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NEON Operations 2016/2017: Toolik Field Station

National Ecological Observatory Network

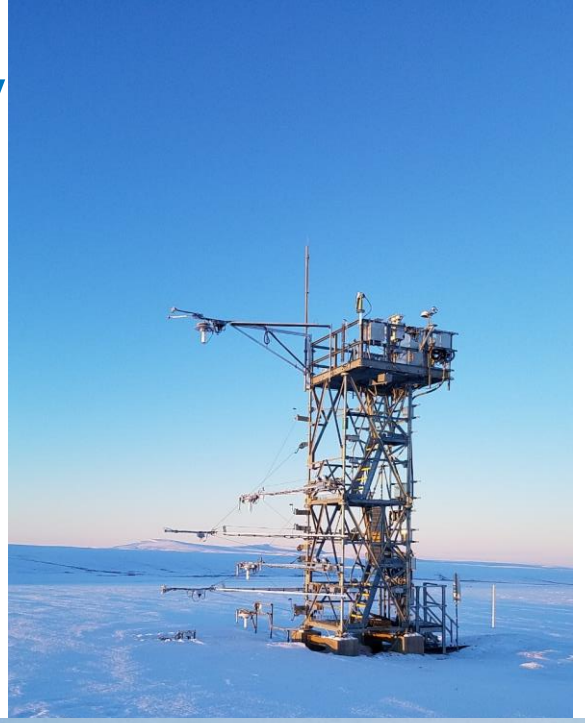
A project sponsored by the National Science Foundation and operated under cooperative agreement by Battelle.

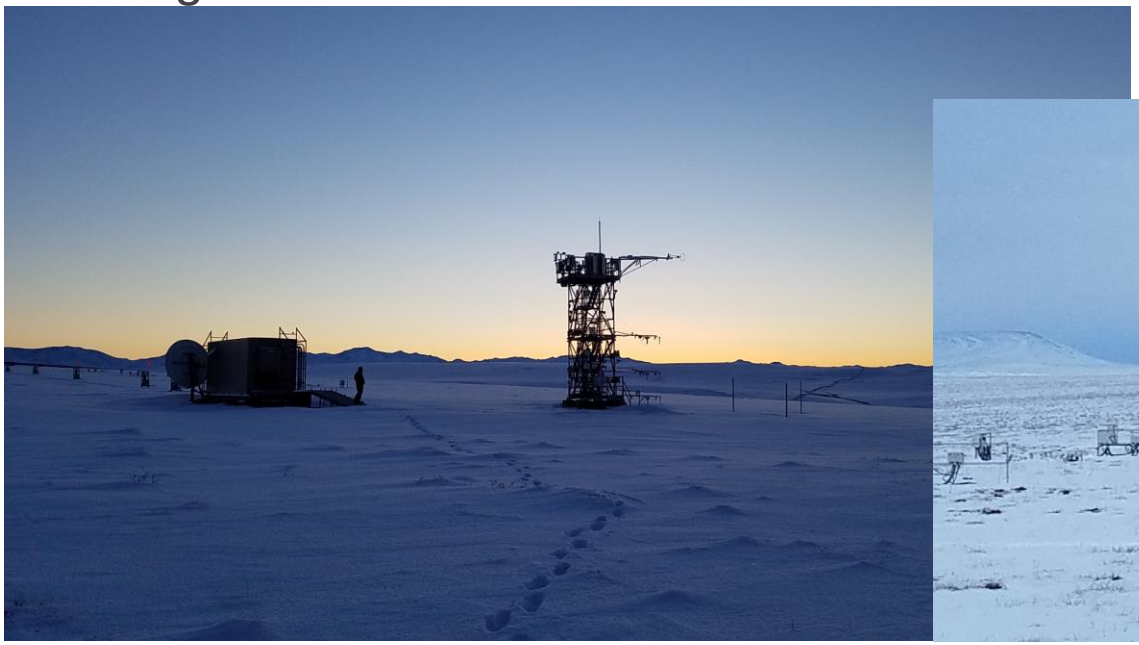
Outline

- Infrastructure (TIS/AIS)
- Terrestrial Observation System (TOS)
- Aquatic Observation Systen (AOS)
- Aerial Observation Platform (AOP)
- NRCS Soil Characterization

NEON Tower & Soil Array

- Constructed & instrumented 2016; 26ft tower
- T20 expected - Data expected spring/summer
- Powered by NEON Genmod
- Data via satellite; relay tower install planned 2017
- Assignable assets



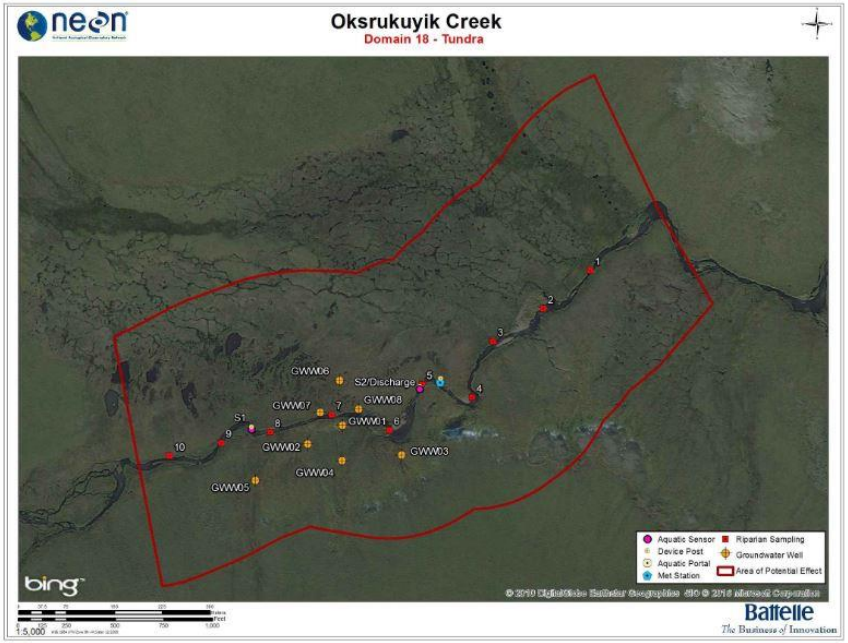


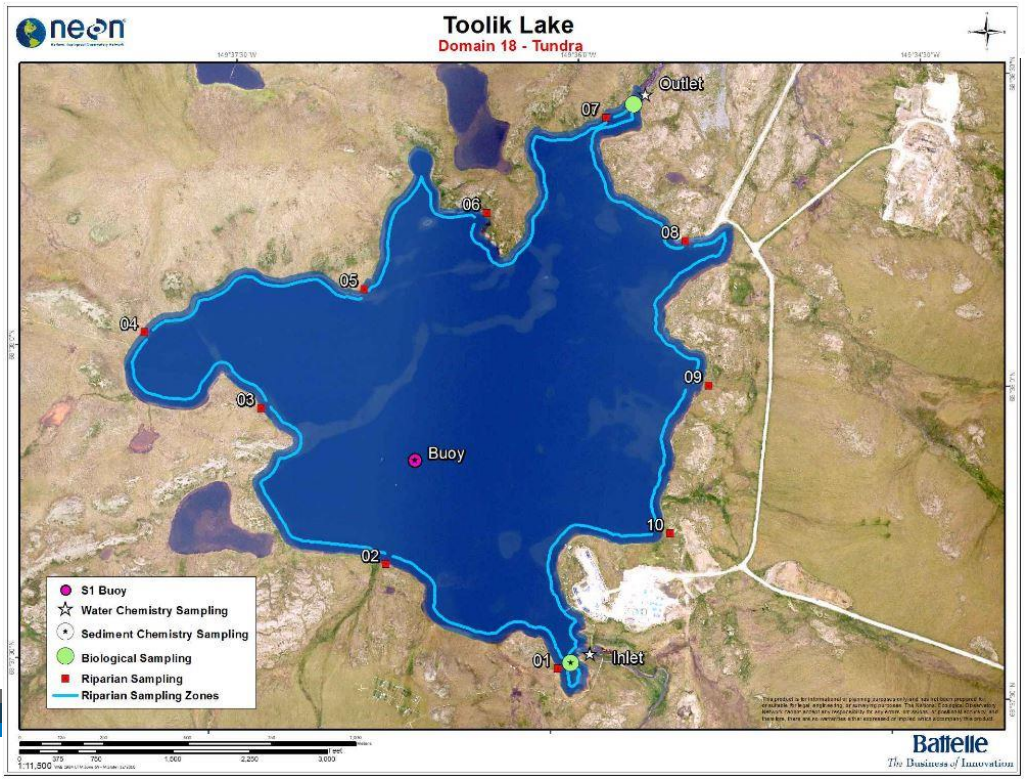
NEON Generator System

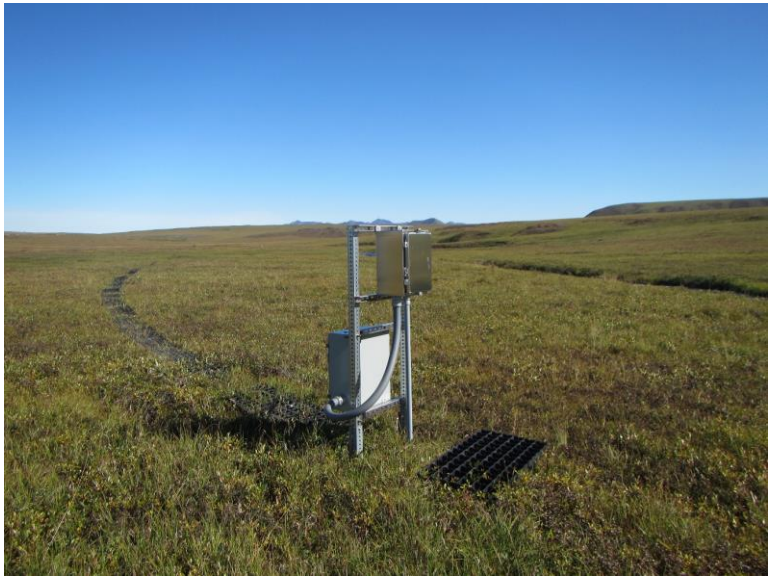
- Two 48kw diesel generators
- 5,000g above-ground tank
- Auto-switch capable
- Diesel release 11/8/16
- Remediation in process
- Additional spill-prevention measures

AIS
Aquatic Instrumentation

- Limited installation 2016
- June 5, 2017 AIS Deployment
- 3 sensor sets proposed for lake
- 2 sensor sets proposed for Oks







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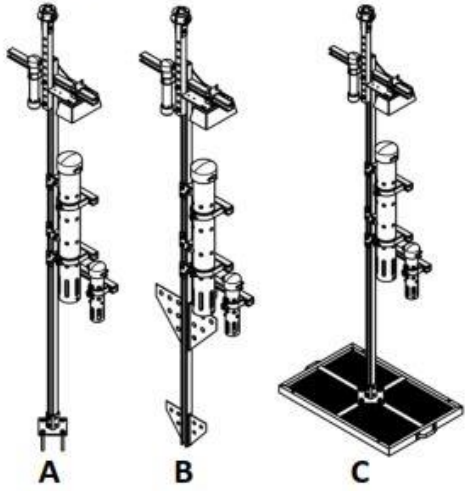
In Stream Sensors

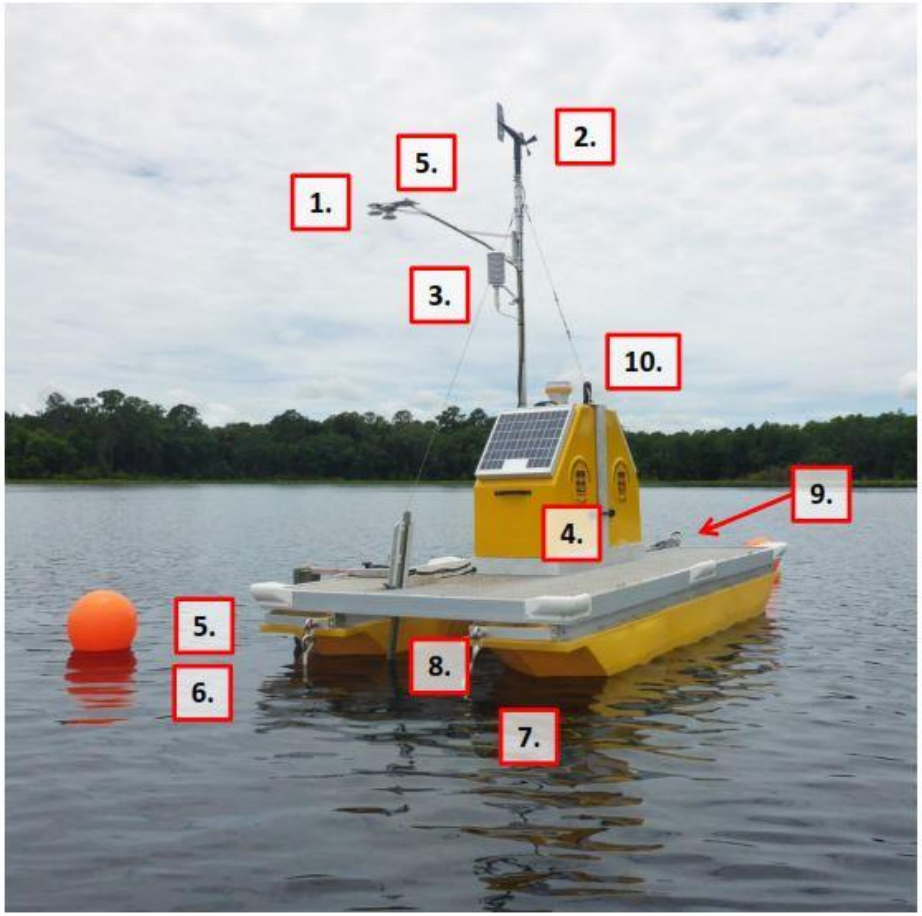
Include:

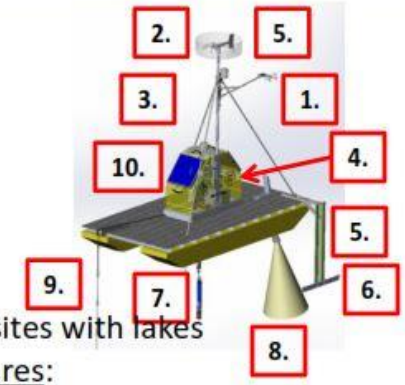
- Level-Troll 500 Sensor
- Exo 2 Sonde
- SUNA
- Kipp and Zonen PQS 1 PAR Sensor
- PRT

Infrastructure:

- Sensors are mounted to Unistrut frame
- The frame can be installed with several foundations for different ground conditions, such as:
  - Bedrock (**A**)
  - Sand (**B**)
  - Cobbles (**C**)







AIS Buoy:

Location:

- Select AIS sites with lakes

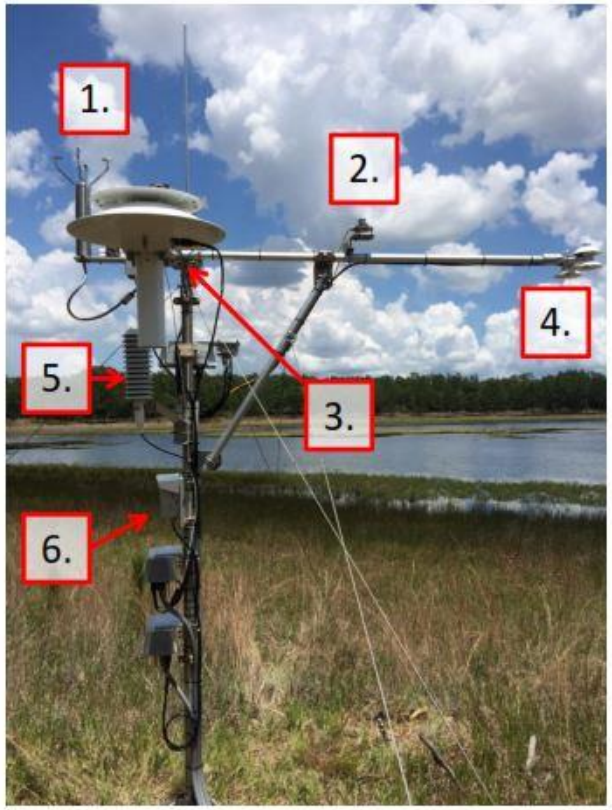
What it Measures:

1. Net Radiation (NR01) and Photosynthetically Active Radiation (PAR)
2. Wind Speed and Direction (R.M. Young Wind Monitor)
3. Temperature and RH (HMP-155)
4. Barometric Pressure
5. Upwelling and Downwelling Underwater PAR
6. Ultraviolet Nitrate Analyzer (Suna V2)
7. Exo 2 Sonde
8. Depth Sounder
9. Temperature Profile (T-Chain)
10. *HMR3300 Digital Compass and a Garmin 16-HVS GPS Receiver*

AIS Met Station

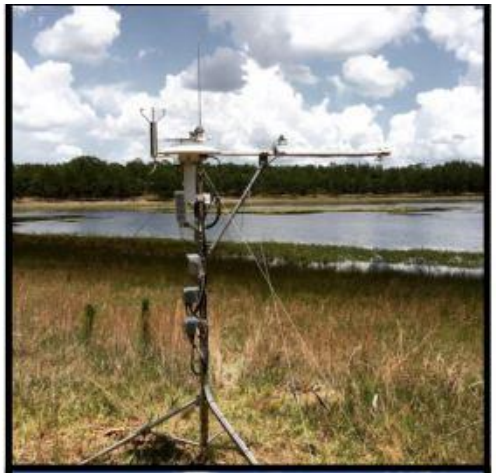
Infrastructure:

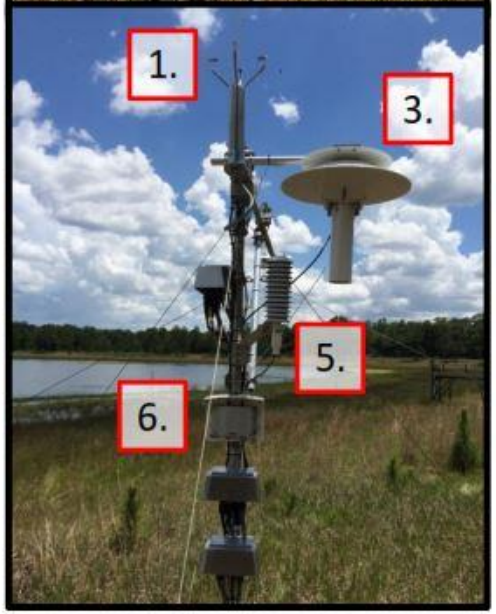
- Campbell Scientific CM110 stainless steel tripod
- Designed to be installed over rough/uneven terrain
- Stabilized using multiple guy wires



Sensors:

1. 2-D Wind Speed and Direction
2. Photosynthetically Active Radiation
3. Aspirated Air Temperature
4. Net LW and SW Radiation
5. Relative Humidity (RH)
6. Barometric Pressure





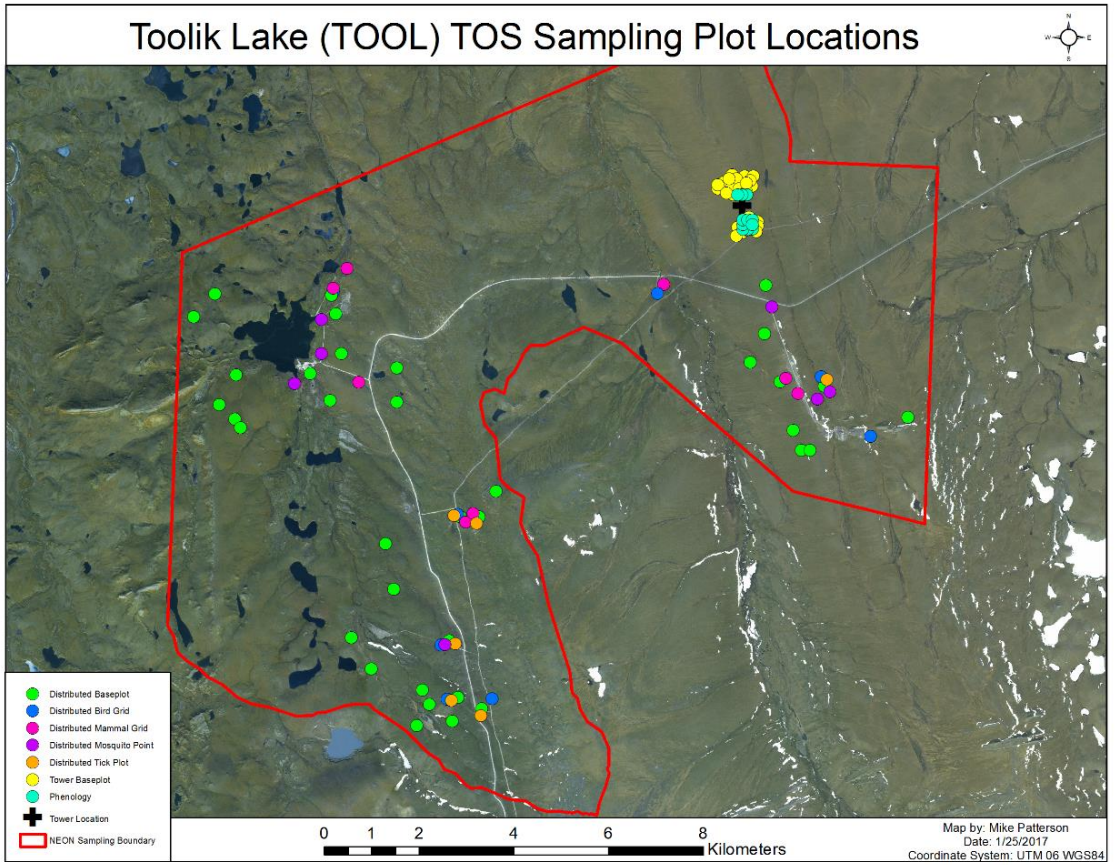
NEON Terrestrial Plots (TOS)

Plot types

- 30 Distributed
- 30 Tower
- 10 Beetle
- 10 Mosquito
- 8 Bird
- 8 Smammals
- 6 Tick
- 2 Phenology

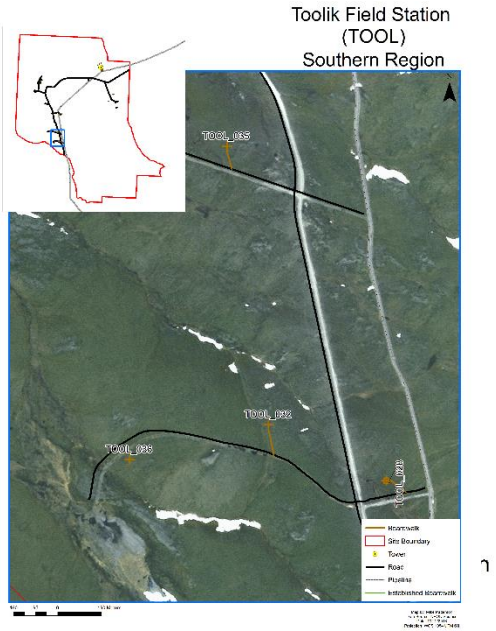
Protocols (Tower/Distrib)

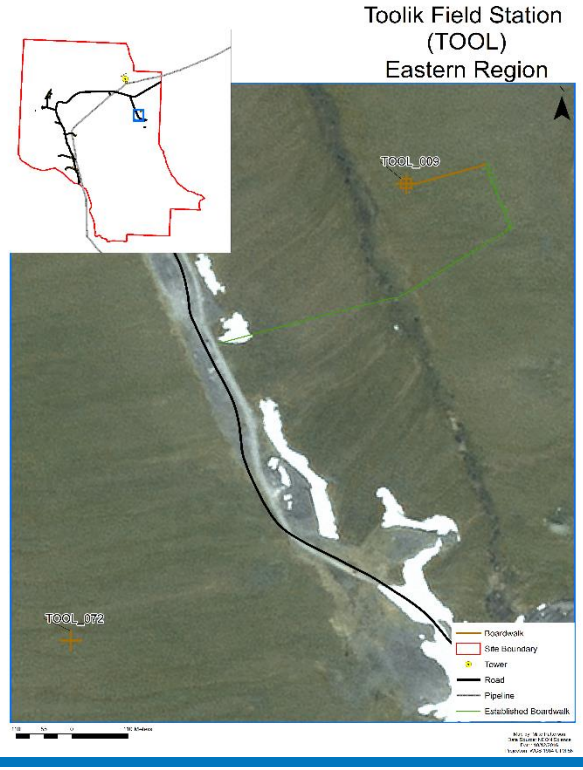
- Soils (bgc, microbes)
- LAI
- MFB
- Herbaceous biomass
- Structure/diversity

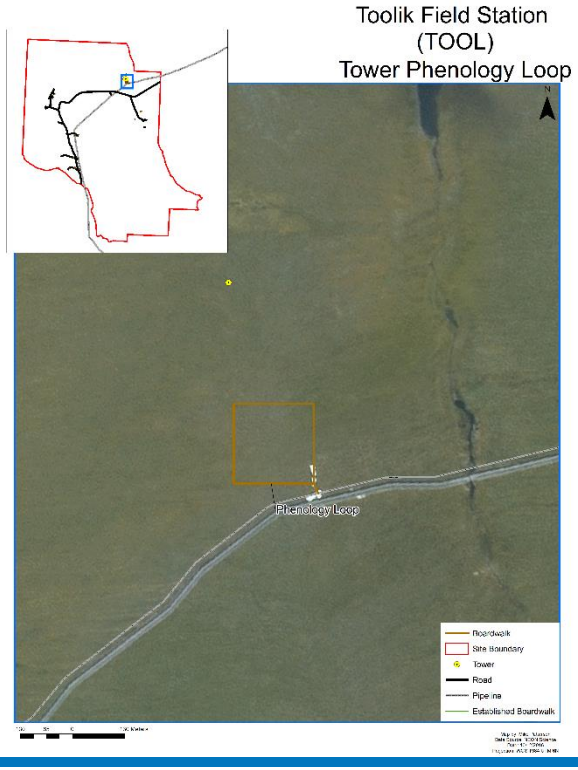


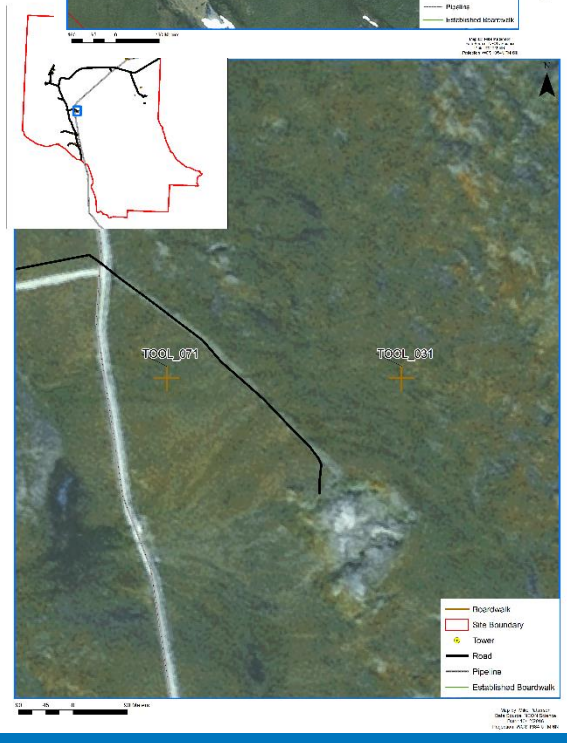
Boardwalks

- 3 tower plots & phenology loop
- 10 distributed plots; 5 w/access boardwalk
- 2x8 & 2x10 rough cut lumber. ‘floating’









Aquatics (AOS)

- Initiated 2016: Toolik lake & Oks creek
- Broadly divided into Biology and chemistry
- First ‘boots on the ground’
- 2 seasonal ‘core’ techs + FFT support

Biology

- 3 ‘bio bouts’ per year
- Use toolik boat on lake

Chemistry

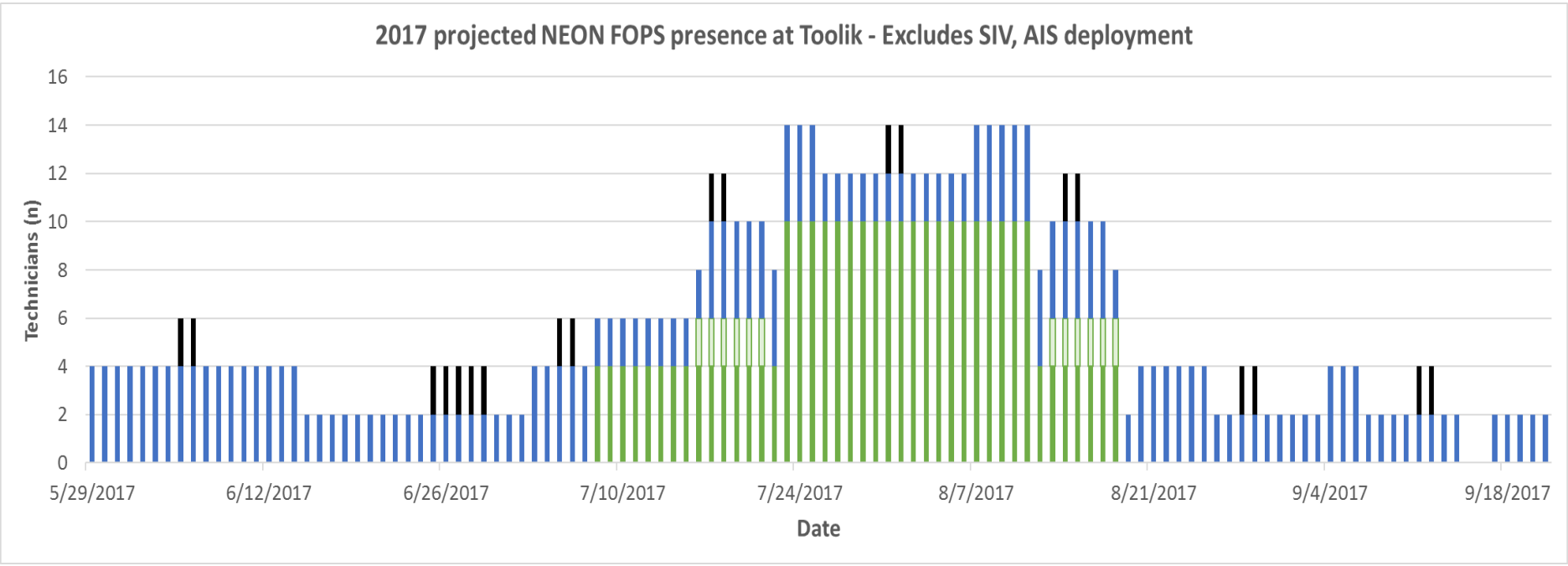
- Lake: 12x yr
- Stream: 12x/yr & 14 flow-weighted

NEON Program at Domain 18 Aquatic Infrastructure and Observational Sampling Strategy
Oksrukuyik Creek and Toolik Lake

Submitted to:
Toolik Field Station Steering Committee
Institute for Arctic Biology
P.O Box 757000, 900 Yukon Drive, Trailer 3
Fairbanks, AK 99775-7000

2017 projected housing needs

- **AOS/TOS/TIS**
- **Earlier aquatic start**
- **2018 onwards will be more even**

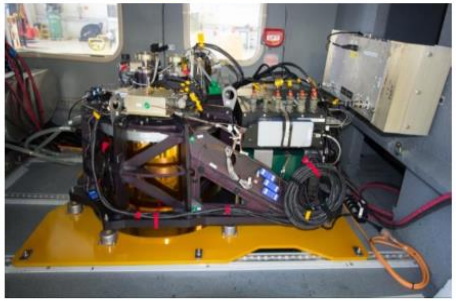


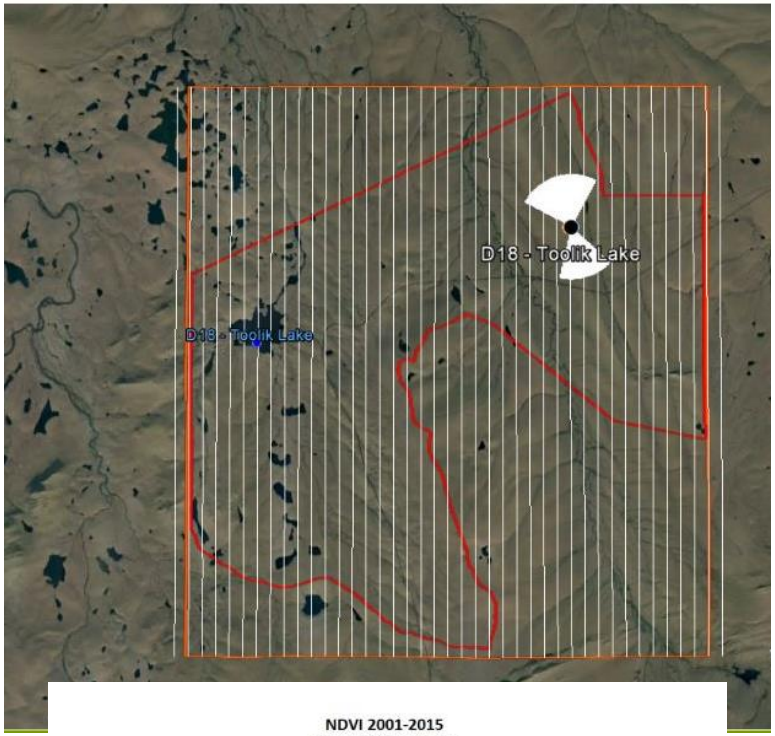
AOP 2017 TFS

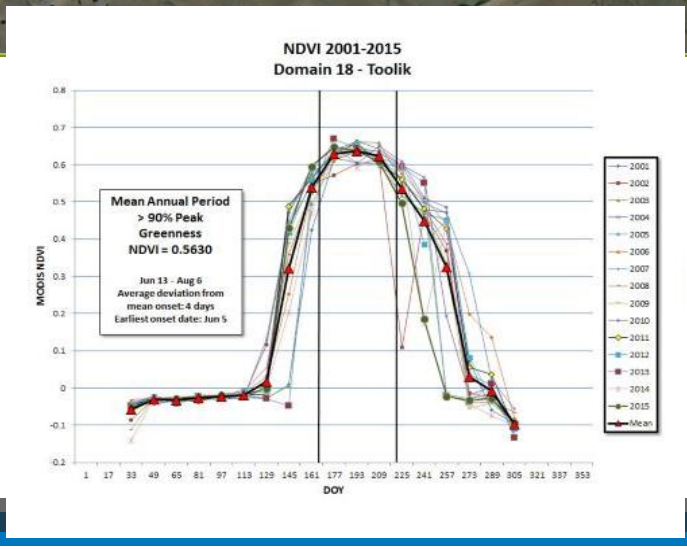
Remote Sensing Payloads

2 NEON Science Payloads plus
1 Assignable Asset Payload

- VSWIR imaging spectrometer (AVIRISng)
- 1064 nm waveform lidar
- High resolution digital camera







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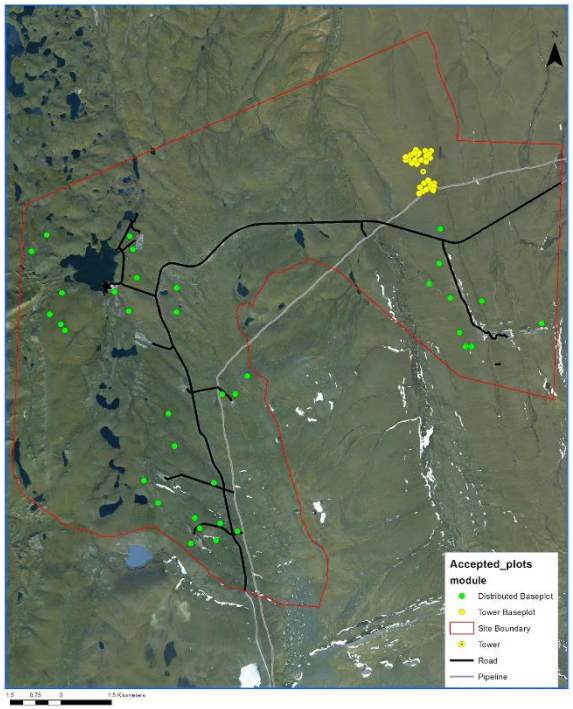
NEON Soil Characterization Project

A one-time, comprehensive, physical and chemical characterization of soils at NEON sites

- **Project Goals:**
  - Characterize soils at the site-level
  - Provide baseline soil biogeochemical data to NEON terrestrial organismal sampling programs (microbes, plants, etc.)
- **Methods:**
  - Work carried out by NRCS soil scientists
  - Hand-operated coring devices to 1m depth. Boreholes backfilled using local/soil materials
  - Typically, 12-20 plots are sampled (34 plots max)
  - Soil sampling is only allowed within NEON plots and in the areas designated for soil sampling (e.g. no disturbances to plants, mammals, etc)



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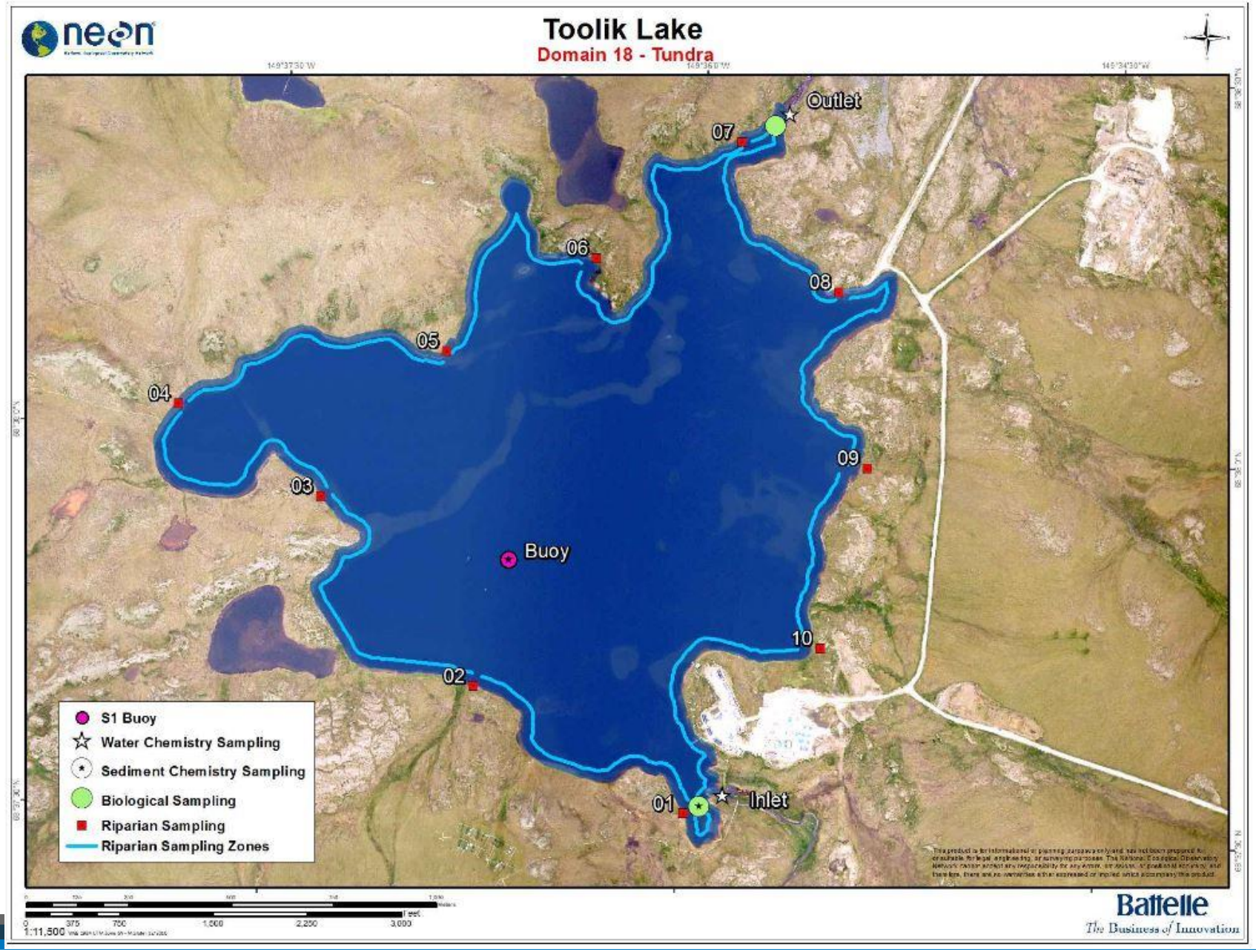
Toolik Lake
Domain 18 - Tundra
Outlet
07
06
08
05
04
09
03
Buoy
10
02
01
Inlet
S1 Buoy
Water Chemistry Sampling
Sediment Chemistry Sampling
Biological Sampling
Riparian Sampling
Riparian Sampling Zones
1:11,500
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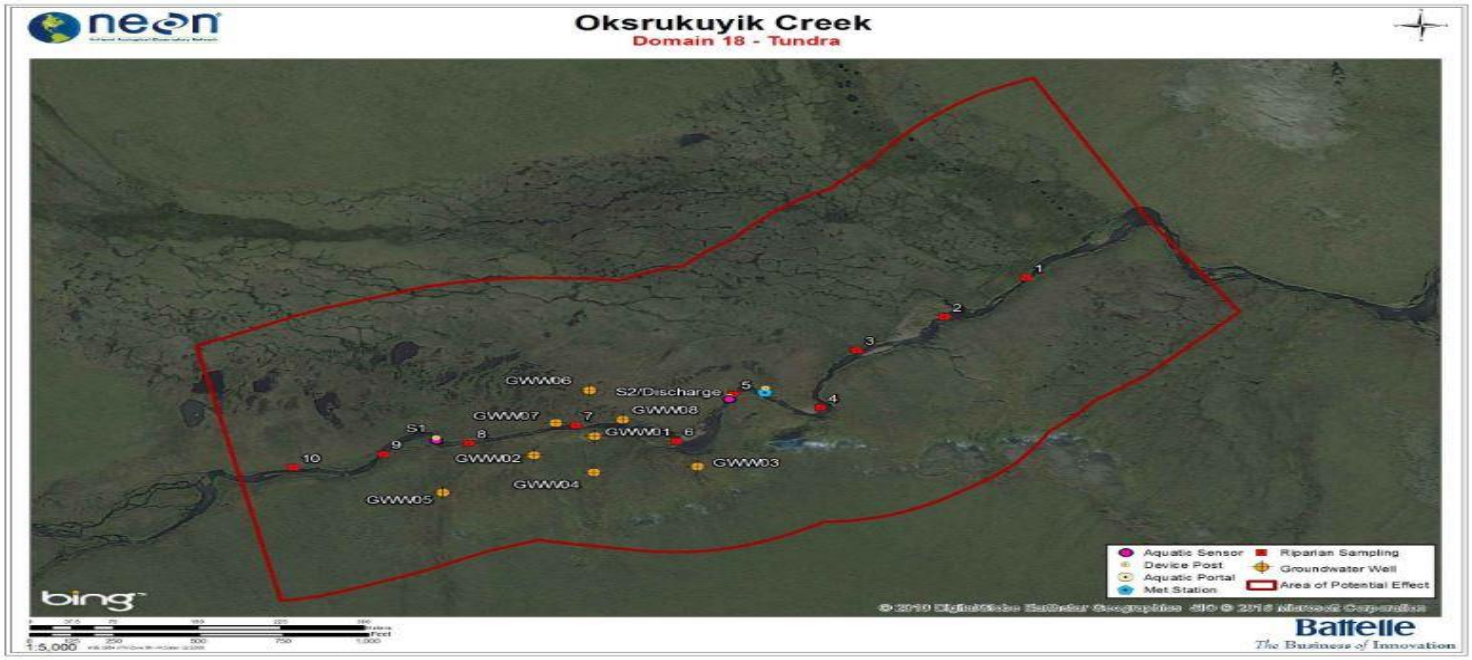
AOS Oksrukuyik Creek

Biology

- Sampling occurs throughout the entire reach
- 3 times annually during ice free period

Chemistry

- Flow weighted and monthly dates
- Water Collection occurs up to 26x year, nearly every ice free Tuesday
- Sampling at S2, Reaeration between S1 and S2



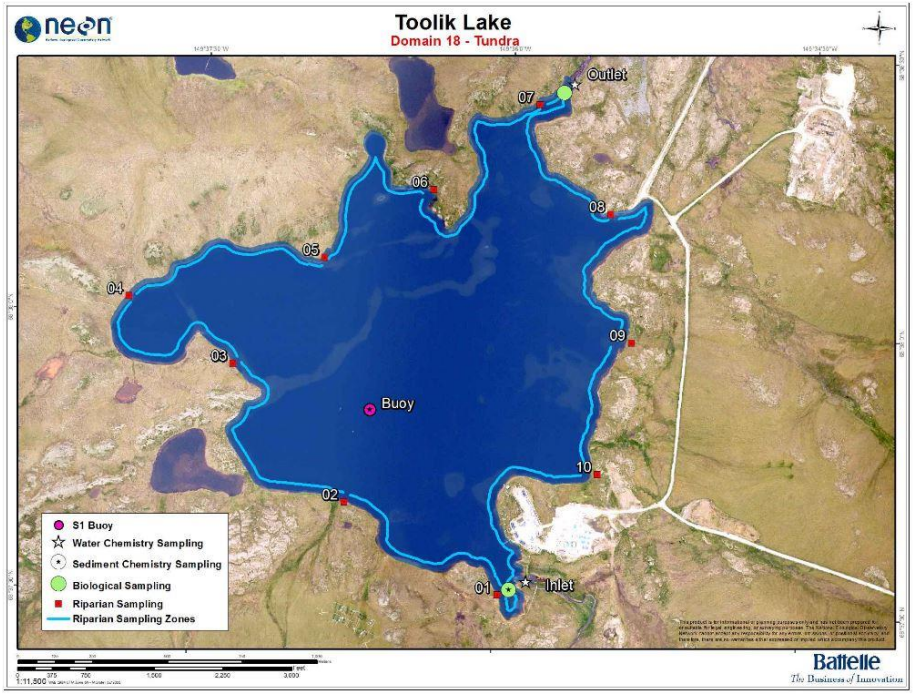
AOS Biology (lake)

All Bouts

- Macroinvertebrates (I,O,B, 5 stations)
- Peri/phytoplankton (I,O,B, 5 stations)
- Zooplankton (I,O,B)
- Sediment Chemistry (I, B)

Bouts 1, 2, *and/or* 3

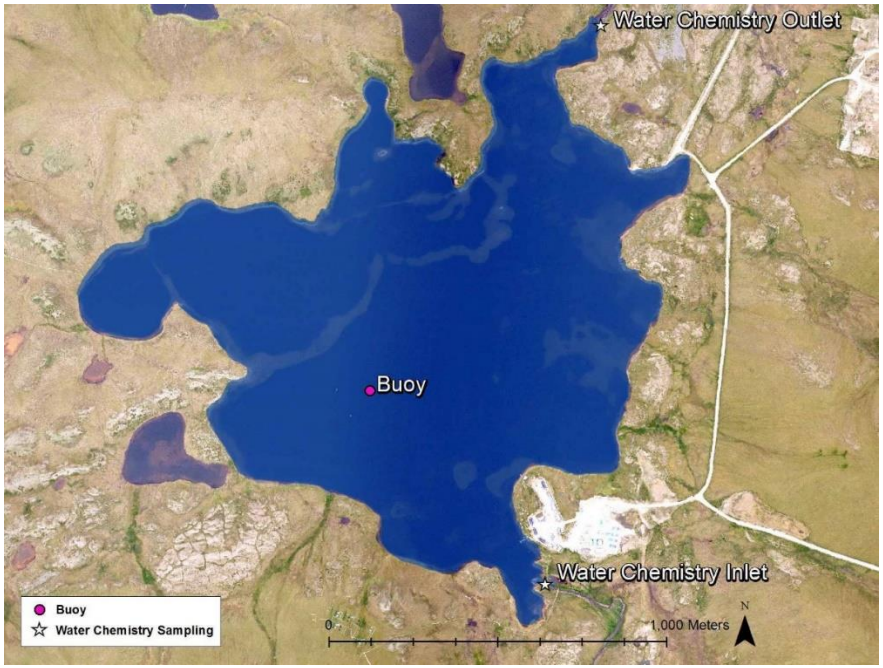
- Fish, Riparian Habitat Assessment, Aquatic Plants, Bathymetry

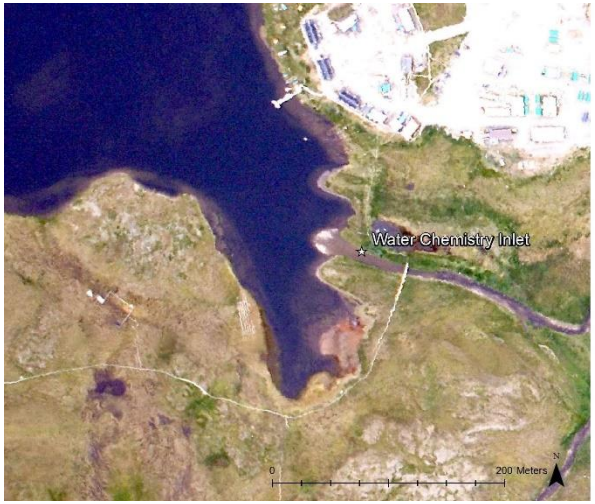


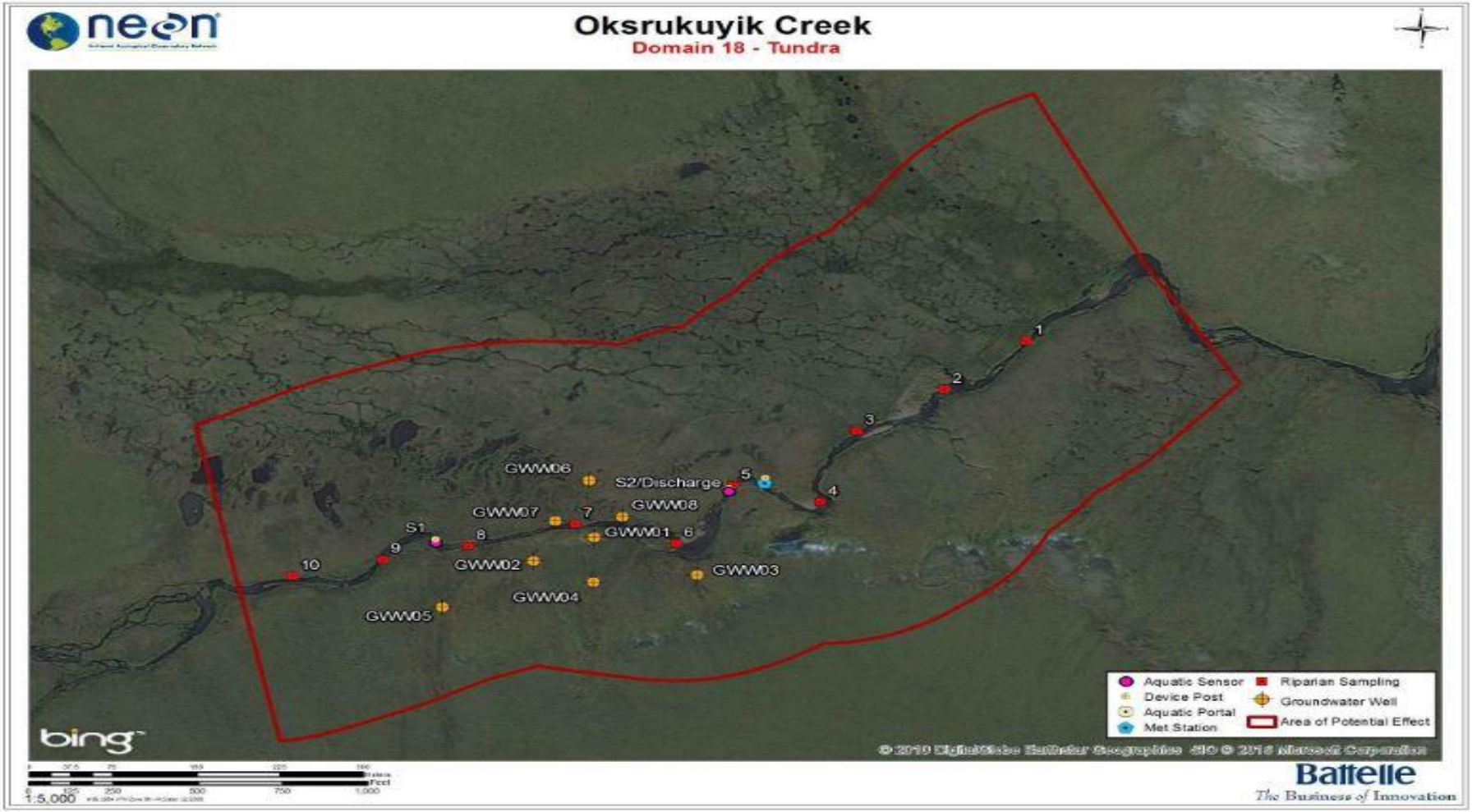
Bout	Tentative 2017 Dates	Protocols Performed
I	June 27- July 5	Macroinvertebrates, Periphyton and Phytoplankton, Zooplankton, Sediment chemistry, and **Fish**
II	July 21- July 26	**Aquatic plants,** Macroinvertebrates, Periphyton and Phytoplankton, Zooplankton, Sediment chemistry, Bathymetry, and **Riparian habitat assessment**
III	August 21- August 31	Macroinvertebrates, Periphyton and Phytoplankton, Zooplankton, Sediment chemistry and **Fish**

AOS Chem (lake)

- Monthly (1st Tuesday)
- 3 locations: Chemerer grabs at buoy, 4L Jugs at inlet & outlet
- Discharge (I,O)
- Surface water chemistry
- Surface microbes
- Stable isotopes
- Dissolved gas
- GW Chemistry (2x/yr)
  - Design TBD
  - ~~June 6th~~
  - Sept 5th






neon
Oksrukuyik Creek
Domain 18 - Tundra
GWW06
S2/Discharge
GWW07
GWW08
S1
GWW01
GWW02
GWW03
GWW04
GWW05
1
2
3
4
5
6
7
8
9
10
Aquatic Sensor
Device Post
Aquatic Portal
Met Station
Riparian Sampling
Groundwater Well
Area of Potential Effect
bing
1:5,000
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AOS Biology (streams)

All Bouts (June 6 - 16; July 18-24; Aug. 7 – 17)

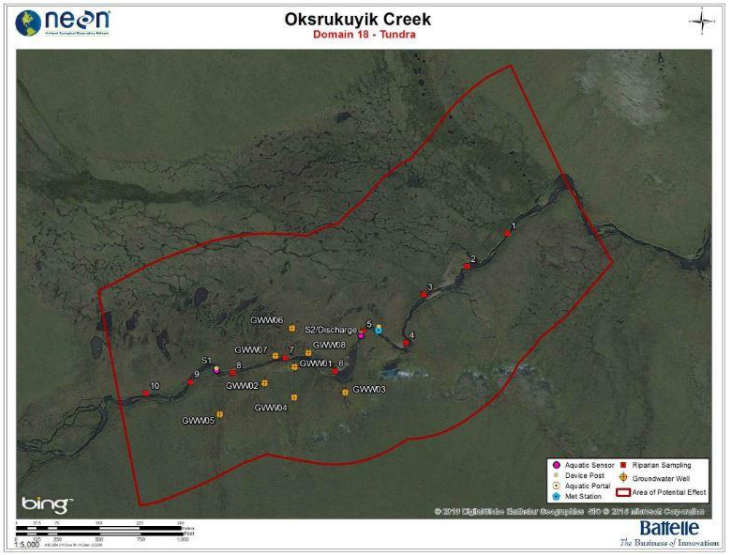
- Aquatic Plant Transects (10 established transects)
- Macroinvertebrates (8 varying locations throughout reach)
- Periphyton and seston (8 varying locations throughout reach for periphyton and seston occurs at S2)
- Benthic Microbes (8 varying locations throughout reach- same locations as algae)
- Sediment Chemistry (sediment of the target size was not found in 2016, it will be collected throughout the reach if it is present in the future)

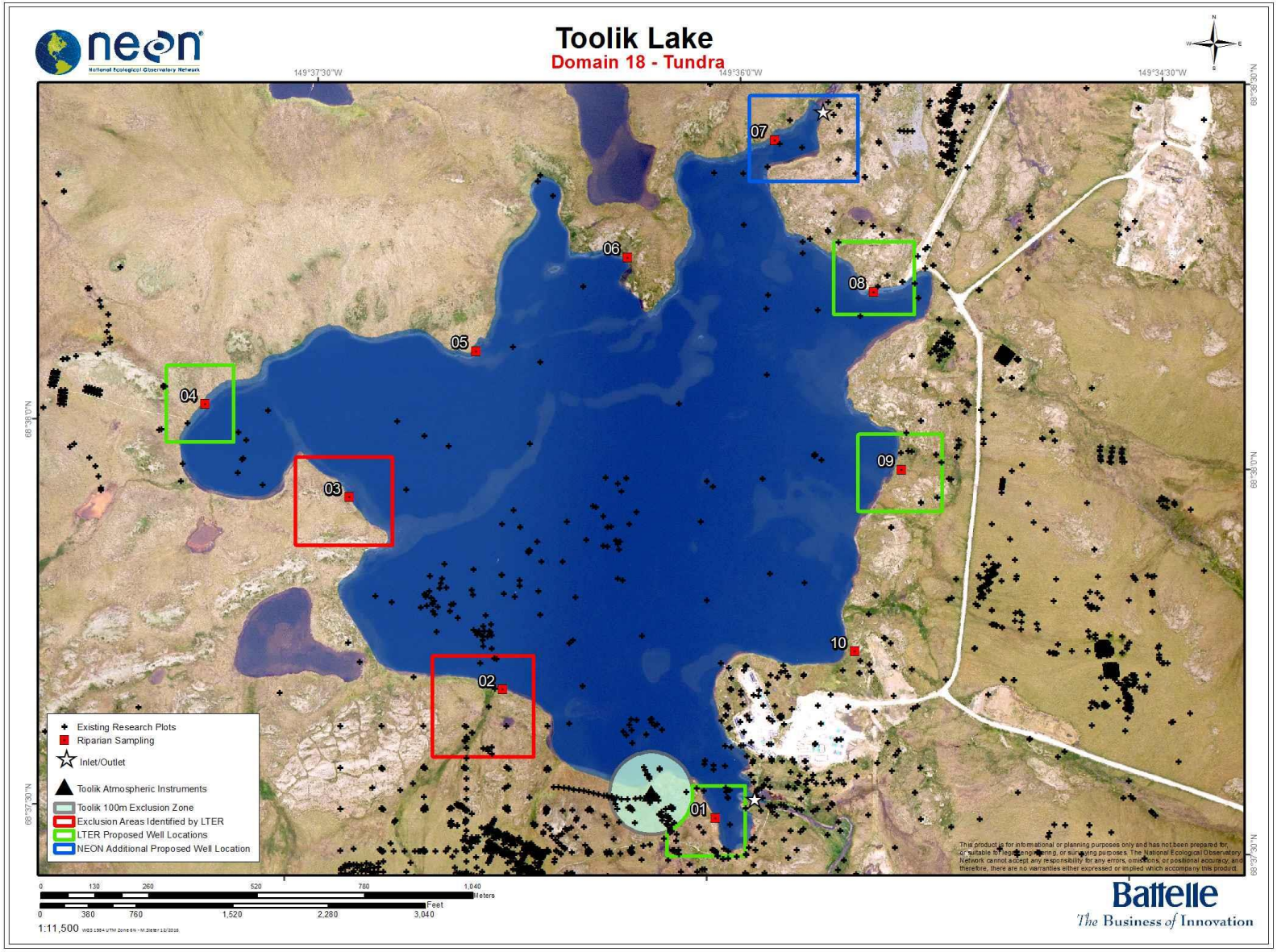
Bouts 1, 2, *and/or* 3

- Fish (bouts 1 and 3, throughout the entire reach)
- Rapid Habitat Assessment (between bout 1 and 2, throughout the entire reach)
- Riparian Habitat Assessment (bout 2, 10 established points)
- Aquatic Plant Biomass Collection (bout 2, 2-4 m downstream of plant transects)

AOS Chemistry (Streams)

- Water Chemistry, Isotopes, Stream Discharge and Dissolved gas- up to 26x/year (S2)
- Surface water microbes- 12 x/year (S2)
- Reaeration occurs 10 x/year (between S1 and S2)
- Groundwater sampling occurs 2 x/year (~~June 6~~; Aug. 29)




Toolik Lake
Domain 18 - Tundra
149°37'30"W
149°36'0"W
149°34'30"W
68°38'0"N
68°37'30"N
01
02
03
04
05
06
07
08
09
10
Existing Research Plots
Riparian Sampling
Inlet/Outlet
Toolik Atmospheric Instruments
Toolik 100m Exclusion Zone
Exclusion Areas Identified by LTER
LTER Proposed Well Locations
NEON Additional Proposed Well Location
0 130 260 520 780 1,040 Meters
0 380 760 1,520 2,280 3,040 Feet
1:11,500
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