

How to decrease the operation cost of wastewater pump stations.



Maid Labs
TECHNOLOGIES

Benoit
Beaudoin

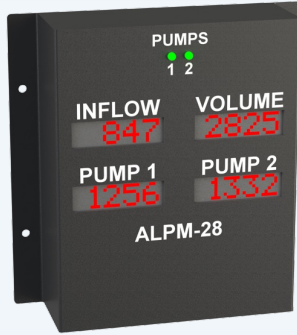
Our History



Benoit Beaudoin

2002: Started Maid Labs Technologies to create the 1st portable instrument to be a real time:

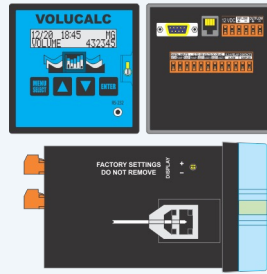
- Volumetric flowmeter,
- Diagnostic tool
- Efficiency/Energy meter



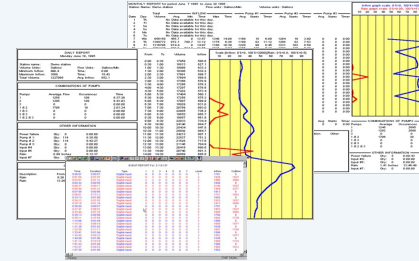
1986: 1st Pump Station Controller with Volumetric Flow



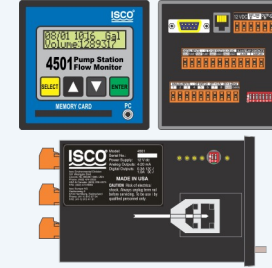
1988: 1st Portable Volumetric Flowmeter



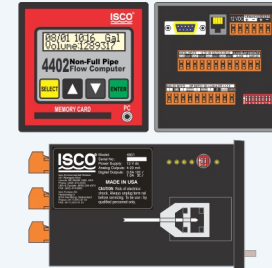
1992: 1st Volumetric Flowmeter used for Billing



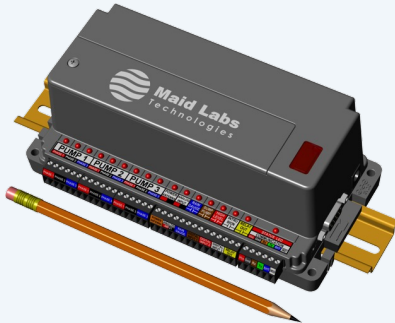
1993: 1st patented Volumetric Flowmeter Software with an Accuracy Above 98%



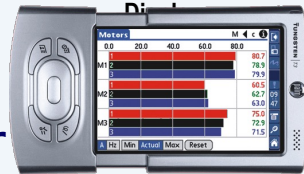
1996: 1st Volumetric Flowmeter Sold by Teledyne Isco



1997: 1st Partially Full Magnetic Flowmeter Controller



2004: 1st Multi-Pump Multiphase Electric Recorder and Volumetric Flowmeter with PDA Download and Diagnostics



2012: EE-400 Submersible Battery Powered Digital Recorder



2013: PressureMaid Potable Water Pressure Recorder



2013: FlowMaid Battery Powered Open Channel Flowmeter



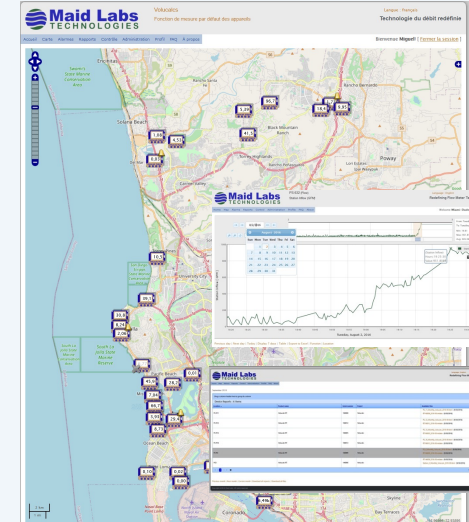
2004: SoftMaid Software Displays Pump Station Abnormal Behaviors and Generates Pump Efficiency Reports



2014: Volucalc Hybrid CS (Constant Speed Pumps) and VS (Variable Speed Pumps)



2020: SensorMaid Generic Analog and Digital Recorder

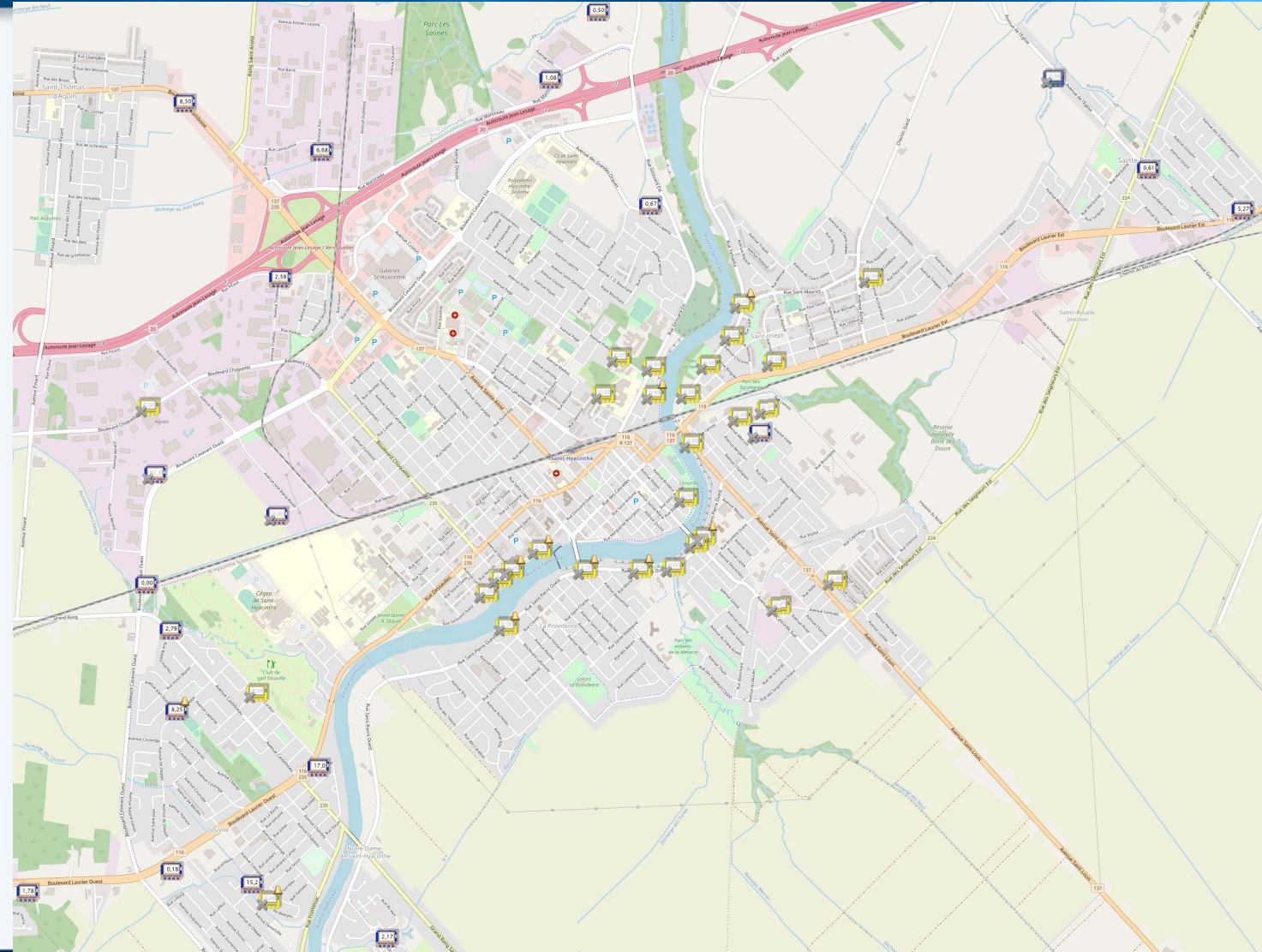


2014: MaidMaps SCADA Remote Monitoring, Alarms, Report Downloads and Instruments Configuration

A Typical Town

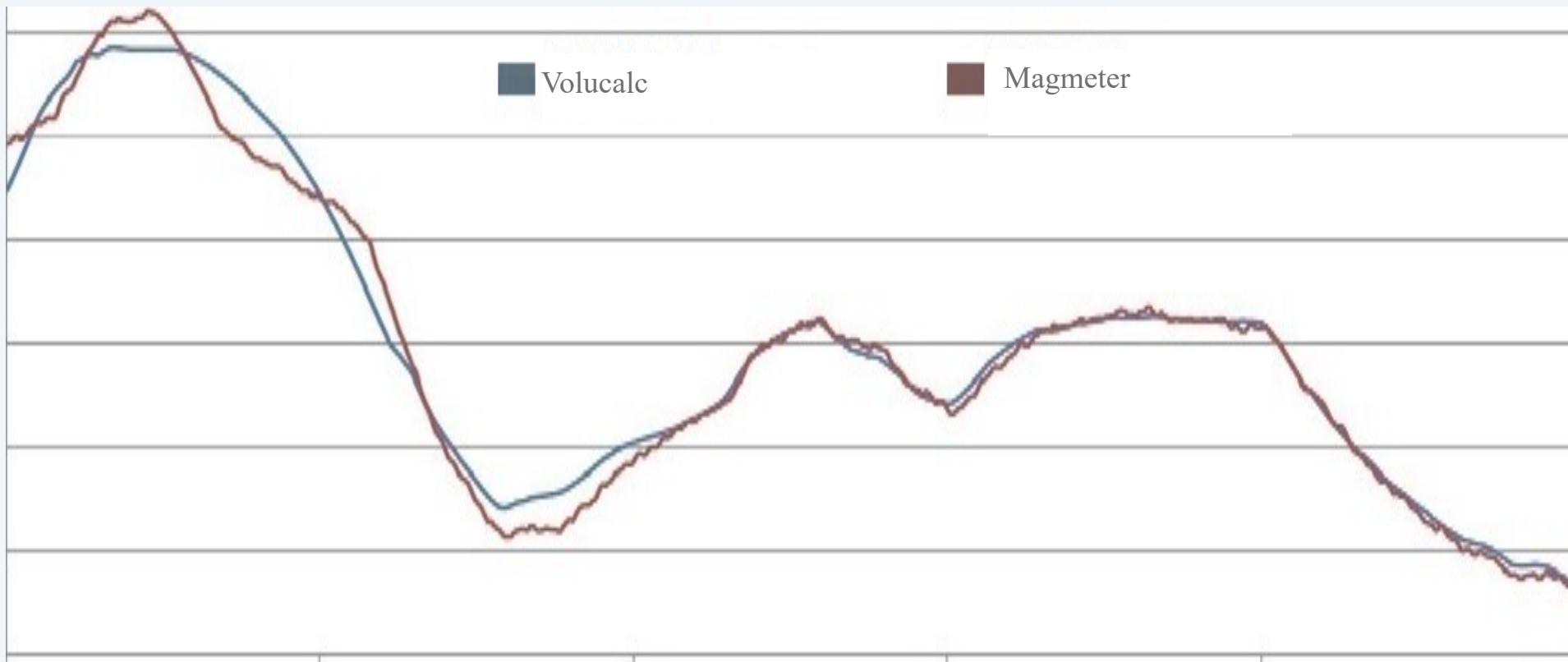
Over 1000 instruments in that family, which are:

- Volucalc Hybrid CS Wastewater Pump Station Flowmeter and Diagnostic Instruments
- FlowMaid Battery Operated Open Channel Flowmeters
- All with Cellular Remote Communication for Alarms and Reports Download.



Accuracy is everything!

Our volumetric flow algorithm, which is programmed in our VoluCalc flow meter, can be as accurate as a mag meter, but you get flow in and out, efficiency, diagnostics, reports, and a low installation cost.



Calculate flow using the right equation

How to achieve this accuracy by simply connecting current clamps and a level sensor?

Entrées enregistrées:

Actuel **M1** * * * **M2** * * * **M3** * * * **An** **Pluie**

3 moteurs $Ph1, Ph2, Ph3, Ph1, Ph2, Ph3, V1, V2, V3, Ph1, Ph2, Ph3$ Pluie
 * pour les tests que l'on va utiliser

Alternative proposée **M1, M2, M3, M4, L, P, V1, V2, V3, An, Pluie**

Niveau (et pression): **A**

- Faire la moyenne aux secondes après avoir enlevé min/max
- Filter et conserver les maximums locaux, minimums locaux et variations > 1cm.

Graphique

— données brutes (1s)
 — moyenne
 — minimum local
 — maximum local
 — Niveau
 — Débit entrant

Algorithme:
 → Normaliser
 → Décaler R/T
 → Décaler

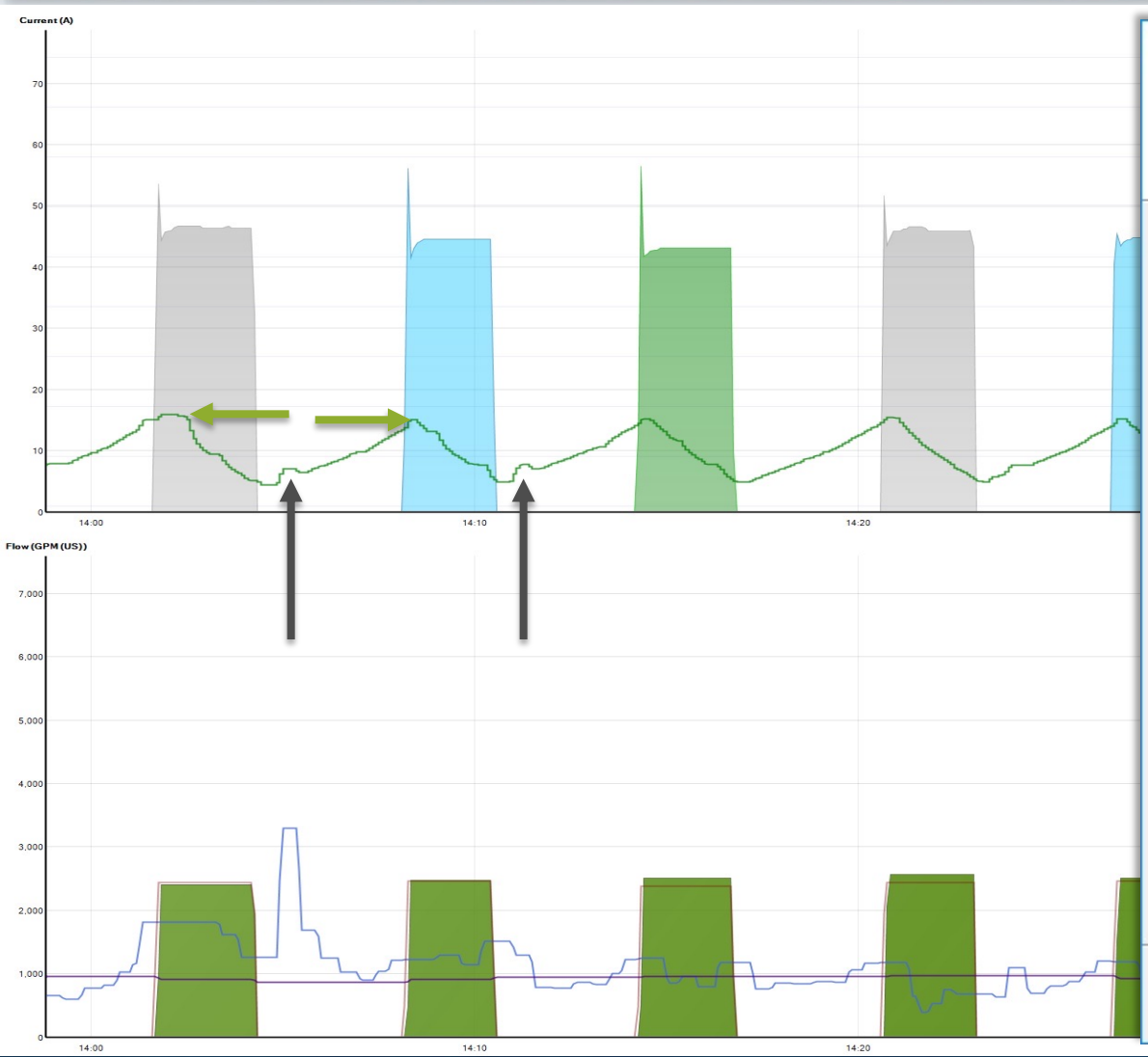
DÉBIT ENTRANT

- 1) Filtrer niveau et pression
- 2) Débit précis
 * Calculer le débit lorsque les pompes sont arrêtées
 Accumulations des débits précis (1 semaine ou par étage)
- 3) Signature de débit
 Filtrer selon min/max précis
 Moyenne par période pour cette période
 Moyenne par période pour cette période
 Moyenne par période pour cette période
- 4) Identification des journées types
 — journées de pluie et jour
 — journées sèches et jour
 — fin de semaine
 sert à choisir les journées à utiliser dans un étage (voir 3)
- 5) Débit en temps réel lorsque les pompes ne fonctionnent pas. basé sur le niveau filtré * lorsque le volume est connu.

TABLES

1) Niveau
 2) Pression
 3) Débit
 4) Niveau
 5) Débit
 6) Niveau
 7) Débit
 8) Niveau
 9) Débit
 10) Niveau
 11) Débit
 12) Niveau
 13) Débit
 14) Niveau
 15) Débit
 16) Niveau
 17) Débit
 18) Niveau
 19) Débit
 20) Niveau
 21) Débit

Select the Abnormal Behaviors to Detect



MaidDevices Configurator

Alarms
Allows to configure alarms.

Alarms:

<input type="checkbox"/>		Name	Thresholds				Relays	Delays
<input checked="" type="checkbox"/>		Flow rate higher than	≥ 100 GPM (US)				P1	00:00:10; 00:00:00
<input checked="" type="checkbox"/>		Abnormal cycle state	automatic					00:00:10; 00:00:00
<input checked="" type="checkbox"/>		Abnormal pump sequence	automatic					00:00:10; 00:00:00
<input checked="" type="checkbox"/>		AC power lost	automatic					
<input type="checkbox"/>		Device restart	automatic					00:00:10; 00:00:00
<input type="checkbox"/>		Ethernet communication problem	automatic					00:00:10; 00:00:00
<input checked="" type="checkbox"/>		Ethernet communication success	automatic					
<input checked="" type="checkbox"/>		Inflow out of normal range	automatic					00:00:10; 00:00:00
<input checked="" type="checkbox"/>		Level drop w/o pump	automatic					00:00:00; 00:00:00
<input checked="" type="checkbox"/>		Long cycle	automatic					00:00:10; 00:00:00
<input checked="" type="checkbox"/>		Operation level changed	automatic					00:00:00; 00:00:00
<input checked="" type="checkbox"/>		Outflow out of normal range	automatic					00:00:10; 00:00:00
<input checked="" type="checkbox"/>		Pump capacity changed	automatic					00:00:10; 00:00:00
<input checked="" type="checkbox"/>		Short cycle	automatic					00:00:10; 00:00:00
<input checked="" type="checkbox"/>		Steady level	automatic					00:00:00; 00:00:00

Options... Units...

Buttons: Add... Duplicate... Modify... Delete

Navigation: ≤ Back Next ≥ Cancel

Tools to analyze a station

- Per cycle data
- Highlighted abnormal behaviors

Time			Period	Combination			Rain		Volume	Inflow		Outflow
Date	Day	Time	Duration	Pump 1	Pump 2	Pump 3	Rain	Graph	Volume	Inflow	Graph	Outflow
M/d/yy	dddd	H:mm:ss	hhh:mm:ss	state	state	state	in		US gal.	GPM (US)		GPM (US)
4/4/10	Sunday	2:51:38	0:01:03.00	Off	On	Off	0.00		1,155	1,100.0		2,741.4
4/4/10	Sunday	2:52:41	0:01:17.00	Off	Off	Off	0.00		1,412	1,100.0		0.0
4/4/10	Sunday	2:53:58	0:00:02.00	Off	Off	On	0.00		37	1,100.0		0.0
4/4/10	Sunday	2:54:00	0:00:46.00	Off	Off	Off	0.00		843	1,100.0		0.0
4/4/10	Sunday	2:54:46	0:01:09.00	On	Off	Off	0.00		1,714	1,490.0		2,988.6
4/4/10	Sunday	2:55:55	0:00:55.00	Off	Off	Off	0.00		1,723	1,880.1		0.0
4/4/10	Sunday	2:56:50	0:01:20.00	Off	On	Off	0.00		2,530	1,897.5		3,190.0
4/4/10	Sunday	2:58:10	0:00:54.00	Off	Off	Off	0.00		1,723	1,914.9		0.0
4/4/10	Sunday	2:59:04	0:01:21.00	Off	Off	On	0.00		2,585	1,914.9		3,191.5
4/4/10	Sunday	3:00:25	0:00:39.00	Off	Off	Off	0.00		1,568	2,411.7		0.0
4/4/10	Sunday	3:01:04	0:00:15.00	On	Off	Off	0.00		479	1,914.9		1,704.6
4/4/10	Sunday	3:01:19	0:02:13.00	Off	Off	Off	0.00		4,245	1,914.9		0.0
4/4/10	Sunday	3:03:32	0:00:04.00	Off	On	Off	0.00		128	1,914.9		0.0
4/4/10	Sunday	3:03:36	0:00:36.00	Off	Off	Off	0.00		1,149	1,914.9		0.0
4/4/10	Sunday	3:04:12	0:01:36.00	Off	Off	On	0.00		3,186	1,991.5		3,068.6
4/4/10	Sunday	3:05:48	0:00:50.00	Off	Off	Off	0.00		1,723	2,068.1		0.0
4/4/10	Sunday	3:06:38	0:00:23.00	On	Off	Off	0.00		624	1,628.3		1,704.6
4/4/10	Sunday	3:07:01	0:01:27.00	Off	Off	Off	0.00		1,723	1,188.5		0.0
4/4/10	Sunday	3:08:28	0:01:00.00	Off	On	Off	0.00		761	761.1		2,484.4
4/4/10	Sunday	3:09:28	0:05:10.00	Off	Off	Off	0.00		1,723	333.6		0.0
4/4/10	Sunday	3:14:38	0:01:29.00	Off	Off	On	0.00		1,359	916.1		2,077.9
4/4/10	Sunday	3:16:07	0:01:09.00	Off	Off	Off	0.00		1,723	1,498.6		0.0
4/4/10	Sunday	3:17:16	0:00:10.00	On	Off	Off	0.00		252	1,509.6		1,716.6

Advanced Diagnostics and Reporting

This Evaluation Report informs on:

- Number of abnormal events
- Which pump is the most expensive to use and the cost of leaving it the way it is
- Run times, starts, pump capacities, average run times, power consumption.

Project	Name: Jacobs Creek No.2	Type: Station
File: Jacobs Creek.mlsdf	Data: Jacobs Creek.mlsdf	
From: 4/1/2010 1:00:00 AM	To: 4/30/2010 1:00:00 PM	Duration: 29.12:00:00
Contact: Benoît Beaudoin	Phone: 1-855-875-2144 ext. 1021	Email: benoit@maidlabs.com

Dimensions	Cylinder	A: 2,438 m
Well input: Influent at the top		Well depth: m
Operation mode: Softmaid compatible mode		Measurement method: Distance from top
	Description	Depth m
		Volume l
	Start of third pump	3,861
	Start of second pump	4,216
	Start of first pump	4,750
	Stop of all pumps	6,147
		18 029
		19 690
		22 181
		28 704

Electricity													
Input	Measure	Unit	Δ / Y	Phase 1 Δ: 1-2	Unbal. 1 %	Phase 2 Δ: 2-3	Unbal. 2 %	Phase 3 Δ: 3-1	Unbal. 3 %	Average	Hours	Starts	Susp. events ≤ 10 s
Fixed	Voltage	V	Δ	480,0		480,0		480,0		480,0			
Computed	Voltage	V	Y	277,1		277,1		277,1		277,1			
Motor 1	Current	A		39,9	0,9	38,0	-4,0	40,7	3,0	39,5	83,8	1 902	23
Motor 2	Current	A		34,3	1,9	31,9	-5,4	34,9	3,5	33,7	242,2	1 905	9
Motor 3	Current	A		39,0	2,1	36,3	-5,0	39,3	2,9	38,2	74,5	1 968	13

Efficiency											Power consumption	Power factor: 0,90	Volumetric flow
Pumps	Total kWh	%	Phase 1 kWh	Phase 2 kWh	Phase 3 kWh	Run time hours	Events	Capacity l/s	Pumped volume l × 1,000	Efficiency %	Avg cycle hh:mm:ss		
1	2 335	21,8	785	747	802	78,7	1 894	85,5	24 240	25,9	0:02:29		
2	5 775	53,9	1 960	1 821	1 994	228,9	1 900	52,4	43 197	46,2	0:07:13		
3	1 861	17,4	633	589	639	64,9	1 893	92,2	21 520	23,0	0:02:03		
1 and 2	236	2,2	80	75	81	4,4	11	93,7	1 486	1,6	0:24:01		
1 and 3	38	0,4	13	12	13	0,7	7	113,5	283	0,3	0:05:56		
2 and 3	472	4,4	161	149	162	8,9	75	86,6	2 780	3,0	0:07:08		
Total	10 717	100,0	3 633	3 394	3 690	386,5	5 780		93 506	100,0			

Annual Energy Cost							Cost per kWh	0,150 \$
Pumps	Actual cost	%	Cost if single ¹	% variation	Variation / best	Same volume ²		
Pump 1	4 336 \$	21,8 %	16 727 \$	-8,7 %	1 711 \$	570 \$		
Pump 2	10 726 \$	53,9 %	23 218 \$	26,7 %	8 202 \$	2 734 \$		
Pump 3	3 456 \$	17,4 %	15 016 \$	-18,0 %				
Other	1 386 \$	7,0 %						
Total	19 904 \$	100,0 %				3 304 \$		

Extra annual electrical cost if modifications are not made: **4 888 \$** **25 %**

(1) Cost if only one pump would pump everything (2) Extra cost of electricity if each pump pumps the same volume of water

Pump Capacity and Run Time Variations

Pump Capacity Variation vs Run Time Variation

Compared Identical Pump Pairs in Over 150 Lift Stations

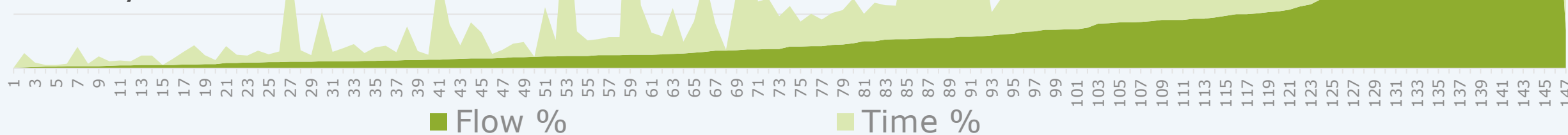
The average run time variation is **twice** the average capacity variation.

↑ **Levels 1 m** ≥ ↑ **Pump Capacity by 10%**

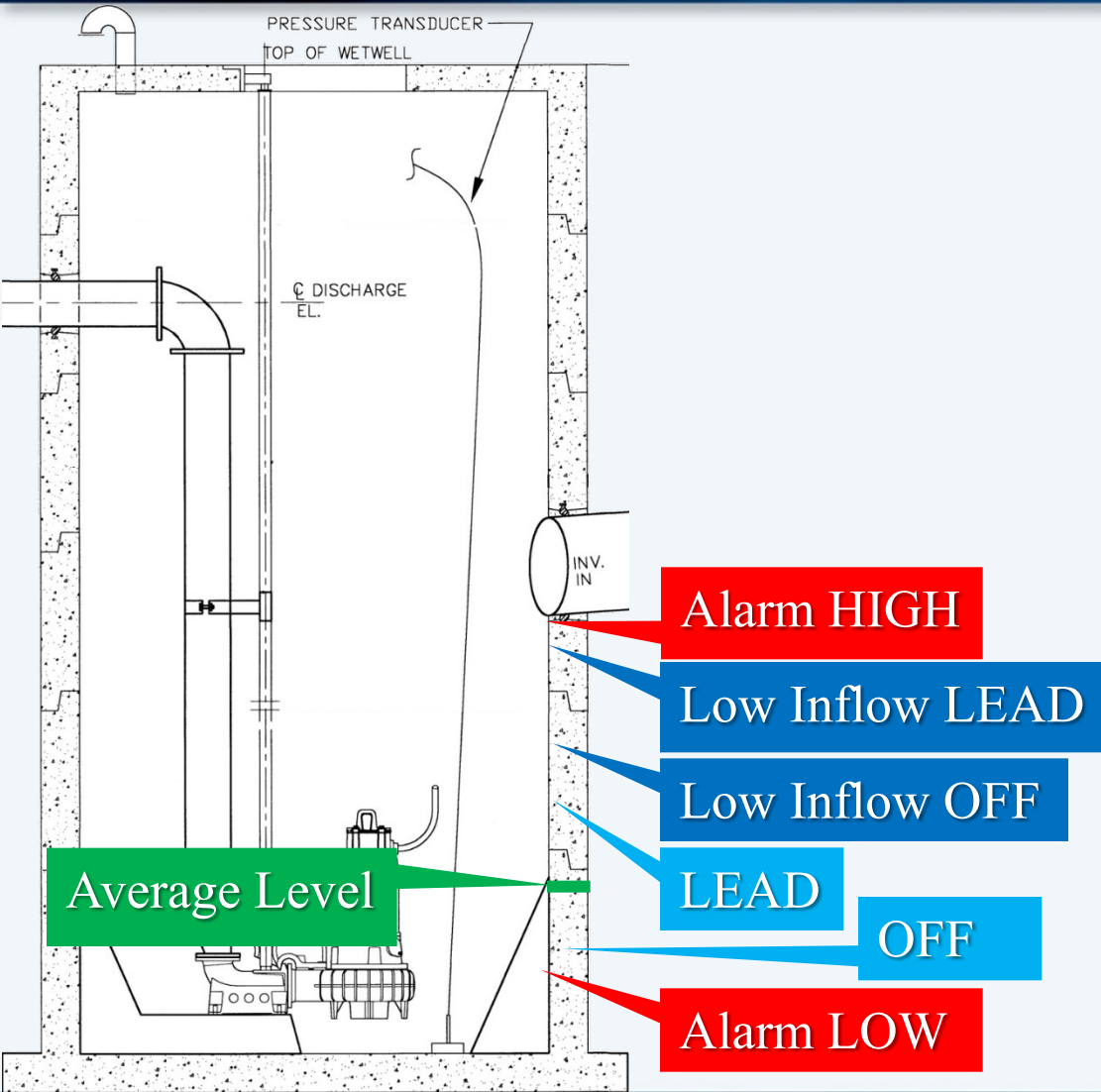
↑ **Pump Capacity 10%** = ↓ **Time 20%**

Directly affecting:

- **Energy Cost of pump station**
- Maintenance cost
- System wear



Rising Energy Efficiency of Pumps



- ❖ **Raise the level of operation when the inflow is low.**
- ❖ **Delay the start of additional pumps by starting the first pump earlier when the inflow is high.**

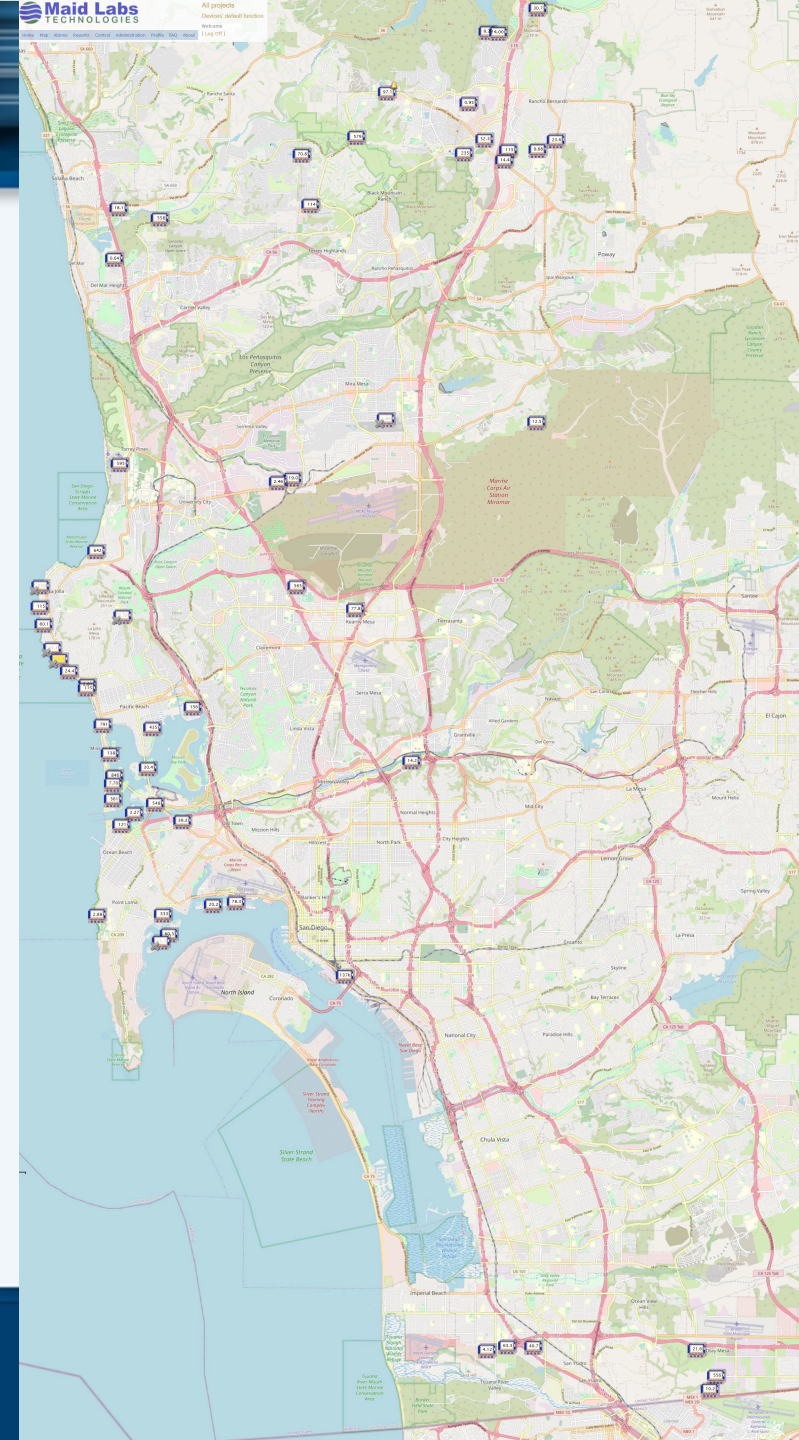
Energy Savings

San Diego, USA (Used as SCADA Backup)

- 59 pump stations out of 63 could raise the pumps operation levels.

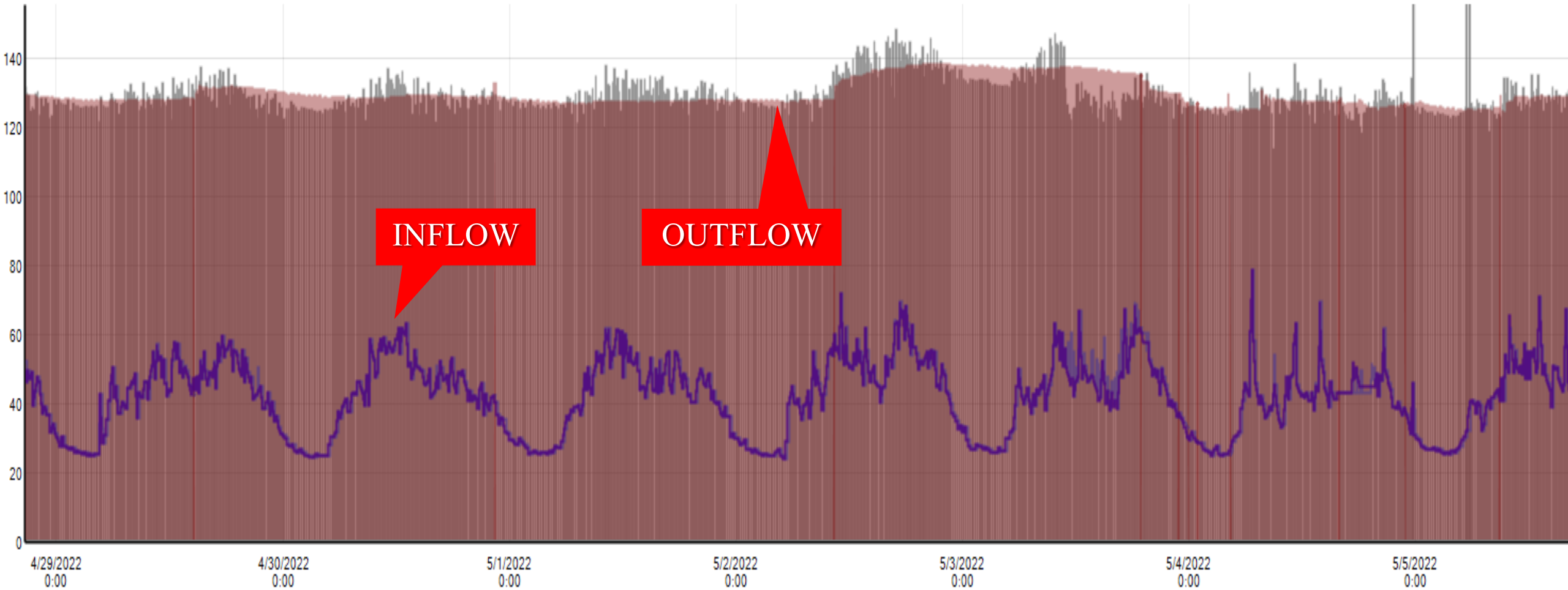
São Paulo, BR (To reduce energy cost)

- 1st test site: Raised the pump operation levels by 7 cm. Achieved 9.3% of energy reduction.
- 2nd site: Raised the pump operation levels by 70 cm. Achieved 37% of energy reduction.



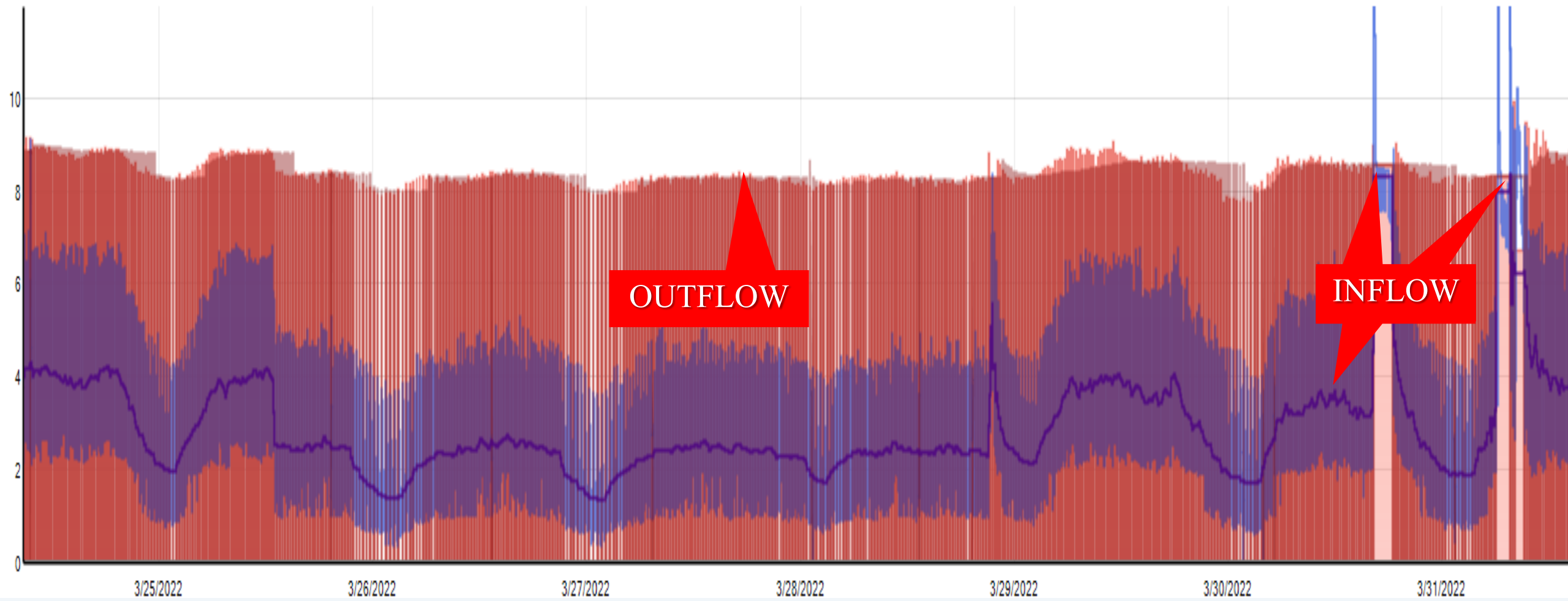
Where Can It Be Done?

Flow (l/s)



Where Can It Be Done?

Flow (l/s)



Summary

- Accurate, even in abnormal situations.
- Multiple operational and hydraulic diagnostics.
- Cost of inefficiency.
- Ratio of pump capacity to pump run time: 1:2
- Identify energy saving sites.
- Raising operation level = COST REDUCTION

This is why you should use our technology!