Nepal

FY2023 Ex-Post Evaluation Report of Japanese ODA Loan

"Melamchi Water Supply Project"

External Evaluator: Yukiko Sueyoshi, International Development Center of Japan Inc.

0. Summary

This project supports the construction of a water treatment plant as part of the first phase of a co-financing program aimed at developing a series of water supply facilities, ranging from intake facilities to distribution pipe networks, with the Melamchi River serving as the water source. The primary objective is to alleviate the severe water shortages in the Kathmandu Valley. The implementation of this project aligns with Nepal's development policies and needs, as well as Japan's aid policies. Furthermore, the collaboration with the Japan International Cooperation Agency (JICA) and other donors has been confirmed, making the project highly relevant and coherent. Although the project outputs were achieved as planned and the project cost was within the plan, the efficiency of the project is rated moderately low due to the significant extension of the project timeline beyond the original plan. Following the completion of the project, operational restrictions on the water intake facility and the water conduit tunnel have arisen due to flood damage. Kathmandu Upatyaka Khanepani Limited (KUKL), the agency responsible for operation and maintenance, is helping alleviate water shortages in the Kathmandu Valley by ensuring the continuous operation of the water treatment plant, expanding the water pipeline, and diversifying water sources. No water quality issues have been identified at the water treatment plant, and the tap water quality is expected to improve with future upgrades to the distribution pipeline network. Positive impacts, such as the continuous increase in the number of connection taps and improvements in user satisfaction, have been reported. Considering the external factors, such as the inability to secure sufficient water from the originally planned source due to damage caused by a large-scale natural disaster, the project has largely progressed as planned. Consequently, its effectiveness and impact are deemed to be high. Regarding sustainability, the restoration of the water intake facilities is crucial for the water treatment plant to operate as originally planned. Although a restoration plan is in progress, the sustainability of the project is considered relatively low due to the ongoing need to address climate change and natural disasters, and the necessity for continuous monitoring of these efforts.

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

1. Project Description

Project Location
(source: https://www.freemap.jp/)

New Sundarijal Water Treatment Plant
(source: Implementing Agency)

1.1 Background

Before the initiation of this project, severe water shortages were a significant issue in Nepal, particularly in the rapidly growing Kathmandu Valley. The water supply was primarily divided between surface water and groundwater. During the rainy season, the relatively abundant surface water was utilized, whereas, during the dry season, groundwater extraction from wells was used to address surface water shortages. However, low groundwater levels and declining water quality restricted the volume of extractable groundwater, rendering it insufficient to meet the water demand, particularly during the dry season. Consequently, identifying and securing a new water source became a critical challenge.

Additionally, the financial situation of the entity responsible for water supply and sewerage services had deteriorated due to a high leakage rate of nearly 40% and a low fee collection rate. These financial constraints led to inadequate funds for the repair and maintenance of water supply facilities, perpetuating a cycle of increasing leakage rates and worsening management. Addressing these issues became an urgent priority.

In response, the Nepalese government developed a program aimed at securing a new water source outside the Kathmandu Valley to meet long-term water demand. Simultaneously, the program sought to enhance the efficiency of water supply services within the Valley by outsourcing operations to private companies, repairing the water distribution network, and reducing the leakage rate. A study conducted by the United Nations Development Program (UNDP) in 1970 identified the need for a water source outside the Kathmandu Valley, and the Melamchi River was selected as the optimal source. The Melamchi River offered the potential to supply a substantial quantity of water through a water conduit tunnel. Moreover, the tunnel could be extended to access additional water sources from the Yangiri and Lark Rivers to meet potential future demand. Consequently, the Melamchi Drinking Water Project was established as a co-financing program involving Japan and other doner(s). The project was designed in two phases.

The first phase focused on constructing water supply facilities using the Melamchi River as the source, while the second phase planned for the gradual expansion of these facilities to utilize the Yangiri and Lark Rivers. The first phase of the project encompassed four major components: water intake facilities and conduit tunnels, a water treatment plant, water transmission pipes, and the rehabilitation of the water distribution network. This project specifically supports the construction of the water treatment plant.

1.2 Project Outline

The objective of this project[1] is to secure a new water supply source to cope with the deteriorating water supply conditions caused by the population growth in the urban areas of the Kathmandu Valley, thereby improving the standard of living by alleviating the imbalance between water supply and demand situation over the medium to long term.

<ODA Loan Project>

Loan Approved Amount / Disbursed Amount	5,494 million yen / 4,044 million yen
Exchange of Notes Date / Loan Agreement Signing Date	March 2001 / March 2001
Terms and Conditions	Interest Rate -Main part 1.00% -Consultant part 0.75% Repayment Period (Grace Period) -Main part 30 years (10 years) -Consultant part 40 years (10 years) Conditions for Procurement General Untied
Borrower / Executing Agency(ies)	Government of Nepal / Ministry of Water Supply
Project Completion[2]	December 2017
Target Area	Katmandu
Main Contractor(s) (Over 1 billion yen)	・NJS Co., Ltd. (Japan) /Nepal Consultant Ltd. (Nepal) /Mott Macdonald International Ltd. (U.K.) /Binnie BL /Ack & Veatch International (U.K.) (JV)

[1] Although the project purpose at the time of appraisal could be considered to refer to the entire donor co-financing package, this ex-post evaluation focuses on the construction of the water treatment plant financed by the Japanese yen loan.

[2] In this evaluation, the project completion was defined as the completion of inspection.

	Va Tech Wabag Ltd. (India)/Pratibha Industries Ltd. (India) (JV)
Main Consultant(s) (Over 100 million yen)	NJS Co., Ltd. (Japan) /Nepal Consultant Ltd. (Nepal) /Mott Macdonald International Ltd. (U.K.) /Binnie BL /Ack & Veatch International (U.K) (JV)
Related Studies (Feasibility Studies, etc.)	'Special Assistance for Project Implementation the Melamchi Water Supply Project Phase I' (started Oct.2002) 'Special Assistance for Project Implementation the Melamchi Water Supply Project Phase II' (started Mar.2004)
Technical Assistance Project Related to ODA Loan	'The Project on Capacity Development of KUKL to Improve Overall Water Supply Service in Kathmandu Valley' (hereinafter referred to as Technical Assistance)[3]
Related Projects	<Japanese Grant Aid> The Project for Improvement of Kathmandu Water Supply Facilities phase 1 (December 2001) The Project for Improvement of Kathmandu Water Supply Facilities phase 2 (November 2002) The Project for Improvement of Kathmandu Water Supply Facilities phase 3 (August 2003) <ADB Loan> Kathmandu Valley Water Supply Improvement Project [4] (Approved: September 2011)

[3] The technical assistance is scheduled from March 2021 to March 2026 to improve KUKL's capacity for operation and maintenance management, including "water distribution management using GIS," "non-revenue water reduction measures," "water treatment plant maintenance and water quality management," and "customer service improvement," including "complaint handling" and "awareness raising activities." In addition, KUKL is working to strengthen its capacity for "internal training" so that the results of these activities can be internalized at KUKL.

[4] URL address: https://www.adb.org/projects/34304-043/main; (i) construction of the Melamchi water conduit tunnel and intake facilities; (ii) development of the water distribution pipeline network, including installation of water pipes and meters; (iii) construction of distribution reservoirs and water distribution testing; (iv) construction of an 85 million L/day water treatment plant (accessed July 9, 2024)

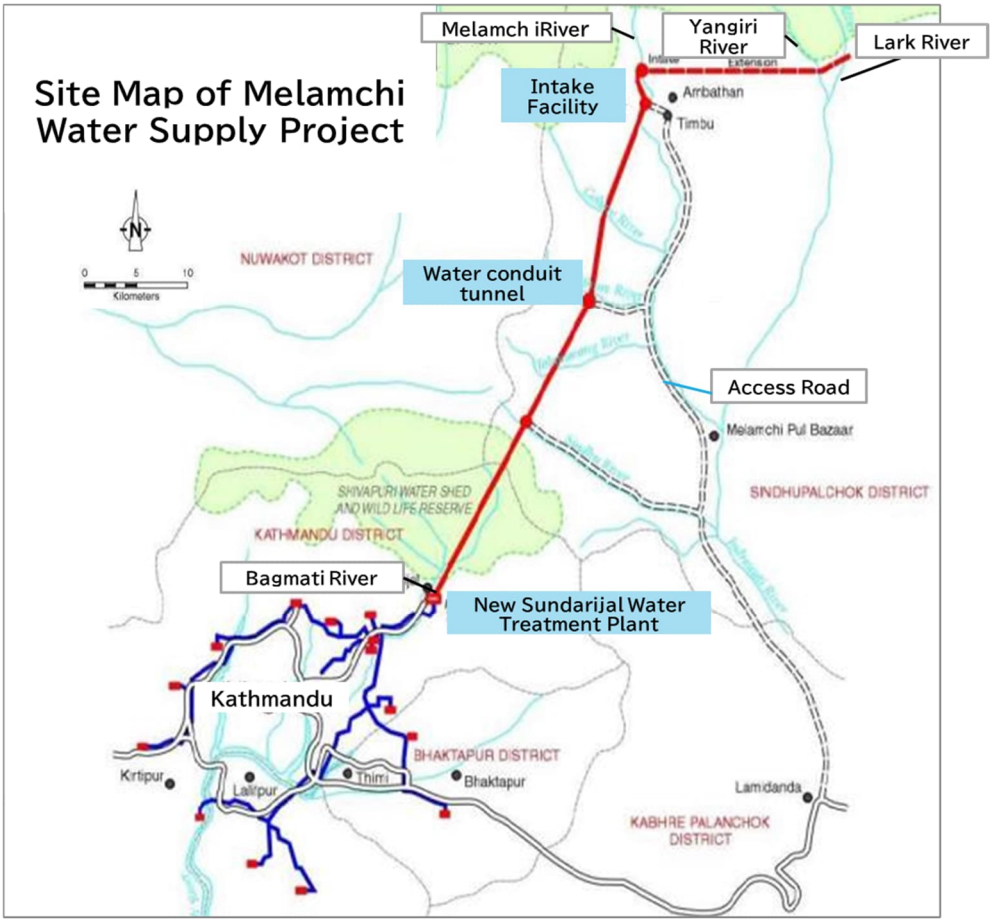

Figure 1 Site Map of Melamchi Water Supply Project

Source: Evaluation of Water Supply and Demand under Climate Change Scenarios in Kathmandu Valley, Nepal, International Centre for Integrated Mountain Development 2014, Edited by the evaluator.

2. Outline of the Evaluation Study

2.1 External Evaluator

Yukiko Sueyoshi, International Development Center of Japan Inc.

2.2 Duration of Evaluation Study

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

Duration of the Study: December 2023–January 2025

Duration of the First Field Study: March 24, 2024–April 5, 2024

Duration of the Second Field Study: July 31, 2024–August 8, 2024

2.3 Constraints During the Evaluation Study

The intake facility, which was essential for withdrawing water to the treatment plant constructed under the project, was destroyed by a massive flood and landslide only a few months after its completion. At the time of this ex-post evaluation, water withdrawal as originally planned was

not feasible. However, given that five years had passed since the completion of the project's loan, the evaluation was conducted as scheduled. Considering these circumstances, the assessment of the project's effectiveness involved not only a comparison of planned outcomes and targets, as is customary in ex-post evaluations, but also an examination of the operational status of the water treatment plant from the project's completion to the time of evaluation. Furthermore, the analysis accounted for the limitations imposed by external factors on the plant's operation.

3. Results of the Evaluation (Overall Rating: B[5])

3.1 Relevance/Coherence (Rating:③[6])

3.1.1. Relevance (Rating: ③)

3.1.1.1 Consistency with the Development Plan of Nepal

At the time of appraisal, Nepal's development policy was outlined in *The Ninth Plan (FY1997/98–2001/02)*. This plan identified five priority sectors: (1) agricultural development, (2) water and power development, (3) human resources and social development, (4) promotion of industrialization and tourism, and (5) infrastructure development. Within the third sector, the quantitative and qualitative improvement of water supply and sewage systems was emphasized alongside education and healthcare. Specifically, the plan aimed to provide a minimum water-supply service, defined as access to water supply facilities located within 200 m horizontally and 50 m vertically, to all citizens by July 2002.

At the time of the ex-post evaluation, Nepal's national development policy was articulated in *The Fifteenth Plan (FY2019/20–2023/24)*. This plan set the goal of "providing quality basic drinking water and sanitation services to all," addressing the challenges posed by unsafe and unsustainable drinking water services. These challenges stemmed from the contamination and depletion of water sources, exacerbated by inadequate waste management and rapid urbanization. To achieve this goal, the plan proposed eight strategies, with the seventh strategy focusing on the development and conservation of water sources to ensure the provision of drinking water to urban areas. Additionally, The Fifteenth Plan highlighted 22 National Pride Projects, which are large-scale infrastructure initiatives critical to Nepal's socioeconomic growth. The Melamchi Drinking Water Project, which encompasses this project, was identified as one of these priority initiatives. The plan explicitly stated that the implementation of these projects would be accelerated, with prioritized resource allocation.

In light of these factors, the project, which supported the construction of a new water treatment plant to mitigate water shortages in the Kathmandu Valley, aligns with Nepal's development policies at the time of both appraisal and ex-post evaluation.

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

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

3.1.1.2 Consistency with the Development Needs of Nepal

At the time of appraisal, Nepal's overall water supply coverage was estimated at 61.1% (1997). In rural areas, coverage had improved due to the construction and rehabilitation of small-scale water supply facilities supported by the WB and the UNDP. Conversely, in urban areas, the water supply system coverage has been declining steadily since the 1980s due to rapid population growth. The Kathmandu Valley, in particular, faced acute water shortages during the dry season. Although water from wells supplemented surface water sources, the availability was constrained by declining groundwater levels and deteriorating water quality. During the dry season, only approximately 60% of the demand was met, while in the rainy season, coverage improved but still only reached about 80%. Given the limited water sources within the Kathmandu Valley, securing additional water sources from outside the Valley had become an urgent necessity.

At the time of the ex-post evaluation, water demand within the Kathmandu Valley was estimated to be 485 million liters per day (MLD). While the commencement of water intake from the Melamchi River during the dry season of 2021 had increased supply, demand continued to rise due to sustained population growth. In the most recent year (2023/24), the annual average water supply was approximately 175 MLD. Accounting for an estimated 20% leakage rate by KUKL, the effective supply amounted to only 129 MLD, which remained insufficient to meet the growing demand. With respect to water supply services, many customers lacked sufficient access despite having water supply contracts. Some households received water only intermittently—either every other day or for limited hours—and continued to rely on alternative sources such as water trucks or groundwater, the latter often being of poor quality.

Consequently, from the time of appraisal to the ex-post evaluation, the need for improved water supply services in the Kathmandu Valley remained substantial. This project effectively addressed the region’s critical development needs.

Table 1　Estimated water demand, water supply, and available water within the Kathmandu Valley

Unit: Million Liters Per Day

Year[7]	2019/20	2020/21	2021/22	2022 /23	2023/24
Estimated water demand					
Average	430.00	470.00	472.00	472.00	485.00
Water supply					
Minimum	95.00	100.00	129.60	102.66	146.20
Maximum	196.00	133.00	157.07	154.68	218.46
Average	129.00	114.00	137.47	126.55	175.02
Available water (Assuming 20% leakage rate)					
Minimum	76.00	80.00	97.00	82.13	116.82
Maximum	157.00	106.00	126.00	123.74	174.77
Average	103.00	91.00	110.00	101.24	129.63

Source：KUKL Annual Report

[7] Within the report, it will be written based on the official Nepalese calendar. The New Year in the Nepali calendar would be in mid-April in the Western calendar.

3.1.1.3 Appropriateness of the Project Plan and Approach

After the loan agreement (L/A) was signed in March 2001, several donors withdrew from the program (refer to Section 3.1.2.3 for details on external consistency). As a result, it became necessary to reassess the co-financing program in its entirety. JICA conducted the "Project Implementation Support Study on the Melamchi Water Supply Project" on two occasions. These studies identified a potential issue: if the water treatment plant, supported by Japan, retained its initial design capacity of 170 MLD, the corresponding distribution network might not be completed in time. This misalignment could result in insufficient infrastructure to supply the treated water, hindering the plant's ability to achieve its planned performance targets. To address this concern, construction of the facility was proposed in two phases, each with a capacity of 85 MLD. The first phase, comprising 85 MLD, was to be funded through yen loans. In June 2009, the Government of Nepal submitted a formal request to modify the project scope and extend the loan disbursement period. This request was approved by Japan, reflecting an appropriate decision from the perspective of enhancing the project's overall effectiveness. The modification aligned the project plan with the progress of other donors' activities, ensuring better coordination and coherence in implementation.

3.1.2 Coherence (Rating: ③)

3.1.2.1 Consistency with Japan's ODA Policy

At the time of the project appraisal, *Japan's Country Assistance Policy for Nepal*[8] outlined the following priority areas: (1) human resource development, (2) social sector development, (3) agricultural development, (4) development of economic infrastructure, and (5) environmental preservation. Within the fourth priority area, the policy emphasized that "the development of basic economic infrastructure such as electricity, roads, bridges, water supply, and telecommunications is important" to facilitate the effective implementation of economic cooperation in the first three areas. This project, aimed at enhancing water supply facilities in the Kathmandu Valley, aligned with Japan's Official Development Assistance (ODA) policy.

3.1.2.2 Internal Coherence

The grant aid projects, titled "Kathmandu Water Supply Facility Improvement Project Phase I-III[9]," was undertaken to strengthen the water supply capacity in the Kathmandu Valley, with all facilities completed by August 2004. As of the ex-post evaluation, the facilities constructed under these grant aid projects are being operated by KUKL. These facilities, in conjunction with the water treatment plants developed under the current project, have significantly contributed to

[8] Annual Report on Japan's Official Development Assistance (FY1999) (mofa.go.jp)

[9] The project aims to strengthen water supply services within the Kathmandu Valley by constructing water intake, water conduction, and water treatment plants using the Manohara River, groundwater, and other water sources that flow within the Valley, as well as facilities such as the Shaibu water distribution reservoir.

increasing the water supply within the Kathmandu Valley.

Furthermore, from 2013 to 2017, JICA deployed a Water Supply Policy Advisor to the then Ministry of Water Supply and Sewerage. The advisor conducted a capacity assessment of KUKL, identifying the need for further capacity building to ensure the efficient operation of the water treatment plant planned for expansion under the current project. In response, JICA implemented technical assistance initiatives. Under this project, technical guidance was provided to the staff of the water treatment plants established through both the current project and the earlier grant aid. This included the development of standard operating procedures for facility maintenance and water quality management. Such measures have ensured the integration of this project with other JICA-supported initiatives, thereby contributing to the stable operation and maintenance of water treatment facilities and a consistent water supply in the Kathmandu Valley.

3.1.2.3 External Coherence

This project was implemented within a donor co-financing scheme. However, after the L/A was signed, WB, which had planned to promote privatization of the water supply sector, withdrew in 2002 due to unsuccessful bidding. Norway and Sweden subsequently withdrew in 2005 and later, citing political and security instability within Nepal. Despite the continued withdrawal of other donors, Japan maintained its support for the Nepalese government as it sought to consolidate democracy and build peace. The project was sustained due to its critical importance in addressing the severe water shortages in the Kathmandu Valley. Other donors, including ADB, the OPEC Fund for International Development, and the Nordic Development Fund, also continued their support.

As of the ex-post evaluation, the water treatment plant constructed under this project has been supplying water to residents of the Kathmandu Valley, utilizing the water conduit tunnel, transmission pipelines, and distribution network constructed and maintained with ADB loans. This outcome reflects effective collaboration with other donor-supported projects. The donor co-financing program history is summarized in the table below.

Table 2 Donor co-financing program (major facilities only)

(Unit of amount: Millions of U.S. dollars)

Facilities	Donors (Budget): Financing plan as of 2000	Donors (Budget): Financing plan as of 2009
Water intakes and reservoirs Water conduit tunnels Access road	Norwegian Development Agency (28) Swedish International Development Cooperation Agency (25) Nordic Development Fund (9) Asian Development Bank (25) OPEC Fund for International Development (14)	Asian Development Bank (61) OPEC International Development Fund (14) Nordic Development Fund (10)
Water treatment plant	**JICA (52)**	**JICA (43)**
Water transmission	Asian Development Bank (57)	Asian Development Bank (23)

Facilities	Donors (Budget): Financing plan as of 2000	Donors (Budget): Financing plan as of 2009
pipelines		
Water distribution pipe network Rehabilitation	World Bank (80)	

Source: Materials provided by JICA
Note 1: All amounts are planned values. The originally planned water treatment plant (170 MLD) was divided into Part 1 and Part 2, with Part 1 funded by JICA (85 MLD) and Part 2 funded by ADB (85 MLD).
Note 2: OPEC = Organization for Petroleum Exploration and Production

From the above, the implementation of this project is fully consistent with Nepal's development policy, development needs, and Japan's aid policy, and internal and external consistency was confirmed. Therefore, its relevance and coherence are high.

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

Figure 2 illustrates the layout of the new Sundarijal water treatment plant constructed under the project. In August 2009, an agreement between the two governments resulted in a reduction of the facility's capacity to 85 MLD. Subsequently, an additional 85 MLD facility was constructed using ADB financing and completed in March 2021. As of the ex-post evaluation, the total capacity of the water treatment plant has reached 170 MLD, as initially planned.

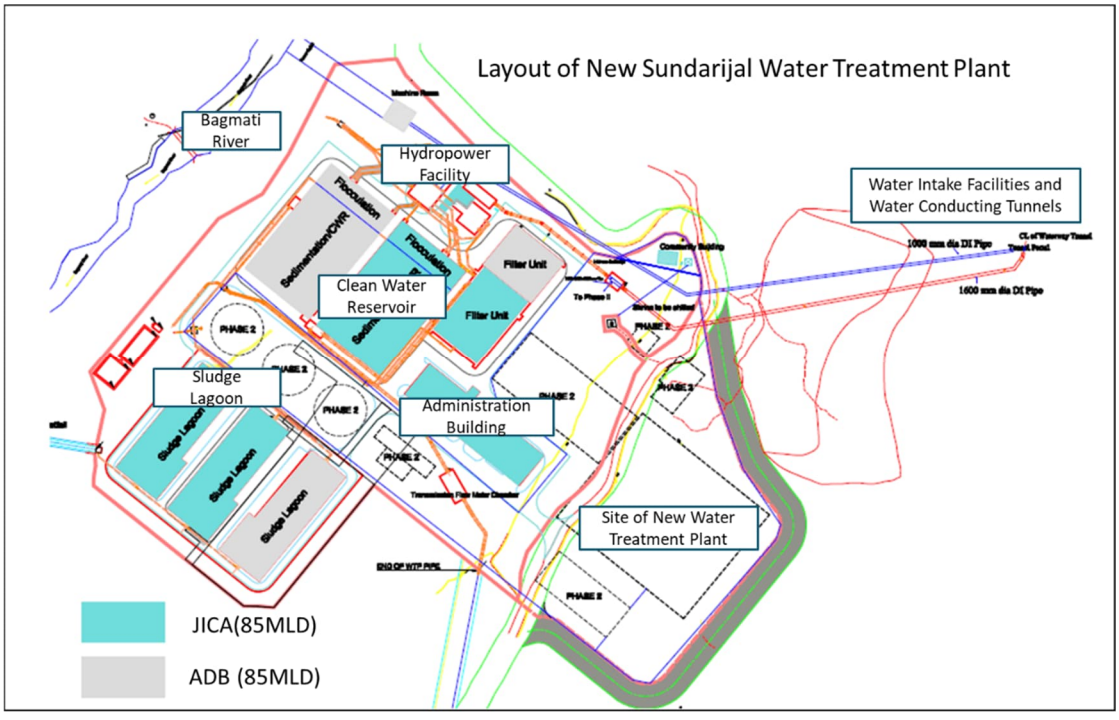

Figure 2 Layout of the new Sundarijal water treatment plant

Source: Prepared by evaluator based on materials provided by KUKL

As discussed in "3.1.1.3 Adequacy of the Project Plan and Approach," the scope changes agreed

by both countries upon in 2009 were deemed appropriate. A comparison of the changed plan and actual outputs was conducted accordingly. As shown in Table 3, all outputs were delivered as planned.

Table 3 Original (2001) and revised (2009) plans and actual results for outputs

Original Plan (2001)	Revised Plan (2009)	Actual
Water Treatment Plant		
Treatment capacity (170 MLD)	Reduced capacity to 85 MLD	As revised plan
Pre- treatment work	No change	As revised plan
Chemical dosing facility	No change	As revised plan
Flocculation basins	No change	As revised plan
Sedimentation basins	Facility scaled down to match treatment capacity	As revised plan
Rapid sand Filters	Facility scaled down to match treatment capacity	As revised plan
Chlorination disinfection injection facility	No change	As revised plan
Clear water reservoir	Scale down to match treatment capacity	As revised plan
Back washing system	No change	As revised plan
Sludge thickener	Deleted due to low sludge volume (to be introduced by KUKL in the future after the water treatment plant is expanded)	—
Sludge lagoons	Facility size reduced to match treatment capacity (from 3 to 2)	As revised plan
Chemical building	No change	As revised plan
Administration building	No change	As revised plan
Access Road		
Road construction 1.5 km	Excluded from the project and constructed by the Government of Nepal with OECD funds	—
Hydroelectric facility		
Not in the original plan	Added when output is changed 1 site (200 KW)	As revised plan

Source: Materials provided by JICA, KUKL and Melamchi Water Supply and Development Board, and answers of questionnaire for consultants who conducted the project.

Photo 1 Chlorine Disinfection Injection Facility

Photo 2 Sedimentation basins

Photo 3 Sludge lagoons

Photo 4 Administration building

Photo 5 SCADA[10] room

Photo 6 Hydroelectric facility

Source: Evaluator

[10] SCADA (Supervisory Control and Data Acquisition) system is a system that gathers information obtained from devices and equipment that make up a large facility or infrastructure, monitors it in one place using a network, and controls it as needed.

3.2.2 Project Inputs

(For details, refer to the section titled “Main Plan/Actual Comparison,” presented on the last page of the report.)

3.2.2.1 Project Cost

The total project cost agreed upon at the time of the L/A in 2001 was 6,463 million yen, including 5,494 million yen provided through yen loans. Following the modification of the project scope in 2009, a re-estimation of the total project cost revealed a significant increase due to the price escalation of materials and equipment during the project delay. To address this issue, the Japanese side maintained the original loan amount but reduced the project scope. It was agreed that the Government of Nepal would cover the portion of costs not supported by the yen loan. The actual project cost amounted to 5,584 million yen, including 4,044 million yen in yen loans, which was within the revised plan at 86 % of the total. A detailed breakdown of the total project cost indicates that the expenditure covered by the yen loan was within the plan at 74 %, reflecting the reduced scale of the facility. In contrast, the Nepalese government’s share exceeded the planned amount by 159 %, primarily due to the escalation in material and equipment prices and increased construction costs associated with the extension of the project period.

Table 4 Planned and Actual Project Costs (Unit: millions of yen)

	Planned Cost	Actual Cost*	% of the plan
Total project cost	6,463	5,585	86 %
Nepal side	969	1,541	159 %
Japan side	5,494	4,044	74 %

Source: Project completion report and materials provided by JICA

Note 1: The actual amount on the Nepal side was recalculated using the IMF rate (1 NPR = 1.262 JPY) because the project cost was indicated in yen in the PCR using the same exchange rate (1 NPR = 1.6155 JPY) throughout the project implementation period.

3.2.2.2 Project Period

At the time of appraisal, the planned project period was 70 months, from March 2001 (L/A signing) to December 2006. However, the actual project duration extended to 202 months, from March 2001 to December 2017, marking the completion of the construction inspection. Even after excluding a seven-month interruption caused by external factors such as the Nepal Earthquake and the India-Nepal border issue, the project period totalled 195 months, significantly exceeding the plan and reaching 279 % of the planned timeframe. Throughout the implementation period, the deadline for the loan was extended twice. The main reasons for each extension are outlined below.

The first extension of the loan term (2009)

Withdrawal of co-financing donor: WB had been pursuing the outsourcing of water utility services to the private sector; however, the bidding process was unsuccessful. Thus, it withdrew from the co-

financing program. Subsequently, Norway and Sweden also withdrew due to the political instability caused by the Maoist conflict[11] and democratic retreat (ADB eventually took over the donor-financed portion of these loans).

Reconsideration of ADB loan conditions: The ADB, similar to WB, initially required the privatization of the water supply utility as a prerequisite for the loan. However, the attempt to select a contractor proved unsuccessful, delaying the initiation of construction for the water conduit tunnel. In February 2008, the privatization requirement was removed, and by February 2009, the contract for the water conduit tunnel was finalized. Construction of the tunnel subsequently commenced in June 2009. To ensure synchronization in the operational start of all related facilities, Japan planned to initiate the construction of the water treatment plant only after the ADB had begun constructing the water conduit tunnel. Consequently, the commencement of this project was also delayed.

The second extension of the loan term (2014)

Contractor Selection Issues: Contractor bidding for the project was held in November 2009, but challenges persisted, including inaccurate information disclosure by the selected firms. Finally, the contractor was selected in April 2013. Moreover, the contract for the water conduit tunnel construction by ADB was cancelled in September 2012 due to poor performance of the company, with construction recommencing in October 2013 after a re-bidding of the contractor.

The Nepal earthquake[12] in 2015 and the India-Nepal border issue[13] : The Nepal Earthquake in April 2015, along with Nepal–India border issues from September 2015 to February 2016, significantly hindered the procurement and transportation of construction materials.

For reference, the planned and actual performance for each task item in this project is outlined below. Since the plan underwent multiple revisions, the comparison is made against the most recent plan available as of 2014, which was considered during this evaluation. The most substantial delay occurred in the contractor selection process, which took 229% of the originally planned duration. In contrast, the construction of the water treatment plant faced unforeseen challenges, including the earthquake and border-related disruptions. Even after accounting for the period affected by these external factors,

[11] In 1996, communist forces calling themselves the Communist Party of Nepal (Maoist) initiated an armed anti-government struggle in the midwestern region of the country. This conflict subsequently spread nationwide and continued for 11 years (https://www.mofa.go.jp/mofaj/gaiko/oda/shiryo/hakusyo/07_hakusho/column/column17.html).

[12] The earthquake occurred at a depth of 15 km in Saurapani, Gorkha District, Gandaki District, near 77 km northwest of Kathmandu, the capital of Nepal, and the magnitude of the earthquake is estimated to be 7.8 on the Richter scale, according to the U.S. Geological Survey.

[13] In Nepal, in protest against the new constitution promulgated in September 2015, the Madhesi minority residing in southern Nepal initiated demonstrations and staged sit-ins near border checkpoints, leading to prolonged disruptions in logistics. As a result, the supply of essential goods, which Nepal relied on importing from India, drastically decreased, causing severe shortages of fuel and clothing. The border issue between Nepal and India persisted from September 24, 2015, until February 2016.

the construction still exceeded the planned schedule, consuming 152% of the originally allocated time.

Table 5 Comparison of project plan and actual results by task items

Task Items	Revised plan in 2014	Actual	Main reasons
Consulting Services	65 months	Approx. 109 months (167% of plan) *Only for JICA-contracted projects. In addition to the above, there is a 56-month project commissioned by the Nepalese government.	Due to the withdrawal of several donors, it became necessary to revise the overall program design.
Access Roads	10 months	*Deleted from JICA scope, implemented by the Nepalese government using OPEC funds; project implementation period unknown.	－
Contractor Selection	24 months from preparation of bid documents to contract	Approx. 55 months (229% of plan)	Due to changes in the capacity of the water treatment plant facilities, bid documents were reviewed and contractors were re-bid.
Water Treatment Plant Construction	27 months	Approx. 48 months (178% of plan) *Out of this, 7 months of construction was suspended due to the earthquake and border issues (152%).	Due to the Nepal earthquake and India-Nepal border issues, there was a period of difficulty in procuring and transporting materials and equipment.

Source: Prepared by the evaluator based on responses to the implementation consultant questionnaire, materials provided by JICA, PCR, etc.

Based on the above, it is assessed that the project cost was within the planned budget (86% of the original plan), while the project duration was considerably extended (279% of the planned period), even when excluding external factors such as earthquakes and border issues. Consequently, the efficiency of the project is considered to be moderately low.

3.3 Effectiveness and Impacts[14] (Rating: ③)

3.3.1 Effectiveness

The project aimed to address the severe imbalance between water supply and demand within the Kathmandu Valley over the medium to long term, and the operation and effectiveness indicators were set as (1) water supply within the Kathmandu Valley (rainy/dry season) and (2) drinking water quality of purified water (WHO drinking water quality guidelines). While the target year for these indicators was 2007, the facility did not actually begin operation until 2017, and the project environment changed significantly during the project implementation period. Given this context, it would have been prudent

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

to review the indicators and target values when the project scope was revised or before the facility's completion. However, no changes to the indicators were agreed upon, which could be confirmed (see lesson 4.3: Revision of indicators at the time of scope change).

Therefore, this ex-post evaluation was performed as follows. (1) As an alternative indicator, the water purification volume and operating rate of the new Sundarijal water treatment plant were selected as a direct measure of the project's effects. Operating rate is typically calculated by comparing the average daily water supply volume[15] to the facility's capacity. However, as described in detail below, it was deemed appropriate to confirm the achievement status by using the average daily water supply based on the available water withdrawal volume[16], considering the operational limitations of the facilities due to the major flooding in 2021 and the environmental impact. (2) The water supply in the Kathmandu Valley set at the time of the appraisal includes not only the Project but also the water supply of existing water treatment plants in the Kathmandu Valley. Since the target year was 2007, it is challenging to evaluate the achievement status precisely in comparison to the plan. Therefore, this data was used as a reference indicator and was excluded from the evaluation judgment. (3) Finally, regarding the “water quality of purified water,” the parameters of the WHO standards specified at the time of appraisal remain consistent with the current Nepalese water quality standards. This consistency enabled a direct comparison of the planned and actual values, facilitating an accurate assessment of whether the water quality goals were met.

3.3.1.1 Operation and Effect Indicators

(1) Water purification volume and operating rate (Achievement status: Mostly achieved)

The operational status of the facility from its completion to the time of the ex-post evaluation is detailed below.

The completion inspection of the new Sundarijal water treatment plant was finalized in December 2017. However, the water conduit tunnel, which channels raw water from the Melamchi River as part of the co-financed project, was not yet completed. Consequently, operations commenced in July 2018 using the nearby Bagmati River as an alternative raw water source. Due to the significantly lower water volume of the Bagmati River compared to the Melamchi River, water intake was only feasible during the rainy season, when water levels were relatively high. During the dry season, operations were halted because of insufficient water availability.

In March 2021, approximately three years after the completion of the water treatment plant, the water conduction test for the conduit tunnel was successfully completed, and operations using

[15] Indicates the amount of cleaned water per day produced at the water treatment plant; the facility capacity of the new Sundarijal water treatment plant after 2021, when an additional 85 MLD size facility was built with ADB financing, is 170 MLD.

[16] It indicates the daily amount of water that can be withdrawn from rivers and other sources to the water treatment plant, based on the results of the EIA conducted under Nepal's Environmental Protection Act. In the case of the project, 170 MLD from the Melamchi River and 40 MLD from the Bagmati River.

raw water from the Melamchi River commenced. However, within three months, a severe flood and landslide occurred near the intake facility in June 2021, causing extensive damage to the infrastructure. As of the time of the ex-post evaluation, restoration of the intake facility to its original condition was deemed almost impossible (see 3.4.6 Risk Response for future restoration plans).

In response, the Nepalese authorities installed a temporary, simplified intake point upstream of the damaged facility. Water intake from the Melamchi River resumed in December 2022, approximately 18 months after the flooding, via a bypass route. Following technical guidance provided by contractors, the water treatment plant facilities were officially handed over to KUKL in March 2023, enabling the commencement of water supply services.

As of the ex-post evaluation, ownership of the water intake facilities and conduit tunnel remains with the Melamchi Water Supply Development Board (MWSDB). Because of the risk of damage to the tunnel due to sediment inflow during the rainy season, water intake from the Melamchi River is regulated during the dry season when water quality is comparatively better. Thus, the water treatment plant primarily sources raw water from the Melamchi River during the dry season, with an intake capacity of 170 MLD. During the rainy season, water is sourced from the Bagmati River, with an intake capacity of 30–40 MLD. In periods when raw water cannot be secured from either river, operations continue by utilizing water released from nearby reservoirs.

Photo 7 Part of water intake facility buried by mudslide

Photo 8 A simple water intake installed as an emergency measure

(Source: provided by evaluator)

The table 6 shows the water treatment volume, categorized by maximum monthly, minimum monthly, and monthly average values for each water source since the completion of the project. The operating rate has been calculated as the ratio of the average monthly water purification volume to the available water intake capacity for each respective water source.

Table 6 Water treatment volume and operating status of the new Sundarijal water treatment plant

Unit：Million Liter per Day: MLD

water source			2018	2019	2020	2021	2022	2023	2024
Melamchi River water intake capacity 170 MLD	water treatment volume (MLD)	maximum monthly	—	—	—	157.6	105.4	92.6	175.0
		minimum monthly	—	—	—	167.9	171.5	171.5	168.3
		monthly average	—	—	—	162.8	141.8	154.4	168.0
	operating rate (%)		—	—	—	95.7	83.4	90.8	98.8
Bagmati River water intake capacity 40 MLD	water treatment volume (MLD)	maximum monthly	13.5	5.9	3.4	4.3	6.8	10.0	
		minimum monthly	34.2	32.7	21.8	71.0	28.0	44.3	
		monthly average	26.7	19.9	11.9	15.0	17.4	35.7	
	operating rate (%)		66.7	49.8	29.7	37.6	43.5	89.2	

Source: Va Tech Wabag Ltd. Monthly Report for 2018-2021; KUKL questionnaire responses for 2022-2023.
Note 1: In 2018-2020, the water treatment plant was not in operation because the intake facility on the Melamchi River was not yet completed. During that time, maintenance and inspections were conducted by contractors.
Note 2: Water intake periods from the Melamchi River: May-June 2021, April-May 2022, November 2022-June 2023, and January-June 2024.
Note 3: Water withdrawals from the Bagmati River in 2024 are not available for this study, as they are actual values after the second field survey.

During the dry season, when water is withdrawn from the Melamchi River, the facility utilization rate exceeds 80% of the available intake volume, indicating that the facility is generally operating as intended. However, when water is sourced from the Bagmati River, the utilization rate exhibits significant variability. Notably, in 2023, when the facility was transferred to KUKL, the utilization rate reached approximately 90%, suggesting that this level of performance can reasonably be sustained moving forward.

KUKL is planning to construct an additional conduit[17] to augment water withdrawal from the Bagmati River during the rainy season, and is waiting for approval of an Environmental Impact Assessment (EIA) under the “Nepal Environmental Protection Act” at the time of ex-post evaluation. In addition, in August 2023, an agreement was reached with the responsible authority (Project Implementation Irrigation Unit) to release water from a nearby reservoir into the Bagmati River during periods of low water flow in both rivers. Thus, KUKL continues its efforts to secure multiple water sources and to increase water withdrawals, thus enabling year-round operation.

As discussed in the section on efficiency, the new Sundarijal water treatment plant has achieved its planned facility capacity of 170 MLD, as initially envisioned through the project and the ADB

[17] Since the completion of the new Sundarijal water treatment plant, 40 MLD has been available for intake through two water pipelines from the Bagmati River intake. At the time of the ex-post evaluation, KUKL has a plan to expand the water intake capacity by double through the installation of a third water pipeline. The amount of water intake will be determined by the Ministry of Forest and Environment after reviewing the EIA conducted under the Nepal Environmental Protection Act.

loan. However, the absence of the water supply tunnel, also funded by the ADB, along with the requisite water transmission pipes, distribution reservoirs, and pipe networks, would render it impossible to supply treated water to residents in the Kathmandu Valley. Japan and other donor projects are mutually complementing each other and contributing to the improvement of water supply services in the Kathmandu Valley.

(2) Water supply within the Kathmandu Valley (reference indicator)

As a reference indicator, the water supply within the Kathmandu Valley, established at the time of the appraisal, has been confirmed. The Valley is served by six major water treatment plants operated by KUKL, including the newly constructed Sundarijal water treatment plant. The total water supply is calculated as the aggregate output of these facilities.

The target values presented in the table 7 were established based on the assumption that the Project would be completed in 2007, coinciding with the commencement of water supply from the Melamchi River. The actual values reflect the most recent data for the year 2022/23, which corresponds to the period when the water supply from the Melamchi River was initiated, as originally anticipated during the appraisal. The average water supply recorded during the rainy season is 161 MLD, while that during the dry season is 231 MLD. Both figures fall short of the target values for their respective seasons. The target was established based on the assumption that water would be continuously sourced from the Melamchi River throughout the year. However, under current conditions, water intake is shifted to the Bagmati River during the rainy season, which presents challenges in meeting the target. Conversely, during the dry season, when water intake from the Melamchi River is feasible, approximately 90% of the target is achieved compared to the projections made at the time of appraisal. As highlighted in the relevance section, there is a pressing need to expand the water purification plant facilities, given the estimated water demand of 485 MLD in the Kathmandu Valley and the persistence of a severe water shortage. Supported by the ADB, the Nepalese government is planning to both expand the new Sundarijal water treatment plant and develop a new water source. Land for this expansion has already been acquired. If these plans are successfully implemented, the Sundarijal water treatment plant alone will have the capacity to produce 510 MLD of drinking water. Furthermore, when combined with the proposed distribution pipe network improvement project, the expanded system has the potential to meet the water demand of the Valley.

Table 7　Water supply within the Kathmandu Valley

	Baseline 1997	Target value 2007	Actual (2022/23)
Rainy season	113 MLD	293 MLD	161 MLD (vs. target value 55 %)
Dry season	75 MLD	269 MLD	231 MLD (vs. target value 86 %)

Source: Prepared by the evaluator based on the appraisal documents and the KUKL Annual Report.
Note: The target year was 2007, when all projects by other donors were expected to be completed.

(3) Water quality of purified water (Achievement status: Mostly achieved)

KUKL conducts regular water quality testing at four laboratories, including the newly established Sundarijal water treatment plant. The results of these tests are disclosed on the KUKL website on a monthly basis. Each water treatment facility tests for 12 water quality parameters, including *E. coli*, visual appearance, turbidity, color, residual chlorine, pH, electrical conductivity, alkalinity, hardness, iron, ammonia, free residual chlorine, and coliform bacteria. At the new Sundarijal water treatment plant, these tests are performed at least four times daily. With the exception of residual chlorine, all tested parameters meet both the target values established in 2007 and the national water quality standards of Nepal. Consequently, it can be concluded that the water quality at the site of the water treatment plant has almost achieved its designated targets.

Table 8 Water quality at the water treatment plant point

Item	Baseline value* 1997	Target value* 2007	Nepal Drinking Water Quality Standards (2022)	the new Sundarijal water treatment plant Actual Value 2024
E. coli	0CFU/100 mL	0CFU/100 mL		0CFU/100 mL
Residual chlorine	0.2-2.3 mg/L	0.2-0.5 mg/L	0.1-0.5 mg/L	0.1 - 2.5 mg/L**
Turbidity	5.8 NTU	5 NTU or below	5 NTU or below	0.2–5 NTU
pH	7.2-8.0	6.5-8.5	6.5-8.5	6.5-8.5

*Transcribed from the review documents (baseline values were measured at Mahankarthur Water Treatment Plant, target values were based on WHO drinking water guideline)

** Residual chlorine is set to maintain more than 1.0 mg/L considering the decrease in the pipe network, as it is necessary to meet Nepal drinking water quality standards at the water tap.

Source: Materials provided by JICA, KUKL Water Quality Report

In addition to the above, KUKL's annual report discloses the results of water quality testing at 10 water distribution reservoirs in the city that draw raw water from the Melamchi River. According to KUKL's water quality inspectors, there are challenges in controlling residual chlorine. This was due to the delay in procurement of chlorine gas for disinfection at the new Sundarijal water treatment plant in 2024 and the lack of sufficient skills in adjusting the chlorine injection rate. Later, the procurement of chlorine gas was completed, and technical guidance on chlorine management was provided through JICA's technical assistance. Further improvements are expected in the future. Water quality testing at the water tap level has rarely been conducted in the past due to a lack of staffing. However, under the JICA's technical assistance, water quality inspections at the point of water supply taps have been conducted by each branch office. At the time of the ex-post evaluation, the water distribution network is under construction with ADB financing, but only a few districts are being supplied through the new network, and the majority of customers connected to the water supply are still using the existing network. According to the water quality inspector at KUKL, there is still a possibility of water contamination through aging distribution pipes, and therefore, KUKL is always reminding its customers to boil their water

before using it.

Although there are no water quality issues at the water treatment plants, improvements in water quality at the customer level remain necessary. With the advancement of the water distribution network improvement project and ongoing technical support aimed at enhancing water quality management capacity through JICA's technical assistance, improvements in water quality are anticipated in the future.

3.3.2 Impacts

3.3.2.1 Intended Impacts

The appraisal documents identified the following expected impacts: (1) increased water supply coverage within the Kathmandu Valley, (2) improved sanitation conditions, and (3) the promotion of the tourism sector. Following discussions with the relevant agencies, it was determined that, for (1), KUKL did not estimate the water supply population or water supply rate. Consequently, it was decided to assess the number of connected water taps as an alternative indicator. For (2), confirmation was made through interviews with mainly KUKL staff. Regarding (3), the causal relationship between the water supply project and the promotion of the tourism sector proved difficult to establish, and therefore, this impact was excluded from the analysis. The impact of the project on (1) trends in the number of connected water taps, (2) improvements in sanitation conditions, and (3) changes in user satisfaction is described below, based on the information obtained from the field survey.

(1) Increase in KUKL connections taps

As illustrated in Figure 3, the number of water supply taps has consistently increased, with a notable surge in FY2022/23, reflecting a significant rise compared to the previous year. KUKL attributes this growth primarily to the ongoing improvements in the water distribution network, including the installation of water meters, which are being funded by the ADB loan. Additionally, it can be inferred that the commencement of water supply from the Melamchi River has led to increased demand for KUKL's water services. Therefore, the increase in the number of water supply connections can be regarded as a synergistic outcome of

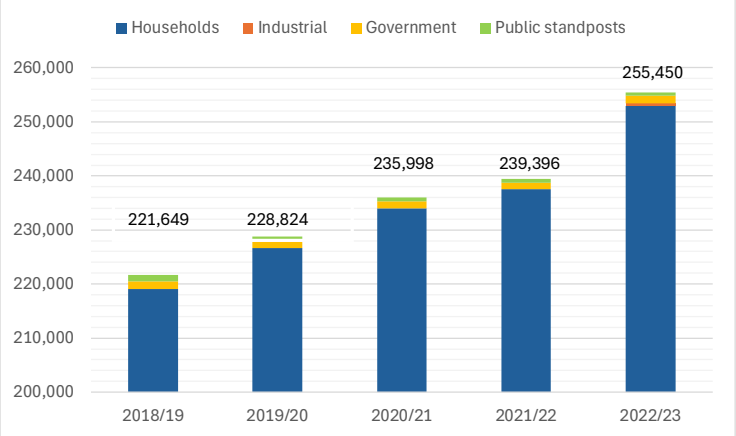

Figure 3 Changes in KUKL's Connected Water Taps

Source: prepared by evaluator based on KUKL annual reports

this project and ADB's water distribution network improvement initiative.

(2) Improvement of sanitation conditions

Based on interviews with officials from the Ministry of Water Supply, KUKL, and other relevant stakeholders, residents were informed about the timing of the water supply from the Melamchi River through various channels, including newspapers, television, and KUKL meter readers. During this period, it was noted that both the volume and duration of the water supply improved. Consequently, residents increased the frequency of activities such as washing and bathing, which contributed to enhanced sanitation conditions. Furthermore, residents reported several changes, including the cessation of using water from private wells on their property, the reallocation of well water for agricultural purposes rather than drinking, and a reduction in the frequency of purchasing water from water trucks.

(3) Changes in User Satisfaction

Under the technical assistance by JICA, KUKL conducted its first customer satisfaction survey[18] on two occasions: once in October 2021 and again in May 2023. The results confirmed an increase in user satisfaction.

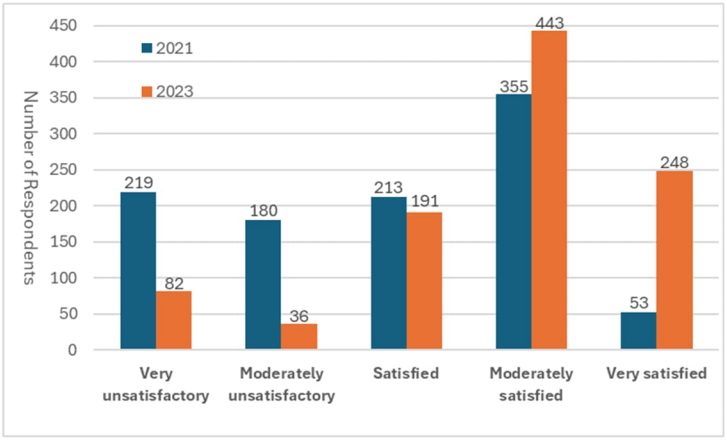

Figure 4 Satisfaction with KUKL's overall services

Figure 4 illustrates the significant improvement in user satisfaction with KUKL. Prior to the commencement of water supply from the Melamchi River, it was not possible to deliver water as notified to customers in advance due to inadequate water availability. However, water is now supplied as planned, although this occurs only during the dry season. Furthermore, the improvement in water quality is considered another contributing factor to the enhanced satisfaction levels.

[18] The target group for the survey was KUKL customers within the Ring Road (the ring road surrounding the city of Kathmandu and the city of Patan, located on the south side of the Bagmati River). The final sample size was 1,000 (sample size for each zone was determined according to the percentage of customers in each of the 13 water distribution management zones/districts).

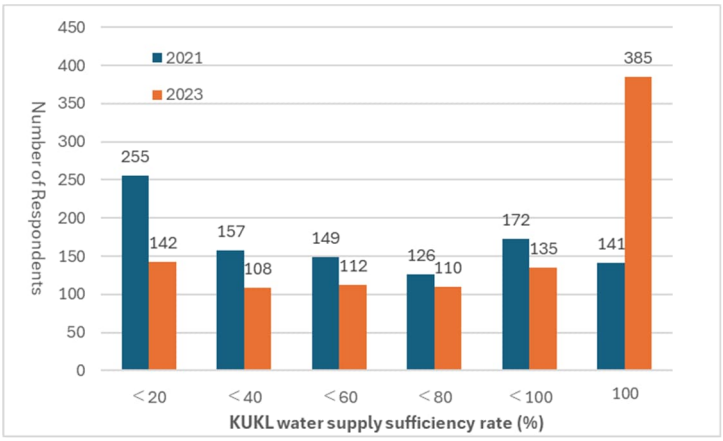

Figure 5 Sufficiency ratio of KUKL water supply to domestic demand

Sources for Figures 4 and 5: Prepared by evaluator from KUKL Annual Report 2080.

Figure 5 displays the water supply sufficiency rate for KUKL. In reality, even KUKL users continue to rely on additional water sources, such as water vendors, private water tankers, and well water, in conjunction with KUKL's water service. Nonetheless, the 2023 survey reveals a significant increase in the proportion of households exclusively using KUKL's water supply (100%). It is believed that the water supply project from the Melamchi River, including this initiative, has played a substantial role in driving this improvement.

3.3.2.2 Other Positive and Negative Impacts

1) Impacts on the Environment

Under the "JBIC Guidelines for Environmental Considerations in Yen Loans" (1999), this project was classified as Category B[19]. Based on the environmental monitoring plan developed in accordance with the EIA, several measures were implemented: road watering to prevent dust from construction vehicles (conducted twice a day during the dry season), noise monitoring (carried out every four months), and the proper disposal of construction waste and removal of construction structures as needed. Furthermore, during the project implementation period, the Ministry of MWSDB coordinated with a committee consisting of representatives from the local community near the water treatment plant site as necessary. Specific actions taken in response to local residents' requests included the construction of a diversion of an existing canal on the water treatment plant site, the rehabilitation of a community road, and the construction of an irrigation canal to serve neighboing agricultural lands. No environmental or social issues were reported during the ex-post evaluation. KUKL has not received any complaints from local residents, as the amount of water withdrawn from each river is regulated by environmental protection laws, and KUKL has adhered to these regulations in its water extraction practices.

2) Resettlement and Land Acquisition

At the time of the review, the land acquisition area for the project construction covered approximately 12 hectares. One household was to be resettled, and 48 households were to be

[19] Definition of Category B: Projects that are not required to submit an environmental assessment report but are assessed in accordance with the guideline.

expropriated from their private land. In accordance with Nepal's Land Acquisition Act, the MWSDB monitored the resettlement process to ensure its smooth and proper execution, while coordinating with the committee representing local residents as needed. According to MWSDB, land acquisition was completed in February 2008 without significant issues, and there were no substantial changes in the final land expropriation area or the number of affected households. The estimated cost of land acquisition at the time of the appraisal was approximately 299 million rupees, while the actual cost was approximately 343 million rupees. No factors differing from those identified during the review period were confirmed. After the completion of the water treatment plant, ongoing negotiations took place with local residents regarding the relocation of the remaining shrine located on the plant site. An agreement was eventually reached to allow the shrine to remain on the site, with a gate installed to provide restricted access to residents only during certain hours of the day. At the time of the post-evaluation, no complaints were reported regarding either the relocation of residents or the land acquisition process.

3) Others

Other impacts were not identified.

With the completion of a water treatment plant with a facility capacity of 170 MLD under this project and in collaboration with the ADB, the water supply has been realized as initially expected during the period of intake from the Melamchi River. However, due to operational limitations on temporary intakes and water conduit tunnels after flood damage, KUKL has been forced to reduce the amount of water treatment during the period when it switches to water from the Bagmati River. Despite these constraints, KUKL has played a significant role in alleviating water demand in the Kathmandu Valley by maintaining continuous operation of the water treatment plant, expanding water pipelines, and diversifying water sources. Water quality at the treatment plant remains generally satisfactory and is expected to improve further at the consumer level once the distribution pipeline network is upgraded. As for the impact, the number of taps connected to KUKL has continuously increased and user satisfaction has improved, due to improvements in water supply services, such as the volume and frequency of water supply. Considering external factors, this project has mostly achieved its objectives.

Therefore, effectiveness and impacts of the project are high.

3.4 Sustainability (Rating: ②)

3.4.1 Policy and System

The Melamchi Drinking Water Project, designated as a National Pride Project in Nepal's 15th National Development Plan, is a large-scale infrastructure initiative aimed at providing a stable water supply to the people in the Kathmandu Valley. This project forms a key component of the development plan and was identified as a high-priority infrastructure project at the time of the ex-

post evaluation. During a hearing at the Ministry of Water Supply, it was noted that the early rehabilitation of the water intake facilities at the Melamchi River, as well as the capacity expansion of the new Sundarijal water treatment plant to meet the growing water demand in the Kathmandu Valley, were top priorities for the Ministry. Consequently, the project's sustainability in terms of policy is considered to be high.

3.4.2 Institutional/Organizational Aspect

The main organizations related to the Project at the time of the ex-post evaluation are listed in Figure 6. The implementing agency during the project implementation period was the MWSDB, which was established under the Ministry of Water Supply (Ministry of Housing and Urban Planning at the time of the assessment), and it was still the implementing agency of the Melamchi Drinking Water Project at the time of the ex-post evaluation, in charge of decision making regarding the project. At the time of the ex-post evaluation, the Kathmandu Valley Water Supply Management Board (KVWSMB) was the owner and responsible agency for water and wastewater facilities in the Kathmandu Valley, and KUKL[20] provided water and wastewater services under an asset lease agreement. The new Sundarijal water treatment plant has been operated and maintained by the contractor under the supervision of MWSDB since its completion in 2017, and after water conveyance and distribution testing and technical guidance from the Melamchi River, ownership of the facility was handed over to KVWSMB and operation and maintenance services to KUKL in March 2023. There are no problems with the operation and maintenance system, excluding the hydropower facilities constructed under the project (see 3.4.7 Operation and Maintenance Status).

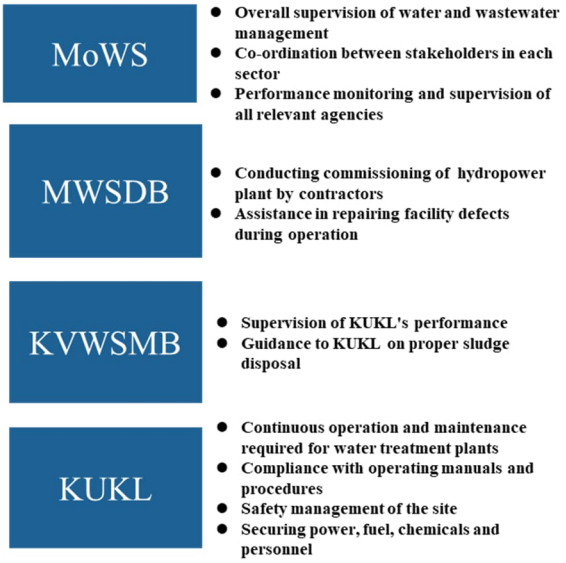

Figure 6: Key organisations related to the project
Source: prepared by the evaluator based on JICA documents

In terms of KUKL staffing, 624 posts are actually assigned, compared to the officially approved 1,384 posts, leaving less than half of the total staffing. In this situation, the new Sundarijal water treatment plant has been assigned 39 personnel as a result of priority staffing. Although no

[20] KUKL is a public corporation established under the Nepal Government's Company Act (2006) as a public-private partnership (PPP) model, and at the time of the ex-post evaluation, the shareholding ratio of KUKL at the time of the ex-post evaluation was 24% government, 40% Kathmandu Municipality, 12% private sector and 4% others.

operational management problems have been observed at this point, it is desirable to promote more efficient operational management and to work on appropriate personnel allocation at KUKL as a whole. KUKL does not have the authority to hire staff and is continually requesting KVWSMB to increase staffing. It is necessary to gradually increase personnel in line with future plans for the expansion of water treatment facilities.

3.4.3 Technical Aspect

KUKL has accumulated experience in operating and maintaining water supply and sewage facilities in the Kathmandu Valley since 2008. The daily operation and maintenance of the water treatment plant constructed under this project are generally managed effectively. However, as the new Sundarijal water treatment plant is the largest in Nepal and includes facilities not found in existing plants, further technical enhancement is required. According to interviews with KUKL staff, ongoing technical support is needed, particularly regarding the effective use and maintenance of the SCADA system, which is being introduced for the first time in the country, and the proper operation of the chlorine dosing system. Additionally, to expand the scope of water quality testing to include distribution reservoirs and water taps, it is essential not only to strengthen the capabilities of individual staff members but also to establish an efficient implementation system, including robust data management, despite the challenges of limited staffing. Furthermore, as the completed District Metered Areas (DMAs) will be gradually handed over to KUKL under the ADB-supported water distribution network development, the smooth development and operation of GIS data, including water meters and customer information, are also crucial. To address these technical support needs, JICA's technical assistance program, which began in March 2021 and is scheduled for five years, is expected to resolve many of the technical issues. In this context, the ADB recognizes that a combined approach—supporting infrastructure development, such as the construction of water distribution networks, alongside water supply sector reforms, complemented by JICA's technical assistance for operation and maintenance—is essential and effective for comprehensively strengthening water supply services in the Kathmandu Valley.

3.4.4 Financial Aspect

Table 9 presents KUKL's operating income-to-expenses ratio[21], which is calculated based on KUKL's total operating revenues and operating expenses from its financial documents over the past three years. During this period, total operating revenues have exhibited an upward trend, driven by an increase in the number of new connections and the strengthening of measures against illegal connections. The operating income-to-expenses ratio for FY 2021/22 was below 100%,

[21] This is one of the indicators of the extent to which operating expenses are covered by operating revenues. A higher ratio indicates a better operating margin, while a ratio below 100% indicates an operating loss.

indicating that operating revenues did not fully cover operating expenses; however, profitability has improved since that time.

In interviews with KUKL officials, no major concerns were reported regarding the operation and maintenance of the new Sundarijal water treatment plant. Although the budget approval process is time-consuming and there are delays in the procurement of necessary equipment and materials, the required budget is eventually secured.

Table 9 KUKL's operating income/expenses ratios for the past three years

Unit: Nepalese Rupees

Items		2021/22	2022/23	2023/24
Operating Revenues	Sales Revenue	875,910,162	965,105,726	1,063,356,045
	Other Revenue	129,209,241	210,415,049	238,462,452
	Grant Revenue	—	30,792,771	35,873,249
	Total Revenue	**1,005,119,403**	**1,206,313,545**	**1,337,691,746**
Operating Expenses	Cost of Sales	678,377,982	722,605,923	792,942,346
	Selling Expenses	95,668,127	94,790,078	105,493,070
	Administration and Other Operating Expenses	316,802,749	313,908,501	363,852,477
	Total Expenses	**1,090,848,858**	**1,131,304,502**	**1,262,287,893**
Operating Balance Ratio (%)		92.1 %	106.6 %	106.0 %
Revenues-Expenses		-85,729,455	75,009,043	75,403,853

Source: Prepared by the evaluator based on materials provided by KUKL

Note: Due to rounding, some items do not match the breakdown and totals.

As shown in Table 10, KUKL's water fee collections have increased annually, and the collection rate has also improved. The Ministry of Water Supply has emphasized that further improvements in the water charge collection rate and operational efficiency are critical for enhancing KUKL's management. In this regard, support is being provided through the Supplemental Technical Assistance Program, which focuses on effective techniques to reduce non-revenue water (commercial losses). These techniques include verifying meter accuracy, improving the precision of meter readings and customer data entry, and implementing countermeasures against illegal connections.

Table 10 Fee collection rates (last 5 years)

Unit: Nepalese Rupees

	2018/19	2019/20	2020/21	2021/22	2022/23
Amount billed	814,990,326	817,061,332	866,326,077	946,902,170	1,112,862,459
Amount collected	741,252,062	684,606,966	819,942,672	950,505,612	1,054,684,375
Rate of collection	91.0%	83.8%	94.6%	100.4%	94.8%

Source: Prepared by the evaluator based on materials provided by KUKL

3.4.5 Environmental and Social Aspects

None.

3.4.6 Preventative Measures to Risks

The Kathmandu Valley and surrounding watersheds are susceptible to frequent natural disasters, including active seismic activity, floods caused by glacial lake outbursts, and landslides resulting from the fragile ground. Additionally, it has been noted that climate change may lead to more frequent heavy rains and floods during the rainy season, as well as severe water shortages during the dry season[22]. Furthermore, the upper Melamchi River basin has been identified as particularly vulnerable, with a high potential for recurring floods and landslides[23]. These factors present future risks in the relocation and construction of the water intake facilities, and consequently, for the continued operation of the new Sundarijal water treatment plant. In November 2024, the ADB approved the Kathmandu Valley Water Supply Improvement Project (Phase II) [24]. This phase, in addition to the relocation and construction of water intake facilities, includes the expansion of water treatment plants and the water supply network, the establishment of an early warning system, the strengthening of KUKL's financial management capacity, and support for community rehabilitation in the Melamchi intake area. Detailed design and bidding documents for the relocation and construction of the intake facility will commence in 2025, with two years of construction work set to begin in 2027. The completion of all projects is planned for 2030.

3.4.7 Status of Operation and Maintenance

As of the time of the ex-post evaluation, nearly seven years have passed since the completion of this facility. Some of the facilities and equipment are aging and require rehabilitation. The following defects and non-operational conditions were identified during the field investigation for this evaluation; however, none of these issues are serious enough to affect the operation of the water treatment plant:

- Water Quality Testing Lab: The automatic water quality analyzer is not functioning properly; although it operates, it displays values that differ from the results of manual analysis. Consequently, data that does not reflect actual conditions is being transferred to SCADA. Currently, water quality testing is performed manually; thus, this is not considered a significant issue.
- Chlorine Injection Facility: The water quality standard was not met during a period when the procurement of chlorine cylinders was delayed, due to the limited amount of chlorine injected. However, as of the time of the post-evaluation, procurement

[22] ADB, Nepal: Kathmandu Valley Water Supply Improvement Project (Phase 2) Project Administration Manual, 2024
[23] ADB, Mapping Hazards in Nepal's Melamchi River: Catchment to Enhance Kathmandu's Water Security, 2023
[24] Same as footnote 23.

has been completed. Additionally, one of the two check valves on the chlorine injection pumps is malfunctioning, and spare parts are scheduled to be purchased.

- Hydroelectric power generation facilities: Commissioning took place during the rainy season when water intake from the Melamchi River was available, and it has been confirmed that the facilities are in good working condition. However, during the dry season, the facility has been unable to operate for certain periods due to insufficient water pressure. Furthermore, although operation and maintenance guidance was provided to KUKL, concerns have been raised regarding the lack of skills in operation. Although the system is currently not in use, it is scheduled to be transferred to KUKL after technical guidance is provided during the trial operation of hydropower generation once again.
- The SCADA system is in operation but lacks the technology and staff to utilize the monitored data for actual operations. While there are no equipment malfunctions at this time, future maintenance inspections and repairs will need to be outsourced to an external contractor.
- Two of the 14 filtration ponds were out of operation due to malfunctioning electric valve controllers. However, KUKL arranged for the procurement of replacement parts through a local contractor and completed the repairs. It is expected that KUKL will be able to secure the necessary budget and take appropriate repair actions in the future when equipment malfunctions occur.

As previously discussed, there are no sustainability issues concerning policy, organization, structure, finance, or social and environmental considerations. Additionally, there are prospects for improvement in technical aspects through JICA's technical assistance. However, the Kathmandu Valley and its surrounding watersheds are likely to experience floods and landslides resulting from earthquakes and glacial lake outbursts, as well as heavy rainfall and water shortages attributed to climate change. These factors may impact the future rehabilitation plans for water intake facilities and the operation of the new Sundarijal water treatment plant. Although the ADB project approved in November 2024 includes medium- and long-term risk mitigation measures that address climate change and natural disasters, the sustainability of the project effects is moderately low. This is because the progress of future activities will require ongoing monitoring.

4. Conclusion, Lessons Learned, and Recommendations

4.1 Conclusion

This project supports the construction of a water treatment plant as part of the first phase of a co-financing program aimed at developing a series of water supply facilities, ranging from intake facilities to distribution pipe networks, with the Melamchi River serving as the water source. The

primary objective is to alleviate the severe water shortages in the Kathmandu Valley. The implementation of this project aligns with Nepal's development policies and needs, as well as Japan's aid policies. Furthermore, the collaboration with JICA and other donors has been confirmed, making the project highly relevant and coherent. Although the project outputs were achieved as planned and the project cost was within the plan, the efficiency of the project is rated moderately low due to the significant extension of the project timeline beyond the original plan. Following the completion of the project, operational restrictions on the water intake facility and the water conduit tunnel have arisen due to flood damage. KUKL, the agency responsible for operation and maintenance, is helping alleviate water shortages in the Kathmandu Valley in by ensuring the continuous operation of the water treatment plant, expanding the water pipeline, and diversifying water sources. No water quality issues have been identified at the water treatment plant, and the water quality at distribution points is expected to improve with future upgrades to the distribution pipeline network. Positive impacts, such as the continuous increase in the number of connection taps and improvements in user satisfaction, have been reported. Considering the external factors, such as the inability to secure sufficient water from the originally planned source due to damage caused by a large-scale natural disaster, the project has largely progressed as planned. Consequently, its effectiveness and impact are deemed to be high. Regarding sustainability, the restoration of the water intake facilities is crucial for the water treatment plant to operate as originally planned. Although a restoration plan is in progress, the sustainability of the project is considered relatively low due to the ongoing need to address climate change and natural disasters, and the necessity for continuous monitoring of these efforts.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

(1) Recommendations to MWSDB

- Although water supply in the Kathmandu Valley has improved with the commencement of water intake from the Melamchi River, it is still insufficient to meet the growing demand due to continued population growth. It is essential to ensure that the water treatment plant can operate consistently during the reconstruction of the intake facilities and the expansion of the water treatment plant.
- The hydropower facility constructed as part of the project has been commissioned but remains unused. This situation is primarily due to insufficient water from the Melamchi River, changes in water conduction conditions since the design phase, and the lack of technical capacity within KUKL for operation and maintenance management. If this situation persists, there is a risk of premature deterioration of the facility. Therefore, it is advisable to explore measures for the early operation of the facility, such as providing

KUKL with operation and maintenance support from the Nepal Electricity Corporation, and restricting its operation to periods when water intake from the Melamchi River is available.

(2) Recommendations to KUKL

- One of the indicators used to measure the effectiveness of this project is the water quality at the point of the water treatment plant. It has been confirmed that the target for water quality has been met, except for residual chlorine. Water quality testing at the water tap level has recently begun under the support of JICA's technical assistance, conducted by the KUKL branch office. At the time of the post-evaluation, the water distribution network was still under development, with only a few areas receiving supply through the new distribution network, while the majority of customers were still served by the existing network. It is recommended that KUKL prioritize human resource development and the preparation of operational manuals to ensure that water quality testing at the water tap level can be carried out effectively in the districts where the new distribution pipeline network will be introduced in the future.
- As highlighted in the sustainability section, staffing shortages remain a significant challenge throughout KUKL. Given that KUKL does not have the mandate to recruit additional staff, it is crucial to enhance operational efficiency within the existing manpower structure. One potential solution is the effective utilization of the SCADA system installed at the water treatment plant, which could improve operational efficiency and help mitigate staffing limitations. Although SCADA is operational, much of the work is still being performed manually, similar to the previous workflow. It would be advisable for KUKL to seek consulting services from an external professional organization to optimize the use of the SCADA system and further improve operational efficiency.

4.2.2 Recommendations to JICA

- As discussed in the effectiveness section, KUKL began operations in March 2023, and this ex-post evaluation was conducted approximately one and a half years later. The water treatment plant was affected by an unexpected large-scale natural disaster and has not been able to intake sufficient water from the originally planned water source. However, with the support of JICA's technical assistance, the plant is generally operating as intended. Although the positive impact on consumers has been confirmed, particularly with the ongoing upgrades to the water distribution network in the central Kathmandu Valley, there remains a significant need for improved water supply services, given the current supply-demand imbalance in the Kathmandu Valley. Considering that more than 20 years have passed since the signing of the L/A, it was timely and appropriate to conduct this ex-post evaluation. This

evaluation has provided insights into the actual situation and has identified key issues through an independent third-party assessment. However, in order to assess the impact set at the time of planning this project, it is recommended to conduct a joint evaluation with other donors in the future or an ex-post evaluation of JICA's technical assistance to better assess the synergistic effects of the project. The evaluation should be scheduled to coincide with the completion of the rehabilitation of the water intake facilities, or at the time when the operation and maintenance rights are transferred to KUKL, following the completion of most of the water distribution network development.

4.3 Lessons Learned

Revision of Indicators at the Time of Scope Change: This project was initially launched as a donor co-financing program, with indicators and targets established during the appraisal based on the assumption that the entire donor project would proceed without changes or delays. However, in practice, several donors withdrew from the program, necessitating changes to the overall plan. As a result, the scope and implementation schedule of the yen loan had to be revised. When these revisions were made, no new indicators were established to assess the effectiveness of the water treatment plant, nor were target values set for the revised scale of the facility. Consequently, the absence of alternative indicators or target values during this evaluation made it essential to establish new criteria for judging the achievement of the project. Therefore, when approving significant changes to the project scope and implementation schedule, it is recommended that the operational and effectiveness indicators be revised to reflect the new circumstances. Furthermore, it is advisable to document the baseline and target values agreed upon with the implementing agencies in the partner country.

5. Non-Score Criteria

5.1 Performance

5.1.1 Objective Perspective

None

5.2 Additionality

To enhance water supply services in the Kathmandu Valley, JICA has dispatched water supply policy advisors continuously and constructed water supply facilities through grant assistance, in addition to supporting this project. At the time of the ex-post evaluation, JICA was also implementing a technical cooperation project to complement the efforts of this project. Over an extended period, JICA has consistently provided support through a combination of various initiatives. ADB, a major donor involved in co-financing programs, has similarly been promoting infrastructure development and sector reforms in the water supply sector for many years.

Concurrently, JICA is also assisting with human resource development to enhance the capacity for operation and maintenance within waterworks organizations. Consequently, cooperation among donors has been confirmed to be progressing steadily.

Given this context, JICA is expected to develop a long-term strategy that clearly delineates the roles and synergies with other aid organizations in order to further enhance the value of JICA's assistance.

(End)

【Comparison of the Original and Actual Scope of the Project】

Item	Revised Plan (2009)	Actual
1.Project Outputs Water Treatment Plant	Water Treatment Capacity (85 MLD)	As the revised plan
	Pre- treatment work (170 MLD)	As the revised plan
	Chemical dosing facility (170 MLD)	As the revised plan
	Flocculation basins (85 MLD)	As the revised plan
	Sedimentation basins (85 MLD)	As the revised plan
	Rapid sand filters (85 MLD)	As the revised plan
	Chlorination facility (85 MLD)	As the revised plan
	Clear water reservoir (85 MLD)	As the revised plan
	Back washing system (170 MLD)	As the revised plan
	Sludge lagoons (2)	As the revised plan
	Chemical building	As the revised plan
	Administration building	As the revised plan
Access Road	Excluded from the project and constructed by the Government of Nepal with OECD funds.	-
Hydropower facilities	1 facility (200 KW)	As the revised plan
2. Project Period	March 2001-December 2006 (70 months)	March 2001-December 2017 (202 months)
3. Project Cost Foreign Currency Local Currency Total ODA Portion Exchange Rate	 3,156 million yen 3,307 million yen 6,463 million yen 5,494 million yen 1 Nepalese Rupee ＝1.69 yen (As of February 1999)	 unknown unknown 5,585 million yen 4,044 million yen 1 Nepalese Rupee ＝1.26 yen (Average between January 2002 and December 2018)
4. Final Disbursement	September 2018	

[Reference: Main Background of the Project]

1992	Jun	A feasibility study of the Melamchi project was completed by UNDP.
1998	Oct	Japan (then Overseas Economic Cooperation Fund): dispatched fact-finding missions.
1999	Feb	Japan dispatches mission to inspect this project.
2001	Jan	ADB signed the L/A.
	Mar	Japan signed the L/A.
2002	Jun	World Bank withdraws from co-financing (due to unsuccessful private sector participation, which was promoted by the World Bank. The ADB has expressed support for the World Bank potion).
	Oct	Japan conducted 'Special Assistance for Project Implementation (SAPI) the Melamchi Water Supply Project Phase I. Ⅰ
2003	Jul	Japan conducted SAPI Phase II, and proposed revised plan for construction of water treatment plant (170 MLD of water treatment capacity in two phases (85 MLD x 2)).
2005	Jul	NORAD withdrew from co-financing (due to concerns about anti-democratic and human rights abuses as a result of the start of the King's pro-democracy regime).
2006	Apr	SIDA also withdrew from co-financing (for the same reasons as NORAD).
2009	Jun	ADB started construction of water conduit tunnels.
2009	Jul	Japan approved the request from the Government of Nepal (reduction of water treatment capacity: 170 to 85 MLD).
2010	Dec	Japan, problems was found in the selection of contractors for water treatment plants.
2012	Sep	ADB dismissed the contractor for the construction of water conduit tunnels.
2013	Apr	Japan selected the contractor for the construction of water treatment plant through a re-bidding process.
	10月	ADB also selected a new contractor for the construction of water conduit tunnels.
2014	Jan	Japan started construction of a water treatment plant.
	Apr	Japan approved an extension of the loan term for this project.
2015		Nepal Government requested a change in the deadline for completion of the project.
2017	Sep	Operational testing of water treatment plant started.
	Dec	Completion of the construction of the water treatment plant, completion of the completion inspection, and issuance of The Taking-Over Certificate.
2018	Jul	Operation of water purification plant started (intake of 30-40 MLD of raw water from Bagmati River and start of water supply).
2020	Jul	ADB completed the water conduit tunnel, but a serious accident occurred during the water conduit test, and the tunnel was temporarily suspended.
2021	Mar	ADB completed water conduction test of water conduit tunnel.

	Jun	Severe flood occurred near the Melamchi Intake Facility.
2023	Jan	Resumed water conveyance from upstream of the original intake point to the tunnel, and facility operation training for the water treatment plant was implemented.
	Mar	Handover of operational and management responsibility for the water treatment plant (from the contractor) to KUKL.