FINAL REPORT
Adaptive Environmental Management for the Columbia River Channel Improvement Project:

Annual Report for 2011

prepared by

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List of Acronyms and Abbreviations

AEM	Adaptive Environmental Management
AFEP	Anadromous Fish Evaluation Program
AMP	adaptive management process
AMT	Adaptive Management Team
BiOp	Biological Opinion
C	centigrade
CI	confidence intervals
CMOP	Coastal Margin Observation and Prediction
CORIE	Columbia River Environment
CRCIP	Columbia River Channel Improvement Project
CRM	Columbia River Mile
CZMA	Coastal Zone Management Act
DLCD	Department of Land and Conservation Development
E2	E2 Consulting Engineers, Inc.
FTP	file transfer protocol
LCR	Lower Columbia River
m	meters
MA	Monitoring Action
MCR	mouth of the Columbia River
NMFS	National Marine Fishery Service
NOAA	National Oceanic and Atmospheric Administration
O&M	operations and maintenance
ODEQ	Oregon Department of Environmental Quality
ODFW	Oregon Department of Fish and Wildlife
OCMP	Oregon Coastal Management Program
PCBs	Polychlorinated biphenyl
PRG	Project Review Group
psu	practical salinity unit
SD	standard deviation
SEF	Sediment Evaluation Framework
SQER	Sediment Quality Evaluation Report
TOC	total organic carbon
UDB	Upper Dobelbower
USACE	United States Army Corps of Engineers
WDOE	Washington Department of Ecology
woody	Woody Island
WST	Westport
y	year
YOY	young of the year

1 Introduction

This 2011 report continues the series of annual reports produced of the Adaptive Environmental Management (AEM) Program for the Columbia River Channel Improvement Project (CRCIP). The first annual report was developed for the calendar year 2006, which was the first full year of Project construction and implementation of the CRCIP AEM Program. Subsequent annual reports were produced for calendar years 2007–2010. The 2011 annual report documents the activities and results of Project construction and ecosystem mitigation activities completed through December 31, 2011. Importantly, 2011 was a year of transition from Project construction to operation and maintenance (O&M).

Each CRCIP AEM annual report is developed as a separate stand-alone document for the convenience of the reader. Therefore, the previously developed background materials that describe the adaptive management process (AMP) for the CRCIP AEM Program are presented in each annual report. There is considerable redundancy among the annual reports. Again, this is intentional to save the reader from having to consult each annual report for important background materials developed as part of the CRCIP AEM Program.

To provide a degree of continuity from year-to-year, the 2011 annual report also briefly reviews the major AEM results and decisions for calendar year 2010. The results for Monitoring Action (MA)-1 for 2010 are presented for convenient comparison with the 2011 results. In addition, each of the monitoring activities includes a continuous summary of decisions made during the course of the CRCIP AEM Program. However, the details of the 2010 AEM activities are described more fully in the 2010 CRCIP AEM Program annual report.

1-1 CRCIP Construction Progress

The overall CRCIP construction was completed in November 2010. The Project transitioned into the operations and maintenance (O&M) phase in 2011. Transition of the channel improvement project from construction to O&M is important in relation to the organization and continued operation of the CRCIP AEM Program. Transition of the AEM Program to the O&M phase is discussed throughout the 2011 report in relation to AEM management actions that are affected by the transition.

Several of the monitoring and management components of the Project AEM program have been completed (e.g., dredging volumes, Dungeness crab, smelt, sturgeon). Report sections previously devoted to these program components have been correspondingly abbreviated, but retained for continuity in reporting, during the O&M phase of the AEM Program.

1-2 Ecosystem Restoration and Mitigation

Ecosystem restoration and mitigation actions remain as important components of the CRCIP. These components primarily serve as sources of additional information for overall evaluation of the Project by the Adaptive Management Team (AMT). However, restoration and mitigation activities associated with the Project do not enter directly into the decision-making aspects of the

AEM Program. Formal decision criteria have not been developed to evaluate the restoration or mitigation activities within the framework of the CRCIP AEM Program.

During 2011, riparian vegetation planted previously at the Chumbley site continued to be managed and monitored. The site was mowed in the summer of 2011. The plants have become well-established and future actions will likely be limited to the monitoring of plant growth and distribution.

Project mitigation efforts also continued on Cottonwood Island during 2011. The primary efforts that were completed included mowing, tilling, and spraying. Planting of native species of riparian vegetation had been scheduled for November 2011, but this was not completed by the end of 2011. Previous evaluation of spring planting recognized a conflict with use of the island as a rookery by herons. Steps are also underway to minimize any impacts of invasive species on the success of the island vegetation restoration. Reed-canary grass poses a substantial problem unless there is a persistent (i.e., evergreen) canopy cover. In addition, the area of Cottonwood Island that has been newly planted could be fenced to protect growing plants from grazing by the introduced deer. The Cottonwood Island mitigation project has been planned for a 50-year (y) lifespan. Follow-up monitoring of similar vegetation restoration performed at the Chumbley site suggests that the overall restoration approach should be successful. A project completion report will be provided for the Cottonwood Island restoration.

Translocation of white-tailed deer to Cottonwood began in August 2010. Approximately fifteen deer were introduced to the island. Many were killed by automobile traffic. Some the remaining 7 individuals swam from the island. The Julia Butler Hansen Refuge is planning to reintroduce deer to the Island, but in the meantime they are planning to test forage plots on the Island to see which forage would best grow and appear most important in sustaining a local population. The USACE has provided $250,000 for the 5-year project and Mark Dasso is the USACE project contact. The lead for the Refuge is Paul Meyers. The AMT expressed concerns that deer inhabiting the island would negatively impact the success of the December plantings. Greg Smith (USACE) indicated that there should be a clause in the contract that holds the contractor responsible for ensuring the protection of the planting as a performance measure for the overall project.

As-Built reports and O&M plans for the mitigation sites were under development during 2011.

1-3 Annual Report Structure

As suggested previously, the CRCIP AEM annual reports are similar in structure. Following a brief description of the CRCIP AEM process, each MA of the adaptive management effort is addressed. Summaries of the monitoring results for 2011 are provided along with comparisons of the results with AEM decision criteria. Decisions concerning adaptive management for each of the MAs recorded by the AMT during the assessment year are also reported.

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 become available; the workbook serves as an

ongoing documentation of the AEM process. The workbook is reviewed by the AMT at each of the quarterly meetings. An electronic working version of the workbook is available to the AMT at the website (www.e2tm.com/CRCIP) hosted by E2 Consulting Engineers, Inc. (E2).

1-4 CRCIP AEM Process

The AEM process developed for the CRCIP 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 USACE to explain the variances or offer a mitigation plan.

5. Based on an evaluation of the USACE 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).

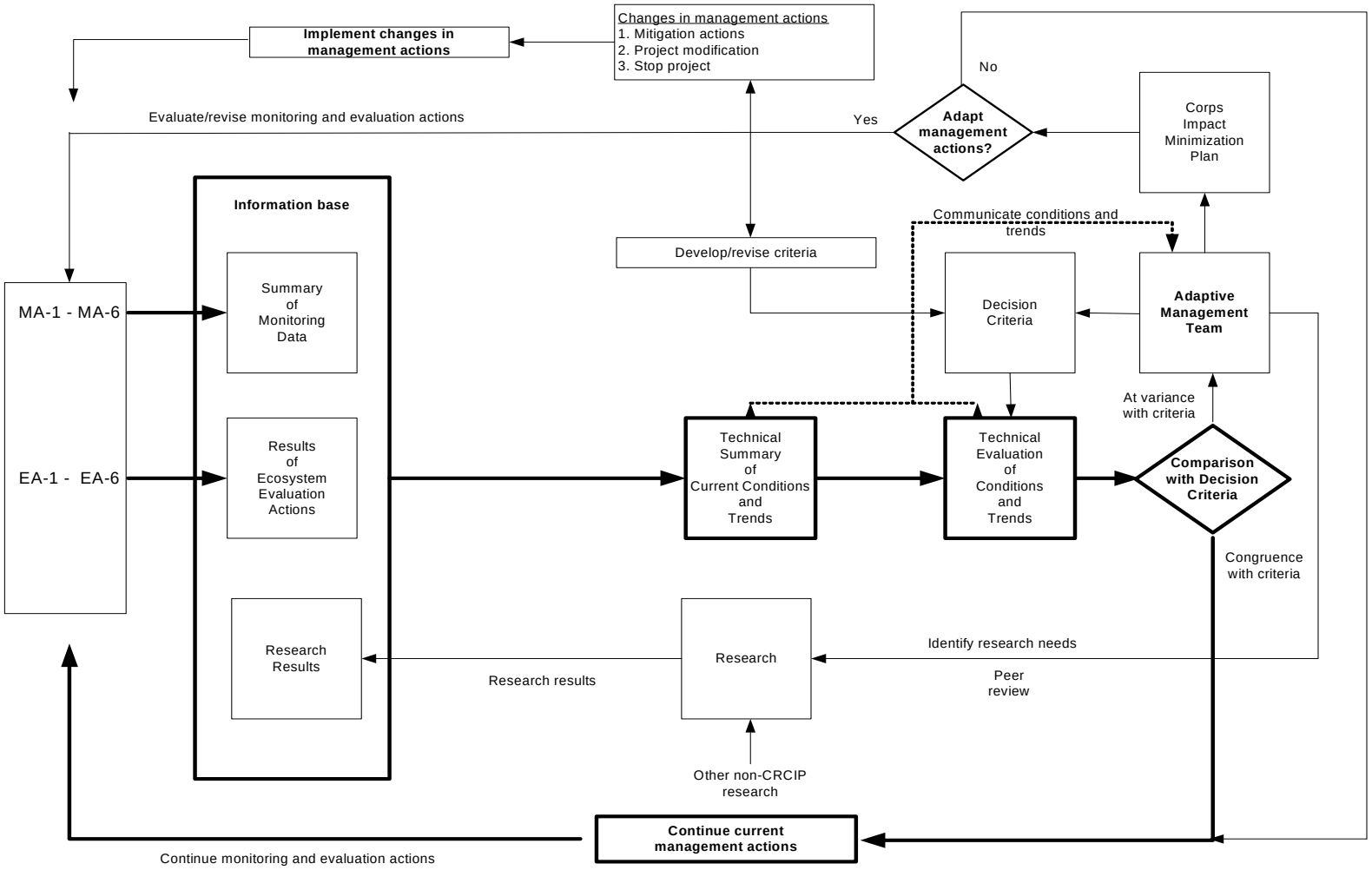


Figure 1-4.1. Flowchart describing the AEM process for the CRCIP.

1-5 Post-Construction Transition of the AEM Program

As stated in the 2005 CRCIP Biological Opinion (BiOp), the O&M Biological Assessment proposes to continue the CRCIP AEM for three years following the 2010 completion of construction. The 2011 AEM Program represented the first year of transition from the Project construction adaptive management to the O&M phase.

The following consensus decisions regarding the continued implementation of the CRCIP adaptive management program resulted from AMT discussions that continued throughout 2011:

- MA-1: continue the data analysis for three years post Project construction.
- MA-2: transition into O&M monitoring and reporting.
- MA-3: continue the cross-section surveys for three years post Project construction.
- MA-4: unresolved, but continued topic of discussion in 2011.
- MA-5: transition to O&M for compliance with Sediment Evaluation Framework (SEF).
- MA-6: possibly deferring post-construction studies based on fish stranding analysis performed by Dr. Walter Pearson (Pearson 2011).
- Bank to Bank Survey: complete post construction survey two years after construction Washington Department of Ecology (WDOE) and for National Marine Fishery Service (NMFS), five years after the State of Washington's required survey.
- Sediment Management: will transition to the USACE regional sediment management program (Jarod Norton USACE).
- Sturgeon: a green sturgeon study program has begun as part of the CRCIP O&M phase.
- Crab: the CRCIP completed this requirement under Oregon and Washington's 401 requirements and Department of Land and Conservation Development's (DLCD) Coastal Zone Consistency Determination.
- Smelt: the assessment of potential CRCIP impacts on smelt has been completed in relation to Project construction.

The AMT recognizes that changes to the current consensus decisions might result from continued discussions and revisions to the CRCIP AEM Program during 2012.

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 the calendar year 2011. The results are based on analyses of verified data downloaded from the Columbia River Environment (CORIE) public website (www.ccalmr.ogi.edu/CORIE). Note that the CORIE stations have become integrated as part of the Center for Coastal Margin Observation and Prediction (CMOP). Data can now be retrieved from the CMOP observation network (www.stccmop.org/datamart/observation_network). The monitoring data are obtained from three sampling stations located in the lower river and estuary: tansy, grays, and cbnc3 (Figure 2-1). The tansy station replaced the red26 station (used in previous years of the AEM Program), which was physically lost from the CORIE network during 2008.

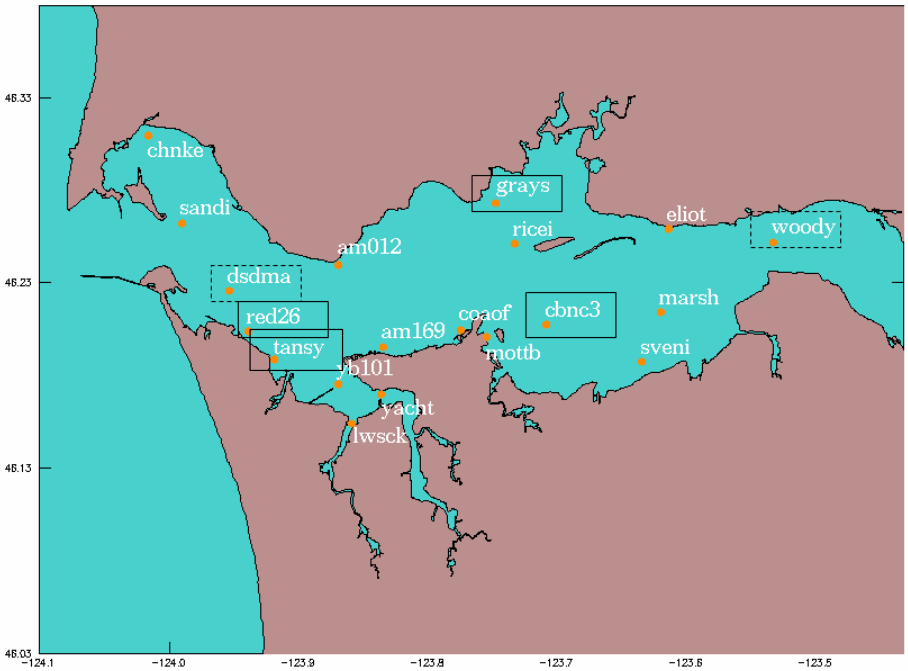


Figure 2-1. Location of CORIE monitoring stations in the Lower Columbia River (LCR) and estuary. The three stations (tansy, grays, and cbnc3) indicated by the solid rectangles provide data for MA-1. The two stations indicated by the dashed rectangle provide salinity (dsdma) and temperature (woody) data 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 (i.e., depth, water temperature, and salinity). 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 years 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 CRCIP AMT.

2-1 Depth

As in previous years (2006–2010), water depth data were only available for the grays sampling station in 2011 (Figure 2-1.1).

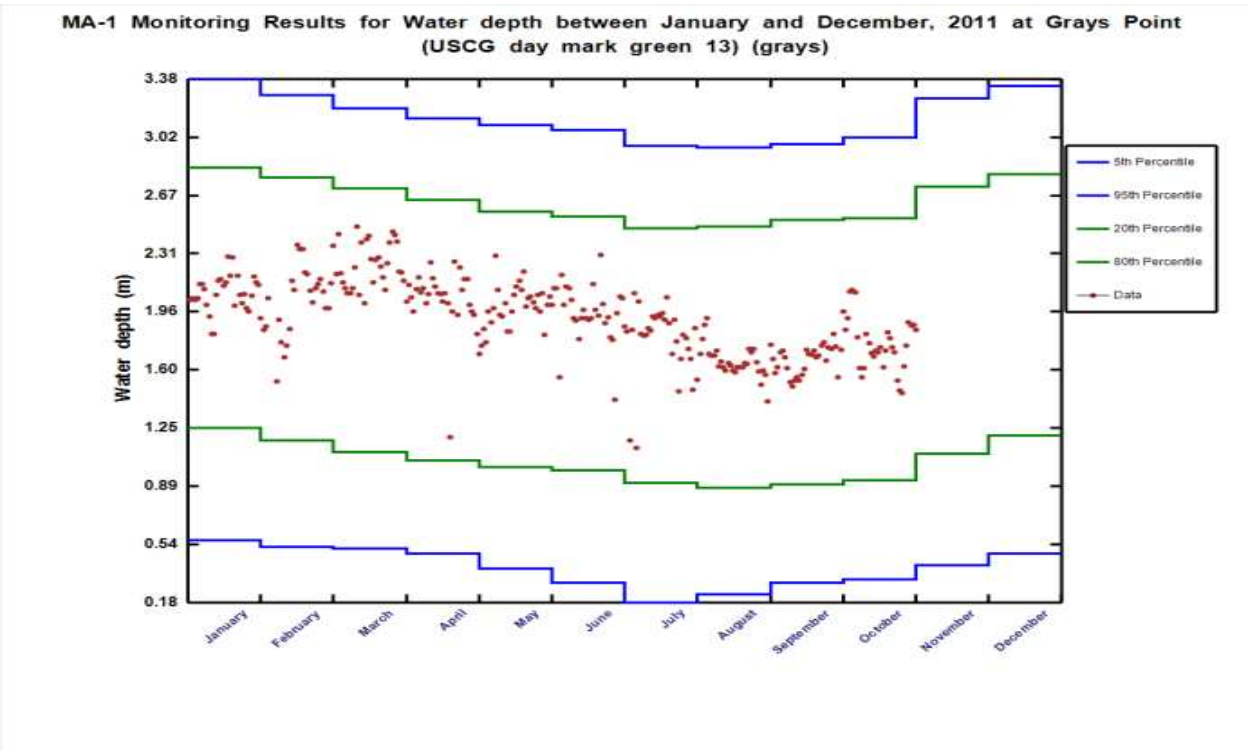


Figure 2-1.1. Daily median values of depth for the grays sampling location for 2011 plotted in relation to the CRCIP AEM decision criteria.

Depth data were available for the grays station through October 2011. The daily values are nearly centered within the 20th–80th percentile decision criteria during this period.

Table 2-1.1 lists the monthly median depth values calculated using the 2011 data from the grays station. All reported 2011 monthly values were within the 20th–80th percentile range of the decision criteria derived from the 1996–2004 pre-Project data.

Table 2.1.1. Summary of 2011 Monthly Median Depth Values (bold numbers) for grays Station in Relation to AEM Percentile Decision Criteria.

	Monthly Median Depth Meters (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**	**2.3**	**2.1**	**2.0**	**2.0**	**1.8**	**1.7**	**1.7**	**1.8**	**No data**	**No data**
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) shows the daily median water temperature values calculated for 2011 for two CORIE stations: tansy, and grays. Temperature data were not available for the cbnc3 station in 2011. The daily values are plotted in relation to the monthly 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).

Water temperature data were available January through August 2011 for tansy (Figure 2-2.1a). Values for the first half of March were lower than the decision criteria. Temperatures from mid-April through June shifted towards warmer than average values, but were within the monthly decision criteria. Tansy's July temperatures were warmer than average values, but were within the monthly decision criteria.

Temperature data were available for the grays station from January through October 2011 (Figure 2-2.1b). Data median temperature values were generally within the decision criteria for the first quarter 2011 period of interest (January–March) for the grays stations. Several daily values in February were slightly colder than the decision criteria. Temperature data analyzed for the grays station indicated somewhat cooler than historical temperatures at this location for most of the January–June timeframe. Values were lower than the monthly decision criteria in early March, as observed for the tansy station. In contrast to tansy, several daily values in June were also cooler than the monthly decision criteria.

Tables 2-2.1–2-2.2 list the calculated monthly median values for 2011 and the corresponding temperature decision criteria derived from analysis of the pre-Project data (1996–2004). Despite the above mentioned variances in the daily temperature data, the spreadsheet summaries of monthly average temperatures used in the AEM decision-making process were nearly all within the decision criteria for both tansy and grays stations for the months with available data. The monthly summary of the additional July 2011 temperature data confirmed that, except for March, values were within the 20th–80th percentile decision criteria for the tansy station (Table 2-2.1). The March monthly value for tansy of 6.8° centigrade (C) was just slightly less than the 20th percentile decision criterion of 6.9°C. The average monthly value for July (17.2°C) was very near the 80th percentile value of 17.5°C.

Monthly summaries for grays also showed values that were within the 20th–80th percentile criteria for January–March and May (Table 2-2.2). Monthly temperature values were cooler in April and June, but still within the 5th–20th percentile decision criteria. The July monthly average value was equal to the 20th percentile decision value (18.0°C).

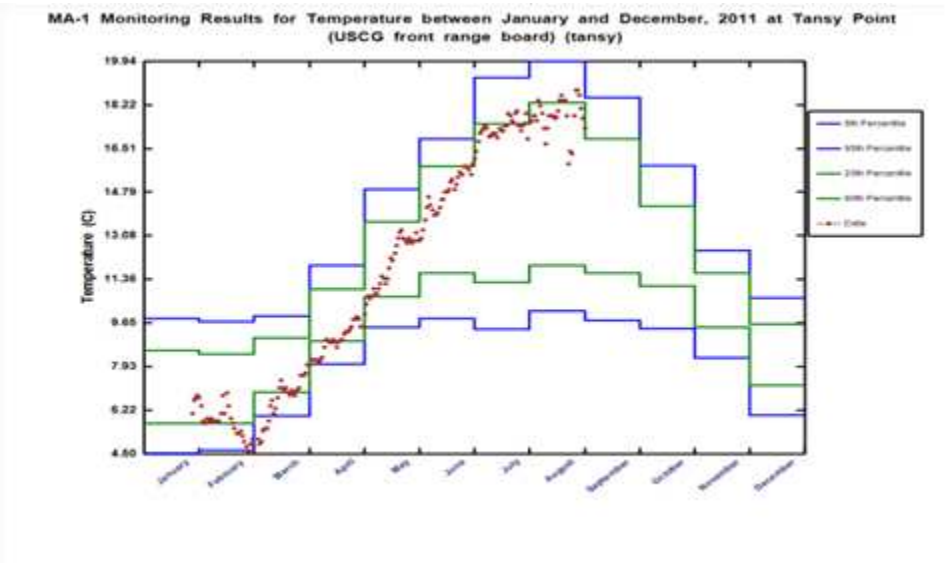
To further evaluate the potential impacts of channel modification on water temperatures, the daily median values for 2011 were plotted against corresponding baseline values (1996–2004) for the upriver Woody Island (woody) sampling location (Figure 2-2.2a,b). Water temperatures at woody are primarily 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. Corresponding July temperature data were available for the woody station. Normalized temperature plots were developed for the tansy, and grays stations. The additional

data points determined for 2011 are well within the cluster of variability in the normalized data based on the pre-Project construction period for the tansy station. The data for the normalized grays station suggests some possible outlier values at lower temperatures. The plotted daily values of temperature for the tansy and grays stations were within the corresponding clusters of normalized temperature points defined by the pre-Project data (Figure 2-2.2a,b).

The plots of daily median temperature values of both stations versus the temperatures recorded for the woody station demonstrated that the data available for 2011 were consistent with the relationships established using the 1996–2004 pre-Project construction data.

The overall conclusion from the MA-1 analysis of water temperatures was that no discernible impacts of Project construction were evident based on the limited CORIE monitoring data available for 2011.

(a)


MA-1 Monitoring Results for Temperature between January and December, 2011 at Tansy Point
(USCG front range board) (tansy)
Temperature (C)
19.94
18.22
16.51
14.79
13.08
11.36
9.65
7.93
6.22
4.50

(b)

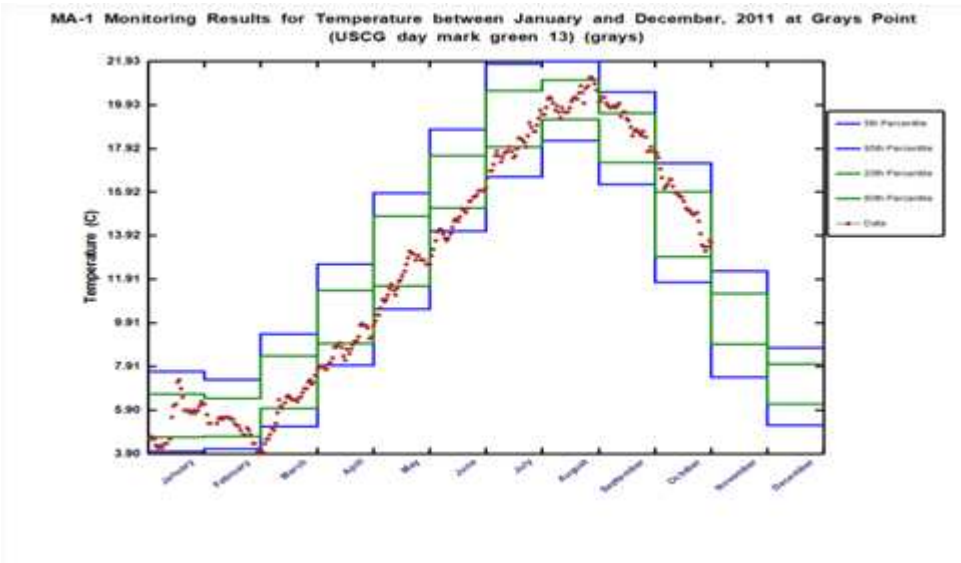


Figure 2-2.1. Daily median values of water temperature for (a) tansy, and (b) grays sampling stations for 2011 plotted in relation to the CRCIP AEM decision criteria.

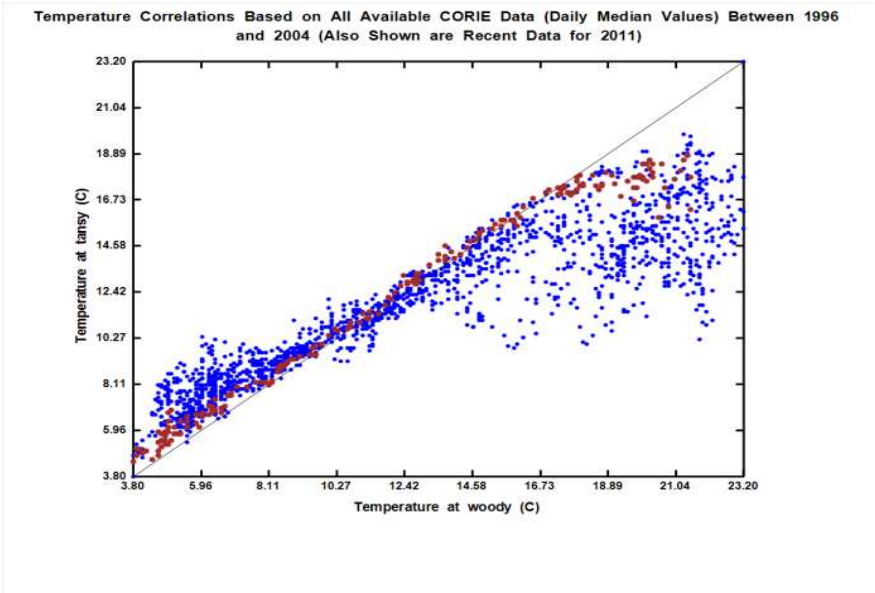
Table 2-2.1. Summary of 2011 Monthly Median Temperature Values (bold numbers) for tansy Station in Relation to AEM Percentile Decision Criteria.

	Monthly Median Temperature C											
Percentile	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
5	4.5	4.6	6.0	7.0	9.5	9.8	9.4	10.1	9.8	9.4	8.3	6.0
			6.8									
20	5.7	5.7	6.9	8.9	10.7	11.6	11.2	11.9	11.6	11.1	9.5	7.2
	6.6	**5.8**		**9.0**	**12.1**	**14.7**	**17.2**	**17.8**	**No data**	**No data**	**No data**	**No data**
80	8.9	8.4	9.1	11.0	13.6	15.8	17.5	18.3	16.9	14.2	11.6	9.6
			9.1									
95	9.8	9.7	9.9	11.9	14.9	16.9	19.3	19.9	18.5	15.8	12.5	10.6

Table 2-2.2. Summary of 2011 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
				8.8		**14.8**	**18**					
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
	5.8	**5.2**	**6.4**		**12.1**			**20.1**	**19.0**	**15.5**	**No data**	**No data**
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
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

(a)


Temperature Correlations Based on All Available CORIE Data (Daily Median Values) Between 1996 and 2004 (Also Shown are Recent Data for 2011)
Temperature at tansy (C)
Temperature at woody (C)
23.20
21.04
18.89
16.73
14.58
12.42
10.27
8.11
5.96
3.80
3.80
5.96
8.11
10.27
12.42
14.58
16.73
18.89
21.04
23.20

(b)

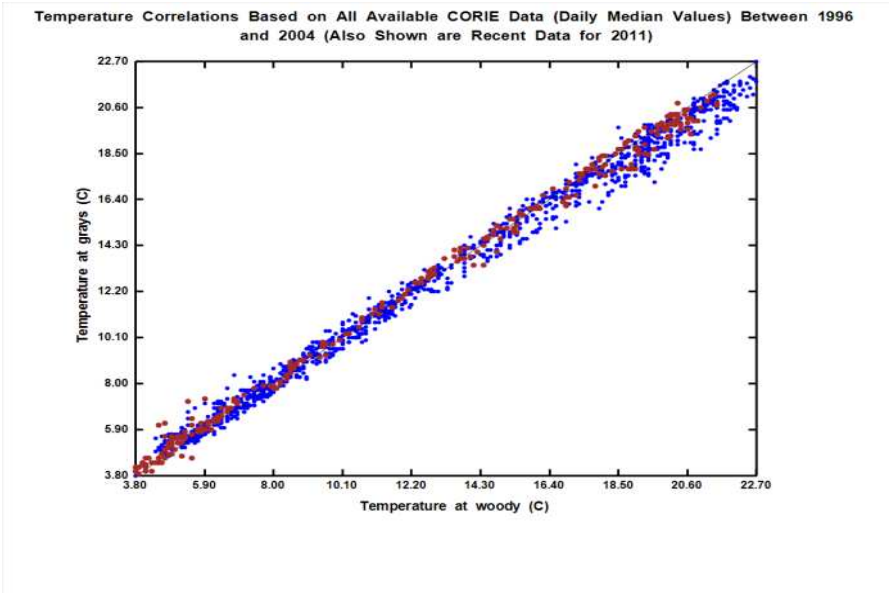


Figure 2-2.2. Median daily water temperatures for (a) tansy and (b) grays stations plotted for 2011 against median daily water temperatures for the "woody" station.

2-3 Salinity

MA-1 includes an analysis of potential Project construction impacts on salinity values in the LCR and estuary. The analyses are based on the CORIE data and performed 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 elevate salinity values, which can impact habitat quality for juvenile salmon. Figure 2-3.1 (a,b) presents the daily median values of salinity measured in 2011 at the two MA-1 sampling locations: (tansy, and grays). Salinity data were not available for the cbnc3 station in 2011. 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.

Similar to previous years of monitoring, the greatest variations in daily median salinity values were observed for tansy in 2011 (Figure 2-3.1a), although data were only available from late January through August in 2011. Daily values ranged from near 0 to ~16 practical salinity units (psu) during the 2011. This station is strongly influenced by tidal flows (Figure 2-3.1a). The greatest ranges of within-month values occurred in January–March and August in 2011. Daily values observed during March into early July were consistently lower than the 5th percentile decision criteria during 2011. Values for the remainder of July and August were primarily within the 5th and 20th percentile decision criteria.

Daily median salinity values reported in 2011 for the grays station are illustrated in Figure 2-3.1b. Data were not available for November or December. Daily median salinity values ranged from ~0 to 4 psu during 2011. The majority of daily values were essentially 0 from January through July, as well as several days in August. Daily values were highly variable during September and October. However, these daily median values were within the 20th–80th decision criteria for the remainder of 2011 (Figure 2-3.1b).

Data for dsdma, the salinity reference station, were not available during 2011. Therefore, it was not possible to develop normalized salinity plots as in previous years.

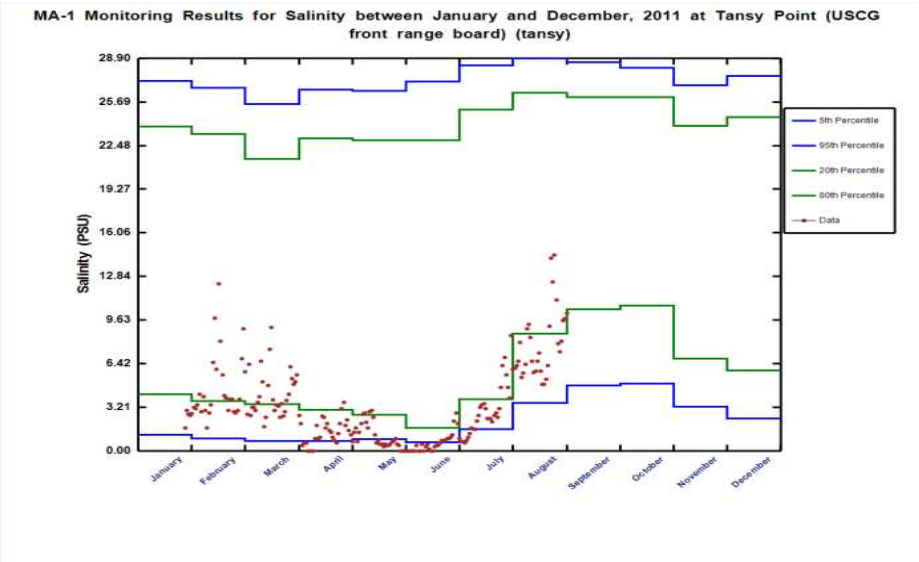
Tables 2-3.1–2-3.2 list the monthly median salinity values calculated for 2011 and the decision criteria developed by the AMT for MA-1. Despite the variations in the daily median values, the 2011 monthly average salinity values for tansy were within the 20th–80th percentile decision criteria, except for June (Table 2-3.1). The June value was 0.1 psu lower than the decision value and was well within the 5th–20th percentile criterion.

The average monthly values for the grays station did not suggest any issues concerning saltwater intrusion in relation to Project construction (Table 2-3.2). Monthly values were within the 20th–80th percentile criteria for 5 of the 10 months for which data were available in 2011. The remaining monthly values were ~0 or within the lower salinity criteria (i.e., 5th–20th percentile values).

The 2011 monitoring results fail to demonstrate any evidence of saltwater intrusion or other impacts on salinity for this sampling location.

The MA-1 monitored salinity results for 2011 are consistent with those of the temperature data analysis and further suggest that the Project construction was producing no measurable impact on salinity at these two station locations in the LCR and estuary.

(a)


MA-1 Monitoring Results for Salinity between January and December, 2011 at Tansy Point (USCG front range board) (tansy)
Salinity (PSU)
28.90
25.69
22.48
19.27
16.06
12.84
9.63
6.42
3.21
0.00
January
February
March
April
May
June
July
August
September
October
November
December
5th Percentile
95th Percentile
20th Percentile
80th Percentile
Data

(b)

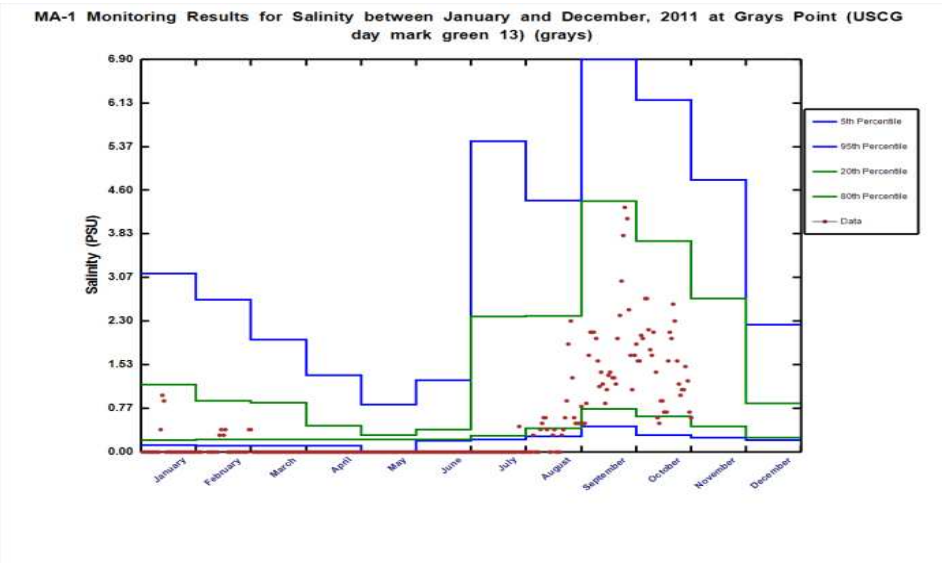


Figure 2-3.1. Daily median values of salinity for (a) tansy, and (b) grays sampling stations for 2011 plotted in relation to the CRCIP AEM decision criteria.

Table 2-3.1. Summary of 2011 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
	2.8			**1.3**	**0.9**	**0.6**	**2.8**	**8.1**				
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
		4.4	**4.0**	**6.3**	**4.3**		**6.7**	**13.1**	**16.8**	**14.9**	**9.1**	**No data**
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 2011 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**	**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
								0.4			**0.4**	
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
									1.8	**1.5**		
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
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

2-4 Columbia River Discharge

The collation and analysis of the Bonneville Dam discharge data continued through 2011 (Figure 2-4.1). Potential outlier values of temperature and salinity observed at the MA-1 stations during the AEM Program have previously been related to changes in river flows. The seasonal pattern for 2011 indicated higher than typical (e.g., mean, median) flows compared to pre-Project years (1996–2004). The three spring and early summer periods of peak flows for 2011 are nearly as high as the flows reported for 1997, which was the pre-Project year with highest flows. The latter 100 days of 2011 demonstrate flows that lie approximately mid-range compared to the pre-Project years.

The higher than average flows in winter, spring and early summer (January – July) might explain in part the lower monthly average values of salinity at the grays monitoring station (Table 2-3.2).

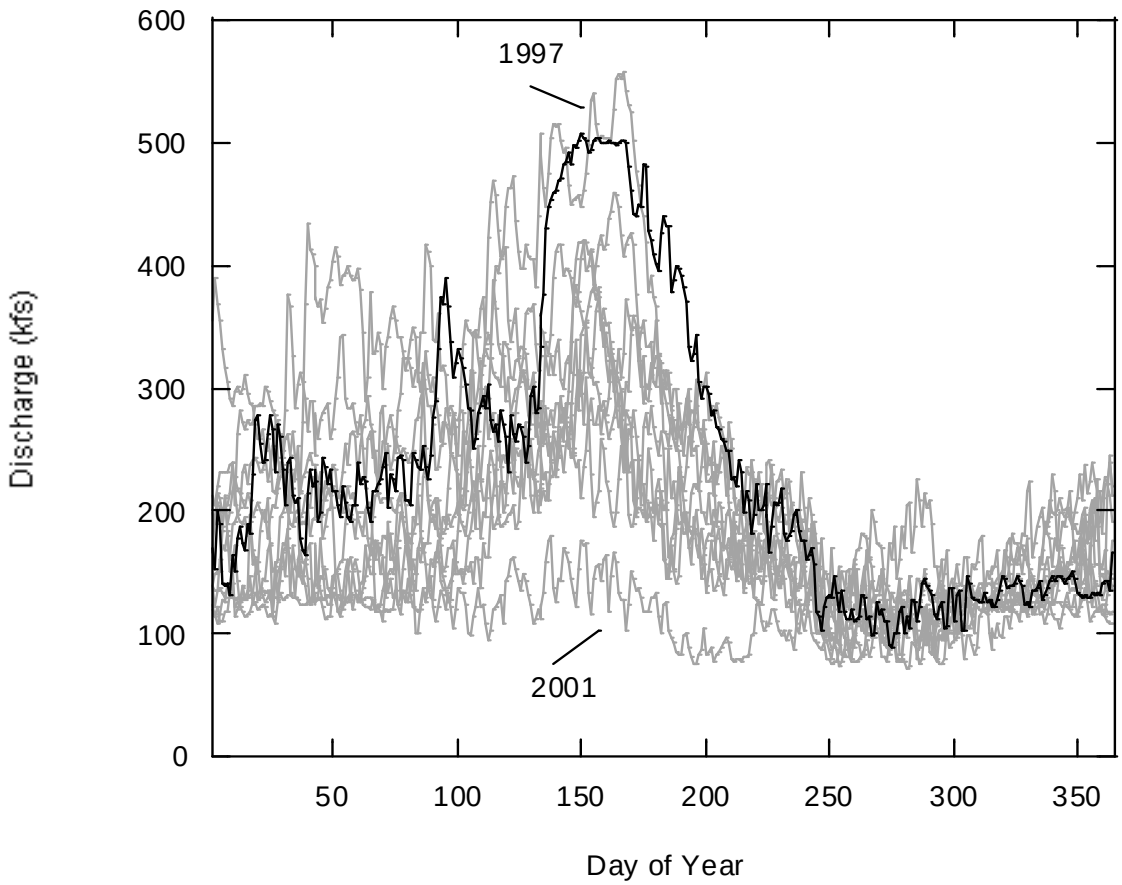


Figure 2-4.1. Daily flow values recorded at Bonneville Dam for calendar year 2011 (solid black line). Light gray lines show pre-Project (baseline) values for 1996–2004. (Data: Columbia Basin Fishery Agencies and Tribes http://www.fpc.org/river/flowspill/FlowSpill.asp).

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 2011.

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. NMFS agreed with the stated rationale for the selection of cbnc3.	
28 Jun 2005	**MA-1**	The team discussed the desire by 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 Tortorici (NMFS) 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 to be able detect change. The USACE 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 be 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 (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 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 USACE 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 suggests 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.	
14 Jan 2009	**MA-1 CORIE Analyses**	No decisions were made concerning the MA-1 results at the January 2010 meeting.	
8 Apr 2009	**MA-1 CORIE Analyses**	The AMT decided to continue using publicly available CORIE data that have been through the CORIE quality assurance/quality control process.	
8 Jul 2009	**MA-1 CORIE Analyses**	Monitoring results for depth, temperature, and salinity were within the monthly decision criteria for MA-1.	
18 Nov 2009	**MA-1 CORIE Analyses**	Monitoring results for depth, temperature, and salinity were within the monthly decision criteria for MA-1.	
18 Nov 2009	**MA-1 CORIE Analyses**	The AMT decided by consensus that MA-1 monitoring activities should continue according to the terms and conditions specified in the BiOp.	
20 Jan 2010	**MA-1 CORIE Analyses**	No decisions were made concerning the MA-1 results reported at the January 20 meeting. E2 will follow up on obtaining additional temperature data not currently reported for the grays station.	
14 Apr 2010	**MA-1 CORIE Analyses**	No decisions were made concerning the MA-1 results reported at the April 14 th meeting.	
14 Jul 2010	**MA-1 CORIE Analyses**	No decisions were made concerning the MA-1 results reported at the July 14 th meeting. .	
13 Oct 2010	**MA-1 CORIE Analyses**	No decisions were made concerning the MA-1 results reported at the October 13th meeting.	
12 Jan 2011	**MA-1 CORIE Analyses**	The January 2011 AMT meeting was cancelled.	
13 Apr 2011	**MA-1 CORIE Analyses**	The AMT concluded that there were no discernible impacts of the Project on measured values of temperature or salinity for the Jan - Mar 2011 period.	

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

Date	Issue	MA-1 Decisions	Comments
13 Jul 2011	**MA-1 CORIE Analyses**	The AMT concluded that there were no discernible impacts of the Project on measured values of temperature or salinity for the Apr - Jul 2011 period.	
12 Oct 2011	**MA-1 CORIE Analyses**	The AMT concluded that there were no discernible impacts of the Project on measured values of temperature or salinity for the Aug - Oct 2011 period.	

3 Monitoring Action 2—Dredging Volumes

MA-2 tracks and reports annual dredging volumes and their disposal associated with construction and operation of the 43-foot navigation channel. MA-2 activities have transitioned into operations and maintenance since completion of the Project construction.

3-1 Volumes of Dredged Materials

Post-construction volumes of materials dredged as part of the O&M activities are not included in the CRCIP AEM Program. The 2011 O&M volumes are therefore not reported in the 2011 AEM Annual Report. The USACE will provide this information within the context of its O&M reporting procedures.

3-2 Disposal of Project Dredged Materials

During Project construction, detailed summaries of the disposal of Project dredged materials were provided in the previous AEM Program annual reports. The intent was to review the reported disposal of construction materials in relation to pre-Project approved locations and evaluate the amounts disposed in relation to the estimated capacity of the disposal locations. With the project now in the O&M phase, these summaries of the disposal of dredged materials will no longer be included in the AEM annual reports.

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 through 2011. Although MA-2 activities have transitioned into O&M, the table of decisions has been included for continuity in AEM reporting. This format also readily permits addition of any future issues that might develop concerning MA-2 and the 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 by 15% or more that the AMT members would be notified. Agreement was also reached, that at the quarterly meetings, the USACE 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% proposed exceedance value. Therefore, following discussion, the AMT reached consensus to abandon the 15% decision criterion and simply compare projected dredging volumes to actual volumes.	

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

Date	Issue	MA-2 Decisions	Comments
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.	
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.	
14 Jan 2009	**MA-2 Dredging Summary**	The upland disposal summary table was modified to show that the Northport site includes two disposal locations.	
8 Apr 2009	**MA-2 Dredging Summary**	Upland disposal has not exceeded capacity for any of the disposal locations used thus far in the CRCIP construction.	
8 Jul 2009	**MA-2 Dredging Summary**	No new information was presented for MA-2. However, the AMT will continue to be informed concerning monitoring plans being developed for rock removal as part of the CRCIP construction.	
18 Nov 2009	**MA-2 Dredging Summary**	No new information was presented for MA-2.	
20 Jan 2010	**MA-2 Dredging Summary**	MA-2 monitoring and assessment activities will transition into the post-Project O&M phase for reporting.	
14 Apr 2010	**MA-2 Dredging Summary**	MA-2 monitoring and assessment activities will transition into the post-Project O&M phase for reporting.	
14 Jul 2010	**MA-2 Dredging Summary**	Revisions will be made to the annual reports for 2007 and 2008 to clarify the in-water disposal at the Fazio site, previously reported incorrectly as upland disposal.	
13 Oct 2010	**MA-2 Dredging Summary**	No new information was presented concerning MA-2.	

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

Date	Issue	MA-2 Decisions	Comments
12 Jan 2011	**MA-2 Dredging Summary**	The January AMT meeting was cancelled.	
13 Apr 2011	**MA-2 Dredging Summary**	The MA-2 spreadsheet summaries have been included in the 2010 Annual Report for the CRCIP AEM Program.	
13 Jul 2011	**MA-2 Dredging Summary**	No new information was presented concerning MA-2.	
12 Oct 2011	**MA-2 Dredging Summary**	No new information was presented concerning MA-2.	

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. The 2011 results represent the first of three post-construction surveys. Annual surveys are performed at Columbia River mile (CRM) 42, 46, 72, 75, 86, and 99. These river mile locations were identified through previous USACE 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 SD is based on analysis of the 1996–2004 pre-construction data reported for each location. The calculation of depth envelopes did not include the change of the authorized channel from 40 to 43-feet, or the 100 feet overwidth.

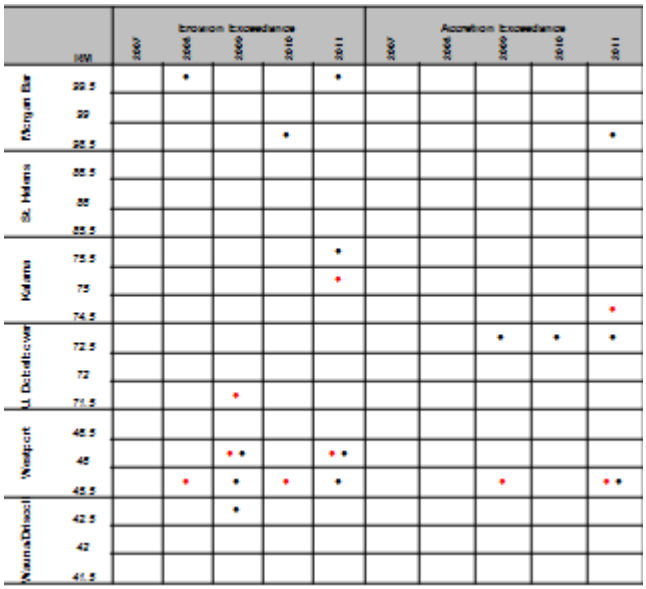


Figure 4-1.1. Summary of erosion and accretion exceedances for MA-3 crossline surveys. Red dots identify the Oregon side of the navigation channel; black dots refer to the Washington side.

The results of the 2011 MA-3 crossline survey results indicated six erosion exceedances located at Morgan Bar (CRM 99.5), Kalama (CRM 75.5, 75.0), and Westport (WST) (CRM 46.0, CRM 45.5) as outlined in Figure 4-1.1. Accretion exceedances were determined for Morgan Bar (CRM 98.5), Kalama (CRM 74.5), Upper Dobelbower (UDB) (CRM 72.5), and WST (CRM 45.5). The results in Figure 4-1.1 show that WST has exhibited the highest number of exceedances (mainly erosion) during the previous years of MA-3 sampling. Erosion exceedances at CRM 45.5 have been observed from 2008–2011. Accretion exceedances have been measured at UDB (CRM 72.5) in 2009–2011. Otherwise, erosion and accretion exceedances appear as transient phenomena—present one year, and absent the following. There appears to be no demonstrable pattern of exceedances across the survey years and locations associated with channel deepening.

Importantly, all but two of the 2010 survey outliers had returned to values within envelope limits prior to the 2011 MA-3 survey and analysis.

The updated crossline survey analysis for 2011 has been posted to the MA-3 folder in the AEM Workbook at the E2 CRCIP website. The MA-3 surveys are scheduled to continue through 2013.

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**
41.5 South	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 and the dates of the post construction surveys conducted through 2011.

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

	Morgan Bar	St. Helens Bar	Kalama Bar	UDB	WST Bar	Wauna/Driscoll
Year	CRM 98-101	CRM 84-87	CRM 73-76	CRM 70-73	CRM 45-48	CRM 41-44
1996	24-Feb	21-Feb	20-Feb	20-Feb	20-Feb	20-Feb
1997	-	24-Feb	12-Feb	12-Feb	10-Feb	6-Feb
1998	5-Jan	-	21-Jan	21-Jan	28-Jan	28-Jan
1999	12-Jan	19-Jan	26-Jan	26-Jan	1-Feb	27-Jan
2000	20-Jan	11-Jan	10-Jan	6-Jan	26-Jan	25-Jan
2001	13-Feb	5-Feb	31-Jan	30-Jan	30-Jan	29-Jan
2002	13-Feb	12-Feb	7-Feb	6-Feb	24-Jan	24-Jan
2003	7-Jan	14-Jan	23-Jan	28-Jan	5-Feb	5-Feb
2004	22-Jan	31-Mar	28-Apr	29-Apr	17-May	13-May
2005	4-Apr	10-May	24-May	25-May	22-Jun	18-May
2006	12-Jan	25-Jan	7-Feb	7-Feb	31-Jan	24-Jan
2007	12-Feb	14-Feb	21-Feb	22-Mar	27-Mar[a]	26-Mar
2008	27-Mar	10-Apr	8-Apr	8-Apr	1-May	2-Apr
2010	12-Feb	26-Feb	5-Mar	10-Mar	2-Feb	27-Jan
2011	25-Jan	3-Feb	18-Feb	18-Feb	24-Feb	10-Feb

[a]Dates in blue indicate post-construction surveys.

4-2 AMT Decisions for MA-3

Table 4-2.1 briefly summarizes the key AMT discussion points and decisions concerning potential effects of Project construction on channel bathymetry through calendar 2011.

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.	
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 BiOp - 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 envelope decision criteria. The AMT will continue to review future crossline survey results for these locations.	
14 Jan 2009	**MA-3 Decision Criterion**	No new information was presented regarding MA-3.	
8 Apr 2009	**MA-3 Decision Criterion**	No new information was presented for MA-3 at the April 2009 meeting.	
8 Jul 2009	**MA-3 Crossline Surveys**	No new information was presented for MA-3 at the July 2009 meeting.	

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

Date	Issue	MA-1 Decisions	Comments
18 Nov 2009	**MA-3 Crossline Surveys**	No new information was presented for MA-3 at the November 2009 meeting.	
20 Jan 2010	**MA-3 Crossline Surveys**	MA-3 activities will continue for three years post-Project construction.	
14 Apr 2010	**MA-3 Crossline Surveys**	MA-3 activities will continue for three years post-Project construction.	
14 Jul 2010	**MA-3 Crossline Surveys**	The USACE will determine if crossline surveys are available for 2009.	
13 Oct 2010	**MA-3 Crossline Surveys**	Results of the 2009 MA-3 surveys were reported at the October 13th meeting. No decisions were made in relation to adaptive management.	
12 Jan 2011	**MA-3 Crossline Surveys**	No AMT meeting was held in January 2011.	
13 Apr 2011	**MA-3 Crossline Surveys**	No new information for MA-3 was available for the April AMT meeting.	
13 Jul 2011l	**MA-3 Crossline Surveys**	No new information for MA-3 was available for the July AMT meeting.	
12 Oct 2011	**MA-3 Crossline Surveys**	Results of the 2010 MA-3 surveys were reported at the October 12 meeting. No decisions were made in relation to adaptive management.	

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 occur until three years after the Project construction is completed (~2013). However, it is important to point out that initial considerations to changes in the MA-4 studies and decision criteria were addressed by the AMT during several of the 2011 AMT meetings. These discussions were very preliminary in nature and the AMT agreed to focus on MA-4 during the 2012 AEM Program activities.

5-1 MA-4 Decision Criteria

Originally, estimates of habitat opportunity were to be calculated using the post-Project bathymetry of the LCR. Table 5-1.1 illustrates a template for future use in evaluating results of MA-4 habitat surveys. Pre- and post-Project comparisons may require re-calculation of pre-Project opportunity values given the availability of more recent pre-Project bathymetry than used in the original Bottom et al. (2001) analyses. The post-construction MA-3 survey data can also contribute to the calculations of habitat opportunity. Blaine Ebberts (USACE) discussed the history of previous efforts and potential future work in relation to MA-4. The USACE contributed funds (2001–2007) to support the National Oceanic and Atmospheric Administration (NOAA) AFEP. NOAA has continued studies primarily on the upper river with one small project in the lower river. The CRCIP had intended to fund one habitat survey conducted under the AFEP. The survey was originally proposed to be conducted three years following Project construction (i.e., 2013). This will no longer be possible. Discussions during several 2011 AMT meetings revisited the feasibility of the pre- and post-Project estimation of habitat opportunity.

In July 2011, Steve Bartell (Cardno ENTRIX) summarized the discussion of MA-4 habitat analysis contained in the original CRCIP AEM Plan. The intention of the presentation was mainly to review what the AMT had developed in relation to MA-4 activities as described in the CRCIP AEM Plan and to initiate discussion concerning post-Project activities that could fulfill expectations concerning MA-4. Issues relevant to MA-4 (e.g., habitat opportunity, habitat capacity, and the juvenile conceptual model) were reviewed in relation to pre-Project computations made by Bottom et al. (2001). Key findings of recent field investigations concerning juvenile salmonid habitat availability and utilization studied by Bottom and his colleagues were also discussed. The results of studies thus far completed by Bottom suggest that the variance in the data will not likely permit the drawing of any inferences concerning the

effects of channel improvements (or other potential stressors) on salmonids. A pending proposal by Bottom et al. to perform additional field studies and revise previous calculations of habitat opportunity was also briefly outlined in the presentation to the AMT. The MA-4 presentation made by Bartell is available at the E2 CRCIP website.

Bartell translated the presentation into a draft “strawman” proposal for discussion at the October 2011 AMT meeting. These discussions will continue throughout the 2012 AEM Program as part of the transition to the O& M phase of channel improvement.

The original example template for MA-1 pre- and post-construction comparisons (e.g., Table 5-1.1) may be revised as a result of the 2012 deliberations by the AMT.

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 2011 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 USACE proposed target year designated as three years post-construction.	
5 Jul 2005	**MA-4 Decision Criterion**	The USACE 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 USACE 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.	
8 Oct 2008	**MA-4 Habitat Surveys**	No decisions were made for MA-4 at the October 2008 meeting.	

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

Date	Issue	MA-4 Decisions	Comments
14 Jan 2009	**MA-4 Habitat Surveys**	No new information was available for MA-4.	
8 Apr 2009	**MA-4 Habitat Surveys**	No new information was presented for MA-4 at the April 2009 meeting.	
8 Jul 2009	**MA-4 Habitat Surveys**	No new information was presented for MA-4 at the July 2009 meeting.	
18 Nov 2009	**MA-4 Habitat Surveys**	No new information was presented for MA-4 at the November 2009 meeting.	
20 Jan 2010	**MA-4 Habitat Surveys**	No new information was presented for MA-4 at the January 2010 meeting. MA-4 will be discussed at the April 201 0AMT meeting.	
14 Apr 2010	**MA-4 Habitat Surveys**	The USACE will support studies to evaluate habitat utilization by Evolution Significant Units in the lower river and estuary. A submitted research proposal for MA-4 related work will be discussed at the July 201 0AMT meeting.	
14 Jul 2010	**MA-4 Habitat Surveys**	Discussions concerning post-construction MA-4 activities will continue at upcoming AMT meetings.	
13 Oct 2010	**MA-4 Habitat Surveys**	Discussion of MA-4 activities was re-scheduled for the January 2011 AMT meeting.	
12 Jan 2011	**MA-4 Habitat Surveys**	No AMT meeting was held in January 2011.	
13 April 2011	**MA-4 Habitat Surveys**	No decisions were made in relation to MA-4 at the April AMT meeting. Discussion will continue at the July meeting.	
13 Jul 2011	**MA-4 Habitat Surveys**	The AMT discussed several approaches to address MA-4 objectives. Bartell will develop and present a "strawman" proposal at the October AMT. This draft proposal will include the main points of the July discussion.	
12 Oct 2011	**MA-4 Habitat Surveys**	Bartell presented a draft proposal including several technical approaches aimed at meeting MA-4 objectives. The AMT agreed to further discuss the proposal at the January 2012 AMT 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.

As of December 2011 the CRCIP construction requirements for MA-5 have been completed and the assessment of sediment contaminants will transition into the Project O&M phase in subsequent adaptive management related to channel improvement.

6-1 Sediment Contaminants

As described in the 2010 annual report, chemical analyses have been performed for samples collected in 2008 from 23 locations (Table 6.1-1). Analytes included metals, total organic carbon, pesticides, polychlorinated biphenyl (PCBs), chlorinated hydrocarbons, phthalates, polycyclic aromatic hydrocarbon (PAHs), phenols, miscellaneous extractables, and petroleum. Initial evaluation of the results of the chemical analysis suggested that the materials obtained within the navigation channel were suitable for in-water placement. Based on this evaluation further characterization of sediment contaminants might not be necessary for another ten years (i.e., 2018).

However, one sample from CRM 100.7 contained PCBs (Arochlors) at concentrations slightly greater than the SEF screening level for freshwater benthic invertebrates. As a result, the PRG listed this site as “moderate” and this location will need to be retested in five years. The USACE plans to re-test this CRM location. Results will be provided to the PRG and the AMT.

During 2010, the Project Review Group (PRG) reviewed the September 2010 “Columbia River Mainstem Federal Navigation Channel Sediment Quality Evaluation Report” (SQER). The review addressed the management area ranking and recent data for sediment quality in relation to the 2010 SEF for the Pacific Northwest. The PRG report was provided in July 2011. Based on this 2011 report, the PRG verified that sediments from CRM 3 through CRM 106.5 (except CRM 100.7) ranked as “very low” within the SEF. According to the PRG review, the sediment quality data reported for this area in the SQER are sufficient for ten years before any evaluation of the need for retesting. As a result of this review process, additional sediment testing will not be required until 2018. The PRG report has been uploaded to the E2 CRCIP web site and located in the MA-5 reporting link for the electronic version of the AEM Workbook.

Table 6-1.1. Locations of 23 Columbia River Sediment Samples Collected in August 2008 and Analyzed for Metals.

Sample Location (CRM)	Sample Identification Number
9+00-WA	082608CRWA- 9+00BC-04
9+30-OR	082608CROR - 9+30BC-04A
12+45-OR	082608CROR-12+45BC-12
13+05-OR	082608CROR-13+05BC-14
20+30-OR	082608CROR-20+30BC-22
33+10-OR	082608CROR-33+10BC-30
33+20-OR	082608CROR-33+20BC-31
35+15-OR	082608CROR-35+15BC-33
41+00-OR	082608CROR-41+00BC-38
56+25-OR	082608CROR-56+25BC-47
67+00-WA	082708CRWA-67+00BC-57
80+40-CL	082708CRCL -80+40BC-65
84+40-OR	082708CROR-84+40BC-68
86+00-OR	082708CROR-86+00BC-70
86+20-OR	082708CROR-86+20BC-71
86+50-OR	082708CROR-86+50BC-72
97+00-OR	082708CROR-97+00BC-83
97+00-WA	082708CRWA-97+00BC-85
99+30-WA	082708CRWA-99+30BC-88
100+25-WA	082708CRWA-100+25BC-90
100+40-OR	082708CROR -100+40BC-91
102+20-WA	082708CRWA-102+20BC-93
102+40-WA	082708CRWA-102+40BC-94

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 2011.

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 the technical group already performing this work.	
16 Dec 2004	**MA-5 Decision Criterion**	The AMT will interact with the LCR and Estuary Program 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 USACE 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 USACE 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 USACE (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 website (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 2010 AMT meeting.	

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

Date	Issue	MA-5 Decisions	Comments
14 Jan 2009	**MA-5 Decision Criterion**	No decisions were made regarding MA-5 monitoring activities.	
8 Apr 2009	**MA-5 Decision Criterion**	Based on chemical analysis of 23 samples from the Columbia River navigation channel, dredged sediments were judged as suitable for in-water placement.	
8 Jul 2009	**MA-5 Decision Criterion**	No new information was presented for MA-5 at the July 2009 meeting.	
18 Nov 2009	**MA-5 Decision Criterion**	No new information was presented for MA-5 at the November 2009 meeting.	
20 Jan 2010	**MA-5 Decision Criterion**	MA-5 activities will transition into the O&M phase for compliance with the SEF.	
14 Apr 2010	**MA-5 Decision Criterion**	MA-5 activities will transition into the O&M phase for compliance with the SEF.	
14 Jul 2010	**MA-5 Decision Criterion**	MA-5 has been completed for the CRCIP AEM Program. Sediment contaminant activities will transition into the O&M phase of channel improvement. The SEF PRG will be requested to review previous sediment findings concerning disposal of dredge materials.	
13 Oct 2010	**MA-5 Decision Criterion**	The PRG verified that sediments from CRM 3 through CRM 106.5 will not require further testing for ten years, with the exception of one sample from CRM 100.7 that will require testing in five years. The USACE plans to re-sample and test this location in 2011.	
12 Jan 2011	**MA-5 Decision Criterion**	January 2011 AMT meeting was cancelled.	
13 April 2011	**MA-5 Decision Criterion**	No decisions were made in relation to MA-5 at the April 2011 AMT meeting.	
13 Jul 2011	**MA-5 Decision Criterion**	The report from the Project Review Group determined that materials from CRM 3 - 106.5 were suitable for unconfined aquatic placement. The next testing will occur in 2018.	
12 Oct 2011	**MA-5 Decision Criterion**	No decisions were made in relation to MA-5 at the October 2011 AMT meeting.	

7 Monitoring Action 6—Fish Stranding

Similar to MA-4, the monitoring of fish stranding in relation to Project construction was originally planned to be based on a before-and-after comparison of field studies. Because Project construction was anticipated to be completed in December 2011; the AMT discussed the necessity, practicality, and feasibility of performing the post-construction field studies during several of the 2011 quarterly meetings. At issue were the noted minimal changes in commercial navigation during the construction period and the possible use of one of the three pre-construction stranding study locations for beach nourishment.

Dr. Walter Pearson, Peapod Research Inc., was contracted by E2 and the USACE to evaluate the expected changes in fish stranding probabilities as a result of channel improvements. Dr. Pearson was also tasked with estimating the number of field samples that would be necessary to demonstrate changes in stranding probabilities. The analysis performed by Dr. Pearson was based on a statistical model developed using the results of the pre-construction field studies of fish stranding.

7-1 Frequency of Stranding

The following sections are identical to the 2010 annual report, which are provided for the convenience of the reader. 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% of the vessel passages were associated with stranding events. This frequency ranged from ~18 to 30% 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 website (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 Post-Construction Probability of Stranding

The AMT discussions during 2010 concerning fish stranding initially addressed the post-construction follow-up field studies that were scheduled to be performed in March 2012–2013. Following further discussions, the AMT agreed to the analysis of the likely changes in stranding probabilities that might have resulted from channel improvement. Based on AMT deliberations in 2010, Dr. Walter Pearson (Peapod Research) was contracted to develop a statistical model and analyze different navigation scenarios with an emphasis on (1) estimating changes in the frequency (probability) of fish stranding and (2) determining the sampling intensity required in post-Project field studies to statistically demonstrate any changes in stranding suggested by the analysis.

As a follow up to previous 2010 AMT deliberations, Dr. Pearson was contracted to develop a statistical model and analyze different navigation scenarios with an emphasis on (1) changes in the frequency (probability) of fish stranding and (2) estimates of the sampling intensity required in post-Project field studies to statistically demonstrate any changes in stranding suggested by the analysis.

Dr. Pearson presented the results of his empirical analysis of post-Project fish stranding at the October 2010 AMT meeting. The model results indicated the potential for both increases and decreases in stranding probability, depending on the assumptions (e.g., fleet composition, navigation intensity) associated with the individual scenarios. The results of the analysis also suggested that the numbers of samples required to obtain desired statistical performance in post-Project field studies were substantially greater than the numbers of samples collected in the pre-Project stranding studies. Dr. Pearson's 2010 draft report and his October presentation have been posted to the MA-6 fish stranding component of the electronic version of the AEM Workbook available at the E2 CRCIP website.

In 2011, the AMT reviewed the preliminary report produced by Dr. Pearson and provided comments that were used in developing a final report. Dr. Pearson provided a final fish stranding report (Pearson 2011) and supporting appendices in March 2011. These reports were uploaded to the E2 CRCIP web site.

Following additional discussion of the Pearson model results during 2011, the AMT achieved consensus that there was insufficient justification for simply repeating the post-Project stranding studies as originally proposed. However, in the absence of field verification of the Pearson model, the AMT further suggested that Dr. Pearson's analysis and modeling of fish stranding undergo a rigorous external peer-review. The AMT agreed to base recommendations concerning resolution of MA-6 requirements on the results of such a review.

Further discussions by the AMT concerning the efficacy of performing the post-construction field stranding studies were planned for 2012. These discussions will be guided by the results of the external peer review of Dr. Pearson's analysis that will be performed in 2012.

7-4 AMT Decisions for MA-6

Table 7-4.1 summarizes the key discussion points and decisions concerning the possible impacts of CRCIP construction on fish stranding through calendar 2011 for the AEM Program.

Table 7-4.1. 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 was made concerning fish stranding at the October 2005 AMT meeting.	
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.	
14 Jan 2009	**MA-6 Fish Stranding**	No new information was presented regarding MA-6.	
8 Apr 2009	**MA-6 Fish Stranding**	No new information was presented for MA-6 at the April 2009 meeting.	
8 Jul 2009	**MA-6 Fish Stranding**	No new information was presented for MA-6 at the July 2009 meeting.	
18 Nov 2009	**MA-6 Fish Stranding**	The AMT requested that the post-construction (Phase 2) fish stranding studies be performed as originally specified in the BiOp.	
20 Jan 2010	**MA-6 Fish Stranding**	Post-Project construction studies will be performed in March 2012–2013.	
14 Apr 2010	**MA-6 Fish Stranding**	Post-Project construction studies will be performed in March 2012 and March 2013. Additional discussion concerning the design of the studies is planned for the July 2010 AMT meeting.	
14 Jul 2010	**MA-6 Fish Stranding**	Dr. Walter Pearson has been contracted to evaluate the efficacy of post-construction experiments for fish stranding. Dr. Pearson will present initial results of his analysis at the October 2010 AMT meeting.	

Table 7-4.2. CRCIP AEM Plan Record of AMT MA-6 Decisions. Continued.

Date	Issue	MA-6 Decisions	Comments
13 Oct 2010	**MA-6 Fish Stranding**	Dr. Pearson presented the results of his analysis of the probability of fish stranding in the post-Project channel for several scenarios of commercial navigation. The AMT will review the report prepared by Dr. Pearson for discussion at the January 2011 AMT meeting.	
12 Jan 2011	**MA-6 Fish Stranding**	No AMT meeting was held in January 2011.	
13 Apr 2011	**MA-6 Fish Stranding**	The AMT does not intend to accept Dr. Pearson's results as justification for not performing post-Project stranding studies. The studies remain part of the terms and conditions in the BiOp. However, the results of Pearson's analysis might be used to carefully design a subset of the originally stipulated follow-up studies to verify the empirical model and draw inferences concerning the effects of channel modification on fish stranding.	
13 Jul 2011	**MA-6 Fish Stranding**	The AMT did not arrive at a consensus process for resolving MA-6 during the July meeting. The USACE agreed to have some internal meetings to discuss possible approaches prior to the October AMT meeting.	
12 Oct 2011	**MA-6 Fish Stranding**	The AMT agreed that there was insufficient justification for performing the post-construction stranding studies. The AMT recommended that Dr. Pearson's analysis undergo an external peer review. The results of this review will be used by the AMT to develop recommendations for completing the requirements of MA-6.	

8 Sturgeon

The sturgeon component of the AEM Program is considered completed for the CRCIP project. No new information concerning project impacts on sturgeon was presented or discussed during 2011. However, a green sturgeon study has been included as part of the O&M phase.

8-1 Decision Criteria for Sturgeon

In the original CRCIP AEM Plan, decision criteria for sturgeon were based on the potential impacts of dredging and disposal of dredged materials on sturgeon behavior (e.g., foraging, habitat selection). The two reports that summarize the studies of dredging activities have been essentially finalized. The first study describes the behavioral response of tagged white sturgeon to dredging activities. The second study developed a model that predicts sturgeon habitat quality based on descriptions of channel physical characteristics. The resulting reports have been previously posted on the E2 CRCIP website.

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 2011 for the AEM Program. Although the sturgeon component of the CRCIP AEM Program has been completed, the table of AMT decisions will continue to be updated for continuity in reporting and to provide a convenient format for capturing any future sturgeon issues that might arise during the O&M phase.

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.	
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.	

Table 8-2.3. CRCIP AEM Plan Record of AMT MA-6 Decisions. Continued.

Date	Issue	Sturgeon Decisions	Comments
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 USACE had previously indicated that additional work would be done on correlating sturgeon abundance with habitat using the existing data.	
1 Sep 2005	**Sturgeon**	The USACE 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 USACE 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 United States Geological Survey 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 2008 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 website.	
8 Oct 2008	**Sturgeon**	No decisions were made for sturgeon at the October 2008 meeting.	
14 Jan 2009	**Sturgeon**	No new information was available for sturgeon at the January 2009 meeting.	
8 Apr 2009	**Sturgeon**	Finalization of the sturgeon report was re-scheduled for the July 2009 AMT meeting.	
8 Jul 2009	**Sturgeon**	The two reports that summarize the responses of sturgeon to dredging have been finalized.	
18 Nov 2009	**Sturgeon**	No new information was available concerning sturgeon for the November 2009 meeting.	
20 Jan 2010	**Sturgeon**	A green sturgeon study program is underway as part of the CRCIP O&M phase.	
14 Apr 2010	**Sturgeon**	A green sturgeon study program is underway as part of the CRCIP O&M phase.	
14 Jul 2010	**Sturgeon**	No new information was available concerning sturgeon for the July 2010 meeting.	
13 Oct 2010	**Sturgeon**	No new information was available concerning sturgeon for the October 2010 meeting.	
12 Jan 2011	**Sturgeon**	The January 2011 AMT meeting was cancelled.	
13 Apr 2011	**Sturgeon**	No new information was available concerning sturgeon for the April 2011 meeting.	
13 Jul 2011	**Sturgeon**	No new information was available concerning sturgeon for the July 2011 meeting.	
12 Oct 2011	**Sturgeon**	No new information was available concerning sturgeon for the October 2011 meeting.	

9 Smelt

The assessment of potential CRCIP impacts on smelt has been completed in relation to Project construction. Criteria to protect smelt (Eulachon) as part of the AEM process addressed the possible CRCIP impacts on the survival, movements, and habitat utilization of these fish in relation to the dredging process. Water Quality Certificates dated 2008 from the states of Oregon and Washington prohibit in-water disposal between the 8th and 20th weeks of the year (out migration) between CRM 35 and CRM 75.

9-1 Decision Criteria for Smelt

Decision criteria concerning effects of disposal of dredged materials on smelt were provided in the 2006 annual report for the CRCIP 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.

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 USACE 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

Because the smelt component of the CRCIP AEM Program has been completed, no decisions were required on the part of the AMT concerning project impacts on smelt during 2011 (Table 9-2.1). However, the decision table for smelt is included in the 2011 report for continuity and to provide a convenient format in case future issues emerge concerning smelt in relation to the CRCIP.

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 USACE 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 CRM 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.	

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

Date	Issue	Smelt Decisions	Comments
3 Oct 2007	**Smelt**	No decisions were required for smelt.	
9 Jan 2008	**Smelt**	No new information was provided for smelt, although there was some discussion and recognition concerning smelt in the diet of sturgeon.	
29 Apr 2008	**Smelt**	No new information was available regarding smelt.	
9 Jul 2008	**Smelt**	No new information was available regarding smelt.	
8 Oct 2008	**Smelt**	No decisions were made for smelt at the October 2008 meeting.	
14 Jan 2009	**Smelt**	The AMT was informed that smelt might be listed as an endangered species during the spring of 2009.	
8 Apr 2009	**Smelt**	NMFS indicated that smelt would not likely be listed prior to the Project rock removal planned for the November–December 2009 and January–February 2010 in-water work window.	
8 Jul 2009	**Smelt**	It seems unlikely that smelt will be listed before completion of Project construction.	
18 Nov 2009	**Smelt**	No new information was available regarding smelt.	
20 Jan 2010	**Smelt**	The O&M phase of adaptive management will need to address the inclusion of smelt. Conditions may be placed on smelt in relation to an anticipated O&M BiOp due from NMFS in April or May of 2011.	
14 Apr 2010	**Smelt**	No new information was available regarding smelt.	
14 Jul 2010	**Smelt**	No new information was available regarding smelt.	
13 Oct 2010	**Smelt**	No new information was available regarding smelt.	
12 Jan 2011	**Smelt**	The January 2011 AMT meeting was cancelled.	
13 Apr 2011	**Smelt**	No new information was available regarding smelt.	
13 Jul 2011	**Smelt**	No new information was available regarding smelt.	
13 Oct 2011	**Smelt**	No new information was available regarding smelt.	

10 Dungeness Crab

In 2010, the CRCIP completed its obligations under Oregon and Washington's 401 requirements and DLCD's Coastal Zone Consistency Determination in relation to Dungeness crab. The following sections are reproduced from the 2010 annual report for the reader's convenience.

The original objectives of the AEM Plan concerning Dungeness crab were to avoid or minimize (1) entrainment mortality during dredging and (2) crab burial by disposal of dredged materials. The underlying intent was "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 were not 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 (MCR), 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/cubic yards) 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+ crab 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 young of the year (YOY) and age 1+ crabs.

The remaining issues concerning crab were further pointed out by the ODFW during the calendar year 2010. These issues concerned the potential impacts of dredging and disposal of dredged

materials on crabs. While the ODFW recognized the value of the Phase I and Phase II studies of crab entrainment and burial, the agency remained concerned about the comparative lack of information for YOY and smaller sized individuals. Previously proposed Phase III studies were to extend the laboratory entrainment and burial studies to field conditions. However, the logistical challenges posed by field conditions in further studying potential impacts on crabs have precluded the Phase III studies. ODFW requested additional studies that describe the spatial-temporal variability in the distribution and abundance of crabs in areas potentially impacted by dredging or the in-water disposal of dredged materials.

The USACE underscored the difficulties of studying crab burial under field conditions and indicated that, as a result, Phase III studies would not likely be performed. In addition, the recent commercial harvests do not indicate that the crab populations are declining. Surveys of crabs following dredging and disposal indicate that crabs inhabit and utilize the newly deposited dredged materials. Despite the remaining issues and data gaps, ODFW indicated that no additional actions seemed necessary on the part of the AMT.

Nevertheless, ODFW asked for confirmation that the Oregon Coastal Management Program (OCMP) crab conditions [II.a.(i)–(iv)] would apply to O&M following the completion of the Channel Improvement Project construction. These conditions primarily address activities to minimize crab entrainment and burial (e.g., use of the crab distribution model to schedule dredging and disposal), restrictions on dredging and flow lane disposal below CRM 17 during periods of high crab abundance, and a crab mitigation strategy. The opinion of the ODFW was that the conditions have been satisfied in relation to Project construction, but indicated that the final OCMP provisions apply to maintenance activities, as well as construction.

ODFW cautioned that although there is an ongoing and continuing AMP, state decisions [i.e., 401 and Coastal Zone Management Act (CZMA)] are requirements that must be met by the USACE. This caution refers not only to crabs, but also to the sediment issues referred to previously (i.e., MA-3 and MA-4 above). It was noted, however, that the new 401 water quality certification does not identify crabs, although the sediment monitoring requirements are retained in the current CZMA.

10-2 AMT Decisions regarding Dungeness Crab

Table 10-2.1 summarizes the accumulated decision and key discussion points through calendar year 2011 concerning the CRCIP and potential impacts on Dungeness crab in the LCR and estuary. The Dungeness crab component of the CRCIP AEM Program has been completed. However, the decision table will be continued for continuity in reporting results of the AMT meetings and to provide a convenient format should any Dungeness crab issues emerge during future meetings during the O&M phase.

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 WDOE accepted the USACE 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 website.	
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 website.	
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.	
14 Jan 2009	**Crab**	ODFW indicated that there were some remaining concerns regarding dredging and disposal for crabs, but no actions of the AMT were required.	
8 Apr 2009	**Crab**	ODFW requested confirmation that OCMP crab conditions [II.a(i)–(iv)] would apply to O&M following completion of the CRCIP construction.	
8 Jul 2009	**Crab**	No new information was presented concerning crab at the July 2009 meeting.	
18 Nov 2009	**Crab**	No new information was presented concerning crab at the November 2009 meeting.	
20 Jan 2010	**Crab**	The CRCIP completed requirements concerning crab in relation to Oregon and Washington 401 requirements and the DLCD Coastal Zone Consistency Determination.	
14 Apr 2010	**Crab**	No new information was presented concerning crab at the April 2010 meeting.	
14 Jul 2010	**Crab**	No new information was presented concerning crab at the July 2010 meeting.	

Table 10-2.2. CRCIP AEM Plan Record of AMT Decisions for Crab. Continued.

Date	Issue	Crab Decisions	Comments
13 Oct 2010	**Crab**	No new information was presented concerning crab at the October 2010 meeting.	
12 Jan 2011	**Crab**	The January 2011 AMT meeting was cancelled.	
13 Apr 2011	**Crab**	No new information was presented concerning crab at the April 2011 meeting.	
13 Jul 2011	**Crab**	No new information was presented concerning crab at the July 2011 meeting.	
10 Oct 2011	**Crab**	No new information was presented concerning crab at the October 2011 meeting.	

11 Sediments

Given that the Project construction was completed in November 2010, the sediment management activities have moved to the O&M phase and Jarod Norton (USACE) will be the USACE contact for this work. The sediment management component of the CRCIP AEM Program is considered complete.

11-1 Summary of Decisions

Table 11-1.1 summarizes the decisions made through 2011 regarding the relevance of Project disposal of dredged materials to regional sediment management. While the sediment management component is considered complete, the decision table will continue to be updated for continuity in AEM reporting and to provide the opportunity to capture any future AMT deliberations concerning sediment management in relation to the O&M phase.

Table 11-1.1. CRCIP AEM Plan Record of AMT Decisions for Sediments.

Date	Issue	Sediments Decisions	Comments
11 Jan 2006	**Sediment Management**	The USACE 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.	
12 Apr 2006	**Sediment Management**	The USACE 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 USACE 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 USACE 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.	

Table 11-1.2. CRCIP AEM Plan Record of AMT Decisions for Sediments. Continued.

Date	Issue	Sediments Decisions	Comments
8 Oct 2008	**Sediment Management**	The 2008 AMT sediment management workshop report was approved as final.	
14 Jan 2009	**Sediment Management**	The AMT expressed a desire that the CRCIP Sediment Management Plan be communicated to regional sediment management activities underway.	
8 Apr 2009	**Sediment Management**	Mike Ott (USACE) will replace Doris McKillip (USACE) with regard to future AMT discussions of regional sediment management.	
8 Jul 2009	**Sediment Management**	The USACE reinforced its intentions of looking for beneficial uses of Project construction dredged materials. This interest will continue into the O&M activities.	
18 Nov 2009	**Sediment Management**	Sediment management (i.e., beach nourishment) was discussed in relation to post-construction fish stranding studies. A decision was made to go forward with the Phase 2 fish stranding studies.	
20 Jan 2010	**Sediment Management**	No new information was presented in relation to sediment management.	
14 Apr 2010	**Sediment Management**	No new information was presented in relation to sediment management.	
14 Jul 2010	**Sediment Management**	No new information was presented in relation to sediment management.	
13 Oct 2010	**Sediment Management**	No new information was presented in relation to sediment management.	
12 Jan 2011	**Sediment Management**	The January 2011 AMT meeting was cancelled.	
13 Apr 2011	**Sediment Management**	No new information was presented in relation to sediment management.	
13 Jul 2011	**Sediment Management**	No new information was presented in relation to sediment management.	
12 Oct 2011	**Sediment Management**	No new information was presented in relation to sediment management.	

12 Integration with 2010 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 2010 AMT activities and summarize AEM monitoring results with emphasis on MA-1 results. Additional details can be found in the notes from the quarterly AMT meetings and the AEM Program Workbook that are available through the project website hosted by E2 (www.e2tm.com/CRCIP).

12-1 Results for Analyses of 2010 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 2010. Detailed plots of daily median values and normalized values of temperature and salinity can be examined by downloading the corresponding files at the E2 website.

Depth

As in previous years (2006–2009), depth data were only available for the grays sampling station in 2010. Depth data were available for the grays station only between July and December 2010. The daily values are nearly centered within the 20th–80th percentile decision criteria during this period.

Table 2-1.1 lists the monthly median depth values calculated using the 2010 data from the grays station. All reported 2010 monthly values were within the 20th–80th percentile range of the decision criteria derived from the 1996–2004 pre-Project data.

Table 12-1.1. Summary of 2010 Monthly Median Depth Values (bold numbers) for grays Station in Relation to AEM Percentile Decision Criteria.

	Monthly Median Depth Meters (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
	No data	**No data**	**No data**	**No data**	**No data**	**No data**	**1.7**	**1.7**	**1.7**	**1.8**	**1.9**	**2.2**
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

Temperature

Tables 12-1.2–12-1.4 list the calculated monthly median values for 2010 and the corresponding temperature decision criteria derived from analysis of the pre-Project data (1996–2004). Despite the above mentioned variances in the daily temperature data, the spreadsheet summaries of monthly average temperatures used in the AEM decision-making process were nearly all within the decision criteria for all three stations for the months with available data. However, the June value of 14.8°C calculated for the cbnc3 station is 0.1°C less than the decision criterion of 14.9°C. The AMT did not consider this discrepancy to be of any significance in relation to the Project. The spreadsheet summaries of monthly average temperatures used in the decision-making process were predominantly within the 20th–80th percentile decision criteria for all three stations based on the available 2010 data. The February value for cbnc3, the March values for grays and tansy, and the October and November values for tansy were within the 80th–95th percentile decision criteria. The June value for grays was within the 5th–20th percentile decision criteria.

The overall conclusion from the MA-1 analysis of water temperatures was that no discernible impacts of Project construction were evident based on the CORIE monitoring data available for 2010.

Table 12-1.2. Summary of 2010 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	4.5	4.6	6.0	7.0	9.5	9.8	9.4	10.1	9.8	9.4	8.3	6.0
20	5.7	5.7	8.9	8.9	10.7	11.6	11.2	11.9	11.6	11.1	9.5	7.2
	7.3	**8.2**		**10.5**	**12.8**	**14.7**	**16.6**	**16.3**	**15.3**			**No data**
80	8.9	8.4	9.1	11.0	13.6	15.8	17.5	18.3	16.9	14.2	11.6	9.6
			9.1							**14.5**	**12.4**	
95	9.8	9.7	9.9	11.9	14.5	16.9	19.3	19.9	18.5	15.8	12.5	10.6

Table 12-1.3. Summary of 2010 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
						14.8						
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
	No data	**No data**		**10.7**	**13.5**		**18.7**	**19.8**	**17.8**	**15.3**	**11.3**	**7.4**
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
			9.3									
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 2010 Monthly Median Temperature Values (bold numbers) for cbnc3 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**
						14.8						**5.2**
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
	6.0		**8.0**	**10.4**	**13.3**		**18.6**	**20.0**	**18.1**	**No data**	**No data**	**No data**
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
		6.9										
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

Salinity

MA-1 importantly includes an analysis of potential Project construction impacts on salinity values in the LCR and estuary. The analyses are based on the CORIE data and performed 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 elevate salinity values, which can impact habitat quality for juvenile salmon.

Tables 12-1.5–12-1.7 list the monthly median salinity values calculated for 2010 and the decision criteria developed by the AMT for MA-1. Despite the variations in the daily median values, the 2010 monthly average salinity values for tansy were within the 20th–80th percentile decision criteria, except for June (Table 12-1.5). The June value was 0.1 psu lower than the decision value and was well within the 5th–20th percentile criterion.

The average monthly values for the grays station did not suggest any issues concerning saltwater intrusion in relation to Project construction (Table 12-1.6). Monthly values were within the 20th–80th percentile criteria for 5 of the 10 months for which data were available in 2010. The remaining monthly values were ~0 or within the lower salinity criteria (i.e., 5th–20th percentile values).

Based on the available 2010 data, monthly average salinity values for cbnc3 were ~0 or within the 20th–80th percentile decision criteria (Table 12-1.7). The 2010 results fail to demonstrate any evidence of saltwater intrusion or other impacts on salinity for this sampling location.

The MA-1 monitored salinity results for 2010 are consistent with those of the temperature data analysis and further suggest that the Project construction had produced no measurable impact on salinity at these three station locations in the LCR and estuary.

Table 12-1.5. Summary of 2011 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
						1.6						
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
	9.1	**11.7**	**11.1**	**6.3**	**4.3**		**6.7**	**13.1**	**16.8**	**14.9**	**9.1**	**No data**
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 12-1.6. Summary of 2011 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**
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
											0.4	
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
	No data	**No data**	**0.8**				**0.4**	**1.7**	**3.3**	**2.0**		
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
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 2011 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**					
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
		0.4						**0.8**	**3.3**	**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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