



Mapping Solutions

Preserving the Value of Your Legacy Data

Like many municipalities, the City of Lake Oswego, Oregon (population 35,000) has maintained detailed information about their Water and Sewer systems for **more than 50 years**. Over that period of time the mapping tools have changed from Linen to Mylar and finally to AutoCAD. The detail and accuracy possible with the today's tools has transformed the expectations of those charged with maintaining this information.

The goal now is to build and maintain seamless utility maps that truly reflect "the real world".

In early 2002, Lake Oswego made a decision to update and integrate all of their legacy information into a new seamless **Water System Atlas** that would accurately overlay a new COGO'ed basemap and high resolution aerial photography.

Because of the volume and wide variety of legacy data, the City decided to subcontract the work and **TCI Mapping Services** was selected to do the job.

The Lake Oswego Water System Atlas

Lake Oswego's Water System Atlas had been maintained over the years on Section size sheets. All total, they had over 30 of these, making up a total service area of more than 10 square miles.



How can TCI help You Preserve the Value of Your Legacy Utility Data?

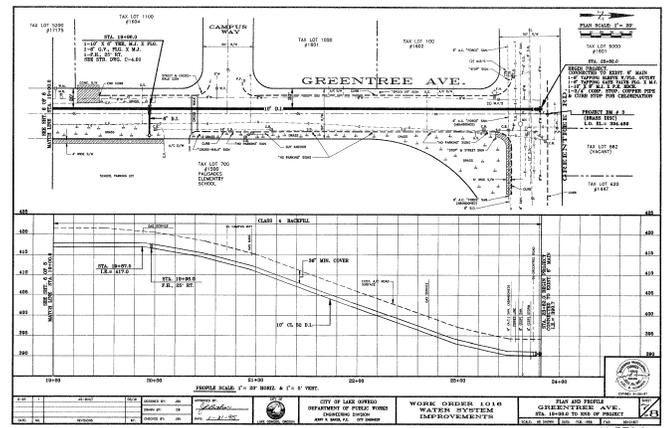
VALIDATION – Do your Utility Maps represent the "real world" conditions?

One of the most important tasks associated with any utility mapping project is the process of making sure that the map information truly represents the system as it is built - is it current and accurate.

If As-Built records exist, they are the key to the validation process. Over the course of the Lake Oswego Water System Atlas update project, we entered new information from over 500 "as-built" sheets.

We also reviewed over a thousand historical as-built sheets to verify and in some cases to correct accuracy and completeness.

The results; an accurate reflection of the Water System.

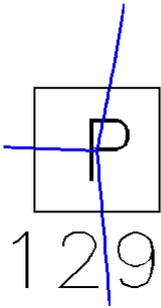


STANDARDIZATION – Do your Utility Maps serve all of your needs?

For Lake Oswego we reformatted over 10,000 map elements, including over 6000 feature blocks (hydrants, valves, etc) to exactly meet a new standard. We applied our unique automated mapping tools (MapTools) to perform 1000's of changes to the Lake Oswego Water System Atlas that are Not Possible with standard AutoCAD or even with AutoCAD Map. Lake Oswego's new Water Atlas includes over 10,000 utility feature blocks and **100% of them comply** with the City's new standards.

Block RePurposing

Lake Oswego's old feature blocks included several remnant attributes (information that no longer needed to be stored with the block) and one very important attribute – **UnitID**.

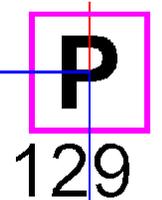


Edit Attributes	
Block name:	WS-PS
Handles of all connected features	240 940802.16333503 940802.16313782
Handle	940802.10421374
WATER VALVE ID NUMBER	E10C-129W
PERTINENT STREET SEGMENT ID	S.SIDE
AS-BUILT DRAWING FILE NUMBER	2107-15A

This UnitID attribute was included for all 20 block types and provided a unique identifier used as a link to other City database applications.

A separate 3-character Text entity derived from the UnitID served as a label for each block (129 in this case).

Edit Attributes	
Block name:	W_PS
Unit ID	E10C-129W
Unit ID Label	129



The new City standard required each feature block to have just 2 attributes, both based on the existing UnitID; one invisible and the other a condensed version (using only characters 6-9 of the UnitID) to serve as a visible label. This new standard not only reduced the storage requirements for each block but also allowed the elimination of 6000+ unassociated Text labels. We applied automated "MapTools" operations to process all 6000+ blocks to meet the new standard – a feat not possible with AutoCAD or AutoCAD Map.

CALIBRATION – Do your Utility Maps accurately overlay your Basemap and Aerial Photos?

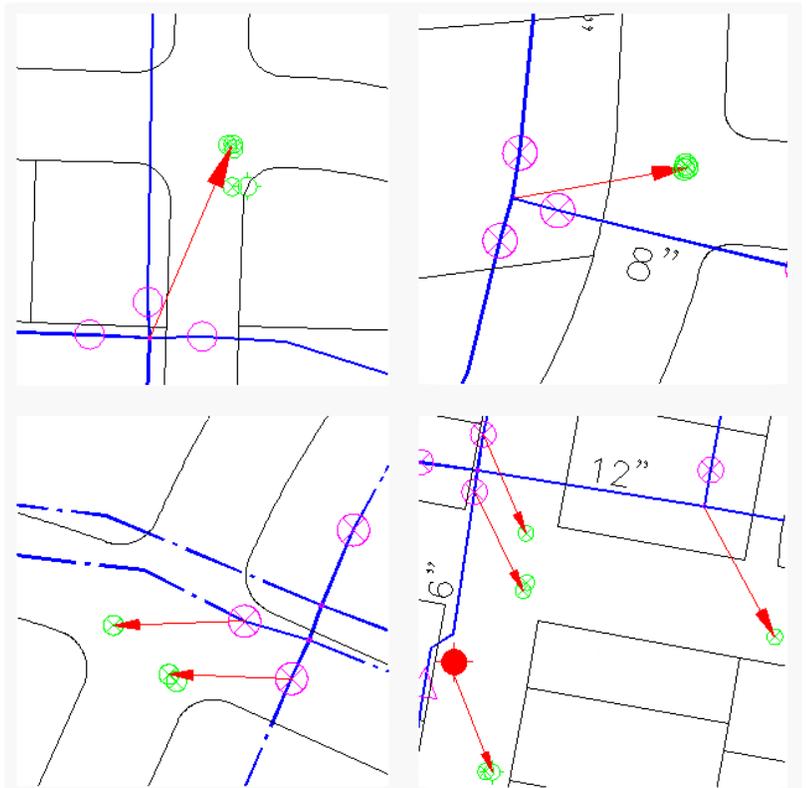
Map Calibration is the art of manipulating map elements to fit a different representation of the underlying geography. This could take the form of a new, more accurate Parcel Basemap, high quality Aerial Photography, GPS field data or a combination as was the case for Lake Oswego.

If a overlay map, such as a water distribution map, has been accurately depicted in relation to an accurate basemap of some known standard (such as NAD 27 State Plane), it can easily be converted to a new standard (such as NAD 83 State Plane) using conventional coordinate conversion tools.

A more difficult situation arises when an overlay map has been drawn in relation to an inaccurate basemap. When these maps are converted to a new standard and/or overlaid with a new basemap or Aerial Photo, it becomes obvious that Map Calibration is needed. Here we see four different areas of the Lake Oswego Water System Atlas overlaid with the new parcel basemap, a typical example of this predicament.

Using GPS Points for Calibration

Lake Oswego wanted to use the GPS survey points they had collected, to represent the "actual locations" of all utility features. A set of "calibration pairs" were generated (shown by the Red Arrows). These effectively represent the positional inaccuracies of the legacy map.

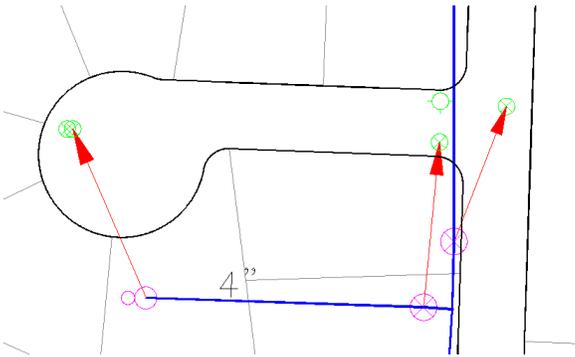


We used our automated Rubbersheeting toolkit (**ADJUST**) to identify over 3000 of these "calibration pairs" and as might be expected, the length and direction of these Error Vectors was widely variant. Some were over 300 feet long while others were closer than 1 foot – and they pointed in almost every direction.

Rubbersheeting – the Key to Accurate Map Calibration.

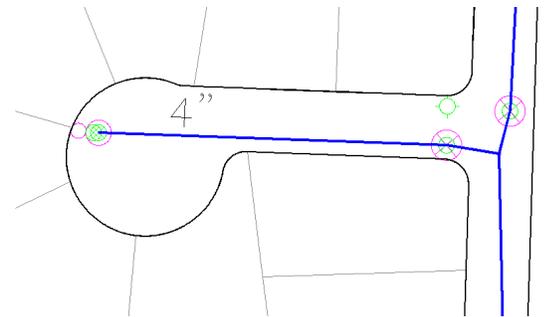
We define Rubbersheeting as “**nonlinear stretching in all directions simultaneously**”. Over 10 years ago we developed and introduced a Rubbersheeting Toolkit for AutoCAD – **ADJUST**. Now with over 500 customers worldwide, **ADJUST** is acknowledged as a leading, “engineering grade” Rubbersheeting processor. **ADJUST** guarantees a **Zero Error** at every calibration point and allows **Unlimited Calibration** (any number and any pattern).

Unstable and Conflicting Calibration



Among the commercially available Rubbersheeting processors (including Arc/Info), only **ADJUST** can deliver flawless results using Unlimited Calibration. Projection based and Triangulation based Rubbersheeting processors need “well distributed” calibration. Patterns such as this example, where all of the calibration points are lined up along an edge or path, are deemed “unstable” – for all Rubbersheeting processors except **ADJUST**.

Conflicting calibration is another common source of Rubbersheet difficulty. Here we see three calibration pairs in close proximity but with very different directions. Most commercially available Rubbersheet processors would produce undesirable results in these areas - **ADJUST** handles them perfectly.



ADJUST allows Unlimited Calibration and delivers flawless results

When we Rubbersheeted Lake Oswego’s Water System Atlas, we used 2038 calibration pairs to manipulate 6609 Blocks, 8680 Linework entities and 6385 Text entities covering an area larger than 10 square miles. The results can be seen here.

In each of these four areas you can see near perfect results in spite of the fact that each area was stretched in a different direction.

You can see that each calibration location is now exactly located at its target and more importantly, all of the surrounding features have been relocated appropriately.

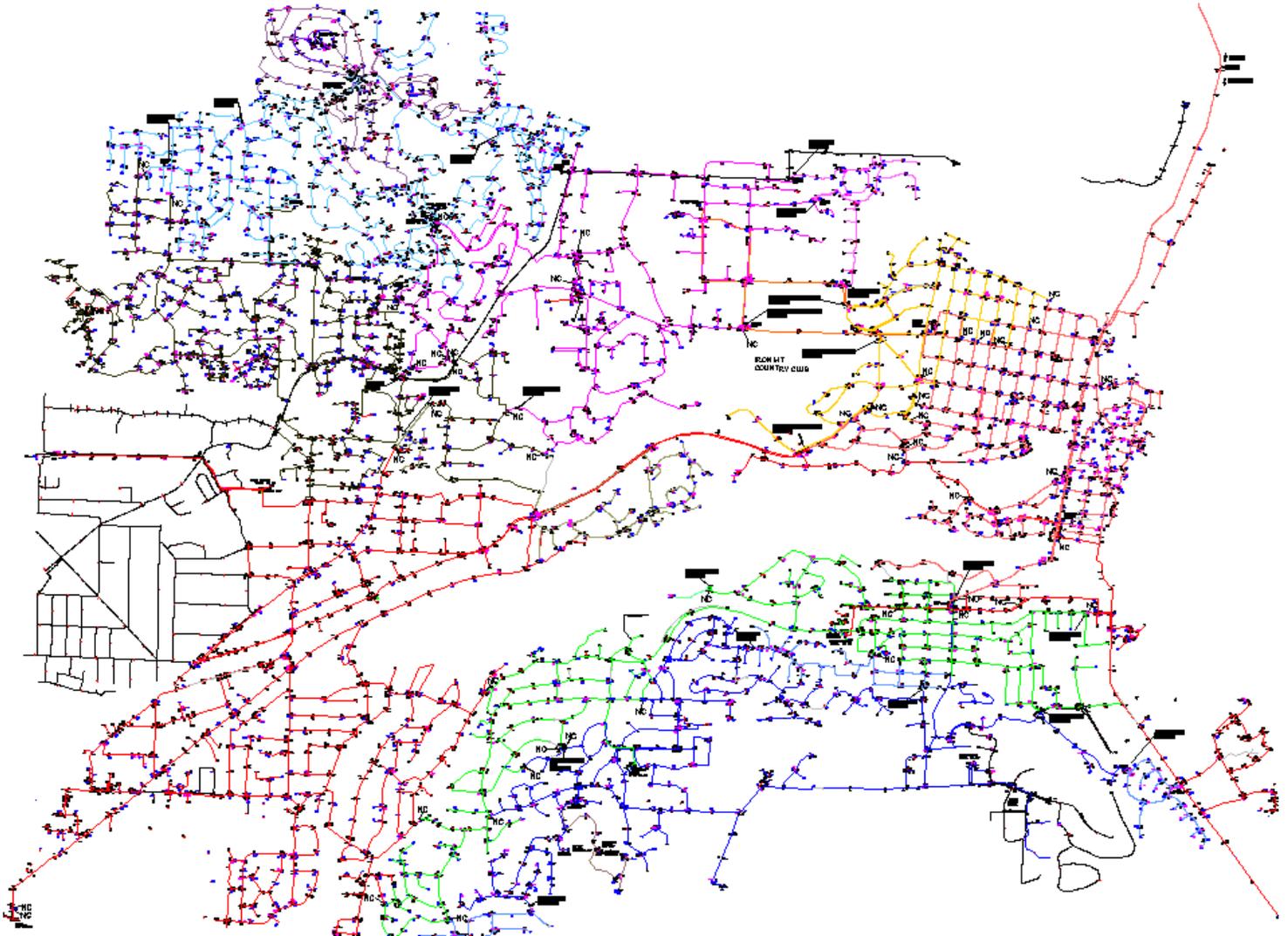
Accurate Map Calibration requires:

- a complete and accurate representation of the underlying geography.
[In this case we used an accurate COGO’ed Basemap and 1000’s of GPS field points]
- a complete set of “calibration pairs”
[In this case we created over 2000 calibration pairs using the GPS points and the basemap as reference]
- a Rubbersheet processor that can carry out all of the calibration instructions.
[In this case **ADJUST** did the job]



The new Lake Oswego Water System Atlas

The end result of the Water System Atlas Update Project performed for the City of Lake Oswego is this new seamless AutoCAD water distribution system map. We applied over 15 years of utility mapping expertise and our industry leading automated mapping tools to deliver a final product that the City has confidence in.



Here's what the City had to say after we delivered the final product:

"The City now has an up-to-date and accurate Water System Atlas which will facilitate future updates, provide more accurate hydraulic modeling and increase our confidence that what we're seeing on paper more closely reflects "the real world" than ever before.

For projects of a similar scope and objective, it is my opinion that TCI Mapping Services can provide outstanding service value for each public or private dollar spent."

**Joel B. Komarek, P.E.
City Engineer
City of Lake Oswego**

To find out how TCI can help you Preserve the Value of your Legacy Utility Information:

Call toll free: **1-800-291-7533**

Or send an email to: **tom@tcicorp.com**