

PERMIT

Permission is hereby granted to John Hobbie of Marine Biological Laboratory The Ecosystems Center Woods Hole MM 02543 to use the following-described lands:	Permit Number F-85682
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TOWNSHIP	RANGE	SECTION	SUBDIVISION
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Numerous sites mostly in the Toolik Lake Natural Resource Area within Ts. 9, 10 S., Rs. 11, 12 and 13 W., Umiat Meridian
 See attached Exhibit A for partial list of locations by GPS

Meridian	State Alaska	County	Acres (number) 0.01
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for the purpose of scientific research as described in Exhibit B

and subject to the following conditions:

1. This permit is issued for the period specified below. It is revocable at the discretion of the authorized officer of the Bureau of Land Management, any time upon notice. This permit is subject to valid adverse claims heretofore or hereafter acquired.

2. This permit is subject to all applicable provision of the regulations (43 CFR 2920) which are made a part hereof.

3. This permit may not be assigned without prior approval of the authorized officer of the Bureau of Land Management.

4. Permittee shall not enclose roads or trails commonly in public use.

5. Authorized representatives of the Department of the Interior, other Federal agencies, and State and local law officials shall at all times have the right to enter the premises on official business.

6. Permittee shall pay the United States for any damage to its property resulting from the use.

7. Permittee shall notify the authorized officer of address change immediately.

8. Permittee shall observe all Federal, State, and local laws and regulations applicable to the premises and to erection or maintenance of signs or advertising displays including the regulations for the protection of game birds and game animals, and shall keep the premises in a neat, orderly, and sanitary condition.

9. Permittee shall pay the authorized officer, in advance, the lump sum of \$ _____ for the period of use authorized by this permit or \$ 1,100 dollars annually, as rental or such other sum as may be required if a rental adjustment is made.

Permit issued for period
 From Janauary 1, 2003
 To December 31 each year

10. Use or occupancy of land under this permit shall commence within N/A months from the date hereof and shall be exercised at least N/A days each year.

11. Permittee shall take all reasonable precautions to prevent and suppress forest, brush, and grass fires and prevent pollution of waters on or in the vicinity of the lands.

12. Permittee shall not cut any timber on the lands or remove other resources from the land without prior written permission from the authorized officer. Such permission may be conditioned by a requirement to pay fair market value for the timber or other resources.

13. Permittee agrees to have the serial number of this permit marked or painted on each advertising display or other facility erected or maintained under the authority of such permit.

14. This permit is subject to the provisions of Executive Order No. 11246 of September 24, 1965, as amended, which sets forth the Equal Opportunity clauses. A copy of this order may be obtained from the signing officer.

15. Permittee acknowledges, by signing below, that he/she knows, understands and accepts the terms and conditions which this permit is issued.

16. Special conditions: (attach additional sheets, if necessary)

See Stipulations and Terms and Conditions in Exhibit C
 Permit may be automatically renewed annually by payment of annual rent per 43 CFR 2920.7(i)

John E. Hobbie
 (Permittee)

 (Authorized Officer)

 (Title) (Date)

INSTRUCTIONS

1. Submit, in duplicate, to any local office of the Bureau of Land Management having jurisdiction of the lands.
2. Applications for Land Use Permits will not be accepted unless a notification of availability of the land for non-BLM use (Notice of Realty Action) has been published in the Federal Register and for 3 weeks thereafter in a newspaper of general circulation. This provision does not apply in those situations where the publication of a (Notice of Realty Action) has been waived by the authorized officer.
3. If the annual rental exceeds \$250 dollars per year; cost of processing the application must be paid by the applicant in advance.

4. The authorized officer may require additional information to process the application. Processing will be deferred until the required information is furnished by the applicant.
 The Paperwork Reduction Act of 1980 (44 U.S.C. 3501 e. seq.) requires us to

inform you that: Information is needed to process application of land use authorizations, pursuant to 43 CFR 2920. Information shows if the applicant and proposed use meet the requirements of 43 CFR 2920.1. Applicant must respond before he/she can be granted an authorization to use public lands.

EXHIBIT C
F-85682

Additional Terms and Conditions

1. All equipment used in this project shall be removed from the public lands within 30 days of expiration of this permit.
2. There shall be no additions to this site without the written approval of the Authorized Officer.
3. At no time shall the Alyeska Access Road be blocked in any manner.
4. The sites shall be a minimum of 35 feet away from the Trans Alaska Pipeline System
5. There shall be no removal of any vegetation except for sampling.
6. All structures will be painted so as to blend into the natural environment. All colors are to be pre- approved by the Authorized Officer of BLM.
7. A site diagram of each site will be produced and submitted to the Authorized Officer along with precise geographic positions of each site. These locations shall be noted by Latitude and Longitude. This information shall be submitted to the Authorized Officer no later than December 31, of the year.
8. A summary of the previous field seasons activities shall be submitted to the Authorized Officer by December 31st of each year during the authorized period. The summary shall include the approximate number of times each site was visited, by how many people, and at what time periods. This summary shall also include any changes to the type of collection taking place and any proposed site additions.
9. Reprints of reports, publications and abstracts will be submitted to the Authorized Officer.
10. A copy of all data acquired will be submitted to the Authorized Officer upon Permit expiration or renewal.
11. All operations must not impede rural residents from pursuing their traditional subsistence activities (ANILCA, PL 96-487).
12. Protection of Survey Monuments. The Holder shall protect all survey monuments. Survey monuments include, but are not limited to, General Land Office and Bureau of Land Management Cadastral Survey Corners, reference corners, witness points, U.S. Coast and Geodetic benchmarks and triangulation stations, military control monuments, and recognizable civil (both public and private) survey monuments. In the event of obliteration or disturbance of any of the above, the Holder shall immediately report the incident, in writing, to the Authorized Officer and the respective installing agency, if known. Where General Land Office or Bureau of Land

Management right-of-way monuments or references are obliterated during operations, the Holder shall secure the services of a registered land surveyor or a Bureau Cadastral surveyor to restore the disturbed monuments and references using surveying procedures found in the Manual of Surveying Instructions for the Survey of Public Lands of the United States, latest edition. If the Bureau Cadastral surveyors or other Federal surveyors are used to restore the disturbed survey monuments, the Holder shall be responsible for survey costs.

13. Snow machine use is permitted as long as the machine has a gross vehicle weight of less than 1500 pounds, the ground is frozen, and there is an average of six inches of snow cover.

14. Permittee shall observe all Federal, State and local laws and regulations applicable to the premises. Specifically the following additional permit requirements have been identified as conditions of approval:

Exclosures which prohibit fish passage require proper permitting from the State of Alaska, Department of Fish and Game.

Taking, holding or possessing fish or their eggs, birds or their eggs, or mammals or their fur for scientific or educational purposes requires a collection permit from the Alaska Department of Fish and Game.

A Fish Transport Permit may be required for the live transport of fish and their eggs.

Projects involving radioactive materials requires approval from the Nuclear Regulatory Commission.

Stipulations

1. All operations will be conducted in such a manner as not to cause damage or disturbance to any fish or wildlife and subsistence resources.
2. No chasing by vehicles or buzzing by aircraft of any wildlife. Particular attention will be given to not disturbing caribou.
3. Holder shall prohibit the feeding of wildlife. Research sites will be kept clear of garbage and potentially edible items will be kept in covered containers to discourage attracting animals. Garbage or other potentially edible items which would attract wildlife shall be kept in covered containers while awaiting incineration.
4. Aircraft shall maintain 1,000 foot above ground level (AGL) (except for take off and landings) over designated caribou concentration areas (i.e., winter and summer ranges, insect relief areas, etc.) during the specific time period designated (winter -October 1st through May 15th, summer -May 15th through September 30th) unless doing so would endanger human life or safe flying practices.
5. All operations shall be conducted with due regard for good resource management and in such a manner as not to block any stream, or drainage system, or change the character or course of a stream, or cause the pollution or siltation of any stream or lake.

6. All activities shall be conducted so as to avoid or minimize disturbance to vegetation.
7. Cultural and Paleontological Resources. Any cultural or Paleontological resource (historic or prehistoric site or object) discovered by the holder, or any person working on his behalf, on public or Federal land shall be immediately-reported to the authorized officer. Holder shall suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the Authorized Officer. An evaluation of the discovery will be made by the Authorized Officer to determine appropriate actions to prevent the loss of significant cultural or scientific values. The Holder will be responsible for the cost of evaluation and any decision as to the proper mitigation measures will be made by the Authorized Officer after consulting with the Holder.
8. Black water shall be kept separate from grey wash and kitchen waste water. Grey wash water and kitchen waste water may be filtered to remove the solids and the liquid discharged to the land surface. All solids and sludges shall be incinerated.
9. All solid wastes shall be removed from the public lands to Alaska State DEC approved solid waste disposal facilities. Solid waste combustibles may be incinerated. All non-combustible solid waste, including ash from incineration and fuel drums, shall be removed for approved disposal. There will be no burial of garbage or human wastes.
10. All fuel spills will be cleaned up immediately, taking precedence over all other matters, except the health and safety of personnel. Spills will be cleaned up utilizing absorbent pads or other Alaska State DEC approved methods.
11. As soon as possible, but not later than 24 hours, notice of any such discharge of oil or hazardous substance as defined in AS 46.03.755, 18 AAC 75.300-.307, will be given to the Authorized Officer and any other Federal and State officials as are required by law.
12. DEC approved oil spill cleanup materials (absorbents) will be carried by each field crew and stored at all fueling points and vehicle maintenance areas.
13. State and Federal safety standards for fuel handling will be followed.
14. No fuel storage or refueling of equipment will be allowed within the flood plain of a river or lake.
15. Drip basins or absorbent diapers will be placed under all non dry-disconnect-type fuel line couplings and valves.
16. Fuel storage in excess of 55 gallons and/or fuel storage containers that are situated where a spill may reach a water body or watercourse require secondary containment. Secondary containment is defined as a diked,

impermeable impoundment capable of containing 110 percent of the volume of the largest independent container.

17. Above ground storage of fuels or other petroleum products exceeding an above ground storage capacity of greater than 1,320 gallons; and/or any facility which, due to location, could reasonably expect spilled fuels to reach waters of the United States or adjoining shorelines must prepare and maintain a Spill Prevention Control and Countermeasure (SPCC) Plan in accordance with 40 CFR 112 regulations. A current copy must be on file with BLM.
18. All fuel containers, including barrels and propane tanks, shall be marked with Permittee's name, product type, and year filled or purchased (e.g., Company Name, Hydraulic Fluid, 1999).
19. Gray-checked thrushes that are captured inadvertently will be released unharmed.
20. No ground disturbing activity will be permitted within 50m of known populations of *Erigeron murii* or other identified rare plants. BLM is responsible for identifying these sites. At present *Erigeron murii* is known to exist within sections 33 and 34 T. 9 S., R. 12 E. Umat Meridian east of Toolik Lake.
21. Stream bed structures will be constructed such that the combination of structure height and subsequent water velocity allows all occurring fish species free movement within the water body.
22. Snow machine travel along portions of stream beds identified as overwintering habitat is prohibited.
23. Long-term fuel and chemical storage (not associated with active experiments) will not be permitted within 100 ft of a stream or lake edge.
24. All fertilizers and chemicals used afield will be stored in waterproof containers.
25. Batteries must be stored within rigid, waterproof boxes and securely fastened to the ground. On each site visit, batteries are to be inspected for damage and replaced as necessary.
26. In specific instances where visual sensitivity might warrant and research will not be compromised, structures, instrument case(s) and equipment should be modified in terms of color, form, line or texture to reduce contrast with background features.
27. Identified sections of boardwalk, that result in an unnecessary visual intrusion as viewed from the Dalton Highway should, in the course of normal maintenance, be replaced with boards treated with (semitransparent) stains of appropriate color to reduce visibility. Staining could be done off-

site to eliminate introduction of unwanted contaminants to the research environment.

28. Repeated use of the same trail along stream banks should be avoided to minimize bank deterioration.
29. Boardwalks will be built, used and properly maintained in areas where repeated trampling will create visible trails, water tracks, or impede vegetative growth.
30. Prompt removal of discarded or unneeded material, equipment or debris is required.
31. The following stipulations apply to projects involving (small scale) radiation release.
 - The entire work area is to be fenced and posted with access restricted to only authorized users.
 - From the top of the enclosure to four feet from the bottom, it will be covered with a small gauge bird mesh to prevent birds from entering.
 - A 1/2" hardware cloth will be buried around the kennel's perimeter or stapled to timbers to prevent access to ground squirrels. On each side of the kennel, the cloth will extend upward four feet (until it meets the bird mesh) to further prevent ground squirrel entry.

Exhibit A

F-85682

(strikethroughs are casual use)

Arctic LTER Permit Renewal

Coordinates of Primary Features

All Coordinates are UTM zone 6 meters, NAD27

TERRESTRIAL	UTM-E	UTM-N	TYPE
1981 Tussock Acidic Tundra	395334	7615041	Center of Plot Group
1988 Heath Site	394971	7616386	Center of Plot Group
1988 Shrub Site 1	395750	7616121	Center of Plot Group
1988 Shrub Site 2	394940	7615801	Center of Plot Group
1988 Tussock Acidic Tundra	393920	7614592	Center of Plot Group
1988 Wet Sedge 1	394281	7614672	Center of Plot Group
1988 Wet Sedge 2	395426	7617075	Center of Plot Group
1998 Non-acidic Tussock	392770	7615744	Center of Plot Group
Chapin Bretharte	393894	7614352	Center of Plot Group
Experimental Watershed	393694	7614498	Center of Plot Group
Imnavait Creek NEcorner	406232	7613249	Bounding Corner
Imnavait Creek NWcorner	405820	7613267	Bounding Corner
Imnavait Creek SEcorner	406315	7612337	Bounding Corner
Imnavait Creek SWcorner	405921	7612345	Bounding Corner
reuth-h	395483	7615442	Single Plot
reuth-h	395549	7615417	Single Plot
reuth-h	393519	7615096	Single Plot
reuth-h	393676	7614755	Single Plot
reuth-h	393644	7614739	Single Plot
reuth-h	393577	7614745	Single Plot
reuth-h	394394	7614511	Single Plot
reuth-h	394320	7614478	Single Plot
reuth-h	394452	7614183	Single Plot
koba-k	406430	7612612	Single Plot
koba-k	406434	7612592	Single Plot
koba-k	405936	7612509	Single Plot
koba-k	406379	7612442	Single Plot
koba-k	405939	7612488	Single Plot
LAKES			
E1	396204	7614697	Lake Centroid Coord
E2	396679	7614309	Lake Centroid Coord
E3	397175	7614402	Lake Centroid Coord
E4	398552	7614776	Lake Centroid Coord
E5	400227	7616323	Lake Centroid Coord
E6	400945	7616428	Lake Centroid Coord
Fog1	415673	7620365	Lake Centroid Coord
Fog2	415216	7619925	Lake Centroid Coord
Fog3	415384	7619180	Lake Centroid Coord
Fog4	415921	7619930	Lake Centroid Coord
Fog5	416347	7619782	Lake Centroid Coord
Green Cabin Lake	408766	7604252	Lake Centroid Coord

I Minus 1	395435	7606931	Lake Centroid Coord
I Minus 2	396740	7606574	Lake Centroid Coord
I1	394604	7608348	Lake Centroid Coord
I2	395521	7608601	Lake Centroid Coord
I3	394817	7609101	Lake Centroid Coord
I4	394819	7609550	Lake Centroid Coord
I5	394629	7610431	Lake Centroid Coord
I6	394583	7611384	Lake Centroid Coord
I7	394409	7611946	Lake Centroid Coord
I8	395037	7612956	Lake Centroid Coord
I9	394538	7613960	Lake Centroid Coord
N1	394170	7616311	Lake Centroid Coord
N2	393439	7616460	Lake Centroid Coord
N3	393215	7616630	Lake Centroid Coord
N4	392842	7616951	Lake Centroid Coord
N5	393308	7616966	Lake Centroid Coord
N6	392914	7619721	Lake Centroid Coord
N7	392382	7620083	Lake Centroid Coord
NE1	394898	7616715	Lake Centroid Coord
NE10	394203	7617727	Lake Centroid Coord
NE11	394108	7617152	Lake Centroid Coord
NE12	393652	7618840	Lake Centroid Coord
NE14	393580	7620257	Lake Centroid Coord
NE15	395115	7618055	Lake Centroid Coord
NE16	395094	7618633	Lake Centroid Coord
NE2	395185	7616986	Lake Centroid Coord
NE3	395210	7617417	Lake Centroid Coord
NE7	395293	7617791	Lake Centroid Coord
NE8	395050	7617687	Lake Centroid Coord
NE9	394671	7617813	Lake Centroid Coord
NE9B	394535	7617719	Lake Centroid Coord
S1	394293	7614592	Lake Centroid Coord
S11	392352	7615301	Lake Centroid Coord
S12	392134	7615252	Lake Centroid Coord
S13	392012	7615465	Lake Centroid Coord
S14	392353	7615958	Lake Centroid Coord
S2	393932	7614901	Lake Centroid Coord
S3	393393	7615108	Lake Centroid Coord
S4	393195	7615355	Lake Centroid Coord
S5	392923	7615420	Lake Centroid Coord
S6	392712	7615200	Lake Centroid Coord
S7	392601	7615281	Lake Centroid Coord
Toolik Lake	394139	7615495	Lake Centroid Coord

LEXEN

Toolik Lake	394139	7615495	Lake Centroid Coord
Campsite Lake	411262	7610897	Lake Centroid Coord

LAND WATER

Experimental Watershed	393694	7614498	Center of Plot Group
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STREAMBED STABILIZATION

Toolik weir 1
Toolik weir 2

394564 7614692 One End of Weir
394564 7614701 Other End of Weir

Exhibit B
F-85682
(Strikethroughs are casual use)

STREAMS

WHAT SORT OF WORK IS TAKING PLACE?

New:

1. Monitor-level water sampling and datalogger maintenance in Hershey Creek to follow recovery from fertilization experiment conducted in 2002.
2. Follow-up water and biological sampling in Ivishak Mountain Stream and Ivishak Spring Stream.
3. Survey sampling in the Upper Kuparuk and Toolik Lake Drainage area. Specific sites yet to be determined.
4. Monitor stream flow in the outlet of Toolik Lake to calibrate the long-term data on lake level to flow.

Ongoing:

1. Continue long-term fertilization and fish growth studies in the Kuparuk River.
2. Continue monitoring-level sampling and datalogger maintenance in Oksrukuyik Creek.
- ~~3. Sampling of mountain, spring, glacial and outlet streams once per summer.~~

WHERE IS WORK TAKING PLACE?

Kuparuk River - near Dalton Highway crossing, upstream to 2 km above road, downstream to 3 km below road.

Oksrukuyik Creek - from road to 3 km upstream of road

Hershey Creek – from road crossing at top of stream, downstream to 2.2 km.

Toolik Lake outlet stream.

~~Survey streams – (only visited once per summer for biological sample collection) – Sadlerochit Spring, Trevor Creek (68°17'03", 149°19'05") and China Valley mountain stream (68°24'35", 149°16'04").~~

WHAT EQUIPMENT AND MATERIAL IS AT EACH SITE?

Kuparuk River

Microperpex peristaltic pump (one used for phosphorus fertilizer addition) left on site for 6 weeks in summer, 0.2 km below Dalton Highway.

Pump size: 3x3x5 inches, driven by a 12 volt, auto type battery which is stored in a black plastic battery case on the tundra next to the pump during summer only, and recharged by a solar panel

Solar panel - standard 55 watt solar panel, ARCO Solar M-55, 1.3 m x 0.3 m size

30 gallon black plastic barrel, on site, Kuparuk R., screw-top capped black plastic with 6 cm

diameter opening at top. This contains food grade 85% phosphoric acid, is the container the material is shipped in, is carried out to the site as needed, and H_3PO_4 is pumped into the river directly from the barrel.

3 weirs, located at -1 km, -2 km and +2 km relative to road; stored under green tarps, on west side of river

Surveying stakes are located alongside the river to mark the sampling locations.

Hershey Creek

1 Campbell Scientific datalogger, summer only, internal batteries.

Small wooden stakes with flags mark the sampling locations.

Oksrukuyik Creek

3 weirs, located at -1 km, -2.7 km, and -4 km upstream from road; stored under green tarps alongside of river.

1 Campbell Scientific datalogger, located immediately downstream of the Dalton Highway crossing; summer only, internal batteries.

Toolik Lake outlet stream

A structure extending across the stream to serve as a streambed stabilization structure to help in the measurement of stream discharge. This will not impede fish movement. The structure will be two berms of natural rock with grout that extend one foot above the bottom of the stream and form a shallow V to direct water flow into a narrow central passage.

HOW ARE SITES ACCESSED?

Kuparuk River and Hershey Creek are accessed by foot from the Dalton Highway/ Kuparuk River crossing.

Oksrukuyik Creek is accessed by road to MS 118, and then by foot.

Survey streams are accessed by helicopter, or by foot from the Dalton Highway.

PERIOD OF USE FOR THE SITES

Within a season, from May 1 to September 30, and between seasons for 6 years at a time, as that is the funding cycle of NSF - LTER projects.

LAKES

WHAT SORT OF WORK IS TAKING PLACE?

- Long term monitoring of the chemical, physical, and biological parameters of Arctic Lakes
- Studies to determine the effects of nutrient enrichment, food web alteration, and other manipulations on lake processes

New Experiments

1. Low level addition of nitrogen (N) and phosphorus (P) to Lakes S6 and S7 (3x Toolik loading by area)(sampled weekly)
2. Lake TBA for addition of slimy sculpin (*Cottus cognatus*) to fish-less lake (sampled 3x year)

Continuing Experiments

1. Low level addition of N and P to Lakes E5 and E6 (4x volumetric loading of Toolik):
E5 annual loading of 2379.8 moles N (95.3kg NH₄NO₃) and 148.7 moles P (10 liters 85% H₃PO₄), E6 annual loading 141.5 moles N (5.66 kg NH₄NO₃) and 8.8 moles (595 mls 85% H₃PO₄)

New Sampling

1. Surveys of lakes in different watersheds of various glacial ages. Measure sediment nutrient fluxes, and take sediment cores to determine concentrations and vertical distributions of Fe, Mn.
2. In lakes N1 and N2 measure sediment nutrient fluxes, and take sediment cores to determine concentrations and vertical distributions of Fe, Mn.
3. ~~Surveys to identify lakes with lake trout (*Salvelinus namaycush*), arctic char (*Salvelinus alpinus*), and lakes with both species.~~
4. Alaska transect, regionalization and cross site activities. Data loggers placed in lakes in autumn prior to measurement. Lakes will receive full sampling the following summer when loggers are retrieved.

Continuing Sampling

Lakes to be sampled during the 2003-2006 field seasons as part of ongoing research.

Lakes Sampling (some lakes not sampled annually)				
Lake	Site Code	Biological Sampling Only	Full Sampling	Sampling Depths (m)*
E1	146	2x each summer	once each summer	0, 1, 10
E5	145		weekly	0, 1, 3, 5, 8, 10
E6	399		weekly	0, 1, 3
Fog 2	165		3x (every 3 weeks)	0, 1, 3, 5, 8, 12, 16
Fog 4	167		3x (every 3 weeks)	0, 1, 2
I minus	388		3x (every 3 weeks)	1, metalimnion (6)
I swamp	313		3x (every 3 weeks)	1, metalimnion (3)
11	111		3x (every 3 weeks)	1, metalimnion (5)
12	112		3x (every 3 weeks)	1, metalimnion (3-5)
13	113		3x (every 3 weeks)	1, metalimnion (3)
14	114		3x (every 3 weeks)	1, metalimnion (3)
15	115		3x (every 3 weeks)	1, metalimnion (5)
16	116		3x (every 3 weeks)	1, metalimnion
I6WH	431		3x (every 3 weeks)	1, metalimnion (2-3)
17	117		3x (every 3 weeks)	1, metalimnion (5)
18	118		3x (every 3 weeks)	1, metalimnion (5)
N1	103		once each summer	1, 3, 5
N2	104		once each summer	1, 3, 5, 8
NE-12	108	once each summer	once each summer	1, 5, 10
NE-9B	171	2x each summer	2x each summer	1, 3, 5
S1	241	once each summer	once each summer	0
S11	156	2x each summer	once each summer	1, 5, 10
S2	149	once each summer	once each summer	0
S6	107		2x each summer	1, 3, 5
S7	152		once each summer	0, 1, 2
Toolik	100		weekly	0, 1, 3, 5, 8, 12, 16, 20

*Sampling may also occur at lake inlets and outlets

Biological sampling includes:

1. Zooplankton and phytoplankton samples are collected on each sampling trip.
2. Microplankton samples are taken at every lake and depth sampled (except I series inlets and outlets).
3. Primary Production samples are taken at every lake and depth sampled.
4. Chlorophyll *a* samples are taken at every lake and depth sampled.
5. pH, temperature, conductivity, oxygen, measured at every meter on every lake and light (0, .1, .2, .5, 1 and every meter to the bottom).
6. Secchi depth is measured on every lake.
7. Alkalinity samples are taken at every lake and depth sampled. In Toolik samples are taken from each sampled depth for the first sample date only. For the remainder of the summer only epilimnion, metalimnion and hypolimnion samples are taken.

Full Sampling includes the following, in addition to biological sampling:

1. Cation and anion samples are taken at every lake and depth sampled. In Toolik samples are taken from each sampled depth for the first sample date only. For the remainder of the summer only epilimnion, metalimnion and hypolimnion samples are taken.
2. Inorganic nutrient samples (NH-4, NO-3, PO-4) are collected from each depth sampled in each lake (or inlet).
3. Total dissolved nitrogen (TDN) and total dissolved phosphorus (TDP) samples are collected from each depth sampled in each lake (or inlet).
4. Particulate (N, C, P) samples are collected from each depth sampled in each lake (or inlet) .
5. Dissolved organic carbon (DOC) samples are collected from each depth sampled in Toolik, N1, N2, S6, S7, and the I series.
6. Bacteria samples are collected from each depth sampled in Toolik.

WHERE IS WORK TAKING PLACE?

Ongoing work is all taking place in the ACEC. Sites for new experiments are undetermined.

WHAT EQUIPMENT AND MATERIAL IS AT EACH SITE?

Lake S6, S7, I-7, E5, and E6

One motorized boat will remain on lakes E5 and E6 during the summer. Lakes E5 and E6 will have two rafts located in the center of the lake, one containing a meteorological station and data loggers, another with fertilization equipment (see below).

Fertilization Equipment

- Microperpex peristaltic pump (used for phosphorus and ammonium fertilizer addition) left on site for about 6 weeks in summer. Size: 3x3x5 inches, driven by a 12 volt, auto type battery. Both the battery and pump are housed in weather tight containers secured to the raft.
- Solar panel - standard 55 watt solar panel, ARCO Solar M-55, 1.3 m x 0.3 m size, used to charge 12 volt battery.
- Tank-100 gallon HDPE tank containing dilute food grade phosphoric acid (H_3PO_4) and ammonium nitrate (NH_4NO_3) fertilizer, which is taken to the lakes as needed.
- Floating wooden platform to house fertilization equipment listed above.

Toolik Lake

- Water level gauge and temperature monitoring equipment (Campbell Scientific data logger) 50 meters upstream of lake inlet.
- On lake surface, a meteorological station (on raft) is kept during the field season and removed at the end of each season. In addition various water temperature dataloggers and suspended apparatus used for sediment/water sample incubation and primary production experiments.
- Three boats with motors are on Toolik Lake year-round. In the summer they are docked at camp, in the winter pulled up on shore. The boats are 12, 16 and 20 feet long, and powered by 8, 15 and 15 hp Honda 4 stroke engines respectively. A removable floating dock is placed out at the beginning of every field season and removed at the end of the season and placed on shore near the lake.

All lakes sampled have a float placed at the deepest point for the summer - floats are removed at the end of the field season:

In addition to floats, the following lakes also have:

- 1) 104 N-2 - divided by a nylon curtain as part of an ongoing experiment begun in 1985
- 2) 107 S-6 - a 14 foot row boat used for sampling. There will also be two tanks present with the start of the low level nutrient addition.
- 3) 152 S-7 - a 12 foot row boat used for sampling. There will also be two tanks present with the start of the low level nutrient addition.
- 4) 103 N-1 - a green Coleman canoe left on N1 during the summer for sampling
- 5) 117 I-7 - a 12 foot row boat used for sampling. There will also be two tanks present.
- 6) Tanks mentioned in #2, #3 and #5 above are described in the specific section on Lakes S6, S7, I-7, E5, and E6 (also above).
- 7) 165 Fog 2- an 8 foot row boat used for sampling

HOW ARE SITES ACCESSED?

Lakes are accessed via foot (some by crossing Toolik in boat first) or helicopter.

PERIOD OF USE FOR THE SITES

Within a season, from May 1 to September 30, and between seasons for 6 years at a time, as that is the funding cycle of NSF - LTER projects.

TERRESTRIAL

WHAT SORT OF WORK IS TAKING PLACE?

Continue with the treatment and monitoring of the 1981 and 1988 plots, and the 1998 non-acidic tussock tundra plots. (see Map T1). Treatments include nutrient addition of N and P, liming, soil acidification, greenhouse, and shade houses. The 1981 plots only have nutrient addition. A subset of treatments 1988 tussock acidic tundra plots were sampled for plant biomass.

Several small plots near the 1988 tussock acidic tundra plots were chosen for comparison to the treatments plots. These will be monitored for 2-3 years. See Table 1, reuth h sites.

Continue to monitor weather and atmospheric deposition and to maintain the LTER climate database.

Continue to track annual variation in flowering and growth of *Eriophorum* (cotton grass) along the Dalton Highway and of other species at 5 sites on the North Slope.

Continue to monitor soil N mineralization in the experimental plots using buried bags at Toolik Lake.

Work was begun in the upper Innavaik Creek watershed near Toolik Lake (see Map T1). Some preliminary sites were chosen and monitored. However locations for further study within the watershed have not yet been decided (see Table 1 for locations of some flagged sites). Work involved sampling of stream and soil water at multiple locations along the toposequence from the upper ridges to the stream that empties the watershed. In addition data loggers were installed to record physical properties of the environment, e.g. soil temperature and moisture, air temperature, stream depth, temperature and conductivity.

Two sites set up by Donald Walker are added to this permit. These are 1 km grids (a marker with UTM coordinates every 100 m), one adjacent to Toolik Lake and one along Innavaik Creek. The LTER helped pay for the Toolik site. Both are very valuable locators of sampling sites for long-term studies of vegetation change.

LTER continues to take responsibility for Terry Chapin's and Syndonia Bret-Harte's plots (BLM permit number F-91142). Syndonia will continue to visit the site for maintenance and monitoring purposes. In 2003 Syndonia plans to harvest the treatments.

WHERE IS WORK TAKING PLACE?

On the tundra surrounding Toolik Lake: Below are the UTM coordinates each of our sites.

See Table 1 and 2. and Map T1.

Table 1 Location of Arctic LTER Terrestrial sites.

Arctic LTER Permit Renewal			
Coordinates of Primary Features			
All Coordinates are UTM zone 6 meters, NAD27			
TERRESTRIAL	UTM-E	UTM-N	TYPE
1981 Tussock Acidic Tundra	395334	7615041	Center of Plot Group
1988 Heath Site	394971	7616386	Center of Plot Group
1988 Shrub Site 1	395750	7616121	Center of Plot Group
1988 Shrub Site 2	394940	7615801	Center of Plot Group
1988 Tussock Acidic Tundra	393920	7614592	Center of Plot Group
1988 Wet Sedge 1	394281	7614672	Center of Plot Group
1988 Wet Sedge 2	395426	7617075	Center of Plot Group
1998 Non-acidic Tussock	392770	7615744	Center of Plot Group
Chapin Bretharte	393894	7614352	Center of Plot Group
Innavait Creek-Shaver S NEcorner	406232	7613249	Bounding Corner
Innavait Creek-Shaver NWcorner	405820	7613267	Bounding Corner
Innavait Creek-Shaver SEcorner	406315	7612337	Bounding Corner
Innavait Creek-Shaver SWcorner	405921	7612345	Bounding Corner
reuth h	395483	7615442	Single Plot
reuth h	395549	7615417	Single Plot
reuth h	393519	7615096	Single Plot
reuth h	393676	7614755	Single Plot
reuth h	393644	7614739	Single Plot
reuth h	393577	7614745	Single Plot
reuth h	394394	7614511	Single Plot
reuth h	394320	7614478	Single Plot
reuth h	394452	7614183	Single Plot
koba k	406430	7612612	Single Plot

koba k	406434	7612592	Single Plot
koba k	405936	7612509	Single Plot
koba k	406379	7612442	Single Plot
koba k	405939	7612488	Single Plot

Table 2 Location of Latitudinal flowering sites.

Flowering sites along the Dalton		A latitudinal study on the growth and flowering <i>Eriophorum</i> .	
Site	Latitude N	Longitude W	Mile Post
Smith Lake	64.87	147.86	
Eagle Creek	65.17	145.50	102.0
Elliott Highway	65.31	149.16	94.6
No Name Creek	66.12	150.17	80.3
Kanuti	66.43	150.58	103.5
Old Man	66.46	150.63	108.4
Fish Creek	66.53	150.77	113.5
Gobblers Knob	66.75	150.68	132.0
Prospect Creek	66.81	150.68	136.8
Grayling Lake	66.97	150.34	152.3
Macs Lake	67.14	150.34	166.0
Wiseman	67.41	150.09	183.8
Sukakpak 2	67.52	149.84	192.6
Sukakpak 1	67.54	149.85	200.5
Dietrich	67.70	149.72	209.8
Snowden Mtn.	67.80	149.80	219.6
Timberline	68.03	149.65	236.0
Chandalar	68.07	149.61	238.7
Atigun Camp	68.18	149.45	251.1
Pump 4	68.43	149.38	270.5
Galbraith	68.50	149.49	276.0
Toolik Camp	68.63	149.56	284.4
Kuparuk River	68.65	149.41	289.5
Kuparuk Ridge	68.62	149.32	291.6
Toolik Dust	68.69	149.22	297.3

APPROXIMATE NUMBER OF VISITS FOR EACH SITE

Non-acid Site - In June and August: 3 to 4 times per week by 3 persons. July: 3-4 times per week by 2 persons.

Acid Tussock - In June and August: 3 to 4 times per week by 3 persons. July: 5-6 times per week by 2 persons.

Wet Sedge Block - In June and August: 3 to 4 times per week by 3 persons. July: 1 time per week by 2 persons.

Heath - In June and August: 3 to 4 times per week by 3 persons. July: 1 time per week by 2 persons.

Shrub - In June and August: 3 to 4 times per week by 3 persons. July: 1 time per week by 2 persons.

1981 Tussock - In June and August: 3 to 4 times per week by 3 persons. July: 1 time per week by 2 persons.

Imnavait Creek: 4-6 times weekly by 2-6 persons during June, July, and August

WHAT EQUIPMENT AND MATERIAL IS AT EACH SITE?

1988 Tussock Tundra:

- a) Four each of greenhouses, nutrient addition of N and P greenhouses, shade houses, and nutrient addition of N and P shade houses. Each house is 2.5 x 5 m, made of 2 x 4's and covered in the summer with clear plastic or shade cloth. Covers are removed at end of field season.
- b) Experimental exclosures made of 1.5 m high 4 x 6-inch netwire fence with smaller inside nested plots fenced with 1 inch or ½ inch hardware cloth. Two exclosures are 10 x 10 m and 8 exclosures are 5 x 10 m.
- c) Year-round weather station (3-meter maximum sensor height), including a precipitation wet/dryfall collector, tipping rain fall sensor, and soil temperature probes.
- d) Small 0.3 x 0.3 m aluminum squares or 0.3 m round plastic rings set 0.45 m deep and flush with the tundra.
- e) Boardwalks - see Map T3.
- f) 1 x 10 m snow fence.
- g) 1 m high fiberglass markers, spaced 100 m in a 1x1 km grid. Skip Walker surveyed and installed the grid in 1989.
- h) Sydonia Bret-Harte's plots - A portable data logger with thermocouple wire in 36 plots and approximately 2467 feet of boardwalk.

1988 Non-acid Tussock

- a) 2 each of greenhouses and nutrient addition of N and P greenhouses. Each house is 2.5 x 5 m and is made of 2 x 4's and covered in the summer with clear plastic or shade cloth. Covers are removed at end of field season.
- b) Not all of the boardwalks were installed. Remaining boardwalks will be installed when material and time is available. (see map T1)

1988 Wet Sedge 1 and 2

- a) 2 each of greenhouses, nutrient addition of N and P greenhouses, and shade houses. Each house is 2.5 x 5 m and is made of 2 x 4's and covered in the summer with clear plastic or shade cloth. Covers are removed at end of field season.
- b) Year-round weather station at site 1.
- c) Small 0.3 x 0.3 m aluminum squares or 0.3 m round plastic rings set 0.45 m deep and flush with the tundra.
- d) Boardwalks - see attached.

1988 Shrub Site 1 and 2.

- a) 2 each of greenhouses, nutrient addition of N and P greenhouses, and shade houses. Each house is 2.5 x 5 m and is made of 2 x 4's and covered in the summer with clear plastic or shade cloth. Covers are removed at end of field season.
- b) At Site 1- a year-round weather station (3-meter maximum sensor height), including air and soil temperature probes.

1988 Heath site

- a) 2 shade houses. Each house is 2.5 x 5 m, made of 2 x 4's and covered in the summer with shade cloth. Covers are removed at end of field season.
- b) Experimental exclosures made of 1.5 m high '4 x 6 inch net wire' fence with smaller inside nested plots fenced with 1 inch or ½ inch hardware cloth. Two exclosures are 10 x 10 m and 6 x 6 m. Exclosures are 5 x 10 m.
- c) Small 0.3 m round plastic rings set 0.45 m deep and flush with the tundra.
- d) 1 x 10 m snow fence.
- e) Year-round weather station (3-meter maximum sensor height), including air and soil temperature probes.

1981 Tussock Site.

An older site with only stakes and flags marking the various plots. Included are plots with nutrient additions, and a plot that is a long-term reciprocal transplant garden of *Eriophorum vaginatum* tussocks, established in 1980. Measurements are made in this experiment about every 5-8 years. Tussocks are marked with wooden stakes. Another plot is just off the old Toolik Lake Camp access road. One 5 x 5 m plot wired with heat cable and one 5 x 5 m control plot, both with temperature sensors (not heated or monitored at this time).

Eriophorum monitoring sites along the Dalton Highway. (see Section above: Where Working is Taking Place).

Sites, established in 1980 along the Dalton Highway, are marked with stakes. Not all sites are visited yearly for monitoring of *Eriophorum*. In some years a few of the sites may have additional parameters measured, e.g., soil chemistry, plant diversity.

Imnavait

- a) An ISCO automated water sampler and data logger at the Imnavait weir.
- b) Three to four data loggers with associated probes and solar panels are distributed along eastern slope of watershed. Several small temperature only logger near sampling points will also be installed.

- c) Soil water lysimeters placed from the crest of the hill down slope to the stream. All sampling sites are marked with flagging and wooden stakes.
- d) Short length of boardwalks will be needed at stream and water track sampling point to minimize damage to the tundra.
- e) Portable infrared gas analysis system and static chambers (for gas chromatograph analysis of collected air samples at Toolik field Station).
- f) A 10x12 ft tent, setup each year in June and taken down the end of August, will be used for storing equipment and for getting out of the weather. It will be located on a gravel pad next to the access road.

Chapin Bretharte (formerly BLM F- 91142)

Reciprocal transplant garden. Ten cores (8 inches in diameter) of moss and underlying peat were transplanted from Fairbanks to Toolik Lake in 1994 in plastic PVC tubes. Five of the cores have been harvested and removed from the site. Monitoring of the remaining 5 cores will continue. A battery operated gas analyzer will be used twice during the summer to measure the photosynthesis. A portable data logger will be kept at the site to record soil temperature, air temperature, humidity, precipitation, and radiation. Access to the site is by foot.

Impacts of vegetation change on tundra ecosystem processes. The research, species removal, will involve setting up 50 plots with a total study area of 25 x 90 feet in tussock tundra and removing different species from each plot. In 10 plots they will remove (by clipping) dwarf birch, another 10 plots will involve removing cotton grass, another 10 will be moss, and another 10 will be both moss and birch removal.

The approximately 2,217 feet of boardwalks are approximately 8 inches wide and secured in place by wooden stakes every 5-6 feet and are approximately 10 inches above the ground. The boardwalks are placed within each study plot around the rows.

All Sites

All sites have experimental plots marked by stakes and/or flags. Activities at the sites include soil sampling, both small cores (5 cm) and larger (30 cm), occasional soil pit or trench for measuring soil properties (back-filled within a day), fertilization of 5 x 10 or 5 x 20 m plots with N only (10 g N/m²/y), P only (5 g P/m²/y) and an N+P (10 g N and 5 g P/m²/y), agricultural lime and sulfur addition (new 1998) to raise and lower pH at the Tussock Tundra and Non-acid tundra sites.

During June, July and August (depending on the experiment), measurement equipment, gas sampling chambers (30 x 30 cm or 100 x 100 cm), gas sampling collars, summer only data loggers, or small 1 kw generator may be used at the sites.

All fertilizers, lime, and sulfur are carried by backpack to the sites in the beginning of June. Generally only the amount needed for each year's application is bought. Any leftover materials are stored under cover at Toolik Field Station.

Weather Stations.

Besides the stations mentioned above at Tussock Tundra, Wet Sedge, Heath, and Imnaviat sites, there is a year-round station just off the Toolik Field Station gravel pad (see attached). This station has maximum sensor height of 5 meters. In 1999 a Wyoming style snow gauge was installed next to this station.

Boardwalk. See Map T1.

DIAGRAM OF EACH SITE

See Map T1

HOW ARE SITES ACCESSED?

Access to all sites is by foot or occasionally by helicopter. Most sites are visited only 3 or 5 times a month by a few people. In sites where there are weekly visits, access by other projects or water-logged soils, boardwalks are mostly in place. Because of lack of material, some sections are not complete (see attached). If access at non-boardwalk sites were needed more frequently, and by more people, Stipulation 29 requires the installation of boardwalks.

Because several independently funded projects coordinate their data gathering with LTER-supported research, usually by additional sampling of LTER experiments, experimental plots and sites are designed to accommodate this additional sampling by making the treatments cover a larger area, and by incorporating extra untreated plots.

Non-acid Site - In June and August: 3 to 4 times per week by 3 persons. July: 3-4 times per week by 2 persons.

Acid Tussock - In June and August: 3 to 4 times per week by 3 persons. July: 5-6 times per week by 2 persons.

Wet Sedge Block - In June and August: 3 to 4 times per week by 3 persons. July: 1 time per week by 2 persons.

Heath - In June and August: 3 to 4 times per week by 3 persons. July: 1 time per week by 2 persons.

Shrub - In June and August: 3 to 4 times per week by 3 persons. July: 1 time per week by 2 persons.

1981 Tussock - In June and August: 3 to 4 times per week by 3 persons. July: 1 time per week by 2 persons.

Imnaviat - In late May and early September: 3 to 4 times per week by 2 persons. June through August: 6 time per week by 2-4 persons

All site access is by foot.

PERIOD OF USE FOR THE SITES

Typically from the last week in May to the first week in September, for 6 years at a time, since that is the funding cycle of LTER projects.

In addition sites may be visited in early and late winter (September -October; March - May) for winter sampling.

LAND-WATER

WHAT SORT OF WORK IS TAKING PLACE?

Ongoing Research

1. Watering Plot Experiment – One question being studied asks about the effect of in increase is soil moisture on the soil processes. Water is added every day so that the soil receives the natural precipitation plus the added water. Soil water chemistry, nutrients, and gases are measured and compared at experimental and control plots.
2. Soil chemistry –Investigating the variation of the chemistry of the soil water as the water moves downslope in the soil. Collect soil water and gases for chemical analyses along an elevational gradient of the Tussock Watershed.
3. Stream Chemistry – As a part of a long-term study of the changing water chemistry in the area around Toolik lake, measure stream discharge and water chemistry, including rain events, at Tussock Watershed and Toolik Inlet weirs, and along the inlet series of streams and lakes flowing into Toolik Lake (I-series).
4. Thaw Depth Survey – As a part of an Arctic-wide program that compares the depth of thaw at many sites, make twice-seasonal measurement of thaw depth along the Tussock watershed.
5. LTER Long Term Plots –Investigating how soil chemistry changes from year to year. To do this, collect soil water for chemical analysis from the LTER Acidic Tussock Tundra sites south of Toolik Lake inlet and the Wet Sedge plots northeast of Toolik lake outlet (LTER B2, see map).
- ~~6. Routine sites – For nearly 25 years, the LTER project has collected routine samples of water chemistry (mostly gases, inorganic chemistry, and dissolved organic carbon) and biology (mostly chlorophyll and primary production measurements at many streams and lakes during the summer. With these samples, we have discovered changes occurring in the water chemistry that are likely caused by a warming of the climate. No equipment is left at the sites by the Land-water group. Access to the sites is by foot or by boat.~~

WHERE IS WORK TAKING PLACE?

The terrestrial plots including the Watering Experiment, Thaw Depth survey, and Tussock Watershed as well as the small stream at the base of this Watershed (called the Tussock Weir), are all located in the Tussock Tundra area just south of Toolik Lake and just west of the LTER long-term plots, greenhouses, and climate station (see the Terrestrial LTER Figure earlier in the report, “Experimental Watershed”).

The stream sites include the Kuparuk River (both fertilized and unfertilized sites), numerous sites on the inlet stream to Toolik Lake (I-series), and the outlet stream from Toolik Lake.

The routinely visited lake sites include Toolik, E5, E6, N1, N2, S5, S6, S7, and the lakes of the Toolik Inlet, I1-I9 and I swamp. On Toolik Lake and Lake E5 maintain floating rafts

during the summer months that hold a climate station to measure wind, solar radiation, air temperature, and humidity. In addition there are buoys on both lakes (removed at the end of each summer), which mark the location of the thermistor chains used to measure water temperature at various depths.

WHAT EQUIPMENT AND MATERIAL IS AT EACH SITE?

1. Water plots - Control and experimental plots

- Wooden raised boardwalk around plots and under the barrels, approximately 150 m total length.
- between 4-8 plastic trash cans with lids (120 L volume) (these hold the water that is dispersed to the plots).
- Tubing- 3 inch diameter PVC tubing extending from watering plots to pump at Toolik Lake. Tubing decreases in diameter as it nears the water plots and ends in a garden hose size tubing. Approximately 200 m of tubing. There is another ¾" diameter (garden hose type) tubing to water the experimental plots. This tubing extends from the trash can to the watering plot. The water plot hose is placed in a zigzag pattern through the experimental plot. This tubing is approximately 25 m in length.
- Gasoline powered 5 hp engine to pump water to barrels (operated every 2-4 days for approximately 10 minutes). Engine is on wooden pallet with thick yellow plastic liner underneath pallet and is located next to the south shore of Toolik Lake, on a line south with the LTER climate station. Removed at the end of each summer.
- Data logger (enclosed in a 14"x14"x6" weatherproof box) on a metal post (2" square pipe) recording soil temperature and moisture.
- Soil temperature and moisture probes extend a maximum of 16" into the ground. Each probe is 4" to 6" long and attached to a ~ 1/4" wire cable that connects to the data logger box. There are 16 located in control and experimental plots.

2. Tussock Watershed

- 14 sites split along an elevation gradient (6 sites at 770 m above sea level, 2 sites at 765 m above sea level, and 6 sites at 760 m above sea level).
- 14 lysimeters, 1 inch diameter PVC white pipe extends 30 cm into the soil with about the same length extending above ground. White PVC caps cover the exposed ends.
- Wooden raised boardwalk across each elevation level, about 150 m total length .

3. Weir - Toolik Inlet and Tussock Watershed.

- Tussock weir – 40 ft. wide by 4 ft. tall wooden "V"-shaped structure that drains water to a 8 ft. by 4 ft. channel.
- In addition to the weir, at the Toolik Inlet and the Tussock Watershed there is a:
 - Data logger (size is 6"x6"x9") on a wooden post (4"x4"x4 ft.) recording stage height and water temperature.
 - Data logger (enclosed in a 14"x14"x6" weatherproof box) on a metal post (2" square pipe) recording temperature, pH, and conductivity of water and soil temperature.

- auto-sampler (in a 30 gallon barrel) with ½" diameter tygon tubing extending from the auto-sampler to the water. The auto-sampler collects a 0.5 L water sample every 3 hr.
 - at the Tussock weir there is a 8 ft. x 6 ft. platform for sampling and 30m of board walk
4. Thaw Depth Survey
- 800 m x 200 m plot bounded by UTM markers (000/800, 000/600, 900/800, 900/600). The same sites are sampled twice a year, and these sites are marked with small flags every 100 m. Survey is done in the Tussock Watershed area.
5. Toolik Climate Station and Thermistors
- 1.5 m x 1.5 m floating wooden raft with solar powered climate station to record air temperature, relative humidity, solar radiation, and wind direction and speed. The
 - See plots associated with the terrestrial, lakes, and streams components (i.e., All sites are occupied or sampled by the other groups.)
 climate station is anchored near Toolik Main for the May-September season and is stored near the camp pad during the winter months.
 - 2 thermistor strings anchored at the bottom and supported by orange floats. One chain has 8 6" long 2" diameter cylindrical thermistors attached to a nylon rope suspended by a float and located in the Northeastern arm of Toolik Lake. The other thermistor chain has 11 4" x 8" x 2" thermistors attached to a plasticized metal cord suspended by a float and located near Toolik Main. All these thermistors measure water temperature at the depth which they are placed. These strings are removed from the lake during the winter months.
6. Lake E5 Climate Station and Thermistors
- 1.5 m x 1.5 m floating wooden raft with solar powered climate station to record air temperature, relative humidity, solar radiation, and wind direction and speed. The climate station is anchored near the middle of the lake is stored on the north shore of the lake during the winter months.
 - 2 thermistor strings anchored at the bottom and supported by orange floats. One chain has ~8 6" long x 2" diameter cylindrical thermistors attached to a nylon rope suspended by a float and located just south of the climate station, and the other chain has ~10 4" x 8" x 2" thermistors attached to nylon rope suspended by a float and located just north of the climate station. All these thermistors measure water temperature at the depth which they are placed. These strings are removed from the lake during the winter months.
7. LTER Acidic and Non-Acidic plots
- No equipment on site

HOW ARE SITES ACCESSED?

- All sites are accessed by foot or by boat.
- Except where otherwise noted, the sampling team consists of 2 or 3 persons.

PERIOD OF USE FOR THE SITES

Sampling season is from May 1 to September 30.

- Water Plot Experiment
12 sites sampled every 10-14 days.
- Tussock Watershed
14 sites sampled 3-4 times per season.
- Weirs - Toolik Inlet and Tussock Watershed.
Toolik Inlet sampled weekly and Tussock Watershed Weir sampled every 10-14 days.
- Thaw Depth Survey
Survey completed twice per year.
- Toolik Climate Station and Thermistors
Thermistor strings and climate station left in same place for entire season and removed at end of season.
- LTER Acidic and Non-Acidic plots
Both are sampled every 10-14 days.
- Streams
Kuparuk sites are sampled every 10-14 days. The entire Toolik inlet series is sampled twice per season, but the closer inlet stream sites are sampled every 10 days.
- Lakes
The set of routinely sampled lakes (N1, N2, E5, E6, Toolik) are sampled 2-3 times per season, other lakes are sampled less frequently.
- I-Series
The inlets and outlets of the I-Series lakes (I1-I9, I swamp) are sampled 3 times per season, approximately 3 weeks apart.

NEW PLANS FOR DURATION OF THE PERMIT

Currently there are no plans for any changes in sampling equipment, frequency, or locations over the duration of this permit.