indirect, and cumulative effects to SONCC coho salmon, CC Chinook salmon and NC steelhead. Nearly all of the potential impacts mentioned above can be avoided or minimized through the proposed impact minimization measures. However, there is no way to ensure that injury or mortality to anadromous salmonids can be totally avoided. Therefore, the proposed project may affect, and is likely to adversely affect SONCC coho salmon, CC Chinook salmon and NC steelhead. The proposed project is not likely to result in the destruction or adverse modification of SONCC coho salmon, CC Chinook salmon and NC steelhead designated critical habitat.

11 EFH ASSESSMENT

All stream reaches in the project area are utilized by coho and Chinook salmon as migration corridors with limited rearing habitat, and one site provides one suitable spawning habitat unit. Thus, based on accessibility and utilization, all sites have EFH for coho and Chinook salmon. The BA's effects analysis considers effects to Pacific salmonid habitat in general, which is the functional equivalent to EFH. Thus, effects of the Project analyzed above in Section 7.0 of this BA apply to, and are identical for, EFH. Based on the above discussions, the proposed Project may result in a minor level of direct, indirect, and cumulative effects. Fish distribution information based on gravel extraction biological monitoring and other sources cited herein (refer to Section 6.0 of the BA) was used to analyze effects to salmonid habitat (refer to Section 7.0 of the BA) and to identify EFH for Chinook and coho salmon within the project area The proposed extraction design process and effects minimization measures contained in Section 4.0 of this BA are proposed as conservation recommendations to address reasonably foreseeable adverse effects to EFH. Further, restorative extraction designs are expected to enhance EFH for coho and Chinook salmon. Direct adverse effects on EFH will be limited to the temporary disturbance of high-flow aquatic habitat due to gravel mining and haul road construction. These effects are short-term (exposed bars are not utilized until inundated) and temporary until gravel is recruited on to the bar surfaces during subsequent high-flow events. Potential indirect effects to EFH may include reductions in channel substrate sizes, pool habitats, and riparian vegetation, as well as intrusion of fine sediment into spawning gravel (limited to a few sites in the project area) and loss of high flow refuge. Potential impacts can be avoided or minimized through the proposed impact minimization measures. However, there is no way to ensure that all impacts to EFH can be totally avoided. Therefore, the proposed Project is likely to adversely affect coho and Chinook salmon EFH.

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APPENDIX A -DECISION MATRIX

Table A-1. Decision Matrix for aggregate extraction sites in Humboldt County.

	MAINTAINING RIFFLE/POOLS (HOLD/REAR)	MINIMIZE SPAWNING EFFECTS	MINIMIZE ADULT STRANDING	MINIMIZE VEG. EFFECTS	MAINTAIN MIGRATION PASSAGE	MAINTAIN CHANNEL FORM FLO	MINIMIZE EDGE-H20 EFFECTS	WIDTH TO DEPTH	COST TO EXTR.	REPLENISH. POTENTIAL	V
TRADITIONAL SKIM											
TERRACE PIT (DRY)											
TERRACE PIT (WET)											
SECONDARY CHANNEL SKIM											
OXBOW EXTRACTION											
ALCOVE EXTRACTION											
PARALLEL TRENCHING											
HORSESHOE EXTRACTION											
PERPENDICULAR BAR SLOTS											
NARROW SKIM											
HIGH TERRACE SKIM											
INBOARD SKIM											

KEY:

5 - EXCELLENT
4 – ABOVE AVERAGE
3 – AVERAGE
2 – BELOW AVERAGE
1 – POOR

EXHIBIT NO. D
APPLICATION NOS.
1-09-005 (Eureka Ready Mix) 1-09-006 (Eureka Ready Mix) 1-09-011 (Hansen) 1-09-022 (Mercer-Fraser Co.)
NOAA FISHERIES PRELIMINARY CONCLUSIONS & DRAFT TERMS & CONDITIONS

PRELIMINARY CONCLUSIONS

After reviewing the best available scientific and commercial information, the current status of SONCC coho salmon, CC Chinook salmon, NC steelhead, and their designated critical habitats, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the biological opinion of NMFS that gravel mining under LOP 2009 for the five-year permit period, ending December 31, 2013, is not likely to jeopardize the continued existence of threatened SONCC coho salmon, threatened NC steelhead, and threatened CC Chinook salmon, and is not likely to adversely modify or destroy SONCC coho salmon, CC Chinook salmon or NC steelhead designated critical habitat.

PRELIMINARY MEASURES TO MINIMIZE THE AMOUNT OR EXTENT OF TAKE

Take is defined as to harass, harm, pursue, hunt, shoot, kill, trap, capture or collect, or attempt to engage in any such conduct [ESA section 3(18)]. NMFS further defines "harm" as "an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding or sheltering" (November 8, 1999, 64 FR 60727). Incidental take is any take of listed animal species that results from, but is not the purpose of, carrying out an otherwise lawful activity. Under the terms of sections 7(b)(4) and 7(o)(2)of the ESA, taking that is incidental to and not the purpose of the agency action is not considered a prohibited taking, provided that such taking is in compliance with the terms and conditions of this ITS.

The measures described below are non-discretionary and must be undertaken by the Corps so that they become binding conditions of any grant or permit issued to an applicant, as appropriate, for the exemption in section 7(o)(2) to apply. If the Corps: (1) fails to assume and implement the measures or fails to require the applicant to adhere to the measures through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Corps must report the progress of the action and its impact on the species to NMFS as specified in the ITS [50 CFR § 402.14(i)(3)].

A. Amount or Extent of the Take

NMFS anticipates that annual gravel mining operations under LOP 2009 over the five-year permit term will result in take of SONCC coho salmon, CC Chinook salmon and NC steelhead. This will primarily be in the form of harm to salmonids by impairing essential behavior patterns as a result of reductions in the quality or quantity of their habitat. NMFS anticipates that the number of individuals harmed will be low. NMFS anticipates that a small number of juveniles may be killed, injured, or harassed during heavy equipment use while constructing and removing temporary stream channel crossings or during instream trenching. In addition, NMFS expects that adults and juveniles may become stranded in trenches and wetland pits. Although, the trenches will be designed to avoid stranding, unexpected river changes may cause stranding of fish with mortality before fish rescue operations commence. While we cannot reliably estimate the number of individuals that may become stranded in a given year, NFMS expects that on the order of five adult and 10 juvenile salmonids (in any combination of the three species) may become stranded in trenches.

The take of the listed salmonids above will be difficult to detect because finding a dead or injured salmonid is unlikely as the species occurs in habitat that makes such detection difficult. The impacts of gravel mining under LOP 2009 will result in changes to the quality and quantity of salmonid habitat. These changes in the quantity and quality of salmonid habitat are expected to correspond to injury to, or reductions in, survival of salmonids by interfering with essential behaviors such as spawning, rearing, feeding, migrating, and sheltering. Because the expected impacts to salmonid habitat correspond with these impaired behavior patterns, NMFS is describing the amount or extent of take anticipated from the proposed action in terms of limitations on habitat impacts. NMFS expects that physical habitat impacts will be: (1) limited to the areas described in Table 1 below, (2) compliant with the project design features of LOP 2009 and these measures, and (3) within the expected effects of the proposed action as described in this Opinion. Critical project design features in LOP 2009 include, implementing a head-of-bar buffer, giving preference to alternative extraction techniques on the South Fork Eel River, Lower Eel River and Van Duzen River, and limiting the type of skimming on the lower 2 miles of the Van Duzen River to narrow skims with widths of no more than 90 feet as measured across the top of the extraction. We expect more frequent use of alcoves, trenches and narrow skims in these reaches in lieu of traditional skimming, and that a fish migration channel will be designed and implemented in the Van Duzen River delta at the Leland Rock site and the Hauck Bar site. Where traditional skimming is used, it will occur in more confined settings (*e.g.*, bedrock confined areas in the South Fork Eel River, as described in this Opinion) or be smaller in extent and be located away from the low-flow channel and not adjacent to spawning habitat.

Table 1. For each river, gravel bar sites are listed from the most upstream site to the most downstream site, and are not necessarily contiguous. The approximate length of each site is measured along the center-line of the stream, adjacent to each bar. Data was provided by Humboldt County Planning Division (April 26, 2000), except for the Cook's Valley site and the Fort Seward site where data was provided by the Corps (June 27, 2000), and the McKnight site, where data was provided by the Corps (June 25, 2001).

Stream	Length (ft)	Gravel Bar Site Name
Middle Eel River	3646	Vroman and Maynard Bars
	4160	Truck Shop and Scotia Bars
	8340	Dinner Creek and Three Mile Bars
	8398	Elinor Bar
	4844	Holmes Bar
	7900	Dyerville, South Fork and Bowlby Bars

Stream	Length (ft)	Gravel Bar Site Name
Lower Eel River	1117	Hansen Bar
	1754	Upper Sandy Prairie Bar
	3507	Canevari - Sandy Prairie Bar
	2160	Lower Sandy Prairie Bar
	3413	Warswick Bar
	2807	Singley Bar (downstream of Fernbridge)
South Fork Eel River	809	Cook's Valley (at the Humboldt/Mendocino County line)
	1218	Tooby Park/Garberville
	2097	Randall Sand and Gravel/Tooby Park/Garberville
	1854	Wallen/Johnson Redway Bar (near the town of Redway)
Lower Van Duzen River	2304	Pacific Lumber Bar (near the town of Carlotta)
	661	Thomas Bess Ranch
	15506	Van Duzen Ranch
	1890	Leland Rock Gravel Bars
Lower Trinity River	2000	McKnight Bar (near the town of Salyer)
	4497	Big Rock (near the town of Willow Creek)
	834	Klamath River Aggregate (near the town of Hoopa)
North Fork Mattole	4909	Cook Bar (at confluence with mainstem Mattole River)
Upper-Mid Eel	2000	Satterlee Bar near Fort Seward, at approximate river mile 68
Bear River	975	Branstetter Bar

C. Reasonable and Prudent Measures

NMFS considers that the following reasonable and prudent measures are necessary and appropriate to minimize take of SONCC coho salmon, CC Chinook salmon and NC steelhead.

The Corps shall:

1. Ensure that the monitoring necessary to track changes to salmonid habitat quality and quantity in the vicinity of gravel extraction sites is implemented.

2. Ensure that the location of wetland pits are located above the 2-year flood frequency elevation.

D. Terms and Conditions

The Corps, and its permittees, must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

RPM 1. Ensure that the monitoring necessary to track changes to salmonid habitat quality and quantity in the vicinity of gravel extraction sites is implemented.

a. The Corps will ensure that all required monitoring is completed annually. This requirement includes both the biological monitoring that is described in the biological monitoring plan dated September 2005 and added to LOP 2009 on July 10, 2009, as Appendix D, and the physical monitoring that is described in LOP 2009 Appendix C. Completion of required monitoring will be documented by development of a tracking system by the Corps that clearly shows that all applicants meet all monitoring requirements annually.

b. The Corps will provide a cross section data protocol and reporting format that NMFS and CHERT have reviewed to ensure that all data is provided in a consistent format. If modifications to the protocol are necessary, proposals for the modifications will be circulated to CHERT, NMFS and the permitees for review and comment prior to approval and implementation.

c. Ensure that the checklists included in LOP 2009 are completed annually.

d. Ensure that monitoring reports are provided to NMFS each year by January 15. Reports shall be submitted to:

Irma Lagomarsino
Arcata Area Office Supervisor
National Marine Fisheries Service
1655 Heindon Road
Arcata, CA 95521

RPM 2. Ensure that the location of wetland pits are above the 2-year flood elevation in order to reduce the potential for salmonid stranding.

a. Pre-extraction plans will provide either an air photo showing observed edge of water of the previous winter flood flow with a frequency above the 2-year flood and below the proposed wetland pit location or a HEC-RAS model will be provided that deomonstrates the location of wetland pits are above the 2-year flood level.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802- 4213

AUG 13 2004

151422SWR04AR9101: SF

Mr. Calvin Fong
Chief, Regulatory Branch
Department of the Army, Corps of Engineers
333 Market Street
San Francisco, California 94105-2197

Dear Mr. Fong:

This letter transmits the National Marine Fisheries Service's (NOAA Fisheries) biological opinion (Opinion) based on our review of Letter of Permission procedure 2004-1 (LOP 2004-1) for proposed gravel extraction operations in rivers of Humboldt County, California Project, and its effects on Southern Oregon/Northern California Coast (SONCC) coho salmon *(Oncorhynchus kisutch)* and its designated critical habitat, California Coastal (CC) Chinook salmon (*O. tshawytscha*) and Northern California (NC) steelhead (*O. mykiss*), pursuant to section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq*.). This Opinion (Enclosure 1) is based on the best available information provided to NOAA Fisheries by the U.S. Department of the Army, Corps of Engineers (file number 284270N), and other relevant published studies and unpublished information.

After reviewing the best available scientific and commercial information, the current status of SONCC coho salmon, CC Chinook salmon and NC steelhead, the environmental baseline for the action area, the anticipated effects of the Project, and cumulative effects, it is NOAA Fisheries' biological opinion that LOP 2004-1, as proposed, is not likely to jeopardize the continued existence of these three species or result in the destruction or adverse modification of SONCC coho salmon critical habitat.

Essential Fish Habitat Consultation

In addition, recent amendments to the Magnuson-Stevens Fishery Conservation and Management Act (MSA) require Federal agencies to consult with NOAA Fisheries regarding any action or proposed action that may adversely affect essential fish habitat (EFH) for Federally managed fish species. NOAA Fisheries evaluated the Project for potential adverse effects to EFH pursuant to section 305(b)(2) of the MSA.

EXHIBIT NO. E
APPLICATION NOS.
1-09-005 (Eureka Ready Mix)
1-09-006 (Eureka Ready Mix)
1-09-011 (Hansen)
1-09-022 (Mercer-Fraser Co.)
8/13/04 NOAA FISHERIES
BIOLOGICAL OPINION (EXCERPTS)

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CALIFORNIA
COASTAL COMMISSION

The action area of the Project includes areas identified as EFH for various life stages of Chinook salmon and coho salmon, species that are Federally-managed under the Pacific Coast Salmon Fishery Management Plan. After reviewing the effects of the Project, NOAA Fisheries has determined that the proposed action may adversely affect coho salmon and Chinook salmon EFH. However, NOAA Fisheries has no conservation measures to recommend over what is currently proposed. Conservation recommendations provided in past gravel mining consultations were incorporated into the proposed action. For more information on EFH, see our website at http://swr.nmfs.noaa.gov.

If you have any questions regarding these consultations, please contact Mr. Sam Flanagan at (707) 825-5173.

Sincerely,

Rodney R McInnis

Rodney R. McInnis
Regional Administrator

Enclosure

cc: Mr. Kelly Reid, Corps of Engineer

Enclosure

Endangered Species Act – Section 7 Consultation

BIOLOGICAL OPINION

ACTION AGENCY:	U.S. Army Corps of Engineers, San Francisco District
ACTIVITY:	Letter of Permission Procedure 2004-1 for Gravel Mining and Excavation Activities within Humboldt County
CONSULTATION CONDUCTED BY:	Southwest Region, National Marine Fisheries Service
FILE NUMBER:	151422SWR04AR9101
DATE ISSUED:	AUG 1 3 2004

I. BACKGROUND AND CONSULTATION HISTORY

A. Consultations on Letter of Permission 96-1

Gravel mining activities in Humboldt County were formerly permitted through the Letter of Permission (LOP) 96-1. NOAA Fisheries issued a July 17, 1997, biological opinion (1997 Opinion) on the U.S. Army Corps of Engineers' (Corps) *Letter of Permission Procedure for Gravel Mining and Excavation Activities within Humboldt County, California* (LOP 96-1). The 1997 Opinion determined that implementation of LOP 96-1 was not likely to jeopardize the continued existence of the threatened Southern Oregon/Northern California Coast (SONCC) coho salmon *(Oncorhynchus kisutch)* Evolutionarily Significant Unit[1] (ESU).

Subsequent to issuance of the 1997 Opinion, critical habitat was designated for the SONCC coho salmon ESU (May 5, 1999, 64 FR 24049), and the California Coastal (CC) Chinook salmon (*O. tshawytscha*) ESU was listed as threatened (September 16, 1999, 64 FR 50394), and critical habitat was designated for CC Chinook salmon (February 16, 2000, 65 FR 7764). In addition, the Northern California (NC) steelhead (*O. mykiss*) ESU was proposed for listing as threatened (February 11, 2000, 65 FR 6960). Reinitiation of consultation was required due to the listing of a new species and the designation of critical habitat that may be affected by the identified action [50 CFR § 402.16(d)]. NOAA Fisheries, Southwest Region, requested that the Corps reinitiate formal consultation for LOP 96-1 [July 19, 1999 letter, from R. McInnis, National Marine Fisheries Service (NOAA Fisheries), to Lt. Col. Grass, Corps]. Subsequently, NOAA Fisheries received a request for Endangered Species Act (ESA) section 7 conferencing and consultation from the Corps on LOP 96-1 (July 23, 1999, letter and information packet, from C. Fong, Corps, to W. Hogarth, NOAA Fisheries). This request for reinitiation was based on designation of

[1]For the purposes of conservation under the Endangered Species Act, an Evolutionarily Significant Unit (ESU) is a distinct population segment that is substantially reproductively isolated from other specific population units and represents an important component in the evolutionary legacy of the species (Waples 1991).

critical habitat and the listing of additional salmonid species, and resulted in the May 1, 2000, conference and biological opinion (2000 Opinion).

The 2000 Opinion contains an analysis of the effects of LOP 96-1 from May 1, 2000, through May 1, 2001. The 2000 Opinion determined that continued implementation of LOP 96-1 for one additional year was not likely to jeopardize the continued existence of threatened SONCC coho salmon, CC Chinook salmon, or result in the destruction or adverse modification of designated critical habitat for SONCC coho salmon or CC Chinook salmon.

The Corps then requested (June 27, 2000, letter from C. Fong, Corps, to R. McInnis, NOAA Fisheries) that the 2000 Opinion be amended to add an additional mining site, to better describe an existing mining site, and to clarify terms and conditions of the Incidental Take Statement (ITS). The 2000 Opinion was amended (September 6, 2000, letter from R. Lent, NOAA Fisheries, to C. Fong, Corps) and included an amended ITS.

Although NOAA Fisheries expected that the Corps would issue a new LOP procedure for gravel mining activities, on June 29, 2001, the Corps extended the expiration date of LOP 96-1 to October 31, 2001, and requested an amendment to the duration of the 2000 Opinion. As described in LOP 96-1, the Corps included the option of extending LOP authorization for up to one year past the original August 19, 2001, expiration date. The Corps utilized the extension option in order to provide continuity to the permitting process through the 2001 gravel mining season. NOAA Fisheries responded to the first extension of LOP 96-1 with our second amendment (dated July 5, 2001) to the 2000 Opinion. Our second amendment analyzed the extended duration of the proposed action for one additional mining season, the addition of two mining sites to the action area, and adopted the conference opinion as the biological opinion for NC steelhead (the NC steelhead ESU was listed as threatened on June 7, 2000, 65 FR 36074).

NOAA Fisheries worked with the Corps, other agencies, and Humboldt County gravel operators and their consultants during the winter of 2001-2002 on a replacement LOP procedure (draft LOP 2002-1) for 2002 through 2007. On April 2, 2002, the Corps issued a Public Notice for the draft LOP 2002-1 for gravel mining activities in Humboldt County. LOP 2002-1 was intended to supercede LOP 96-1, which had been used by the Corps to authorize gravel mining activities between 1996 and 2001. The public comment period for the draft LOP 2002-1 ended May 2, 2002, leaving little time to resolve issues prior to the 2002 mining season. Following discussions with the Humboldt County gravel operators, NOAA Fisheries, and the U.S. Fish and Wildlife Service (USFWS), the Corps decided to further extend LOP 96-1 by one year to December 31, 2002 (Public Notice File Number 22152N, June 12, 2002) in order to provide an authorization process for the 2002 gravel mining season, and to allow additional time to resolve issues regarding the draft LOP 2002-1. This extension request also included a request to eliminate the Security East gravel bar site on the Trinity River. NOAA Fisheries responded to the second extension of LOP 96-1 with our third amendment (dated August 5, 2002,) to the 2000 Opinion. Our third amendment utilized additional information to analyze the continued implementation of LOP 96-1 for one additional operating season, and the potential for effects to listed salmonids that were not analyzed in the second amendment to the 2000 Opinion. Additionally, there were changes to the status of the species and environmental baseline since the second amendment, which were also described in the third amendment.

B. Consultation on LOP 2003-1

On November 26, 2002, the Corps issued a Public Notice for the proposed LOP 2003-1. The Corps worked informally with NOAA Fisheries prior to the issuance of the Public Notice to incorporate some of our technical assistance recommendations into the LOP (*e.g.,* 35% exceedence flow minimum skim floor recommendation). NOAA Fisheries formally commented on the Public Notice (January 8, 2003, letter from I. Lagomarsino, NOAA Fisheries, to K. Reid, Corps). However, the Corps did not incorporate these comments in a subsequent draft of the LOP, but rather requested formal consultation on the November 26, 2002, draft of the proposed LOP 2003-1 (December 20, 2002, letter and referenced information packet, from C. Fong, Corps, to R. McInnis, NOAA Fisheries).

On December 2, 2002, the Corps issued the Public Notice for Granite Construction's individual permit application. Rather than seeking coverage under the LOP procedure, Granite Construction opted to seek an individual permit for their extraction activities on the Mad River. Technical assistance from NOAA Fisheries was not requested during formulation of the proposed action. NOAA Fisheries formally commented on the Public Notice (January 17, 2003, letter from I. Lagomarsino, NOAA Fisheries, to K. Reid, Corps) and suggested a meeting with the Corps and the applicant to discuss our comments and concerns regarding its proposed action. Neither Granite Construction, nor the Corps requested a meeting to discuss our comments on Granite Construction's proposed action, but rather, Granite Construction responded to our comments by letter, dated February 10, 2003, and did not alter its proposed action in response to our comments. The Corps requested formal consultation on Granite Construction's application for a Clean Water Act (CWA) section 404 permit authorizing gravel extraction and related activities in the Mad River, Humboldt County, California (January 30, 2003, letter and referenced information packet, from C. Fong, Corps, to R. McInnis, NOAA Fisheries) based on the December 2, 2002 Public Notice.

Based on the best available information at the time, and after reviewing the current status of the listed salmonids, environmental baseline, the effects of the proposed action and cumulative effects, on June 11, 2003, NOAA Fisheries issued a "batched" draft biological opinion (June 2003 draft Opinion) that activities under proposed LOP 2003-1 and Granite Construction's permit over the five-year periods, as proposed, were individually and cumulatively likely to jeopardize the continued existence of SONCC coho salmon, CC Chinook salmon, and NC steelhead, and would adversely modify designated critical habitat for SONCC coho salmon. The June 2003 draft Opinion also included a draft Reasonable and Prudent Alternative (RPA). The draft RPA was included with the June 2003 draft Opinion as a starting point for discussions with the Corps and the applicants to cooperatively develop a final RPA that would meet all statutory and regulatory requirements of RPAs.

Subsequent to release of the June 2003 draft Opinion, the Corps and NOAA Fisheries hosted two meetings on June 24, 2003, one meeting with Granite Construction and one meeting with the applicants under the proposed LOP 2003-1. During these meetings, NOAA Fisheries presented the analysis and findings of the June 2003 draft Opinion and discussed the elements of the draft RPA. NOAA Fisheries also received verbal feedback on the draft RPA from the Corps and the applicants, and asked the Corps and the applicants to provide ideas on other potential RPAs. During these meetings, the Corps set July 7, 2003, as the deadline for receiving comments on the

June 2003 draft Opinion from the applicants, and committed to providing its own comments to NOAA Fisheries, along with those of the applicants, by July 11, 2003. NOAA Fisheries received a few comments from applicants, or their consultants, by July 11, 2003, but did not receive the Corps' comments or those of most of the applicants at that time.

The next meeting with the Corps and the applicants was held on July 24, 2003, in response to a request from some of the applicants to extend the comment period, and to provide a forum for discussion on the "state of the science" of the Mad River. At the July 24, 2003, meeting, the applicants expressed that their primary concern was that an analysis had not been completed of the cross-sections that they had been required to collect during LOP 96-1 and as part of the Humboldt County permitting program, particularly for the Mad River. NOAA Fisheries explained that it had unsuccessfully attempted to obtain the entire electronic cross-sectional record many times over the past two years. Specifically, NOAA Fisheries staff had requested on numerous occasions that the County of Humboldt Extraction Review Team (CHERT, a team of riverine scientists composed of hydrologists, geomorphologists and a fisheries biologist, and whose review and recommendation are also required as part of the County and State regulatory processes), provide the entire electronic cross-section data set. Additionally, as a term and condition of the third amendment to the 2000 Opinion, NOAA Fisheries had required that the Corps provide the electronic cross-sectional data for our analysis. The Corps provided us with the electronic cross-sections that it had in its possession, approximately 20% of the electronic cross-sections collected under LOP 96-1. Unable to obtain the entire electronic data set, NOAA Fisheries proceeded with consultation on LOP 2003-1 and Granite Construction's permit with the best information available at the time. Although we received the raw, electronic data set on July 25, 2003, it was not in a format suitable for analysis and required substantial work to get the data into a format for appropriate analysis.

NOAA Fisheries, Humboldt County, the Corps and the Mad River gravel miners agreed that an analysis of the entire electronic cross section data should be conducted to provide better insight on the potential influence of the change in management of gravel mining activities on the Mad River after the advent of CHERT in 1992. As stated in the Corps' LOP 96-1, a study plan for the electronic cross-section data will be developed by Humboldt County as part of the update to the Mad River Programmatic Environmental Impact Review. As the study will be conducted under the California Environmental Quality Act, all stakeholders will be involved in the development and review of the study plan. The Humboldt County study of the electronic cross-section data will help inform the proposed LOP 2004-1, other applications to mine on the Mad River, and the associated consultations for mining season 2004 and beyond.

Also at the July 24, 2003, meeting, some of the applicants requested another two-week extension of the comment period on the June 2003 draft Opinion. Recognizing that the 2003 mining season was rapidly approaching, and that the study of the electronic cross-sections would take approximately 6 to 8 months to complete, NOAA Fisheries worked with Humboldt County and the Corps to extend LOP 96-1 for one additional year, with modifications to the proposed action that reduce the effects to threatened salmonid species and their critical habitat. This modification and extension of LOP 96-1 provided additional time for the cross-section study to be completed. The completion of this modified LOP 96-1 was through a re-initiation of the consultation on LOP 96-1 following the issuance of the draft jeopardy biological opinion on LOP 2003-1.

C. Consultation on the modified LOP 96-1

On August 15, 2003, the National Marine Fisheries Service (NOAA Fisheries) received a request for reinitiation of ESA section 7 consultation from the Corps on the modified LOP procedure for gravel mining (modified LOP 96-1) in the streams and rivers of Humboldt County, California (August 15, 2003 letter from C. Fong, Corps, to R. McInnis, NOAA Fisheries). The request for reinitiation of consultation concerned the effects of the modified LOP 96-1 on threatened SONCC coho salmon and its designated critical habitat, CC Chinook salmon, and NC steelhead during 2003.

In its August 15, 2003, letter, the Corps also withdrew its request for batched consultation on LOP 2003-1 and Granite Construction's individual permit. Instead of completing consultation on LOP 2003-1 and Granite Construction's individual permit, the Corps chose to modify LOP 96-1 to provide additional protection to threatened species of salmon and steelhead, and to extend the modified LOP 96-1 until December 31, 2003. In its request for reinitiation of consultation, the Corps stated that the modification and extension of LOP 96-1 "will provide the agencies and the gravel operators additional time to resolve issues associated with a proposed replacement LOP procedure for Humboldt County." On September 3, 2003, NOAA Fisheries issued a biological opinion that determined that implementation of the modified LOP 96-1 was not likely to jeopardize the continued existence of SONCC coho salmon, CC Chinook salmon or NC steelhead. Furthermore, implementation of modified LOP 96-1 was determined to not destroy or adversely modify designated critical habitat for SONCC coho salmon.

D. Consultation on the Current Proposed Action – LOP 2004-1

During the winter of 2003/2004, the Corps and NOAA Fisheries met several times to discuss the LOP and NOAA Fisheries provided comments on early drafts of the document. On May 3, 2004, NOAA Fisheries received a request for formal consultation on LOP 2004-1 (April 28, 2004, letter from C. Fong, Corps to R. McInnis, NOAA Fisheries). On June 22, 2004, NOAA Fisheries met with CHERT, the Corps and several of the Mad River applicants to discuss the draft results of the Mad River cross-section analysis. The results of this analysis are discussed in this Opinion. Following this meeting, the Corps requested the proposed action be modified to change the total extraction limit on the Mad River from 150,000 cubic yards per year (cy/yr) to 175,000 cy/yr (July 2, 2004, letter from C. Fong, Corps, to I. Lagomarsino, NOAA Fisheries). This revised volume is analyzed in the *Effects of the Action* section of this Opinion.

II. DESCRIPTION OF THE PROPOSED ACTION

LOP 2004-1 is for a five-year period, and will expire on December 31, 2008. The project locations of the proposed action are shown in Figure 1.

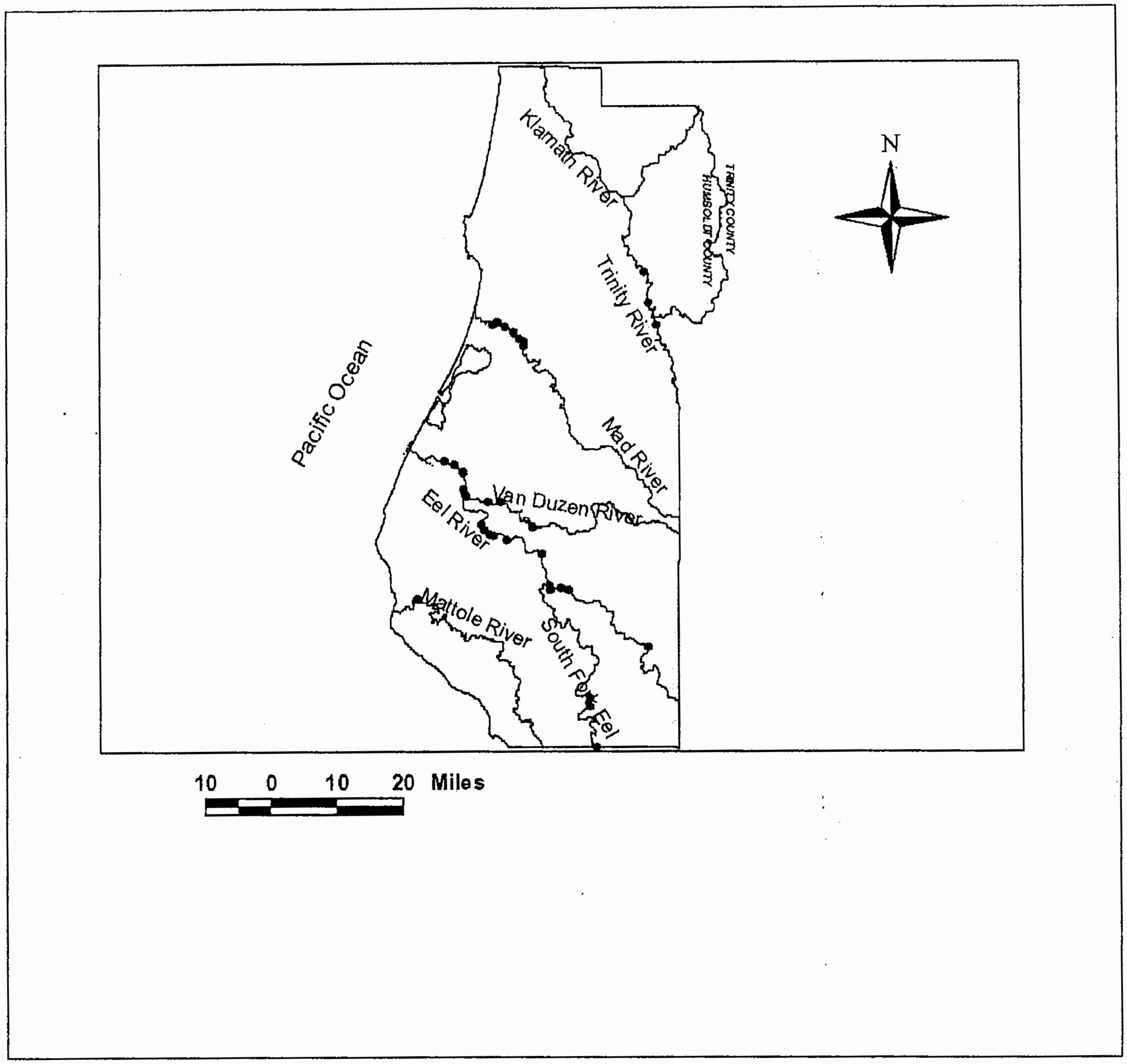

Figure 1. Locations of gravel mining sites in Humboldt County. With the exception of several sites on the Mad River and one site on the lower Eel River (Hauck Bar), all sites depicted are proposed for extraction under LOP 2004-1.

As described in LOP 2004-1, the purpose of the LOP is to streamline section 404 of the CWA and section 10 of the Rivers and Harbors Act of 1899 authorizations for gravel mining and extraction activities in Humboldt County that do not pose significant adverse individual or cumulative impacts.

LOP 2004-1 will contain limitations intended to protect the environment and natural and cultural resources. In cases where the District Engineer (DE) considers it necessary, applications will be required for individual permits.

A. Scope of Work

Work authorized by LOP or modification (Mod) under this procedure is limited to discharges of dredged or fill material associated with gravel mining activities in waters, including navigable waters, of the United States, within Humboldt County, California and also any projects that straddle county lines. Activities that may be authorized by LOP 2004-1 include, but are not limited to, sand and gravel mining and work associated with these activities, such as temporary stock piling of gravel in a dry section of the stream and construction of temporary coffer dams and road crossings. Impacts to waters of the United States, including wetlands, will be avoided or minimized through the use of practicable alternatives. Reasonable compensation for unavoidable adverse impacts to waters of the United States will be required. Work that would have unmitigatable adverse impacts on the aquatic environment or would cause a substantial reduction in the extent of waters of the United States will not be authorized by LOP 2004-1. The activities authorized under LOP 2004-1 procedure will be part of a single and complete project.

B. Evaluation Procedures

Applicants will submit complete applications, after consulting with CHERT, to the Corps and NOAA Fisheries for review to determine whether the excavation activity qualifies under LOP 2004-1. CHERT will help identify areas of concern and locations for cross-section monitoring. If the activity qualifies under LOP 2004-1, it will be authorized for the duration of LOP 2004-1. However, each permittee must also submit yearly monitoring data regarding extraction amounts, cross-sectional information, biological monitoring and aerial photos.

The CHERT review serves as an independent scientific review and recommendation process. The Corps makes the final determination on whether to authorize a permit under LOP 2004-1. Due to annual changes in stream flows, and sediment transport and deposition within stream channels, LOP 2004-1 creates a framework, describing project design features, mitigation and monitoring, and requiring the applicants to consult with CHERT prior to submitting applications to the Corps. CHERT recommends extraction quantities and site-specific minimization measures on an annual basis. The goal of the independent scientific review provided by CHERT is to protect river form and function, while recommending extraction quantities that are within the estimated long-term average annual sustained yield amount for a specific river. Because of the variability in flood magnitudes and sediment load from year to year, CHERT has used a range of estimates for sustained yield.

In summary, CHERT provides the annual site specific recommendations for extraction quantities, site specific minimization measures, and mitigation, that tier to the general project design features and mitigation measures as described in LOP 2004-1. LOP 2004-1 requires this link to the independent scientific review process for assessing annual changes in site conditions in order to reduce impacts to listed salmonids and designated critical habitat.

The Corps conducts a public interest evaluation and coordination meeting with the Environmental Protection Agency (EPA), NOAA Fisheries, USFWS, California Coastal Commission (CCC), California Department of Fish and Game (CDFG), and the California Regional Water Quality Control Board (RWQCB) to review new applications and yearly compliance data of previously authorized activities.

Should an agency or member of the public object to continuing an activity under an existing authorization, based on evidence of non-compliance or evidence of more than minimal impacts, the Corps may suspend and/or revoke the existing authorization and require an individual permit unless the permittee can demonstrate compliance with LOP 2004-1, or reduce the future impacts of its operations to minimal impacts, and mitigate for past non-compliance.

The general time line for annual activities under LOP 2004-1 is stated below. Biological monitoring dates are listed in Appendix D of LOP 2004-1, which is incorporated here by reference.

FEB 1	New Class A and all Class B projects must submit notification to the Corps and NOAA Fisheries with environmental documentation.
SPRING	Gravel Week: the regulating agencies meet to review permit applications and compliance. No specific date is established for the annual meeting.
MAY 15	Gravel extraction plans along with CHERT recommendations must be submitted to the Corps and NOAA Fisheries, unless late season rains prevent data gathering. In that case, the Corps will establish new deadlines. Annual extraction plans for continuing Class B permits are due to the Corps and NOAA Fisheries.
JUN 1	Earliest extraction.
JUN 30	Earliest construction of temporary channel crossings.
SEP 15	Last day that channel crossings can be removed from the Mad River.
SEP 20- OCT 7	Post extraction orthographic aerial photos to be taken.
OCT 1	Gravel stockpiled on river bars must be removed on a daily basis after October 1. Each day, thereafter, extraction sites shall be groomed and graded to drain freely at the end of each working day.
OCT 15	All channel crossings must be removed. Regrading must be completed for all gravel bars. All gravel extraction ceases on river bars, unless an approved river flow monitoring plan is enacted and a time extension granted.
NOV 1- FEB 28	Plan mitigation areas. Post-extraction aerial photos are delivered to the Corps, CHERT, and NOAA Fisheries.
DEC 1	Post-extraction cross section data and biological monitoring data must be submitted to the Corps, NOAA Fisheries and CHERT except biological monitoring data gathered in November and December.

DEC 31 Mitigation monitoring reports due to the Corps, NOAA Fisheries, and CHERT. Biological monitoring data gathered in November and/or December submitted to Corps and CHERT.

C. Gravel Extraction Limitations

Projects authorized under LOP 2004-1 are subject to the limitations described below. The limitations on gravel extraction for LOP 2004-1 have been expanded relative to those in the original LOP 96-1 to reflect new information and concerns. They also require closer coordination between the Corps, NOAA Fisheries, and CHERT in project review and approval. The Corps has the right to add or modify limitations as appropriate. Modifications to excavation procedures may be made to increase fisheries and wildlife habitat with Corps approval.

1. CHERT Process for Annual Review and Recommendations

All applicants will use the CHERT process for annual review and recommendations. CHERT is a critical part of LOP 2004-1. In addition to making recommendations to the operators, CHERT also provides the Corps and NOAA Fisheries with a summary of its rationale supporting the preferred alternative. Gravel extraction proposals will include a summary of the rationale supporting how the CHERT recommendation does not increase channel braiding and promotes channel confinement, and does not increase the risk of adult salmonid stranding or decrease riffle and redd stability.

2. Minimum Head-of-Bar Buffer

The upstream end of the bar (head-of-bar) will not be mined or otherwise altered by the proposed action. The minimum head-of-bar is defined as that portion of the bar that extends from at least the upper third of the bar to the upstream end of the bar as exposed at summer low flow (minimum head-of-bar buffer). The intent of the minimum head-of-bar buffer is to provide protection of the natural stream flow steering effect provided by the undisturbed bar.

Some alternative extraction techniques, such as longer and much narrower skims adjacent to the low flow channel, have specific geomorphic objectives that may require extraction on a portion of the head-of-bar buffer. Variances to the minimum head-of-bar buffer may be considered on a case-by-case basis, if the proposed alternative provides equal or greater protection. NOAA Fisheries will inform the Corps and CHERT if a proposed variance does not comply with the terms and conditions of its ITS. The specific nature of the proposed variance must be described, along with sufficient biological, hydrological, and sediment transport rationale to support the recommended alternative. For example, any modification in the default head-of-bar buffer dimensions should, at a minimum, provide for protection of the adjacent cross-over riffle, by limiting extraction to the area downstream of the riffle. In addition, NOAA Fisheries may impose special requirements, including additional monitoring on approved variances to the minimum head-of-bar buffer, to ensure that there is no take beyond what is anticipated in the ITS of this Opinion.

3. Minimum skim floor elevation

The minimum skim floor elevation will remain above the water surface elevation of the 35% exceedence flow for each site, on an annual basis. Instructions for determining, marking and reporting the water surface elevation of the 35% exceedence flow are available from NOAA Fisheries and are attached as Appendix A of this Opinion.

Additionally, the water surface elevation of the 35% exceedence flow shall be marked on the gravel bar and indicated on the cross section survey data.

To aid in compliance with these setbacks, the area of extraction will be clearly flagged, painted, or staked. Excavated material will be skimmed off the surface. Other methods of excavation, such as trenching, may be approved by the Corps, however, these alternative designs will be discussed with resource agencies (*e.g.,* NOAA Fisheries, CDFG) and CHERT prior to submitting extraction plans in the spring.

4. Temporary Channel Crossings

a. Design and construction

The location, construction and removal of all temporary channel crossings will be reviewed by CHERT for conformance with these guidelines and described in the CHERT recommendation. Crossings will be designed and installed to minimize turbidity and geomorphic impacts from bridge construction, use and removal. Factors to consider include habitat quality, channel width, length of available bridges, required bridge width, water depth and velocity, amount of fine sediment in the native gravel, and the availability of washed rock.

Main channels will be spanned to the maximum length practicable using either a flatcar or bridge span. Culverts may be approved for use in secondary channels on a case-by-case basis. Heavy equipment passes across the wetted channel during temporary channel crossing construction and removal will be kept to an absolute minimum and described in the CHERT recommendation. Heavy equipment passes will be limited to two passes per bridge construction and two passes per removal.

Native gravel can be used for bridge approaches and abutments if the bridge will completely span the wetted channel, and the abutment materials are removed and regraded onto approved sites upon bridge removal.

Brow logs, concrete blocks, concrete K-rail or other suitable materials will be used in temporary abutments to minimize the amount of sediment required for abutments or approach ramps.

If encroachment into the low flow channel is necessary to span the wetted channel, then approach ramps will be constructed using techniques that will reduce the input of fine sediment into the channel. These techniques could include a base of washed rock or cobbles on the access side of the stream. The base would extend from the bed of the stream to six inches above the water surface at construction time. This base can be topped with native gravel. Alternatively, if washed rock is not readily available, native gravel used in wetted approaches and abutments may be lined with filter fabric and surrounded with K-rails. Other methods that would provide equal or superior protection from turbidity impacts may be suggested by the operator and presented for review and recommendation by CHERT and NOAA Fisheries. Other methods may be approved if they meet the objective of minimizing sediment delivery to the low-flow channel.

Upon bridge removal, the original channel configuration will be restored to the fullest extent feasible.

b. Timing

Temporary crossings will only be placed after June 30. All crossings and associated fills will be removed after excavation ceases, but before September 15 for the Mad River and before October 15 for all other rivers. The Corps will provide NOAA Fisheries a copy of any request for a time extension for bridge construction or removal for its review before the time extension may be authorized by the Corps, due to the sensitivity of working directly within the wetted channel. The Corps does not expect that extensions will be granted if CC Chinook salmon adults have entered the extraction reach.

c. Location

Bridge locations will avoid known spawning areas. The middle of riffles may provide the best location for temporary crossings since the bridge may be able to span the entire wetted channel. Where bridges are not able to span the entire wetted channel, the crossing location will be determined on a site-specific basis. The proposed location, and rationale used to determine how the crossing location minimizes effects to salmonids, will be included in the CHERT recommendation. Haul roads will follow the shortest route possible while avoiding sensitive areas such as riparian vegetation. If excessive compaction is identified, the roads will be scarified after extraction is complete.

D. Reach-Specific Extraction Measures

1. Mad River

- Gravel extraction on the Mad River will be limited to less than 175,000 cy/yr.
- Temporary bridges will be removed before September 15, each year. The CHERT recommendation will include justification for the bridge location.
- Upstream of the Highway 299 bridge, alternative extraction techniques will be preferred over traditional skimming (bar scalping). These alternative techniques may include, but are not limited to, horseshoe extractions, wetland pits, trenches and dry-trenches, and "narrow skims," as described in Appendix B of this Opinion.

2. Lower Eel River

- Alternative extraction techniques will be preferred over traditional skimming (bar scalping). These alternative techniques may include, but are not limited to horseshoe extractions, wetland pits, trenches and dry-trenches, and "narrow skims," as described in Appendix B of this Opinion.

- In addition to the alternative extraction techniques listed above, narrow skims that are adjacent to the low flow channel but provide for protection of the adjacent cross-over riffle, by limiting extraction to the areas away from the entire riffle will also be considered for the lower Eel River on a case-by-case basis. These narrow skims may have a minimum vertical offset of two feet above the water surface elevation of the low flow channel. Narrow skim widths will be determined on a site specific basis, but narrow skims will: (1) not increase channel braiding, (2) not lower the elevation at which flows enter secondary channels, (3) avoid the higher portions of the annually inundated bar surface, and (4) must promote channel confinement. The CHERT recommendation will include a summary of the reasoning, along with sufficient biological, hydrological, and sediment transport rationale to support the recommended width.

3. South Fork Eel River

- The South Fork Eel River provides habitat for Chinook salmon, coho salmon and steelhead, but especially is spawning habitat for Chinook salmon. Alternative extraction techniques will be given deference over traditional skimming. These alternative techniques may include, but are not limited to horseshoe extractions, wetland pits, trenches and dry-trenches, as described in Appendix B of this Opinion.

4. Van Duzen River

- Extraction proposals in the lower 2 miles of the Van Duzen River will be limited to alternative extraction designs, such as trenching, alcoves, horseshoe pits, very narrow skims, *etc.* In particular, trenching is recommended in some locations in the lower Van Duzen River. "Very Narrow Skims" on the lower two miles of the Van Duzen River [confluence to river mile (RM) 2] will be limited to 90 feet total width, as measured across the top of the extraction. This width provides for confinement of typical early season (November/December) peak flows of 1,000 cubic feet per second (cfs) and maintains a depth of 1 foot within the narrow skim area, which will also be above the water surface elevation of the 35% exceedence flow, so that impairment of adult passage is reduced.

- Extraction proposals will include a justification describing how the proposal will prevent increases in the width-to-depth (W/D) ratio and not increase the likelihood of salmon stranding.

5. Trinity River

- The minimum skim floor elevation on the Trinity River will be a minimum of two feet above the adjacent summer low-flow water surface elevation.

E. Storage and Stockpiles

Temporary storage of excavated material may occur on the gravel bar, but will be removed by October 1. Temporary stockpiling of gravel on bars that are on rivers listed under the Wild and Scenic Rivers Act (Appendix C of this Opinion) may occur from Monday through Saturday, but will be removed on or before Saturday of each weekend.

In order to minimize the turbidity associated with excavating wet sediment, all wet excavated sediment will be stockpiled on the gravel bar away from the low flow channel and allowed to drain prior to hauling across the temporary channel crossing.

F. Vegetation and Wetlands

All riparian woody vegetation and wetlands will be avoided to the maximum extent possible. Any riparian vegetation or wetland that is disturbed will be clearly identified by mapping. Woody vegetation that is part of a contiguous 1/8-acre complex, or is at least 2 inches in diameter at breast height (dbh), that is disturbed will be mitigated. Impacts to other woody vegetation will be described and submitted to the Corps and CHERT with the gravel extraction plans. These impacts may require mitigation at the discretion of the Corps. Impacted areas which will be mapped consist of riparian vegetation which have driplines within 25 feet of excavation activities (excavation, stockpiling, parking, *etc.*) or wetlands which are filled, excavated or drained. Mitigation for impacts to woody vegetation will not be required for pre-existing haul roads, stockpile areas and facilities (see discussion under subsection "O" titled "Required Mitigation").

G. Structure Setbacks

Gravel removal will remain a minimum distance of 500 feet from any structure (*i.e.*, bridge, water intake, dam, *etc.*) in the river. For bridges, the minimum setback distance is the length of the bridge or 500 feet, whichever is greater. Gravel removal may encroach within this structure setback if a request is made by the operator and written approval is given by owners of these structures. A copy of written approvals will be provided to the Corps.

H. Regrading

The project areas will be regraded, if necessary, before the water levels rise in the rainy season and will be completed by October 15. Regrading includes filling in depressions, grading the construction/excavation sites according to the approved configuration, leaving the areas in a free-draining configuration (no depressions and sloping toward the low flow channel), and removing all temporary fills from the project areas. Regrading may not be necessary if extraction operations leave the extraction area free of depressions and temporary fills and meet the approved mining configuration.

I. Timing of Extraction

Unless the operator's LOP is specifically modified, gravel extraction will cease by October 15 each year. Regrading, if necessary, will be completed prior to October 15. Requests for a extension will be reviewed on a case by case basis. The applicant, however, must have regraded the site before an extension can be authorized. Requests for an extension must include an approved CDFG Stream Alteration Agreement (SAA) extension or exemption. The Corps will coordinate with CHERT and NOAA Fisheries before a decision is made on the time extension. Also note water crossing timing restrictions described above in subsection B.

J. Habitat Enhancement and Protection

Occasionally, gravel extraction operators propose projects that entail gravel extraction with a focus on habitat enhancement. NOAA Fisheries will advise the Corps on any requests for potential fisheries enhancement projects.

Large woody debris (LWD) in the wetted channel and on floodplains and terraces is an important component of aquatic and riparian habitat. However, LWD is commonly gathered by local residents for firewood and other uses. To reduce the adverse effects of this longstanding practice, educational signing regarding the importance of LWD for salmonids will be placed on access roads owned, controlled, or utilized by the gravel operators. In addition, in order to protect LWD deposited on mined gravel bars, all access roads owned or controlled by gravel operators will be gated and locked to reduce access. Operators should consult with NOAA Fisheries for suggestions on the wording and design of the signs.

K. Special Conditions

Additional special conditions may be added to the LOP on a case by case basis to minimize adverse impacts to the aquatic ecosystem and to the scenic and recreational values of the rivers listed in the Wild and Scenic Rivers Act. Modifications to excavation procedures may be made to increase fisheries and wildlife habitat with Corps approval.

In addition to limitations discussed above, projects authorized by LOP 2004-1 are subject to the general conditions contained in Appendix D of this Opinion and any special conditions that may be added.

L. Location of Work

Permits issued under LOP 2004-1 will apply to work in waters, including navigable waters, of the United States, within Humboldt County, California, and also any projects that straddle the county lines.

M. Authorization from Other Agencies

The permittee is responsible for obtaining any and all additional Federal, state, tribal, or local permits that may be required, which may include, but are not limited to: (1) State Water Quality

Certification; (2) SAA from the CDFG, except when working within the boundaries of a Federally recognized Indian Reservation; (3) California Department of Conservation Division of Mines and Geology's lead agency, which is Humboldt County Department of Community Services; (4) a Coastal Development Permit and a Coastal Zone Management Act Consistency Concurrence for activities located within the Coastal Zone; (5) Water Quality Certification from the EPA or from the Indian Reservation (if it is authorized by the EPA to grant water quality certification) for activities within the boundaries of a Federally recognized Indian Reservation; and (6) obtaining easements from or pay fees to the California State Lands Commission (SLC) for activities that occur below the mean high water mark in tidal waterways and below the ordinary high water mark in non-tidal waterways.

N. Application Procedures

Applications are divided into two categories based on quantity of material removed from the river basins. The two categories are: Class A projects: Projects which remove 5,000 cubic yards or more of material per year; and Class B projects: Projects which remove less than 5,000 cubic yards of material per year. For new projects, a notice of intent to mine gravel will be submitted to the Corps, Eureka Field Office, by February 1 of that year.

Before mining each year, a pre-extraction report (mining proposal) is submitted that contains the information described below. Following completion of extraction, a post-extraction report will be submitted (also described below). Copies of all pre- and post-extraction information, including cross sections, aerial photos, and other information will be provided to the Corps, NOAA Fisheries, and CHERT at about the same time. Once the pre-extraction report has been submitted, a site review will be scheduled for all Class A projects. A mutually agreeable date will be scheduled between CHERT, the Corps and NOAA Fisheries for site reviews, or a five working-day notice of when the site review is scheduled to occur will be provided to NOAA Fisheries.

At the discretion of the operator, a preliminary site review may be requested to discuss preferred mining alternatives before a pre-extraction report is prepared. This can often save costs of unnecessary surveying and plan preparation, as well as time, by narrowing the scope of mining design alternatives to one that is likely to meet the restrictions set forth herein. Should operators desire a preliminary review, a mutually agreeable date will be scheduled between CHERT, the Corps and NOAA Fisheries for site reviews, or a five working-day notice of when the site review is scheduled to occur will be provided to NOAA Fisheries.

In all cases, an application for authorization of work under LOP 2004-1 will include a written description of the project, proposed work schedule, the address and telephone number of a point of contact who can be reached during working hours, an 8.5-by-11-inch vicinity map, and an 8.5-by-11-inch site or location map showing all the boundaries of all work to be done (maps and figures can also be on 11-by-17-inch paper). The information may be submitted on an Application for Department of the Army Permit form (ENG Form 4345), or in any other form, which will clearly supply the information in a concise manner. Projects that remove more than 250,000 cy/yr will not be considered eligible for authorization under LOP 2004-1. Projects will also be considered in relation to other extraction operations.

1. Class A Projects

Class A projects remove 5,000 cubic yards or more of material per year from the river basin. Project submittal will include a description of the project and at least the following information on a yearly basis, unless modified by the Corps:

1. A pre-extraction report will be submitted to the Corps, CHERT, and NOAA Fisheries at least two weeks prior to excavation. Pre-extraction reports will include:

   a. Cross-section Surveys: Monitoring and Extraction cross-section surveys will be done according to Appendix C of this Opinion, unless modified by CHERT and approved by the Corps. Each year spring surveys will be submitted to CHERT for review. Applicants will submit gravel extraction plans meeting CHERT recommendations to the Corps for approval prior to commencing gravel extraction operations;

   b. An SAA or any extension signed by the CDFG, or a Riparian Protection and Surface Mining Permit signed by a Federally recognized Indian Reservation. Permits may be obtained concurrently with the Corps permit;

   c. A pre-extraction vertical aerial photo of the project area. Photos will be taken the spring of each year and will include the entire project reach [extraction zone reach of the project site and immediate upstream and downstream reaches within one-half length of the extraction zone reach of the project, as measured along the thalweg (the bottom of the low-flow channel)]. Pre-extraction photos will be vertical photos at a scale of 1:6,000 and will diagram proposed extraction activities as described in Appendix C of this Opinion;

   d. A mitigation report containing the mapped areas that are impacted (riparian vegetation and wetlands) and the mitigation proposed to minimize these impacts; and

   e. For new projects, the applicant will submit to the Corps and the consulting regulatory agencies participating in the March meetings, by February 1 of the initial gravel mining year, copies of the environmental documentation required by the Lead Agency when requesting a conditional use permit, vested right or exemption. The Corps may also require additional information.

2. A post-extraction report will be submitted to the Corps, CHERT, and NOAA Fisheries by December 1 of each year. Post-extraction reports will include:

   a. A post-extraction survey, which will be conducted following cessation of extraction and before alteration of the extraction area by flow following fall rains, preferably before October 15. Post-extraction reports will include the amount and dimensions of material excavated from each area mined. See Appendix E of this Opinion for post-extraction requirements;

b. Vertical aerial photo coverage of the project reach. Photo coverage will be taken in the low-flow periods and be at a scale no larger than 1:12,000. Photos will be taken from a fixed or vertical oriented (*i.e.* belly-mounted) camera. Stereoscopic photo coverage will be taken in late September or early (first week) October;

c. A longitudinal profile view of the thalweg for the active channel line along the project reach based on the monitoring cross-sections and additional thalweg survey points taken at dominant riffle crests and pool bottoms; and

d. The results of required biological monitoring information, as described in Appendix F of this Opinion, are due January 1 of the following year.

2. Class B Projects

These projects remove less than 5,000 cy/yr of material from the river basin. Class B projects must be physically separated from other gravel operations to be considered separate projects. Projects cannot be located on the same gravel bar, or on the same parcel number as other projects, and be considered as separate projects. The Corps reserves the right to elevate a Class B project to the Class A category.

Project submittal will include a description of the project and at least the following information on a yearly basis, unless modified by the Corps:

1. A pre-extraction report, submitted by May 15 of the gravel year, that includes:

a. A site map showing project and extraction area boundaries and cross sections on 8.5-by-11-inch or 11-by-17-inch paper. Drawings will be labeled with approximate scale and quantities of material removed from the site. Plan views will also map any known salmonid spawning sites;

b. A minimum of one monitoring cross-section and five extraction cross-sections per extraction site (See Appendix C of this Opinion for cross-section details);

c. A copy of the SAA signed by the CDFG, or a Riparian Protection and Surface Mining Permit signed by the Federally recognized Indian Reservation. Permits may be obtained concurrently with the Corps permit;

d. Aerial photos of the mining area before excavation. The point(s) from which the photos are taken will be shown on a site map along with the direction of the photos. These are identical to the aerial photos used for stereoscopic viewing without the 60% overlap.

e. Mapping and description, including size, species and number, of any riparian vegetation that will be removed, cut, or within 25 feet of excavation, stockpiling or trafficking of gravel and any wetland that will be impacted. Also included in the submittal will be a mitigation plan to minimize any unavoidable impacts.

2. A post project report, due by December 1 of each extraction year, which will include:

   a. Post-extraction data for extraction and monitoring cross-sections according to Appendix E of this Opinion.

   b. Aerial photos of the mining area after excavation. Photos will be taken from the same location as pre-project photos and be of similar coverage, quality and scale.

O. Required Mitigation

Each permittee will mitigate impacts to wetlands and riparian zones in the following manner and order: avoiding the impact, minimizing the impact, rectifying the impact, reducing or eliminating the impact over time, and finally, compensating for impacts. For all unavoidable impacts, a mitigation plan will be submitted with applications for all projects that will adversely affect wetlands and riparian vegetation. Mitigation will consider the size and age of the vegetation removed or adversely impacted. All vegetative mitigation will be planted between November 1 and February 28 following excavation and will have an approved survival rate over three growing seasons. Failure to achieve the three-year survival rate will require replanting. Annual reports depicting the survival of vegetation will be due by December 31 each year for three growing seasons after the planting year.

P. Site Visits

Site visits will be conducted before and after gravel extraction operations at all Class A operations. Additional site visits can be made upon request to the operator or when otherwise deemed necessary by the Corps, NOAA Fisheries, CHERT, or other participating agencies. Pre-extraction visits will be done as part of the review and approval process. Post-extraction visits will be as soon as possible following completion of operations **and** prior to site inundation by rising river stages in the fall. To help ensure this occurs in a timely manner, operators will notify the Corps, NOAA Fisheries, and CHERT by electronic mail, phone, or facsimile within two business days of project completion.

Work may not proceed until the DE has issued a LOP. For projects which have obtained the LOP, the activity may not begin each year until a confirmation letter (Letter of Modification, or LOM) has been issued by the Corps. The Corps will attach the NOAA Fisheries ITS to all LOMs issued under LOP 2004-1 to aid in compliance with the terms and conditions by the permittees.

The applicant is responsible to ensure that the authorized project meets the terms and conditions set forth herein; failure to abide by them will constitute a violation of the Clean Water Act and/or the Rivers and Harbors Act of 1899.

The Corps is responsible for determining compliance with the LOP. The Corps may take actions to rectify projects that are not in compliance. These actions may include, but are not limited to, the following:

1. Permit revocation
2. Permit suspension
3. Project and habitat site restoration
4. Reduction of authorized gravel extraction amounts per year

No authorization will be granted under a LOP for any excavation or grading that is for the primary purpose of river engineering, channel or river capture, channel realignment or for a project that is likely to result in the above, unless approved by the Corps. Projects outside the scope of LOP 2004-1 will be considered for authorization by individual permit.

Q. Action Area

Action area is defined as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR § 402.02). The action area for this consultation is within the rivers of Humboldt County that have gravel mining operations that were permitted during implementation of LOP 96-1, including: the lower Mad River from near the town of Blue Lake to the mouth, the lower Eel River from the mouth of the Van Duzen River to below Fernbridge, the Eel River from the mouth of the South Fork Eel River to near the town of Scotia, the South Fork Eel River from the Humboldt/Mendocino County line to near the town of Redway, the lower Van Duzen River (a major tributary to the Eel River) from near the town of Carlotta to its confluence with the Eel River, the lower Trinity River near the towns of Salyer, Willow Creek and Hoopa, and one site each on the North Fork Mattole River at its confluence with the Mattole River, within the Bear River near the town of Ferndale, and at one site on the upper Eel River near Fort Seward (Figure 1).

The commercially mined river sections that have ongoing operations are in generally unconfined, alluvial reaches that allow for gravel deposition. The lateral extent of the action area for LOP 2004-1 includes the river channel, the floodplain and the contemporary river meanderbelt. The action area also includes adjacent tributaries and downstream habitat that may be affected by the proposed action. The action area of LOP 2004-1 is more specifically defined by watershed in the *Environmental Baseline* section of this Opinion.

Based on information received from the Corps in both LOP 2004-1 and the request for formal consultation on LOP 2004-1, NOAA Fisheries expects that gravel mining authorized by LOP 2004-1 will occur at the locations described in Table 1, below.

Table 1. For each river, gravel bar sites are listed from the most upstream site to the most downstream site, and are not necessarily contiguous. The approximate length of each site is measured along the center line of the stream, adjacent to each bar. Data was provided by Humboldt County Planning Division (April 26, 2000), except for the Cook's Valley site and the Fort Seward site where data was provided by the Corps (June 27, 2000), and the McKnight site, where data was provided by the Corps (June 25, 2001).

Stream	Length (ft)	Gravel Bar Site Name
Middle Eel River	3646	Vroman and Maynard Bars
	4160	Truck Shop and Scotia Bars
	8340	Dinner Creek and Three Mile Bars
	8398	Elinor Bar
	4844	Holmes Bar
	7900	Dyerville, South Fork and Bowlby Bars
Lower Eel River	1117	Hansen Bar
	1754	Upper Sandy Prairie Bar
	3507	Canevari - Sandy Prairie Bar
	2160	Lower Sandy Prairie Bar
	3413	Warswick Bar
	2807	Singley Bar (downstream of Fernbridge)
Lower Mad River	675	Essex Bar
	750	Miller Almquist Bar (near Hwy 299 bridge)
South Fork Eel River	809	Cook's Valley (at the Humboldt/Mendocino County line)
	1218	Tooby Park/Garberville
	2097	Randall Sand and Gravel/Tooby Park/Garberville
	1854	Wallen/Johnson Redway Bar (near the town of Redway)
Lower Van Duzen River	2304	Pacific Lumber Bar (near the town of Carlotta)
	661	Thomas Bess Ranch
	15506	Van Duzen Ranch
	1890	Leland Rock Gravel Bars
Lower Trinity River	2000	McKnight Bar (near the town of Salyer)
	4497	Big Rock (near the town of Willow Creek)
	834	Klamath River Aggregate (near the town of Hoopa)
North Fork Mattole	4909	Cook Bar (at confluence with mainstem Mattole River)
Upper-Mid Eel	2000	Satterlee Bar near Fort Seward, at approximate river mile 68
Bear River	975	Branstetter Bar

III. STATUS OF THE SPECIES AND CRITICAL HABITAT

The following listed threatened species and designated critical habitat occur in the action area and may be affected by the proposed action: SONCC coho salmon and their designated critical habitat, California Coastal Chinook salmon and Northern California steelhead. Table 2 presents a summary of the Federal Register Notice dates and citations, and geographic distributions for these species and critical habitat. This section summarizes the status of critical habitat, species life history and population trends at the ESU scale and factors affecting the species and critical habitat.

Table 2. The scientific name, listing status under the Endangered Species Act, Federal Register Notice citation, and geographic distribution of the Evolutionarily Significant Units (ESU) covered in this Opinion.

	SONCC coho salmon	NC Steelhead	CC Chinook Salmon
Scientific Name	*Oncorhynchus kisutch*	*O. mykiss*	*O. tshawytscha*
Listing Status	threatened	threatened	threatened
Federal Register Notice	May 6, 1997, 62 FR 24588	June 7, 2000, 65 FR 36074	September 16, 1999, 64 FR 50393
Geographic Distribution	from Cape Blanco, Oregon, to Punta Gorda, California	from Redwood Creek (Humboldt County), south to the Gualala River, inclusive	from Redwood Creek (Humboldt County) south through the Russian River
Critical Habitat Designation	May 5, 1999, 64 FR 24049	N/A	N/A

A. Critical Habitat

This Opinion analyzes the effects of the proposed action on designated critical habitat for SONCC coho salmon. Critical habitat for SONCC coho salmon includes all accessible waterways, substrate, and adjacent riparian zones. Excluded are: (1) areas above specific dams identified in the FR notice; (2) areas above longstanding natural impassible barriers (*i.e.*, natural waterfalls); and (3) tribal lands.

In designating critical habitat, NOAA Fisheries considers the following requirements of the species (1) space for individual and population growth, and for normal behavior, (2) food, water, air, light, minerals, or other nutritional or physiological requirements, (3) cover or shelter, (4) sites for breeding, reproduction, or rearing offspring, and, generally, (5) habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of this species [see 50 CFR § 424.12(b)]. In addition to these factors, NOAA Fisheries also focuses on the known physical and biological features (primary constituent elements) within the designated area that are essential to the conservation of the species and that may require special management considerations or protection. These essential features may include, but are not limited to, spawning sites, food resources, water quality and quantity, and riparian vegetation. The current condition of critical habitat for SONCC coho salmon is discussed in the *Factors Affecting the Species and Critical Habitat* section below.

B. Species Life History and Population Trends

1. Coho Salmon

a. General Life History

In contrast to the life history patterns of other Pacific salmonids, coho salmon generally exhibit a relatively simple three-year life cycle. Most coho salmon enter rivers between September and February. Coho salmon river entry timing is influenced by many factors, one of which appears to be river flow. In addition, many small California stream systems have their mouths blocked by sandbars for most of the year except winter. In these systems, coho salmon and other Pacific salmonid species are unable to enter the rivers until sufficiently strong freshets open passages through the bars (Weitkamp *et al.* 1995). Coho salmon spawn from November to January (Hassler 1987), and occasionally into February and March (Weitkamp *et al.* 1995).

Although each native stock appears to have a unique time and temperature for spawning that theoretically maximizes offspring survival, coho salmon generally spawn at water temperatures within the range of 10-13°C (Bell 1991). Bjornn and Reiser (1991) found that spawning occurs in a few third-order streams, but most spawning activity was found in fourth- and fifth-order streams. Nickelson *et al.* (1992) found that spawning occurs in tributary streams with a gradient of 3% or less. Spawning occurs in clean gravel ranging in size from that of a pea to that of an orange (Nickelson *et al.* 1992). Spawning is concentrated in riffles or in gravel deposits at the downstream end of pools featuring suitable water depth and velocity (Weitkamp *et al.* 1995).

The favorable thermal range for coho salmon egg incubation is 10-13°C (Bell 1991). Coho salmon eggs incubate for approximately 35-50 days, and start emerging from the gravel two to three weeks after hatching (Hassler 1987, Nickelson *et al.* 1992). Following emergence, fry move into shallow areas near the stream banks. As coho salmon fry grow, they disperse upstream and downstream to establish and defend territories (Hassler 1987).

Juvenile rearing usually occurs in tributary streams with a gradient of 3% or less, although they may move up to streams of 4% or 5% gradient. Juveniles have been found in streams as small as three- to six-feet wide. At a length of 1.5-1.75 inches, the fry may migrate upstream a considerable distance to reach lakes or other rearing areas (Godfrey 1965, Nickelson *et al.* 1992). Rearing requires temperatures of 20°C or less, preferably 12-14°C (Reiser and Bjornn 1979, Reeves *et al.* 1987, Bell 1991). Coho salmon fry are most abundant in backwater pools during spring. During the summer, coho salmon fry prefer pools featuring adequate cover such as LWD, undercut banks, and overhanging vegetation. Juvenile coho salmon prefer to over-winter in large mainstem pools, backwater areas and secondary pools with LWD, and undercut bank areas (Hassler 1987, Heifetz *et al.* 1986). Coho salmon rear in fresh water for up to 15 months, then migrate to the sea as smolts between March and June (Weitkamp *et al.* 1995).

The ideal food channel for maximum coho salmon smolt production would have shallow depth (3-24 inches), fairly swift mid-stream flows (2 ft/sec), numerous marginal back-eddies, narrow width, copious overhanging mixed vegetation (to lower water temperatures, provide leaf-fall, and contribute terrestrial insects), and banks permitting hiding places (Boussu 1954). The early diets of emerging fry include chironomid larvae and pupae (Mundie 1969). Juvenile coho salmon are carnivorous opportunists that primarily eat aquatic and terrestrial insects. They do not appear to pick stationary items off the substratum (Sandercock 1991, Mundie 1969).

Little is known about residence time or habitat use in estuaries during seaward migration, although it is usually assumed that coho salmon spend only a short time in the estuary before entering the ocean (Nickelson *et al.* 1992). Growth is very rapid once the smolts reach the estuary (Fisher *et al.* 1984). While living in the ocean, coho salmon remain closer to their river of origin than do Chinook salmon (Weitkamp *et al.* 1995). Nevertheless, coho salmon have been captured several hundred to several thousand kilometers away from their natal stream (Hassler 1987). After about 12 months at sea, coho salmon gradually migrate south and along the coast, but some appear to follow a counter-clockwise circuit in the Gulf of Alaska (Sandercock 1991). Coho salmon typically spend two growing seasons in the ocean before returning to their natal streams to spawn as three year-olds. Some precocious males, called "jacks," return to spawn after only six months at sea.

b. Range-wide (ESU) Status and Trends of SONCC Coho Salmon

Available historical and most recent published coho salmon abundance information are summarized in the NOAA Fisheries coast-wide status review (Weitkamp *et al.* 1995). The following are excerpts from this document:

> "Gold Ray Dam adult coho passage counts provide a long-term view of coho salmon abundance in the upper Rogue River. During the 1940s, counts averaged ca. 2,000 adult coho salmon per year. Between the late 1960s and early 1970s, adult counts averaged fewer than 200. During the late 1970s, dam counts increased, corresponding with returning coho salmon produced at Cole Rivers Hatchery. Coho salmon run size estimates derived from seine surveys at Huntley Park near the mouth of the Rogue River have ranged from ca. 450 to 19,200 naturally-produced adults between 1979 and 1991. In Oregon south of Cape Blanco, Nehlsen *et al.* (1991) considered all but one coho salmon population to be at 'high risk of extinction.' South of Cape Blanco, Nickelson *et al.* (1992) rated all Oregon coho salmon populations as 'depressed.'
>
> Brown and Moyle (1991) estimated that naturally-spawned adult coho salmon returning to California streams were less than one percent of their abundance at mid-century, and indigenous, wild coho salmon populations in California did not exceed 100 to 1,300 individuals. Further, they stated that 46% of California streams which historically supported coho salmon populations, and for which recent data were available, no longer supported runs.
>
> No regular spawning escapement estimates exist for natural coho salmon in California streams. California Department of Fish and Game (CDFG 1994) summarized most

information for the northern California region of this ESU. They concluded that "coho salmon in California, including hatchery populations, could be less than six percent of their abundance during the 1940s, and have experienced at least a 70% decline in the 1960s." Further, they reported that coho salmon populations have been virtually eliminated in many streams, and that adults are observed only every third year in some streams, suggesting that two of three brood cycles may already have been eliminated.

The rivers and tributaries in the California portion of this ESU were estimated to have average recent runs of 7,080 natural spawners and 17,156 hatchery returns, with 4,480 identified as "native" fish occurring in tributaries having little history of supplementation with non-native fish. Combining recent run-size estimates for the California portion of this ESU with Rogue River estimates provides a rough minimum run-size estimate for the entire ESU of about 10,000 natural fish and 20,000 hatchery fish."

Schiewe (1997) summarized updated and new data on trends in abundance for coho salmon from the northern California and Oregon coasts. The following are excerpts from this document regarding the status and trends of the SONCC coho salmon ESU:

"Information on presence/absence of coho salmon in northern California streams has been updated since the study by Brown *et al.* (1994) cited in the status review. More recent data (Table 3) indicates that the proportion of streams with coho salmon present is lower than in the earlier study (52% vs. 63%). In addition, the BRT received updated estimates of escapement at the Shasta and Willow Creek weirs in the Klamath River Basin, but these represent primarily hatchery production and are not useful in assessing the status of natural populations.

New data on presence/absence in northern California streams that historically supported coho salmon are even more disturbing than earlier results, indicating that a smaller percentage of streams in this ESU contain coho salmon compared to the percentage presence in an earlier study. However, it is unclear whether these new data represent actual trends in local extinctions, or are biased by sampling effort."

NOAA Fisheries (2001) updated the status review for the Central California Coast (CCC) and the California portion of the SONCC coho salmon ESUs. The following is a summary of the updated status review:

"In the California portion of the SONCC coho salmon ESU, there appears to be a general decline in abundance, but trend data are more limited in this area and there is variability among streams and years. In the California portion of the SONCC coho salmon ESU, Trinity River Hatchery maintains large production and is thought to create significant straying to natural populations. In the California portion of the SONCC coho salmon ESU, the percent of streams with coho present in at least one brood year has shown a decline from 1989-1991 to the present. In 1989-1991 and 1992-1995, coho were found in over 80% of the streams surveyed. Since then, the percentage has declined to 69% in the most recent three-year interval.

Both the presence-absence and trend data presented in this report suggest that many coho salmon populations in this ESU continue to decline. Presence-absence information from the past 12 years indicates fish have been extirpated or at least reduced in numbers sufficiently to reduce the probability of detection in conventional surveys. Unlike the CCC ESU, the percentage of streams in which coho were documented did not experience a strong increase in the 1995-1997 period. Population trend data were less available in this ESU, nevertheless, for those sites that did have trend information, evidence suggests declines in abundance.

After considering this information, we conclude that the Southern Oregon/Northern California Coasts ESU is presently not at risk of extinction, but it is likely to become endangered in the foreseeable future. The conclusion is tempered by the fact that population trend data was limited, and further analysis may reveal declines sufficient to conclude that the California portion of this ESU is in danger of extinction."

Table 3. Summary statistics of historical and current presence-absence data for coho salmon from the California portion of the SONCC ESU (from Schiewe 1997).

Area	Streams historically inhabited by coho salmon	Streams recently surveyed	Number of streams with coho salmon present	Percent of streams with coho salmon present	
				New data [refer to Schiewe (1997) for data sources used]	Brown *et al.* (1994)
Del Norte County	130	46	21	46	55
Humboldt County	234	130	71	55	69
Total	364	176	92	52	63

Based on the very depressed status of current coho salmon populations discussed above as well as insufficient regulatory mechanisms and conservation efforts over the ESU as a whole, NOAA Fisheries concluded that the ESU is likely to become endangered in the foreseeable future (May 6, 1997, 62 FR 24588). A more recent status update (NOAA Fisheries 2003b) indicates a continued low abundance with no apparent trends in abundance and possible continued declines in several California populations. The relatively strong 2001 brood year, likely due to favorable conditions in both freshwater and marine environments was viewed as a positive sign, but was a single strong year following more than a decade of generally poor years (NOAA Fisheries 2003b).

2. <u>Steelhead</u>

a. General Life History

Biologically, steelhead can be divided into two basic run-types, based on the state of sexual maturity at the time of river entry and duration of spawning migration (Burgner *et al.* 1992). The stream-maturing type, or summer steelhead, enters fresh water in a sexually immature condition and requires several months in freshwater to mature and spawn. The ocean-maturing type, or winter steelhead, enters fresh water with well-developed gonads and spawns shortly after river entry (August 9, 1996, 61 FR 41542; Barnhart 1986). Variations in migration timing exist between populations. Some river basins have both summer and winter steelhead, while others only have one run-type. South of Cape Blanco, Oregon, summer steelhead are known to occur in the Rogue, Smith, Klamath, Trinity, Mad, and Eel rivers, and in Redwood Creek (Busby *et al.* 1996) in addition to the winter steelhead present in these streams.

Summer steelhead enter fresh water between May and October in the Pacific Northwest (Busby *et al.* 1996, Nickelson *et al.* 1992). They require cool, deep holding pools during summer and fall, prior to spawning (Nickelson *et al.* 1992). They migrate inland toward spawning areas, over winter in the larger rivers, resume migration in early spring to natal streams, and then spawn (Meehan and Bjornn 1991, Nickelson *et al.* 1992) in January and February (Barnhart 1986).

Winter steelhead enter fresh water between November and April in the Pacific Northwest (Nickelson *et al.* 1992, Busby *et al.* 1996), migrate to spawning areas, and then spawn, generally in April and May (Barnhart 1986). Some adults, however, do not enter some coastal streams until spring, just before spawning (Meehan and Bjornn 1991).

There is a high degree of overlap in spawn timing between populations within an ESU regardless of run type (Busby *et al.* 1996). Difficult field conditions at that time of year and the remoteness of spawning grounds contribute to the relative lack of specific information on steelhead spawning. Unlike Pacific salmon, steelhead are iteroparous, or capable of spawning more than once before death (Busby *et al.* 1996). However, it is rare for steelhead to spawn more than twice before dying; most that do so are females (August 9, 1996, 61 FR 41542; Nickelson *et al.* 1992). Iteroparity is more common among southern steelhead populations than northern populations (Busby *et al.* 1996).

Steelhead spawn in cool, clear streams featuring suitable gravel size, depth, and current velocity. Intermittent streams may be used for spawning (Everest 1973, Barnhart 1986). Steelhead enter streams and arrive at spawning grounds weeks or even months before they spawn and are vulnerable to disturbance and predation. Cover, in the form of overhanging vegetation, undercut banks, submerged vegetation, submerged objects such as logs and rocks, floating debris, deep water, turbulence, and turbidity (Giger 1973) are required to reduce disturbance and predation of spawning steelhead. It appears that summer steelhead occur where habitat is not fully utilized by winter steelhead; summer steelhead usually spawn further upstream than winter steelhead (Withler 1966, Behnke 1992).

Steelhead require a minimum depth of 7 inches and a maximum velocity of 8 ft/sec for active upstream migration (Smith 1973). Spawning and initial rearing of juvenile steelhead generally take place in small, moderate-gradient (generally 3-5%) tributary streams (Nickelson *et al.* 1992). A minimum depth of 7 inches, water velocity of 1-3 ft/sec (Thompson 1972, Smith 1973), and clean substrate 0.25-4 inches (Hunter 1973, Nickelson *et al.* 1992) are required for spawning. Steelhead spawn in 4-9°C water (Bell 1991).

Depending on water temperature, steelhead eggs may incubate for 1.5 to 4 months before hatching, generally between February and June (Bell 1991). Bjornn and Reiser (1991) noted that steelhead eggs incubate about 85 days at 4°C and 26 days at 12°C to reach 50% hatch. Nickelson *et al.* (1992) stated that eggs hatch in 35-50 days, depending upon water temperature.

After two to three weeks, in late spring, and following yolk sac absorption, alevins emerge from the gravel and begin actively feeding. After emerging from the gravel, fry usually inhabit shallow water along banks of perennial streams. Fry occupy stream margins (Nickelson *et al.* 1992). Older fry establish and defend territories.

Summer rearing takes place primarily in the faster parts of pools, although young-of-the-year (YOY) are abundant in glides and riffles. Winter rearing occurs more uniformly at lower densities across a wide range of fast and slow habitat types. Productive steelhead habitat is characterized by complexity, primarily in the form of large and small in-stream wood. Some older juveniles move downstream to rear in larger tributaries and mainstem rivers (Nickelson *et al.* 1992).

Juvenile steelhead migrate little during their first summer and occupy a range of habitats featuring moderate to high water velocity and variable depths (Bisson *et al.* 1988). Rearing juveniles prefer water temperatures ranging from 12-15°C (Reeves *et al.* 1987). Juvenile steelhead feed on a wide variety of aquatic and terrestrial insects (Chapman and Bjornn 1969), and older juveniles sometimes prey on emerging fry. Steelhead hold territories close to the substratum where flows are lower and sometimes counter to the main stream. From these, they can make forays up into surface currents to take drifting food (Kalleberg 1958). Juveniles rear in freshwater from one to four years (usually two years in the California ESUs), then smolt and migrate to the ocean in March and April (Barnhart 1986). Winter steelhead populations generally smolt after two years in fresh water (Busby *et al.* 1996). Steelhead smolts are usually 6-8 inches total length and migrate to the ocean in the spring (Meehan and Bjornn 1991). Based on incidental purse seine catches, juvenile steelhead tend to migrate directly offshore during their first summer from whatever point they enter the ocean rather than migrating along the coastal belt as salmon do. During the fall and winter, juveniles move southward and eastward (Hartt and Dell 1986).

Steelhead typically reside in marine waters for two or three years prior to returning to their natal stream to spawn as four- or five-year olds (August 9, 1996, 61 FR 41542). Populations in Oregon and California have higher frequencies of age-1 ocean steelhead than populations to the north, but age-2 ocean steelhead generally remain dominant (Busby *et al.* 1996). Age structure appears to be similar to other west coast steelhead, dominated by four-year-old spawners (Busby *et al.* 1996). Some steelhead return to fresh water after only two to four months in the ocean and are termed "half-pounders" (Snyder 1925). Half-pounders generally spend the winter in fresh water and then out migrate again the following spring for several months before returning to fresh water to spawn. Half-pounders occur over a relatively small geographic range in southern

Oregon and northern California, and are only reported in the Rogue, Klamath, Mad, and Eel Rivers (Snyder 1925, Kesner and Barnhart 1972, Everest 1973, Barnhart 1986).

b. Range-Wide Status and Trends of NC Steelhead

Available historical and most recent published steelhead abundance are summarized in the NOAA Fisheries west coast steelhead status review (Busby *et al.* 1996). The following are excerpts from this document:

> "Prior to 1960, estimates of abundance specific to this ESU were available from dam counts in the upper Eel River (Cape Horn Dam–annual average of 4,400 adult steelhead in the 1930s), the South Fork Eel River (Benbow Dam–annual average of 19,000 adult steelhead in the 1940s), and the Mad River (Sweasey Dam–annual average of 3,800 adult steelhead in the 1940s).
>
> In the mid-1960s, estimates of steelhead spawning populations for many rivers in this ESU totaled 198,000. The only current run-size estimates for this area are counts at Cape Horn Dam on the Eel River where an average of 115 total and 30 wild adults were reported.
>
> Adequate adult escapement information was available to compute trends for seven stocks within this ESU. Of these, five data series exhibit declines and two exhibit increases during the available data series, with a range from 5.8% annual decline to 3.5% annual increase. Three of the declining trends were significantly different from zero. We have little information on the actual contribution of hatchery fish to natural spawning, and little information on present total run sizes for this ESU. However, given the preponderance of significant negative trends in the available data, there is concern that steelhead populations in this ESU may not be self-sustaining."

Schiewe (1997a) summarized more recent data on trends in abundance for summer and winter steelhead in the Northern California ESU. The following are excerpts from this document:

> "Updated spawner surveys of summer steelhead in Redwood Creek, the south for of the Van Duzen River (Eel River Basin), and the Mad River suggest mixed trends in abundance: the Van Duzen fish decreased by 7.1% from 1980-96 and the Mad River summer steelhead have increased by 10.3% over the same time period. The contribution of hatchery fish to these trends in abundance is not known.
>
> New weir counts of winter steelhead in Prairie Creek (Redwood Creek Basin, Humboldt County) show a dramatic increase (over 36%) in abundance during the period 1985-1992. This increase is difficult to interpret because a major highway construction project during this time period resulted in intensive monitoring of salmonids in the basin and Prairie Creek Hatchery was funded to mitigate lost salmonid production. Therefore, it is unclear whether the increase in steelhead reflects increased monitoring effort and mitigation efforts or an actual recovery of Prairie Creek steelhead."

In 2000, NOAA Fisheries concluded that the status of the population had changed little since the 1997 evaluation. Based on this and a lack of implementation of State conservation measures, NOAA Fisheries concluded that the Northern California steelhead ESU warrants listing as a threatened species (June 7, 2000, 65 FR 36074). A more recent review of the status of NC steelhead (NOAA Fisheries 2003a) indicates that none of the recent data suggest any improvements in the status of the species.

3. Chinook Salmon

a. General Life History

The coastal drainages south of Cape Blanco, Oregon are dominated by the Rogue, Klamath, and Eel rivers. The Chetco, Smith, Mad, Mattole, and Russian Rivers and Redwood Creek are smaller systems that contain sizable populations of fall-run Chinook salmon [Campbell and Moyle 1990, Oregon Department of Fish and Wildlife (ODFW) 1995]. Presently, spring runs are found in the Rogue, Klamath, and Trinity Rivers. Additionally, a vestigial spring run may still exist on the Smith River [Campbell and Moyle 1990, U.S. Department of Agriculture – Forest Service (USDA-FS) 1995]. Historically, fall-run Chinook salmon were predominant in most coastal river systems south to the Ventura River. However, their current distribution only extends to the Russian River (Healey 1991). There have also been spawning fall-run Chinook salmon reported in small rivers draining into San Francisco Bay (Nielsen *et al.* 1994).

Of the Pacific salmon, Chinook salmon exhibit arguably the most diverse and complex life history strategies. Healey (1986) described 16 age categories for Chinook salmon, 7 total ages with three possible freshwater ages. Two generalized freshwater life-history types were described by Healey (1991): "stream-type" Chinook salmon reside in freshwater for a year or more following emergence, whereas "ocean-type" Chinook salmon migrate to the ocean within their first year.

Chinook salmon mature between 2 and 6+ years of age (Myers *et al.* 1998). Freshwater entry and spawning timing are generally thought to be related to local water temperature and flow regimes (Miller and Brannon 1982). Runs are designated on the basis of adult migration timing. However, distinct runs also differ in the degree of maturation at the time of river entry, thermal regime and flow characteristics of their spawning site, and actual time of spawning (Myers *et al.* 1998).

Run timing for spring-run Chinook salmon in the CC ESU typically begins in March and continues through July, with peak migration occurring in May and June. Spawning begins in late August and can continue through October, with a peak in September. Historically, spring-run Chinook salmon spawning areas were located in the river headwaters (generally above 1,300 feet). Run timing for fall-run Chinook salmon varies depending on the size of the river. Adult Rogue, Upper Klamath, and Eel River fall-run Chinook salmon return to freshwater in August and September and spawn in late October and early November (Stone 1897, Snyder 1931, Nicholas and Hankin 1988, Barnhart 1995). In other coastal rivers and the lower reaches of the Klamath River, fall-run freshwater entry begins later in October, with peak spawning in late November and December--often extending into January (Leidy and Leidy 1984, Nicholas and Hankin 1988, Barnhart 1995). Late-fall or "snow" Chinook salmon from Blue Creek, on the lower Klamath River, were described as resembling the fall-run fish from the Smith River in run and spawning timing, as well as the degree of sexual maturation at the time of river entry (Snyder 1931).

When they enter freshwater, spring-run Chinook salmon are immature and they must stage for several months before spawning. Their gonads mature during their summer holding period in freshwater. Over-summering adults require cold-water refuges such as deep pools to conserve energy for gamete production, redd construction, spawning, and redd guarding. The upper limit of the optimal temperature range for adults holding while eggs are maturing is 15-16°C (Hinz 1959). The upper preferred water temperature for spawning adult Chinook salmon is 13-14°C (Reiser and Bjornn 1979). Unusual stream temperatures during spawning migration and adult holding periods can alter or delay migration timing, accelerate or retard mutations, and increase fish susceptibility to diseases. Sustained water temperatures above 27°C are lethal to adults (Cramer and Hammack 1952, CDFG 1998).

Spring-run Chinook salmon eggs generally incubate between October to January, and fall-run Chinook salmon eggs incubate between October and December (Bell 1991). Length of time required for eggs to develop and hatch is dependent on water temperature and is quite variable, typically ranging from 3-5 months. The optimum temperature range for Chinook salmon egg incubation is 7-12°C (Rich 1997). Incubating eggs show reduced egg viability and increased mortality at temperatures greater than 14°C and show 100% mortality for temperatures greater than 17°C (Velson 1987). Velson (1987) found that developing Chinook salmon embryos exposed to water temperatures of 2°C or less before the eyed stage experienced 100% mortality (CDFG 1998). Emergence of spring- and fall-run Chinook salmon fry begins in December and continues into mid-April (Leidy and Leidy 1984, Bell 1991). Fry use woody debris, interstitial spaces in cobble substrates, and undercut banks as cover (Everest and Chapman 1972). As the fry grow, habitat preferences change. Juveniles move away from stream margins and begin to use deeper water areas with slightly higher water velocities.

Post-emergent fry seek out shallow, nearshore areas with slow current and good cover, and begin feeding on small terrestrial and aquatic insects and aquatic crustaceans. As they grow to two to three inches in length, the juvenile salmon move out into deeper, swifter water, but continue to use available cover to minimize the risk of predation and reduce energy expenditure. The optimum range for rearing Chinook salmon fry is 10°C to 13°C (Seymour 1956, Rich 1997) and for fingerlings is 13-16°C (Rich 1997). Data from the Mad River (Sparkman 2002) and nearby Redwood Creek (Sparkman 2003) indicate that emergent Chinook salmon fry develop rapidly following emergence. Over a fifteen week period in the spring of 2001, Chinook fry increased in average length from 1.6 inches to 2.6 inches with the bulk of this growth occurring during a ten week period in May and June (Sparkman 2002). The months of May and June accounted for 91.5% of the total captures of migrating YOY Chinook salmon in 2001 (Sparkman 2002).

Chinook salmon populations south of Cape Blanco all exhibit an ocean-type life history. The majority of fish emigrate to the ocean as sub yearlings, although yearling smolts can constitute up to approximately a fifth of out-migrants from the Klamath River Basin, and to a lesser proportion in the Rogue River Basin. However, the proportion of fish which smolted as sub yearling versus yearling varies from year to year (Snyder 1931, Schluchter and Lichatowich

1977, Nicholas and Hankin 1988, Barnhart 1995). This fluctuation in age at smoltification is more characteristic of an ocean-type life history. Furthermore, the low flows, high temperatures, and barrier bars that develop in smaller coastal rivers during the summer months would favor an ocean-type (sub-yearling smolt) life history (Kostow 1995).

Ocean-type juveniles enter saltwater during one of three distinct phases. "Immediate" fry migrate to the ocean soon after yolk resorption at 1.2-1.8 inches in length (Lister *et al.* 1971, Healey 1991). In most river systems, however, fry migrants, which migrate at 50-150 days post-hatching, and fingerling migrants, which migrate in the late summer or autumn of their first year, represent the majority of ocean-type emigrants. Stream-type Chinook salmon migrate during their second or, more rarely, their third spring (Healey 1991). Under natural conditions, stream-type Chinook salmon appear to be unable to smolt as sub-yearlings (Groot and Margolis 1991).

The diet of out-migrating ocean-type Chinook salmon varies geographically and seasonally, and feeding appears to be opportunistic (Healey 1991). Aquatic insect larvae and adults, *Daphnia*, amphipods (*Eogammarus* and *Corophium spp.*), and *Neomysis* have been identified as important food items (Kjelson *et al.* 1982, Healey 1991).

Juvenile stream- and ocean-type Chinook salmon have adapted to different ecological niches. Ocean-type Chinook salmon tend to utilize estuaries and coastal areas more extensively for juvenile rearing. In general, the younger (smaller) juveniles are at the time of emigration to the estuary, the longer they reside there (Kjelson *et al.* 1982, Levy and Northcote 1982, Healey 1991). Stream-type juveniles are much more dependent on freshwater stream ecosystems because of their extended residence in these areas. A stream-type life history may be adapted to those watersheds, or parts of watersheds, that are more consistently productive and less susceptible to dramatic changes in water flow, or which have environmental conditions that would severely limit the success of sub-yearling smolts (Miller and Brannon 1982, Healey 1991).

In preparation for their entry into a saline environment, juvenile Chinook salmon undergo physiological transformations known as smoltification that adapt them for their transition to salt water (Hoar 1976). These transformations include different swimming behavior and proficiency, lower swimming stamina, and increased buoyancy that also make the fish more likely to be passively transported by currents (Saunders 1965, Folmar and Dickhoff 1980, Smith 1982). In general, smoltification is timed to be completed as fish are near the fresh water to salt water transition. Too long a migration delay after the process begins is believed to cause the fish to miss the "biological window" of optimal physiological condition for the transition (Walters *et al.* 1978). The optimal thermal range for Chinook salmon during smoltification and seaward migration is 10-13°C (Rich 1997).

Chinook salmon spend between one and four years in the ocean before returning to their natal streams to spawn (Myers *et al.* 1998). Fisher (1994) reported that 87% of returning spring-run adults are three years old based on observations of adult Chinook salmon trapped and examined at Red Bluff Diversion Dam on the Sacramento River between 1985 and 1991.

b. Range-wide Status and Trends of CC Chinook salmon

Available historical and most recent published Chinook salmon abundance information are summarized in Myers *et al.* (1998). The following are excerpts from this document:

> "Estimated escapement of this ESU was estimated at 73,000 fish, predominantly in the Eel River (55,500) with smaller populations in; Redwood Creek, Mad River, Mattole River (5,000 each), Russian River (500), and several small streams in Del Norte and Humboldt Counties.
>
> Within this ESU, recent abundance data vary regionally. Dam counts of upstream migrants are available on the South Fork Eel River at Benbow Dam from 1938 to 1975. Counts at Cape Horn Dam, on the upper Eel River are available from the 1940s to the present, but they represent a small, highly variable portion of the run. No total escapement estimates are available for this ESU, although partial counts indicate that escapement in the Eel River exceeds 4,000.
>
> Data available to assess trends in abundance are limited. Recent trends have been mixed, with predominantly strong negative trends in the Eel River Basin, and mostly upward trends elsewhere. Previous assessments of stocks within this ESU have identified several stocks as being at risk or of concern. Nehlsen *et al.* (1991) identified seven stocks as at high extinction risk and seven stocks as at moderate extinction risk. Higgins *et al.* (1992) provided a more detailed analysis of some of these stocks, and identified nine Chinook salmon stocks as at risk or of concern. Four of these stock assessments agreed with Nehlsen *et al.* (1991) designations, while five fall-run Chinook salmon stocks were either reassessed from a moderate risk of extinction to stocks of concern (Redwood Creek, Mad River, and Eel River) or were additions to the Nehlsen *et al.* (1991) list as stocks of special concern (Little and Bear Rivers). In addition, two fall-run stocks (Smith and Russian Rivers) that Nehlsen *et al.* (1991) listed as at moderate extinction risk were deleted from the list of stocks at risk by Higgins *et al.* (1992), although the U.S. Fish and Wildlife Service reported that the deletion for the Russian River was due to a finding that the stock was extinct."

Observed widespread declines in abundance and the present distribution of small populations with sometimes sporadic occurrences contribute to the risks faced in this ESU. Based on this information, NOAA Fisheries concluded that the CC Chinook salmon ESU is likely to become endangered in the near future (September 16, 1999, 64 FR 50393).

More recent information for the status of CC Chinook salmon (NOAA Fisheries 2003b) continues to support this conclusion:

> "No information exists to suggest new risk factors, or substantial effective amelioration of risk factors noted in the previous status reviews save for recent changes in ocean conditions. Recent favorable ocean conditions have contributed to apparent increases in abundance and distribution for a number of anadromous salmonids, but the expected persistence of this trend is unclear."

C. Factors Affecting the Species and Critical Habitat

Salmonids on the west coast of the United States have experienced declines in abundance in the past several decades as a result of loss, damage or change to their natural environment. Studies indicate that in most western states, about 80 to 90% of the historic riparian habitat has been eliminated (Norse 1990, California State Lands Commission 1993). Loss of habitat complexity and habitat fragmentation have also contributed to the decline of salmonids. For example, in national forests within the range of the northern spotted owl in western and eastern Washington, there has been a 58% reduction in large, deep pools due to sedimentation and loss of pool-forming structures such as boulders and large wood (FEMAT 1993). Similar effects are likely in California. The California Advisory Committee on Salmon and Steelhead Trout (CACSST) reported habitat blockages and fragmentation, logging and agricultural activities, urbanization, and water withdrawals as the most predominant problems for anadromous salmonids in California's coastal basins (CACSST 1988). They identified associated habitat problems for each major river system in California. CDFG (1965, Vol. III, Part B) reported that the most vital habitat factor for coastal California streams was "degradation due to improper logging followed by massive siltation, log jams, *etc.*" They cited road building a another cause of siltation in some areas. They identified a variety of specific critical habitat problems in individual basins, including extremes of natural flows (Redwood Creek and Eel River), logging practices (Mad, Eel, Mattole, Ten Mile, Noyo, Big, Navarro, Garcia, and Gualala rivers), and dams with no passage facilities (Eel and Russian rivers), and water diversions (Eel and Russian rivers).

The factors for decline among populations of SONCC coho salmon, CC Chinook salmon, and NC steelhead are similar and are discussed collectively below. Factors affecting only a particular species are highlighted, where appropriate. For more detailed discussions on factors for decline of SONCC coho salmon, refer to Weitkamp *et al.* (1995) as updated by Schiewe (1997a) and CDFG (2002). Factors influencing CC Chinook salmon are discussed in Myers *et al.* (1998). Factors causing NC Steelhead declines are described in Busby *et al.* (1996).

1. Timber harvest

Timber harvest and associated activities occur over a large portion of the ESUs of the affected species. Timber harvest has caused widespread increases in sediment delivery to channels through both increased landsliding and surface erosion from harvest units and log decks. Much of the riparian vegetation has been removed, reducing future sources of LWD needed to form and maintain stream habitat that salmonids depend on for various life stages. Cumulatively, the increased sediment delivery and reduced woody debris supply have led to widespread impacts to stream habitats and salmonids. These impacts include reduced spawning habitat quality, loss of pool habitat for adult holding and juvenile rearing, loss of velocity refugia, and increases in the levels and duration of turbidity which reduces the ability of juvenile fish to feed, and, in some cases may cause physical harm by abrading the gills of indivual fish. These changes in habitat have led to widespread decreases in the carrying capacity of the streams that support salmonids.

2. Road construction

Road construction, whether associated with timber harvest or other activities, has caused widespread impacts to salmonids (Furniss *et al.* 1991). Where roads cross salmonid-bearing streams, improperly placed culverts have blocked access to many stream reaches. Landsliding and chronic surface erosion from road surfaces are large sources of sediment across the affected species' ranges. Roads also have the potential to increase peak flows with consequent effects on the stability of stream substrates and banks. Roads have led to widespread impacts on salmonids by increasing the sediment loads. The consequent impacts on habitat include reductions in spawning, rearing and holding habitat, and increases in turbidity. These effects are similar to those described for timber harvest above.

3. Hatcheries

Artificial propagation is also a factor in the decline of salmonids due to the genetic impacts on indigenous, naturally-reproducing populations, disease transmission, predation of wild fish, depletion of wild stock to enhance brood stock, and replacement rather than supplementation of wild stocks through competition and the continued annual introduction of hatchery fish. Artificial propagation and other human activities such as harvest and habitat modification can genetically change natural populations so much that they no longer represent an evolutionarily significant component of the biological species (Waples 1991). NOAA Fisheries specifically identified the past practices of the Mad River Hatchery as potentially damaging to NC Steelhead. CDFG out-planted non-indigenous Mad River Hatchery brood stocks to other streams within the ESU. They also attempted to cultivate a run of non-indigenous summer steelhead within the Mad River. CDFG ended these practices in 1996.

4. Water diversions

Streamflow diversions are common throughout the species' ranges. Unscreened diversions for agricultural, domestic and industrial uses are a significant factor for salmonid declines in many basins. Reduced streamflows due to diversions reduces the amount of habitat available to salmonids and can degrade existing water quality, particularly where return flows enter the river. Reductions in the quantity of water in a given stream reach will reduce the carrying capacity of the reach. Where warm return flows enter the stream, fish may seek reaches with cooler water, thus increasing competitive pressures in other areas.

5. Predation

Predation was not believed to have been a major cause in the species decline, however, they may have had substantial impacts in local areas. For example, Higgins *et al.* (1992) and CDFG (1994) reported that Sacramento River pikeminnow have been found in the Eel River basin and are considered a major threat to native salmonids (this is discussed further in the *Environmental Baseline* section). Furthermore, California sea lions and Pacific harbor seals, which occur in most estuaries and rivers where salmonid runs occur on the West Coast, are known predators of salmonids. However, salmonids appear to be a minor component of the diet of marine mammals (Scheffer and Sperry 1931, Jameson and Kenyon 1977, Graybill 1981, Brown and Mate 1983, Roffe and Mate 1984, Hanson 1993). In the final rule listing the SONCC coho salmon ESU, for example, NOAA Fisheries indicated that it was unlikely that pinniped predation was a significant factor in the decline of coho salmon on the west coast, although they may be a threat to existing depressed local populations. NOAA Fisheries (1997) determined that although pinniped predation did not cause the decline of salmonid populations, in localized areas where they co-occur with salmonids (especially where salmonids concentrate or passage may be constricted), predation may preclude recovery of these populations. Specific areas where predation may preclude recovery cannot be determined without extensive studies.

6. Disease

Infectious disease is one of many factors that can influence adult and juvenile salmonid survival. Salmonids are exposed to numerous bacterial, protozoan, viral, and parasitic organisms in spawning and rearing areas, hatcheries, migratory routes, and the marine environment. Very little current or historical information exists to quantify changes in infection levels and mortality rates attributable to these diseases for salmonids. However, studies suggest that naturally spawned fish tend to be less susceptible to pathogens than hatchery-reared fish (Sanders *et al.* 1992).

7. Existing regulatory mechanisms

Existing regulatory mechanisms, including land management plans (*e.g.*, National Forest Land Management Plans, State Forest Practice Rules), Clean Water Act section 404 activities, urban growth management, and harvest and hatchery management all contributed to varying degrees to the decline of salmonids due to lack of protective measures, the inadequacy of existing measures to protect salmonids and/or their habitat, or the failure to carry out established protective measures.

The Clean Water Act (CWA), enforced in part by the EPA, is intended to protect beneficial uses, including fishery resources. To date, implementation has not been effective in adequately protecting fishery resources, particularly with respect to non-point sources of pollution. In addition, section 404 of the CWA does not adequately address the cumulative and additive effects of loss of habitat through continued development of waterfront, riverine, coastal, and wetland properties that also contribute to the degradation and loss of important aquatic ecosystem components necessary to maintain the functional integrity of these habitat features. Sections 303 (d) (1) (C) and (D) of the CWA require states to prepare Total Maximum Daily Loads (TMDLs) for all water bodies that do not meet State water quality standards. Development of TMDLs is a method for quantitative assessment of environmental problems in a watershed and identification of pollution reductions needed to protect drinking water, aquatic life, recreation, and other uses of rivers, lakes, and streams. Appropriately protective aquatic life criteria are critical to the TMDL process for affecting the recovery of salmonid populations, as the criteria's exceedence will determine which water bodies will engage in the TMDL process and criteria compliance goals are the impetus for developing mass loading strategies. The ability of these TMDLs to protect salmonids should be significant in the long term. However, developing them quickly in the short term will be difficult, and their efficacy in protecting salmonid habitat will be unknown for years to come.

In August, 2002 the California Fish and Game Commission (Commission) issued a finding that coho salmon warranted listing as a threatened species in the Southern Oregon/Northern California Coast ESU under the California Endangered Species Act. The Commission directed the Department of Fish and Game to develop a Recovery Strategy. Subsequently, the Directory of the Department of Fish and Game initiated a multi-stakeholder statewide Coho Recovery

Team to make recommendations on components of a plan to recover the species. Once officially listed by the state, implementation of the recovery plan and protective regulations will potentially have significant long term benefits to coho salmon. However, we do not know the manner in which additional regulations and recovery actions will be implemented. Therefore, at this time, we cannot estimate how coho salmon will benefit from the state listing.

8. Sport and commercial harvest

Commercial and recreational ocean salmon fisheries result in adult mortality of listed Chinook salmon and coho salmon originating from the action area. Steelhead are rarely caught in the ocean fisheries. Ocean salmon fisheries are managed by NOAA Fisheries to achieve Federal conservation goals for certain key stocks specified in the Pacific Coast Salmon Fishery Management Plan (FMP) for west coast salmon. The goals specify numbers of adults that must be allowed to spawn annually, or maximum allowable adult harvest rates. The key stocks in California are Klamath River fall Chinook salmon and Sacramento River fall Chinook salmon. In addition to the FMP goals, salmon fisheries must meet requirements developed through NOAA Fisheries intra-agency section 7 consultations. The commercial and recreational take of listed salmon from the action area is treated as incidental to the harvest of more abundant Chinook salmon stocks from the Central Valley and Klamath River basins. In the past, NOAA Fisheries has issued Reasonable and Prudent Alternatives (RPAs) in connection with the ocean harvest of several listed salmon ESUs, including CC Chinook salmon and SONCC coho salmon, both of which occur in the action area.

Reliable harvest rates are available for Klamath River fall Chinook salmon, which are not part of the CC Chinook salmon ESU but have a pattern of ocean distribution similar to that of Eel River Chinook salmon, as described in the 2000 FMP Opinion (NOAA Fisheries 2000a). Beginning in 1991, ocean harvest rates on Klamath River fall Chinook salmon declined from an average of 45% (1981-1990) to an average of 12% (1991-2002). The reduction in ocean harvest was a result of implementing the Federally reserved fishing rights of the Yurok and Hoopa Valley Indian tribes of the Klamath Basin, quantified in 1993 as 50% of the available harvest. NOAA Fisheries' 2000 biological opinion on the FMP required that ocean harvest rates on Klamath River fall Chinook salmon (used as an indicator for harvest rates on CC Chinook salmon) not exceed 16%.

Figure 2 shows a time series of post-season estimates of ocean harvest rates on age-4 Klamath River fall Chinook salmon. The total harvest rate on Klamath River fall Chinook salmon, including ocean commercial and recreational, river recreational, and tribal harvest is substantially higher than the ocean harvest rate. For example, the fraction of the age-4 ocean abundance taken by ocean and river fisheries between 1998 and 2002 ranged from 27% to 40%, two to four times the rate of ocean harvest alone. Total harvest rates on CC Chinook salmon would be closer to the ocean harvest rate for Klamath River fall Chinook salmon, since no tribal fisheries occur in the CC Chinook salmon ESU spawning area, and no retention of fish is permitted in recreational river fisheries in the CC Chinook salmon ESU spawning area, so that mortality is limited to that associated with hook and release fishing.

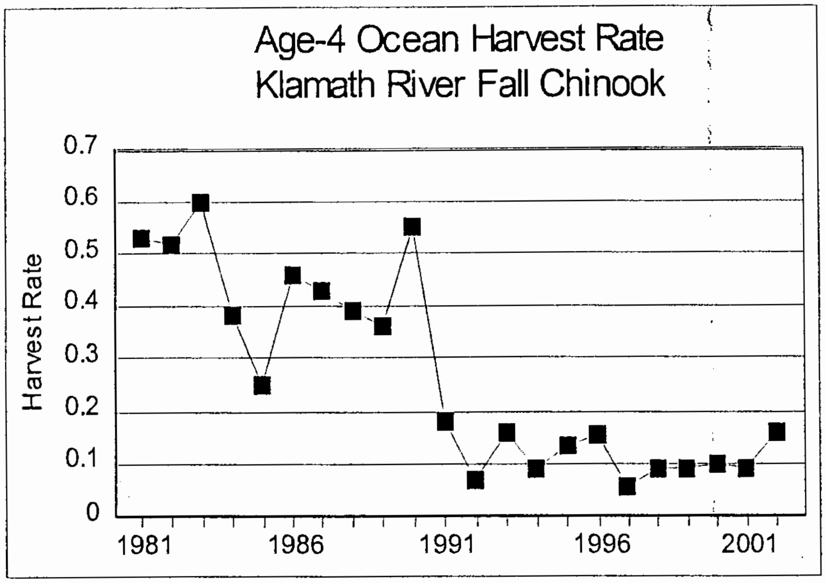

Figure 2. Ocean harvest rate on age-4 Klamath River fall Chinook salmon. Harvest rate defined as the fraction of the ocean abundance available on September 1 (year-1) that was harvested during the period September 1 (year-1) through September 1 (year). From PFMC Preseason Report I 2003.

In addition to the reduction in numbers of spawners, ocean salmon fisheries may reduce the viability of Chinook salmon populations through negative effects on demographics. The sequential interception of immature fish by ocean fisheries results in a reduction in the proportion of a cohort that spawns as older, larger fish. The reduction in the average age of spawning would be further intensified by genetic changes in the population due to the heritability of age of maturation (Ricker 1980, Hankin and McKelvey 1985, Hankin and Healy 1986). The higher productivity of larger and older female Chinook salmon results from the larger size and number of eggs they carry (Healey and Heard 1984) as well as their ability to spawn in larger substrates and create deeper egg pockets (van den Berge and Gross 1984, Ricker 1980, Shelton 1955). This reduces scour potential, which may be especially important to the productivity of redds in areas subject to high sediment loads and scour, such as those found in streams included in the action area.

Ocean exploitation rate estimates are available for tagged hatchery coho salmon from the Klamath, Trinity, and Rogue rivers and serve as an index for the impact rates on SONCC coho salmon. NOAA Fisheries' 1999 FMP biological opinion (NOAA Fisheries 1999a) requires that management measures developed under the FMP achieve an ocean exploitation rate on Rogue/Klamath hatchery coho salmon stocks of no more than 13%. The mortality is a result of post-release mortality associated with marking selective fisheries for coho salmon off Washington and Oregon and Chinook salmon fisheries. Retention of either marked or unmarked coho salmon is prohibited off California. Post-season estimates of exploitation rates on Rogue/Hatchery stocks have been below the required 13% since 1998.

The RPA of the 2000 biological opinion (NOAA Fisheries 2000a) on the effects of the FMP on CC Chinook salmon, like all RPAs, was intended to avoid jeopardizing the continued existence of the species and not designed to ensure recovery of the species. The 2000 FMP Opinion concluded that the incidental take of CC Chinook salmon in ocean fisheries between 1996 and 1999 appeared to be sufficiently low as to allow persistence of CC Chinook salmon populations at low abundance levels. The RPA in the FMP Opinion was designed to prevent ocean harvest rates from rising substantially above those experienced by the population during those years. The FMP Opinion noted that the uncertainty regarding abundance trends of CC Chinook salmon populations and the absence of reliable estimates of ocean harvest rates for CC Chinook salmon make it difficult to assess the potential for CC Chinook salmon populations to recover under the current levels of fishing mortality. Under these conditions, any action that reduces the viability of the CC Chinook salmon salmon population in ways not anticipated by previous biological opinions, must be carefully considered to ensure that the combined effects of the actions do not result in a level of take that would jeopardize the ESU.

IV. ENVIRONMENTAL BASELINE

During section 7 consultation, NOAA Fisheries analyzes the effects of past and ongoing human and natural factors which have led to the current status of the species, its habitat (including designated critical habitat), and ecosystems within the action area. The action area is composed of the six river reaches and two isolated sites extending from the uppermost extent of mining downstream to the Pacific Ocean (Figure 1). The extent of the action area for each river reach is more specifically defined in the discussion for each reach.

"Effects of the action" refers to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process (50 CFR § 402.02).

The discussion below first describes current and historic impacts to salmonids and salmonid habitat across the action area as a whole. Then, the general setting and factors unique to each river reach in the action area are discussed. This discussion includes a description of habitat condition, salmonid trends, abundance and utilization of each reach. Finally, factors limiting the survival and recovery of ESA-listed salmonids in the action area are described. This final step recognizes that there are some factors that may be unique to a river reach, yet continue to limit the survival and recovery of a particular species at the ESU-scale.

A. Historic and Current Impacts to Salmonids Across the Action Area

1. Artificial Propagation

There are several salmonid production facilities in operation within or upstream of the action area. Currently, hatcheries are located on the Trinity River, Mad River, Yager Creek (Van Duzen River tributary), and three facilities in the Eel River watershed, above the action area.

Hatcheries on the Pacific Coast have been used for more than a hundred years in attempts to mitigate the effects of human activities on salmon and to replace declining and lost natural populations. These hatchery fish appear to have had substantial adverse effects on native fish populations. Artificial propagation threatens the genetic integrity, and diversity that protects overall productivity against changes in environment (October 31, 1996, 61 FR 56138). The potential adverse impacts of artificial propagation programs are well documented (reviewed in Waples 1991, National Research Council 1995, Natural Resource Council 1996, Waples 1999). These potential impacts have three broad categories: disease, genetic, and ecological.

a. Disease Impacts

There are two important elements to consider in regard to the effects of disease as a result of artificial propagation: disease/pathogen amplification and disease/pathogen transmission. Amplification is simply the increase in disease (pathogens) from artificial propagation. Hatcheries may act as reservoirs of infection due to conditions (crowding or increased stress) or practices (handling) which increase the vulnerability of fish to infection and maintain pathogen populations at infective levels (Goede 1986). Disease problems may also persist in hatcheries because of contaminated water supplies and vertical transmission of pathogens. In addition, fish may carry latent disease from one generation to the next. Fish kept at high densities in hatcheries are prone to epidemics involving diseases that are uncommon in the natural environment, supplying strong selection for disease-resistant fish. These disease resistant fish subsequently can act as carriers for disease to the non-resistant wild population (National Research Council 1995).

b. Genetic Impacts

The potential genetic impacts that result from artificial propagation programs are both the most serious and the hardest to detect. Potential genetic impacts from artificial propagation can be classified as: (1) extinction of native genetic stocks, (2) erosion of diversity among populations, (3) erosion of diversity within populations, and (4) domestication (Busack and Currens 1995). These impacts do not necessarily occur independently and may result either directly or indirectly from artificial propagation. Understanding and managing genetic impacts are imperative for both directing existing artificial propagation programs and for assessing the benefits and risks of new programs.

c. Ecological Impacts

Ecological interactions between natural and hatchery fish are complex and may occur at different biological levels from individual to community (National Research Council 1995). As such, an understanding of ecological processes and the interactive, biophysical attributes necessary for Pacific salmon survival is necessary to assess interactions between natural and hatchery fish. The ecological impacts of hatchery programs on natural Pacific salmon and their ecosystems may be classified as: (1) carrying capacity, (2) competition, (3) predation, and (4) altered migration behavior. When considering these impacts, it is important to consider not only fish biology, but also the processes that influence ecosystems, including human influences. If a wild population is small because of habitat loss or alteration, the increased population density that results from augmentation can increase competition for food, space, or other functions the habitat provides. That competition can further reduce the size of the wild population. The migration and spawning timing of hatchery stocks of steelhead in northern California has been truncated since hatchery operations began due to hatchery selection of breeding stock from only the early part of the run (Busby *et al.* 1996). This shortening of spawning time limits the ability of the population to respond to stochastic events, such as late onset of rains, large storm events, or unusual low flow periods. It may also condense the population in spawning grounds, stressing the individuals.

The National Research Council (1995, 1996) concluded that hatcheries altered behavior of fish, caused ecological problems by eliminating the nutritive contributions of carcasses of spawning salmon from streams, and probably displaced the remnants of wild runs. Hatcheries have also increased the effects of mixed-population fisheries on depleted natural populations. If fisheries respond to apparent abundance without considering the mixture of population portions from different stock sources or hatchery contributions, the natural population will be overfished. Many problems arise when the goal of hatcheries is to provide substitutes for natural populations lost or displaced because of human development activities, and from insufficient incorporation of basic genetic, evolutionary, and ecological principles into hatchery planning, operation, and monitoring (National Research Council 1995, 1996).

Mad River hatchery, located at the upstream end of the Mad River portion of the action area, was opened in 1970. Chinook salmon, coho salmon and steelhead were produced. Chinook salmon broodstock has generally been drawn from fish returning to the Mad River, however, releases in the 1970s and 1980s included substantial releases of fish from out-of-basin and out-of-ESU (NMFS 2003b). Coho salmon production ceased after the 1999 brood year. The original broodstock was from the Noyo River, which lies outside of the SONCC coho salmon ESU. Subsequent releases included several other out-of-ESU stocks as well as out-of-basin, within-ESU transfers. Concern about both out-of-ESU and out-of-basin stock transfers, as late as 1996, was sufficiently great that the Mad River Hatchery was excluded from the SONCC ESU by NOAA Fisheries (Schiewe 1997). CDFG recently decided to cease coho salmon production at the facility (NMFS 2003) and the current future of Mad River Hatchery is unknown, but private funding may keep the hatchery operating. An average of 5,536 adults were trapped annually from 1991-2002 (NMFS 2003). Original broodstock was supplied from the Eel River with additional transfers from the San Lorenzo River (NMFS 2003). NOAA Fisheries specifically identified the past practices of the Mad River Hatchery as potentially damaging to NC Steelhead. CDFG out-planted non-indigenous Mad River Hatchery brood stocks to other streams within the ESU. They also attempted to cultivate a run of non-indigenous summer steelhead within the Mad River. CDFG ended these practices in 1996. Therefore, indigenous steelhead in the Mad River possess an out-of-basin genetic component and are subject to the genetic effects of hatcheries described in the *Status of the Species* section.

The hatchery is currently marked for closure due to budget constraints, but local fishing groups may find funding to keep the hatchery operating. The hatchery rears 250,000 yearling steelhead each year that are planted in March into the Mad River. The hatchery operates a ladder into their facility during the winter months to collect adult steelhead for broodstock. Currently, the hatchery is closed, but may operate in the future if local groups can raise sufficient funds for its operation. As such, future impacts that will occur if the hatchery remains closed are primarily genetic, which are described in greater detail below. Even though the hatchery may remain closed, we expect long-term impacts, primarily reduced fitness and production, from hatchery steelhead and the progeny of hatchery and wild fish intermingling and mating on spawning grounds (outbreeding depression).

In the early 1900s as many as 20 million hatchery steelhead were produced and planted into the Eel River (SEC 1998). Hatchery plants to the South Fork Eel River and upper Eel River have varied greatly since that time, but have likely had significant adverse impact upon wild salmonids over time. The relatively large steelhead smolts produced by hatcheries are known to prey upon and displace smaller wild salmonids.

2. Floods

Major floods in 1955 and 1964 occurred during a period of intense land use, primarily related to timber harvest (CDFG 1997), which resulted in major adverse changes to the quantity and quality of salmonid habitat across the action area. Effects have been a decrease in the overall quality and complexity of habitat, such as filling of pools, erosion of riparian vegetation, and export of in-stream woody debris. Changes to spawning and rearing habitat, as a result of the floods, in combination with overfishing and poor ocean conditions, caused a decline in the Chinook salmon population from which they never recovered (Moyle 2002). In the action area, legacy effects that likely persist are widened and aggraded channels due to the immense quantity of sediment that was deposited in the reach during the floods. This material will likely continue to limit the formation of higher quality habitat until mature vegetation re-establishes on the deposited materials or the material is transported downstream. In particular, the Eel and Van Duzen rivers are likely still recovering from these past events. However, NOAA Fisheries is not aware of any information that describes the progress of this recovery. In the Mad River, however, preliminary information presented by CHERT (pers. comm., R. Klein, CHERT, June 22, 2004) suggests the lower river reach has largely recovered from the effects of these floods as evidenced by channel widths that are similar to the pre-flood conditions.

3. Timber Harvest

Forestry management on non-Federal timberlands, which utilizes existing California Forest Practice Rules, falls short of providing adequate protections for salmonid habitats (June 7, 2000, 65 FR 36074). Ongoing forest activities on non-Federal lands are likely to continue to degrade essential salmonid habitat values. Environmental impacts identified with timber harvest may include increased sediment production from roads and other sources, loss of LWD recruitment, reduced function of riparian areas, reductions in water quality and quantity, increased water temperatures and loss of channel complexity. Timber harvest activities have altered watershed conditions by changing the quantity and size distribution of sediment, leading to stream channel instability, pool filling by coarse sediment, or introduction of fine sediment to spawning gravels. These conditions may have contributed to a reduction in overall habitat complexity within the action area, which in turn reduces the survival of salmonid populations.

On March 1, 1999, the USFWS and NOAA Fisheries issued a section 10(a)(1)(B) Incidental Take Permit to, jointly, Pacific Lumber Company, Scotia Pacific Company LLC and Salmon Creek Corporation (collectively "PALCO") for their Habitat Conservation Plan (HCP). The Incidental Take Permit exempts take of a number of species, including CC Chinook Salmon, SONCC coho Salmon, and NC steelhead.

A portion of the action area for the PALCO HCP is within the middle and lower sections of the Eel River basin, including the lower Van Duzen River, the Mattole River, Bear River, as well as a small portion in tributaries above the Mad River, above the proposed mining reaches. Included in the HCP is an Aquatic Conservation Plan (ACP) to minimize, mitigate and monitor the effects of timber harvesting activities on aquatic ecosystems. The goal of the ACP is to maintain or achieve, over time, properly functioning aquatic habitat conditions, which are essential to the survival of salmonids. The six main elements of the ACP are of: riparian management strategy, hillslope management, road management, watershed analysis, a disturbance index, and monitoring.

The PALCO HCP is in effect for fifty years and focuses on the goal of moving towards properly functioning conditions over the fifty-year term of the PALCO HCP. However, there is no timeline established for achieving properly functioning conditions in watersheds covered by the PALCO HCP. Whether some watersheds that have been damaged to such an extent that they currently only marginally, or do not at all, support listed species (*e.g.*, Bear Creek, a tributary to the Eel River) will measurably improve over the term of the PALCO HCP to the point where they again support healthy fish populations, is unclear.

Timber harvest has long been a major economic use in the action area watersheds, resulting in a long and continuing legacy of effects to salmonids. In the most recent designation of critical habitat (February 16, 2000, 65 FR 7764), NOAA Fisheries noted that human activities in the riparian zone and upslope areas can harm stream function and salmonids, both directly and indirectly. These activities include timber harvests that can increase sediment inputs, destabilize banks, reduce organic litter and woody debris, and increase water temperatures. Collectively, these impacts have simplified stream habitat that salmonids depend on. This simplification of habitat has occurred through the filling of pools, the lack of LWD to create and maintain habitat and provide cover. Increased sediment loads from timber harvesting has also increased turbidity levels, impairing the ability of juvenile salmonids to feed. Where temperatures are sufficiently high, salmonids may avoid the reach entirely, or suffer from increased metabolic stress. Therefore, past timber harvest has reduced both the abundance and distribution of salmonids in the action area.

4. <u>Historic and Current Salmon Fishery</u>

NOAA Fisheries is concerned with the potential mortality of salmonids as a result of catch and release angling that occurs in the action area during the fall. Despite restrictions on the retention of non-hatchery salmonids once they enter freshwater, a catch and release fishery for Chinook salmon remains popular; especially in the action area (J. Froland, CDFG, pers. comm. 2002; M. Gilroy, CDFG, pers. comm. 2002). No analysis of the effects of this fishery on salmonids has been undertaken and the amount of death or injury is unknown; however, it is likely that this fishery results in a decrease in the number of adult salmonids that survive to spawn once they enter freshwater.

5. Reservoirs and Flow Regulation

Reservoirs and associated flow releases influence salmonids and their habitat on the Eel, Mad and Trinity rivers. Each of these is discussed in the following sections on the impacts to salmonids for each river reach.

6. Past Gravel Extraction

Gravel extraction has occurred throughout the action area in the past. CHERT recommended extraction volumes and actual extraction volumes per year for each river reach are listed in.

Table 4. CHERT recommended extraction volumes for Humboldt County rivers and isolated extraction sites (cubic yards).

River	1997	1998	1999	2000	2001	2002	2003	Average
Total recommended volume for Mad River	252,926	265,796	196,213	204,749	199,551	204,992	150,390	210,660
Actual Extraction Volume	210,976	223,352	174,974	146,534	174,980	171,937	136,790	177,078
Total recommended volume for South Fork Eel River	67,840	75,351	86,118	75,756	68,106	68,174	87,060	75,486
Actual Extraction Volume	74,762	66,630	75,945	53,812	43,120	59,774	54,660	61,243
Total recommended volume for Middle Eel River	147,332	157,908	134,921	203,189	116,431	132,768	74,030	138,083
Actual Extraction Volume	84,976	99,444	124,811	153,971	63,760	121,608	54,060	100,376
Total recommended volume for Van Duzen River	119,931	119,071	156,860	188,925	161,360	202,528	175,130	160,544
Actual Extraction Volume	81,652	103,767	146,814	116,675	85,620	167,366	123,030	117,846
Total recommended volume for Lower Eel River	550,620	405,151	421,451	291,858	461,530	387,344	318,340	405,185
Actual Extraction Volume	326,454	272,899	290,533	208,612	173,440	220,015	163,930	236,555
Total recommended volume for Trinity River	47,538	35,000	58,700	18,000	36,621	38,145	102,089[a]	48,013
Actual Extraction Volume	40,040	28,186	66,889	22,181	15,124	19,394	70,001[b]	37,402
Total recommended volume for Cook Bar, NF Mattole River			30,000					30,000
Actual Extraction Volume			19,028					19,028
Total recommended volume for Satterlee Bar, Eel River				43,200				43,200

near Ft. Seward								
Actual Extraction Volume				22,908				22,908

a – Includes 25,879 cubic yards recommended through an interagency review team rather than CHERT for the Hoopa Valley Tribe
b – Includes 20,611 cubic yards actually extracted by the Hoopa Valley Tribe through an individual permit

Understanding the potential reach-scale effects of the multiple extraction sites is important. In reaches where multiple excavations occur, bed lowering may occur downstream of the excavation sites, particularly if extraction rates exceed natural replenishment. This bed lowering, as discussed below, can promote simplification of in-stream habitat elements as the extent of habitat-forming bars are decreased. Therefore, the removal of sediment, particularly if extraction rates exceed natural replenishment, can be expected to both lower bed elevations and increase lateral instability through bank erosion (Simon and Hupp 1992), each of which tends to simplify stream habitats.

Sediment removal can result in localized or reach-scale bed degradation. Over time, stream channels adjust toward equilibrium between the sediment load and dominant sediment transporting flows. A gradual migration of the channel by eroding the outside of bends and depositing equal volumes on the inside of bends creates the dynamic equilibrium condition where the bed and banks are not net sources of sediment. Therefore, the equilibrium stream channel is efficient at maintaining its geomorphic form and pattern, although the system remains dynamic as it responds to cyclic floods and sediment delivery events. Dunne *et al.* (1981) stated, "bars are temporary storage sites through which sand and gravel pass, most bars are in approximate equilibrium so that the influx and downstream transport of material are equal when averaged over a number of years. If all the sand and gravel reaching such a bar is removed, the supply to bars downstream will diminish. Since sand and gravel will continue to be transported from these downstream bars by the river, their size will decrease."

If stream bed lowering increases bank heights to the degree that banks become unstable, rapid bank retreat may occur, further destabilizing the width, but supplying the channel with sediments that restore the transport-supply balance, to prevent further degradation until they are flushed out (Knighton 1984, Little *et al.* 1981). Thus, sediment removal from a relatively confined reach can trigger erosion migrating upstream, causing erosion of the bed and banks which increases sediment delivery to the site of the original sediment removal. Channel morphology could be simplified as a result of degradation following sediment removal (Church *et al.* 2001). Also, Simon and Hupp (1992) show there is a positive correlation between bed lowering and channel widening, or bank retreat. As discussed above, channel widening can simplify habitats (Collins and Dunne 1990) and increase bank erosion, which can deliver sediment to downstream sites (Olson 2000), further reducing the quality of pools. Repeated sediment extraction at a certain percent of natural sediment replenishment rates, such as what has occurred in the past, may also deplete sediment sources and impact habitats downstream.

Unfortunately, estimating sustainable yields for gravel extraction in a reach is difficult. CHERT's definition of the long-term average annual sustained yield is equivalent to the mean annual recruitment (MAR) into the extraction reach. In the action area, MAR has only been estimated with reasonable confidence for the Mad and Van Duzen rivers (Klein *et al.* 2001). The use of MAR as a sustained yield extraction volume assumes that the average volume transported into the reach is available for extraction. The actual sustained yield volume should be the volume into the upper end of the extraction reach less the volume transported through and out of the downstream end of the reach, to maintain downstream river morphology. Given the small quantities or missing number of bedload samples and bed material samples in the mining reaches, MAR into and out of the reach can only be estimated with low confidence. Aside from the low confidence level in the estimation of the MAR, there is also an enormous natural variation in bedload volumes from year to year, where the average value may be much higher than the actual recruited volume during a less than normal water year. Site specific criteria, designed to provide a minimum limit for excavation design, may provide protection of the stream morphology and may result in an excavated volume decrease during drought periods.

The scope of gravel extraction is discussed in the following sections on the impacts to salmonids for each individual river reach.

B. Eel River Baseline

1. <u>General Setting and Location</u>

The Eel River basin is located in northern California in Humboldt, Mendocino, and Lake counties. The basin drains 9,400 sq. km (3,630 sq. mi.) with a mean annual discharge of 6.5 million acre feet. Flows are highly variable between seasons and years. The basin is divided into two climates, the Mediterranean climate with hot, dry summers and cool, wet winters in the upper and middle basin, and a coastal climate with cool, foggy summers and moderate, rainy winters in the lower basin. Flows near the mouth of the Eel River have ranged from 0.34 cubic meters per second (cms) to 21,297 cms (12 to 752,000 cfs) in the historic record. Flows are consistently and vastly different between wet and dry seasons. The headwaters of the Eel River at elevations near 2,134 m (7,000 ft) receive 178 cm (70 in) of precipitation per year [U.S. Geological Survey (USGS) 1969]. Snow pack in elevations over 5,000 ft persists through May and into June.

For the purposes of this Opinion, the discussion of the Eel River is divided into four reaches: the South Fork Eel River, Middle Eel River (above the confluence with the Van Duzen River), the lower Eel River (below the Van Duzen River confluence) and the lower Van Duzen River. The following sections provide more detailed information for the individual reaches.

a. Lower Eel River Below the Van Duzen River Confluence

The Lower Eel River reach extends from the mouth of the Van Duzen River approximately eight miles downstream to about one mile below Fernbridge. Mining has occurred from 15 areas on six bar features in the Lower Eel River each year. Halligan (1997) described the lower reach of the Eel River as an area contained within a 0.5-mile to several mile-wide river valley that extends from Singley Bar, below Fernbridge, upstream approximately 40 km (25 mi.). The lower Eel River, from Rio Dell downstream, continues to the estuary through an unconfined depositional reach to the ocean. This low lying alluvial reach is typified by agriculture, dairy farms, and urban development. During the summer, water temperatures are cooled by the air temperatures in the coastal fog belt. The gage at Scotia recorded an average of 127-152 cm (50-60 in) of rain per year (USGS 1969). Upland habitats are typically comprised of dense redwood forests. Mainstem flows have ranged between 12 cfs during drought years and 750,000 cfs during extremely wet years in this reach. The valley is bordered by foothills of the coastal mountains.

b. Middle Eel River Above the Van Duzen River Confluence

The Middle Eel River reach is approximately 30.7 miles total and begins approximately 5.7 miles above the South Fork Eel River confluence, and extends down approximately 25 miles from the South Fork Eel River confluence to the Van Duzen River confluence. There are 10 gravel bars proposed to be mined in the reach. Four of the mined bars are located in the 5.7 miles above the South Fork confluence. The Holmes-Larabee Bar is relatively isolated about eight miles below the South Fork Eel River confluence. The lower five sites are located along the four-mile stretch of river above Scotia, approximately three miles below the Holmes-Larabee Bar.

c. South Fork of the Eel River

The South Fork Eel River is the second largest tributary to the Eel River, with a drainage basin of 1,784 sq. km (689 sq. mi., Halligan 1997). The South Fork Eel River mining reach extends approximately 17.5 miles from Cook's Valley to Redway. Seven of the 12 mined areas occur at Cook's Valley within about one mile of each other. Gravel extraction is proposed on 12 areas within the reach. The reach downstream of Legget Valley averages two percent gradient and is highly aggraded with assorted gravels (CDFG 1997). Mean annual precipitation in most of this watershed is between 152 and 178 cm (60 and 70 in). The upland areas are predominantly old growth redwood stands and previously logged mixed redwood-conifer-hardwood forest. The river is bordered by California State Park, Highway 101, Highway 254, small communities, and private timber land. The area of gravel extraction extends from near the town of Redway upstream to the Mendocino County line at Cook's Valley. This reach tends to be somewhat confined and subject to bedrock control in some areas (Halligan 1997a). For example, the Randall Sand and Gravel operation in Garberville excavates sediment that has been deposited on top of a bedrock shelf.

d. Van Duzen River

The Van Duzen River, a tributary to the Eel River, drains 1,100 sq. km (429 sq. mi., Halligan 1997) and enters the Eel River approximately 22 km (14 mi.) from its mouth at the Pacific Ocean. Headwaters of the Van Duzen River watershed originate at over 1,520 m (5,000 ft) elevation in the northern California Coast Ranges, and the river is 15 m (50 ft) in elevation at the confluence of the Eel River. The geology of the Van Duzen River watershed is comprised of Franciscan, Yager, and tertiary and quaternary sediments. The climate is typical of northern California, Mediterranean with cool wet winters to warm dry summers. Annual precipitation ranges from 127 cm (50 in) near the confluence with the Eel River to 178 cm (70 in) at the headwaters. Flows within the Van Duzen River watershed vary considerably, with 75% of the rainfall occurring between November and April. August through September stream flows are less than 1.5% of the total. Bankfull discharge is 17,700 cfs at Bridgeville, with peak discharges of 48,700 cfs in 1964 and 34,600 cfs in 1974. Bankfull discharge is 37,400 cfs at its confluence with the Eel River, with peak discharges of 74,300 cfs in January 1995 and 57,000 cfs in March 1995 (Halligan 1997). Agriculture (*e.g.*, ranching), timber harvest and gravel extraction are the primary land uses in the watershed, as described above in the discussion of general impacts within Humboldt County.

The Van Duzen River mining reach extends from the mouth of the Van Duzen River upstream about 5 miles to near Yager Creek. Mining has occurred from nine areas in the Van Duzen River. Four of the extraction sites are located in the last mile of the Van Duzen River just upstream from the confluence with the Eel River. Another three sites are located about four miles upstream, just below the Yager Creek confluence. Another two sites are located about one mile above the Yager Creek confluence.

2. <u>Salmonid Distribution, Trends and Abundance in the Eel River</u>

a. Distribution

The lower Eel River supports summer rearing for juvenile salmonids, and holding areas for adult summer steelhead (Halligan 1997, 1998, 1999, 2003). Juvenile coho salmon do not appear to rely heavily on the lower mainstem for a nursery (Murphy and DeWitt 1951). Brown (1980) reported many more steelhead in lower river pools than in upper river pools. These steelhead may prefer lower river pools because they are cooler and more frequently shaded by fog in the summer than upper river pools. Steelhead may use lower river pools as rearing areas in their second year before they migrate to the sea. Puckett (1977) found heavy concentrations of yearling steelhead in the Eel River estuary through the summer of 1975. Brown (1980) found considerable numbers of yearling steelhead in pools in the lower mainstem Eel River from the confluence of the South Fork Eel River to the estuary. Halligan (1997, 1998, and 1999) reported the presence of summer steelhead, steelhead half-pounders, and Chinook salmon within the lower Eel River. Chinook salmon "jacks" and steelhead half-pounders begin river entry into the lower reach in August and September, with the main run of Chinook salmon occurring in October and November. These observations demonstrate that the lower Eel River provides important rearing habitat for juvenile yearling steelhead in the action area. The Eel River estuary also provides important habitat for juvenile Chinook salmon, which depend on estuarine areas prior to entering the ocean. The estuary also provides spawning and nursery habitat for marine fishes and invertebrates, which are important for both sport and commercial fisheries, as well as forage for juvenile and adult salmonids in the ocean.

Several tributaries to the lower Van Duzen River mainstem provide spawning and rearing habitat for Chinook and coho salmon and steelhead (PALCO 2002). In particular, Grizzly Creek is identified as one of the most important tributaries in the Eel River watershed for Chinook salmon spawning based on mark and recapture research conducted in 40 Eel River tributaries during 1982-83 (CDFG 1982).

b. Population Abundance and Trends

Population trend data for fish spawned and reared entirely within the action area are unavailable. However, overall population trends for the entire Eel River reflect at least an 80% decline in salmon and steelhead from the early 1960s, and roughly a 97% decline over the last century (Table 4).

Table 4. Estimates of Eel River anadromous adult salmonid escapement.

	Estimate of Individuals			
Era	**Coho salmon**	**Chinook salmon**	**Steelhead**	**Reference**
1900	70,000[(1)]	175,000[(1)]	255,000[(1)]	CDFG (1997)
1964	14,000	55,500	82,000	CDFG (1965)
late 1980's	1,000	10,000	20,000	CDFG (1997)
2003	<1,000[(2)]	<5,000	<9,000	
(1) – NOAA Fisheries estimate based upon 1964 run proportions. (2) - NOAA Fisheries estimate of wild runs averaged over the last 10 years				

The California Department of Water Resources (CDWR, 1965), in a 1965 report to the California Department of Water Resources, characterized the Eel River as ". . . one of California's most important anadromous fish streams; ranking second in silver [coho] salmon and steelhead trout production, and third in king [Chinook] salmon production." The most recent population estimates of 10,000 natural SONCC coho salmon (Weitkamp *et al.* 1995), when compared to estimates by NOAA Fisheries of Eel River coho salmon runs of less than 1,000 fish (approximately 10% of the ESU) indicate that the Eel River population is important to the overall ESU, and implies that a self-sustaining and self-regulating Eel River population will be necessary for the recovery of SONCC coho salmon. Summer surveys of coho salmon juveniles in index regions of the South Fork Eel River watershed did not reveal obvious trends in abundance. CDFG (1965) estimated that approximately 500 coho salmon annually migrated up the Van Duzen River. More recently, the 1996, 1997, and 1999 year classes were relatively strong, whereas the 1995, 1998, and 2000 year classes were comparatively weak (NOAA Fisheries 2001).

Similarly, the Eel River is also important for the recovery of the CC Chinook salmon ESU and NC steelhead ESU. CDFG (1965) estimated Eel River Chinook salmon spawning escapement at 55,500, which represented 73% of the Chinook salmon production within the CC Chinook salmon ESU (CDFG 1965). However, recent partial counts in the Eel River indicate escapement slightly exceeding 4,000 Chinook salmon and an overall negative trend (-0.02%, Meyers *et al.* 1998) since the late 1980s. CDFG (1965) also estimated that approximately 2,500 Chinook salmon annually migrated up the Van Duzen River. Eel River steelhead spawning escapement in 1964 was estimated at 82,000, about 41% of the overall production within the NC steelhead ESU

(Busby *et al.* 1996). The summer steelhead run in the Van Duzen River is generally considered to be less than 100 adults (Higgins *et al.* 1992). Annual adult summer steelhead monitoring conducted under LOP 96-1 is summarized in Table 5 to show the low number of adults that are typically encountered.

Table 5. Adult summer steelhead survey results for the lower Eel River (*i.e.,* downstream of the Van Duzen River), 1996-2002 (Halligan 2003).

Survey year	Total number observed*
1996	0
1997	11
1998	1
1999	8
2000	18
2001	20
2002	7
*Totals do not include hatchery fish or half-pounders.	

3. Impacts to Salmonids in the Eel River Portion of the Action Area

The following discussion of current and historic impacts to salmonids and habitat in the Eel River portion of the action area is in addition to the impacts that were identified for the action area as a whole.

a. Potter Valley Flow Releases

Water diversion within the Eel River basin has occurred for many years at the Potter Valley facilities. Cape Horn Dam, on the upper mainstem Eel River, was constructed in 1907 and included fish passage facilities. Soon after construction, CDFG recognized that the ladder design presented difficulties to migrating adult fish. In 1962 and 1987, major modifications were made to the ladder to improve passage of salmonids [Steiner Environmental Consulting (SEC) 1998]. Roughly 160,000 acre feet (219 cfs average) are diverted at Cape Horn Dam, through a screened diversion, to the Russian River Basin annually. Scott Dam, which is approximately 19 km (12 mi.) upstream of Cape Horn Dam, was constructed in 1921 without fish passage facilities. VTN Oregon, Inc. (1982) reported that prior to dam construction, 56 to 72 km (35 to 45 mi.) of spawning and rearing habitat existed above Scott Dam and supported 2,000-4,000 fall-run Chinook salmon and winter-run steelhead. The USDA-FS and U.S. Department of Interior - Bureau of Land Management (USDI-BLM, 1995) estimate that 160 km (100 mi.) of potential anadromous salmonid habitat were blocked by the dam.

Flow releases from the Potter Valley facilities have reduced both the quantity of water in the mainstem Eel River, particularly during summer and fall low flow periods, as well as dampened the within-year and between-year flow variability that is representative of unimpaired flows. These conditions have restricted juvenile salmonid rearing habitat, impeded adult and late emigrating smolt migration, and provided ideal low-flow, warm water conditions for the predatory Sacramento pikeminnow (NOAA Fisheries 2002a).

On November 26, 2002, NOAA Fisheries issued a biological opinion that determined that continued operation of the Potter Valley Project in a manner similar to its historic operation would be likely to jeopardize the continued existence of the three ESA-listed ESUs of salmonids. The biological opinion included an RPA that results in flows that more closely resemble the natural hydrograph and are deemed necessary to avoid jeopardy. NOAA Fisheries thinks that the hydrograph produced with implementation of the RPA will more closely resemble the natural hydrograph of the upper Eel River Basin, which should provide improved habitat conditions for listed salmonids more frequently. Of particular importance is the superior response to hydrologic events in the Upper Eel River Basin and the provision of summer flows that allow for more realistic within-year and between-year flow variability that is representative of the unimpaired flow patterns within the Eel River. These features should provide improved habitat conditions and better survival rates for several salmonid life history phases and thus avoid jeopardy to listed salmonid species.

The Potter Valley Project RPA should result in improved temperature conditions in the upper Eel River. However, salmonids will still encounter sub-optimal temperature conditions in tributaries unaffected by improved conditions below the Potter Valley Project. Sub-optimal temperatures caused by existing watershed conditions are likely to continue in the lower Eel River, which is less influenced by Potter Valley Project releases.

In the South Fork Eel River, Benbow Dam, located near Garberville, was constructed in 1937. California State Parks operates the facility from July through the last weekend in September as a seasonal recreational facility. The facility, which historically blocked passage to adult and juvenile salmonids during the summer operating season, was modified in 1977 to allow adult and juvenile anadromous salmonid fish passage (NOAA Fisheries 2002b). Operational procedures for managing the seasonal lake have reduced the impacts to listed anadromous fish species.

b. Sacramento Pikeminnow

The introduction of Sacramento pikeminnow into Lake Pillsbury, and subsequently into much of the mainstem Eel River and major tributaries, has increased the risk of predation that lowers overall salmonid productivity. Since their introduction, the Sacramento pikeminnow have distributed below Cape Horn Dam and now range throughout the basin (SEC 1998). Geary *et al.* (1992) suggested that the effect of pikeminnow on steelhead and Chinook salmon in the Upper Eel River has been serious, and the effect on rearing steelhead is most pronounced for marginal steelhead habitat (due to warm temperatures) downstream of Cape Horn Dam. Sacramento pikeminnow impact salmonids by direct predation, and in the case of rearing steelhead, by displacing steelhead from pool habitat (Brown and Moyle 1991). Sacramento pikeminnow impacts are exacerbated by summer thermal conditions and low flows that provide ideal conditions for Sacramento pikeminnow in the mainstem Eel River. Reese and Harvey (2002) have also shown that there are more incidences of interspecific competition between young Sacramento pikeminnow and steelhead in warmer water compared to cooler water in laboratory streams. Due to predation and competition, Sacramento pikeminnow have decreased the carrying capacity of juvenile steelhead in the mainstem Eel River (Moyle 2002). While it may be too late to eradicate pikeminnow from the watershed (Moyle 2002), suppression efforts will occur as part of the Potter Valley Project FERC license term and conditions. As the native fish assemblages in the Eel River adjust to the presence of Sacramento pikeminnow, we expect that salmonid abundance will remain reduced below historic levels in the face of the increased predatory pressures.

c. Past Gravel Extraction

Past gravel mining has had chronic effects on the Eel River resulting in substantial changes to channel form and function. In combination with other cumulative impacts in the watershed, gravel mining has caused declines in the value and quantity, and reduced the carrying capacity, of salmonid habitat. As early as the 1950s, river morphology of the Eel River from Rio Dell to the estuary was affected by gravel extraction (Humboldt County 1992) through construction of trenches which diverted the low flow channel. Historic annual maximum amounts of gravel removal ranged from approximately 700,000 to 1,000,000 cubic yards during 1957 and 1958 for the construction of Highway 101 (Humboldt County 1992). Gravel was also extracted from the lower Eel River at close to these annual maximum quantities during the late 1980s and 1990, further changing the morphology of the low flow channel of the river (Humboldt County 1992). Beginning in the early 1990s, the CHERT review and recommendation process required by Humboldt County reduced total mining volumes for the Eel River from historic levels, and provided a mechanism to reduce geomorphic impacts at the site scale. However, due to the lack of sediment budget information and an estimate of sustained yield, mining volumes on the Eel River have only been limited by site-specific conditions and/or by vested right or by Humboldt County Conditional Use Permit (CUP) amounts (Klein *et al.* 2001).

(1) Lower Eel River reach. In the lower Eel River extraction reach, an average maximum of 405,185 cy/yr of sediment removal was approved by CHERT and authorized by the Corps between 1997 and 2003. However, during the same time period, an average of 236,555 cy/yr was actually extracted. The primary method of gravel extraction has been bar skimming, but recently, alternative methods such as trenching have also been used. Channel degradation has been documented in the lower Eel River by comparing 1968 air photos and cross sections with those from 1998 (Corps 1999). Overall net degradation in this reach ranged from 0.5 to 3.2 feet with channel bottoms showing degradation of 1.3 to 7.5 feet at Fernbridge. However, the degree to which this degradation is due to gravel mining versus recovery from the 1964 flood, which deposited enormous quantities of sediment in the mainstem Eel River, is unknown.

Klein *et al.* (2001) describes that restricting volumes based on site-specific conditions may be sufficient to reduce adverse impacts in areas with low mining density, but there is the potential to exceed sustained yield in river reaches where numerous mining sites are concentrated, such as on the lower Eel River. CHERT has expressed a critical need for an objective analysis of sustained yield on the Eel River (Klein *et al.* 2003). In addition, the PEIR for the lower Eel River

(Humboldt County 1992) required the development of a river management plan that has never been completed.

An individual permit application for gravel extraction on the Hauck Bar on the lower Eel River (Corps 2004) provided available information to estimate rates of replenishment in the reach. Two estimates of Regional Sediment Yield were prepared for the Eel River basin based upon estimates by Brown and Ritter (1971) and are used to construct a sediment budget for the Eel River drainage above the Van Duzen River confluence (Table 6). The estimate utilizes a similar process as that used for the Van Duzen River in the Addendum to the Cumulative Impact Evaluation, Response to Comments, FSEIR, for the Van Duzen River Ranch Gravel Extraction Project, prepared by CHERT, April 27, 2000.

In Brown and Ritter (1971), two estimates of total sediment yield per square mile were provided: one for the water years of 1958-1967, that included the 1964 flood (10,080 tons/mi^2/yr) and another estimate for the period of 1958-1964, excluding the 1964 flood (4,330 tons/mi^2/yr). Converting these values to cubic yards (dividing by 1.4, or 104 pounds per cubic foot; CHERT 1999, 2001) and calculating the proportion of total sediment yield composed of bedload, using 9% of total sediment yield as the bedload fraction, produces 648 cy/mi^2/yr with, and 278 cy/mi^2/yr without the 1964 flood (Table 6).

The Eel River drainage area above Scotia equals approximately 3,113 square miles. Adding the area between Scotia and the Van Duzen confluence produces an area of approximately 3,149 square miles: multiplied by the two bedload values provides a MAR range of 2,040,600 cy/yr with, and 875,400 cy/yr without the 1964 flood and a median MAR value of 1,458,000 cy/yr (Table 6).

Table 6. Estimates of mean annual recruitment for the Eel River above the Van Duzen confluence based on the bedload investigations of Brown and Ritter (1971).

Annual average bedload sediment yield at Scotia (Brown & Ritter 1971)		Mean Annual Recruitment (MAR) for the **Eel River above the Van Duzen** (Basin area of 3149 square miles)			*Eel River permitted volume
Low Estimate	High Estimate	Low	High	Median	1,490,000 cy
278 cy/mi^2/yr	648 cy/mi^2/yr	875,400 cy	2,040,600 cy	1,458,000 cy	73% of High MAR

*Excludes Van Duzen River operations

A similar approach is used for the Van Duzen River where sediment yield data calculated by Kelsey (1977) are used to estimate mean annual recruitment for the Van Duzen River (Table 7). These values for the Van Duzen River are combined with the Eel River estimates to calculate an estimate of MAR for the action area reach (Table 7).

Table 7. Estimates of mean annual recruitment for the Van Duzen River based on the sediment yield estimates of Kelsey (1977). These values are combined with Eel River estimates from the Table 6 estimates of the mean annual recruitment for the lower Eel River reach in the action area.

Annual average bedload sediment yield at Bridgeville (Kelsey 1977)		Mean Annual Recruitment (MAR) for the **Lower Van Duzen River** (Basin area of 430 square miles)			Van Duzen permitted volume
Low Estimate	High Estimate	Low	High	Median	220,000 cy
315 cy/mi^2/yr	469 cy/mi^2/yr	135,000 cy	202,000 cy	168,500 cy	109% of High MAR
TOTALS Van Duzen & Eel Rivers	------	1,010,400 cy	2,242,600 cy	1,627,000 cy	1,710,000 76% of High MAR

Brown and Ritter (1971) also produced long term average suspended sediment discharge estimates at Scotia for the period of 1911-1914 and 1917-1967 and arrived at a value of 23,000,000 tons/yr. Utilizing the 9% fraction of bedload to suspended load and a conversion of 1.4 tons/cy provides a bedload estimate of 1,478,600 cy/yr for the period. The result of this long term estimate of annual bedload is comparable to the median MAR for the Eel River above the Van Duzen River confluence. This estimate would be less any suspended load contribution from tributaries and mass wasting occurring within the area between Scotia and the Van Duzen River confluence.

Over the past seven years (1997-2003), combined CHERT approved extraction volumes for the Eel and Van Duzen rivers have averaged 789,000 cy/yr, or 48% of the median value of MAR from Table 7. This estimate suggests that extraction in excess of sustained yield has not been occurring in the recent past in the action area.

Despite these estimates, channel degradation has been documented in the lower Eel River (*i.e.*, from the mouth of the Van Duzen River downstream to Fernbridge) by comparing 1968 air photos and cross sections with those from 1998 (Corps 1999) as discussed previously in this section. NOAA Fisheries reasons that two factors have contributed to this degradation: the large volumes of sediment annually removed from this extraction reach prior to the CHERT process and channel recovery following the 1964 flood event. Given the time span of the cross-section analysis, the effects on channel changes since the advent of the CHERT program cannot be determined.

The effects of this past extraction on salmonids and their habitat is difficult to describe. First, little long-term information is available that describes the habitat conditions in the reach through time. Second, numerous factors have shaped the habitat conditions in the lower Eel River reach. The lack of woody debris, excessive sediment loads and paucity of streamside vegetation have all interacted in the mining reach to create current habitat conditions. In the absence of repeated mining, we expect the gravel bars would be higher and contribute to deeper pools and narrower riffles. In this manner, past extraction has likely reduced the carrying capacity of the reach slightly by reducing available pool and high quality riffle areas.

*(2) **Middle Eel River.*** In the Middle Eel River extraction reach, an average of 138,038 cy/yr was recommended by CHERT and authorized by the Corps between 1997 and 2003. During the same time period, an average of 100,376 cy/yr was actually extracted. Bar skimming has been the primary method of gravel extraction in this reach, however, in the past three years, trenching and a horseshoe skim were also utilized. A review of the aerial photos for the reach over an approximately 50-year time span indicates that the location of individual habitat elements has been relatively fixed through time. Past gravel mining has likely contributed to localized increases in the low-flow width at riffles, thereby decreasing the area of deeper water within the riffle and reducing the area available for juvenile rearing. However, these changes are likely confined to a few individual sites in the reach and we cannot discern the relative role of past mining versus natural changes in river configuration that would be expected in the absence of mining.

*(3) **South Fork Eel River.*** In the South Fork Eel River, an average of 75,486 cy/yr was recommended by CHERT and authorized by the Corps between 1997 and 2003. During the same time period, an average of 61,243 cy/yr was actually extracted. Bar skimming has been the primary method of gravel extraction. However, during the past three years, alternative methods, such as trenching and alcove extractions, have also been used. Specifically, trenching was recommended by CHERT at the Cook's Valley site to reduce the increased width and shallow riffle conditions, which had been aggravated and increased by repeated bar skimming. Similar to the middle Eel River reach, past mining has likely resulted in localized increases in the low-flow channel width. These areas of widening may delay adult migration and reduce the amount of high quality riffle habitat available to salmonids. However, no long-term information exists to indicate the degree to which this has happened.

*(4) **Lower Van Duzen River.*** In the Van Duzen River, and average of 160,544 cy/yr was recommended by CHERT and authorized by the Corps. During the same time period, an average of 117,846 cy/yr was actually extracted. The estimate of MAR for the Van Duzen River that CHERT bases sustained yield on has been between 135,000 to 202,000 cubic yards with an average value of 168,500 cubic yards (Klein *et al.* 2001). Bar skimming has been the primary method of gravel extraction. In the past, bar skimming has contributed to stranding of adults near the Eel River confluence. In response to braided channel conditions, reduced channel confinement, shallow riffle conditions and adult stranding and mortality, all aggravated by bar skimming, alternative methods such as trenching and wetland pits have been utilized.

4. Reach-Specific Salmonid and Habitat Information in the Eel River

a. Lower Eel River (Downstream of the Van Duzen River)

Historic land and water management practices, as described generally for Humboldt County, contributed to loss of habitat diversity within the lower mainstem Eel River. Cooling trends in downstream water temperatures continue to provide habitat for listed salmonids in the Lower Eel River. Cool water seeps, thermal stratification, and habitat complexity all play important roles in sustaining micro-habitat for juvenile and adult salmonids. Fishery data indicate depressed or declining abundance trends, yet observational data indicates natural populations persist in the Eel River, albeit at low levels. The degraded condition of the estuary, coupled with the marginal habitat conditions in the rest of the Eel River because of elevated temperatures, high sediment loads, paucity of woody debris, and presence of Sacramento pikeminnow highlight the sensitive setting of the lower Eel River for salmonids, especially Chinook salmon and steelhead.

The lower Eel River portion of the action area serves as an important holding area and migration corridor for salmonids. Therefore, conditions encountered along this reach, particularly during low-water periods, influence salmonid populations in the entire Eel River basin. We expect that CC Chinook salmon are most sensitive to conditions in this reach because they are known to enter the lower river in late summer and early fall when high water temperatures and low stream flows create stressful conditions for adults prior to upstream migration. Since the Eel River is one of the largest river systems in the ESUs of the salmonids considered in this Opinion, conditions that influence basin-wide populations will have a measurable effect at the ESU level as well.

Habitat in this area has been characterized as being more homogeneous and simplified in comparison to other Humboldt County extraction reaches (Halligan 1996). Fishery data indicate depressed or declining abundance trends, yet observational data indicates individual natural populations persist, albeit at low levels.

b. Middle Eel River (Van Duzen Confluence Upstream to Near South Fork Eel Confluence)

Historic land and water management practices have contributed to loss of habitat diversity within the middle Eel River above the Van Duzen River. Existing conditions indicate that the middle Eel River has limited rearing habitat due to elevated water temperatures, high sediment loads, paucity of woody debris, and competition/interaction with Sacramento pikeminnow. Cool water seeps, thermal stratification, and habitat complexity all play critical roles in sustaining micro-habitat for juvenile and adult salmonids. Spawning habitat is present, but its use has not been documented, except upstream near Van Arsdale and above. Fishery data indicate that individual natural populations of anadromous salmonids persist at low levels in the middle Eel River.

The middle Eel River portion of the action area serves as a migration corridor and juvenile rearing area for salmonids. In low-water years, the reach provides important Chinook salmon spawning habitat. For these reasons, conditions encountered along this reach, particularly during low-water periods, influence salmonid populations in the entire Eel River basin upstream of the Van Duzen River. We expect that CC Chinook salmon are most sensitive to conditions in this reach because they are known to enter the lower river in late summer and early fall when high water temperatures and low stream flows create stressful conditions for adults prior to upstream migration. Since the Eel River is one of the largest river systems in the ESUs considered in this Opinion, conditions that influence basin-wide populations will have a measurable effect at the ESU level as well.

Gravel extraction volumes are greatest near the town of Scotia. The channel is moderately confined in the reach with large-scale roughness features such as bedrock bluffs and large alluvial flats providing a degree of stability to the location of individual habitat units. Salmonids use the action area for migration and rearing. Of these, at least Chinook salmon are known to use the reach for spawning, particularly during low-flow periods. Persistence of salmonids in the reach is influenced by upstream flow releases, predation from Sacramento pikeminnow and activities which occur upslope in the watershed. Upstream activities and past floods have contributed to generally degraded habitat conditions along the middle Eel River. Pools are large, broad and shallow. Analysis of aerial photos presented by PALCO (2003) suggest that the river has been in a similar configuration since the 1940s. However, we caution that this inference is based on a limited set of historic photos and does not permit evaluation of more specific habitat indicators such as pool depths, substrate size and overall habitat complexity.

b. South Fork Eel River

Historic land and water management practices have contributed to loss of habitat diversity within the South Fork Eel River. The South Fork Eel River reach provides habitat for all three salmonid species considered in this Opinion. Specifically, the reach provides habitat for all life stages of the three salmonid species. Existing conditions indicate that the South Fork Eel River has limited rearing habitat due to elevated water temperatures. Cool water seeps, thermal stratification, and habitat complexity all play critical roles in sustaining micro-habitat for juvenile and adult salmonids. Spawning habitat is present and actively used, as indicated by observations of redds at the Cook's Valley site. Fishery data indicate that individual natural populations of anadromous salmonids persist, at low levels, in the South Fork Eel River.

d. Van Duzen River

The Van Duzen River portion of the action area reflects a long legacy of upstream and upslope impacts coupled with the effects of continued instream disturbances. The effects of past floods, coupled with intensive land management coalesce in the low-gradient, unconfined reaches of the lower river. In this setting, the reach is inherently unstable – experiencing wide swings in low-flow channel location from year to year. Stream habitat in this reach is transient and reflects the interaction of streamside vegetation, valley walls, higher alluvial bars and LWD. Each of these habitat influencing elements is in limited supply and salmonids are confined to a limited number of suitable spawning and rearing sites. Rearing habitat is severely limited in the reach due to high water temperatures and poor habitat quality.

The reach also functions as a migration corridor for both juvenile and adults of all three salmonid species. Past stranding of migrating adults near the mouth due to insufficient water depth highlights the overall degraded habitat conditions present. NOAA Fisheries considers the large width evident along much of the reach to be the key factor limiting habitat formation and, hence, salmonid production in the lower Van Duzen River. This condition is reflected in the lateral instability of the channel. Although channel migration is to be expected in this reach of the river, the lack of habitat forming elements provides little opportunity for the formation of higher quality stream habitat as the stream migrates.

The extraction reach of the Van Duzen River may also provide an important spawning reach for Chinook salmon during moderate- to low-water periods when upstream access is limiting, or fish have been holding in the lower Eel River for a sufficient duration that upstream migration is curtailed in favor of spawning. The importance of this reach for spawning is likely to increase because of the landslide that occurred in Grizzly Creek, an important spawning tributary located upstream of the extraction reach. The large landslide will affect spawning and rearing conditions in Grizzly Creek for a number of years into the future. As such, the extraction reach of the Van at Fort Seward. Due to the high water temperatures, salmonids would most likely have migrated to cooler tributaries or downstream locations before late summer. In contrast to the lower Eel River, which contains many active mining sites, Fort Seward is the only mining site located in this section of the Eel River.

The gravel bar at this site is large and unvegetated, has approximately 2.4 m (8 ft) of vertical offset from the low flow river elevation, a cobble layer providing surface armor, and bedrock control on the opposite side of the river. In 2000, a total of 43,200 cubic yards at this site was recommended by CHERT and authorized by the Corps, and 22,908 cubic yards of sediment was actually removed. The stream length adjacent to this bar that may be affected by the proposed action is approximately 610 m (2,000 ft). NOAA Fisheries and CHERT have both reviewed the site, and have made site specific recommendations to the Corps regarding the location of skimming on the bar, vertical and horizontal offsets, and the appropriate quantity of gravel to be mined from the site.

Although fish abundance and distribution data are not available for this particular reach of the Eel River, the presence of CC Chinook salmon, SONCC coho salmon and NC steelhead suggest that all three species may utilize the area for one or more life history stages.

3. Bear River

The Bear River is located near Ferndale and has a drainage area of 81.2 square miles. Mining has occurred infrequently approximately two miles upstream from the Pacific Ocean. Little information exists on habitat conditions or salmonid populations in this watershed. Chinook salmon and steelhead are known to occur in the watershed (NOAA Fisheries 1999). No information on coho salmon is available.

F. Factors Limiting Survival and Recovery of Salmonids in the Action Area

Based on our review of past and current impacts to salmonids and their habitat, the status and trends of salmonids in the action area and current habitat conditions, timber harvesting, sport and commercial fishing, reservoirs and regulated flows, and hatcheries continue to limit the survival and recovery of salmonids in the action area. These factors have been described previously.

Little information on historic conditions in the action area exists to assess the resiliency of the reaches to continued impacts. We generally assume that extensive riparian forests and LWD were much more abundant and created complex stream habitats not unlike those described by Abbe and Montgomery (1996) for large, lowland rivers in the Pacific Northwest. For example, in the lower Mad River, Tolhurst (1995) summarized historic descriptions of the river, noting long, deep pools, extensive riparian forests, and cobble substrate. The presence of riparian forests along these reaches likely provided an important stabilizing feature as well as a depositional environment for sediment transported during flood flows.

Watershed disturbances that caused channel responses were likely more stochastic and occurred in a patchwork fashion, and channels likely experienced longer periods of quasi-stability in between disturbances (Reeves *et al.* 1995). This is in contrast to current conditions in the action area which reflect watershed-wide disturbances beginning with timber harvest in the late 1800s, followed by extensive road construction, development, and other activities discussed previously in this section. Channels that were once relatively stable over a time frame of years to decades continue to be chronically impacted from upslope and instream activities. Although many of the streams in the action area are widely recognized as having some of the world's highest sediment yields (*e.g.,* Eel River), prior to extensive land altering activities, these high sedimentation rates were likely accompanied by extensive riparian forests and abundant LWD which provided habitat complexity and moderated the impacts of excess sedimentation. Similarly, the resultant channel bedforms were also likely in balance with the high sediment yields such that a quasi-equilibrium was achieved where gravel bars built up in response to the high sediment loads, thereby creating reach-scale roughness elements that promoted the formation of adjacent pool and riffle habitats. A more thorough discussion of the role of bars in habitat formation and maintenance is provided in the *Effects of the Action* section. The result is that across the action area, channels are much more uniformly degraded than in the past, prior to extensive land altering activities, and many of the elements (*e.g.,* woody debris, lowland riparian forests, and in-stream gravel bars) that provide some resiliency to continuing impacts have been and/or continue to be removed from the stream system.

In general, reaches with frequent bedrock exposures along the channel provide a greater degree of resiliency than those reaches in more unconfined valley settings. Bedrock provides a similar role as woody debris and mature gravel bars by forming sites of pool scour and sediment sorting. Reaches where bedrock provides channel roughness include the Trinity, South Fork Eel, Middle Eel and portions of the Mad rivers. In the *Effects of the Action* section, we further discuss the role of bedrock in moderating the effects of the proposed action. This is in contrast to the more unconfined, valley settings that occur throughout the action area, including portions of the Mad River, the Van Duzen River and the lower Eel River. In these locations, the absence of bedrock controls on stream habitat and sediment routing result in stream reaches that are much more sensitive to additional disturbances.

The diversity of salmonid populations has likewise declined as the patchwork nature of disturbance that formerly created a mosaic of habitat types and conditions has been replaced with this more pervasive degradation and simplification of habitats (Reeves *et al.* 1997). Resiliency of the current populations is likely much reduced as fewer refuge habitats are available and continued disturbances, both instream and upslope, continue to impact stream habitats and salmonids. This broad scale degradation of habitats has likely increased the extinction risk of salmonids similar to conclusions reached by Nickelson and Lawson (1997) and Reeves *et al.* (1995). In general, across the action area, stream habitat has been simplified as a result of numerous factors. Salmonid populations in the action area are faced with less rearing habitat and poorer quality spawning habitat than likely occurred prior to these impacts.

V. EFFECTS OF THE ACTION

This Opinion addresses the Corps' LOP 2004-1 procedure for gravel mining in Humboldt County (more specifically within the lower reaches of major rivers within Humboldt County). NOAA Fisheries provided an overview of LOP 2004-1 procedure in the *Description of the Proposed Action* section of this Opinion. In the *Status of the Species* section of this Opinion, NOAA Fisheries provided an overview, at the ESU scale, of the status and trends of SONCC coho salmon and their designated critical habitat, CC Chinook salmon, and NC steelhead. In the *Environmental Baseline* section of this Opinion, NOAA Fisheries summarized the effects of past and present Federal, State, local and private activities on SONCC coho salmon and their designated critical habitat, CC Chinook salmon, and NC steelhead within the action areas. The *Environmental Baseline* section established that numerous human activities upstream of, within, and downstream from the action area have significantly adversely affected SONCC coho salmon and their designated critical habitat, CC Chinook salmon, and NC steelhead, and the distribution and abundance of these species in the action areas.

In this section of the Opinion, as required by the ESA and its implementing regulations (50 CFR § 402), NOAA Fisheries assesses the direct and indirect effects of the proposed action, and any interrelated and interdependent actions, on SONCC coho salmon and their designated critical habitat, CC Chinook salmon, and NC steelhead. The purposes of this assessment are to determine if the proposed action: (1) is likely to have effects on SONCC coho salmon, CC Chinook salmon, or NC steelhead that appreciably reduce their likelihood of both survival and recovery in the wild by reducing their numbers, reproduction, or distribution (the jeopardy standard identified in 50 CFR 402.02); or (2) is likely to appreciably diminish the value of designated critical habitat for the conservation of SONCC coho salmon in the wild.

A. Assessment Approach

To conduct our assessment of the proposed action, NOAA Fisheries considers the direct and indirect effects of the proposed action, and any activities interrelated and interdependent with the proposed action on the area, connectivity, and quality of habitats that support listed species as well as effects that result in injury, death, reduced reproduction, reduced growth or feeding to listed species. NOAA Fisheries uses published and unpublished data and studies of interactions between gravel mining operations and listed species or their habitats to estimate the likelihood of future effects. There is an extensive amount of published literature on the relationship between changes in habitat quantity, quality, and connectivity and the persistence of animal populations (Fiedler and Jain 1992, Gentry 1986, Gilpin and Soule 1986, Nicholson 1954, Odum 1971, 1989, and Soulé 1986, 1987). With respect to listed species, NOAA Fisheries bases its assessment on the relationship between habitat and species populations and assumes that an activity that destroys or modifies habitat listed species are dependent upon will be followed by a demographic response (*e.g.*, changes in birth rates, death rates, or other vital rates, abundance, *etc.*), and assumes this response will result in a reduction in the diversity of the ESU.

A fundamental assumption used in this effects analysis is that impacts to habitat equate to adverse effects on individual salmonids. Gregory and Bisson (1997) stated that habitat degradation has been associated with greater than 90% of documented extinctions or declines of Pacific salmon stocks. This assumption is also supported by Lichatowich (1989) who identified habitat loss as a significant contributor to declines of coho salmon stocks in Oregon's coastal streams. Beechie *et al.* (1994) estimated a 24% and 34% loss of coho salmon smolt production capacity of summer and winter rearing habitats, respectively, in a Washington stream since European settlement. Beechie *et al.* (1994) identified three principal causes for these habitat losses, in order of importance, as hydromodification, blocking culverts, and forest practices. Several authors have found positive relationships between habitat complexity, LWD in streams, and salmonid populations (Tschaplinsky and Hartman 1983, McMahon and Holtby 1992, Reeves *et al.* 1993). Nickelson and Lawson (1997), in modeling extinction risk of coho salmon along the Oregon coast, found that probability of extinction was inversely related to habitat quality for starting populations of 50 and 100 individuals. Furthermore, Nickelson and Lawson (1997) found that there would be a substantial increase in risk of extinction for Oregon coast coho salmon in basins with poor habitat quality if habitat quality declines by 30-60% over the next century.

Thus, if our assessment determines that gravel mining operations under LOP 2004-1 are likely to result in adverse effects to salmonid habitat in the action areas, it would then be reasonable to expect that SONCC coho salmon, CC Chinook salmon, and/or NC steelhead populations would experience demographic changes (that is, changes in population size, distribution, reproduction, mortality, *etc.*) as a result of the proposed action. We use this habitat-demographic response given the extent of habitat degradation that has occurred in the action area as discussed in the *Environmental Baseline* section. Under current conditions we expect that existing salmonid populations are faced with a limited amount of usable habitat and any reduction in the quantity or quality of this habitat will be manifested as a further decrease in population abundance.

Additionally, our assessment must consider the effects of maintaining or inhibiting recovery of habitat conditions that led to the initial listing of salmonids under the ESA. If we determine that habitat conditions will be maintained in a degraded condition and, therefore, will limit potential for recovery or substantially decrease the rate of recovery of listed salmonid populations, then we must consider the increased risk that genetic, demographic, and environmental stochasticity will further negatively affect populations. In essence, if the action maintains habitat in a degraded condition or inhibits its recovery, then it also decreases the probability that species will survive over the long-term (NRC 1995).

Critical habitat is defined as the specific areas within the geographical areas occupied by the species, at the time it is listed, on which are found those physical and biological features essential to the conservation of the species and which may require special management considerations or protection, or specific areas outside the geographical area occupied by the species at the time it is listed when the Secretary determines that such areas are essential for the conservation of listed species. The ESA defines conservation as "to use all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to the ESA are no longer necessary." As a result, NOAA Fisheries approaches its "destruction and adverse modification" determinations by examining the effects of actions on the *conservation value* of the designated critical habitat, that is, the value of the critical habitat for the conservation of threatened or endangered species.

The effects of the action are considered in six parts. First, we describe the general effects associated with gravel extraction in river channels. Second, we consider the direct effects of the proposed action on salmonids. These include effects that occur at the time of mining, such as bridge construction and use, heavy equipment operation near the wetted channel and the short-term impacts of the various extraction methods. Third, we describe the general indirect effects associated with gravel extraction. These effects primarily occur as changes in channel form and function and are described in terms of expected changes to stream habitat types used by salmonids for various life history stages. Fourth, we consider reach-specific indirect effects of the proposed action. Fifth, we consider other indirect effects associated with the proposed action. Finally, we assess the effects of interrelated and interdependent actions. Prior to synthesizing the effects of the action, we consider the cumulative effects that are reasonably certain to occur in the action areas.

Finally, we integrate and synthesize the effects of the proposed action combined with the environmental baseline, interrelated and interdependent actions, and cumulative effects. In this step, we consider the aggregate of effects on the populations of the three salmonid species and SONCC coho salmon designated critical habitat. The expected response of salmonid populations is determined by assessing any potential reductions in the numbers, reproduction, or distribution of listed salmonid populations in the action area. We then determine whether any reductions in numbers, reproduction or distribution will appreciably reduce the likelihood of both the survival and recovery of each listed salmonid ESU. This final step takes into account the status and trends of the population or ESU in question, the factors currently and cumulatively affecting them, and the role the affected population likely plays in the ESU to determine if reductions in probability of survival and recovery would be expected to reduce the likelihood of survival and recovery of the species.

B. General Discussion of Effects

Impacts from gravel mining on physical channel conditions have been well documented in the published literature. Brown *et al.* (1998), and Pauley *et al.* (1989) conducted studies that include biological effects of gravel mining. Brown *et al.* (1998) compared mined sites to reference reaches in gravel bed streams and found that total fish densities in pools were higher in reference reaches than in mined sites and downstream reaches. Biomass and densities of invertebrates were higher in reference reaches. Bankfull channel widths were significantly increased at mined sites, and distance between riffles increased, resulting in fewer pools in reaches downstream of mined sites. Although the Pauley *et al.* (1989) study was of short duration and their sample size was not large enough for statistical testing for some effects, the authors were able to make inferences regarding changes in channel form and resultant impacts to habitat function for salmonids from gravel bar skimming, including: decreased channel confinement, with widening and shallowing of the low flow channel and decreased water depths over riffles which created adult salmonid migration barriers, obliteration of side channels with complex habitat on skimmed bars and formation of secondary channels that lack complex habitat features, resulting in reduced habitat for salmonids, and channel instability at the top of skimmed bars, with an increase in the probability of redd scouring.

Instream gravel extraction operations impact listed salmonids and their habitats within the action areas of this Opinion. These impacts include: (1) direct effects, which are those effects that occur at the actual time of mining; and (2) indirect effects, which are those effects that are caused by the proposed action and are later in time, but still are reasonably certain to occur. Examples of effects that occur at the time of mining include: mortality during heavy equipment use in the wetted channel; disruption of rearing, holding and migration patterns by heavy equipment noise and vibration disturbance; and elevated turbidity/sediment from connection of dry trenches to the wetted channel. Examples of indirect effects include: channel widening and decrease in channel confinement over a range of flows; simplification of pool and riffle habitats; and reduction in food sources. Some of the impacts from gravel mining are reduced through project design features (*e.g.*, project timing restrictions). Other impacts may be chronic in nature, and occur incrementally with, subsequent to, and offsite from the mining activity (*e.g.*, possible reduction of substrate size, and the decline in spawning gravel quality and associated increase in redd scour). The potential impacts of the proposed action are discussed in detail in the sections below.

C. Direct Effects

1. Stream Crossing Construction and Use

Proposed temporary channel crossings, usually bridges, but occasionally culverts, will be placed at or near riffles for sediment hauling equipment access. The placement and removal of temporary channel crossings may affect salmonids and their habitat due to: (a) injury or death from equipment contact, (b) increases in turbidity and sedimentation from pushing up bridge approaches and abutments, (c) attraction of spawning adults and redd building by changes to local channel form, (d) reduction in the quality of migratory habitat, (e) noise and vibration disturbance from heavy equipment use, (f) introduction of petroleum products, and (g) reduction of invertebrate production at temporary channel crossing locations.

In addition, the use of bridges by sediment extraction/hauling equipment can result in significant increases in turbidity and sedimentation. Some wet and dry sediments typically spill from the equipment as they are hauled to stockpiles. Additionally, abutments that encroach into the wetted channel and are constructed of native bar materials undergo continual sloughing into the channel caused by the vibration and compaction from tens to hundreds of passes by heavy equipment, both loaded and unloaded. NOAA Fisheries personnel (pers. comm. with D. Free, fisheries biologist, NOAA Fisheries, 2002) have observed this and the consequent turbidity and sedimentation of downstream areas during crossing use. In 2002, Dr. Doug Jager, a CHERT member, notified NOAA Fisheries personnel of his concern regarding hauling of wet sediment removed during a wetland pit extraction. Dr. Jager observed a significant amount of "mud" escaping the hauling equipment as it passed over the Mad River (pers. comm. with D. Jager, CHERT, 2002).

a. Injury or Death from Equipment Contact

Sediment removal operations require heavy equipment that often needs to cross the low flow wetted channel to construct a crossing. Interactions with equipment can be potentially harmful or lethal to salmonids by several mechanisms, as explained below.

Timing of temporary channel crossing construction is important to reduce the number of juveniles that may be crushed or otherwise injured. Delaying the construction of temporary channel crossings provides time for juvenile growth and would reduce the number of juveniles that would seek cover in substrate. Given that crossings for LOP 2004-1 will not be installed until July 1, we anticipate that nearly all YOY Chinook salmon will have migrated downstream. For steelhead and coho salmon, as well as the portion of the Chinook salmon population that over-winters in freshwater, the size increases and behavioral changes that occur prior to crossing installation will minimize the potential for death or injury to individuals from crushing.

Both Halligan (1997a) and Granite Construction described that installation/removal of a temporary channel crossing requires one loader to cross through the wetted channel to prepare the gravel abutment and secure (or remove) the flatcar bridge. However, NOAA Fisheries (pers. comm. with L. Wolff, hydrologist, NOAA Fisheries, 2003) has observed that heavy equipment must cross the wetted channel more than once in order to construct or remove a crossing. In order to better understand how channel crossings are constructed and removed, and the potential effects of these activities to listed salmonids, we observed channel crossing construction and removal over the past few years. NOAA Fisheries (pers. comm. with L. Wolff, hydrologist, NOAA Fisheries, 2003) observed that the typical minimum number of times that heavy equipment crosses the channel is at least two times per installation/removal. To minimize the frequency of equipment crossing, bridge abutments on the far side of the channel will be constructed of native bar material, rather than transporting washed material across the wetted channel.

LOP 2004-1 limits the season of crossing construction and removal between June 30 and September 15 for the Mad River and between June 30 and October 15 for all other rivers. Should they be present in the construction area, NOAA Fisheries expects that adults, smolts, and older juveniles should be able to avoid or flee areas when loaders are building or removing proposed channel crossings. However, young juveniles may still be killed. NOAA Fisheries estimates that a small number of juvenile steelhead, Chinook salmon and coho salmon may die due to bridge construction/removal under LOP 2004-1. While we cannot estimate the number of individuals that will die due to bridge construction/removal, we expect that a portion of individuals in the footprint of the bridge location will be killed due to burial or crushing by equipment.

b. *Increases in Turbidity and Sedimentation from Temporary Bridge Construction and Removal (Episodic) and Bridge Use (Chronic)*

Gravel mining can result in elevated turbidity and suspended sediment levels through installation, removal, and use of temporary channel crossings. Turbidity may also occur if abutments are constructed of native gravel bar sediments and are not protected by brow logs, concrete blocks or large cobble. Elevated turbidity/sediment levels can affect stream biota, including salmonids, in numerous ways: stream primary productivity can be reduced if sunlight cannot reach the substrate, benthic macro-invertebrate production can be hindered, salmonid feeding opportunities can be reduced, and suspended sediment may deposit on redds, suffocating incubating salmonid eggs. When background turbidity levels are low, typically during the low flow season, sediment inputs cloud otherwise clear waters, making salmonid prey and predator detection difficult, and may infiltrate spawning gravels and reduce invertebrate production when the sediment settles.

Sediment removal or disturbance above the wetted stream may still create a persistent source of turbidity from activities associated with bridge construction, and from use of the bridges by heavy equipment during the summer low-flow period which may spill sediment over the crossing. Stream crossing and bridge building activities are likely to cause short-term increases in turbidity during periods of low stream flow when salmonids are present and may be stressed by other environmental factors such as high water temperatures. Bridge use by heavy equipment results in chronic inputs of fine sediment over the extraction season during the low-flow summer period causing chronic increases in turbidity and deposition of fines on stream-bottom substrate.

Channel crossing construction and removal methods will minimize the amount of fine sediment delivery associated with these activities. LOP 2004-1 requires that temporary channel crossings avoid spawning habitat. Given past rates of crossing construction, we expect that extraction sites, on average, will involve the construction and removal of less than one crossing. In some instances, two crossings may be needed, such as on the multiple channels of the lower Eel River, but we expect other sites in the action area will not need a crossing to access the extraction site. If encroachment into the low flow channel is necessary to span the wetted channel, then approach ramps will be constructed using techniques that will minimize the input of fine sediment into the channel. These techniques include using a base of washed rock or cobbles on the access side of the stream. The base would extend from the bed of the stream to six inches above the water surface at construction time. Alternately, if washed rock is not readily available, native gravel used in wetted approaches and abutments may be lined with filter fabric and surrounded by K-rails. Other methods that would provide equal or greater protection from turbidity and fine sediment impacts may be suggested by the operator and presented for review and recommendation by CHERT and NOAA Fisheries. Using these measures, NOAA Fisheries does not anticipate that fine sediment from stream crossing construction and removal under LOP 2004-1 will adversely affect more than a few individuals (< 10) in the action area in a given year.

Bridge use is also addressed in LOP 2004-1 by requiring that wet excavated sediment must be stockpiled on the bar, away from the low flow channel, and allowed to drain prior to being hauled across the temporary channel crossing. Based on the above, NOAA Fisheries anticipates that fine sediment inputs to the stream channel from bridge use under LOP 2004-1 will not significantly reduce invertebrate production or result in significant behavior modification of juvenile salmonids, especially steelhead, which may be present at the bridge sites.

c. Attraction of Spawning Adults and Redd Building by Changes to Local Channel Form

The CDFG has observed Chinook salmon redds built under, or very near to, channel crossing locations on the Mad River in September and October of 2001 (pers. comm. with J. Froland, CDFG warden, 2001). Temporary channel crossings are typically built at riffle locations, which are also locations where Chinook salmon build redds and spawn (spawning activity begins in September, and peaks during November and December). Due to the cover at temporary bridges, the local channel restriction caused by abutment construction, and the associated increases in water velocities, Chinook salmon may be attracted to spawn under or near the temporary bridges, and redds may experience direct crushing during crossing removal. In addition, Chinook salmon that have begun redd construction and defense and spawning behavior could be frightened off redds during crossing removal.

Project timing restrictions that are developed based on Chinook salmon run timing for each river would reduce the probability that Chinook salmon would be attracted to spawn under, or very near to, channel crossing locations. The project timing for bridge removal under LOP 2004-1 is before September 15 for the Mad River and October 15 for all other rivers. Based on known Chinook salmon run timing and spawning locations (Halligan 2003), these project timing restrictions will minimize the attraction to redd building at or near bridge locations. In addition, LOP 2004-1 states that bridge locations will avoid known spawning locations. Given the location of crossings and timing of crossing removal, NOAA Fisheries anticipates that less than five redds per year will be influenced by crossings across the action area.

d. Reduction in the Quality of Migratory Habitat

Use of temporary culverts rather than temporary bridges may reduce or eliminate fish passage. The Corps seldom approved culverts associated with gravel mining during the period of 1996-2002. LOP 2004-1 states that culvert requests and information describing the need for culverts must be provided to NOAA Fisheries for review and approval of salmonid impact minimization measures, and that culverts will allow upstream and downstream fish passage for all life history stages. NOAA Fisheries anticipates that during the life of LOP 2004-1, the Corps will approve few culverts as temporary channel crossings, and that they would typically be used in secondary channels, and seldomly used in the main river channel. Additionally, all culverts would be sized for fish passage of all life history stages of listed salmonids present during the time the culvert is in place. Thus, NOAA Fisheries expects that temporary channel crossings will not impede salmonid migration.

e. Noise and Vibration Disturbance from Heavy Equipment Use

Noise and vibration produced by use of heavy equipment adjacent to and over the wetted low flow channel (channel crossings) may disrupt migration and holding patterns by harassing or frightening fish. Habitat types, salmonid holding locations, and run timing within the action area have been documented during previous seasons of LOP 96-1 implementation (Halligan 1997, 1998, 1999, Jensen 2000). Data from these reports showed that salmonids were holding in suitable habitat (deep pools with structural complexity and deep runs with sufficient flow and cover), regardless of whether or not extraction operations were occurring nearby. Extraction reaches have not been compared with non-extraction reaches, therefore, the relative abundance of holding salmonids in the action area is not known. However, the monitoring reports for LOP 96-1 indicate that the quality of holding habitat was the determinant for salmonid presence. The observers performing the monitoring also reported that no agitation or flight behavior was observed in any fish, even though gravel extraction operations were occurring as close as 13.7 m (45 feet) away, and heavy equipment was crossing on nearby flatcar bridges. Jensen (2000) also documented that early migrating adult Chinook salmon and steelhead appeared to move continuously through the Mad and Trinity rivers during the fall portion of the extraction season, with no apparent effects to migration patterns from gravel extraction operations.

The above monitoring results suggest that salmonids are able to hold and migrate through active gravel extraction areas despite noise and vibration. Therefore, although there may be some unmeasurable delay or disruption, NOAA Fisheries does not anticipate that noise and vibration from active gravel extraction will have adverse effects on listed adult salmonids in the action area.

Juvenile salmonids (YOY steelhead in particular) were recently observed during the day in the vicinity of operating heavy equipment (used to install a summer dam), although increased numbers were observed in the same vicinity in the absence of operating equipment (D. Ashton, NOAA Fisheries, pers. comm., 2002). This observation suggests that operation of heavy equipment used to construct channel crossings, or heavy equipment used to skim gravel bars adjacent to the low flow channel, (especially early in the mining season) may have an effect on juvenile salmonids, YOY life stage in particular. The potential for temporary displacement of juveniles exists from the disturbance caused during heavy equipment operation. Whether the habitat that juveniles may be displaced into is less favorable than the habitat that they were utilizing prior to disturbance is unknown at this time. Regardless, the effect will be short-term and NOAA Fisheries does not expect any adverse effects on salmonids due to adjacent noise and vibration from heavy equipment.

f. Introduction of Petroleum Products

All sediment removal operations use equipment powered by diesel fuel and lubricated by other petroleum products that are potentially hazardous to listed salmonids. With the use of this equipment, there is potential for spill of hazardous compounds in the stream, on bars in contact with the hyporheic zone, or at nearby processing sites. The risk of potential chemical pollution is significantly higher near or in streams because of the proximity of sensitive aquatic species and because of the role of water in transporting contaminants to sensitive receptors.

Since the proposed action does not place restrictions on where fueling may occur, NOAA Fisheries expects some fuel may be inadvertently leaked onto gravel bars. Additionally, small leaks in machinery may occasionally add hydraulic fluids and machine lubricants onto gravel bars. NOAA Fisheries does not expect that the quantity of leaked material will lead to adverse effects to salmonids since any leaked fuel and oil would be limited to isolated leaks and on the dry bar. These substances would then be diluted in the storm flows and have a very low likelihood of adversely affecting salmonids. We expect very low pollution levels in these storm flows given the relatively undeveloped nature of the watersheds above the extraction reaches.

2. Effects of Trenching

Trenching was used as an extraction method in Humboldt County during the implementation of LOP 96-1 (1996-2002) and modified LOP 96-1 (2003), and is also included in LOP 2004-1 as a potential extraction technique that may be authorized during the five-year permit period. The use of trenching as an extraction method has increased during the past three extraction seasons, and as described in the *Proposed Action* section of this Opinion, trenching is expected to continue at similar rates. Past trenching operations occurred on dry bars, and, when completed, the operator typically connects the trench to the wetted channel to prevent salmonid stranding ("dry trenching").

a. Increased Turbidity/Sediment

The effects of increased turbidity are as previously described in the "Stream Crossing Construction" section. Increased turbidity would also result from the connection of a dry trench to the wetted channel, and/or diversion of stream flow and wet trenching. Project design features are typically used to reduce the amount and duration of turbidity when connecting a dry trench to the low flow channel. These include the use of berms to separate the trench from the low flow channel, and waiting for settling of fine sediment in the trench before connection to the wetted channel. However, during connection of the dry trench, a pulse of turbidity is released to the otherwise clear, low-flow river. Based on observation of the magnitude and duration of the pulse of turbidity associated with dry trenches, and the few dry trenches or wet trenches that are expected to be implemented under LOP 2004-1, NOAA Fisheries anticipates that the pulse of turbidity from trenching will have adverse effects on listed salmonids in the action area. The adverse effects of increased turbidity and sedimentation were previously described in the section on temporary channel crossing construction and removal.

b. Injury or Death from Equipment Contact

On a very limited basis, heavy equipment may be authorized under LOP 2004-1 to install temporary coffer dams in order to divert the low flow channel. We expect the timing of these activities will be similar to those for bridge construction. The effects associated with equipment use in the wetted channel are described in the above section on "Stream Crossing Construction." NOAA Fisheries expects that adults, smolts, and older juveniles should be able to avoid or flee areas when loaders are installing temporary coffer dams when this activity occurs. However, young juveniles may still be killed. NOAA Fisheries expects that the number of young juveniles that may die due to temporary coffer dam installation under LOP 2004-1 will be similar to the construction and removal of stream crossings.

c. Injury or Death and Behavioral Changes Due to Diversion of the Low Flow Channel

LOP 2004-1 allows for placement of temporary coffer dams in order to divert the low flow channel. However, the requirement to remove listed salmonids before coffer dam installation and stream flow diversion is not included in LOP 2004-1. Therefore, we expect that some juveniles would be killed during dewatering activities, and that injury may also occur from displacement of juveniles. Displaced fish may impinge on other rearing salmonids' territories, thereby resulting in increased energy expenditure through territorial defense, reduced feeding potential, and increased predation potential as a result of interactions between individual fish. NOAA Fisheries expects that diversion of the low flow would cause injury and/or death of juvenile salmonids and impacts to their habitat (as discussed below) without fish relocation measures. However, temporary coffer dam installation was not authorized under LOP 96-1 during 1996-2002 or modified LOP 96-1 (2003), and NOAA Fisheries anticipates very limited, if any, authorization of temporary coffer dams under LOP 2004-1. Where coffer dams are used, we expect that fish will be relocated as a part of the CHERT review, recommendation and approval process. However, we expect a fraction of the individuals in a given area will remain and perish due to dewatering of the low-flow channel.

d. Decreased Invertebrate Production from Habitat Change

Habitat change occurs due to both wet and dry trenching and diversion of the low flow. These habitat changes include changes in substrate composition, and resulting changes in aquatic macroinvertebrates as previously described the "Stream Crossing Construction" section. NOAA Fisheries expects that these changes in the food base will be significant as a result of wet trenching because of dramatic reductions in invertebrates in the dewatered section and change in habitat in the trenched areas because of reduced flows, changes in substrate, and lag of several weeks in re-colonization by invertebrates. NOAA Fisheries anticipates that invertebrates in the temporary channel will be unlikely to provide any substantial amount of forage. NOAA

Fisheries expects minimal change to invertebrate production as a result of dry trenching because sediment replenishment is expected to be rapid and trenches will unlikely significantly affect existing adjacent habitats. Based on past implementation, NOAA Fisheries expects that most, if not all, of the trenching authorized under LOP 2004-1 will be dry trenching. Therefore, NOAA Fisheries does not anticipate any adverse effects to salmonids from short-term changes in invertebrate abundance.

e. Increased Susceptibility to Predation

Trenches constructed in the active channel, whether by stream flow diversion and excavation in the low-flow channel, or by dry trenching on the gravel bar with connection to the wetted channel, have the potential to attract migrating adults for holding opportunities during fall migration, as well as rearing juveniles during the summer and fall. If the newly excavated trenches do not provide cover and hiding opportunities, then a potential increase in predation of juveniles would be expected, as well as the potential for an increase in susceptibility to poaching of adults. LOP 2004-1 requires that when trenching is used, vegetative cover must be provided within the trench in the form of placing woody debris within the excavated trench in order to reduce impacts to salmonids, and that the pre-extraction mining plan will describe the cover that will be associated with the proposed trench. Based on the requirement to provide cover within the excavated trench, and on the number and location of past and proposed trenches in Humboldt County, NOAA Fisheries expects that susceptibility to poaching will be low to moderate for adults in trenches that are constructed, but cumulatively low given the anticipated number and location of trenches with respect to river reaches. NOAA Fisheries also anticipates that few juveniles will occupy the trenches due to the lack of forage associated with trenches, and that the cover provided in the trench will reduce predation for those individuals that do utilize the trenches. We expect that no more than five adults of any species and ten juveniles will be adversely affected by the trenches.

f. Adult Stranding

Trenches and wetland pits have the potential to trap salmonids. In 2003, under the modified LOP 96-1, there were two instances of adults stranded in excavated trenches. Although the trenches are intended to facilitate fish passage and avoid stranding of either adults or juveniles, fish may become isolated in the trenches when unpredicted shifts in channel form occur and unexpectedly close off the trench, and subsequent streamflows are insufficient to re-open the trench to salmonid migration. Where this occurs, salmonids may perish due to lack of flowing water. Even with suitable flow infiltrating through the gravels, adults may perish due to their limited lifespan dictated by reproductive needs. However, NOAA Fisheries expects that trenches excavated under LOP 2004-1 will provide an overall benefit in terms of fish migratory conditions and deeper holding habitat. Trenches constructed under LOP 2004-1 will have woody debris and other elements of cover added. Furthermore, we expect the design of the trenches will consider the effects of premature migration and trench design will incorporate elements that do not promote adult migration into reaches that otherwise would not experience migration. NOAA Fisheries expects that no more than five adults and ten juveniles of any combination of the species will be stranded in trenches in any given year of LOP 2004-1 implementation. These estimates are based on past instances of stranding where trenches were designed with the intent of avoiding stranding, yet due to channel shifts, fish became isolated and perished. However, we expect that trenches will be designed, to the best ability, to avoid all stranding of salmonids. Any stranding that does occur will be due to unanticipated river changes and not be a result of intentional design. Furthermore, in the past, these stranding events were followed by a fish rescue effort and modification of the trench to eliminate the stranding hazard.

D. Indirect Effects

Gravel extraction has numerous potential indirect effects on salmonids, primarily by modifying the stream habitat that various life stages depend upon. Sediment removal from streams can result in destruction of spawning, feeding, and resting habitats. Other undesirable physical effects include bed degradation, bank erosion, channel and habitat simplification, and reduced effectiveness of geomorphic processes such as pool maintenance, sediment sorting, and sediment intrusion. Adverse biologic effects include reduced quality of spawning gravels, reduced egg and alevin development and success, reduced riparian vegetation and all associated aquatic benefits, reduced water quality, and mortality of juveniles.

In order to understand the mechanisms by which stream habitat may be affected by gravel extraction, we first describe how changes in physical processes, such as streamflow and sediment transport, affect channel form and function and, consequently, salmonids and their habitat. In this section, we describe how these changes may influence specific salmonid habitat elements. Next, in part 2 we describe the general effects of wetland pit excavations. In part 3, we describe the general effectiveness of LOP 2004-1 at reducing impacts to habitat. In part 4 we describe the effectiveness of the CHERT review process. These four sections are intended to provide the background for the indirect effects of the proposed actions for each river reach in the action area.

1. General Effects of Sediment Removal on Habitat and Salmonids

In this section, we describe the general effects of sediment removal on salmonids and their habitat based on changes in various alluvial river attributes. We provide this general discussion in order to develop the framework for assessing the effects of the proposed action for each river reach in the sections that follow.

Sediment removal projects that decrease bar elevation (*e.g.*, bar skimming) cause bar overtopping to occur at lower discharges. One result is a more uniform, lateral velocity profile across the channel during moderate and large flows that occur in early winter. The velocity of the main channel in the new geometry is slower and the water near the edge of the channel is faster than in the original configuration. In addition to the simplification of the velocity profile in the extraction area, the extraction will cause an increase in main channel velocity upstream of the extraction which may result in excess erosion of the upstream riffle. This local erosion may increase the delivery of sediment to downstream areas (Olson 2000). Consequently, the changes in channel geometry and flow energy resulting from sediment removal can reduce the potential of flows to scour pools adjacent to the extraction area and increase the potential of the stream to scour the upstream riffle.

The reduced convergence and divergence caused by the changed bar geometry may result in a more simplified channel with less concentrated and less effective particle-sorting processes.

Therefore, reductions in bar height will simplify stream habitat by causing decreases in the area of spawning beds and reductions in pool area and depth.

The simplification of stream habitat that may be caused by the changes in bar form and resulting effects to the stream velocity resulting from sediment removal are:

a. Loss of pool habitat quantity and quality
b. Increased riffle instability and migration blockage at riffles
c. Loss of velocity refugia
d. Increased water temperatures
e. Elevated turbidity and sediment loads
f. Increased stranding of salmonids on extraction surfaces

a. Loss of Pool Habitat Quantity and Quality

Sediment removal from stream reaches in the action area will decrease the overall quality and quantity of pools. This reduction in pool quantity and quality may occur in three ways; (1) increased width, (2) channel degradation, and (3) reduced riparian vegetation.

(1) Increased width. Removal of sediment from the active channel alters the natural channel configuration. We expect sediment removal from bars to create a wider, more uniform channel cross section with less lateral variation in depth, and reduced prominence of the pool-riffle sequence in the longitudinal profile (Collins and Dunne 1990, Church *et al.* 2001). For example, where bars are skimmed, we expect a more rectangular channel is created with a wider and shallower cross section. This will result in a change in the sediment transport regime indirectly influencing habitat by removing the steering effect provided by the bar and simplifying the velocity distribution, therefore lessening the hydraulic controls on pool and riffle formation and maintenance. In this instance, pools will become shallower, or disappear altogether as more uniform, flatwater habitat forms. Riffle crests will become less pronounced and substrate quality will degrade due to the reduced sediment sorting ability provided by the adjacent bar. This is consistent with observations by Church *et al.* (2001), who note simplified channel morphology as a result of reductions in topographic complexity following sediment removal. We note that these changes are both instantaneous, as a direct result of sediment removal from a site, as well as chronic when bars are repeatedly mined and natural bar recovery is inhibited.

Where multiple, sequential bars are lowered or removed, a reach-scale effect also occurs. In this instance, the removal of sediment from multiple bars over a reach creates a channelized condition where former topographic roughness elements in the channel (*e.g.* bars) are reduced or eliminated. In this instance, habitats may be simplified over a much greater length than single pool-riffle sequences adjacent to a given bar as the reach-scale hydraulic and sediment transport characteristics are changed. Therefore, we note two processes by which stream habitat may become simplified – site-specific adjustments of the channel associated with a particular extraction site, and reach-scale changes in channel morphology as a cumulative effect of multiple extraction sites.

Changes in the channel width should be considered in the appropriate spatial scale with respect to water elevation as well. The relevant spatial scale is both the low-flow channel and the high-flow channel. Potential changes in the high-flow configuration may be constrained by resistant valley walls, such as on portions of the Trinity River where there is a limit to the amount of channel widening that may occur. Conversely, channels in wide, alluvial valleys, such as portions of the Mad and Eel Rivers, are relatively less constrained and have the potential to affect larger areas as the channel is free to migrate via bank erosion. Therefore, changes in the high-flow channel dimensions would cause changes in habitat at the larger reach scale. Multiple habitat elements would be affected by the changing channel configuration in these settings. This is in contrast to changes in the low flow width where increases would be more confined to individual habitat elements. Thus, repeated sediment removal at a site has the potential to affect habitat at both the reach and site scales depending on the overall confinement of the channel in the valley.

Stream channels in sediment removal areas typically become progressively wider as the channel is less stable. The relationship between channel widening and habitat values are well documented in the literature. Overall, salmonid habitat is reduced in unstable channels (*e.g.*, Newport and Moyer 1974, Behnke 1990, Kanehl and Lyons 1992, Hartfield 1993, Waters 1995, Brown *et al.* 1998) and the associated riparian habitat deteriorates (Rivier and Seguier 1985, Sandecki 1989). Effects on salmonid habitat include reduced pool depth and complexity, decreased riffle quality and less influence from streamside vegetation in the form of instream cover and shade.

(2) Channel degradation. Sediment removal can result in localized or reach-scale bed degradation. Over time, stream channels adjust towards equilibrium between the sediment load and dominant sediment transporting flows. A gradual migration of the channel by eroding the outside of bends and depositing equal volumes on the inside of bends creates the dynamic equilibrium condition where the bed and banks are not net sources of sediment. Therefore, the equilibrium stream channel is efficient at maintaining its geomorphic form and pattern, although the system remains dynamic as it responds to cyclic floods and sediment delivery events. Dunne *et al.* (1981) stated that "bars are temporary storage sites through which sand and gravel pass, most bars are in approximate equilibrium so that the influx and downstream transport of material are equal when averaged over a number of years. If all the sand and gravel reaching such a bar is removed, the supply to bars downstream will diminish. Since sand and gravel will continue to be transported from these downstream bars by the river, their size will decrease."

If stream bed lowering increases bank heights to the degree that banks become unstable, rapid bank retreat may occur, further destabilizing the width but supplying the channel with sediments that make good the transport-supply imbalance, to prevent further degradation until they are flushed out (Knighton 1984, Little *et al.* 1981). Thus, sediment removal from a relatively confined reach can trigger erosion migrating upstream, causing erosion of the bed and banks, which increases sediment delivery to the site of original sediment removal. Channel morphology is simplified as a result of degradation following sediment removal (Church *et al.* 2001). Also, Simon and Hupp (1992) show there is a positive correlation between bed lowering and channel widening, or bank retreat. As discussed above, channel widening can simplify habitats (Collins and Dunne 1990) and increase bank erosion, which can deliver sediment to downstream sites (Olson 2000), further reducing the quality of pools.

Increases in width and bed degradation due to sediment removal are inter-related. Where extraction occurs in excess of rates of natural replenishment, bars may become smaller, the channel may widen and/or the channel bed may degrade. The specific response(s) will depend on the confinement of the river in the valley, the volume of extraction relative to natural replenishment rates, and the methods of extraction. Where the river is confined in the valley, changes would occur in the form of bed lowering and decreases in bar size. Where the channel is unconfined, changes in all three aspects of channel form could occur. We note, though, that all these changes in channel form lead to similar effects on pool habitat; that of simplification and reduction in overall quantity and quality.

Therefore, the effects of the action, particularly in reaches where multiple excavations occur, may cause bank erosion and bed lowering near the excavation sites, particularly if extraction rates exceed natural replenishment (Simon and Hupp 1992). This bed lowering, as discussed above, can promote continued simplification of in-stream habitat elements as the extent of habitat-forming bars are decreased. The effects of bed degradation on individual river reaches, where applicable, will be discussed in the reach-specific sections that follow this general overview section.

(3) Reductions in riparian vegetation quantity and size. Pool quality in the action area is strongly influenced by the presence of riparian vegetation (Halligan 2003). Riparian vegetation provides bank stability, which may locally resist scour and form deeper pools. Overhanging vegetation and vegetation that is recruited directly into the channel provide an important cover element for salmonids. Annual bar skimming removes riparian vegetation that would otherwise colonize a portion of gravel bar surfaces. Extraction sites also increase vehicular access, resulting in increased removal of woody debris. In the stream reaches that are not confined by levees or naturally resistant boundaries, long-term or repeated modification of gravel bars at low elevations promotes frequent channel shifting that precludes the establishment of riparian vegetation to provide habitat complexity. As discussed above, stream channels in the action area can be expected to become progressively wider and less stable with consequent deterioration of adjacent riparian habitat (Rivier and Seguier 1985, Sandecki 1989). Where sediment removal exceeds sediment input, resulting in channel degradation, the water table may decline, further reducing the ability of riparian vegetation to become established or survive on bar surfaces.

Mature vegetation provides additional benefits to juvenile salmonids in the form of physical structure. Structure in the form of LWD, when recruited into the active channel promotes localized scour, pool formation and is, itself, utilized as cover. Cover is also provided to juvenile salmonids by overhanging vegetation, submerged vegetation, and exposed roots. The cover provided by complexities in structure can increase survival rates for rearing salmonids in summer and winter, and as outmigrating smolts (Meehan 1991).

Ecological energy is typically derived from detritus in streams (Cummins *et al.* 1973, Vannote *et al.* 1980) and is processed by different organisms (Anderson and Sedell 1979) in a continuum from larger to smaller particles (Boling *et al.* 1975). Riparian vegetation provides important nutrient inputs to streams such as leaf litter (Cummins *et al.* 1973) and terrestrial invertebrates that drop into the stream. Such "allochthonous inputs" can serve as the principal source of energy for higher trophic levels in stream ecosystems (Reid 1961, Gregory *et al.* 1991). Leaf litter provides the trophic base for aquatic macro-invertebrate communities that in turn are the fundamental food source for salmonids (Hawkins *et al.* 1982, Beschta 1991, Bretscko and Moser 1993).

Decreases in pool quality and quantity will impact adult holding by both reducing the ability of pools to provide for cool water and cover, and by an overall reduction in the number of pools available for holding. Decreases in pool quality and quantity will also reduce juvenile rearing success through decreases in the overall amount of habitat available, and reductions in available food base and cover. Juvenile salmonids are morphologically, behaviorally and ecologically different, which result in differential interspecific exploitation of riverine habitats (*e.g.*, pools; Bisson *et al.* 1988). For example, coho salmon are dorso-laterally compressed and have larger fins, which enables maneuverability in slower velocity pool habitats (Bisson *et al.* 1988). Steelhead are more cylindrically-shaped and have smaller fins, which enables utilization of higher velocity habitats such as riffles and runs (Bisson *et al.* 1988). These morphological differences demonstrate one reason why coho salmon are found in pools and steelhead are typically found in higher velocity habitats. Coho salmon out-compete juvenile steelhead for preferred pool habitats, but are unable to compete with steelhead in higher velocity habitats (Hartmann 1965). If pool quality and quantity declines, competitive interactions between coho salmon and steelhead will increase and steelhead will gain a competitive advantage. Increased overlap between steelhead and coho salmon in habitats where steelhead hold a competitive advantage is likely to result in decreased growth of coho salmon (Harvey and Nakamoto 1996), which can affect size of smolts and subsequent smolt- to-adult survival (Ward and Slaney 1988, Holtby *et al.* 1990).

b. Increased Riffle Instability and Migration Blockage at Riffles

Sediment removal has three principal effects on riffle habitats: (1) impacts to spawning habitat, (2) impacts to rearing habitat, and (3) increased migration blockage. Additional impacts to spawning habitat resulting from increased sedimentation are described in a following section discussing the impacts of elevated turbidity and sediment loads.

(1) Impacts to spawning habitat. Similar to decreases in pool quality, sediment removal also initiates channel instability that has consequent effects on the stability and quality of riffle habitats. Sediment removal, particularly in-stream trenching, can cause bed lowering to propagate both upstream and downstream, thereby scouring spawning areas. Increased channel instability, either through degradation or lateral migration, increases the risk that salmonid redds will be destroyed. For example, the loss of egg inoculated gravel from riffles was documented by Pauley *et al.* (1989), who concluded the eggs were scoured because bar skimming reduced bar heights, increasing shear stress over riffles. Where flow diverges over riffles, the flow depth and velocity-field become more uniform, providing conditions conducive to the formation of well sorted patches of gravel. It is these gravel patches, combined with the gradient of the hyporheic flow field (subsurface water), which provide optimal substrates for spawning salmonids (Groot and Margolis 1991). Where habitat is simplified and the pool-riffle sequence is less pronounced as noted by Collins and Dunne (1990), spawning habitat quantity, and more importantly, quality, will be reduced. Sediment extraction at a site has also been demonstrated to reduce the overall substrate size. Therefore, in lower rivers, where larger particles may be in short supply, extraction at a site could reduce the quality of spawning habitat by reducing the size of spawning substrate needed for various salmonids, particularly Chinook salmon. Decreased particle size due to sediment removal activities would both lead to increased bed mobility and a higher likelihood of redd scour.

(2) Impacts to rearing habitat. The shallow, swift flows over riffles are also important habitats for numerous species of invertebrates, many of which are important food sources for salmonids. Reductions in the quality of riffles occur by a decrease in overall substrate size by chronic sediment removal (especially in locations with a high density of mining), resulting in changes and overall reductions in macro-invertebrates, thereby decreasing food availability for rearing juvenile salmonids. Decreased food availability will result in smaller juveniles. Decreases in smolt size at the time of ocean entry has been shown to decrease ocean survival, and thus reduce the abundance of returning adults (Ward and Slaney 1988, Holtby *et al.* 1990).

(3) Increased Migration Blockage. Thompson (1972) provided minimum depth and maximum velocity recommendations that enable upstream migration of adult salmon species and that have been widely cited (Bovee 1982, Bjornn and Reiser 1991). According to those recommendations, Chinook salmon, the largest salmonid species, require minimum riffle depths of 9.5 inches and, for successful passage, this depth should be provided "on at least 25% of the total [*cross-sectional*] transect width and a continuous portion equaling at least 10% of its total width." In reviewing the baseline conditions for the action area, and given the lack of complex habitat elements and extensive flatwater habitat in the action area, NOAA Fisheries reasons that a minimum depth of 24 inches is necessary to allow for uninhibited migration of adults. We reason that salmonids in the lower river reaches of the action area are already faced with extensive areas that are less than the cited 9.5" minimum and that many channel cross sections do not provide the necessary widths of deeper water. Under these conditions, salmonids are forced to expend additional enery to move upstream than if greater depths were present. Sediment removal operations that increase low-flow channel widths (particularly bar scalping) increase the probability that shallow flows at riffles will form migration barriers. Increased widths (particularly from bar scalping) increase the probability that shallow flows at riffles will form migration barriers. Pauley *et al.* (1989) and Woodward-Clyde Consultants, Inc. (1980) verified that flow depths decreased over riffles, creating barriers to upstream-migrating adult salmonids, adjacent to and upstream from skimmed bars.

Migration blockage is a significant concern in the action area. Streamflows are typically at annual lows at the onset of adult migration. Many of the riffles in the reach may impede adult upstream migration under current conditions. In some years, this results in significant concentration of migrating adults, thereby predisposing them to poaching, increased angling pressure, and increased potential for disease (CDFG 2002). For angling, we note that while possession of listed species is prohibited, considerable catch-and-release effort occurs along the lower Eel River and subjects released fish to delayed hooking mortality (pers. observation by S. Flanagan, fisheries biologist, NOAA Fisheries 2003).

The extent to which the presence of shallow, migration-blocking riffles is due to past mining is difficult to determine. Evidence suggests that skimming on the lower Van Duzen River increased the low-flow width, aggravating shallow riffle conditions, and contributing to the stranding and mortality of adult Chinook salmon in a shallow reach (NOAA Fisheries 2002d).

Migration blockages may be created through two mechanisms. First, where a skim floor is taken down to the level of an adjacent riffle at low-flow, rising flows will not be confined. Therefore, during the first rising flows of the fall, river width would increase rapidly while depth would increase very little and the riffle continues to be a migration barrier. A second mechanism by which migration would be impeded is through longer-term increases in width due to repeated sediment removal at a site. As discussed previously, various sediment extraction methods can increase channel width at the site. Channel degradation has been accompanied by channel widening (Simon and Hupp 1992). This occurs as bars are lowered or removed, and stream habitat becomes less complex. The habitat simplification that occurs as a result of sediment removal produces a greater amount of "flat water" habitat, with an overall decrease in topographic complexity. Adult migration may be impeded if long stretches of flat water habitat occur without holding cover (Thompson 1972).

c. Loss of Velocity Refugia

Sediment removal can alter the distribution of velocity refugia in extraction reaches. These may occur through (1) reach-scale changes in habitat quality, (2) changes in channel bed roughness, and (3) reductions in riparian vegetation.

(1) Reach-scale changes in habitat quality. Pools provide a complex of deep, low velocity areas, backwater eddies, and submerged structural elements that provide cover, winter habitat, and flood refuge for fish (Brown and Moyle 1991). During their upstream migrations, adult salmonids typically move quickly through rapids and pause for varying duration in deep holding pools (Briggs 1953, Ellis 1962, Hinch *et al.* 1996, Hinch and Bratty 2000). Holding pools provide salmon with safe areas in which to rest when low flows and/or fatigue inhibit their migration. Pools are also the preferred habitat of juvenile coho salmon (Hartman 1965, McMahon 1983, Fausch 1986), the subset of Chinook salmon juveniles that over-summer, and juvenile steelhead, although this latter species is also able to utilize riffle habitat if it is complex with velocity refuges behind cobble and small boulders (Hartman 1965, Raleigh *et al.* 1984, Hearn and Kynard 1986, Nielsen *et al.* 1994). Pools with sufficient depth and size can also moderate elevated water temperatures stressful to salmonids (Matthews *et al.* 1994). Deep, thermally stratified pools with low current velocities, or connection to cool groundwater, provide important cold water refugia for cold water fish such as salmonids (Nielsen *et al.* 1994).

Degradation initially creates a deeper, narrower channel. Back channels are cut off and river-edge wetlands are de-watered. Initially complex channels tend to degrade to less complex channels with a decrease in the pool/riffle expression of topographic complexity. These effects amount to reduction in habitat diversity (Lisle *et al.* 1993). Lack of both margin and topographic complexity reduce important velocity refuge in the lower main stem rivers of the action area.

(2) Changes in channel bed roughness. Reductions in exposed particle size result from the removal of overlying coarse sediments and abrasion and particle breakage caused by the passage of heavy equipment. Coastal watersheds in the action area are composed of sedimentary and low-grade metamorphic rocks. Particles that easily break into smaller particles when moving downstream and when heavy equipment crushes them dominate the coarse sediment load in these streams. As a result of disrupting the natural armoring process and mechanical crushing, disturbed bar surfaces are typically finer-grained than undisturbed bar surfaces.

Areas of heavy bed armor can provide valuable fish habitat during high flows (Church *et al.* 2001) because of low near-bed velocity and productive benthic habitat whenever inundated (Bjornn *et al.* 1977). Loss of pool quality discussed above is one manner in which important velocity refugia can be reduced or eliminated. In addition, riffles with course substrate such as cobble and small boulders provide velocity refuges for juvenile salmonids (Hartman 1965, Raleigh *et al.* 1984, Hearn and Kynard 1986, Nielsen *et al.* 1994). As described previously, sediment removal results in finer substrate sizes, resulting in increased bed mobility. Increased bed mobility will result in less stable velocity refugia.

(3) Reductions in Riparian Vegetation Size and Distribution. Vegetative structure increases hydraulic boundary roughness, resulting in relatively lower velocities near the flow-substrate interface (Beschta and Platts 1986) and increases channel and habitat stability (Lisle 1986). These low velocity zones provide refuge habitat to salmonids during high-flow events. Many salmonids seek out low velocity areas close to high velocity areas in order to optimize foraging and maximize net energy gain (Fausch 1984).

d. Increased Water Temperatures

Riparian vegetation protects stream temperatures from rising unduly by providing canopy that shades the water and reduces direct solar radiation reaching the water surface (Beschta 1991, Hetrick *et al.* 1998). Stream temperatures are affected to a lesser degree by ambient air temperatures (Spence *et al.* 1996). In addition, riparian vegetation lessens the temperature differential between the air and the water by creating a cool and moist microclimate near the water surface.

As streams get larger, they typically get wider. The resulting increase in surface area exposes the water to more insolation and more heat gain (Beschta *et al.* 1987). The influence of riparian vegetation decreases in proportion to the fraction of the water's surface shaded by trees adjacent to the watercourse. The influence of heat energy transfer is also diminished as stream flows increase (Beschta *et al.* 1987). This decreases the cooling influence of shade on main stem waters, particularly those that have higher than normal summer flows because of releases from upstream storage reservoirs. However, recent temperature modeling efforts (Stillwater Sciences 2001) indicate that the Russian River, a relatively large stream in Sonoma County and similar in size to Humboldt County rivers, is well below the channel width threshold that would nullify the temperature mitigating influence of riparian vegetation. Stream temperature is also influenced by season, latitude, elevation, topography, orientation, and local climate (Spence *et al.* 1996). Despite this, the relative contribution of riparian vegetation and its inverse relationship to channel width, as represented in the Stillwater Sciences (2001) model, indicates that a channel width roughly seven times greater than tree height is needed before changes to insolation are reduced to insignificance. The Stillwater Sciences (2001) modeling effort is the best available information on the effects of riparian vegetation and channel widths on temperature.

Increased water temperatures due to losses of riparian vegetation are of particular concern, given that salmon and steelhead prefer relatively cold water habitats with water temperatures less than about 15°C. Water temperature influences juvenile steelhead growth rates, population densities, swimming ability, ability to capture and metabolize food, and disease resistance (Barnhart 1986, Bjornn and Reiser 1991). Upper lethal temperature limits generally range in the vicinity of about 23-25°C, although many salmonid species can survive short-term exposures to temperatures as high as 27-28°C (Lee and Rinne 1980). Fluctuating diurnal water temperatures also help salmonids survive short episodes of high temperature (Busby *et al.* 1996). Large, thermally stratified pools, springs, and cool tributary inflow can also provide cold water refuges that help juveniles survive hot summer temperatures (Nielsen *et al.* 1994).

e. Elevated Turbidity and Sediment Loads

Sediment generated from upstream eroding banks or eroded off of freshly skimmed bar surfaces can smother incubating salmonid embryos. Sediment intrusion resulting from the excavation of in-channel bars is likely a transient process that occurs when an altered bar is initially overtopped and flushed of its fine-grained surface layer. This process, in terms of increased sediment load, is difficult to detect, especially in streams with high background sediment concentration. However, the potential for harm to spawning and incubating salmonids in areas within and downstream of altered bars is great because of the critical timing between reproductive activities and the first winter storms. Increased sedimentation of riffle habitats reduces the interstitial spaces of cobbles and gravel, and directly decreases the habitable area for aquatic invertebrates, an important food source for juvenile salmonids (Bjornn *et al.* 1974, Bjornn *et al.* 1977).

Removal of an armor layer, which protects the stream bed or bar from sediment transport, creates a less stable bed or bar and can be transported earlier in a given flood season. The finer-grained disturbed surfaces, which are at a reduced elevation, create a new source of fine sediment within the active channel that can be mobilized by the first freshets during late fall or early winter. The first freshets may entrain the fine-grained surface material, but lack the magnitude or duration to transport the locally derived fine sediment sufficiently downstream.

Wickett (1954) showed that sediment intrusion is most damaging to young embryos in the first 30 days of incubation because this stage is less efficient at oxygen uptake. Chinook and coho salmon typically spawn in main stem streams from November through January, and steelhead from January through April. The early winter storm events described above are likely to occur at the height of the Chinook and coho salmon spawning season. This timing increases the likelihood that increased sedimentation at relatively low flow would impact those species.

Besides inhibiting the emergence of alevins, one of the principal means by which fine sediment reduces survival of salmonid embryos is by reducing intra-gravel water flow, thereby reducing the amount of dissolved oxygen available for respiration (Bjornn and Reiser 1991). Temporary sedimentation episodes, as described above, can exceed the ability of embryos to cope with such conditions (Alderice *et al.* 1958). The transitory natures of these effects make them difficult to detect and monitor. The least desirable situation for sediment removal would combine large disturbed areas with a location in or immediately upstream from spawning habitat.

f. Increased Stranding of Salmonids on Extraction Surfaces

Gravel extraction surfaces (*i.e.*, skimmed bars, trenches, horseshoe skims, alcoves and wetland pits) all have an increased potential for salmonid stranding after inundation and subsequent receding flows. Increased stranding potential can occur when skimmed bars have been left with closed undulations or depressions. As described in the *Proposed Action* section of this Opinion, skimmed surfaces must be final graded to provide a free draining surface, although a slope percentage is not specified. NOAA Fisheries expects that the increased potential for stranding on skimmed surfaces relative to unskimmed surfaces will be low, but that in some cases not enough slope will be left for free drainage, or small depressions may be left on the skimmed surface. NOAA Fisheries anticipates that up to 10 juvenile salmonids per year may be stranded and killed in isolated depressions on extracted surfaces after initial inundation of the area. Any stranding would occur in isolated areas that were not readily visible in the field or from survey data.

2. General Effects of Wetland Pits

Based on implementation of wetland pits during the original LOP 96-1, we anticipate that wetland pits may be authorized under LOP 2004-1 as an extraction method on, at least, the Mad and Van Duzen rivers, and possibly other rivers as well. Excavating a wetland pit in a frequently inundated floodplain (2-5 year floodplain) may be a relatively low risk method for producing high quality aggregate outside the bankfull stream channel. The frequency of fish interaction is lower than within the bankfull channel, however, both adult and juvenile salmonids can become trapped in pits. The risk of stranding adult salmonids is lower than the risk of stranding juveniles, since adults are typically migrating upstream while juveniles may be seeking refuge from the high water velocities and may remain within the pits when flows recede. In addition, the sediment volumes excavated from wetland pits must be accounted for in the total annual extraction volumes in order to address the effects of cumulative over-extraction, such as bed degradation and pool/riffle simplification.

Wetland pits have been used on the Mad and Van Duzen rivers in conjunction with other sediment extraction methods, so that volumes excavated from wetland pits are a part of the total annual volume recommendation by CHERT, and are considered by CHERT when restraining extraction volumes within its estimate of sustained yield for a river reach. Therefore, size and elevation should be designed relative to the flow frequency and magnitude that can be expected to refill the pit. A reliable sediment budget, and inundation frequency analysis, are therefore required to design a wetland pit excavation that reduces the total volume-related effects, such as bed degradation at the reach scale.

The increased risk, above natural levels, of stranding of juvenile and adult salmonids in wetland pits occurs during recession of high flow events. During high flow events, wetland pits will likely be at, or near, channel margins, where both adult and juvenile salmonids will be seeking velocity refugia. However, the risk of fish stranding is reduced by the location of wetland pits on the 2-5 year floodplain, so that inundation of these pits only occurs during large, winter flow events, and most likely not on an annual basis. NOAA Fisheries expects that wetland pits will be utilized on the 2-5 year floodplain to minimize potential salmonid stranding.

NOAA Fisheries anticipates that there will be take of salmonids by stranding as a result of wetland pit excavations on at least the Mad River and the Van Duzen River, and possibly other rivers as well. However, we anticipate that the probability of adult stranding is low, as discussed above, and should not rise to a level of population significance. Juvenile salmonids may be stranded in wetland pits, and NOAA Fisheries expects that a low number of juveniles may perish due to stranding in pits. Based on past implementation of wetland pits on the 2-5 year floodplain on a few sites in the Mad and Van Duzen rivers, wetland pits are expected to be used on a limited basis during the implementation of LOP 2004-1. We anticipate that the take of juveniles through wetland pit stranding will be low in the river systems of the action area.

3. <u>General Effectiveness of the Measures in the Proposed Actions to Minimize Effects</u>

a. General Effectiveness of LOP 2004-1 Project Standards

The *Description of the Proposed Action* section of this Opinion contains a thorough description of LOP 2004-1. This section provides an overview of the ability of project standards contained in LOP 2004-1 to reduce the general effects of gravel mining. The more specific effects, by river reach, are discussed below in the *Effects of the Proposed Action by River Reach* section.

(1) Minimum skim floor elevation. LOP 2004-1 proposes to set minimum skim floor elevations to correspond to the water surface elevation of the flow that is exceeded 35% of the time in the historic record of daily average flows for rivers in Humboldt County (Table 12). For the Trinity River, where the annual flow regime is influenced by reservoir releases and the only Federally listed salmonid present is SONCC coho salmon, a minimum skim floor elevation of two feet is used. Similarly, for the lower Eel River, where narrow skims are used, a minimum two-foot skim floor is proposed.

Table 11. The flow in the table represents the flow that is exceeded 35% of the time in the historic record of daily average flows.

USGS Stream Gage	Flow Exceeded 35% of Time
Mad River near Arcata	900 cfs
Lower/Middle Eel River at Scotia	3800 cfs
Van Duzen River near Bridgeville	500 cfs
South Fork Eel River near Miranda	900 cfs

The 35% exceedence flow is the flow where significant movement of fine bed load material begins in the rivers of Humboldt County (NOAA Fisheries 2002). The 35% exceedence flow is a relatively low flow, near the average daily flow. Calculations of water surface elevation using cross sections available in mined areas indicate that the 35% exceedence flow provides for a water depth sufficient to allow for adult salmonid migration that is consistent with observations and recommendations for depths across a cross section that is consistent with Thompson (1972). A skim floor at the 35% exceedence flow will provide confinement of the low flow channel until the stream is naturally beginning to transport fine sediment, providing confinement of the low flow until the very beginning of the channel's response to increasing stream flow. Timing of sediment increases can be critical for impacts to spawning and migration during the fall and early winter.

In the absence of the 35% exceedence flow skim floor requirement, increased sediment from lower skimmed surfaces would be entrained prior to the beginning of significant movement of fine bed load material in the rivers of Humboldt County. Therefore, the general effect of skim floor elevations is that effects associated with sediment inputs are reduced as the elevation of the skim floor increases.

Water depths for large salmon spawning have been noted between 6 and 14 inches (Meehan 1991). Most main-stem spawning occurs near riffles or at the pool tail just upstream of the riffle. Similarly, ten inches of water over the riffle crest in an undisturbed river should be sufficient to provide unimpeded fish passage. However, in disturbed channels, fish expend additional energy to migrate through simplified and reduced pool-riffle structures. Frequently disturbed rivers are often missing some of the important attributes of a natural river that allow unimpeded migration or spawning. Those attributes include channel margin complexity, bed roughness, and vegetative cover. Additional flow depth beyond the cited minimums can help offset the lack of habitat complexity. NOAA Fisheries thinks that a flow depth over riffles of 24 inches during migratory flows is necessary to help offset the lack of channel complexities that aid in migration and spawning. The water surface elevation of the 35% exceedence flow and a two-foot vertical offset above summer low flow, in the case of the Trinity River and narrow skims on the lower Eel River, should all provide for at least 24 inches of flow depth over riffles.

The minimum skim floor elevation should be used in conjunction with limits on gravel volume extracted, area disturbed, and with consideration for specific geomorphic features. Based on the normalized flow duration curves, NOAA Fisheries (2002) assumed that the 35% exceedence flow represents a similar flow for each of the rivers in Humboldt County that are affected by gravel mining. At the 35% exceedence flow, some spawning-sized bed material has been put into motion, and the depth for migration should be protected. The 35% exceedence flow is far below the flow that moves significant-sized bed material, which would be considered a channel forming flow. Setting the flow-based extraction limit at the 35% exceedence flow is expected to provide a minimum extraction elevation for typical skim type mining. The limit cannot provide for maintenance of morphological features of a stream or for the reconstruction of degraded morphological features, particularly if too large of an area is skimmed, or too large a cumulative volume is mined. Bar elevations considerably above the minimum extraction elevation are necessary to drive the hydraulics necessary to form essential channel morphology (*e.g.*, deep pools and the related riffle structure, moderate flow meanders, velocity diversity, and all other associated geomorphic features).

(2) Alternative extraction designs. LOP 2004-1 requires that alternative extraction techniques are given preference over traditional skimming in the Mad River, the Lower Eel River, and the South Fork Eel River. A 90-foot maximum skim width is specified for the lower Van Duzen River where larger skims in the past have contributed to wide, shallow braided conditions. Giving preference to alternative extraction techniques, including narrow skims, in spawning reaches, or reaches with channel braiding and widening, should reduce the effects of gravel extraction and, over the permit period, will likely maintain current habitat conditions of pools and riffles rather than promoting continued degradation.

NOAA Fisheries expects that this provision for alternative extraction techniques will reduce the frequency of skimming in the South Fork Eel, Lower Eel, and Mad rivers. At each potential extraction site, alternative extraction methods will be given preference over traditional skimming. These may include:

a. Alcove extractions, which would occur at the lower end of the bar and typically extend upstream along the landward edge of the bar;
b. Horseshoe excavations, which would also occur at the downstream end of the bar and extend upstream into the interior portion of the bar, leaving a buffer of undisturbed gravel bar on each side;
c. Dry trenching, which would occur in areas of low bar relief where alcoves and horseshoe excavations are not feasible. In these instances, trenching may be used as an alternative in order to reduce the potential for channel migration or braiding across the low surfaces; and
d. Narrow skims. These narrow, crescent-shaped benches may be excavated following the low-flow channel and are defined below for each river reach below. The intent of this narrow skim is to maintain the overall bar shape and form versus traditional skims of the past which remove a large portion of the bar, often including the higher points of the bar which provide hydraulic control.

Note that the above list is not in any particular order of preference. Specific extraction methods will depend on the site. Also, wetland pits are not included in this list as they are typically used following dry years when recruitment of gravel is low.

For the Van Duzen River, narrow skims will be limited to a maximum width of 90 feet across the top of the extraction. This width is designed to contain average peak flows of 1,000 cfs, commonly seen during the early period of adult salmonid migration in November and December. The minimum skim floor elevation will be equal to the water surface elevation of the 35% exceedence flow.

Along the lower Eel River reach, narrow skims are adjacent to the low-flow channel, but are not adjacent to entire riffle areas. These narrow skims will have a minimum vertical offset of 2 feet above the water surface elevation in order to minimize the footprint of disturbance versus what could occur if a higher skim surface was used. The intent of the constrained skim width is to avoid the higher portions of the bar, which provide hydraulic control at higher flows. These skim widths will be determined on a site-specific basis, but subject to the following limitations:

a. Narrow skims must not increase channel braiding;
b. The skim cannot lower the elevation at which flows enter secondary channels;
c. Narrow skims must avoid the higher portions of the annually inundated bar surface; and
d. Narrow skims must promote channel confinement

Narrow skims on the Mad River will be limited to a maximum width of one-third the exposed bar width, as measured at the widest point of the bar, and will have a minimum skim floor elevation at least as high as the water surface elevation of the 35% exceedence flow. The exposed bar is defined as that area subject to annual flow inundation and active sediment transport and replenishment cycles, and lacking transitional vegetation colonization, grasses and shrubs. The area may contain sparse patches of widely scattered individual woody plants.

We expect that where traditional skimming does occur in the three river reaches, it will be confined to a small area relative to the overall bar size, and not be located adjacent to spawning riffles. For example, on the Mad River, most of the spawning areas and unconfined portion of the reach are upstream of Highway 299. Therefore we expect that traditional bar skimming would be more frequently used downstream of Highway 299. Whichever method is utilized, we expect that maximum height of the bar will be retained to help preserve hydraulic function in addition to the head-of-bar buffer. We expect the overall effect will be a reduction in impacts to spawning habitat, and reduction in channel widening and braiding.

Past bar skimming has typically disturbed a large area of the bar surface (*i.e.*, often greater than one-fourth the bar area exposed at low flows), reduced topographic complexity that influences adjacent channel form and function, and abutted the low flow channel, thus more readily translating effects to the low-flow channel. The specific effects on salmonids due to minimization of this traditional skimming is discussed in greater detail in the relevant river reach effects sections that follow.

(3) Minimum head-of-bar buffer. The minimum head-of-bar buffer is defined in LOP 2004-1 as that portion of the bar that extends from at least the upper third of the bar to the upstream end of the bar that is exposed at summer low flow. The intent of the buffer is to provide protection of the natural stream flow steering effect provided by an undisturbed bar. The head-of-bar buffer will minimize the potential for geomorphic changes to the river from sediment extraction.

Some alternative extraction techniques described above, such as longer and much narrower skims adjacent to the low flow channel, have specific geomorphic objectives that may require extraction on a portion of the head-of-bar buffer. Variances to the minimum head-of-bar buffer may be considered on a case-by-case basis, if the proposed alternative provides equal or greater protection. NOAA Fisheries will inform the Corps and CHERT if a proposed variance does not comply with the ITS. The specific nature of the proposed variance must be described, along with sufficient biological, hydrological, and sediment transport rationale to support the recommended alternative. For example, any modification in the default head-of-bar buffer dimensions should, at a minimum, provide for protection of the adjacent cross-over riffle, by limiting extraction to the area downstream of the riffle. In addition, NOAA Fisheries may impose special requirements, including additional monitoring on approved variances to the minimum head-of-bar buffer, to ensure there is no take beyond what is allowed in the ITS of this Opinion.

The minimum head-of-bar buffer in LOP 2004-1 provides for the maintenance of an important element of the pre-extraction bar topography and will provide a corresponding degree of protection to existing habitats. The head-of-bar buffer helps to guide streamflows that are effective at creating and maintaining habitats. The head-of-bar buffer also provides for bar slope and form that provides for reach and site scale hydraulic roughness. The head-of-bar buffer is discussed in greater detail in the river reach effects sections that follow.

(4) Extraction volumes and CHERT review and recommendation process. LOP 2004-1 requires all applicants to use the CHERT process for annual review and recommendation, and limits the total extraction volume in the Mad River to 175,000 cy/yr over the five-year permit period. NOAA Fisheries notes that three operators are currently permitted through individual permits on the Mad River. However, the 175,000 cy/yr volume limit applies for all gravel operation in the Mad River regardless of the regulatory mechanism by which these operations are permitted (July 2, 2004, letter from C. Fong, Corps, to I. Lagomarsino, NOAA Fisheries). LOP

2004-1 relies, in part, on the CHERT review and recommendation process to constrain total reach extraction volumes, and to recommend mining techniques that will minimize site specific geomorphic impacts. CHERT's definition of the long-term average annual sustained yield is equivalent to MAR into the extraction reach as described in the *Description of the Proposed Action* section. MAR has only been estimated with reasonable confidence for the Mad and Van Duzen rivers, with the Mad River calculations being more rigorous than the Van Duzen estimate (Klein *et al.* 2001). The use of MAR as a sustained yield extraction volume assumes that the average volume transported into the reach is available for extraction. Given the small quantities or missing number of bedload samples and bed material samples in the mining reaches, MAR into and out of the reach can only be estimated with low confidence. Aside from the low confidence level in the estimation of the MAR, there is also an enormous natural variation in bedload volumes from year to year, where the average value may be much higher than the actual recruited volume during a less than normal water year. The cross sectional analysis presented in the *Environmental Baseline* section indicated channel enlargement in the extraction reach above Johnson Bar over the past ten years. Though the trend in channel enlargement and contraction can be at least partially explained by the intensity of the water year type, the net enlargement of the channel suggests that more volume is being removed than is being imported into the reach. NOAA Fisheries cannot discern the exact cause of the overall enlargement of the extraction reach above Johnson Bar, but this response would be expected if the entire average recruitment volume was extracted annually. If the sediment is not available on the gravel bars due to extraction, NOAA Fisheries expects increased bank erosion, resulting in channel enlargement. The effects to critical habitat and affected species will be discussed in the reach specific sections that follow.

The estimate of MAR for the Van Duzen River that CHERT bases sustained yield on has been between 135,000 to 202,000 cubic yards with an average value of 168,500 cubic yards (Klein *et al.* 2001). The estimate of MAR for the Mad River that CHERT bases sustained yield on has been between 150,000 to 200,000 cubic yards. Between 1997-2003 the average total CHERT recommendation for gravel extraction in the Mad River was 210,660 cubic yards, greater than CHERT's high-end estimate of MAR, although the actual average extraction volume for the Mad River was 177,078 cubic yards, about the average of CHERT's estimate of MAR. Lehre (1993) recommended an average total extraction not to exceed 150,000 cy/yr to keep the Mad River in its current state. In order to induce recovery of bed elevation, Lehre recommended that average total extraction should be limited to no more than 100,000 cy/yr. In 2003, in response to a draft analysis conducted by the Corps, extraction on the Mad River was constrained to no more that 150,000 cubic yards. Other available estimates of sediment stored in the Mad River extraction reach, or parts of the extraction reach, vary, though reported values are all within the same order of magnitude. Regardless of the permitting mechanism, the Corps proposes limiting the total extraction in the Mad River to a maximum of 175,000 cy/yr (July 2, 2004, letter from C. Fong, Corps, to I. Lagomarsino, NOAA Fisheries). Further discussion on the effects of the proposed extraction of 175,000 cubic yards from the Mad River is provided in the Mad River reach-specific effects section that follows.

(5) Effects on riparian vegetation. LOP 2004-1 requires that disturbance of woody riparian vegetation greater than 2 inches diameter or that is part of a 1/8 acre contiguous complex be mapped and either avoided or re-planted. LOP 2004-1 does not require that LWD found on the gravel bar be stockpiled and replaced after extraction occurs, nor does the proposed LOP require the protection of newly emergent, or potentially emergent riparian vegetation. However, the CHERT process does take protection of existing riparian vegetation into account during the review and recommendation of mining plans, and the LOP does require that educational signing regarding the importance of LWD for salmonids be placed at access roads owned, controlled or utilized by the gravel operators. We expect that gravel mining, as authorized under LOP 2004-1, will maintain, or further degrade, the current condition of riparian vegetation and LWD function, especially in river reaches with a high density of mining.

(6) Effects on pools and riffles. As described above, we expect that gravel mining under LOP 2004-1 will minimize the likelihood of migration blockages at riffles by providing a minimum depth of 24"adjacent to the riffle and by requiring a head-of-bar buffer. However, this low flow channel confinement is not sufficient to protect the hydraulic processes that sort substrate particles and determine water velocities that maintain and form quality riffle habitat for spawning and rearing, or quality pool habitat for rearing and holding. We anticipate some riffle instability and scour, although the head-of-bar buffer and the limitations on the use of skimming will minimize these effects. Thus, the current condition of holding, rearing and spawning habitat will likely be maintained, or slightly reduced in quality and quantity.

(7) Effects of temporary channel crossings. As described in the *Direct Effects* section of this Opinion, elevated turbidity associated with temporary channel crossings should be minimized by the implementation standards described in LOP 2004-1. Impacts to Chinook salmon redds associated with temporary channel crossings will be minimized as a result of the standards in LOP 2004-1.

b. LOP 2004-1 Project Guidelines

LOP 2004-1 relies in part on the CHERT review and recommendation process to constrain total reach extraction volumes, and to recommend mining that will minimize site specific geomorphic impacts. In Humboldt County's mining program, as implemented by CHERT, several guidelines are provided to minimize both geomorphic and habitat impacts at mining sites. CHERT described the guidelines as follows (Klein *et al.* 2003):

- Skim boundaries are typically laid out as curvilinear benches along the outside of point bars, as this usually provides a good replenishment configuration without preventing riparian colonization or encouraging braiding;
- Skim widths are constrained to avoid braiding (divided flow) by being no wider than about half the unvegetated bar width;
- Skim floors are sloped to provide for drainage following inundation (either directly toward the low flow channel, in a downstream direction, or somewhere in between) to reduce salmonid stranding potential;
- A vertical offset of the skim floor above the low water surface (typically about 2 feet or more) is provided to retain sufficient low flow channel confinement;
- The upper one-third of a bar is usually left undisturbed to preserve sufficient high flow confinement of flows entering the bend and discourage braiding.
- In low recruitment years, bar skimming may be forgone in favor of wetland pits outside the active channel, but on surfaces no higher than the 5-year floodplain;

- Gentle (10:1) side slopes are provided around the outer edges of wetland pits, with deeper areas in the interior to increase volumes;
- Wetland pit boundaries are laid out to limit disturbance to existing riparian vegetation by conforming to existing openings in perennial riparian vegetation;
- Wetland pits are avoided near the upstream ends of bars to prevent elevating the risk of meander cutoff; and
- Total pit area on a bar should not exceed about 10% of the bar's surface area to avoid elevating the risk of meander cutoff.

Three of the above guidelines are included in LOP 2004-1 as project standards: (1) the head-of-bar buffer, (2) the minimum skim floor elevation, and (3) sloping of finished skim floors to provide for free-drainage. The general effects of minimizing skimming and providing a minimum skim floor elevation were discussed previously in this section, and more reach-specific effects on salmonids are provided in the reach-specific sections that follow. The effects of providing free drainage on finished skim floors was discussed in the *General Effects of Sediment Removal on Habitat and Salmonids* section.

4. General Effectiveness of the CHERT Process

LOP 2004-1 requires applicants to use the CHERT review and recommendation process as an important component of the proposed action. The CHERT review and recommendation process began in the early 1990s, and has been effective at reducing effects when compared to the effects of gravel mining that occurred prior to the inception of the CHERT process. However, there are limitations to the CHERT process at continuing to minimize the effects of gravel mining. CHERT functions as an adaptive management process, and mining volumes and/or techniques may be tried based on professional judgement, with an assessment of the effectiveness occurring after implementation. Funding for CHERT to fulfill the assessment portion of the adaptive management process has been limited. And, like any process that relies, in large part, on professional judgement, both past mistakes (*e.g.*, past recommendation of bar skimming at the mouth of the Van Duzen River that aggravated shallow conditions and fish passage problems over riffles, recommending in excess of MAR for the Mad River) and past successes (*e.g.*, utilizing trenching at Cook's Valley on the South Fork Eel River to improve migratory and rearing habitat) have occurred.

NOAA Fisheries anticipates that combined with the project standards and limitations found in LOP 2004-1, the CHERT review and recommendation process will be effective at reducing effects to salmonids and their habitat.

E. Reach-Specific Indirect Effects of the Proposed Action

1. Lower Eel River Effects

a. Baseline Summary

The lower Eel River is defined here as the gravel extraction reach between the mouth of the Van Duzen River to just below Fernbridge. Historic land and water management practices, as described generally for Humboldt County, contributed to loss of habitat diversity within the lower mainstem Eel River. Habitat in this area has been characterized as being more homogeneous and simplified in comparison to other Humboldt County extraction reaches (Halligan 1996). Cooling trends in downstream water temperatures continue to provide habitat for listed salmonids in the lower Eel River. Cool water seeps, thermal stratification, and habitat complexity all play important roles in sustaining micro-habitat for juvenile and adult salmonids. Fishery data indicate depressed or declining abundance trends, yet observational data indicate natural populations persist in the Eel River, albeit at low levels. The degraded condition of the estuary, coupled with the marginal habitat conditions in the rest of the Eel River because of elevated temperatures, high sediment loads, paucity of woody debris, and presence of Sacramento pikeminnow highlight the importance of the lower Eel River to salmonids, especially Chinook salmon and steelhead.

The lower Eel River portion of the action area serves as an important holding area and migration corridor for salmonids. Therefore, conditions encountered along this reach, particularly during low-water periods, influence salmonid populations in the entire Eel River basin. We expect that CC Chinook salmon are most sensitive to conditions in this reach because they are known to enter the lower river in late summer and early fall when high water temperatures and low stream flows create stressful conditions for adults prior to upstream migration. Since the Eel River is one of the largest river systems in the ESUs of the salmonids considered in this Opinion, conditions that influence basin-wide populations will have a measurable effect at the ESU level as well.

Gravel extraction addressed in this Opinion will occur at up to five sites on the lower Eel River. One additional site, Hauck Bar, will also be mined, although incidental take will be granted through an individual permit rather than this LOP process. The average CHERT recommended volume between 1997 and 2003 is 405,185 cy/yr, and similar volumes are anticipated to be authorized over the term of LOP 2004-1 (including mining at Hauck bar, which is covered by an individual permit). The average actual extraction volume between 1997-2003 was 236,555 cy/yr. Extraction methods have included predominantly bar skimming, but, more recently, alternative extraction designs such as trenches have been implemented. A map of the lower Eel River extraction sites is found in the Van Duzen River reach specific effects section (Figure 8).

b. Pool Quantity and Quality

(1) Increased width. Aerial photos indicate that the lower Eel River is a wide channel with some channel braiding, which may have been exacerbated by past gravel extraction. Some of the channel braiding may be a consequence of the channel slope in this reach. This setting promotes habitat conditions dominated by relatively shallow pools and poorly pronounced riffle crests. Shallow "flatwater" habitat dominates the lower Eel River (Halligan 1997, Jensen 2000), and provides poor conditions for juvenile rearing. Halligan (1996) considered the lower Eel River to be more simplified and homogeneous in comparison to other Humboldt County rivers. The lower Eel River is an important reach for adult Chinook salmon and summer steelhead holding and migration, and for Chinook salmon and steelhead rearing. We expect the current conditions to limit the amount and quality of these important habitat functions. We expect that alternative extraction techniques rather than traditional skimming, the proposed provisions for narrow skims, and the head-of-bar buffer will minimize further increases in the low-flow channel width.

Examples of how the preferential selection of alternative extraction techniques will be applied were discussed previously in the *General Effectiveness of the Proposed Actions at Reducing Effects* section.

Pools in the lower Eel River tend to occur where the low flow channel abuts higher elevation bars or scours along rip-rap. Bars approaching bankfull height are capable of providing somewhat higher quality habitat features, including alcove habitats at moderately high flows, than locations where the channel is unconstrained by these highest bars. Past skimming has likely exacerbated this problem by not allowing sufficient bar height recovery to allow for channel confinement over a greater range of flows. As discussed in the *General Effectiveness of the Proposed Actions at Reducing Effects* section, we expect that where skimming does occur in this reach, it will be located away from riffles that provide critical channel control, and the skim will be limited in extent relative to the overall bar size versus past skims, which often removed much of the topographic expression of the bars. Under the proposed action, we do not expect channel widening will occur to the degree that it causes adverse effects to salmonids. We expect that migratory routes will be unaffected by the proposed action and holding habitat will be maintained in the reach.

Lower Eel and Lower Van Duzen River Gravel Mining Sites

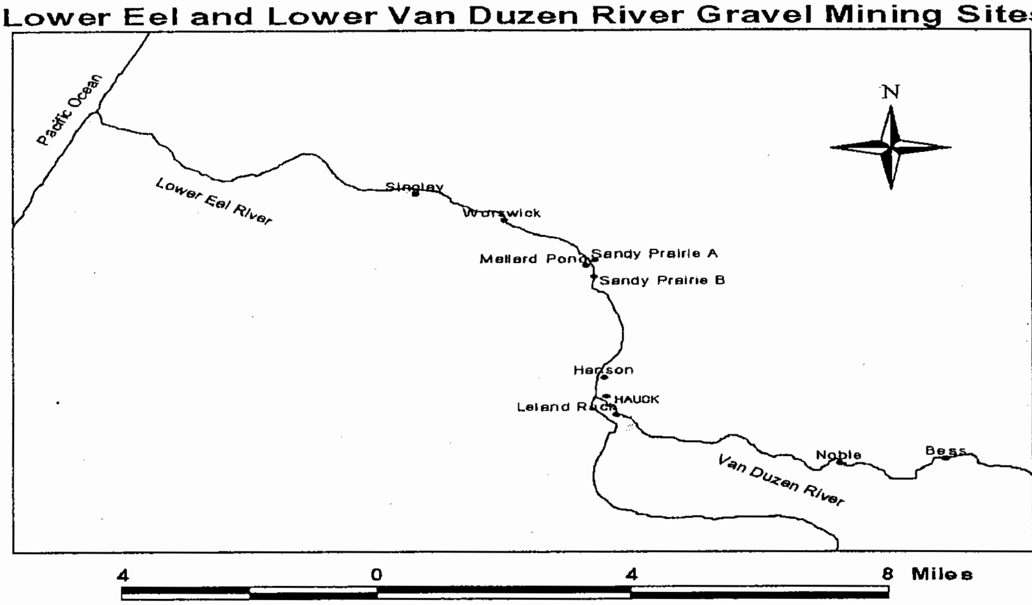

Figure 8. Gravel mining sites on the Lower Eel River and the Van Duzen River proposed in LOP 2004-1. Note that the Hauck Bar site is permitted through an individual permit rather than LOP 2004-1 and is shown here to fully depict the extent of extraction occurring in the reach.

(2) Channel degradation. As described in the *Environmental Baseline,* sediment removal can result in localized or reach-scale bed degradation. While past extraction rates have likely contributed to the one to three feet of channel degradation for the period 1968 to 1998 (Corps 1999), the flood of 1964 has certainly influenced the observed channel response. While we do not have data to indicate if channel degradation continues, particularly in response to implementation of the CHERT program, the estimates for MAR described in the *Environmental Baseline* suggest that degradation is much less likely to occur under recent extraction volumes than those seen prior to the CHERT program. The proposed action requires the applicant to continue to use the CHERT process for annual review and recommendation. The proposed action relies, in part, on the CHERT review and recommendation process to constrain total reach extraction volumes, and to recommend mining that will minimize site specific geomorphic impacts.

A critical assumption used in this effects analysis is that past extraction volumes will continue at a similar rate to those seen in the period 1997-2003. Under the assumption that past extraction volumes in the action area will remain similar, we do not expect gravel extraction to result in widespread degradation of the channel bed as suggested in the *Environmental Baseline* section. We attribute this to the use of improved extraction methods that avoid the higher portions of the bars and are confined to areas where more frequent sediment replenishment is likely. We are concerned, however, that the longer-term degradation noted by the Corps (1999) from 1968 to 1998 suggests the channel is sensitive to additional removal of material. To address this over the long term, LOP 2004-1 requires annual surveys of existing channel monitoring cross-sections over the life of the permit. We anticipate this will provide long-term information on the trends in channel bed elevation and changes in width. However, the proposed action does not outline a schedule for when these long-term data sets will be analyzed. Under the Humboldt County conditional use permitting process, analysis of these data to update the PEIR (Humboldt County 1992) is overdue. While we do not know when this analysis will be completed, we expect the analysis will occur sometime over the five-year term of the permit period.

In the absence of additional information, we expect that minor channel degradation will continue to occur in the action area, both in response to gravel extraction and recovery from past flood events. As a result, we expect that current habitat conditions in the action area will be maintained, with localized instances of both habitat improvement (*e.g.,* pool deepening as noted in recent monitoring) and habitat simplification. Therefore, we do not expect the proposed action will inititate channel degradation that causes adverse effects to salmonids.

(3) Reductions in riparian function. Historic removal of streamside vegetation has largely eliminated LWD sources. This has likely contributed to the paucity of pool habitat complexity along the lower Eel River, although we expect that LWD was not the dominant pool forming mechanism in this reach. Localized habitat complexity is provided by willow patches in the active channel and along eroding alluvial banks, and these will continue to provide a valuable source of habitat complexity. We anticipate that the effect of gravel extraction, particularly skimming, will suppress riparian succession at the individual mining sites. Where a site is repeatedly skimmed, the effect is a chronic reduction in the quantity of vegetation in the reach. Therefore, on average, we expect a reduction in riparian vegetation in the immediate vicinity of the extraction sites. This will reduce the quality and quantity of habitat complexity afforded by vegetation and reduce allochthonous inputs occurring in the vicinity of the extraction sites. We expect this will also inhibit development of bar heights necessary for forming and maintaining pools. Since the proposed action will minimize the use of traditional skimming in lieu of alternative techniques and provide for a head-of-bar buffer, we anticipate these effects will be minimized. Therefore, we expect measures provided for in LOP 2004-1 will minimize the effects associated with altered riparian function on salmonids. Where localized reductions in riparian vegetation occur in the reach, we expect that salmonids will be able to relocate to other suitable unoccupied areas, given the low densities of salmonids in the reach.

c. Riffle Stability and Migration Blockage at Riffles

(1) Impacts to spawning habitat. Information presented in the *Environmental Baseline* section indicates that Chinook salmon use the lower Eel River for spawning, but at very low levels. We do not expect the lower Eel River to be an important spawning reach in its current condition. Where spawning does occur adjacent to extraction sites, the head-of-bar buffer and minimization of skimming will minimize the effects on spawning habitat. Under this provision, we do not expect skimming will occur adjacent to spawning sites. NOAA Fisheries does not expect any impacts to occur to spawning salmonids as a result of the proposed action.

(2) Impacts to rearing habitat. The effects to riffles from mining (*i.e.*, decreased particle size, increased susceptibility to erosion, and increased instability) also decrease the quality of rearing habitat at riffles by affecting food and cover availability for rearing juvenile salmonids, particularly steelhead. However, rearing coho and Chinook salmon would also be affected by an overall decrease in aquatic macroinvertebrates. An overall decrease in riffle stability will lead to a decrease in the quality and quantity of juvenile rearing habitat at riffles adjacent to the mined sites. However, we expect the provisions for head-of-bar buffer and minimum skim floor elevation (where skimming does occur) will minimize the likelihood of riffle instability and, therefore, minimize any impacts to rearing habitat. Given the low densities of salmonids in the reach we expect individual salmonids will be able to relocate to suitable unoccupied habitat should rearing habitat become unsuitable at a site.

(3) Migration blockage. Migration blockage is a significant concern in the lower Eel River. Shallow flatwater areas, shallow riffles, and presence of braided channels significantly impair upstream migration of Chinook salmon adults. In some years, this results in significant concentration of migrating adults, thereby predisposing them to poaching, increased angling pressure, and increased potential for disease (CDFG 2002). For angling, we note that while possession of listed species is prohibited, considerable catch-and-release effort occurs along the lower Eel River and subjects released fish to delayed hooking mortality (pers. observation by S. Flanagan, fisheries biologist, NOAA Fisheries, 2003).

Although we expect the minimum skim floor elevation corresponding to the 35% exceedence flow to provide for adequate depth, assuming that the width is sufficiently low, we are concerned that repeated gravel extraction, particularly by skimming, may chronically maintain or increase the widths of the lower Eel River. The processes that inhibit the formation of pools for holding habitat also contribute to extensive shallow water stretches that present migration barriers. Since the proposed action will employ narrow skims and provide a head-of-bar buffer where skimming does occur, we expect that the extraction methods implemented in the lower Eel River will not create migration blockages. The process for selecting extraction techniques and locating them was described previously in the *General Effectiveness of the Proposed Actions at Reducing Effects* section. Similarly, the CHERT review process is capable of limiting skim sizes and locating sites to avoid specific problem areas.

d. Effects on Velocity Refugia

(1) Impacts due to Habitat Changes or Maintenance of Existing Habitat. Given the currently degraded state of habitat in the lower Eel River, existing velocity refugia in the form of complex pools, off-channel habitat, and topographic complexity are limited. We expect that continued gravel extraction, in the absence of bar height recovery, will have the effect of maintaining this degraded condition near the individual extraction sites. Alternative extraction methods such as trenching may provide short-term refuge sites, but we expect these will be transitory features and rapidly filled in during higher flows. Again, we are concerned with the findings in Corps (1999) that degradation is occurring, which suggests the lower Eel River is sensitive to over-extraction. Although the proposed action will favor narrow skims and alternative extraction techniques over wide, traditional skims, and implement a head-of-bar buffer, we expect that continued mining at current levels will maintain or further simplify habitat, thereby limiting velocity refugia provided, for the most part, by habitat complexity. We believe this reach is especially important for juvenile Chinook salmon in the late winter and early spring. Therefore, we expect that continued maintenance or degradation of the current habitat conditions in the lower Eel River will reduce the survival and production of salmonids, especially Chinook salmon, by decreases in or maintenance of existing simplified habitat that is limited in its ability to provide for velocity refugia. We expect a portion of the the juvenile Chinook salmon in the lower river may be prematurely swept downstream into the estuary or out to sea during high flows.

(2) Changes in bed roughness. The characteristic particle size distribution along the lower Eel River is largely dominated by gravel and cobble. Where gravel extraction occurs, particularly skimming, and a larger portion of the coarse armor layer is removed, we expect localized reductions in high-flow velocity refugia to occur. However, given the already small particle sizes present, we do not expect the overall texture of the bed to change to such a degree that bar-scale reductions in velocity refugia are likely to occur. Therefore, we do not expect reductions in the coarse sediment fraction to result in adverse effects to salmonids in the lower Eel River due to a loss of coarse substrate velocity refugia.

(3) Changes in riparian function. Smaller patches of younger vegetation (typically willows) in the active channel and along eroding alluvial banks will continue to provide valuable velocity refugia. In addition, large patches of older vegetation form islands between multiple channel networks and provide important velocity refugia. The potential instability in the lower Eel River resulting from degradation compromises these important features. In addition, skimming will continually repress development of new vegetation, thereby reducing the probability that a migrating channel will intercept riparian vegetation. Given the lack of complexity of the channel, continued sediment extraction that promotes instability and represses riparian development will continue to reduce the amount of this habitat. Since the proposed action will minimize skimming and implement a head-of-bar buffer, we expect the reductions in riparian vegetation to be isolated and, given the low density of salmonids present in the reach, individuals will be able to locate suitable unoccupied habitat.

e. Effects to Water Temperature

The current width of the lower Eel River allows for low flows to spread out over the bar surface and experience increased insolation over what would be expected in a more confined setting.

We expect the minimization of bar skimming as described previously in this section and provision for a head-of-bar buffer will limit any increases in low-flow channel width. Additionally, the mined reaches are in the coastal zone and summer maximum air temperatures are not as frequently high as those in more inland areas. Additionally, monitoring data from the extracted reach presented by Jensen (2000) indicate that the lower Eel River cools in a downstream direction, presumably due to the moderating influence of the coast. Therefore, we do not expect any detectable increases in overall temperature, and therefore do not anticipate any adverse thermal effects due to increased insolation on salmonids as a result of the proposed action.

f. Effects of Turbidity and Sedimentation of Adjacent and Downstream Habitat

Where bar skimming does occur along the lower Eel River, inundation of unarmored bar surfaces will occur. Although the minimum skim floor elevation corresponding to the 35% flow will ensure that the river is already transporting fine sediment from other sources when the bar is overtopped, we expect the effect will be to add further sediment to the river. Fish losses could occur through reduced interstitial spaces in the channel bed available for sheltering and impaired feeding ability in the turbid water. However, given the already high background sediment levels when flows reach the skimmed bar surfaces, we anticipate that inputs of sediment from extraction areas would be diluted by the background sediment levels found at the 35% exceedence flow. In essence, the sediment impact has already occurred to salmonids before the flow reaches the 35% exceedence level. Therefore, sediment generated from skimmed bar surfaces will only serve to maintain conditions and not have a detectable effect on salmonids, particularly given the minimization of skimming and lack of spawning in the reach.

Trenching will result in increased turbidity and sedimentation downstream of the extraction. This has been previously discussed in the *Direct Effects* section and, therefore, will not be covered here. We do not expect turbidity or sedimentation to be increased other than during, or immediately following the extraction.

g. Lower Eel River Summary - Effects on Salmonids

The dominant concern for salmonids in the lower Eel River centers on the potential effects of gravel mining on juvenile rearing and adult holding/migration habitat. The wide channel and the associated effects on habitat, coupled with the degraded condition of the Lower Eel River, leads to habitat conditions that only marginally support salmonids. The effects on juveniles may be greater than the reach length would otherwise indicate because of fish moving downstream into the cooler waters afforded by the coastal influence. Since the lower Eel River reach is located downstream of much of the spawning habitat in the Eel and Van Duzen River watersheds, effects that impede migration and reduce adult survival will have impacts on the entire population of salmonids that use the Eel and Van Duzen River watersheds. This is particularly relevant for Chinook salmon and summer steelhead that are often present in this reach of the river during low flows.

Our analysis of conditions in the lower Eel River suggests that traditional, wide bar skims may not be an appropriate method at some of the sites on the lower Eel River due to the currently poor habitat condition and potential effects on the low-flow channel width. In the absence of bar height recovery, we expect that alternative extraction designs (*e.g.*, trenching), may minimize further increases in channel width and impacts to habitat. This is consistent with the proposed action, which will favor alternative extraction techniques and much narrower skims over traditional, wide skims. However, we are concerned with the observed channel degradation and the effects of this to salmonid habitat. The Eel River PEIR selected as its preferred alternative the development of a "River Management Plan" and development of an extensive physical and biological monitoring plan (Humboldt County 1992). The purpose of this management plan would be to minimize and control effects from lowering the river bed due to over-extraction, partly based on the results of the monitoring plan. Specifically, the management plan was intended to enable data collection funded by the miners that would enable the agencies with jurisdiction over sediment extraction to make informed decisions on where and how much sediment should be removed without adversely affecting the river's resources and infrastructure. Although annual monitoring data continue to be collected, the data have not been analyzed. In the absence of reliable estimates of average annual deposition, decisions regarding appropriate extraction volumes will continue to be poorly informed, with the increased potential for over-extraction and consequent effects.

2. Middle Eel River Reach

a. Baseline Summary

Historic land and water management practices have contributed to loss of habitat diversity within the middle Eel River above the Van Duzen River. Existing conditions indicate that the middle Eel River has limited rearing habitat due to elevated water temperatures, high sediment loads, paucity of woody debris, and competition/interaction with Sacramento pikeminnow. Cool water seeps, thermal stratification, and habitat complexity all play critical roles in sustaining micro-habitat for juvenile and adult salmonids. Spawning habitat is present, and the reach is likely important during low water years when fish are confined to the lower river reaches. Fishery data indicate that individual natural populations of anadromous salmonids persist at low levels in the Middle Eel River. Persistence of salmonids in the reach is influenced by upstream flow releases, predation from Sacramento pikeminnow, and activities which occur upslope in the watershed. Upstream activities and past floods have contributed to generally degraded habitat conditions along the middle Eel River. Analysis of aerial photos presented by PALCO (2003) suggests that the river has been in a similar configuration since the 1940s. However, we caution that this inference is based on a limited set of historic photos and does not permit evaluation of more specific habitat indicators such as pool depths, substrate size and overall habitat complexity. A map of the Middle Eel River extraction sites is found at the beginning of the South Fork Eel River reach specific effects section (Figure 9).

The Middle Eel River portion of the action area serves as a migration corridor and provides limited juvenile rearing area for salmonids. In low-water years, the reach provides important Chinook salmon spawning habitat. For these reasons, conditions encountered along this reach, particularly during low-water periods, influence salmonid populations in the entire Eel River basin upstream of the Van Duzen River. We expect that CC Chinook salmon are most sensitive to conditions in this reach because they are known to enter the lower river in late summer and early fall, when high water temperatures and low stream flows create stressful conditions for adults prior to upstream migration. Since the Eel River is one of the largest river systems in the

ESUs of the salmonids considered in this Opinion, conditions that influence basin-wide populations will have a measurable effect at the ESU level as well.

The Middle Eel River portion of the action area extends from near the town of Scotia to approximately three miles upstream of the South Fork Eel River confluence (Figure 9). Gravel extraction volumes are greatest near the town of Scotia. The channel is moderately confined in the reach, with large-scale roughness features such as bedrock bluffs and large alluvial terraces providing a degree of stability to the location of individual habitat units.

b. Pool Quantity and Quality

Review of aerial photos and site visits show that pools along the middle Eel River are generally associated with bedrock outcrops and other resistant features along the valley margins as well as scour along infrequently flooded alluvial terraces and higher bars within the active channel. The location of pools through time appears to be relatively fixed primarily due to these large-scale roughness elements.

(1) Increased width. As discussed in the *General Effects* section, gravel extraction has the potential to increase the width of the adjacent river reach. Where this occurs, stream habitat may become simplified as evidenced by shallower pools and less pronounced riffles. Our review of past extraction reports and site visits suggest that the measures contained in the previous LOP 96-1 have been effective at limiting the effects of extraction on changes to channel width. Assuming that past extraction volumes over the reach do not appreciably increase, we anticipate that the site-specific provisions to minimize channel widening, such as the head-of-bar buffer, will not significantly alter the current width of the middle Eel River. In reaching this conclusion, we also are assuming that channel monitoring will continue along the reach and continue to provide information on long-term changes in channel configuration, particularly with regard to changes in channel width, to support or refute this conclusion. We do not expect any adverse effects to salmonids as a result.

(2) Channel degradation. Based on our review of the sites in this reach, and past extraction volumes compared to the overall size of the reach, it does not appear that the channel is degrading such that changes in pool quality or frequency of pool occurrence is evident. Additionally, evidence suggests that the channel bed continues to aggrade, at least in the vicinity of Holmes Flat in the middle portion of the reach (Corps 1999). Since many of the pools along the reach appear to be relatively fixed due to large-scale roughness elements along the channel margins (*e.g.*, bedrock bluffs), we do not anticipate a reduction in pool frequency as a result of the proposed action. We expect that any changes occurring as a result of extraction would be long-term changes in habitat quality, such as a change in pool depths. Given the channel configuration and past extraction volumes, coupled with the site-specific extraction measures implemented as part of the proposed action, we expect that channel degradation, if any, will not occur to an extent that degradation of pool habitat from channel degradation will be detectable. Therefore, we do not expect any adverse effects on salmonids. As discussed previously, we would rely on continued channel monitoring to confirm or refute this conclusion.

(3) Reductions in riparian function. Riparian function, as it relates to pool formation and maintenance of pool quality, primarily serves to increase cover in individual pools. The size of the Eel River in the action area does not allow LWD to remain in place long enough to form pools. Woody debris and smaller-rooted vegetation typically provide transient cover in pools, particularly where the low-flow channel abuts a vegetated eroding alluvial bank. Given that extraction typically occurs on the outside margin of point bars in the reach and that LOP 2004-1 will avoid woody vegetation, we do not expect any significant reductions in riparian function as it pertains to pool quality. Also, given the lack of appreciable changes in channel width discussed above, we do not expect that channel widening or increased lateral instability will appreciably reduce the availability of riparian vegetation through changes in succession patterns. However, bar skimming will continue to suppress the emergence of riparian vegetation on an unknown percentage of skimmed bar area within the active channel.

Overall, we do not expect LOP 2004-1 to have a significant effect on pools in the reach. We base this conclusion on the overall size of the river in relation to the extraction sites, the evidence of continued aggradation (Corps 1999), and the relatively fixed nature of existing habitat features. Therefore, we do not expect any injury or death to individual salmonids due to changes in pool habitat in this reach.

c. Riffle Stability and Migration Blockage at Riffles

(1) Impacts to spawning habitat. Chinook salmon use the middle Eel River reach for spawning, particularly during low flow years when the population is confined to the lower reaches. Our analysis of the effects of LOP 2004-1 on pool habitats largely applies to riffles as well. However, we recognize that riffles are more sensitive to changes in channel configuration with respect to impacts on salmonids; changes in bed elevation or lateral shifts in channel location at lower flows than would otherwise occur could scour or strand redds. In addition, the decrease in particle size associated with gravel extraction could result in less suitable sized material or increase riffle instability due to lack of larger substrate. However, our earlier assessment of habitat changes in this reach indicates that adverse effects to riffles would be confined to riffles immediately adjacent to the mined sites and could affect up to five redds, based on the number of riffles that might be impacted and the limited use of these riffles for spawning. Additionally, because scour and stranding of redds is a natural occurrence in such a large river setting, any additional increases in riffle instability would be difficult to determine amidst the natural background variation.

(2) Impacts to rearing habitat. The effects to riffles from mining (*i.e.*, decreased particle size, increased susceptibility to erosion, and increased instability) also decrease the quality of rearing habitat at riffles by affecting food and cover availability for rearing juvenile salmonids, particularly steelhead. However, rearing coho salmon and Chinook salmon would also be affected by an overall decrease in aquatic macroinvertebrate availability. An overall decrease in riffle stability will lead to a decrease in the quality and quantity of juvenile rearing habitat. However, our past assessment of habitat changes in this reach indicates that adverse effects to riffles would be confined to riffles immediately adjacent to the mined sites, and could affect the quality of riffle habitat for juvenile steelhead rearing at those sites. Given the relatively low intensity of mining through this reach, we anticipate that only a small portion of the riffles will be affected, and those riffles that are affected will continue to provide some level of functional habitat such that steelhead are still able to use the area. We expect these changes in habitat may increase competition at a given riffle and result in reduced growth rates for a portion of the fish using the riffle.

(3) Migration blockage. We do not expect any appreciable changes in riffle configurations such that adult passage is impaired as a result of the proposed action. However, flow releases from the Potter Valley project in the upper watershed continue to restrict the quantity of water in the river during fall migration (NOAA Fisheries 2002a), making the issue of migration barriers more of a concern compared to unimpaired conditions. Similar to our conclusions for pool and spawning habitats, we do not expect the proposed action to increase the frequency of migration barriers in the reach.

d. Effects on Velocity Refugia

(1) Impacts due to habitat changes or maintenance of existing habitat. Our previous discussions on the effects of the proposed action on pool quality and riffle stability suggest that there will be no significant changes in habitat elements that restrict the availability of velocity refugia provided by larger habitat features. In fact, alternative extraction methods at the downstream end of bars (*i.e.*, alcoves, horseshoes and trenches) may create temporary velocity refuge during moderately high flows.

(2) Changes in bed roughness. Since gravel extraction may decrease the overall grain size and distribution adjacent to the sites, the potential exists for decreasing velocity refuge habitat along the channel bed. Although we expect rearing capacity in the reach to be reduced, given the separation of the sites and the overall size of the bars in the reach, we expect these reductions to be minor and localized and not adversely affect juvenile salmonids using the reach.

(3) Changes in riparian function. Smaller riparian vegetation on gravel bars within the active channel may provide important velocity refuge habitat in the reach. Primarily willows, these patches of vegetation often persist through high flows and provide localized slack water habitat, as evidenced by the deposits of fine sediment at the base of the vegetation. The requirement of LOP 2004-1 to avoid mature woody vegetation will retain some of these features. We do not expect appreciable changes in channel width that would otherwise impede riparian succession. However, we do expect that a subset of the mined, active channel would have emergent riparian vegetation in the absence of bar skimming, although the amount of area disturbed by annual skimming is low compared to the size of this reach. In sum, we expect that velocity refuge habitat afforded by vegetation will be not significantly impaired. In the isolated instances where vegetation colonization is precluded by mining, we expect that juvenile salmonids will find nearby suitable habitat.

e. Effects on Water Temperature

Since extractions in this reach have occurred outside of the wetted low-flow channel, we do not expect any increases in low-flow width that could increase stream surface area and increase temperatures. Our discussions above suggest that any increase in width due to the proposed action will be minor and not result in any longer-term changes in channel configuration that could increase temperatures. Also, current riparian vegetation that provides shade to the channel is limited, and mainly occurs in areas outside of the extraction sites. Therefore, we anticipate no adverse effects to salmonids from temperature increases due to the proposed action.

f. Effects of Turbidity and Sedimentation of Adjacent and Downstream Habitat

Skimming on bars along the Middle Eel River will allow inundation of unarmored bar surfaces at lower flows. Although the minimum skim floor elevation corresponding to the 35% exceedence flow will ensure that the river is already transporting fine sediment from other sources when the bar is overtopped, we expect the effect will be to add further sediment to the river. Harm could occur through smothering of incubating eggs in the gravel, reduced interstitial spaces in the channel bed available for sheltering, and impaired feeding ability in the turbid water. Given the relative surface area of the extraction sites to the overall river size, we expect that the increases in sediment delivery will be minor and confined to the area immediately downstream of the extraction site. Therefore, the amount of additional sediment allowed into the stream as a result of gravel mining would be a relatively small fraction of what is already in the system at the 35% exceedence flow. Therefore, we expect that the impacts associated with increased sediment production will not have a detectable effect on salmonids in the middle Eel River.

Trenching will result in increased turbidity and sedimentation downstream of the extraction site. This has been previously discussed in the *Direct Effects* section and, therefore, will not be addressed here. We do not expect turbidity or sedimentation to increase other than during, or immediately following, the trench excavation.

5. Middle Eel River Summary - Effects on Salmonids

Our analysis of the indirect effects of gravel extraction on salmonids along the Middle Eel River suggests that relatively minor indirect effects will occur as a result of LOP 2004-1. We anticipate the greatest impacts to be primarily from localized simplification of juvenile rearing habitat. Additionally, should a low-water year occur following implementation of LOP 2004-1, we anticipate a minor reduction in emergence success from redds due to an increased number of fish using the mainstem Eel River for spawning. We expect a minor reduction in the overall abundance of juvenile salmonids as a result of gravel extraction in the middle Eel River reach. This effect will be most pronounced should a low-water year occur after the extraction season.

3. South Fork Eel River

a. Baseline Summary and Past Gravel Extraction

Historic land and water management practices have contributed to loss of habitat diversity within the South Fork Eel River. The South Fork Eel River reach provides habitat for all life stages of the three salmonid species considered in this Opinion. Existing conditions indicate that the South Fork Eel River has limited rearing habitat due to elevated water temperatures. Cool water seeps, thermal stratification, and habitat complexity all play critical roles in sustaining micro-habitat for juvenile and adult salmonids. Spawning habitat is present and actively used, as indicated by observations of redds at the Cook's Valley site. Fishery data indicate that individual natural populations of anadromous salmonids persist at low levels in the South Fork Eel River.

Gravel extraction has occurred at up to twelve sites located at three general locations on the South Fork Eel River (Figure 9). The average total volume recommended by CHERT, and permitted by the Corps for extraction between 1997 and 2003 is 75,486 cy/yr. The actual extraction volume for the 1997-2003 period is 61,243 cy/yr. Extraction has predominantly been accomplished by bar skimming, but more recently, alternative extraction designs such as alcoves and a trench at Cook's Valley have been implemented.

b. Pool Quantity and Quality

(1) Increased width. Habitat conditions in the South Fork Eel River are dominated by relatively shallow pools and poorly pronounced riffle crests. Shallow "flatwater" habitat dominates the South Fork Eel River (Halligan 1998, Jensen 2000) and provides poor conditions for juvenile rearing. Most of the higher quality pools that provide depth, cover, and velocity refuge appear to occur when the low flow channel abuts bedrock outcrops. Locations of these pools are not fixed, as the channel migrates across the floodplain, however they appear to represent the highest quality pool habitat along the South Fork Eel River. Pools also occur where the low flow channel abuts higher elevation bars that are not subject to annual sediment removal. Bars approaching bankfull height are capable of providing somewhat higher quality habitat features, including alcove habitats at moderately high flows, than locations where the low flow channel is unconstrained by these higher bars.

Past skimming has likely exacerbated this problem by not allowing sufficient bar height recovery to allow for low flow channel confinement. Continued skimming at the site will likely perpetuate the lack of adult holding and juvenile rearing habitat in the absence of sufficient bar height recovery. We expect this effect will be minimized by protecting the upper portion of the bar and implementation of alternative extraction designs (*e.g.*, trenching), as proposed. For example, in a wide, braided section, we expect a trench would be used over a traditional skim. This would reduce the potential for increased channel widening and braiding.

We expect the proposed action will cause reductions in deeper water juvenile rearing habitat near the extraction sites. This will result in increased competition among individual steelhead juveniles, which to be the primary salmonid species present during the summer. As a result, affected individuals near the extraction sites may experience reduced growth rates.

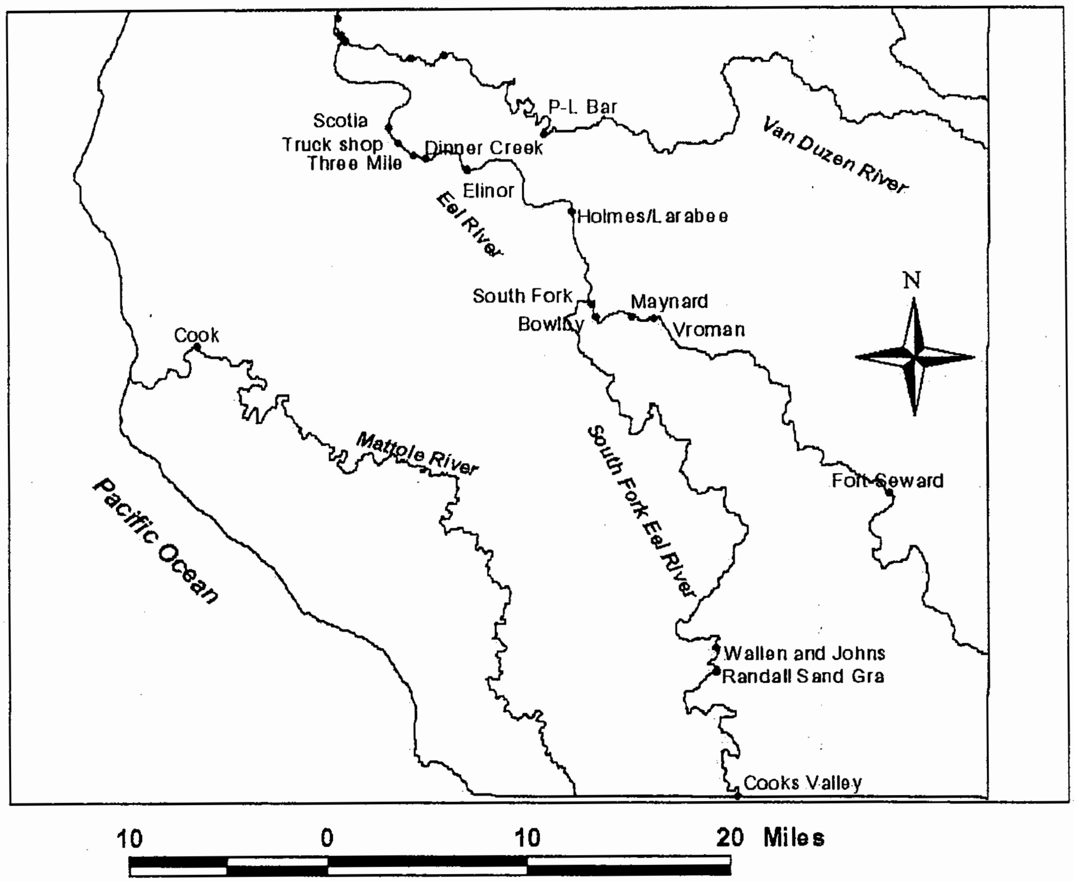

Figure 9. Gravel mining sites on Middle Eel River, South Fork Eel River, and Mattole River as proposed in LOP 2004-1.

(2) Channel degradation. Channel degradation in the South Fork Eel River is not evident. The Corps' general assessment of the South Fork Eel River compared 1968 air photos and cross-sections with those taken in 1998 and determined that, overall, aggradation was observed (Corps 1999). This determination was somewhat confounded by major shifts in the channel as well as the use of data taken immediately after major floods in 1964 and 1997. It would be useful to make comparisons in between these two periods as well. Overall, the amount of annual

extraction does not appear to be excessive with respect to anticipated recruitment, although mean annual recruitment for the South Fork Eel River has not been determined.

We expect that the South Fork Eel River may be more resistant to channel instability than other reaches because the channel is more confined and bedrock provides greater control over channel morphology. However, as noted in the Corps' (1997) analysis, portions of the river are still prone to lateral instability.

(3) Reductions in riparian function. Land management activities have historically removed larger streamside vegetation, greatly reducing LWD sources. Reductions in LWD sources have likely contributed to the decreased quality and quantity of pool habitat along the South Fork Eel River. Willow patches in the active channel, eroding alluvial banks, and bedrock outcrops provide localized habitat complexity. These locations will continue to provide a valuable source of riparian function and habitat complexity. However, we expect that given the potential for channel instability in some localized areas of the South Fork Eel River, lateral shifts in the channel will reduce the amount of habitat afforded by riparian vegetation as the channel may shift away from current riparian sources.

Since the proposed action will ultilize alternative extraction techniques and provide a head-of-bar buffer where skimming is proposed, we anticipate these effects will be reduced over what has occurred in the past. For example, given a wide, braided channel, we expect that trenching would be used instead of skimming, therefore reducing the amount of vegetation that is potentially disturbed. Where a site is repeatedly skimmed, the effect is a chronic reduction in the quantity of vegetation. Therefore, on average, we expect a lesser extent of riparian vegetation in the immediate vicinity of the skimmed sites. This will reduce the extent of habitat complexity afforded by vegetation and reduce allochthonous inputs occurring in the vicinity of the extraction sites. Effects to fish from this reduction in habitat complexity and ecological changes from interrupting the processes of energy transformation from plant to animal will be manifested in a reduced yield of eggs to adults.

In summary, given expected extraction volumes, the bedrock controls along the South Fork Eel River provide some resiliency to pool habitat changes from gravel extraction. Continued extraction along the South Fork Eel River will likely perpetuate the lack of adult holding and juvenile rearing habitat in the absence of sufficient bar height recovery. Furthermore, we expect that reductions in riparian vegetation may affect a small number of juveniles by reducing growth rates and survival rates. However, we expect this effect to be somewhat moderated by the use of alternative extraction techniques in sensitive areas and the implementation of a head-of-bar buffer.

c. Riffle Stability and Migration Blockage at Riffles

(1) Impacts to spawning habitat. Information presented in the *Environmental Baseline* section indicates that the South Fork Eel River provides spawning habitat for Chinook salmon. The extent to which steelhead and coho salmon use the reach for spawning is unknown. The lateral channel instability that aerial photos and the Corps (1999) portray suggest that a portion of the spawning habitat in the South Fork Eel River portion of the action area may be predisposed to instability. We expect that gravel extraction will increase the frequency at which channel migration occurs in the extraction reach, thereby further reducing spawning habitat conditions. Both skimming and in-channel trenching can produce this effect; skimming by promoting lateral instability and increased scour as the flow path is shortened over the bar, and trenching by increasing channel downcutting which could scour redds as the channel locally readjusts to accommodate the trench site. For all extraction techniques, we expect a general decrease in substrate size, which will limit the availability of suitable spawning sites.

Design features provided in LOP 2004-1, including minimum skim floor elevations, minimization of skimming, and the head-of-bar buffer will reduce the probability of increased lateral channel migration and scour. However, we do not expect that the project design features will avoid the impacts. We anticipate that a portion of nearby Chinook salmon redds could be destroyed or experience reduces emergence as a result of adjacent extraction and consequent changes in the scour and depositional environment due to changes in channel location. The extent or probability of redds being destroyed depends on the timing of hydrologic events relative to spawning time.

(2) Impacts to rearing habitat. The effects to riffles from mining (*i.e.*, decreased particle size, increased susceptibility to erosion, and increased instability) also decrease the quality of rearing habitat at riffles by affecting food and cover availability for rearing juvenile salmonids, particularly steelhead. However, rearing coho and Chinook salmon would also be affected by an overall decrease in aquatic macroinvertebrate availability. An overall decrease in riffle stability will lead to a decrease in the quality and quantity of juvenile rearing habitat at riffles adjacent to the mined sites. However, as discussed above, we expect the provisions for head-of-bar buffer and minimum skim floor elevation (where skimming does occur) will minimize the likelihood of riffle instability and, therefore, minimize any impacts to rearing habitat. As a result of the proposed action, we expect that juvenile steelhead rearing habitat will be locally reduced, increasing competitive pressures and decreasing growth rates of the affected individuals.

(3) Migration blockage. NOAA Fisheries does not expect significant adult migration impediment as a result of LOP 2004-1. Downstream migration barriers typically result in a delay in fish reaching the South Fork Eel River action area until later in the fall season, when stream flows are typically high enough to avoid migration impediments, given the channel confinement provided by LOP 2004-1. Some summer steelhead adults may be infrequently affected by shallow water depths resulting from mining, forcing them to remain in downstream pools longer or expend additional energy as they move upstream, but this is not expected to result in a decrease in summer steelhead populations.

d. Effects on Velocity Refugia

(1) Impacts due to habitat changes or maintenance of existing habitat. Given the currently degraded habitat of the South Fork Eel River, existing velocity refugia in the form of complex pools, off-channel habitat, and topographic complexity are limited. We expect that continued gravel extraction, in the absence of habitat recovery, will have the effect of maintaining this reduced habitat condition near the individual extraction sites. The effects of continued lowering of the downstream ends of bars and impeding the development of natural alcove and backwater habitat will be manifested in reduced fry habitat and high-flow refuge. However, alternative extraction techniques such as trenching that has been implemented in the past may provide short-term refuge and fry rearing sites. Where trenches are used to guide the channel into a more stable configuration, such as along a bedrock wall, a longer-term site of velocity refuge might be created. Overall, we expect the distribution of velocity refuge habitat will not change due to the proposed action.

*(2) **Changes in bed roughness.*** The characteristic particle size distribution along the South Fork Eel River is largely dominated by gravel with both finer sediments such as pea gravel and sand and courser sediment such as boulders, depending on the habitat type (Jensen 2000). In-channel boulders provide unique roughness elements in some localized areas. Where gravel extraction occurs, particularly skimming, and a larger portion of the coarse armor layer is removed, we expect localized reductions in high-flow velocity refugia to occur. We expect a small decrease in survival of salmonid fry, particularly Chinook salmon fry, in the South Fork Eel River due to a loss of coarse substrate velocity refugia. Loss of these individuals will occur adjacent to the extraction sites.

*(3) **Changes in riparian function.*** Smaller patches of younger vegetation (typically willows) in the active channel and along eroding alluvial banks will continue to provide valuable velocity refugia. We expect this refugia to be most important for Chinook salmon fry. However, given the areas of channel instability in the South Fork Eel River, lateral shifts in the channel will continually erode young vegetation and reduce the amount of velocity refugia afforded by riparian vegetation. Any increases in channel migration rates will reduce the overall age and size of vegetation able to provide velocity refugia. In addition, where skimming occurs, the development of new vegetation will be continually repressed, thereby reducing the probability that a migrating channel will intercept habitat-forming riparian vegetation.

Given the lack of larger vegetation, generally small particle sizes, and lack of complex habitats in the form of pools and off-channel habitats, we expect that the smaller riparian vegetation located within the active channel provides one of the few velocity refuge habitats in the South Fork Eel River. Therefore, continued sediment extraction that promotes lateral channel migration and represses riparian development will continue to reduce the amount of this habitat. However, we expect lateral channel migration will be minimized due to the combination of a head-of-bar buffer and minimization of skimming that is part of the proposed action. Specifically, where a site is prone to channel migration, we expect that trenches or alcoves will be utilized to minimize any potential increases in channel migration rates. Also, as discussed in the *General Effectiveness of the Proposed Actions at Reducing Effects* section, where skimming does occur, we expect it will be located in areas where potential increases in channel instability will be limited.

We expect the loss of velocity refugia to primarily affect newly emergent salmonid fry because fry are highly dependent upon edgewater and submerged riparian vegetation. Given the close proximity of Chinook salmon spawning, we expect a significant number of Chinook salmon fry will be present in the extraction reach. We also expect a smaller number of steelhead fry will be present in these areas, but coho salmon fry are expected to be rare. Given the limited availability of adequate habitat under the current degraded habitat conditions, we conclude that any additional loss of velocity refuge will result in a concomitant decrease in salmonid fry survival, as these fish will be more readily swept downstream. We cannot adequately estimate the numbers of fry that will not survive to smolt as a result of the loss of velocity refugia under the proposed action. We expect that many displaced fry will be able to locate suitable habitat downstream. Therefore, we expect the reduction in juvenile survival to be small, as there will continue to be localized areas of riparian vegetation providing refugia within the affected area. The various site-specific measures will limit the influence of these effects on velocity refugia to more site-specific instances.

e. Effects on Water Temperature

Temperatures in the South Fork Eel River are already at the higher end of the tolerance range for salmonids. Even minute changes to temperature as a result of mining will exacerbate the temperature problem in the South Fork Eel River, potentially reducing the capacity of this habitat to support salmonids.

Deeper pools in the South Fork Eel River may provide thermal stratification. In addition, cool water seeps have been identified within the extraction reach (Jensen 2000). Where activities reduce the depth of pools, as is expected to locally occur as a result of sediment extraction in the South Fork Eel River, lack of thermal stratification or loss of cool water seeps may eliminate critical thermal refugia. We expect this effect would be greatest adjacent to and immediately downstream of a particular extraction site. Since summer maximum water temperatures are at the upper end of tolerance for juvenile salmonids, loss of these areas, or maintenance of currently degraded pool habitats, would likely result in injury or mortality (displacement, predation, reduced growth) of juvenile salmonids that rely on these pools during the warmest periods. Since the deepest, highest quality pools and cool water seeps in the South Fork Eel River are associated with bedrock, we expect that the greatest potential for injury or mortality would be an extraction that results in migration of the channel away from these bedrock controls. Any reduction in stratification or reduction of cool water seeps in the area is expected to result in a reduction in the numbers of juveniles that would ordinarily occupy that habitat. Alternative extraction techniques such as dry, wet, or alcove trenching, or wetland pits may reduce the risk of channel migration away from bedrock controls. Where skimming is proposed, the head-of-bar buffer will help to reduce the potential for channel migration.

Trenching is not expected to have a detectable effect on water temperature, except where the trench persists through a dry winter and provides thermal stratification or intercepts ground water the following summer. In this case, the trench could potentially provide a valuable cool water refuge, especially if associated with cover. However, in most years, we do not expect that a trench in the South Fork Eel River will persist through to the following year.

The harm to salmonids associated with water temperature effects is difficult to determine, especially without good population estimates for the number of fish that utilize the extraction reach of the South Fork Eel River in the summer. Seven pools were identified in the South Fork Eel River extraction reach in 1999 (Jensen 2000). All of these pools would most likely not be lost in any single year, and pools that are lost might re-form. We expect that at least one pool that provides cool water refugia, and some portion of the juveniles that would reside there, would be lost over the five-year permit period. We assume only a portion would be lost because some fraction of the fish that would otherwise use a pool may reside in other pools in the area. The remainder are lost due to density-dependent processes and predation as they fail to locate suitable unoccupied habitats.

f. Effects of Turbidity and Sedimentation of Adjacent and Downstream Habitat

Given the already high background sediment levels when flows reach the skimmed bar surfaces, we anticipate that inputs of sediment from extraction areas would be diluted by the background sediment levels found at the 35% exceedence flow. Therefore, the amount of additional sediment allowed into the stream as a result of gravel mining would be a relatively small fraction of what is already in the system at the 35% exceedence flow. Therefore, we expect the proposed action will not result in impactful levels of fine sediment coming from skimmed surfaces.

Trenching will result in increased turbidity and sedimentation downstream of the extraction site. This has been previously discussed in the *Direct Effects* section and, therefore, will not be covered here. We do not expect turbidity or sedimentation to be increased other than during, or immediately following, the trench excavation.

g. South Fork Eel River Summary - Effects on Salmonids

The dominant concern for salmonids in the South Fork Eel River centers on the potential adverse effects of sediment extraction on Chinook salmon redds and reduced velocity refugia afforded by riparian vegetation and coarse substrate. Additionally, the poor habitat condition of the South Fork Eel River leads to habitat conditions that only marginally support salmonids during the warm summer months. In this condition, the South Fork of the Eel River reach is sensitive to further impacts to habitat. The proposed action under LOP 2004-1 is expected to impair natural riverine recovery processes that form and maintain salmonid habitat adjacent to the mining sites by maintaining or slightly increasing lateral channel instability and causing minor localized increases in channel width. We expect these effects to occur during subsequent storm events, suppressing the recovery that would otherwise occur. Salmonid populations will be impacted in proportion to the length of mined reaches. Effects such as reduction in riparian vegetation may be small as juvenile salmonids are able to relocate to other areas for velocity refuge habitat. However, impacts to redds as an indirect effect of gravel extraction will lead to a decrease in the abundance of salmonid juveniles, particularly Chinook salmon which use the reach for spawning. We expect the process for implementing alternative extraction techniques as described in the *General Effectiveness of the Proposed Actions at Reducing Effects* section will be effective at designing and locating extraction sites to minimize impacts to spawning habitat and juvenile rearing habitat. In this context, the natural river processes that promote improvement of these habitat conditions will be suppressed, but not eliminated. Harm to salmonid populations in the form of reduced spawning success and juvenile survival will occur in the areas adjacent to the extraction sites, but not lead to an appreciable reduction in the ability of the South Fork Eel River populations to survive and recover, given the distribution of salmonids throughout this watershed and the limited extent of the expected effects.

4. Van Duzen River Effects

a. Baseline Summary

The Van Duzen River portion of the action area reflects a long legacy of upstream and upslope impacts, coupled with the effects of continued instream disturbances. The effects of past floods, coupled with intensive land management, coalesce in the low-gradient, unconfined reaches of the lower river. In this setting, the reach is inherently unstable, experiencing wide swings in low-flow channel location from year to year. Stream habitat in this reach is transient and reflects the interaction of streamside vegetation, valley walls, higher alluvial bars, and LWD. Each of these habitat-influencing elements is in limited supply and salmonids are confined to a limited number of suitable spawning and rearing sites. Rearing habitat is severely limited in the reach due to high water temperatures and poor habitat quality.

The reach also functions as a migration corridor for both juvenile and adults of all three salmonid species. Past stranding of migrating adults near the mouth due to insufficient water depth highlights the overall poor habitat conditions present. NOAA Fisheries considers the large width evident along much of the reach to be the key factor limiting habitat formation and, hence, salmonid production in the lower Van Duzen River. This condition is reflected in the lateral instability of the channel. Although channel migration is to be expected in this reach of the river, the lack of habitat forming elements provides little opportunity for the formation of higher quality stream habitat as the stream migrates.

The extraction reach of the Van Duzen River may also provide an important spawning reach for Chinook salmon during moderate- to low-water periods when upstream access is limiting, or fish have been holding in the lower Eel River for a sufficient duration that upstream migration is curtailed in favor of spawning. The importance of this reach for spawning is likely to increase because of the landslide that occurred in Grizzly Creek, an important spawning tributary located upstream of the extraction reach. The large landslide will affect spawning and rearing conditions in Grizzly Creek for a number of years into the future. As such, the extraction reach of the Van Duzen River represents a critical low-water year Chinook salmon spawning stretch for the entire Eel River system. Since the Eel River is one of the larger river systems in the three listed salmonid ESUs, activities that adversely affect the lower Van Duzen River may have a demonstrable effect on the CC Chinook salmon, SONCC coho salmon and NC steelhead ESUs if those effects are sustained and dramatically alter the habitat conditions throughout the reach.

In considering the effects of gravel extraction along the Van Duzen River in this Opinion, we reviewed historic aerial photos of the reach to qualitatively determine reach-scale habitat conditions. Our review shows that the Van Duzen River is extremely dynamic - experiencing wide shifts in low flow channel location from year to year. Pool habitat at low flows, if any flow is present, is shallow (Halligan 2003) and lacks complexity from channel roughness elements such as woody debris and streamside vegetation. Most higher quality pools that provide depth, cover and velocity refuge appear to occur when the low flow channel abuts bedrock outcrops along the southern valley wall (left bank). Locations of these pools are not fixed as the channel migrates across the floodplain. However, they appear to represent the highest quality pool habitat along the lower Van Duzen River. In other locations, higher quality pools are also associated with streamside vegetation (primarily willow patches) and, to a lesser degree, accumulations of woody debris. Pools also occur where the low flow channel abuts higher elevation bars. Further examination of the aerial photos and site visits suggest that bars approaching bankfull height are capable of providing somewhat higher quality habitat features, including alcove habitats, at moderately high flows, than locations where the low flow channel is unconstrained by these highest bars. These latter habitat-influencing elements (vegetation, woody debris and high bars) are transient features, given the frequent shifts in channel location through time, and we would emphasize that only moderate-quality habitats, at best, occur at these sites. However, given the overall poor habitat condition of the reach, with extensive stretches of uniform, flatwater habitat, these moderate quality habitats represent valuable sites for various life history stages of salmonids. The persistence of salmonids in the reach is influenced by these habitat conditions in addition to the larger scale factors discussed in the *Environmental Baseline* section of this Opinion. Extraction in the reach occurs at the upstream end of the reach, near the confluence with Yager Creek, and the lower end at and near the mouth (Figure 8.). The middle portion of the reach is unmined.

b. Pool Quantity and Quality

(1) Increased width. The lower Van Duzen River is a wide reach dominated by relatively shallow pools and poorly pronounced riffle crests. Extensive shallow "flatwater" habitat dominates the lower Van Duzen River, and provides poor conditions for juvenile rearing and adult migration at low flows. Past skimming has exacerbated this condition by not allowing sufficient bar height recovery to allow for low flow channel confinement. Where traditional skimming may occur in the upper portion of the reach, we expect gravel extraction will likely add to poor habitat conditions by inhibiting the development of suitable quality pools for holding, sheltering and rearing. The result is most acute near the mouth of the Van Duzen River where shallow, braided conditions resulted in the stranding of adult Chinook salmon in both 1996 and 2001 (NOAA Fisheries 2002d). Lateral instability at the mouth, fostered by the increased low-flow channel width, largely precludes the formation of deeper water holding habitat. Since the proposed action limits skims to no wider than 90 feet along the lower two miles of the Van Duzen River, we do not expect adverse effects associated with channel widening and lateral instability. Furthermore, avoiding wide, traditional skims will allow for bar height recovery and promote better migratory conditions for adult salmonids. For example, skimming was conducted in the late 1990s and year 2000 near the mouth, both upstream and downstream of the Highway 101 bridge, resulting in very wide, shallow and braided conditions at low flows. In the following two years, skimming was curtailed and bar heights recovered somewhat. Shallow trenching through an overflow channel was used as an alternative method during the 2002 season. Observations indicate that this method may be a less-impactive alternative to traditional skimming if it is designed in such a way as to provide fish passage and deeper water habitat. However, we are concerned that where in-stream trenching is conducted and adult holding habitat is created, increased catch-and-release angling pressure will result in the mortality of migrating adults due to handling stress.

(2) Channel degradation. CHERT bases its sustained yield recommendations for total extraction quantities on its estimates of MAR. CHERT estimates that the MAR for the Van Duzen River extraction reach is between 135,000 cubic yards and 202,000 cubic yards, with a median value of 168,500 cubic yards (Klein *et al.* 2001). The average recommended CHERT total extraction quantity for the Van Duzen River between 1997 and 2003 was 160,544 cy/yr, although the average actual extraction quantity between 1997 and 2003 for the Van Duzen River was 117,846 cy/yr. Information on sustained yield as defined by Knuuti (2003) is not available for the Van Duzen River as it is for the Mad River. In order to assess past effects of gravel extraction in a particular river, the past extraction values can be used. However, to assess the effects of future extraction, NOAA Fisheries uses the past CHERT recommended values as what could occur in the future.

The average total extraction value between 1997 and 2003 for the Van Duzen River is less than the estimated low-end range of MAR, however, the 1964 flood had aggraded the Van Duzen River in the recent past. The use of bar skimming as the predominant extraction technique has exacerbated problems found with aggradation, such as a wide low-flow channel, decreased channel confinement and topographic simplicity of the channel, by maintaining the same channel cross-section as found in aggraded conditions. Using trenching as an extraction technique during 2002 was effective at improving migratory habitat. Trenching may also prove to be effective at improving channel complexity, rearing and holding habitat. The average CHERT recommended volume for the period between 1997-2003 is very close to its median estimate of MAR. NOAA Fisheries assumes that future extraction rates will be similar to those recommended by CHERT from 1997-2003. Given this, we expect that the current channel widths will be maintained and simplified habitat conditions will persist in the upper reach where traditional skimming is expected to occur. However, we expect that the lack of traditional skimming in the lower two miles of the extraction reach will minimize the potential for channel widening and lateral instability. Consequently, these measures will minimize the adverse effects on habitat and migratory conditions in the lower two miles. Furthermore, avoiding the use of wide, traditional skimming there will allow for some degree of bar height recovery.

We suspect the Van Duzen River, in its current configuration, is highly susceptible to additional disturbances. Unlike more confined streams, where channel morphology is dictated largely by bedrock control points and may possess some degree of resiliency, the Van Duzen River channel is largely self-formed. Therefore, disturbances in the channel are likely to initiate significant changes to channel form and habitat. Under the proposed action, we do not expect significant bed degradation to occur such that adverse effects to salmonids results.

(3) Reductions in riparian function. Historic removal of streamside vegetation has largely eliminated sites of bank stability and LWD sources. This has likely contributed to the paucity of pool habitat along the lower Van Duzen River. Poaching of large wood along the reach is another impact that continues to eliminate sources of habitat complexity. Additionally, willow patches in the active channel and along eroding alluvial banks provide habitat complexity. However, given the wide channel and associated instability in the lower Van Duzen River, we expect that frequent lateral shifts in the channel will continually erode young vegetation and reduce the amount of future habitat afforded by riparian vegetation colonization. Examination of the aerial photo record reveals that riparian vegetation provides only transient habitat complexity, yet these short-lived habitat features are important areas for salmonid rearing and holding. Frequent channel migration erodes currently functioning vegetation while providing new surfaces for recolonization. We anticipate that the effect of gravel extraction, particularly skimming, will suppress riparian succession at the individual mining sites. Where a site is repeatedly skimmed, the effect is a chronic reduction in the quantity of vegetation. Therefore, on average, we expect a lesser extent of riparian vegetation in the immediate vicinity of the extraction sites where skimming occurs. This will contribute to the maintenance of poor pool quality and reduce the extent of habitat complexity afforded by vegetation occurring in the vicinity of the extraction sites. We expect fish production will be reduced due to decreased growth where fish density is increased in the limited habitats available, allochthonous food inputs reduced, and more energy is expended in territorial interactions.

c. Riffle Stability and Migration Blockage at Riffles

(1) Impacts to spawning habitat. Information presented in the *Environmental Baseline* section demonstrates that the lower reaches of the Van Duzen River provide spawning habitat for Chinook salmon. We expect the importance of this reach for spawning will increase as a result of the loss of spawning habitat in Grizzly Creek due to a large landslide entering the creek. The extent to which steelhead or coho salmon use the extraction reach for spawning is unknown. The reach likely provides a larger portion of the spawning habitat in the Van Duzen River watershed during low flow years when upstream access is difficult. The lateral channel instability that the aerial photo record portrays suggests that much of the spawning habitat in the Van Duzen River portion of the action area may be pre-disposed to instability. We expect that gravel extraction will further increase channel instability immediately adjacent to the sites and further reduce or maintain the degraded spawning habitat condition. Both skimming and in-channel trenching can produce this effect; skimming by promoting lateral instability and trenching by increasing downcutting of the channel which could scour redds as the channel locally readjusts to accommodate the trench site. For skimmed sites, we expect that the head-of-bar buffer provision will prevent increased channel instability by retaining the steering influence the upstream portion of the bar provides on streamflow. Where trenches are used, we expect that they will avoid spawning areas to minimize the chance for downcutting into redds.

We expect the effect on spawning habitat and listed species will be greatest during low-flow years, when spawning is confined to the lower reaches of mainstem rivers such as the Van Duzen River. The CHERT review process will assist in locating sites that minimize disruptions to adjacent spawning habitat. However, we do not expect this will avoid the impacts. In low water years, we anticipate that on the order of 3-5 redds per year could be adversely impacted as a result of adjacent extraction. We base this on the assumption that on the order of three to five spawning riffles will be most affected by the proposed action and each riffle may have multiple redds. We assume multiple redds (2-3) might be located on each riffle because of the paucity of spawning riffles in this reach and the size of the channel which suggests enough space is available to accommodate multiple redds per riffle. Spawning sites are generally chosen by females based on a number of factors, including hydraulics and substrate size, so we expect multiple females may choose the same location, provided there is adequate space, to take advantage of favorable conditions. Within these riffles, we assume that a portion of the redds will be destroyed by processes unrelated to the implementation of LOP 2004-1. Although the impacts may affect all redds, we expect that the total of all impacts will be be equivalent to destroying one redd. An estimate of 3-5 redds is only intended to provide an estimate of the number of redds potentially impacted by the proposed action. This could be lower or higher depending on the size of the spawning population utilizing the lower river.

(2) Impacts to rearing habitat. We expect the head-of-bar buffer will limit the effects on riffles from mining (*i.e.*, decreased particle size, increased susceptibility to erosion, and increased instability). Under LOP 2004-1 we do not expect measurable decreases in the quality of rearing habitat at riffles.

(3) Migration blockage. Past occurrences of adult stranding were discussed above in the effects on pool habitat quality and quantity. The currently wide channel of the Van Duzen River, particularly at low flows, creates a vulnerable setting for migrating salmonids. We expect the proposed skim floor elevation corresponding to the 35% flow to provide for adequate depth. We expect the prohibition on the use of traditional skimming on the lower Van Duzen River will minimize future instances of adult stranding in shallow stretches. The 90-foot maximum width was obtained by calculating the average peak flow occurring during the months of November and December and determining the maximum skim dimensions that would contain the flow at a depth of one foot. Also, as discussed previously, the head-of-bar buffer will provide for some stability in the immediate vicinity of the extraction site.

Trenching was used an as alternative method during the 2002 season, and initial observations indicate that this method may be a feasible alternative to skimming if it is designed in such a way to provide fish passage and deeper water habitat. Although trenching may still maintain the widths along the Van Duzen River due to the removal of sediment in general, we expect that proper design and placement will minimize potential migration blockages.

NOAA Fisheries concludes that the head-of-bar buffer proposed in LOP 2004-1 will help to maintain the location of the low flow channel and avoid increases in channel width. NOAA Fisheries anticipates that alternative extraction techniques will allow for bars to recover and low- to moderate-flow confinement to be restored. However, they will continue to influence low-flow channel confinement, but the effect will not be evident above natural changes in channel form. We do not expect that the proposed action will result in migration blockages.

d. Effects on Velocity Refugia

(1) Impacts due to habitat changes or maintenance of existing habitat. Given the currently degraded state of habitat in the lower Van Duzen River, existing velocity refugia in the form of complex pools, off-channel habitat, and topographic complexity are limited. We expect that continued gravel extraction, in the absence of bar height recovery, will have the effect of maintaining this poor habitat condition near the individual extraction sites. Where some bar height recovery occurs, as might be expected in the lower two miles where wide skims will be prohibited, the effect will be less pronounced. Alternative extraction methods, such as trenching, may provide short-term refuge sites, but we expect these will be transitory features and rapidly filled in during higher flows. Where trenches are used to guide the channel into a more stable configuration, such as along a bedrock wall, a longer lasting velocity refuge might be created. Again, given the already poor habitat conditions of the Van Duzen River due to a myriad of other cumulative watershed effects influencing the reach, we do not expect that continued gravel extraction will have a detectable impact on velocity refuge due to changes in habitat. We expect a more pronounced effect due to changes in bed roughness and riparian vegetation succession adjacent to mined sites. This effect is discussed below.

(2) Changes in bed roughness. The characteristic particle size distribution along the Van Duzen River is largely dominated by gravel and cobble. Where gravel extraction occurs, particularly skimming, and a larger portion of the coarse armor layer is removed, we expect localized reductions in velocity refugia to occur. Because of the proximity of Chinook salmon spawning to mining sites, primarily during low-flow years, we expect that habitat for newly emergent fry in the form of bed roughness will be reduced under LOP 2004-1 when compared to un-mined conditions. Given the degraded condition of the existing habitat in the Van Duzen River and downstream in the lower Eel River, we expect this loss of fry habitat to result in a reduction, though unquantifiable, in the survival of Chinook salmon fry. However, we expect the effect will be localized and not lead to a detectable change in returning adult abundance.

(3) Changes in riparian function. Historic removal of streamside vegetation has largely eliminated high flow velocity refugia. Although the proposed action will avoid removal of larger vegetation, we are concerned that continued channel instability due to extraction will suppress natural riparian succession and reduce the quantity of larger vegetation available for high flow shelter. Since skim widths will be constrained to less than 90 feet in the lower two miles of the Van Duzen River and a head-of-bar buffer implemented where skimming does occur, we expect less channel instability and, consequently, less disturbance to vegetation and riparian succession.

Smaller patches of younger vegetation (typically willows) in the active channel and along eroding alluvial banks will continue to provide valuable velocity refugia, as discussed below. Nevertheless, given the instability in the Van Duzen River, lateral shifts in the channel will continually erode young vegetation and reduce the amount of velocity refuge afforded by riparian vegetation. Any increases in channel migration rates will reduce the overall age and size of vegetation able to provide velocity refugia.

Given the lack of larger vegetation, generally small particle sizes, and lack of complex habitats in the form of pools and off channel habitats, we expect that the smaller riparian vegetation located within the active channel provides one of the few velocity refuge habitats in the mainstem Van Duzen River. Therefore, continued sediment extraction that promotes lateral channel migration will continue to reduce the amount of this habitat available. Since no wide skims will occur in the lower two miles of the Van Duzen River and a head-of-bar buffer will be implemented where skimming does occur, we expect lateral instability will occur at rates near what would be expected in an unmined setting. Salmonids, juveniles in particular, will be adversely affected by the lack of velocity refugia, particularly in the upper reach where skimming is expected to continue. In the Van Duzen River portion of the action area, juveniles may be dislocated downstream where conditions are less favorable for rearing, particularly when flows subside in the summer and suitable rearing habitat is limited.

e. Effects on Water Temperature

The current width of the Van Duzen River allows for low flows to spread out over the bar surface and experience increased insolation over what would be expected in a more confined setting. Where skimming occurs in the upper reach, we expect LOP 2004-1 will maintain or increase the low-flow channel width and perpetuate this condition. However, the mined reaches are in the coastal zone and summer maximum air temperatures are not as frequently high as those in more inland areas such as the Trinity River. Additionally, monitoring data from the extracted reach (Jensen 2000) indicate that the lower Van Duzen River cools in a downstream direction, presumably due to the moderating influence of the coast. Given the relatively dispersed extraction sites occurring mostly in the cooler coastal setting, we do not expect any detectable increases in temperature, and therefore, do not anticipate any adverse thermal effects from increased insolation on salmonids as a result of the proposed action.

Deeper pools in the Van Duzen River may provide thermal stratification (Jensen 2000) and may also intersect cooler groundwater seeps as noted in the middle Eel River reach (PALCO 2003). Where activities reduce the depth of pools, as is expected to locally occur in the upper reach where skimming is expected to occur, lack of thermal stratification may reduce or eliminate a critical thermal refuge. We expect this effect would be greatest adjacent to and immediately downstream of a particular extraction site in the upper reach where skimming is expected to occur. Since summer maximum water temperatures are at the upper end of tolerance for juvenile salmonids, loss of these areas, or maintenance of currently degraded pool habitats, would likely result in mortality of juvenile salmonids that rely on these pools during the warmest periods. Since the deepest, highest quality pools in the lower Van Duzen River are associated with bedrock walls along the valley margins, we expect that the greatest potential for habitat degradation would be from an extraction that results in migration of the channel away from the valley wall. Examination of the aerial photo record through time suggests that lateral channel migration is common. A loss of thermally stratified pools due to gravel mining at these bedrock pools would be difficult to discern from natural channel migration. Any increase in channel migration rates in the upper reach due to gravel mining could arguably increase the rate at which pools are formed and abandoned, but not change the overall distribution of thermally stratified pools in the reach. Also, we expect that the site-specific review procedures outlined in the proposed action will be effective at avoiding extraction sites that have a high likelihood of realigning the channel away from pool-forming features. Therefore, we do not expect the proposed gravel extraction to appreciably change the distribution of thermally stratified pools in the lower Van Duzen River. We expect juvenile losses resulting from this aspect of LOP 2004-1 would be limited to the number of juveniles in one pool over the course of the extraction reach. We use one pool based on our review of the aerial photos which suggests the reach has on the order of 5-10 potentially thermally stratified pools, not all of which are likely to be affected by the proposed action.

Trenching is not expected to have a detectable effect, except where the trench persists through a dry winter and provides thermal stratification the following summer. In this case, the trench could potentially provide a valuable cool water refuge for salmonids, particularly when coupled with the proposed addition of woody debris. However, in most years, we do not expect that a trench in the mainstem will persist through to the following year.

f. Effects of Turbidity and Sedimentation of Adjacent and Downstream Habitat

Proposed bar skimming along the Van Duzen River will allow inundation of unarmored bar surfaces at lower flows than would otherwise occur. Although the minimum skim floor elevation corresponding to the 35% exceedence flow will ensure that the river is already transporting fine sediment from other sources when the bar is overtopped, we expect the effect of this will be to add further fine sediment to the mainstem that is already listed under section 303(d) of the CWA. Injury or mortality to fish could occur through smothering of incubating eggs in the gravel, reduced interstitial spaces in the channel bed available for sheltering, reduced invertebrate production, and impaired feeding ability in the turbid water. However, given the already high background sediment levels in the Van Duzen and lower Eel rivers at the 35% exceedence flow, the impacts to salmonids have already occurred prior to the additional inputs from extraction surfaces to the channel. Thus, we expect that this increased sediment production this reduction in salmonid numbers will not have an appreciable effect on the ability of the population to survive and recover.

d. Effects in Water Temperature

Repeated extraction at gravel mining sites may cause an increase in low flow width over time. However, given the dispersed extraction sites and infrequent extraction, coupled with the head-of-bar buffer, we expect that any channel widening will be small and not produce a detectable increase in stream temperatures. Therefore, we do not expect any adverse effects on salmonids from altered temperature regimes as a result of LOP 2004-1 at the isolated sites.

e. Isolated Sites Summary – Effects on Salmonids

Mining at the various isolated sites will result in localized effects on salmonids and their habitat. Since past mining has not occurred every year at these sites and we expect this pattern to continue, we expect bar recovery to occur between extraction operations. At the North Fork Mattole River, Ft. Seward and Bear River sites, impacts to salmonids will be proportional to the area disturbed. Some reduction in juvenile velocity refuge habitat is expected to occur as regeneration of riparian vegetation is suppressed. Spawning habitat and redd persistence, particularly for the Ft. Seward site, may be reduced. However, given the isolated nature of these sites, and the limited use of areas such as the Fort Seward site for summer rearing, we expect only minor reductions in the overall salmonid populations.

F. Other Indirect Effects Associated with the Proposed Action

The following effects are expected to occur as a consequence of the proposed action. These occur primarily due to increased vehicle access at particular sites resulting in removal of woody debris, increased angling pressure and direct effects of vehicles in the wetted channel; and changes in channel configuration which result in bank and bridge stabilization projects, and, in the case of the Mad River, an annual in-stream construction project to maintain water supply at the HBMWD pumping facility.

1. <u>Removal of Woody Debris</u>

LWD is an important component in pool formation, in providing cover for salmonids, and for habitat complexity in general. Although much of the debris currently supplied to reaches in the action area is readily transported at high flows, our review of the aerial photos, site visits, and published information (Abbe and Montgomery 1996) indicates that many debris accumulations provide functional habitat elements at low and moderate flows. Even at the highest flows, rafts of debris may create important slack water environments for salmonids. Gravel extraction operations can decrease the availability of LWD to the lower mainstem rivers by increasing vehicular access to river bars through unlocked gates on roads specifically constructed and maintained for gravel extraction, where LWD that has been deposited on gravel bars is then collected by private individuals for firewood or lumber. Additionally, gravel extraction operations maintain bars in a more "access friendly" state; that is, they grade the bars and inhibit riparian growth which otherwise might impair the ability of vehicles to maneuver in the stream bed. NOAA Fisheries personnel (pers. comm. with L. Wolff and D. Free, NOAA Fisheries,

2003) have observed harvesting of firewood, redwood, and other commercially or aesthetically (*i.e.*, stump burls) valuable wood products from mining sites accessed through unlocked gates.

To address this, LOP 2004-1 requires that educational signing regarding the importance of LWD for salmonids will be placed at access roads owned, controlled, or utilized by the gravel operators. In addition, in order to protect LWD deposited on mined gravel bars, all access roads owned or controlled by gravel operators will be gated and locked to reduce access.

An additional project design feature taken to minimize the loss of LWD is stockpiling of LWD material on the edges or upstream of extraction bars prior to bar skimming, which may allow for the natural redistribution of LWD during winter storms. This may be of limited benefit because vehicular access and firewood cutting is not restricted. Therefore NOAA Fisheries anticipates that the loss of LWD will still occur as a result of the proposed action, possibly resulting in continued declines in habitat quality in the action area and downstream reaches, and reducing the survival of adult or juvenile salmonidsof all three listed species.

2. Increased Angling Pressure

Where access is not restricted at extraction sites, increased angling pressure will result. In the past, extraction sites along the Mad River and lower Eel River have provided access to anglers. In fact, the Eel River PEIR (Humboldt County 1992) suggested that gates on the lower Eel River would be kept unlocked specifically to allow angler access. Although current angling regulations require the release of all non-hatchery fish, take may occur in form of harassment and hooking mortality. The effects of this on the overall salmonid populations is unknown as we assume that much, if not all, of the angling pressure would occur at other sites where access is not associated with the proposed action. However, during low-water periods, when adults are confined to specific pools in the lower river reaches such as the lower Eel River, access at the extraction sites could result in the take of several Chinook salmon adults prior to upstream migration and prior to annual low-flow angling closures. Although it is difficult to estimate the extent of take that could occur as a result of hooking mortality, NOAA Fisheries expects that on the order of 10-100 Chinook salmon adults and a lesser number of coho salmon and steelhead could be captured annually as a result of low-water angling and an unknown portion of these individuals will die due to hooking mortality facilitated by access at the extraction sites (pers. observation by S. Flanagan, fisheries biologist, NOAA Fisheries, 2003).

3. Increased Vehicle Access

Where extraction sites afford access to the active channel, the increased use by vehicles may adversely affect salmonids and redds by directly crushing them when vehicles cross the wetted channel, presumably for wood cutting, angling, or simply, "four-wheeling." Since these crossings are not subject to any of the provisions provided for in the proposed action, we anticipate that a much greater amount of take will occur due to increased vehicle traffic. The point where vehicles cross is often at the riffle crest, where spawning most often occurs and rearing juveniles may be present. Therefore, destruction of redds or crushing of juveniles of all three listed species may occur as a result of vehicle use in the wetted channel.

In the past, access roads to and from the extraction areas may have increased vehicle use throughout the year. This increased use may lead to rutting of the road surface, generation of fine sediment and subsequent delivery to the adjacent river channel. The proposed action requires that all access roads be gated and locked. NOAA Fisheries expects this provision will limit sediment delivery during the winter period. Consequently, we expect that the effects across the action area will be on the order of that seen from bridge construction with increases in turibidity causing displacements of salmonids in areas where road sediment enters the river.

4. Increased Need for Rock Slope Protection

The lateral instability (*i.e.*, increased bank erosion) evident in many of the action area reaches has resulted in the use of various bank stabilization techniques. The Mad River, in particular, has several extensive bank stabilization projects to protect roads, water withdrawal facilities and farmland from additional channel migration. Channel bed degradation has also raised concerns over the stability of area bridges. Numerous effects on salmonids are associated with these types of projects. Short-term effects associated with these projects include increased turbidity, equipment access in the low-flow channel, and dewatering of the channel during construction. Longer term effects include reduced interactions of streamside vegetation with the active channel. This results in less overhanging vegetation and decreased recruitment potential of woody debris.

G. Inter-Related and Inter-Dependent Effects of the Proposed Action

In considering the effects of the proposed action, NOAA Fisheries also assesses the effects of interrelated and interdependent actions that are likely to occur. For the proposed action, these involve effects to salmonids resulting from the development of the railroad and/or the Humboldt Bay shipping capacity for sediment hauling to areas where demand is high and prices are at a premium. Each of these is discussed below.

1. Increased Construction and Development

The use of in-stream gravel is widely used for construction and maintenance of roads and other infrastructure. Presumably, this facilitates increased development in the form of greater urbanization and rural development. Consequently, these inter-related activities have effects on salmonids, as was discussed in the *Status of the Species* and *Environmental Baseline* sections. However, in the absence of the proposed action, rock sources would likely be obtained from other sources, such as upland quarries.

2. Adverse Effects to Habitat from Railroad or Humboldt Bay Port Development

Recent economic analyses of re-establishing a rail link to California counties south of Humboldt County as well as development of a deep-water port in Humboldt Bay have identified gravel as one of the more important products that could be exported out of Humboldt County via one or both of these pathways (*i.e.*, by rail or ship). Development of rail service to Humboldt County would require extensive construction in the Eel River corridor where the railroad once ran. Port development would require increased dredging and construction of dock facilities, which would likely impact important salmonid rearing habitat such as eel grass beds. Additionally, increased ship traffic from larger vessels could result in increased shoreline erosion and sedimentation of existing eel grass beds.

3. Offsite processing areas

Once gravel is excavated from the river, it is taken to a processing area, typically near the site, to be washed, crushed and sorted. These processing sites may be areas of fine sediment generation if measures are not employed to contain the runoff. Similarly, if water used to wash gravel is not properly controlled, the effluent may enter the stream, causing increases in turbidity and effects on salmonids in the vicinity. Since the proposed action or the biological assessment does not describe the extent of these activities and their potential effects, we cannot accurately determine the extent of the effects. In the absence of this information, we assume that the post-extraction site reviews will be able to identify areas near the extracted bars that are potential sediment sources and provide mitigation measures. However, we still expect these areas and other areas not identified in the review process to deliver fine sediment to water courses. We expect the effects will be input of turbid water with consequent displacement of salmonids in the vicinity and short-term reductions in macro-invertebrate production.

VI. CUMULATIVE EFFECTS

NOAA Fisheries must consider both the "effects of the action" and the cumulative effects of other activities in determining whether the action is likely to jeopardize the continued existence of the three salmonid species considered in this Opinion or result in the destruction or adverse modification of SONCC coho salmon designated critical habitat. Under the ESA, cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

NOAA Fisheries thinks that listed species may be affected by numerous State, tribal, local, or private actions that are reasonably certain to occur in the action area. These actions include those discussed below. Although each of the following actions may reasonably be expected to occur based on their past occurrence, we lack definitive information on the extent or location of many of these categories of actions. The following discussion provides available information on the expected effects of these activities on the salmonid species analyzed in this Opinion. Section 9 of the ESA prohibits take of fish and wildlife species listed under the ESA, unless exempted by Incidental Take Permits. However, this discussion is limitied to activities that are not currently covered under section 7 of the ESA. Take of State listed species is also prohibited under the California Endangered Species Act (CESA). In addition to the ESA and CESA, other laws regulating certain of these activities provide protections for listed species, especially the CWA, the California Environmental Quality Act (CEQA), the California Fish and Game Code, and the California Forest Practice Rules (FPRs). Enforcement of existing law is expected to reduce the impacts of these activities on listed species.

A. Timber Management

Timber management, with associated activities such as harvest, yarding, loading, hauling, site preparation, planting, vegetation management, and thinning, is the dominant human activity in the action area. Future timber harvest levels in the action area cannot be precisely predicted, however, we assume that harvest levels on private lands in Humboldt County in the foreseeable future will be within the approximate range of harvest levels that have occurred since the listing of the northern spotted owl in 1992. Based on data for recent years, the annual harvest level in Humboldt County is expected to be about 500 million board feet (California Board of Equalization 1998).

Implementation of Timber Harvest Plans under the FPRs has not consistently provided protection against unauthorized take in relation to Pacific salmonids listed under the ESA by NOAA Fisheries. NOAA Fisheries has informed the California Department of Forestry (CDF) of its ongoing concern over the lack of specific provisions for salmonids in the FPRs. Discussions continue on this issue between NOAA Fisheries, CDF, and California Resources Agency. Recent revisions to the FPRs address many concerns related to salmonids. However, until these issues are resolved, unauthorized take from direct, indirect, and cumulative effects to salmonids from timber harvest and its associated activities may be occurring and likely will continue to occur. The extent and amount of any unauthorized take of salmonids is unknown.

Reasonably foreseeable effects of timber management activities may also impact designated critical habitat for SONCC coho salmon. Within the action area, direct, indirect, and cumulative effects of timber harvesting may degrade the habitat features identified as essential for coho salmon critical habitat. The extent of the effect to critical habitat is unknown given the uncertainty of protective measures in THPs.

B. Control of Wildland Fires

Control of wildland fires may include the removal or modification of vegetation due to the construction of firebreaks or setting of backfires to control the spread of fire. An undetermined amount of suitable habitat for salmonids may be removed or modified by this activity. The forested setting that occurs upstream of much of the action area predisposes the watersheds to frequent wildland fires. The effects of wildland fire suppression range from increased sediment inputs to streams that further degrade habitat, to the effects of fire retardants and other chemicals, which may introduce toxic substances into watercourses. These could all lead to decreased spawner success, reduced juvenile rearing habitat and possibly toxic-induced mortaility in the case of fire suppressants.

C. Industrial Activities, Sawmills, and Associated Activities

Most sawmills located in the action area are expected to remain in operation for the foreseeable future, based on a relatively steady supply of timber, as discussed above. Facilities are expected to operate within applicable laws. Where waste water discharge may affect habitat for listed species, we expect that the ESA and the CESA will be enforced. Further large-scale industrial development is not anticipated, but if such development should occur, we expect that all applicable laws will be applied. Effects on listed species include increased sediment delivery, similar to that described for roads below, and possibly delivery of toxic materials that could result in mortaility of affected individuals.

D. Construction, Reconstruction, Maintenance, and Use of Roads

While the level of construction of new roads and reconstruction of old roads on private and state lands cannot be anticipated, we expect it to continue at a similar rate. Under current rates of road construction and maintenance, we expect road mileage to increase, principally on commercial forest lands where the roads are needed to access timber harvest areas. The increased emphasis on protection of aquatic resources is expected to result in higher standards for road construction, reconstruction, maintenance, and use as compared to historical standards. Improvement of environmental conditions related to roads throughout the action area is expected over the long term. Noticeable improvements in the short term are unlikely due to an expected increase in the number of road miles per square mile of land, the lack of comprehensive road standards, existence of numerous older, legacy roads within the action area, and lack of routine inspections and maintenance of existing roads. These trends will be especially noticeable on industrial timberlands. Roads will continue to adversely affect salmonids primarily through sediment delivery with consequent effects on spawner success and reductions in juvenile habitat.

E. Gravel Mining, Quarrying, and Processing

In addition to the gravel extraction activities covered in this Opinion, other sediment extraction activities occur in more upland settings that ultimately have the potential for affecting the action area. The effects of quarries and rock mines on aquatic resources in the action area depend on the type of mining, the size of the quarry or mine, and distance from waters. Rock mining can cause increased sedimentation, accelerated erosion, increased streambank and streambed instability, and changes to substrate. Surface mining may result in soil compaction and loss of the vegetative cover and humic layer, increasing surface runoff. Mining may also cause the loss of riparian vegetation. Because the effects of quarries and rock mines depend on several variables, the effects of quarries and other commercial rock operations within the action area on listed species are unknown. Commercial rock quarrying will continue to be under the regulation of Humboldt County and the California Coastal Commission (for those activities conducted within the Coastal Zone). NOAA Fisheries expects the effects of these upland mining operations will be similar to those for roads, described above.

F. Habitat Restoration Projects

Because stream restoration projects are usually coordinated with one or more of the resource agencies, we expect that all applicable laws will be followed. Restoration activities that are not conducted pursuant to CDFG's Fisheries Habitat Restoration Program, which has a section 7 consultation and take exemption through the Corps, may cause temporary increases in turbidity, alter channel dynamics and stability, and injure or harass salmonids if equipment is used in the stream during restoration projects. Properly constructed stream restoration projects may increase habitat complexity, stabilize channels and streambanks, increase spawning gravels, decrease sedimentation, and increase shade and cover for salmonids. NOAA Fisheries does not know how many restoration projects are completed outside of CDFG's program, therefore the effects of these projects cannot be predicted. We anticipate the amount of upslope restoration projects to increase. These projects often focus on identifying source problems in an area (*i.e.*, roads) and applying corrective measures to eliminate or minimize the adverse effects to aquatic resources.

G. Agricultural Activities

Agricultural activities including grazing, dairy farming, and the cultivation of crops.
The recent upward trend in value of dairy-related agricultural products (*e.g.,* milk, cows and calves, pasture, hay, and silage) in Humboldt County, for example, is expected to continue as human populations continue to increase (USDA 1998). As a result, the dairy industry near the action area, primarily in the lowlands of the Eel, Van Duzen and Mad River watersheds, is expected to persist. Impacts on water quality would be expected to be regulated under applicable laws.

The impacts of this use on aquatic species is anticipated to be locally intense, but the longevity of the impact depends on the degree of grazing pressure on riparian vegetation, both from dairy and beef cattle. Grasses, willows, and other woody species can recover quickly once grazing pressure is reduced or eliminated (Platts 1991) through fencing, seasonal rotations, and other measures. Assuming that appropriate measures are not taken to reduce grazing pressure, impacts to aquatic species are expected to increase with the predicted continuation or increase in grazing. Anticipated impacts include decreased bank stability, loss of shade- and cover-providing riparian vegetation, increased sediment inputs, and elevated coliform levels.

H. Residential Development

The moderate rate of human population growth in Humboldt County (about 2.8% increase from 1995 through 1998, California Department of Finance 1998) is expected to continue. In Humboldt County, most of this growth is expected to occur near the cities of Eureka, Arcata, and McKinleyville. Impacts on water quality related to residential infrastructure would be expected to be regulated under applicable laws.

Once development and associated infrastructure (roads, drainage, *etc.*) are established, the impacts to aquatic species are expected to be permanent. Anticipated impacts to aquatic resources include loss of riparian vegetation, changes to channel morphology and dynamics, altered watershed hydrology (increased storm runoff), increased sediment loading, and elevated water temperatures where shade-providing canopy is removed. The presence of structures and/or roads near waters may lead to the removal of LWD in order to protect those structures from flood impacts. The anticipated impacts to listed salmonids from continued residential development are expected to be sustained and locally intense. However, given the predicted slow growth rate development within the action area, impacts are not expected to increase substantially over current levels, but rather, continue similar to past rates of degradation.

I. Recreation, Including Hiking, Camping, Fishing, and Hunting

Expected recreation impacts to salmonids include increased turbidity, barriers to movement, and changes to habitat structures. Streambanks, riparian vegetation, and spawning redds can be disturbed wherever human use is concentrated. Campgrounds can impair water quality by elevating coliform bacteria and nutrients in streams. Construction of summer dams to create swimming holes causes turbidity, destroys and degrades habitat, and blocks migration of juveniles between summer habitats. Impacts to salmonid habitat are expected to be localized, mild to moderate, and temporary. Fishing within the action area is expected to continue subject to the California Fish and Game Code. The level of take of salmonids within the action area from angling is unknown, but is expected to remain at current levels. Under current levels, listed salmonids are subject to considerable catch-and-release angling pressure. This is particularly prevalent in the fall when salmonids are holding in the lower rivers of the action area, awaiting rainfall and rising rivers. The numbers of fish hooked in any given year likely range into the thousands, with a portion of these subsequently dying due to hooking stress. Death of these adults likely continues to limit the abundance of the population as fewer adults are able to successfully spawn.

J. Water Withdrawals

An unknown number of permanent and temporary water withdrawal facilities exist within the action area. These include diversions for urban, agricultural, commercial, and residential use, along with temporary diversions, such as drafting for dust abatement. Due to the anticipated slow urban/residential growth within the action area and the expected increase in agriculture (dairy farming), the number of diversions and amount of water diverted is expected to increase gradually within the action area. Impacts to salmonids are expected to include entrapment and impingement of younger salmonid life stages, localized dewatering of reaches, and depleted flows necessary for migration, spawning, rearing, flushing of sediment from the spawning gravels, gravel recruitment, and transport of LWD. Water diversions are expected to comply with applicable laws, including the ESA, California Fish and Game Code, and CWA.

K. Chemical Use

NOAA Fisheries anticipates that chemicals such as pesticides, herbicides, fertilizers, and fire retardants will continue to be used within the action area. Chemical application is under the jurisdiction of several Federal, State, and local agencies, and their use is expected to be conducted under applicable laws. Effects range from sub-lethal effects such as reduced reproductive success and to mortaility when chemicals occur in sufficient concentration. Most chemicals occurring in the action area likely derive from forestry operations in the upper portions of the watershed. Therefore, the risk of lethal concentrations occurring in the action area is extremely low. We also expect that sublethal effects of chemicals will be similarly low, given that the action area occurs along the lower rivers of Humboldt County where dilution of chemical inputs is likely to have occurred.

L. Global Warming

The Earth's climate has entered a period of more rapid warming than experienced over the past 1,000 years, and probably over an even longer period of time (IPCC 2001). The 1990s were the warmest decade in the instrumental record, both in terms of surface air and ocean temperatures, and the warmest in the past 1,000 years based on comparisons with northern hemisphere paleo-temperature proxies from ice cores, tree rings, and corals (Boesch 2002). Global climate models predict an average global temperature increase of 1.4-5.8°C by the end of the 21st century

(Boesch 2002). General circulation models suggest this recent warming is partially caused by anthropogenic increases in greenhouse gases (Boesch 2002).

The consequences of increased global temperatures are particularly important with respect to the ecological implications that will directly influence salmonid populations. Increased global temperatures can be expected to change precipitation and runoff patterns, ocean currents, storms, accelerate sea rise, and increase ambient temperatures. Some implications these changes have for salmon and steelhead include increased stream temperatures, seasonal changes in precipitation and runoff timing, increased opportunities for invasive species, biogeographic shifts in salmonid predators (e.g., increased mackerel abundance), and decreased upwelling (Boesch 2002). The predicted speed of these changes over the next century compared with expected species adaptation times and ability, given the depressed populations and reduced diversity of extant salmon and steelhead populations, is likely to severely limit the survival of a number of salmon and steelhead ESUs, especially those at the southern end of their range.

VII. INTEGRATION AND SYNTHESIS OF THE EFFECTS ON SALMONIDS AND CRITICAL HABITAT

The preceding analyses focused on both the likely direct effects and indirect effects from LOP 2004-1 on salmonids and their habitat in the action area for each river reach. This portion of the effects analysis summarizes this information for each species and considers the overall effects on the populations in the context of other activities occurring within the action area or influencing conditions within the action area (*Environmental Baseline* and *Cumulative Effects* sections). This analysis considers population-level effects from the five years of mining under the proposed action.

A. Effects on NC Steelhead

The proposed action will result in a number of direct effects to NC steelhead. Juvenile steelhead are present year-round in the action area. Therefore, our analysis indicates that juvenile steelhead are most vulnerable to the direct effects of mining given their presence in all of the reaches at the time of the proposed activities. We anticipate the number of steelhead juveniles injured or killed from the direct effects of mining will be relatively small. A small number of juvenile steelhead will be injured or killed from turbidity and fine sediment originating from trenches, and contact with equipment during trenching and stream crossing construction. We expect individual juvenile steelhead would be injured or killed, relative to the footprint of the activity, as a result of stream diversion for trenching operations. However, we expect stream diversions to be used infrequently because wet trenching will be limited. Under the proposed action, we expect wet-trenching to occur in the South Fork Eel River and the lower Van Duzen River. Although we expect some dry trenching may occur, particularly in the reaches where alternative extraction techniques are preferred over skimming, we do not expect wet-trenching to occur elsewhere in the action area. Adult steelhead stranding in trenches is a possibility under LOP 2004-1. While we expect trenches will be designed to avoid stranding, we cannot rule out the possibility that unpredicted shifts in channel location will occur and strand adults, which occurred on the Mad River in 2003. Based on our analysis of effects, we expect that up to five adult salmonids (a combination of any of the three species) may become stranded in any given year of LOP 2004-1 implementation.

Our analysis of indirect effects, related primarily to changes in habitat, suggests that steelhead juveniles are the species and life history stage most vulnerable to the effects of the proposed action. However, we cannot discount the potential indirect effects of mining on steelhead redds from increased scour. Our analysis indicates that the proposed action will inhibit natural habitat recovery processes. We also anticipate minor, more localized reductions in the quality and quantity of habitat. We note that extraction will occur during this same period at several nearby sites not included in this Biological Opinion (these sites have been the subject of previous opinions). We expect that harm to individual juvenile steelhead may occur in the various river reaches, primarily due to localized reductions in habitat quality.

Summer steelhead use a number of the mining reaches in the action area for holding through the summer prior to their upstream migration and spawning. Summer steelhead represent an important life history type of the NC steelhead ESU. In fact, summer steelhead in the Middle Fork Eel River seem to represent the southern extent of this life history type for any steelhead population (Busby *et al.* 1996). Although Busby *et al.* (1996) determined that summer steelhead did not represent a distinct monophyletic unit, they did not discount the potential for genetic differences between summer- and winter-runs of steelhead in the NC ESU. Thus, although there is currently no identified relationship between genetics and steelhead run timing, life history diversity still exists within the NC steelhead ESU. This diversity is important for buffering against both short-term and long-term (*e.g.,* climate change) environmental stochasticity and allows the population to use a wider array of environments. This may be especially important for steelhead near the peripheries of their range where conditions for salmonid survival are marginal and subject to greater variation. In essence, diversity increases the likelihood of species survival in a spatially and temporally varying environment.

Summer steelhead observations in the action area are consistently coincident with higher quality pools. We do not expect a decline in number or quality of these pools as a result of the proposed action. Therefore, we expect the current summer steelhead population will persist under the proposed action. We expect that the proposed action will continue to limit the holding habitat available for summer steelhead in the action area, but not appreciably diminish the ability of the individuals of the population to survive and reproduce since the principal spawning and holding areas are well upstream of the action area. In the absence of the proposed action, NOAA Fisheries expects that pool quality may increase at a greater rate than with the proposed action. However, these changes in pool quality will be principally dictated by changes in upstream delivery of sediment and woody debris.

Taken together, we do not expect the proposed action will appreciably alter the distribution of NC steelhead in the action area. Furthermore, we expect the reductions in juvenile abundance expected in the action area as a result of the proposed action will not be detectable in returning adult abundance. Adults may be killed if stranded in trenches, although this loss may not occur every year if it occurs at all. We expect the trenches will increase the reproductive success of steelhead by providing increased access to spawning habitat. On balance, we expect trenches constructed under LOP 2004-1 will provide a benefit to the species. Therefore, we do not expect the proposed action will reduce the distribution and abundance of steelhead in the action area.

Therefore, we do not expect the proposed action will appreciably reduce the likelihood of survival and recovery of the NC steelhead ESU.

B. Effects on CC Chinook Salmon

The action area encompasses a significant portion of the habitat for CC Chinook salmon, including some of the largest river systems that currently support CC Chinook salmon; a considerable portion of which is spawning habitat. Populations in these rivers comprise a significant portion of the CC Chinook salmon ESU, and its diversity and these populations are essential for the survival and recovery of the ESU as a whole. The Van Duzen River, and South Fork Eel River portions of the action area are especially important for CC Chinook salmon spawning. Therefore, the action area is critical to the survival and recovery of the CC Chinook salmon ESU. Incidental capture of adults in ocean and freshwater fisheries, coupled with the poor habitat conditions of the action area and current small population sizes, reduces the resilience of the population to losses of adult salmon and their redds and decreased smolt-to-adult survival.

The proposed action will affect multiple life stages of Chinook salmon in the action area. A very small number of juvenile Chinook salmon will be injured or killed during stream crossing construction or trenching operations. The proposed action will slightly reduce egg-to-fry success for CC Chinook salmon primarily because redd scour and sedimentation is expected to increase in some areas. However, many of these impacts are expected to occur in more localized settings adjacent to specific extraction areas and reductions in emergence rates will be limited to a few individual redds. We anticipate stranding of adult Chinook salmon may occur in trenches due to unforeseen changes in river configuration, although this loss may not occur every year if it occurs at all. We do not expect more than five adults will become stranded in any given year as a result of implementation of LOP 2004-1. We expect the trenches will increase the reproductive success of Chinook salmon by providing increased access to spawning habitat. On balance, we expect trenches constructed under LOP 2004-1 will provide a benefit to the species. Beyond this benefit, the affected Chinook salmon populations are unlikely to experience either positive or negative growth as a result of the proposed action since habitat will remain in a relatively similar state and the losses of juveniles due to the proposed action will be a very minor when compared to the high mortality rates these early life history phases typically experience (Groot and Margolis 1991). Therefore, we do not expect the proposed action to appreciably reduce the distribution and abundance of returning adults in the action area. Consequently, we do not expect the proposed action will appreciably reduce the survival and recovery of the CC Chinook salmon ESU.

C. Effects on SONCC Coho Salmon

The proposed action will primarily influence adult coho salmon in the action area. Coho salmon juveniles that emigrate from tributaries into the mainstem Mad River due to poor conditions and/or density dependency will be forced into simplified habitat where competition will occur. However, our analysis indicates that the proposed action will not further simplify this habitat, as evidenced by the aggradation of the lowermost Mad River. Elsewhere in the action area, juvenile coho salmon infrequently use the lower river reaches for rearing, particularly during the time of the proposed activities when direct effects are expected. However, we expect that adult coho may become stranded in trenches constructed under LOP 2004-1. We do not expect stranding to occur every year, if at all. In any given year, we expect no more than five adult coho would be stranded due to unforeseen changes in river configuration near the trench. However, we expect the trenches will increase the reproductive success of coho salmon by providing increased access to spawning habitat. On balance, we expect trenches constructed under LOP 2004-1 will provide a benefit to the species. Therefore, we do not expect the proposed action will reduce the distribution and abundance of coho salmon in the action area. Therefore, we do not expect the proposed action to appreciably reduce the likelihood of survival and recovery of the SONCC coho salmon ESU.

D. Effects on SONCC Coho Salmon Critical Habitat

Implementation of the proposed action will maintain habitat in a simplified state. Although we expect habitat recovery could occur in the action area if other habitat influencing processes improved, the recovery would be inhibited by the proposed action. The specific river reaches in the action areas that support coho salmon are especially important because much of the habitat outside these areas is similarly degraded and less ecologically functional. For example, the mainstem Mad River upstream of the action area is currently less viable for coho salmon, mainly because of high temperatures and a higher stream gradient than the lower Mad River in the action areas. Therefore, the Mad River action area, with moderated temperatures because of the coastal climate and lower gradient slope, is essential for the conservation of the Mad River population of SONCC coho salmon. Since we do not expect further decline in habitat quantity or quality, the conservation value of that habitat will not be appreciably diminished. However, any further decline in ecological function of coho salmon habitat in these rivers will substantially reduce its conservation value. Therefore, NOAA Fisheries has determined that SONCC coho salmon critical habitat is not likely to be destroyed or adversely modified so as to appreciably diminish the value of the critical habitat for the conservation of SONCC coho salmon.

VIII. CONCLUSIONS

After reviewing the best available scientific and commercial information, the current status of SONCC coho salmon and its designated critical habitat, CC Chinook salmon, and NC steelhead, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is NOAA Fisheries biological opinion that gravel mining under LOP 2004-1 for the five-year permit period, ending December 31, 2008, is not likely to jeopardize the continued existence of threatened SONCC coho salmon, NC steelhead, and threatened CC Chinook salmon, and is not likely to adversely modify or destroy SONCC coho salmon critical habitat.

IX. INCIDENTAL TAKE STATEMENT

Take is defined as to harass, harm, pursue, hunt, shoot, kill, trap, capture or collect, or attempt to engage in any such conduct [ESA section 3(18)]. NOAA Fisheries further defines "harm" as "an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding or sheltering" (November 8, 1999, 64 FR 60727). Incidental take is any take of listed animal species that results from, but is not the purpose of, carrying out an otherwise lawful activity. Under the terms of sections 7(b)(4) and 7(o)(2)of the ESA, taking that is incidental to and not the purpose of the agency action is not considered a prohibited taking, provided that such taking is in compliance with the terms and conditions of this ITS.

The measures described below are non-discretionary and must be undertaken by the Corps so that they become binding conditions of any grant or permit issued to an applicant, as appropriate, for the exemption in section 7(o)(2) to apply. The Corps has a continuing duty to regulate the activity covered by this ITS. If the Corps: (1) fails to assume and implement the terms and conditions or fails to require the applicant to adhere to the terms and conditions of the ITS through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Corps must report the progress of the action and its impact on the species to NOAA Fisheries as specified in the ITS [50 CFR § 402.14(i)(3)].

A. Amount or Extent of the Take

NOAA Fisheries anticipates that annual gravel mining operations under LOP 2004-1 over the five-year permit term will result in take of SONCC coho salmon, CC Chinook salmon and NC steelhead. This will primarily be in the form of harm to salmonids by impairing essential behavior patterns as a result of reductions in the quality or quantity of their habitat. NOAA Fisheries anticipates that the number of individuals harmed will be low. NOAA Fisheries anticipates that a small number of juveniles may be killed, injured, or harassed during heavy equipment use while constructing and removing temporary stream channel crossings or during instream trenching. In addition, NOAA Fisheries expects that adults and juveniles may become stranded in trenches and wetland pits. Although, the trenches will be designed to avoid stranding, unexpected river changes may cause stranding of fish with mortality before fish rescue operations commence. While we cannot reliably estimate the number of individuals that may become stranded in a given year, NOAA Fisheries expects that on the order of five adult and 10 juvenile salmonids (in any combination of the three species) may become stranded in trenches.

The take of the listed salmonids above will be difficult to detect because finding a dead or injured salmonid is unlikely as the species occurs in habitat that makes such detection difficult. The impacts of gravel mining under LOP 2004-1 will result in changes to the quality and quantity of salmonid habitat. These changes in the quantity and quality of salmonid habitat are expected to correspond to injury to, or reductions in, survival of salmonids by interfering with essential behaviors such as spawning, rearing, feeding, migrating, and sheltering. Because the expected impacts to salmonid habitat correspond with these impaired behavior patterns, NOAA Fisheries is describing the amount or extent of take anticipated from the proposed action in terms of limitations on habitat impacts. NOAA Fisheries expects that physical habitat impacts will be: (1) limited to the areas described in Table 13 below, (2) compliant with the project design features of LOP 2004-1 and this ITS, and (3) within the expected effects of the proposed action as described in this Opinion. Critical project design features in LOP 2004-1 include limiting extraction to no more than 175,000 cy/yr on the Mad River, implementing a head-of-bar buffer, giving preference to alternative extraction techniques on the South Fork Eel River, Lower Eel

River and Mad River, and limiting skim widths to no more than 90 feet as measured across the top of the extraction. We expect more frequent use of alcoves, trenches and narrow skims in these reaches in lieu of traditional skimming. Where skimming does occur in these reaches, it will occur in more confined settings (*e.g.*, the lowermost Mad River as described in this Opinion) or be smaller in extent and be located away from the low-flow channel and not adjacent to spawning habitat.

Table 13. For each river, gravel bar sites are listed from the most upstream site to the most downstream site, and are not necessarily contiguous. The approximate length of each site is measured along the center-line of the stream, adjacent to each bar. Data was provided by Humboldt County Planning Division (April 26, 2000), except for the Cook's Valley site and the Fort Seward site where data was provided by the Corps (June 27, 2000), and the McKnight site, where data was provided by the Corps (June 25, 2001).

Stream	Length (ft)	Gravel Bar Site Name
Middle Eel River	3646	Vroman and Maynard Bars
	4160	Truck Shop and Scotia Bars
	8340	Dinner Creek and Three Mile Bars
	8398	Elinor Bar
	4844	Holmes Bar
	7900	Dyerville, South Fork and Bowlby Bars
Lower Eel River	1117	Hansen Bar
	1754	Upper Sandy Prairie Bar
	3507	Canevari - Sandy Prairie Bar
	2160	Lower Sandy Prairie Bar
	3413	Warswick Bar
	2807	Singley Bar (downstream of Fernbridge)
Lower Mad River	2219	Essex Bar
	1000	Miller Almquist Bar (near Hwy 299 bridge)
South Fork Eel River	809	Cook's Valley (at the Humboldt/Mendocino County line)
	1218	Tooby Park/Garberville
	2097	Randall Sand and Gravel/Tooby Park/Garberville
South Fork Eel (cont'd)	1854	Wallen/Johnson Redway Bar (near the town of Redway)
Lower Van Duzen River	2304	Pacific Lumber Bar (near the town of Carlotta)
	661	Thomas Bess Ranch
	15506	Van Duzen Ranch
	1890	Leland Rock Gravel Bars

Stream	Length (ft)	Gravel Bar Site Name
Lower Trinity River	2000	McKnight Bar (near the town of Salyer)
	4497	Big Rock (near the town of Willow Creek)
	834	Klamath River Aggregate (near the town of Hoopa)
North Fork Mattole	4909	Cook Bar (at confluence with mainstem Mattole River)
Upper-Mid Eel	2000	Satterlee Bar near Fort Seward, at approximate river mile 68
Bear River	975	Branstetter Bar

B. Effect of the Take

NOAA Fisheries determined that the proposed action, as described, is not likely to jeopardize the continued existence of SONCC coho salmon, CC Chinook salmon or NC steelhead.

C. Reasonable and Prudent Measure

NOAA Fisheries considers that the following reasonable and prudent measure is necessary and appropriate to minimize take of SONCC coho salmon, CC Chinook salmon and NC steelhead.

The Corps shall:

1. Ensure that the monitoring necessary to track changes to salmonid habitat quality and quantity in the vicinity of gravel extraction sites is implemented.

D. Terms and Conditions

The Corps, and its permittees, must comply with the following terms and conditions, which implement the reasonable and prudent measure described above. These terms and conditions are non-discretionary.

RPM 1. Ensure that the monitoring necessary to track changes to salmonid habitat quality and quantity in the vicinity of gravel extraction sites is implemented.

a. The Corps, the applicants, CHERT and NOAA Fisheries will develop an extraction reach-specific monitoring plan by December 31, 2004. Final approval of the monitoring plan must be obtained from NOAA Fisheries prior to implementation.

b. The Corps, NOAA Fisheries and CHERT shall review cross-section protocols. If necessary, cross-section protocols shall be modified based on input from CHERT, the Corps or NOAA Fisheries. Proposals for modification will be circulated among these three entities and the permitees for review and comment prior to approval and implementation.

c. Ensure that all required monitoring is completed and that monitoring reports are provided to NOAA Fisheries each year by January 15. Reports shall be submitted to:

Irma Lagomarsino
Supervisor Arcata Area Office
National Marine Fisheries Service
1655 Heindon Road
Arcata, CA 95521

X. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Conservation recommendations are discretionary measures suggested to minimize or avoid adverse effects of a proposed action on listed species, to minimize or avoid adverse modification of critical habitat, or to develop additional information.

NOAA Fisheries considers the following conservation measure consistent with these obligations, and, therefore, should be implemented by the Corps:

1) Measures should be taken to ensure that offsite processing areas are not sources of fine sediment delivery. These measures may include, but are not limited to, creating stilling basins, silt fences and routing of effluent to areas where it may infiltrate into the soil.

2) Volume allocations for the Mad River should be tailored to the geomorphic conditions of the reach. For example, analysis of cross-section data indicates that the lower, more confined setting found in the lower river is less sensitive to extraction than the upper reach, where the river is less confined and more sensitive to channel enlargement. Future volume allocations should reflect the different response of each section of the Mad River.

In order for NOAA Fisheries to be kept informed of the actions minimizing or avoiding effects or benefitting listed species or their habitats, NOAA Fisheries requests notification of the implementation of the conservation recommendations.

XI. REINITIATION OF CONSULTATION FOR LOP 2004-1

This concludes formal consultation on the actions and processes described in LOP 2004-1 procedure. Reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the extent of incidental take is exceeded, (2) new information reveals effects of the agency action may affect listed species or critical habitat in a manner or to an extent not considered in the Opinion, (3) the agency action is modified in a manner that causes an effect to the listed species or critical habitat not considered in the Opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount of incidental take is exceeded, consultation shall be reinitiated immediately.

For example, reinitiation of consultation may be required if (1) the extraction volumes that were analyzed in the Opinion (the average CHERT recommended volumes for the period from 1997-2003) are exceeded for the South Fork Eel River (75,486 cy/yr), Middle Eel River (138,083 cy/yr), Van Duzen River (160,544 cy/yr), or the lower Eel River (405,185 cy/yr), and result in habitat changes not anticipated in this Opinion; or (2) critical project design features such as limiting extraction to no more than 175,000 cy/yr on the Mad River, implementing a head-of-bar buffer, giving preference to alternative extraction techniques on the South Fork Eel River, Lower Eel and Mad River, and limiting skim widths in the lower two miles of the Van Duzen River to no more than 90 feet as measured across the top of the extraction, are not implemented. Reinitiation of consultation is also required if additional sites other than those listed in of the ITS Table 13 are authorized by LOP 2004-1.

XII. REFERENCES

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United States Department of the Interior

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In Reply Refer To:
8-14-2005-2730

SEP 06 2005

Ms. Jane Hicks
Department of the Army
San Francisco District, Corps of Engineers
333 Market Street
San Francisco, CA 94105-2197

EXHIBIT NO. F
APPLICATION NOS.
1-09-005 (Eureka Ready Mix)
1-09-006 (Eureka Ready Mix)
1-09-011 (Hansen)
1-09-022 (Mercer-Fraser Co.)
9/6/05 FISH & WILDLIFE SERVICE BIOLOGICAL OPINION

Subject: Formal Consultation (8-14-2005-2730) on the Proposed Gravel Operations in Humboldt County, California: Letter of Permission, Procedure 2004-1

This document transmits the Fish and Wildlife Service's (Service) biological opinion based on our review of the proposed gravel operations in Humboldt County, California, and its effect on the Federally threatened western snowy plover (*Charadrius alexandrinus nivosus*) and its proposed critical habitat, in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.). Your April 28, 2004, request for formal consultation was received on May 3, 2004.

This biological opinion is based on information provided in the April 21, 2004, Public Notice for Gravel Mining Activities within Humboldt County and other sources of information. A complete administrative record of this consultation is on file at the Arcata Fish and Wildlife Office.

Consultation History

Gravel extraction has been occurring within the Eel River basin for decades, and has been regulated under many programs, including the Section 404 permit process of the Clean Water Act, administered by the Army Corps of Engineers (Corps). As a result, the Corps is the lead Federal action agency for purposes of fulfilling Section 7 obligations under the Act. Since the discovery of the Federally listed Pacific coast population of the western snowy plover (hereafter plover) on selected gravel bars within the Eel River watershed in 1996 (Tuttle, et al. 1997), the Corps has received technical assistance from the Service regarding is actions relative to the effects of gravel extraction on plovers; starting in 1996. In past years, the Corps has initiated formal Section 7 consultation for an earlier version and extension of the LOP (LOP 96-1). However, initiation of consultation began too late in the breeding season(s) to be relevant to that year's action. A complete history regarding the Corps' consultation actions and our responses are on file at our office

As a result of a multi-year effort at authorizing a new LOP, and procedural concerns with the consultation process over the years, Eureka Ready Mix requested an individual permit from the

Corps in 2004 for their operations on the Hauk bar. The Corps initiated formal consultation with us, the Service, in a March 18, 2004 letter, for Eureka Ready Mix's individual permit. Later, a July 2, 2004, request was received from the Corps to amend the previous request for a formal consultation on the individual permit, to an informal consultation. The July 2, 2004, request for an amendment was submitted without the applicant's (Eureka Ready Mix) prior knowledge (P. Kraus, pers. comm.). Eureka Ready Mix contacted the Service to let us know that they still wanted to be included in a formal consultation that provided them incidental take coverage. They also stated that their activities would be the same, or more protective to the plover than those provided under LOP 2004-1 (P. Kraus, pers. comm.). The reasoning for the switch from formal to informal consultation on Eureka Ready Mix's individual permit application was that the Corps believed protective measures incorporated in the authorization would avoid adverse effects. However, the Corps did not present that rationale for the same actions and protective measures proposed under LOP 2004-1.

Concurrent to the request for consultation on Eureka Ready Mix's individual permit, we received a request from the Corps to initiate formal Section 7 consultation under the Act for gravel extraction activities under LOP 2004-1, in an April 28, 2004, letter. Proposed activities that may affect the plover and its habitat were the same under LOP 2004-1 as those proposed by Eureka Ready Mix in their individual permit; yet the Corps had not amended the request under LOP 2004-1 to an informal consultation. Regarding LOP 2004-1, the Corps requested consultation only on gravel extraction activities on the Eel River below the confluence with the Van Duzen River, Humboldt County, California. Suitable plover habitat may occur elsewhere within the limits of the area covered by LOP 2004-1; however, the Corps was unwilling to initiate Section 7 consultation for those areas. As a consequence, we provided a letter of technical assistance dated September 10, 2004, that did not extend to plovers or those areas of suitable habitat outside of the Eel River drainage downstream of the confluence with the Van Duzen River. We also addressed Eureka Ready Mix's proposed extraction on the Hauk bar because we believed that the proposed activities were identical in scope and geographic proximity to LOP 2004-1 relative to plovers. We further stated in our technical assistance that we intended to comply with the Corps' request for formal consultation under Section 7(a)(2) of the Act for activities proposed under the LOP 2004-1 that would occur after the 2004 gravel extraction season. This biological opinion fulfills our stated intention.

Other Service Conclusions

On December 17, 2004, the Service proposed to designate the Eel River gravel bars as critical habitat for the Pacific coast population of the western snowy plover (USDI Fish and Wildlife Service 2004b). The proposed Eel River gravel bars critical habitat unit, CA 4D, is 6.4 miles long from the Town of Fernbridge, upstream to the confluence of the Van Duzen River. It contains a total of 1,193 acres of which 176 acres are owned and managed by Humboldt County, 79 acres are under the jurisdiction of the California State Lands Commission, and 938 acres are privately owned. Section 7(a)(4) of the Act requires Federal agencies to confer with the Service when proposed actions are likely to adversely modify proposed critical habitat. The Corps did not request a conference on proposed western snowy plover critical habitat. Therefore, proposed critical habitat will not be addressed further in this biological opinion. The following biological opinion will deal only with impacts to the western snowy plover.

1.3 Time-frame of Biological Opinion

This biological opinion is valid through December 31, 2008.

2.0 STATUS OF THE SPECIES: Western Snowy Plover

2.1 Legal Status

The Pacific coast population of the western snowy plover was Federally listed as threatened on March 5, 1993 (USDI Fish and Wildlife Service 1993). In August 2002, we received a petition from the Surf Ocean Beach Commission of Lompoc to delist the Pacific Coast western snowy plover population. The City of Morro Bay submitted substantially the same petition dated May 30, 2003. On March 22, 2004, we published a notice that the petition presented substantial information to indicate that delisting may be warranted (USDI Fish and Wildlife Service 2004a). We are currently conducting both a 12-month and a 5-year status review of the population under sections 4(b)(3)(B) and 4(c)(2) of the Act. In California, the western snowy plover has been classified by the California Department of Fish and Game as a "species of special concern" throughout all of California since 1978 (California Natural Diversity Database 2001).

Critical habitat was designated on December 7, 1999 (USDI Fish and Wildlife Service 1999). On June 19, 2003, the U.S. District Court for the District of Oregon found that our critical habitat designation was not consistent with the requirements of section 4(b)(2) of the Act, and remanded the designation to us; the Court partially vacated the 1999 critical habitat designation. On December 17, 2004, we published a proposed rule to re-designate critical habitat along the coasts of California, Oregon, and Washington (USDI Fish and Wildlife Service 2004b).

2.2 Taxonomy and Life History

Accounts of the taxonomy, ecology, and reproductive characteristics of the western snowy plover are found in the following recent publications: final rule listing the Pacific coast population of the western snowy plover as threatened (USDI Fish and Wildlife Service 1993); proposed rule designating critical habitat (USDI Fish and Wildlife Service 2004b); the draft recovery plan and appendices (U.S. Fish and Wildlife Service 2001); and *Snowy Plover* (Page et al. 1995).

2.3 Threats

The primary threats that warranted listing of the Pacific coast population include loss and degradation of nesting sites due to European beachgrass (*Ammophila arenaria*) encroachment and urban development; disturbance from human recreational activities; and predation exacerbated by human disturbance (USDI Fish and Wildlife Service 1993).

2.4 Conservation Needs/Strategy

The draft western snowy plover recovery plan provides a strategy for recovery of the listed population. Recovery objectives in the draft recovery plan (U.S. Fish and Wildlife Service 2001) include: (1) achieving well-distributed increases in numbers and productivity of breeding adult birds, and (2) providing for long-term protection of breeding and wintering plovers and their habitat.

The draft recovery plan states that delisting will be considered when the following criteria have been met: (1) maintain for 10 years an average of 3,000 breeding adults distributed among 6 recovery units as follows: Washington and Oregon, 250 breeding adults; Del Norte to Mendocino Counties, California, 150 breeding adults; San Francisco Bay, California, 500 breeding adults; Sonoma to Monterey Counties, 400 breeding adults; San Luis Obispo to Ventura Counties, California, 1,200 breeding adults; and Los Angeles to San Diego Counties, California, 500 breeding adults; (2) maintain a 5-year average productivity of at least 1.0 fledged chick per male in each recovery unit in the last 5 years prior to delisting; and (3) have in place participation plans among cooperating agencies, landowners, and conservation organizations to assure protection and management of breeding, wintering, and migration areas listed in Appendix B of the draft plan to maintain the subpopulation sizes and average productivity specified in criteria 1 and 2 above.

Appendix B of the draft recovery plan identifies specific breeding and wintering locations important for recovery (U.S. Fish and Wildlife Service 2001). The draft plan identifies management goals for the number of adults at each of the breeding sites and recommends that managers consistently aim to achieve these goals annually. The management goal breeding numbers represent population targets that, in the view of the snowy plover recovery team's technical subteam, can be achieved under a very intensive management scheme. These numbers are about 15 percent higher than the recovery criteria subpopulation sizes, but lower than potential carrying capacity.

The Service considers the Pacific coast plover population to be a single management entity (U.S. Fish and Wildlife Service 2001). The recovery team recommended that no state, geographic region, or subpopulation be considered for delisting separately from the others. To consider delisting the population the recovery criteria will need to be achieved in each recovery unit.

A population viability analysis was conducted to aid the recovery team in developing recovery criteria for the draft recovery plan (Nur et al. 1999). The analysis makes the following conclusions. "Under status quo scenarios, even with intensive management in some areas, the population is almost certain to decline. Without question, ceasing current management efforts (area closures, predator exclosures, and predator control) would be disastrous for the Pacific coast population." "Recovery is plausible. It will require, however, short-term intensive management and long-term commitments to maintaining gains." These conclusions emphasize the immediate need for intensive management. The most direct means to increase population size is to enhance reproductive success throughout the listed range (Nur et al. 1999).

The population viability analysis suggests that reproductive success between 1.2 to 1.3 fledglings per male per year, with adult survival of 76 percent and juvenile survival of 50 percent, provides a 57 to 82 percent probability of reaching a population of 3,000 plovers within 25 years (Nur et al. 1999). Enhancing productivity is critical to population growth. Once the population size criterion is met, a lower rate of productivity can sustain the population (U.S. Fish and Wildlife Service 2001).

The role of Federal agencies in achieving recovery of the plover is described in the draft recovery plan as follows. Lands managed by Federal agencies are extremely important to the conservation of the snowy plover. Under section 7(a)(1) of the Act, Federal agencies are required to actively promote the conservation of listed species. The snowy plover cannot be recovered simply through general habitat protection or compliance with required section 7 consultations. The snowy plover must be actively monitored and managed for the full purposes of recovery or its population size will continue to decline. Federal agencies alone cannot assure recovery of the snowy plover, but they need to significantly increase their current monitoring and management efforts now to assure survival and recovery of this species. Federal agencies should take the lead role in conserving this species and serve as examples to non-Federal landowners.

Snowy plovers must also be actively monitored and managed to achieve recovery goals on State lands or their populations will continue to decline. Regional, county, city, and private lands also need to serve a role in conserving breeding and winter habitats. The draft recovery plan identifies the following goals for these lands: 1) protect and intensively manage all breeding and wintering locations on State lands; 2) develop and implement site-specific habitat conservation plans to minimize and mitigate impacts on State lands; and 3) encourage and assist local governments and private landowners to develop and implement habitat conservation plans.

2.5 Current Conditions (Range-wide)

The current conditions incorporate the effects of all past human and natural activities or events that have led to the present-day status of the species (USDI Fish and Wildlife Service and USDC National Marine Fisheries Service 1998). The current Pacific coast western snowy plover population breeds from Damon Point, Washington, to Bahia Magdalena, Baja California, Mexico, and winters mainly in coastal areas from southern Washington to Central America (U.S. Fish and Wildlife Service 2001). The draft recovery plan identifies the following six recovery units for the Pacific Coast population: Unit 1 includes Washington and Oregon; Unit 2 includes Del Norte, Humboldt, and Mendocino Counties, California; Unit 3 includes San Francisco Bay, California; Unit 4 includes Monterey Bay, California; Unit 5 includes San Luis Obispo, Santa Barbara, and Ventura Counties, California; and Unit 6 includes Los Angeles, Orange, and San Diego Counties, California (U.S. Fish and Wildlife Service 2001).

2.5.1 Habitat and Population

2.5.1.1 Breeding Habitat (Amount and Quality)

The Pacific coast population is defined as those individuals nesting adjacent to tidal waters of the Pacific Ocean and includes all nesting birds on the mainland coast, peninsulas, offshore islands, adjacent bays, estuaries, and coastal rivers (USDI Fish and Wildlife Service 2004b). The Pacific coast population breeds primarily above the high tide line on coastal beaches, sand spits, dune-backed beaches, sparsely-vegetated dunes, beaches at creek and river mouths, and salt pans at lagoons and estuaries (U.S. Fish and Wildlife Service 2001). Less common nesting habitat includes bluff-backed beaches, dredged material disposal sites, salt pond levees, dry salt ponds, and river bars (U.S. Fish and Wildlife Service 2001). Suitable nesting habitat is distributed throughout the listed range.

The Service has identified 109 breeding locations that are important for recovery (U.S. Fish and Wildlife Service 2001). Acreage and miles of coastline by recovery unit are estimated as follows: Recovery Unit 1 (135 miles of coastline and 15,098 acres); Recovery Unit 2 (77 miles of coastline and 6,922 acres); Recovery Unit 3 (2 miles of coastline and 2,200 acres); Recovery Unit 4 (51 miles of coastline and 3,870 acres); Recovery Unit 5 (93 miles of coastline and 9,255 acres); and Recovery Unit 6 (30 miles of coastline and 7,112 acres) (U.S. Fish and Wildlife Service 2001).

The Pacific coast population has experienced widespread loss and degradation of nesting habitat at many nesting locations due to human disturbance, urban development, encroachment of introduced European beachgrass, and expanding predator populations. European beachgrass was introduced to the west coast around 1898 and now occurs from British Columbia to southern California (U.S. Fish and Wildlife Service 2001).

2.5.1.2 Breeding Population (Numbers, Distribution, and Reproduction)

Along the California coast the size of the Pacific coast population was first estimated at 1,566 adults, based on window surveys completed during the period 1977 to 1980 (Table 1). Window surveys are a one-time pass of a single surveyor or team of surveyors through potential snowy plover nesting habitat during May or June. The surveys suggested that plovers had disappeared from significant parts of its California breeding range (U.S. Fish and Wildlife Service 2001). Subsequent breeding season window surveys during 1989 and 1991 indicated a further decline in numbers (Point Reyes Bird Observatory unpublished data). Window surveys from 2001 through 2004 demonstrate an increase in observed breeders (Point Reyes Bird Observatory unpublished data), although there is still an overall decline when compared to historic breeding populations numbers. In 2004, 1,904 birds were counted along the California coast (Point Reyes Bird Observatory unpublished data). We attribute the recent population increases to the implementation of conservation strategies for this species.

The draft recovery plan provides an estimate of approximately 2,000 snowy plovers breeding along the U.S. Pacific coast (Table 2). This estimate is based on window surveys, breeding surveys, and data used in the population viability analysis. In 2004, the rangewide breeding season window survey counted 1,999 adult birds (Table 3). About 50 percent of the birds were located within the area of San Luis Obispo and Ventura Counties, California. The draft recovery plan states that delisting will be considered when an average of 3,000 breeding adults distributed among the 6 recovery units has been maintained for 10 years. The goal is for approximately 40 percent of the breeding adults to be located from San Luis Obispo to Ventura Counties. The Point Reyes Bird Observatory reports a U.S. Pacific coast population estimate of 2,600 individuals (Stenzel, *in litt.* 2004). This range-wide figure was developed by applying a multiplier to window survey data in Washington, Oregon, and California. The multiplier is based on the known number of breeders from the Observatory's Monterey Bay study site compared to the number of breeders observed at the same location on window surveys.

The current Pacific coast breeding population ranges from Damon Point, Washington, to Bahia Magdelena, Baja California, Mexico (U.S. Fish and Wildlife Service 2001). Historical records indicate that nesting plovers were once more widely distributed throughout the listed range. In Washington, plovers formerly nested at five locations; compared to only three current locations (U.S. Fish and Wildlife Service 2001). In Oregon, plovers historically nested at 29 sites, compared to nine locations used when the draft Recovery Plan was developed (U.S. Fish and Wildlife Service 2001). In California, plovers were known to nest at 53 general nesting areas prior to 1970 (Page and Stenzel 1981); as of 1991, no evidence of breeding birds had been found at 33 of those 53 areas (Page, et al. 1991). Plovers have disappeared from significant parts of the coastal California breeding range including locations in San Diego, Orange, Los Angeles, Ventura, Santa Barbara, Santa Cruz, San Mateo, Sonoma, Humboldt, and Del Norte counties (U.S. Fish and Wildlife Service 2001).

The U.S. Fish and Wildlife Service (2001) identifies the following gaps in the breeding distribution of the plover: Leadbetter Point/Gunpowder Sands, Washington south to Bayocean Spit, Oregon; Bayocean Spit south to Heceta Head, Oregon; Bandon State Park, Oregon south to Humboldt County, California; Humboldt County south to MacKerricher State Park, California; MacKerricher State Park south to Salmon Creek or Marin County, California; and Point Sur, California south to San Carpoforo Creek, California.

The fledging success of snowy plovers (percentage of hatched young that reach flying age) varies greatly by location and year (U.S. Fish and Wildlife Service 2001). The draft recovery plan uses the annual number of young fledged per adult male to assess reproductive success. Reproductive success for various sites was as follows: 1) Monterey Bay without predator control and exclosures, males averaged 0.85 fledglings annually (1984 to 1991); with predator control and exclosures, males averaged 1.11 fledglings (1992 to 1997); 2) San Diego County with some indirect management activities, males averaged 0.92 fledged young (1995 to 1997); and 3) Oregon with intensive management, males averaged 1.04 fledglings (1993 to 1997) (Nur et al. 1999). The draft recovery plan states that delisting will be considered when a 5-year average productivity of at least 1.0 fledged chick per male has been achieved in each recovery unit.

2.5.1.3 Wintering Habitat (Amount and Quality)
Wintering (winter is defined as November 1 through February) plovers are found on many beaches used for nesting and some beaches where nesting does not occur (U.S. Fish and Wildlife Service 2001). In California, the majority of wintering plovers utilize sand spits and dune-backed beaches (U.S. Fish and Wildlife Service 2001). Suitable wintering habitat is distributed throughout the listed range of the snowy plover.

The Service has identified 143 wintering locations that are important for recovery (U.S. Fish and Wildlife Service 2001). We also estimated the following acreage and miles of coast line for each of these locations: Recovery Unit 1 (91 miles of coastline and 10,446 acres); Recovery Unit 2 (80 miles of coastline and 8,336 acres); Recovery Unit 3 (2 miles of coastline and 2,200 acres); Recovery Unit 4 (64 miles of coastline and 4,654 acres); Recovery Unit 5 (107 miles of coastline and 9,785 acres); and Recovery Unit 6 (79 miles of coastline and 9,931 acres) (U.S. Fish and Wildlife Service 2001).

The Pacific coast plover population has experienced widespread loss and degradation of wintering habitat due to human disturbance, development, and encroachment of introduced European beachgrass. Small changes in the adult survival rate can have relatively large effects on population stability (Nur et al. 1999), so the maintenance of quality overwintering habitat is important to conservation (USDI Fish and Wildlife Service 2004b).

2.5.1.4 Wintering Population (Numbers and Distribution)
Fewer than 40 plovers winter on the Washington coast, fewer than 100 winter on the Oregon coast, and more than 2,500 winter along the California coast (U.S. Fish and Wildlife Service 2001). In 1986, the estimated winter population for the California and Oregon coast was 3,100 plovers (Page et al. 1986). The 2005 winter window survey numbers for California and Oregon are 3,426 and 97, respectively, totaling 3,523 individuals (Page, 2005. *in litt.*, Kelly, 2005. *in litt.*).

Plovers winter at two locations on the Washington coast, at nine locations on the Oregon coast, and at various locations along the California coast (U.S. Fish and Wildlife Service 2001). The majority of wintering birds in California are found from Sonoma County southward.

2.6 Current Conditions (Recovery Unit 2 - Del Norte, Humboldt, and Mendocino Counties)

2.6.1 Habitat and Population

2.6.1.1. Breeding Habitat (Amount and Quality)
The draft recovery plan identifies 12 breeding locations in Recovery Unit 2 that are important for recovery (Table 4). Since 1999, nesting has only been documented at six of these 12 locations: Clam Beach/Little River; Humboldt Bay, south spit; Eel River, north spit and beach; Eel River gravel bars, Eel River, south spit and beach, and MacKerricher State Park (LeValley 1999; Mad River Biologists 2000; Colwell, et al. 2001). In recent years, nesting has also been documented at the following sites not included in the above list: Gold Bluffs Beach (Humboldt County) and

Brush Creek (Mendocino County). Preliminary data for the 2005 breeding season also shows 2 nests at Big Lagoon State Park (Transou, 2005).

In Humboldt County, the majority of the breeding plovers occur in two locations, Clam Beach/Little River and the Eel River gravel bars. The quality of the available habitat in these areas is heavily impacted by human use. Vehicles are allowed in or adjacent to nesting habitat at both of these areas. The Clam Beach/Little River area is heavily used by recreationists. On Clam Beach/Little River, street-licensed 4-wheel drive vehicles are allowed to drive on the waveslope. The southern portion of this beach is closed to recreational vehicles during the nesting season; however, permitted commercial fishermen are allowed to drive vehicles during the day and night. Tire tracks above the waveslope showing evidence of vehicle play are frequently observed on this beach. Vehicle tracks indicating regular driving in tight circular tracks have been noted in areas where adults tend broods (Colwell, et al. 2001). It is not unusual after a holiday weekend for the entire area on the northern portion of the beach from the waterline to the foredunes to be covered by vehicle tracks. Ruts created by vehicle tracks make it difficult for plover chicks to avoid oncoming vehicles, horses, unleashed dogs, predators, or other hazards.

In 2004, daily morning focal observations were made of incubating plovers throughout the nesting season at Clam Beach (Colwell et al. 2004). The frequency with which human activities occurred within 150 meters of 11 nests (6 nests on the north section of Clam Beach and 5 nests on the south section) was recorded (Colwell et al. 2004). Human activities averaged nearly seven times greater on the north end than south end of the beach, although there was considerable variation among nests (Colwell et al. 2004). Even though these observations are restricted to the vicinity of the nest sites, they are indicative of the relative levels of recreational activity on the north and south sections of Clam Beach. In 2004, 40 percent of the chicks hatched on the north section fledged and 69 percent of the chicks hatched on the south section fledged (Colwell et al. 2004). In 2003, 9 percent of the chicks on the north section fledged and 21 percent of the chicks on the south section fledged (Colwell et al. 2003).

No restrictions on recreational vehicle use exist for the Eel River gravel bar nesting areas. Depending on public access, significant disturbance of the nesting areas along the Eel River may occur due to four-wheel drive vehicles, motorcycles, wood collecting, target shooting, and homeless encampments (Mad River Biologists 2000). Plover researchers have documented vehicles destroying nests on the gravel bars in multiple years (Colwell, et al. 2004). Vehicle use related to gravel mining along the Eel River is governed by permits from the California Coastal Commission and the U.S. Army Corps of Engineers.

2.6.1.2 Breeding Population (Numbers, Distribution, and Reproduction)
In 2004, the estimated number of breeding plovers in Recovery Unit 2 was 72 (37 females and 35 males) (Colwell et al. 2004). There were no breeding plovers in Del Norte County, 62 in Humboldt County, and 10 in Mendocino County (Colwell et al. 2004). The 2004 population represents 36 percent of the draft recovery plan management goal of 200 breeding adults in Recovery Unit 2. This breaks down to 0 percent of the draft management goal of 18 breeding adults in Del Norte County, 38 percent of the draft management goal of 162 breeding adults in Humboldt County, 50 percent of the draft management goal of 20 breeding adults in Mendocino County (Table 4).

From 2000-2003, adult survival was estimated for color-banded plovers breeding in Humboldt County (Colwell et al. 2004). During this period, the number of marked adults ranged from 36 to 59. Annual adult survival ranged from 0.59 ± 0.06 to 0.81 ± 0.05 (Colwell et al. 2004). The population viability analysis for the listed subspecies assumed an adult survival rate of 76 percent for all subpopulations, but also modeled population trajectories with adult survival rates of 75 and 77percent (Nur et al. 1999). The results of the analysis showed that even a one percent change in adult survival can have a substantial impact on population growth (Nur et al. 1999).

Since 1977, plovers have nested at two locations in Del Norte County, 11 locations in Humboldt County, and two locations in Mendocino County (Page and Stenzel 1981; LeValley 1999; Mad River Biologists 2000; Colwell, et al. 2001; Colwell et al. 2004). Since 1999, no nesting has occurred in Del Norte County, nesting occurred at the following six locations in Humboldt County: Gold Bluffs Beach, Clam Beach/Little River; South Spit; Eel River Wildlife Area; Centerville Beach, and Eel River gravel bars, and occurred at MacKerricher and Manchester State Parks in Mendocino County (LeValley 1999; Mad River Biologists 2000; Colwell, et al. 2001; Colwell et al. 2004). In recent years, no nesting has been documented at the following historic Del Norte County nesting areas: Lake Talawa and Smith River spit, and no nesting has been documented at the following historic Humboldt County nesting areas: Big Lagoon, Mad River north, Lanphere Dunes, Samoa Spit, or Elk River. In summary, since the late 1970's the number of nesting locations has declined 100 percent in Del Norte County, declined 45 percent in Humboldt County, and remain the same in Mendocino County (Table 5).

Since 1977, window surveys in Recovery Unit 2 have documented birds during the breeding season at the following 15 locations: Del Norte County - Smith River mouth and Lake Earl/Lake Talawa; Humboldt County – Gold Bluffs Beach, Big Lagoon, Clam Beach/Little River, Mad River spit, Lanphere Dunes, north spit of Humboldt Bay, south spit of Humboldt Bay, Eel River gravel bars, Eel River Wildlife Area, and south spit of Eel River; Elk River spit, and Mendocino County - MacKerricher and Manchester State Parks. Clam Beach/Little River is the only site in Humboldt County where breeding birds were sighted during every survey year. Since at least 1991, breeding birds have not been present during the window survey period in the following four locations: Smith River mouth, Lake Earl/Lake Talawa, Lanphere Dunes, and Elk River spit. Since 2000, breeding birds have consistently only occurred at three locations (Clam Beach/Little River; Eel River Wildlife Area; and the Eel River gravel bars).

Based on the 2004 surveys, breeding plovers were only sighted on 5 (42 percent) of the 12 breeding sites in Recovery Unit 2 identified as important for recovery in the draft recovery plan (Table 4). The five sites are Clam Beach/Little River; Humboldt Bay south spit; Eel River gravel bars; Eel River south spit, and MacKerricher State Park. The 2004 number of breeding birds at only one of the 12 sites (Clam Beach/Little River) met or exceeded the draft recovery plan's management goal (Colwell, et al. 2004).

In California, pre-nesting bonds and courtship activities are observed as early as mid-February (U.S. Fish and Wildlife Service 2001). From 2001 through 2004, the earliest nest initiation dates in Humboldt County have been as follows: 2003 (March 18), 2002 (March 19), 2001 (March 25), and 2004 (March 26) (Colwell, et al. 2002; Colwell, et al. 2003; Colwell, et al. 2004). From 2001 through 2004, the latest nest initiation dates in Humboldt County have been as follows: 2002 (July 17), 2003 (July 15), 2004 (July 14), and 2001 (July 6) (Colwell, et al. 2002; Colwell, et al. 2003; Colwell, et al. 2004).

In 2004, males breeding in Recovery Unit 2 fledged 1.2 ± 1.1 chicks (Colwell et al. 2004). In one of the past four years, annual reproductive success for Recovery Unit 2 exceeded 1.3 fledged chicks per male (2001, 1.7 ± 1.4) (Colwell et al. 2004), which is the target for an increasing population assuming adult survival of at least 76 percent and juvenile survival of 50 percent (Nur et al. 1999). The 4-year (2001-2004) average productivity for Recovery Unit 2 has been 1.2 chicks fledged per male. Over the past 4 years, males that nested on the Eel River gravel bars fledged significantly more chicks (1.5± 1.4) than those breeding on ocean beaches (0.8± 1.0) (Colwell et al. 2004). In 2004 and 2005, productivity on the gravel bars has declined, so it is likely that future overall productivity for the recovery unit may also decline.

In 2004, a total of 76 chicks hatched in Recovery Unit 2 and 39 of these chicks survived to 28 days (Colwell, et al. 2004). The majority (87 percent) of the chicks fledged from Clam Beach and the Eel River gravel bars. On beaches, 43 percent of 46 chicks successfully fledged, whereas 60 percent of 30 chicks fledged on the gravel bars (Colwell et al. 2004). Of the chicks that died, most (82 percent; n=33 chicks) succumbed within 10 days of hatching (Colwell et al. 2004).

In 2004, the number of breeding males (35) in Recovery Unit 2 was well below the recovery target of 75 males (population target of 150 and assuming a 1:1 sex ratio). Therefore, in addition to producing few chicks per male, the recovery unit had a low number of males. Increasing the current population size will require relatively high productivity, juvenile survival, and adult survival. To achieve this objective, intensive management of nesting areas will be required.

2.6.1.3 Wintering Habitat (Amount and Distribution)
The draft recovery plan identifies 14 wintering locations in Recovery Unit 2 that are important for recovery (Table 6). Potential winter habitat is distributed in Recovery Unit 2 as follows: 12 miles of coastline (1,700 acres) in Del Norte County; 45 miles of coastline (5,450 acres) in Humboldt County; and 11 miles of coastline (1,170 acres) in Mendocino County (U.S. Fish and Wildlife Service 2001).

Habitat quality at wintering locations has been lost or degraded due to human disturbance and European beachgrass.

2.6.1.4 Wintering Population (Numbers and Distribution)
Between 1979 and 1985, 89 wintering plovers were recorded in Recovery Unit 2, based on the median of the maximum number of plovers counted (Table 6) (Page, et al. 1986). Winter window surveys in Recovery Unit 2 recorded 155 adult plovers in 2001; 123 plovers in 2002; 168 in 2003; and 147 in 2004 (Table 6).

The draft recovery plan identifies 14 wintering locations in Recovery Unit 2 that are important for recovery. Table 6 summarizes the results of winter window surveys conducted in these areas

2.7 Conservation Needs/Strategy Recovery Unit 2

The draft recovery plan identifies management goals for the number of breeding adults in Recovery Unit 2 (U.S. Fish and Wildlife Service 2001, Appendix B, Table B-1) (Table 4). Management goals are about 15 percent higher than the recovery criteria subpopulation sizes. The draft recovery plan also identifies the following delisting criteria for Recovery Unit 2; 1) maintain for 10 years an average of 150 breeding adults; maintain a 5-year average productivity of at least 1.0 fledged chick per male; and 3) have in place participation plans among cooperating agencies, landowners, and conservation organizations to assure protection and management of the breeding listed in Table 4 and for the wintering areas listed in Table 6 to maintain the population size and average productivity specified in criteria 1 and 2.

3.0 ENVIRONMENTAL BASELINE (in the Action Area)

Regulations implementing the Act (50 CFR 402.02) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed State or Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation process. As stated earlier, the action area for this consultation includes the Lower Eel River, downstream of the Van Duzen River.

3.1 Breeding Season

In California, pre-nesting bonds and courtship activities of western snowy plovers have been observed as early as mid-February (U.S. Fish and Wildlife Service 2001). The earliest nest initiation dates in Humboldt County have been as follows: 2001 (March 25), 2002 (March 19), 2003 March 18 (Colwell, et al. 2002), and 2004 (March 26) (Colwell, et al. 2004).

The gravel bars along the Eel River are unique and productive breeding habitat for plovers in Humboldt County (Colwell, et al. 2004). Plovers were first documented nesting on the gravel bars along the Eel River in 1996 (Tuttle, et al. 1997), although observation records indicate plovers may have been nesting on the gravel bars in 1983 (Hunter, et al 2005). Plovers have been observed along the Eel River from early April until early September (Mad River Biologists 2002). Data from the current 2005 breeding season indicates that plover chicks from three nests are likely to be present on the County's Worswick Bar until early September (MRBR 2005).

3.2. Current Condition (Action Area)

3.2.1 Habitat and Population

3.2.1.1 Breeding Habitat (Amount and Quality)

The Service has identified the gravel bars along the Eel River downstream from the mouth to the Van Duzen River, as a breeding area that is important for the recovery of the snowy plover (U.S. Fish and Wildlife Service 2001, Appendix B). The action area is comprised of approximately 1190 acres of habitat; all of which may not be suitable to the plover. In 2002, the amount of potentially suitable nesting habitat along the Eel River downstream from the confluence with the Van Duzen River was estimated to be approximately 806 acres (Mad River Biologists 2002). The amount of available gravel bar habitat varies each year depending on river flow levels (Mad River Biologists 2002). The 2002 estimate of 806 acres includes gravel bars not identified in the action area for the proposed action. Additionally, the Eel River is a dynamic system where gravel bars change from year to year, and river banks erode. Although the action area is confined by levees, bank erosion upstream can significantly contribute towards gravel deposits along the stretch of river within the action area.

The gravel bars include substrates ranging from pea-sized gravel to bowling ball-sized cobble mixed with sand and/or silt (Mad River Biologists 2000). From 1996-2000, approximately 12 percent (range 11-15 percent) of the potentially suitable habitat along the Eel River was mined for gravel in any one year (Mad River Biologists 2002). Generally, plovers along the Eel River select low gradient, topographically uniform sites for nesting (Mad River Biologists 2002). Plovers have been documented nesting in locations where gravel mining occurred in the previous year (Mad River Biologists 2001a).

On the gravel bars, substrates at plover nests are larger ($P=0.0002$), more heterogeneous ($P=.00004$), and have more egg-sized stones ($P=0.004$) than random sites (Colwell, et al. 2004). However, there was no difference in substrate size, heterogeneity, or number of egg-sized stones between successful and unsuccessful nest sites (Colwell, et al. 2004). It appears that plovers on the gravel bars select nest sites enhancing egg crypsis, although this behavior does not appear to influence nest success (Colwell, et al. 2004).

The gravel bars are mostly privately owned with one site, Worswick, owned by Humboldt County. Depending on public access, significant disturbance of the nesting areas along the Eel River may occur due to recreational use of four-wheel drive vehicles and motorcycles, wood collecting, target shooting, and homeless encampments (Mad River Biologists 2000). Little or no enforcement of these activities exists (Mad River Biologists 2000). Hall (2004) noted that anecdotal evidence indicates that human activity, particularly vehicle use, is increasing on the gravel bars that have easily accessible points of entry.

From 2001 through 2004, corvids were more prevalent on the gravel bars than in beach nesting areas, although the differences were significant in only two years (Colwell, et al. 2004). Corvid abundance on the gravel bars averaged 2 to 3 times that found on the beaches (Colwell, et al. 2004). Humans, dogs, and vehicles were found to be 5 to 10 times more abundant on the beaches than the gravel bars (Colwell, et al. 2004). During this same period, beach nesting males fledged significantly fewer chicks than males nesting on the gravel bars (Colwell, et al 2004).

3.2.1.2 Breeding Population (Numbers, Distribution, and Reproduction)
Plover numbers are difficult to compare from year-to-year because of variations in survey efforts. Annual survey efforts in the action area have ranged from one-day window surveys to bi-monthly, weekly, or daily surveys. The window survey results are not comparable to the more frequent surveys efforts; therefore, these results are discussed separately. Breeding season window surveys in 1991 and 1995 did not record plovers on the Eel River (Point Reyes Bird Observatory 2000 and 2002 unpublished reports). However, 22 and 26 adult plovers were recorded during window surveys along the Eel River in 2000 and 2002, respectively.

The Eel River gravel bars have been intensively monitored since 2001, yielding the following annual number of breeding adults: 39 adults in 2001 (Colwell, et al. 2001); 34 adults in 2002 (Colwell, et al. 2002); 31 adults in 2003 (Colwell, et al. 2003); and 27 adults in 2004 (Colwell, et al. 2004). The 27 breeding birds observed in 2004 represent 68 percent of the draft recovery plan's population target of 40 breeding adults for the Eel River. It also represented 42 percent of the total number of breeding birds (64) in Humboldt County during 2004.

Plovers occur on virtually all gravel bars with suitable habitat along the Eel River from Cock Robin Island upstream to the mouth of the Van Duzen River (Mad River Biologists 2002). The majority of the breeding activity has been near Fernbridge (Mad River Biologists 2002). Broods are typically observed at or near the edge of the river, presumably where prey items are most available (Mad River Biologists 2002). During the four-year period 2001-2004, scattered nests occurred along the gravel bars with concentrations of plovers at the county-owned Worswick and the Loleta gravel bar (Colwell, et al. 2004).

Surveys on the Eel River gravel bars from 1999 through 2004 documented the following nest success: 1999, 6 nests; 33 percent of which hatched (LeValley 1999); 2000, 18 nests; 78 percent of which hatched (Mad River Biologists 2001b); 2001, 39 nests; 64 percent of which hatched (Colwell, et al. 2001); 2002, 30 nests; 53 percent of which hatched (Colwell, et al. 2002); 2003, 36 nests; 42 percent of which hatched (Colwell, et al. 2003); and 2004, 25 nests, 48 percent of which hatched.

Ravens and crows are common at beach and river plover nesting areas and have been observed depredating eggs and chicks (Colwell, et al. 2004). Plovers nesting along the gravel bars consistently experience higher reproductive success than plovers nesting on beaches (Colwell, et al. 2004). From 2001 through 2004 in Humboldt County, male plovers nesting on the gravel bars fledged significantly more chicks (1.5± 1.4 chicks per male) than plovers breeding on ocean beaches (0.8± 1.0). Predator exclosures have not been installed around nests on the gravel bars because the gravel and rock substrate makes construction of exclosures difficult.

Intensive monitoring since 2001, has shown that most of the plovers in Recovery Unit 2 nest on the gravel bars and that both hatching and fledging success of gravel bar nesting plovers has been significantly higher than beach nesting plovers (Colwell, et al. 2004). Colwell, et al 2004 surmises that clutches survive better in the cryptic gravel substrates than beach substrates.

3.2.1.3 Wintering Habitat and Population
We assume that snowy plovers leave the gravel bars after the last broods fledge (Mad River Biologists 2002). To date, no plovers have been documented wintering in the action area.

4.0 EFFECTS OF THE ACTION

This section presents an analysis of the direct and indirect effects of the proposed action, including interrelated and interdependent actions, on the western snowy plover and its proposed critical habitat. The effects of the proposed gravel operations will be evaluated with respect to the numbers, distribution, and reproduction of western snowy plovers in the action area.

4.1 Scientific Basis for Evaluating Potential Effects on the Western Snowy Plover

The proposed action has the potential to result in adverse effects to the western snowy plover through habitat modification, harassment, and direct mortality. These mechanisms are discussed in more detail below.

4.1.1 Habitat Modification
Proposed gravel mining activities will physically modify suitable western snowy plover nesting habitat. Snowy plovers are visually oriented. They rely on their eyesight to detect food items and potential predators. Proposed gravel extraction activities that will physically modify suitable habitat resulting in flat or gently sloped bars, and the removal or maintenance of areas devoid of vegetation and debris, have been considered by some as a benefit to nesting plovers (Mad River Biologists 2002). Conversely, snowy plover chicks are known to hide near debris items or vegetation when threatened. As a result, removing debris or herbaceous vegetation through gravel extraction could put chicks at an increased risk to predation (Mad River Biologists 2002).

Scraping, as an extraction methodology, could modify gravel bars to potentially enhance nesting habitat by providing low gradient, topographically uniform bars that lack debris and dense vegetation (Mad River Biologists 2002). At some locations, extraction has resulted in low terraces, or shelves, that break up the bar's topography and consequently restrict a plovers' field of view. These 'terraces' could restrict an incubating plover's ability to detect an approaching mammalian predator (Mad River Biologists 2002).

Trenching, as an extraction method will physically modify suitable habitat. After gravel extraction, any berms are breached and the trench is connected to the river. Trenches could result in injury or death as described below. However, trenches should not impair the plovers' ability to detect predators or food items because neither plovers nor their predators are likely to use the trenches. On an annual basis, trenches are likely to be filled in with gravel after the breeding season by over-winter flows. Trenching potentially affects less surface area, thereby reducing the amount of habitat disturbed. This is especially true when a low water year follows extraction, and gravel recruitment is therefore low.

Plovers continue to use mined and unmined gravel bars habitats with no apparent difference in nest or chick survivorship (Mad River Biologists 2001a). Whereas plover nesting was concentrated on the upper gravel bars near the Van Duzen River in the late 1990's and early 2000, there has been a shift to the Worswick bar (Fernbridge) and unmined gravel bars downstream, where gravel mining does not occur (Colwell, et al. 2004).
In summary, it is unclear if gravel mining activities that physically modify suitable habitat are beneficial or adverse to the species. The affects to habitat largely depend on the technique utilized, quantities extracted, and the timing of the activities.

4.1.2 Harassment
The proposed activities will require the use of personnel, heavy equipment, and vehicles, all of which introduce high levels of noise and human activity into the environment. Disturbance from human presence or activities during the breeding season may potentially disrupt the species' essential breeding behaviors by causing: 1) abandonment of the breeding effort by failure to initiate nesting or to complete incubation; 2) separation of adults from their broods; and 3) deterring adults and broods from utilizing favored foraging areas. The potential effects of disturbance will depend on the frequency, timing, location, and intensity of activities.

There is a single observation of a bulldozer operating at approximately 1,000 feet from an active plover nest on an Eel River gravel bar. The incubating plover showed no apparent sign of distress (Mad River Biologists 2002). Based on this observation, disturbance from noise and activity associated with gravel mining is not likely to be adverse if the activity is greater than 1,000 feet from plovers.

4.1.3 Injury or Mortality
The draft recovery plan (U.S. Fish and Wildlife Service 2001) summarizes potential ways activities may cause mortality of plovers. Plover chicks and eggs are highly cryptic, making them difficult to see, even at close range. Many species that predate on plover chicks are visual predators. When in the presence of danger, snowy plover chicks tend to 'freeze' in place and rely on their cryptic plumage for safety from these visual predators. Pedestrians, vehicles, and heavy equipment may crush highly cryptic eggs or chicks and flush adult plovers off their nests. Separation of plover adults from their nests and broods can cause mortality through exposure of eggs or chicks to heat, cold, blowing sand, and/or predators. Repeated disturbances may cause plovers to nest in marginal habitat where their chances of reproductive success are reduced.

Vehicle and heavy equipment traffic presents a very real threat to the survival of plover eggs and chicks. Circumstantial evidence indicates that vehicles crushed nests at Clam Beach/Little River in 1998 and 2002. A vehicle crushed an active nest on the Eel River gravel bar in 2002 (U.S. Fish and Wildlife Service unpublished data). Vehicles crushed adult plovers at Vandenberg Air Force Base and Oceano Dunes State Vehicular Recreation Area in 1994 and 1998, respectively. A snowy plover chick was stepped on during the 1998 nesting season by a pedestrian at Oceano Dunes State Vehicular Recreation Area, in a portion of the park closed to vehicle use (U.S. Fish and Wildlife Service unpublished data).

Trenching, as an extraction method, may entrap flightless chicks. Trenches may be as deep as the reach of the equipment. If a flightless chick becomes entrapped in a trench, it could be more vulnerable to predation or may die due to starvation.

In summary, injury or mortality of adults, chicks, or eggs could occur from gravel mining activities as described above.

4.2 Analysis of Project Effects

4.2.1 Likelihood of Species Presence
Potentially suitable nesting habitat exists on all the gravel bars in the action area. In July 2005, three nests were located on the Worswick Bar. In the past, plovers have nested at the Hauk Bar site on the Eel River approximately 0.25 to 0.50 mile downstream from the confluence with the Van Duzen River. As many as 39 breeding plovers have been documented along the Eel River. An estimated 27 plovers nested along the Eel River gravel bars in 2004 (Colwell, et al. 2004).

Habitat suitability fluctuates annually along the Eel River. In high water years many gravel bars may still be submerged early in the nesting season, while in low water years, more gravel bars will be exposed. However, in low water years vegetation may become established earlier in the year and reduce the overall amount of available habitat (Mad River Biologists 2002). The quantity of gravel that is re-deposited every year is variable depending upon flows.

4.2.2 Habitat Modification
Modification of suitable plover nesting habitat will occur on the gravel bars annually as a result of gravel operations. Gravel mining activities are likely to alter the topography of the natural gravel bars. An estimated 1,190 acres of gravel bars could be modified during each year of the LOP period. Mad River Biologists' 2002 estimate of 806 acres of suitable nesting habitat could potentially be modified annually. We do not anticipate that snowy plovers will be adversely affected due to habitat modification for the following reasons: 1) plovers along the Eel River have nested successfully in areas mined for gravel in the previous year (Mad River Biologists 2001a, Colwell, et al. 2004); 2) gravel extraction does not appear to adversely affect nesting habitat or success downstream from the action area; and 3) during all but a low water year, it is expected that water levels during the winter will redeposit gravel throughout the action area.

4.2.3 Harassment
Project-generated noise and activities, including the presence of workers and use of vehicles and heavy equipment, may disturb adults and/or chicks. Repeated auditory or visual disturbances can interrupt brooding, incubating, and foraging of adults and cause chicks to be separated from their parents.

The proposed action includes measures to reduce impacts. Among other restrictions, operators must ensure that extraction activities do not occur when plovers or nests are within 1,000 feet of an extraction site. However, due to cryptic nature of plover nests, active nests could be missed or plovers could wander into a work area after surveys are complete. We anticipate that the level of activity associated with the proposed action will likely result in adverse affects due to harassment to an unknown number of plover adults or chicks in the action area during the LOP period.

4.2.4 Injury or Mortality
Mortality of adults, chicks, and eggs may occur as a result of collisions with extraction equipment and/or workers. Plover eggs in the gravel bar environment are especially difficult to detect. It is possible that chicks from an undetected nest or adults may enter the extraction areas during extraction and after daily surveys. Undetected nests, chicks, or adults in the extraction areas will be highly vulnerable to injury or mortality from crushing or entrapment.

The likelihood of injury or mortality will be minimized by the protective measures described in the project description, Section 1.1 of this BO. It is unlikely that more than one nest would be established within the action area during the LOP period that would be missed during surveys because surveyors are well trained, and pre-approved by the Service. The typical plover clutch size is three. Therefore, we expect that three eggs associated with one nest could be lost either directly or indirectly due to proposed gravel extraction activities. It is unlikely that more than one flightless chick would wander into the area after surveys are complete. Therefore we expect that no more than one chick would be lost due to proposed gravel extraction activities.

4.2.5 Effects on Numbers

The proposed action could affect the number of snowy plovers by disturbing reproductive efforts and by injury or mortality. The Eel River is identified in the draft recovery plan as a breeding location important for recovery. Current plover use (27 breeding adults in 2004 (Colwell, et al. 2004)) along the Eel River is below the draft recovery plan's population target of 40 breeding adults for recovery. The proposed action will not likely prevent achievement of the draft recovery plan's population target for the following reasons: 1) the likelihood of adverse affects to plovers will be minimized through project minimization measures, and 2) during the LOP period, we anticipate, at most, harm of one nest (three eggs) and one chick due to implementation of the Corps' action.

4.2.6 Effects on Distribution

The draft recovery plan identifies 12 breeding sites in Recovery Unit 2 that are important for recovery (Table 1). For the past three years, nesting has only occurred at four of these locations (Clam Beach/Little River, Eel River Wildlife Area, Humboldt Bay south spit, and Eel River gravel bars). The proposed action will affect plovers at only one of these breeding sites, and is not expected to eliminate plover use of the Eel River gravel bars. Therefore, it is unlikely that the proposed action will influence the long-term distribution of breeding plovers along the Eel River or within Recovery Unit 2.

4.2.7 Effects on Reproduction

In 2002, 47 percent of the nests (14 of 30) along the Eel River did not successfully hatch and 50 percent (20 of 40) of the hatched chicks failed to fledge (Colwell, et al. 2002). The cause of most of the clutch failures is unknown; however, predation is suspected to be the cause in most cases, and vehicles in three (Colwell, et al. 2002). Results during the 2004 breeding season indicated that 52 percent of the nests hatched along the gravel bars (13 of 25), with 19 chicks fledging (Colwell, 2004).

In 2002, 87 percent (20 of 23) of the chicks fledged in Humboldt County came from nests on the Eel River gravel bars (Colwell, et al. 2002). Males on the Eel River fledged 1.46 ± 1.13 chicks in 2002 (Colwell, et al. 2002) and 1.6 ± 1.6 chicks in 2001 (Colwell, et al. 2001). This represents a 2-year average productivity of 1.5 fledged chicks per male along the Eel River. The draft recovery plan indicates that a productivity of 1.2 or more chicks fledged per male should increase population size at a moderate rate. The delisting criteria is to maintain a 5-year average productivity of at least 1.0 fledged chicks per male. This level of productivity should result in a stable population.

We do not anticipate that the potential loss of one nest (three eggs) during the four years of gravel extraction will hinder the long-term attainment of the draft recovery plan's target for productivity. Since plovers are known to re-nest after loss of their eggs, it is possible that if a nest is destroyed the adults may still be successful at fledging chicks that year. The 2-year average productivity for male plovers along the Eel River, during 2001 and 2002, was 1.5 fledged chicks. If one additional nest had failed in one of these two years the average productivity level would still have been above the level (1.0 fledged chicks per male) necessary to maintain a stable population.

Therefore, assuming that the productivity during the four-year extraction period is similar to the rates in 2001 and 2002, the potential lost of one additional nest is not expected to hinder the long-term attainment of the plan's target for productivity on the Eel River.

4.2.8 Summary

The proposed gravel extraction activities may harass plover adults and chicks within 1,000 feet of the project during four breeding seasons. Plovers will not be adversely affected due to habitat modification, since the topography of the gravel bar will be restored after construction and plovers are known to have successfully nested in areas mined for gravel the previous year. During the four-year construction period, a maximum of three eggs associated with one nest and one chick may be harmed. We do not expect the proposed project to effect any of the following: 1) attainment of the draft recovery plan's population target for the Eel River; 2) long-term distribution of breeding plovers along the Eel River or within Recovery Unit 2; or 3) achievement of the draft recovery plan's target for productivity. Therefore, the proposed project is not expected to impede recovery of plovers in this important breeding location.

4.2.9 Interrelated and Interdependent Activities

Regulations implementing the Act require the Service to consider the effect of activities which are interrelated and interdependent to the proposed action (50 CFR 402.02). The Act defines interrelated activities as those which are part of a larger action and depend upon the larger action for their justification, and interdependent activities as those projects which have no independent utility apart from the action that is under consideration.

Gravel mining access to the gravel bars also provides incidental access for recreationists, many of whom operate vehicles for fishing, target shooting, or vehicle play. It is the belief of researchers that nest loss due to vehicles on the gravel bars is attributed to recreationists (Colwell, et. al. 2003). In addition, vehicles are used to deposit trash on the gravel bars, potentially attracting corvids and other nest and chick predators. Access to Humboldt County's Worswick bar has been gated, and berms or other barriers have been installed during the summer months in an attempt to deter vehicle access from the County's extraction and storage facility. However, vehicles continue to access the gravel bars from other sites, such as private land across from the Worswick bar.

5.0 CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. The majority of the suitable nesting habitat along the Eel River is either under private ownership, or under the management of the California State Lands Commission, and recreational vehicle traffic on some gravel bars is high. Four plover nests were crushed by vehicles on the Eel River gravel bars in 2003. Due to the increasing recreational use of the gravel bars, it is likely that additional plover nests or chicks could be crushed in the future.

6.0 CONCLUSION

After reviewing the current status of the western snowy plover, the environmental baseline for the action area, and the effects of the proposed gravel operations in Humboldt County, and the cumulative effects, it is the Service's biological opinion that the gravel operations, as proposed, are not likely to jeopardize the continued existence of the western snowy plover.

The Service reached this conclusion based on the following factors:

1. Conservation measures included in the proposed action will minimize the likelihood of injury, mortality, or harassment of adult snowy plovers, eggs and chicks.

2. It is believed that the habitat modifications of the gravel bars could be beneficial as well as adverse to the suitability of the substrate as nesting habitat.

3. Attainment of the draft recovery plan's management goals for the Eel River and Recovery Unit 2 will not be compromised by the proposed action.

INCIDENTAL TAKE STATEMENT

1.0 INTRODUCTION

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act, prohibit the take of endangered and threatened species, respectively, without a special exemption. Take is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under that Act provided that such taking is in compliance with this Incidental Take Statement.

The measure described below is non-discretionary, and must be undertaken by the ACOE so that it becomes a binding condition of any grant or permit issued to the applicant, as appropriate, for the exemption in section 7(o)(2) to apply. The ACOE has a continuing duty to regulate the activity covered by this incidental take statement. If the ACOE (1) fail to assume and implement the terms and conditions or (2) fail to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the ACOE must report the progress of the action and its impact on the species to the Service as specified in the Incidental Take Statement [50 CFR §402.12(I)(3)].

2.0 AMOUNT OR EXTENT OF TAKE: Western Snowy Plover

Western snowy plovers are small, cryptically-colored birds that are difficult to detect in their natural habitats. The Service anticipates one western snowy plover chick, and one nest containing up to three eggs could be taken as a result of this proposed action. The incidental take is expected to be in the form of harm of one plover chick and one nest containing three eggs as a result of gravel mining activities. This amount of take (one chick and one nest containing three eggs) is the total amount of take due to harm for the LOP period. In addition, the Service anticipates take in the form of harassment of an unknown number of adults and chicks on the gravel bars annually for the LOP period.

3.0 EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the western snowy.

4.0 REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measure is necessary or appropriate to minimize impacts of incidental take of western snowy plovers:

Minimize gravel mining related impacts to adult plovers and their nests, chicks, and eggs.

5.0 TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, the ACOE must comply with the following terms and conditions, which implement the reasonable and prudent measure described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

1. To protect flightless chicks, an exclusionary fence will be installed around all trenches to minimize the potential for chick entrapment. The fencing will be installed within 24 hours of digging the trench. The fencing will be a silt fence fabric not less than 24 inches tall. The fabric will be keyed-in to the gravel bar so that no gaps greater than 0.5 inch exist below the fabric. The fabric will extend across both sides of the entire trench The exclusionary fencing will remain in place until September 15 or until no plovers are detected on the gravel bars within the action area.

2. All trash and food scraps brought into the action area will be removed daily and secured in covered receptacles. Feeding wildlife, including corvids and gulls, will be prohibited.

3. The Corps will ensure that gravel operators are aware of the plover protective measures described in the project description, and terms and conditions in this biological opinion

4. Prior to January 31st of each year for the duration of project, the Corps shall provide the Service with an annual report. The report shall discuss plover survey results from the previous year(s) including, but not limited to, adult plover use of the survey area, nest numbers and locations, nest fates, brood activity, and reproductive success. This report shall include a complete list of survey dates, weather conditions, names of surveyors, and survey results, even for surveys when no plovers were detected. The first report shall be submitted by January 31st of 2007 due to the date of issuance of this biological opinion. The final, cumulative report shall be submitted by January 31st of 2009.

The Service believes that no more than one chick and one nest containing up to three eggs will be incidentally taken as a result of harm during the LOP period, and that an unknown number of adults or chicks will be incidentally taken as a result of harassment during LOP period. The reasonable and prudent measure, with its implementing terms and conditions, is designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measure provided. The Corps must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measure.

6.0 REPORTING REQUIREMENTS

Upon locating a dead or injured western snowy plover, initial notification must be made to the Service's Division of Law Enforcement in Chico, California at (530) 342-8724 and the Field Supervisor of the Arcata Fish and Wildlife Office at (707) 822-7201 immediately, and in writing within three (3) working days. Notification must include the date, time, and location of the carcass; cause of death or injury, if known; and any other pertinent information. Care must be taken in handling injured animals to ensure effective treatment and care, and in handling dead specimens to preserve biological material in the best possible state for later analysis of cause of death. The finder has the responsibility to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed, unless to remove it from the path of further harm or destruction. Should any treated listed species survive, the Service should be contacted regarding the disposition of the animal. In the case of take or suspected take of western snowy plovers not exempted in this biological opinion, the Arcata Fish and Wildlife Office and the Division of Law Enforcement shall be notified within 24 hours.

7.0 COORDINATION OF INCIDENTAL TAKE WITH OTHER LAWS, REGULATIONS AND POLICIES

The Service will not refer the incidental take of any migratory bird or bald eagle for prosecution under the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. §§ 703-712), of the Bald and Golden Eagle Protection Act of 1940, as amended (16 U.S.C. §§ 668-668d), if such take is in compliance with the terms and conditions (including amount and/or number) specified herein.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. Annually submit western snowy plover survey data to the Northern California western snowy plover recovery unit 2 working group.
2. Encourage gravel operators to restrict access to gravel bars by installing gates or other barriers, and providing signs asking for cooperation with access goals.

To keep the Service informed of actions which minimize or avoid adverse effects or which benefit listed, proposed, or candidate species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION NOTICE

This concludes formal consultation on the action outlined in your April 28, 2004, request. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion; or (4) a new species is listed or critical habitat is designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

If you have any questions regarding this biological opinion, please contact staff biologist Jim Watkins at (707) 882-7201.

Sincerely,

Michael M. Long
Field Supervisor

cc:
Karen Kovaks, CDFG, Eureka, CA

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TABLES

Table 1. Number of adult snowy plovers counted during breeding season window surveys along the California coast during surveys from 1977 to 2004.

Year	Adult Plovers Counted
1977-1980[1]	1,566
1989[2]	1,386
1991[3]	1,371
2000[3]	976
2002[3]	1,387
2003[3]	1444
2004[3]	1904

[1] Page and Stenzel 1981, [2] Page et al. 1991, [3] Point Reyes Bird Observatory 2004

Table 2. Estimated plover population size for the six recovery units (Nur et al. 1999).

Recovery Unit	Estimated Population Size
Washington and Oregon (Unit 1)	134
Del Norte through Mendocino Counties (Unit 2)	50
San Francisco Bay (Unit 3)	264
Sonoma through Monterey Counties (Unit 4)	300
San Luis Obispo through Ventura Counties (Unit 5)	886
Los Angeles through San Diego Counties (Unit 6)	316
Total	1,950

Table 3. Rangewide breeding season window survey results for 2004 (Point Reyes Observatory unpublished data).

Recovery Unit	Adult Plovers
Washington and Oregon (Unit 1)	95
Del Norte through Mendocino Counties (Unit 2)	40
San Francisco Bay (Unit 3)	113
Sonoma through Monterey Counties (Unit 4)	381
San Luis Obispo through Ventura Counties (Unit 5)	1089
Los Angeles through San Diego Counties (Unit 6)	281
Total	1,999

Table 4. Management goals for number of breeding adult birds at important nesting locations in Recovery Unit 2 and the number of adult plovers counted during the 2004 breeding season (U.S. Fish and Wildlife Service 2001; Colwell et al. 2004).

Western Snowy Plover Recovery Unit 2			
Location	**Management Goal Breeding Numbers (adult birds)**	**2004 Surveys**	
		Adult birds	**Percent of goal**
DEL NORTE COUNTY			
Smith River Mouth	8	0	0
Lake Earl	10	0	0
Subtotal	18	0	0
HUMBOLDT COUNTY			
Gold Bluffs Beach[1]	NA	2	NA
Big Lagoon	16	0	0
Clam Beach/Little River	6	27	450
Mad River Mouth and Beach	12	0	0
Humboldt Bay, North Spit	8	0	0
Humboldt Bay, South Spit Eel River North Spit (Eel River WA)	50	4	0.08
Eel River Mouth to Van Duzen	40	27	67.5
Eel River, South Spit and Beach	20	2	10
McNutt Gulch	10	0	0
Subtotal	162	62	38
MENDOCINO COUNTY			
MacKerricher State Park	20	6	30
Manchester State Park[1]	NA	4	NA
Subtotal	20	10	50
TOTAL	200	72	36

[1] The draft recovery plan did not establish management goals for the number of breeding adult birds at Gold Bluffs Beach or Manchester State Park. The management goals are about 15 percent higher than the recovery criteria subpopulation sizes.

Table 5. Number of adult snowy plovers and number of sites where adults were located during the breeding season window surveys, 1977 to 2004 (Point Reyes Bird Observatory Unpublished data).

Location	Number of Adults/Number of Sites by Year							
	1977 to 1980	1989[1]	1991	1995	2000	2002	2003	2004
Del Norte County	11/2	8/?	3/1	0/0	0/0	0/0	0/0	0/0
Humboldt County	54/6	32/?	30/6	19/4	39/3	49/4	38/4	37/4
Mendocino County	15/1	2/?	0/0	4/1	1/1	0/0	1/1	3/1
TOTAL	80/9	42/?	33/7	23/5	40/4	49/4	39/5	40/5

[1] Adult plover numbers are from Page et al. (1991). Data were presented by county with no site specific information.

Table 6. Wintering locations in Recovery Unit 2 identified as important for recovery (U.S. Fish and Wildlife Service 2001, Appendix B). Survey data presented are of varying efforts, for example window surveys and monthly surveys. Blanks represent no data.

Wintering Location	Number of Adult Plovers								
	1979-1985[1]	1992[2]	1993[3]	1998[4]	2001[5]	2002[5]	2003[5]	2004[5]	2005[5]
DEL NORTE COUNTY									
Smith River Mouth					1	0	0	0	0
Lake Earl	1				0	0	0	0	0
HUMBOLDT COUNTY									
Gold Bluffs Beach	2				0	0	0	2	3
Stone Lagoon	9			0	0	0	0	0	0
Big Lagoon				0	6	5	6		0
Clam Beach/Little River	11	30	16	40	32	55+	44	45	31
Mad River Mouth and Beach					0	0	0	0	0
Humboldt Bay, North Spit	2				0	0	0	0	0
Humboldt Bay, South Spit	27		9		0	0	0	0	5
Eel River Wildlife Area	6	2	6		0	0	0	0	0
Eel River, Spit and Beach	6	5			75	22	69	38	1
McNutt Gulch					0	0		0	
MENDOCINO COUNTY									
MacKerricher	23				37	41	41	50	33
Manchester	2				4		8	12	14

[1] Median of the maximum bird numbers (Page et al. 1986). This paper mentions a report of 6 wintering birds at the mouth of the Smith River; Mad River beach was not completely surveyed.
[2] Median number per survey Humboldt County surveys in January (Fisher 1992).
[3] Monthly means Humboldt County surveys in February (Fisher 1993)
[4] Maximum observed. Surveys were only conducted at Big Lagoon, Stone Lagoon, and Clam Beach/Little River (Griggs 1998).
[5] Window survey data.