FILE NAME: Station Record AK 001.doc

LAST UPDATED: 08/28/2023

**BARROW, ALASKA**

SITE 1, CMDL

### Station Record

**STATION:** AK001, BARROW1 (001)

|  |  |  |  |
| --- | --- | --- | --- |
| **PROJECT MANAGER:**  Phone:  FAX:  E-mail: | C.A. Seybold  USDA NRCS  Federal Bldg., Rm. 152  Lincoln, NE 68508  (402) 437-4132  (402) 437-5336  cathy.seybold@lin.usda.gov | F. E. Nelson  Department of Geography  University of Delaware  Newark, Delaware 19711  (302) 831-0852  (302) 831-6654  fnelson@udel.edu | K. M. Hinkel  Department of Geography  University of Cincinnati  Cincinnati, Ohio 45221-0131  513-556-3430  513-556-3370  71042.2643@compuserve.com |

**LOCATION:** North of Barrow, Alaska, near the NOAA CMDL facility.

GPS (06/29/95): 71º 19’ 22.16” N

156º 36’ 26.54” W

\_\_ m elevation

GPS (06/14/97): 71º 19’ 20.68” N

156º 36’ 39.37” W

9 m elevation

GPS (08/10/98): 71º 19’ 20.1” N

156º 36’ 41.1” W

51 ft elevation

GPS (05/10/99): 71º 19’ 20.8” N

156º 36’ 39.2” W

\_\_ ft elevation

GPS (09/17/99): 71º 19’ 20.3” N

156º 36’ 38.5” W

104 ft elevation

GPS (04/25/00): 71º 19’ 18.9” N

156º 36’ 45.4” W

57 ft elevation

GPS (08/18/01): 71º 19’ 20.7” N

156º 36’ 39.3” W

37 ft elevation

GPS (08/17/03): 71º 19’ 20.7” N

156º 36’ 39.4” W

6 ft elevation

GPS (08/23/04): 71º 19’ 20.6” N

156º 36’ 39.4” W

10 ft elevation

GPS (08/20/05): 71º 19’ 20.7” N

156º 36’ 39.4” W

28 ft elevation

GPS (08/19/07): 71º 19’ 20.7” N

156º 36’ 39.2” W

30 ft elevation

GPS (08/19/09): 71º 19’ 20.7” N

156º 36’ 39.3” W

22 ft elevation

GPS (08/16/10): 71º 19’ 20.7” N

156º 36’ 39.2” W

38 ft elevation

**INSTRUMENTATION:**

Summary

| Quantity | Description | Comments |
| --- | --- | --- |
| (1) | Campbell CR-10 datalogger SN: 23007. | Installed 1995; replaced 2000 |
| (1) | Campbell CR-10X-2M datalogger SN: X18062. Wiring panel SN: 3312 | Installed 2000. Recalled. Replaced 8/01 |
| 1 | Campbell CR-10X-2M datalogger SN: X16671. Wiring panel SN: 3312 | Installed 8/01 |
| 1 | Campbell AM416 multiplexer SN: | Installed 1995. |
| (1) | Campbell SM192 storage module.  (Campbell SM716 SN: 4878) | Installed 1995, upgraded by Nelson (date?) to SM716; removed 2000. |
| 1 | Campbell Storage module SM4M | Installed 2003. |
| 1 | Campbell PS12LA power supply. | Installed 1995 |
| (1) | 7 Ah battery | replaced 2003, removed 2005 |
| 1 | 12 Ah battery | Installed 2005 |
| 1 | Campbell Solar panel. | Installed 1995, replaced 2005 |
| 1 | Campbell ENC 16/18 enclosure. | Installed 1995. |
| 12 | Vitel dielectric constant soil moisture/temperature sensors. | Installed 1995. |
| 3 | Campbell 107B soil temperature sensors | Installed 1997 |
| 1 | MRC soil temperature probe | Supplied by Fritz Nelson, installed in 1997. |
| 1 | Gabel TDR instrument. | Portable, left in 1995 |
| 3 | Gabel TDR probes, 2(20/20), 1(30). | Installed 1995. |

| MULTIPLEXER  POSITION | STACK | VITEL PROBE  SERIAL # | DEPTH  (in) | COMMENTS |
| --- | --- | --- | --- | --- |
| 1 | 2 | 166 | 14.0 | Vertical installation. |
| 2 | 2 | 167 | 8.0 | Horizontal installation. |
| 3 | 2 | 168 | 2.0 | Horizontal installation. |
| 4 | 1 | 169 | 12.0 | Vertical installation. |
| 5 | 1 | 170 | 7.5 | Horizontal installation. |
| 6 | 1 | 171 | 2.0 | Horizontal installation. |
| 7 | 3 | 186 | 11.0 | Vertical installation. |
| 8 | 3 | 187 | 8.0 | Horizontal installation. |
| 9 | 3 | 188 | 2.0 | Horizontal installation. |
| 10 | 4 | 189 | 11.0 | Vertical installation. |
| 11 | 4 | 190 | 8.0 | Horizontal installation. |
| 12 | 4 | 191 | 2.0 | Horizontal installation. |

**HISTORY:**  June 29, 1995: Station initiated. Four stacks of three Vitel Hydra probes were installed and attached to a Campbell Scientific CR10 datalogger. The datalogger, a Campbell AM416 multiplexer, a Campbell 192 Storage Module, and a Campbell PS12LA power supply, were located inside of a Campbell ENC16/18 enclosure. Datalogger was set to Alaska Savings Time. The datalogger program, *barrow*, was downloaded to the CR10. Measurements are made at 20-minute intervals and averaged and recorded every two hours. The enclosure was placed in a plastic garbage sack and wrapped with a plastic coated tarp, secured with duct tape. The wrapped enclosure was placed on two boards to raise it off the ground. Power is supplied by a Campbell (SolarX) MSX10 solar panel, placed beside the enclosure and leaning on it with one side on the ground.

June 27, 1996: The Vitel V4 voltage divider circuit was removed and installed at the Atqasuk site. This was done because Atqasuk is difficult to get to and I had failed to bring the necessary 1-MΩ resistors for the voltage divider circuit.

June 28, 1996: A new Vitel V4 voltage divider circuit was fabricated from resistors obtained from the NOAA facility adjacent to the site. The multimeter indicated that each resistor was 0.923 MΩ.

June 14, 1997: Downloaded data. All Vitel V4 voltages reading -6999. An examination of the data indicated that they had been reading that since June 27,1996. After much trouble shooting, a new voltage divider circuit was fabricated and installed and the V4 voltages appear normal. At this time, I installed Campbell 107B soil temperature sensors at 5, 20, and 30 cm near stack 2. The datalogger will read the sensors in the order: 5, 20, and 30 cm. The 5-cm depth soil-temperature sensor was placed in a horizontal orientation in a shallow excavation. The other sensors were installed vertically in holes made using a 3/8-in ship auger bit. This worked very well and soil was packed around sensor leads. Downloaded revised datalogger program *barrow1a*.

August 15, 1997: Fritz Nelson’s MRC soil temperature probe was connected to the site. Previously, this probe was connected to a datalogger (Campbell CR10) located inside the NOAA facility and called CMDL. The probe itself was installed (in 1993) very near to the Vitel installation, so it did not have to be moved. The second temperature sensor on the MRC probe is not working. Downloaded data from Fritz’s datalogger (inside CMDL) to CMDL9701.dat, CMDL9702.dat, and CMDL9703.dat. A separate hole was drilled into the enclosure to accommodate the sensor lead. The opening was sealed with plumbers putty. Downloaded data to Barow101.dat, Barow102.dat, … An upgraded datalogger program, *barrow1b*, was downloaded (modified to read the MRC probe).

August 10, 1998: Soil characterization sampling by Chien-Lu Ping about 75 ft SSE of site. Downloaded data to files called Barw1001.dat and Barw1002.dat. Added desiccant to enclosure. GT program indicated that all sensors were working OK.

May 8, 1999: Serviced site. Everything seems OK. Only top of blue tarp above snow. Dugout enclosure and solar panel. Evidently enough light gets through the snow to keep the battery charged because the voltage was higher than 13V. Downloaded data to file AK001.001.dat. Added two new packets of desiccant to enclosure. All sensors appear to be working OK.

May 10, 1999: Downloaded data to file AK001001.dat. Downloaded modified program Barrow1b to eliminate Vitel sensor delays and to change reading interval from one hour to 15 minutes. Each reading is stored, not averaged. We want to get better spatial resolution during the spring thaw and will change back to hourly readings averaged every two hours when we return in the fall.

September 17, 1999: Downloaded data to Barrow1b.dat. All sensors appear to be working OK. Changed *barrow1b* to read hourly and record every 2 hours.

April 25, 2000: Only very tip of blue tarp visible above hard crusted snow. Solar panel buried under about a foot of snow. Battery voltage is 12.6V. Downloaded data to Barrow1.dat. All sensors appear to be working OK. Replaced CR10 datalogger with CR10X-2M. Downloaded *barrow1* v.2.00 program to read at 20-minute intervals and record hourly. Removed SM716 storage module. Added desiccant.

August 18, 2001: Replaced recalled datalogger with CR10X-2M-XT. Downloaded *barrow1* v.2.00 program and set datalogger time. All sensors appear to be working OK. Left tarp off enclosure and placed enclosure on large block of wood. Did not add desiccant. Downloaded data from recalled datalogger.

June 26, 2002: Downloaded data. All sensors appear to be working OK. Did not add desiccant.

August 17, 2003: Serviced site. Downloaded data. Added desiccant to enclosure. Replaced power supply (12V). Added storage module (SN: 3472). Second location of the MRC probe is not working.

August 23, 2004: Downloaded data from storage module. Added storage module SN:3471. Added two desiccant packs to enclosure. Second location of the MRC probe is not working. Station clock was 85 min behind. Reset clock. MRC probe was 9 cm above soil surface. Everything seems to be working OK.

August 20, 2005: Enclosure had been moved and put on wood block; desiccant had been removed and one new pack added; solar panel was 10 ft from enclosure and facing east. Downloaded data from datalogger and swapped storage modules. Added four desiccant packs to enclosure. Station clock was 2 min behind. Internal battery was 3.106 volts. Retrieved program from datalogger. Replaced the solar panel and put it on T-post, one foot off the ground. Replaced 7-Ah battery with a 12-Ah battery. MRC probe was 10.5 cm above soil surface. Everything seems to be working OK.

August 24, 2006: Arrived at station at about 12:45 PM. Everything seemed to be working Okay. One of the 107 soil temp sensors was chewed, but still recording correctly; the cable was tapped. Also, tapped around MRC cable insertion point; cable was starting to split. The #1 sensor cable on the MRC probe that measures vegetation temp was cracking/spliting around sensor; tapped cracked/split area. Station clock was 1 min 22 sec behind. Internal battery voltage was 3.11. MRC probe was 9 cm out of the ground (measured from ground surface to middle of cable insertion point of MRC). Swapped storage modules. Added two desiccant packs to enclosure.

August 19, 2007: Downloaded data from logger to computer. Swapped storage modules. Everything seemed to be working Okay. Lithium battery was 3.12 volts. Station clock was within a minute of the computer clock. MRC probe was 11 cm out of the ground (measured from ground surface to middle of cable insertion point of MRC). Added two desiccant packs to enclosure.

August 19, 2008: Swapped storage modules. Everything seemed to be working okay. Lithium battery was 3.12 volts. Battery was 14.0 volts. Station clock was one minute behind computer clock. MRC probe was 8.5 cm out of the ground (measured from ground surface to middle of cable insertion point of MRC). Added one desiccant pack to enclosure.

August 19, 2009: Downloaded data from data logger and swapped storage modules. Everything seemed to be working okay. The first 2 positions and the last position were reading -248. Lithium battery was 3.14 volts. Battery was 13.9 volts. Station clock was 2 minute behind—reset clock. MRC probe was 8.5 cm out of the ground (measured from ground surface to middle of cable insertion point of MRC). The cable insertion point to the MRC probed had many teeth marks and the vegetation temp sensor was chewed off—put silicone sealant around cable insertion point. Added 2 desiccant packs.

August 16, 2010: Downloaded data from data logger (with RECON) and swapped storage modules. Everything seemed to be working okay. The first 2 positions and the last position were reading -248. Lithium battery was 3.12 volts; battery was 11.8 volts. Station clock was 40 sec behind. MRC probe was 8.75 cm out of the ground (measured from ground surface to middle of cable insertion point of MRC). MRC cable appeared to be chewed, but data was being recorded on the data logger. Solar panel was chewed in two places; cable was repaired and concealed as best as possible. Battery was charging. Everything was working OK. Added 2 desiccant packs.

August 15, 2012: Swapped storage modules. Everything seemed to be working okay. Lithium battery was 3.12 volts; battery was 13.66 volts. Station clock was 1 min behind. MRC probe was 9.5 cm out of the ground (measured from ground surface to middle of cable insertion point of MRC). Battery was charging. Everything was working OK. Downloaded program to data logger to clear the data and reset the program (fixes the scrambling of stored data). It was raining.

August 23, 2014: Swapped storage modules 12:10 PM. Power light was on. Height of top of MRC probe above ground surface is 9 cm (8.5 cm if measured from middle of cable insertion point).

August 27, 2015: Swapped storage modules (SM 6064 removed; SM 4185 installed at 1335 ADT. Height to top of MRC probe is 13.0 cm.

August 24, 2016: Opened box at 0824 ADT. Clean and dry inside. SM #4185 removed, replaced with SM #6989. Status light came on when new storage module was connected. Box closed at 0827. Height to top of MRC is 13 cm.

August 21, 2017: Swapped storage modules.

August 19, 2018: Swapped storage modules. MRC probe height above ground was 11 cm.

August 20, 2019: Swapped storage modules at 11:50 am. MRC probe height above ground was 11.8 cm.

August 17, 2022: Swapped storage modules. MRC probe height above ground was 11 cm.

August 14, 2023: Swapped storage modules. MRC probe height above ground was 12 cm. All sensors on the multiplexer were not recording (Vitels, Campbell 107s). The MRC probe had some data. This climate station will no longer be continued. The End.

**DATA:**

DATALOGGER OUTPUT:

| COL | OUTPUT | UNITS | LOCATION | SENSOR | COMMENTS |
| --- | --- | --- | --- | --- | --- |
| 1 | Station ID | N/A | N/A | Campbell CR10 | 001 |
| 2 | Year | N/A | N/A | Campbell CR10 |  |
| 3 | Day | N/A | N/A | Campbell CR10 |  |
| 4 | Time | N/A | N/A | Campbell CR10 | AK savings time |
| 5 | Battery | Volts | Enclosure | Campbell CR10 |  |
| 6 | Int Temp | °C | Datalogger | Campbell CR10 |  |
| 7 | Ref Temp | °C | Enclosure | Campbell CR10TCR |  |
| 8 | Enc Temp | °C | Enclosure | Thermocouple |  |
| 9 | 1V1 | Volts | Soil 14.0 in | Vitel Soil Moisture/Temp | 35.56 cm |
| 10 | 2V1 | Volts | Soil 8.0 in | Vitel Soil Moisture/Temp | 20.32 cm |
| 11 | 3V1 | Volts | Soil 2.0 in | Vitel Soil Moisture/Temp | 5.08 cm |
| 12 | 4V1 | Volts | Soil 12.0 in | Vitel Soil Moisture/Temp | 30.48 cm |
| 13 | 5V1 | Volts | Soil 7.5 in | Vitel Soil Moisture/Temp | 19.05 cm |
| 14 | 6V1 | Volts | Soil 2.0 in | Vitel Soil Moisture/Temp | 5.08 cm |
| 15 | 7V1 | Volts | Soil 11.0 in | Vitel Soil Moisture/Temp | 27.94 |
| 16 | 8V1 | Volts | Soil 8.0 in | Vitel Soil Moisture/Temp | 20.32 |
| 17 | 9V1 | Volts | Soil 2.0 in | Vitel Soil Moisture/Temp | 5.08 |
| 18 | 10V1 | Volts | Soil 11.0 in | Vitel Soil Moisture/Temp | 27.94 |
| 19 | 11V1 | Volts | Soil 8.0 in | Vitel Soil Moisture/Temp | 20.32 |
| 20 | 12V1 | Volts | Soil 2.0 in | Vitel Soil Moisture/Temp | 5.08 |
| 21 | 1V2 | Volts | Soil 14.0 in | Vitel Soil Moisture/Temp | 35.56 cm |
| 22 | 2V2 | Volts | Soil 8.0 in | Vitel Soil Moisture/Temp | 20.32 cm |
| 23 | 3V2 | Volts | Soil 2.0 in | Vitel Soil Moisture/Temp | 5.08 cm |
| 24 | 4V2 | Volts | Soil 12.0 in | Vitel Soil Moisture/Temp | 30.48 cm |
| 25 | 5V2 | Volts | Soil 7.5 in | Vitel Soil Moisture/Temp | 19.05 cm |
| 26 | 6V2 | Volts | Soil 2.0 in | Vitel Soil Moisture/Temp | 5.08 cm |
| 27 | 7V2 | Volts | Soil 11.0 in | Vitel Soil Moisture/Temp | 27.94 |
| 29 | 8V2 | Volts | Soil 8.0 in | Vitel Soil Moisture/Temp | 20.32 |
| 29 | 9V2 | Volts | Soil 2.0 in | Vitel Soil Moisture/Temp | 5.08 |
| 30 | 10V2 | Volts | Soil 11.0 in | Vitel Soil Moisture/Temp | 27.94 |
| 31 | 11V2 | Volts | Soil 8.0 in | Vitel Soil Moisture/Temp | 20.32 |
| 32 | 12V2 | Volts | Soil 2.0 in | Vitel Soil Moisture/Temp | 5.08 |
| 33 | 1V3 | Volts | Soil 14.0 in | Vitel Soil Moisture/Temp | 35.56 cm |
| 34 | 2V3 | Volts | Soil 8.0 in | Vitel Soil Moisture/Temp | 20.32 cm |
| 35 | 3V3 | Volts | Soil 2.0 in | Vitel Soil Moisture/Temp | 5.08 cm |
| 36 | 4V3 | Volts | Soil 12.0 in | Vitel Soil Moisture/Temp | 30.48 cm |
| 37 | 5V3 | Volts | Soil 7.5 in | Vitel Soil Moisture/Temp | 19.05 cm |
| 38 | 6V3 | Volts | Soil 2.0 in | Vitel Soil Moisture/Temp | 5.08 cm |
| 39 | 7V3 | Volts | Soil 11.0 in | Vitel Soil Moisture/Temp | 27.94 |
| 40 | 8V3 | Volts | Soil 8.0 in | Vitel Soil Moisture/Temp | 20.32 |
| 41 | 9V3 | Volts | Soil 2.0 in | Vitel Soil Moisture/Temp | 5.08 |
| 42 | 10V3 | Volts | Soil 11.0 in | Vitel Soil Moisture/Temp | 27.94 |
| 43 | 11V3 | Volts | Soil 8.0 in | Vitel Soil Moisture/Temp | 20.32 |
| 44 | 12V3 | Volts | Soil 2.0 in | Vitel Soil Moisture/Temp | 5.08 |
| 45 | 1V4 | Volts | Soil 14.0 in | Vitel Soil Moisture/Temp | 35.56 cm |
| 46 | 2V4 | Volts | Soil 8.0 in | Vitel Soil Moisture/Temp | 20.32 cm |
| 47 | 3V4 | Volts | Soil 2.0 in | Vitel Soil Moisture/Temp | 5.08 cm |
| 48 | 4V4 | Volts | Soil 12.0 in | Vitel Soil Moisture/Temp | 30.48 cm |
| 49 | 5V4 | Volts | Soil 7.5 in | Vitel Soil Moisture/Temp | 19.05 cm |
| 50 | 6V4 | Volts | Soil 2.0 in | Vitel Soil Moisture/Temp | 5.08 cm |
| 51 | 7V4 | Volts | Soil 11.0 in | Vitel Soil Moisture/Temp | 27.94 |
| 52 | 8V4 | Volts | Soil 8.0 in | Vitel Soil Moisture/Temp | 20.32 |
| 53 | 9V4 | Volts | Soil 2.0 in | Vitel Soil Moisture/Temp | 5.08 |
| 54 | 10V4 | Volts | Soil 11.0 in | Vitel Soil Moisture/Temp | 27.94 |
| 55 | 11V4 | Volts | Soil 8.0 in | Vitel Soil Moisture/Temp | 20.32 |
| 56 | 12V4 | Volts | Soil 2.0 in | Vitel Soil Moisture/Temp | 5.08 |
| 57 | Soil Temp | °C | Soil 5 cm | Campbell 107B |  |
| 58 | Soil Temp | °C | Soil 20 cm | Campbell 107B |  |
| 59 | Soil Temp | °C | Soil 30 cm | Campbell 107B |  |
| 60 | Soil Temp | °C | Vegetation | MRC Temperature Probe |  |
| 61 | Soil Temp | °C | Soil 0 cm | MRC Temperature Probe | Not working |
| 62 | Soil Temp | °C | Soil 5 cm | MRC Temperature Probe |  |
| 63 | Soil Temp | °C | Soil 10 cm | MRC Temperature Probe |  |
| 64 | Soil Temp | °C | Soil 15 cm | MRC Temperature Probe |  |
| 65 | Soil Temp | °C | Soil 20 cm | MRC Temperature Probe |  |
| 66 | Soil Temp | °C | Soil 25 cm | MRC Temperature Probe |  |
| 67 | Soil Temp | °C | Soil 30 cm | MRC Temperature Probe |  |
| 68 | Soil Temp | °C | Soil 35 cm | MRC Temperature Probe |  |
| 69 | Soil Temp | °C | Soil 45 cm | MRC Temperature Probe |  |
| 70 | Soil Temp | °C | Soil 70 cm | MRC Temperature Probe |  |
| 71 | Soil Temp | °C | Soil 95 cm | MRC Temperature Probe |  |
| 72 | Soil Temp | °C | Soil 120 cm | MRC Temperature Probe |  |
| 73 | Soil Temp | °C |  | MRC Temperature Probe | Reference value |

DATA PROCESSING ALGORITHMS:

Vitel Hydra Probe soil moisture, temperature, complex dielectric constant, electrical conductivity, and salinity are determined from the raw data (four voltages), and a calibration option (1, 2, or 3), depending on the soil texture, with a program supplied by Vitel, Inc. Option 2 (silt) is used here.

DATA STORAGE AND ACCESS:

Data are in Excel files organized by calendar year. Each file consists of a page containing all downloaded data for that year and 12 pages of processed Vitel sensor data (one page for each sensor) with the following column headings: SENSOR, SOIL (calibration option), ER (real part of the soil dielectric constant), EI (imaginary part of the soil dielectric constant), TEMP (soil temperature °C), ER-COR (temperature corrected ER), EI\_COR (temperature corrected EI), WATER (volume fraction soil water content), SALINITY (soil salinity in g/l NaCl), SOIL\_COND (soil electrical conductivity in S/m or mhos/m), SOIL\_COND\_COR (temperature corrected SOIL\_COND in S/m or mhos/m), WATER\_CON\_COR (temperature corrected soil water electrical conductivity in S/m or mhos/m). The column headings for the annual data are: ID (site), YEAR, DAY OF YEAR, HOUR, TIME, DATE, BATT VOLT (battery voltage), INT TEMP °C (datalogger temperature), REF TEMP °C, TC °C (enclosure temperature), 1V1 (14-in depth, Vitel stack 2), 1V2 (14-in depth Vitel, stack 2), 1V3 (14-in depth Vitel, stack 2), 1V4 (14-in depth Vitel, stack 2), 2V1 (8-in depth Vitel, stack 2), 2V2 (8-in depth Vitel, stack 2), 2V3 (8-in depth Vitel, stack 2), 2V4 (8-in depth Vitel, stack 2), 3V1 (2-in depth, Vitel stack 2), 3V2 (2-in depth Vitel, stack 2), 3V3 (2-in depth Vitel, stack 2), 3V4 (2-in depth Vitel, stack 2), 4V1 (12-in depth, Vitel stack 1), 4V2 (12-in depth Vitel, stack 1), 4V3 (12-in depth Vitel, stack 1), 4V4 (12-in depth Vitel, stack 1), 5V1 (7.5-in depth, Vitel stack 1), 5V2 (7.5-in depth Vitel, stack 1), 5V3 (7.5-in depth Vitel, stack 1), 5V4 (7.5-in depth Vitel, stack 1), 6V1 (2-in depth, Vitel stack 1), 6V2 (2-in depth Vitel, stack 1), 6V3 (2-in depth Vitel, stack 1), 6V4 (2-in depth Vitel, stack 1), 7V1 (11-in depth, Vitel stack 3), 7V2 (11-in depth Vitel, stack 3), 7V3 (11-in depth Vitel, stack 3), 7V4 (11-in depth Vitel, stack 3), 8V1 (8-in depth, Vitel stack 3), 8V2 (8-in depth Vitel, stack 3), 8V3 (8-in depth Vitel, stack 3), 8V4 (8-in depth Vitel, stack 3), 9V1 (2-in depth, Vitel stack 3), 9V2 (2-in depth Vitel, stack 3), 9V3 (2-in depth Vitel, stack 3), 9V4 (2-in depth Vitel, stack 3), 10V1 (11-in depth, Vitel stack 4), 10V2 (11-in depth Vitel, stack 4), 10V3 (11-in depth Vitel, stack 4), 10V4 (11-in depth Vitel, stack 4), 11V1 (8-in depth, Vitel stack 4), 11V2 (8-in depth Vitel, stack 4), 11V3 (8-in depth Vitel, stack 4), 11V4 (8-in depth Vitel, stack 4), 12V1 (2-in depth, Vitel stack 4), 12V2 (2-in depth Vitel, stack 4), 12V3 (2-in depth Vitel, stack 4), 12V4 (2-in depth Vitel, stack 4), SOIL T 5 cm °C, SOIL T 20 cm °C, SOIL T 30 cm °C, MRC1 veg °C, MRC2 0 cm °C, MRC3 5 cm °C, MRC4 10 cm °C, MRC5 15 cm °C, MRC6 20 cm °C, MRC7 25 cm °C, MRC8 30 cm °C, MRC9 35 cm °C, MRC10 45 cm °C, MRC11 70 cm °C, MRC12 95 cm °C, MRC13 120 cm °C, MRC ref.

**SOILS:** Sampled for characterization by Chien-Lu Ping, August 10, 1998.

CLASSIFICATION:

**LANDSCAPE:** Old beach ridge.

SLOPE:

ASPECT:

ELEVATION:

**VEGETATION:** Moss, grass, and small annual flowers.

GROUND COVER:

CANOPY COVER:

**COMMENTS:** The sensors installed at the two-inch depth were just below the organic mat. The sensors installed at the deepest depths were just into the top of a gravely horizon. The soil was unfrozen at the two-inch depth and the sensors were pushed into place. The soil at the other sensor installation depths was frozen and the sensors were installed with the aid of an installation jig (from Vitel, Inc.) and a portable electric drill using a long bit. We had problems with the Pico gasoline powered jackhammer; the starter cord broke. Most of the holes for sensor installation, therefore, were dug by hand with the aid of a spud bar.

**NOTES FOR NEXT STATION VISIT:** Routine maintenance.