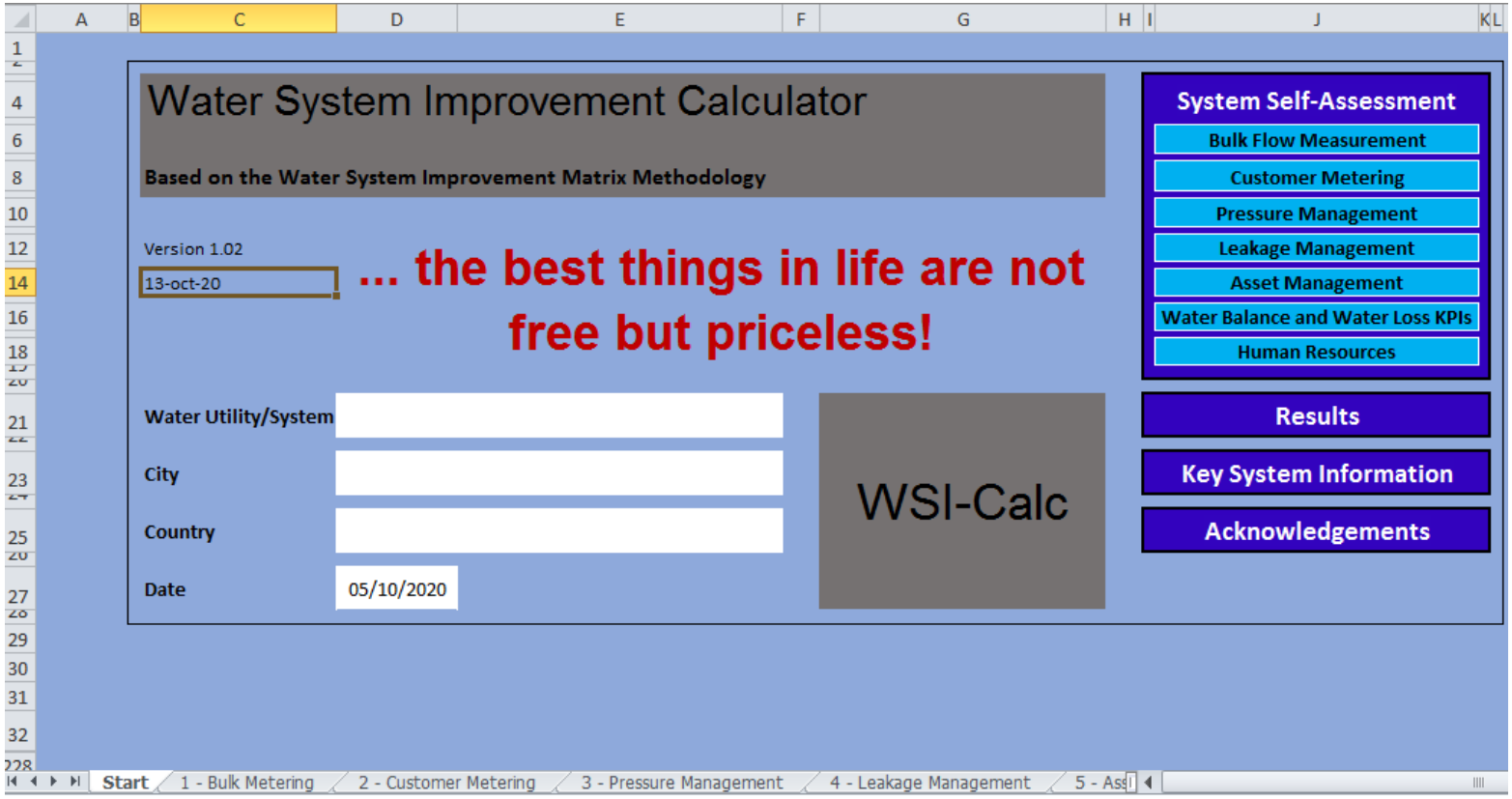
Sesión No. 2

- Matriz para determinar cual es el tipo de distribución de agua potable que se tiene, utilizando WSI-calc
- Ejemplo de utilización de WSI-calc
- Análisis de resultados de WSI-Calc y planteamiento de estrategias para lograr el cambio de un sistema tradicional a uno inteligente
- Selección de indicadores de desempeño de operación para evaluar el cambio de un sistema tradicional a uno inteligente

Matriz (WSI-Calc)



7 Áreas Claves

1. Bulk Flow Measurement
   (Agua en Bloque)
2. Customer Metering
   (Micromedidores)
3. Pressure Management
   (Gestión de Presiones)
4. Leakage Management
   (Control de Fugas)
5. Asset Management
   (Gestión de Activos)
6. Water Balance and Key Performance Indicators (KPIs)
   (Balances)
7. Human Resources
   (Recursos Humanos)

Para cada área clave hay tres niveles de mejora (siendo el nivel 1 el más bajo y 3 el más alto).

Áreas claves y niveles

Bulk Flow Measurement

Instructions	System Level
Click on the red box and use the drop down menu to choose the system level which best describes your system	

Back to Start | Results | Next Topic

System	BASIC NETWORK SYSTEM A	ORDINARY NETWORK B	SMART NETWORK SYSTEM C	INTELLIGENT NETWORK D
1	No reliable flow measurement Limited metering of bulk flows in the system	All bulk flows are metered but not sure about the meter accuracy	Bulk flows are metered, remotely read, monitored, and analysed with a permanent meter accuracy test program in place	Bulk flows metered, remotely read, monitored and analysed with software recognition for meter accuracy drifts and flow pattern analysis
2	A continued program for the installation of bulk meters.	Meters are manually read and/or remotely monitored with meter accuracy occasionally checked	Bulk flows are metered, remotely read, monitored and analysed with software to recognise when meter accuracy drifts	Bulk flows are metered, remotely read, monitored and analysed with software recognition for meter accuracy drifts with automatic meter recalibration capability and flow forecasting based on historical supply and demand trends
3	The majority or all of the system bulk flows are metered	Bulk flows are metered, remotely read, monitored, and analysed with frequent meter accuracy tests	Bulk flows metered, remotely read, monitored and analysed with software recognition for meter accuracy drifts and flow pattern	Complete machine learning algorithms that control the system, to manage system input volumes and pressures

Problemas comunes para aplicar la matriz:

- Sobreestimación del nivel en que se encuentra
- Subestimar los cambios necesarios
- Subestimar el trabajo requerido para generar un cambio
- No considerar el tiempo necesario
- Menospreciar la inversión necesaria

WSI-calc

La matriz se divide en 4 categorías de sistemas de diferente nivel.

Lo que resulta en 12 pasos que describen ampliamente la escala de mejora para cada área.

Tabla 1.1Sistema de puntuación para usar en cada una de las siete áreas clave de mejora.

Puntuación	Red básica Sistema	Red Ordinaria Sistema	Red inteligente Sistema	Red Inteligente Sistema
Nivel 1	1	4	7	10
Nivel 2	2	5	8	11
Nivel 3	3	6	9	12

Sistema de Puntuación

La Matriz de mejora del sistema de agua se puede utilizar para evaluar el rendimiento general del sistema. El puntaje de cada área clave se suma para evaluar la empresa de servicio público.

Puntaje Total	Clase	Descripción
7-12	E3	Procedimientos operativos que no hacen un uso adecuado de los recursos y activos, lo que repercute en el continuo deterioro de los activos y el nivel de servicio
13-19	E2	Estándar y calidad inferiores de la gestión del sistema, sin una administración y planificación organizadas de la red de suministro de agua, sin poder brindar el nivel requerido de servicio y compromiso con la mejora del sistema
20-26	E1	Etapa operativa crítica, que debe reforzarse con procesos, estándares y procedimientos mejorados para revertir la espiral descendente de operación ineficiente y recuperar el control del sistema.
27-36	D	Régimen de suministro satisfactorio pero, sin embargo, uso derrochador de recursos y operación ineficiente del sistema que requiere una mayor mejora y control de las operaciones del sistema que conducen a un mayor rendimiento.
37-48	C	Uso eficiente de los recursos con sistemas implementados que brindan el nivel de servicio deseado; sin embargo, hay espacio para la eficiencia del sistema y la optimización de los procesos
49-61	B	Alto grado de eficiencia en todas las operaciones del sistema, empleando tecnologías y conocimientos avanzados para mantener las ganancias de eficiencia y construir una plataforma que permita un mayor avance.
62-73	A	Uso óptimo de tecnología, equipos y recursos humanos en la operación y mantenimiento del sistema de abastecimiento de agua de manera inteligente, productiva, rentable y eficaz
74-84	A*	Posiblemente descrito ahora como un 'sueño', este sería el sistema de suministro del futuro operado por algoritmos de aprendizaje automático, autocontrolado y administrado con mínima supervisión por parte de humanos

Características Generales

Red Básica:

Deficiente medición del agua en bloque y micromedidores; no hay G.P. ni de disminución de fugas; falta de inversión; balances de agua inexistentes; no hay capacitaciones de personal.

- Nivel 1

  Inexistente medición; no hay gestión tampoco inversión ni capacitación.

- Nivel 2

  Se instalan algunos medidores; se monitorea algunos p. de presión y de fugas; planeación y entrenamientos básicos.

- Nivel 3

  Faltan medidores de instalar; monitoreo constante de la presión con data loggers; intentos de evaluar el NRW;

Características Generales

Red Ordinaria:

Medición y análisis manual del agua en bloque y micromedidores; G.P. constante con data loggers y algunas PRVs; se empieza la implementación de DMAs; se desarrollan planes de inversión; se utilizan algunos indicadores; capacitaciones generales.

- Nivel 1

Dudas en la fiabilidad de medición; medición constante de P.; programas de gestión de activos; balances de IWA; capacitación general.

- Nivel 2

Lectura manual; se tienen DMAs; programa de disminución de fugas; balances (95%); capacitación interdepartamental.

- Nivel 3

Se evalúan manualmente las lecturas; se empieza una G.P. automática y de MNF; programas costo/beneficio; capacitación planificada.

Características Generales

Red Inteligente:

Medición remota de macro-micromedidores; bases de datos GIS actualizada; G.P. con PRVs y variadores; sectorización completa con DMAs; planes de inversión a largo plazo; los KPIs y balances se actualizan; innovación tecnológica.

- Nivel 1

Mediciones remotas; control de presión con variadores; sectorización completa; balances actualizados; capacitación específica.

- Nivel 2

Análisis de las mediciones con software; G.P. avanzada; monitoreo acústico de DMAs; balances automáticos;

- Nivel 3

Encuentra patrones en las mediciones; monitoreo de las variaciones de presión; uso satelital, acústico y detección predictiva; balances y KPIs automáticos;

Características Generales

Red Inteligente Avanzada:

Medición remota de macro-micromedidores con fiabilidad y calibración; G.P. completa en el sistema que funciona a base de machine learning; planes de inversión generados por algoritmos alimentados a través de los KPIs y balances.

- Nivel 1

Mediciones remotas evaluadas; sensores que alimentan modelos de G.P.; monitoreo automático de fugas; balances de agua actualizados;

- Nivel 2

Encuentra patrones en las mediciones y predice; reparaciones automáticas;

- Nivel 3

Algoritmos que controlan el sistema; algoritmos que se optimizan y controlan; predicción futura de fugas;

Agua en Bloque

Bulk Flow Measurement

Instructions	System Level	Back to Start	Results
Click on the red box and use the drop down menu to choose the system level which best describes your system	B2		Next Topic

System	BASIC NETWORK SYSTEM A	ORDINARY NETWORK B	SMART NETWORK SYSTEM C	INTELLIGENT NETWORK D
1	No reliable flow measurement Limited metering of bulk flows in the system	All bulk flows are metered but not sure about the meter accuracy	Bulk flows are metered, remotely read, monitored, and analysed with a permanent meter accuracy test program in place	Bulk flows metered, remotely read, monitored and analysed with software recognition for meter accuracy drifts and flow pattern analysis
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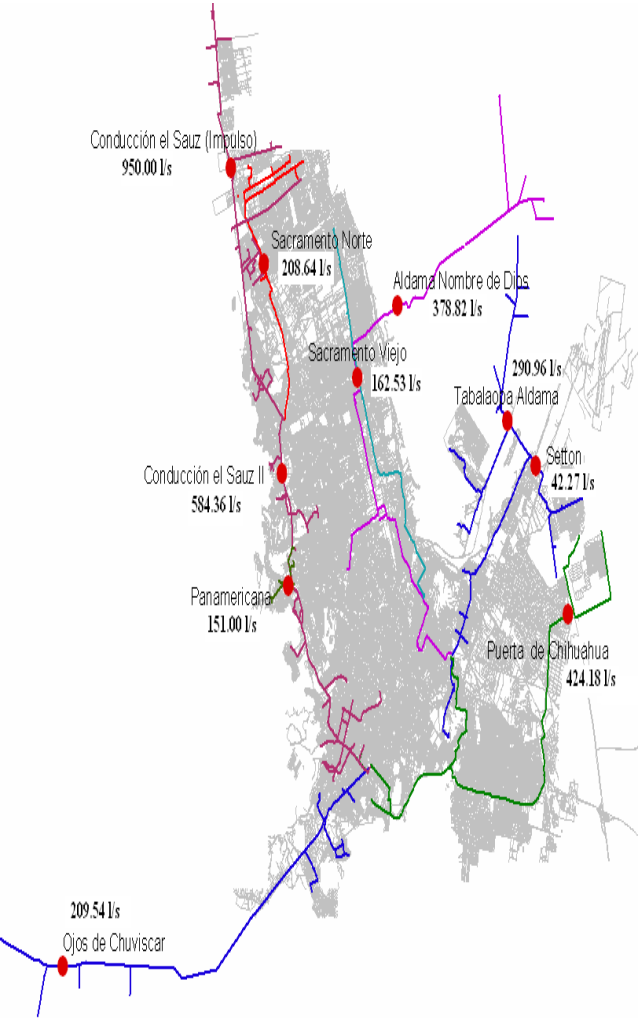
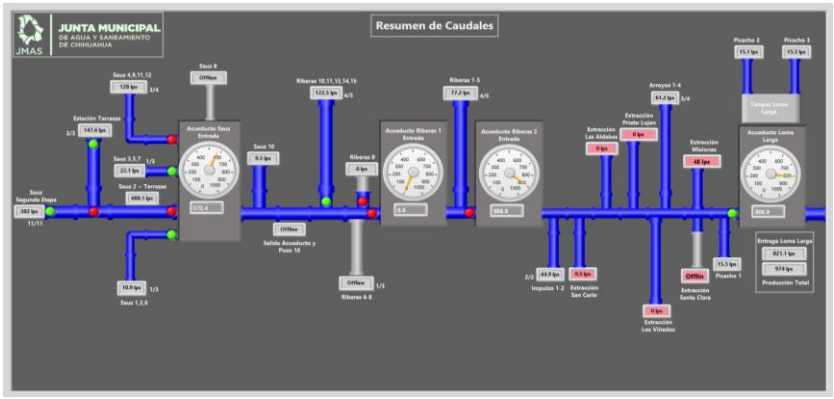
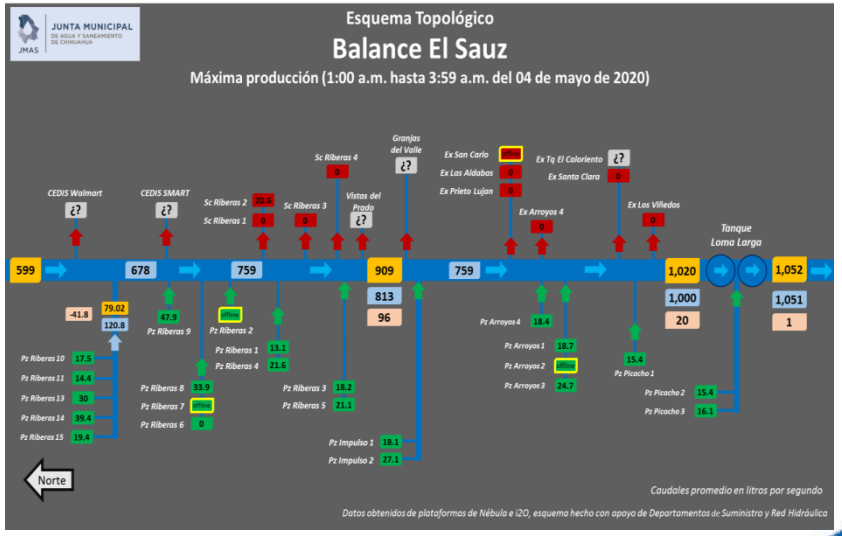
Agua en Bloque



Medición de Caudales en acueducto





Micromedidores

Customer Metering

Instructions	System Level	Back to Start	Results
Click on the red box and use the drop down menu to choose the system level which best describes your system	B2	Previous Topic	Next Topic

System	BASIC NETWORK SYSTEM A	ORDINARY NETWORK B	SMART NETWORK SYSTEM C	INTELLIGENT NETWORK D
1	No or limited customer metering Unreliable information on the age and type of meters Customer database has not been updated for a long time	Substantial or Universal customer metering Customer database is periodically updated Illegal connections are sporadically detected	Customer database is updated and linked to a GIS. Handheld devices are used for meter reading and bills issued on the spot. AMR meters introduced	All customer meters have sound sensors, to detect leak noises, with connected communication systems allowing for automatic correlation and pinpointing of leaks. Fraudulent activities are detected via the AMI and AMR systems
2	Inadequate meter and customer information No assessment is made and there is no program to deal with water theft	There is a meter replacement program in place Customer database is regularly updated There is a thorough illegal connections detection program in	Demand management program in place based on consumption patterns identified via a GIS-billing infrastructure Continuous replacement programme of customer meters to AMR capability	All customer meters have sound sensors, to detect leak noises, with connected communication systems allowing for automatic correlation and pinpointing of leaks. Automatic alerts sent out to customers, when excessive customer side usage experienced
3	Not all customers have meters installed No regular replacement policy, only when meters stop No system of controlling meter readers	All customers are metered with good accuracy meters Meter readers are rotated, and often spot checks are made Handheld devices are used for meter reading	All customers are metered with high accuracy AMR system AMI system in place following a strict meter replacement policy	Complete machine learning algorithms that control the system, so the system is run with internal flow measurement, measuring and adjusting the meters for accuracy with a total self-billing and billed collection procedure without any human interventions

Gestión de Presiones

Pressure Management

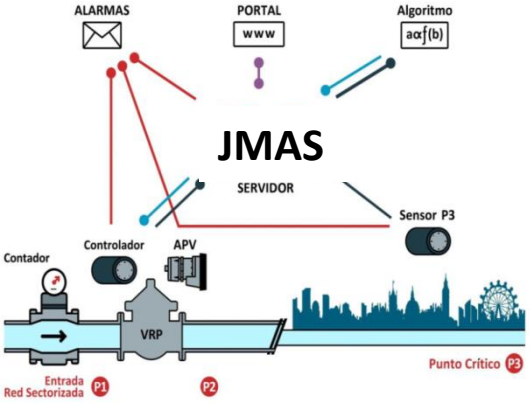
Instructions	System Level	Back to Start	Results
Click on the red box and use the drop down menu to choose the system level which best describes your system	B2	Previous Topic	Next Topic

System	BASIC NETWORK SYSTEM A	ORDINARY NETWORK B	SMART NETWORK SYSTEM C	INTELLIGENT NETWORK D
1	No recording or control of pressure Perhaps partial network zoning but not used for pressure control	Permanent pressure measurement at some points with pressure loggers Some form of further pressure control, e.g. fixed downstream control with a PRV	Fully pressure-controlled network Introduction to pumps installed with VFD drives to enable constant pressures with varying demands.	Pressure sensors installed in strategic locations in the network continuously feeding pressure readings into leak and demand analyses models
2	Some pressure control, through sizing of zones to maximise system pressures Pressure monitoring (if any) only at pumping stations and trunk mains	Pressure zoning in place (e.g. DMAs) Manual analysis of pressure patterns and compared to the corresponding flow patterns	Pressure control via PRVs in all areas of the network using advanced types of control, e.g. flow modulation, critical point, etc.	Multiple pressure sensors installed across the network, analysing system pressures continuously and using data analytics to enable automated control of the pumps and valves to calm the network.
3	Partly pressure control through zoning by elevation Periodic pressure monitoring using lift and shift pressure loggers.	Pressure control and monitoring at salient points in the network with automatic pressure / flow analysis	Sensors installed in the network, permanently monitoring pressure variations, which are used to adjust system pressures to develop calm networks	Complete machine learning algorithms that monitor and optimise pressures in the system, for a completely calm network ensuring maximum asset life.

Gestión de Presiones

Gestión de Presiones

Instrumentación para generar datos y realizar la Gestión de Presiones



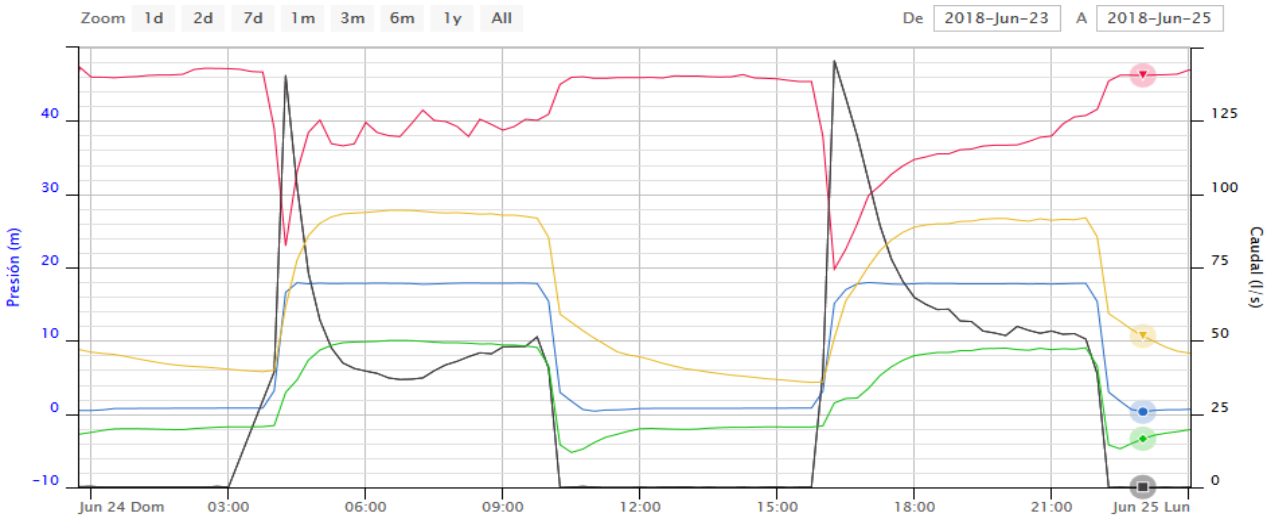
SISTEMA

1. **CAUDALIMETRO REGISTRADOR Y LOGGER**
2. **VRP**
3. **CONTROLADOR REGISTRADOR PC**
4.
5. **ANTENA**
6.

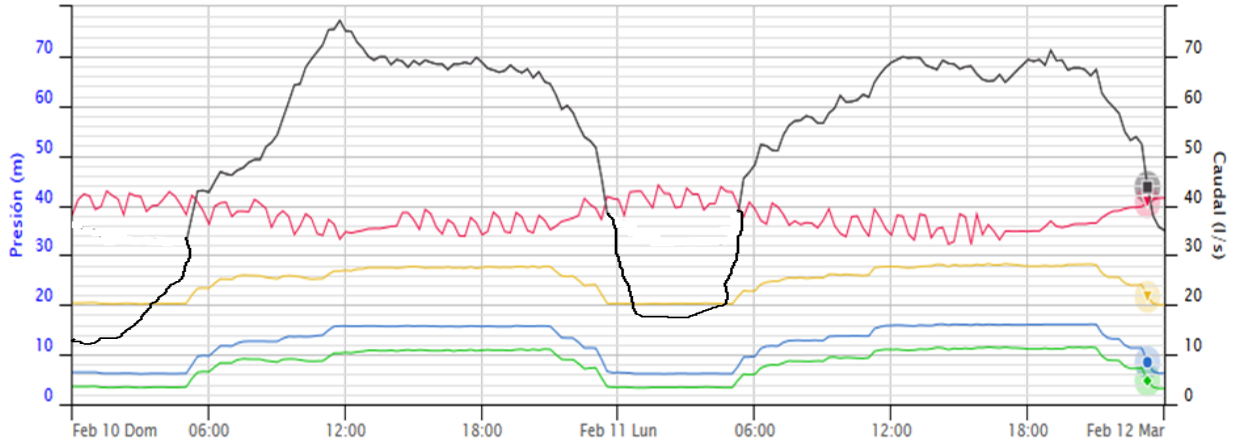
Gestión de Presiones

Gestión de Presiones

Operación SIN Gestión de Presiones (IWS)



Operación CON Gestión de Presiones



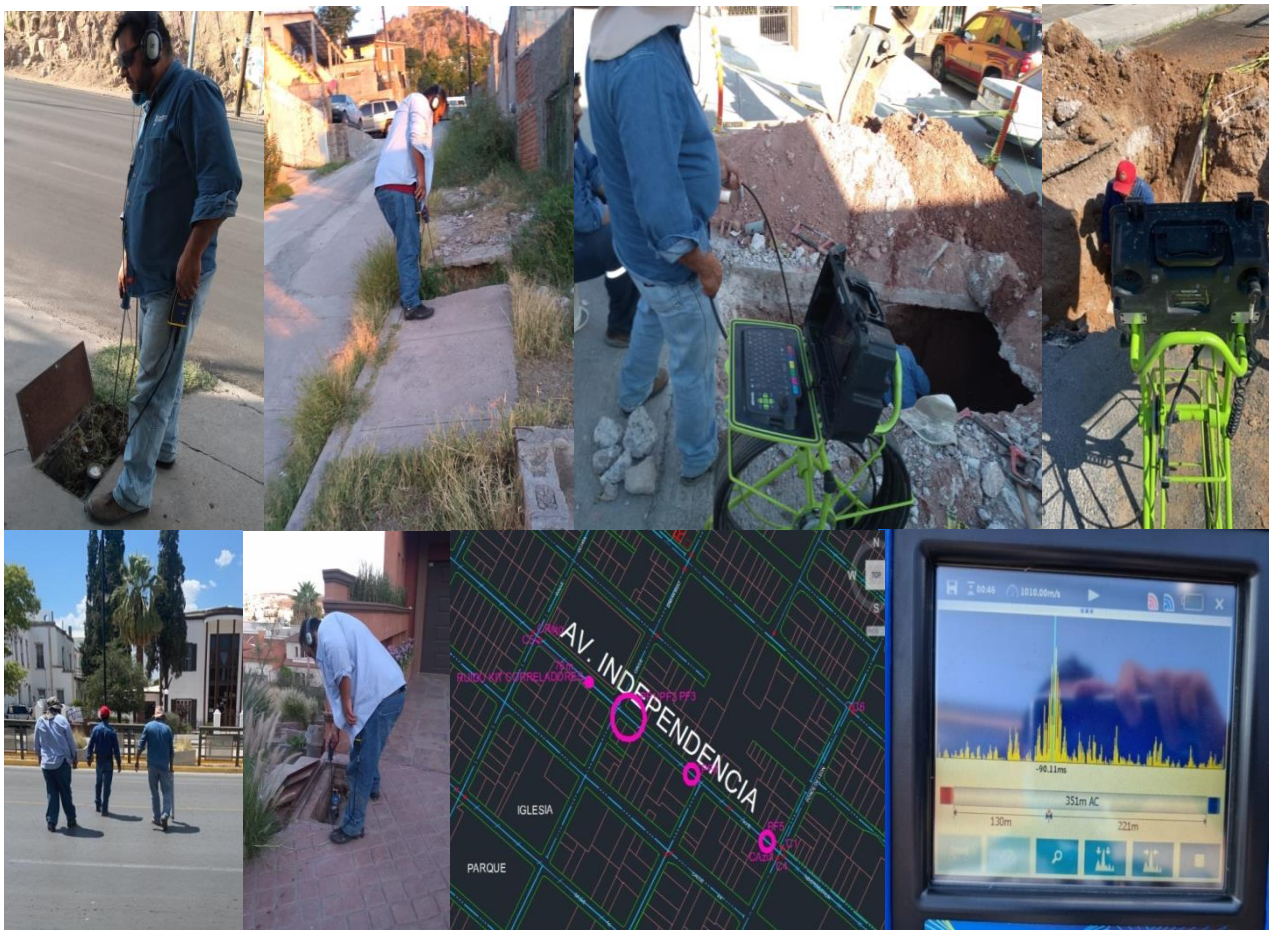
Control de Fugas

Leakage Management

Instructions	System Level	Back to Start	Results
Click on the red box and use the drop down menu to choose the system level which best describes your system	B1	Previous Topic	Next Topic

System	BASIC NETWORK SYSTEM A	ORDINARY NETWORK B	SMART NETWORK SYSTEM C	INTELLIGENT NETWORK D
1	No leakage control, only repair large mains bursts No records kept. No ALC programme in place	Some DMAs are established. Introduction of technologies to assist in ALC activities. Analysis of leak detection and repair records	Complete sectorization (DMAs/zoning) in place, and flow and pressure are monitored via permanent installations. Leak detection and repair records are maintained on a GIS platform Prioritising leak detection technology based on asset characteristics including ALC on large diameter mains with minimal	All data received from permanent monitoring devices and surveys, pulled automatically into a dynamic asset management system, for planning, undertaking and reporting of leakage management and repair activities
2	Start to undertake a visual ALC programme. Limited leak repair records are kept	Multiple DMAs established and analyse of leakage and NRW data. Planned regular leak surveys. Short repair times in place. Detailed records of all leaks and repairs maintained and analysed.	Introduction of permanently installed acoustic monitoring systems, with correlating ability. Analysis of system NRW data, undertaken automatically using specialised software. Large diameter surveys undertaken using internal or specialised acoustic technology	Leak locations automatically detected, pinpointed and linked into a programme to execute the repair process, allowing automated repairs to take place. Repairs undertaken inside the pipe using automated processes, without excavation or water shutdowns, negating the need for customer disruption.
3	Prioritising of ALC activities. Improved leak repair times. Leak detection and repair records kept	Maximise DMA coverage, with permanent monitoring and communication with a central control room. Leak detection program prioritised using DMA MNF analysis. Problematic areas permanently monitored with acoustic devices.	Advanced and innovative technology and equipment used for leakage detection, on all mains diameters and materials, including aerial and satellite applications. Permanent monitoring of system noises and pressures used to analyse changes in historical data and predict new leaks / bursts.	Complete machine learning algorithms that control the system and undertake analysis of the network to identify asset weaknesses and potential leak locations, analyses causes of failure and where possible rectifies the cause, whilst linked into the asset management system to prioritise systematic pipe replacement, including the optimum choice of pipe material

Control de Fugas

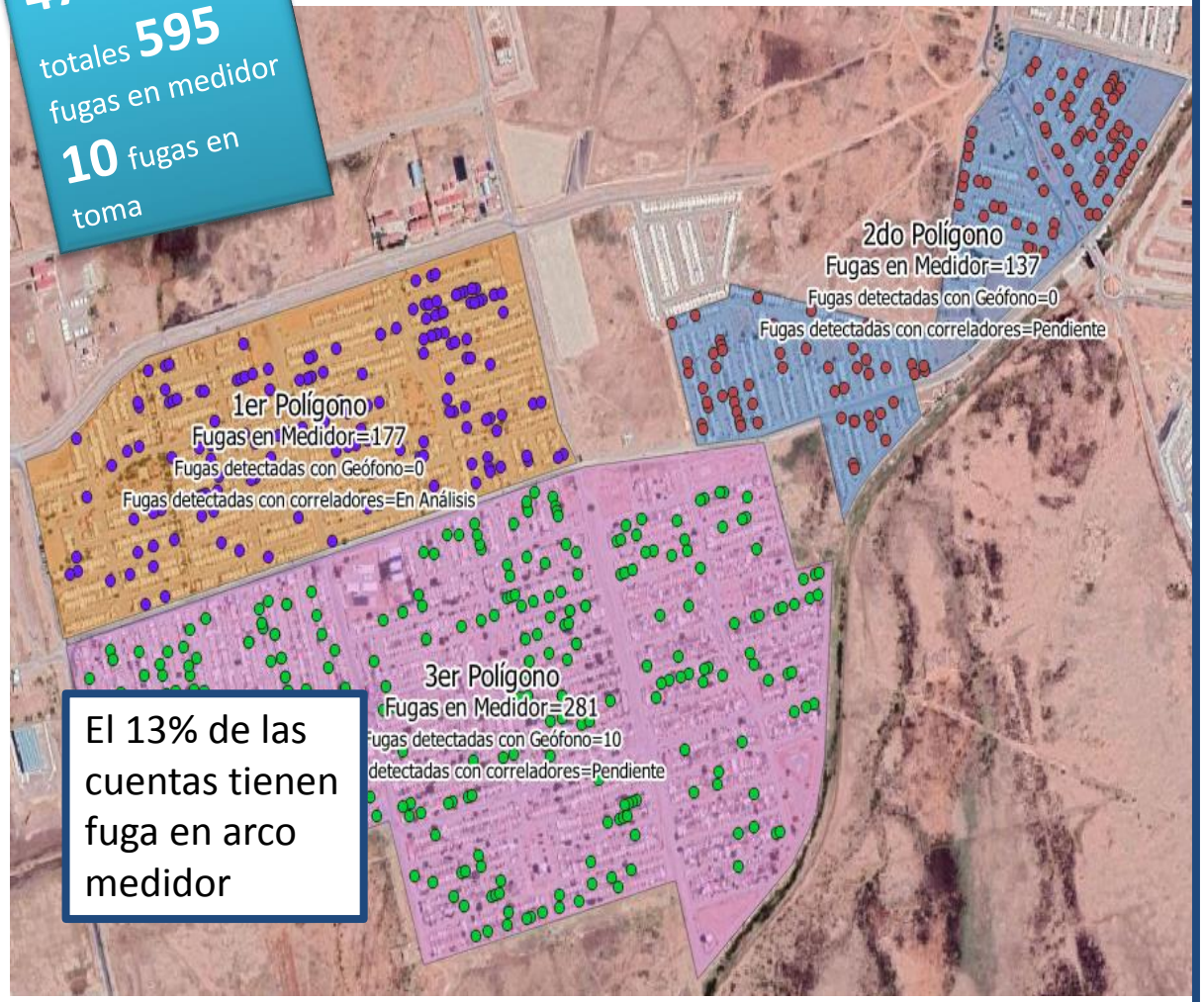


Trabajos de detección de fugas

Control de Fugas

4773 cuentas totales **595** fugas en medidor **10** fugas en toma

CONTROL ACTIVO DE FUGAS



El 13% de las cuentas tienen fuga en arco medidor

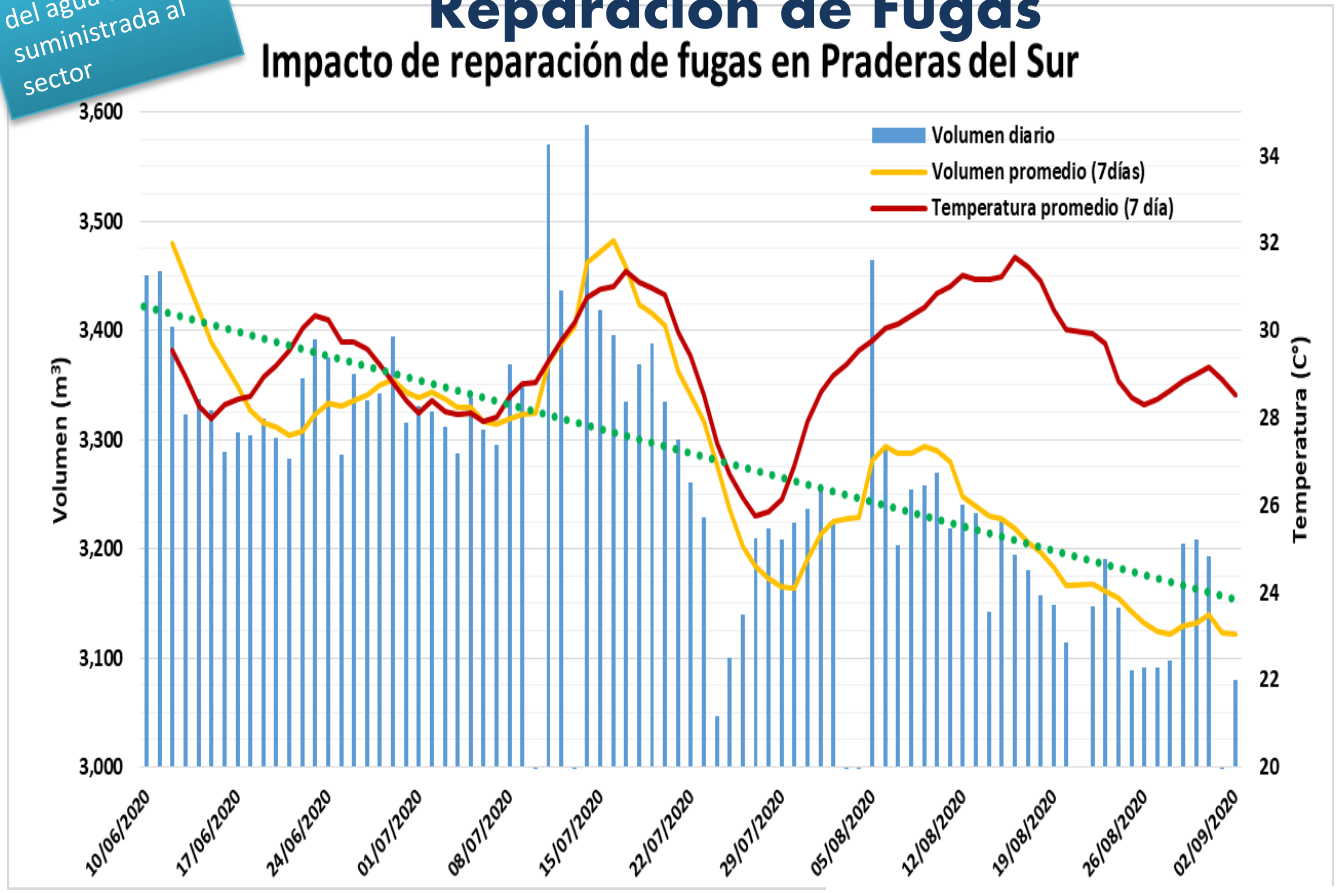
Trabajos que se están realizando:

1. Barrido de fugas visibles
2. Reparación de fugas encontradas
3. Detección de fugas no visibles con equipo especializado
4. Se tenía un caudal mínimo nocturno de 52 lps con servicio continuo en la zona y presión de 2.0 kg/cm2 a la salida de la VRP, el cual nos indicaba una presencia fuerte de fugas en el sector

Control de Fugas

Ahorro del **13%** del agua **total** suministrada al sector

Recuperación de Caudal por Reparación de Fugas

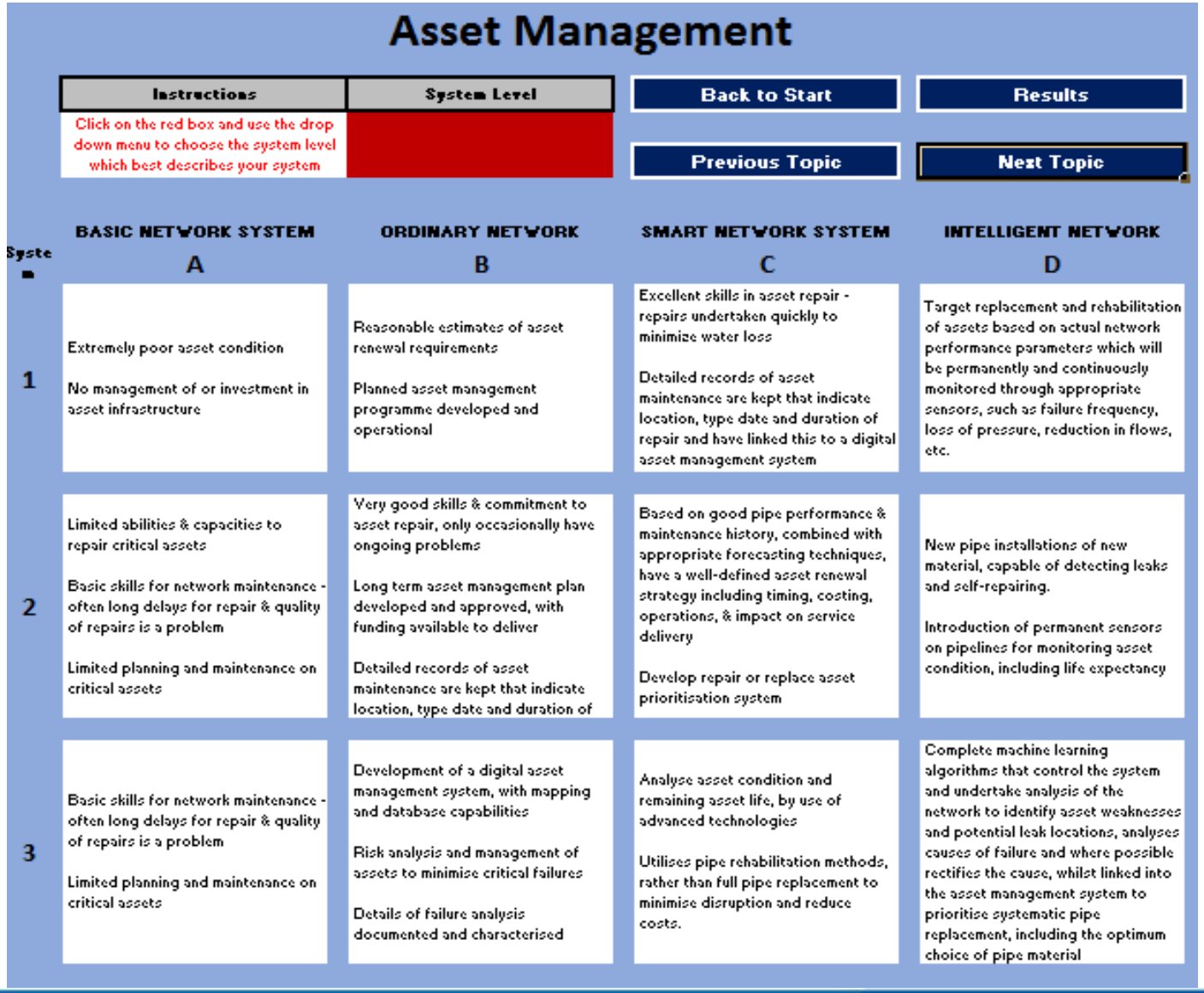


Representó un ahorro de **751 lt/día/fuga = 1 tinaco**

La **dotación** en el sector bajó de **365 lt/hab/día** a **327 lt/hab/día**

10 % volumen ahorro por reparación de fugas en medidor

Gestión de Activos



Asset Management

Instructions	System Level	Back to Start	Results
Click on the red box and use the drop down menu to choose the system level which best describes your system		Previous Topic	Next Topic

Syste m	BASIC NETWORK SYSTEM A	ORDINARY NETWORK B	SMART NETWORK SYSTEM C	INTELLIGENT NETWORK D
1	Extremely poor asset condition No management of or investment in asset infrastructure	Reasonable estimates of asset renewal requirements Planned asset management programme developed and operational	Excellent skills in asset repair - repairs undertaken quickly to minimize water loss Detailed records of asset maintenance are kept that indicate location, type date and duration of repair and have linked this to a digital asset management system	Target replacement and rehabilitation of assets based on actual network performance parameters which will be permanently and continuously monitored through appropriate sensors, such as failure frequency, loss of pressure, reduction in flows, etc.
2	Limited abilities & capacities to repair critical assets Basic skills for network maintenance - often long delays for repair & quality of repairs is a problem Limited planning and maintenance on critical assets	Very good skills & commitment to asset repair, only occasionally have ongoing problems Long term asset management plan developed and approved, with funding available to deliver Detailed records of asset maintenance are kept that indicate location, type date and duration of	Based on good pipe performance & maintenance history, combined with appropriate forecasting techniques, have a well-defined asset renewal strategy including timing, costing, operations, & impact on service delivery Develop repair or replace asset prioritisation system	New pipe installations of new material, capable of detecting leaks and self-repairing. Introduction of permanent sensors on pipelines for monitoring asset condition, including life expectancy
3	Basic skills for network maintenance - often long delays for repair & quality of repairs is a problem Limited planning and maintenance on critical assets	Development of a digital asset management system, with mapping and database capabilities Risk analysis and management of assets to minimise critical failures Details of failure analysis documented and characterised	Analyse asset condition and remaining asset life, by use of advanced technologies Utilises pipe rehabilitation methods, rather than full pipe replacement to minimise disruption and reduce costs.	Complete machine learning algorithms that control the system and undertake analysis of the network to identify asset weaknesses and potential leak locations, analyses causes of failure and where possible rectifies the cause, whilst linked into the asset management system to prioritise systematic pipe replacement, including the optimum choice of pipe material

Balances de Agua, Perdidas e Indicadores

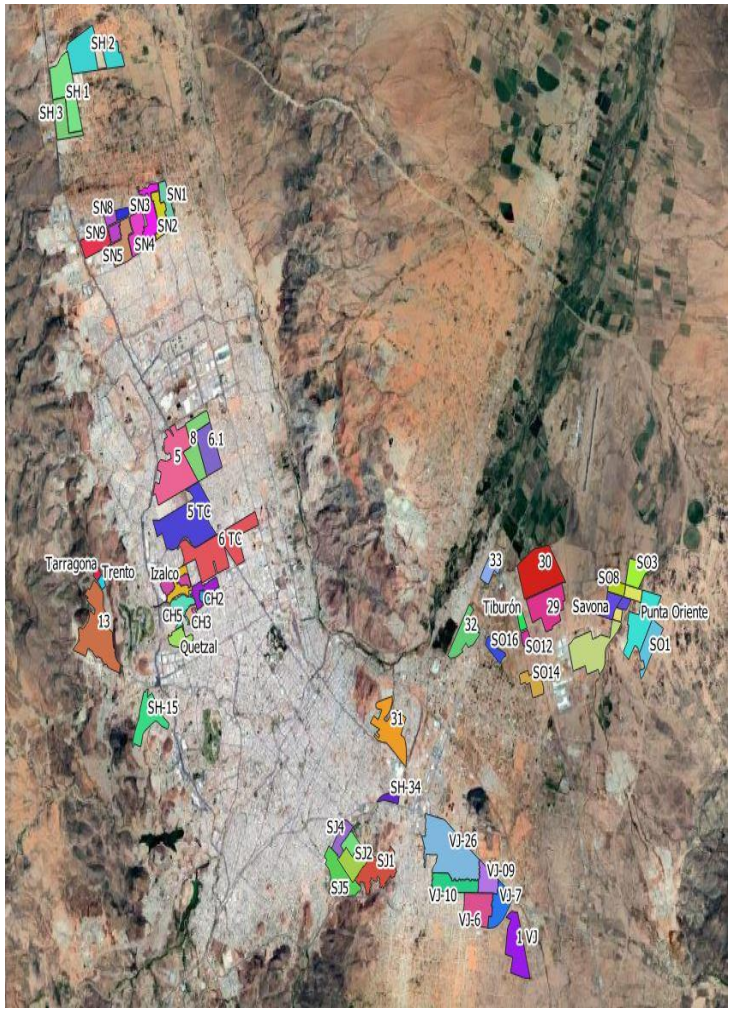
Water Balance and Water Loss KPIs

Instructions	System Level	Back to Start	Results
Click on the red box and use the drop down menu to choose the system level which best describes your system	B1	Previous Topic	Next Topic

System Level	BASIC NETWORK SYSTEM A	ORDINARY NETWORK SYSTEM B	SMART NETWORK SYSTEM C	INTELLIGENT NETWORK SYSTEM D
1	No water balance established	Annual water balance in accordance with the international (IWA) format Regularly calculates physical and commercial loss performance indicators Occasionally calculate KPIs such as ILI	Water balance updated regularly, with latest billing and flow data and used to prioritised NRW activities	Water Balance and Minimum Night Flow analyses performed automatically per DMA / zone relevant software and intervention activities prioritised on a daily basis
2	Attempts to establish water balance using water utility's own water accounting methodology Only KPI used is % NRW based on water utility's own water accounting methodology	Establish an annual water balance fully in accordance with the international (IWA) format and using 95% confidence limits to indicate accuracy bands.	DMA water balance automatically updated daily, utilising AMI / AMR data and DMA flow data.	All data and information to develop a water balance and KPIs are pulled in automatically from respective databases, to be analysed automatically and improvement actions prioritised
3	Attempts to calculate NRW performance indicators other than percentage	Regularly calculate physical and commercial loss performance indicators and publish them in our annual report. Use KPI's such as ILI for benchmarking	Water Balance and relevant KPIs calculated automatically using relevant software linked to bulk flow measurements, billing and asset management data bases.	Water balance calculated daily complete with accurate KPI's with full financial costings, calculated with daily costs for chemical and direct costs calculated from access to the financial systems and online chemical costs. Errors calculated and adjusted based on machine learning algorithms

Balances de Agua, Perdidas e Indicadores

RESULTADOS SECTORES HIDROMETRICOS



2018

20 implementados = 48,759 cuentas
Horario 24/7=17% de las cuentas totales
Volumen no fugado (ahorrado)= 1,110,273m3
Equivalente a la producción de un pozo de 35 lps

2019

26 implementados = 63,349 cuentas
Horario 24/7=22% totales
Volumen no fugado = 5,695,084m3
Equivalente a la producción de 181 lps

2020

43 implementados= 89,740 cuentas
Horario 24/7=27% totales
Volumen no fugado a Septiembre= 6,141,908m3
Equivalente a la producción de 261 lps

EL 82% de los sectores presentan menor volumen suministrado
Con un ahorro del 21% de volumen suministrado

Balances de Agua, Perdidas e Indicadores

INDICADORES DE SATISFACCIÓN DE LA DEMANDA

NIVEL SOCIO ECONOMICO	BAJO		MEDIO		ALTO	
SECTORES	RS1		TC5		C1	
OPERACIÓN	SIN GESTION	CON GESTION	SIN GESTION	CON GESTION	SIN GESTION	CON GESTION
DOTACION DIARIA AL SECTOR	5,466	3,741	4,495	2,159	2,098	2,602
DOTACION DIARIA POR CUENTA	3.2	2.4	1.7	0.8	2.4	3.0
DOTACION MENSUAL POR CUENTA	90	54	51	24	72	90
CONTINUIDAD DEL SERVICIO	8.0	24.0	7.0	12.0	8.0	8.0

NOTA: Volumen en m3

Balances de Agua, Perdidas e Indicadores

RANGO DE PRESIONES Y TIEMPO DE PERMANENCIA EN EL DISTRITO

N° de punto	Horas por nivel de servicio por presión					Duración de servicio (T)	Duración de servicio (t)	Presión promedio (> 7mca)			Retraso en el reflejo del servicio		Tiempo de llenado de la red	
	Nivel 0	Nivel 1	Nivel 2	Nivel 3	Nivel 4			Matutino	Verpertino	Sin servicio	Matutino	Vespertino	Matutino	Vespertino
	< 0.1 mca	0 - 7 mca	7 - 15 mca	15 -25 mca	> 25 mca	(Horas)	(Días)	(mca)	(mca)	(mca)	(horas)		(horas)	
1	0.00	0.00	20.75	3.25	0.00	24.00	1.00	12.19	10.58	SERVICIO CONTINUO	SERVICIO CONTINUO		1.50	4.00
2	0.00	6.25	11.25	1.00	5.50	17.75	0.74	28.42	16.11	5.51	-	0.25	0.75	1.50
3	0.00	17.75	1.00	1.00	4.25	6.25	0.26	27.23	23.88	2.94	0.75	0.75	1.75	2.00
4	0.00	18.25	4.25	1.50	0.00	5.75	0.24	13.98	11.08	6.75	0.50	0.75	2.00	2.25
5	0.00	18.25	1.25	4.50	0.00	5.75	0.24	18.01	16.51	0.42	0.50	0.50	1.25	1.50
6	0.00	0.00	3.00	15.25	5.75	24.00	1.00	25.27	22.25	SERVICIO CONTINUO	SERVICIO CONTINUO		1.50	1.75
8	0.00	1.50	16.50	6.00	0.00	22.50	0.94	11.82	10.43	6.77	0.00	0.00	1.00	1.75
9	0.00	0.00	24.00	0.00	0.00	24.00	1.00	10.10	9.89	SERVICIO CONTINUO	SERVICIO CONTINUO		1.50	2.25
10	1.75	15.50	0.50	0.75	5.50	6.75	0.28	30.30	26.19	0.95	0.25	0.25	1.25	1.00
11	9.75	7.50	1.00	1.75	4.00	6.75	0.28	24.58	22.40	0.18	0.25	0.25	1.25	1.75

Recursos Humanos

Human Resources

Instructions	System Level	Back to Start	Results
Click on the red box and use the drop down menu to choose the system level which best describes your system	A3	Previous Topic	

System Level	BASIC NETWORK SYSTEM A	ORDINARY NETWORK SYSTEM B	SMART NETWORK SYSTEM C	INTELLIGENT NETWORK SYSTEM D
1	No staff training or education and no related budget No measurable efforts in NRW management	Staff training and capacity building, availability for an education plan in operational and maintenance activities	Staff training programmes for all new technologies and systems	Continued professional development of staff to improve and build knowledge and capacity in intelligent systems
2	Basic training for some activities provided, mostly on-the-job training Training efforts in NRW management are in place, but mostly opportunistic	A cross-departmental NRW unit in place dealing efficiently with both real and apparent losses, with adequate staff to undertake the activities	Improved staff development programme in place addressing cutting edge technologies and systems	Coordination with research institutions in areas of system improvement using artificial intelligence and systems
3	Coordination between technical and commercial departments is being introduced as part of efforts to reduce NRW Sustained and adequate staffing levels to deliver planned programmes	Actively managed staff training and capacity building, based on a comprehensive and budgeted plan	Appropriate staffing levels and capabilities, to complement the advanced and innovative technologies in place	Match staff levels and capabilities to complement intelligent systems adopted

Resultados

Results

Water Utility	Organismo Operador
Date	7/7/2022

Back to start

Topic	System Level	Score	Back to:
Bulk Flow Measurement	B3	6	Bulk Flow Measurement
Customer Metering	B2	5	Customer Metering
Pressure Management	B2	5	Pressure Management
Leakage Management	B2	5	Leakage Management
Asset Management	B1	4	Asset Management
Water Balance and Water Loss KPIs	B1	4	Water Balance and Water Loss KPIs
Human Resources	A3	3	Human Resources
Total Score		**32**	

Total Score	Class	Remarks
7 – 12	E3	Wasteful and inefficient system operating procedures failing to make proper use of resources and assets impacting in the continued deterioration of assets and level of service
13 – 19	E2	Inferior standard and quality of system management lacking organised administration and planning of the water supply network failing to deliver the required level of service and commitment to system improvement
20 – 26	E1	Critical operational stage which needs to be bolstered with improved processes, standards and procedures in order to reverse the downward spiral and take back system control
27 – 36	D	Satisfactory supply regime nevertheless wasteful use of resources and inefficient system operation which requires further enhancement, strengthening, improvement and control leading to increased performance
37 – 48	C	Efficient use of resources with systems in place that deliver the desired level of service, however there is room for system efficiencies and optimisation of processes
49 – 61	B	High degree of efficiency in all system operations employing advanced technologies and knowhow to sustain the gains of efficiency and to build a platform to enable further advancement
62 – 73	A	Optimum use of technology, equipment, and human resources in operating and maintaining the water supply system in an intelligent, productive, cost efficient and effective manner
74 – 84	A*	It could be described now as a "dream". This would be the utility of the future operated by machine learning algorithms, self-controlled and managed with minimal supervisory control by humans

PREGUNTAS Y COMENTARIOS

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MUCHAS GRACIAS

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