SUMMARY REPORT
OF THE
FIELD AND CARTOGRAPHIC WORK
AT
FORT CLATSOP NATIONAL MEMORIAL
ASTORIA, OREGON
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Report to
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FOCUS OF WORK

The intent of this project was to provide the National Park Service (NPS) with map originals indicating:

1. A base map depicting the trail network, the Visitors' Center (VC), the parking areas, the fort reconstruction, and the historic "topographic calls" made by historic surveys dating to 1856.
2. The overall contours (digital terrain model) of the site.
3. The previous archaeological exavation, with an enlargement of the same.
4. The project coordinate file converted to Oregon State Plane Coordinate System North zone.

HISTORIC FIELD PROCEDURES

Every newly created territorial district was administered by a Surveyor General. The Surveyor General's responsibilities included the establishment of the meridian and baseline for the district, and subsequent division of the meridian district into township, range, and section. The land division was accomplished by General Land Office (GLO) deputy surveyors working under contract for the Surveyor General. In Oregon and Washington the basis for the public lands surveys is the Willamette Meridian established in 1851.

The deputy surveyor's responsibilities were to field establish the township and section lines, and to locate any donation land claims (DLC) in his contract area. All deputy surveyors were required to follow a Congressional manual of field instructions, and any additional field instructions written for their particular meridian. The 1855 manual of field instructions required that the deputy surveyor physically describe the land's topography, natural curiosities, and to describe and note the positions of all improvements. Improvements were defined as "towns and villages; Indian towns and wigwams; houses or cabins; fields, mill seats," etc.

These descriptions are referred to as "topographic calls." A topographic call is any observation noted by the deputy surveyor at the time of his survey. The observations were made by measuring the angle and distance to the observed feature from a point along the section line, and then noting the information in a field book. The field books were then transcribed by the deputy surveyor at the end of his contract and submitted to the GLO. Finally a corresponding plat was drawn from them.

The instrument used for the surveys was a Burt's Solar Compass, capable of reading to the nearest one-quarter degree. The significance of this instrument was its ability to provide the deputy surveyor with an azimuth originating with the sun (solar azimuth), as opposed to magnetic azimuths (surveyor's box compass) whose direction was subject to magnetic variation. All distances were measured horizontally with either a two-pole (33 foot) or four pole (66 foot) chain.

HISTORIC SURVEYS

Trutch Brothers' Survey of 1856

The first deputy surveyors in the Fort Clatsop area were Joseph and John Trutch in 1856. They were charged with the subdivision of Township 8 north, Range 10 west into 36 equal sections of land as prescribed in their contract with the Surveyor General.

The Trutch brothers' topographic calls originated from the section corner common to sections 1 & 2 and 35 & 36. The distances were accumulated north, and a quarter corner (the mid-point between section corners 1, 2, 35, 36; and section corners 25, 26, and 35, 36) was set as required by their contract.

The Trutch brothers called the following (all calls are in chains, and the only ones listed are inside the FOCL site area):

32.00	*Moores mill East about 250 lks (links)*
33.36	*house on line - leave bottom & ascend NE level*
37.00	*house bears west abt. 400 lks*
39.00	*Moores house bears West abt. 300 lks enter garden & ascend NE & SW*
40.00	*Set qr. sec. post from which (various bearing trees are described)*
42.25	*Shanes house West 8 lks.*
44.20	*leave garden E & W*

Even though the Trutch brothers made measured calls north on the section line from the section corner, almost all the distances noted to the various structures were off line and "abt." (about). The "Shanes house" call, however, was so short as to be almost on the section line, and a second structure "house on line" was called directly on the section line. It is assumed that these particular calls were more accurate than the off line calls. It must also be remembered that at the time these calls were made, there was minimal undergrowth to contend with. Consequently, the distances to the features were most likely paced. Deputy surveyors were not required to denote building corners, simply the approximate distance and bearing to the feature, and a note identifying it and perhaps who owned it.

Gelo F. Parker Survey of 1882

Clatsop County Surveyor Gelo Parker retraced the section line common to sections 35 & 36, and when he reached the quarter corner, he noted the following:

> *Find remains in ground of old stake, I set new ...*
> *Find remains of old witnesses, I set new*
> *A Spruce 18 ins. S85° 30'E 2.65ch = 174.9 ft.*
> *SE Cor. Smiths House S88°11'W 2.16ch = 142.56ft*

As noted above, Parker reset the quarter corner and he set witness posts to his reestablished corner. Witness posts are used to find (relocate) significant cadastral points. Without witness posts, very few cadastral points would ever be found.

A quarter corner is a significant cadastral point. Quarter corners were placed at the time of the original survey precisely half way between one section corner to another. Because of the distances involved from section corner to section corner (one mile), quarter corners were necessary to hold the section line's field position. The distance from the 1/4 corner to the section corner was frequently cut in half again, and a 1/16th corner would be established.

The southeast corner to the Smith house that Parker field-tied as a witness post to the quarter corner was more accurately measured than the topographic calls that the Trutch brothers made in their original survey of the section line. The southeast corner to the Smith house will prove to be significant in the reconstruction of the Smith house. According to Harlan Smith son of the builder of the house, a Fort Clatsop "round" was incorporated into some aspect of the houses foundation.

Gelo F. Parker Survey of 1905

Parker, in retracing the section line in 1905, relocated his original bearing trees (witness posts), and quarter corner set in 1882, and also noted:

> *The Stevenson house which I used as a witness at that time (1882) has been burned down this year*

Arthur Danielson Survey of 1923

Clatsop County Surveyor Arthur Danielson introduced a 67 foot error into the re-establishment of the quarter corner that was found just 18 years previously. Apparently he failed dismally in his search for the witness posts and quarter corner set by Parker, remeasured the distance from the southern section corner to the quarter corner, a distance that should have been 2,640 feet, and set it 67 feet south at a distance of about 2,573 feet. At any rate, subsequent surveys (five in all, excluding the Hovden survey of 1993) incorporated Danielson's error into their surveys.

This is common land surveying practice. Land surveyors follow others' work and are not required to "reinvent the wheel." Whatever evidence is left in the ground as witness posts, or the actual mark itself, is incorporated into their own work. This was particularly true prior to the advent of present-day laser generated data collection measurement systems.

Hovden Survey of1993

In May of 1993, Clatsop County Surveyor Robert Hovden retraced the section line mentioned previously, and searched for the quarter corner. He noted in his survey that in "about 1960 the area was graded when the old county road was relocated and has since grown up in brush and trees." Failing to find any evidence of the monument, he attempted to find it by starting at the section corners (north and south) and then reestablishing the corner as noted by all of the more recent surveys.

He subsequently located Danielson's bearing tree, and other witnesses to Danielson's quarter corner but didn't find any evidence of Parker's bearing trees set in 1882, and relocated again in 1906. He also found it odd that Danielson's witness posts were all referencing a quarter corner that placed it 67 feet south of the computed mid-point of 2,640 feet. He attempted to find Parker's witness posts from computed field-ties to Danielson's quarter corner and found nothing.

He then searched north about 75 feet and found a 30" spruce stump with what appeared to be a scar. Bearing trees are blazed and then scribed inside the blaze, leaving a scar on the tree itself. Hovden then exposed the scar by opening it with an ax, and found the words "1/4S" plainly visible," he believed that this spruce was the southerly bearing tree that Parker set in 1882. Hovden proceeded to search for other witnesses left by Parker, but couldn't find any.

Based on that evidence, Hovden used Parker's spruce to reestablish the quarter corner to its present position.

The importance of Hovden's work must not be understated. By reestablishing this quarter corner point to its original and correct position, all of the historic deputy surveyors' calls to historic dwellings could be accurately field set - as accurately as the Trutch brothers measured them. Additionally, the southeast corner of the Smith house could also be field set, thus providing an archaeological predictive area for the house itself, and consequently the "round" mentioned by Harlan Smith in 1957.

FIELD METHODOLOGY

Cartographic reconstruction and analysis of any historic site is essentially a three step process. The first step requires a search for, and a review of, the GLO deputy surveyors' notes. This first step was already made by David Ek of the NPS at Fort Clatsop who provided this project with the necessary documents.

The second step requires a search of present-day, (or the most recent), surveys of record that field locate any cadastral monuments within the project. In this case, Clatsop County land surveyor Robert Hovden provided the necessary cadastral monuments outlined above, and again, David Ek provided the project with copies of Hovden's work and record of survey.

The third step involves field-tying (via standard surveying techniques) all cadastral monuments and any other contractual topographic features, to a geographic survey system of record.

For this project, the record system used was Oregon State Plane Coordinate System North (north zone) that Clatsop County Surveyor Robert Hovden brought to the FOCL site in his cadastral work of 1993.

Project Coordinate Systems

Project coordinate system files are essentially isolated planimetric grids that have as their point of origin an arbitrarily chosen set of numbers for a north point (northing) and an east point (easting). All surveyed angles and distances in this grid are calculated from these points, and the resultant set of data (a coordinate file) have coordinate values (northings and eastings) that are distances north and distances east of this imaginary point of beginning. Coordinate system files can ultimately be rotated and translated (moved) to other coordinate systems, or to a state plane coordinate system of permanent record.

Once the file has been converted to a state plane coordinate system, then it no longer exists as an entity, and can be converted to any grid system (UTM, latitude and longitude, for example) and becomes part of a global network of data. This project required field-setting the Trutch brothers' 1856 calls to various historic structures. In order to field-set the calls, the Trutch brothers' geodetic bearing along the section line needed to be calculated, and then the project file rotated to that bearing. The only way the project coordinate file could be accurately rotated to geodetic north, was to first convert it to Oregon State Plane Coordinates.

Field Procedure

Survey traverse points were set at approximately 15 positions throughout the FOCL site from the parking area and the VC, to the canoe landing area. The traverse points were one inch by one inch by ten inch wooden stakes driven almost flush with the ground. Additionally, two small asphalt nails (PK's) were driven into sweat joints in the top of two parking curbs in the main parking area, and the over-flow parking on the north of the site.

All of the traverse points were then field-tied using laser generated data collection that automatically stores each field-point by a record number and corresponding northing, easting, elevation, and a field-point description, producing a project coordinate file.

A topographic survey of the site began at the VC, extended to the fort reconstruction, then traversed down the path to the canoe landing area, and back up another path to the picnic area, and ended at the parking areas. Site contours were restricted to "open areas," that is, areas where dense brush was less abundant, and field angles and laser generated survey distance could be taken.

A minimum number of field-points were taken in the VC, and the parking area. Existing NPS construction plans containing necessary building and parking detail were submitted by David Ek, so it was only necessary to field-register to the plans from the project control points.

Ek also supplied the project with the Oregon State Plane Coordinate file of Hovden's survey work in 1993. To convert the project coordinate file to this file, two points common to both files would be required to make the necessary rotation and translation. The two points chosen were the quarter corner, and a US Army corps of engineers brass disk "FRO" at the canoe landing area. These monuments were chosen for two reasons. The first because of their distance apart, and the second because they are cadastral monuments set in concrete and marked with aluminum and brass disks.

After accurately field-tying these points to the project file, the horizontal distance between them was calculated and checked against Hovden's horizontal distance. If the distances were the same (within six hundredths of a foot), then the project coordinate file's corresponding bearing could be subtracted from Hovden's bearing, and the project file could then be rotated and translated directly to Oregon state plane coordinates. The project distance was 587.690 feet, and Hovden's distance between these two points was 587.696 feet. A difference of six thousandths of one foot, about the width of <u>this</u> letter "a." The distance difference was absorbed, and the entire file converted to state plane coordinates.

Subsequently, a separate (duplicate) project file was created for placing the Trutch brother's calls, and Parker's witness tie to the Smith house. This duplicate file was then rotated around the quarter point using the theta angle supplied by Hovden of -2°23'45". The resultant file became the geodetic file for the project.

The various historic ties from the section-line and quarter-corner were calculated and added directly to this geodetic file, and these coordinates were then field-set using the data-collector's "stake-out" program. A wooden stake and lathe were left to mark the points.

The project elevation benchmark was a Clatsop County monument (GPS point 9210) set at the southern end of the FOCL site on the east side of Fort Clatsop road. This monument was occupied directly, and through vertical angles, a project control point at the Canoe landing area was field tied and the elevation established. The remainder of the project was then recalculated to this elevation.

CARTOGRAPHIC/COMPUTER METHODOLOGY

At the conclusion of four days of field work, approximately 300 individual survey points were digitally stored to the data collector attached to the project surveying instrument (a Topcon GTS 3D).

This data was then downloaded to computer, and an ASCII file containing all the data was created. This ASCII file was then read by a point-plot/contour-generating program, a base map drawing scale of one inch equaling 40 feet was chosen, and then this data in turn was opened and saved to a computer aided drawing (CAD) program - PowerDraw v6.0 (Macintosh platform). The CAD program provides an efficient and concise method of computer compilation and creation of the various project maps.

The point-plot , for example, was embedded into one layer of the CAD program, the contour index lines were embedded in another layer, the contour lines were embedded in another layer and so on. Ultimately, sidewalks, roads, trails, the spring, the VC and the GLO historic calls, were all placed on individual layers in the CAD program. In this way, various layers can be turned on (made visible), or turned off (invisible), as well as made active or inactive. Thus, one CAD document can contain all the data (via the map layers) for any number of maps that a user wishes to create.

An additional requirement for the project was the mapping of the VC, the parking areas, and most importantly, the past archaeology surrounding the fort reconstruction. To accomplish this task, a 25" by 25" grid divided into 25 squares was drawn and placed in a CAD layer. This grid was then physically plotted (plotter) with the point plot layer. The construction drawings of both parking areas, and the visitor center, were registered to this drawing via various field points, and the grid lines were then traced onto the construction drawings.

The construction drawings were then optically scanned, saved as a PICT file, and placed in a layer of the CAD document. These individual scans were then registered to their corresponding grid square, and subsequently traced at the computer.

The archaeological drawings presented a slightly different problem. There wasn't any visual evidence remaining of them, so nothing (a trench corner for example) was picked up in the field. The archaeological drawings included the fort reconstruction as well as the spring, however, so those points were used to register the drawings to the grid point-plot drawing. Once the trenches were registered, the drawings were similarly scanned, placed, and traced at the computer.

Once all of the project tasks were completed, color hard-copies were plotted depicting: 1) The physical environment, 2) The overall project site, and, 3) The archaeology at the site (a separate enlargement was also plotted). A conversion from the native Macintosh CAD document to a DOS based autocad DXF file document was created for inclusion in the NPS GIS program.

APPLICATIONS

Because the DXF documents submitted to the NPS were converted and drawn to Oregon State Plane Coordinate System "grid north" (North American Datum 1983), there are distinct and significant applications for this project. It provides direct field data position to the map user from the CAD document itself. A map user could pick a point on the map, calculate the coordinate position using the grid square (the grid square has the northings and eastings indicated at the four corners), and then field-place that object. This saves the user considerable time with gains in accuracy and coordination.

Should the NPS need to have the Caywood excavations placed on the ground, the coordinates of the excavation area could be calculated directly from the CAD grid square. A field control-point would subsequently be occupied, the calculated angles turned and distances measured to the excavation corners, and the old excavation accurately placed.

Or, for example, if a subsurface engineering project were to be proposed in the terrace area just east of the parking area, the proposed impact area could be placed in the CAD drawing. The historic GLO dwelling calls layer could be turned on, and the proposed impact area could be moved or otherwise realigned in relation to the historic dwelling call.

Additionally, any future archaeological excavation can be added directly to the CAD document either through rag tape and compass measurement, or through traditional data-collection techniques.

The CAD document of the FOCL site is a malleable, on-going work. Presently, it represents what has been mapped, but perhaps more importantly, it can absorb any future mapping needs. The CAD document retains real-world geographic coordinates, coordinates that can be translated to any global geographic system in the world.

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