Republic of India

FY2022 Ex-Post Evaluation Report of
Japanese ODA Loan
Ganga Action Plan Project (Varanasi)

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0. Summary

The objective of the Ganga Action Plan Project (Varanasi) (hereinafter referred to as "the Project") was to improve wastewater treatment capacity and sanitation conditions in Varanasi, Uttar Pradesh, by constructing and rehabilitating sewage treatment facilities, constructing sanitation facilities such as community toilets, and implementing sanitation improvement activities such as public awareness programs, thereby contributing to the improvement of water quality in the Ganges River and sanitation conditions for citizens, pilgrims, and tourists.

The implementation of this Project, from the time of appraisal to the time of ex-post evaluation, was fully consistent with India's development plan and development needs, and the planning and approach of the Project were appropriate. In addition, the Project was found to be consistent with Japan's development assistance policy and other projects within and outside of JICA, hence the relevance and coherence of the Project are high.

Regarding the outputs, although changes from the plan occurred in each component, the increase or decrease from the plan was not such as to affect the achievement of the Project's outcomes. Although the project cost was within the plan, the project period was much longer than planned, rendering the efficiency of the Project moderately low.

As for project effectiveness, the Project largely achieved its goals in terms of operation and effectiveness indicators related to the improvement of sewerage infrastructure, with the exception of indicators related to water quality in the downstream area of the Ganges River. The qualitative effects and impacts related to the improvement of the sanitation environment were confirmed, and no negative impact of the Project on the natural environment was reported. Therefore, the effectiveness and impact of the Project are high.

Regarding the sustainability, considering the operation and maintenance of the Project, no problems were found in the related policies and systems, institutional/organizational aspect, technical aspect, environmental and social aspect, and risk prevention measures, but the financial situation was partially worrisome because of a delay in the payment of operation and maintenance expenses at the time of the ex-post evaluation, and the prospects for improvement and resolution were uncertain. Therefore, the sustainability of the Project is moderately low.

In light of the above, this Project is evaluated to be satisfactory.

1. Project Description

Project location
(Source: evaluator)

Sewage treatment plant constructed by the Project (Source: evaluator)

1.1 Background

The Ganges River is the largest river in India, with a basin area of 861,404 km2, or one-fourth of the country's total land area. About 43% of India's total population lives in the Ganges River basin. The Ganges River is not only a source of drinking water and irrigation but is also a sacred river where many Hindus bathe daily in devotion to their faith. However, due to rapid population growth and industrialization in the basin since the early 1980s, sewage far in excess of the natural purification capacity has been discharged into the river, resulting in rapid deterioration of water quality, which has had a significant negative impact on the living environment. In order to improve this situation, the Government of India launched the Ganga Action Plan (GAP) in 1985, and has been promoting the construction of sewage treatment facilities in major cities in the river basin to implement countermeasures against water pollution in the Ganges River.[1]

Varanasi City in Uttar Pradesh is an ancient city located on the banks of the Ganges River, and as the sacred city of Hinduism, it is visited by many people from home and abroad for pilgrimage and tourism purposes. In Varanasi City, although sewage treatment facilities and a network of sewage pipes were constructed under the Ganga Action Plan (GAP) mentioned above, at the time of the appraisal of this Project, only about 35% of the sewage was treated at sewage treatment plants (hereinafter referred to as "STP"), and the rest flowed into the Ganges River through rainwater drainage channels and the Varuna River. As a result, the water quality of the Ganges River had deteriorated significantly to a maximum of 15 mg//L BOD[2], compared to the bathing-qualified water quality standard of less than 3 mg/L BOD, and there were concerns about the sanitary impact not only on the city's residents but also on pilgrims.

[1] The Ganga Action Plan (GAP) was divided into two phases: Phase I, launched in 1985, covered the three states of Uttar Pradesh, Bihar, and West Bengal; Phase II, launched in 1993, covered seven states: Uttarakhand, Uttar Pradesh, Bihar, Jharkhand, West Bengal, Delhi, and Haryana.

[2] Abbreviation for Biochemical Oxygen Demand, one of the most common water quality indicators. High BOD means that dissolved oxygen is easily depleted and that there is a high level of organic matter.

1.2 Project Outline

The objective of this Project is to improve wastewater treatment capacity and sanitation conditions in Varanasi, Uttar Pradesh, by constructing and rehabilitating sewage treatment facilities, constructing sanitation facilities such as community toilets, and implementing sanitation improvement activities such as public awareness programs, thereby contributing to the improvement of water quality in the Ganges River and sanitation conditions for citizens, pilgrims, and tourists.

Loan Approved Amount / Disbursed Amount	11,184 million yen / 6,200 million yen	
Exchange of Notes Date / Loan Agreement Signing Date	March 2005 / March 2005	
Terms and Conditions	Interest Rate	0.75%
	Repayment Period (Grace Period	40 years 10 years)
	Conditions for Procurement	General Untied
Borrower / Executing Agency(ies)	The President of India / National Mission for Clean Ganga (NMCG)[3]	
Project Completion	June 2022	
Target Area	Varanasi, Uttar Pradesh	
Main Contractor(s) (Over 1 billion yen)	Satish Kumar (India) / Toshiba Water Solutions Pvt. Ltd. (India), VA Tech Wabag Ltd. (India) / Bahadur & Company (India), Shriram EPC Ltd. (India)	
Main Consultant(s) (Over 100 million yen)	Aecom Asia Company Ltd. (Hong Kong) / TTI Consulting Engineers India Pvt. Ltd. (India) /NJS Consultants Co., Ltd. (Japan) / NJS Engineers India Pvt. Ltd. (India), TEC International Co, Ltd. (India)	
Related Studies (Feasibility Studies, etc.)	The Study on Water Quality Management Plan for the Ganga River in the Republic of India (2005)	

[3] The executing agency of the Project was the National River Conservation Directorate (NRCD) of the Ministry of Environment and Forests prior to October 2014, which was changed to the NMCG established in the Ministry of Water Resources, River Development and Ganga Rejuvenation in 2014. The Ministry of Water Resources, River Development and Ganga Rejuvenation was merged into the Ministry of Jal Shakti, which specializes in water-related affairs, in 2019, and at the time of the ex-post evaluation, the NMCG is under the jurisdiction of the Department of Water Resources, River Development and Ganga Rejuvenation in the Ministry of Jal Shakti.

Related Projects	Project for the Comprehensive Improvement of Environmental Sanitation in Varanasi (Technical Cooperation Project, 2020-2023)

2. Outline of the Evaluation Study

2.1 External Evaluator

Maki Nakamura, Metrics Work Consultants

Hiroshi Nishino, Metrics Work Consultants

2.2 Duration of Evaluation Study

This ex-post evaluation study was conducted with the following schedule.

Duration of the Study: September 2022 – November 2023

Duration of the Field Study: December 10-27, 2022, May 21-27, 2023

3. Results of the Evaluation (Overall Rating: B[4])

3.1 Relevance/Coherence (Rating: ③[5])

3.1.1. Relevance (Rating: ③)

3.1.1.1 Consistency with the Development Plan of India

At the time of appraisal, the Government of India's Tenth Five Year Plan (2002-2007) included a commitment to improve sanitation sector indicators with a focus on poverty reduction, as well as to ensure sustainable access to drinking water in all villages by 2007, and to clean up major polluted rivers and improve their basin environments. In addition, the Common Minimum Programme under the Singh administration, inaugurated in May 2004, included a commitment to increase public investment in water supply, sewage treatment infrastructure, and sanitation facilities. The Ministry of Environment and Forests[6] was implementing nationwide river water quality protection projects through sewage treatment improvement under the National River Conservation Plan, a national policy covering 157 cities in 31 river basins. The Ganga Action Plan (GAP), which is the core of the Plan, has been implemented since 1985, and this Project was positioned as a Phase II project of the GAP.

At the time of the ex-post evaluation, the national policy and initiative for conservation of river water quality of the Ganges River basin is the Namami Gange Programme[7], which was launched in 2015. The Namami Gange Programme was launched by Prime Minister Modi,

[4] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

[5] ④: Very High, ③: High, ②: Moderately Low, ①: Low

[6] At the time of appraisal, the National River Conservation Directorate (NRCD) under the Ministry was the executing agency for the Project.

[7] *Namami Ganga* is a Sanskrit term meaning “to pray to the Ganges River”.

appointed in May 2014, and is being promoted by NMCG, the executing agency of the Project[8]. Namami Ganga focuses on sewage treatment infrastructure, river-front development, afforestation, biodiversity, public awareness, and so on. Some 315 projects (including 151 sewerage infrastructure projects) were implemented by 2020, with a budget of 288.5 billion rupees[9]. In December 2022, four states, including Uttar Pradesh, approved sewerage infrastructure projects worth 27 billion rupees, making Namami Ganga an important flagship program for the country.

In terms of policies to improve sanitation, the Swachh Bharat Mission[10], a key policy launched in 2014, is being promoted on a national scale. One of the most important policies of the mission is the promotion of toilet facilities, with the goal of becoming open defecation-free (ODF).

Given the above, this Project is consistent with India's development plan, as pollution of rivers, especially the Ganges River, has continuously been an important agenda in India, both at the time of the appraisal and at the time of the ex-post evaluation. As for sanitation improvement, the objectives and contents of the sanitation improvement component of the Project are consistent with the policies of India, as the country has been promoting sanitation improvement measures, including the promotion of toilet facilities, under the Swachh Bharat Mission, an important initiative launched in 2014, at the time of the ex-post evaluation.

Therefore, the Project has been in line with the development plan of India both at the time of appraisal and at the time of ex-post evaluation.

3.1.1.2 Consistency with the Development Needs of India

At the time of appraisal, the sewage treatment capacity of Varanasi City was only about 102 MLD[11] for a sewage discharge of about 290 MLD, which meant that only about 35% was treated. The water quality of the Ganges River in Varanasi was significantly degraded from the Ministry of Environment and Forests' standard of less than 3 mg/L BOD to a maximum of 15 mg/L, and there were concerns about the sanitary effects not only on the city residents but also on pilgrims.

The actual/predicted data of population, sewage generation, sewage treatment capacity, and sewage inflow in Varanasi at the time of the ex-post evaluation are shown in Table 1 below. As the sewage treatment capacity of Varanasi City was enhanced to 361.8 MLD by the Project, followed by the construction of a new 50 MLD STP with self-financing by the Indian side, the sewage treatment capacity of Varanasi City reached 411.8 MLD as of 2022. Although the

[8] Prime Minister Modi had made a commitment to purify the Ganges River before taking the post, establishing the NMCG in October 2014 in the Ministry of Water Resources, River Development and River Ganges Restoration and launching the Namami Ganga Programme in 2015.
[9] Source: Namami Gange Programme At a Glance (September 2020)
[10] *Swachh Bharat* means “Clean India”.
[11] MLD: Million Liters per Day. 1 MLD=1,000 m3/day

increased sewage treatment capacity ensures that the city has enough capacity to handle the volume of incoming sewage, there are still areas of the city where the sewer network has not yet been developed, and sewage and wastewater treatment during the rainy season continues to be a challenge. In addition, the population of Varanasi is increasing, and the amount of sewage is expected to increase in the future, so it is recognized that further expansion of sewage treatment capacity is necessary to cope with this demand. There is also a strong need to continue to encourage behavior change of the residents and improve the sanitation environment in the city. The water quality (BOD) in the Ganges River basin in Varanasi City is up to 2.5 mg/L near Assi Ghat, upstream, and 3.8 mg/L at Malviya Bridge, downstream, as of 2022, which is a significant improvement from the time of the appraisal, although the levels downstream may exceed the standard level.

Table 1 Changes in population and volume of sewage generated and treated in Varanasi

Item	Unit	2020 (actual)	2022 (actual)	2035 (estimate)	2050 (estimate)
Population*	1,000	1,832	2,488	3,218	4,331
Sewage production	MLD	302	299	386	519
Sewage treatment capacity		361.8	411.8	466.8	521.8
Inflow to STP		270.5	375	-	-

Source: Data provided by UPJN and NMCG
*All population figures are projections (as no census has been conducted since 2011)

Therefore, although sewage treatment capacity has been increased, the sewer network needs to be improved, and sewage treatment capacity needs to be further increased to meet the needs of a growing population, and also the environmental sanitation in the city needs to be improved. Given the above, the need for improvement of sewerage infrastructure and environmental sanitation in Varanasi City continues to be recognized.

3.1.1.3 Appropriateness of the Project Plan and Approach

Based on the lessons learned from the previous projects[12], this Project included procurement assistance and implementation supervision under the consulting service component, as well as an Institutional Development Program (IDP) to strengthen the organizational capacity of the implementing agencies, which included studies and recommendations for setting appropriate fees.

[12] At the time of the ex-ante evaluation, it was noted that "delays in the construction schedule and securing sewerage fee revenues for operation and maintenance have been identified as problems" as lessons learned from the past. As measures for the construction period, it was assumed that the TOR of consultants for detailed design and procurement would be clarified, the organization of the implementing agency for operation and maintenance of sewerage facilities would be strengthened, and appropriate technology would be transferred to the implementing agency, etc. It was assumed that measures for revenue sources would include interim supervision to ensure appropriate fee setting and collection.

Although there were differences between the planned and actual outputs (see 3.2.1 Project Outputs), all changes were due to rational reasons, and it can be considered that the changes in the plan were appropriate.

One distinctive feature of the Project approach is that, in addition to the construction of sewerage infrastructure, the non-sewerage component included the construction of community toilets and laundry facilities (Dhobi Ghats) for local residents, as well as awareness-raising activities related to public health. The non-sewerage component was positioned as the social development component, and activities focused on the poor and vulnerable, especially in slum areas, in cooperation with local NGOs. The context for this was that 30% of the population of Varanasi City lived in slums, many of whom poor, with poor sanitation conditions. In the construction of community toilets, which was carried out in collaboration with Sulabh International, a local NGO that has been working on sanitation projects in India for more than 50 years, a pro-equity approach was adopted, with priority given to slum communities, which have low rates of toilet ownership. In addition, the toilets were designed to be accessible to people with disabilities, toilet management staff were hired from the local community, and the toilets in slum communities were set at a low cost of 50 rupees per household per month for unlimited use (urban toilets charge 5 rupees per use) to ensure that underserved populations could benefit from the facilities. In selecting the location of the community toilets, based on the opinions and suggestions of the representatives of each district and Sulabh International, Varanasi Municipal Corporation (Varanasi Nagar Nigam; hereinafter referred to as "VNN"), the implementing agency of the component of the Project, decided on the location of the community toilets after consulting with the parties concerned. Based on the idea that active participation of beneficiaries and other stakeholders is essential for social development, awareness-raising activities related to public health were effectively implemented by four local NGOs using participatory methods in the form of Public Awareness and Public Participation (PAPP)[13]. The approach was appropriate in that it involved partners who knew the local area well, used participatory methods, and focused on the poor and vulnerable so that no one would be left behind.

As discussed below in "3.3.1.2 Qualitative Effects (Other Effects)," the synergistic effects of combining the infrastructure development and sanitation improvement components were remarkable, and the project design was appropriate for enhancing the manifestation of the project effects.

3.1.2 Coherence (Rating: ③)

3.1.2.1 Consistency with Japan's ODA Policy

[13] Regarding public awareness activities related to public health, collaboration with NGOs was not planned at the time of appraisal but was organized and implemented during the implementation of the Project.

At the time of the appraisal, the Country Assistance Policy for India (2005) included the following priority objectives: (1) promotion of economic growth, (2) improvement of poverty and environmental problems, and (3) assistance for human resource development and expansion of human resource exchange. In the area of (2) improvement of poverty and environmental problems, support for water supply and wastewater management to prevent and improve water pollution was included in the "Addressing environmental problems" section. In addition, in the former JBIC's Overseas Economic Cooperation Implementation Plan (2005-2008), the country-specific policy for India identified the improvement of economic infrastructure, rural development benefiting the poor, and addressing environmental issues as priority areas.

3.1.2.2 Internal Coherence

This Project was planned based on the master plan of the JICA Development Study "The Study on Water Quality Management Plan for Ganga River in the Republic of India" in FY2002. At the time of appraisal, no specific linkage with other JICA projects was planned, but at the time of ex-post evaluation, the technical cooperation "Project for the Comprehensive Improvement of Environmental Sanitation in Varanasi (2020-2023)" (hereinafter referred to as the "Technical Cooperation Project") and the "Verification Survey with the Private Sector for Disseminating Japanese Technologies for Tafgard Technology for Environmentally-Friendly Toilets in India" (hereinafter referred to as the "Verification Survey") were identified.

There was mutual coordination between the Technical Cooperation Project and the Project. Specifically, the IDP component of the Project included capacity-building for maintenance and management of sewer pipes in areas where sewer networks had been developed, and the Technical Cooperation Project focused on treatment of septage sludge in areas where sewer networks had not been developed, and efforts to improve the hygiene awareness of local residents were implemented under both projects. Adjustments were made to segregate the sewerage network areas and underserved areas, thus avoiding duplication.

In the Verification Survey, a demonstration test was conducted to introduce environmentally friendly toilets using the community toilets developed in this Project. Some of the community toilets constructed in this Project were not connected to the sewer system and used septic tanks, but the leakage of untreated wastewater was a problem. Environmentally friendly treatment systems that utilize technology from a private Japanese company were installed in these areas, and demonstration tests were conducted with the aim of promoting the use of these systems as an environmentally friendly public toilet model.

3.1.2.3 External Coherence

At the time of appraisal, plans were made to collaborate with a local NGO for the construction and maintenance of public toilets in the slum area. As mentioned above in "3.1.1.3 Appropriateness of the Project Plan and Approach," this Project has constructed and is maintaining community-based public toilets in collaboration with Sulabh International. Sulabh International had been operating public toilets in Varanasi before this Project, and had abundant knowledge and experience in the locations where public toilets were needed, the details of toilet facilities, and the setting of fees.[14] In particular, Sulabh International's experience in operating public toilets enabled it to select locations for public toilets, giving priority to slum communities with low rates of toilet ownership. This collaboration and division of roles with Sulabh International's own existing projects led to the effective implementation of this Project.

In light of the above, the implementation of this Project is fully consistent with India's development plan and development needs, and the project plan and approach are considered appropriate. The Project is also coherent with Japan's development assistance policy, JICA's other projects, and other organizations' projects. Therefore, its relevance and coherence are high.

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

The Project consists of three major components: a sewerage component, a non-sewerage component (sanitation improvement component), and consulting services. Under the supervision of the executing agency (NMCG), the sewerage component was to be carried out by the Uttar Pradesh State Water Supply and Sewerage Corporation (U.P. Jal Nigam, hereinafter referred to as "UPJN") and the non-sewerage component was to be implemented by VNN.

The contents of each component are shown in Table 2, and the proposed and actual outputs of each component, as well as the reasons for changes from the plan, are described below.

[14] Sulabh International, founded in 1970, has been working on toilet issues in India for 50 years since its establishment, installing household toilets, public toilets in urban areas, community toilets in slums, and school toilets, as well as overseeing awareness-raising, education, and human rights issues for the toilet-cleaning segment of the population. Prior to the construction of community toilets under this Project, the company had constructed and operated multiple public and community toilets in Varanasi, and had a track record of proper operation and much better sanitary conditions compared to other toilet facilities.

Table 2 Components of the Project

Sewerage component	Non-sewerage component (sanitation improvement)	Consulting services
(1) Construction/rehabilitation of STPs (2) Construction/rehabilitation of pumping stations (3) Construction/renovation /rehabilitation of sewers (4) Renovation/rehabilitation of existing irrigation canal	(1) Construction of community toilet complexes (2) Construction/renovation of Dhobi Ghats (3) Public Awareness and Public Participation (PAPP)	(1) Assistance of procurement process, management and supervision of project implementation (2) Comprehensive assistance for public health conditions (3) Institutional Development Programme (IDP)

Sewerage Component

The plans, modified plans, and actual details of the outputs were as follows.

Note that the numbers in parentheses after the name of the STP or pumping station (MLD) indicate the sewage treatment capacity of each facility.

Table 3 Planned and Actual Outputs of the Sewerage Component

Components	Plan (2005)	Modified Plan (2010)	Actual
(1) Construction /rehabilitation of STPs	[Construction] ・Location: Sathwa (200 MLD) [Rehabilitation] ・Location: Old Dinapur, Bhagwanpur	[Construction] ・Location: Sathwa (140 MLD) [Rehabilitation] ・Location: Old Dinapur, Bhagwanpur	[Construction] ・Location: Dinapur (140 MLD) [Rehabilitation] ・Location: Old Dinapur, Bhagwanpur
(2) Construction /rehabilitation of pumping stations	[Construction: 5 locations] -Chaukaghat R/B (140 MLD) -Chaukaghat L/B (19 MLD) -Phulwaria (8 MLD) -Narokhar Nalla (18 MLD) -Saraiya (4 MLD)	[Construction: 3 locations] -Chaukaghat R/B (140 MLD) -Phulwaria (8 MLD) -Saraiya (4 MLD)	[Construction: 3 locations] -Chaukaghat R/B (140 MLD) -Phulwaria (7.6 MLD) -Saraiya (3.7 MLD)
	[Rehabilitation] ・Konia (replacement of pumps and diesel generation sets) ・5 Ghat pumping stations (Trilochan Ghat, Jalesean Ghat, Dr. Rajendra Prasad Ghat, Mansarovar Ghat, Harishchandra Ghat)	[Rehabilitation] ・Konia (replacement of pumps and diesel generation sets) ・5 Ghat pumping stations (Trilochan Ghat, Jalesean Ghat, Dr. Rajendra Prasad Ghat, Mansarovar Ghat, Harishchandra Ghat)	[Rehabilitation] ・Konia (replacement of pumps and diesel generation sets) ・5 Ghat pumping stations (Trilochan Ghat, Jalesean Ghat, Dr. Rajendra Prasad Ghat, Mansarovar Ghat、Harishchandra Ghat)[15]
(3) Construction /renovation /rehabilitation of sewers	[Construction] Total length: 35.8 km ・Interceptor sewers (14.7 km) -Assi primary interceptor sewers 5,170 m -Assi secondary interceptor sewers 3,575 m - Varuna Right Bank (Upstream and Downstream) and Left Bank (Upstream) Interceptor Sewers 6,000 m ・Sewers/Rising Mains (21.1 km) -Varuna Left Bank (Downstream) 17,275 m -Extension of Relieving Trunk Sewer 3,810 m	[Construction] Total length: 33.2 km ・Interceptor sewers (14.5 km) -Assi primary interceptor sewers 5,821 m -Assi secondary interceptor sewers 3,575 m -Varuna Right Bank (Upstream and Downstream) Interceptor Sewers 5.135 m ・Sewers /Rising Mains (18.7 km) -Extension of Relieving Trunk Sewer 4,310m -Rising Mains for Chaukaghat R/B pumping station 7,419m	[Construction] Total length: 28.8 km ・Interceptor sewers (13.3 km) -Assi primary interceptor sewers 6,185 m -Assi secondary interceptor sewers 2,262 m -Varuna Right Bank (Upstream and Downstream) Interceptor Sewers 4,808 m ・Sewers/Rising Mains(15.5 km) -Extension of Relieving Trunk Sewer 3,904 m

[15] Among the five Ghat pumping stations, Jalesean Ghat was closed in 2021 due to the government's large-scale development project around the Shri Kashi Vishwanath Temple, but no sewage spillage or other problems have occurred because a new pump was constructed underground. The pumps replaced by this Project were moved to another pumping station.

Components	Plan (2005)	Modified Plan (2010)	Actual
	-Sathwa Rising Mains 40 m -Rising Mains for Phulwaria, Narokhar, Saraiya, Chaukaghat Left and Right Bank pumping stations	-Rising Mains for Phulwaria pumping station 1,650 m -Rising Mains for Saraiya pumping station 1,100m	-Rising Mains for Chaukaghat R/B pumping station 7,072 m -Rising Mains for Phulwaria pumping station 2,137 m -Rising Mains for Saraiya pumping station 1,207 m
	[Rehabilitation] ・Detailed Investigation & Rehabilitation of old trunk sewer 7,172 m	[Rehabilitation] ・Detailed Investigation & Rehabilitation of old trunk sewer 7,172 m	[Rehabilitation] ・Detailed Investigation & Rehabilitation of old trunk sewer 6,905 m
(4) Renovation /rehabilitation of existing irrigation canal	・Total length 18 km	・Total length 18 km	・Due to the change in location of the STP, the discharge channel did not need to be rehabilitated, and a 1.7 km drainage channel was constructed instead.

Since the contents of the Modified Plan (2010) in the table above were formally agreed upon in a written document between the Government of India and JICA, and the details of the modification are reasonable considering the circumstances at that time, it is appropriate to use the Modified Plan (2010) as the planned value and compare it with the actual results.

The main reason for the change in scope in 2010 was the delay in government approval of the Project, during which time another project (JNNURM: Jawaharl Lal Nehru National Urban Renewal Mission) decided to construct a 120 MLD STP in Goithaha (northern part of the Varuna River, the same area where the Sathwa STP is to be located). As a result, the capacity of the STP to be constructed under this Project was revised from 200 MLD to 140 MLD, and the construction of pumping stations (Chaukaghat Left Bank Pumping Station and Narokar Pumping Station) and associated sewer construction components planned for the northern part (left bank) of the Varuna River were reorganized as the scope of the JNNURM project and excluded from this Project. The change was reasonable to avoid duplication with other projects, and the change process was also appropriate, as it was formalized through a decision within JICA based on the change request letter from the executing agency.

The differences between the Modified Plan (2010) and the actual details and the reasons for the changes are as follows.

(1) Construction/rehabilitation of STPs

The difference between the Modified Plan and the actual details is the location of the STP.

In 2012, the location of the STP was changed from Sathwa to Dinapur due to a land acquisition issue in Sathwa. The land to be expropriated was agricultural land, but the farmers did not agree to the acquisition of the land, which resulted in the change of location. There was an STP in Dinajpur, which started operation in 1994, and the new sewage treatment plant was constructed as the New Dinajpur STP on an adjacent site.

(2) Construction/rehabilitation of pumping stations

The difference between the Modified Plan and the actual details is a minor change in the treatment capacity of the Phulwaria and Saraiya pumping stations. The change in the treatment capacity of the pump stations was due to the re-calculation of the actual treatment capacity at the time of detailed design.

(3) Construction/renovation/rehabilitation of sewers

The difference between the Modified Plan and the actual details is the change in the total length of sewer pipe installation/rehabilitation (from 33.2 km to 28.8 km). The sewer pipe installation plan was affected by the change in location of the STP (from Sathwa to Dinapur). The changes in the plan were caused by the results of the implementation design according to the actual conditions at the site and the surrounding road and railroad facilities, and the change did not affect the increase or decrease of the sewage treatment capacity. In the renovation of sewers, it was necessary to dig up sewers that were laid more than 100 years ago, and sometimes the exact location and conditions could not be determined until after excavation. It was therefore necessary to make adjustments based on the actual site conditions when renovating sewers.

(4) Renovation/rehabilitation of existing irrigation canal

Due to the change in location of the STP, it was no longer necessary to renovate the irrigation canal, and instead a 1.7 km drainage channel was constructed at the New Dinajpur STP. There was no need to construct an irrigation canal at the STP.

None of the above changes affected the achievement of the Project's outcome, "Improvement of sewage treatment capacity and sanitation," and the changes were reasonable and in line with local conditions.

Non-Sewerage Component

The planned and actual outputs were as follows.

Table 4 Planned and Actual Outputs of the Non-Sewerage Component

Component	Plan	Actual
(1) Construction of Community Toilet Complexes	・Construction of Community Toilet Complexes (205 in slum areas, 26 in bathing Ghats)	・Construction of Community Toilet Complexes (154 in slum communities and urban areas, 952 seats in total, 26 in bathing Ghats) ・Renovation of 26 bathing Ghats (construction of changing rooms, repair and painting of dilapidated Ghats, etc.)[16]

[16] Bathing Ghats are stair-like water facilities along the Ganges River where people can bathe, pray, and hold funerals.

Component	Plan	Actual
(2) Construction/Renovation of Dhobi Ghats	・Construction: 7 locations Renovation 3 locations	・Construction: 4 locations Renovation 3 locations
(3) Public Awareness and Public Participation (PAPP)	・Raising awareness of public health among residents and government officials through the use of local newspapers, workshops at schools, billboards, street skits, etc.	・Public Awareness and Public Participation (PAPP) activities were carried out by several local NGOs. (See BOX-1 below.)

The differences between the Modified Plan (2010) and the actual details and the reasons for the changes are as follows.

(1) Construction of Community Toilet Complexes

At the time of planning, 205 public toilets were planned to be constructed in slum areas, but only 154 were built, both in slum communities and in the city center (along roads with heavy human and vehicular traffic). The reason for constructing toilets in the city center was that Varanasi has a large floating population of tourists, pilgrims, and migrant workers, and there was a significant need for facilities that could be used by these groups (in selecting locations for public toilets, as described in "3.1.1.3 Appropriateness of the Project Plan and Approach," VNN, the implementing agency, made the decision in consultation with the representatives of each district and Sulabh International based on their opinions and suggestions). The number of public toilets constructed was lower than planned due to factors such as increased costs and difficulties in acquiring land, as well as the government's promotion of the Swachh Bharat Mission to install individual toilets for household use. As a result of this mission, a total of 10,448 individual toilets were constructed in Varanasi, resulting in a decrease in the number of public toilets needed. On the other hand, the 154 public toilets with a total of 952 seats constructed by the Project have provided daily access to public toilets to 25,000 to 30,000 people, including the poor who cannot afford to build toilets at home and floating populations such as pilgrims and tourists, contributing to improved sanitation, which was the outcome of this Project.

In the bathing Ghats, at the 26 locations that were improved, not only were toilets installed, but also changing rooms were installed and the Ghats were restored and renovated according to the request of VNN, the implementing agency.

(2) Construction/Renovation of Dhobi Ghats

At the time of planning, the idea was to have 7 new Dhobi Ghats and 3 renovated, but the number of new Dhobi Ghats was changed from 7 to 4. The reason for the change in the number of new Dhobi Ghats was not only the budget and land availability problems, but also the unavoidable factor of not being able to reach a consensus with the local Dhobi community.

(3) Public Awareness and Public Participation (PAPP)

At the time of planning, the Project was supposed to use local newspapers to raise awareness, hold workshops at schools, install billboards, and perform street skits. The actual results of the Project were that in cooperation with four local NGOs (Amar Shahid Chetana Sansthan, Janvikas Avam Kalyan Samiti, Shanti Niketan Jan Seva Samiti, and the Centre for Environmental Education (CEE)), the activities were carried out in six areas (Bhelupur, Dashsurame, Varunapar, Adampur, Kotwali, and Ghat zones). Based on the concept that the participation of local residents is important in changing their awareness and behaviour, the activities were efficiently implemented by assigning an NGO in charge of each area. The specific activities are shown in BOX-1 below.

The outputs of the non-sewerage component include changes (decreases) from the plan in the construction of community toilet complexes and laundry facilities (Dhobi Ghats). On the other hand, as outputs not expected at the time of the plan, the maintenance of bathing Ghats (installation of changing rooms, restoration/renovation of Ghats, etc.) was implemented, and more diverse activities than planned were also implemented in the public awareness and public participation activities in collaboration with local NGOs.

BOX-1 Details of Public Awareness and Public Participation (PAPP) activities

Activities such as participatory workshops and study sessions were held at various locations in Varanasi to promote understanding of environmental issues, reduce open defecation, reduce household and commercial waste, and improve knowledge of hygiene and health, etc. In addition, educational activities were conducted in 100 schools with the participation of 15,000 children, and the "Clean Ganga Club" was established to promote environmental education in schools (including training for teachers). In Ghat areas, activities were conducted to prevent pollution of the Ganges River, such as reducing the amount of refuse in the river, promoting the use of toilets, reducing the use of soap for bathing, and cleaning the Ghats, as well as educational activities using an exhibition booth.

Awareness workshops in schools

Exhibition booth in Ghat zone

School awareness rally

Exhibition at Assi Ghat

Workshop on water conservation at a college

Teachers review workshop in the Clean Ganga Club (CGC) training program

Source: Project Completion Report

Consulting Services

The planned and actual outputs were as follows.

Table 5 Planned and Actual Outputs of the Consulting Services

Plan	Actual
(1) Assistance of procurement process, Management and supervision of project implementation (2) Comprehensive assistance for public health conditions (3) Establishment of action plans to strengthen the organizational capacity of implementing agencies (IDP component)	(1) As planned (2) As planned (3) Organizational enhancement and capacity-building training, development of a GIS-based asset management system, introduction of ICT for better administration and service delivery, financial management and measures to increase tax revenue, restructuring of the water/sewerage fee structure (including user surveys, etc.), and improvement of operation and maintenance of WATSAN (Water & Sanitation) assets

The outputs of the IDP component covered a broader scope than just establishment of action plans for organizational capacity strengthening, which was the plan at the time of appraisal. Specifically, with the aim of strengthening the organizational capacity of the Varanasi municipal water works department (Jal Kal Vibhag under VNN, hereinafter referred to as "Jal Kal Varanasi") and ensuring efficient and effective service delivery related to water and wastewater, the IDP component considered the development of an asset management system, implementation of ICT systems, and restructuring of water/sewerage tariffs (tax system), in addition to training.

3.2.2 Project Inputs

3.2.2.1 Project Cost

At the time of appraisal, the planned project cost was 13,248 million yen, of which 2,277 million yen was in foreign currency and 10,971 million yen was in domestic currency, and 11,184 million yen of the project cost was subject to ODA loans. The actual project cost was 6,194 million yen in total for the ODA loan and 3,637 million yen from India's self-financing, for a total project cost of 9,831 million yen.

The actual total project cost was 74% of the planned cost and was therefore within the plan. The reason why the total amount of the ODA loan was below the planned amount was that the Project was not completed within the loan period due to project delays, and the Indian side made expenditures for necessary outputs even after the yen loan period. In addition, a change in the location of the STP eliminated the need for land acquisition, which also affected the reduction in total project cost.

Table 6 Comparison of Planned and Actual Project Costs

Item	Plan (million yen)				Actual (million yen)*		
	Foreign currency	Domestic currency	Total	Of which, ODA loan	ODA loan	Indian side	Total
Sewerage component	1,099	6,417	7,516	7,516	5,604	2,730	8,334
Improvement of public health (non-sewerage component)	0	413	413	413	58	430	488
Price escalation	51	659	710	710	0	0	0
Physical contingency	149	713	862	862	0	0	0
Consulting service	679	705	1,384	1,384	414	477	891
Land acquisition	0	476	476	0	0	0	0
Taxes and duties	0	427	427	0	0	0	0
Administration	0	1,161	1,161	0	0	0	0
Interest during construction	299	0	299	299	118	0	118
Total project cost	2,277	10,971	**13,248**	11,184	6,194	3,637	**9,831**

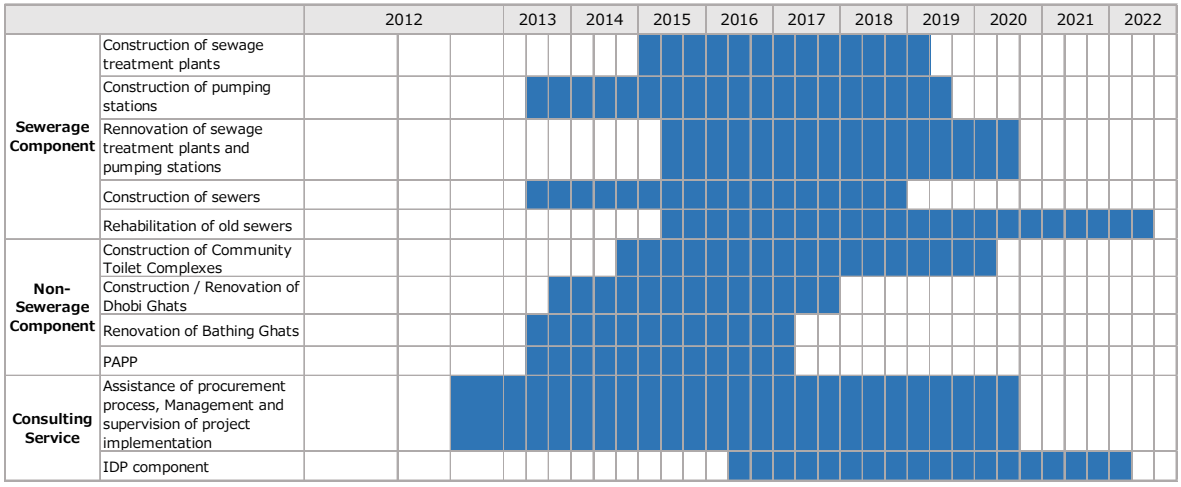
Source: Documents provided by JICA, data provided by NMCG
*The actual cost on the Indian side is converted into yen using the average exchange rate obtained from IMF statistics (1 INR = 1.644 JPY) for the period from 2010, when the Project was approved by the government, to 2022, when the Project was completed.

3.2.2.2 Project Period

The actual project period was 208 months (March 2005 to June 2022; 15 years and 5 months) compared to the planned project period of 85 months (March 2005 to March 2012; 7 years and 1 month), which was 245% of the plan and significantly exceeded the plan.

The implementation period for each component is shown in Table 7 below.

Table 7 Actual Project Period by Components



Source: Created by evaluator based on the Project Completion Report and materials provided by implementing agencies

The following points have been identified as factors that contributed to the delay, and the combination of multiple factors led to the significant delay.

Delay in the commencement of the Project

- Due to delays in project approval by the Indian government, which was granted in 2010 (a delay of more than 60 months), the start date of the consultancy contract was pushed back from the original target of 2005 to 2012.

Delay factors during implementation

- The delay was caused by the inability to secure a site in Sathwa, which was originally planned, meaning that the location had to be changed from Sathwa to Dinajpur. A change in the treatment method due to the change in location of the STP also contributed to the delay.
- The change of executing agency (see footnote 3) and the timing of the consultancy contract coincided, resulting in a total delay of 20 months due to delays in the procurement process and other factors.
- There were compensation demands from farmers near the Dinapur STP, and protests led to the suspension of work at the site for 6 months in 2015 and 1 month in 2017. In addition, compensation procedures and re-mobilization of workers took time.
- It took time to determine the location of the Phulwaria pumping station due to problems in securing a site and identifying an alternative site.
- Due to the delay in obtaining permission from the local administration to occupy the road, the construction of the sewers was delayed for more than 30 months. The rehabilitation of the old trunk sewer, the old STPs and the five Ghat pumping stations was temporarily suspended due to the need for a technical committee review of the proposal submitted by a local NGO (Sankat Mochan Foundation).
- The sanitation improvement component was also delayed due to land availability issues.
- Project implementation required a high degree of coordination among the various agencies involved, including the administration, the railways, the state public works department, and the city of Varanasi, and obtaining approvals and permits took time.
- Varanasi is a year-round festival city, and the construction of the sewage pipes was particularly affected. Flooding and bad weather also contributed to construction delays.
- Repeated lockdowns during the COVID-19 pandemic also affected project delays.

3.2.3 Results of Calculations for Internal Rates of Return (Reference only)

In this Project, the Economic Internal Rate of Return (EIRR) was calculated at the time of appraisal as shown in the table below. The internal rate of return at the time of ex-post evaluation was recalculated using the L/A signing year as the starting point, in accordance with the ex-post evaluation reference, as shown in the table below. As for the benefits, since similar data were not available at the time of the ex-post evaluation, the value calculated at the time of appraisal

was multiplied by the rate of increase of the consumer price index. Although the Project cost was lower than planned, the EIRR at the time of the ex-post evaluation was slightly lower than that at the time of the appraisal because the commencement of operation of the facility was delayed due to the delay in project implementation, and the period during which benefits were generated was shorter than that at the time of the appraisal.

Table 8 Calculation of Internal Rates of Return

	Economic Internal Rate of Return (EIRR)
IRR	Appraisal: 13.1% Ex-post evaluation: 12.7%
Cost	Actual project costs, estimated operation and maintenance costs
Benefit	Willingness to pay (WTP) for improvement of the water quality of the Ganges River, WTP for sewage treatment services, additional river visitors
Project life	30 years

Given the above, to summarize the efficiency, the outputs, sewerage component, non-sewerage component (sanitation improvement component), and consulting services, all underwent changes from the plan, but the changes from the plan were not such as to affect the achievement of the Project's outcomes. Although the project costs were within the plan (74% of plan), the project period significantly exceeded the plan (245% of plan). Therefore, the efficiency of the project is moderately low.

3.3 Effectiveness and Impacts[17] (Rating: ③)

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

All quantitative indicators set at the time of appraisal were related to the sewerage component, mainly operation and effect indicators related to sewage treatment and the quality of the water in the Ganges River. Since the new Dinapur sewage treatment plant constructed under the Project was completed in 2019 and the Project Completion Report was submitted in 2020, a comparison of target and actual values was made, using 2020 as the Project completion year (see Table 9). A comparative analysis of the target and actual performance for each indicator is described below.

[17] When providing the sub-rating, Effectiveness and Impacts are to be considered together.

Table 9 Operation and Effect Indicators of the Project

	Baseline value	Target value	Actual value	
	2003	2015	2020	2022
		4 Years After Completion	Completion Year	2 Years After Completion
1) Total population served (*1)	435,525	1,437,762	570,000	1,343,000
2) Amount of wastewater treated (m3/d)	101,800(*2)	318,000	361,800 *Below is the breakdown* New Dinapur140,000 Old Dinapur 80,000 Bhagwanpur 9,800 DLW Campus 12,000 Goithaha[18] 120,000	411,800 *Below is the breakdown* New Dinapur 140,000 Old Dinapur 80,000 Bhagwanpur 9,800 DLW Campus 12,000 Goithaha 120,000 Ramana[19] 50,000
3) Rate of facility utilization (%)	-	100	100	100
4) BOD concentration of Each STP (Effluent) (mg/L)	-	<30	<20	<20
5) Fecal Coliform of each STP (Effluent) (MPN/100ml)	-	<10,000	<1000	<1000
6) Percentage of population served (%)	30	45	45 (*3)	54 (*4)
7) Improve of water quality (BOD mg/L)	3 - 15	<3	2.1 - 3.7	3.8
8) Improve of water quality (Fecal Coliform, MPN/100 ml)	2,500-50,000	<2,500	1,100-14,000	-

Source: documents provided by JICA, materials provided by UPJN and NMCG, project completion report

*1: The baseline value in the ex-ante evaluation was 575,000, but according to "The Study on Water Quality Management Plan for Ganga River in the Republic of India" (2005), the population connected to the sewage network in 2003 was 435,525. Also, according to the Project Completion Report, the connected population in 2010 was 485,000, so it can be inferred that the baseline value of 435,525 is appropriate. With regard to the target, although no information was available on the basis of which the target (1,437,762 persons) was calculated, the implementing agency was of the opinion that the target was an estimate of the population of the entire city of Varanasi. The actual figure for the year of completion (2020) is the figure stated in the Project Completion Report, but information on the basis of the calculation was not available. The actual population in 2022 is the estimated population of the target area covered by the sewage treatment facilities developed (constructed/rehabilitated) by the Project.

*2: The total of the old Dinajpur (80,000 m3/day), Bhagwanpur (9,800 m3/day), and DLW campus (12,000 m3/day). The baseline value (88,000 m3/day) in the ex-ante evaluation did not include the DLW campus sewage treatment plant, and the treatment capacity of the Bhagwanpur sewage treatment plant was modified from 8,000 m3/day to 9,800 m3/day, as the figure in the ex-ante evaluation was incorrect.

*3: According to UPJN, this figure is considered to be the percentage of sewage generated in Varanasi that will be treated at the new Dinapur STP only. Therefore, the actual figure could be even higher.

*4: Calculated by the evaluator based on population estimates for the city of Varanasi and the areas covered by the Project for sewage treatment.

Regarding Indicator 1, Total population served, as described in Note 1 of Table 9, information on the basis of calculation was not available for the target value (1,437,762 persons) set at the time of appraisal for the sewage treatment population, but according to NMCG and UPJN, the target value was considered to refer to the population of the entire city of Varanasi. Likewise, information on the basis of the calculation of the actual value for the

[18] Goithaha STP started operation in 2019 (construction funded by JNNURM)

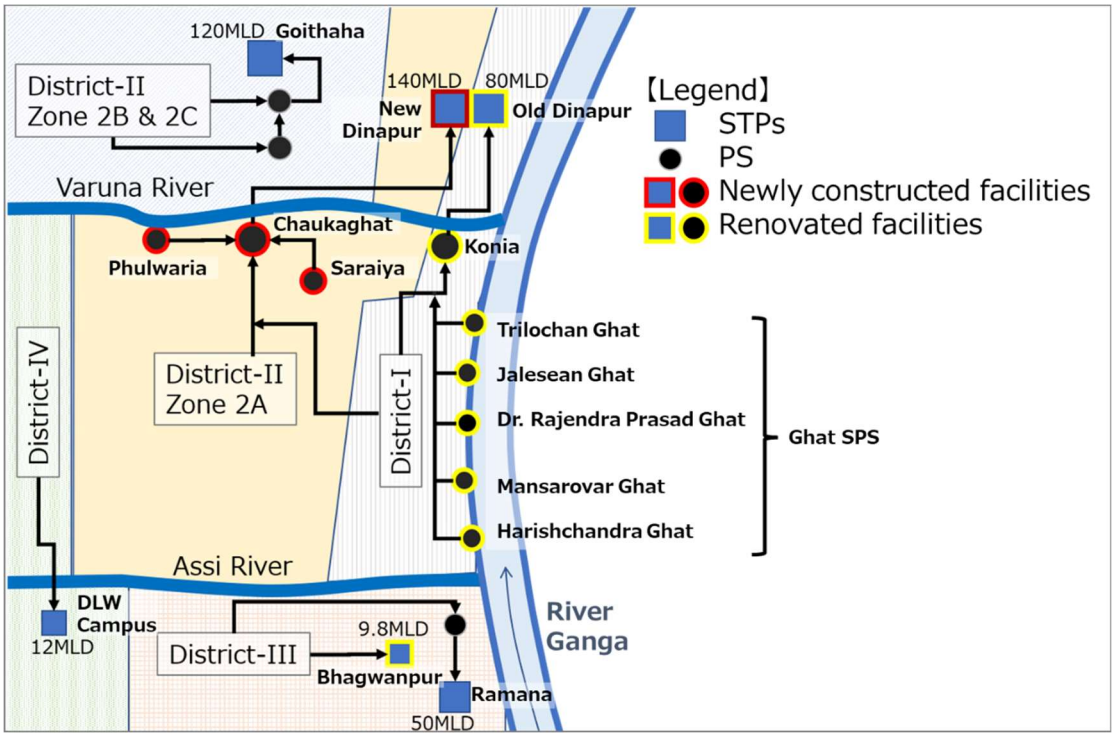
[19] Ramana STP started operation in 2021 (construction funded by Namami Ganga Programme)

year of project completion (2020) for the sewage treatment population was not available. According to NMCG and UPJN, the actual value for the year of project completion (2020), 570,000 persons, is considered to be the population estimate for the area to be treated by the new Dinapur STP, which corresponds to Zone 2A of District-II in Figure 1.

The actual figures for 2022 represent the estimated population in the area to be treated by the Project's sewage treatment facilities (including not only the new Dinapur STP but also renovated STPs, pumping stations, and areas where sewers are laid) and correspond to District-I and District-II Zone 2A, but since no census has been conducted in India since 2011 and the city of Varanasi expanded in 2020, the accurate figures for 2022 were not available. Therefore, although a comparison of the planned and actual figures is not simple to make, it can be concluded that the target has been achieved because new sewage treatment plants have been constructed through this Project and the Indian-budgeted project, and the areas to be treated are covered[20], which was assumed at the time of appraisal.

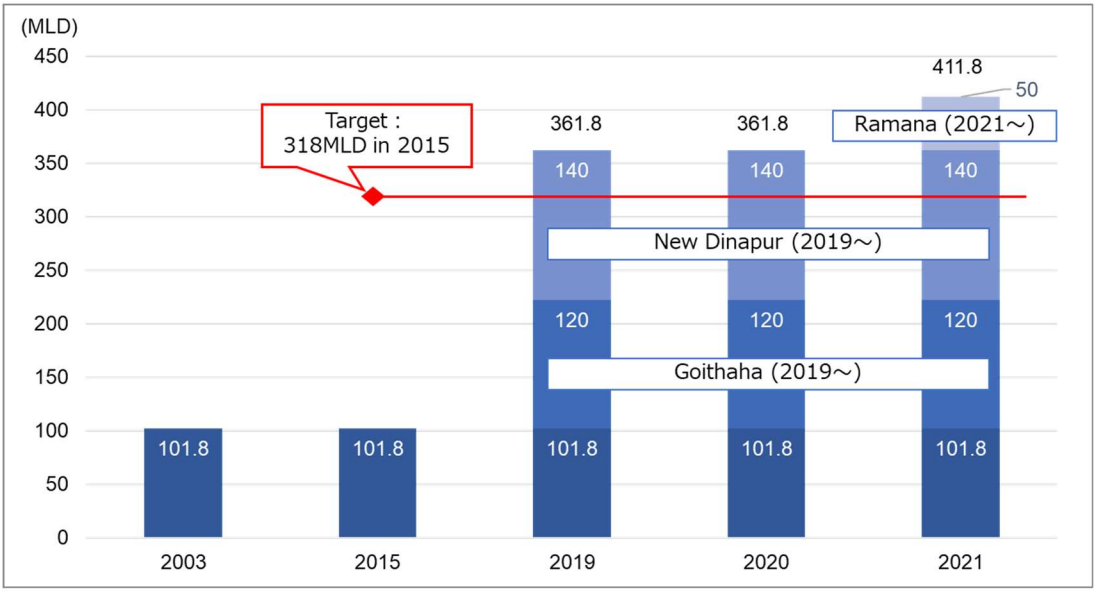
Indicator 2, Amount of wastewater treated (m3/d), is an indicator of the overall sewage treatment capacity of Varanasi City. The progress of sewage treatment capacity of Varanasi City is shown in Figure 2, and although the emergence of the effect was later than the target year, the target was achieved in 2019 when the New Dinapur STP (140 MLD) constructed by the Project and the Goithaha STP (120 MLD) constructed with the Indian budget started operation. By the time of the ex-post evaluation (2022), the sewage treatment capacity of Varanasi City had reached 411.8 MLD (129% of the target). The New Dinapur STP has the highest treatment capacity among the six sewage treatment plants in Varanasi, treating sewage from the heavily populated District I and District II Zone A areas and stopping the discharge of untreated sewage into the Ganges River.

[20] At the time of appraisal, a 200 MLD Sathwa STP was to be constructed in the northern area of the Varuna River (now District-II Zone 2B&2C), but the Goithaha STP was decided to be constructed, so the treatment capacity of the STP for this project was changed to 140 MLD and the location was changed as well. See Outputs for details on the change.



Source: Created by evaluator based on documents provided by UPJN

Figure 1　Location Map of Sewage Treatment Facilities in Varanasi City (2022)



Source: Created by evaluator based on documents provided by UPJN

Figure 2　Sewage Treatment Capacity in Varanasi City

Indicator 3, Rate of facility utilization (%), Indicator 4, BOD concentration of each STP (Effluent) (mg/L), and Indicator 5, Fecal coliform of each STP (Effluent) (MPN/100 ml), are all operational indicators for the new Dinapur STP, and all have met their targets. The quality of treated water discharged from the STP is tested in the laboratory.

Wastewater before and after treatment
Source: Evaluator

Aeration tank of the STP
Source: Evaluator

Indicator 6, Percentage of population served (%), is the percentage of the total population served by the sewage system in Varanasi City. However, as mentioned in Indicator 1, only estimated data on the population is available, making it difficult to calculate an accurate figure. On the other hand, the ratio of the population served in 2022 (estimated served population in the area covered by the sewerage facilities developed by the Project as mentioned in Indicator 1) out of the total estimated 2022 population of Varanasi City (2,488,000) is 54%. The percentage is even higher when areas not covered by the Project (District-II 2B&2C, District-III, and District-IV) are included, thus achieving the target value. At the same time, however, since there are still areas where sewer networks have not been developed in each region and the STP in District-IV covers only a part of the area, according to NMCG, the total percentage of sewage generated that is treated in the STPs is about 85%.

Indicator 7, Improvement of water quality (BOD mg/L), and 8, Improvement of water quality (Fecal Coliform, MPN/100 ml), are both indicators related to water quality in the downstream of the Ganges River, and are greatly affected by external factors. Although the actual values are significantly improved compared to the baseline values, they are lower than the target values depending on the season. It is difficult to calculate the degree of achievement against the target due to the fluctuation of actual values, but in 2020, the BOD mg/L (Indicator 7) was 2.1 mg/L, 30% lower than the target, at the best time, and 3.7 mg/L, 23% higher than the target, at the worst time. The actual values of Indicator 8, Improvement of water quality (Fecal Coliform, MPN/100 ml), were 1,100 MPN/100 ml, 56% lower than the target (2,500 MPN/100 ml) at the best time, but 14,000 MPN/100 ml, 460% higher than the target, at the worst time. The water quality of the Ganges River is maintained in good condition outside of the rainy

season, but when floods occur upstream during the rainy season, it is inevitable that sewage flows into the river together with rainwater.

Given the above, the construction of the new STP, pumping stations, and the installation of sewers by the Project has dramatically increased the sewage treatment capacity of Varanasi City, and the indicators related to the improvement of sewage treatment capacity and operational indicators have met their targets, but the indicators related to the improvement of water quality in the downstream area of the Ganges River, although there are seasonal fluctuations, have not always met their targets.

3.3.1.2 Qualitative Effects (Other Effects)

The Project not only improved the sewage treatment capacity, but also implemented a non-sewerage component, or sanitation improvement component, such as the construction of community toilets and laundry facilities (Dhobi Ghats), and educational activities on public sanitation, aiming to improve the sanitation environment and raise the awareness of local residents and government officials on public sanitation. In order to understand the effects of these components, interviews were conducted with VNN, the implementing agency of the sanitation improvement component, as well as with local NGOs and beneficiaries to investigate the outcomes of the Project.

Improvement of Sanitation in Varanasi City

According to VNN, the construction of 154 public toilets has enabled approximately 25,000 to 30,000 people, including the floating population, to use toilets every day, contributing to the reduction of open defecation (ODF). Access to toilets has dramatically improved as a result of the synergy between the construction of public toilets under the Project and the promotion of the installation of toilets in households under the Swachh Bharat Mission, a government campaign to improve sanitation. In addition, the awareness-raising activities conducted by both parties encouraged behavioral change. In the ODF assessment[21], Varanasi City achieved ODF+ in 2020 and ODF++ in 2021.

With the construction of 4 new Dhobi Ghats and the renovation of 3 existing Dhobi Ghats, approximately 1,200 to 1,500 Dhobies (laundry workers) work daily in the newly constructed washing stations connected to the water supply and sewage system, and the harmful washing sewage containing large amounts of chemicals is no longer discharged directly into the river. According to interviews with Dhobies, the improved facilities have improved the work environment. In addition, the restoration and renovation of the bathing Ghats and the campaign

[21] The ODF level certification system for each city/region is implemented as part of the Swachh Bharat Mission, with ODF+ requiring that public toilets are constructed and maintained in addition to zero open defecation, and ODF++ requiring that all sludge, waste, and sewage are safely managed and disposed of. Although it is not truly zero, as evaluators sometimes witnessed open defecation during the field survey, it has been significantly reduced as awareness of the need to stop open defecation has spread.

to improve sanitation around the Ghats have improved the landscape and sanitation along the Ganges River, benefiting not only the citizens but also tourists and pilgrims.

Community toilet constructed by the Project

Dhobi Ghat constructed by the Project

Bathing Ghats along the Ganges River, renovated by the Project

Awareness-raising paintings of "Namami Ganga" found all along the Ganges River

(Source: Evaluator)

Improvement of local residents' awareness for better living environment

Based on interviews with 45 households in three slum communities where community toilets were constructed under the Project, it was found that participation in the participatory workshops led to increased awareness, with comments such as "People started using community toilets instead of defecating outdoors," "Public spaces became cleaner and there were more places to sit and talk with each other," and "Children's hygiene awareness improved, and children became aware of the need to stop littering."

According to the same interview survey, 34 (75.6%) of the respondents indicated that they use the community's public restrooms, and the following comments were made: "Women and children can now use the restrooms safely," "I no longer see outdoor defecation," "Guests can now use the restrooms, and I feel proud of that," "In the past, I used to be scared to defecate outdoors on rainy days or at night," "The mindset of my children has changed," and "I am now able to lead a healthier life." Respondents who did not use community toilets indicated that they primarily used their own home toilets.

In the same interview survey, 33 respondents (73.3%) answered that they had participated in the participatory workshops of this Project, commenting that "the idea that cleanliness is godliness" had become widespread and that their perception of open defecation and refuse disposal had changed.

Thus, the Project not only improved the sewage treatment capacity but also constructed community toilets and laundry facilities as a sanitation improvement component, while also conducting public awareness activities on sanitation. This has helped residents understand that the living environment can be improved by proper treatment of wastewater generated through daily activities such as toilets and laundry, with a sense of realization, and has led to a change in behavior. If the sanitation improvement component had not been implemented, outdoor defecation and laundry wastewater would have continued to flow out, and the goal of improving water quality might not have been achieved to this extent. The combination of the two components has created a significant synergistic effect in improving the city's environment and the living conditions of local residents.

3.3.2 Impacts

3.3.2.1 Intended Impacts

To verify the impact of the Project in terms of "improvement of the water quality of the Ganges River and the sanitary environment for citizens, pilgrims, and tourists," interviews were conducted with hospitals in the city to examine the impact of the improved sanitary environment on the health situation, and with travel agencies in the city to examine the impact on the pilgrimage and tourism industry.

Impact on improvement of health condition of local residents and pilgrims/tourists

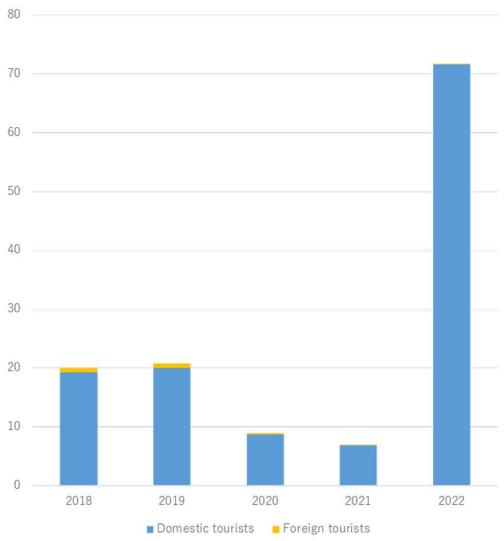
Interviews with doctors and health care workers at two community hospitals in the city revealed a significant decrease in the number of patients suffering from waterborne diseases with diarrhea symptoms such as cholera, typhoid fever, and dysentery, as well as skin diseases in particular. In the past, due to the deterioration of the water quality of the Ganges River, many patients suffered from skin problems after bathing, but the improvement of the water quality of the river has contributed to the decrease in the number of patients.

Impact on pilgrimage and tourism industry

In interviews at two travel agencies involved in pilgrimage and tourism, both stated that the water pollution situation in the Ganges River has improved dramatically over the past five years. They also said that although the number of tourists and pilgrims declined for a time due to the COVID-19 pandemic, domestic tourism demand has already recovered and Varanasi has become the most popular pilgrimage destination in the country. The government's large-scale

development of the corridor of the Shri Kashi Vishwanath Temple (Varanasi's largest Hindu temple and a center of pilgrimage) is the biggest factor, but the improved water quality of the Ganges River and the cleanliness of the Ghats have also contributed to its popularity, and according to the interviewees, the number of pilgrims and tourists has increased 1.6 to 2 times compared to 7 to 8 years ago. Statistical data also show that at the time of the ex-post evaluation (2022), more than 70 million people a year visited Varanasi, and considering that the number of pilgrims and tourists visiting Varanasi was slightly more than 1 million a year at the time of the ex-ante evaluation, the number of pilgrims and tourists visiting Varanasi has increased remarkably.

Figure 3 Number of visitors to Varanasi (million people)



Source: Created by evaluator based on tourist statistics in U.P.

3.3.2.2 Other Positive and Negative Impacts

1) Impacts on the Environment

At the time of appraisal, the Project was classified as Category B, because the Project aimed to improve the environment and was considered to have no significant undesirable effects on the environment in light of the sector, project, and regional characteristics listed in the Japan Bank for International Cooperation's "Guidelines for Confirmation of Environmental and Social Considerations" (April 2002). In addition, the Project area and its surrounding area were not classified as a nature conservation area, etc., and no negative impact on the natural environment was foreseen.

According to the confirmation with UPJN at the time of the ex-post evaluation, appropriate environmental mitigation measures were taken in accordance with the Environment and Social Management Report (ESMP), and no negative impacts on the natural environment have occurred. Since the completion of the Project, the water quality of the discharged water at the new STP has been tested daily to monitor the environmental impacts, and no negative impacts on the natural environment have occurred.

2) Resettlement and Land Acquisition

At the time of appraisal, no resettlement was expected for the construction of the new sewage treatment plant, the required land acquisition area was approximately 44 ha, and the land acquisition was to be conducted in accordance with Indian domestic law.

The land that was to be acquired, Sathwa, was agricultural land at the time of appraisal, but farmers' opposition made it difficult to expropriate the land, and consequently, the site for the construction of the new STP plant was changed.

At the time of the ex-post evaluation, it was confirmed by UPJN that no new land was acquired in Dinajpur, where the new site was to be located, but there was opposition by farmers on the grounds that they were not adequately compensated when the existing Dinapur sewage treatment plant (in operation since 1994; land acquisition was conducted from 1985 to 1989) was constructed. In response to this issue, the farmers were paid compensation calculated in accordance with national law, based on the instructions of the Hon'ble Court. No relocation of residents, including informal residents, occurred. At the time of the ex-post evaluation, there were no problems observed related to land acquisition.

3) Gender Equality

At the time of appraisal, there were plans to introduce a scheme for the construction and maintenance of community toilets that would involve participation by residents' organizations with the support of local NGOs, and which would include women as members of residents' organizations.

At the time of the ex-post evaluation, it was confirmed that the construction and maintenance of the community toilets are being carried out by Sulabh International, and that the toilet caretakers (who collect fees and perform cleaning) are social workers hired from the local community (not limited to women, but female caretakers were also observed during the field survey). All community toilet facilities have separate entrances for men and women, and women-only spaces are reserved[22]. In addition, the renovation of the bathing Ghats was designed with women in mind, including the installation of women-only changing rooms.

4) Marginalized People

At the time of appraisal, more than 30% of the population of Varanasi City lived in slums, and the construction of community toilets in slum areas was planned in view of the low rate of ownership and use of toilets and the poor sanitation environment.

It was confirmed at the time of the ex-post evaluation that the installation of community toilets in the slum areas has contributed significantly to improving the sanitation of people living in the slum areas (see 3.3.1.2 Qualitative Effects (Other Effects)).

[22] For facilities with a capacity of 5 people, there are 2 stalls for men, 2 for women, and 1 for the disabled; for facilities with a capacity of 10 people, there are 5 stalls for men, 4 for women, and 1 for the disabled; and for facilities with a capacity of 15 people, there are 8 stalls for men, 6 for women, and 1 for the disabled. All facilities also have showers.

Each community toilet complex also has a private room designed for people with disabilities. In addition, a fee structure was introduced in consideration of low-income groups, such as an affordable fee of 50 rupees per household per month for unlimited use of the toilets in slum areas.

5) Social Systems and Norms, Human Well-being and Human Rights

At the time of the ex-post evaluation, no particular impact on existing policies and social systems or cultural/social impacts were identified.

In order to obtain a deeper understanding of the Project outcomes, including impacts that were not anticipated in the Project, a detailed analysis was conducted with a particular focus on the impact on people's well-being. As a result, while various aspects of life such as income and assets, housing, education, environment, social connections, governance, and employment affect the subjective well-being and life satisfaction of the beneficiaries, the improvement of sanitation brought about not only the improvement of the living environment and health, but other positive changes too.

Unexpected impacts that emerged from interviews with beneficiaries included, for example, an increased sense of community belonging, ease of commuting to work and school, increased tranquility and relaxation (resulting from the improved riverfront environment), and increased religious devotion. The improvement of the sanitation environment, which was the focus of this Project, was found to have brought about these changes and consequently affected people's well-being. (See BOX-2 for details.)

Given the above, to summarize the effectiveness and impacts of the Project, the quantitative operational and effectiveness indicators that measure the effectiveness of the sewerage facility improvement component have mostly met their targets, except for the indicators related to water quality in the downstream area of the Ganges River, and the qualitative effects of the sanitation improvement, which are the outcomes of the sanitation improvement component, were confirmed.

No negative impacts on the natural environment have been observed, and the farmers' protests that occurred during the construction of the facility have been appropriately dealt with.

Therefore, the effectiveness and impacts of the Project are high.

BOX-2 Detailed Analysis of People's Well-being

A detailed analysis focusing on people's well-being was conducted with the aim of gaining a deeper understanding of the Project's outcomes, including unanticipated impacts.

Summary of the Survey

Target	Out of the slum communities where community toilets were constructed under the Project, 3 sites were selected, with 15 households in each community, for a total of 45 households.
Method	In-person semi-structured interviews were conducted by the evaluation team consisting of evaluator, and a local assistant. The evaluation team asked respondents about changes in subjective happiness or life satisfaction before and after the Project, and explored the factors that brought about such changes in each domain that is thought to define people's happiness (see below). Specifically, for those respondents who indicated that there was a change in subjective happiness or life satisfaction, we asked regarding each domain whether there was a relationship to the change in satisfaction[23], and if so, we identified the factors (changes in specific domains) that were relevant to the change in overall satisfaction. Based on the information obtained, we analyzed the relationship between the Project and changes in well-being and examined whether there was any unanticipated impact from the Project.

Interview scene
(Source: Local assistant)

Based on a pilot survey conducted by the evaluator, the domains that are thought to define people's well-being in this context were narrowed down to seven domains, for a total of 22 items.

Domains	Items
Income, assets	1 Income
	2 Income inequality
Housing	3 Availability of housing
	4 Quality of housing
Education	5 Reading and writing skills
	6 Basic arithmetic ability
	7 Years of school
Environment	8 Availability of fresh water
	9 Cleanliness of the local community
	10 Sewerage system and water logging
	11 Riverside environment
	12 Access to the natural environment
Social capital	13 Connection with the community
	14 Connection with family
	15 Free will
	16 Respect for cultural norms of behavior including rituals and beliefs
	17 Ganges River and faith
Governance	18 Level of trust in the local government
	19 Participation in political decision-making
	20 Discrimination and exclusion, such as gender discrimination and racism
Employment	21 Availability of employment
	22 Job satisfaction

Results of the Survey

1) Change in subjective happiness/satisfaction

When asked about subjective satisfaction, 73% (33 persons) answered "Much more satisfied" or "More satisfied," while 16% (7 persons) answered "Less satisfied" and 13% (6 persons) answered "No change."

[23] For each domain, we asked "Is XXX (income, for example) related to the changes in your life satisfaction?" and obtained a yes/no response. If yes, we further asked "How is it related to the changes in your life satisfaction?

2) Factors that affected the change in subjective happiness/satisfaction

- Those 39 respondents who indicated that their level of satisfaction had changed were asked whether each of the seven domains (22 items in total) had affected their level of subjective happiness and satisfaction. Most of the respondents answered that all of the following aspects had an impact on their satisfaction: income, assets, housing, education, environment, social connections, governance, and employment.
- Given the above, it can be said that all factors affect changes in subjective happiness, but it is also clear that the improvement of the sanitation environment, which was addressed in this Project, is one of the factors affecting happiness and life satisfaction.
- All respondents answered that environmental factors such as "Cleanliness of the local community" and " Sewerage system and water logging," which were expected as objectives of the Project, had an impact on their level of satisfaction, while other factors such as "Riverside environment " and "Ganges River and faith" were also considered as spillover impacts of the Project. For example, the impact of the Project was seen in terms of improved health (fewer illnesses), improved sanitation during the rainy season thanks to the improved sewerage system, spiritual enrichment resulting from the improved environment along the river, and increased religious devotion due to the purification of the Ganges River.

The following are some of the responses from the interviees.

<u>How did the cleanliness of the local community affect your level of happiness and satisfaction?</u>

Communities are cleaner and less vulnerable to seasonal diseases; fewer endemic diseases; fewer mosquito bites

Increased access for outsiders; better community environment makes people feel more comfortable in their homes; positive impact on mental health and well-being; community areas are cleaner and better maintained, leading to a sense of pride and belonging

<u>How did the improvement of the sewerage system affect your level of happiness/satisfaction?</u>

Improved sewerage system has reduced flooding, especially during the rainy season; sewage problems used to cause unpleasant smells and health hazards: in the past, the area used to be knee-deep in water containing sewage during the rainy season, but this is no longer the case; this is a big change from when the area was flooded and almost no one could enter the area; there is no wastewater logging now; it is now convenient to commute to work and school because roads are usable even during the rainy season; and the area has become more accessible during the rainy season.

<u>How did the riverside environment affect your level of happiness/satisfaction?</u>

The changed riverside environment has made it a place where the community frequents and spends quality time; families now prefer to visit; people regularly come for morning walks and spend quality time riverside with their families; trash cans have been installed and the area is greener and cleaner, so more people are visiting; the area provides tranquility and relaxation; release from the noise and pollution of the city.

<u>How did the river pollution and beliefs of the Ganges affect changes in well-being/satisfaction?</u>

Satisfied with the changes that have occurred as a result of the Ganges pollution control and government action, the level of religious belief has greatly increased; the Ganges is worshipped as a sacred river, and frequent family visits and spending time together have strengthened faith; pollution of the Ganges had led to a decrease in faith-related practices such as bathing and religious ceremonies; addressing the pollution of the Ganges has increased faith-related practices and improved the overall well-being of the individuals and the community.

3.4 Sustainability (Rating: ②)

3.4.1 Policy and System

The purification of the Ganges River, which is the goal of the Project, has been a priority policy focus from the time of appraisal to the time of ex-post evaluation, and has always remained as high priority even through the change of administrations. At the time of the ex-post evaluation, the Namami Ganga Programme driven by NMCG, the executing agency of the Project, has been positioned as an important national flagship program with respect to the conservation of river water quality in the Ganges River basin. Namami Ganga was selected as one of the top ten ecosystem restoration initiatives in the world in the United Nations Decade on Ecosystem Restoration, an initiative of the United Nations Environment Programme (UNEP) and the Food and Agriculture Organization of the United Nations (FAO), announced in December 2022. This achievement comes from the Indian government's emphasis on the restoration of the Ganges River as a top priority issue and its strong promotion of this program.

As for policies to improve environmental sanitation, the Swachh Bharat Mission, an important initiative that has been promoted on a national scale since 2014, has been expanded to Phase 2 since 2020, focusing on maintaining open defecation-free conditions and improving waste management to further improve the sanitation environment.

From the above, it can be concluded that the sustainability of the policy and institutional aspects of the Project are ensured in terms of securing the sustainability of the project effects.

3.4.2 Institutional/Organizational Aspect

Sewerage Component

At the time of appraisal, UPJN was supposed to maintain and manage STPs and pumping stations after completion of the Project, while the maintenance and management of the sewers were to be carried out by Jal Kal Varanasi, and it was planned that the maintenance and management of all sewerage facilities would be transferred to Jal Kal Varanasi in the future.

Based on the verification at the time of the ex-post evaluation, the existing STPs and pumping stations rehabilitated under the Project are maintained and managed by UPJN as in the past. The newly constructed Dinajpur STP has been maintained and managed by VA Tech Wabag Ltd., which executed the construction, for 10 years after completion, after which the responsibility for maintenance will be decided by the U.P. state government.

The newly constructed pumping stations (Chaukaghat, Phulwaria, and Saraiya) have been maintained for 10 years since completion by UEM India Pvt. (now Toshiba Water Solution Co., Ltd.), which implemented the construction, after which the U.P. state government will determine the maintenance operator, as is the case with the STP. The maintenance of sewer pipes (new and rehabilitated) will be transferred from UPJN to Varanasi City (VNN) in phases, with gravity sewer pipes and old trunk sewers to be transferred to VNN first, which is being

coordinated as of the ex-post evaluation. According to UPJN, the maintenance and management of rising mains will be carried out by UPJN for the time being.

UPJN was separated into UPJN Urban and UPJN Rural in 2021, and the sewage treatment plants and pumping stations constructed under the Project are under the jurisdiction of UPJN Urban. The separation has had no particular impact on the maintenance and management structure, and the organizations responsible for the operation and maintenance of the various facilities established under the Project have clear and functioning inter-organizational responsibilities, decision-making processes, reporting systems, and so on.

Non-sewerage Component

At the time of appraisal, the maintenance of the community toilets was to be carried out by local residents with the support of an NGO, and the Dhobi Ghats were to be maintained and managed by VNN.

At the time of the ex-post evaluation, it was confirmed that, with regard to the community toilets, the contractors who built them (Sulabh International, an NGO, and M/S Prem Biogas) are contracted to operate and maintain the toilets for a period of 30 years. Each community toilet complex is staffed by a social worker employed by the local community. The Dhobi Ghats are operated and maintained by the Dhobi Association of Varanasi and the city of Varanasi under an MoU, with the association bearing the costs and VNN providing monitoring and supervision. In addition, operation and maintenance of the renovated bathing Ghats are being carried out by VNN with the cooperation of NGOs.

In each organization responsible for the operation and maintenance of the various facilities established under this Project, the responsibilities among the organizations, decision-making processes, and reporting systems are clear and functional, and no particular problems have been observed. The operation and maintenance of the newly constructed Dinapur STP, three pumping stations, and community toilet facilities have been outsourced to private organizations, but the division of roles and responsibilities is clear. The operation, maintenance, and management system after the outsourcing period has ended has not yet been determined at the time of the ex-post evaluation, but the appropriate system should be discussed at the UPJN and VNN.

3.4.3 Technical Aspect

At the time of appraisal, the executing agency had experience in implementing the Yamuna Action Plan Project under ODA loans, and although this was the first time for VNN to implement an ODA loan project, the sanitation improvement measures that they were in charge of had been implemented in the past under the Ganga Action Plan, so it was considered that

there were no problems with technical capacity and implementation capability. In addition, the consulting services for this Project were scheduled to include technical training, financial improvement, and organizational reform to improve the organizational capacity of Jal Kal Varanasi.

At the time of the ex-post evaluation, site visits and interviews with on-site staff indicated that the new STP in Dinapur has been properly operated and maintained by Wabag, with daily operational data and laboratory inspection data recorded and managed in accordance with the operation and maintenance manuals. At the new pumping stations, it was confirmed during the site visit that Toshiba Water Solutions was properly operating and maintaining the pumping stations, that regular training was provided for staff, and that daily operational data recording were being conducted in accordance with the operation and maintenance manuals. It was also confirmed during the site visit that UPJN's staff members are operating and maintaining the pumping stations that were renovated under the Project, and that daily operational data recording is being conducted in accordance with the operation and maintenance manuals.

The IDP component, implemented as part of the consulting services, included capacity building programs for VNN and Jal Kal Varanasi, such as training and skills development to strengthen organizational capacity, financial management including tax system review, and development of an asset management system[24].

In terms of operation and maintenance, no particular problems have been observed in terms of technical aspects, as sufficient experienced and competent engineers are in charge of operating each facility.

3.4.4 Financial Aspect

At the time of appraisal, the budget allocation from the state government for the Ganga Action Plan (GAP) in Varanasi, which has been implemented since 2003, had been made without delay, and there were no particular concerns about the financial aspects of the Project. While the sewerage rates at that time were not high enough to cover maintenance and management costs, based on the recommendations of JICA's feasibility study, including (1) establishment of a revenue department, (2) review of the taxation system, and (3) tax payment awareness activities through publicity, it was decided to formulate measures for financial improvement for UPJN and VNN in the consulting services for this Project.

At the time of the ex-post evaluation, information on revenues and expenditures of UPJN, VNN, and Jal Kal Varanasi was obtained: from UPJN, the operation and maintenance budget

[24] As for the asset management system, at the time of the ex-post evaluation, it was not available at the Jal Kal Varanasi and was not being utilized. This system is a database designed to manage the assets of citizens (location and size of houses, water and sewage facilities, etc.) using GIS, but it does not correspond to the technology required for the operation and maintenance of the project, and is therefore excluded from the perspective of the technical aspects of the evaluation.

related to the sewerage facility; from VNN, the budget for the entire sanitation sector; and from Jal Kal Varanasi, the revenue and expenditure information.

Table 10 Budget and Revenue/Expenditure Information of UPJN, VNN, Jal Kal Varanasi

(Million Rupees)

Organisation	Item	2020	2021	2022
UPJN	Budget for operation and maintenance of sewerage infrastructure	35.1	37.4	39.7
VNN	Budget for sanitation sector	158.8	162.4	155.2
		2021-22	2022-23	2023-24
Jal Kal Varanasi	Income	337.3	837.0	841.0
	Non-operating income	685.7	877.5	927.5
	Total Income	1123.0	1714.5	1768.5
	O&M cost	707.3	1145.4	1143.3
	Other cost	274.3	552.1	557.0
	Total Cost	978.7	1697.5	1700.3
	Income/Expenses	**44.3**	**17.0**	**68.2**

Source: Data provided by UPJN, VNN, and Jal Kal Varanasi

As confirmed at the time of the ex-post evaluation, no payments have been made since April 2022 to the private contractors that operate and maintain the sewerage facilities (Wabag, which maintains the STP, and Toshiba Water Solutions, which maintains the pumping stations). According to UPJN, the delay is due to a delay in the distribution of the operation and maintenance budget from the government. As of May 2023, the budget distribution process is ongoing and is expected to take place within a few months, but the exact timing of the payment is unknown. According to interviews with contractors, at the time of the post-evaluation, the delay in budget distribution had not had any particular impact on operations and maintenance yet, as they are required to treat incoming sewage on an ongoing basis.

According to VNN, the annual budget for the operation and maintenance of community toilets has not been distributed to Sulabh International, and since it is difficult to cover the operation and maintenance costs from toilet charges alone, they are also using revenue sourced from advertising in the public toilets.

According to an interview with Jal Kal Varanasi, the fee structure for the sewerage system is 4% of the annual rental value (ARV) of the property, which generates 130 million rupees per year. Jal Kal's main source of income is from water and wastewater use tax as well as government subsidies, and it has a surplus in revenues and expenditures.

Looking at the sustainability of operation and maintenance from a financial perspective, UPJN, VNN, and Jal Kal Varanasi have been able to secure the necessary financial resources, but a concern is that payments from UPJN to private contractors have been delayed for over a year.

3.4.5 Environmental and Social Aspect

At the time of the ex-post evaluation, no sustainability impacts were identified with respect to environmental and social considerations.

3.4.6 Preventative Measures to Risks

At the time of appraisal, the risks identified were economic stagnation/worsening in India and the surrounding areas, natural disasters, and an increase in the volume of untreated sewage discharged from the upstream cities of the Ganges River.

At the time of the ex-post evaluation, although there was an impact from the COVID-19 pandemic, there was no economic stagnation/worsening or major natural disasters, and there was no significant change in the volume of untreated sewage from the upstream area of the Ganges River.

It was confirmed to NMCG at the time of the ex-post evaluation that 25-30 MLD of sewage was discharged near Raj Ghat (a bathing Ghat located in the downstream area of the Ganges River) after the new Dinapur STP was commissioned. Then, a proposal was made by the state government to link the sewerage system laid under the JICA project with the sewerage system rehabilitated under the JICA project. As a result of this response, the sewage that was being discharged is now being treated at the new Dinapur STP through the Chaukaghat pumping station. The measure has already been completed, and no untreated sewage is currently discharging into the Ganges River. Thus, even after the completion of the Project, appropriate measures are being taken to address the risks.

3.4.7 Status of Operation and Maintenance

At the time of the post-evaluation, the following sites were inspected on-site to visually confirm the operational status of the facilities and the operation and maintenance of the facilities.

<u>Sewerage Component</u>

- New Dinapur STP (newly constructed)
- Chaukaghat R/B main pumping station (newly constructed)
- Phulwaria pumping station (newly constructed)
- Saraiya pumping station (newly constructed)
- Old Dinapur STP (rehabilitated/renovated)
- Bhagwanpur STP (rehabilitated/renovated)
- Konia main pumping station (rehabilitated/renovated)
- 4 Ghat pumping stations (rehabilitated/renovated): Trilochan Ghat, Dr. RP Ghat, Mansarovar Ghat, Harishchandra Ghat

Non-sewerage Component:

- 5 out of 154 newly constructed community toilet complexes
- 2 out of 4 newly constructed Dhobi Ghats (Pandeypur, Machodary)
- 2 out of 3 Dhobi Ghats renovated (Konia, Nadesar)
- At least 5 bathing Ghats along the Ganges River that have been renovated

From the confirmation of equipment and daily records during site visits and interviews with facility staff, it was observed that regular inspections and maintenance are conducted at each facility, no major problems have occurred to date, and the facilities are operated and maintained in good condition and properly managed.

From the above, to summarize the sustainability of the Project, no problems were found in the operation and maintenance of the Project in terms of related policy/system, institutional/ organizational aspect, technical aspect, environmental and social aspect including the current status of operation and maintenance, and preventative measures to risks. However, the financial aspects are partially problematic due to the delay in payments to private contractors at the time of the ex-post evaluation, and the uncertainty regarding the prospects for improvement and resolution of the situation. Although the delay in budget distribution did not have any impact on operation and maintenance at the time of the ex-post evaluation, it could be a cause for concern for the continuation of appropriate operation and maintenance in the future. Therefore, the sustainability of the project effects is moderately low.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The objective of the Ganga Action Plan Project (Varanasi) (hereinafter referred to as “the Project”) was to improve wastewater treatment capacity and sanitation conditions in Varanasi, Uttar Pradesh, by constructing and rehabilitating sewage treatment facilities, constructing sanitation facilities such as community toilets, and implementing sanitation improvement activities such as public awareness program, thereby contributing to the improvement of water quality in the Ganges River and sanitation conditions for citizens, pilgrims, and tourists.

The implementation of this Project, from the time of appraisal to the time of ex-post evaluation, was fully consistent with India's development plan and development needs, and the planning and approach of the Project were appropriate. In addition, the Project was found to be consistent with Japan's development assistance policy and other projects within and outside of JICA, hence the relevance and coherence of the Project are high.

Regarding the outputs, although changes from the plan occurred in each component, the increase or decrease from the plan was not such as to affect the achievement of the Project's outcomes. Although the project cost was within the plan, the project period was much longer than planned, rendering the efficiency of the Project moderately low.

As for project effectiveness, the Project largely achieved its goals in terms of operation and effectiveness indicators related to the improvement of sewerage infrastructure, with the exception of indicators related to water quality in the downstream area of the Ganges River. The qualitative effects and impacts related to the improvement of the sanitation environment were confirmed, and no negative impact of the Project on the natural environment was reported. Therefore, the effectiveness and impact of the Project are high.

Regarding the sustainability, considering the operation and maintenance of the Project, no problems were found in the related policies and systems, institutional/organizational aspect, technical aspect, environmental and social aspect, and risk prevention measures, but the financial situation was partially worrisome because of a delay in the payment of operation and maintenance expenses at the time of the ex-post evaluation, and the prospects for improvement and resolution were uncertain. Therefore, the sustainability of the Project is moderately low.

In light of the above, this Project is evaluated to be satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

With regard to the operation and maintenance of sewerage facilities, it is proposed that NMCG and UPJN review the appropriateness of the operation and maintenance budget allocation process and consider measures to prevent recurrence, as there have been delays of more than one year in the payment of operation and maintenance fees to private contractors. Regarding the future operation and maintenance system, it is also suggested that if the operation and maintenance is outsourced to the private sector, an appropriate structure be established prior to the end of the outsourcing period so that proper operation and management can continue seamlessly after the end of the outsourcing period.

Regarding the maintenance and management of public toilets, some of the community toilets constructed under this Project are not connected to the sewer pipes and using septic tanks. Since untreated sewage spillage and maintenance of septic tanks have become issues, it is proposed that VNN check the current status and examine the measures to be taken.

4.2.2 Recommendations to JICA

None

4.3 Lessons Learned

Multi-component sanitation improvement approach (combining sewerage, non-sewerage, and other components)

The Project was designed and implemented under the master plan of the development study "The Study on Water Quality Management Plan for Ganga River in the Republic of India" with multiple components: a sewerage component, a non-sewerage component (sanitation improvement component), and consulting services (including organizational development). To reduce river pollution and improve environmental sanitation in the city as a whole, it is necessary not only to build infrastructure such as STP, sewers, and pumping stations, but also to stop runoff from other sources of wastewater (open defecation, washing water, etc.), to encourage people to change their attitudes and behaviors, and to improve the capacity of implementing agencies. A multi-pronged approach is effective, and this Project is a good example of such an approach.

Many residents of the local community, as well as hospitals and travel agencies, have realized an improvement in sanitation in the city of Varanasi. The factors contributing to this realization include not only the improvement in the water quality of the Ganges River, but also the change in people's awareness and behavior, such as the reduction of open defecation and littering in the river. These are the results of a multi-component approach that includes awareness-raising activities and the construction of facilities to improve the living environment (construction of toilets and washing facilities, improvement of bathing Ghats, etc.). Under the supervision of VNN, the implementing agency, the sanitation improvement component of the Project was also effective, in that the construction and maintenance of community toilets and awareness-raising activities were outsourced to local NGOs. The construction and maintenance of community toilets was achieved by outsourcing to a local NGO with extensive experience in operating public toilets, and by working with the NGO from the stage of considering the location and specifications of the toilets. Awareness-raising activities were also effectively implemented by partnering with local NGOs with experience in sanitation education and community activities. This suggests that when implementing a multi-component project, it is effective to work with NGOs that have a wealth of experience in working with local communities, especially when implementing the sanitation component of a project.

On the other hand, multi-component projects involve a wide range of implementing agencies/other agencies, and there is a risk of increased complexity in project management, and in fact, this Project experienced significant delays (due to a variety of factors). However, by incorporating different components into one project, it was possible to respond flexibly to construction delays and site changes. When planning similar projects in the future, it will be necessary to establish a smooth project management mechanism while considering a multi-component approach aiming for significant results and impacts.

A brief analysis of other sewerage sector ODA loan projects shows that of the sewerage sector projects planned during the same period as this Project (2005-2010), 77% included organizational development and capacity building as a non-sewerage component (excluding assistance of procurement process and construction supervision), 38% included awareness-raising activities and environmental education, and only 23% worked to improve local sanitation. Looking at projects initiated in recent years (2019-2022), all projects include organizational development and capacity-building, and 75% of the projects include awareness-raising activities and environmental education. On the other hand, few projects included a local sanitation improvement component.

Table 11　Components of ODA loan sewerage infrastructure projects

	Sewerage Sector ODA Loan Projects initiated in 2005-2010	Sewerage Sector ODA Loan Projects initiated in 2019-2022
Number of projects	13	8
a) Incorporates organizational development and capacity-building components	10 (77%)	8 (100%)
b) In addition to a), awareness-raising and environmental education component is incorporated	5 (38%)	6 (75%)
c) In addition to b), local sanitation improvement component is incorporated	3 (23%)	1 (13%)

Source: Created by evaluator based on ex-ante evaluation reports of each project

The projects that incorporate local sanitation improvement component both from the same period as this Project (2005-2010) and from more recent years are projects in India, and they include slum development (transition to metered individual and shared water supply, construction and renovation of toilets, waste management) and construction of sanitation facilities such as electric crematoriums and cattle washing stations, etc.

The Project has contributed to improving people's wellbeing through the synergistic effects of the sewerage component and the sanitation improvement component (see BOX-2), suggesting that it is effective to implement a project directly related to improving local sanitation at the same time as the sewerage facility improvement. The multi-component approach is an approach that has been widely adopted in projects in India based on the policies of the Indian government, but it may also be a useful reference for similar projects in other countries.

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5. Non-Score Criteria

5.1 Performance

5.1.1 Objective Perspective

Although the Project experienced significant delays and changes in the executing agency, and did not progress as planned, there was continuous communication between JICA and the executing agency, and an appropriate supervision system was put in place to respond to the changes in the project environment.

5.2 Additionality

None.

(End)

Comparison of the Original and Actual Scope of the Project

Item	Plan	Actual
1. Project Outputs a. Sewerage component	<u>Construction/rehabilitation of STPs</u> ・Construction of Sathwa STP (140MLD) ・Rehabilitation of 2 STPs <u>Construction/rehabilitation of pumping stations</u> ・Construction of 3 pumping stations ・Rehabilitation of 1 main pumping station and 5 Ghats pumping stations <u>Construction/renovation /rehabilitation of sewers</u> ・Construction: 33.2km ・Renovation 7,172m <u>Renovation/rehabilitation of existing irrigation canal</u> ・Total length 18km	・Location of STP was changed (140MLD) ・As planned ・Almost as planned ・As planned ・Construction: 28.8km ・Renovation; 6,905m ・Due to the change in location of the STP, it was no longer necessary to renovate the irrigation canal, and instead a 1.7 km drainage channel was constructed
b. Non-sewerage component	<u>Construction of community toilet complexes</u> ・205 in slum areas, 26 in bathing Ghats <u>Construction/renovation of Dhobi Ghats</u> ・Construction: 7 locations, Renovation 3 locations <u>Public Awareness and Public Participation (PAPP)</u>	・154 in slum communities and urban areas, 26 in bathing Ghats ・Renovation of 26 bathing Ghats ・Construction: 4 locations, Renovation 3 locations ・Almost as planned
c. Consulting services	・Assistance of procurement process, management and supervision of project implementation ・Comprehensive assistance for public health conditions ・Institutional Development Programme (IDP)	・As planned ・As planned ・More comprehensive content was implemented than planned
2. Project Period	March 2005- March 2012 (85 months)	March 2005- June 2022 (208 months)
3. Project Cost Amount Paid in Foreign Currency Amount Paid in Local Currency	2,277 million yen 10,971 million yen （4,571 million INR）	No data No data

Total ODA Loan Portion Exchange Rate	13,248 million yen 11,184 million yen 1INR ＝2.4 JPY (As of August 2004)	9,831 million yen 6,194 million yen 1 INR=1.644 JPY (Average between January 2010 and December 2022)
4. Final Disbursement	July 2020	