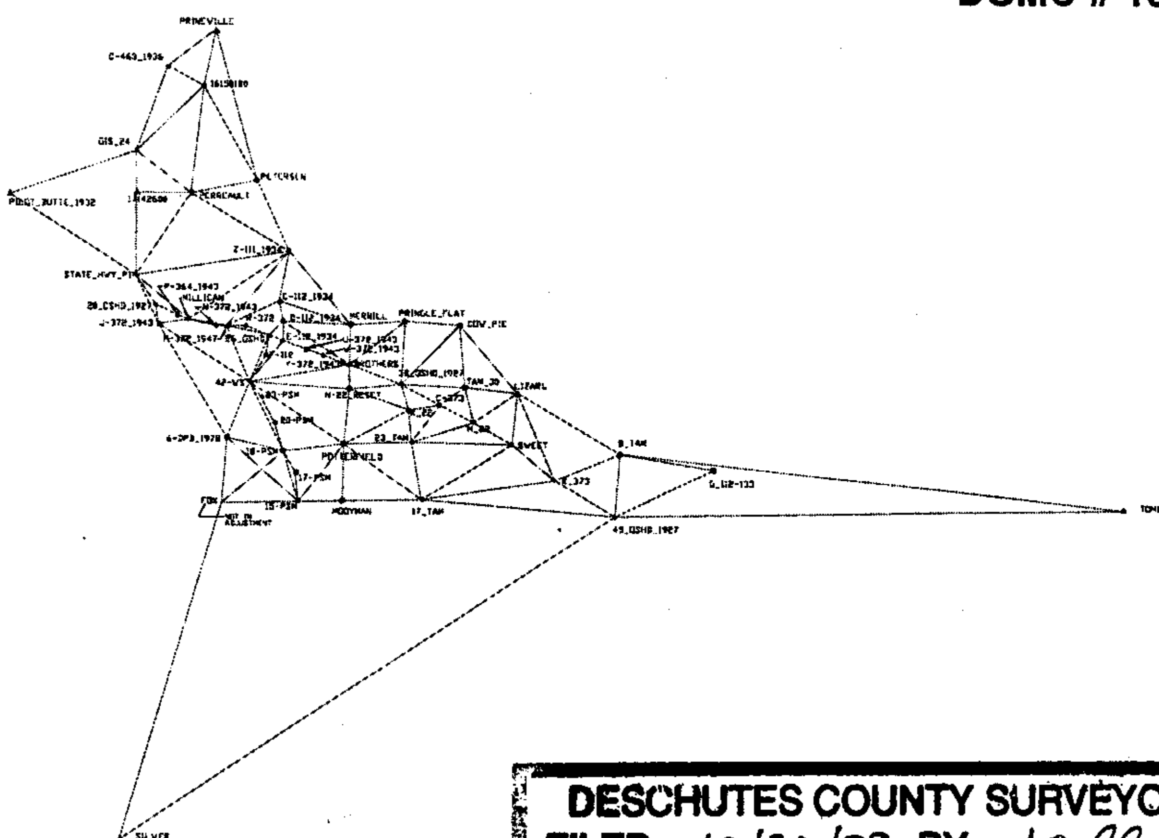
SURVEY REPORT

EXPANSION OF DESCHUTES COUNTY PRIME CONTROL NETWORK.

BY

DESCHUTES COUNTY SURVEYOR'S OFFICE
BEND, OREGON

DGMC # 18



EXPANSION
OF
DESCHUTES COUNTY
PRIME CONTROL NETWORK

GENERAL:

The purpose of this survey was to expand the Deschutes County Prime Control Network to the east part of Deschutes County and a southeast part Crook County. To establish high precision mapping coordinates on existing control points, bench marks, government land corners, section and quarter section corners with G.P.S.. Deschutes County Surveyor's Office measured and reduced the baseline measurements and computed geodetic coordinates on the NAD 83-91 (North American Datum of 1983, readjusted in 1991) and NAD 83-91 Deschutes County Plane Coordinates in international feet.

MEASUREMENTS:

All measurements where made with two Trimble SSE receivers with L1/L2 ground plane antennas on tripods and check centered over control points, height of instrument was measured in meters and feet.

We used GPSurvey baseline processor for the reduction of GPS measurements to produce fix solution base lines and holding to Trimble's guideline to high confidence limits for the ratio and rms criteria.

Level loops were run with a Wild Ni 2 level and standard rod. Most were 1 turn from bench to control point.

REGISTERED
PROFESSIONAL
LAND SURVEYOR

W.C. Kauffman

OREGON
AUGUST 22, 1975
W. C. KAUFFMAN
1031

RENEWAL 6-30-99

CLOSURES:

We ran numerous loop closures on the base lines to check for HI errors and isolation of bad lines for remeasure. In the most part loop closures were 0.5 to 1 ppm for lines from 8 to 40 km in length with all being independent sessions. The computations of open end closures from one fix point to another fix point (high precision points) using all independent sessions with closures of 0.86 to 1.76 ppm.

ADJUSTMENT:

HORIZONTAL

A minimal constrained adjustment was accomplished by holding Brothers fix with excellent result and many partial constrained adjustments using combinations of two to five fix points, all showing excellent internal consistency. For completion of the final adjustment we held Brothers, Pilot Butte, Prineville, Tomb, Silver, GIS 24, J 732, 17142600, and P 372 fix for the fully constrained adjustment of the network. Datum for all adjustments was NAD 83 (1991) in latitude, longitude and ellipsoidal height.

ORTHOMETRIC

First we used NGS GEOID 93 program to compute geoid heights at each control point to make a geoid model of the control area. By fixing orthometric heights of three reliable points in a constrained adjustment, we can cause the geoid model transformation (deflection in latitude and longitude plus a height constant) onto the same orthometric datum. Here we can analyze the record elevation at our control points by using different combinations of fixed height to find errors in data entry, movement of bench marks and bad elevations. Of the 37 known orthometric elevations we held 32 fix for ngvd 27.

NGS bench mark N 22 was found to be disturb, reset the mark and stamped RESET 1997.

DESCRIPTION SHEET:

The mark data sheet shows information about each control station in the network, such as name, number, horizontal & vertical datum, coordinates, scale factor, convergence, general information and sketch.

NOTE: ALL VALUES ARE NAD 83 (1991) GPS

CENTRAL OREGON COORDINATE SYSTEM:

The County Surveyors Office and the County GIS Section agreed on a conformal mapping projection for the best fit of the 80 % population area of Deschutes County, for a grid to ground distances, being no worse than 1 part in 50,000. This system is the best for the integration maps, deeds, etc., into the County GIS and should be of assistance to local surveyors. The County Surveyor in the process of establishing coordinates at section and 1/4 section corners on the Central Oregon Coordinate System.

<u>SYSTEM DATA</u>:

DATUM = NAD 83(1991)

PROJECTION = TRANSVERSE MERCATOR

ZONE = NONE

CENTRAL MERIDIAN = W 121° 17' 00.0000"

LATITUDE OF ORIGIN = N 43° 00' 00.000"

ORIGIN NORTHING = 0.00000

ORIGIN EASTING = 3,300,000.00

LINEAR UNITS = INTERNATIONAL FOOT

ACKNOWLEDGMENT:

A big thank you to Don Sweet, who is ready to measure with GPS any time and any where, this project not be accomplished without your help and cooperation,

Four control points where set in the names of special people at Trimble Navigation, (MOOYAN, PERREAULT, PETERSEN AND POTTERFIELD) who I had the pleasure working with over the last 10 years.

GENERAL INFORMATION

ON

DATA SHEET

CORNER NUMBERING

GROUND TO GRID REDUCTION

AND

LEAST SQUARES ADJUSTMENT

GENERAL INFORMATION ABOUT MARK DATA SHEET

BOX 1

MARK NAME: Is a name that may be stamped on the monument (FIRST) or a point identifier (17122604).

MARK SET BY: Best information obtainable of who may have set mark.

DATE OF MARK: Best information obtainable of date that mark was set.

LOCATION: What section, township and range that mark is located.

REFERENCE NUMBER The reference document and number that has important information about mark at the time the G.P.S. survey was performed. (CS # = COUNTY SURVEY NUMBER) (OCRR # = OREGON CORNER RESTORATION RECORD NUMBER, DGMC # = DESCHUTES GEODETIC MAPPING CONTROL NUMBER,DESCHUTES CO.) (MF# = MICROFILM NUMBER ,JEFFERSON CO.) (OLCM = OREGON LAND CORNER MONUMENTATION, CROOK CO.)These records are on file in the County Surveyor's Office.

BOX 2

MARK SKETCH: A quick free hand sketch of mark to show general location and brief description.

BOX 3

PART 1 Self-explanatory

PART 2 All the needed information about the datum's and coordinate system to use for transformations.

PART 3 Latitude and longitude of the horizontal datum used.

Northing, easting, convergence and scale factor of the coordinate system used.

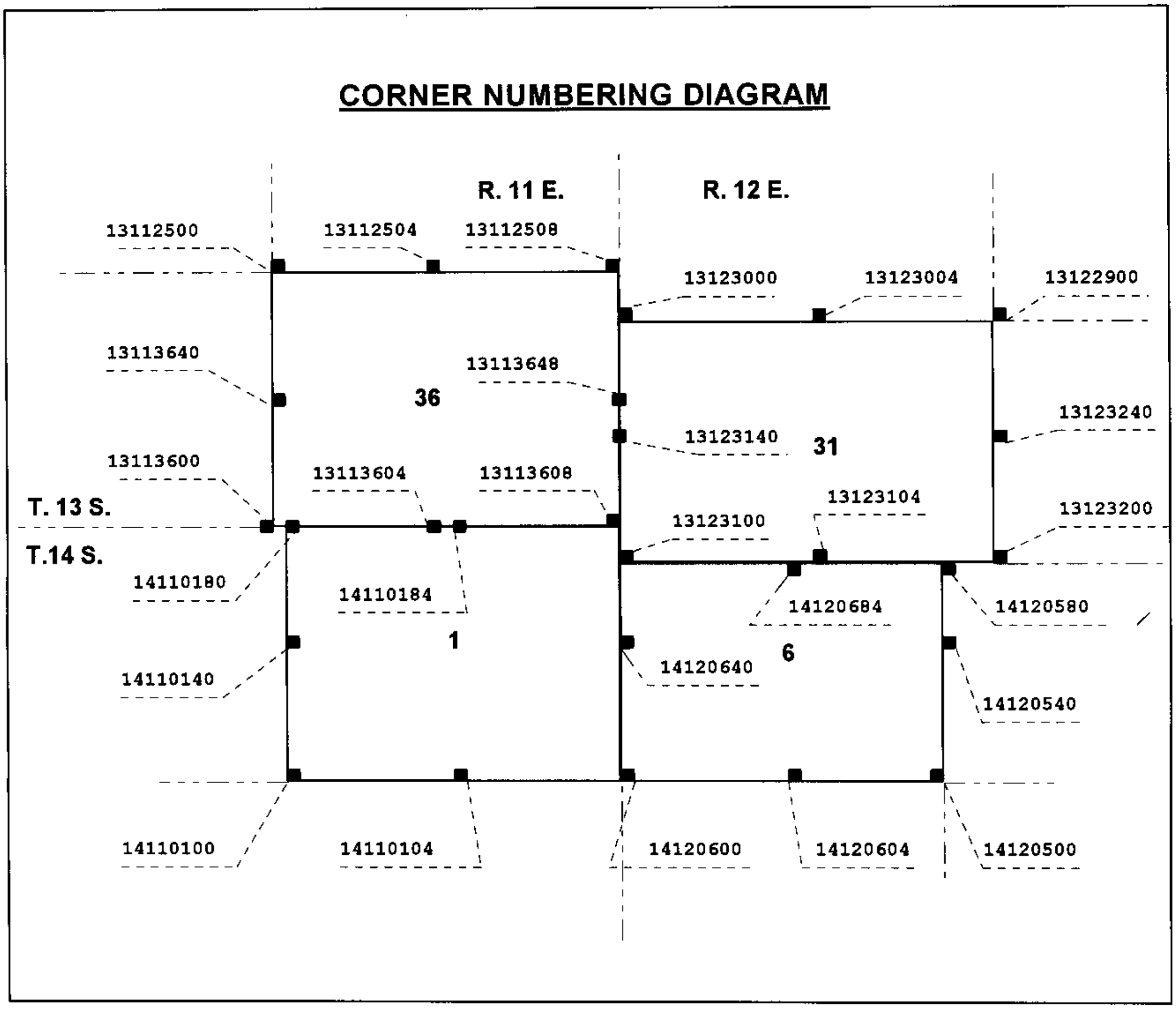
Ellipsoid height: height of mark above the reference ellipsoid

Orthometric height: height of mark on the vertical datum (elevation).

Geoid height: the difference between the reference ellipsoid and zero elevation of the vertical datum.

Combine factor: grid distance to ground distance factor.

One sigma error: the estimated error of uncertainty at the 68% confidence region.(FGCC Standard)



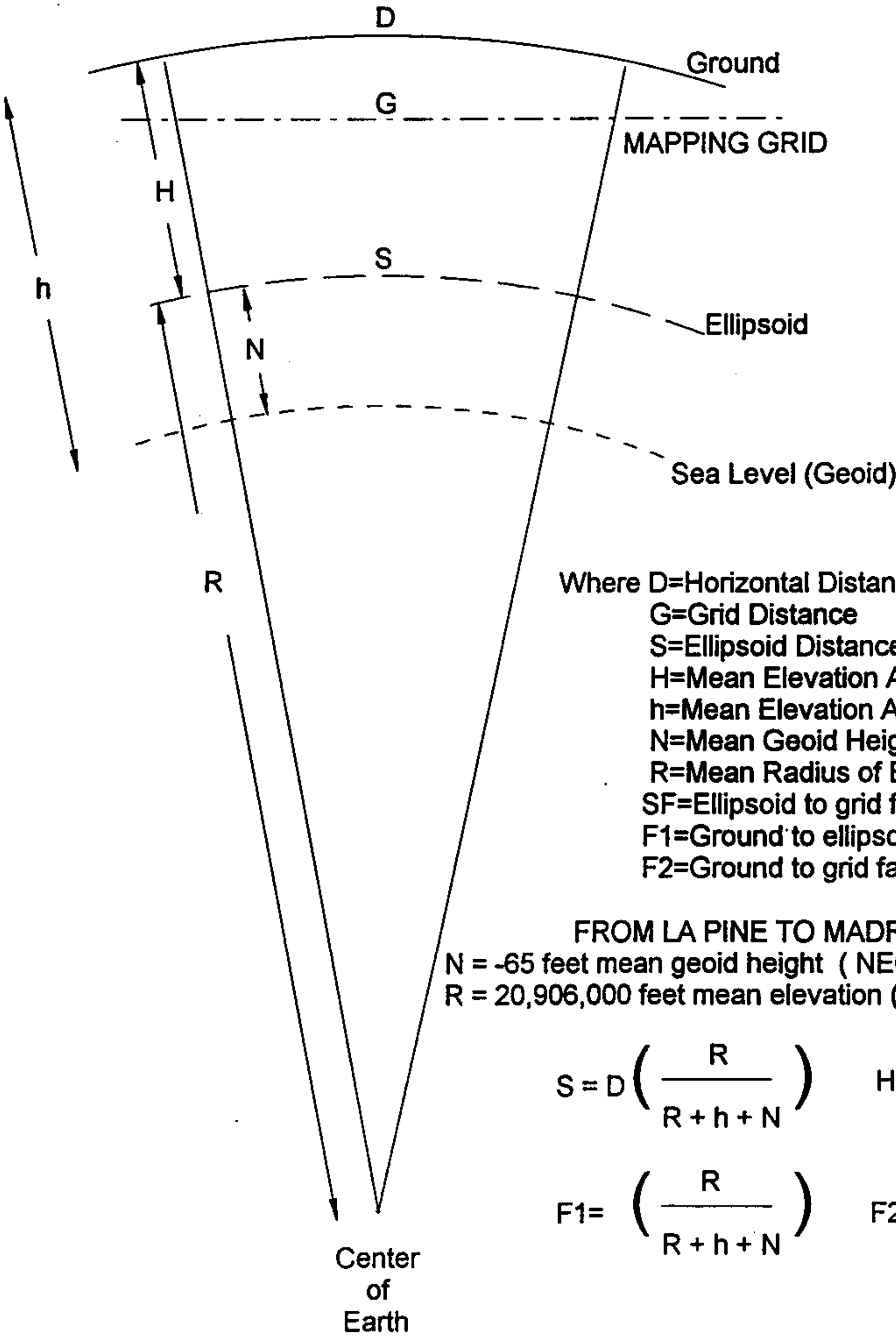
SECTION & QUARTER CORNER NAMING CONVENTION

MARK NAME: 17 12 23 4 0 A

- **17** Township 17 South of the Willamette Base Line
- **12** Range 12 East of the Willamette Principal Meridian
- **23** Section 23
- **4** 4 X 10 chains North from SW. Cor. of Section 23.
- **0** 0 X 10 chains East from SW. Cor. of Section 23.
- **A** More than one important corner in proximity.

Note: The 10 chains is more a fractional part than a distance.

SATISFACTORY APPROXIMATION OF GROUND TO GRID REDUCTION



Where D=Horizontal Distance
G=Grid Distance
S=Ellipsoid Distance
H=Mean Elevation Above Ellipsoid
h=Mean Elevation Above Geoid
N=Mean Geoid Height
R=Mean Radius of Earth
SF=Ellipsoid to grid factor
F1=Ground to ellipsoid factor
F2=Ground to grid factor

FROM LA PINE TO MADRAS

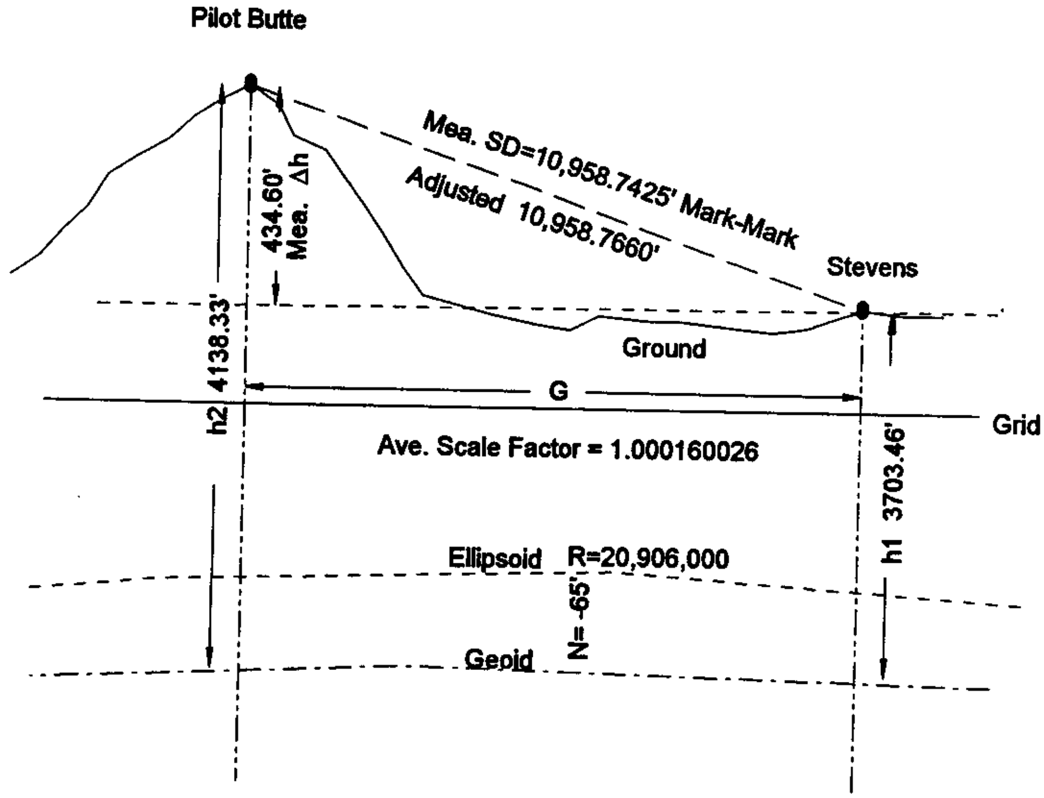
N = -65 feet mean geoid height (NEGATIVE HEIGHT)
R = 20,906,000 feet mean elevation (ELLIPSOID)

$$S = D\left(\frac{R}{R + h + N}\right) \qquad H = h + N$$

$$F1 = \left(\frac{R}{R + h + N}\right) \qquad F2 = SF \times F1$$

NOTE: See NOAA Manual NOS NGS 5, State Plane Coordinate System of 1983 by James E. Stem, for more information on this subject

Transformation of Mark to Mark Distance to Grid Distance



$$G=(SF)\left(\sqrt{\frac{SD^2-\Delta h^2}{\left(1+\frac{h_1+N}{R}\right)\left(1+\frac{h_2+N}{R}\right)}}\right)$$

$$G=1.000160026\sqrt{\frac{10,958.7425^2-434.60^2}{\left(1+\frac{3703.46+(-65)}{20906000}\right)\left(1+\frac{4138.38+(-65)}{20906000}\right)}}$$

$$G=1.000160026\sqrt{\frac{119,905,160.0}{1.00036892}}=1.000160026\sqrt{119860941.3}$$

$$G=1.000160026\cdot 10,948.1022=10,949.8542'$$

Below is the inverse of adjusted coordinates in our data base. As we can see that the measured slope distance from Pilot Butte to Stevens in the EC CARTESIAN column was adjusted by +0.0235 feet, when we add 0.0235 feet to the transformed distance that we computed form the measured slope distance it fits quite well with the inverse of the MAPPING PROJECTION coordinates.

In using a approximation for the radius of the ellipsoid and the geoid height with an average ground to grid factor at intervals for ever 100 feet of elevation should keep the transformation to 1 part to 200,000 or better in a local area.

For more information on this subject see NOAA Technical Memorandum NOS NGS-10 , USE OF CALIBRATION BASE LINES, by Charles J. Fronczek, Appendix I. The geometrical transformation of electronically measured distances.

Datum = NAD-83
Coordinate system = User-Defined Transverse Mercator
Zone = DESCHUTES COUNTY
Linear unit = Internatl Foot

POINT	MAPPING PROJECTION	GEODETIC	EC CARTESIAN
Pt# 19 COORDINATES	N= 386640.6780	N 44°03'37.943010"	X= -7822586.5374
	E= 3300025.6995	W 121°16'59.648110"	Y=-12874379.0293
GIS 31 PILOT BUTTE		H 4073.9731F	Z= 14480943.1881
		h 4138.3327F	
	Az=141°52'23.783806"	NSFA=141°52'24.023877"	D X= +2830.3733
	_=+ 0°00'00.244711"	NSBA=321°53'28.357821"	D Y= -8361.1757
	t-T Corr= +0.004639"	Ell Dist= 10948.1255F	D Z= -6494.1727
	Dist= 10949.8773F	Delta H = -434.6198F	S D= 10958.7660
	Scale=1.000160017592	Delta h = -434.8681F	
INVERSE:		Gnd Dist= 10950.1443F	
		Rad(_)= 20914559.5776F	
		Skew Corr= -0.060692"	
		GsFA=141°52'24.023893"	
		Gsc Dist= 10948.1255F	
		GsBA=321°53'28.357837"	
Pt# 62 COORDINATES	N= 378026.9887	N 44°02'12.883064"	X= -7819756.1641
	E= 3306786.1854	W 121°15'27.117216"	Y=-12882740.2050
STEVENS		H 3639.3533F	Z= 14474449.0154
		h 3703.4646F	

TELEPHONE: 313/981-4600
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P.O.B.

December 7, 1993

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Getting the Most Out of Least Squares

by Sean Curry and Ron Sawyer

"Least squares! I don't do that kind of survey—haven't done a large network in years. Most of our work is just *regular* survey work. Our compass rule works fine, just press a button and the whole thing's balanced. Why would we want to use something as sophisticated as least squares? Anyhow, I'm not quite sure what it does."

Does this sound familiar? Unfortunately, the least squares adjustment method seems to be a mysterious creature to most surveyors. It is frequently thought of as being difficult to learn, or not being applicable to "the type of surveys that I do." The fact is that least squares is not difficult to understand once a few basic principles are explained; more importantly, it is applicable to nearly all types of survey work, including the small "regular" job. It does not require you to make major changes in your daily practice, although certain field procedures enhance its power.

In addition to producing the best adjustment of field data, least squares provides other benefits not even possible with other adjustment methods. It helps you to locate errors in your survey data, gives you an easy way to plan surveys, and provides a statement on the amount of uncertainty for every point in your network. Our goal in this article is to remove the mystery of least squares by explaining, in nonmathematical terms, some of the basic concepts, and to illustrate its application to a number of common surveying problems.

Exactly What Is Least Squares?

A least squares adjustment is a rigorous mathematical method for adjusting survey data. It has actually been used by surveyors for a number of years, but was generally implemented only on mainframe computers and was somewhat difficult to handle for the uninitiated user. With the advent of new high-speed, inexpensive personal computers and especially modern software techniques, least squares is now readily available to every surveyor.

As surveyors we have long recognized that adding extra angle and distance observations adds strength to our surveys and allows for error checking. But we also realize that these extra measurements make the resulting survey computations more complex. What can we do to resolve these redundant observations to arrive at a single set of coordinates for all our points? Some type of adjustment must be applied. In the case of interconnecting traverse loops, arriving at the single best solution can be difficult. In fact, how can you even define a "best" solution?

Various approximate adjustment methods such as the compass rule and transit rule have traditionally been used. But how, for example, do you resolve a multiloop traverse with a compass rule adjustment? You probably attack one loop at a time, first "balancing" the angles by adding the same amount of correction to each angle, and then "correcting" the bearing and distance of each leg, based on some mechanical proportioning of the closure error. Then you move on to the next loop and repeat the process. When all the loops are adjusted, you call it quits if they all fit together pretty well. Otherwise, you might rebalance the loops in some other order to see if the fit gets better.

If this procedure sounds messy and potentially time-consuming, you are right. But even more importantly, it can be shown that the underlying logic of these approximate adjustments is wrong, even for a single traverse loop. Survey errors are random! These methods make assumptions about measurement errors accumulating in proportion to the lengths of traverse legs that just are not true—in fact, they can introduce distortions into the final coordinates that were not present in the original survey.

In addition, approximate adjustment methods provide no means of analyzing your survey. But, you ask, is not a traverse closure good enough? Not at all! It is like your accountant giving you a final bank balance for the year, but not giving you a breakdown of income and expenses by various categories. You would be hard pressed to determine exactly why you ended up where you did financially. Least squares gives you an itemized "accounting sheet" for your survey, showing exactly how each of your field observations fits into the overall survey.

What Does Least Squares Adjust And How?

As a surveyor, you know that all measurements contain errors. In fact, a measurement is only an estimate of the true value, which is never really known. The table below shows three types of errors commonly present in surveying data (although strictly speaking blunders are not errors), and three methods for handling them.

TABLE 1 - Error Types

Error Type	Method for Handling
Blunders (Mistakes, recording errors, etc.)	Eliminate
Systematic Errors (EDM calibration, etc.)	Compensate
Random Errors (Normal, unavoidable)	Adjust with Least Squares

Blunders (mistakes, recording errors, etc.) must be eliminated! No adjustment method can tolerate blunders, although least squares can help you detect and remove them from your field data. Systematic errors, such as in

Why We Use Least Squares

by Glennon J. Watson, LS

The story is all too familiar. You have the commission to survey a 150-acre farm. It is a routine job, or is it? This time there is a public highway crossing in one direction and a utility easement crossing in the other. Of course your code of practice requires you to show all the visible improvements on the property.

The solution is routine—traverse the perimeter, traverse the road, and traverse the utility line, then tie them all together. Easy, right? Easy enough in the field, but what happens when you compute and balance the control traverses? In the first loop you get 1 in 35,000 and one second per station in the angles. Great! The first cross-tie results in 1 in 15,000 and three seconds per station. OK? Probably. The second cross-tie produces 1 in 5000 and 12 seconds per station. No good! Third cross-tie? Even worse.

What happened? We measured all the angles the same way, and we measured all the distances from each end of the line. They all checked. We checked all the abstractions. Twice! We looked them over again—nothing wrong. Sure, we picked up a rounding error here and there, but basically nothing is wrong. What should we do? Unfortunately, some of our peers will make it work, but we are not among them. What would you do?

We would routinely try other solutions. Solving different loops in different orders would often help. Perhaps we lost the 1 in 35,000 loop, as fictitious as it actually was, but we would also improve the third and fourth connections—most of the time. Sometimes we would go back in the field to look for something that really was not there. More often than not we would settle. The baselines met the specification, although they could and should have been better.

Have you ever noticed that the error is not on the first loop you solve, and often it is not on the second? It is the third and fourth connections that get you. There is a reason these connections are the ones that do not work. It is because the errors balanced into the first and second loops were balanced improperly. The method used was prejudiced—it hid the errors rather than balanced them. Some balancing methods put the errors where they will not get in the way—if you are lucky.

Even those of us fortunate enough to own a true least squares adjustment program for single-loop traverses only postpone the inevitable. Simply put, a least squares adjustment places the errors where they

continued

Least Squares In Practice

by Roger A. Frank, PLS

In late 1969, I was first introduced to least squares adjustments while working with the Orange County Surveyor's Office in Santa Ana, California. At that time, most of our "regular" surveys were still being computed with rotary calculators and trig tables with the aid of the compass rule to adjust and close our traverses.

Orange County was in the process of revalidating and densifying its horizontal control network. To adjust this network, the county had obtained a least squares program called Cosmos from the Canadian equivalent of our National Geodetic Survey (NGS). Of course, the program required a computer with a large memory capacity. The county had two computers that took up about 5000 square feet of the engineering building basement. If the computers were linked together, they would have a whopping 128KB of memory. The county surveyor's office used the computers to run Cosmos at night so that we would not interfere with the more important jobs of assessing property, taxing the residents, and last but certainly not least, printing our paychecks.

Data entry was accomplished by hand-lettered, double-checked code sheets. These would be delivered to the keypunch department to be converted to punched cards. We would then manually check the punched cards for accuracy and make our own corrections on an extra keypunch machine. These trays of punched cards would be delivered to the computer services department in the late afternoon to run that night. Each morning we would pick up the results, figure out why it did not work or how the overall adjustment could be better, and after two or three weeks we would obtain a very satisfactory adjustment.

Quite a process, but when we were done we would have an adjustment where all measurements were weighted according to their strengths, along with a set of statistics showing the precision of each measurement and coordinate. This was something that we could have confidence in, and a far cry from what we could do with our rotary calculators, Peters tables, and compass rule.

In 1975, two of us left the Orange County Surveyor's Office to form our own surveying firm. Of course, we tried to keep up with the latest desktop calculators and computers, the HP 9810, (then HP 85s and HP 86s), but nothing that could perform a true least squares network adjustment. I missed the ability to use least squares to properly

continued

electronic distance meter (EDM) calibration, must be compensated for before any adjustment takes place. What is left?

Random errors! These are small unavoidable errors that are an integral part of the measuring process. They are the few seconds difference in angle readings, and the few hundredths difference in distances that you see all the time in the field. They are no cause for concern, except that they must be adjusted correctly, and that is the job least squares does right.

Least squares simultaneously adjusts all field data, even in multiloop traverses. In a least squares adjustment, the "best" solution is defined as the solution producing the smallest changes to the input field measurements. These changes between the best-fit measurements and the original field data are called residuals. Technically speaking, the least squares adjustment method minimizes the sum of the squares of the weighted residuals—hence its name.

But now we have introduced a new term—weight. The weight tells the adjustment how much influence a measurement should have. In least squares each observation (distance, angle, etc.) can be given an individual weight.

The weight you place on your measurements might be based on the type of instrument you are using, the method of observation (chained or EDM distance), and the skill of the field crew. Low weights can be given to less accurately known field data and greater weights to observations that are more accurately known. During the adjustment, larger changes will be given to the less accurate data, minimizing the changes to the more accurate data. For example, an angle with short sights can be given a low weight so that it does not influence stronger angles with longer sights. Table 2 summarizes the relationship between weights, precision, and influence on the adjustment.

TABLE 2 - Weights

	"Strong" Measurement	"Weak" Measurement
Weight	HIGH	LOW
Precision	HIGH	LOW
Influence	HIGH	LOW
Standard Error	LOW	HIGH

This ability to weight individual measurements is only available in least squares, and it gives you the extra control needed to produce the best adjustment. However, least squares does far more than compute the best adjustment. It also provides a complete analysis of the survey, including a list of residuals for all measurements, and a statement on the positional accuracy of each computed point. This analysis can assist in the detection of survey blunders and the preplanning of surveys to meet specified accuracy requirements.

What Are Its Advantages?

Least squares provides a number of advantages over other adjustment methods.

- It is mathematically correct for all types of surveys, including traverses, triangulation, trilateration, resection, and intersection in any combination.

Why We Use Least Squares *continued*

are "statistically most probable to have occurred," not where they actually happened. Unfortunately, cross-ties always seem to find the points where the errors actually occurred.

My partners and I knew that if we practiced in a specific location long enough we would eventually uncover our own errors. That thought has been in our minds since the day we began our practice. Our philosophy has been to isolate and correct those errors as they were found rather than to bury them and hope they disappeared. Over the years we have been careful enough not to have experienced many instances where we had to admit our mistakes. Nevertheless, we have had to admit a few, which is never a comfortable thing to do.

We have all heard about network adjustments. They are exotic routines that were once only used by the National Geodetic Survey. What did they do? Simply put, they considered all the measurements of a traverse network simultaneously rather than one at a time. This simultaneous approach considered the fourth loop at the same time it considered the first. Although it still put the errors where they were statistically most likely to occur, the analysis considered all the data rather than just a part of it.

As a practical matter, the least squares adjustment method was rigorous, costly, and took too long to achieve within the time and budget constraints of a particular job. The fact is, we could meet the specifications for the job using one of the less rigorous routines. So why try harder?

The effort involved in "trying harder" is not just for the individual job. It is for your practice. It is why you traverse around the entire block rather than setting out a single baseline with the hope that you will not have to shove the front corners of your rear adjoiner onto the sidewalk. It is so people believe you when you say you have better evidence and measurements now than you did five years ago.

However, something has finally made our lives easier. For the past two years we have been using STAR*NET—one of a number of available programs—a least squares solution that allows us to solve our traverses. With just a few minutes of additional time we have been able to solve our traverses as networks. I believe the network adjustment could be accomplished in less time, but we have elected to balance the individual loops of the traverses independently before performing the network adjustment. The payoff has resulted in less time spent rechecking material that was checked twice before, fewer returns to the field, and more reliable coordinate values for individual points. The proof of this is not in the abstract, but in the quality of the fourth- and fifth-generation cross-tie traverses added after the adjustment is complete and the map published.

continued

- It computes a *single* solution, no matter how complex the survey.
- It does not distort field data, as do some approximate methods.
- It allows independent weighting of all field observations.
- It allows flexibility during data collection—field data can be collected in any order and configuration.
- It gives you a statement of the accuracy of each computed point.
- It helps detect blunders in field data.
- It helps with survey planning.
- It tells you a lot about the survey.

How Do You Use Least Squares?

You do not need to make major changes to your field procedures in order to use least squares. In fact, least squares adds a lot of flexibility to data collection. Distances and angles can be conveniently collected in any order without worrying about how the survey will be computed, because the adjustment handles all the data simultaneously. Traditionally, cross-ties and extra shots were used mainly to "check in." In least squares, these redundant shots actually become part of the adjustment, adding strength to the survey (more *is* better). Rather than making the survey solution more difficult, redundancies strengthen the survey, make blunder detection easier, and add more confidence that the adjustment is the "best" solution. Also, to make a surveyor's life really easy, additional field data can be added to an existing survey at any time, and the adjustment can be rerun.

```
C    1     1000.00      1000.00
C    5      427.12      3245.55
#
TB   N45-30-40W                        # Backsight to fixed bearing
T    1    123-40-28     537.52
T    2    217-11-37     719.56
T    3    113-53-15     397.66
T    4    260-19-24     996.23
TE   5    121-22-46     N70-56-55E     # End by turn to fixed bearing
#
TB   1                                 # Backsight to known station
T    2    120-11-12     473.25
T    6    -101-32-30    625.76
T    7    198-13-09     533.66
T    8    172-07-27     753.22
T    9    -84-32-20     661.01
TE   5     48-20-00     N70-56-55E     # Close to fixed bearing
#
D    4-8   361.30                      # Extra distance tie
```

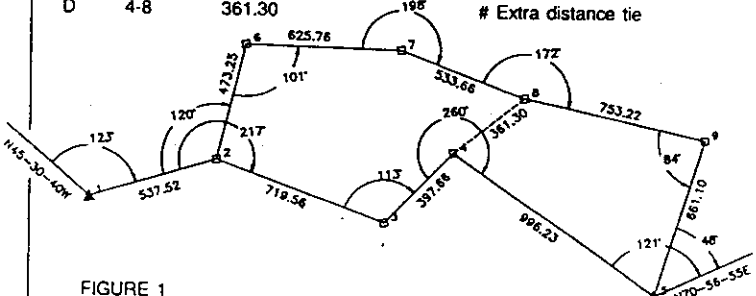


FIGURE 1

Figure 1 illustrates a small survey with two traverse loops and a distance tie between the loops. The two known points have coordinates supplied, and the rest of the field measurements are supplied as angle and distance traverse

Why We Use Least Squares *continued*

I would like to relate two specific instances where we have used a network solution to improve our database and our product.

The first involves the villages of Cold Spring and Nelsonville, New York, which are located in Philipstown where we practice. These villages have seen very little construction during the past 18 years of our practice. However, sales of various parcels have resulted in many surveys for our office. Correspondingly, we have developed a network of approximately 350 traverse points that were connected as the individual surveys were performed. The network became too dense for us to handle because the balancing was done linearly and the inevitable breakdown of the data became apparent. A traverse measured through a block connecting older points might result in a 1 in 3000 closure, but what could we do—the error of closure was only a tenth of a foot and the traverse was only 300 feet long.

During the summer of 1990 our college intern reentered and rebalanced the original field data using the least squares network program. The results are incredible. The reliability of the traverses has improved markedly. The integrity of our network has increased substantially. So far, 285 stations representing traverses around and through about 25 blocks have been entered. Because the adjustment runs so quickly, we have made intermediate adjustments as each section is added to the network. With the simultaneous adjustment we have been able to strengthen every one of those weakened cross-ties. Even before the entire project was successfully completed in the fall, we knew that our control in the villages was substantially better.

The second instance concerns a surveying problem involving a 60-acre parcel that was surveyed in the late 1940s by a firm whose records we own. The original survey was bounded by three earlier surveys the older firm had done prior to surveying the 60 acres. The firm's basic traverse method involved a 30-second transit using two repetitions on string sights and single slope taping. The surveyors made all the proper corrections, but because they had committed to three sides they forced about one foot into the fourth side to make things work. Our method for this survey involved one and two full circle positions with a one-second instrument and double electronic-distance-meter (EDM) observations from each end of each line.

This particular parcel narrowed considerably near its middle so we decided to cross-tie the traverse in that area. Since we had the original notes, we were able to recover and traverse through about 60 percent of the original baseline points. Most of the points, which were on exposed ledge rock, were "4-cuts," a variation of a crosscut that the surveyor used

continued

legs. The sample data field uses a simple code to indicate coordinates (C), traverse lines (TB, TE, and T), and distances (D).

Once the field data has been prepared, you need to decide how the observations will be weighted. You do this by establishing a "standard error" for each observation. Think of the standard error as a way of expressing your confidence in your field data. For example, you might decide that your distances have standard errors of 0.02 feet ±3ppm, and your angles five seconds. These values are normally determined from instrument specifications and observation procedures. In addition, you might choose a centering error of 0.005 feet to account for imprecise instrument centering. This centering error value will increase the standard error value for angles with short sights so that they have less influence in the adjustment than those with long sights. The least squares adjustment will use these standard error values to determine weights for all the field data in order to arrive at the best solution.

Now that you have established the amount of influence that each measurement will have, you can run the adjustment and analyze the output. Although the specifics of running an adjustment depend on the package being used, some output elements are common to most least squares programs. These include:

- A brief summary of the overall strength of the adjustment. This summary often provides a useful breakdown of how individual measurement types (distances, angles, etc.) fit into the adjustment.
- A list of residuals for all input observations. This list is a valuable tool for finding blunders in the survey and for checking the weights you assigned to your input observations.
- A list of adjusted coordinates for all stations in the survey. These coordinates can be trarsferred to your CAD or COGO package.
- A list of the computed positional tolerances (error ellipses) for all stations in the adjustment. The ellipses (to be discussed next) show the amount of uncertainty in the computed position of each point, and can often be viewed graphically.

What Do Error Ellipses Reveal?

Error ellipses are used to indicate the amount of uncertainty in a computed point's position, sometimes called the point's positional tolerance. As one surveyor put it, "It's not that the *point* is uncertain—it's a well-established monument. It's my *idea* of where the point is (as expressed by its coordinates) that has some possible error." If you look at the northing or easting of a point by itself, you can express its error as plus or minus so many hundredths of a foot. However, to show the combined effects of the uncertainty in northing and easting requires an error ellipse.

Why does the point have this positional uncertainty anyway? Again, as the surveyor said, "Surveying is one of the few professions where you rarely get to measure what you really want. You want coordinates, but you have to settle for measuring angles and distances, and then computing coordinates." Remember that all your measurements are affected by small random errors. Therefore, you would expect any value computed from these measurements to also be affected. Least squares, as a part of the solution process, computes how much uncertainty in the coordinates results from the random errors in the field measurements. It is all there in the solution—you do not need to go to any trouble. These positional uncertainties, as represented by the error ellipses, are also affected by the geometry of the survey.

Two simple cases of error ellipses are illustrated in Figure 2. The ellipse dimensions indicate the size of the error region, and the orientation indicates the weaker and stronger directions.

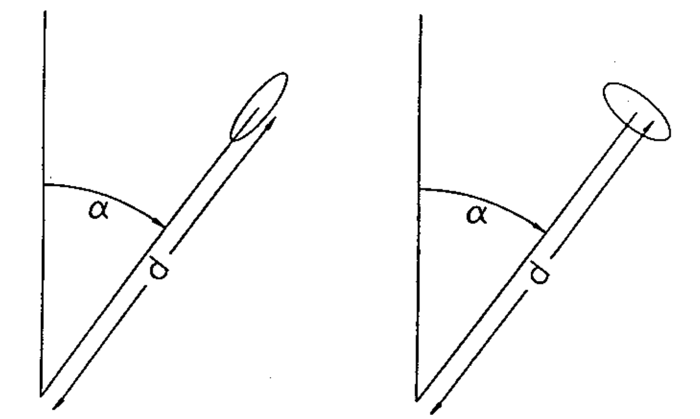
Why We Use Least Squares *continued*

to distinguish his baselines. The solution used the weighting options in the least squares network program. First, we balanced the network of our new measurements as a control. Then we added the older survey measurements, giving them considerably looser constraints, and readjusted. After all the observations were subjected to the network solution, we compared the residuals (the differences between the observed values and the adjusted values) in our angles and distances to those that were produced when our data alone was considered. There was very little change. When we compared the older data (that had been adjusted by the original surveyor) we noticed larger residuals, as might be expected with the older methods. As a result, we were able to isolate errors into specific sections of the earlier survey and replace the corners much closer to the original surveyor's positions than if we had simply translated and rotated his data to fit our new baseline.

The foregoing is not the product of a mathematician. Had it been, the reasons why the least squares network solution works would be explained in detail. Rather, it is the product of a surveyor who tries to deliver a reliable product to his client and still profit from the work. Not only has the use of least squares network solutions enhanced our ability to do both, but it has made it simple to do so. It has improved our product while decreasing the time necessary to reach a solution that meets specifications. We have concluded that a least squares network solution has brought our balancing procedures into line with improvements in our traversing procedures, which occurred when our transit and tape were retired in favor of a theodolite and EDM. ▲

Glennon J. Watson, LS, is a founding partner of Badey & Watson, a surveying and civil engineering firm located in Cold Spring, New York. He has 30 years of surveying experience. Watson is a member of the American Congress on Surveying and Mapping, New York State Association of Professional Land Surveyors, Inc., and New York State Society of Professional Engineers, Inc.

FIGURE 2

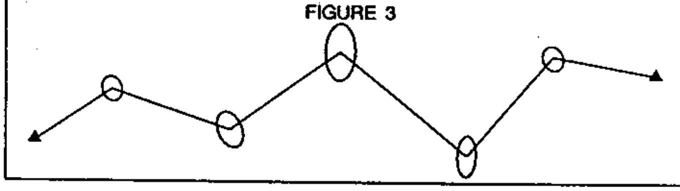


Angle measured with high precision.
Distance measured with low precision.

Angle measured with low precision.
Distance measured with high precision.

In a simple traverse between two fixed points, the error ellipses tend to increase in size according to the point's distance from a fixed station, as shown in Figure 3.

FIGURE 3



You should realize that least squares gives numerical values for the positional uncertainty of each point. For example, Figure 4 shows an actual ellipse that resulted from the adjustment of a multiloop traverse survey. Also shown are the ground dimensions of the error ellipse around the point. Even survey loops that close with very high precision may have large ellipses around the points, depending on the geometry of the survey.

Take the example of the surveyor who traversed through several miles of forest to discover that his newly located section corner was a half a foot away from a monument he found. When he traversed back, he closed to 1:55,000—so should the corner be reset? A least squares adjustment of the survey shows that the error ellipse for the new corner was over 1.5 feet long. This ellipse obviously raises some doubt about whether the new point is really any better than the existing monument. The closing

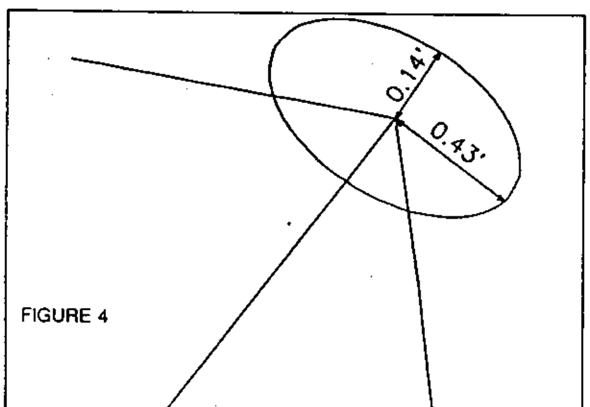


FIGURE 4

continued

weigh and adjust our surveys, which were generally multiloop traverses. While our compass rule programs worked, in order to really use all the data we had to adjust each loop several times, or adjust the big loop and hope the cross connections would fit. This was a tedious and only an approximate procedure.

On several occasions where we had large control nets for cities or a Federal agency, we did manage to coerce the county into adjusting them with Cosmos. During these years, I always had my ear to the ground trying to find a program package to do even a small amount of least squares on computers that a mid-sized surveying firm such as ours could afford.

In 1987, we started converting our office from the tried and true HP 86s to IBM PC compatibles. These newer computers had memory and capabilities rivaling or exceeding the older mainframes we previously used for least squares.

I checked with NGS, which was in the process of converting one of its programs, called Adjust, to work on a PC. We obtained a prerelease copy of this program and used it to adjust an aerial control network of about 70 stations. While the program worked, it was difficult for non-NGS-trained personnel to decipher the instructions and code the inputted data. We also had to break the project into two sections due to capacity limitations.

So we kept looking and came across another reasonably priced package. We purchased it and found data input to be quite easy. During initial testing however, we discovered we would get different answers depending on the order in which the data was entered. In other words, it did not work.

I then acquired (for a nominal donation) a package from one of the top-rated western universities. While this one may have been effective, it had such a lack of documentation that I could never get it to function.

Undaunted by these unsuccessful ventures, in mid-1988 I obtained a commercial package that lives up to its advertisements. The package has usable documentation, easy coding of input data, and a very helpful blunder detection feature. The authors are open to suggestions and the program continues to improve due to input from users.

We can now properly adjust our normal traverses as well as complex networks and have confidence in our results. And, unlike the old days, the process of coding, checking, and adjusting is completed in two to three hours instead of two to three weeks. This tool allows us to do numerous tasks that we were unable to reasonably do before.

Our firm purchased and began using GPS (Global Positioning System) survey equipment for control at about the same time we obtained a workable least squares package. (Of course, our GPS system has its own least squares package that deals with the Earth Centered Three Dimensional Rectangular system but does not work well with conventional surveys). GPS

continued

precision resulting from a compass rule adjustment tells you nothing about the positional accuracies of individual points. Only error ellipses can do that correctly.

A Word About Finding Blunders

As you know by now, blunders cannot be part of the adjustment; they must be located and removed from your field data. Least squares provides some useful tools for locating blunders. Normally, the entire adjustment is subjected to a statistical test (called the Chi Square test for the experts in the crowd) that checks the overall validity of your data, the standard errors that you assigned, and the adjustment results. You do not have to understand statistics to know that if your adjustment fails this test, you had better start looking for the source of the problem. This test is usually a part of the adjustment program, and failing it sounds a warning bell to alert you to a potential problem.

Let us imagine that you carefully prepared your field data, assigned standard errors that really reflect the way you survey, and have run your first least squares adjustment. Unfortunately, the program has told you that your survey "Fails the Test." Should you give up and return to the compass rule, because it never gave you such discouraging news? If you have read this far, you know by now we are not going to allow that.

At this point, you need to perform some detective work, with the adjustment providing all the clues you need to find the source of your problems. There are a number of techniques for finding blunders in a least squares adjustment, including automated blunder detection routines in some software. However, one simple manual technique is to look at the resulting *residuals* on your field data after the adjustment. If everything was perfect, you would expect the residuals to be roughly equal to the standard errors that you chose for your field data. Due to random errors, there will be some variation up and down, but if a residual exceeds three times its standard error, there may be a problem.

TABLE 3 - Checking For Blunders

Residuals in Angles

At	From	To	Adj Angle	Residual	StdErr	StdRes
1	4	2	+58-15-40.22	+0-00-27.22	4.00	6.8*
3	2	4	+129-57-21.68	+0-00-32.68	4.00	8.2*
4	3	1	+99-58-37.68	+0-00-29.68	4.00	7.4*
1	2	6	+61-47-49.93	-0-00-02.07	4.00	0.5
6	1	7	+90-00-02.47	-0-00-02.53	4.00	0.6

Residuals in Distances

At	To	Adj Dist	Residual	StdErr	StdRes
1	2	973.9700	-0.0090	0.030	0.3
2	3	422.5785	0.0675	0.030	2.3
3	4	512.6738	0.0298	0.030	1.0

Table 3 shows an excerpt from an actual adjustment containing a blunder. The last column in the table, called the *standardized residual*, is the ratio of the residuals to the input standard errors. Those with values above 3.0 are flagged to draw your attention to them. You can see imme-

continued

control and conventional surveys with least squares adjustment work hand in hand. One of the great advantages of GPS is that the points do not have to be intervisible. One of the disadvantages of GPS points when later used in conventional surveys, is that they generally are *not* intervisible, and hence no backsight is available. Using least squares we can easily start at one known GPS point with no backsight, conventionally survey to another known point, and adjust between the two. If a third known point is included anywhere in the traverse, sufficient redundancy is introduced to allow complete confidence in this no-backsight, no-check-in-azimuth type of survey.

Given the task of locating a series of intersecting transmission lines in a refinery and determining clearances for additional construction, we measured a baseline along one side of the project, turned horizontal and vertical angles from the ends of this baseline to all the insulators at each end of the subject lines and to the low point of each line, and coded the angles into the least squares program. The software produced the horizontal locations of all the subject lines, the elevation of both ends of each line, and the low point of the catenary. Although these results could have been achieved by other methods, this procedure saved us much time in both the field and the office, and again, we have a lot of confidence in our answers.

When we were surveying the centerline of a winding mountain road with 300-plus courses, most of which were 50 to 100 feet in length but with visibility into a broad river wash on one side, we set a large sight on a known control station in the wash area about two miles away. We then turned angles to this sight at all the traverse points from which it could be seen. Using least squares, this redundant data was easily incorporated into the traverse adjustment along the road and allowed us to have a high level of confidence in our azimuths and in the entire survey. It might be worthy to note here that using this same technique, but turning to a natural sight whose position is not known from a number of points in the survey, should control azimuth nearly as well.

Somewhere in the past I have heard that the difference between a technician and a professional is that the technician uses his education, training, and the available equipment to perform his job as trained or educated, while a professional uses his education, training, and equipment to innovate new, better, or more efficient methods of performing his projects.

The least squares method is a valuable tool that is now readily available to all professional surveyors. It allows these professionals to expand their capabilities to the limits of their imaginations. ▲

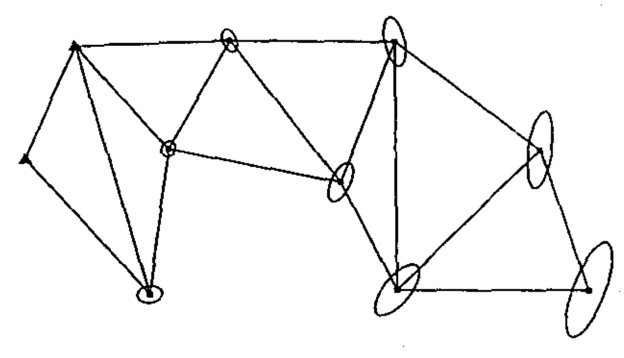
Roger A. Frank, PLS, is a principal of Johnson-Frank & Associates, Inc., a land surveying firm based in Anaheim, California. He is registered in seven western states and specializes in high-order horizontal and vertical control, aerial control, and boundary determination.

diately that there are several very large standardized residuals on the angles. A good place to start looking for blunders would be the angle with the largest standardized residual. That may not always be the one, and you may need to look at the next few angles as well, but it represents a good clue.

Using Preanalysis To Plan Surveys

Least squares can be used to compute the accuracies of survey points, and the relative accuracies between points, *before* any field observations are made. How is this possible? First you supply a list of input station names along with their approximate coordinates scaled from a map or photograph, indicating roughly where the survey points are planned. Then you enter a list of the proposed measurements, using "From and To" station names rather than actual field survey data. Finally, just as in regular data, you need to indicate standard error values for these proposed measurements so that the proper weighting can be applied.

FIGURE 5



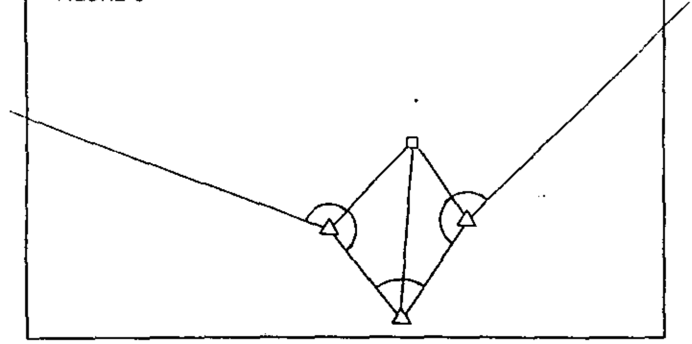
Preanalysis results for a small network. The shape and size of the error ellipses indicate increasing positional uncertainty as we move away from the fixed stations.

The least squares preanalysis will now take this proposed survey and generate computed accuracies (error ellipses) for all survey stations. You can then review the results, and add or delete measurements as needed to meet the required accuracy specifications. Even if the actual survey varies somewhat from the proposed configuration, this technique allows you to develop a general plan for each survey that will result in the most efficient use of your field time.

What Else Can I Use It For?

Because least squares allow so much flexibility in data collection, and because it provides a single "best-fit" solution no matter what kind of survey was performed, you can use it to help you in a variety of field applications. For example, imagine that you. are running a traverse and reach a point where several short legs would be required. You know that the short sights will weaken the traverse, but with least squares you can set an additional point, and observe all possible distances and angles to it. The adjustment will use all the data, and strengthen the corner considerably.

FIGURE 6



Strengthening of traverse with short traverse legs by observing a remote point.

Resections can be easily handled, with any number and combination of angle and distance observations. Least squares will automatically compute the best coordinates, plus produce an error ellipse showing how accurate the resection was. Traversing becomes much more flexible. You can begin with or without a backsight to a known bearing, and close to a known point with or without a closing angle to another known bearing. Solar azimuths, appropriately weighted, can be added wherever needed to strengthen the traverse. Additional distance and angle ties can be observed wherever possible. They will assist with blunder detection and will strengthen the traverse.

Least squares is a powerful adjustment technique that gives you a complete accounting sheet for your surveys. It gives you the best possible results while preserving your field data as much as possible. It provides you with a detailed statement of how each observation fits into the adjustment, and a statement of accuracy for each computed point. All this information allows you to make intelligent and informed decisions about the strength of any particular survey. Least squares also provides tools for locating blunders in field data, and for preplanning surveys to meet accuracy specifications. Least squares is the *only* adjustment method that does justice to your high precision equipment and your good field practice.

Several states and many Federal government agencies are now (or soon will be) requiring the use of least squares adjustments and positional tolerance statements for all surveys, rather than the more traditional traverse closing precisions. In the near future, we will probably look back and wonder how we ever managed without least squares. ▲

Sean Curry, PhD, serves as director of development at STARPLUS Software, Inc. in Oakland, California. He has graduate degrees from the University of California Berkeley in civil engineering. He taught surveying at this same university and has extensive experience in software development for the surveying and photogrammetry communities.

Ron Sawyer serves as director of sales at STARPLUS Software, Inc. He has a Master of Science degree in architectural engineering from the University of Illinois and is a registered civil engineer in the state of California. He has developed software for civil engineers and surveyors both as a private consultant and as a manager of a software service company.

CONTROL

POINTS

HELD

FIX

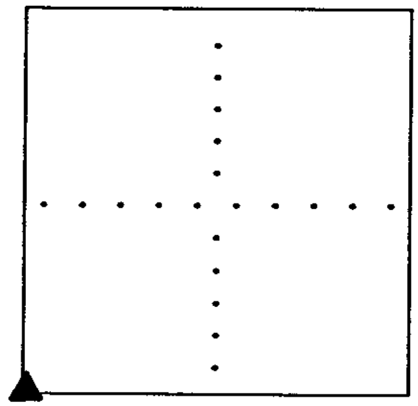
DESCHUTES COUNTY PRIME CONTROL NETWORK
CONTROL STATION DESCRIPTION

NAME: 17142600
GIS # 0026
ORDER C-1st. (GPS)

HORIZONTAL DATUM: NAD 83 (1991)
VERT. DATUM: NGVD 29 & NAVD 88

LATITUDE: 44° 03' 47.48952" N
LONGITUDE: 121° 01' 37.30908" W

STATION LOCATION



T. 17 S.- R. 14 E., SEC.26

------- EC CARTESIAN ---------

X:	-2366562.236	METERS
Y:	-3934415.386	METERS
Z:	+4413842.595	METERS

----------- HEIGHT -----------

ELLIPSOIDAL:	1010.726	METERS
NGVD 29 :	1030.162	METERS
NAVD 88 :	1031.309	METERS

---- SPC -- OREGON SOUTH ------

NORTH:	266358.002±.004	METERS
EAST:	1457773.371±.004	METERS

SCALE FACTOR: 1.000016675
CONVERGENCE: - 0° 21' 38.04 "

The horizontal coordinates & ellipsoidal height was determined by GPS observations constrainted by Oregon High Percision Network. Adjusted by Deschutes Co. Surveyor's Office in July 1991. The orthometric height was determined by GPS.

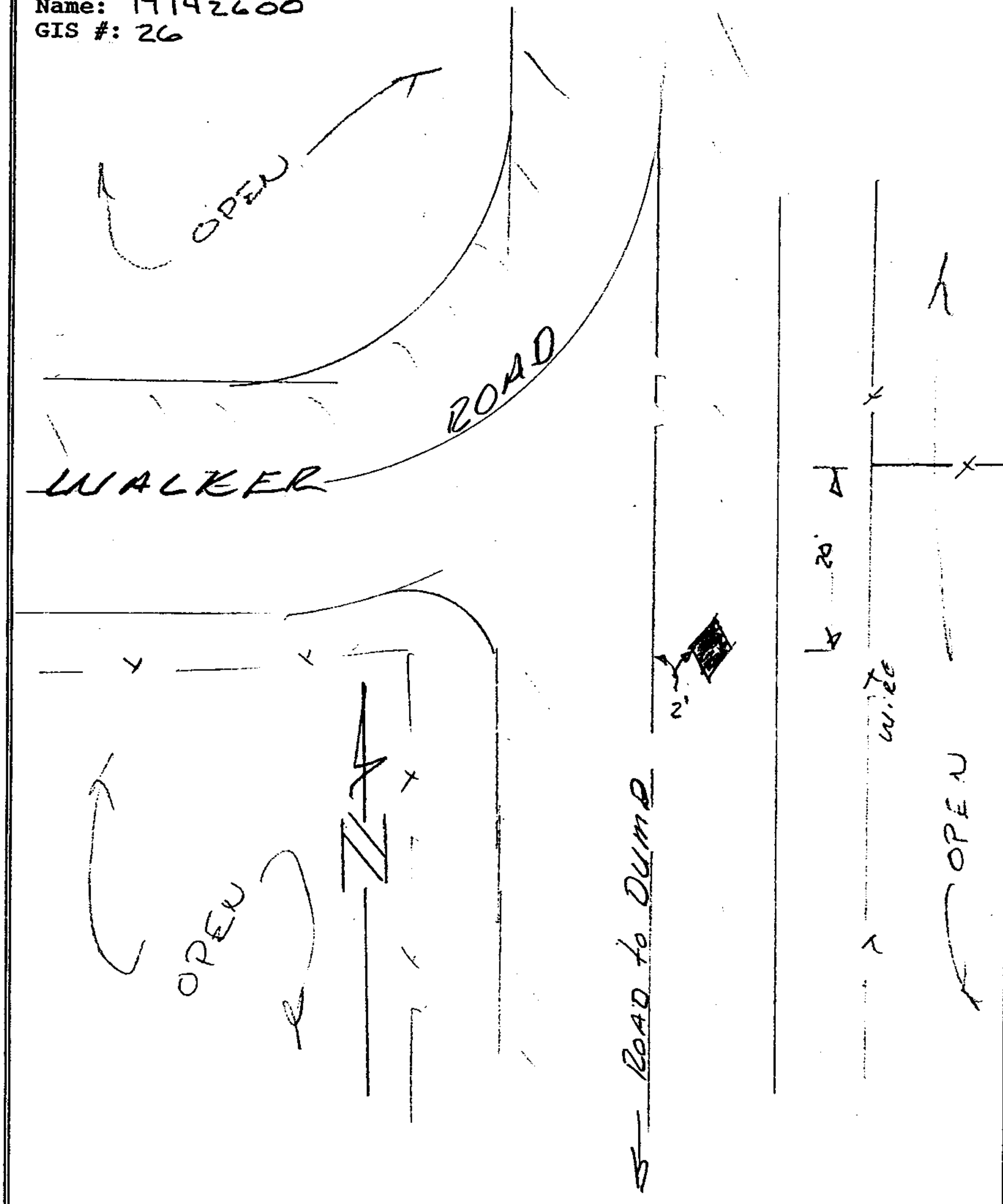
SURFACE MARKER:
MARK IS STAMPED - T 17 S R 14 S 27|26 34|35 1988 LS 1031
AGENCY INSCRIPTION - DESCHUTES COUNTY SURVEYORS OFFICE
THE STATION IS LOCATED ABOUT 13.7 MILES EASTERLY OF BEND.

TO REACH THE STATION FROM BEND, START AT THE INTERSECTION OF US HWY 20 (GREENWOOD AV.) & US HWY 97 (3RD ST.), PROCEED EAST ON HWY 20 FOR 4.25 MI., TURN LEFT ON POWELL BUTTE HWY & PROCEED NORTEAST FOR 0.6 MI., TURN RIGHT ON ALFALFA MARKET RD. & PROCEED EASTERLY FOR 9.40 MILES, TURN RIGHT ON RIGHT ON WALKER ROAD AND PROCEED SOUTH FOR 1.0 MILES TO THE STATION IN A WATER VALVE BOX IN THE CENTER OF THE PAVED ROAD.

THE STATION MARK IS A 3 1/2 IN. STANDARD DESCHUTES COUNTY ALUMINUM DISK ON AN IRON PIPE IN A MASS OF CONCRETE 1.2 FEET BELOW ROAD SURFACE IN A WATER VALVE BOX.
9 FEET WEST OF THE EAST EDGE OF PAVEMENT.

DESCHUTES COUNTY SURVEYOR'S OFFICE
61150 S.E. 27th St.
Bend, Oregon. 97702
(503) 383-4395

Location and refference sketch:
Name: 17142600
GIS #: 26



DESCHUTES COUNTY SURVEYOR'S OFFICE
61150 S.E. 27th. St.
Bend, Oregon. 97702
(503) 383-4395

DEPARTMENT OF COMMERCE
NOAA - NOS - C&GS
NATIONAL GEODETIC SURVEY

PUBLICATION DATE: APRIL 26, 1991
USGS QUAD SHEET: BROTHERS

BROTHERS

PID: PB0791

HORIZONTAL DATUM: NAD 83 (1991)
VERTICAL DATUM: NGVD 29

STATE: OREGON
COUNTY: DESCHUTES

LATITUDE:	43° 48' 49.79156" N	±0.00010	SECONDS
LONGITUDE:	120° 36' 01.00060" W	±0.00010	SECONDS
ORTHOMETRIC HEIGHT:	1412.74		METERS
	4635.0		FEET

GEOID HEIGHT:	-18.332		METERS
ELLIPSOIDAL HEIGHT:	1394.222	±0.030	METERS
X:	4768562.584		METERS
Y:	-2776310.160		METERS
Z:	-3191074.265		METERS

HORIZONTAL NETWORK ORDER: B
VERTICAL NETWORK ORDER: THIRD
ELLIPSOIDAL HEIGHT ORDER: SECOND CLASS III

THE HORIZONTAL COORDINATES WERE ESTABLISHED BY GPS OBSERVATIONS AND ADJUSTED BY THE NATIONAL GEODETIC SURVEY IN FEBRUARY 1991
THE ORTHOMETRIC HEIGHT WAS DETERMINED BY DIFFERENTIAL LEVELING.
THE GEOID HEIGHT WAS DETERMINED BY GEOID90.
THE ELLIPSOIDAL HEIGHT WAS DETERMINED BY GPS OBSERVATIONS.

HORIZONTAL DATUM SHIFT	LATITUDE	LONGITUDE	
NAD83 minus NAD27	-00.5"	+04.0"	(Based on Nadcon Interpolation)

PLANE COORDINATES

GRID	ZONE	NORTHING METERS	EASTING METERS	POINT SCALE FACTOR	CONVERGENCE DEG MIN SEC
SPC	OR S	238,523.649	1,491,932.322	0.99995802	- 0 04 7.0
UTM	10	4,853,994.766	692,998.579	1.00005816	+ 1 39 42.8

STATION MARK IS A .... SURVEY DISK
WITH SETTING .... TOP OF CONCRETE MONUMENT (ROUND)
THE MARK IS STAMPED ... BROTHERS 1989

STATION MARK HISTORY

YEAR MONUMENTED OR RECOVERED	CONDITION OF MARK	RECOVERED OR DESCRIBED BY
1989	STATION MONUMENTED	DESCHUTES COUNTY OREGON

(Continued on Next Page)

DEPARTMENT OF COMMERCE
NOAA - NOS - C&GS
NATIONAL GEODETIC SURVEY

PUBLICATION DATE: APRIL 26, 1991
USGS QUAD SHEET: BROTHERS

BROTHERS

PID: PB0791

STATION DESCRIPTION

DESCRIBED 1989
THE STATION IS LOCATED ON EAST SIDE OF BROTHERS, OREGON.
TO REACH FROM BROTHERS START AT THE INTERSECTION OF US HIGHWAY 20 AND CAMP CREEK ROAD (COUNTY ROAD NUMBER 5114) GO NORTH ON CAMP CREEK ROAD ABOUT .10 KM (0.06 MI) AND THE STATION ON THE RIGHT.
THE STATION IS 10.7 M (35.1 FT) SOUTHEAST OF THE CENTER OF CAMP CREEK ROAD, 1 M (3.3 FT) SOUTHEAST OF A FENCE AND IN THE NORTHEAST CORNER OF THE BROTHERS OASIS REST AREA.
DESCRIBED BY WILLIAM C. KAUFFMAN OF DESCHUTES COUNTY.

CONTROL MARK DATA

NAME OF MARK: C-463 COUNTY: CROOK

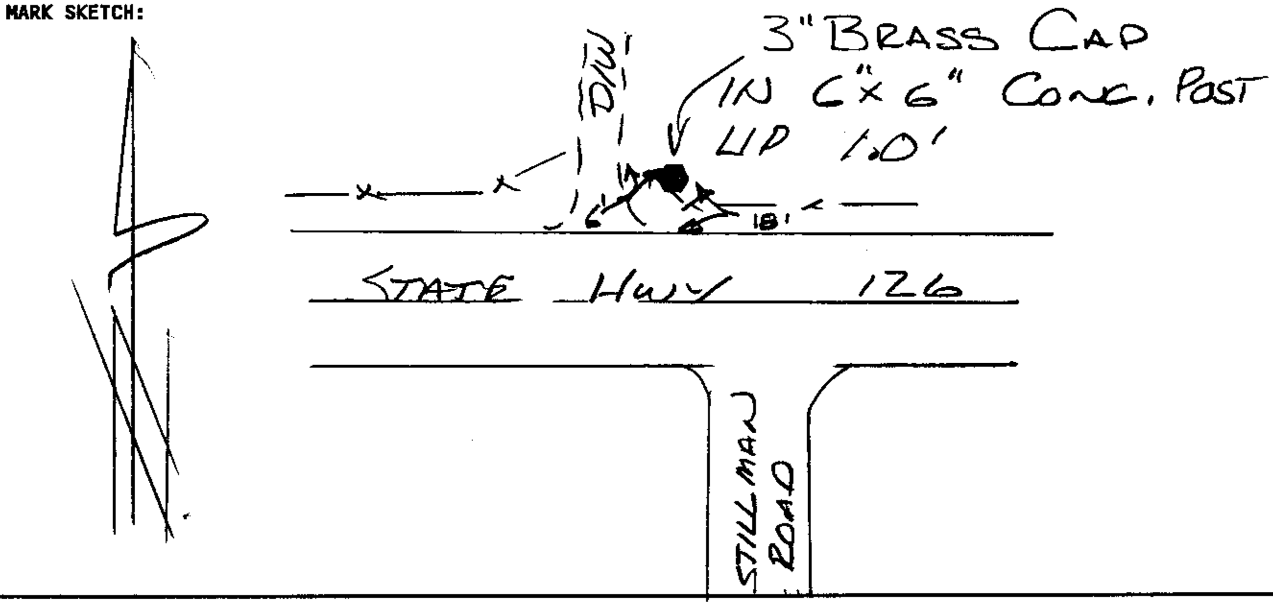
MARK SET BY: U.S. C. & G.S. STATE: OREGON

DATE OF MARK: 1936 COUNTRY: U.S.A.

LOCATION: SECTION 20 TOWNSHIP 15 S. RANGE 15 E. MERIDIAN: WILLAMETTE

REFERENCE NUMBER: NONE

MARK SKETCH:



DATA COMPUTED BY: DESCHUTES COUNTY SURVEYOR'S OFFICE DATE: 1994

FIELD METHOD: GPS FIELD EQUIPMENT: TRIMBLE 4000ST ADJUSTED WITH: TRIMNET PLUS

DATUM: HOIZONTAL= NAD (83-91) CENTRAL MERIDIAN: W 121°17'00.000000"

VERTICAL= NGVD 29 LATUIDE OF ORIGIN: N 43°00'00.000000"

COORDINATE SYSTEM: TRANSVERSE MERCATOR ORIGIN NORTHING: 0.0000 F

ZONE: DESCHUTES COUNTY ORIGIN EASTING: 3,300,000.0000 F

LINEAR UNITS: INTERNATIONAL FOOT SCALE ALONG MERIDIAN: 1.000160000000

GEODETIC AND MAPPING COORDINATES

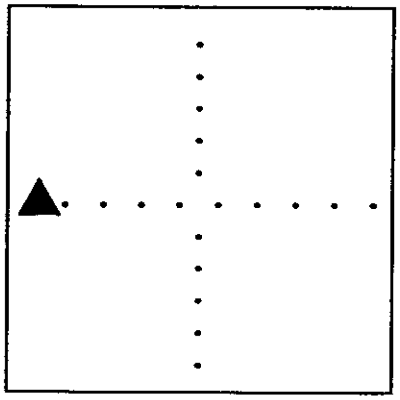
MARK: C-463 HORIZONTAL ORDER: FIRST

		ONE SIGMA ERROR
Latitude:	44°14'51.087520"	
Longitude:	120°57'45.313982"	
Northing:	454981.2495	0.015
Easting:	3384064.0886	0.014
Convergence:	+ 0°13'25.6975"	
Scale Factor:	1.000168069520	
Ellipsoid Height:	3169.2169	0.020
Orthometric Height:	3232.9757	FIXED
Geoid Height:	-63.7588	

DESCHUTES COUNTY PRIME CONTROL NETWORK
CONTROL STATION DESCRIPTION

NAME: GIS 0024
GIS # 0024
ORDER C-1st. (GPS)

STATION LOCATION



T. 17 S.- R. 14 E., SEC. 2

HORIZONTAL DATUM: NAD 83 (1991)
VERT. DATUM: NGVD 29 & NAVD 88

LATITUDE: 44° 07' 28.46935" N
LONGITUDE: 121° 01' 37.71932" W

------- EC CARTESIAN ---------

X:	-2364118.671	METERS
Y:	-3930335.256	METERS
Z:	+4418733.026	METERS

----------- HEIGHT ------------

ELLIPSOIDAL:	997.990	METERS
NGVD 29 :	1017.420	METERS
NAVD 88 :	1018.553	METERS

---- SPC -- OREGON SOUTH ------

NORTH:	273178.643±.005	METERS
EAST:	1457807.173±.004	METERS

SCALE FACTOR: 1.000034051
CONVERGENCE: - 0° 21' 38.32 "

The horizontal coordinates & ellipsoidal height was determined by GPS observations constrainted by Oregon High Percision Network. Adjusted by Deschutes Co. Surveyor's Office in July 1991. The orthometric height was determined by GPS.

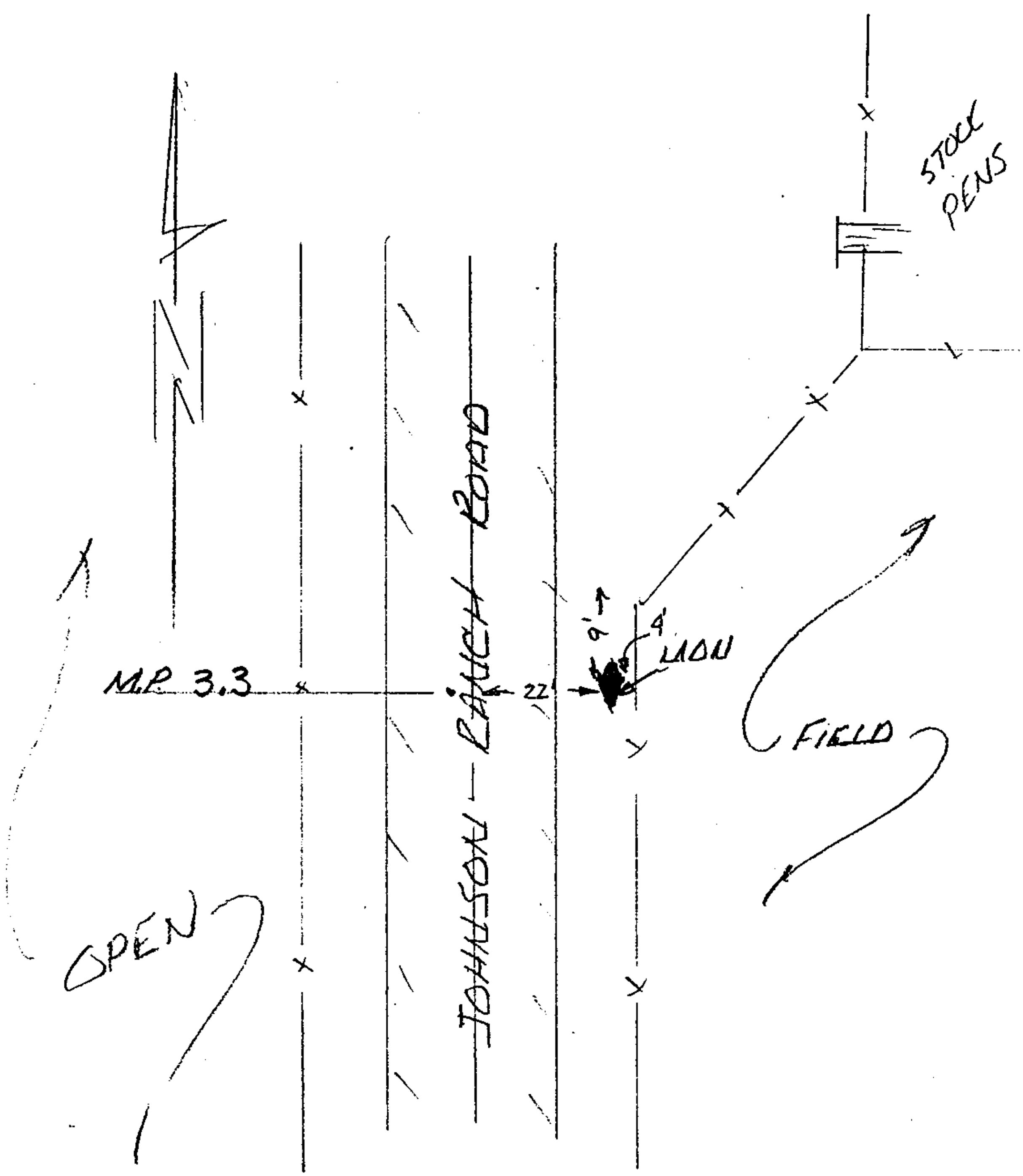
SURFACE MARKER:
MARK IS STAMPED - GIS 0024 1988 LS 1031
AGENCY INSCRIPTION - DESCHUTES COUNTY SURVEYORS OFFICE
THE STATION IS LOCATED ABOUT 14.4 MILES EASTERLY OF BEND.

TO REACH THE STATION FROM BEND,START AT THE INTERSECTION OF US HWY 20 (GREENWOOD AV.) & US HWY 97 (3RD ST.), PROCEED EAST ON HWY 20 FOR 4.25 MI., TURN LEFT ON POWELL BUTTE HWY & PROCEED NORTEAST FOR 0.6 MI., TURN RIGHT ON ALFALFA MARKET RD. & PROCEED EASTERLY FOR 9.40 MILES, TURN RIGHT ON JOHNSON RANCH ROAD AND PROCEED NORTH FOR 3.23 MILES TO THE STATION ON THE RIGHT.

THE STATION MARK IS A 3 1/2 IN. STANDARD DESCHUTES COUNTY ALUMINUM DISK IN A MASS OF CONCRETE 0.3 FEET ABOVE GROUND LEVEL.
3.7 FEET WEST OF A WIRE FENCE.
12 FEET EAST OF THE EAST EDGE OF JOHNSON RANCH ROAD.

DESCHUTES COUNTY SURVEYOR'S OFFICE
61150 S.E. 27th St.
Bend, Oregon. 97702
(503) 383-4395

Location and refference sketch:
Name: GIS 0024
GIS #: 24

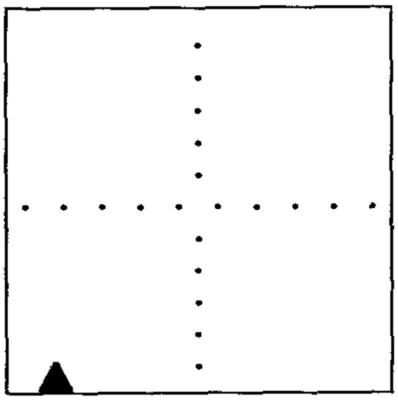


DESCHUTES COUNTY SURVEYOR'S OFFICE
61150 S.E. 27th. St.
Bend, Oregon. 97702
(503) 383-4395

DESCHUTES COUNTY PRIME CONTROL NETWORK
CONTROL STATION DESCRIPTION

NAME: J-372 1943
GIS # 0058
ORDER C-1st. (GPS)

STATION LOCATION



T. 19 S.- R. 15 E., SEC.31

HORIZONTAL DATUM: NAD 83 (1991)
VERT. DATUM: NGVD 29 & NAVD 88

LATITUDE: 43° 52' 26.95459" N
LONGITUDE: 120° 59' 04.31007" W

------- EC CARTESIAN ---------

X:	-2371247.514	METERS
Y:	-3948833.184	METERS
Z:	+4398902.226	METERS

----------- HEIGHT -----------

ELLIPSOIDAL:	1269.286	METERS
NGVD 29 :	1288.326	METERS
NAVD 88 :	1289.523	METERS

---- SPC -- OREGON SOUTH ------

NORTH:	245333.680±.006	METERS
EAST:	1461056.966±.006	METERS

SCALE FACTOR: 0.999970454
CONVERGENCE: - 0° 19' 53.37 "

The horizontal coordinates & ellipsoidal height was determined by GPS observations constrainted by Oregon High Percision Network. Adjusted by Deschutes Co. Surveyor's Office in July 1991. The orthometric height was determined by differential leveling.

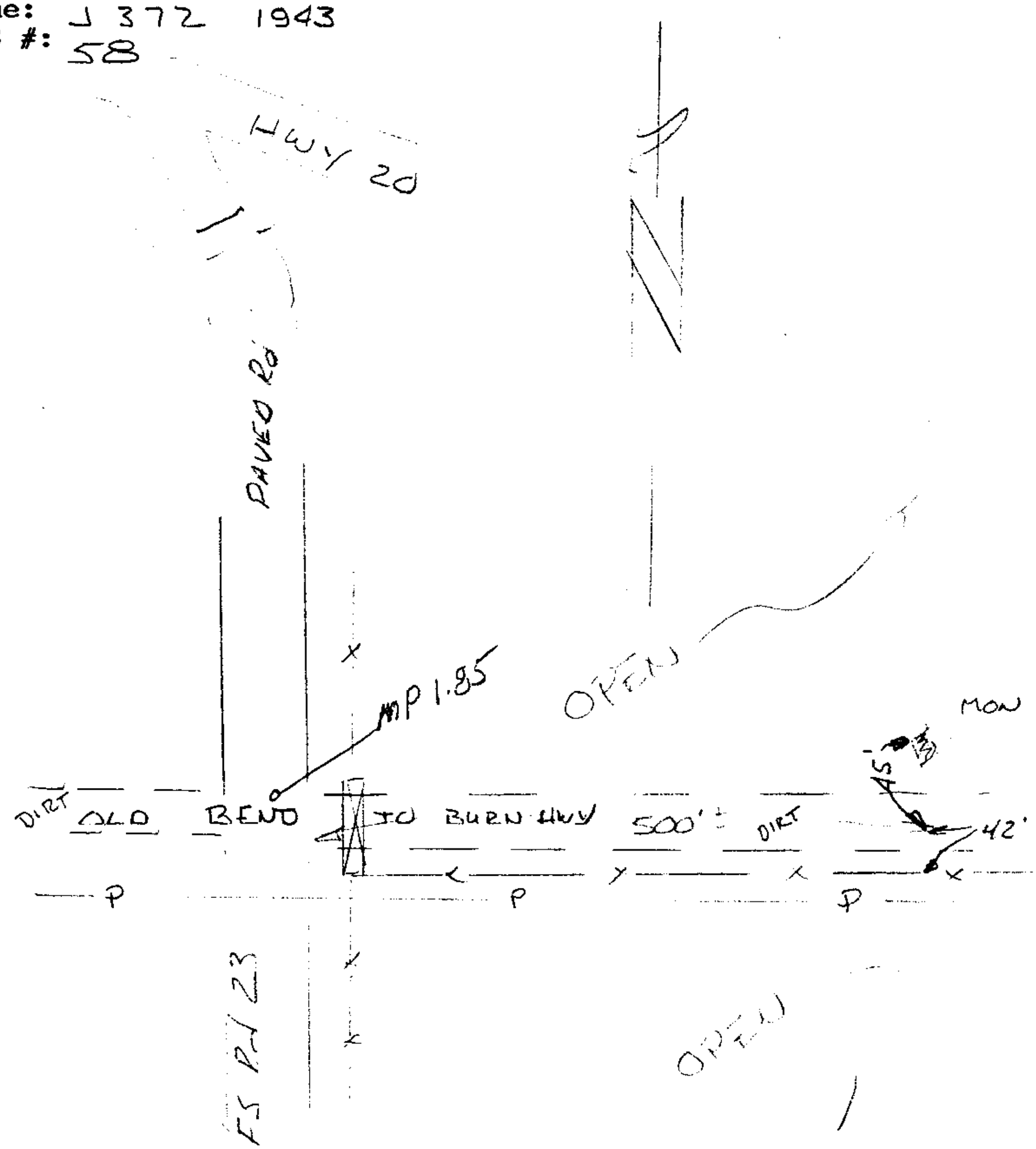
SURFACE MARKER:
MARK IS STAMPED - J 372 1943
AGENCY INSCRIPTION - USC & GS
THE STATION IS LOCATED ABOUT 3 MI. WESTERLY OF MILLICAN.

TO REACH THE STATION FROM MILLICAN, GO WESTERLY ON HWY 20 FOR 3.7 MI., TURN LEFT ON SPENCER WELLS ROAD (FOREST ROAD 23) PROCEED SOUTH FOR 1.85 MI. TURN LEFT ON A DIRT ROAD AND PROCEED WEST FOR 680 FEET TO THE STATION ON THE LEFT.

THE STATION MARK IS A 3 1/2 IN. BRASS CAP IN A CONCRETE POST
0.6 FEET ABOVE GROUND LEVEL.
60 FEET NORTH OF A WIRE FENCE
680 FEET EAST OF THE CENTER LINE SPENCER WELLS RD.
1 FEET SOUTH OF A WITNES POST
45 FEET NORTH OF THE DIRT ROAD.

DESCHUTES COUNTY SURVEYOR'S OFFICE
61150 S.E. 27th St.
Bend, Oregon. 97702
(503) 383-4395

Location and refference sketch:
Name: J 372 1943
GIS #: 58

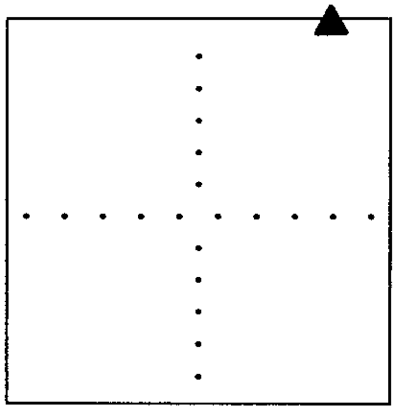


DESCHUTES COUNTY SURVEYOR'S OFFICE
61150 S.E. 27th. St.
Bend, Oregon. 97702
(503) 383-4395

DESCHUTES COUNTY PRIME CONTROL NETWORK
CONTROL STATION DESCRIPTION

NAME: P-372 1943
GIS # 0059
ORDER C-1st. (GPS)

STATION LOCATION



T. 20 S.- R. 16 E., SEC.06

HORIZONTAL DATUM: NAD 83 (1991)
VERT. DATUM: NGVD 29 & NAVD 88

LATITUDE: 43° 52' 16.02375" N
LONGITUDE: 120° 50' 50.06584" W

------- EC CARTESIAN ---------

X:	-2361909.360	METERS
Y:	-3954722.572	METERS
Z:	+4398679.191	METERS

----------- HEIGHT ------------

ELLIPSOIDAL:	1298.456	METERS
NGVD 29 :	1317.291	METERS
NAVD 88 :	1318.484	METERS

---- SPC -- OREGON SOUTH ------

NORTH:	244941.530±.007	METERS
EAST:	1472089.866±.005	METERS

SCALE FACTOR: 0.999969801
CONVERGENCE: - 0° 14' 15.23 "

The horizontal coordinates & ellipsoidal height was determined by GPS observations constrainted by Oregon High Percision Network. Adjusted by Deschutes Co. Surveyor's Office in July 1991. The orthometric height was determined by differential leveling.

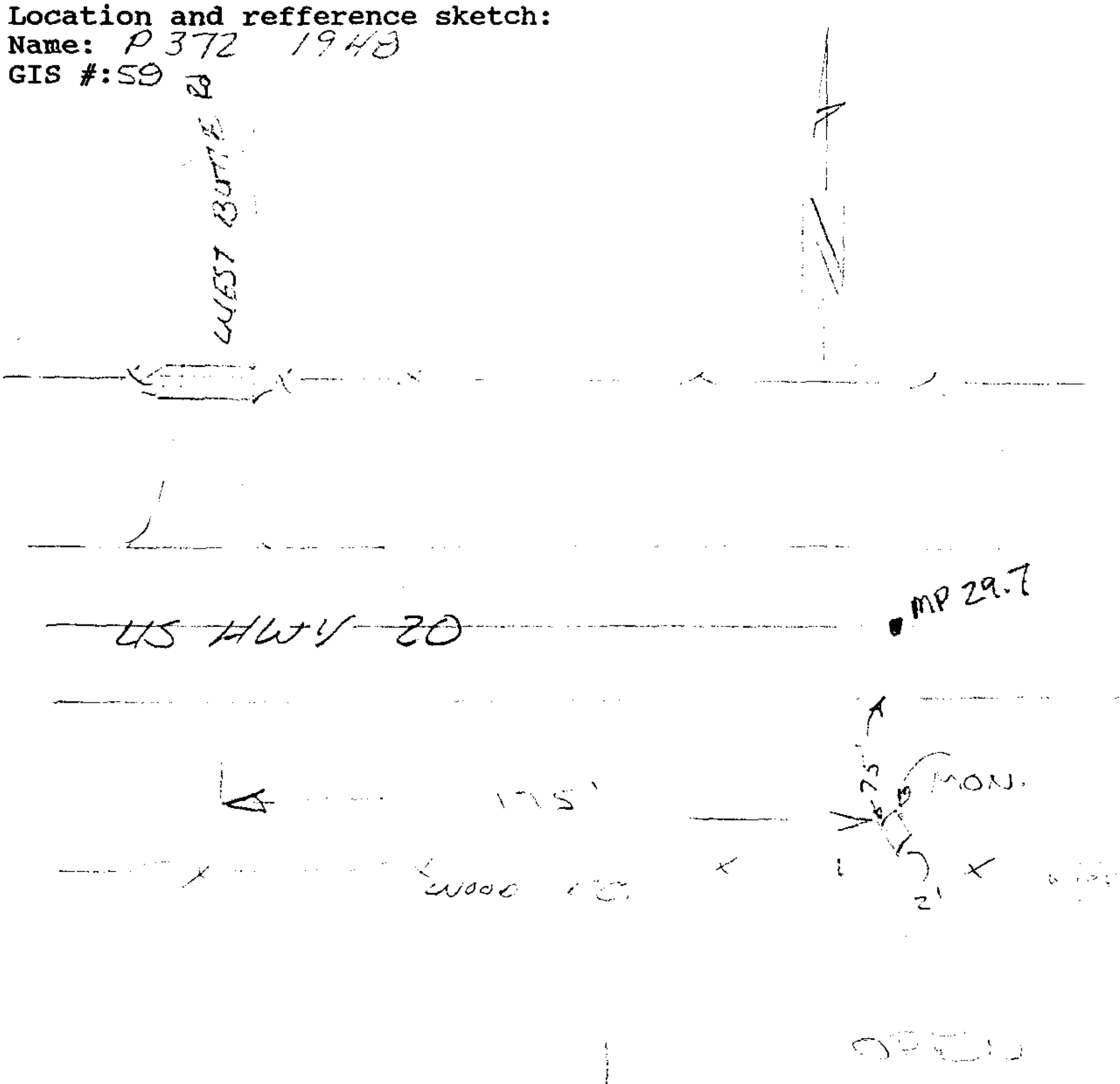
SURFACE MARKER:
MARK IS STAMPED - P 372 1943
AGENCY INSCRIPTION - USC & GS
THE STATION IS LOCATED ABOUT 3.2 MILES EASTERLY OF MILLICAN.

TO REACH THE STATION FROM MILLICAN, GO EASTERLY ON HWY 20 FOR 3.8 MI. TO THE STATION ON THE RIGHT.

THE STATION MARK IS A 3 1/2 IN. BRASS CAP IN A CONCRETE POST
0.2 FEET ABOVE GROUND LEVEL.
1.7 FEET NORTH OF A WIRE FENCE
150 FEET EAST OF THE CENTER LINE WEST BUTTE RD.
1 FEET NORTH OF A WITNES POST
82 FEET SOUTH OF THE SOUTH EDGE OF HWY 20.

DESCHUTES COUNTY SURVEYOR'S OFFICE
61150 S.E. 27th St.
Bend, Oregon. 97702
(503) 383-4395

Location and refference sketch:
Name: P 372 1948
GIS #: 59



DESCHUTES COUNTY SURVEYOR'S OFFICE
61150 S.E. 27th. St.
Bend, Oregon. 97702
(503) 383-4395

DEPARTMENT OF COMMERCE
NOAA - NOS - C&GS
NATIONAL GEODETIC SURVEY

PUBLICATION DATE: APRIL 26, 1991
USGS QUAD SHEET: BEND

PILOT BUTTE

PID: QD1681

HORIZONTAL DATUM: NAD 83 (1991)
VERTICAL DATUM: NGVD 29

STATE: OREGON
COUNTY: DESCHUTES

LATITUDE:	44° 03′ 37.94301″ N	±0.00010	SECONDS
LONGITUDE:	121° 16′ 59.64811″ W	±0.00020	SECONDS

ORTHOMETRIC HEIGHT: { 1261.4 METERS / 4138. FEET

GEOID HEIGHT:	-19.433		METERS
ELLIPSOIDAL HEIGHT:	1241.747	±0.034	METERS
X:	1801468.589		METERS
Y:	2876581.605		METERS
Z:	5383440.509		METERS

HORIZONTAL NETWORK ORDER: B
ELLIPSOIDAL HEIGHT ORDER: SECOND CLASS III

THE HORIZONTAL COORDINATES WERE ESTABLISHED BY GPS OBSERVATIONS
AND ADJUSTED BY THE NATIONAL GEODETIC SURVEY IN FEBRUARY 1991
THE ORTHOMETRIC HEIGHT WAS DETERMINED BY VERTICAL ANGLE OBSERVATIONS.
THE GEOID HEIGHT WAS DETERMINED BY GEOID90.
THE ELLIPSOIDAL HEIGHT WAS DETERMINED BY GPS OBSERVATIONS.

HORIZONTAL DATUM SHIFT	LATITUDE	LONGITUDE	
NAD83 minus NAD27	-00.58599″	+04.10711″	(Based on Adjusted Positions)

PLANE COORDINATES

GRID	ZONE	NORTHING METERS	EASTING METERS	POINT SCALE FACTOR	CONVERGENCE DEG MIN SEC	*GRID AZIMUTH TO PILOT BUTTE AZ MK DEG MIN SEC
SPC	OR S	266,223.939	1,437,243.481	1.00001595	- 0 32 9.1	267 51 56.9
SPC	OR N	44,073.993	2,437,239.542	1.00007981	- 0 33 19.7	267 52 56.9
UTM	10	4,880,029.657	637,500.737	0.99983253	+ 1 11 38.6	266 08 09.2

(*ARC-TO-CHORD CORRECTION NOT APPLIED)

(Continued on Next Page)

DEPARTMENT OF COMMERCE
NOAA - NOS - C&GS
NATIONAL GEODETIC SURVEY

PUBLICATION DATE: APRIL 26, 1991
USGS QUAD SHEET: BEND

PILOT BUTTE

PID: QD1681

STATION MARKS AND REFERENCE OBJECTS

PID	REFERENCE OBJECT	DISTANCE	GEODETIC AZIMUTH
QD1680	PILOT BUTTE USGS 1932	10.270 METERS	030 17
	PILOT BUTTE RM 1	184.670 METERS	151 40
QD1679	SCENIC PIER ARROW PIVOT S 1945	7.814 METERS	158 27
QD1678	BEND WATER TANK	APPROX. 4.0 KM	188 02 02.9
	PILOT BUTTE RM 2	127.580 METERS	247 32
QD1683	BEND BROOKS SCANLON INC TANK	APPROX. 3.5 KM	247 41 28.4
	PILOT BUTTE AZ MK		267 19 47.8
QD1687	BEND PACIFIC GAS MICROWAVE	APPROX. 4.3 KM	295 30 55.1
QD1688	BEND BONNIVILLE POW ADM RD MST	APPROX. 4.3 KM	295 50 23.0
QD1685	BEND RAD STA KBND NW MAST	APPROX. 1.9 KM	329 34 53.6
QD1686	BEND RAD STA KBND SE MAST	APPROX. 1.9 KM	331 20 53.0
QD1682	SCENIC PIER ARROW PIVOT N 1945	6.209 METERS	338 44
QD1689	BEND RAD STA KGRL MAST	APPROX. 2.1 KM	358 24 40.9

STATION MARK IS A .... HORIZONTAL CONTROL DISK
WITH SETTING .... TOP OF CONCRETE MONUMENT (ROUND)
THE MARK IS STAMPED ... PILOT BUTTE 1932

STATION MARK HISTORY

YEAR MONUMENTED OR RECOVERED	CONDITION OF MARK	RECOVERED OR DESCRIBED BY
1932	STATION MONUMENTED	COAST AND GEODETIC SURVEY
1945		COAST AND GEODETIC SURVEY (CAG)
1958	GOOD	US GEOLOGICAL SURVEY
1959		BONNEVILLE POWER ADMINISTRATION
1966	GOOD	US GEOLOGICAL SURVEY
1971		NATIONAL GEODETIC SURVEY (LDF)
1987	GOOD	NATIONAL GEODETIC SURVEY (LLR)
1989	GOOD	LOCAL SURVEYOR (INDIVIDUAL OR FIRM)

STATION DESCRIPTION

DESCRIBED BY COAST AND GEODETIC SURVEY 1932

STATION IS LOCATED ABOUT 1.0 MILE E OF BEND ON THE TOP OF PILOT BUTTE.

STATION MARK IS A STANDARD BRONZE DISK SET IN CONCRETE AS DESCRIBED IN NOTE 1A. REFERENCE MARKS ARE STANDARD BRONZE DISKS IN OUTCROPPING BEDROCK AS DESCRIBED IN NOTE 12A.

U.S.G.S., PILOT BUTTE IS A U.S.G.S. STANDARD DISK IN OUTCROPPING BEDROCK NNE OF STATION.

REFERENCE MARK NO.1 IS WNW OF STATION.

SCENIC PIERS ARE NW AND SE OF STATION.

WATER TANK, (AZIMUTH MARK) IS S OF STATION.

(Continued on Next Page)

PILOT BUTTE

PID: QD1681

REFERENCE MARK NO.2 IS WSW OF STATION.

STATION IS REACHED FROM BEND BY GOING E ON THE GREENWOOD AVENUE OR BURNS HIGHWAY FOR ABCUT 3/4 MILE TO THE JUNCTION WITH THE PILOT BUTTE ROAD. TAKE THE PILOT BUTTE ROAD AND FOLLOW THE CORKSCREW ROAD TO THE TOP OF THE BUTTE AND THE STATION.

HEIGHT OF SIGNAL ABOVE STATION MARK - 1-1/2 METERS.

STATION RECOVERY (1945)

RECOVERED BY COAST AND GEODETIC SURVEY 1945 (CAG)
THE STATION AND ALL MARKS WERE RECOVERED AS DESCRIBED AND FOUND IN GOOD CONDITION WITH THE EXCEPTION OF REFERENCE MARK NO. 1 WHICH COULD NOT BE RECOVERED AND IS BELIEVED TO HAVE BEEN DESTROYED BY ROAD CONSTRUCTION. AN AZIMUTH MARK WAS ESTABLISHED.

A COMPLETE NEW DESCRIPTION FOLLOWS.

THE STATION IS LOCATED ABOUT 1 MILE EAST OF BEND ON THE HIGHEST PART OF PILOT BUTTE AND IS IN THE CENTER OF A TRAFFIC CIRCLE. IT IS DESCRIBED BY NOTE 1A AND IS FLUSH WITH THE SURFACE OF THE GROUND. IT IS STAMPED PILOT BUTTE 1932.

U.S.G.S. MARK IS A STANDARD DISK B.M. TABLET SET IN A SMALL LAVA BOULDER THAT IS FLUSH WITH THE GROUND SURFACE. IT IS STAMPED PILOT BUTTE 4136 1916.

REFERENCE MARK NO. 2 IS SET IN A LARGE BOULDER THAT PROJECTS ABOUT 3 FEET. IT IS ABOUT 5 FEET BELOW STATION ELEVATION. IT IS DESCRIBED BY NOTE 12C AND IS STAMPED PILOT BUTTE NO 2 1932.

SCENIC PIER, ARROW PIVOT, NORTH. IT IS A SMALL TOWER 3.5 FEET HIGH AND 2X2 FEET SQUARE. IT IS CONSTRUCTED OF ROCK AND HAS A FLAT TOP WITH A POINT IN THE CENTER FOR A ARROW PIVOT TO BE PLACED.

SCENIC PIER, ARROW PIVOT, SOUTH. IT IS A SMALL TOWER 3.5 FEET HIGH AND 2X2 FEET SQUARE. IT IS CONSTRUCTED OF ROCK AND HAS A FLAT TOP WITH A POINT IN THE CENTER FOR A ARROW PIVOT TO BE PLACED.

AZIMUTH MARK IS ABOUT 0.8 MILE WEST OF THE STATION. IT IS A STANDARD DISK CEMENTED INTO A DRILL HOLE IN A CONCRETE CURB. IT IS 141 FEET WEST OF THE CENTER OF THE INTERSECTION OF THIRD ST. AND U.S. HIGHWAY NO. 20, 125 FEET EAST OF THE NORTHEAST CORNER OF THE MISSIONARY BAPTIST CHURCH AND 28 FEET SOUTH OF THE CENTERLINE OF U.S. HIGHWAY NO. 20. IT IS STAMPED PILOT BUTTE 1945. TO REACH FROM THE JUNCTION OF U.S. HIGHWAY NO. 97 AND U.S. HIGHWAY NO. 20. GO EAST ON U.S. HIGHWAY NO. 20, TOWARDS BURNS, FOR 0.45 MILE TO THE AZIMUTH MARK ON THE RIGHT AS DESCRIBED.

TO REACH FROM THE JUNCTION OF U.S. HIGHWAY NO. 97 AND U.S. HIGHWAY NO. 20 IN BEND, GO EAST, TOWARDS BURNS, ON U.S. HIGHWAY NO. 20 FOR 1.7 MILES TO A ROAD FORKS. TURN LEFT ON TO PILOT BUTTE ROAD AND CONTINUE 1.1 MILES TO TOP OF BUTTE AND THE STATION AS DESCRIBED.

(Continued on Next Page)

DEPARTMENT OF COMMERCE
NOAA - NOS - C&GS
NATIONAL GEODETIC SURVEY

PUBLICATION DATE: APRIL 26, 1991
USGS QUAD SHEET: BEND

PILOT BUTTE

PID: QD1681

STATION RECOVERY (1958)

RECOVERED BY US GEOLOGICAL SURVEY 1958
RECOVERED AS DESCRIBED BY NGS. RMS NOT OBSERVED.

STATION RECOVERY (1959)

RECOVERED BY BONNEVILLE POWER ADMINISTRATION 1959
STATION RECOVERED AS DESCRIBED. THE HIGHWAY IS NOW UNITED STATES HIGHWAY NO. 20.

STATION RECOVERY (1966)

RECOVERED BY US GEOLOGICAL SURVEY 1966
RECOVERED AS DESCRIBED BY NGS. RMS NOT OBSERVED.

STATION RECOVERY (1971)

RECOVERED BY NATIONAL GEODETIC SURVEY 1971 (LDF)
STATION MARK, REFERENCE MARKS 1,2 AND THE AZIMUTH MARK WERE RECOVERED AND FOUND IN GOOD CONDITION. SCENIC PIER ARROW PIVOT NORTH WAS RECOVERED IN GOOD CONDITION BUT SCENIC PIER ARROW PIVOT SOUTH HAD BEEN REMOVED. A SLIGHT DIFFERENCE WAS NOTED IN THE DISTANCE AND DIRECTION TO BOTH REFERENCE MARKS AND A NOTICEABLE DIFFERENCE WAS NOTED IN THE DIRECTION TO THE AZIMUTH MARK AND WAS CHECKED IN THE FIELD.

FOLLOWING IS A NEW AND COMPLETE DESCRIPTION--

STATION IS LOCATED ABOUT 1 MILE EAST OF BEND AND IS ON THE HIGHEST POINT OF WHAT IS LOCALLY KNOWN AS PILOT BUTTE.

TO REACH THE STATION FROM THE JUNCTION OF U.S. HIGHWAYS 97 AND 20 IN BEND, (THE AZIMUTH MARK IS LOCATED AT THIS JUNCTION) GO EAST ON U.S. HIGHWAY 20 FOR 0.75 MILE TO A FORK AND SIGN PILOT BUTTE STATE PARK. TAKE THE LEFT FORK AND GO EAST UP WINDING PAVED ROAD FOR 1.0 MILE TO THE HIGHEST POINT AND THE STATION.

STATION MARK IS A STANDARD DISK, STAMPED PILOT BUTTE 1932, SET IN THE TOP OF A 12-INCH SQUARE CONCRETE MONUMENT WHICH PROJECTS ABOUT 2 INCHES ABOVE THE SURFACE OF THE GROUND. IT IS IN THE CENTER OF A TRAFFIC CIRCLE AND IS 59 FEET NORTH OF A SET OF ROCK STEPS LEADING TO THE TOP OF THE HILL, 24.5 FEET NORTHWEST OF A ROCK MONUMENT AND 19 FEET EAST-SOUTHEAST OF A ROCK MONUMENT.

REFERENCE MARK 1 IS A STANDARD DISK, STAMPED PILOT BUTTE NO 1 1932, CEMENTED IN A DRILL HOLE IN THE TOP OF A 1 X 2 FOOT OUTCROP WHICH PROJECTS ABOUT 2 INCHES ABOVE THE SURFACE OF THE GROUND. IT IS 93 FEET EAST-SOUTHEAST OF THE APPROXIMATE CENTER OF THE CIRCLE DRIVE ROAD AND 41 FEET WEST OF THE CENTER OF THE PAVED ROAD LEADING UP THE HILL.

(Continued on Next Page)

PILOT BUTTE

PID: QD1681

REFERENCE MARK 2 IS A STANDARD DISK, STAMPED PILOT BUTTE NO 2 1932, CEMENTED IN A DRILL HOLE IN THE TOP OF A LARGE BOULDER WHICH PROJECTS ABOUT 2-1/2 FEET ABOVE THE SURFACE OF THE GROUND. IT IS 88 FEET SOUTHWEST OF THE ROCK STEPS AND 47 FEET SOUTHWEST OF THE APPROXIMATE CENTER OF THE ROAD CIRCLING THE TOP OF THE HILL.

SCENIC PIER ARROW PIVOT NORTH IS A PUNCH HOLE IN THE TOP OF A ROUND METAL PLATE FASTENED TO THE TOP OF A ROCK AND CONCRETE MONUMENT WHICH PROJECTS ABOUT 3-1/2 FEET. IT IS ON THE HIGHEST PART OF THE HILL.

AZIMUTH MARK IS A STANDARD DISK, STAMPED PILOT BUTTE 1945, CEMENTED IN A DRILL HOLE IN THE SOUTH CURB OF U.S. HIGHWAY 20 (BUSINESS). IT IS 145 FEET WEST OF THE CENTER OF THIRD STREET, 125 FEET EAST OF THE NORTHEAST CORNER OF A CHURCH AND 28 FEET SOUTH OF THE CENTER OF THE ROAD.

STATION IS IN THE NORTHWEST 1/4 OF SECTION 34, T 17 S, R 12 E.

HEIGHT OF LIGHT ABOVE STATION MARK 30 FEET.

AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN
1 MILE EAST OF BEND.

STATION RECOVERY (1987)

RECOVERED BY NATIONAL GEODETIC SURVEY 1987 (LLR)
THE STATION WAS RECOVERED AT THIS DATE.
NONE OF THE OTHER MARKS WERE SEARCHED FOR AT THIS DATE. THE 1971 RECOVERY NOTE IS ADEQUATE FOR RECOVERY.

STATION RECOVERY (1989)

RECOVERED BY LOCAL SURVEYOR (INDIVIDUAL OR FIRM) 1989
TEXT WAS SUPERSEDED BY LATER RECOVERY.
STATION IS LOCATED ABOUT 3.2 KM (2.00 MI) EAST OF DOWNTOWN BEND ON THE TOP OF PILOT BUTTE. OWNERSHIP--PILOT BUTTE STATE PARK, DISTRICT MANAGER-STEVE WEINMEYER, 62796 O B RILEY RD, BEND OR 97701, PHONE 503-388-6055.
TO REACH THE STATION FROM THE JUNCTION OF U.S. HIGHWAY 20 AND U.S. HIGHWAY 97, IN BEND, GO EAST ON U.S. HIGHWAY 20 FOR 0.72 KM (0.45 MI) TO N.E. 8TH STREET. CONTINUE AHEAD, EAST, FOR 0.48 KM (0.30 MI) ON U.S. HIGHWAY 20 TO THE ENTRANCE OF PILOT BUTTE STATE PARK ON THE LEFT. TURN LEFT AND FOLLOW PARK ROAD PAST GATE (GATE MAYBE LOCKED BY HIGHWAY DEPARTMENT DURING WINTER MONTHS) GOING UPHILL, CIRCLING BUTTE FOR 1.8 KM (1.10 MI) TO TOP OF BUTTE AND STATION IN THE CENTER OF VIEWING AREA.
STATION IS LOCATED 11.9 M (39.0 FT) WEST OF STONE MONUMENT PROJECTING 1.3 M (4.3 FT) ABOVE GROUND WITH PLAQUE HONORING TERRANCE FOLEY, 8.2 M (26.9 FT) NORTHWEST OF STONE MONUMENT PROJECTING 1.1 M (3.6 FT) ABOVE GROUND AND 6.1 M (20.0 FT) SOUTHEAST OF STONE MONUMENT WITH PLAQUE IDENTIFYING LOCAL MOUNTAIN PEAKS.

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DEPARTMENT OF COMMERCE
NOAA - NOS - C&GS
NATIONAL GEODETIC SURVEY

PUBLICATION DATE: APRIL 26, 1991
USGS QUAD SHEET: PRINEVILLE

PRINEVILLE

PID: QD1782

HORIZONTAL DATUM: NAD 83 (1991)
VERTICAL DATUM: NGVD 29

STATE: OREGON
COUNTY: CROOK

LATITUDE:	44° 18′ 04.56691″ N	± 0.00010	SECONDS
LONGITUDE:	120° 51′ 54.05792″ W	± 0.00020	SECONDS

ORTHOMETRIC HEIGHT: { 972.0 METERS / 3189. FEET

GEOID HEIGHT:	-19.193		METERS
ELLIPSOIDAL HEIGHT:	952.540	±0.032	METERS
X:	57378.829		METERS
Y:	603285.617		METERS
Z:	6328970.746		METERS

HORIZONTAL NETWORK ORDER: B
ELLIPSOIDAL HEIGHT ORDER: SECOND CLASS III

THE HORIZONTAL COORDINATES WERE ESTABLISHED BY GPS OBSERVATIONS AND ADJUSTED BY THE NATIONAL GEODETIC SURVEY IN FEBRUARY 1991
THE ORTHOMETRIC HEIGHT WAS DETERMINED BY VERTICAL ANGLE OBSERVATIONS.
THE GEOID HEIGHT WAS DETERMINED BY GEOID90.
THE ELLIPSOIDAL HEIGHT WAS DETERMINED BY GPS OBSERVATIONS.

HORIZONTAL DATUM SHIFT	LATITUDE	LONGITUDE	
NAD83 minus NAD27	-00.56209″	+04.09692″	(Based on Adjusted Positions)

PLANE COORDINATES

GRID	ZONE	NORTHING METERS	EASTING METERS	POINT SCALE FACTOR	CONVERGENCE DEG MIN SEC
SPC	OR S	292,744.119	1,470,869.451	1.00009057	- 0 14 59.0
SPC	OR N	70,585.485	2,470,871.856	1.00000823	- 0 15 31.9
UTM	10	4,907,551.579	670,302.948	0.99995670	+ 1 29 29.4

STATION MARK IS A .... SURVEY DISK
WITH SETTING .... DRILL HOLE IN ROCK OUTCROP
THE MARK IS STAMPED ... PRINEVILLE 1938

STATION MARK HISTORY

YEAR MONUMENTED OR RECOVERED	CONDITION OF MARK	RECOVERED OR DESCRIBED BY
1939	STATION MONUMENTED	OREGON DEPARTMENT OF TRANSPORTATION
1958	GOOD	US GEOLOGICAL SURVEY
1989	GOOD	NATIONAL GEODETIC SURVEY

(Continued on Next Page)

DEPARTMENT OF COMMERCE
NOAA - NOS - C&GS
NATIONAL GEODETIC SURVEY

PUBLICATION DATE: APRIL 26, 1991
USGS QUAD SHEET: PRINEVILLE

PRINEVILLE

PID: QD1782

STATION DESCRIPTION

DESCRIBED BY OREGON DEPARTMENT OF TRANSPORTATION 1939 (LAM)
STATION IS AT THE VERY EDGE OF THE PROMINENT HIGH RIMROCK W OF PRINEVILLE, ABOUT 1000 FEET W OF CROOKED RIVER BRIDGE, AND ABOUT 500 FEET ABOVE THE RIVER. STATION MAY BE MOST EASILY REACHED FROM SW AND W. STATION IS MARKED BY O.S.H.D. DISK, STAMPED PRINEVILLE 1938, SET IN SOLID ROCK.

STATION RECOVERY (1958)

RECOVERED BY US GEOLOGICAL SURVEY 1958
RECOVERED AS DESCRIBED BY NGS. ALL MARKS IN GOOD CONDITION.

STATION RECOVERY (1989)

RECOVERED BY NATIONAL GEODETIC SURVEY 1989
AT A VIEWPOINT ON THE TOP OF A BLUFF OVERLOOKING PRINEVILLE, TO REACH FROM THE COURTHOUSE IN PRINEVILLE GO WESTERLY ON E. THIRD ST. TO JUNCTION WITH STATE HIGHWAY 126, TURN LEFT ONTO HIGHWAY 126 AND GO 1.6 KM (1.0 MI) TO A ROAD RIGHT LEADING TO OCHOCO WAYSIDE VIEW POINT, TURN RIGHT AND GO TOWARD WAYSIDE FOR 0.48 KM (0.30 MI) TO NORTH END OF A PARKING AREA. THE STATION IS ABOUT 41 METERS NORTH OF THIS POINT.
THE STATION IS 40.7 M (133.5 FT) NNW OF NORTHERN MOST END OF A ROCK GUARDRAIL FOR VIEWPOINT, 1.8 M (5.9 FT) WEST OF THE TOP EDGE OF BLUFF AND 1.4 M (4.6 FT) ESE OF A WITNESS POST.
DESCRIBED BY L.L. RIGGERS.

DEPARTMENT OF COMMERCE
NOAA - NOS - C&GS
NATIONAL GEODETIC SURVEY

PUBLICATION DATE: APRIL 26, 1991
USGS QUAD SHEET: HAGER MTN

SILVER

PID: PB0793

HORIZONTAL DATUM: NAD 83 (1991)
VERTICAL DATUM: NGVD 29

STATE: OREGON
COUNTY: LAKE

LATITUDE:	43° 07' 29.32932"	N	±0.00010	SECONDS
LONGITUDE:	121° 03' 41.33596"	W	±0.00030	SECONDS

ORTHOMETRIC HEIGHT:	1335.0		METERS
	4380.		FEET
GEOID HEIGHT:	-19.283		METERS
ELLIPSOIDAL HEIGHT:	1315.451	±0.046	METERS
X:	6161454.887		METERS
Y:	-1160953.727		METERS
Z:	1173475.604		METERS

HORIZONTAL NETWORK ORDER: B
ELLIPSOIDAL HEIGHT ORDER: SECOND CLASS III

THE HORIZONTAL COORDINATES WERE ESTABLISHED BY GPS OBSERVATIONS
AND ADJUSTED BY THE NATIONAL GEODETIC SURVEY IN FEBRUARY 1991
THE ORTHOMETRIC HEIGHT WAS DETERMINED BY GPS OBSERVATIONS.
THE GEOID HEIGHT WAS DETERMINED BY GEOID90.
THE ELLIPSOIDAL HEIGHT WAS DETERMINED BY GPS OBSERVATIONS.

HORIZONTAL DATUM SHIFT	LATITUDE	LONGITUDE	
NAD83 minus NAD27	-00.5 "	+04.0 "	(Based on Nadcon Interpolation)

PLANE COORDINATES

GRID	ZONE	NORTHING METERS	EASTING METERS	POINT SCALE FACTOR	CONVERGENCE DEG MIN SEC
SPC	OR S	162,127.401	1,454,314.122	0.99989490	- 0 23 2.9
UTM	10	4,776,499.173	657,687.213	0.99990589	+ 1 19 31.5

STATION MARK IS A .... SURVEY DISK
WITH SETTING .... TOP OF CONCRETE MONUMENT (ROUND)
THE MARK IS STAMPED ... SILVER 1989

STATION MARK HISTORY

YEAR MONUMENTED OR RECOVERED	CONDITION OF MARK	RECOVERED OR DESCRIBED BY
1989	STATION MONUMENTED	OREGON DEPARTMENT OF TRANSPORTATION

(Continued on Next Page)

DEPARTMENT OF COMMERCE
NOAA - NOS - C&GS
NATIONAL GEODETIC SURVEY

PUBLICATION DATE: APRIL 26, 1991
USGS QUAD SHEET: HAGER MTN

SILVER

PID: PB0793

STATION DESCRIPTION

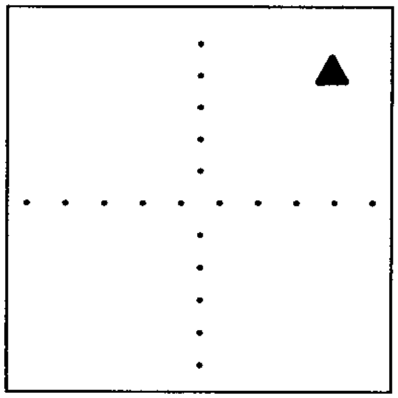
DESCRIBED 1989
THE STATION IS LOCATED ABOUT 0.8 KM (0.5 MI) WEST OF SILVER LAKE AND AT THE SILVER LAKE RANGER STATION OF THE USFS.
THE MARK IS LOCATED 30.78 M (100.98 FT) SOUTHEAST OF THE CENTERLINE OF CATTLE GUARD, 30.5 M (100.1 FT) NE OF THE NORTHEAST CORNER OF USFS OFFICE, 12.2 M (40.0 FT) WEST OF A FENCE, 9.8 M (32.2 FT) NORTH OF NORTHERN MOST CORNER OF FENCE AROUND WEATHER STATION, AND 1.0 METER WEST OF A WITNESS POST.
DESCRIBED BY PHIL LEWELLYN OF ORDOT.

DESCHUTES COUNTY PRIME CONTROL NETWORK

CONTROL STATION DESCRIPTION

NAME: STATE HWY DEPT 'PI'
GIS # 0061
ORDER C-1st. (GPS)

STATION LOCATION



T. 19 S.- R. 14 E., SEC.10

HORIZONTAL DATUM: NAD 83 (1991)
VERT. DATUM: NGVD 29 & NAVD 88

LATITUDE: 43° 56' 39.13776" N
LONGITUDE: 121° 01' 44.79138" W

------- EC CARTESIAN ---------

X:	-2371468.099	METERS
Y:	-3942247.622	METERS
Z:	+4404383.677	METERS

----------- HEIGHT -----------

ELLIPSOIDAL:	1086.090	METERS
NGVD 29 :	1105.340	METERS
NAVD 88 :	1106.517	METERS

---- SPC -- OREGON SOUTH ------

NORTH:	253138.424±.005	METERS
EAST:	1457523.319±.004	METERS

SCALE FACTOR: 0.999986299
CONVERGENCE: - 0° 21' 43.16 "

The horizontal coordinates & ellipsoidal height was determined by GPS observations constrainted by Oregon High Percision Network. Adjusted by Deschutes Co. Surveyor's Office in July 1991. The orthometric height was determined by differential leveling.

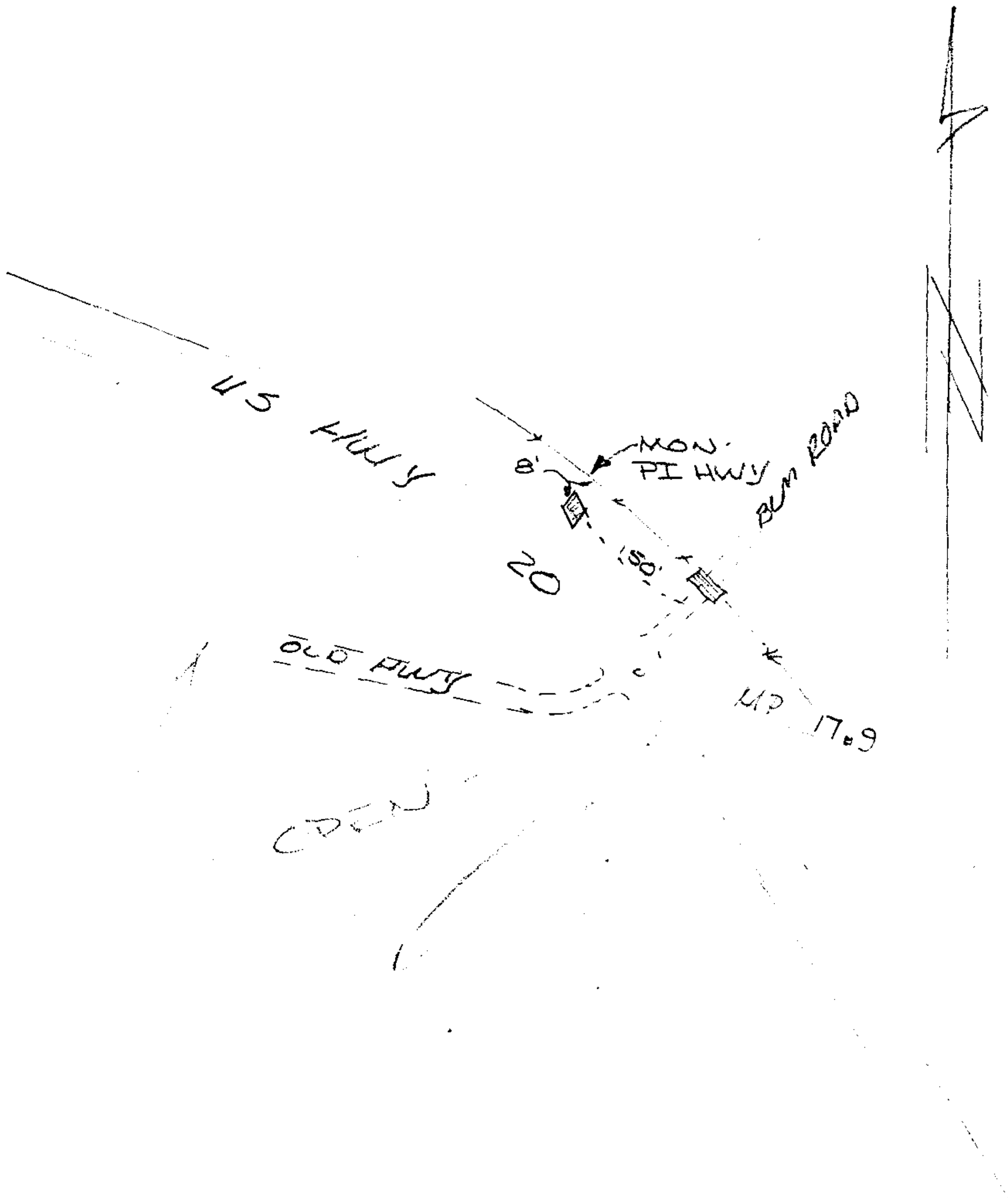
SURFACE MARKER:
MARK IS STAMPED - PUNCH MARK ONLY
AGENCY INSCRIPTION - STATE HWY DEPT OREGON
THE STATION IS LOCATED ABOUT 13.5 MILES SOUTHEASTERLY OF BEND.

TO REACH THE STATION FROM BEND,START AT THE INTERSECTION OF US HWY 20 (GREENWOOD AV.) & US HWY 97 (3RD ST.), PROCEED EAST ON HWY 20 FOR 17.1 MI. TO A SIDE ROAD ON THE LEFT, TURN LEFT AND PROCEED 70 FEET MORE OR LESS TO A CATTLEGUARD IN FENCE LINE, THE STATION IS ON THE LEFT 150 FEET, BEING THE CENTERLINE POINT OF INTERSECTION OF HWY 20.

THE STATION MARK IS A 1 1/2 IN. ALUM. CAP ON A IRON RON IN A MASS OF CONCRETE.
10.5 FEET SOUTHERLY OF A WIRE FENCE
XX FEET NORTHEAST FROM THE CENTERLINE OF HWY 20.
2 FEET SOUTHWEST OF A WITNES POST

DESCHUTES COUNTY SURVEYOR'S OFFICE
61150 S.E. 27th St.
Bend, Oregon. 97702
(503) 383-4395

Location and refference sketch:
Name: STATE HWY DEPT. P.I.
GIS #: 61



DESCHUTES COUNTY SURVEYOR'S OFFICE
61150 S.E. 27th. St.
Bend, Oregon. 97702
(503) 383-4395

DEPARTMENT OF COMMERCE
NOAA - NOS - C&GS
NATIONAL GEODETIC SURVEY

PUBLICATION DATE: APRIL 26, 1991
USGS QUAD SHEET: BURNS

TOMB

PID: PA0745

HORIZONTAL DATUM: NAD 83 (1991)
VERTICAL DATUM: NGVD 29

STATE: OREGON
COUNTY: HARNEY

LATITUDE:	43° 35′ 07.63836″	N	±0.00010	SECONDS
LONGITUDE:	119° 03′ 59.11068″	W	±0.00020	SECONDS
ORTHOMETRIC HEIGHT:	1273.92			METERS
	4179.5			FEET

GEOID HEIGHT:	-17.755		METERS
ELLIPSOIDAL HEIGHT:	1256.202	±0.040	METERS
X:	926030.527		METERS
Y:	2250994.851		METERS
Z:	5877043.497		METERS

HORIZONTAL NETWORK ORDER: B
VERTICAL NETWORK ORDER: THIRD
ELLIPSOIDAL HEIGHT ORDER: SECOND CLASS III

THE HORIZONTAL COORDINATES WERE ESTABLISHED BY GPS OBSERVATIONS
AND ADJUSTED BY THE NATIONAL GEODETIC SURVEY IN FEBRUARY 1991
THE ORTHOMETRIC HEIGHT WAS DETERMINED BY DIFFERENTIAL LEVELING.
THE GEOID HEIGHT WAS DETERMINED BY GEOID90.
THE ELLIPSOIDAL HEIGHT WAS DETERMINED BY GPS OBSERVATIONS.

HORIZONTAL DATUM SHIFT	LATITUDE	LONGITUDE	
NAD83 minus NAD27	-00.5″	+03.8″	(Based on Nadcon Interpolation)

PLANE COORDINATES

GRID	ZONE	NORTHING METERS	EASTING METERS	POINT SCALE FACTOR	CONVERGENCE DEG MIN SEC
SPC	OR S	214,137.215	1,615,764.772	0.99992104	+ 0 58 50.8
UTM	11	4,827,906.442	333,175.647	0.99994233	- 1 25 30.0

STATION MARK IS A .... SURVEY DISK
WITH SETTING .... TOP OF CONCRETE MONUMENT (ROUND)
THE MARK IS STAMPED ... TOMB 1989

STATION MARK HISTORY

YEAR MONUMENTED OR RECOVERED	CONDITION OF MARK	RECOVERED OR DESCRIBED BY
1989	STATION MONUMENTED	NATIONAL GEODETIC SURVEY

(Continued on Next Page)

DEPARTMENT OF COMMERCE
NOAA - NOS - C&GS
NATIONAL GEODETIC SURVEY

PUBLICATION DATE: APRIL 26, 1991
USGS QUAD SHEET: BURNS

TOMB

PID: PA0745

STATION DESCRIPTION

DESCRIBED 1989
THE STATION IS LOCATED IN BURNS AT THE ENTRANCE TO THE CEMETERY.
TO REACH FROM THE POST OFFICE IN BURNS GO SOUTH ON BROADWAY (HIGHWAY 20) FOR .16 KM (0.10 MI) , TURN RIGHT (STILL HIGHWAY 20) AND GO 0.64 KM (0.40 MI) TO WHERE HIGHWAY TO TURNS SOUTH, KEEP STRAIT AHEAD ON MONROE STREET AND GO 0.4 KM (0.2 MI) TO ENTRANCE TO CEMETERY ON THE LEFT, TURN LEFT INTO CEMETERY AND MARK ON THE RIGHT.
THE MARK IS 18.8 M (61.7 FT) SOUTH OF THE CENTERLINE OF MONROE STREET, 3.7 M (12.1 FT) SE OF CLARA HANLEY MEMORIAL, 3.1 M (10.2 FT) WEST OF TJE ROAD INTO CEMETERY, AND 3.0 M (9.8 FT) SOUTH OF WEST GATE POLE.
THE MARK IS SET FLUSH WITH THE GROUND.
DESCRIBED BY L.L. RIGGERS.

ADJUSTED

SURVEY POINTS

IN

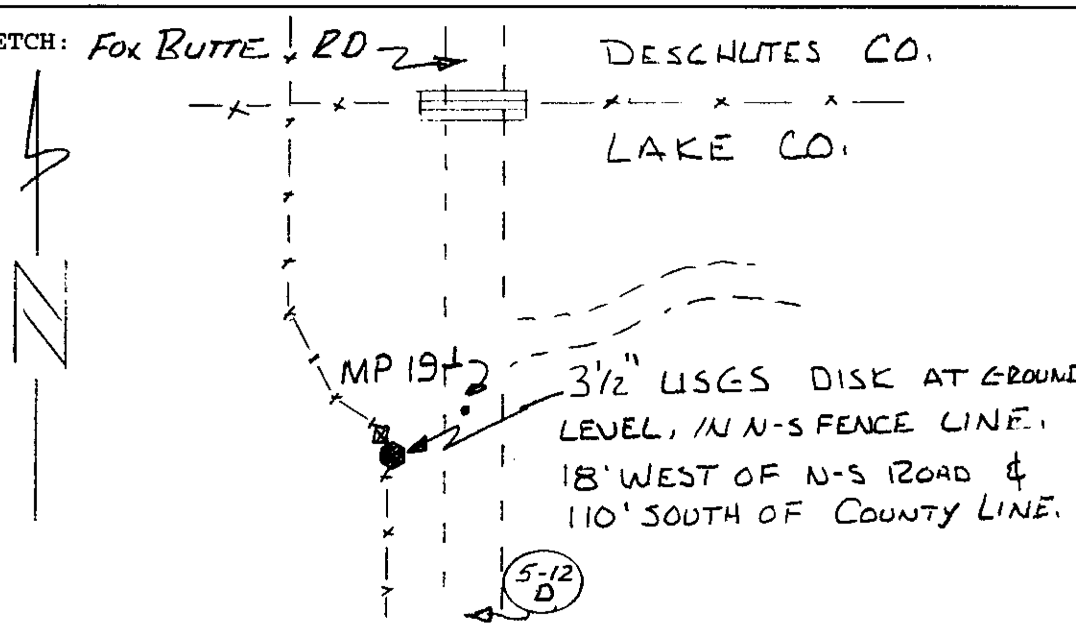
DESCHUTES COUNTY

PLANE COORDINATES

MARK DATA SHEET

NAME OF MARK:	15-PSM	COUNTY:	LAKE
MARK SET BY:	U. S. G. S.	STATE:	OREGON
DATE OF MARK:	1978	COUNTRY:	U.S.A.
LOCATION:	SECTION 5 TOWNSHIP 23 S RANGE 17 E		
REFERENCE:	NONE		

MARK SKETCH:



DATA COMPUTED BY:	DESCHUTES COUNTY SURVEYOR'S OFFICE	DATE:	1997
METHOD-EQUIPMENT:	GPS-TRIMBLE 4000SSE GEODETIC	ADJUSTED WITH:	TRIMNET

HOIZONTAL DATUM:	NAD 83 (91)	VERTICAL DATUM:	NAVD 29
PROJECTION:	TRANSVERSE MERCATOR	ZONE:	CENTRAL OREGON LCS
CENTRAL MERIDIAN:	W 121° 17'00.00"	ORIGIN NORTHING:	0.00F
LATITUDE OF ORIGIN:	N 43° 00'00.00"	ORIGIN EASTING:	3,300,000.00F
LINEAR UNITS:	INTERNATIONAL FOOT	SCALE ALONG MERIDIAN:	1.0001600

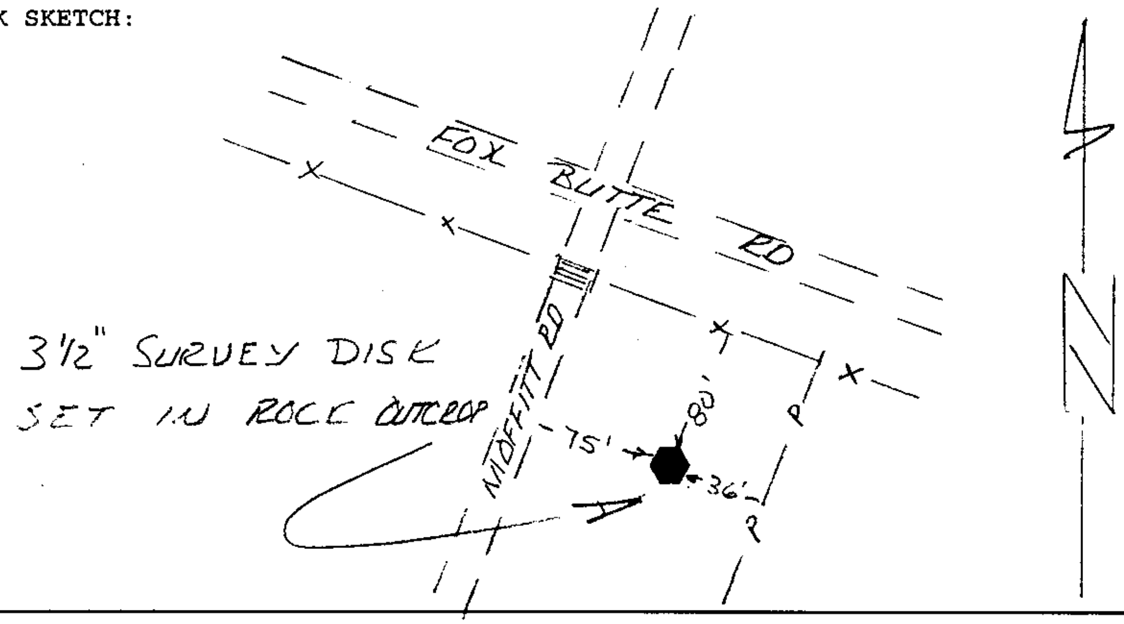
GEODETIC AND MAPPING COORDINATES

MARK:	15-PSM	HORIZONTAL ORDER:	FIRST	ONE SIGMA ERROR
Latitude:	43°36'53.580016"	Northing:	224693.223	0.017
Longitude:	120°42'16.405520"	Easting:	3453307.638	0.014
Convergence:	+0°23'57.3053"	Ell Height:	4794.78	0.035
Scale Factor:	1.000186842614	Ortho Height:	4856.38	FIXED
Combined Factor:	0.99995800	Geoid Height:	-61.60	

MARK DATA SHEET

NAME OF MARK:	42-WS	COUNTY:	DESCHUTES
MARK SET BY:	U. S. G. S.	STATE:	OREGON
DATE OF MARK:	1977	COUNTRY:	U.S.A.
LOCATION:	SECTION 34 TOWNSHIP 20 S RANGE 16 E		
REFERENCE:	NONE		

MARK SKETCH:



DATA COMPUTED BY:	DESCHUTES COUNTY SURVEYOR'S OFFICE	DATE:	1997
METHOD-EQUIPMENT:	GPS-TRIMBLE 4000SSE GEODETIC	ADJUSTED WITH:	TRIMNET

HOIZONTAL DATUM:	NAD 83 (91)	VERTICAL DATUM:	NAVD 29
PROJECTION:	TRANSVERSE MERCATOR	ZONE:	CENTRAL OREGON LCS
CENTRAL MERIDIAN:	W 121° 17'00.00"	ORIGIN NORTHING:	0.00F
LATITUDE OF ORIGIN:	N 43° 00'00.00"	ORIGIN EASTING:	3,300,000.00F
LINEAR UNITS:	INTERNATIONAL FOOT	SCALE ALONG MERIDIAN:	1.0001600

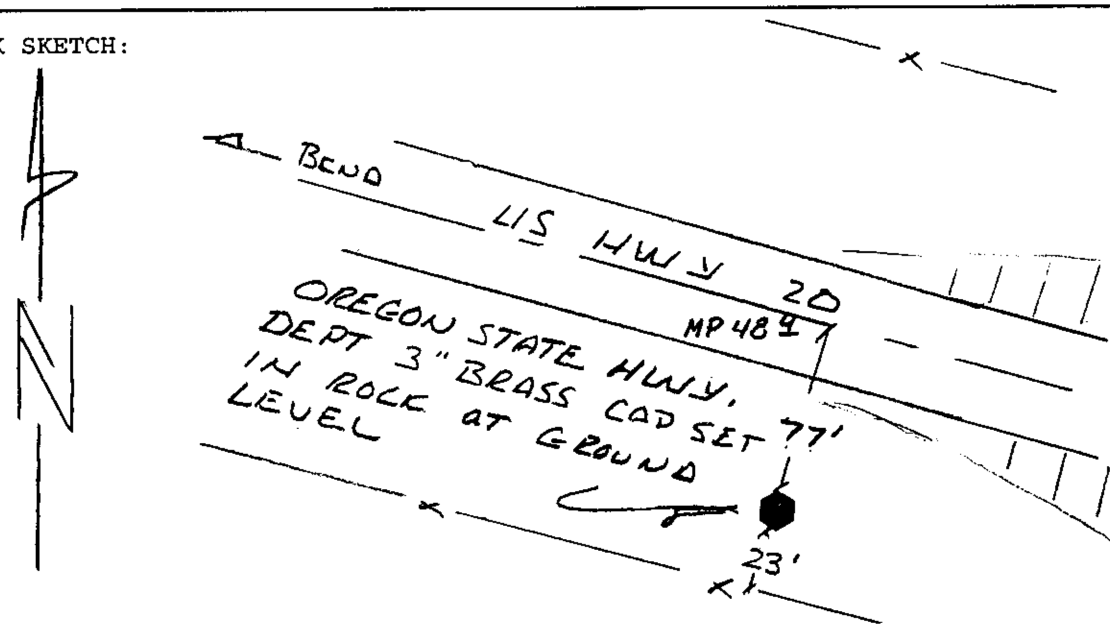
GEODETIC AND MAPPING COORDINATES

MARK:	42-WS	HORIZONTAL ORDER:	FIRST	ONE SIGMA ERROR
Latitude:	43°47'21.761629"	Northing:	288147.665	0.009
Longitude:	120°48'03.496852"	Easting:	3427399.117	0.008
Convergence:	+0°20'01.6914"	Ell Height:	4654.92	0.022
Scale Factor:	1.000178535724	Ortho Height:	4716.49	FIXED
Combined Factor:	0.99995638	Geoid Height:	-61.57	

MARK DATA SHEET

NAME OF MARK:	38 OSHD 1927	COUNTY:	DESCHUTES
MARK SET BY:	OREGON STATE HIGHWAY	STATE:	OREGON
DATE OF MARK:	1927	COUNTRY:	U.S.A.
LOCATION:	SECTION 1 TOWNSHIP 21 S RANGE 18 E		
REFERENCE:	NONE		

MARK SKETCH:



DATA COMPUTED BY:	DESCHUTES COUNTY SURVEYOR'S OFFICE	DATE:	1997
METHOD-EQUIPMENT:	GPS-TRIMBLE 4000SSE GEODETIC	ADJUSTED WITH:	TRIMNET

HOIZONTAL DATUM:	NAD 83 (91)	VERTICAL DATUM:	NAVD 29
PROJECTION:	TRANSVERSE MERCATOR	ZONE:	CENTRAL OREGON LCS
CENTRAL MERIDIAN:	W 121° 17'00.00"	ORIGIN NORTHING:	0.00F
LATITUDE OF ORIGIN:	N 43° 00'00.00"	ORIGIN EASTING:	3,300,000.00F
LINEAR UNITS:	INTERNATIONAL FOOT	SCALE ALONG MERIDIAN:	1.0001600

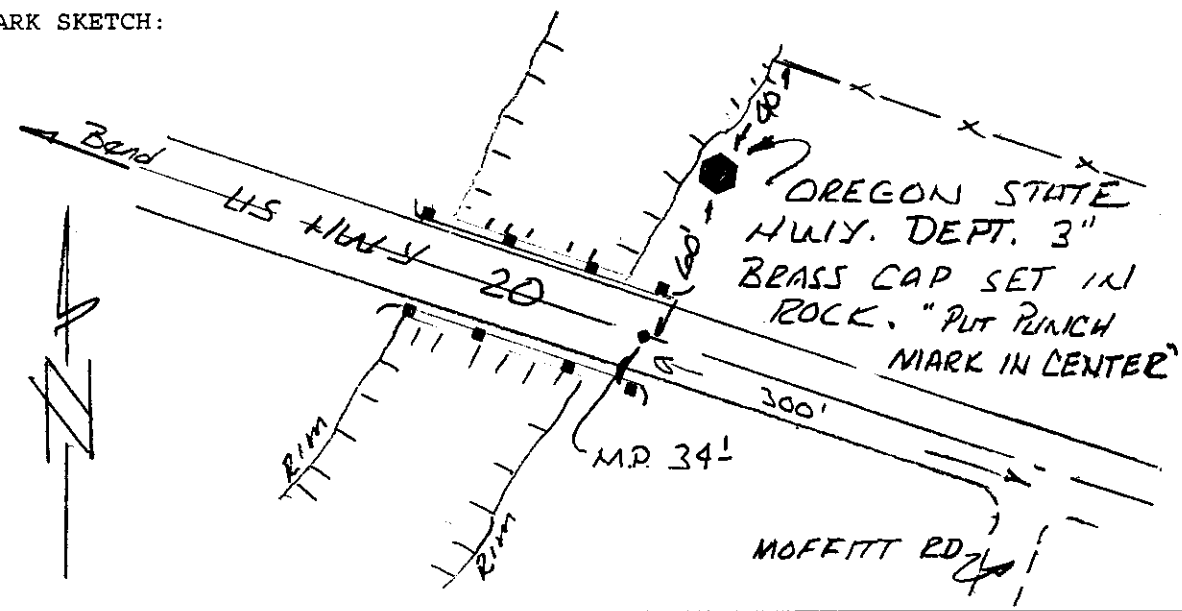
GEODETIC AND MAPPING COORDINATES

MARK:	38 OSHD 1927	HORIZONTAL ORDER:	FIRST	ONE SIGMA ERROR
Latitude:	43°47'03.429860"	Northing:	286906.503	0.011
Longitude:	120°29'48.838566"	Easting:	3507726.890	0.009
Convergence:	+0°32'39.0734"	Ell Height:	4636.93	0.023
Scale Factor:	1.000209280190	Ortho Height:	4697.47	FIXED
Combined Factor:	0.99998797	Geoid Height:	-60.54	

MARK DATA SHEET

NAME OF MARK:	26 OSHD 1927	COUNTY:	DESCHUTES
MARK SET BY:	OREGON STATE HIGHWAY	STATE:	OREGON
DATE OF MARK:	1927	COUNTRY:	U.S.A.
LOCATION:	SECTION 1 TOWNSHIP 20 S RANGE 16 E		
REFERENCE:	NONE		

MARK SKETCH:



DATA COMPUTED BY:	DESCHUTES COUNTY SURVEYOR'S OFFICE	DATE:	1997
METHOD-EQUIPMENT:	GPS-TRIMBLE 4000SSE GEODETIC	ADJUSTED WITH:	TRIMNET

HOIZONTAL DATUM:	NAD 83 (91)	VERTICAL DATUM:	NAVD 29
PROJECTION:	TRANSVERSE MERCATOR	ZONE:	CENTRAL OREGON LCS
CENTRAL MERIDIAN:	W 121° 17'00.00"	ORIGIN NORTHING:	0.00F
LATITUDE OF ORIGIN:	N 43° 00'00.00"	ORIGIN EASTING:	3,300,000.00F
LINEAR UNITS:	INTERNATIONAL FOOT	SCALE ALONG MERIDIAN:	1.0001600

GEODETIC AND MAPPING COORDINATES

MARK: 26 OSHD 1927		HORIZONTAL ORDER:	FIRST	ONE SIGMA ERROR
Latitude:	43°51'27.507913"	Northing:	313098.790	0.011
Longitude:	120°45'41.385174"	Easting:	3437668.236	0.009
Convergence:	+0°21'41.6528"	Ell Height:	4274.15	0.020
Scale Factor:	1.000181644034	Ortho Height:	4335.65	FIXED
Combined Factor:	0.99997765	Geoid Height:	-61.50	

MARK DATA SHEET

NAME OF MARK: **23-PSM** | COUNTY: **DESCHUTES**

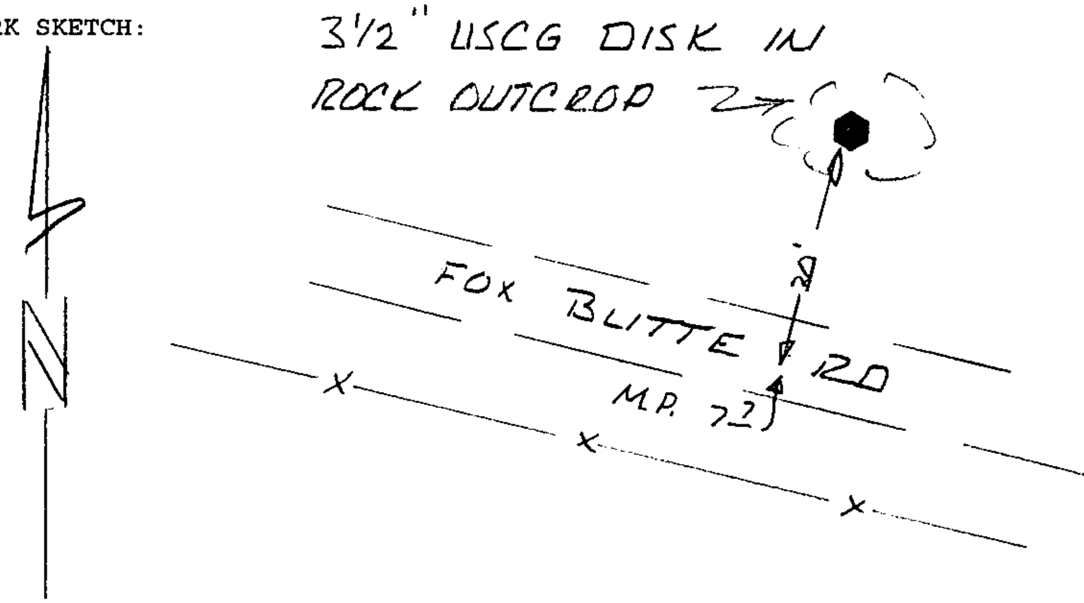
MARK SET BY: **U. S. G. S.** | STATE: **OREGON**

DATE OF MARK: **1978** | COUNTRY: **U.S.A.**

LOCATION: **SECTION 11 TOWNSHIP 21 S RANGE 16 E**

REFERENCE: **NONE**

MARK SKETCH:



DATA COMPUTED BY: DESCHUTES COUNTY SURVEYOR'S OFFICE | DATE: 1997

METHOD-EQUIPMENT: GPS-TRIMBLE 4000SSE GEODETIC | ADJUSTED WITH: TRIMNET

HOIZONTAL DATUM:	NAD 83 (91)	VERTICAL DATUM:	NAVD 29
PROJECTION:	TRANSVERSE MERCATOR	ZONE:	CENTRAL OREGON LCS
CENTRAL MERIDIAN:	W 121° 17'00.00"	ORIGIN NORTHING:	0.00F
LATITUDE OF ORIGIN:	N 43° 00'00.00"	ORIGIN EASTING:	3,300,000.00F
LINEAR UNITS:	INTERNATIONAL FOOT	SCALE ALONG MERIDIAN:	1.0001600

GEODETIC AND MAPPING COORDINATES

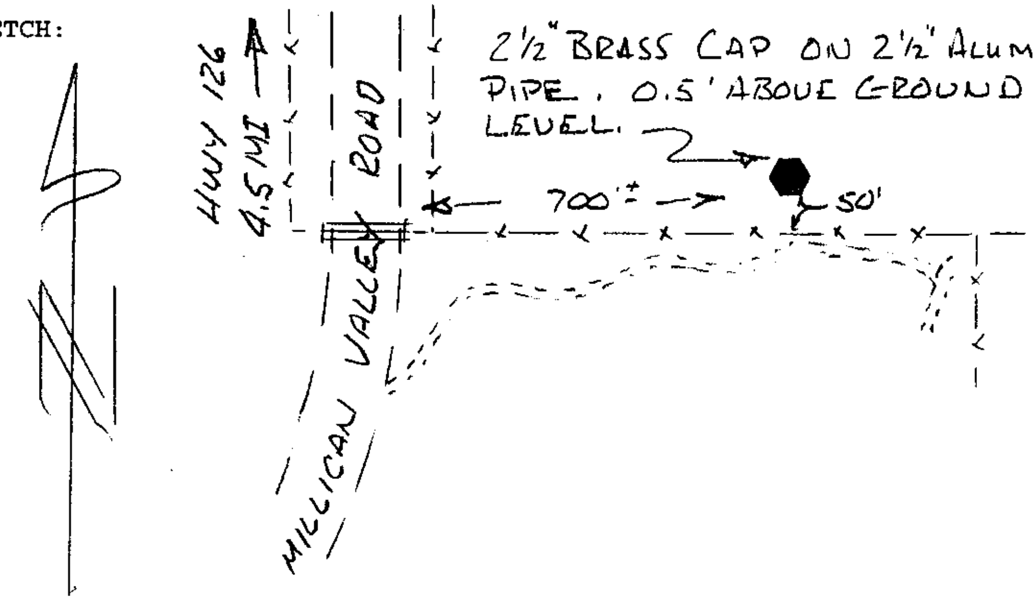
MARK: **23-PSM** | HORIZONTAL ORDER: **FIRST**

				ONE SIGMA ERROR
Latitude:	43°46'00.284519"	Northing:	279932.523	0.018
Longitude:	120°46'40.402430"	Easting:	3433545.736	0.016
Convergence:	+0°20'58.6768"	Ell Height:	4715.06	0.030
Scale Factor:	1.000180367591	Ortho Height:	4776.59	FIXED
Combined Factor:	0.99995534	Geoid Height:	-61.53	

MARK DATA SHEET

NAME OF MARK:	16150180	COUNTY:	CROOK
MARK SET BY:	LS 1026 DAVID ARMSTRONG	STATE:	OREGON
DATE OF MARK:	1997	COUNTRY:	U.S.A.
LOCATION:	SECTION 1 TOWNSHIP 16 S RANGE 15 E		
REFERENCE:	OLCM A 21		

MARK SKETCH:



DATA COMPUTED BY:	DESCHUTES COUNTY SURVEYOR'S OFFICE	DATE:	1997
METHOD-EQUIPMENT:	GPS-TRIMBLE 4000SSE GEODETIC	ADJUSTED WITH:	TRIMNET

HOIZONTAL DATUM:	NAD 83 (91)	VERTICAL DATUM:	NAVD 29
PROJECTION:	TRANSVERSE MERCATOR	ZONE:	CENTRAL OREGON LCS
CENTRAL MERIDIAN:	W 121° 17'00.00"	ORIGIN NORTHING:	0.00F
LATITUDE OF ORIGIN:	N 43° 00'00.00"	ORIGIN EASTING:	3,300,000.00F
LINEAR UNITS:	INTERNATIONAL FOOT	SCALE ALONG MERIDIAN:	1.0001600

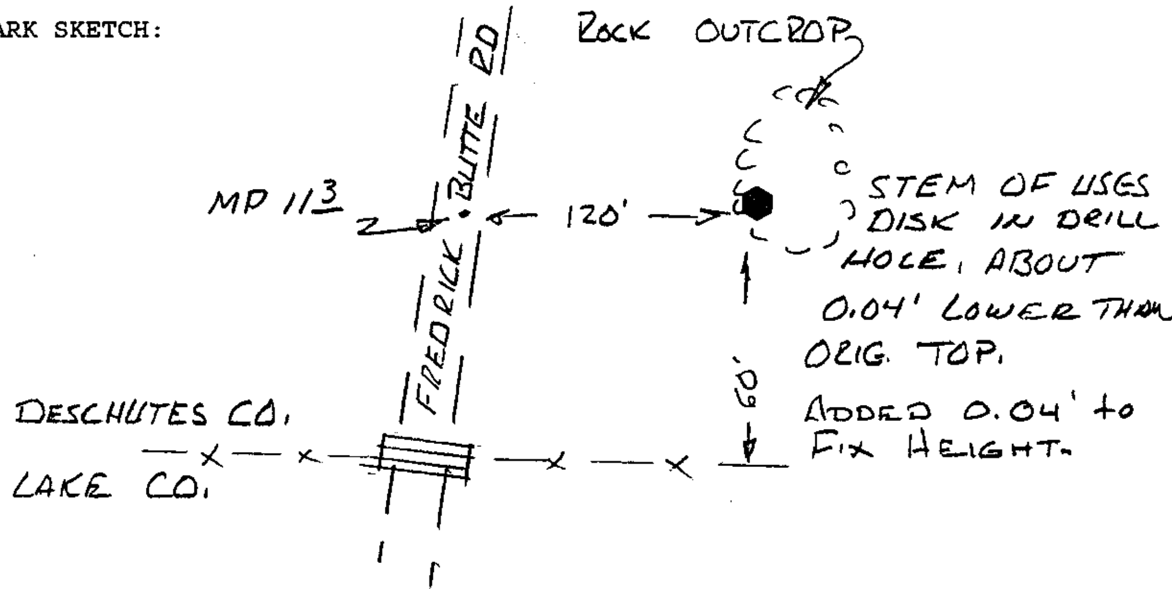
GEODETIC AND MAPPING COORDINATES

MARK:	16150180	HORIZONTAL ORDER:	FIRST	ONE SIGMA ERROR
Latitude:	44°13'06.349310"	Northing:	444456.468	0.014
Longitude:	120°53'22.318638"	Easting:	3403261.690	0.013
Convergence:	+0°16'28.6929"	Ell Height:	3283.55	0.033
Scale Factor:	1.000172176132	Ortho Height:	3346.84	0.056
Combined Factor:	1.00001546	Geoid Height:	-63.29	

MARK DATA SHEET

NAME OF MARK:	17 TAM	COUNTY:	DESCHUTES
MARK SET BY:	U. S. G. S.	STATE:	OREGON
DATE OF MARK:	1977	COUNTRY:	U.S.A.
LOCATION:	SECTION 33 TOWNSHIP 22 S RANGE 19 E		
REFERENCE:	NONE		

MARK SKETCH:



DATA COMPUTED BY:	DESCHUTES COUNTY SURVEYOR'S OFFICE	DATE:	1997
METHOD-EQUIPMENT:	GPS-TRIMBLE 4000SSE GEODETIC	ADJUSTED WITH:	TRIMNET

HOIZONTAL DATUM:	NAD 83 (91)	VERTICAL DATUM:	NAVD 29
PROJECTION:	TRANSVERSE MERCATOR	ZONE:	CENTRAL OREGON LCS
CENTRAL MERIDIAN:	W 121° 17'00.00"	ORIGIN NORTHING:	0.00F
LATITUDE OF ORIGIN:	N 43° 00'00.00"	ORIGIN EASTING:	3,300,000.00F
LINEAR UNITS:	INTERNATIONAL FOOT	SCALE ALONG MERIDIAN:	1.0001600

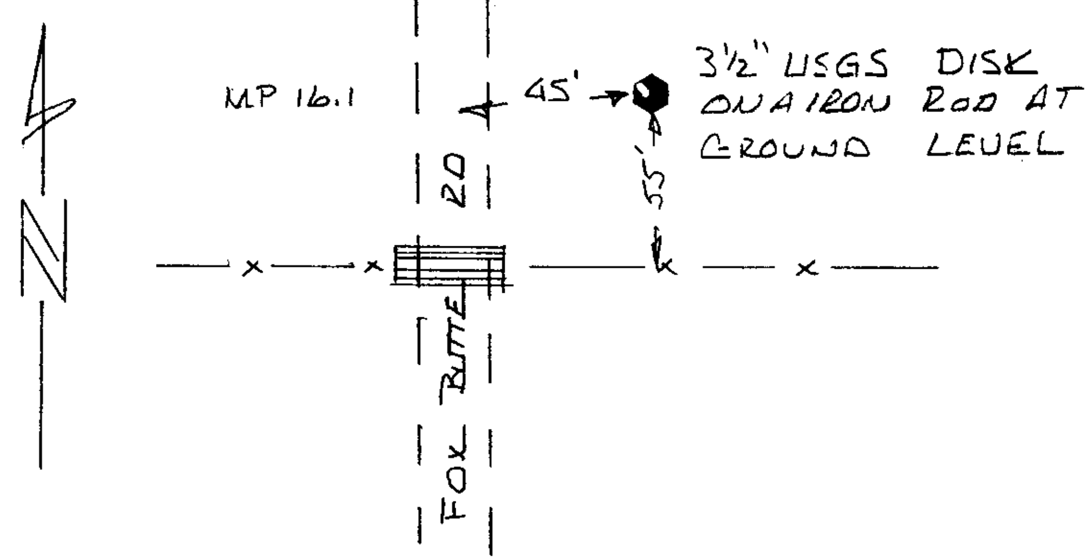
GEODETIC AND MAPPING COORDINATES

MARK:	17 TAM	HORIZONTAL ORDER:	FIRST	ONE SIGMA ERROR
Latitude:	43°36'58.255379"	Northing:	225717.465	0.017
Longitude:	120°27'30.548690"	Easting:	3518483.095	0.014
Convergence:	+0°34'08.4739"	Ell Height:	4998.31	0.037
Scale Factor:	1.000214518213	Ortho Height:	5059.11	FIXED
Combined Factor:	0.99997596	Geoid Height:	-60.80	

MARK DATA SHEET

NAME OF MARK:	17-PSM	COUNTY:	DESCHUTES
MARK SET BY:	U. S. G. S.	STATE:	OREGON
DATE OF MARK:	1978	COUNTRY:	U.S.A.
LOCATION:	SECTION 17 TOWNSHIP 22 S RANGE 17 E		
REFERENCE:	NONE		

MARK SKETCH:



DATA COMPUTED BY:	DESCHUTES COUNTY SURVEYOR'S OFFICE	DATE:	1997
METHOD-EQUIPMENT:	GPS-TRIMBLE 4000SSE GEODETIC	ADJUSTED WITH:	TRIMNET

HOIZONTAL DATUM:	NAD 83 (91)	VERTICAL DATUM:	NAVD 29
PROJECTION:	TRANSVERSE MERCATOR	ZONE:	CENTRAL OREGON LCS
CENTRAL MERIDIAN:	W 121° 17'00.00"	ORIGIN NORTHING:	0.00F
LATITUDE OF ORIGIN:	N 43° 00'00.00"	ORIGIN EASTING:	3,300,000.00F
LINEAR UNITS:	INTERNATIONAL FOOT	SCALE ALONG MERIDIAN:	1.0001600

GEODETIC AND MAPPING COORDINATES

MARK:	17-PSM	HORIZONTAL ORDER:	FIRST	ONE SIGMA ERROR
Latitude:	43°39'33.239926"	Northing:	240850.384	0.018
Longitude:	120°42'39.626328"	Easting:	3451487.624	0.020
Convergence:	+0°23'42.4407"	Ell Height:	4754.03	0.053
Scale Factor:	1.000186208778	Ortho Height:	4815.56	0.056
Combined Factor:	0.99995932	Geoid Height:	-61.53	

MARK DATA SHEET

NAME OF MARK: 18-PSM | COUNTY: DESCHUTES

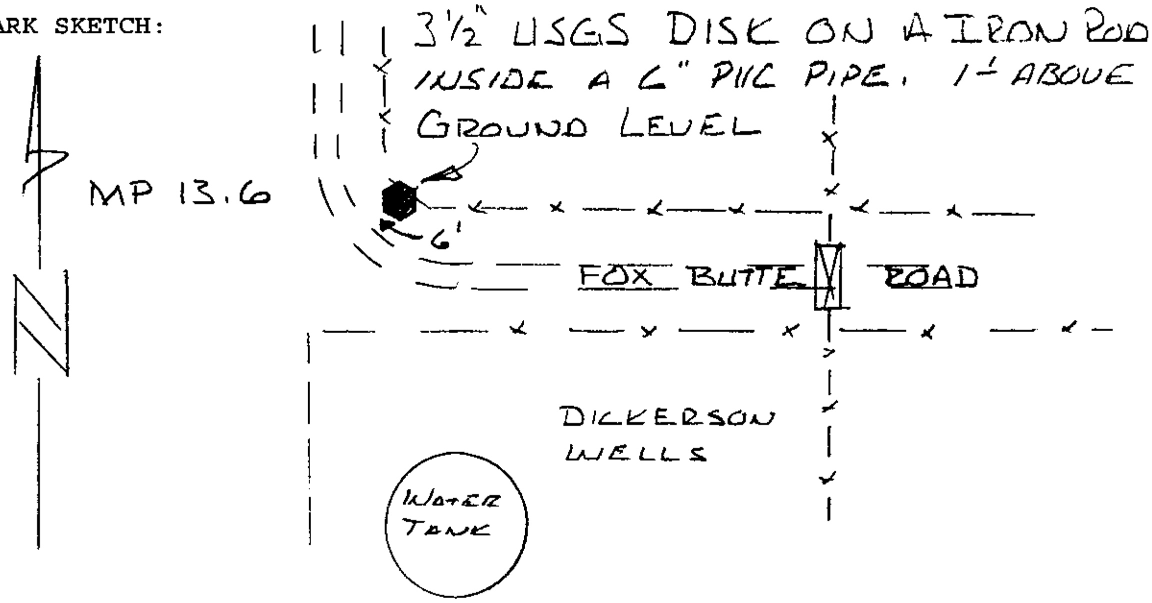
MARK SET BY: U. S. G. S. | STATE: OREGON

DATE OF MARK: 1978 | COUNTRY: U.S.A.

LOCATION: SECTION 6 TOWNSHIP 22 S RANGE 17 E

REFERENCE: NONE

MARK SKETCH:



DATA COMPUTED BY: DESCHUTES COUNTY SURVEYOR'S OFFICE | DATE: 1997

METHOD-EQUIPMENT: GPS-TRIMBLE 4000SSE GEODETIC | ADJUSTED WITH: TRIMNET

HOIZONTAL DATUM:	NAD 83 (91)	VERTICAL DATUM:	NAVD 29
PROJECTION:	TRANSVERSE MERCATOR	ZONE:	CENTRAL OREGON LCS
CENTRAL MERIDIAN:	W 121° 17'00.00"	ORIGIN NORTHING:	0.00F
LATITUDE OF ORIGIN:	N 43° 00'00.00"	ORIGIN EASTING:	3,300,000.00F
LINEAR UNITS:	INTERNATIONAL FOOT	SCALE ALONG MERIDIAN:	1.0001600

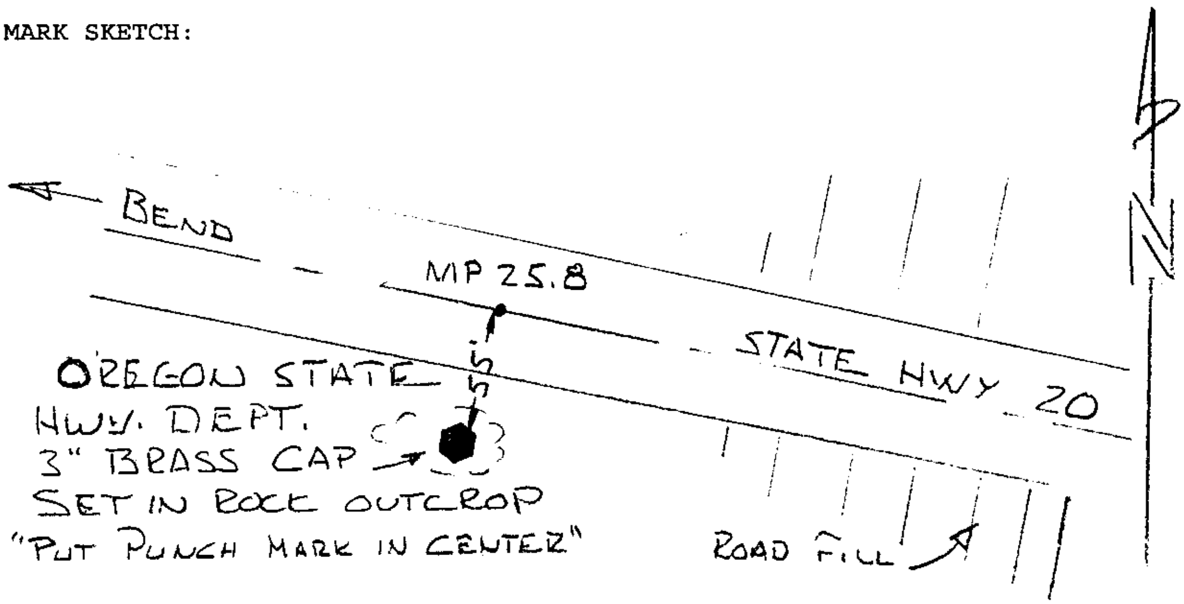
GEODETIC AND MAPPING COORDINATES

MARK:	18-PSM	HORIZONTAL ORDER:	FIRST	ONE SIGMA ERROR
Latitude:	43°41'17.632617"	Northing:	251382.045	0.014
Longitude:	120°44'00.929511"	Easting:	3445439.802	0.012
Convergence:	+0°22'47.0332"	Ell Height:	4743.87	0.033
Scale Factor:	1.000184157690	Ortho Height:	4805.43	0.039
Combined Factor:	0.99995775	Geoid Height:	-61.55	

MARK DATA SHEET

NAME OF MARK:	20 OSHD 1927	COUNTY:	DESCHUTES
MARK SET BY:	OREGON STATE HIGHWAY	STATE:	OREGON
DATE OF MARK:	1927	COUNTRY:	U.S.A.
LOCATION:	SECTION 25 TOWNSHIP 19 S RANGE 14 E		
REFERENCE:	NONE		

MARK SKETCH:



DATA COMPUTED BY:	DESCHUTES COUNTY SURVEYOR'S OFFICE	DATE:	1997
METHOD-EQUIPMENT:	GPS-TRIMBLE 4000SSE GEODETIC	ADJUSTED WITH:	TRIMNET

HOIZONTAL DATUM:	NAD 83 (91)	VERTICAL DATUM:	NAVD 29
PROJECTION:	TRANSVERSE MERCATOR	ZONE:	CENTRAL OREGON LCS
CENTRAL MERIDIAN:	W 121° 17'00.00"	ORIGIN NORTHING:	0.00F
LATITUDE OF ORIGIN:	N 43° 00'00.00"	ORIGIN EASTING:	3,300,000.00F
LINEAR UNITS:	INTERNATIONAL FOOT	SCALE ALONG MERIDIAN:	1.0001600

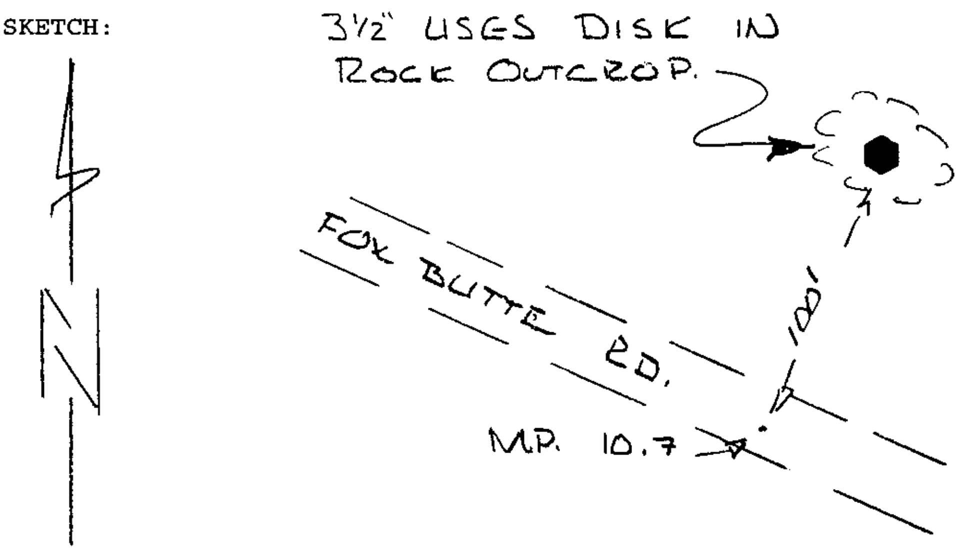
GEODETIC AND MAPPING COORDINATES

MARK:	20 OSHD 1927	HORIZONTAL ORDER:	FIRST	ONE SIGMA ERROR
Latitude:	43°54'06.905588"	Northing:	328944.882	0.018
Longitude:	120°59'23.531147"	Easting:	3377362.574	0.014
Convergence:	+0°12'12.5863"	Ell Height:	4128.73	0.019
Scale Factor:	1.000166834762	Ortho Height:	4191.40	FIXED
Combined Factor:	0.99996979	Geoid Height:	-62.67	

MARK DATA SHEET

NAME OF MARK:	20-PSM	COUNTY:	DESCHUTES
MARK SET BY:	U. S. G. S.	STATE:	OREGON
DATE OF MARK:	1978	COUNTRY:	U.S.A.
LOCATION:	SECTION 25 TOWNSHIP 21 S RANGE 16 E		
REFERENCE:	NONE		

MARK SKETCH:



DATA COMPUTED BY:	DESCHUTES COUNTY SURVEYOR'S OFFICE	DATE:	1997
METHOD-EQUIPMENT:	GPS-TRIMBLE 4000SSE GEODETIC	ADJUSTED WITH:	TRIMNET

HOIZONTAL DATUM:	NAD 83 (91)	VERTICAL DATUM:	NAVD 29
PROJECTION:	TRANSVERSE MERCATOR	ZONE:	CENTRAL OREGON LCS
CENTRAL MERIDIAN:	W 121° 17'00.00"	ORIGIN NORTHING:	0.00F
LATITUDE OF ORIGIN:	N 43° 00'00.00"	ORIGIN EASTING:	3,300,000.00F
LINEAR UNITS:	INTERNATIONAL FOOT	SCALE ALONG MERIDIAN:	1.0001600

GEODETIC AND MAPPING COORDINATES

MARK:	20-PSM	HORIZONTAL ORDER:	FIRST	ONE SIGMA ERROR
Latitude:	43°43'43.598180"	Northing:	266134.199	0.020
Longitude:	120°45'03.892204"	Easting:	3440717.843	0.015
Convergence:	+0°22'04.5209"	Ell Height:	4750.33	0.033
Scale Factor:	1.000182614269	Ortho Height:	4811.86	FIXED
Combined Factor:	0.99995590	Geoid Height:	-61.53	

MARK DATA SHEET

NAME OF MARK: 23 TAM

COUNTY: DESCHUTES

MARK SET BY: U. S. G. S.

STATE: OREGON

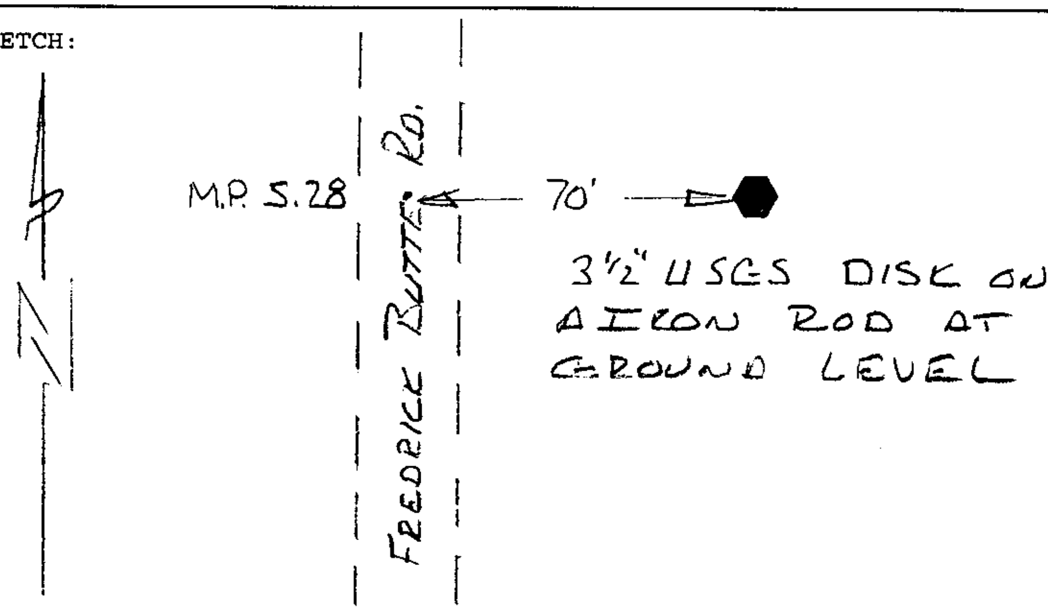
DATE OF MARK: 1977

COUNTRY: U.S.A.

LOCATION: SECTION 5 TOWNSHIP 22 S RANGE 19 E

REFERENCE: NONE

MARK SKETCH:



DATA COMPUTED BY: DESCHUTES COUNTY SURVEYOR'S OFFICE

DATE: 1997

METHOD-EQUIPMENT: GPS-TRIMBLE 4000SSE GEODETIC

ADJUSTED WITH: TRIMNET

HOIZONTAL DATUM: NAD 83 (91)

VERTICAL DATUM: NAVD 29

PROJECTION: TRANSVERSE MERCATOR

ZONE: CENTRAL OREGON LCS

CENTRAL MERIDIAN: W 121° 17'00.00"

ORIGIN NORTHING: 0.00F

LATITUDE OF ORIGIN: N 43° 00'00.00"

ORIGIN EASTING: 3,300,000.00F

LINEAR UNITS: INTERNATIONAL FOOT

SCALE ALONG MERIDIAN: 1.0001600

GEODETIC AND MAPPING COORDINATES

MARK: 23 TAM

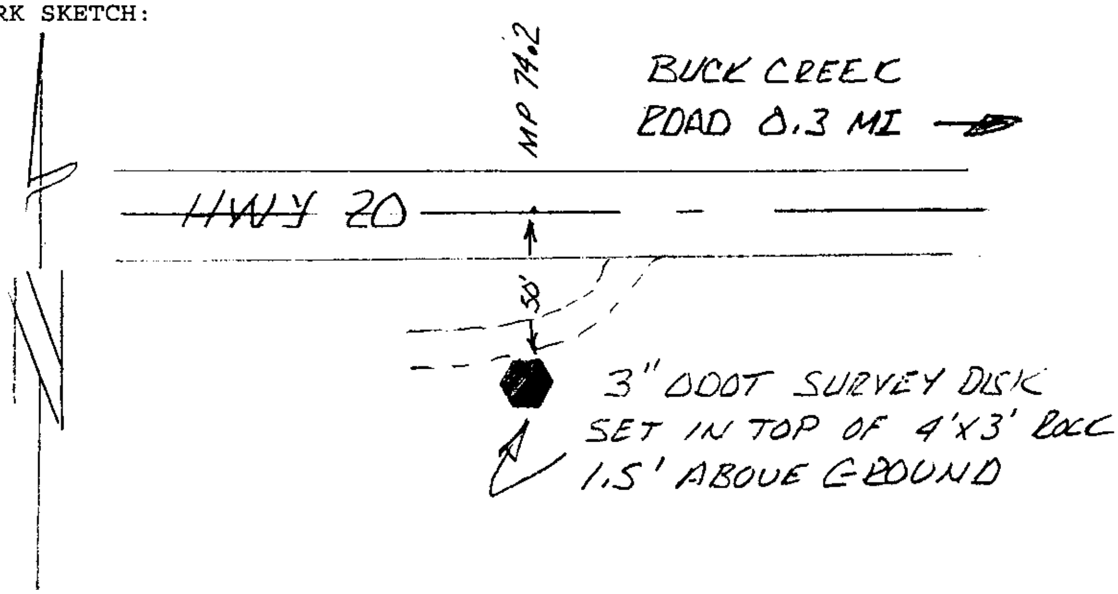
HORIZONTAL ORDER: FIRST

				ONE SIGMA ERROR
Latitude:	43°41'59.058845"	Northing:	256131.559	0.016
Longitude:	120°28'38.256873"	Easting:	3513205.445	0.014
Convergence:	+0°33'24.8236"	Ell Height:	4684.24	0.031
Scale Factor:	1.000211915025	Ortho Height:	4745.09	FIXED
Combined Factor:	0.99998835	Geoid Height:	-60.86	

MARK DATA SHEET

NAME OF MARK:	45 OSHD 1927	COUNTY:	LAKE
MARK SET BY:	OREGON STATE HIGHWAY	STATE:	OREGON
DATE OF MARK:	1927	COUNTRY:	U.S.A.
LOCATION:	SECTION 1 TOWNSHIP 21 S RANGE 18 E		
REFERENCE:	NONE		

MARK SKETCH:



DATA COMPUTED BY:	DESCHUTES COUNTY SURVEYOR'S OFFICE	DATE:	1997
METHOD-EQUIPMENT:	GPS-TRIMBLE 4000SSE GEODETIC	ADJUSTED WITH:	TRIMNET

HOIZONTAL DATUM:	NAD 83 (91)	VERTICAL DATUM:	NAVD 29
PROJECTION:	TRANSVERSE MERCATOR	ZONE:	CENTRAL OREGON LCS
CENTRAL MERIDIAN:	W 121° 17'00.00"	ORIGIN NORTHING:	0.00F
LATITUDE OF ORIGIN:	N 43° 00'00.00"	ORIGIN EASTING:	3,300,000.00F
LINEAR UNITS:	INTERNATIONAL FOOT	SCALE ALONG MERIDIAN:	1.0001600

GEODETIC AND MAPPING COORDINATES

MARK:	45 OSHD 1927	HORIZONTAL ORDER:	FIRST	ONE SIGMA ERROR
Latitude:	43°35'16.641126"	Northing:	216679.358	0.009
Longitude:	120°04'21.447570"	Easting:	3620839.509	0.008
Convergence:	+0°50'05.3165"	Ell Height:	4562.70	0.023
Scale Factor:	1.000277572223	Ortho Height:	4622.47	FIXED
Combined Factor:	1.00005979	Geoid Height:	-59.77	

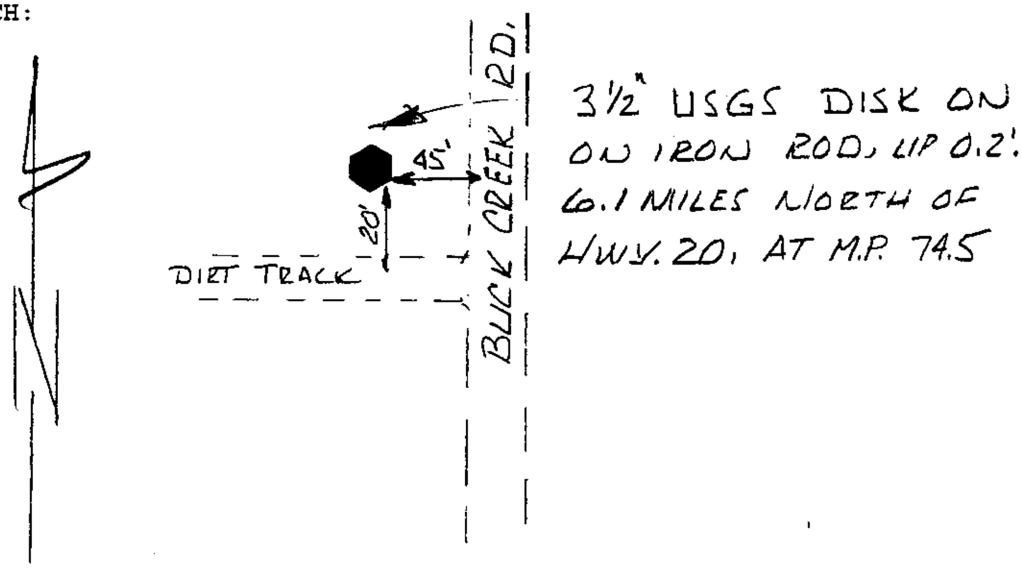
MARK DATA SHEET

NAME OF MARK:	8 TAM	COUNTY:	DESCHUTES
MARK SET BY:	U. S. G. S.	STATE:	OREGON
DATE OF MARK:	1979	COUNTRY:	U.S.A.

LOCATION: SECTION 10 TOWNSHIP 22 S RANGE 22 E

REFERENCE: CS

MARK SKETCH:



DATA COMPUTED BY:	DESCHUTES COUNTY SURVEYOR'S OFFICE	DATE:	1997
METHOD-EQUIPMENT:	GPS-TRIMBLE 4000SSE GEODETIC	ADJUSTED WITH:	TRIMNET

HOIZONTAL DATUM:	NAD 83 (91)	VERTICAL DATUM:	NAVD 29
PROJECTION:	TRANSVERSE MERCATOR	ZONE:	CENTRAL OREGON LCS
CENTRAL MERIDIAN:	W 121° 17'00.00"	ORIGIN NORTHING:	0.00F
LATITUDE OF ORIGIN:	N 43° 00'00.00"	ORIGIN EASTING:	3,300,000.00F
LINEAR UNITS:	INTERNATIONAL FOOT	SCALE ALONG MERIDIAN:	1.0001600

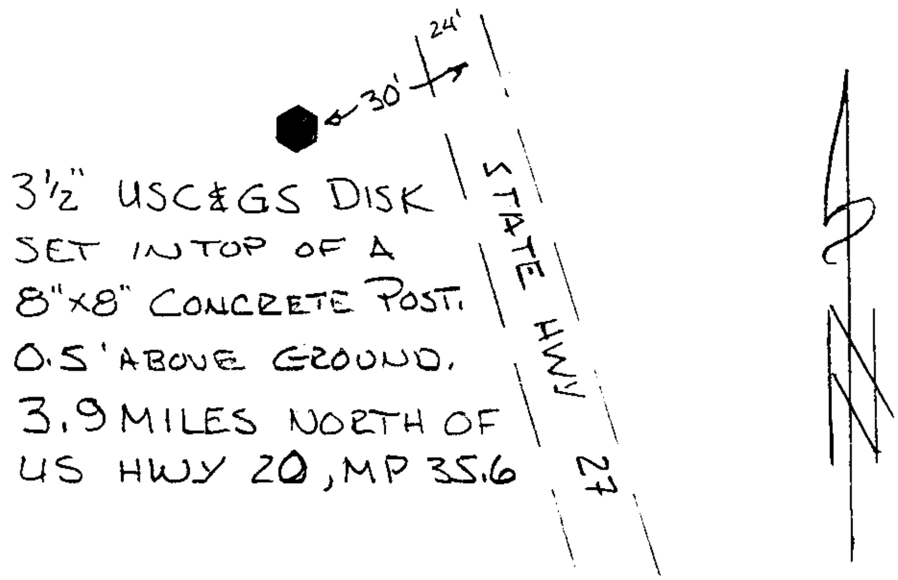
GEODETIC AND MAPPING COORDINATES

MARK:	8 TAM	HORIZONTAL ORDER:	FIRST	ONE SIGMA ERROR
Latitude:	43°40'45.672707"	Northing:	250044.676	0.015
Longitude:	120°03'41.061790"	Easting:	3623321.939	0.013
Convergence:	+0°50'38.2463"	Ell Height:	4107.48	0.037
Scale Factor:	1.000279396170	Ortho Height:	4167.14	0.058
Combined Factor:	1.00008334	Geoid Height:	-59.66	

MARK DATA SHEET

NAME OF MARK:	C-112 1934	COUNTY:	CROOK
MARK SET BY:	U.S. C. & G. S.	STATE:	OREGON
DATE OF MARK:	1934	COUNTRY:	U.S.A.
LOCATION:	SECTION 19 TOWNSHIP 19 S RANGE 17 E		
REFERENCE:	NONE		

MARK SKETCH:



DATA COMPUTED BY:	DESCHUTES COUNTY SURVEYOR'S OFFICE	DATE:	1997
METHOD-EQUIPMENT:	GPS-TRIMBLE 4000SSE GEODETIC	ADJUSTED WITH:	TRIMNET

HOIZONTAL DATUM:	NAD 83 (91)	VERTICAL DATUM:	NAVD 29
PROJECTION:	TRANSVERSE MERCATOR	ZONE:	CENTRAL OREGON LCS
CENTRAL MERIDIAN:	W 121° 17'00.00"	ORIGIN NORTHING:	0.00F
LATITUDE OF ORIGIN:	N 43° 00'00.00"	ORIGIN EASTING:	3,300,000.00F
LINEAR UNITS:	INTERNATIONAL FOOT	SCALE ALONG MERIDIAN:	1.0001600

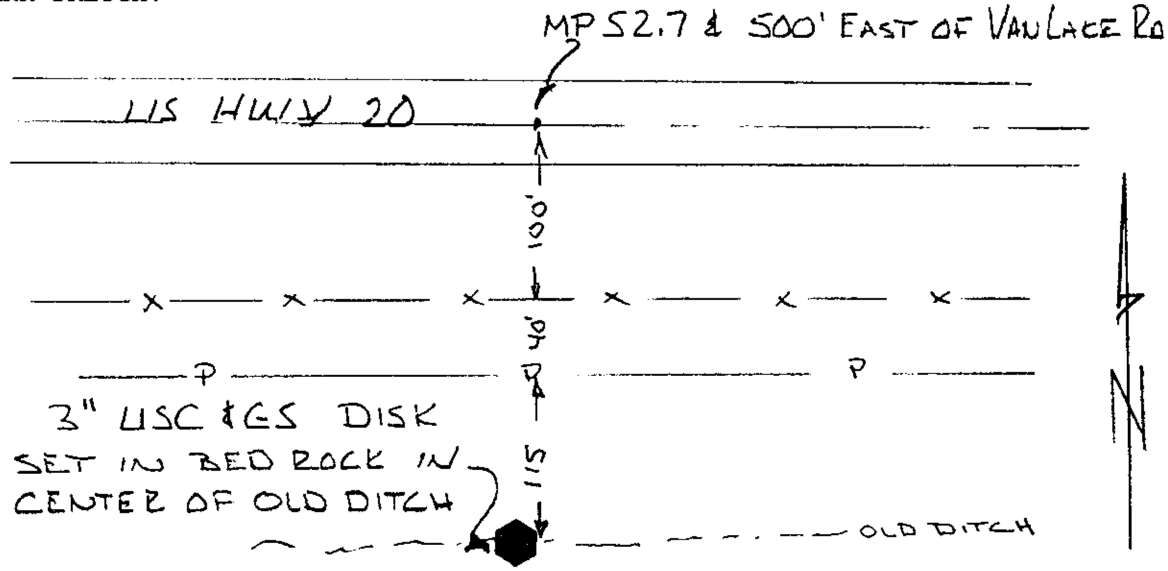
GEODETIC AND MAPPING COORDINATES

MARK:	C-112 1934	HORIZONTAL ORDER:	FIRST	ONE SIGMA ERROR
Latitude:	43°54'22.667641"	Northing:	330873.206	0.013
Longitude:	120°44'27.224515"	Easting:	3442986.449	0.011
Convergence:	+0°22'34.2339"	Ell Height:	4382.54	0.028
Scale Factor:	1.000183348341	Ortho Height:	4443.84	0.035
Combined Factor:	0.99997419	Geoid Height:	-61.30	

MARK DATA SHEET

NAME OF MARK:	C-373	COUNTY:	CROOK
MARK SET BY:	U.S. C. & G. S.	STATE:	OREGON
DATE OF MARK:	1943	COUNTRY:	U.S.A.
LOCATION:	SECTION 16 TOWNSHIP 21 S RANGE 19 E		
REFERENCE:	NONE		

MARK SKETCH:



DATA COMPUTED BY:	DESCHUTES COUNTY SURVEYOR'S OFFICE	DATE:	1997
METHOD-EQUIPMENT:	GPS-TRIMBLE 4000SSE GEODETIC	ADJUSTED WITH:	TRIMNET

HOIZONTAL DATUM:	NAD 83 (91)	VERTICAL DATUM:	NAVD 29
PROJECTION:	TRANSVERSE MERCATOR	ZONE:	CENTRAL OREGON LCS
CENTRAL MERIDIAN:	W 121° 17'00.00"	ORIGIN NORTHING:	0.00F
LATITUDE OF ORIGIN:	N 43° 00'00.00"	ORIGIN EASTING:	3,300,000.00F
LINEAR UNITS:	INTERNATIONAL FOOT	SCALE ALONG MERIDIAN:	1.0001600

GEODETIC AND MAPPING COORDINATES

MARK:	C-373	HORIZONTAL ORDER:	FIRST	ONE SIGMA ERROR
Latitude:	43°45'12.143277"	Northing:	275837.631	0.013
Longitude:	120°25'13.023085"	Easting:	3528081.428	0.011
Convergence:	+0°35'48.7329"	Ell Height:	4372.30	0.029
Scale Factor:	1.000219411863	Ortho Height:	4432.95	FIXED
Combined Factor:	1.00001073	Geoid Height:	-60.64	

MARK DATA SHEET

NAME OF MARK: COW PIE | COUNTY: DESCHUTES

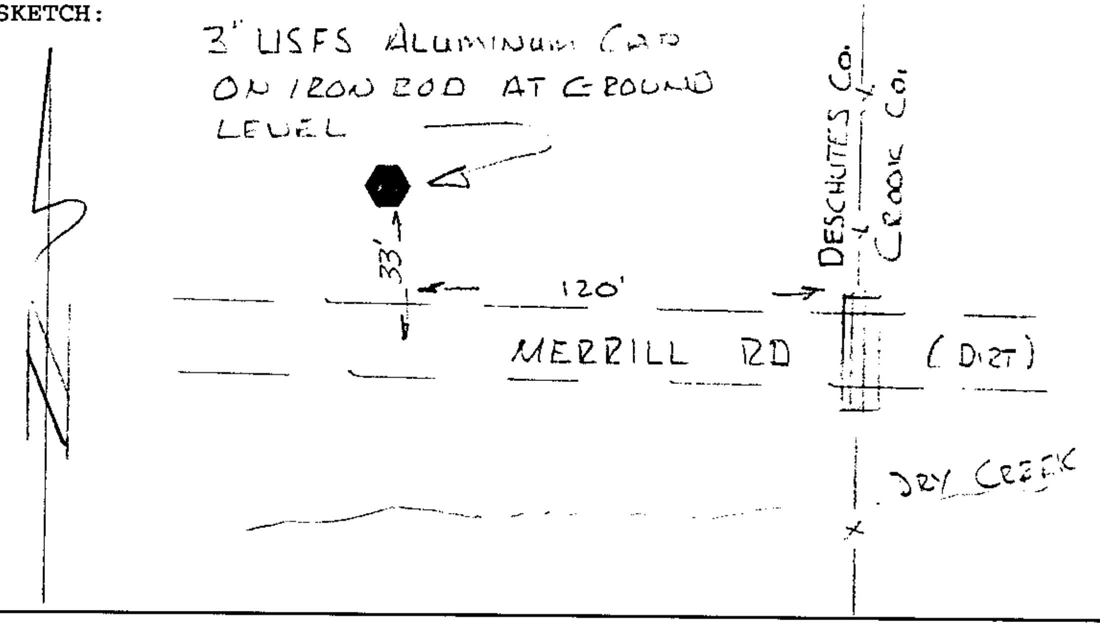
MARK SET BY: U. S. FOREST SERVICE | STATE: OREGON

DATE OF MARK: 1991 | COUNTRY: U.S.A.

LOCATION: SECTION 5 TOWNSHIP 20 S RANGE 18 E

REFERENCE: NONE

MARK SKETCH:



DATA COMPUTED BY: DESCHUTES COUNTY SURVEYOR'S OFFICE | DATE: 1997

METHOD-EQUIPMENT: GPS-TRIMBLE 4000SSE GEODETIC | ADJUSTED WITH: TRIMNET

HOIZONTAL DATUM:	NAD 83 (91)	VERTICAL DATUM:	NAVD 29
PROJECTION:	TRANSVERSE MERCATOR	ZONE:	CENTRAL OREGON LCS
CENTRAL MERIDIAN:	W 121° 17'00.00"	ORIGIN NORTHING:	0.00F
LATITUDE OF ORIGIN:	N 43° 00'00.00"	ORIGIN EASTING:	3,300,000.00F
LINEAR UNITS:	INTERNATIONAL FOOT	SCALE ALONG MERIDIAN:	1.0001600

GEODETIC AND MAPPING COORDINATES

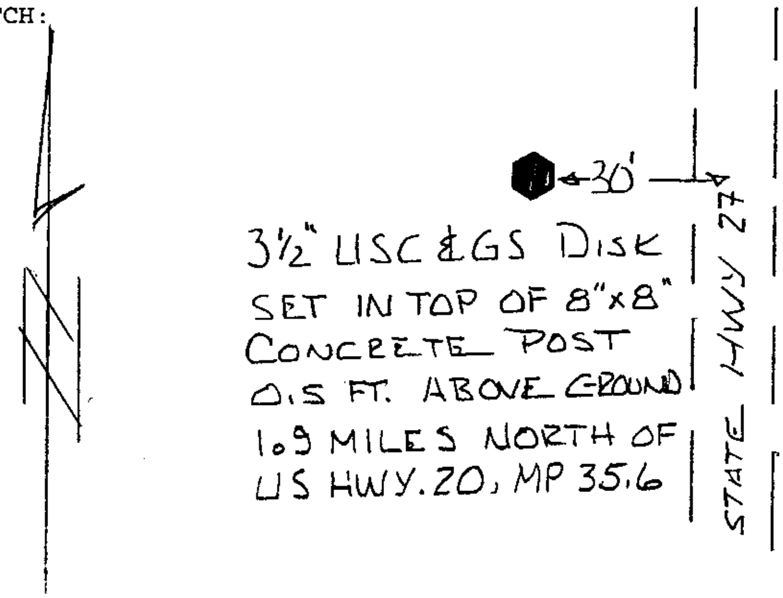
MARK: COW PIE | HORIZONTAL ORDER: FIRST

				ONE SIGMA ERROR
Latitude:	43°52'10.423020"	Northing:	318314.457	0.015
Longitude:	120°22'45.397253"	Easting:	3538455.828	0.013
Convergence:	+0°37'35.5997"	Ell Height:	4590.25	0.039
Scale Factor:	1.000224938002	Ortho Height:	4649.92	0.062
Combined Factor:	1.00000586	Geoid Height:	-59.67	

MARK DATA SHEET

NAME OF MARK:	D-112 1934	COUNTY:	CROOK
MARK SET BY:	U.S. C. & G. S.	STATE:	OREGON
DATE OF MARK:	1934	COUNTRY:	U.S.A.
LOCATION:	SECTION 31 TOWNSHIP 19 S RANGE 17 E		
REFERENCE:	NONE		

MARK SKETCH:



DATA COMPUTED BY:	DESCHUTES COUNTY SURVEYOR'S OFFICE	DATE:	1997
METHOD-EQUIPMENT:	GPS-TRIMBLE 4000SSE GEODETIC	ADJUSTED WITH:	TRIMNET

HOIZONTAL DATUM:	NAD 83 (91)	VERTICAL DATUM:	NAVD 29
PROJECTION:	TRANSVERSE MERCATOR	ZONE:	CENTRAL OREGON LCS
CENTRAL MERIDIAN:	W 121° 17'00.00"	ORIGIN NORTHING:	0.00F
LATITUDE OF ORIGIN:	N 43° 00'00.00"	ORIGIN EASTING:	3,300,000.00F
LINEAR UNITS:	INTERNATIONAL FOOT	SCALE ALONG MERIDIAN:	1.0001600

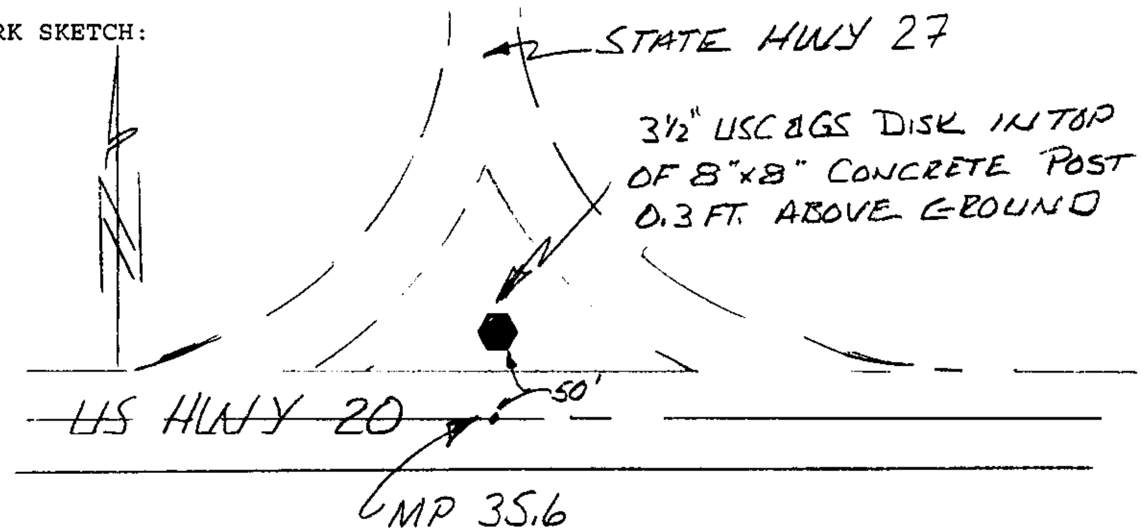
GEODETIC AND MAPPING COORDINATES

MARK:	D-112 1934	HORIZONTAL ORDER:	FIRST	ONE SIGMA ERROR
Latitude:	43°52'37.228894"	Northing:	320208.744	0.010
Longitude:	120°43'58.418686"	Easting:	3445166.802	0.009
Convergence:	+0°22'53.4812"	Ell Height:	4380.73	0.021
Scale Factor:	1.000184066011	Ortho Height:	4442.05	FIXED
Combined Factor:	0.99997499	Geoid Height:	-61.31	

MARK DATA SHEET

NAME OF MARK:	E-112 1934	COUNTY:	DESCHUTES
MARK SET BY:	U.S. C. & G. S.	STATE:	OREGON
DATE OF MARK:	1934	COUNTRY:	U.S.A.
LOCATION:	SECTION 7 TOWNSHIP 20 S RANGE 17 E		
REFERENCE:	NONE		

MARK SKETCH:



DATA COMPUTED BY:	DESCHUTES COUNTY SURVEYOR'S OFFICE	DATE:	1997
METHOD-EQUIPMENT:	GPS-TRIMBLE 4000SSE GEODETIC	ADJUSTED WITH:	TRIMNET

HOIZONTAL DATUM:	NAD 83 (91)	VERTICAL DATUM:	NAVD 29
PROJECTION:	TRANSVERSE MERCATOR	ZONE:	CENTRAL OREGON LCS
CENTRAL MERIDIAN:	W 121° 17'00.00"	ORIGIN NORTHING:	0.00F
LATITUDE OF ORIGIN:	N 43° 00'00.00"	ORIGIN EASTING:	3,300,000.00F
LINEAR UNITS:	INTERNATIONAL FOOT	SCALE ALONG MERIDIAN:	1.0001600

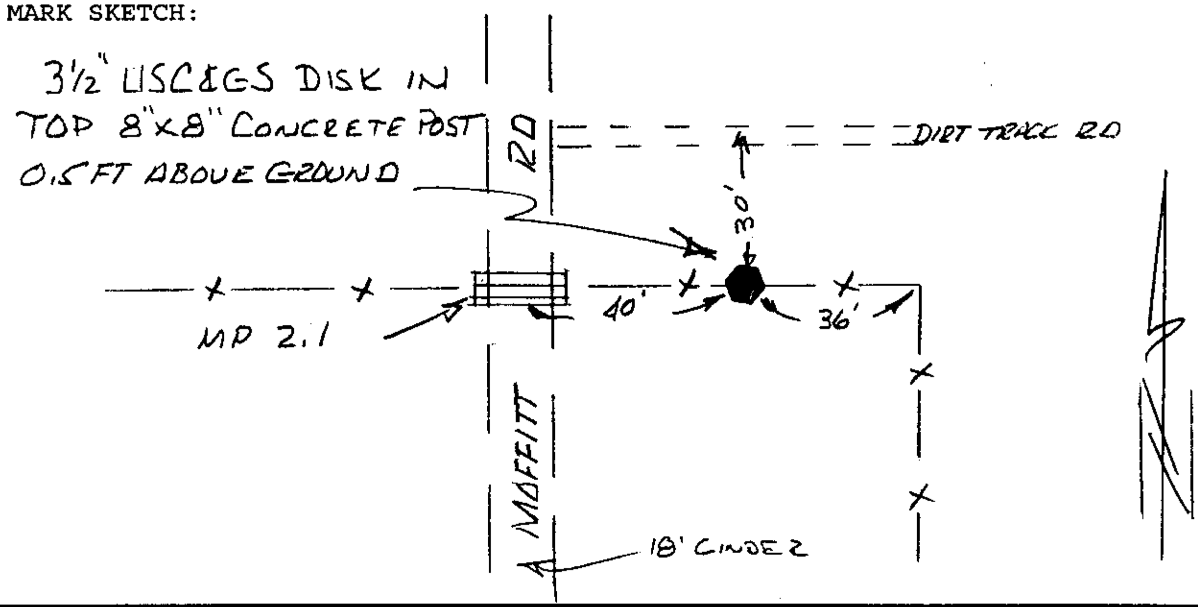
GEODETIC AND MAPPING COORDINATES

				ONE SIGMA ERROR
MARK:	E-112 1934	HORIZONTAL ORDER:	FIRST	
Latitude:	43°50'58.023704"	Northing:	310161.276	0.014
Longitude:	120°43'59.268107"	Easting:	3445171.432	0.011
Convergence:	+0°22'52.2056"	Ell Height:	4318.60	0.023
Scale Factor:	1.000184067703	Ortho Height:	4379.97	FIXED
Combined Factor:	0.99997796	Geoid Height:	-61.36	

MARK DATA SHEET

NAME OF MARK:	F-112	COUNTY:	DESCHUTES
MARK SET BY:	U.S. C. & G. S.	STATE:	OREGON
DATE OF MARK:	1934	COUNTRY:	U.S.A.
LOCATION:	SECTION 13 TOWNSHIP 20 S RANGE 16 E		
REFERENCE:	NONE		

MARK SKETCH:



DATA COMPUTED BY:	DESCHUTES COUNTY SURVEYOR'S OFFICE	DATE:	1997
METHOD-EQUIPMENT:	GPS-TRIMBLE 4000SSE GEODETIC	ADJUSTED WITH:	TRIMNET

HOIZONTAL DATUM:	NAD 83 (91)	VERTICAL DATUM:	NAVD 29
PROJECTION:	TRANSVERSE MERCATOR	ZONE:	CENTRAL OREGON LCS
CENTRAL MERIDIAN:	W 121° 17'00.00"	ORIGIN NORTHING:	0.00F
LATITUDE OF ORIGIN:	N 43° 00'00.00"	ORIGIN EASTING:	3,300,000.00F
LINEAR UNITS:	INTERNATIONAL FOOT	SCALE ALONG MERIDIAN:	1.0001600

GEODETIC AND MAPPING COORDINATES

MARK:	F-112	HORIZONTAL ORDER:	FIRST	ONE SIGMA ERROR
Latitude:	43°49'42.569159"	Northing:	302461.303	0.016
Longitude:	120°46'02.704746"	Easting:	3436172.187	0.013
Convergence:	+0°21'26.1990"	Ell Height:	4330.27	0.025
Scale Factor:	1.000181176315	Ortho Height:	4391.78	FIXED
Combined Factor:	0.99997451	Geoid Height:	-61.52	

MARK DATA SHEET

NAME OF MARK: **FOX** — COUNTY: **LAKE**

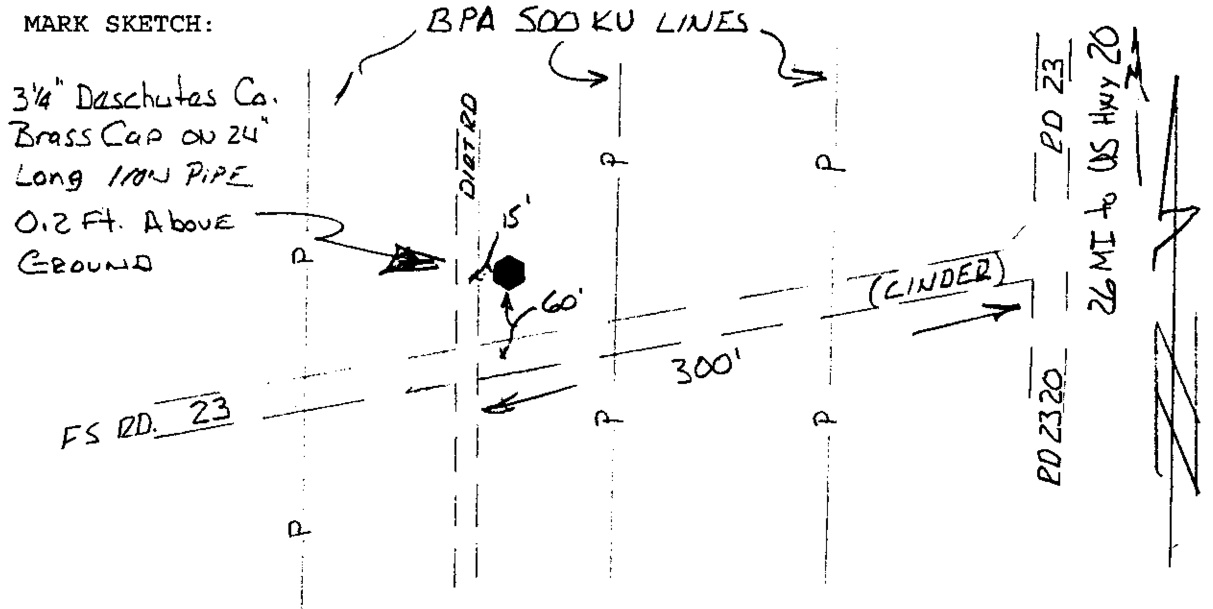
MARK SET BY: **DESCHUTES CO. SURVEYOR** — STATE: **OREGON**

DATE OF MARK: **1997** — COUNTRY: **U.S.A.**

LOCATION: **SECTION 1 TOWNSHIP 23 S RANGE 15 E**

REFERENCE: **NONE**

MARK SKETCH:



DATA COMPUTED BY: DESCHUTES COUNTY SURVEYOR'S OFFICE — DATE: 1997

METHOD-EQUIPMENT: GPS-TRIMBLE 4000SSE GEODETIC — ADJUSTED WITH: TRIMNET

HOIZONTAL DATUM:	NAD 83 (91)	VERTICAL DATUM:	NAVD 29
PROJECTION:	TRANSVERSE MERCATOR	ZONE:	CENTRAL OREGON LCS
CENTRAL MERIDIAN:	W 121° 17'00.00"	ORIGIN NORTHING:	0.00F
LATITUDE OF ORIGIN:	N 43° 00'00.00"	ORIGIN EASTING:	3,300,000.00F
LINEAR UNITS:	INTERNATIONAL FOOT	SCALE ALONG MERIDIAN:	1.0001600

GEODETIC AND MAPPING COORDINATES

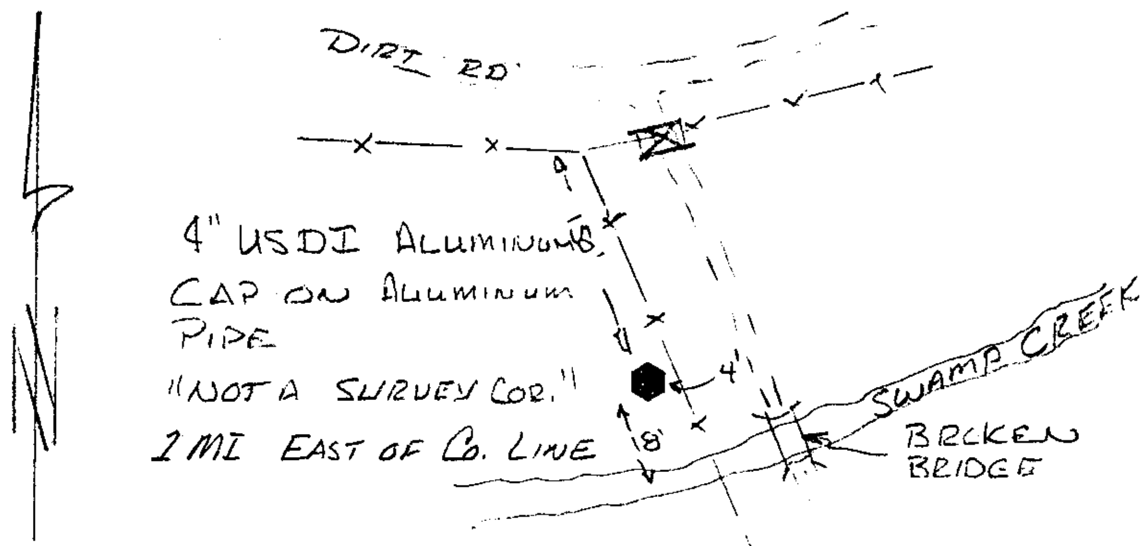
MARK: **FOX** — HORIZONTAL ORDER: FIRST

				ONE SIGMA ERROR
Latitude:	43°36'46.670411"	Northing:	223746.617	0.013
Longitude:	120°51'31.945930"	Easting:	3412435.371	0.011
Convergence:	+0°17'34.0365"	Ell Height:	5275.08	0.033
Scale Factor:	1.000174437745	Ortho Height:	5336.97	0.066
Combined Factor:	0.99992269	Geoid Height:	-61.89	

MARK DATA SHEET

NAME OF MARK:	G 112-133	COUNTY:	HARNEY
MARK SET BY:	U.S. DEPT. INT. (B L M)	STATE:	OREGON
DATE OF MARK:	1940	COUNTRY:	U.S.A.
LOCATION:	SECTION 20 TOWNSHIP 22 S RANGE 23 E		
REFERENCE:	NONE		

MARK SKETCH:



DATA COMPUTED BY:	DESCHUTES COUNTY SURVEYOR'S OFFICE	DATE:	1997
METHOD-EQUIPMENT:	GPS-TRIMBLE 4000SSE GEODETIC	ADJUSTED WITH:	TRIMNET

HOIZONTAL DATUM:	NAD 83 (91)	VERTICAL DATUM:	NAVD 29
PROJECTION:	TRANSVERSE MERCATOR	ZONE:	CENTRAL OREGON LCS
CENTRAL MERIDIAN:	W 121° 17'00.00"	ORIGIN NORTHING:	0.00F
LATITUDE OF ORIGIN:	N 43° 00'00.00"	ORIGIN EASTING:	3,300,000.00F
LINEAR UNITS:	INTERNATIONAL FOOT	SCALE ALONG MERIDIAN:	1.0001600

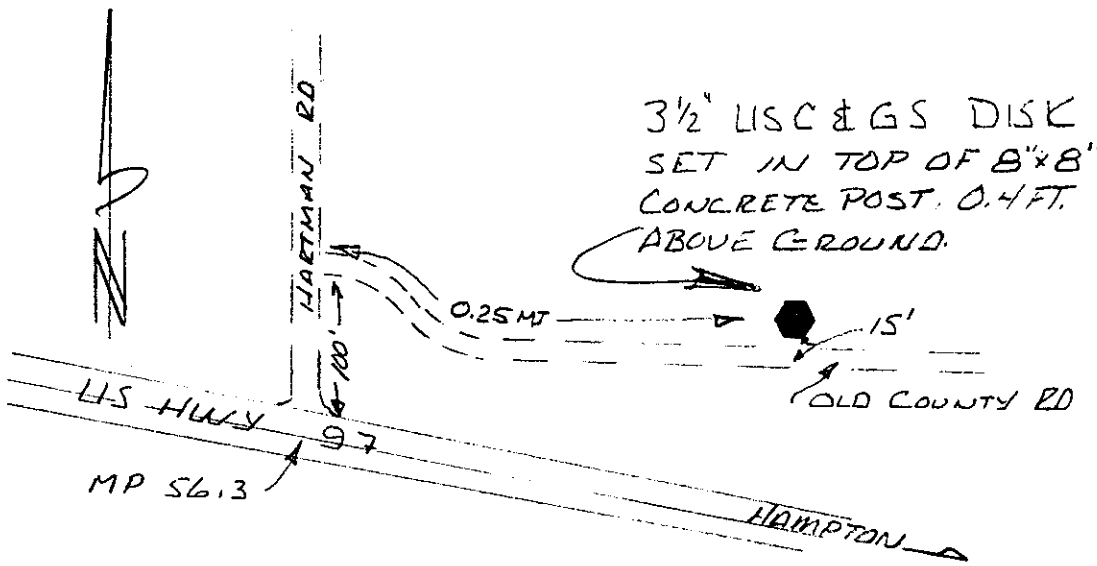
GEODETIC AND MAPPING COORDINATES

MARK:	G 112-133	HORIZONTAL ORDER:	FIRST	ONE SIGMA ERROR
Latitude:	43°39'16.397841"	Northing:	241783.211	0.017
Longitude:	119°52'31.864194"	Easting:	3672661.819	0.014
Convergence:	+0°58'18.9510"	Ell Height:	4430.76	0.053
Scale Factor:	1.000318622556	Ortho Height:	4489.68	0.093
Combined Factor:	1.00010713	Geoid Height:	-58.93	

MARK DATA SHEET

NAME OF MARK:	H 22	COUNTY:	DESCHUTES
MARK SET BY:	U.S. C. & G. S.	STATE:	OREGON
DATE OF MARK:	1920	COUNTRY:	U.S.A.
LOCATION:	SECTION 20 TOWNSHIP 21 S RANGE 20 E		
REFERENCE:	NONE		

MARK SKETCH:



DATA COMPUTED BY:	DESCHUTES COUNTY SURVEYOR'S OFFICE	DATE:	1997
METHOD-EQUIPMENT:	GPS-TRIMBLE 4000SSE GEODETIC	ADJUSTED WITH:	TRIMNET

HOIZONTAL DATUM:	NAD 83 (91)	VERTICAL DATUM:	NAVD 29
PROJECTION:	TRANSVERSE MERCATOR	ZONE:	CENTRAL OREGON LCS
CENTRAL MERIDIAN:	W 121° 17'00.00"	ORIGIN NORTHING:	0.00F
LATITUDE OF ORIGIN:	N 43° 00'00.00"	ORIGIN EASTING:	3,300,000.00F
LINEAR UNITS:	INTERNATIONAL FOOT	SCALE ALONG MERIDIAN:	1.0001600

GEODETIC AND MAPPING COORDINATES

MARK:	H 22	HORIZONTAL ORDER:	FIRST	ONE SIGMA ERROR
Latitude:	43°43'39.937431"	Northing:	266692.186	0.015
Longitude:	120°21'10.655766"	Easting:	3545978.391	0.012
Convergence:	+0°38'35.2834"	Ell Height:	4366.12	0.030
Scale Factor:	1.000229102372	Ortho Height:	4426.67	FIXED
Combined Factor:	1.00002071	Geoid Height:	-60.56	

MARK DATA SHEET

NAME OF MARK: K 22 — COUNTY: DESCHUTES

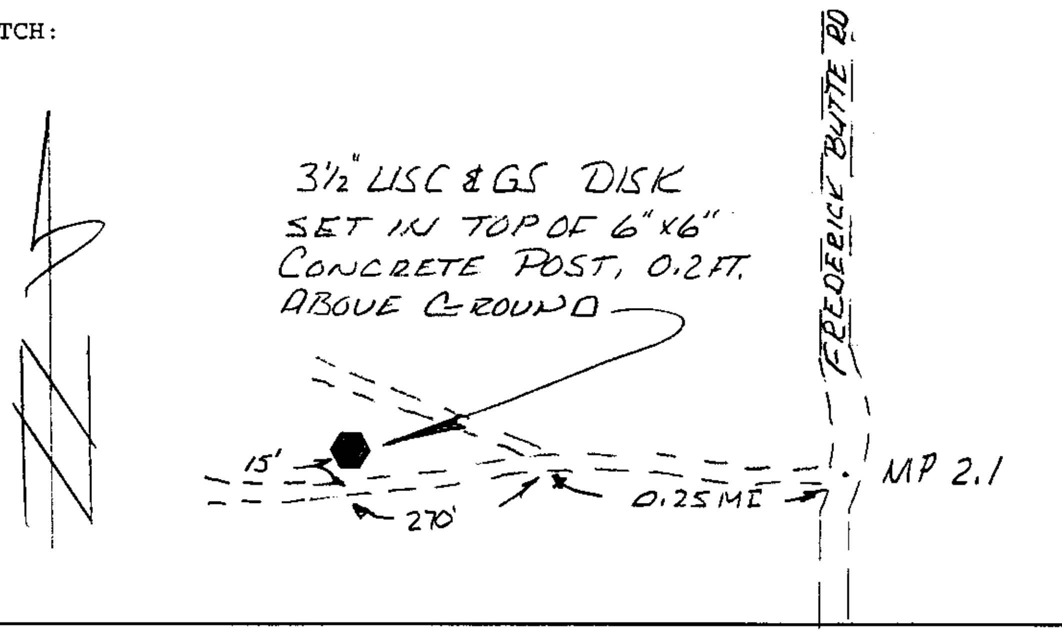
MARK SET BY: U.S. C. & G. S. — STATE: OREGON

DATE OF MARK: 1920 — COUNTRY: U.S.A.

LOCATION: SECTION 18 TOWNSHIP 21 S RANGE 19 E

REFERENCE: NONE

MARK SKETCH:



DATA COMPUTED BY: DESCHUTES COUNTY SURVEYOR'S OFFICE — DATE: 1997

METHOD-EQUIPMENT: GPS-TRIMBLE 4000SSE GEODETIC — ADJUSTED WITH: TRIMNET

HOIZONTAL DATUM:	NAD 83 (91)	VERTICAL DATUM:	NAVD 29
PROJECTION:	TRANSVERSE MERCATOR	ZONE:	CENTRAL OREGON LCS
CENTRAL MERIDIAN:	W 121° 17'00.00"	ORIGIN NORTHING:	0.00F
LATITUDE OF ORIGIN:	N 43° 00'00.00"	ORIGIN EASTING:	3,300,000.00F
LINEAR UNITS:	INTERNATIONAL FOOT	SCALE ALONG MERIDIAN:	1.0001600

GEODETIC AND MAPPING COORDINATES

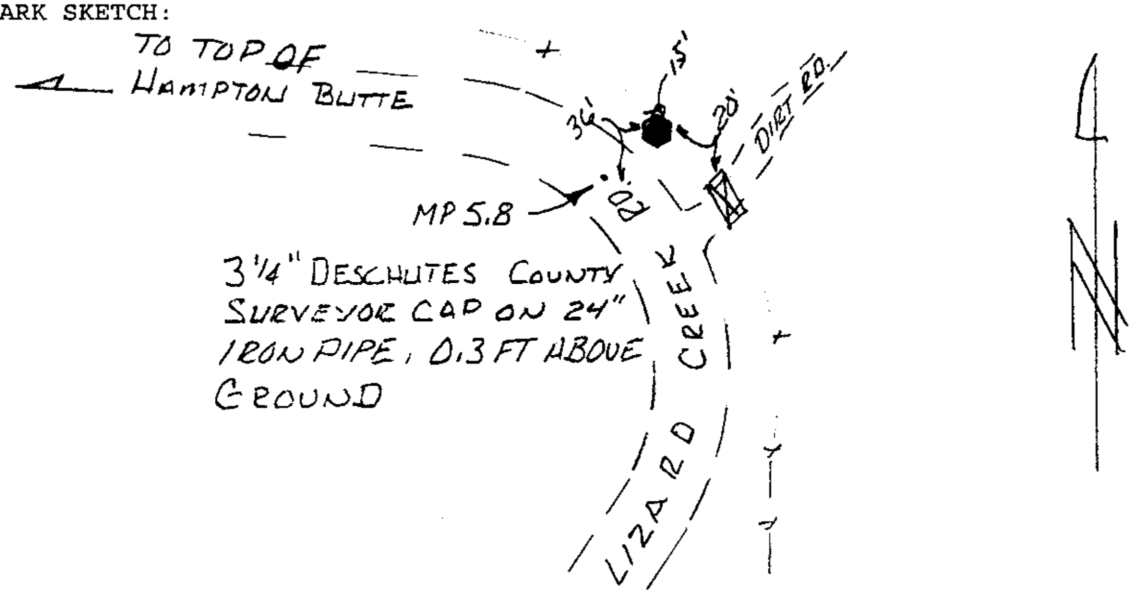
MARK: K 22 — HORIZONTAL ORDER: FIRST

				ONE SIGMA ERROR
Latitude:	43°44'49.142902"	Northing:	273343.014	0.012
Longitude:	120°28'57.238102"	Easting:	3511644.393	0.010
Convergence:	+0°33'13.4263"	Ell Height:	4468.63	0.026
Scale Factor:	1.000211156981	Ortho Height:	4529.35	FIXED
Combined Factor:	0.99999788	Geoid Height:	-60.73	

MARK DATA SHEET

NAME OF MARK:	LIZARD	COUNTY:	DESCHUTES
MARK SET BY:	DESCHUTES CO. SURVEYOR	STATE:	OREGON
DATE OF MARK:	1997	COUNTRY:	U.S.A.
LOCATION:	SECTION 12 TOWNSHIP 21 S RANGE 20 E		
REFERENCE:	NONE		

MARK SKETCH:



DATA COMPUTED BY:	DESCHUTES COUNTY SURVEYOR'S OFFICE	DATE:	1997
METHOD-EQUIPMENT:	GPS-TRIMBLE 4000SSE GEODETIC	ADJUSTED WITH:	TRIMNET

HOIZONTAL DATUM:	NAD 83 (91)	VERTICAL DATUM:	NAVD 29
PROJECTION:	TRANSVERSE MERCATOR	ZONE:	CENTRAL OREGON LCS
CENTRAL MERIDIAN:	W 121° 17'00.00"	ORIGIN NORTHING:	0.00F
LATITUDE OF ORIGIN:	N 43° 00'00.00"	ORIGIN EASTING:	3,300,000.00F
LINEAR UNITS:	INTERNATIONAL FOOT	SCALE ALONG MERIDIAN:	1.0001600

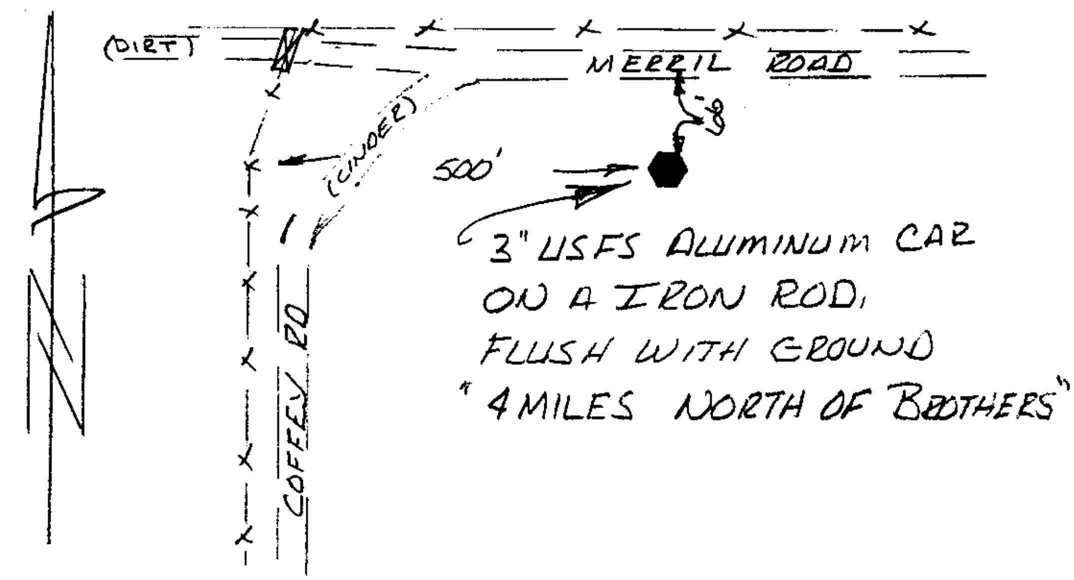
GEODETIC AND MAPPING COORDINATES

MARK:	LIZARD	HORIZONTAL ORDER:	FIRST	ONE SIGMA ERROR
Latitude:	43°46'11.460279"	Northing:	282310.799	0.014
Longitude:	120°15'54.112468"	Easting:	3569037.069	0.011
Convergence:	+0°42'16.0671"	Ell Height:	5569.69	0.033
Scale Factor:	1.000242665292	Ortho Height:	5629.51	0.048
Combined Factor:	0.99997684	Geoid Height:	-59.82	

MARK DATA SHEET

NAME OF MARK:	MERRILL	COUNTY:	DESCHUTES
MARK SET BY:	U. S. FOREST SERVICE	STATE:	OREGON
DATE OF MARK:	1991	COUNTRY:	U.S.A.
LOCATION:	SECTION 5 TOWNSHIP 20 S RANGE 18 E		
REFERENCE:	NONE		

MARK SKETCH:



DATA COMPUTED BY:	DESCHUTES COUNTY SURVEYOR'S OFFICE	DATE:	1997
METHOD-EQUIPMENT:	GPS-TRIMBLE 4000SSE GEODETIC	ADJUSTED WITH:	TRIMNET

HOIZONTAL DATUM:	NAD 83 (91)	VERTICAL DATUM:	NAVD 29
PROJECTION:	TRANSVERSE MERCATOR	ZONE:	CENTRAL OREGON LCS
CENTRAL MERIDIAN:	W 121° 17'00.00"	ORIGIN NORTHING:	0.00F
LATITUDE OF ORIGIN:	N 43° 00'00.00"	ORIGIN EASTING:	3,300,000.00F
LINEAR UNITS:	INTERNATIONAL FOOT	SCALE ALONG MERIDIAN:	1.0001600

GEODETIC AND MAPPING COORDINATES

MARK:	MERRILL	HORIZONTAL ORDER:	FIRST	ONE SIGMA ERROR
Latitude:	43°52'18.753377"	Northing:	318604.217	0.014
Longitude:	120°35'51.694881"	Easting:	3480838.826	0.012
Convergence:	+0°28'30.6969"	Ell Height:	4520.60	0.031
Scale Factor:	1.000197347156	Ortho Height:	4581.20	0.046
Combined Factor:	0.99998159	Geoid Height:	-60.60	

MARK DATA SHEET

NAME OF MARK: MILLICAN | COUNTY: DESCHUTES

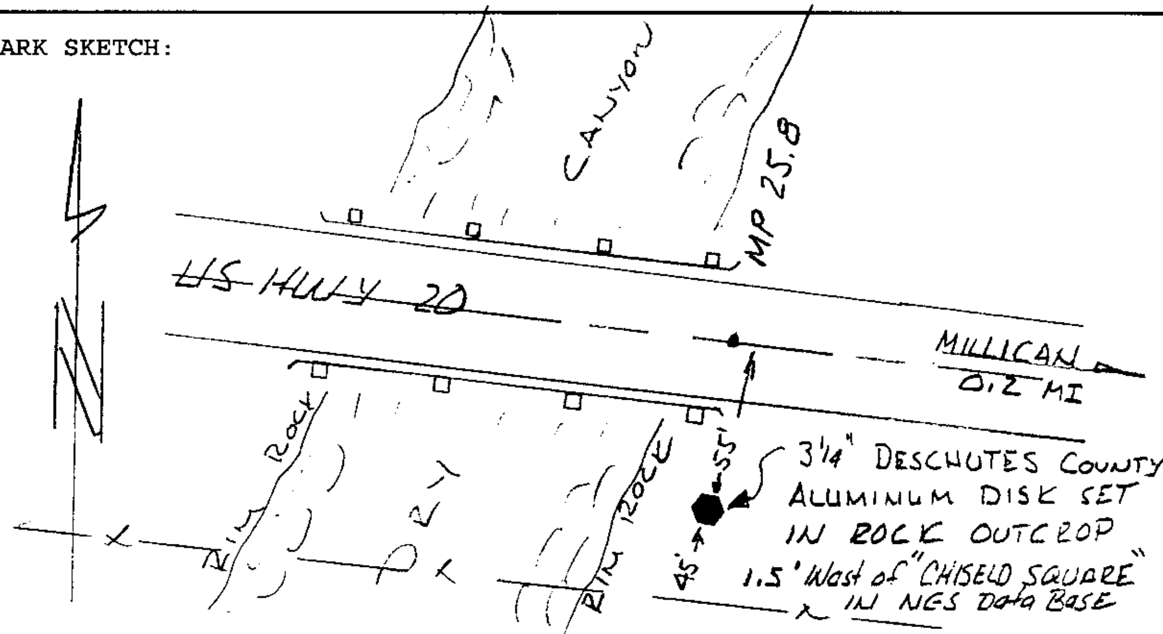
MARK SET BY: DESCHUTES CO. SURVEYOR | STATE: OREGON

DATE OF MARK: 1997 | COUNTRY: U.S.A.

LOCATION: SECTION 34 TOWNSHIP 19 S RANGE 15 E

REFERENCE: NONE

MARK SKETCH:



DATA COMPUTED BY: DESCHUTES COUNTY SURVEYOR'S OFFICE | DATE: 1997

METHOD-EQUIPMENT: GPS-TRIMBLE 4000SSE GEODETIC | ADJUSTED WITH: TRIMNET

HOIZONTAL DATUM:	NAD 83 (91)	VERTICAL DATUM:	NAVD 29
PROJECTION:	TRANSVERSE MERCATOR	ZONE:	CENTRAL OREGON LCS
CENTRAL MERIDIAN:	W 121° 17'00.00"	ORIGIN NORTHING:	0.00F
LATITUDE OF ORIGIN:	N 43° 00'00.00"	ORIGIN EASTING:	3,300,000.00F
LINEAR UNITS:	INTERNATIONAL FOOT	SCALE ALONG MERIDIAN:	1.0001600

GEODETIC AND MAPPING COORDINATES

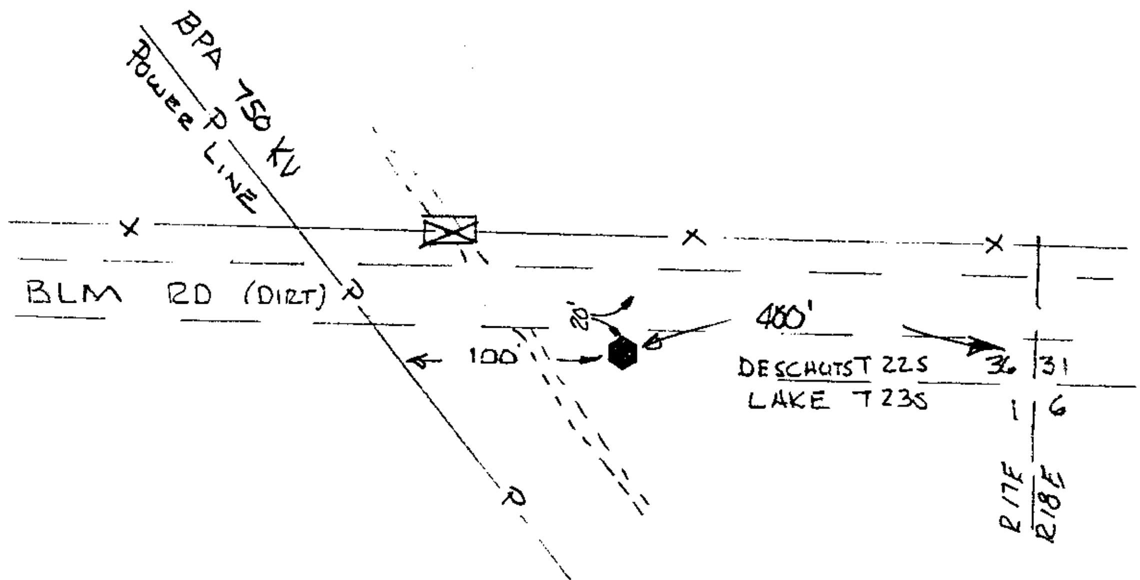
MARK: **MILLICAN** | HORIZONTAL ORDER: FIRST

				ONE SIGMA ERROR
Latitude:	43°52'48.936526"	Northing:	321117.312	0.009
Longitude:	120°55'25.713711"	Easting:	3394811.711	0.007
Convergence:	+0°14'57.1453"	Ell Height:	4196.00	0.015
Scale Factor:	1.000170265706	Ortho Height:	4258.20	FIXED
Combined Factor:	0.99997001	Geoid Height:	-62.20	

MARK DATA SHEET

NAME OF MARK:	MOOYMAN	COUNTY:	DESCHUTES
MARK SET BY:	DESCHUTES CO. SURVEYOR	STATE:	OREGON
DATE OF MARK:	1997	COUNTRY:	U.S.A.
LOCATION:	SECTION 36 TOWNSHIP 22 S RANGE 17 E		
REFERENCE:	NONE		

MARK SKETCH:



DATA COMPUTED BY:	DESCHUTES COUNTY SURVEYOR'S OFFICE	DATE:	1997
METHOD-EQUIPMENT:	GPS-TRIMBLE 4000SSE GEODETIC	ADJUSTED WITH:	TRIMNET

HOIZONTAL DATUM:	NAD 83 (91)	VERTICAL DATUM:	NAVD 29
PROJECTION:	TRANSVERSE MERCATOR	ZONE:	CENTRAL OREGON LCS
CENTRAL MERIDIAN:	W 121° 17'00.00"	ORIGIN NORTHING:	0.00F
LATITUDE OF ORIGIN:	N 43° 00'00.00"	ORIGIN EASTING:	3,300,000.00F
LINEAR UNITS:	INTERNATIONAL FOOT	SCALE ALONG MERIDIAN:	1.0001600

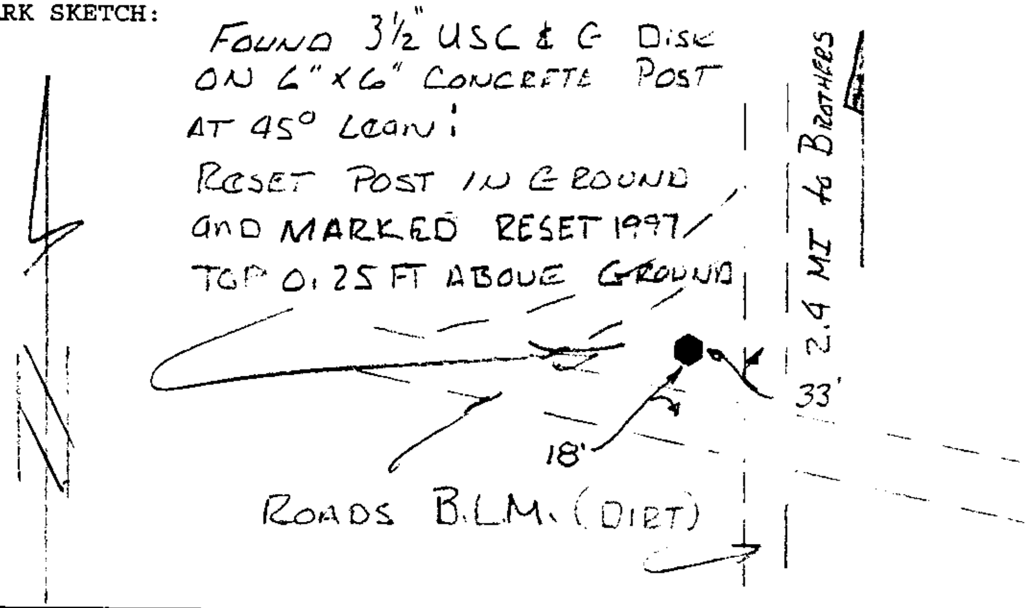
GEODETIC AND MAPPING COORDINATES

MARK:	MOOYMAN	HORIZONTAL ORDER:	FIRST	ONE SIGMA ERROR
Latitude:	43°36'55.679199"	Northing:	225080.159	0.021
Longitude:	120°37'00.334649"	Easting:	3476561.984	0.018
Convergence:	+0°27'35.3647"	Ell Height:	4903.51	0.050
Scale Factor:	1.000195603637	Ortho Height:	4964.77	0.057
Combined Factor:	0.99996158	Geoid Height:	-61.27	

MARK DATA SHEET

NAME OF MARK:	N-22 RESET 1997	COUNTY:	DESCHUTES
MARK SET BY:	U.S. C. & G. S.	STATE:	OREGON
DATE OF MARK:	1920	COUNTRY:	U.S.A.
LOCATION:	SECTION 6 TOWNSHIP 21 S RANGE 18 E		
REFERENCE:	NONE		

MARK SKETCH:



DATA COMPUTED BY:	DESCHUTES COUNTY SURVEYOR'S OFFICE	DATE:	1997
METHOD-EQUIPMENT:	GPS-TRIMBLE 4000SSE GEODETIC	ADJUSTED WITH:	TRIMNET

HOIZONTAL DATUM:	NAD 83 (91)	VERTICAL DATUM:	NAVD 29
PROJECTION:	TRANSVERSE MERCATOR	ZONE:	CENTRAL OREGON LCS
CENTRAL MERIDIAN:	W 121° 17'00.00"	ORIGIN NORTHING:	0.00F
LATITUDE OF ORIGIN:	N 43° 00'00.00"	ORIGIN EASTING:	3,300,000.00F
LINEAR UNITS:	INTERNATIONAL FOOT	SCALE ALONG MERIDIAN:	1.0001600

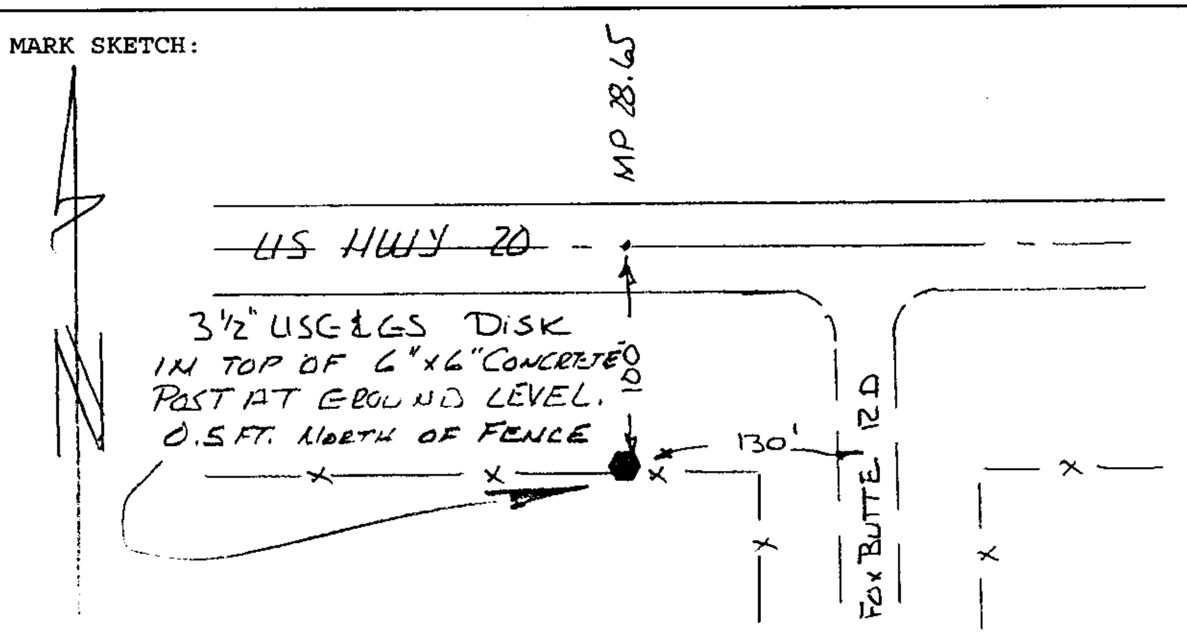
GEODETIC AND MAPPING COORDINATES

MARK:	N-22 RESET 1997	HORIZONTAL ORDER:	FIRST	ONE SIGMA ERROR
Latitude:	43°46'42.005389"	Northing:	284491.490	0.011
Longitude:	120°36'05.892845"	Easting:	3480079.609	0.009
Convergence:	+0°28'17.9658"	Ell Height:	4637.76	0.028
Scale Factor:	1.000197035036	Ortho Height:	4698.62	0.038
Combined Factor:	0.99997569	Geoid Height:	-60.86	

MARK DATA SHEET

NAME OF MARK:	N-372 1943	COUNTY:	DESCHUTES
MARK SET BY:	U.S. C. & G. S.	STATE:	OREGON
DATE OF MARK:	1943	COUNTRY:	U.S.A.
LOCATION:	SECTION 11 TOWNSHIP 20 S RANGE 15 E		
REFERENCE:	NONE		

MARK SKETCH:



DATA COMPUTED BY:	DESCHUTES COUNTY SURVEYOR'S OFFICE	DATE:	1997
METHOD-EQUIPMENT:	GPS-TRIMBLE 4000SSE GEODETIC	ADJUSTED WITH:	TRIMNET

HOIZONTAL DATUM:	NAD 83 (91)	VERTICAL DATUM:	NAVD 29
PROJECTION:	TRANSVERSE MERCATOR	ZONE:	CENTRAL OREGON LCS
CENTRAL MERIDIAN:	W 121° 17'00.00"	ORIGIN NORTHING:	0.00F
LATITUDE OF ORIGIN:	N 43° 00'00.00"	ORIGIN EASTING:	3,300,000.00F
LINEAR UNITS:	INTERNATIONAL FOOT	SCALE ALONG MERIDIAN:	1.0001600

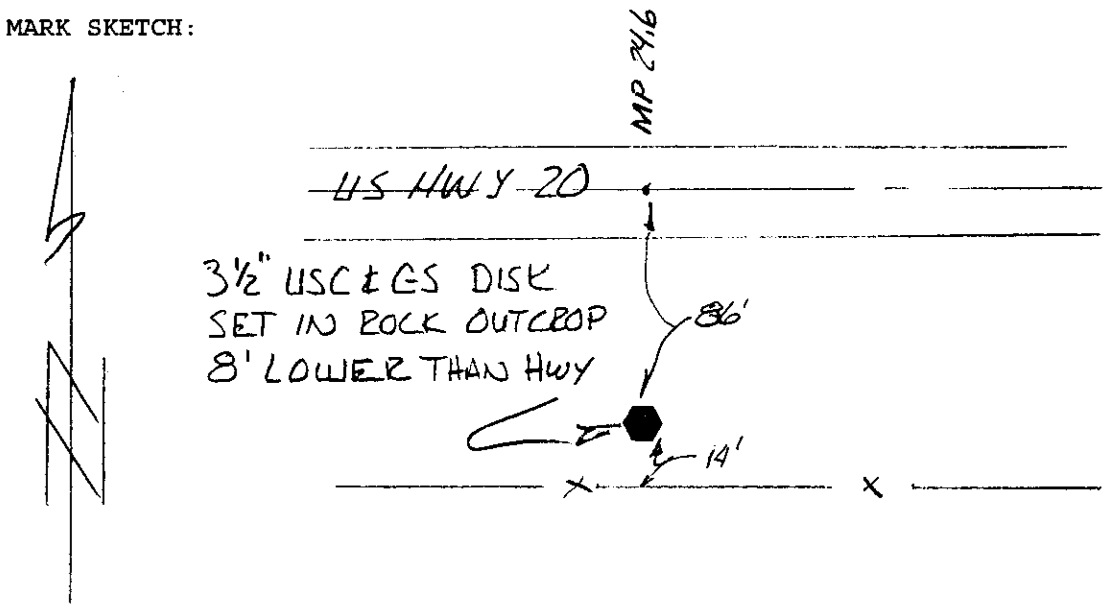
GEODETIC AND MAPPING COORDINATES

MARK:	N-372 1943	HORIZONTAL ORDER:	FIRST	ONE SIGMA ERROR
Latitude:	43°52'16.421705"	Northing:	317893.562	0.012
Longitude:	120°52'04.188984"	Easting:	3409590.775	0.009
Convergence:	+0°17'16.6663"	Ell Height:	4265.53	0.014
Scale Factor:	1.000173715601	Ortho Height:	4327.41	FIXED
Combined Factor:	0.99997014	Geoid Height:	-61.89	

MARK DATA SHEET

NAME OF MARK:	P-364 1943	COUNTY:	DESCHUTES
MARK SET BY:	U.S. C. & G. S.	STATE:	OREGON
DATE OF MARK:	1943	COUNTRY:	U.S.A.
LOCATION:	SECTION 29 TOWNSHIP 19 S RANGE 15 E		
REFERENCE:	NONE		

MARK SKETCH:



DATA COMPUTED BY:	DESCHUTES COUNTY SURVEYOR'S OFFICE	DATE:	1997
METHOD-EQUIPMENT:	GPS-TRIMBLE 4000SSE GEODETIC	ADJUSTED WITH:	TRIMNET

HOIZONTAL DATUM:	NAD 83 (91)	VERTICAL DATUM:	NAVD 29
PROJECTION:	TRANSVERSE MERCATOR	ZONE:	CENTRAL OREGON LCS
CENTRAL MERIDIAN:	W 121° 17'00.00"	ORIGIN NORTHING:	0.00F
LATITUDE OF ORIGIN:	N 43° 00'00.00"	ORIGIN EASTING:	3,300,000.00F
LINEAR UNITS:	INTERNATIONAL FOOT	SCALE ALONG MERIDIAN:	1.0001600

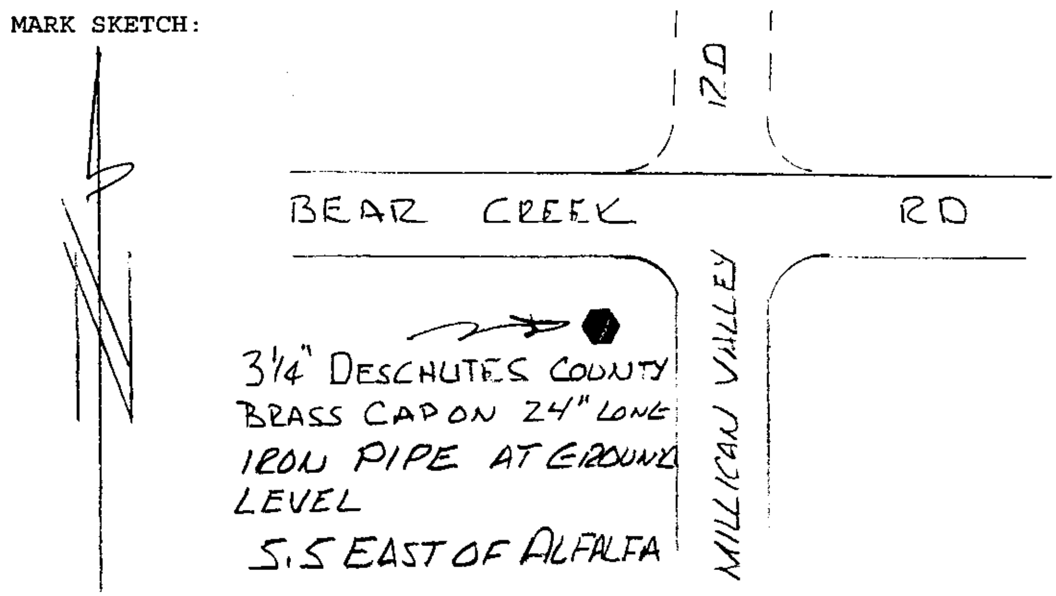
GEODETIC AND MAPPING COORDINATES

MARK:	P-364 1943	HORIZONTAL ORDER:	FIRST	ONE SIGMA ERROR
Latitude:	43°53'11.317650"	Northing:	323358.909	0.016
Longitude:	120°56'46.937462"	Easting:	3388852.499	0.015
Convergence:	+0°14'00.9385"	Ell Height:	4169.44	0.019
Scale Factor:	1.000169015776	Ortho Height:	4231.79	FIXED
Combined Factor:	0.99997002	Geoid Height:	-62.35	

MARK DATA SHEET

NAME OF MARK:	PERREAULT	COUNTY:	CROOK
MARK SET BY:	DESCHUTES CO. SURVEYOR	STATE:	OREGON
DATE OF MARK:	1997	COUNTRY:	U.S.A.
LOCATION:	SECTION 27 TOWNSHIP 17 S RANGE 15 E		
REFERENCE:	NONE		

MARK SKETCH:



DATA COMPUTED BY:	DESCHUTES COUNTY SURVEYOR'S OFFICE	DATE:	1997
METHOD-EQUIPMENT:	GPS-TRIMBLE 4000SSE GEODETIC	ADJUSTED WITH:	TRIMNET

HOIZONTAL DATUM:	NAD 83 (91)	VERTICAL DATUM:	NAVD 29
PROJECTION:	TRANSVERSE MERCATOR	ZONE:	CENTRAL OREGON LCS
CENTRAL MERIDIAN:	W 121° 17'00.00"	ORIGIN NORTHING:	0.00F
LATITUDE OF ORIGIN:	N 43° 00'00.00"	ORIGIN EASTING:	3,300,000.00F
LINEAR UNITS:	INTERNATIONAL FOOT	SCALE ALONG MERIDIAN:	1.0001600

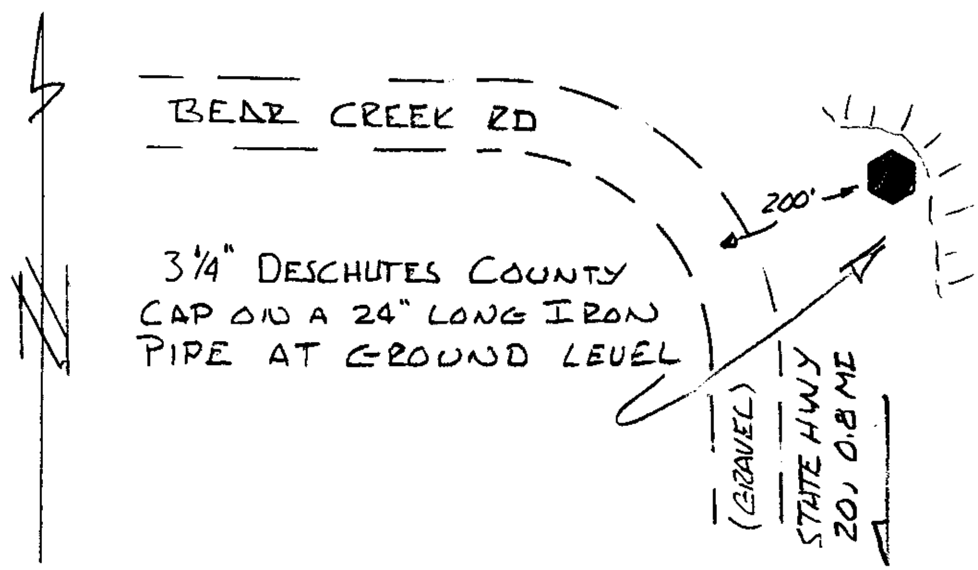
GEODETIC AND MAPPING COORDINATES

MARK:	PERREAULT	HORIZONTAL ORDER:	FIRST	ONE SIGMA ERROR
Latitude:	44°03'44.301487"	Northing:	387498.730	0.011
Longitude:	120°55'01.366074"	Easting:	3396300.666	0.008
Convergence:	+0°15'17.0376"	Ell Height:	3409.40	0.024
Scale Factor:	1.000170590219	Ortho Height:	3472.63	0.046
Combined Factor:	1.00000787	Geoid Height:	-63.23	

MARK DATA SHEET

NAME OF MARK:	PETERSEN	COUNTY:	CROOK
MARK SET BY:	DESCHUTES CO. SURVEYOR	STATE:	OREGON
DATE OF MARK:	1997	COUNTRY:	U.S.A.
LOCATION:	SECTION 23 TOWNSHIP 17 S RANGE 16 E		
REFERENCE:	NONE		

MARK SKETCH:



DATA COMPUTED BY:	DESCHUTES COUNTY SURVEYOR'S OFFICE	DATE:	1997
METHOD-EQUIPMENT:	GPS-TRIMBLE 4000SSE GEODETIC	ADJUSTED WITH:	TRIMNET

HOIZONTAL DATUM:	NAD 83 (91)	VERTICAL DATUM:	NAVD 29
PROJECTION:	TRANSVERSE MERCATOR	ZONE:	CENTRAL OREGON LCS
CENTRAL MERIDIAN:	W 121° 17'00.00"	ORIGIN NORTHING:	0.00F
LATITUDE OF ORIGIN:	N 43° 00'00.00"	ORIGIN EASTING:	3,300,000.00F
LINEAR UNITS:	INTERNATIONAL FOOT	SCALE ALONG MERIDIAN:	1.0001600

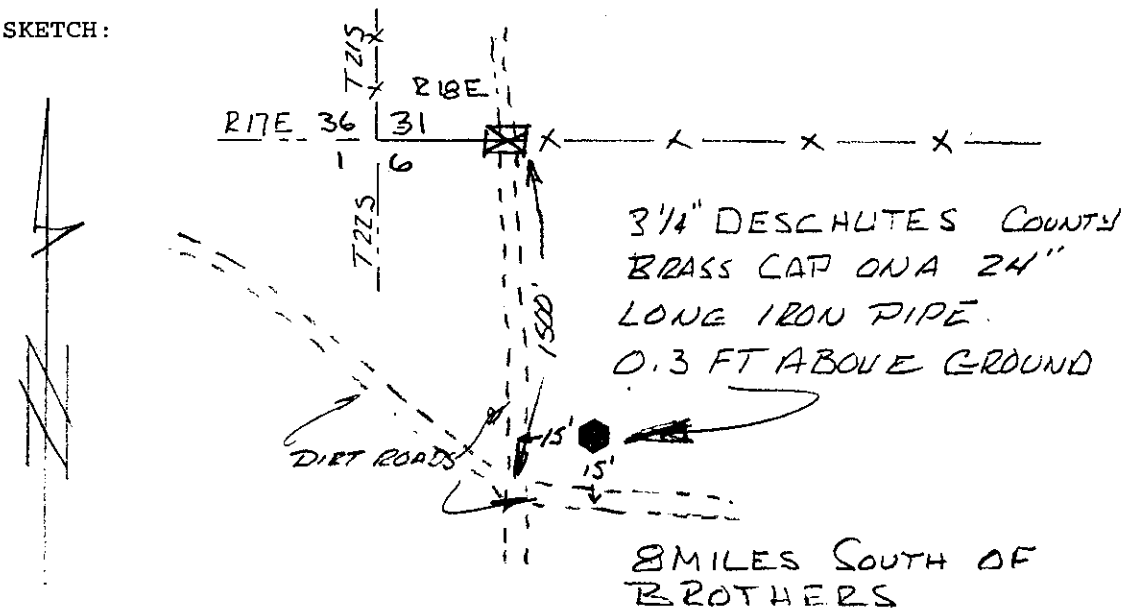
GEODETIC AND MAPPING COORDINATES

MARK:	PETERSEN	HORIZONTAL ORDER:	FIRST	ONE SIGMA ERROR
Latitude:	44°04'50.921861"	Northing:	394431.543	0.011
Longitude:	120°46'58.339807"	Easting:	3431535.412	0.010
Convergence:	+0°20'53.3816"	Ell Height:	3877.35	0.029
Scale Factor:	1.000179757531	Ortho Height:	3939.56	0.057
Combined Factor:	0.99999470	Geoid Height:	-62.21	

MARK DATA SHEET

NAME OF MARK:	POTTERFIELD	COUNTY:	DESCHUTES
MARK SET BY:	DESCHUTES CO. SURVEYOR	STATE:	OREGON
DATE OF MARK:	1997	COUNTRY:	U.S.A.
LOCATION:	SECTION 6 TOWNSHIP 22 S RANGE 18 E		
REFERENCE:	NONE		

MARK SKETCH:



DATA COMPUTED BY:	DESCHUTES COUNTY SURVEYOR'S OFFICE	DATE:	1997
METHOD-EQUIPMENT:	GPS-TRIMBLE 4000SSE GEODETIC	ADJUSTED WITH:	TRIMNET

HOIZONTAL DATUM:	NAD 83 (91)	VERTICAL DATUM:	NAVD 29
PROJECTION:	TRANSVERSE MERCATOR	ZONE:	CENTRAL OREGON LCS
CENTRAL MERIDIAN:	W 121° 17'00.00"	ORIGIN NORTHING:	0.00F
LATITUDE OF ORIGIN:	N 43° 00'00.00"	ORIGIN EASTING:	3,300,000.00F
LINEAR UNITS:	INTERNATIONAL FOOT	SCALE ALONG MERIDIAN:	1.0001600

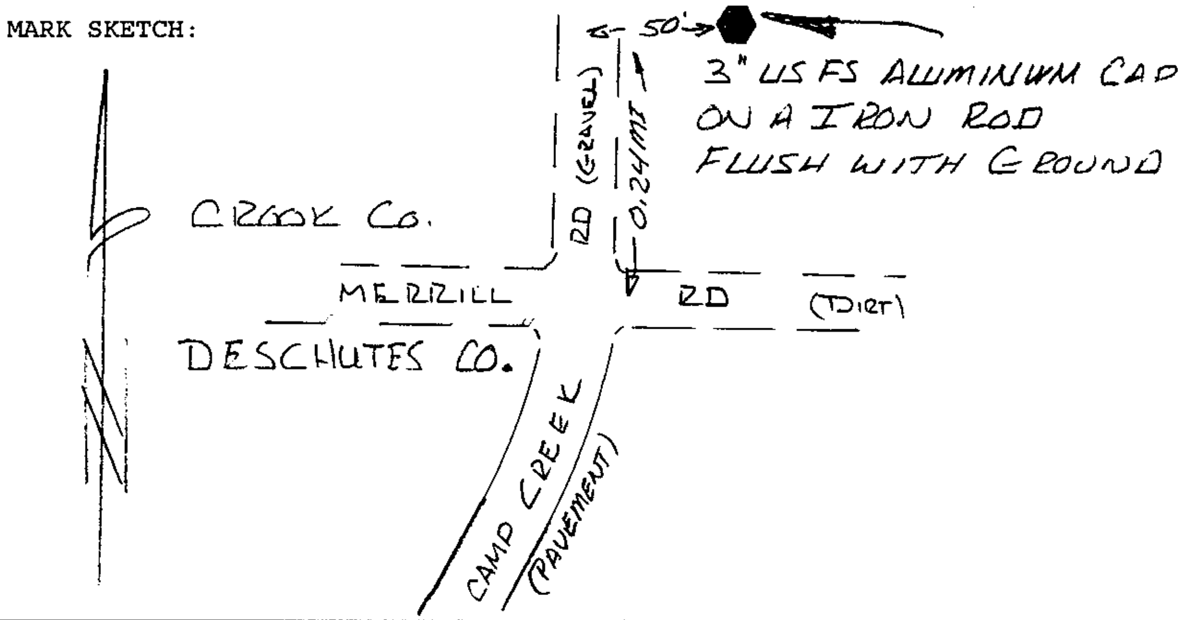
GEODETIC AND MAPPING COORDINATES

MARK:	POTTERFIELD	HORIZONTAL ORDER:	FIRST	ONE SIGMA ERROR
Latitude:	43°41'52.502754"	Northing:	255148.441	0.014
Longitude:	120°36'46.183776"	Easting:	3477360.321	0.012
Convergence:	+0°27'47.6400"	Ell Height:	4765.53	0.032
Scale Factor:	1.000195925641	Ortho Height:	4826.67	0.044
Combined Factor:	0.99996848	Geoid Height:	-61.14	

MARK DATA SHEET

NAME OF MARK:	**PRINGLE FLAT**	COUNTY:	**CROOK**
MARK SET BY:	**U. S. FOREST SERVICE**	STATE:	**OREGON**
DATE OF MARK:	**1990**	COUNTRY:	**U.S.A.**
LOCATION:	**SECTION 31 TOWNSHIP 19 S RANGE 19 E**		
REFERENCE:	**NONE**		

MARK SKETCH:



DATA COMPUTED BY:	DESCHUTES COUNTY SURVEYOR'S OFFICE	DATE:	1997
METHOD-EQUIPMENT:	GPS-TRIMBLE 4000SSE GEODETIC	ADJUSTED WITH:	TRIMNET

HOIZONTAL DATUM:	NAD 83 (91)	VERTICAL DATUM:	NAVD 29
PROJECTION:	TRANSVERSE MERCATOR	ZONE:	CENTRAL OREGON LCS
CENTRAL MERIDIAN:	W 121° 17'00.00"	ORIGIN NORTHING:	0.00F
LATITUDE OF ORIGIN:	N 43° 00'00.00"	ORIGIN EASTING:	3,300,000.00F
LINEAR UNITS:	INTERNATIONAL FOOT	SCALE ALONG MERIDIAN:	1.0001600

GEODETIC AND MAPPING COORDINATES

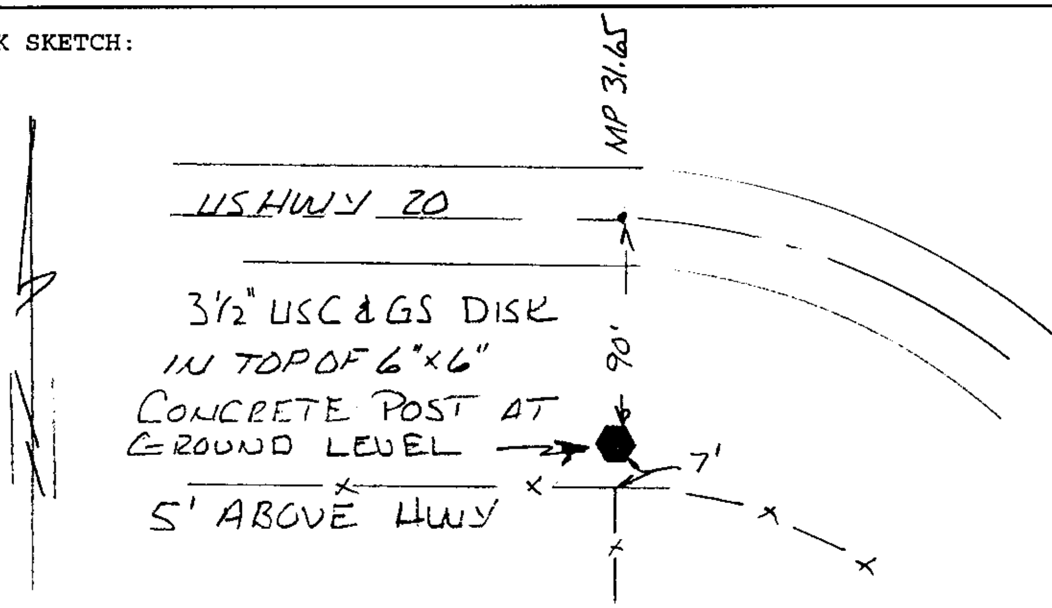
MARK: **PRINGLE FLAT** HORIZONTAL ORDER: **FIRST**

				ONE SIGMA ERROR
Latitude:	43°52'34.315797"	Northing:	320438.288	0.014
Longitude:	120°29'18.476169"	Easting:	3509632.664	0.012
Convergence:	+0°33'03.3960"	Ell Height:	4542.55	0.033
Scale Factor:	1.000210187510	Ortho Height:	4602.64	0.055
Combined Factor:	0.99999338	Geoid Height:	-60.09	

MARK DATA SHEET

NAME OF MARK:	R-372 1943	COUNTY:	DESCHUTES
MARK SET BY:	U.S. C. & G. S.	STATE:	OREGON
DATE OF MARK:	1943	COUNTRY:	U.S.A.
LOCATION:	SECTION 3 TOWNSHIP 20 S RANGE 16 E		
REFERENCE:	NONE		

MARK SKETCH:



DATA COMPUTED BY:	DESCHUTES COUNTY SURVEYOR'S OFFICE	DATE:	1997
METHOD-EQUIPMENT:	GPS-TRIMBLE 4000SSE GEODETIC	ADJUSTED WITH:	TRIMNET

HOIZONTAL DATUM:	NAD 83 (91)	VERTICAL DATUM:	NAVD 29
PROJECTION:	TRANSVERSE MERCATOR	ZONE:	CENTRAL OREGON LCS
CENTRAL MERIDIAN:	W 121° 17'00.00"	ORIGIN NORTHING:	0.00F
LATITUDE OF ORIGIN:	N 43° 00'00.00"	ORIGIN EASTING:	3,300,000.00F
LINEAR UNITS:	INTERNATIONAL FOOT	SCALE ALONG MERIDIAN:	1.0001600

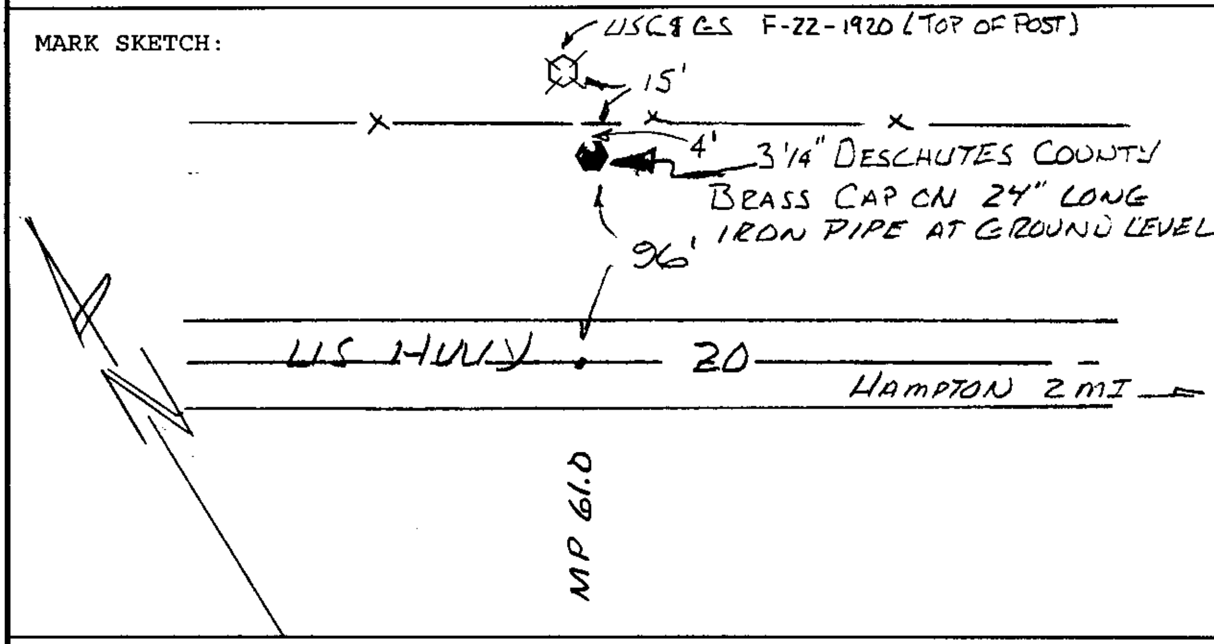
GEODETIC AND MAPPING COORDINATES

MARK:	R-372 1943	HORIZONTAL ORDER:	FIRST	ONE SIGMA ERROR
Latitude:	43°52'15.937555"	Northing:	317929.766	0.014
Longitude:	120°48'28.290371"	Easting:	3425408.909	0.012
Convergence:	+0°19'46.2945"	Ell Height:	4248.24	0.020
Scale Factor:	1.000177960771	Ortho Height:	4309.91	FIXED
Combined Factor:	0.99997521	Geoid Height:	-61.67	

MARK DATA SHEET

NAME OF MARK:	SWEET	COUNTY:	DESCHUTES
MARK SET BY:	DESCHUTES CO. SURVEYOR	STATE:	OREGON
DATE OF MARK:	1997	COUNTRY:	U.S.A.
LOCATION:	SECTION 1 TOWNSHIP 22 S RANGE 20 E		
REFERENCE:	NONE		

MARK SKETCH:



DATA COMPUTED BY:	DESCHUTES COUNTY SURVEYOR'S OFFICE	DATE:	1997
METHOD-EQUIPMENT:	GPS-TRIMBLE 4000SSE GEODETIC	ADJUSTED WITH:	TRIMNET

HOIZONTAL DATUM:	NAD 83 (91)	VERTICAL DATUM:	NAVD 29
PROJECTION:	TRANSVERSE MERCATOR	ZONE:	CENTRAL OREGON LCS
CENTRAL MERIDIAN:	W 121° 17'00.00"	ORIGIN NORTHING:	0.00F
LATITUDE OF ORIGIN:	N 43° 00'00.00"	ORIGIN EASTING:	3,300,000.00F
LINEAR UNITS:	INTERNATIONAL FOOT	SCALE ALONG MERIDIAN:	1.0001600

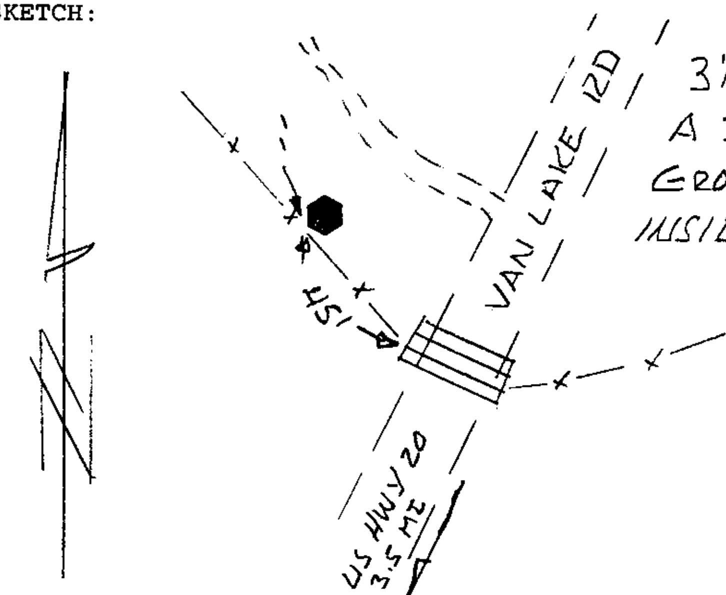
GEODETIC AND MAPPING COORDINATES

MARK:	SWEET	HORIZONTAL ORDER:	FIRST	ONE SIGMA ERROR
Latitude:	43°41'42.112070"	Northing:	254996.873	0.015
Longitude:	120°16'34.272555"	Easting:	3566421.236	0.013
Convergence:	+0°41'44.8603"	Ell Height:	4357.11	0.032
Scale Factor:	1.000241066964	Ortho Height:	4417.47	FIXED
Combined Factor:	1.00003310	Geoid Height:	-60.37	

MARK DATA SHEET

NAME OF MARK:	TAM 30	COUNTY:	DESCHUTES
MARK SET BY:	U. S. G. S.	STATE:	OREGON
DATE OF MARK:	1978	COUNTRY:	U.S.A.
LOCATION:	SECTION 6 TOWNSHIP 21 S RANGE 20 E		
REFERENCE:	NONE		

MARK SKETCH:



DATA COMPUTED BY:	DESCHUTES COUNTY SURVEYOR'S OFFICE	DATE:	1997
METHOD-EQUIPMENT:	GPS-TRIMBLE 4000SSE GEODETIC	ADJUSTED WITH:	TRIMNET

HOIZONTAL DATUM:	NAD 83 (91)	VERTICAL DATUM:	NAVD 29
PROJECTION:	TRANSVERSE MERCATOR	ZONE:	CENTRAL OREGON LCS
CENTRAL MERIDIAN:	W 121° 17'00.00"	ORIGIN NORTHING:	0.00F
LATITUDE OF ORIGIN:	N 43° 00'00.00"	ORIGIN EASTING:	3,300,000.00F
LINEAR UNITS:	INTERNATIONAL FOOT	SCALE ALONG MERIDIAN:	1.0001600

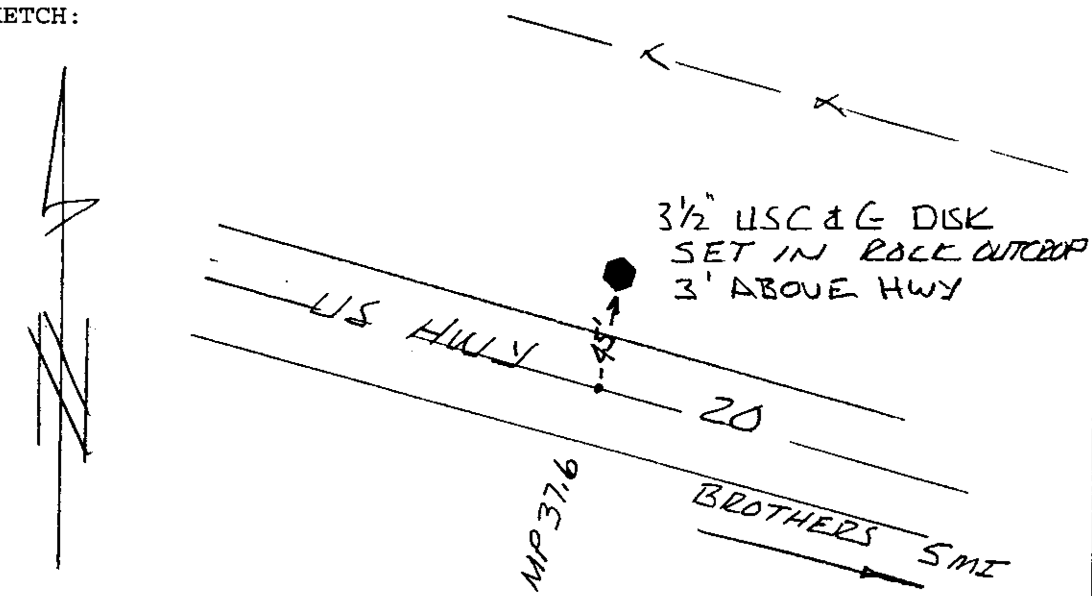
GEODETIC AND MAPPING COORDINATES

MARK: TAM 30		HORIZONTAL ORDER:	FIRST	ONE SIGMA ERROR
Latitude:	43°46'43.589656"	Northing:	285239.756	0.013
Longitude:	120°22'13.854939"	Easting:	3541132.042	0.011
Convergence:	+0°37'53.7054"	Ell Height:	4503.63	0.031
Scale Factor:	1.000226405301	Ortho Height:	4563.89	0.037
Combined Factor:	1.00001145	Geoid Height:	-60.26	

MARK DATA SHEET

NAME OF MARK:	U-372 1943	COUNTY:	DESCHUTES
MARK SET BY:	U.S. C. & G. S.	STATE:	OREGON
DATE OF MARK:	1943	COUNTRY:	U.S.A.
LOCATION:	SECTION 16 TOWNSHIP 20 S RANGE 17 E		
REFERENCE:	NONE		

MARK SKETCH:



DATA COMPUTED BY:	DESCHUTES COUNTY SURVEYOR'S OFFICE	DATE:	1997
METHOD-EQUIPMENT:	GPS-TRIMBLE 4000SSE GEODETIC	ADJUSTED WITH:	TRIMNET

HOIZONTAL DATUM:	NAD 83 (91)	VERTICAL DATUM:	NAVD 29
PROJECTION:	TRANSVERSE MERCATOR	ZONE:	CENTRAL OREGON LCS
CENTRAL MERIDIAN:	W 121° 17'00.00"	ORIGIN NORTHING:	0.00F
LATITUDE OF ORIGIN:	N 43° 00'00.00"	ORIGIN EASTING:	3,300,000.00F
LINEAR UNITS:	INTERNATIONAL FOOT	SCALE ALONG MERIDIAN:	1.0001600

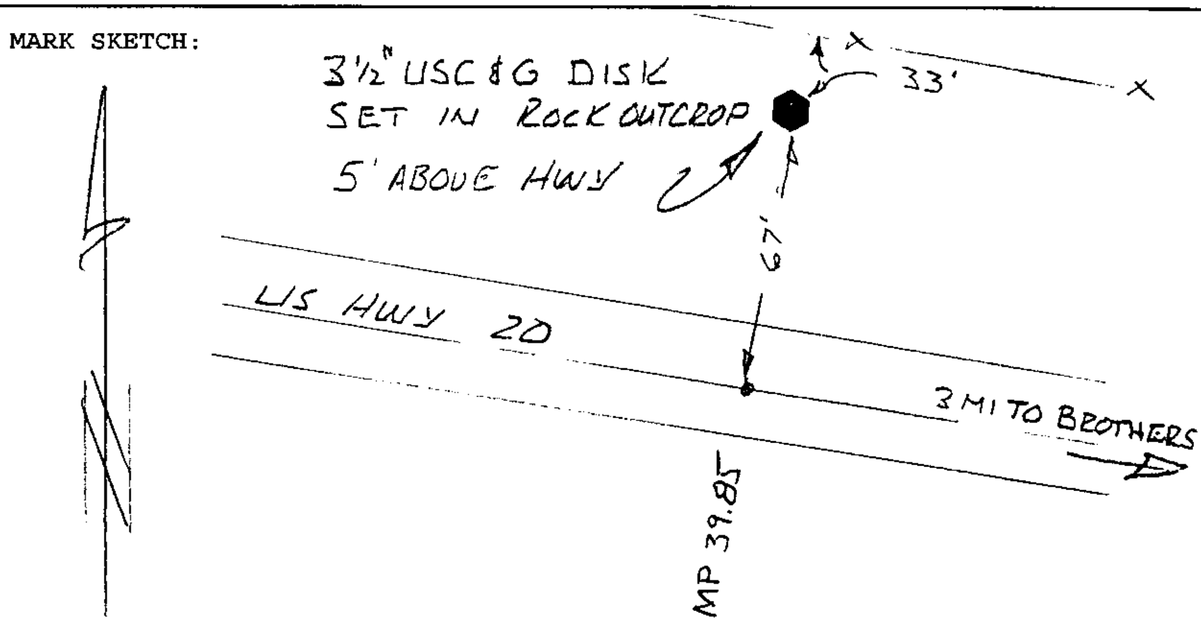
GEODETIC AND MAPPING COORDINATES

MARK:	U-372 1943	HORIZONTAL ORDER:	FIRST	ONE SIGMA ERROR
Latitude:	43°50'22.764608"	Northing:	306655.336	0.021
Longitude:	120°41'50.299521"	Easting:	3454649.088	0.019
Convergence:	+0°24'21.2951"	Ell Height:	4364.88	0.028
Scale Factor:	1.000187312979	Ortho Height:	4426.07	FIXED
Combined Factor:	0.99997899	Geoid Height:	-61.18	

MARK DATA SHEET

NAME OF MARK:	W-372 1943	COUNTY:	DESCHUTES
MARK SET BY:	U.S. C. & G. S.	STATE:	OREGON
DATE OF MARK:	1943	COUNTRY:	U.S.A.
LOCATION:	SECTION 14 TOWNSHIP 20 S RANGE 17 E		
REFERENCE:	NONE		

MARK SKETCH:



DATA COMPUTED BY:	DESCHUTES COUNTY SURVEYOR'S OFFICE	DATE:	1997
METHOD-EQUIPMENT:	GPS-TRIMBLE 4000SSE GEODETIC	ADJUSTED WITH:	TRIMNET

HOIZONTAL DATUM:	NAD 83 (91)	VERTICAL DATUM:	NAVD 29
PROJECTION:	TRANSVERSE MERCATOR	ZONE:	CENTRAL OREGON LCS
CENTRAL MERIDIAN:	W 121° 17'00.00"	ORIGIN NORTHING:	0.00F
LATITUDE OF ORIGIN:	N 43° 00'00.00"	ORIGIN EASTING:	3,300,000.00F
LINEAR UNITS:	INTERNATIONAL FOOT	SCALE ALONG MERIDIAN:	1.0001600

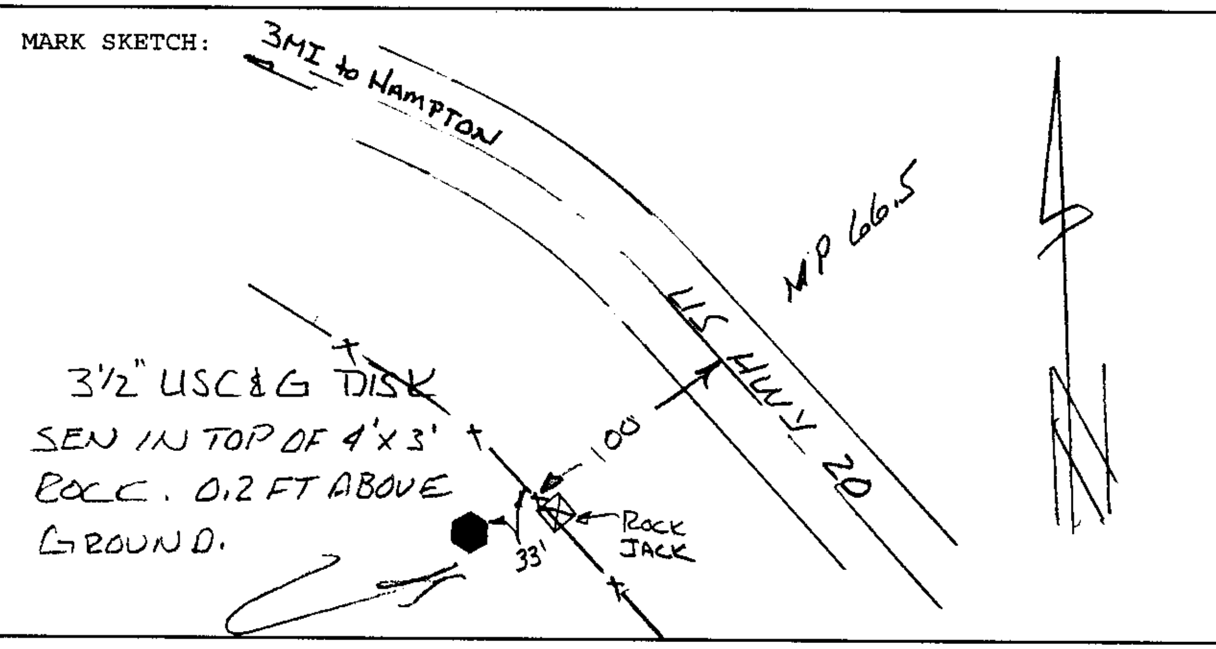
GEODETIC AND MAPPING COORDINATES

				ONE SIGMA ERROR
MARK:	W-372 1943	HORIZONTAL ORDER:	FIRST	
Latitude:	43°49'41.385496"	Northing:	302546.673	0.024
Longitude:	120°39'17.895421"	Easting:	3465852.739	0.019
Convergence:	+0°26'06.5356"	Ell Height:	4418.40	0.026
Scale Factor:	1.000191413918	Ortho Height:	4479.38	FIXED
Combined Factor:	0.99998054	Geoid Height:	-60.97	

MARK DATA SHEET

NAME OF MARK:	X 373	COUNTY:	DESCHUTES
MARK SET BY:	U.S. C. & G. S.	STATE:	OREGON
DATE OF MARK:	1943	COUNTRY:	U.S.A.
LOCATION:	SECTION 21 TOWNSHIP 22 S RANGE 21 E		
REFERENCE:	NONE		

MARK SKETCH:



DATA COMPUTED BY:	DESCHUTES COUNTY SURVEYOR'S OFFICE	DATE:	1997
METHOD-EQUIPMENT:	GPS-TRIMBLE 4000SSE GEODETIC	ADJUSTED WITH:	TRIMNET

HOIZONTAL DATUM:	NAD 83 (91)	VERTICAL DATUM:	NAVD 29
PROJECTION:	TRANSVERSE MERCATOR	ZONE:	CENTRAL OREGON LCS
CENTRAL MERIDIAN:	W 121° 17'00.00"	ORIGIN NORTHING:	0.00F
LATITUDE OF ORIGIN:	N 43° 00'00.00"	ORIGIN EASTING:	3,300,000.00F
LINEAR UNITS:	INTERNATIONAL FOOT	SCALE ALONG MERIDIAN:	1.0001600

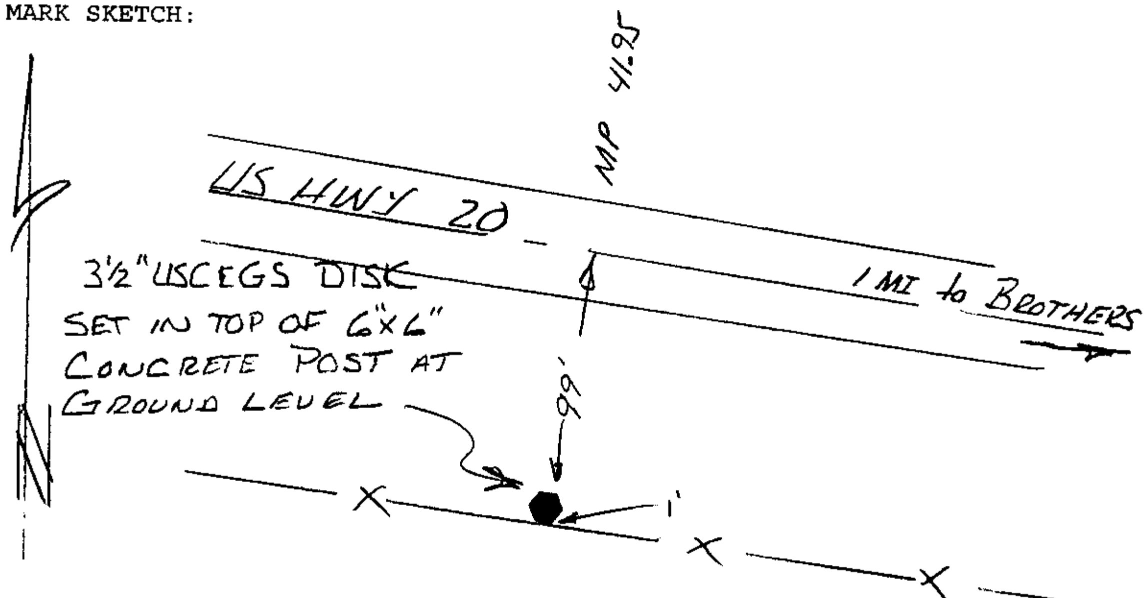
GEODETIC AND MAPPING COORDINATES

MARK:	X 373	HORIZONTAL ORDER:	FIRST	ONE SIGMA ERROR
Latitude:	43°38'32.058021"	Northing:	236030.682	0.015
Longitude:	120°11'31.890617"	Easting:	3588893.741	0.013
Convergence:	+0°45'11.1708"	Ell Height:	4370.89	0.030
Scale Factor:	1.000255321864	Ortho Height:	4431.15	FIXED
Combined Factor:	1.00004670	Geoid Height:	-60.25	

MARK DATA SHEET

NAME OF MARK:	Y-372 1943	COUNTY:	DESCHUTES
MARK SET BY:	U.S. C. & G. S.	STATE:	OREGON
DATE OF MARK:	1943	COUNTRY:	U.S.A.
LOCATION:	SECTION 19 TOWNSHIP 20 S RANGE 18 E		
REFERENCE:	NONE		

MARK SKETCH:



DATA COMPUTED BY:	DESCHUTES COUNTY SURVEYOR'S OFFICE	DATE:	1997
METHOD-EQUIPMENT:	GPS-TRIMBLE 4000SSE GEODETIC	ADJUSTED WITH:	TRIMNET

HOIZONTAL DATUM:	NAD 83 (91)	VERTICAL DATUM:	NAVD 29
PROJECTION:	TRANSVERSE MERCATOR	ZONE:	CENTRAL OREGON LCS
CENTRAL MERIDIAN:	W 121° 17'00.00"	ORIGIN NORTHING:	0.00F
LATITUDE OF ORIGIN:	N 43° 00'00.00"	ORIGIN EASTING:	3,300,000.00F
LINEAR UNITS:	INTERNATIONAL FOOT	SCALE ALONG MERIDIAN:	1.0001600

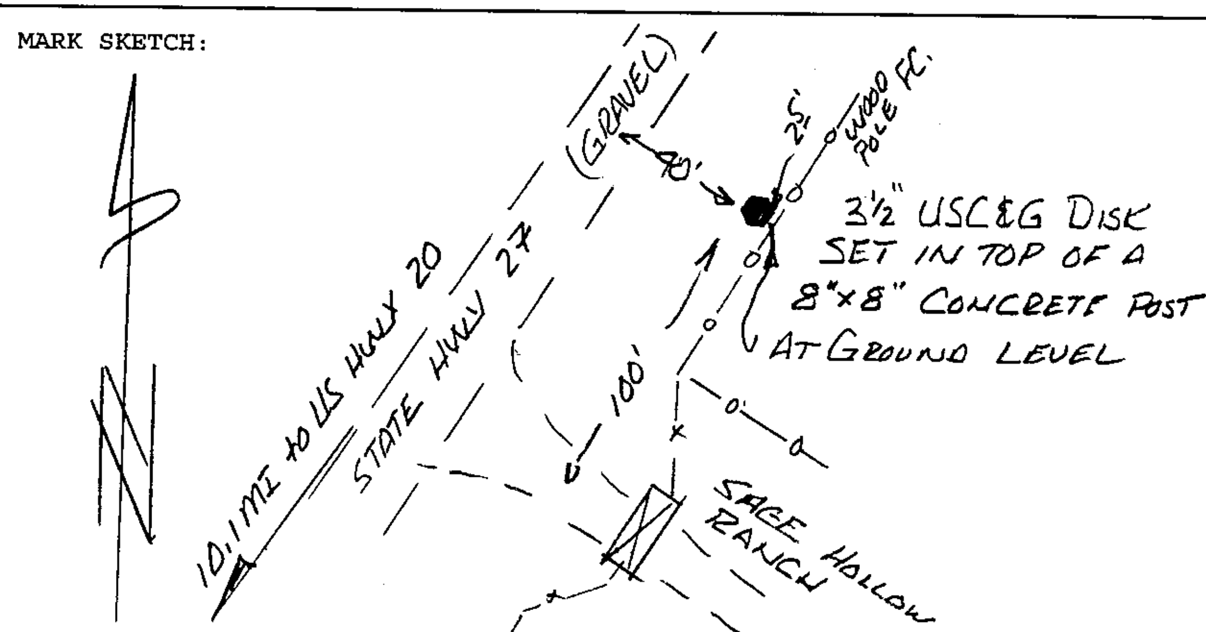
GEODETIC AND MAPPING COORDINATES

MARK:	Y-372 1943	HORIZONTAL ORDER:	FIRST	ONE SIGMA ERROR
Latitude:	43°49'01.329868"	Northing:	298570.065	0.019
Longitude:	120°36'58.489276"	Easting:	3476106.428	0.016
Convergence:	+0°27'42.7441"	Ell Height:	4537.47	0.017
Scale Factor:	1.000195418456	Ortho Height:	4598.28	FIXED
Combined Factor:	0.99997886	Geoid Height:	-60.81	

MARK DATA SHEET

NAME OF MARK:	Z-111 1934	COUNTY:	CROOK
MARK SET BY:	U.S. C. & G. S.	STATE:	OREGON
DATE OF MARK:	1934	COUNTRY:	U.S.A.
LOCATION:	SECTION 29 TOWNSHIP 18 S RANGE 17 E		
REFERENCE:	NONE		

MARK SKETCH:



DATA COMPUTED BY:	DESCHUTES COUNTY SURVEYOR'S OFFICE	DATE:	1997
METHOD-EQUIPMENT:	GPS-TRIMBLE 4000SSE GEODETIC	ADJUSTED WITH:	TRIMNET

HOIZONTAL DATUM:	NAD 83 (91)	VERTICAL DATUM:	NAVD 29
PROJECTION:	TRANSVERSE MERCATOR	ZONE:	CENTRAL OREGON LCS
CENTRAL MERIDIAN:	W 121° 17'00.00"	ORIGIN NORTHING:	0.00F
LATITUDE OF ORIGIN:	N 43° 00'00.00"	ORIGIN EASTING:	3,300,000.00F
LINEAR UNITS:	INTERNATIONAL FOOT	SCALE ALONG MERIDIAN:	1.0001600

GEODETIC AND MAPPING COORDINATES

MARK:	Z-111 1934	HORIZONTAL ORDER:	FIRST	ONE SIGMA ERROR
Latitude:	43°58'39.629497"	Northing:	356934.501	0.008
Longitude:	120°43'11.721334"	Easting:	3448337.375	0.007
Convergence:	+0°23'28.4159"	Ell Height:	3589.37	0.020
Scale Factor:	1.000185128160	Ortho Height:	3650.57	FIXED
Combined Factor:	1.00001381	Geoid Height:	-61.20	

NEW CONTROL POINTS

IN

CENTRAL OREGON

COORDINATES

CENTRAL OREGON COORDINATE SYSTEM

Geodetic and Mapping Coordinates & Output

Datum = NAD-83
Projection: Central Oregon Transverse Mercator
Zone = NONE
Central Meridian = W 121°17'00.000000"
Latitude of Origin = N 43°00'00.000000"
Origin Northing = 0.00' Easting = 3,3000,000.00'
Scale along Central Meridian = 1.000160000000
Linear units = International Foot

STATION	DATA		1 SIGMA ERROR
15-PSM	Latitude	N 43°36'53.580016"	
	Longitude	W 120°42'16.405520"	
	Scale Factor	1.000186842614	
	Convergence	0°23'57.3053"	
	Northing(y)	224693.2226	0.017678F
	Easting (x)	3453307.6383	0.014170F
	Ellipsoid Height	4794.7799	0.035409F
	Orthometric Height	4856.3780	FIXED
	Geoid Height	-61.5981	0.035409F
16150180	Latitude	N 44°13'06.349310"	
	Longitude	W 120°53'22.318638"	
	Scale Factor	1.000172176132	
	Convergence	0°16'28.6929"	
	Northing(y)	444456.4681	0.014658F
	Easting (x)	3403261.6900	0.013368F
	Ellipsoid Height	3283.5487	0.033887F
	Orthometric Height	3346.8380	0.057165F
	Geoid Height	-63.2893	0.050911F
17 TAM	Latitude	N 43°36'58.255379"	
	Longitude	W 120°27'30.548690"	
	Scale Factor	1.000214518213	
	Convergence	0°34'08.4739"	
	Northing(y)	225717.4653	0.017682F
	Easting (x)	3518483.0946	0.014834F
	Ellipsoid Height	4998.3086	0.037713F
	Orthometric Height	5059.1076	FIXED
	Geoid Height	-60.7990	0.037713F
17-PSM	Latitude	N 43°39'33.239925"	
	Longitude	W 120°42'39.626327"	
	Scale Factor	1.000186208778	
	Convergence	0°23'42.4407"	
	Northing(y)	240850.3841	0.018745F
	Easting (x)	3451487.6236	0.020379F
	Ellipsoid Height	4754.0287	0.053632F
	Orthometric Height	4815.5587	0.057147F
	Geoid Height	-61.5301	0.042170F

18-PSM	Latitude	N 43°41'17.632617"	
	Longitude	W 120°44'00.929511"	
	Scale Factor	1.000184157690	
	Convergence	0°22'47.0332"	
	Northing(y)	251382.0445	0.014547F
	Easting (x)	3445439.8017	0.012500F
	Ellipsoid Height	4743.8732	0.033934F
	Orthometric Height	4805.4274	0.040581F
	Geoid Height	-61.5543	0.042078F
20 OSHD 1927	Latitude	N 43°54'06.905588"	
	Longitude	W 120°59'23.531148"	
	Scale Factor	1.000166834762	
	Convergence	0°12'12.5863"	
	Northing(y)	328944.8824	0.018188F
	Easting (x)	3377362.5739	0.014887F
	Ellipsoid Height	4128.7273	0.020176F
	Orthometric Height	4191.4009	FIXED
	Geoid Height	-62.6736	0.020176F
20-PSM	Latitude	N 43°43'43.598179"	
	Longitude	W 120°45'03.892204"	
	Scale Factor	1.000182614269	
	Convergence	0°22'04.5209"	
	Northing(y)	266134.1984	0.020109F
	Easting (x)	3440717.8431	0.015646F
	Ellipsoid Height	4750.3339	0.034304F
	Orthometric Height	4811.8602	FIXED
	Geoid Height	-61.5263	0.034304F
23 TAM	Latitude	N 43°41'59.058845"	
	Longitude	W 120°28'38.256874"	
	Scale Factor	1.000211915025	
	Convergence	0°33'24.8236"	
	Northing(y)	256131.5586	0.016871F
	Easting (x)	3513205.4447	0.014648F
	Ellipsoid Height	4684.2360	0.031651F
	Orthometric Height	4745.0919	FIXED
	Geoid Height	-60.8559	0.031651F
23-PSM	Latitude	N 43°46'00.284518"	
	Longitude	W 120°46'40.402429"	
	Scale Factor	1.000180367591	
	Convergence	0°20'58.6768"	
	Northing(y)	279932.5232	0.018517F
	Easting (x)	3433545.7363	0.016246F
	Ellipsoid Height	4715.0643	0.030695F
	Orthometric Height	4776.5912	FIXED
	Geoid Height	- 61.5269	0.030695F

26 OSHD 1927	Latitude	N 43°51'27.507915"	
	Longitude	W 120°45'41.385175"	
	Scale Factor	1.000181644034	
	Convergence	0°21'41.6528"	
	Northing(y)	313098.7903	0.011454F
	Easting (x)	3437668.2360	0.009761F
	Ellipsoid Height	4274.1436	0.020985F
	Orthometric Height	4335.6463	FIXED
	Geoid Height	-61.5027	0.020985F
38 OSHD 1927	Latitude	N 43°47'03.429859"	
	Longitude	W 120°29'48.838566"	
	Scale Factor	1.000209280190	
	Convergence	0°32'39.0734"	
	Northing(y)	286906.5028	0.011418F
	Easting (x)	3507726.8903	0.009686F
	Ellipsoid Height	4636.9286	0.024017F
	Orthometric Height	4697.4672	FIXED
	Geoid Height	-60.5386	0.024017F
42-WS	Latitude	N 43°47'21.761629"	
	Longitude	W 120°48'03.496851"	
	Scale Factor	1.000178535724	
	Convergence	0°20'01.6914"	
	Northing(y)	288147.6651	0.009954F
	Easting (x)	3427399.1166	0.008508F
	Ellipsoid Height	4654.9250	0.022716F
	Orthometric Height	4716.4895	FIXED
	Geoid Height	-61.5645	0.022716F
45 OSHD 1927	Latitude	N 43°35'16.641126"	
	Longitude	W 120°04'21.447569"	
	Scale Factor	1.000277572223	
	Convergence	0°50'05.3165"	
	Northing(y)	216679.3575	0.009820F
	Easting (x)	3620839.5089	0.008235F
	Ellipsoid Height	4562.7011	0.023441F
	Orthometric Height	4622.4705	FIXED
	Geoid Height	-59.7694	0.023441F
8 TAM	Latitude	N 43°40'45.672707"	
	Longitude	W 120°03'41.061790"	
	Scale Factor	1.000279396170	
	Convergence	0°50'38.2463"	
	Northing(y)	250044.6761	0.015784F
	Easting (x)	3623321.9390	0.013074F
	Ellipsoid Height	4107.4775	0.037366F
	Orthometric Height	4167.1421	0.059948F
	Geoid Height	-59.6645	0.055112F

C-112 1934	Latitude	N 43°54'22.667641"	
	Longitude	W 120°44'27.224515"	
	Scale Factor	1.000183348341	
	Convergence	0°22'34.2339"	
	Northing(y)	330873.2063	0.013202F
	Easting (x)	3442986.4489	0.011692F
	Ellipsoid Height	4382.5373	0.028591F
	Orthometric Height	4443.8368	0.036475F
	Geoid Height	-61.2995	0.030676F
C-373	Latitude	N 43°45'12.143277"	
	Longitude	W 120°25'13.023085"	
	Scale Factor	1.000219411863	
	Convergence	0°35'48.7329"	
	Northing(y)	275837.6307	0.013687F
	Easting (x)	3528081.4281	0.011623F
	Ellipsoid Height	4372.3018	0.029306F
	Orthometric Height	4432.9462	FIXED
	Geoid Height	-60.6444	0.029306F
COW PIE	Latitude	N 43°52'10.423020"	
	Longitude	W 120°22'45.397252"	
	Scale Factor	1.000224938002	
	Convergence	0°37'35.5997"	
	Northing(y)	318314.4567	0.015226F
	Easting (x)	3538455.8282	0.013533F
	Ellipsoid Height	4590.2542	0.039134F
	Orthometric Height	4649.9223	0.064302F
	Geoid Height	-59.6680	0.058113F
D-112 1934	Latitude	N 43°52'37.228894"	
	Longitude	W 120°43'58.418686"	
	Scale Factor	1.000184066011	
	Convergence	0°22'53.4812"	
	Northing(y)	320208.7439	0.010345F
	Easting (x)	3445166.8023	0.009144F
	Ellipsoid Height	4380.7319	0.021217F
	Orthometric Height	4442.0472	FIXED
	Geoid Height	-61.3154	0.021217F

E-112 1934	Latitude	N 43°50'58.023706"	
	Longitude	W 120°43'59.268108"	
	Scale Factor	1.000184067703	
	Convergence	0°22'52.2056"	
	Northing(y)	310161.2763	0.014090F
	Easting (x)	3445171.4323	0.011950F
	Ellipsoid Height	4318.6023	0.023829F
	Orthometric Height	4379.9672	FIXED
	Geoid Height	-61.3649	0.023829F
F-112	Latitude	N 43°49'42.569160"	
	Longitude	W 120°46'02.704748"	
	Scale Factor	1.000181176315	
	Convergence	0°21'26.1990"	
	Northing(y)	302461.3036	0.016233F
	Easting (x)	3436172.1871	0.013404F
	Ellipsoid Height	4330.2657	0.026315F
	Orthometric Height	4391.7848	FIXED
	Geoid Height	-61.5191	0.026315F
FOX	Latitude	N 43°36'46.670411"	
	Longitude	W 120°51'31.945930"	
	Scale Factor	1.000174437745	
	Convergence	0°17'34.0365"	
	Northing(y)	223746.6168	0.013950F
	Easting (x)	3412435.3713	0.011825F
	Ellipsoid Height	5275.0837	0.033180F
	Orthometric Height	5336.9708	0.068064F
	Geoid Height	-61.8871	0.065277F
G 112-133	Latitude	N 43°39'16.397840"	
	Longitude	W 119°52'31.864194"	
	Scale Factor	1.000318622556	
	Convergence	0°58'18.9510"	
	Northing(y)	241783.2112	0.017867F
	Easting (x)	3672661.8192	0.014523F
	Ellipsoid Height	4430.7580	0.053469F
	Orthometric Height	4489.6840	0.095795F
	Geoid Height	-58.9260	0.085270F
H 22	Latitude	N 43°43'39.937432"	
	Longitude	W 120°21'10.655766"	
	Scale Factor	1.000229102372	
	Convergence	0°38'35.2834"	
	Northing(y)	266692.1860	0.015439F
	Easting (x)	3545978.3914	0.012687F
	Ellipsoid Height	4366.1152	0.030981F
	Orthometric Height	4426.6732	FIXED
	Geoid Height	-60.5581	0.030981F

K 22	Latitude	N 43°44'49.142902"	
	Longitude	W 120°28'57.238102"	
	Scale Factor	1.000211156981	
	Convergence	0°33'13.4263"	
	Northing(y)	273343.0138	0.012365F
	Easting (x)	3511644.3931	0.010444F
	Ellipsoid Height	4468.6281	0.026399F
	Orthometric Height	4529.3537	FIXED
	Geoid Height	-60.7255	0.026399F
LIZARD	Latitude	N 43°46'11.460280"	
	Longitude	W 120°15'54.112468"	
	Scale Factor	1.000242665292	
	Convergence	0°42'16.0671"	
	Northing(y)	282310.7991	0.014153F
	Easting (x)	3569037.0694	0.011959F
	Ellipsoid Height	5569.6886	0.033235F
	Orthometric Height	5629.5069	0.049310F
	Geoid Height	-59.8183	0.050856F
MERRILL	Latitude	N 43°52'18.753377"	
	Longitude	W 120°35'51.694881"	
	Scale Factor	1.000197347156	
	Convergence	0°28'30.6969"	
	Northing(y)	318604.2173	0.014557F
	Easting (x)	3480838.8263	0.012069F
	Ellipsoid Height	4520.6018	0.031763F
	Orthometric Height	4581.1974	0.047121F
	Geoid Height	-60.5956	0.037044F
MILLICAN	Latitude	N 43°52'48.936526"	
	Longitude	W 120°55'25.713711"	
	Scale Factor	1.000170265706	
	Convergence	0°14'57.1453"	
	Northing(y)	321117.3119	0.009549F
	Easting (x)	3394811.7110	0.007366F
	Ellipsoid Height	4195.9996	0.015945F
	Orthometric Height	4258.1955	FIXED
	Geoid Height	-62.1959	0.015945F
MOOYMAN	Latitude	N 43°36'55.679198"	
	Longitude	W 120°37'00.334649"	
	Scale Factor	1.000195603637	
	Convergence	0°27'35.3647"	
	Northing(y)	225080.1586	0.021366F
	Easting (x)	3476561.9840	0.018336F
	Ellipsoid Height	4903.5066	0.050257F
	Orthometric Height	4964.7730	0.057797F
	Geoid Height	-61.2664	0.046772F

N-22 RESET 1997	Latitude	N 43°46'42.005388"	
	Longitude	W 120°36'05.892845"	
	Scale Factor	1.000197035036	
	Convergence	0°28'17.9658"	
	Northing(y)	284491.4899	0.011817F
	Easting (x)	3480079.6090	0.009347F
	Ellipsoid Height	4637.7620	0.028454F
	Orthometric Height	4698.6249	0.039223F
	Geoid Height	-60.8629	0.030258F
N-372 1943	Latitude	N 43°52'16.421705"	
	Longitude	W 120°52'04.188984"	
	Scale Factor	1.000173715601	
	Convergence	0°17'16.6663"	
	Northing(y)	317893.5619	0.011989F
	Easting (x)	3409590.7746	0.009224F
	Ellipsoid Height	4265.5280	0.015074F
	Orthometric Height	4327.4147	FIXED
	Geoid Height	-61.8867	0.015074F
P-364 1943	Latitude	N 43°53'11.317650"	
	Longitude	W 120°56'46.937462"	
	Scale Factor	1.000169015776	
	Convergence	0°14'00.9385"	
	Northing(y)	323358.9089	0.016524F
	Easting (x)	3388852.4988	0.015408F
	Ellipsoid Height	4169.4404	0.019648F
	Orthometric Height	4231.7913	FIXED
	Geoid Height	-62.3509	0.019648F
PERREAULT	Latitude	N 44°03'44.301487"	
	Longitude	W 120°55'01.366074"	
	Scale Factor	1.000170590219	
	Convergence	0°15'17.0376"	
	Northing(y)	387498.7297	0.010996F
	Easting (x)	3396300.6660	0.008527F
	Ellipsoid Height	3409.4029	0.024556F
	Orthometric Height	3472.6327	0.047896F
	Geoid Height	-63.2298	0.041897F
PETERSEN	Latitude	N 44°04'50.921861"	
	Longitude	W 120°46'58.339807"	
	Scale Factor	1.000179757531	
	Convergence	0°20'53.3816"	
	Northing(y)	394431.5433	0.011801F
	Easting (x)	3431535.4115	0.010348F
	Ellipsoid Height	3877.3527	0.029821F
	Orthometric Height	3939.5628	0.058554F
	Geoid Height	-62.2101	0.051863F

POTTERFIELD	Latitude	N 43°41'52.502753"	
	Longitude	W 120°36'46.183776"	
	Scale Factor	1.000195925641	
	Convergence	0°27'47.6400"	
	Northing(y)	255148.4405	0.014475F
	Easting (x)	3477360.3209	0.012389F
	Ellipsoid Height	4765.5325	0.032265F
	Orthometric Height	4826.6674	0.045543F
	Geoid Height	-61.1349	0.042648F
PRINGLE FLAT	Latitude	N 43°52'34.315797"	
	Longitude	W 120°29'18.476169"	
	Scale Factor	1.000210187510	
	Convergence	0°33'03.3960"	
	Northing(y)	320438.2880	0.013993F
	Easting (x)	3509632.6642	0.011988F
	Ellipsoid Height	4542.5530	0.033637F
	Orthometric Height	4602.6393	0.056139F
	Geoid Height	-60.0863	0.048290F
R-372 1943	Latitude	N 43°52'15.937557"	
	Longitude	W 120°48'28.290371"	
	Scale Factor	1.000177960771	
	Convergence	0°19'46.2945"	
	Northing(y)	317929.7666	0.014762F
	Easting (x)	3425408.9085	0.012100F
	Ellipsoid Height	4248.2424	0.020806F
	Orthometric Height	4309.9114	FIXED
	Geoid Height	-61.6690	0.020806F
SWEET	Latitude	N 43°41'42.112070"	
	Longitude	W 120°16'34.272555"	
	Scale Factor	1.000241066964	
	Convergence	0°41'44.8603"	
	Northing(y)	254996.8728	0.015758F
	Easting (x)	3566421.2361	0.013392F
	Ellipsoid Height	4357.1069	0.032612F
	Orthometric Height	4417.4738	FIXED
	Geoid Height	-60.3668	0.032612F
TAM 30	Latitude	N 43°46'43.589656"	
	Longitude	W 120°22'13.854938"	
	Scale Factor	1.000226405301	
	Convergence	0°37'53.7054"	
	Northing(y)	285239.7562	0.013643F
	Easting (x)	3541132.0416	0.011439F
	Ellipsoid Height	4503.6266	0.031619F
	Orthometric Height	4563.8894	0.038658F
	Geoid Height	-60.2628	0.041787F

Station	Parameter	Value	Std. Error
U-372 1943	Latitude	N 43°50'22.764609"	
	Longitude	W 120°41'50.299521"	
	Scale Factor	1.000187312979	
	Convergence	0°24'21.2951"	
	Northing(y)	306655.3362	0.021762F
	Easting (x)	3454649.0881	0.019153F
	Ellipsoid Height	4364.8816	0.028881F
	Orthometric Height	4426.0663	FIXED
	Geoid Height	-61.1847	0.028881F
W-372 1943	Latitude	N 43°49'41.385496"	
	Longitude	W 120°39'17.895420"	
	Scale Factor	1.000191413918	
	Convergence	0°26'06.5356"	
	Northing(y)	302546.6733	0.024002F
	Easting (x)	3465852.7392	0.019641F
	Ellipsoid Height	4418.4046	0.026735F
	Orthometric Height	4479.3766	FIXED
	Geoid Height	-60.9720	0.026735F
X 373	Latitude	N 43°38'32.058021"	
	Longitude	W 120°11'31.890616"	
	Scale Factor	1.000255321864	
	Convergence	0°45'11.1708"	
	Northing(y)	236030.6818	0.015403F
	Easting (x)	3588893.7408	0.013103F
	Ellipsoid Height	4370.8944	0.030911F
	Orthometric Height	4431.1483	FIXED
	Geoid Height	-60.2539	0.030911F
Y-372 1943	Latitude	N 43°49'01.329868"	
	Longitude	W 120°36'58.489276"	
	Scale Factor	1.000195418456	
	Convergence	0°27'42.7441"	
	Northing(y)	298570.0649	0.019970F
	Easting (x)	3476106.4283	0.016490F
	Ellipsoid Height	4537.4702	0.017734F
	Orthometric Height	4598.2808	FIXED
	Geoid Height	-60.8107	0.017734F
Z-111 1934	Latitude	N 43°58'39.629496"	
	Longitude	W 120°43'11.721334"	
	Scale Factor	1.000185128160	
	Convergence	0°23'28.4159"	
	Northing(y)	356934.5011	0.008871F
	Easting (x)	3448337.3754	0.007816F
	Ellipsoid Height	3589.3704	0.020236F
	Orthometric Height	3650.5709	FIXED
	Geoid Height	-61.2005	0.020236F

FIX & ADJUSTED

SURVEY POINTS

IN

OREGON SOUTH

PLANE COORDINATES

MAP PROJECTION TRANSFORMATION

Projection: User-Defined Lambert
Zone = ORE_SOUTH
Central Meridian = W 120ø30'00.000000"
Latitude of Origin = N 41ø40'00.000000"
Origin Northing = 0.0000 Easting = 4921259.8430
North Standard Parallel = N 44ø00'00.000000"
South Standard Parallel = N 42ø20'00.000000"
Scale along Standard Parallels = 1.000000000000

Linear units = Internatl Foot

POINT	NAME	GEODETIC	MAP	SCALE & CONVERGENCE
1	15-PSM	N 43ø36'53.580016"	710091.4998	0.999924908553
		W 120ø42'16.405520"	4867089.1073	- 0ø08'23.8099"
2	16150180	N 44ø13'06.349310"	930274.1708	1.000062868232
		W 120ø53'22.318638"	4819127.4610	- 0ø15'59.3926"
3	17 TAM	N 43ø36'58.255379"	710501.4345	0.999925085386
		W 120ø27'30.548690"	4932253.4085	+ 0ø01'42.2467"
4	17-PSM	N 43ø39'33.239925"	726260.8975	0.999931239286
		W 120ø42'39.626327"	4865421.6940	- 0ø08'39.6963"
5	17142600	N 44ø03'47.489520"	873877.9580	1.000016674658
		W 121ø01'37.309080"	4782721.0345	- 0ø21'38.0390"
6	18-PSM	N 43ø41'17.632617"	736846.3734	0.999935704051
		W 120ø44'00.929511"	4859474.8050	- 0ø09'35.3197"
7	20 OSHD 1927	N 43ø54'06.905588"	815029.2648	0.999976553632
		W 120ø59'23.531148"	4792145.3094	- 0ø20'06.5152"
8	20-PSM	N 43ø43'43.598179"	751638.7294	0.999942378592
		W 120ø45'03.892204"	4854893.1120	- 0ø10'18.3955"
9	23 TAM	N 43ø41'59.058845"	740955.4127	0.999937547164
		W 120ø28'38.256874"	4927264.5702	+ 0ø00'55.9243"
10	23-PSM	N 43ø46'00.284518"	765500.7337	0.999949085566
		W 120ø46'40.402429"	4847852.9619	- 0ø11'24.4227"
11	26 OSHD 1927	N 43ø51'27.507915"	798619.2739	0.999966938304
		W 120ø45'41.385175"	4852286.9312	- 0ø10'44.0462"
12	42-WS	N 43ø47'21.761629"	773771.5240	0.999953293781
		W 120ø48'03.496851"	4841785.3863	- 0ø12'21.2715"
13	6-DPB 1978	N 43ø42'29.474099"	744223.9810	0.999938926201
		W 120ø50'48.399686"	4829567.2905	- 0ø14'14.0894"
14	8 TAM	N 43ø40'45.672707"	733828.1048	0.999934309817
		W 120ø03'41.061790"	5037284.6555	+ 0ø18'00.2264"

15 BROTHERS	N 43ø48'49.791559"	782557.9019	0.999958017043
	W 120ø36'01.000599"	4894791.0835	- 0ø04'06.9776"
16 C-112 1934	N 43ø54'22.667641"	816338.9820	0.999977537179
	W 120ø44'27.224515"	4857771.4964	- 0ø09'53.3094"
17 C-373	N 43ø45'12.143277"	760514.5736	0.999946672941
	W 120ø25'13.023085"	4942322.1243	+ 0ø03'16.3345"
18 C-463 1936	N 44ø14'51.087553"	940978.5594	1.000072353992
	W 120ø57'45.313624"	4800032.0203	- 0ø18'59.3199"
19 COW PIE	N 43ø52'10.423020"	802879.9450	0.999969467813
	W 120ø22'45.397252"	4953095.8644	+ 0ø04'57.3323"
20 D-112 1934	N 43ø52'37.228894"	805656.6480	0.999971069959
	W 120ø43'58.418686"	4859850.6371	- 0ø09'33.6019"
21 E-112 1934	N 43ø50'58.023706"	795611.7533	0.999965225736
	W 120ø43'59.268108"	4859760.4594	- 0ø09'34.1831"
22 F-112	N 43ø49'42.569160"	787998.6792	0.999960936821
	W 120ø46'02.704748"	4850690.9763	- 0ø10'58.6319"
23 FOX	N 43ø36'46.670411"	709529.3970	0.999924648160
	W 120ø51'31.945930"	4826220.1908	- 0ø14'43.8814"
24 G 112-133	N 43ø39'16.397840"	725101.4919	0.999930543081
	W 119ø52'31.864194"	5086525.7983	+ 0ø25'38.0562"
25 GIS 24	N 44ø07'28.469350"	896255.3915	1.000034050890
	W 121ø01'37.719320"	4782831.9336	- 0ø21'38.3197"
26 H 22	N 43ø43'39.937432"	751202.7100	0.999942205041
	W 120ø21'10.655766"	4960126.7223	+ 0ø06'02.1495"
27 J-372 1943	N 43ø52'26.954590"	804900.5249	0.999970453866
	W 120ø59'04.310070"	4793493.9846	- 0ø19'53.3651"
28 K 22	N 43ø44'49.142902"	758176.2037	0.999945539619
	W 120ø28'57.238102"	4925866.6528	+ 0ø00'42.9384"
29 LIZARD	N 43ø46'11.460280"	766597.5847	0.999949653487
	W 120ø15'54.112468"	4983325.6878	+ 0ø09'38.7117"
30 MERRILL	N 43ø52'18.753377"	803715.5247	0.999969963881
	W 120ø35'51.694881"	4895498.0651	- 0ø04'00.6111"
31 MILLICAN	N 43ø52'48.936526"	807039.4764	0.999971775051
	W 120ø55'25.713711"	4809516.6769	- 0ø17'23.8130"
32 MOOYMAN	N 43ø36'55.679198"	710259.4329	0.999924987885
	W 120ø37'00.334649"	4890339.8762	- 0ø04'47.5708"
33 N-22	N 43ø46'42.005388"	769619.5731	0.999951220782
	W 120ø36'05.892845"	4894416.6790	- 0ø04'10.3246"

34 N-372 1943	N 43ø52'16.421705"	803677.4168	0.999969824866
	W 120ø52'04.188984"	4824261.7714	- 0ø15'05.9404"
35 38 OSHD	N 43ø47'03.429859"	771772.5862	0.999952333265
	W 120ø29'48.838566"	4922078.6043	+ 0ø00'07.6361"
36 45 OSHD	N 43ø35'16.641126"	700499.5125	0.999921358304
	W 120ø04'21.447569"	5034487.0246	+ 0ø17'32.5966"
37 P-364 1943	N 43ø53'11.317650"	809336.5875	0.999973131998
	W 120ø56'46.937462"	4803579.9888	- 0ø18'19.3820"
38 P-372 1947	N 43ø52'16.023750"	803613.9417	0.999969801152
	W 120ø50'50.065840"	4829691.1614	- 0ø14'15.2292"
39 PERREAULT	N 44ø03'44.301487"	873392.1718	1.000016432478
	W 120ø55'01.366074"	4811630.3511	- 0ø17'07.1556"
40 PETERSEN	N 44ø04'50.921861"	879991.0406	1.000021543589
	W 120ø46'58.339807"	4846923.4666	- 0ø11'36.6945"
41 STATE HWY DEPT PI	N 43ø56'39.137760"	830506.6408	0.999986299305
	W 121ø01'44.791380"	4781900.6543	- 0ø21'43.1580"
42 PILOT BUTTE 1932	N 44ø03'37.943013"	873438.1201	1.000015950176
	W 121ø16'59.648124"	4715365.7518	- 0ø32'09.0548"
43 POTTERFIELD	N 43ø41'52.502753"	740310.8954	0.999937252773
	W 120ø36'46.183776"	4891421.3075	- 0ø04'37.8896"
44 PRINEVILLE	N 44ø18'04.566914"	960446.5846	1.000090565460
	W 120ø51'54.057932"	4825687.1757	- 0ø14'59.0093"
45 PRINGLE FLAT	N 43ø52'34.315797"	805276.5012	0.999970895023
	W 120ø29'18.476169"	4924301.2623	+ 0ø00'28.4084"
46 R-372 1943	N 43ø52'15.937557"	803564.5961	0.999969796017
	W 120ø48'28.290371"	4840076.2867	- 0ø12'38.2339"
47 SILVER	N 43ø07'29.329307"	531914.0453	0.999894898311
	W 121ø03'41.335957"	4771371.7918	- 0ø23'02.8917"
48 SWEET	N 43ø41'42.112070"	739317.8360	0.999936788276
	W 120ø16'34.272555"	4980451.8862	+ 0ø09'11.2363"
49 TAM 30	N 43ø46'43.589656"	769790.1329	0.999951302675
	W 120ø22'13.854938"	4955457.6030	+ 0ø05'18.9119"
50 TOMB	N 43ø35'07.638379"	702549.9180	0.999921039841
	W 119ø03'59.110676"	5301065.5254	+ 0ø58'50.8088"
51 U-372 1943	N 43ø50'22.764609"	792017.3125	0.999963204784
	W 120ø41'50.299521"	4869202.5117	- 0ø08'05.9495"
52 W-372 1943	N 43ø49'41.385496"	787803.9972	0.999960870615
	W 120ø39'17.895420"	4880364.3290	- 0ø06'21.6827"

53 X 373	N 43ø38'32.058021"	720145.7260	0.999928742223
	W 120ø11'31.890616"	5002736.7425	+ 0ø12'38.1101"
54 Y-372 1943	N 43ø49'01.329868"	783731.6499	0.999958649735
	W 120ø36'58.489276"	4890577.6067	- 0ø04'46.3083"
55 Z-111 1934	N 43ø58'39.629496"	842343.3995	0.999994402982
	W 120ø43'11.721334"	4863367.2980	- 0ø09'01.6541"