



# Climate Station Maintenance in the Arctic Network

## *2015 Summary*

Natural Resource Data Series NPS/ARCN/NRDS—2015/990



**ON THE COVER**

Killik Pass weather station, Gates of the Arctic National Park and Preserve.  
Photograph by: Ken Hill

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## *2015 Summary*

Natural Resource Data Series NPS/ARCN/NRDS—2015/990

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## **Abstract**

The mission of the Arctic Network Inventory and Monitoring Program (ARCN) is to collect, compile and synthesize scientific information about the Arctic Network of parks in order to manage park resources "unimpaired for the enjoyment of future generations". The Inventory and Monitoring (I&M) Program is a major component of the National Park Service's (NPS) strategy to improve park management through greater reliance on scientific information.

In an attempt to better understand climate variation as well as long-term changes in park ecosystems, seventeen I&M climate stations have been installed in the five ARCN parks. The objective of the climate monitoring program is to monitor and record weather conditions at representative locations throughout ARCN in order to identify long and short-term trends, provide reliable climate data to other researchers, and to participate in large scale climate monitoring and modeling efforts beyond park boundaries. Seventeen existing I&M stations were maintained, four fire remote automated weather stations (RAWS) were maintained in cooperation with NPS staff in Anchorage, and the Kelly Snotel station was maintained by the Natural Resources Conservation Service (NRCS) staff. This report summarizes the 2015 field season and includes current sensor metadata.

## **Acknowledgments**

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## List of Acronyms

|        |                                                                                                                              |
|--------|------------------------------------------------------------------------------------------------------------------------------|
| Ah     | Amp hour                                                                                                                     |
| AKDST  | Alaska Daylight Savings Time                                                                                                 |
| AKRO   | Alaska Regional Office                                                                                                       |
| AT-RH  | Air Temperature-Relative Humidity                                                                                            |
| OAS    | Office of Aviation Services                                                                                                  |
| ARCN   | Arctic Network                                                                                                               |
| AS350  | A-star 350 Helicopter                                                                                                        |
| AT-RH  | Air Temperature- Relative Humidity                                                                                           |
| BELA   | Bering Land Bridge National Preserve                                                                                         |
| C185   | Cessna 185 airplane                                                                                                          |
| C206   | Cessna 206 airplane                                                                                                          |
| CAKR   | Cape Krusenstern National Monument                                                                                           |
| CS     | Campbell Scientific                                                                                                          |
| DCS    | Data Collection System                                                                                                       |
| DLP    | Data Logger Program                                                                                                          |
| FTS    | Forest Technology Systems                                                                                                    |
| GAAR   | Gates of the Arctic National Park and Preserve                                                                               |
| GOES   | Geostationary Operational Environmental Satellite                                                                            |
| GPS    | Global Positioning System                                                                                                    |
| I&M    | Inventory and Monitoring                                                                                                     |
| KOVA   | Kobuk Valley National Park                                                                                                   |
| LED    | Light-Emitting Diode                                                                                                         |
| NESDIS | National Environmental Satellite, Data, and Information Service                                                              |
| NIFC   | National Interagency Fire Center                                                                                             |
| NOAT   | Noatak National Park and Preserve                                                                                            |
| NPS    | National Park Service                                                                                                        |
| NRCS   | Natural Resource Conservation Service                                                                                        |
| RAWS   | Remote Automated Weather Station                                                                                             |
| RG-TB  | Rain Gauge - Tipping Bucket                                                                                                  |
| SD     | Snow Depth                                                                                                                   |
| SDI    | Serial Digital Interface                                                                                                     |
| SR     | Solar Radiation                                                                                                              |
| ST     | Soil Temperature                                                                                                             |
| W      | Watt                                                                                                                         |
| WEAR   | Western Arctic National Parklands                                                                                            |
| WFMI   | Wildland Fire Management Information                                                                                         |
| WRCC   | Western Regional Climate Center                                                                                              |
| WS-WD  | Wind Speed - Wind Direction                                                                                                  |
| YUGA   | Collective administrative unit for Yukon-Charley Rivers National Preserve and Gates of the Arctic National Park and Preserve |

## Climate Station Locations

For the 2015 field season, the Arctic Network (ARCN) continued its climate monitoring program by maintaining seventeen existing stations in the network (Figure 1, Table 1). These park units include, Gates of the Arctic National Park and Preserve (GAAR), Bering Land Bridge National Preserve (BELA), Cape Krusenstern National Monument (CAKR), Kobuk Valley National Park (KOVA), and Noatak National Preserve (NOAT). Maintenance includes downloading data, updating software and programming, replacing sensors, and troubleshooting problems. Maintenance is necessary in order to provide continuous, high-quality meteorological data. There are additional weather and climate stations in the parks run by other state and federal agencies with specific objectives. Remote automated weather stations (RAWS) deployed as part of the NPS fire program record real-time weather data for fire management. NRCS Snotel stations record weather and snow information. It is in the best interest of the ARCN program to cooperate with these and other entities by assisting in station maintenance; a total of 23 sites are maintained annually, including 17 ARCN RAWS, 5 fire RAWS and 1 Snotel station.

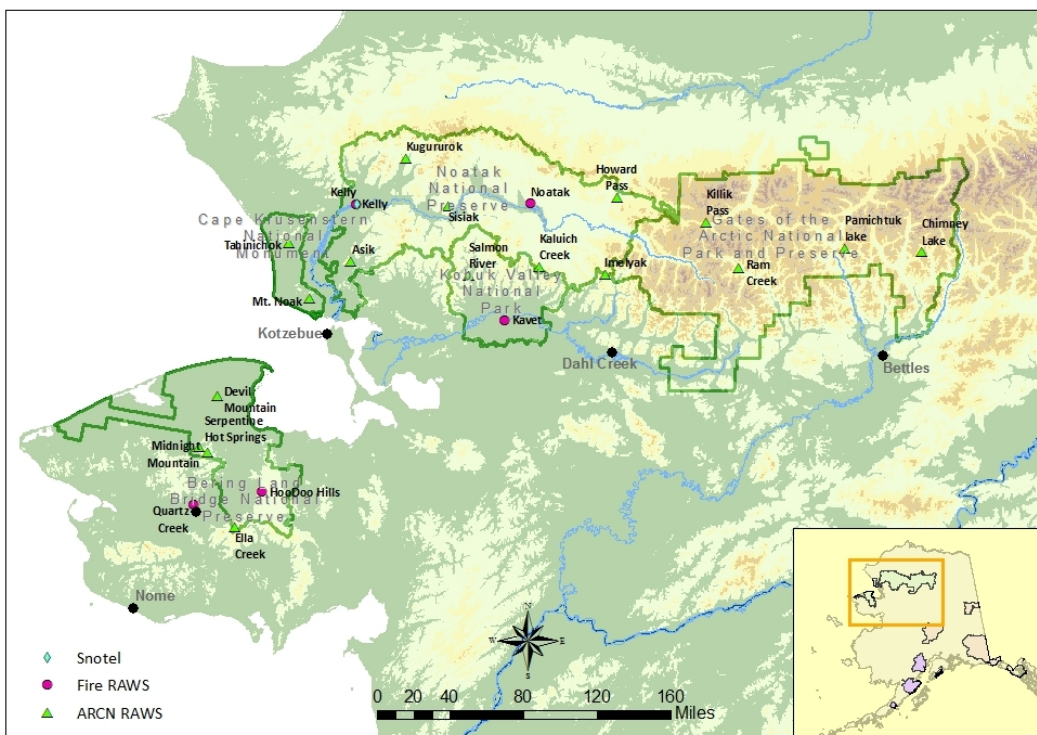


**Figure 1.** Locations of ARCN I&M stations, fire RAWS, Kelly Snotel, and base locations.

**Table 1.** Locations of ARCN stations maintained in 2015 field season.

| Station Name      | Station Type | Latitude (N) | Longitude (W) | Elevation (ft) | Park |
|-------------------|--------------|--------------|---------------|----------------|------|
| Chimney Lake      | I&M          | 67° 42.853'  | 150° 35.100'  | 3780           | GAAR |
| Killik Pass       | I&M          | 67° 59.007'  | 155° 00.782'  | 4355           | GAAR |
| Pamichtuk Lake    | I&M          | 67° 45.977'  | 152° 09.854'  | 3294           | GAAR |
| Ram Creek         | I&M          | 67°37.458'   | 154° 20.678'  | 4110           | GAAR |
| Asik              | I&M          | 67° 28.493'  | 162° 15.986'  | 1329           | NOAT |
| Howard Pass       | I&M          | 68° 09.361'  | 156° 53.749'  | 2062           | NOAT |
| Imelyak           | I&M          | 67°32.689'   | 157° 04.646'  | 3620           | NOAT |
| Kaluich           | I&M          | 67° 34.403'  | 158° 25.903'  | 2486           | NOAT |
| Kavet Creek RAWS  | Fire RAWS    | 67° 8.317'   | 159° 2.617'   | 235            | KOVA |
| Kelly RAWS*       | Fire RAWS    | 67° 55.778'  | 162° 17.775'  | 412            | NOAT |
| Kelly Snotel      | Snotel       | 67° 55.780'  | 162° 17.410'  | 310            | NOAT |
| Kugururok         | I&M          | 68° 19.003'  | 161° 29.518'  | 908            | NOAT |
| Noatak RAWS       | Fire RAWS    | 68° 4.222'   | 158° 42.224'  | 1040           | NOAT |
| Salmon River      | I&M          | 67° 27.594'  | 159° 50.475'  | 1262           | KOVA |
| Sisiak            | I&M          | 67° 59.702'  | 160° 23.739'  | 1823           | NOAT |
| Tahinichok        | I&M          | 67° 33.009'  | 163° 34.031'  | 966            | CAKR |
| Mt. Noak          | I&M          | 67° 08.486'  | 162° 59.672'  | 809            | CAKR |
| Devil Mountain    | I&M          | 66° 16.553'  | 164° 31.851'  | 285            | BELA |
| Ella Creek        | I&M          | 65° 16.289'  | 163° 48.681'  | 2258           | BELA |
| Hoodoo Hills RAWS | Fire RAWS    | 65° 35.711'  | 163° 24.671'  | 1550           | BELA |
| Midnight Mountain | I&M          | 65° 49.220'  | 164° 32.565'  | 2267           | BELA |
| Quartz Creek RAWS | Fire RAWS    | 65° 24.429'  | 164° 39.444'  | 276            | BELA |
| Serpentine        | I&M          | 65° 51.138'  | 164° 42.469'  | 518            | BELA |

## Climate Station Maintenance Summaries

This next section describes the maintenance details of seventeen climate stations in the Arctic Network organized by base locations. See Appendix A for detailed logistics for each of the base locations. Appendices B and C provide sensor specifications and metadata.

### **Bettles Base**

Stations maintained from Bettles include: Chimney Lake, Killik Pass, Pamichtuk Lake, and Ram Creek.

Logistics: NPS staff and equipment flew to Bettles on scheduled air service with Wright Air. Ken Hill and Pam Sousanes were transported from Bettles via NPS pilot and aircraft to access Pamichtuk and Killik Pass climate stations. Hill and Sousanes hiked to Pamichtuk Lake on June 23 and Killik Pass on June 24. Ken Hill and Mat Sorum packrafted from Gaedeke Lake to Circle Lake from June 24-29. The team hiked from the Alatna River to/from the Ram Creek station on June 27. Vendor aircraft picked up Hill and Sorum at Circle Lake June 29. On June 30, vendor aircraft dropped off Hill and Sorum at Chimney Lake. Hill and Sorum hiked 12 miles round trip to perform maintenance at the Chimney Lake climate station on July 1. Vendor aircraft picked up the team on July 2 and returned to Bettles. All staff stayed in the NPS/FWS bunkhouse at Bettles between outings.

### **Chimney Lake**

Date: July 1, 2015

Time of visit: 1200-1400

Personnel: Ken Hill, Mat Sorum

Mode of transport: Brooks Range Aviation DeHavilland Beaver (N1954J); hike from lake

Purpose of trip: Annual Maintenance

Weather: 52°F, 5-15 mph, partly cloudy

Sensors replaced:

AT-RH

WS-WD

RG-TB (mount repaired and re-leveled)

Radiation shield (T109 AT sensor)

Narrative:

The Chimney Lake station was accessed by hiking from Chimney Lake (4-8 hours round trip). The station was in good condition except for the rain gauge (RG-TB) and the radiation shield for the 109-L secondary air temperature (AT) sensor which were damaged, presumably by high winds. The RG-TB mount had been damaged and the sensor was hanging freely from its cable. The 109-L AT radiation shield was also damaged and the sensor was not shielded upon arrival. All data were downloaded from the datalogger. The HMP45 air temperature/relative humidity (AT-RH) and wind speed/wind direction (WS-WD) sensors were replaced for routine calibration. The RG-TB mount was repaired and the sensor was tested and re-leveled. The 109-L AT radiation shield was repaired and remounted on the mast. A new datalogger program (*Chimney2015.CR1*) was sent to the datalogger which transmits cumulative rainfall. The height of the snow depth sensor was entered into the program at 79 inches. The electric fence was

repaired and a new fence charger was mounted on the fence post. The desiccant packets were replaced in the enclosure. Photos were taken from the eight cardinal directions both towards and away from the station.



**Figure 2.** Chimney Lake, July 1, 2015 before (left) and after (right) maintenance. Upon arrival at the site the RG-TB and 109-L AT radiation shield were damaged.

### ***Killik Pass***

Date: June 24, 2015

Time of visit: 1200-1400

Personnel: Ken Hill, Pam Sousanes

Mode of transport: Hike from Lake; NPS Float Plane – Cessna 185 – Dan Shelden – N5163E

Purpose of trip: Annual Maintenance and Repairs

Weather: 60°F, sunny, light breeze

Sensors replaced:

AT-RH

WS-WD

RG-TB

Coax cable

GPS cable

SR50a cable

109-L AT

AT-RH radiation shield

ST1 (10 cm soil temperature; reinserted)

Narrative:

Killik Pass was accessed by hiking from a nearby lake (2-4 hours round trip). The lake where the aircraft landed contains a small island near the W-NW shore. The station had been damaged by a bear. All data were downloaded from the datalogger. The AT-RH and WS-WD sensors were replaced for routine calibration. The charge regulator had been loosened inside the box by the bear pulling on the wires, which caused the power connection at the datalogger to disconnect. The RG-TB sensor was badly damaged and replaced. The coax, GPS, and snow depth (SD) sensor cables were replaced. The 109-L AT cable was damaged and repaired by splicing. The AT-RH radiation shield and sensor were badly damaged and replaced. The ThermX AT sensor

cable was pulled out, but not damaged. The radiation shield for the ThermX sensor is bent at 45 degrees. The 10-cm soil temperature sensor (ST1) was lying near the surface and reinserted to the appropriate depth. A new datalogger program (*Killik2015.CR1*) was sent to the datalogger which transmits cumulative rainfall. The height of the snow depth sensor was measured as 70.1 inches and entered into the program. The AT-RH sensor was wired to continuous 12 V as necessitated by the new program. After the obvious repairs, the transmitter was not synchronizing with the GPS and data were not being sent to the buffer. To troubleshoot the issue, a new configuration file was sent to the transmitter. This reset the transmitter and solved the problem. The desiccant packets were replaced in the enclosure. Photos were taken from the eight cardinal directions both towards and away from the station.

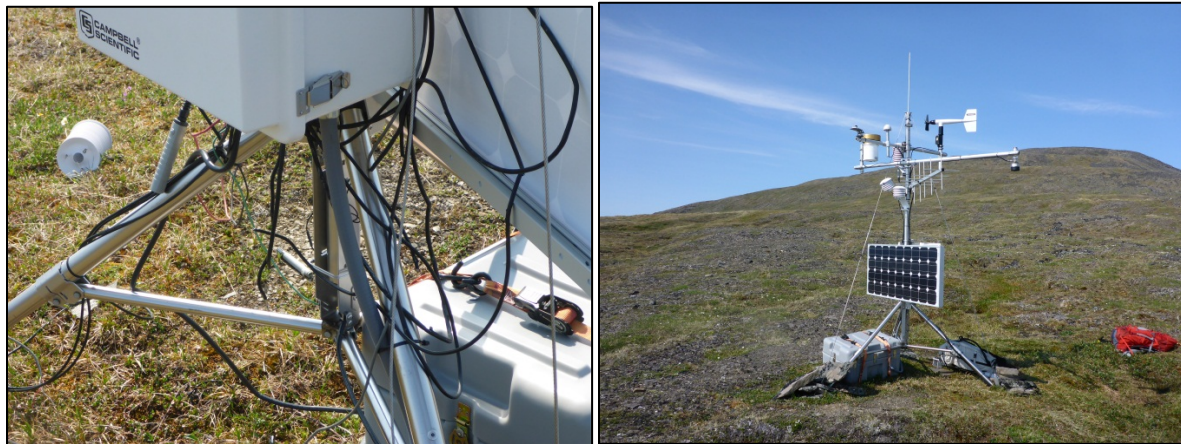


**Figure 3.** Killik Pass, June 24, 2015 before (left) and after (right) annual maintenance and repairs.

### ***Pamichtuk***

Date: June 22, 2015

Time of visit: 1300-1500

Personnel: Ken Hill, Pam Sousanes

Mode of transport: Hike from Lake; NPS Float Plane – Cessna 185 – Dan Shelden – N5163E

Purpose of trip: Annual Maintenance

Weather: 65°F, 5-15 mph

Sensors replaced:

AT-RH

SR

Narrative:

The Pamichtuk station was accessed by hiking from Pamichtuk Lake (3-6 hours round trip). The station looked good upon arrival. All data were downloaded from the datalogger. The AT-RH and solar radiation (SR) sensors were replaced for routine calibration. The ST1 10-cm soil temperature was lying on the surface and reinserted to the appropriate depth. A new datalogger program (*Pamichtuk2015.CR1*) was sent to the datalogger which transmits cumulative rainfall. The height of the snow depth sensor was entered into the program at 79.7 inches. The electric fence was repaired as needed. The SW post was wobbly and stabilized with rocks. The memory card in the CC5MPX phenology camera was swapped and camera settings were updated. A new

battery (100-aH Sun Extender) was added to power the camera. The power systems for the camera and climate station are independent. A PVC pipe with six inch incremental white/black striping was added to the SE corner fence post to monitor snow depth from the photos. The desiccant packets were replaced in the enclosure. Photos were taken from the eight cardinal directions both towards and away from the station.

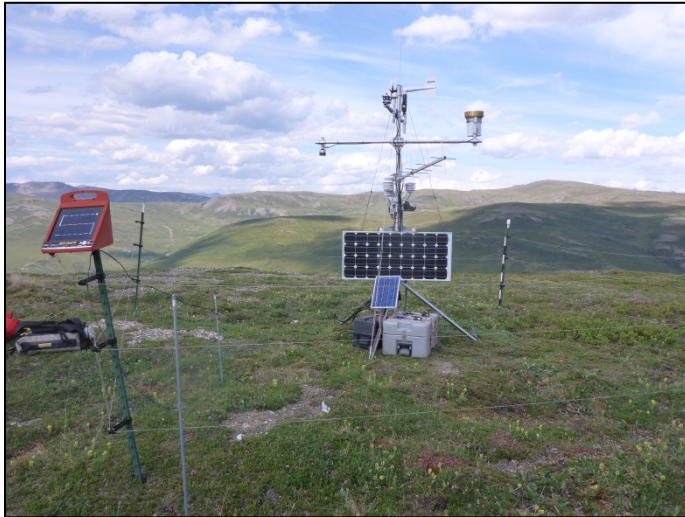


**Figure 4.** Pamichtuk, June 12, 2015.

### ***Ram Creek***

Date: June 27, 2015

Time of visit: 1400-1630

Personnel: Ken Hill, Mat Sorum

Mode of transport: Packraft/Hiking from Alatna River

Purpose of trip: Annual Maintenance

Weather: 52°F, 5-10 mph, scattered showers

Sensors replaced:

AT-RH

### **Narrative:**

The Ram Creek station was accessed by hiking from the Alatna River. Ken Hill and Mat Sorum packrafted from Gaedeke Lake (Appendix A). The station was in good condition. The AT-RH sensor was replaced for routine calibration. A new datalogger program (*Ram2015.CR1*) that transmits cumulative rainfall was sent to the datalogger. The height of the snow depth sensor was entered into the program at 79 inches. The AT-RH sensor was wired to 12 V instead of switch 12 V to account for the program changes. The electric fence was in good condition and maintained as needed. The desiccant packets were replaced in the enclosure. Photos were taken from the eight cardinal directions both towards and away from the station.



**Figure 5.** Ram Creek, June 27, 2015.

### **Dahl Creek Base**

I&M stations maintained from Dahl Creek include: Howard Pass, Imelyak, Kaluich, and Salmon River. Additionally, Kavet Creek and Noatak fire RAWS stations were maintained.

Logistics: A Robinson-44 helicopter (N7528Z; Pollux; pilot Brad Vansyckle) was used to access the sites. Climate staff flew to/from Fairbanks and Dahl Creek in the NPS Cessna-206 (N473YC; pilot Cebulski). All staff stayed in the NPS bunkhouse at Dahl Creek.

### **Howard Pass**

Date: July 20, 2015

Time of visit: 1600-1800

Personnel: Ken Hill, Dave Swanson

Mode of transport: R-44 helicopter – Pollux N7528Z

Purpose of trip: Annual maintenance

Weather: 52°F, light winds

Sensors replaced:

AT-RH (HMP155)

WS-WD

SR

Narrative:

The Howard Pass station was accessed from Dahl Creek by helicopter. The WS-WD sensor stopped transmitting after a prolonged wind event in December 2014. The last gust recorded from this sensor was 89 mph at which point the wind sensor was probably ripped off its base mount. A new WS-WD sensor was installed (alpine version). The AT-RH sensor and the SR sensor were replaced for routine calibration. The snow depth sensor was removed, because accumulation at the site is minimal due to strong winds. A new program (*HowardPass2015.CR1*) that transmits cumulative rainfall was sent to the datalogger. All bolts and guy wires were tightened. The solar panel cables were loose and were re-taped and cable tied to the back of the

panel. The desiccant packets were replaced in the enclosure. Dave Swanson completed soil and vegetation descriptions at the site. Photos were taken from the eight cardinal directions both towards and away from the station.



**Figure 6.** Howard Pass, July 25, 2015 (top left). New alpine WS-WD sensor (top right). Soil pit and vegetation classification (bottom).

### ***Imelyak***

Date: July 20, 2015

Time of visit: 1800-1930

Personnel: Ken Hill, Dave Swanson

Mode of transport: R-44 helicopter – Pollux N7528Z

Purpose of trip: Annual Maintenance

Weather: Breezy, 48°F, 10-20 mph, partly cloudy

Sensors replaced:

AT-RH (HMP155)

SR

SD

Narrative:

The Imelyak site was accessed by helicopter from Dahl Creek – Howard Pass. The site was in good condition upon arrival. All data were downloaded from the datalogger. The AT-RH and SR sensors were replaced for routine calibration. The HMP60 AT-RH sensor was replaced with a HMP155 AT-RH sensor. A new datalogger program (*Imelyak2015.CR1*) that transmits cumulative rainfall was sent to the datalogger. The snow depth sensor height is 104.8 inches. The antenna was realigned to 140° (previously at 120°). The WS-WD cross arm was also corrected from 204° to 180°. Archived data should be corrected. All bolts and guy wires were tightened.

The desiccant packets were replaced in the enclosure. Photos were taken from the eight cardinal directions both towards and away from the station.



**Figure 7.** Imelyak, July 20, 2015.

### ***Kaluich***

Date: July 21, 2015

Time of visit: 1600-1800

Personnel: Ken Hill, Dave Swanson

Mode of transport: R-44 helicopter – Pollux N7528Z

Purpose of trip: Annual Maintenance

Weather: 55°F, 3-10 mph, partly cloudy

Sensors replaced:

AT-RH (HMP-155)

WS-WD

### **Narrative:**

The Kaluich site was accessed by helicopter from Dahl Creek – Noatak RAWS. The WS-WD and RG-TB sensors were damaged, presumably by strong winds. All data were downloaded from the datalogger. The AT-RH sensor was replaced for routine calibration. The damaged WS-WD sensor was replaced with an alpine version. The mounting bracket on the RG-TB was damaged. The sensor was remounted directly to the 1" pipe on the cross arm. A new datalogger program (*Kaluich2015.CR1*) that transmits cumulative rainfall was sent to the datalogger. The measured snow depth sensor height was 80 inches. All bolts and guy wires were tightened. The desiccant packets were replaced in the enclosure. Dave Swanson completed soil and vegetation descriptions at the site. Photos were taken from the eight cardinal directions both towards and away from the station.



**Figure 8.** Kaluich, July 21, 2015. Clockwise from top: damaged WS-WD sensor, damaged RG-TB mount, repaired RG-TB mount, site after maintenance and repairs.

### ***Kavet Creek fire RAWS***

Date: July 22, 2015

Time of visit: 0900-1100

Personnel: Ken Hill, Dave Swanson

Mode of transport: R-44 helicopter – Pollux N7528Z

Purpose of trip: Annual Maintenance

Weather: 70°F, mostly sunny

Sensors replaced:

AT-RH

WS-WD

ST3 (reinstalled)

Narrative:

The Kavet Creek fire RAWS station was accessed via helicopter from Dahl Creek on July 22. The station looked good upon arrival. All data were downloaded from the datalogger. The AT-RH and WS-WD sensors were replaced for routine calibration. The RG-TB was tested and reset. All sensors were scanned. The SDI sensors were “mapped” according to instructions from NPS radio shop staff. A soil sensor was lying on the surface and reinstalled to 10 cm depth. Further investigation is required to verify that all soil temperature sensors are installed at the correct depths. Dave Swanson completed soil pit and vegetation descriptions at the site. All bolts and guy wires were tightened.



**Figure 9.** Kavet Creek fire RAWS. Photo from July 24, 2014.

***Noatak fire RAWS***

Date: July 21, 2015

Time of visit: 1300-1600

Personnel: Ken Hill, Dave Swanson

Mode of transport: R-44 helicopter – Pollux N7528Z

Purpose of trip: Annual Maintenance

Weather: 65°F, 5-10 mph, mostly sunny

Sensors replaced:

AT-RH

WS-WD

Narrative:

The Noatak fire RAWS station was accessed via helicopter from Dahl Creek - Kaluich. The station looked good upon arrival. All data were downloaded from the datalogger. The AT-RH and WS-WD sensors were replaced for routine calibration. The ST1 and ST3 soil temperature sensors were repaired by splicing. The RG-TB was tested and reset. All sensors were scanned. The SDI sensors were “mapped” according to instructions from NPS radio shop staff. All bolts and guy wires were tightened. Dave Swanson completed soil and vegetation descriptions at the site. Photos were taken from the eight cardinal directions both towards and away from the station.

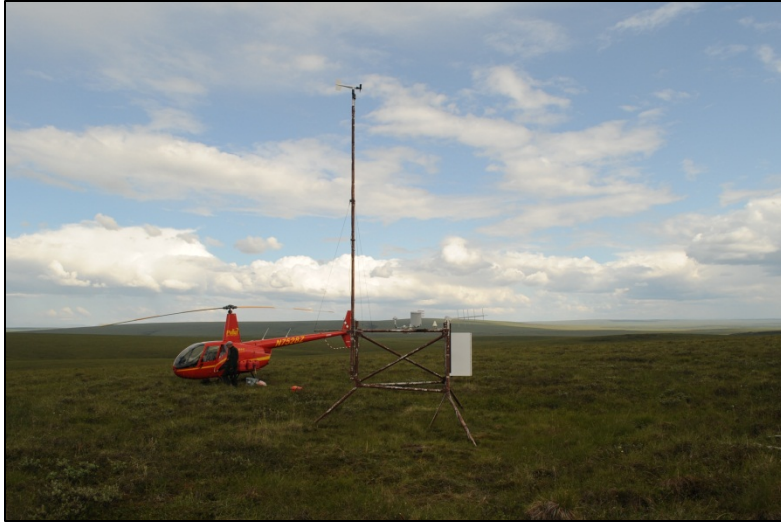


**Figure 10.** Noatak fire RAWS, July 21, 2015.

### ***Salmon River***

Date: June 5, 2015

Time of visit: 1600-1900

Personnel: Ken Hill, Pam Sousanes

Mode of transport: R-44 Helicopter – Pollux – N4164Q

Purpose of trip: Unscheduled Repair

Weather: 46°F, mostly calm

Sensors replaced:

SR

### **Narrative:**

The Salmon River site was accessed by helicopter from Kotzebue for an unscheduled repair. The station had been damaged by a bear and was not transmitting. There was mud smeared on the solar panel and bite marks on the battery box. The SR sensor cable was severed and the snow depth sensor cable was damaged. The power supply to the station seemed okay, but initial attempts to connect to the datalogger failed. Troubleshooting involved power manipulation and replacing the datalogger without success. The original datalogger was reinstalled and a connection was made. All data were downloaded from the logger. When re-wiring the damaged snow depth sensor cable, the wire sparked, indicating a potential short in the wiring. The snow depth sensor was removed (and replaced during the scheduled maintenance visit in July). A new datalogger program (*Salmon2015.CR1*) that transmits cumulative rainfall was sent to the datalogger. The data card from the CC5MPX camera was swapped and camera settings were updated. The electric fence was in poor condition, but the charger was still functioning. The fence was repaired. All bolts and guy wires were tightened. The desiccant packets were replaced in the enclosure. Photos were taken from the eight cardinal directions both towards and away from the station.



**Figure 11.** Salmon River, June 5, 2015 before (left) and after (right) repairs.

### ***Salmon River 2***

Date: July 21, 2015

Time of visit: 1000-1200

Personnel: Ken Hill, Dave Swanson

Mode of transport: R-44 Helicopter – Pollux – N7528Z – Brad Vansyckle

Purpose of trip: Annual Maintenance

Weather: 46°F, mostly calm

Sensors replaced:

AT-RH

CC5MPX 12 Volt Battery

### **Narrative:**

The Salmon River site was accessed by helicopter from Dahl Creek. The station was in good condition. All data were downloaded from the datalogger. The AT-RH sensor (HMP-155) was replaced for routine calibration. The snow depth sensor cable was replaced (see site visit from June 5). The *Salmon2015.CR1* datalogger program was re-sent to the datalogger with a snow depth sensor height of 85.3 inches. The data card from the CC5MPX camera was swapped. A new 12-Volt battery (100 aH Sun Extender) was installed as the power supply for the camera. The station and the camera operate on independent battery supplies. The electric fence was in good condition and maintained as needed. A PVC pipe with six inch incremental white/black striping was added to the SE corner fence post to monitor snow depth from the photos. The camera scene, zoom, and focus were adjusted. Dave Swanson completed soil and vegetation descriptions at the site. All bolts and guy wires were tightened. The desiccant packets were replaced in the enclosure. Photos were taken from the eight cardinal directions both towards and away from the station.



**Figure 12.** Salmon River, July 21, 2015.

### **Kotzebue Base**

I&M stations maintained from Kotzebue include: Asik, Kugururok, Mt. Noak, Sisiak, and Tahinichok. The Kelly fire RAWS and Kelly Snotel stations were also maintained.

Logistics: NPS climate staff flew commercially from Nome on Bering Air. Extra cargo (CC5MPX battery and case) was shipped in advance through Everts Cargo from Fairbanks. All sites were accessed via R44 Pollux helicopter from Kotzebue. NRCS Snotel staff accessed the Kelly River site with NPS fleet aircraft. All staff were housed at the BLM bunkhouse in Kotzebue.

### **Asik**

Date: June 6, 2015

Time of visit: 1500-1700

Personnel: Ken Hill, Pam Sousanes

Mode of transport: R44 helicopter – Pollux – N4164Q – Robert Kozakiewicz

Purpose of trip: Annual maintenance

Weather: 42°F, 15-20 mph

Sensors replaced:

AT-RH

WS-WD

Narrative:

Asik station was accessed by helicopter from Kotzebue – Tahinichok - Kelly. The station looked good upon arrival. All data were downloaded from the datalogger. The AT-RH and WS-WD sensors were replaced for routine calibration. A new datalogger program (*Asik2015.CR1*) was sent to the datalogger with a snow depth sensor height of 72 inches. The new program transmits cumulative rainfall. The red solar panel wire had pulled out of the solar panel control box. It was reconnected and secured. All bolts and guy wires were tightened. The desiccant packets were

replaced in the enclosure. Photos were taken from the eight cardinal directions both towards and away from the station.



**Figure 13.** Asik, June 6, 2015.

***Kelly fire RAWS***

Date: June 6, 2015

Time of visit: 1400-1600

Personnel: Pam Sousanes, Ken Hill

Mode of transport: R44 helicopter – Pollux – N4164Q – Robert Kozakiewicz

Purpose of trip: Annual maintenance

Weather: 50°F, 5-10 mph

Sensors replaced:

AT-RH

WS/WD

Narrative:

The Kelly fire RAWS station was accessed via helicopter from Kotzebue – Tahinichok. The station looked good upon arrival. All data were downloaded from the datalogger. The AT-RH and WS-WD sensors were replaced for routine calibration. The RG-TB was tested and reset. All sensors were scanned. The SDI sensors were “mapped” according to instructions from NPS radio shop staff. All bolts and guy wires were tightened. Photos were taken from the eight cardinal directions both towards and away from the station.

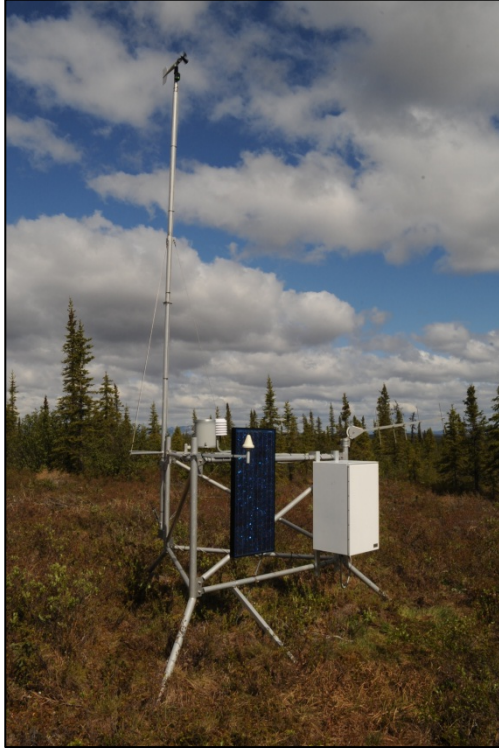


**Figure 14.** Kelly RAWS, June 6, 2015.

### ***Kelly Snotel***

Date: August 6, 2015

Personnel: Tony DeMarco (NRCS) Dan Kenney (NRCS)

Mode of transport: NPS Fleet – Dan Shelden

Purpose of trip: Annual maintenance

Sensors replaced: as needed by NRCS

Narrative: Tony DeMarco and Dan Kenney completed the annual maintenance at the Kelly Snotel site on August 6. The precipitation gauges were flushed and 10 gallons of fresh antifreeze liquid added for the winter. The electric fences were repaired. The sensors were tested and the site was working on departure.

### ***Kugururok***

Date: June 5, 2015

Time of visit: 1000-1200

Personnel: Pam Sousanes, Ken Hill

Mode of transport: R44 helicopter – Pollux – N4164Q – Robert Kozakiewicz

Purpose of trip: Annual Maintenance

Weather: 40°F, 5-10 mph

Sensors Replaced:

AT-RH

Narrative:

Kugururok station was accessed by helicopter from Kotzebue. The station looked good upon arrival. All data were downloaded from the datalogger. The AT-RH sensor was replaced for routine calibration. A new datalogger program (*Kugururok2015.CR1*) was sent to the datalogger with a snow depth sensor height of 80 inches. The new program transmits cumulative rainfall. A CC5MPX phenology camera was added to the site. The camera captures images five times daily, centered on solar noon. The camera is powered independently of the station with a 100 aH battery and 10 W solar panel. The camera scene points north with snow patches, the river valley, poplars, and distant peaks. All bolts and guy wires were tightened. The desiccant packets were replaced in the enclosure. Photos were taken from the eight cardinal directions both towards and away from the station.

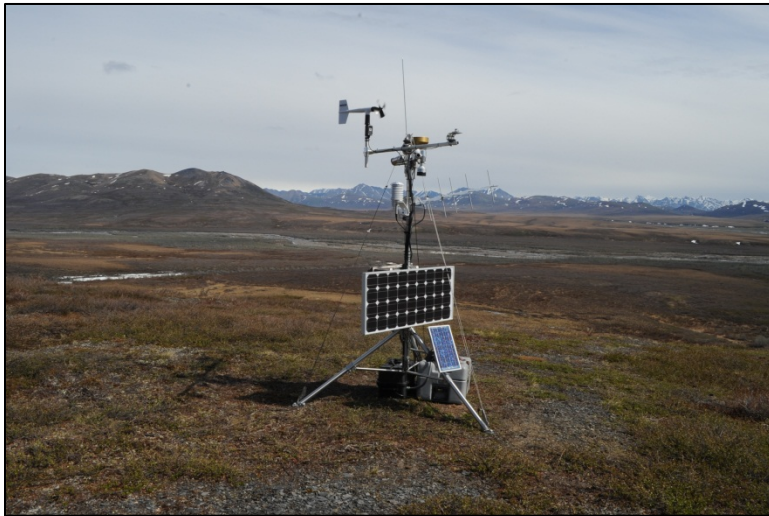


**Figure 15.** Kugururok, June 5, 2015.

### ***Mt. Noak***

Date: June 4, 2015

Time of visit: 1500-1800

Personnel: Ken Hill, Pam Sousanes

Mode of transport: R44 helicopter – Pollux – N4164Q – Robert Kozakiewicz

Purpose of trip: Annual maintenance

Weather: 45°F, 5-10 mph

Sensors replaced:

AT-RH

WS-WD

RG-TB (lid)

Radiation shield (12-plate)

Narrative:

Access to Mt. Noak was by helicopter from Kotzebue. The station had been damaged, presumably by musk oxen. Musk ox fur was visible on the guy wires and there was mud on the enclosure box and camera lens. The long cross bar was out of level, the RG-TB lid was missing, and the radiation shields were both bent horizontally. The solar panel had been rotated and was oriented to the west. All data were downloaded from the datalogger. The AT-RH and SR sensors

were replaced for routine calibration. The cross arms and solar panel were leveled and aligned. A new datalogger program (*Noak2015.CR1*) was sent to the datalogger with a snow depth sensor height of 74 inches. The lid on the tipping bucket was replaced. A few missing antenna tines were replaced. The damaged 12-plate AT-RH radiation shield was replaced. The horizontal 6-plate shield was left at the site and could be replaced during the next field visit. The memory card from the CC5MPX camera was swapped. Camera settings were updated (site name, etc.) and image capture times edited to take five images daily centered on solar noon. A new 12-Volt, 100 aH battery was installed as the power supply for the camera. The station and the camera operate on independent power supplies. All bolts and guy wires were tightened and all sensors were leveled. The desiccant packets were replaced in the enclosure. Photos were taken from the eight cardinal directions both towards and away from the station.



**Figure 16.** Mt. Noak, June 4, 2015. Site shown before (left) and after (right) repairs. The AT-RH radiation shields (middle) were bent horizontally, presumably by musk oxen.

### ***Sisiak***

Date: June 5, 2015

Time of visit: 1400-1600

Personnel: Ken Hill, Pam Sousanes

Mode of transport: R44 helicopter – Pollux – N4164Q – Robert Kozakiewicz

Purpose of trip: Annual maintenance

Weather: 38°F, 15-20 mph

Sensors replaced:

AT-RH

SR

Narrative:

Sisiak station was accessed via helicopter from Kotzebue - Kugururok. The station looked good upon arrival. All data were downloaded from the datalogger. The AT-RH and SR sensors were replaced for routine calibration. A new datalogger program (*Sisiak2015.CR1*) was sent to the datalogger with the measured snow depth sensor height of 83 inches. The new program transmits cumulative rainfall. All bolts and guy wires were tightened. The desiccant packets were replaced in the enclosure. Photos were taken from the eight cardinal directions both towards and away from the station.



**Figure 17.** Sisiak, June 5, 2015.

### ***Sisiak 2***

Date: September 16, 2015

Time of visit: 100-1200

Personnel: Ken Hill

Mode of transport: R44 helicopter – Pollux – N4164Q – Craig Furmage

Purpose of trip: Repair

Weather: 30°F, 20-30 mph

Sensors replaced:

Coax Cable

### **Narrative:**

Sisiak station was accessed via helicopter from Kotzebue. The station had been damaged by a bear on July 16, 2015. The coax cable was severed at the connection to the antenna. The radiation shield was bent. The solar panel cables were disconnected. The long cross arm was out of level. All data were downloaded from the datalogger. The coax cable was replaced and the radiation shield was straightened. The solar panel cables were reconnected. The cross arm and sensors (snow depth, RG-TB) were releveled. A new datalogger program (*Sisiak2015.CR1*) was sent to the datalogger and the cumulative rainfall total was reset to its previous value of 2.67 inches. Note that rainfall data from the date of the bear damage to the repair date (7/16/2015 - 9/16/2015) is not accurate because the sensor was out of level. An electric fence will be added to this site in the future. Photos were taken from the eight cardinal directions towards the station.



**Figure 18.** Sisiak station September 16, 2015 shown before (left) and after (right) repairs.

### ***Tahinichok***

Date: June 6, 2015

Time of visit: 0930-1230

Personnel: Ken Hill, Pam Sousanes

Mode of transport: R44 helicopter – Pollux – N4164Q – Robert Kozakiewicz

Purpose of trip: Annual maintenance

Weather: Light rain, intermittent fog, 52°F, 10-15 mph

Sensors replaced:

AT-RH

SR

GOES Antenna

Coax Cable

SD sensor cable

Narrative:

Tahinichok station was accessed via helicopter from Kotzebue. The station had been damaged by a bear and was not transmitting. The GOES antenna, coax cable, and snow depth sensor cable were damaged and replaced. The electric fence was damaged with the SE post bent and the charger damaged. A spare charger was not available and was replaced at a later date (see below). A new hole was drilled in the enclosure to properly install the power cable conduit. The cross arms and sensors were leveled and the solar panel/enclosure realigned. The field computer was having problems connecting to the datalogger and a power issue was suspected. After replacing the snow depth sensor cable, the computer connected to the datalogger. All data were downloaded from the datalogger. The AT-RH and SR sensors were replaced for routine calibration. A new datalogger program (*Tahinichok2015.CR1*) with a snow depth sensor height of 81 inches was sent to the datalogger. All bolts and guy wires were tightened. The desiccant packets were replaced in the enclosure. Photos were taken from the eight cardinal directions both towards and away from the station.

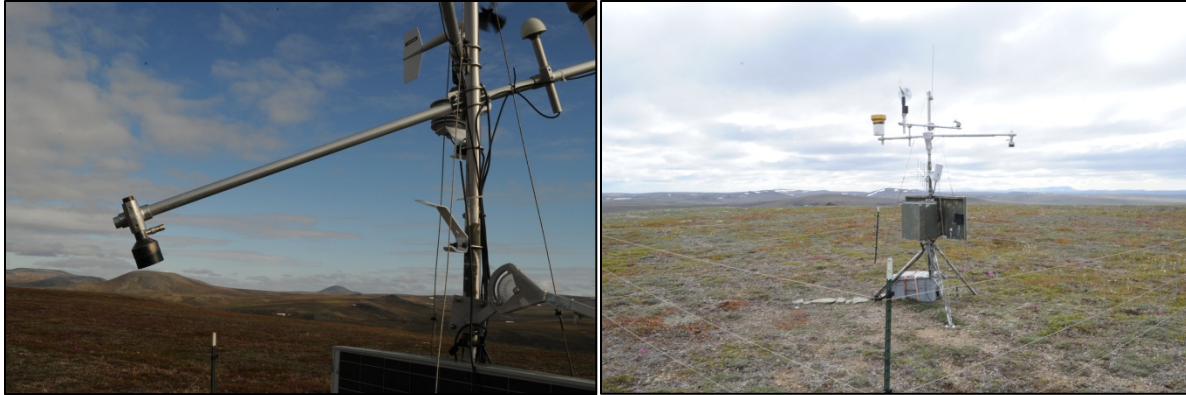


**Figure 19.** Tahinichok station June 6, 2015 shown before (left) and after (right) repairs.

### ***Tahinichok 2***

Date: July 28, 2015

Time of visit: 1100-1200

Personnel: Mat Sorum

Mode of transport: R44 helicopter – Pollux

Purpose of trip: Repair

Weather: 50°F, 15-20 mph

Sensors replaced:

AT-RH sensor and cable

Fence charger

Narrative:

Tahinichok station was accessed via helicopter from Red Dog Mine. Mat Sorum (NPS wildlife biologist) stopped at the station while retrieving caribou collars. The AT-RH sensor was corroded. Sorum replaced the sensor and cable and a new fence charger was added to the station.

### **Nome Base**

I&M stations maintained from Nome include Devil Mountain, Ella Creek, Midnight Mountain, and Serpentine Hot Springs. Fire RAWS stations at Hoodoo Hills and Quartz Creek were also maintained.

Logistics: NPS staff flew via commercial airline to Nome and based out of Nome and Quartz Creek for the station maintenance. Extra equipment was shipped in advance with Everts Cargo and picked up in Nome. A Bering Air R-44 helicopter was used to reach the site locations from Quartz Creek. Staff stayed at the NPS bunkhouse in Nome and the DOT cabin in Quartz Creek. An NPS vehicle was used for transport. On the drive north to Quartz Creek, Mark Hall and Rocky Bilotta from the NWS CRN network joined Ken Hill and Pam Sousanes. Hall and Bilotta were completing site surveys for a possible CRN site on the Seward Peninsula. NOAA will pursue permitting through BLM for a future installation at Salmon Lake.

### ***Devil Mountain***

Date: June 2, 2015

Time of visit: 1400-1600

Personnel: Ken Hill, Pam Sousanes

Mode of transport: R44 helicopter – Bering Air – N4237W - Thomas St. Romain

Purpose of trip: Annual Maintenance

Weather: 50°F, 10-15 mph

Sensors replaced:

AT-RH

WS-WD

SR

Narrative:

Devil Mountain was accessed by helicopter from Quartz Creek. All data were downloaded from the datalogger. The AT-RH, WS-WD, and SR sensors were replaced for routine calibration. A new datalogger program (*Devil2015.CR1*) with the measured snow depth sensor height of 84 inches was sent to the datalogger. The new program transmits cumulative rainfall. The RG-TB mount had snapped and was repaired and leveled. The set screw on the solar radiation sensor leveling stand was corroded and stripped. The stand was replaced and the sensor was leveled. The electric fence was repaired as needed and the charger was secured to the fence post with cable ties and strapping tape. Sea ice was visible in Kotzebue Sound to the east. Musk ox scat and fur were visible near/on the enclosure. All bolts and guy wires were tightened. The desiccant packets were replaced in the enclosure. Photos were taken from the eight cardinal directions both towards and away from the station.



**Figure 20.** Devil Mountain, June 2, 2015 before (left) and after (right) maintenance and repairs.

### ***Ella Creek***

Date: June 3, 2015

Time of visit: 1200-1400

Personnel: Ken Hill, Pam Sousanes

Mode of transport: R44 helicopter – Bering Air – N4237W - Thomas St. Romain

Purpose of trip: Annual Maintenance

Weather: 40°F, 15-25 mph

Sensors replaced:

AT-RH

WS-WD

Narrative:

Ella Creek was accessed by helicopter from Quartz Creek. All data were downloaded from the datalogger. The AT-RH and WS-WD sensors were replaced for routine calibration. The WS-WD sensor had been damaged during a strong wind event 12/31/2014. The propeller had unscrewed from the main shaft. An alpine version of the sensor was used as a replacement. The radiation shield for the AT-RH sensor had blown apart. The shield was rebuilt as well as possible, but some pieces were missing. *A new shield should be installed next year.* A few antenna tines were missing and replaced. The antenna azimuth was realigned from 0° to 13°. A new datalogger program (*Ella2015.CR1*) with the measured snow depth sensor height of 74 inches was sent to the datalogger. The new program transmits cumulative rainfall. All bolts and guy wires were tightened. The desiccant packets were replaced in the enclosure. Photos were taken from the eight cardinal directions both towards and away from the station.

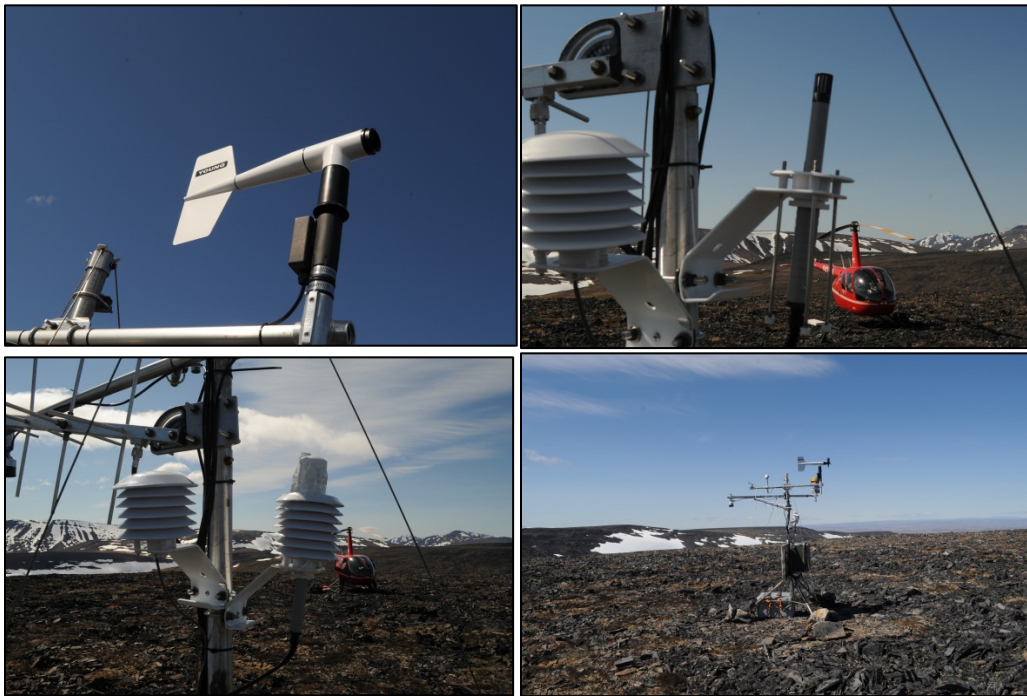


**Figure 21.** Ella Creek, June 3, 2015. Clockwise from top: damaged WS-WD sensor, damaged radiation shield, field repair of radiation shield, site after maintenance.

### ***Hoodoo Hills fire RAWS***

Date: June 3, 2015

Time of visit: 1500-1800

Personnel: Ken Hill, Pam Sousanes

Mode of transport: R44 helicopter – Bering Air – N4237W - Thomas St. Romain  
Purpose of trip: Annual Maintenance  
Weather: 42°F, 10-20 mph

Sensors replaced:

AT-RH

WS-WD

Battery

Narrative:

The Hoodoo Hills fire RAWS station was accessed via helicopter from Quartz Creek – Ella Creek. All data were downloaded from the F6 datalogger. The AT-RH and WS-WD sensors were replaced for routine calibration. The electric fence was repaired using existing posts on site. New posts were brought to the site, but were not needed. The new posts were left at the site. The fence charger was fixed to the post with strapping tape and bailing wire. Two old batteries were replaced with one new battery. The old batteries were left at the site and scheduled to be removed by the NPS radio shop later in the summer. The fence posts, poly-wire, and charger should be replaced during the next field visit. The station is slightly out of level and possibly sinking. Future site visits should consider addressing this problem. All bolts and guy wires were tightened.

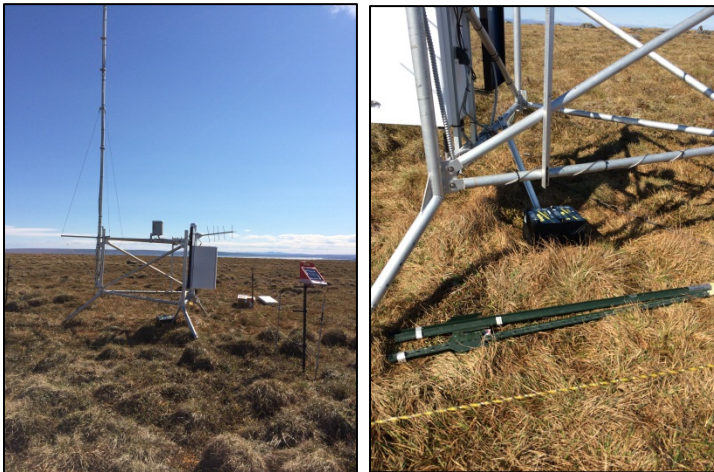


**Figure 22.** Hoodoo Hills fire RAWS, June 3, 2015. Station photo from after scheduled maintenance (left). Extra fence posts were left at the station (right).

### ***Midnight Mountain***

Date: June 2, 2015

Time of visit: 1700-1800

Personnel: Ken Hill, Pam Sousanes

Mode of transport: R44 helicopter – Bering Air – N4237W - Thomas St. Romain

Purpose of trip: Annual maintenance

Weather: 42°F

Sensors replaced/repared:

ST2 (-20cm): spliced

Power Cable

Narrative:

Midnight Mountain was accessed by helicopter from Quartz Creek – Devil Mountain. Because of heavy riming in winter months, only air and soil temperature sensors are installed at this site. All data were downloaded from the datalogger. After troubleshooting, it was determined that the power cable from the battery to the datalogger was damaged. Data were only being collected when the solar panel was charging the station directly. A new battery power cable was installed to fix the problem. One soil temperature sensor cable was damaged and was repaired by splicing. The desiccant packets were replaced in the enclosure.

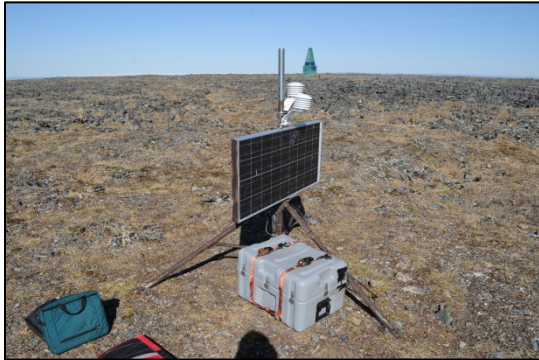


**Figure 23.** Midnight Mountain, June 2, 2015.

**Quartz Creek fire RAWS**

Date: June 3, 2015

Time of visit: 1500-1600

Personnel: Ken Hill, Pam Sousanes

Mode of transport: NPS vehicle

Purpose of trip: Annual Maintenance

Weather: 52°F, 25-30 mph

Sensors replaced:

AT-RH

WS-WD

Transmitter

Narrative:

The Quartz Creek fire RAWS station was accessed from the air strip. The station looked good upon arrival. All data were downloaded from the datalogger. The AT-RH and WS-WD sensors were replaced for routine calibration. The G4 transmitter was replaced with a G5 transmitter. The RG-TB was tested and reset. All sensors were scanned. All bolts and guy wires were tightened.

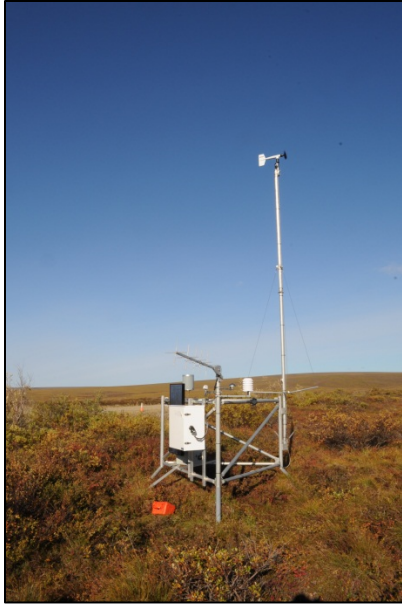


**Figure 24.** Quartz Creek fire RAWs. Photo from September 4, 2014.

### ***Serpentine Hot Springs***

Date: June 2, 2015

Time of visit: 1830-2030

Personnel: Ken Hill, Pam Sousanes

Mode of transport: R44 helicopter – Bering Air – N4237W - Thomas St. Romain

Purpose of trip: Annual Maintenance

Weather: 42°F, 15-20 mph

Sensors replaced:

AT-RH

SR

Narrative:

Serpentine was accessed by helicopter from Quartz Creek – Devil Mountain – Midnight Mountain. The station was in good condition upon arrival. All data were downloaded from the datalogger. The AT-RH and SR sensors were replaced for routine calibration. A new datalogger program (*Serpentine2015.CR1*) with the measured snow depth sensor height of 88 inches was sent to the datalogger. The new program transmits cumulative rainfall. The memory card from the CC5MPX camera was swapped. A new battery (100 aH Sun Extender) was installed as the power supply for the camera. The power supply for the camera is independent of the station power supply. The camera image capture settings were verified to capture five images each day at hourly intervals between 1300 and 1700 (centered near solar noon). All bolts and guy wires were tightened. The desiccant packets were replaced in the enclosure. Photos were taken from the eight cardinal directions both towards and away from the station.

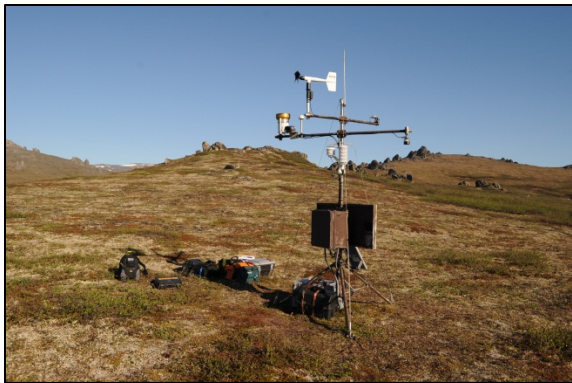


**Figure 25.** Serpentine, June 2, 2015.

## Appendix A: Logistics Summary 2015

### Bettles Logistics June 22 - July 3

2015 was the first year with access to GAAR sites by float plane. Previous years involved helicopter access. In 2015, fixed wing access was determined to be the “minimum tool” to access the wilderness climate stations as outlined in the environmental assessment. Based on telemetered data from the sites in late spring, the stations appeared to be in good working order. This allowed staff to plan on maintaining the sites with minimal backup equipment. Future circumstances may require helicopter access as the minimum tool if, for example, stations are not transmitting or are known to require extensive repairs/maintenance.

On 6/22, Ken Hill and Pam Sousanes traveled to Bettles on scheduled air service with Wright Air. Dan Shelden arrived in fleet aircraft from Kotzebue on 6/22 (Cessna 185; N5163E). Hill, Sousanes, and Shelden flew to Pamichtuk Lake. The plane was parked on a beach on the southeast edge of the lake. Hill and Sousanes hiked through dwarf birch and tundra from the lake to the station (two miles and 1300 feet) in about two hours. After completing station maintenance, Hill and Sousanes hiked back to the float plane in about one hour. Note: the 75 pound battery and pelican case for the CC5MPX camera had been placed at the station by NPS biologists in April while they were completing bear captures with a helicopter.

While returning from Pamichtuk to Bettles, Shelden, Hill, and Sousanes circled over Chimney Lake to assess its suitability for landing in the fleet Cessna-185 aircraft. Based on the surrounding topography and weather conditions Shelden determined that the lake was not well suited for a Cessna-185, and recommended either a smaller aircraft or a DeHavilland Beaver.

On 6/24, Hill, Sousanes, and Shelden flew to Killik Pass lake (Location: N 67.96552, W 154.99459) in N5163E. The lake closest to the climate station has an island near the northern shore. In favorable conditions, Shelden advised that a Cessna-185 was an appropriate aircraft for this lake, but consideration should be given to steep topography at the western end of the lake. The plane was parked at the eastern edge of the lake. Hill and Sousanes hiked on good ground from the lake to the station (1.75 miles; 1050 feet) in approximately one hour. Shelden, Hill, and Sousanes stayed in NPS housing in Bettles 6/22 - 6/24.

On 6/25, Mat Sorum arrived on scheduled service with Wright Air. Shelden, Hill, and Sorum flew from Bettles to Gaedeke Lake (N 67.89469, W 155.08474). Pack weights for Hill and Sorum were approximately 60 pounds and included ten days of food, equipment for packrafting (including dry suits), backpacking, emergencies, navigation, and station maintenance (tools, PDA computer, sensors, etc.). After dropping Hill and Sorum at Gaedeke Lake, Shelden returned in fleet aircraft to Kotzebue. Hill and Sorum hiked on the east side of the Alatna River from Gaedeke Lake to the confluence with the Weyahok River (4.5 miles; 2 hours). Water levels on the Alatna were low. At higher water, a packrafter may be able to paddle this section of river from the lake outlet. Hill and Sorum prepared the rafts and paddled from the confluence approximately 7 miles downstream before setting up camp. The river difficulty was class II with occasional rapids and wall pushes. After a leisurely morning on 6/26, Hill and Sorum paddled approximately 20 miles to the second camp on the Alatna River below the Ram Creek station. After scouting multiple possible ascent routes to gain the Ram Creek ridge, a good route was found through sparse forest and tundra ridges north of the station (ascending the ridge at N

67.641385, W 154.390461). The hike took approximately 4 hours on 6/27 (3.5 miles; 3250 feet elevation gain). On 6/28, Hill and Sorum paddled approximately 18 miles to within one mile of Circle Lake. The river gradient flattens substantially below the confluence with Pegeluk Creek and is primarily class I. During the trip, water samples were collected for the ARCN aquatic ecologist at Gaedeke Lake, Kutuk Creek, and the Alatna River near Circle Lake. Two days ahead of schedule, the team called Brooks Range Aviation (BRA) for a pickup at Circle Lake. Thick smoke delayed a pickup until the afternoon of 6/29. Hill and Sorum portaged from the Alatna River (one mile; < one hour) to the pickup location on the northwest corner of Circle Lake (N 67.482396, W 153.869563) and returned to Bettles (DeHavilland Beaver; N4040W; Garrett Houser). Hill and Sorum stayed in NPS housing at Bettles on 6/29.

On the afternoon of 6/30, BRA flew Hill and Sorum to Chimney Lake (DeHavilland Beaver; N1954J; Lauren DeWitt). The team set up camp on a bench on the south side of the lake. On 7/1, Hill and Sorum hiked to Chimney Lake station (4.5 miles, 2500 feet) allowing 3-5 hours each way. Along the route, the team observed a herd of over 20 Dall's sheep rams at Chimney Mountain. BRA picked up Hill and Sorum from Chimney Lake on 7/2. Hill and Sorum returned to Fairbanks the afternoon of 7/2 on scheduled service with Wright Air.

### **Dahl Creek Logistics July 20-23**

Ken Hill and Dave Swanson flew to Dahl Creek in NPS fleet aircraft on July 20 (Cessna 206 – N473YC – Curtis Cebulski). The vendor helicopter arrived midday on 7/20 (Pollux – R44 – N7528Z – Brad Vansyckle). Howard Pass and Imelyak station maintenance was completed on 7/20. On 7/21, Hill and Swanson were dropped at Salmon River. The pilot returned to Dahl Creek to retrieve additional gear (CC5MPX battery, etc.) and fuel jugs. Noatak RAWS and Kaluich stations were also maintained on 7/21. On 7/22, Hill and Swanson serviced Kavet Creek RAWS. Swanson completed soil pits and vegetation classifications at all sites. Approximately 160 gallons of Avgas was used from the Dahl Creek tank. The helicopter departed on 7/22 to Unalakleet for its next contract. All staff were housed at the NPS bunkhouse in Dahl Creek. Staff cooked and slept in the cabin. Hill and Swanson returned to Fairbanks with NPS fleet N473YC on 7/23.

### **Kotzebue Logistics June 4-7; September 15-16**

Ken Hill and Pam Sousanes traveled from Nome to Kotzebue on a Bering Air commercial flight arriving the morning of 6/4. The total baggage weight was 320 pounds. Local staff (expediter Ryan Sherman) provided transportation to the BLM bunkhouse, Everts Air Cargo, and the I&M cache at the NPS warehouse. Sousanes shipped the CC5MPX batteries via Everts and the NPS radio shop had also shipped fire RAWS equipment through Northern Air Cargo. After some difficulties, all the equipment was located and Sherman brought NPS climate staff to the FWS hangar at the National Guard ramp. The vendor helicopter (Pollux – N4164Q – Robert Kozakiewicz) arrived at the hangar in the afternoon. The NPS fuel tank at the hangar was used as the fuel supply. The door combination to the hangar code is available from Kotzebue staff. An I&M fuel key is used to turn on the pump inside the hangar door and fuel totals are logged on the notebook hanging next to the keys. Currently (as of October 2015), an antenna and a fence charger are being stored in the I&M cache of the Kotzebue warehouse.

Mt. Noak was serviced the evening of 6/4. On 6/5 the helicopter dropped Hill and Sousanes at the Kugururok site and returned to Kotzebue to transport batteries (Kelly, Kugururok) and fuel

jugs (10 gallons). Sisiak (scheduled maintenance) and Salmon River (unscheduled repair) were serviced later that day before returning to Kotzebue. On 6/6 Tahinichok, Kelly RAWS, and Asik were maintained. The pilot remained in Kotzebue for his next scheduled project with USGS/NPS. Approximately 100 gallons of fuel was used from the NPS avgas tank. On 6/7, Hill and Sousanes returned to Fairbanks via Alaska Airlines.

Ken Hill traveled to Kotzebue on Alaska Airlines on 9/15. Vendor helicopter N4164Q (Pollux – R44 – Craig Furmage) ferried from Wasilla on 9/15 as part of the joint USGS/NPS project on the Agashashok River watershed. On 9/16, Hill repaired the Sisiak station. From 9/16-9/20, Hill assisted USGS staff and ARCN aquatic ecologist on the Agashashok River project. Primary tasks included installing two meteorological stations and taking streamflow measurements. The two stations are located at: 1) the headwaters of the south fork of the Agashashok River and 2) near the confluence of the Agashashok and Noatak Rivers. The stations are part of Arctic Landscape Conservation Cooperative's (LCC) Terrestrial Environmental Observatory Network (TEON).

### **Nome Logistics June 1-4**

Pam Sousanes and Ken Hill traveled to Nome on Alaska Airlines, arriving the evening of 6/1. Local staff arranged for transport from the airport to NPS housing (previously reserved through Nome staff). Extra equipment was sent with Everts. Sousanes had reserved an NPS vehicle in Nome for the intended dates of travel to Quartz Creek. The morning of 6/2, Sousanes and Hill completed errands at Everts, the NPS warehouse, and Bering Air. Mark Hall and Rocky Bilotta from NOAA coordinated to drive to Quartz Creek with Sousanes and Hill. Hall and Bilotta were completing site surveys at Salmon Lake, Quartz Creek, and UAF sites south of Quartz Creek as potential locations for a new Climate Reference Network site. The vendor helicopter (R44 – Pollux – N4237W, Thomas St. Romain) met Sousanes and Hill at Quartz Creek on 6/2. NPS staff and the helicopter pilot stayed at the Quartz Creek DOT cabin. Devil Mountain, Midnight Mountain, and Serpentine Hot Springs stations were serviced the afternoon/evening of 6/2. Hoodoo Hills RAWS, Ella Creek, and Quartz Creek RAWS were serviced on 6/3. Sousanes and Hill drove back to Nome on 6/3 and stayed at the NPS bunk house. Maintenance staff from the Nome office provided transport to the airport on 6/4.

## Appendix B: ARCN I&M Station Specifications

**Table 2.** Sensor Specifications.

| Measurements                        | Model/Manufacturer/Item#                                        | Purchased from:     |
|-------------------------------------|-----------------------------------------------------------------|---------------------|
| Air Temperature 1/Relative Humidity | HMP-45C/HMP155a/HMP 60Temperature and Relative Humidity Probe   | Campbell Scientific |
| Air Temperature 2                   | Resistance Temperature Detector (RTD) Thermistor. Custom build. | Therm-X             |
| Air Temperature 2                   | 109 Temperature Probe (alternate)                               | Campbell Scientific |
| Wind Speed and direction            | RM Young 05103/05103-45 (alpine version)                        | Campbell Scientific |
| Precipitation (summer rainfall)     | Texas Electronics TE525WS Rain Gage                             | Campbell Scientific |
| Solar Radiation (incoming)          | LI-COR LI200X                                                   | Campbell Scientific |
| Snow Depth                          | SR50A sonic ranging sensor                                      | Campbell Scientific |
| Soil Temperature                    | 107 Temperature Probe (3)                                       | Campbell Scientific |

**Table 3.** Datalogger Specifications.

| Datalogger                               | Purchased from:     |
|------------------------------------------|---------------------|
| CR1000-XT Measurement and Control System | Campbell Scientific |

**Table 4.** Satellite Communication Specifications

| Satellite Communication    | Model/Item #                                | Purchased From:     |
|----------------------------|---------------------------------------------|---------------------|
| GOES Satellite transmitter | TX312/TX320 High Data rate GOES Transmitter | Campbell Scientific |
| GPS Antenna                | GPS Antenna 3.3 V 17992                     | Campbell Scientific |
| GPS Cable                  | Antenna Cable 18017                         | Campbell Scientific |
| GOES Antenna               | GOES 11 dBi YAGI RHCP Antenna 25316         | Campbell Scientific |
| Coaxial Cable              | Antenna Cable RG8 COAXNTN                   | Campbell Scientific |

**Table 5.** Power Specifications

| Power              | Model                                                    | Purchased form:            |
|--------------------|----------------------------------------------------------|----------------------------|
| Batteries          | Concorde Sun Extender PV 1040 T 12 Volt 100 Amp hour (2) | ABS Alaskan                |
| Solar Panel        | 60-75 watt                                               | Varies depending on prices |
| Battery Box        | Pelican Hardigg Single Lid Case                          | AllCases                   |
| Charging Regulator | CH100 12V Charging Regulator                             | Campbell Scientific        |

**Table 6.** Hardware Specifications

| <b>Station Hardware - Item</b>                                          | <b>Type/Model</b>                                         | <b>Purchased from:</b> |
|-------------------------------------------------------------------------|-----------------------------------------------------------|------------------------|
| Tripod                                                                  | CM110 10 ft. stainless-steel tripod w/grounding kit       | Campbell Scientific    |
| Guy Kit                                                                 | Guy Kit for Tripod 19239                                  | Campbell Scientific    |
| Crossarm – 4 ft.                                                        | CM204 Sensor crossarm with mounting hardware – 4ft        | Campbell Scientific    |
| Crossarm – 6 ft.                                                        | CM206 Sensor crossarm with mounting hardware – 6ft        | Campbell Scientific    |
| Enclosure with (2) 1.5” diameter holes and mounting hardware for tripod | Weather Resistant 16” x 18” enclosure ENC 16/18 – DC - MM | Campbell Scientific    |

**Table 7.** Electric Fence Specifications

| <b>Electric Fence Parts</b> | <b>Type/Model</b>                                    | <b>Purchased from:</b> |
|-----------------------------|------------------------------------------------------|------------------------|
| Metal fence posts           | 6 ft. T-Posts                                        | Various local vendors  |
| T-Post Insulators           | 5-inch extender insulators                           |                        |
| Poly wire                   | 200 ft. Poly-wire                                    | Various local vendors  |
| Solar fence charger         | 10 mile low impedance fence charger – various models | Various local vendors  |

## Appendix C: ARCN I&M Components by Station

**Table 8.** Metadata for Asik I&M.

| Station Name | Item        | Model              | Start Date |
|--------------|-------------|--------------------|------------|
| Asik         | Antenna     | 25316 YAGI         | 7/13/2012  |
| Asik         | AT          | ThermX             | 7/13/2012  |
| Asik         | AT-RH       | HMP45              | 6/6/2015   |
| Asik         | Battery     | 100 AH (x2)        | 7/13/2012  |
| Asik         | Cross arm   | CM204              | 7/13/2012  |
| Asik         | Cross arm   | CM206              | 7/13/2012  |
| Asik         | Datalogger  | CR1000             | 7/13/2012  |
| Asik         | DLP         | Asik2015           | 6/6/2015   |
| Asik         | GPS         | 17992 GPS          | 7/13/2012  |
| Asik         | RG-TB       | TE525              | 7/13/2012  |
| Asik         | SD          | SR50a              | 7/13/2012  |
| Asik         | Solar Panel | 75 W               | 7/13/2012  |
| Asik         | SR          | Li200x             | 7/15/2014  |
| Asik         | ST -10 cm   | 107                | 7/13/2012  |
| Asik         | ST -20 cm   | 107                | 7/13/2012  |
| Asik         | ST -50 cm   | 107                | 7/13/2012  |
| Asik         | Tripod      | CM106              | 7/13/2012  |
| Asik         | TX312       | NESDIS ID 3961A40E | 7/13/2012  |
| Asik         | WSWD        | 5103               | 6/6/2015   |

**Table 9.** Metadata for Chimney Lake I&M.

| <b>Station Name</b> | <b>Item</b>    | <b>Model</b>                    | <b>Start Date</b> |
|---------------------|----------------|---------------------------------|-------------------|
| Chimney Lake        | Antenna        | 25316 YAGI                      | 8/7/2012          |
| Chimney Lake        | AT             | T-109                           | 8/7/2012          |
| Chimney Lake        | AT             | ThermX                          | 5/27/2013         |
| Chimney Lake        | AT-RH          | HMP45                           | 7/1/2015          |
| Chimney Lake        | Battery        | 100 AH (x2)                     | 8/7/2012          |
| Chimney Lake        | Cross arm      | CM204                           | 8/7/2012          |
| Chimney Lake        | Cross arm      | CM206                           | 8/7/2012          |
| Chimney Lake        | Datalogger     | CR1000                          | 8/7/2012          |
| Chimney Lake        | Datalogger     | Chimney2015                     | 7/1/2015          |
| Chimney Lake        | Electric Fence | T-post, poly-wire solar charger | 5/27/2013         |
| Chimney Lake        | GPS            | 17992 GPS                       | 8/7/2012          |
| Chimney Lake        | RG-TB          | TE525                           | 8/7/2012          |
| Chimney Lake        | SD             | SR50a                           | 8/7/2012          |
| Chimney Lake        | Solar Panel    | 75 W                            | 8/7/2012          |
| Chimney Lake        | SR             | Li200x                          | 6/12/2014         |
| Chimney Lake        | ST -10 cm      | 107                             | 8/7/2012          |
| Chimney Lake        | ST -20 cm      | 107                             | 8/7/2012          |
| Chimney Lake        | ST -50 cm      | 107                             | 8/7/2012          |
| Chimney Lake        | ST -75 cm      | 107                             | 5/27/2013         |
| Chimney Lake        | Tripod         | CM106                           | 8/7/2012          |
| Chimney Lake        | TX312          | NESDIS ID 3961F472              | 8/7/2012          |
| Chimney Lake        | WSWD           | 5103                            | 7/1/2015          |

**Table 10.** Metadata for Devil Mountain I&M.

| <b>Station Name</b> | <b>Item</b>    | <b>Model</b>                    | <b>Start Date</b> |
|---------------------|----------------|---------------------------------|-------------------|
| Devil Mountain      | Antenna        | 25316 YAGI                      | 8/23/2012         |
| Devil Mountain      | AT             | ThermX                          | 8/18/2011         |
| Devil Mountain      | AT-RH          | HMP45                           | 6/2/2015          |
| Devil Mountain      | Battery        | 100 AH (x2)                     | 8/18/2011         |
| Devil Mountain      | Cross arm      | CM204                           | 8/18/2011         |
| Devil Mountain      | Cross arm      | CM206                           | 8/6/2013          |
| Devil Mountain      | Datalogger     | CR1000                          | 8/18/2011         |
| Devil Mountain      | DLP            | Devil2015                       | 6/2/2015          |
| Devil Mountain      | Electric Fence | T-post, poly-wire solar charger | 8/23/2012         |
| Devil Mountain      | Enclosure      | ENC 16/18                       | 8/18/2011         |
| Devil Mountain      | GPS            | 17992 GPS                       | 8/18/2011         |
| Devil Mountain      | RG-TB          | TE525                           | 8/18/2011         |
| Devil Mountain      | SD             | SR50a                           | 8/6/2013          |
| Devil Mountain      | Solar Panel    | 75 W                            | 8/18/2011         |
| Devil Mountain      | SR             | Li200x                          | 8/18/2011         |
| Devil Mountain      | ST -10 cm      | 107                             | 8/18/2011         |
| Devil Mountain      | ST -20 cm      | 107                             | 8/18/2011         |
| Devil Mountain      | ST -50 cm      | 107                             | 8/18/2011         |
| Devil Mountain      | Tripod         | CM106                           | 8/18/2011         |
| Devil Mountain      | TX312          | NESDIS ID 3961221A              | 8/18/2011         |
| Devil Mountain      | WSWD           | 5103                            | 6/2/2015          |

**Table 11.** Metadata for Ella Creek I&M.

| <b>Station Name</b> | <b>Item</b> | <b>Model</b> | <b>Start Date</b> |
|---------------------|-------------|--------------|-------------------|
| Ella Creek          | Antenna     | 25316 YAGI   | 8/7/2013          |
| Ella Creek          | AT          | ThermX       | 9/18/2012         |
| Ella Creek          | AT-RH       | HMP45        | 6/3/2015          |
| Ella Creek          | Battery     | 100 AH (x2)  | 9/18/2012         |
| Ella Creek          | Cross arm   | CM204        | 9/18/2012         |
| Ella Creek          | Cross arm   | CM206        | 9/18/2012         |
| Ella Creek          | Datalogger  | CR1000       | 9/18/2012         |
| Ella Creek          | DLP         | Ella2015     | 6/3/2015          |
| Ella Creek          | Enclosure   | ENC 16/18    | 9/18/2012         |
| Ella Creek          | GPS         | 17992 GPS    | 9/18/2012         |
| Ella Creek          | RG-TB       | TE525        | 8/7/2013          |
| Ella Creek          | SD          | SR50a        | 8/7/2013          |
| Ella Creek          | Solar Panel | 75 W         | 9/18/2012         |
| Ella Creek          | SR          | Li200x       | 9/3/2014          |
| Ella Creek          | ST -10 cm   | 107          | 9/18/2012         |
| Ella Creek          | ST -20 cm   | 107          | 9/18/2012         |
| Ella Creek          | ST -50 cm   | 107          | 9/18/2012         |
| Ella Creek          | Tripod      | CM106        | 9/18/2012         |
| Ella Creek          | TX312       | 396182E2     | 8/7/2013          |
| Ella Creek          | WSWD        | 5103         | 6/3/2015          |

**Table 12.** Metadata for Howard Pass I&M.

| Station Name | Item        | Model              | Start Date |
|--------------|-------------|--------------------|------------|
| Howard Pass  | Antenna     | 25316 YAGI         | 7/7/2011   |
| Howard Pass  | AT          | ThermX             | 7/7/2011   |
| Howard Pass  | AT-RH       | HMP155             | 7/20/2015  |
| Howard Pass  | Battery     | 100 AH (x2)        | 7/7/2011   |
| Howard Pass  | Cross arm   | CM204              | 7/7/2011   |
| Howard Pass  | Cross arm   | CM206              | 7/7/2011   |
| Howard Pass  | Datalogger  | CR1000             | 7/7/2011   |
| Howard Pass  | DLP         | Howard2015         | 7/20/2015  |
| Howard Pass  | Enclosure   | ENC 16/18          | 7/7/2011   |
| Howard Pass  | GPS         | 17992 GPS          | 7/7/2011   |
| Howard Pass  | RG-TB       | TE525              | 7/7/2011   |
| Howard Pass  | SD          | SR50a              | 7/17/2013  |
| Howard Pass  | Solar Panel | 75 W               | 7/7/2011   |
| Howard Pass  | SR          | Li200x             | 7/20/2015  |
| Howard Pass  | ST -10 cm   | 107                | 7/7/2011   |
| Howard Pass  | ST -20 cm   | 107                | 7/7/2011   |
| Howard Pass  | ST -50 cm   | 107                | 7/7/2011   |
| Howard Pass  | Tripod      | CM106              | 7/7/2011   |
| Howard Pass  | TX312       | NESDIS ID 39617266 | 7/7/2011   |
| Howard Pass  | WSWD        | 5103-alpine        | 7/20/2015  |

**Table 13.** Metadata for Imelyak I&M.

| <b>Station Name</b> | <b>Item</b> | <b>Model</b>       | <b>Start Date</b> |
|---------------------|-------------|--------------------|-------------------|
| Imelyak             | Antenna     | 25316 YAGI         | 7/6/2011          |
| Imelyak             | AT          | ThermX             | 7/6/2011          |
| Imelyak             | AT-RH       | HMP155             | 7/20/2015         |
| Imelyak             | Battery     | 100 AH (x2)        | 7/6/2011          |
| Imelyak             | Cross arm   | CM204              | 7/6/2011          |
| Imelyak             | Cross arm   | CM206              | 7/6/2011          |
| Imelyak             | Datalogger  | CR1000             | 7/20/2012         |
| Imelyak             | DLP         | Imelyak2015        | 7/20/2015         |
| Imelyak             | Enclosure   | ENC 16/18          | 7/6/2011          |
| Imelyak             | GPS         | 17992 GPS          | 7/6/2011          |
| Imelyak             | RG-TB       | TE525              | 7/6/2011          |
| Imelyak             | SD          | SR50a              | 7/6/2011          |
| Imelyak             | Solar Panel | 75 W               | 7/6/2011          |
| Imelyak             | SR          | Li200x             | 7/20/2015         |
| Imelyak             | ST -10 cm   | 107                | 7/6/2011          |
| Imelyak             | ST -20 cm   | 107                | 7/6/2011          |
| Imelyak             | ST -50 cm   | 107                | 7/6/2011          |
| Imelyak             | Tripod      | CM106              | 7/6/2011          |
| Imelyak             | TX312       | NESDIS ID 3961316C | 7/20/2012         |
| Imelyak             | WSWD        | 5103               | 7/25/2014         |

**Table 14.** Metadata for Kaluich I&M.

| <b>Station Name</b> | <b>Item</b> | <b>Model</b>       | <b>Start Date</b> |
|---------------------|-------------|--------------------|-------------------|
| Kaluich             | Antenna     | 25316 YAGI         | 7/20/2012         |
| Kaluich             | AT          | ThermX             | 7/20/2012         |
| Kaluich             | AT-RH       | HMP155             | 7/21/2015         |
| Kaluich             | Battery     | 100 AH (x2)        | 7/20/2012         |
| Kaluich             | Cross arm   | CM204              | 7/20/2012         |
| Kaluich             | Cross arm   | CM206              | 7/20/2012         |
| Kaluich             | Datalogger  | CR1000             | 7/20/2012         |
| Kaluich             | DLP         | Kaluich2015        | 7/21/2015         |
| Kaluich             | Enclosure   | ENC 16/18          | 7/20/2012         |
| Kaluich             | GPS         | 17992 GPS          | 7/20/2012         |
| Kaluich             | RG-TB       | TE525              | 7/20/2012         |
| Kaluich             | SD          | SR50a              | 7/20/2012         |
| Kaluich             | Solar Panel | 75 W               | 7/20/2012         |
| Kaluich             | SR          | Li200x             | 7/25/2014         |
| Kaluich             | ST -10 cm   | 107                | 7/20/2012         |
| Kaluich             | ST -20 cm   | 107                | 7/20/2012         |
| Kaluich             | ST -50 cm   | 107                | 7/20/2012         |
| Kaluich             | Tripod      | CM106              | 7/20/2012         |
| Kaluich             | TX312       | NESDIS ID 39617266 | 7/20/2012         |
| Kaluich             | WSWD        | 5103-alpine        | 7/21/2015         |

**Table 15.** Metadata for Killik Pass I&M.

| Station Name | Item        | Model              | Start Date |
|--------------|-------------|--------------------|------------|
| Killik Pass  | Antenna     | 25316 YAGI         | 8/8/2012   |
| Killik Pass  | AT          | T109               | 8/8/2012   |
| Killik Pass  | AT          | ThermX             | 5/29/2013  |
| Killik Pass  | AT-RH       | HMP45              | 6/24/2015  |
| Killik Pass  | Battery     | 100 AH (x2)        | 8/8/2012   |
| Killik Pass  | Cross arm   | CM204              | 8/8/2012   |
| Killik Pass  | Cross arm   | CM206              | 8/8/2012   |
| Killik Pass  | Datalogger  | CR1000             | 8/8/2012   |
| Killik Pass  | DLP         | Killik2015         | 6/24/2015  |
| Killik Pass  | Enclosure   | ENC 16/18          | 8/8/2012   |
| Killik Pass  | GPS         | 17992 GPS          | 8/8/2012   |
| Killik Pass  | RG-TB       | TE525              | 6/24/2015  |
| Killik Pass  | SD          | SR50a              | 8/8/2012   |
| Killik Pass  | Solar Panel | 75 W               | 8/8/2012   |
| Killik Pass  | SR          | Li200x             | 6/10/2014  |
| Killik Pass  | ST -10 cm   | 107                | 8/8/2012   |
| Killik Pass  | ST -20 cm   | 107                | 8/8/2012   |
| Killik Pass  | ST -50 cm   | 107                | 8/8/2012   |
| Killik Pass  | Tripod      | CM106              | 8/8/2012   |
| Killik Pass  | TX312       | NESDIS ID 3961C1E8 | 8/8/2012   |
| Killik Pass  | WS/WD       | 5103               | 6/24/2015  |

**Table 16.** Metadata for Kugururok I&M.

| Station Name | Item                       | Model                          | Start Date |
|--------------|----------------------------|--------------------------------|------------|
| Kugururok    | Antenna                    | 25316 YAGI                     | 7/18/2014  |
| Kugururok    | AT                         | T109                           | 7/18/2014  |
| Kugururok    | AT                         | ThermX                         | 7/18/2014  |
| Kugururok    | AT-RH                      | HMP45                          | 6/5/2015   |
| Kugururok    | Battery                    | 100 AH (x2)                    | 7/18/2014  |
| Kugururok    | Camera                     | CC5MPX                         | 6/5/2015   |
| Kugururok    | Camera battery/solar panel | 12 V - 100 AH/10 W solar panel | 6/5/2015   |
| Kugururok    | Cross arm                  | CM204                          | 7/18/2014  |
| Kugururok    | Cross arm                  | CM206                          | 7/18/2014  |
| Kugururok    | Datalogger                 | CR1000                         | 7/18/2014  |
| Kugururok    | DLP                        | Kugururok2015                  | 6/5/2015   |
| Kugururok    | Enclosure                  | ENC 16/18                      | 7/18/2014  |
| Kugururok    | GPS                        | 17992 GPS                      | 7/18/2014  |
| Kugururok    | RG-TB                      | TE525                          | 7/18/2014  |
| Kugururok    | SD                         | SR50a                          | 7/18/2014  |
| Kugururok    | Solar Panel                | 75 W                           | 7/18/2014  |
| Kugururok    | SR                         | Li200x                         | 7/18/2014  |
| Kugururok    | ST -10 cm                  | 107                            | 7/18/2014  |
| Kugururok    | ST -20 cm                  | 107                            | 7/18/2014  |
| Kugururok    | ST -50 cm                  | 107                            | 7/18/2014  |
| Kugururok    | Tripod                     | CM106                          | 7/18/2014  |
| Kugururok    | TX312                      | NESDIS ID 396203F8             | 7/18/2014  |
| Kugururok    | WS/WD                      | 5103                           | 7/18/2014  |

**Table 17.** Metadata for Midnight Mountain I&M.

| <b>Station Name</b> | <b>Item</b> | <b>Model</b>           | <b>Start Date</b> |
|---------------------|-------------|------------------------|-------------------|
| Midnight Mountain   | AT_1        | ThermX                 | 8/6/2013          |
| Midnight Mountain   | AT_2        | ThermX                 | 8/6/2013          |
| Midnight Mountain   | AT_3        | ThermX                 | 8/6/2013          |
| Midnight Mountain   | Battery     | 12 V                   | 9/3/2014          |
| Midnight Mountain   | Datalogger  | CR1000                 | 8/6/2013          |
| Midnight Mountain   | DLP         | Midnight_2013_ThermX_6 | 8/6/2013          |
| Midnight Mountain   | Enclosure   | ENC 16/18              | 7/8/2011          |
| Midnight Mountain   | Solar Panel | 75 W                   | 7/8/2011          |
| Midnight Mountain   | ST -10 cm   | ThermX                 | 8/6/2013          |
| Midnight Mountain   | ST -20 cm   | ThermX                 | 8/6/2013          |
| Midnight Mountain   | ST -50 cm   | ThermX                 | 8/6/2013          |
| Midnight Mountain   | Tripod      | CM106                  | 7/8/2011          |

**Table 18.** Metadata for Mt. Noak I&M.

| Station Name | Item                       | Model                          | Start Date |
|--------------|----------------------------|--------------------------------|------------|
| Mt. Noak     | Antenna                    | 25316 YAGI                     | 7/11/2011  |
| Mt. Noak     | AT                         | ThermX                         | 7/11/2011  |
| Mt. Noak     | AT-RH                      | HMP45                          | 6/4/2015   |
| Mt. Noak     | Battery                    | 100 AH (x2)                    | 7/11/2011  |
| Mt. Noak     | Camera                     | CC5MPX                         | 6/29/2013  |
| Mt. Noak     | Camera battery/solar panel | 12 V - 100 AH/10 W solar panel | 6/4/2015   |
| Mt. Noak     | Cross arm                  | CM204                          | 7/11/2011  |
| Mt. Noak     | Cross arm                  | CM206                          | 7/11/2011  |
| Mt. Noak     | Datalogger                 | CR1000                         | 7/11/2011  |
| Mt. Noak     | DLP                        | Noak2015                       | 6/4/2015   |
| Mt. Noak     | Enclosure                  | ENC 16/18                      | 7/11/2011  |
| Mt. Noak     | GPS                        | 17992 GPS                      | 7/11/2011  |
| Mt. Noak     | RG-TB                      | TE525                          | 7/11/2011  |
| Mt. Noak     | SD                         | SR50a                          | 6/29/2013  |
| Mt. Noak     | Solar Panel                | 75 W                           | 7/11/2011  |
| Mt. Noak     | SR                         | Li200x                         | 6/4/2015   |
| Mt. Noak     | ST -10 cm                  | 107                            | 7/11/2011  |
| Mt. Noak     | ST -20 cm                  | 107                            | 7/11/2011  |
| Mt. Noak     | ST -50 cm                  | 107                            | 6/29/2013  |
| Mt. Noak     | ST -75 cm                  | 107                            | 6/29/2013  |
| Mt. Noak     | Tripod                     | CM106                          | 7/11/2011  |
| Mt. Noak     | TX312                      | NESDIS ID 39616110             | 7/15/2014  |
| Mt. Noak     | WS/WD                      | 5103                           | 7/15/2014  |

**Table 19.** Metadata for Pamichtuk I&M.

| <b>Station Name</b> | <b>Item</b>                | <b>Model</b>                    | <b>Start Date</b> |
|---------------------|----------------------------|---------------------------------|-------------------|
| Pamichtuk           | Antenna                    | 25316 YAGI                      | 8/6/2012          |
| Pamichtuk           | AT                         | T109                            | 8/6/2012          |
| Pamichtuk           | AT                         | ThermX                          | 5/29/2013         |
| Pamichtuk           | AT-RH                      | HMP45                           | 6/22/2015         |
| Pamichtuk           | Battery                    | 100 AH (x2)                     | 8/6/2012          |
| Pamichtuk           | Camera                     | CC5MPX                          | 5/28/2013         |
| Pamichtuk           | Camera battery/solar panel | 12V-100 AH/10 W solar panel     | 6/22/2015         |
| Pamichtuk           | Cross arm                  | CM204                           | 8/6/2012          |
| Pamichtuk           | Cross arm                  | CM206                           | 8/6/2012          |
| Pamichtuk           | Datalogger                 | CR1000                          | 8/6/2012          |
| Pamichtuk           | DLP                        | Pamichtuk2015                   | 6/22/2015         |
| Pamichtuk           | Electric Fence             | T-post, poly-wire solar charger | 5/28/2013         |
| Pamichtuk           | Enclosure                  | ENC 16/18                       | 8/6/2012          |
| Pamichtuk           | GPS                        | 17992 GPS                       | 8/6/2012          |
| Pamichtuk           | RG-TB                      | TE525                           | 8/6/2012          |
| Pamichtuk           | SD                         | SR50a                           | 8/6/2012          |
| Pamichtuk           | Solar Panel                | 75 W                            | 8/6/2012          |
| Pamichtuk           | SR                         | Li200x                          | 6/22/2015         |
| Pamichtuk           | ST -10 cm                  | 107                             | 8/6/2012          |
| Pamichtuk           | ST -20 cm                  | 107                             | 8/6/2012          |
| Pamichtuk           | ST -50 cm                  | 107                             | 8/6/2012          |
| Pamichtuk           | Tripod                     | CM106                           | 8/6/2012          |
| Pamichtuk           | TX312                      | NESDIS ID 3961E704              | 8/6/2012          |
| Pamichtuk           | WSWD                       | 5103                            | 5/28/2013         |

**Table 20.** Metadata for Ram Creek I&M.

| <b>Station Name</b> | <b>Item</b>    | <b>Model</b>                    | <b>Start Date</b> |
|---------------------|----------------|---------------------------------|-------------------|
| Ram Creek           | Antenna        | 25316 YAGI                      | 8/7/2012          |
| Ram Creek           | AT             | T109                            | 8/7/2012          |
| Ram Creek           | AT             | ThermX                          | 5/28/2013         |
| Ram Creek           | AT-RH          | HMP45                           | 6/27/2015         |
| Ram Creek           | Battery        | 100 AH (x2)                     | 8/7/2012          |
| Ram Creek           | Cross arm      | CM204                           | 8/7/2012          |
| Ram Creek           | Cross arm      | CM206                           | 8/7/2012          |
| Ram Creek           | Datalogger     | CR1000                          | 8/7/2012          |
| Ram Creek           | DLP            | Chimney2015                     | 6/27/2015         |
| Ram Creek           | Electric Fence | T-post, poly-wire solar charger | 6/10/2014         |
| Ram Creek           | Enclosure      | ENC 16/18                       | 8/7/2012          |
| Ram Creek           | GPS            | 17992 GPS                       | 8/7/2012          |
| Ram Creek           | RG-TB          | TE525                           | 6/10/2014         |
| Ram Creek           | SD             | SR50a                           | 8/7/2012          |
| Ram Creek           | Solar Panel    | 75 W                            | 8/7/2012          |
| Ram Creek           | SR             | Li200x                          | 6/10/2014         |
| Ram Creek           | ST -10 cm      | 107                             | 8/7/2012          |
| Ram Creek           | ST -20 cm      | 107                             | 8/7/2012          |
| Ram Creek           | ST -50 cm      | 107                             | 8/7/2012          |
| Ram Creek           | Tripod         | CM106                           | 8/7/2012          |
| Ram Creek           | TX312          | NESDIS ID 3961D29E              | 6/10/2014         |
| Ram Creek           | WSWD           | 5103                            | 6/10/2014         |

**Table 21.** Metadata for Salmon River I&M.

| <b>Station Name</b> | <b>Item</b>                | <b>Model</b>                    | <b>Start Date</b> |
|---------------------|----------------------------|---------------------------------|-------------------|
| Salmon River        | Antenna                    | 25316 YAGI                      | 7/17/2013         |
| Salmon River        | AT                         | T109                            | 7/17/2013         |
| Salmon River        | AT-RH                      | HMP155                          | 7/21/2015         |
| Salmon River        | Battery                    | 100 AH (x2)                     | 7/8/2011          |
| Salmon River        | Camera                     | CC5MPX                          | 7/17/2013         |
| Salmon River        | Camera battery/solar panel | 12 V - 100 AH/10 W solar panel  | 7/21/2015         |
| Salmon River        | Cross arm                  | CM204                           | 7/8/2011          |
| Salmon River        | Cross arm                  | CM206                           | 7/8/2011          |
| Salmon River        | Datalogger                 | CR1000                          | 7/17/2013         |
| Salmon River        | DLP                        | Salmon2015                      | 7/21/2015         |
| Salmon River        | Electric Fence             | T-post, poly-wire solar charger | 7/17/2013         |
| Salmon River        | Enclosure                  | ENC 16/18                       | 7/8/2011          |
| Salmon River        | GPS                        | 17992 GPS                       | 7/17/2013         |
| Salmon River        | RG-TB                      | TE525                           | 7/17/2013         |
| Salmon River        | SD                         | SR50a                           | 7/17/2013         |
| Salmon River        | SR                         | Li200x                          | 6/5/2015          |
| Salmon River        | ST -10 cm                  | 107                             | 7/17/2013         |
| Salmon River        | ST -20 cm                  | 107                             | 7/17/2013         |
| Salmon River        | ST -50 cm                  | 107                             | 7/17/2013         |
| Salmon River        | Tripod                     | CM106                           | 7/17/2013         |
| Salmon River        | TX312                      | NESDIS ID 3960F688              | 7/24/2014         |
| Salmon River        | WS/WD                      | 5103                            | 7/17/2013         |

**Table 22.** Metadata for Serpentine I&M.

| Station Name | Item                       | Model                          | Start Date |
|--------------|----------------------------|--------------------------------|------------|
| Serpentine   | Antenna                    | 25316 YAGI                     | 8/18/2011  |
| Serpentine   | AT                         | ThermX                         | 8/18/2011  |
| Serpentine   | AT-RH                      | HMP155                         | 6/2/2015   |
| Serpentine   | Battery                    | 100 AH (x2)                    | 8/18/2011  |
| Serpentine   | Camera                     | CC5MPX                         | 8/7/2013   |
| Serpentine   | Camera battery/solar panel | 12 V - 100 AH/10 W solar panel | 6/2/2015   |
| Serpentine   | Cross arm                  | CM204                          | 8/18/2011  |
| Serpentine   | Cross arm                  | CM206                          | 8/18/2011  |
| Serpentine   | Datalogger                 | CR1000                         | 8/18/2011  |
| Serpentine   | DLP                        | Serpentine2015                 | 6/2/2015   |
| Serpentine   | Enclosure                  | ENC 16/18                      | 8/18/2011  |
| Serpentine   | GPS                        | 17992 GPS                      | 8/18/2011  |
| Serpentine   | RG-TB                      | TE525                          | 8/18/2011  |
| Serpentine   | SD                         | SR50a                          | 8/18/2011  |
| Serpentine   | Solar Panel                | 75 W                           | 8/18/2011  |
| Serpentine   | SR                         | Li200x                         | 6/2/2015   |
| Serpentine   | ST -10 cm                  | 107                            | 8/18/2011  |
| Serpentine   | ST -20 cm                  | 107                            | 8/18/2011  |
| Serpentine   | ST -50 cm                  | 107                            | 8/18/2011  |
| Serpentine   | Tripod                     | CM106                          | 8/18/2011  |
| Serpentine   | TX312                      | NESDIS ID 3961C1E8             | 8/18/2011  |
| Serpentine   | WS/WD                      | 5103                           | 9/3/2014   |

**Table 23.** Metadata for Sisiak I&M.

| <b>Station Name</b> | <b>Item</b> | <b>Model</b>       | <b>Start Date</b> |
|---------------------|-------------|--------------------|-------------------|
| Sisiak              | Antenna     | 25316 YAGI         | 7/13/2011         |
| Sisiak              | AT          | ThermX             | 7/13/2011         |
| Sisiak              | AT-RH       | HMP45              | 6/5/2015          |
| Sisiak              | Battery     | 100 AH (x2)        | 7/13/2011         |
| Sisiak              | Cross arm   | CM204              | 7/13/2011         |
| Sisiak              | Cross arm   | CM206              | 7/13/2011         |
| Sisiak              | Datalogger  | CR1000             | 7/13/2011         |
| Sisiak              | DLP         | Sisiak2015         | 6/5/2015          |
| Sisiak              | Enclosure   | ENC 16/18          | 7/13/2011         |
| Sisiak              | GPS         | 17992 GPS          | 7/13/2011         |
| Sisiak              | RG-TB       | TE525              | 7/13/2011         |
| Sisiak              | SD          | SR50a              | 7/13/2011         |
| Sisiak              | Solar Panel | 75 W               | 7/13/2011         |
| Sisiak              | SR          | Li200x             | 6/5/2015          |
| Sisiak              | ST -10 cm   | 107                | 7/13/2011         |
| Sisiak              | ST -20 cm   | 107                | 7/13/2011         |
| Sisiak              | ST -50 cm   | 107                | 7/13/2011         |
| Sisiak              | ST -75 cm   | 107                | 7/1/2013          |
| Sisiak              | Tripod      | CM106              | 7/13/2011         |
| Sisiak              | TX312       | NESDIS ID 3961548A | 7/13/2011         |
| Sisiak              | WSWD        | 5103               | 7/18/2014         |

**Table 24.** Metadata for Tahinichok I&M.

| <b>Station Name</b> | <b>Item</b>    | <b>Model</b>                    | <b>Start Date</b> |
|---------------------|----------------|---------------------------------|-------------------|
| Tahinichok          | Antenna        | 25316 YAGI                      | 6/6/2015          |
| Tahinichok          | AT             | ThermX                          | 7/10/2011         |
| Tahinichok          | AT-RH          | HMP45                           | 7/18/2015         |
| Tahinichok          | Battery        | 100 AH (x2)                     | 7/10/2011         |
| Tahinichok          | Cross arm      | CM204                           | 7/10/2011         |
| Tahinichok          | Cross arm      | CM206                           | 7/10/2011         |
| Tahinichok          | Datalogger     | CR1000                          | 7/10/2011         |
| Tahinichok          | DLP            | Tahinichok2015                  | 6/6/2015          |
| Tahinichok          | Electric Fence | T-post, poly-wire solar charger | 7/18/2015         |
| Tahinichok          | Enclosure      | ENC 16/18                       | 7/10/2011         |
| Tahinichok          | GPS            | 17992 GPS                       | 7/10/2011         |
| Tahinichok          | RG-TB          | TE525                           | 7/10/2011         |
| Tahinichok          | SD             | SR50a                           | 6/6/2015          |
| Tahinichok          | Solar Panel    | 75 W                            | 7/10/2011         |
| Tahinichok          | SR             | Li200x                          | 6/6/2015          |
| Tahinichok          | ST -10 cm      | 107                             | 7/10/2011         |
| Tahinichok          | ST -20 cm      | 107                             | 7/10/2011         |
| Tahinichok          | ST -50 cm      | 107                             | 7/10/2011         |
| Tahinichok          | ST -75 cm      | 107                             | 6/30/2013         |
| Tahinichok          | Tripod         | CM106                           | 7/10/2011         |
| Tahinichok          | TX312          | NESDIS ID 3961548A              | 7/10/2011         |
| Tahinichok          | WSWD           | 5103                            | 7/15/2014         |



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NPS 953/130690, November 2015

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