Status of Framework Layers in Iowa
September 2008

1) Geodetic Control

FGDC Description: *Geodetic control provides a common reference system for establishing the coordinate positions of all geographic data. It provides the means for tying all geographic features to common, nationally used horizontal and vertical coordinate systems. The main features of geodetic control information are geodetic control stations. These monumented points (or in some cases active Global Positioning System control stations) have precisely measured horizontal or vertical locations and are used as a basis for determining the positions of other points. The geodetic control component of the framework consists of geodetic control stations and related information -- the name, feature identification code, latitude and longitude, orthometric height, and ellipsoid height, and metadata for each station. The metadata for each geodetic control point contains descriptive data, positional accuracy, condition, and other pertinent characteristics for that point. Geodetic control information plays a crucial role in developing all framework data and users' applications data, because it provides the spatial reference source to register all other spatial data. In addition, geodetic control information may be used to plan surveys, assess data quality, plan data collection and conversion, and fit new areas of data into existing coverages.*

Current status:

1. There are 6597 (142 HARN) NGS control points in Iowa (retrieved summer 2006 from NGS database), 1757 of them having been visited in the last 20 years by NGS.
2. There are 142 HARN control points in Iowa (retrieved summer 2006 from NGS database)
3. About 60 counties in Iowa have GPS control surveys. Some are available to the public through real estate web mapping applications or the ICIT data repository https://www.iowagisdata.org/.
4. There are pdf files containing information on USGS benchmarks, but no GIS coverage showing their approximate locations.

Table 1: Description of Geodetic Control layers:

Layer or Sub-layer name	**Source or compiled by:**	**GIS Data Status and update cycle:**	**Integrated into statewide coverages:**	**Distributed by:**	**Accuracy:**	**Data model/ Data standard:**
NGS control points for Iowa	NGS	Exists/yearly?	IGIC Geodetic Committee	IGIC server and control point web viewer	varies	Point shape file/ NGS/FGDC
HARN points for Iowa	NGS	Exists/unknown	"	"	Very high - cm	Point shape file/ NGS/FGDC
County GPS control monuments	Counties and contractors	CPs exist for about 66-70 counties; some	"	Point description files stored	Very high - cm	Point shape file/ ?

		are digital /unknown		on county servers		
USGS Benchmarks	Coordinates unknown	Does not exist	?	None	Unknown	No known GIS coverage

2) Orthoimagery

FGDC Description: *Orthoimagery provides a positionally correct image of the earth. An orthoimage is a georeferenced image prepared from an aerial photograph or other remotely sensed data from which displacements of images caused by sensor orientation and terrain relief have been removed. An orthoimage has the same metric properties as a map and has a uniform scale. Digital orthoimages are composed of an array of georeferenced pixels that encode ground reflectance as a discrete digital value. Many geographic features, including those that are part of the framework, can be interpreted and compiled from an orthoimage. Orthoimages can also serve as a backdrop to reference the results of an application to the landscape. The framework may include imagery that varies in resolution from submeter to tens of meters. Accurately positioned, high-resolution data (pixels of 1 meter or finer) are presumed to be the most useful for supporting the compilation of framework features, particularly those that support local data needs. In some areas, lower-resolution imagery may be sufficient to support the framework and applications.*

Orthoimagery provides a useful tool for a variety of applications. Because many land features can be seen on an orthoimage, it can serve as a backdrop for visual reference purposes, saving the expense of creating vector files of features that are needed only for reference. Orthoimagery can be used to compile vector themes photogrammetrically.

Current status:

1. Many county and cities in Iowa contract for different orthoimagery mostly 2', 1' and 6" pixel products, in black and white or natural color. In rural areas 1"=400' is the usual target accuracy and in urban areas, 1"=100'. Some of this imagery is available to the public, mostly through county real estate web applications. Recently, groups of counties are starting to coordinate regional flights to save acquisition costs. Collection of countywide 6" color orthos is becoming more common.
2. IGIC is leading an effort to acquire a statewide, multi-band ortho coverage to coincide with the lidar acquisition (2' pixel). http://ortho.gis.iastate.edu/ DNR is working on an RFP for completion of this project in 2009 and 2010.
3. Imagery for the Nation (IFTN) is a National States Geographic Information Council (NSGIC) led effort to get the federal government to fund consistent, regular orthoimagery acquisitions across the US (http://www.nsgic.org/hottopics/imageryforthenation.cfm). So far no funding has been appropriated for this effort, so if may be several years before it produces any data. The 1-meter NAIP orthos would be completely federally funded with yearly flights; 1' color orthos would be 50% federal and 50% local option on a 3 year cycle (otherwise the federal pays 100% every 6 years); and the urban 6" color orthos

would require 50% local funding (otherwise no acquisition without the local involvement).

Table 2: Description of Ortho-imagery Projects (future IFTN products included for comparison):

Sub-layer name	**Source or compiled by:**	**Data Status and update cycle:**	**Integrated into IGI coverages:**	**Distributed by:**	**Accuracy:**	**Data model/ Data standard:**
Statewide 2' pixel, 4-band ortho	IGIC and DNR	2007 17 counties in NW Iowa; RFP to be released in 2008 for rest/ one-time over 3 years.	IGIC and DNR	IGIC/ISU Ortho server	1"=400' (16' or 5 meters)	DOQQs and county mosaics/?
IFTN NAIP 1-meter color ortho, leaf-on	USGS/USDA	Future/Yearly	IGI service bureau	IGI server	1:12,000 topo scale (38' or 12 meters)	DOQQs and county mosaics/?
IFTN 1' color – leaf off; all counties	USGS	Future/3 year cycle	IGI service bureau	IGI server	>1"=100' (5' or 1.5 meters)	?? tiles and county mosaics/?
IFTN 6" color – leaf off, census urban areas	USGS	Future/3 year cycle	IGI service bureau	IGI server	<1"=100' (2.5' or .76 meter)	?? tiles and city mosaics/?

3) Administrative Boundaries (Governmental Units)

FGDC description of Governmental Units:

The framework includes the geographic areas of units of government. These units include:

the nation,

states and statistically equivalent areas,

counties and statistically equivalent areas,

incorporated places and consolidated cities,
functioning and legal minor civil divisions,
federal- or state-recognized American Indian reservations and trustlands, and
Alaska Native regional corporations.

Each of these features includes the attributes of name and the applicable Federal Information Processing Standard (FIPS) code. Features boundaries include information about other features (such as roads, railroads, or streams) with which the boundaries are associated and a description of the association (such as coincidence, offset, or corridor). Governmental unit boundaries are used for a wide variety of applications. Some need the boundaries only for information and orientation; others require the polygons to determine inclusion related to a number of other features. Business GIS is a very active field that uses these boundaries for statistical analysis and decision making.

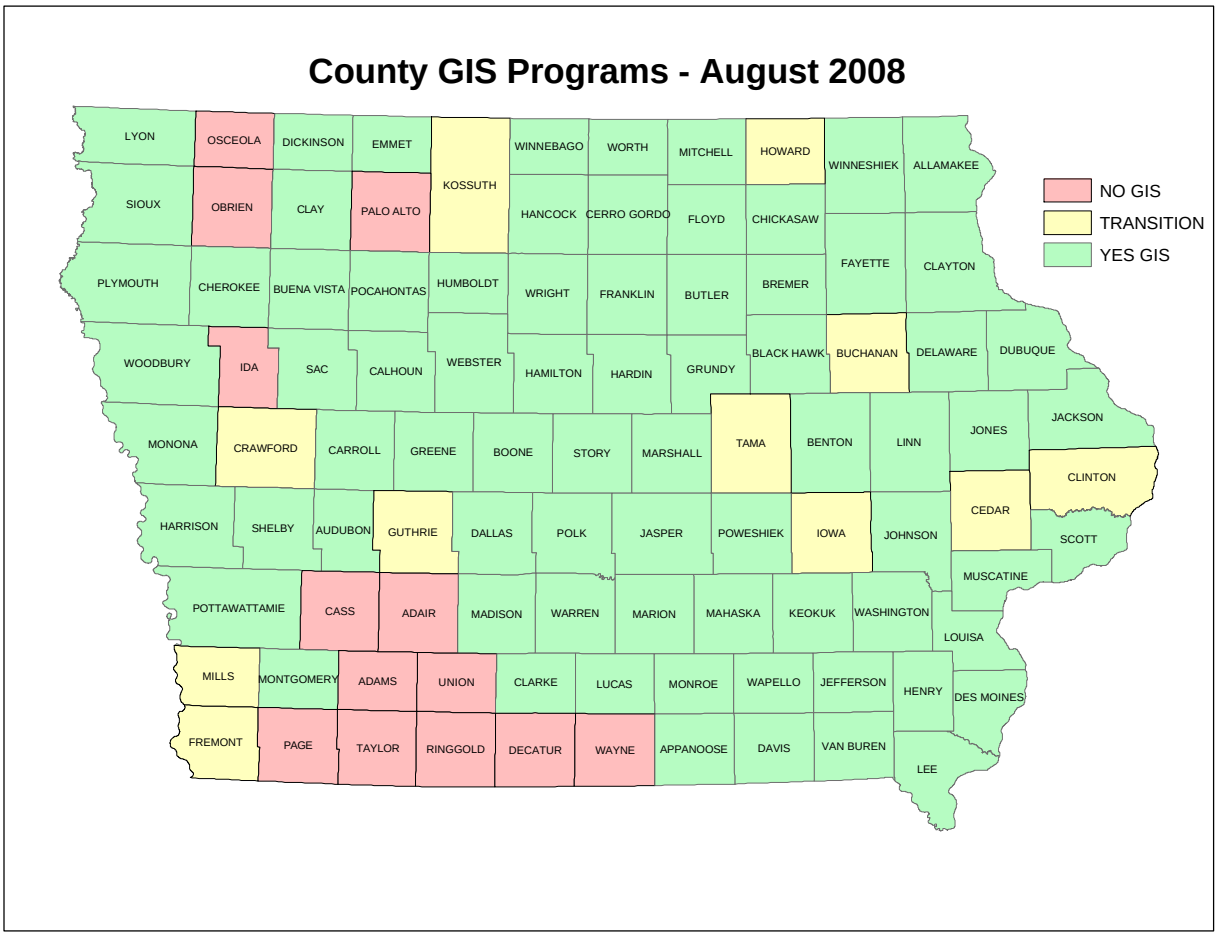
Current status:

1. Iowa DNR has a coverage of counties and the state outline that was digitized from USGS 24k topographic maps over 25 years ago. ftp://ftp.igsb.uiowa.edu/GIS_library/IA_State/Admin_Political_Boundary/
2. City boundary coverages are available from the Iowa DOT http://gis.iowadot.gov/downloads/zipped_files/Boundaries/
3. US Census Bureau has TIGER line files now as shape files. These will continue to be updated up until the 2010 census. ftp://ftp2.census.gov/geo/tiger/TIGER2007FE/19_IOWA/
4. The most accurate boundary data is maintained by city and county GIS programs (about 75 counties – see Figure 1), but none are currently integrated into a statewide coverage. Some are available to the public through real estate web mapping applications or the ICIT data repository https://www.iowagisdata.org/ .

Table 3: Description of Administrative Boundary Layers:

Sub-layer name	**Source or compiled by:**	**GIS Status and update cycle:**	**Integrated into statewide coverages:**	**Distributed by:**	**Accuracy:**	**Data model/ Data standard:**
State boundary	USGS topo maps - compiled from county boundaries	Exists/none	DNR/IGS	NRGIS server	USGS 24k topo maps: ~12 meters	Polygon shape file/?
County boundaries	USGS topo maps - compiled from county boundaries	Exists/none	"	"	USGS 24k topo maps: ~12 meters	Polygon shape file/?
City boundaries	1990 and 2000 Census Tiger/Line files	Exists/decadal	"	"	unknown	Polygon shape file/?
Political townships	1990 Census Tiger/Line files	Exists/none	"	"	unknown	Polygon shape file/?
City boundaries	City and county GIS programs	Available for some counties from ICIT data repository	Future IGI service bureau	Future IGI server	1" = 100'	Polygon shape file/?

Figure 1. Shows the status of county GIS programs in Iowa. Counties in green will likely have most framework layers, while counties in red and yellow will not (except for some county E911 systems may have roads and addresses).



4) Cadastral

FGDC Description: *Cadastral information refers to property interests. Cadastral data represent the geographic extent of the past, current, and future rights and interests in real property. The spatial information necessary to describe the geographic extent and the rights and interests includes surveys, legal description reference systems, and parcel-by-parcel surveys and descriptions. Cadastral information included in the framework:*

- *cadastral reference systems, such as the Public Land Survey System (PLSS) and similar systems for areas not covered by the PLSS (for example, the Connecticut Western Reserve in Ohio), and*
- *Parcels, including publicly administered parcels, such as military reservations, national forests, and state parks*

Features include the survey corner, survey boundary, and parcel. Each instance of a feature has the attributes of name (or other common identifier) and information about data quality. Each instance also should have a permanent feature identification code. For the PLSS, the minimum content is the boundaries of sections, including deflection points and the positions for quarter corners along section boundaries. Boundaries that have been surveyed are the preferred content for cadastral reference systems. Cadastral information is the basis of many analysis, decision-making, and operational applications, such as site selection, land use administration, and transportation planning. The reference system can be used to register locally produced information into the framework. Information about publicly owned lands serves both those who administer the lands and those who have interests in them. Framework representation of these lands provides useful information about their location, boundaries, extent, and relationships to other geographic features and phenomena. Because parcels play an important role in many public and private sector activities, and parcel information is a basic ingredient of many applications, there is interest in providing multiple levels of cadastral data. These levels would be based on available data and customer requirements. The framework provides a means to link existing parcel data into the larger cadastral network.

Current status:

1. Iowa DNR has a GIS shape file coverage of the PLSS sections and townships that was digitized from USGS 24k topographic maps almost 20 year ago. ftp://ftp.igsb.uiowa.edu/GIS_library/IA_State/Geographic/
2. IDOT recently re-digitized the PLSS boundaries. http://gis.iowadot.gov/downloads/zipped_files/Boundaries/
3. The most accurate PLSS and parcel boundary data is maintained by city and county GIS programs (about 75 counties – see Figure 1), but none are currently integrated into a statewide coverage. Some are available to the public through real estate web mapping applications or the ICIT data repository https://www.iowagisdata.org/ .

Table 4: Description of Cadastral Layers:

Sub-layer name	**Source or compiled by:**	**GIS status and update cycle:**	**Integrated into IGI coverages:**	**Distributed by:**	**Accuracy:**	**Data model/ Data standard:**
PLSS sections and townships	Compiled from USGS 24k topo maps	Exists/none	DNR/IGS	NRGIS server	~ 12 meters	Polygon shape file/?
PLSS corners	"	Exists/none	"	"	~ 12 meters	point shape file/?
Parcel boundaries and right of way	County and City GIS	Exists in digital form for about 75 counties/yearly	Future IGI service bureau	Future IGI server	1"=400' in rural areas; 1"=100' in cities	Polygon shape file/?

Issues and questions: PLSS corners and certificates could be made available through a web application similar to the Geodetic Control Monument viewer.

5) Transportation

FGDC description: *The framework's transportation data include the following major common features of transportation networks and facilities:*

- *roads -- centerlines, feature identification code (using linear referencing systems where available), functional class, name (including route numbers), and street address ranges;*
- *trails -- centerlines, feature identification code (using linear referencing systems where available), name, and type;*
- *railroads -- centerlines, feature identification code (using linear referencing systems where available), and type;*
- *waterways -- centerlines, feature identification code (using linear referencing systems where available), and name;*
- *airports and ports -- feature identification code and name; and*
- *bridges and tunnels -- feature identification code and name.*

Transportation information is used in many applications. Some use it only for reference purposes, as an element of base mapping, while many others use it to attach other types of information, such as address-related information or street characteristics. Transportation features and related data are important elements of many planning applications. Geocoding applications use road and related address data for uses ranging from marketing analysis to site identification. Routing applications use street network data for operations such as vehicle dispatch and fleet management.

Current status:

1. IDOT has available road centerlines and other layers from its GEMS system for each county and statewide. They have 28E agreements with 28 counties to update the road

centerlines with local GIS info. Otherwise the GEMS road centerlines are digitized from the 1:12,000 CIR and NAIP DOQQs.

- Roads: http://gis.iowadot.gov/downloads/zipped_files/GIMS_History/
- Trails: http://gis.iowadot.gov/downloads/zipped_files/miscBoundaries/2006/TRAILS_SO_2006.zip
- Rails: http://gis.iowadot.gov/downloads/zipped_files/rail/2002/RAILROADS.zip
- Waterways: http://www.iwr.usace.army.mil/ndc/db/waternet/data/ Not sure if there's a place to get this in GIS format already
- Aviation: http://gis.iowadot.gov/downloads/zipped_files/Aviation/
- Bridges and tunnels: http://gis.iowadot.gov/downloads/zipped_files/GIMS_History/

2. IDOT Linear Referencing System transportation data will be available in 2009 from DOT and through CAP Infrastructure project
3. US Census Bureau Tiger/Line and Tiger Shape Files available at ftp://ftp2.census.gov/geo/tiger/TIGER2007FE/19_IOWA/
4. Some counties and cities maintain their own road centerlines. Some are available to the public through real estate web mapping applications or the ICIT data repository https://www.iowagisdata.org/ .

Table 5: Description of Transportation sub-layers:

Sub-layer name	**Source or compiled by:**	**Update cycle:**	**Integrated into IGI coverages:**	**Distributed by:**	**Accuracy:**	**Data model/ Data standard:**
Road centerlines	IDOT; with some county road centerline files	Yearly?	IDOT	IDOT server or IGI server	5-10 meters	line shape file/?
trails	County and city GIS, COGS, DNR, DOT	?	"	"	?	line shape file/?
railroads	County and City GIS; Federal Highway Admin	?	"	"	?	line shape file/?
waterways	US COE	?	unknown	"	?	line or point shape file
airports and ports	IDOT	?	IDOT	"	?	Point shape files/?
bridges and tunnels	IDOT	?	IDOT	"	?	Point or line shape files/?

6) Elevation

FGDC Description: *Elevation data provide information about terrain. Elevation refers to a spatially referenced vertical position above or below a datum surface. The framework includes*

the elevations of land surfaces and the depths below water surfaces (bathymetry). For land surfaces, the framework employs an elevation matrix. Elevation values will be collected at a post-spacing of 2 arc-seconds (approximately 47.4 meters at 40° latitude) or finer. In areas of low relief, a spacing of 1/2 arc-second (approximately 11.8 meters at 40° latitude) or finer will be sought.

For depths, the framework consists of soundings and a gridded bottom model. Water depth is determined relative to a specific vertical reference surface, usually derived from tidal observations. In the future, this vertical reference may be based on a global model of the geoid or the ellipsoid, which is the reference for expressing height measurements in the Global Positioning System.

Elevation data are used in many different applications. Users may want a representation of the terrain, such as a contour map, spot elevations, or a three-dimensional perspective view. Elevation data are also used to build models and perform applications, ranging from line-of-sight calculations, to road planning, to water runoff. Elevation data are often combined with other data themes in applications and mapping.

Current status:

1. USGS has available the ubiquitous 10 and 30 meter National Elevation Data (NED) DEMs for the US derived from the 24k topo contours. Iowa DNR has these available in statewide ESRI grid files for download: ftp://ftp.igsb.uiowa.edu/GIS_library/IA_State/Elevation/NED/
2. State has a lidar program that is collecting 1.4 meter postings statewide, with 18cm RMSE vertical accuracy in bare areas, 37 cm in vegetated areas. DNR is working to produce 1 meter DEMs, shaded relief and intensity images, and 2' contours from the lidar data. ASCII and LAS files for raw 2x2km tiles are available from UNI Geotree site: http://www.geotree.uni.edu/LidarProject.aspx

Table 6: Description of Elevation sub-layers:

Sub-layer name	**Source/ compiled by:**	**GIS Data Status Update cycle:**	**Integrated into IGI coverages:**	**Distributed by:**	**Accuracy:**	**Data model/ Data standard:**
High-resolution DEM (1-meter grid spacing, elevation in meters)	Statewide 1.4 meter bare earth lidar/ DNR	Currently about 22% of state available for download as individual tiles/None	DNR	DNR, ISU and UNI servers	Hor. 1 meter Ver. 18 cm bare; 37 cm vegetated	?? tiles/ county mosaics and HUC-12 watersheds
2' contours	Statewide 1.4 meter bare earth lidar/	Future/None	DNR	DNR or UNI	"	Line shape files/?

	DNR					

7) Hydrography

FGDC description: *Framework hydrography data include surface water features such as lakes and ponds, streams and rivers, canals, oceans, and shorelines. Each of these features has the attributes of a name and feature identification code. Centerlines and polygons encode the positions of these features. For feature identification code, many federal and state agencies use the Reach scheme developed by the U.S. Environmental Protection Agency. Many hydrography data users need complete information about connectivity of the hydrography network and the direction in which the water flows encoded in the data. To meet these needs, additional elements representing the flow of water and connections between features may be included in framework data.*

A shoreline is the intersection of the water's surface with land. It usually is referenced to some analytically determined stage of the tide for coastal water, or other water level for lakes and rivers. Several shorelines, referenced to different stages of the water such as "mean high water" and "mean lower low water," are included in the framework. These shorelines are included because different users require different shorelines and the complex, nonlinear relationships between various shorelines make it difficult to determine them analytically. Attributes include the description of the tidal reference for the shoreline.

Hydrography is important to many applications. As with other data themes, many users need hydrographic features as reference or base map data. Other applications, particularly environmentally oriented analyses, need the information for analysis and modeling of water supply, pollution, flood hazard, wildlife, development, and land suitability.

Current situation:

1. USGS has produced 1:24,000 scale National Hydrography Dataset for Iowa and is available here: http://nhd.usgs.gov/data.html This data is subdivided by watershed. It is based on the USGS 7.5' Topographic maps, which vary in age from the 1950s to the 1990s in Iowa.
2. Iowa DNR and USGS are partnering to develop a local resolution NHD dataset for Iowa, extracting line work from the statewide lidar data, and conflating 24k NHD attributes and updated National Wetlands Inventory attributes. The pilot includes 27 HUC-12s, out of about 1700 watersheds covering the state.

Table 7: Description of Hydrography sub-layers:

Sub-layer name	**Source/ compiled by:**	**GIS data status/update cycle:**	**Integrated into IGI coverages:**	**Distributed by:**	**Accuracy:**	**Data model/ Data standard:**
River and stream centerlines	Iowa DNR and USGS	Pilot for 27 HUC-12s/unknown	DNR	DNR	At least 1"=400' in rural areas	Line shape files/ArcHydro and NHD
Water	"	"	"	"	"	Polygon shape

bodies						files/ArcHydro and NHD
Watershed boundaries (12-digit HUC)	Lidar DEMs/DNR	Future/none	"	"	"	"

8) Address Points

There is apparently no federal standard for address points. Many states and counties have address point GIS data, but there doesn't appear to be many standards documents. There is a USGS National Map best practice data model for structures that has a point layer, but this best practice model is not the same as a formal data content standard. (http://bpgeo.cr.usgs.gov/model/acrodocs/Poster_BPStructures_03_01_2006.pdf)

Current Status:

1. A few counties are known to have an address point data layers but none of the GIS layers are publicly available at this time. Some counties also have point address files for the E911 systems, but again these are not publicly available nor the extent of use well known.
2. Iowa DNR in conjunction with other state agencies has submitted a proposal to the state's Pooled Technology Fund for a project to create an address point file for 30-50 counties to be used in a geocoding web application. If funding is approved by the state legislature in the spring of 2009, work could begin next July. A second project proposal will be prepared to finish the state in subsequent years.

9) Structures

There is apparently no federal data standard for structures but there is a USGS National Map best practice data model for structures, (http://bpgeo.cr.usgs.gov/model/acrodocs/Poster_BPStructures_03_01_2006.pdf). Beyond this, there is little documentation for this basic framework layer.

Current Status:

1. A few counties are known to have building footprint and other structures (bridges, tunnels, cell towers, etc.) as part of their county GIS programs. The extent of this type of coverage is unknown at this time.
2. The Iowa Geographic Information Council has received a FGDC CAP Grant, Category 5 Structures and Transportation Stewardship, in 2008. Iowa State University is using funding from the grant to enhance the Iowa Geographic Map Server to include additional

space for new ortho-imagery to serve as background data for a structure web update tool, which will be using ArcGIS server technology to allow updates to a centralized statewide database of structures (building footprints) derived from the lidar data. The web tool is being tested with structures data for Polk County, which was flown in 2006 with lidar data for the National Governor's Conference, and building footprints were extracted. Building footprints will be extracted from the state's lidar program as more lidar data is processed by DNR.

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LEGEND

SCALE	NSSDA Horizontal Accuracy (95%)	Pixel size in feet	Pixel size In meters
statewide-regional 1:100,000+	190+ feet (60+ meters)		10-30 m
quadrangle-regional 1:12,000-1:24,000	38 - 46 feet (12-14 meters)		1-5 m
county 1"=400'	16 feet (5 meters)	2'	.61 m
city 1"=100'	4 feet (1.2 meters)	6"-1'	.15-.3 m
site 1"=50'	2 feet (.6 meters)	3"-6"	.08-.15 m
Survey-grade GPS	cm accuracy		