



**DRAFT ENVIRONMENTAL BASELINE STUDIES
2006 STUDY PLANS**

**CHAPTER 7.
TRACE ELEMENTS**

JULY 2006

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7. TRACE ELEMENTS

This document summarizes the proposed scope of work for the 2006 trace elements study program for Pebble Project. The 2005 study plan for trace elements is documented in Chapter 7 of the *Draft Environmental Baseline Studies, Proposed 2005 Study Plan*; the following discussion indicates where the 2006 program differs from that presented for 2005.

7.1 Mine Studies

Table 7.1-1 summarizes study activities in 2004, 2005, and 2006. Figure 7.1-1 shows the sampling locations for the mine study area, and Tables 7.1-2a and b summarize sampling at those locations in 2004, 2005, and 2006.

The 2006 study will characterize naturally occurring constituents (e.g., trace elements) in:

- Surface soil.
- Terrestrial vegetation that is used as forage by wildlife or as food or medicine by humans.
- Aquatic vegetation associated with lakes and ponds in the mine study area.
- Sediment found in tundra lakes and ponds and in streams.

Subsurface soil samples will not be collected in 2006 because review of data from the 2004 and 2005 sampling programs indicated that the results from samples collected at depth were equal to or less than the concentrations from surface samples.

A subset of surface-soil samples will be analyzed for total organic carbon (also referred to as fraction organic carbon) and petroleum hydrocarbons as diesel-range organics and residual-range organics.

The number of samples to be collected in 2006 is summarized by area and study on Table 7.1-3. Two sampling events will be conducted for terrestrial vegetation. The rationale for the sampling this year is twofold:

- The short-term goal of the program is to collect data from two years at each location. Since some locations were only added last year, an additional round of sampling is needed at these new locations. This is a subset of the locations sampled in the mine study area in 2005.
- Identification of the new eastern deposit (Pebble East) requires characterization of baseline conditions in the watershed in the vicinity of this new deposit. Surface soil samples, vegetation samples, pond and lake water samples, and pond and lake sediment samples will be collected from sample sites in Pebble East.

Differences in sampling for Pebble West from year to year are summarized in Table 7.1.2a. Sampling for Pebble East is summarized in Table 7.1-2b. A total of 16 ponds will be sampled as part of this program.

Stream and lake sediment sampling will be conducted as outlined in Section 7.1.2.2 of the 2005 study plan, with an additional chemical analysis included. This new analysis, which involves total sulfur and acid volatile sulfide/simultaneously extracted metals (AVS-SEM), is designed to evaluate the bioavailability of trace elements in sediment. Pond sampling is intended to be conducted in coordination with the water quality team so that sediment and aquatic vegetation samples are temporally co-located.

7.2 Transportation Corridor Studies

The study program for the transportation corridor will be conducted as outlined in Section 7.2 of the 2005 study plan, but additional sampling, focusing on trace elements in soil and vegetation, will be conducted in areas within the transportation corridor east of Summit Lake (Figure 7.2-1). In addition to locations sampled in 2004, new locations sampled in 2006 will include additional natural drainages and habitats typical of the areas east of the lake.

The methodology for sampling is identical to that presented in Section 7.2.2.2 of the 2005 study plan. Sampling in 2006 will include soil, plants (berries and vegetative portions kept separate), pond sediment, surface water, and aquatic plants, and stream sediment and surface water media. Consistent with other trace element work done on the transportation corridor, only a single sampling event is planned for 2006. Tables 7.2-1a, b, and c summarize study activities in 2004, 2005, and 2006 (Mine Studies Area in Table 7.2-1a, and Transportation Corridor in Tables 7.2-1b and c). Table 7.2-2 summarizes the sampling at each sample location in 2004, 2005, and 2006. The number of samples of each medium proposed for 2006 is summarized in Table 7.2-3.

Table 7.1-1
Pebble Project Environmental Studies
Study Summary for Trace Elements, Mine Studies, 2004-2006
Consultant: SLR Alaska

Discipline	2004 Data Collected or Tasks (some done by CH2M Hill)	2005 Data Collected or Tasks	2006 Tasks to be Completed
Trace Elements		Mine Study Area	
	Information Gathering	Information Gathering	Information Gathering
	Scope, Schedule, Field Sampling Plan	Scope, Schedule, Field Sampling Plan	Scope, Schedule, Field Sampling Plan
	2004 Study Plan	2005 Study Plan	2006 Study Plan Summary
	Soil Sampling (Aug/Sep)	Soil sampling (July and August)	QAPP update: aquatic species
	Vegetation Sampling (Aug/Sep) - leaves and berries	Vegetation Sampling (July - leaves; Aug - leaves and berries)	Aquatic plant sampling
	QAPP review	Aquatic plant sampling (August)	Aquatic pond sediment sampling
		QAPP update	Coordination with HDR and BEESC
		Data Entry and Analysis	Data Analysis
		Communication and Data Management	Communication and Data Management
		Coordination with NDM & Agencies, monthly reporting	Coordination with NDM, agency meetings, and monthly reporting
		Mercury/methylmercury fish tissue analysis	Stream Sediment and Surface Water Data Analysis
		2004 Progress Report	Fish Tissue Data Analysis
			Draft Environmental Baseline Document
		Soil sampling (July)	
		Terrestrial Vegetation Sampling (July - leaves only; Aug - leaves and berries)	

**Table 7.1-3
Trace Element Analytical Sampling Estimate
Mine Studies, 2006**

Pebble West - July (SLR)

	Soil	Terrestrial Veg ¹	Aquatic Veg ¹	Pond Sed ²	Stream SW	Stream Sediment	Totals
Primary	30	36	24	9	0	0	99
Duplicate	3	3	3	1	0	0	10
QA	3	3	3	1	0	0	10
Totals	36	42	30	11	0	0	119

Pebble East - July (SLR)

	Soil	Terrestrial Veg ¹	Aquatic Veg ¹	Pond Sed	Stream SW	Stream Sediment	Totals
Primary	16	28	0	0	0	0	44
Duplicate	2	3	0	0	0	0	5
QA	2	3	0	0	0	0	5
Totals	20	34	0	0	0	0	54

Pebble West - August (SLR)

	Soil	Terrestrial Veg ¹	Aquatic Veg ¹	Pond Sed ²	Stream SW	Stream Sediment	Totals
Primary	0	54	40	15	0	0	109
Duplicate	0	5	4	2	0	0	11
QA	0	5	4	2	0	0	11
Totals	0	64	48	19	0	0	131

Pebble East - August (SLR)

	Soil	Terrestrial Veg ¹	Aquatic Veg ¹	Pond Sed ³	Stream SW	Stream Sediment	Totals
Primary	0	42	4	3	0	0	49
Duplicate	0	4	1	1	0	0	6
QA	0	4	1	1	0	0	6
Totals	0	50	6	5	0	0	61

¹ Assumes four species per location, plus two berry samples per upland location.

² Assumes three samples for every two ponds (two samples at larger ponds, one at smaller ponds).

³ Assumes three samples from one pond.

Table 7.2-1a
Pebble Project Environmental Studies
Study Summary for Trace Elements, Transportation Corridor, 2004-2006
Consultant: SLR Alaska

Discipline	2004 Data Collected or Tasks	2005 Data Collected or Tasks	2006 Tasks to be Completed
Trace Elements	Transportation Corridor		
	None	Information Gathering	Information Gathering
		BEESC Study Plan Review	Scope, Schedule, Field Sampling Plan
		2004 Progress Report	2006 Study Plan Summary
		Data Analysis	Coordination with HDR and BEESC
		Coordination with NDM & Agencies	Coordination with NDM, Resource Agencies and Monthly Reporting
			Data Entry and Analysis
			Draft Environmental Baseline Document

Table 7.2-1b
Pebble Project Environmental Studies
Study Summary for Trace Elements in Vegetation, Transportation Corridor, 2004-2006
Consultant: BEESC

Discipline	2004 Data Collected or Tasks	2005 Data Collected or Tasks	2006 Tasks to be Completed
Vegetation Trace Elements	Transportation Corridor		
	Information Gathering	None	Information Gathering
	Scope, Schedule, Field Sampling Plan		Scope, Schedule, Field Sampling Plan
	Field Sampling - August		Field Sampling - August
	Communication and Data Management		Communication and Data Management
	Coordination with local communities for observers		Coordination with local communities for observers
	Prepared presentation		Data Compilation
	Report Writing		Prepare preliminary EBD

Table 7.2-1c
Pebble Project Environmental Studies
Study Summary for Trace Elements in Sediment, Transportation Corridor, 2004-2006
Consultant: BEESC

Discipline	2004 Data Collected or Tasks	2005 Data Collected or Tasks	2006 Tasks to be Completed
Sediment Trace Elements	Transportation Corridor		
	Information Gathering	Information Gathering	Information Gathering
	Scope, Schedule, Field Sampling Plan	Scope, Schedule, Field Sampling Plan	Scope, Schedule, Field Sampling Plan
	Field Sampling - July, Sept.	2005 Field Sampling Plan	Field Sampling - August
	Communication and Data Management	Field Sampling - May, July, Sept.	Data Compilation and Analysis
	Coordination with NDM	Coordination with NDM	Coordination with NDM
	Coordination with local communities for observers	Coordination with local communities for observers	Coordination with local communities for observers
	Prepared presentation	Data Compilation and Analysis	Preliminary EBD
	Report Writing	2004 Progress Report	

Table 7.2-3
Trace Element Analytical Sampling Estimate
Transportation Corridor, 2006

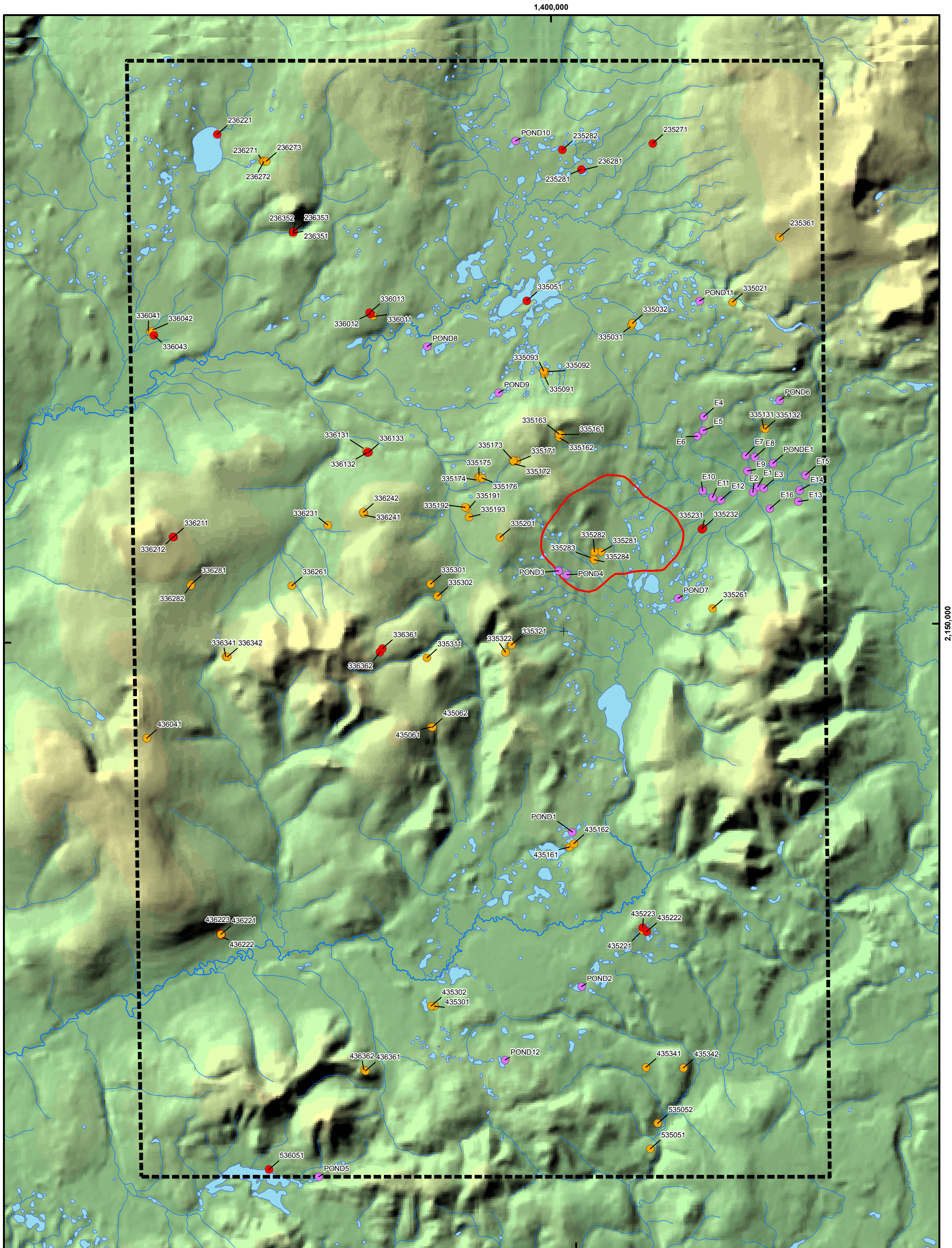
Transportation Corridor (BEESC)

	Soil	Terrestrial Veg¹	Aquatic Veg¹	Pond Sed²	Stream SW	Stream Sediment³	Totals
Primary	12	72	4	3	7	7	105
Duplicate	2	7	1	1	1	1	13
QA	2	7	1	1	1	1	13
Totals	16	86	6	5	9	9	131

¹ Assumes four species per location, plus two berry samples per upland location.

² Assumes three samples from one pond.

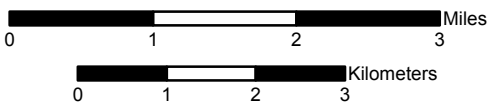
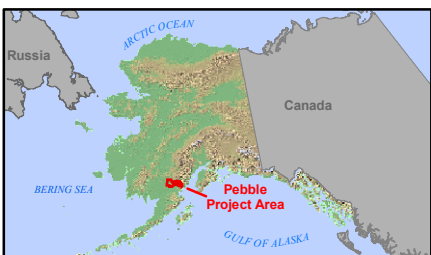
³ Assumes two samples per location.



2,150,000

1,400,000

2,150,000



Scale 1:85,000

Alaska State Plane Zone 5 (units feet)
1983 North American Datum

Legend

- Proposed 2006 Sample Location (pre-existing)
- Proposed 2006 New Sample Location
- Locations Sampled in 2004 and 2005
- 2004 Sample Location
- Study Boundary
- 2005 Pit Outline

Pebble Project
NORTHERN DYNASTY MINES INC.

Figure 7.1-1
Pebble Project
2006 Study Plan
Existing and Proposed Natural
Occurring Constituents Sampling
Locations for Soil, Sediment, and
Vegetation, Mine Study Area

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RDI_SLR_2004-06_sample_loc_11x17P_v06.mxd

Date: June 27, 2006

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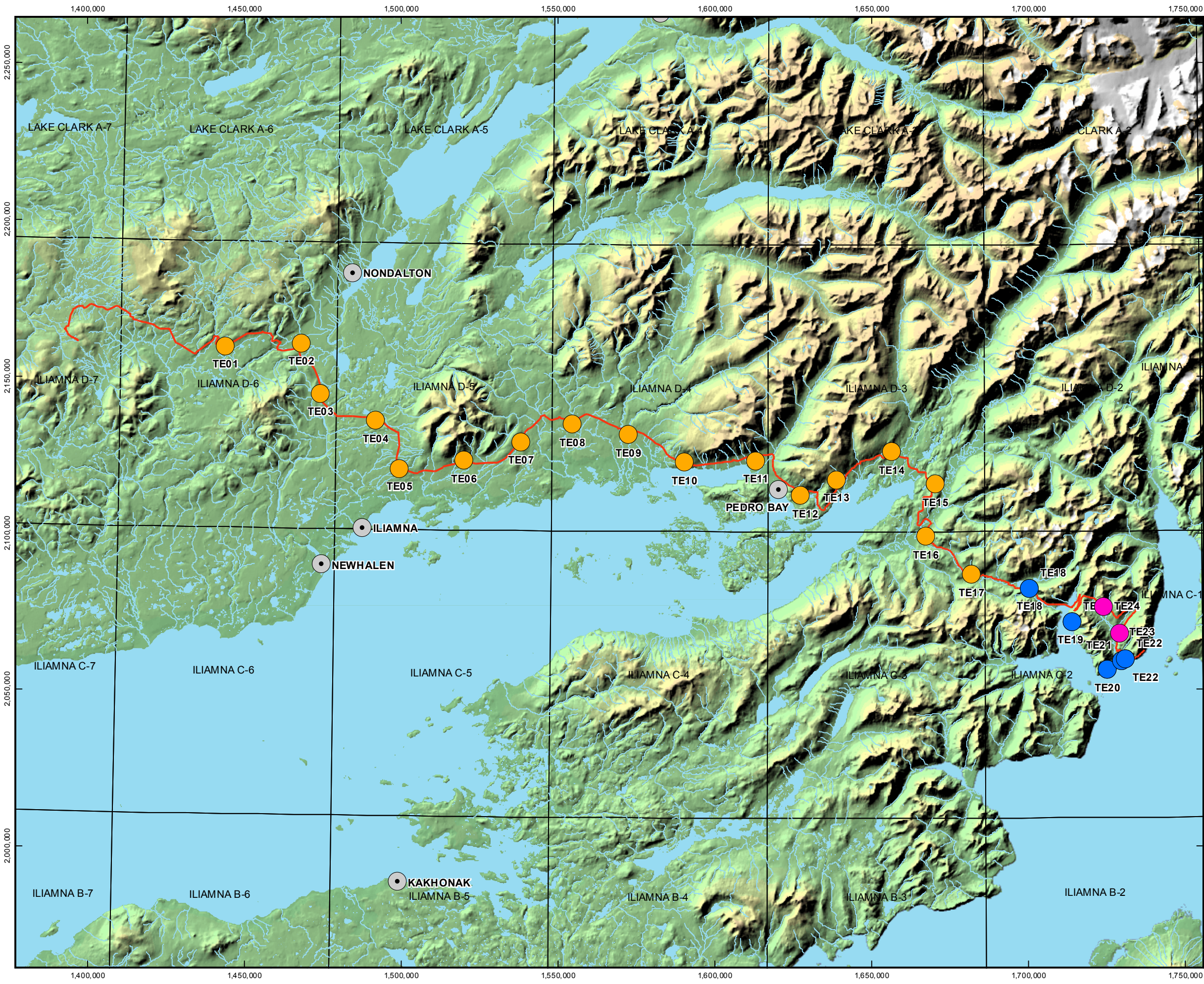
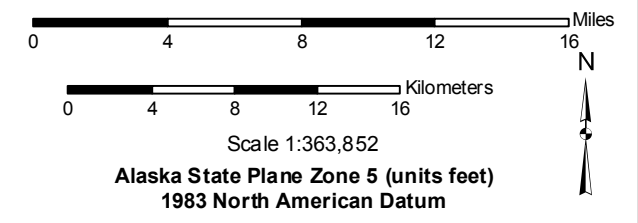
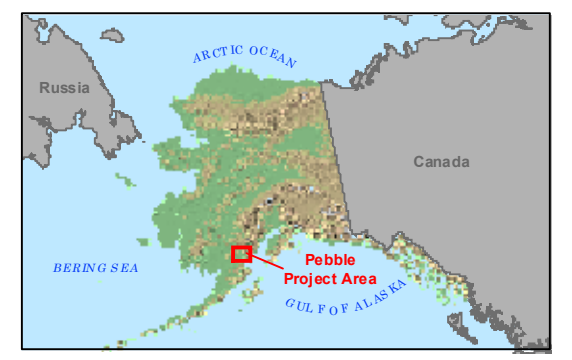


Figure 7.2-1
Trace Elements
Transportation Corridor
Study Area and Sampling Locations

- Legend**
- Soil and Vegetation sampled in 2004
 - Soil and Vegetation sampled in 2004 and to be sampled in 2006
 - Soil and Vegetation to be sampled in 2006
 - Towns
 - Proposed Transportation Corridor



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