ATTACHMENT A

USDA AERIAL FILM CAMERA SPECIFICATIONS

1. PRECISION AERIAL MAPPING CAMERA

Tested and calibrated aerial cameras for taking aerial photographs are required. Camera systems must be compatible with precision stereoscopic mapping instruments and with analytical mensuration procedures used in photogrammetric surveys and in preparing accurate topographic maps.

1.1 Camera System "Report of Calibration"

One copy of the "Report of Calibration" from the U.S. Geological Survey, for any camera system to be used, is required to be either on file at the USDA, or submitted with the contractor's offer. A camera system "Report of Calibration" will not be acceptable if more than three (3) years old at the scheduled date for receipt of offers.

1.2 Calibration Tests

Tests to determine compliance with these specifications will be performed by the Optical Science Laboratory of the U.S. Geological Survey. The fee for the tests and the arrangements to have the tests performed are the responsibility of the contractor. Delays encountered in having camera systems tested by the USGS Optical Science Laboratory will not be considered reason for the USDA to accept offers lacking such reports. Each camera system submitted for calibration shall be accompanied by all magazines and filters that might be used with the camera. Controls and camera mounts should not be submitted unless requested by the calibrating laboratory. Instructions for operation of the camera, including directions for holding the shutter open for laboratory tests, shall accompany each camera unless ascertained to be on file with the calibrating laboratory.

1.21 Interval Between Tests

The interval between tests for camera system calibrations shall not exceed three (3) years, unless otherwise approved by the Contracting Officer. However, when there is any reason to believe that the dimensional relationship of the lens, fiducial marks, and film plane have been disturbed by partial disassembly or unusual mechanical shock, the camera must be submitted for recalibration at contractor expense.

1.22 Contact for Calibration Tests

U.S. Geological Survey
National Mapping Division
560 National Center
Reston, Virginia 20192
Attention: Chief, Optical Science Laboratory
Phone: (703) 648-4692

1.23 Shipping Address for Calibration Tests

U.S. Geological Survey
12201 Sunrise Valley Drive
Reston, Virginia 20192
Attention: Frank MacCue (703) 648-4692

1.3 Constructional Design Necessary to Permit Testing

To permit testing for determination of calibrated focal length, distortion, resolving power, fiducial mark locations, and stereomodel flatness, the constructional design of the camera shall be as follows:

1.31 Focal Plane

The focal plane shall be accessible from the rear so that a telescope placed behind the camera may view objects in front of the lens, limited only by the size of the focal plane opening. It shall be possible to place the surface of an optical flat having a thickness of 31 mm (1 1/4 in.) on the focal plane of the camera.

1.32 Focal Plane Frame

The focal plane frame shall be so constructed as to permit placement of a glass photographic plate on its surface so that the emulsion surface of the glass photographic plate lies in the true focal plane of the camera. The size of the frame image shall be 23 x 23 cm (9 x 9 inches).

1.4 Camera Components Required for Testing

1.41 Lens Cone Assembly

The lens cone assembly must be so constructed that the lens and fiducial marks comprise an integral unit. The design of the lens cone shall be such that it maintains the required precise relationship between the lens, fiducial marks, and focal plane on which the film platen shall be positioned. Construction shall be such as to maintain the dimensional relationship of these components under normal conditions of transportation, handling, and use, which can include considerable mechanical and thermal shock. The structure holding these components shall be supported in use in such a manner that stresses likely to change the required dimensional relationships cannot be transmitted to it from the supporting body or mount. The lens cone assembly shall be so designed and manufactured that all parts will return precisely to their original positions, should it be necessary for any reason to disassemble it. However, any disassembly of the lens cone assembly shall require recalibration at contractor's expense before further use.

1.42 Film Platen

Cameras shall be equipped with an approved means of flattening the film at the instant of exposure. The platen against which the film is held shall not depart by more than ± 0.013 mm from a true plane, when the camera/magazine vacuum is applied.

1.43 Shutter

The camera shall be equipped with a between-the-lens shutter of the variable-speed type. The range of speed settings shall be such that, for all anticipated combinations of flight heights, aircraft speeds, film speeds, and light conditions, the camera will produce high-resolution photographs. The effective exposure time and efficiency of the shutter as mounted in the camera will be measured at a maximum aperture and shall have a minimum efficiency of 70 percent at a speed of 1/200 second. This test shall be made in accordance with the "American National Standard Shutter Tests for Still-Picture Cameras," Method I, approved January 12, 1972, American national Standards Institute (PH3.48-1972) (R1978). The shutter shall have a speed of 1/400 second and slower for exposing film negatives during calibration.

1.44 Fiducial Marks

Either four or eight fiducial marks are required. If the four fiducial marks are in the corners of the format area, there must be a set of marks (V-notches or equivalent) in the frame at the midsides for use in centering diapositives in a stereoplotter. If there are eight fiducial marks, the corner fiducial marks shall form a quadrilateral whose sides are equal within ±0.500 mm. The midside fiducial marks shall be equidistant within ±0.500 mm from the adjacent corner fiducial marks. All fiducial marks and other marks intended for precise measuring shall be clear and well-defined on the aerial film and shall be of such a form and contrast that the standard deviation of repeated reading of the coordinates of each made on a precision comparator shall not exceed 0.002 mm. For cameras with projection type fiducial marks the projected images of all marks must be in sharp focus on the emulsion surface. Drawings in figure 1 show acceptable fiducial marks and their arrangements. Fiducials without a center point mark or intersecting lines will not be acceptable. Glass or plastic mounts for fiducial marks will not be acceptable.

1.441 The lines joining opposite pairs of fiducial markers shall intersect at an angle within one minute of 90 degrees. (See figure 2.)

1.442 The intersection of lines between fiducials--the indicated principal point--shall not be further than 0.030 mm from the point of autocollimation. (See figure 2.)

1.45 Filter

Only glass filters with metallic antivignetting coating shall be used to reduce the illumination for uniform distribution of light over the focal plane format. A microdensitometer trace will be made from the antivignetting

coating side of the filter to determine if any deterioration is present that would affect the uniformity of illumination in the focal plane. Deteriorations in excess of 50% of the height of the nominal curve for a lease type will be reason for rejection of a filter. The surface with the antivignetting coating shall be toward the camera lens. The filter shall have surfaces parallel within 10 seconds of arc, and its optical quality shall be such that its addition to the camera shall enhance the uniformity of focal plane illumination and not cause a reduction in image resolution. Glass filter combinations which may be required will be specified in Section B.

1.5 Lens and Platen/Magazine Identification

The camera or lens number, and the most recent calibrated focal length shall be recorded clearly on the film for each frame either on the inside of the focal plane frame or on a data strip between frames. An alpha numeric mark (or symbol) contained in the platen/magazine which identifies the platen/magazine may also be recorded if available on each frame of film. Data markers located on the inside of the focal plane frame shall not exceed 6.35 mm (0.25 inch) in height and 25.4 mm (1.0 inch) in length and shall not obscure any part of the fiducial marks.

1.6 Optical Requirements

Cameras will be given both a static and an operational type test made after final assembly of all parts of the camera system with the light filter in place on the lens. All tests of the lens cone assembly for determination of the calibration constants, calibrated focal length, distortion and resolution will be made using high contrast targets and Eastman Kodak Spectroscopic emulsion Type 157-01 on Kodak Aerial Calibration Plates. Cameras will be operationally tested for stereomodel flatness and resolution by exposing Eastman Kodak Double-X Aerographic film 2405 in the camera while mounted on a multicollimator camera calibrator. (The optical requirements for distortion, model flatness, and resolution for various focal length cameras are defined and tabulated in table 1.) The camera focal length stated in Section B must meet the minimum requirements for that focal length as shown in table 1.

1.61 Distortion

1.611 Radial

The distortion in image position as measured along radial lines from the principal point of symmetry. The value of the average radial distortion referred to the calibrated focal length shall not exceed the amount shown in table 1.

1.612 Decentering

The distortion in image position as measured perpendicular to radial lines from the principal point of symmetry. The value of the decentering distortion shall not exceed the amount shown in table 1. This value shall be evaluated for 153 mm cameras only.

1.62 Point of Symmetry

The calibrated principal point — the point of symmetry — shall not be further than 0.020 mm from the point of autocollimation for 153 mm focal length lenses and no further than 0.040 mm for all other focal length lenses. (See figure 2 / table 1.)

1.63 Resolution

Radial and tangential resolving power, in line pairs per millimeter, shall be no less than the value listed in table 1 for each focal length lens.

1.64 Test Aperture

All camera-lens calibration tests shall be made at the maximum aperture specified by the manufacturer for that lens.

1.65 Model Flatness

The model flatness test will be performed only for 153 mm and 88 mm cameras. Diapositives will be printed from two film exposures of the collimator targets on micro flat glass plates. Two stereomodels will be analytically formed from these using different halves of the exposures for each model. Each model thus formed will consist of a small fixed number of symmetrically arranged points. The allowable deviation from flatness, taken as the range between the maximum negative and the maximum positive value shall be no greater than ± 1/8000 of the focal length of a nominal 6-inch (153-mm) camera, or ± 1/5000 of the focal length of a nominal 3 1/2-inch (85-88 mm) camera. If elevation discrepancies exceed this value, the camera will not be acceptable. (See table 1.)

Figure 1
EXAMPLES OF ACCEPTABLE FORMS OF FIDUCIAL MARKS

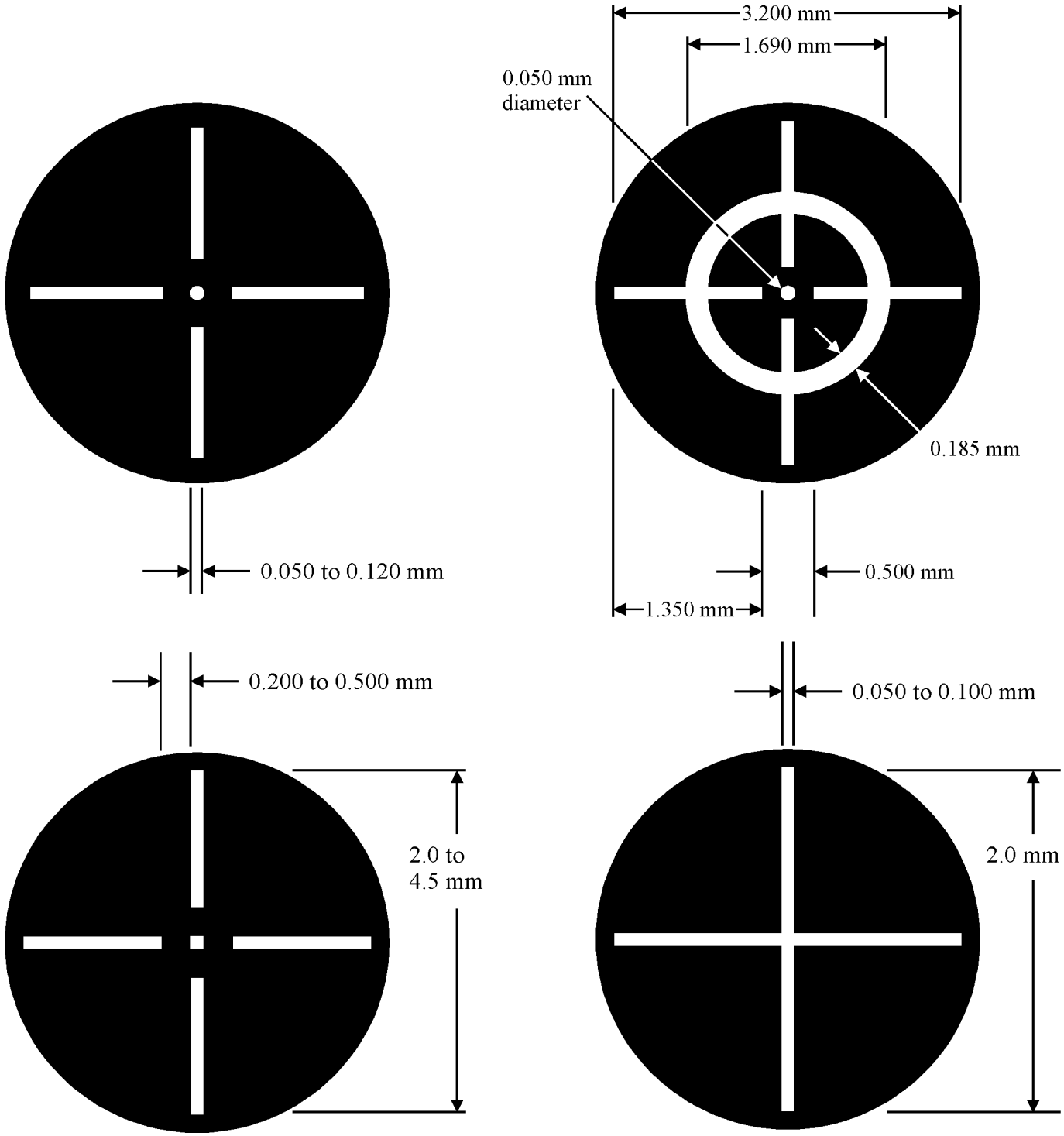
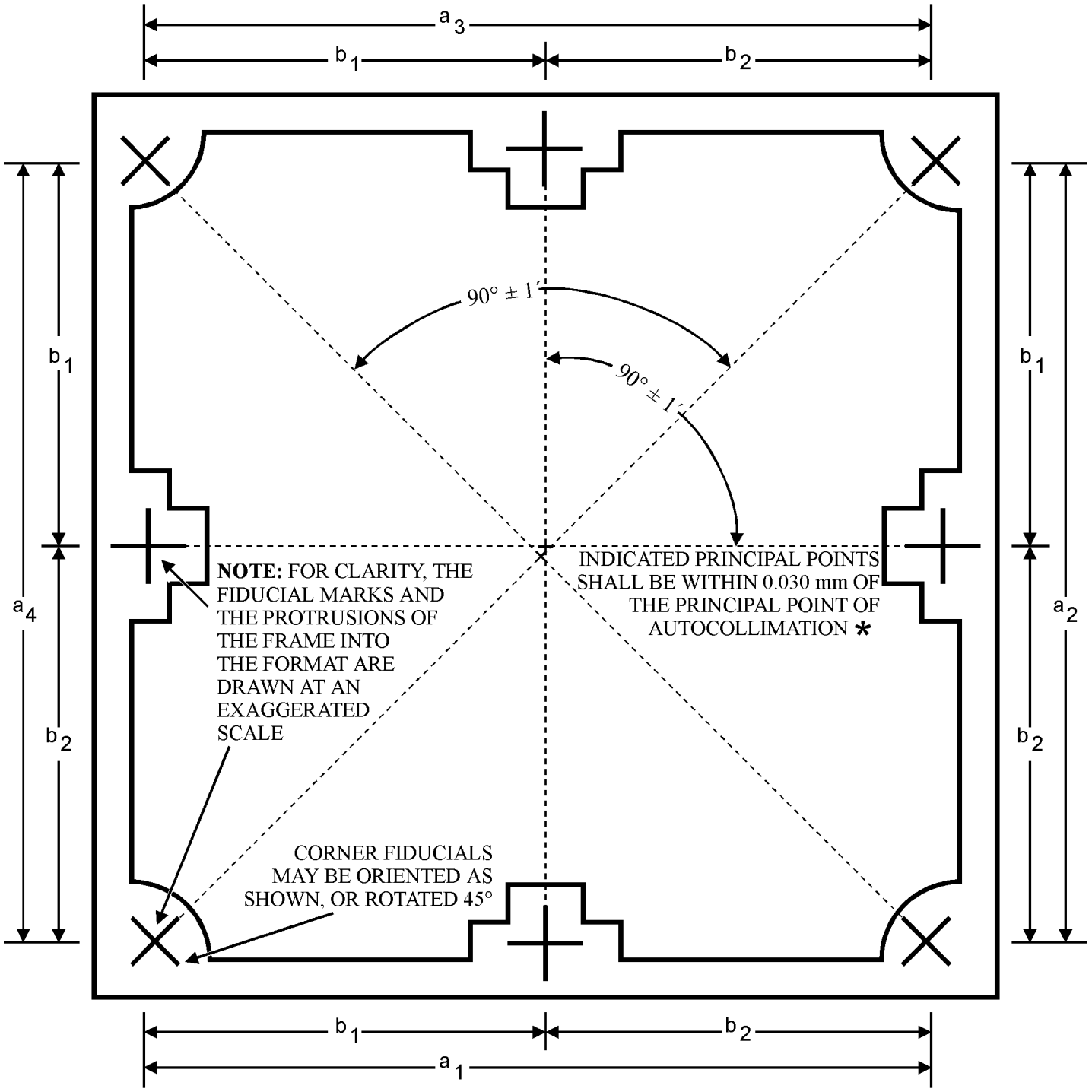


Figure 2
ARRANGEMENT OF FIDUCIAL MARKS



$a_1 = a_2 = a_3 = a_4$ (within 0.500 mm)

$b_1 = b_2$ (±0.500 mm)

* THE CALIBRATED PRINCIPAL POINT - THE POINT OF SYMMETRY - SHALL BE WITHIN 0.015 mm OF THE PRINCIPAL POINT OF AUTOCOLLIMATION FOR 153 mm LENSES AND 0.030 mm FOR ALL OTHER FOCAL LENGTH LENSES.

USDA OPTICAL REQUIREMENTS

Table 1

TABULATION OF OPTICAL REQUIREMENTS

Focal Length	88mm	153mm	210mm	305mm
Focal Length Within	± 4mm	± 3mm	± 4mm	± 5mm
Useable Angular Field	120^{o}	90^{o}	70^{o}	50^{o}
Field Angle-From Axis out to:	54.5^{o}	40^{o}	30^{o}	22.7^{o}
DISTORTION - At Maximum Aperture				
Radial Distortion - Tolerance (um)	± 15	± 10	± 20	± 20
Decentering Distortion - Tolerance (um)	-	≤ 8	-	-
MODEL FLATNESS - (um) Total Difference	± 17	± 19	-	-

INDICATED PRINCIPAL POINTS (Fiducial Centers)

The indicated principal points - fiducial centers - shall fall within a 0.040mm radius circle around the principal point of autocollimation.

CALIBRATED PRINCIPAL POINT (Point of Symmetry)

The calibrated principal point - point of symmetry - shall fall within a 0.020mm radius circle around the principal point of autocollimation for 153mm focal length lenses and 0.040mm for all others.

RESOLUTION
Measured on Spectroscopic Plate at Maximum Aperture

Minimum Radial & Tangential Resolution in Line Pairs per mm
LENS HALF ANGLE

Lens		0^{o}	7.5^{o}	15^{o}	22.7^{o}	30^{o}	35^{o}	40^{o}	45^{o}	50^{o}	54.5^{o}
86mm	Wild Super Aviogon II Zeiss S-Pleogon A or equivalent	59	59	49	42	35	30	17	14	12	12
153mm	Wild U. Aviogon Zeiss Pleogon A Jena Lamegon Pl or equivalent	57	57	48	48	40	34	14			
210mm	Wild N-Aviogon II Zeiss Topargon or equivalent	49	49	42	35	29					
305mm	Wild N. Aviotar Zeiss Topar or equivalent	48	48	28	24						

ATTACHMENT B

DIRECT-DIGITAL CAMERA SPECIFICATION FOR 2010 NRCS DIGITAL STUDY

(Dated December 19, 2008)

1.0 INTRODUCTION AND BACKGROUND

The U.S. Federal Government has not yet established an independent government evaluation and calibration policy for digital camera systems since digital sensor technology is still rather new. Until a policy is developed and implemented, the U.S. Department of Agriculture (USDA), Farm Service Agency (FSA) has proceeded to validate the quality and capabilities of current digital camera systems by obtaining relevant information from camera manufacturers and data providers. The following specifications and requirements have been developed to ensure that any digital camera proposed for use on this pilot project meet minimum requirements to provide the highest quality image tiles and ortho products.

2.0 DIGITAL CAMERA SPECIFICATIONS AND REQUIREMENTS

This document covers digital camera specifications and requirements for the 2010 NRCS Digital Study project and is not applicable to any other USDA aerial photography contract. Acquisition of the digital imagery may be from airborne or space borne platforms. Digital cameras for acquiring precise vertical digital imagery are required to be tested and calibrated (geometrically and radiometrically). Digital camera systems proposed for use must be of comparable precision and quality with traditional stereoscopic mapping cameras. Digital camera systems must also be compatible with analytical mensuration procedures used in photogrammetric surveys and in preparing accurate orthophotography. Only digital camera systems approved by the Contracting Officer, which meet the requirements of these specifications as determined by appropriate camera system documentation and sample imagery submitted, shall be used on this project.

3.0 GENERAL REQUIREMENTS

Digital camera systems must be tested and calibrated with appropriate certification documentation. The digital camera must be geometrically stable and suitable for use in precise, high-accuracy photogrammetric orthoimagery applications. The digital camera system shall provide the following:

3.1 Ground Sample Distance

The camera shall provide the resolution and field of view necessary to meet the ground sample distance (GSD) requirement, as specified in Section B of the contract.

3.2 Single-chip Sensor Systems

The digital camera shall capture red, green, and blue, and near infrared bands (channels). Digital camera systems that use a single-chip sensor, such as a Bayer pattern color filter array, are permitted on this project if the system has method of acquiring and co-registering all color bands (channels), such as a dual boresighted camera system.

3.3 Pan Sharpening

Color interpretation or pan sharpening will be permitted to achieve the required GSD requirements if the panchromatic to color resolution ratio is no greater than 1:5.

3.4 Color Band and Depth

The camera shall capture a minimum of 12-bits per color band (channel).

3.5 Radiometric Accuracy

If the camera system requires more than one camera to acquire the multi-spectral data or the system contains more than one lens and/or shutter (mechanical or electrical), the difference in radiometric values between bands (channels) of a calibrated neutral object shall be less than ±5%. For example, a 12-bit image shall not have more than ±205 difference in between any color band.

3.6 Exposure Control

An automatic exposure control device is permitted, but a manual override capability is required for some types of terrain to achieve proper coverage and exposure.

3.7 Calibration Reports

The Contractor shall submit to the Contracting Officer any new or updated calibration reports that are issued after Government's approval for use within 10 business days of the report release/publication. The calibration reports shall include the same system information listed in Paragraph 4.1.

3.8 System Maintenance

The contractor shall perform all maintenance in accordance with the manufacturers recommended and established procedures. The contractor shall maintain a complete history of all maintenance done to the digital camera system and have it available for Government inspection. The contractor shall provide certification that the system has

been maintained, preventive maintenance and calibration performed, to the manufacturer's requirements.

3.9 Malfunctions

The contracting officer shall be notified of all digital camera system malfunctions within 72 hours with a written report of the malfunction. A malfunction is defined as a failure in any element or process of the digital camera system that causes an interruption of the normal operations of the system. Any malfunctions or failures of global positioning systems or inertial measurement unit systems shall be reported directly to the Contracting Officer.

4.0 DIGITAL CAMERA APPROVAL REQUIREMENTS

All digital camera systems must be approved by the Contracting Officer before acquiring imagery under this contract. When requesting approval, the Contractor shall submit an "digital camera approval package" that contains a report of calibration (see Paragraph 4.1), sample digital imagery (see Paragraph 4.2), and camera documentation (see Paragraph 4.3).

4.1 Calibration Reports

The package shall include the manufacturer and any owner/operator calibration report(s), if performed, for each digital camera proposed for use. The contractor shall follow manufacturer's specifications for appropriate owner calibration and/or recalibration. The calibration reports shall address the geometric performance of the system, and at a minimum, include:

(a) Date of report
(b) The name of the person or company performing the calibration
(c) The methodology and procedures used for calibration
(d) Final calibration parameters, such as calibrated focal length, lens distortion values, radiometric calibration parameters, and principal point location.

NOTE: The government recognizes that individual calibration reports, procedures, and parameters may be unique to a certain manufacturer since equipment and systems vary from manufacturer to manufacturer.

4.2 Sample Imagery Requirements

The package shall include sample images from the digital camera proposed for use. The sample imagery must be at the same resolution and represent similar terrain (agriculture, cropland, forest, etc.) for the project that the Contractor is requesting approval for. The digital camera sample imagery shall provide the following minimum characteristics:

(a) Display the same GSD resolution being offered as indicated in Section B of the contract.

(b) It may be collected no less than 12-bits per color band (channel), but be re-sampled to 8-bits per band for sample image delivery.
(c) Color band (channels) order shall be RGB, NRG, and RGBN for natural color, infrared, and multi-spectral, respectfully (where N is the near infrared).
(d) Sample image shall be ortho-rectified, with geodetic standards of North American Datum 1983 (NAD83) and UTM projection with the appropriate Zone indicated.
(e) Sample shall be delivered in a GeoTIFF file formatted, using the TIFF/GeoTIFF requirements indicated in the contract.
(f) The sample imagery shall fit on one standard DVD/CD-ROM, formatted as described in the contract.

4.3 Digital Camera Documentation Requirements

The package shall include detailed documentation of the digital camera and post-processing system proposed for use. Documentation may include brochures, technical specifications, marketing material, manufacturer's user manuals, or other descriptive literature. The documentation shall contain at a minimum the following information:

(a) General overview information
(b) Product configuration description
(c) Camera component description
(d) Technical specifications
(e) Computer management and storage systems
(f) Image acquisition and processing workflow.

4.4 Multiple Camera Approval

The use of more than one type of digital camera system (i.e.: DSS, ADS40, UltraCam) in the acquisition of the same project area is prohibited unless a waiver from the Contracting Officer is obtained.

ATTACHMENT C

USDA DIRECT-DIGITAL SMALL AREA ORTHOIMAGERY TILE SPECIFICATION

(Dated December 19, 2008)

USDA Farm Service Agency
Aerial Photography Field Office
2222 West 2300 South
Salt Lake City, UT 84119-2020
(801) 844-2910

1.0 SCOPE

This document establishes the technical criteria to be used in the production of direct-digital orthoimagery tiles on the 2010 NRCS NRI Digital Study RFP issued by the Aerial Photography Field Office. This specification is not applicable to imagery required to be delivered unprocessed.

2.0 APPLICABLE DOCUMENTS

In the event of conflict between the contents of this specification and the documents referenced herein, the contents of this specification shall take precedence.

2.1 TIFF Specification Revision, 6 dated June 3, 1992 (Adobe Systems Inc.). The Tagged Image File Format (TIFF) is a copyrighted standard of Adobe Systems, Inc.

2.2 GeoTIFF Revision 1.0 Specification, dated December 28, 2000 (Version 1.8.2). The GeoTIFF Format Specification is a public domain extension of TIFF that provides a robust and flexible method of storing georeferencing information in a TIFF file.

3.0 GENERAL REQUIREMENTS

United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) has several programs, such as the National Resources Inventory (NRI and Wetlands Reserve Program (WRP), programs orthoimagery for various program uses including, but not limited to photo interpretation, area and point delineation, and Geographic Information Systems (GIS) measurements in support of multiple natural resource management and inventory programs. The complex nature and the need for consistent but radiometric correct imagery require the tiles to adhere to exact format and content of this specification.

3.1 General.

(a) Geographic Extent. Each site/location shall cover the entire area with a mandatory meter buffer of 400 (±40) on all four cardinal directions. Extents shall be computed by projecting the geographic corners and side midpoints to the appropriate projection, then adding the buffer on each side of the resulting minimum bounding rectangle.

(b) Non-image data. Titles shall not contain any non-image data. Non-image data includes, but not limited to, borders, fiducal marks, and artifacts. Non-image data also includes “fill” induced by a lack of elevation surface model coverage that results in white, black, or spurious intensity values.

(c) Datums and Coordinates. All tiles shall be projected in the North American Datum of 1983 (NAD83), using the corresponding native Universal Transverse Mercator (UTM) zone (see Figure 1, UTM Zones) with coordinates in meters.

The vertical datum for all tiles shall be North American Vertical Datum of 1988 (NAVD88). The latest datum version shall be used.

(d) Image Mosaicking. Tiles may be created using multiple digital images ("chips") to produce the final product. Specular reflections in tiles should be minimized, especially in agriculture areas, by patching the area using chips from other imagery.

(1) Radiometry Balance. When a mosaic of two or more chips is made, the brightness and color values of the other chips will be adjusted to match that of the principal chip. The join lines between the overlapping chips will be chosen to minimize tonal variations. Localized adjustment of the brightness and color values will be done to reduce radiometric differences between join areas.

(2) Edge-Matching. All chips shall not have more than ±3 pixels offset between the principal chip.

3.2 Image Quality. All tiles shall have proper histograms and tone balance. Color imagery shall also have proper color balance and saturation. When adjusting the radiometric values on multi-spectral tiles, the natural color (RGB bands) should take precedence over the near infrared band.

(a) Clipping. The tiles shall have a tonal range that prevents the clipping of highlight or shadow detail from the image. When calculated against the luminosity histogram (using the RGB bands), the cumulative pixel count between the 5 and 250 histogram bin values shall not be less than 98.0%, with a preferred value greater than 99%.

(b) Contrast. When calculated against the luminosity histogram (using the RGB bands), the difference between the histogram bin value that contains 99.0% of the cumulative pixel count and the value that contains 1.0% shall be greater than 140 but less than 160 (with a goal of 150). If the cumulative pixel count percentage falls between two histogram bin values, the close value shall be used. For example, if the luminosity value 222 contains 99% of the cumulative pixel count and value 44 contains 1% count, therefore the difference is 178.

(c) Histogram Median. When calculated against the luminosity histogram (using the RGB bands), the tiles shall have a median bin value between 108 and 148.

(d) Color Balance. All tiles should have a neutral tonal range without the dominance of any individual color. The difference between the minimum and maximum value in a RBG triplet of any nearly neutral objects within the image shall be less than 5.

(e) Band-to-Band Registration Accuracy. Misregistration between any color bands shall not exceed 1 pixel.

(f) Image blemishes, scratches and artifacts. Imagery shall be free of blemishes, scratches, and artifacts that obscure ground feature detail. The following table defines the maximum acceptable limits for blemishes, scratches, and artifacts. Clusters of blemishes, scratches, and artifacts that do not individually meet these criteria may be considered unacceptable.

Acceptable Image blemishes, scratches and artifacts	
1 pixel wide	100 pixels in length
2 pixels wide	60 pixels in length
3 pixels wide	20 pixels in length
4 – 12 pixels wide	12 pixels in length

3.3 Radiometic Resolution.

(a) Color Imagery. All imagery shall be an 8-bit RGB image in accordance with Section 6, RGB Full Color Images, of the TIFF Specification.

(b) 4-Band Imagery. All imagery that contains both natural color and near infrared shall meet the same requirements as color imagery specified in the paragraph (a) above and shall have the samples saved in the following order: Red, Green, Blue, and iNfrared (RGBN).

3.4 Spatial Resolution. The spatial resolution will be specified in the contract. Tiles produced under this specification shall not be resampled from the original image or original capture, with resolution greater or less than the following numbers:

Ground Sample Distance (GSD)	**Original Image Resolution**	
	Minimum (cm)	**Maximum (cm)**
8 centimeters	4	9
15 centimeters	9	16.5
30 centimeters	16	33

3.5 Horizontal Accuracy. All tiles shall have 95% of all well-defined points tested fall within the specified distance in the contract.

3.6 File Format. All tiles shall be produced using a georeferenced tagged image format (GeoTIFF) in accordance with this specification, the GeoTIFF 1.0 Specification, and the baseline TIFF 6.0 Specification (stated in order of precedence). All tiles shall be readable by older applications that assume TIFF 5.0 or an earlier version of the specification. List 1, Tag Listings, List 2, Sample "tiffinfo" Output, and List 3, Sample ListGeo Output shows an example of a TIFF tag listing.

Tiles that use designated "Extended TIFF 6.0 file" features, as defined in Section 2 of the TIFF Specification, shall not be used. This includes, but not limited to, any of the major new extensions such as "tiled images." Features designated as "not recommended for general data interchange" are considered extensions to the baseline TIFF specification and shall not be used.

(a) Tagged Image File Format (TIFF) Requirements

(1) All public tags shall confirm to the TIFF Specification and shall not be modified outside of the parameters given in the specification. Use of tag numbers not specified in the TIFF Specification for either Grayscale or RGB full color images, depending on color band of the tiles, is not permitted. As a minimum, the TIFF tags listed in Table 1, Required TIFF Tags, and Table 2, Required GeoTIFF Specific Tags, shall be included when creating tiles under this specification.

(2) Tags numbered 32,768 or higher, sometimes called private tags, are reserved and shall not be used unless listed in Table 3, Approved Private Tags. Enumeration constants numbered 32,768 or higher are reserved and shall not be used.

(3) Tags numbered in the "reusable" 65,000-65,535 range shall not be used.

(4) All tile files shall be created using the little-endian byte order as specified in the TIFF Specification. Bytes 0-1 of the Image File Header must be "II" (4949.H).

(5) All tiles files shall only have a single Image File Directory (IFD).

(6) Tiled TIFF files are not allowed.

(b) Georeferenced Tagged Image Format (GeoTIFF) Requirements. A GeoTIFF file is a TIFF file, and inherits the file structure as described in the corresponding portion of the TIFF Specification. All GeoTIFF specific information is encoded in several additional reserved TIFF tags, and contains no private Image File Directories (IFD's), binary structures or other private information invisible to standard TIFF readers.

The GeoTIFF specification uses a MetaTag (GeoKey) approach to encode dozens of data elements into just six TIFF tags. GeoKeys are structurally similar to TIFF tags, but at one lower level of abstraction. As a minimum, the four tags listed in Table 4, Required GeoTIFF MetaTags, shall be included when creating tiles under this specification.

4. VERIFICATION

Any tiles not meeting the requirement in Section 3 may be rejected for non-compliance. Each tile or, at the APFO's determination, a random sample from the lot may be inspected using the following methods. The use of automated processes, such as computer scripts, may be substituted for visual verification.

4.1 General.

(a) Geographic Extent. Visual verification will be done to verify tiles coverage.

(b) Non-image items. Visual verification will be done to ensure tiles do not contain any non-image.

(c) Datums and Coordinates. Verification of georeferencing, correct datums and coordinate systems, by shall be accomplished by visually viewing the image using GIS software other than the software used to create the image.

(d) Image Mosaicking. Visual verification will be done to verify tonal and brightness values across chips used to create the tiles and to verify edge-matching against adjacent tiles.

4.2 Image Quality.

(a) Clipping. Visual or automated verification on the luminosity histogram will be done to verify overall clipping.

(b) Contrast. Visual or automated verification on the luminosity histogram will be done to verify image contrast range.

(c) Histogram Peak. Visual or automated verification on the luminosity histogram will be done to verify peak histogram value.

(d) Color Balance. Visual or automated verification on the luminosity histogram will be done to verify overall clipping. Visual verification will be done to each tiles verify proper histogram and tone balance.

(e) Band-to-Band Registration Accuracy. Visual verification on the luminosity histogram will be done to verify band-to-band registration.

(f) Image blemishes, scratches and artifacts. Visual verification on the luminosity histogram will be done to verify that the image does not contain artifacts.

4.3 Radiometic Resolution. Visual verification will be done to verify bit depth and compliance with TIFF Specification.

4.4 Spatial Resolution. Visual verification will be done to measure spatial resolution.

4.5 Horizontal Accuracy. Visual verification will be done to verify tiles horizontal accuracy. This may include measurements compared against existing ground control points, control imagery or other means at the disposal of USDA.

4.6 File Format. Automated computer scripts will be used to verify that all GeoTIFF and TIFF Specifications are complied with. Correct encoding of all required Meta-Keys (also called GeoKeys) shall be confirmed by referencing each GeoKey using a software application designed to check each against the specifications.

5.0 NOTES

Reserved.

5.1 DEFINITIONS

Band – a range of wavelengths of electromagnetic radiation. Also, image data gathered at this wavelength range. Sometimes referred to as channel.

Brightness value – a number (normally 0-255 in a 8-bit image) representing a discrete intensity gray level of a pixel in an image.

Chip – each separate piece of a mosaick image that contributes to the final image.

Clipping – The presence of pixels exhibiting the minimum or maximum digital count in an image's dynamic range.

Dodging – manipulation of the intensity of part if a photograph by selectively shading or masking.

Field – refers only to the entire field, including the value, of the geokey (as defined in the TIFF Specification).

Ground Sample Distance (GSD) – the area of ground represented in each pixel in x and y components.

Image File Directory – contains information about the image. There must be at least 1 IFD in a TIFF file and each IFD must have at least one entry.

Metadata – description of the content, quality, condition, and other characteristics of the data.

Private tags – TIFF tags numbered 32,768 or higher. Private tags are not defined in the TIFF Specification.

Public tags – TIFF tags that are defined by the TIFF Specification.

Resample – interpolation of pixel values based upon neighboring pixel values.

Tag – refers only to the identifying number portion of the geokey (as defined in the TIFF Specification).

Figure 1, UTM Zones

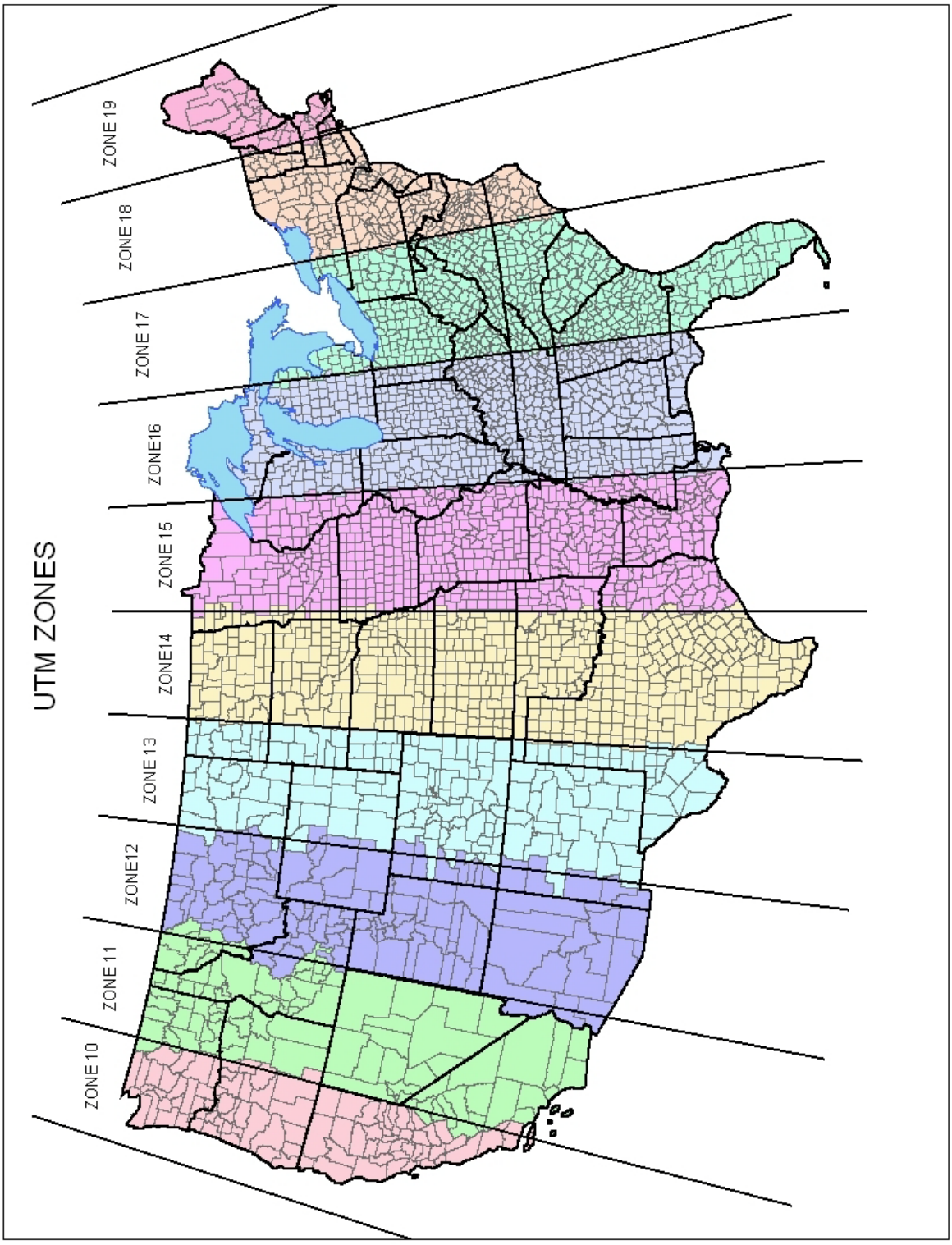


Table 1, Required TIFF Tags

TAG NAME	DESCRIPTION
ImageDescription tag (270.d, 10e.h)	The ImageDescription tag shall contain the program name. Tag should read: "2009 NRCS Digital Pilot Program"
DocumentName tag (269.d, 10d.h)	The DocumentName tag shall have the following form: <loc> _<r> where: <loc > - site/location id number listed in the boundary shapefile <r> - GSD resolution (in centimeters) Example: 01001-020401R_15

Table 2, Required GeoTIFF Specific Tags

TAG NAME	DESCRIPTION
ModelPixelScaleTag (33550.d, 830e.h)	The X and Y values must be populated and be equal to the ground distance of one tile pixel.
ModelTiepointTag (33922.d, 8482.h)	This tag specifies the (X,Y) ground coordinates of the (0,0) image pixel, by convention in the upper left corner of the image. All tiles shall use the UTM project reference frame. GeoTIFF allows considerable flexibility in how an image is tied to the ground, but tiles image data should be tied to the (0,0) pixel. The Z coordinate value should be set to 0. See section 2.6.1 of the GeoTIFF specification.
GeoAsciiParamsTag (34737.d, 87b1.h) (required)	This tag is used to store all the ASCII-valued GeoKeys. See section 2.4 of the GeoTIFF specification.
GeoKeyDirectoryTag (34735.d, 87af.h) (required)	This tag references all non-ASCII GeoKeys. All projection and datum information is stored in GeoKeys. See section 2.10.2.2 of this standard and section 2.4 of the GeoTIFF specification.

Table 3, Approved Private Tags

TAG NAME	ID (OWNER)
ModelPixelScaleTag	33550 (SoftDesk)
ModelTransformationTag	34264 (JPL Carto Group)
INGR Packet Data Tag	33918 (Intergraph)
INCR Flag Registers	33919 (Intergraph)
IrasB Transformation Matrix	33920 (Intergraph)
UnUsed	33921 (Intergraph)
ModelTiepointTag	33922 (Intergraph)
GeoKeyDirectoryTag	34735 (SPOT)
GeoDoubleParamsTag	34736 (SPOT)
GeoAsciiParamsTag	34737 (SPOT)

Table 4, Required GeoTIFF MetaTags

TAG NAME	DESCRIPTION
GTModelTypeGeoKey (1024.d, 400.h) (required)	The required value is 1 (ModelTypeProjected).
GTRasterTypeGeoKey (1025.d, 401.h) (required)	a. The required value is 1 (RasterPixelIsArea) which is the default value. b. The "PixelIsArea" raster grid space uses coordinates I and J, with (0,0) denoting the upper-left corner of the image, and increasing I to the right, increasing J down. The first pixel-value fills the square grid cell with the bounds top-left = (0,0), bottom-right = (1,1) and so on; by extension this one-by-one grid cell is also referred to as a pixel. An N by M pixel image covers an area with the mathematically defined bounds (0,0),(N,M). c. This raster space designates the upper-left corner of an image. The coordinate pair values for this location shall be "a whole number of pixels." Each value "must be integer multiple of the resolution" of the tile image. d. The desired result is to have "Exact Pixel Registration," meaning that pixels from multiple images line up exactly. This should not be confused with overlaps or gaps, but the cells have to fall on an even multiple of the cell width and height from one another, and adjacent images cannot have cells starting halfway, or partially into the cells of the original image.

ProjectedCSTypeGeoKey (3072.d, c00.h) (required)	This key contains a coded value for the projection, datum, and possibly plane coordinate zone. Legal values for this key are listed in section 6.3.3.1 of the GeoTIFF specification.
PCSCitationGeoKey (3073.d, c01.h) (required)	This is a free text field for describing the projection and datum. Tile images are projected into the UTM coordinate system. These fields shall describe the projection, zone, and datum and shall be in the following form: <datum>/UTM Zone <number> <N/S> where: <datum> - common datum abbreviation, NAD83. <number> - UTM zone number. Example: NAD83/UTM zone 15N
GTCitationGeoKey (1026.d, 402.h) (required)	This is a free text field for providing a description of the tile. The GeoKey contents shall be in the following form. <program>_<loc>_<xx>_<r>_<yyyymmdd> where: <program> - Program Name (i.e., NRCS-Pilot). <loc> - site/location id number listed in the boundary shapefile <r> – GSD resolution (in centimeters). <yyyymmdd> - date of acquisition. b. Example: NRCS-Pilot _01001-020401R _15_20090714
ProjLinearUnitsGeoKey (3076.d, c04.h) (required)	This key contains a coded value for the linear units used by the projection. Legal values for this key are listed in section 6.3.3.1 of the GeoTIFF specification. Tiles shall use the code value of 9001 (“Linear_Meter”).

List 1, Tag Listings

The following table summarizes the TIFF, GeoTIFF, and GeoKey requirements. The values in the table are consistent with the TIFF and GeoTIFF specifications, but there are fewer options than are allowed by TIFF. Additional guidelines and requirements for the values of tags and keys are detailed in the body of this standard. Additional public tags and keys may be used at the data producer's option, providing they do not conflict with the required tags.

TIFF tags required by baseline TIFF:

TagName	Decimal	Hex	Type	Value
ImageWidth	256	100	SHORT or LONG	
ImageLength	257	101	SHORT or LONG	
BitsPerSample	258	102	SHORT	8,8,8
Compression	259	103	SHORT	1
PhotometricInterpretation	262	106	SHORT	2
Orientation	274	112	SHORT	1
StripOffsets	273	111	SHORT or LONG	
SamplesPerPixel	277	115	SHORT or LONG	3
RowsPerStrip	278	116	SHORT or LONG	1
StripByteCounts	279	117	LONG or SHORT	

TIFF tags defined by GeoTIFF:

TagName	Decimal	Hex	Type	Value
ModelPixelScaleTag	33550	830E	DOUBLE	
ModelTiepointTag	33922	8482	DOUBLE	
GeoAsciiParamsTag	34737	87B1	ASCII	
GeoKeyDirectoryTag	34735	87AF	SHORT	

GeoKeys defined by GeoTIFF and used by APFO:

TagName	Decimal	Hex	Type	Value
GTModelTypeGeoKey	1024	400	6.3.1.1 code	1
GTRasterTypeGeoKey	1025	401	6.3.1.2 code	1
GTCitationGeoKey		1026	402	ASCII
ProjectedCSTypeGeoKey	3072	C00	6.3.3.1 code	
PCSCitationGeoKey	3073	C01	ASCII	
ProjLinearUnitsGeoKey	3076	C04	SHORT	

List 2, Sample “tiffinfo” Output

This listing is an output of the libtiff utility program “tiffinfo”.

```
TIFF Directory at offset 0x2370bc4
  Image Width: 3247 Image Length: 3815
  Resolution: 200, 200 (unitless)
  Bits/Sample: 8
  Compression Scheme: none
  Photometric Interpretation: RGB color
  Document Name: “Garvin NE 3309401:
  Image Description: “USDA-FSA-APFO National Agriculture Imagery Program”
  Samples/Pixel: 3
  Rows/Strip: 1
  Planar Configuration: single image plane
```

List 3, Sample ListGeo Output

The following is an example of a GeoTIFF tag and GeoKey listing from a NAIP image. This listing is the output of the libgeotiff utility program “listgeo”. The projection information below the line “End_Of_Geotiff” is implied by the standard projection and is not stored explicitly in the data file. The descriptions are retrieved from libgeotiff lookup tables in the listgeo application.

```
Geotiff_Information:
   Version: 1
   Key_Revision: 1.0
   Tagged_Information:
      ModelTiepointTag (2,3):
        0            0            0
        337962       3763838      0
      ModelPixelScaleTag (1,3):
        2            2            1
      End_Of_Tags.
   Keyed_Information:
      GTModelTypeGeoKey (Short,1): ModelTypeProjected
      GTRasterTypeGeoKey (Short,1): RasterPixelIsArea
      GTCitationGeoKey (Ascii,45): "2004 NAIP n_3309403_nw_15_2_20050714"
      ProjectedCSTypeGeoKey (Short,1): PCS_NAD83_UTM_zone_15N
      PCSCitationGeoKey (Ascii,21): "NAD83 / UTM zone 15N"
      ProjLinearUnitsGeoKey (Short,1): Linear_Meter
      End_Of_Keys.
   End_Of_Geotiff.
```

List 3, Sample ListGeo Output (con't)

PCS = 26915 (name unknown)
Projection = 16015 ()
Projection Method: CT_TransverseMercator
  ProjNatOriginLatGeoKey: 0.000000 (0d 0' 0.00"N)
  ProjNatOriginLongGeoKey: -93.000000 (93d 0' 0.00"W)
  ProjScaleAtNatOriginGeoKey: 0.999600
  ProjFalseEastingGeoKey: 500000.000000
  ProjFalseNorthingGeoKey: 0.000000
GCS: 4269/NAD83
Datum: 6269/North American Datum 1983
Ellipsoid: 7019/GRS 1980 (6378137.00,6356752.31)
Prime Meridian: 8901/Greenwich (0.000000/ 0d 0' 0.00"E)
Projection Linear Units: 9001/metre (1.000000m)

Corner Coordinates:
Upper Left (337962.000,3763838.000) (94d45'16.56"W, 34d 0' 9.55"N)
Lower Left (337962.000,3756208.000) (94d45'11.47"W, 33d56' 1.94"N)
Upper Right (344456.000,3763838.000) (94d41' 3.51"W, 34d 0'13.09"N)
Lower Right (344456.000,3756208.000) (94d40'58.63"W, 33d56' 5.47"N)
Center (341209.000,3760023.000) (94d43' 7.54"W, 33d58' 7.53"N)

ATTACHMENT D

STATE NRI SITE & WRP EXPOSURE INFORMATION

STATE: ALABAMA
FLYING SEASON: MAR 15 – JUN 30, 2010
TOTAL COUNTIES: 67
TOTAL NRI SITES: 1,400
TOTAL WRP EXPOSURES: 74
MEAN GROUND ELEVATION RANGE:
3’ TO 1686’

STATE: ARIZONA
FLYING SEASON: MAR 15 – SEP 30, 2010
TOTAL COUNTIES: 15
TOTAL NRI SITES: 580
TOTAL WRP EXPOSURES: 21
MEAN GROUND ELEVATION RANGE:
82’ TO 8810’

STATE: ARKANSAS
FLYING SEASON: MAR 15 – SEP 30, 2010
TOTAL COUNTIES: 75
TOTAL NRI SITES: 1,399
TOTAL WRP EXPOSURES: 1,315
MEAN GROUND ELEVATION RANGE:
62’ TO 2368’

STATE: CALIFORNIA
FLYING SEASON: MAR 15 – SEP 30, 2010
TOTAL COUNTIES: 58
TOTAL NRI SITES: 2,023
TOTAL WRP EXPOSURES: 558
MEAN GROUND ELEVATION RANGE:
-273’ TO 11529’

STATE: COLORADO
FLYING SEASON: MAR 15 – AUG 15, 2010
TOTAL COUNTIES: 62
TOTAL NRI SITES: 1,649
TOTAL WRP EXPOSURES: 363
MEAN GROUND ELEVATION RANGE:
3362’ TO 12494’

STATE: CONNECTICUT
FLYING SEASON: MAR 15 – AUG 15, 2010
TOTAL COUNTIES: 8
TOTAL NRI SITES: 454
TOTAL WRP EXPOSURES: 1
MEAN GROUND ELEVATION RANGE:
0’ TO 1417’

STATE: DELAWARE
FLYING SEASON: AUG 15 – SEP 15, 2010
TOTAL COUNTIES: 3
TOTAL NRI SITES: 290
TOTAL WRP EXPOSURES: 18
MEAN GROUND ELEVATION RANGE:
0’ TO 397’

STATE: FLORIDA
FLYING SEASON: MAR 15 – JUN 15, 2010
TOTAL COUNTIES: 67
TOTAL NRI SITES: 1,938
TOTAL WRP EXPOSURES: 820
MEAN GROUND ELEVATION RANGE:
0’ TO 331’

STATE: GEORGIA
FLYING SEASON: MAR 15 – MAY 15, 2010
TOTAL COUNTIES: 159
TOTAL NRI SITES: 1,600
TOTAL WRP EXPOSURES: 128
MEAN GROUND ELEVATION RANGE:
0’ TO 3447’

STATE: IDAHO
FLYING SEASON: MAR 15 – JUL 31, 2010
TOTAL COUNTIES: 44
TOTAL NRI SITES: 1,599
TOTAL WRP EXPOSURES: 97
MEAN GROUND ELEVATION RANGE:
774’ TO 10024’

STATE: ILLINOIS
FLYING SEASON: MAR 15 – JUL 31, 2010
TOTAL COUNTIES: 102
TOTAL NRI SITES: 2,200
TOTAL WRP EXPOSURES: 930
MEAN GROUND ELEVATION RANGE:
298’ TO 1122’

STATE: INDIANA
FLYING SEASON: MAR 15 – SEP 30, 2010
TOTAL COUNTIES: 92
TOTAL NRI SITES: 1,500
TOTAL WRP EXPOSURES: 612
MEAN GROUND ELEVATION RANGE:
344’ TO 1214’

STATE: IOWA
FLYING SEASON: JUL 1 – AUG 31, 2010
TOTAL COUNTIES: 99
TOTAL NRI SITES: 1,749
TOTAL WRP EXPOSURES: 1,456
MEAN GROUND ELEVATION RANGE:
518’ TO 3175’

STATE: KANSAS
FLYING SEASON: MAR 15 – JUL 15, 2010
TOTAL COUNTIES: 105
TOTAL NRI SITES: 1,975
TOTAL WRP EXPOSURES: 159
MEAN GROUND ELEVATION RANGE:
702’ TO 3916’

STATE: KENTUCKY
FLYING SEASON: MAR 15 – AUG 31, 2010
TOTAL COUNTIES: 120
TOTAL NRI SITES: 1,450
TOTAL WRP EXPOSURES: 171
MEAN GROUND ELEVATION RANGE:
262’ TO 3929’

STATE: LOUISIANA
FLYING SEASON: MAR 15 – SEP 30, 2010
TOTAL COUNTIES: 64
TOTAL NRI SITES: 2,049
TOTAL WRP EXPOSURES: 1,610
MEAN GROUND ELEVATION RANGE:
0’ TO 380’

STATE: MAINE
FLYING SEASON: MAR 15 – AUG 15, 2010
TOTAL COUNTIES: 16
TOTAL NRI SITES: 688
TOTAL WRP EXPOSURES: 5
MEAN GROUND ELEVATION RANGE:
0’ TO 3349’

STATE: MARYLAND
FLYING SEASON: MAR 15 – SEP 15, 2010
TOTAL COUNTIES: 23
TOTAL NRI SITES: 1,028
TOTAL WRP EXPOSURES: 48
MEAN GROUND ELEVATION RANGE:
0’ TO 2982’

STATE: MASSACHUSETTS
FLYING SEASON: MAR 15 – AUG 15, 2010
TOTAL COUNTIES: 14
TOTAL NRI SITES: 612
TOTAL WRP EXPOSURES: 13
MEAN GROUND ELEVATION RANGE:
0’ TO 2198’

STATE: MICHIGAN
FLYING SEASON: MAR 15 – SEP 30, 2010
TOTAL COUNTIES: 83
TOTAL NRI SITES: 2,061
TOTAL WRP EXPOSURES: 401
MEAN GROUND ELEVATION RANGE:
571’ TO 1797’

STATE: MINNESOTA
FLYING SEASON: MAR 15 – JUL 31, 2010
TOTAL COUNTIES: 87
TOTAL NRI SITES: 2,350
TOTAL WRP EXPOSURES: 808
MEAN GROUND ELEVATION RANGE:
607’ TO 2017’

STATE: MISSISSIPPI
FLYING SEASON: MAR 15 – JUL 15, 2010
TOTAL COUNTIES: 82
TOTAL NRI SITES: 1,700
TOTAL WRP EXPOSURES: 1,681
MEAN GROUND ELEVATION RANGE:
3’ TO 613’

STATE: MISSOURI
FLYING SEASON: MAR15 – AUG 31, 2010
TOTAL COUNTIES: 114
TOTAL NRI SITES: 2,125
TOTAL WRP EXPOSURES: 1,305
MEAN GROUND ELEVATION RANGE:
239’ TO 1548’

STATE: MONTANA
FLYING SEASON: JUN 15 – JUL 31, 2010
TOTAL COUNTIES: 56
TOTAL NRI SITES: 1,474
TOTAL WRP EXPOSURES: 270
MEAN GROUND ELEVATION RANGE:
1899’ TO 9968’

STATE: NEBRASKA
FLYING SEASON: MAR 15 – SEP 30, 2010
TOTAL COUNTIES: 93
TOTAL NRI SITES: 1,700
TOTAL WRP EXPOSURES: 505
MEAN GROUND ELEVATION RANGE:
892’ TO 5399’

STATE: NEVADA
FLYING SEASON: MAR 15 – JUL 31, 2010
TOTAL COUNTIES: 17
TOTAL NRI SITES: 699
TOTAL WRP EXPOSURES: 2
MEAN GROUND ELEVATION RANGE:
1220’ TO 8699’

STATE: NEW HAMPSHIRE
FLYING SEASON: MAR 15 – JUL 1, 2010
TOTAL COUNTIES: 10
TOTAL NRI SITES: 500
TOTAL WRP EXPOSURES: 11
MEAN GROUND ELEVATION RANGE:
3’ TO 2965’

STATE: NEW JERSEY
FLYING SEASON: MAR 15 – SEP 15, 2010
TOTAL COUNTIES: 21
TOTAL NRI SITES: 600
TOTAL WRP EXPOSURES: 36
MEAN GROUND ELEVATION RANGE:
0’ TO 1299’

STATE: NEW MEXICO
FLYING SEASON: MAR 15 – AUG 15, 2010
TOTAL COUNTIES: 33
TOTAL NRI SITES: 1,375
TOTAL WRP EXPOSURES: 10
MEAN GROUND ELEVATION RANGE:
3323’ TO 11595’

STATE: NEW YORK
FLYING SEASON: MAR 15 – SEP 15, 2010
TOTAL COUNTIES: 62
TOTAL NRI SITES: 1,689
TOTAL WRP EXPOSURES: 441
MEAN GROUND ELEVATION RANGE:
0’ TO 3562’

STATE: NORTH CAROLINA
FLYING SEASON: MAR 15 – MAY 15, 2010
TOTAL COUNTIES: 100
TOTAL NRI SITES: 1,572
TOTAL WRP EXPOSURES: 299
MEAN GROUND ELEVATION RANGE:
0’ TO 5497’

STATE: NORTH DAKOTA
FLYING SEASON: MAR 15 – JUL 31, 2010
TOTAL COUNTIES: 53
TOTAL NRI SITES: 2,033
TOTAL WRP EXPOSURES: 167
MEAN GROUND ELEVATION RANGE:
790’ TO 3198’

STATE: OHIO
FLYING SEASON: MAR 15 – SEP 30, 2010
TOTAL COUNTIES: 88
TOTAL NRI SITES: 1,670
TOTAL WRP EXPOSURES: 214
MEAN GROUND ELEVATION RANGE:
489’ TO 1381’

STATE: OKLAHOMA
FLYING SEASON: MAR 15 – AUG 15, 2010
TOTAL COUNTIES: 77
TOTAL NRI SITES: 1,550
TOTAL WRP EXPOSURES: 366
MEAN GROUND ELEVATION RANGE:
331’ TO 3657’

STATE: OREGON
FLYING SEASON: MAR 15 – JUL 31, 2010
TOTAL COUNTIES: 36
TOTAL NRI SITES: 1,274
TOTAL WRP EXPOSURES: 287
MEAN GROUND ELEVATION RANGE:
0’ TO 9210’

STATE: PENNSYLVANIA
FLYING SEASON: MAR 15 – AUG 31, 2010
TOTAL COUNTIES: 67
TOTAL NRI SITES: 1,800
TOTAL WRP EXPOSURES: 59
MEAN GROUND ELEVATION RANGE:
3’ TO 2893’

STATE: RHODE ISLAND
FLYING SEASON: MAR 15 – AUG 15, 2010
TOTAL COUNTIES: 5
TOTAL NRI SITES: 290
TOTAL WRP EXPOSURES: 1
MEAN GROUND ELEVATION RANGE:
0’ TO 758’

STATE: SOUTH CAROLINA
FLYING SEASON: MAR 15 – MAY 15, 2010
TOTAL COUNTIES: 46
TOTAL NRI SITES: 1,249
TOTAL WRP EXPOSURES: 620
MEAN GROUND ELEVATION RANGE:
0’ TO 2998’

STATE: SOUTH DAKOTA
FLYING SEASON: MAR 15 – JUL 31, 2010
TOTAL COUNTIES: 66
TOTAL NRI SITES: 1,825
TOTAL WRP EXPOSURES: 883
MEAN GROUND ELEVATION RANGE:
974’ TO 6668’

STATE: TENNESSEE
FLYING SEASON: MAR 15 – AUG 31, 2010
TOTAL COUNTIES: 95
TOTAL NRI SITES: 1,550
TOTAL WRP EXPOSURES: 239
MEAN GROUND ELEVATION RANGE:
203’ TO 3651’

STATE: TEXAS
FLYING SEASON: MAR 15 – AUG 15, 2010
TOTAL COUNTIES: 254
TOTAL NRI SITES: 4,798
TOTAL WRP EXPOSURES: 459
MEAN GROUND ELEVATION RANGE:
0’ TO 5563’

STATE: UTAH
FLYING SEASON: MAR 15 – JUL 31, 2010
TOTAL COUNTIES: 29
TOTAL NRI SITES: 797
TOTAL WRP EXPOSURES: 119
MEAN GROUND ELEVATION RANGE:
2598’ TO 11073’

STATE: VERMONT
FLYING SEASON: MAR 15 – SEP 15, 2010
TOTAL COUNTIES: 14
TOTAL NRI SITES: 550
TOTAL WRP EXPOSURES: 17
MEAN GROUND ELEVATION RANGE:
95’ TO 3031’

STATE: VIRGINIA
FLYING SEASON: MAR 15 – MAY 15, 2010
TOTAL COUNTIES: 100
TOTAL NRI SITES: 1,748
TOTAL WRP EXPOSURES: 28
MEAN GROUND ELEVATION RANGE:
0’ TO 4113’

STATE: WASHINGTON
FLYING SEASON: JUN 1 – AUG 15, 2010
TOTAL COUNTIES: 39
TOTAL NRI SITES: 1,365
TOTAL WRP EXPOSURES: 238
MEAN GROUND ELEVATION RANGE:
0’ TO 7098’

STATE: WEST VIRGINIA
FLYING SEASON: MAR 15 – AUG 15, 2010
TOTAL COUNTIES: 55
TOTAL NRI SITES: 826
TOTAL WRP EXPOSURES: 15
MEAN GROUND ELEVATION RANGE:
394’ TO 4385’

STATE: WISCONSIN
FLYING SEASON: MAR 15 – AUG 31, 2010
TOTAL COUNTIES: 72
TOTAL NRI SITES: 1,833
TOTAL WRP EXPOSURES: 506
MEAN GROUND ELEVATION RANGE:
587’ TO 1843’

STATE: WYOMING
FLYING SEASON: MAR 15 – AUG 15, 2010
TOTAL COUNTIES: 23
TOTAL NRI SITES: 924
TOTAL WRP EXPOSURES: 33
MEAN GROUND ELEVATION RANGE:
3264’ TO 12995’

TOTALS: NRI Sites 70,076 and WRP Exposures 18,722

STATE: HAWAII
FLYING SEASON: MAR 15 – DEC 31, 2010
TOTAL COUNTIES: 4
TOTAL NRI SITES: 375
TOTAL WRP EXPOSURES: 2
MEAN GROUND ELEVATION RANGE:
0’ TO 10972’

HAWAII TOTALS: 375 Sites and 2 WRP Exposures

STATE: PUERTO RICO & U.S. VIRGIN ISLANDS
FLYING SEASON: MAR 15 – DEC 31, 2010
TOTAL COUNTIES: 75
TOTAL NRI SITES: 450
MEAN GROUND ELEVATION RANGE:
0’ TO 3113’

Puerto Rico & US Virgin Islands TOTALS: 450 Sites

USDA-NRCS-2-10

ATTACHMENT E

2010 OVERSIZED NRI SITE LOCATION MAPS

1. **PROJECT AREA(S) TO BE PHOTOGRAPHED**

The area covered in each NRI Site is nominally 160 acres, but varies from 40 acres to 1084 acres. There are approximately 1,338 PSU sites over 500 acres (300 acres in CA and MO; 200 acres in UT) which are identified as "oversize" sites.

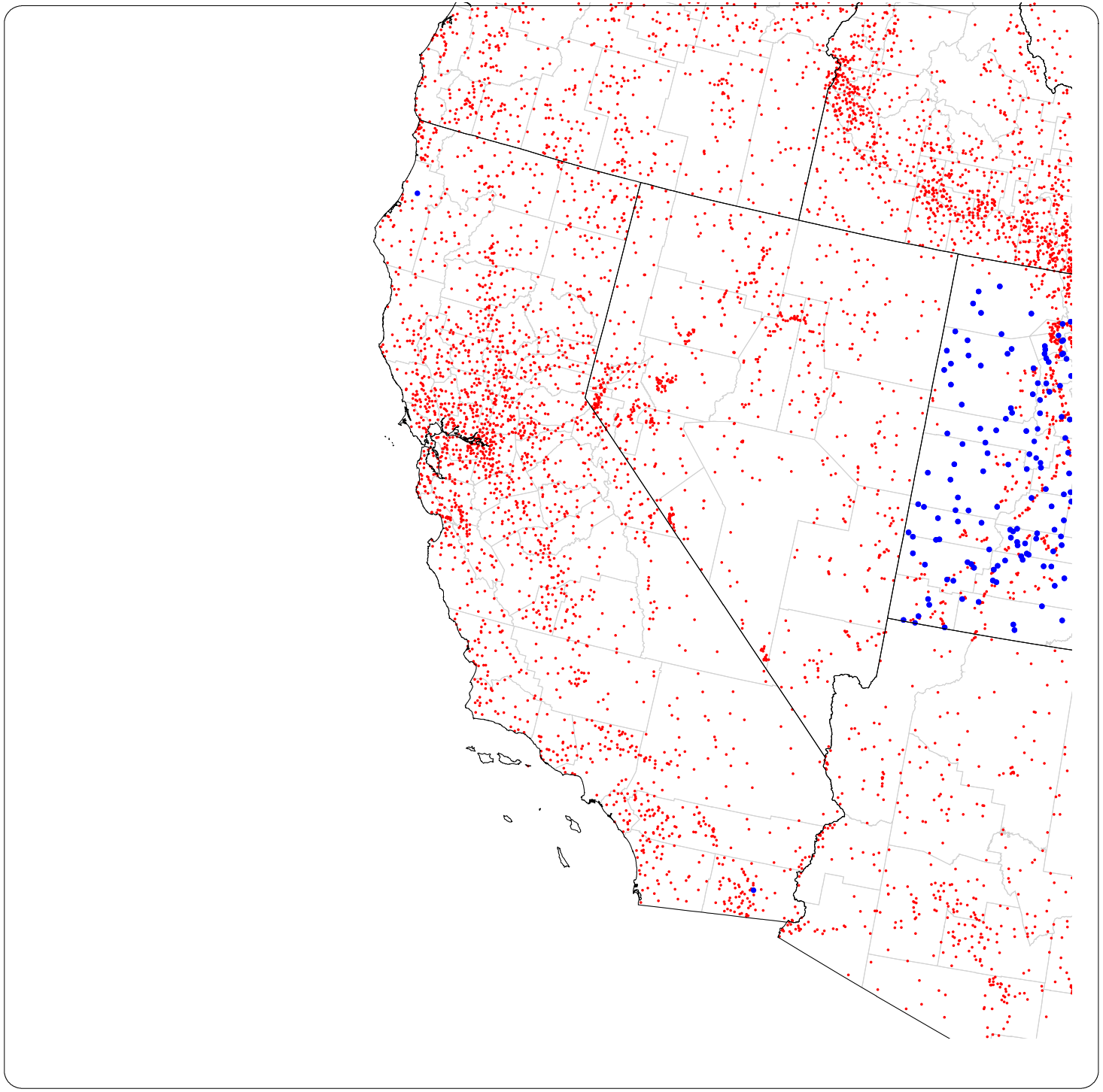
USDA requires the entire site to be on a single frame regardless of size. Contractor must adjust flight altitudes from the stated 1:7,920 nominal scale, to flight altitudes achieving either a 1:12,000 nominal scale or 1:15,840 scale for sites greater than 900 acres to ensure complete coverage of each oversize site on one frame of film. USDA prefers a minimum buffer of 1320 feet (1/4 mile) on all sides, but will accept a buffer of 660 feet (1/8 mile) on all sides for oversize NRI Sites.

2. **PROJECT FLIGHT PLAN DESCRIPTION**

The nominal photographic scale for the majority of this project is 1:7,920, with the nominal flight altitude above mean ground elevation of 3,960 feet (1,207 meters). For oversize NRI sites of 500 acres or more (300 acres in CA and MO; 200 acres in UT), the nominal photographic scale is 1:12,000, with the nominal flight altitude above ground elevation of 6,000 feet (1,829 meters); sites greater than 900 acres with a nominal photographic scale of 1:15,840 have a nominal flight altitude above ground elevation of 7,920 feet (2,414 meters.) There are approximately 1,338 oversize sites located in the following states:

STATE	QUANTITY	MIN. ACRES	MAX. ACRES
CALIFORNIA	2	327	460
KANSAS	3	306	523
MISSOURI	14	313	480
NEBRASKA	203	553	707
NEW MEXICO	227	506	1570
SOUTH DAKOTA	373	505	706
UTAH	255	207	882
WYOMING	261	562	1084
TOTAL QUANTITY	1,338		

3. The following maps indicate the location of all oversize NRI Sites in the RFP for 2010.



California Oversized Segments

Photo Scale

Us_conus_rfp_2010_cnt.shp

1:7,920

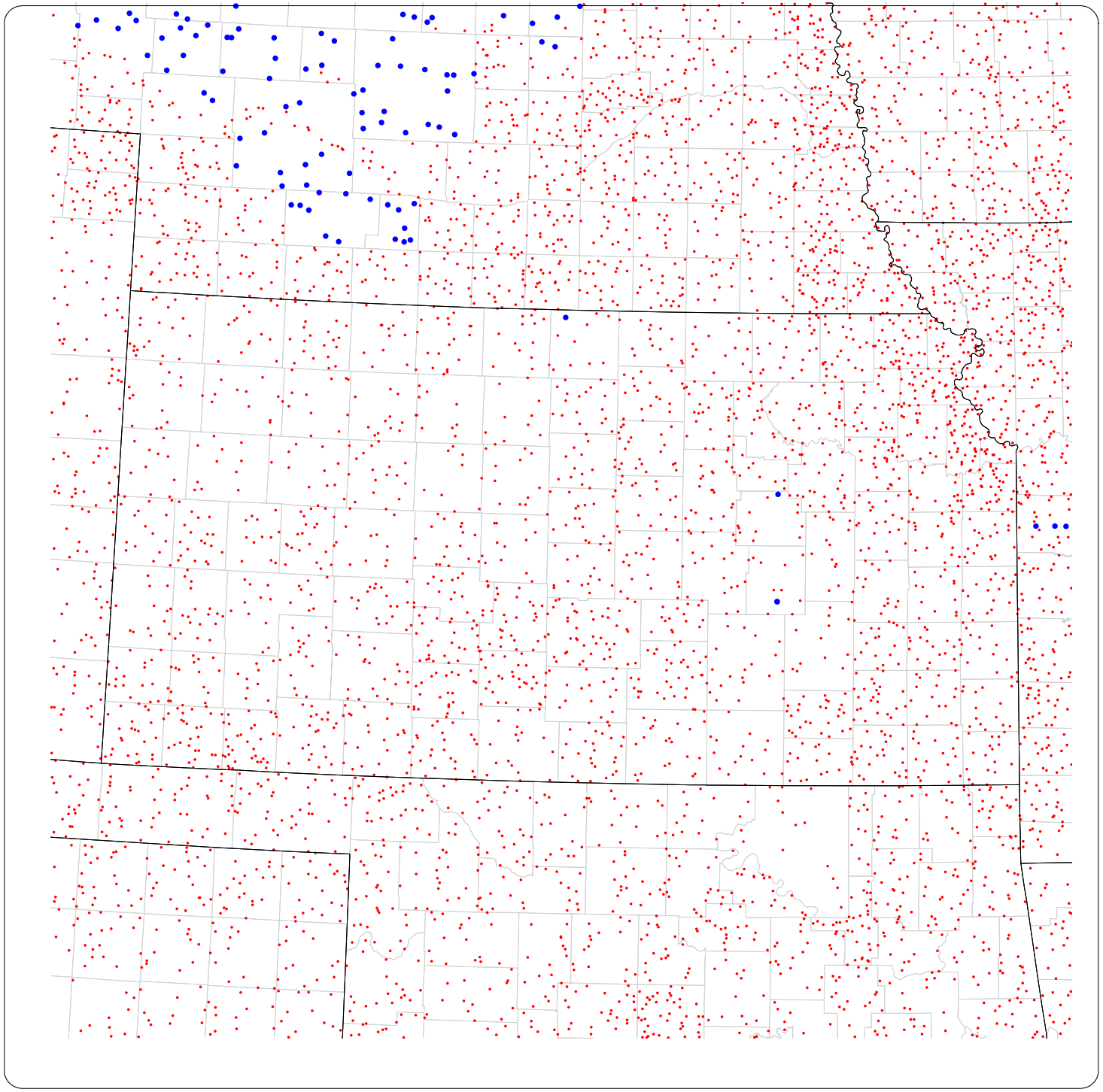
1:12,000

1:15,840

0 80 Miles

USDA Natural Resources Conservation Service

NCGC Fort Worth, Texas, Oct. 2009



Kansas Oversized Segments

Photo Scale

Us_conus_rfp_2010_cnt.shp

1:7,920

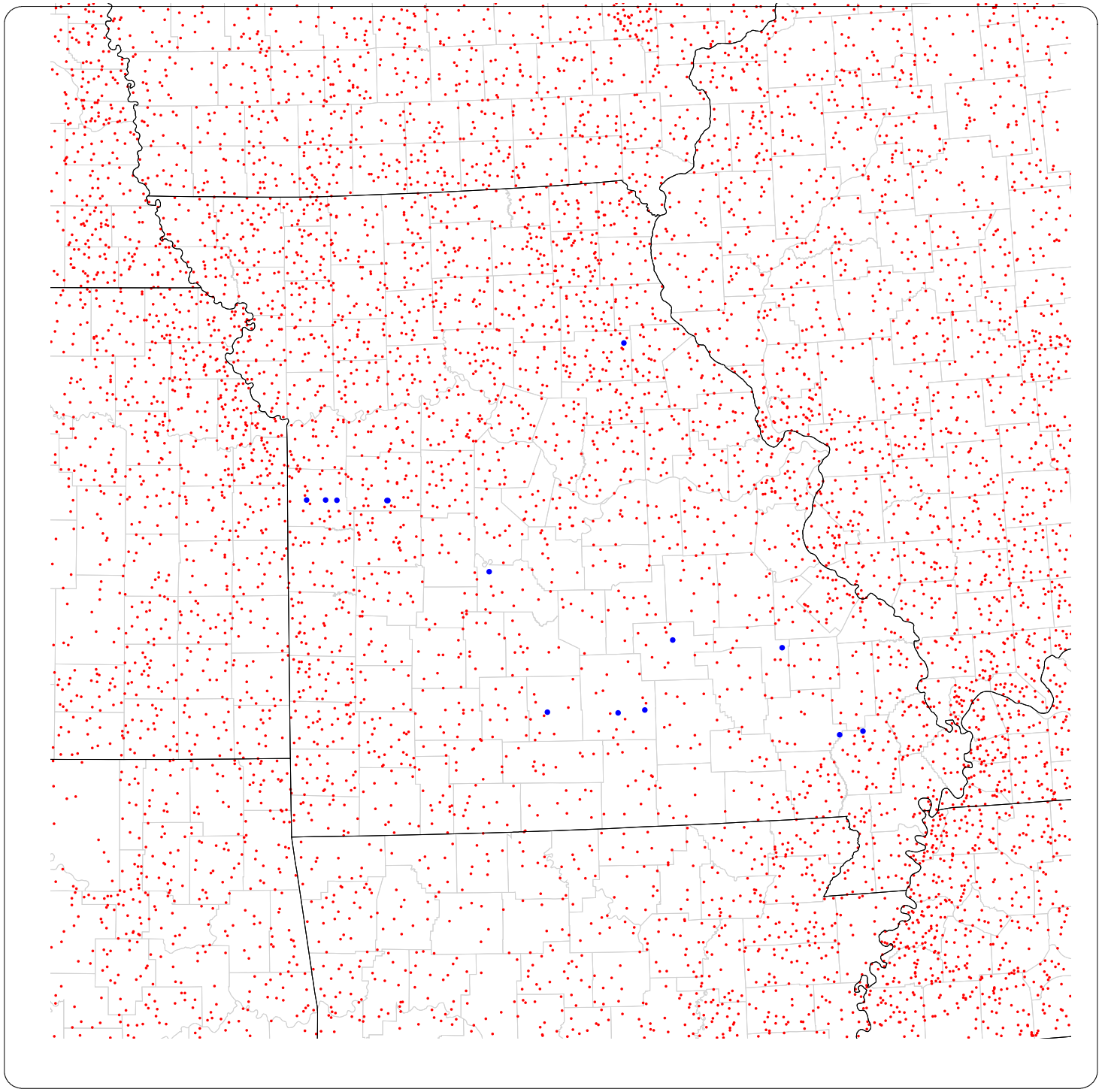
1:12,000

1:15,840

0 40 Miles

USDA Natural Resources Conservation Service

NCGC Fort Worth, Texas, Oct. 2009



Missouri Oversized Segments

Photo Scale

Us_conus_rfp_2010_cnt.shp

1:7,920

1:12,000

1:15,840

0 40 Miles

USDA Natural Resources Conservation Service

NCGC Fort Worth, Texas, Oct. 2009

Nebraska Oversized Segments

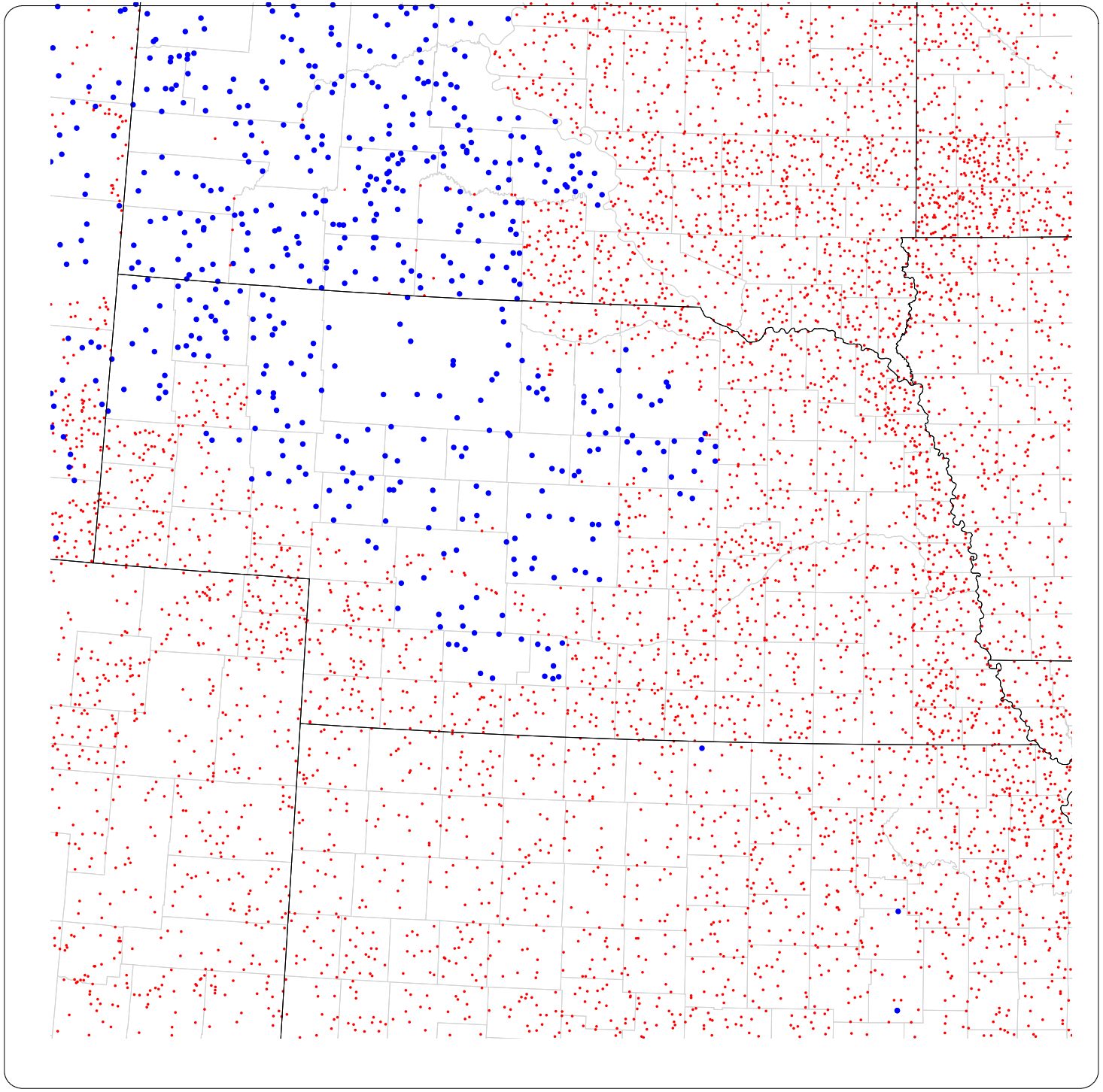


Photo Scale

Us_conus_rfp_2010_cnt.shp

1:7,920

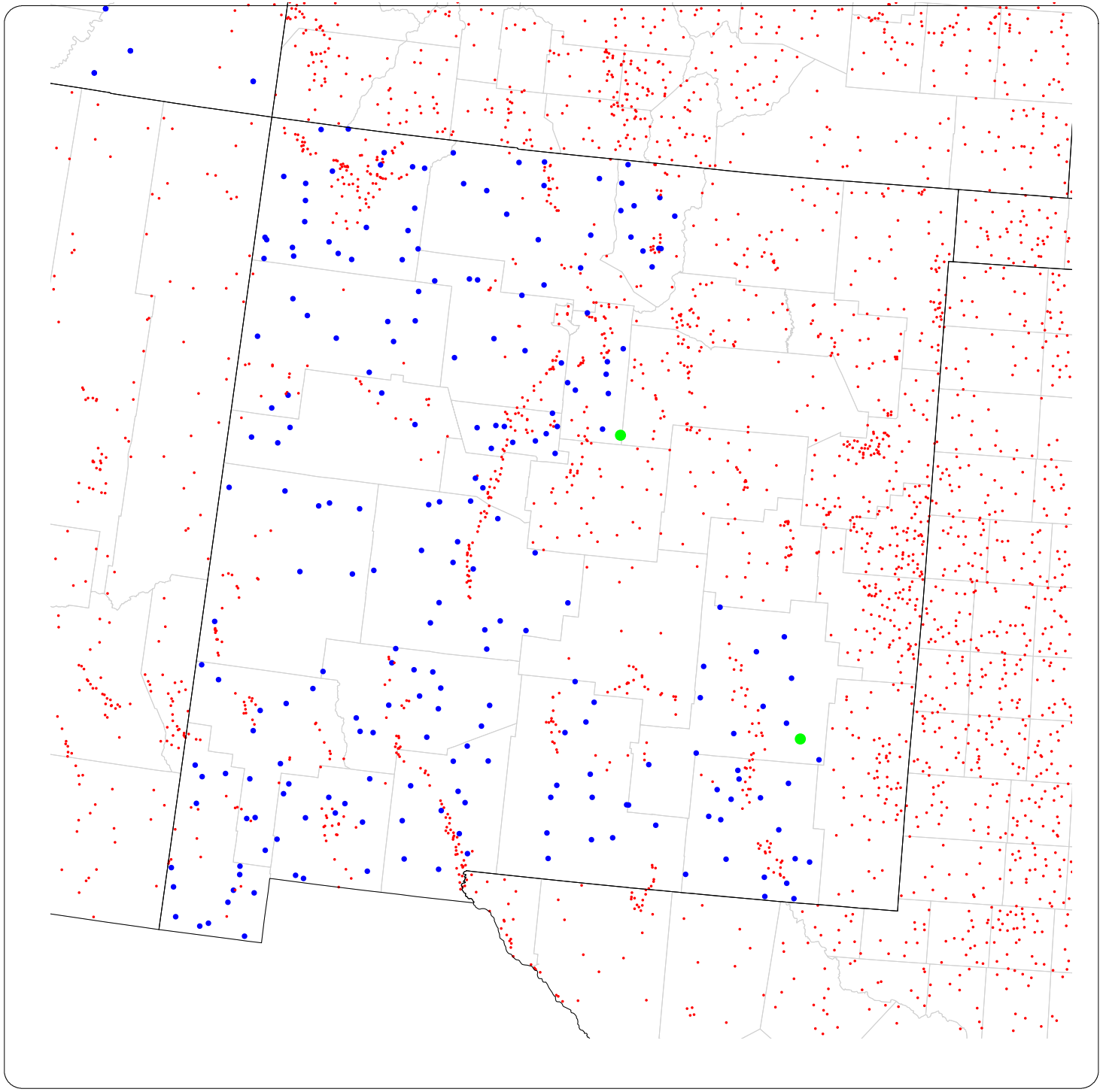
1:12,000

1:15,840

0 40 Miles

USDA Natural Resources Conservation Service

NCGC Fort Worth, Texas, Oct. 2009



New Mexico Oversized Segments

Photo Scale

Us_conus_rfp_2010_cnt.shp

1:7,920

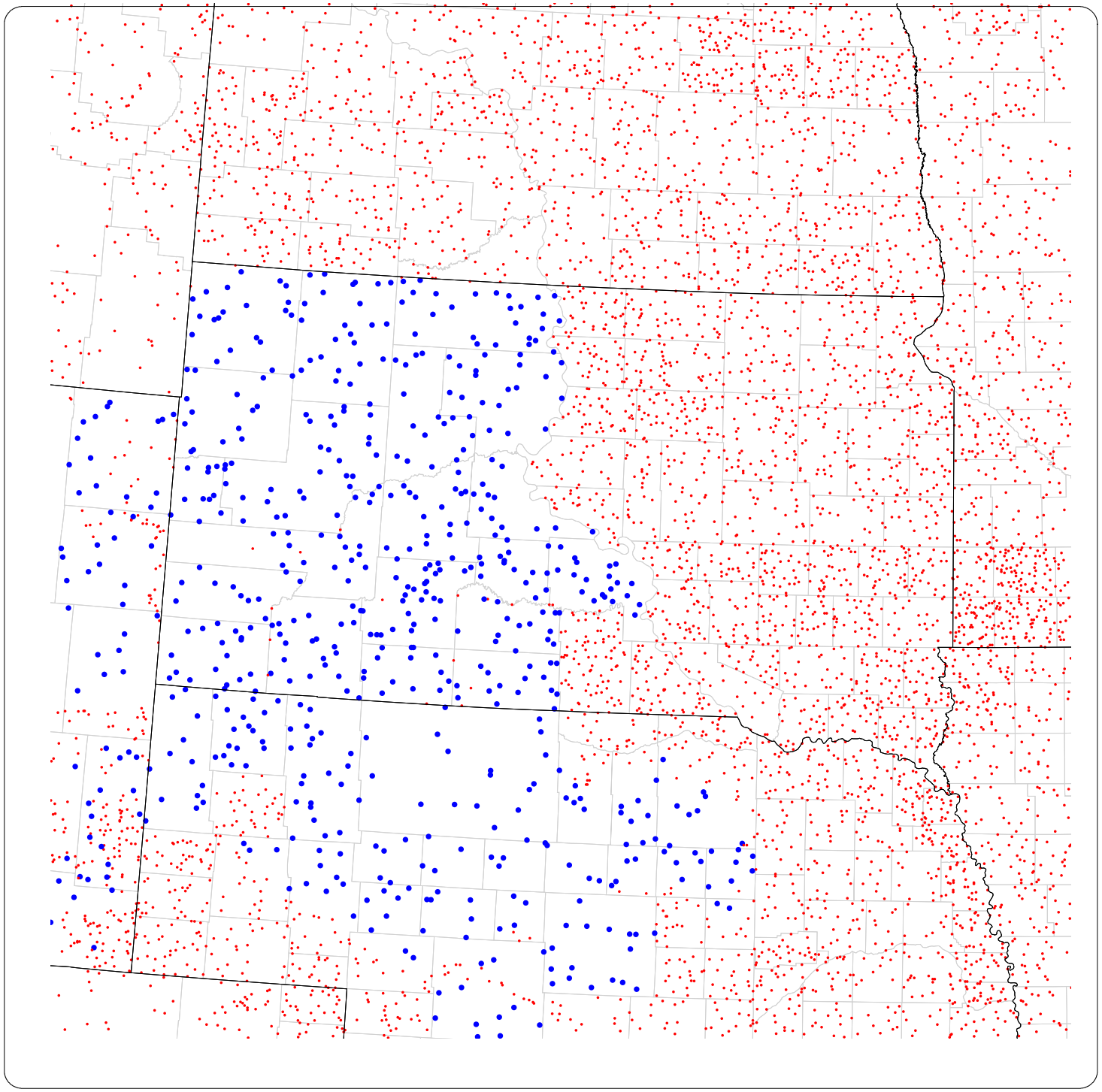
1:12,000

1:15,840

0 40 Miles

USDA Natural Resources Conservation Service

NCGC Fort Worth, Texas, Oct. 2009



South Dakota Oversized Segments

Photo Scale

Us_conus_rfp_2010_cnt.shp

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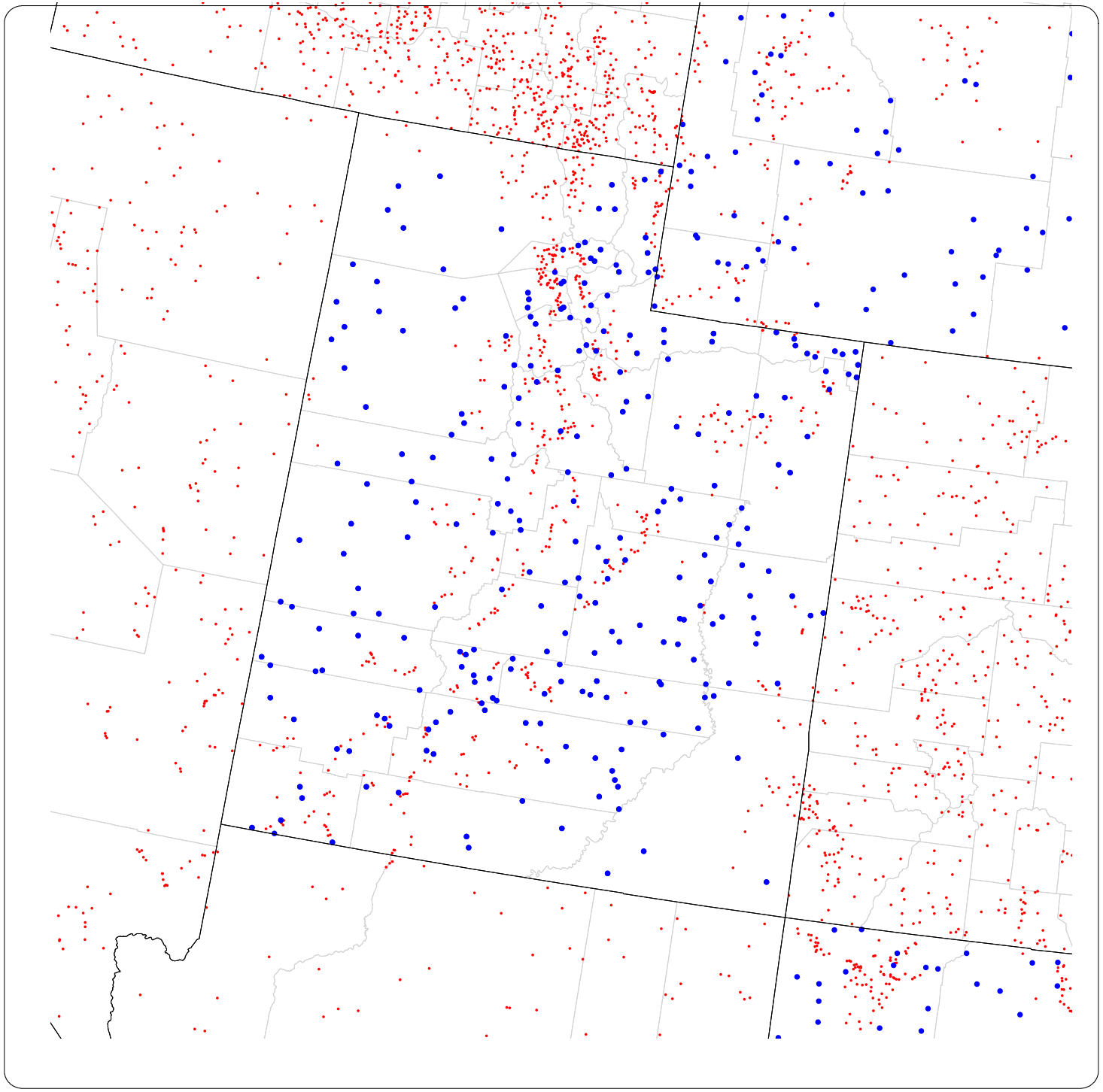
1:12,000

1:15,840

0 40 Miles

USDA Natural Resources Conservation Service

NCGC Fort Worth, Texas, Oct. 2009



Utah Oversized Segments

Photo Scale

Us_conus_rfp_2010_cnt.shp

1:7,920

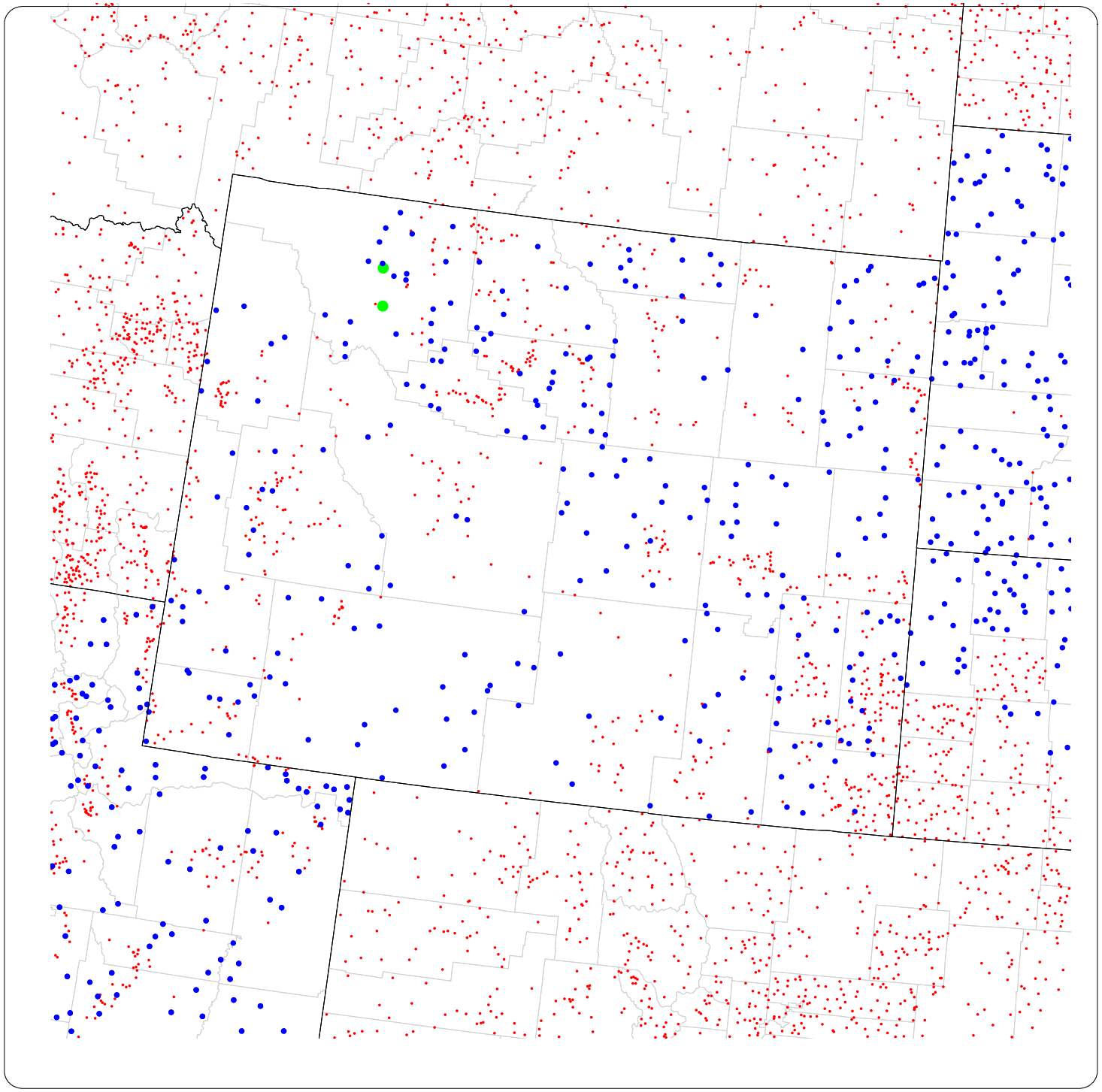
1:12,000

1:15,840

0 40 Miles

USDA Natural Resources Conservation Service

NCGC Fort Worth, Texas, Oct. 2009



Wyoming Oversized Segments

Photo Scale

Us_conus_rfp_2010_cnt.shp

1:7,920

1:12,000

1:15,840

0 40 Miles

USDA Natural Resources Conservation Service

NCGC Fort Worth, Texas, Oct. 2009