Operation & Maintenance of Sewage Treatment Plants and Pumping Stations

2015

Water and Sewer Bureau City of Kitakyushu
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   ・Remote monitoring of pumping stations
   ・Effective use of sludge and treated water
   ・Actions to reduce CO₂ emissions
   ・Actions to improve combined systems (storm water reservoirs)
   ・Water Plaza
1 Structure & Roles of STPs and Pumping Stations
What is sewage?  •  •  •  **Generic term for wastewater and storm water**

Sewage: Household wastewater (kitchens, baths, toilets), factory effluent, etc.

What is a sewerage system?  •  •  •  All facilities/equipment used to treat sewerage, such as pipes and sewage treatment plants, etc.
Overview of Sewage Facilities in Kitakyushu

- **STP**: 5 plants (Amount treated: approx. 450,000 m$^3$/day)
- **Pumping stations**: 34 stations, pipe length: 4,428 km
Pumping Station System (Separated System)

Wastewater pumping station

Wastewater

Pump for wastewater

Grit chamber

Screenings

Sand

Eng

Grit chamber

Screenings Sand

Pump for storm water

Storm water pumping station

Storm water

Discharged to rivers / ocean

Separated system area

Water conveyed to STP

Pump for storm water

Pump for wastewater
Sewage flow differs when weather is fair or when it rains.

Fair weather: Conveyed to waste water pump
Rainy weather: Sewage that overflows diversion weir is conveyed to storm water pump → Discharged as storm water
Main Equipment at Pumping Stations

(1) Inflow gate
(2) Grit chamber equipment
   - Screenings
   - Sand pumps
(3) Main pumps
(4) Electricity, instrumentation, monitoring control equipment
   (same for all STPs)
Main Equipment at Pumping Stations

(1) Inflow gate

- Controls and cuts off the inflow of water

![Inflow gate (above-ground)](image1)

![Inflow gate (main part)](image2)

(2) Grit chamber equipment (screenings)

- Removes rubbish/waste from sewage inflow in order to protect pumps
  - Prevents blockage of main pump(s)
- Protection of public waters (storm water)

![Screenings (bottom)](image3)
Main Equipment at Pumping Stations ②

(2) Grit chamber equipment (sand pump)

- Removes earth and sand from sewage and prevents wear and tear of main pump impeller

Water flow

Earth and Sand

Grit Chamber

Sewage pump well

Sand pump

Lubrication water tank

Drive unit

Sand pipe

Sewage chamber

Grit pipe

Screw conveyor
(3) Main pumps
Wastewater: Conveyed to STPs
Storm water: Discharged into rivers and ocean

(4) Electricity, instrumentation, monitoring control equipment
- Supply electricity from incoming power to end load
- Monitoring control using signals from measurement equipment
Sewage Treatment Plant System

- Primary settling tank
- Aeration tank
- Secondary settling tank
- Disinfection tank
- Sludge thickening
- Digestion tank
- Dehydration
- Drying

Flow of water:
- Primary settling tank to Aeration tank
- Aeration tank to Secondary settling tank
- Secondary settling tank to Disinfection tank
- Disinfection tank to Discharge

Flow of sludge:
- Sludge thickening to Digestion tank
- Digestion tank to Dehydration
- Dehydration to Drying
Main Equipment at Sewage Treatment Plants

◆ Wastewater treatment
   (1) Primary settling tank
   (2) Aeration tank
   (3) Secondary settling tank
   (4) Disinfection tank

◆ Sludge treatment
   (1) Digestion tank
   (2) Dehydration
   (3) Drying
Main Equipment at STPs: Wastewater treatment

(1) Primary settling tank
   - Removal of deposits such as fine sand and suspended matter

(2) Aeration tank
   - Treatment of organic matter in sewage using microorganisms

- Oxygen
- Activated sludge (bacteria)

Microorganisms in aeration tank (Epistylis)

Effective utilization

Discharge
(3) Secondary settling tank

- Settles activated sludge from aeration tank to produce clear, treated water
- Returns settled activated sludge to aeration tank

(4) Disinfection tank

- Wastewater is disinfected with hypochlorous acid in order to improve the safety of final effluent.
Main Equipment at STPs: Sludge treatment

(1) Digestion tank
- Reduces quantity of sludge and stabilizes quality
- Effective use of digestive gas emitted

(2) Dehydration
- Increases the efficiency of sludge treatment and removal of water content from sludge that is generated during treatment of wastewater.
Main Equipment at STPs: Sludge treatment ②

(3) Drying

- Dried sludge in this form allows it to be incinerated at waste incineration facilities

Sludge drying equipment

Internal section of drying furnace

Sludge after drying (Water content ~15%)

Formed dried sludge
Important Points for Improvement & Maintenance

**Risk Management**

- **Prevents operational mistakes**
  - Standardizes equipment specifications
  - Uses general-purpose equipment

- **Reliable sludge extraction**
  - Procures multiple disposal points

- **Continuous operation**
  - Installation of reserve equipment and backup power
  - Implementation of earthquake-proof measures

- **Manages changes in inflow**
  - Installation of pumps to deal with unexpectedly heavy rain

**Economic Efficiency**

- **Systematic improvements**
  - Appropriately-sized facilities in anticipation of long-term plans

- **Optimized facility layouts**
  - Optimized layout with consideration of water catchment conditions and discharge points

**Reduces environmental impacts**

- **Reduction of CO₂ emissions**
  - Energy conservation, reuse of treated water

- **Protection of surrounding environment**
  - Controls vibration, noise, odors, other
2  Operation & Maintenance
Importance of Operation & Maintenance

- Permanent use of sewerage system once operations start.
- Serious impact on society if STPs and pumping stations stop functioning.
- Merits or demerits of O&M are reflected in user fees.

Proper and reliable operation and maintenance of sewerage systems is required.
# O&M System in STPs and Pumping Stations

<table>
<thead>
<tr>
<th>Category</th>
<th>Subdivision</th>
<th>Objective</th>
</tr>
</thead>
</table>
| O&M                   | Operational management |  ・ Prevent flooding  
                         |  ・ Protect water quality of public waters  
                         |  ・ Reduce environmental impacts |
|                        | Safety inspections    |  ・ Prevent serious accidents and breakdowns before occurring.              |
|                        | Waste management      |  ・ Treatment of screenings, grit, sludge                                 |
|                        | Water quality management |  ・ Water quality management from inflow to discharge                        |
|                        | Workplace management  |  ・ Manage effluent from businesses to public sewerage system               |
| Asset management       | Record management     |  ・ Manage existing assets using records                                   |
|                        | Site management       |  ・ Manage operations/installation of existing assets                        |
What is Operation and Maintenance?

- Operations carried out to satisfy regulations for effluent quality

<Important Points>
- Operations must consider inflow changes
- Operations must ensure flooding does not occur in rainy weather
- Operations must respond to problems quickly
- Operations must conserve energy and be low-cost
- Operations must consider the surrounding environment

※Operations must be carried out based on operational guidelines and manuals
Safety Inspections (1)

- **Proper maintenance from mid-/long-term perspective**
  ⇒ Prevents problems before they occur

<table>
<thead>
<tr>
<th>Daily monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Check outside appearance, cleaning, check indicated values for each instrument</td>
</tr>
<tr>
<td>• Use senses (such as sound and heat) to discover abnormalities early</td>
</tr>
</tbody>
</table>
  ⇒ Ascertain aging and determine periodic repair times |

<table>
<thead>
<tr>
<th>Regular inspections</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Conduct checks for comparatively long periods and replace or repair parts</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Regular repairs</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Large-scale replacement of parts for each fixed cycle and carry out repairs to recover functionality</td>
</tr>
<tr>
<td>(Sewage pumps, engines, underwater agitator, dehydrator, sludge drying, controlled power supply, etc.)</td>
</tr>
</tbody>
</table>
## Safety Inspections (2): Inspection standards

<table>
<thead>
<tr>
<th>Type</th>
<th>Target</th>
<th>Frequency</th>
<th>Standards</th>
<th>Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily monitoring</td>
<td>All equipment</td>
<td>1x/day to several times/day</td>
<td>Check presence of abnormalities using senses Ex) Pumps · Bearing temp is room temp + 40 degrees or less · Current value is below rated value</td>
<td>· Data sheets · Flashlights, etc.</td>
</tr>
<tr>
<td>Regular inspections</td>
<td>All equipment</td>
<td>1x/month to 1x/several years</td>
<td>· Greasing on lubricated parts · Lubricant change · Cleaning of each part, change expendable parts · Check voltage currents · Insulation measurements · Check protective instrument operations · Maintenance operations · Vibration measurements · Noise measurements</td>
<td>· Vibrometer · Noise level meter · Tester · Assembly / disassembly tools · Test hammer</td>
</tr>
</tbody>
</table>
Safety Inspections (3): Example of inspection formats

### <Daily monitoring form>

<table>
<thead>
<tr>
<th>2/7</th>
<th>3/7</th>
<th>4/7</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Point Names</strong></td>
<td><strong>Test Results</strong></td>
<td><strong>Test Results</strong></td>
</tr>
<tr>
<td>1.</td>
<td>2.</td>
<td>3.</td>
</tr>
<tr>
<td>5.</td>
<td>6.</td>
<td>7.</td>
</tr>
</tbody>
</table>

- **Amount of oil on inflow gate reduction gear**
- **Dust removed by dust eliminator**
- **Dust eliminator current**
- **Sand pump current**
- **Hopper weight**
- **Special items**

### <Regular inspection form (Measurement of pump vibration)>

**Example of inspection formats**

- **Measurement of pump vibration**
  - Measure level, axis, vertical vibration

**Ex) Measurement of pump vibration**

**Measure level, axis, vertical vibration**
Safety Inspections (4): Important points

- Practice good housekeeping and cleaning to detect abnormalities early.
- Set security level to correspond to level of importance and price.
- Reconstruction and updates should respond flexibly to various situations.
- Labor safety measures should be well-thought out before adoption.

Safety measures at opening

Indicating name of project
<Corrective Maintenance>
・Response after failure occurs
・In principle, corrective maintenance has reserve equipment in place and is low priority, i.e. not an emergency.

<Preventative Maintenance>
・Measures are taken before failure occurs to prevent failure.

※ With the exception of corrective maintenance, it is best for preventative maintenance to be carried out in a systematic manner.

<Standards for reconstruction & updates (Ex)>
・Settling tank equipment: Service life of 15 years → Can be used ~22 years with extended life
・Sewage pump: Service life of 15 years → Can be used ~30 years with extended life

※ Extending service life is a key point for O&M
Waste Management

- Proper treatment according to industrial waste treatment guidelines (manifest) that are based on existing laws
- Prevents illegal dumping before it occurs

**Important points**

- Check final disposal points and overloading during transport
- Check manifest (based on operation records and monthly reports)
- Provide guidance to contractors, when necessary

Manifest for Industrial Waste

Measurement form
Water Quality Management

- Proper water quality inspections based on law
  ⇒ Reflected in O&M

※ Kitakyushu established original water quality targets!
- Water quality treated at current facilities
- Water quality based on characteristics/track records of STPs
- Influent quality is continuously monitored by automatic measuring equipment

<table>
<thead>
<tr>
<th>Item</th>
<th>Shinmachi</th>
<th>Hiagari</th>
<th>Sone</th>
<th>Kitaminato</th>
<th>Kogasaki I</th>
<th>Kogasaki II</th>
<th>Regulation values</th>
</tr>
</thead>
<tbody>
<tr>
<td>COD</td>
<td>11</td>
<td>8.5</td>
<td>8.4</td>
<td>15</td>
<td>8.8</td>
<td>8.0</td>
<td>20</td>
</tr>
<tr>
<td>Total nitrogen</td>
<td>10</td>
<td>15</td>
<td>11</td>
<td>12</td>
<td>11</td>
<td>13</td>
<td>20</td>
</tr>
<tr>
<td>Total phosphorus</td>
<td>0.3</td>
<td>1.6</td>
<td>0.2</td>
<td>0.6</td>
<td>0.2</td>
<td>0.2</td>
<td>2</td>
</tr>
<tr>
<td>Coliform (#/ml)</td>
<td></td>
<td></td>
<td></td>
<td>300</td>
<td></td>
<td></td>
<td>3,000</td>
</tr>
</tbody>
</table>
Record Management

- Adjust assets held at the end of the fiscal year
- Quick registration in system
  - Register acquired and cancelled assets
  - Register equipment names with easily identifiable names
  - Register details of safety inspections

※ The collection of information is the basis for O&M
Important Points for Equipment

(1) Inflow gate

◆ O&M
  • Proper valve adjustment in consideration of the amount of water being conveyed
  • Valve adjustment to prevent flooding

◆ Safety inspections
  • Periodic testing of full valve closure/opening
  • Amount of leakage when valve fully closed
  • Application of grease to spindles

(2) Settling tank equipment (screenings)

◆ O&M
  • Intermittent operations to conserve energy

◆ Safety inspections
  • Oil changes
  • Tension adjustment of chains
  • Painting repair of corroded areas
Important Points for Equipment ②

(2) Settling tank equipment (sand pumps)

- O&M
  - Adjust flow speed uniformly
  - Should not be stagnant for long periods
- Safety inspections
  - Removal of foreign substances
  - Oil changes

(3) Main pumps

- O&M
  - Ascertain pump rate of flow
  - Regulate operation time
- Safety inspections
  - Check that there is no water leakage
  - Record numerical values during operation (current values, vibration, etc.)
  - Periodic application of grease to bearings
(4) Electricity, instrumentation, monitoring control equipment

◆ O&M
  - Check indicated values for meters
  - In principle, operated remotely from STP
    (Manual operation is necessary when failure occurs)

◆ Safety inspections
  - Daily inspections
  - Safety operations (self-powered equipment)
  - Insulation measurements, zero span adjustment, etc.
Important Points for Equipment ④

(5) Primary settling tanks

◆ O&M
  - Equalize inflow volume to each line
  - Proper extraction of sludge sediment

◆ Safety inspections
  - Removal of scum on water surface
  - Ascertain amount of wear and tear and corrosion of sludge collectors
  - Oil changes

(6) Aeration tanks

◆ O&M
  - Equalize inflow volume to each line
  - Manage air volume (DO), density of suspended particulates (SV), mixed liquor suspended solids (MLSS)

◆ Safety inspections
  - Check that air diffusion is uniform
Important Points for Equipment ⑤

(7) Secondary settling tanks
◆ O&M
  • Equalize inflow volume to each line
  • Adjust return sludge volume
◆ Safety inspections
  • Removal of scum and algae on water surface
  • Ascertain amount of wear and tear and corrosion of sludge collectors
  • Oil changes

(8) Disinfecting equipment
◆ O&M
  • Adjust injection rates to clear water quality targets (less than 300 E.coli)
◆ Safety inspections
  • Check for leaks from hypochlorous acid storage tank
  • Visual check of injection conditions
  • Unclog pipes
  • Change expendable parts of injection pump
  • Be aware of chemical inventory and adjust where necessary
Important Points for Equipment ⑥

(9) Digestion tank

◆ O&M
  • Equalize tank temperatures with sufficient stirring
  • Manage temperature of thickened sludge
  • Prevent decay of sludge

◆ Safety inspections
  • Inspection and dredging of sand deposits

(10) Dehydration of sludge

◆ O&M
  • Proper management of moisture content in consideration of transport and disposal
    Reference: Moisture content is ~72-76% in Kitakyushu
  • Assessment of dehydrated and separated liquid

◆ Safety inspections
  • Periodic change of expendable parts

Deposits on inside of sludge digestion tank

Change of filter cloth in dehydrating belt press
(Reference) Sludge Drying

- Dehydrated sludge is dried and incinerated with general waste

- **O & M**
  - Adjustment of moisture content for dried sludge (~10-18%)
  - Adjustment of moisture content for sludge in cake form (~40%)

- **Safety inspections**
  - Regular overhaul

Maintenance of drying furnace
Checking operation of drying furnace
3 Distinctive Features of O&M in Kitakyushu
Distinctive Features of O&M in Kitakyushu

(1) Outsourcing of work
(2) O&M system and costs
(3) Remote monitoring of pumping stations
(4) Effective use of sludge
(5) Effective use of treated water
(6) Actions to reduce CO₂ emissions
(7) Conversion of sludge to fuel
(8) Optimized measures
(9) Actions to improve combined systems (storm water reservoirs)
(10) Water Plaza
Outsourcing of Work

- Effective management of projects with clear role-sharing between private and public sectors
  ⇒ Utilize originality and creativity of private businesses
  - **Public sector**
    - Accountable as based on law
    - Guidance provided to contractors
  - **Private sector**
    - Project operation
    - Safety inspections/maintenance
    - Water quality inspections, etc.

<Public sector management system>
- Specify project details and standards in order specifications
- Impose timely submission of required documents: operation log sheet, project plan, maintenance inspection schedule, maintenance inspection record, reports, etc.
- Check that order details and required standards have been met in submitted documents.
- Provide guidance to contractors, where needed.
Public Sector (City of Kitakyushu: 65 people)

Water and Sewer Bureau

- Sewer System Department (Executive Director E)
  - Facilities Construction Division: 22 staff (Director E) Manager (CL,M,E2)
    17 staff (CL2,M7,E7,CH)
  - Water Quality Control Division: 13 staff (Director CH) Manager (CL2)
    10 staff (CL,CH,BIO)
  - East Sewage Treatment Plant: 17 staff
    Hiagari, Shinmachi, Sone Treatment Plant
    Managing Director (M)
    Manager (M,E)
    14 staff (office staff, electricians 5, machine operators 8)
  - West Sewage Treatment Plant: 12 staff
    Kogasaki Treatment Plant, Kitaminato Treatment Plant
    Managing Director (E)
    Manager (M,E)
    9 staff (office staff, electricians 5, machine operators 3)
- General Affairs Division, Administration and Planning Division, Planning Division, etc.
Outsourced to Private Sector (225 people)

- O&M (3 staff, shift work)
  - Operation of STP pumping stations (24 h/day, 365 days/year)
  - Central supervision
  - Onsite inspections

- Safety inspections (daily)
  - Maintenance of STP pumping stations

- Water quality inspections
  - Auxiliary management of part of water quality tests and water quality management

<East Sewage Treatment Plant> 131 staff
- Hiagari Treatment Plant: 73 staff
  - Operations: 15 staff
  - Safety inspections: 58 staff
- Shinmachi Treatment Plant: 29 staff
  - Operations: 12 staff
  - Safety inspections: 17 staff
- Sone Treatment Plant: 29 staff
  - Operations: 13 staff
  - Safety inspections: 16 staff

<West Sewage Treatment Plant> 85 staff
- Kogasaki Treatment Plant: 52 staff
  - Operations: 17 staff
  - Safety inspections: 35 staff
- Kitaminato Treatment Plant: 33 staff
  - Operations: 12 staff
  - Safety inspections: 21 staff

<Water quality management supporting projects> 7 staff
## O&M Costs

### FY 2011 balance sheet

<table>
<thead>
<tr>
<th>Details</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sewage treatment costs</td>
<td>¥4.988 billion</td>
</tr>
<tr>
<td>Transport costs to STPs</td>
<td>¥2.204 billion</td>
</tr>
<tr>
<td>O&amp;M costs for sewage pipes</td>
<td>¥1.362 billion</td>
</tr>
<tr>
<td>O&amp;M costs for pumping stations</td>
<td>¥842 million</td>
</tr>
<tr>
<td>O&amp;M costs for STPs</td>
<td>¥2.784 billion</td>
</tr>
<tr>
<td>Personnel costs, other</td>
<td>¥2.454 billion</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>¥7.442 billion</strong></td>
</tr>
</tbody>
</table>

### Total

¥36.5 billion

*O&M Costs*
Remote Monitoring of Pumping Stations

Remote monitoring and operation of pumping stations in order to improve work efficiency and safety

- Automatic operation (in principle)
- Remote monitoring/operations from STP Central Operation Room

**Required items for remote monitoring**

<Hard infrastructure>
- Installation of standby operation pumps (Combined pump stations)
- Redundancy of pump well water levels
- Installation of remote monitoring equipment (redundancy of control sequencers, installation of mini-UPS)
- Installation of large screen displays (improves visibility), etc.

<Soft infrastructure>
- Close cooperation between operational teams and pumping station maintenance teams

※System is operating well with no major problems
Effective Use of Sludge

- Mixed incineration of sludge with general waste
- Collection of thermal energy as steam to generate power

※100% effective use of actual sewage sludge in energy cycles

⇒ Sizable cuts in power costs (electricity costs)
Effective Use of Treated Water

- Sale of treated water to private factories for miscellaneous and landscape use
  - Secure new income source (sale to private factories)
  - Use in treatment process (anti-foaming water)

- Recycled water ratio: 5.26%

- All treated water: ~156,041,985 m³/year
- Recycled water: ~8,206,581 m³/year

- Used on grounds: 92.8%
- Used in private factories: 2.3%
- Water for landscape use, sprinkling: 4.9%

- Anti-foaming water
- Road sprinkling
- Landscape use
STPs have been enhanced as local energy renewable bases

Biogas Power Generation
Annual amount of power: 1,106,000 kWh
CO₂ reductions: 408 t

Small-scale Water Power
Annual power generated: 8,000 kWh
CO₂ reductions: 3 t

Small-scale Wind Power
Annual power generated: 6,000 kWh
CO₂ reductions: 2 t

Solar Power (Group 1-4)
Annual power generated: 252,000 kWh
CO₂ reductions: 92 t
※Groups 5-7 will be installed after 2013

Use of LED Lighting
Annual reduction in power consumption: 147,000 kWh
CO₂ reductions: 54 t

Hiagari Treatment Plant

Water Plaza

Sludge Incineration (planned)
(Use as alternative fuel for coal)
Overall CO₂ reductions in project: 11,200 t

Overall CO₂ reductions in project: 11,200 t
### Power Generation (Solar, digestion gas, wind, water)

#### <Overview>
- Clarification of energy-saving and energy-creating actions in Kitakyushu’s sewage vision (2010)
- Positioning of Hiagari STP as renewable energy base
- Plans to increase solar power generation to over 1000 KW by 2020

#### <Outcomes>
- **Solar power generation** 577 KW
  - Hiagari Treatment Plant FY 2010: 150 KW, FY 2011: 120 KW
  - Shinmachi Treatment Plant FY 2011: 140 KW, FY 2012: 70 KW
  - Kitaminato Treatment Plant FY 2011: 57 KW, FY 2012: 40 KW
- **Digestion gas power generation**
  - Hiagari Treatment Plant FY 2010: 150 KW
- **Wind power generation (small-scale)**
  - Hiagari Treatment Plant FY 2011: 3 KW
- **Water power generation (small-scale)**
  - Hiagari Treatment Plant FY 2011: 1 KW
Energy Income & Expenditure at Hiagari STP

◆ 90% is renewable energy!

Digestive gas, solar power, wind power, small-scale water power, etc.
4,104 kWh/day
8.9%

Power generated in combined waste incineration
37,724 kWh/day
81.6%

Power companies
4,379 kWh/day
9.5%

Total 46,207 kWh/day
(FY 2012)

Breakdown of electric power used
Conversion of Sludge to Fuel

- Used as alternative fuel for coal

Energy of sewage sludge is approximately equal to two-thirds the energy of coal

⇒ **Valuable, new income source**
Reduced ventilation in aeration tanks

Precision aeration equipment is installed in aeration tanks, which reduces the amount of ventilation required.

Optimized equipment specifications

Use equipment with well-balanced capacity to respond to various situations

Ex) Tobata pumping station (storm water pump)

- Large pumps (3): 522 m³/min
- Small pumps (2): 150 m³/min

※Reduced power costs
Actions to Improve Combined Systems (Storm water reservoir)

- Temporary storage of storm water with high pollution concentration in early stages of rainfall

⇒ When weather is fine, storm water is released to STPs as sewage
Water Plaza

- Advanced fresh water generation system that combines seawater desalination and membrane filtration for sewage reuse

【Merits】

- Energy-saving
- Low-cost
- Low environmental impact

Public and private sectors aiming to develop business overseas

Private Companies
Actual operations

City of Kitakyushu
Sharing know-how

Nat’l Gov’t
Financial support

※ Focus of attention from Japan and abroad
Visitors: 4,400
(1,000 people from 66 countries overseas)

Many visitors from overseas
Visit by Kaohsiung mayor (Taiwan)
(Reference) Development of International Strategic Base

- Information dissemination base for water infrastructure that is a hub for people, technologies and information

※Water Plaza is the core facility of this base (start of operations planned from 2015)
Thank you!

*Kitakyushu willingly supports*

*Sewerage Development*