WaQuAC Net
Water Quality Asian Cooperation Network

WaQuAC-NET 7th Webinar

Current situation of small water utilities in rural areas of three countries
(Rwanda, Thailand, Japan)

21 May 2021

Outline of today's webinar

WaQuAC Net
Water Quality Asian Cooperation Network

- **Title:**

  Current situation of small water utilities in rural areas of three countries

- **Objectives:**

  Small water supply in rural areas is behind in development compared to water supply in urban areas. More attention is needed to improve this situation.

  1. Participants will understand the current situation of rural water supply in three countries through presentations.
  2. Participants and presenters will discuss measures to improve the situation.

Outline of today's webinar

WaQuAC Net
Water Quality Asian Cooperation Network

- **Program**

00:00 – 00:15	Opening and introduction	
00:15 – 1:08	3 Presentations	Presenter
	Rural Water Services and Infrastructure Management in Rwanda	Vincent de Paul MUGWANEZA Director of Rural Water and Sanitation Services/ WASAC
	Current situation of community water supply in Khon Kaen region and collaborative project with PWA (Provincial Waterworks Authority), Khon Kaen University and 10th Regional Office of Environment	Dr. Rittirong Junggoth Mr. Mongkol Thananawanukul Ms. Wasana Watanakul Supported by Dr. Yoshinobu Ishibashi
	Small water supply systems in Japan	Dr. Mari Asami National Institute of Public Health
1:08 – 1:28	Q&A	
1:28 – 1:30	Closing	

7th WaQuAC-NET Webinar

Rural Water Services and Infrastructure Management in Rwanda

BY: Vincent de Paul MUGWANEZA
Director of Rural Water and Sanitation Services/ WASAC

May 2021

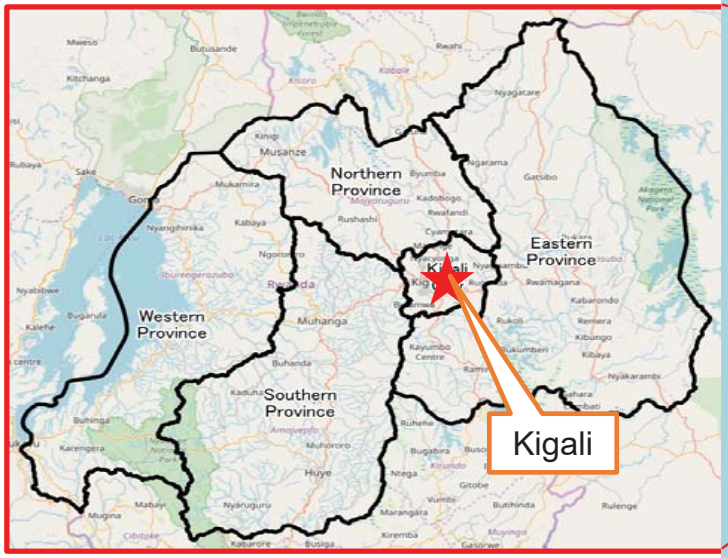
OUTLINE

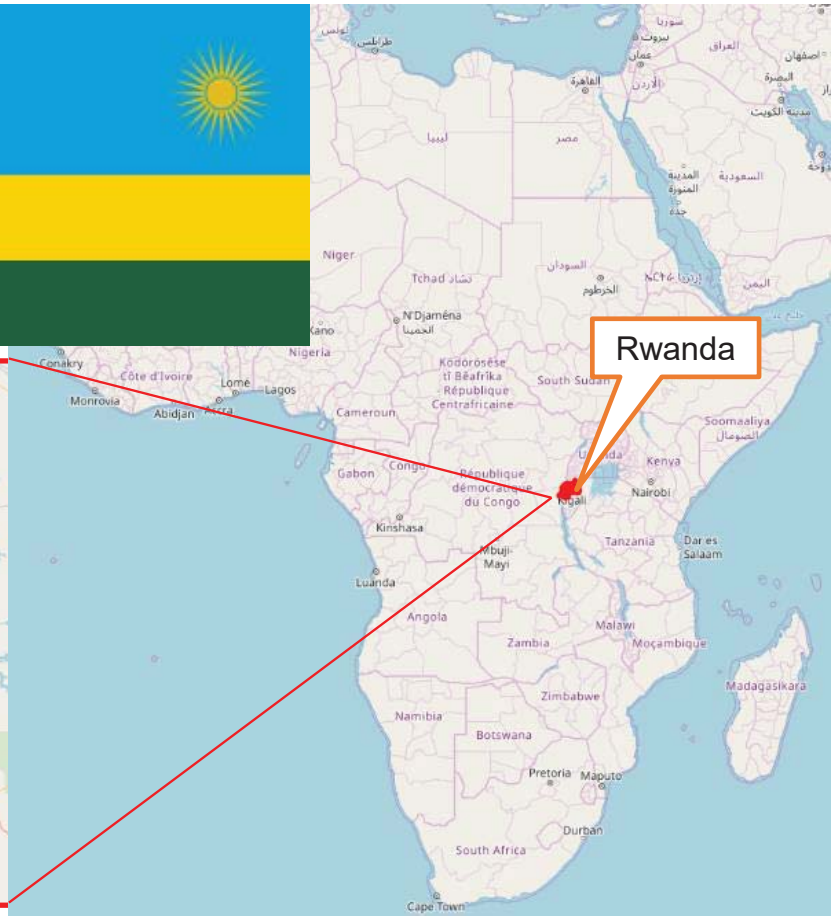
- General information about Rwanda
- Water Supply in Rwanda - Government policy
- Structure of O&M Framework for Water Supply Systems
- Water supply systems status in the Rural areas of Rwanda
- The Instruments Developed to Maintain Water Supply Infrastructure in Rural areas

OUTLINE Cont'd

- Problems/challenges associated with the maintenance of Water Supply Infrastructure in Rural areas and Criteria to address the challenges .

General information about Rwanda





General information about Rwanda Cont'd

- Area: 26,338km2
- Population: 12.6 million (2019)
- Capital city: Kigali
- Language: Kinyarwanda, English, French, Swahili
- Religion: Christianity, Islam
- GDP: USD 10.209 billon (2019)
- GNI per capita: USD 830 (2019)
- Economic Growth Rate: 7.2% (2019)
- The most **safe** and **clean** country in Africa

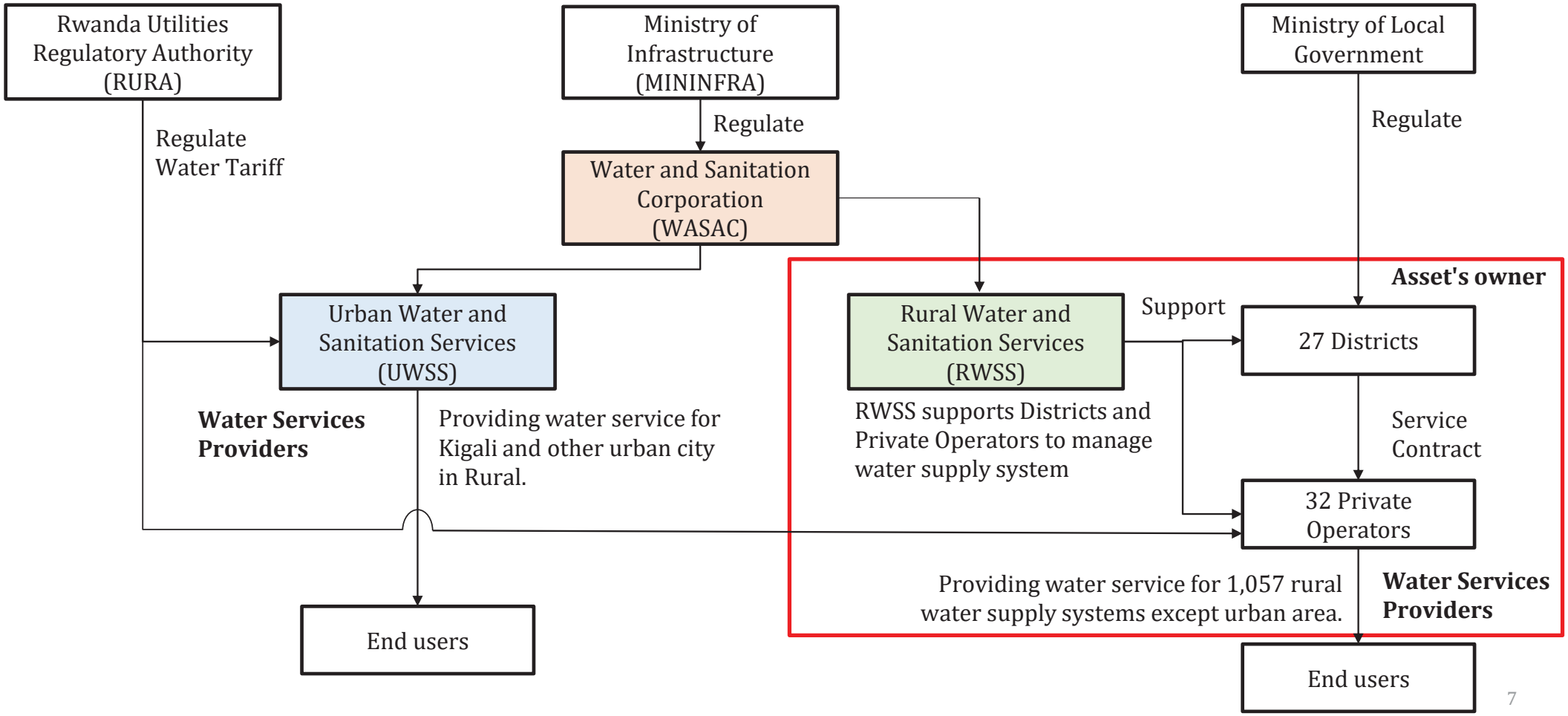
Water Supply in Rwanda - Government policy

- The water and sanitation sector in Rwanda is guided by the National Water Supply and Sanitation Policies and Strategies which were approved in December 2016;

- The Government of Rwanda, through WASAC, recognizes that access to water is a human right, and is a necessity for improvement in many other living standards, thus much effort and investment have put to ensure all Rwandans have access to potable Water.

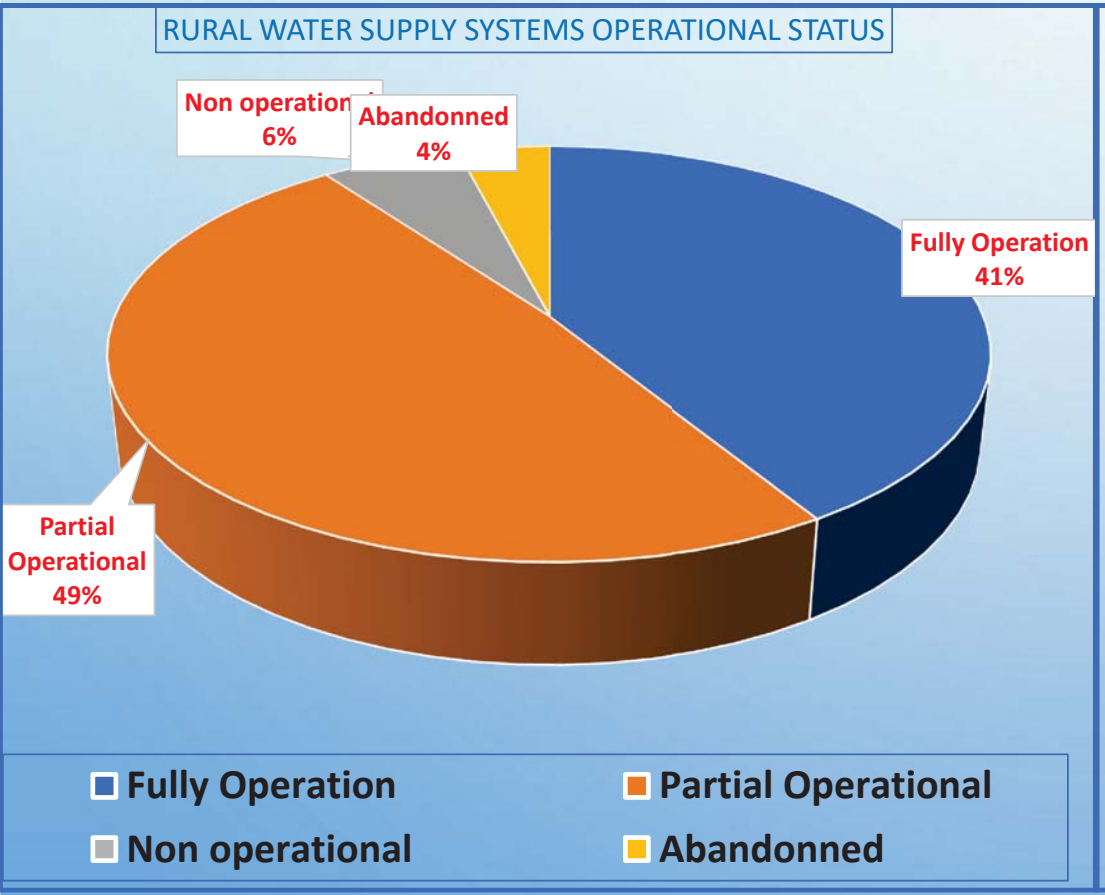
- Therefore, Rwanda has committed to reach SDGs targets by 2030 through the different programs such as the NST1 and 7 Years Government Program aim of achieving universal access to basic water and sanitation services by 2024;

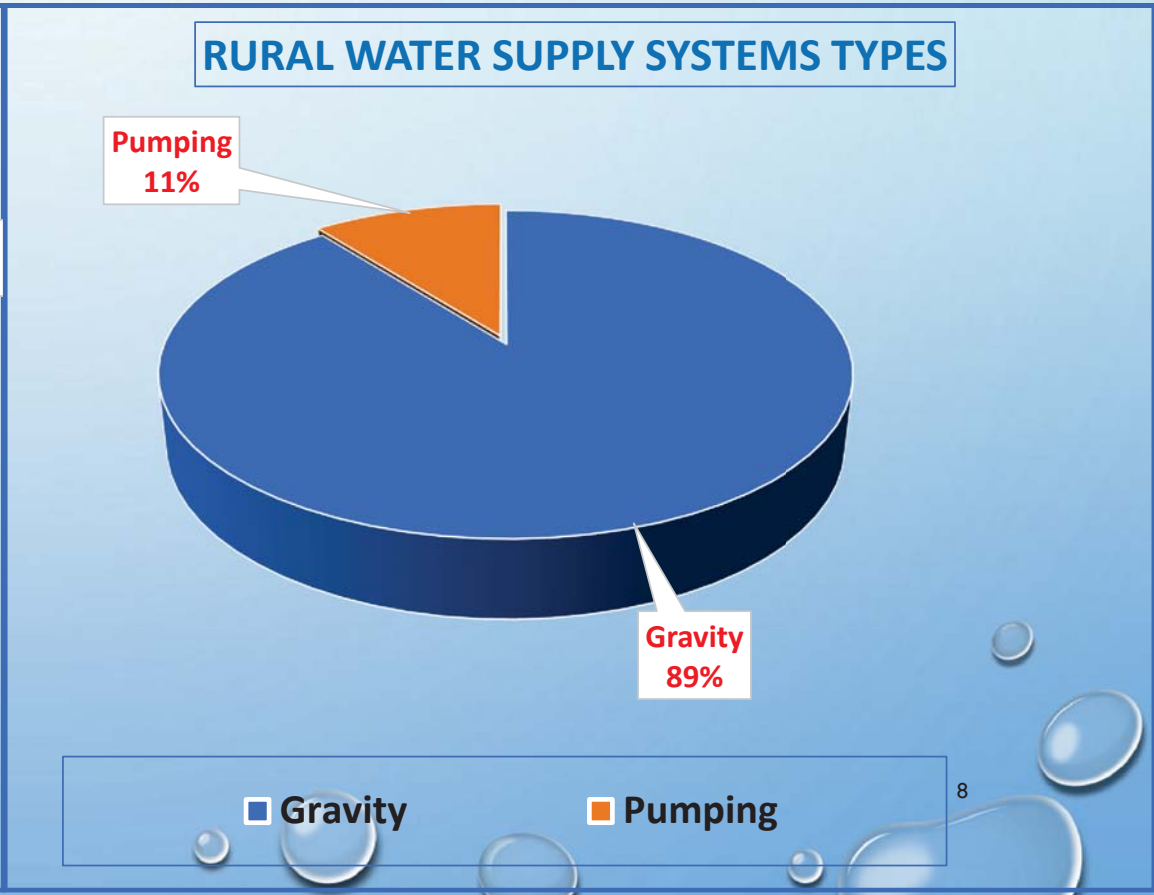
Structure of O&M Framework for Water Supply Systems



WATER SUPPLY SYSTEMS STATUS IN THE RURAL AREAS OF RWANDA

RURAL WATER SUPPLY SYSTEM TYPES & STATUS

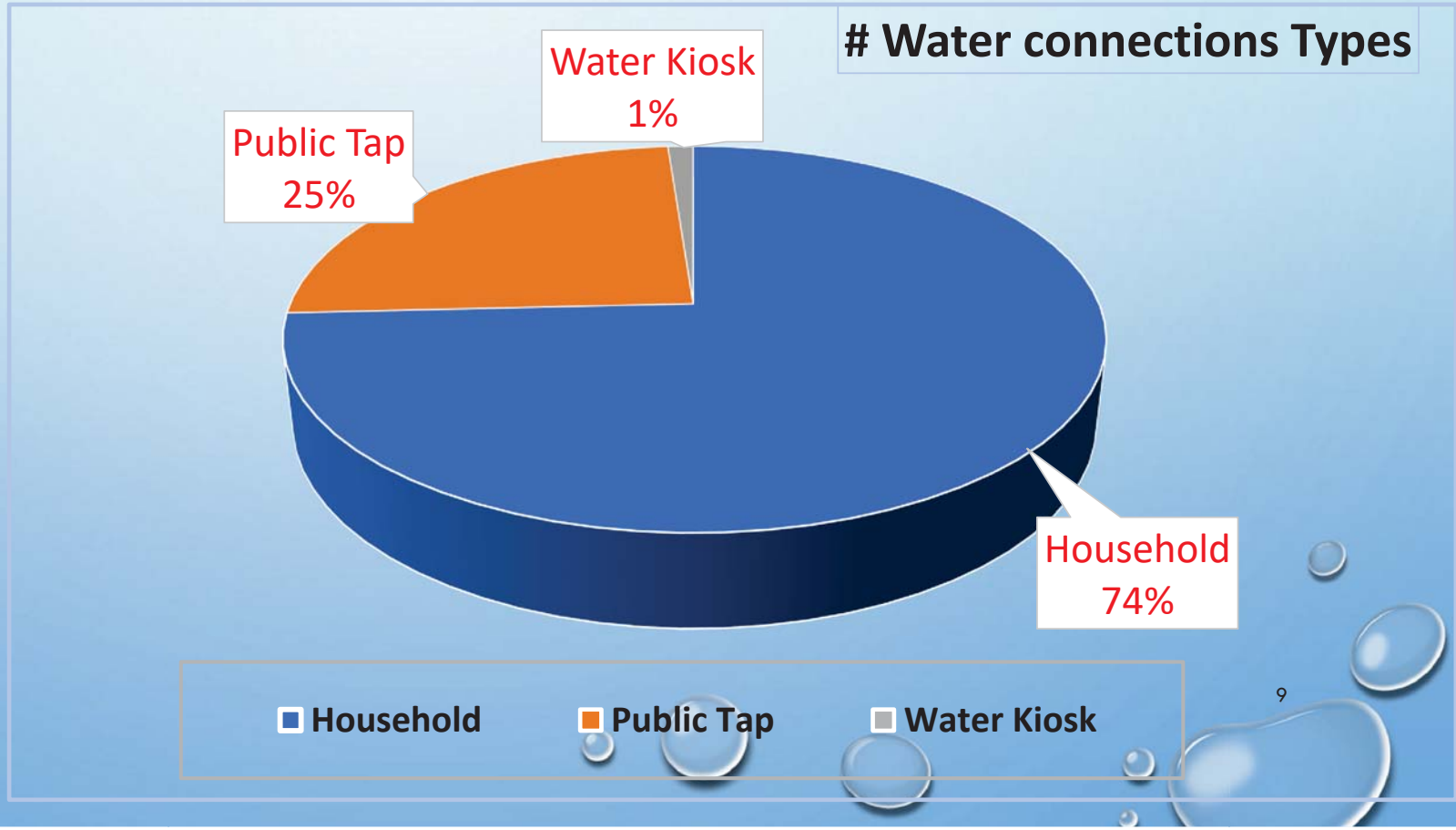




WATER SUPPLY SYSTEMS STATUS IN THE RURAL AREAS OF RWANDA CONT'D

WATER CONNECTION S TYPE

Conn. Type	# Water connections
Household	39,970
Public Tap	13,249
Water Kiosk	636
Other connections	971
TOTAL	**54,826**



Types of water connections available in Rwanda

The Rural water tariff applied in Rwanda depends on the type of water supply system in terms of energy used to deliver water

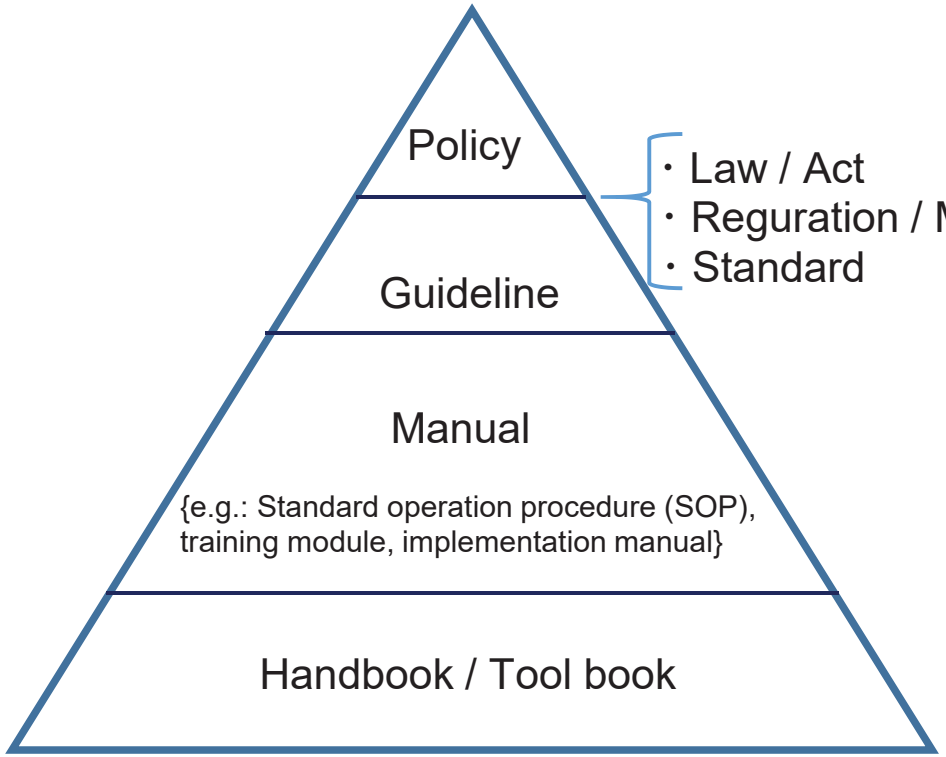
Water system	TARIFFS VAT EXCLUSIVE		TARIFFS VAT INCLUSIVE	
	Tariff RWF/m^3	Tariff RWF/Jerrican	Tariff RWF/m^3	Tariff RWF/Jerrican
Gravity	**287**	**7**	**338**	**8**
Electricity pumping	**731**	**17**	**863**	**20**
Diesel Pumping	**921**	**21**	**1,087**	**25**
Turbo	**689**	**16**	**814**	**19**
Complex System	**597**	**14**	**704**	**16**

TYPES OF WATER SOURCES USED IN RWANDA

WATER TREATMENT METHODS USED IN RWANDA DEPEND ON WATER SOURCE

The Instruments Developed to Maintain Water Supply Infrastructure in Rural areas

Conceptual



- Law / Act
- Reguration / Ministerial order
- Standard

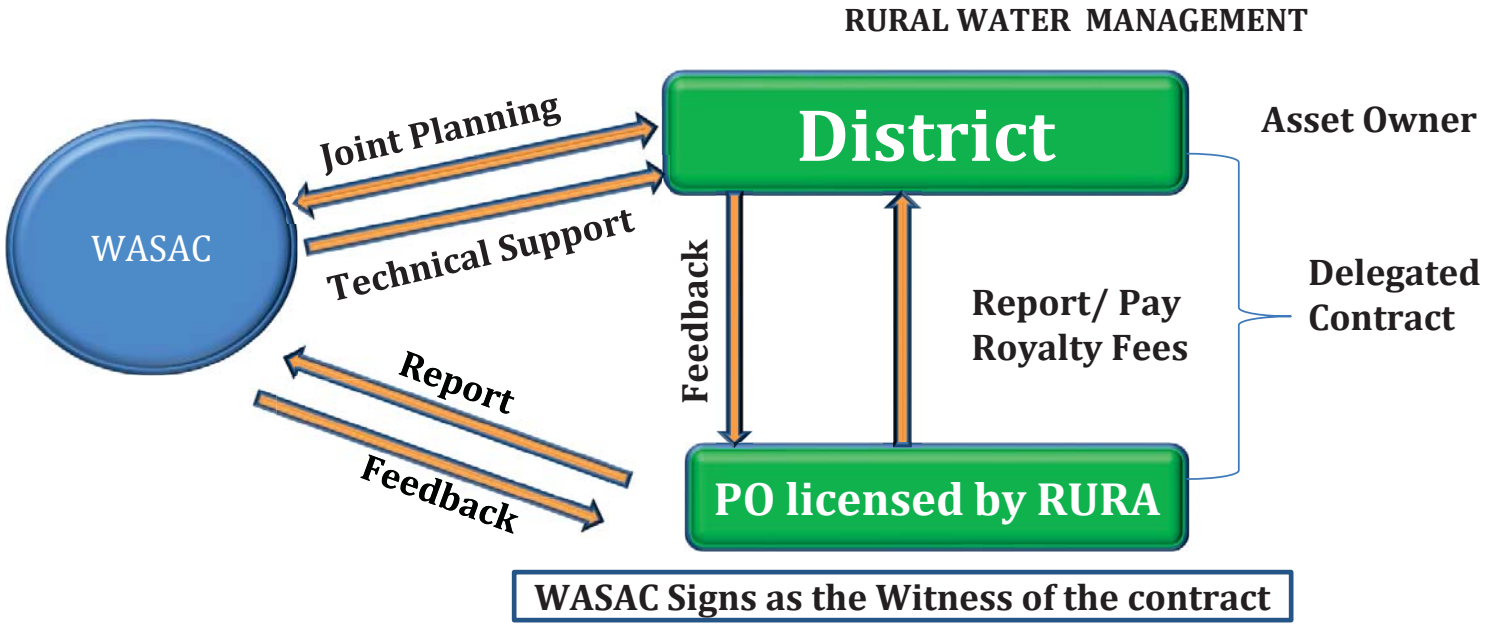
Practical

Major problems/challenges associated with the maintenance of WS Infrastructure in Rural areas and proposed measures .

Challenges	Measures to address the challenges
1 PO's Capacity gaps still observed in the delegation of Rural Water Supply systems, mostly their contractual obligations and responsibilities	More effort to be put in their capacity building, to ensure that their improved managerial and technical levels

Major problems/challenges associated with the maintenance of WS Infrastructure in Rural areas and proposed measures .

Challenges	Measures to address the challenges
2 Effectiveness in overseeing the Private Operator's management contract	More effort is needed in the monitoring of the Rural Water supply systems management contract and the enforcement of the contract.



Major problems/challenges associated with the maintenance of WS Infrastructure in Rural areas and proposed measures .

Challenges	Measures to address the challenges
3 Hand pumps, and Boreholes not properly managed and resulting to damages, and unsustainability.	A framework for the management of boreholes and their Operation and Maintenance should be put in place.

Major problems/challenges associated with the maintenance of WS Infrastructure in Rural areas and proposed measures cont'd.

	Challenges	Measures to address the challenges
4	Vandalism of Water infrastructure	Community mobilization on the ownership of the infrastructure need to be emphasized, and the involvement of local government is needed.

Stolen Reservoir metallic cover

THANK YOU FOR YOUR ATTENTION

Current situation of community water supply in Khon Kaen region and collaborative project with PWA (Provincial Waterworks Authority), Khon Kaen University and 10th Regional Office of Environment

Mr. Rittirong Junggoth
Ph.D. in Environmental Management,
Lecturer: Department of Environmental Health & Occupational Health and Safety,
Faculty of Public Health, Khon Kaen University
Mr. Mongkol Thananawanukul
Environmentalist Senior Professional Level, 10th Regional Office of Environment(Khon Kaen), Pollution Control Department, Ministry of Natural Resources and Environment
Ms. Wasana Watanakul
Director of Regional Training Center 2, Provincial Waterworks Authority

Supported by

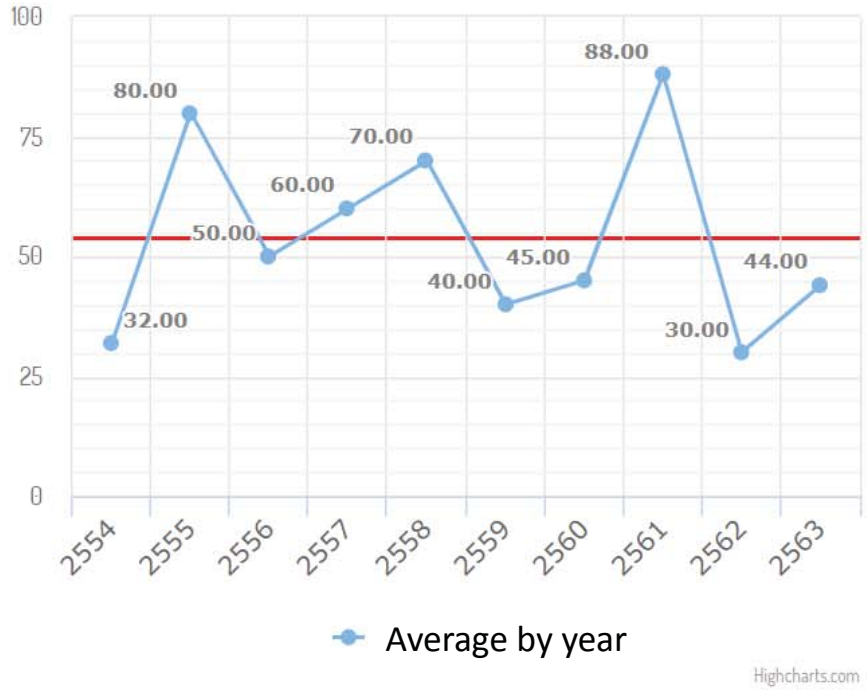
Yoshinobu Ishibashi
Former Professor, Faculty of Public Health, Khon Kaen University

Current Situation of Water Supply and Drinking Water of Thailand

http://dashboard.anamai.moph.go.th/envwaterquality/envwaterquality/index?year=2021

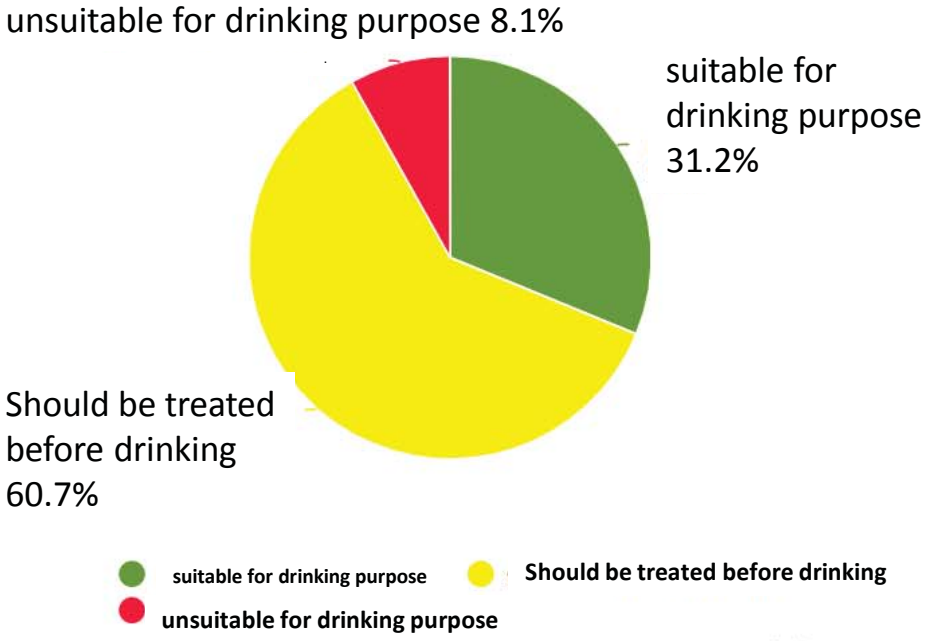
Department of Health, Ministry of Public health

Percentage of Water supply which are meet standard in 10 years retrospective.

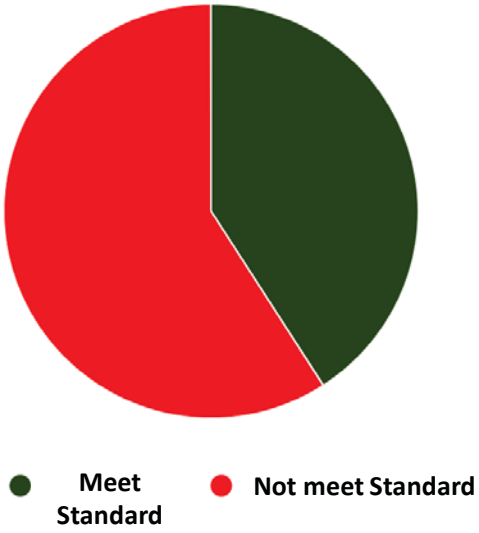


Average in past 10 years (53.9)

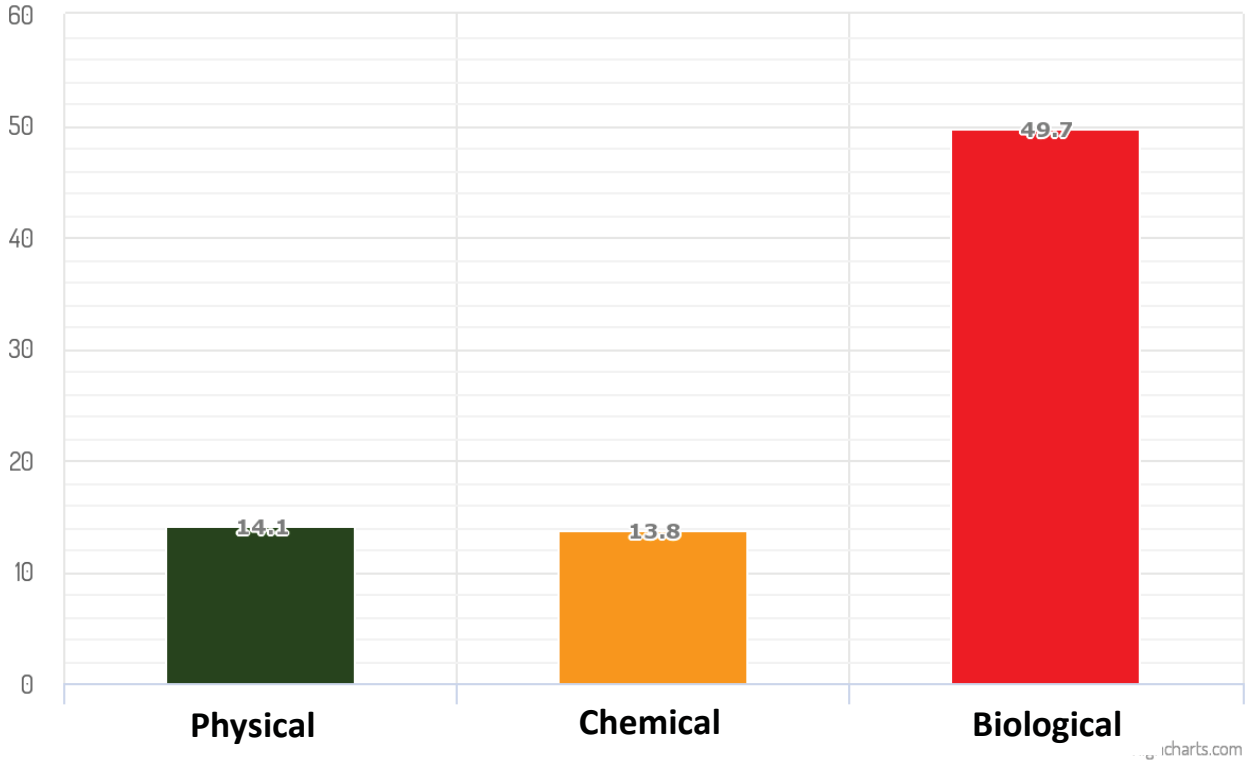
Water supply suitability for drinking proportion



Percentage of Water supply which are meet standard

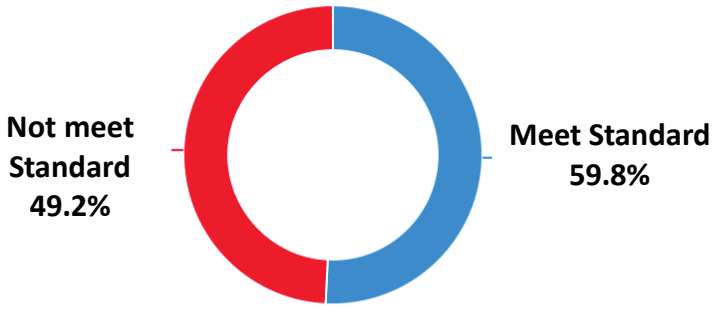


Percentage of Water supply which are NOT meet standard sorted by characteristics

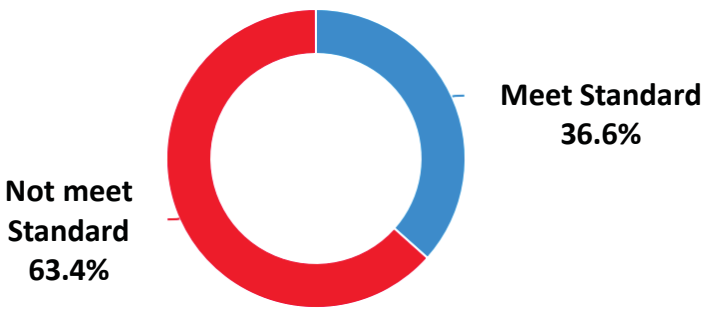


Local Administrative Organizations (LAOs)

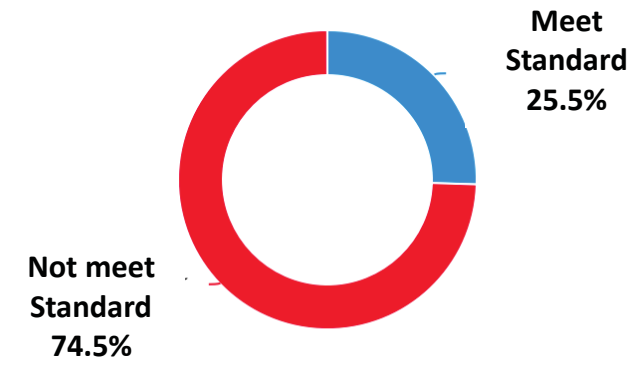
City /Town Municipality



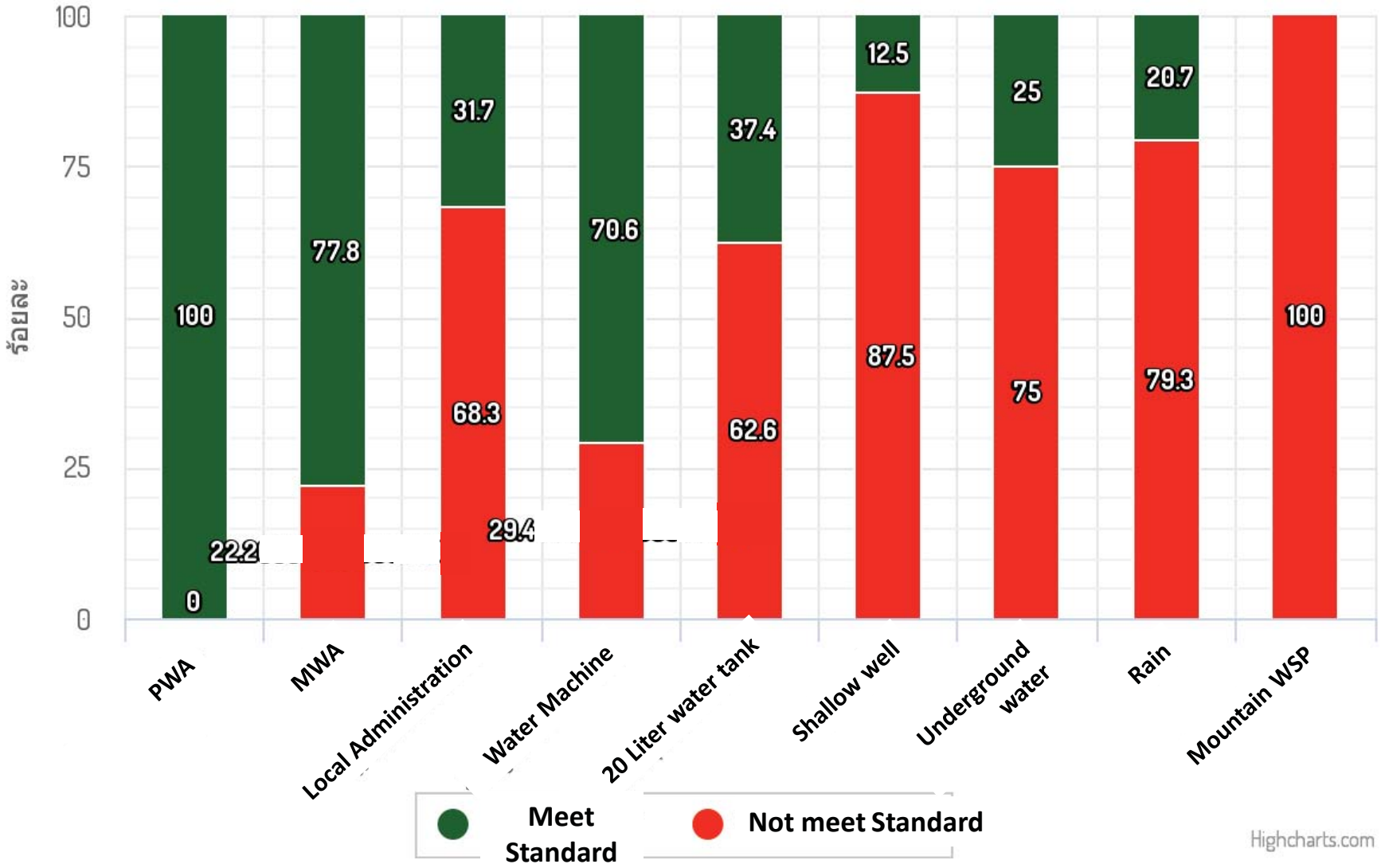
Subdistrict Municipality



Subdistrict Administrative Organization



Percentage of Water supply which are meet standard sorted by sources



Thailand's water supply

MWA : Metropolitan Waterworks Authority

Bangkok, Nonthaburi and Smut PraKan

PWA : Provincial Waterworks Authority

74 Provinces

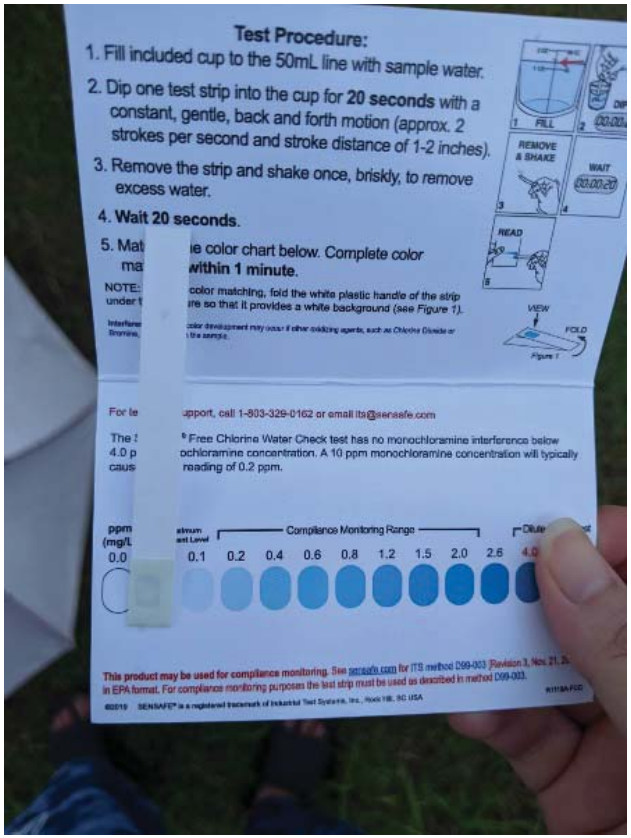
LAOs : Local Administrative Organizations

Village Water supply Committee

Water quality items that do not meet Thai water standards

Source:: REO10

		Total number 30
Water quality item	Number that does not meet the standard	Percent
Turbidity	**7**	**22.3**
Color	**11**	**36.7**
TDS	1	3.3
Chloride	2	6.7
Sulfide	2	6.7
pH	6	20
Total coliform bacteria（TCB）	**20**	**66.7**
Fecal coliform bacteria（FCB）	**20**	**66.7**
Fe	**4**	**13.3**
Mn	**4**	**13.3**
Fluoride	1	3.3
Pb	2	6.7
Zn	1	3.3
As	1	3.3



No residual chlorine detected with tap water

Full of trash

flocculation basin with no flow, overflow, and algae attachment

Impossible coagulation operation to pour raw water directly

Improbable coagulation operation

Aluminum Ammonium Sulfate

Calcium hypochlorite

Water leakage

Role of 10th Regional Office of Environment (Khon Kaen)

Mr. Mongkol Thananawanukul
Environmentalist Senior Professional Level

Role of 10th Regional Office of Environment (Khon Kaen)

Mr. Mongkol Thananawanukul
Environmentalist, Senior Professional Level
Director of Environmental Quality Analysis Section, REO 10





The development of water quality analysis system for village water supply



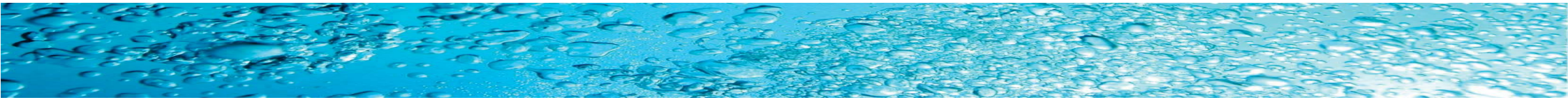


Role of Regional Training Center 2 Provincial Waterworks Authority

Ms. Wasana Watanakul
Director of Regional Training Center 2, Provincial Waterworks Authority

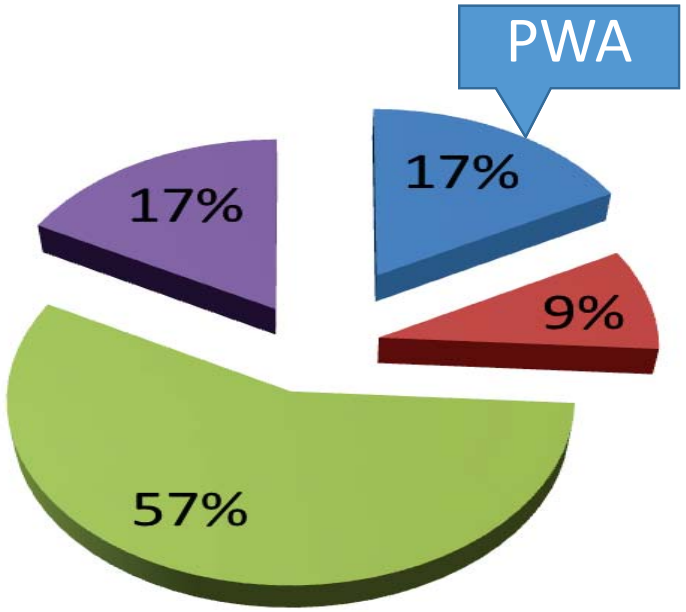
Provincial Waterworks Authority

PWA



การประปาส่วนภูมิภาค
Provincial Waterworks Authority

The Organization providing water supply in Thailand



- Provincial Waterworks Authority
- Metropolitan Waterworks Authority
- Municipality/Subdistrict/Village
- No Tap water

การประปาส่วนภูมิภาค
Provincial Waterworks Authority

PWA organization structure of serving customer is determined into 5 operation areas, 10 regional offices, 234 branches and 350 sub-brunch

การประปาส่วนภูมิภาค
Provincial Waterworks Authority

PWA policy

- Public service
  - To provide academic assistance to Local Administrative Organization by giving Knowledge and guiding standard practices in relation to producing clean water with international standards.

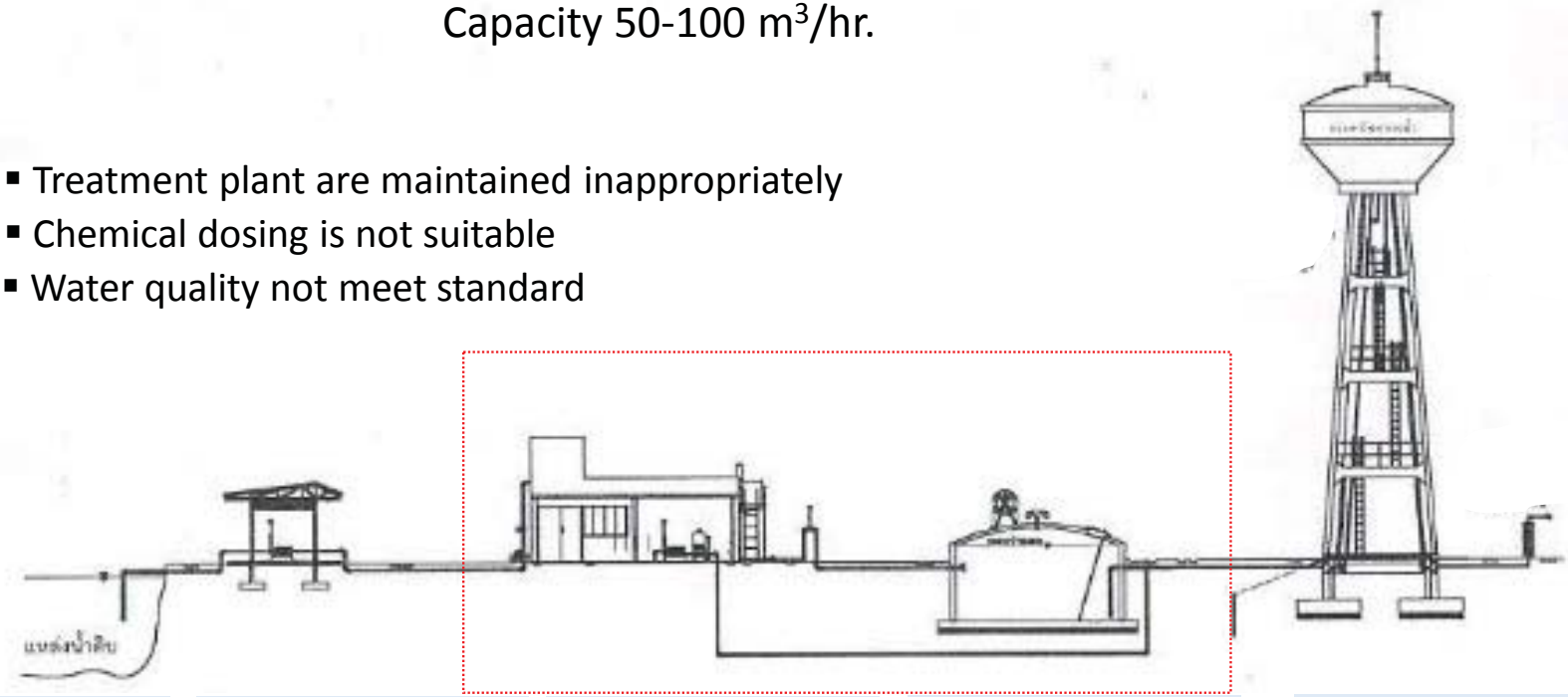
Regional training center 2 khon kaen

- Survey for Training need and Design Training Course for Small water supply
  - Water Treatment plant operation course
    - coagulation & flocculation
    - Jar test
    - disinfection
  - Water distribution system course
    - O&M pipeline
    - Leakage control

The process of water treatment plant in rural area

Capacity 50-100 m^3/hr.

- Treatment plant are maintained inappropriately
- Chemical dosing is not suitable
- Water quality not meet standard



Surface raw water	Intake pump	Treatment plant	Clear water tank	Elavated tank

Main topic to improve ability to operator

1. How to use chemical in optimum dose

2. How to monitoring water quality control such as pH , turbidity , Residual Chlorine
(Basic measurements in field, not in laboratory)

Main topic to improve ability to operator

4. Water distribution system

3. Operation & Maintenance pipeline

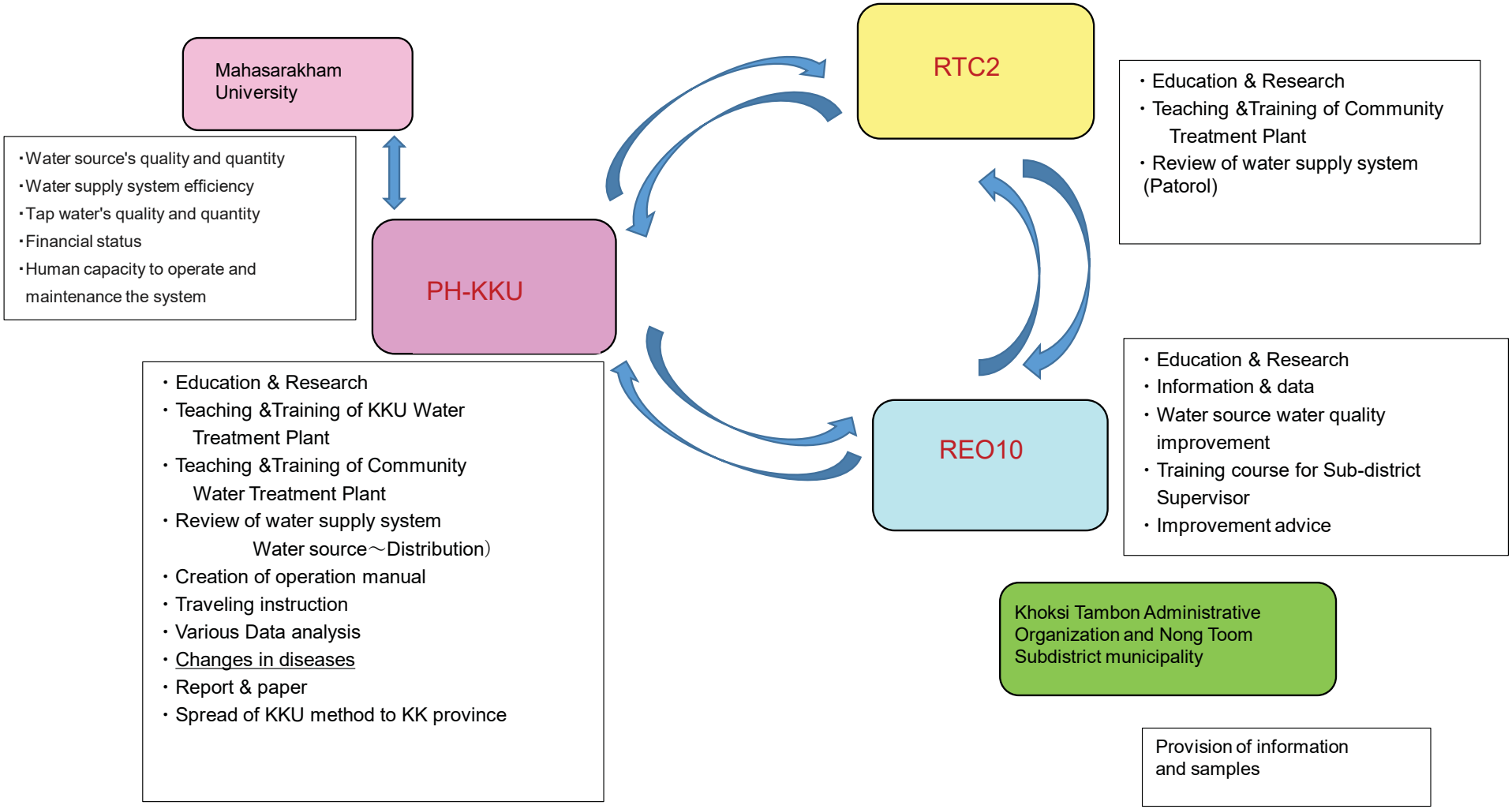
Different Agency-Different Ministry-One Hope

A healthy and well-being life through "safe water"

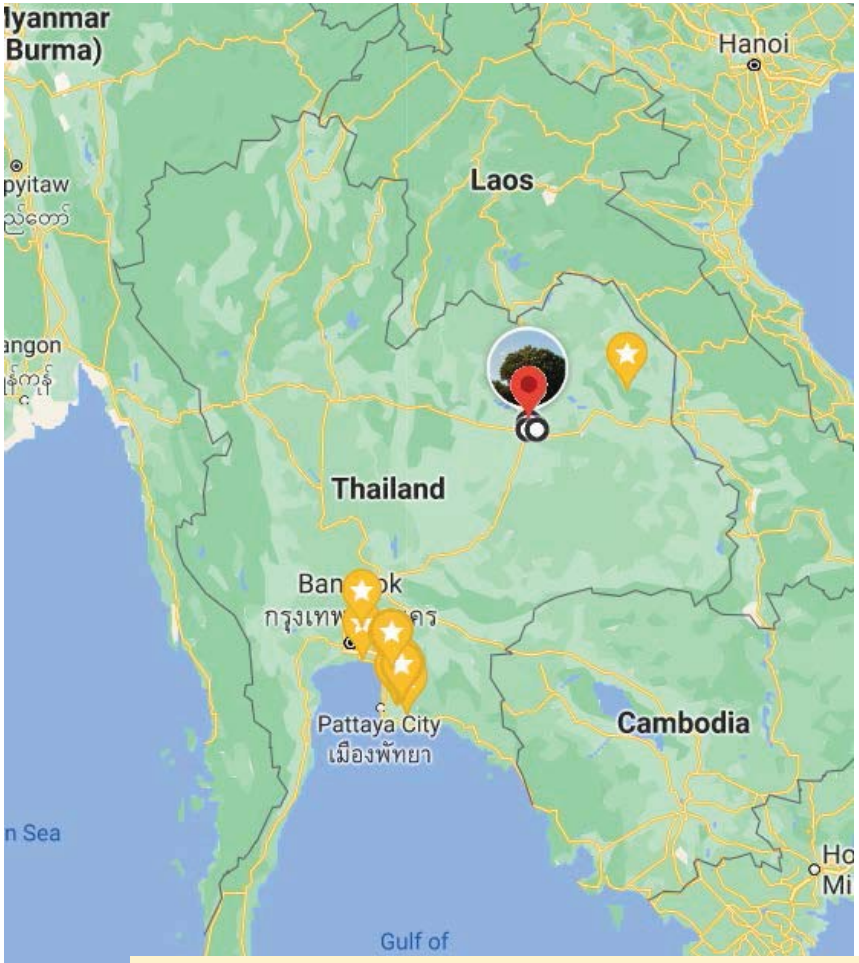
- The 10th Regional Office of Environment (Khon Kaen),
  Pollution Control Department
  Ministry of Natural Resources and Environment
- The Regional Training Center 2, Provincial Waterworks Authority
  State enterprise, Ministry of Interior
- Faculty of Public Health, Khon Kaen University
  Ministry of Higher Education, Science, Research and Innovation

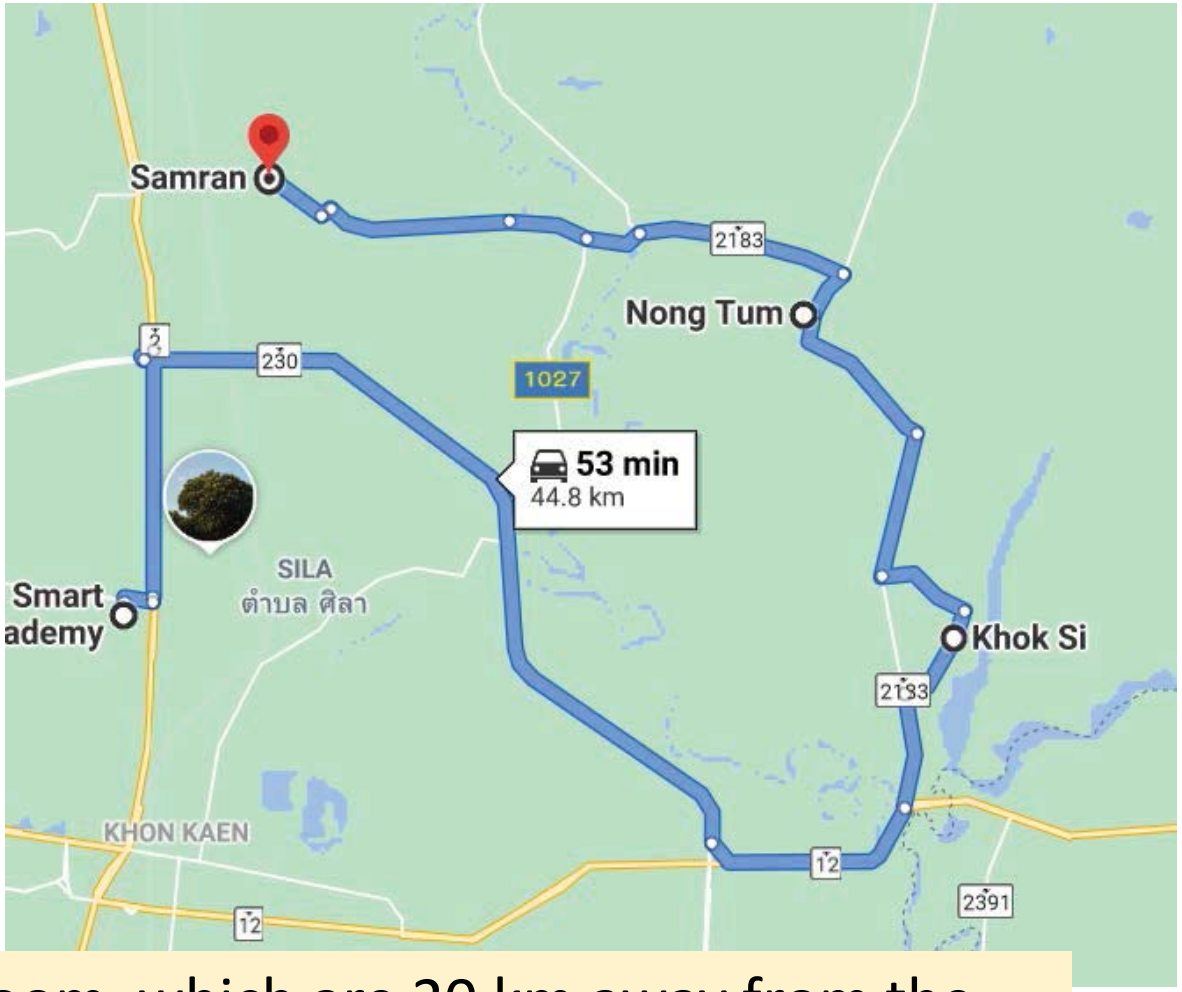
Collaborative research on improvement of water supply in rural communities of Thailand: Khoksi and Nong Toom Sub-district, Khon Kaen Province

A project was established to improve the water supply of the community water supply (village water supply)



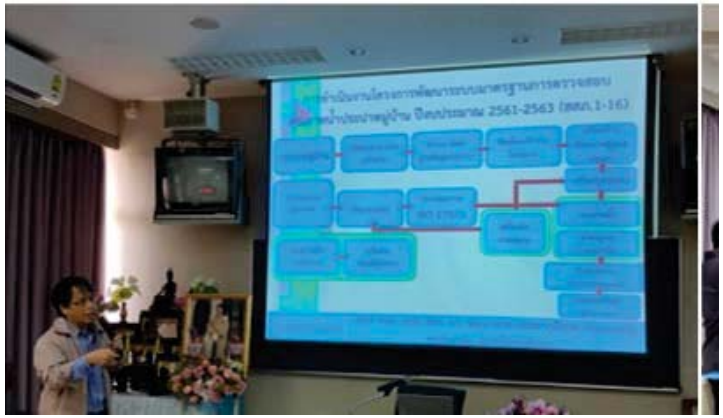
Role sharing in each organization





- We set Khoksi and Nong Toom, which are 20 km away from the university, as model areas and repeated the inspection
- We included Samran Subdistrict

Planning with them - Training - Working together



The first Workshop (2 Days) was held at Nong Toom
30 June – 1 July 2020

Lecture on water purification theory

Jar test and other indoor experiments

Training at an actual Water purification Plant

Not only the calculation of coagulant and chlor[redacted]e of injection amount, but also water quality inspection and electrical system were checked

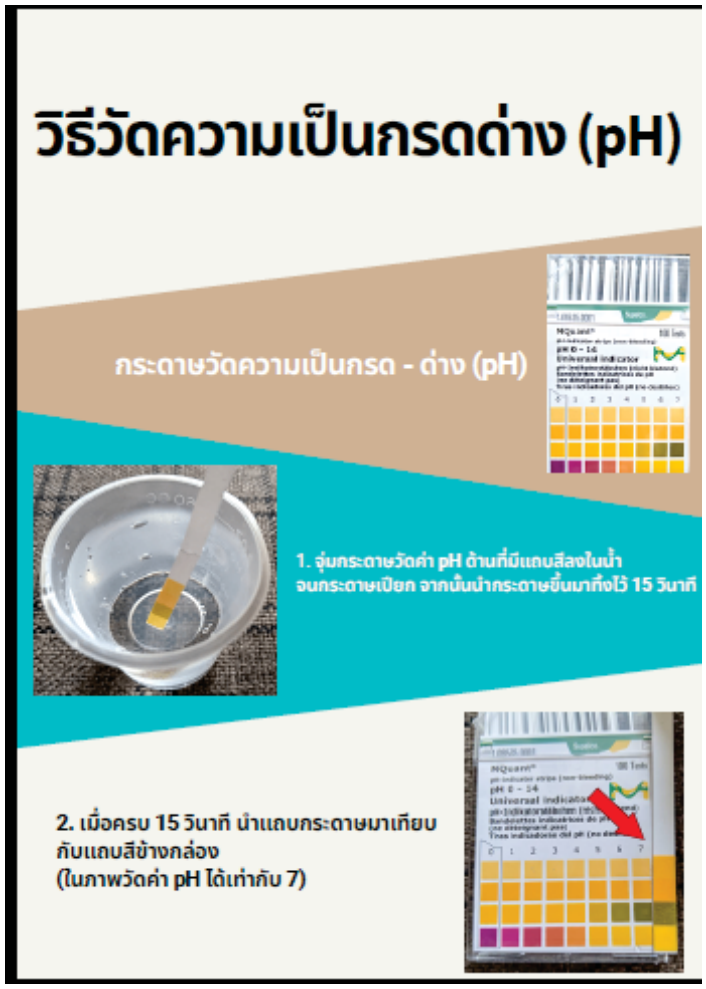
The second Workshop (2 Days) was held at RTC2
Distribution pipeline maintenance and water leakage

The study on the efficiency of using the appropriate amount of chlorine in the water supply system of Phrom Nimit Village, Khok Si Subdistrict, Mueang District, Khon Kaen Province

The optimum chlorine concentration in each coliform bacterial amount

Range of TCB (MPN/ 100 mL.)	Chlorine conc. (mg/L)	TCB , FCB in each contact time (MPN/ 100 ml.)									
		0		2		4		6		24	
		TCB	FCB	TCB	FCB	TCB	FCB	TCB	FCB	TCB	FCB
TCB : 0 – 1,000	Control	560	220	633	220	633	260	767	260	1,600	633
	1.50	6.67	4.00	3.33	2.00	< 1.8	< 1.8	5.33	2.00	3.33	2.00
	1.75	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8
	2.00	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8
TCB : 1,001 - 2,000	Control	1,440	900	1,340	880	1,560	960	1,560	900	1,960	1,340
	1.75	3.33	< 1.8	31.7	< 1.8	26.0	< 1.8	23.3	< 1.8	18.3	< 1.8
	2.00	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8
	2.25	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8
TCB : 2,001 - 3,000	Control	2,400	1,220	2,260	1,220	3,200	1,700	2,700	1,440	3,500	1,860
	2.00	6.67	< 1.8	17.0	< 1.8	15.7	< 1.8	29.7	< 1.8	31.0	< 1.8
	2.25	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8
	2.50	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8

The guide for chlorine disinfection at water treatment plant was tested at Khoksi, Nong Toom and Samran Subdistrict



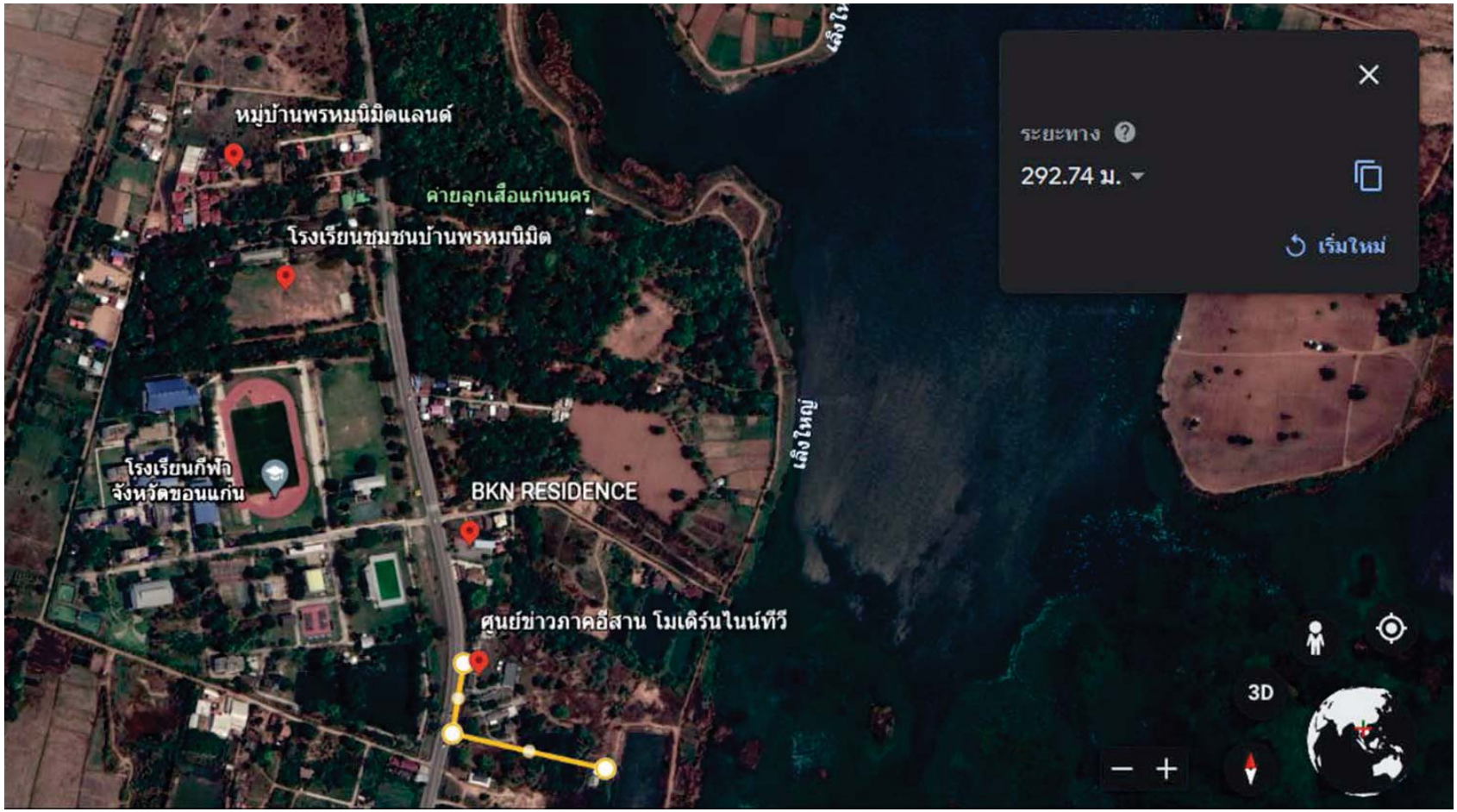
Khoksi: Ban Phrom Nimit water supply plant

Before

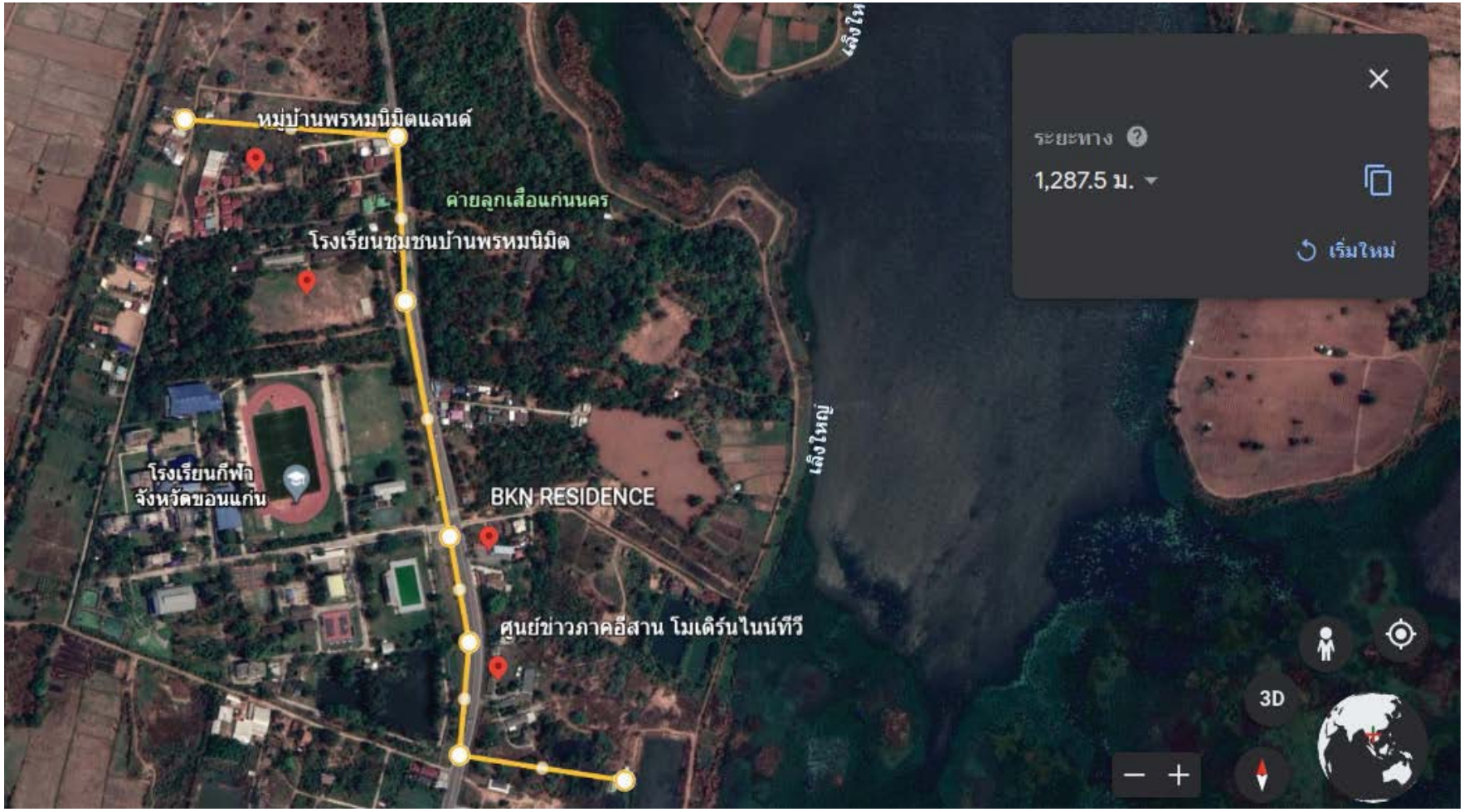
- **TCB = 2,800 MPN/100mL**
- **Free residual chlorine = 0 mg/L**

After

- **TCB = 0**
- **Free residual chlorine at the Plant= 2.0 - 2.6 mg/L**
- **Free residual chlorine at the nearest point = 2.0 mg/**
- **Free residual chlorine at the Farthest point = 0.6 mg/L**



Free residual chlorine at the nearest point = 2.0 **mg/**



Free residual chlorine at the Farthest point = 0.6 **mg/L**

Samran Subdistrict

Range of Total coliform bacteria (MPN/100 mL)	Chlorine concentration (mg/L)
0 – 1,000	1.75
1,001 – 2,000	2.00
2,001 – 3,000	2.25

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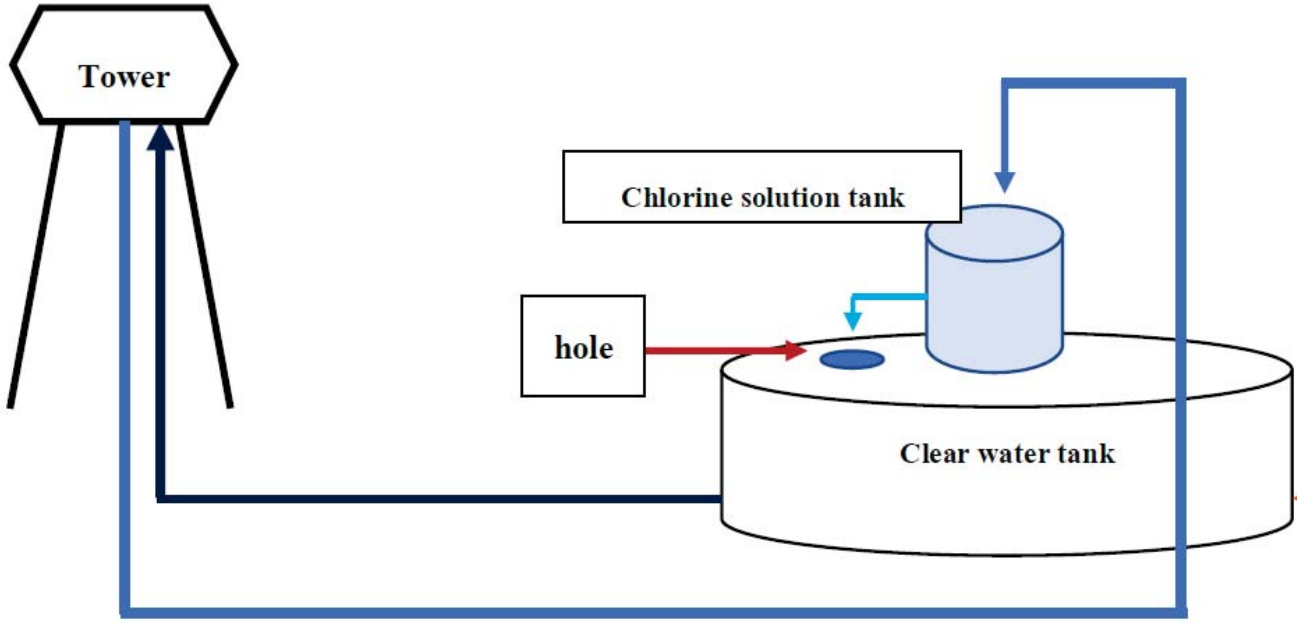
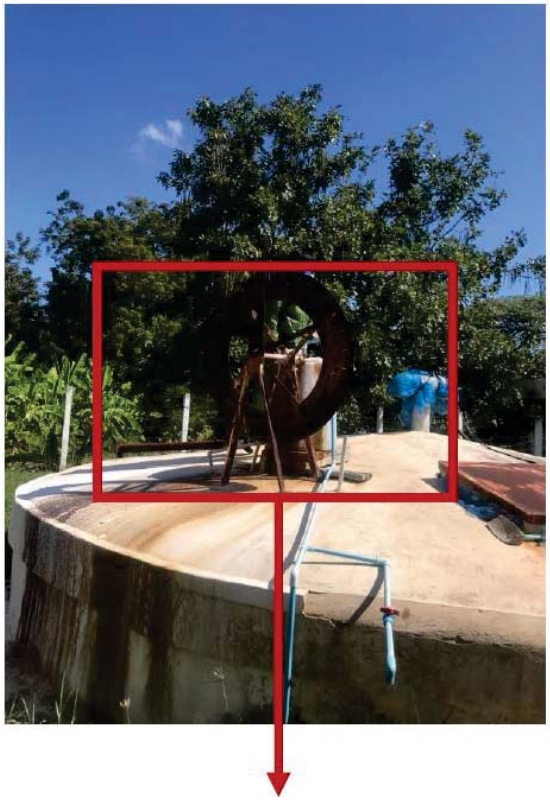
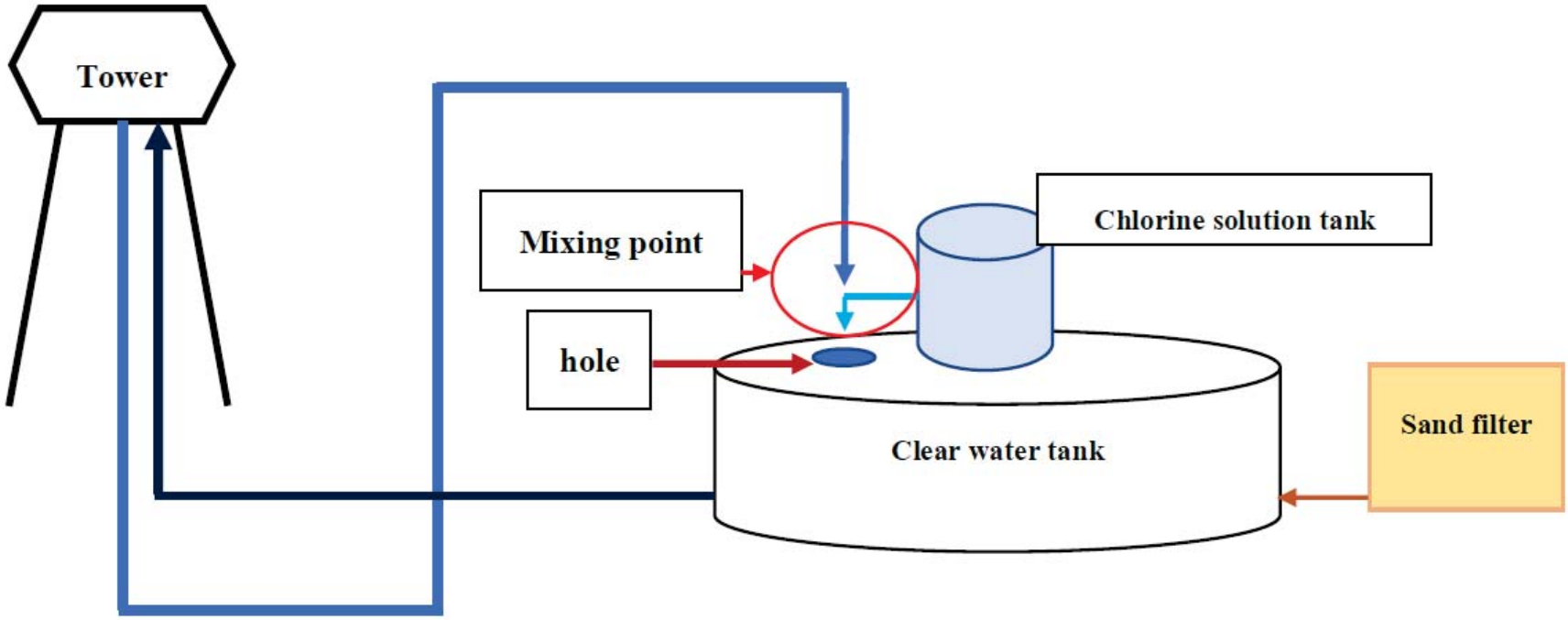


Old flow chart of chlorination in Samran WSP



Chlorine solution tank



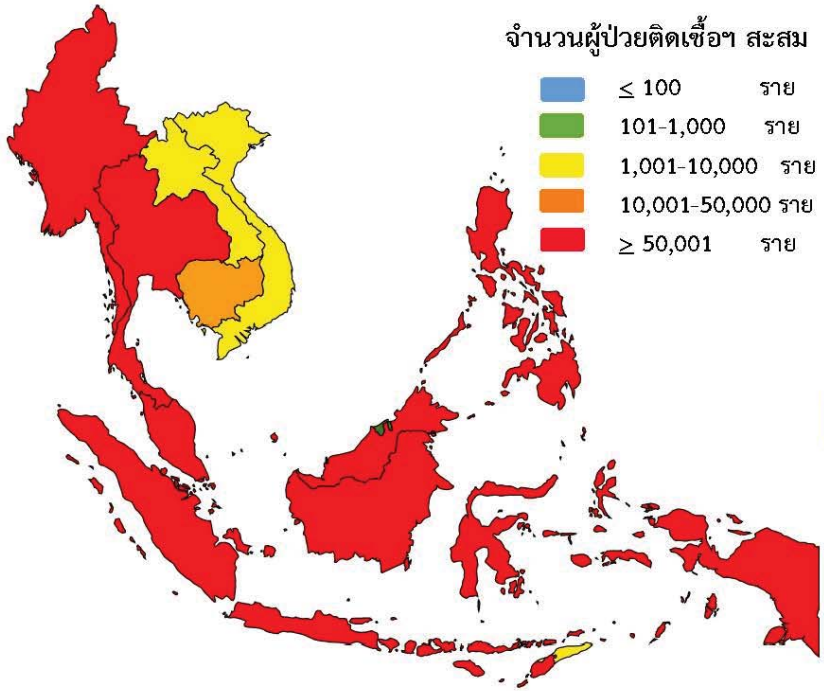
New flow chart of chlorination in Samran WSP that I request them to change

Still can not control Flow rate of Chorine solution

Nong Toom Sub-district

สถานการณ์ COVID-19 ประเทศในทวีปเอเชีย

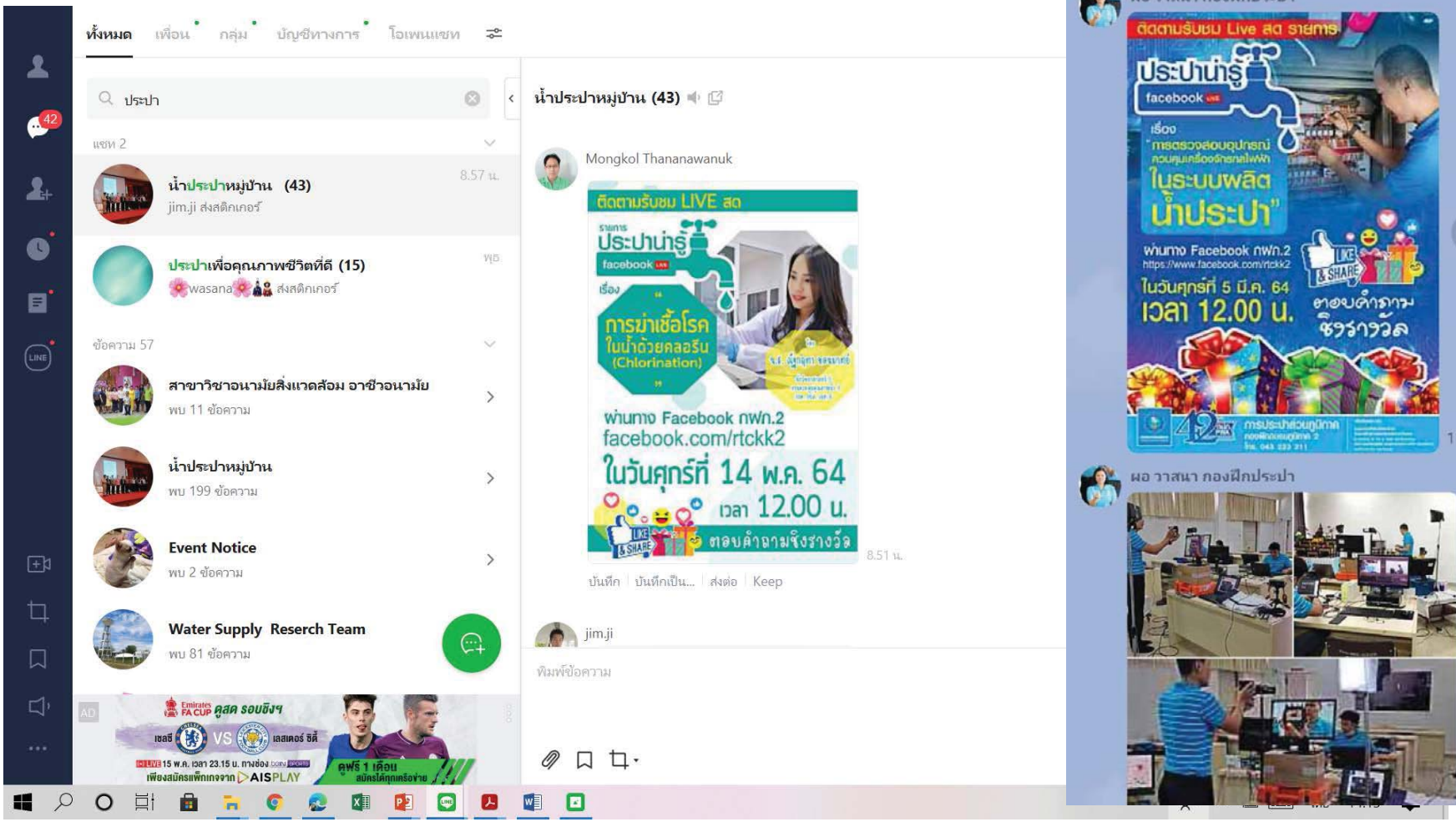
ประเทศในเอเชียพบผู้ป่วยอย่างต่อเนื่อง ได้แก่
อินเดีย อินโดนีเซีย ปากีสถาน ญี่ปุ่น บังคลาเทศ ฟิลิปปินส์ มาเลเซีย



(ข้อมูล ณ วันที่ 14 พฤษภาคม 2564 เวลา 10.00 น.) ที่มา : *worldometers*

	PLACES	CONFIRMED	NEW CASES	DEATHS	ACTIVE CASES
2	India	24,046,120	343,288	262,350(3,999)	3,710,403
18	Indonesia	1,731,652	3,448	47,716(99)	94,857
25	Philippines	1,124,724	6,385	18,821(107)	55,260
29	Pakistan	870,703	3,265	19,336(126)	75,052
33	Bangladesh	778,687	1,290	12,076(31)	46,992
38	Japan	658,629	7,058	11,165(101)	73,551
42	Malaysia	458,077	4,855	1,788(27)	41,582
82	Myanmar	143,004	7	3,212(1)	7,723
84	S. Korea	130,380	715	1,893(7)	8,092
94	Thailand	96,050	2,256	548(30)	33,186
96	China	90,815	9	4636	285
105	Singapore	61,453	34	31	393
133	Cambodia	21,141	446	142(6)	11,480
176	Vietnam	3,710	87	35	1,018
192	Laos	1,482	65	1	1,050
201	Brunei	231	0	3	8

We are still keeping in touch



Challenges for the future

- Aftercare is very important and needs to be dealt with patiently
- Manual and encouraging materials must be enriched
- A simple and easy to use Guideline for Coagulation and turbidity removal is important for the villager who taking care of water supply plant

Ms. Sujira Prasarnpun (Jeaw), graduate student: Coagulation
The use of coagulants to improve the quality of village water supply. A case study of Ban Phrom Nimit water supply plant, Khok Si subdistrict, Mueang district, Khon Kaen province, Thailand

THANK YOU

Small water supply systems in Japan

May 2021

7th WaQuAC-Net Webinar

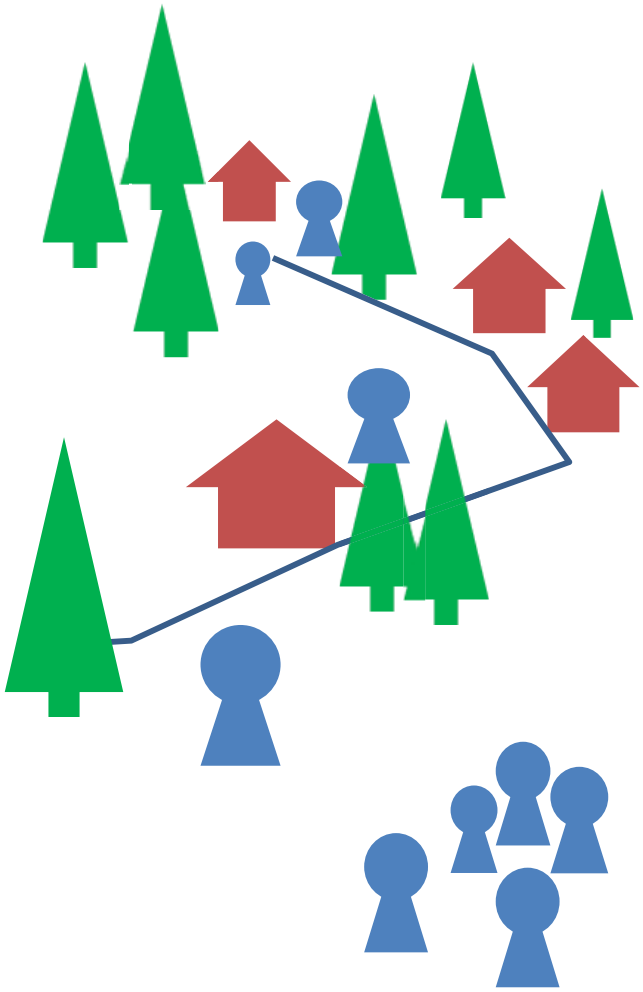
Mari Asami

Water Management Division
Department of Environmental Health
WHO Collaborating Centre for Community Water Supply and Sanitation
National Institute of Public Health

Today's issue

Sharing issues on small water supplies in Japan

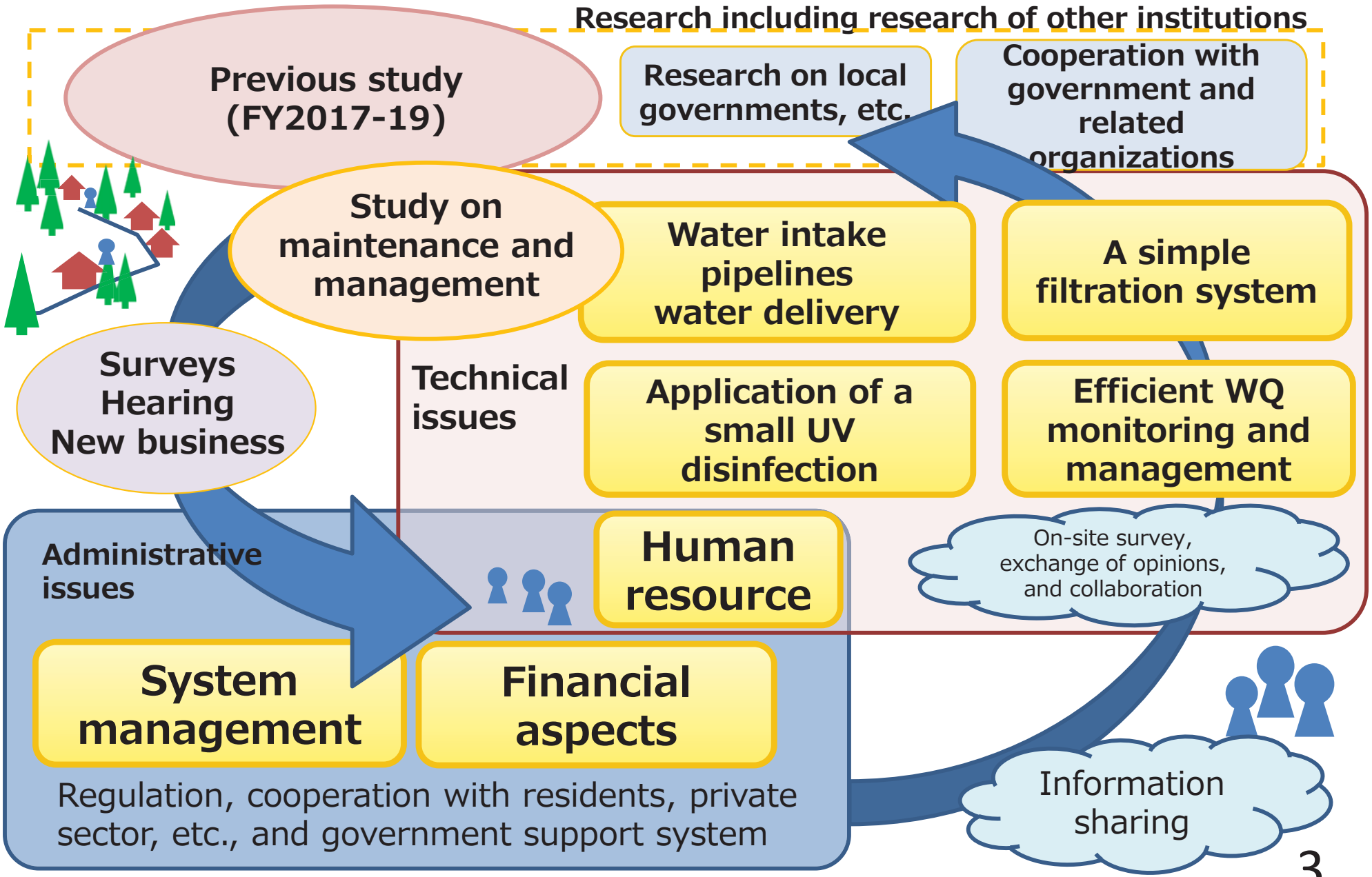
- Gov. Framework
- Technical issues
- Management
- Human resource



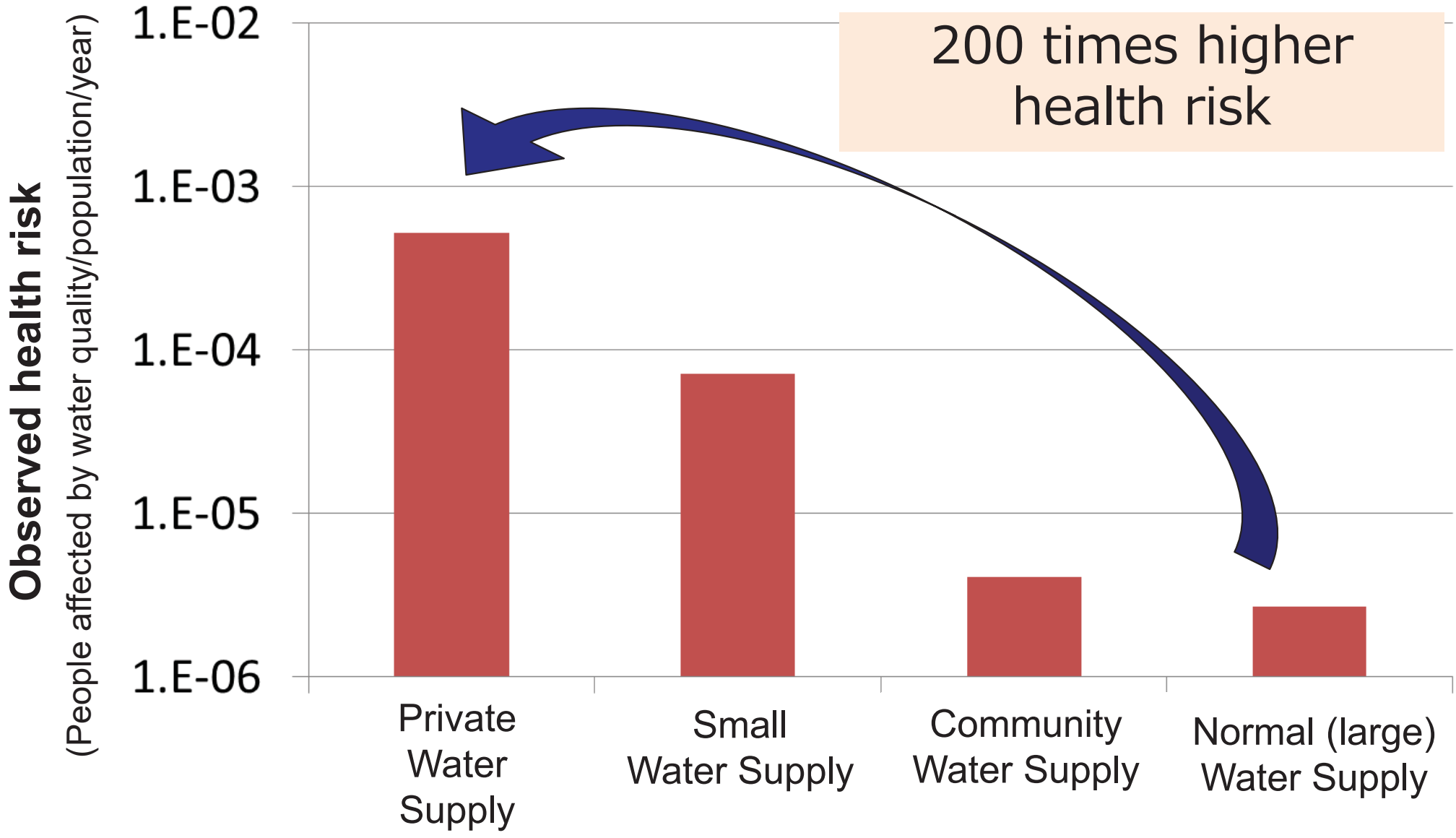
Introducing ongoing and future activities of the Small Water Supply Research Group

Grant-in-Aid for Scientific Research on Health, Labour and Welfare

Integrated research on sustainable maintenance of small water supply systems FY2020-2022



Small water supply facilities face higher risk



Health incidents over 30 years, illustrated by Asami based on Kishida et al.2015, Journal of National Institute of Public Health

Classification of water supply systems in Japan

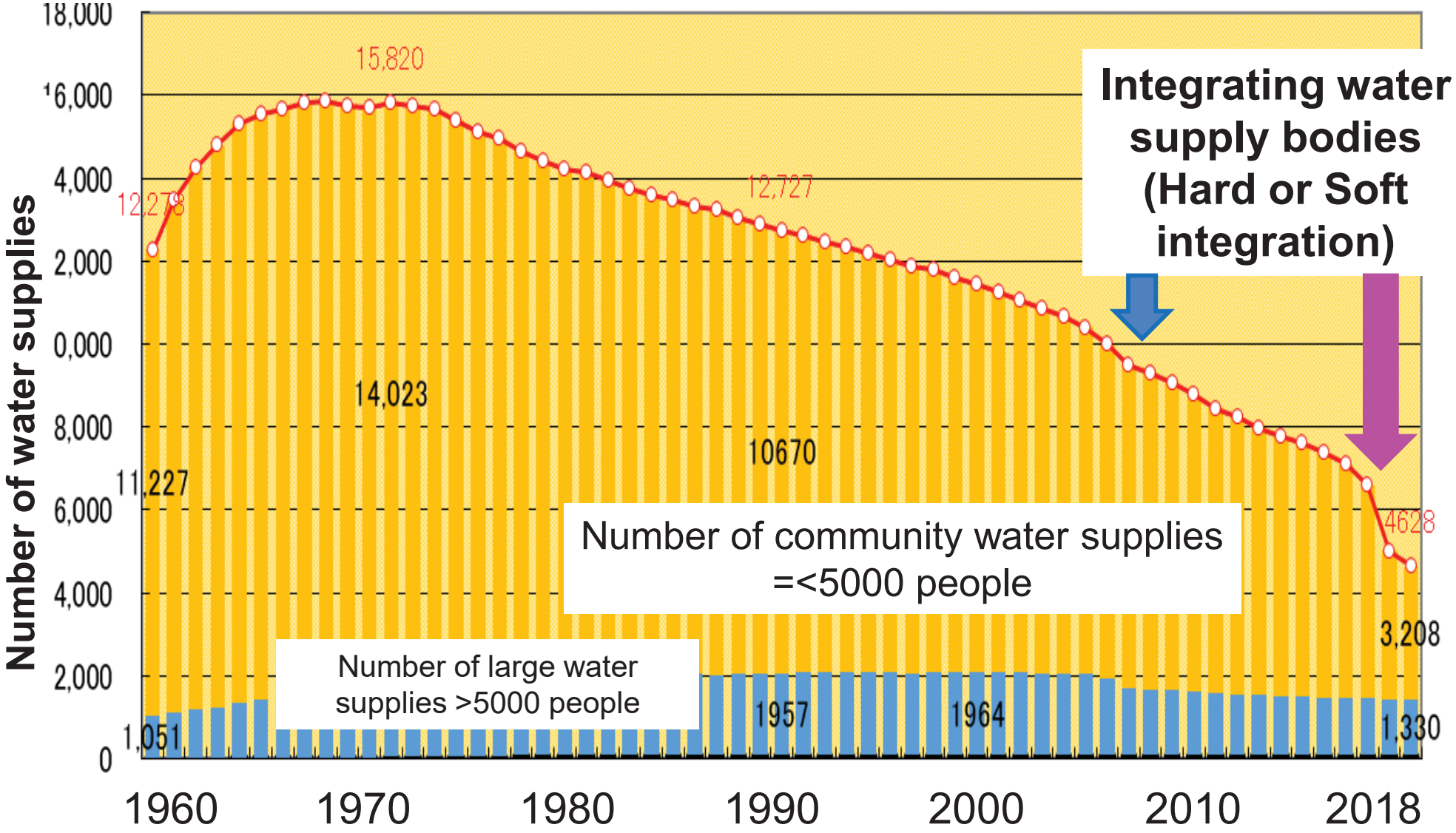
Water supply population	Classification	Authorization Body	Operation	Remarks
> approx. 50,000 people (*1)	(Public) Water supply body	Approved by Ministry (*2)	Prefectures, cities, public association, etc.	Strong public enterprise Enterprise
5,001 - 50,000	(Public) Water supply body	Approved by Prefecture	Cities, towns and villages	It actually varies depending on the scale and location
101 - 5,000 people	Community water supply	Approved by Prefecture	Cities, towns and villages	Integration with water supply is underway.
50 (30) -100	Small water supply facilities	Established by municipalities	Cities, towns and villages/Residents	By ordinance
Several houses	Group	(Partialy) Subsidized by municipalities	Residents (Adviced by municipal staff if available.)	Areas outside the zone, etc.
One family	Private well	Guidance by health departments and health centers	Residents	

around 3 million -> decreasing

Small water supply is used by 160 thousands of people

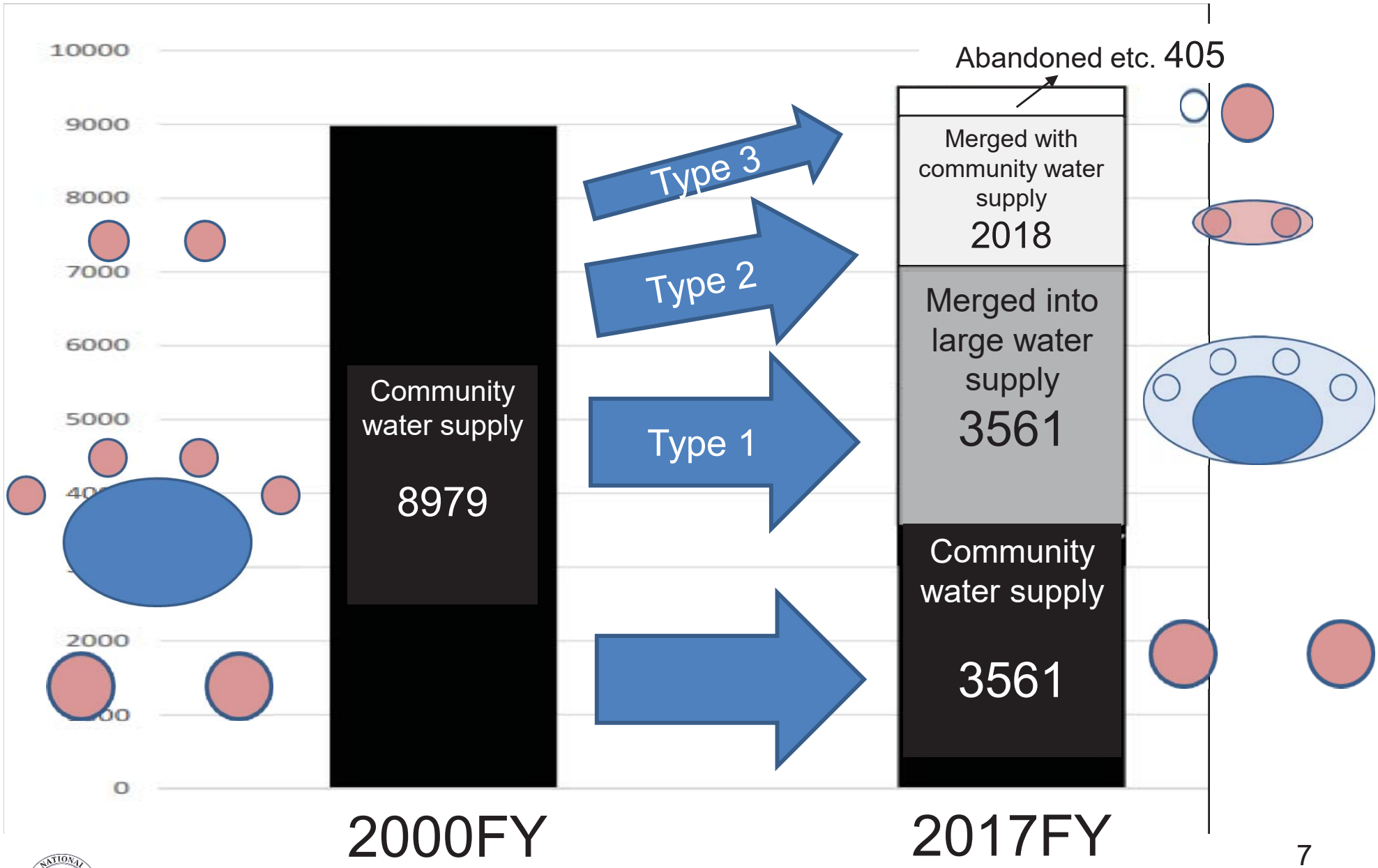
*1 Other than specified bulk water water suppliers or big water suppliers, normally approved by prefectural governments. *2 In some cases, the designated prefecture is the main approval body.

Trend of the number of water supplies in each category



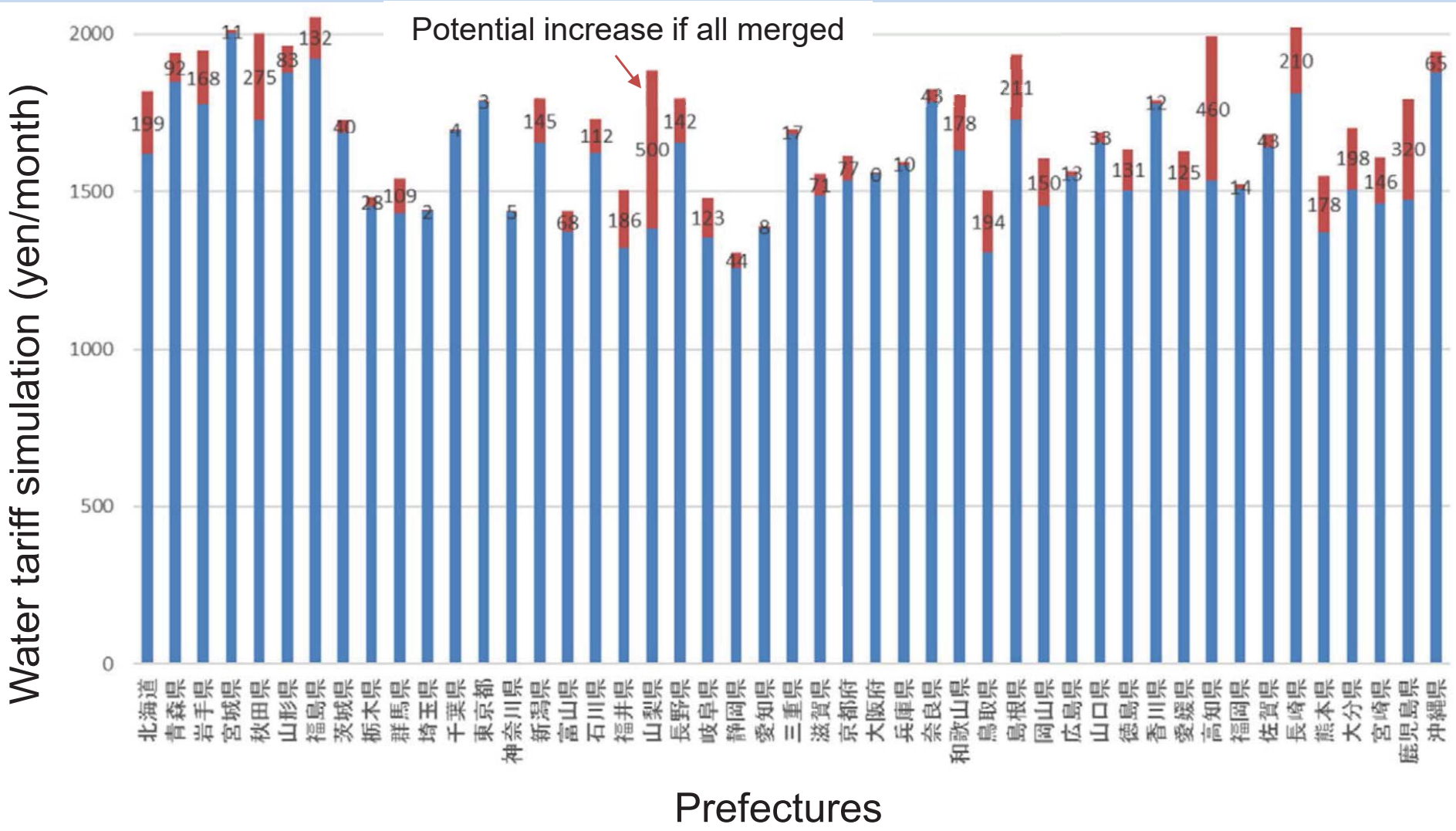
National Institute of Public Health

Trend of community water suppliers



Water tariff **simulation** in case all community water suppliers are merged with large water suppliers in each prefecture

(yen/month, estimated by Ministry of Health, Labour and Welfare)

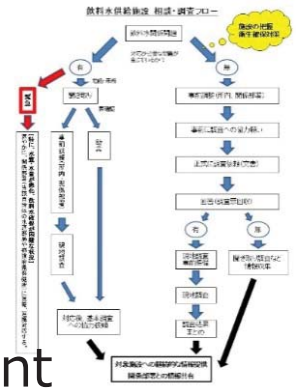


Integrated study on stability and safety of small-scale water supply system (2017 FY-2019 FY)

Financial affairs

maintenance and management

Technology



Management and guidance

An example

9 families
13 people
1000 yen/month
($7)

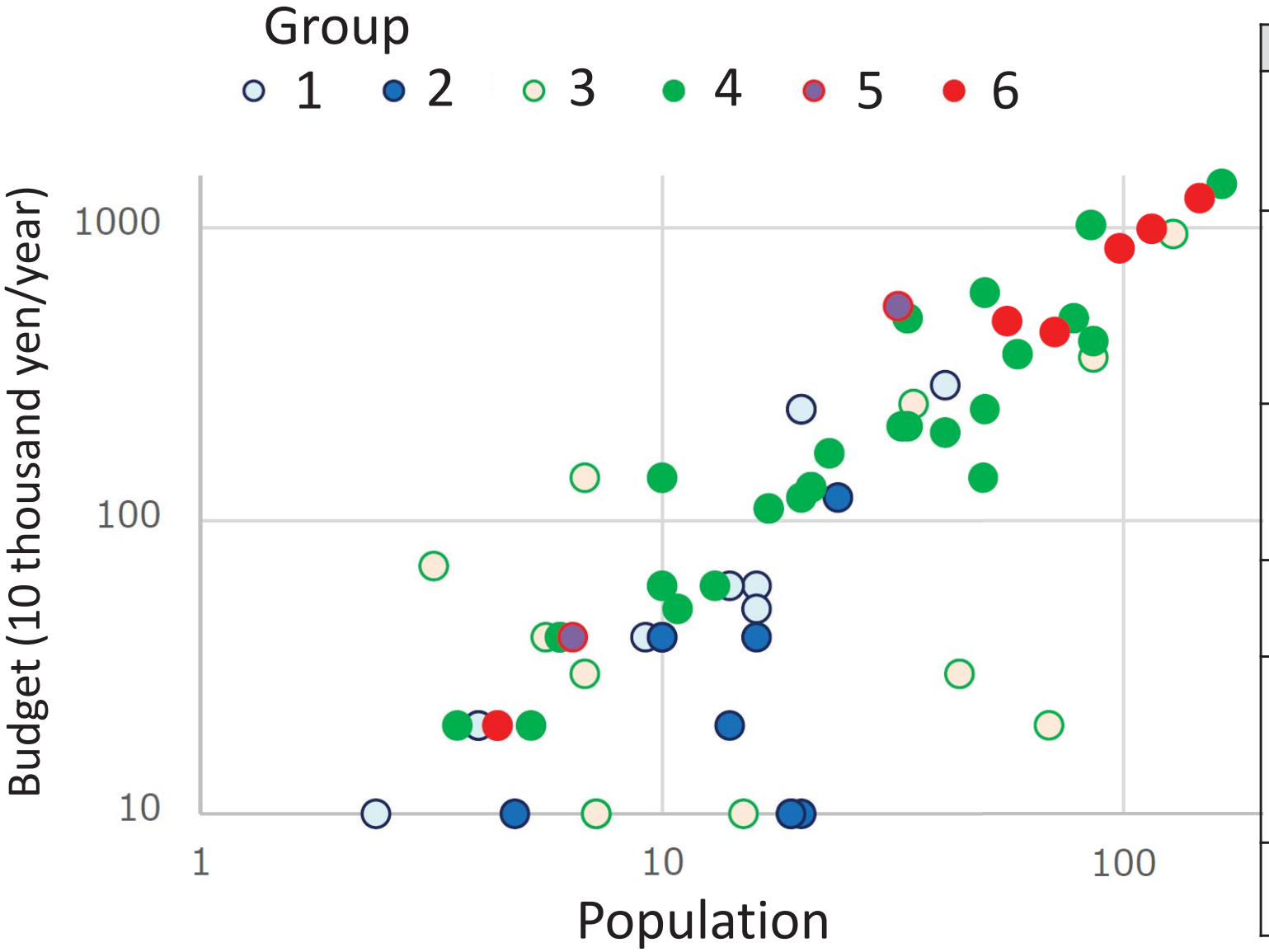
Sand was removed due to clogging 20 yeas ago
Filter cloth

Chlorina-tion facilities

Thanks to Prof. Sadahiko Itoh, Kyoto University

https://www.niph.go.jp/soshiki/suido/pdf/R01SWSA/03_Kyoto_Univ.pdf

Classification of 189 small water facilities



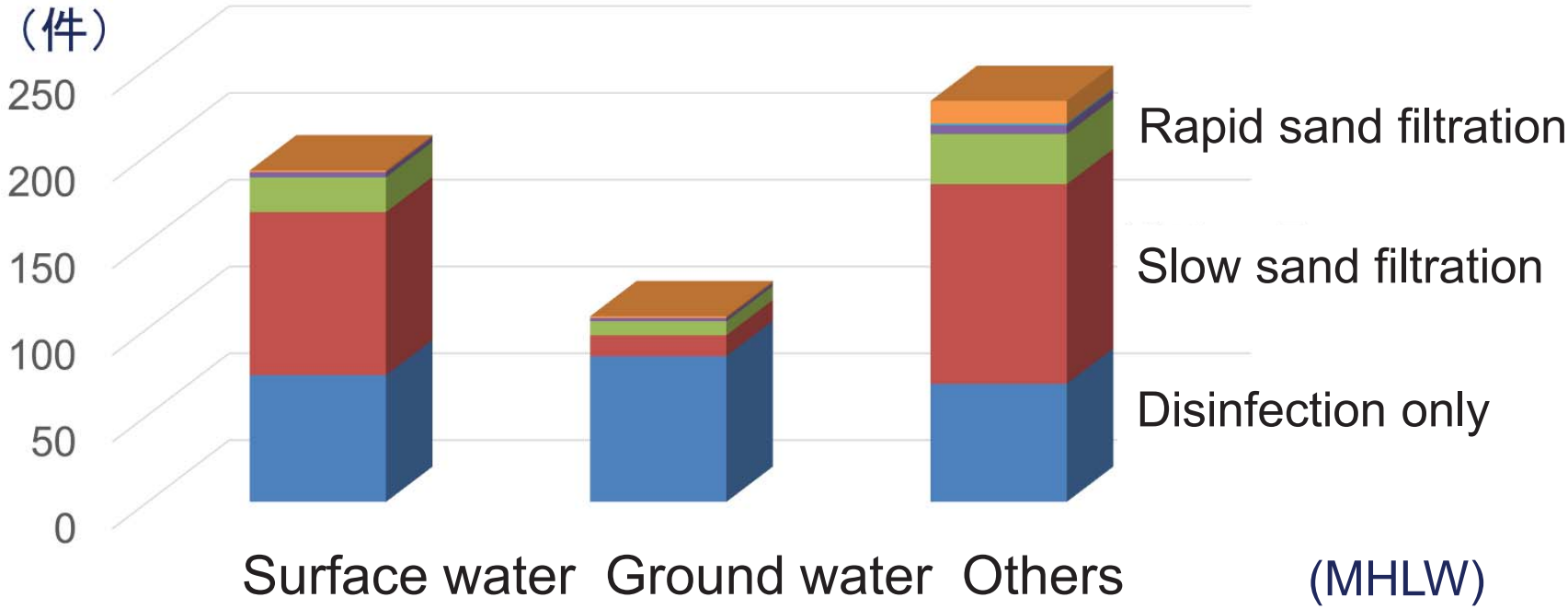
	Features
1	No-turbid water source. No disinfection.
2	Turbidity control due to surface water change. Usually safe, no disinfection.
3	Generally safe, but disinfection is performed for safety.
4	Filtration and disinfection.
5	Turbidity control required. Commonly rapid filtration. Disinfection required.
6	Treatment process is installed.

189 cases

Unpublished data in 2021 report

Development of Water Treatment Device for Small Water Supply

Current water treatment in small water supply smaller than 50 people



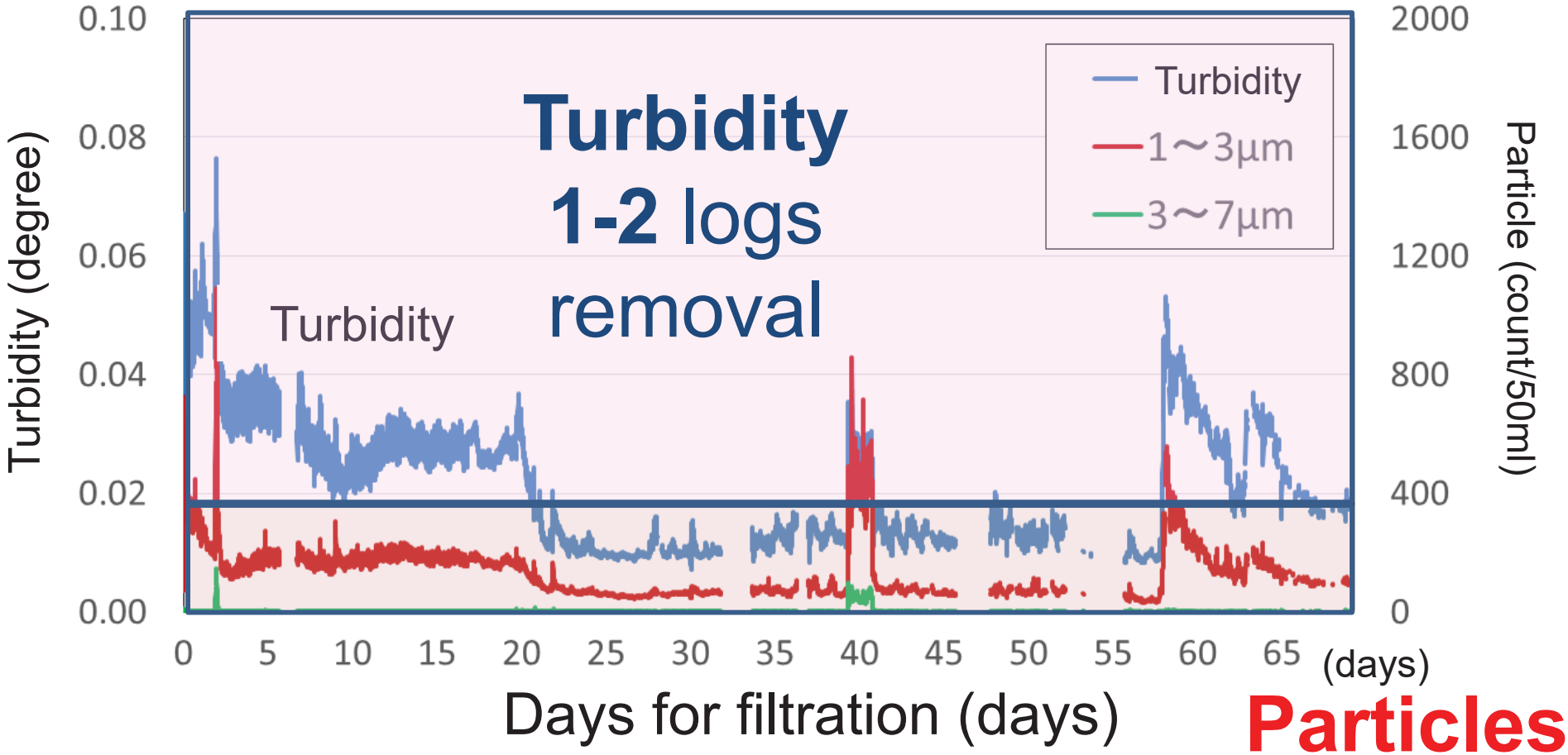
Reasonable slow sand filtration is needed

Development of Water Treatment Device for Small Water Supply

-Objective

To develop technical measures to supply safe water in remote areas

Long term turbidity removal by upflow sand filtration

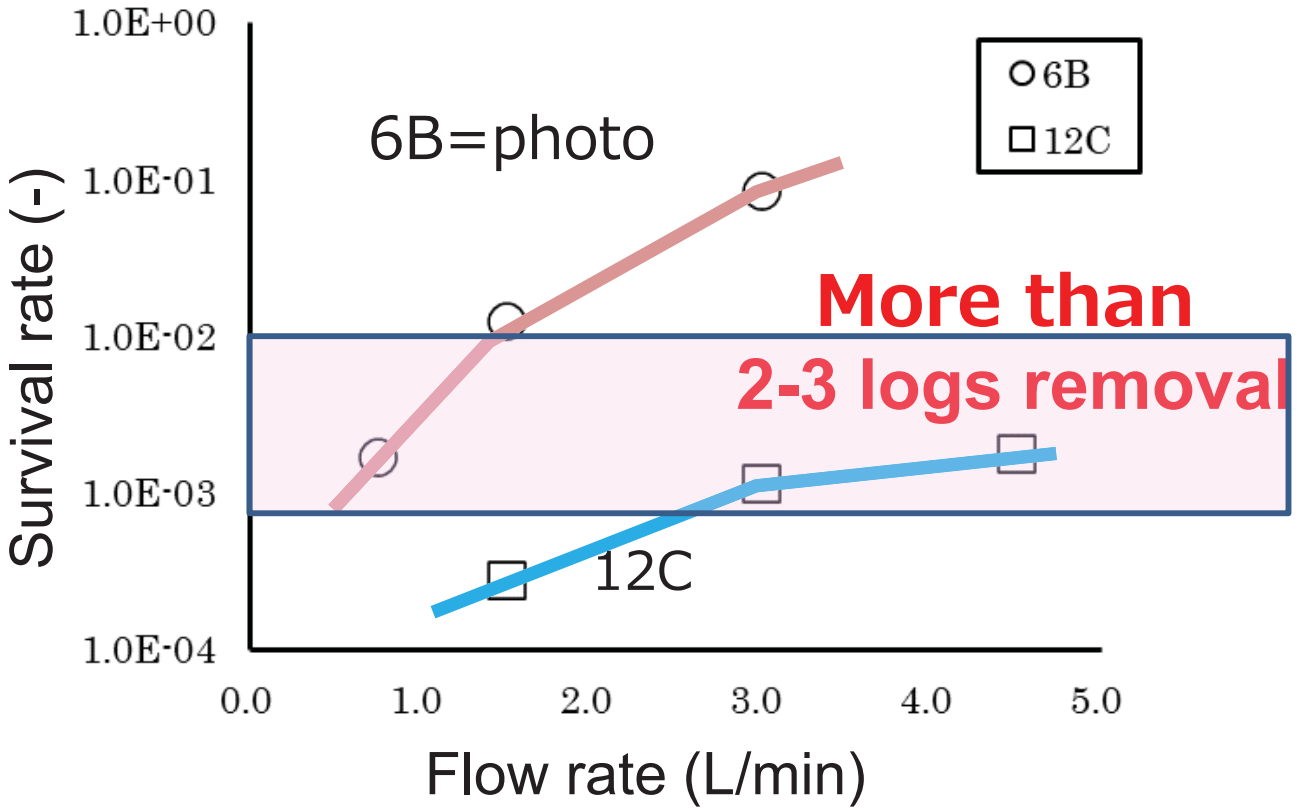


Particles
2-3 logs
removal

Raw water turbidity=2 TU, Flow rate = 5m/d
Kept under 0.05 TU for 70 days.
Particle counter also confirmed removal
of Φ1～3μm and Φ3～7μm.

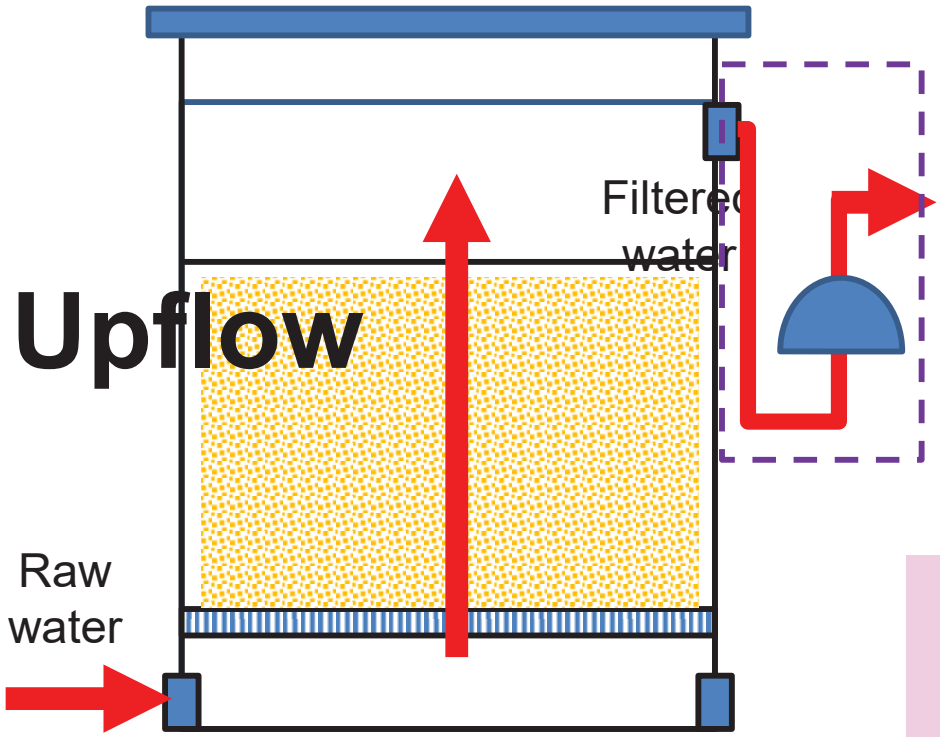
E. coli inactivation by UV-LED

Small UV-LED
Nikkiso pearl aqua



E. coli inactivation
by UV-LED

Development of Water Treatment Device for Small Water Supply



Upflow filtration

+

Simple (auto on-off) UV-LED

II

One solution for small water supply systems

3 logs removal

2-3 logs removal

More than 5 logs removal!

Risk assessment for water safety based on changes in water quality and water testing results (draft)

Water Quality Test Results	No change	Color and odor only (Occasional coloration)	Turbidity fluctuates (occasionally muddy)
E. coli, crypto, and health items exceeding standards	**4** (Treatment needs to be reviewed depending on the cause of contamination)	**4** (Treatment needs to be reviewed depending on the cause of contamination)	**5** (High risk, surface water)
Health Items exceeding the 50% of the standards.	**2**	**3**	**4**
Not exceeding the 50% of the standards	**1**	**2**	**3**
No water quality test	**1**	**2** If there's fluctuation, urgent need to examine WQ.	**5** Need to be tested

level
1: In general, there is little concern about water quality.
2: Less concern about water quality, but needs to be considered
3: Concerns about water quality and needs to be treated
4: Concerns about water quality and need for adequate monitoring of treatment
5: Major concerns about water quality, urgent action needed

Problems with 174 Small-Scale Waterworks in Shizuoka City, City-wide Survey

Difficulties		Cases	%	
1	Difficulties in management due to remote water source, danger, road issue, aged or no human resource	61	35	Especially clogged water resource
2	Water quality damage by typhoon or heavy rain	45	26	
3	Aged facilities, wild boar and water pressure decline	33	19	Solved by planned renewal
4	Depopulation, forest devastation	25	14	Redesign before depopulation
5	Water tariff	14	8	
6	Others	9	5	

1) Water intake screen

Installed in Shizuoka City

2) Compact water purification system

Installed in Shizuoka City

3) Membrane filtration

Installed in Shizuoka City

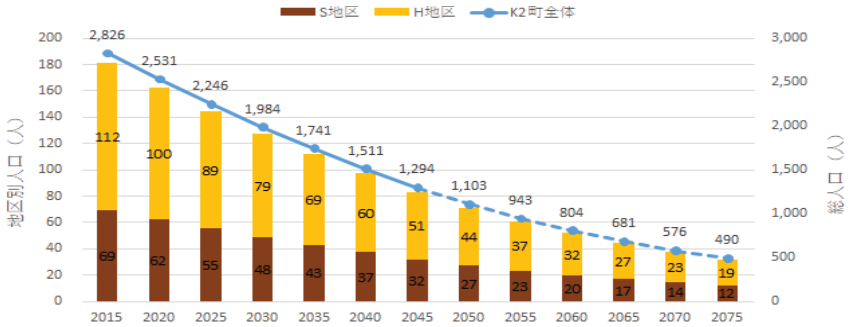
4) Installation of UVLED

Nikkiso HP

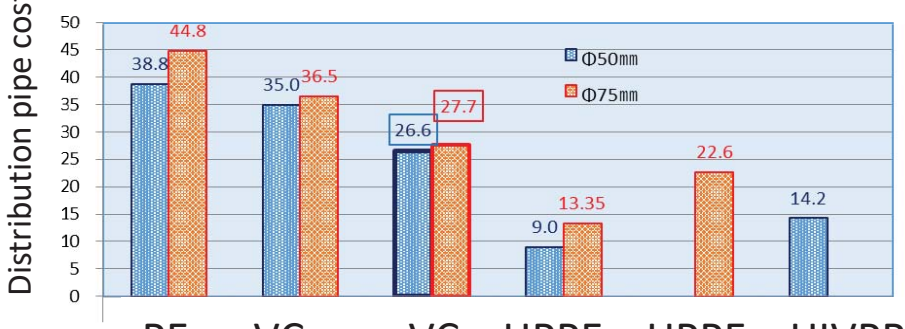
Installed in Shizuoka City

Simulation in other small areas

Population decrease

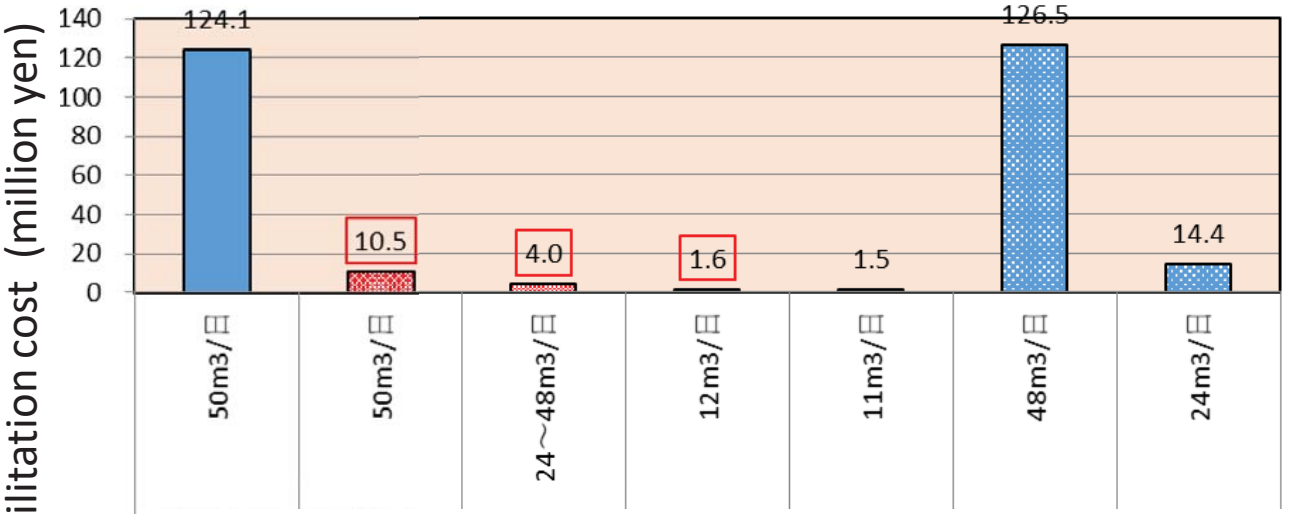


Distribution pipe cost (million yen)



Cost (million yen)

Facilitation cost (million yen)

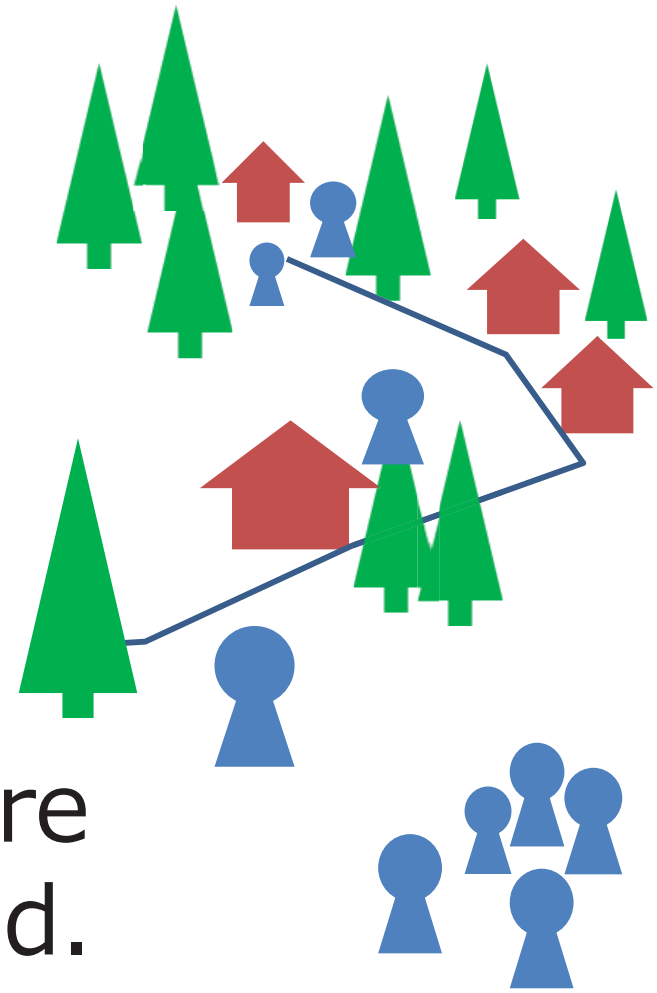


SSF Cal　Purification facilities　SSF MHLW Report　Filter Real

Conclusion

-Small water facilities are facing serious decline

Gov. Framework	Technical issues
Management	Human resource



-Integrated solution : new business model and appropriate technologies are ongoing and further needed.

Thank you for your kind attention!

asami.m.aa@niph.go.jp

Drinking water supply facilities consultation and investigation flow

Population decrease