

Enterprise GIS and Asset Management

ESRI Southwest User Conference
April 2018



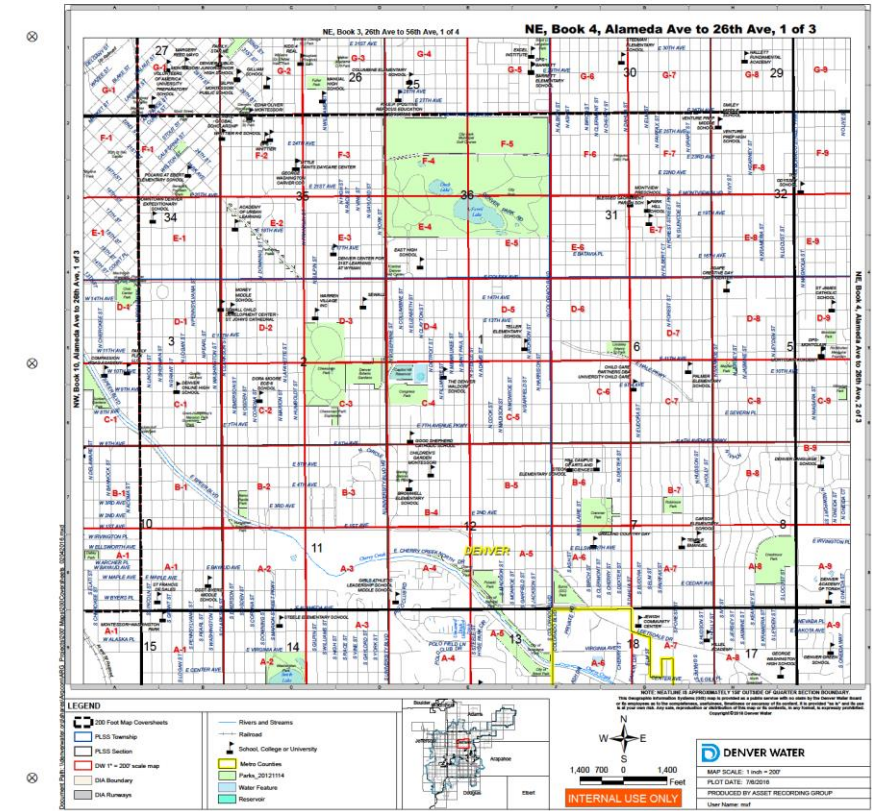
About Denver Water

- Established 1918
 - 2018 is our **100 year anniversary!**
- Serves 1.4 million customers
- Service area = 335 sq. miles
- Largest and oldest water utility in Colorado
- Denver Water is a separate entity from the City and County of Denver.
- ESRI customer #1640
 - 1st water utility to buy ESRI software?



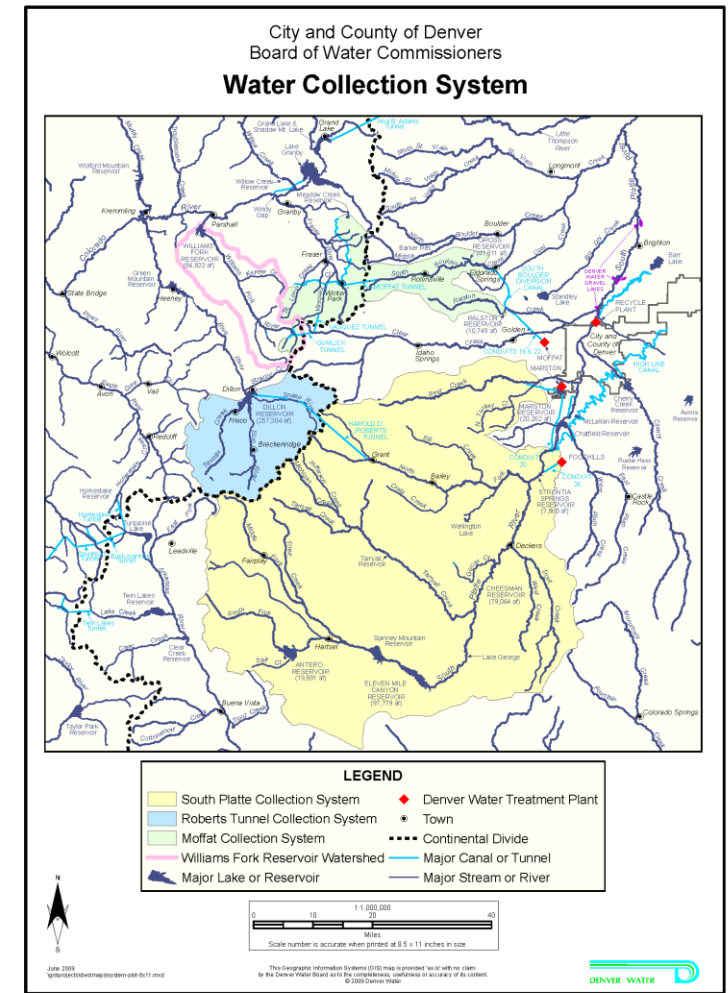
Distribution System

- 3,000+ miles of Mains
 - ✓ More than 1,600 map sheets printed at a scale of 1" = 200 feet
- 500+ miles of Conduits (>24" pipe)
- 23 Pump Stations
- Includes Denver International Airport

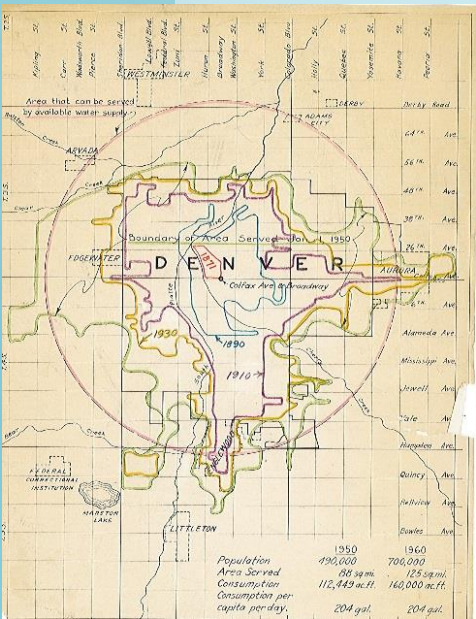


Collection System

- Covers 4,000 sq. miles (2.5M acres)
- Extends into Park, Grand, Jefferson, Gilpin, Summit, Teller, Douglas, Clear Creek counties
- Water = Mostly Mountain Snowmelt



History of GIS at Denver Water

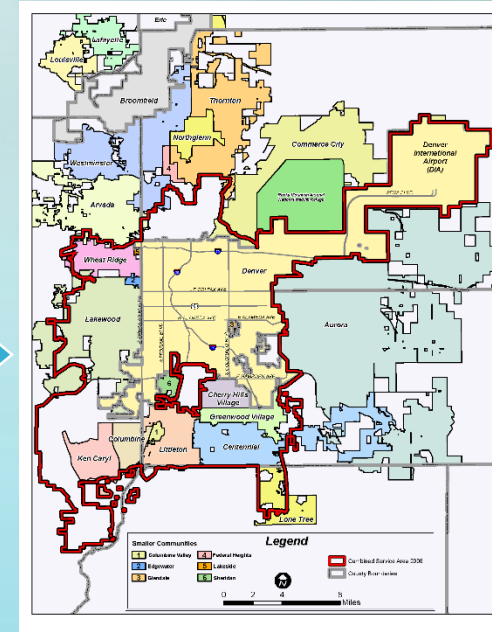


1985 - 1990

- Digital Conversion from Paper
- Attributes Added
- Distribution Facilities Digitized
- Technology Migration

2001 – 2006

- Data Improvements
- 2nd Technology Migration – ESRI/SDE



Historically – two GIS Groups:

- ❖ Water Resources GIS in Planning
- ❖ Distribution GIS in Engineering/IT

❖ Now three groups:

- ❖ **Engineering/Asset Recording**
- ❖ Administrative GIS Services
- ❖ IT Geospatial Asset Management

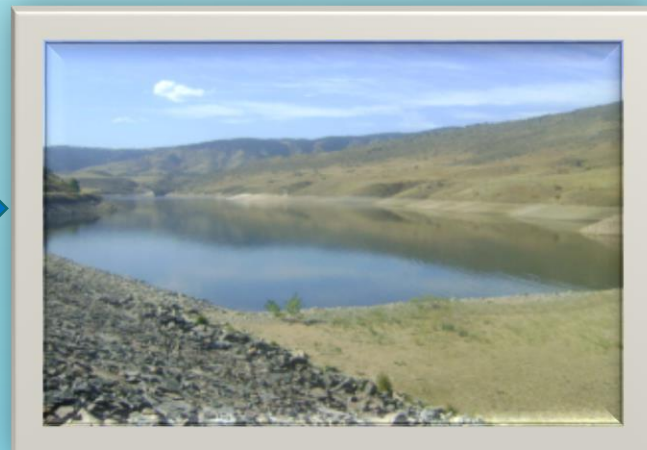


5661 June 13, 1938. Pipe locating device demonstrating on W. Colfax Ave. and 2nd St.



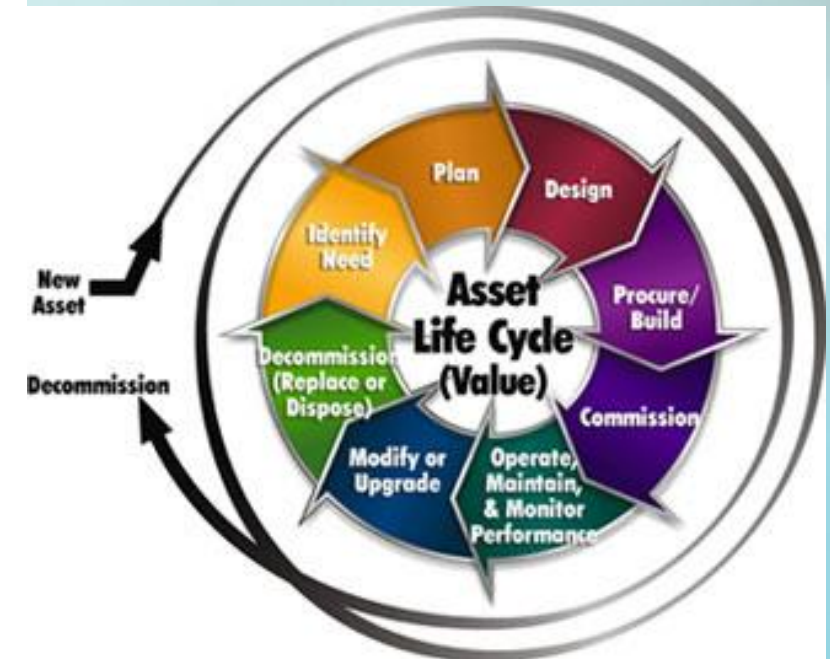
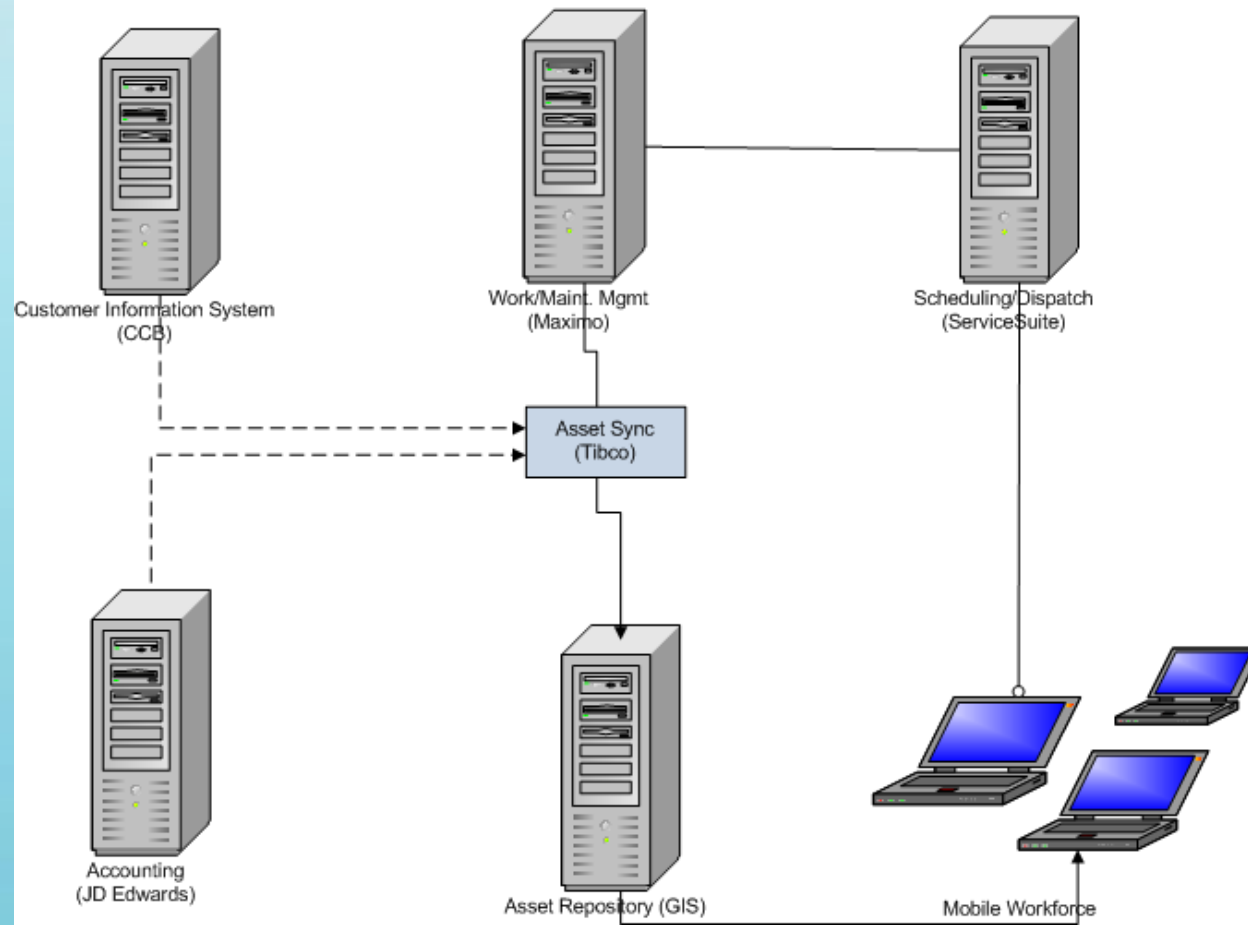
Overview of GIS and Asset Management

- Robust GIS supports many aspects of our business
- Asset management is core to operations, maintenance, finance, planning, and engineering.
- Keeping data current and accurate is an ongoing challenge
- Integrates multiple, legacy systems
- Supports field operations with mobile solution



Enterprise Asset Management

Enterprise Asset Management System (EAMS)
Conceptual Diagram

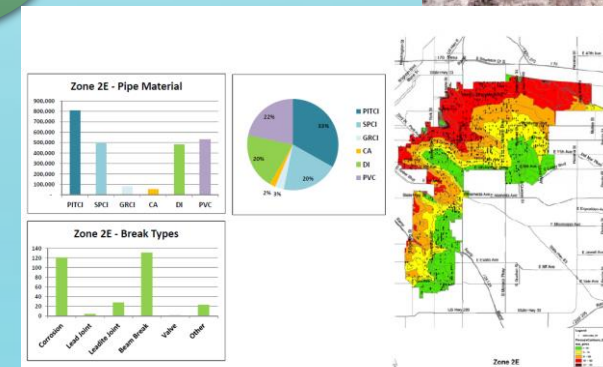
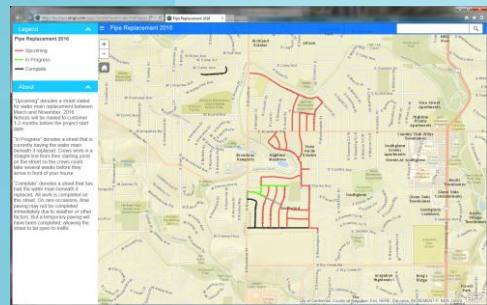
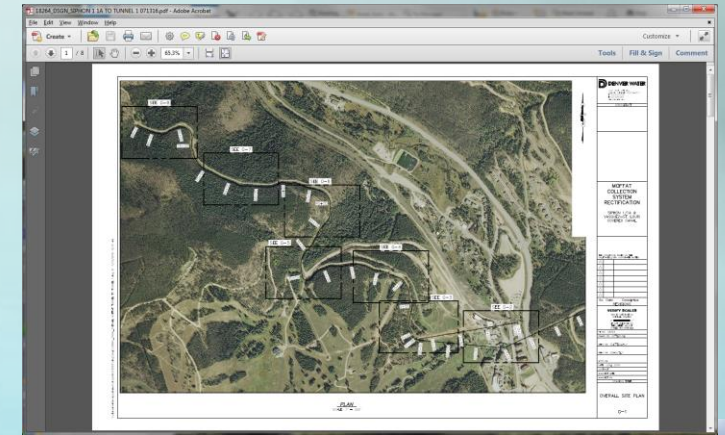
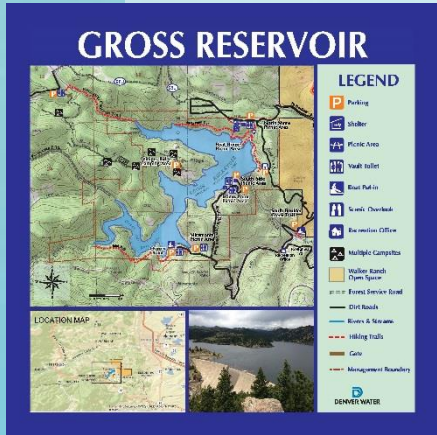


Managing \$2B in Water System Assets

- 3,000+ miles of transmission and distribution mains
- More than 240,000 active taps serving 1.4M customers
- 80,000+ valves used to operate the system
- 23 Pump Stations, 4 Treatment Plants
- Mountain Collection system spans 4,000 square miles across 8 counties
 - with pipes, canals, tunnels, and siphons to maintain



GIS is at the hub of our business



Why do we need GIS?

Capital Projects in 2017

- 130 Projects – \$160M budgeted
- 69 Projects in Construction
- 35 Completed Construction Projects
- \$107M Construction cost
- 100 year old facilities require maintenance!

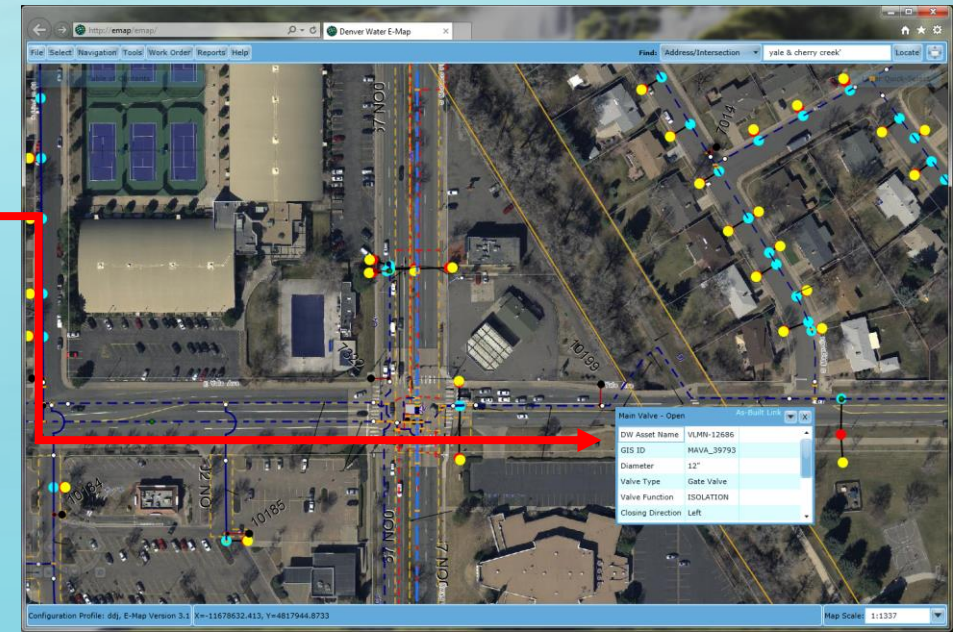
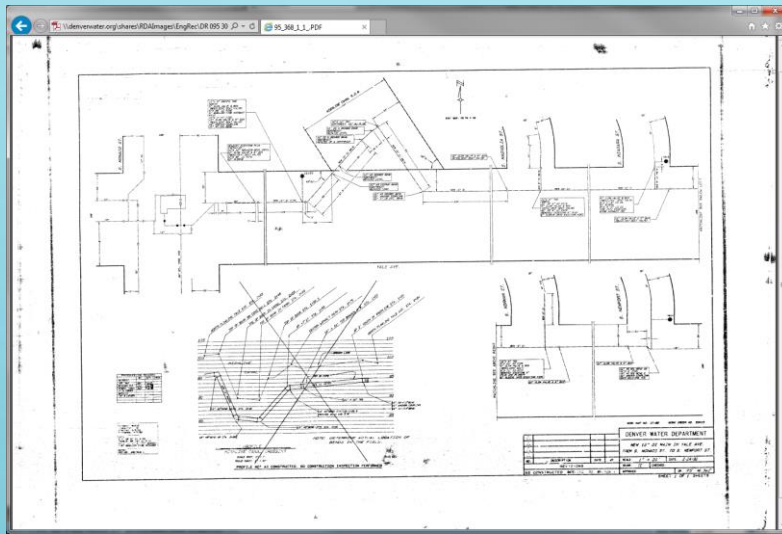
Gross Reservoir Flyover

<https://youtu.be/eF0hwI2PySk>

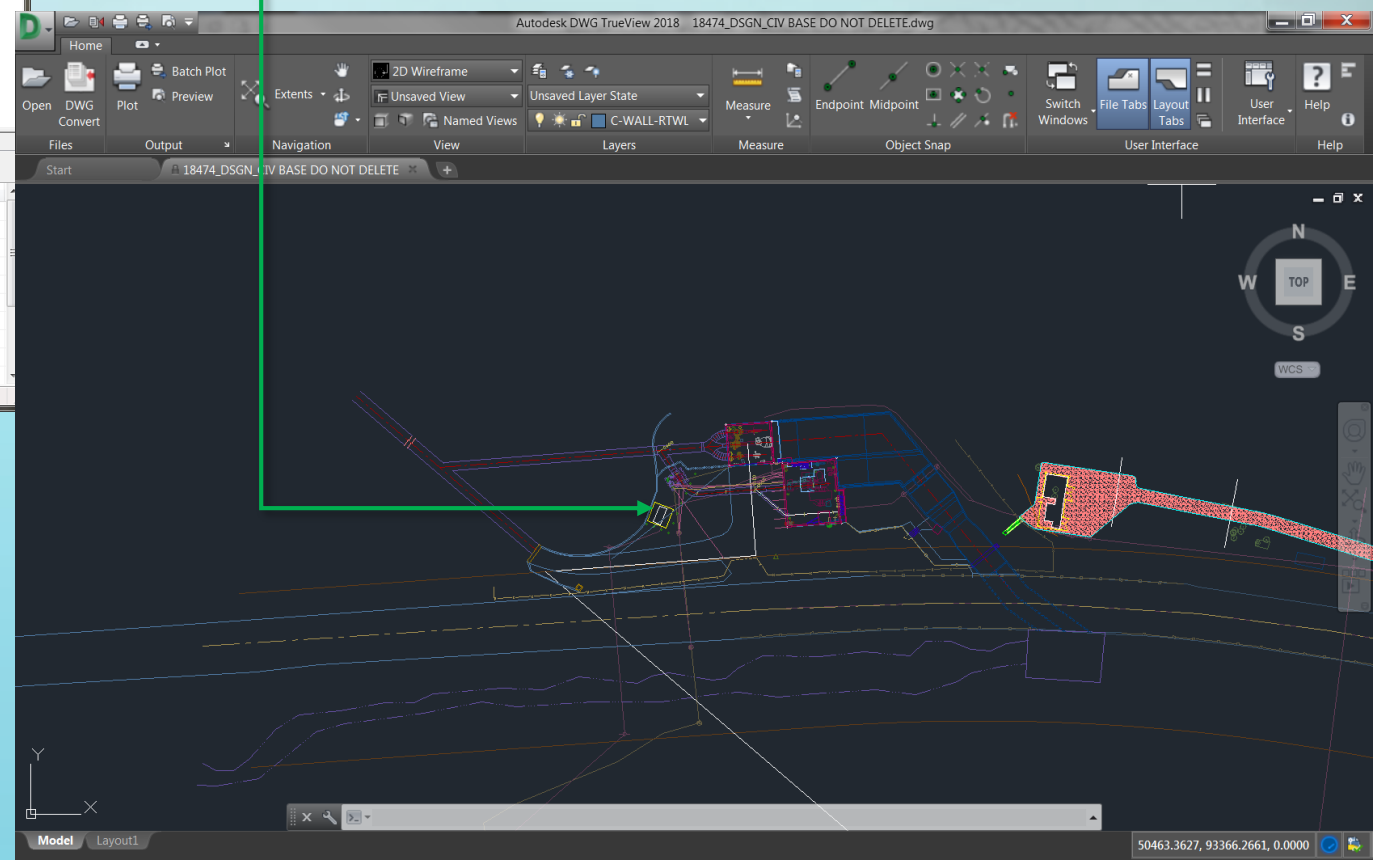
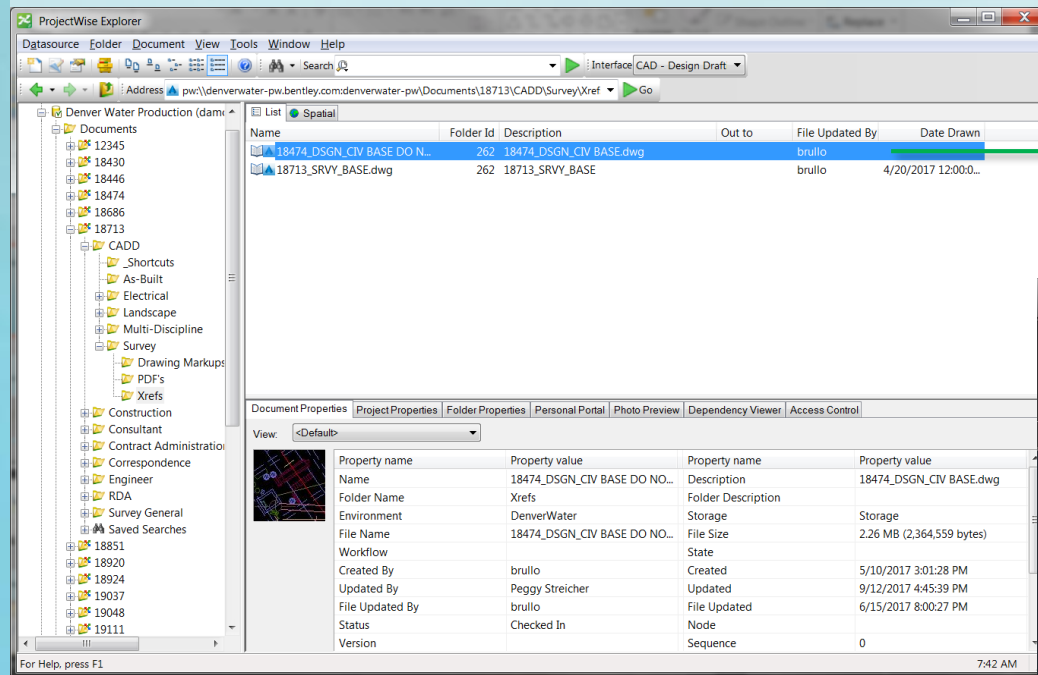


Posting As-Built Drawings to ArcGIS

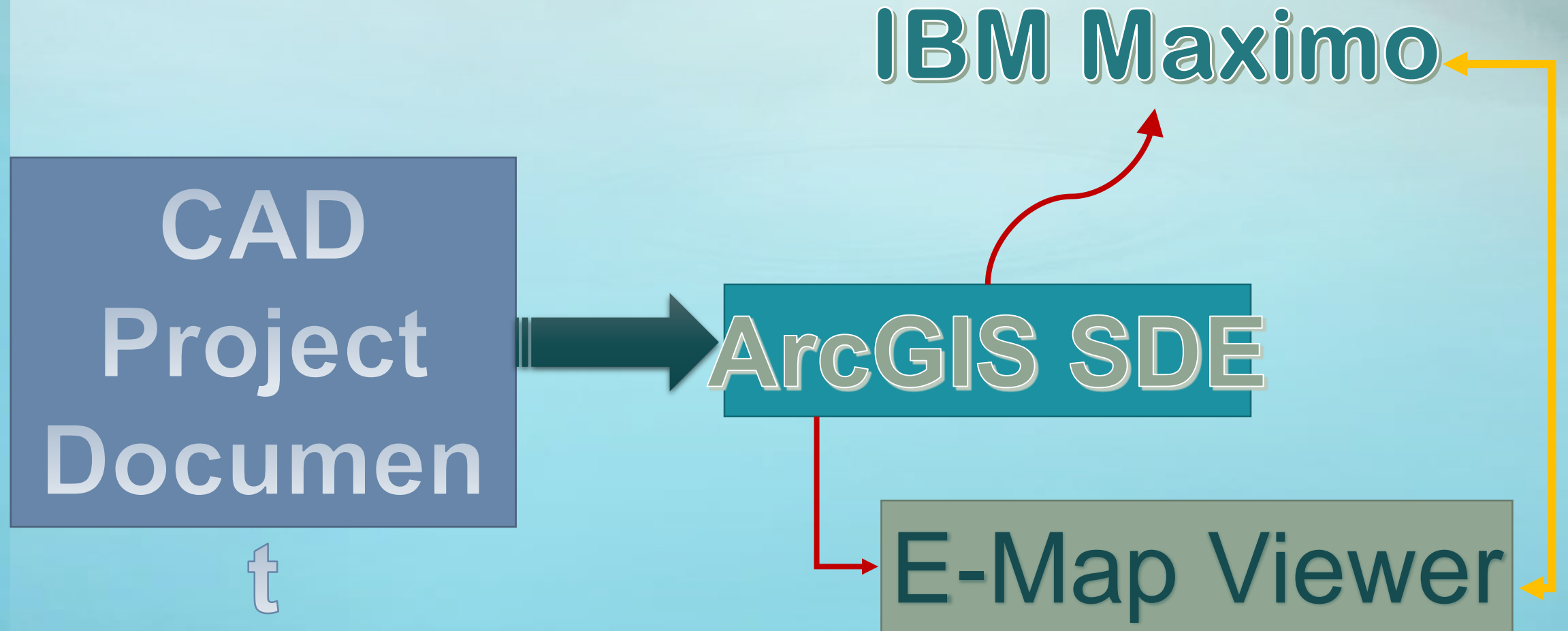
- AutoCAD drawings depict as-built conditions
- E-Map is an ArcGIS Server based intranet GIS (internally developed)
- CAD drawings are used to update E-Map via ArcGIS SDE
- E-Map includes links to the PDF drawings for reference
- Mobile crews can access E-Map in the field



ProjectWise for CAD document management



CAD to GIS to Maximo



Work Management

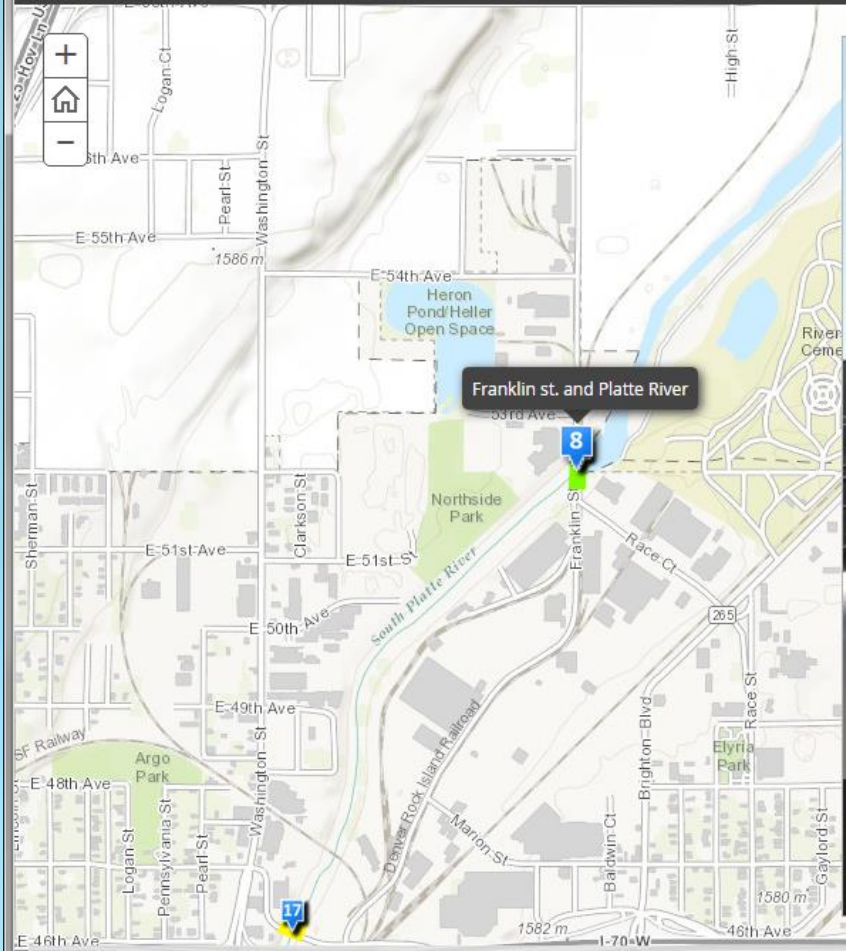
The screenshot displays the MAXIMO Work Management interface, which is a web-based application for managing water utility assets and work orders. The interface is divided into several sections:

- Asset Information:** Located on the left, it provides details for a specific fire hydrant (HYDT_25883).
 - FIRE HYDRANT**
 - GIS ID:** HYDT_25883
 - Hydrant Number:** 11744
 - Customer Contract:** Denver Water
 - Diameter:** 6"
 - Elevation:** 0
 - Installation Date:** 8/25/1999
 - Manufacturer:** Waterous
 - Collection Method:** 5cm RTK / GPS
 - Installation Type:** Dedicated Street
 - Access Permission:** psi
 - Modeled Static (pitot):** psi
 - Calculated Available Flow:** gpm
 - Record Information:** Drawer and number Dr. 239 / Num. 889
- Work Orders:** A table listing work orders related to the asset.

WO Group	Task	Description	Location	Asset	GL Account	Status	Priority	Target Start
09-206132	N	WATEROUS Hydrant recall work (Installation Date 1999) HB-11744	HB-11744	HYD-11744	850500-W95196	WSCH	3	10/31/09 12:00
HYD-011570	N	HYDS Work History	HB-11744	HYD-11744	850500	CLOSE	2	
HYD-027321	N	HYDS Work History	HB-11744	HYD-11744	850500	CLOSE	2	
HYD-059410	N	HYDS Work History	HB-11744	HYD-11744	850500	CLOSE	2	
HYD-074416	N	HYDS Work History	HB-11744	HYD-11744	850500	CLOSE	2	
HYD-103850	N	HYDS Work History	HB-11744	HYD-11744	850500	CLOSE	2	
HYD-131519	N	HYDS Work History	HB-11744	HYD-11744	850500	CLOSE	2	
HYD-159016	N	HYDS Work History	HB-11744	HYD-11744	850500	CLOSE	2	
09-210470	N	Hydrant Inspection	HB-11744	HYD-11744	850500	CLOSE	1	11/2/09 12:00
- Map:** A map view showing the location of the hydrant (11744) and surrounding infrastructure (10567, 10564, 10566, 10568, 10569, 10570, 10571, 10572, 10573, 10574, 10575, 10576, 10577, 10578, 10579, 10580, 10581, 10582, 10583, 10584, 10585, 10586, 10587, 10588, 10589, 10590, 10591, 10592, 10593, 10594, 10595, 10596, 10597, 10598, 10599, 10600, 10601, 10602, 10603, 10604, 10605, 10606, 10607, 10608, 10609, 10610, 10611, 10612, 10613, 10614, 10615, 10616, 10617, 10618, 10619, 10620, 10621, 10622, 10623, 10624, 10625, 10626, 10627, 10628, 10629, 10630, 10631, 10632, 10633, 10634, 10635, 10636, 10637, 10638, 10639, 10640, 10641, 10642, 10643, 10644, 10645, 10646, 10647, 10648, 10649, 10650, 10651, 10652, 10653, 10654, 10655, 10656, 10657, 10658, 10659, 10660, 10661, 10662, 10663, 10664, 10665, 10666, 10667, 10668, 10669, 10670, 10671, 10672, 10673, 10674, 10675, 10676, 10677, 10678, 10679, 10680, 10681, 10682, 10683, 10684, 10685, 10686, 10687, 10688, 10689, 10690, 10691, 10692, 10693, 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Aerial Pipe Crossings

Sharepoint Site



Franklin st. and Platte River

System is relatively new and overall in excellent condition. There are a few dings in the polyurethane coating, most notably on the south side, that could be touched up. The short reach of 1965 pipe on the north side should eventually be re-coated.



C81 over Clear Creek



C81 over Clear Creek



C81 over Clear Creek



C81 over Clear Creek



C81 over Clear Creek



C81 over Clear Creek



Franklin st. and Platte River



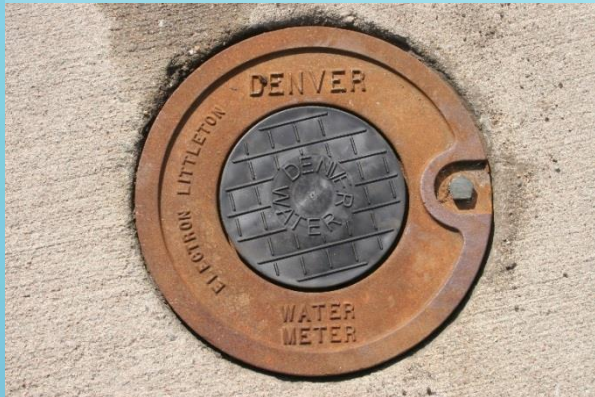
Franklin st. and Platte River



Franklin st. ar

Customer Locations

- More than 320,000 taps and associated meter locations mapped
- Initial data collection using GPS over 3 year period
- Supplemented by visual identification from aerial imagery and Google Street View maps
- New taps located with GNSS survey receivers



All Activated Taps In Denver Water Service Area by Tap Date

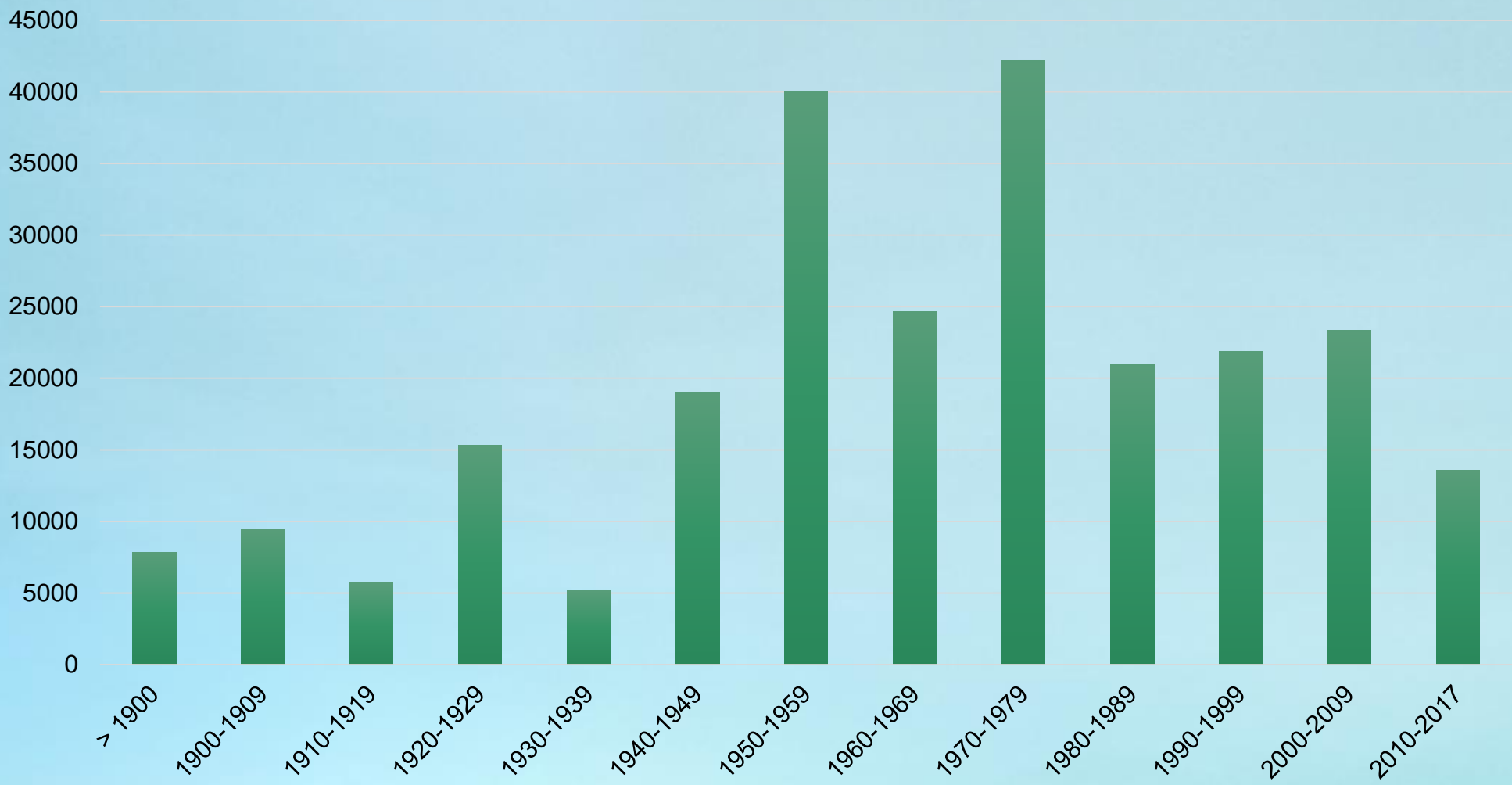
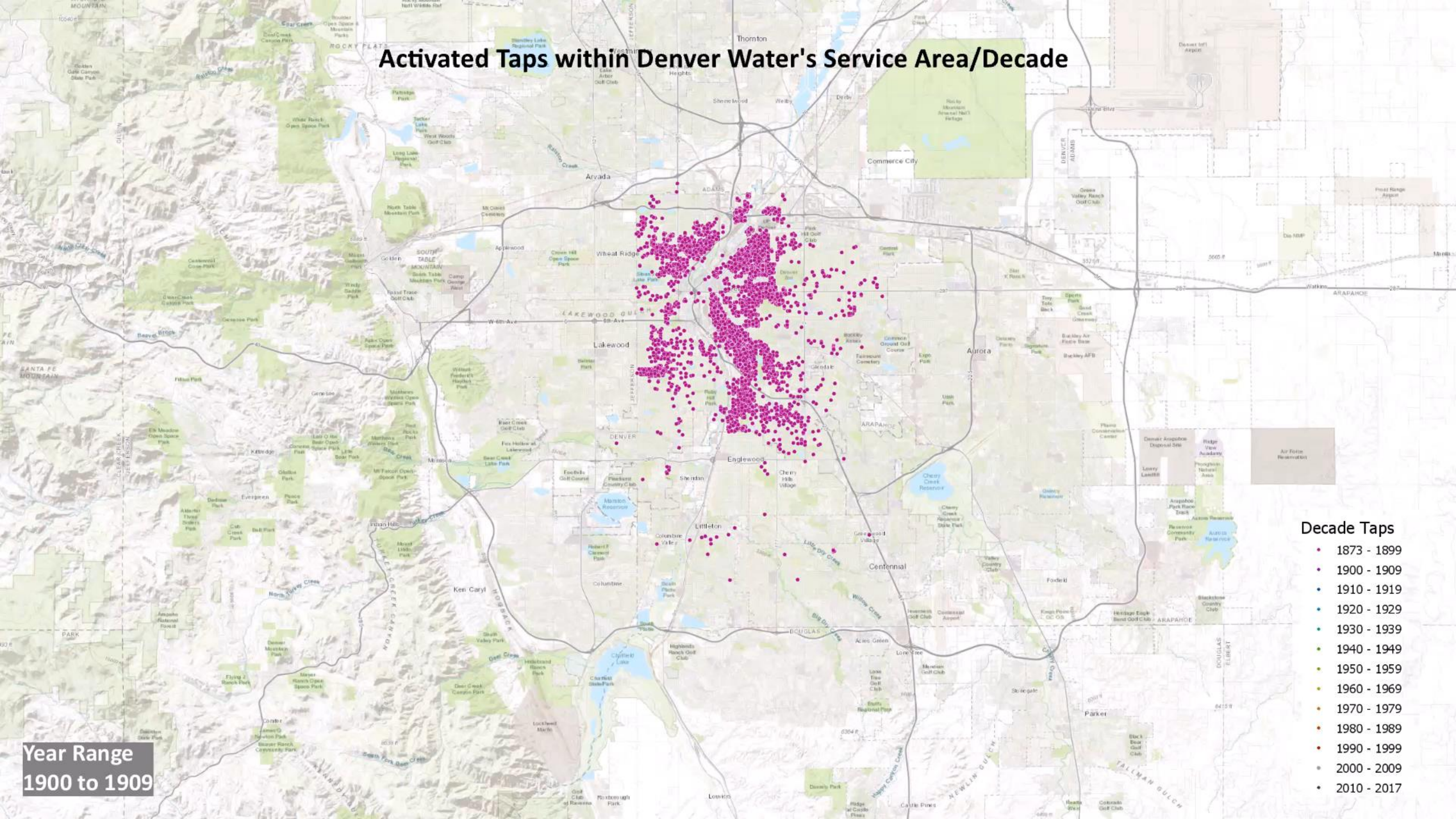


Chart represents all of Denver, total service and read and bill customers.
Master metered customers are not included.

Activated Taps within Denver Water's Service Area/Decade



Decade Taps

- 1873 - 1899
- 1900 - 1909
- 1910 - 1919
- 1920 - 1929
- 1930 - 1939
- 1940 - 1949
- 1950 - 1959
- 1960 - 1969
- 1970 - 1979
- 1980 - 1989
- 1990 - 1999
- 2000 - 2009
- 2010 - 2017

Year Range
1900 to 1909

Hydraulic Model Integration

- 1 to 1 GIS to InfoWater all pipes model
- Semi-automated update process for ~357,000 pipe segments
- Excellent GIS data quality supports model integration
- Utilities have *talked* about Model/GIS integration for years. Denver Water is doing it!



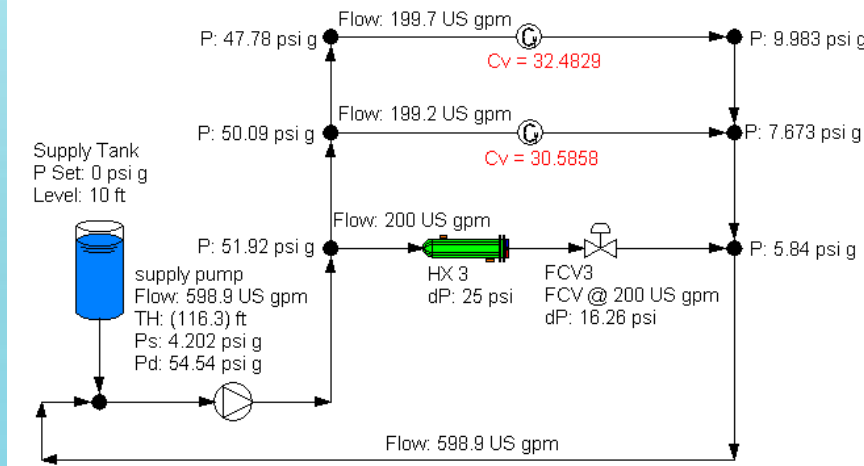
GIS Exchange Cluster

GIS Data Source
GIS Data Source: C:\Users\kszana\OneDrive - Denver Water\My Documents\Models\GIS
Feature Class/Table: pipes (File Geodatabase Feature Class) WHERE Clause:

Network Data Source
Type: Pipe Tables
ID:
☐ Apply on Domain
☒ Apply on Active Network

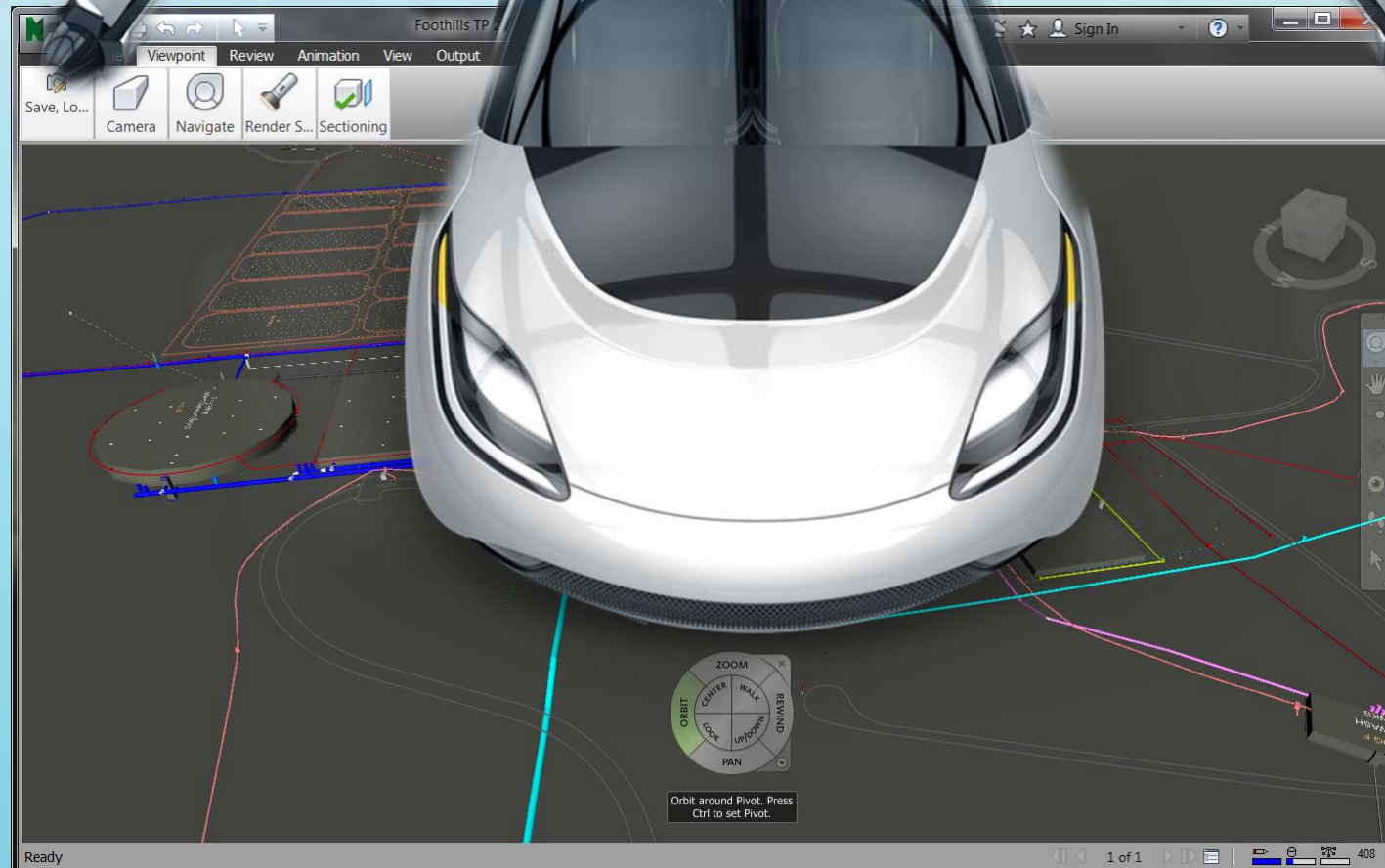
Exchange Options
Relate Type: ☒ Tabular Join ☐ Spatial Join
Update Direction: 0: Bi-Direction
☒ Create New Records
☐ Update Existing Records
☐ Delete Non-Matching Records
☐ Support Batch Exchange
☐ Create Unique IDs
☐ Update Geometry Data
☐ Reformat ESRI IDs (GUID)

Tabular Join Spatial Join Field Mapping
GIS ID Mapping Field: GIS_ID



Evolving technology for the next 100 years!

- Example: 3-D models of treatment require accurate asset mapping
- One benefit of a mature GIS and management system



Questions?

