

# Water Corporation's Journey from Application to Infrastructure

Presented by **Ian Scott**

**Water Corporation of Western Australia**

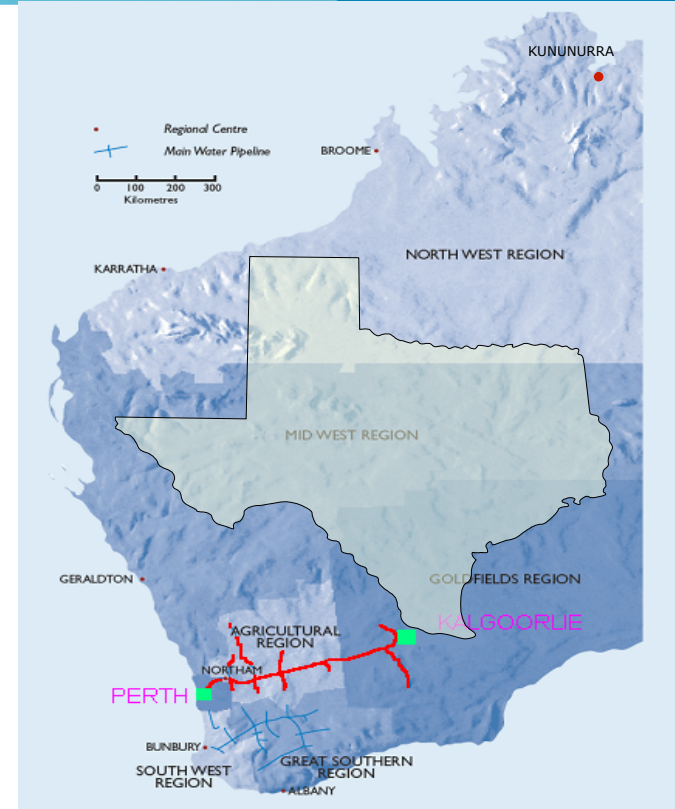
# Agenda

- About the Water Corp
- Strategic Challenges
- Modular solutions
  - Dashboards
  - Alert Monitoring (Cockburn Sound)
  - IT Monitoring
  - Data Quality Manager (AANT)
  - Drinking Water Compliance Tracking (CCP)
  - System Capability Forecasting
  - Automatic Meter Reading
- The Next Challenge



# Water Corporation at a glance

- One of the Australia's largest water service providers
  - State-wide responsibility
  - Area of over 2.5 million km<sup>2</sup>
  - World's largest water supply area
  - +\$25 Billion Asset Base
  - Serves population of 2.4 million
  - More than 2,000 employees
  - Annual revenue >\$1.5 Billion
  - Capital program - +\$900M /yr.
  - Water to 300 cities and towns
  - Wastewater to 100 cities and towns
- Western Australia is almost 4 times larger than Texas
  - Texas has over 10 times the population
  - It is almost as far from Perth to Kununurra as it is from San Francisco to Dallas



# Strategic challenges

- Drying Climate
  - Impact on water resources (Reducing stream flows and groundwater levels)
- Population Growth
- Booming Economy
  - Significant capital program
  - Difficulty in accessing skilled staff
  - Increasing costs
- Increasing Customer and Stakeholder Expectations
- Increasing Regulator Requirements



# Dashboards

What do you do when you have >600 assets to check each day?



## Business Challenge

- SCADA shows current activities on the site.
- Poor at identifying if the asset is meeting design specs.
- Difficult to focus on problem sites.

## Solution

- Build a repeatable and scalable solution in PI ACE for each site
- Develop roll up logic to group sites
- Develop ProcessBook dashboard display for easy access

## Results and Benefits

- Provides a quick view of long-term performance of each asset.
- These KPI's are not monitored by SCADA.
- Each site is analysed using the same method – "one best way".
- Predictive forecasting when design limits will be reached

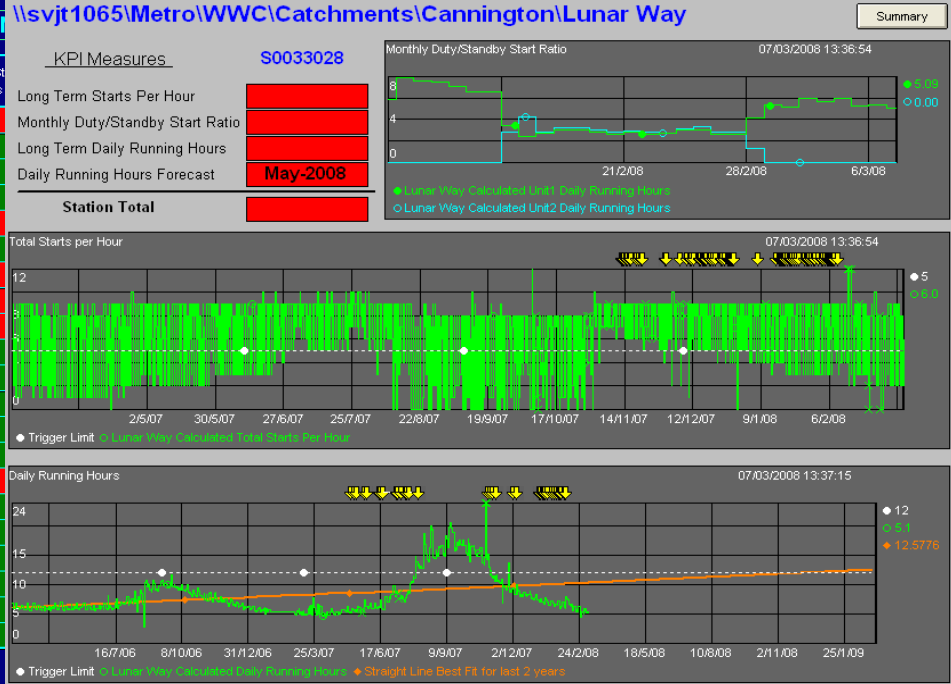
# Wastewater pump station KPI forecasting

## METROPOLITAN CA



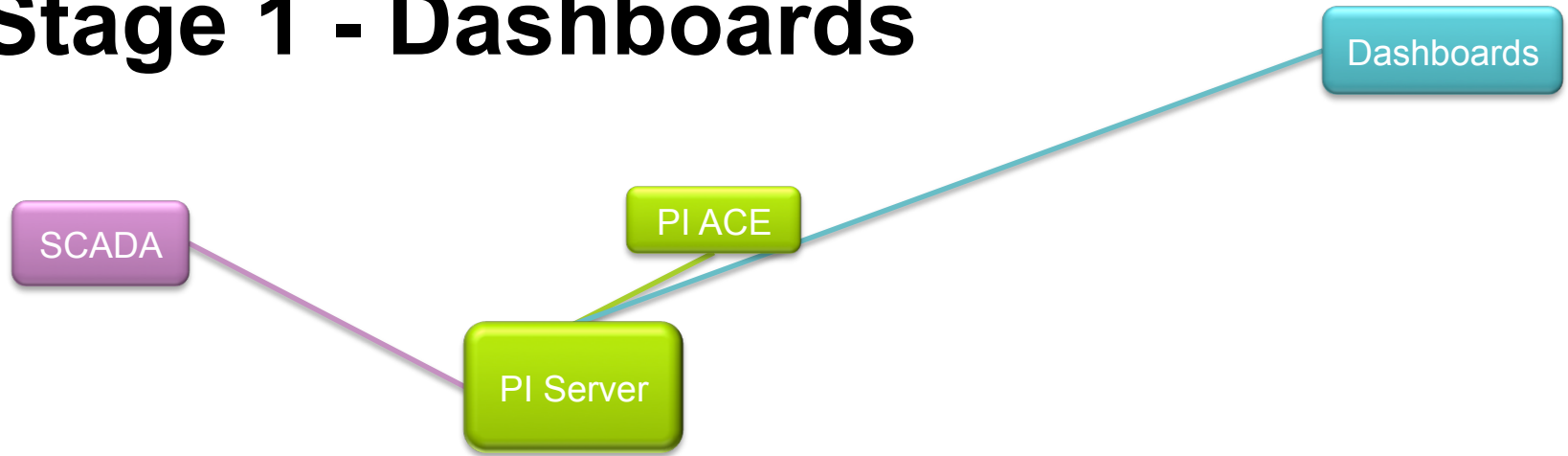
## CANNINGTON

SUMMARY	Long Term Starts Per Hour	Duty/Standby Starts
Bone Street		
Chisholm Crescent		
Fern Road		
Foxton Boulevard		
Kilkenny Circle		
Knutsford Avenue		
Lunar Way		
Luyar Avenue		
Manning Road East		
Manning Road West		
Packer Street		
Palmerston Street		
Richmond Street		
Rochester Avenue		
Saint John Road		
Sheffield Road		
Weir Crescent		
Welshpool Road		
Wittenoom Road		
Worrell Avenue		
Wright Street		



- “A wastewater overflow that makes the front page of the newspaper is about \$1M in lost reputation” – CEO Water Corporation

# Stage 1 - Dashboards



Source

Information

# Alert Monitoring

Shifting PI from a historian to an operational partner of SCADA



## Business Challenge

- Critical monitoring for brine discharge into Cockburn Sound.
- Operating License has comprehensive parameters that can cause the Desalination Plant to be shut down if exceeded.
- EPA/DEC need to “interact” with the data. **Static web pages not workable.**

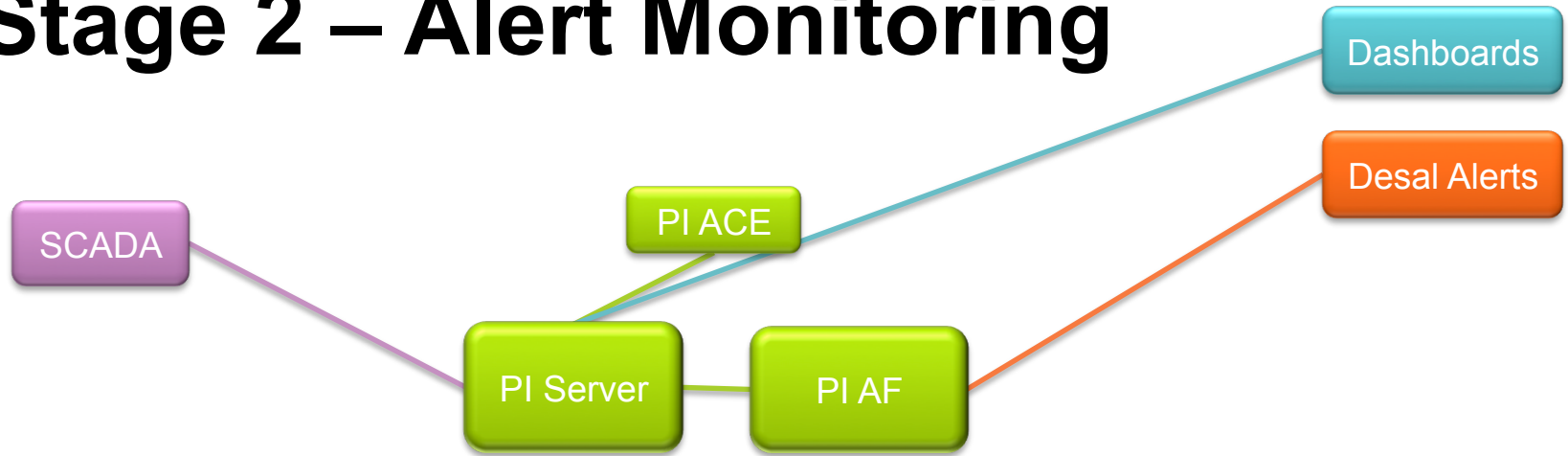
## Solution

- PI delivered requirements for modelling, data collection and client delivery.
- Integration with PI ACE modelling and PI AF structure.
- External Regulator view of the data via Citrix.

## Results and Benefits

- Broke down perceived barriers within the business
- Data is viable across a wider audience
- It is reliable
- Confidence with Regulators as they can see live data.

# Stage 2 – Alert Monitoring



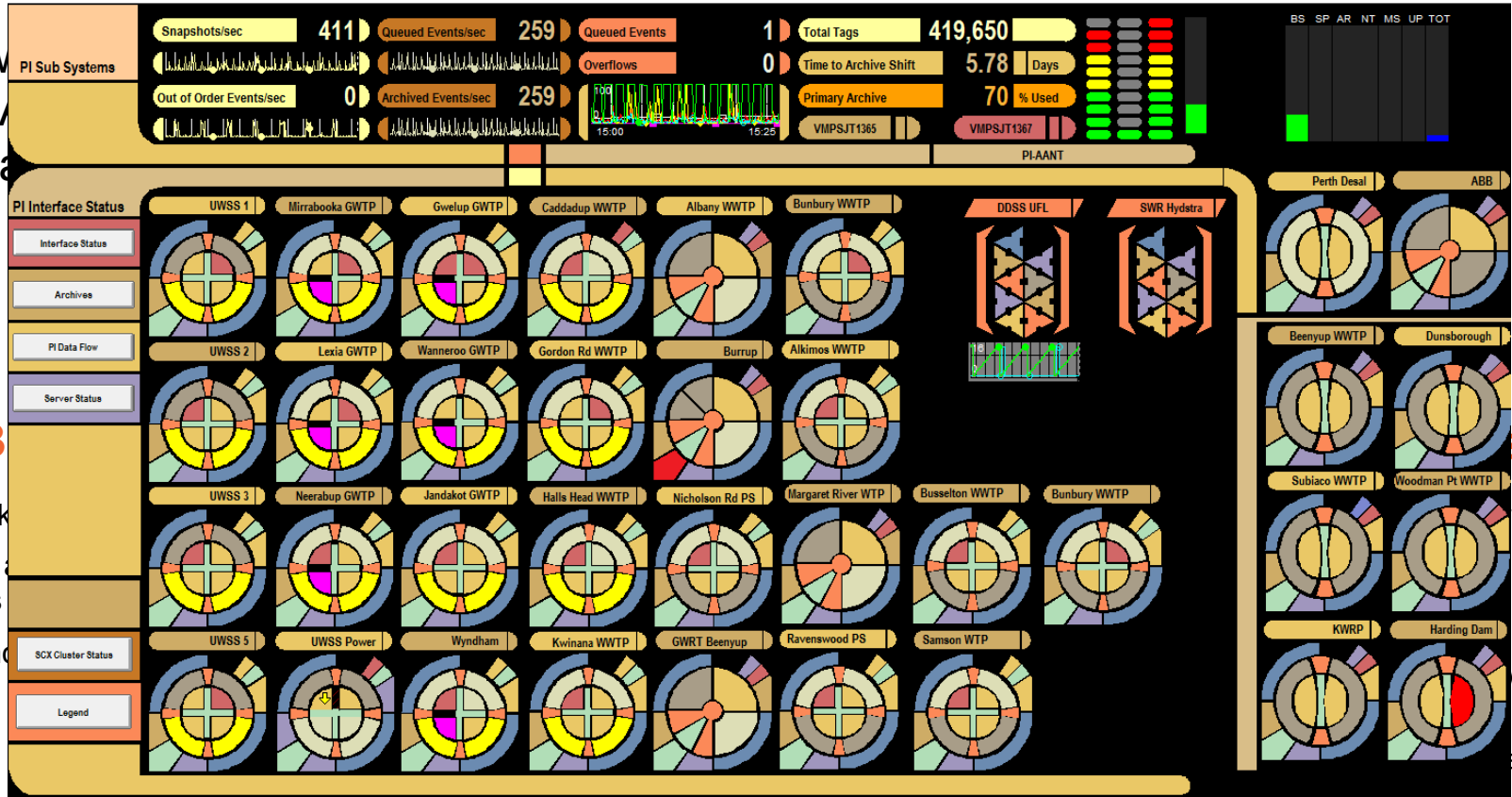
Source

Information

Monitoring

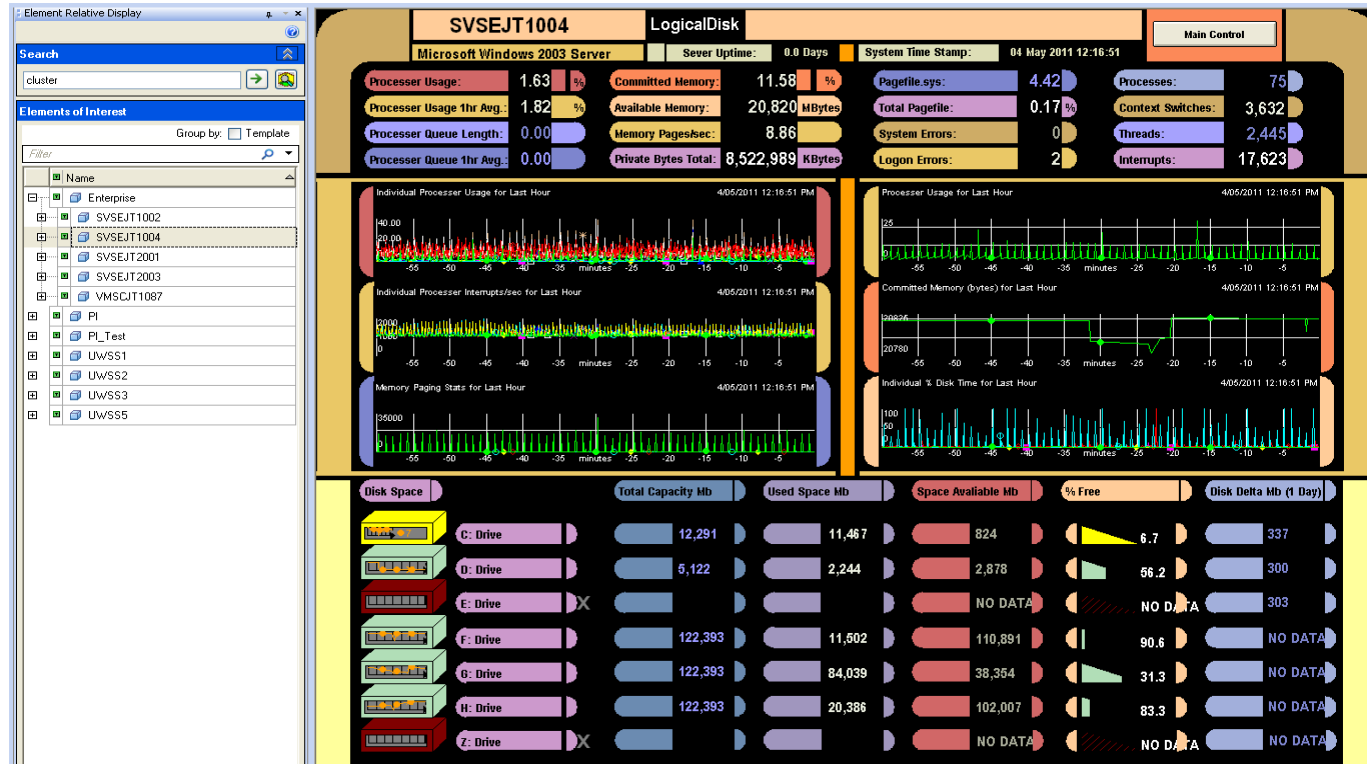
# IT Monitoring

How  
SCA  
infra



- Must k
- Need a status
- Diagn chain

# IT Monitoring Element Relative Display for Servers





# IT Monitoring AF structure

**Elements**

- Application
  - Givelpak
  - Jandakot
  - Lesia
  - Mirrabooka
  - Neerabup
  - Ravenswood\_PS
  - Samson\_WTP
  - UWSS1
  - UWSS2
  - UWSS3
  - UWSS5
  - Wanneroo
  - Windham
  - Health Rules
  - PI Interfaces
  - PI Systems
  - Pings
  - Servers
  - Switches
  - UPS

**Standby 0**

Attribute Name	Value	Settings
Calc Settings		
Attribute Name	Connection Status	
Calc Type	Comparison	
CatchStringChange	False	
Ignore	False	
Calc Tags		
Connection Status	4	\\svr1065UWSS3_Status_Standby 0.ReadOnly=False
PI Tags		
Connected Status	Yes	\\svr1065UWSS3_Connected_Standby 0.ReadOnly=False.ptclassname=classic.pointtype...
Node Name	SVSEJT1013	\\svr1065UWSS3_NodeName_Standby 0.ReadOnly=False.ptclassname=classic.pointtype...
Pending Configuration	0	\\svr1065UWSS3_PendConfig_Standby 0.ReadOnly=False.ptclassname=classic.pointtype...
Pending Data	2	\\svr1065UWSS3_PendData_Standby 0.ReadOnly=False
Pending Dynamic	6	\\svr1065UWSS3_PendDynamic_Standby 0.ReadOnly=False.ptclassname=classic.pointtype...
Pending Historical Bytes	11648	\\svr1065UWSS3_PendHisBytes_Standby 0.ReadOnly=False.ptclassname=classic.pointtype...
Pending Historical Reco.	134	\\svr1065UWSS3_PendHisRecord_Standby 0.ReadOnly=False.ptclassname=classic.pointtype...
Percentage Configuration	100 %	\\svr1065UWSS3_PercentConfigSync_Standby 0.ReadOnly=False.ptclassname=classic.pointtype...
Percentage Data Sync	99.962661743164...	\\svr1065UWSS3_PercentDataSync_Standby 0.ReadOnly=False.ptclassname=classic.pointtype...
Percentage Dynamic Sync	99.982887268066...	\\svr1065UWSS3_PercentDynamicSync_Standby 0.ReadOnly=False.ptclassname=classic.pointtype...
Percentage Historic Sync	99.99084472656...	\\svr1065UWSS3_PercentHisSync_Standby 0.ReadOnly=False.ptclassname=classic.pointtype...
Running Status	Yes	\\svr1065UWSS3_Running_Standby 0.ReadOnly=False.ptclassname=classic.pointtype=Digital...
Synchronized Status	Yes	\\svr1065UWSS3_Sync_Standby 0.ReadOnly=False.ptclassname=classic.pointtype=Digital...
Total Historical Bytes	1315782400	\\svr1065UWSS3_TotalHisBytes_Standby 0.ReadOnly=False.ptclassname=classic.pointtype...
Total Historical Objects	128953	\\svr1065UWSS3_TotalObjects_Standby 0.ReadOnly=False.ptclassname=classic.pointtype...
Total Historical Sync	14377812	\\svr1065UWSS3_TotalHisSync_Standby 0.ReadOnly=False.ptclassname=classic.pointtype...

**Notifications**

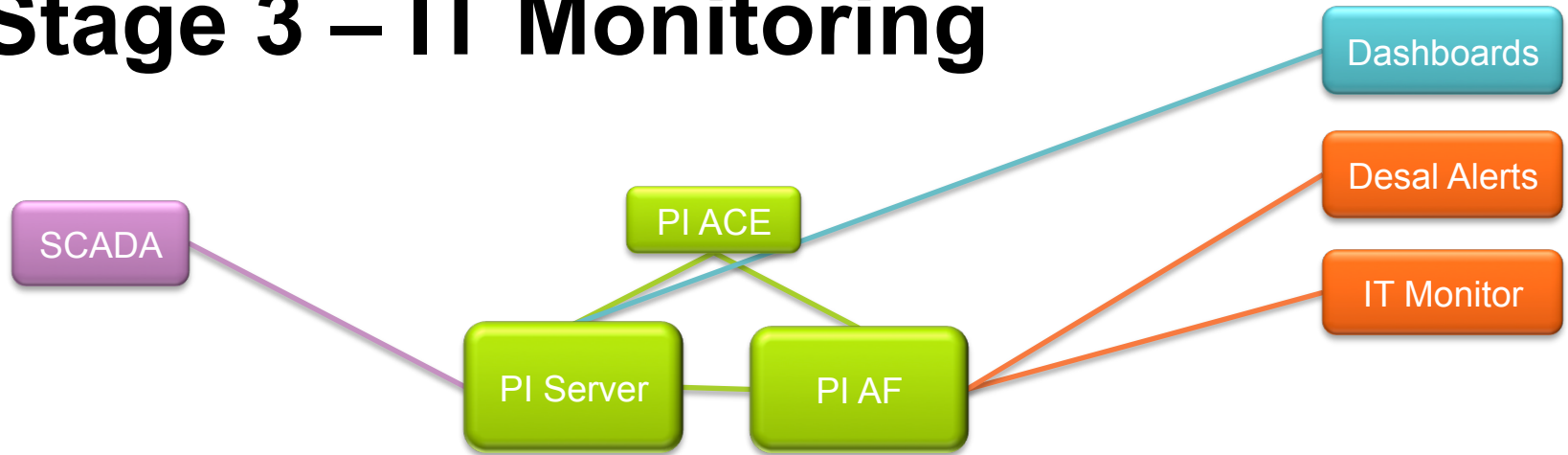
- New
- OPC Cluster (11)
- OPC Single (10)
- PI Systems (3)
- Ping Time (31)
- SCX Apps (11)
- Server Health (7)
  - Server Cluster Status (Enterprise) (Enterprise)
  - Server Cluster Status (PI) (PI)
  - Server Cluster Status (PL Test) (PL Test)
  - Server Cluster Status (UWSS1) (UWSS1)
  - Server Cluster Status (UWSS2) (UWSS2)
  - Server Cluster Status (UWSS3) (UWSS3)
  - Server Cluster Status (UWSS5) (UWSS5)

- Settings for tag construction using substitution parameters

- Site name includes point source, location 1 for child attributes.
- Rollup status calculation triggers PI Notifications

- Create tags directly from the attributes panel
- Driven by templates

# Stage 3 – IT Monitoring



Source

Information

Monitoring

# Data Quality Manager

If machines are gathering data how do you know the data is any good and how do you let the data consumer know?

**Annotation,  
Aggregation and  
Notification  
Tool for PI data**



## Solution

### Business Challenge

- A fundamental need to quality assure its data from the field
- Current culture relies on people to spot errors, rather than systems.
- Have information the business uses without question

- Consistent analysis approach
- Audit both business logic modification along with the data
- Aggregates the data.
- Auto analyse the raw data for quality issues (out of limits, missing data, etc.) and flag the aggregated data as questionable.
- Allow users to modify the questionable data to establish the Corporate truth.

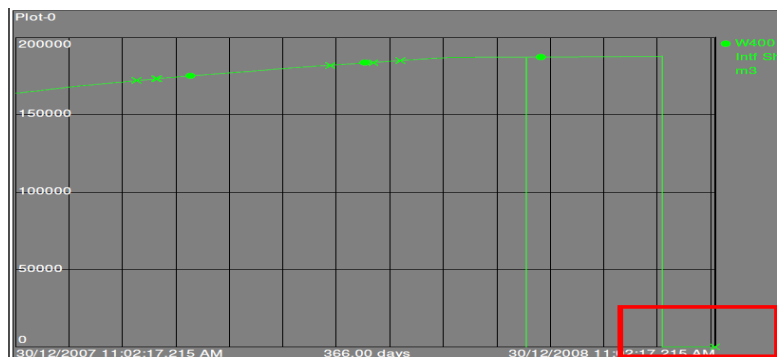
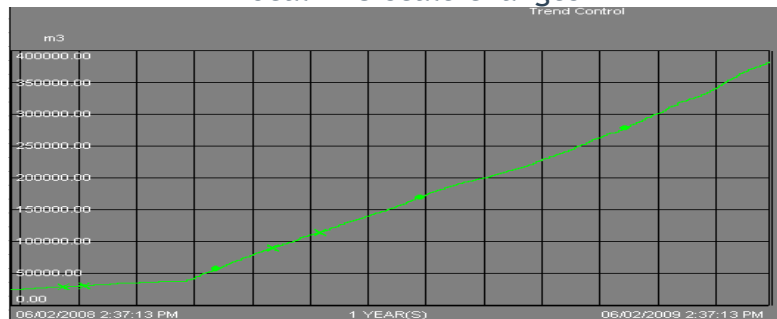
### Results and Benefits

- Enforces business quality levels on the data
- Easy to organically grow the structure to fit the changing business
- One Version of the Truth
- Data Integration can now progress to other systems.



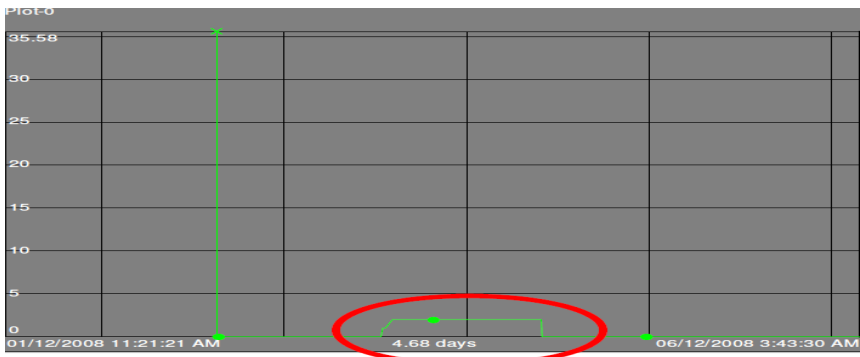
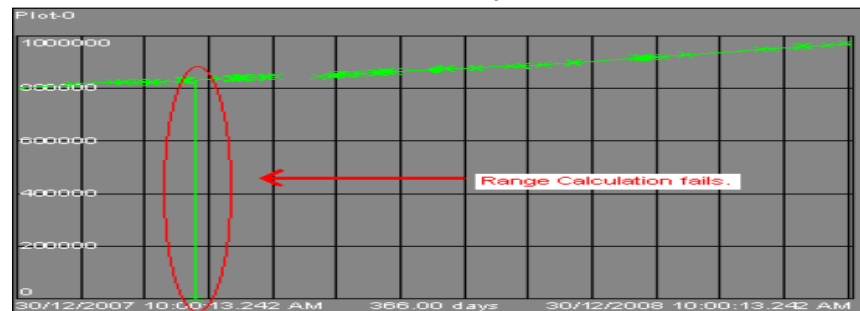
# Data Error examples

## Local RTU scale changes



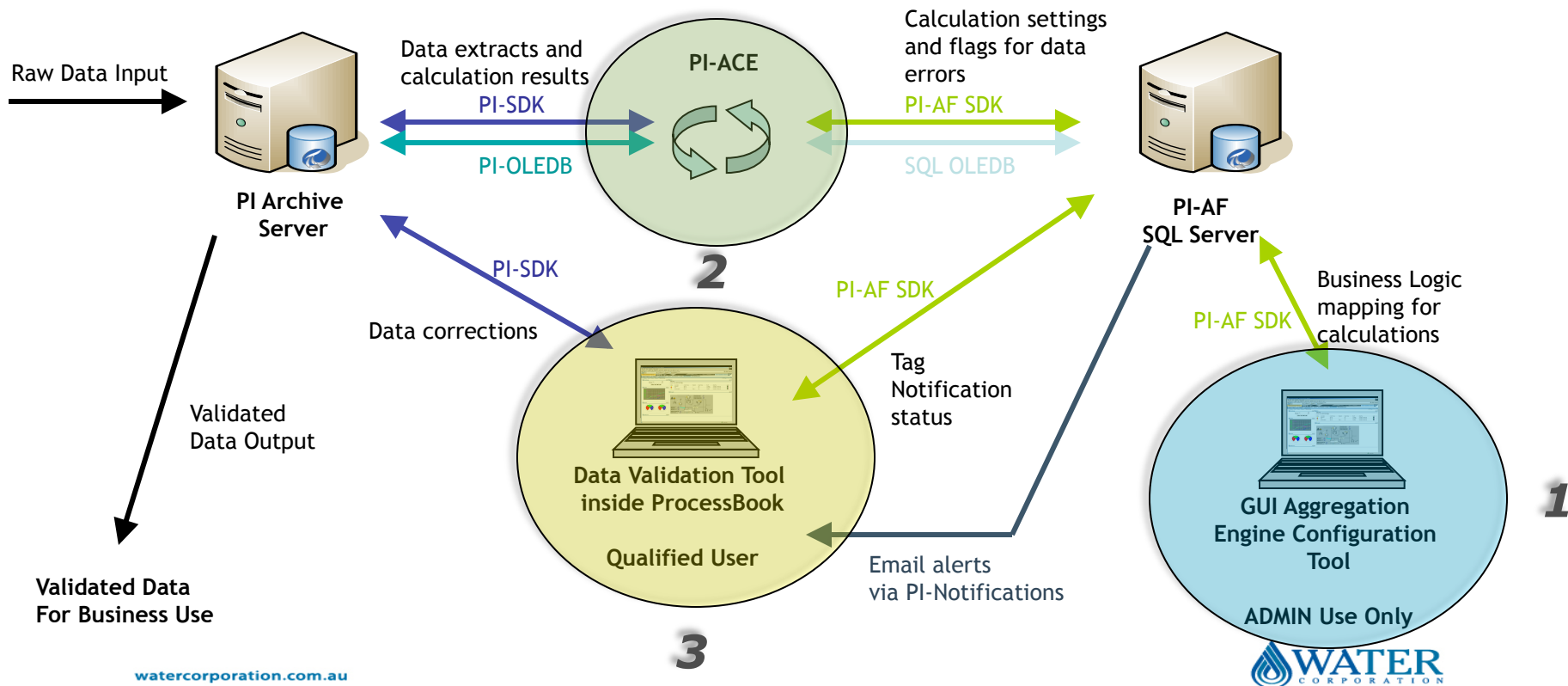
## Scales set to zero

## Instrument spikes

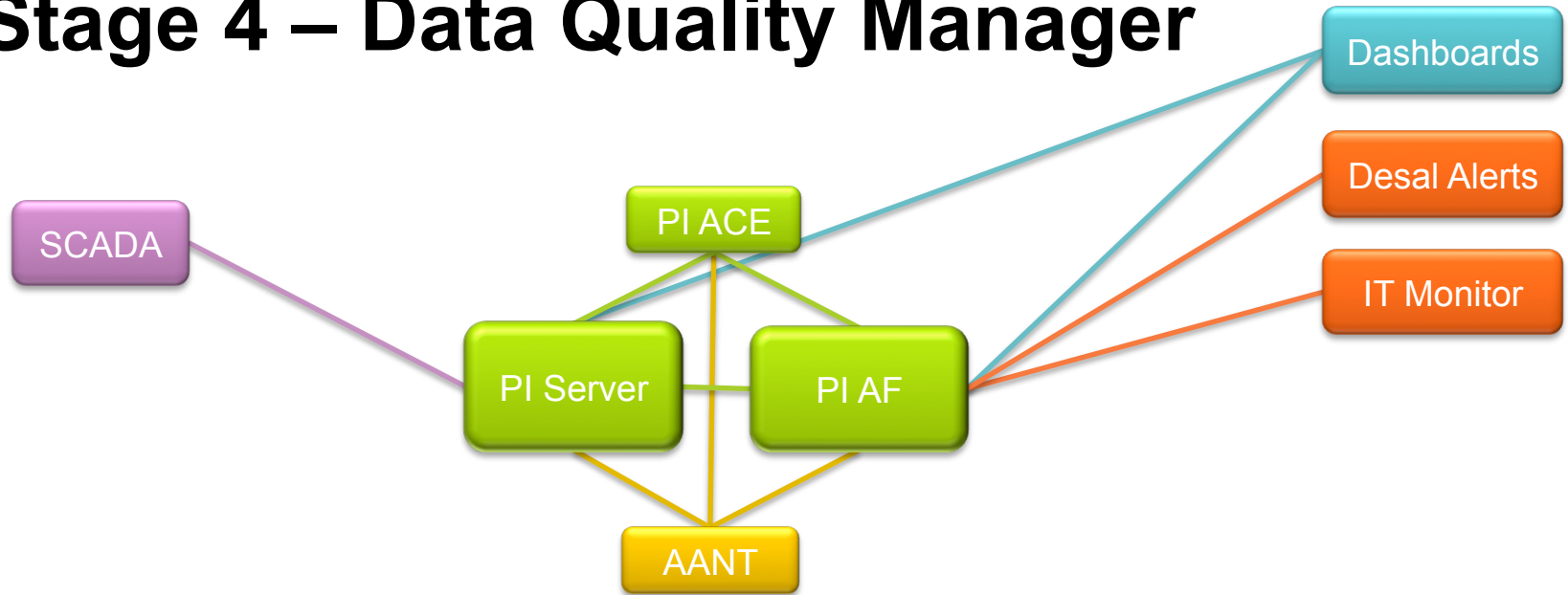


## Totaliser not functioning correctly

# AANT – 3 Part Solution



# Stage 4 – Data Quality Manager



Source

Information

Monitoring

# Water Quality Monitoring

Is that water safe to drink ALL of the time?

## Business Challenge

- Historical spot sampling gave confidence the water was safe for each sample
- 210 remote water quality dosing modules across the state for Chlorination, Turbidity and UV
- Spreadsheet prototype to slow and poor scalability



elements

## Results and Benefits

- Forces compliancy rigor to analysis
- Fully Scalable
- Version of the Truth
- Is transparent from field to Regulators



The screenshot displays the PI AF Pro ServerAE\_AF - PI System Explorer application. The interface is divided into two main panes.

**Left Pane (Elements):**

- A hierarchical tree view showing the structure of the system. The root is "Elements".
  - Under "Elements": DWQ, Favourite, Region.
    - Under "Region": GAR, Groundwater Metro, GSR, MWR, NWR, SWR.
    - Under "Blackwood": Balingup, Boyup Brook, Bridgetown, Greenbushes, Hester, Knp/Mullalyup (SCADA), Manjimup - Phillips Creek, Manjimup Dam - Scabby Gully, Nannup (SCADA), Northcliffe, Pamberton.
      - Under "Pamberton": Chlorine\_Residual\_Inlet.
        - Under "Chlorine\_Residual\_Inlet": Critical, Target.
        - Under "Target": Turbidity, UV\_Dose.
        - Under "UV\_Dose": Guinninup.
        - Under "Guinninup": Leeuwini.
        - Under "Leeuwini": Wellington.
        - Under "Wellington": Water Technologies (PR).

Red arrows point from specific elements in the tree to the corresponding rows in the table:

- From "High SCADALimitSP" in the "Category: Config" section to "HighAlarmSPDifferential" in the "Category: PITags" section.
- From "Low SCADALimitSP" in the "Category: Config" section to "LowAlarmSPDifferential" in the "Category: PITags" section.
- From "TimeAbove" in the "Category: PIResults" section to "TimeAboveDailyPct" in the "Category: PITags" section.
- From "TimeBelow" in the "Category: PIResults" section to "TimeBelowDailyPct" in the "Category: PITags" section.

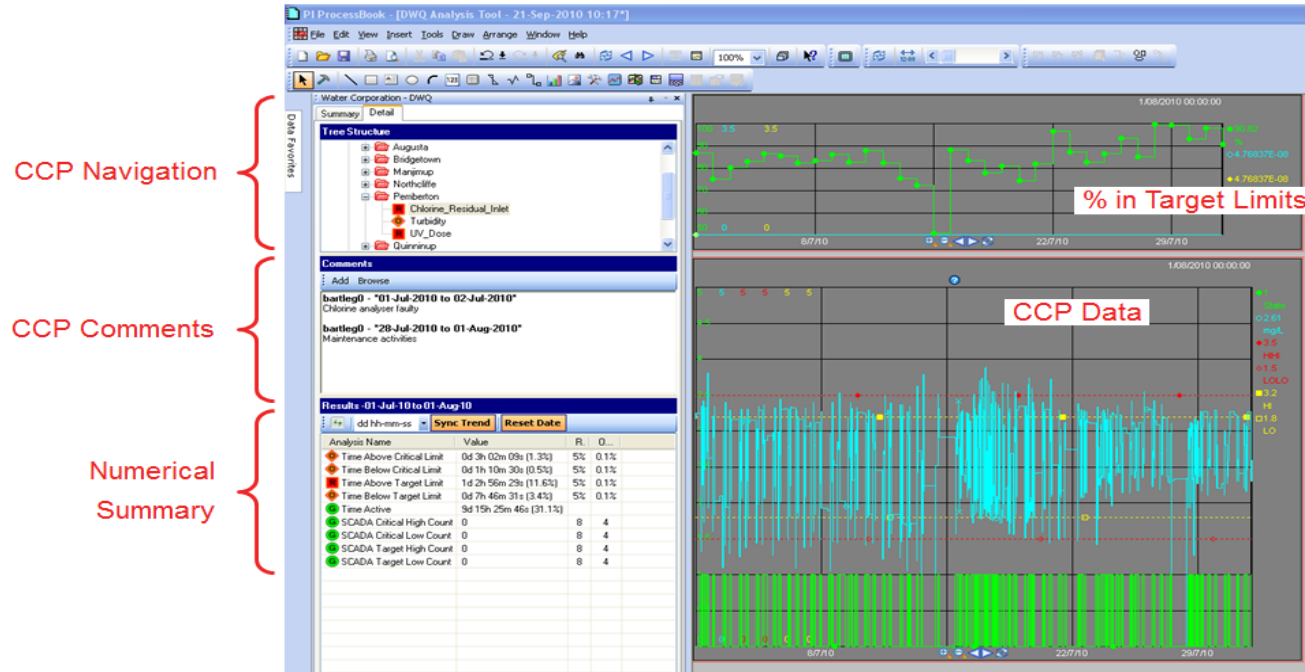
**Right Pane (Critical):**

- Tabs: General, Child Elements, Attributes, Ports, Version. The "General" tab is active.
- Filter: [Empty]
- Table with columns: Name, Value.
 

Name	Value
<b>Category: Config</b>	
High SCADALimitSP	3.99000000953674 mg/L
Low SCADALimitSP	1.30000007152557 mg/L
<b>Category: PIResults</b>	
SCADAHighCount	0 count
SCADALowCount	0 count
TimeAbove	0 s
TimeBelow	0 s
<b>Category: PITags</b>	
HighAlarmSPDifferential	0.49000000953674316
LowAlarmSPDifferential	0.10000007152557378
TimeAboveDailyPct	0 %
TimeBelowDailyPct	0 %
<b>Category: Regulation Limits</b>	
HighLimit	3.5
LowLimit	1.2
<b>Category: TrafficLight Threshold</b>	

# Locality Barrier Tool – Detail Page

The Detail page shows the data from a single CCP in graphical and numeric forms.



# Locality Barrier Tool – Reporting

Microsoft Excel - PM-3416354-v31-DWQ\_Locality\_Barriers\_CCP\_Report\_Template\_Prototype\_3.XLS

Filter: Date From: 01/07/2010 Date To: 31/07/2010 31 day period Data Last Updated: 21/09/2010 12:00

District/Locality CCP	% Hours Recorded	Critical Limit - % Good			Target Limit - % Good			# Alarms	Critical Alarms		Target Alarms		Last Refresh
		In Band	Low	High	In Band	Low	High		Low	High	Low	High	
<b>SWR</b>													
<b>Bunbury</b>													
<b>Australind</b>													
Chlorine_Residual_Inlet	R 31.1	G 98.7	G 95.5	G 98.7	G 95.5	G 98.7	G 95.5	G 98.7	G 95.5	G 98.7	G 95.5	G 98.7	21/09/2010 12:40
Turbidity	R 31.1	G 100.0	G 100.0	G 100.0	O 98.7		G 98.7	G 95.5	G 98.7	G 95.5	G 98.7	G 95.5	21/09/2010 12:40
UV_Dose	R 31.1	R 88.7	G 88.7		N/A		G 88.7	G 85.0	G 88.7	G 85.0	G 88.7	G 85.0	21/09/2010 12:40
<b>Boyanup</b>													
Chlorine_Residual_Inlet	R 31.1	O 88.2	O 95.5	O 98.7	R 85.0	O 96.6	R 98.4	G 95.5	G 98.7	G 95.5	G 98.7	G 95.5	21/09/2010 12:40
Turbidity	R 31.1	G 100.0	G 100.0	G 100.0	O 98.7		R 98.7	G 95.5	G 98.7	G 95.5	G 98.7	G 95.5	21/09/2010 12:40
UV_Dose	R 31.1	R 88.7	G 88.7		N/A		G 88.7	G 85.0	G 88.7	G 85.0	G 88.7	G 85.0	21/09/2010 12:40
<b>Collie</b>													
Chlorine_Residual_Inlet	R 31.1	G 98.7	G 95.5	G 98.7	G 95.5	G 98.7	G 95.5	G 98.7	G 95.5	G 98.7	G 95.5	G 98.7	21/09/2010 12:40
Turbidity	R 31.1	G 100.0	G 100.0	G 100.0	O 98.7		G 98.7	G 95.5	G 98.7	G 95.5	G 98.7	G 95.5	21/09/2010 12:40
UV_Dose	R 31.1	R 88.7	G 88.7		N/A		G 88.7	G 85.0	G 88.7	G 85.0	G 88.7	G 85.0	21/09/2010 12:40
<b>Darkan</b>													
Chlorine_Residual_Inlet	R 31.1	G 98.7	G 95.5	G 98.7	R 85.0	O 96.6	R 98.4	G 95.5	G 98.7	G 95.5	G 98.7	G 95.5	21/09/2010 12:40
Turbidity	R 31.1	G 100.0	G 100.0	G 100.0	O 98.7		O 98.7	G 95.5	G 98.7	G 95.5	G 98.7	G 95.5	21/09/2010 12:40
UV_Dose	R 31.1	R 88.7	G 88.7		N/A		G 88.7	G 85.0	G 88.7	G 85.0	G 88.7	G 85.0	21/09/2010 12:40
<b>Busselton</b>													
<b>Mandurah</b>													
<b>Dwellingup</b>													
Chlorine_Residual_Inlet	R 31.1	G 98.7	G 95.5	G 98.7	R 85.0	O 96.6	O 98.4	G 95.5	G 98.7	G 95.5	G 98.7	G 95.5	21/09/2010 12:40
Turbidity	R 31.1	G 100.0	G 100.0	G 100.0	O 98.7		G 98.7	G 95.5	G 98.7	G 95.5	G 98.7	G 95.5	21/09/2010 12:40
UV_Dose	R 31.1	R 88.7	G 88.7		N/A		G 88.7	G 85.0	G 88.7	G 85.0	G 88.7	G 85.0	21/09/2010 12:40
<b>Mandurah</b>													
Chlorine_Residual_Inlet	R 31.1	O 88.2	O 95.5	O 98.7	R 85.0	O 96.6	R 98.4	G 95.5	G 98.7	G 95.5	G 98.7	G 95.5	21/09/2010 12:40
Turbidity	R 31.1	G 100.0	G 100.0	G 100.0	O 98.7		G 98.7	G 95.5	G 98.7	G 95.5	G 98.7	G 95.5	21/09/2010 12:40

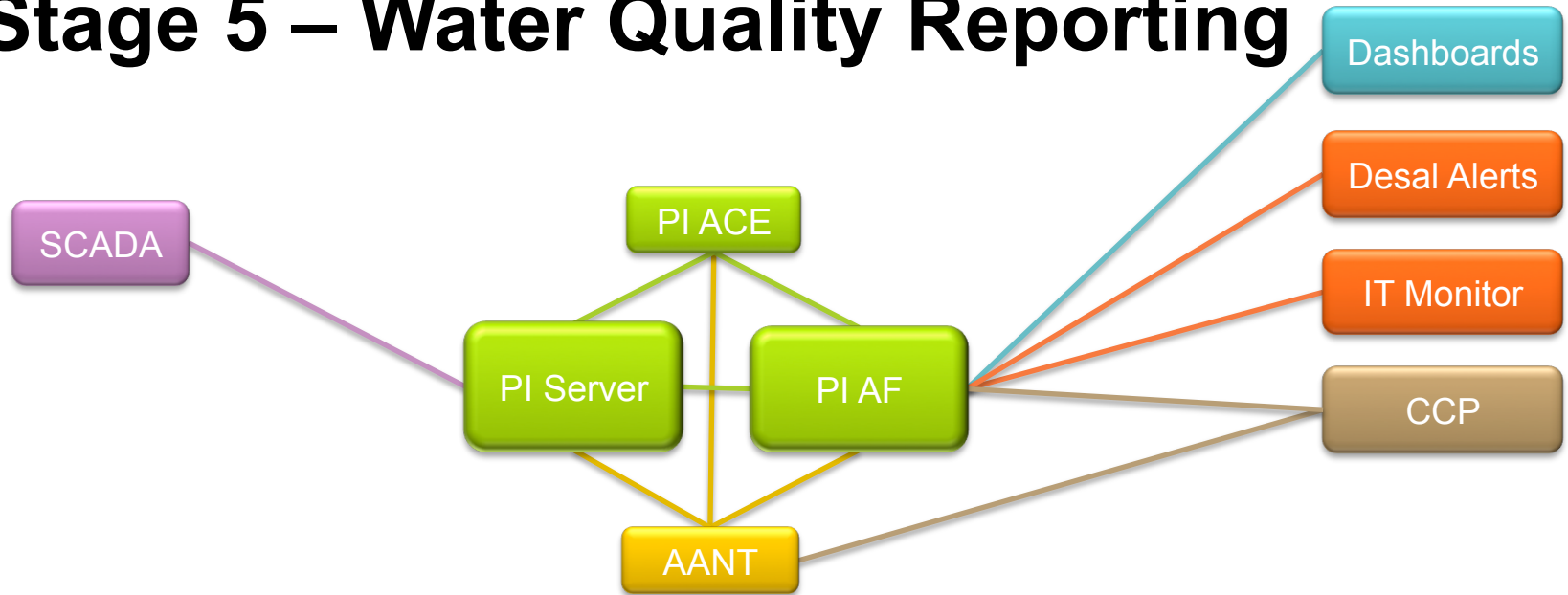
Home / GSR / IMS\_Trial / NWR / SWR / Thresholds /

The report data is loaded into the spreadsheet, one region to a tab. Districts are collapsible for easier reading.

The report allows users to view comments entered in the Data Review client and summarise these for the report.

Individual CCPs, localities, districts or regions can be refreshed with the latest data.

# Stage 5 – Water Quality Reporting



Source

Information

Monitoring

Infrastructure Project

# System Capability Forecasting

How do I know if my scheme infrastructure is capable of meeting my customers needs?

If its OK now when will it be a problem?



## Business Challenge

- Current growth/capacity information is done in a ad-hoc and manual manner
- Inconsistent and multiple data sources exist
- There is no single source of the “truth” regarding data and assumptions.
- There are knowledge capability gaps for people undertaking the analysis.

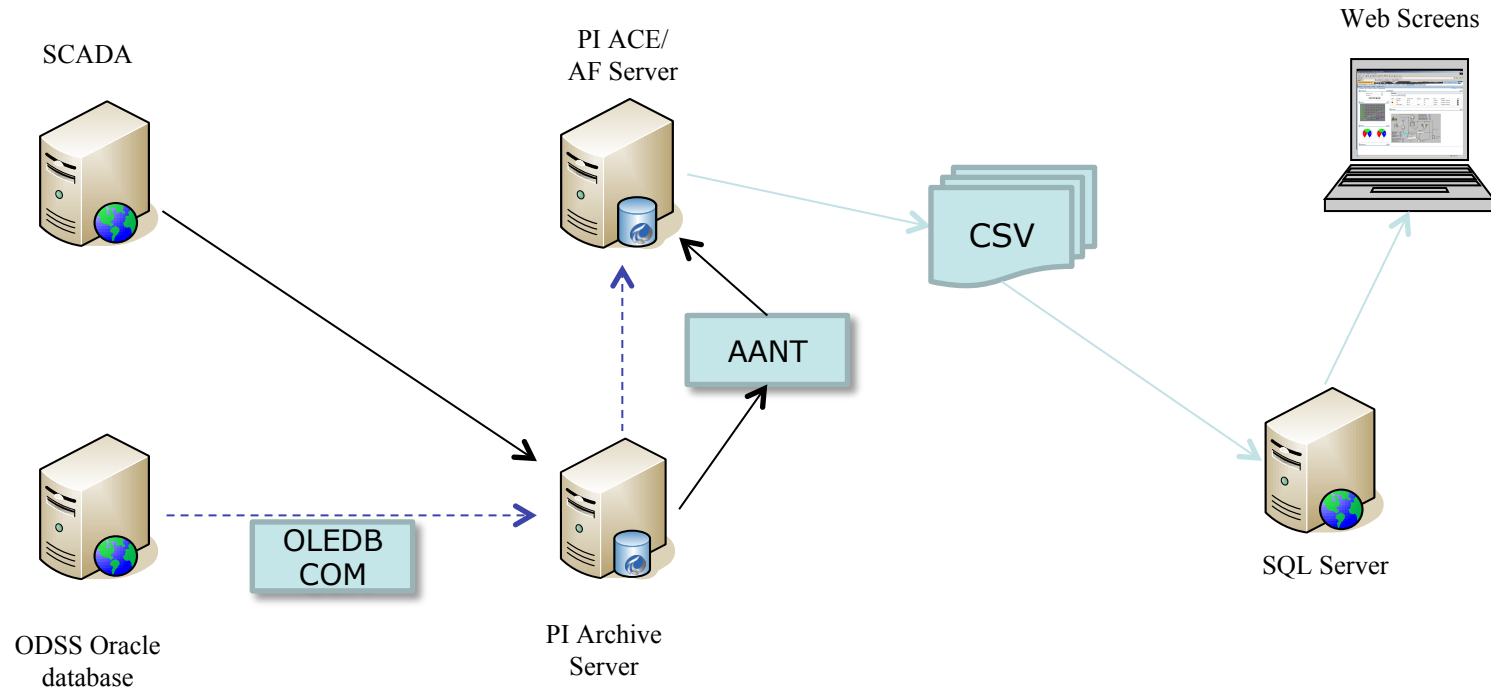
## Solution

- Use PI Server and PI AF to centralise operational data from key systems
- Use PI AF to define the information distributed to the Reporting solution

## Results and Benefits

- One Version of the Truth
- Focus on long term growth/ capacity
- Become proactive instead of reactive.
- To streamline and speed up delivery of information.

# Architecture Diagram



# AF Structure – Site Level

File Edit View Go Tools Help

Database Query Date Back Check In Refresh New Element New Attribute

### Elements

- Broome
  - Borefield Master Meter
  - Observation Bores
    - Bore 1/08
    - Bore 1/81
    - Bore 1/89
      - Abstraction
      - Rainfall
      - Salinity
      - Water Levels
  - Production Bores
    - Bore 1/91
    - Bore 1/95
    - Bore 1/96
    - Bore 18/85
    - Bore 2/08
    - Bore 2/91
    - Bore 2/94
    - Bore 2/95

### Bore 1/89

General Child Elements Attributes Ports Version

Filter

	Name	Value	Settings...
Category: <None>			
	AssetClass	W_BORE_SITE	
	ODSS Functional Location	W0025982	SELECT [ODSS_Asset_FL] FROM [FLAlignmentT...
	SP Functional Location	W3000127	SELECT [ODSS_SP_FL] FROM [FLAlignmentTab...
Category: FL			
	Functional Location	W0025982	
	SCF		
	Functional Location SCF	W0025982	SELECT [SCF_FL] FROM [FLAlignmentTable_Bor...

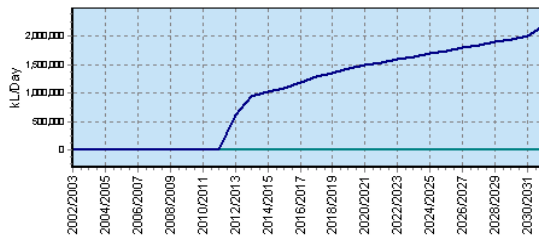


# Scheme Overview

[List](#)
[System Overview](#)
[Development](#)
[Data Sheets](#)
[Hierarchical Flow Chart](#)
[PI Tag Analysis](#)

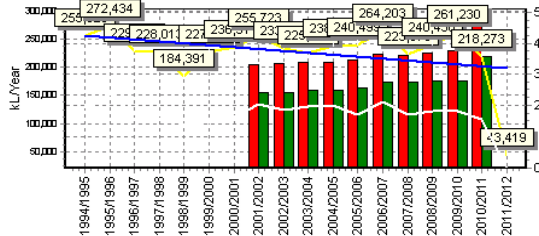
## Scheme Capacity

Onslow Scheme Capacity Exceeded 2001/2002

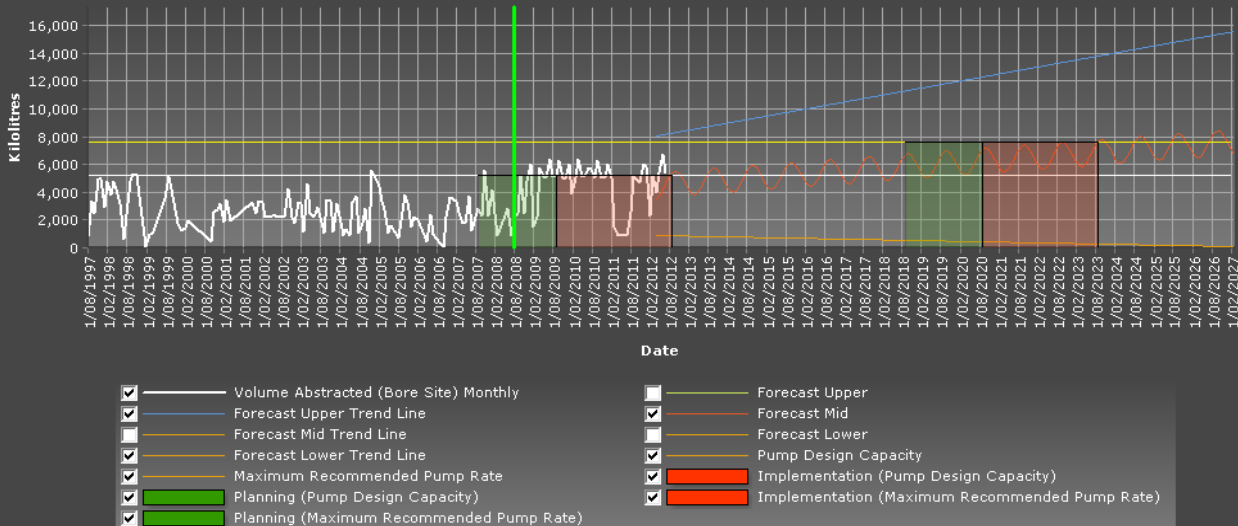


## Town Services vs Consumption

Onslow Town Services vs Consumption



System Capability Forecast - Volume Abstracted (Bore Site) Monthly - BORE 13/94 CANE R - Onslow



Forecast Break Date: 2/08/2008

Pump Design Capacity (5,259 kL/Month)

Forecast Date Upper: 1/4/2012  
Forecast Date Mid: 1/9/2012  
Forecast Date Lower: Not Reached

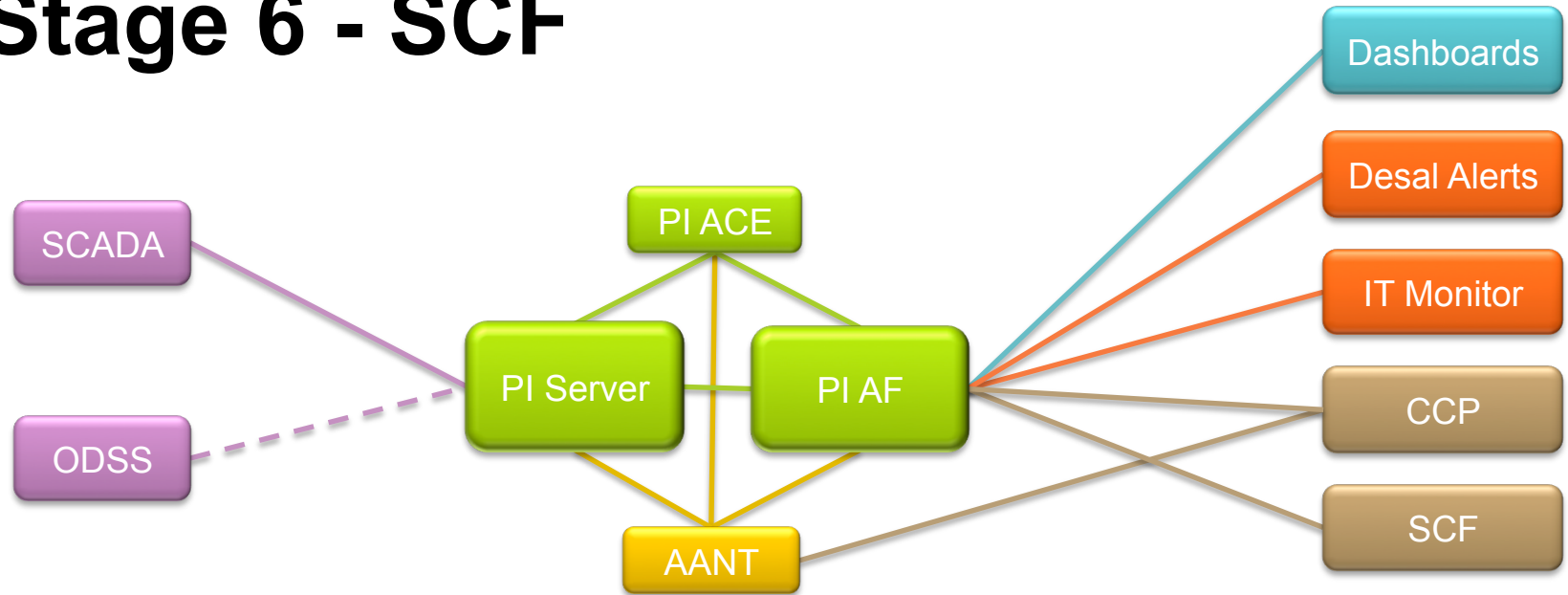
Maximum Recommended Pump Rate (7,609 kL/Month)

Forecast Date Upper: 1/5/2012  
Forecast Date Mid: 1/9/2023  
Forecast Date Lower: Not Reached

# Success Story

- SCF identified an upgrade was required at Yanchep WWTP caused by overloading at peak flow periods
- Planning identified a capital upgrade of +\$5M
- Multi-stage level settings for pump starts were added to two main wastewater pump stations
- Inflow to the WWTP flattened out in peak periods improving the efficiency of the plant and deferred the upgrade by 5-10 years

# Stage 6 - SCF



Source

Information

Monitoring

Infrastructure Project

# Automatic Metering

We will spend \$1M on water saving options before spending \$1M on new infrastructure.



## Business Challenge

- Major OSH risk to personnel reading meters
- Add value to customers to inform them of leakage
- Cost of delivering water ~5x \$/kL than Perth
- Infrastructure upgrades in x\$10M
- Water Corporation is one of the largest energy users in the State

## Solution

- Install meters and connection infrastructure to bring it back to PI
- Develop Interfaces to gather the XML from the field
- Develop connections between PI AF and the customer database to manage meter changes
- Develop web connections to provide meter data into billing system



## Results and Benefits

- Customers already saving money
- Water Zones being established for water loss detection.
- Better determine customer water use patterns on a weekly/monthly basis
- Optimise the scheme storage for a given period.
- Schedule maintenance windows during months of low use

# Reading Meters Manually

The reader would stand  
back of a truck and look  
the fence to read the

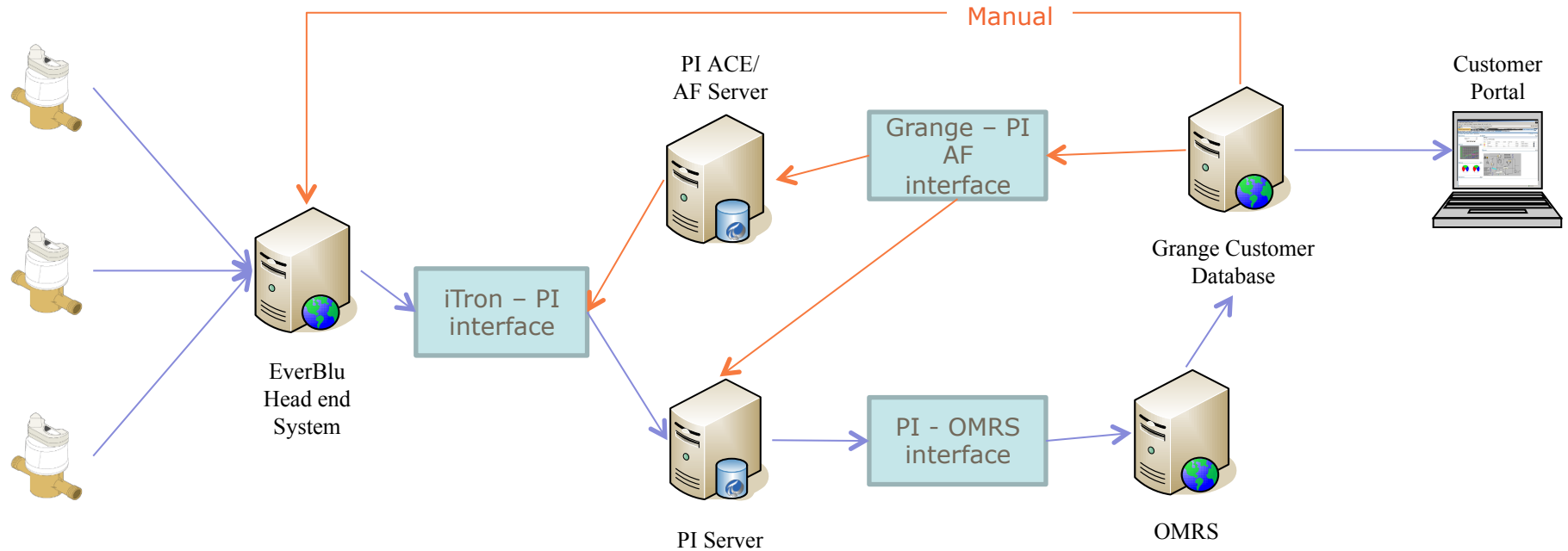


[watercorporation.com.au](http://watercorporation.com.au)





# Architecture Diagram

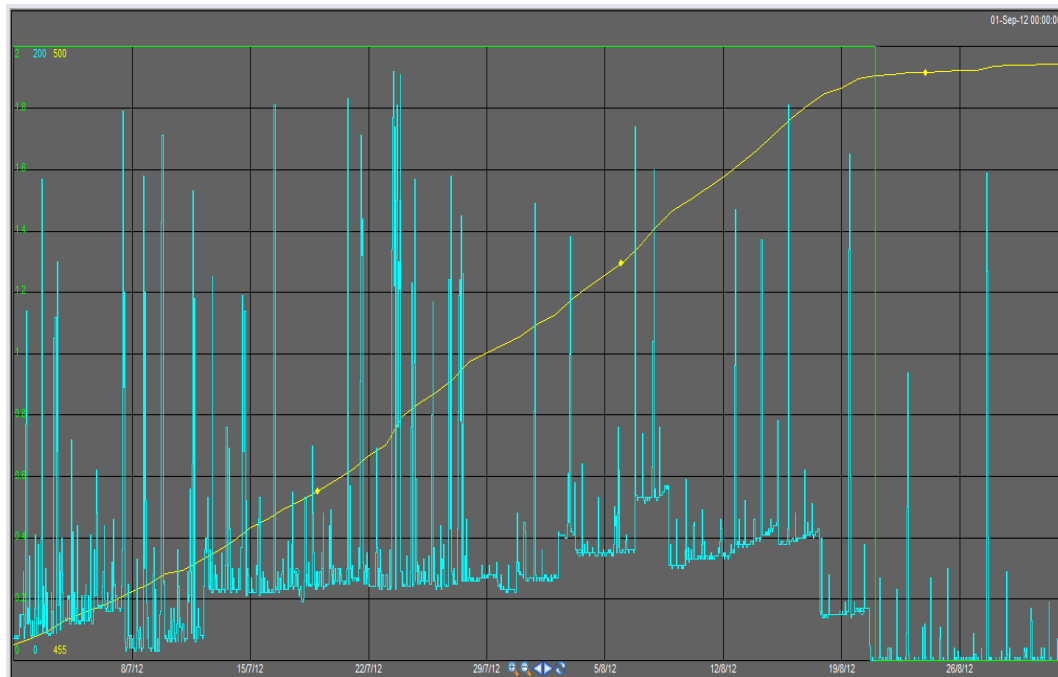


Data Flow

Configuration changes

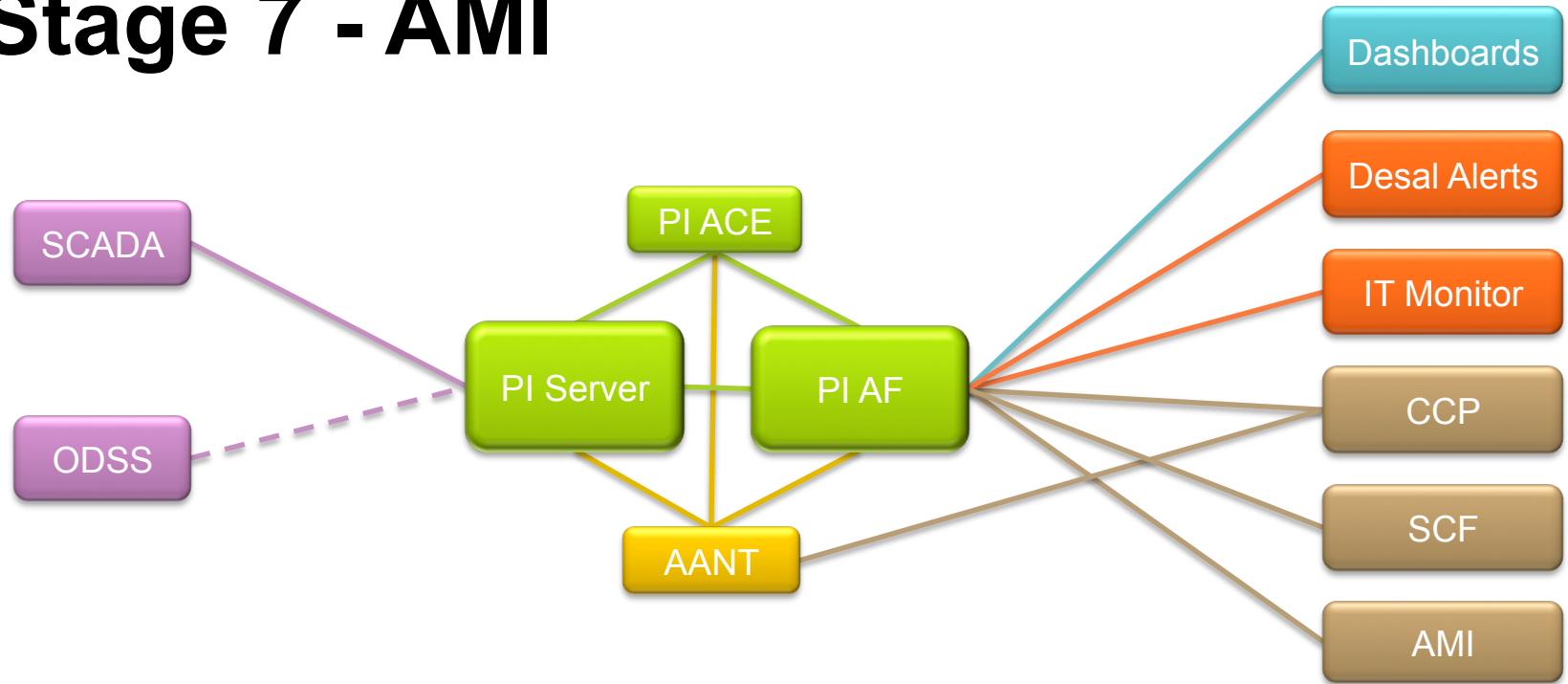
# Success Story

- Detected constant flow alarm of 1.5kL per hour
  - 25 litres per minute
  - 37kL per day
- Property was unoccupied
- Contacted agent and had site inspection
- 170kL was lost due to the leak
- Leak could have wasted 3700kL until the next meter reading
- Account would have been about \$21,000





# Stage 7 - AMI



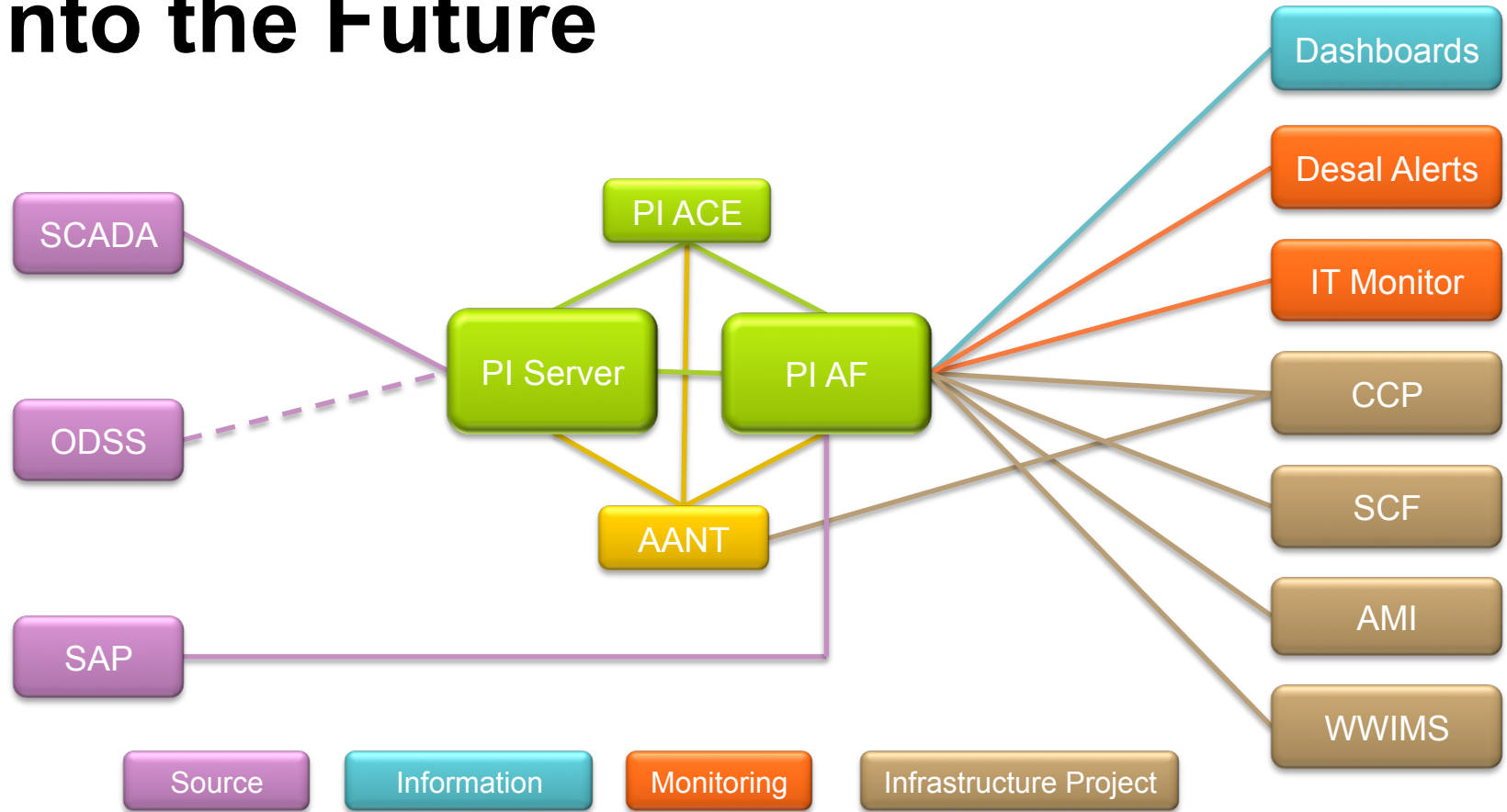
Source

Information

Monitoring

Infrastructure Project

# Into the Future



# Conclusion

- Each new development is built on top of the learning from the last
- Key to the solutions is PI AF and a solid integration partner (Optimate)
- PI System has moved from data storage to a key infrastructure platform on the last 6 years
- Business change with PI System is our next big challenge.
- Francois Mevis, Verve Energy, is an example of doing it right.

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