Alaska EMAP 2002 – National Coastal Assessment Northern Gulf of Alaska

Research Plan and Quality Assurance Project Plan for 2002 Field Program

01 June 2002

Alaska EMAP 2002 –
National Coastal Assessment Northern Gulf of Alaska:
Research Plan and Quality Assurance Project Plan for 2002 Field Program

Management Approvals:
Signature indicates that the Research Plan and QAPP is approved and will be implemented in conducting the research of the project.

_____

Walt Nelson, U.S. EPA – WED, *date*
EPA Project Officer – C2000 West Region

_____

Dixon Landers, U.S. EPA – WED, *date*
EPA Project Officer – C2000 Alaska

Extramural Project Management and Lead Scientist Approvals:

_____

Ron Klein, Alaska Department of Environmental Conservation *date*
Project Manager

_____

Susan Saupe, Cook Inlet RCAC *date*
Lead Scientist/State Coordinator for Alaska

Background and Introduction

In 2001, the Alaska Department of Environmental Conservation (ADEC) developed a Cooperative Agreement with the Environmental Protection Agency (EPA) to join collaboratively in the Western States Coastal Environmental Monitoring and Assessment Program (EMAP). Through this agreement, the state of Alaska's legislature accepted funds from the EPA to conduct a coastal EMAP program in southcentral Alaska's coastal waters. The field program is planned for early summer 2002.

The Western States Coastal EMAP was initiated as one component of a national EMAP program called the National Coastal Assessment (NCA), led by EPA to survey the condition of the Nation's coastal resources. The main goal of the overall EMAP is to "monitor the condition of the Nation's ecological resources to evaluate the cumulative success of current policies and programs and to identify emerging problems before they become widespread or irreversible." As a part of the overall EMAP, the NCA is a five-year effort to (1999-2004) to monitor and assess the status and trends of significant estuarine and coastal resources to survey the condition of the Nation's coastal resources (bays and estuaries) during a five-year effort (1999-2004) that will create an integrated and comprehensive coastal monitoring program among the coastal states. The NCA is being accomplished through strategic partnerships with all 24 U.S. coastal states, Guam, and Puerto Rico.

The core set of parameters that are included in the EMAP that ensures the consistency and comparability of data from all coastal states includes several oceanographic and water quality parameters, sediment toxicity analyses, sediment chemistry, tissue chemistry, fish pathology, benthic community analyses, and fish community analyses. This necessitates the collection of surface, water column, and bottom water samples; sediment grab sampling (up to nine Van-Veen grabs at each site), and; bottom trawling (ten-minute tows).

Alaska is the last state to conduct field monitoring as part of the NCA's Western States Coastal EMAP. The ADEC is the lead agency facilitating sampling for EMAP in Alaska. Partnerships with other federal, state, and local agencies is being incorporated into the Alaska component of WEMAP. Data from EMAP are envisioned as the beginning of an ADEC statewide ambient water monitoring program that will include interior as well as coastal waters.

The EPA has identified five regions of Alaska's coastline, one of which is contained within the northwestern Gulf of Alaska extending from the Alaska Peninsula to the northern Gulf coast east of Prince William Sound. ADEC will be sampling this first sub-region of Alaska's coastline in the summer of 2002. If additional funds become available in future years, Alaska will extend the EMAP sampling to incorporate the additional four regions of Alaska.

Objectives

The broad goals and objectives of the Alaskan component of the Western States Coastal EMAP are:

- To assess the physical, biological, and chemical condition of Alaska's estuaries and offshore waters, completely in one Alaskan stratum, using a standardized (to other coastal states) suite of environmental indicators,
- To develop and implement sampling and quality assurance protocols, to test field equipment and logistics, and to establish interagency partnerships,
- To train ADEC staff in standard sampling processes and quality assurance protocols,
- To determine the relative importance of various stressors on coastal resources,
- To determine if the responses and conditions of biological indicators are similar to those found in other western states,
- To build partnerships among the implementing agencies for more effective monitoring and assessment in the future,
- To adapt the required EMAP database into the ADEC data base (STORET) system, and
- To the extent possible, coordinate the Alaska portion of EMAP with existing Alaskan research projects, such as the Gulf Ecosystem Monitoring Program (GEM) of the Exxon Valdez Oil Spill Trustee Council.

Study Design

The EPA has identified five regions of Alaska's coastline, one of which is contained within the northwestern Gulf of Alaska extending from the Alaska Peninsula to the northern Gulf coast east of Prince William Sound. ADEC will be sampling this first sub-region of Alaska's coastline in the summer of 2002. If additional funds become available in future years, Alaska will extend the EMAP sampling to incorporate the additional four regions of Alaska. The EMAP program relies on a probabilistic, stratified-random sampling design. The EMAP program allows for stratification, with sample locations distributed across pre-selected strata with sample sites randomly selected within each stratum. In 2002, the Alaska sampling will be conducted in an area of the northern Gulf of Alaska that encompasses the coastal bays and areas between Unimak Pass and Cape St. Elias, including Cook Inlet, Prince William Sound, and several bays on Kodiak Island. There are 50 core EMAP sites that are required as part of the national EMAP program and an additional 25 sites that the ADEC has added to further characterize the two major waterbodies of the southcentral Alaskan coast; Cook Inlet and Prince William Sound. Table 1 below lists the locations of the sites that were selected through EPA's randomization procedures and Figure 1 shows those locations on a map.

Partners in Alaskan EMAP Program

The ADEC is the state agency that will administer the EMAP program in Alaska. However, the success of the planning, field sampling, laboratory analyses, data analyses and interpretation, and reporting relies on the expertise and participation of numerous

other organizations. The Lead Scientist for the program is provided through a Memorandum of Understanding between the ADEC and the Cook Inlet Regional Citizens Advisory Council (RCAC). The Cook Inlet RCAC's Director of Science and Research is the Alaska EMAP Lead Scientist for program planning, field sampling, data analyses, and report writing. For the field program, scientific sampling crew will be provided by the Cook Inlet RCAC, National Marine Fisheries Service (Northwest Fisheries Science Center), International Halibut Commission, Washington Department of Ecology, University of Washington, ADEC, and EPA.

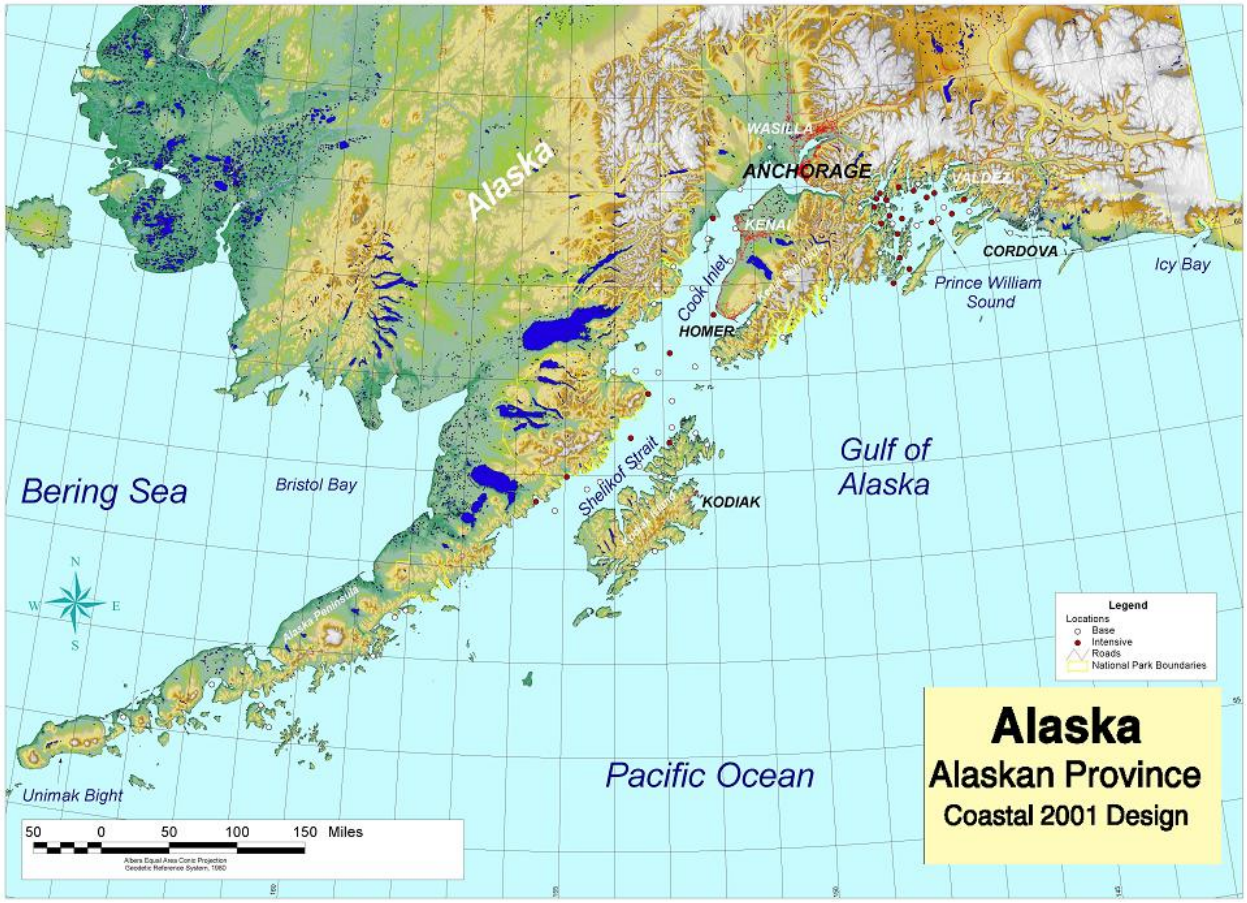


Figure 1. Location of sites for southeast Alaska EMAP program. White dots signify the "base" sites and the red dots indicate the 25 additional "intensification" or "back-up" sites.

The rest of this document describes the Alaska 2002 EMAP Research Plan for field sampling in 2002. This report is presented based on the organization sections presented in the NCA QAPP 2001-2004. Additional information is provided on the research plan for the State of Alaska.

A1-A8

By reference, the Alaska QAPP adopts these sections in the NCA QAPP 2001-2004. The problem definition/background, project description, data quality objectives for measurement data (including representativeness, completeness, comparability, accuracy and precision) are as defined in the NCA QAPP 2001-2004 except as noted below:

Table A7-2 of the NCA QAPP 2001-2004 lists Target Method Detection Limits (MDLs) for laboratory analyses of Coastal 2000 samples. Additional parameters will be added to the analyte list for sediment organics. The Alaska EMAP 2002 program will include C10-C34 aliphatic hydrocarbons (with pristane, and phytane). MDLs for laboratory analyses of these compounds are 120 ppb, dry weight.

Table A7-3 lists the quality assurance sample types, frequency of use, and types of data generated for EMAP-Coastal 2000 Monitoring. The Alaska EMAP 2002 program adopts these criteria by Sediment Toxicity Tests, Benthic Species Composition, Sediment Grain Size (with additional grain size categories within the core EMAP categories of silt and clay), Total Organic Carbon, Nutrients, Chlorphyll *a*, Total Suspended Solids, Fish Identifications, and Fish Gross Pathologies.

Water quality parameters will be collected using a CTD. DO, salinity, temperature, depth, optical back scatter (transmissivity), and fluorometry sensors were calibrated at Seabird, a certified calibration center for the Seabird 19 CTD and associated sensors, in May 2002. During the approximately 50-day field sampling program in Alaska, there will be no access to a laboratory to conduct monthly calibration checks. These sensors will be re-checked at the end of the research cruise when the CTD and sensors are back in a laboratory setting, extend the monthly check to about 60 days. However, since the calibration was just conducted in May and the instrument was also checked by the University of Washington's School of Fisheries and Ocean Sciences just prior to our leasing of the equipment, we are confident that the Seabird calibration and the University calibration checks are more than sufficient to ensure the accuracy and precision of the instruments. Daily comparisons of DO will be conducted daily on discrete water samples using a LaMott Winkler titration kit with accuracy ±0.5 mg/L. Salinity will be checked daily using discrete water sample measured with a refractometer with accuracy ± 1.0 ^{o}/oo. The fluorometry and OBS sensor data will provide additional information beyond that measured for discrete water sample analyses for chlorphyll *a* and TSS. The CTD is not equipped with a separate pH sensor so pH will be measured on discrete water samples from the surface, mid-depth, and bottom. These will be measured using a pH meter with daily comparisons to a LaMott pH color kit with accuracy ± 0.3 and 0.5 units, respectively.

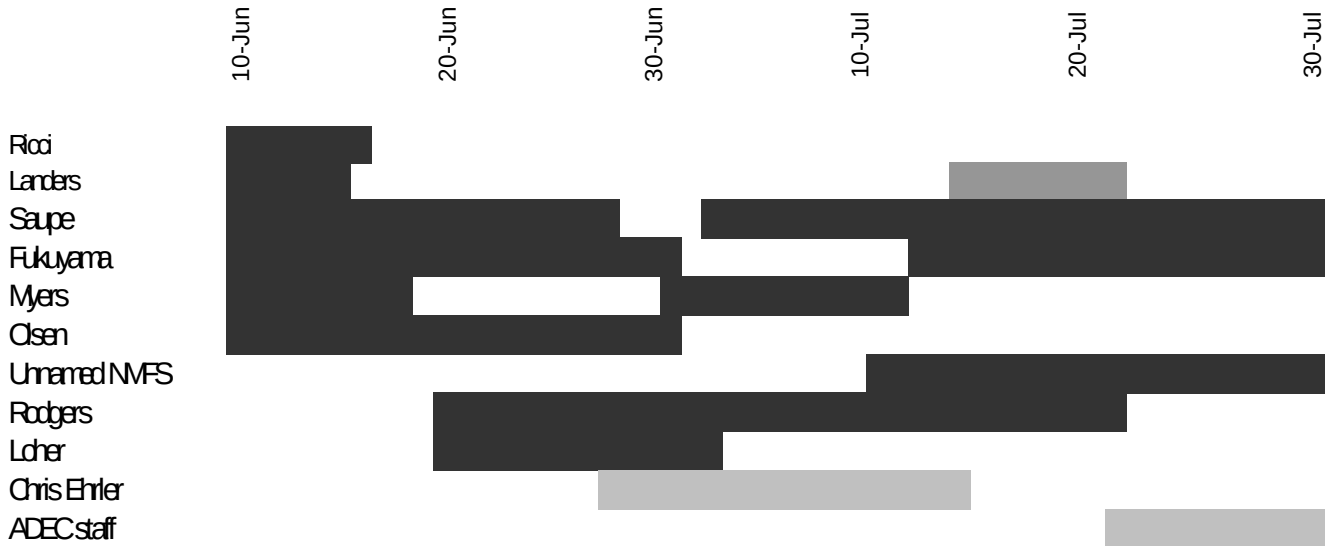
A9 SPECIAL TRAINING REQUIREMENTS/CERTIFICATION

The field crew that will be conducting the Alaskan Coastal 2002 EMAP consists of personnel from a range of agencies and organizations. Appendix A provides C.V.s for each of the main field personnel. However, there is not a "core" group that will be consistently sampling throughout the entire 50 day period at sea. At least two personnel (and usually three) that were fully trained together at the beginning of the field program will be onboard the vessel at all times. The third and/or fourth field sampling crew will either have also been trained with the others or will have the opportunity to be trained by these experienced personnel. In this way, we will always have three fully trained personnel onboard to ensure sampling consistency across the entire 50-day sampling period.

There is no current pool of water quality sampling staff within the Alaska Department of Environmental Conservation. Thus, the field crew will include participants from other agencies and research institutions and will bring individual expertise from their organizations. Currently, the "core" field sampling crew are:

Core Crew	**Organization**	**Field Responsibilities**
Susan Saupe	Cook Inlet RCAC/ADEC	Lead Scientist/All aspects of program where needed most
Allan Fukuyama	University of Washington	Sediments and Water Quality
Mark Myers	NWFSC/NMFS	Trawl/Fish Pathology; Training
Paul Olsen	NWFSC/NMFS	Trawl/Fish Pathology; Training
Kirsten Rodgers	University of Washington	Student Intern/All aspects of program where needed most
Other Participants		
Tim Loher	International Halibut Commission	Trawl/Fish pathology
Chris Ehler	Tenera Environmental	Sediments and Water Quality; general help
Crissy Ricci	Washington Department of Ecology	Training and general support of project
Dixon Landers	Environmental Protection Agency	QAPP/Training

Unfortunately, none of the participants is available for the entire fifty-day research cruise. A current schedule is as follows that maximizes the experience onboard the vessel while incorporating the various researchers' outside schedules:



The field personnel will demonstrate individual and team proficiency during the training and QAPP evaluation procedures during the first several days in Cook Inlet. Additional team members that arrive at a later date will be trained and evaluated by the existing scientific crew for those portions of the sampling in which they will be participating. Field trainers will include two personnel who have completed EMAP projects elsewhere; Mark Myers from the Northwest Fisheries Science Center at NMFS who provided EMAP support for Washington and Oregon EMAP sampling and Crissy Ricci who was a technician for EMAP sampling for the Washington Department of Ecology. They will ensure that the field crew are sampling in an EMAP acceptable manner such that the information and data gathered is compatible with other western coast EMAP data. Most of the other "core" sampling crew have experience conducting water quality, sediment quality, and /or trawl operations as well as experience sampling in an Alaskan coastal environment.

A10 DOCUMENTATION AND RECORDS

Each data generating activity, both field measurements and laboratory analyses, will be thoroughly documented in accord with the guidelines that are presented in the NCA QAPP 2 001-2004.

GROUP B MEASUREMENT/DATA ACQUISITION

B1 SAMPLING PROCESS DESIGN (EXPERIMENTAL DESIGN)

The Alaska QAPP adopts this section of the NCA QAPP 2001-2004 by reference, with the following explanations. There were 50 base sites selected for Alaska using the EMAP sampling approach of probabilistically generating sampling locations within three coastal strata; estuary/bay size < 100 km^2, estuary/bay size >100 km^2 and <250 km^2, and estuary size >250 km^2. These strata were selected within three systems; Cook Inlet [Cook Inlet and Shelikof Strait], Alaska [Peninsula and Kodiak Island], and Prince

William Sound. It is somewhat misleading that several sites that are on the west side of Kodiak Island are not in the Alaska system with sites that are on the east side of Kodiak. These sites are considered coastal sites to Shelikof Strait and are, thus, considered the Cook Inlet system.

Additional "intensive" sites were also selected within the Cook Inlet and the Prince William Sound systems. These sites will be "back-up" sites for the core, or base, 50 EMAP sites within the Cook Inlet and Prince William Sound systems. The order with which any intensive sites are sampled and used as replacement sites is determined through random sampling as follows:

A random number between 0 and 1 was provided for each of the intensive sites. Within each system, these random numbers, each associated with a specific site, were sorted by ascending number. The intensive site with the lowest random number within the Cook Inlet system will be the first back-up (replacement) site sampled for an un-sampleable site in this same system. Similarly, the intensive site in the Prince William Sound system with the lowest random number will be the first back-up (replacement) site for an un-sampleable site in the same system. The Alaska system has no back-up (replacement) sites. The order with which back-up (replacement) sites are used in place of the "core" or base sites is as follows:

Order	ID	Longitude			Latitude			Rand. No.	System
1	AK01-010	-155	34	5.64794	57	42	53.615556	0.006926923	Cook Inlet
2	AK01-008	-154	57	36.14367	57	58	58.978884	0.240634314	Cook Inlet
3	AK01-018	-151	54	35.12707	59	41	20.674824	0.289736993	Cook Inlet
4	AK01-019	-152	50	49.24968	59	17	37.616784	0.298755566	Cook Inlet
5	AK01-006	-153	18	16.61583	58	51	50.631552	0.408946847	Cook Inlet
6	AK01-007	-152	53	10.70865	58	20	47.696352	0.48092838	Cook Inlet
7	AK01-025	-153	40	8.51329	58	23	53.06586	0.530708424	Cook Inlet
8	AK01-012	-151	51	26.348	60	42	31.072428	0.718337807	Cook Inlet
1	AK01-052	-147	45	22.94028	60	34	54.48234	0.0443802	Prince William Sound
2	AK01-047	-147	26	30.26601	60	51	44.935596	0.117396954	Prince William Sound
3	AK01-045	-147	52	42.26484	60	10	4.621512	0.166808976	Prince William Sound
4	AK01-049	-147	10	37.05902	60	46	46.496892	0.178013874	Prince William Sound
5	AK01-039	-148	15	57.18474	60	48	58.155408	0.281085743	Prince William Sound
6	AK01-037	-148	11	6.42458	60	52	2.845776	0.282729289	Prince William Sound
7	AK01-054	-146	39	56.64373	60	34	38.184096	0.381694571	Prince William Sound
8	AK01-043	-148	12	46.18004	60	32	56.294376	0.442282531	Prince William Sound
9	AK01-060	-148	3	53.39361	59	54	29.577096	0.478306896	Prince William Sound
10	AK01-048	-146	59	51.81115	60	48	53.813376	0.485582534	Prince William Sound
11	AK01-040	-146	21	40.95864	60	42	41.928876	0.510036632	Prince William Sound
12	AK01-032	-147	45	34.89091	60	54	47.881656	0.605877139	Prince William Sound
13	AK01-059	-147	42	2.08256	60	2	27.970728	0.663349257	Prince William Sound
14	AK01-038	-148	3	28.06617	60	47	32.39232	0.754411099	Prince William Sound
15	AK01-053	-147	7	12.19353	60	30	38.4696	0.833706654	Prince William Sound
16	AK01-042	-148	1	11.9289	60	37	26.398596	0.868068293	Prince William Sound
17	AK01-033	-148	20	0.28766	60	43	34.399092	0.895671984	Prince William Sound
18	AK01-057	-147	53	5.56987	60	25	19.74486	0.964379429	Prince William Sound

Field Collection of Environmental Data

The Alaska QAPP adopts the NCA QAPP 2001-2004 by reference. The vessel and scientific crew will make their best efforts to locate each site and hold the vessel and gear on station within the 0.02 nautical mile radius.

The entire geographic linear range across the entire study area is more than 800 miles and there are numerous instances where there is more than a hundred miles, and even up to 200 miles, between sites. In other areas, there are numerous sites within a closer geographical range. The sites out the Alaska Peninsula will be extremely weather dependent, for both sampling and transiting. Thus, there is the potential that there will be many days when no sampling is possible as the boat waits for weather, is transiting a long distance, or is in port resupplying and shipping samples. However, there will be many days when we can sample two or three sites per day. Thus, we are estimating an average of 1.5 sites per day over the length of the 50-day field sampling.

At each station, the core field data/samples will include:

- Instantaneous water column profiles (DO, salinity, temperature, depth, transmittance, and fluorometry with a CTD and sensors; A PAR profile using a XXX sensor and water clarity with a secchi disk)
- Water quality parameters (nutrient loads-phosphates, nitrates/nitrites, ammonium, chlorophyll *a*, Total Suspended Solids, and pH) will be collected from discrete water samples at surface, mid-depth, and bottom.
- Surficial sediments, top 2-3 cm for chemical contaminants (organics, trace metals), sediment toxicity, total organic carbon, and sediment grain size.
- Benthic macroinvertebrate communities (taxonomy and abundance; richness)
- Fish/shellfish (general community structure-taxonomy, abundance, length; richness), fish pathological examinations; fish tissue contaminants (organics and trace metals)
- Habitat (general habitat information as described in NCA QAPP 2001-2004)

Samples collected in the field will be stored onboard the R/V Ocean Cape between ports, at which time they will be appropriately packed and shipped to respective laboratories. The vessel specifications, however, provide for adequate freezer and refrigerator space to meet the guidelines outlined in Table B-1, allowing us to side-step the "field holding" and store samples onboard in a manner equivalent to "lab storage." Thus, Table B1-1 (Sampling handling and storage guidelines for EMAP Coastal 2000 Monitoring) in the NCA QAPP 2001-2004 is revised for the Alaska QAPP as follows:

Sample Type	Container	Field Holding	Lab Storage	Max. Holding
Sediment: Organic Contaminants	Pre-cleaned I-Chem jars	Freezer (-20^{o}C)	Freezer (-20^{o}C)	1 year
Inorganic Contaminants	Pre-cleaned I-Chem jars	Freezer (-20^{o}C)	Freezer (-20^{o}C)	1 year*

Sample Type	Container	Field Holding	Lab Storage	Max. Holding
Total Organic Carbon	Glass jar	Freezer (-20°C)	Freezer (-20°C)	1 year
Grain Size	Nalgene jar	Refrigerator (4°C)	Refrigerator (4°C)	1 year
Toxicity	Pre-cleaned HDPE jar	Refrigerator (4°C)	Refrigerator (4°C)	28-days
Water Quality: Chlorophyll *a*	25 mm GF/F in HDPE snap-tube (foil wrapped)	Freezer (-20°C)	Freezer (-20°C)	6 months
Nutrients	60 ml Nalgene bottle	Freezer (-20°C)	Freezer (-20°C)	6 months
Total Suspended Solids (TSS)	25 mm pre-weighted GF/F in petri dish	Freezer (-20°C)	Freezer (-20°C)	3 months
Biota:				
Benthos (0.5 and 1.0 mm sieved)	100-1000 ml wide-mouth Nalgene	10% buffered formalin	Transfer to isopropyl alcohol	Indefinately
Fish Contaminants	Individuals wrapped in foil and combined in Zip-lock bag	Freezer (-20°C)	Freezer (-20°C)	1 year*
Histopathology specimens	Dependent on fish population showing abnormalities	Dietrich's fixative	Transfer to 70% ethanol	6 months

*Except for Hg, which has a recommended maximum recommended holding time before laboratory analyses of 28 days.

Because most samples will skip the temporary field storage step (although they will still, by definition, be in "the field"), samples will typically be shipped every 10 to 14 days to appropriate analytical laboratories. The great geographic distances between sample locations and between ports at which samples can be delivered, the limitations of field sampling along this coast of Alaska will not allow more frequent shipping of samples.

Laboratory Analyses of Samples

National Laboratories/In-State Laboratory Analyses

The state of Alaska does not have adequately equipped or staffed facilities to conduct many of the analyses required for the Alaska EMAP program in 2002. Thus, most of the

analytical services will be provided through Memorandum of Agreement or Understanding (MOA or MOU) between the Alaska Department of Environmental Conservation (ADEC) and other agencies or organizations. The following laboratories will be contracted to do the analyses:

Washington Department of Ecology-Manchester Laboratories	Sediment Organics and Inorganics; Sediment TOC, Sediment Grain Size; Fish Tissue Organics and Inorganics; Benthic Invertebrate QA/QC
Northwest Aquatics (Subcontracted through MOU with Washington Department of Ecology's Manchester Laboratories)	Sediment Toxicity
University of Washington's School of Oceanography	Nutrients, Chlorophyll *a*, Total Suspended Solids
University of Alaska's School of Fisheries and Ocean Sciences	Benthic Invertebrate Taxonomy and Abundance
Dave Orders Associates	CTD Calibration (via Seabird)

The Washington Department of Ecology's Manchester Laboratory has conducted West Coast EMAP sample analyses for the Washington State Coastal 2000 sampling. Northwest Aquatics, a private consulting firm, conducted the toxicity testing for the Oregon State Coastal 2000 sampling. The University of Washington's School of Oceanography conducted the discrete water quality sample analyses for the Washington State Coastal 2000 sampling. The University of Alaska has not conducted benthic invertebrate sorting for any EMAP program. They have, however, extensive experience conducting benthic invertebrate sorting for numerous Alaskan programs in the northern Gulf of Alaska, including Cook Inlet and Prince William Sound. They commonly use the same protocols as defined for the West Coast EMAP programs. We have ensured QA/QC checking of their sorting and taxonomy by coordinating through the Washington Department of Ecology, which has provided QA/QC for all West Coast benthic invertebrate sorting and taxonomy.

B2 SAMPLING METHODS REQUIREMENTS

The Alaska program will make all attempts to ensure that their EMAP sampling methods approved EMAP protocols as defined in the NCA QAPP 2001-2004. We will work to ensure that any modifications in the field sampling procedures meet the general guidelines of these established protocols and adhere to the spirit of the QA/QC established for the EMAP so that the resultant data remain comparable to that collected by standard procedures.

Site Location

The coastline, bays, and estuaries included in Alaska's 2002 EMAP sampling program include a vast array of habitats (soft substrate to hard rocky bottom), exposures (very

protected bays to areas exposed to hundreds or thousands of miles of fetch), estuary/bay type (depositional vs. heavily scoured or flushed; deep fjord, silled fjord, shallow estuary, etc…). There are numerous sites within areas that have extreme tidal ranges. For example, Cook Inlet has the second highest tidal range in the Western Hemisphere (up to 40 feet in upper Cook Inlet). The location of tidal nodes relative to the geography of the region creates tides that are almost 180^{o} out of phase between the head and mouth of Cook Inlet. As a result of that and other physical forcing factors, there are areas of Cook Inlet where there is no slack tide; there are always currents even during low or high tides. Every attempt will be made to hold the vessel on station using knowledge of currents and using the vessels maneuvering abilities provided by stern thrusters, but there may be instances where the 0.02 nm acceptable tolerance cannot be met. Anchoring the vessel on these sites would result in even lower likelihood of maintaining station since the required anchor line scope would provide a swinging radius far greater than the 0.02 nm (120 foot) acceptable radius and, even in relatively low winds, a vessel can "swing" a wide arc around an anchorage. Again, the vessel and scientific crew will make every attempt to maintain station location within the acceptable defined radius of 120 feet around the defined GPS location.

Given the remote location of most sites in the Alaska sampling region, and the high cost of accessing these sites, very few sites could be field "reconnoitered." The locations of all sites were plotted on various charts and PDF files for the sites can be found at http://info.dec.state.ak.us/pdf/emap. Through this type of evaluation, several sites are known ahead of time to be unsampleable and will be replaced by back-up or replacement sites as described in a previous section.

The vessel will be out of cell phone range often for days or weeks at a time. Opportunities to have discussions with the Regional EPA Project Officer will not be feasible for much of the field program. The field team, which will include the State Team Coordinator, will need to rely on their field sampling experience and their knowledge and understanding of the EMAP protocols to make many of the field decisions and determine what is appropriately "flexible" before a site is dropped as unsampleable outside of the defined, acceptable EMAP protocol range. ANY relocations greater than 0.02 nm will be documented in detail in the field record and any site relocations that exceeds 0.05 nm will be flagged for future evaluation on whether the data collected from that station is acceptable for inclusion to the study database.

Water Measurements

After a basic evaluation of a site's location relative to navigational hazards, etc…the first sampling activity conducted on site will be the collection of water column measurements and the collection of discrete water samples.

Hydrographic Profile

Water column profiles will be performed at each site to measure the following basic water quality parameters:

- Dissolved oxygen (DO)
- Conductivity (Salinity)
- Temperature
- Pressure (depth)
- Optical Back Scatter (OBS)/Turbidity
- Fluorometry
- Secchi Depth

All above measurements, except for the secchi disk profile for determining extinction coefficients, will be obtained using a self-contained SeaBird 19 CTD with sensors. Sensors include Seabird temperature (S/N 3036), pressure (SBE S/N 1925532-3036), conductivity (S/N 3036), and SBE 23y (Yellow Springs Instruments type) dissolved oxygen sensors; a D&A Instrument's OBS-3 Optical Backscatter Sensor, and Turner Design SCUFA Fluorometer. The sampler will be programmed to sample every 0.5 seconds and can be averaged at other intervals in the post-processing software. The instrument will be allowed two to three minutes of warm-up while at the surface and will be lowered at a rate of one meter per second or less during the down-cast ande up-cast. Near bottom conditions will be measured at 0.5 m off of the bottom.

Water Quality Indicators

At stations sampled from the large 100-m vessel, a Seabird SBE 32 Carousel Water Sampler with an autofire module will be used for collecting discrete water samples and pre-determined depths; surface, mid-depth, and bottom. Individual ten-liter Niskin bottles will be mounted on the carousel and will collect the water grabs. Additional Niskin bottles are rigged for wire-casts with a messenger for sites that are sampled from the smaller, 22-foot nearshore vessel. These bottles will also provide back-up sampling from the larger vessel in the event of the AFM not firing the bottles at correct depths.

After water is collected by the Niskin bottles on either the large or small vessel, water samples will be collected into appropriate sample containers (each pre-rinsed each time with the sample water) for the following analyses as follows:

Chlorophyll a*:*

Chlrophyll *a* samples will be filtered no more than four hours after collection to minimize possible cell lysis. If not immediately filtered, they can be held up to four hours at 4^{o}C. A filter rack designed for 25 mm filters will be used to filter the samples. Vaccum pressure will not be allowed to exceed 12 psi. The volume of water filtered will be recorded on each data sheet and on the label for the filter container. Depending on suspended sediment load, up to 200 ml of sample water will be filtered for each chlorophyll *a* sample. The filter will be removed carefully using forceps, folded with the pigment side on the inside of the fold, and then placed into a prelabeled, disposable screw-top polypropylene tube. The tube will be wrapped in aluminum foil and labeled with the station and sample name. The syringes will be rinsed in distilled water and stored in a clean environment between sampling stations.

Dissolved Nutrients

Up to 50-ml (no less than 40-ml) of sample filtered through a GF/F filter will be collected into a prelabeled, clean 60-ml Nalgene screw-capped bottle. The sample will be stored in a –20°C freezer. Although recommended in the NCA QAPP 2001-2004, the salinity (=/- 2 °/oo) of each sample will not be recorded on the outside of each water sample bottle. The contracting analytical laboratory does not want that information permanently marked on their nutrient bottles as they are continuously reused; they also requested no additional labels be affixed to the bottles as they can cause problems in the automated nutrient analyzer. Instead, we will provide a spreadsheet of sample salinities corresponding to the sample numbers provided by the University of Washington's analysis laboratory.

Total Suspended Solids

Up to one liter of seawater will be collected for TSS at each water sampling depth. These samples can be held up to 7 days at 4°C before they must be processed (filtered and frozen). This SOP recognizes changes made to the NCA 2002 field protocols in March 2002 that recommends processing the samples in the field instead of shipping large volumes of water to the contract laboratory. For each sample, a pre-weighed, numbered 25-mm GF/F filter will be placed on a filter assembly and vacuum will be applied. A sufficient amount of the sample will be filtered (measured in a graduated cylinder) until the filter is almost clogged. A good rule of thumb is at 50 mg/L TSS, approximately 1000 ml is appropriate. So, in the very high TSS loads in areas like upper Cook Inlet (up to 2000mg/L), a significantly smaller volume will be filtered. After filtration, the filter will be removed with forceps and stored in the original container (flat petri-type dish) that the pre-weighed filter was removed from. These containers are pre-numbered and correlate to the known weights of each filter, so extra care will be taken to absolutely ensure that each filter is placed in its appropriate container. The filter apparatus will be rinsed with distilled water between samples.

pH

An Orion Model 250A pH meter will be used to measure pH at the surface, mid-depth, and bottom using the discrete water samples. A water sample will be collected into a polypropylene jar. The pH will be determined using a pH meter within two hours of sampling. The sample will be held at 4°C until the measurements are made. Before each set of measurements, the instrument will be manually calibrated with at least two buffer solutions.

Sediment Collections

Sediments are collected for numerous analyses; benthic species composition and abundance, sediment toxicity, sediment organic and inorganic chemical analyses, grain size analyses, and total organic carbon.

Van Veen 0.1 m^2 grabs will be used to collect sediments. On the larger 100 ft research vessel, a double Van Veen grab (two o.1 m^2 grabs) will be used. For shallower, nearshore stations, a single Van Veen grab will be used. All metal parts of the Van Veen grab are fabricated from stainless steel components. The grabs will be throgouhly washed with Alconox prior to use at each station, then rinsed with ambient seawater .

Benthic Infaunal Community

The Alaska QAPP adopts the standards of the NCA QAPP 2001-2004 by reference. The first grab will be used for benthic invertebrate analyses. This will be from one side of the first double Van Veen grab or the first grab when the single Van Veen is deployed. The sediment from a successful grab will be immediately transferred into a stacked series of 1.0 and 0.5 mm sieves and processed using a seawater hose. Organisms retained on each screen will be gently transferred to separate labeled, wide-mouth, Nalgene containers and preserved with buffered formalin (10 % final concetration). Within one week, the samples will be re-sieved and re-fixed and rose bengal added. The NCA QAPP 2001-2004 lists the final solution as 70% ethanol. The Alaska program will be transferring their formalized samples to 70% isopropyl alcohol due to the laboratory protocols of the contracting sorting and taxonomy laboratory. EMAP does not require samples to be weighed for biomass estimates. However, the Alaska program may incorporate weights into their database and would thus like to ensure that as much consistency remain to allow comparisons with other Alaska data. The differences between isopropyl and ethyl alcohol will not affect the ability to sort, identify, or count the benthic invertebrates and will, therefore, not have an effect on the QA/QC. All samples will be retained onboard the vessel until the end of the field program when they will be transferred to the contracting laboratory

Composited Surficial Sediment

The Alaska QAPP adopts the standards of the NCA QAPP 2001-2004 by reference. At each site, multiple sediment grabs will be taken with the Van Veen grabs. Surface water will be siphoned off and an assessment of the sediment quality will be made to ensure fine sediments are included. The sediments will be composited into a stainless steel container with a teflon cover. Additional cover between grabs will be provided by aluminum foil. These composited sediments will be mixed well and collected using a stainless steel scoop. The total number of grabs required will depend on how successful each grab is, as only the two 2-3 cm of surficial sediments will be used. But, at least three grabs (three x 0.1 m^2) are recommended. Between grabs, the container of composited sediment will be kept cold in a 4^oC cooler and covered with a clean stainless steel lid.

Organic chemical contaminants

The Alaska QAPP adopts the standards of the NCA QAPP 2001-2004 by reference. Approximately 350 ml of composited sediment will be placed in a clean, prelabeled, glass wide-mouth, 500 ml I-Chem jar to fill the jar no more than 75% to capacity. The

samples will be sealed closed with electrical tape and immediately frozen at –20°C. Samples will be shipped to the analytical laboratory approximately every two weeks.

Inorganic chemical contaminants

The Alaska QAPP adopts the standards of the NCA QAPP 2001-2004 by reference. Approximately X ml of composited sediment will be placed in a clean, prelabeled glass wide-mouth I-Chem jar, filled no more than 75% capacity. The samples will be sealed closed with electrical tape and immediately frozen at –20°C. Samples will be shipped to the analytical laboratory approximately every two weeks.

Toxicity testing

The Alaska QAPP adopts the standards of the NCA QAPP 2001-2004 by reference. Approximately 3 liters of sediment will be collected into pre-labeled, pre-cleaned HDPE I-chem jars into three separate 1 liter jars (these will be recomposited at the analytical laboratory. The samples will be sealed with electrical tape and stored at 4°C until shipped to the laboratory approximately every two weeks.

TOC

The Alaska QAPP adopts the standards of the NCA QAPP 2001-2004 by reference. Sediment will be collected into a X ml jar. The samples will be sealed with electrical tape and stored at –20°C until shipped to the laboratory approximately every two weeks.

Grain size determination

The Alaska QAPP adopts the standards of the NCA QAPP 2001-2004 by reference. Sediment will be collected into a X ml jar. The samples will be sealed with electrical tape and stored at 4°C until shipped to the laboratory approximately every two weeks.

Habitat

The Alaska QAPP adopts the standards of the NCA QAPP 2001-2004 by reference.

Fish and Epibenthic Invertebrate Collection

After all water quality and sediment samples are collected, trawl operations will commence to collect fish for species composition, relative abundance, fish tissue chemistry analyses, and pathological conditions.

Fish trawls will be conducted at each site where it is feasible to deploy one of the three trawl nets that will be available for the wide range of sampling conditions. Depending on conditions such as bottom type, shoreline geomorphology, and bathymetry, trawling may be conducted from either a 100 foot trawl vessel or a smaller 22 foot skiff. Thus, the nets that can be deployed from these vessels will differ: the larger vessel would too easily

shred the small nets on the bottom and the smaller skiff will not have the horsepower necessary to fish the larger gear.

To conduct sampling across the range of site conditions that we anticipate, we will rely on three different benthic trawls:

- Small otter trawls (tri-nets or "baby" trawls) with 14-foot headrope, ½" stretch mesh, and ¼" cod-end.
- Mid-size modified-SQWRRP research trawl with a 34-foot headrope, 1.5" body mesh, and 1.25" cod-end.
- Eastern 400 Research Trawl (fabricated for this project by NET systems, Inc.) with rubber disk footrope and high lift doors. It has a 70 foot headrope, 4" body mesh, and 3.5" cod end.

In open water, trawls will be conducted in a straight line with the site location centered along the trawl track, roughly parallel to bathymetry lines. However, winds and currents may necessitate trawling into a current or wind. Trawls will be conducted for ten minutes at 2-3 knots. There may be instances where a full 10 minute tow is not possible. The tow time will then be reduced to a length that will ensure sample collection and this change will be fully explained and documented on field sheets and in the database. Trawl data will be normalized to account for the differing "sweeps" of the different trawls. The data will be reported as organisms caught per unit area trawled.

Community Structure

Fish from each trawl will be sorted and identified to genus and species, or to the lowest taxonomic group possible. Vouchers will be collected for unknown species. Up to thirty individual per species will be measured by using a fish measuring board to the nearest centimeter (standard fish measuring techniques using fork length when tail forked and over length from snout to the tip of the caudal fin when the tail is not forked). Lengths and counts by species will be recorded. All fish not retained for histopathology or chemistry will be returned to the estuary. Invertebrates will be identified and counted.

Contaminant Analyses

The Alaska 2002 EMAP project team expects to find different community compositions across the study area. However, there are species that we expect to be common at many sites and are known to be relatively prolific across much of the northern Gulf of Alaska. Based on information obtained from various benthic fish surveys conducted throughout the Gulf of Alaska by National Marine Fisheries Service and the Alaska Department of Fish and Game, a list of potential target species has been identified, but may change as sampling occurs. This list of species includes arrowtooth flounder (*Atheresthes stomias*), flathead sole (*Hippoglossoides elassodon*), yellowfin sole (*Limanda aspera*), because of their geographic range across the study area and the fact that they live on or within the sediments much of the time. Other benthic finfish commonly found in our study area and that spend much of their time on or in the sediments include the Pacific halibut

(Hippoglossus stenolepis), Kamchatka flounder (*Atheresthes evermanni*), slender sole (*Lyopsetta exillis*), English *Sole (Parophrys vetulu*s), Dover sole (*Microstomusu pacificus*), rex sole (*Glyptocephalus zachirus*), starry flounder (*Platichthys stellatus*). At very nearshore or shallow stations, we expect to find young-of-the-year of the earlier described species and possibly other species that have significant contact with sediments such as sand lance (*Ammodytes hexapterus*).

There is also the possibility that trawling will not be possible at a site. If, however, we would be able to collect the water quality and sediment samples, we would consider alternate gear, such as hook and line, to obtain fish tissue samples for contaminant analyses.

The fish will first be measured, then rinsed with site water, individually wrapped with heavy-duty aluminum foil, and placed together in a plastic, ziploc bag labeled with the Station ID and species. They will be immediately frozen at -20^{o}C.

Gross Pathology

All fish will be screened in the field for external gross pathologies as they are measured and counted for community structure and abundance evaluation. Each fish will be examined for obvious external conditions, as will the gills. Fish that exhibit pathological conditions will be saved for further laboratory histopathological evaluation using standard procedures listed in the NCA QAPP 2001-2004.

B3 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

Field Data

Field data will be written on water resistant field data forms as the data are collected and information needs to be recorded on deck or in the wheelhouse. Field sheets used for this project are based on those provided by the regional QA and IM personnel and by the Washington Department of Ecology folks. These data sheets will ultimately be transcribed into an electronic format and submitted in the required standardized format for the West Coast National Coastal Assessment EMAP program.

Field Data Forms

Alaska 2002 EMAP field personnel will record most of their raw field data or collection records on hardcopy data sheets.

Site/Sample Identity Codes

Unique site codes were provided by EPA's ORD. The site codes are configured in a series specific to Alaska and to a field program in 2002. Each code includes a two character abbreviation for Alaska (AK), a two code number for the year (02), and

sequential numerical series to differentiate the individual sites (up to 75 for Alaska's 2002 EMAP program). Alaska's site identity codes are AK02-001 through AK02-075.

Sample jars will be labeled prior to arriving at each station and the labels sealed with clear tape to minimize water damage to the labels. The labels have been pre-printed with all pertinent information for analysis type.

Data Transfer

After the field data sheets are transferred into digital files. The Alaska EMAP 2002 cannot wait until returning from the field to do this data entry as it precludes the opportunity to catch mistakes or missing information while the field personnel can still remember and/or reconstruct what took place on site. Thus, we will be entering data onboard the vessel, but will wait to transfer the files until late summer or early fall 2002.

Data files uploaded from the SBE 19 CTD are saved as .hex files and processed into Seabird's SeaSave® software to convert the saved electronic signals to the appropriate values for each sensor. The saved files are backed up to disk daily.

Sample Transfer

All samples collected will be documented through chain-of-custody forms. The Alaska EMAP 2002 field team does not have a land-based support team. They will be going into different ports along the study area approximately every 10-12 days. At port, the crew will live onboard the vessel and prepare samples for shipping, complete chain-of-custody forms, and make hardcopies of all data sheets from the stations. All samples will remain onboard the vessel until ready for shipments to the analytical laboratories. All chemistry samples (sediment and tissue) will be shipped from port by overnight mail or air cargo. The designated laboratories will be notified that the packed coolers will be arriving to ensure that they are expecting the shipment. All other recommendations and requirements of the NCA QAPP 2001-2004 for sample transfer will be followed.

B4 Analytical Methods Requirements

The Alaska EMAP 2002 program has successfully sought the analytical services of several of the laboratories that have already participated in the analyses of west coast EMAP NCA samples. Analytical services for our EMAP samples will be conducted by the following laboratories:

Analysis	**Laboratory**
Sediment chemisty - organics and inorganics	Washington State Dept. of Ecology's Manchester Laboratory – Stuart Magoon
TOC, grain size	Washington State Dept. of Ecology's Manchester
Sediment Toxicity	Northwest Aquatics (through a WDOE Memorandum of Agreement)
Nutrients, Chlorophyll, TSS	University of Washington's Ocean

	Services Laboratory
Benthic Invertebrates	University of Alaska Fairbanks School of Fisheries and Ocean Sciences
CTD Calibration: Calibration reports for each sensor's calibration check prior to the cruise are provided. The instrument will be tested for Temperature, Conductivity, and Pressure on its immediate return to the laboratory. The DO, fluorometer, and optical backscatter will not be re-calibrated at the end of the project.	Dave Orders Associates, Inc. and Seabird Instruments, Inc.

All analytical methods and processes will be conducted by the individual laboratories according to EMAP protocols and the NCA QAPP 2001-2004. Minor variations, additions, or deletions are noted below.

Chemical contaminants: The Alaska EMAP program has discussed with their contracting laboratory the addition of C10-C34 aliphatic hydrocarbons, and pristane and phytane. These analytes were added at the request of the Alaska Program Coordinator, Susan Saupe, as these data provide analytes from which recent "fingerprinting" methods have been developed for determining potential sources of hdyrocarbon contamination. The "background" signatures for several areas in the Gulf of Alaska have been determined, but not with a coastal assessment using random procedures for selecting sites. Standard EPA protocols for these analytes will be used and through discussions with other laboratories that provide these data and with the contract laboratory, an estimated 100-150 ppb MDL has been determined for these analytes.

Sediment Silt-Clay Content Determination: The Alaska EMAP program will have a total of nine sediment grain sizes evaluated by their contracted analytical laboratory. These grain sizes will provide much more detailed information than can be obtained through silt/clay determinations. There are numerous known sediment depositional areas throughout the study area that consist of glacially derived clays that are geographically close to areas that that are highly scoured by tidal currents. Previous studies in some of these areas have shown potential interaction between sediment grain sizes and toxicity test results. Thus, the Alaska program wishes to have the more detailed information.

Macrobenthic Community Assessments: The laboratory that will be conducting the sorting and the taxonomy for all of the samples collected in 2002. This laboratory has not conducted EMAP analyses before, but have used very similar procedures and QA/QC procedures for numerous coastal Alaskan studies. They have reviewed the macrobenthic invertebrate portions of the NCA QAPP 2001-2004 and have shown documentation that indicates they can meet these criteria. However, all QA/QC for these samples will continue to be provided by the Washington Department of Ecology, as has been for other west coast states' EMAP marine projects.

Sediment Toxicity Testing: The contracted laboratory will conduct all test methods as described in "Section 2: Sediment Toxicity Test Method" of the EMAP Laboratory Methods Manual Volume 1 (U.S. EPA, 1995). The marine amphipod, *Ampelisca abdida*, will be used for these tests.

B5 QUALITY CONTROL REQUIREMENTS

The Alaska QAPP adopts the NCA QAPP 2001-2004 by reference unless a deviation is explained below.

FIELD ACTIVITIES

Locating station

The field crew will use GPS to locate the sampling site longitudes and latitudes that were provided by EPA. At most sites, the vessel will not be at anchor, as the depths for many of the Alaska EMAP site locations is great and the potential swing of the vessel may provide a greater range of motion than would holding the station using the engine powered into the current. The Alaska EMAP team recognizes that the target criteria for accuracy in siting each station is 0.02 nm and that we will be granted a buffer zone of up to 0.05 nm from the intended position in the event that there are mitigating circumstances. We will make all efforts to hold station within those guidelines. We will sample in the buffer zone only when it is not feasible to sample within the 0.02 nm goal.

We also anticipate that there will be several instances where we will not be able to navigate by either vessel to within the 0.05 nm buffer zone around a site. Given the long distances between sites and the effort to reach them, we will make every effort to sample a site within a reasonable distance, even if the closes sampleable location falls outside of the 0.05 nm buffer zone. These instances will be thoroughly documented and justified with physical information and the reasons for the limitations. We respect the goals of the national EMAP program and will sample outside the buffer zone only when truly warranted and agreed upon by the State EMAP Coordinator, the other scientific crew, and, when necessary, the skipper of the vessel.

Water column measurements

<u>CTD Water Column Datalogger</u>

A Seabird SBE19 CTD with additional sensors has been leased to conduct the necessary field sampling. This equipment, along with an SEB 32 Carrousel Sampler, and SBE 25 AFM (auto-fire module). The CTD and its sensors was recently calibrated by Seabird Instruments, Inc. (copies of the calibration records have been provided to the Alaska EMAP Coordinator) and was used just prior to this project by the University of Washington's School of Fisheries and Ocean Sciences. Thus, the annual calibrations of the sensors was conducted within the last three months and additional calibration against standards was conducted in May. Daily checks on the dissolved oxygen probe will be

conducted using a Winkler titration kit. Daily salinity and temperature checks are made by a refractometer and a thermometer. The refractometer is calibrated before each set of readings. Differences between the refractometer or thermometer and the CTD will be noted but it will not be assumed that the CTD is deficient as they have shown to be very stable across long time periods and will be checked on return to the leasing company. However, differences that don't make sense (as also viewed by reviewing the CTD data) will provide a signal to the Lead Scientist that the probe needs to be checked and an evaluation made via conversations with Seabird and Dave Orders Associates, Inc. on whether there is a potential problem with the probe. If out of cell-phone range, CTD casts will continue until arrangements can be made to get into port because post-calibration corrections can be made to CTD cast data.

Secchi disk

The secchi depth is determined both as the disk is descending and then again when it is ascending. Typically, more than one person estimates depth and they compare their measurements. No other measure of the extinction coefficient is measured.

Prelabeled Sample Containers

Sample containers are labeled with pre-printed labels as reocmmended in the NCA QAPP 2001-2004. As all sampling arrangements are made onboard the vessel, sample jar labeling and preparations are conducted inside the vessel before bringing the containers on deck.

Water Quality Samples

The water sampling kit onboard the vessel is conducted using the best laboratory practices practicable under the vessel conditions and follow procedures described in the NCA QAPP 2001-2004. All containers that will hold samples are rinsed at least three times. A filter rack is used to filter out both the chlorophyll a and TSS samples. Care is taken to monitor the vacuum pressure while chlorophll a samples are being filtered to reduce the chance of lysing cells. Filters for both TSS and chlorophyll a are immediately placed into their respective containers, labeled, and frozen.

Sediment Collection

The sediment sampling onboard the vessel follow procedure described in the NCA QAPP 2001-2004. All Van Veen grabs are 0.1 square meter and are fabricated of all stainless steel parts. Each grab is evaluated upon retrieval to the deck to ensure that the sample is good. A grab is rejected if it looks like it's been washed, has obstructions in the jaws, did not have good penetration, or looks as if the surface was disturbed.

Fish Collections

The fish collections will follow procedures described in the NCA QAPP 2001-2004 except as described below. Full ten-minute trawls may not be conducted as the trawl used for most Alaska 2002 EMAP sampling stations is a large, commercial-sized, research trawl that can easily catch so many fish that it is unreasonable to bring onboard or to process. The purpose of the trawling is to bring onboard representative communities of benthic organisms and every attempt will be made to do so. The expertise of the vessel crew, captain, and EMAP crew from the National Marine Fisheries Service will be relied upon to determine whether the trawl is correctly fishing the bottom. If the trawl is determined to not be correctly fishing, the trawl will be aborted and another attempt made. Fish will be sorted and counted according to the protocols in the NCA QAPP 2001-2004. Various local and/or academic texts will be used to identify the fish and invertebrates. Fish and invertebrates are counted and the first thirty fish of any species will have their lengths measured.

At least one species of fish that is from the "target list" will be collected (n = 6 fish) for subsequent tissue contaminants. Fish tissue will be wrapped in aluminum foil, individually, and then combined into one ziploc bag with an internal tag and a label on the outside of the bag. The tissues will be frozen at -20^{o}C until sent to the analytical laboratory. Each fish that is counted and measured will be briefly examined for gross external pathologies as described in the NCA QAPP 2001-2004.