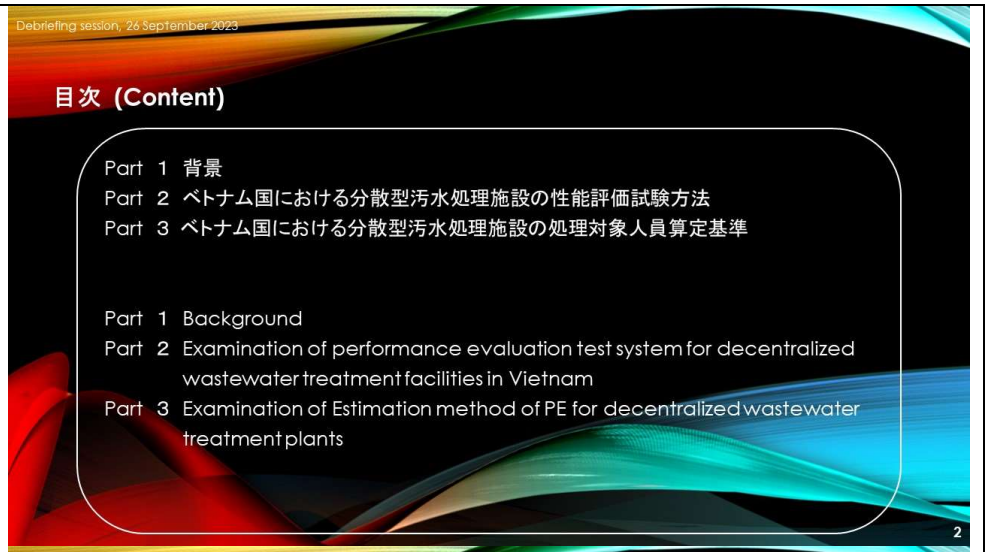
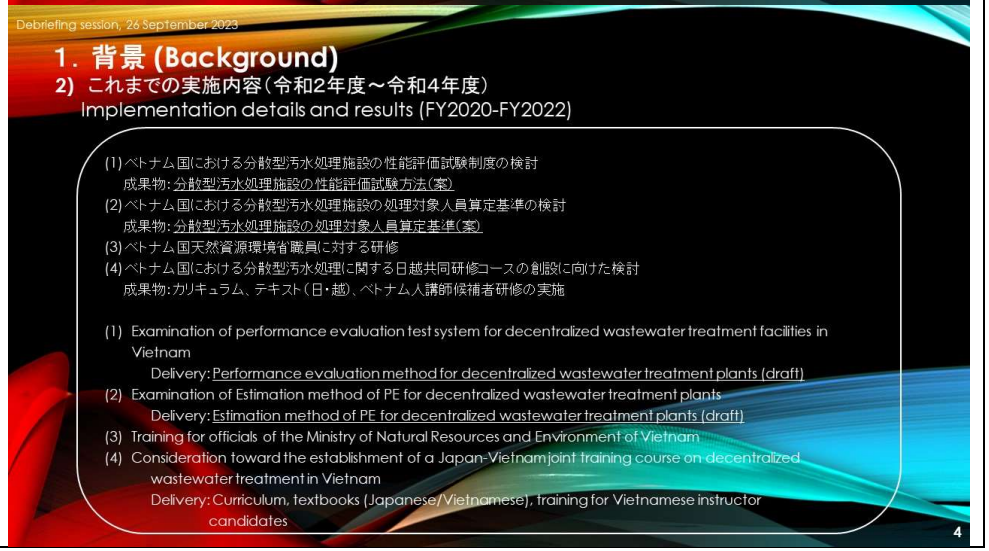
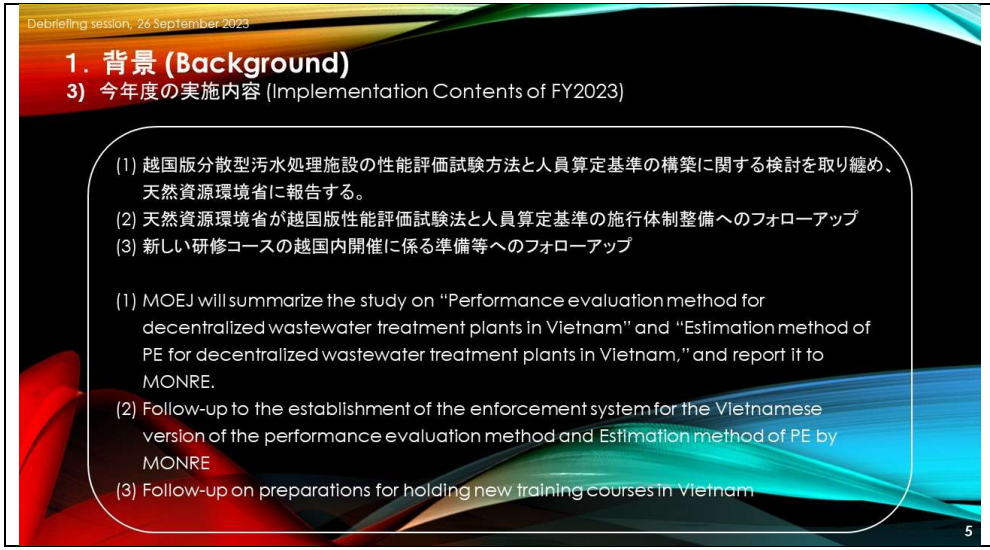
7.3. 越国天然資源環境省に対するフォローアップ等の実施に係る資料

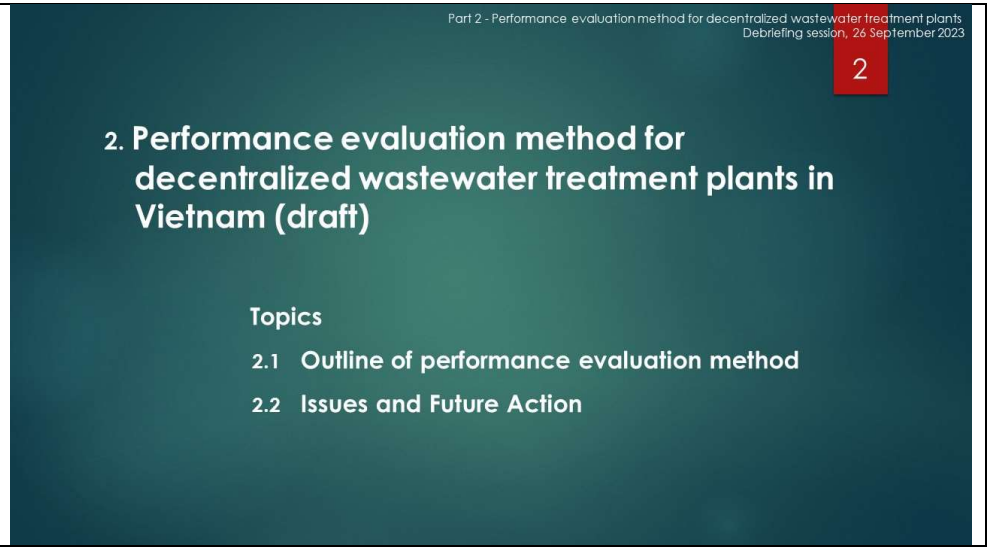
7.3.1. MONRE 報告会資料　—　パート１：背景







7.3.2. MONRE 報告会資料　—　パート２：分散型汚水処理プラントの性能評価方法（案）



2.1 Outline of performance evaluation method

3

Performance evaluation method for decentralized wastewater treatment plants in Vietnam (draft)

Content

2.1 Outline of performance evaluation method

5

2. Terms and definitions

Term	Term
(1) PE, population equivalent	(9) Field short-term stress test
(2) Household type plant	(10) Field assessment test 1
(3) Normal type plant	(11) Field assessment test 2
(4) Low-temperature normal load test	(12) Field long-term assessment test method
(5) Constant-temperature normal load test	(13) Assessment method for maintenance
(6) Constant-temperature short-term stress test	(14) Sludge feeding operation
(7) Constant-temperature short-term assessment method	(15) Half-day survey
(8) Field normal load test	(16) One-day survey

2.1 Outline of performance evaluation method

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1. Scope

This performance evaluation method aims to appropriately evaluate the treatment performance of decentralized wastewater treatment plants to be installed in Vietnam.

In view of this gist, the scope of the decentralized wastewater treatment plant to which this test method is applied shall be the following (1) and (2).

(1) Products manufactured in Vietnam for the purpose of installation in Vietnam, manufactured by manufacturers other than Japanese johkasou manufacturers

(2) Non-Vietnamese products manufactured by manufacturers other than Japanese johkasou manufacturers for the purpose of installation in Vietnam

Note: This (2) assumes, for example, that a foreign-affiliated company intends to install a product manufactured outside of Vietnam in Vietnam, and in such a case, this test method is applied.

2.1 Outline of performance evaluation method

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3. Type of testing plant

Type	Building use	Treatment capability (water volume)	Treatment performance (water quality)
Household type	Individual house	1.3 m^3/day at Max.	Refer to Table below
Normal type	All except individual house	— (no limitation)	Refer to Table below

4. Performance classification

Classification	Water quality item and criteria values									
	pH	BOD (mg/L)	COD (mg/L)	TOC (mg/L)	TSS (mg/L)	NH4-N (mg/L)	T-N (mg/L)	T-P[1] (mg/L)	Coliform (/ml)	FOG (mg/L)
QCVN 14 (A type[2])	6-9	25	50	40	35	4	25	1.5 2.5	1000	10
QCVN 14 (B type[3])	6-9	30	60	45	40	8	30	2 3	3000	15
QCVN 14 (C type[4])	6-9	35	70	50	50	10	30	2 4	3000	20
Other[5]	※	※	※	※	※	※	※	※	※	※

2.1 Outline of performance evaluation method

5. Test type

Test method	Period	Test unit	Evaluation item
Constant-temperature short-term assessment test	Acclimation + 8 weeks or more (2 Test unit) Acclimation + 16 weeks or more (1 Test unit)	1 or 2	Water quality, sludge and maintenance
Field assessment test 1	Acclimation + 48 weeks or more	1 or more	Water quality, sludge and maintenance
Field assessment test 2	Acclimation + 48 weeks or more	3 or more	Water quality, sludge and maintenance

2.1 Outline of performance evaluation method

6. Constant-temperature short-term assessment method

A. Test conditions

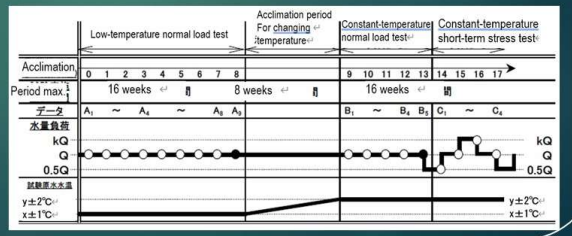
Test method	Hydraulic flow loading	Raw wastewater	Raw wastewater volume	Raw water temperature
Constant-temperature short-term assessment method	Planned WW amount, Q	Raw wastewater from existing treatment facilities	Flowing in with Q in the inflow pattern in Annex 1. (In the Short-term overload field test, the water volume is 0.5Q and kQ)	Y±2 ℃ or X±1℃

Y℃ is the water temperature of raw wastewater set for Constant-temperature normal load/short-term load test)
X℃ is the water temperature of raw wastewater set for Low-temperature normal load test

B. Test period

16 weeks using 1 test plant

8 weeks using 2 test plants



2.1 Outline of performance evaluation method

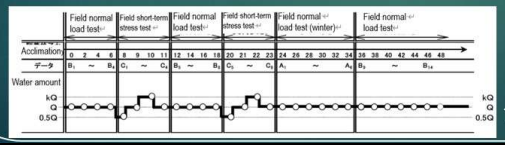
7. Field long-term assessment method

A. Test conditions

Test method	Hydraulic flow loading	Raw wastewater	Raw wastewater volume	Raw water temperature
Field assessment test 1	Q	Influent of primary sedimentation tank of sewage treatment plant mainly containing domestic wastewater, or sewage equivalent to this	Flowing in with Q water volume in the inflow pattern in Figure 1. (In the Short-term field test, the water volume is 0.5Q, kQ)	The minimum water temperature must be around x°C, including in winter (12 weeks from December to February; the same applies thereafter)..
Field assessment test 2	Less than 0.45Q More than 0.45Q but less than 0.75 Q More than Q	Wastewater similar to that discharged from target buildings	Flowing in with the flow loadings shown in the 2nd column of this table.	

Y℃ is the water temperature of raw wastewater set for Constant-temperature normal load/short-term load test)
X℃ is the water temperature of raw wastewater set for Low-temperature normal load test

B. Test period 48 weeks including a winter season



Test period of Field assessment test 1

2.1 Outline of performance evaluation method

8. Assessment method for maintenance

A. Evaluation item

About 40 items related OM of the treatment plants are evaluated.
Please refer to Annex 7

Table 7-2 Evaluation items during the test

No.	evaluation item	Applicant write-in column	Tester write-in column
6	Were the tanks safe with no deformation, etc., against water pressure, their own weight, and other loads?		
7	Were the parts/members maintained in good condition for a long period of time without deformation, damage, or corrosion?		
8	Were the parts/materials held in the specified position and in the specified state? (Example: Floating and outflow prevention of filter media, etc.)		
9	Did the water in the tank flow out from the opening or other places? (Example: Exclusively for overflow from the opening due to clogging of biofilm)		
10	Unless the ceiling of the tank also serves as a lid, manholes (45 cm in diameter) (if there are 51 PE or more, 60 cm or more in diameter) and is there a lid that can be sealed?		

B. Evaluation method

For the items shown in Tables 7-1 to 7-3, the following two-stage judgment is performed.

- **If it is considered that the evaluation items are sufficiently satisfied, mark "satisfaction".**
- **If it is considered insufficient, mark it with "dissatisfaction".**

2.1 Outline of performance evaluation method

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9. Evaluation method

A. Evaluation criteria

Test method	Data for each test	Total data	Evaluation criteria
Constant-temperature short-term assessment test	Constant-temperature normal load test 4 Constant-temperature short-term stress test 4 Low-temperature normal load test 8	16	• More than 75% of all data for each evaluation water quality item satisfies the application value. • Complies with all management performance evaluation items.
Field long-term assessment test 1	Field normal load test 14 Field short-term stress test 8 Winter 6	28	
Field long-term assessment test 2	Each plant 12 (including 3 in winter)	36 (total of 3 plants)	• More than 75% of all data for each testing plant and evaluation water quality items satisfy the application value. • Complies with all management performance evaluation items.

2.1 Outline of performance evaluation method

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10. Annex

Annex 1 Inflow pattern of raw wastewater
Annex 2 Requirement for the shape of test plant
Annex 3 Acclimation method
Annex 4 Measurement method for sludge and scum
Annex 5 Method of adjusting raw wastewater quality
Annex 6 Sludge feeding operation
Annex 7 Assessment method for maintenance
Annex 8 Scope of decentralized wastewater treatment plants applicable to this test method

2.2 Issues and Future Action

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Content

1. Water temperature setting method for constant temperature short-term tests etc.
2. Method of adjusting raw wastewater quality
3. Inflow pattern of raw wastewater
4. Calculation method for overload coefficient (value k)

2.2 Issues and Future Action

2.2.1 Water temperature setting method for constant temperature short-term tests etc.

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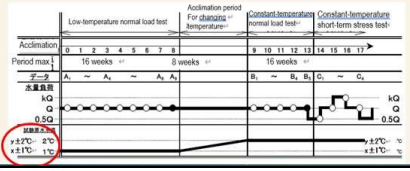
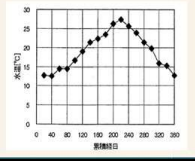
Item	In Japan	In Vietnam
Raw water temperature in Low-temperature normal load test	13±1℃	X±1℃ (tbd)
Raw water temperature in constant-temperature normal load test	20±1℃	Y±1℃ (tbd)
Water temperature setting method	A one-year survey of the water temperature in biological treatment chamber/tank at 19 Johkasou was conducted. The minimum value and the median value of the water temperature were as set to the water temperature of the low temperature load test, and the constant-temperature normal load / short-term load test, respectively. (Refer to Column 1)	Proposal of water temperature setting method in Vietnamese version test method.





2.2 Issues and Future Action

2.2.1 Water temperature setting method for constant temperature short-term tests etc.

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water temperature setting method in Vietnamese version test method (draft)	
1. General	Using Japan's experience as a reference, water temperature surveys will be conducted for sewage treatment facilities in Vietnam, and water temperature data for pretreatment tanks (sedimentation and separation tanks, etc.) will be used to set the water temperature. 1) Type and scale of wastewater treatment facility Domestic wastewater treatment facilities with treatment capacity equivalent to a 5 PE (current provisional value of 0.65 m^3/day) to 1,000 PE (current provisional value of 130 m^3/day). 2) Location of wastewater treatment facility Since water temperature data will be collected from major regions throughout Vietnam, facilities will be selected so as to cover the whole country without being biased towards a specific region. 3) Number of facilities Around 20 facilities
2. Water temperature survey method	1) A water temperature gauge will be installed in the pre-treatment tank (sedimentation tank etc.) of the target facility, and the facility manager will record the water temperature in the tank every day to collect water temperature data for about one year (360 days). 2) Organize the collected data into (1) daily average water temperature, (2) average water temperature for every 20 days from the date of the survey, and (3) average water temperature for every 20 days for all surveyed facilities. 3) Based on the average water temperature for every 20 days of all surveyed facilities, the minimum value is set as the water temperature for the test water during the low temperature load test (water temperature in winter for on-site evaluation test In addition, the median value is set as the temperature of the test water for the constant temperature normal load test and the short-term load test.

2.2 Issues and Future Action

2.2.2 Method of adjusting raw wastewater quality.

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Range of raw wastewater quality

Item	pH	SS	COD	BOD	NH_4-N	T-N	T-P
		(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
Min	6	255	341	278	34	45	4.1
Std. Avg		340	455	370	45	60	5.5
Max	9	425	569	463	56	75	6.9

Range of raw wastewater quality for testing

Item	pH	SS	COD	BOD	NH_4-N	T-N	T-P
		(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
Min	6	333	410	306	40.5	54	4.95
Max	9	407	501	374	49.5	66	6.05

Raw water conditioner

Item	pH	SS	COD	BOD	T-N	T-P
sodium chloride	○					
hydrochloric acid	○					
Methanol			○	○		
Urea					○	
Phosphorus primary potassium						○
Phosphorus potassium						○
cellulose		○				

2.2 Issues and Future Action

2.2.3 Survey on inflow pattern of raw wastewater

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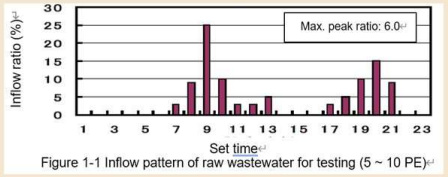
Item	In Japan	In Vietnam
Inflow pattern of raw wastewater for testing (5 – 10 PE)	 Figure 1-1 Inflow pattern of raw wastewater for testing (5 ~ 10 PE)	In Vietnam, there is no inflow pattern. In the future, MONRE should conduct surveys of residential drainage and accumulate data on drainage patterns of residential drainage in Vietnam and determine the inflow pattern for the normal load test in this testing method.
Inflow ratio of raw wastewater for testing (5 – 10 PE)	Table 1-2 Inflow ratio of raw wastewater for testing (5-10 PE)	Proposal of survey method of inflow pattern of raw wastewater for individual house.

Set time	0~1	1~2	2~3	3~4	4~5	5~6	6~7	7~8	
Inflow ratio (%)	0	0	0	0	0	0	0	3	
Set time	8~9	9~10	10~11	11~12	12~13	13~14	14~15	15~16	
Inflow ratio (%)	9	25	10	3	3	5	0	0	
Set time	16~17	17~18	18~19	19~20	20~21	21~22	22~23	23~24	Total
Inflow ratio (%)	0	3	5	10	15	9	0	0	100

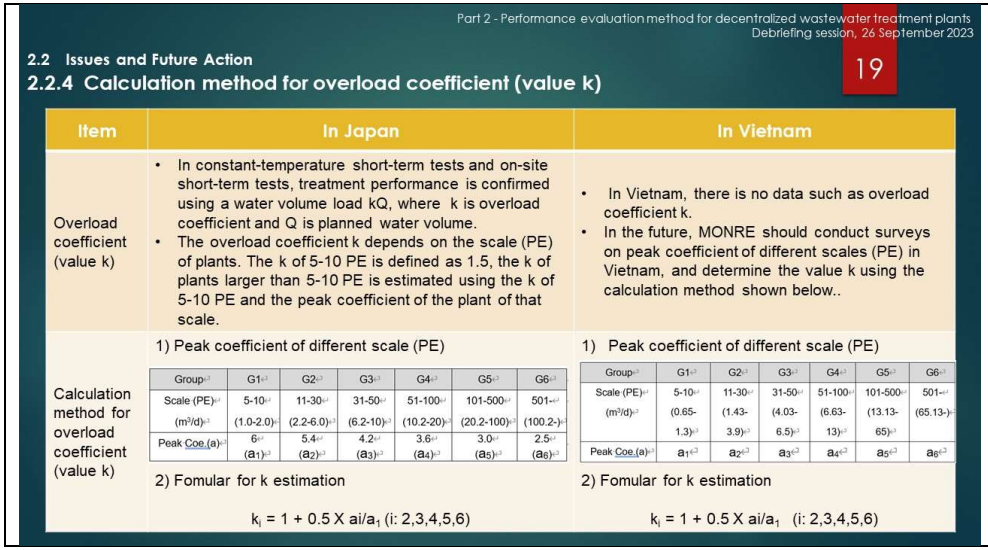
2.2 Issues and Future Action

2.2.3 Survey on inflow pattern of raw wastewater

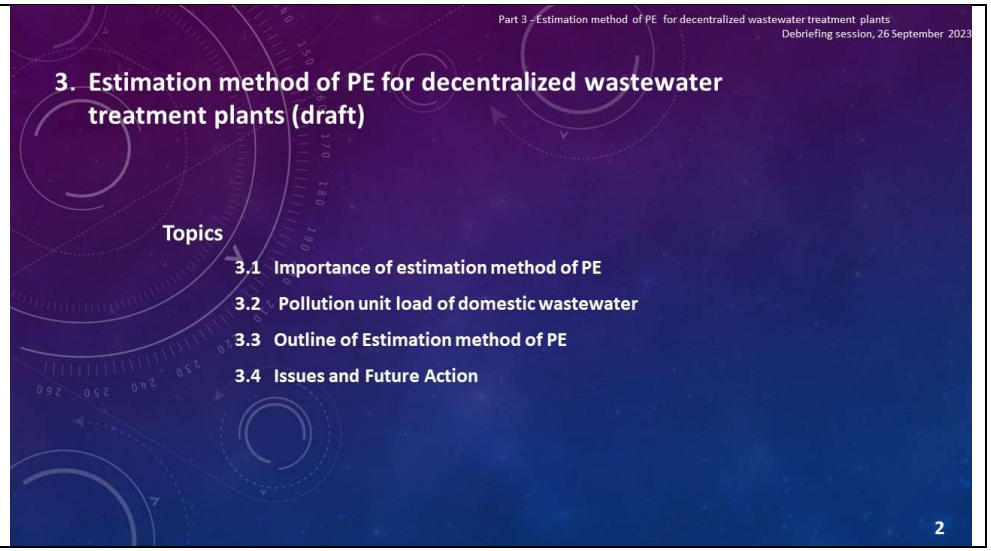
Survey method of inflow pattern of raw wastewater for individual house	
1) Target house	① Representative family composition (the husband and wife, and 2-3 children), general salaryman family ② A exclusive water meter for the house is installed and can be read 24 hours throughout a day. ③ There is no storage tank on a roof. ④ There is storage tank on a roof, however, the owner is cooperative with survey, and consent to the installation of survey equipment (water meters, etc.), and the structure of the house is suitable for the installation of survey equipment.
2) Survey method	① Select about 20 target houses for survey. Priority will be given to housing without rooftop water storage tanks. ② In the case of housing without rooftop water storage tanks, ✓ Conduct drainage one-day (24 hours) surveys once a week for 50 weeks (total of 50 time) per house. ✓ During the survey period, the surveyor will read the water meter once an hour and record the reading of the water meter. Organize the recorded water consumption data for 24 hours and calculate the hourly average water quantity (Q), hourly maximum water quantity (Qmax) and peak coefficient (Qmax/Q) in that day. ③ In the case of housing with rooftop water storage tanks, Install a water meter downstream of the rooftop water storage tank of the target house. In addition, for the selection and installation work of water meters, please refer to
3) Data processing	① Organize the data of each house obtained in 2). Calculate the average daily water volume, hourly average water volume, hourly maximum water volume, and peak coefficient for the inflow water of each house. ② Organize the data obtained from the 20 houses. Calculate the inflow pattern and peak coefficient of individual houses using the data in the "average value" column.
4) An example	The table and figure shown in the right show a result of a trial calculation of the inflow pattern of individual houses using fictitious data.

Table 4 Data of all survey houses (summary)

Time, hour	Water amount, L House 1	House 2	・・・	House 20	Average	Std
0	0	0		0	0	0.0
1	0	0		0	0	0.0
2	0	0		0	0	0.0
3	0	0		0	0	0.0
4	0	0		0	0	0.0
5	0	0		0	0	0.0
6	60	65		45	57	10.4
7	85	85		68	79	9.8
8	55	46		55	52	5.2
9	65	76		86	74	11.5
10	25	15		25	22	5.8
11	20	30		30	27	5.8
12	8	6		8	7	1.0
13	0	0		0	0	0.0
14	0	0		0	0	0.0
15	23	15		25	21	5.2
16	80	80		75	78	2.9
17	95	90		88	91	3.6
18	60	60		60	60	0.0
19	125	140		135	133	7.8
20	95	100		120	105	13.2
21	30	60		55	48	16.1
22	30	30		25	28	2.9
23	0	0		0	0	0.0
Daily water amount, L	855	898		902	885	26.1
Hourly ave. water amount, L	36	37		38	37	1.1
Hourly max. water amount, L	125	140		135	133	7.8
Peak coefficient	3.5	3.7		3.6	3.6	0.1



7.3.3. MONRE 報告会資料 — パート３：分散型汚水処理プラントの人員算定基準（案）



3.1 Importance of estimation method of PE

- The "Estimation method of PE for decentralized wastewater treatment plants" is based on the building use (housing, office, etc.), scale (total floor area, capacity, etc.), type of drainage equipment, etc. It is a calculation method to obtain the treatment capacity (planned wastewater amount/pollution loads) of the wastewater treatment facility required in terms of population equivalent (PE). Note that 1 PE means the amount of domestic wastewater and pollutant load per person per day, and is also called pollution unit load.
  In Japan, 1 PE is 200 L/cap.day of wastewater amount and 40 g/cap.day of BOD load.
- When designing and constructing a building that requires a decentralized wastewater treatment facility,
  - It is necessary to determine in advance the treatment capacity of the wastewater treatment facility required for the building.
  - A method is needed to determine the capacity of wastewater treatment plants for buildings with different building uses.
  - If a building serves multiple building uses, the required wastewater treatment capacity should be determined according to the real situation of building uses.
- In Japan, there is a standard "PE estimation method for johkasou (JIS A: 3302)", which makes it possible to easily calculate the capacity of johkasou required for buildings of various sizes and building uses, creating an environment that facilitates the introduction of johkasou. In order to disseminate decentralized wastewater treatment facilities in Vietnam in the future, it is necessary to create a Vietnamese version of PE estimation method.

3.2 Pollution unit load of domestic wastewater

Item	In Japan	In Vietnam
Domestic wastewater amount	200 L/cap.day	130 L/cap.day
Pollution unit load	BOD: 40 g/cap.day SS: 32 g/cap.day T-N: 9 g/cap.day T-P: 1.0 g/cap.day	BOD: 48 g/cap.day SS: 44 g/cap.day NH4-N: 6.0 g/cap.day T-N: 7.7 g/cap.day T-P: 0.7 g/cap.day
Concentration of pollution unit load	BOD: 200 mg/L SS: 160 mg/L T-N: 45 mg/L T-P: 5 mg/L	BOD: 370 mg/L SS: 340 mg/L NH4-N: 45 mg/L T-N: 60 mg/L T-P: 5.5 mg/L
Survey method	Drainage survey of individual house	• Drainage survey of individual houses • 24H-survey for 3 individual houses, 3 times per house • 9 composite samples for water quality analysis

3.3 Outline of Estimation method of PE

Types of target buildings and building use

Category	Building use
1 Housing	Individual house
	Housing complex
	Dormitory
2 Hotel	Hotel with meeting rooms and wedding halls
	Other hotel
3 Hospital	Hospital with kitchens
	Hospital without kitchens
	Clinic
4 Store	Restaurant/normal pollutant loads Restaurant/high pollutant loads
5 School	Elementary/junior high school
6 Office	Office (without kitchens)

3.3 Outline of Estimation method of PE

1. Individual house

Calculation formula	Unit for calculation
n=5 100≧A n=7 140≧A>100 n=10 A>140	n: PE A: Total floor area (m^2) Note ・It is necessary to separately consider how to calculate the PE for a) housing with a large total floor area for the wealthy class or individual houses in rural areas, b) housing in rural areas without water service. ・If the number of family size is fixed at the stage of applying for a housing development plan, it will be possible to change the PE at the discretion of the administrative side.

Special individual houses

Type of individual houses	Calculation formula	Unit for calculation
Luxury individual houses	n=5 200≧A n=7 400≧A>200 n=10 A>400	n: PE A: Total floor area (m^2)
Individual houses in rural areas (with large floor area)		
Individual houses in rural areas (with small floor area)	n=5 1-family house n=7 2-family house	

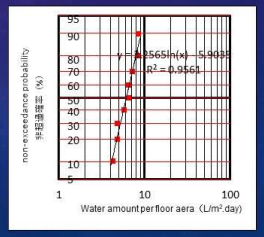
3.3 Outline of Estimation method of PE

2. Housing complex

Calculation formula	Unit for calculation
n=0.059 A	n: PE A: Total floor area（m^2） Note: 0.059 PE/m^2 = 7.714 L/m^2.day ÷ 130 L/cap.day 7.714 L/m^2.day is the 75% value of non-exceedance probability of wastewater amount per floor area, which was obtained by processing survey data shown below.

Amount of wastewater per floor area of housing complex
L/m^2.day

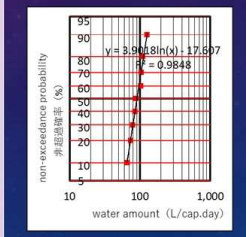
	Day1	Day2	Day3
Building A	4.8	4.3	4.8
Building B	8.4	7.2	8.3
Building C	5.8	6.5	6.5



3.3 Outline of Estimation method of PE

3. Dormitory

Calculation formula	Unit for calculation
n=0.83P < Formula 1 > or n=0.068A < Formula 2 >	n: PE P: capacity of the dormitory A: Total floor area（m^2） Note 1: If A/P is less than 12.2, using Formula 1 If A/P is 12.2 or higher, using Formula 2 to calculate n. Note 2: 0.83 = 108 L/cap.day ÷ 130 L/cap.day 0.068 = 8.85 L/m^2.day ÷ 130 L/cap.day 108 L/cap.day and 8.85 L/m^2.day is the 75% values of non-exceedance probability of wastewater amount unit load and wastewater amount per square meter per day, which were obtained by processing survey data shown below.



Wastewater amount of dormitory, L/cap.day

	Day1	Day2	Day3
Dormitory A	79.2	85.7	87.2
Dormitory B	104.6	66.2	74.2
Dormitory C	110.0	127.1	102.2

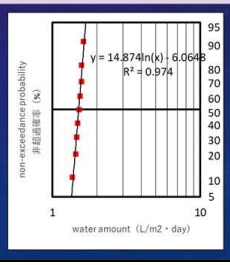
3.3 Outline of Estimation method of PE

4. Office

Calculation formula	Unit for calculation
n=0.012 A	n: PE A: Total floor area（m^2） Note: 0.012 PE/m2 = 1.57 L/m^2.day ÷ 130 L/cap.day 1.57 L/m2.day is the 75% probability of non-exceedance of wastewater amount per floor area, which was obtained by processing survey data shown below.

Amount of wastewater per floor area of office buildings
L/m^2.day

	Day1	Day2	Day3
Building A	1.52	1.58	1.46
Building B	1.57	1.36	1.48
Building C	1.43	1.62	1.53



3.3 Outline of Estimation method of PE

5. Hotel

Building use	Calculation formula	Unit for calculation
a. Hotel with meeting rooms and wedding halls	n=a × A Note, a is the larger of a=q/Q and a=mq/C	n: PE A: Total floor area（m^2） q: wastewater amount (L/m^2・day) m: BOD concentration Q: Unit load of wastewater amount (130 L/cap.day) C: BOD unit load (48 g/cap.day)
b. Other hotel	n=b × A Note, b is the larger of b=q/Q and b=mq/C	

Data are to be collected through drainage survey in the future
q: wastewater amount (L/m^2・day)
m: BOD concentration

3.3 Outline of Estimation method of PE

6. Hospital

Building use	Calculation formula	Unit for calculation
a. Hospital with kitchens	n=a × B Note, a is the larger of a=q/Q and a=mq/C	n: PE B: Number of bed q: wastewater amount (L/bed・day) m: BOD concentration Q: Unit load of wastewater amount (130 L/cap.day) C: BOD unit load (48 g/cap.day)
b. Hospital without kitchens	n=b × B Note, b is the larger of b=q/Q and b=mq/C	
c. Clinic	n=a × A Note, a is the larger of a=q/Q and a=mq/C	n: PE A: Floor area (m^2) q: wastewater amount (L/m^2・day) m: BOD concentration Q: Unit load of wastewater amount (130 L/cap.day) C: BOD unit load (48 g/cap.day)

Data are to be collected through drainage survey in the future
q: wastewater amount (L/bed・day)
m: BOD concentration

3.3 Outline of Estimation method of PE

7. Restaurant

Building use	Calculation formula	Unit for calculation
a. Restaurant/normal pollutant loads	n=a × A Note, a is the larger of a=q/Q and a=mq/C	n: PE A: Total floor area (m^2) q: wastewater amount (L/m^2・day) m: BOD concentration Q: Unit load of wastewater amount (130 L/cap.day) C: BOD unit load (48 g/cap.day)
b. Restaurant/high pollutant loads	n=b × A Note, b is the larger of b=q/Q and b=mq/C	

Data are to be collected through drainage survey in the future
q: wastewater amount (L/m2・day)
m: BOD concentration

3.3 Outline of Estimation method of PE

8. Elementary/Junior high school

Calculation formula	Unit for calculation
n=a × P Note, a is the larger of a=q/Q and a=mq/C	n: PE P: capacity of school q: wastewater amount (L/cap・day) m: BOD concentration Q: Unit load of wastewater amount (130 L/cap.day) C: BOD unit load (48 g/cap.day)

Data are to be collected through drainage survey in the future
q: wastewater amount (L/cap・day)
m: BOD concentration

3.4 Issues and future action

Issue	Building use	Future action
1 Survey Procedures Manual for Wastewater Pollution Load	Individual house Housing complex Dormitory Office	• Collect data of wastewater amount and pollution loads by conducting additional drainage survey
	Hotel Hospital Restaurant Elementary/Junior high school	• Conducting drainage survey, collect data of wastewater amount and pollution loads and determine the PE estimation method for each building use
2 PE estimation method for luxury individual houses and individual houses in rural areas	Luxury individual houses	• Collect data on floor area per house, family size etc., revise the PE estimation method.
	Individual houses in rural areas	• Collect data on floor area per house, family size etc. • Conducting drainage survey, revise the PE estimation method.
3 Other building category/ buildings use	New building category/building use that are expected to install decentralized wastewater treatment plants	• List up the new building category/building use. • Conducting drainage survey, collect data of wastewater amount and pollution loads • Determine the PE estimation method