Internal Ex-Post Evaluation for Technical Cooperation Project (SATREPS[1])

conducted by Nepal Office: September, 2024

Country Name	Project for Hydro-microbiological Approach for Water Security in Kathmandu Valley, Nepal
Nepal	

I. Project Outline

Background	Although Nepal had abundant water resources, its supply services of safe water were still inadequate, and only a limited number of communities in urban and rural areas received such services. The actual water supply remained at a low level, and many people did not have access to improved water sources. Even the area surrounding Kathmandu and the major cities in districts where the water supply services were comparatively well provided faced various problems such as water leakage from existing outdated water distribution facilities and inappropriate piping of water distribution. In most of these areas, water outage was a common phenomenon. Thus, response to adequate and safe water supply became the most important issue, considering the increase of water demand in the future because of rapid population growth. High levels of contamination in groundwater required affordable treatment technologies to ensure the safety of the water. However, responses from science, government, and enterprises failed to address water security risks in the Kathmandu Valley adequately mainly because of the lack of research based on scientific evidence.
Objectives of the Project	Through the studies in Kathmandu Valley on potable water resources, situation and sources of groundwater pollution, the microbiological situation of environmental water, by the development of appropriate locally-fitted, compact and distributed (LCD) water treatment, and its social and economic evaluation, the project aimed to enhance the management system of potable water resources in Kathmandu Valley, thereby contributing to exercising the tools and technologies for water security developed by the project known as "the Kathmandu Model*". *("Kathmandu Model": A combination of a water treatment system with water security maps and guidelines for its introduction.) 1. Expected Overall Goal: Tools and technologies for water security developed by the Project ("Kathmandu Model") are exercised. 2. Project Purpose: Management system on potable water resources - shallow and deep groundwater, and surface and rainwater - is enhanced.
Activities of the Project	1. Project Site: Kathmandu Valley 2. Main Activities: 1) Study of potable water resource, the situation and sources of groundwater pollution, microbiological situation of environmental water, etc. 2) Development of LCD water treatment 3) Social and economic evaluation of the LCD water treatment system installation 4) Organization of taskforce on social implementation 3. Inputs (to carry out above activities) Japanese Side 1) Experts: 26 (1 long-term, 25 short-term) persons 2) Trainees received: 52 persons *3 trainees participated in the long-term training, 29 in the short-term training, 20 for the invitation program in Japan 3) Equipment: System microscopes, Emergency energy storage, Centrifuge, Hydrogen generators, etc. Nepalese Side 1) Staff Allocated: 25 persons 2) Land and Facilities: Office space at Institute of Engineering, Tribhuvan University(TU/IOE)
Project Period	(ex-ante) April 2014 – March 2019 (60 months) (actual) May 2014 – October 2019 (66 months)
Project Cost (Japanese side only)	(ex-ante) 305 million yen, (actual) 364 million yen
Implementing Agency	・Ministry of Urban Development (MOUD)[2], Kathmandu Valley Water Supply Management Board (KVWSMB) Kathmandu Upatyaka Khanepani Limited (KUKL) ・Tribhuvan University (TU): Institute of Engineering (IOE), Central Department of Geology (CDG), Institute of Medicine (IOM) (Cooperating agencies) ・Ministry of Environment Science & Technology[3]: Nepal Academy of Science and Technology, The Asian Institute of Technology & Management, Department of Hydrology and Meteorology *NGO: Center of Research for Environment Energy and Water (CREEW), The Small Earth Nepal
Cooperation Agency in Japan	・University of Yamanashi (UY) (Supporting organizations) Kyoto University, Kitasato University, Kobe City College of Nursing, University of Tokyo, Kobe Gakuin University, Nittetsu Mining Consultants Co., Ltd., Meiwa Industry Ltd.

II. Result of the Evaluation

<Special Perspectives Considered in the Ex-Post Evaluation >

[Evaluation of the Expected Overall Goal]

[1]SATREPS: Science and Technology Research Partnership for Sustainable Development

[2]On 24th of December, 2015, the Government of Nepal instituted the Ministry of Water Supply and Sanitation (MOWS) and the responsibility of water and sanitation of MOUD was shifted to MOWS.

[3] As of 2018, Ministry of Environment Science & Technology was renamed as Ministry of Education, Science and Technology due to the organizational reform.

・For the Overall Goal, “Tools and technologies for water security developed by the Project (“Kathmandu Model”) are exercised”, the following three indicators with no target values are set: “Status of LCD water treatment systems which were installed through the Project and potential new installation (Indicator 1)”, “status of disclosure, updating of water security maps (Indicator 2)” and “status of implementation of an action plan prepared by the Project (Indicator 3)”. The definition of “Kathmandu Model” is explained as “a combination of a water treatment system with water security maps and guidelines for its introduction”. The model is also explained as a mechanism to evaluate the introduction of water treatment systems and provide feedback to the water security maps to ensure a continuous supply of safe water that can withstand population growth and disasters. Considering the above, in the ex-post evaluation, “Has the mechanism to evaluate the introduction of water treatment systems and provide feedback to the water security maps to ensure a continuous supply of safe water (Kathmandu Model) been constructed and been functioned?” is used as the supplementary information 1.

1 Relevance/Coherence

[Relevance]

<Consistency with the Development Policy of Nepal at the Time of Ex-Ante Evaluation >

The project was consistent with the development policy of the Government of Nepal, which identified “safe drinking water and sanitation services” as a top priority in its Approach Paper for the “13th Plan (2013/14-2015/16)”, which was positioned at the top of the National Development Strategy, with a target of achieving 93% of basic water supply services and 85% of sanitation services at the time of ex-ante evaluation. Furthermore, the “National Water Plan (2005)”set a goal to provide reliable water supply and sanitation services to all people by 2017.

<Consistency with the Development Needs of Nepal at the Time of Ex-Ante Evaluation >

The project was consistent with the Nepalese development needs of enhancement of the management system on potable water resources at the time of ex-ante evaluation as described in “Background” above.

<Appropriateness of Project Design/Approach>

The project design/approach was highly appropriate. The LCD type of water supply system was targeted to those who did not have access to piped water supply or who could not afford other public or private water supply services. In identifying the location for installation of the LCD water treatment system, the project selected those communities that had poor access to water supply and through conducting the social economic survey, the project chose the locations of LCD water treatment systems for equally benefiting the vulnerable community.

<Evaluation Result>

In light of the above, the relevance of the project is ③[4].

[Coherence]

<Consistency with Japan’s ODA Policy at the Time of Ex-Ante Evaluation>

The project was consistent with the Japan’s Country Assistance Policy for Nepal (2012), which identified “social and economic infrastructure development” as a priority area at the time of ex-ante evaluation.

<Collaboration/Coordination with JICA’s other interventions>

Although the collaboration/coordination between the project and the “Melamchi Water Supply Project (ODA Loan Project, signed March 2001)” was planned at the time of ex-ante evaluation, it was not implemented.

<Cooperation with other institutions/ Coordination with international framework>

The cooperation/coordination with the United Nations Children’s Fund (UNICEF),and with the Department of Water Supply and Sewerage Management (DWSSM) under the World Bank funded project, respectively were planned at the time of ex-ante evaluation and the positive effects were confirmed at the time of ex-post evaluation. KVWSMB shared the data and information obtained from the water security maps, which were instrumental in conducting any water quality analysis within Kathmandu Valley. For example, UNICEF consulted with KVWSMB for data of the water security maps to implement the Water Safety Plan in Kathmandu water supply systems.~~,~~. In return, KVWSMB utilized necessary information from UNICEF particularly in identifying physical, microbial, and major chemical contaminants that pose health risks to consumers based on available data of the water security maps. DWSSM under MOWS consulted with KVWSMB on methodology and data management on water security maps to develop similar maps in the World Bank funded project in Surkhet, far western region. In return, KVWSMB utilized necessary information obtained from DWSSM to compare the context of Kathmandu valley with other valleys of Nepal.

<Evaluation Result>

In light of the above, the coherence of the project is ③.

[Evaluation Result of Relevance/Coherence]

In light of the above, the relevance/coherence of the project is ③.

2 Effectiveness/Impact

<Status of Achievement of the Project Purpose at the Time of Project Completion>

At the time of project completion, the Project Purpose, “Management system on potable water resources - shallow and deep groundwater, and surface and rainwater - is enhanced” was mostly achieved as planned. To enhance the management system on potable water resource, an Integrated Water Security Map (IWSM) was developed through the study on potable water resources, the situation and sources of groundwater pollution, microbiological situation of environmental water and so on (Indicator 1). Then, LCD water treatment technology options best suited for local water quality were compiled (Indicator 2). Finally, LCD water treatment systems developed in this research project were installed at six locations (Indicator 3). Accordingly, the basic ground for the management system of the potable water system was enhanced. It was planned to examine the improved status of water security for local people by reassessment of the IWSM after the completion of the Melamchi Water Supply Project; however, the reassessment did not take place because the Melamchi Project was not completed by the time of project completion (Indicator 4).

<Continuation Status of Project Effects at the Time of Ex-Post Evaluation>

By the time of the ex-post evaluation, the project effects on research outputs have been continued. KVWSMB has continuously carried out similar project activities as per the Action Plan and prepared water security maps for the remaining 13 municipalities[5] inside Kathmandu Valley through the updating of the available guidelines and methodologies considering the limitations and requirements of

[4]④ : very high, ③ : high, ② : moderately low, ① : low

[5]There are 18 municipalities within Kathmandu Valley.

peri-urban settings for those municipalities. Key research outputs have also been utilized in various ways. For example, KVWSMB has been using the water security maps to understand the water quality such as the concentration and source of contamination so that appropriate/additional treatment mechanisms can be installed. Major users are KUKL, local community including community users' groups and other stakeholders such as Water Aid, Environment and Public Health Organization (ENPHO), UNICEF, etc. Water security maps have also been used for microorganisms to prevent E-coli and to determine the volume of chlorination.

A new research project based on the research outputs was also identified. IOM in collaboration with UY started the study on waterborne infections for identifying new genomes, pathogenic microorganisms as well as new strains of bacteria from wastewater and published more than three journal publications. In collaboration with the Center Department of Geology (TU/CDG), KVWSMB extended the survey related to Land Subsidence in Kathmandu, which was once conducted during the project period, by utilizing local research experts.

So far, eight LCD water treatment systems have been installed, but it was identified by the study that two of them have not been functioning. The one located in Jwagal UN Park had a problem in the hydrogen gas equipment damaged by floodings and could not be repaired due to the unavailability of the spare parts in the local market.[6] The other is in Lokanthali with a problem on the transformer, but it is expected to be fixed shortly since KUKL in coordination with KVWSMB is in the process of procurement of a new transformer. One of the hydrogen gas generators of the LCD water treatment system at Chapacho has not been working and has been left unrepaired because of the unavailability of necessary components in the market for replacement.[7] Several other equipment, such as water purifiers, cover of centrifuge and sand filter, have not been functioning as expected due to the unavailability of spare parts or necessary components for repairment in the local market.

<Status of Achievement for the Expected Overall Goal at the Time of Ex-Post Evaluation>

At the time of ex-post evaluation, the Overall Goal, "Tools and technologies for water security developed by the Project ("Kathmandu Model") are exercised" has been mostly achieved as planned. After the project completion, two LCD water treatment systems were newly installed based on the guideline, Standard Operation Procedures (SOPs) and manuals developed by the project (Indicator 1). Water security maps have been developed for all municipalities of Kathmandu Valley and they have been used for various purposes, such as to examine the water quality, waterborne infections, and microorganisms (Indicator 2). The Action Plan was prepared among relevant agencies in May 2019, effective from October 2019 to 2022. Many activities, such as LCD water treatment systems, water security maps, updating water quality data and an integration of the maps to an IWSM have been carried out and been monitored by KVWSMB through periodic field monitoring or telephone communication, etc. KVWSMB has shared the progress of activities of the Action Plan with MOWS in several internal planning and review meetings. Furthermore, the progress of the development of the water security maps was shared with all 18 municipalities/ local government officials including Mayors as well as development partners in the form of workshops and seminars (Indicator 3). There have been regular monitoring and evaluation of water security maps as per a regular program and activity under Research and Development Section of KVWSMB (Supplementary Information 1).

<Other Impacts at the Time of Ex-Post Evaluation>

Community people who are users of LCD water treatment plants have benefited from clean water. Especially those vulnerable people who are poor in economic terms and could not access tanker water[8] during the non-availability of the piped water comes from the Melamchi river have been getting clean drinking water in a very affordable rate (ex. LCD treatment plant users' group of Chayasal in Lalitpur are providing water to local community with minimum charge of Rs. 5/per 20 liter). Furthermore, through the provision of drinking water, women in the community have benefited by saving time and physical effort since they do not have to fetch water from nearby areas.

<Evaluation Result>

In light of the above, the effectiveness/impact of the project is ③.

Achievement of Project Purpose and Overall Goal

Aim	Indicators	Results	Source
(Project Purpose) Management system on potable water resources – shallow and deep groundwater, and surface and rainwater – is enhanced.	Indicator 1: An integrated water security map is developed based on the results obtained about potable water resources from output 1 to 3.	Status of the Achievement (Status of the Continuation): mostly achieved as planned (continued) (Project Completion) ・Most of the water security maps from the respective Working Groups were received and the IWSM of 5 municipalities, combining water resource availability, water quality, demand-supply scenario and groundwater recharge potential were prepared using the same framework introduced by the project. All the tasks including updating the maps and uploading them on the web portal as well as completion of the maps and web posting were completed by the time of project completion. (Ex-Post Evaluation) ・KVWSMB has carried on similar project activities as per the Action Plan and prepared the IWSM of the remaining 13 municipalities inside Kathmandu Valley through updating on the available guideline/methodology considering the limitations and requirements of peri-urban settings for those municipalities.	JICA documents, Questionnaire and interview with KVWSMB

[6]In spite of the efforts made by KVWSMB, LCD water treatment system in Jwagal UN Park is nonfunctioning at present due to the unavailability of spare parts.

[7]LCD water treatment system at Chapacho itself is functioning since broken hydrogen gas generator was replaced by the one of the two hydrogen gas generators at Lokanthali that was not in use.

[8]Tanker water also known as water trucking is transporting water in area of need especially where the piped water supply is not available or during emergency, etc.

<table>
<tr><td></td><td>Indicator 2:
The strategy on introduction and installation of the shallow groundwater treatment system, based on the integrated water security map, is elaborated.</td><td>Status of the Achievement (Status of the Continuation): mostly achieved as planned (continued)
(Project Completion)
・Project intended to compile LCD water treatment technology options best suited for local water quality, rather than preparing the strategy. Accordingly, the IWSM was developed, adding multiple layers of water quality datasets ranging from physical, chemical, microbiological, and heavy metals. The integrated Water Quality Index was developed using published empirical methods. Accordingly, KVWSMB, KUKL and local municipalities came to prioritize areas and appropriate technology for water quality treatments based on the nature of water contaminants.
(Ex-Post Evaluation)
・The IWSM was updated based on LCD water treatment technology options of monitoring well such as using Analytic Hierarchy Process (AHP) tool.[9]</td><td>JICA documents, Questionnaire, and interview with IOE, KVWSMB</td></tr>
<tr><td></td><td>Indicator 3:
An LCD water treatment system developed in this research project is installed at more than five (5) locations.</td><td>Status of the Achievement (Status of the Continuation): achieved beyond the plan (continued)
(Project Completion)
・The project installed the LCD water treatment systems in six locations, which exceeded the target value of this indicator.
(Ex-Post Evaluation)
・KVWSMB/ CREEW newly installed two LCD water treatment systems in 2021 under the aXis project.[10]
<table>
<tr><th>#</th><th>Location</th><th>Treatment volume Liter per day (Treatment volume at project completion)</th><th>Monitoring status</th><th>Organization in charge</th></tr>
<tr><td colspan="5">LCD water treatment systems installed during the project period</td></tr>
<tr><td>1</td><td>Jwagal water plant（in UN Park）</td><td>1,000 / day (1,000 / day)</td><td>Temporally nonfunctional due to flooding</td><td>KUKL</td></tr>
<tr><td>2</td><td>Chayasal community in Lalitpur</td><td>1,500 (3,000)</td><td>Well-functioning and monitored every month</td><td>Community</td></tr>
<tr><td>3</td><td>IOE girls' hostel</td><td>1,500 (1,500)</td><td>Well-functioning and monitored every month</td><td>IOE</td></tr>
<tr><td>4</td><td>Chapacho community in Thimi</td><td>250 (500)</td><td>Well-functioning[11] and monitored every month</td><td>Community</td></tr>
<tr><td>5</td><td>Lokanthali water treatment plant</td><td>1,000 (1,000)</td><td>Temporally nonfunctional due to transformer problems. Expected to be repaired</td><td>KUKL</td></tr>
<tr><td>6</td><td>Private residence</td><td>500 (na)</td><td>Functioning and monitored every month</td><td>Resident</td></tr>
<tr><td colspan="5">LCD water treatment systems installed after the project completion</td></tr>
<tr><td>7</td><td>Mahadev Temple, Koteshwor</td><td>na</td><td>Temporarily uninstalled after the damage of the screen of the deep tubewell, which is under repair process by KVWSMB.</td><td>KVWSMB/ CREEW</td></tr>
<tr><td>8</td><td>Vindyalachhi</td><td>na</td><td>functioning and monitored periodically, monthly</td><td>KVWSMB/ CREEW</td></tr>
</table></td><td>JICA documents, Questionnaire, and interview with IOE, KVWSMB</td></tr>
<tr><td></td><td>Indicator 4:
The integrated water security map is reassessed based on the operation results of the LCD water treatment system.</td><td>Status of the Achievement (Status of the Continuation): not applicable (not applicable)
(Project Completion)
・The project originally planned to reassess the IWSM to reflect the water security status of local people after the completion of the Melamchi Water Supply Project because it was supposed to generate many impacts on water security. However, the reassessment was not applicable since the Melamchi Water Supply Project has not been completed.</td><td>JICA documents</td></tr>
<tr><td>(Expected Overall Goal) Tools and technologies for water security developed by</td><td>Indicator 1:
Status of LCD water treatment systems which were installed through the Project and potential new installation.</td><td>Status of the Achievement: mostly achieved as planned
(Ex-Post Evaluation)
・By referring to the IWSM developed by the project, which was regarded as the foundation of documents in water security as well as being based on guidelines, SOPs and manuals developed by the project, two LCD water treatment systems were newly installed as shown above.</td><td>Questionnaire and interview with CREEW, KVWSMB</td></tr>
</table>

[9]Analytic Hierarchy Process (AHP) is a statistical tool used to prioritize the project for example installation site for monitoring well.
[10]aXis project is collaborative research project between CREEW and University of Yamanashi from April 2018 till April 2021 to promote LCD water treatment system by reinforcing achievements of SATREPS Project. The project installed two LCD in Vindyalachhi and Mahadev Temple managed by the community in Kathmandu.
[11]Hydrogen gas generator installed originally by the project was non-functional. With the support of CREEW, KVWSMB installed one of the two hydrogen gas generators at Lokanthali that was not in use.

<table>
<tr><td rowspan="2">the Project (“Kathmandu Model”) are exercised.

*(“Kathmandu Model”: A combination of a water treatment system with water security maps and guidelines for its introduction.)</td><td>Indicator 2: Status of disclosure, updating of water security maps</td><td>Status of the Achievement: mostly achieved as planned
Status of disclosure, updating of water security maps
<table><tr><th></th><th>Field</th><th>Institutes in charge</th><th>Utilization (disclosure/website)</th><th>Users</th><th>Updates (frequency)</th></tr><tr><td>1</td><td>Water quality</td><td>KVWSMB</td><td>To understand the concentration and source of contamination. (meetings, interaction, and website)</td><td>KUKL, Local Community including community users’ group, Water Aid, ENPHO, UNICEF</td><td>Every two years</td></tr><tr><td>2</td><td>Waterborne infections</td><td>TU/IOM</td><td>To find out the new strains of genomes. (meetings, interaction, and website)</td><td>Global Research community in general and TU/IOM, UY</td><td>Every two years</td></tr><tr><td>3</td><td>Microorganisms</td><td>KVWSMB</td><td>To prevent E-coli and to determine the volume of chlorination., etc. (meetings, interaction, and website)</td><td>KUKL
Local Community including community users’ group</td><td>Periodically</td></tr><tr><td>4</td><td>IWSP</td><td>KVWSMB</td><td>To access water demand /supply situation and available water resource (meetings, interaction, and website)</td><td>KUKL, Municipalities DWSSM, Water Aid Kathmandu Valley Development Authority (KVDA)</td><td>Expected to update every five years[12]</td></tr></table></td><td>Questionnaire and interview with KVWSMB</td></tr>
<tr><td>Indicator 3: Status of implementation of an action plan prepared by the Project.</td><td>Status of the Achievement: mostly achieved as planned
(Ex-Post Evaluation)
・The Action Plan, which includes activities on the IWSM, updating water quality data and Integration of maps, was prepared among relevant agencies in May 2019, effective from October 2019 to 2022.
・Most of the activities in the Action Plan have been implemented although some activities have delayed due to the effect of COVID-19. Many activities and LCD water treatment plants have been monitored by KVWSMB by periodic field monitoring, telephone communication, etc.</td><td>Questionnaire and interview with IOM, IOE, CREEW, KVWSMB</td></tr>
</table>

3 Efficiency

Both the project cost and the project period slightly exceeded the plan (the ratio against the plan: 119% and 107%, respectively). The excess of the project cost was due to the extension of the project period caused by the earthquake and border disruption. As for the project period, the project was forced to postpone the field survey supposed to be implemented during the wet season in 2015 covering the entire Kathmandu Valley (procedural reasons and security reasons). The postponement was because of (1) earthquakes in April and May 2015[13] and (2) the fuel shortage caused by logistical disruptions near the Indian border from September 2015 to January 2016. The disruptions were triggered by protests against the new constitution passed by the Congress in September. Accordingly, the extension of the Project period for six months was agreed on March 2, 2017. Outputs were produced as planned.

	Project Cost (Japanese side only, yen)	Project Period (months)
Plan (ex-ante)	305 million yen	60 months
Actual	364 million yen	66 months
Ratio (%)	119%	107%

In the light above, the efficiency of the project is ③.

4 Sustainability

<Policy Aspect>

The following policies have ensured the sustainability in the policy aspect. “The Fifteenth Plan (2019/20-2023/24)” which is positioned at the top of the National Development Strategy, has set the target of achieving 99% of basic water supply services and 100% of sanitation services. In the water sector, “Water Supply and Sanitation Act 2022”, which is considered as major legal document to govern water supply and sanitation sector, emphasizes ensuring easy and accessible water supply services with an effective monitoring mechanism. Furthermore, “Groundwater Management Policy 2012”, which is considered as guiding document to control and monitor ground water extraction, recharge etc., emphasizes detailed inventory or data on ground water status and quality to be maintained by KVWSMB. The water security maps introduced by the project have served well for this purpose.

<Institutional/Organizational Aspect>

KVWSMB under MOWS, which assumes the overall responsibility of water and sanitation in Kathmandu valley, has maintained the institutional arrangement to utilize the research outputs of the project through their activities. KVWSMB and KUKL as key governmental entities of the project have been continuing to advance research outcomes. For instance, KVWSMB has an annual program and budget for activities related to water security and groundwater monitoring. KVWSMB has also been collaborating with other development partners, such as UNICEF and Water Aid in advancing research activities in monitoring groundwater quality, etc. Headed by an experienced civil engineer, necessary number of staff is allocated to the Training and Research Section, KVWSMB, which is arranging and facilitating all

[12]Updated once using year-round data on water discharge, groundwater table and water quality of two seasons.

[13]The suspended period of two months in April and May 2015 when the influence of the great earthquake caused considerable physical and human damages was deducted from the project period considering it as unexpected external conditions.

the trainings conducted through the currently ongoing JICA technical cooperation project, namely "The Project on Capacity Development of KUKL to Improve Overall Water Supply Service in Kathmandu Valley (2019-2024)". In the Research and Development Section of KVWSMB, the person trained under the training program of the project has continuously worked to improve the water security map and disseminate "Kathmandu Model" in any relevant platform. The Research Cell, which was envisioned by the Action Plan was not separately created but merged its activities under Research and Development Section due to lack of space in KVWSMB. There is a collaborative mechanism or network among institutions and researchers as per demand basis or need basis.

<Technical Aspect>

There are several researchers and trainees capacitated under the project, and they have been continuing their research and activities in the fields of water quality monitoring, ground water research etc. Trained engineers of KVWSMB and KUKL under the project are still working and contributing to advancing research outputs. Moreover, the scientific literacy of KVWSMB and KUKL has been advanced by improving/extending water security maps. Technical knowledge and skills have been disseminated through SOPs and Manuals developed under the project and giving orientation to community users' groups. Leaflets and brochures have been distributed and attached in the LCD plants to guide operators for the operation and maintenance of the systems. It was confirmed by the study that technical knowledge and skills have been ensured by those operators in responsible institutes to manage facilities and equipment. On the other hand, as mentioned above, this study also pointed out a situation in which some research activities have been hindered because of the unavailability of spare parts in the local market, that are needed to repair the equipment.

<Financial Aspect>

To continue and/or start the related research activities using the research outputs by the project, financial resources have been secured by the aXis project, MOU between KVWSMB and IOE, or KVWSMB research survey on Land Subsistence, etc. While there is no specific budget heading for specific project equipment, the financial resources for the operation and maintenance of the research facilities and equipment installed by the project have been secured by those responsible institutes as part of their regular annual budget and program. LCD water treatment systems are owned by KVWSMB. The facilities of LCD water treatment plants are managed by KUKL through its regular operation and maintenance budget as well as by communities through the revenue generated by selling the water. The budget is newly allocated to the Training and Research Section of KUKL. IOE has owned the lab facilities to manage its operation and maintenance by its internal university program and resource mobilization.

<Environmental and Social Aspect>

No issue on environmental and social aspects has been observed, and it has not been necessary to take any countermeasures.

<Evaluation Result>

In light of the above, slight problems have been observed in terms of the technical aspects related with nonfunctioning of some equipment. Therefore, the sustainability of the project effects is ③.

5 Summary of the Evaluation

The project mostly achieved the Project Purpose, "Management system on potable water resources - shallow and deep groundwater, and surface and rainwater - is enhanced" as planned, by the development of LCD water treatment systems to obtain the data and information to improve the water security situation for the local people. The Overall Goal, "Tools and technologies for water security developed by the Project ("Kathmandu Model") are exercised" has mostly achieved as planned. As a result, community people who are users of LCD treatment plants have benefited from clean water. "Kathmandu Model" has now been expanded and continuously monitored.

As for the sustainability, slight problems have been observed in terms of the technical aspects of the implementing agency. In the institutional/organizational aspect, there is a collaborative mechanism or network among institutions and researchers. As for efficiency, both project cost and project period slightly exceeded the plan.

Considering all of the above points, this project is evaluated to be highly satisfactory.

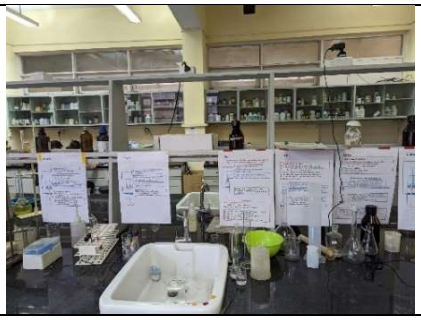
III. Recommendations & Lessons Learned

Recommendations for Implementing Agency:

・It is recommended for the implementing agency to continue to secure budget heading for project outputs in order to continuously sustain project research activities.

Lessons Learned for JICA:

・Natural disasters are unpredictable and it is impossible to procure appropriate equipment considering unforeseen disaster. Nonetheless, when selecting equipment to be provided in the project in disaster affected country like Nepal, the availability of spare parts in the domestic market should be confirmed in the ex-ante evaluation phase. If it proves to be impossible to procure locally, and procurement of the appropriate equipment is necessary to achieve the project objectives, then maintenance methods should be considered against any incident such as natural disasters. This is important to avoid abandonment of the equipment that, once malfunctioned or not functional. Some of the equipment used in the project was manufactured in Japan, and its spare parts were not available in the Nepalese domestic market nor in the Indian market. Due to this lack of availability of spare parts, some of the equipment was left non-functional after natural disaster (e.g., hydrogen gas generator).

	
SOPs and manual being utilized in IOE Lab	Hydrogen Gas Generator, Jwagal LCD, being damaged due to inundation from flooding