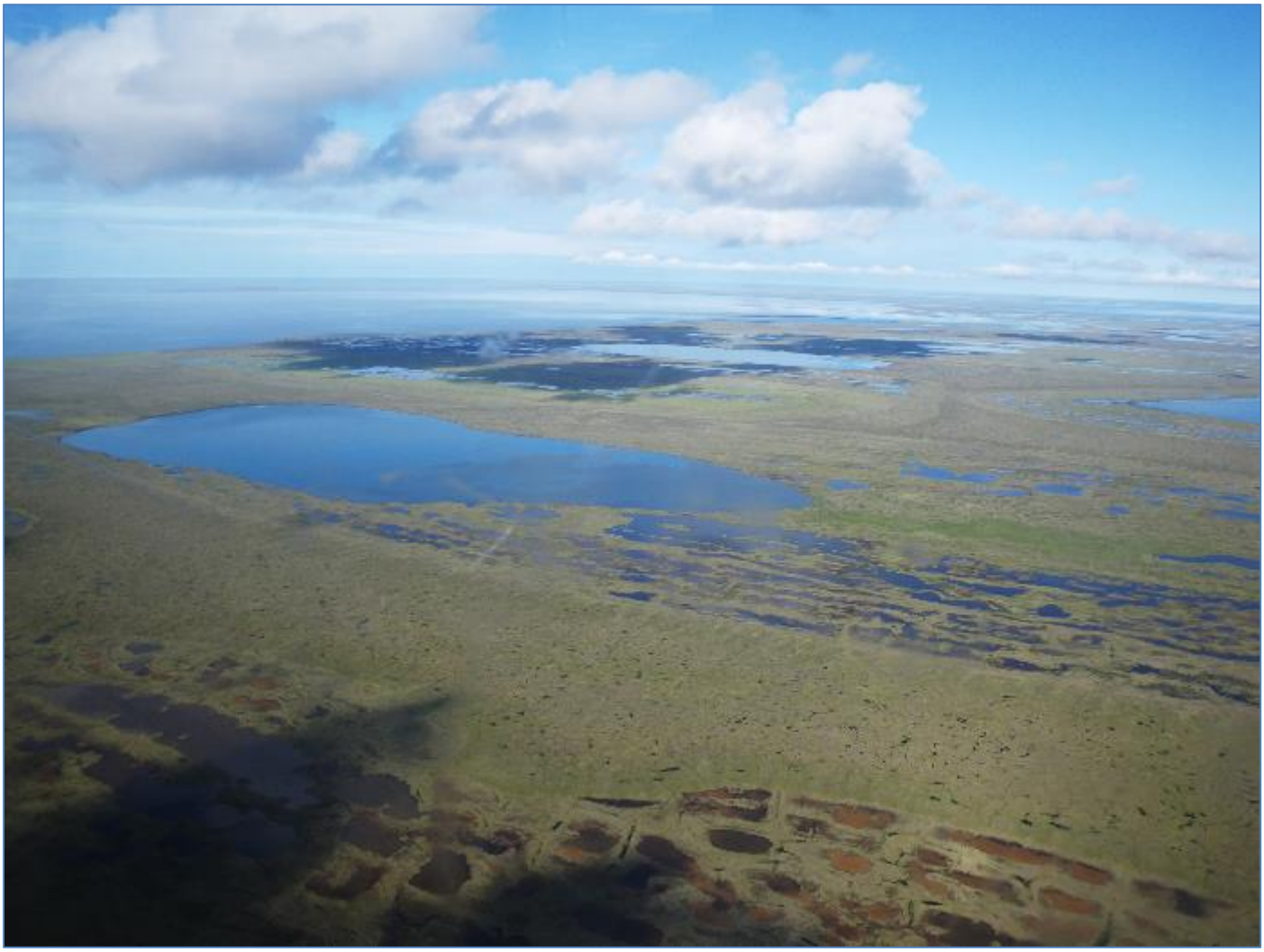
Field Report

Alaska Monitoring and Assessment Program (AKMAP)

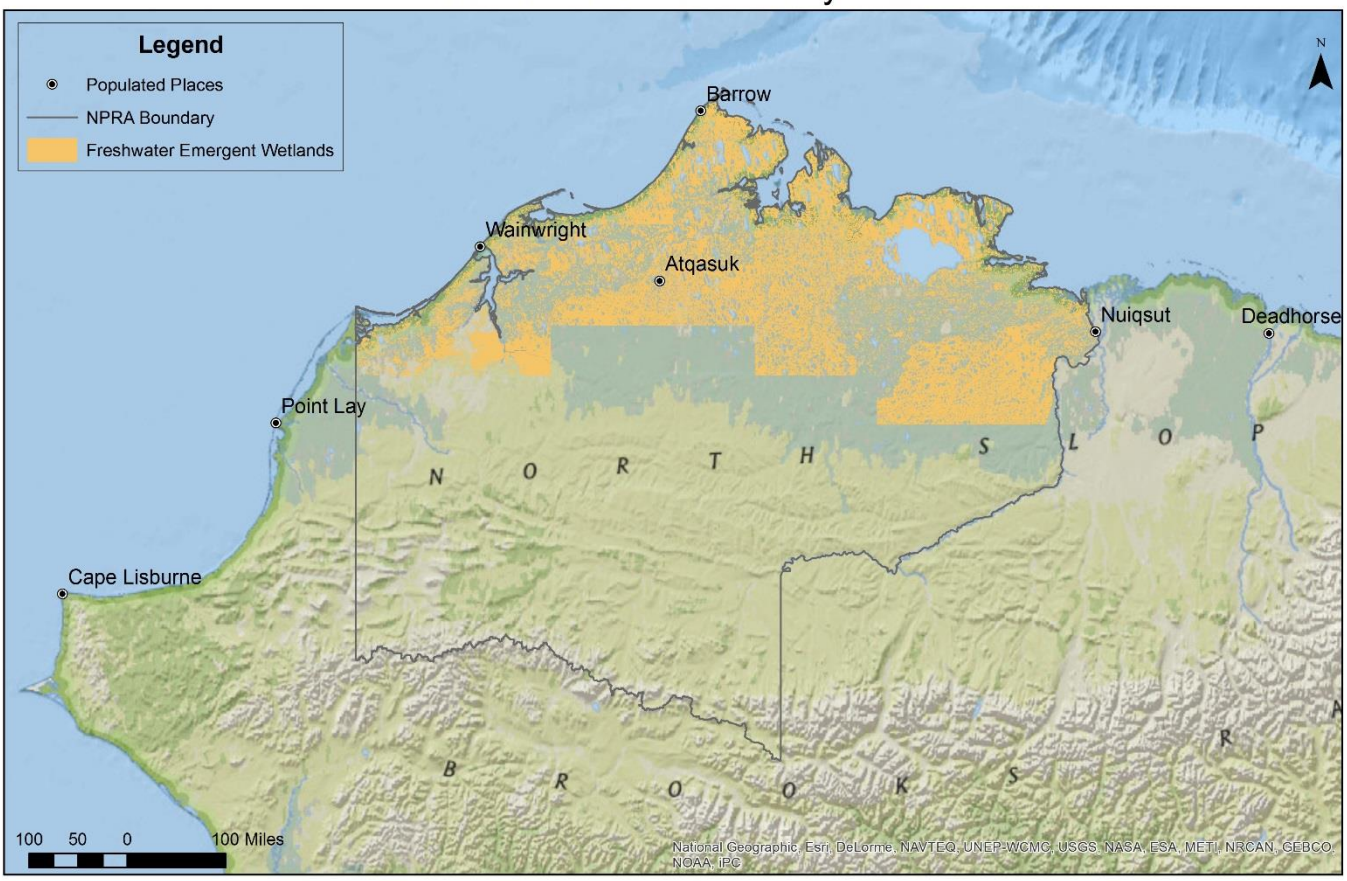
2011 Arctic Wetlands Survey

July 6 – August 1, 2011



Alaska Natural Heritage Program
University of Alaska Anchorage

Alaska Monitoring and Assessment Program
2011 Arctic Wetlands Survey Area



Acknowledgements

This survey was funded in part through Environmental Protection Agency (EPA) Section 106 Clean Water Act grant I-00J28601. Work was completed in cooperation with University of Alaska's Alaska Natural Heritage Program (AKNHP), EPA, USDA Natural Resource Conservation Service (NRCS), North Slope Borough, Bureau of Land Management, Olgoonik Fairweather LLC, Shell Oil and the Barrow Arctic Science Consortium.

Disclaimer

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AKMAP 2011 Arctic Wetlands Survey

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The Alaska Department of Environmental Conservation (DEC) established the Alaska Monitoring and Assessment Program (AKMAP) in 2004. It focuses on conducting applied environmental research that uses a statistical survey design to provide estimates of the spatial extent of water quality based on a variety of indicators. Examples of indicators include chemical contaminants, macroinvertebrate community structure and water chemistry. Environmental managers use this information to improve and protect Alaska's water quality.

In an effort to characterize the state of the nation's aquatic resources EPA has partnered with states and tribes to complete a National Wetlands Condition Assessment (NWCA). These assessments, or surveys, are designed based on a random selection and have been used in a variety of fields (health surveys, election polls, etc.) to determine the status of large populations or resources of interest using a representative sample of relatively few numbers or sites. Random surveys provide scientifically-defensible assessments of the nation's waters and can be used to track changes in condition over time.

As part of NWCA DEC and our partners the University of Alaska's Alaska Natural Heritage Program (AKNHP), EPA, and USDA Natural Resource Conservation Service (NRCS) focused on freshwater emergent wetlands in the Arctic Coastal Plain (ACP) of the National Petroleum Reserve-Alaska. This survey is the second in a five year series of aquatic resource surveys within this region. Other surveys that will be or have been completed in this region include lakes, rivers/streams and coastal.

Freshwater emergent wetlands, identified from the National Wetland Inventory, are the dominant wetland type in this region and were used to develop the sample population. From this population a potential of 57,188 freshwater emergent wetland polygons exist, totaling more than 5 million acres. Buffers were created around high subsistence use areas within the sample population to relieve community concerns about potential helicopter interference with subsistence hunting activities, wetlands in the buffers areas were excluded from the sample population. From the remaining population 40 random sites were selected, these sites were selected according to national protocols using a Generalized Random-Tessellation Stratified design. Alaska's limited infrastructure, small population base, and the remote nature of most of the state drives selection of sites in random surveys, typically only selecting sites in reference or near reference condition. In prior DEC surveys this proved to be problematic as a range of disturbance is needed to understand condition and develop metrics based on stress. To overcome this we added 10 targeted sites to our survey. These targeted sites were known or potentially impacted freshwater emergent wetland sites within the sample area. A summary of wetland sites surveyed is shown in Table 1.

Table 1. Summary of sites surveyed during the 2011 Arctic Wetlands Survey. GPS coordinates were collected using North American Datum of 1983.

Site ID	Stratum	Date	Latitude	Longitude	Landowner	Region
NWCA11-AK-0001	Random	7/9/11	69.99209	-152.65298	BLM	Inigok
NWCA11-AK-0002	Random	7/26/11	70.02784	-159.35597	BLM	Wainwright
NWCA11-AK-0003	Random	7/28/11	70.43744	-157.67676	BLM	Wainwright
NWCA11-AK-0004	Random	7/18/11	70.49812	-155.26105	BLM	Barrow
NWCA11-AK-0005	Random	7/9/11	69.8811	-151.88908	BLM	Inigok
NWCA11-AK-0006	Random	7/13/11	69.92175	-152.89496	BLM	Inigok
NWCA11-AK-0007	Random	7/11/11	70.51542	-154.14502	BLM	Inigok
NWCA11-AK-0008	Random	7/10/11	70.1015	-154.36507	BLM	Inigok
NWCA11-AK-0009	Random	7/27/11	70.63903	-159.49796	Olgoonik Corp.	Wainwright
NWCA11-AK-0010	Random	7/15/11	70.98132	-154.98207	BLM	Inigok
NWCA11-AK-0011	Random	7/31/11	70.07401	-160.67097	BLM	Wainwright
NWCA11-AK-0012	Random	7/29/11	70.80963	-159.30898	BLM	Wainwright
NWCA11-AK-0013	Random	8/1/11	70.26209	-160.55394	BLM	Wainwright
NWCA11-AK-0014	Random	7/17/11	70.84241	-156.48596	BLM	Barrow
NWCA11-AK-0016	Random	7/30/11	70.6232	-158.57307	BLM	Wainwright
NWCA11-AK-0017	Random	7/20/11	70.79968	-157.36211	BLM	Barrow
NWCA11-AK-0019	Random	7/30/11	70.57965	-158.12309	BLM	Wainwright
NWCA11-AK-0020	Random	7/21/11	70.79881	-155.69974	BLM	Barrow
NWCA11-AK-0021	Random	7/20/11	70.86152	-157.33296	BLM	Barrow
NWCA11-AK-0022	Random	8/1/11	70.68282	-159.24397	BLM	Wainwright
NWCA11-AK-0023	Random	7/31/11	70.11031	-161.07402	BLM	Wainwright
NWCA11-AK-0025	Random	7/29/11	70.71672	-158.56007	BLM	Wainwright
NWCA11-AK-0026	Random	7/22/11	70.67279	-154.76678	BLM	Barrow
NWCA11-AK-0027	Random	7/19/11	70.86471	-156.18303	BLM	Barrow
NWCA11-AK-0028	Random	7/22/11	70.63864	-154.3499	BLM	Barrow
NWCA11-AK-0029	Random	7/11/11	70.36023	-153.5041	BLM	Inigok
NWCA11-AK-0030	Random	7/8/11	69.9251	-153.18405	BLM	Inigok
NWCA11-AK-0032	Random	7/12/11	70.05158	-154.88197	BLM	Inigok
NWCA11-AK-0033	Random	7/28/11	70.25952	-157.89909	BLM	Wainwright
NWCA11-AK-0034	Random	7/18/11	70.40982	-155.24001	BLM	Barrow
NWCA11-AK-0035	Random	7/10/11	70.14108	-153.71333	BLM	Inigok
NWCA11-AK-0036	Random	7/12/11	70.05555	-155.24585	BLM	Inigok
NWCA11-AK-0037	Random	7/13/11	69.78378	-152.57593	BLM	Barrow
NWCA11-AK-0038	Random	7/13/11	69.78378	-152.57593	BLM	Inigok
NWCA11-AK-0040	Random	7/26/11	70.16931	-159.30106	BLM	Wainwright
NWCA11-AK-0041	Targeted	7/23/11	70.97849	-154.67389	BLM	Inigok
NWCA11-AK-0044	Targeted	7/23/11	70.97849	-154.67389	BLM	Barrow
NWCA11-AK-0045	Targeted	7/6/11	70.91096	-153.25429	BLM	Inigok
NWCA11-AK-0047	Targeted	7/16/11	71.27647	-156.63353	Ukpeagvik Inupiat Corp.	Barrow
NWCA11-AK-0048	Targeted	7/8/11	70.004	-153.09778	BLM	Inigok
NWCA11-AK-0050	Targeted	7/29/11	70.61094	-159.8714	Olgoonik Corp.	Wainwright

In July and August 2011 DEC staff, with partners from AKNHP and NRCS, sampled 41 freshwater emergent wetlands. The sampling team consisted of two crews of two scientists each. On arrival the wetland was verified to meet survey criteria including whether the assessment area (the point identified in the sample draw) was contained within the wetland boundary, and if water depth was less than one meter. If the wetland did not meet these criteria then the site was dropped and we proceeded to the nearest alternate site. Both crews completed site layout, vegetation plots, located pre-identified soil pit locations and laid out buffer lines. The standard vegetation plot used the pre-identified site coordinates as the assessment area center point. From that point a ½ hectare vegetation plot was laid out with 40 meter transects in each of the cardinal directions – north, south, east and west. Within the ½ hectare plot, five $100m^2$ vegetation plots were laid at specified locations (Figure 1).

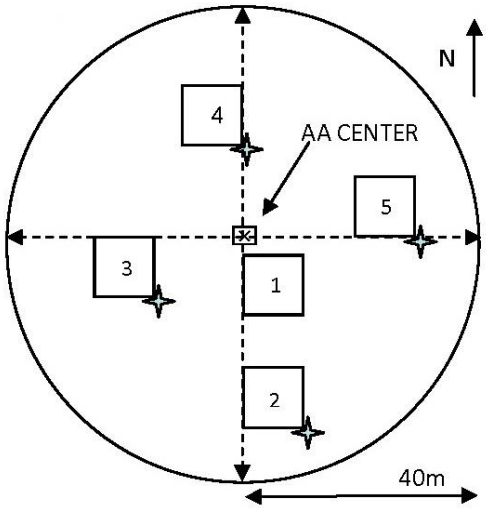


Figure 1: Map of key locations within the wetland survey plot including AA center, vegetation plots (1-5), and soil pit locations (indicated by star).

Indicators for this survey included the following:

- Hydrology: degree of saturation, degree of inundation, types of hydrologic alterations
- Water quality: dissolved oxygen, pH, conductivity, temperature, salinity, ammonia-N, total nitrate/nitrite-N, total Kjeldahl nitrogen, total phosphorus, turbidity and color
- Soils: C:N ratio, permafrost depth, trace metals, total nitrogen, total carbon, total phosphorus, pH, cation exchange capacity, enzymes, type, horizons, percent sand/silt/clay, carbon, nitrogen, sulfur, conductivity and bulk density
- Vegetation: species composition, native species, alien species, floristic quality, guild community and vegetation structure
- Biology: diatoms, algae (species composition, abundance, algal toxins), and chlorophyll-a

One crew excavated soil pits, which were located at the SE corner of vegetation plots. Two to four pits that were most representative of the wetland site were sampled. Pits were excavated using an ice auger due to shallow permafrost across the region. Soil horizons and types were identified from the soil cores, and samples for soil isotopes, enzymes, chemistry and bulk density were collected. Photos were taken in each of the four cardinal compass directions.

The second crew characterized vegetation, completed USA-Rapid Assessment Methodology (RAM), assessed hydrology, and collected water and biological samples. Vegetation was characterized within the plots shown in Figure 1. Plant species, percent cover and vegetation type were recorded, and voucher specimens were collected for quality assurance and for unknown or difficult to identify species. Three buffer plots were located on each of four (N, S, E, W) transects and at the Assessment Area (AA) center plot (Figure 2). For each buffer plot, natural cover, stressors and invasive species were recorded.

As a part of NWCA EPA evaluated the utility of RAM, which are used to quickly evaluate the ecological integrity of wetlands. Condition and stressor metrics included topographic complexity, plant community complexity, vertical and patch mosaic complexity, alterations to hydroperiod, stress to substrate and vegetation, and cover of invasive species. Presence and severity of these stressors along the north, south, east and west transects was recorded. Any other areas of the buffer zone that imagery suggested may have stressors were also evaluated.

Hydrology was described by identifying water sources and outflows, hydrologic alterations or stressors, and indicators of hydrology such as surface water and saturated soils. If sufficient water was present, water chemistry samples were collected, and surface water was characterized according to color, clarity and depth. Temperature, pH, dissolved oxygen, conductivity were collected with an YSI 556 multi-probe system.

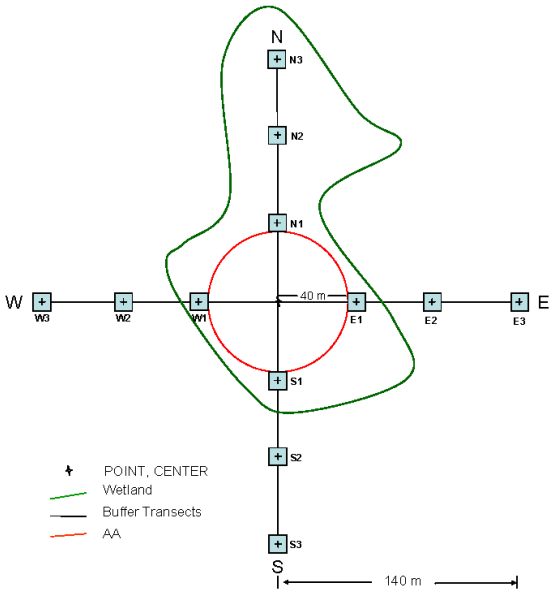


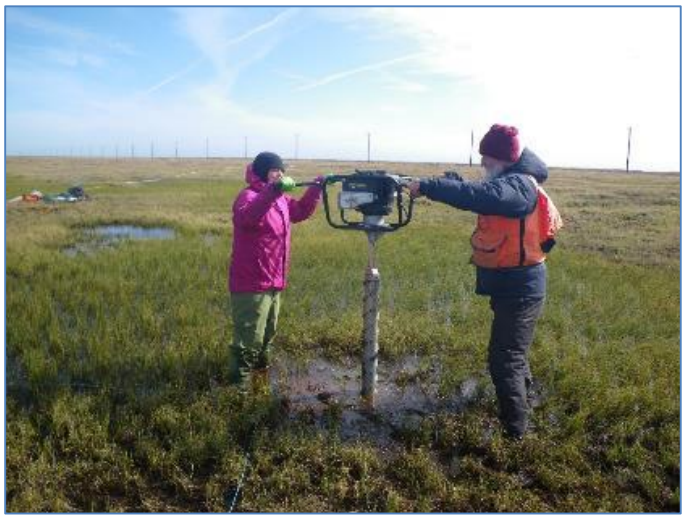
Figure 2: Buffer sample plots placed relative to vegetation plot. Note that some plots may fall in upland locations outside the wetland.

Collection of algae depended on where water was observed. When standing water was present, water samples were collected for chlorophyll-a, algal toxins and algae taxonomic identification. In addition, epiphytic algae was collected from substrate and aquatic or emergent vegetation if present. If no water was present, algae was collected from substrate for taxonomic identification.

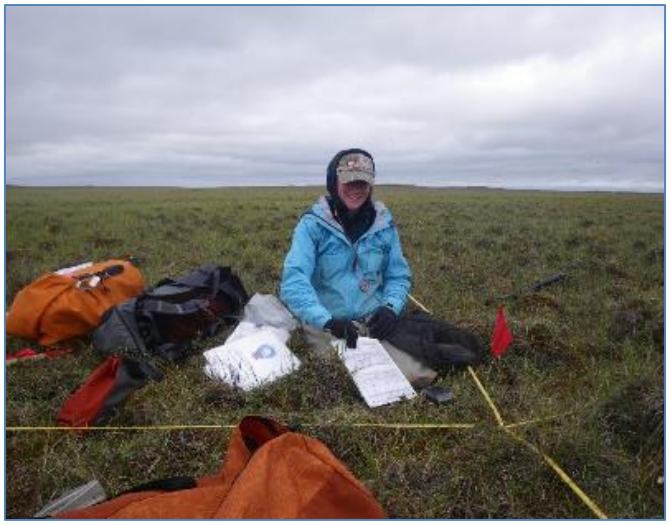
We are in the process of analyzing data several ways: overall, targeted vs. random, and across the landscape. Overall, the plant community was made up of short woody or short emergent species. The dominant plant species identified in 65% of all sites was *Carex aquatilis*; *Eriophorum vaginatum* was the second most common plant identified. When *Carex* was present it averaged 43% land cover. Water chemistry and soil profiles do not illustrate significant differences. The percentage of sites with stressors identified in the buffer and assessment area was greater in targeted sites, additionally plant and diatom richness was greater at targeted sites than random sites.

An additional concern in evaluating the data is the effect of the short growth cycle in the Arctic. Our survey began in mid-July, with some areas still frozen and dormant. This made plant identification difficult. By the end of the survey, mid-August, the peak of the Arctic growing season, plants were flowering and much easier to identify.

As expected, stressors were more often observed in targeted sites, and typically involved changes in the soil (soil compaction, recent fill, and grading). The differences identified in plant and diatom communities, may be attributed to soil alterations as well. Targeted sties were typically adjacent to a gravel fill pads, which can alter adjacent areas in numerous ways: subsidence into wetland areas, decreased ground insulation, changes to wildlife habitat, and altered drainage patterns. The next most common stressor identified was off-road vehicle use. Mild to moderately severe stressors were seen in the assessment area of 100% of targeted sites with only mild stressors observed in 37% of random sites. Similar stressors were observed in the buffer of all targeted and none of the buffers of random sites. Permafrost was encountered at all sites, the average depth permafrost occurred was 35 cm and 45 cm in targeted and random, respectively.



Photos: above, Dennis Moore and Terri Lomax collect a soil core; below, Rebecca Schaftel gathers supplies to survey a site.



Laboratory analysis is complete and some data is presented in Table 2. Detailed data is available on request.

The success of this project is attributed to the following outstanding personnel:

<u>Scientific Crew</u>
Terri Lomax, DEC
Mary Ann Theising, EPA
Dennis Moore, NRCS
Dan Bogan, UAA
Dan Rinella, UAA
Brian Heitz, UAA
Rebecca Schaftel, UAA
Matt Carlson, UAA
Rob Lipkin, contractor to UAA

Table 2 – Water Quality Sample Results

Site ID	DO (mg/L)	pH	Conductivity (µs/cm)	Temp (°C)	Sal (ppt)	Max Depth (cm)	% AA covered with surface water	Chl-a (µg/L)	Microcystin (µg/L)
NWCA11-AK-0001	2.8	6.12	46	15.9	0.02	17	40	1.20	<0.10
NWCA11-AK-0002	0.8	5.73	43	9.8	0.03	70	2	4.30	<0.10
NWCA11-AK-0003	1.8	5.97	58	12.7	0.04	20	40	14.00	<0.10
NWCA11-AK-0004	1.7	8.06	202	*	0.11	27	5	1.70	<0.10
NWCA11-AK-0005	1.2	6.18	68	11.4	0.04	32	5	3.10	<0.10
NWCA11-AK-0007	1.5	7.09	241	13.1	0.15	5	25	**	**
NWCA11-AK-0008	2.8	6.12	46	15.9	0.02	21	5	3.40	<0.10
NWCA11-AK-0011	0.01	6.2	131	5.2	0.1	115	20	0.00	<0.10
NWCA11-AK-0012	1.7	6.15	135	11.4	0.09	22	20	6.30	<0.10
NWCA11-AK-0013	0.2	5.97	137	7.9	0.1	20	92	0.00	<0.10
NWCA11-AK-0016	1.1	5.06	36	8.6	0.02	15	10	1.90	<0.10
NWCA11-AK-0019	1.1	4.78	53	8.3	0.03	32	3	3.70	<0.10
NWCA11-AK-0020	0.8	6.95	207	11.3	0.36	32	8	2.10	<0.10
NWCA11-AK-0021	0.6	5.35	124	14.4	0.07	17	0.01	3.70	<0.10
NWCA11-AK-0022	1.6	5.79	55	9.6	0.04	25	35	0.08	<0.10
NWCA11-AK-0023	0.5	5.37	52	7.9	0.04	24	5	1.90	<0.10
NWCA11-AK-0025	0.5	4.29	150	9.2	0.1	28	15	1.60	<0.10
NWCA11-AK-0026	1.7	8.61	252	12.6	0.16	50	5	0.43	<0.10
NWCA11-AK-0027	1.9	6.71	273	16.7	0.16	18	30	1.90	<0.10
NWCA11-AK-0028	1.7	8.41	200	10.4	0.13	35	10	0.40	<0.10
NWCA11-AK-0029	1.6	6.46	96	13.3	0.06	37	5	0.80	<0.10
NWCA11-AK-0032	2.6	7.08	66	14.2	0.04	19	2	1.70	<0.10
NWCA11-AK-0033	2	6.69	75	12.9	0.04	10	15	**	**
NWCA11-AK-0034	1.5	7.84	73	*	0.04	29	20	4.10	<0.10
NWCA11-AK-0035	2.8	6.12	46	15.9	0.02	31	2	0.85	<0.10

Site ID	DO (mg/L)	pH	Conductivity (µs/cm)	Temp (°C)	Sal (ppt)	Max Depth (cm)	% AA covered with surface water	Chl-a (µg/L)	Microcystin (µg/L)
NWCA11-AK-0036	2.2	7.12	38	16.6	0.02	19	40	1.60	<0.10
NWCA11-AK-0038	1.5	6.77	62	14.9	0.04	37	10	4.60	<0.10
NWCA11-AK-0040	0.6	6.03	62	9.8	0.04	115	3	0.00	<0.10
NWCA11-AK-0044	1.7	7.05	277	12.4	0.18	35	2	0.93	<0.10
NWCA11-AK-0045	2.9	7.74	488	14	0.3	30	15	0.00	<0.10
NWCA11-AK-0047	1.9	6.64	185	13.4	0.11	37	15	0.00	<0.10
NWCA11-AK-0048	1.3	6.98	206	10.5	0.14	35	5	8.00	<0.10
NWCA11-AK-0050	0.01	6.6	445	7.3	0.33	40	5	0.00	0.2

*Temperature not recorded

**Insufficient depth for water collection