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Spreadsheets: An “Excel”-lent Tool to Make Data Work for You

**Wisconsin Wastewater Operators’ Association
52nd Annual Conference**

Wednesday October 17, 2018

**Sam Hocevar
Troy Larson**

What tools are in your toolbox?



What tools are in your toolbox?





Today's Discussion will include:

- Spreadsheets vs Database vs Proprietary Software
- Spreadsheets and Excel Basics
- Advanced Functions
- Visualizing Data with Graphs
- Best Practices

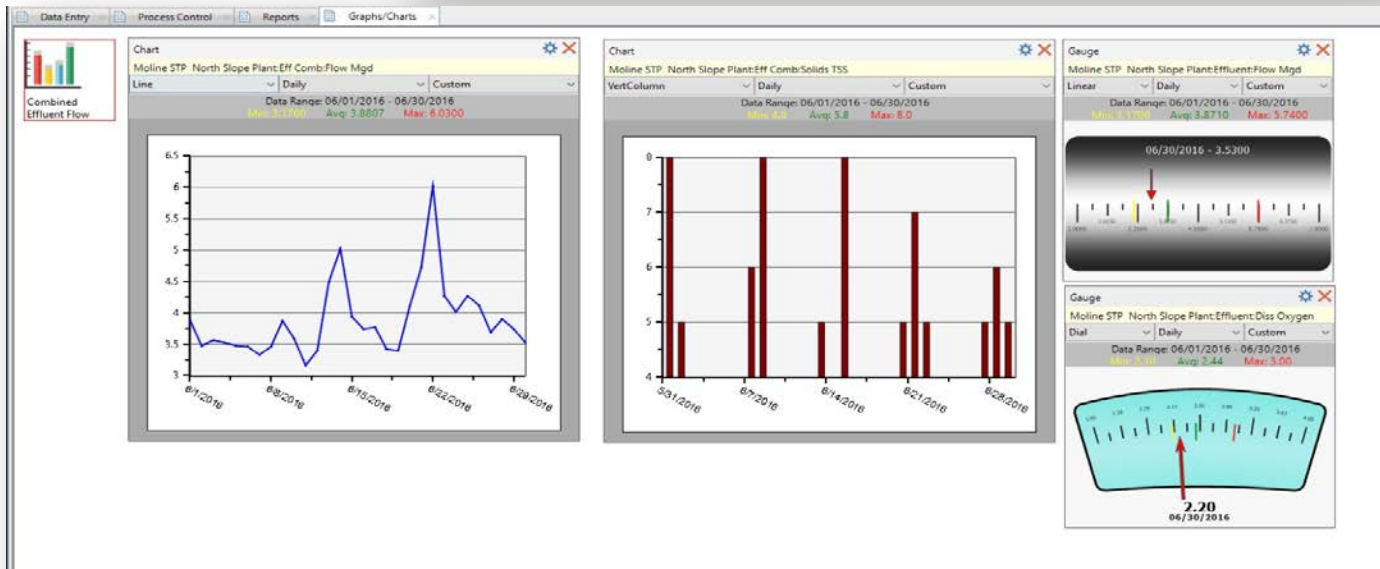
- Case Study #1
- Case Study #2
- Case Study #3

Databases or proprietary software may be preferred in some situations.



Understanding What Each Tool Is For

Common Uses	
Excel	Access
data analysis	data management
mathematical, logical	display data subsets, data structuring, complex queries
calculations, statistical comparisons	automation of common events
easy to generate sharable output	database management with multiple users
conditional formatting, chart management	reports for data summarisation



Terminology: Sound like an excel expert after just one slide

The image shows a screenshot of the Microsoft Excel application window. The window title is "Book1 - Excel" and the user name is "Hoevar, Sam". The ribbon is set to "Home" and shows various tabs like File, Home, Insert, Page Layout, Formulas, Data, Review, View, and Help. The ribbon includes groups for Clipboard, Font, Alignment, Number, Styles, Cells, and Editing. The formula bar shows "C13" and the active cell is C13. The worksheet grid shows columns labeled A through S and rows numbered 1 through 30. A selection is made in the grid, covering cells C13 and D13. The status bar at the bottom shows "Ready" and "Sheet1".

Ribbon

Formula Bar

Cell

Columns (Letters)

Worksheet

Rows (Numbers)



Selection

View Buttons

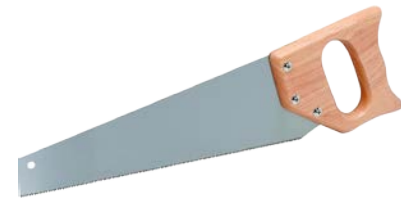
Status Bar

Zoom

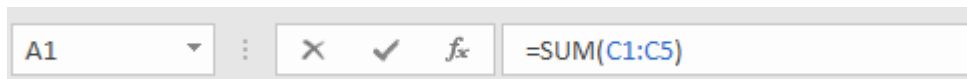
Tabs (Multiple Worksheets)



You can enter just about anything into a cell



- Data (numbers, text, dates)
- Formulas – an expression which calculates the value of a cell.
 - Examples:
 - =1+4+10
 - =4*C1
 - =B2+B3
- Functions – predefined formulas and are already available in Excel.
 - =FUNCTION(Function Arguments)
 - =SUM(**number1**,number2,...) would look like:



- Useful Functions: =SUM, =COUNT, =AVERAGE, =MIN, =MAX, =IF, =AND
- Unexpected: =ROMAN → Roman Numbers, =TODAY → today's date

Case Study #1



City of Waterloo, IA

Unique configuration of treatment plants and influent characteristics make operation more challenging

Satellite Facility Designed to Accept Designated Industrial Waste only




Easton Facility Designed to Accept Domestic and Minor Industrial Waste only

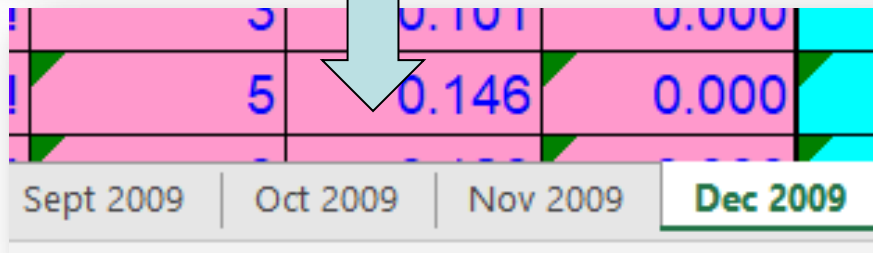
Current Mode of Operation was To Combine the Waste and Treat Only Thru the Easton Facility

Challenge - Data collected in monthly sheets

Reports 2009	4/25/2017 8:42 AM	File folder
Reports 2010	4/25/2017 8:42 AM	File folder
Reports 2011	4/25/2017 8:42 AM	File folder
Reports 2012	4/25/2017 8:42 AM	File folder
Reports 2013	4/25/2017 8:42 AM	File folder
Reports 2014	7/19/2017 10:40 AM	File folder
Reports 2015	2/5/2018 2:35 PM	File folder
Reports 2016	10/9/2017 3:46 PM	File folder
Reports 2017	7/3/2017 9:28 AM	File folder



DNR 2009.xls	3/12/2010 8:49 AM	Microsoft Excel 97...	535 KB
Easton Performance 2009.xls	2/15/2017 2:37 PM	Microsoft Excel 97...	724 KB
Industry 2009.xls	1/26/2010 12:06 PM	Microsoft Excel 97...	874 KB
Landfill 2009.xls	1/20/2010 10:06 AM	Microsoft Excel 97...	70 KB
Sludge 2009.xls	1/12/2010 10:11 AM	Microsoft Excel 97...	379 KB



5	0.101	0.000
5	0.146	0.000

Sept 2009 | Oct 2009 | Nov 2009 | **Dec 2009**

All data sources consolidated into one spreadsheet tool

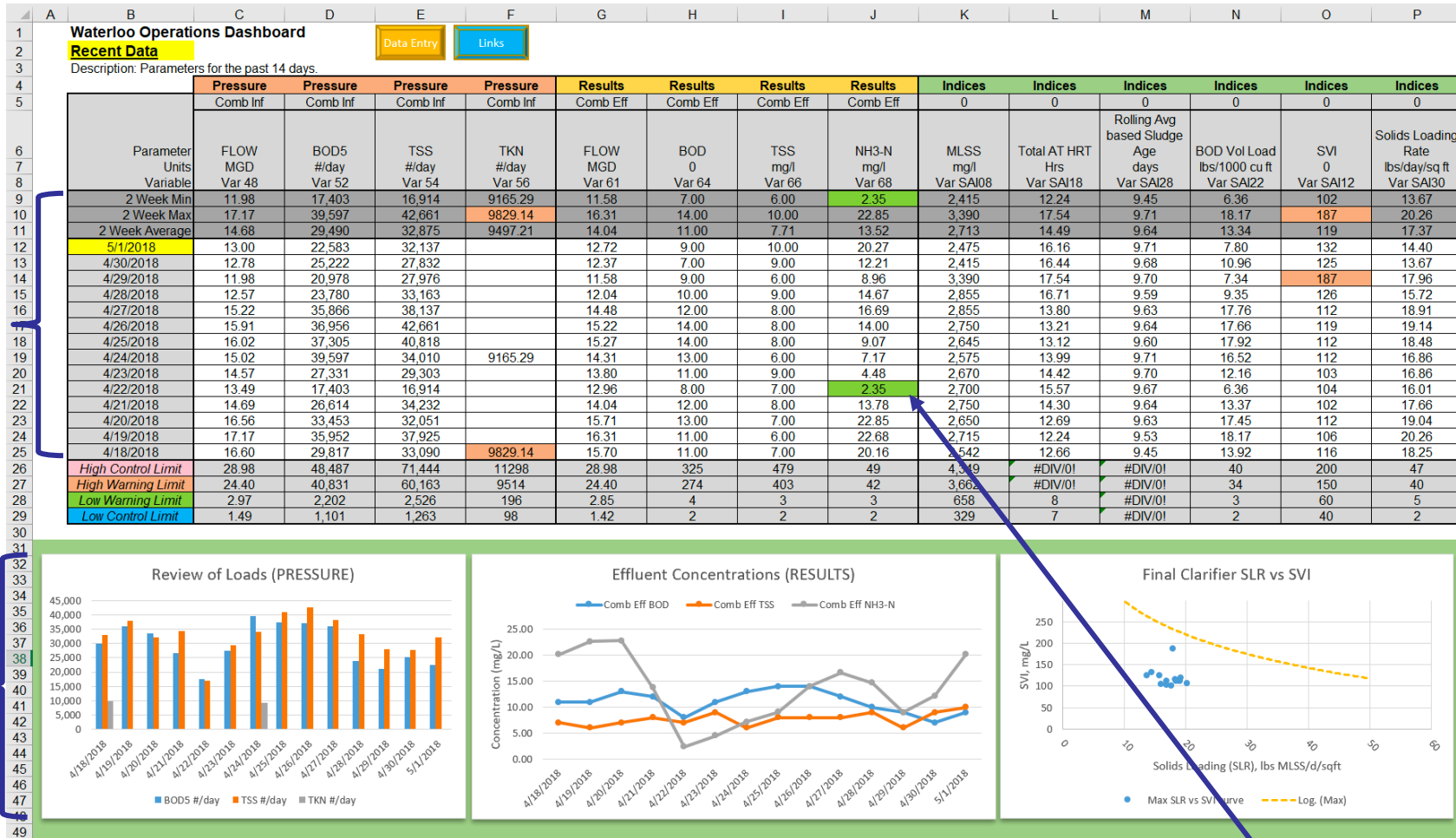
- New Spreadsheet Tool was created for plant staff

Links	Dashboard	Wasting Dashboard	100 Day Highlight	Data Sheet	Flows and Loads	Wasting Considerations	Clarifier Considera ...	+
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- “Data Sheet” consolidates historical data and new data collected by staff

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	
5	Home	Links	Total	10253											
6			Min	5.64	30.00	0.00	72.00	0.00	5.60	0.00	9.07	0.00	2.81	0.00	6.61
7			Max	27.00	442.00	36853.79	990.00	63162.99	110.88	7453.40	111.90	13468.51	29.40	1989.06	8.26
8			Average	11.65	210.45	17908.26	228.28	20257.22	42.42	3778.32	44.16	3892.32	10.48	915.32	7.49
9	<-- Click Plus to Expand		Count	880	611	618	616	618	117	120	109	113	111	114	880
10			Upper Warning	26	420	35011	941	60005	105	7081	106	12795	28	1890	9.0
11			Upper Watch (6	22	354	29483	792	50530	89	5963	90	10775	24	1591	8.5
12			Lower Watch (1	8	100	3582	100	4051	8	756	9	778	2	183	6.5
13			Lower Warning	5	75	1791	75	2026	4	378	4	389	1	92	6.0
14															
15	East Inf	Metals Eff	RAS/WAS	Var 1	Var 4	Var 5	Var 6	Var 7	Var 8	Var 9	Var 10	Var 11	Var 12	Var 13	Var 14
16	East Eff	Comb Eff	Primaries	Eas Inf	Eas Inf	Eas Inf	Eas Inf	Eas Inf	Eas Inf	Eas Inf	Eas Inf	Eas Inf	Eas Inf	Eas Inf	Eas Inf
17	Sat Inf	Statistics	TAS	INFLUENT											
18	Sat Eff	EQ OF	Digesters	FLOW	BOD5	BOD5	TSS	TSS	TKN	TKN	TOTAL N	TOTAL N	TOTAL P	TOTAL P	pH
19	Comb Inf	AB 1-4	Limits	MGD	mg/l	#/day	mg/l	#/day	mg/l	#/day	mg/l	#/day	mg/L	#/day	SU
20	Comb Eff														
21			1/1/2016	12.76											7.57
22			1/2/2016	13.24											6.34
23			1/3/2016	12.33											7.52
24			1/4/2016	13.04											7.30
25			1/5/2016	13.31	332.00	36853.79	320.00	35521.73							7.21
26			1/6/2016	13.02	234.00	25403.31	330.00	35833.64	45.92	4386.31					7.56
27			1/7/2016	15.17	212.00	26821.77	250.00	31623.45							7.63
28			1/8/2016	18.00											7.14
29			1/9/2016	16.65											7.10
30			1/10/2016	15.40											7.38
31			1/11/2016	15.31											7.42
32			1/12/2016	14.77	166.00	20448.18	200.00	24636.36							7.23
33			1/13/2016	14.23	168.00	19937.94	200.00	23735.64	39.20	4652.19					7.31
34			1/14/2016	13.98	200.00	23318.64	240.00	27982.37							7.54

Dashboard presents key parameters and trends for operators' review

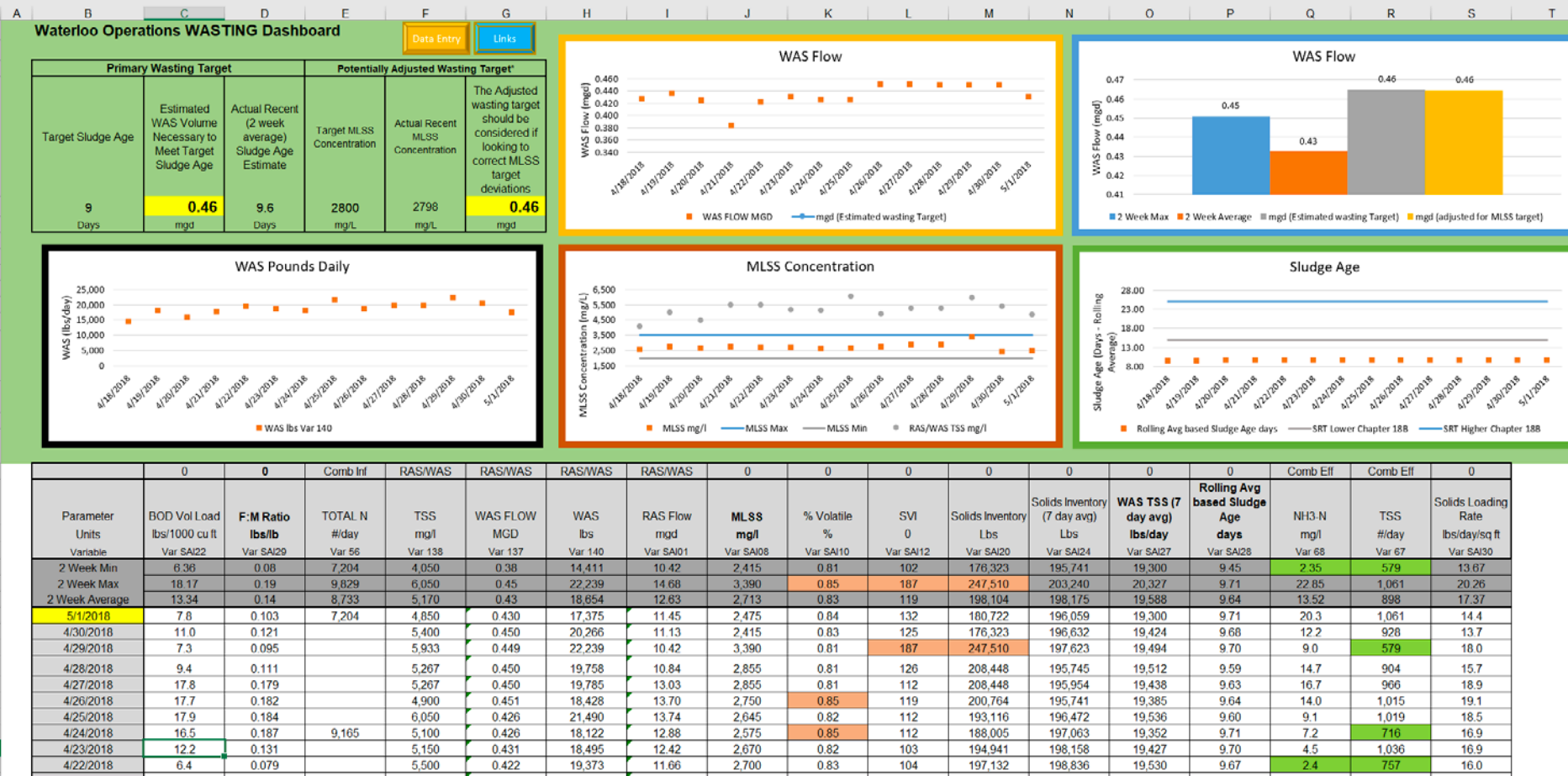


Most Recent 14 days of Data Shown

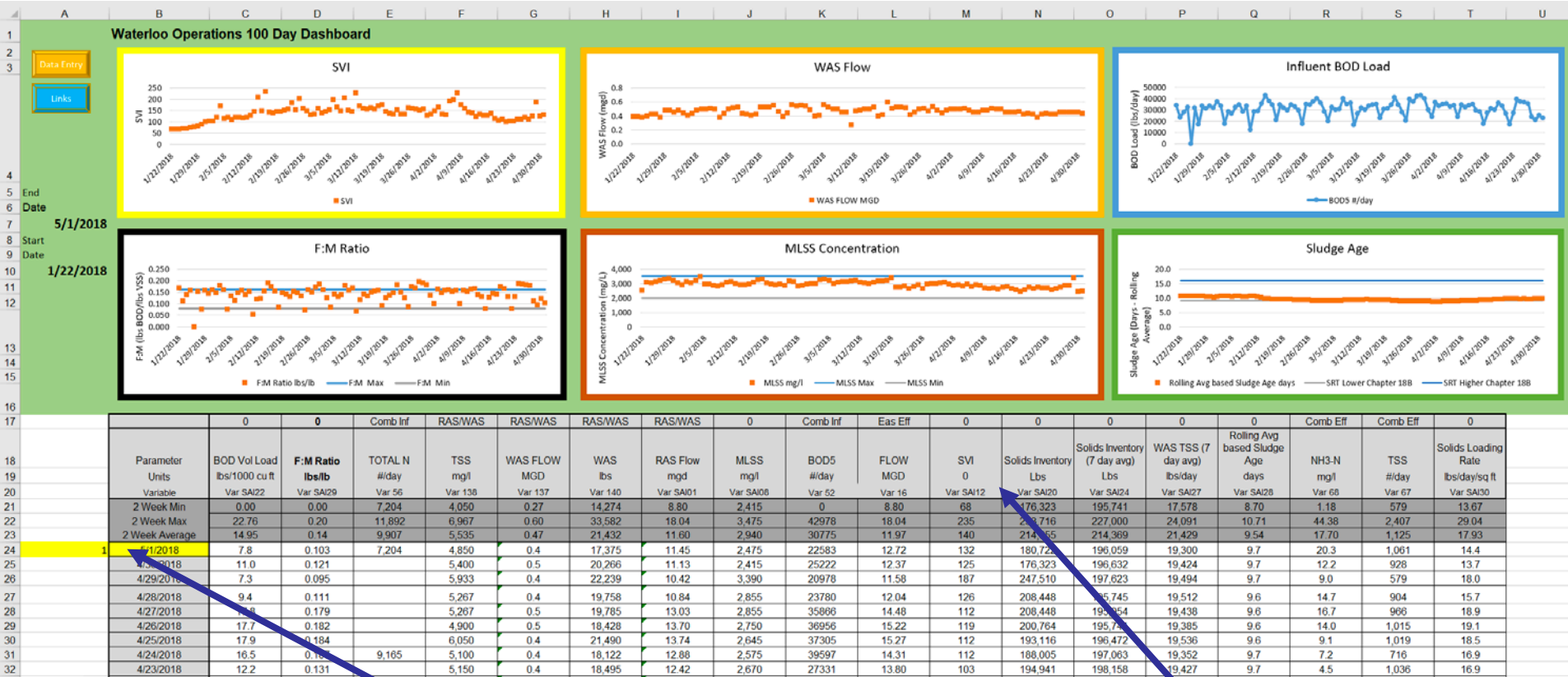
Charts show recent trends

Conditional Formatting Warns of High or Low Values

Specialized dashboards were created for specific processes



Long-term trends help operators understand system performance



100 day trend can be most recent data (default) or starting at a user-defined date.

Trending parameters can be customized

Use of functions allows “Dashboard” functionality



	A	B	C
17			0
18		Parameter	BOD Vol Load
19		Units	lbs/1000 cu ft
20		Variable	Var SAI22
21		2 Week Min	6.07
22		2 Week Max	22.76
23		2 Week Average	14.90
24	Date Offset	20	5/13/2018
25			5/12/2018

Formula in C24...

```
=VLOOKUP($B24,'Data Sheet'!$B$21:$HJ$901,MATCH(C$20,'Data Sheet'!$B$15:$HJ$15,0),FALSE)
```

Advanced functions make finding important data easier



=VLOOKUP

- Use when, you want to find things in a table
- =VLOOKUP(lookup_value, table_array, col_index_num, [range_lookup])
 - Value you want to look up
 - range where you want to lookup the value,
 - the column number in the range containing the return value,
 - Exact Match or Approximate Match – indicated as 0/FALSE or 1/TRUE).
- **Important: Lookup value needs to be in the Left most Column**

=MATCH

- The MATCH function is designed for one purpose: find the numeric position of an item in a list.
- =MATCH(lookup_value, lookup_array, [match_type])

Extra Credit: =INDEX

Operators can dive into the "nitty gritty" data to study performance and develop correlation

Solids Inventory - Sludge Age

Solids Inventory is the total amount of solids managed in the system. For simplicity, this measurement will include solids in the aerobic and anoxic zones but will not attempt to quantify solids in the clarifiers.

Sludge age is the average amount of time (in days) that solids will be allowed to remain in the system. This factors in the solids inventory as described above as well as the solids removed in the effluent and the waste activated sludge.

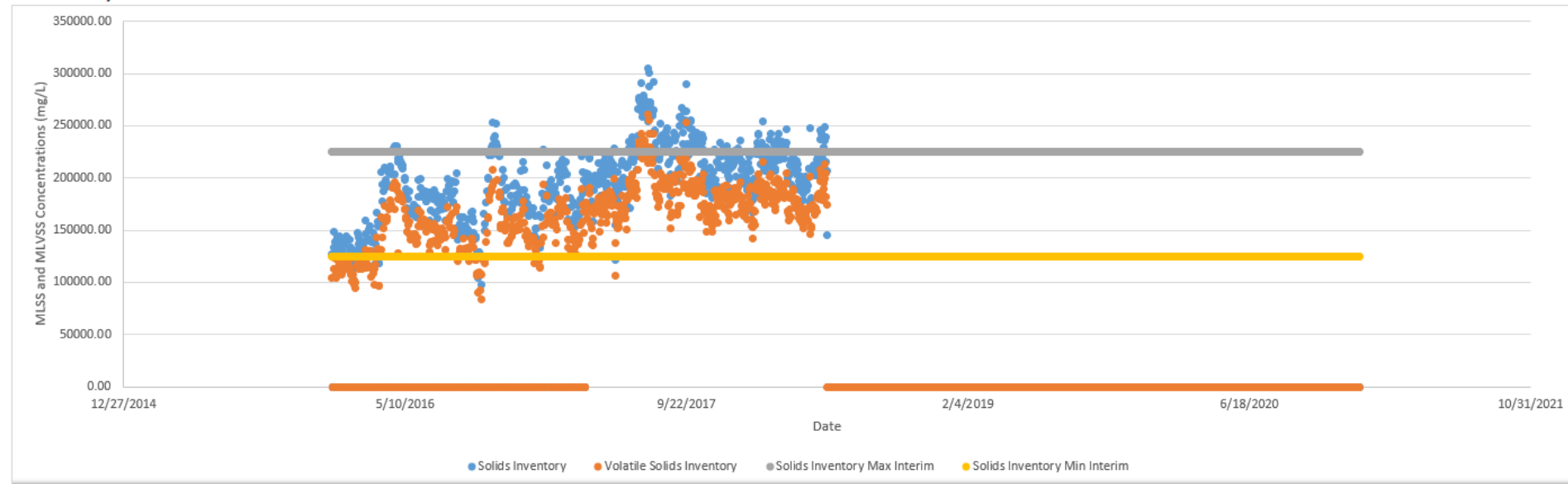
Target Inventory TBD

Adequate quantities of organisms need to be present to both remove the carbonaceous BOD and the Nitrogenous BOD. Too few solids might result in poor BOD and ammonia removal efficiencies. Too many solids may result in promotion of filamentous organisms and may create solids loading stress on the clarifiers.

Data Entry

Links

Solids Inventory MLSS and MLVSS



Links

Dashboard

Wasting Dashboard

100 Day Highlight

Data Sheet

Flows and Loads

Wasting Considerations

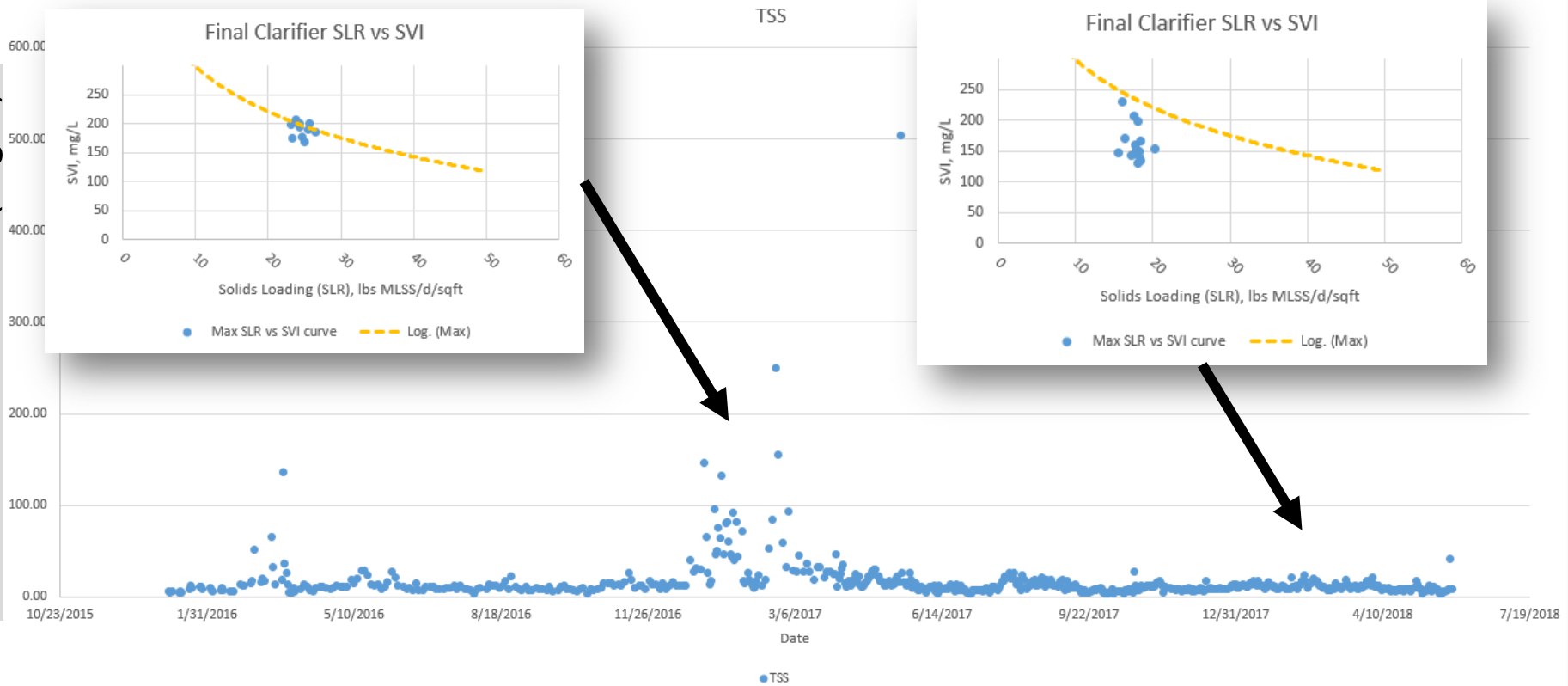
Clarifier Considera ... (+)

Operators can dive into the "nitty gritty" data to study performance and develop correlation

February 2017

March 2018

TSS Concentration (mg/L)



Hyperlinks are used for easy navigation around document

DASHBOARDS

Dashboard

Wasting Dashboard

100 Day Highlights

DATA ENTRY

Data Entry Home

East Inf EQ OF

East Eff AB 1-4

Sat Inf RAS/WAS

Sat Eff Primaries

Comb Inf TAS

Comb Eff Digesters

Metals Eff Limits

Comb Eff Statistics

FIGURES

click chart name to jump directly to specific charts

Flows and Loads

[Influent Flows and Loads](#)

[Influent versus Effluent Flow](#)

[Effluent, RAS, WAS Flow](#)

[Influent BOD Load](#)

[Influent TKN Load](#)

[Influent BOD Load vs Influent Load](#)

[Units in Service](#)

Clarifier Considerations

[Solids Loading Rate](#)

[SVI](#)

[RAS vs SVI](#)

[MLSS vs RAS SS](#)

[Blanket Depth](#)

Performance

[Effluent BOD and TSS](#)

[SVI](#)

[Effluent Nitrogen](#)

Wasting Considerations

[Solids Inventory](#)

[Percent Volatile](#)

[Sludge Age vs SVI](#)

[Sludge Age](#)

[F:M Ratio](#)

[MLSS Concentration](#)

Nitrification

[HRT vs Eff NH3](#)

[Solids Inventory vs Eff NH3](#)

[Sludge Age vs Eff NH3](#)

[pH vs Eff NH3](#)

[Temperature vs Eff NH3](#)

[Influent Load vs Eff NH3](#)

[Vol Load vs Eff NH3](#)

[Volumetric Loading](#)

SLR vs SVI

Case Study #2



Meister Dairy



Parameters for existing and new processes clearly documented with data collection notes

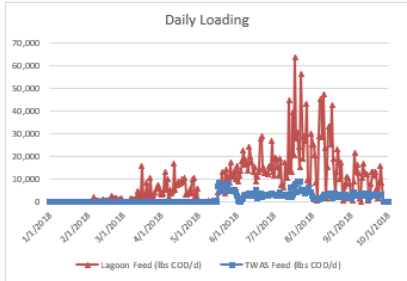
MEISTER CHEESE / MUSCUDA PROTIN PRODUCTS WWTP					Wastewater Treatment Operating Data Log				
Process Spreadsheet					Gas Spreadsheet				
Group	Parameter	Unit	Data Collection Notes	Code	Group	Parameter	Unit	Data Collection Notes	Code
Influent	Flowrate	gpd		I1	Heat Exchange	Hot In	Deg F	From heat exchanger	HE1
	COD	mg/L		I2		Hot Out	Deg F	From heat exchanger	HE2
		lbs/day	Calculated	I3		Cold In	Deg F	From heat exchanger or SCADA	HE3
	pH	s.u.		I4		Cold Out	Deg F	From heat exchanger or SCADA	HE4
To Aerobic Treatment	Feed	Gal		LB1		Flowrate	gpm	From SCADA	HE5
	pH	S.u.	Calculated	LB2	Gas	WGB Bio	cfm	SCADA	G1
	COD	mg/L	Calculated	LB3		CoGen Bio	cfm	SCADA	G2
	Feed	lbs COD/d	Calculated	LB4		Total Bio	cfm	Calculated	G3
To Lagoon Influent	Feed	Gal		LF1		Methane CH4	% Frac	SCADA	G4
	pH	S.u.	Calculated	LF2		Lag 1	H2O	SCADA	G5
	COD	mg/L	Calculated	LF3		Lag 2	H2O	SCADA	G6
	Feed	lbs COD/d	Calculated	LF4					
Flow Check			LF5						
TWAS Feed	Feed	Gal	Estimate based on feeding	TF1	Sludge Spreadsheet				
	pH	s.u.	Grab Sample during feeding	TF2	001 - Ridge and Furrow				
	COD	mg/L	Grab during feeding	TF3	Group	Parameter	Unit	Data Collection Notes	Code
	TWAS Feed	lbs COD/d	Calculated	TF4	Ridge and Furrow Feed	Sample Point			
Primary Lagoon Contents (IR at mixing Pump)	TSS	mg/L	From mixing pump sample tap	PL1		Feed	Gal		
	SS		From mixing pump sample tap	PL2		Chloride TKN	mg/L		
	pH	s.u.	From mixing pump sample tap	PL3		Total Nitrogen	mg/L		
	VA	mg/L	From mixing pump sample tap	PL4		COD	mg/L		
	Alk	mg/L	From mixing pump sample tap	PL5		Phosphorus, T	mg/L		
	VA:Alk	Ratio	Calculated	PL6	Outfall 001	Source of Discharge			
	sCOD	mg/L	From mixing pump sample tap	PL7		Start Time	hh:mm		
	Level	Feet	Measure down at Control Structure 1 - (17-measured depth = level)	PL8		End Time	hh:mm		
	Volume	MG	Use table	PL9		Cell A	Gallons		
	Alk	lbs in lag	Calculated	PL10			Cell		
	Weekly NH3	mg/L		PL11		Cell B	Gallons		
	HRT	Days	Future calculation once discharging	PL12			Cell		
	MS Loc.		1 = North Middle; 2 = North East location	PL13		Cell C	Gallons		
	Temp	Deg F	SCADA or TT at suction side of mixing pump	PL14		Cell			
Influent	TSS	mg/L	Future sample once discharging	LE1	Notes				
	SS		Future sample once discharging	LE2					

Charts allow operators to monitor multiple parameters for user-defined periods

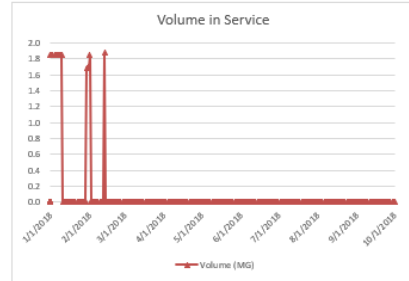
MEISTER CHEESE / MUSCUDA PROTIEIN PRODUCTS WWTP

Wastewater Treatment Operating Data Log

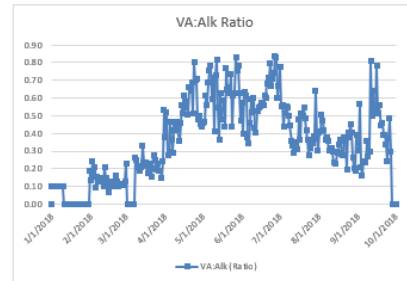
Start [1/1/2018](#)
End [10/1/2018](#) [Click dates to edit](#)



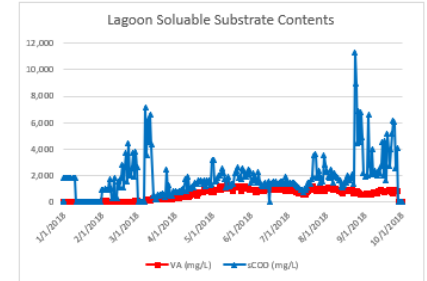
	Unit	Average	Maximum	Minimum	Total
LF4 Lagoon Fee (lbs COD/d)		10,833	-	-	-
TF4 TWAS Feed (lbs COD/d)		-	-	-	-



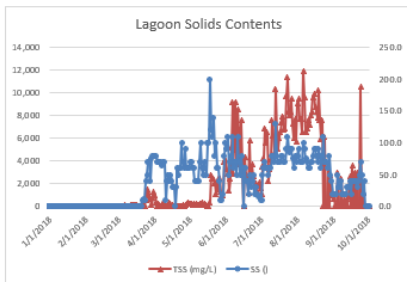
	Unit	Average	Maximum	Minimum
PL9 Volume (MG)		1	2	-



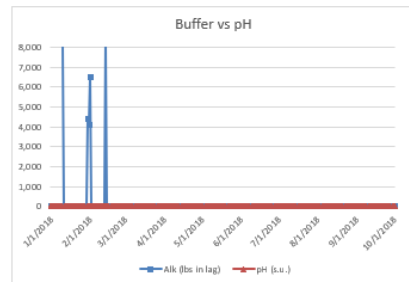
	Unit	Average	Maximum	Minimum	Total
pl6 VA:Alk (Ratio)		0	0	-	1



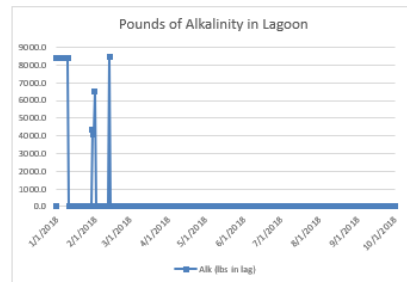
	Unit	Average	Maximum	Minimum	Total
pH VA (mg/L)		19	55	-	-
p17 sCOD (mg/L)		597	1,850	-	18,500



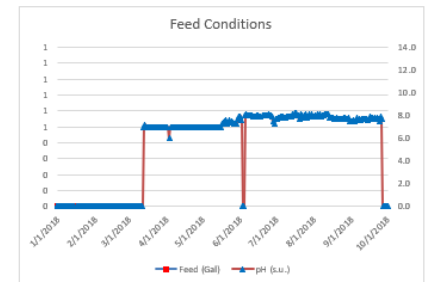
	Unit	Average	Maximum	Minimum	Total
p11 TSS (mg/L)		4	13	-	-
p12 SS (l)		-	-	-	-



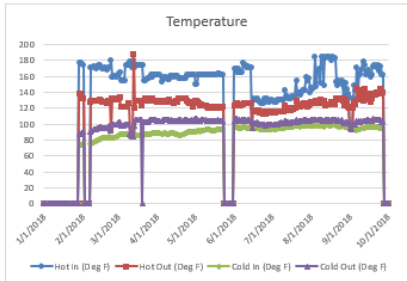
	Unit	Average	Maximum	Minimum
p10 Alk (lbs in lag)		2,992	8,424	-
p13 pH (s.u.)		3	8	-



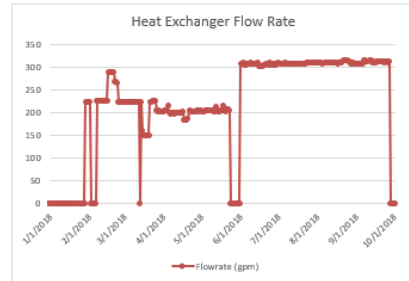
	Unit	Average	Maximum	Minimum	Total
PL10 Alk (lbs in lag)		2,992	8,424	-	-



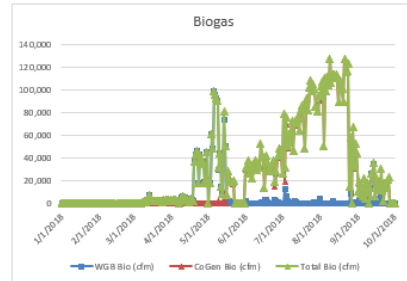
	Unit	Average	Maximum	Minimum	Total
TF2 pH (s.u.)		-	-	-	-
TF3 COD (mg/L)		-	-	-	-



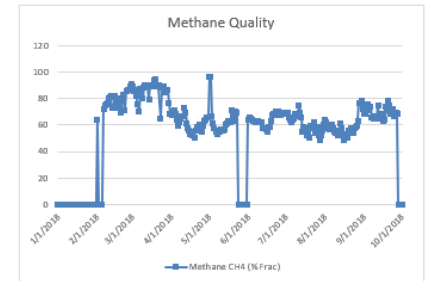
	Unit	Average	Maximum	Minimum	Total
HE1 Hot In (Deg F)		17	178	-	532
HE2 Hot Out (Deg F)		13	138	-	-
HE3 Cold In (Deg F)		7	75	-	-
HE4 Cold Out (Deg F)		8	89	-	-



	Unit	Average	Maximum	Minimum
HE5 Flowrate (gpm)		22	225	-



	Unit	Average	Maximum	Minimum	Total
G1 WGB Bio (cfm)		-	-	-	-
G2 CoGen Bio (cfm)		-	-	-	-
G3 Total Bio (cfm)		-	-	-	-



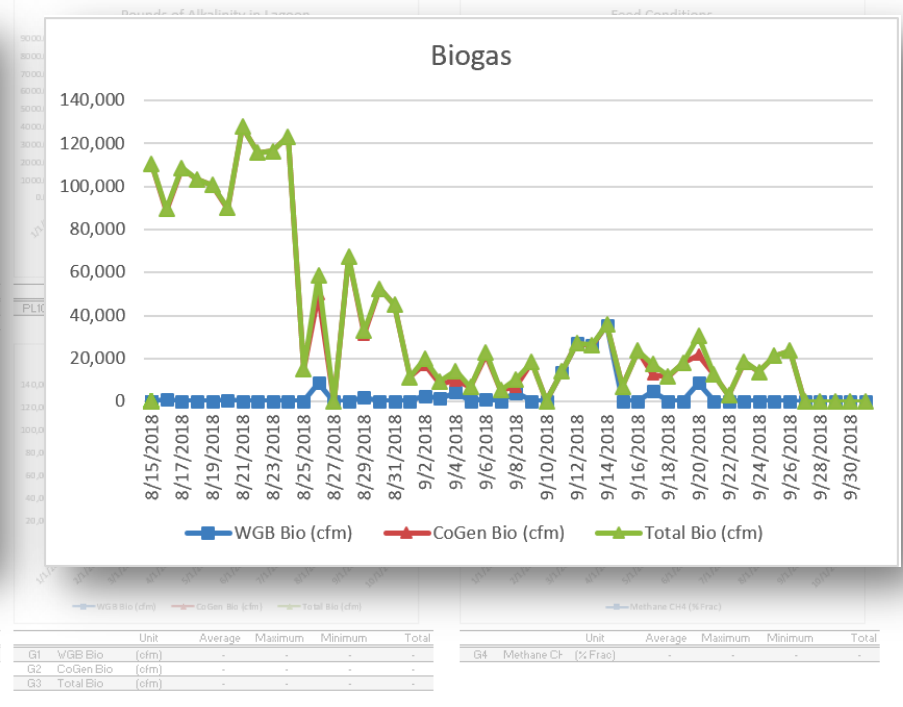
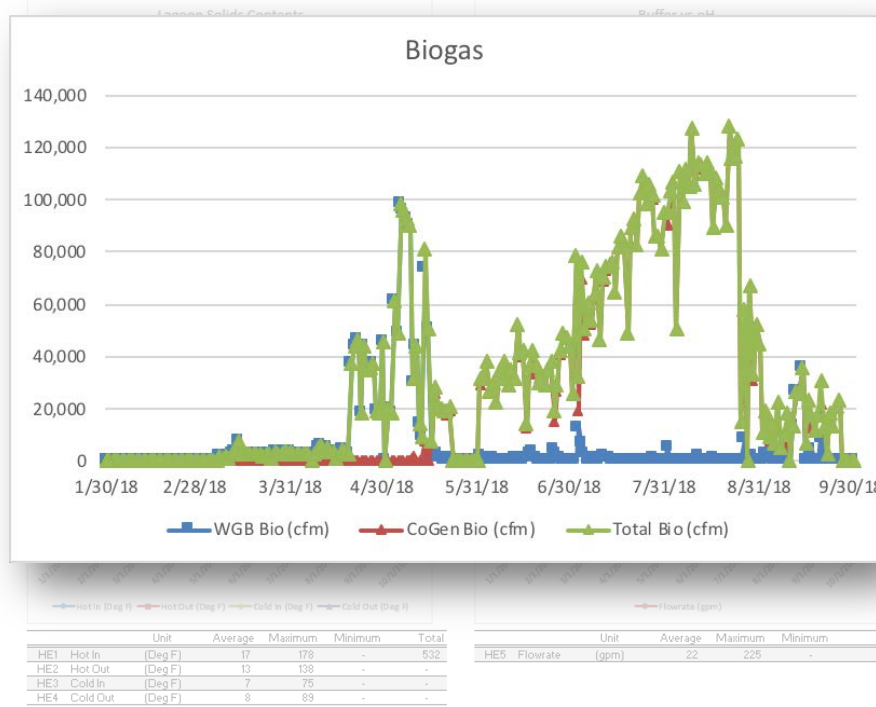
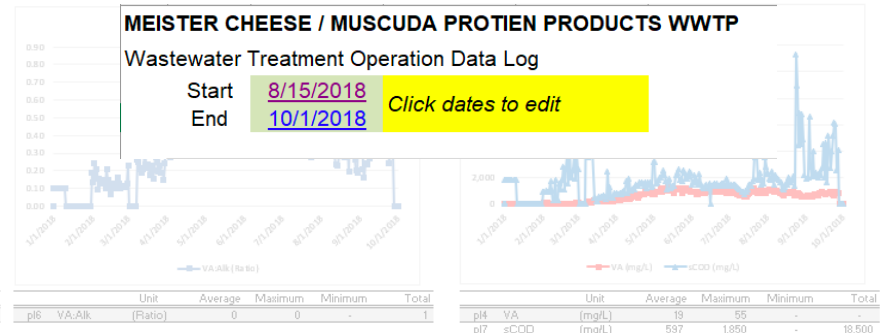
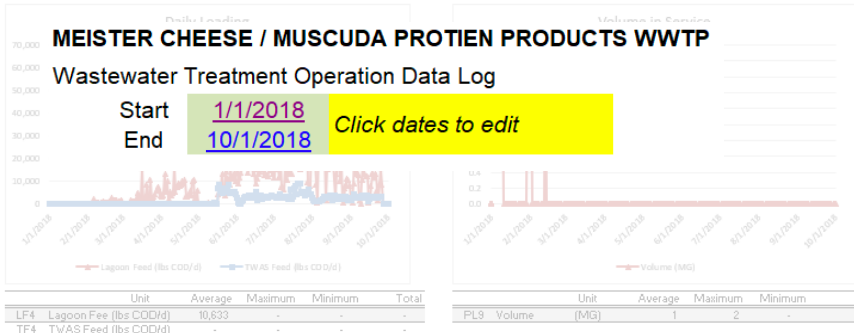
	Unit	Average	Maximum	Minimum	Total
G4 Methane CH4 (%Frac)		-	-	-	-

Charts allow operators to monitor multiple parameters for user-defined periods

MEISTER CHEESE / MUSCUDA PROTIEI PRODUCTS WWTP

Wastewater Treatment Operation Data Log

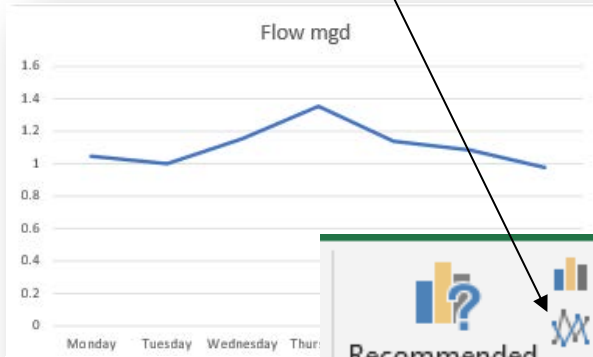
Start [1/1/2018](#)
End [10/1/2018](#) [Click dates to edit](#)



Visualizing your data starts with picking the right chart

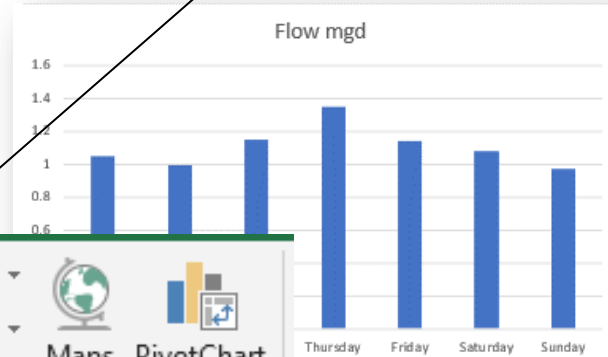


Line

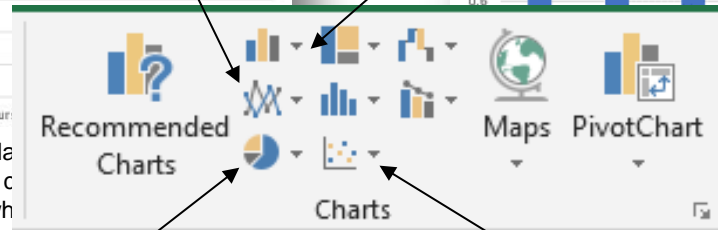


A line chart is used to display data over time (days, months or years) or categories where the order is important. Use it when the order of points and the order is important.

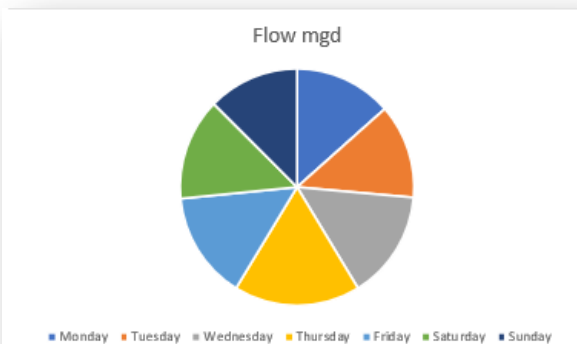
Bar



A bar chart is used to compare values across categories. Use it when the order of categories is not important.

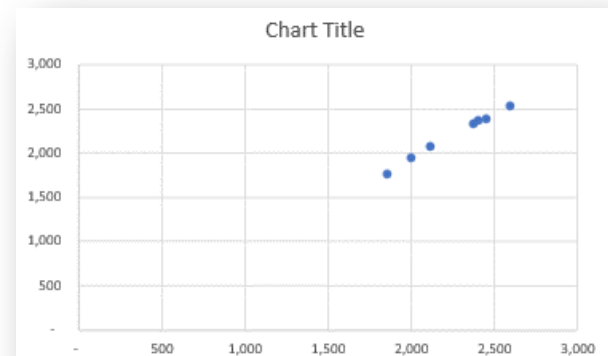


Pie



A pie chart is used to show proportions of a whole. Use it to show numbers that relate to a larger sum and always equal 100%. Do not use this chart if it contains many slices as angles are hard to estimate.

Scatter



A scatter chart is used to compare at least two sets of values or pairs of data. Use it to show relationships between sets of values.

Add charts to your worksheet with just a few clicks



1. Organize data

	A	B
1	Date	Flow (mgd)
2	7/19/17	6.08
3	7/20/17	6.13
4	7/21/17	6.91
5	7/22/17	7.18
6	7/23/17	8.41
7	7/24/17	8.09
8	7/25/17	7.76
9	7/26/17	6.77
10	7/27/17	6.26
11	7/28/17	6.94
12	7/29/17	9.16
13	7/30/17	8.38
14	7/31/17	7.66
15	8/1/17	7.12
16		

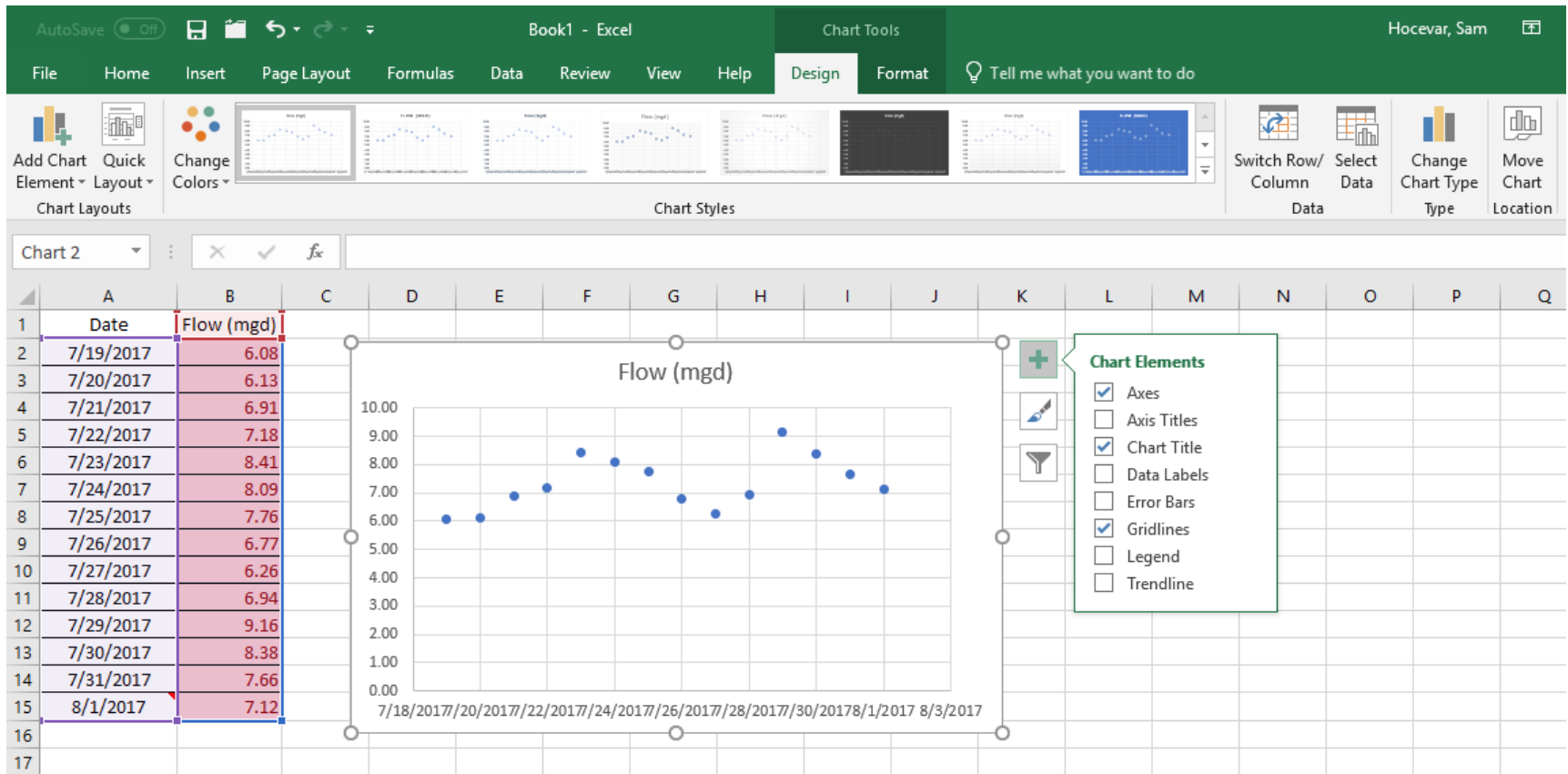
2. Choose your chart type.

The screenshot shows the Microsoft Excel ribbon with the 'Insert' tab selected. The 'Recommended Charts' task pane is open, displaying various chart options. The 'Scatter' category is selected, showing several scatter plot styles. A light blue arrow points from the 'Insert' tab to the 'Recommended Charts' task pane, and another light blue arrow points from the 'Recommended Charts' task pane to the 'Scatter' category.

Add charts to your worksheet with just a few clicks



3. Format to suit – *Practice Makes Perfect*



Case Study #3



Morgantown Utility Board (MUB)

Morgantown, WV

Upgrade at the Star City WWTP will reduce biological treatment capacity while constructing new MBR System



Dashboard brings recent data front and center

Morgantown Utility Board
 WWTP SOP - Version 2.6
 Today's Date 10/2/2018

Maximum Allowable Flow: 10.05 mgd
 Maximum Flow Determined By: Additional Flow to AT Max Loading (mgd) - 7 day avg

Historical Data

Description: Stress parameters for the past 14 days, starting with yesterday.

Date	Select Parameters										Stress Parameters						FC in Service
	Flow to AS mgd	RAS Flow mgd	Flow to Bypass mgd	Settled PRE BOD mg/L	Settled PRE BOD/"Total" PRE BOD Ratio	"Total" PRE BOD mg/L	AS BOD ^a lbs/d	MLSS mg/L	30 Min SSV	lb BOD/ 1,000 cuft	AT HRT ^c hours	Clarifier OF gpd/sf	SLR ^b lb MLSS/d/sf	SVI ^b mg/L	SLR vs SVI Warning		
Max	8.472	3.233	4.223	86.40		141.64	7555	3300	190	21	12	561	19	60			
Min	5.382	2.122	0.000	62.07		101.75	4832	2880	150	14	8	357	13	47			
7-day average	6.94	2.653	0.217	62.07		101.75	6046	3050	167	17	9	460	16	54			
14-day average	6.541	2.507	0.411	74.44		122.04	6083	3055	165	17	10	433	16	53			
8/28/2017	6.70	2.56	0.00		0.61			3300	170		9.53	443.80	16.9	52	Good	3	
8/27/2017	6.07	2.33	0.00		0.61				190		10.51	402.45				3	
8/26/2017	6.10	2.34	0.00		0.61			2900	170		10.47	404.17	13.5	59	Good	3	
8/25/2017	6.79	2.61	0.00		0.61			3020	180		9.40	450.03	15.7	60	Good	3	
8/24/2017	7.32	2.80	0.00		0.61			3100	160		8.72	485.02	17.3	52	Good	3	
8/23/2017	8.47	3.23	0.35		0.61			2920	150		7.54	561.43	18.9	51	Good	3	
8/22/2017	7.12	2.72	1.17	62.07	0.61	101.75	6046	3060	150	17.00	8.96	472.10	16.6	49	Good	3	
8/21/2017	6.40	2.44	0.00	86.40	0.61	141.64	7555	2880	160	21.25	9.98	423.86	14.1	56	Good	3	
8/20/2017	5.67	2.18	0.00	62.31	0.61	102.15	4832		160	13.59	11.26	375.88				3	
8/19/2017	6.77	2.60	0.00		0.61			3140	160		9.42	448.91	16.3	51	Good	3	
8/18/2017	7.37	2.81	4.22		0.61			3120	160		8.67	488.14	17.5	51	Good	3	
8/17/2017	5.63	2.16	0.00	79.11	0.61	129.69	6088	3160	150	17.12	11.34	373.03	13.6	47	Good	3	
8/16/2017	5.38	2.12	0.00	76.02	0.61	124.62	5594	3040	175	15.73	11.86	356.66	12.6	58	Good	3	
8/15/2017	5.78	2.22	0.01	80.76	0.61	132.39	6382	3020	170	17.95	11.04	383.04	13.3	56	Good	3	
High Control Limit	11	12	12	200		200	3000	5000	800	16.6	18	750	50	225			
High Warning Limit	9	10	8	120		120	5000	4000	700	14	15	600	40	180			
Low Warning Limit	6	4	0	60		60	1500	1500	200	5	6	250	5	70			
Low Control Limit	0	3	0	40		40	1000	1000	100	3	5	150	3	50			

Note: adding or removing columns to Data Entry may break VLOOKUP.

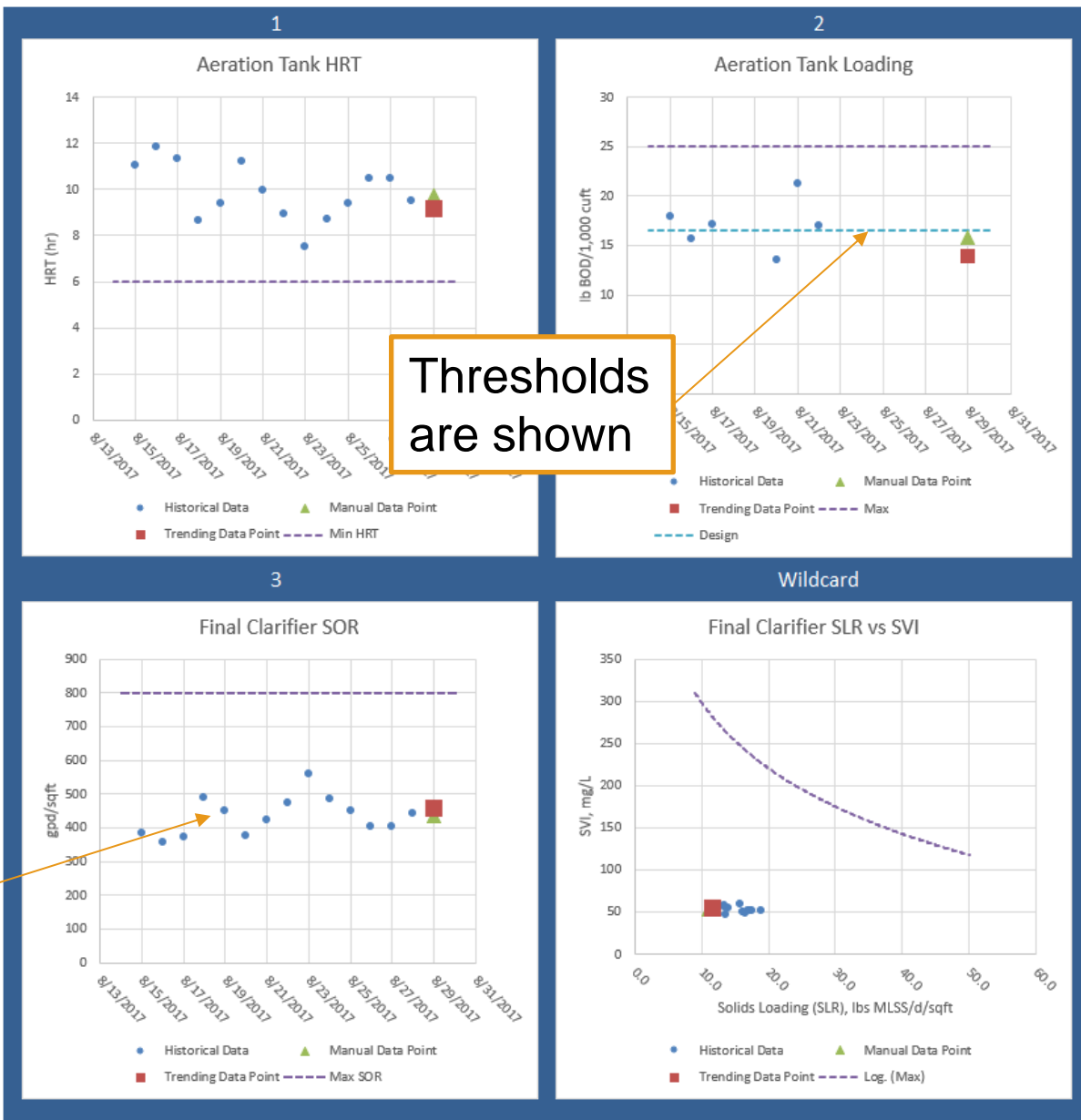
Most Recent 14 days of Data Shown

Conditional Formatting Warns of High or Low Values

Dashboard graphs help to visualize trends and system pressure

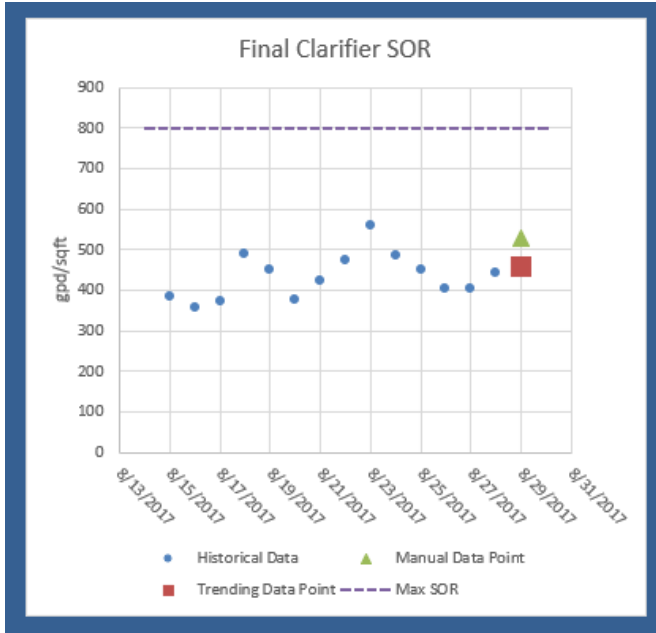
- Tool focused on four key parameters which would indicate AS stress


Recent data can be compared to design conditions



Thresholds are shown

“Trending” and “What If” data points allow staff to evaluate several future scenarios



 Trending data point predicts the next value if conditions remain as trending.

Trending Data Point

Description: The values in the cells below show tomorrow's projected data point based on the 7-day average values shown above. If 7-day average is not available due to lack of data, 14-day average is used and cell(s) are highlighted.

Date	Projected Flow to AS mgd	Projected RAS Flow mgd	Projected lb BOD/ 1,000 cuft	Projected AT HRT hours	Projected Clarifier OF gpd/sf	Projected SLR lb MLSS/d/sf	Projected SVI mg/L
8/29/2017	6.94	2.65	13.96	9.20	460	11.7	55

Note: If number of FC in service will change, modify shaded cell below to adjust Clarifier OF and SLR calculations.

FC in service	3
---------------	---



Manual data point allows operation staff to review potential “what if” scenarios.

Calculator: Manual Data Point

Description: Used to manually plot a data point based on desired parameters. Enter values into the green cells below. To return to historical values, clear cells.

Input Table

Parameters	14-Day Average	Value
Flow to AS, mgd	6.541	8.00
RAS Flow, mgd	2.507	
BOD, mg/L	74	200
MLSS, mg/L	3055	3500
30 Min SSV, mg/L	165	400
Number of FC in Service		3
Final Clarifier SA, total, sf		15090
Aeration Tank Volume, mg		2.66

Manual Data Point

Date	Manual lb BOD/ 1,000 cuft	Manual AT HRT hours	Manual Clarifier OF gpd/sf	Manual SLR lb MLSS/d/sf	Manual SVI mg/L
8/29/2017	49.29	7.98	530	15.5	114

Tool calculates potential unutilized capacity based on key stress parameters

- The most conservative result is posted for consideration by the operator.

Additional AS Capacity

Calculates unutilized capacity and total potential flow through AS before key stress parameter is exceeded. See area to right of charts for unutilized capacity calculations for each stress parameter; smallest value used to calculate total potential flow.

Yesterday Flow:	6.70 mgd
Unutilized Capacity:	3.35 mgd
Maximum Allowable Flow:	10.05 mgd
Limiting Factor:	Additional Flow to AT Max Loading (mgd) - 7 day avg

Unutilized Capacity Calculations*

Aeration Tank HRT	Value	Based on Value
Inputs		
Flow (Yesterday***)	6.70 mgd	Yesterday
Min HRT	6.0 hours	
Max Flow at Min HRT	10.64 mgd	
Additional Flow to AT Max HRT (mgd)	3.94 mgd	
Aeration Tank Loading		
Inputs		
Aeration Tank Loading (7-day Average)	17.00 lb/1000cuft	
PRE BOD (7-day average)	101.75 mg/L	
Additional Flow to AT Design Loading (mgd) - 7 day avg	-0.17 mgd	
Additional Flow to AT Max Loading (mgd) - 7 day avg	3.35 mgd	
Aeration Tank Loading (14-day Average)	17.1 lb/1000cuft	
PRE BOD (14-day average)	122.0 mg/L	
Additional Flow to AT Design Loading (mgd) - 14 day avg	-0.18 mgd	
Additional Flow to AT Max Loading (mgd) - 14 day avg	2.76 mgd	
Final Clarifier SOR		
Inputs		
SOR (Yesterday***)	443.80 gpd/sf	Yesterday
Max SOR	795 gpd/sf	
Clarifiers in Service (Yesterday)	3	
SA	15090 sf	
Additional Flow to FC Max SOR	5.30 mgd	
Final Clarifier SLR vs SVI		
Inputs		
SLR (Yesterday***)	17 lb MLSS/d/sf	Yesterday
MLSS (Yesterday***)	3300 mg/L	Yesterday
SVI (Yesterday***)	52 mg/L	Yesterday
RAS (Percent of Influent Q)	40%	
Clarifiers in Service	3	
SA	15090 sf	
Critical SLR for 7-day Avg SVI	90.4 mg/L	
Additional Flow to Max SLR (mgd)	28.8 mgd	
<i>(Assumes constant SVI)</i>		

* Note: Highlighted value is limiting condition.

** Number of Clarifiers in Service based on most recent day (i.e. first row of table)

*** If yesterday value is not available, value from day before yesterday used. If day before yesterday is not available, 7-day avg is used.

As you prepare to use your new digital tool kit, don't forget about "Safety First"

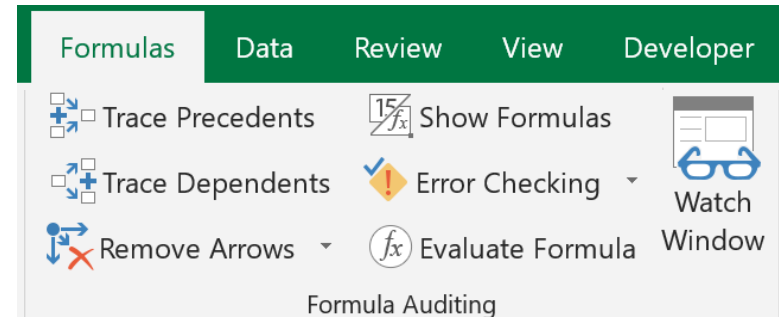
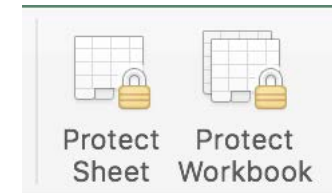
● Potential Pitfalls

- Mistakes/Errors
- Tracking Changes
- Version Control
- Data Quantity
- Not a substitute for professional judgement or experience

} Evaluate Database

● Best Practices

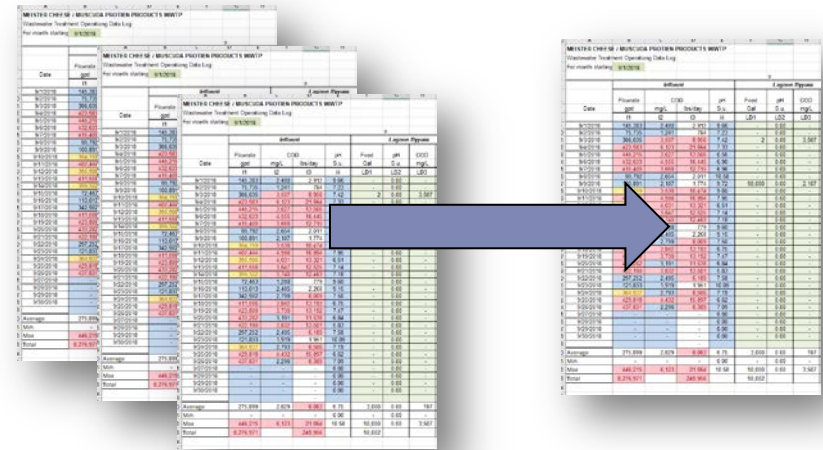
- Plan before you Execute
- Protection: Lock cells to prevent changes
- Check equations, cell references
- Less can be more
- Tailor for needs, users
- Ask for help (start with a Google Search)!



Recap: Why might you want to use excel?

Improve...

- Data Management
- Operations decisions
- Reporting

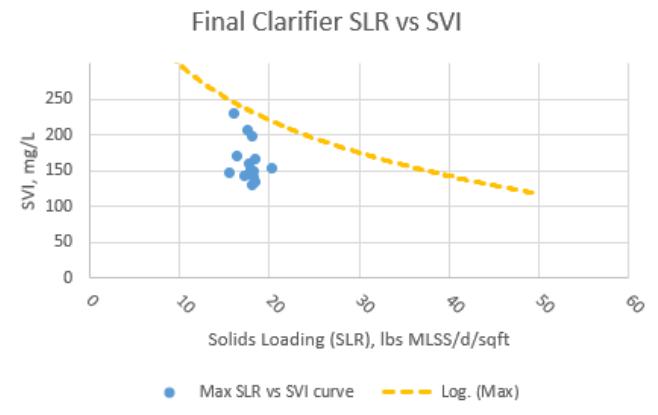


Supplement Existing Practices...

- Data Visualization
- Learning Tools
- Special projects or short term needs

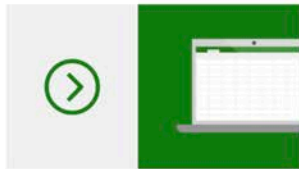
Excel is easily customizable and accessible...

But it's not the only tool!



Additional Resources

- Office Support (<https://support.office.com/en-us/excel>)



Excel training

Get the basics or explore more with these training courses.

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Questions and Answers





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