

Appendix E

Summary of Phase II Sampling Program for the DMTS Fugitive Dust Risk Assessment

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Introduction

The Phase II field study for the DeLong Mountain Regional Transportation System (DMTS) fugitive dust risk assessment consisted of five major elements that provided additional information to assess possible risk to the environment and human health from the DMTS. These elements were a terrestrial assessment, a freshwater aquatic (i.e., streams and tundra ponds) assessment, a coastal lagoon assessment, a marine assessment, and a supplemental subsistence foods assessment for the human health risk assessment. The Phase II assessment was primarily focused on addressing data gaps by evaluating concentrations of chemicals of potential concern (CoPCs) in biota in each environment: small mammals, ptarmigan, soil and aquatic invertebrates, lagoon fishes, vegetation, salmonberries, and sourdock, as well as in tundra soil and sediment. Vegetation community analyses were also performed. Information on the study design and objectives is provided in Exponent (2004a,b).

The Phase II field study included four sampling events. The first sampling event was conducted in June 2004, during which marine sediment samples were collected at the port site prior to shipping activities. The second sampling event was conducted in June and July 2004, during which selected biota in each environment and tundra soil and sediment were collected. The third sampling event was a supplemental program added in late July/early August 2004 to obtain additional subsistence foods data for salmonberries and sourdock (Exponent 2004c). The fourth sampling event was conducted in September 2004, during which marine sediment samples were collected at the port site during the shipping season. The following subsections describe the sampling and any modifications relative to the field sampling plan (Exponent 2004a). A summary of the data collected during the Phase II field study is presented in Table E-1. Further detail is provided in Table E-2.

All sampling equipment was decontaminated prior to sampling according to the procedures described in the Phase II field sampling and analysis plan (Exponent 2004a). The samples were placed into appropriate chemically cleaned containers and were either held at 4°C or frozen (depending on the holding requirements for each respective sample type) during shipment and at the laboratory prior to analysis. Field duplicates and replicates were collected at a frequency of 1 per 20 samples. The samples were sent to Columbia Analytical Services, Inc. (Kelso, Washington) for chemical analysis and to MEC-Weston, Inc. (Carlsbad, California) for toxicity testing.

June 2004 Sampling Event

Marine Assessment

Surface sediment samples were collected at the port site in June 2004 prior to the seasonal start of shipping activities at the facility, and 1 year after major shiploader and lightering barge improvements were made to further control fugitive concentrate dust. Sediment samples were located at the same stations that were sampled in 2003. The marine assessment evaluated the concentrations of CoPCs in surface sediments at stations in the Chukchi Sea in the vicinity of the shiploader. The station locations were selected primarily on the basis of historical evaluations (RWJ 1997; Exponent 2003a, 2004b) and offshore current patterns (prevailing current is northward) and were designed to allow evaluation of possible gradients of CoPC concentrations in relation to potential sources, as well as potential temporal changes in CoPC concentrations (i.e., by resampling stations from previous studies).

Undisturbed surface sediment was collected from the upper 0–2 cm interval using a modified Ponar grab sampler. Twenty-nine stations were sampled for surface sediment during the June 2004 sampling event (Figure E-1): 26 site stations and 3 reference area stations. The site stations were located on a grid that had been sampled historically in the vicinity of the port site (RWJ 1997; Exponent 2003a,b, 2004a,b). The reference area stations were located upwind and upcurrent of the port facility. Metals and conventional analytes listed in Table E-2 were analyzed at 7 of the 26 site stations and at all of the reference area stations (locations shown on Figure E-1). The subset of seven locations (NMD, NMGZ, NML, NMM, NMN, NMO, and NMAA) included the 4 stations where these chemicals exceeded benchmarks in 2003 (i.e., NMD, NMGZ, NML, and NMM), and also represented a range of concentrations observed historically, at different distances and orientations relative to the shiploader, including locations beneath and downcurrent (north) of the shiploader that were expected to have the highest concentrations, based on data collected previously (RWJ 1997; Exponent 2003d, 2004b). Lead, zinc, and cadmium analyses were conducted at all of the remaining site grid stations (Figure E-1). Extra sediment volume was also collected at these locations for possible toxicity testing.

The following modifications were made to the Phase II sampling strategy for the June 2004 marine assessment described in the field sampling and analysis plan (Exponent 2004a):

- A modified Ponar grab sampler was used to collect the sediment samples rather than the stainless-steel Ekman grab sampler, modified petite-Ponar grab sampler, or a drive rod check valve (DRCV) corer suggested in Exponent (2004a). The modified Ponar grab sampler provides the same quality of sediment sample, but the grab sampler is slightly larger than the petite version and therefore provides more sediment per grab.
- The location of Station NM-REF-1 was adjusted slightly to allow for the movement of beach material that occurred during the 2003–2004 winter

storms. Station NM-REF-1 was placed as close as possible to the beach and the previously sampled station coordinate.

The quality and usability of the data generated from this field event were not affected by these modifications.

June/July 2004 Sampling Event

Terrestrial Assessment

The terrestrial assessment focused on addressing data gaps by evaluating concentrations of CoPCs in terrestrial biota: small mammals, ptarmigan, soil invertebrates, and vegetation, as well as tundra soil. Vegetation community analyses were also conducted to assess the general health and vitality of vegetation, and species richness and diversity. The stations where sampling and community analyses were performed were located along the length of the DMTS road between the port and mine on transects that extended to the downwind (northwest) side of the DMTS road and mine ambient air boundary (Figures E-2 and E-3).

Reference site samples of small mammals, ptarmigan, soil invertebrates, vegetation, and tundra soil were also collected. Reference sample stations were located in the terrestrial reference area shown in Figure E-2. The reference area was selected because it is near the DMTS, but far enough away in the prevailing upwind direction (southeast of the DMTS) that it is expected to be unaffected by fugitive dust. In addition, the geology and topography prevalent at the reference area were similar to the study area.

Small Mammal Collection

Small mammals (different species depending on availability; see Table E-2 for specific species collected at each station) were collected for chemical analysis of tissue. Small mammal species targeted for collection were either the tundra vole (*Microtus oeconomus*) or the brown lemming (*Lemmus trimucronatus*), depending on availability. Small mammals were also collected from one station at the terrestrial reference area to evaluate background risk to terrestrial carnivores.

The small mammal traps were placed in close proximity to the tundra soil stations (see Figures E-4 and E-5). Chemical analyses were conducted on whole body tissue to evaluate potential ecological risks to terrestrial receptors. Each individual small mammal was analyzed as a single, whole body sample.

The following modifications were made to the Phase II sampling strategy for small mammal collection as described in the field sampling and analysis plan (Exponent 2004a):

- Small mammal traps were placed at 14 of the 16 stations specified in the field sampling plan (Exponent 2004a). Traps were placed at an additional two stations in an attempt to supplement the samples obtained on the planned stations. Due to poor habitat conditions, small mammal traps could not be set on transect stations TT6-0020 or on TT7 transect stations (too open; no habitat cover). Small mammals were captured at 7 of the 15 stations. Information on the level of small mammal trapping activities during the June/July 2004 sampling event is presented in Table E-3.

- The sampling plan called for the collection of five individual small mammal samples at each station on each terrestrial transect and five individual small mammal samples from the reference area. However, the number of small mammals collected at each site station varied, and four individual small mammals were collected at the reference area (Table E-2).
- Northern red backed voles (*Clethrionomys rutilus*) and masked shrews (*Sorex cinereus*) were added in the field to the small mammal target species list. Northern red backed voles were collected at four site stations and masked shrews were collected at four site stations (see Table E-2 for specific stations where northern red backed voles and masked shrews were collected). Both species were collected at the terrestrial reference area.
- Oats were used in the Sherman live traps instead of an oat/peanut butter mixture to prevent unwanted disruption of the traps by larger mammals that may be attracted to the peanut butter smell.
- Snap traps were not found effective as compared with the live traps, and were not used after June 17, 2004.
- Sherman live traps were placed in the sampling grid at 10-ft intervals instead of the 20-ft intervals specified in Exponent (2004a).

Because the substituted methods are similar to the methods specified in the field sampling plan (Exponent 2004a), the quality and usability of the data generated from this field event were not affected by any of the modifications.

Ptarmigan Collection

Ptarmigan were collected using steel shot. Five ptarmigan were collected near the DMTS road and three ptarmigan were collected in the terrestrial reference area. Ptarmigan were collected for chemical analysis of tissue. Each ptarmigan sample consisted of one individual adult bird. Breast muscle tissue (including the skin), liver, and kidneys from each bird were analyzed separately.

The following modifications were made to the Phase II sampling strategy for ptarmigan collection as described in the field sampling and analysis plan (Exponent 2004a):

- The samples were collected by a member of the field team, rather than being collected by local hunters. Local hunters do not specifically seek out ptarmigan, but rather will sometimes shoot them when they happen to find them. A similar approach was used by the field team member, shooting them when they were found in the areas where collection was planned and permitted.
- Ptarmigan collection was very difficult, as their numbers were apparently very low compared to other years. Many days of effort were applied to

collect ptarmigan. Anecdotal evidence from a Teck Cominco employee who lives in one of the villages indicated that it was a hard winter for ptarmigan. He stated that high winds formed a wind crust on the snow that prevented the ptarmigan from finding shelter beneath the snow, resulting in a large winter die-off. This information was seemingly corroborated by some field observations of dead ptarmigan. It was anticipated that five ptarmigan would be collected in the terrestrial reference area. However, only three ptarmigan were collected in the reference area.

- Due to the limited number of ptarmigan available in the originally specified terrestrial reference area, the hunting area for ptarmigan collection was increased to include the valleys to the southwest of the originally specified terrestrial reference area (see Figure E-2), but still but far enough away in the prevailing upwind direction (south of the DMTS) that it was expected to be unaffected by fugitive dust. In addition, the geology and topography prevalent at the extended reference area were similar to the study area and the original terrestrial reference area.

Because the requirements for an appropriate reference area are similar to those specified in the field sampling plan (Exponent 2004a), the quality and usability of the data generated from this field event were not affected by this change.

Soil Invertebrate Collection

Soil invertebrates (different species depending on availability; see Table E-2 for species collected at each station) were collected for chemical analysis of tissue. Soil invertebrates were also collected from one station at the terrestrial reference area to evaluate background risk to terrestrial avian and mammalian insectivores.

The soil invertebrates were collected at seven tundra soil stations near the port facility and DMTS road (four on transect TT5 and three on transect TT2). Soil invertebrates were also collected from one station at the terrestrial reference area. The soil invertebrates were collected in close proximity to the tundra soil stations (see Figures E-4 and E-5). Chemical analyses were conducted on whole body tissue. All soil invertebrates collected at a given station were combined into a single tissue sample and weighed (wet weight). Soil invertebrates in the samples were identified to the lowest possible taxonomic level in the field and the weights of each taxonomic group within the sample were measured.

The following modifications were made to the Phase II sampling strategy for soil invertebrate collection as described in the field sampling and analysis plan (Exponent 2004a):

- Soil invertebrates were collected at six additional stations (three stations on transect T3 and three stations on transect TT6; see Table E-2).
- Thirty-six pitfall traps were placed at each station instead of the originally specified 15 traps per station. Due to the narrow distance between tundra tussocks, pan traps were not used to collect the soil invertebrates.

- Surfactant (soapy water) was placed in the bottom of each pitfall trap instead of using a moist paper towel.
- A barrier was not used to "herd" the invertebrates into the pitfall traps.
- Due to limited observations of predation from avian predators, the pitfall traps were not covered.
- The pitfall traps were checked daily (in most cases) instead of being left in place for 2 days before removal of any soil invertebrates that had been captured.
- In a few cases, to reach the desired sample weight for analysis of the CoPCs, the pitfall traps were left in place at a given station for longer than the 4 days stipulated in the field sampling plan (Exponent 2004a).

The addition of stations from those proposed in the study design will increase the quality and usability of the data. Because the substituted methods are similar to the methods specified in the field sampling plan (Exponent 2004a), the quality and usability of the data generated from this field event were not affected by any of the modifications.

Vegetation Tissue Collection

Vegetation samples were collected to provide tissue data for use in food web models to evaluate risks to terrestrial avian and mammalian herbivores. Vegetation samples for chemical analysis were collected at 20 stations near the DMTS road or mine and also at three stations at the terrestrial reference area. A summary of vegetation tissue samples is included in Table E-2. The vegetation samples were collected in close proximity to the tundra soil stations (see Figures E-4 and E-5). Young willow leaves and new growth shoots, whole lichens, and sedge plants (blades only; no root material) were sampled to represent the aboveground plant material that herbivores would eat while grazing or browsing in the tundra.

The following modifications were made to the Phase II sampling strategy for vegetation collection as described in the field sampling and analysis plan (Exponent 2004a):

- Both willow and birch leaves were collected as “bridge data” at the 100 m station on transect TT3 and at the 1,000 m station on transect TT5.
- Despite walking the grid pattern specified in the field sampling and analysis plan (Exponent 2004a), field staff located no willow trees at the 1,000 m station on transect TT3 or at the 2,000 m station on transect TT5. Therefore, no willow leaves were collected at either of these stations. Birch leaves were collected at both stations instead (alternate species as stipulated in Exponent [2004a]).
- Reindeer lichen (*Cladina spp.*), a preferred food item for caribou (*Rangifer tarandus*), was added to the terrestrial vegetation sampling scope.

- Cottongrass (*Eriophorum vaginatum*) was found to be very common in tussock tundra habitats. Therefore, cottongrass rather than *Carex* sedge was collected as the representative herbaceous plant at most terrestrial stations. *Carex spp.* was collected at stations located at higher elevations near the mine, where cottongrass was less abundant or absent. Bridge data for *Eriophorum* and *Carex* sedges were collected at the 100 m station on transect TT6 and at station TS-REF-5.
- Sedge seeds were not collected opportunistically at terrestrial stations as stated in the field sampling and analysis plan (Exponent 2004a), but were sampled opportunistically at freshwater aquatic and coastal lagoon stations (described below), where avian receptors such as the green-winged teal and the brant might feed.
- Willow and birch leaf samples were collected from at least three shrubs at each station rather than exactly three shrubs, as specified in the field sampling and analysis plan (Exponent 2004a). In some instances, it was necessary to collect leaves from more than three plants in order to accumulate enough tissue mass for analysis without completely defoliating the shrubs.
- Cottongrass blades were collected from multiple tussocks to obtain a sedge sample representative of the station, not necessarily from plants at 15-cm intervals, as specified in the field sampling and analysis plan (Exponent 2004a).
- Terrestrial station locations were documented with GPS, and vegetation sampling locations within each station were described in the field notebook. Sampling locations were typically described in relation to the small mammal grid or the vegetation plot line (Figures E-4 and E-5).
- In general, lichens were not abundant near the DMTS road. Consequently, lichen samples could not be collected at some stations located 10 m from the road, including stations TT2-0010, TT5-0010, and TT8-0010. Instead, lichens were identified farther away from the road, and samples of these were collected at approximately 40-45 m along transect TT2, 60-70 m along transect TT5, and 35 m along transect TT8.

Because the substituted methods are similar to the methods specified in the field sampling plan (Exponent 2004a), the quality and usability of the data generated from this field event were not affected by any of the modifications. The collection of bridge data between species at several stations improved the quality and usability of the data.

Vegetation Community Analysis

The general health and vitality of vegetation and species richness and diversity was assessed at 32 stations on 4 terrestrial transects, at 2 site and 2 reference coastal lagoon stations, and at 4 terrestrial reference stations (3 in the terrestrial reference area, and 1 on the coastal plain). On

one of the transects (Transect TT8), the community structure of vegetation was assessed at 17 additional microplots at incremental distances from the DMTS road to better document any possible gradient in plant community structure versus distance from the road. A listing of stations where vegetation community analysis plots were placed is included in Table E-2. The station locations are shown on Figures E-2 and E-3.

The general health and vitality of vegetation was assessed qualitatively through field observations and photographs. Field team members documented the overall appearance of plants, estimated the amount of foliage cover on shrubs, noted whether species were flowering or senescing, and recorded any signs of disease, infestation, or herbivory. Plant richness, dominance, and distribution were assessed quantitatively by identifying each plant species (to the lowest possible taxon), estimating its canopy coverage, and calculating the frequency with which each species occurred within the vegetation microplots.

The following modifications were made to the Phase II sampling strategy for vegetation community analysis as described in the field sampling and analysis plan (Exponent 2004a):

- At each station, 10 microplots were spaced every 30 ft along a 300-ft line oriented parallel to the road, rather than placed within a 10-m square as originally stipulated in Exponent (2004a). The microplots were placed along the north side of the line at the stations on road transects. Also, when a shrub habitat was present at a station, the point-intercept method was used along the 300-ft line to assess the shrub stratum for comparison with the results from the microplots. These modifications to the field sampling plan were made for the following reasons: 1) for the stations in close proximity to the road, the microplots along a line were all more or less equidistant from the road, whereas in a square layout, they would not have been equidistant from the road; 2) the line-intercept method was conducted along the 300-ft line, which was equidistant from the road, whereas the original plan had four shorter transects from the corners of the 10-m-square plot, which would not have been equidistant from the road; and 3) placing the microplots along a 300-ft line was expected to provide more complete coverage of the range of vegetation types and conditions present at a station, in comparison to a 10-m-square orientation of microplots.
- Because topography was more consistent with distance from the road at transect TT8, discretionary stations to assess plant community structure versus distance from the DMTS road were added at transect TT8 rather than at transect TT3, as originally planned. This change was made because the topography was more consistent over the length of transect TT8 than it was at TT3. At TT8, plant community analysis was conducted at the 10 m, 100 m, and 1,000 m stations by the method described above, with 10 microplots along a 300-ft line at each station. Sixteen additional single microplots were added between these stations (perpendicular to the road) to provide regular coverage from the road to 1,000 m. The additional microplots were located at distances of 50, 150, 200, 250, 300, 350, 400, 450, 500, 550, 600, 650,

700, 750, 800, and 900 m from the road, to supplement the 10, 100, and 1,000 m stations.

- A reference location (TS-REF-12) was added in the coastal plain to match conditions observed at the onsite transect TT5 and to supplement the three reference stations in the terrestrial reference area (Figure E-2).
- The location of reference station TS-REF-11 was slightly modified to better match the vegetation community found at the site stations.
- GPS coordinates were taken from the center point and at the ends of the vegetation plot line.

The modifications are expected to improve the quality and usability of the data generated from the plant community analyses.

Tundra Soil Collection

Tundra soil was collected from 43 stations for chemical analysis. Tundra soil, as defined and sampled historically, is the decayed or decaying peaty organic material just beneath the live tundra mat. Tundra soil samples (0–2 cm from beneath the live tundra mat, which is approximately 5 to 15 cm [2–6 in.] thick depending on location) was collected from five transects that extended to the north/west of the DMTS road and from one transect that extended to the north/west of the mine's ambient air/solid waste permit boundary. Five of the transects were located on the prevailing downwind side of the DMTS road and the sixth transect was located downwind of the mine's permit boundary. All of the transects were oriented in the general downwind direction, and generally perpendicular to the road or solid waste permit boundary at each respective location. The exact station placement was determined in the field based on the location of target plant species collected in the immediate area of the transect. On one transect (TT8), tundra soil was collected at an additional 17 locations in conjunction with vegetation community analysis (i.e., at each additional vegetation community microplot). A listing of stations where tundra soil samples were collected is included in Table E-2. The station locations are shown on Figures E-2 and E-3.

The following modifications were made to the Phase II sampling strategy for tundra soil collection as described in the field sampling and analysis plan (Exponent 2004a):

- It was anticipated that plant community structure versus distance from the DMTS road would be determined on transect TT3. However, based on field observations and the location of the transects between the port facility and the mine, it was decided that transect TT8 was a better choice for this analysis. Therefore, an additional 17 tundra soil samples were collected in conjunction with the vegetation microplots on transect TT8.
- As mentioned above, it was anticipated that the community structure of vegetation would be documented at three stations in the terrestrial reference area. However, this number was increased to four reference area stations

(Station TS-REF-12 was added to the vegetation community analysis) to better match vegetation conditions found at the site stations. An additional tundra soil sample was collected at Station TS-REF-12.

- The location of reference station TS-REF-11 was slightly modified to better match the vegetation community found at the site stations on transect TT6. The tundra soil sample was taken in proximity to the modified vegetation station location.

Because the substituted methods are similar to the methods specified in the field sampling plan (Exponent 2004a), the quality and usability of the data generated from this field event were not affected by any of the modifications. In addition, the relocation of stations from those proposed in the study design will benefit the quality and usability of the data.

Freshwater Aquatic Assessment

The structure of the aquatic invertebrate community in freshwater streams along the DMTS between the port and the mine and the CoPC concentrations in willows and sedges near these streams were evaluated for the freshwater aquatic assessment. In addition, samples of tundra soil and surface sediment were also collected. Water quality parameters were measured in streams and tundra ponds. A schematic of the typical stream station sampling layout is provided in Figure E-6. The freshwater aquatic assessment also evaluated CoPC concentrations in sedges and tundra soil at the edges of tundra ponds located between the port and the mine.

Streams

Aquatic invertebrates, willow leaves and new growth shoots, sedges, and tundra soil were collected from or near three streams that cross the DMTS (Aufeis Creek, Omikviorok River, and Anxiety Ridge Creek), as shown in Figure E-7. These three streams were selected to represent varying conditions over the length of the road, and to match Phase II sampling stations with stations where sampling has been previously conducted (Exponent 2002a, 2004b; Morris and Ott 2001). Aufeis Creek is nearest to the port, Omikviorok River represents conditions in the middle portion of the road, and Anxiety Ridge Creek represents conditions nearer to the mine. Stations coincided with stations at which Teck Cominco regularly collects water samples (Exponent 2002a) and where surface sediment samples were collected during the Phase I sampling event. A listing of samples collected at stream stations is provided in Table E-2.

Aquatic Invertebrate Tissue Collection

Aquatic invertebrate samples were collected to provide tissue data for use in food web models to evaluate risks to aquatic ecological receptors. The aquatic invertebrates were collected using a kick net and were collected after aquatic invertebrates in the stream had been collected for community analysis. One multi-species composite of aquatic invertebrates was collected from each of the three stations on streams that cross the DMTS (Aufeis Creek, Omikviorok River, and Anxiety Ridge Creek; Figure E-7). In addition, one multi-species composite of aquatic

invertebrates was collected from each of two streams in the freshwater aquatic reference area (ST-REF-3 and ST-REF-6).

The following modifications were made to the Phase II sampling strategy described in the field sampling and analysis plan (Exponent 2004a):

- Based on field observations, it was determined that aquatic invertebrates of sufficient mass to meet sample analysis and detection limit requirements could be collected from the freshwater streams that were specified for aquatic invertebrate community analysis in Exponent (2004a). Therefore, five new aquatic tissue samples were added to the study design.

The collection of aquatic invertebrates for chemical analysis of their tissue at each freshwater stream station enhanced the study design and improved the quality and usability of the data.

Aquatic Invertebrate Community Analysis

To determine the characteristics of aquatic invertebrate communities in the freshwater streams near the DMTS road, five replicate samples of aquatic invertebrates were collected from each of the following six locations: Aufeis Creek, Omikviorok River, Anxiety Ridge Creek, and three reference area streams (Figure E-7).

The following modifications were made to the Phase II sampling strategy for aquatic invertebrate community analysis as described in the field sampling and analysis plan (Exponent 2004a):

- Aquatic invertebrates for community analysis were collected at two additional reference area streams not specified in Exponent (2004a). Therefore, data on two new aquatic invertebrate communities in the reference area were added to the study design.
- Modifications to the specific steps in the freshwater invertebrate collection procedures stipulated in Exponent (2004a) were made in the field:
 1. Rather than washing the collected material from the driftnet into a No. 30 sieve (which has 600 μm mesh), the collection cup (which had 363 μm mesh) attached to the driftnet was used as the sieve.
 2. After the collection time was complete and the stakes pulled from the net, the net was first gently moved around in the streamflow (with the net opening out of the water), so as to dislodge material from the sides of the net and wash it into the cup at the bottom of the net.
 3. The net was then raised out of the water, and a clean scoop was used to collect stream water and run it down the outsides of the net, to move any remaining material within the net down into the cup.

4. The collection cup was then removed from the net and inverted into a sample jar to transfer the bulk of the sample volume. A limited amount of stream water was then used to help rinse and transfer the remaining sample material from the collection cup to the sample jar. The collection cup was checked to ensure all of the sample material had been transferred.
 5. The formalin was then added to the sample jar immediately, prior to departing the sampling station (as stipulated in Exponent 2004a).
- Prior to implementing the above modifications, the very first samples (ST0001A through ST0001E) were transferred from the driftnet collection cup into a double Ziploc bag, excess air was removed, and then the samples were transported to the field lab where they were then sieved using a No. 60 sieve (which has 250 μm mesh), transferred to sample jars, and then preserved with formalin.

The quality and usability of the data generated from this field event were improved by these modifications to the sample collection procedures. In addition, the addition of stations from those proposed in the study design improved the quality and usability of the data.

Vegetation Tissue Collection

Young willow leaves and new growth shoots were collected at three stations near streams crossing the DMTS road and at three reference area stream stations. Sedge plants (rinsed roots [i.e., no sediment] and unwashed blades) were collected at two stations near streams crossing the DMTS road and at three reference area stream stations (Figure E-7).

The following modification was made to the Phase II sampling strategy for aquatic invertebrate community analysis as described in the field sampling and analysis plan (Exponent 2004a):

- Despite walking the grid pattern specified in the field sampling and analysis plan (Exponent 2004a), field staff located no sedge plants near Aufeis Creek. Therefore, no sedge plants were collected at this station.
- Sedge seeds were sampled opportunistically at freshwater aquatic stations where avian receptors such as the green-winged teal and the brant might feed.
- Willow leaves were collected from at least five shrubs per stream station, rather than three shrubs, as specified in the field sampling and analysis plan (Exponent 2004a). The shrubs coincided approximately with the five drift net locations along the sampling reach.
- When possible, sedge plants and sedge seeds were collected from multiple locations along the sampling reach in order to form composite samples representative of the station, rather than at 15-cm intervals as specified in the field sampling and analysis plan (Exponent 2004a).

- Dead tissue was removed from whole sedge samples using gloves or decontaminated stainless steel scissors. Sedge roots were dabbed dry with clean paper towels after the site water rinse to minimize the potential for tissues to rot.

The usability and quality of the data generated from this field event were not affected by these changes.

Tundra Soil Collection

To provide plant and media CoPC data near the stream stations, tundra soil samples (0–2 cm from beneath the live tundra mat, which is approximately 5 to 15 cm [2–6 in.] thick depending on location) were collected adjacent to the immediate area of the streams where willow and sedge samples were collected, at all stream stations (Figure E-7). There were no modifications relative to the field sampling and analysis plan (Exponent 2004a).

Stream Sediment Collection

Sediments were collected from each of the three streams that cross the DMTS (Aufeis Creek, Omikviorok River, and Anxiety Ridge Creek; Figure E-7). In addition, one surface sediment sample was collected from each of two streams in the freshwater aquatic reference area (ST-REF-3 and ST-REF-6). Undisturbed surface sediment was collected from the upper 0–2 cm interval using an Ekman grab sampler.

The following modification was made to the Phase II sampling strategy for surface sediment collection as described in the field sampling and analysis plan (Exponent 2004a):

- Because it was determined that there were aquatic invertebrates of sufficient mass to meet sample analysis and detection limit requirements in the freshwater streams, surface sediment samples (the primary media that the aquatic invertebrates come in contact with) were also collected. Therefore, five new sediment samples were added to the study design, collocated with the benthic invertebrate composite tissue samples.

The collection of surface sediment for chemical analysis from these freshwater streams, when paired with the benthic invertebrate composite tissue samples, enhanced the study design and improved the quality and usability of the data.

Water Quality Parameter Measurements

Water quality parameters (i.e., pH, dissolved oxygen, temperature, conductivity, and salinity) were measured at each stream station. There were no modifications relative to the field sampling and analysis plan (Exponent 2004a).

Tundra Ponds

Sedges and tundra soil from the edges of four tundra ponds at varying distances between the mine and the port site (i.e., near the mine, middle of the road, and toward the port) were sampled during the Phase II field event to evaluate gradients of CoPC concentrations in relation to sources. Two of the four tundra pond stations were located at the tundra ponds that were sampled during the Phase I sampling event (i.e., TP1-0100 and TP1-1000; see Figure E-7). Those two ponds were located within the port facility boundary, and the other two ponds were located on the downwind (north/west) side of the road. In addition, sedges and tundra soil were also collected from two stations at the freshwater aquatic reference area (see Figure E-7). The reference area stations coincided with stations sampled during the Phase II sampling event.

Vegetation Tissue Collection

Sedge samples were collected at the edges of tundra ponds to evaluate risks to freshwater avian and mammalian herbivores. Sedge samples were collected in close proximity to the tundra soil stations. Sedge samples were collected from four tundra ponds near the port facility and along the DMTS road and from three stations near the reference area tundra ponds (Figure E-7). The whole sedge plant (rinsed roots and unwashed blades) was collected to include the above- and below-ground plant material that herbivorous receptors might eat.

The following modifications were made to the Phase II sampling strategy for vegetation tissue near tundra ponds as described in the field sampling and analysis plan (Exponent 2004a):

- After extensive searching, field staff located only two tundra ponds (rather than the planned three) near the middle of the road and toward the mine that were within the desired 100–500 m from the road. Therefore, sedge plants were collected at only four tundra ponds near the DMTS road and port.
- Dead tissue was removed from whole sedge samples using gloves or decontaminated stainless steel scissors. Sedge roots were dabbed dry with clean paper towels after the site water rinse to minimize the potential for tissues to rot.

The usability of the data generated from this field event was not affected by this change.

Tundra Soil Collection

To provide plant and media CoPC data near the tundra pond stations, tundra soil samples (0–2 cm from beneath the live tundra mat, which is approximately 5 to 15 cm [2–6 in.] thick depending on location) were collected adjacent to the immediate area of the streams where willow and sedge samples were collected, at all stream stations.

The following modification was made to the Phase II sampling strategy for tundra soil near a tundra pond as described in the field sampling and analysis plan (Exponent 2004a):

- As mentioned above, only two tundra ponds (rather than the planned three) were found near the middle of the road and toward the mine that were within the desired 100–500 m from the road. Therefore, tundra soil (in conjunction with the vegetation tissue samples) was collected at only four tundra ponds near the DMTS road and port.

The usability of the data generated from this field event was not affected by this change.

Water Quality Parameter Measurements

Water quality parameters (i.e., pH, dissolved oxygen, temperature, conductivity, and salinity) were measured at each tundra pond station.

The following modification was made to the Phase II sampling strategy for tundra soil near a tundra pond as described in the field sampling and analysis plan (Exponent 2004a):

- As mentioned above, only two tundra ponds (rather than the planned three) were found near the middle of the road and toward the mine that were within the desired 100–500 m from the road. Therefore, water quality measurements (in conjunction with the vegetation tissue samples) were collected at only four tundra ponds near the DMTS road.

The usability of the data generated from this field event was not affected by this change.

Coastal Lagoon Assessment

The coastal lagoon assessment evaluated the CoPC concentrations in aquatic invertebrates, fishes, sedges, surface sediments, and tundra soil at stations in or adjacent to the coastal lagoons to the north and west (prevailing downwind) of the port facilities. The station locations (see Figure E-8) were selected to allow evaluation of risk in locations with the highest measured CoPC concentrations in lagoon media, as well as to provide a gradient of concentrations away from port site facilities. The stations have all been sampled historically as part of periodic monitoring conducted at the port site (RWJ 1997; Exponent 2003b) and were sampled in Phase I of the fugitive dust risk assessment sampling program.

Aquatic Invertebrate Tissue Collection

To evaluate risks to avian invertebrates, representative samples of aquatic macroinvertebrates (multiple species and multiple individuals in each sample) were collected for chemical analysis of tissue at each of the three stations in the coastal lagoons near the DMTS port facility and at two stations in reference lagoons southeast of the DMTS port facility. Chemical analyses were conducted on whole body tissue. All aquatic macroinvertebrates collected at a given station were combined into a single tissue sample and weighed (wet weight). Aquatic

macroinvertebrates in the samples were documented to the lowest possible taxonomic level in the field and the weights of each taxonomic group within the sample were measured.

The following modification was made to the Phase II sampling strategy for aquatic invertebrate tissue collection as described in the field sampling and analysis plan (Exponent 2004a):

- Because it was determined that there were aquatic invertebrates of sufficient mass to meet sample analysis and detection limit requirements in an additional reference lagoon, an additional aquatic invertebrate tissue sample was collected. Therefore, one new aquatic invertebrate tissue sample from a coastal lagoon was added to the study design.

The collection of an additional aquatic invertebrate tissue sample for chemical analysis from an additional reference lagoon enhanced the study design and improved the quality and usability of the data.

Aquatic Invertebrate Community

To evaluate community structure, aquatic invertebrate samples were collected at three stations in the coastal lagoons near the DMTS port facility spanning a CoPC gradient in sediment, and at three stations in reference lagoons southeast of the DMTS port facility (Figure E-8). The aquatic invertebrates were collected in close proximity to the sediment stations. Undisturbed surface sediment was collected using an Ekman grab sampler. Five replicate samples were collected at each station for community analysis (i.e., based on taxonomic composition). There were no modifications from the field sampling and analysis plan (Exponent 2004a).

Fish Collection

Fish were to be collected from the coastal lagoons to evaluate risks to coastal avian piscivores. Individual fish were to be collected from two coastal lagoons near the port facility (i.e., Port Lagoon North and North Lagoon) and from one reference lagoon southeast of the DMTS port facility. No fish were collected during the Phase II sampling event.

The following modification was made to the Phase II sampling strategy for fish collection as described in the field sampling and analysis plan (Exponent 2004a):

- After thoroughly seining each of the three coastal lagoons from one end to the other, field staff determined that there were no fish present in the coastal lagoons. In addition, no visual observations of fish were made by the sampling team during collection of other media at the coastal lagoons. No fish were collected from coastal lagoons during the Phase II sampling event.

Vegetation Tissue Collection

Sedge samples were collected at the edges of the coastal lagoons to evaluate risks to avian herbivores. Sedge samples were collected in close proximity to the sediment stations (Figure E-8). Sedge samples were collected from two stations in the coastal lagoons near the DMTS port facility and at two stations in reference lagoons southeast of the DMTS port facility (see Table E-2). The whole sedge plant (blades and roots) was collected to include above- and below-ground material that a brant or other avian herbivore might pull from the sediment and eat.

The following modification was made to the Phase II sampling strategy for vegetation collection as described in the field sampling and analysis plan (Exponent 2004a):

- As a result of the sand dune and coarse gravel environment on the seaward side of all of the coastal lagoons, the habitat was determined to be inhospitable to sedge plants. Sedges were not present at site lagoon station NLF (on the seaward shore). Therefore, sedge plants were only collected at four of the six coastal lagoon stations (see Table E-2). Tufted hairgrass (*Deschampsia sp.*) was collected as a representative herbaceous plants at this station using the same method described for sedge collection in the field sampling and analysis plan (Exponent 2004a). Tufted hairgrass was also collected at reference lagoon station CL-REF-3b for comparison with that collected at site station NLF.
- Sedge seeds were sampled opportunistically at coastal lagoon stations where avian receptors such as the green-winged teal and the brant might feed.
- Samples of two sedge species (*Carex aquatilis* and *Eriophorum angustifolium*) were collected at coastal lagoon stations PLNL and CL-REF-1 rather than one sample per station.
- Sourdock (*Rumex arcticus*) leaf and stem samples were collected at stations PLNL, NLK, and CL-REF-3b. These samples were archived at the analytical laboratory.
- Dead tissue was removed from whole sedge samples using gloves or decontaminated stainless steel scissors. Sedge roots were dabbed dry with clean paper towels after the site water rinse to minimize the potential for tissues to rot.
- Coastal lagoon station locations were documented with GPS. Vegetation sampling locations within each station (e.g., relative to the vegetation community assessment transect) were described in the field notes.

Because the substituted methods are similar to the methods specified in the field sampling plan (Exponent 2004a), the quality and usability of the data generated from this field event were not affected by any of the modifications.

Vegetation Community Analysis

The community structure of the vegetation fringing the lagoons was evaluated near two site lagoon stations and near two reference area lagoon stations. The exact location of these community surveys was determined in the field based on slope and distance from the lagoons (which vary in size seasonally), and vegetation present at a given station.

The following modification was made to the Phase II sampling strategy for vegetation community analysis as described in the field sampling and analysis plan (Exponent 2004a):

- Due to the sand dune and coarse gravel environment on the seaward side of all of the coastal lagoons, the habitat was determined to be inhospitable to tundra plants. Therefore, community analysis data was only collected at four of the six coastal lagoon stations (see Table E-2).
- At each station, the microplots were originally planned to be placed within a 10-m square as described in Exponent (2004a). Instead, at the lagoon stations, the 10 microplots were placed along a 300-ft vegetation plot line (as for the community analyses in the terrestrial environment, described above). The lagoon vegetation survey line was generally oriented north-south (parallel with the lagoon shoreline), and the microplots were placed along the west side of the line.

The modifications are expected to improve the quality and usability of the data generated from the plant community analyses.

Tundra Soil Collection

Tundra soil samples (0–2 cm from beneath the live tundra mat, which is approximately 5 to 15 cm [2–6 in.] thick depending on location) were collected at the three site and three reference lagoon stations. There were no modifications from the field sampling and analysis plan (Exponent 2004a).

Lagoon Sediment Collection

A sample of the 0–2 cm sediment interval was collected from three stations in the coastal lagoons near the DMTS port facility and from three stations in reference area lagoons southeast of the DMTS port facility (Figure E-8). Stations corresponded with locations where samples were collected for aquatic invertebrate community analysis.

Field sampling observations indicated that benthic macroinvertebrates may be scarce or absent in the coastal lagoons, so additional surface sediment (0–2 cm) was collected for toxicity testing at three stations in the coastal lagoons near the DMTS port facility and at three stations at the reference lagoons southeast of the DMTS port facility (Figure E-7). Sediment samples collected for toxicity testing were collected from the same sediment sample volume from which sediment was collected for chemical analysis.

The following modification was made to the Phase II sampling strategy for sediment analysis as described in the field sampling and analysis plan (Exponent 2004a):

- Interstitial water quality tests prior to test initiation determined that the amphipod *Hyalella azteca* was a more appropriate test species than the estuarine amphipod *Leptocheirus plumulosus*. Therefore, the toxicity tests were performed using *H. azteca*.

Because the substituted species is similar to the test species specified in the field sampling plan (Exponent 2004a), the quality and usability of the data generated from this field event were not affected by any of the substitutions, but rather enhanced by switching to a more appropriate test species for the conditions encountered in the field.

Water Quality Parameter Measurements

Water quality parameters (i.e., pH, dissolved oxygen, temperature, conductivity, and salinity) were measured at each lagoon station. There were no modifications from the field sampling and analysis plan (Exponent 2004a).

July/August 2004 Sampling Event

Additional subsistence food sampling for the DMTS fugitive dust risk assessment was conducted during July and August 2004. This supplemental sampling program had two purposes: 1) to assess current conditions 3 years after the 2001 sampling event and following the implementation of various fugitive dust controls, and 2) to obtain data for additional analytes in subsistence foods to meet a data need for the human health risk assessment. A supplemental field sampling and analysis plan was prepared for this subsistence food sampling (Exponent 2004c). Salmonberries and sourdock were collected and analyzed for CoPCs.

Salmonberry and Sourdock Tissue Collection

Salmonberry and sourdock samples were collected to provide tissue data for use in the human health risk assessment. Five samples of washed and unwashed salmonberries and five samples of washed and unwashed sourdock were collected in each of the three sampling areas (see Figure E-2); each of these sampling areas represent food collection sites. The location of sampling sites B and C were chosen in the field by members of the Subsistence Committee and the Tribal Council.

The following modifications were made to the Phase II sampling strategy for salmonberry and sourdock collection as described in the draft supplemental field sampling and analysis plan (Exponent 2004c):

- Due to a request from the members of the Subsistence Committee and the Tribal Council that were assisting with the sample collection, the salmonberry and sourdock samples were not collected in the order specified in Exponent (2004c).
- Sourdock at Site B was collected along the edge of a pond approximately 3 miles south of Kivalina (Station KIVSS) and the berries were collected further to the south along the a small berm or old beach berm that extended from the coast inland approximately a mile and half (Station KIVSB). The berm provided higher ground, which was more suitable habitat for the berries, but which did not have the lower wetter conditions that the sourdock seems to prefer.
- Sourdock at Site C was collected to the southwest of the mouth of New Heart Creek (Station IPLS) and salmonberries were collected to the northeast of the mouth of New Heart Creek (Station IPLB) (i.e., the sourdock was collected seaward and the salmonberries were located from the mouth of New Heart Creek toward Ipiavik Lagoon).

Because the modified sampling locations are close to the sampling locations specified in the field sampling plan (Exponent 2004a), the quality and usability of the data generated from this field event were not affected by the changes.

September 2004 Sampling Event

Marine Assessment

Surface sediment samples were collected at the port site in September 2004 during shipping activities at the facility, and more than 1 year after major shiploader and lightering barge improvements were made to further control fugitive concentrate dust. Sediment samples were located at the same stations that were sampled in 2003 and in June 2004. The marine assessment evaluated the concentrations of CoPCs in surface sediments at stations in the Chukchi Sea in the vicinity of the shiploader. The station locations were selected primarily on the basis of historical evaluations (RWJ 1997; Exponent 2003b, 2004b) and offshore current patterns (prevailing current is northward) and were designed to allow evaluation of possible gradients of CoPC concentrations in relation to potential sources, as well as potential temporal changes in CoPC concentrations (i.e., by resampling stations from previous studies).

Undisturbed surface sediment was collected from the upper 0–2 cm interval using a modified Ponar grab sampler. Twenty-nine stations were sampled for surface sediment during the September 2004 sampling event (Figure E-1): 26 site stations and 3 reference area stations. The site stations were located on a grid that had been sampled historically in the vicinity of the port site (RWJ 1997; Exponent 2003a,b, 2004a,b). The reference area stations were located upwind and upcurrent of the port facility. Metals and conventional analytes listed in Table E-2 were analyzed at 7 of the 26 site stations and at all of the reference area stations (locations shown on Figure E-1). The subset of seven locations (NMD, NMGZ, NML, NMM, NMN, NMO, and NMAA) includes the four stations where these chemicals exceeded benchmarks in 2003 (i.e., NMD, NMGZ, NML, and NMM), and also represents a range of concentrations observed historically, at different distances and orientations relative to the shiploader, including locations beneath and downcurrent (north) of the shiploader that were expected to have the highest concentrations, based on data collected previously (RWJ 1997; Exponent 2003b, 2004b). Lead, zinc, and cadmium analyses were conducted at all of the remaining site grid stations (Figure E-1). Extra sediment volume was also collected at these locations for possible toxicity testing.

The following modifications were made to the Phase II sampling strategy for the June 2004 marine assessment described in the field sampling and analysis plan (Exponent 2004a):

- A modified Ponar grab sampler was used to collect the sediment samples rather than the stainless-steel Ekman grab sampler, modified petite-Ponar grab sampler, or a DRCV corer suggested in Exponent (2004a). The modified Ponar grab sampler provides the same quality of sediment sample, but the grab sampler is slightly larger than the petite version and therefore provides more sediment per grab.
- The location of Station NM-REF-1 was adjusted slightly to match the station coordinate sampled during the 2003 and June 2004 sampling events. Station

NM-REF-1 was placed as close as possible to the beach and the previously sampled station coordinate.

The quality and usability of the data generated from this field event were not affected by these modifications.

References

- Exponent. 2003a. Port site characterization data report. Prepared for Teck Cominco Alaska Inc., Anchorage, AK. Exponent, Bellevue, WA.
- Exponent. 2003b. Current and historical metals concentrations in marine sediment samples from the DMTS port site. Memorandum to Teck Cominco, April 2, 2003. Exponent, Bellevue, WA.
- Exponent. 2004a. Phase II field sampling and analysis plan for the DMTS fugitive dust risk assessment. Prepared for Teck Cominco Alaska Inc., Anchorage, AK. Exponent, Bellevue, WA.
- Exponent. 2004b. Draft DMTS fugitive dust risk assessment work plan. Prepared for Teck Cominco Alaska Inc., Anchorage, AK. Exponent, Bellevue, WA.
- Exponent. 2004c. Draft field sampling and analysis plan for supplemental salmonberry and vegetation assessment. Prepared for Teck Cominco Alaska Inc., Anchorage, AK. Exponent, Bellevue, WA.
- Morris, W.A., and A.G. Ott. 2001. Metals concentrations in juvenile Dolly Varden (*Salvelinus malma*) sampled at two streams along the DeLong Mountain Regional Transportation System, Red Dog Mine. Alaska Department of Fish and Game.
- RWJ. 1997. Red Dog port site monitoring program. Prepared for Cominco Alaska, Inc., Anchorage, AK. RWJ Consulting, Chugiak, AK.

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- Sediment (sampled for Ag, Cd, Cu, Hg, Pb, and Zn; extra sediment volume collected)
- Sediment (sampled for Cd, Pb, and Zn only)

Notes: All marine locations were sampled before shipping activities and during the shipping season.

NM—Near Shore Marine

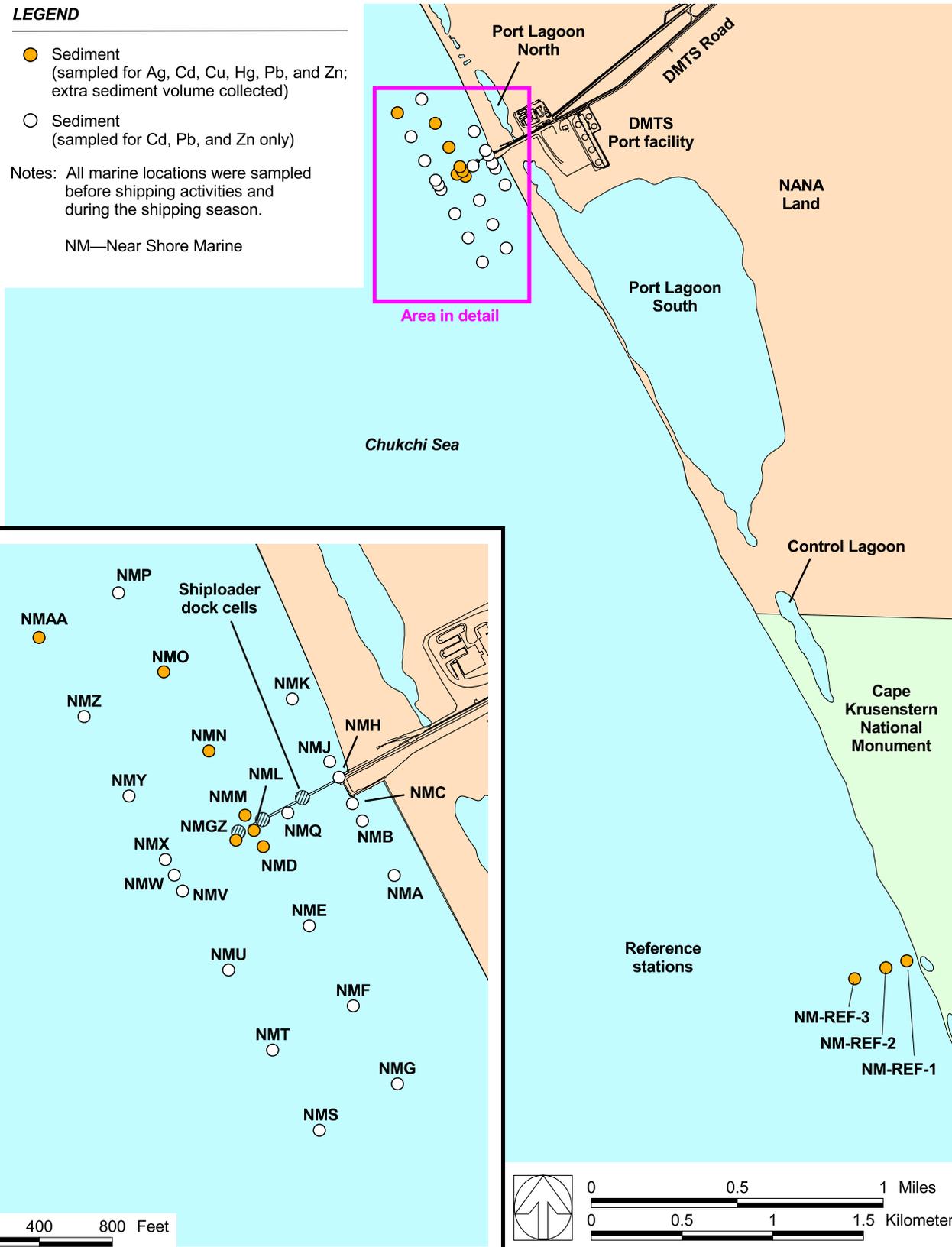
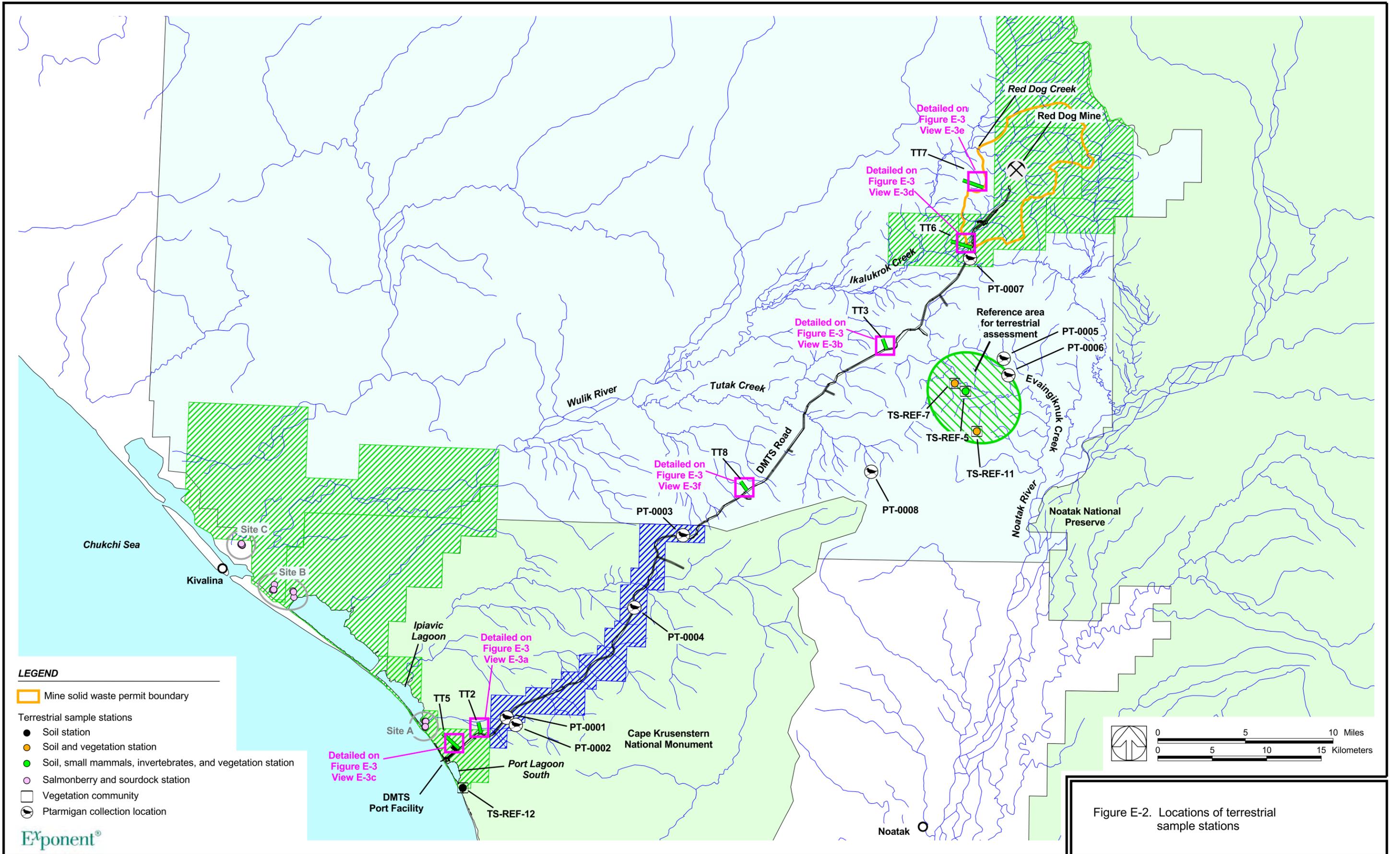
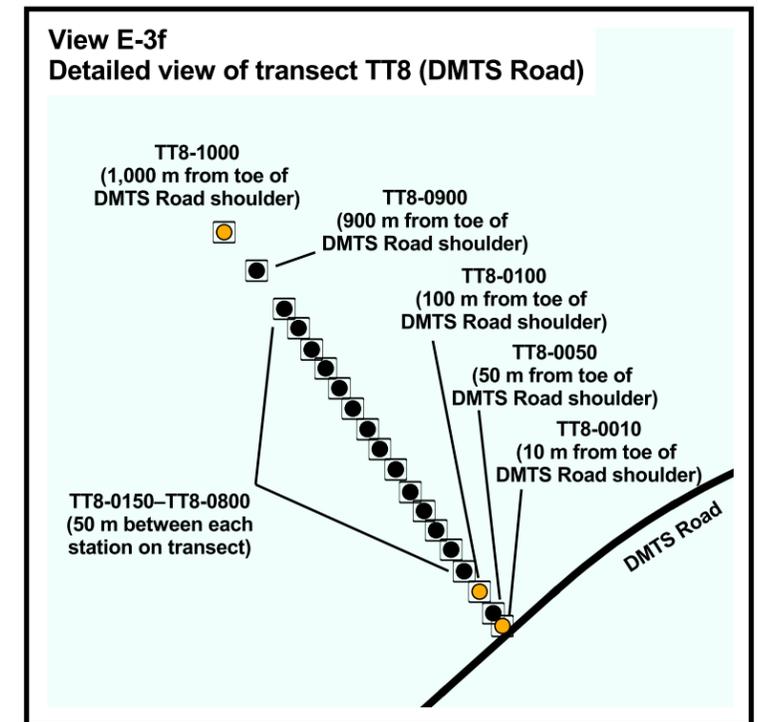
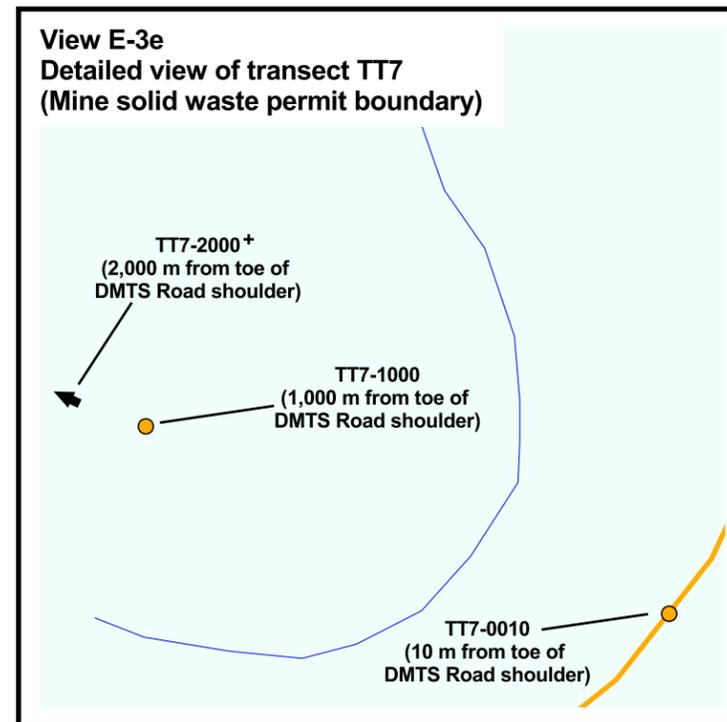
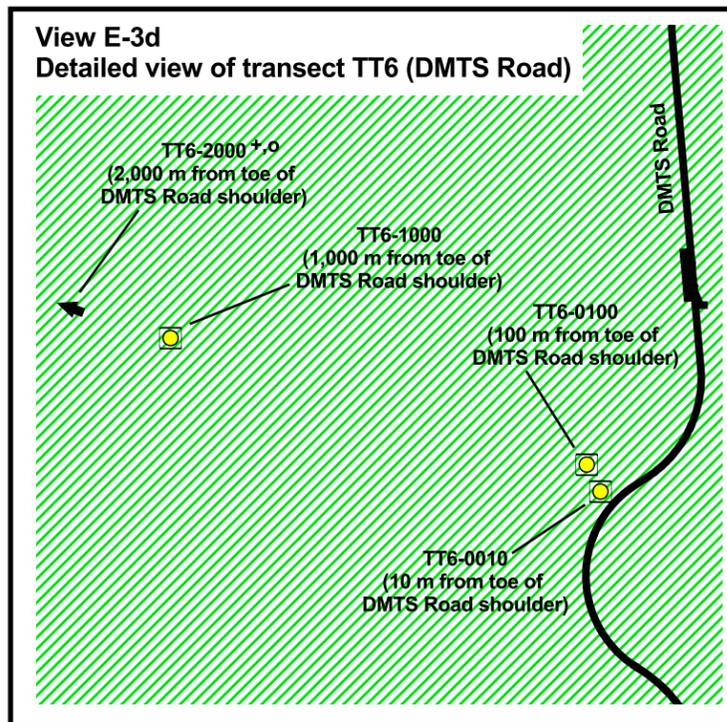
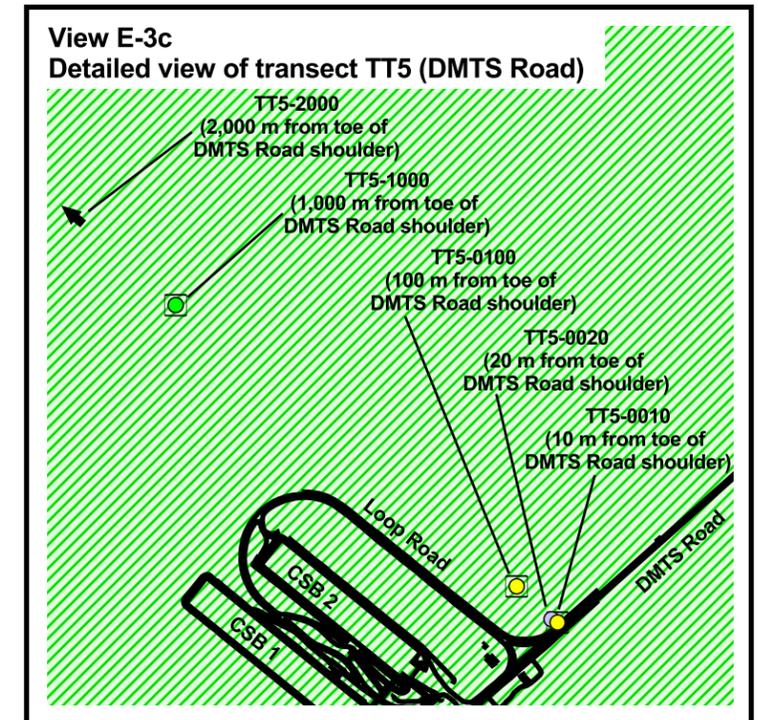
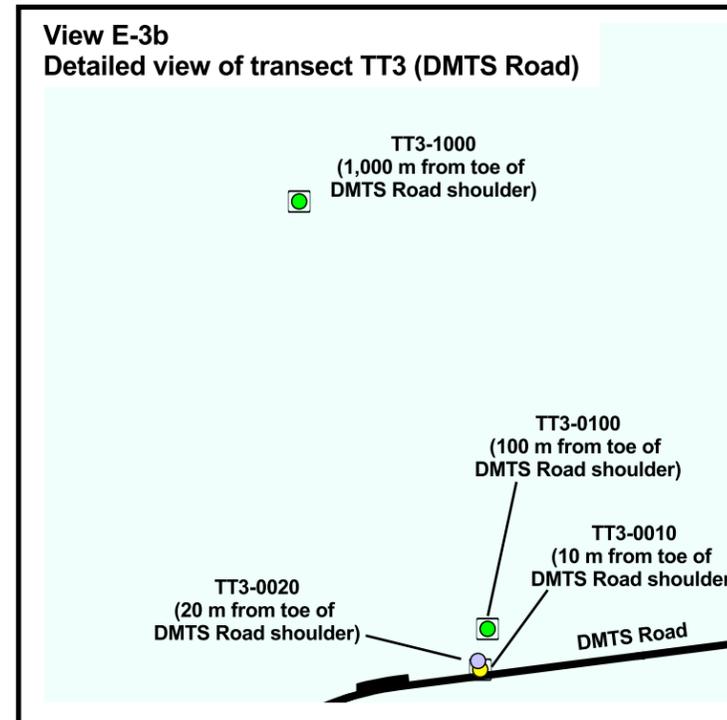
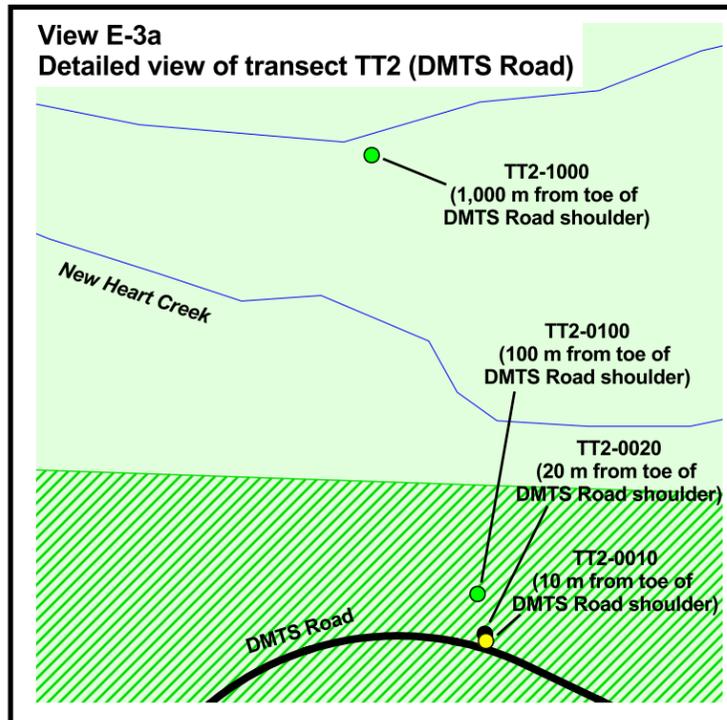


Figure E-1. Locations of marine sediment sample stations







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Mine solid waste permit boundary

Terrestrial sample stations

- Soil station
- Soil and vegetation station
- Soil, invertebrates, and vegetation station
- Soil, small mammals, invertebrates, and vegetation station
- Soil and small mammals
- Vegetation community

Notes: + No small mammals or invertebrates collected at this station
o No vegetation community analysis at this station

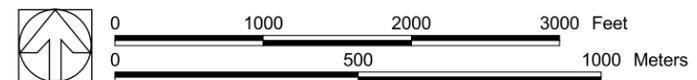


Figure E-3. Detailed views of locations of terrestrial sample stations

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- Tundra soil sampling location
- 🌿 Sedges
- 🍄 Lichen
- 🌳 Willow
- Traps for small mammals
- × Pit traps for soil invertebrates
- 1m² microplot for plant community analysis

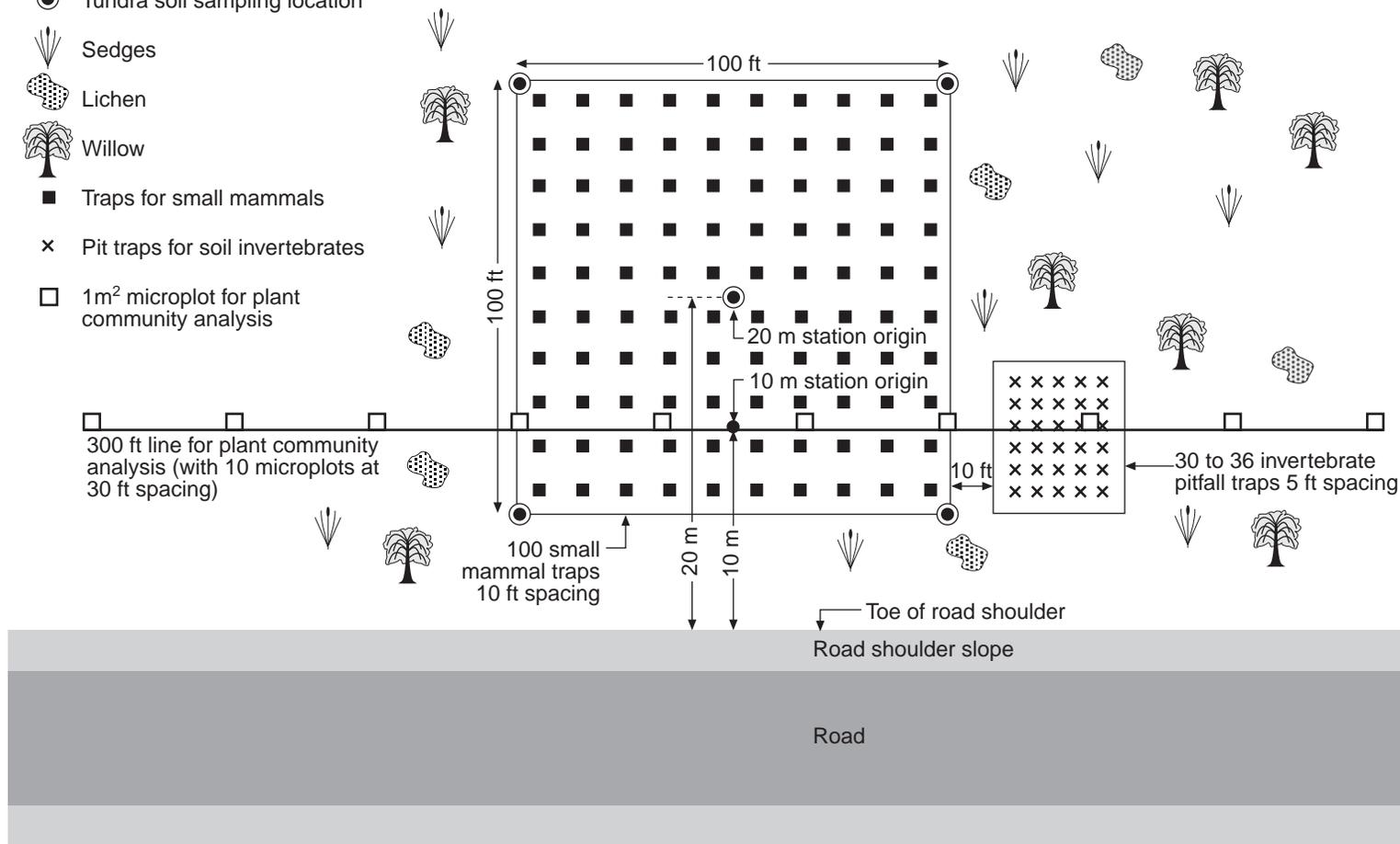


Figure E-4. Schematic layout of typical 10 m and 20 m terrestrial transect station

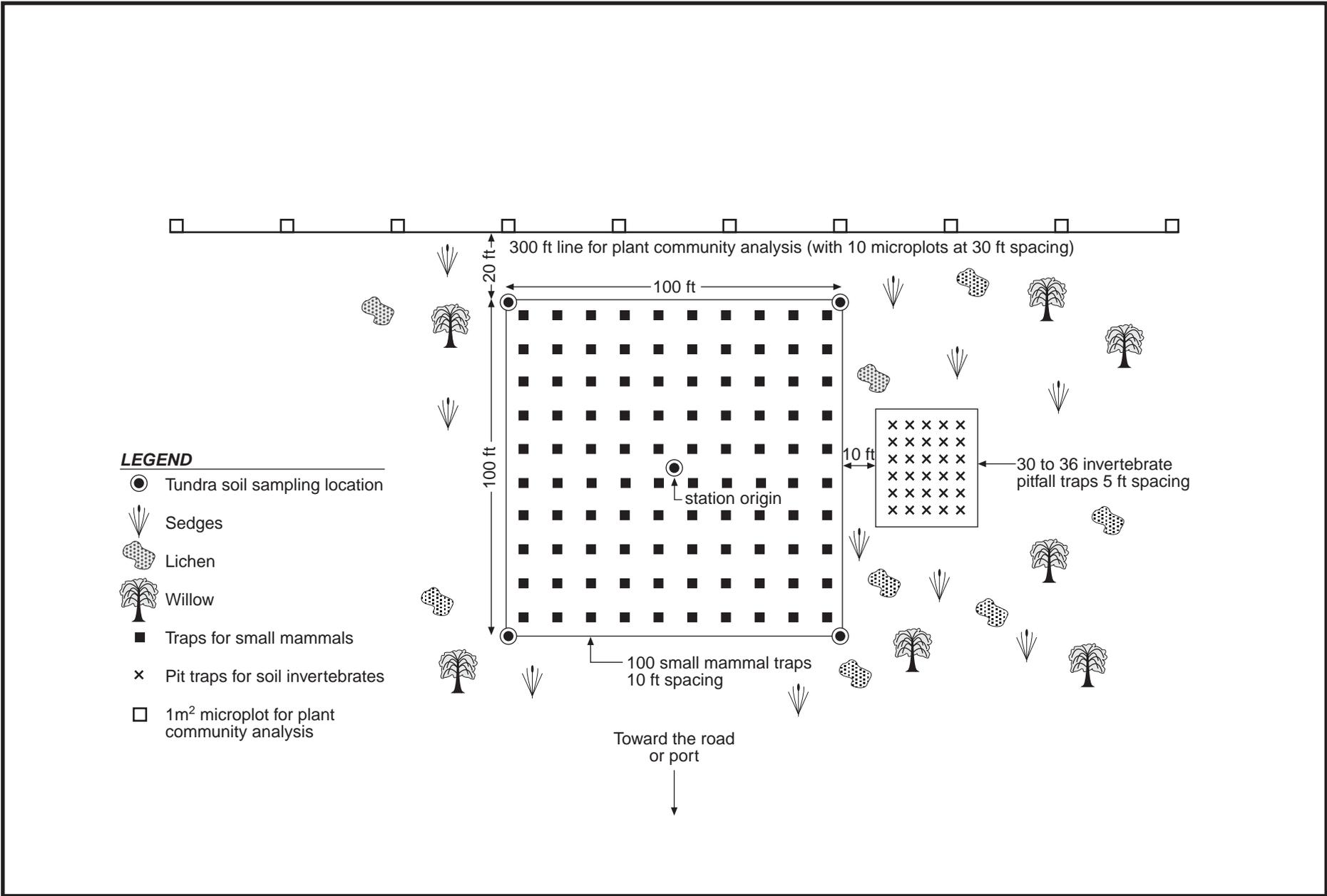
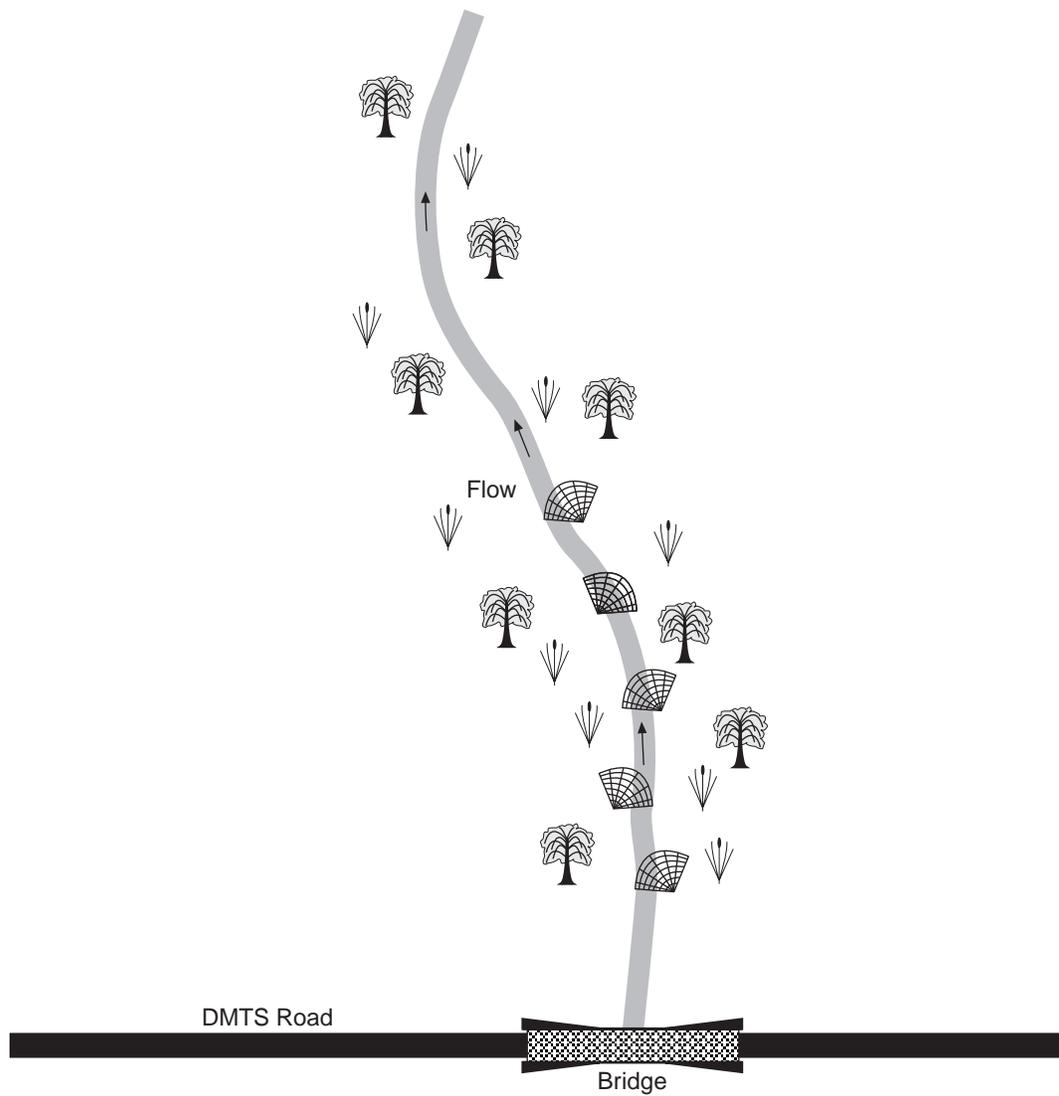


Figure E-5. Schematic layout of typical 100 m, 1,000 m, and 2,000 m terrestrial transect station

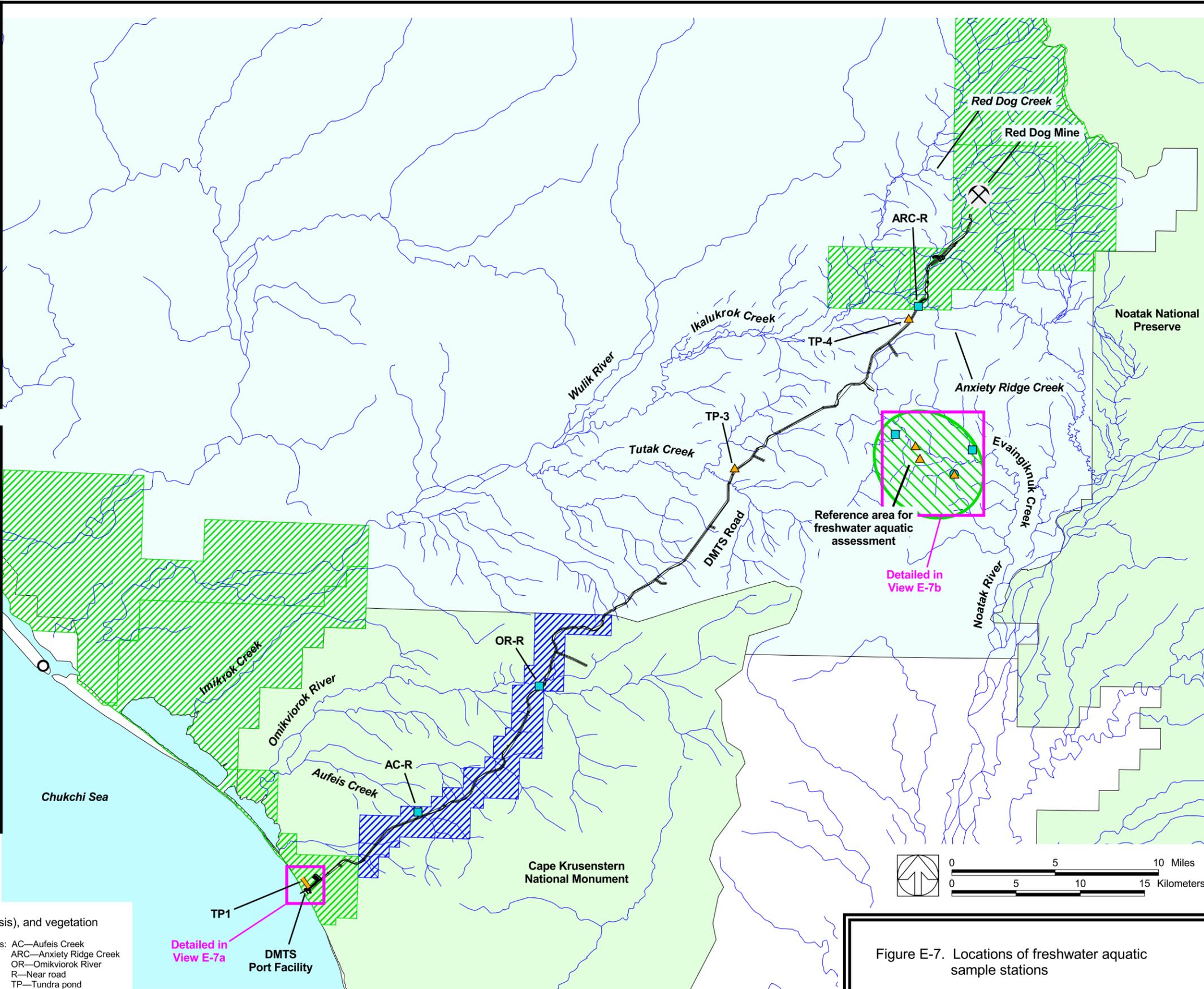
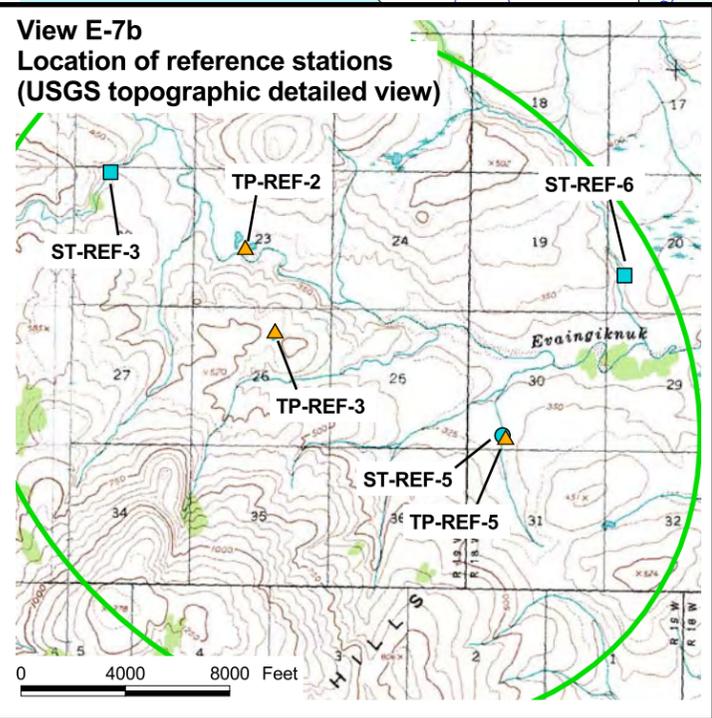
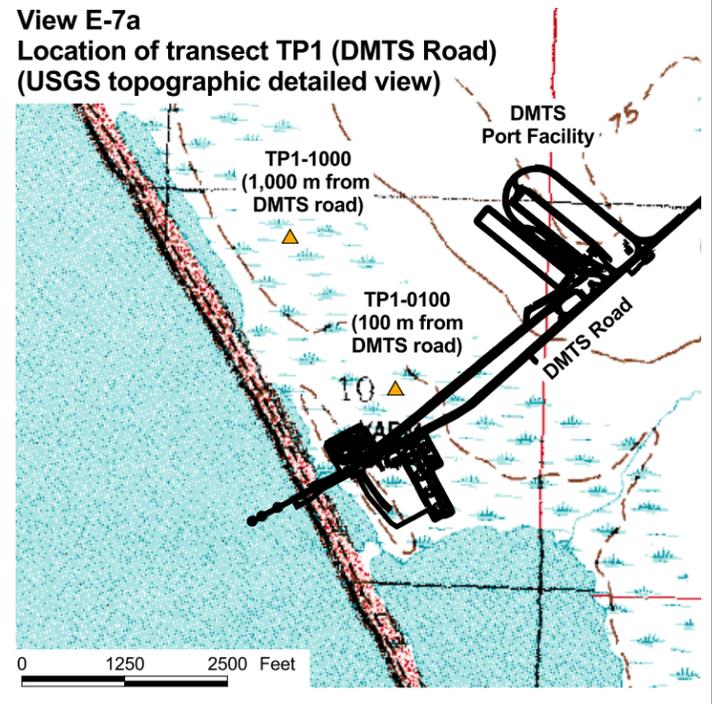


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-  Drift nets
-  Sedges
-  Willow

Note: The typical range of stream reach length between the road edge and the last net is 150–300 ft.

Figure E-6. Schematic layout of typical stream station



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Stream station

- Aquatic invertebrates (community analysis), and vegetation
- Sediment, aquatic invertebrates (tissue chemistry and community analysis), and vegetation

Tundra pond station

- ▲ Tundra soil and vegetation

Notes: AC—Aufeis Creek
 ARC—Anxiety Ridge Creek
 OR—Omikviorok River
 R—Near road
 TP—Tundra pond

Figure E-7. Locations of freshwater aquatic sample stations

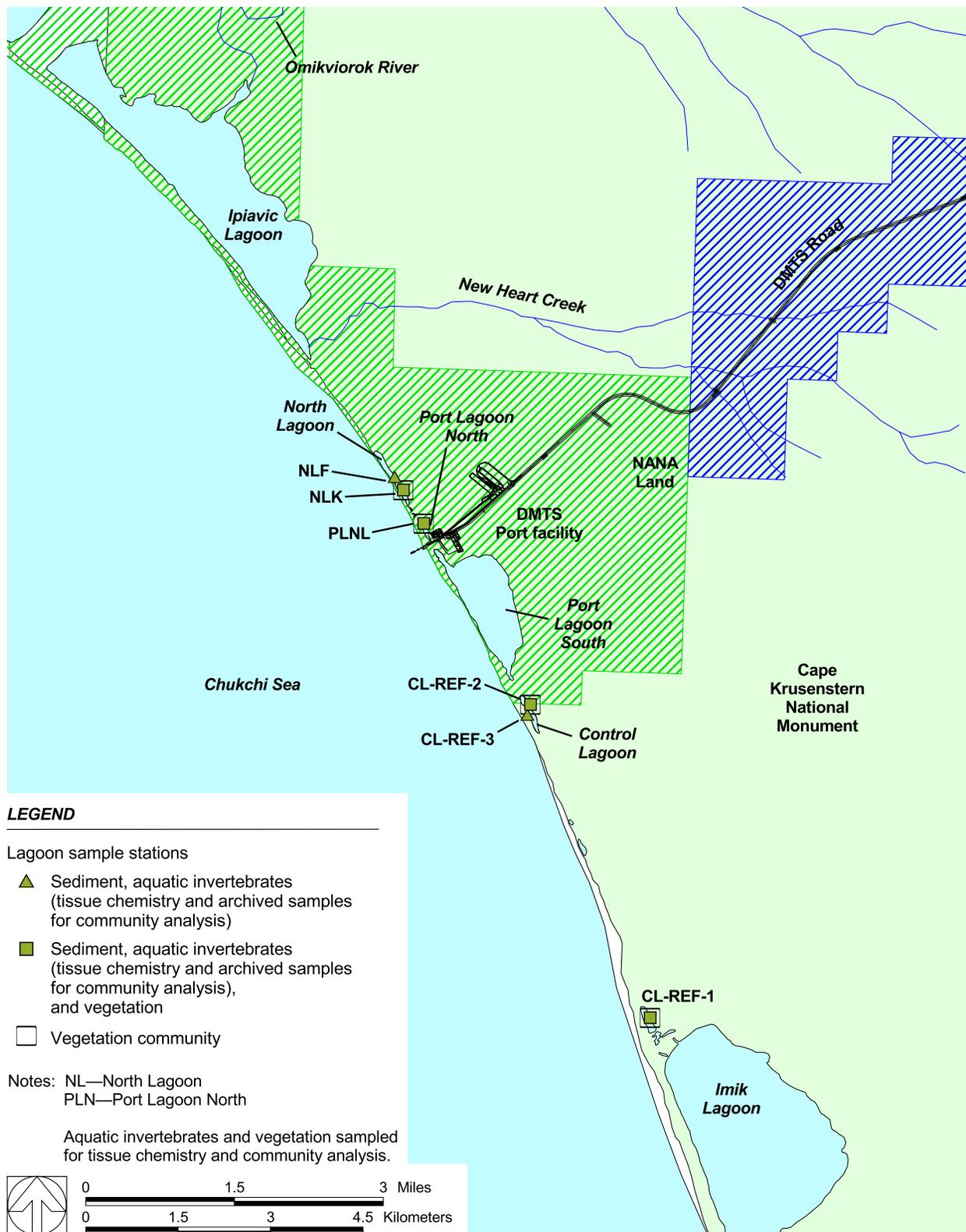


Figure E-8. Locations of coastal lagoon sample stations

Table E-1. Overview of Phase II data

Assessment Endpoint	Station/Transect	Distance (m)	Small Mammals	Ptarmigan	Terrestrial Invertebrate Tissue	Vegetation						Salmon-berries	Sour-dock	Vegetation Plots	Tundra Soil	Aquatic Invertebrates		Sediment		Water Quality Parameters
						Willow	Birch	Sedge	Lichen		Tissue					Analysis	Chemistry	Toxicity Test		
									Peltigera	Cladina										
Terrestrial																				
	TT5	10			X	X		X	X				X	X						
		20	X			X	X		X	X				X	X					
		100	a			X	X		X	X				X	X					
		1,000	X			X	X	X	X	X				X	X					
		2,000	X			X		X	X		X			X	X					
	TT2	10			X	X		X	X					X	X					
		20	a			X	X		X	X				X	X					
		100	X			X	X		X	X				X	X					
		1,000	X			X	X		X	X				X	X					
	TT8	10				X		X	X				X	X						
		20	a											X ^b	X					
		50												X	X					
		100	a				X		X	X				X ^b	X					
		150												X ^b	X					
		200												X ^b	X					
		250												X ^b	X					
		300												X ^b	X					
		350												X ^b	X					
		400												X ^b	X					
		450												X ^b	X					
		500												X ^b	X					
		550												X ^b	X					
		600												X ^b	X					
		650												X ^b	X					
	700												X ^b	X						
	750												X ^b	X						
	800												X ^b	X						
	900												X ^b	X						
	1,000					X		X	X	X			X	X						
	TT3	10			X	X		X	X				X	X						
		20	X												X					
		100	X			X	X	X	X	X				X	X					
		1,000	X			X		X	X	X	X			X	X					
	TT6	10			X	X		X	X	X			X	X						
		20	c												X					
		100				X	X		X	X	X			X	X					
		1,000				X	X		X	X	X			X	X					
	2,000					X		X	X	X				X						
	TT7	10				X		X		X				X	X					
		1,000					X		X		X			X	X					
		2,000					X		X		X			X	X					

Table E-1. (cont.)

Assessment Endpoint	Station/Transect	Distance (m)	Small Mammals	Ptarmigan	Terrestrial Invertebrate Tissue	Vegetation					Salmon-berries	Sour-dock	Vegetation Plots	Tundra Soil	Aquatic Invertebrates		Sediment		Water Quality Parameters
						Willow	Birch	Sedge	Lichen						Tissue	Analysis	Chemistry	Toxicity Test	
									Peltigera	Cladina									
	TS-REF-5		X		X	X		X	X			X	X						
	TS-REF-7				X	X	X	X	X			X	X						
	TS-REF-11				X	X	X	X	X			X	X						
	TS-REF-12											X	X						
	Near the DMTS road																		
	Terrestrial reference area			X															
	Site A									X ^d	X ^d								
	Site B									X ^d	X ^d								
	Site C									X ^d	X ^d								
Streams																			
	AC-R					X							X	X	X	X		X	
	OR-R					X		X					X	X	X	X		X	
	ARC-R					X		X					X	X	X	X		X	
	ST-REF-3					X		X					X	X	X	X		X	
	ST-REF-5					X		X					X	X	X			X	
	ST-REF-6					X		X					X	X	X	X		X	
Tundra Ponds																			
	TP1	100						X					X					X	
		1,000						X					X					X	
	TP3							X					X					X	
	TP4							X					X					X	
	TP-REF-2							X					X					X	
	TP-REF-3							X					X					X	
	TP-REF-5							X					X					X	
Coastal Lagoons																			
	PLNL							X					X	X	X ^e	X	X	X	
	NLK							X					X	X	X ^e	X	X	X	
	NLF												X	X	X ^e	X	X	X	
	CL-REF-1							X					X	X	X ^e	X	X	X	
	CL-REF-2							X					X	X	X ^e	X	X	X	
	CL-REF-3												X	X	X ^e	X	X	X	
Marine (Pre-shipment - June 2004)																			
	NMA																X		
	NMB																X		
	NMC																X		
	NMD																X		
	NME																X		
	NMF																X		
	NMG																X		
	NMH																X		
	NMJ																X		

Table E-1. (cont.)

Assessment Endpoint	Station/Transect	Distance (m)	Small Mammals	Ptarmigan	Terrestrial Invertebrate Tissue	Vegetation					Salmon-berries	Sour-dock	Vegetation Plots	Tundra Soil	Aquatic Invertebrates		Sediment		Water Quality Parameters
						Willow	Birch	Sedge	Peltigera	Cladina					Community	Tissue	Analysis	Chemistry	
	NMK																	X	
	NML																	X	
	NMM																	X	
	NMN																	X	
	NMO																	X	
	NMP																	X	
	NMQ																	X	
	NMS																	X	
	NMT																	X	
	NMU																	X	
	NMV																	X	
	NMW																	X	
	NMX																	X	
	NMY																	X	
	NMZ																	X	
	NMAA																	X	
	NMGZ																	X	
	NM-REF-1																	X	
	NM-REF-2																	X	
	NM-REF-3																	X	

^a Grid set; no small mammals collected.

^b Single microplot for vegetation community.

^c No small mammal grid set; not correct habitat (too open).

^d Five washed and five unwashed samples were collected at each site.

^e Samples archived.

^f Aquatic invertebrate tissue sample collected from area encompassed by both Stations CL-REF-2 and CL-REF-3.

Table E-2. Phase II data collection matrix

Sample Type	Description	No. of Proposed Stations	No. of Stations Sampled	No. of Field Samples	Kind of Sample	Analytes	Comments
Terrestrial							
Small Mammals (presented in ascending order from port facility to mine along the DMTS)					Tissue chemistry; whole body; each individual mammal equals one sample	List 1 ^a	
TT5	-- Port transect	4	3				
	20 m north of road			5; 2 brown lemmings and 3 tundra voles			
	100 m north of road			None			Grid set; no small mammals were collected
	1,000 m north of road			3 northern red backed voles			
	2,000 m north of road			1 masked shrew			
TT2	-- DMTS road transect	3	2				
	20 m north of road			None			Grid set; no small mammals were collected
	100 m north of road			3 northern red backed voles			
	1,000 m north of road			1 northern red backed vole			
TT8	-- DMTS road transect	0	0				Stations were added in the field.
	20 m north of road			None			Grid set; no small mammals were collected
	100 m north of road			None			Grid set; no small mammals were collected
TT3	-- DMTS road transect	3	3				
	20 m north of road			1 masked shrew			
	100 m north of road			2; 1 masked shrew and 1 tundra shrew			
	1,000 m north of road			3; 2 northern red backed voles and 1 masked shrew			
TT6	-- DMTS road transect	3	0				
	20 m north of road			None			No grid set; not correct habitat (too open)
	100 m north of road			None			Grid set; no small mammals were collected
	1,000 m north of road			None			Grid set; no small mammals were collected
TT7	-- Solid waste permit boundary transect	2	0				
	10 m downwind of boundary			None			No grid set; not correct habitat (rock face)
	1,000 m downwind of mine			None			No grid set; not correct habitat (rock face)
TS-REF-5	-- Terrestrial reference area	1	1	4; 3 masked shrews and 1 northern red backed vole			
Ptarmigan	Near the DMTS road	NA	NA	5 individual birds	Tissue chemistry;	List 2: Antimony,	
	Terrestrial reference area	NA	NA	3 individual birds	breast muscle tissue (skin on), liver, and kidneys from each bird analyzed separately	barium, cadmium, lead, thallium, and zinc	
Soil Invertebrate Tissue (presented in ascending order from port facility to mine along the DMTS)					Tissue chemistry;	List 1 ^a	
TT5	-- Port transect	4	4				
	10 m north of road			1 spiders-only composite and 1 multi-species composite			tissue sample of all soil invertebrates collected at a given station
	100 m north of road			1 crane flies-only composite and 1 multi-species composite			
	1,000 m north of road			2 spiders-only composites and 1 multi-species composite			
	2,000 m north of road			1 multi-species composite			

Table E-2. (cont.)

Sample Type	Description	No. of Proposed Stations	No. of Stations Sampled	No. of Field Samples	Kind of Sample	Analytes	Comments
TT2	-- DMTS road transect 10 m north of road 100 m north of road 1,000 m north of road	3	3	1 multi-species composite 1 multi-species composite 1 multi-species composite			
TT3	-- DMTS road transect 10 m north of road 100 m north of road 1,000 m north of road	0	3	1 multi-species composite 1 multi-species composite 1 multi-species composite			Stations were added in the field.
TT6	-- DMTS road transect 10 m north of road 100 m north of road 1,000 m north of road	0	3	1 multi-species composite 1 multi-species composite 1 multi-species composite			Stations were added in the field.
TS-REF-5	-- Terrestrial reference area	1	1	1 multi-species composite			
Vegetation Tissue (presented in ascending order from port facility to mine along the DMTS)							
TT5	-- Port transect 10 m north of road 100 m north of road 1,000 m north of road 2,000 m north of road	4	4	3; willow, sedge, and lichen (Peltigera) (1 composite sample per species) 3; willow, sedge, and lichen (Peltigera) (1 composite sample per species) 4; willow, birch, sedge, and lichen (Peltigera) (1 composite sample per species) 3; birch, sedge, and lichen (Cladina) (1 composite sample per species)	Tissue chemistry; unwashed willow or birch leaves (debris removed in field), unwashed sedge blades (minimum 3 plants per station), unwashed lichen (debris removed in field with minimum 3 plants per station)	List 1 ^a	Willow and birch leaves were collected at this station. No willow leaves were collected at this station. Birch leaves were collected at this station.
TT2	-- DMTS road transect 10 m north of road 1,000 m north of road 1 km north of road	3	3	3; willow, sedge, and lichen (Peltigera) (1 composite sample per species) 3; willow, sedge, and lichen (Peltigera) (1 composite sample per species) 3; willow, sedge, and lichen (Peltigera) (1 composite sample per species)			
TT8	-- DMTS road transect 10 m north of road 100 m north of road 1,000 m north of road	3	3	3; willow, sedge, and lichen (Peltigera) (1 composite sample per species) 3; willow, sedge, and lichen (Peltigera) (1 composite sample per species) 4; willow, sedge, and lichen (both Peltigera and Cladina) (1 composite sample per species)			

Table E-2. (cont.)

Sample Type	Description	No. of Proposed Stations	No. of Stations Sampled	No. of Field Samples	Kind of Sample	Analytes	Comments	
TT3	-- DMTS road transect 10 m north of road	3	3	3; willow, sedge, and lichen (Peltigera) (1 composite sample per species)				
	100 m north of road			4; willow, birch, sedge, and lichen (Peltigera) (1 composite sample per species)				Willow and birch leaves were collected at this station.
	1,000 m north of road			4; birch, sedge, and lichen (Peltigera and Cladina) (1 composite sample per species)				No willow leaves were collected at this station. Birch leaves were collected at this station.
TT6	-- Port transect 10 m north of road	4	4	4; willow, sedge, and lichen (Peltigera and Cladina) (1 composite sample per species)				
	100 m north of road			4; willow, sedge, and lichen (Peltigera and Cladina) (1 composite sample per species)				
	1,000 m north of road			4; willow, sedge, and lichen (Peltigera and Cladina) (1 composite sample per species)				
	2,000 m north of road			4; willow, sedge, and lichen (Peltigera and Cladina) (1 composite sample per species)				
TT7	-- Solid waste permit boundary transect 10 m downwind of boundary	3	3	3; willow, sedge, and lichen (Cladina) (1 composite sample per species)				
	1,000 m downwind of mine			3; willow, sedge, and lichen (Cladina) (1 composite sample per species)				
	2,000 m downwind of mine			3; willow, sedge, and lichen (Cladina) (1 composite sample per species)				
TS-REF-5	-- Terrestrial reference area	1	1	4; willow, sedge, and lichen (Peltigera and Cladina) (1 composite sample per species)				
TS-REF-7	-- Terrestrial reference area	1	1	5; willow, birch, sedge, and lichen (Peltigera and Cladina) (1 composite sample per species)			Willow and birch leaves were collected at this station.	
TS-REF-11	-- Terrestrial reference area	1	1	5; willow, birch, sedge, and lichen (Peltigera and Cladina) (1 composite sample per species)			Willow and birch leaves were collected at this station.	
Berries								
Site A	-- just north of the port ambient air boundary at Ipiavik Lagoon	1	1	10; 5 washed and 5 unwashed salmonberry samples	Tissue chemistry; for all washed samples any debris was removed in field	Antimony, barium, cadmium, lead, thallium, and zinc		
Site B	-- north of the port facility but closer to Kivalina	1	1	10; 5 washed and 5 unwashed salmonberry samples				

Table E-2. (cont.)

Sample Type	Description	No. of Proposed Stations	No. of Stations Sampled	No. of Field Samples	Kind of Sample	Analytes	Comments
Site C	-- reference area north of Kivalina	1	1	10; 5 washed and 5 unwashed salmonberry samples			
Site D	-- south of Site A on Ipiavik Lagoon but closer to the port facility	0	1	10; 5 washed and 5 unwashed salmonberry samples			
Sourdock							
Site A	-- just north of the port ambient air boundary at Ipiavik Lagoon	1	1	10; 5 washed and 5 unwashed sourdock samples	Tissue chemistry; for all washed samples any debris was removed in field; minimum 3 sourdock plants per station	Antimony, barium, cadmium, lead, thallium, and zinc	
Site B	-- north of the port facility but closer to Kivalina	1	1	10; 5 washed and 5 unwashed sourdock samples			
Site C	-- reference area north of Kivalina	1	1	10; 5 washed and 5 unwashed sourdock samples			
Site D	-- south of Site A on Ipiavik Lagoon but closer to the port facility	0	1	10; 5 washed and 5 unwashed sourdock samples			
Vegetation Plots (presented in ascending order from port facility to mine along the DMTS)							
TT5	-- Port transect	4	4		Community analysis	--	
	10 m north of road			--			
	100 m north of road			--			
	1,000 m north of road			--			
	2,000 m north of road			--			
TT8	-- DMTS road transect	3	19				
	10 m north of road			--			Station was added in the field.
	50 m north of road			--			Single microplot; station was added in the field.
	100 m north of road			--			
	150 m north of road			--			Single microplot; station was added in the field.
	200 m north of road			--			Single microplot; station was added in the field.
	250 m north of road			--			Single microplot; station was added in the field.
	300 m north of road			--			Single microplot; station was added in the field.
	350 m north of road			--			Single microplot; station was added in the field.
	400 m north of road			--			Single microplot; station was added in the field.
	450 m north of road			--			Single microplot; station was added in the field.
	500 m north of road			--			Single microplot; station was added in the field.
	550 m north of road			--			Single microplot; station was added in the field.
	600 m north of road			--			Single microplot; station was added in the field.
	650 m north of road			--			Single microplot; station was added in the field.
	700 m north of road			--			Single microplot; station was added in the field.
	750 m north of road			--			Single microplot; station was added in the field.
	800 m north of road			--			Single microplot; station was added in the field.
	900 m north of road			--			Single microplot; station was added in the field.
	1,000 m north of road			--			Single microplot; station was added in the field.
TT3	-- DMTS road transect	3	3				
	10 m north of road			--			
	100 m north of road			--			
	1,000 m north of road			--			
TT6	-- Port transect	3	3				
	10 m north of road			--			
	100 m north of road			--			
	1,000 m north of road			--			

Table E-2. (cont.)

Sample Type	Description	No. of Proposed Stations	No. of Stations Sampled	No. of Field Samples	Kind of Sample	Analytes	Comments
TS-REF-5	-- Terrestrial reference area	1	1	--			
TS-REF-7	-- Terrestrial reference area	1	1	--			
TS-REF-11	-- Terrestrial reference area	1	1	--			Reference area station location was modified to better match vegetation community at site stations.
TS-REF-12	-- Terrestrial reference area	0	1	--			Station was added in the field.
Tundra Soil (presented in ascending order from port facility to mine along the DMTS)					Chemistry; 0–2 cm	List 3 ^b and pH	
TT5	-- Port transect	5	5				
	10 m north of road			1			
	20 m north of road			1			
	100 m north of road			1			
	1,000 m north of road			1			
	2,000 m north of road			1			
TT2	-- DMTS road transect	4	4				
	10 m north of road			1			
	20 m north of road			1			
	100 m north of road			1			
	1,000 m north of road			1			
TT8	-- DMTS road transect	3	19				
	10 m north of road			1			
	50 m north of road			1			Station was added in the field.
	100 m north of road			1			
	150 m north of road			1			Station was added in the field.
	200 m north of road			1			Station was added in the field.
	250 m north of road			1			Station was added in the field.
	300 m north of road			1			Station was added in the field.
	350 m north of road			1			Station was added in the field.
	400 m north of road			1			Station was added in the field.
	450 m north of road			1			Station was added in the field.
	500 m north of road			1			Station was added in the field.
	550 m north of road			1			Station was added in the field.
	600 m north of road			1			Station was added in the field.
	650 m north of road			1			Station was added in the field.
	700 m north of road			1			Station was added in the field.
	750 m north of road			1			Station was added in the field.
	800 m north of road			1			Station was added in the field.
	900 m north of road			1			Station was added in the field.
	1,000 m north of road			1			
TT3	-- DMTS road transect	6	4				
	10 m north of road			1			
	20 m north of road			1			
	100 m north of road			1			
	1,000 m north of road			1			Vegetation transition points at 50 m and 250 m were moved from TT3 to TT8.

Table E-2. (cont.)

Sample Type	Description	No. of Proposed Stations	No. of Stations Sampled	No. of Field Samples	Kind of Sample	Analytes	Comments
TT6	-- Port transect	5	4				
	10 m north of road			1			
	20 m north of road			0			No tundra soil sample was collected at 20 m.
	100 m north of road			1			
	1,000 m north of road			1			
	2,000 m north of road			1			
TT7	-- Solid waste permit boundary transect	3	3				
	10 m downwind of boundary			1			
	1,000 m downwind of mine			1			
	2,000 m downwind of mine			1			
TS-REF-5	-- Terrestrial reference area	1	1	1			
TS-REF-7	-- Terrestrial reference area	1	1	1			
TS-REF-11	-- Terrestrial reference area	1	1	1			Reference area station location was modified to better match vegetation community at site stations.
TS-REF-12	-- Terrestrial reference area	0	1	1			Station was added in the field.
Streams							
Aquatic Invertebrate Tissue (presented in ascending order from port facility to mine along the DMTS)					Tissue chemistry	Cadmium, lead, mercury, and zinc	Stations were added in the field.
AC-R	Aufeis Creek	0	1	1 multi-species composite			
OR-R	Omikviorok River	0	1	1 multi-species composite			
ARC-R	Anxiety Ridge Creek	0	1	1 multi-species composite			
ST-REF-3	-- Freshwater aquatic reference area	0	1	1 multi-species composite			
ST-REF-6	-- Freshwater aquatic reference area	0	1	1 multi-species composite			
Aquatic Invertebrate Community (presented in ascending order from port facility to mine along the DMTS)					Community analysis	--	
AC-R	Aufeis Creek	1	1	5 replicates per station			
OR-R	Omikviorok River	1	1	5 replicates per station			
ARC-R	Anxiety Ridge Creek	1	1	5 replicates per station			
ST-REF-3	-- Freshwater aquatic reference area	1	1	5 replicates per station			
ST-REF-5	-- Freshwater aquatic reference area	0	1	5 replicates per station			
ST-REF-6	-- Freshwater aquatic reference area	0	1	5 replicates per station			
Vegetation Tissue (presented in ascending order from port facility to mine along the DMTS)					Tissue chemistry;	List 1 ^a	
AC-R	Aufeis Creek	1	1	1; willow (1 composite sample)	unwashed willow leaves (debris removed in field),		Sedge was not collected at this station.
OR-R	Omikviorok River	1	1	2; willow and sedge (1 composite sample per species)	sedge plant (rinsed roots [no sediment] and unwashed blades		
ARC-R	Anxiety Ridge Creek	1	1	2; willow and sedge (1 composite sample per species)	with minimum 3 plants per station)		
ST-REF-3	-- Freshwater aquatic reference area	1	1	2; willow and sedge (1 composite sample per species)			

Table E-2. (cont.)

Sample Type	Description	No. of Proposed Stations	No. of Stations Sampled	No. of Field Samples	Kind of Sample	Analytes	Comments
ST-REF-5	-- Freshwater aquatic reference area	1	1	2; willow and sedge (1 composite sample per species)			
ST-REF-6	-- Freshwater aquatic reference area	1	1	2; willow and sedge (1 composite sample per species)			
Tundra Soil (presented in ascending order from port facility to mine along the DMTS)					Chemistry; 0–2 cm	List 3 ^b and pH	
AC-R	Aufeis Creek	1	1	1			
OR-R	Omikviorok River	1	1	1			
ARC-R	Anxiety Ridge Creek	1	1	1			
ST-REF-3	-- Freshwater aquatic reference area	1	1	1			
ST-REF-5	-- Freshwater aquatic reference area	1	1	1			
ST-REF-6	-- Freshwater aquatic reference area	1	1	1			
Stream Sediment (presented in ascending order from port facility to mine along the DMTS)					Chemistry; 0–2 cm	List 3 ^b and pH	Stations were added in the field (associated with the stream aquatic invertebrate tissue samples).
AC-R	Aufeis Creek	0	1	1			
OR-R	Omikviorok River	0	1	1			
ARC-R	Anxiety Ridge Creek	0	1	1			
ST-REF-3	-- Freshwater aquatic reference area	0	1	1			
ST-REF-6	-- Freshwater aquatic reference area	0	1	1			
Stream Water (presented in ascending order from port facility to mine along the DMTS)					Field measurements	Water quality parameters ^c	
AC-R	Aufeis Creek	1	1	1			
OR-R	Omikviorok River	1	1	1			
ARC-R	Anxiety Ridge Creek	1	1	1			
ST-REF-3	-- Freshwater aquatic reference area	1	1	1			
ST-REF-5	-- Freshwater aquatic reference area	1	1	1			
ST-REF-6	-- Freshwater aquatic reference area	1	1	1			
Tundra Ponds							
Vegetation Tissue (presented in ascending order from port facility to mine along the DMTS)					Tissue chemistry;	List 1 ^a	
TP1	-- Port transect				sedge plant (rinsed roots [no sediment] and unwashed blades with minimum 3 plants per station); entire plant will be sampled		
	100 m north of road	1	1	1			
	1 km north of road	1	1	1			
	--DMTS road						
	TP3	1	1	1			
	TP4	1	1	1			
TP-REF-2	-- Freshwater aquatic reference area	1	1	1			
TP-REF-3	-- Freshwater aquatic reference area	1	1	1			
TP-REF-5	-- Freshwater aquatic reference area	1	1	1			2 ponds at 100-500 m north of road - near mine and middle of road; a suitable third pond was not identified

Table E-2. (cont.)

Sample Type	Description	No. of Proposed Stations	No. of Stations Sampled	No. of Field Samples	Kind of Sample	Analytes	Comments
Tundra Soil (presented in ascending order from port facility to mine along the DMTS)					Chemistry; 0–2 cm	List 3 ^b	
TP1	-- Port transect						
	100 m north of road	1	1	1			
	1 km north of road	1	1	1			
	--DMTS road						
	TP3	1	1	1			
	TP4	1	1	1			
TP-REF-2	-- Freshwater aquatic reference area	1	1	1			
TP-REF-3	-- Freshwater aquatic reference area	1	1	1			
TP-REF-5	-- Freshwater aquatic reference area	1	1	1			
Tundra Pond Water (presented in ascending order from port facility to mine along the DMTS)					Field measurements	Water quality parameters ^c	
TP1	-- Port transect						
	100 m north of road	1	1	1			
	1 km north of road	1	1	1			
	--DMTS road						
	TP3	1	1	1			
	TP4	1	1	1			2 ponds at 100-500 m north of road - near mine and middle of road; a suitable third pond was not identified
TP-REF-2	-- Freshwater aquatic reference area	1	1	1			
TP-REF-3	-- Freshwater aquatic reference area	1	1	1			
TP-REF-5	-- Freshwater aquatic reference area	1	1	1			
Coastal Lagoons							
Aquatic Invertebrate Tissue (presented in ascending order from port facility to the north))					Tissue chemistry; composite sample of all invertebrates collected at a station	List 4: Cadmium, lead, and zinc	
PLNL	Port Lagoon North (inland shore)	1	1	1 multi-species composite			
NLK	North Lagoon (inland shore)	1	1	1 multi-species composite			
NLF	North Lagoon (seaward shore)	1	1	1 multi-species composite			
CL-REF-1	-- Reference lagoon	1	1	1 multi-species composite			
CL-REF-2/3	-- Control lagoon	0	1	1 multi-species composite			Station was added in the field.
Aquatic Invertebrate Community (presented in ascending order from port facility to the north)					Community analysis	--	
PLNL	Port Lagoon North (inland shore)	1	1	5 replicates per station			
NLK	North Lagoon (inland shore)	1	1	5 replicates per station			
NLF	North Lagoon (seaward shore)	1	1	5 replicates per station			
CL-REF-1	-- Reference lagoon	1	1	5 replicates per station			
CL-REF-2	-- Control lagoon (inland shore)	1	1	5 replicates per station			
CL-REF-3	-- Control lagoon (seaward shore)	1	1	5 replicates per station			
Fish							
	2 site lagoons	2	0	0			All 3 coastal lagoons were seined and trapped; no fish were collected.
	Reference lagoon TBD	1	0	0			

Table E-2. (cont.)

Sample Type	Description	No. of Proposed Stations	No. of Stations Sampled	No. of Field Samples	Kind of Sample	Analytes	Comments
Vegetation Tissue (presented in ascending order from port facility to the north)							
PLNL	Port Lagoon North (inland shore)	1	1	1	Tissue chemistry; sedge plant (rinsed roots [no sediment] and unwashed blades with minimum 3 plants per station); entire plant will be sampled	List 1 ^a	No sedge was present at Station NLF.
NLK	North Lagoon (inland shore)	1	1	1			
NLF	North Lagoon (seaward shore)	1	0	0			
CL-REF-1	-- Reference lagoon	1	1				
CL-REF-2	-- Control lagoon (inland shore)	1	1	1			
CL-REF-3	-- Control lagoon (northern shore)	1	0	0			
Vegetation Plots (presented in ascending order from port facility to the north)							
PLNL	Port Lagoon North (inland shore)	1	1	--	Community analysis	--	No vegetation plots were surveyed at Station NLF; sand dune environment
NLK	North Lagoon (inland shore)	1	1	--			
NLF	North Lagoon (seaward shore)	1	0	--			
CL-REF-1	-- Reference lagoon	1	1	--			No vegetation plots were surveyed at Station CL-REF-3
CL-REF-2	-- Control lagoon (inland shore)	1	1	--			
CL-REF-3	-- Control lagoon (northern shore)	1	0	--			
Tundra Soil (presented in ascending order from port facility to the north)							
PLNL	Port Lagoon North (inland shore)	1	1	1	Chemistry; 0–2 cm	List 3 ^b and pH	
NLK	North Lagoon (inland shore)	1	1	1			
NLF	North Lagoon (seaward shore)	1	1	1			
CL-REF-1	-- Reference lagoon	1	1	1			
CL-REF-2	-- Control lagoon (inland shore)	1	1	1			
CL-REF-3	-- Control lagoon (northern shore)	1	1	1			
Lagoon Sediment (presented in ascending order from port facility to mine along the DMTS)							
PLNL	Port Lagoon North (inland shore)	1	1	1	Chemistry and toxicity test; 0–2 cm	List 5: Arsenic, cadmium, lead, zinc; List 6: Grain size and total solids; <i>Hyalella</i> survival and growth	
NLK	North Lagoon (inland shore)	1	1	1			
NLF	North Lagoon (seaward shore)	1	1	1			
CL-REF-1	-- Reference lagoon	1	1	1			
CL-REF-2	-- Control lagoon (inland shore)	1	1	1			
CL-REF-3	-- Control lagoon (seaward shore)	1	1	1			
Lagoon Water (presented in ascending order from port facility to the north)							
PLNL	Port Lagoon North (inland shore)	1	1	1	Field measurements	Water quality parameters ^c	
NLK	North Lagoon (inland shore)	1	1	1			
NLF	North Lagoon (seaward shore)	1	1	1			
CL-REF-1	-- Reference lagoon	1	1	1			
CL-REF-2	-- Control lagoon (inland shore)	1	1	1			
CL-REF-3	-- Control lagoon (seaward shore)	1	1	1			

Table E-2. (cont.)

Sample Type	Description	No. of Proposed Stations	No. of Stations Sampled	No. of Field Samples	Kind of Sample	Analytes	Comments
Marine							
Surface sediment	19 stations around the port	19	19	38 (two events) ^d	Chemistry and toxicity test; 0–2 cm	List 4: Cadmium, lead, zinc	
Surface sediment	7 port stations - NMD, NMGZ, NML, NMM, NMN, NMO, NMAA	7	7	14 (two events) ^d		List 7: Cadmium, copper, lead, mercury, silver, zinc; List 6: Grain size, total solids; <i>Hyalella</i> survival and growth ^e	
Surface sediment	3 reference stations to the southeast	3	3	6 (two events) ^d			

Note: DMTS - DeLong Mountain Regional Transportation System
NA - not applicable
TBD - to be determined

^a List 1: Aluminum, antimony, arsenic, barium, cadmium, chromium, cobalt, lead, mercury, molybdenum, selenium, thallium, vanadium, and zinc.

^b List 3: Antimony, arsenic, barium, cadmium, cobalt, copper, lead, manganese, mercury, molybdenum, selenium, silver, thallium, vanadium, and zinc.

^c Water quality measurements were taken in the field (i.e., pH, dissolved oxygen, temperature, conductivity, and salinity).

^d Marine sediment sampling events conducted in June and September 2004.

^e The criteria described in the sampling and analysis plan (Exponent 2004b) were not met, so no sediment toxicity testing was conducted on marine sediments.

Table E-3. Information on level of small mammal trapping activities during the June/July 2004 sampling event

Station	Date Set	Date Picked Up	Nights Set	Number of Traps	Trap Nights	Number of Mammals	Incidental Take	Notes
TT5-0010	06/12/04	06/16/04	4	150	600	5	None	100 live traps, 50 snap traps
TT5-0100	06/16/04	06/19/04	3	100	300	0	None	100 live traps
TT5-1000	06/13/04	06/16/04	3	150	450	3	None	100 live traps, 50 snap traps
TT5-2000	06/11/04	06/15/04	4	118	472	0	1 masked shrew caught in pitfall trap	80 live traps, 38 snap traps
TT2-0010	06/18/04	06/21/04	3	100	300	0	None	100 live traps
TT2-0100	06/16/04	06/19/04	3	100	300	3	None	100 live traps
TT2-1000	06/15/04	06/18/04	3	150	450	1	None	100 live traps, 50 snap traps
TT8-0010	06/25/04	07/05/04	10	100	1,000	0	None	100 live traps
TT8-0100	06/26/04	07/05/04	9	100	900	0	None	100 live traps
TT3-0010	06/19/04	06/22/04	3	100	300	0	1 masked shrew caught in pitfall trap	100 live traps
TT3-0100	06/19/04	06/22/04	3	100	300	1	1 masked shrew caught in pitfall trap	100 live traps
TT3-1000	06/21/04	06/24/04	3	100	300	1	2 - 1 masked shrew and 1 northern red backed vole caught in pitfall trap	100 live traps
TT6-0100	06/25/04	06/29/04	4	100	400	0	None	100 live traps
TT6-1000	06/22/04	06/25/04	3	100	300	0	None	100 live traps
TS-REF-5	07/01/04	07/05/04	4	100	400	1	3 masked shrews caught in pitfall traps	100 live traps
					6,772	15	1 capture per 451.5 nights	