Date: 04/26/02

USCRN SITE SURVEY CHECKLIST

(Complete One Form for Each Property Surveyed)

DATE OF SITE SURVEY _____

LOCATION (City, County, State, and Zip) _____

_____

NAME/PHONE/E-MAIL OF RCC AND SC REPs DOING SURVEY

RCC Person: _____

SC Person: _____

SITE VISIT CONTACT INFORMATION

Contact Name: _____

Organization: _____

Address (street, city, county, zip): _____

_____

Phone: _____

Fax: _____

Email: _____

HOST ORGANIZATION INFORMATION (Property Owner)

Contact Name: _____

Name/Title of Person Signing the SLA: _____

_____

Organization: _____

Address (street, city, county, zip): _____

_____

Phone: _____

Fax: _____

Email: _____

LOCAL CONTACT FOR LONG TERM COORDINATION OF SITE MATTERS

Contact Name: _____

Organization: _____

Address (street, city, county, zip): _____

_____

Phone: _____

Fax: _____

Email: _____

LOCAL CONTACT FOR <u>GENERAL MAINTENANCE/SECURITY</u> SUPPORT

Contact Name: _____

Organization: _____

Address (street, city, county, zip): _____

_____

Phone: _____

Fax: _____

Email: _____

<u>Discuss local level of general routine support available (if any)</u> – i.e. periodic visual inspection/security visit, general maintenance (mowing, clean pyranometer lens dust/dirt/snow, remove branches/debris from and periodic empting rain gauge, etc. General CRN policy is not to provide nominal stipend for these services. However, should address this issue. CRN Program Manager will determine if appropriate and offer and negotiate dollar amount. May be written into the SLA. If agreed to pay small stipend, will require to know who/where to send funding. Prefer annual payment.

_____

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LOCAL TECHNICAL SUPPORT PERSON CONTACT INFORMATION

Contact Name: _____

Organization: _____

Address (street, city, county, zip): _____

_____

Phone: _____

Fax: _____

Email: _____

Discuss Option of providing Immediate Local Technical Maintenance Response (May be same person as General Support) – i.e. evaluate potential instrument/equipment problems, such as replacing temperature probe, fan motor, anemometer, etc. working on other observing sites in area, experience, etc. ATDD will provide video, manual, and basic training for routine technical support. Discuss reimbursement cost options – Annual or per hour reimbursement. Need to know who/where to send funding. Prefer annual payment. Quarterly, particularly monthly, less desirable.

_____

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BEFORE GOING ON THE SURVEY FIELD TRIP TO THE SITES

- At least two, preferably three or more, pieces of property to survey.

- Discuss CRN Site Information Handbook contents and other items with Host Org.

- Host Organization reviewed SLA and Discussed CRN Long-Term (50+ yrs.) needs.

- Get general site description and digital pictures, aerial photos, topographic maps, etc.

- Discuss Access and AC power in the area.

- Discuss current and future uses of offered site and surrounding area with Host Org.

- Look at past growth and potential future (20+ years) growth patterns (N-S-E-W). Some population density growth projections are available from Census Bureau and City Planners. It is useful to engage in pointed questions and discussions with the Host Organization and other local contacts.

- Attempt to identify, talk to, and then meet with, existing local technical support (i.e. SURFRAD, NADP, etc. support).

SPECIFIC LOCATION INFORMATION

(Note: It is very important that you record the latitude, longitude, and elevation of the exact place where the instrument tower will be installed. It is equally important to get the Host Org. Rep with you on the site survey to agree to that spot.)

Latitude (degree, minutes, tenths): _____

Longitude (degree, minutes, tenths): _____

Elevation in Feet {indicate below sea level with a minus (–) sign}: _____

City/County or Parish/State: _____

Type Property (National Park, Deeded University, Botanical Garden, Audubon, Arboretum, etc.) _____

_____

_____

_____

Other Type Observing Sites in Vicinity (ASOS, COOP, NADP, ARM, BLM, COE, USGS, LITR, Astronomy, etc. – Describe, include Point of Contact Info):

_____

_____

_____

_____

_____

_____

Other Remarks: _____

_____

_____

_____

PHYSICAL DESCRIPTION OF THE SITE AND SURROUNDING AREA

(**Notes:** Take Topographic Maps with you - Best scale for the individual site and best scale which includes all potential sites in the area. If available, bring Aerial Photos. Take lots of pictures – Stand where tower will be and take: distant 360 degree shots all cardinal points of the compass, close-up (out to ~300 meters) 360 degree, zoom of nearby obstructions (<300 meters), best shot of distance between tower and AC power (ensure terrain shown). Step back ~ 30+ feet from tower location and take close-up shots of tower location and ground cover from several points of the compass.) Avoid areas where nearby land is regularly tilled, large bodies of water, flood areas due to streams, etc.

A. Describe the Use of the Property and Surrounding Area (i.e. pasture land used for grazing, grow wheat/barley/soy which is cut once/twice a year, tilled fields, etc.)

B. Describe Terrain (360 degrees) - Long Distance (miles) and Nearer (~300-600 meters), i.e. rolling hills, steep escarpments, relatively flat, distance/direction to nearest town and size of town, etc.

C. Document all Obstructions (360 degrees) within 300 meters of the tower location, include for each a description (tree, building, etc.), azimuth, distance, and estimated height.

D. Evaluate Site "Meteorological Measurements Representivity" for Each Instrument (Instruments installed 1.5 meters above the ground surface)
Evaluate and Assign (Circle) the "BEST" Classification Value (1 through 5)
Provide Brief Rationale for Each Classification Number Assigned

Temperature/Humidity **1** **2** **3** **4** **5**

_____

_____

_____

Precipitation **1** **2** **3** **4** **5**

_____

_____

_____

Wind (Speed Only) **1** **2** **3** **4** **5**

_____

_____

_____

Solar Radiation **1** **2** **3** **4** **5**

_____

_____

_____

Surface Ground Temperature (IR sensor) – Not Applicable

Other Comments:

_____

_____

_____

E. Document Direction, Distance, and Intervening Terrain between Tower and AC power source, include photos, type soil, rocks, etc. that will impact trenching AC line.

F. Discuss Local Routine and Technical Level Maintenance Support – Complete information sheet (name, etc.) earlier in this checklist. Routine Grooming (mowing, clean pyranometer lens dust/dirt/snow, remove branches/debris from and periodic empting rain gauge, etc., as well as Periodic Security Visits - How often in the area? Technical support - Evaluate potential instrument/equipment problems, such as replacing temperature probe, fan motor, anemometer, etc. working on other observing sites in area, experience, etc.

G. Discussions with Host Organization Rep w.r.t. various topics to include but not limited to: 1) Unusual Local Weather Phenomena/Influences, 2) Host willing to absorb cost of AC power (about cost of a 60 watt bulb burning continuously 24/7/356), 3) Access to CRN Site, 4) Local routine housekeeping support, 5) Long-Term Stability of the site, past and future plans for the surrounding area, and anything else that you deem appropriate to Reduce Risk, 6) Tilled Fields nearby, 7) Fences-Site Dependent. Discuss with rep- make a decision, Typically minimum ~20' x ~20' around tower, 4' high green chain link w/gate; Small DFIR for precip gauge; Grazing cattle - Barb Wire (3 or 5 strand) entire site; Host Org. might want chain link entire site, etc. **Ask Pointed Questions.**

PRACTICAL SITE PREPARATION INFORMATION NEEDED
(May not be able to get all the information during the site visit. Try to gather prior to visit or at least let local site rep know what you need. Follow-up in cooperation with ATDD may/will be required.

A. Permits – Install meter for power, trench for power line from meter to tower location, install underground cable, excavation for concrete pads for tower and precipitation gauge(s), pouring concrete, building fence, etc. There could be union regulations precluding some work from being performed by CRN Site Preparation and Installation Team members.

Host organization willing to cover the AC power costs – YES or NO (Circle one)

Will need Point of Contact for the Local Power Company to discuss installation of meter (if required), etc.

If YES for Permit(s) - Required Info for Each:

Contact Name (Power): _____

Organization: _____

Address: _____

_____

Phone: _____

Fax: _____

Email: _____

==========

Contact Name (Excavation/Concrete): _____

Organization: _____

Address: _____

_____

Phone: _____

Fax: _____

Email: _____

To Be Determined: Follow-Up May Be Required for Local Contractor Support for Excavation, Deliver/Pour Concrete, Pull Power Cables, and Install Fence.

B. Climatological Summary Report – Currently prepared by Grant Goodge, CRN Program Office, National Climatic data center (NCDC), 828-271-4330, Grant.Goodge@noaa.gov.

Please contact Grant as soon as you have identified a general geographic location and when specific site properties are identified.

C. Other Useful Information to Consider and will eventually needed by the Site Preparation and Installation Team (if site approved for CRN)

- How close can Trucks/Vehicles get to site for delivery of site equipment/instruments and building materials (concrete truck, fence material deliveries, etc.)

- Roads Nearest Tower location

- Contractor Information for:
  - Excavation
  - Concrete Delivery and pouring
  - Electrical Work
  - Fence Installation

- Driving/Airport Information to point closest to the site

- Local Hotel and Emergency Room/Hospital Locations (Name, Location, Phone Numbers, Web Sites)

- Directions from nearest town to the site

- Local truck rental name/location

Miscellaneous Notes:

APPENDIX TO USCRN SITE SURVEY CHECKLIST FORM

References:

- CRN Web Site: http://lwf.ncdc.noaa.gov/oa/climate/research/crn/crnmain.html
- CRN Site Information Handbook posted at CRN web site (current version 12/13/01)
- National Research Council (NRC), 1999, Adequacy of Climate Observing Systems, National Academy Press, D.C.
- Leroy, M., 1998: Meteorological Measurements Representativity, Nearby Obstacles Influence. 10 Symp. On Met. Observ. & Instr., 233-236.
- WMO (World Meteorological Organization), 1996: Doc 8, Guide to Instruments and Methods of Observation, Geneva, Switzerland.

Top Most Geographic and Site Selection Criteria:

- Long Term Stability of the Instrument Sites – Low Risk of significant Change
- Larger Climate Signal Not Influenced by Local Topographic Features
- Year Round Access for maintenance visits (scheduled and non-scheduled)
- Nearby Access to AC Power (solar panels under evaluation)

Sequence of Events:

- Contact potential Host Organizations
- Provide copies of CRN Site Information handbook, CRN web URL, and Site Survey Checklist.
- Obtain via phone/e-mail as much information on proposed properties as possible/POCs.
- Latitude/longitude digital photos of specific pieces of property and if available aerial photos.
- Physical condition of property and surrounding area.
- Check maps at: http://topozone.com/ and http://www.mapquest.com/ and http://www.geographynetwork.com/ and http://www.terraserver.com/
- IF you feel meets criteria for instrument site, schedule an on-site visit. Ensure have at least three pieces of property to examine.
- Take lots of digital pictures and fill in Site Survey Form/Checklist. Provide good description of land cover/surrounding features, etc.
- Write summary report on each site. Make recommendation on best two and why.
- Submit by e-mail with link to aerial photo URL, if any. If provided paper aerial photos, either mail or scan and send digitally. Send all digital pictures, ID by site and describe what looking at. Using PPT a good way to organize/grouping photos per site.
- Send digital copy of completed Site Survey Form/Checklist to CRN Program Manager.
- Work with John Hughes to keep CRN Tracking Spreadsheet current.

NOTE: It is not desirable to get the SLA signed before selecting the actual property. This can present false sense of acceptance before competing the site review/selection. The site might not be acceptable. Hopefully the up front work and discussions will produce at least two good pieces of property in a given location.

Equipment Required: Handheld GPS, Digital Camera, and Laptop (useful in downloading digital photos and filling in Site Survey Checklist)

Local Site Representativity Evaluation (Classification Scheme)

Local environmental and nearby terrain factors have an influence on the "quality of a measurement." The selection of a CRN instrument site will be the result of a balance between competing demands, such as those highlighted above and an assessment of the "quality of measurements" guidelines outlined below.

The most desirable local surrounding landscape is a relatively large and flat open area with low local vegetation in order that the sky view is unobstructed in all directions except at the lower angles of altitude above the horizon. No significant obstruction within 300 meters of the instrument tower. The area occupied by an individual instrument site is typically about 18 m x 18 m (~60 ft x ~60 ft).

There will be many sites that are less than ideal. Selecting a site is a series of compromises between a number of factors. The CRN will use the classification scheme below to document the "meteorological measurements representativity" at each site. This scheme, described by Michel Leroy (1998), is being used by Meteo-France to classify their network of approximately 550 stations. The classification ranges from 1 to 5 for each measured parameter. The errors for the different classes are estimated values.

Classification for Temperature and Humidity

Class 1: Flat and horizontal ground surrounded by a clear surface with a slope below 1/3 (<19 degrees). Grass/low vegetation ground cover <10 cm high. Sensors located at least 100 meters (m) from artificial heating or reflecting surfaces, such as buildings, concrete surfaces, and parking lots. Far from large bodies of water, except if it is representative of the area, and then located at least 100 meters away. No shading when the sun elevation >3 degrees.

Class 2: Same as Class 1 with the following differences. Surrounding Vegetation <25 cm. Artificial heating sources within 30m. No shading for a sun elevation >5 degrees.

Class 3 (error 1 C): Same as Class 2, except no artificial heating sources within 10m.

Class 4 (error >/= 2 C): Artificial heating sources <10m.

Class 5 (error >/= 5 C): Temperature sensor located next to/above an artificial heating source, such a building, roof top, parking lot, or concrete surface.

b) Classification for Precipitation

One factor to consider is an area surrounded by uniform obstacles of about the same height. Wind speed is a significant factor that affects the accuracy of measuring liquid and frozen precipitation. A wind shield can be placed around the gauge to improve the accuracy of the "catch." CRN measure only wind speed (no direction) at a height of 1.5m, near the height of the gauge orifice.

Class 1: Flat horizontal ground surround by a cleared surface with a slope below 1/3 (<19 degrees). Any obstacle must be located at a distance of at least 4 times the height of the obstacle. An obstacle is an object seen from the precipitation gauge with an angular width of =/>10 degrees.

Class 2 (error 5%): Same as Class 1, except an obstacle is located at a distance of at least two (2) times its height.

Class 3 (error 10% to 20%): Ground with a slope below 1/2 (<30 degrees). Any obstacle is located at a distance of at least its height.

Class 4 (error >20%): Ground with a slope >30 degrees. Obstacles located at a distance less than their height.

Class 5 (error > 50%): Obstacles overhanging the gauge.

c) Classification for Solar Radiation

Class 1: Flat horizontal ground with a slope of the terrain <2 degrees. No obstacles within 100 meters.

Class 2 (error 10%): Slope of the terrain <5 degrees. Obstacles within 100m and an angular height >7 degrees but <10 degrees.

Class 3 (error 15%): Slope of the terrain <7 degrees. Obstacles within 100m and an angular height =/>10 degrees.

Class 4 (error 20%): Obstructions that would obstruct a significant portion of direct radiation.

Class 5 (error 30%): Obstacles overhanging the sensor or near a building.

d) Classification for Wind

Defined for wind sensor at a height of 10m. CRN measures wind speed only (no direction0 at a height of 1.5m.

Class 1: Sensor located at a distance of at least ten (10) times the height of the obstacle (elevation angle <5.7 degrees). Object considered an obstacle if seen at angular width >10 degrees. Obstacle is below 5.5m height within a 150m radius and 7m within a 300m radius. Wind sensor located a minimum distance of 15 times the width of thin nearby obstacles (i.e. mast, tree with angular width <10 degrees). Surrounding terrain relief change </= 5m within a 300m radius.

Class 2 (error 10%): Same as Class 1 except terrain change </= 5m within a 100m radius.

Class 3 (error 20%): Same as Class 1 except no obstacles within five times the height of the nearby obstacles (elevation angle <11.3 degrees). Wind sensor located a minimum distance of 10 times the width of thin nearby obstacles. Terrain change </= 1m within a 10m radius.

Class 4 (error 30%): Same as Class 3 except no obstacles within 2.5 times the height of the nearby obstacles (elevation angle <21.8 degrees).

Class 5 (error >40%): Obstacles within 2.5 times the height of the nearby obstacles. Class 6 (error >50%): Obstacles with a height >10m, seen with an angular width greater than 60 degrees are within a 20m distance.

Other Important Information:

How far away should a tilled field be from a USCRN instrument site?
As a guide, land that will undergo periodic agricultural projects, such a regular tilling, etc., should be a minimum of 90 meters (~300 feet) from the proposed USCRN instrument site. Ideally, the distance should be 200 meters.

In general, Agricultural Experimentation Sites and nearby land used for agricultural purposes should not be the first choice of a USCRN instrument site. Identification and selection of these type potential sites require close examination of the issues before committing to a Site Survey. National Parks, Botanical Gardens, as well as locations near other long term observing sites, such as LTER, PrimeNet, etc., should be considered first as prime candidates. Arboretums, Audubon, and Botanical Gardens might till land. Must ask the right questions and gage the situation.

AC Power – How Far Is Too Far? - Distance between the AC source and the CRN instrument site should be as short as possible, typically <300 feet is preferred. However, in some cases the terrain between the AC source and the CRN site may be a more critical consideration of site acceptability than the distance factor.

Currently one site has a run of 700 feet. The related cost of installation was driven much higher at this site. The longest run we can make from an AC source is 2,000 feet (less than 10 volt drop over length of power line). If the run were longer than 2,000 feet, a high voltage line and transformer would need to be used. This would have to be done by the electric company.

The longest spool of 10-gauge wire typically comes in spools up to 1,000 feet. If the total distance (down power pole, across land, into CRN site terminal box) exceeds 1,000 feet, then there will be a need to come out of the ground to splice the wires. This presents a significant safety issue associated with bring the wire above ground and installing a junction box inside which the power cables are spliced together. CRN needs to avoid this situation.

Fences - The size and type fence required will be Site Dependent. You and the Host Org. Rep. will need to make a decision. Need to know the Fence Requirement for Site Prep/Installation. In many cases, the CRN instrument suite will be in a relatively "secure" location. It is not possible to deter the determined trespasser, so no fence arrangement will be completely adequate. The objective of a fence is to provide a physical barrier, which makes a statement - please do not come closer or touch the equipment. Also, if the area is used for grazing, then perhaps a barbwire fence is needed to deter the animals, typically cattle and horses.
Typically, the minimum CRN fence requirement is around the instrument tower. Usually ~20' x ~20', chain link, green, four (4) feet high with a gate. In most cases, the Small DFIR fence should provide an adequate barrier around the precipitation gauge.
Barbwire - If the area is used for grazing, then barbwire (three or five strand - ask host) around the entire 60' x 60' perimeter is recommended.

In some cases, the Host Org. might ask for a fence (other than barb wire) to enclose the entire 60' x 60' piece of property. This is the case at the Audubon Society location near Lincoln, NE. The Host Org. has many visitors, particularly children, and wanted to limit their physical proximity to the instruments.

Small DFIR with a Single Alter (in center of SDFIR inner fence ring) is the selected CRN Wind/Snow Shield for the Geonor Precipitation Gauge. Diameter - Outer Fence 26 feet, Inner Fence 13 feet, then Single Alter 4 feet, then the precipitation gauge in the center. Top of shield is about eight (8) feet high. Refer to the October 2001 NCAR Report for design specs and digital pictures. At least in FY 02 - Most all Initial Installations come with ONLY the Single Alter Shield and Geonor. The Small DFIR will be installed during first scheduled maintenance visit. In the latter half of FY 02, the SDFIR will start appearing as part of the initial installation.

Second Precipitation Gauge and Relative Humidity Sensors will follow in FY 03. Items are under evaluation and testing in FY 02/03.

Data Access by Host Organization, RCCs, and SCs
CRN Web Page (Background Info and Data Posted for Public Access):

http://www.ncdc.noaa.gov/crn.html
(Data only from sites completing nine (9) month OT&E. Currently, two Asheville, NC sites.)

Also, Access to above CRN web pages through the NCDC Home Page: www.ncdc.noaa.gov