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Pump & Controls Specialists

A Crawford Champlin Company

MONITORING YOUR SYSTEM REMOTELY

David Crawford

Champlin Associates

Essex Junction, VT

INTRODUCTION

- Champlin Associates is an Essex, VT based business focused on pumps, controls, and operations for the water and wastewater industry.
- We rep and supply products across New England but focus on Vermont and New Hampshire
- Ten employees
- Our SCADA and Remote Monitoring systems focus on Mission and Primex Products, but we have others.
- I will be showing items we rep as examples – my “strawman”
  - Not as a sales pitch, but I know those best. (and they are really good….)

Questions are WELCOME during this presentation!

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SCADA & REMOTE MONITORING

It is an acronym like SCUBA…

S – Supervisory

C – Control

A – And

D – Data

A – Acquisition

SCADA

What it is

- A tool
- A time saver
- A record keeper and report creator

What it is not

- **A replacement for a qualified operator – YOU NEED HUMAN INTELGENCE AND EXPERIENCE TO MAKE A SYSTEM RUN**

Goals for a good SCADA system

- To give the end user the information they need, when they needed it, to make good decisions.

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SCADA'S FUNCTION

- SCADA systems **gather information** such as:
  - Pump Runtimes, Flow, Water Levels, Pressure, Amperage, Temperature, Total/Free Chlorine
- Thresholds can be set to cause **alarms** when readings are out of the norm
- SCADA systems can **monitor and analyze** specific conditions such as:
  - High or Low Level, Pump Failure, Intrusion, Power Loss, Generator Running, Phase Loss, High Temperature, Excess Pump Starts, Analog Thresholds
  - Analytics is a buzz word – let the machine do SOME of the thinking for you
- Then transfers the information back to a central site (computer or cloud) where it is stored for analysis, alarming and **reporting** purposes. And to provide information for decision making

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TYPES OF SCADA COMMON TO WATER AND WASTEWATER

- Auto Dialers – land line and cellular
- Mission Communication Managed SCADA – cellular connection with central cloud server (our example)
- Client/ Server (traditional) – on desk systems with remote access
- Cloud based SCADA Primex IControl (our example)

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WHY IS IT NEEDED – ESPECIALLY IN THESE TIMES

- No town or municipality is over staffed
  - Remote monitoring gives you the ability to check on operations without being there. This is a tool to make the most of the operators you have
- During the COVID crisis this has become even more important
  - Many operator teams split up for coverage and Remote Monitoring allowed the covering operator to see more places at once and work on problems that needed to solved rather than driving and checking on well functioning stations.
- Increasing regulatory restrictions are being imposed on Water and Wastewater operators for efficient & safe system operations
  - CSO is an example of information that is needed rapidly to provide the correct response and data to document the event
- Both current & historical data from electronic databases greatly simplify the reporting process

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SCADA "WORDS"

Digital Points

- DI/DO – Digital In/Digital Out
- An on – off switch
- Alarm points -floats, door alarms, switches

Analog Points

- AI/AO – Analog In/Analog out
- Scaled points – 4-20mA, 0-5v, 0-10v
- Examples - Tank levels, pressure levels, chlorine levels

HMI – Human machine interface

PLC – Programmable Logic Controller

RTU – Remote Terminal Unit

SCADA Software – ties it all together

SCADA RTU

The RTU, an acronym for Remote Terminal Unit, is the term commonly used for the field device/computer which gathers data from the local field devices and outputs electrical signals for operation or for trending of data

RTU

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SCADA COMPONENTS

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TIE IT TOGETHER & MANAGEMENT

Wire

- Network, DLS, cable…

Radio

Cell

Traditional is client/server

- You buy the hardware and software
- You keep it up to date
- Not my focus today

Web Based (our examples)

- Mission – one solution – packaged
- Icontrol – many solutions, with standard items in a custom configuration

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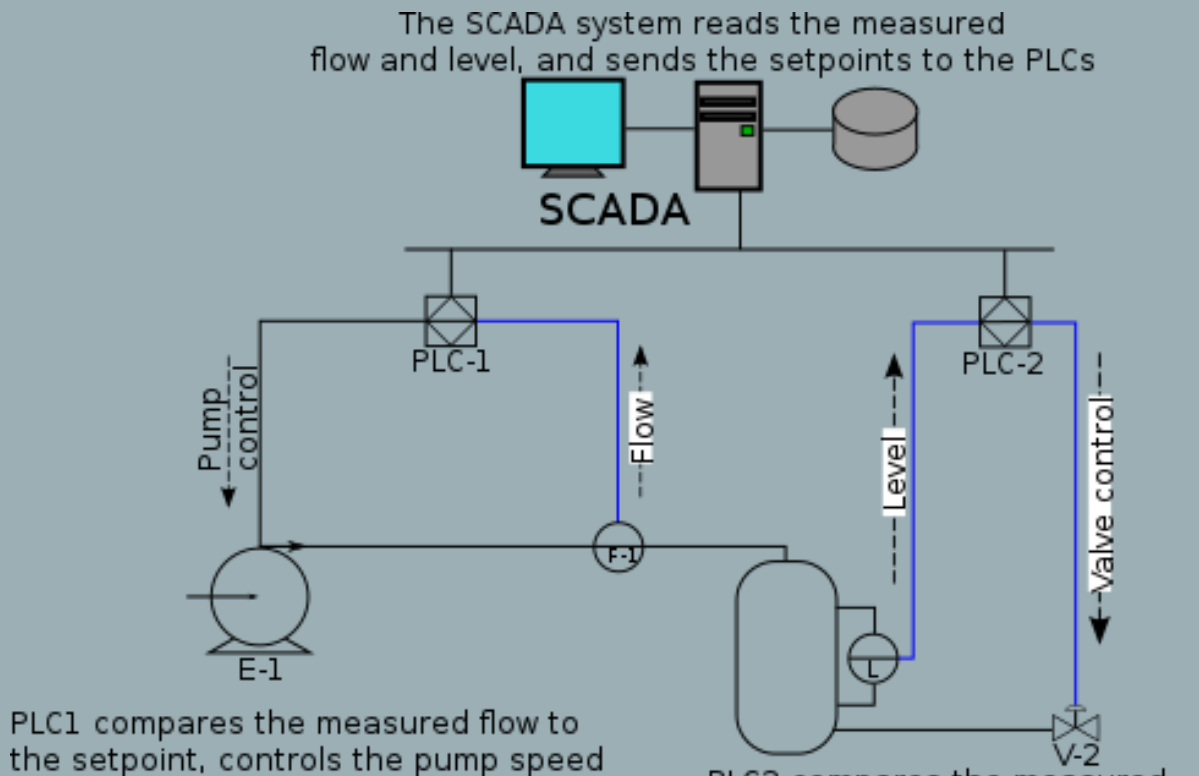
SIMPLE SCADA



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GETTING THE DATA TO YOU

Cell phone

Land line

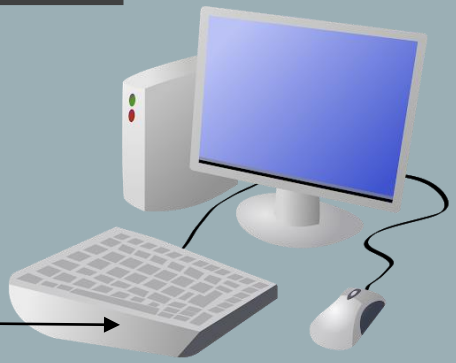
Desktop

Pager

Laptop

Ipad

FAX???



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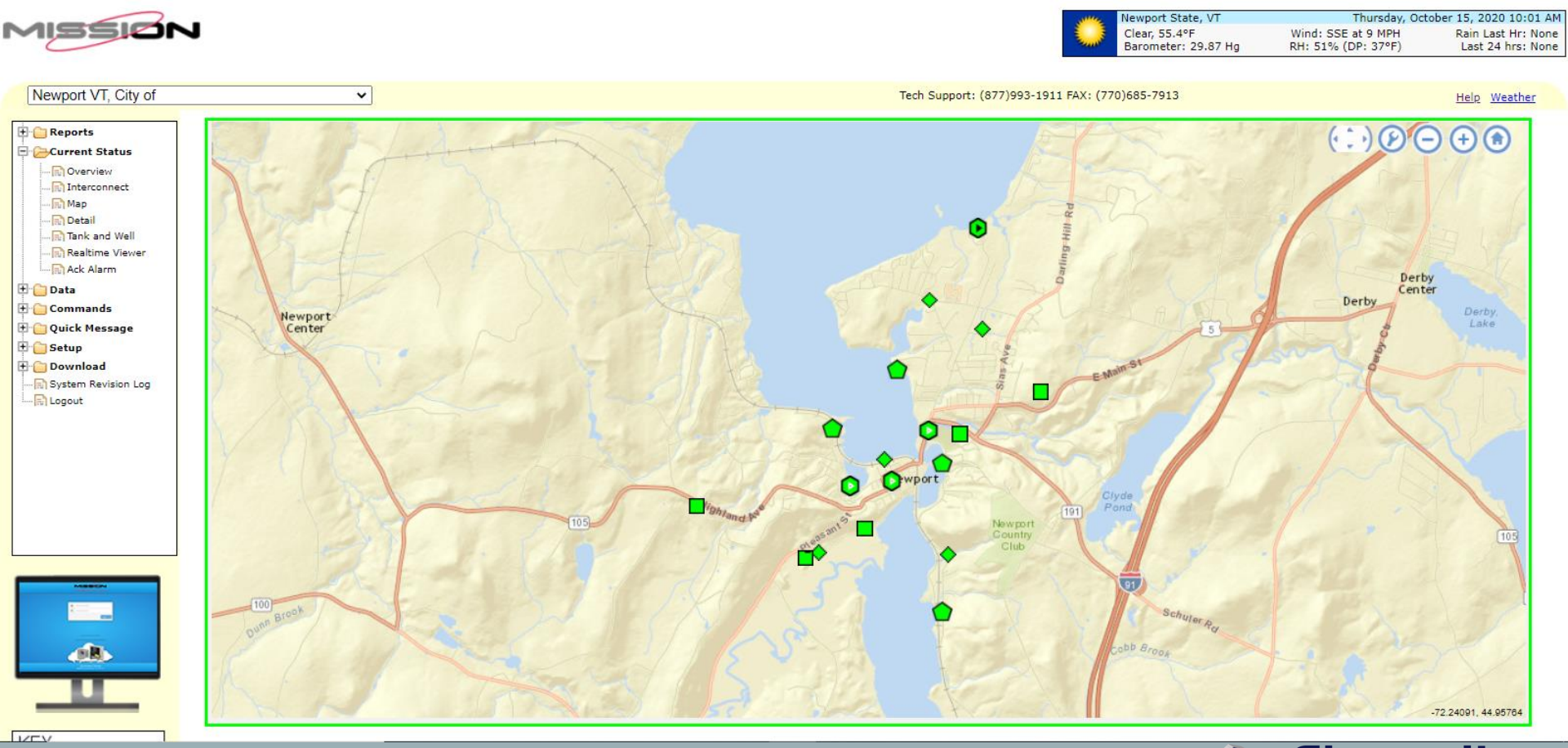
EXAMPLES OF HELPFUL DATA



Information at a glance – all good here go about your normal day

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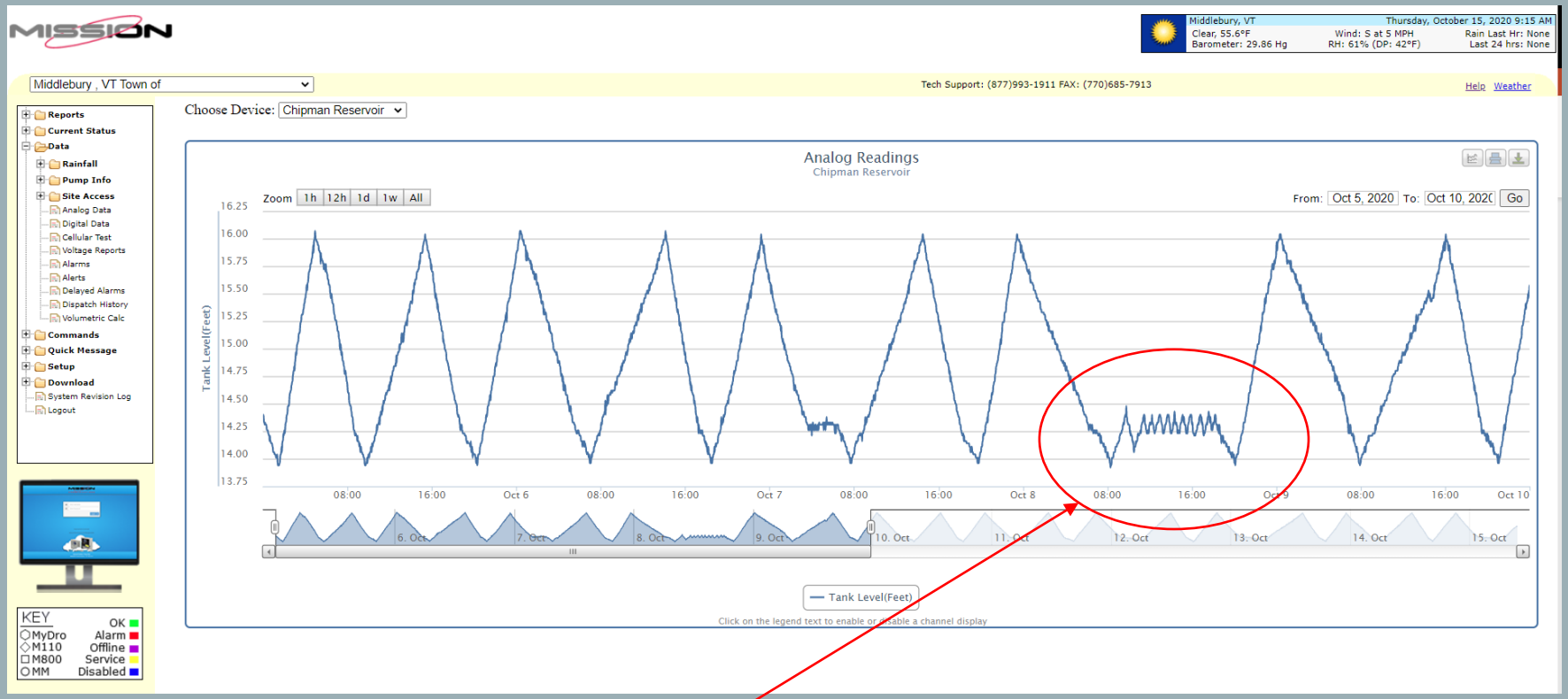
EXAMPLES OF HELPFUL DATA



Someone swapped pumps and forgot to swap them back

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EXAMPLES OF HELPFUL DATA

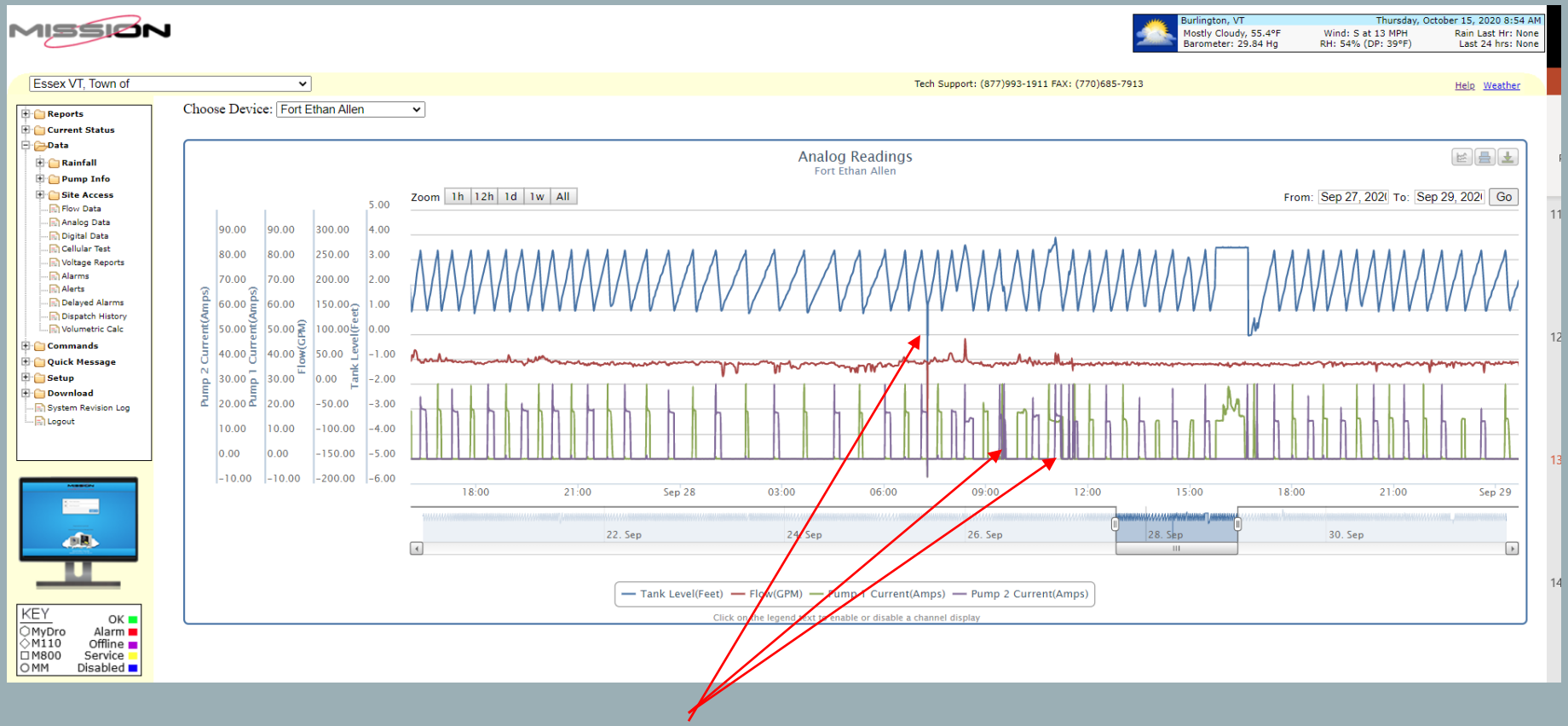

Chart showing tank level, flow, and pump amps and something not quite right

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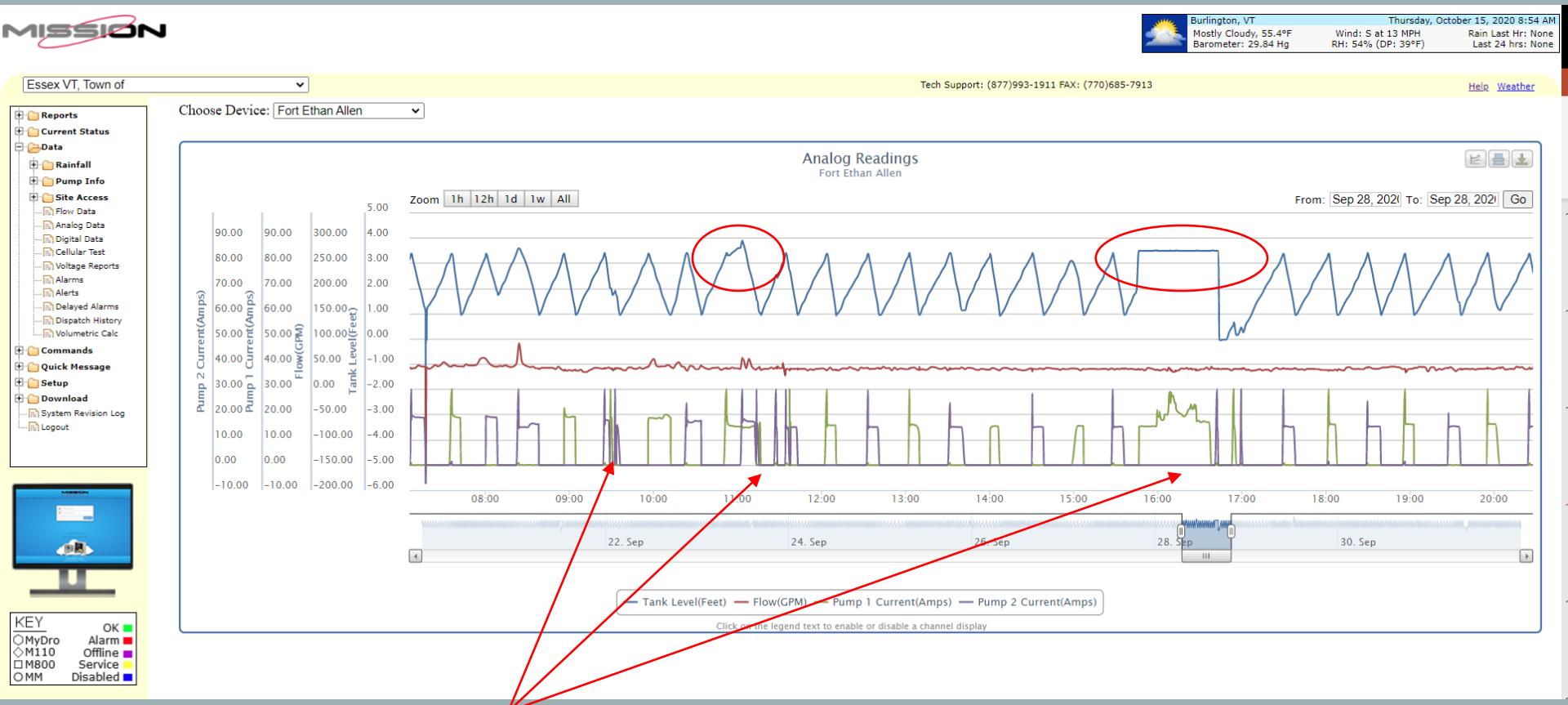
EXAMPLES OF HELPFUL DATA



Zoomed in – Pump 1 is the issue

Had a power bump, during a rain storm, washed material in to wet well

Amps were all over the place because it was plugged

The team knew where to really look for the problem from this data

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REMOTE TANKS WITH OUT POWER

Remote Location?

Solar Power is the Answer!

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SMALL SCADA COSTS

- Cost vary based on what data you are taking in and what equipment you select
  - A basic dialer for simple alarms can run around $500 but only calls when something is wrong – you will need a phoneline or cell package as well – budget about $30 per month
  - The Mission examples I have shown you are out of the box solutions and vary from $3000 to $5000 per station depending on the model you choose and that is driven by the data you need to collect. You will need a cell plan via Mission at $36 per month – these obviously provide more data and features than a traditional dialer
  - A custom programmed RTU can run $5000 to $10000 depending on the IO you need, you still need to collect the information somewhere and transmit it as well.

LARGER SYSTEMS AND CLOUD VS TRADITIONAL

TRADITIONAL

On your site on a computer or server

Access to system is local OR via a log in to the site computer (ie via LOG ME IN) But they can have a web interface if set up that way

Data back up local/remote self managed

Software to keep up to date

CLOUDBASED

Remote from your site on a cloud based server

Access from any internet connected device if you have permission to accsss

Remote back up of data managed by others

No software to buy or update

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CLOUD BASED VS TRADITIONAL SERVER BASED

How WE bought music

How our kids buy music

Google Play Music

amazon music

Spotify

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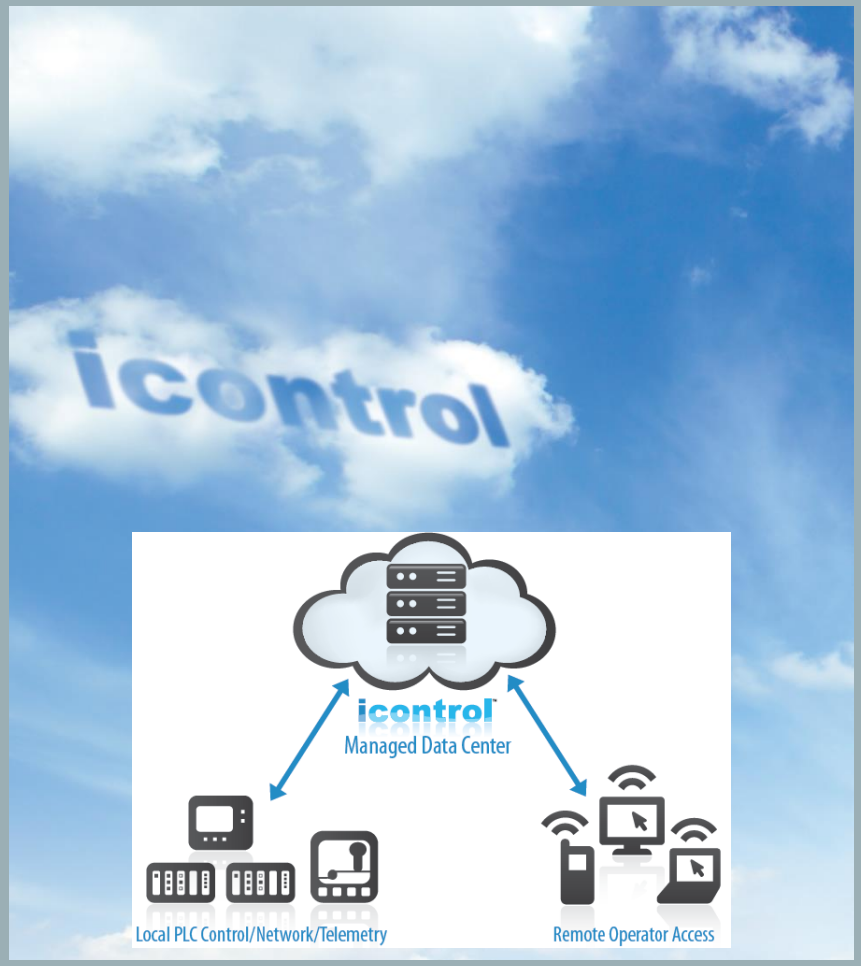
LARGER CLOUD BASED SCADA



icontrol™ solutions

- Affordable Control. Anytime. Anywhere.
  - Icontrol® is the ideal solution for operators seeking all the benefits of a SCADA system – without the expense and hassle of owning and maintaining these systems.

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HOW IT WORKS

Local Controls

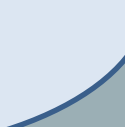
- Virtually any mix of PLC or Modbus Device Local networks and/or telemetry

Communications

- Via Broadband, Cellular, Satellite, … or Mix

Redundant, Secure, Managed Data Center

- SCADA
- Alarms
- Data



Remote Backup of Data Center

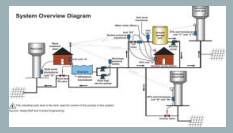
Customer Access

Via internet-connected devices

Only their unique project and privilege level

Customer A

1 Lift Station



Customer B

Distribution System

8 RTUs (4 VPAC, 2 AB, 2 GE) via Radio Telemetry to an AB CTU/Master

Customer C

Wastewater Treatment Plant

Entire plant control network of diverse processes and controls

Customer A

Customer B

Customer C

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PROGRAMMING & GRAPHICS

- Icontrol utilizes prepackaged programming and graphics for cost savings and for standardization.
- Custom programming us used for custom situations
- This allows equipment to be added at later dates easily
  - Example – you want to do all your pump stations now but your plant later – can be done that way or in reverse, plant first then pump stations

- This is two-way communication – you can **control** from anywhere you can connect. Just like desk top SCADA you have the ability to stop and start equipment and take other actions.
- Most small systems have limited or no capability like this.

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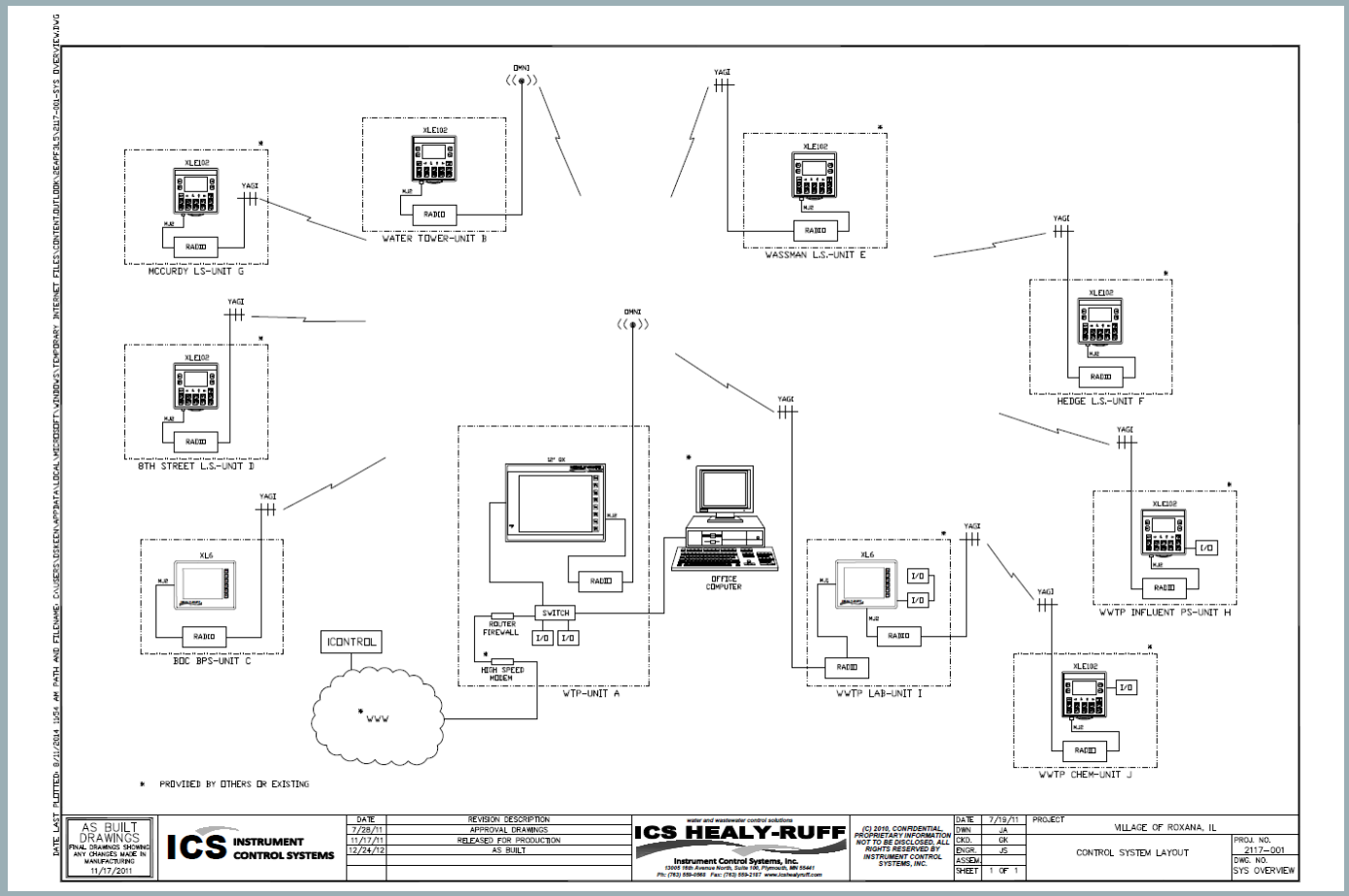
FLEXIBILITY



Very flexible to add points from anywhere that can be connected via DSL, Cable, cellular

Can be complex or simple, all pump stations or a plant or a mix

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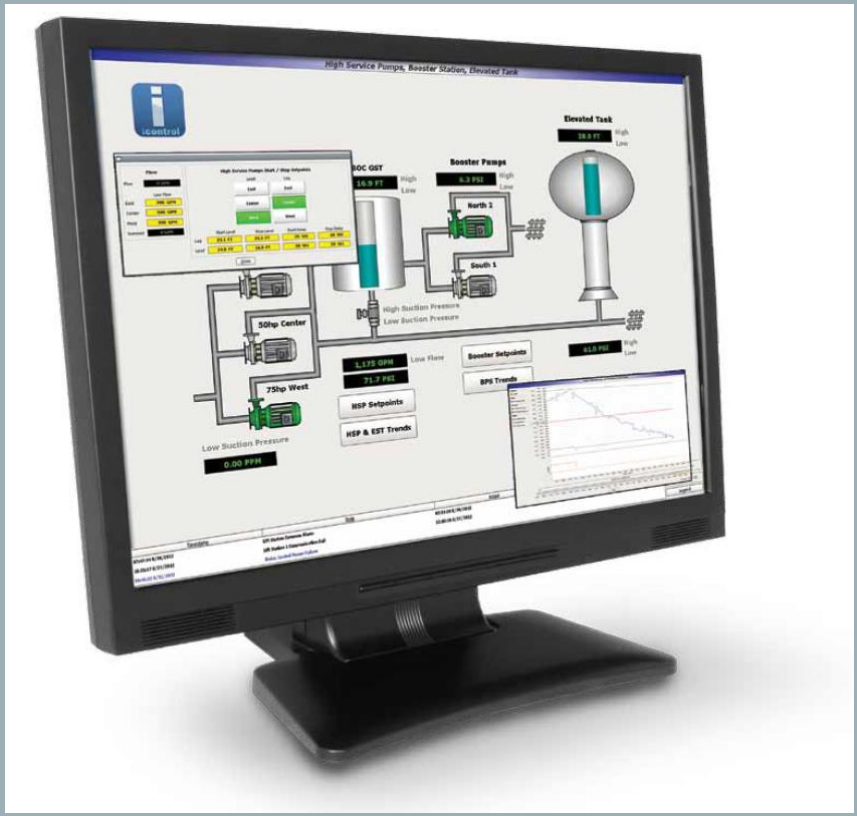
YOU MANAGE YOUR OPERATIONS



icontrol™ solutions

Full-featured, open-architecture SCADA platform.

- Secure, Remote Access
- Dynamic Process Graphics
- Full Control
- Alarm Management
- Data and Reporting
- Maintenance Tools

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SOMEONE ELSE MANAGES YOUR SCADA SOFTWARE

icontrol™ solutions

Professionally managed data center hosts your application.

- Full Redundancy
- Physical and Cyber-Security
- Data and Program Back-up and Archiving
- Unlimited (used defined) Remote System Access
- Scalability As Needed
- SCADA Software and Hardware Updates

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FLEXIBLE PACKAGES

Total Control. Whenever and Wherever You Need It.

A full-featured, open-architecture platform for supervisory control, monitoring and alarming, data and reporting, and more. icontrol can be integrated with most existing local PLC control systems and accessed anywhere from most web-enabled devices.

Accessibility

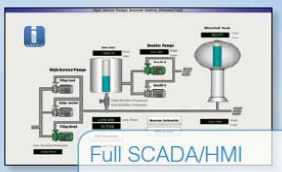
- Full access from any PC and most mobile devices
- No software to load, or maintain
- No "client" licensing – unlimited users
- Managed levels of access / security

Monitoring and Alarming

- Alerts via text, e-mail and system screen
- User managed priority and call out lists
- Full alarm history and log
- Remote acknowledgement

System Management Services
in Data Center Environment

icontrol



Full SCADA/HMI

- Dynamic, custom process graphics
- Multiple sites, systems and processes on one application

Data and Reporting

- Trend charts
- Standard and custom reports
- Electronic filing options
- Data redundancy and archiving

24/7 Monitoring and Management Redundant/High Capacity Systems

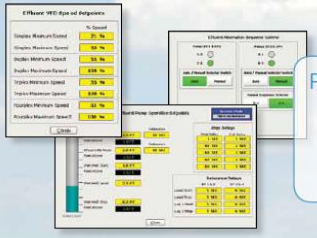
- Servers and software
- Power and internet connections

Security and Integrity

- Cyber-and physical security
- Data and application backup and restore
- Managed communications

Maintenance, Licensing and Upgrades

- Server hardware and network infrastructure
- Operating and application software

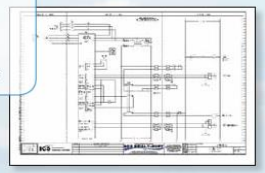


Process Control

- Operating set points
- Alarm set points
- Equipment control (e.g. H-0-A, VFD settings)
- Control schemes (e.g. alternation) and schedules

Asset Management

- Preventive and predictive maintenance tools
- Maintenance logs and procedures
- Operation and maintenance manuals



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LARGE SCADA COSTS

- Cost vary based on what data you are taking in and what equipment you select – THIS IS THE LARGEST FACTOR IN COSTS
  - The benefit is the ability to spend up front for a framework then add items like pump stations or remote equipment at a later time
  - How the data is transmitted effects costs – with multiple cellular connections there are additional fees. If the unit can be DSL or Cable internet that is a one point connection with one fee.

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SUMMARY

- Automation and remote monitoring can help make the most of the people you have by giving them visibility to your equipment
- Data helps make good decisions
- Systems do not have to be very expensive to make a big difference – often the cost of one or two call outs can pay for the system
- There are benefits to cloud base systems to shift the cost and hassle of keeping systems up to date – might be a mindset shift to having it off site

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QUESTIONS – NOW OR LATER

- www.champlinassociates.com
- Dave Crawford
  - Dave@champlinassociates.com
- 802-879-7136

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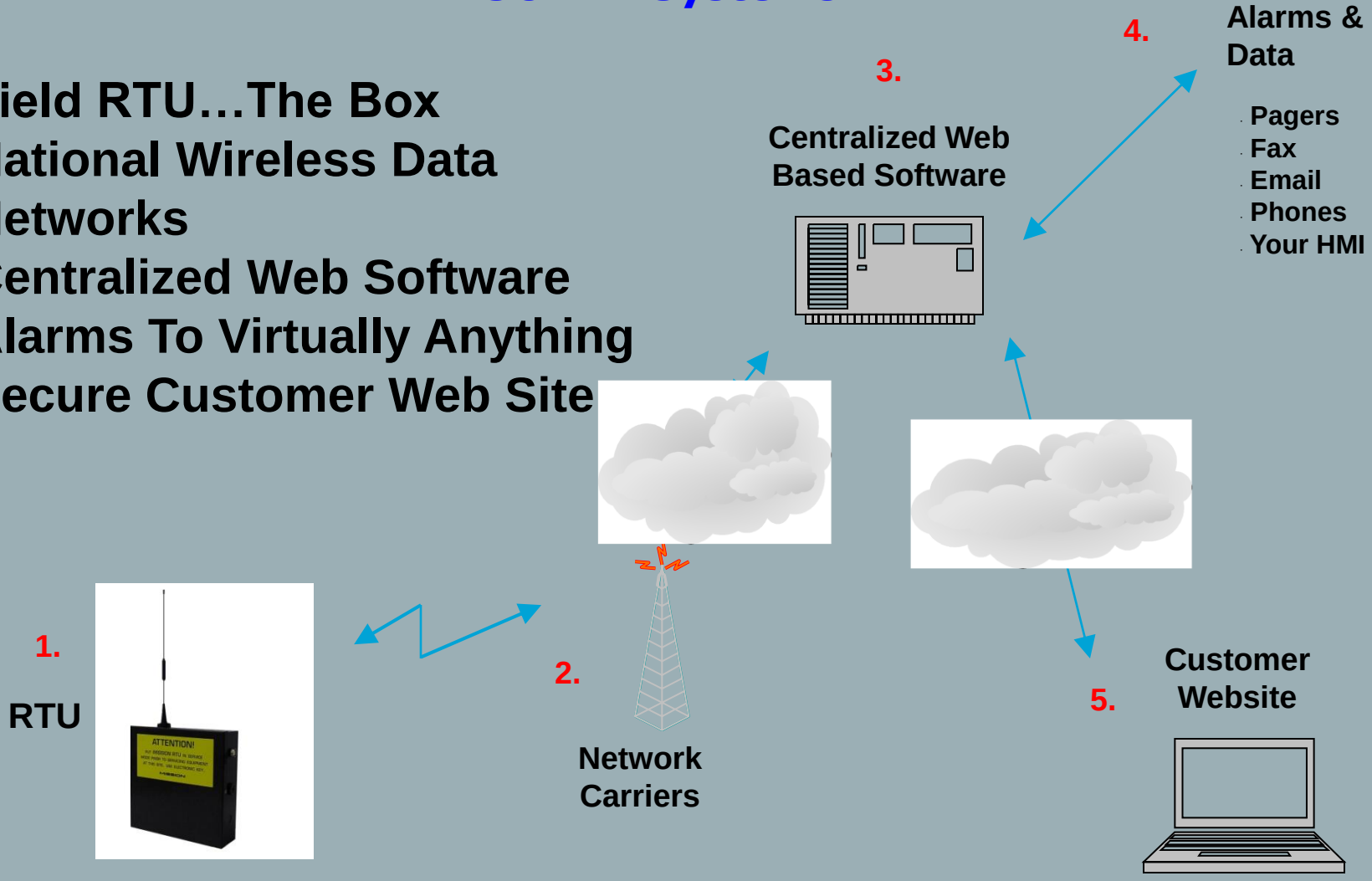
NOTHING PAST HERE YET

Mission's Managed SCADA

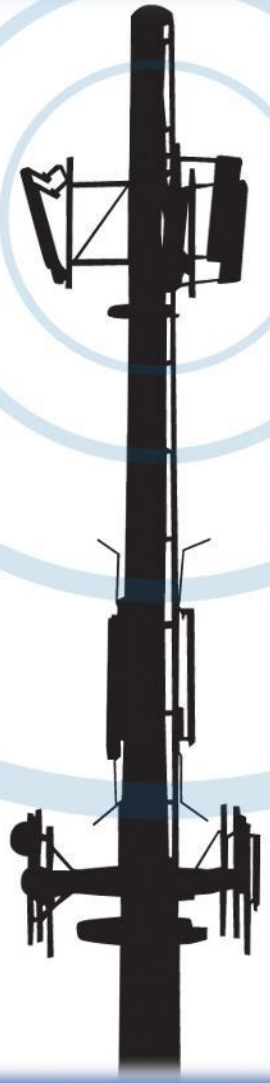
- Server hardware and software maintained by Mission
- Clients access data with a standard web browser from any computer or mobile device with internet access – REDUNDANT DATA STORAGE
- Economies of scale allow low cost
- One vendor for the entire system including hardware, connectivity, and the presentation of the data
- New features that benefit one client can be provided to all clients with no upgrade hassles or costs
- Very fast deployment

Basic Components of Internet Enabled Monitoring & SCADA Systems

1. Field RTU…The Box
2. National Wireless Data Networks
3. Centralized Web Software
4. Alarms To Virtually Anything
5. Secure Customer Web Site



Connectivity

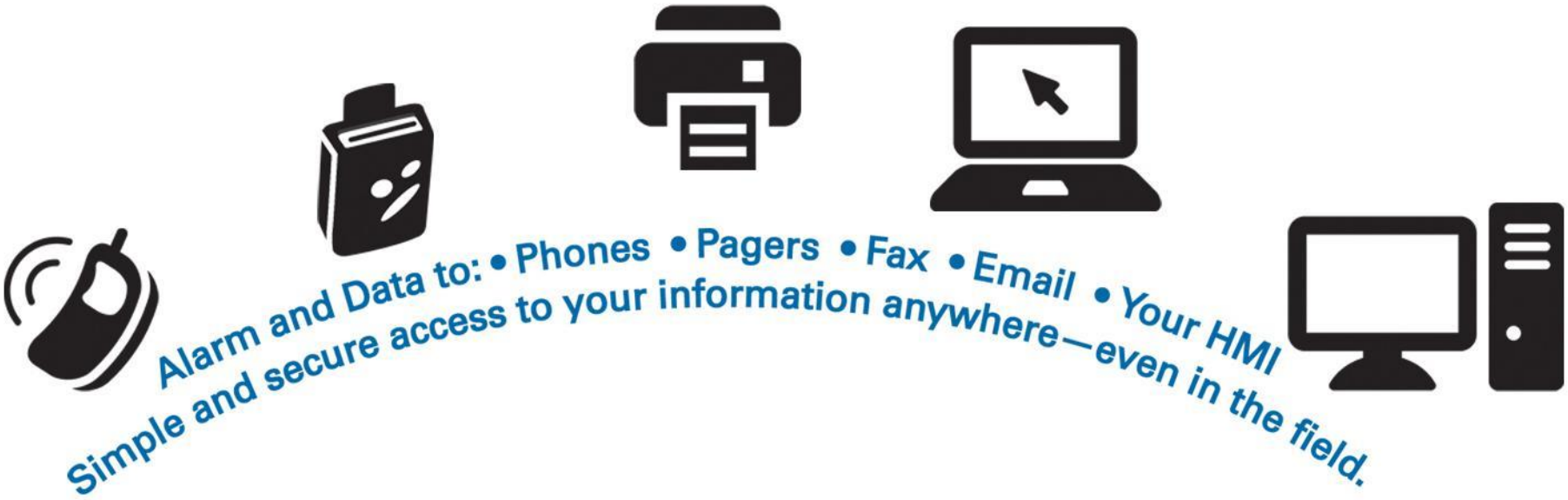


- Direct relationships ATT, Verizon, Sprint, Rogers
- GSM- HSPA+ (4G), CDMA
- Nationally maintained towers
- Radios are stationary
- Omni v. directional antennas
- Coax best practices
- Connections monitored
- 99+% connectivity for 12,000+ units throughout the US & Canada!

Is Cellular Reliable?

- The short answer is…YES!
- We use the data channel, not the voice
- Each transmission is confirmed end to end
- All transmissions are encrypted
- After disasters, cell towers are brought in on tractor trailers and communication is restored

Alarms and Data to all Devices



Always on, always connected

MISSION COMMUNICATIONS

M110 & M800 Enclosures and Included Items

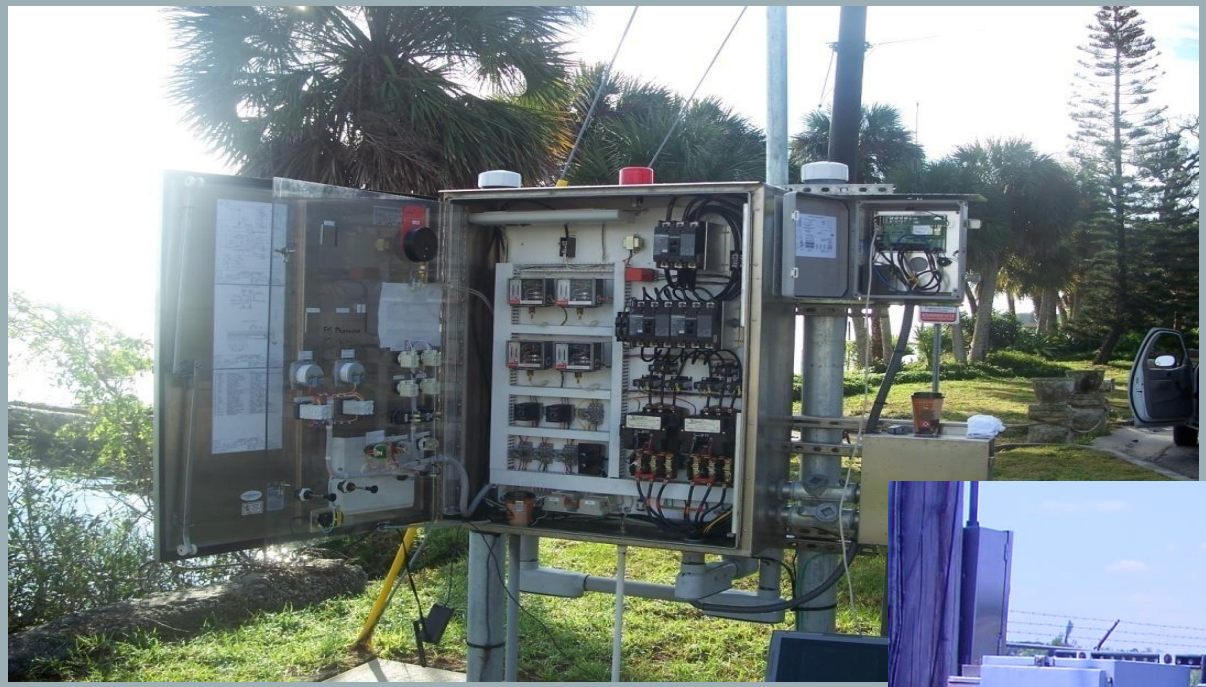
- Nema 1- indoors
- Nema 4- outdoors
- Flat Pack-inner door of control panel
- Antenna with universal bracket
- Transformer and battery
- Electronic keys
- Resistors- 2 types

How It Applies to Water/Wastewater

- Cellular Technology Can Be Applied In A Variety of Remote Applications
- Water Pumping Stations
- Sewer Lift Stations
- Level / Flow / Pressure Applications
- Tank Storage Applications
- Storm Water / Sewer Flow Applications
- Meter Reading Applications
- Water Well and Tank Control
- Rainfall Monitoring

Applications & Examples

MISSION COMMUNICATIONS



Typical Lift Station

Rainfall Monitoring

Pump Stations

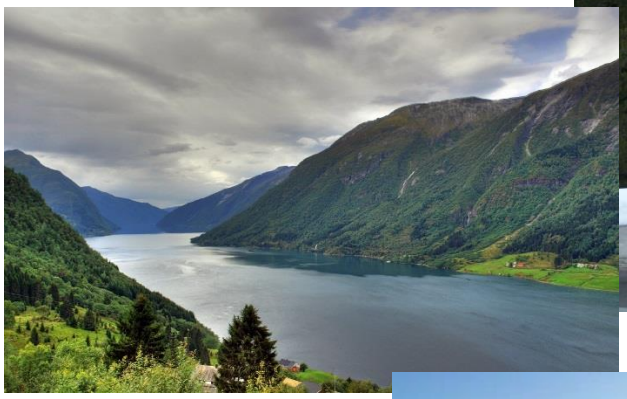
Water Tower Monitoring

Remote Location?

Solar Power is the Answer!

Why Solar Power?

- Remote locations with no access to AC power
- AC Power is not under your control or difficult to access
- Remote control of generator



Manhole Monitor

- **Sewer overflow alarm and tracking system**
- **Enhanced 3rd generation**
- **All-Metal, waterproof enclosure; meets IP68 requirements**
- **Reliable 4G cellular radio**
- **Pushbutton & LCD**
- **5+ year replaceable battery**
- **Floats, non-wicking cable, waterproof connectors**

Manholes are often out of reach from traditional Wired SCADA

Why Monitor Manholes?

Property Damage

Fines

Wetland damage

Health risks

Public uproar

Unpleasant odor

Detect bigger problems

Proactive vs. Reactive

Maintenance Schedules

Alternative Locations

- Border areas
- Environmentally sensitive areas
- Manholes without pavement or cement:
  - Antennas should not be buried, or be covered by debris
  - Embed the antenna in a concrete paver or sprinkler service bucket
  - Optional post

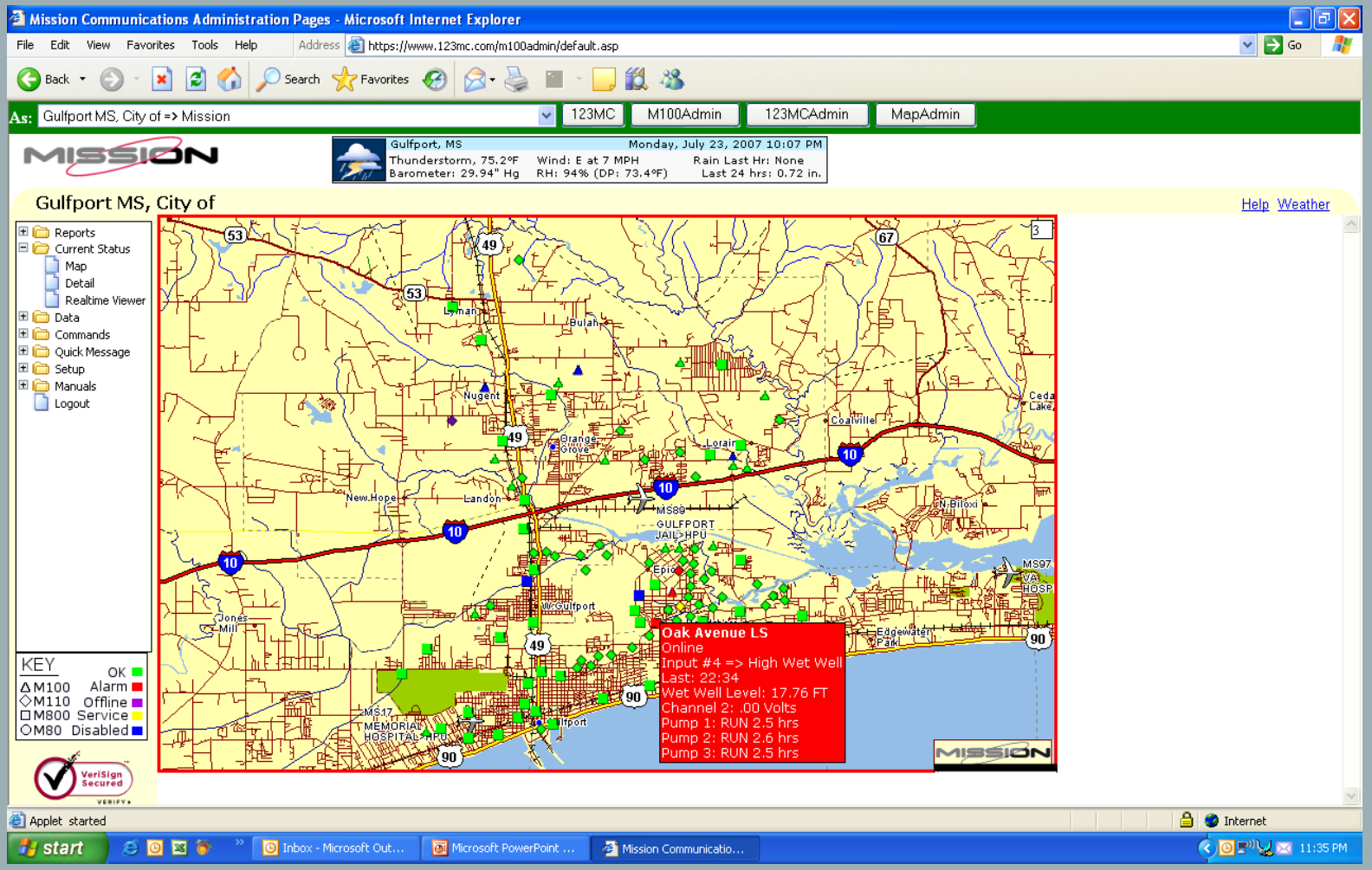
Timely Data Yields Better Management Decisions

- Profiling and understanding:
  - Flow Data
  - Level Data
  - Pump Activity
  - Rainfall Data
  - Surcharge Data
  - Total/Free Chlorine

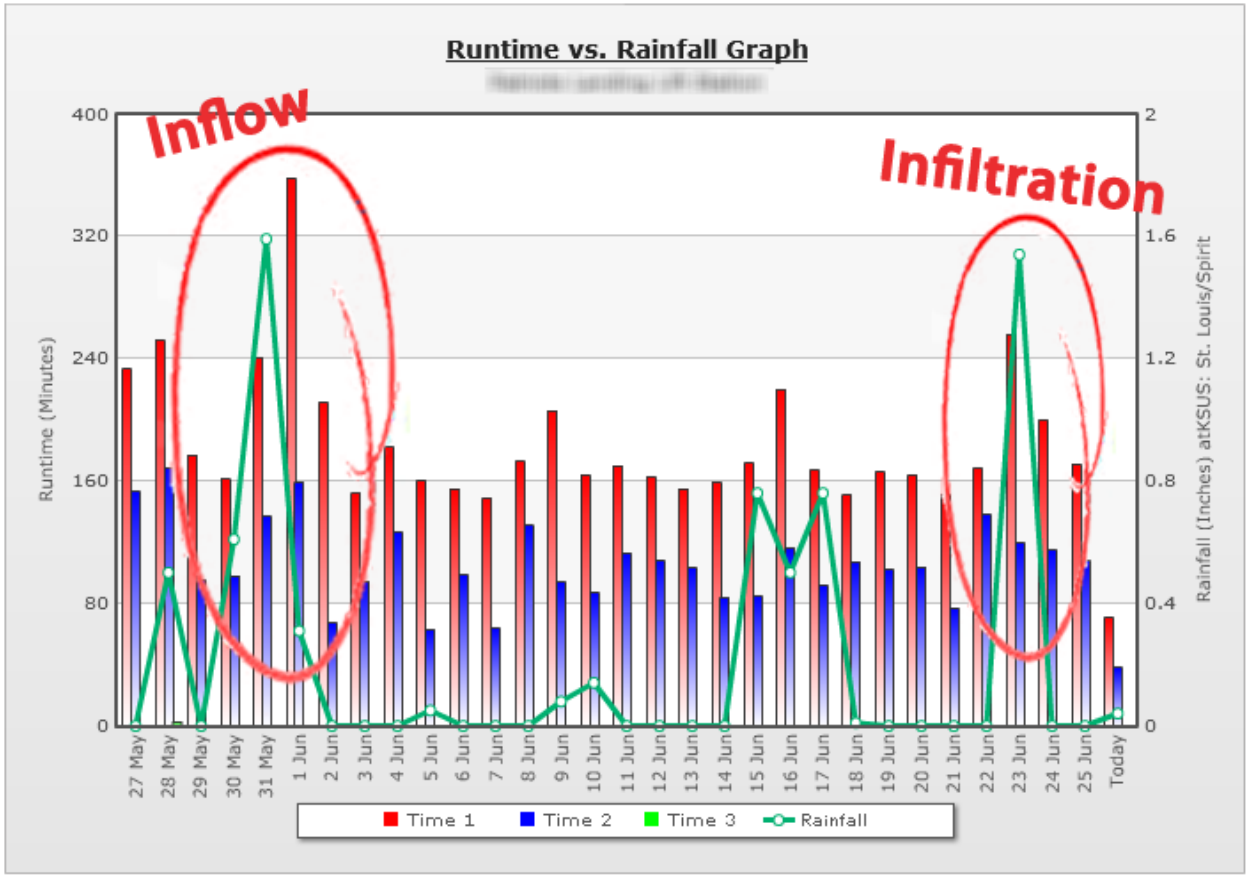
…is crucial for effective operations

- The Mission Service includes these reports and more automatically!

Map location of your stations

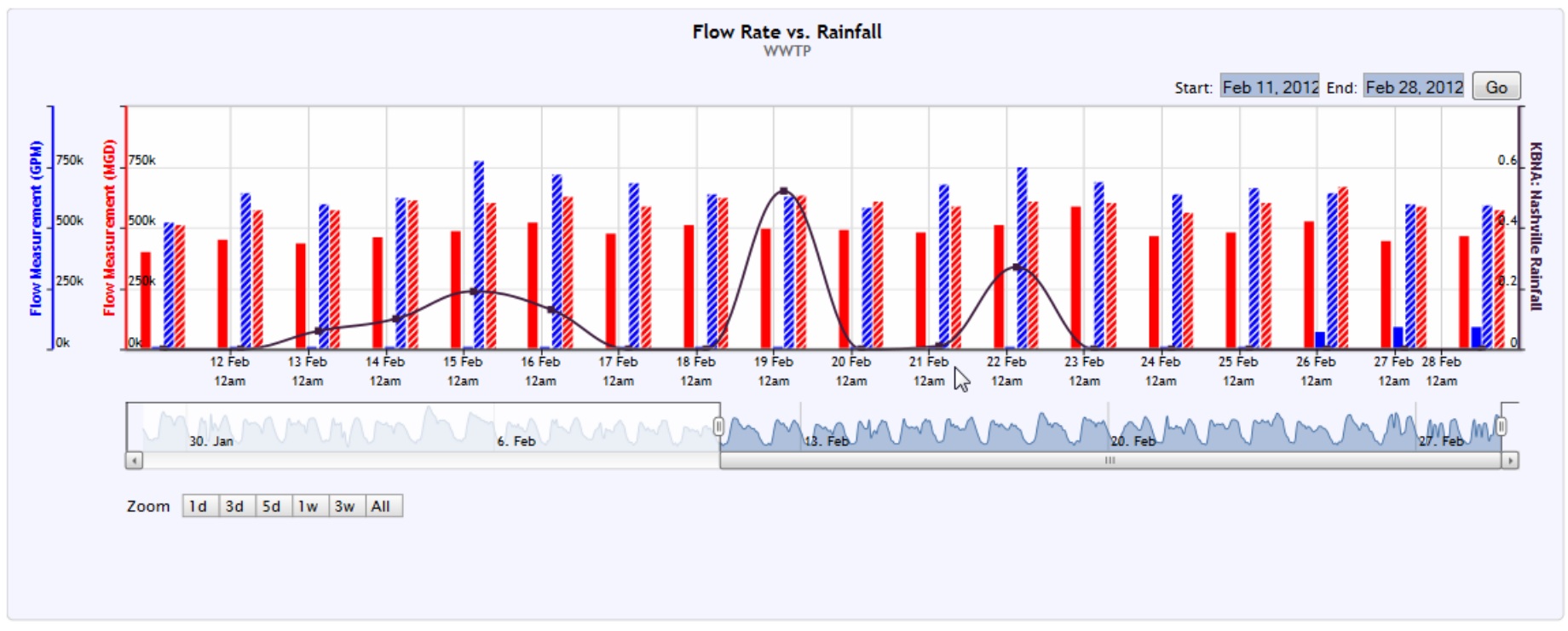


Understand Your Inflow and Infiltration (I&I)

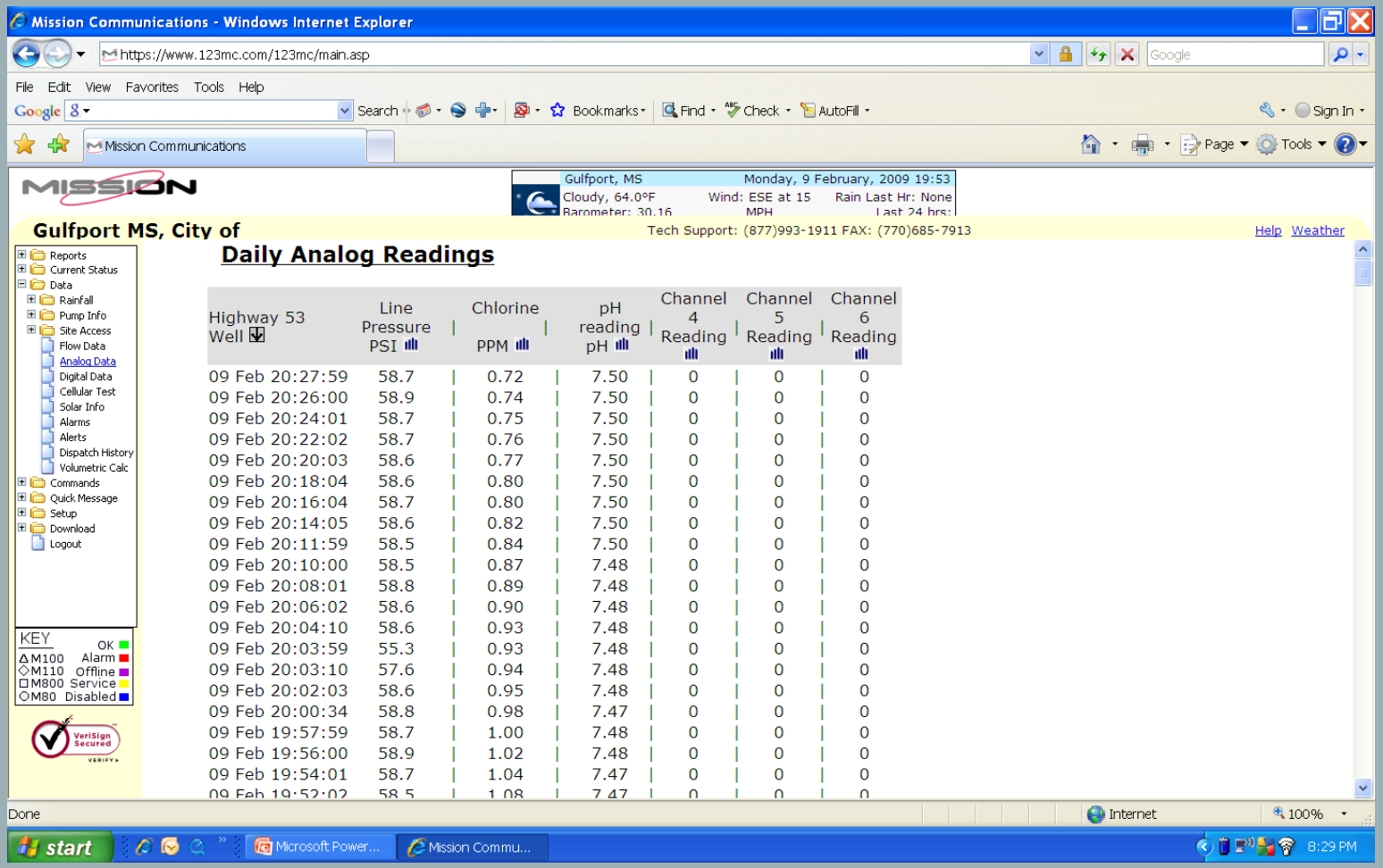


MISSION COMMUNICATIONS

Flow Rate vs. Rainfall

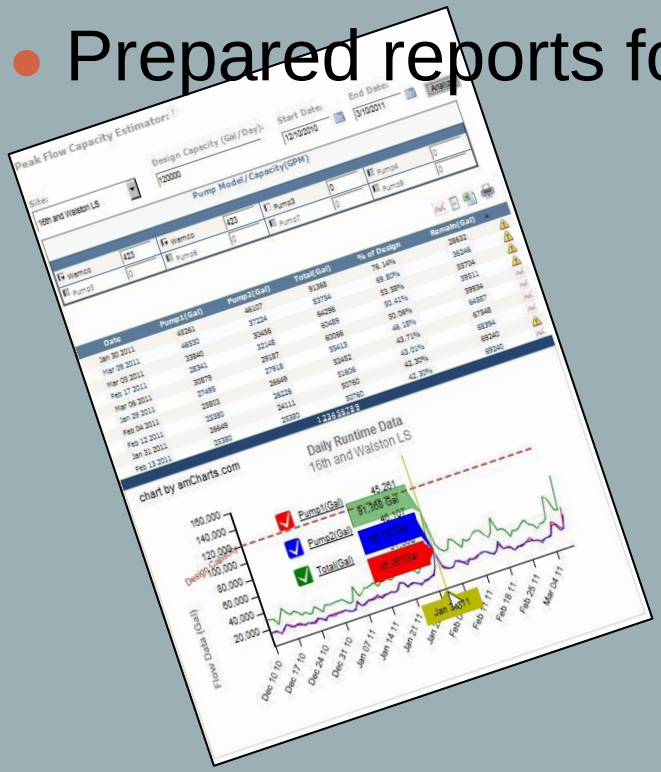


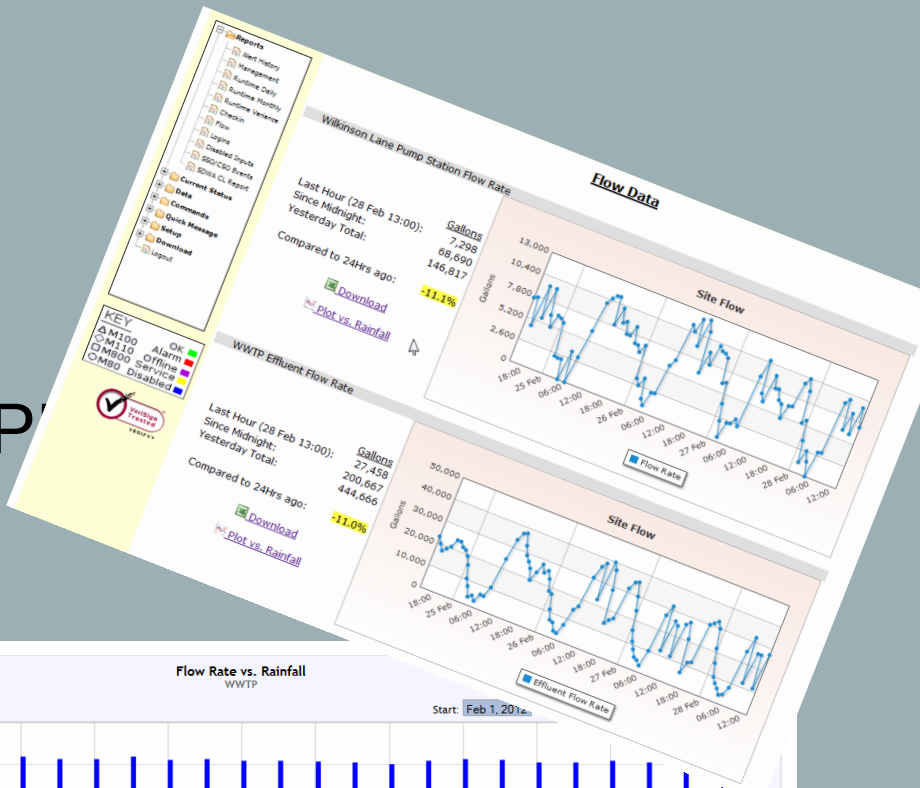
Record Data

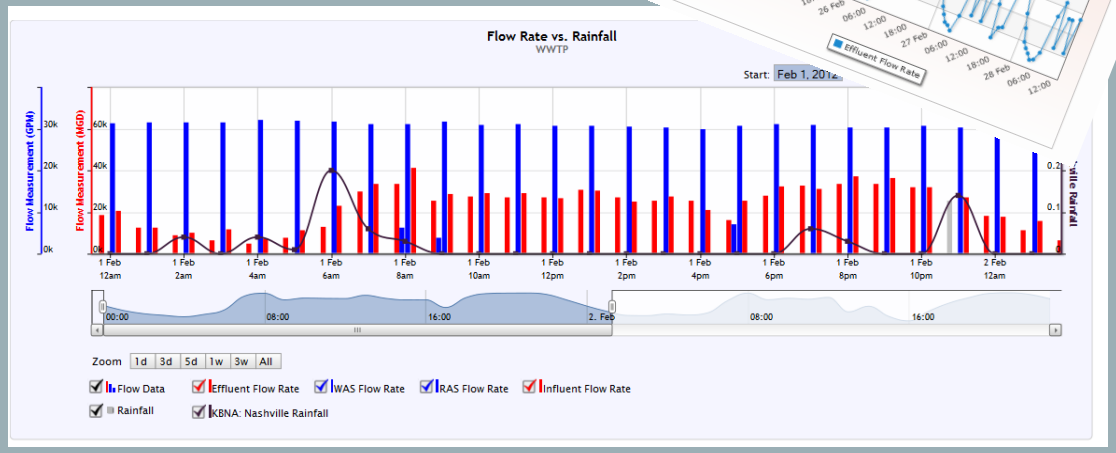

Mission Communications - Windows Internet Explorer
https://www.123mc.com/123mc/main.asp
Mission Communications
Gulfport, MS Monday, 9 February, 2009 19:53
Cloudy, 64.0°F Wind: ESE at 15 MPH Rain Last Hr: None
Barometer: 30.16 Last 24 hrs:
Gulfport MS, City of
Tech Support: (877)993-1911 FAX: (770)685-7913
Help Weather
Reports
Current Status
Data
Rainfall
Pump Info
Site Access
Flow Data
Analog Data
Digital Data
Cellular Test
Solar Info
Alarms
Alerts
Dispatch History
Volumetric Calc
Commands
Quick Message
Setup
Download
Logout
KEY
OK
M100 Alarm
M110 Offline
M800 Service
M80 Disabled
Daily Analog Readings
Highway 53 Well
Line Pressure PSI
Chlorine PPM
pH reading pH
Channel 4 Reading
Channel 5 Reading
Channel 6 Reading
09 Feb 20:27:59 58.7 0.72 7.50 0 0 0
09 Feb 20:26:00 58.9 0.74 7.50 0 0 0
09 Feb 20:24:01 58.7 0.75 7.50 0 0 0
09 Feb 20:22:02 58.7 0.76 7.50 0 0 0
09 Feb 20:20:03 58.6 0.77 7.50 0 0 0
09 Feb 20:18:04 58.6 0.80 7.50 0 0 0
09 Feb 20:16:04 58.7 0.80 7.50 0 0 0
09 Feb 20:14:05 58.6 0.82 7.50 0 0 0
09 Feb 20:11:59 58.5 0.84 7.50 0 0 0
09 Feb 20:10:00 58.5 0.87 7.48 0 0 0
09 Feb 20:08:01 58.8 0.89 7.48 0 0 0
09 Feb 20:06:02 58.6 0.90 7.48 0 0 0
09 Feb 20:04:10 58.6 0.93 7.48 0 0 0
09 Feb 20:03:59 55.3 0.93 7.48 0 0 0
09 Feb 20:03:10 57.6 0.94 7.48 0 0 0
09 Feb 20:02:03 58.6 0.95 7.48 0 0 0
09 Feb 20:00:34 58.8 0.98 7.47 0 0 0
09 Feb 19:57:59 58.7 1.00 7.48 0 0 0
09 Feb 19:56:00 58.9 1.02 7.48 0 0 0
09 Feb 19:54:01 58.7 1.04 7.47 0 0 0
Done
Internet
100%
start
Microsoft Power...
Mission Commu...
8:29 PM

Presentation of data

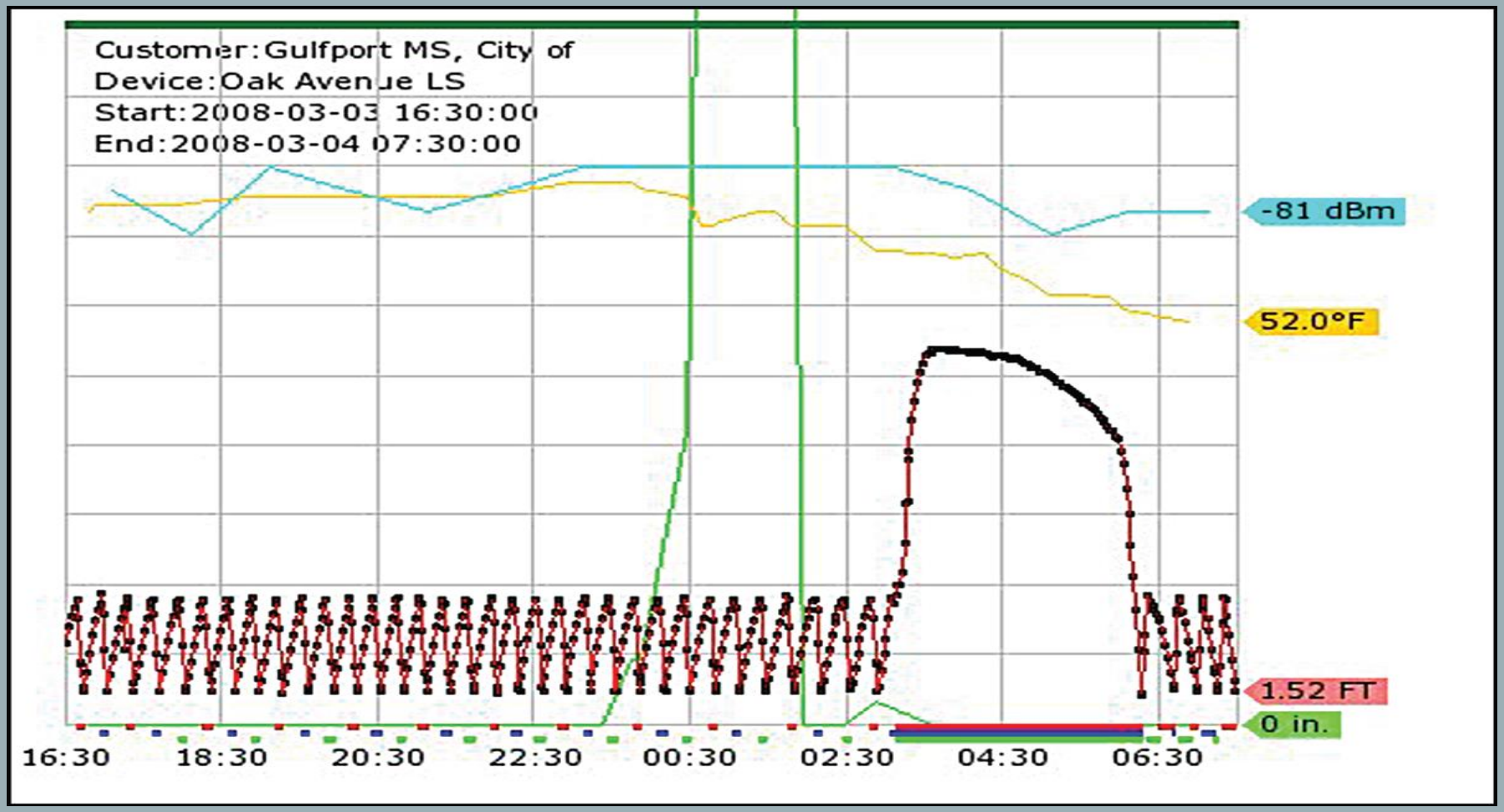
- Pre-formatted reports
- Download Excel Files file
- Prepared reports for EPA/ EP





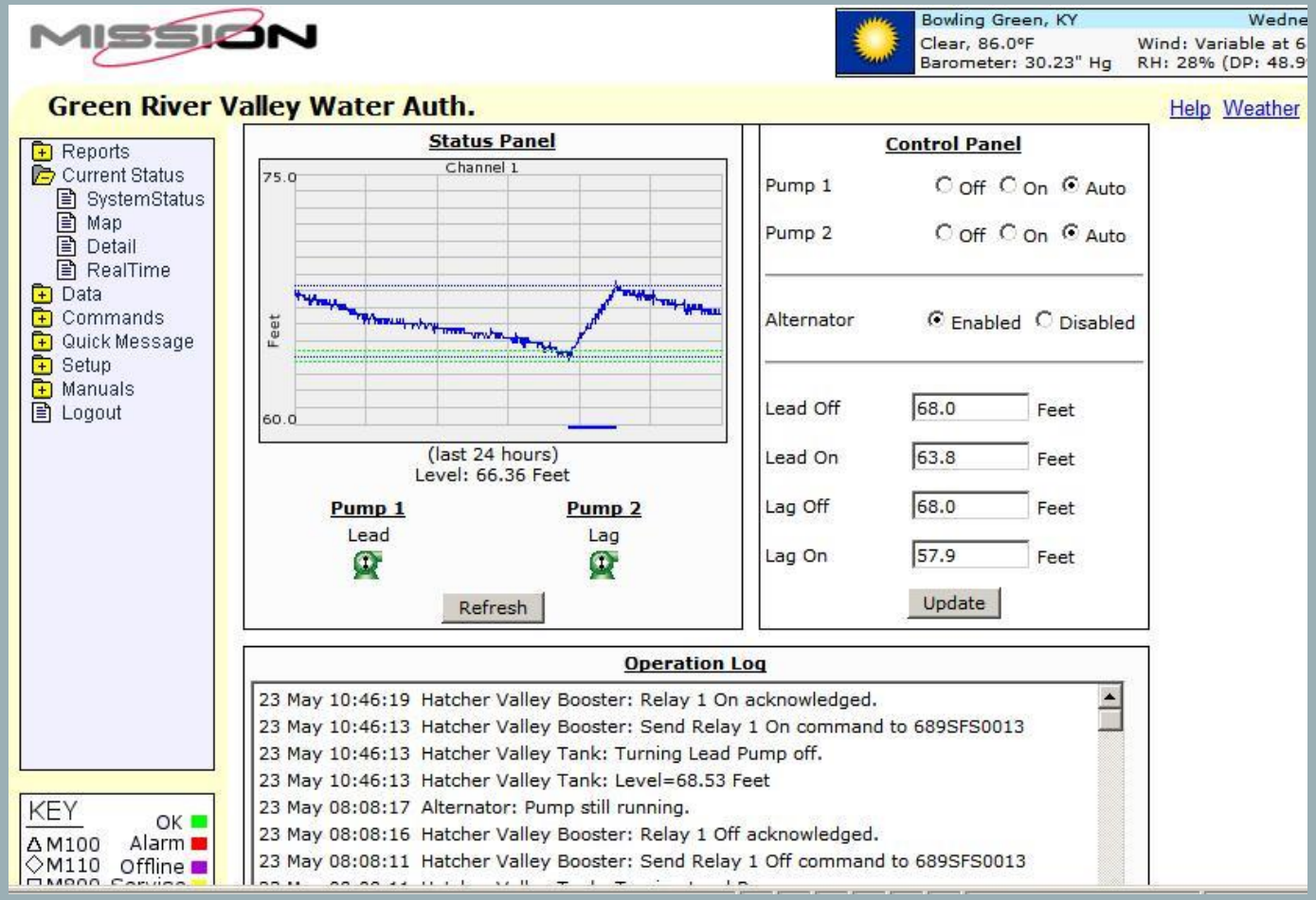


Graphing Capabilities Isolate Problems

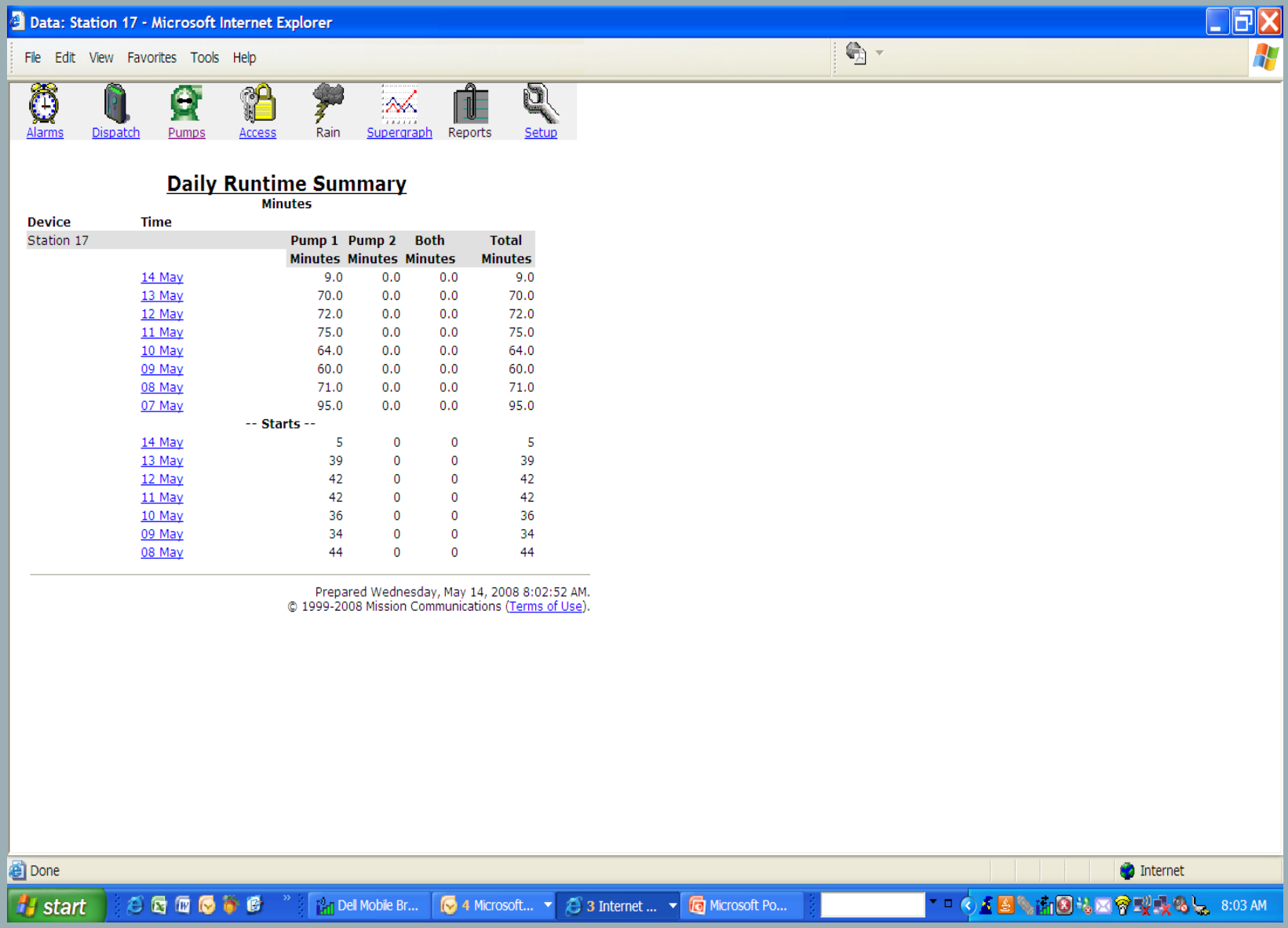


Live Data Anywhere You Can Access Internet

Control Your Water System Remotely

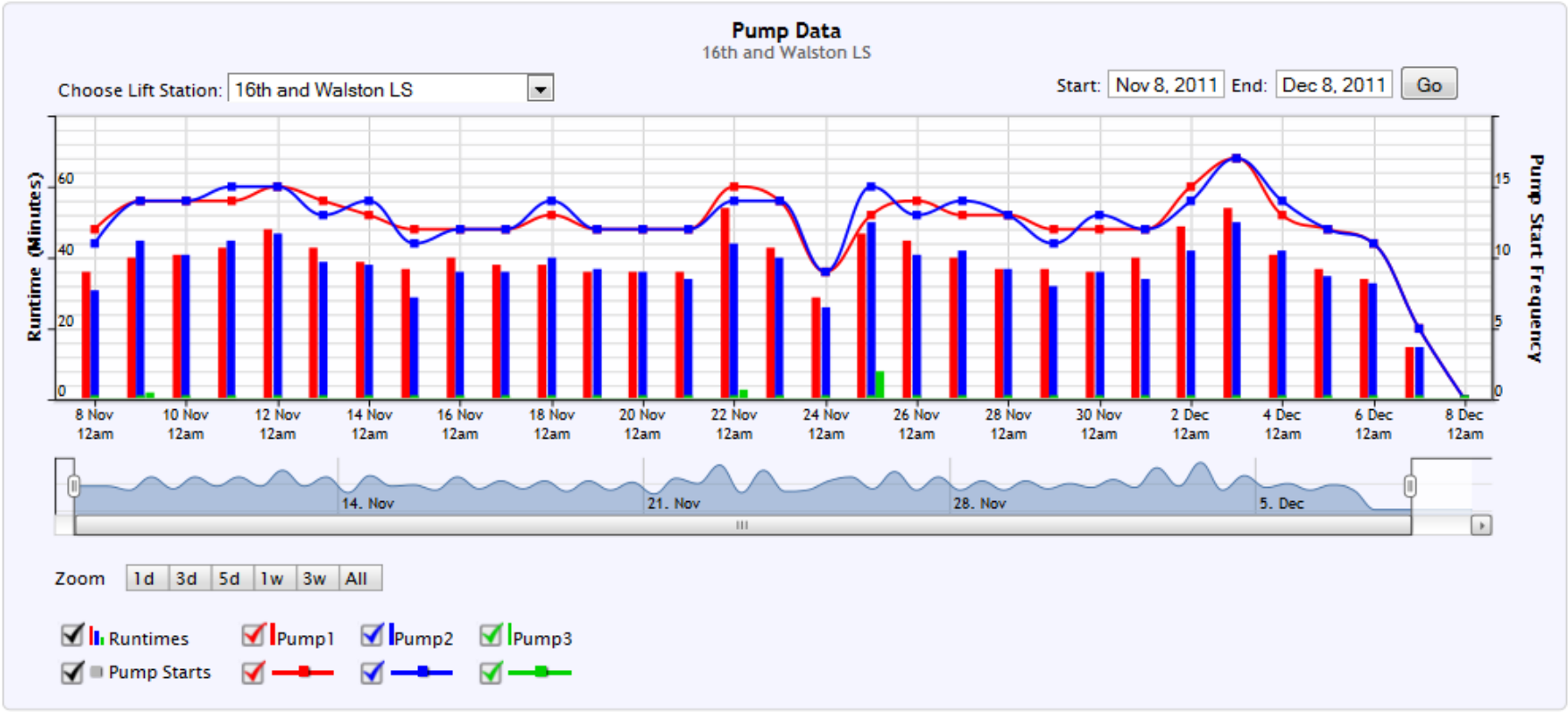


Pump Runtimes/Starts Available Online

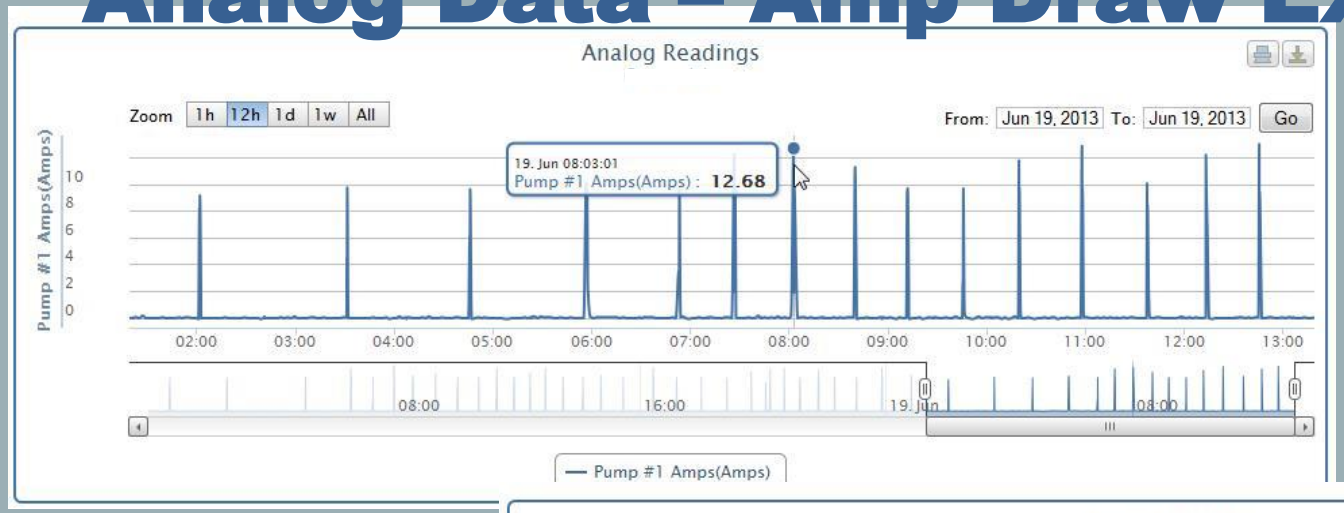


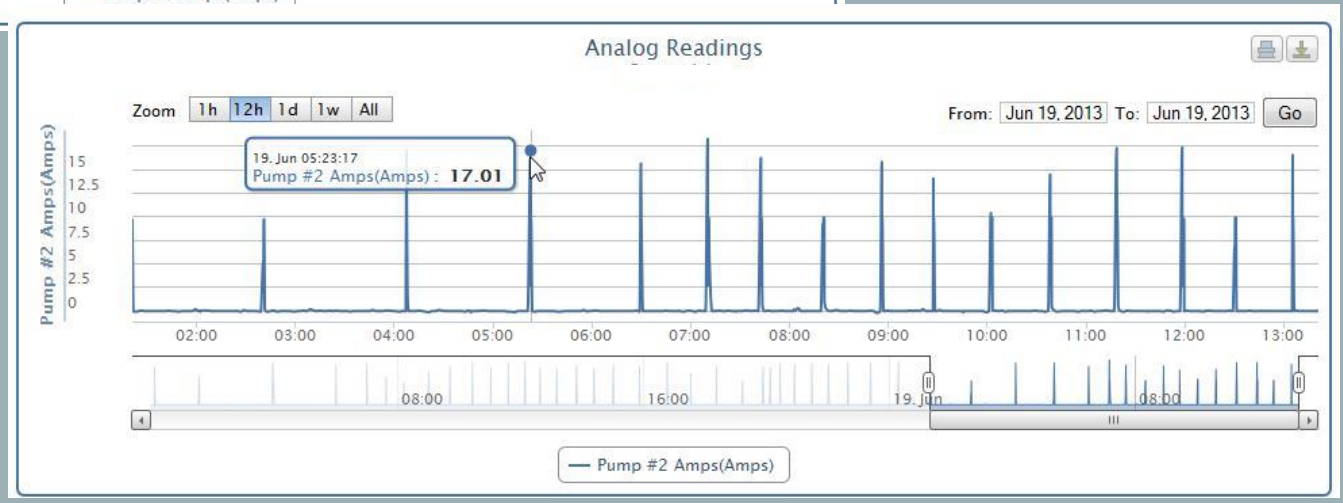
New Pump Data Chart

- Scales with Browser Window
- Easy to zoom into data



Analog Data – Amp Draw Example





Daily Volumetric Flow Summary

- In depth analysis of events of previous day
- Merges volumetric flow calculation and rain flow to graphically show inflow and infiltration problems
- Alarm count and type shown
- Also shows pump runtime variance (today's runtime v. average and std deviation)

Web Portals

MISSION COMMUNICATIONS

www.123mc.mobi

Managed SCADA Costs

- $1,500 to $3,500 For The Complete RTU Installed
- $20 to $60 Per Month For Rest Of The System
  - Fees typically vary relative to timing of data transfers.
  - Fees typically includes comm. link charges, tech support, web site or sites, databases, software licenses and upgrades.
- Some Monthly Charges Have Overage Fees For Excess Data Transfers
- Some Charge Extra For Tech Support
- Pros and Cons