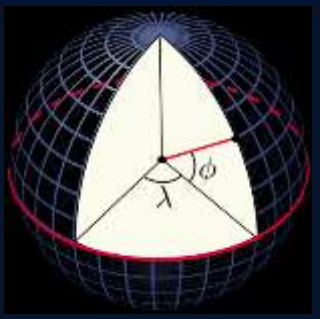
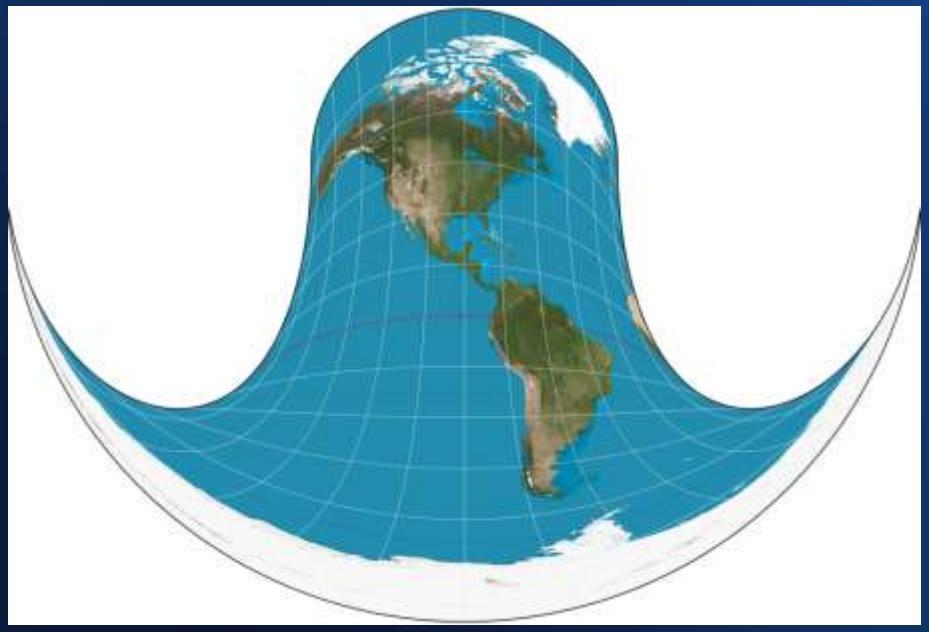


How Good is Good Enough?



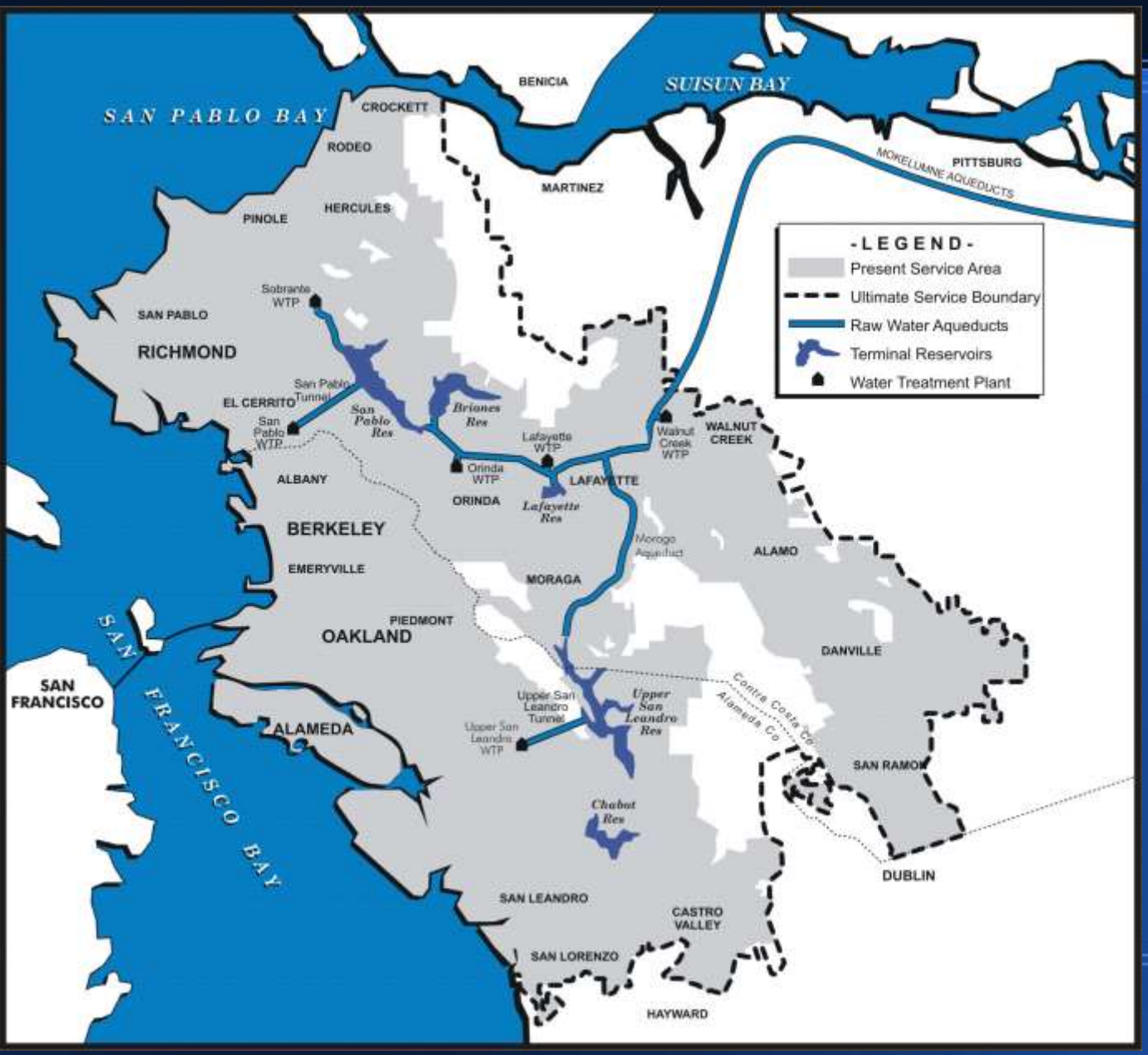
September 27, 2016
NGAC Meeting

This image shows a Hammer retro-azimuthal projection, in which azimuths to center are true. All world views sacrifice fidelity in one aspect to gain it in others.

Outline

1. EBMUD and its geospatial data
2. What's the problem?
3. Outline of a solution

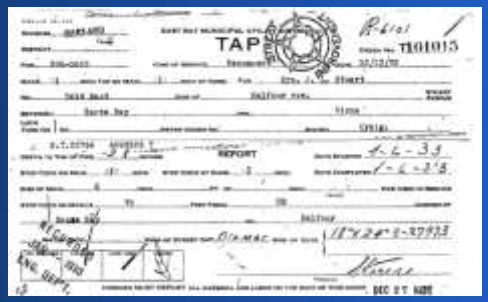
EBMUD's Water System



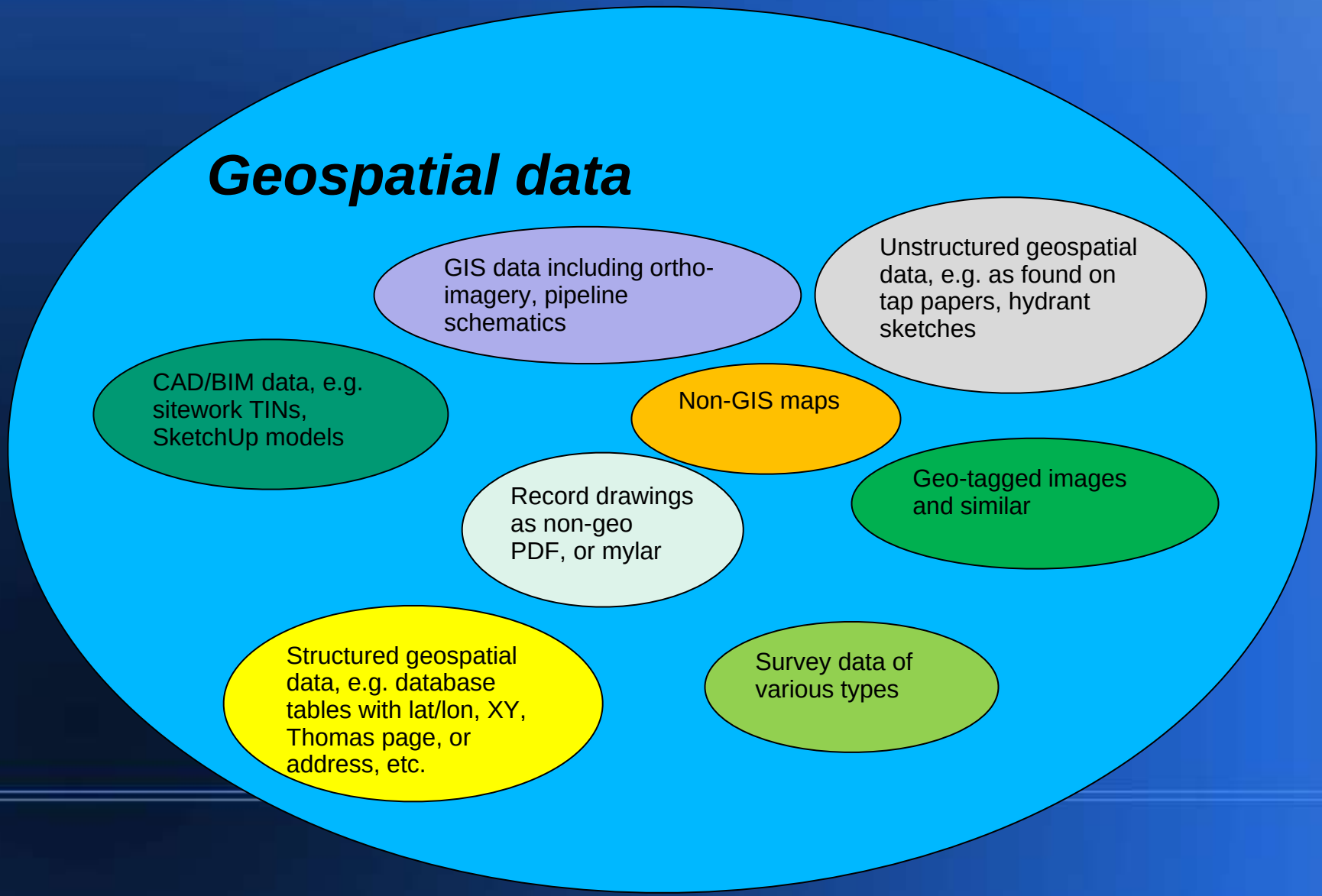
1,300,000 retail customers
400,000 services
6,600 km pipe
31 dams
5 treatment plants
126 pumping plants
165 reservoirs/tanks
122 pressure zones
Elevation: MSL-442 m

Geospatial data used by EBMUD

- Location and geometry of assets:
  - 4,300 miles of pipe
  - 400,000 meters
  - Hundreds of 1000's of appurtenances (services, valves, et
- Location of important events
  - Work orders
  - Leaks
  - Repairs
  - Investigations



Geospatial ⊃ GIS



EBMUD Work Revolves Around Geospatial Data

Field Survey

Other data

Base Drawings

Design

Construction

Mapping,
Record Drawing Creation

Operations and
Maintenance

One of Our Geospatial Challenges

1. Existing GIS is schematic
2. Not able to properly support modern workflows:
   - 50,000 utility locates per year
   - 10,000 excavations per year
   - Increasingly congested sub-surface

Existing GIS still shows its 1920's roots since 1928

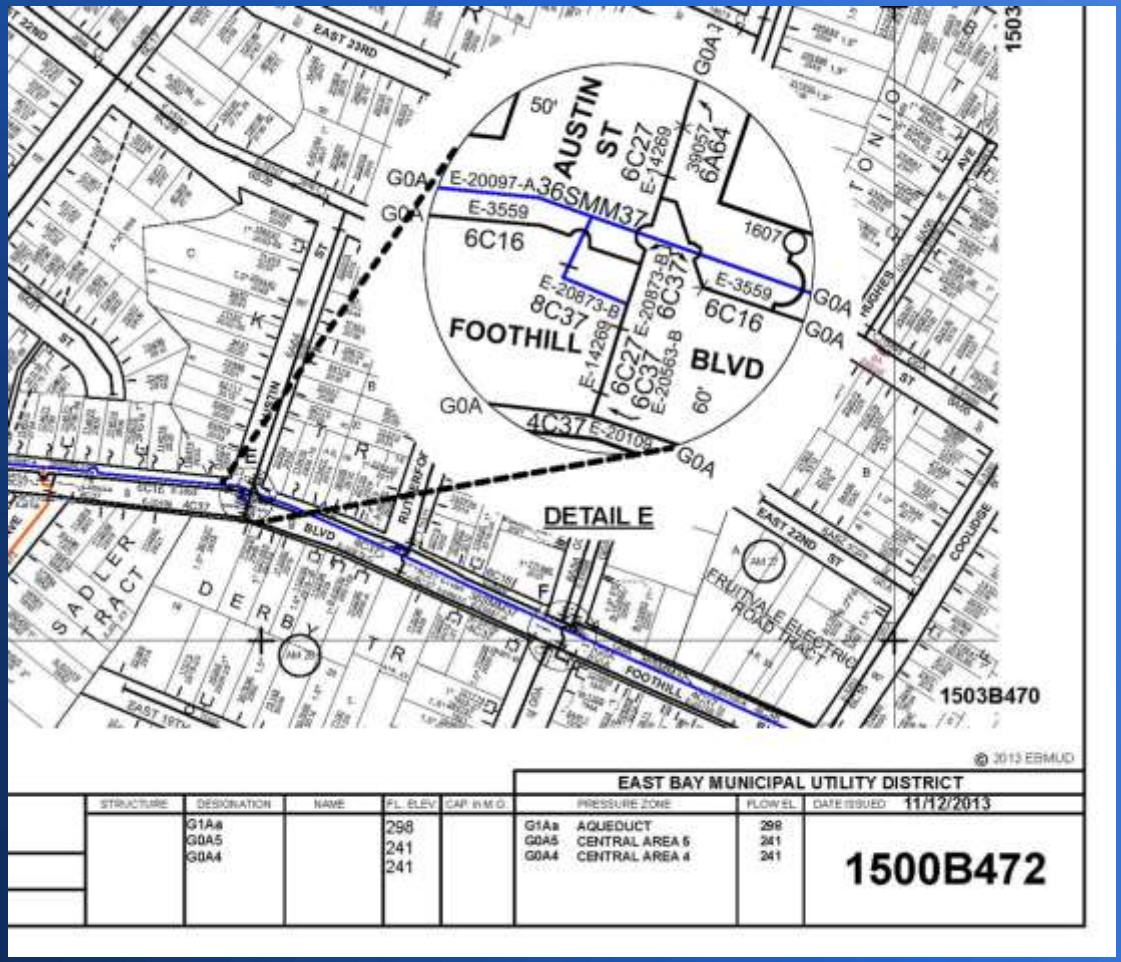
Traditional Emphasis on "Cartographic Clarity" over Geographic Fidelity

Rationale:

- Maps of today are schematic because if shown geographically true, parallel pipes will end up nearly atop one another
- Many pipe intersections are very complex

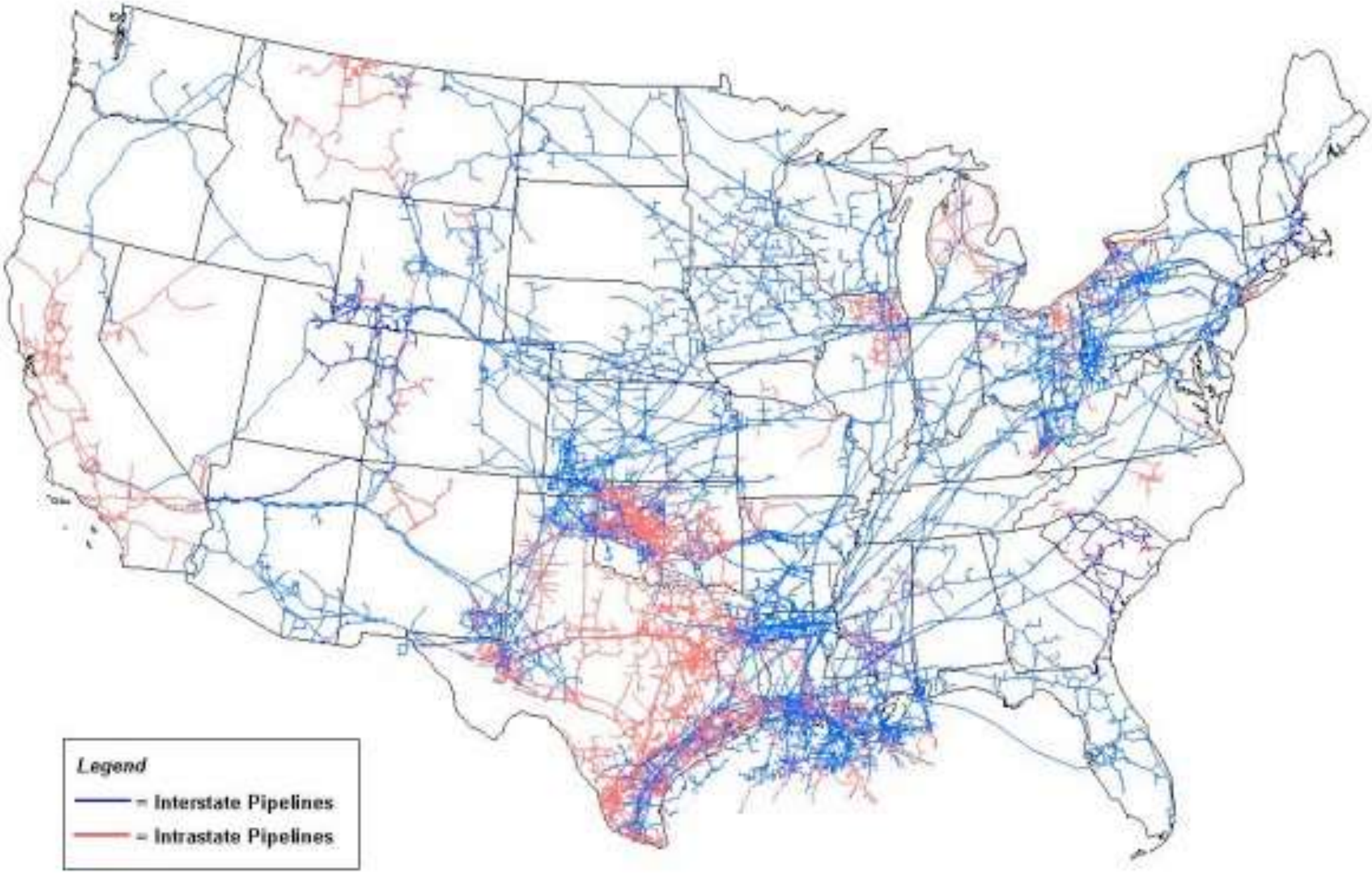
Downsides to schematic approach:

- Pipes may be shown far from true location
- Inter-utility conflict detection is impossible
- Requires extra labor
- Not good for location-aware apps



Locating Valves and Pipes is Hugely Time-Consuming

image:
Wachs water service



Source: Energy Information Administration, Office of Oil & Gas, Natural Gas Division, Gas Transportation Information System

Dig-ins of gas and high-voltage electrical lines happen many times per year, often with disastrous results.

LOHO

How Exactly Should We Transition to Geographic Accuracy?

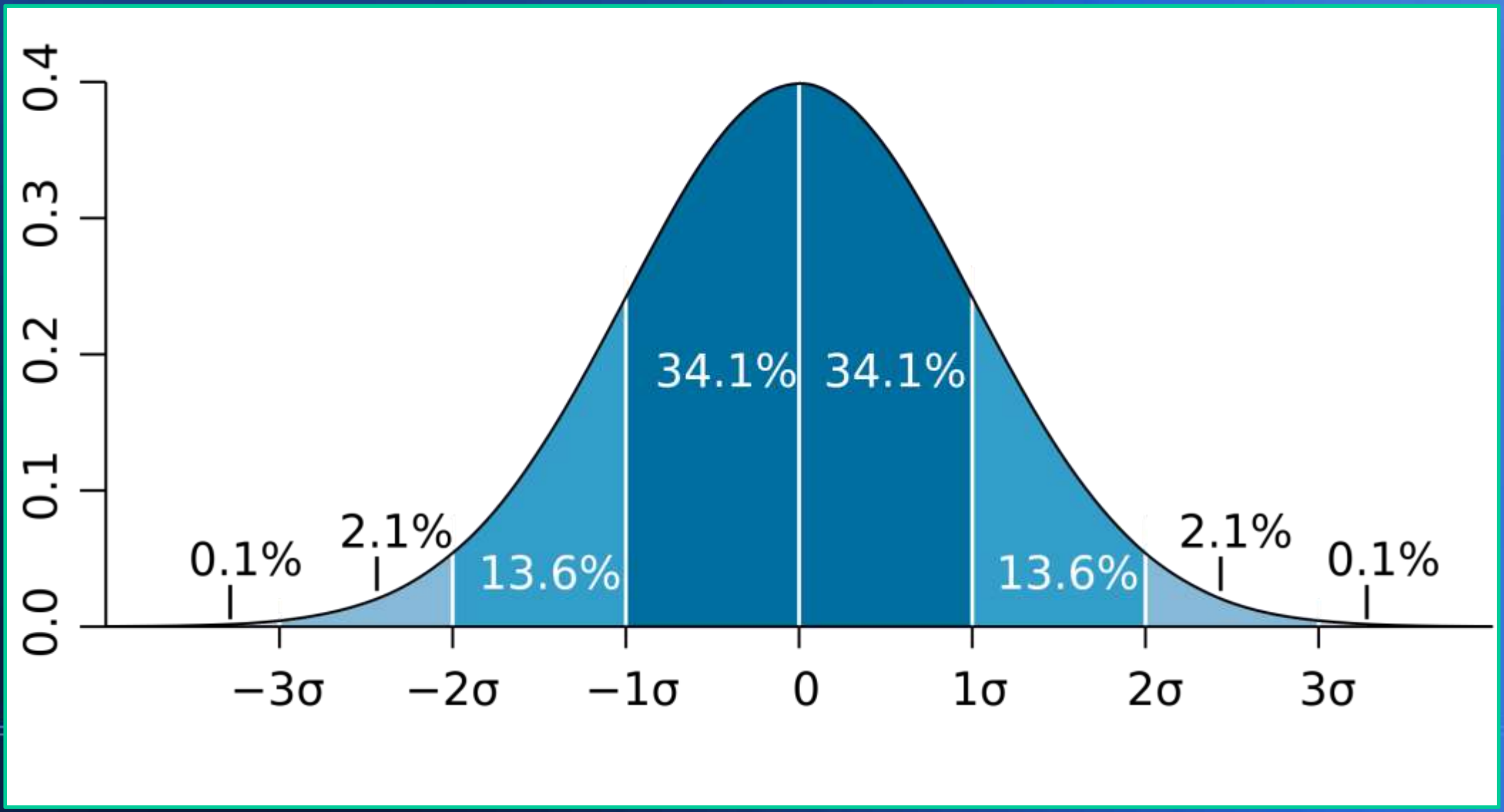
Modern GPS systems can provide:

- 1” accuracy XY in the field
- Text annotations and photos linked to the data
- No post-processing required

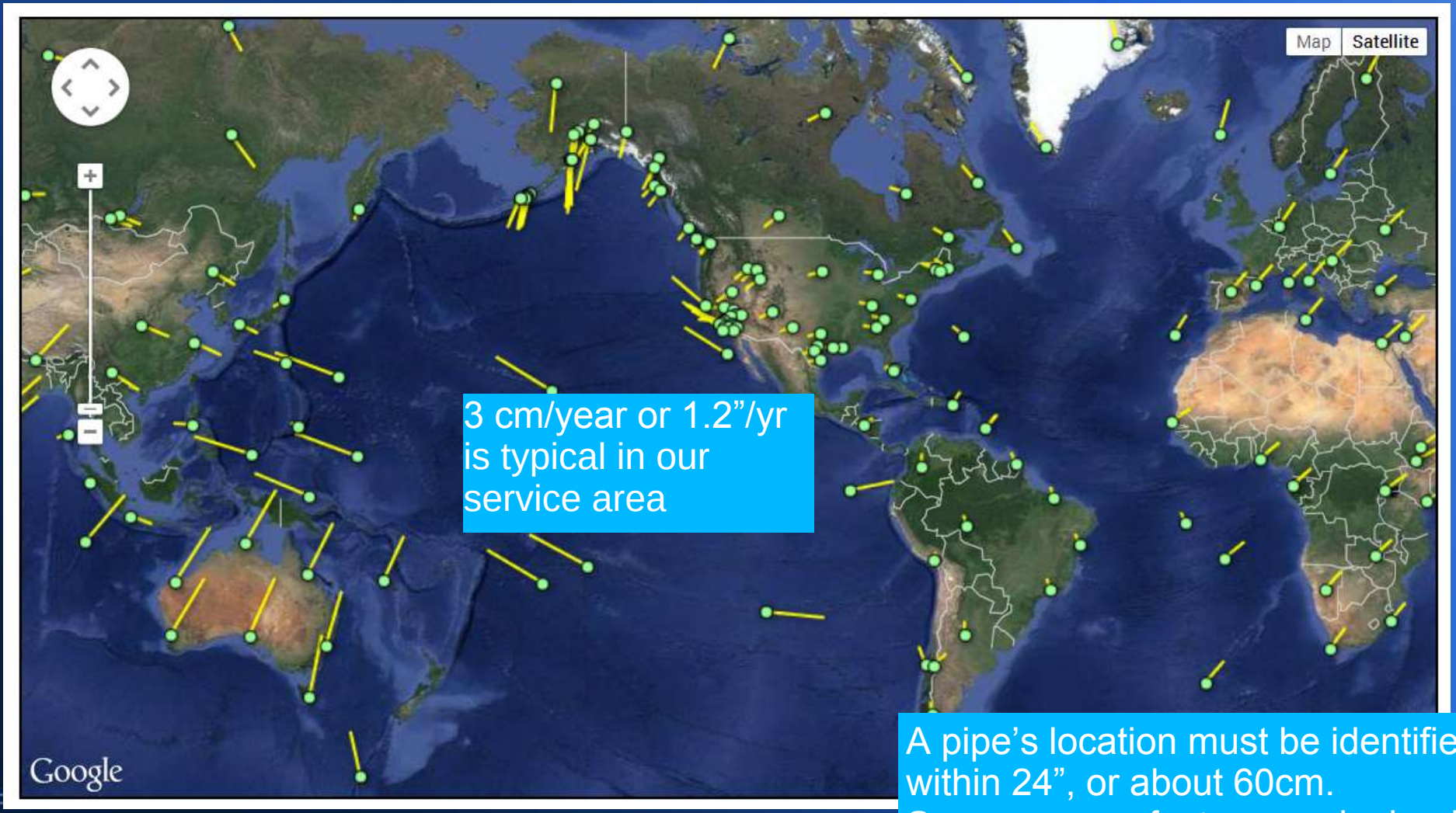
Versus smart phones:

- Data are super cheap and easy to grab
- But accuracy is often 2’ or worse RMS

How Good is Good Enough?

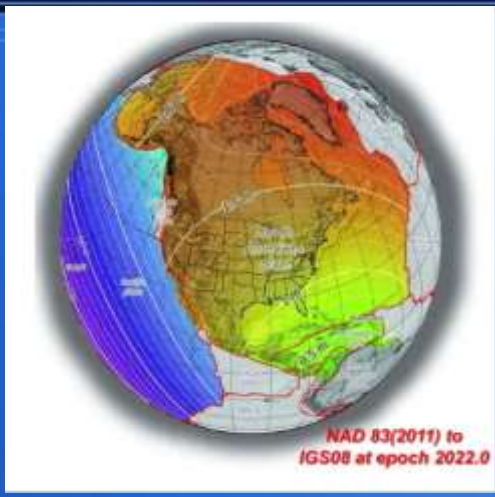


Hold Your Answer:
Tectonic Drift is not negligible



A pipe’s location must be identified to within 24”, or about 60cm.
So, even a perfect survey is dead wrong in 20 years if not adjusted.

http://sideshow.jpl.nasa.gov/post/series.html

Summary

1. We need to reliably be within 2’
2. That means RMS error of about 8”
3. We need to allow for various sources of error including initial capture, tectonic drift, datum conversions, mapping error
4. Capture accuracy of 3” or so is not unreasonable
5. And we need to get our datums, projections, etc. right — this means good metadata & user training