This presentation premiered at WaterSmart Innovations

watersmartinnovations.com

Consumption Profile Study
AMI Interval Data Research and Applications

Canyon Jorgensen
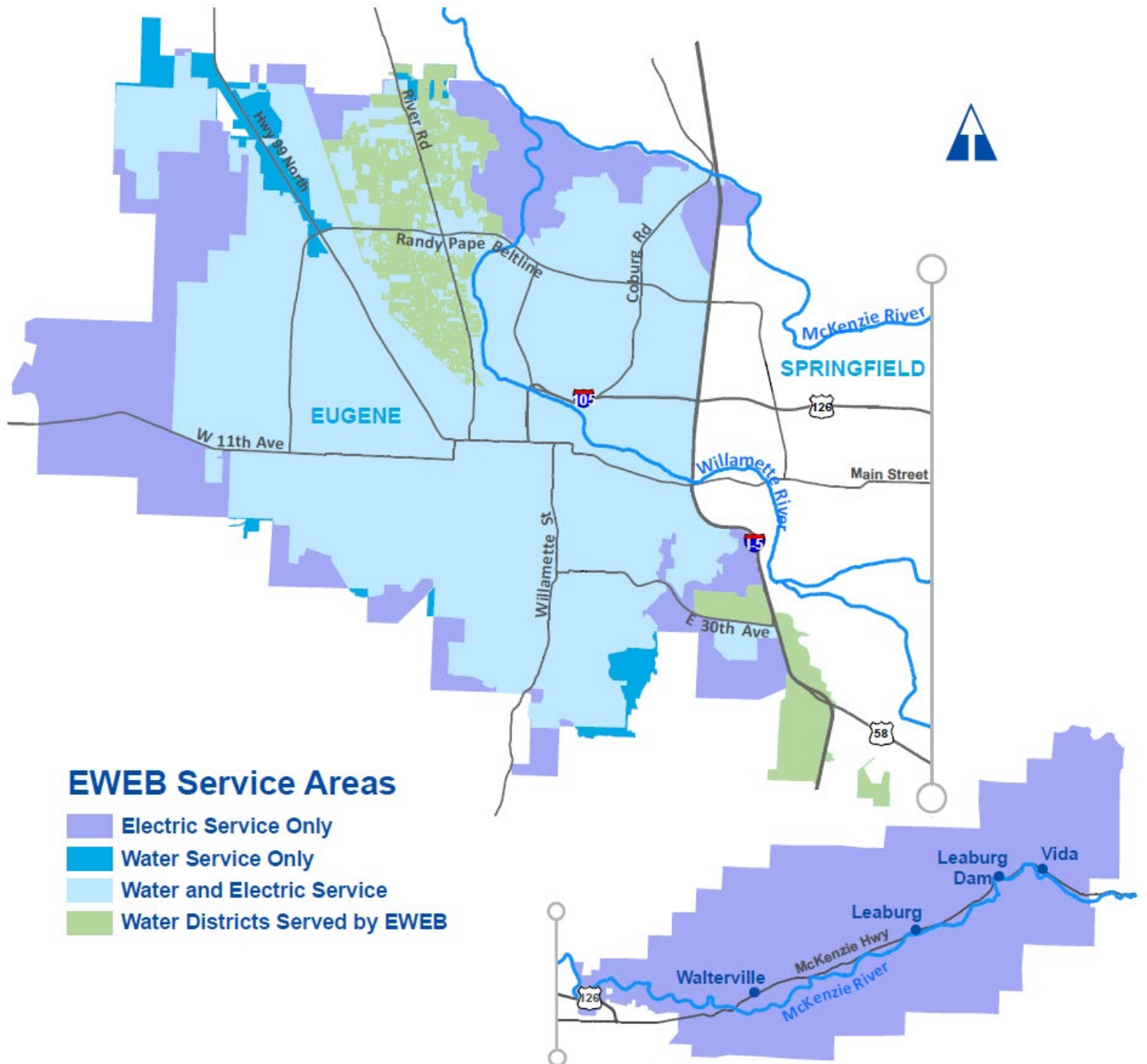**Data Analyst**
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EWEB Service Territory

- 101,092 Active Accounts (Water & Electric)

- 8,847 MG Water Delivered in 2020

- Served by Hayden Bridge WTP on McKenzie River

- 50% Water AMI Installation Complete

- 66% Electric AMI Installation Complete

EWEB Service Areas
- Electric Service Only
- Water Service Only
- Water and Electric Service
- Water Districts Served by EWEB

Growing Population of Deployed AMI

Increased Meters Means Increased Data

What to Learn From the Data?

- Hourly Consumption Behavior
- Comparisons of Consumption Between Groups
- Trends of Consumption

Deployed AMI Meters with an 'On' Power Status as of 9/22/2021

Commodity	Meter Count	Daily Interval Reads
Electric	64,411	6,183,456
Water	31,783	762,792

Consumption Profile Study Purpose and Methodology

*Determine whether EWEB **can** and **should** develop unique water and electricity consumption profile groups based on Location within EWEB Service Territory and Premise Attributes*

Methodology
Three Sample Groups of Residential Premises with Water and Electric AMI Services
Meters Communicating Since at Least August 1, 2019
MDM Virtual Meter Interval Reads
Analysis of Variance (ANOVA) Testing
Regional Land Information Database of Lane County (RLID)

Consumption Profile Study Samples and Selection

Silver Study Group	Minda Study Group	Random Study Group

| Selection Criteria |
|---|
| Dual Commodity AMI Services |
| Statistically Significant Representation of EWEB Service Population |
| Distinct Locations Within EWEB Service Territory |
| Highly Communicating Meters |
| Proximity of Premises Within the Sample Group (Random Excluded) |

Silver Study Group

- 92 Premises
- 92 Water Meters
  - 89 5/8" Meters
  - 3 1" Meters
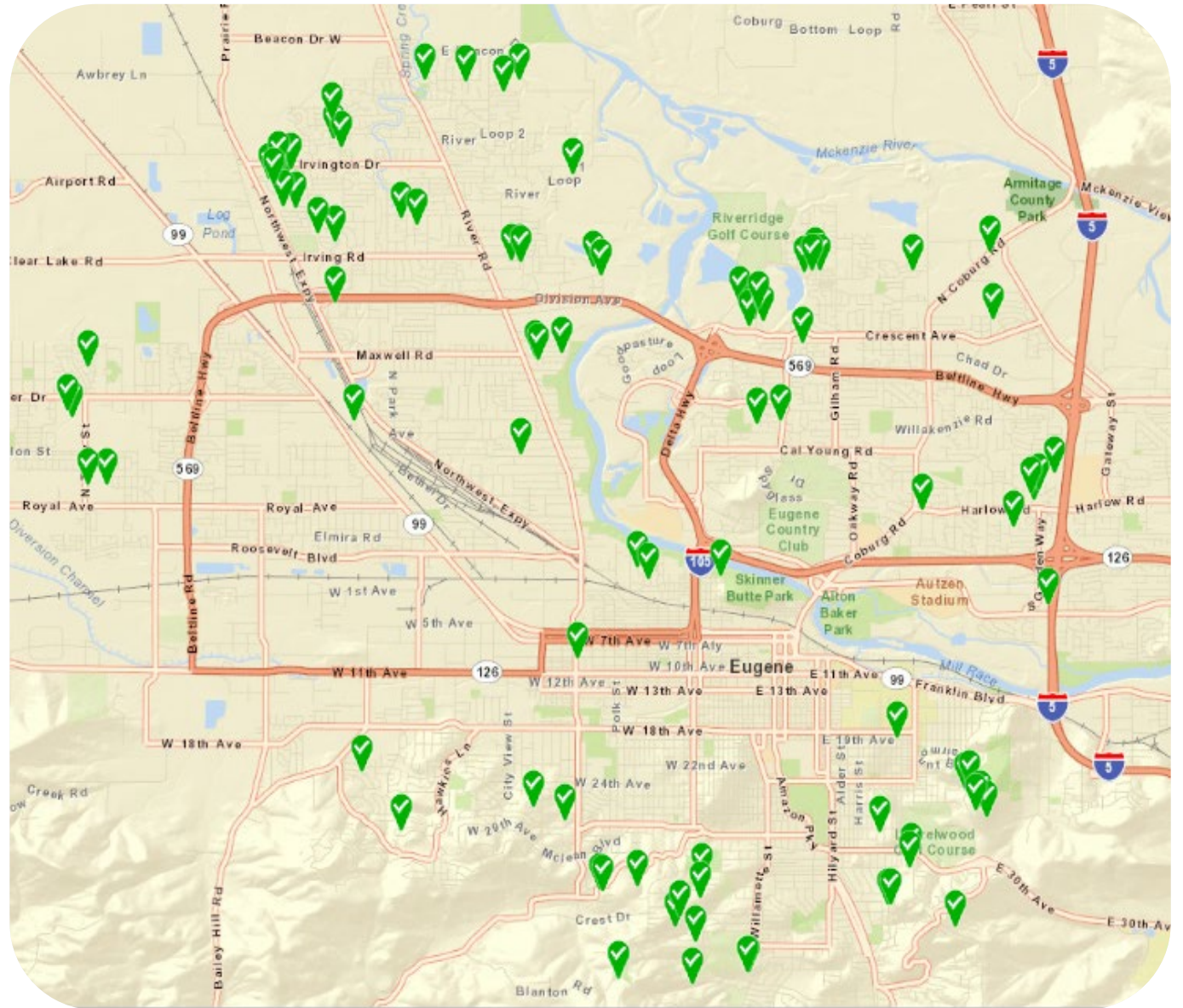- 95 Single Phase Electric Meters
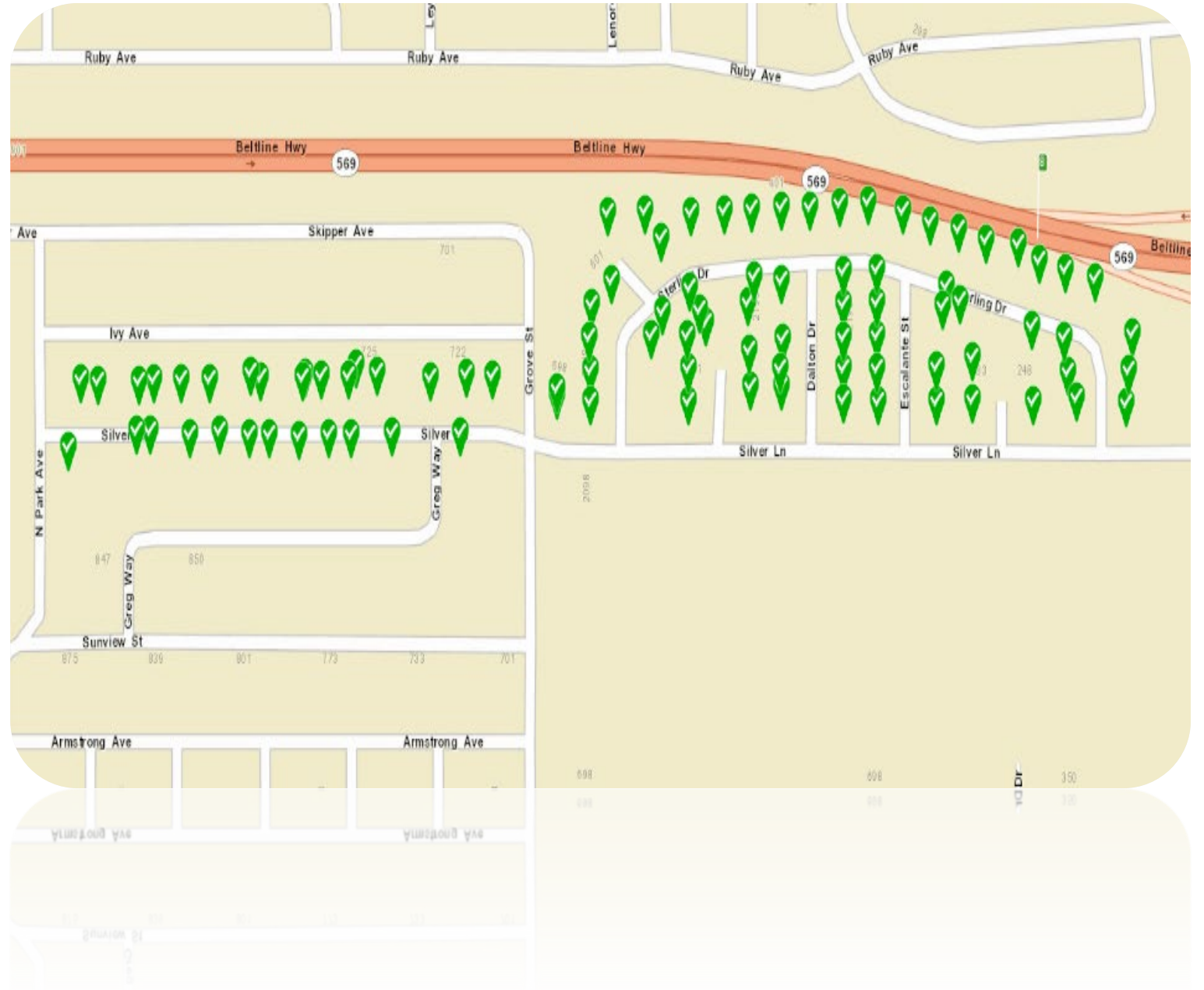
Minda Study Group

- 89 Premises
- 90 Water Meters
  - 90 5/8" Meters
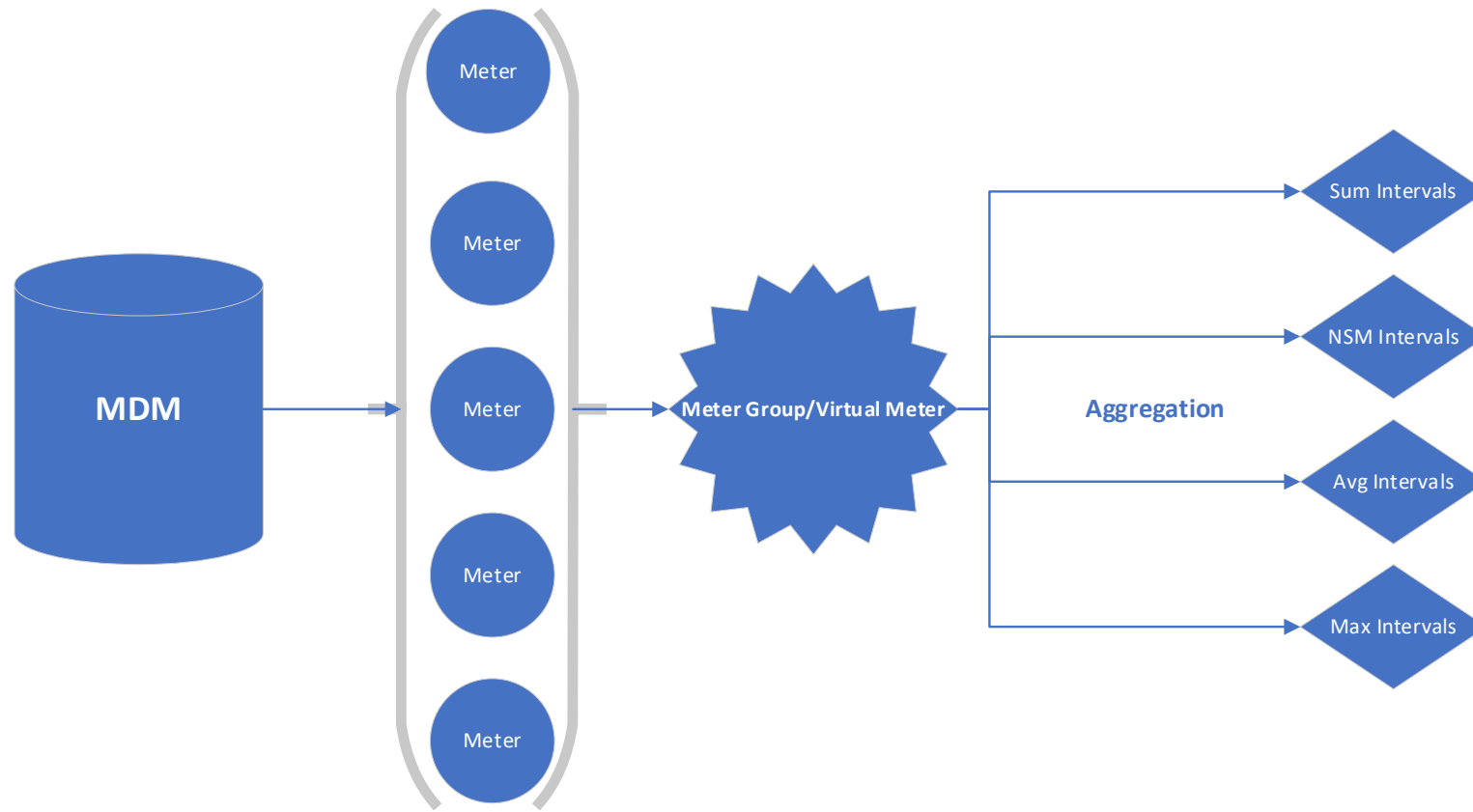- 89 Single Phase Electric Meters
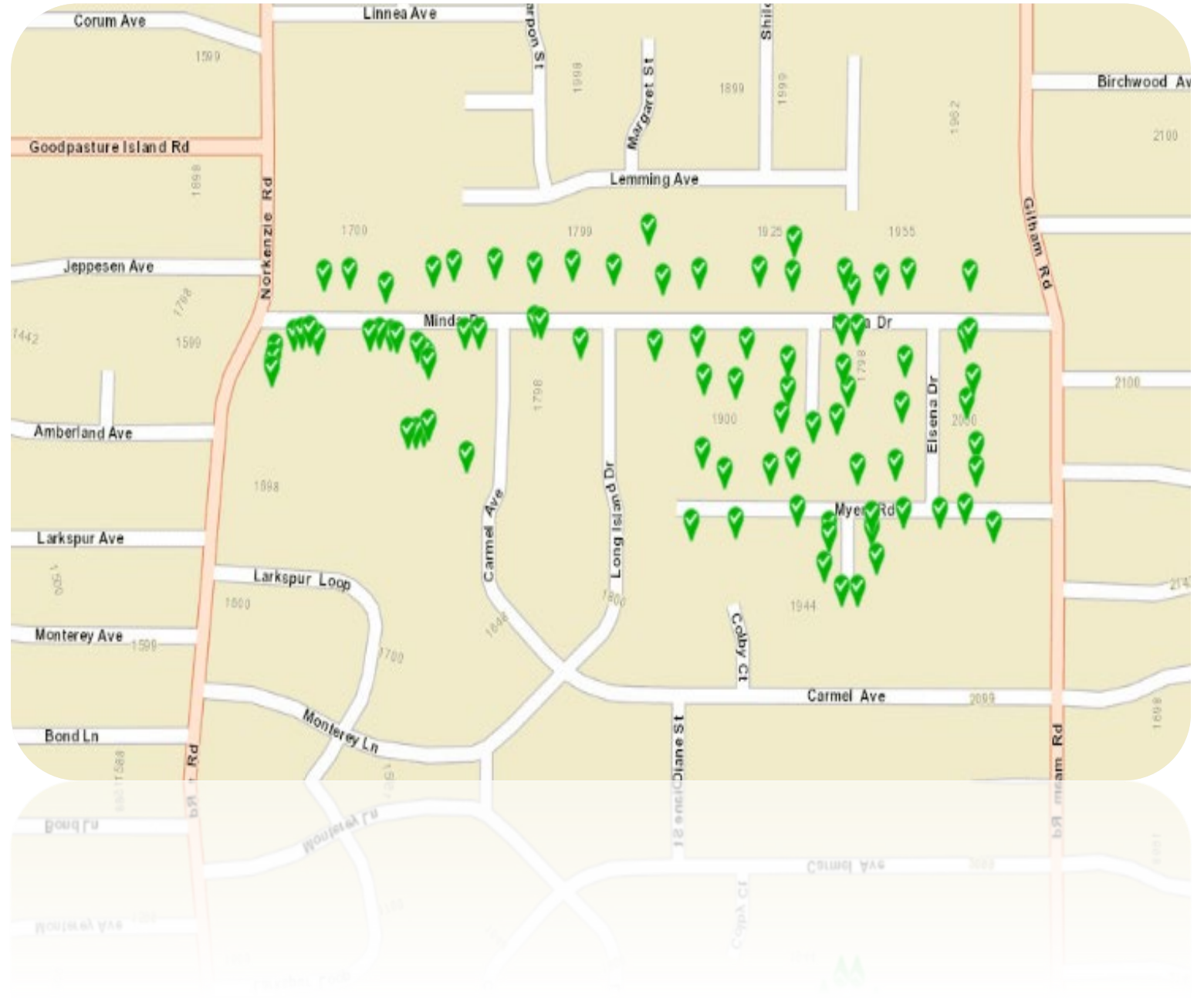
Random Study Group

- 91 Premises
- 92 Water Meters
  - 76 5/8" Meters
  - 14 1" Meters
  - 1 ¾" Meter
  - 1 1.5 " Meter
- 94 Single Phase Electric Meters

Meter Data Management and Virtual Meters

Meter Data Management and Virtual Meters

Virtual Meter Example	
Virtual Meter Type	Sum Aggregation
Interval Time Period	1:00 P.M. – 2:00 P.M.
Commodity Type	Water

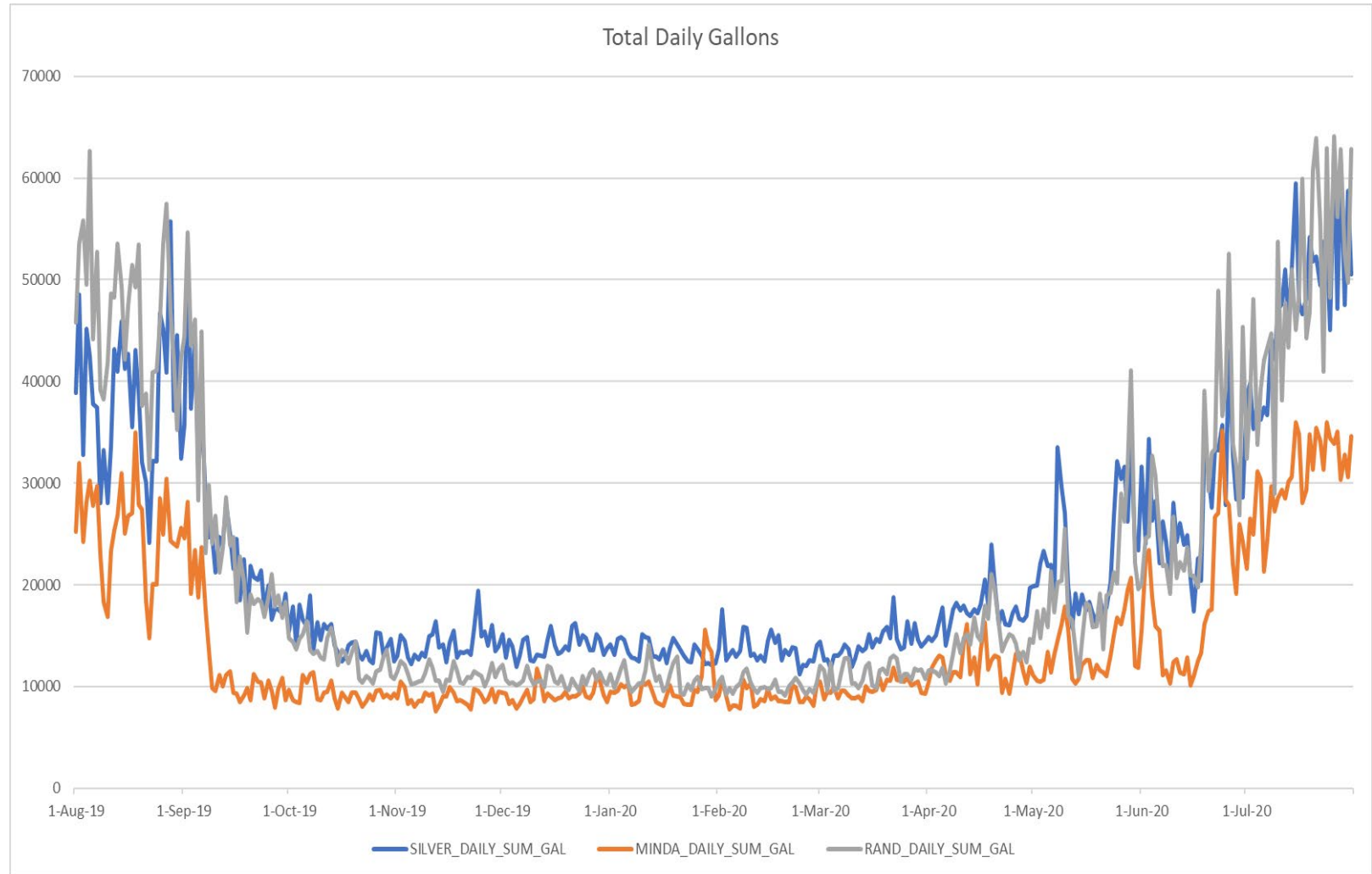10 Gal + 5 Gal + 30 Gal + 5 Gal + 10 Gal = One Interval Read of 60 Gallons

Total Water Consumption by Study Group

- Silver Higher During Winter; Median in Summer

- Minda Lowest Year-Round

- Random Higher During Summer; Median in Winter

Total Daily Gallons

Legend: SILVER_DAILY_SUM_GAL, MINDA_DAILY_SUM_GAL, RAND_DAILY_SUM_GAL

Total Electric Consumption by Study Group

- Silver Higher Year-Round

- Minda Lower Year-Round

- Random Median Year-Round

Total Daily kWh

SILVER_DAILY_SUM_KWH — MINDA_DAILY_SUM_KWH — RAND_DAILY_SUM_KWH
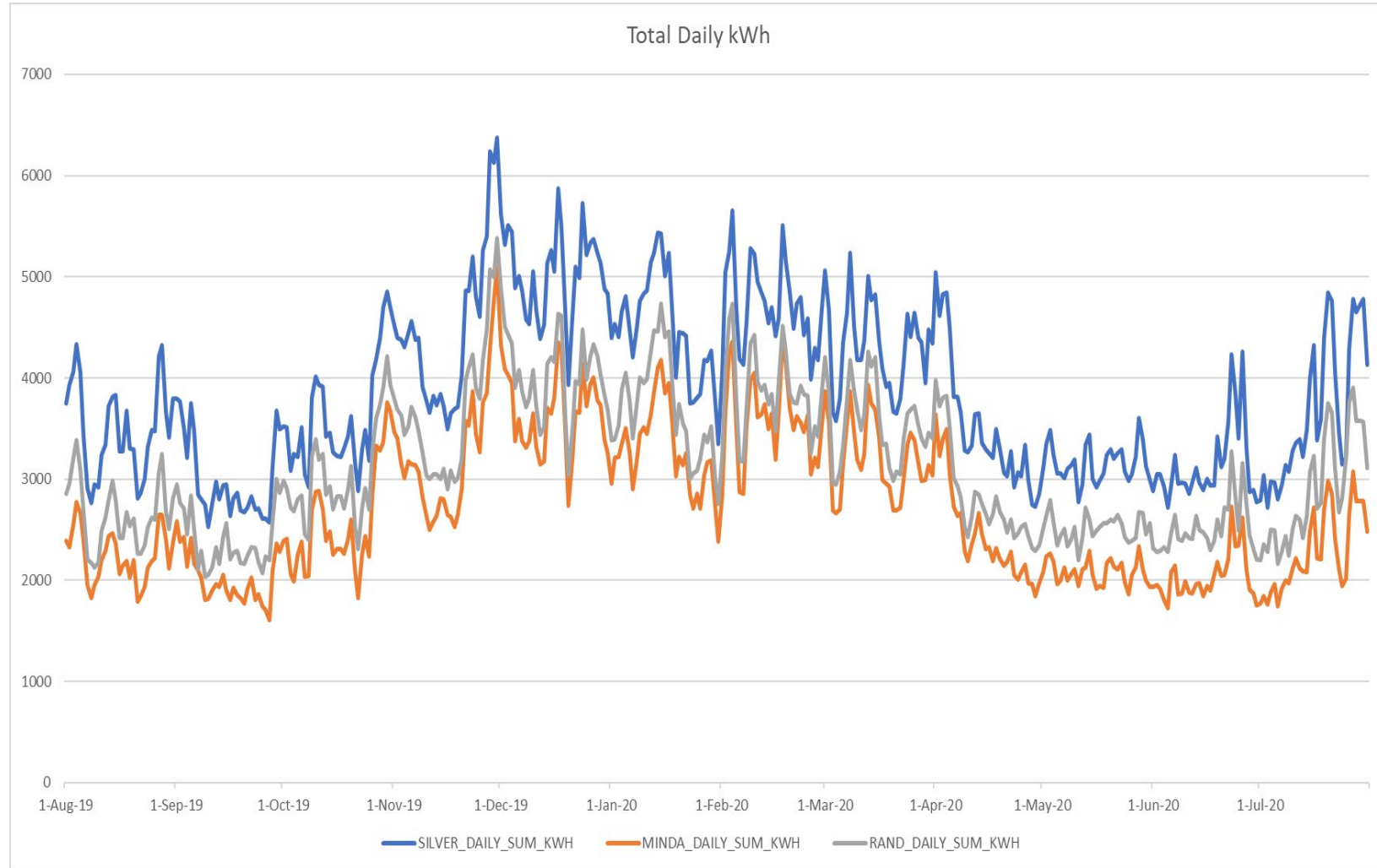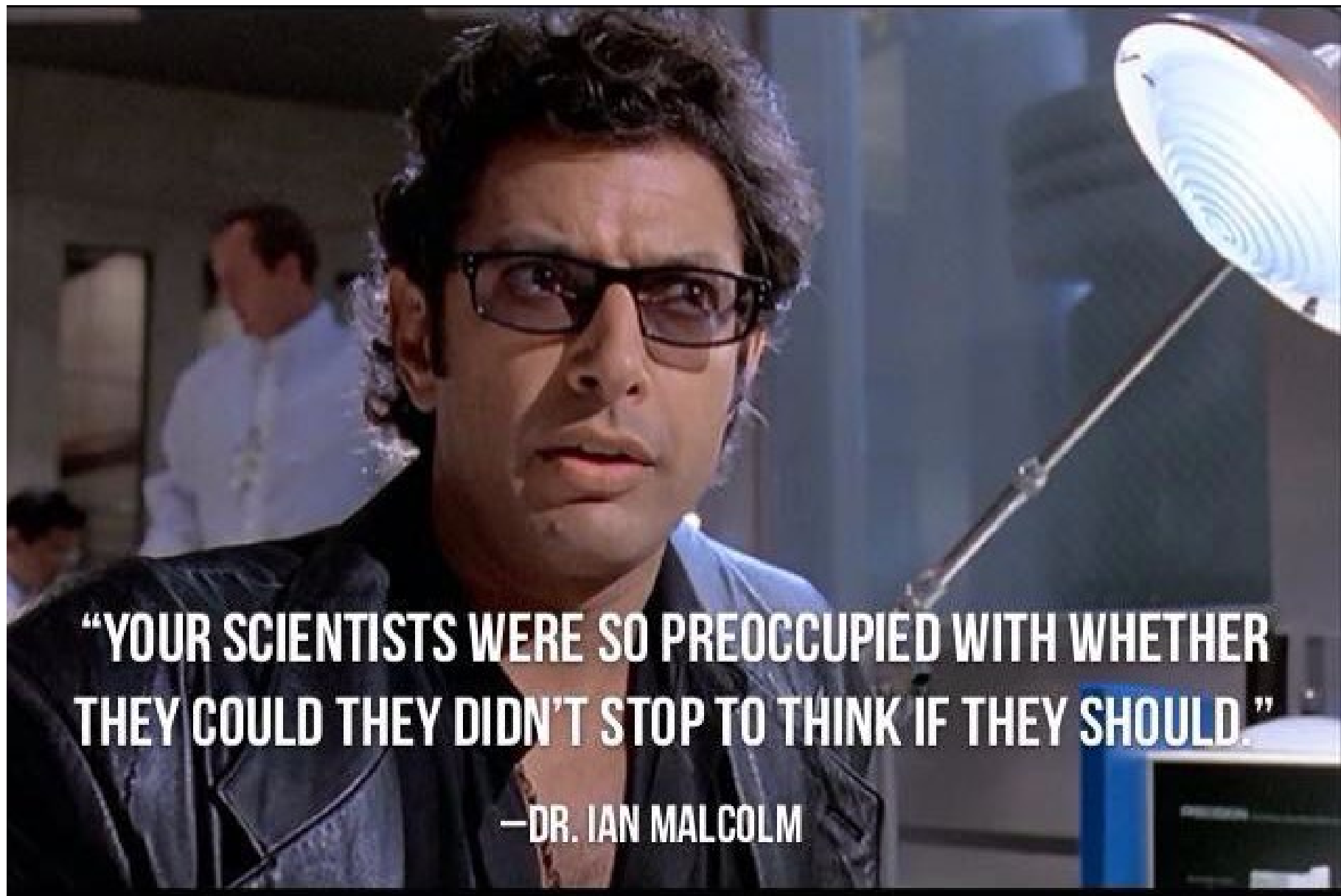
"YOUR SCIENTISTS WERE SO PREOCCUPIED WITH WHETHER THEY COULD THEY DIDN'T STOP TO THINK IF THEY SHOULD."

—DR. IAN MALCOLM

Statistical Analysis - Methods

Analysis of Variance (ANOVA) – Statistical model used to analyze the variability (variance) within and between sample groups of a population

Methodology	Google Translate
Determine Ratio (F-Score) of Variance of Between-Groups and Variance Within-Groups	Assign Score to any Variability
Interpret F-Score and Test Against the Null Hypothesis	Determine if enough Variability Exists
Conduct Post-Hoc Testing	Determine Where it Varies
Compare Results for Between-Groups Variation Significance	Rank the Variability
Interpret Final Results	Determine Groups that are Most Variable

Statistical Analysis - Results

Water Interval Findings

- Variance Greatest Between Silver and Minda Study Groups
- Variance Between Silver and Random Groups Considerably Lower than Between Other Groups
- Attributes that May Affect Water Consumption Behavior of Silver and Random Groups More Likely to be Similar

Electric Interval Findings

- Variance Greatest Between Silver and Minda Study Groups
- Variance Between Minda and Random Groups Considerably Lower than Between Other Groups
- Attributes that May Affect Electricity Consumption Behavior of Minda and Random Groups More Likely to be Similar

Service Location Attribute Analysis

Regional Land Information Database of Lane County **R L I D**

Three Indicators for Analysis
Physical Attributes including Age of Home; Size of Home, and Size of Lot
Occupancy Type
Ownership

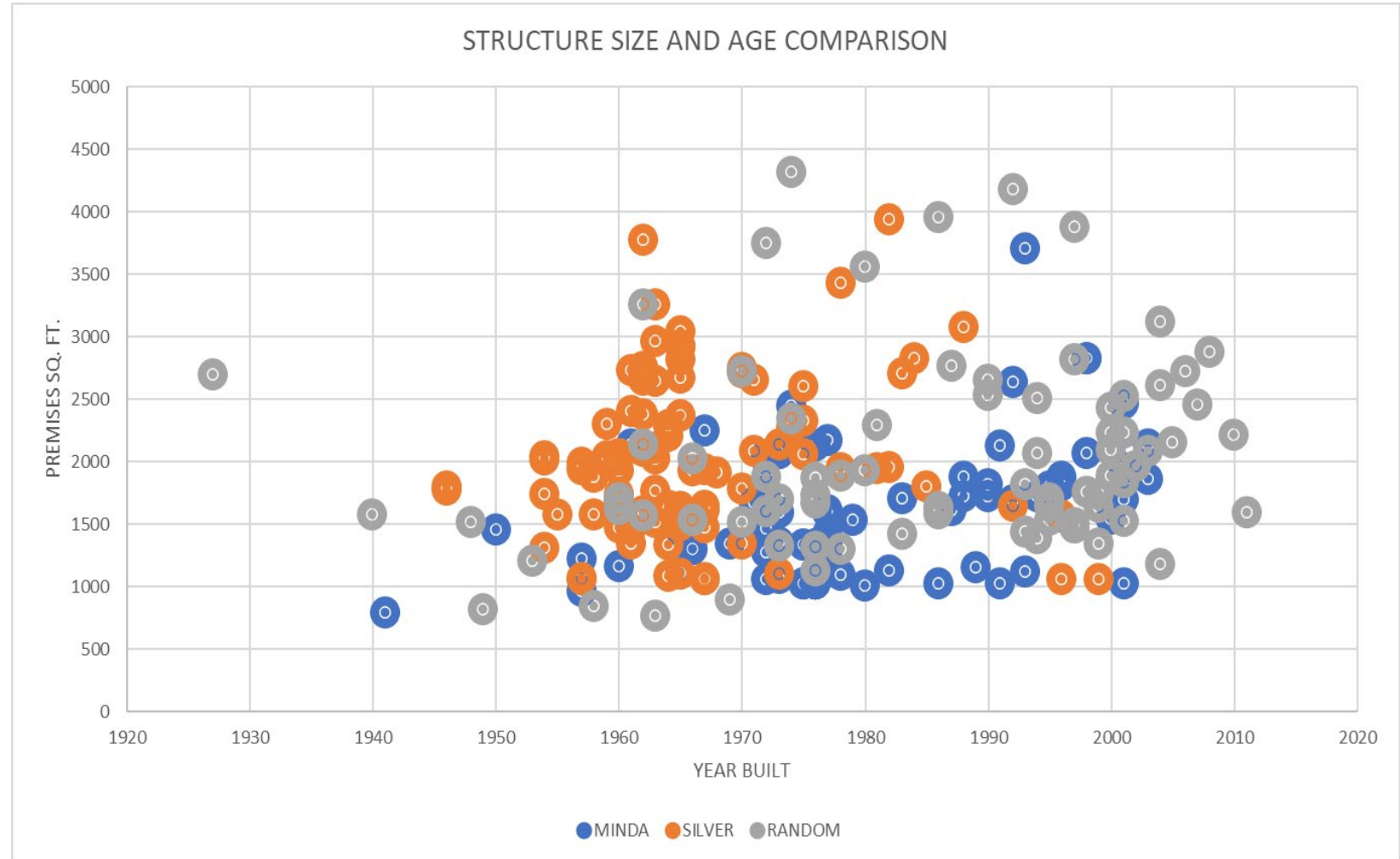# Service Location Attribute Analysis - Physical

STUDY GROUP	Average Effective Year Built	Average Total Base SQ FT	Average Acreage of Lot
MINDA	1979.64	1581.24	0.19
RANDOM	1984.86	2105.13	0.29
SILVER	1966.58	2065.18	0.25

Service Location Attribute Analysis - Physical

- Silver – Larger and Older

- Minda – Smaller and Newer

- Random – Greater Distribution

STRUCTURE SIZE AND AGE COMPARISON

Service Location Attribute Analysis – Occupancy Code

- Silver and Random – Most Likely to Reflect Single Family Consumption Behavior

- Minda – Most Likely Reflects Mixed Occupancy Consumption Behavior

STUDY GROUP	Occupancy Code Percent of Total
SILVER	
Duplex	2.17%
Single family	97.83%

STUDY GROUP	Occupancy Code Percent of Total
MINDA	
Duplex	11.24%
Single family	66.29%
Townhs-owner	22.47%

STUDY GROUP	Occupancy Code Percent of Total
RANDOM	
4-6 family	1.18%
Duplex	2.35%
Single family	92.94%
Townhs-owner	1.18%
Triplex	2.35%

Service Location Attribute Analysis – Ownership

- Silver – Likely Lower Population of Rental Units

- Minda and Random – Likely Higher Population of Rental units

STUDY GROUP	Percent of Prem/Owner Address Match
SILVER	
No	15.22%
Yes	84.78%
MINDA	
No	32.58%
Yes	67.42%
RANDOM	
No	29.41%
Yes	70.59%

Consumption Profiles

Silver Premise Profile

PHYSICAL: Older Year Built, Median SQ FT, Median Lot Size

OCCUPANCY: Lower Deviation from Single Family

OWNERSHIP: Lower Population of Rental Units

Minda Premise Profile

PHYSICAL: Median Year Built, Lower SQ FT, Lower Lot Size

OCCUPANCY: Higher Deviation from Single Family

OWNERSHIP: Higher Population of Rental Units

Random Premise Profile

PHYSICAL: Newer Year Built, Higher SQ FT, Higher Lot Size

OCCUPANCY: Median Deviation from Single Family

OWNERSHIP: Median Population of Rental Units

Consumption Profile Analysis

- Occupancy and Ownership Effects on Consumption Behavior

- Square Footage and Lot Size

- Age of Structure at Premises

Water Study Group

Anova Ranking	Water Groups	Year Built	Square Footage	Lot Size	Occupancy	Ownership
1	Silver & Minda	🟨	🟨	🟩	🟥	🟥
2	Minda & Random	🟩	🟥	🟥	🟩	🟩
3	Random & Silver	🟥	🟩	🟩	🟩	🟩

Electric Study Group

Anova Ranking	Electric Groups	Year Built	Square Footage	Lot Size	Occupancy	Ownership
1	Silver & Minda	🟨	🟨	🟩	🟥	🟥
2	Random & Silver	🟥	🟩	🟩	🟩	🟩
3	Minda & Random	🟩	🟥	🟥	🟩	🟩

# Conclusion of Findings and Recommendations

ANOVA and RLID Research

- Significant Variance between Study Groups
- Profiles Based on Location in EWEB Service Area
- Occupancy and Ownership Indicators Highest Affect on Variance
- Premise Structure Size Greater Affect on Variance in Water Consumption
- Premise Age Greater Affect on Variance in Electricity Consumption

Ongoing Efforts/Recommendations

- Introduction of Granular Time Components
- SQL Query Development for Continued Comparative Statistical Analysis (Peak Consumption)
- Data Visualization Development (GIS Partnership)
- Water Conservation and Marketing Applications
- Power Load Profile Analysis

Updates: Peak Consumption Analysis

Silver WT Peak Consumption Windows
August 31, 2021
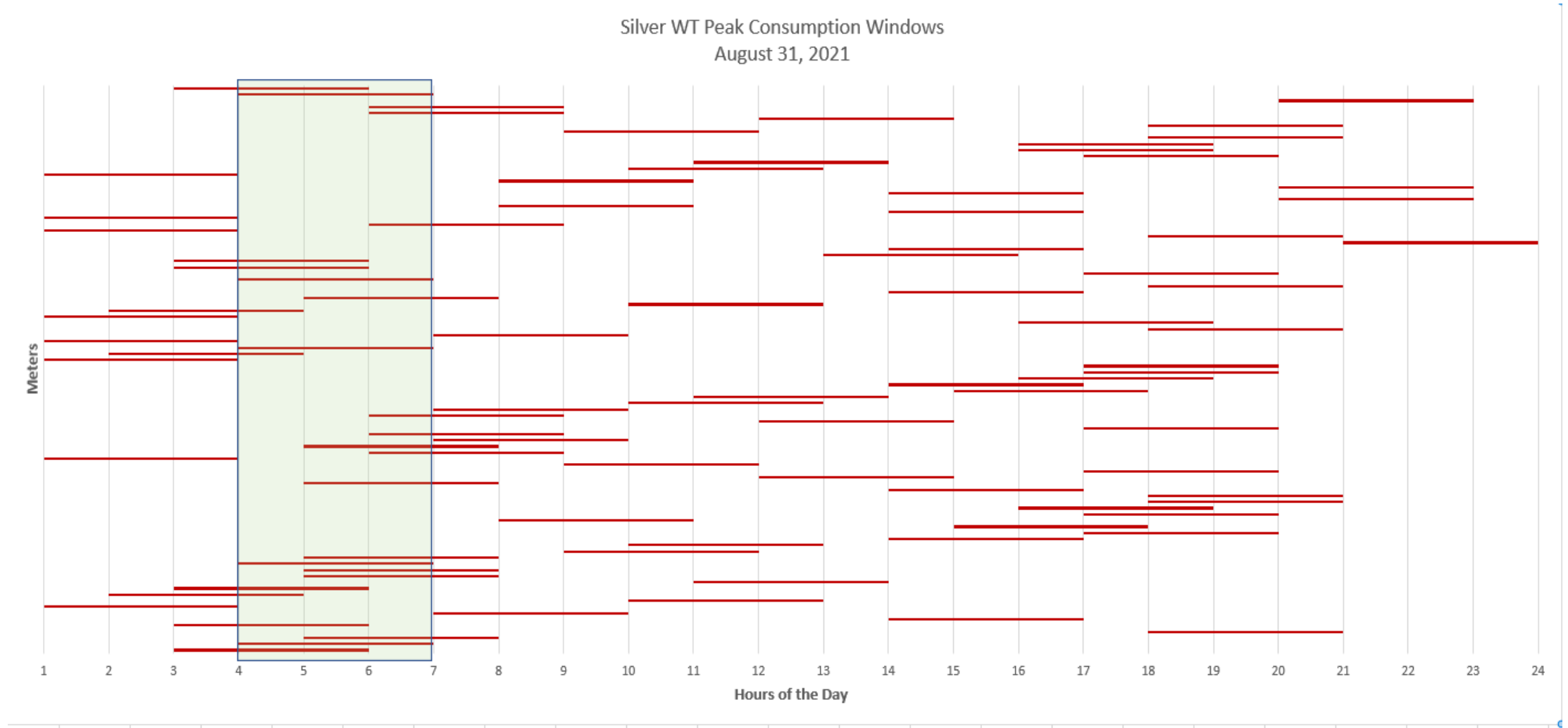
Updates: Predictive Modeling

SILVER JUNE-JULY 2020 ACTUAL PEAK CONSUMPTION & MODEL
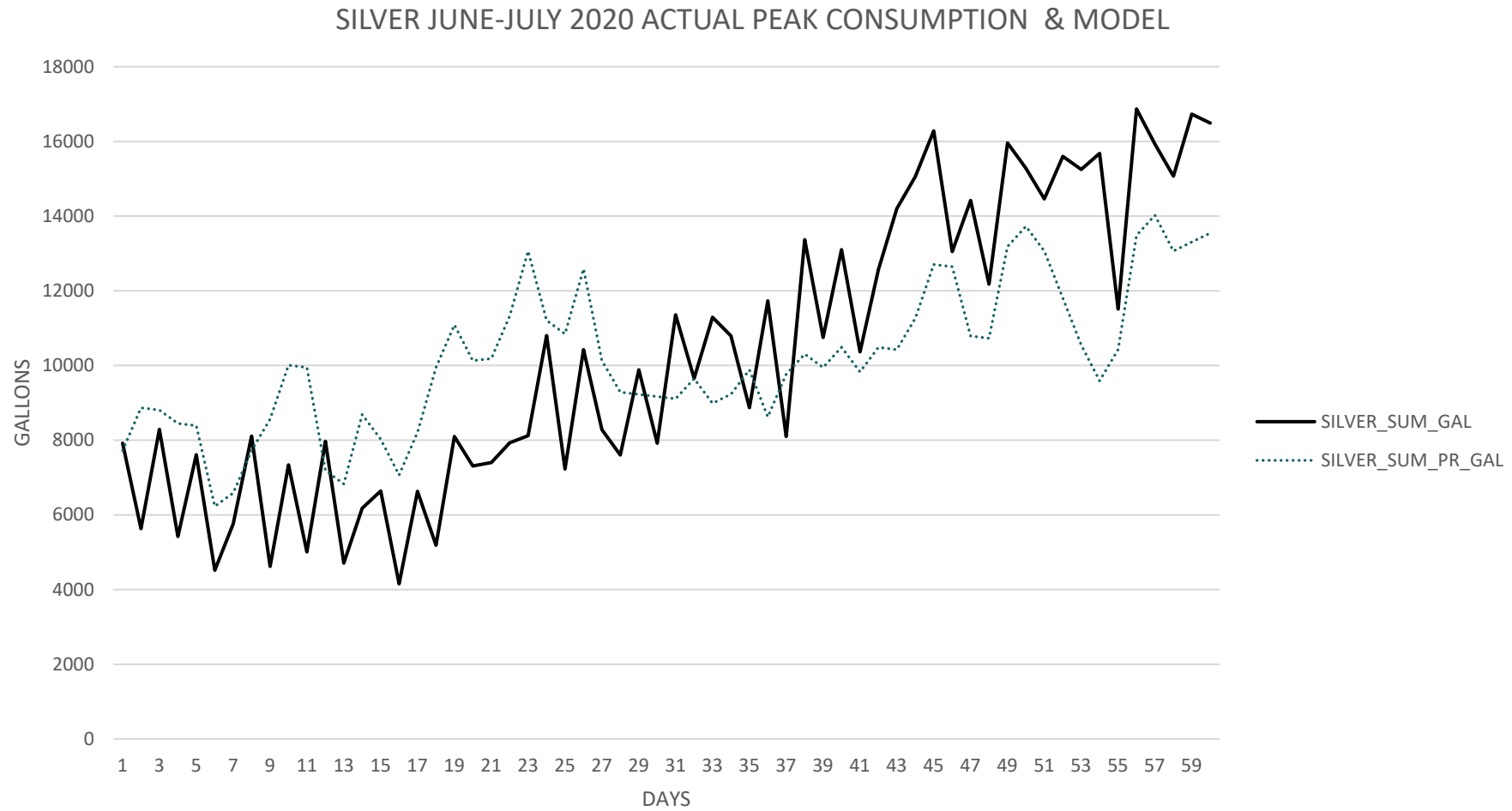
Thank You!

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