

77,000 Service Lines Identified in 1,000 days – GIS to the Rescue

Jerek Laursen & Aaron
Murphy, GIS;
Patrick Craney, Water
Engineering



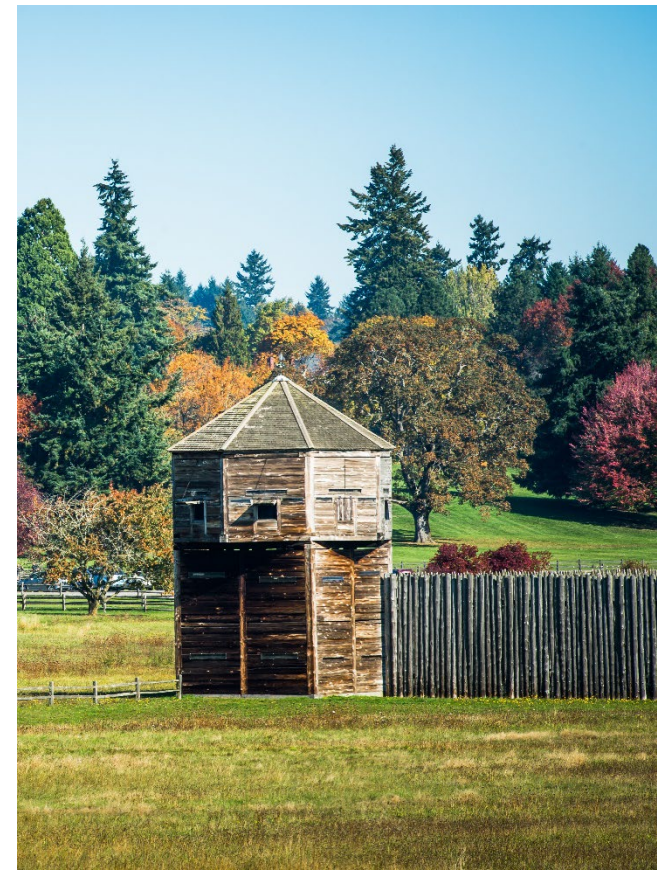
Vancouver

Oldest Washington Community

- Settled 1825
- Incorporated 1857

Third Largest Water Utility

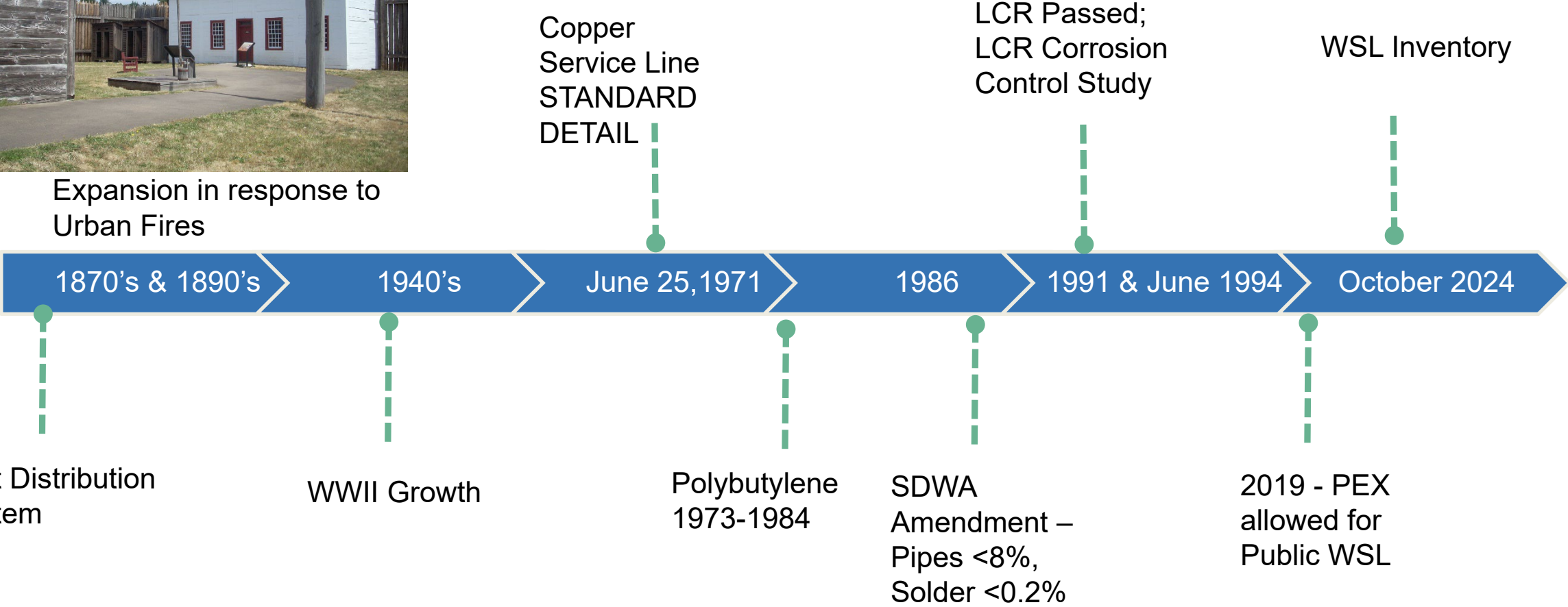
- Streets – 1,900 lane miles
- Sewers – 773 miles (1890)
- Water – 1,050 miles, 10 BGal/yr



Water System Milestones



Expansion in response to Urban Fires



1994 Corrosion Control Study WSL section focusing on Public Side – 80% Cu, 20% GIP

Service Line Identification Methods



GIS Tools



**Field
Methods**



**Historical
Records**



Interpolation

Where to start?

BIG
TASK

SMALL
TASK



Maryke

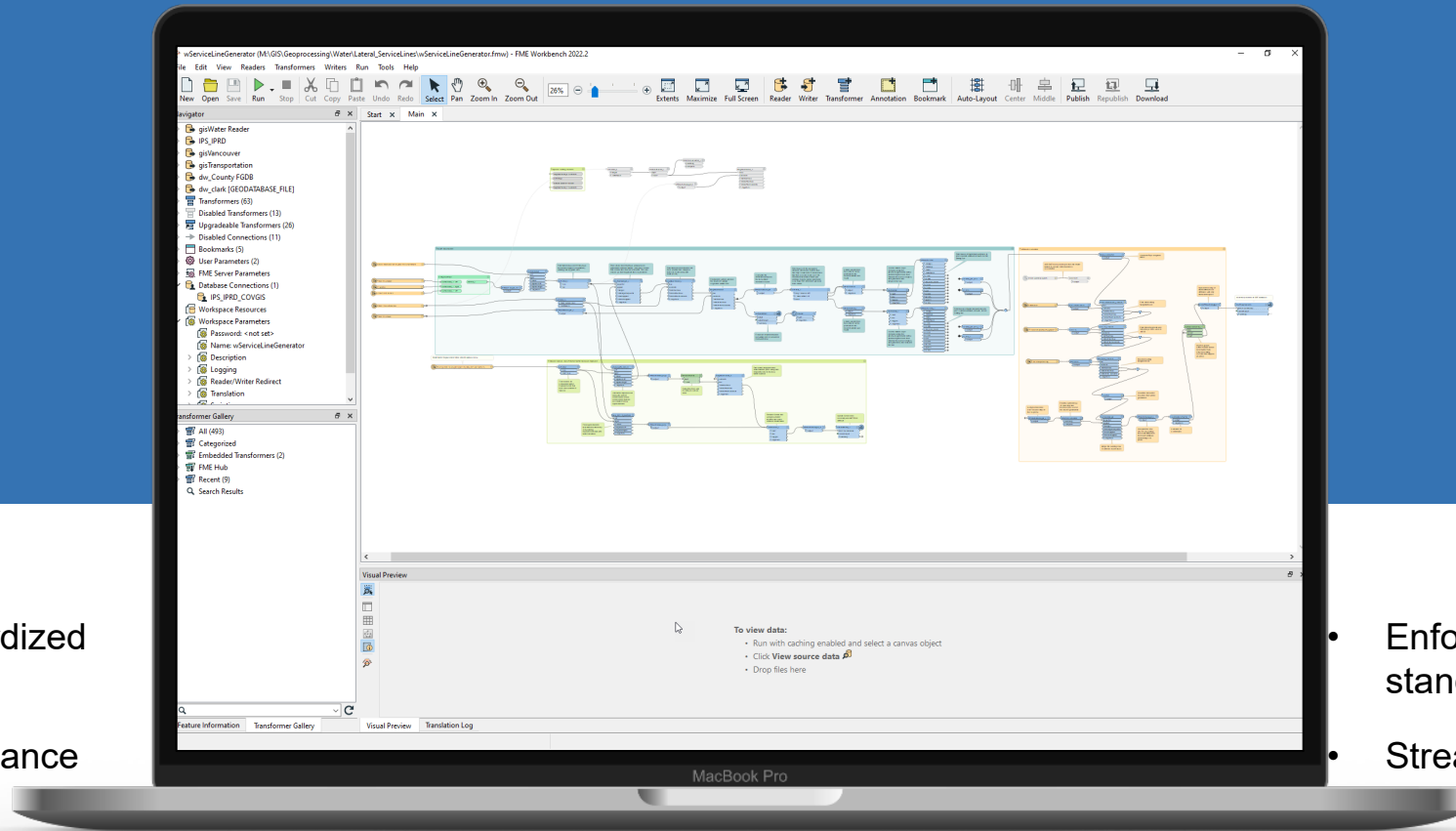
Challenges

- How to create and maintain such a large dataset from scratch (150k + records)
- Integrate data between systems and workflows
- Resources
- Timelines
- Historical or non-existent records

Path forward

- Small tasks that will build to the end goal
 - Public, Private, QA, Desktop & Field
- Streamline workflow and limit resource output
- Find a starting place to build from
 - Water Meters
 - Locations: survey grade precision
 - Attributes: Utility Billing maintained

One automation (FME) to rule them all



Logic

- Built off of known standardized dataset – Water Meters
- Integrate service maintenance replacement records
- Data QA
- Attribution and defaults
- INSERT or UPDATE

Advantages

- Enforces creation and management standards
- Streamlines field and manual workflows
- Runs routinely in the background
- Low code visual environment allows non-experts insight into process flow

OPS Field Crew collecting Data

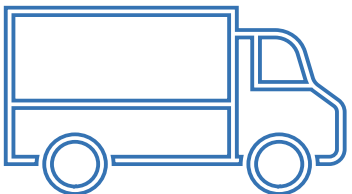
Field Crew using Field Maps

We have a dedicated 2 man crew that is inspecting the Service Lines in the field. This crew is using Field Maps on an iPad so they can make Real Time updates to the Service Line Layer.

Field Maps also shows the location of the Field Crew so they can see their location and make sure they are inspecting the correct Service Line

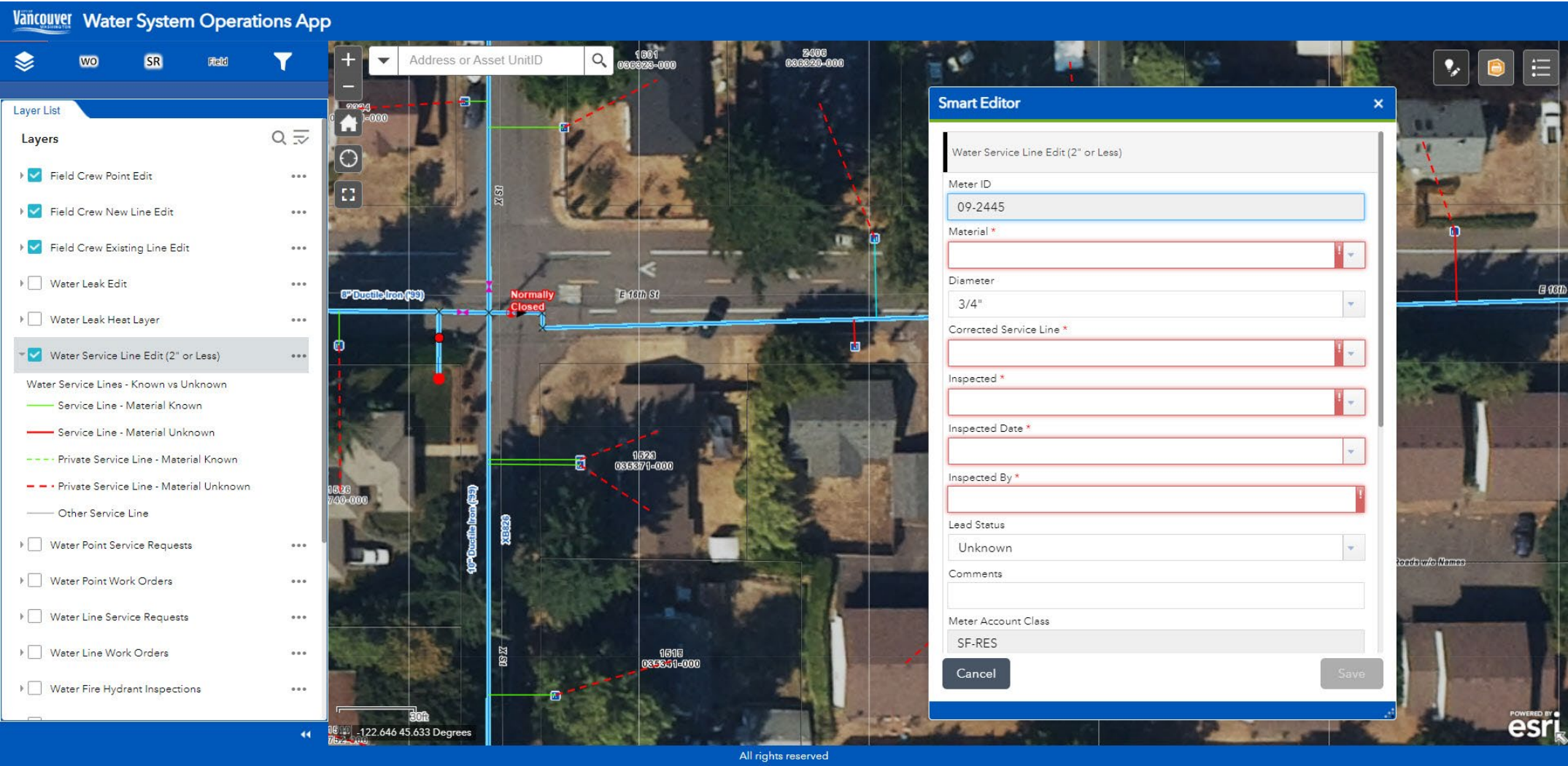
We have made **6 fields Required (*)**. These fields need to be filled out before they can submit their updates/changes.

Required Fields: Material, Diameter, Inspected (Yes or No), Inspection Date, Inspected By & Corrected Service Line (Yes or No). We added the Corrected Service Line (Yes or No) to track if our inventory & office work is correct and consistent.

A screenshot of a mobile application interface for editing a water service line. The form is titled "Water Service Line Edit (2" or L..." and shows a length of 22.8 ft. The form includes several required fields: "Material *" (No Value), "Diameter *" (3/4"), "Inspected *" (No Value), "Inspected Date *" (No Value), "Inspected By *" (empty), and "Corrected Service Line *" (No Value). There is also a "Comments" field at the bottom. The interface has a dark theme and includes navigation buttons like "Cancel", "Collect", and "Submit" at the top.

OPS Field Crew collecting Data

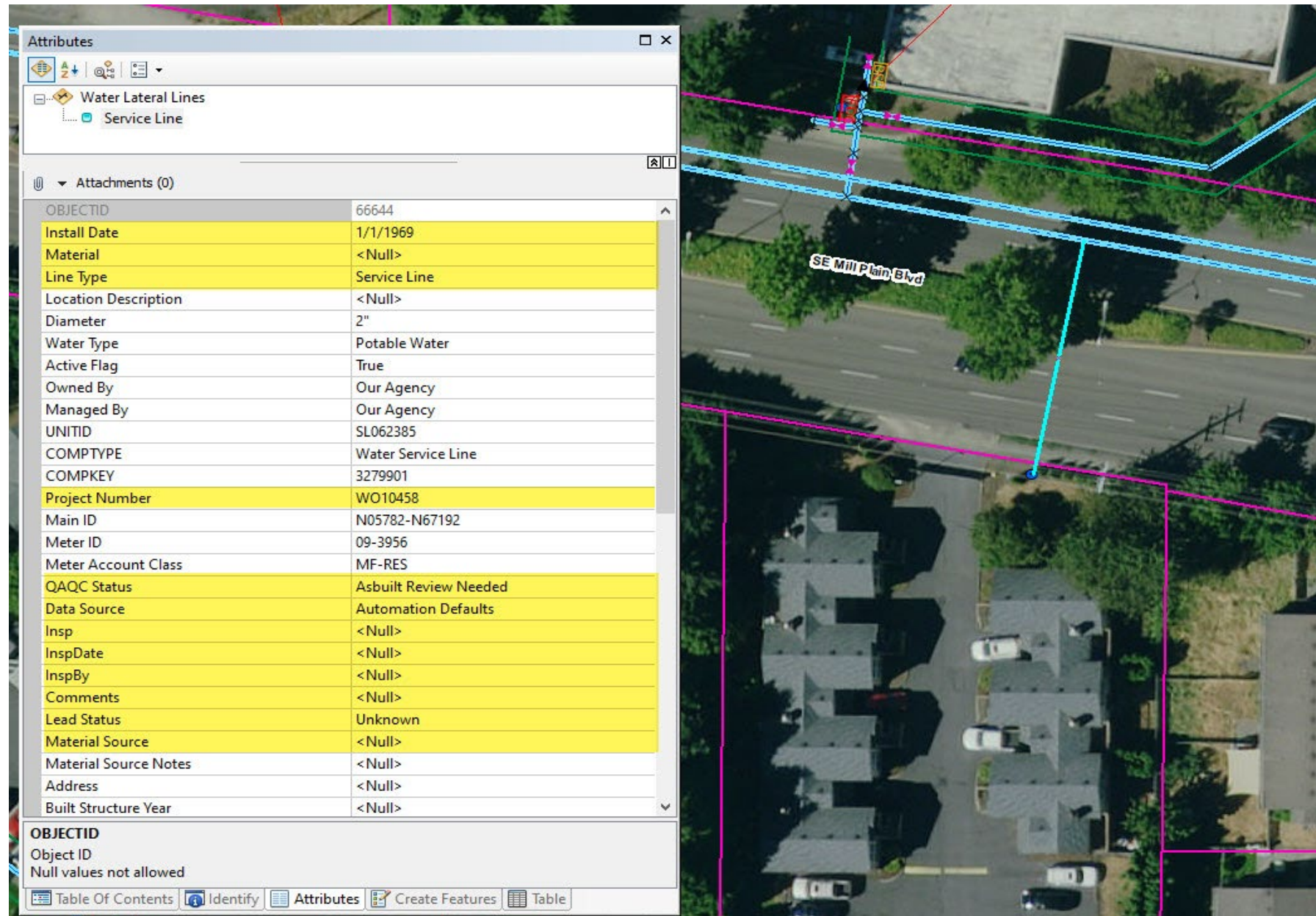
OPS Field Crews collect Data in the field and the Manager inputs the Data into our Water System App back in the office. This is done because not all of our Field Crews have handheld devices out in the field.



The screenshot displays the Vancouver Water System Operations App interface. On the left, a 'Layer List' sidebar shows various data layers, with 'Water Service Line Edit (2" or Less)' selected. The main area is a map showing water service lines overlaid on an aerial view of a residential street. A red dashed line indicates a 'Normally Closed' valve. A 'Smart Editor' window is open on the right, allowing for data entry for a specific service line edit. The form includes fields for Meter ID (09-2445), Material, Diameter (3/4"), Corrected Service Line, Inspected, Inspected Date, Inspected By, Lead Status (Unknown), Comments, and Meter Account Class (SF-RES). 'Cancel' and 'Save' buttons are at the bottom of the form. The bottom of the app shows a scale bar (30ft) and coordinates (122.646 45.633 Degrees).

GIS Tech Steps

- Service Lines added by Automation (FME) or manually by GIS Tech
- Service Lines are created by Automation (FME) after new Water Meter has been GPS and within 50' of Water Main
- Service Lines created manually by GIS Tech if Water Meters are further than 50' from Water Main
- QAQC is needed to add missing Service Lines and to update the Attributes (Materials, Non-Lead Status & etc.)



The screenshot displays a GIS application interface. On the left, an 'Attributes' window is open, showing a table of data for a selected object. The table has two columns: 'OBJECTID' and various attribute names. The 'OBJECTID' is 66644. The 'Line Type' is 'Service Line'. The 'QAQC Status' is 'Asbuilt Review Needed'. The 'Material Source' is '<Null>'. The 'Address' is '<Null>'. The 'Built Structure Year' is '<Null>'. The 'Data Source' is 'Automation Defaults'. The 'Material' is '<Null>'. The 'Line Type' is 'Service Line'. The 'Diameter' is '2\".

OBJECTID	66644
Install Date	1/1/1969
Material	<Null>
Line Type	Service Line
Location Description	<Null>
Diameter	2"
Water Type	Potable Water
Active Flag	True
Owned By	Our Agency
Managed By	Our Agency
UNITID	SL062385
COMPTYPE	Water Service Line
COMPKEY	3279901
Project Number	WO10458
Main ID	N05782-N67192
Meter ID	09-3956
Meter Account Class	MF-RES
QAQC Status	Asbuilt Review Needed
Data Source	Automation Defaults
Insp	<Null>
InspDate	<Null>
InspBy	<Null>
Comments	<Null>
Lead Status	Unknown
Material Source	<Null>
Material Source Notes	<Null>
Address	<Null>
Built Structure Year	<Null>

OBJECTID
Object ID
Null values not allowed

Table Of Contents Identify Attributes Create Features Table

QAQC Tools

As-Builts are used for New and Existing Service Lines to Identify Material, Date, Diameter

From 1988 – 1994 Operation Crews replaced all polybutylene service and some galvanized services with copper

CONSTRUCTION NOTES

- ① INSTALL 4" SEWER LATERAL TO THE BACK OF THE 6" UTILITY TRENCH. SEE DETAIL S-1.4
- ② INSTALL 4" SEWER LATERAL AT 2% SLOPE TO LENGTH SHOWN ON THE SEWER LATERAL TABLE. SEE DETAIL S-1.4
- ③ STA 0+00.00 WATERLINE=STA 5+11.06 8.0' LT CUT IN AND INSTALL 12"x8" MJ TEE WITH TB. INSTALL (1) 8" MJ GATE VALVES AND (1) 12" MJ BUTTERFLY VALVE. INSTALL 34.3 LF OF 8" CL 52 DUCTILE IRON PIPE. PIPE BEDDING AND BACKFILL PER DETAIL W-5.
- ④ STA 0+34.35 WATERLINE=STA 5+45.41 8.0' LT INSTALL 8" MJ X 6" FLG TEE WITH TB. INSTALL 6" FLG X MJ VALVE. INSTALL 10.7 LF OF 6" CL 52 DUCTILE IRON PIPE. INSTALL 8"x4" MJ REDUCER. INSTALL STANDARD FIRE HYDRANT ASSEMBLY WITH 'STORZ' ADAPTER AS PER DETAIL W-10. MECHANICALLY RESTRAIN ALL JOINTS. CONSTRUCT 4'X4' CONC. PAD.
- ⑤ INSTALL 368.8 LF OF 4" CLASS 52 DUCTILE IRON PIPE. PIPE BEDDING AND BACKFILL PER DETAIL W-5.
- ⑥ STA 2+76.12 WATERLINE=STA 7+87.18 6.82' LT INSTALL 4" MJ 22 1/2' ELBOW WITH TB. DEFLECT JOINT 4 1/2 DEGREES.
- ⑦ STA 4+03.10 WATERLINE=STA 9+16.57 8.0' LT INSTALL 4" MJ PLUG WITH TB. INSTALL 2" STANDARD BLOWOFF ASSEMBLY. SEE DETAIL W-8.
- ⑧ INSTALL 1" SEAMLESS TYPE K COPPER WATER SERVICE. CITY TO PROVIDE METER. INSTALL VALVE BOX AND COVER PER DETAIL W-12.
- ⑨ NOTE NOT USED
- ⑩ MANHOLE SEALING REQUIRED

The screenshot shows a GIS 'Identify' window with the following metadata:

Field	Value
OBJECTID	75785
Install Date	1/1/1990
Material	Copper
Line Type	Service Line
Location Description	PolyBandGalv lines replaced with Copper 1988_1994
Diameter	3/4
Water Type	Potable Water
Active Flag	True
Owned By	Our Agency
Managed By	Our Agency
UNITID	SL071315
COMPTYPE	Water Service Line
COMPKEY	2924401
Project Number	WB445
Main ID	V00193-N00194
Meter ID	03-0619
Meter Account Class	SF-RES
QAQC Status	Asbuilt Review Needed
Data Source	Automation Defaults
Insp	<null>
InspDate	<null>
InspBy	<null>
Comments	<null>
Lead Status	Non-Lead
Material Source	<null>
Material Source Notes	<null>

QAQC Tools

OPS Crews surveyed from 2009 – 2014 (about 17,000 services), in which case the material will show based on their survey

	A	B	C	D	E	J	K	L
1	UnitID	Address	Diameter	Length	Material	Insp	InspDate	yes
1567	98-5698	2511 E 18TH ST	0.75	L	COPPER	Y	Apr 22, 2013	petersda
1578	67621	2808 E 29TH ST	0.75	S	COPPER	Y	May 01, 2011	petersda
1579	03-1110	3007 FAIRMOUNT AV	1	L	COPPER	Y	May 02, 2011	petersda
1580	05-3946	707 GILLIS ST	0.75	S	COPPER	Y	Oct 18, 2010	petersda
1581	53122	3601 E 11TH ST	1	L	COPPER	Y	Jun 25, 2011	petersda
1582	97-0556	2611 NEALS LN	0.75	L	COPPER	Y	Aug 16, 2011	petersda
1583	99-5559	701 E 29TH ST	1	L	COPPER	Y	Mar 28, 2013	petersda
1584	54809	900 E 29TH ST	0.75	S	COPPER	Y	May 25, 2011	petersda
1585	10-0960	2609 E 5TH ST	0.75	L	COPPER	Y	Dec 03, 2010	petersda
1592	01-2081	2402 BROADWAY ST	1	L	COPPER	Y	Dec 04, 2014	petersda
1593	07-2250	2704 E MCLOUGHLIN BL	1	L	COPPER	Y	Feb 27, 2013	petersda
1594	08-2749	8618 SE EVERGREEN HY	1	S	COPPER	Y	Jul 28, 2011	petersda

Sample Spot Checks for Neighbors (OPS) – If enough Service Lines are a certain material then that material will be applied to the rest of the Neighborhood on the Public Side. (The Private Side is another story because the Material can be all of the place.)

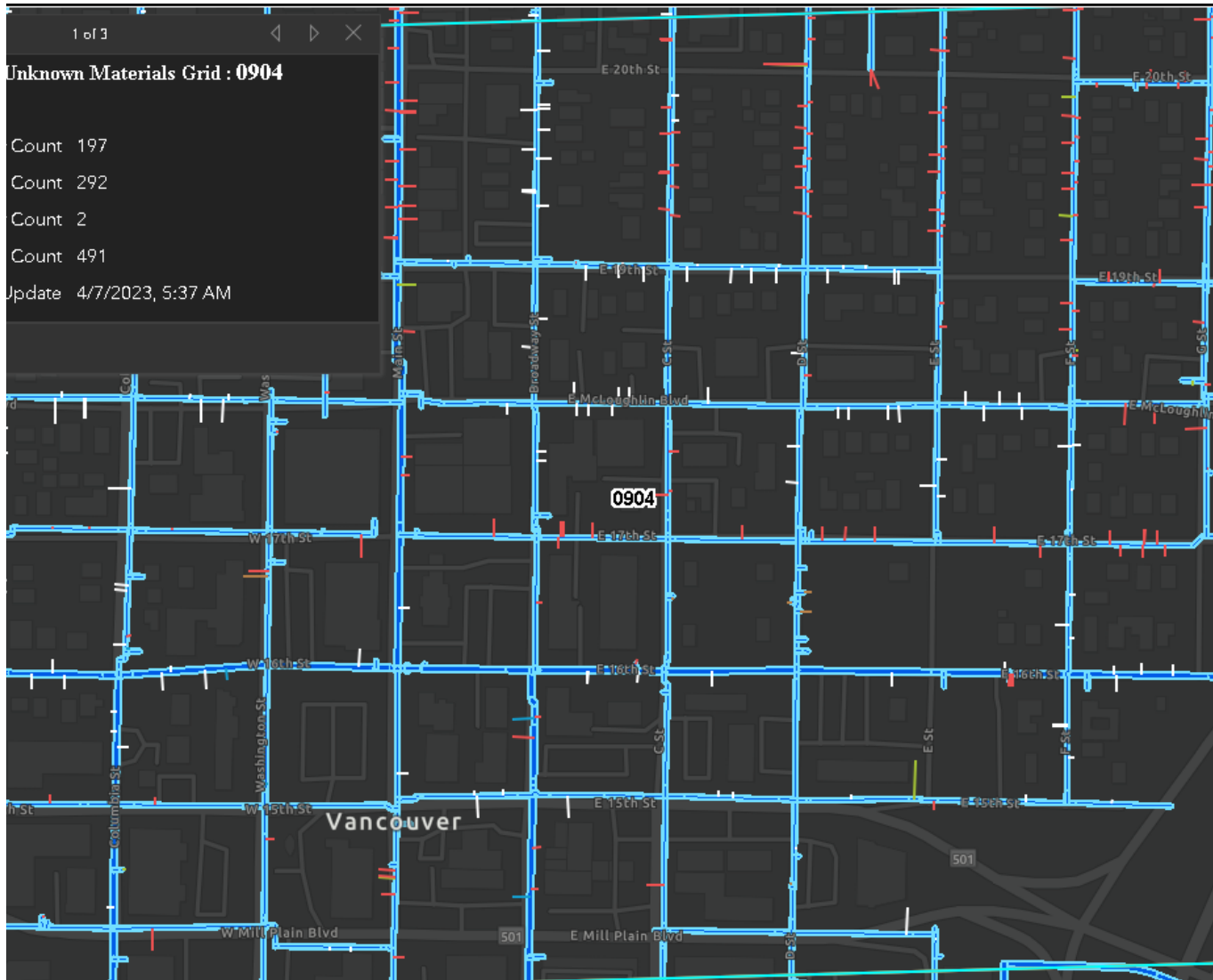
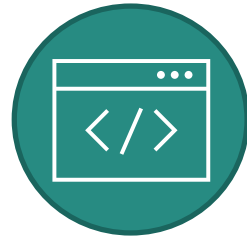
	WTR MTR #	ADDRESS	DATE ID'd	TEAM	METHOD	SYSTEM	CUSTOMER	SUBDIVISION
GRANADA 1	99-1358	11717 NE 79th St.	2016	Mike Rosdahl	PRJ083418 picture	1" Copper ✓	PVC 3/4"	GRANADA 1
	08-3821	11721 NE 79th St.	2016	Mike Rosdahl	PRJ083418 picture	1" Copper ✓	NA Pex 3/4"	
GRANADA 2	98-5792	12110 NE 78th St.		Ops	Vector at Mtr Box	1" Copper ✓	Copper 3/4"	GRANADA 2
	99-4039	12100 NE 77th St.		Ops	Vector at Mtr Box	1" Copper ✓	galv 3/4"	
GRANADA 3	21-2777	8103 NE 122nd Ave.		Ops	Vector at Mtr Box	1" Copper ✓	Copper 3/4"	GRANADA 3
	13-1478	7713 NE 123rd Ave.		Ops	Vector at Mtr Box	1" Copper ✓	PVC 3/4"	
GRANADA 4	96-2368	8104 NE 124th Ave.		Ops	Vector at Mtr Box	1" Copper ✓	Copper 3/4"	GRANADA 4
	61576	7711 NE 124th Ave.		Ops	Vector at Mtr Box	1" Copper ✓	Pex 3/4"	
	17-2725	7805 NE 125th Ave.				1" Copper ✓	Pex 3/4"	
	05-1307	7719 NE 125th Ave.		Ops	Vector at Mtr Box	1" Copper ✓	Copper 3/4"	
HAPPY HOLLOW	70635	7914 NE 126th Ave.		Ops	Vector at Mtr Box	1" Copper ✓	Copper 3/4"	HAPPY HOLLOW
	99-1055	8011 NE 127th Ave.		Ops	Vector at Mtr Box	1" Copper ✓	galv 3/4"	
	14-8125	7704 NE 127th Ave.		Ops	Vector at Mtr Box	1" Copper ✓	Pex 3/4"	
	08-3232	7616 NE 128th Ave.		Ops	Vector at Mtr Box	1" Copper ✓	galv 3/4"	
NE 130th Ave.	98-3351	7820 NE 130th Ave.		Ops	Vector at Mtr Box	1" Copper ✓	Poly 3/4"	NE 130th Ave.
	06-1962	8012 NE 130th Ave.		Ops	Vector at Mtr Box	1" Copper ✓	Poly 1"	
	12-0498	8010 NE 130th Ave.		Ops	Vector at Mtr Box	1" Copper ✓	Copper 1"	
NE 130th St. served from NE 79th St.	06-1261	7902 NE 130th Ave.		Ops	Vector at Mtr Box	3/4" Copper ✓	PVC 3/4"	NE 130th St. served from NE 79th St.
	06-1261	7902 NE 130th Ave.		Ops	Vector at Mtr Box	3/4" Copper ✓	PVC 3/4"	
	99-4752	7904 NE 130th Ave.		Ops	Vector at Mtr Box	3/4" Copper ✓	PVC 3/4"	
	99-1053	7904 NE 130th Ave.		Ops	Vector at Mtr Box	3/4" Copper ✓	PVC 3/4"	

Improvement Steps

- City Inspectors collect WSL information when they are on a Project Site Visit
- GIS Data Reviewer Tool to check for any issues or Attributes that don't line up
- Hire an Intern to help review the more than 150,000 Service Lines (Public & Private) in our Water Boundary
- OPS Water Meter Crew reviews Service Line Material & Size when changing out old Water Meters



Grid-by-Grid



SL043839 - Service Line

Material	Copper
Diameter	3/4"
Inspected	Yes
Inspected Date	4/7/2023
Inspected By	Jonas v
Install Date	12/31/1962

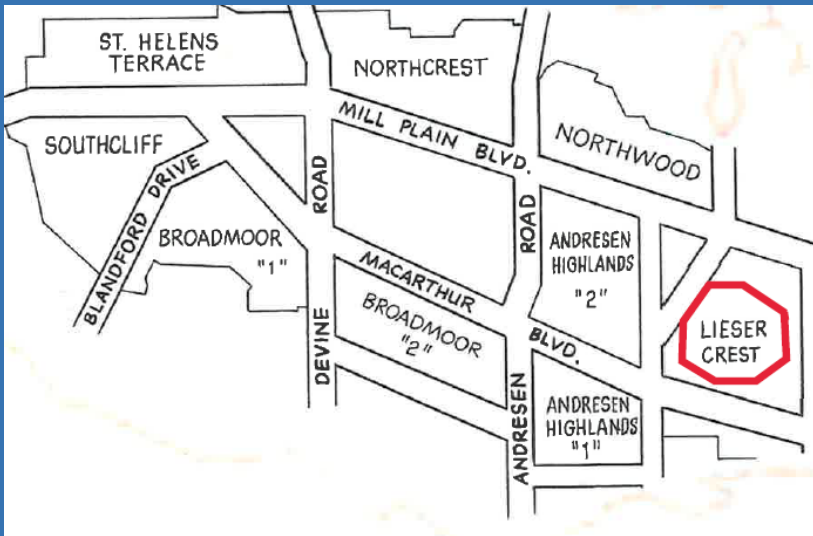
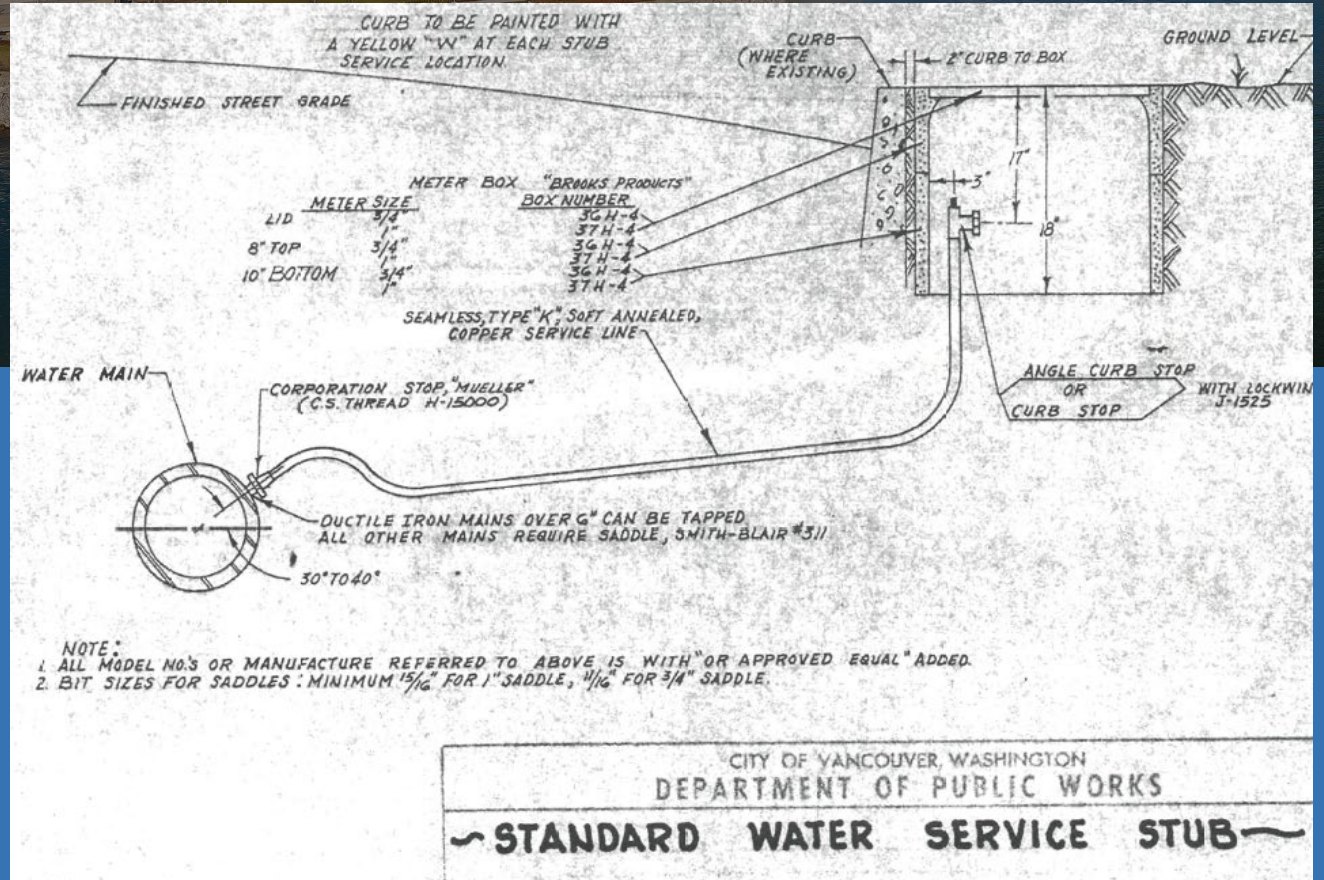
- Serviceline attributes added in field with tablet.
- Picture taken as well.

Historical Records

Pre-1986 records are not really accessible.

Difficult to convince others of importance.

Services not documented.

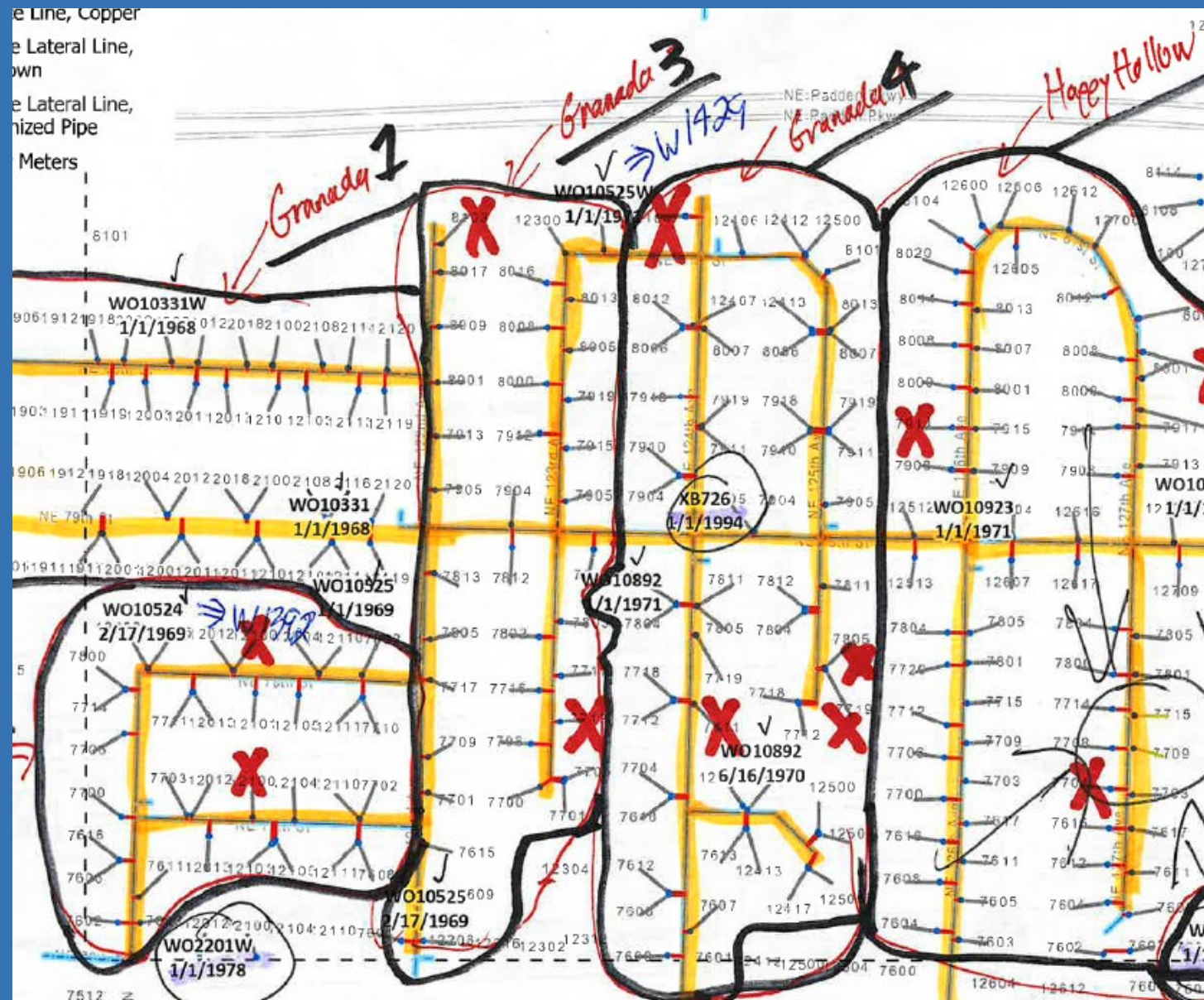


Subdivision – Interpolation

System built subdivision by sub incrementally with same material.

Identify a portion of each segment and apply to all units.

Only appropriate for public side.



Thank You

To learn more, visit

[Drinking Water | City of Vancouver, Washington, USA](#)

