

# A HRSD Story: How we use the PI System to Monitor events on our Infrastructure



Presented By:  
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# Introductions



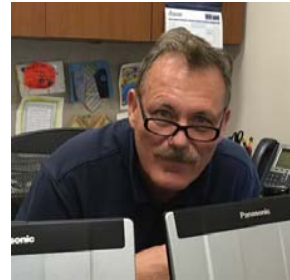
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# Agenda



- Who is HRSD?
- Operational and Environmental Concerns
- How we use the PI System
  - Storm Preparedness
  - Data Center Monitoring
- Future Goals

# HRSD - Location





# HRSD - Legacy

- 1920s – Estimated 25 MG of raw sewage entering local waters daily
- November 5, 1940 - the referendum to create HRSD was approved
- Mid 1970s HRSD owned and operated 9 treatment plants with plans to open 3 more
- 2020 - Sustainable Water Initiative for Tomorrow (SWIFT)



# HRSD - Mission

- We protect public health and the waters of Hampton Roads by treating wastewater effectively
  - HRSD is recognized as a leader in the industry, with an impressive record of environmental permit compliance

# HRSD - Vision

HRSD VISION:

Future generations will inherit clean waterways and be able to keep them clean.



# HRSD – Service Area

HRSD serves 18 counties and cities

**Serving the Cities of:**

Chesapeake, Hampton, Newport News, Norfolk, Poquoson, Portsmouth, Suffolk, Virginia Beach, Williamsburg

**And the Counties of:**

Gloucester, Isle of Wight, James City, King and Queen, King William, Mathews, Middlesex, Surry and York



# HRSD – Fast Facts

- **Population Served:**
  - 1.7 million (nearly 1/4<sup>th</sup> of VA's population)
- **Collection System:**
  - More than 600 miles of pipes, 6 to 66 inches in diameter
- **Pump Stations:**
  - ~ 109
- **Treatment Plants:**
  - 9 major plants in Hampton Roads and 7 smaller plants in eastern Virginia
- **Combined Capacity:**
  - 249 million gallons of wastewater per day





# HRSD – Data Analysis Section

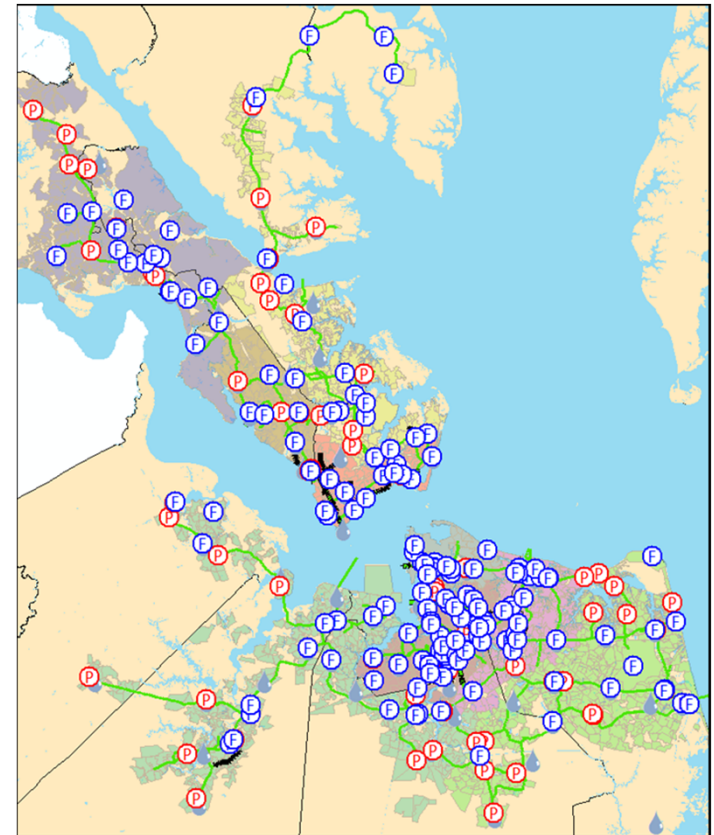
- Provides environmental and wastewater collection data to HRSD and regional customers





# HRSD – Monitoring Network

- 219 flow meters
- 179 pressure sensors
- 73 rain gauges
- 21 groundwater shallow well sensors
- NOAA Tide Data
- Multiple Weather Stations
- Collecting Pump Station data
  - RPMs, Drive Outputs, Wet Well Level



# Storm Preparedness

# Hampton Roads, Virginia

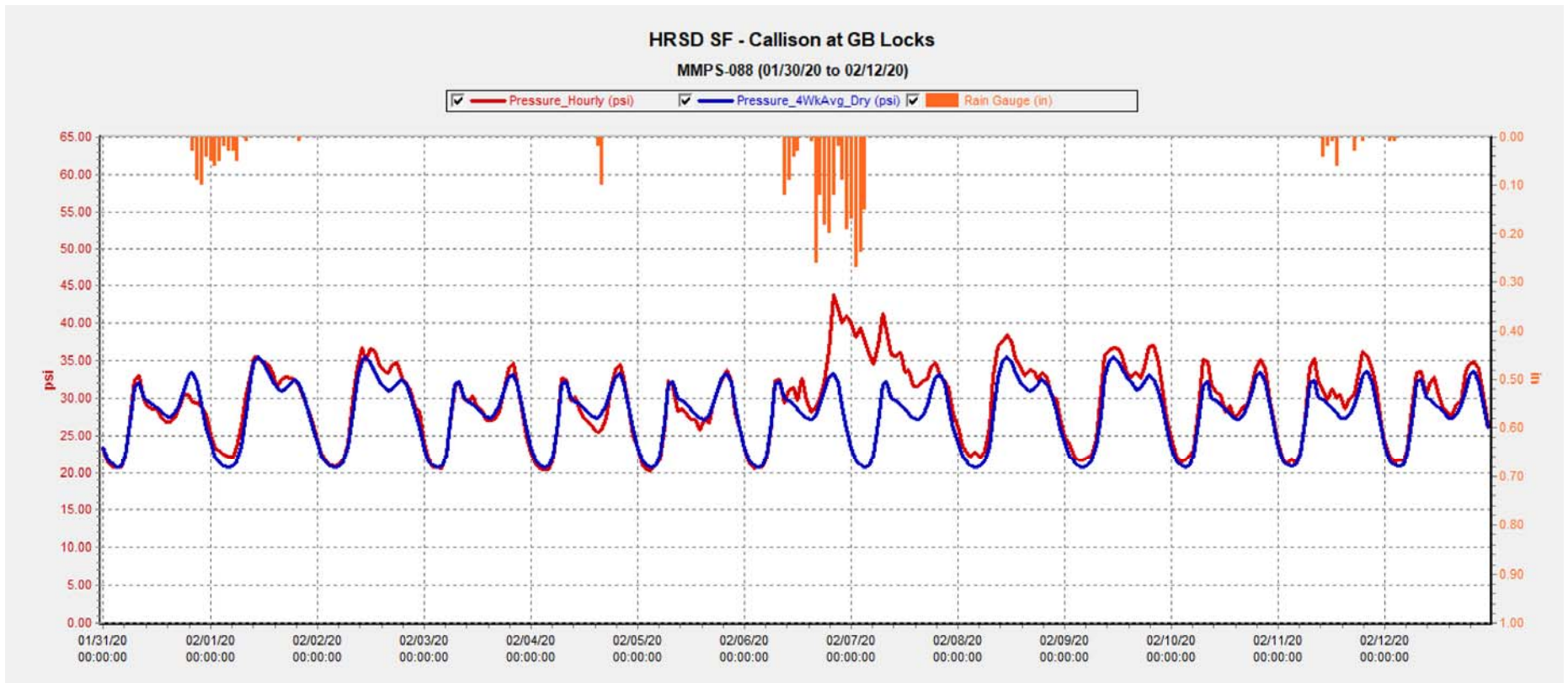


# The Business Challenge - Telog

- Basic graphs – limited to 5 measurements
- Took a long time to load large data sets
- Limited Data Analytics
- Not user-friendly
  - templates and reports were not easily created or accessible



# Telog – Pressure and Rain

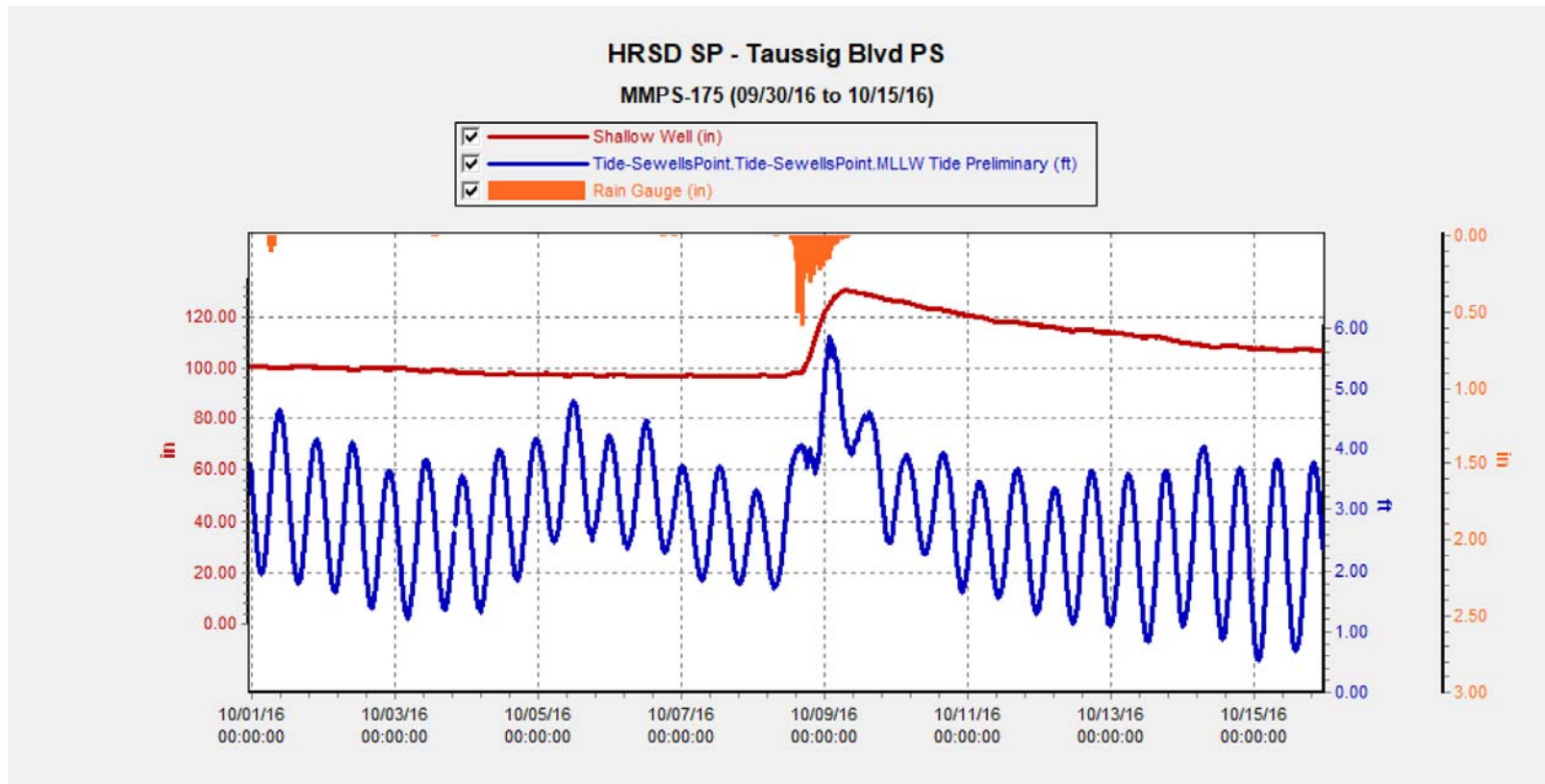




# Why is Rainfall Important?



# Telog – Groundwater and Tide



# Why is Groundwater Important to HRSD?

- Infiltration of groundwater - Cracked pipes and leaky manholes
- Adds additional wastewater for treatment and pump

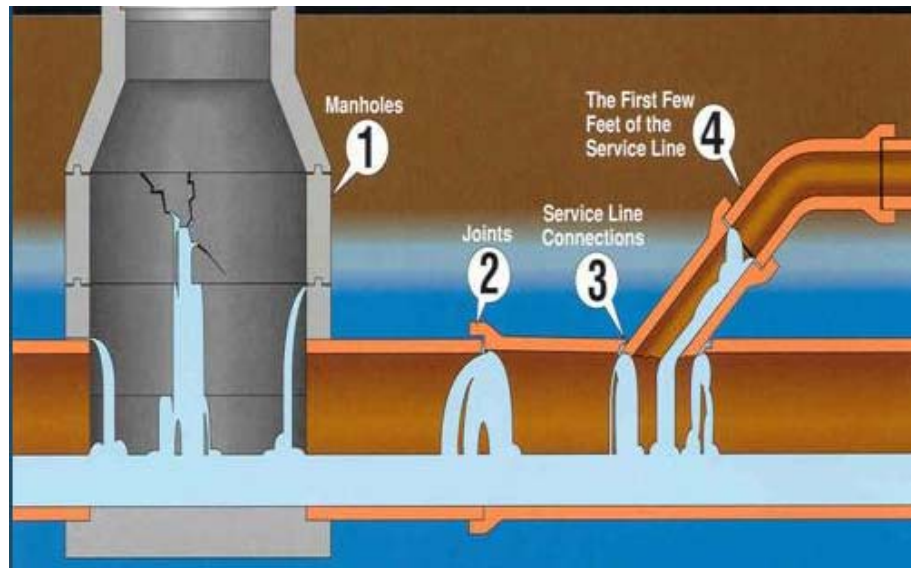


Photo courtesy of ICGA

# What Does Infiltration Look Like?



# How the PI System Changed how we Monitor Storm Events



## PI Vision

- ✓ Ease of access
- ✓ User-friendly
- ✓ Better visualization



## PI Datalink Report

- ✓ Dynamic reports update in real-time
- ✓ Increased efficiency



## PI Asset Framework and PI Notifications

- ✓ Powerful Analytics
- ✓ Meaningful Notifications



# Storm Dashboard

## Emergency Operations Center HRSD Operations Data



### Flows

- NS Treatment Plant Flows
- SS Treatment Plant Flows
- SCD Treatment Plant Flows

### NS Rainfall

NS Rain and Tide Data

### SS East Rainfall

SS East Rain and Tide Data

### SS West Rainfall

SS West Rain and Tide Data

### SCD Rainfall

SCD Rain and Tide Data

### Misc

- HRSD's Telog Web Module
- Wind Analysis

## Local Weather Data

### Tide Data

- NOAA Tides and Currents - Sewells Pt
- Tides and Flooding Potential
- NOAA Tides and Currents - Yorktown USCG
- NOAA's Marine Forecasts

**National Hurricane Center**

**NOAA Forecasted Tide**

- NWS Forecasted Wind Speeds
- Wundermap

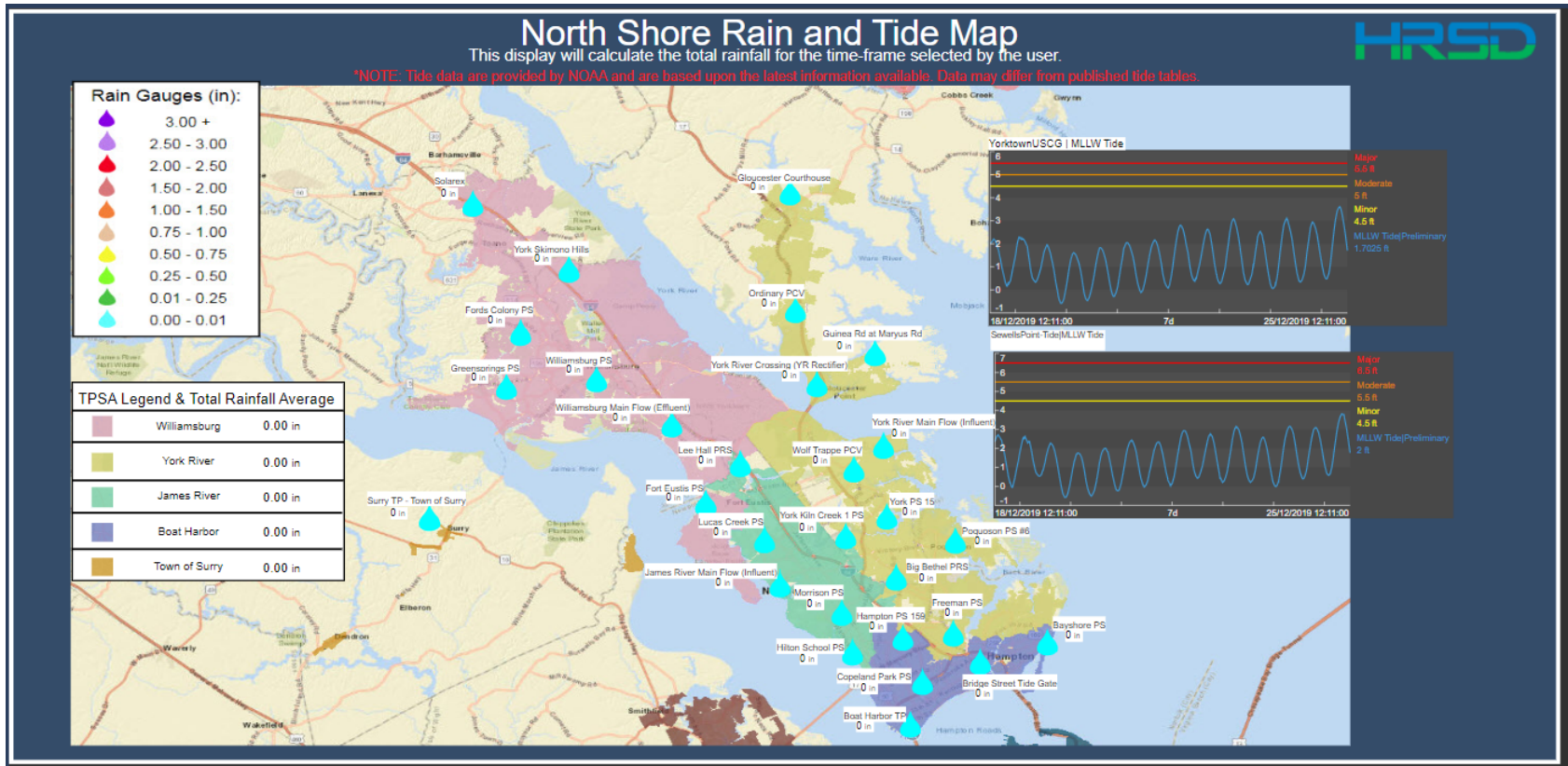
### Weather Forecast

- Local Radar Loop
- NWS Forecast for Norfolk, VA
- NWS Forecast for Newport News, VA
- NWS Forecast for West Point, VA

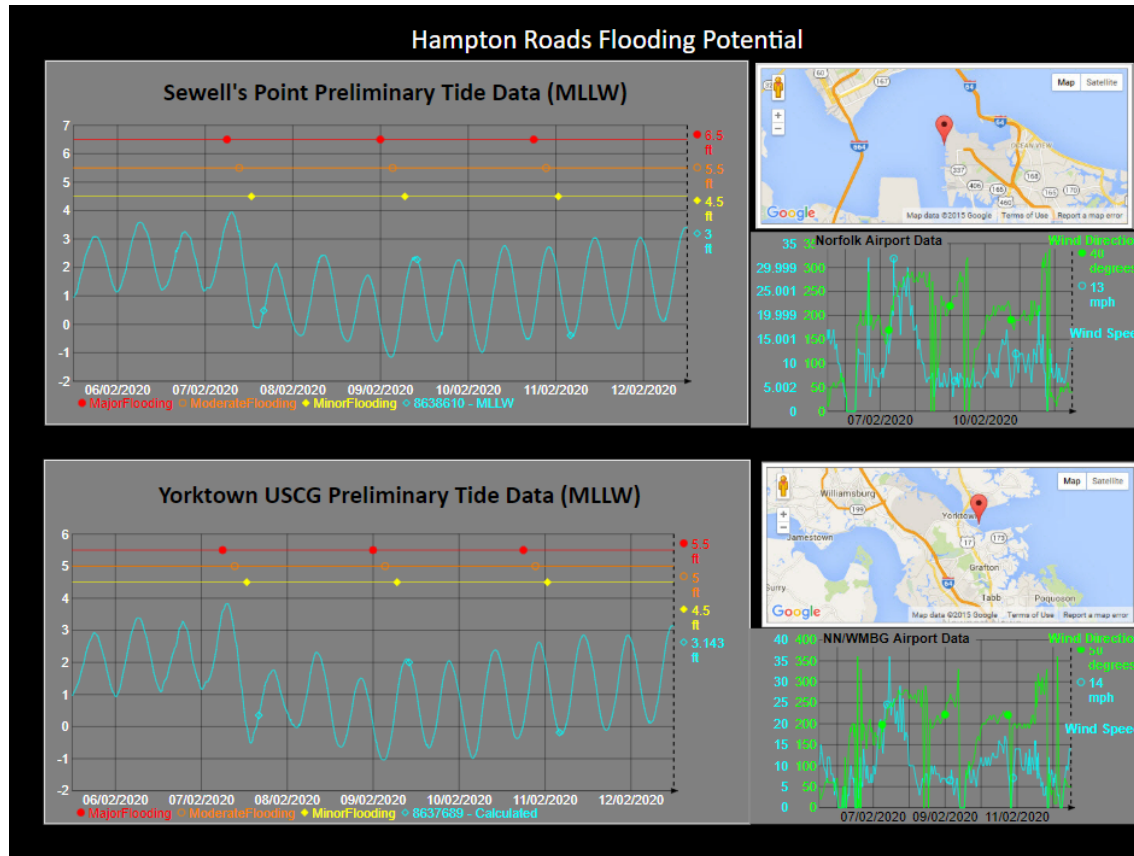
## Other Useful Websites

- VIPER-Emergency Management
- VDOT 511 Traffic Information
- VA Storm Surge Maps
- Current Weather Hazards
- HRSD Emergency Preparedness SharePoint Site
- ReadyHamptonRoads
- FEMA ICS Resource Center

# Rainfall Accumulation



# Flooding Potential

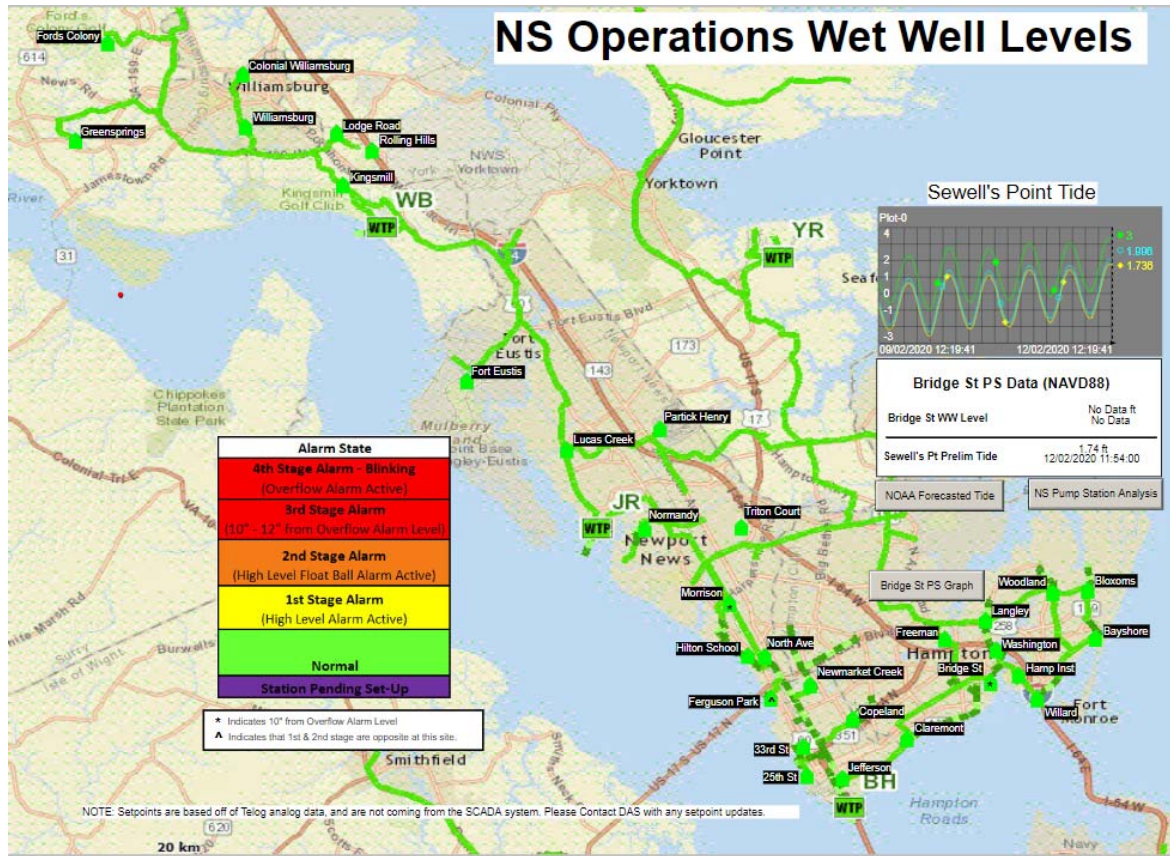


# Flooding Potential



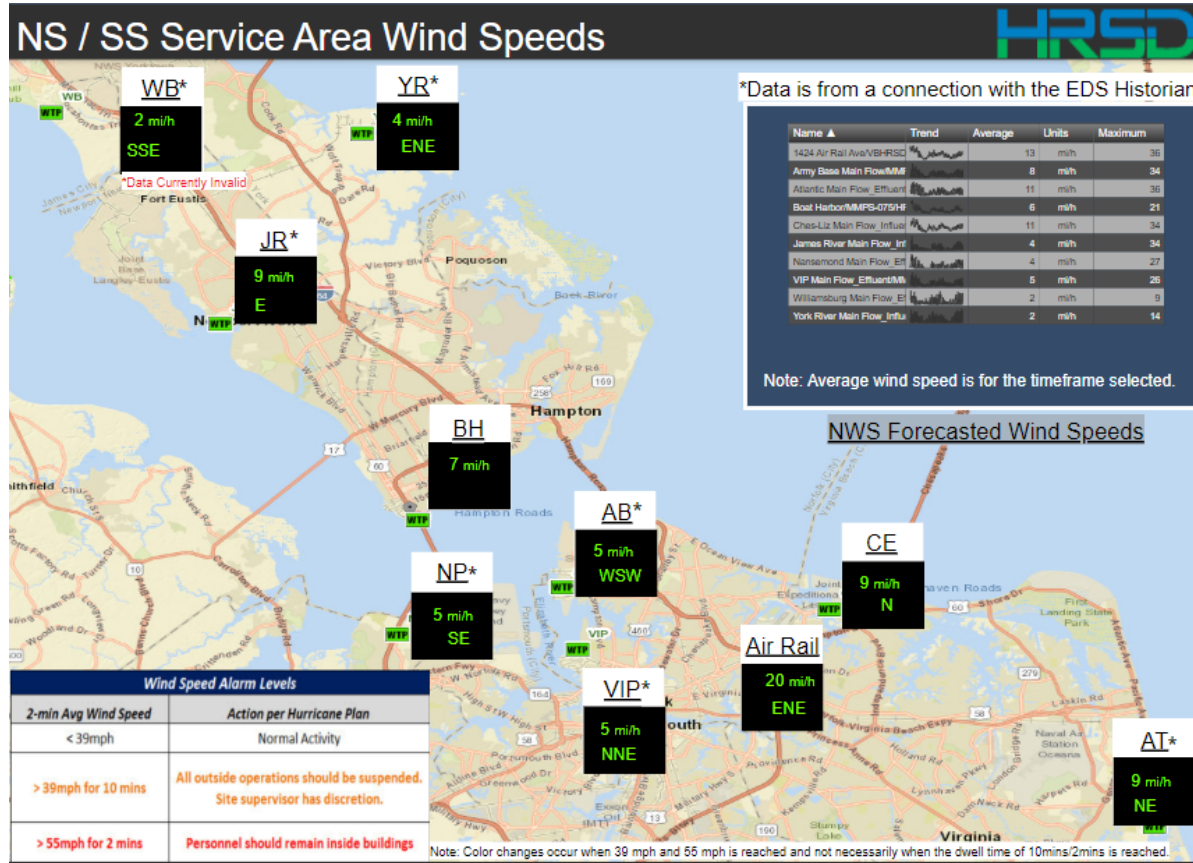


# Potential Overflow





# Winds Speed and Direction



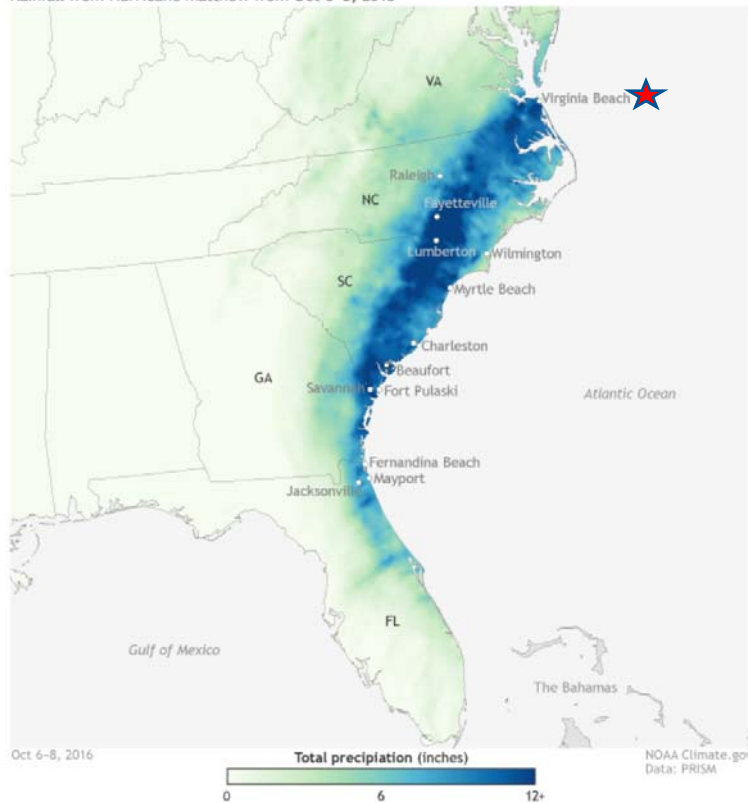
# PI Operations Dashboard – Demo 1



# Application and Use Case

# Tropical Storm Matthew

Rainfall from Hurricane Matthew from Oct 6-8, 2016



What Happened:

Tightly tracked along the North Carolina Coast and headed out to sea just before reaching Virginia

Impacts to our area were primarily due to long duration bands of rain on the backside of the cyclone

Rainfall totals reached over 14” in some areas of Hampton Roads

Pre-existing saturated conditions set the stage for disastrous flooding

# Tropical Storm Matthew Aftermath

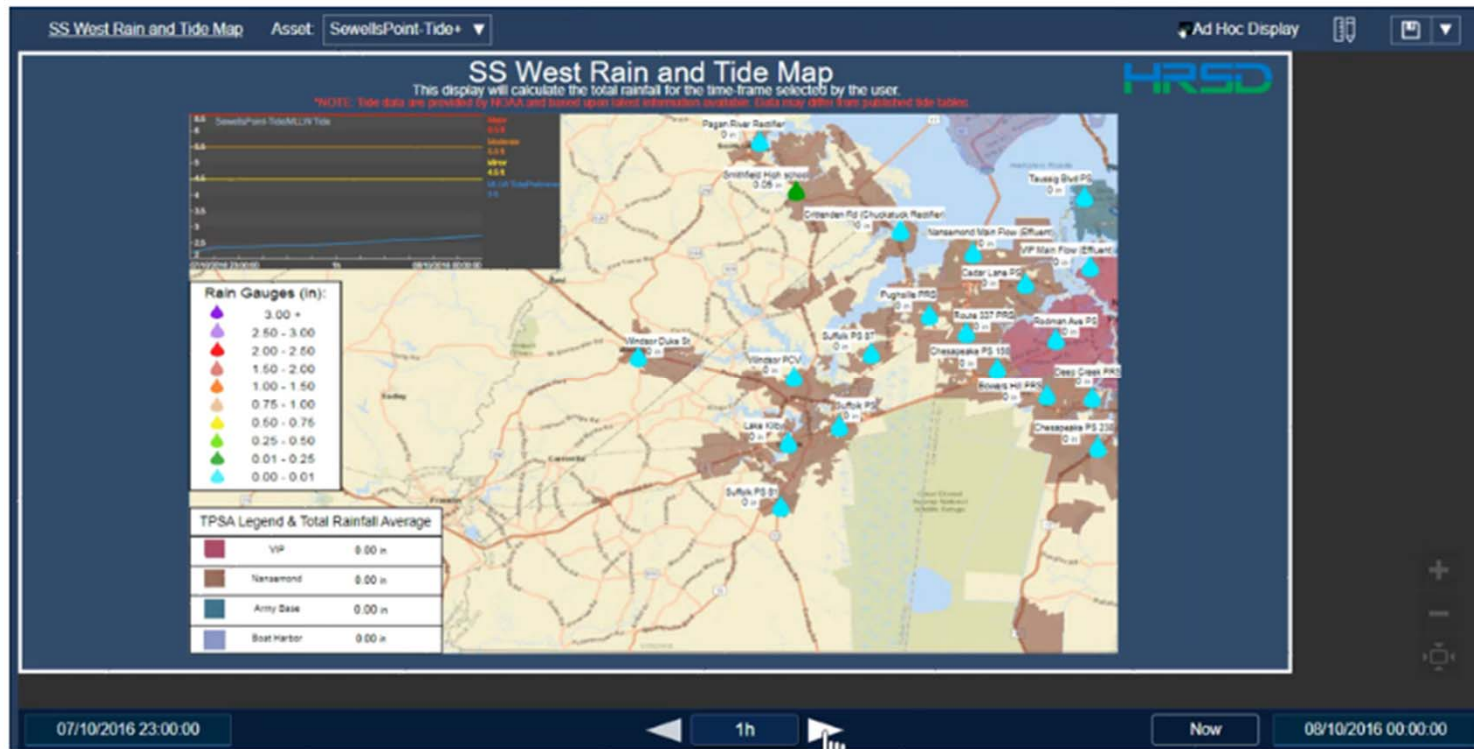




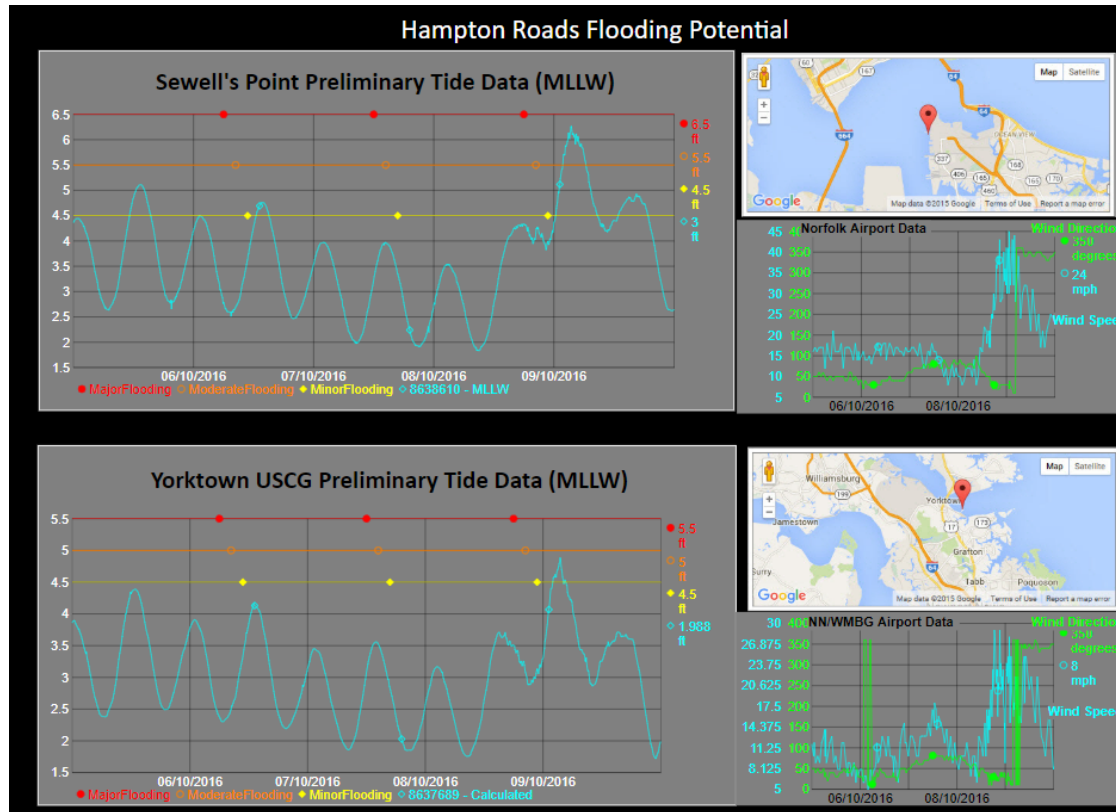
# Tropical Storm Matthew Aftermath



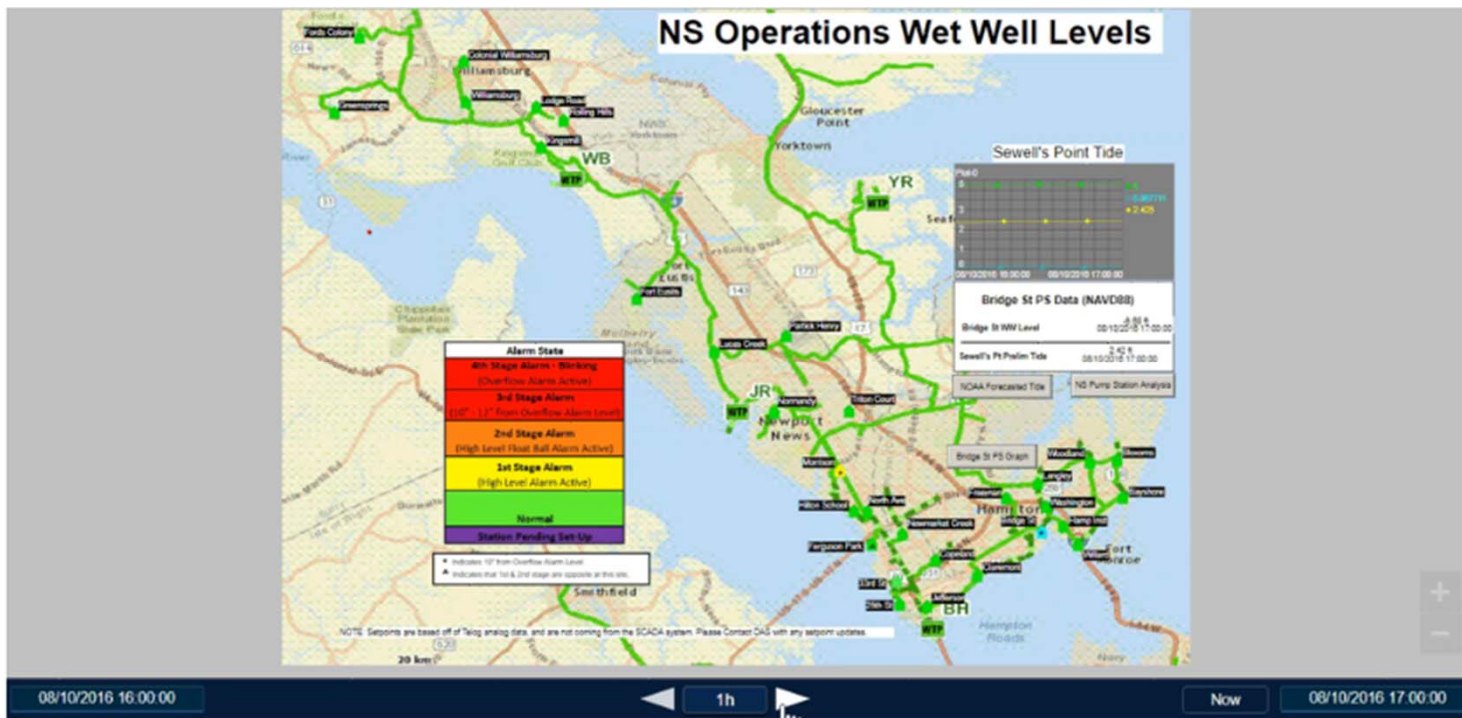
# Tropical Storm Matthew – Demo 2



# Tropical Storm Matthew



# Tropical Storm Matthew – Demo 3



# Tropical Storm Matthew – Demo 4

SS PS Runtime Screen    Asset: Pump Stations+    Ad Hoc Display

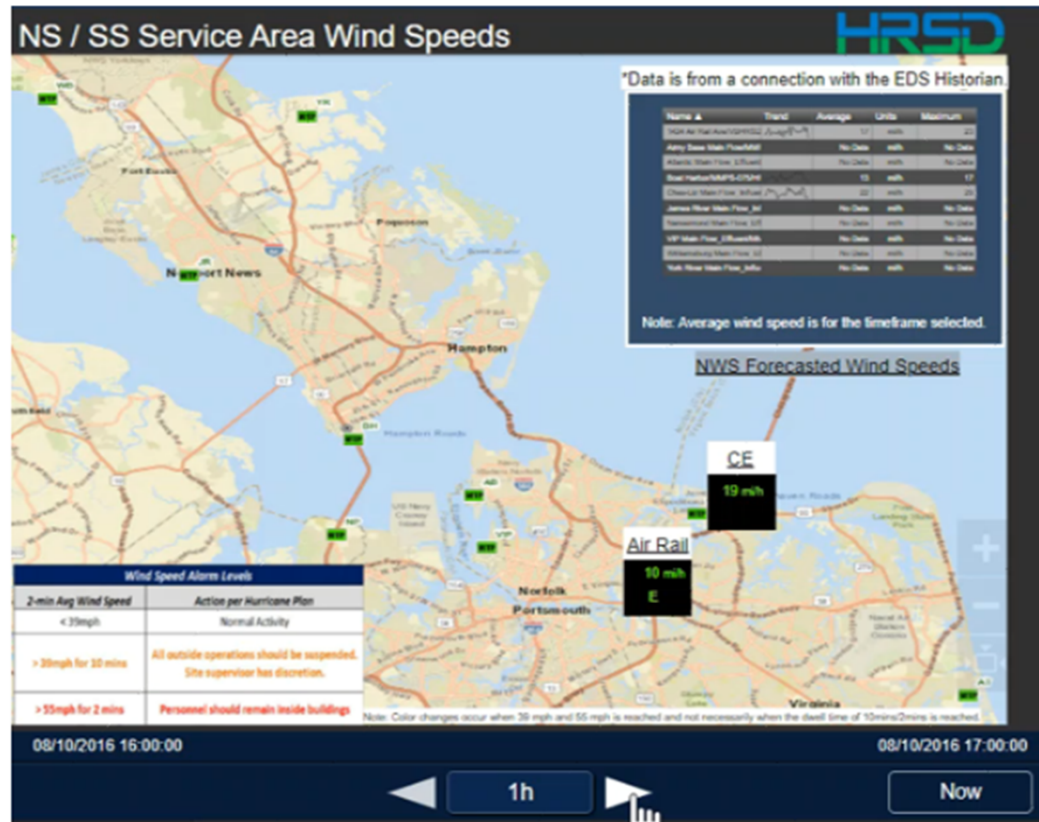
[Return to Dashboard](#)    **South Shore PS Screen**    **HRSD**

● No Data    ● OFF    ● ON

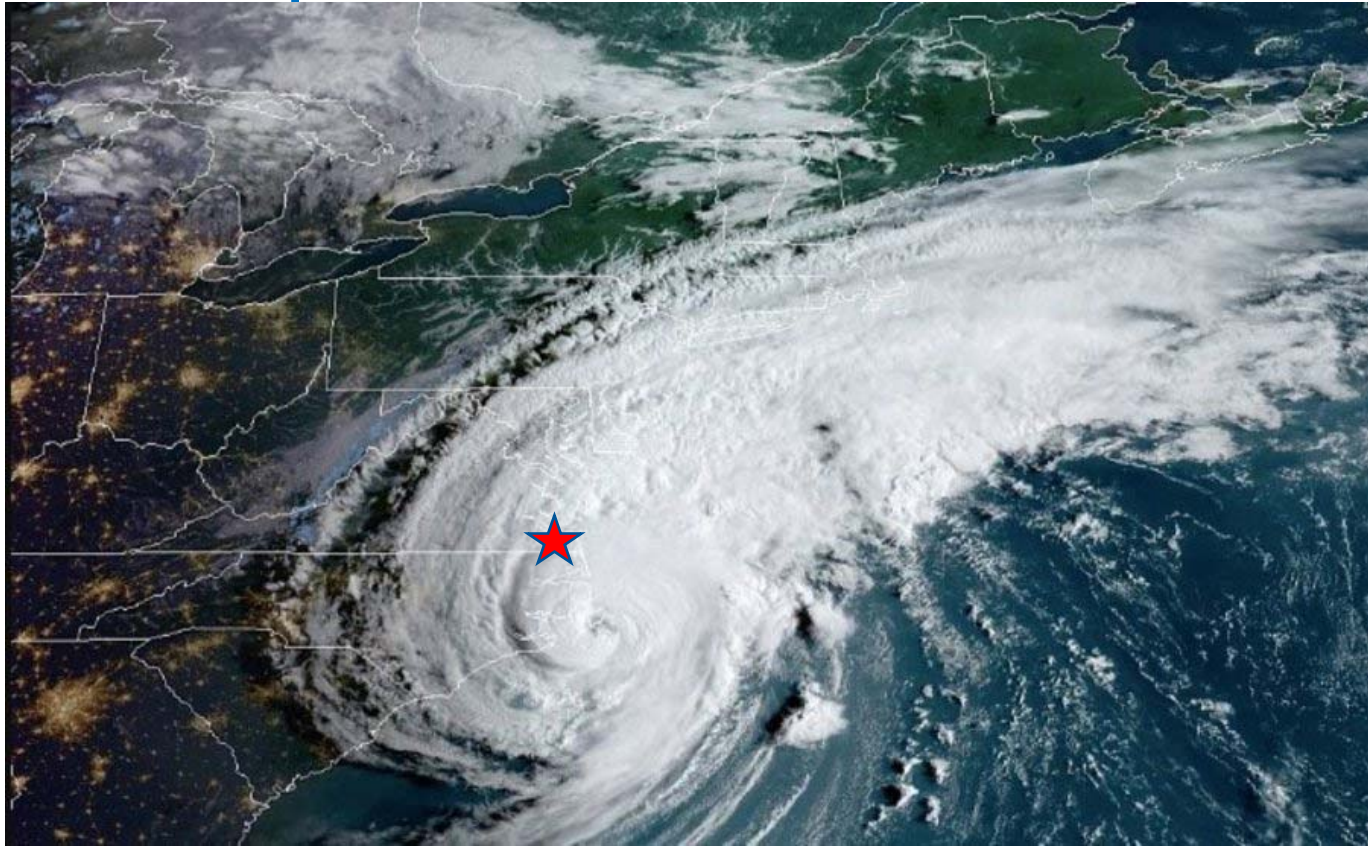
	Pump 1	Pump 2	Pump 3	Pump 4	Level (in)	High WW Alarm (in)	Overflow Alarm (in)	VEPCO	Generator	Alt Power
Arctic Avenue PS&MPS 1131-RRSD-SP	OFF	ON	OFF		16	70	119	OK		OFF
Ashford Circle PS&MPS 1131-RRSD-SP	OFF	ON			39	110	130	OK	OFF	
Barringer Blvd PS&MPS 1151-RRSD-SP	OFF	OFF			50	126	173	OK	OFF	
Camden Ave PS&MPS 1211-RRSD-SP	OFF	OFF	OFF		87	201	296	OK	OFF	
Center Lane PS&MPS 1221-RRSD-SP	OFF	OFF	ON		95	150	241	OK		OFF
Chapelwood Blvd PS&MPS 0431-RRSD-SP	OFF	OFF	ON		74	137	145	OK	OFF	
Cherryfield Blvd PS&MPS 1241-RRSD-SP	OFF	OFF			86	106	141	OK		
City Park PS&MPS 1251-RRSD-SP	OFF	OFF			44	136	181	OK		
Colby Avenue PS&MPS 1271-RRSD-SP	OFF	OFF	OFF		57	70	113	OK	OFF	
Downcourt PS&MPS 1281-RRSD-SP	OFF	OFF	ON	ON	40	156	229	OK		OFF
Duane's Corner PS&MPS 1301-RRSD-SP	OFF	ON			44	120	186	No Data	OFF	
Elmhurst Lane PS&MPS 1311-RRSD-SP	OFF	OFF	OFF		71	126	244	OK	OFF	
Fenwick Avenue PS&MPS 1321-RRSD-SP	OFF	ON	OFF		23	85	98	OK	Bad	
Grandy Street PS&MPS 1361-RRSD-SP	OFF	OFF			74	140	181	OK		
Hanover Avenue PS&MPS	OFF	ON			31	78.6	141.4	OK		



# Tropical Storm Matthew – Demo 5



# Storm Preparedness



# Data Center Monitoring

# What is a Data Center?

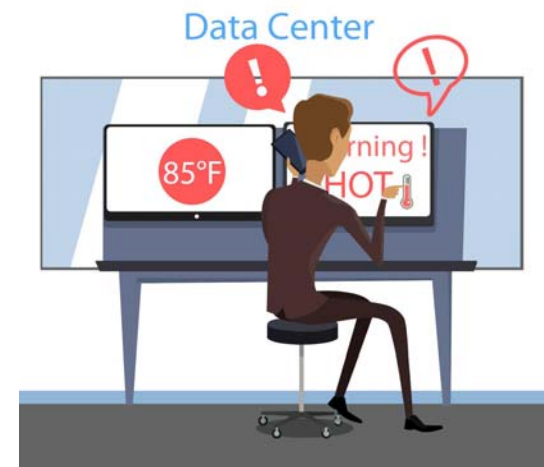
- Houses the supporting infrastructure for software applications



- Often taken for granted until a failure takes place.

# How do you protect a Data Center?

- Build a facility that will withstand a hurricane
- Monitor environmental conditions
- Maintain a stable power supply





# HRSD Data Center

- The HRSD Data Center Locations:
  - North Shore
  - South Shore
  - Small Communities
- Redundant HVAC
- Power Surge Protectors
- Emergency Power Generation
- FM200 Fire Suppression System



# The Business Challenge

- Prior to July 2015
  - No formal monitoring of thermal events in the data center
  - Data Center HVAC system had issues in the past
  - Only knew of issues after equipment failure
- July 2015
  - Began environmental monitoring using Telog® recorders
  - Allowed for the ability to be alerted to thermal events

# The Business Challenge




- Advantages
  - Thermal monitoring
  - Alert levels
- Disadvantages
  - Hardwired Sensors
  - Delay in available data



# How the PI System Changed how we Monitor the Data Center

- First Steps
  - Began bringing Telog® data into PI System and created PI ProcessBook screens for visualization

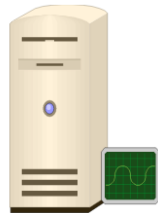


**IT Data Centers**  
**IT On-Call Phone:** \_\_\_\_\_

**North Shore Data Center**

NS IT Data Center

	Alarm Level (°F)	Current Temp (°F)
East	74.00	69.94
West	74.00	69.52



**South Shore Data Center**

SS IT Data Center

	Alarm Level (°F)	Current Temp (°F)
<b>Rack 101-6</b>	83.48	78.56
<b>Rack 104-1</b>	77.63	72.70
<b>Rack 104-11</b>	76.64	71.25
<b>Rack 107-5</b>	73.08	66.75

**IT Emergency Contact List**

	Home Phone	Mobile Phone
Nick Boardman		
John Peake		
Robert Walling		
Amy Wood		
Shawn Williams		
Clay Wise		


**Useful Websites and Local Weather**

HRSD's Telog Web Module

National Hurricane Center

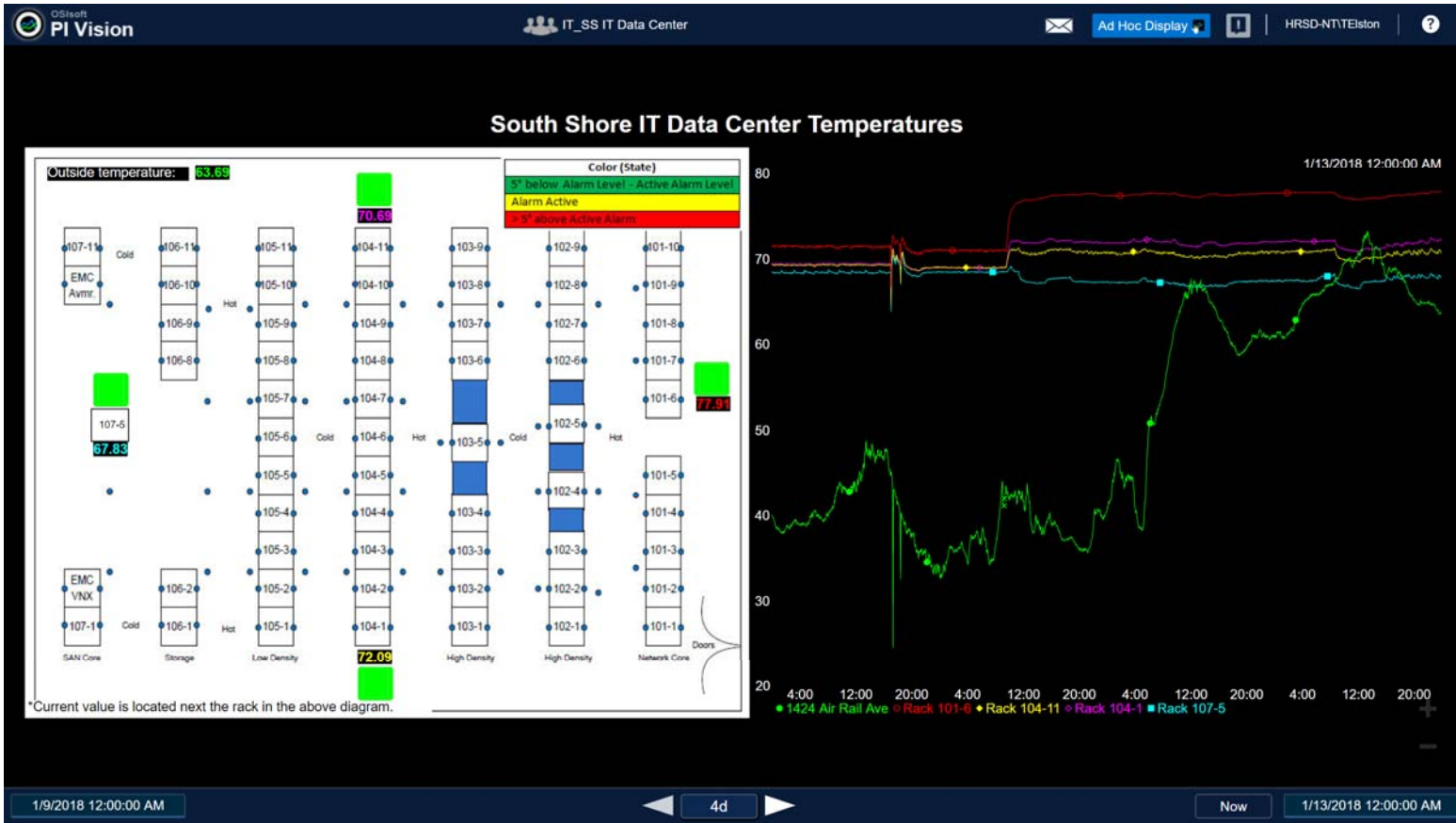
WunderMap

NWS Forecast for Norfolk, VA


**PIWorld** SAN FRANCISCO 2020

#PIWorld ©2020 OSIsoft, LLC

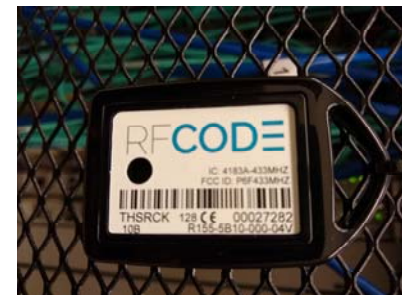
43





# How the PI System Changed how we Monitor the Data Center

- August 2016
  - Installed RF Code™ sensors and integrated these sensors into the PI System
  - Increased monitoring for both data centers



# How the PI System Changed how we Monitor the Data Center

- PI Vision Displays
- PI Datalink Report
- PI Asset Framework, PI Event Frames and PI Notifications

# PI VISION – Demo 6

The screenshot displays the PI Vision interface for monitoring IT Data Centers. The main title is "IT Data Centers" with the HRSD logo. Below the title, there are contact numbers for "IT On-Call Phone" and "PPM On-Call Phone". The interface is divided into two main sections: "North Shore Data Center" and "South Shore Data Center".

**North Shore Data Center**

NS Thermal Screen

		Current Temp (°F)
Row01	Average	76.73
Row02	Average	71.96

**South Shore Data Center**

SS Thermal Screen

		Current Temp (°F)
Row101	Average*	71.15
Row102	Average*	71.04
Row103	Average*	69.91
Row104	Average*	67.66
Row105	Average*	67.55
Row106	Average*	68.11
Row107	Average*	67.55

\* Average of hanging sensors


**Useful Websites and Local Weather**

- HRSD's Tilog Web Module
- WunderMap
- National Hurricane Center
- NWS Forecast for Norfolk, VA

The interface also shows a central image of server racks, a navigation bar at the bottom with a "Now" button, and a timestamp of 2/13/2020 9:25:29 PM.

PI Vision - Live Data

# PI Datalink Report




Select start date for the week below to update:

Month: February  
Day: 1  
Year: 2020

**South Shore Summary**

Row101
High Sensor 78.29 101-7
Low Sensor 69.62 101-7
Row Average 73.32
Row102
High Sensor 80.18 102-4
Low Sensor 67.99 102-6
Row Average 74.63
Row103
High Sensor 89.55 103-5
Low Sensor 79.00 103-2
Row Average 84.28
Row104
High Sensor 82.74 104-2
Low Sensor 67.51 104-6
Row Average 71.60
Row105
High Sensor 79.73 105-2
Low Sensor 67.37 105-9
Row Average 68.80
Row106
High Sensor
Low Sensor
Row Average



Select start date for the week below to update entire workbook.

Month: February  
Day: 1  
Year: 2020


**South Shore Summary**

Row101
High Sensor 78.29 101-7   HotAisleBottomTemp
Low Sensor 69.62 101-7   ColdAisleBottomTemp
Row Average 73.32
Row102
High Sensor 80.18 102-4   HotAisleBottomTemp
Low Sensor 67.99 102-6   ColdAisleBottomTemp
Row Average 74.63
Row103
High Sensor 89.55 103-5   HotAisleBottomTemp
Low Sensor 79.00 103-2   HotAisleTopTemp
Row Average 84.28
Row104
High Sensor 82.74 104-2   HotAisleTopTemp
Low Sensor 67.51 104-6   ColdAisleBottomTemp
Row Average 71.60

**Shore Summary**

83.64 1C   HotAisleMiddleTemp
66.08 1C   ColdAisleTopTemp
73.93
78.53 2E   HotAisleMiddleTemp
62.74 2E   ColdAisleBottomTemp
69.52

**Server Floor Plans**



IT Data Center Dashboard
Weekly Report
Monthly South Shore Graphs
Monthly South Shore Report
Floor Plans

# PI Datalink Report

Return to Dashboard

North Shore Data Center Weekly Report

HRSD

Select desired row below.

Row: Row02  
Month: February

Return to Dashboard



## North Shore Data Center Weekly Report

Select desired row below.

Row: Row02  
Month: February  
Day: 1  
Year: 2020

*NOTE: Data is in a RAW format. Any questions in validity should be addressed with HRSD's Data Analysis Section*

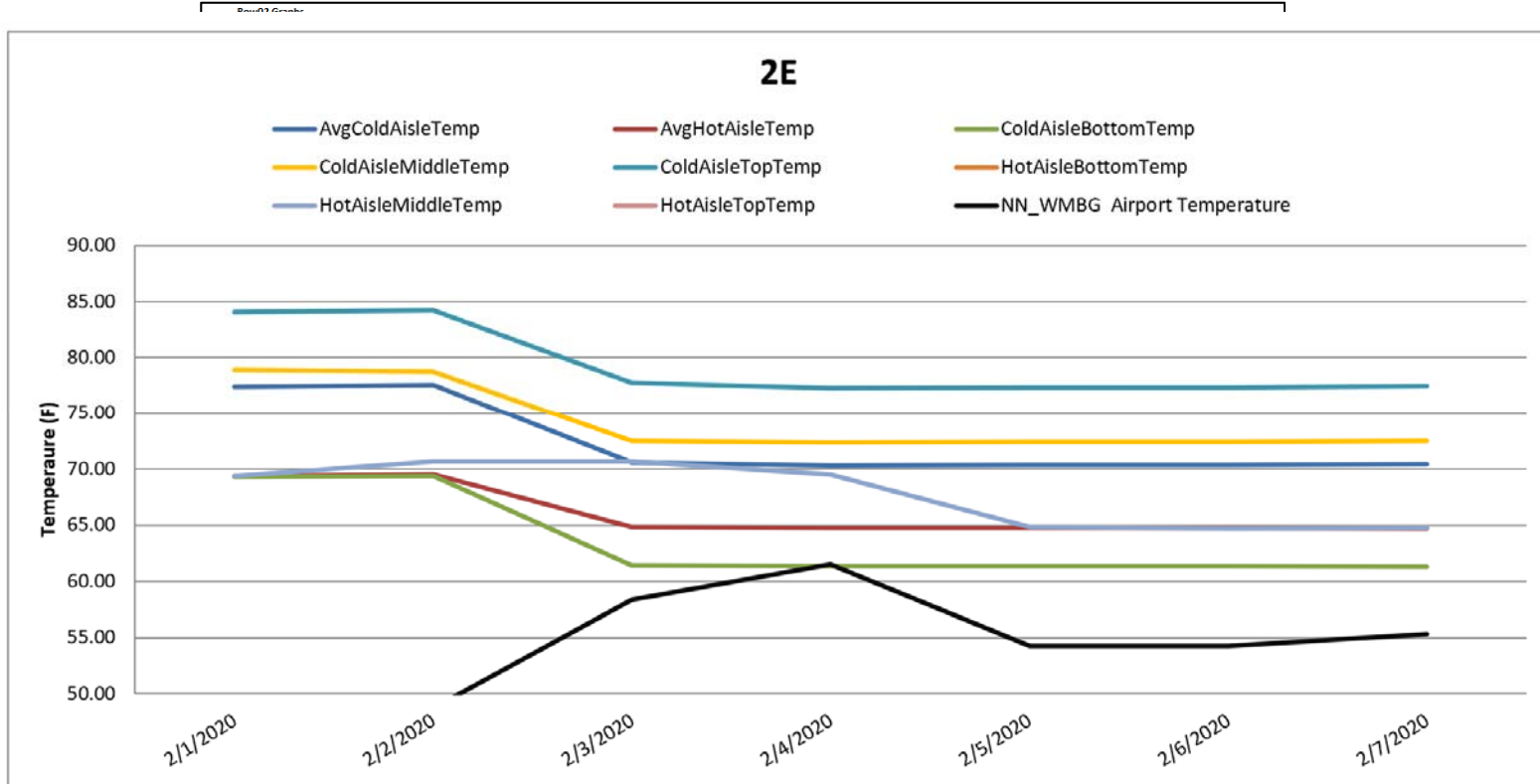
	Sat, 01/Feb/2020		Sun, 02/Feb/2020		Mon, 03/Feb/2020		Tue, 04/Feb/2020		Weekly Average	Average - Last 30 days 01/02/2020 - 02/01/2020
	Average	Max	Average	Max	Average	Max	Average	Max		
NN_WMBG Airport Temperature	45.55	51.80	48.72	57.20	58.39	71.60	61.53	66.20	54.01	45.93
AvgColdAisleTemp	66.59	69.26	66.71	68.72	65.74	67.78	65.68	66.38	65.96	66.23
AvgHotAisleTemp	67.02	69.62	67.16	69.08	65.88	68.95	65.82	67.28	66.20	66.52
ColdAisleBottomTemp										
ColdAisleMiddleTemp										
ColdAisleTopTemp	66.59	69.26	66.71	68.72	65.74	67.78	65.68	66.38	65.96	66.23
HotAisleBottomTemp										
HotAisleMiddleTemp										
HotAisleTopTemp	67.02	69.62	67.16	69.08	65.88	68.95	65.82	67.28	66.20	66.52

HotAisleTopTemp


IT Data Center Dashboard Weekly North Shore Report Weekly North Shore Graphs Monthly North Shore Report Weekly South Shore Report Weekly South Shore Graphs Monthly South Shore Report Floor Plans



# PI Datalink Report



# PI Datalink Report

Return to Dashboard


## North Shore Data Center Monthly Report

Select row below.

Row: Row01

Month: Row01  
Row02

Year: 2020

**NOTE: Data is in a RAW format. Any questions in validity should be addressed with HRSD's Data Analysis Section**

Date	NN_WMBG Airport Temperature	Average COLD Aisle Temperatures					Average HOT Aisle Temperatures				
		1A	1B	1C	1D	1E	1A	1A	1C	1D	1E
Sat, 01/Feb/2020	45.74			74.78					78.93		76.50
Sun, 02/Feb/2020	48.01			74.95					79.11		76.63
Mon, 03/Feb/2020	58.47			64.38					76.70		76.10
Tue, 04/Feb/2020	61.62			64.31					76.70		76.11
Wed, 05/Feb/2020	53.00			64.34					76.71		76.15
Thu, 06/Feb/2020	55.70			64.31					76.81		76.15
Fri, 07/Feb/2020	55.91			64.30					76.89		76.16
Sat, 08/Feb/2020	40.55			64.49					76.70		76.04
Sun, 09/Feb/2020	42.32			64.48					76.65		75.96
Mon, 10/Feb/2020	53.60			74.83					78.82		76.41

# PI Asset Framework and PI Notifications

Elements

- NS\_ServerRoom
  - SS\_DataCenter
    - Row101
      - Row102
        - 102-1
        - 102-2
        - 102-3
        - 102-4
        - 102-5
        - 102-6
        - 102-7
        - 102-8
        - 102-9
      - Row103
      - Row104
      - Row105
      - Row106
      - Row107
      - Telog\_SS IT Data Center Temperature

Row102

General Child Elements Attributes Ports Analyses Notification Rules Version

Filter

Name	Value
Template: IT_Aisle	
AisleReturn1	70.7 °F
AisleReturn2	71.6 °F
AisleReturn3	72.5 °F
AisleReturn4	71.6 °F
AisleSupply1	70.7 °F
AisleSupply2	71.6 °F
AisleSupply3	73.4 °F
AisleSupply4	70.7 °F



Elements

- NS\_ServerRoom
  - SS\_DataCenter
    - Row101
      - Row102
        - 102-1
        - 102-2
        - 102-3
        - 102-4
        - 102-5
        - 102-6
        - 102-7
        - 102-8
        - 102-9
      - Row103
      - Row104
      - Row105
      - Row106
      - Row107
      - Telog\_SS IT Data Center Temperature
      - Weather-VBHRSD Temperature

102-4

General Child Elements Attributes Ports Analyses Notification Rules Version

Filter



Name	Value
Template: IT_Rack	
AvgColdAisleTemp	72.68 °F
AvgHotAisleTemp	79.79 °F
ColdAisleBottomTemp	72.86 °F
ColdAisleMiddleTemp	72.5 °F
ColdAisleTopTemp	Excluded
HotAisleBottomTemp	80.42 °F
HotAisleMiddleTemp	79.16 °F
HotAisleTopTemp	Excluded


# PI Asset Framework and PI Notifications

- Two Alarm Levels based on hanging sensors

- WARNING Alarm
  - If average is  $> 75^{\circ}$  for 15 minutes

WARNING: SS Data Center has reached the warning threshold of 75F for 15 minutes!

 PI-System-Alert@hrsd.com  
To  Elston, Tiffany

 You forwarded this message on 9/4/2019 6:12 PM.



**Time Stamp at Start:** 09-04-2019 05:53:04  
**Average at Start:** 74.883


\*\*Average is of all hanging sensors

[SS Data Center Thermal Dashboard](#)

- CRITICAL Alarm
  - If average is  $> 80^{\circ}$  no dwell time

CRITICAL ALARM: SS Data Center has reached Alarm Threshold of 80 F. Attention is needed immediately!!

 PI-System-Alert@hrsd.com  
To  Elston, Tiffany

 You forwarded this message on 9/4/2019 6:38 PM.  
This message was sent with High importance.

**Time Stamp at Start:** 09-04-2019 06:28:20  
**Average at Start:** 80

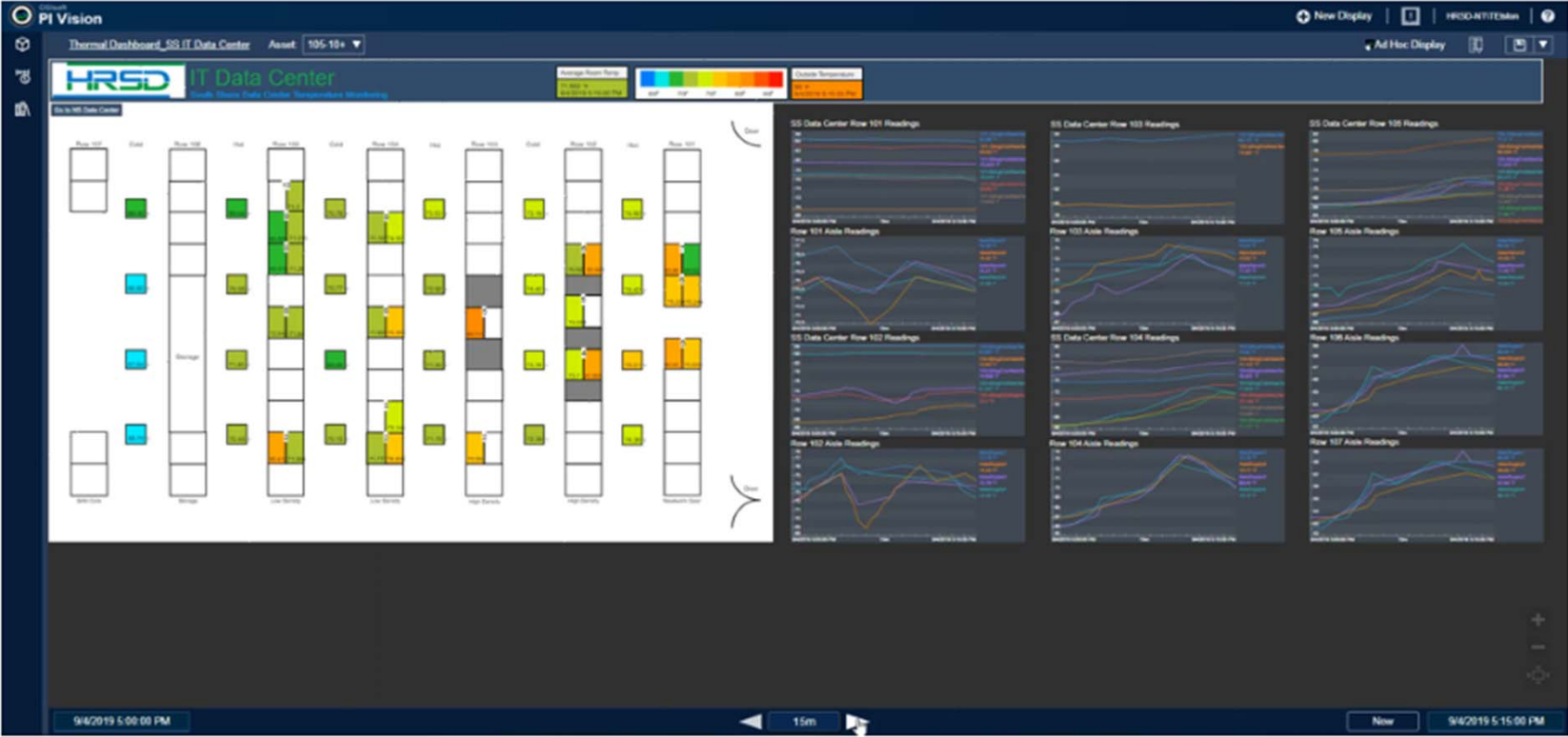
\*\*Average is of all hanging sensors

[SS Data Center Thermal Dashboard](#)

# Application and Use Case



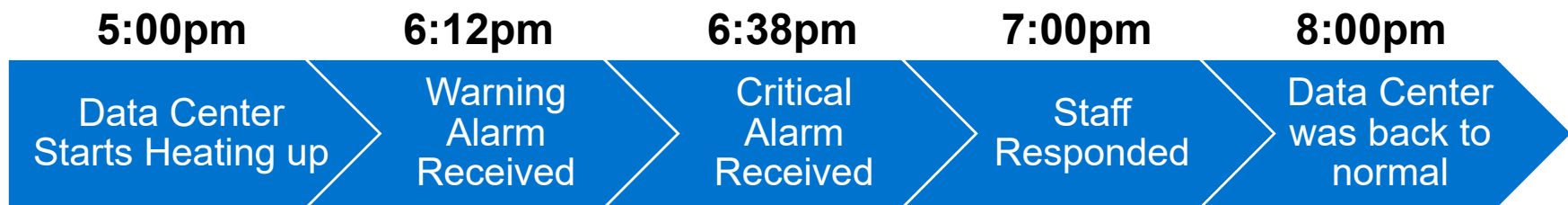
# September 2019 Event – Demo 7



[Thermal-Dashboard SS-IT-Data-Center](#)

# September 2019 Event

- Two days before Hurricane Dorian was supposed to impact our area



- Cause – Comm failure for panel that controls the chillers

# A HRSD Story

## CHALLENGES

- Storm Preparedness
- Data Center Monitoring

## SOLUTION

- Use the PI System to monitor tide, wind rainfall, flooding potential as well as wet well level and pump station monitoring.
- Use the PI System to increase thermal monitoring within our main data centers

## BENEFITS

- More time efficient
- Ease of use for users in the field
- Speed of data delivery
- Bigger picture of current situations

# Future Plans for Expansion

- Storm Preparedness
  - Forecasted Tide, Wind and Rain Data – currently in the testing phase
  - Condition Assessment of key assets using PI data in Power BI analytics
- Data Center
  - Installation of more sensors
  - Monitoring the Computer Room Air Conditioning (CRAC) units and chillers
  - Integration of the building automation system into PI
  - Expansion to our Small Communities Data Center

# Contact Information



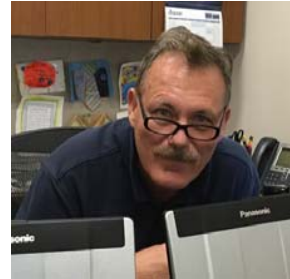
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**Robert Davis**  
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– [rdavis@hrsd.com](mailto:rdavis@hrsd.com)



# Questions?

Please wait for  
the **microphone**

State your  
**name & company**



## Please remember to...

Complete the Survey!  
Navigate to this session in  
the mobile app for survey

