

Appendix H

Technical Memo 8

Mapping and GIS

TECHNICAL MEMORANDUM – MAPPING AND GIS

September, 2008

TECHNICAL MEMORANDUM NO. 8

BASE MAP DEVELOPMENT

A mapping framework was needed in order to present a number of the elements of this Alpine County Facilities Master Plan (Master Plan) for the South Tahoe Public Utilities District (District). It was determined that this mapping framework should be:

1. At a scale that could depict the districts facilities and adjoining properties in Carson (West Fork), Wade and Diamond Valleys from Indian Creek Reservoir to the Nevada state line (Study Area)
2. In digital format.
3. Adaptable to future refinements in scale and accuracy.
4. Translatable to different coordinate systems.
5. Transparent or translatable to both GIS (Geographic Information System) and CADD (Computer Aided Drafting and Design) software platforms.

The Kennedy/Jenks Consultant team decided to utilize TIFF (Tagged Information File Format) files of the USGS 7.5 minute Quadrangle Maps for the base map for this master plan. TIFF files of the following quadrangle maps were downloaded from the GIS Data Depot internet site:

- § Woodfords, Calif. – Nev., N3845-W11945/7.5, Aerial Photography date 1973, Mapped 1979.
- § Carter’s Station, Nev. – Calif., N3845-W11937.5/7.5, Aerial Photography date 1973, Mapped 1979.
- § Markleeville, Calif., N3837.5-W11945/7.5, Aerial Photography date 1973, Mapped 1979.
- § Henan Lake, Calif. – Nev., N.3837.5-W11937.5/7.5, Aerial Photography date 1973, Mapped 1979.

The TIFF Files of the quadrangle maps were then inserted into an AutoCAD 2000® Land Development Desk Top Drawing in the UTM Zone II, 1983 datum coordinate system and spliced together. Section, Range and Townships were “digitized” into separate layers by drawing lines connecting the sectionalized grid system shown on the quadrangle maps. Center section and quarter-quarter lines, dividing each section into sixteenths were then entered in as shown on the Government Land Office and BLM Survey Plats.

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The accuracy of this base map is limited by the accuracy of the U.S.G.S. 7.5 minute Quadrangle Map and the date of aerial photography. For instance if a Section Corner is out of position by 100 feet on the quadrangle map, then the same corner will be out of position by 100 feet on the Base Map. The 7.5 minute quadrangle maps were developed to be best utilized at a scale of 1 inch = 2,000 feet. The contour interval shown on the Woodfords, Carter's Station, and Markleeville quadrangle maps is 40 feet and the contour interval shown on the Henan Lake quadrangle is 80 feet.

ASSESSOR'S PARCELS

Copies of the Assessor's Maps covering Carson (West Fork), Wade and Diamond Valleys from Indian Creek Reservoir to the Nevada state line were obtained from the Alpine County Assessor's Office and maps were digitally scanned into TIFF files. The TIFF files were then brought into ACAD® and the parcel lines were "digitized" as individual closed polygons into a layer by drawing lines connecting parcel corners. The digital parcels were then stretched to fit the section and quarter-quarter lines developed for the base map and existing features such as roads, river, creeks, ditches and fence lines which appear on the quadrangle maps. They were also adjusted to features on the Aerial Photography described below.

A copy of the Assessor's role for properties in the Study Area was obtained from the Alpine County Assessor's Office. The Assessor's Parcel Number, Owner and Acreage for each parcel were then entered into a spreadsheet database. Parcel numbers which did not appear on the current Assessor's maps were eliminated. In the numbering system used in the data base for this study, the first number reflects the Book number, the next three the Page and the last three the Parcel. For example Parcel 2230029 represents Book 2, Page 23, Parcel 29. Parcel numbers were then entered as a layer on the base map.

EASEMENTS AND AGREEMENTS

As discussed in Technical Memorandum 6, copies of Easement and Agreement documents and Right of Way Maps were obtained from the District's files and then scanned into a data base of portable document files (pdf) readable by Adobe Acrobat ®. These documents were reviewed and any legal descriptions for the easements and agreements purporting to involve district facilities were entered by bearing and distance or aliquot part of section into layers overlying the above described base map. The mapping of these easements and agreements is further discussed in TM 8A. The easements and legal descriptions found in the agreements were adjusted to fit features on the aerial photography and quadrangle maps.

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WATER RIGHTS

As discussed in Technical Memorandum 7, the water rights associated with the District holdings and adjacent lands are surface water rights from the West Fork of the Carson River, Indian Creek and smaller creeks and are established by the Alpine Decree (United States of America v. Alpine Land & Reservoir Company et. Al.) issued 28 October 1980. For purposes of this Master Plan, it was determined that it would be beneficial to know the location of Alpine Decree water rights appurtenant to the different ownerships in the Study Area. Copies of the maps supporting the decree were obtained from the Federal Water Master's Office, which administers the decree. Three different types of Maps were available:

- § A set of maps commonly known as the “Decree Maps” for the Alpine or Carson River Decree. The maps show the outline of irrigated areas and the acreage irrigated. This acreage correspond to the acres listed in the decree for each 1/16th of a Section. The maps do not show the claim numbers and are at a scale of 4 inches = 1 mile Sheets 1 thru 3 cover the Study Area. A hand written note in the margin says the maps were completed 6 June 1979.
- § A much more detailed set of maps consisting of 12 sheets prepared by the State Water Commission of California entitled “Plane Table Survey of Lands Irrigated from the West Fork of The Carson River, Alpine County, California” and dated May and June 1920. These maps were probably prepared as support for the “Price Decree” dated 29 November 1921. These maps are at a scale of 1 inch = 300 feet and show irrigated areas and the acreage irrigated in each 1/16th of a Section, ownership lines, type of culture, fence lines, ditches, roads and other topographical features. These maps show only areas irrigated from the West Fork of the Carson River. They do not depict lands irrigated from the tributaries, such as Scott and Indian Creek.
- § A composite map at a scale of 1 inch = 1000 feet of the 12 sheet plane table map described above. This map is difficult to read and was not able to be scanned. It does note that the Plane Table Survey was performed by C.L. Rakestraw.

Sheets 1 through 3 of the 23 sheet set were digitally scanned and the water righted acreages were digitized as closed polygons for each of the 38 West Fork Claims, or group of claims and 10 Indian/Scott Creek Claims. When the acreages of the digitized areas were compared to the acreages shown by quarter-quarter on the 3 sheets and in the Decree, it was found that there was a great deal of error, both in the individual quarter-quarters and in the total acreages per claim. The 12 sheets of the Plane Table Maps were then scanned and the irrigated areas were digitized as closed polygons into a layer for each claim. Note that some claims smaller than 5 acres were not found on the Plane Table Maps. The claims were then stretched to fit the section and quarter-quarter lines developed for the base map and existing features such as roads, river, creeks, ditches and fence lines, which appear on the quadrangle maps. They will be further adjusted when the mapping from the aerial photography is completed. The acreages of

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individual claim polygons were compared to the acreages shown in the Alpine Decree, they were within plus or minus one to two percent of the total acreages for claims greater than 20 acres in size. Scott and Indian Creek claims are mostly supplemental. These claims were added as layers, but their locations are depicted with less certainty than the West Fork claims.

A number of different Exhibits were prepared which are discussed in greater detail in Technical Memorandum No. 7, Water Rights.

AERIAL PHOTOGRAPHY

Aerial Photography

Spencer B. Gross Photogrametric Engineers flew 1:18000 scale (1" = 1,500') natural color imagery of the project area. Six (6) flight lines and a total of 55 exposures were required to cover the project area with stereo imagery for both topographic and orthophoto production.

Airborne GPS methods are being used to lessen the need for ground control within the project area. A 1-foot topographic survey has been developed.

Ground Survey

It is important to have established ground control stations within the project area to check and correct the accuracy of the Airborne GPS solution. Seven points were required. Tri-State Surveying was contracted to provide survey grade differential GPS locations. This was accomplished by setting up GPS receivers at two known locations on opposite sides of the project area. A station was located on the Geodetic control point, Carin, near the Nevada state line, while another receiver was set up to the south on a found USGS section corner near the Alpine County School. This method allowed for Differential GPS control, creating sub-meter accuracy for all control point coordinates.

Aerotriangulation:

Aerotriangulation methods were used to supplement, integrate, and verify both the ground and airborne GPS control networks. Only senior personnel are used to complete the aerotriangulation for this project.

Terrain Data Capture

To successfully ortho-rectify this imagery a digital terrain model has been created over the project area. After aerotriangulation was completed, each stereo-model was oriented to the UTM coordinate system in our softcopy or analytical stereoplotters. Within the project area vertical profiles will be digitized at an interval of 50-75 feet with points taken along the profile at a 10'-20' spacing. This will be used to create a Digital Terrain Model (DTM) that, while not accurate

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enough to interpolate accurate 5-foot contours from, will be accurate enough to create accurate orthophotos.

Please note that accurate 5-foot contours can be created from this orthophoto imagery at a later date if required; with no additional ground or airborne surveying required.

Digital Orthophotos

Two foot pixel color orthophotos will be created from even numbered images along each flightline. Each raw image will cover approximately 4 square miles and be 100 MB in size. These raw images will be color balanced and mosaiced into a final project wide or tiled image product that will be compatible with ARC/INFO, ArcView, and a variety of CADD systems.

Geographical Information System

The Geographic Information System (GIS) developed for the Alpine County Facilities Master Plan has been designed to provide a mapping and data organization platform to assist in the evaluation of temporal and spatial relationships of various data required for the Districts operation in Alpine County.

A GIS system is a collection of data organized in a common geographical map projection and coordinate system. The common system used in Alpine County, on existing District maps, and with this GIS is Universal Transverse Mercator (UTM) Zone II, 1983 datum, in US Feet. Although this coordinate system is common, the GIS system has the capability to translate, or project, maps to other useful projections such as State Plane coordinates. The coordinate system of choice can be specified when calling up a map.

The GIS software used to construct and display the data for this project is ESRI's ArcView 3.2a. This common and user friendly platform is currently in use by the District, therefore the GIS design and data generated for the Alpine County Facilities Master Plan can be combined with other data sets currently or being developed by use by the District.

Data for the GIS was collected from existing District data sets, USGS, USBLM, USFS, and the NRCS. The following table summarizes the coverages contained in the GIS and provides the data source and accuracy information.

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Table 1 - Mapping and Topographical Products

Coverage	Source	Scale	Update	File Name
Addresses	Alpine County Assessor		April 2000	Addresses.shp
Lakes	7.5 min USGS - DLG	1:2000	1979	Lakes.shp
Permits	LRWQCB Permit	1:2000		Permits.shp
Pipeline	STPUD - Easement Survey	1:2000		Pipeline.shp
Monitoring Wells	STPUD - GPS	1:2000		Points.shp
Roads	7.5 min USGS - DLG	1:2000	1979	Roads.shp
Scenic Highway	7.5 min USGS -DLG	1:2000	1979	Scenic.shp
Soil	NRCS Soil Survey - USGS 7.5 min	1:2000		Soils.shp
Nevada/California	7.5 min USGS - DRG	1:2000	1979	Stateline.shp
Streams	7.5 min USGS - DRG	1:2000	1979	Streams.shp
Watershed	7.5 min USGS - DEM	1:2000	1979	Watershed.shp
Assessors Parcel	Alpine County Assessor Maps		April 2000	Assesors_parcel.shp
USGS 7.5 Quad	7.5 min USGS	1:2000	1979	Stupdfac.tif
Land owners	Alpine County Assessor		April 2000	Landown.shp
Irrigated	LRWQCB Permit	Unknown		Irrigated.shp
Easements	Record of Survey	Unknown	unknown	unknown
Right of Way	Record of Survey	Unknown	unknown	unknown
Ditches	Aerial Photography	1:400	unknown	unknown
Crop Type	Aerial Photography	1:400	unknown	unknown

Monitoring Data

In addition to the mapping and topographical products listed in Table 1, are data sets generated from the South Tahoe PUD surface and ground water and soil monitoring program. These databases have been linked to well locations that have known coordinates. Data associated with wells that have not been located with a GPS or survey can be added later.

The original draft of this technical memorandum was prepared by Kennedy/Jenks Consultants in 2003 and updated by Stantec Consulting in 2008.