Esri Utility Network Deployment for a Municipal Utility

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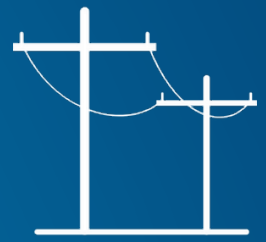
KAUKAUNA UTILITIES

By the numbers

Founded in
1912

Over 15,000
Customers



485 Miles of
Primary Distribution Lines

Residential:
13,853

Commercial:
1,838

Industrial:
58

KAUKAUNA UTILITIES

Services

Water

Five groundwater wells throughout the city

438 million gallons of treated water a year

100 miles of water main

Generation

Owns & operates seven hydro-electric plants

Combustion turbine plant

Member of WPPI Energy

34.5 kV Subtransmission

3 substations; 10 circuits

~15 miles of overhead line

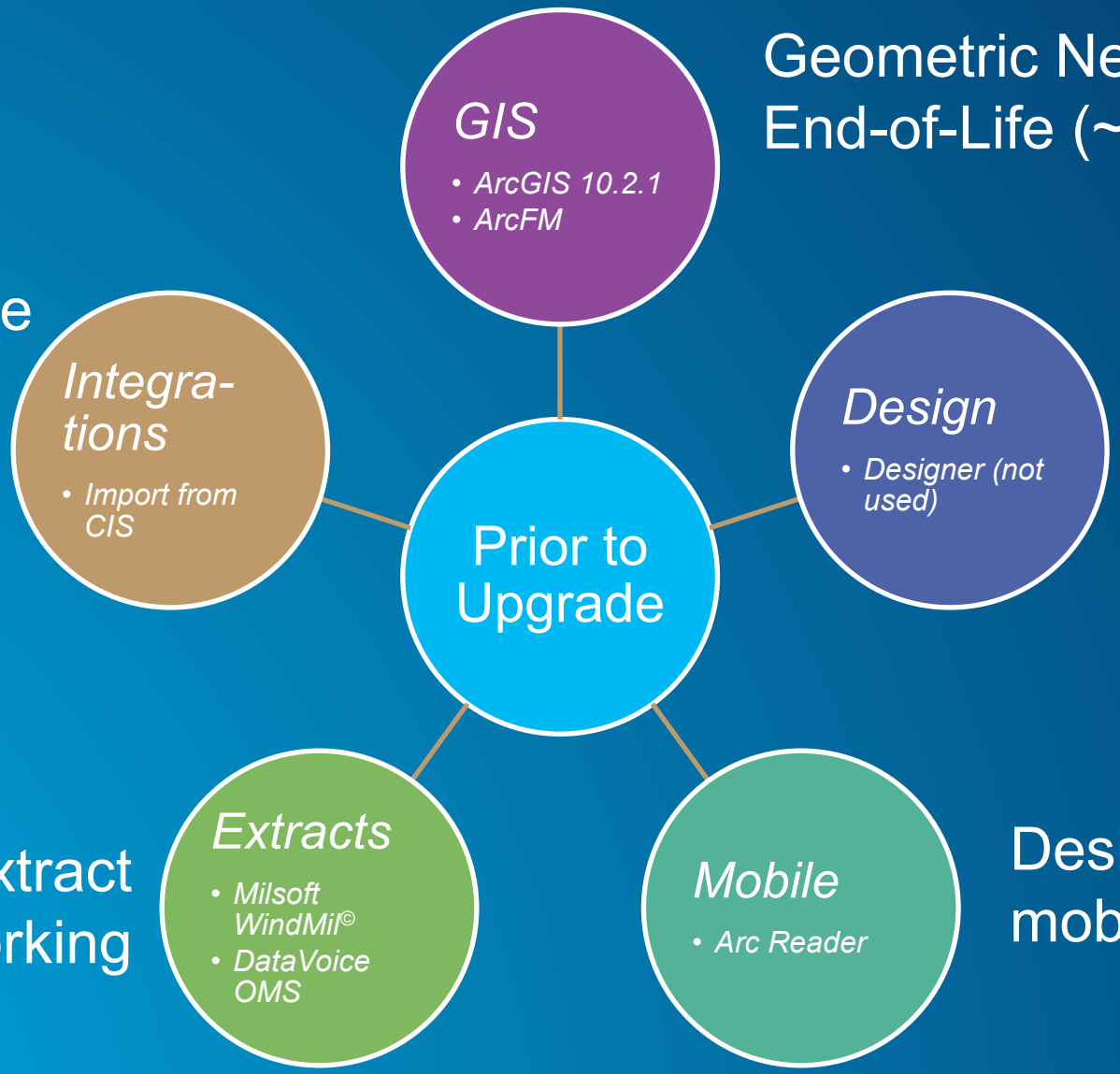
12.47 kV Distribution

7 substations; 36 radial circuits

~174 miles of overhead line

~158 miles of underground line

Motivation



Geometric Network End-of-Life (~2024)

Desire to integrate GIS with other systems like SCADA

Staff turnover

WindMil extract stopped working

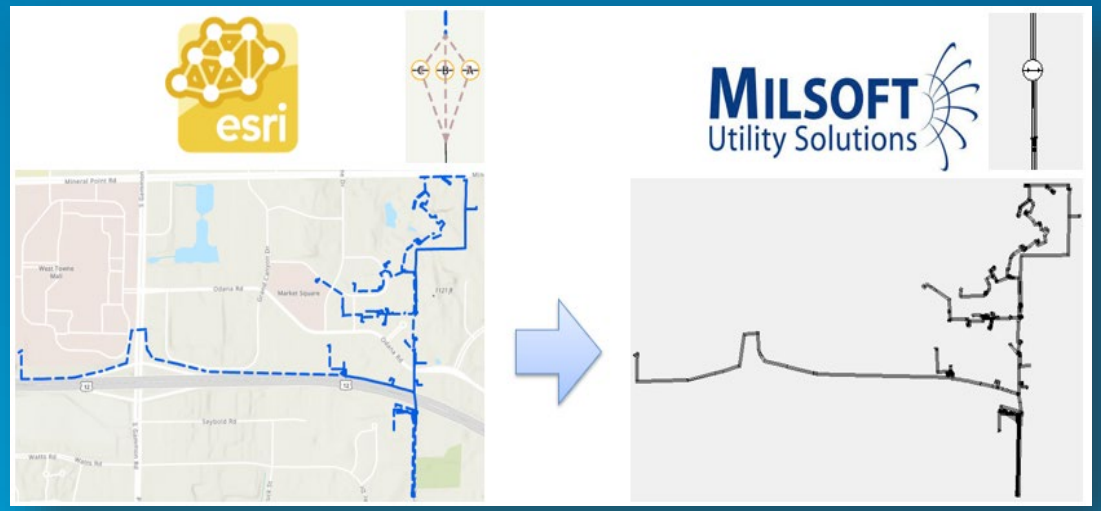
Desire for more mobile functionality

Fix or Replace?

Questions & Concerns

- How long will it take and what does it cost to convert to the UN?
- How much effort will be required from KU staff?
- Not a lot of UN systems in production – how risky is it?
- Are there tools available to extract the UN to Milsoft?
- Will ArcFM still be required?
- Will OMS work with the UN?
- Can this be done 100% remotely?

First Steps – Selecting a Partner



Needed a partner with electric Utility Network and Milsoft WindMil experience

Utility Network Specialty
Electric Utilities Solutions

Utility Network Specialty
Water Utilities Services

Utility Network Specialty
Gas Utilities Solutions

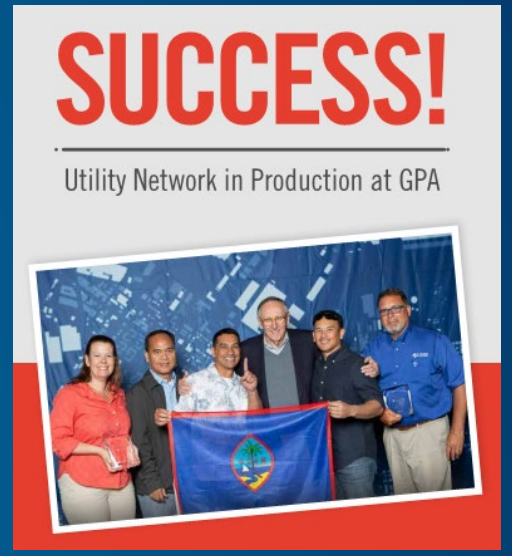
Utility Network Specialty badges for Electric, Water & Gas plus over a dozen similar Utility Network implementations

POWER ENGINEERS

esri™ Partner since 1989 (GOLD Level Partner)

ArcGIS Enterprise Experts

Esri SAG Award in 2019 for successfully converting first electric UN implementation



First Steps – Readiness Assessment

POWER's Utility Network Readiness Assessment (UNRA) has two parts:

Data Assessment

Go Forward Plan

SEMCO ENERGY GAS COMPANY

OUC The Reliable One

ENSTAR Natural Gas Company

P.U.D. CHELAN COUNTY

MGE your community energy company

AEL&P since 1893 ALASKA ELECTRIC LIGHT & POWER CO.

provo WELCOME HOME

NAVFAC Naval Facilities Engineering Command NAVFAC HAWAII

TID WATER & POWER

EPUD EMERALD PEOPLE'S UTILITY DISTRICT

PNM Resources

First Steps – Readiness Assessment

- **Data Assessment is designed to answer two simple questions:**

#1 - What current GIS data doesn't fit in the standard UN data model?

#2 - How much effort will it take to get the circuits all connected with the UN connectivity rules?

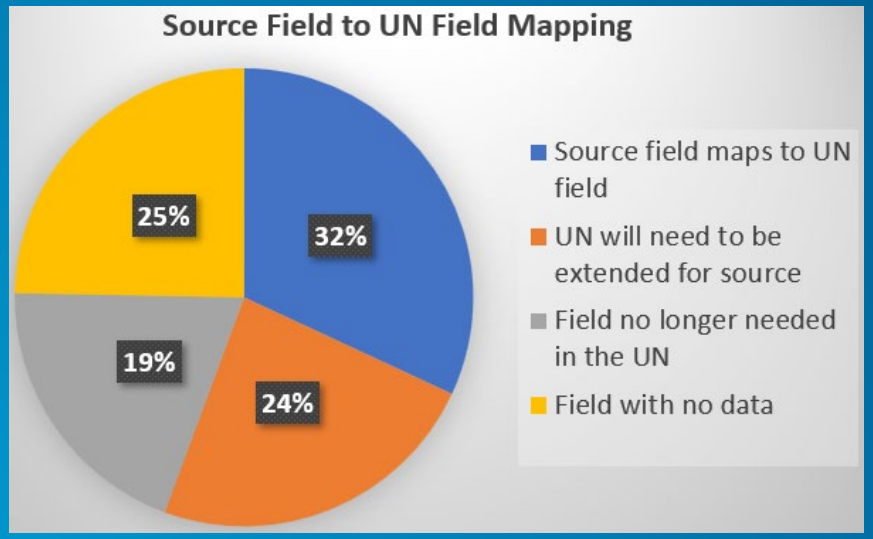
First Steps – Source Data Quality

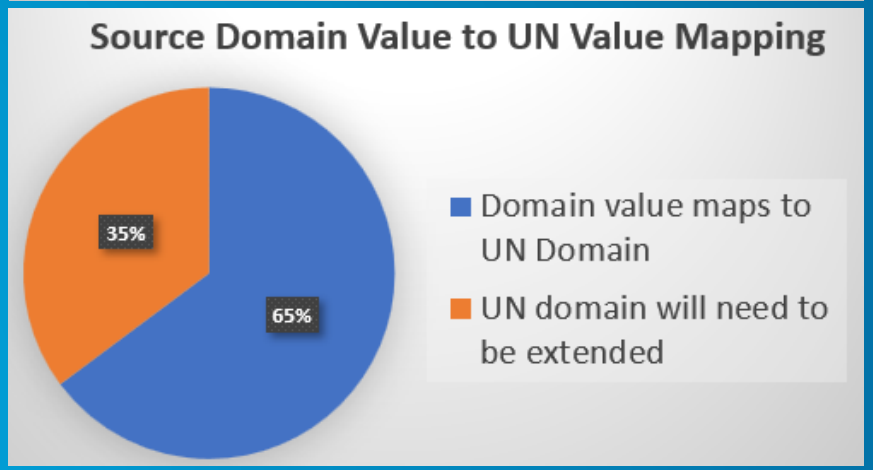
Source Summary

Source Data	Count
Feature Classes	25
Subtypes	69
Features	81,717
Attributes	3,381,749

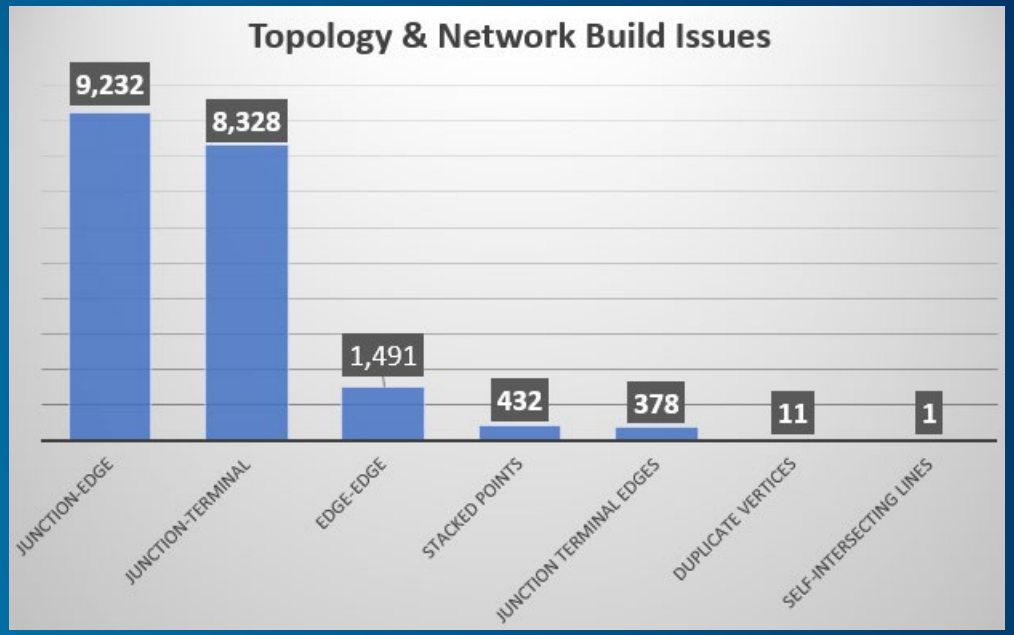
Note: Schema was close to standard ArcFM and included secondaries and meters

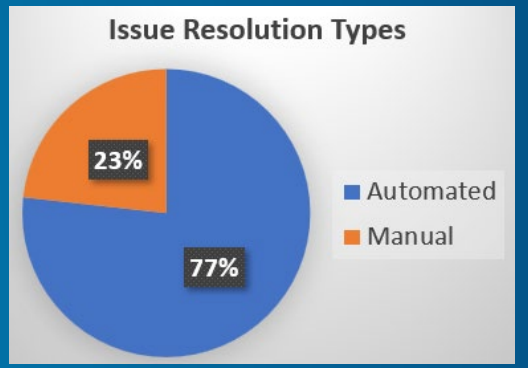
Fit Analysis





Connectivity Analysis

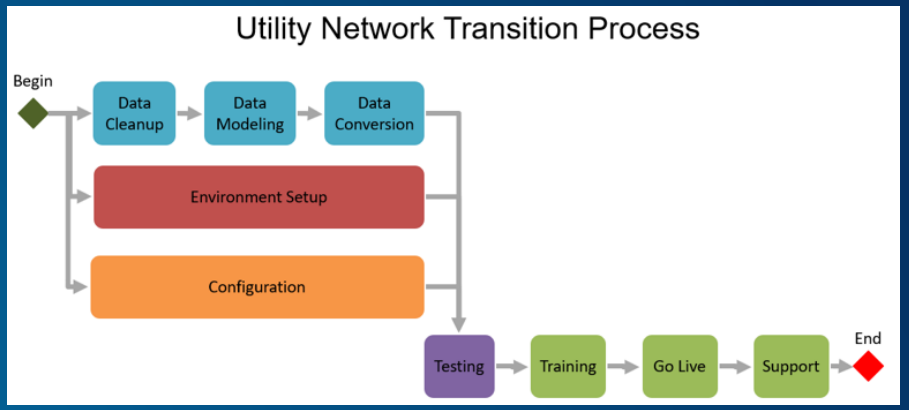




Issues per Meter = 1.3

Typical Range:
0.5 (no secondaries)
2 (with secondaries)

First Steps – Go Forward Plan



Only one environment – Production (no Development or Test)

OMS could utilize Milsoft extract (std format)

ArcFM XI was not required

Mobile needs would be met by ArcGIS Explorer on existing Windows Surface Tablets

KU could go without GIS updates for up to 4 weeks during a transition

Factors dictating the type of transition process

UN compatible design software to be implemented after UN conversion

Moving Forward – Data

Started with education on UN schema and functionality

Considerable effort went into data modeling and data mapping – more than expected

Data Conversion Statistics

Source

Item	*Count*
Mapped	34
Not Migrated	23
No Data	20
Just Copy	30
Total Feature Classes & Tables	**107**

Target

Item	*Count*
ElectricDevice	17
ElectricJunction	6
ElectricLine	10
StructureJunction	9
StructureLine	10
Assembly	17
ElectricDeviceUnit	10
ElectricWireData	1
JointUse	2
Service	32
Total Extended Fields	**114**

Domains Created	60
Domains Values Created	799

Conversions

Item	*Count*
Conversion Definitions	87
Source Fields Finalized	3,213
Target Sources Defined	2,329
Lookups Created	67

Conversion Fields

Item	*Count*
Mapped (confirmed)	1,901
Extend (confirmed)	724
Total	**2,625**

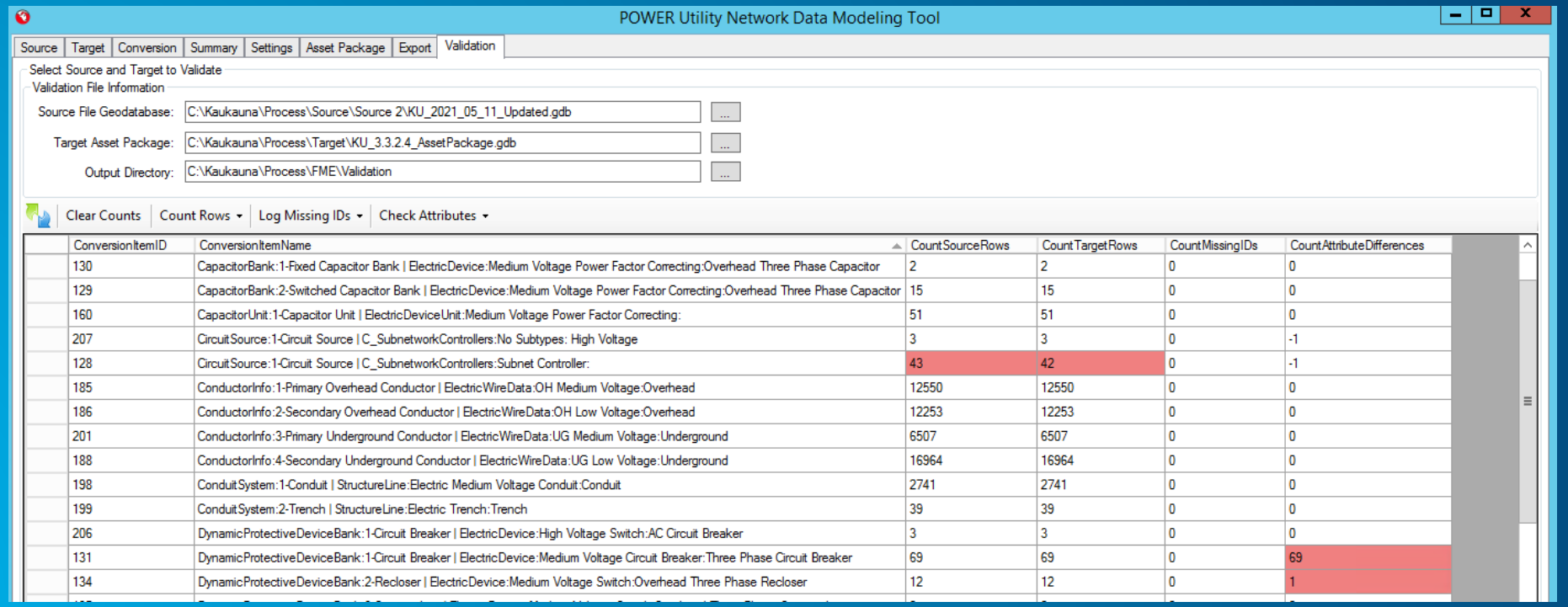
No Source (confirmed)	2,957

Moving Forward – Data

Used a low fidelity UN data model. Needed to move and automatically connect transformers to accommodate UN Phase Propagation

Performed 3 full conversions with QA between each cycle

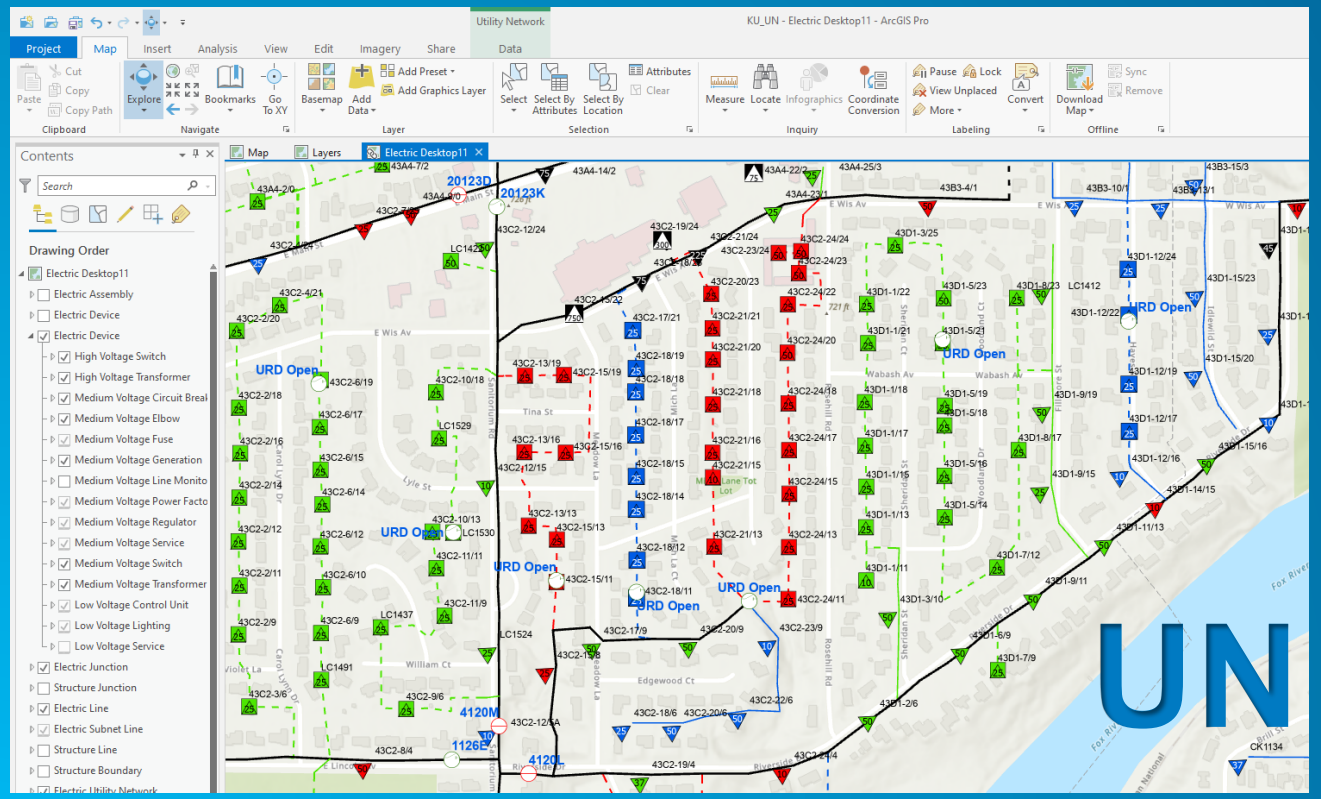
Used automated verification to ensure that each attribute for each object was converted as designed

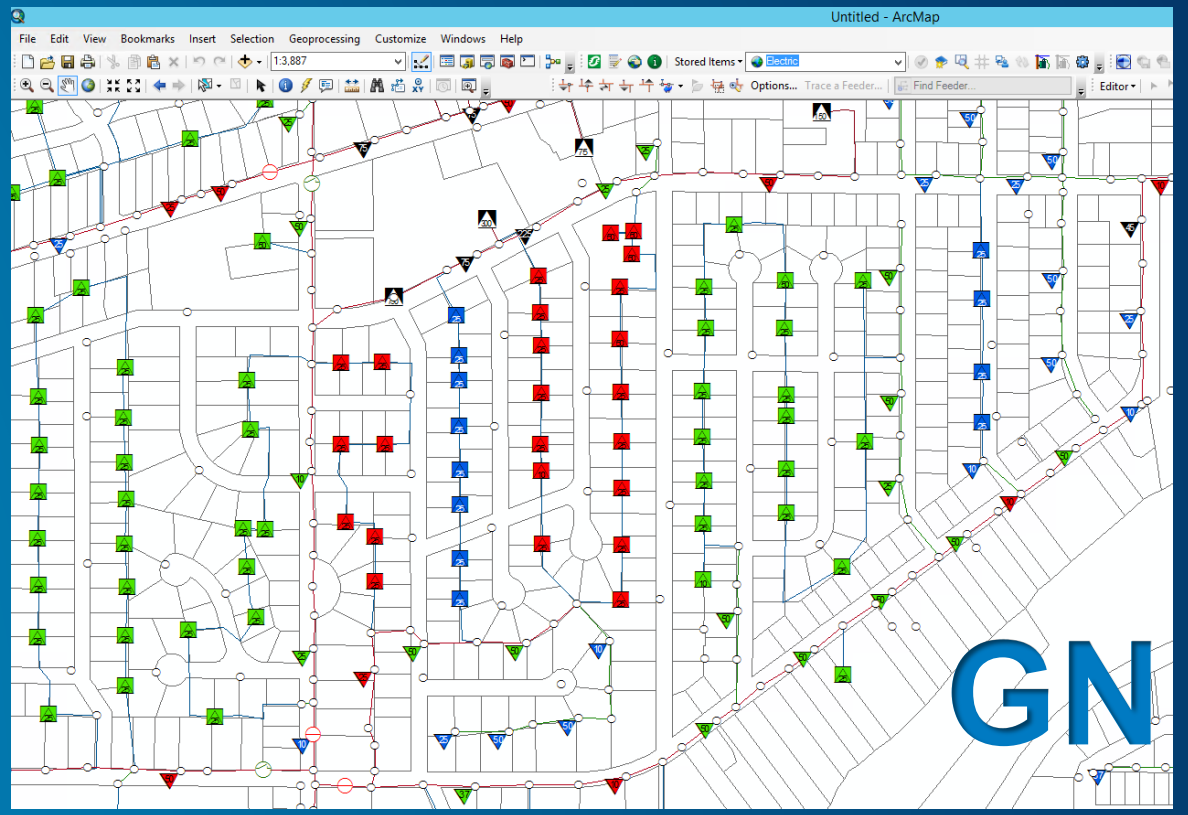


ConversionItemID	ConversionItemName	CountSourceRows	CountTargetRows	CountMissingIDs	CountAttributeDifferences
130	CapacitorBank:1-Fixed Capacitor Bank | ElectricDevice:Medium Voltage Power Factor Correcting:Overhead Three Phase Capacitor	2	2	0	0
129	CapacitorBank:2-Switched Capacitor Bank | ElectricDevice:Medium Voltage Power Factor Correcting:Overhead Three Phase Capacitor	15	15	0	0
160	CapacitorUnit:1-Capacitor Unit | ElectricDeviceUnit:Medium Voltage Power Factor Correcting:	51	51	0	0
207	CircuitSource:1-Circuit Source | C_SubnetworkControllers:No Subtypes: High Voltage	3	3	0	-1
128	CircuitSource:1-Circuit Source | C_SubnetworkControllers:Subnet Controller:	43	42	0	-1
185	ConductorInfo:1-Primary Overhead Conductor | ElectricWireData:OH Medium Voltage:Overhead	12550	12550	0	0
186	ConductorInfo:2-Secondary Overhead Conductor | ElectricWireData:OH Low Voltage:Overhead	12253	12253	0	0
201	ConductorInfo:3-Primary Underground Conductor | ElectricWireData:UG Medium Voltage:Underground	6507	6507	0	0
188	ConductorInfo:4-Secondary Underground Conductor | ElectricWireData:UG Low Voltage:Underground	16964	16964	0	0
198	ConduitSystem:1-Conduit | StructureLine:Electric Medium Voltage Conduit:Conduit	2741	2741	0	0
199	ConduitSystem:2-Trench | StructureLine:Electric Trench:Trench	39	39	0	0
206	DynamicProtectiveDeviceBank:1-Circuit Breaker | ElectricDevice:High Voltage Switch:AC Circuit Breaker	3	3	0	0
131	DynamicProtectiveDeviceBank:1-Circuit Breaker | ElectricDevice:Medium Voltage Circuit Breaker:Three Phase Circuit Breaker	69	69	0	69
134	DynamicProtectiveDeviceBank:2-Recloser | ElectricDevice:Medium Voltage Switch:Overhead Three Phase Recloser	12	12	0	1

Moving Forward – Configuration & Integration

Maps - Kept same symbology in order to ease the transition on the users





Moving Forward – Configuration & Integration

CIS Integration

- POWER developed script to import information from CIS on a nightly basis

Mobile

- Used ArcGIS Explorer because KU standard for mobile devices are Windows Surface Tablets
  - Configured to support disconnected map viewing
  - Configured Markup capability
  - Needed some slight adjustments to symbology
  - Can view related records – just can't search them
  - Feature search not as good as Arc Reader

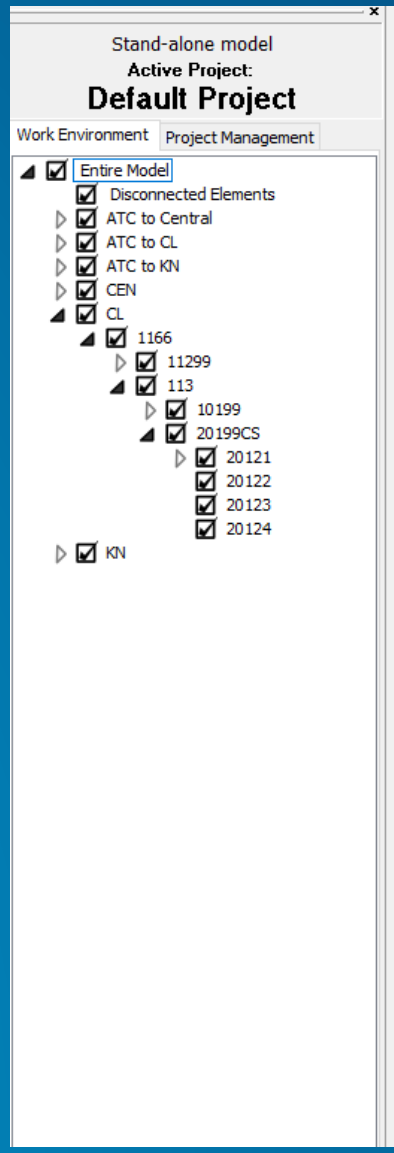
Moving Forward – Milsoft

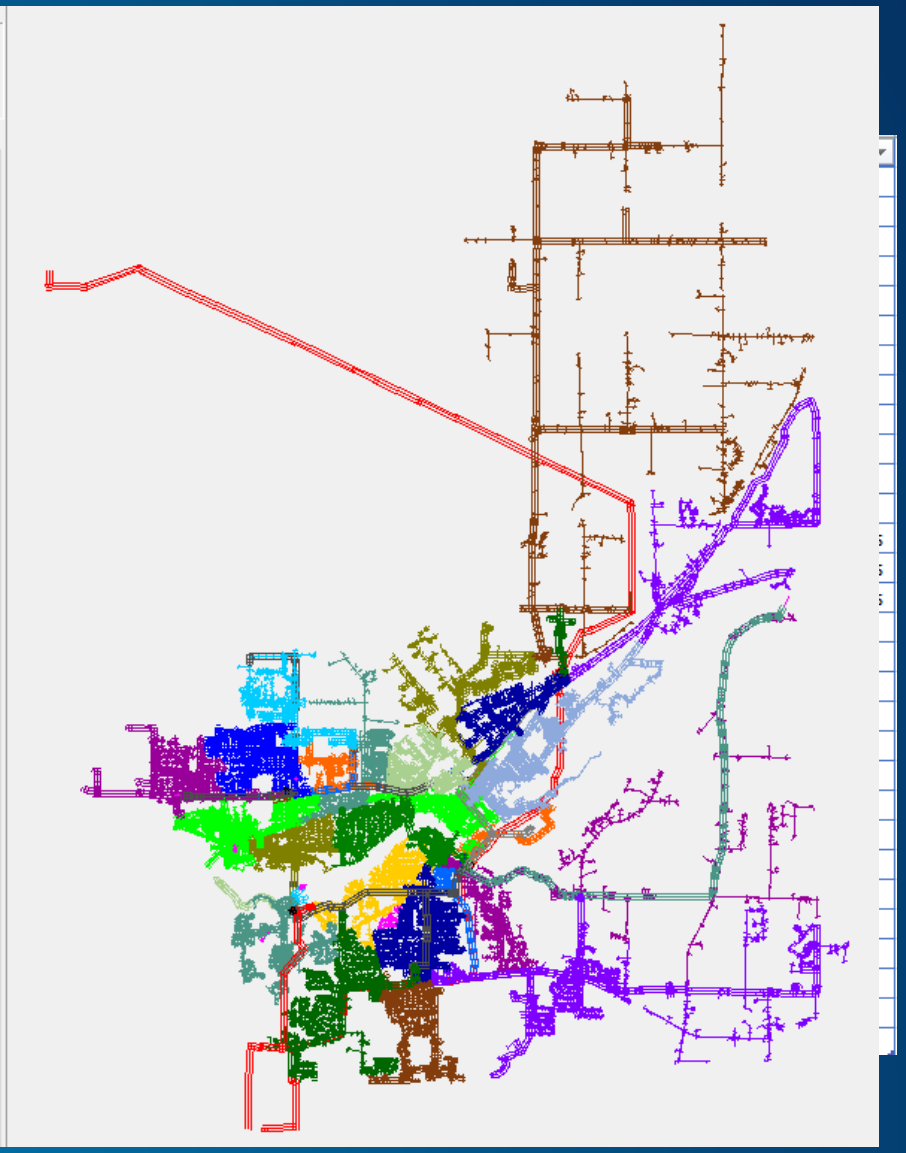
Standardized the WindMil Equipment Library → Created Milsoft Equipment Domains in UN and populated them

Digitized substation internals → KU sources are defined at the subtransmission level so model needed to be able to trace from transmission all the way to the meter

Populated Milsoft extractor spreadsheet → Configured extraction script

- Many Options – KU chose to export entire system every night into a single model
- Takes less than 15 minutes





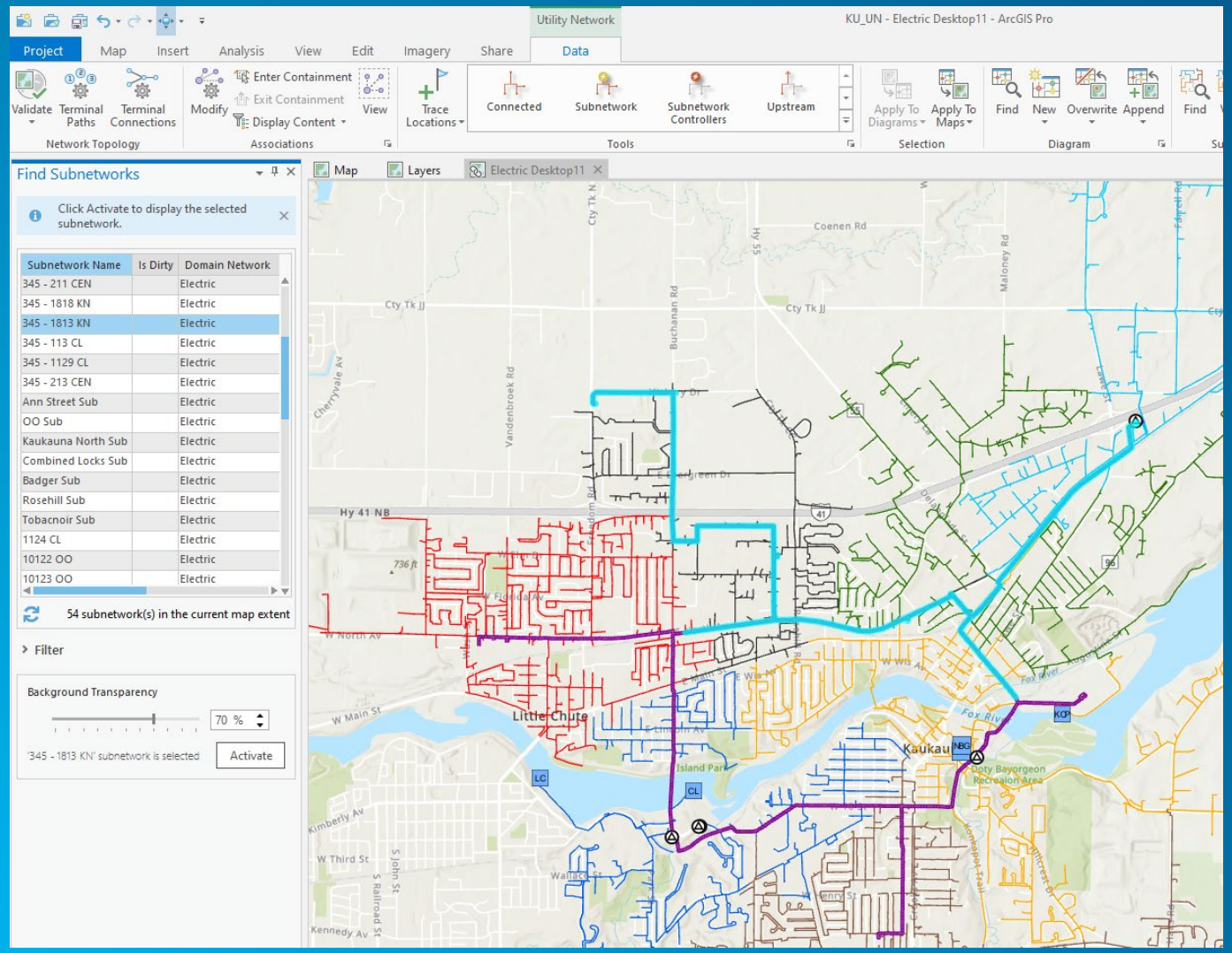
Training

Completed various on-line courses from Esri

POWER provided 40 hours of remote Quick Start training including the following

- Basic Utility Network Understanding
- Editing Basics in the Utility Network
- Performing QA/QC in the Utility Network
- Utility Network Map Display Creation
- Group Template Creation in Utility Network
- ArcGIS Enterprise and Utility Network Administration

Go Live



Took final cut of data → Performed migration

↓

Installed new data → Tested system

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Went into production → Ran into a Esri bug that prohibited validation of dirty areas

↓

Upgraded software → Installed data again

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Tested system → Went into (and stayed) in production

Lessons Learned & Recommendations

- Transition to the UN can be done!
- Find a good consultant to partner with – it will be a journey
- Start working with IT early to get the hardware required
- Start working with Esri early to get the proper licensing
- Allocate plenty of time for the following – it takes more effort than you think
  - Data cleanup
  - Substation digitization
  - Data mapping
  - Data conversion review (do at least 3 conversion cycles)
  - Testing
  - Training
- Be open to the UN changes – don't try and build a new old GIS
- Focus on getting it to work, then add improvements

Next Steps

Working with POWER and Spatial Business Systems to implement AUD – an AutoCAD© based UN compatible graphical design tool

Extending ArcGIS Explorer to provide mobile water maps

KAUKAUNA UTILITIES

POWER ENGINEERS

sbs

AUTOMATED UTILITY DESIGN

UTILITY DATAHUB

Questions

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