ATTACHMENT I

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QUALITY ASSURANCE PROJECT PLAN
WATER QUALITY MONITORING
PETERSON CREEK, NORTH DOUGLAS ISLAND

to Provide Information and Assess Possible Impacts
from Construction and Operation of the

Totem Creek Inc Golf Course and Related Residential Housing

Project Schedule

Begin.....	Jan 1997
Coliforms, turbidity, color, nitrates, phosphates, pH, etc.....	monthly
Inorganics, volatile organics, pesticides (Class A MCL).....	yearly

Sampling Locations (see map, page 4)

Peterson Creek main channel
- at the end of the North Douglas Road

Spawning Tributaries Streams "A26" "A53" "A83" "A107" "A122"
- upstream of roads or disturbances (once determined)
- downstream of roads or disturbances

As requested by ADEC
- "A73" "A95"

This Quality Assurance Project Plan has been prepared using the guidance and assistance of the Alaska Department of Environmental Conservation and adopts procedures, methods, and models developed by state and federal agencies. The City and Borough of Juneau Wetlands Committee also reviewed this plan.

Smith Bayliss LeResche Inc by
Randolph Bayliss, P.E., Environmental Engineer,
Managing Principal

1.0 PURPOSE AND BACKGROUND

1.1 Site Setting and History

Peterson Creek follows along an exposed marine terrace and evidence of intertidal seashells can be seen at the 500-foot elevation contour. Thin organic soils overlay stream outwash sand, silt, and beach deposits. Alluvial fans have built up where steep streams have deposited weathered bedrock onto the flat terrace. These alluvial fans are well-drained uplands with oxidized soil and are classified as the Kupreanof series. The lower terrace exhibits backwaters, ponding, and beaver dams which have drowned timber. These lower soils are rich organic mucks and are classified as the Maybeso series. Some intermediate soils are mineral but often hydric and may be wetlands and are classified as the Wadleigh series.

Due to the thin soils and steep slopes in the watershed, groundwater flows are relatively small in size and variable in duration. The mainstem channel shows pronounced meandering uncommon for this area with well-defined vertical and overhanging banks, and does not appear to carry a heavy bedload. Based on about 50 inches of annual rainfall measured by Peterson Creek residents and watershed, nominal flow in Peterson Creek has been calculated to be about 15 cubic feet a second using USGS methods. Peterson Creek drains an area of about four square miles and supports spawning and rearing habitat for several important fish, which Fish and Game estimates the following annual returns.

Peterson Creek Fish Use

Species	Estimated Escapement
Coho salmon	200-500
Pink salmon	5,000-8,000
Chum salmon	300-1,000
Dolly Varden	1,000+
Cutthroat trout	300+

ADF&G trapping has shown that most of the Peterson Creek tributaries contain smolt from resident coho and trout. Deep pockets on the main channel provide overwintering areas for Dolly Varden. The Peterson Creek watershed contains wetlands and beaver dams with some commercial trapping, as well as supporting deer and bear habitat. Eagle nests have also been identified in the area.

In the lower reaches of Peterson Creek, several residents have water use permits to withdraw water from the creek for drinking water supplies.

This water quality monitoring program is expected to evolve during road building, tree cutting and clearing, golf course construction and operation to track expected impacts to water quality from the project.

1.2 Project Description

Totem Creek Inc proposes to develop an 18-hole golf course and related residential areas in the Peterson Creek Watershed on North Douglas Island. About half of the golf course area would be cleared for the fairways, with the balance for buffer zones, fairway separation strips, and pockets of wetlands. Roads would be built for clearing and access.

The routing of the golf course has been designed to avoid wetlands and provide buffers for salmon streams. It has been located upland from the Peterson Creek mainstem. No part of the golf course fairways, greens, or tees will be filled on wetlands. The entire filled areas for the golf course have been located on well-drained uplands. About 2,950 cubic yards of gravel fill will be discharged into 1.4 acres of wetlands to accommodate 763 linear feet of main access road and 1,944 linear feet of golf cart paths. The golf course architect will design the stormwater runoff and drainage systems to control erosion and moderate impacts to wetlands. Tributaries to salmon spawning and rearing streams will be protected by buffer strips which will also control erosion. Sewage from the clubhouse and maintenance building would be treated by extended aeration package plants and sand filters.

2.0 SAMPLING LOCATIONS AND PREVIOUS TESTING

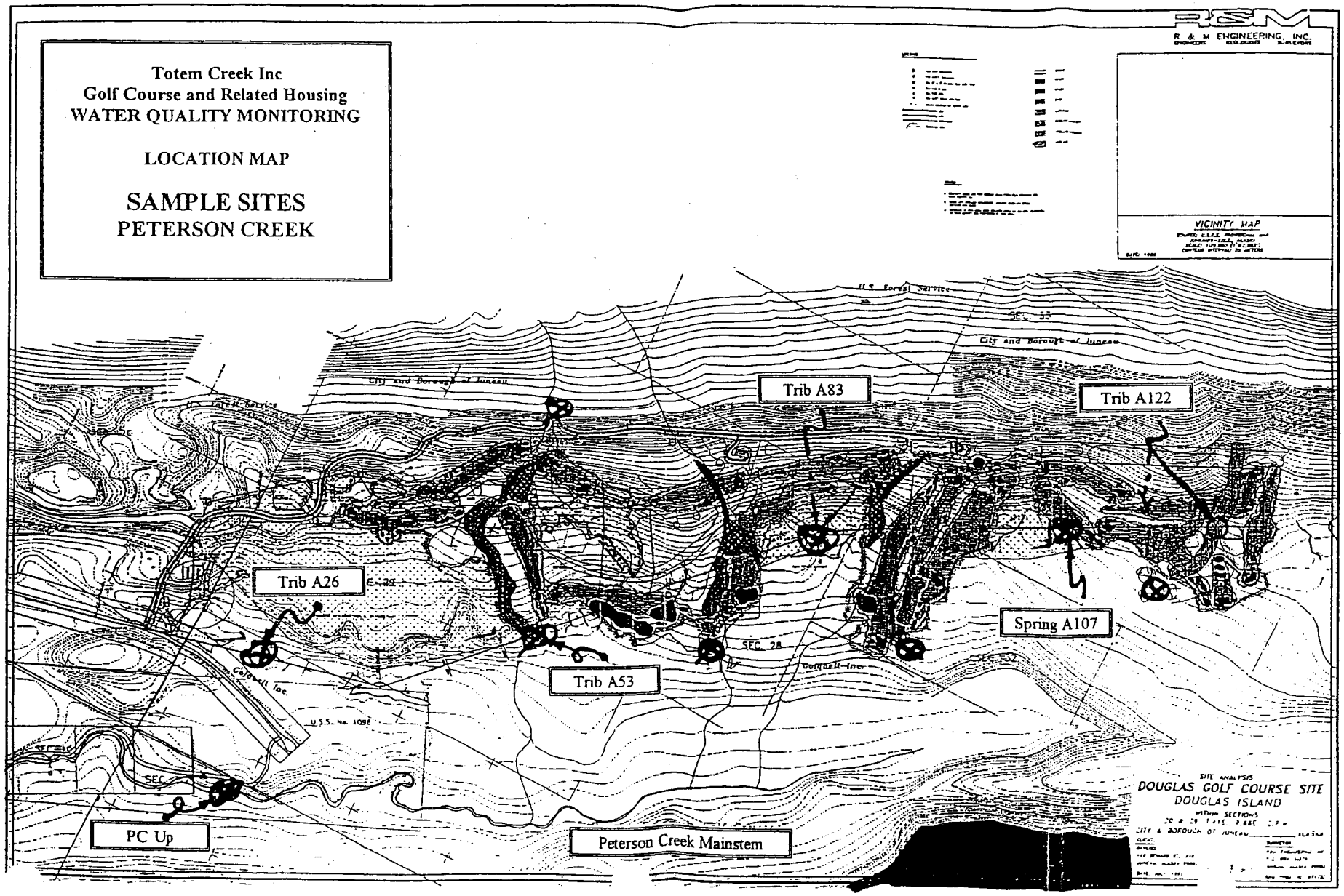
Sample locations have been revised as a result of stream surveys in October and November 1995, other testing in 1995 and 1996, and an ADEC Certificate of Reasonable Assurance. In fall 1995, we followed every stream and drainage that intercepted the old DOT&PF "A-line" survey done for the DEIS for the Highway Extension Project in the early 1980s. We used Dan Bishop's stream survey as a basis for our work. Each stream was surveyed up to the elevation where the stream either disappeared or where fish blocks were encountered due to steep terrain. Some tributaries shown on USGS Quads were found to be dry. Other large tributaries were not shown on USGS Quads.

Sample locations can be seen on the site map on the following page. Four of the stream sites shown – A26, A53, A83, and A122 – are the only tributaries to Peterson Creek that flow across the proposed golf course area as it is now envisioned. Station A107 is a spring that orginates at the downhill of the proposed fairway for hole #6. Sampling locations are located downstream of the proposed activities and areas to be disturbed. Stations A73 and A93 were added in 1998 as requested by ADEC as part of the Certificate of Reasonable Assurance. Future changes in locations will be discussed with ADEC, CBJ, and interested memebers of the public prior to sampling.

Totem Creek Inc
Golf Course and Related Housing
WATER QUALITY MONITORING

LOCATION MAP

SAMPLE SITES
PETERSON CREEK



Results of Previous Testing:

In summer 1995, we tested some water in Peterson Creek (PC) and Stream A26 about 1000 feet upstream of the A-line at a transition zone between upland Wadleigh soils and wetland Maybeso soils. Results of those tests are tabulated below.

Summary of Lab Results from Samples Taken 6/12/95

	units (LDL)	PC Mouth	PC Up	Trib "A26"
Turbidity	NTU (0.05)	0.85	1.1	0.30
Color	acu (5)	40	40	100
Conductivity	umho/cm (4)	240	48	36
pH	--	7.5	7.3	7.1
Nitrates	ppm (0.10)	0.11	0.13	0.13
Phosphates	ppm (0.05)	<0.05	<0.05	< 0.05
Fecal Coliforms	MPN/100ml	170 and 220 (fd)	540	33

Notes and comments on these results:

1. Locations of sampling are shown on the map on page 4;
2. "PC Mouth" showed indications of brackish water and tidal influence and this site will not be used in the future;
3. Low turbidity values do not reflect a need for routine TSS testing;
4. LDL = lower detection limit of testing procedure;
5. Fecal coliform indicate this water is not safe to drink without treatment;
6. (fd) = field duplicates for fecals were within acceptable limits.

We also collected some background samples on 23 July 1996 to represent typical summer conditions, and test results have been tabulated below.

Summary of Lab Results from Samples Taken 7/23/96

	units (LDL)	PC Up	Trib "A26"	Trib "A53"
Temperature	deg F	56	54	54
Turbidity	NTU (0.05)	0.44	0.22	0.08
Color	acu (5)	55	110	23
Conductivity	umho/cm (4)	54	33	43
pH	--	7.5	7.3	7.7
Nitrates	ppm (0.10)	<0.1	<0.1	<0.1
Phosphates	ppm (0.05)	<0.05	<0.05	< 0.05
Iron	ppm (0.10)	0.19	0.21	<0.1
Fecal Coliforms	MPN/100ml	32	5	8 and 8 (fd)

In September 1996, Juneau encountered a high rainfall described as the 100-year storm. Within 24 hours after the rain storm, we took a samples. Results follow.

Summary of Lab Results from Samples Taken 9/26/96

	units (LDL)	PC Up	Trib "A26"
Turbidity	NTU (0.05)	0.90	0.69
Color	acu (5)	220	300
Conductivity	umho/cm (4)	42	30
Alkalininty	ppm (2)	14.0	4.8

In October 1996, we sampled for typical fall season conditions. Results follow.

Summary of Lab Results from Samples Taken 10/4/96

	units (LDL)	PC Up	Trib "A26"	Trib "A53"	Trib "A83"	Trib "A101"
Temperature	deg F	43.9	46.6	43.0	43.7	43.9
Turbidity	NTU (0.05)	0.58	0.49	0.18	0.62	0.32
Color	acu (5)	200	250	75	--	100
Conductivity	umho/cm (4)	34	33	39	57	46
pH	--	7.5	7.3	7.3	7.6	7.6
Nitrates	ppm	nd	nd	nd	nd	nd
Phosphates	ppm	nd	nd	nd	nd	nd
Dissolved Oxygen	ppm (1)	13	12	14	14	11
Fecal Coliforms	MPN/100ml	8	7	<2	27	2

"nd" = no detection using Hach kit methods

In late December 1996 and early January 1997, an extended cold spell reduced surface water flows to a "worst case" condition. On January 10th, we sampled one flowing spring at A107 and noted much less flow at springs A69 and A72. Streams A26, A53, and A83 were frozen solid at the A-line but some flowing water gurgling noises could be heard under ice for these streams at the control line intercepts futher upgrade. The water measurements at spring A107 were as follows.

Measurement @ Spring A107	Results
Temperature	41.2 deg F
Dissolved Oxygen	13 ppm
Conductivity	66 umho/cm
pH	7.6
Turbidity	0.25 NTU
Color	13 acu
Flow (using floating stick method)	100,000 gallons per day
Fecal Coliforms	0 colonies per 100 ml

3.0 TESTS SELECTED: RATIONALE AND FREQUENCY

3.1 Fecal Coliform Bacteria

Coliform bacteria can originate from the intestinal tract of animals. Coliform bacteria will be found in most natural surface waterways. Levels above natural background often indicate the presence of untreated sewage or urban storm water runoff. High levels of coliform indicate the presence of disease-causing organisms, such as the bacteria that cause dysentery or the parasites that cause *Giardiasis*. For this reason, background sampling for coliform to find the natural level is essential, especially for Peterson Creek with beaver, deer, and bear in the watershed. Samples will be taken monthly during golf operating season and during the non-operating season, once in November and once in February.

3.2 Turbidity

Turbidity measures the light-scattering effects from finely suspended particles in the water. These suspended particles originate from natural weathering, erosion from road construction, and golf course runoff. Natural pulses of high turbidity often can be seen after high rainfalls or during breakups. Samples will be taken monthly during golf operating season and during the non-operating season, once in November and once in February. Events of high rainfall or breakup will be followed and samples may be taken to look for extremes due to natural variations.

3.3 Total Suspended Solids

The finely dispersed particles larger than colloidal but small enough to remain suspended in turbulent water will also result from road erosion, course runoff, and other activities as discussed in the turbidity section. TSS are those particles that can be filtered out with a paper filter. Samples will be taken if the turbidity is greater than 10 NTU.

3.3 Nitrates and Phosphates

Most golf courses will require fertilization to promote grass growth. Slow release nitrogen fertilizers are often used in golf courses. Improper use of fertilizers or improper types of fertilizers (the normal agricultural fertilizers do not work well on golf courses) will result in elevated levels of nitrogen and phosphates in the runoff. Background levels of nitrates and ortho-phosphates will provide the best indicator of fertilizer runoff problems. Samples will be taken monthly during golf operating season and during the non-operating season, once in November and once in February.

3.4 pH

Southeast Alaska soils and tea-colored bog streams are naturally acidic. Often, the pH of soil must be adjusted for optimum plant growth. The addition of lime, crushed seashells, or other alkaline chemicals may be needed for golf course fairways or greens. Monitoring of pH in the watershed will indicate evidence of excessive alteration. Samples will be taken monthly during golf operating season and during the non-operating season, once in November and once in February.

3.5 Class A Drinking Water

Since Peterson Creek is used for drinking water supplies, we will sample it yearly for the spectrum of inorganics, organics (BTEX and PAH), and pesticides that would be normally required for a Class A Public Drinking Water Supply, as set forth in 18 AAC 80.200. Sample location would be the mouth of the Creek above the influence of tidewater. Iron will also be tested at all sampling stations.

3.6 Characteristic Testing

Certain basic water quality testing will be done to provide general information about Peterson Creek. Such tests will include dissolved oxygen, conductance, alkalinity, hardness, color, and temperature. Samples will be taken monthly during golf operating season and during the non-operating season, once in November and once in February.Ammonia nitrogen will be tested to verify the assumption that nitrogen will be in the oxidized state. We do not suspect any reason for any of these parameters to be outside of normal limits. Conductance will be used routinely as an indicator of fluctuations

3.7 Event Sampling

Following high rainfalls and breakup or following long periods without rainfall, samples will be taken to determine the fluctations caused by natural forces.

3.8 Future Sampling and Frequency

Modifications will be made in the future as more information is developed and as more activities are known. For example, if the need for pesticides or herbicides becomes apparent, any use of those chemicals will be regulated by permits. Those permits will require certain sampling depending upon those chemicals and their proposed used. Likewise, stormwater runoff and wastewater discharge permits may require certain other monitoring of water quality.

4.0 TESTING AND SAMPLING PROCEDURES

4.1 Techniques and Approach

Samples will be grab samples taken by hand.

4.2 Sample Containers, Handling Procedures, and Preservation

Filled sample containers would be packed in frozen blue ice and placed in an ice chest to maintain a temperature of four degrees Centigrade or less. Maximum holding times, preservation methods, and others are listed as follows in Sec 4.3

4.3 Field Testing

Dissolved oxygen, temperature, and pH will be measured in the field at the time of sampling. pH will also be measured in the laboratory.

ANALYTICAL REQUIREMENTS

Test	Container	Preservation	Holding Time
Fecal coliform	120-ml sterilized	cooled to 4 deg C	6 hours
Turbidity Color	1 liter plastic	cooled to 4 deg C	48 hours
NO_3 o-PO_4	use turbidity bottle	cooled to 4 deg C	48 hours
pH	use turbidity bottle	cooled to 4 deg C	asap
Inorganics	1 liter plastic	4 deg C	6 months
Organics	three 40-ml glass, amber	4 deg C; pH<2 HCl	7 days
Herbicides	1 liter glass, amber	4 deg C	7 days
Pesticides	1 liter glass, amber	4 deg C	7 days

4.4 Chain-of-Custody Procedures

From the time the sample containers are received from the lab until the lab has disposed of them, the sample containers will be under control and supervision. The sample will either be in the possession or view of a responsible identified person or locked up or in a designated secure area. Upon return from the field, an Chain of Custody forms would be filled out by the project manager.

4.5 Field Quality Control Measures

4.5.1 Duplicates or Field Splits: At least one sample site during the sampling program, two sample jars would be filled from the same sample location. Field duplicates will be made available to ADEC or any other party requesting them for independent verification.

4.5.2 Negatives, Positives: From time to time, samples of sterilized water or known to be contaminated with coliforms will be submitted for testing.

4.5.3 Trip Blanks: When supplied by ARI, trip blanks will be carried to the field and returned to the laboratory unopened.

5.0 ANALYTICAL PROCEDURES

5.1 Laboratory

5.1.1 Class A: inorganics, organics, pesticides, herbicides

Lab Contact:
Dave Mitchell
Analytical Resources, Inc
333 Ninth Avenue N
Seattle, WA 98109-5187
206-621-6490

ARI follows Protocols for EPA Contract Laboratories and has been certified by the US Army Corps of Engineers, the Washington Department of Ecology, and the Alaska Department of Environmental Conservation. The ARI Quality Assurance Plan is available for review.

5.1.2 Fecals, Turbidity, Nitrates, Phosphates, pH, inorganics

Lab Contact:
David Wetzel
Analytica Alaska, Inc.
Shuane Drive
PO Box 2014
Juneau, AK 99801
907-780-6668

5.1.3 Field Testing

We may use Hach or other field measurement kits for coliforms, dissolved oxygen, alkalinity, pH, alkalinity, hardness, iron, nutrients, and other parameters.

5.2 Laboratory Quality Control

Both labs routinely use matrix spikes, lab splits, surrogate recoveries, method blanks, and similar measures for in-house quality control. These practices comply with EPA-recommended methods.

5.3 Data Reduction

Formulae, calculations, interpretations of method blank results, and names of those involved in data reduction will be included on data sheets and attached as part of the final report.

6.0 QUALITY ASSURANCE PROCEDURES

6.1 QA Objectives

Test results should meet the following objectives in order to be reliable enough to support regulatory decisions.

DATA QUALITY OBJECTIVES FOR MEASUREMENTS

Parameter	Method #	Detection Limits	Precision	Accuracy
Fecal coliform	9221	1	na	25% to 200%
Turbidity	180.1	0.05 NTU	+/- 20% RPD	na
Color	110.2	5 ACU		
Nitrates	300.0	0.1 ppm	+/- 10% RPD	90% to 110%
o Phosphates	365.2	0.05 ppm	+/- 10% RPD	90% to 110%
pH	150.1	na	na	na
Inorganics	6010, 7000 et seq	varies	+/- 20% RPD	75% to 125%
Organics	524.2	1 ppb	+/- 20% RPD	75% to 125%
Herbicides	8151	1 to 10 ppb	+/- 30% RPD	30% to 150%
Pesticides	8081	25 ppt to 1 ppb	+/- 30% RPD	30% to 150%

Details on minimum detection for inorganics and pesticides can be found in ARI's QA plan and will also be presented on their final report.

Formulae for precision and accuracy can be found in ADEC's "Guidelines for Preparing Quality Assurance Project Plans" Revision 3, dated September 20, 1990.

6.2 Comparability, Completeness and Representativeness

Various sets of data will be compared with one another. For example, trends, highs, and lows in soil contaminant data will be compared with trends, highs, and lows in water contaminant data. All data should be handled in the same manner so that data sets can be compared. Also, the amount of invalid data thrown out because of poor precision or accuracy should be compared with the total amount of data. All invalid data should be explained. Finally, sampling plans will be reviewed to insure that samples were taken at locations most likely to be contaminated, when that is the purpose.

6.3 Data Validation

Upon receipt of returned Chain of Custody forms and analytical results, a second determination will be done to find if holding times have been exceeded and review QA/QC results to determine validity of data.

6.4 Corrections for Out-of-Control Situations

When holding times, method blank contamination, recovery of surrogate standards in samples, or other deviations of QC measures outside of established control limits have been detected by the lab, they will notify the samplers of this situation. The proposed actions to re-sample or modify the sampling program will be presented to the agencies for their consideration and advice.

6.5 Performance Audits

ADEC and ADF&G Juneau Habitat office will be notified in advance of sampling activities to allow oversight of field activities to determine if QA/QC measures as outlined in this plan have been followed. Any other party requesting prior notice will also be advised of sampling activities so that they may be able to accompany the project samplers.

6.6 Final Reports

The lab will submit test results and QA/QC information. Interpretation of results, information, and field testing will be provided in the final report. Copies of all lab results will be attached to the report. Reports and results will be available to the agencies and public. Any exception to Water Quality Standards will be reported to ADEC.

7.0 EQUIPMENT LIST

Survey Equipment

- camera, film
- field notebook
- tape measure
- pen

Sampling Equipment

- D.O. sampling bottle, line
- thermometer
- sample jars (from labs)
- indelible label markers
- blue ice (frozen)
- ammonia kit
- conductivity meter
- D.O. test chemcials
- extra D.O. bottles
- extra labels
- ice chest
- pH meter
- iron kit

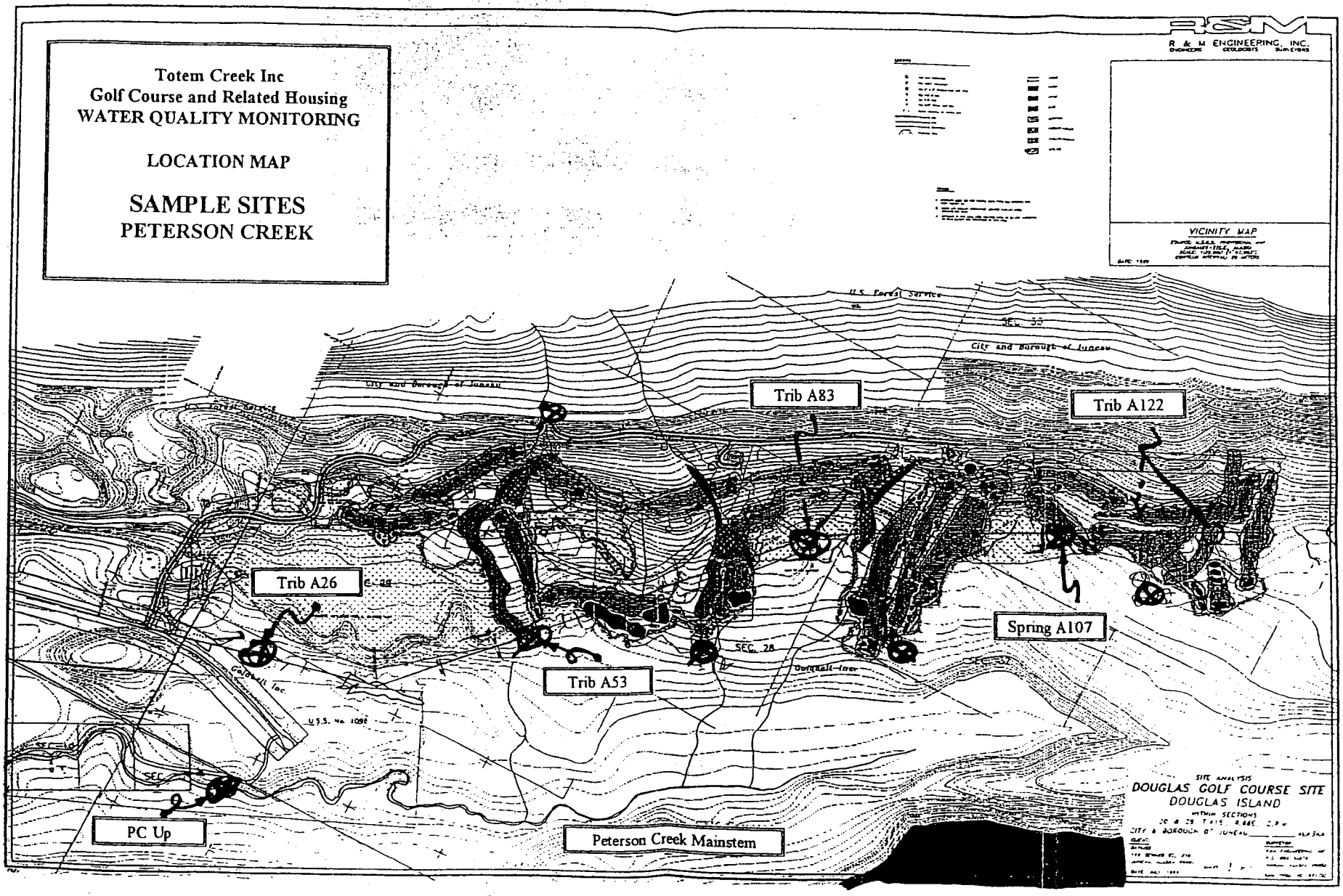
Safety Equipment

- flares
- VHF radio
- first aid kit
- duct tape, soap
- 12 gauge or bear spray
- flashlight
- cellular phone

8.0 SAFETY PROCEDURES

Trip plans and return times will be left with a responsible party. Whenever possible, two people will operate using the buddy system. Weather forecasts will be checked prior to departure. VHF batteries will be fully charged. Lena Point marine operator coverage on Channel 25 is excellent for this area in the event of emergency.

[end of plan]


Totem Creek Inc
Golf Course and Related Housing
WATER QUALITY MONITORING
LOCATION MAP
SAMPLE SITES
PETERSON CREEK
R & M ENGINEERING, INC.
VICINITY MAP
Trib A83
Trib A122
Trib A26
Trib A53
Spring A107
PC Up
Peterson Creek Mainstem
U.S. Forest Service
City and Borough of Juneau
SEC. 28
SITE ANALYSIS
DOUGLAS GOLF COURSE SITE
DOUGLAS ISLAND