What is Happening in Small-City Sewerage Systems?

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key words: public sewerage, depopulation, small-scale sewerage system, facility management, Research and Development Committee on Sewerage (RDCS)

1. Introduction

In Japan, sewerage is a type of infrastructure that is managed by local public bodies, and no projects are implemented directly under the jurisdiction of the national government. In public sewerage systems managed by municipalities, the scale of the city which is the responsible organization varies widely, from major "ordinance-designated" cities with populations exceeding 1 million to small cities, towns and villages with populations from several 10,000 to several 1,000 persons. Among these, a total of 1,201 responsible organizations manage sewerage systems in cities with populations of less than 50,000, towns and villages (colored areas in **Table-1**; hereinafter called "small cities"), accounting for 70 % of all responsible organizations nationwide. At present, however, little information is available on the types of problems confronting sewerage systems in these small cities, and those issues seldom become a topic.

Table-1 Number of responsible organizations of public sewerage systems

Population class, etc.		Number of responsible organizations
Ordinance-designated cities		21
Cities	500,000 or more	7
	300,000 or more to less than 500,000	45
	100,000 or more to less than 300,000	192
	50,000 or more to less than 100,000	253
	Less than 50,000	274
Towns and villages	Towns	744
	Villages	183
Total		1,719

Source: Prepared based on p. 20 of "Sewerage of Japan (FY 2019), Materials."

2. Large problems of small cities

Until now, large cities were the driving force for sewerage system construction and were in the forefront in carrying out projects in all parts of the world. In Japan as well, technical guidelines, etc. were arranged based on the actual results of large cities, and were then applied in smaller cities with revisions suitable for small-scale systems. The Japan Sewage Works Agency (JSWA), which is a group of technical experts in the sewerage field, provided powerful support for the construction and improvement of small-scale sewerage systems by dispatching many engineers from large cities.

However, sewerage systems are now confronted with various changes in social conditions, such as population decline. These changes will directly affect small cities first, making common use of the "urban-driven model" difficult. The trend of low birthrates and aging of the population in Japan is the most serious in the world, and depopulation of local areas is progressing rapidly. Under these conditions, planning and design methodologies for sewerage systems are extremely difficult, and it is also difficult to see how operation and management of small-scale sewerage systems can be maintained in the future.

As an additional problem, facility management inherently tends to be inefficient in small cites. In addition to the small scale of the facilities, mergers of cities, towns and villages increase the number of facilities that must be managed, but the number of staff in charge of that work decreases. Moreover, in many cases, drainage and other facilities for agricultural communities are managed centrally by the section in charge of sewerage in the town office, but this tends to result in a business structure in which facilities are scattered over mountainous areas, making it difficult to avoid inefficient management.

In spite of these obvious problems, we found that it was unexpectedly difficult to identify the concrete issues confronting small cities, and to find hints of their solution, even when looking at the large tendencies of these problems.

3. Listening earnestly to problems and needs

The essential purpose of the Research and Development Committee on Sewerage (RDCS), which is hosted by the Water Quality Control Department of NILIM, is to follow up on Japan's Technical Vision on Sewerage in order to ensure its achievement. On the other hand, however, identifying the technical problems and needs of sewerage of local public bodies is also one of the

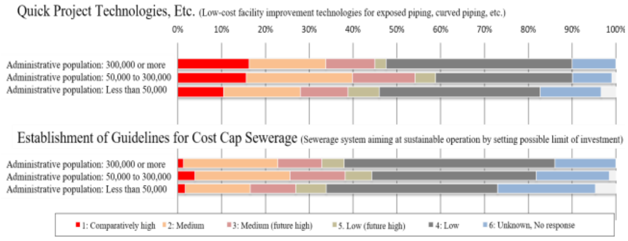

Fig.-1 Partial results of questionnaire on technical needs by city size
(Excerpted from the results of a survey of technical needs by the RDCS in FY 2017. Participants responded by indicating the necessity of development and application of the technical items shown above by selecting the options shown in the legend.)

roles of the RDCS.

One relatively easy technique for identifying these problems and needs is analysis of the technical issues proposed and discussed at meetings sponsored by cities. However, almost none of those meetings targeted small cities, or it was difficult for the persons in charge of sewerage systems to participate in meetings and training due to the small size of the local staff. As a result, the difficulty of creating cross-connections and building networks with more advanced cities and related organizations by this approach became clear.

Although the RDCS has also conducted nationwide questionnaire surveys on technical needs, the results were somewhat difficult to understand (**Fig. 1**), for example, because the reported necessity of technologies intended for small cities was lower in small cities than in cities with larger populations. Thus, it was extremely difficult to understand the actual situation. Ultimately, ongoing interviews since the RDCS was launched in 2016, although conducted at only a limited number of locations, have been effective in grasping the actual conditions, and clarified some of the problems of small cities. (For example, the aforementioned problem of management inefficiency of scattered facilities was raised at an interview.) The following are some examples of technical problems.

(1) <u>Feeling that there are no technologies applicable to small cities</u>

B-DASH and other new technologies are perceived as not being applicable to small cities (opinion at interview).

(2) <u>Difficulty of obtaining information on new technologies</u>

Manufacturers rarely make sales calls, and even when they do, it is difficult to assess the suitability of the information received. There is also nobody available for technical consultations (same as in (1)).

(3) <u>Lack of time even for technical studies</u>

Due to the pressures of general desk work, staff cannot visit the actual site. There is a tendency to choose simply not thinking about introduction of new technologies as the best option (opinion expressed by member of the RDCS, estimated to be one reason for the results of the questionnaire in Fig.-1).

Although these comments involve various factors other than technical problems, it became clear that there is no single quick remedy that can solve these problems. Hence, a variety of steady efforts will be needed.

4. Toward problem-solving for small cities

For example, in response to issue (1), in the B-DASH Project, we made a rather bold shift toward technological development for medium- and small-sized cities in recent years in order to solve this problem (**Fig.-2**). However, this alone is not sufficient to solve the problem because issues (2) and (3) are also obstacles to those efforts. Of course, measures such as wide area and joint projects are also effective, but early realization on a nationwide basis is considered difficult.

As one way to break this impasse, steady trial efforts are underway in the Energy Subcommittee of the RDCS. For example, based on the results of a study by the Subcommittee, it was considered possible to reduce electric power rates by a maximum of about 40 % in small-scale sewerage systems by innovations in the general wastewater treatment method (OD method). However, those in charge in the town office were not interested in the actual site, and there is no merit for the contractor entrusted with management of the treatment plant if the contractor made efforts to improve operation, even if an energy saving was achieved. As a result, no progress was made implementing this carefully-developed economy plan. However, various efforts were made to overcome this problem, including information sharing among the persons in charge at NILIM, the town office and the plant management contractor, popularization and educational activities with the cooperation of related organizations, and recommendation of incentives for the contractor through a full-scale consignment of plant operation to the private sector. This trial in sharing information and networking in the model district lowered the barriers to problem-solving at the site, and activities aimed at horizontal development of these efforts to other regions have begun.

Although this kind of effort to approach small cities probably cannot be considered an efficient research activity, I feel that it is an effort that somebody must make to solve this kind of problem. In addition to the example introduced here, the RDCS is also developing other efforts for small cities. Those initiatives have only begun, and slow-but-steady efforts will also be needed in the future

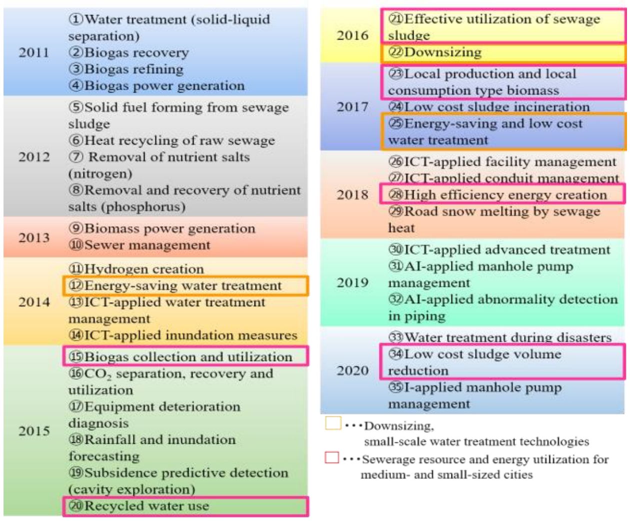

Fig.-2 Transition of publicly-offered themes of B-DASH Project
(Areas enclosed in the yellow and red boxes are technologies mainly for small-scale sewerage systems. In labor-saving technologies utilizing ICT and AI, there are also some suitable small-scale systems.)

☞ **See the following for details:**

Website of the Research and Development Committee on

Sewerage (Energy Subcommittee)
http://www.nilim.go.jp/lab/eag/gesuidougijyutsukaihatsukaigi.html
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