Calm Network：Reduction of impact due to transients in Macao water networks

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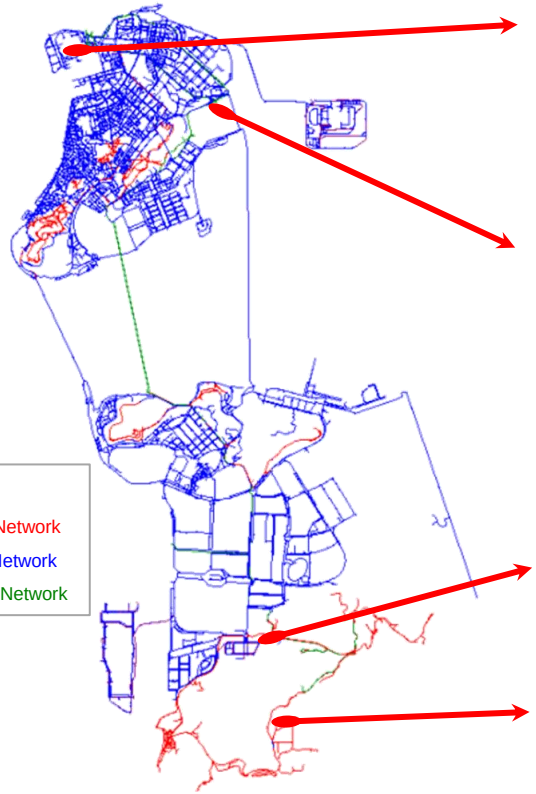
4/19/2022

AGENDA

1. General introduction of Macao Water
2. Background of the project
3. User case sharing
4. Next step

Macao Water



IV WTP
180,000m3/d

MSR WTP
180,000m3/d

Coloane WTP
30,000m3/d

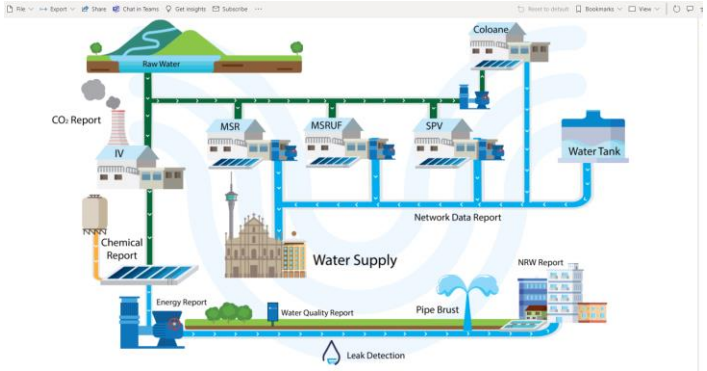
SPV WTP
130,000m3/d

Area:	~33 km2
Population：	683,200
Network Length:	~ 641 km
Average age	~18 years
Avg. pressure:	4.7 bar

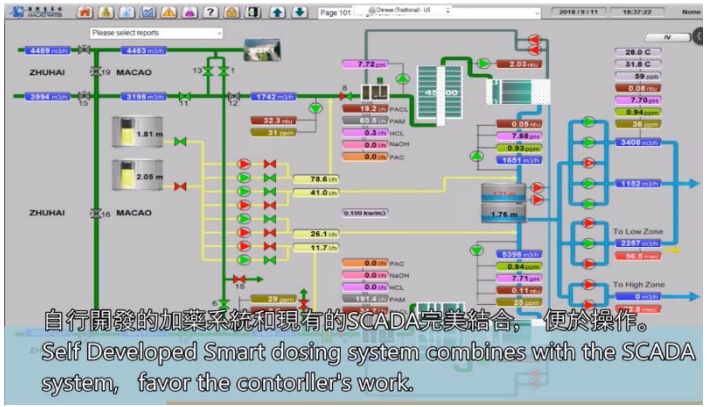
520,000m3/d

Macao Water Innovations

BI reports

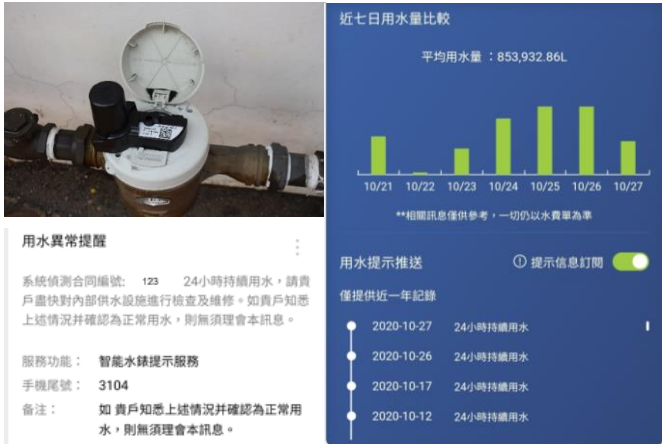


Smart dosing



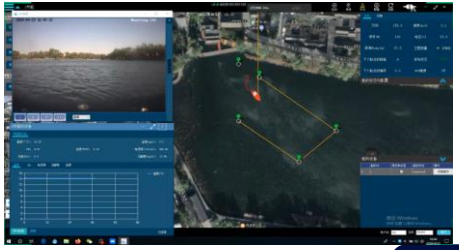
Digitalization

AMR(169MHz) & WeChat for Customer



AR-GIS

Reservoir autonomous vessel



Background

WATER HAMMER

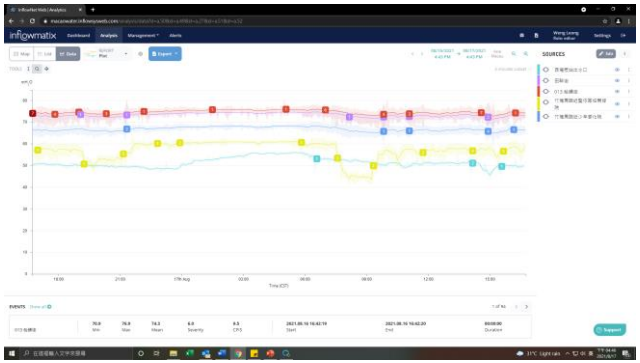
- Change of the velocity within pipes
- Can occurs in several circumstances
- Difficult to identify – can be potential hazard to pumps' facilities and pipes

https://www.youtube.com/watch?v=ujNGaQKap98

Common challenge for the water utilities

High frequency network pressure analytics

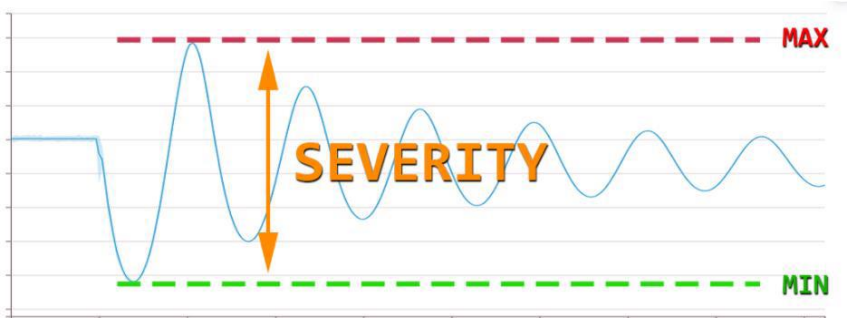
Inflowmatix



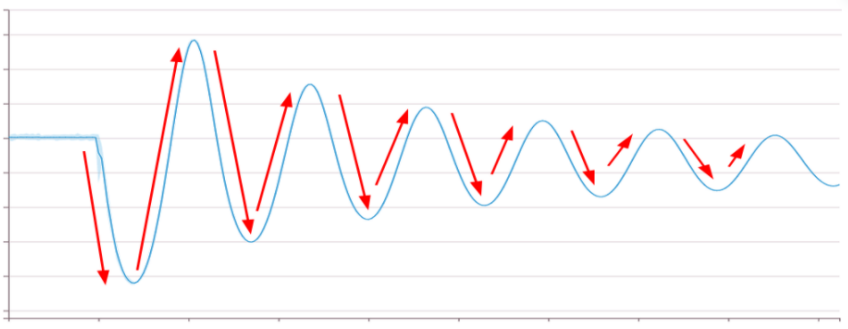
- High sample rate - 128 Samples / s
- Robust and Easy to install
- Mobile and Long lifetime > 3 yrs.

- Data illustration platform
- Data analysis capability
- User friendly interface.

Pressure curve



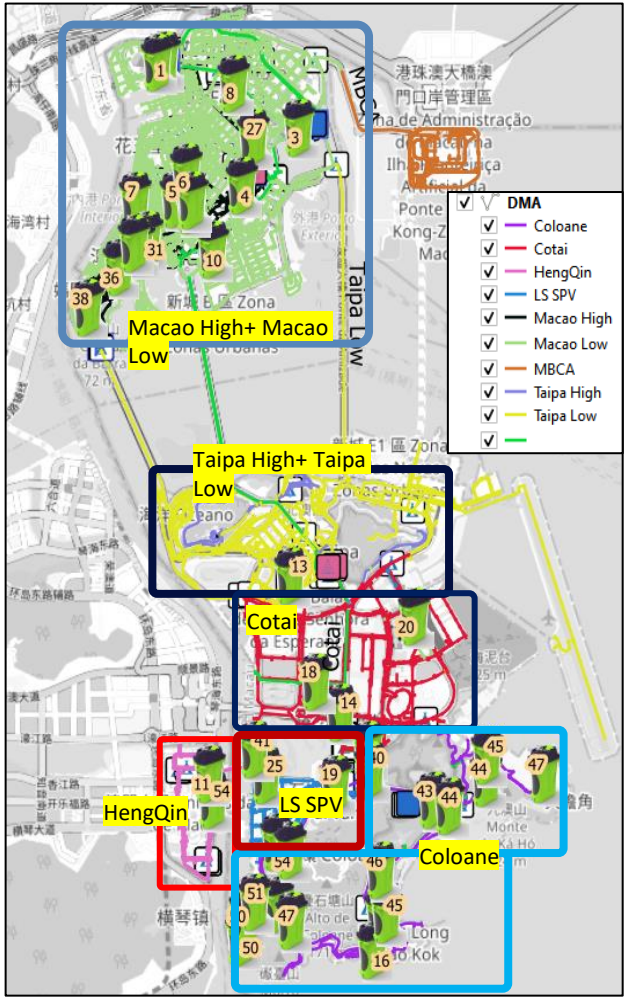
CPIS: The Cumulative Pressure Induced Stress



Pilot Project Summary

1) First installations of 15 devices were carried out in October 2020 distributed around different DMAs. Devices are re-deployed in following months.
2) Second round of 10 additional devices installed in July 2021.

	Macao Peninsula	Taipa Low +High	Cotai	HengQin	LS-SPV	Coloane
Total of events	874	7	235	94	27	2579
Hotspots	010 Madtang New Street 004 G70 tank outlet, 003 Rito street, Fung Shun Tong Street, 001 Rue A-Ma	012 Lawyer Street FH2288	0015 Avenida Cotai	001 University Road FH2332	009 Lotus Beach Road Sampling box near Sheik Pai wan rd.	All the locations almost
Daily avg. CPIS	350	40	175	2000	1500	4000



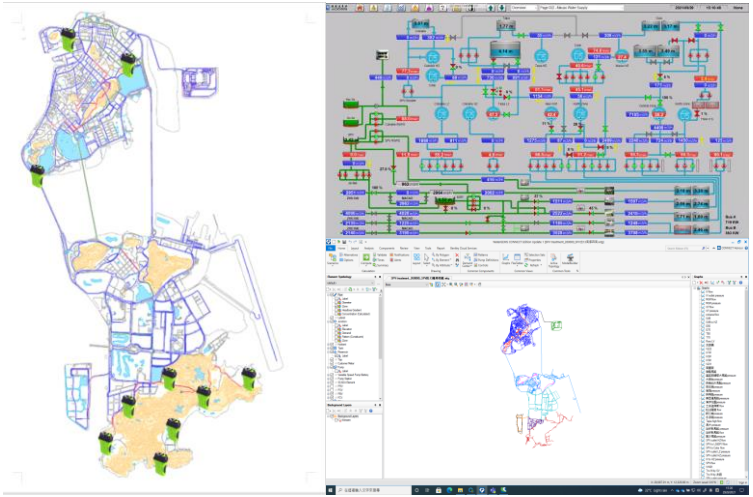
Pilot Project Summary

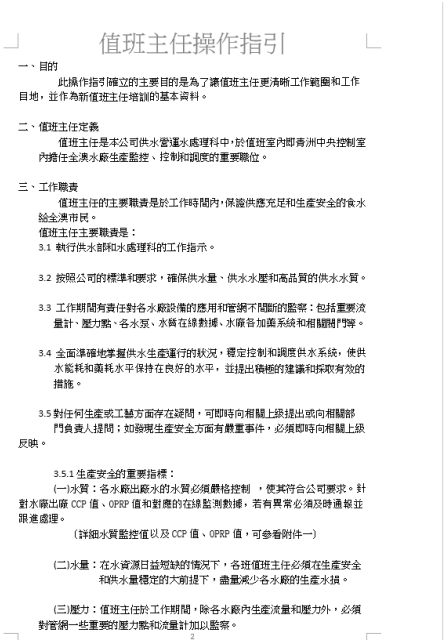
1 Event Identification

2 Cause Analysis

- Based on hydraulic & network knowledge capability
- Follow- up procedure created
- Mitigate the potential damage

3 Solution(SOP & Project)





值班主任操作指引

一、目的

此操作指引確立的主要目的是為了讓值班主任更清晰工作範圍和工作目地，並作為新值班主任培訓的基本資料。

二、值班主任定義

值班主任是本公司供水管運水處理科中，於值班室內即青洲中央控制室內擔任全澳水廠生產監控、控制和調度的重要職位。

三、工作職責

值班主任的主要職責是於工作時間內，保證供應充足和生產安全的食水給全澳市民。

值班主任主要職責是：

3.1 執行供水部和水處理科的工作指示。

3.2 按照公司的標準和要求，確保供水量、供水水壓和高品質的供水水質。

3.3 工作期間有責任對各水廠設備的應用和管網不間斷的監察；包括重要流量計、壓力點、各水泵、水質在線數據、水廠各加藥系統和相關閥門等。

3.4 全面準確地掌握供水生產運行的狀況，穩定控制和調度供水系統，使供水能耗和藥耗水平保持在良好的水平，並提出積極的建議和採取有效的措施。

3.5 對任何生產或工藝方面存在疑問，可即時向相關上級提出或向相關部門負責人提問；如發現生產安全方面有嚴重事件，必須即時向相關上級反映。

3.5.1 生產安全的重要指標：

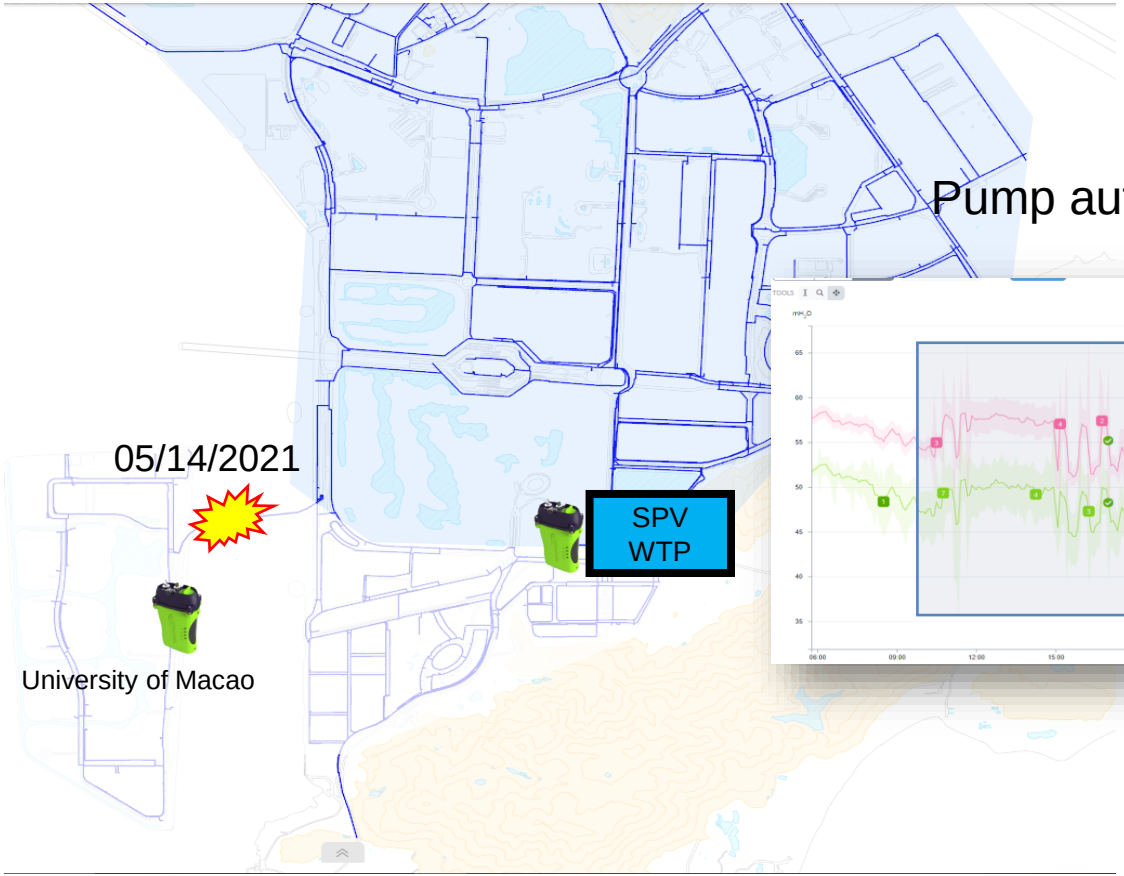
(一)水質：各水廠出廠水的水質必須嚴格控制 ，使其符合公司要求。針對水廠出廠 CCP 值、OPRP 值和對應的在線監測數據，若有異常必須及時通報並跟進處理。

(詳細水質監控值以及 CCP 值、OPRP 值，可參看附件一)

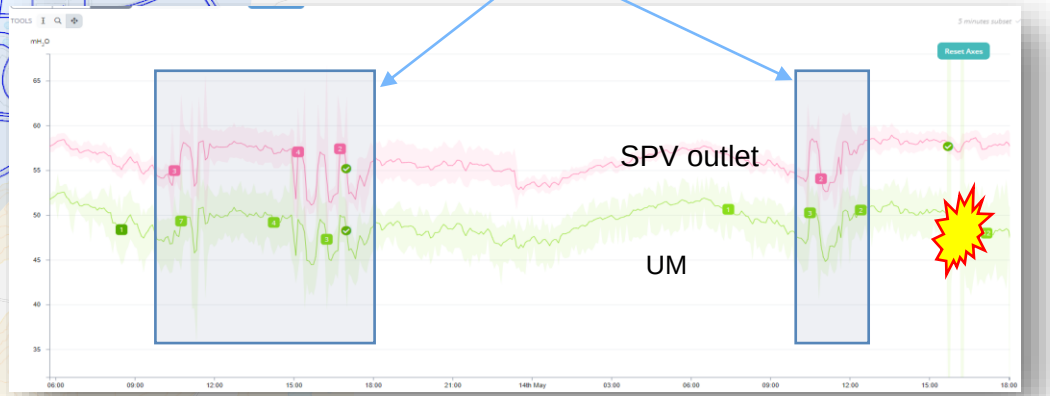
(二)水量：在水資源日益短缺的情況下，各班值班主任必須在生產安全和供水量穩定的大前提下，盡量減少各水廠的生產水損。

(三)壓力：值班主任於工作期間，除各水廠內生產流量和壓力外，必須對管網一些重要的壓力點和流量計加以監察。

Case Introduction



Pump auto boost test in SPV WTP



Case Introduction

Pump auto boost test in SPV WTP
2021 May 14, June 4, July 8

8.68mH₂O
6.53mH₂O
7.39mH₂O

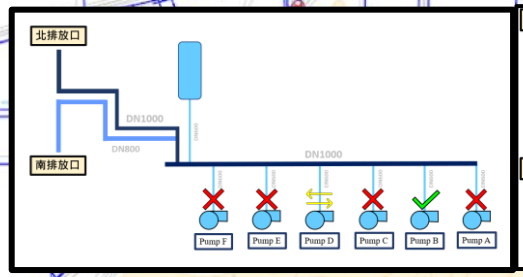
2nd open the valve

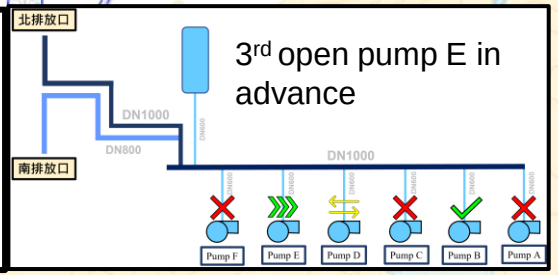
13.98mH₂O
8.43mH₂O
6.39mH₂O

13.12mH₂O
7.28mH₂O
6.50mH₂O

SPV WTP

12.97mH₂O
10.43mH₂O
6.78mH₂O



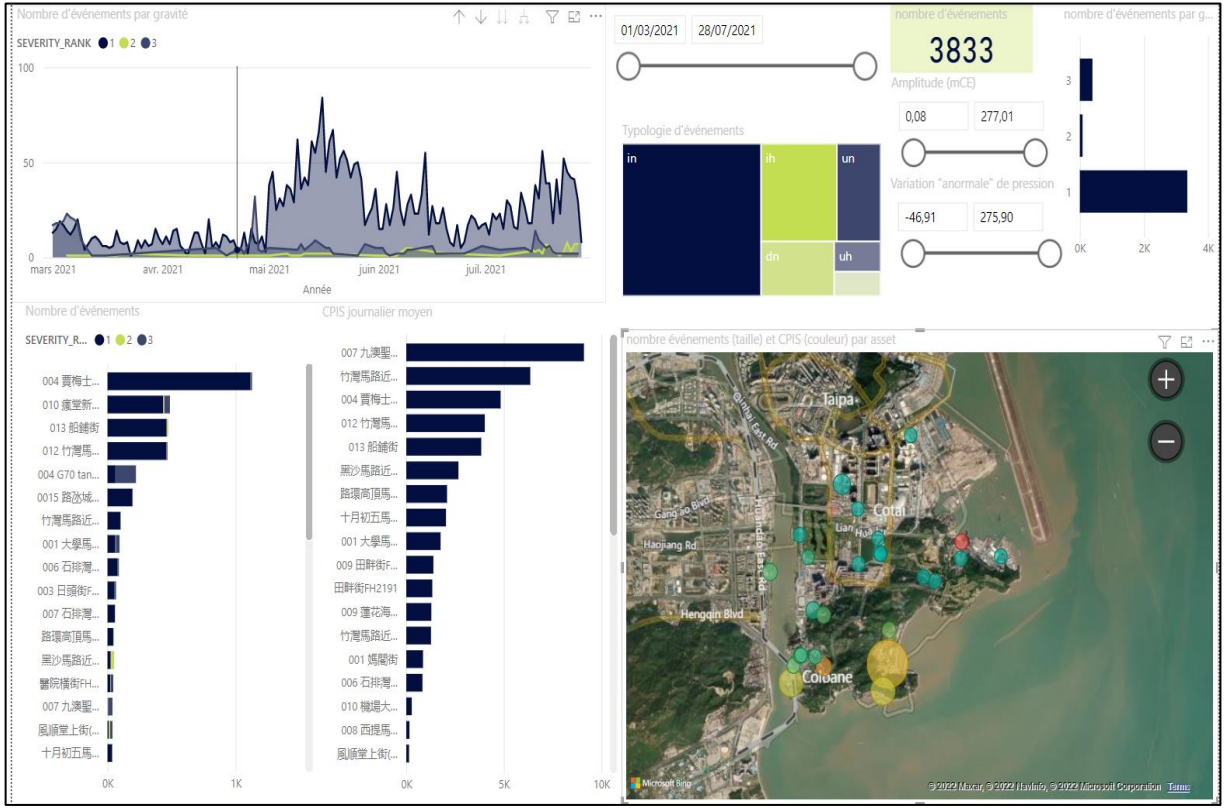


3rd open pump E in advance

Case Introduction

2021 May 14

Data Analyses



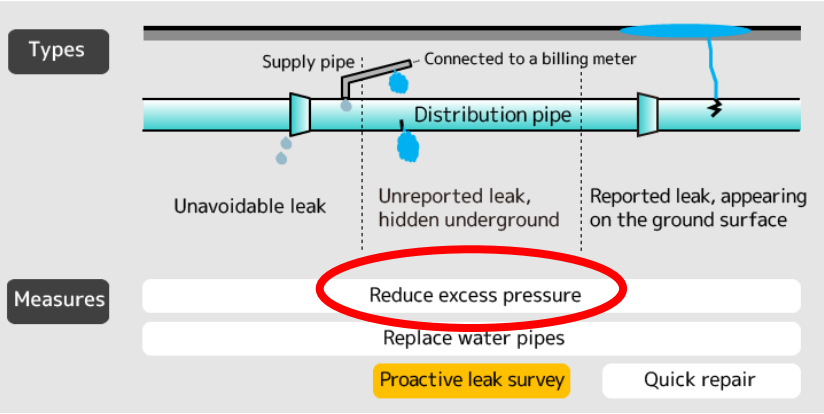
Data is transformed into insightful dashboards using Power BI visualization abilities

Beneficent to Water Business

- By adopting the solution of the water transient management (loggers, platform and SOPs), significant saving can be anticipated, also avoid serious bursts which affecting the operations & image of company

	2020	Expected Reduce 5%	Expected Revenue
Bursts and Leaks cases (cases/yr)	660	627	33
Water Loss Volume (m3/year)	2,000,000	1,900,000	100,000
Water Production Cost (MOP/m3)		1.5	
Maintenance cost (MOP/case)		50,000	
Revenue = Cases x Maintenance cost per case + Water Loss Volume × Water Production Cost per m3			
Total (MOP/yr)	36,000,000	34,200,000	1,800,000

- Stabilize and reduce excess pressure is the prime action for NRW management

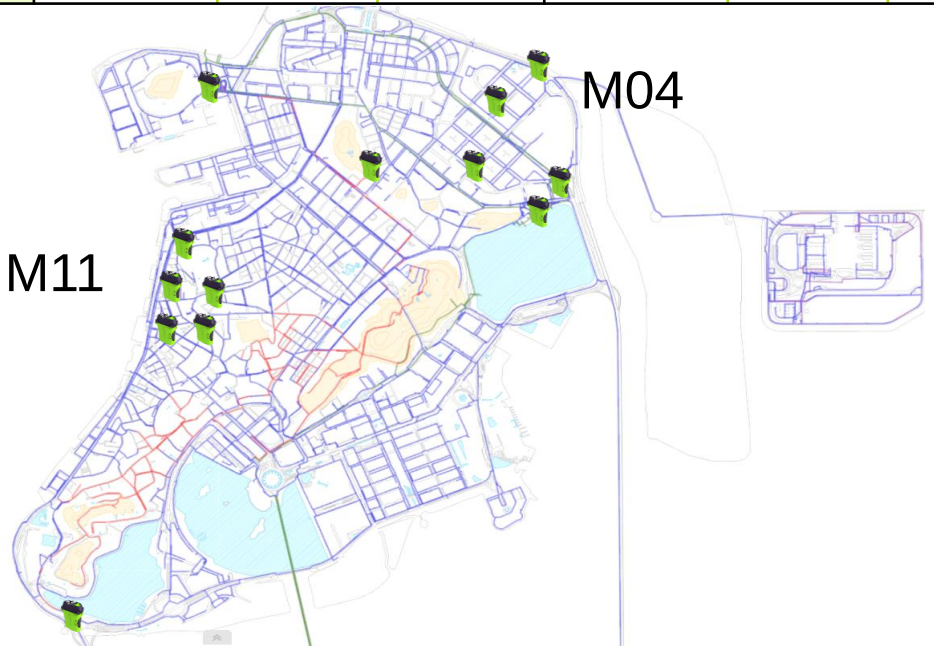


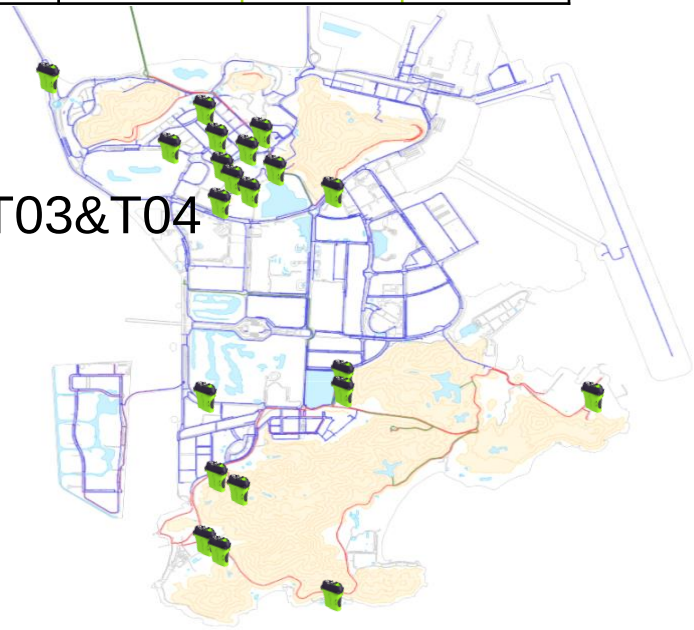
Objective 2022-2024

- Reduction of the pressure event &CPIS of Macao pipe network
- The influence analysis of the Pressure event and CPIS on the “leaks +burst rate” of the pipe network
- Combination the inflow sensor and noise logger to help the leakage/burst case identification
- Studying the impact of transients on the network caused by big consumers

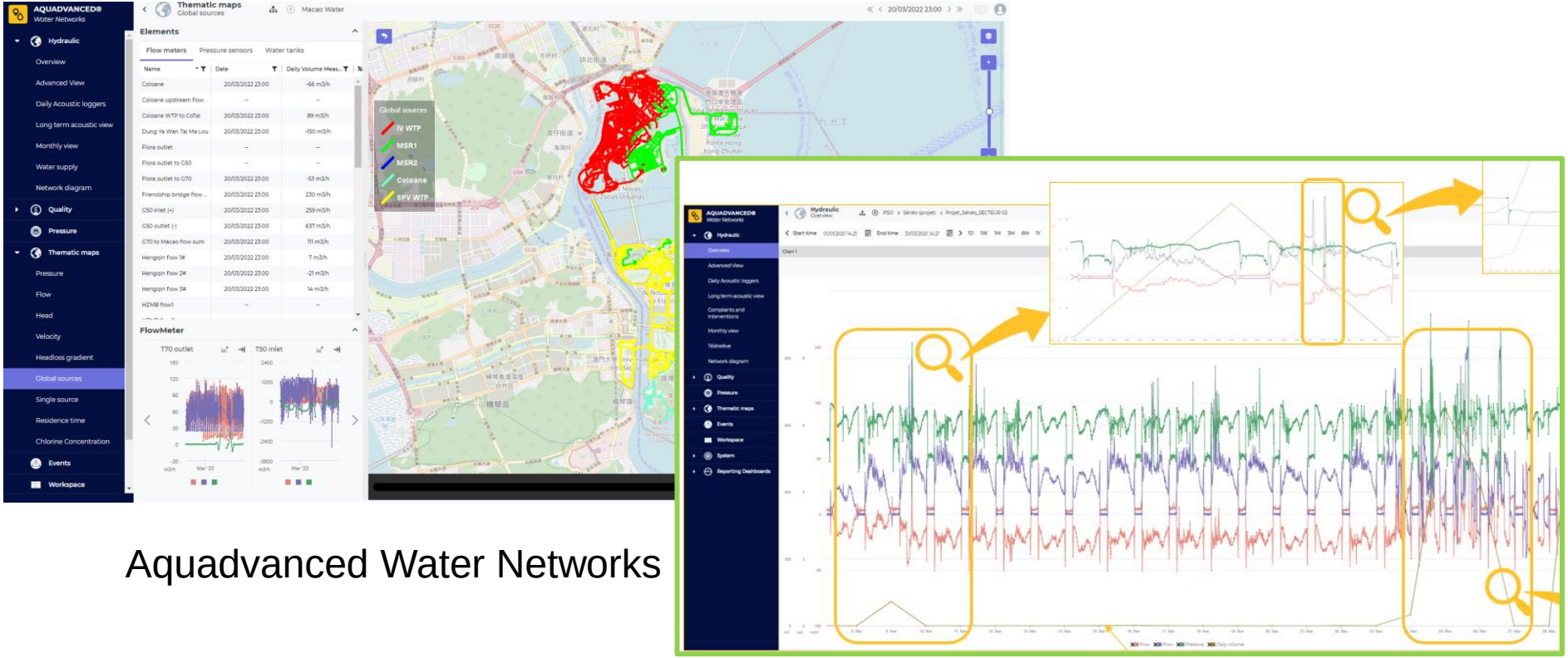
- **The influence analysis of the Pressure event and CPIS on the leaks +burst rate of the pipe network**

zone	2022			2023			2024		
	event registered	*Daily avg. CPIS*	*burst+leak rate*	*event registered*	*Daily avg. CPIS*	*burst+leak rate*	*event registered*	*Daily avg. CPIS*	*burst+leak rate*
A	100	300	20	60	280	15	30	280	8
B									
C									
D									
…									





Integration of Calm Network analysis in Aquadvanced



Aquadvanced Water Networks

THANK YOU
谢谢