PIMA COUNTY REGIONAL FLOOD CONTROL DISTRICT
DISTRICT STANDARD

PROCEDURE NO: **District Standard DS-302**
EFFECTIVE DATE: May 12, 2011

PROCEDURE NAME: Ground and Aerial Survey Standards

PURPOSE: The Regional Flood Control District is experiencing increased sharing of data between its stakeholders, partners and the consulting/contractor community. To maximize the utilization of this data, the District wishes to institute consistency and accuracy in the way aerial and ground survey data is captured, presented and maintained.

DESCRIPTION: *The District's primary goal* is the development of survey standards which are flexible enough to accommodate a variety of situations encountered by RFCD personnel, while incorporating existing industry standards to the extent possible.

Per the request of the District Director, RFCD Divisions which procure aerial and ground survey data for use by the District shall adhere to these standards. Based upon staff use and input, these standards will be updated as appropriate in the future.

All survey work will conform to the standards set forth in the *Pima County Roadway Design Manual,* unless otherwise stated.

APPLICATION:

RFCD personnel who procure aerial and/or ground survey information must include, at a minimum, the following specifications as part of their project **Scope of Work**:

A. GROUND SURVEY (also see Supporting Links below)

1) Contact Pima County Field Survey (Dan Tremblay, 740-2608, daniel.tremblay@pima.gov) to discuss your ground survey project. Be prepared to discuss the information presented below in items 2 through 7.

2) Specify project limits
   - Prepare plan map of project boundaries

3) Specify horizontal and vertical datum
   - Horizontal Datum: Arizona State Plane Coordinate System, Central Zone 0202, North American Datum of 1983 (NAD 83), National Spatial Reference System of 2007 (NSRS 2007), unless otherwise specified
   - North American Vertical Datum of 1988 (NAVD 88), unless otherwise specified

4) Specify surface coordinate system, or grid coordinate system, or both. Conversion factors should be obtained for your area of work to move between the two systems.
   - Surface coordinate system: points gathered along the curve of the earth (legal descriptions and design)
   - Grid coordinate system: points gathered along a plane-rectangular system (design and GIS applications)

5) Specify Project Kick-off Meeting prior to commencement of work to discuss project details

6) Specify format for survey deliverables (review *Supporting Links* below)
   - Survey Documentation Report
   - Digital Terrain Model or Digital Elevation Model
   - Topography/Planimetrics
   - Legal Descriptions
   - Record of Survey/Land Survey

7) Use the *Survey Request Form* in the Supporting Links to procure Field Survey assistance

B. AERIAL SURVEY (also see Supporting Links below)

1) Contact Pima County Field Survey; Dan Tremblay 740-2608 (daniel.tremblay@pima.gov)

2) Specify project limits
   - Prepare shape file of project boundaries

3) Specify horizontal and vertical datum
   - Horizontal Datum: Arizona State Plane Coordinate System, Central Zone 0202, North American Datum of 1983 (NAD 83), National Spatial Reference System of 2007 (NSRS 2007), unless otherwise specified
   - North American Vertical Datum of 1988 (NAVD 88), unless otherwise specified

4) Specify surface coordinate system or grid coordinate system or both (conversion factors should also be obtained for your area of work to move between the two systems)
   - Surface coordinate system: points gathered along the curve of the earth (legal descriptions and design)
   - Grid coordinate system: points gathered along a plane-rectangular system (design and GIS applications)

5) Output Map Scale
   - The output scale determines the size of the output map for a defined geographic area and most importantly, it determines the amount of detail that can be represented on or extrapolated from the map
     - Typical map scales for developed areas are 1"=100'
     - Typical map scales for rural areas are 1"=200’ or 1”=400’

- More detailed Photogrammetric needs can increase a map scale to 1"=50'

6) Aerial Mapping Product Accuracy
   - Mapping accuracy defines the maximum permissible error between data points captured
     - American Society of Photogrammetric and Remote Sensing (ASPRS) Class 1
     - American Society of Photogrammetric and Remote Sensing (ASPRS) Class 2
     - National Map Accuracy Standards (NMAS)

7) Photo Scale
   - Photo Scale represents the flying height (above ground level) divided by the camera's focal length.
   - The lower the photo scale the more accurate and detailed the products become
   - The lower photo scale will result in an increased cost and will increase the project schedule

8) Control and Aerial Triangulation
   - Ground Control is used to establish the coordinate system and the defined datum and projection. It is also used to verify accuracy of the photogrammetric data captured
   - The purpose of aerial triangulation is to establish precise and accurate relationships between the individual photographic film coordinate systems and a defined datum and projection. This relationship is used to link the ground surveyed control points via photographic measurements.

9) Contour Interval
   - 1 foot - Final design, excavation and grading plans, earthwork computations for bid estimates, and contract measurement and payment
   - 2 foot - Route location, preliminary alignment and design
   - 4-5 foot - Preliminary project planning, hydraulic sections, rough earthwork estimates
   - 10-20 foot - High-gradient terrain, low unit cost earthwork excavation estimates

10) Specify Project Kick-off Meeting prior to commencement of work

11) Specify format for survey deliverables (review *Supporting Links* below)
   - Quality Control Plans
   - Digital Ortho Photography
   - Digital Terrain Model or Digital Elevation Model
   - Topography/Planimetrics
   - Legal Descriptions
   - Record of Survey/Land Survey

Specific contract language, which clarifies deliverables to the District, must be included in RFCD consulting or vendor contract documents. Examples of contract language are provided below in the Supporting Data Links. A sealed *Survey Documentation Report* should be included as a project deliverable.

Upon completion of a draft Scope of Work, all Project Managers must send a notice to:

- The County DOT Survey Section for verification of specifications, and
- All RFCD Division Managers as an alert to forthcoming work.

SUPPORTING DATA LINKS

Ground Survey

Arizona Spatial Data Accuracy and Georeferencing Standards (November 2008)

General Datum, State Plane, and Monumentation Survey Information (2010)

Services Performed by Pima County DOT Survey Section (November 2010)

Example Ground Survey Control Language (September 2010)

Department of Transportation Field Survey Request Form (December 2010)

Aerial Survey

Designing an Aerial Mapping Project (January 2011)

RFCD Photogrammetric Worksheet (January 2011)

Example Aerial Survey Contract Language (December 2010)

Example Aerial Project Methodology Memorandum (January 2011)

FEMA Guidelines and Specifications for Flood Hazard Mapping (April 2003)

APPROVED BY:

Suzanne Shields 8/15/2011

Suzanne Shields Date
Director

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