



AVEVAWORLD

# DATA MODERNIZATION AT THE UNIVERSITY OF IOWA WATER TREATMENT PLANT

Philip Shambaugh  
Process Improvement Project Manager





## **Philip Shambaugh**

Process Improvement Project Manager  
with ENGIE at the University of Iowa's  
Water Treatment Plant





# **The University of Iowa and ENGIE**

Began a 50 year public private partnership in January 2020

Both have been active PI users since the early 2000s





**“ The core advantage of data is that  
it tells you something about the world that  
you didn’t know before. ”**

Hilary Mason

# Old Methods of Data Capture

- Access database from 1990s
  - Confusing names
  - Broken links
  - Inaccurate constraints
  - What everyone was used to using

## Operations Log Entry Sheet

Date / Time:

11/28/2022 4:00:00 PM

Go To Main

Additional Data E

Pump Men

1

2

Filter Menu

1

2

Remarks

1

2

Misc Da

Plant Flow	Sludge Solids %			Sludge Hauled	Raw Temp (F)	Raw Temp (C)	Turbidity Units NTU					
	Softeners						Raw River	Sed Basins	Softeners			CC In
	1	2	3						1	2	3	
2.4					42	5.6	7.34	1.89	0.43	0.72		0.04

Alkalinity (mg/l)													Sat pH	Lang. Stab. Index	
River	Sed Basin		Softener 1			Softener 2			Softener 3			CC In			
	P	T	P	T	2p-t	P	T	2p-t	P	T	2p-t	P			T
182		164	42	66	18	44	72	16				4	36	8.8	0.50

Hardness (mg/l)											
River		Sed Basin		Softener 1		Softener 2		Softener 3		CC In	
tot.	Ca.	tot.	Ca.	tot.	Ca.	tot.	Ca.	tot.	Ca.	tot.	Ca.
224	134	222	132	122	70	128	88			68	46

pH										Chlorine Residual (mg/l)							
River	Sed Basin	Softeners			Filters			CW	CCEff	Ignore			Filters			CW	CCEff
		#1	#2	#3	1-2	3-4	5-6			#1	#2	#3	1-2	3-4	5-6		
8.2	7.88	11.1	11.1		9.2		9.2	9.3	9.2				1.5		1.5	1.3	2.3

CT Values			PO4 mg/l	Fluoride (mg/l)		Nitrate (mg/l)		Softener Sludge Settling Volumes								
cTq	cTa	Frac						Reaction Zone						Bottom Zone		
				No.1		No. 2		No. 3		No. 1	No. 2	No. 3				
				5 min	15 min	5 min	15 min	5 min	15 min	1 Hr	1 Hr	1 Hr				
58.6	326	5.6	0.62	0.19	0.63	0.8	0.5	230	150	190	130			840	560	



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Go To Main

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Pump Menu

1

2

Filter Menu

1

2

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1

2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
1	Date	ant flos-uf-#	s-uf-#	s-uf-#	sh	temp	t-rr	t-esl	t-uf-#1	t-uf-#2	t-uf-#3	t-cw	a-r	a-sl	a-sl	uf-#1	uf-#2	uf-#3	uf-#4	uf-#5	uf-#6	uf-#7	uf-#8	uf-#9	uf-#10	uf-#11	uf-#12	uf-#13	uf-#14	uf-#15	uf-#16	uf-#17	uf-#18	uf-#19	uf-#20	uf-#21	uf-#22	uf-#23	uf-#24	uf-#25	uf-#26	uf-#27	uf-#28	uf-#29	uf-#30	uf-#31	uf-#32	uf-#33	uf-#34	uf-#35	uf-#36	uf-#37	uf-#38	uf-#39	uf-#40	uf-#41	uf-#42	uf-#43	uf-#44	uf-#45	uf-#46	uf-#47	uf-#48	uf-#49	uf-#50	uf-#51	uf-#52	uf-#53	uf-#54	uf-#55	uf-#56	uf-#57	uf-#58	uf-#59	uf-#60	uf-#61	uf-#62	uf-#63	uf-#64	uf-#65	uf-#66	uf-#67	uf-#68	uf-#69	uf-#70	uf-#71	uf-#72	uf-#73	uf-#74	uf-#75	uf-#76	uf-#77	uf-#78	uf-#79	uf-#80	uf-#81	uf-#82	uf-#83	uf-#84	uf-#85	uf-#86	uf-#87	uf-#88	uf-#89	uf-#90	uf-#91	uf-#92	uf-#93	uf-#94	uf-#95	uf-#96	uf-#97	uf-#98	uf-#99	uf-#100	uf-#101	uf-#102	uf-#103	uf-#104	uf-#105	uf-#106	uf-#107	uf-#108	uf-#109	uf-#110	uf-#111	uf-#112	uf-#113	uf-#114	uf-#115	uf-#116	uf-#117	uf-#118	uf-#119	uf-#120	uf-#121	uf-#122	uf-#123	uf-#124	uf-#125	uf-#126	uf-#127	uf-#128	uf-#129	uf-#130	uf-#131	uf-#132	uf-#133	uf-#134	uf-#135	uf-#136	uf-#137	uf-#138	uf-#139	uf-#140	uf-#141	uf-#142	uf-#143	uf-#144	uf-#145	uf-#146	uf-#147	uf-#148	uf-#149	uf-#150	uf-#151	uf-#152	uf-#153	uf-#154	uf-#155	uf-#156	uf-#157	uf-#158	uf-#159	uf-#160	uf-#161	uf-#162	uf-#163	uf-#164	uf-#165	uf-#166	uf-#167	uf-#168	uf-#169	uf-#170	uf-#171	uf-#172	uf-#173	uf-#174	uf-#175	uf-#176	uf-#177	uf-#178	uf-#179	uf-#180	uf-#181	uf-#182	uf-#183	uf-#184	uf-#185	uf-#186	uf-#187	uf-#188	uf-#189	uf-#190	uf-#191	uf-#192	uf-#193	uf-#194	uf-#195	uf-#196	uf-#197	uf-#198	uf-#199	uf-#200	uf-#201	uf-#202	uf-#203	uf-#204	uf-#205	uf-#206	uf-#207	uf-#208	uf-#209	uf-#210	uf-#211	uf-#212	uf-#213	uf-#214	uf-#215	uf-#216	uf-#217	uf-#218	uf-#219	uf-#220	uf-#221	uf-#222	uf-#223	uf-#224	uf-#225	uf-#226	uf-#227	uf-#228	uf-#229	uf-#230	uf-#231	uf-#232	uf-#233	uf-#234	uf-#235	uf-#236	uf-#237	uf-#238	uf-#239	uf-#240	uf-#241	uf-#242	uf-#243	uf-#244	uf-#245	uf-#246	uf-#247	uf-#248	uf-#249	uf-#250	uf-#251	uf-#252	uf-#253	uf-#254	uf-#255	uf-#256	uf-#257	uf-#258	uf-#259	uf-#260	uf-#261	uf-#262	uf-#263	uf-#264	uf-#265	uf-#266	uf-#267	uf-#268	uf-#269	uf-#270	uf-#271	uf-#272	uf-#273	uf-#274	uf-#275	uf-#276	uf-#277	uf-#278	uf-#279	uf-#280	uf-#281	uf-#282	uf-#283	uf-#284	uf-#285	uf-#286	uf-#287	uf-#288	uf-#289	uf-#290	uf-#291	uf-#292	uf-#293	uf-#294	uf-#295	uf-#296	uf-#297	uf-#298	uf-#299	uf-#300	uf-#301	uf-#302	uf-#303	uf-#304	uf-#305	uf-#306	uf-#307	uf-#308	uf-#309	uf-#310	uf-#311	uf-#312	uf-#313	uf-#314	uf-#315	uf-#316	uf-#317	uf-#318	uf-#319	uf-#320	uf-#321	uf-#322	uf-#323	uf-#324	uf-#325	uf-#326	uf-#327	uf-#328	uf-#329	uf-#330	uf-#331	uf-#332	uf-#333	uf-#334	uf-#335	uf-#336	uf-#337	uf-#338	uf-#339	uf-#340	uf-#341	uf-#342	uf-#343	uf-#344	uf-#345	uf-#346	uf-#347	uf-#348	uf-#349	uf-#350	uf-#351	uf-#352	uf-#353	uf-#354	uf-#355	uf-#356	uf-#357	uf-#358	uf-#359	uf-#360	uf-#361	uf-#362	uf-#363	uf-#364	uf-#365	uf-#366	uf-#367	uf-#368	uf-#369	uf-#370	uf-#371	uf-#372	uf-#373	uf-#374	uf-#375	uf-#376	uf-#377	uf-#378	uf-#379	uf-#380	uf-#381	uf-#382	uf-#383	uf-#384	uf-#385	uf-#386	uf-#387	uf-#388	uf-#389	uf-#390	uf-#391	uf-#392	uf-#393	uf-#394	uf-#395	uf-#396	uf-#397	uf-#398	uf-#399	uf-#400	uf-#401	uf-#402	uf-#403	uf-#404	uf-#405	uf-#406	uf-#407	uf-#408	uf-#409	uf-#410	uf-#411	uf-#412	uf-#413	uf-#414	uf-#415	uf-#416	uf-#417	uf-#418	uf-#419	uf-#420	uf-#421	uf-#422	uf-#423	uf-#424	uf-#425	uf-#426	uf-#427	uf-#428	uf-#429	uf-#430	uf-#431	uf-#432	uf-#433	uf-#434	uf-#435	uf-#436	uf-#437	uf-#438	uf-#439	uf-#440	uf-#441	uf-#442	uf-#443	uf-#444	uf-#445	uf-#446	uf-#447	uf-#448	uf-#449	uf-#450	uf-#451	uf-#452	uf-#453	uf-#454	uf-#455	uf-#456	uf-#457	uf-#458	uf-#459	uf-#460	uf-#461	uf-#462	uf-#463	uf-#464	uf-#465	uf-#466	uf-#467	uf-#468	uf-#469	uf-#470	uf-#471	uf-#472	uf-#473	uf-#474	uf-#475	uf-#476	uf-#477	uf-#478	uf-#479	uf-#480	uf-#481	uf-#482	uf-#483	uf-#484	uf-#485	uf-#486	uf-#487	uf-#488	uf-#489	uf-#490	uf-#491	uf-#492	uf-#493	uf-#494	uf-#495	uf-#496	uf-#497	uf-#498	uf-#499	uf-#500	uf-#501	uf-#502	uf-#503	uf-#504	uf-#505	uf-#506	uf-#507	uf-#508	uf-#509	uf-#510	uf-#511	uf-#512	uf-#513	uf-#514	uf-#515	uf-#516	uf-#517	uf-#518	uf-#519	uf-#520	uf-#521	uf-#522	uf-#523	uf-#524	uf-#525	uf-#526	uf-#527	uf-#528	uf-#529	uf-#530	uf-#531	uf-#532	uf-#533	uf-#534	uf-#535	uf-#536	uf-#537	uf-#538	uf-#539	uf-#540	uf-#541	uf-#542	uf-#543	uf-#544	uf-#545	uf-#546	uf-#547	uf-#548	uf-#549	uf-#550	uf-#551	uf-#552	uf-#553	uf-#554	uf-#555	uf-#556	uf-#557	uf-#558	uf-#559	uf-#560	uf-#561	uf-#562	uf-#563	uf-#564	uf-#565	uf-#566	uf-#567	uf-#568	uf-#569	uf-#570	uf-#571	uf-#572	uf-#573	uf-#574	uf-#575	uf-#576	uf-#577	uf-#578	uf-#579	uf-#580	uf-#581	uf-#582	uf-#583	uf-#584	uf-#585	uf-#586	uf-#587	uf-#588	uf-#589	uf-#590	uf-#591	uf-#592	uf-#593	uf-#594	uf-#595	uf-#596	uf-#597	uf-#598	uf-#599	uf-#600	uf-#601	uf-#602	uf-#603	uf-#604	uf-#605	uf-#606	uf-#607	uf-#608	uf-#609	uf-#610	uf-#611	uf-#612	uf-#613	uf-#614	uf-#615	uf-#616	uf-#617	uf-#618	uf-#619	uf-#620	uf-#621	uf-#622	uf-#623	uf-#624	uf-#625	uf-#626	uf-#627	uf-#628	uf-#629	uf-#630	uf-#631	uf-#632	uf-#633	uf-#634	uf-#635	uf-#636	uf-#637	uf-#638	uf-#639	uf-#640	uf-#641	uf-#642	uf-#643	uf-#644	uf-#645	uf-#646	uf-#647	uf-#648	uf-#649	uf-#650	uf-#651	uf-#652	uf-#653	uf-#654	uf-#655	uf-#656	uf-#657	uf-#658	uf-#659	uf-#660	uf-#661	uf-#662	uf-#663	uf-#664	uf-#665	uf-#666	uf-#667	uf-#668	uf-#669	uf-#670	uf-#671	uf-#672	uf-#673	uf-#674	uf-#675	uf-#676	uf-#677	uf-#678	uf-#679	uf-#680	uf-#681	uf-#682	uf-#683	uf-#684	uf-#685	uf-#686	uf-#687	uf-#688	uf-#689	uf-#690	uf-#691	uf-#692	uf-#693	uf-#694	uf-#695	uf-#696	uf-#697	uf-#698	uf-#699	uf-#700	uf-#701	uf-#702	uf-#703	uf-#704	uf-#705	uf-#706	uf-#707	uf-#708	uf-#709	uf-#710	uf-#711	uf-#712	uf-#713	uf-#714	uf-#715	uf-#716	uf-#717	uf-#718	uf-#719	uf-#720	uf-#721	uf-#722	uf-#723	uf-#724	uf-#725	uf-#726	uf-#727	uf-#728	uf-#729	uf-#730	uf-#731	uf-#732	uf-#733	uf-#734	uf-#735	uf-#736	uf-#737	uf-#738	uf-#739	uf-#740	uf-#741	uf-#742	uf-#743	uf-#744	uf-#745	uf-#746	uf-#747	uf-#748	uf-#749	uf-#750	uf-#751	uf-#752	uf-#753	uf-#754	uf-#755	uf-#756	uf-#757	uf-#758	uf-#759	uf-#760	uf-#761	uf-#762	uf-#763	uf-#764	uf-#765	uf-#766	uf-#767	uf-#768	uf-#769	uf-#770	uf-#771	uf-#772	uf-#773	uf-#774	uf-#775	uf-#776	uf-#777	uf-#778	uf-#779	uf-#780	uf-#781	uf-#782	uf-#783	uf-#784	uf-#785	uf-#786	uf-#787	uf-#788	uf-#789	uf-#790	uf-#791	uf-#792	uf-#793	uf-#794	uf-#795	uf-#796	uf-#797	uf-#798	uf-#799	uf-#800	uf-#801	uf-#802	uf-#803	uf-#804	uf-#805	uf-#806	uf-#807	uf-#808	uf-#809	uf-#810	uf-#811	uf-#812	uf-#813	uf-#814	uf-#815	uf-#816	uf-#817	uf-#818	uf-#819	uf-#820	uf-#821	uf-#822	uf-#823	uf-#824	uf-#825	uf-#826	uf-#827	uf-#828	uf-#829	uf-#830	uf-#831	uf-#832	uf-#833	uf-#834	uf-#835	uf-#836	uf-#837	uf-#838	uf-#839	uf-#840	uf-#841	uf-#842	uf-#843	uf-#844	uf-#845	uf-#846	uf-#847	uf-#848	uf-#849	uf-#850	uf-#851	uf-#852	uf-#853	uf-#854	uf-#855	uf-#856	uf-#857	uf-#858	uf-#859	uf-#860	uf-#861	uf-#862	uf-#863	uf-#864	uf-#865	uf-#866	uf-#867	uf-#868	uf-#869	uf-#870	uf-#871	uf-#872	uf-#873	uf-#874	uf-#875	uf-#876	uf-#877	uf-#878	uf-#879	uf-#880	uf-#881	uf-#882	uf-#883	uf-#884	uf-#885	uf-#886	uf-#887	uf-#888	uf-#889	uf-#890	uf-#891	uf-#892	uf-#893	uf-#894	uf-#895	uf-#896	uf-#897	uf-#898	uf-#899	uf-#900	uf-#901	uf-#902	uf-#903	uf-#904	uf-#905	uf-#906	uf-#907	uf-#908	uf-#909	uf-#910	uf-#911	uf-#912	uf-#913	uf-#914	uf-#915	uf-#916	uf-#917	uf-#918	uf-#919	uf-#920	uf-#921	uf-#922	uf-#923	uf-#924	uf-#925	uf-#926	uf-#927	uf-#928	uf-#929	uf-#930	uf-#931	uf-#932	uf-#933	uf-#934	uf-#935	uf-#936	uf-#937	uf-#938	uf-#939	uf-#940	uf-#941	uf-#942	uf-#943	uf-#944	uf-#945	uf-#946	uf-#947	uf-#948	uf-#949	uf-#950	uf-#951	uf-#952	uf-#953	uf-#954	uf-#955	uf-#956	uf-#957	uf-#958	uf-#959	uf-#960	uf-#961	uf-#962	uf-#963	uf-#964	uf-#965	uf-#966	uf-#967	uf-#968	uf-#969	uf-#970	uf-#971	uf-#972	uf-#973	uf-#974	uf-#975	uf-#976	uf-#977	uf-#978	uf-#979	uf-#980	uf-#981	uf-#982	uf-#983	uf-#984	uf-#985	uf-#986	uf-#987	uf-#988	uf-#989	uf-#990	uf-#991	uf-#992	uf-#993	uf-#994	uf-#995	uf-#996	uf-#997	uf-#998	uf-#999	uf-#1000

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UIOWA Water Plant 8 A.M. Readings									
Date:	#####					Operator:	Brock		
Main Console									
Plant Flow Rate:	1.2	mgd					Clearwell:	8	ft
Low Service:	2079	kgal					Elevated Storage:	27.3	ft
High Service:	1415	kgal							
Backwash:	19.7	kgal					CL <sub>2</sub> Contact Tank:	30.02	ft
Well	0	kgal					Temperature	35.9	°F
CO <sub>2</sub> Meter	522	lb							
PAC	298	lb					PAC Added:		
Main Gallery									
#1	414		#2	414		#3	414		
#4	316		#5	316		#6	298		
Lime 1st	2640						Lime 2nd		
Setting									
Monosodium									
Tri-poly									
Chlorine Tanks	W (3)	811	E (1)	0					
Circle on-line tank	W (4)	1987	E (2)	1994					
Ferric Sulfate Pump Settings									
Up stairs									
Ferric Sulfate Tank Levels:	33.1	49	49	48.7	21.7				
Antiscalant:	Before	84	After	125					
Sodium Bisulfite:	Before	53	After	160					
Sodium Hydroxide:	Before	568	After	745					
Soda Ash:	lb								
Soda Ash Added:									
Basement									
Plant Service: East	32149	West	494934	Potable Low	69704	High	21866		
Fluoride (Before 8	299	(Add 8am)	17						
Basement Meters				Coralville Lake Readings: 338-3543.1					
				Res. Level	684.35				
				TW Level	651.03				
River Turbidity	15.3				In:	2860	Out:	2410	
Strait Ltr. Turbidity	4.3				IC flow	2,520	Precip:	0.0	
				I.C. Level	12.02				
Lime Rec'd N:									



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UIOWA Water Plant 8 A.M. Readings									
Date:		#####				Operator:		Brock	
M a i n C o n s o l e									
Plant Flow Rate:	1.2	mgd					Clearwell:	8	ft
Low Service:	2079	kgal					Elevated Storage:	27.3	ft
High Service:	1415	kgal							
Backwash:	19.7	kgal					CL <sub>2</sub> Contact Tank:	30.02	ft
Well	0	kgal					Temperature	35.9	°F

## University of Iowa Water Plant Daily Water Production Log

Today is: 2/21/2023

### Flow Data

	Total Low	Iowa River X 1000	Jordan Well X 100		No.1	No.2	No.3	No.4	No.5	No.6	Backwash X 100	Potable Low X 10	High X 100	Plant Service E X 1000	W X 1000	High Serv X 1000	
Today's Readings	2079	#####	0		414	414	414	316	316	298	19.7	69704	21263	32149	416983	1415	414
Yesterday's Readings	0	#####	0		0	0	0	0	0	0	0	69570	21263	32135	416983	0	298
Total for the Day	2079	2079	0		414	414	414	316	316	298	19.7	134	0	14	0	1415	

### Chemicals Used

	Yesterday's Reading	Today's Reading	Amount Added	Daily Use (LBS)
CO <sub>2</sub>	0	522	0	522
Cl <sub>2</sub> -East	1994	1994		0
Cl <sub>2</sub> -West	2891	2798		93
Cl <sub>2</sub> -Total				93
Antiscalant	84	125		41
Sodium Bisulfite	53	160		107
Sodium Hydroxide	568	745		177
Fluoride	333.4	299	17	51.4
Lime 1 <sup>st</sup>	0	2640	0	2640
Lime 2 <sup>nd</sup>	0	0	0	0.0
Total Lime				2640
Mono Phos.	0	0		0
Poly Phos.	0	119	0	119
Total Phos.	0			119
PAC	387	298		135
Soda Ash	0	0		0
B LOW SER	0	0		0
B HIGH SER	0	0		0
FeSO <sub>4</sub> SFT	82.9	82.1	0	264
FeSO <sub>4</sub> IPM	121	119.4		528

Water Level in Storage @ 8:00 AM		Weather and River Stage	
Clearwell	8.0	Max Air	
Elevated Storage	27.3	Temp	0
Ground Storage	0	Min Air	
Chlorine Contact	30.02	Temp	0
Water Temp - River	35.9	Precip.	0
Water Temp - CW		Dam Disch.	2410
Treatment Summary X 1000 Gals.			
Total Low Service	2079		
Iowa River	2079		
Jordan Well	0		
Filter Effluent	217.2		
Backwash	1.97		
Potable Low	1.34		
Potable High	0		
Plant Service	14		
High Service	1415		
From 8 AM	#####		
To 8 AM	#####		

# AVEVA™ PI System



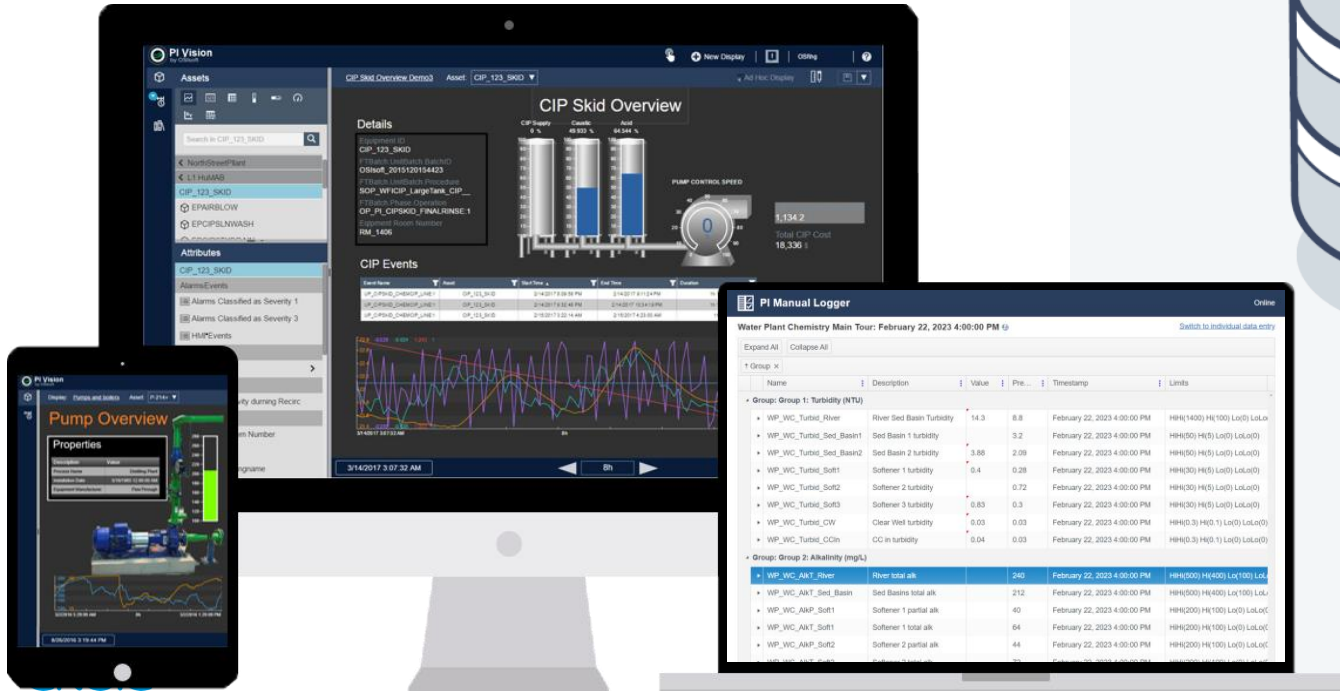
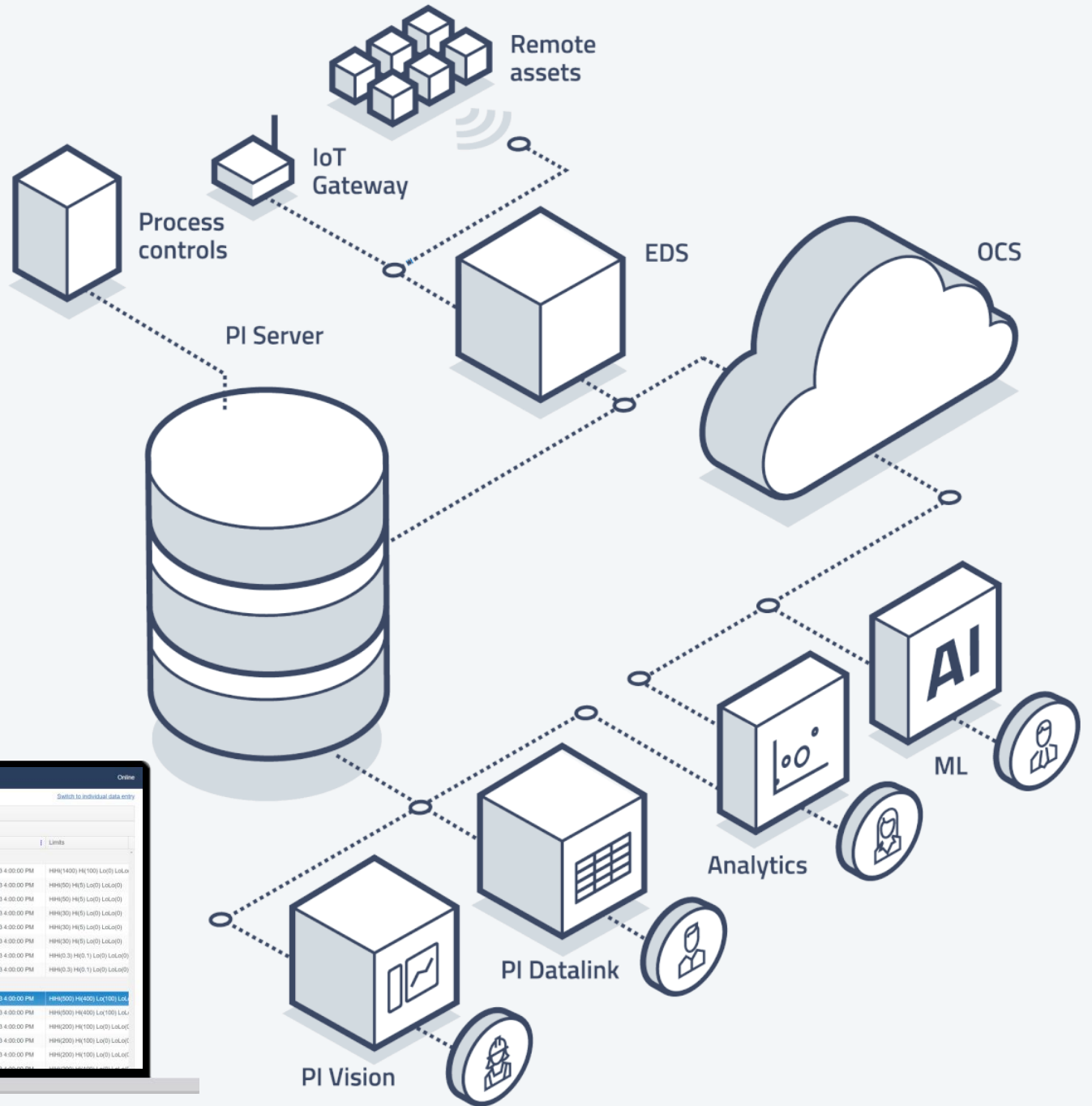
# PI Manual Logger



## PI Vision



## Asset Framework





PI Manual Logger



PI Vision



Asset Framework



Water Plant Chemistry Main Tour: Tuesday, April 8, 2025 4:00:00 PM



[Switch to individual data entry](#)

Expand All

Collapse All

↑ Group ×

	Description	Value	Previous	UOM	Limits
Group: Group 1: Turbidity (NTU)					
▶	River Turbidity	17.2	14.5	Ntu	HiHi(1400) Hi(100) Lo(0) LoLo(0)
▶	Sed Basin 1 turbidity	1.44	0.97	NTU	HiHi(50) Hi(5) Lo(0) LoLo(0)
▶	Sed Basin 2 turbidity	1.68	1.42	NTU	HiHi(50) Hi(5) Lo(0) LoLo(0)
▶	Softener 1 turbidity		0.51	NTU	HiHi(30) Hi(5) Lo(0) LoLo(0)
▶	Softener 2 turbidity	0.62	0.57	NTU	HiHi(30) Hi(5) Lo(0) LoLo(0)
▶	Softener 3 turbidity	0.43	0.47	NTU	HiHi(30) Hi(5) Lo(0) LoLo(0)
▶	Clear Well turbidity	0.04	0.05	NTU	HiHi(0.3) Hi(0.1) Lo(0) LoLo(0)
▶	CC in turbidity	0.05	0.06	NTU	HiHi(0.3) Hi(0.1) Lo(0) LoLo(0)
Group: Group 2: Alkalinity (mg/L)					
▶	River total alk	188	186	mg/L	HiHi(500) Hi(400) Lo(100) LoLo(0)
▶	Sed Basins total alk		170	mg/L	HiHi(500) Hi(400) Lo(100) LoLo(0)
▶	Softener 1 partial alk		36	mg/L	HiHi(200) Hi(100) Lo(0) LoLo(0)
▶	Softener 1 total alk		54	mg/L	HiHi(200) Hi(100) Lo(0) LoLo(0)

# AVEVA™ PI System



PI Manual Logger



PI Vision



Asset Framework



Water Plant Chemistry Main Tour: Tuesday, April 8, 2025 4:00:00 PM



[Switch to individual data entry](#)

Expand All

Collapse All

↑ Group ×

	Description	Value	Previous	UOM	Limits
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▶	Softener 1 turbidity				li(30) Hi(5) Lo(0) LoLo(0)
▶	Softener 2 turbidity	0.62			li(30) Hi(5) Lo(0) LoLo(0)
▶	Softener 3 turbidity	0.43	0.47	NTU	HiHi(30) Hi(5) Lo(0) LoLo(0)
▶	Clear Well turbidity	0.04	0.05	NTU	HiHi(0.3) Hi(0.1) Lo(0) LoLo(0)
▶	CC in turbidity	0.05	0.06	NTU	HiHi(0.3) Hi(0.1) Lo(0) LoLo(0)

### Trigger Message Prompt

Lo: Is soda ash on?


Ok

### Group: Group 2: Alkalinity (mg/L)

▶	River total alk	188	186	mg/L	HiHi(500) Hi(400) Lo(100) LoLo(0)
▶	Sed Basins total alk	17	170	mg/L	HiHi(500) Hi(400) Lo(100) LoLo(0)
▶	Softener 1 partial alk		36	mg/L	HiHi(200) Hi(100) Lo(0) LoLo(0)

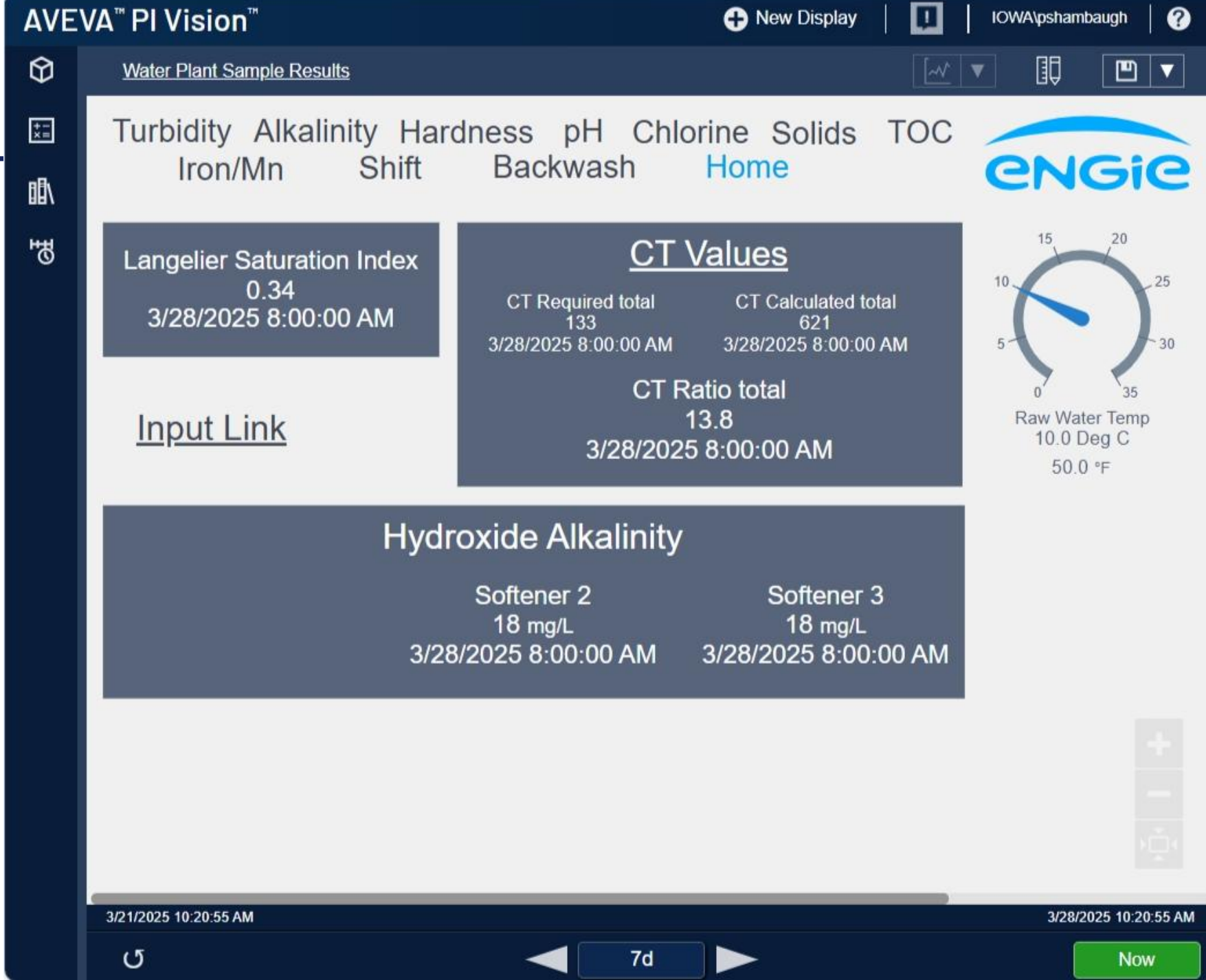


# AVEVA™ PI System


 PI Manual Logger

 **PI Vision**

 Asset Framework



# AVEVA™ PI System

 PI Manual Logger

 PI Vision

 Asset Framework

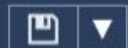


AVEVA™ PI Vision™

 New Display |  | IOWA\pshambaugh | 

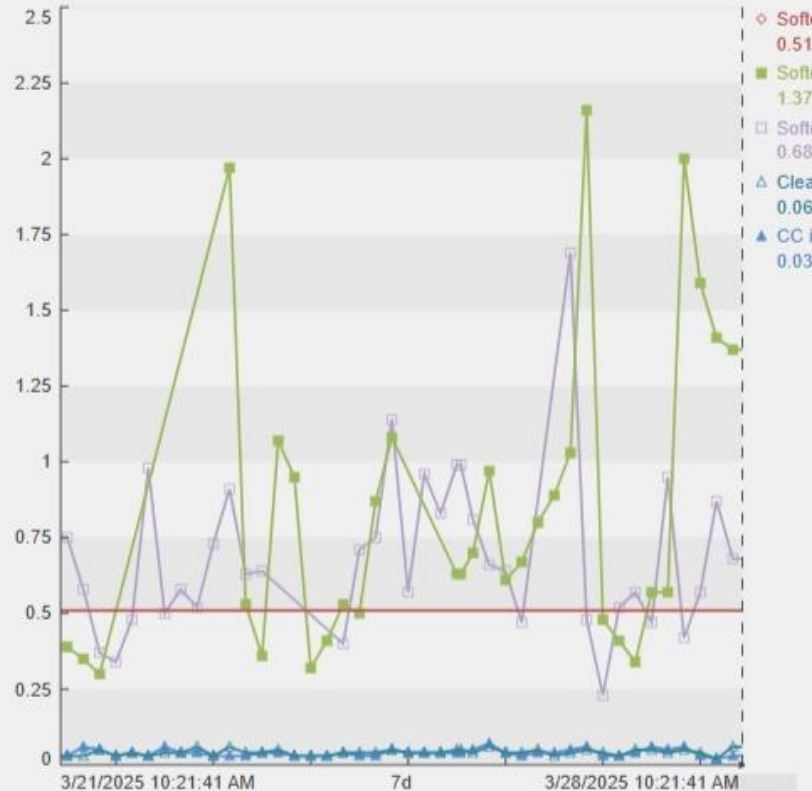
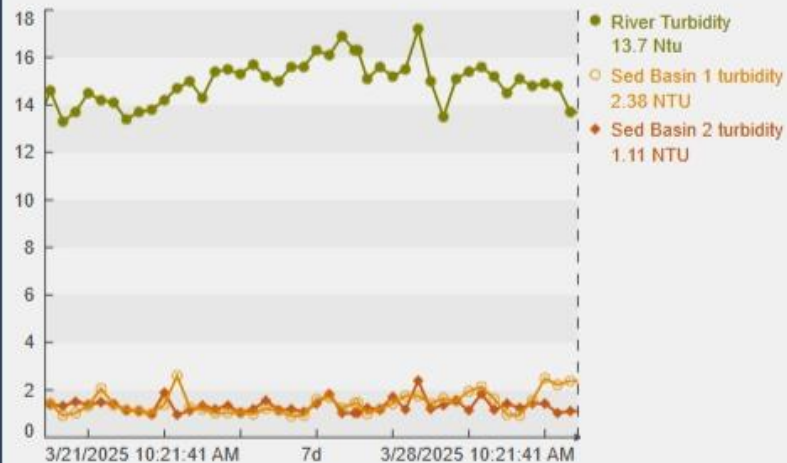


WP Water Chemistry, Turbidity



Turbidity Alkalinity Hardness pH Chlorine Solids TOC  
Iron/Mn Shift Backwash Home

Description	Value	Time	Trend	Average
Sed Basin 1 turbidity	2.38	3/28/2025 8:00:00 AM		1.438
Sed Basin 2 turbidity	1.11	3/28/2025 8:00:00 AM		1.3268
Softener 1 turbidity	0.51	1/29/2025 8:00:00 AM		0.51
Softener 2 turbidity	1.37	3/28/2025 8:00:00 AM		0.89092
Softener 3 turbidity	0.68	3/28/2025 8:00:00 AM		0.68205
CC in turbidity	0.03	3/28/2025 8:00:00 AM		0.03997
Clear Well turbidity	0.06	3/28/2025 8:00:00 AM		0.041284



3/21/2025 10:21:41 AM


3/28/2025 10:21:41 AM




7d

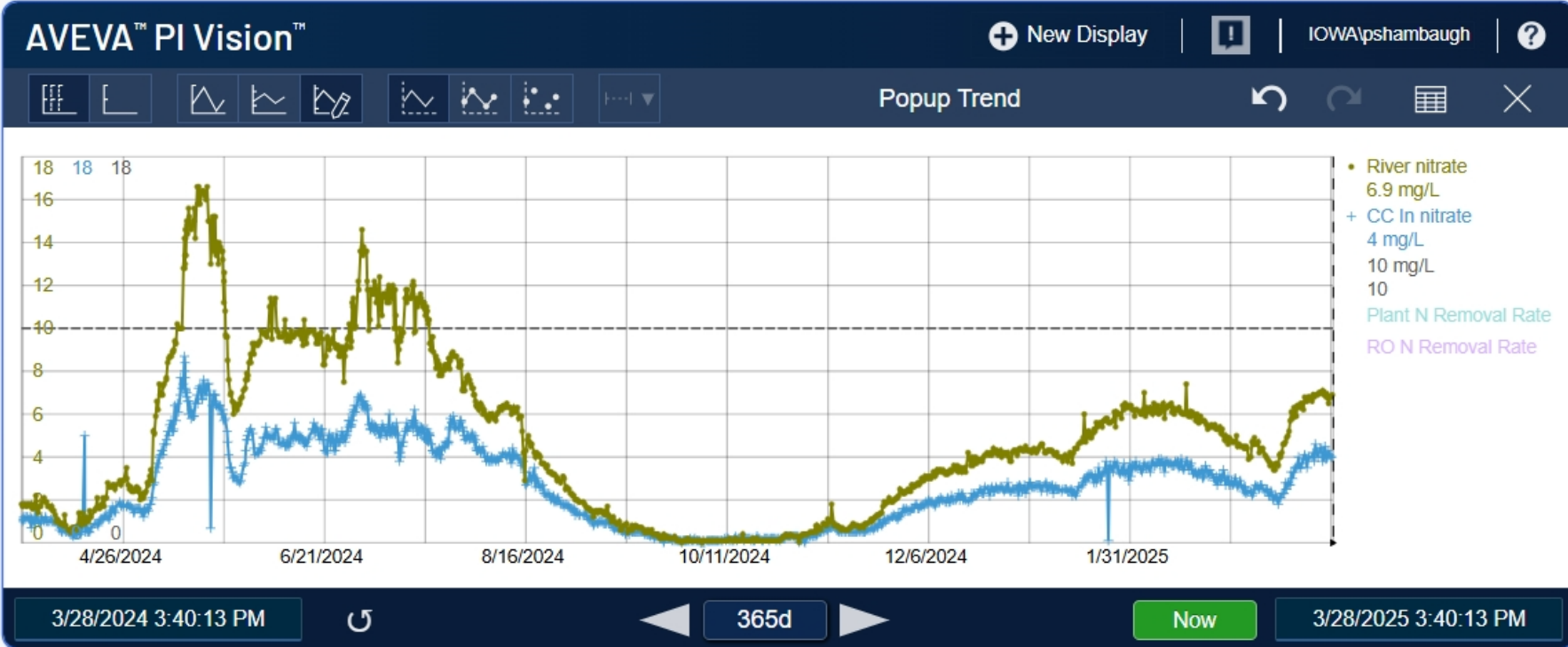
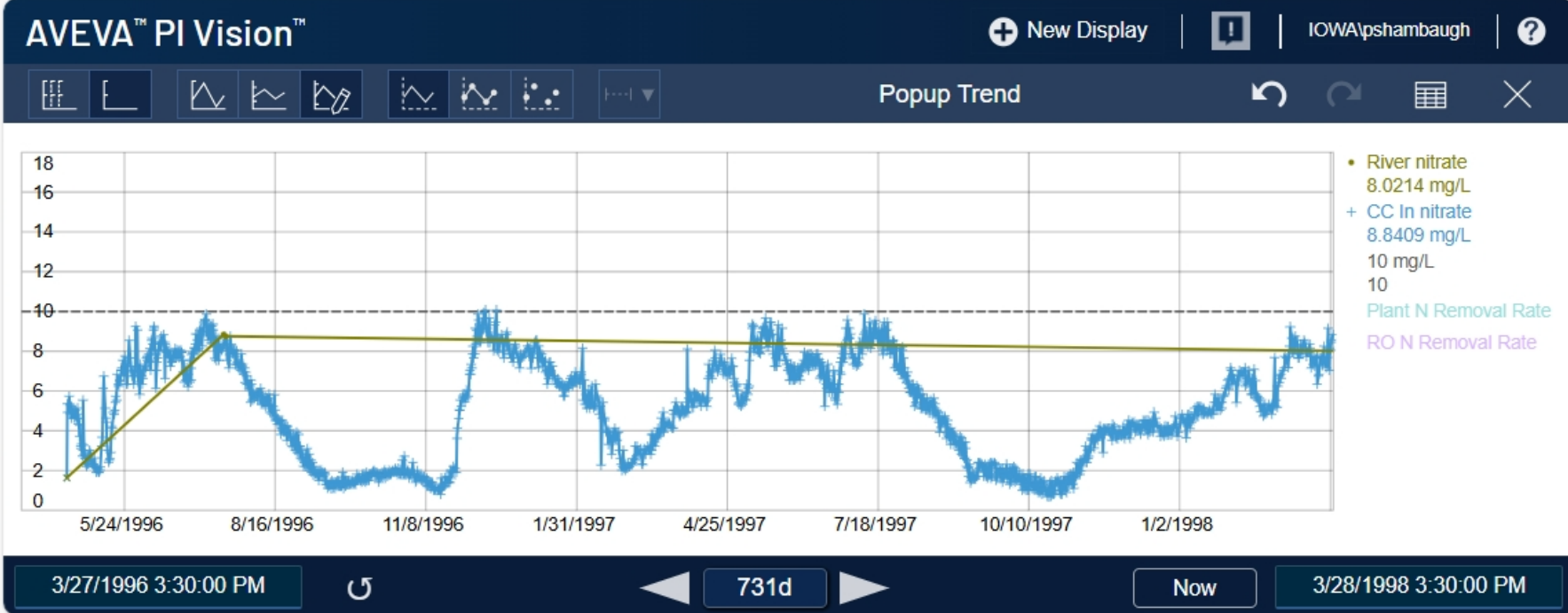
Now

# AVEVA™ PI System

 PI Manual Logger

 PI Vision

 Asset Framework





PI Manual Logger



PI Vision



Asset Framework

## Langelier Saturation Index Calculation

$$LSI = pH - pH_s$$

Where:

$pH_s$  = Saturation pH, estimated using the following

$$pH_s = [(9.3 + A + B) - (C + D)]$$

$$pH_s = (9.3 + ((\text{Log}_{10}[\text{TDS}] - 1) / 10) + (-13.2 \times \text{Log}_{10}[\text{Temperature}(\text{°C}) + 273] + 34.55)) \\ - ((\text{Log}_{10}[\text{Ca}_{+2} \text{ as CaCO}_3] - 0.4) + (\text{Log}_{10}[\text{Alkalinity as CaCO}_3]))$$

$$WP\_WC\_pH\_LSI = WP\_WC\_pH\_CCIn - [9.3 + ((\text{Log}_{10}[WP\_WC\_TDS\_CCIn] - 1) / 10) + \\ (-13.2 \times \text{Log}_{10}[WP\_CAM.PAC.WaterTempInput\_C + 273] + 34.55)) \\ - ((\text{Log}_{10}[WP\_WC\_HardCa\_CCIn] - 0.4) + (\text{Log}_{10}[WP\_WC\_AlkT\_CCIn]))]$$





## CT Calculations

- Pulled CT equations from an engineering report
- Plugged in both sample data and online process data
- Utilized PI Web API to pull process and sample data, run calculations, and then write the results to new tags

### CT<sub>calculated</sub>:

$$CT_{calc} \text{ Filters} = Cl_{2CW} \times 1440 \times 0.75 \times (.10 \times (\# \text{ filters in service} / 6)) / (Flow_{CW})$$

$$CT_{calc} \text{ CW} = Cl_{2CW} \times 1440 \times 0.32 \times 7.4805 \times (3352 \times CW \text{ level} - 9884) / (1,000,000 \times Flow_{CW})$$

$$CT_{calc} \text{ CC Tk} = Cl_{2CC} \times 1440 \times 0.29 \times (0.374 \times CC \text{ Tk level} / 13) / (Flow_{Finished})$$

$$CT_{calc} = CT_{calc} \text{ Filters} + CT_{calc} \text{ CW} + CT_{calc} \text{ CC Tk}$$

Where:

$Cl_{2CW}$  is the concentration of free chlorine leaving the clear well. [WP\\_WC\\_Cl2\\_CW](#)

Minimum of the previous 4 hrs.

$Cl_{2CC}$  is the concentration of free chlorine leaving the chlorine contact tank. [WP\\_WC\\_Cl2\\_CCEF](#)

Triggering event, entered every 4 hrs.

$Flow_{CW}$  is transfer pump flow + Backwash Pump 1 and Pump 2 flows. [WP-CAM.PAC.XFP\\_FIC5000\\_PV](#) +

Peak flow of the previous 4 hrs.

$Flow_{Finished}$  is the finished water flow leaving the chlorine contact tank. [WP-CAM.PAC.MainFlowAvg](#)

Peak flow of the previous 4 hrs.

CW level: Level of Clear Well (1) [WP-CAM.PAC.ClearWell1Level](#)

Minimum of the previous 4 hrs.

Chlorine Contact Tank level: [WP-CAM.PAC.CL2ContactLevel](#)

Minimum of the previous 4 hrs.

# filters in service: Read off of [WP-FLT-12\(34, 56\).PAC.FLTx\\_FE\\_FM\\_815x\\_FLOW](#) (x=filter #).

Minimum number of the previous 4 hrs. Not less than 3.

### CT<sub>required</sub>:

If the temperature is  $< 5^{\circ}\text{C}$ :

$$CT_{req} \text{ Filters} = 0.36 \times (pH_{CW}^{2.69}) \times (Temp_{CW}^{-0.15}) \times (Cl_{2CW}^{0.15}) \times 0.5$$

$$CT_{req} \text{ CW} = CT_{req} \text{ Filters}$$

$$CT_{req} \text{ CC Tk} = 0.36 \times (pH_{CC}^{2.69}) \times (Temp_{CCTK}^{-0.15}) \times (Cl_{2CC}^{0.15}) \times 0.5$$

If the temperature is  $\geq 5^{\circ}\text{C}$ :

$$CT_{req} \text{ Filters} = 0.2828 \times (pH_{CW}^{2.69}) \times (0.933^{(Temp_{CW} - 5)}) \times (Cl_{2CW}^{0.15}) \times 0.5$$

$$CT_{req} \text{ CW} = CT_{req} \text{ Filters}$$

$$CT_{req} \text{ CC Tk} = 0.2828 \times (pH_{CC}^{2.69}) \times (0.933^{(Temp_{CCTK} - 5)}) \times (Cl_{2CC}^{0.15}) \times 0.5$$

So:

$$CT_{req} = CT_{req} \text{ Filters} + CT_{req} \text{ CW} + CT_{req} \text{ CC Tk}$$

Where:

$Cl_{2CW}$  is the concentration of free chlorine leaving the Clear Well. [WP\\_WC\\_Cl2\\_CW](#)

Minimum of the previous 4 hrs.

$Cl_{2CC}$  is the concentration of free chlorine leaving the Chlorine Contact Tank. [WP\\_WC\\_Cl2\\_CCEF](#)

Triggering event.

$pH_{CW}$ : [WP\\_WC\\_pH\\_CW](#)

Maximum of the previous 4 hrs.

$pH_{CC}$ : [WP\\_WC\\_pH\\_CCEF](#)

Maximum of the previous 4 hrs.

$Temp_{CW}$ : [WP\\_WC\\_Temp\\_CW](#)

Last temp entered manually.

$Temp_{CCTK}$ : [WP\\_WC\\_Temp\\_CCIIn](#)

Last temp entered manually.

### Inactivation Ratio:

$$CT_{ratio} \text{ Filters} = CT_{calc} \text{ Filters} / CT_{req} \text{ Filters}$$

$$CT_{ratio} \text{ CW} = CT_{calc} \text{ CW} / CT_{req} \text{ CW}$$

$$CT_{ratio} \text{ CC Tk} = CT_{calc} \text{ CC Tk} / CT_{req} \text{ CC Tk}$$

$$CT_{ratio} = CT_{ratio} \text{ Filters} + CT_{ratio} \text{ CW} + CT_{ratio} \text{ CC Tk}$$



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$$CT_{calc} \text{ CW} = Cl_{2CW} \times 1440 \times 0.32 \times 7.4805 \times (3352 \times CW \text{ level} - 9884) / (1,000,000 \times Flow_{CW})$$

$$CT_{calc} \text{ CC Tk} = Cl_{2CC} \times 1440 \times 0.29 \times (0.374 \times CC \text{ Tk level} / 13) / (Flow_{Finished})$$

$$CT_{calc} = CT_{calc} \text{ Filters} + CT_{calc} \text{ CW} + CT_{calc} \text{ CC Tk}$$

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$Flow_{Finished}$  is the finished water flow leaving the chlorine contact tank. [WP-CAM.PAC.MainFlowAvg](#)

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CW level: Level of Clear Well (1) [WP-CAM.PAC.ClearWell1Level](#)

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$$CT_{req} \text{ CW} = CT_{req} \text{ Filters}$$

$$CT_{req} \text{ CC Tk} = 0.2828 \times (pH_{CC}^{2.69}) \times (0.933^{(Temp_{CCTK} - 5)}) \times (Cl_{2CC}^{0.15}) \times 0.5$$

So:

$$CT_{req} = CT_{req} \text{ Filters} + CT_{req} \text{ CW} + CT_{req} \text{ CC Tk}$$

Where:

$Cl_{2CW}$  is the concentration of free chlorine leaving the Clear Well. [WP\\_WC\\_Cl2\\_CW](#)

Minimum of the previous 4 hrs.

$Cl_{2CC}$  is the concentration of free chlorine leaving the Chlorine Contact Tank. [WP\\_WC\\_Cl2\\_CCEF](#)

Triggering event.

$pH_{CW}$ : [WP\\_WC\\_pH\\_CW](#)

Maximum of the previous 4 hrs.

$pH_{CC}$ : [WP\\_WC\\_pH\\_CCEF](#)

Maximum of the previous 4 hrs.

$Temp_{CW}$ : [WP\\_WC\\_Temp\\_CW](#)

Last temp entered manually.

$Temp_{CCTK}$ : [WP\\_WC\\_Temp\\_CCI](#)

Last temp entered manually.

### Inactivation Ratio:

$$CT_{ratio} \text{ Filters} = CT_{calc} \text{ Filters} / CT_{req} \text{ Filters}$$

$$CT_{ratio} \text{ CW} = CT_{calc} \text{ CW} / CT_{req} \text{ CW}$$

$$CT_{ratio} \text{ CC Tk} = CT_{calc} \text{ CC Tk} / CT_{req} \text{ CC Tk}$$

$$CT_{ratio} = CT_{ratio} \text{ Filters} + CT_{ratio} \text{ CW} + CT_{ratio} \text{ CC Tk}$$



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Where:

$Cl_{2CW}$  is the concentration of free chlorine leaving the clear well. [WP\\_WC\\_Cl2\\_CW](#)

Minimum of the previous 4 hrs.

$Cl_{2CC}$  is the concentration of free chlorine leaving the chlorine contact tank. [WP\\_WC\\_Cl2\\_CCEF](#)

Triggering event, entered every 4 hrs.

$Flow_{CW}$  is transfer pump flow + Backwash Pump 1 and Pump 2 flows. [WP-CAM.PAC.XFP\\_FIC5000\\_PV](#) +

Back flow of the previous 4 hrs.

## CT Values

CT Required total	CT Calculated total
133	621
3/28/2025 8:00:00 AM	3/28/2025 8:00:00 AM

CT Ratio total  
13.8  
3/28/2025 8:00:00 AM

maximum of the previous 4 hrs.

Temp<sub>CW</sub>: [WP\\_WC\\_Temp\\_CW](#)

Last temp entered manually.

Temp<sub>CCTk</sub>: [WP\\_WC\\_Temp\\_CCI](#)

Last temp entered manually.

### Inactivation Ratio:

$$CT_{ratio} \text{ Filters} = CT_{calc} \text{ Filters} / CT_{req} \text{ Filters}$$

$$CT_{ratio} \text{ CW} = CT_{calc} \text{ CW} / CT_{req} \text{ CW}$$

$$CT_{ratio} \text{ CC Tk} = CT_{calc} \text{ CC Tk} / CT_{req} \text{ CC Tk}$$

$$CT_{ratio} = CT_{ratio} \text{ Filters} + CT_{ratio} \text{ CW} + CT_{ratio} \text{ CC Tk}$$

# ENGIE uses the PI System to capture and utilize its lab data

## Challenge

- An ancient data capture and storage system limited our ability to store and access all our sample and operational data accurately
- Needed an application which would fit a limited budget
- Operators and management were used to the old system and naturally hesitant to changing aspects of it

## Solution

- Implemented AVEVA™ PI Manual Logger to capture lab sample data
- Utilized AVEVA™ PI Vision to display sample findings, calculation results, and operational stats side by side
- Organized the resulting new tags and programed calculations in AVEVA PI Server's Asset Framework

## Results

- Created a data entry, storage, calculation, and visualization process contained in one already existent ecosystem
- Compiled easily accessible data for operations, management, and project engineers

