

Ex-Post Evaluation of Japanese ODA Grant Aid Project
The Project for Improvement of Water Supply Facilities in Urban and Semi-Urban Centres

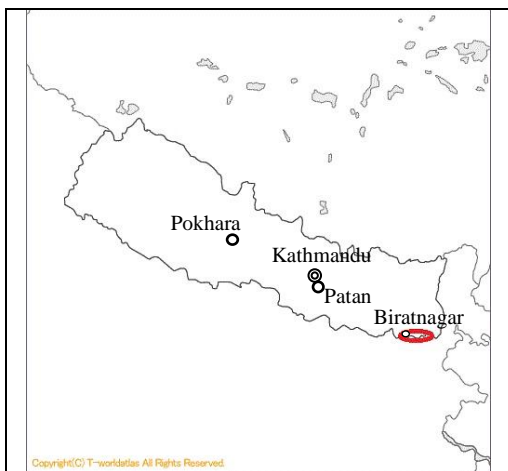
External Evaluator: Noriko Ishibashi, IC Net Limited

0. Summary

This project places its objectives in increasing the population receiving safe and reliable water supply through improvements in water supply facilities in three local cities where there is an urgent need to improve the water supply conditions. As such, the objectives are consistent with those development needs and development policies of Nepal, as well as that of the aid policies of the Government of Japan, therefore the relevance is high. Although the outputs have been achieved almost as planned, the efficiency of the project may be rated as fair because the project duration extended compared to the original plan. The amount of water supply, population served, and water quality of the three water purification plants have mostly achieved their planned targets and the users' high level of satisfaction toward the water supply services revealed that the objective of this project, increasing the population served with safe drinking water, is evaluated to have been achieved. Therefore the project's effectiveness and impact is high. However, more efforts are required for the extension of water supply network in order to expand the effect of this project. Furthermore, despite the operators of the water supply facilities, the Water Users and Sanitation Committees (WUSCs) were able to produce retained earnings, factors such as deficiencies found in its draft business plans by not having precise and sufficient financial backing to implement the planned replacement of equipment outlined in its draft long-term business plan, and the understanding that in the short-run the establishment of support mechanism to WUSC by WSSDO (Water Supply and Sanitation Division Office) may be difficult despite the technical cooperation project currently supported by JICA, lead to the assessment that the sustainability of this project is fair.

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

1. Project Description



Project location



Clear water tank at the Gauradaha Water Purification Plant

1.1 Background

Based on its 9th Five-year Plan (1998 – 2002), the Federal Democratic Republic of Nepal has been expanding the supply of safe drinking water to its nationals, and as at the final year of this Plan, the water service coverage extended to 71.6% of the entire population, but almost a third of its nationals were still without drinking water supply services. Raising the water service coverage rate was considered as one of the top priorities among its national policies.

As at 2004/2005, three areas targeted under this project (Dhulabari, Gauradaha, and Mangadh) only had water supply coverage of about 30 % in Dhulabari, and at the remaining 2 targeted areas, 15 %. Also, their existing water service facilities did not adequately supply enough volume of water, with time restrictions and/or frequent cuts placed on the water supply. Water from the existing facilities was quite turbid and had a high content of iron, thus it was inappropriate for drinking. Upgrading the water service facilities to improve water quality and also supply a larger volume of water was an urgent issue to address.

Against such backdrop, the Japan International Cooperation Agency (JICA) conducted a project formulation study in 2003. The study confirmed that a project to improve water supply services was both necessary and feasible, and eight towns and cities including those targeted under this project were selected as priority areas for possible projects.

1.2 Project Outline

The objective of this project is to increase population receiving reliable supply of safe drinking water through the improvement of water supply facilities in the 3 targeted project areas in Nepal.

Grant Limit/ Actual Grant Amount		1,124 million yen/1,123 million yen
Exchange of Notes Date (Grant Agreement Date)		December, 2005
Implementing Agency		Department of Water Supply and Sewerage (DWSS) and Water Users and Sanitation Committees (WUSCs)
Project completion		July, 2007
Contractor	Consultant	NJS Consultants Co., Ltd. (Japan) and Nihon Suido Consultants Co., Ltd. (Japan) (Joint venture)
	Constructor	Hazama Corporation
	Equipment procurement	Hazama Corporation
Feasibility study	Basic Design Study	Basic Design Study on the Project for the Improvement of Water Supply Facilities in Urban and Semi-urban Centers 1st: June & July, 2005; 2nd: September, 2005
	Detailed Design Study	January – April, 2006 (As per Completion Report)
Related Projects	Technical cooperation	• Project for Capacity Development for Water Supply in Semi-urban Areas in Nepal (2010 – 2013)
	Grant aid	• Katmandu Water Supply Facility Improvement Project 1st: 3,372 million yen (1992 – 1994); Katmandu Water Supply Facility Improvement Project 2nd: 2,244 million yen (2001 – 2003)
	Other international and aid organizations, etc.	Asian Development Bank (ADB) • Construction of existing water supply facilities in Dhulabari (1996); • Construction of a meeting facility in Itahari (2000)

2. Outline of the Evaluation Study

2.1 External Evaluator

Noriko Ishibashi, IC Net Limited

2.2 Duration of Evaluation Study

This ex-post evaluation was conducted as follows:

Duration of the Study: October 2011 – November 2012;

Duration of the Field Study: December 17–31, 2011; June 3 – 15, 2012

3. Results of the Evaluation (Overall Rating: B¹)

3.1 Relevance (Rating: [3]²)

3.1.1 Consistency with the National Development Policies

Under the 10th Five-year Plan (2002 – 2007) issued by the National Planning Commission (NPC) in 2002, with respect to the policy objectives of supplying drinking water, the following objectives, amongst others, were raised: (1) increase the water service coverage ratio to 85 %, and (2) improve the water quality in order to secure safe drinking water. The Three-year Interim Plan (2008–2010) mentions water supply and sewerage services as one of the priority issues in the social development sector, and sets the target of raising the service coverage rate to 85 %. It also depicts organizational enhancement of water supply related agencies, improved water supply services, and improved water quality among its strategies.

Both the National Water Plan (2005) and the National Policy on Rural Water Supply and Sanitation Policy (2004) mention the supply of safe water as their policy targets, and these policies are still in effect at the time of conducting this ex-post evaluation.

As described above, raising the water service coverage and improving water quality have continuously been among the policy targets set in several national policies of Nepal since 2002 onwards. The supply of safe water has also been among the targets of the local water supply and sanitation policies. Therefore this project is highly consistent with Nepal's development policies.

3.1.2 Consistency with the Development Needs of Nepal

At the time of the planning of this Project, the water services coverage rate in the targeted areas of this project, was about 30% in Dhulabari (2004), and in Gauradaha, and Mangadh, about 15% (2004 and 2005 respectively). Water from the existing sources, which were wells, contained 2 milligrams of iron per liter, much higher than the national water quality standards for drinking water of 0.3 milligrams per liter, meaning it was not appropriate for drinking (Table 1). An urgent issue was to install water purification facility at the existing water supply facilities and to develop new water sources in order to supply safe drinking water to a larger population.

At the time of this evaluation, some of the targeted areas covered by this project saw their population increase by more than 3%. The draft long-term business plans prepared in 2011 by the WUSCs which operate and administer the water supply facilities, also expect population growth, implying there will be a further need for increase in water supply. The quality of the water obtained from existing wells also had room for improvement. Therefore, this project can also be regarded as being highly consistent with Nepal's development needs.

¹ A: Highly satisfactory; B: Satisfactory; C: Partially satisfactory; D: Unsatisfactory

² [3]: High; [2] Fair; [1] Low

Table 1: Water Supply in the Areas Covered by the Project at the Time of Planning

	Dhulabari (2005)	Gauradaha (2005)	Mangadh (2005)	Water supply service level definitions ¹⁾ Moderate standards
Water quality				National water quality standards
Turbidity (NTU)	High	n.a.	n.a.	Ex) Turbidity: 5 or less
Iron (mg/L)	n.a.	High: 2.2-5.7	High: 2-2.5	Iron: 0.3 or less
Duration of supply (hrs/day)	8.6	23.9	n.a.	24
Water supply coverage (%)	34 ²⁾	14 ²⁾	15	

Source: Extracts from the Basic Design Study (BD) Report and the Urban Water Supply and Sanitation Policy (2009)
 Note: 1) Service level defined in the 9th Five-year Plan (1998 - 2002) which was referred in Urban Water Supply and Sanitation Policy (2009)

2) Estimates calculated at the time of the BD, with the number of users of public faucets included.

3.1.3 Consistency with Japan's Aid Policy

JICA's Nepal Country Assistance Programme Implementation Plan (2001), referred in the Report of the Research Committee on Nepal Country Assistance (2003), outlines improvement of social sector services and enhancing people's livelihood, expansion of agricultural productivity, economics, improving people's livelihood through expansion of social infrastructure and promotion of business, and the protection of the environment as four priority areas ³. The Report of the Research Committee on Nepal Country Assistance (2003) recommends providing drinking water supply as part of improving healthcare within the context of development support to impoverished areas as basic policy towards providing aid to Nepal. As such, this project which aims at providing safe water supply is along with the aid policy of Japan. Furthermore, within the implementation period of this project, the Country Data Book for Official Development Assistance (ODA) for Nepal (2006) mentions five issues, namely, social sector improvement, agricultural development, economic infrastructure aid, human resources development, and environmental protection as priority areas. In the area of economic infrastructure aid, the development of the basic social infrastructure, such as electricity, roads, water supply services and disaster prevention, was included. With its consistency with Japan's aid policy, the implementation of this project is highly relevant.

In light of the above, this project has been highly relevant with Nepal's development policies and development needs, as well as those of Japan's aid policy, therefore its relevance is high.

3.2 Effectiveness⁴ (Rating: [3])

3.2.1 Quantitative Effects

The objective of this project is to increase the population receiving stable supply of safe drinking water, and in terms of its indicators for determining this, the actual increase in population receiving water supply and the water supply coverage, - population served by water supply as percent of total population in the service area -, are the main indicators. However, in order to achieve the targeted increase in the population receiving water supply and increase in water supply coverage rate, a comprehensive development of water supply operations such as

³ Referred in the Chapter 2 of 'The Report of the Research Committee on Nepal Country Assistance' (2003).

⁴ The rating is conducted based on the judgment of effectiveness coupled with impact.

expansion of water distribution and service pipe network are the necessary prerequisites in addition to the upgrade and/or establishment of the water purification plants supported as a part of this project. Therefore, in order to evaluate the effectiveness of this project, on the first instance, the operation of the water purification plants from the quantitative perspectives of water supply capacity and the quality of water supplied needs to be evaluated. Then, the achievement in quantitative targets of population served and water supply coverage rate as well as its contributing factors would be analyzed. These two factors need to be taken into consideration in delivering a holistic evaluation. Furthermore, in producing the evaluation on effectiveness, the following changes and constraints were observed, and as such, the points below will be taken into consideration when evaluating.

- **Evaluation of Effectiveness based on the Population Served by the Project**

In general, when evaluating prevalence of water supply in a service area, the number of people served and the water supply coverage rate in a service area are the main indicators used. Of the two, in evaluating the water supply coverage rate, there is the necessity that the area and the population composition of the targeted areas remain the same. The targeted service areas of this project experienced expansion and hence saw a discrepancy between the originally planned coverage area and the total local population served and those of the actual implementation. As a result, it has become difficult to make a simple comparison between the targeted water supply coverage rate set at the planning stage and the actual current water supply coverage rate and thus, the evaluation was conducted mainly with number of population served where concrete and measurable comparison was possible. With respect to the water supply coverage rate, it is used as a reference point.

- **Resetting of the 2011 Target**

With respect to the planned target figures for this project, since the year 2014 was originally set as the target year when the Basic Design Study (BD) was conducted, no clear target was set for the year 2011 when the actual evaluation took place. For this ex-post evaluation study, the level of achievement as of 2011 was evaluated against the provisional target figure for 2011⁵ which is calculated using average figures between 2005 and 2011 based on the 2014 targeted figure. Furthermore, for the target figures of 2014, this was planned under the presupposition that the planned expansion of the water distribution and service pipes networks, primarily by the Nepal side, would have been completed and thus the water supply capacity would have reached to its peak as a result of the implementation of this project.

3.2.1.1 Operational effectiveness indicators

(1) Operational condition of the Water Purification Plants

1) Expansion of the water supply capacity

The water supply capacity and the actual amount of water supplied by the 3 water purification plants before and after the implementation of this project are shown in Table 2. Through the implementation of this project, the water supply capacity was expanded as planned. At the time of this evaluation, the achievement of the target amount of water supply per day (corresponding to maximum amount of water supply per day) for each water purification plant

⁵ The provisional target figures were set for this Ex-Post Evaluation Study after discussing with a construction consultant that had conducted the Basic Design Study for the design.

vary from 82% to 122% (2011) of the planned targets, which show by and large favorable achievement. Among three, Gauradaha fell below its target. The reasons for being short of its target may be explained by the following two factors - actual water demand per household is not as high as originally planned, and despite the actual demand, due to the slow expansion of its water distribution and service network, there are areas where the connection to the water supply system is yet to be realized. Extension of the water supply network to the said unconnected areas in Gauradaha would further increase the total amount of water supply.

Table 2: Operational Conditions of Water Purification Plans

	Dhulabari					Gauradaha					Mangadh				
	2005 bench-mark	2011 Plan	2011 Actual	Result/Plan %	2014 target	2005 bench-mark	2011 Plan	2011 Actual	Result/Plan %	2014 target	2005 bench-mark	2011 Plan	2011 Actual	Result/Plan %	2014 target
Supply capacity (m ³ /d)	n.a.		4,200 *			n.a.		1,100 *			n.a.		2,200 *		
Amount of water supply (m ³ /d)	705	n.a.	2,540	n.a.	n.a.	55	n.a.	499	n.a.	n.a.	155	n.a.	1,530	n.a.	n.a.
Maximum water supply (m ³ /d)	n.a.	2,986	3,048	102%	4,200	n.a.	732	599	82%	1,100	n.a.	1,500	1,836	122%	2,200
Duration of supply (hour/d)	8.6	15-24	24	100%	15-24	23.9	n.a.	24	n.a.	n.a.	n.a.	n.a.	10-15	n.a.	n.a.
Water Supply per capita (litter/person/d)	45	n.a.	69	n.a.	45-100	n.a.	n.a.	66	n.a.	100	n.a.	n.a.	122	n.a.	100

Source: Benchmarks of 2005 and the 2014 targets come from the BD Report. The 2011 targets are validated and set based on the targets for 2014, the calculation of which presupposes possible increase in amount of water due to expected/planned water supply network expansion. The figures other than noted below are actual results by WUSCs.

Note: 1) The figures noted by (*) are already realized water supply capacity after the project implementation, while the one before the project are not shown in the BD Report.

2) Dhulabari's amount of water per capita per day (2011) was derived from the total billed amount of water⁶.

3) Amount of water supply per day (m³/day) is equal to average amount of water supply per day. Maximum amount of water supply per day (m³/day) is the target amount of water supply of this project. Basic Design Study set the ratio of maximum amount of water supply per day / average amount of water supply per day (coefficient of variance) at 1.2 so that this evaluation calculated the target amount of water supply (maximum amount of water) using the formula of 'average amount of water supply per day x 1.2'. The benchmark figures are actual volume of water supply per day at the time of planning while the target (2014) is maximum amount of water supply. The plan (2011) is also using maximum amount of water supply per day.

a) Discrepancy against expected water demands

The amount of water supply per capita per day⁷ at Dhulabari and Gauradaha is slightly lower than 70 liter and this is only 70% of the 100 liter⁸ target. According to the interviews

⁶ Dhulabari's per capita water supply per day would be 164 liters/person/day if calculated based upon actual amount of water supply and the actual population served in Table 4, whereas it would be 69 liters/person/day if calculated based upon water bills. In this report used the billed amount of water as it is objectively verifiable figure that reached to the user since the meter calibrations are not conducted for amount of water intake and distribution. The reasons behind this large discrepancy in the per capita amount of water supply per day is not identified clearly. Please refer to the section '3.5.3 Financial Aspects of Operation and Maintenance (3) Impact of Non Revenue Water'.

⁷ Liter/person/day abbreviated by L/p/d.

with WUSCs of Dhulabari and Gauradaha during this evaluation, their overhead tanks stocking the water for local supply in the two towns were never emptied whereby verifying 24 hours water supply was already achieved. That is to say, in Dhulabari and Gauradaha, the water demand of the already connected population was met by the current amount of water supply per capita, and thus one of the reasons of the water supply volume falling short of the target is caused by the over-projection of the water demand at the time of planning.

b) Incomplete water distribution and service network

The water supply targets (for the target year 2014) set at the time of planning takes into account of the future penetration of the water supply network⁹ into the service areas where the water supply distribution and service pipes were not yet connected and potential users awaiting. However, in Gauradaha and Dhulabari, the increase of connections resulting from the expansion of connection was lower than originally anticipated. Therefore Gauradaha, and Dhulabari, there are potential areas whereby, despite the demand for water, it was yet to be connected thus not feasible to provide the water supply as demanded. It is expected that water supply volume will increase once water service reaches such underserved and/or unconnected areas in the future.

According to the WSSDO, it is generally understood that the slow expansion of the water distribution and service networks is partially due to WUSCs' inability to sufficiently secure capital investment budget for such expansion, and to the inadequate planning for the expansion of the network. Also, based on the interviews with WUSCs, it has become apparent that the plans of distribution network expansion were not based on the reasonable expectation of securing feasible funding (self-financing or from other sources), nor clear annual expansion targets of distribution network were set, hence the feasibility of the plans were low. In Gauradaha, the future expansion plan of water supply distribution pipes is available, and the WUSC estimated that, if the WSSDO would continuously provide distribution pipes and other fittings¹⁰, the 2014 targeted amount of water supply may be achieved in the medium term. However, considering the past rate of expansion and its plan, it is unclear at this point to determine if the planned 2014 target could be achieved. Dhulabari on the other hand, securing their part of capital investment cost for pipes for expansion of the water distribution network is deemed difficult, and has no concrete expansion plan at the time of this evaluation. The delays in extension of water supply network reveal challenges in further expansion of the project effect which attributes to increasing population served. Hence, it may affect prospect of achieving the 2014 target of water supply amount as well as the sustainability of the project effect.

At the time of the planning of this project, overall plan for expanding the water supply distribution networks for each service area was present. However, the Nepal side's feasibility of funding such investments was not identified, nor none of the WUSCs have sufficient financial capacity to procure funds¹¹ based on a possible capital investment plans. At the planning stage of this project, potential concerns with respect to the financial prowess of the implementing

⁸ Per capita amount of water supply per day at the time of planning was calculated at 100 liter for users in households with its own taps and 45 for users of public faucets.

⁹ In this project, JICA side supported the expansion of main distribution lines of Dhulabari and Gauradaha whereas the Nepal side was responsible for supporting the expansion of the service/distribution networks in the target areas.

¹⁰ The WUSC in Gauradaha was granted the pipes and fittings necessary for the expansion of distribution and service network by the WSSDO in the past two consecutive years, and the granted pipe length was mostly as they proposed. However, it is unforeseeable that the similar level of provision would be materialized in the next year onward.

¹¹ After the construction, WSSDOs transfer the facility to a designated WUSC, which formulates its own capital investment plan and procure necessary fund for cost share between WUSC and WSSDO; 4:6 respectively.

entities were not sufficiently examined, and as such, it can be said that more realistic project targets were not set.

2) Water Quality

In Dhulabari, no periodic water quality test was conducted and it was unable to conduct quantitative analysis and evaluation. The water quality of the other two water purification plants was as per table below. Despite the presence of minor deviations from the acceptable range for certain indicators, the water from the two plants mostly reach to the quality of drinking water.

Table 3: Water quality of distributed water

	Dhulabari				Gauradaha				Mangadh			
	2005 bench-mark	2011 Plan	2011 Actual	2014 Target	2005 bench-mark	2011 Plan	2011 Actual	2014 target	2005 bench-mark	2011 Plan	2011 Actual	2014 target
Turbidity (NTU)	High	>5	n/a	n/a	n/a	n/a	0.63	n/a	n/a	n/a	0.84	n/a
Iron (mg/L)	n/a	n/a	n/a	n/a	High 2.2-5.7	<0.3	0.37	<0.3	High 2-2.5	<0.3	0.06	<0.3
Coliform bacteria (col/ml)	n/a	n/a	n/a	n/a	n/a	n/a	nil	n/a	n/a	n/a	nil	n/a

Source: The 2005 benchmarks come from the BD Report, and actual figures from the results of water quality tests offered by WUSCs.

< Gauradaha >

In Gauradaha, the examined items are only 18 despite the national standards of 27 due to the limited test capacity of nearby water quality laboratory, the frequency of the examinations has been almost annually. The water quality test conducted in 2011 verified that 17 out of the 18 items¹² passed the national drinking water quality standard¹³, aside from for the contents of iron. With respect to the iron contents, although it slightly exceeded the 2011 planned target (under 0.3mg/L), it passes the national drinking water quality standard and JICA experts¹⁴ also confirmed that this has few impact on health. These data also confirm that significant improvements have been achieved when compared to the data prior to the implementation of this project.

< Mangadh >

In Mangadh, water quality tests that are compliant with the national water quality standards have been conducted almost annually¹⁵, and out of the 27 checked items, 25 items have passed the national standards in 2009, and in 2011, aside from the residual concentration of chlorine¹⁶, it has passed the national quality standards of Nepal as drinkable water.

¹² Nepal's drinking water quality standards have 27 items nonetheless the nearby laboratory can examine 18 only.

¹³ National drinking water standards sets the upper limit of 0.3mg/l for iron, however, this applies if iron content can be removable. As per JICA expert, water with iron contents of less than 3mg/l is allowed as notified in parentheses.

¹⁴ JICA Experts in the 'Project for Capacity Development for Water Supply in Semi-urban Areas' explained in '3.5 Sustainability'.

¹⁵ Physical parameters for 15 (color, turbidity, iron, manganese, arsenic etc.), chemical ones for 10 (calcium, mercury etc.), and micro germs for 2 (coli form etc.)

¹⁶ The result was 0.3mg/liter (2011) exceeding the national drinking water quality standards of 0.1 to 0.2mg/liter.

< Dhulabari >

According to WUSC, the water quality at Dhulabari is good enough, due to good quality of the water at the source, so that the WUSC has been conducted no water quality tests by water quality laboratory. More precisely, the main source of water in Dhulabari is from springs, and the water quality examination during the BD Study conducted at the planning stage of this project, water quality had no problem except for presence of coliform which can be treated by chlorination in the water purification process. As such, the WUSC understood that need of water quality tests was low. Taking into consideration that the water quality at the time of the project planning stage had been good, and also considering the fact that the beneficiary survey, described later part of the report, did not find any major dissatisfaction concerning water quality. It could be assumed that water quality might have no major issues, but no precise assessment is possible. It should be instructed that the operators of the facilities need to recognize the importance of water quality monitoring and to conduct periodic water quality tests according to the concerned regulations.

It should be noted that water quality control lectures have been conducted by JICA project's training. Through such project's technical support, it is anticipated that WSSDO staff will provide assistance to WUSCs regarding the necessity of conducting water quality tests, and improvements can be made in the medium term.

In summary, the water supply capacity of the water purification plants had been improved according to its original plan and the planned water supply volume target was mostly achieved. Due to over projection of per capita water demands and the slow expansion of the water distribution and service networks, the actual amount of water supply of Gauradaha was short of the targeted level, however the overall achievement of 3 plants is evaluated to be at reasonable level. The target level of water supply for 2014 can be achieved in Gauradaha and Dhulabari at the conditions of further extending the water supply network; particularly Dhulabari requires the network expansion plan as well as technical guidance on fund procurement. With respect to water quality, two of the three water treatment plants have almost achieved the national water quality standards for drinking water. Although Dhulabari's capacity in providing water quality is not verifiable, its source water can be safe with chlorination thus requires less urgency in conducting water quality examination. In sum, the all operators' capacity of supplying safe water has almost been achieved, which is commendable.

(2) Population receiving water supply and water supply coverage rate

The table below shows the population served and water supply coverage rates of the three water purification plants. It should be noted that the population served has achieved the 2011 target in two service areas except Dhulabari among three, which can be favorably assessed. In terms of the water supply coverage rate in the service area, all have come below the target.

Table 4: Population served, amount of water supply, water supply coverage and hours

	Dhulabari					Gauradaha					Mangadh				
	2005 bench-mark	2011 Plan	2011 Actual	Result/ Plan(%)	2014 target	2005 bench-mark	2011 Plan	2011 Actual	Result/ Plan(%)	2014 target	2005 bench-mark	2011 Plan	2011 Actual	Result/ Plan(%)	2014 target
Amount of water supply (m ³ /day)	705	n.a.	2,540	n.a.	n.a.	55	n.a.	499	n.a.	n.a.	155	n.a.	1,530	n.a.	n.a.
Maximum water supply (m ³ /d)	n.a.	2,986	3,048	102%	4,200	n.a.	732	599	82%	1,100	n.a.	1,500	1,836	122%	2,200
Population served (person)	8,480	22,299	15,494	69%	31,360	1,290	5,911	7,604	129%	8,885	2,870	11,262	12,560	112%	16,440
Total population in service area (person)	25,818	32,794	29,237	89%	36,900	9,292	11,822	28,938	245%	13,100	19,180	25,026	30,201	121%	27,400
Water supply coverage (%)	34%	68%	53%	78%	78%	14%	50%	26%	53%	68%	15%	45%	42%	92%	60%
Duration of supply (hour/d)	8.6	15-24	24	100%	15-24	23.9	n.a.	24	n.a.	n.a.	n.a.	n.a.	10-15	n.a.	n.a.

Source: Benchmarks of 2005 and the 2014 targets come from the BD Report. The 2011 targets are validated and set based on the targets for 2014, the calculation of which presupposes possible increase in amount of water due to expected/planned water supply network expansion. The figures other than noted below are actual results by WUSCs.

Note: 1) The figures noted by (*) are already realized water supply capacity after the project implementation, while the one before the project are not shown in the BD Report.

2) Dhulabari's amount of water per capita per day (2011) was derived from the total billed amount of water.

3) Amount of water supply per day (m³/day) is equal to average amount of water supply per day. Maximum amount of water supply per day (m³/day) is the target amount of water supply of this project. Basic Design Study set the ratio of maximum amount of water supply per day / average amount of water supply per day (coefficient of variance) at 1.2 so that this evaluation calculated the target amount of water supply (maximum amount of water) using the formula of 'average amount of water supply per day x 1.2'. The benchmark figures are actual volume of water supply per day at the time of planning while the target (2014) is maximum amount of water supply. The plan (2011) is also using maximum amount of water supply per day.

1) Population served in service area

Of the 3 water purification plants, the two targeted areas covered by Gauradaha and Mangadh have achieved their targets vis-à-vis the 2011 target¹⁷, and this achievement can be favorably assessed. Dhulabari, on the other hand, only reached up to approximately 70% of its planned target. The reasons behind this may be attributed to the fact that there had been slow expansion of water supply distribution network mentioned earlier, and the fact that around 2008 and 2009, the system of public tap had been abolished¹⁸, and thus the reduction of those households that used to use public tap have negatively affected the achievement.

¹⁷ Precisely, 15,494 for Dhulabari (69% of the plan), 7,604 for Gauradaha (129% of the plan), and 12,560 for Mangadh (112% of the plan)

¹⁸ It was due to misuse of public faucets e.g. washing privately owned livestock and so on.

2) Water supply coverage rate in service area

In all 3 targeted areas, the water supply coverage rate vis-à-vis the 2011 planned target rate was at 50 to 90% of their respective target rate and fell below the planned target. Especially in Gauradaha, the water supply coverage rate vis-à-vis the target rate reached only about 50%. With respect to Gauradaha and Magandh, the water supply area and population served increased beyond what had been originally planned, and this, in relative term, lowered the water supply coverage rate¹⁹, thus working against achieving the target. If the overall population served would have stayed as the originally planned, it would have achieved about 50% for both towns (refer to Table 5 and Table 6) and thus, they have approximately met their target. Since the planned target for population served is met, it may be assessed that the original target has been almost met. The significant expansion of the service area and increase in the population served has the following background.

- a) In Gauradaha, based on discussions held with the adjoining WUSC, from 2009 onwards, parts of 2 additional Wards where water supply was not covered were added to the service area. Adding the areas not previously targeted and areas where water supply was not connected, in addition to the fact that the demand for water per household was not as large as originally planned, both led to the amount of water supply falling short of its target. Against the originally planned water supply coverage rate of 50% (set for 2011), the actual water supply coverage rate was at 49% (2008) before this expansion took place, (translating to achievement of 98% vis-à-vis the planned rate) and thus, the target was almost achieved (refer to table below). However, with the expansion in the service area, the coverage rate decreased in relative terms, and thus fell below the plan.

Table 5: Gauradaha Water Supply Coverage
(2008 Actual and before the area expanded)

2008 Actual Population served (persons)	5,012	2008 Actual total population in service area (persons)	10,301	2008 Actual Water supply coverage (%)	49%	2011 Plan Water supply coverage (%)	50%
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Source: The figures other than below are actual results by WUSCs.

Note 1: The figures for population served and the coverage rate in service areas for 2008 Actual are calculated by the same method as was in BD Study due to lack of official population data provided by WUSCs.

- b) In Mangadh, had the total population within the service area remained as 25,026 as originally planned (for 2011), the water supply coverage rate - which is to measure the degree of coverage against the total population in the service area - would have reached 50% (refer to table below). This in turn would have reached 110% of the planned target rate. In reality, the permanent population in some part of the service area increased beyond planned levels, and thus, the denominator for the indicator increased and this had subsequently led to the relative decline of the coverage rate. Despite such increase in population, the water supply coverage rate had reached to 90% of the planned target rate, and this may be favorably assessed as an achievement.

¹⁹ The denominator is the total population in the service area in the calculation of coverage rate in the service area.

Table 6: Mangadh Water Supply Coverage (2011) based upon the Total Population (2011 Plan)

2011 Actual Population served (persons)	12,560	2011 Plan total population in service area (persons)	25,026	Water supply coverage (%) 2011 Actual/ 2011 Plan	50%	2011 Plan Water supply coverage (%)	45%
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Source: The figures other than below are actual results by WUSCs.

Note 1: The figures for population served and the coverage rate in service areas for 2008 Actual are calculated by the same method as was in BD Study due to lack of official population data provided by WUSCs.

- c) In Dhulabari, in addition to the sluggish expansion of the water distribution network, and the fact that the public water taps were discontinued from 2008-2009, have led to a decline in the population served, and this has had dragged down the achievement level.

As shown above, the capacity of the water purification plans have been improved as planned, and setting aside a few exceptions, the population served reached its planned target. Despite the fact that water supply coverage rate is short of the planned target due to the change of the denominator, the increase of the population served mostly achieved the target which is commendable. However, delays in the expansion of the water supply distribution and service network pose a challenge to this project in delivering its planned effect.

3.2.2 Qualitative Effects

(1) Feedback from users

In order to supplement the level of effectiveness of this project from a qualitative viewpoint, a beneficiary survey was conducted with those users living in the targeted area. The sample for the survey consists of 100 people living within the target area covered by the 3 water purification plants. The main results of the survey are shown in the table below, and in general, positive feedback was given with respect to the improvement in water supply conditions.

Table 7: Findings of the Beneficiary Survey (Summary)

	Dhulabari Jhapa District	Gauradaha Jhapa District	Mangadh Morang District
Water supply	Good Water available 24-hours	Good Water available 24-hours	Good Water available 10-15 hours/day
Water quality	Good	Good	Good
Charges	90% of residents can pay	Roughly 90% of residents can pay	80% of residents can pay
Livelihood changes	• Water taps closer, increase in convenience	• Water plugs closer, increase in convenience	• Increased convenience (70%) • Easy to draw water (70%) • Improved health (20%)

Source: Beneficiary survey as part of the ex-post evaluation study (2011)

- All the respondents expressed that the current water supply conditions were favorable. Issues such as water pressure were not raised. With the exception to those responses from Mangadh, all those replied stated that there were mostly 24 hours of water supply.
- All the respondents stated that water quality improved, with no issues experienced with respect to clarity, smell and taste of water.
- With respect to water tariffs, 86% of those who replied stated that they were at an

affordable level.

- With respect to change in livelihood, responses were given that water taps have become much closer and the usage of water easier to access.

From the above, the amount of water supplied, the population served, and the water quality mostly achieved the plan, and the level of satisfaction towards the water services from users is high. As such, from the perspective of increasing the population receiving safe and reliable water supply, it is commendable that this project has achieved the objective. In this regard, delays in expansion of water distribution and service networks, which poses challenges to the increase of water supply volume and population served, necessitates further efforts of expansion. Its expansion is expected to fully deliver the intended effectiveness of this project and to sustain the effect. In light of the above, it is evaluated that the effectiveness of this project is high.

3.3 Impact

3.3.1 Intended Impacts

At the time of planning, according to Basic Design Study, this project was expected to provide stable supply of safe drinking water to the residents and help improve their health conditions. At the time of this evaluation, there was no quantitative data available that supported any improvement in the health of the residents. However, all the respondents in the beneficiary survey pointed out the ease and convenience of water use as a change in their livelihood. In particular, in Mangadh, almost 70 % of the respondents said they could now use water more easily, suggesting to some extent that better water supply conditions have helped improve the living conditions of the residents in this water supply area. There was no specific co-relationship found between this project and invigoration of the local economy.

3.3.2 Other Impacts

(1) Impacts on the natural environment

A simplified Initial Environment Assessment²⁰ conducted as part of the BD Study concluded that there was no issue that would have any significant impact on the environment, and that therefore there was no need for any further environmental assessment. As a result, no further environmental assessment was conducted. A local consultant who accompanied this evaluation study team found that there were no remarkable cases of land subsidence, nor had any member of the local implementing agencies reported land subsidence. It is therefore recognized that this project had no specific impact on the natural environment.

(2) Land acquisition and resettlement

In Dhulabari, the acquisition of land was required in order to expand its water intake site and satisfy the future large demand for water there. According to the members of the WUSC, 7,800 square meters of land was purchased from three households as site for the plant. After negotiations regarding the purchase price between the land users and village officers, the local government officers, WSSDO, and other parties concerned, payment was made according to the

²⁰ The assessment pointed out the level of waste, geographical features and landforms, and the landscape as aspects that this project might have a slight impact on. However, according to BD Report, it was concluded that there would be no problem as long as appropriate measures were taken to mitigate such impacts. Among the specific mitigation measures were the use of existing sludge disposal sites, design to minimize the alteration of landforms, and facilities design with the landscape taken into consideration. It is concluded that these measures were carried out as a part of this project.

agreement that was reached. With no complaints filed by any former land users after the acquisition of the land, there were no negative impacts due to the land acquisition.

In light of the above, this project has largely achieved its objectives, therefore its effectiveness is high.

3.4 Efficiency (Rating: [2])

3.4.1 Project Outputs

This project produced the outputs almost as planned. The Nepal side completed the acquisition of the site for the Dhulabari water intake facilities and the construction of a fence around the site, as well as the installation of power transmission lines. The planned and actual outputs of the Japanese side are shown below in Table 8.

Table 8: Outputs (Plan and Actual Results)

Outputs	Plan	Actual
1. Dhulabari		
1) Reconstruction of water intake facilities	Intake dam x 1 Removal of existing facilities and new construction Water intake facility capacity: 4,326 m ³ /day	As planned.
2) Conduit and water pipe laying	Conduits: 3.02 km Distribution pipes: 8.8 km (11.8 km total)	As planned.
3) Water purification plant construction	Design treatment volume: 4,200 m ³ /day Treatment facilities: Settling reservoir, coarse filter pond, slow filter pond Clear water reservoir: approx. 600 m ³ Disinfection facilities	As planned.
4) New water distribution facilities	Elevated water tank: approx. 450m ³ x 1	As planned.
5) Emergency home generator for existing water distribution facilities	1	As planned.
6) Distribution piping	Pipe extensions: approx. 6.7 km (conduits, distribution and supply pipes: 18.5 km total)	Almost as planned: +0.5 km (19.04 km, +0.5 km)
2. Gauradaha		
1) Water purification plant and water distribution facility improvements	Design treatment volume: 1,100 m ³ /day New iron removal facility x 1 New clean water reservoir: 300m ³ x 1 Elevated water tank pump, emergency home generator	As planned.
2) Distribution piping extensions	Approx. 6.1 km	Almost as planned: 6.2 km, +0.1 km
3. Mangadh		

1) Water purification plant and water distribution facility improvements	Design treatment volume: 2,200 m ³ /day New iron removal facility x 1 New clean water reservoir: 300m ³ x 1 Elevated water tank pump x 2, emergency generator Disinfection facility	As planned.
4. Operational components		
Training and technical guidance	Target: 3 water utilities 1) Water utility O&M staff and O&M skills training 2) WUSC organizational strengthening	As planned.
Deliverables	1) Operational component completion report x 2 2) Texts and manuals x 6 Text and manuals for water utility O&M and WUSC organizational strengthening Operation control manuals, etc.	As planned.

* Iron removal equipment: Equipment installed to remove the iron content in the water.
Source: BD Report, JICA internal documents, and interviews with the parties concerned



Dhulabari Water Purification Plant (entrance)



Gauradaha Water Purification Plant (building and facilities)



Mangadh Water Purification Plant (sterilizer)

3.4.2 Project Inputs

3.4.2.1 Project Cost

The grant ceiling specified in the Exchange of Notes (E/N) for the project is 1,124 million yen. Actual expenditures from ODA were 1,123 million yen (almost 100% of the plan). However, the total expenditure including the extra charges shouldered by the Japanese consultants is 1,163 million yen (105% of the plan). Nepalese side expenditure was originally 7 million yen at the time of plan and actual one amounts to 6 million yen (approximately 3,890 thousand Nepal Rupees) which is 85% of the plan.

For the Japanese side actual expenditure, the one from ODA was almost 100% of the plan. However, there were extra charges, shouldered by the Japanese consultants in order to complete the planned outputs. The extra charges were personnel cost and travel expenses of internal and domestic ones, all of which were incurred by suspension and delays in delivering construction personnel and materials resulted from the series of general strikes and related road blockades.

On the Nepalese side, the actual project costs came in lower by one quarter of the plan in monetary terms, and the outputs produced also saw slight decline. The project costs of the Nepalese side came lower than planned mainly because negotiations with land owners went

smoothly, making the amount of compensation for land acquisitions lower than originally estimated.

3.4.2.2 Project Duration

The project duration, including the extended period incurred by the restriction of movements placed on construction materials and workers, the actual duration was 19 months (119% of the plan) compared to the original plan of 16 months (December 2005 to March 2007).

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

3.5 Sustainability (Rating: [2])

3.5.1 Structural Aspects of Operation and Maintenance

Entities responsible for planning, construction, operation and maintenance of local water supply facility differ before and after the completion of the project. WSSDOs which are a divisional office of the DWSS, execute project planning, design and construction. After completion, WUSCs which are public entities, take the delivery of the facilities and handle operation and maintenance.

While WUSCs are local water users' organizations, they are legally obliged to manage their operations as public entities. As such, the Government of Nepal is not involved in WUSC management.

From a legal perspective, WUSCs are formed by local residents with governmental approval. They are public entities that independently operate, maintain and manage the water supply facilities, including necessary facility investments. WUSC members are elected locally for three-year terms from the water users. The WUSCs hire the staff for operations and maintenance (OM) of the water supply facilities and are responsible for the management.

The WSSDOs, under the guidance and support from the central DWSS, monitor each WUSC's work in the areas of technical and managerial dimensions, and also provide technical support through training and other means. The WSSDOs do not provide WUSCs any direct subsidies or financial support. However, WSSDOs within the limits of their annual budgets provide pipes and fittings and/or cost sharing with the WUSCs for basic water supply pipes and other high cost equipment.

The table below shows the WUSC personnel structure at the time of this evaluation.

Table 9: OM Structure for Water Supply Facilities

(Units: Persons)

	Dhulabari		Gauradaha		Mangadh	
	Plan	Actual	Plan	Actual	Plan	Actual
WUSC Members	n.a.	11	n.a.	11	n.a.	13
Operating staff						
Management	• 3-shift system	9	• 3-shift system	1	• 3-shift system	2
Technical	• Operating staff	10		2		6
Other		10		3		4
Total operating staff	26	29	9	6	16	12

Source: Interviews with each WUSC

While maintenance staff numbers have increased since the project was completed in July 2007, all but Dhulabari have fewer staff members than planned. The others are currently operating understaffed for various reasons; Mangadh is tightening its staff numbers to secure funds needed for a future well and water purification facility construction plan, and Gauradaha is operating at the current staffing level since the maximum daily volume of water supplied is at roughly 80% of its maximum capacity. No daily operational and maintenance issues could be observed in any of the two WUSCs of Gauradaha and Mangadh by having operations and maintenance staff working overtime, hiring short-term contractors, etc. On the other hand, in Dhulabari, since four posts including that of the manager's post remained vacant for over a year until March 2012, some confusion on the duties and functions among staff were found. As of June 2012, however, they are in the process of rebuilding its management system with a new manager hired and the vacant posts filled.

(1) Support structure aimed for WUSC

The WSSDO conducts surveys in the process of planning and designing for new water supply projects within its jurisdiction, handles construction and monitoring, provides technical guidance and supports to each WUSC, and runs several sanitation awareness programmes. Technical guidance is mainly for WUSC engineers and other technical staff. The personnel structure is provided in the table below.

According to WSSDO staff members, a 2 to 3 day training session for WUSC staff members were conducted before the transfer of water purification plants. Since then, as technical support aimed at 3 WUSCs, WSSDO has provided training and technical advice on operation and maintenance on average, once or twice a month average as required. However, due to personnel and budgetary constraints, they are not offering any specific practical training or guidance catered for each water purification plant.

Table 10: WSSDO Staff

Units: Persons	(Unit: persons)	
	Morang District WSSDO	Jhapa District WSSDO
Management	9	11
Technical Staff	13	14
Community Support Staff	2	2
Total	24	27

Source: WSSDO interviews and questionnaire responses

Note: For the targeted areas in the project, the Mangadh WUSC is under jurisdiction of the Morang District WSSDO, and the Dhulabari and Gauradaha WUSCs are under jurisdiction of the Jhapa District WSSDO.

Furthermore, a JICA Technical Cooperation Project aimed at strengthening technical support structure for WUSCs run by WSSDO is currently underway from 2010 (see table below). This Technical Cooperation Project has two aims: 1) train WSSDO staff and the three WUSCs under this project in maintenance skills and managerial aspects of water purification plants, and 2) build a technical support mechanism for WUSCs centered around the WSSDOs. While there has been training to this point for both WSSDO and WUSC staff, the midterm review survey (November 2011) conducted for the said Technical Cooperation Project indicated that WSSDOs did not have any guidance staff pertaining to managerial issues along with other issues.

Based on the report of the midterm review for the said project, it is unclear whether a technical support structure and mechanism aimed for WUSC by WSSDO, can be established

within the said project period. The report forecasts that the decision will be made in the second half of the project. According to DWSS, in order to strengthen the managerial directives of WSSDO, placement of dedicated staff to WSSDO is underway, and positioning of central level staff has been decided to strengthen the organizational structure and thus, it can be expected that future support structure will adequately be positioned.

Table 11: Overview of JICA Project for Capacity Development
for Water Supply in Semi-urban Areas
Duration of the project: January 2010 – July 2013

Target groups:		
	DWSS line Office of Eastern Regional Monitoring Supervision Office (EMRO) staff	
	Morang and Jhapa District WSSDO staff	
	Dhulabari, Gauradaha and Mangadu WUSC staff	
Project Objectives:		
	DWSS technical support system to WUSCs is implemented in Morang and Jhapa districts	
Examples of capabilities expected to be strengthened		
	Technical	Managerial
WSSDO	Creating construction management indicators	Construction management ability
	OM of waterworks and facility	Water supply facility OM guidance for WUSC
	Studying monitoring methods	Evaluating management and facility control indicators
	Community measures (claims, etc.)	Creating support models
WUSC	OM for water utilities, pipeline, meters, etc.	Maintaining water facility and water supply ledgers
	Meter reading, billing and water rate revisions	Fixing leaks and otherwise improving revenue water and profitability
	Non-revenue water measures, water quality control	Monitoring evaluations
	Creating monitoring items, monitoring methods	Creating medium and long-term business plans and annual reports
	Processing and handling claims	Expediting claim measures

Source: Excerpted from Project Inception Report

Note: The Eastern Regional Monitoring Supervision Office (EMRO) is the supervision office for the DWSS branch office for eastern Nepal, where Morang and Jhapa Districts are located.

3.5.2 Technical Aspects of Operation and Maintenance

In the said Technical Cooperation Project conducts a series of technical training in areas related to their work duties, the trainees of which include staff at the 3 WUSCs and water purification plants. With few turnovers of skilled and experienced OM staff in Gauradaha and Mangadh, the experienced staff members in the purification plants are mostly responsible for maintaining technical expertise. As such, the basic daily operations such as purification and distribution of water, maintenance of water quality and maintaining operational records, etc., are sufficiently met technically. If there are no major problems in the facilities, they are at a technical level where effective operation could be maintained. In Gauradaha and Mangadh, issues exist in the internal weaknesses seen in lack of mechanism for sustaining and improving technical expertise in OM, necessity for standardizing the technical skills of staff, lack of preventative maintenance measures²¹, and lack of ability to respond to emergency situations as malfunctions of pumps and electrical systems are reliant on external support.

In Dhulabari, as with the other 2 water purification plants, daily operations of the water purification and supply facilities are conducted and basic level of technical capacity exists.

²¹ Regular checkups that are conducted, e.g. bi/monthly and/or bi/annually, even without particular malfunction.

However, unlike the other water purification plants, the skilled and experienced staff have already left their posts, and this casts uncertainty as to the sustainability of the required technical capacity in OM. Field observation and interviews during this evaluation revealed several issues. More specifically, lack of maintaining basic records such as records of water purification operations and water pumping to the overhead tanks, maintenance records of water supply facility and equipments including purification facility, lack of water quality tests by the laboratory, non-attention to water leakages seen inside the water purification facilities, inability to respond to pumps and electrical malfunctions, etc., and the awareness towards sustainable OM seem to be low.

At all three water supply facilities, turnover of skilled and experienced staff could pose challenges to WUSCs in maintaining the skill levels of the staff, as their internal system for maintaining and improving sustainable OM skills are weak. As such, they are taking in external technical support to be fully capacitated in the long-run, and are currently working to build and establish internal systems for improving OM skills from the Technical Cooperation Project of JICA and from WSSDOs. In this regards, it is understood that the demonstration of project effects might have been earlier if the Technical Cooperation Project would have been initiated at a more appropriate timing, at the same time of the implantation of this project for instance.

3.5.3 Financial Aspects of Operation and Maintenance

(1) Balance of payments

As seen in the financial overview in the table below, all the WUSCs are currently managing to produce retained earnings. About 70% of their operating revenue is from sale of water and other miscellaneous revenues generated e.g. connection fees collected from new water users, interest income, etc. In recent years, fuel and electricity costs are rising, and there is a necessity to increase the water tariff that compensates for the respective rise in such costs. However, in accordance with WUSC procedure, any rise in water tariff requires the WUSC to consult with and obtain consent from the water users at the annual general meeting²². According to WUSC members, it takes an average of two years to obtain consumer consent. Thus, such factor may become a destabilizing element for the financial situations of the WUSCs.

Table 12: Financial Summary

(Units: 10,000 Nepalese Rupees)

	Dhulabari ²⁾	Gauradaha ³⁾	Mangadh
Operating balance (2011)	17.02	3.68	31.36
Revenue from water charges/total revenues	69%	72%	65%
Charge collection rates	95%	95%	95%

Source: Operation earning reports, business plans and interviews with each WUSC

Notes: 1) Charge collection rates obtained in WUSC interviews.

2) Results for 2010

3) The Gauradaha earnings report includes amounts for WSSDO-provided equipment in its monetary income and expenditures. However, as no actual money is transferred, this figure is not including this amount.

The current financial state conditions for each of the WUSC are as follows:

²² WUSCs hold an annual general meeting once a year for local residents/users who are WUSC members to explain the year's performances, earnings report and plans for the following year. Here, there is also an exchange of opinions.

<Dhulabari>

- Have had retained earnings since 2007. However, the income figures for water sales as estimated from water bills do not reconcile with the accounting ledgers.
- The 2009 annual report of the Technical Cooperation Project reported problems such as no spare parts being purchased. However, in interviews at the time of the evaluation, the WUSC chairman said that there was budget in place for fuel expenses and spare parts and that the Dhulabari WUSC was procuring spare parts both locally and from India.
- In the WUSC annual general meeting in the start of 2012, consumers were consulted about raising water tariffs, but it was not possible to successfully raise the rates. Further, the cost of production has not been calculated.

<Gauradaha>

- While the Gauradaha WUSC has kept excess income for each fiscal year since 2009, its profitability is on the decline. With less secure power supply over the past three years due to a worsening power supply, Gauradaha relies upon generators for supplemental power. This has greatly increased fuel costs and electricity tariffs increased. These increases are responsible for the decrease in account surplus.
- According to WUSC members, the WUSC has the budget for fuel costs, spare parts and repairs and purchases parts available in nearby areas. As requisite chlorine was provided by the WSSDO up through mid 2011, the WUSC had no related spending on file. Further, cost of production has not been calculated.
- Tariff collection rates are at least 95%.
- According to WUSC members, Gauradaha area electricity rates are scheduled to increase in 2012, and they are aware of the need to reflect this cost increase in their water tariffs. The rate increase will require WUSC to consult with their consumers at the annual general meeting, and they expect to obtain consumer consent.

<Mangadh>

- The main source of revenue is from sale of water and other miscellaneous revenues. Revenues from water sales alone cover their total expenditures. Connection fees and other miscellaneous revenues have totaled 50-70% of water sale revenues over the past three years, keeping their revenue sources stable overall.
- According to WUSC members, the WUSC has the budget for procuring fuels, spare parts, requisite chlorine and other items. It seems to have sufficient financial capacity to sustain operations for their current activities.
- According to WUSC members, they have not raised water tariffs in the past three years, but they are reliant on generators for supplemental power due to a worsening power situation and less secure power supply. They recognize the need to reflect the increase in fuel costs and other expenses in the water tariffs and have explained this to residents in past annual general meetings. They look to gain users' approval for a water tariff increase at the next annual general meeting and the outlook for this is reasonable.

(2) Long-term business plan and equipment upgrades plans

The WUSCs' draft long-term business plans (2010 - 2025) formulated with the assistance of JICA Technical Cooperation Project incorporate maintenance costs, equipment upgrades and service area expansion plans. Mangadh has created a maintenance fund based on calculations of the expenses needed for equipment upgrades and installations. Dhulabari and Gauradaha have

similar funds²³, but their balance of the funds are not in line with the long-term business plan since targeted amount for covering necessary expenses have not been calculated. Therefore their viewpoints in management, which would be revealed in long-term business plan and capital investment plan with necessary financial backing, shows deficiency. In this sense, it might have been possible for the Technical Cooperation Project to assist them prepare a more complete long-term business plan if the said project started earlier. Mangadh, under sound management, the financial conditions are well maintained, and factors such as prospects for succeeding to raise water tariff²⁴ which can potentially raise profitability, possibility of securing private sector financing for capital investment²⁵ for facility and equipment, etc., can help raise the possibility of achieving their long-term business plan. Of the other two WUSCs, the Gauradaha WUSC is expecting at its next annual general meeting to have its water tariff increase approved, and it is expected that this can raise profitability. In Gauradaha and Dhulabari, measures for water leakages have commenced through the JICA Technical Cooperation Projects, and this can potentially help strengthen the measures against non-revenue water (NRW) mentioned in the next section. Furthermore, DWSS's efforts in improving its support structure to WUSCs can be expected to produce improvements in WUSCs' management.

(3) Impact of Non Revenue Water

The following chart gives the rate of NRW²⁶ for the three water supply facilities in this project.

Table 13: Non Revenue Water Rate (2011)

		Dhulabari	Gauradaha	Mangadh
Non-revenue water rate (%)	Actual	58%	33%	21%
	Plan	n.a.	n.a.	n.a.

Source: Calculated from data collected in the ex-post evaluation

With the exception seen in Mangadh, non-revenue water rates are high. It exceeds 30% of the total water production volume in Dhulabari and Gauradaha, but the cause of the high non-revenue water rate is not clearly identified.

The rates are estimated to be particularly high in Dhulabari, exceeding 50%²⁷. Possible causes include leaks in supply and distribution pipes, faulty meters and leaks within the water purification plants. However, as Dhulabari has not calibrated its flow meters for water intake and distribution and does not record other water flow within the purification plants²⁸, none of

²³ Both towns had total reserves of roughly 500,000 yen in 2011.

²⁴ According to the Chairperson, in 2011 annual meeting requested for the understanding on the financial situation and possible improvement of service after water tariff increase so that the prospect of approving raising water tariff would be high.

²⁵ The draft business plan shows good financial situation, further increase of water demand and population in the service area, future water tariff setting and possible balance of payments. The WUSC Chairperson is confident in taking loans, based upon good financial perspective, from banking institutions in private sector.

²⁶ The amount of water not delivered to the users, calculated by deducting the portion of billed amount of water from total amount of water supplied.

²⁷ The NRW rate is calculated based upon the following data for 2011: total amount of water supplied 2540m³/day, the total billed amount of water 1076m³/day, and the amount of non-revenue water 1464m³/day.

²⁸ According to the new manager who took office in March 2012, they have started new initiatives, including

technical staff or WUSC committee members have identified the cause. The likely causes in Gauradaha are increased water use during piping maintenance and faulty meters.

In interviews with each WUSC, the Chairpersons answered that non-revenue water negatively affected the financial situation. In order to fix the leaks, the three water supply facilities are making repairs as they are notified of leaks by residents and have started installing new type of joints to prevent leakage from the joints²⁹. However, the WUSCs are only capable of limited work and have no forecasts on how much the work will reduce non-revenue water rates. They are repairing leaks for joints on pipes when notified, new type of joints are only installed when any excavation is scheduled, and are only checking faulty meters which show no reading for water flow or are otherwise obviously faulty. As this could lead to medium and long-term financial instability, the WUSCs must conduct in-depth search of all leaks, identify the faulty meters and replace them quickly.

3.5.4 Current Status of Operation and Maintenance

While this has had no impact on project's effectiveness, malfunctioning of flow meters and some problems with monitoring panel displays, buzzers that would not sound, etc., were found at the time when this evaluation was conducted. Aside from Dhulabari, there were generally few problems with day to day maintenance of the other facilities and equipment. In Dhulabari, the problems were seen with the maintenance of slow filtration facilities and the frequency in which filter sand is washed. A field survey of this evaluation in December 2011 also revealed a roughly 0.5 liter per minute leakage in the premise of the purification plant.

The plants also have issues with upgrading equipment. According to some WUSC members, WSSDOs assisted the WUSCs to procure parts which can be obtained locally, but some parts such as filter sand and flow meters are not available locally. There are also issues with preventive maintenance; neither Dhulabari nor Gauradaha plants have long-term plans for equipment upgrades with financial backing³⁰ or equipment maintenance plans.

From the above, the operations and maintenance of this project in part, faced some systematic and technical issues and the existence of some concerns for future financial sustainability. Therefore sustainability of this project effect is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project places its objectives in increasing the population receiving safe and reliable water supply through improvements in water supply facilities in three local cities where there is an urgent need to improve the water supply conditions. As such, the objectives are consistent with those development needs and development policies of Nepal, as well as that of the aid policies of the Government of Japan, therefore the relevance is high. Although the outputs have been achieved almost as planned, the efficiency of the project may be rated as fair because the project duration extended compared to the original plan. The amount of water supply,

recording water distribution from the overhead tanks.

²⁹ Apart from the information confirmed during the interviews, the said Technical Cooperation Project is providing technical knowledge on; i) routine run of water distribution pipe routes and method of identifying and repairing leakage by checking air valves and gate valves; ii) installation and inspection of household water meter; iii) handling of claims on meter and exchange of meter.

³⁰ Both of the draft long-term business plans, which included equipment upgrading plan, for each WUSC were prepared as a part of assistance from the Technical Cooperation Project. However their equipment upgrading plans have few actual financial backing such as funding and installment saving that can cover the accrued expense, thus yet to demonstrate its validity.

population served, and water quality of the three water purification plants have mostly achieved their planned targets and the users' high level of satisfaction toward the water supply services revealed that the objective of this project, increasing the population served with safe drinking water, is evaluated to have been achieved. Therefore the project's effectiveness and impact is high. However, more efforts are required for the extension of water supply network in order to expand the effect of this project. Furthermore, despite the operators of the water supply facilities, the WUSCs were able to produce retained earnings, factors such as deficiencies found in its draft business plans by not having precise and sufficient financial backing to implement the planned replacement of equipment outlined in its draft long-term business plan, and the understanding that in the short-run the establishment of support mechanism to WUSC by WSSDO may be difficult despite the technical cooperation project currently supported by JICA, lead to the assessment that the sustainability of this project is fair.

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

4.2 Recommendations

4.2.1 Recommendations to Executing Agency and Operation and Maintenance Agency

(1) Enhancing the WSSDO support system for WUSCs

As mentioned in "3.5 Sustainability," the current JICA Technical Cooperation Project is in the process of building technical support systems and mechanisms for the WUSCs. While it is not clear how this project will establish such support systems and mechanisms, in order to improve the technical guidance aimed at WUSC quantitatively and qualitatively, there is a necessity to strengthen the capacity of WSSDOs by developing its staff capable of providing managerial supports. WSSDO is responsible in providing necessary guidance and training to WUSCs. Also, the WSSDOs need to increase the allocation of personnel who are capable of providing assistance for management aspect because current WSSDO staff members are mostly engineering backgrounds.

(2) Extending water distribution and service pipe network for water supply facilities

As mentioned in "3.2 Effectiveness," through the extension of water supply and distribution network, more people in the service areas would benefit from this project, but delays in the expansions of the networks are dragging down the achievement of this project. Dhulabari's achievement in population served was short of the target due to slow expansion of the water supply network. Gauradaha's achievement in effectiveness is high but the amount of water supply, which is caused by slow expansion of the water supply network, and thus could hinder the sustainability of the project's effectiveness. Based on the draft long term business plan, in Gaurada and Mangadh, population in the two water service areas are expected to grow, and as such, in Gauradaha, further effort on expansion of water distribution and service network is necessary to sustain the project's effect and also to meet the future increase in population.

(3) Water quality checks by designated examination agency, and awareness in water quality control

As stated in "3.2 Effectiveness," Dhulabari does not have water quality inspections and has low awareness in terms of water quality control and in improving water quality based on the examination results. As safe drinking water is a key issue in water supply, the WSSDO should promote the usage of external water quality examination agencies to periodically conduct water

quality tests. The WSSDO should assist Dhulabari WUSC members and the staff in charge of water quality checks to better understand the importance of controlling water quality. Also, it needs to properly monitor inspection status and results, follow up with technical guidance on water quality control as required.

4.2.2 Recommendations to JICA

(1) Strengthening managerial support system through the Technical Cooperation Project

As stated in “3.5 Sustainability”, in order for WUSC to be able to maintain and operate facilities in a fuller extent, managerial dimensions of their capacity must be strengthened. Not only should capacity building support to WUSC include facility maintenance skills but also skills for financial management. Further, there should have been a support system in place before the project commences to provide sufficient guidance both quantitatively and qualitatively for WUSCs throughout the project period. The current JICA Technical Cooperation Project needs to further strengthen short to mid-term managerial support contents³¹ for WUSC by giving guidance in preparing more practical long-term business plan and strengthen the WSSDO in terms of guiding on basis of monitoring data. It is perceived that such measures could further strengthen the effects of this project and improve sustainability.

4.3 Lessons Learned

(1) Appropriateness in setting the project target

The planned water supply target of this project was set based on the presupposition that the implementing agency, through its self-support or WSSDO, expand water distribution and service pipe network to the unconnected areas. Enlarging such water distribution network necessitates investment in facilities, but no evidence was found that verifying the feasibility of procuring such necessary funds at the planning stage. When setting project targets, if major influencing factors in achieving the planned target such as expanding the water supply pipe network exist, more prudent project scope by verifying the feasibility of funding for the capital investment plan made at the planning stage and cautious target setting should be considered.

(2) Guidance given to technical and managerial dimensions in the Technical Cooperation Project.

Management and technical expertise vary from WUSC to WUSC, and at the planning stage, the WSSDOs were providing the WUSCs insufficient technical support both qualitatively and quantitatively. These may have led to the necessity of having extensive external support provided from organizations such as ADB and JICA. In this project, such supports were provided a few years after the completion of the project, and as such, it could have been expected that the effect of this project may had been produce more rapidly, should such support had been provided on a more timely basis simultaneously to the implementation of this project. Any support for projects such as water purification facilities, which require both technical and managerial expertise and skills, should consider having the appropriate combination of technical cooperation and other support commensurate to the capacities of the managing entities at the planning stage of the project.

³¹ In addition, practical contents might be desirable using precise case studies to learn through discussions on problem solving and other exercises.