ICT based water leakage control
- In the era of the 4th Industrial Revolution

USOL
Total U-city solutions

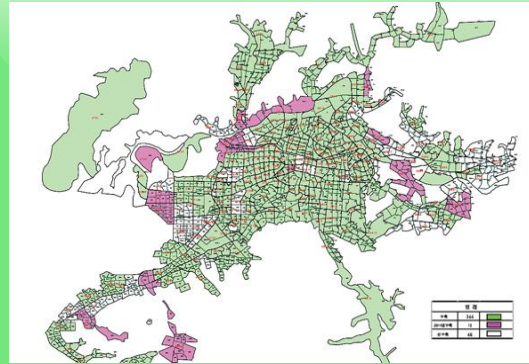# 1. Water pipe leak in Korea

What we did to resolve the problem?

Replace Old Pipes

▶ To replace the old pipes?
- replace the 30% of the all pipes in this year &
- replace the 5% of the all pipes every year. (Is it possible?)

Block System

▶ Block isolation, water flow monitoring
- needs long time and big budget.
- Still needs leak investigation

Leak Investigation

▶ Random leak investigation
- Use sound stick
- They can not find leaks immediately.

Water leak ratio of Korea : 10.8% (2010) ⇒ 10.9% (2015)

Main Idea : Leak is inevitable. Find it immediately & Fix it ASAP

The problem of leak investigation

- Leak investigators have to patrol all around of the city every night.

- They don't know the leak points, so random search is the only way to find the point.

- The investigation must be done at night, but it's not so easy.

➡ They can not invest all the pipes everyday, so leaks last long.

6 months ~ more than 1 year later

Area "A"   Area "A"

Leak !

Leak lasts long time

So we must have water leak monitoring system.

Water pipes leak monitoring system

● **Beside of a water meters, we install leak detection sensors.**

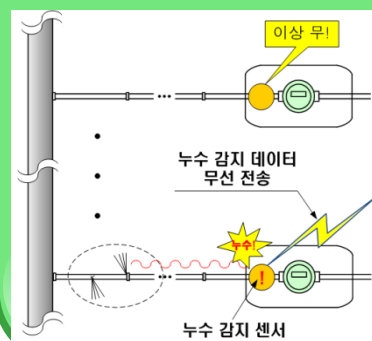**The sensors monitor leak sound on the pipe and report every day.**

System shows leaking pipe on internet map. → We know where leaking pipes are in the city.

If a leak occurred yesterday, we know it this morning, we can repair it this afternoon!!

leak detection sensor Installed beside of water meter	Leak monitoring and reporting Everyday (RF & Internet)	System shows leaking pipe on internet map	AMI With a digital water meter

We can monitor all the pipes EVERYDAY!

The benefits summary

- **<u>Minimize the water loss with immediate leak detection.</u>**

  * If a leak occurred yester day, we know it this morning and will fix it this afternoon!

- **<u>Use the budget for replacing old pipes exactly.</u>**

  * This system produce nice big data that determines real status of pipes.
  * We can judge which pipes should be replaced not in the order of burial.

- **<u>Free AMI network & endpoint (You only need digital water meters)</u>**

  * We already have communication network and wireless transceiver.
  * We need only digital water meters to have AMI.

- **<u>Easy block isolation (Easy DMA installation)</u>**

  * Easy to find unknown pipes. Only with following red dots, hidden pipes will be found.

- **<u>This is problem resolving & maintenance system</u>**

  * It works from the beginning to the end of the leak reduction project.

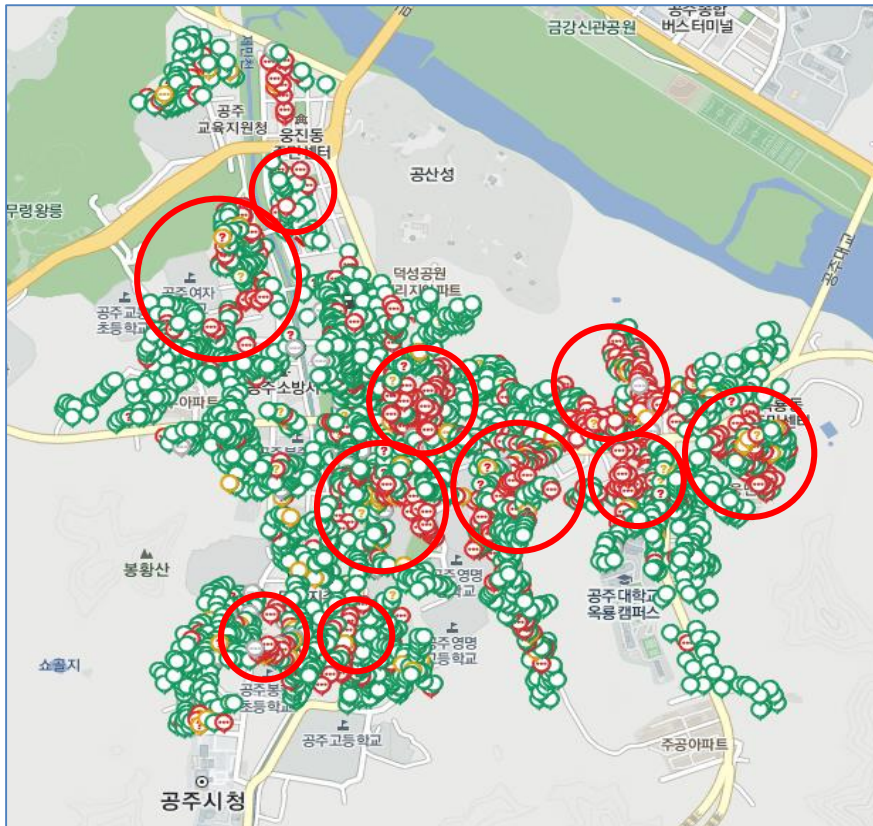## NRW decrease with leak monitoring

● **Gongju city situation (2013)**

▶ **The number of water meters : 12,850**

▶ **revenue water ratio : 63.9% (2013)**

▶ **They deployed 6,945 leak sensors from Nov. 2014 to May. 2017.**

▶ **They invest 2 million USD, and saved 3 million USD only in 2 years. (The sensors will work more than 10 years.)**
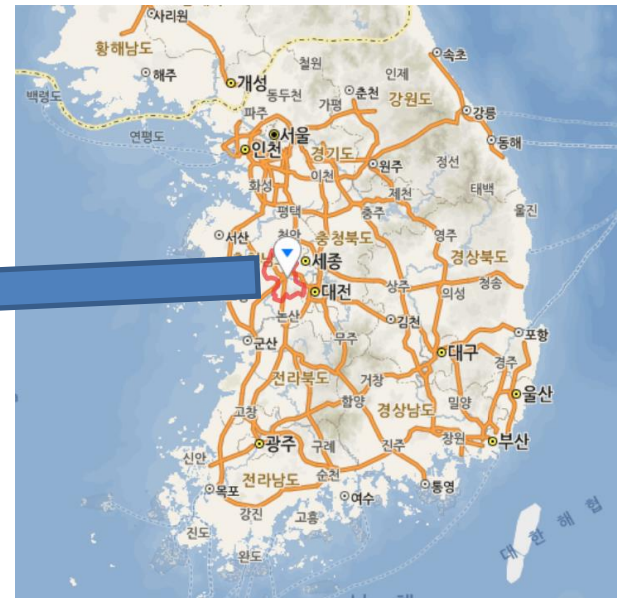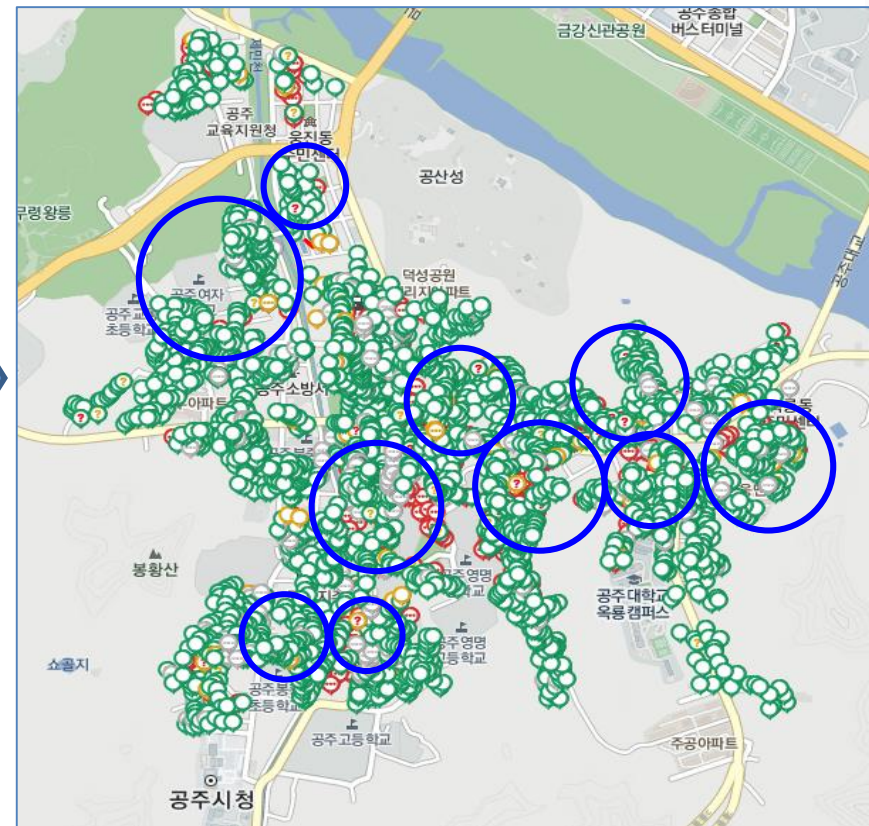
NRW decrease with leak monitoring

- **Change of the leak situation**

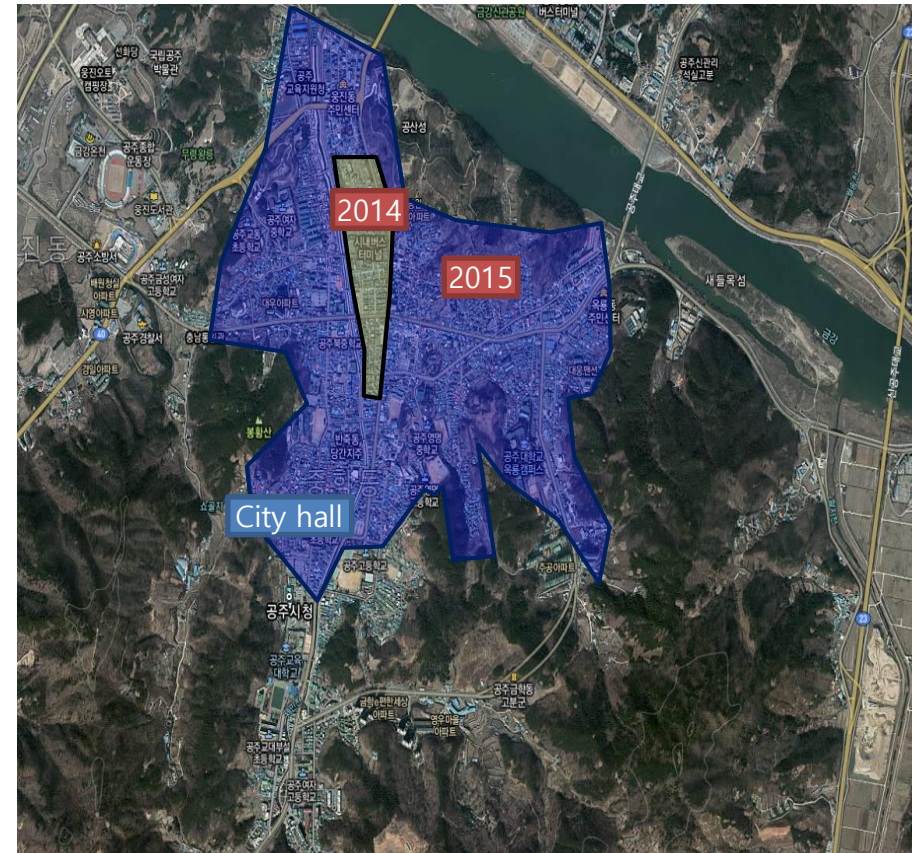< 15 Aug 2015 >   < 8 May 2016 >

NRW decrease with leak monitoring

● **2014 – First installation**
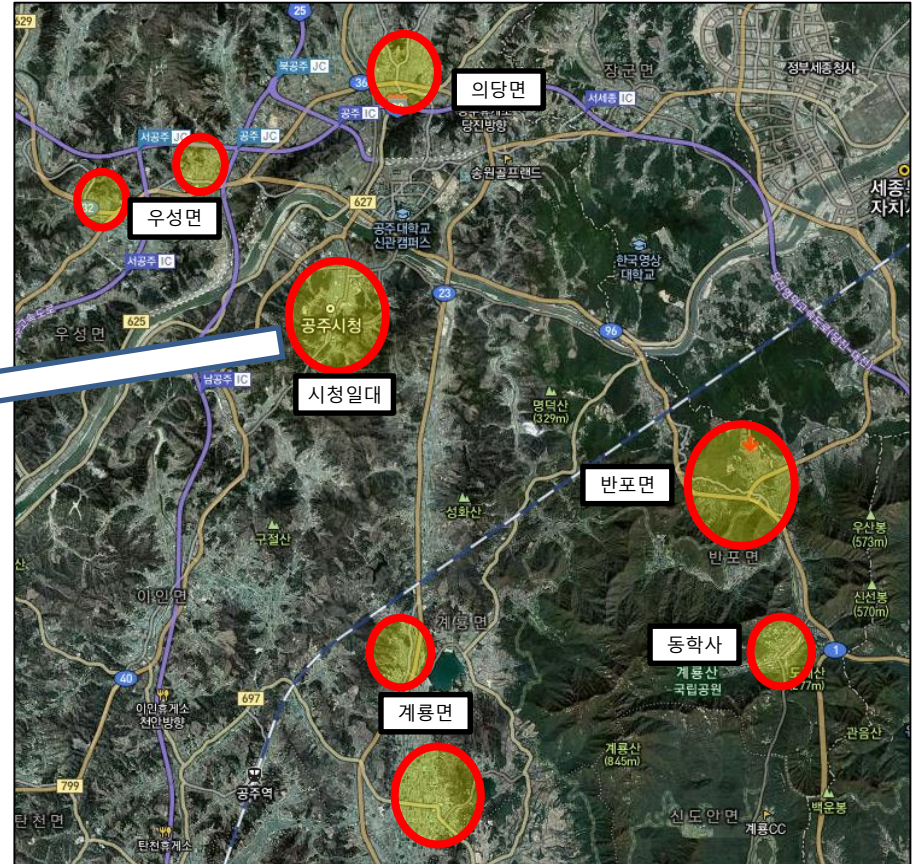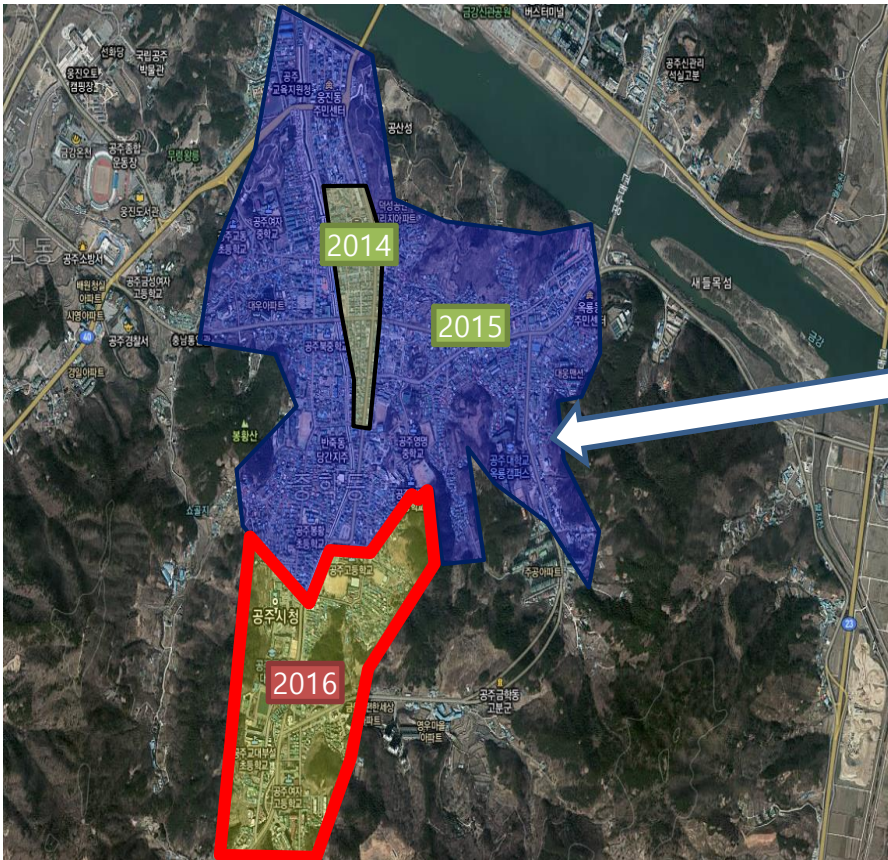
● **2015 – Spread to old town area**
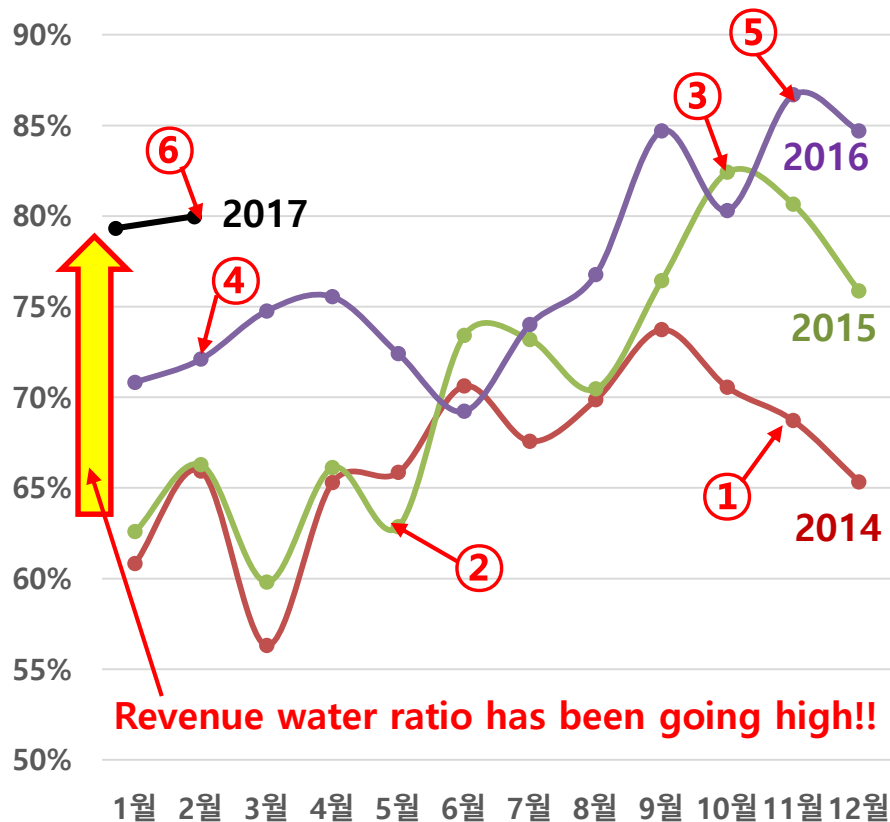
NRW decrease with leak monitoring

- **2016 – Finish covering old town area and suburban area**

Case 3 – NRW decrease before block isolation

● **Revenue water ratio change**

① **Nov.2014**

- **Started to deploy sensors**

② **May.2015**

- **Started to fix leaking pipes**

③ **Oct. 2015**

- **Got the first result!**
- **Monthly revenue water ratio : More than 80%**

④ **Feb. 2016**

- **Deploy more sensors on rural are of the city, fix, & replace pipes.**

⑤ **Nov. 2016**

- **Got the second result**
- **The 2nd half of 2016 revenue water ratio : 81%**

⑥ **Feb. 2017**

- **Deploy more sensors, fix, & replace pipes.**
- **They covered whole city with 6,945 sensors**
- **We expect the revenue water ratio of 2017 will be about 85%.**
- **Now they started to block isolation.**

Revenue water ratio has been going high!!

2017
2016
2015
2014

⑥ ⑤ ③ ④ ② ①

90%
85%
80%
75%
70%
65%
60%
55%
50%

1월 2월 3월 4월 5월 6월 7월 8월 9월 10월 11월 12월

Leak position, AMI, water flow, water pressure

NRW reduction

SeeLeak (Leak Monitoring + AMI)
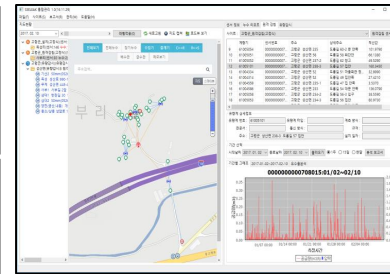
SeeFlow

SeePressure

Quality control

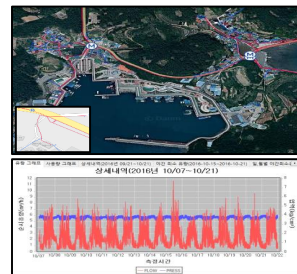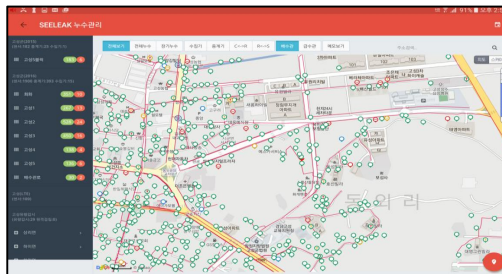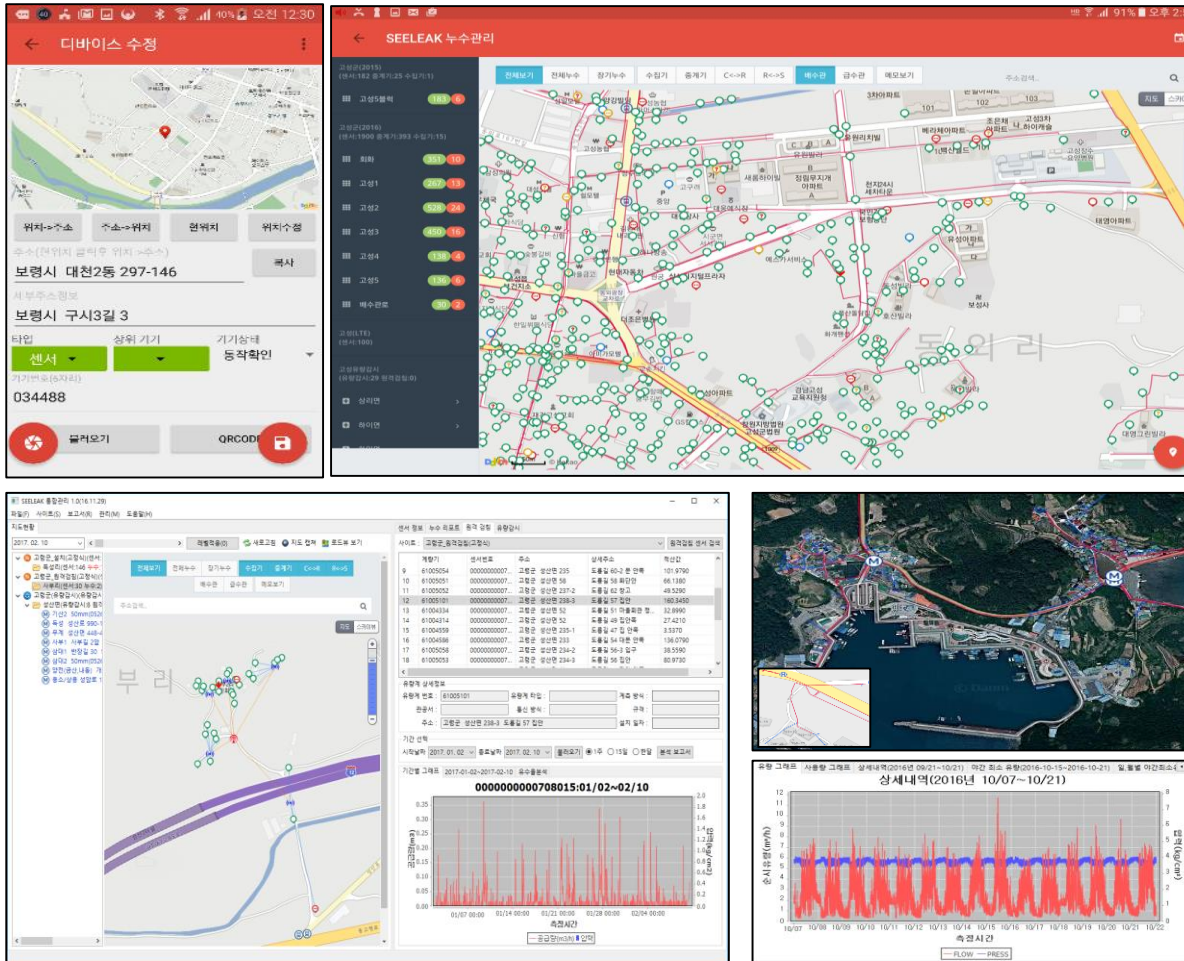**SeeQuality**

LTE, RF, LTE-M, NB-IoT

USOL Cloud

SeeALL

See ALL – Simple, but powerful system

🔴 **You can see all of this on your laptop or smart phone.**

▶ **Device registration**

▶ **Pipe map on internet map**

▶ **Leak monitoring result**

▶ **Leak position**

▶ **Leaking pipe repair result**

▶ **Water flow pattern**

▶ **Water flow quantity**

▶ **Customer water use quantity**

▶ **Customer water use pattern**

▶ **Block water supply quantity**

▶ **Non-Revenue water quantity**

▶ **Daily revenue water ratio**

▶ **And so on.**

Why we made this system?

▶ **No Assumption or Estimation : We want real data**

- You have 3 essential real data (Leak position, water flow, water pressure).
- Real data can lead us exact decision.

▶ **We can get data at any time and everywhere.**

- You know leaking points of your country even if you are in Korea.
- Engineers in the field and office see same thing together at the same time.

▶ **We want to make jobs easy.**

- Minimize the jobs that need many people, equipment, and civil complain.
(Minimize closing water supply, night step test, and so on.)

Reduce NRW in very short time, and keep it low with small money and people

1. ADB TA project : Sri Lanka

🔴 **Flow & Pressure monitoring**
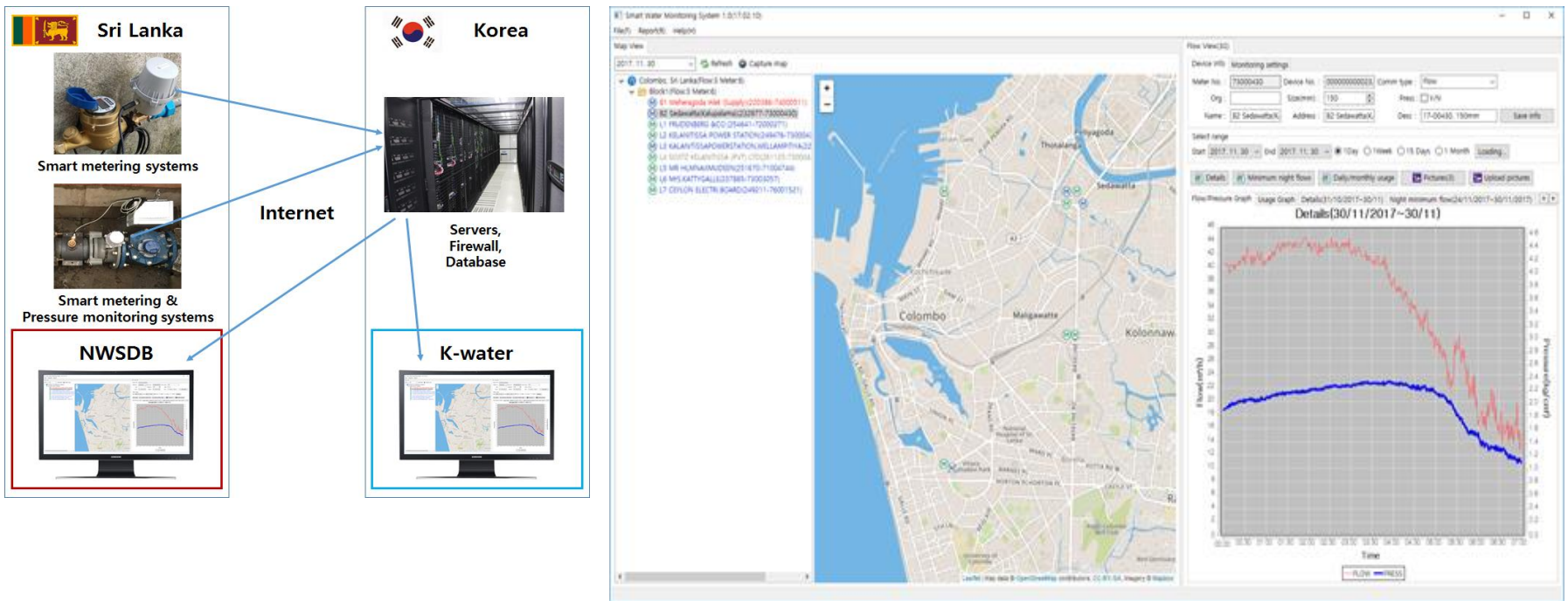
1. ADB TA project : Sri Lanka

🔴 **Flow & Pressure monitoring**

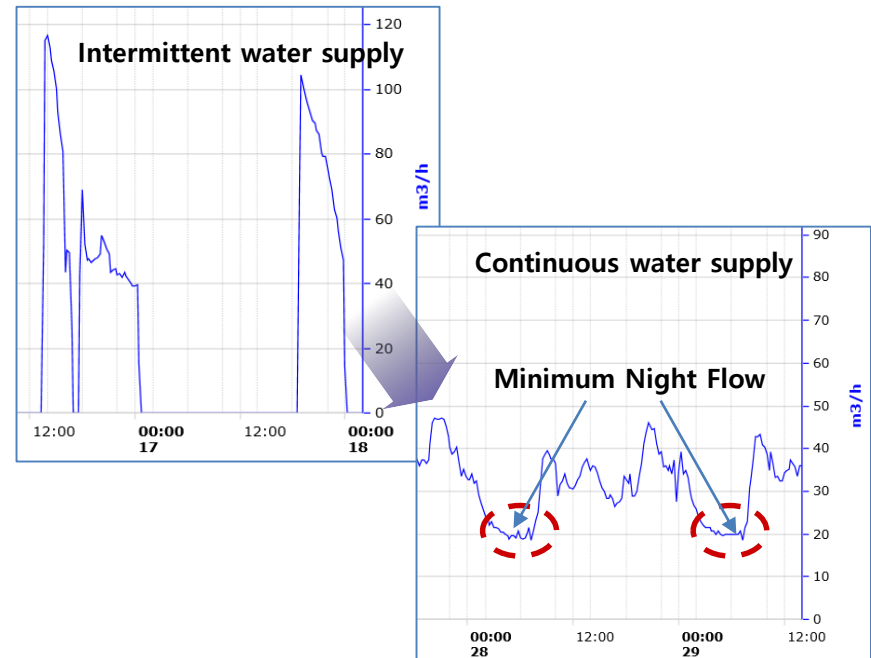*** This is the process of knowing the current state problems**

2. NRW reduction pilot project : Viet Nam

🔴 **Leak detection & monitoring : The process of solving the problem**

DMZ D1

Ninh Binh Water Company

NRW : About 30%

Intermittent water supply

Continuous water supply

Minimum Night Flow

▶ **Features of DMZ D1**

• **Very close to water supply facility**
• **Already SCADA system is working**
• **A PRV on Inlet & old pipes**
• **Intermittent water supply**

▶ **What we requested?**

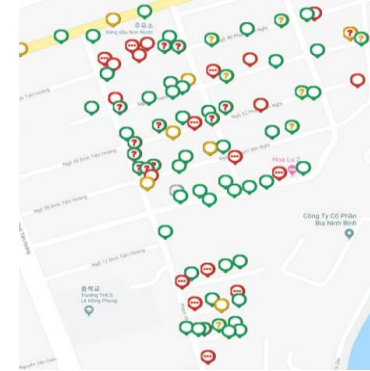• **Continuous water supply**
• **Open PRV 100%**

2. NRW reduction pilot project : Viet Nam

● **Leak detection & monitoring**

1. Leak sensors deployment
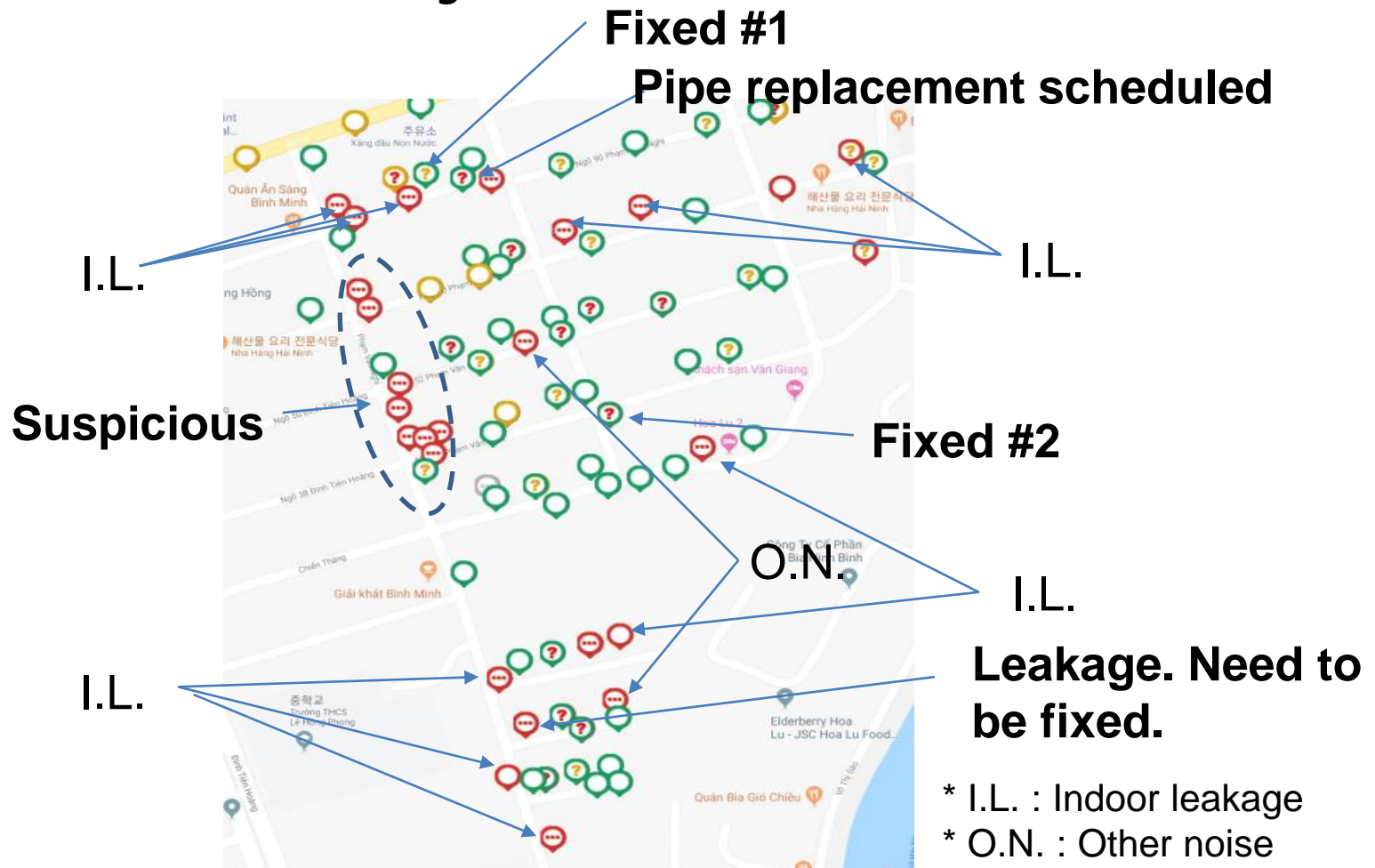
2. Analysis Detection result

3. Pin pointing

4. Find leak & Fix the pipe

2. NRW reduction pilot project : Viet Nam

● **Leak detection & monitoring**

Fixed #1
Pipe replacement scheduled

I.L.

I.L.

Suspicious

Fixed #2

O.N.

I.L.

I.L.

Leakage. Need to be fixed.

* I.L. : Indoor leakage
* O.N. : Other noise

2. NRW reduction pilot project : Viet Nam

● **Leak detection & monitoring**

Flow meter #2
: 1.5m³/h

Flow meter #3
: 3.1m³/h

Flow meter #1
: 7.8m³/h

NMF : 21m³/h

Real DMZ D1 MNF
= 21 – 7.8 – 1.5 – 3.1
= 8.1 m³/h
= Leakage on pipe
 + Indoor Leakage
 + Indoor usage (small)
 + Illegal usage (maybe)

2. NRW reduction pilot project : Viet Nam

● **Leak detection & monitoring**

At the beginning : MNF = 21.6 m³/h

At the End : MNF = 17.2 m³/h
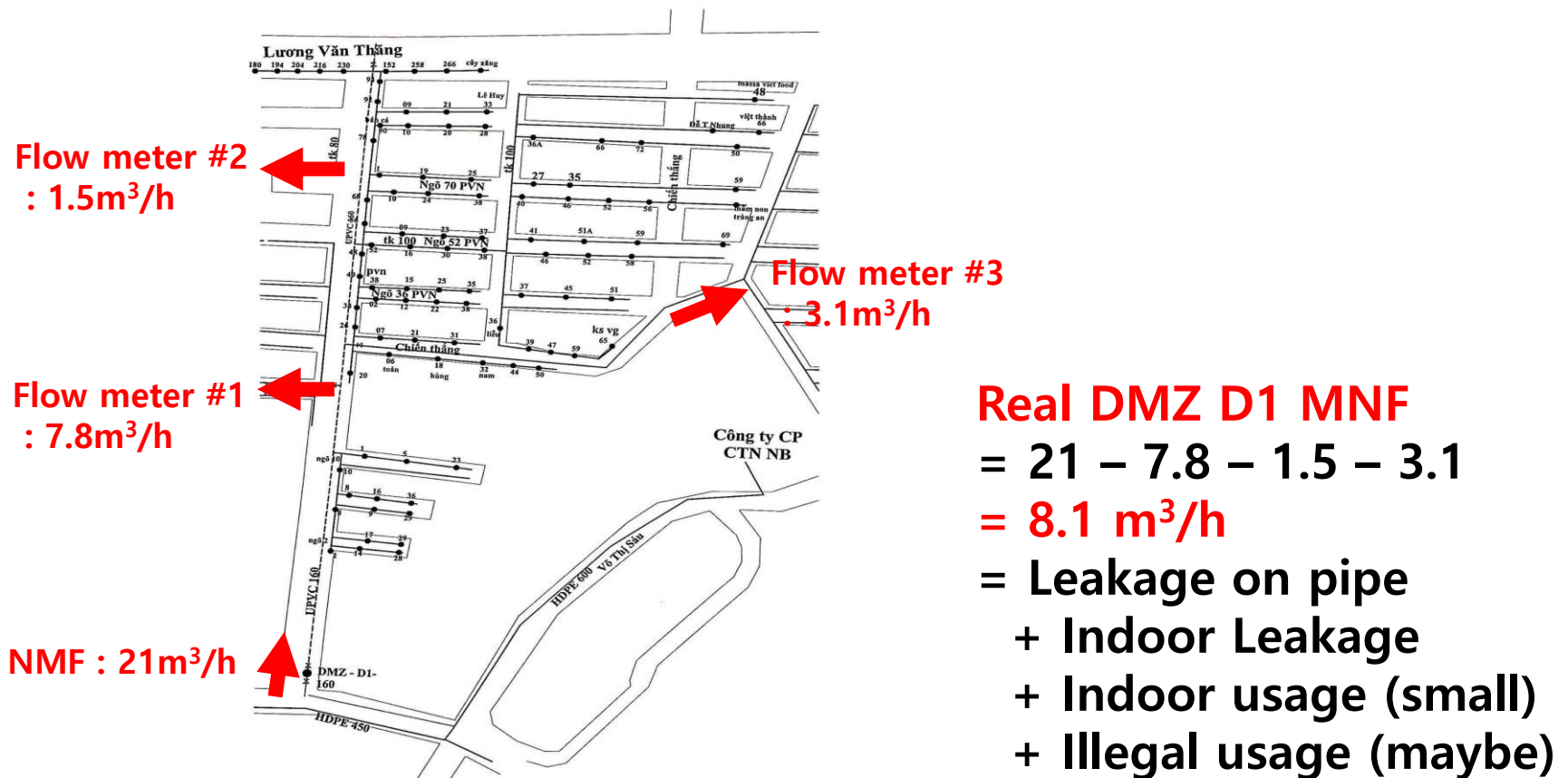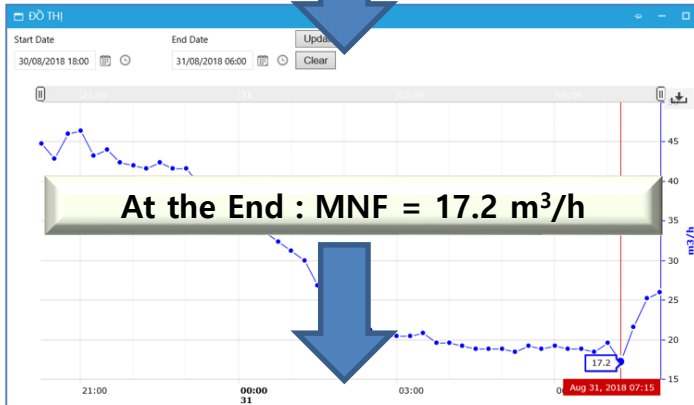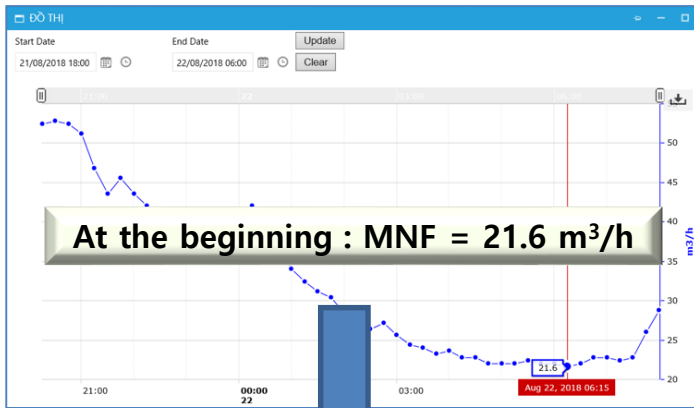
4.4 m³/h reduced, 3.7 m³/h still remain

Flow meter #2

Hidden pipe connection

Flow meter #1

Flow meter #3

Công ty CP CTN NB

Inlet

* They found hidden pipe connection from suspicious area.