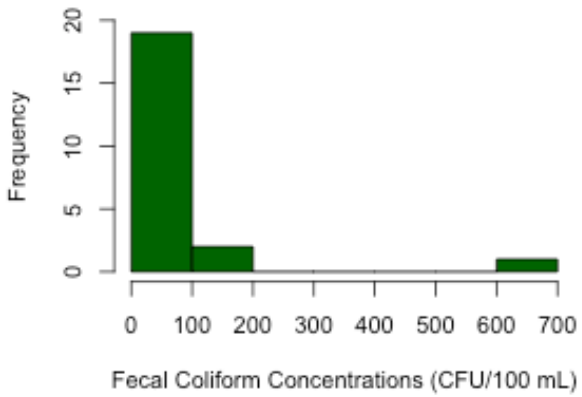
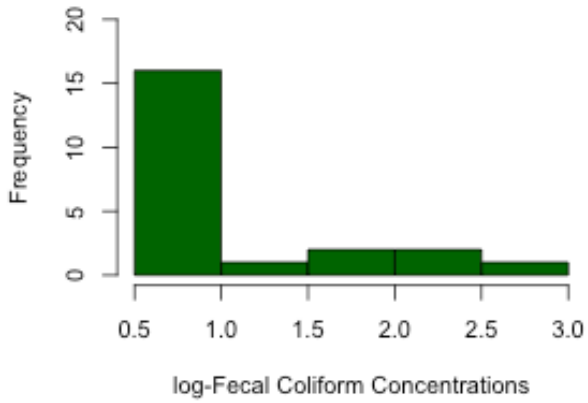
Appendix A: Additional Data Analysis

1. Histograms of Fecal Coliform Concentrations and log-Transformed Fecal Coliform Concentrations Measured in Post-UV Free-Fall Effluent Sample (n=22)

Because of the small number of samples, the fecal coliform data from the study are not log Normally distributed, but they fit a log-Normal distribution better than a Normal distribution.





2. Odds Ratios for UV Bulb Malfunction with Installation, Maintenance, and Functioning Issues as Predictors

Table A.1. Odds Ratios for UV Bulb Malfunction for Binary Variables, Calculated with Fisher's Exact Test

	OR (95% CI)	p-value
Electrical corrosion or damage	13.5 (2.87-88.0)	<0.001
UV bulb with protective sleeve inaccessible	3.05 (0.209-44.6)	0.269
Inadequate cable slack	2.01 (0.516-7.29)	0.34
Leaks/cracks in UVD housing unit	2.01 (0.158-18.9)	0.599
UVD unit not protected from power disconnection	1.52 (0.128-11.5)	0.64
Damage or leakage in protective sleeve	1.2 (0.286-4.37)	0.764
UVD unit on non-dedicated circuit	1.12 (0.294-5.34)	1
UV location	0.95 (0.270-3.89)	1
UVD housing unit unprotected from weather or debris	0.816 (0.077-4.79)	1
LED indicator incorrect	0.802 (0.101-5.12)	1
Power switch inaccessible	0.715 (0.068-4.02)	1

Table A.2 Odds Ratios for UV Bulb Malfunction for Non-Binary Variables, Calculated with Logistic Regression

	Standardized OR (95% CI)	Unstandardized OR (95% CI)	p-value
Biofilm Deposit rank	8.39 (2.63-26.8)	2.98 (1.64-5.42)	<0.001
# of bedrooms	2.62 (0.904-7.61)	1.82 (0.940-3.51)	0.0753
Months since UV unit last cleaned	1.68 (0.717-3.93)	1.02 (0.991-1.04)	0.229
Months since last inspection	1.34 (0.482-3.72)	1.04 (0.918-1.17)	0.571
Months since UV bulb last replaced	0.854 (0.230-3.18)	1.00 (0.966-1.03)	0.811
Age	0.420 (0.154-1.14)	0.916 (0.827-1.01)	0.0889
Months since last pumping	0.365 (0.101-1.32)	0.981 (0.957-1.01)	0.122

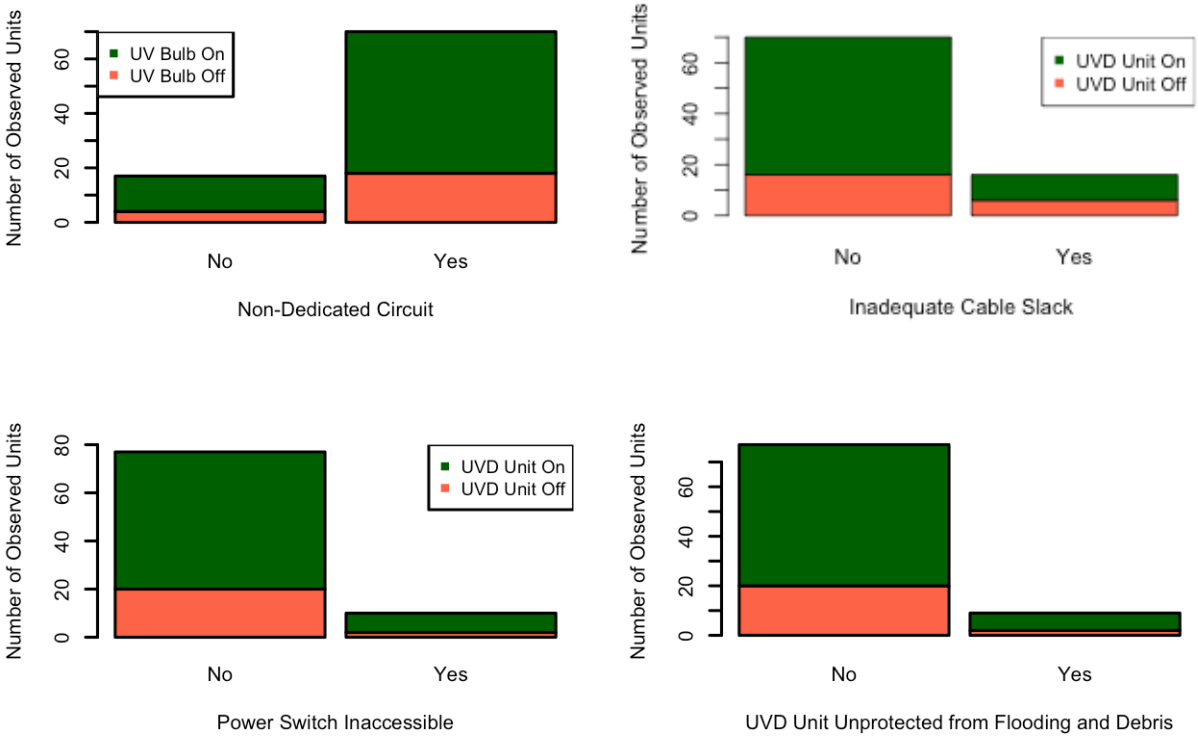
**Categorical and continuous variables were divided by 2 standard deviations to compare the OR magnitude to those of binary variables.*

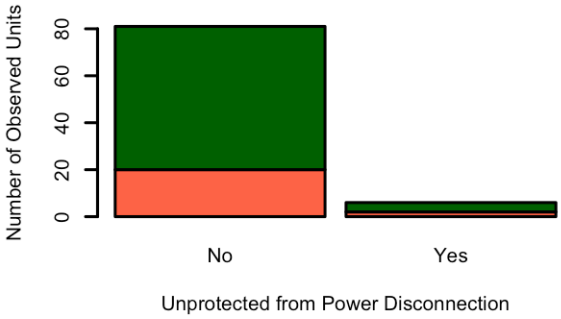
3. Electrical Issues Observed

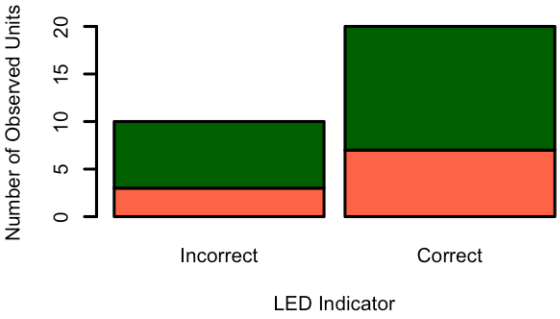
Table A.3 Electrical Issues Observed in UVD Units

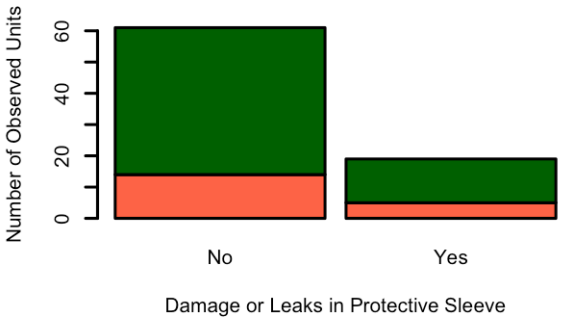
Electrical Damage	Times Observed (not mutually exclusive)
Electrical wires to sensor are corroded, charred, or loose	5
Ballast unprotected from water damage (in top of housing unit)	5
Ballast is corroded	3
Plug between power and bulb is loose	3
Wire to bulb is charred	3
Electrical wires to sensor are disconnected	2
Wire to bulb is corroded	1

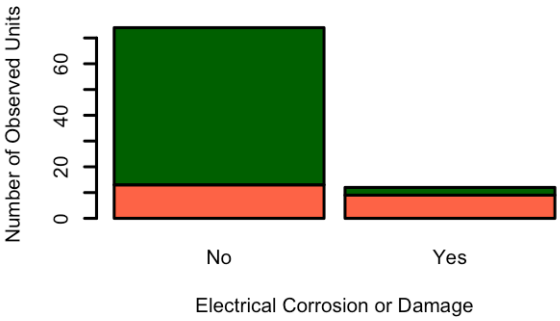
4. Plots Showing Proportion of UVD Units with UV Bulb Malfunction, Divided by Installation, Maintenance, and Current Functioning Characteristics

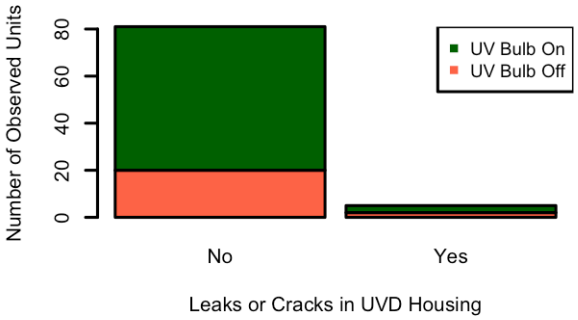


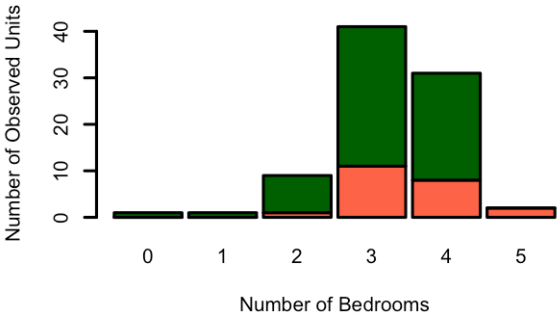

Number of Observed Units
0
20
40
60
80
No
Yes
Unprotected from Power Disconnection

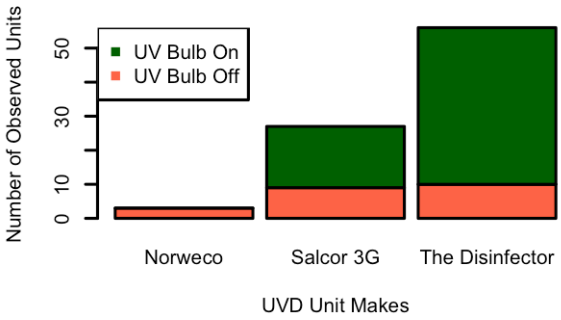

Number of Observed Units
0
5
10
15
20
Incorrect
Correct
LED Indicator

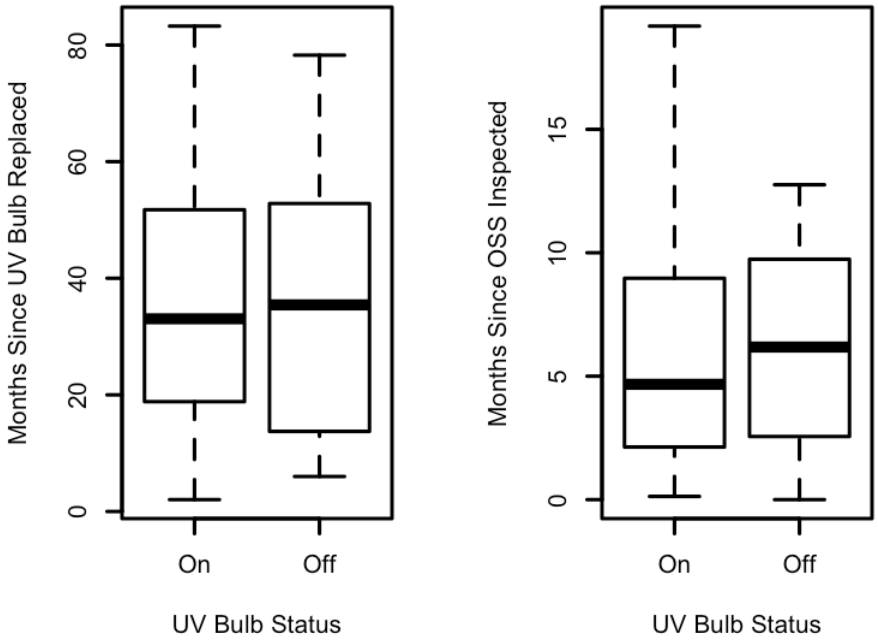

Number of Observed Units
0
20
40
60
No
Yes
Damage or Leaks in Protective Sleeve


Number of Observed Units
0
20
40
60
No
Yes
Electrical Corrosion or Damage

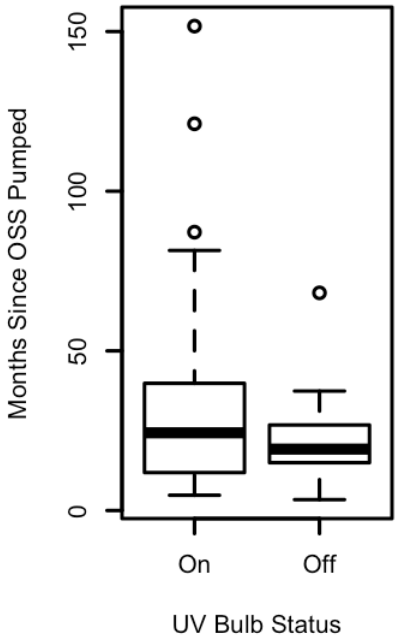

Number of Observed Units
0
20
40
60
80
UV Bulb On
UV Bulb Off
No
Yes
Leaks or Cracks in UVD Housing

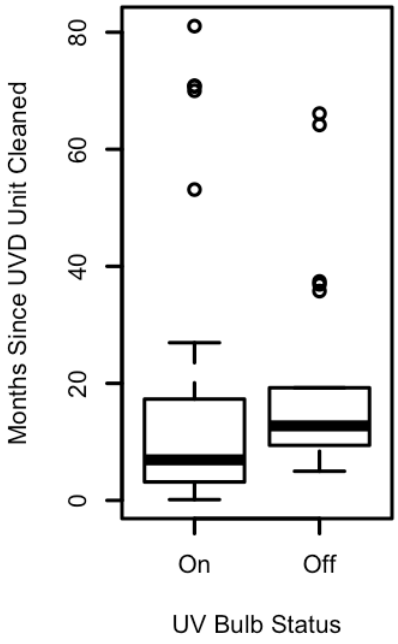

Number of Observed Units
0
10
20
30
40
0
1
2
3
4
5
Number of Bedrooms

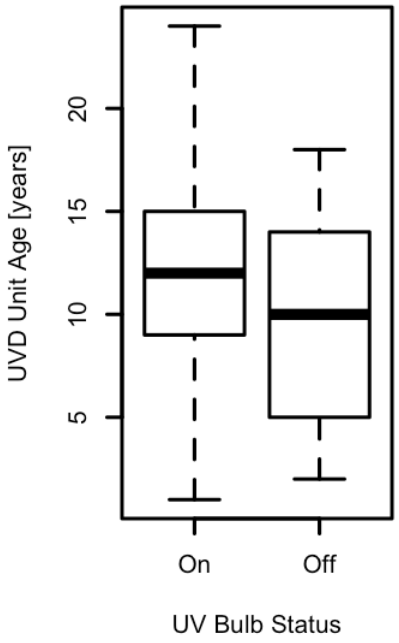

Number of Observed Units
0
10
30
50
UV Bulb On
UV Bulb Off
Norweco
Salcor 3G
The Disinfector
UVD Unit Makes


Months Since UV Bulb Replaced
0
20
40
60
80
On
Off
UV Bulb Status

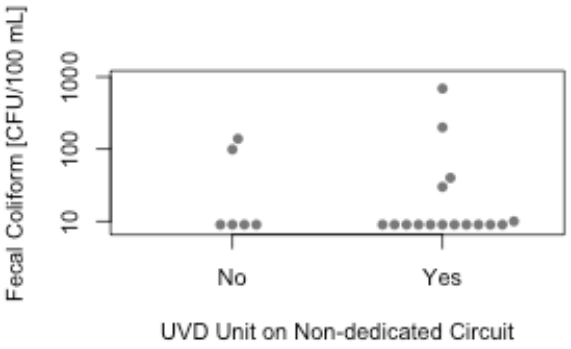
Months Since OSS Inspected
0
5
10
15
On
Off
UV Bulb Status

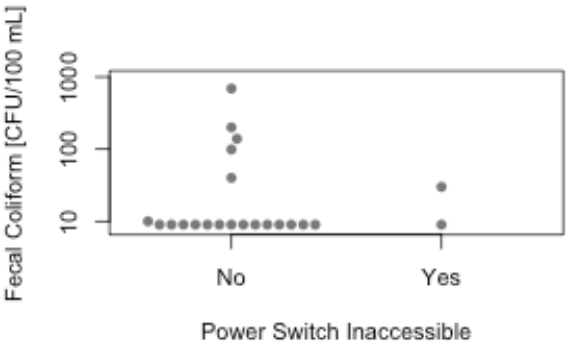

Months Since OSS Pumped
0
50
100
150
On
Off
UV Bulb Status

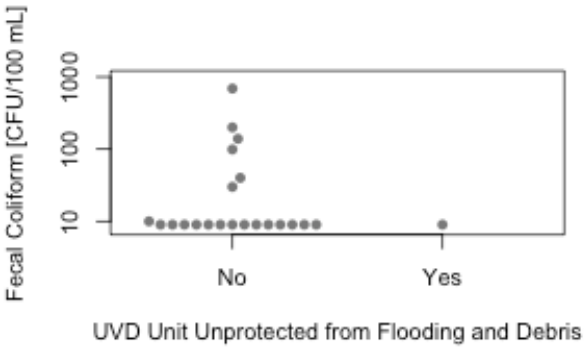

Months Since UVD Unit Cleaned
0
20
40
60
80
On
Off
UV Bulb Status

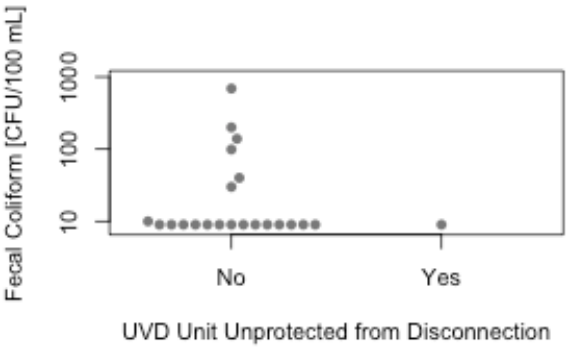

UVD Unit Age [years]
5
10
15
20
On
Off
UV Bulb Status

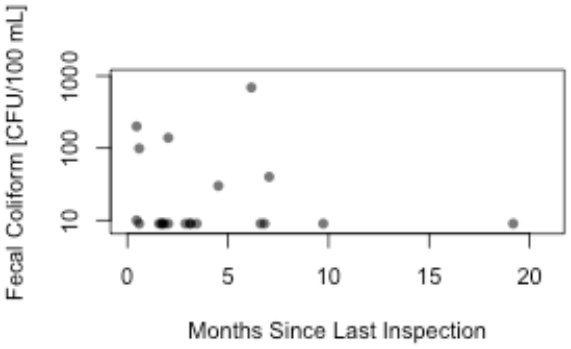
5. Plots of log-Transformed Post-UV Fecal Coliform Concentrations with UVD Units Divided by Installation, Maintenance, and Current Functioning Characteristics

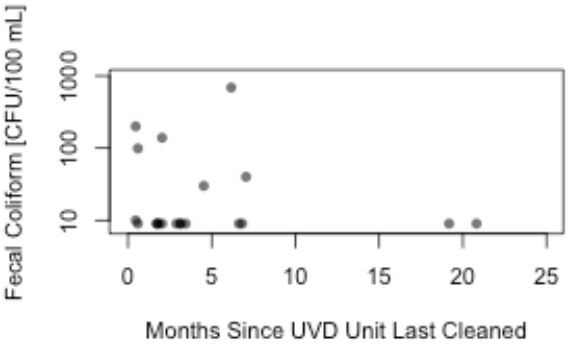


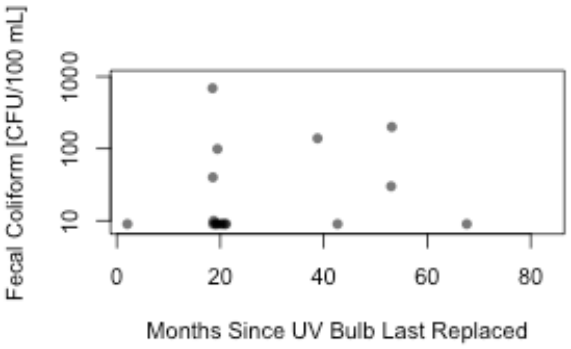


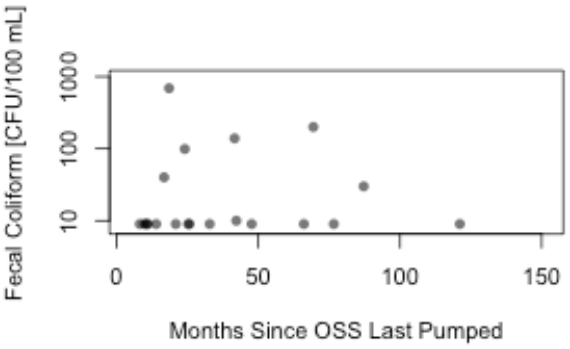


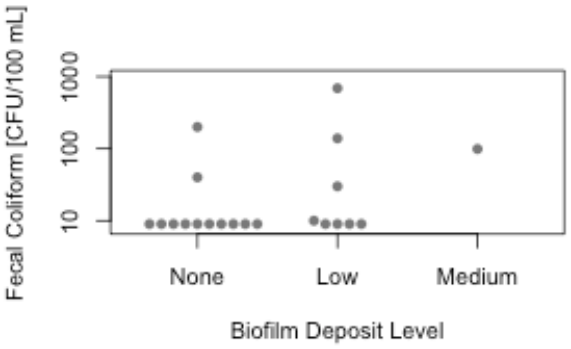


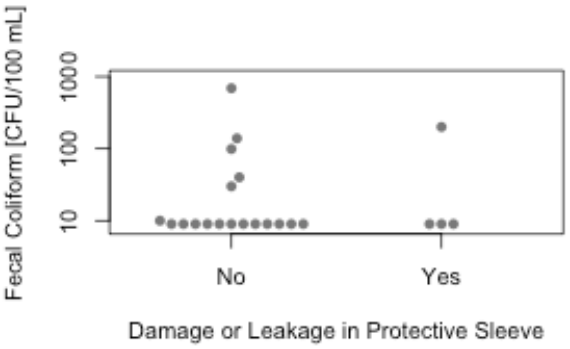


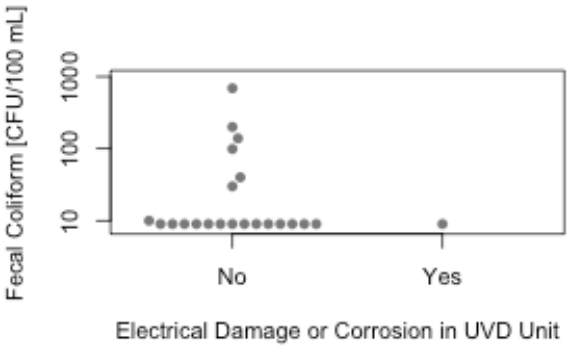


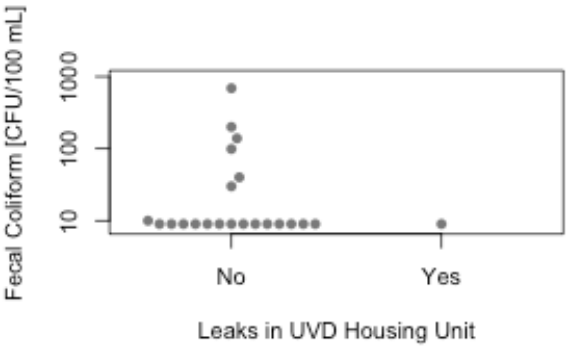

Fecal Coliform [CFU/100 mL]
10
100
1000
0
20
40
60
80
Months Since UV Bulb Last Replaced

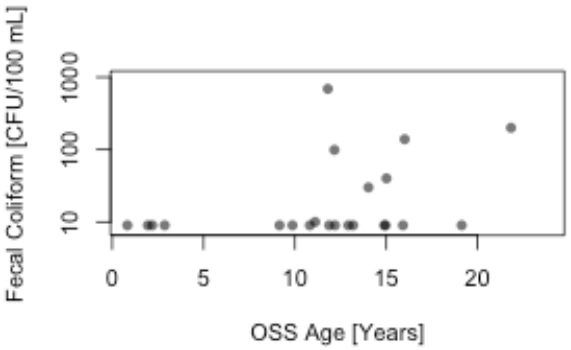

Fecal Coliform [CFU/100 mL]
10
100
1000
0
50
100
150
Months Since OSS Last Pumped


Fecal Coliform [CFU/100 mL]
10
100
1000
None
Low
Medium
Biofilm Deposit Level

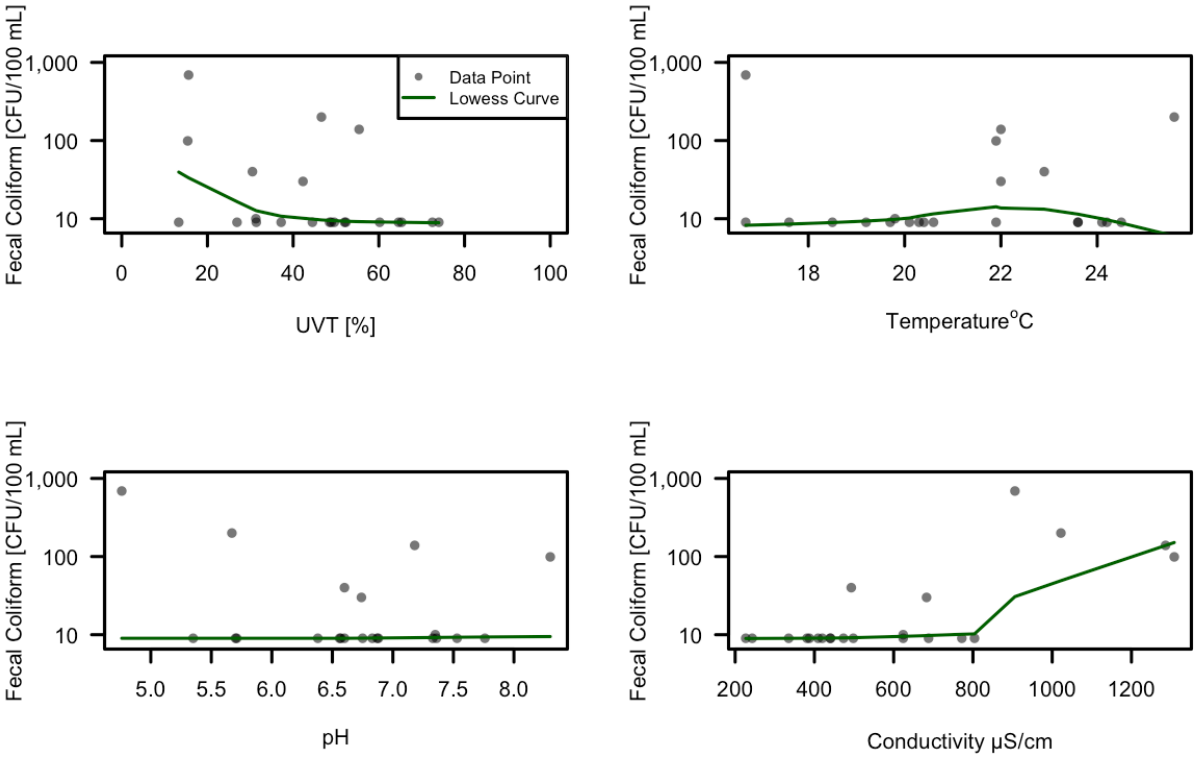

Fecal Coliform [CFU/100 mL]
10
100
1000
No
Yes
Damage or Leakage in Protective Sleeve

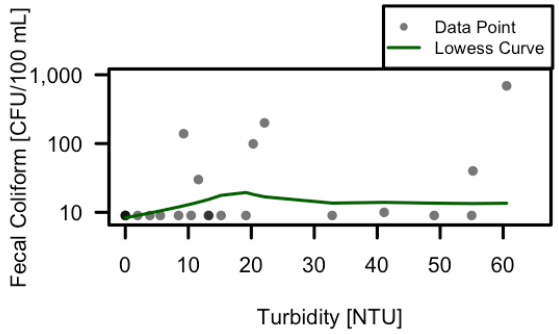

Fecal Coliform [CFU/100 mL]
10
100
1000
No
Yes
Electrical Damage or Corrosion in UVD Unit

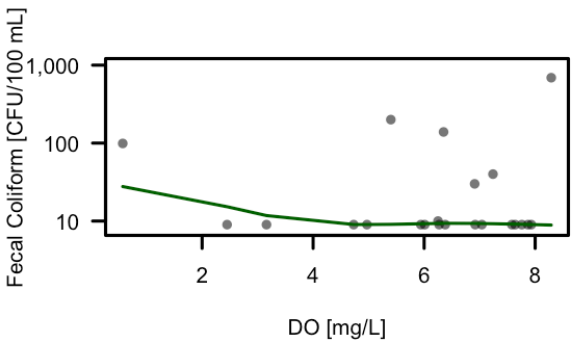

Fecal Coliform [CFU/100 mL]
10
100
1000
No
Yes
Leaks in UVD Housing Unit

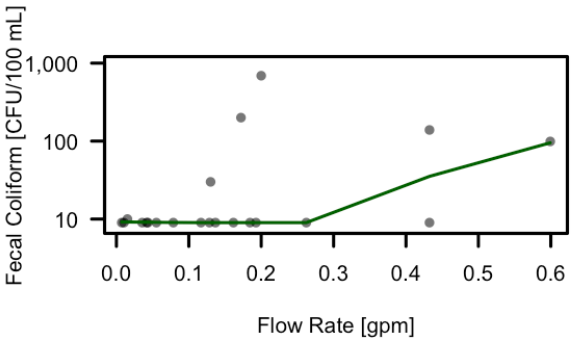

Fecal Coliform [CFU/100 mL]
10
100
1000
0
5
10
15
20
OSS Age [Years]

6. Scatterplots of Wastewater Quality Parameters as Predictors and log-Fecal Coliform Concentrations as Outcome









Appendix A from https://www.doh.wa.gov/Documents/Pubs/337-155.pdf.