Asset Management Contributing to Disaster Risk Reduction

Experience and Challenge in Sendai Wastewater Utility

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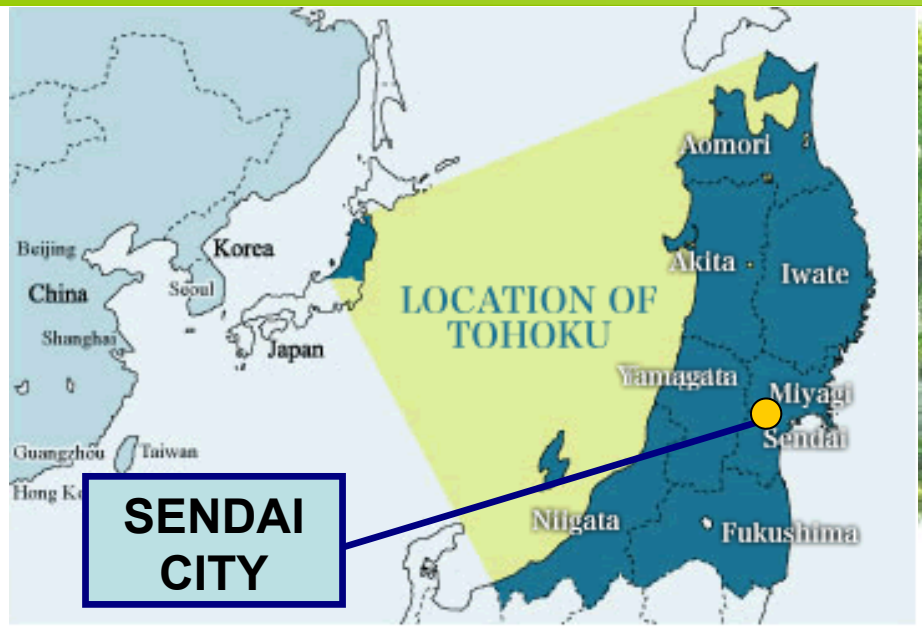
Sendai Wastewater Utility

JAPAN

Outline of Sendai City and Sendai Wastewater Utility



Sendai City

- The economic center of the Tohoku region
- Bullet Train : Tokyo–Sendai about 1.5 hours
- Coach : Narita Airport–Sendai about 5 hours
- Population : 1,086,377 (2017.10)
- Modern city in harmony with nature

Sendai Wastewater Utility

- A part of Sendai City municipal government
- 119 years (The 3rd earliest sewer construction in JPN)
- The coverage of wastewater facilities is 99.6%
- The sewer and drainage length is 4,801km
- 5 wastewater treatment plants
- The biggest WWTP, Minamigamo treats 300,000m3/day

At 4pm, March 11, 2011

Outline of damages on the wastewater infrastructure

- Minamigamo WWTP was completely devastated by the tsunami
  - The restoration cost was about 575 million dollars
- Emergency fuel shortage was a big problem to operate facilities
- About 102km of pipes within 4578km were damaged
- 138 domestic wastewater treatment tanks had to be repaired

Evacuation to the rooftop

Inundation by the Tsunami

Damage of pumping facility

Road collapse

Liquefaction

Displacement by tremor

Recovery of Sendai Wastewater Utility

Minamigamo WWTP

Response measures based on the BCP

Temporary wastewater treatment by the contact oxidation process

Tsunami-proof and eco-friendly facility (build-back

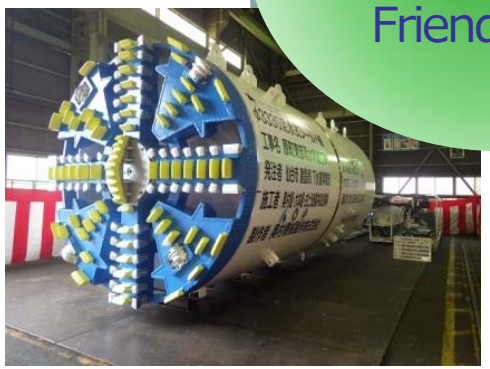
Restoration and reconstruction

Disaster-Resilient and Environmentally-Friendly City

Pipelines

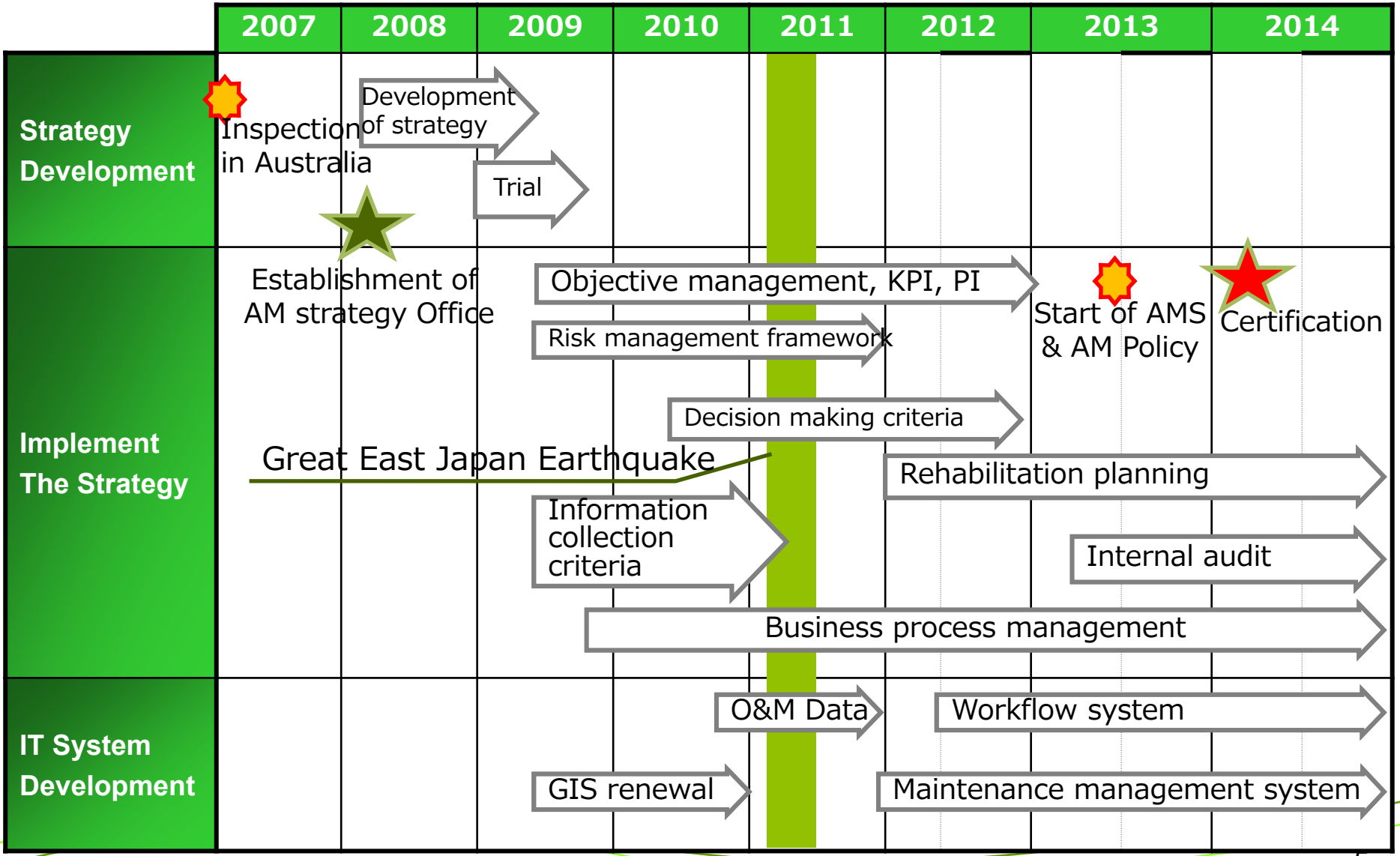
Restoration of damaged pipelines

The by-pass pipe to back up the most important trunk sewer has been constructing



Flood prevention measures in ground subsidence areas after the earthquake

History of Sendai's Asset Management



Development of AM implementation strategy

Completion to develop sewage system → A lot of problems appeared

Deterioration	Disaster risks	Personnel reduction	Budget cut

Formulated the AM implementation strategy to resolve problems

Detail analysis of internal business issues
- Business processes
- IT systems

Design solutions in reference to AU's good practices
- Hearing in Australia
- Process benchmarking

Consideration of business Environment
- National subsidy system
- ISO

Asset management implementation strategy

Objective management	Risk management	Decision making criteria	Long-term cost forecast

Reengineering business processes and organization

Developing framework of condition monitoring (including the sampling CCTV survey of pipe networks)

Developing IT system (GIS, Workflow sys., Maintenance calendaring sys., etc.)

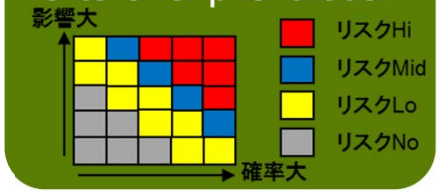
Training programs and systems	Internal Audit

The AM system of SWU and the benefits

Mission and vision

Internal audit and continual improvement

Risk and decision making criteria for prioritization



Training program

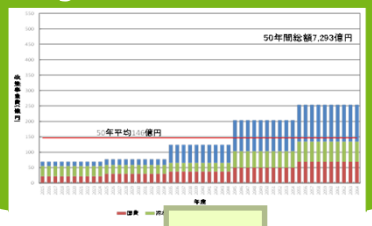
Business processes and IT systems improvement

A P D C

Mid-term planning

件名	金額	リスク点	平均リスク	R/C	判定
○×更新工事	50百万円	100,000	50,000	200	実施
▼△雨水幹線工事	140百万円	250,000	25,000	178	実施
□◆ポンプ更新工事	5百万円	10,000	10,000	200	要検討
○◎耐震化工事	120百万円	120,000	10,000	100	要検討
××雨水枝線工事	80百万円	15,000	1,500	19	先送り
…					

Long-term cost forecast



Condition monitoring

Shortening complaint processing time

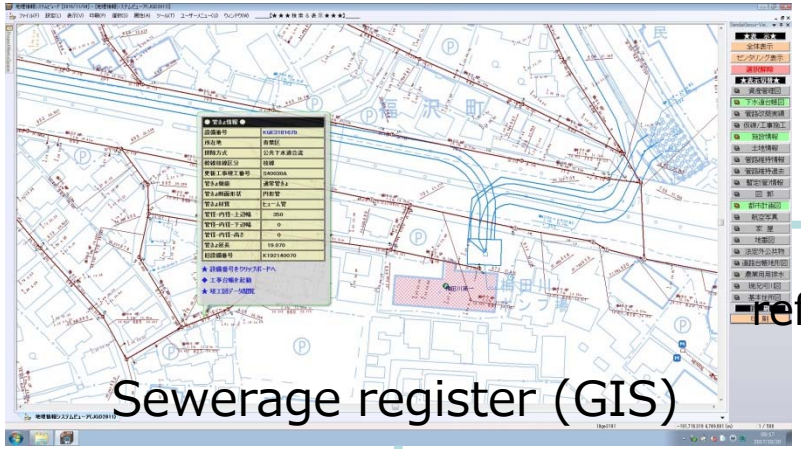
Long-term cost reduction

Future risk reduction

Sendai Wastewater Utility acquired the first certification of ISO55001 in Japan

GIS improving in asset management development

- AM requires accurate data of assets and usable GIS
- IT systems were installed and improved according to necessary functions of the management system
- Various data were integrated and linked to the registers


Sewerage register (GIS)

Cross referencing

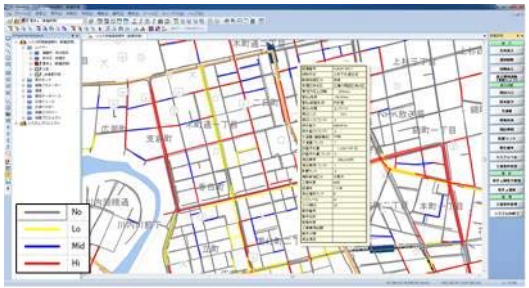

Equipment register

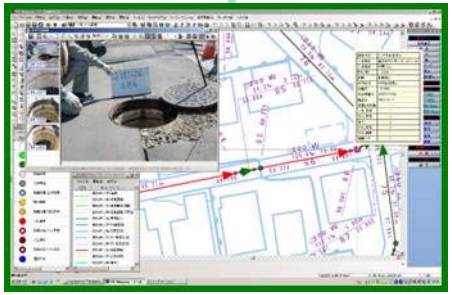

Sewer Condition

CCTV survey system


Complaint and failure

Maintenance management sys.

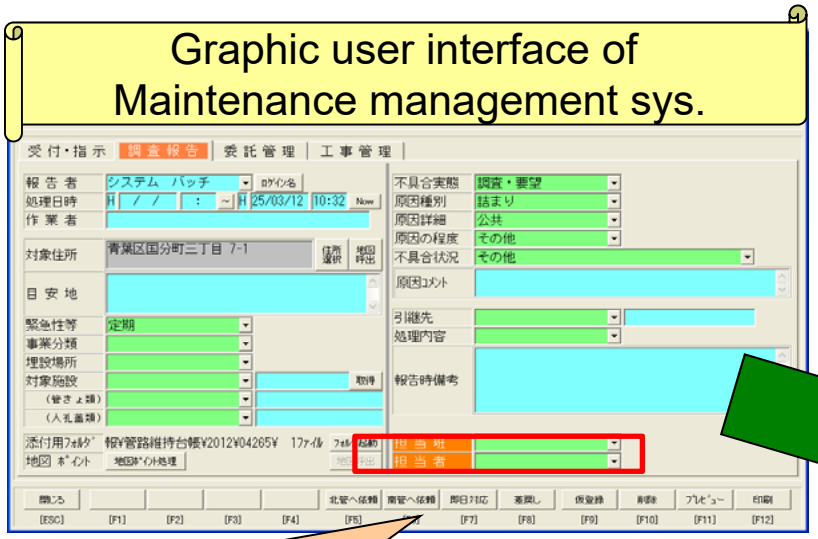

Sewer pipeline risk


Emergency survey

Business processes support the AM system

- Jobs of staff members are redesigned for collecting information and controlled by process flows and IT systems

Graphic user interface of Maintenance management sys.

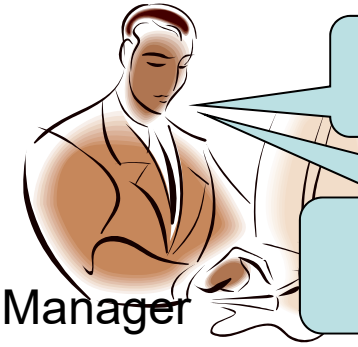


After inputting the result, click the button

Staff members

Let's input the survey results

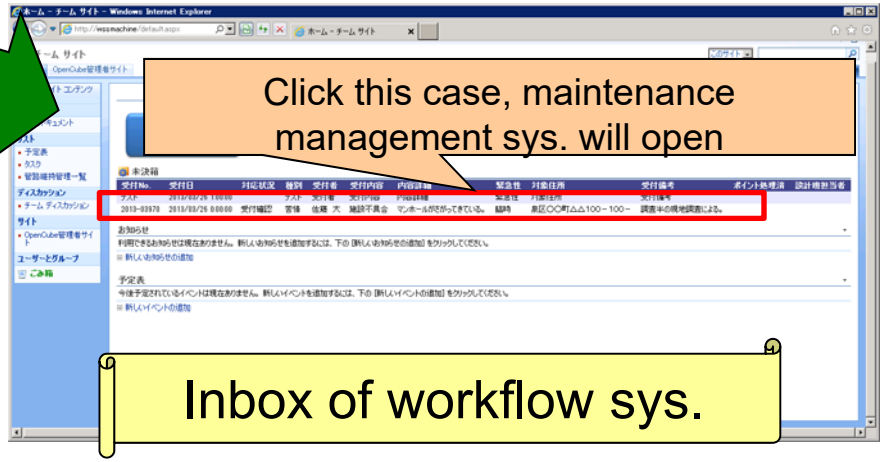
Circulate it to the manager!



Manager

Well, the survey result shows…

After confirmation, I circulate it to …



Click this case, maintenance management sys. will open

Inbox of workflow sys.

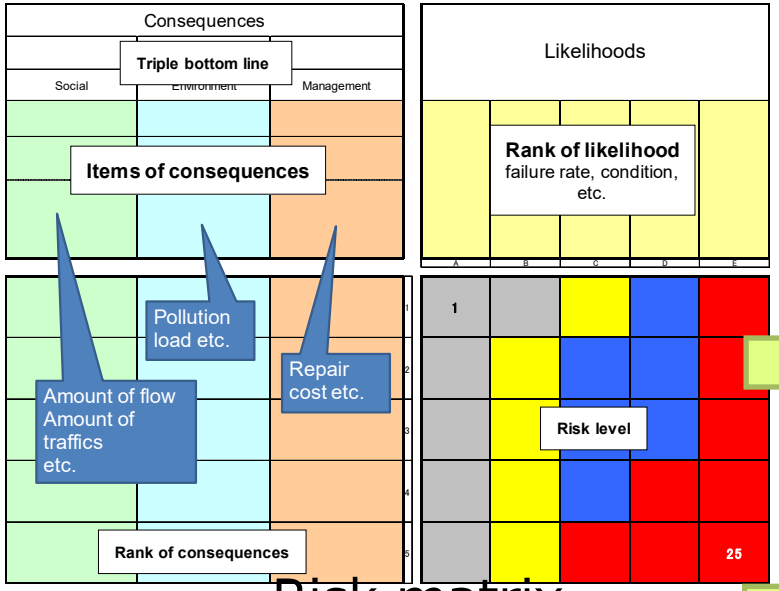
Without authorization, the staff member cannot move to the next step

The processes and IT systems contributes to recording asset failures and natural events such as an flooding

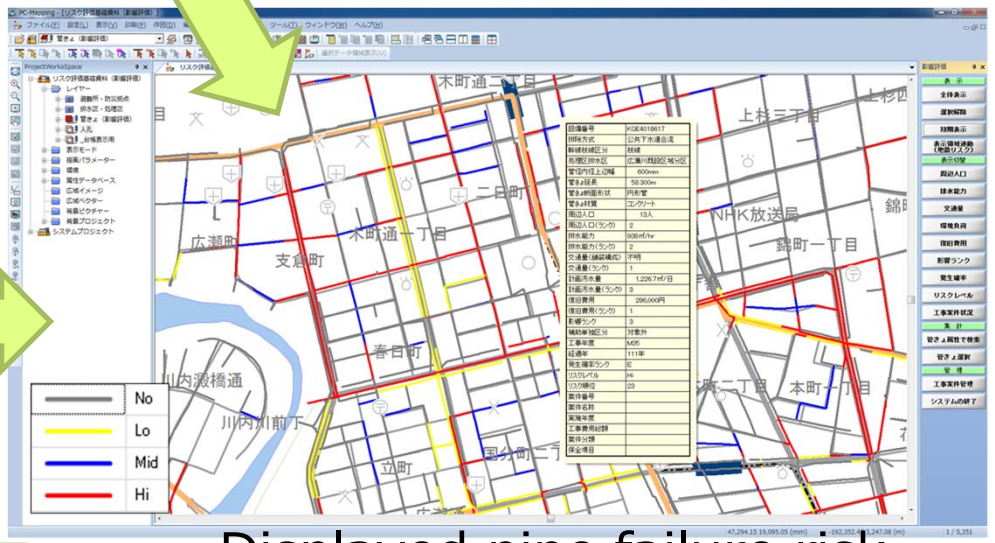
Risk management process in SWU

Major risks in SWU were identified

Equipment deterioration	Pipe deterioration	Earthquakes	Inundation

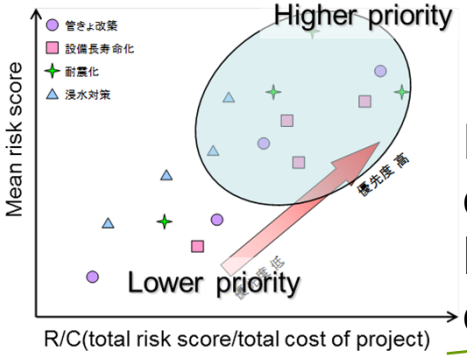


Risk matrix



Displayed pipe failure risk

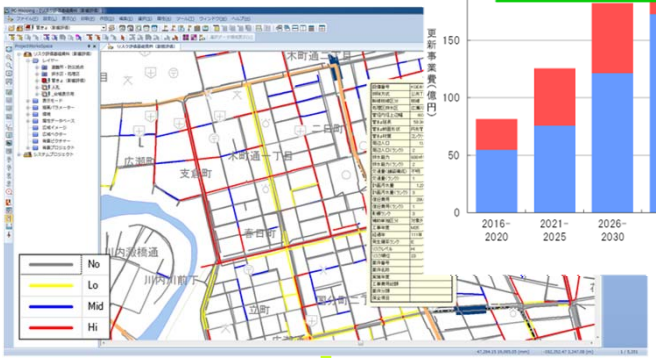
Risk mitigation measures

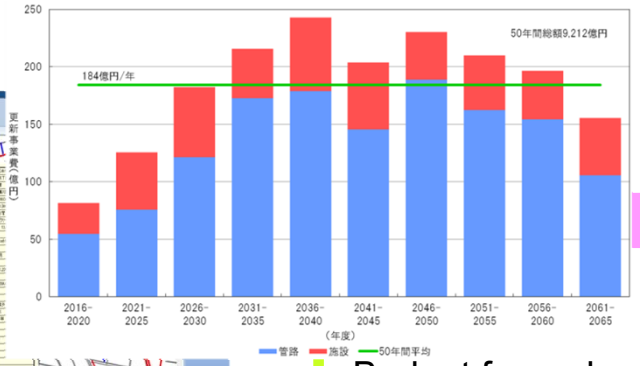


Prioritization based on risks and costs by decision making criteria

Drafting the mid-term (AM) plan based on the AM system

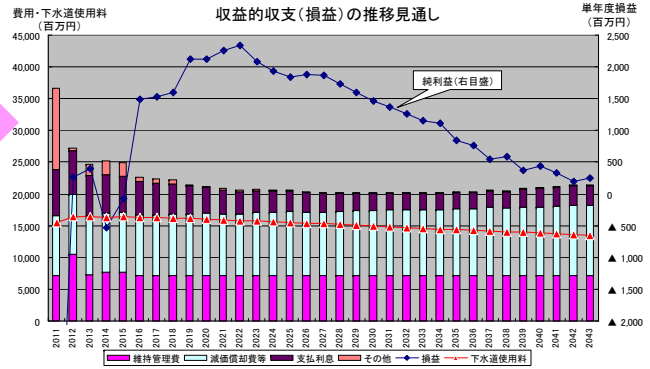
Risk based approach | Long-term view | Prioritization | Aligning with objectives





Projects to mitigate risks are listed up

Cash flow forecasting



Budget frame based on estimated risks

Decision making criteria

Name of project	Cost	Risk score	Mean risk	Risk/Cost	Decision
xx rehabilitation	¥50M	100000	50000	200	◎
XY flood prevention project	¥140M	250000	25000	178	◎
ZZ pump renewal	¥5M	10000	10000	200	△
YY anti-seismic project	¥120M	120000	10000	100	△
YZ drainage project	¥80M	15000	1500	19	×
…					

Prioritizing projects based on risks and costs

[Strategies]
Operation and maintenance of sewerage facilities

<Indicators>
Sewer overflow incidents

【Tactics】
Planned maintenance for pipe network

<Indicators>
CCTV survey length
pipe renewal length

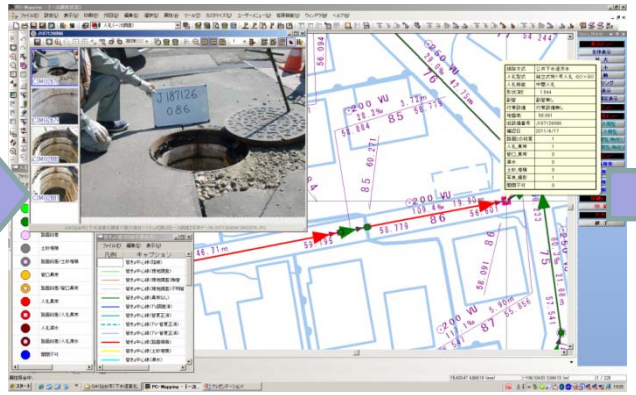
Individual projects

The mid-term business plan and objectives

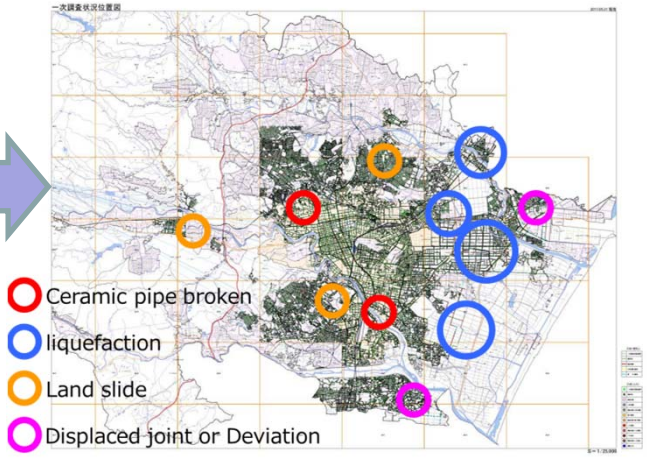
Benefit of asset management in disaster recovery

- The new GIS improved efficiency of the damage survey immediately after the disaster

External staff members participated in the survey



The GIS with database developed in AM make easier to input information.



Survey results were easily reported using GIS

- Simple rules, procedures and IT systems were necessary for external staffs to conduct the survey
- The GIS was set up to browse information of pipes and record the survey data.
- Data input time become drastically shorter in the survey

User-friendly systems are necessary for disaster recovery

Benefits of preparation for disaster

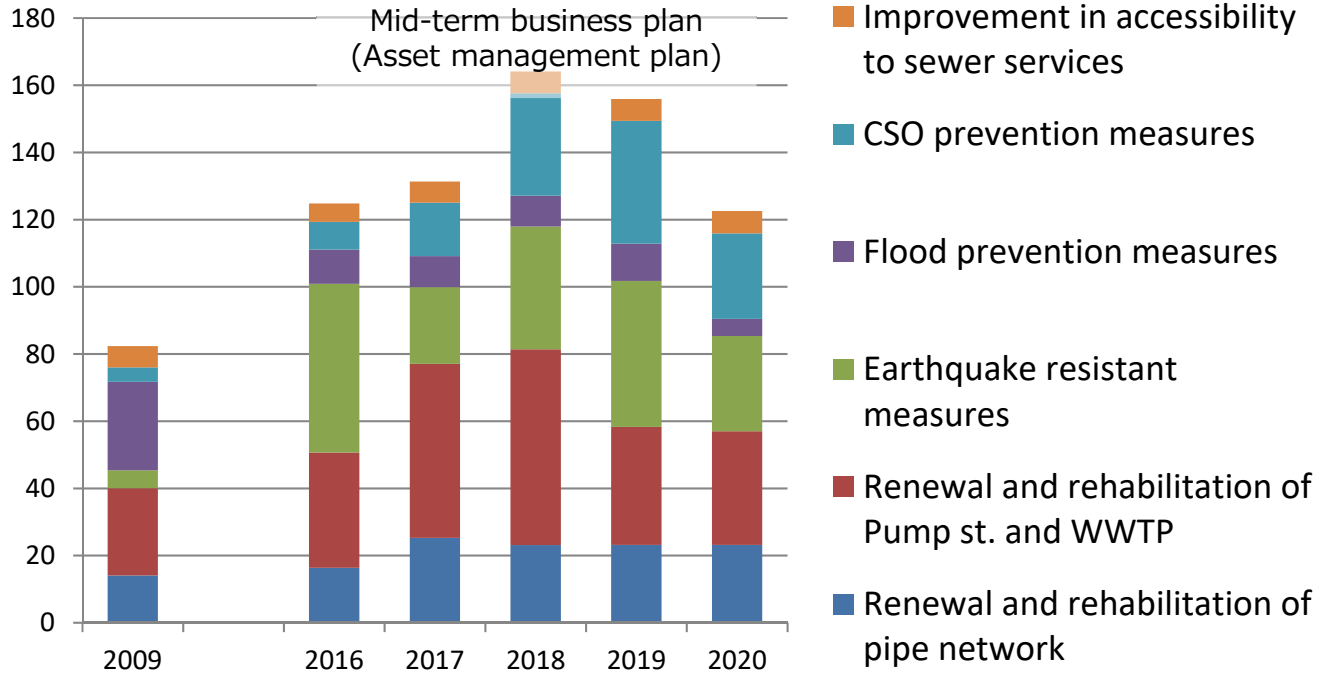
- Effect of earthquake resistant measures
  - In Japan, the pipe lining method is used for enhancing earthquake resistance of pipe.
  - According to the damage survey result, lined pipes didn't damage at all.
  - The national ministry prepares a subsidy system and a design standard for earthquake resistant measures.

	Total length	Damaged length	%
All sewer pipelines	4,758km	102km	2.1
Lined pipes	72km	0km	0

Pipe lining method is effective to enhance earthquake resistance

Influence of the disaster to our measures

- Budget increase after the disaster and asset management



- The national ministry revised the design standard after the disaster.
- The risk criteria of the utility was revised based on the new standard.
- As a result, the budget for rehabilitation including earthquake resistant measures has been increased more than twice before the disaster.

Maintaining and improving the capability for disaster

- An emergency survey drill is conducted every year with other cities, service providers and contractors
- Survey results are used in asset management activities such as risk analysis, CCTV survey and rehabilitation.

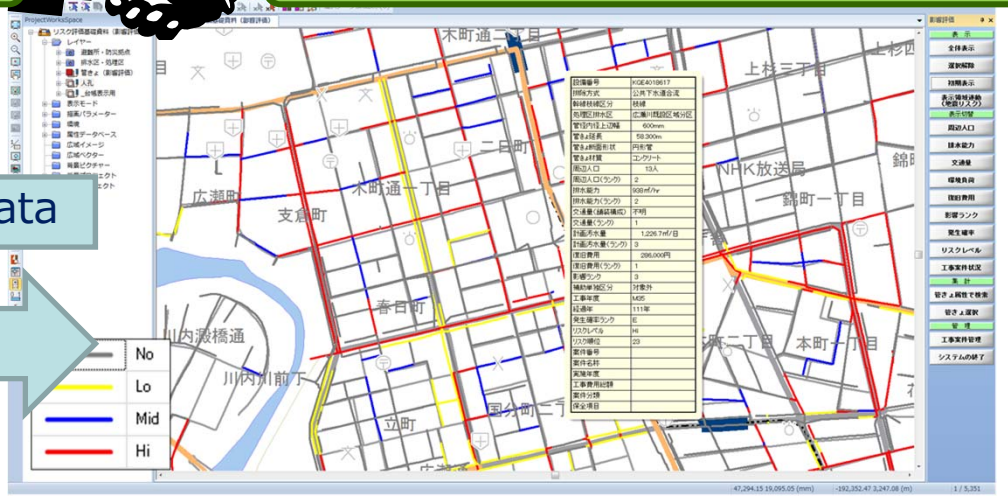
Emergency tools and procedures

Asset management system

Emergency survey drill

Risk data

Survey data



- Damage survey procedures, criteria and IT systems are incorporated into our AM system
- New mobile devises are tested in the drill and will be installed into daily operation

Sendai method was used in the damage survey of the Kumamoto Earthquake

Summary

- To build ‘Disaster-resilient and Environmentally friendly city’ is a long journey.
- Sendai Wastewater Utility incorporates disaster resistant measures and activities into the asset management system.
- We continue to improve our asset management system and make efforts to reduce disaster risk.


Thank you !