Adaptive Environmental Management for the Columbia River Channel Improvement Project:

Annual Report for 2008

prepared by

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Table of Contents

1 Introduction ... 1
1-1 CRCIP Construction Progress ... 1
1-2 Ecosystem Restoration and Mitigation ... 2
1-3 Annual Report Structure ... 3
1-4 CRCIP AEM Process ... 3

2 Monitoring Action 1—Physical, Chemical Data ... 5
2-1 Depth ... 6
2-2 Temperature ... 8
2-3 Salinity ... 13
2-4 Columbia River Discharge ... 18
2-5 AMT Decisions for MA-1 ... 19

3 Monitoring Action 2—Dredging Volumes ... 22
3-1 Volumes of Dredged Materials ... 22
3-2 Disposal of Project Dredged Materials ... 29
3-3 AMT Decisions for MA-2 ... 32

4 Monitoring Action 3—Crossline Surveys ... 34
4.1 MA-3 Decision Criteria ... 34
4.2 AMT Decisions for MA-3 ... 36

5 Monitoring Action 4—Habitat Opportunity ... 38
5-1 MA-4 Decision Criteria ... 38
5-2 AMT Decisions for MA-4 ... 40

6 Monitoring Action 5—Sediment Contaminants ... 42
6-1 Sediment Contaminants ... 42
6.2 AMT Decisions for MA-5 ... 42

7 Monitoring Action 6—Fish Stranding ... 44
7-1 Frequency of Stranding ... 44
7-2 Susceptibility to Stranding ... 44
7-3 AMT Decisions for MA-6 ... 45

8 Sturgeon ... 47
8-1 Decision Criteria for Sturgeon ... 47
8-2 AMT Decisions regarding Sturgeon ... 47

9 Smelt ... 49
9-1 Decision Criteria for Smelt ... 49
9-2 AMT Decisions regarding Smelt ... 49

10 Dungeness Crab ... 52
10-1 Decision Criteria for Dungeness Crab ... 52
10-2 AMT Decisions regarding Dungeness Crab ... 54

11 Sediments ... 55

11-1 Decision Criteria for Sediments 55
11-2 Summary 56

12 Integration with 2007 AEM Results 58

12-1 Results for Analyses of 2007 Data for MA-1 58
Depth 58
Temperature 58
Salinity 58

13 References 62

Appendix A Sediment Management Workshop Report

List of Figures

Figure 1-1.1. Construction Progress of the Columbia River Channel Improvement Project. 2

Figure 1-4.1. Flowchart describing the AEM process for the CRCIP. 4

Figure 2-1. Location of CORIE monitoring stations in the Lower Columbia River (LCR) and estuary. The three stations (tansy, grays, and cbnc3) indicated by the solid rectangles provide data for MA-1. The two stations indicated by the dashed rectangle provide salinity (dsdma) and temperature (woody) data used in normalization of the data collected at the three MA-1 stations. 5

Figure 2-1.1. Daily median values of depth for the grays sampling location for 2008 plotted in relation to the CRCIP AEM decision criteria. 6

Figure 2-2.1. Daily median values of water temperature for (a) tansy, (b) grays, and (c) cbnc3 sampling stations for 2008 plotted in relation to the CRCIP AEM decision criteria. 10

Figure 2-2.2. Median daily water temperatures for (a) tansy, (b) grays, and (c) cbnc3 stations plotted for 2008 against median daily water temperatures for the "woody" station. 12

Figure 2-3.1. Daily median values of salinity for (a) tansy and (b) grays sampling stations for 2008 plotted in relation to the CRCIP AEM decision criteria. (Note: cbnc3 was biofouled or not operational in 2008). 14

Figure 2-3.2. Median daily salinity for (a) tansy and (b) grays stations plotted for 2008 in relation to median daily salinity for the "dsdma" (Desdemona) station. 17

Figure 2-4.1. Daily flow values recorded at Bonneville Dam for calendar year 2008 (solid black line). Light gray lines show pre-Project (baseline) values for 1996–2004. 18

List of Tables

Table 2-1.1. Summary of 2008 monthly median depth values (bold numbers) for grays station in relation to AEM percentile decision criteria. 7

Table 2-2.1. Summary of 2008 Monthly Median Temperature Values (bold numbers) for tansy Station in Relation to AEM Percentile Decision Criteria. 11

Table 2-2.2. Summary of 2008 Monthly Median Temperature Values (bold numbers) for grays Station in Relation to AEM Percentile Decision Criteria. 11

Table 2-2.3. Summary of 2008 Monthly Median Temperature Values (bold numbers) for cnbc3 Station in Relation to AEM Percentile Decision Criteria. 11

Table 2-3.1. Summary of 2008 Monthly Median Salinity Values (bold numbers) for tansy Station in Relation to AEM Percentile Decision Criteria. 15

Table 2-3.2. Summary of 2008 Monthly Median Salinity Values (bold numbers) for grays Station in Relation to AEM Percentile Decision Criteria. 15

Table 2-3.3. Summary of 2008 Monthly Median Salinity Values (bold numbers) for cbnc3 Station in Relation to AEM Percentile Decision Criteria. 15

Table 2-5.1. CRCIP AEM Plan Record of AMT MA-1 Decisions. 19

Table 3-1.1. Comparisons of Projected and Actual CRCIP Construction Volumes for 2008..... 23

Table 3-2.1. Description of CRCIP Phase 2 Removal and Disposal. 29

Table 3-2.2. Disposal of CRCIP Dredged Materials through 2008. 30

Table 3-3.1. CRCIP AEM Plan Record of AMT MA-2 Decisions. 32

Table 4-1.1. Adaptive Management Depth Envelopes for MA-3 Crossline Surveys..... 35

Table 4-1.2. Columbia River Cross-Line Hydrosurvey Dates..... 35

Table 4-2.1. CRCIP AEM Plan Record of AMT MA-3 Decisions. 36

Table 5-1.1. Template for Evaluating Changes in Habitat Opportunity (Velocity, Depth) using Results from MA-4 Habitat Surveys..... 39

Table 5-2.1. CRCIP AEM Plan Record of AMT MA-4 Decisions. 40

Table 6-2.1. CRCIP AEM Plan Record of AMT MA-5 Decisions. 43

Table 7-1.1. Frequency of fish stranding events at study sites (Pearson et al. 2005a). 44

Table 7-2.1. Relative Susceptibility of Different Fish Species to Stranding (Pearson et al. 2005a). 45

Table 7-3.1. CRCIP AEM Plan Record of AMT MA-6 Decisions. 45

Table 8-2.1. CRCIP AEM Plan Record of AMT Decisions for Sturgeon. 47

Table 9-1.1. Compliance Measures Offered as Decision Criteria for Smelt in Implementation of the CRCIP AEM Plan. 49

Table 9-2.1. CRCIP AEM Plan Record of AMT Decisions for Smelt. 49

Table 10-1.1. Crab Entrainment Rates (crabs/cy) Estimated for 2004 (Pearson et al. 2005b). ... 52

Table 10-2.1. CRCIP AEM Plan Record of AMT Decisions for Crab..... 54

Table 11-2.1. CRCIP AEM Plan Record of AMT Decisions for Sediments..... 56

Table 12-1.1. Summary of 2007 Monthly Median Depth Values (bold numbers) for grays Station in Relation to AEM Percentile Decision Criteria. 59

Table 12-1.2. Summary of 2007 Monthly Median Temperature Values (bold numbers) for tansy Station in Relation to AEM Percentile Decision Criteria. 59

Table 12-1.3. Summary of 2007 Monthly Median Temperature Values (bold numbers) for grays Station in Relation to AEM Percentile Decision Criteria. 59

Table 12-1.4. Summary of 2007 Monthly Median Temperature Values (bold numbers) for cnbc3 Station in Relation to AEM Percentile Decision Criteria. 60

Table 12-1.5. Summary of 2007 Monthly Median Salinity Values (bold numbers) for tansy Station in Relation to AEM Percentile Decision Criteria. 60

Table 12-1.6. Summary of 2007 Monthly Median Salinity Values (bold numbers) for grays Station in Relation to AEM Percentile Decision Criteria. 60

Table 12-1.7. Summary of 2007 Monthly Median Salinity Values (bold numbers) for cbnc3 Station in Relation to AEM Percentile Decision Criteria. 61

1 Introduction

This report is a continuation of the series of annual reports of the Adaptive Environmental Management (AEM) Program for the Columbia River Channel Improvement Project (CRCIP). The 2008 annual report documents the activities and results of the AEM CRCIP for Project construction completed as of January 31, 2008. Consistent with previous annual reports, the 2008 annual report also briefly reviews the major AEM results and decisions for calendar year 2007.

1-1 CRCIP Construction Progress

Figure 1-1.1 outlines the progress and plans for completion of the entire CRCIP. Project construction in 2008 focused on Columbia River Miles (CRM) 27–32, 48–58, and 70–104. The Great Lakes vessel was contracted to perform most of this work. Project construction on River Miles 27–32 was completed in 2008. Project construction on CRM 48–58 was completed by the end of 2008. The Megan Reeve–essentially a barge-mounted backhoe, was contracted for work in CRM 70–104. This work was largely completed by the middle of February 2008. By October of 2008, overall Project construction had been completed for CRM 0–27, CRM 37–48, and CRM 87-end of Project.

Construction in 2008 emphasized in-water disposal of dredged materials. However, across the entire Project, there is currently a fairly even allocation of dredged disposal between upland sites and in-water disposal. The U.S. Army Corps of Engineers (Corps) is striving to retain as much in-water disposal capacity as possible for use in future operations and maintenance (O&M) work. The Great Lakes dredge pumped materials to an upland disposal site on Crims Island, Oregon. This work completed the Great Lakes contract with ~$5 million worth of Project construction. Potential upland disposal sites for future construction include Pillar Rock, Ranier Industrial, Rice Island, and Millar Sands. There are also plans being developed for shoreline placement of dredged materials at Puget Island. Disposal of Project dredged materials in 2008 is addressed in detail in the report section for Monitoring Action 2 (MA-2).

Rock removal will be scheduled for 2009 along with some overwidth work planned for the longer term. Overwidth dredging performed in 2008 has been accounted in the reporting of operations and maintenance (O&M) work, which is presented in detail in Monitoring Action 2 (i.e., Table 3-2.1). The blasting zone near Pillar Rock was not addressed by the 2008 construction contract. A blasting plan will be developed for this area in 2009.

A summary of the current Project construction status has been developed in the form of an electronic spreadsheet that indicates progress to date and remaining work. The spreadsheet has been posted on the CRCIP AEM web site (www.e2tm.com) maintained by E2 Consulting Engineers, Inc.

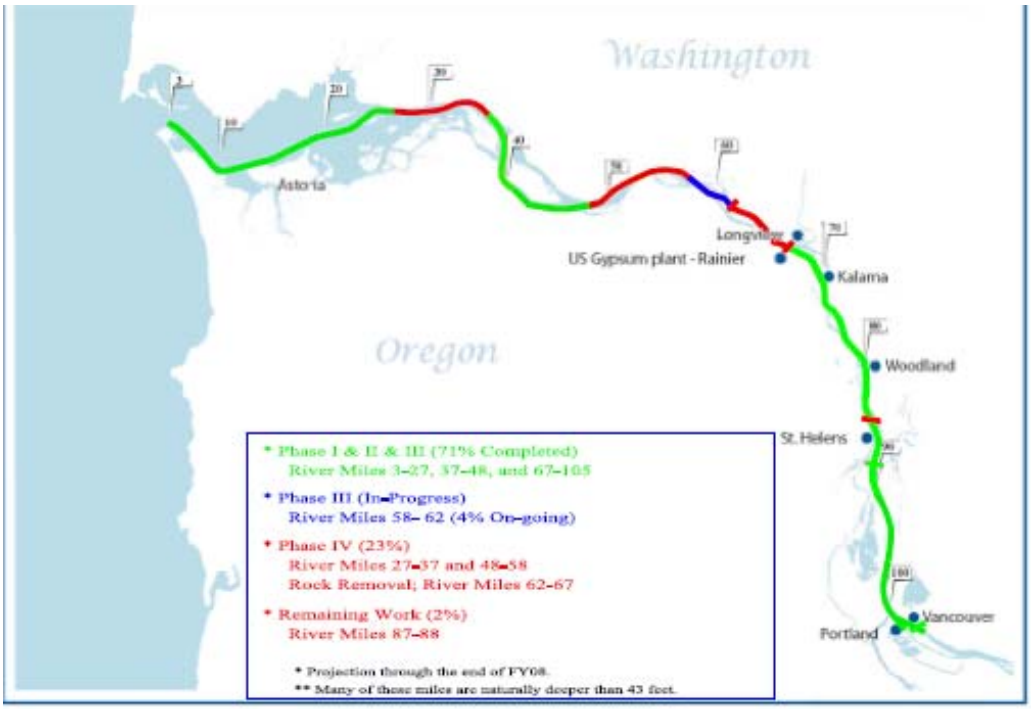


Figure 1-1.1. Construction Progress of the Columbia River Channel Improvement Project.

1-2 Ecosystem Restoration and Mitigation

Ecosystem restoration and mitigation actions are components of the AEM CRCIP. These components primarily serve as sources of additional information for overall evaluation of the Project by the adaptive management team (AMT). However, these components do not enter directly into the decision-making aspects of the AEM Program and decision criteria have not been developed for restoration or mitigation activities.

Several restoration and mitigation actions were presented and discussed during the 2008 quarterly meetings of the AMT. The Corps has purchased a portion of Cottonwood Island for both disposal of Project construction materials and ecosystem restoration. The proposed mitigation actions include introduction of Columbia white-tailed deer to the island, as well as conversion of selected areas from pasture to riparian forested wetlands. As the result of controversy with land owners, the Woodland Bottoms location for disposal of dredged materials has been abandoned.

Mitigation activities are also planned for Chumley Island and Cottonwood Island. Following cultivation of current pasture areas, native riparian trees and shrubs will be planted to replace current pasture on Chumley Island. Physical excavations of swales and removal of overburden will be performed to alter the hydrology of parts of Cottonwood Island (120 acre site). Changes in hydrology are anticipated to favor the germination of native plants and facilitate efforts to

convert areas currently dominated by reed canary grass to riparian forested wetlands. Plans describing the proposed ecosystem restoration actions will be provided to the Washington Department of Ecology for review.

1-3 Annual Report Structure

Following a brief description of the CRCIP AEM process, each monitoring action of the adaptive management effort is addressed. Summaries of the monitoring results for 2008 are provided along with comparisons of the results with AEM decision criteria. Decisions concerning adaptive management for each of the monitoring actions recorded by the AMT during the assessment year are also reported.

Each annual report is developed as a stand-alone document that summarizes the activities of the AMT during the calendar year. In addition, detailed accounts of the actions of the AMT, minutes of the quarterly AMT meetings and additional supporting information are documented in the CRCIP AEM workbook. The workbook is updated as additional monitoring data becomes available and serves as ongoing documentation of the AEM process. The workbook is reviewed by the AMT at each of the quarterly meetings.

1-4 CRCIP AEM Process

The AEM process includes the following steps for adaptively managing the environmental resources of concern in relation to channel deepening (Bartell 2004):

1. Results of the ongoing monitoring programs are summarized and reported quarterly to the AMT.

2. The AMT evaluates monitoring results in relation to the consensus management decision criteria (see Appendix D in Bartell 2004).

3. If none of the decision criteria are exceeded, the AEM process can continue with the current monitoring programs until the next evaluation (i.e., Step 1).

4. If decision criteria are exceeded, the AMT can request the Corps to explain the variances or offer a mitigation plan.

5. Based on an evaluation of the Corps submission, the AMT may (a) determine that there is no justification for changing the current management practices, or (b) recommend changes to the current management practices and/or modifications to the decision criteria.

6. Following resolution of the proposed adaptive management actions and possible revisions to monitoring and criteria recommended by the AMT, the AEM process cycles back to analysis and review of new data and information at the next quarterly meeting.

The steps in the above described AEM process are schematically illustrated in the following AEM plan flowchart (Figure 1-4.1).

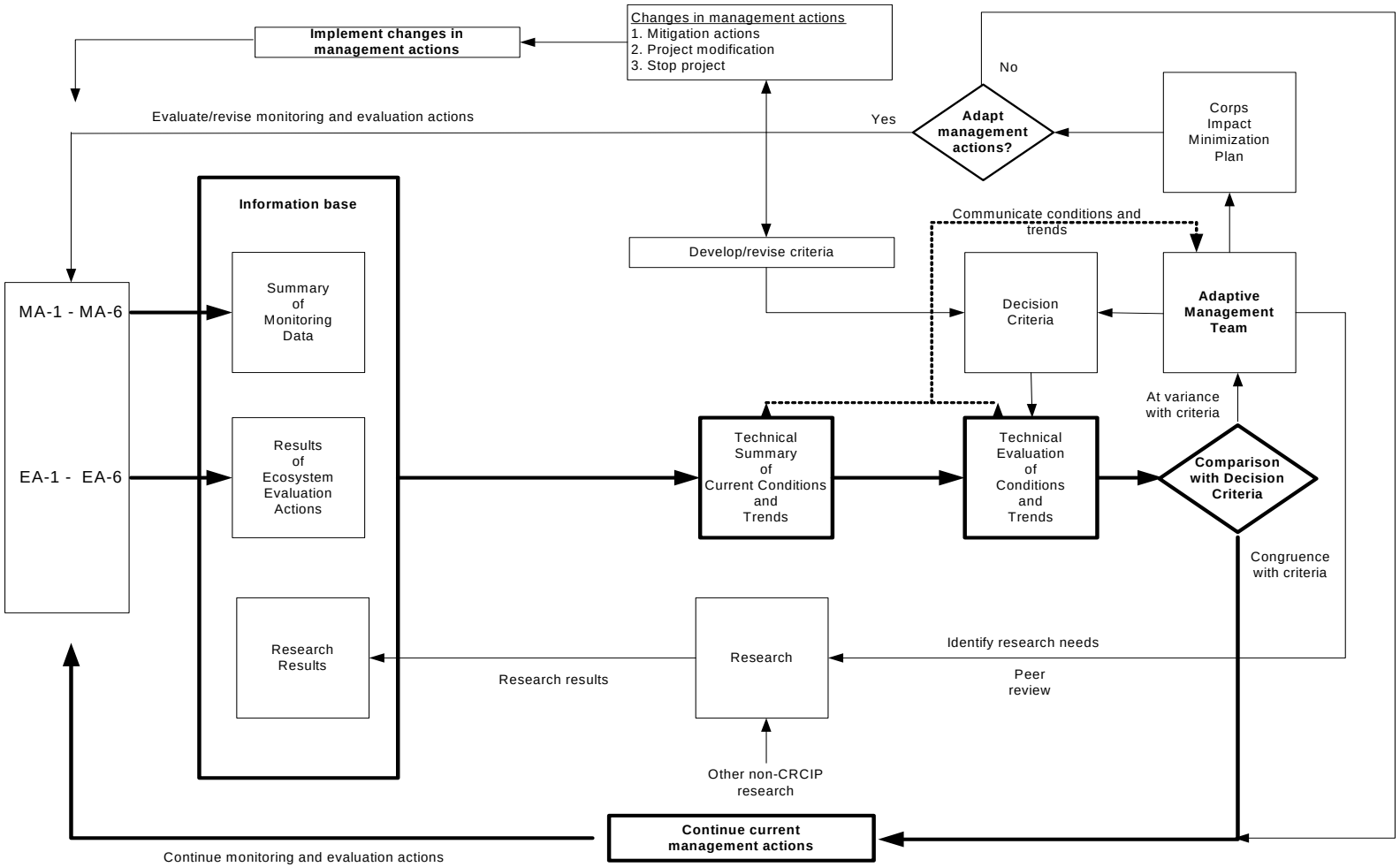


Figure 1-4.1. Flowchart describing the AEM process for the CRCIP.

2 Monitoring Action 1—Physical, Chemical Data

The following figures and tables summarize the MA-1 results of monitoring depth, temperature, and salinity values in relation to channel improvements for calendar 2008. The results are based on analyses of verified data downloaded from the CORIE public web site. The monitoring data are obtained from three sampling stations located in the lower river and estuary: tansy, grays, and cbnc3 (Figure 2-1). The red26 station used in previous years of the AEM Program was physically lost from the CORIE network during 2008.

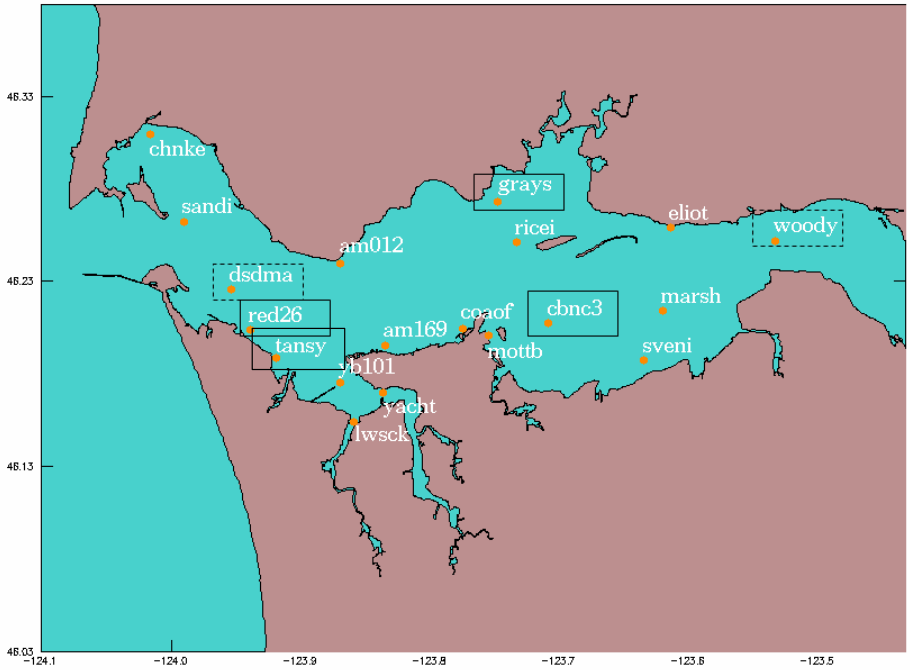


Figure 2-1. Location of CORIE monitoring stations in the Lower Columbia River (LCR) and estuary. The three stations (tansy, grays, and cbnc3) indicated by the solid rectangles provide data for MA-1. The two stations indicated by the dashed rectangle provide salinity (dsdma) and temperature (woody) data used in normalization of the data collected at the three MA-1 stations.

CORIE monitoring data collected from 1996–2004 provided the pre-Project (baseline) physical chemical data. Decision criteria were defined for depth, temperature, and salinity through analyses of these data. Two sets of criteria were defined during the development of the AEM plan in calendar 2004–2005: (1) the upper and lower 90th percentile criteria were defined by the 5th and 95th percentile values computed for each month, and (2) the upper and lower 60th percentile criteria were defined by the 20th and 80th percentile computed monthly values. These values were approved as AEM decision criteria by the AMT.

2-1 Depth

As in 2006 and 2007, depth data were only available for the grays sampling station in 2008 (Figure 2-1.1).

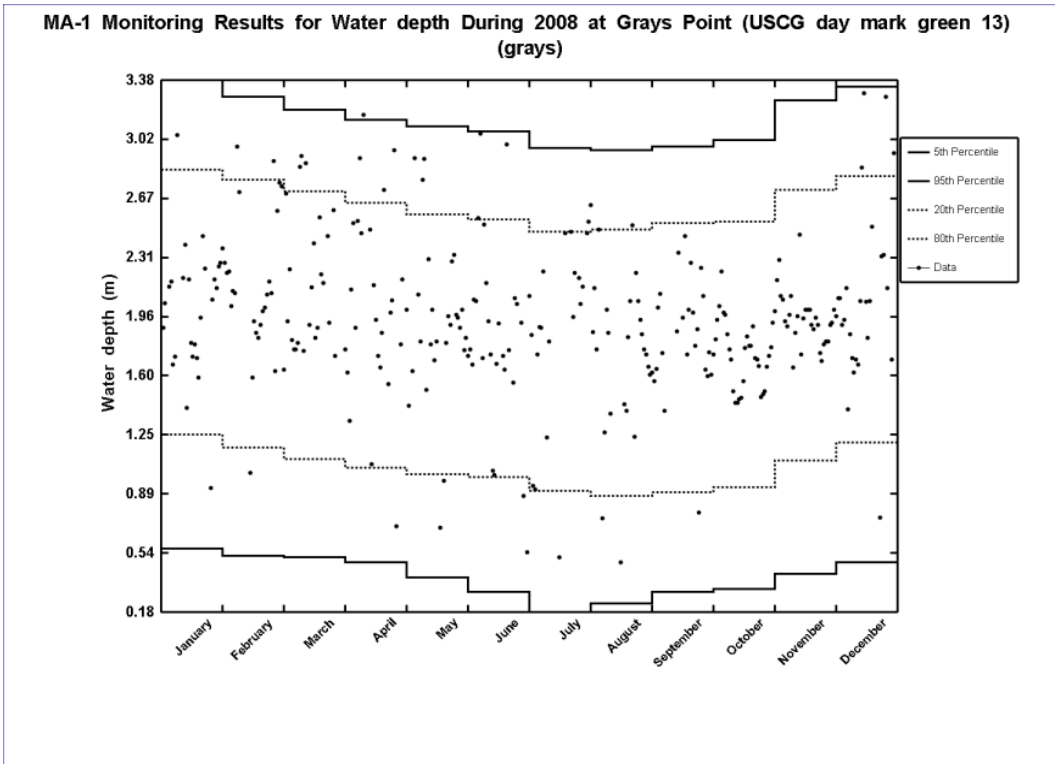


Figure 2-1.1. Daily median values of depth for the grays sampling location for 2008 plotted in relation to the CRCIP AEM decision criteria.

Except for one day in January and one day in April, the median daily depths lie within the 5th–95th percentile decision criteria that were derived from the baseline data. Values were frequently observed outside the 20th and 60th percentile decision criteria. However, most of the daily median depth values reported for the grays station in 2008 were within the 20th and 60th percentile decision criteria.

Table 2-1.1 lists the monthly median depth values calculated using the 2008 data from the grays station. All reported monthly values are within the 20–80th percentile range of the decision criteria derived from the 1996–2004 pre-Project data.

Table 2-1.1. Summary of 2008 monthly median depth values (bold numbers) for grays station in relation to AEM percentile decision criteria.

	Monthly median depth (m)											
Percentile	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
5	0.6	0.5	0.5	0.5	0.4	0.3	0.2	0.2	0.3	0.3	0.4	0.5
20	1.3	1.2	1.1	1.1	1.0	1.0	0.9	0.9	0.9	0.9	1.1	1.2
	2.1	**2.1**	**2.0**	**1.9**	**1.9**	**1.9**	**2.0**	**1.8**	**1.8**	**1.8**	**2.0**	**2.0**
80	2.8	2.8	2.7	2.6	2.6	2.5	2.5	2.5	2.5	2.5	2.7	2.8
95	3.4	3.3	3.2	3.1	3.1	3.1	3.0	3.0	3.0	3.0	3.3	3.3

2-2 Temperature

Figure 2-2.1(a,b,c) shows the daily median temperature values calculated for 2008 for the three CORIE stations: tansy, grays, and cbnc3. The daily values are plotted in relation to the 60th and 90th percentile decision criteria established prior to the Project construction by the AMT. These decision criteria were estimated using CORIE data from 1996–2004 (i.e., pre-Project).

The 2008 temperature values measured at tansy exhibit the greatest temporal fluctuations among the three sampled stations The tansy sampling station is located nearest the river mouth and its temperatures are variously affected by tidal mixing and river flows. The temperature variability in 2008 is particularly evident during January, May through September, and December (Figure 2-2.1a). Many daily temperature values lie outside the 60th percentile decision criteria. The variances with the 60th percentile are mainly in the form of lower temperatures (e.g., February, April, September, and December), although several daily variances resulted from increased temperatures (e.g., May, August). However, except for several daily values at the end of January, and the beginning and end of December 2008, temperature values for tansy lie within the 90th percentile decision criteria.

Daily temperature values lower than the decision criteria were similarly observed for the grays sampling station in 2008 (Figure 2-2.1b). These deviations are apparent for several daily values in January, February, June, and December. Somewhat elevated daily temperatures compared to the decision criteria were obtained during late October, late November, and early December. Despite these departures from the criteria, most of the daily temperature values for grays are within the 60th percentile decision criteria.

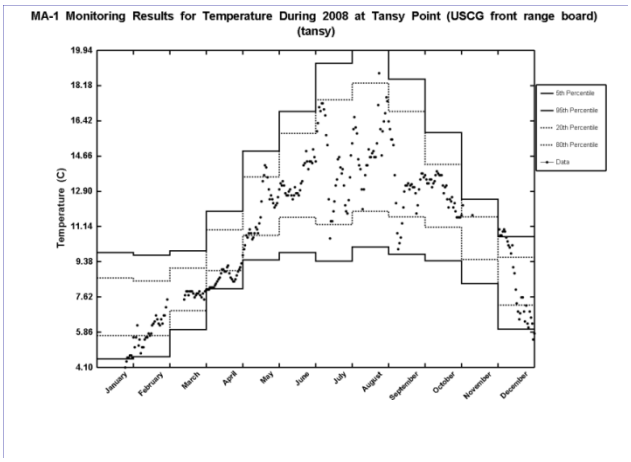
The 2008 seasonal pattern of water temperatures measured at the cbnc3 location is very similar to the pattern described previously for the grays station (Figure 2-2.1c). Temperature values lower than the criteria were measured during late January, early February, early June, and mid- to late December. Elevated temperatures were obtained for several days in October, November, and December. However, similar to the grays results, most of the daily temperature values for 2008 were within the 60th or 90th percentile decision criteria.

Tables 2-2.1–2-2.3 list the calculated monthly median values for 2008 and the corresponding temperature decision criteria derived from analysis of the pre-Project data (1996–2004). Except for January, April, and November, the monthly values for tansy are within the 20–80th percentile values (Table 2-2.1), even though some daily exceedances of these criteria are evident (Figure 2-2.1a). January and April values for tansy were within the 5th and 20th percentile decision criteria; the November monthly value was within the 80th – 90th decision criteria. Monthly values measured at the grays (Table 2-2.2) and cbnc3 (Table 2-2.3) stations are between the 20–80th percentile decision criteria for all but one month. The December value at grays and the November value at cbnc3 lie within the corresponding 80th and 95th percentile decision criteria values.

To further evaluate the potential impacts of channel modification on water temperatures, the daily median values for 2008 (black dots) were plotted against corresponding baseline (gray dots) values (1996–2004) for the upriver “woody” (Woody Island) sampling location (Figure 2-

2.2). Water temperatures at woody are primarily determined by river flows. Explicit decision criteria were not formulated by the AMT to evaluate the nature of the MA-1 temperature values relative to the woody baseline data. However, the Team agreed that if the MA-1 results were essentially included in the baseline cluster of points then it could be concluded that the channel modifications likely did not alter the complex relationships between river flow and tidal mixing in the lower river and estuary. The 2008 monitoring results, with perhaps the exception of certain lower-temperature readings for tansy, and cbnc3 appear within the baseline variations observed at all three MA-1 stations. These lower temperatures extend beyond the 1996–2004 baseline values. Yet, the pattern suggests that the values are consistent with the clustering of the baseline and 2006–2007 values previously normalized to the woody station data.

(a)



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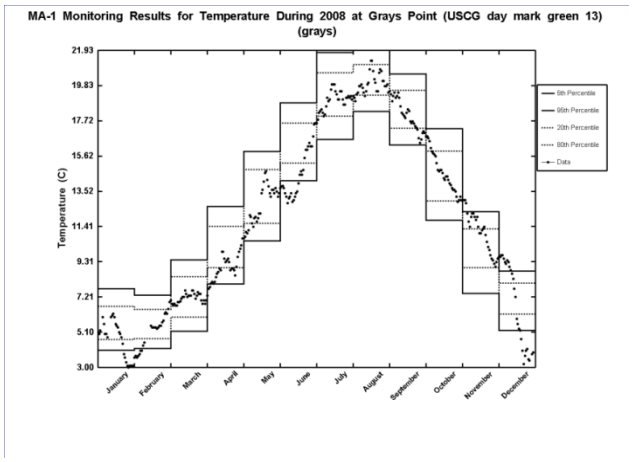

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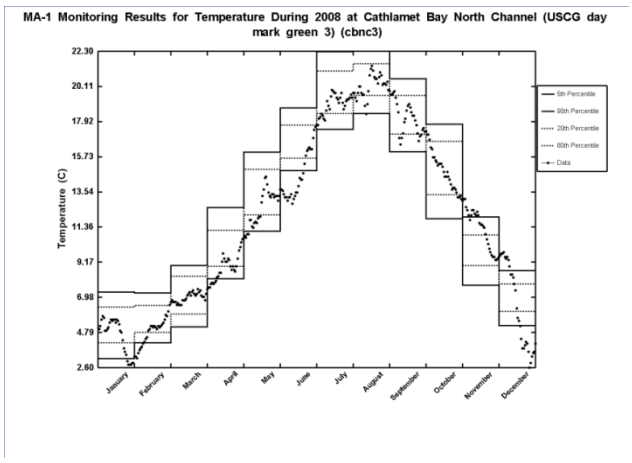


Figure 2-2.1. Daily median values of water temperature for (a) tansy, (b) grays, and (c) cbnc3 sampling stations for 2008 plotted in relation to the CRCIP AEM decision criteria.

Table 2-2.1. Summary of 2008 Monthly Median Temperature Values (bold numbers) for tansy Station in Relation to AEM Percentile Decision Criteria.

	Monthly Median Temperature (C)											
Percentile	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
5	4.9	5.3	6.3	8.4	9.2	9.4	9.4	9.3	9.4	9.3	8.3	6.5
	4.8			**8.6**								
20	6.2	6.4	7.4	9.3	10.6	10.9	10.8	11.0	11.0	11.1	9.4	7.6
		6.1	**7.8**		**11.3**	**13.0**	**14.1**	**15.2**	**13.0**	**13.0**		**8.0**
80	9.2	8.9	9.7	11.2	13.4	15.6	16.9	17.4	16.1	13.9	11.6	9.9
											11.9	
95	10.3	9.9	10.8	12.0	14.5	16.8	18.9	19.3	17.7	15.1	12.5	10.8

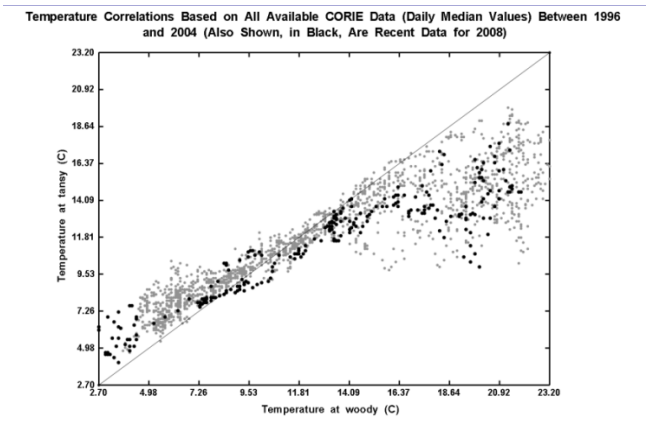
Table 2-2.2. Summary of 2008 Monthly Median Temperature Values (bold numbers) for grays Station in Relation to AEM Percentile Decision Criteria.

	Monthly Median Temperature (C)											
Percentile	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
5	4.0	4.1	5.2	8.0	10.5	14.1	16.6	18.3	16.3	11.8	7.4	5.2
						14.3						
20	4.7	4.7	6.0	9.0	11.6	15.2	18.0	19.3	17.3	12.9	9.0	6.2
	4.9	**5.4**	**7.1**	**9.0**	**13.1**		**19.0**	**19.8**	**17.9**	**14.4**	**11.1**	
80	6.6	6.5	8.4	11.4	14.8	17.6	20.6	21.1	19.5	15.9	11.3	8.0
												8.2
95	7.7	7.3	9.4	12.6	15.9	18.8	21.8	21.9	20.5	17.3	12.3	8.8

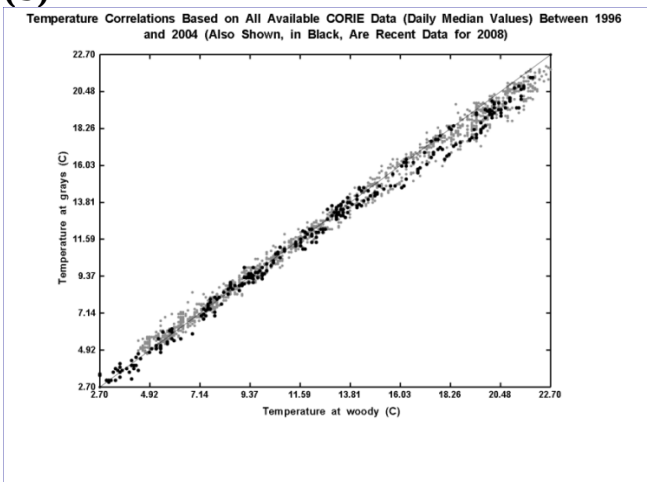
Table 2-2.3. Summary of 2008 Monthly Median Temperature Values (bold numbers) for cnbc3 Station in Relation to AEM Percentile Decision Criteria.

	Monthly Median Temperature (C)											
Percentile	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
						14.1						
5	3.2	4.2	5.1	8.1	11.1	14.9	17.4	18.4	16.0	11.9	7.7	5.2
												5.7
20	4.1	4.8	6.0	8.9	12.1	15.6	18.4	19.5	17.1	13.4	9.0	6.1
	5.0	**5.1**	**7.0**	**8.9**	**13.0**		**19.1**	**20.1**	**18.0**	**14.7**		
80	6.4	6.5	8.3	11.2	15.0	17.7	21.1	21.5	19.5	16.7	10.9	7.6
											11.4	
95	7.3	7.2	9.0	12.6	16.0	18.8	22.3	22.3	20.6	17.8	12.0	8.6

(a)



(b)



(c)

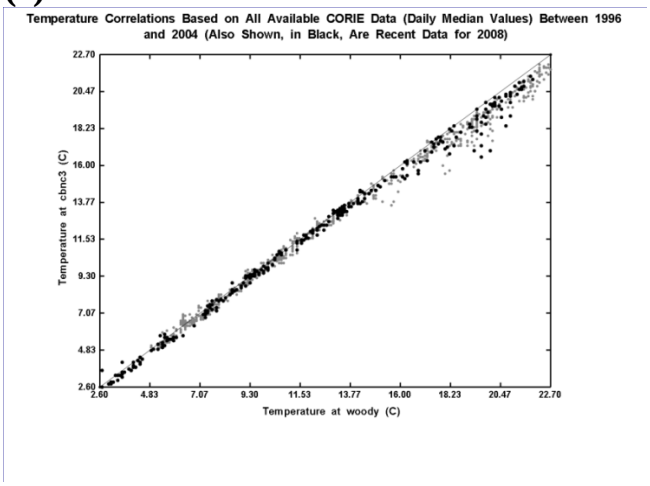


Figure 2-2.2. Median daily water temperatures for (a) tansy, (b) grays, and (c) cbnc3 stations plotted for 2008 against median daily water temperatures for the "woody" station.

2-3 Salinity

MA-1 also provides an analysis of potential Project impacts on salinity. The analyses are preformed and presented in a manner analogous to those previously presented for water temperatures. The issue of concern for salinity is that channel modifications might increase the likelihood of salt water intrusions and increase salinity, which can impact habitat quality for juvenile salmon. Figure 2-3.1 (a,b) presents the daily median values of salinity measured in 2008 at two of the MA-1 sampling locations: tansy and grays. The cbnc3 station was not operational during 2008. The corresponding decision criteria developed from pre-Project salinity data (i.e., 1996–2004) by the AMT are also plotted for convenient comparison with the monitoring results. Importantly, the plotted results also identify periods when data were not available from the monitoring stations. For example, salinity data for tansy were not available in January, August, September, or December in 2008.

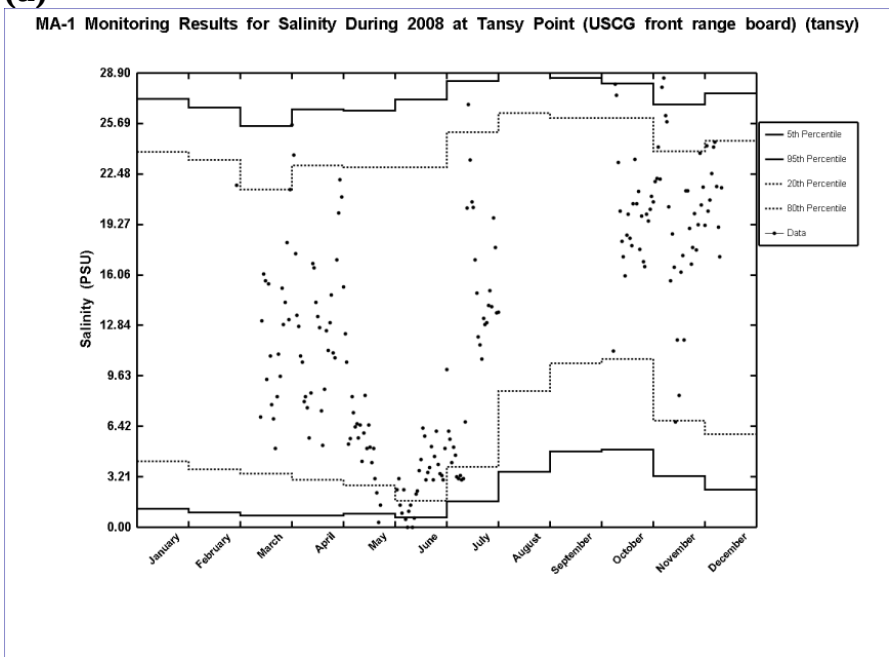
The greatest daily variations in salinity values were observed for tansy in 2008. Daily values ranged from near 0 to ~28 psu during the year. This station is strongly influenced by tidal flows (Figure 2-3.1a). The greatest ranges of values occurred in March–April, July–September, and November. Several daily values in May and June were less than the decision criteria salinity values. This period of low salinity at tansy coincides with the peak river discharges measured at Bonneville Dam in 2008 (See Section 2-4). Despite these daily variations, the monthly mean salinity values reported for tansy did not exceed the 5–95th percentile decision criteria during 2008.

Salinity values reported in 2008 for the grays station largely reinforce the observations in 2007 (Figure 2-3.1b). This station is located sufficiently upriver and its characteristically lower salinity values are determined primarily by the dominance of river flows. Daily median salinity values ranged from 0 to ~6 psu. Circulation of more highly saline tidal waters exhibits lesser influence at this station than observed for tansy, although tidal influence can increase salinity values at grays during periods of very low river flow. Several daily median values of salinity exceeded the 5th and 95th percentile decision criteria for the grays station during 2008. Salinities near zero were prevalent during the earlier months of 2008. Several daily values exceeded the 80th percentile during mid August and mid September in 2008. Three daily median values exceeded the 95th percentile criteria in late December.

Tables 2-3.1–2-3.3 lists the monthly median salinity values and the decision criteria developed by the AMT for MA-1. The monthly values at tansy were within the 20–80th percentile values for all months for which data were available (Tables 2-3.1). The monthly median values for grays were less than the 5th percentile decision criteria for January through June (Table 2-3.2). The monthly median values at grays for July through November lie within the 20–80th percentile decision criteria for this station. Monthly median salinity for grays was slightly greater than the 80th percentile decision criterion in December 2008. The December value did not exceed the 95th percentile value.

Again, data were not available during 2008 for cbnc3. Table 2-3.3 is provided simply to maintain continuity of the AEM documentation for salinity monitoring for MA-1.

(a)



(b)

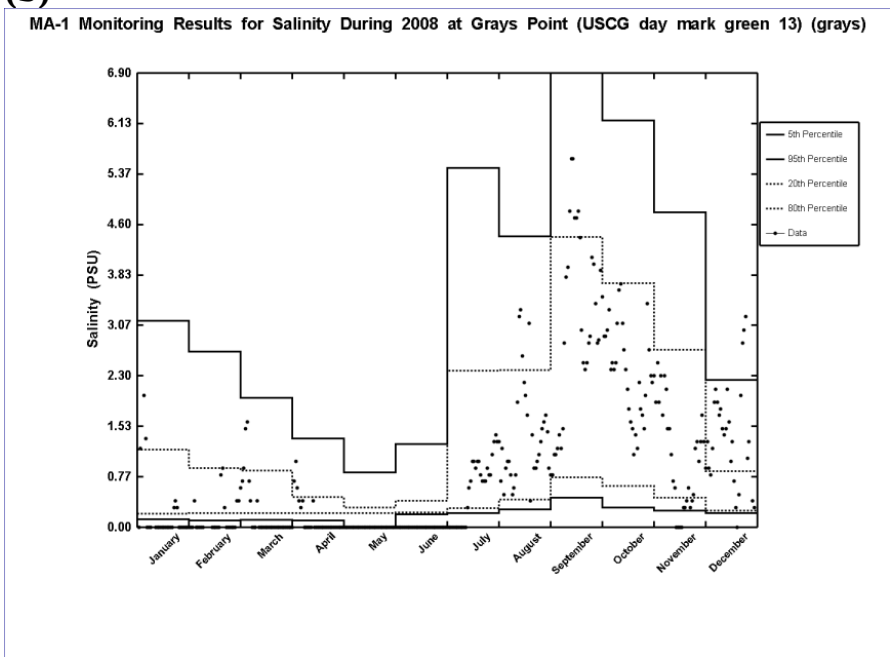


Figure 2-3.1. Daily median values of salinity for (a) tansy and (b) grays sampling stations for 2008 plotted in relation to the CRCIP AEM decision criteria. (Note: cbnc3 was biofouled or not operational in 2008).

Table 2-3.1. Summary of 2008 Monthly Median Salinity Values (bold numbers) for tansy Station in Relation to AEM Percentile Decision Criteria.

	Monthly Median Salinity (psu)											
Percentile	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
5	1.2	0.9	0.7	0.7	0.9	0.4	1.6	3.5	4.8	5.9	3.3	2.4
20	4.2	3.7	3.4	3.0	2.7	1.7	3.8	8.7	10.4	10.7	6.8	5.9
	No data	**20.8**	**12.5**	**13.6**	**5.1**	**3.0**	**12.3**	**No data**	**No data**	**20.2**	**21.1**	**22.0**
80	23.9	23.4	21.5	23.0	22.9	22.9	24.1	26.3	26.0	26.0	23.9	24.6
95	27.3	26.7	25.5	26.6	26.5	27.2	28.4	28.9	28.6	28.0	26.9	27.6

Table 2-3.2. Summary of 2008 Monthly Median Salinity Values (bold numbers) for grays Station in Relation to AEM Percentile Decision Criteria.

	Monthly Median Salinity (psu)											
Percentile	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
	0.0	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**						
5	0.2	0.2	0.2	0.2	0.0	0.2	0.3	0.3	0.5	0.4	0.3	0.3
20	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.5	0.8	0.7	0.5	0.3
							0.4	**1.2**	**3.2**	**2.4**	**1.0**	
80	1.2	0.8	0.8	0.7	0.7	0.7	2.4	2.4	4.4	3.7	2.7	0.8
												1.3
95	3.1	2.7	2.0	1.4	0.8	1.3	5.5	4.4	6.9	6.2	4.8	2.2

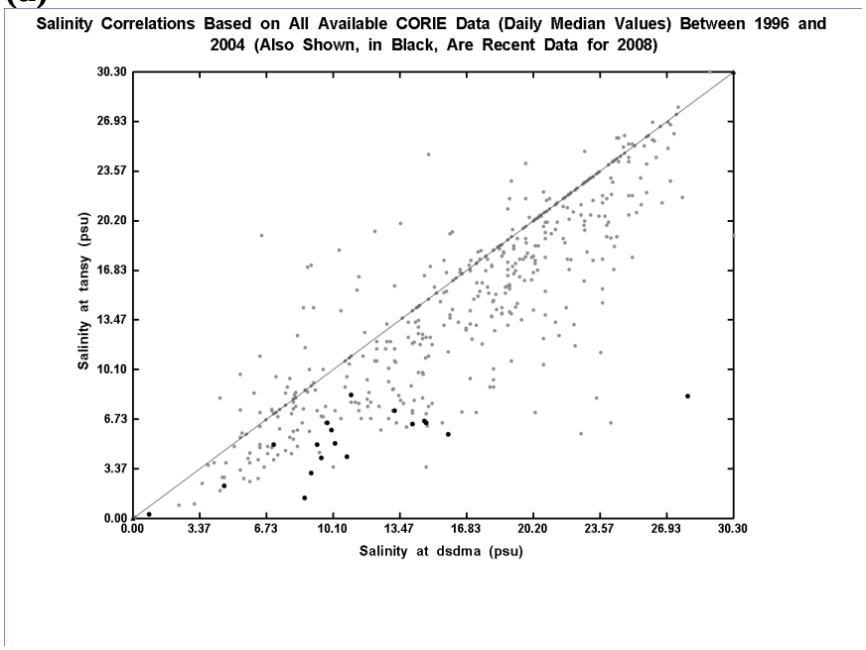
Table 2-3.3. Summary of 2008 Monthly Median Salinity Values (bold numbers) for cbnc3 Station in Relation to AEM Percentile Decision Criteria.

	Monthly Median Salinity (psu)											
Percentile	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
5	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
20	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.4	0.2	0.2	0.2
	No data	**No data**	**No data**	**No data**	**No data**	**No data**	**No data**	**No data**	**No data**	**No data**	**No data**	**No data**
80	0.7	0.7	0.7	0.7	0.7	0.7	1.7	2.5	3.5	7.0	2.2	0.7
95	2.3	2.1	3.3	1.7	0.9	1.5	4.5	6.3	9.3	12.3	5.3	2.0

Further evaluation of 2008 channel modifications on salinity was based on plots of MA-1 salinity values for tansy and grays against corresponding values for the CORIE Desdemona station (dsdma). Data are not available from April through August 2008 at dsdma. As a result, correlations in salinity values for these two stations cannot be evaluated. The dsdma station is located downriver from the red26 location and is influenced by tidal mixing. Figure 2-3.2a illustrates the relationship between salinity values at dsdma and tansy based on pre-Project data (1996–2004, gray dots). The 2008 MA-1 salinity values for tansy are largely within the range of variation determined by the pre-Project data. There were, however, several points for tansy (black) that appeared lower than the general range or "cluster" of points observed previously. These differences were for lower values of salinity that are of lesser concern than increased salinity values associated with longer periods of saltwater intrusion.

The relationships between salinity measured at dsdma and grays are less clear (Figures 2-3.2b). As previously noted, the location of the grays station in comparatively shallow and upriver areas emphasizes the influence of freshwater river flows. Salinity values are often zero for the grays station. The range of salinity values at grays is much less than values for the more estuarine stations of dsdma and tansy. Nevertheless, the 2008 MA-1 data (black dots) were superimposed on the baseline values (gray dots) for comparison. The 2008 values are well within the range defined by the pre-Project salinity data for the grays station.

(a)



(b)

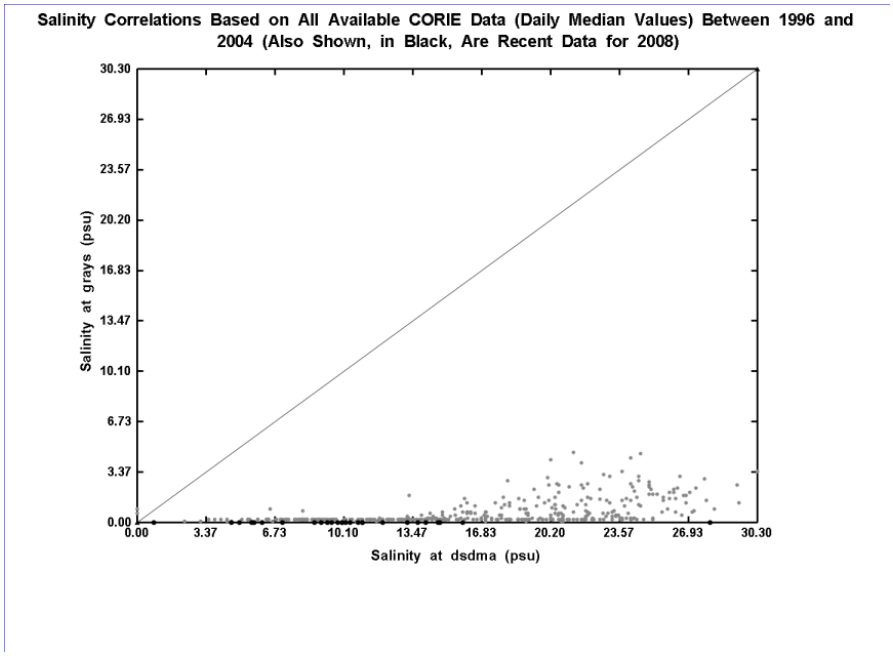


Figure 2-3.2. Median daily salinity for (a) tansy and (b) grays stations plotted for 2008 in relation to median daily salinity for the "dsdma" (Desdemona) station.

2-4 Columbia River Discharge

The collation and analysis of the Bonneville Dam discharge data continued through 2008 as the data became available (Figure 2-4.1). The seasonal pattern indicates that spring and autumn discharges for 2008 tended towards the lower values defined by the 1996–2004 pre-Project discharges. In contrast, the late spring and early summer discharges for 2008 were consistent with the higher values recorded during the pre-Project years. However, the late spring and early summer discharges for 2008 were well within the highest (1997) and lowest (2001) pre-Project values measured at Bonneville.

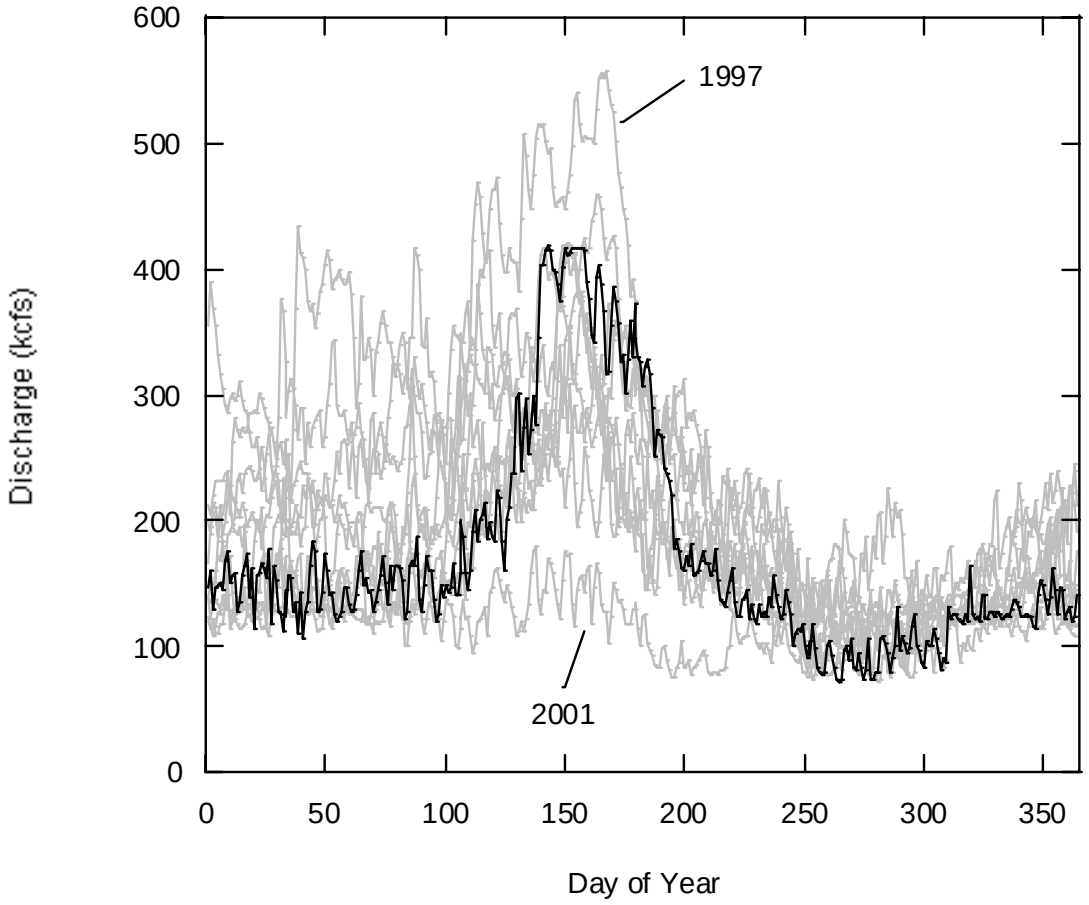


Figure 2-4.1. Daily flow values recorded at Bonneville Dam for calendar year 2008 (solid black line). Light gray lines show pre-Project (baseline) values for 1996–2004.

2-5 AMT Decisions for MA-1

Table 2-5.1 summarizes the key discussions and decisions made by the AMT during the course of the quarterly meetings in relation to MA-1 monitoring and MA-1 monitoring results through calendar 2008.

Table 2-5.1. CRCIP AEM Plan Record of AMT MA-1 Decisions.

Date	Issue	MA-1 Decisions	Comments
16 Dec 2004	**MA-1**	Compare with different monthly confidence intervals (CI) (e.g., 70, 80, 90 percentiles).	
16 Dec 2004	**MA-1**	Develop plots of daily mean values against the CI.	
16 Dec 2004	**MA-1**	Add state water quality standards (e.g., temperature for Washington and Oregon).	
16 Dec 2004	**MA-1**	Produce plots in "real time" as data quality assurance/quality control process permits.	
16 Dec 2004	**MA-1**	Make plots (analyses) available to AMT via file transfer protocol (FTP) site-daily values posted every 1–5 days.	
16 Dec 2004	**MA-1**	At the end of each month, calculate monthly average and compare to the monthly CI values	
16 Dec 2004	**MA-1**	Meet monthly during construction phase to evaluate consensus on criteria.	
14 Jun 2005	**MA-1**	The team tentatively agreed to the water elevation decision criteria. The Science Center http://www.nwr.noaa.gov/ should have the opportunity to review the proposed criteria.	
21 Jun 2005	**MA-1**	Concerns were expressed that cbnc3 had incomplete data and that the Marsh station would provide better data. The cbnc3 station was selected because of the location (channel into Cathlamet Bay) and would be a good indicator of changes that could affect the bay. The Marsh station is too far upstream and would likely not show any changes in salinity or temperature from the deepening. The cnbc3 location is also important for connectivity and conductivity. Natinal Marine Fishery Service (NMFS) agreed with the stated rationale for the selection of cbnc3.	
28 Jun 2005	**MA-1**	The team discussed the desire by Washington Department of Ecology (WDOE) and Oregon Department of Environmental Quality (ODEQ) to substitute cbnc3 for one of the other close proximity CORIE stations (e.g., Marsh), because of the limited historical data availability and it's susceptibility to bio-fouling. However, the change was not agreed to by the AMT and as a result the cbnc3 data that were interpolated will be flagged	
28 Jun 2005	**MA-1**	At the last meeting, Cathy was going to talk to the Science Center about the water elevation decision criteria. She stated that she was waiting for an e-mail back from Ed Castillas. She stated that Ed talked with Antonio Baptista who stated that the evaluation criteria were too broad and we would not be able detect change. The Corps agreed to have a conference call between Steve Bartell, Antonio Baptista and Shyam Nair to discuss these concerns.	
28 Jun 2005	**MA-1**	Sample sizes will be added to the WA-1 tables. The numbers in the tables will be revised and presented to the 10th decimal point. Corrections to the salinity calculations (i.e., binning errors) will be included in the revised tables. Any reference to real-time data needs to be taken out of the decision criteria document. WDOE and ODEQ also requested that the depth at which each CORIE station is monitored is included in each data table provided to the AMT.	

Table 2-5.1. CRCIP AEM Plan Record of AMT MA-1 Decisions. (Continued).

Date	Issue	MA-1 Decisions	Comments
22 Aug 2005	**MA-1**	There was discussion of the normalization of daily median water temperature data for selected CORIE stations to daily median water temperature data for the "woody" sampling location. Temperature values at the woody station are largely determined by river flows. These normalizations have been summarized by simply plotting the data from selected stations against the woody data. Deviations from a linear relationship suggest increasing influence of ocean water on temperature. The suggestion is that alterations in circulation within the estuary due to channel modifications might be indicated by changes in the relations summarized in the plots.	
31 Aug 2005	**MA-1 Decision Criteria**	All agencies concurred on the triggers for MA-1: Two trigger tables will be developed showing triggers values set between the 5th–90th percentile and the 20th–80th percentile. Median daily water temperature values for the three MA-1 CORIE stations will also plotted against corresponding values for the woody station. The data will be evaluated quarterly for the first year and/or after each contract for channel modifications starting October 12, 2005. These data will be reviewed and summarized annually.	
31 Aug 2005	**MA-1 Decision Criteria**	The group also agreed that if one of the stations being used breaks down, one of the other stations close to the unavailable station will be used as a surrogate, if possible.	
1 Sep 2005	**MA-1 Data Analysis**	E2 Consulting Engineers, Inc., (Steve Bartell) will be responsible for analyzing and summarizing the MA-1 data.	
12 Oct 2005	**MA-1 Data Analysis**	Based on the results for depth, temperature, and salinity presented at the AMT meeting, the AMT concluded that adaptive management would not be initiated.	
12 Oct 2005	**MA-1 Data Analysis**	The AMT requested that normalized salinity plots be developed by E2 for the three MA-1 monitoring stations.	
11 Jan 2006	**MA-1 Salinity Plots**	E2 developed salinity plots for the three MA-1 stations and several candidate reference stations. After examining the results of these plots, the AMT agreed that the Desdemona station appeared to provide the best relationship between values of median daily salinity. The AMT concluded that these kinds of normalized salinity plots should become part of the adaptive management process (AMP) and used in the same way as the normalized temperature plots.	
12 Apr 2006	**MA-1 Data Analysis**	Based on the results for depth, temperature, and salinity presented at the AMT meeting, the AMT concluded that adaptive management would not be initiated.	
12 Apr 2006	**Columbia River flow data**	The AMT requested that summaries of flow data be provided to assist in the interpretation of depth, temperature, and salinity data.	
12 Apr 2006	**MA-1 Current Velocity Data**	The AMT asked that the availability of current velocity data be reexamined in relation to MA-1 assessments of changes in physical habitat that might be associated with the CRCIP construction.	
11 Oct 2006	**MA-1 Data Analysis**	The AMT requested that the MA-1 analyses be performed in a timely manner. (This is largely determined by the availability of the data provided by CORIE.)	
10 Jan 2007	**MA-1 Data Analysis**	CORIE and the Corps have agreed that the verified MA-1 data will be available for public download and analyses 30 days after the end of a sampled month. This will essentially introduce a one-month time lag in the reporting of the CORIE analyses to the AMT.	
11 Apr 2007	**MA-1 CORIE Analyses**	Several January and February temperature and salinity values will be examined in relation to river flows and local climate data.	

Table 2-5.1. CRCIP AEM Plan Record of AMT MA-1 Decisions. (Continued).

Date	Issue	MA-1 Decisions	Comments
11 Jul 2007	**MA-1 CORIE Analyses**	No management decisions were required for MA-1.	
3 Oct 2007	**MA-1 CORIE Analysis**	Recommendations were made to examine alternative stations for red26, which has been lost from the CORIE network. Data for dsdma and tansy stations will be analyzed.	
9 Jan 2008	**MA-1 CORIE Analyses**	Analysis of salinity data for tansy station suggest that tansy can be substituted for red26 (which is out of service). Salinity outlier values for cbnc3 in January 2008 will be examined in relation to local climate and river flow data.	
29 Apr 2008	**MA-1 CORIE Analyses**	No decisions were made in relation to the CORIE analysis.	
9 Jul 2008	**MA-1 CORIE Analyses**	No decisions were made in relation to the CORIE analysis.	
8 Oct 2008	**MA-1 CORIE Analyses**	E2 will explore possible reasons to explain the variations in temperature observed in late May and early June.	

3 Monitoring Action 2—Dredging Volumes

MA-2 tracks and reports annual dredging volumes associated with construction and operation of the 48-foot navigation channel.

3-1 Volumes of Dredged Materials

Volumes are reported for each dredging bar (~3-mile reaches). Adaptive management can be triggered if actual construction volumes exceed projected volumes (e.g., Table 3-1.1). In addition, the adaptive component of the proposed AEM Plan might be initiated if the volumes of dredged materials exceed the capacity for disposal. Volumes and disposal of operations and maintenance dredging are also tracked in relation to the Project. These three aspects of Project construction contribute to decision-making concerning adaptive management based on the MA-2 results.

Previous Project construction included work at Desdemona, Flavel Bar, Upper Sands, Willow Bar, Morgan Bar, and Lower Vancouver. In 2008, additional construction occurred at Tongue Point Crossing, Miller Sands, Pillar Rock, Brookfield Welch, Wauna-Driscoll, Westport Bar, Stella Fisher, Walker Island, Lower Dobelbower, Upper Dobelbower, Kalama Bar, Lower and Upper Martin Bar, St. Helens, Warrior Rock, Henrici Bar, Willow Bar, Morgan Bar, Lower Vancouver, and the Vancouver Turning Basin. The results indicate that more dredging was required than originally forecasted for some locations. However, the overall Project construction does not exceed the total amount of dredging originally estimated for the CRCIP. (Table 3-1.1). Phase 2 Project construction removed approximately 4,319,769 cubic yards (cys).

Table 3-1.1. Comparisons of Projected and Actual CRCIP Construction Volumes for 2008.

Sheet ID	Chart	Bar Name	Bar Stations by River Mile	D/S River Mile	Projected Volume Above 48 ftt	Projected Volume Above 45 ft	Projected New Work (48–45 ft.) Volume	Actual New Work (48–45 ft.) Volume	O&M Volume	Location of Placed Material
CL-4		**Lower Desdemona**	04+20+00	04+00+00	317,100	222,412	94,688	38,894		DWS/IW
				05+00+00	550,640	353,916	196,724			
CL-5		**Upper Desdemona**	06+22+00	06+00+00	66,193	0	66,193	22,704	35,000	DWS/IW
	Predicted Bar New Construction Volume =	473,894		07+00+00	1,039	0	1,039			
	Actual Bar New Construction Volume =	61,598		8+00+00	61,140	8,742	52,398			
	Percentage of Prediction =	13%		9+00+00	71,593	8,742	62,851			
CL-9		**Flavel Bar**	10+00+00	10+00+00	379,028	49,732	329,296	337,154		DWS/IW
	Predicted Bar New Construction Volume =	1,169,720		11+00+00	833,973	298,900	535,074	275,367		DWS/IW
	Actual Bar New Construction Volume =	716,828		12+00+00	360,900	121,292	239,608	300	110,000	DWS/IW
	Percentage of Prediction =	61%		13+00+00	138,168	72,425	65,743	104,007		DWS/IW
CL-14		**Upper Sands**	13+30+00	14+00+00	226,017	54,585	171,432	172,599	40,000	DWS/IW
	Predicted Bar New Construction Volume =	858,622		15+00+00	323,787	51,945	271,842	214,174	70,000	DWS/IW
	Actual Bar New Construction Volume =	539,813		16+00+00	354,274	47,557	306,717	152,940	90,000	DWS/IW
	Percentage of Prediction =	63%		17+00+00	108,631	0	108,631			
CL-18		**Tongue Point Crossing**	17+28+00	18+00+00	188,889	14,775	174,113	165,325		IW
	Predicted Bar New Construction Volume =	464,196		19+00+00	169,841	6,976	162,864	207,932		IW
	Actual Bar New Construction Volume =	512,634		20+00+00	140,502	13,283	127,219	139,377		IW
	Percentage of Prediction =	110%								
CL-21		**Miller Sands**	21+20+00	21+00+00	220,662	48,572	172,090	214,956	23,292	DWS
	Predicted Bar New Construction Volume =	457,860		22+00+00	536,271	397,564	138,706	102,188	38,199	DWS
	Actual Bar New Construction Volume =	682,240		23+00+00	16,212	2	16,210	49,477	7,950	DWS

Table 3-1.1. Comparisons of Projected and Actual CRCIP Construction Volumes for 2008. (Continued).

Sheet ID	Chart	Bar Name	Bar Stations by River Mile	D/S River Mile	Projected Volume Above 48 ftt	Projected Volume Above 45 ft	Projected New Work (48–45 ft.) Volume	Actual New Work (48–45 ft.) Volume	O&M Volume	Location of Placed Material
	Percentage of Prediction =	149%		24+00+00	168,189	37,335	130,854	315,619	124,000	DWS/IW
CL-26		**Piller Rock**	25+10+00	25+00+00	384,769	112,426	272,344	194,323	20,524	DWS/IW
	Predicted Bar New Construction Volume =	449,324		26+00+00	171.408	44,197	127,211	55,796		IW
	Actual Bar New Construction Volume =	408,866		27+00+00	56,322	6,553	49,769	158,747		IW
	Percentage of Prediction =	91%								
CL-28		**Brookfield Welch**	28+40+00	28+00+00	193,261	28,356	164,905			
	Predicted Bar New Construction Volume =	404,150		29+00+00	224,225	64,782	159,443	197,346		IW
	Actual Bar New Construction Volume =	197,346		30+00+00	89,561	23,615	65,947			
	Percentage of Prediction =	49%		31+00+00	40,513	26,657	13,855			
CL-33		**Skamokawa Bar**	32+30+00	32+00+00	167,896	31,955	135,941			
	Predicted Bar New Construction Volume =	735,819		33+00+00	651,852	455,132	196,720			
	Actual Bar New Construction Volume =	0		34+00+00	90,709	9,367	81,342			
	Percentage of Prediction =	0%		35+00+00	358,874	37,059	321,816			
CL-36		**Puget Island**	36+31+00	36+00+00	17,288	354	16,934			
	Predicted Bar New Construction Volume =	522,842		37+00+00	162,466	17,838	144,628			
	Actual Bar New Construction Volume =	0		38+00+00	374,599	54,709	319,889			
	Percentage of Prediction =	0%		39+00+00	46,331	4,940	41,391			
CL-40		**Wauna – Driscoll**	40+40+00	40+00+00	164,427	26,349	138,077	382,746		IW
	Predicted Bar New Construction Volume =	860,535		41+00+00	226,584	40,230	186,354			
	Actual Bar New Construction Volume =	782,242		42+00+00	323,422	64,593	238,829			IW
	Percentage of Prediction =	91%		43+00+00	375,149	77,874	297,275	399,496		

Table 3-1.1. Comparisons of Projected and Actual CRCIP Construction Volumes for 2008. (Continued).

Sheet ID	Chart	Bar Name	Bar Stations by River Mile	D/S River Mile	Projected Volume Above 48 ftt	Projected Volume Above 45 ft	Projected New Work (48–45 ft.) Volume	Actual New Work (48–45 ft.) Volume	O&M Volume	Location of Placed Material
CL-44		**Westport Bar**	44+27+00	44+00+00	251,076	32,800	218,276			
	Predicted Bar New Construction Volume =	1,146,351		45+00+00	458,268	67,950	390,318	389,518	155,085	IW/UP
	Actual Bar New Construction Volume =	557,892		46+00+00	285,678	26,341	259,337			
	Percentage of Prediction =	49%		47+00+00	338,946	60,526	278,420	168,374	287,463	IW/UP
CL-50		**Eureka Bar**	48+10+00	48+00+00	200,332	41,415	158,918			
	Predicted Bar New Construction Volume =	229,554		49+00+00	73,575	4,751	68,824			
	Actual Bar New Construction Volume =	0		50+00+00	1,812	0	1,812			
	Percentage of Prediction =	0%		51+00+00	0	0	0			
CL-54		**Gull Island**	51+45+00	52+00+00	0	0	0			
	Predicted Bar New Construction Volume =	18,623		53+00+00	0	0	0			
	Actual Bar New Construction Volume =	0		54+00+00	19,107	485	18,623			
	Percentage of Prediction =	0%								
CL-56		**Stella Fisher**	55+30+00	55+00+00	9,824	0	9,824			
	Predicted Bar New Construction Volume =	594,677		56+00+00	181,756	34,201	147,554			
	Actual Bar New Construction Volume =	539,329		57+00+00	31,463	0	31,463			
	Percentage of Prediction =	91%		58+00+00	543,065	137,229	405,836	539,329	257,785	IW/UP
CL-59		**Walker Island**	59+22+00	59+00+00	95,243	15,759	79,484	199,278		IW/UP
	Predicted Bar New Construction Volume =	209,676		60+00+00	82,387	3,116	79,270			
	Actual Bar New Construction Volume =	402,967		61+00+00	20,432	296	20,136	203,689		IW
	Percentage of Prediction =	192%		62+00+00	32,466	1,679	30,787			
CL-64		**Slaughters Bar**	63+10+00	63+00+00	195,190	15,000	180,190			
	Predicted Bar New Construction Volume =	1,179,942		64+00+00	304,956	30,000	274,956			

Table 3-1.1. Comparisons of Projected and Actual CRCIP Construction Volumes for 2008. (Continued).

Sheet ID	Chart	Bar Name	Bar Stations by River Mile	D/S River Mile	Projected Volume Above 48 ftt	Projected Volume Above 45 ft	Projected New Work (48–45 ft.) Volume	Actual New Work (48–45 ft.) Volume	O&M Volume	Location of Placed Material
CL-64		**Slaughters Bar**	63+10+00	63+00+00	195,190	15,000	180,190			
	Actual Bar New Construction Volume =	0		65+00+00	338,641	67,058	271,583			
	Percentage of Prediction =	0%		66+00+00	561,173	107,960	453,213			
CL-67		**Lower Dobelbower**	67+06+00	67+00+00	192,962	54,691	138,271			
	Predicted Bar New Construction Volume =	187,741		68+00+00	3,116	16	3,100	345,681		IW/UP
	Actual Bar New Construction Volume =	345,681		69+00+00	46,386	16	46,370			
	Percentage of Prediction =	184%								
CL-67		**Upper Dobelbower**	69+50+00	70+00+00	194,244	34,134	160,110			
	Predicted Bar New Construction Volume =	187,381		71+00+00	12,900	0	12,900	340,087		IW/UP
	Actual Bar New Construction Volume =	340,087		72+00+00	14,371	0	14,371			
	Percentage of Prediction =	181%								
CL-73		**Kalama Bar**	72+40+00	73+00+00	115,482	0	115,482			
	Predicted Bar New Construction Volume =	307,268		74+00+00	78,329	5,381	72,948	128,261		IW/UP
	Actual Bar New Construction Volume =	311,663		75+00+00	135,429	16,591	118,838	183,402		IW/UP
	Percentage of Prediction =	101%								
CL-78		**Lower Martin Bar**	76+25+00	76+00+00	406,832	125,671	281,161	204,861		IW/UP
	Predicted Bar New Construction Volume =	654,718		77+00+00	169,712	14,880	154,833			
	Actual Bar New Construction Volume =	572,683		78+00+00	5,860	39	5,821	159,112		IW/UP
	Percentage of Prediction =	87%		79+00+00	281,891	68,988	212,903	208,710		IW/UP
	Predicted Bar New Construction Volume =	409,017		81+00+00	68,884	22,936	45,948	463,724		IW/UP
	Actual Bar New Construction Volume =	815,370		82+00+00	226,583	12,745	213,838	142,936		IW/UP
	Percentage of Prediction =	199%								

Table 3-1.1. Comparisons of Projected and Actual CRCIP Construction Volumes for 2008. (Continued).

Sheet ID	Chart	Bar Name	Bar Stations by River Mile	D/S River Mile	Projected Volume Above 48 ftt	Projected Volume Above 45 ft	Projected New Work (48–45 ft.) Volume	Actual New Work (48–45 ft.) Volume	O&M Volume	Location of Placed Material
CL-84		**St. Helens**	83+44+00	83+00+00	113,920	8,610	105,311	463,884		IW/UP
	Predicted Bar New Construction Volume =	451,717		84+00+00	60,424	7,337	53,087			
	Actual Bar New Construction Volume =	686,924		85+00+00	97,614	3,681	93,933	124,405		IW/UP
	Percentage of Prediction =	152%		86+00+00	268,809	69,223	199,386	98,635		IW/UP
CL-87		**Warrior Rock**	87+15+00	87+00+00	161,482	45,127	116,355	152,966		IW/UP
	Predicted Bar New Construction Volume =	354,413		88+00+00	157,476	21,660	135,816			
	Actual Bar New Construction Volume =	603,174		89+00+00	117,165	14,924	102,241	450,208		IW/UP
	Percentage of Prediction =	170%								
CL-90		**Henrici Bar**	90+20+00	90+00+00	481,852	100,142	381,709	456,476		
	Predicted Bar New Construction Volume =	642,166		91+00+00	232,015	51,233	180,781	297,947		IW
	Actual Bar New Construction Volume =	981,537		92+00+00	86,909	7,234	79,675	227,114		IW
	Percentage of Prediction =	153%								
CL-94		**Willow Bar**	93+50+00	93+00+00	261,237	67,579	193,659			
	Predicted Bar New Construction Volume =	537,183		94+00+00	156,838	45,286	111,552	429,261		IW
	Actual Bar New Construction Volume =	784,884		95+00+00	78,237	6,356	71,881	355,623		Rehandled Material
	Percentage of Prediction =	146%		96+00+00	191,681	31,588	160,093			
CL-97		**Morgan Bar**	97+40+00	97+00+00	167,351	31,430	135,922			
	Predicted Bar New Construction Volume =	191,689		98+00+00	50,416	3,821	46,595	33,637		Rehandled Material
	Actual Bar New Construction Volume =	33,637		99+00+00	9,172	0	9,172			
	Percentage of Prediction =	18%		100+00+00	0	0	0			
CL-102		**Lower Vancouver**	101+18+00	101+00+00	87,054	10,311	76,744			
	Predicted Bar New Construction Volume =	556,043		102+00+00	84	0	84	352,718		Rehandled Material
	Actual Bar New Construction Volume =	1,117,833		103+00+00	87,909	1,810	86,099			

Table 3-1.1. Comparisons of Projected and Actual CRCIP Construction Volumes for 2008. (Continued).

Sheet ID	Chart	Bar Name	Bar Stations by River Mile	D/S River Mile	Projected Volume Above 48 ftt	Projected Volume Above 45 ft	Projected New Work (48–45 ft.) Volume	Actual New Work (48–45 ft.) Volume	O&M Volume	Location of Placed Material
CL-102		**Lower Vancouver**	101+18+00	101+00+00	87,054	10,311	76,744			
	Percentage of Prediction =	201%		104+00+00	393,116	0	393,116	765,115		IW/UP
CL-105		**Vancouver Turning Basin**	104+31+25	105+00+00	287,713	69,220	218,493	765,115		IW/UP
	Predicted Bar New Construction Volume =	218,493		105+31+07			0			
	Actual Bar New Construction Volume =	765,115								
	Percentage of Prediction =	350%								
				TOTAL=	**19,047,502**	**4,573,889**	**14,473,613**	**12,760,343**	**1,259,298**	

3-2 Disposal of Project Dredged Materials

The Corps also provided a detailed summary of Project construction and disposal of construction materials. The summaries have been developed as updates to existing Project MA-2 spreadsheets. The Phase 2 construction materials (~4,319,769 cys) were disposed using the Deep Water Site (852,555 cys), in-water or flow lane (2,154,548 cys), and upland disposal (Table 3-2.1). In Phase 2, approximately 1,312,665 cys were disposed at an upland site on Brown Island (W-46.3).

Table 3-2.2 lists in detail the potential disposal sites, their associated capacities and amounts of dredged materials disposed of to date. Upland disposal has not exceeded capacity for any of the disposal locations used thus far. The Northport site appeared as one possible exception. However, further analysis indicated that the Northport location in the summary table was actually two separate disposal sites. Accounting for the total capacity of these locations, it is not likely that this total capacity has been exceeded.

Table 3-2.1. Description of CRCIP Phase 2 Removal and Disposal.

Limits		Total Removed	In-water or Upland Disposal				Ocean Disposal
Downstream	**Upstream**						
Stuyvesant Phase 2 Removal							
			OR-18-FL	**WA-24-FL**	**W-26-FL**	**W-30-FL**	
21+10	22+20	238,248					238,248
22+20	23+20	140,387					140,387
23+20	24+17	57,427					57,427
24+17	25+20	439,619		70,580	2,759		366,280
25+20	26+20	214,847	104,937		29,706	29,991	50,213
26+20	27+20	55,796				55,796	
27+20	28+10	158,747				158,747	
29+00	30+00	197,346				197,346	
Oregon Phase 2 Removal							
			W-40.6-FL	**W-40.1-FL**	**O-40.1-FL**		
40+30	41+25	382,746	190,038	48,816	143,892		
Essayons/Oregon Phase 2 Removal							
			W-46.3-UD	**O-46.2-IW**	**W-101.0-FL**	**W-97.0-FL**	
45+22	48+10	1,480,283	1,312,665	167,618			
91+00	92+00	297,947				297,947	
92+00	93+00	227,114			227,114		
93+00	95+00	429,261			205,678	223,583	

Table 3-2.2. Disposal of CRCIP Dredged Materials through 2008.

Disposal Site	Site Location/Name	CRCIP Construction		Projected O&M Volume	Actual O&M Volume Placed	Percent Full	Total Estimated Capacity
		Projected Volume	Volume Placed				
W-21.0	Rice island	0		5,500,000			5,500,000
O-23.5	Miller Sands	0		7,000,000			NA
O-27.2	Pillar Rock Island	0		1,000,000			2,555,000
W-33.4	Skamokawa	0		varies			250,000
O-34.0	Welch island	0		400,000			446,000
O-38.3	Tenasillahe Island	0		2,300,000			2,300,000
O-42.9	James River	240,000		830,000			1,280,000
W-44.0	Puget Island (Vik Prop.)	500,000		2,700,000			3,500,000
W-46.3/W-46.0	Brown Island	1,200,000	1,312,665	3,400,000		28%	4,700,000
O-54.0	Port Westward	150,000		1,500,000			1,875,000
O-57.0	Crims Island	30,000	638,954	1,100,000		40%	1,600,000
W-59.7	Hump Island	400,000		900,000			1,500,000
W-62.0	Mt. Solo	300,000		2,100,000			2,500,000
W-63.5	Reynolds Aluminum	180,000		0			500,000
O-63.5	Lord Island Upstream	0		600,000			1,255,000
O-64.8	Rainier Industrial	270,000		2,400,000			2,235,000
W-67.5	International Paper	140,000		2,700,000			1,000,000
O-67.0	Rainier Beach	450,000		2,400,000			1,095,000
W-68.7	Howard Island	0		600,000			6,400,000
W-70.1	Cottonwood Island	240,000	1,405,653	1,300,000		44%	3,200,000
W-71.9	Northport 1	189,000	476,917	1,800,000		53%	900,000
W-71.9	Northport 2 (Beneficial Use)	750,000	750,000	0		100%	750,000
O-75.8	Sandy Island	120,000		860,000			1,100,000
O-77.0	Lower Deer Island	440,000		700,000			1,498,000
W-80.0	Martin Island Mitigation	370,000		0			550,000
W-82.0	Martin Bar	46,000	562,365	700,000		37%	1,500,000
O-82.6	Reichold	320,000		2,300,000			1,285,000
O-86.2	Sand Island	150,000		860,000			1,250,000
W-86.5	Austin Point	136,000	574,752	1,500,000		35%	1,645,000
O-87.8	Railroad Corridor	300,000		0			540,000
O-91.5	Lonestar	900,000		3,200,000			5,350,000
W-96.9	Adjacent to Fazio	0		varies			475,000
W-97.1	Fazio Sand & Gravel	112,000	521,530	1,000,000		80%	650,000
W-101.0	Gateway	587,000	1,157,635	1,600,000		50%	2,300,000
W-102	KTR Furnished Beneficial Use		405,895	0		100%	405,895
O-105.0	West Hayden Island	600,000		3,900,000			5,750,000
Total upland			7,806,366			13%	57,433,000
DWS		6,500,000	2,170,532			1%	225,000,000

Table 3.2.2. Disposal of CRCIP Dredged Materials through 2008. (Continued).

Disposal Site	Site Location/Name	CRCIP Construction	Projected O&M Volume	Actual O&M Volume Placed	Percent Full	Total Estimated Capacity	Disposal Site
		Projected Volume	Volume Placed				
IW-FL		2,000,000	5,490,079			275%	2,000,000
Scour Hole	W-40.6-FL/W-43,5-IW		337,886			100%	337,886
Rehandled Material			2,279,575				

3-3 AMT Decisions for MA-2

Table 3-3.1 lists the decisions made by the AMT in relation to project construction, dredging volumes, and dredged material disposal during the course of the quarterly meetings of the CRCIP AEM Program.

Table 3-3.1. CRCIP AEM Plan Record of AMT MA-2 Decisions.

Date	Issue	MA-2 Decisions	Comments
16 Dec 2004	**MA-2 Decision Criterion**	Compare actual dredging volumes with predicted volumes.	
16 Dec 2004	**MA-2 Decision Criterion**	Annual O&M dredging volumes plus construction volumes.	
16 Dec 2004	**MA-2 Decision Criterion**	Develop plots of predicted vs. actual dredged volumes for the contracted river mile segments; show percentages (e.g., 5, 10, 15, etc.) of possible exceedance.	
16 Dec 2004	**MA-2 Decision Criterion**	Develop similar summaries for dredge disposal.	
16 Dec 2004	**MA-2 Decision Criterion**	Communicate summaries, plots, etc. to the AMT within two months after each contract is completed.	
16 Dec 2004	**MA-2 Decision Criterion**	Trigger for other disposal options (e.g., in-water vs. upland), if larger than predicted volumes are dredged.	
5 Jul 2005	**MA-2 Decision Criterion**	Initial consensus was for reporting the results of dredging on a contract basis, although Washington expressed continued interest in a bar-by-bar summary as well as a summary by contract.	
5 Jul 2005	**MA-2 Decision Criterion**	The AMT achieved consensus that the decision criteria for MA-2 would derive from comparisons between estimated and actual dredging volumes, as summarized and presented in the March annual AMT meeting.	
1 Sept 2005	**MA-2 Decision Criterion**	All agencies concurred that if the dredging volumes exceed the projected amounts in the CRCIP Final Supplemental Environmental Impact Statement (FSEIS) by 15 percent or more that the AMT team members would be notified. Agreement was also reached, that at the quarterly meetings, the Corps would provide: dredging volumes updates for CRCIP construction and O&M, estimated amounts would be compared with actual amounts placed at individual upland sites and that volumes would be provide by bar and river mile.	
12 Oct 2005	**MA-2 Decision Criterion**	The AMT decision criteria refer to bar-by-bar summary of projected and actual dredging volumes. The spreadsheet currently provides a summary based on river miles. The spreadsheet will be modified to include additional rows that provide the bar-by-bar summaries. The location of disposal sites for Project dredging should also be included in the reporting for MA-2.	
11 Jan 2005	**MA-2 Decision Criterion**	It has proved difficult to determine the original source or relevance of the 15 percent proposed exceedance value. Therefore, following discussion, the AMT reached consensus to abandon the 15 percent decision criterion and simply compare projected dredging volumes to actual volumes.	
12 Apr 2006	**MA-2 Reporting**	The AMT made recommendations concerning the format of reporting dredging and disposal of dredged materials. A revised reporting template will be presented to the AMT at the next quarterly meeting.	

Table 3-3.1. CRCIP AEM Plan Record of AMT MA-2 Decisions. (Continued).

Date	Issue	MA-2 Decisions	Comments
10 Jan 2007	**MA-2 Project Construction**	The form and content of the MA-2 spreadsheet summary for the AEM Workbook were accepted by the AMT.	
11 Apr 2007	**MA-2 Dredging Summary**	The spreadsheet summary of disposal will be updated to address concerns regarding disposal capacity.	
11 Jul 2007	**MA-2 Dredging Summary**	MA-2 spreadsheets were updated to address capacity for disposal, especially in the deep ocean areas and Gateway.	
3 Oct 2007	**MA-2 Dredging Summary**	The MA-2 dredging summary tables in the AEM Project Workbook will be updated to include recent construction and disposal of dredged materials.	
9 Jan 2008	**MA-2 Dredging Summary**	Spreadsheet summaries of dredging volumes and disposal locations will be updated upon completion of the year's dredging.	
29 Apr 2008	**MA-2 Dredging Summary**	No decisions were made concerning Project dredging for MA-2.	
9 Jul 2008	**MA-2 Dredging Summary**	Disposal of Project dredged materials will be updated and summarized for the October AMT meeting.	
8 Oct 2008	**MA-2 Dredging Summary**	The summary for disposal at Northport will be revised to reflect that it is actually two disposal sites. Disposal capacity has not been exceeded.	

4 Monitoring Action 3—Crossline Surveys

MA-3 examines accretion/erosion and changes in bathymetry of the main channel in relation to the channel deepening. Crossline surveys will be performed annually for two years prior to construction, during construction, and three years after construction. Annual surveys are performed at CRM 42, 46, 72, 75, 86, and 99. These river mile locations were identified through previous Corps analysis of locations that appeared potentially sensitive to accretion and erosion. Additional surveys will be performed at 0.5 miles up-river and 0.5 miles down-river from each of the selected CRM locations. Comparisons of survey results obtained during and after construction (year 2005+) with the MA-3 decision criteria will determine any need for adaptive management.

4.1 MA-3 Decision Criteria

In 2006, the results of pre-construction surveys (1996–2004) were used to develop consensus decision criteria to evaluate surveys performed in relation to Project construction (Table 4-1.1). The resulting depth "envelopes" define upper and lower depths that should not be exceeded as the result of construction dredging at these locations. The envelopes were calculated by subtracting the value of one standard deviation (SD) (sigma) from the minimum reported depth and adding one SD (sigma) to the maximum reported depth.

The results of the 2008 MA-3 crossline surveys were compiled and presented in relation to the previously developed decision criteria (i.e., depth "envelopes"). The results of the 2008 surveys suggested two possible outlier values: one at CRM 75 (Kalama Bar) on the Washington side and the other at CRM 42.5 (Wauna/Driscoll Bar) also on the Washington side. The 2008 surveys also showed that channel alterations suggested by the 2007 outlier value observed at CRM 45.5 had returned to conditions that were within the decision envelopes.

The revised analysis was posted to the MA-3 folder in the AEM Workbook at the E2 CRCIP web site.

Table 4-1.1. Adaptive Management Depth Envelopes for MA-3 Crossline Surveys.

	Pre-construction Depth Values (ft)			AEM Envelope Depth (ft)	
CRM	**Minimum**	**Maximum**	**Sigma[1]**	**Upper**	**Lower**
41.5south	47.94	50.48	0.69	47.25	51.17
North	46.17	52.02	1.48	44.69	53.50
42.0	51.38	55.60	1.48	49.90	57.08
	43.58	48.74	1.64	41.94	50.38
42.5	47.17	54.54	2.71	44.46	57.25
	41.90	44.95	1.07	40.83	46.02
45.5	44.98	47.13	0.71	44.27	47.84
	40.71	44.31	1.20	39.51	45.51
46.0	46.53	52.64	1.67	44.86	54.31
	40.46	46.72	1.93	38.53	48.65
46.5	42.41	47.83	1.55	40.86	49.38
	41.43	46.83	1.45	39.98	48.28
71.5	40.75	46.79	1.61	39.14	48.40
	45.10	50.98	1.73	43.37	52.71
72.0	47.30	53.48	1.93	45.37	55.41
	44.37	50.44	2.13	42.24	52.57
72.5	61.39	77.15	4.40	56.99	81.55
	60.71	69.81	2.46	58.25	72.27
74.5	43.32	46.25	0.95	42.37	47.20
	52.33	59.04	1.85	50.48	60.89
75.0	42.17	47.14	1.60	40.57	48.74
	42.44	47.90	1.49	40.95	49.39
75.5	41.92	46.86	1.51	40.41	48.37
	45.84	49.54	1.29	44.55	50.83
85.5	42.18	46.55	1.46	40.72	48.01
	43.92	49.88	1.69	42.23	51.57
86.0	41.11	46.70	1.63	39.48	48.33
	46.78	55.77	2.68	44.10	58.45
86.5	39.64	44.42	1.50	38.14	45.92
	45.35	49.66	1.65	43.70	51.31
98.5	49.43	52.69	1.21	48.22	53.90
	43.15	46.94	1.26	41.89	48.20
99.0	50.35	54.55	1.25	49.10	55.80
	43.76	48.81	1.65	42.11	50.46
99.5	48.65	49.92	0.46	48.19	50.38
	45.13	47.36	0.77	44.36	48.13

[1]One SD of mean depth based on analysis of pre-Project surveys.

Table 4-1.2 lists the locations and dates of the crossline survey data used in developing the MA-3 decision criteria.

Table 4-1.2. Columbia River Cross-Line Hydrosurvey Dates.

River Reach	RM	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Morgan Bar	98–101	Feb 24	N/A	Jan 5	Jan 12	Jan 20	Feb 13	Feb 13	Jan 07	Jan 22	Apr 04	Jan 12
St Helens Bar	84–87	Feb 21	Feb 24	N/A	Jan 19	Jan 11	Feb 05	Feb 12	Jan 14	Mar 31	May 10	Jan 25
Kalama Bar	73–76	Feb 20	Feb 12	Jan 21	Jan 26	Jan 10	Jan 31	Feb 07	Jan 23	Apr 28	May 24	Feb 07
Upper Dobelbower Bar	70–73	Feb 20	Feb 12	Jan 21	Jan 26	Jan 06	Jan 30	Feb 06	Jan 28	Apr 29	May 25	Feb 07
Westport Bar	45–48	Feb 20	Feb 10	Jan28	Feb 01	Jan 26	Jan 30	Jan 24	Feb 05	May 17	Jun 22	Jan 31
Wauna and Driscoll	41–44	Feb 20	Feb 06	Jan 28	Jan 27	Jan 25	Jan 29	Jan 24	Feb 05	May 13	May 18	Jan 24

4.2 AMT Decisions for MA-3

Table 4-2.1 outlines the key AMT discussion points and decisions concerning potential effects of Project construction on channel bathymetry through calendar 2007.

Table 4-2.1. CRCIP AEM Plan Record of AMT MA-3 Decisions.

Date	Issue	MA-3 Decisions	Comments
16 Dec 2004	**MA-3 Decision Criterion**	Develop plots that compare pre-construction variations in side slopes with post-construction slopes using results of crossline surveys; show percentages (e.g., 5, 10, 15, etc.) of measured changes in side slopes.	
16 Dec 2004	**MA-3 Decision Criterion**	Focus on six locations identified in the Environmental Impact Statement (EIS).	
16 Dec 2004	**MA-3 Decision Criterion**	Use recorded dredging volumes to identify other possible locations for impacts on slopes. O&M dredging volumes that substantially exceed predicted values might indicate locations of increased side slope adjustments.	
16 Dec 2004	**MA-3 Decision Criterion**	Communicate summaries, plots, etc. to the AMT 2 years prior, 2 years during, and 3 years after construction is completed.	
16 Dec 2004	**MA-3 Decision Criterion**	Trigger for adaptive management if larger than predicted changes in side slope adjustment are observed.	
9 Aug 2005	**MA-3 Decision Criterion**	Crossline data are available at approximately 500-foot intervals throughout the navigable river. The results also summarized the minimum, maximum, and SD for surveyed depths at the southern and northern edges of the navigation channel. An envelope defined by the minimum + 1 SD and the maximum +1 SD was also plotted for each of the cross sections.	
9 Aug 2005	**MA-3 Decision Criterion**	Concerns were expressed that the selected few locations did not provide a sufficient description of potential impacts of channel dredging on slide slope adjustments and corresponding potential impacts on shallow water habitats. Requests were made to include two additional cross sections, upriver and downriver, to the locations currently included in the MA-3 design. Inclusion of more cross sections at other selected river miles into the MA-3 effort was also desired by several AMT members.	
9 Aug 2005	**MA-3 Decision Criterion**	Concerns were raised about the number of years included in the analysis. The years represent different flow conditions, for example, with 1996-97 being years with comparatively higher flows, and 2001 being an example of a low flow year. The surveys are part of an ongoing activity in support of navigation the CRCIP was funding several surveys in relation to the time periods outlined in the terms and conditions of the Biological Opinion - i.e., 2 years before, 2 years during, and 2 years after project construction.	
1 Sept 2005	**MA-3 Decision Criterion**	The consensus AMT decision criteria for MA-3 are defined as an "envelope" calculated as the minimum surveyed depth + 1 SD and the maximum depth + 1 SD. The envelope is defined across the channel for each survey with particular emphasis on the northern and southern boundaries of the navigation channel.	

Table 4-2.1. CRCIP AEM Plan Record of AMT MA-3 Decisions. (Continued).

Date	Issue	MA-3 Decisions	Comments
1 Sept 2005	**MA-3 Decision Criterion**	All agencies concurred that the crossline survey results will be reviewed for exceedances and will reported yearly after the cross line surveys are completed. The MA-3 will examine accretion/erosion and changes in bathymetry of the main channel in relation to the channel deepening. Surveys will be conducted annually for two years prior to construction (by individual contract), two years during construction, and three years after construction. Crossline surveys will be conducted within a December-February time period to coincide with the end of the dredging season. Surveys will be conducted along the navigation channel from CRM 3 to CRM 106. Statistical analyses will produce estimates of mean and median depth at each sampled location across the channel; minimum and maximum values as well as SD and coefficients of variation will also be determined.	
11 Jan 2006	**MA-3 Decision Criterion**	The AMT agreed that the "envelope" calculations for side slope adjustments would serve as initial decision criteria for MA-3. The AMT requested that the O'Brien-Michalsen' plots be incorporated as part of the AEM Plan implementation.	
10 Jan 2007	**MA-3 Crossline Surveys**	Additional pre-construction crossline survey data were used to revise the decision "envelopes" for MA-3.	
11 Apr 2007	**MA-3 Crossline Surveys**	An outlier value in reference to the decision "envelopes" at CRM 45.5 will be examined.	
11 Jul 2007	**MA-3 Crossline Surveys**	No new information was reported for MA-3.	
3 Oct 2007	**MA-3 Crossline Surveys**	No new information was available for MA-3.	
9 Jan 2008	**MA-3 Crossline Surveys**	No new information was available for MA-3.	
29 Apr 2008	**MA-3 Crossline Surveys**	No new information was available for MA-3.	
9 Jul 2008	**MA-3 Crossline Surveys**	Available 2008 survey results will be summarized and presented at the October AMT meeting.	
8 Oct 2008	**MA-3 Crossline Surveys**	The 2008 surveys suggest two possible values that lie outside the decision envelopes on the Washington side at CRM 75 and 42.5. The 2008 survey also shows that an outlier observed in 2007 at CRM 45.5 had returned to conditions within the enveloped decision criteria. The AMT will continue to review future crossline survey results for these locations.	

5 Monitoring Action 4—Habitat Opportunity

Following the completion of Project construction, MA-4 will augment the estuary habitat surveys currently being conducted by NMFS as part of the Anadromous Fish Evaluation Program (AFEP) (Bottom and Gore 2001). The objective is to determine if changes in habitat opportunity and habitat capacity result from modifications to the channel. Habitat opportunity is defined as the number of hours within a 30-day (720-hour) month, wherein values of physical habitat criteria are consistent with criteria developed for juvenile salmonids (Bottom et al. 2001). Pre-construction characterizations of habitat opportunity have been provided for juvenile chinook and chum in terms of suitable water depths and current velocity. These estimates can serve as a basis for comparing post-Project estimates of habitat opportunity to determine any impacts of channel modifications on physical habitat for juvenile salmonids.

The MA-4 activity will not continue until Project construction is completed. As a result, the AMT did not address this monitoring action during 2008. The following sections are identical to the 2007 annual report and are presented in order that the 2008 annual report can stand as a separate document without having to refer to previous annual reports of the AEM Program for the CRCIP.

5-1 MA-4 Decision Criteria

Estimates of habitat opportunity will be calculated using the post-Project bathymetry of the LCR. Pre- and post-Project comparisons may require re-calculation of pre-Project opportunity values given the availability of more recent pre-Project bathymetry than that used in the original Bottom et al. (2005) analyses. The post-construction MA-3 survey data can contribute to the calculations of habitat opportunity.

The CRCIP will fund one habitat survey conducted under the AFEP. The survey will be conducted three years following Project construction. As a result of the AFEP, there will be approximately 10-years of pre-Project habitat survey data. The results of the pre- and post-Project habitat comparisons will be evaluated in the AEM process.

Threshold values of change (i.e., decision criteria) will be defined for each habitat type as a result of the pre-Project survey data. Measures that exceed any of the decision criteria may result in adaptation to current management actions. Table 5-1.1 illustrates a template for future use in evaluating results of MA-4 habitat surveys.

Table 5-1.1. Template for Evaluating Changes in Habitat Opportunity (Velocity, Depth) using Results from MA-4 Habitat Surveys.

	Habitat Opportunity (h/month)[2]											
LCR	Pre-construction[3]			Post-construction[5]			Percent change			Decision criteria (%-change)[6]		
Region[1]	Velocity	Depth	Combined	Velocity	Depth	Combined	Velocity	Depth	Combined	Velocity	Depth	Combined
1	580 - 620[4]	125 - 160										
2	275 - 310	~50										
3	590 - 610	210 - 240										
4	350 - 550	190 - 210	140 - 180									
5	390 - 500	155 - 180										
6	50 - 490	10 - 90										

[1] Regions defined by Bottom et al. (2005)

Region 1	Baker Bay
Region 2	Lower mainstem
Region 3	Youngs Bay
Region 4	Cathlamet Bay
Region 5	Grays Bay
Region 6	Upper estuary

[2] Calculated for 30-d (720 h) month

[3] Results reported in Bottom et al. (2005)

[4] Ranges reflect seasonal variations in river discharge

[5] Post-Project values of habitat opportunity will be estimated using the same methodology as Bottom et al. (2005) and bathymetry data revised in relation to channel deepening

[6] MA-4 decision criteria have yet to be defined by the Adaptive Management Team

5-2 AMT Decisions for MA-4

Table 5-2.1 outlines the key discussion and decisions regarding potential CRCIP impacts on habitat through calendar 2008 of the AEM Program.

Table 5-2.1. CRCIP AEM Plan Record of AMT MA-4 Decisions.

Date	Issue	MA-4 Decisions	Comments
16 Dec 2004	**MA-4 Decision Criterion**	Re-evaluation of Bottom et al.(in prep.) calculations of habitat opportunity.	
16 Dec 2004	**MA-4 Decision Criterion**	Detailed survey to be conducted 3 years after project construction.	
16 Dec 2004	**MA-4 Decision Criterion**	Presentation of ongoing studies (Science Center) that are further elaborating salmonid utilization of the lower river and estuary.	
5 Jul 2005	**MA-4 Decision Criterion**	The Channel Improvement Project will fund one of the 10 years and include support for in-depth analysis of the data obtained during this study. Discussion continues concerning which one of the 10 years will be funded by the CRCIP. It was proposed to select the year corresponding to 3 years after Project completion.	
5 Jul 2005	**MA-4 Decision Criterion**	NOAA Fisheries (C. Tortorici) expressed an interest in selecting the year of Project funding for the more intensive studies to be supported by MA-4. The NOAA emphasis resides in ensuring that the intensive study is performed. NOAA was silent concerning the Corps proposed target year designated as three years post-construction.	
5 Jul 2005	**MA-4 Decision Criterion**	The Corps noted that additional discussion is needed to come to an agreement on identifying the post-construction year selected for MA-4. This should be a topic of future AMT meetings until resolved.	
1 Sep 2005	**MA-4 Decision Criterion**	The agencies concurred that setting triggers at this time would be premature and that this MA would be reviewed quarterly. It was also agreed that either NOAA or the Corps would report the study findings at the yearly AFEP meeting.	
10 Jan 2007	**MA-4 Habitat Surveys**	The AMT made no new decisions concerning MA-4.	
11 Apr 2007	**MA-4 Habitat Surveys**	No decisions were required for MA-4.	
11 Jul 2007	**MA-4 Habitat Surveys**	No new information was reported for MA-4.	
3 Oct 2007	**MA-4 Habitat Surveys**	No new information was reported for MA-4.	
9 Jan 2008	**MA-4 Habitat Surveys**	No new information was available for MA-4.	
29 Apr 2008	**MA-4 Habitat Surveys**	No new information was available for MA-4.	
9 Jul 2008	**MA-4 Habitat Surveys**	No new information was available for MA-4.	

Table 5-2.1. CRCIP AEM Plan Record of AMT MA-4 Decisions. (Continued).

8 Oct 2008	**MA-4 Habitat Surveys**	No decisions were made for MA-4 at the October 2008 meeting.	

6 Monitoring Action 5—Sediment Contaminants

MA-5 addresses the potential for existing sediment contaminants to be suspended by dredging activities. This action includes the collation and evaluation of existing data that describe sediment contaminants in the LCR and estuary. Given limitations in available data, MA-5 has initially focused on samples that were collected well before the onset of the CRCIP. More recent data will be included as they are identified and become available to the AMT.

6-1 Sediment Contaminants

During 2008, the SEDQUAL data base, which is the primary repository for sediment contaminant data relevant to the CRCIP, was incorporated into the Environmental Information Management system that is operated by the state of Washington. The Portland District of the Corps of Engineers will continue to be involved in identifying relevant sediment contaminant data for the CRCIP. However, most of the data of interest will be maintained in the SEDQUAL.

During 2008, sediment samples were obtained for chemical analysis from CRM 3–106.5 by the Corps. Maps showing the locations of sample collection were presented to the AMT. Physical characteristics were obtained for sediments at all sample locations. Chemical analyses were performed for a selected subset of the samples. The results of the chemical analysis were not available at the end of calendar 2008. It was anticipated that the results will be presented at one of the 2009 quarterly AMT meetings.

6.2 AMT Decisions for MA-5

Table 6-2.1 summarizes the important AMT discussion points and decisions concerning the possible impacts of Project construction on redistribution of sediment contaminants through calendar 2007.

Table 6-2.1. CRCIP AEM Plan Record of AMT MA-5 Decisions.

Date	Issue	MA-5 Decisions	Comments
16 Dec 2004	**MA-5 Decision Criterion**	AMT will solicit summaries of sediment contamination data from technical group already performing this work.	
16 Dec 2004	**MA-5 Decision Criterion**	The AMT will interact with the LCREP to acquire additional data and information concerning chemical contaminants in the lower river and estuary.	
1 Sep 2005	**MA-5 Decision Criterion**	WDOE agreed to verify whether they would be housing the system. (Update: WDOE e-mailed the Corps on September 6, stating that WDOE "…will always maintain the SEDQUAL system as for their purposes so it will always be available to use of the AMT.)	
1 Sep 2005	**MA-5 Decision Criterion**	As for the triggers, the team discussed using the new SEF as triggers for sediment quality upon approval and adoption of the SEF.	
12 Oct 2005	**MA-5 Decision Criterion**	While there are some gaps, the SEF largely addresses the sediment contaminants of interest to Washington, Oregon, and Idaho. The AMT agrees that decision criteria for MA-5 should be made on the basis of the final SEF.	
12 Apr 2006	**MA-5 Reporting**	The AMT agreed that the SEDQUAL input template was adequate to describe newly obtained sediment contaminants data.	
10 Jan 2007	**MA-5 Sediment Contaminants**	The Corps will convene a meeting to review available sediment contaminant data.	
11 Apr 2007	**MA-5 Sediment Contaminants**	No decisions were required for MA-5.	
11 Jul 2007	**MA-5 Sediment Contaminants**	No new information was reported for MA-5.	
3 Oct 2007	**MA-5 Sediment Contaminants**	The Corps (Mark Sippola) will be contacting ODEQ to provide sediment toxic chemical information for the base period and optional work that was awarded to the Great Lakes. The AMT also discussed tracking in the decision summary the areas that ODEQ has approved for dredging.	
9 Jan 2008	**MA-5 Sediment Contaminants**	ODEQ has provided a summary of river miles that have been approved for dredging. This information will be summarized in a spreadsheet and posted at the E2 CRCIP web site (Folder: MA-5 Sediment Quality).	
29 Apr 2008	**MA-5 Sediment Contaminants**	No decisions were made concerning MA-5.	
9 Jul 2008	**MA-5 Sediment Contaminants**	No new information was available concerning MA-5.	
8 Oct 2008	**MA-5 Sediment Contaminants**	Results of sediment testing from CRM 3-106.5 will be presented at the January 2009 AMT meeting.	

7 Monitoring Action 6—Fish Stranding

Similar to MA-4, the monitoring of fish stranding in relation to Project construction will be based on a before-and-after comparison. Project construction was not completed in 2008. Therefore, the following sections for MA-6 are identical to the 2007 annual report.

7-1 Frequency of Stranding

The proposed decision criteria for fish stranding are based on a comparison of pre- and post-Project numbers of stranded fish. An increase in the number of stranded fish following channel improvements could initiate the adaptive components of the AEM Program for the CRCIP. Table 7-1.1 summarizes the results of intensive field studies aimed at understanding the potential for fish stranding by commercial navigation in the Columbia River and estuary (Pearson et al. 2005a). On average across all three locations, approximately 26 percent of the vessel passages were associated with stranding events. This frequency ranged from ~18 to 30 percent for these 3 locations. If corresponding post-Project stranding frequencies are statistically greater than the values summarized in Table 7-1.1, the adaptive components of the AEM Plan could be invoked to determine the likely cause for the measured increase.

Table 7-1.1. Frequency of fish stranding events at study sites (Pearson et al. 2005a).

Sites	Stranding events	Total passages	Frequency (%)
County Line Park (RM 51)	3	17	17.6
Barlow Point (RM 62)	7	23	30.4
Sauvie Island (RM 97)	4	14	28.6
Overall frequency: 25.9%	Chi square: p=0.64		

7-2 Susceptibility to Stranding

In addition to potentially changing the frequency of fish stranding events, channel modifications in the Columbia River and estuary might alter the susceptibility of different fish species to stranding. Pearson et al. (2005a) estimated the relative percentage of 11 species commonly collected in the locations of the stranding studies (Table 7-2.1). The results of seining indicated that the relative abundance of fish subject to stranding was dominated by the three-spine stickleback, peamouth, American shad, and age 0+ chinook salmon. The relative abundances of these species among the stranded fish were also calculated. Dividing the relative frequency of stranding by the relative abundance produced a ratio that defines the susceptibility for each of the 11 species (Table 7-2.1). Ratios greater than 1.0 indicate greater susceptibility to stranding. That is, the species is proportionally over-represented among the stranded fish compared to its relative availability. In contrast, susceptibility ratios less than 1.0 indicate some ability of the species to reduce its likelihood of stranding.

Bass (fry) were the most susceptible of the 11 species to stranding by commercial vessel passage. Sunfish (bluegill), crappie, and age 0+ chinook were also susceptible. The remaining species demonstrated some capability to avoid stranding. The susceptibility ratios can also serve as decision criteria for fish stranding in the AEM Plan. Potential modifications in fish habitat and changes in fish behavior associated with channel modifications could increase the local availability or susceptibility of these (or other) species. If post-Project susceptibility ratios increase significantly compared to those reported in Table 7-2.1, the adaptive components of the AEM Plan should be followed to determine the likely reason for the increases.

Table 7-2.1. Relative Susceptibility of Different Fish Species to Stranding (Pearson et al. 2005a).

Species	Percent Stranded	Percent Seined	Susceptibility Ratio
Chinook salmon (0+)	30.1	12.5	2.4
Three-spin stickleback	25.9	28.7	0.9
Peamouth	5.7	22.3	0.3
Banded killifish	10.6	12.3	0.9
Bass (fry)	16.0	0.2	80.0
American shad	8.2	20.1	0.4
Yellow perch	0.8	1.7	0.5
Mountain whitefish	0.6	0	0
Starry flounder	0.8	2.0	0.4
Crappie	0.4	0.1	4.0
Sunfish/bluegill	0.8	0.1	8.0

The pre-construction evaluation of fish stranding was completed in 2007 and the final report has been posted to the E2 Project web site (www.e2tm.com/CRCIP). The form and content of these tables of decision criteria have been accepted by the AMT. The above decision criteria have been included in the AEM Workbook.

7-3 AMT Decisions for MA-6

Table 7-3.1 summarizes the key discussion points and decisions concerning the possible impacts of CRCIP construction on fish stranding through calendar 2008 for the AEM Program.

Table 7-3.1. CRCIP AEM Plan Record of AMT MA-6 Decisions.

Date	Issue	MA-6 Decisions	Comments
16 Dec 2004	**MA-6 Decision Criterion**	Studies of fish stranding will continue in 2005.	
16 Dec 2004	**MA-6 Decision Criterion**	Need to examine the statistical model to identify the factors and interaction terms that can be effectively incorporated into the AEM process.	
16 Dec 2004	**MA-6 Decision Criterion**	Revisit decision criteria after studies are completed (approx. November–December 2005).	
1 Sep 2005	**MA-6 Decision Criterion**	Post-construction studies of stranding will be performed and the results will be compared to pre-construction stranding study results.	
12 Oct 2005	**MA-6 Decision Criterion**	No decisions were made concerning fish stranding at the October 2005 AMT meeting.	

Table 7-3.1. CRCIP AEM Plan Record of AMT MA-6 Decisions. (Continued).

12 Apr 2006	**MA-6 Reporting**	The AMT suggested that tables describing fish stranding be modified to focus on species of concern (i.e., salmonids).	
10 Jan 2007	**MA-6 Fish Stranding**	The final report of the pre-construction evaluation of fish stranding has been completed and will be posted to the E2 FTP site.	
11 Jul 2007	**MA-6 Fish Stranding**	No new information was provided for MA-6.	
3 Oct 2007	**MA-6 Fish Stranding**	No new information was provided for MA-6.	
9 Jan 2008	**MA-6 Fish Stranding**	No new information was provided for MA-6.	
29 Apr 2008	**MA-6 Fish Stranding**	No new information was provided for MA-6.	
9 Jul 2008	**MA-6 Fish Stranding**	No new information was provided for MA-6.	
8 Oct 2008	**MA-6 Fish Stranding**	No decisions were made for MA-6 at the October 2008 meeting.	

8 Sturgeon

Criteria to protect sturgeon as part of the AEM process will address the possible CRCIP impacts on the mortality, survival, growth, movements, feeding behavior, and habitat utilization of these fish in relation to the dredging process and the disposal of dredged materials. These actions emphasize the selection of alternative sites for disposing of dredged materials if significant impacts are observed. Alternatively, the dredging schedule can be modified to minimize impacts on sturgeon.

8-1 Decision Criteria for Sturgeon

AMT discussions during 2008 focused on concerns that modification of channel slopes and bedform as the result of Project construction might impact the quality and distribution of preferred sturgeon habitat. Preliminary analysis of the monitoring data suggests that these fish prefer steeply-sloped channels and rough channel bedform.

The principal investigators of the sturgeon research, Michael Parsley and James Hatten, attended the July 2008 AMT meeting. A report that describes the sturgeon habitat analysis had been prepared by these investigators and made available to the AMT prior to the July meeting. Parsley described the sturgeon habitat model and presented the model results for the LCR. The empirical habitat model is based on water depth, bottom slope, and bottom roughness. The model appears capable of forecasting habitat quality for sturgeon in relation to these three structural attributes in the LCR.

Several AMT members provided comments and raised questions concerning the habitat analysis and modeling. Replies by the investigators to AMT questions and comments were not available at the end of calendar 2008.

The sturgeon habitat modeling presentation was posted on the E2 CRCIP web site in the Sturgeon Reporting folder of the AEM Workbook.

8-2 AMT Decisions regarding Sturgeon

Table 8-2.1 summarizes the key discussion points and decisions concerning the possible impacts of Project construction on sturgeon through calendar year 2008 for the AEM Program.

Table 8-2.1. CRCIP AEM Plan Record of AMT Decisions for Sturgeon.

Date	Issue	Sturgeon Decisions	Comments
16 Dec 2004	**Sturgeon**	Slope characteristics will be further analyzed to identify categories of slope and bed form using existing data. Results will be used to guide dredging and dredge disposal.	
16 Dec 2004	**Sturgeon**	Awaiting completion of report (due mid-January 2005).	
16 Dec 2004	**Sturgeon**	Mitigation strategy to be developed during January.	
16 Dec 2004	**Sturgeon**	Ongoing studies will look at disposal impacts.	

Table 8-2.1. CRCIP AEM Plan Record of AMT Decisions for Sturgeon. (Continued).

5 Jul 2005	**Sturgeon**	Previous monitoring studies of tagged sturgeon suggest minimal or no impacts of dredging or disposal of dredged materials on these fish. Additional analyses of the data are awaited to determine the nature of bottom type (flat or presence of structure) that seem important to sturgeon in the lower river and estuary. With the exception of a desire for additional studies by Washington (L. Randall), there is general consensus among the AMT that sturgeon can be removed from further consideration in relation to implementing the Project AEM Plan.	
1 Sep 2005	**Sturgeon**	At the July 5, 2005 weekly AMT meeting, the AMT agreed that previous monitoring studies of tagged sturgeon suggested minimal or no impacts due to dredging or disposal of dredged materials and that adaptive management will be required only if dredging activities alter habitat. The Corps had previously indicated that additional work would be done on correlating sturgeon abundance with habitat using the existing data.	
1 Sep 2005	**Sturgeon**	The Corps at the current meeting had concerns with funding stating that the work plan for this study was stopped and the study plan was not finalized. The agencies also requested that any study plans for this work be reviewed by all agencies.	
10 Jan 2007	**Sturgeon**	The Corps will check the status of the sturgeon habitat analysis.	
11 Apr 2007	**Sturgeon**	No decisions were required for sturgeon.	
11 Jul 2007	**Sturgeon**	The habitat analysis report for sturgeon has not yet been completed.	
3 Oct 2007	**Sturgeon**	It is anticipated that the USGS will finalize the sturgeon report in time for the January 2008 AMT meeting. If the report is available in time, the results will be discussed at the meeting.	
9 Jan 2008	**Sturgeon**	The report describing habitat analysis for sturgeon should be available for the April 2998 AMT meeting.	
29 Apr 2008	**Sturgeon**	Oregon Department of Fish and Wildlife (ODFW) had some remaining issues and requested time at a future meeting to discuss them with the original investigators, who will be contacted concerning availability.	
9 Jul 2008	**Sturgeon**	The sturgeon habitat analysis and model developed by Parsley and Hatten will be posted to the E2 CRCIP web site.	
8 Oct 2008	**Sturgeon**	No decisions were made for sturgeon at the October 2008 meeting.	

9 Smelt

Criteria to protect smelt (Eulachon) as part of the AEM process address the possible CRCIP impacts on the survival, movements, and habitat utilization of these fish in relation to the dredging process. Decision criteria to minimize channel improvement impacts on smelt take the form of depth constraints (43 ft.) on flow lane disposal between CRM 35 and CRM 75. In-water disposal is not permitted between the eighth and 20th weeks of the year (out migration).

9-1 Decision Criteria for Smelt

Decision criteria concerning disposal of dredged materials on smelt were provided in the 2006 annual report for the channel deepening AEM Plan (Table 9-1.1). The criteria are essentially compliance or non-compliance with state requirements for disposal of dredged materials during smelt migration. The AMT concurred that no variances with the decision criteria for smelt were reported for 2008.

Table 9-1.1. Compliance Measures Offered as Decision Criteria for Smelt in Implementation of the CRCIP AEM Plan.
Washington
In-water disposal of dredged material will not occur in areas shallower than 43-feet between CRM 35 and CRM 75 along the Washington shoreline. These areas are defined by depths determined in the pre-construction bank-to-bank bathymetry supplemented by additional channel bathymetry.
Washington, Oregon
In-water disposal will not occur during the period of peak Eulachon out migration (between the 8th and 20th weeks of the year) from the identified spawning areas (CRM 35–CRM 75). If in-water disposal is essential during the period of peak out migration, then the Corps shall further study the potential for Eulachon losses as a result of dredged material disposal impacts. Appropriate mitigation measures shall be developed based on the study outcomes, as determined through an AMP.

9-2 AMT Decisions regarding Smelt

The information summarized from the quarterly AMT meetings indicated that no decisions were required concerning project impacts on smelt during 2008 (Table 9-2.1).

Table 9-2.1. CRCIP AEM Plan Record of AMT Decisions for Smelt.

Date	Issue	Smelt Decisions	Comments
16 Dec 2004	**Smelt**	Regularly report compliance with state issues concerning flow-lane disposal.	
16 Dec 2004	**Smelt**	If flow-lane disposal becomes necessary, the abundance of smelt and time of peak out-migration will be documented by the Corps and provided to the AMT to determine timing and guidance for dredge disposal.	
28 Jun 2005	**Smelt**	The team agreed that dredging will occur between RM 35-75 between August 1 and September 30.	
10 Jan 2007	**Smelt**	No issues or decisions concerning smelt were raised at the January 10, 2007, AMT meeting.	
11 Apr 2007	**Smelt**	No decisions were required for smelt.	
11 Jul 2007	**Smelt**	No decisions were required for smelt.	

3 Oct 2007	**Smelt**	No decisions were required for smelt.	
9 Jan 2008	**Sturgeon**	No new information was provided for smelt, although there was some discussion and recognition concerning smelt in the diet of sturgeon.	

Table 9-2.1. CRCIP AEM Plan Record of AMT Decisions for Smelt. (Continued).

Date	Issue	Smelt Decisions	Comments
29 Apr 2008	**Sturgeon**	No new information was available regarding smelt.	
9 Jul 2008	**Sturgeon**	No new information was available regarding smelt.	
8 Oct 2008	**Sturgeon**	No decisions were made for smelt at the October 2008 meeting.	

No new Project-related information concerning adaptive management and smelt was presented during the 2008 AEM Program. However, the NMFS noted that smelt are under review for possible Endangered Species Act listing. Smelt will likely be listed sometime during the spring of 2009. The proposal for listing will appear in the Federal Register and NMFS will notify the AMT upon publication. The Corps will have approximately one year (+60 days) to make any necessary modifications to its construction (and potentially, maintenance) practices in relation to the CRCIP. However, it is anticipated that Project construction will have been completed by that time.

10 Dungeness Crab

The objectives of the AEM Plan concerning Dungeness crab are to avoid or minimize (1) entrainment mortality during dredging and (2) crab burial by disposal of dredged materials. The underlying intent is "no net loss" of these organisms as a result of channel improvement. Two studies were performed prior to Project construction to assess the potential impacts on crabs. Phase I studies addressed the physical forces associated with dredging on crabs. Phase II studies focused on the response of crabs to burial in experimental tanks. Phase III studies were proposed to examine crab burial under field conditions. However, it is logistically very difficult to perform the necessary experiments under field conditions and Phase III studies will not likely be conducted in relation to the AEM Program for the CRCIP.

10-1 Decision Criteria for Dungeness Crab

As indicated in previous CRCIP AEM annual reports, entrainment studies were performed at several locations within the estuary, including the mouth of the Columbia River, Desdemona Shoals, Upper Sands, Miller Sands, and Flavel Bar (Pearson et al. 2005b). Estimated crab entrainment rates varied by location, age class, and year. Entrainment rates decreased progressively upriver from the mouth of the estuary, presumably in relation to the reduced abundance of crabs (Table 10-1.1).

Table 10-1.1. Crab Entrainment Rates (crabs/cy) Estimated for 2004 (Pearson et al. 2005b).

Location	Age 0+	Age 1+	Age 2+	Age 3+	All
MCR All	0.0572	0.0028	0.0210	0.0128	0.0937
MCR-1	0.0535	0.0023	0.0147	0.0179	0.0883
MCR-2	0.0445	0.0022	0.0341	0.0126	0.0934
MCR-3	0.0760	0.0042	0.0137	0.0067	0.1007
Desdemona	0.0139	0	0.0035	0.0065	0.0239
Flavel Bar	0	0.0031	0.0035	0.0046	0.0112

Pearson et al. (2005b) recommended actions to mitigate the potential impacts of Project dredging on Dungeness crabs. One, understanding of seasonal patterns of salinity values throughout the lower river and estuary could be used to schedule dredging operations when salinity values are low (<16 psu) and crabs are correspondingly less abundant. Additionally, disposal of dredged materials should be avoided at the North Jetty Site thus reducing potential impacts on 1+ crabs that migrate through this area during the October–November time frame.

The AMT had previously agreed that the results of the crab entrainment studies provided useful information for evaluating the effects of Project-related dredging on crab mortality and distribution. However, during 2008, the AMT was informed that several issues of potential concern to the ODFW remained with regard to crab entrainment and burial. ODFW raised the need for additional information concerning dredging impacts on YOY and age 1+ crabs.

Additional discussion during 2008 addressed concerns of possible dredging conflicts between the time period for juvenile salmon (September–October) out-migration and the movement of age 1+

crab (November–February). Scheduling of Project construction might have to weigh between the potential impacts on crab versus possible impacts on juvenile salmon.

10-2 AMT Decisions regarding Dungeness Crab

Table 10-2.1 summarizes the accumulated decision and key discussion points concerning the CRCIP and potential impacts on Dungeness crab in the LCR and estuary.

Table 10-2.1. CRCIP AEM Plan Record of AMT Decisions for Crab.

Date	Issue	Crab Decisions	Comments
1 Sep 2004	**Crab**	The draft crab mitigation strategy document was sent out for review by the AMT on June 21, 2005. The agencies had no feedback on the document but considered it to be a living document that could potentially change as new information on crabs was obtained. They also indicated that additional information should be obtained on the distribution and abundance of 1+ crab at Desdemona shoal.	
12 Apr 2006	**Crab**	The AMT agreed that reporting on crab entrainment would mainly take the form of including new data that became available during the course of the Project.	
12 Apr 2006	**Crab**	The Washington Department of Ecology accepted the Corps crab mitigation plan subject to the collection of additional data in 2007 at the Desdemona sampling location.	
11 Oct 2006	**Crab**	The final version of the Pearson et al. (2005b) report on crab entrainment will be posted at the E2 Project web site.	
10 Jan 2007	**Crab**	DLCD and ODFW indicated some remaining issues concerning project impacts on Dungeness crab. Conversations will occur separately outside the context of the AMT.	
11 Apr 2007	**Crab**	Final crab entrainment and burial report was posted to the E2 web site.	
11 Jul 2007	**Crab**	The final report was posted for review on the E2 FTP site.	
3 Oct 2007	**Crab**	Awaiting possible comments from ODFW on crab report.	
9 Jan 2008	**Crab**	Dale Blanton will check to see if ODFW has any remaining issues regarding the crab study report. He will report at the July 2008 AMT Meeting.	
29 Apr 2008	**Crab**	No decisions were made concerning crab.	
9 Jul 2008	**Crab**	ODFW indicated that there were some unresolved issues to be discussed concerning potential dredging impacts on crab. ODFW will summarize these issues at the October AMT meeting. There was also recognition of possible dredging conflicts between the time period for outmigration of juvenile salmonids and movement of Age 1+ crab.	
8 Oct 2008	**Crab**	No decisions were made for crab at the October 2008 meeting.	

11 Sediments

A major activity of the AEM Program for the CRCIP during 2008 addressed the role of the CRCIP in contributing towards the development of a regional sediment management plan for the Lower Columbia River and estuary.

11-1 Decision Criteria for Sediments

Discussions continued among the AMT participants in 2008 about the relationship between the CRCIP and recognized needs for regional sediment management for the LCR and estuary. The AMT recognized that opportunities for a CRCIP contribution to regional sediment management appear limited to: (1) identification of beneficial uses in relation to Project construction and disposal of dredged materials, (2) making Project dredged materials that are disposed on upland sites available for relocation for beneficial uses, and (3) interaction with other sediment management projects in the LCR that can make use CRCIP-generated dredged materials. Importantly, an overall desire was expressed to retain as much of the dredged material in the Columbia River system as possible.

Concerns were expressed among the AMT that opportunities for beneficial uses of Project dredged materials were being missed. Emphasis on upland disposal appears to continue to take precedence over possible flow-lane or shallow water disposal. In addition, opportunities for the CRCIP to assist in beach nourishment also seem to be missed. At the same time, it was noted that the Corps is bound by its Congressional authorization to use the disposal sites that were identified in the EIS developed for the CRCIP. In this context, Project funds are tied to specific construction contracts. Firms that bid on construction contracts propose disposal areas from among those that have been approved within the EIS. The contracting process for Project construction would likely have to be modified to permit the evaluation of beneficial use sites by the AMT or other relevant stakeholders. Such a modification might force reopening of the NEPA process.

The AMT devoted the April 2008 quarterly meeting to assessing the opportunities for Project contributions to regional sediment management. Prior to the meeting, language in the current CRCIP AEM Plan concerning sediment management was reviewed and a “strawman” conceptual model for sediment management was developed and provided to the AMT members. Participants were asked to consider what closure (success) might involve beyond the current sediment management language in the Project AEM Plan. Individual agencies represented on the AMT were invited to propose alternative sites for disposal of Project dredged materials. A draft outline of a workshop report was provided at the meeting for use in guiding the workshop activities towards a tangible product – namely, an AMT consensus process for active participation in identification of potential dredged materials disposal sites for the CRCIP.

The April meeting participants evaluated the conceptual model for regional sediment management and undertook an example application of the model within a selected Project river reach. The river reach was analyzed in detail to identify the possibilities for beneficial uses of

dredged materials. By working through a detailed site-specific analysis, a process for further integrating the sediment management within the CRCIP with regional sediment management became apparent. The workshop activities demonstrated the ability of the AMT to work effectively in identifying potential alternative disposal locations. Participants identified possible alternative disposal locations along CRM 46–61. Five sites were reviewed and evaluated based on existing information and decision criteria developed during the workshop. Three of the five sites (Barlow Point, Hump Island, and Willow Grove) appeared as potential opportunities for disposal. The AMT discussed alternative models for participation in the identification of disposal sites prior to the Corps requesting bids or proposals for new construction.

Throughout 2008, the AMT reinforced its interest in contributing to LCR regional sediment management and beneficial uses of Project construction materials. The AMT also underscored the need to integrate CRCIP sediment management with the parallel efforts underway by the Lower Columbia Solutions Group, the Lower Columbia River Estuary Program, and other Corps O&M activities. For example, a regional sediment management framework is being developed by the Corps of Engineers and other LCR stakeholders. Different Corps projects (e.g., mouth of the Columbia River) and O&M activities have been contributing to several regional sediment needs. For example, O&M activities have been using flow-lane disposal up to Puget Island. The AMT expressed an interest that the CRCIP Sediment Management Plan is noted and considered in the development of the regional framework. Also AMT recognized that given the near completion of the Project construction, Project contributions to regional sediment management will likely occur during the O&M phase following construction. The AMT remains committed to contributing towards the development of a regional sediment management plan for the LCR and estuary within the authorization of the CRCIP.

11-2 Summary

Discussion of sediment management issues occurred throughout 2007 without resolution. However, the AMT activities during 2008 successfully addressed the sediment issues within the context of the CRCIP authorization and the AEM Plan. The AMT participants developed a consensus process for effectively involving the AMT in the identification and evaluation of sites for disposal of Project construction materials. Participants worked through the process and suggested alternatives for sediment disposal in relation to beneficial uses and sediment management relevant to the AEM Program for the CRCIP. The AMT consensus process for sediment management is described in a sediment management workshop report (Appendix A).

Table 11-2.1 summarizes the decisions made during 2008 concerning the relevance of Project disposal of dredged materials to regional sediment management.

Table 11-2.1. CRCIP AEM Plan Record of AMT Decisions for Sediments.

Date	Issue	Sediments Decisions	Comments
11 Jan 2006	**Sediment Management**	The Corps and E2 agreed to collaborate with WDOE in the development of language concerning sediments (i.e., management of disposal of dredged materials) for incorporation into the Project of the AEM Plan.	

Table 11-2.1. CRCIP AEM Plan Record of AMT Decisions for Sediments. (Continued).

12 Apr 2006	**Sediment Management**	The Corps agreed to further consultation with WDOE concerning the incorporation of sediment management language into the AEM Plan.	
10 Jan 2007	**Sediment Management**	The AMT requested that the exact state language be incorporated into documentation of the sediment management component of the AEM. The Corps will continue to work with the AMT on achieving consensus regarding sediment management in relation to the Project.	
11 Apr 2007	**Sediment Management**	No decisions were required for sediment management. Discussion was deferred to the July AMT meeting.	
11 Jul 2007	**Sediment Management**	Discussions of sediment management were rescheduled for the October AMT meeting.	
3 Oct 2007	**Sediment Management**	Discussions of sediment management will continue at the January 2008 AMT meeting.	
9 Jan 2008	**Sediment Management**	The April 2008 AMT Meeting will focus on conceptual models and approaches to regional sediment management. E2 will propose a "strawman" conceptual model in advance of the April meeting.	
29 Apr 2008	**Sediment Management**	The April AMT Meeting developed an initial process for sediment management in relation to Project construction. The process has been summarized in a draft sediment management workshop report.	
9 Jul 2008	**Sediment Management**	Sediment management will likely occur under LCR channel operation and maintenance. The AMT agreed to look more broadly across Corps projects for opportunities in regional sediment management. The future of sediment management in relation to CRCIP AEM Program will be addressed at the October AMT meeting.	
8 Oct 2008	**Sediment Management**	The 2008 AMT sediment management workshop report was approved as final.	

12 Integration with 2007 AEM Results

Each annual report refers to AEM activities and conclusions in the prior year to provide continuity during the AEM Program for the CRCIP. The following sections briefly review the 2007 AMT activities and summarize AEM monitoring results. Additional detail can be found in the notes from the quarterly AMT meetings and the AEM program workbook that are available through the project web site hosted by E2 (www.e2tm.com/CRCIP).

12-1 Results for Analyses of 2007 Data for MA-1

The primary MA-1 decision criteria are the monthly percentile values for depth, temperature, and salinity. Monthly median values calculated from the CORIE data for tansy, grays, and cbnc3 are compared against these criteria. Tables 12-1.1–12-1.7 list these decision criteria and corresponding MA-1 monthly results for 2006. Detailed plots of daily median values and normalized values of temperature and salinity can be examined by downloading the corresponding files at the E2 web site.

Depth

Table 12-1.1 lists the monthly median depths for the grays station. All 12 monthly values are within the 20–80th percentile decision criteria.

Temperature

With only three exceptions, the monthly median values of water temperature are all within the 20–80th percentile ranges for tansy (Table 12-1.2), grays (Table 12-1.3), and cbnc3 (Table 12-1.4). The other three monthly values show slight elevations in temperature that are between the 80–95th percentile decision criteria. None of the monthly median values for 2007 are outside of the 5–95th percentile ranges.

Salinity

Tables 12-1.5–12-1.7 present the monthly median salinity values for tansy, grays, and cbnc3. The 2007 results are quite similar to those observed in 2008. The available data for tansy are all within the 20–80th percentile decision criteria. The 2007 monthly median values for grays are more variable in relation to the decision criteria. However, the overall magnitudes of salinity changes are small. Similar results were obtained for cbnc3, although if there were any tendency, it was towards decreased values of salinity–again, not indicative of salinity intrusions.

Table 12-1.1. Summary of 2007 Monthly Median Depth Values (bold numbers) for grays Station in Relation to AEM Percentile Decision Criteria.

	Monthly median depth (m)											
Percentile	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
5	0.6	0.5	0.5	0.5	0.4	0.3	0.2	0.2	0.3	0.3	0.4	0.5
20	1.3	1.2	1.1	1.1	1.0	1.0	0.9	0.9	0.9	0.9	1.1	1.2
	2.2	**-**	**-**	**1.8**	**1.8**	**1.9**	**1.7**	**1.7**	**1.7**	**1.9**	**1.9**	**2.0**
80	2.8	2.8	2.7	2.6	2.6	2.5	2.5	2.5	2.5	2.5	2.7	2.8
95	3.4	3.3	3.2	3.1	3.1	3.1	3.0	3.0	3.0	3.0	3.3	3.3

Table 12-1.2. Summary of 2007 Monthly Median Temperature Values (bold numbers) for tansy Station in Relation to AEM Percentile Decision Criteria.

	Monthly median temperature (C)											
Percentile	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
5	4.9	5.3	6.3	8.4	9.2	9.4	9.4	9.3	9.4	9.3	8.3	6.5
20	6.2	6.4	7.4	9.3	10.6	10.9	10.8	11.0	11.0	11.1	9.4	7.6
	6.4	**7.1**	**8.5**	**9.9**	**12.0**	**14.4**	**17.2**	**16.1**	**13.5**	**12.7**	**10.9**	**8.5**
80	9.2	8.9	9.7	11.2	13.4	15.6	16.9	17.4	16.1	13.9	11.6	9.9
	10.3	9.9	10.8	12.0	14.5	16.8	18.9	19.3	17.7	15.1	12.5	10.8
95	10.3	9.9	10.8	12.0	14.5	16.8	18.9	19.3	17.7	15.1	12.5	10.8

Table 12-1.3. Summary of 2007 Monthly Median Temperature Values (bold numbers) for grays Station in Relation to AEM Percentile Decision Criteria.

	Monthly median temperature (C)											
Percentile	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
5	4.0	4.1	5.2	8.0	10.5	14.1	16.6	18.3	16.3	11.8	7.4	5.2
20	4.7	4.7	6.0	9.0	11.6	15.2	18.0	19.3	17.3	12.9	9.0	6.2
	5.7	**No data**	**No data**	**11.1**	**14.0**	**17.1**		**20.5**	**18.1**	**14.1**	**10.8**	**6.6**
80	6.6	6.5	8.4	11.4	14.8	17.6	20.6	21.1	19.5	15.9	11.3	8.0
							20.7					
95	7.7	7.3	9.4	12.6	15.9	18.8	21.8	21.9	20.5	17.3	12.3	8.8

Table 12-1.4. Summary of 2007 Monthly Median Temperature Values (bold numbers) for cnbc3 Station in Relation to AEM Percentile Decision Criteria.

	Monthly median temperature (C)											
Percentile	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
5	3.2	4.2	5.1	8.1	11.1	14.9	17.4	18.4	16.0	11.9	7.7	5.2
20	4.1	4.8	6.0	8.9	12.1	15.6	18.4	19.5	17.1	13.4	9.0	6.1
	4.3	**5.1**	**7.6**	**9.8**	**13.9**	**17.0**	**20.7**	**20.7**	**18.6**	**14.4**	**No data**	**6.4**
80	6.4	6.5	8.3	11.2	15.0	17.7	21.1	21.5	19.5	16.7	10.9	7.6
											11.1	
95	7.3	7.2	9.0	12.6	16.0	18.8	22.3	22.3	20.6	17.8	12.0	8.6

Table 12-1.5. Summary of 2007 Monthly Median Salinity Values (bold numbers) for tansy Station in Relation to AEM Percentile Decision Criteria.

	Monthly median salinity (psu)											
Percentile	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
5	2.3	2.4	2.0	1.6	2.0	1.5	6.9	6.2	8.1	8.1	6.2	3.1
20	5.3	5.8	5.1	4.5	4.3	4.4	12.8	10.5	12.5	12.8	11.1	7.2
	No data	**No data**	**No data**	**7.7**	**9.4**	**14.2**	**18.0**	**17.8**	**No data**	**No data**	**No data**	**No data**
80	25.5	26.1	24.9	25.3	25.0	26.5	28.1	28.0	27.9	27.6	26.7	26.3
95	28.5	28.6	27.8	27.9	27.9	29.3	29.9	30.0	30.0	29.4	29.0	28.7

Table 12-1.6. Summary of 2007 Monthly Median Salinity Values (bold numbers) for grays Station in Relation to AEM Percentile Decision Criteria.

	Monthly median salinity (psu)											
Percentile	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
	0.0			**0.0**	**0.0**	**0.0**						**0.0**
5	0.2	0.2	0.2	0.2	0.0	0.2	0.3	0.3	0.5	0.4	0.3	0.3
	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.5	0.8	0.7	0.5	0.3
20	**No data**	**No data**	**No data**	**No data**	**No data**	**No data**	**0.7**	**1.4**	**3.4**	**2.1**	**1.2**	**No data**
	1.2	0.8	0.8	0.7	0.7	0.7	2.4	2.4	4.4	3.7	2.7	0.8
80	3.1	2.7	2.0	1.4	0.8	1.3	5.5	4.4	6.9	6.2	4.8	2.2
95	3.1	2.7	2.0	1.4	0.8	1.3	5.5	4.4	6.9	6.2	4.8	2.2

Table 12-1.7. Summary of 2007 Monthly Median Salinity Values (bold numbers) for cbnc3 Station in Relation to AEM Percentile Decision Criteria.

	Monthly median salinity (psu)											
Percentile	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
	0.0	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**					
5	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
20	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.4	0.2	0.2	0.2
								No data	**No data**	**No data**	**No data**	**No data**
80	0.7	0.7	0.7	0.7	0.7	0.7	1.7	2.5	3.5	7.0	2.2	0.7
95	2.3	2.1	3.3	1.7	0.9	1.5	4.5	6.3	9.3	12.3	5.3	2.0

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Appendix A

COLUMBIA RIVER CHANNEL IMPROVEMENT PROJECT

ADAPTIVE ENVIRONMENTAL MANAGEMENT PROGRAM

SEDIMENT MANAGEMENT WORKSHOP
- FINAL REPORT -

Workshop Purpose

The AMT of the CRCIP AEM Program convened a one-day workshop on April 29, 2008, to discuss the disposal of Project dredged materials within the broader context of regional sediment management in the LCR and estuary.

The following language from the CRCIP AEM Plan supports the participation of the AMT in examining how the CRCIP can contribute to regional sediment management.

> "Concerns have been expressed by the AMT about the potential for the disposal of Project dredged materials to impact valued coastal zone habitats. To address these concerns, the Corps is pursuing a regional sediment management program that encompasses the Channel Improvement Project and other Columbia River navigation projects. Consistent with this sediment management program, higher priority will be given to development of near shore sites where disposal of dredged materials can effectively contribute to the littoral zone sediment budget. Accordingly, when near shore sites are available, they will be given priority over estuarine in-water disposal and deepwater ocean disposal to minimize potential dredged material disposal impacts to coastal zone resources." (page *xiv*, Bartell and Nair, 2006)

The overall objective of the workshop was to develop an adaptive management process that (1) facilitates the identification and realization of opportunities for beneficial use of dredged materials generated by Project construction, and (2) encourages the disposal of Project dredged materials in a manner that contributes to regional sediment management in the LCR, within the current authorization of the channel improvement project. Sediment management has been discussed during several previous AMT quarterly meetings, but without resolution concerning the potential contribution of the CRCIP to regional sediment management or the role of the AMT.

This report summarizes the workshop discussions and describes a process whereby the AMT can more actively participate in the selection and evaluation of Project disposal sites. The resulting sediment management process reported here will be incorporated (by reference) as part of the CRCIP AEM Plan.

Sediment Issues within the Lower Columbia River and Estuary

Previous discussions by the AMT have addressed several environmental issues that motivate the development of sediment management plan in relation to the CRCIP. Not all of these issues were revisited during the workshop, but they are briefly outlined in this report to recognize their importance in developing an AEM plan for sediment management.

Upland Disposal

Approximately half of the Project construction materials to date have been disposed in upland locations. Permissible upland disposal sites for Project construction are identified in the FSEIS (2004). MA-2 in the CRCIP AEM Program tracks the amount of dredged materials placed in

each of the approved locations. These amounts are evaluated in relation to the Project forecast for disposal at each location and capacity of each site to receive Project construction materials.

To the extent that upland disposal is used in the CRCIP construction, the AMT expressed a desire that beneficial uses – social, economic, and environmental- of these materials be made wherever possible.

Flow-lane Disposal

In-water and flow-lane disposal are among the least expensive alternatives for dredged material management. By definition, this method of disposal relocates sediments, but does not directly remove them from the system.

Proposals for flow-lane disposal must comply with restrictions on disposal defined by depth and month to protect smelt.

Deep Ocean Disposal

The main advantages of deep ocean disposal are cost and capacity compared to other disposal locations.

Concerns with dredged material disposal at the deep ocean locations focus largely on burial of crabs and potential disturbances to other benthic organisms. Deep ocean disposal also removes sediments from the LCR and estuary.

Beach Nourishment

Dredged materials can be used beneficially to replenish sediments eroded from beaches. Several proposed sites for beach nourishment were removed from consideration in development of the CRCIP list of approved locations (FSEIS 2004). Several of these locations might be available for future Project disposal because additional information has been obtained concerning the sites or subsequent interpretation of existing information now recommends these sites for possible use as disposal locations.

Habitat Loss

Both dredging and disposal of dredged materials can result in the loss of habitat. Habitat creation through the beneficial disposal of dredged materials can in part mitigate for habitat loss.

System-wide Sediment Loss

Debate continues concerning whether the LCR and estuary function regionally as net sources or sinks for sediments. Regardless, deep ocean disposal and confined upland disposal remove sediments from the system.

Unconfined sediments might eventually find there way from upland disposal sites back into the river and estuary.

Use of dredged materials for beach nourishment, disposal at unconfined upland locations, and in-water disposal can help retain sediments within the LCR and estuary.

CRCIP Contribution to Regional Sediment Management

The passage of the 2007 WRDA includes provisions that encourage Corps planners to consider beneficial uses of construction materials. Project disposal of dredged materials can contribute to other agency programs that address regional sediment management within the LCR.

Water Resources Development Act and Sediment Management

As a prelude to sediment workshop activities, Doris McKillip (USACOE) underscored the justification for regional sediment management and beneficial use of dredged materials in relation to the WRDA for 2007. Section 204 of the 2007 WRDA addresses the need for regional sediment management as part of the Corps planning process. The Act encourages consideration of dredged materials as a resource for habitat creation and restoration rather than simply of problem of disposal. The Corps will share 75 percent of costs for beneficial use of dredged materials generated by Corps projects.

Project Contribution towards Regional Sediment Management

Phil Trask, (LCREP/LCSG), an invited workshop participant, described a program directed towards regional sediment management that has been evolving during the past 2 to 3 years under the scope of the LCR and Estuary Program. The scale of this program extends from the Bonneville Dam to the mouth of the river. Previous program efforts have produced digital videography that illustrates near shore and shoreline habitat conditions on both sides of the river and estuary. This digital resource is being integrated with 3-dimensional hydrodynamic model of the river and estuary. The combined resources that include the video, model, GIS data layers, and lidar data are being used to develop long term, large scale geomorphologic capabilities in identifying opportunities for habitat improvements through beneficial uses of dredged materials.

The LCREP/LCSG efforts in sediment disposal for beneficial uses identify an opportunity for the CRCIP to coordinate Project disposal activities and contribute towards regional sediment management within the LCR and estuary.

Current Process for Disposal of Project Dredged Materials

The workshop participants reviewed the current procedures used to identify locations for the disposal of CRCIP construction materials. The ensuing discussion served as a point of departure for the development of an alternative process. The current procedures are outlined in the following paragraphs.

Disposal Sites and Project Construction

In current Project operations, the Corps Project Manager initiates the construction process by identifying dredging needs, the availability of disposal sites, and site capacity for dredged materials. This information is used to develop Project construction plans and solicit participation from interested contractors.

The Corps uses two contracting mechanisms to fund construction: invitations for bids and requests for proposal.

Invitation for Bid

The Corps posts an *invitation for bid*, where selection of a contractor is based on the lowest cost bid for completion of the necessary construction. The bidder must select from among the disposal opportunities identified by the Corps. Alternatively, the contractor can propose other sites for disposal of dredged materials. However, the sites must be permitted and available for use. Costs for permitting and preparation of alternative disposal sites are incurred by the contractor. Not surprisingly, contractor responses to

Request for Proposal

The Corps can also issue a *request for proposal* for the necessary construction. Competing contractors develop proposals to complete the specified construction including a dredged materials disposal plan. The disposal plan could address issues relevant to regional sediment management. Awards are based on the determination of the best overall proposal, which is not necessarily the proposal with the lowest cost. However, as in the invitation for bid, any additional costs for permitting and preparation of proposed alternative disposal sites not currently listed by the Corps are borne by the contractor.

Construction and Disposal

The Corps reviews the bids and makes an award. Issues concerning site capacity and plan compliance with relevant regulations (e.g., seasonal and depth constraints on in-water flow lane disposal) are addressed by the Corps in reviewing proposals. Currently, ODEQ requires dredged materials to be permitted as solid waste. This can incur additional costs for testing materials for contaminants. This policy might also direct prospective contractors to emphasize disposal of dredged materials in available and permitted sites in the state of Washington.

During the CRCIP AEM Project, the Corps has been informing the AMT about the nature of disposal of Project dredged materials (e.g., Monitoring Action-2 in the CRCIP AEM Plan) for individual contract awards.

Monitoring and Evaluation

As part of the overall process, the Corps monitors the construction and disposal of dredged materials to ensure that the contractor is adhering to the approved dredging and disposal plans. The Corps construction office comprises a group of 7–8 staff who monitor construction,

disposal, worker safety, and payment for project construction. These staff members are generally on-site.

Consensus Approach to Sediment Management within the AEM Program

Following discussion of the current process for Project construction and disposal of dredged materials, the workshop participants considered an alternative approach to more actively engage the AMT in sediment management. As a result of these discussions, the AMT developed a consensus process that increases the involvement of the Team in selecting and evaluating disposal sites for Project construction (Figure 1). The initial steps in identifying available disposal sites remain as currently performed by the Corps. However, following the proposed process, the Corps would enlist the AMT to help identify and evaluate the identified disposal sites prior to the solicitation of bids or proposals. This interaction provides an opportunity for the AMT to recommend alternative disposal options.

If the input from the AMT is provided to the Corps at least 60 days prior to the initiation of plans and specifications, the proposed sites can be incorporated into the bid documents. Sites proposed by the AMT must meet the following conditions:

- the disposal site(s) must be available and useable,
- the site(s) must be permitted,
- proposing agencies are willing and able to pay any incremental costs associated with use of proposed site(s), and
- funds to cover additional costs are secured and transferred to the Corps prior to advertising bids or requesting proposals.

Following collaboration between the Corps and the AMT in identifying disposal locations for new construction, the Corps then solicits bids or proposals as currently practiced.

The proposed AMT sediment management process also provides the opportunity for the Corps to inform the Team regarding contractor compliance with the agreed upon plan for disposal of Project dredged materials (Figure 1).

Workshop participants noted that the time required to make alternative disposal sites available for Project use suggests that future beneficial uses of Project construction materials might realistically occur as part of the O&M of the navigation channel following the CRCIP.

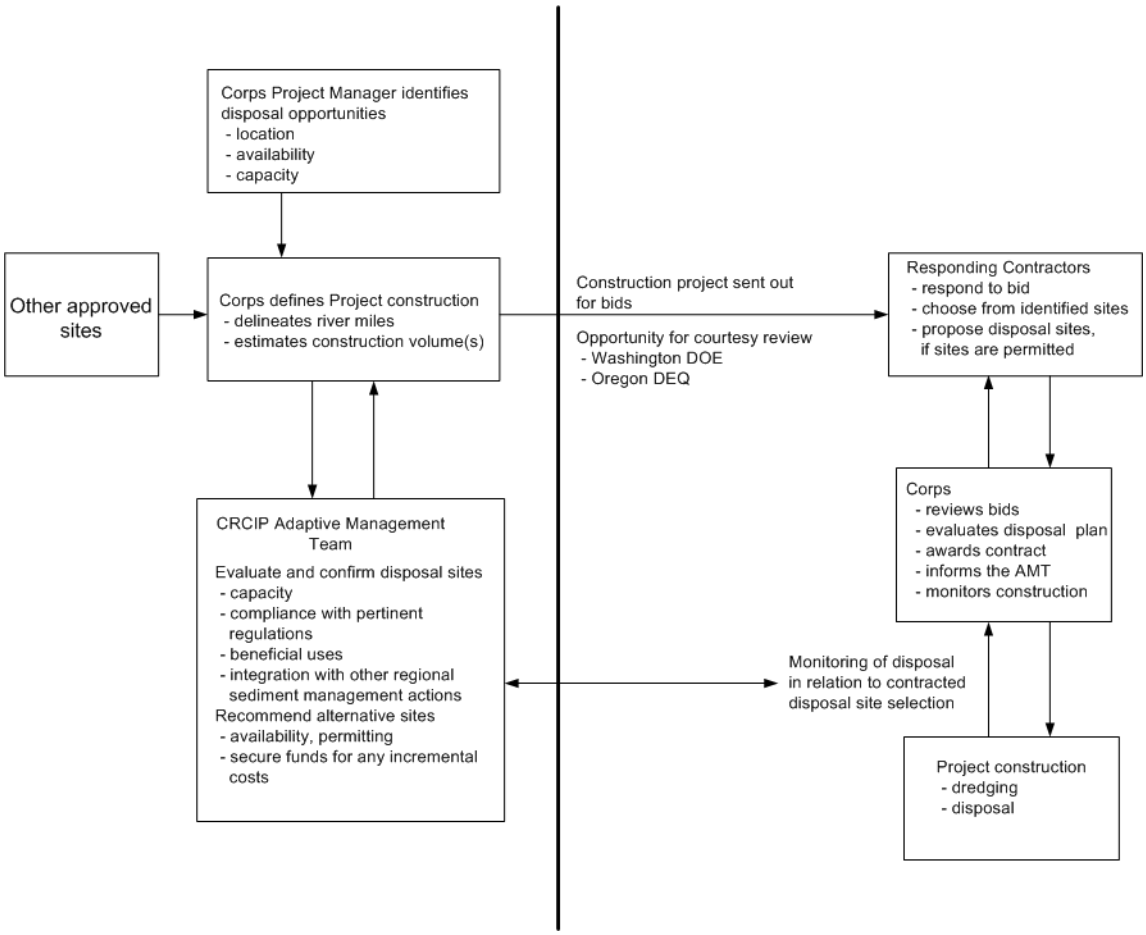

Figure 1. Schematic illustration of AMT participation in sediment management for the CRCIP.

Criteria for Site Selection and Evaluation

The workshop participants identified and discussed various positive and negative attributes of potential alternative locations for the disposal of Project dredged materials.

Positive attributes
Several desirable aspects that enter into site selection and evaluation include the following:

- **Public ownership** of a potential disposal site can facilitate access and shorten the time necessary to acquire necessary permits.

- A beach disposal location (i.e., beach nourishment) that offers an opportunity to **mitigate for fish stranding** represents a positive attribute for site selection and evaluation.

- The opportunity to **enhance habitat** as a result of dredged material disposal can recommend a location for selection.

- The opportunity to use dredged materials (i.e., sand), as an alternative to hardened structures, for **maintaining currently serviceable structures** (e.g., levee's) and stabilizing shoreline is an environmental benefit. This beneficial use can also expedite the permitting process for site use.

Negative attributes
During the workshop disposal site evaluations, the AMT noted several attributes that can remove sites from further consideration or reduce the value of the site for selection:

- The existence of **wetlands** at a potential disposal location will likely remove the location from further consideration as a Project disposal site.

- Dredged materials will not be disposed at sites that contain **sensitive habitats**.

- The time and expense required to obtain the necessary **permits** can importantly influence the evaluation and selection of alternative disposal sites. Aspects of the permitting process that can negatively influence site evaluation include requirements for **easements** to access the location, county requirements for performing **shoreline analysis**, and the need for **concurrence on site use by FWS and NMFS**. Additional **NPDES, NWP, and HPA permits and requirements** can also detract from the value of potential disposal site.

- Disposal site proximity to **endangered species** (e.g., bald eagle nests) will likely remove the site from further consideration.

- Restrictions on in-water or flowlane disposal imposed to **protect smelt** might reduce the value of a potential disposal location.

- Potential conflicts with **traditional or terminal fisheries** can reduce the value of a potential disposal location.

Additional considerations

In addition to the previous site-selection attributes, the AMT recognized several additional issues that should be considered in evaluating potential disposal locations:

- A desirable location should be **readily accessible** by dredges and personnel working on habitat creation and/or restoration.

- Similarly, **river pilots should be consulted** concerning possible navigation safety issues associated with a potential disposal site.

- **Legal jurisdiction** concerning the disposal location should be identified at the outset.

- If the proposed disposal location has been identified as a **site for ecosystem restoration**, consideration may be required to determine the impacts of dredged material disposal on site evaluation.

Implementation of AEM Approach to Project Sediment Management

Following consensus on a process for AMT participation in Project sediment management (i.e., Figure 1) and discussion of the above mentioned attributes and additional information relevant to site selection and evaluation, the workshop continued with application of the consensus process in support of CRCIP Phase IV construction.

Prior to the workshop, the Corps requested the AMT to identify potential disposal opportunities between river miles 48+10 and 58+00 for CRCIP Phase IV construction. Maps for the Phase IV dredging locations can be found on the Corps webpage: https://www.nwp.usace.army.mil/op/nwh/chlines.asp. The AMT was advised to focus its attention on sediment bars 13, 14, and 15.

During the workshop, the AMT evaluated five potential alternative locations for disposal of CRCIP construction materials in relation to the criteria and considerations previously described. Given turbidity monitoring requirements currently enforced by ODEQ, consideration of possible alternative disposal sites was confined to those located on the Washington side of the river. Table 1 summarizes these initial evaluations.

Table 1. Issues identified and discussed in relation to potential disposal locations for CRM 47–61.

Potential Sites	Positive and Negative Aspects; Additional Considerations
W61.3 Barlow Point	Opportunity to reduce fish stranding; site use precludes follow-up study on potential Project impacts on fish stranding.
W59.7 Hump Island	Upland disposal, DNR owned, Previously used; site of ecosystem restoration.
W58.7 Hump Island – cont.	
W57.8 Willow Grove	Recreational beaches, pilot issues – navigation safety.
W56.8 Willow Grove –cont.	Possible fish stranding beach.
W51.3 Eureka Bar	Not used; close to big sturgeon fishing area; fish stranding noted; too-small – not useable
W47.5	Small strip beach close to Cathlamet Inlet; wetlands – not useable.

In addition to the evaluations summarized in Table 1, the AMT noted the need to review site evaluation criteria included in Table 4.4 of the original EIS for additional information that might be useful in review and evaluation of the above locations.

The AMT also noted the distribution of pile dikes along CRM 56.8–57.8. These structures might require further examination in relation to alternative disposal site selection and evaluation.

The AMT further recognized that CRM 55.6–59.4 provides opportunities to mitigate several fish stranding beaches through placement of Project dredged materials.

CRCIP AEM Sediment Management Reporting

Sediment management has always been a component of the AEM Plan (Bartell and Nair 2006) and time for discussion of this topic has been routinely allocated as part of the AMT quarterly meetings. This reporting mechanism will continue.

AMT sediment management activities will also be summarized in the AEM Project Annual Reports.

References

Bartell, S.M. and S.K. Nair. 2006. Columbia River Channel Improvement Project adaptive environmental management plan. Prepared for U.S. Army Corps of Engineers, Portland District, Portland, Oregon.

CRCIP SEDIMENT MANAGEMENT WORKSHOP
WORKSHOP PARTICIPANTS

The following AMT members, technical support personnel, and invited guests participated in the workshop:

Robert Anderson, NMFS
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