

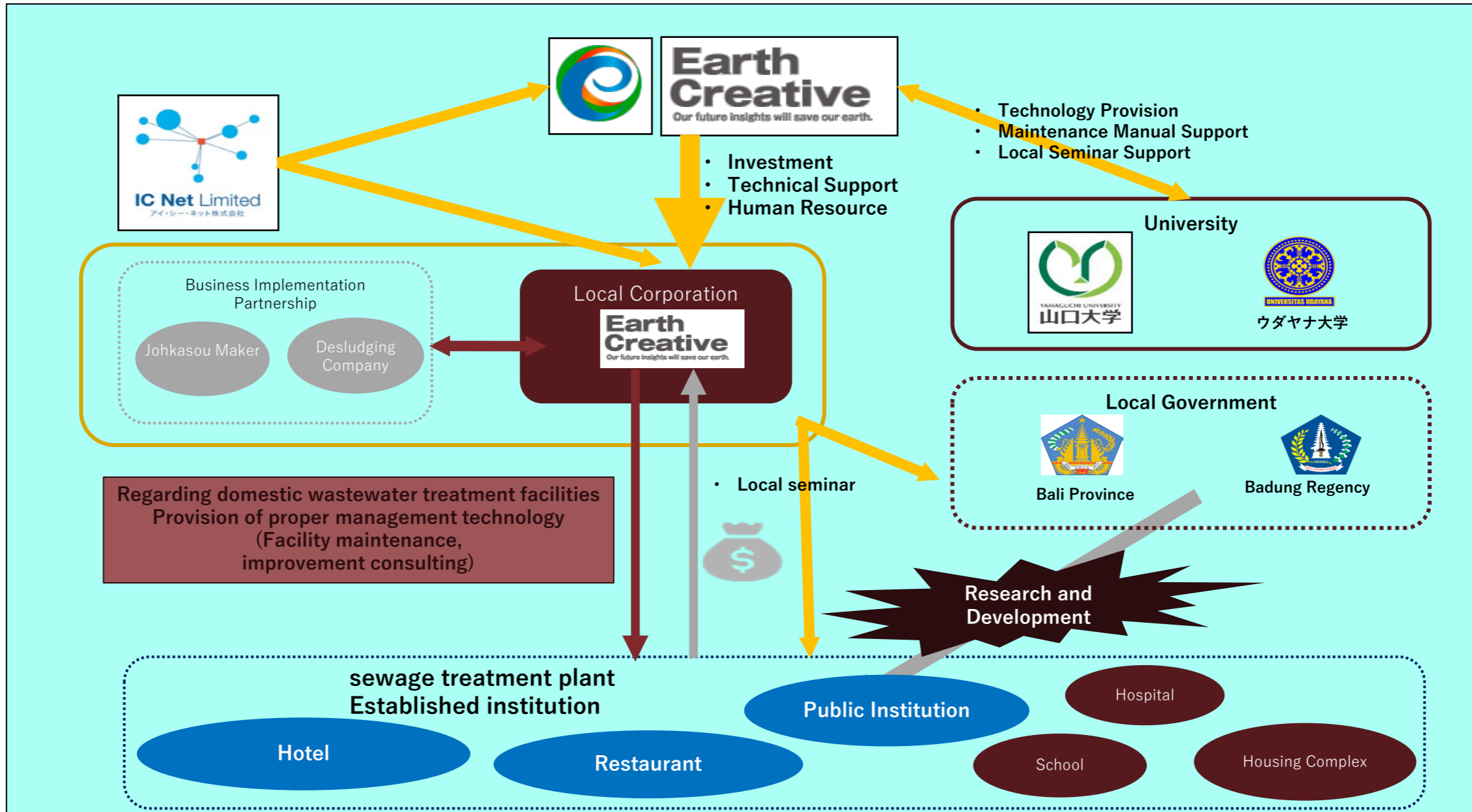
Maintenance of Sewage Treatment Plant/Wastewater Treatment Plant and Installation of IoT (Internet of Things) and Liquid Film Aeration System in Bali, Indonesia

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Project Overview Implementation



Situation and Issues in The Project Implementation Area



● Current Status of Domestic Wastewater Treatment in Indonesia and Bali Province

(1) Deterioration of water quality in public water areas due to population and tourist increases

- In Bali, the deterioration of water quality in public water bodies (rivers and surrounding waters) is accelerating due to the increase in population and tourists. Denpasar, the provincial capital, has shown an increase rate of more than 10% in five years, and the adjacent Badung Regency has many world-famous tourist destinations, attracting 5 million foreign tourists annually (Indonesia). Approximately 41.6% of all foreign visitors in 2019).
- In Denpasar City, sewerage development is underway in three districts, but despite the fact that the installation area is still limited, wastewater that has already exceeded the treatment capacity of the sewage treatment plant is flowing into it. Therefore, it is still important to carry out appropriate treatment at the place of wastewater generation.
- Since hotels for tourists generate a large amount of wastewater per day, they have installed their own wastewater treatment facilities such as septic tanks. However, due to lack of proper maintenance and lack of appropriate management, untreated wastewater is often discharged.

(2) Measures taken by government agencies to improve water quality

- In Bali, natural landscapes such as beaches are major tourism resources, so improving the water quality environment is the most important issue for administrative agencies. Each state has its own effluent standards that are stricter than the national standards.
- Medium- and large-scale commercial facilities such as hotels are obliged to submit water quality analysis results by a specialized inspection agency once a month, and facilities that do not meet the wastewater standards are subject to administrative sanctions such as improvement orders and discharge ban.

Progress of Feasibility Study Activities Related to The Installation of a Liquid Film Aeration System and IoT Monitoring Sensors



- Overview of technologies currently planned for introduction

Technique	1. Liquid film Aeration System	2. IoT Surveillance Sensor
Features	Improvement of processing capacity by increasing DO value / Reduction of electricity consumption / Easy installation to existing facilities / Low cost introduction by local optimization	24-hour online monitoring/Low cost of installation and operation due to local optimization/Easy to change specifications/Easy to install in existing facilities
Technical Details	<p>Liquid film aeration system</p> <p>Forms a liquid film (water bubbles) on the water surface By increasing the number of bubbles on the water surface, oxygen supply from the atmosphere increases in addition to oxygen supply from inside the bubbles.</p> <p>Improved oxygen dissolution efficiency</p> <p>Air Diffuser Blower</p> <p>Liquid film aeration system and operating conditions (example in Thailand)</p>	<p>Water Quality Sensor Mounting part</p> <p>Water Quality Sensor Controller</p> <p>Field Communication Device Installation situation</p> <p>Data that can be confirmed on the cloud (specs may change)</p>

Examples of adaptation to similar projects

- Liquid film aeration system: (1) Demonstration project at a sewage treatment facility (FY2008-FY2010 Ube City, Yamaguchi Prefecture, Sewage Works Agency commissioned project)
- (2) Application of liquid film oxygen supply method to shrimp ponds in Thailand (FY2011-2013 Mitsui & Co., Ltd. Environment Fund grant research)
- IoT monitoring sensor: Utilizing the Yamaguchi Prefecture support subsidy in 2018, prototype manufacturing has been completed and is in the testing stage
- Maintenance service: Business feasibility study of maintenance service in Badung Province in JICA commissioned project "Water environment improvement project feasibility study by building a comprehensive maintenance and management system for septic tanks in Bali, Indonesia (2017-2018)"

Installation of Liquid Film Aeration System in Hotel X

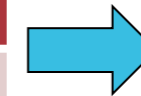


Effect test results of the liquid film aeration system on-site this fiscal year

- At the Hotel X, we installed 3-series and 5-series liquid film units in an aeration tank and conducted a demonstration experiment. We collected basic information for the long-term demonstration test next year.
- Only the liquid film unit part was brought in from Japan, and the blowers and pipes were procured locally, and two sets of 3 units and 2 sets of 5 units were put into the aeration tank. (I changed the set in the middle to see the effect of unit size.)
- The table below shows the results of blowing air by directly connecting existing 200W and 240W blowers to each device. (See the next page for the detailed layout and flow of treated water.)

Change in DO value due to the introduction of a liquid membrane device

February 8, 2020 Installed 2 units of triple liquid membrane	February 12, 2020 Replaced with 2 units of 5 consecutive liquid membranes	March 2, 2020 Switched to AS-25 (no liquid film unit: control experiment)
Before introduction: DO from 1.7mg/L (4 days later) 2/12 DO increased to 3.1mg/L	From 2/12 DO 3.1mg/L (7 days later) 2/19 DO increased to 4.4mg/L	From 3/2 DO 5.2mg/L (2 days later) 3/4 DO decreased to 3.9mg/L



The effect of the liquid film aeration system was confirmed.



Set of 5-unit and 3-unit



Changing to a 5-consecutive liquid membrane device

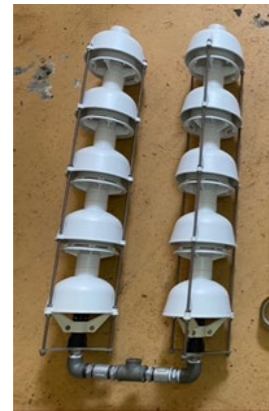


A S-25

FS Survey Results Liquid Film Aeration System



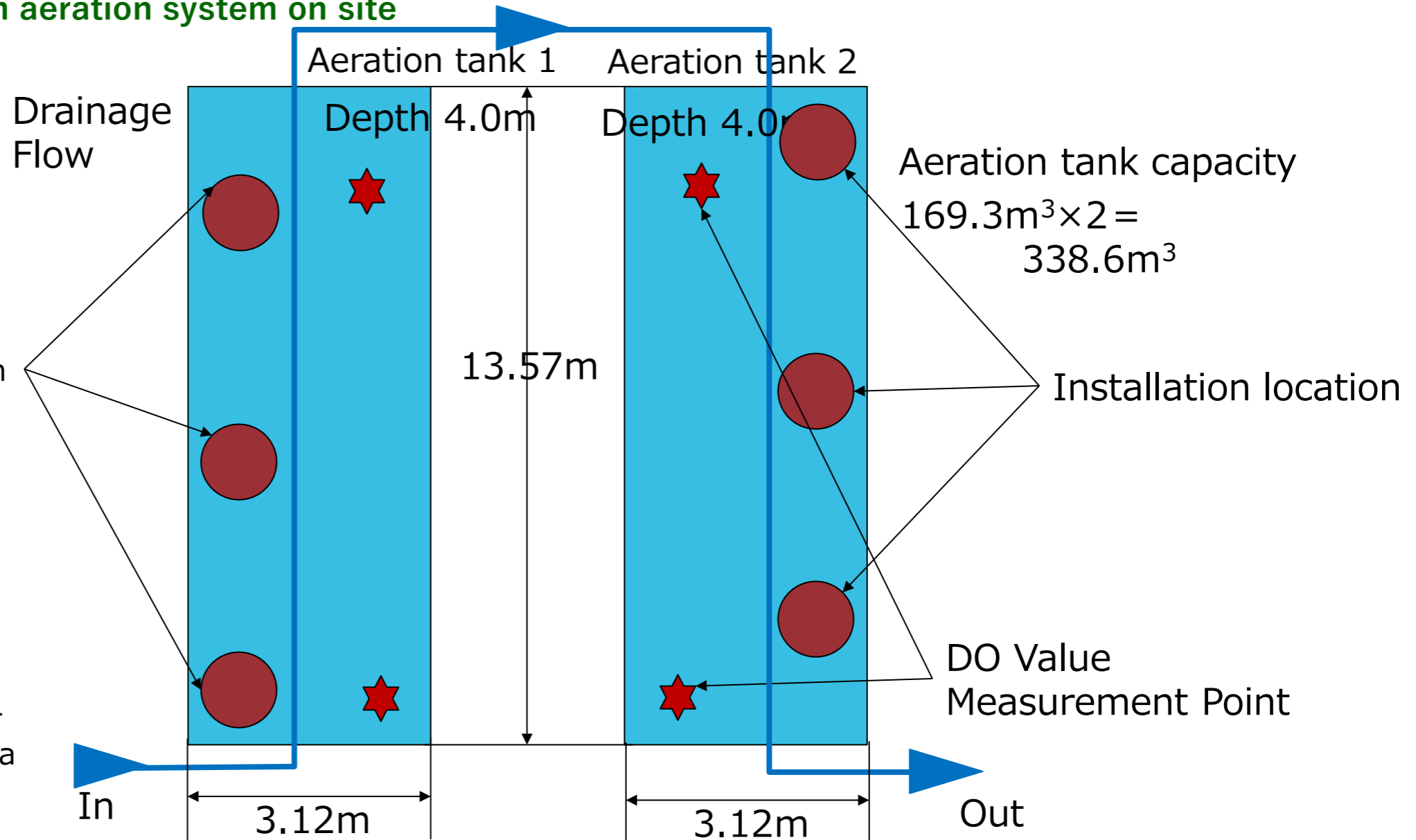
Effect test result of liquid film aeration system on site



Installation location



Liquid Film Aerator
(The photo shows a 5-tube type)



Installation of IoT System in Earth Creath, Japan



Examples of applying IoT sensors to similar projects

- Installation results at Earth Creative Co., Ltd.

Equipment Appearance and Installation Status



Real-time monitoring screen (2020.2)



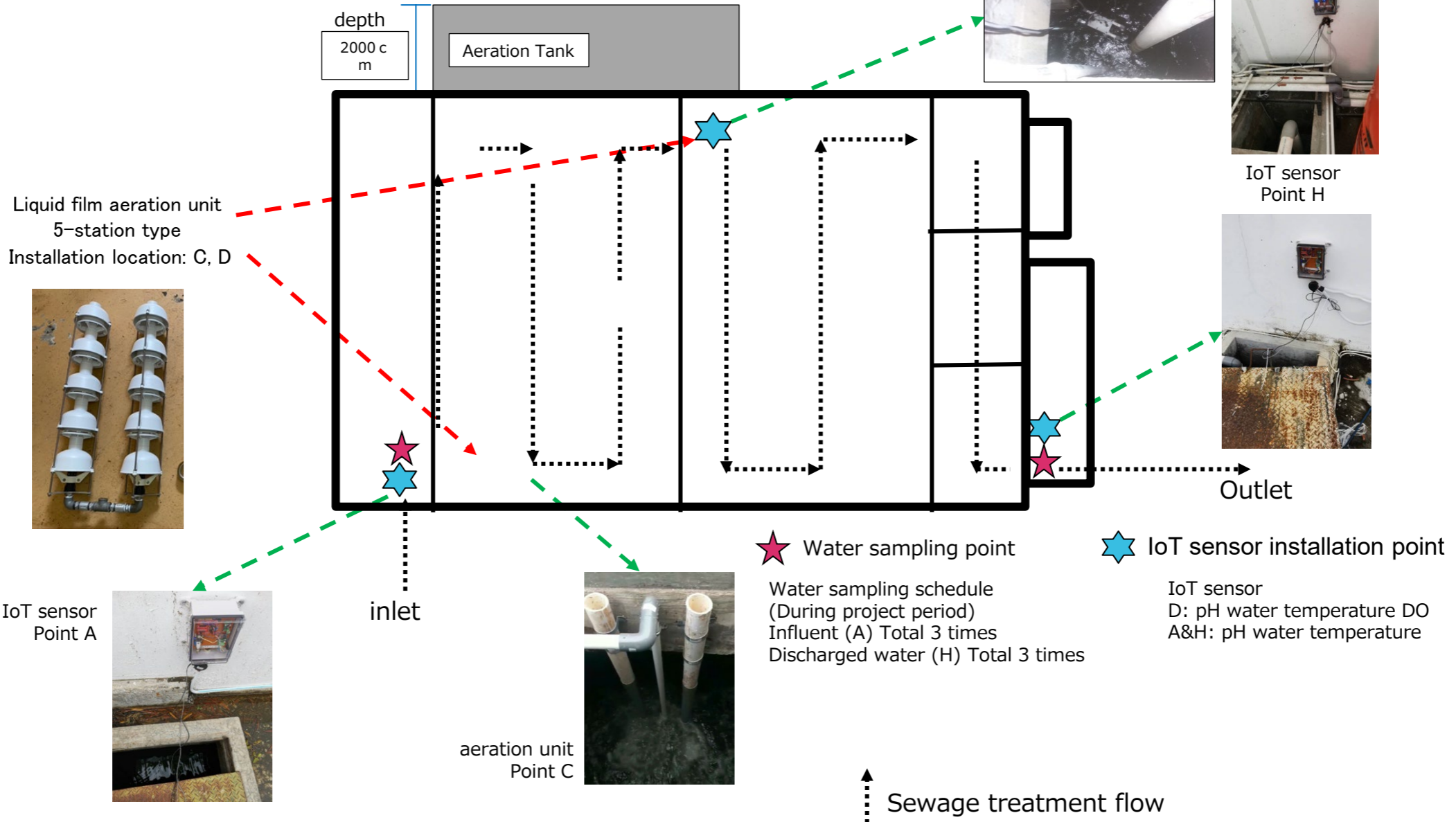
- Adding an automatic email sending function when an error occurs
- introduced locally (Hotel X) in Bali

Demonstration of Liquid Film Aeration System



Wastewater treatment septic tank facility at Udayana University Hospital

- A: Inlet
- B: Equalization
- C: Aeration 1
- D: Aeration 2
- E: Clarifier 1
- F: Effluent 1
- G: Effluent 2
- H: Clear Water



Water Quality Test



- Water quality inspection items are measured simultaneously for Indonesian standards (including special standards for Bali) and for verification surveys. (DO values are measured voluntarily since there is no standard in Bali)
- After the current situation survey, we plan to measure the same items throughout the implementation period including after the liquid film aeration system is installed.
- The measurement period is from August 2020 to March 2022 (planned to continue thereafter)

Inspection items	Standards in Bali	External Inspection		IoT measurement	Specification
		Inlet	Outlet		
TSS	50mg/L	3 times	3 times	-	✓
pH	6~9	3 times	3 times	Continuous	✓
NH ₃ -N	10mg/L	3 times	3 times	-	✓
BOD	28mg/L	3 times	3 times	-	✓
COD	50mg/L	3 times	3 times	-	✓
MBAS (Methylene Blue Active Substances)	5mg/L	3 times	3 times	-	✓
Oil and grease	10mg/L	3 times	3 times	-	✓
DO	-	-	-	Continuous	None

Demonstration of IoT Sensors



- User interface on sensor monitoring software (web browser)



Basic screen

Because it uses a web browser, it can be checked regardless of the OS (Windows, Apple, etc.), device PC, smartphone, tablet, etc.)



You can check the numerical value at the time the cursor is placed

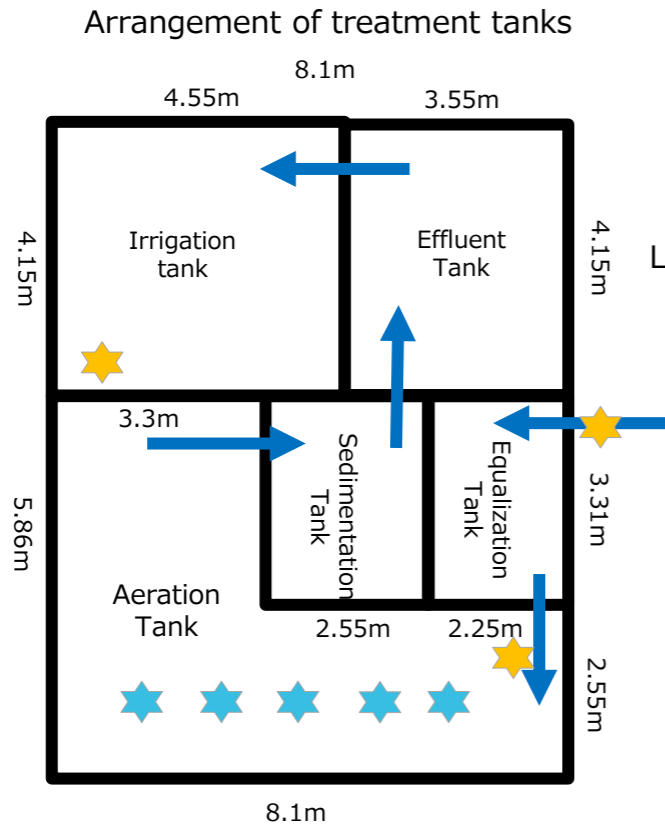


The graph period can be freely selected.
As long as there is data on the server, you can go back to the past and check the measurement values



It is also possible to select and change the desired period with the mouse Selection state by dragging the mouse. When the mouse button is released as it is, this period is enlarged and displayed.

Installation of IoT System in Hotel A



3m deep for all tanks

- ★ Location of liquid film aeration system
- ★ IoT sensor installation location



Liquid film aeration system and IoT monitoring system



Liquid film aeration system (Triple unit)



Maintenance MOU



IoT monitoring system



Installation of IoT monitoring system control panel

Installation of IoT System in Hotel B

Connection between data transmitter and sensor controller

sensor controller



IoT sensor
Data transmitter

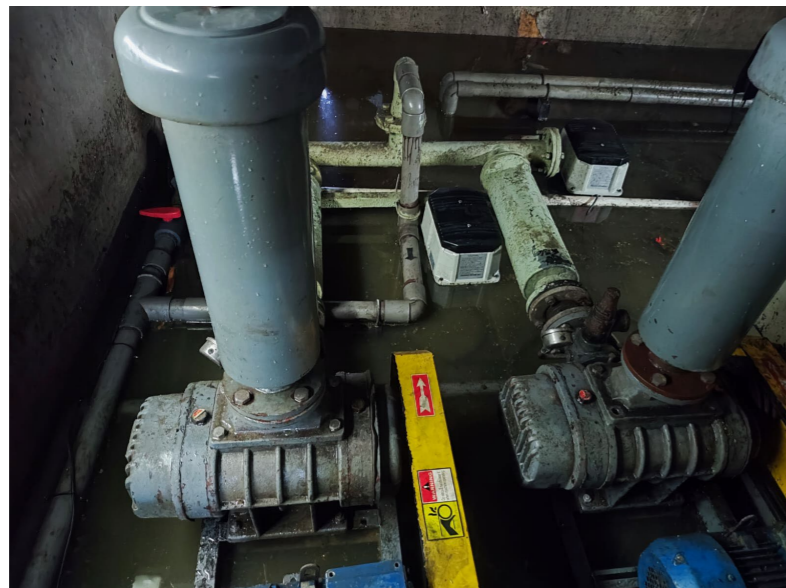


Sensor control unit and sensor connection/power supply connection



sensor body

Installation of IoT System in Hotel C



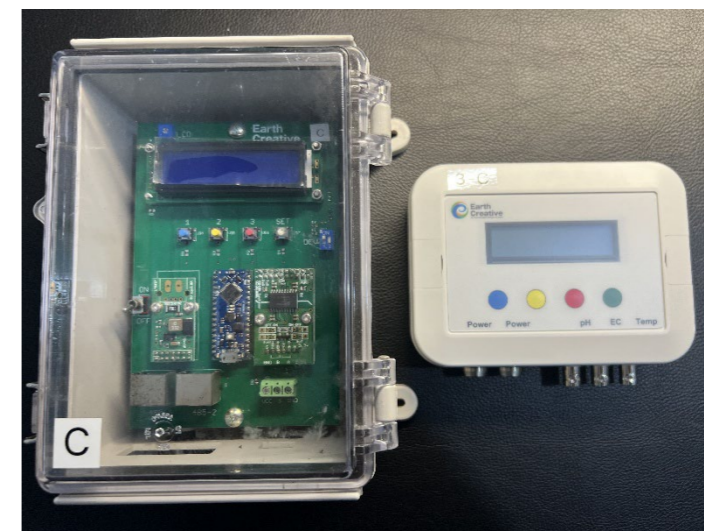
Septic tank in
underground parking lot

Device damage due to
flooding of underground
parking lot due to
underground pump
failure

IoT sensor platform
Old model New model



IoT sensor base Improved waterproofness



Technical Challenges

- Through this project, there were no major issues with the installation and durability of the liquid film aeration system and IoT sensors. In the future, we plan to add a web camera function and improve the PC screen to make it easier to understand.

Policy Issues

- Although the national and state governments have developed laws and regulations such as standards for the discharge of treated water, local governments at the prefecture level, which are directly responsible for monitoring and inspection, are responsible for monitoring, inspection, and enforcement with effectiveness and fairness. It is hard to say that there is a system that can do it. (Insufficient human resources, lack of individual knowledge, etc.)

Corporate Issues

- There are many people in charge who do not have knowledge of sewage treatment, such as the person in charge of the entire facility who is not a specialist in purification facility management. Therefore, countermeasures are ad hoc and do not improve even if costs are incurred. It is urgent and necessary to develop human resources with qualifications like Japanese septic tank managers, but there is no system for doing so.
- Few maintenance workers have the knowledge and skills to solve problems.