4(6) テクニカルノート 4（2021 年 4 月 27 日付）

Technical Notes (No.4)
on the Preparatory Survey for
the Project for Development of Water Supply Facilities of
Small Towns in Oromia Region

Based on the Minutes of Discussions on the Preparatory Survey for the Project for Development of Water Supply Facilities of Small Towns in Oromia Region (hereinafter referred to as "the Project") signed on the 4th April 2019 between the Preparatory Survey Team of the Japan International Cooperation Agency (hereinafter referred to as "the Team") and the Oromia Water and Energy Resources Development Bureau (hereinafter referred to as "OWERDB"), the consultant members of the Team held a series of discussions with the officials of the OWERDB and conducted a field survey. In the course of the discussions, both sides have confirmed the main items described in the attached sheets.

The Technical Note does not state any final result of the Preparatory Survey because the survey will continues and contains issues which are under considerations.

Addis Ababa, 27th April, 2021

吉川 健

Mr. Takeshi YOSHIKAWA
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ATTACHMENT

1. Results of Test Well Drilling and Water Quality Analysis

Re-pumping test was conducted from April 16th to 21st for the Gonde site, where the pumping test was pending. As a result of the continuous pumping test, a production volume of 3.84 l/s was observed.

Regarding the water quality test of the test well at the Gonde site, an abnormal value was detected in the total coliform by the laboratory, so we are currently collecting water quality samples again and retesting,in the laboratory. However, since no coliforms were detected in the field tests using coliform detection test paper, we suspect that the laboratory test results may be a test error in the process or an error in the water quality sampling. For other water quality parameters, the guideline values in the WHO guidelines for drinking water quality were satisfied. We are waiting for the result of the water quality retest of total coliform by the laboratory, but at least the production volume of the test well meets the success criteria (2.0 l/s) agreed at the Inception Report Meeting in April 2019, so we will proceed to the design work.

Table 1: Results of the Test Well Drilling

ID	Zone	Town	Drilling Depth (m)	Yield (L/sec)	Static Water Level (m)	Dynamic Water Level (m)	Diameter of the Well / Material
ES-6	East Shewa	Ude Dankaka	306	10.16	22.30	46.02	6 inches / Steel casing
ES-8	East Shewa	Kamise	330	9.09	52.20	55.75	6 inches / Steel casing
ES-10	East Shewa	Areda	246	9.07	116.70	122.40	6 inches / Steel casing
ES-11	East Shewa	Biyo	225	10.72	32.65	33.27	6 inches / Steel casing
AR-2	Arsi	Bolo	232	4.93	129.33	130.79	6 inches / Steel casing
AR-4	Arsi	Aseko	550	Dry hole			
AR-6-1	Arsi	Gonde	316	Dry hole			
AR-6-2	Arsi	Gonde	550	3.84	320.80	332.80	8 inches / Steel casing
Total drilling depth (m)			2,755	**	**	**	**
Average drilling depth per one test well (m)			344	**	**	**	**

Table 2: Results of the Water Quality Analysis

No.	Item		WHO Guideline		ES-6 Ude Dankaka	ES-8 Kamise	ES-10 Areda	ES-11 Biyo	AR-2 Bolo	AR-6 Gonde2
			Guideline value	Acceptable value						
1	pH		-	6.5 - 8.5	7.31	7.20	6.69	6.81	7.54	7.93
2	T. Dissolved Solid	mg/L	-	1000.0	390.00	322.00	349.00	362.00	253.00	133.10
3	Sodium (Na^+)	mg/L	-	200.0	50.00	43.00	27.00	48.00	29.50	11.30
4	Potassium (K^+)	mg/L	-	-	10.50	12.60	6.60	12.30	8.00	4.60
5	Total Iron (Fe^{2+} & Fe^{3+})	mg/L	-	0.30	0.28	0.15	0.35	0.06	0.15	Trace
6	Ammonia (NH_3-N)	mg/L	-	1.50	0.19	0.28	0.23	0.26	0.09	0.3
7	Total Hardness ($Ca\ CO_3$)	mg/L	-	500.0	241.30	191.90	225.75	247.52	193.44	41.88
8	Alkalinity ($Ca\ CO_3$)	mg/L	-	-	365.20	301.92	275.00	337.84	268.38	107.12
9	Chloride (Cl^-)	mg/L	-	250.0	14.91	10.93	3.98	17.89	9.94	4.97
10	Sulphate (SO^{2-}_4)	mg/L	-	250.0	8.12	7.37	1.19	12.60	Trace	2.99

No.	Item		WHO Guideline		ES-6 Ude Dankaka	ES-8 Kamise	ES-10 Areda	ES-11 Biyo	AR-2 Bolo	AR-6 Gonde2
			Guideline value	Acceptable value						
11	Aluminum (AL)	mg/L	-	0.20	Trace	Trace	Trace	Trace	Trace	Trace
12	Zinc (Zn)	mg/L	-	4.00	0.04	0.01	0.03	0.04	0.00	Trace
13	Manganese (Mn)	mg/L	0.40	0.10	Trace	Trace	Trace	Trace	Trace	Trace
14	Nitrate (NO_3-N)	mg/L	50.00 (acute)	-	1.19	0.88	0.21	1.61	0.68	0.62
15	Nitrite (NO_2-N)	mg/L	3.00 (acute)	-	0.005	0.006	0.010	0.007	0.003	0.037
16	Flouride (F^-)	mg/L	1.50	-	0.78	0.98	1.10	1.10	0.71	0.92
17	Barium (Ba)	mg/L	0.70	-	Trace	Trace	Trace	Trace	Trace	Trace
18	Copper (Cu)	mg/L	2.00	-	Trace	Trace	Trace	Trace	Trace	Trace
19	Chromium (Cr^{+6})	mg/L	0.05	-	Trace	Trace	Trace	Trace	Trace	0.02
20	Boron (B)	mg/L	2.40	-	0.34	0.10	0.03	0.11	Trace	0.30
21	Total Coliform (100 mL)		Undetec table	-	—	Nil	Nil	4.00	—	*1
22	E-coil (100 mL)		Undetec table	-	—	Nil	Nil	Nil	—	Nil
23	EC (Electrical Conductivity)	µS/cm	-	-	710.00	586.00	635.00	663.00	472.00	242.00
24	Total Solids 105 °C	mg/L	-	-	400.00	326.00	358.00	366.00	262.00	138.00
25	Tubidity (NTU)	NTU	-	5.00	0.56	0.75	0.70	0.80	1.25	0.75
26	Calcium (Ca^{2+})	mg/L	-	-	61.56	56.56	63.64	57.41	52.42	15.81
27	Magnesium (Mg^{2+})	mg/L	-	-	20.98	12.12	16.00	24.96	14.98	10.05
28	Carbonate (CO_3^{2-})	mg/L	-	-	Nil	Nil	Nil	Nil	Nil	Nil
29	Bicarbonate (HCO_3^-)	mg/L	-	-	445.54	368.34	335.50	412.16	327.42	130.69
30	Phosphate (PO_4^{3-}-P)	mg/L	-	-	0.29	0.37	0.08	0.10	0.21	0.36

Note: Institution of laboratory: Ethiopian Construction Design & Supervision Works Corporation
*1: under re-testing

2. The Third Screening Work of the Target Towns

As shown in Annex 1 of the Technical Notes (No.3) on April 1, 2021, we will calculate the operation and maintenance cost (water supply cost) of water supply scheme in 6 target towns (Ude Dhankaka, Kamise, Areda, Biyo, Bolo and Gonde) after the design work. This results will then be used for the third screening of the target town. Specifically, if the water supply cost exceeds the amount of residents' willingness to pay for water and the payable amount of each household obtained from household income[1], this town may be excluded from the target of the Project.

3. Protection of Test Drilling Wells

Regarding the test drilling wells constructed in this preparatory survey, the test drilling well at the Gonde site may be converted to production well at the construction stage, and the test drilling wells at other sites (See Annex 1) are also used as observation wells and reserve water sources. OWERDB shall maintain, protect, and not use the test drilling wells until the construction stage begins. In case defects that is not related to construction quality or caused by natural causes were identified before the construction stage begins, OWERDB will be responsible for repairing them, otherwise the site will be excluded from the Project.

[1] Payable amount for water charges: The World Bank estimates that it is about 4% of household income.

4(7) 討議議事録（2021年8月27日付）

Minutes of Discussions
on the Preparatory Survey for
the Project for Development of Water Supply Facilities of Small Towns
in Oromia Region
(Explanation on Draft Preparatory Survey Report)

With reference to the minutes of discussions signed between Oromia Water and Energy Resources Development Bureau and the Japan International Cooperation Agency (hereinafter referred to as "JICA") on 4th April 2019 and in response to the request from the Government of Federal Democratic Republic of Ethiopia (hereinafter referred to as "Ethiopia") dated 11th November 2016, JICA dispatched the Preparatory Survey Team (hereinafter referred to as "the Team") for the explanation of Draft Preparatory Survey Report (hereinafter referred to as "the Draft Report") for the Project for Development of Water Supply Facilities of Small Towns in Oromia Region (hereinafter referred to as "the Project").

As a result of the discussions, both sides agreed on the main items described in the attached sheets.

Addis Ababa, 27th August, 2021
Tokyo, 27th August, 2021

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ATTACHEMENT

1. Objective of the Project

   The objective of the Project is to improve access to safe drinking water through installing piped water supply facilities in the target small towns of Oromia Region, thereby contributing to the improvement of livehoods through reduction of waterborne diseases and burden on collecting water.

2. Title of the Preparatory Survey

   Both sides confirmed the title of the Preparatory Survey as "the Preparatory Survey for the Project for Development of Water Supply Facilities of Small Towns in Oromia Region".

3. Project Site

   Both sides confirmed that the sites of the Project are in Small Towns of East Shewa Zone (Ude Dhankaka, Biyo, Kamise and Areda) and Arsi Zone (Bolo and Gonde) in Oromia Region, which is shown in Annex 1.

4. Responsible Authority for the Project

   Both sides confirmed the authorities responsible for the Project are as follows:
   The Oromia Water and Energy Resources Development Bureau will be the executing agency for the Project (hereinafter referred to as "the Executing Agency"). The Executing Agency shall coordinate with all the relevant authorities to ensure smooth implementation of the Project and ensure that the undertakings for the Project shall be taken care by relevant authorities properly and on time. The organization charts are shown in Annex 2.

5. Contents of the Draft Report

   After the explanation of the contents of the Draft Report by the Team, the Ethiopian side agreed to its contents. JICA will finalize the Preparatory Survey Report based on the confirmed items. The report will be sent to the Ethiopian side around December 2021.

6. Cost Estimate

   Both sides confirmed that the cost estimate including the contingency described in Annex 5, Major Undertakings To Be Taken by the Government of Ethiopia, and total

grant cost are provisional, and total grant cost will be examined further by the Government of Japan for its approval. The contingency would cover the additional cost against natural disaster, unexpected natural conditions, etc.

7. Confidentiality of the Cost Estimate and Technical Specifications
Both sides confirmed that the cost estimate and technical specifications of the Project should never be disclosed to any third parties until all the contracts under the Project are concluded.

8. Procedures and Basic Principles of Japanese Grant
The Ethiopian side agreed that the procedures and basic principles of Japanese Grant (hereinafter referred to as "the Grant") as described in Annex 3 shall be applied to the Project. In addition, the Ethiopian side agreed to take necessary measures according to the procedures.

9. Timeline for the Project Implementation
The Team explained to the Ethiopian side that the expected timeline for the project implementation is as attached in Annex 4.

10. Expected Outcomes and Indicators
Both sides agreed that key indicators for expected outcomes are as follows. The Ethiopian side will be responsible for the achievement of agreed key indicators targeted in year 2029 and shall monitor the progress for Ex-Post Evaluation based on those indicators.

[Quantitative indicators]

Indicator	Baseline Value (Year 2020)	Expected Value (Year 2029)
Daily water supply Amounts (m^3/day) *1	109 *2	1,952 *3
Population served (people)	14,800 *4	47,279
Daily water consumptions per capita (L/person/day)	7.4 *5	40 *6

*1 Planned Average Daily Water in the target area, not including water loss such as water leakage.

*2 Calculated water supply amount of existing piped water supply facilities for the past three years.

*3 The amount of newly developed water by the project is 1,844 m^3/day

*4 Based on the results of interviews with three towns with existing piped water supply facilities. Areda: 478 households x 4.28 persons per household (socio-economic survey results) = 2,046 persons, Bolo: 10,000 people, Gonde: 675 households x 4.08 persons per household (socio-economic survey results) = 2,754 people

*5 Per capita water consumptions in terms of water supply for individual tap and public tap users accessing existing piped system facilities. 109m^3/day x 1,000 ÷14,800 = 7.4

*6 According to Ten Years Development Plan 2021-2030 by the Government of Ethiopia (MoWIE) Water consumptions per capita in terms of water supply for individual tap and public tap users accessing existing piped system facilities in 2029.

[Qualitative indicators]

(1) Reduction of the burden of water collection
(2) Reduction of water-borne diseases
(3) Ensuring safe water in schools and Health Center
(4) Helping improve nutrition through reduction of diarrheal diseases

11. Ex-Post Evaluation

JICA will conduct ex-post evaluation after four (4) years from the project completion, in principle, with respect to six (6) evaluation criteria (Relevance, Effectiveness, Coherence, Efficiency, Impact, and Sustainability). The result of the evaluation will be publicized. The Ethiopian side is required to provide necessary support for the data collection.

12. Technical Assistance ("Soft Component" of the Project)

Considering the sustainable operation and maintenance of the products and services granted through the Project, following technical assistance, including transfer of technical skills and management know-how, is planned under the Project. The Ethiopian side confirmed to establish "Town Water Board" and "Town Water Supply and Sanitation Services Enterprises (hereinafter referred to as "the Water Utility") in each 6 small town in the beginning of Construction Stage, and to deploy necessary number of counterparts who are appropriate and competent in terms of its purpose of the technical assistance as described in the Draft Report.

13. Undertakings of the Project

Both sides confirmed the undertakings of the Project as described in Annex 5 and the

responsible organizations to bear customs duties, internal taxes and other fiscal levies as described in Annex 6 respectively.

(1) Both sides particularly confirmed that indirect taxes, such as value added tax (VAT), withholding tax, technical service tax and stamp duties, which may be imposed in Ethiopia with respect to the purchase of the products and/or the services, shall be borne by the Executing Agency without using the Grant.

(2) With respect to custom duties related to the Project, both sides confirmed the tax shall be exempted or otherwise be borne by the Executing Agency.

(3) The Ethiopian side assured to take necessary measures and coordination including allocation of the necessary budget which are preconditions of implementation of the Project as it is described in Annex 5.

(4) The Executing Agency plans to apply the budget for the Project through Bureau of Finance Economic Cooperation of Oromia Regional State (hereinafter referred to as "the BoFEC") to the Oromia Regional Council around November, 2021. Budget allocation for 2021/2022 fiscal year will be done by December 2021, before the start of detailed design, as the current plan.

(5) In terms of the bearing of indirect taxes, the Executing Agency needs budget allocation from BoFEC. Both sides confirmed that the Executing Agency will finish necessary procedure to secure the budget allocation for 2022/2023 fiscal year from BoFEC before December 2022.

(6) The Ethiopian side assured to complete land acquisition at least two (2) months before the pre-qualification review to participate in the bid which is currently planned at the end of May 2022.

(7) Both sides confirmed that the Ethiopian side will ensure necessary amount of budget for the whole project period.

(8) It is further agreed that the costs are indicative, i.e. at the Outline Design level. More accurate costs will be calculated at the Detailed Design Stage. Both sides also confirmed that Annex 5 will be used as an attachment of Grant Agreement (G/A).

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14. Monitoring During the Implementation

The Project will be monitored by the Executing Agency and reported to JICA by using the form of Project Monitoring Report (PMR) attached as Annex 7. The timing of submission of the PMR is described in Annex 5.

15. Project Completion

Both sides confirmed that the project completes when all the facilities constructed and equipment procured by the Grant are in operation. The completion of the Project will be reported to JICA promptly by the Executing Agency, but in any event not later than six months after completion of the Project.

16. Environmental and Social Considerations

16-1 General Issues

16-1-1 Environmental Guidelines and Environmental Category

The Team explained that 'JICA Guidelines for Environmental and Social Considerations (April 2010)' (hereinafter referred to as "the Guidelines") is applicable for the Project. The Project is categorized as B because the project is not considered to be a large-scale water supply project, and has none of the sensitive characteristics under the JICA guidelines for environmental and social considerations (April 2010), it is not likely to have a significant adverse impact on the environment.

16-1-2 Environmental Checklist

The environmental and social considerations including major impacts and mitigation measures for the Project are summarized in the Environmental Checklist attached as Annex 8. Both sides confirmed that in case of major modification of the content of the Environmental Checklist, the Ethiopian side shall submit the modified version to JICA in a timely manner.

16-2 Environmental Issues

16-2-1 Environmental Impact Assessment (EIA)

Both sides confirmed the EIA report has been approved by Oromia Environment Forest and Climate Change Authority (hereinafter referred to as "OEFCCA") in September, 2020. The Ethiopian side agreed JICA's disclosure of provided EIA report on its website.

16-2-2 Environmental Management Plan and Environmental Monitoring Plan

Both sides confirmed Environmental Management Plan (EMP) and Environmental

Monitoring Plan (EMoP) of the Project is as Annex 9, respectively. Both side agreed that environmental mitigation measures and monitoring shall be conducted based on the EMP and EMoP, which may be updated during the Detailed Design Stage.

16-2-3 Other Specific Environmental Issues which Need to Be Confirmed/Agreed Between the Parties.

Both sides confirmed that among the project sites, two (2) towns (Gonde and Bolo) are located in the Arsi Mountains National Park (hereinafter referred to as "protected area") and five (5) towns (Ude Dhankaka, Kamise, Biyo, Gonde and Bolo) are located in or near the Key Biodiversity Area (KBA), which is considered as critical natural habitats. However, the project area consists of agricultural land and urban areas, and the project implementation in the area has been approved by OEFCCA , Ethiopian Wildlife Conservation Authority (hereinafter referred to as "EWCA") and Oromia Forest and Wildlife Enterprise (hereinafter referred to as "OFWE"). Moreover, residents have agreed to the project, and the EIA has been approved as mentioned in 16-2-1. The scale of the project is small and impacts are expected to be minimum as appropriate mitigation measures and monitoring will be implemented. It has also been confirmed that the requirements for exceptions in protected areas and critical natural habitats shall be met as following;

(1) Protected Areas

The Team explained that according to the JICA Environmental Guidelines, projects must, in principle, be undertaken outside of protected areas that are specifically designated by laws or ordinances for the conservation of nature or cultural heritage. Projects in protected areas will be acceptable only when there are no technically and financially feasible alternatives and the Executing Agency will;

(a) Demonstrate that the proposed development in such areas is legally permitted.

(b) Act in a manner consistent with any government recognized management plans for such areas.

(c) Consult protected area sponsors and managers, Affected Communities, Indigenous Peoples and other stakeholders on the proposed project, as appropriate.

(d) Implement additional programs, as appropriate, to promote and enhance the conservation aims and effective management of the area.

Both sides confirmed the above matters in August 2021.

(2) Critical Natural Habitat

Both sides confirmed that "Koffole Forest" and "Chelekleka Lake and Swamp" are considered as the critical natural habitat in which projects must not involve significant conversion or significant degradation according to the JICA Environmental Guidelines. Any project activities that have potential adverse impacts shall not be implemented unless all of the following conditions are met;

(a) The project does not lead to measurable adverse impacts on those biodiversity values for which the critical habitat was designated, and on the ecological processes supporting those biodiversity values.

(b) The project does not lead to a net reduction in the global and/or national/regional population of any Critically Endangered or Endangered species over a reasonable period of time.

(c) A robust, appropriately designed, and long-term biodiversity monitoring and evaluation program is integrated into the client's management program.

Both sides confirmed the above matters in August 2021.

16-3 Social Issues

16-3-1 Land Acquisition and Resettlement

It was confirmed by OEFCCA that Resettlement Action Plan (RAP) is not required for the Project due to the limited scale of the Project and the expected number of relocated households. Both sides confirmed the about 0.64 ha of land would be acquired and 45 households (250 persons) would be affected due to the implementation of the Project. Such land acquisition shall be implemented based on the Report on Land Acquisition and Resettlement as in Annex 10 which was prepared in line with the Guidelines and its procedure and compensation coverage were approved by the Executing Agency in August, 2021.

16-3-2 Other Specific Social Issues Which Need to Be Confirmed between the Parties

The Executing Agency assured that when new Project Affected Persons (hereinafter referred to as "PAPs") with new attributes arise, the Executing Agency will update Entitlement Matrix and submit it to JICA after Detailed Design as needed.

Both sides agreed that if Entitlement Matrix is updated, resettlement activities will be implemented only after the review by JICA of the updated Report on Land Acquisition and Resettlement (especially Entitlement Matrix) as Annex 10 based on the Detailed Design.

16-3-3 Payment

Both sides confirmed that any physical impact by land acquisition such as displacement may not occur before full payment of compensation. Civil work shall be started only in the sections where PAPs are paid prior compensation, and relocation and/or clearance of land are completed.

16-4 Environmental and Social Monitoring

16-4-1 Environmental Monitoring

Both sides agreed that the Ethiopian side will submit results of environmental monitoring to JICA with PMR by using the monitoring form attached as Annex 11. The timing of submission of the monitoring form is described in Annex 5.

16-4-2 Social Monitoring

Both sides confirmed that the Ethiopian side will implement social monitoring about land acquisition proposed in the Annex 10 and 11.

Both sides agreed that the Executing Agency will submit results of social monitoring to JICA with PMR by using the monitoring form attached as Annex 11.

16-4-3 Information Disclosure of Monitoring Results

Both sides confirmed that the Ethiopian side will disclose results of environmental and social monitoring to local stakeholders in their town administrative offices.

The Ethiopian side agreed JICA will disclose results of environmental and social monitoring submitted by the Ethiopian side as the monitoring forms attached as Annex 11 on its website.

16-4-4 Stakeholder Meeting

Both sides confirmed that local stakeholder meetings on the Project with relevant stakeholders and local residents were held by the local authorities in conjunction with the Executing Agency at the respective small towns from December 2019 to January 2020. Stakeholder meetings were organized by inviting stakeholders of all small towns in which the Project will be implemented and announcement was delivered through the Town Administrative Offices. Questions regarding the Project completion period and the planned water service areas were raised by attendees, however, there were no major objections to the implementation of the Project.

17. Other Relevant Issues

17-1 Disclosure of Information

Both sides confirmed that the Preparatory Survey Report, from which project cost is

excluded, will be disclosed to the public after completion of the Preparatory Survey. The comprehensive report including the project cost will be disclosed to the public after all the contracts under the Project are concluded.

17-2 Gender Mainstreaming

Both sides confirmed that gender mainstreaming should be duly practiced for the Project implementation. In particular, both sides agreed on the following gender elements to be incorporated into the Project activities.

(1) Gender balance should be taken account when assigning members of each Water Board and Water Utility in implementation of soft-component activities.
(2) Includes provisions for providing water supply services to the socially vulnerable in the articles of incorporation or operating regulations of each Water Utility.

(3) Includes provisions in the articles of incorporation or operating regulations of each Water Utility to ensure female member's participation during the decision making process in each Water Board and Water Utility.

17-3 Handling Test Boreholes

(1) Both sides confirmed that six(6) test boreholes in 6 Small Towns (Ude Dhankaka, Biyo, Kamise and Areda, Bolo and Gonde) during the Preparatory Survey were certified as successful boreholes based on the criteria for successful wells, and it was confirmed that one (1) test borehole in Gonde is suitable for conversion to a production well in the Construction Stage.

(2) Five (5) test boreholes except for the Gonde site which are 6 inch diameter boreholes may be used for the production boreholes in case that required production boreholes are not secured within the planned project scope in the Construction Stage.

(3) Both sides confirmed that pumping test and a water quality test shall be conducted by the Japanese side at the time of Detailed Design Stage in order to confirm the changes in the characteristics of the test boreholes. The detailed flow of handling the test boreholes is as shown in Annex 12. The Ethiopian side agreed on the policy for handling test boreholes as shown in Annex 12.

17-4 Protection of the Test Boreholes

Both sides agreed on the responsibility for the test boreholes as shown in Annex 12

as follows:

(1) The Japanese side doesn't take any responsibility of structural defects inside the test boreholes after the Preparatory Survey.

(2) The Ethiopian side shall maintain, protect, and not use the test boreholes until the Construction Stage begins. In case that defects which is not related to construction quality or caused by natural causes were identified before the Construction Stage begins, the Ethiopian side will be responsible for repairing them, otherwise the sites will be excluded from the Project.

(3) With regard to the test boreholes which will be converted to the production boreholes, the Ethiopian side will transfer the responsibility of the test boreholes as mentioned above (2) to Japanese contractor soon after the Construction Stage begins, after the necessary verification of its maintenance condition. After all the facilities constructed and equipment procured, the responsibility of the test boreholes will be transferred to the Ethiopian side again.

(4) In case that the test boreholes converted to the production boreholes, were discovered inadequate to use due to changing condition of aquifer or abnormal seasonal fluctuation after the completion of the Project, the Ethiopian side will inform the Japanese side within 3 years after the completion of the Project and both sides will discuss further actions.

17-5 Scope and Procedures of Drilling Works in the Construction Stage

Both side agreed that a Japanese contractor will conduct maximum eleven (11) drillings during the Construction Stage to secure eight (8) boreholes in total, (Ude Dhankaka (2), Biyo(1), Kamise(1), Areda(1), Bolo (2) and Gonde (1)), to be the production boreholes based on the results of the Preparatory Survey.

Since it is an area where groundwater development is difficult, the design yield per borehole was calculated based on the results of test drilling of the Preparatory Survey and the water demand at each site.

The boreholes will be considered as unsuccessful wells if the water quality is inappropriate for drinking purpose nor the yield is not enough for piped water supply schemes. The detailed process of drilling works in the Construction Stage is as shown in Annex 13. The Ethiopian side agreed on the policy for drilling works in the Construction Stage as shown in Annex 13.

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(1) When eight (8) boreholes to be production boreholes are secured before completion of drilling eleven (11) boreholes, the drilling works will be completed. The boreholes which are confirmed to be unsuccessful for the production boreholes will be dealt with as follows;

(a) Back-filled and seal the boreholes, if it is dry or the water quality is inappropriate for drinking purpose or the Ethiopian side doesn't request.

(b) Handing over to the Ethiopian side if requested, but only if the water quality is within the Ethiopian water quality standard and/or WHO drinking water guidelines.

(2) When eight (8) production boreholes could not be secured by drilling eleven (11) boreholes, both sides will discuss further actions as following.

(a) Considering additional number of drillings on limited budget by both sides.

(b) Considering conversion from the test boreholes to the production boreholes.

(c) However, as a worst-case scenario, both sides confirmed that if the test borehole cannot be converted to a production well because it does not meet the required performance due to a change in characteristics, this small town will be excluded from the scope of cooperation in the Project.

17-6. Necessary Matters for Operation and Maintenance of Water Supply Facilities

The Ethiopian side confirmed necessary matters for operation and maintenance of water supply facilities as follows.

(1) Assignment of Staffs of Each Water Utility

The staffs to be assigned to each Water Utility will be based on the hiring policy of existing Water Utility, and the Ethiopian side will incorporate conditions related to work experience in each position.

(2) Ensuring the Implementation of Operation and Maintenance System

The Executing Agency shall secure the necessary costs, personnel, and support systems to ensure that the water supply facilities developed under the Project are operated, maintained, and managed properly and effectively.

In particular,

(a) The Executing Agency shall make sure that both East Shewa and Arsi Zonal Water and Energy Resources Development Offices (hereinafter referred to as "ZWERDOs") shall supervise each Water Utility appropriately. The Executing Agency shall continue to provide support to the each Town Water Board and Water Utility during and after the Construction Stage.

(b) The Executing Agency shall provide necessary supports including costs for the maintenance and renewal of water supply facilities that cannot be handled by the Water Utility and technical service to each Water Utility for the maintaining sustainable water supply services. Especially for Gonde Town, the difference between necessary costs and the payability shall be covered by the Executing Agency because the operating and maintenance costs are higher than the payability by the residents, which is considered as 5% of the annual household income, and the amount of willingness to pay.

(c) Installation of Service Pipes for House Connection

Both sides confirmed that the residents shall bear the expenses for installation of service pipes and required accessories for house connection. The Executing Agency shall supervise and promote the appropriate installation work for house connection. The Ethiopian side requested equipment and tools for installation of house connection. The Japanese side explained that it is difficult to support due to the budget limitation.

17-7. Power Source of Water Supply Facilities

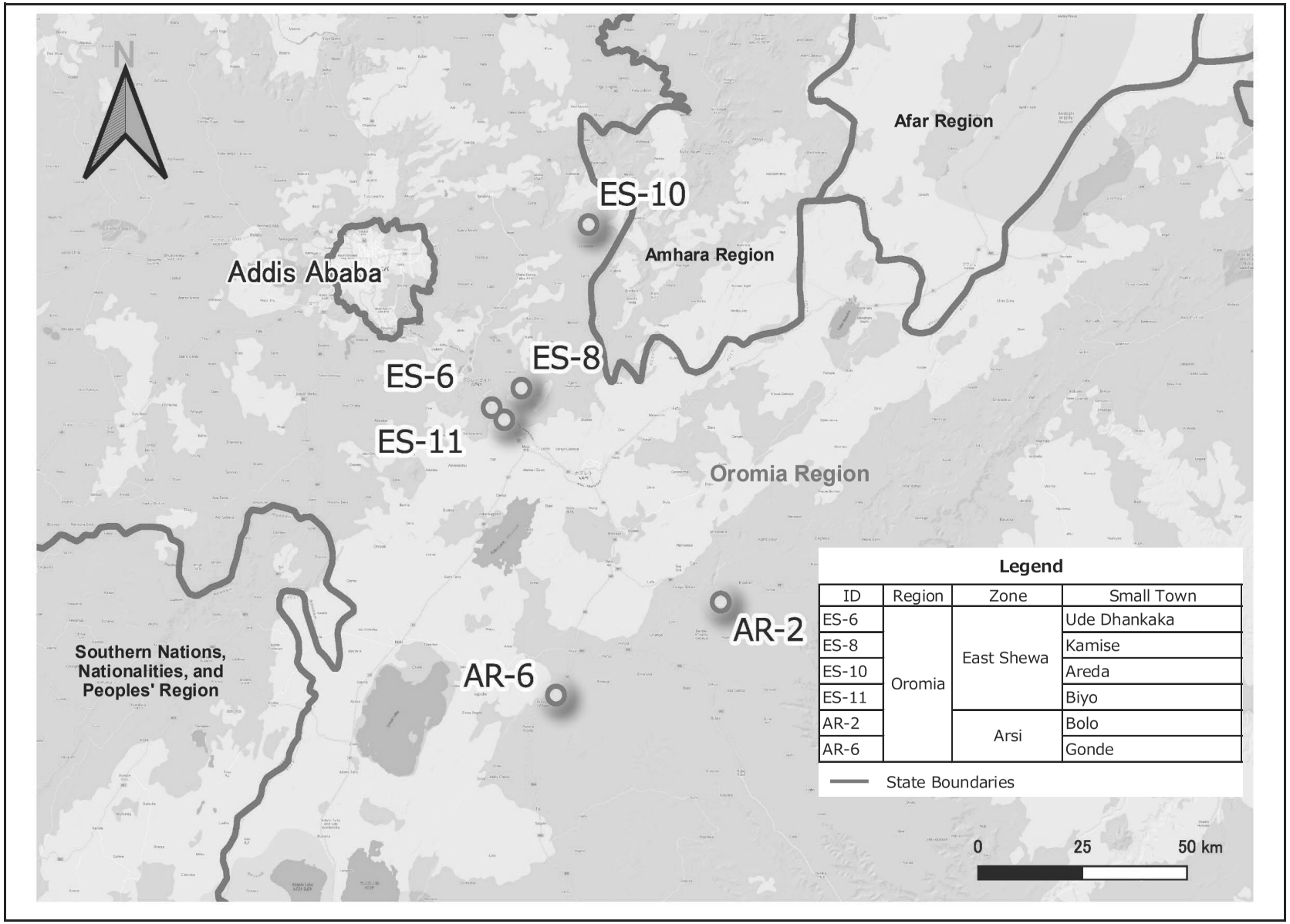
The Ethiopian side agreed that the power source for water supply facilities are basically commercial electricity, and a diesel generator will be installed as a backup power source. As for Kamise Town where does not have an electrification plan, a hybrid power generation system that uses both solar power and diesel generators will be adopted. The Ethiopian side requested to install solar systems or hybrid power generation systems for the other 5 small towns as well, because the Ethiopian Government promotes clean and renewable energy. The Japanese side explained that it is difficult to install due to the budget limitation and technical consideration.

17-8. Adaptation and Mitigation for Climate Change

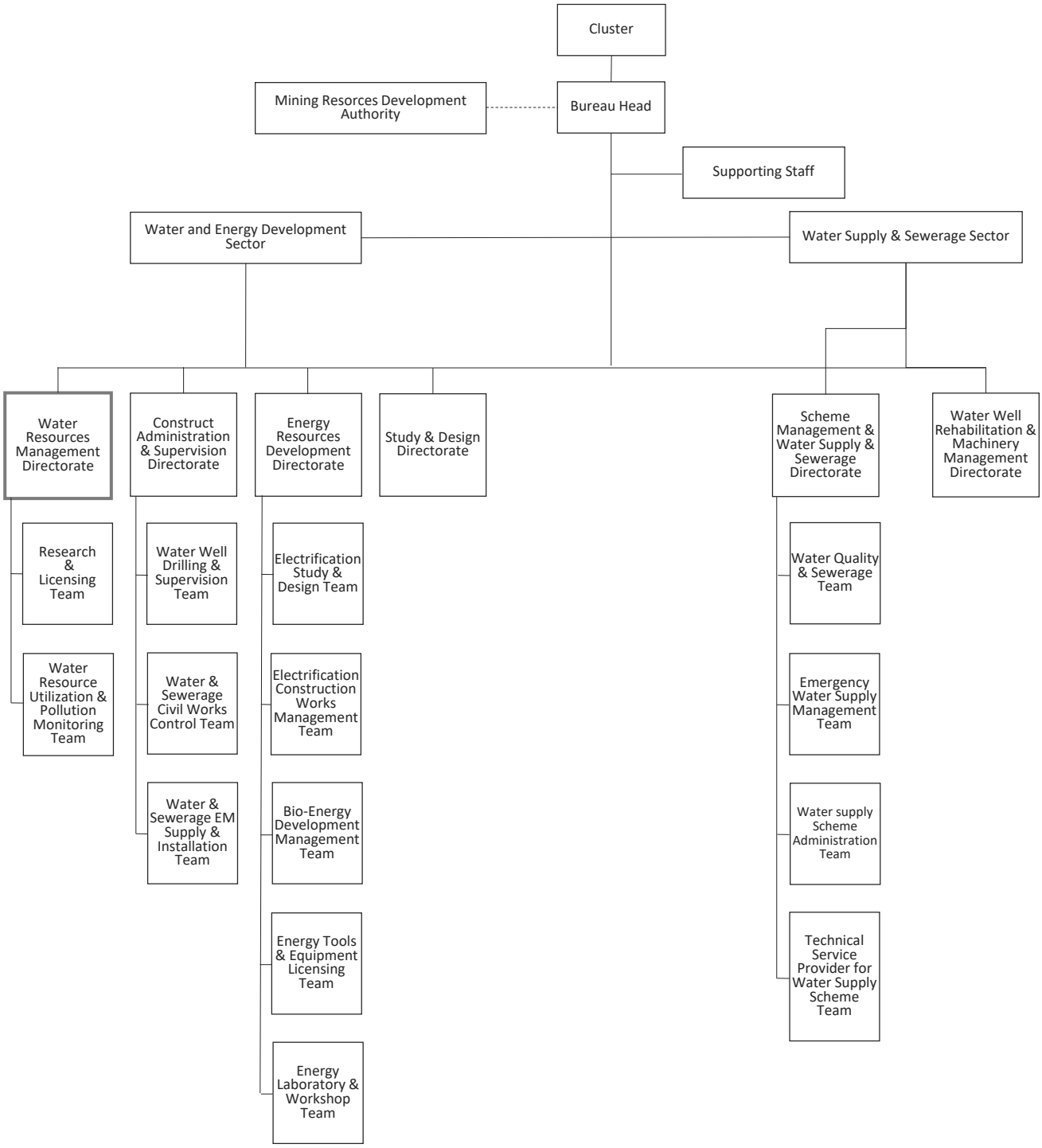
Both sides confirmed that the Project will contribute to climate change adaptation measures by adopting deep groundwater as its water source since the impact on the water quality and amount of the groundwater are smaller than surface water even if heavy rainfall and floods increase due to climate change. Since a hybrid system (solar power and generator) will be adopted in Kamise Town, it will contribute to the reduction of Green House Gas (GHG) emissions and thus contribute to the mitigation of climate change.

Annex 1 Project Site
Annex 2 Organization Chart
Annex 3 Japanese Grant
Annex 4 Project Implementation Schedule
Annex 5 Major Undertakings to be taken by the Government of Ethiopia
Annex 6 Responsible Organizations to Bear Customs Duties, Internal Taxes and Other Fiscal Levies
Annex 7 Project Monitoring Report (PMR) (template)
Annex 8 Environmental Check List
Annex 9 Environmental Management Plan (EMP) / Environmental Monitoring Plan (EMoP)
Annex 10 Land Acquisition and Resettlement
Annex 11 Environmental and Social Monitoring Form
Annex 12 Policy on Handling Test Boreholes Developed in the Preparatory Survey
Annex 13 Countermeasures to be taken when the Required Production Boreholes cannot be secured in the Construction Stage

Annex 1: Project Site



Annex 2: Organization Chart



JAPANESE GRANT

The Japanese Grant is non-reimbursable fund provided to a recipient country (hereinafter referred to as “the Recipient”) to purchase the products and/or services (engineering services and transportation of the products, etc.) for its economic and social development in accordance with the relevant laws and regulations of Japan. Followings are the basic features of the project grants operated by JICA (hereinafter referred to as “Project Grants”).

1. Procedures of Project Grants

Project Grants are conducted through following procedures (See “PROCEDURES OF JAPANESE GRANT” for details):

(1) Preparation

- The Preparatory Survey (hereinafter referred to as “the Survey”) conducted by JICA

(2) Appraisal

-Appraisal by the government of Japan (hereinafter referred to as “GOJ”) and JICA, and Approval by the Japanese Cabinet

(3) Implementation

Exchange of Notes

-The Notes exchanged between the GOJ and the government of the Recipient

Grant Agreement (hereinafter referred to as “the G/A”)

-Agreement concluded between JICA and the Recipient

Banking Arrangement (hereinafter referred to as “the B/A”)

-Opening of bank account by the Recipient in a bank in Japan (hereinafter referred to as "the Bank") to receive the grant

Construction works/procurement

-Implementation of the project (hereinafter referred to as “the Project”) on the basis of the G/A

(4) Ex-post Monitoring and Evaluation

-Monitoring and evaluation at post-implementation stage

2. Preparatory Survey

(1) Contents of the Survey

The aim of the Survey is to provide basic documents necessary for the appraisal of the the Project made by the GOJ and JICA. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of

relevant agencies of the Recipient necessary for the implementation of the Project.

- Evaluation of the feasibility of the Project to be implemented under the Japanese Grant from a technical, financial, social and economic point of view.
- Confirmation of items agreed between both parties concerning the basic concept of the Project.
- Preparation of an outline design of the Project.
- Estimation of costs of the Project.
- Confirmation of Environmental and Social Considerations

The contents of the original request by the Recipient are not necessarily approved in their initial form. The Outline Design of the Project is confirmed based on the guidelines of the Japanese Grant.

JICA requests the Recipient to take measures necessary to achieve its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the executing agency of the Project. Therefore, the contents of the Project are confirmed by all relevant organizations of the Recipient based on the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Survey, JICA contracts with (a) consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

(3) Result of the Survey

JICA reviews the report on the results of the Survey and recommends the GOJ to appraise the implementation of the Project after confirming the feasibility of the Project.

3. Basic Principles of Project Grants

(1) Implementation Stage

1) The E/N and the G/A

After the Project is approved by the Cabinet of Japan, the Exchange of Notes (hereinafter referred to as “the E/N”) will be singed between the GOJ and the Government of the Recipient to make a pledge for assistance, which is followed by the conclusion of the G/A between JICA and the Recipient to define the necessary articles, in accordance with the E/N, to implement the Project, such as conditions of disbursement, responsibilities of the Recipient, and procurement conditions. The terms and conditions generally applicable to the Japanese Grant are stipulated in the “General Terms and Conditions for Japanese Grant (January 2016).”

2) Banking Arrangements (B/A) (See “Financial Flow of Japanese Grant (A/P Type)” for details)

a) The Recipient shall open an account or shall cause its designated authority to open an account under the name of the Recipient in the Bank, in principle. JICA will disburse the Japanese Grant in Japanese yen for the Recipient to cover the obligations incurred by the Recipient under the verified contracts.

b) The Japanese Grant will be disbursed when payment requests are submitted by the Bank to JICA under an Authorization to Pay (A/P) issued by the Recipient.

3) Procurement Procedure

The products and/or services necessary for the implementation of the Project shall be procured in accordance with JICA’s procurement guidelines as stipulated in the G/A.

4) Selection of Consultants

In order to maintain technical consistency, the consulting firm(s) which conducted the Survey will be recommended by JICA to the Recipient to continue to work on the Project’s implementation after the E/N and G/A.

5) Eligible source country

In using the Japanese Grant disbursed by JICA for the purchase of products and/or services, the eligible source countries of such products and/or services shall be Japan and/or the Recipient. The Japanese Grant may be used for the purchase of the products and/or services of a third country as eligible, if necessary, taking into account the quality, competitiveness and economic rationality of products and/or services necessary for achieving the objective of the Project. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm, which enter into contracts with the Recipient, are limited to "Japanese nationals", in principle.

6) Contracts and Concurrence by JICA

The Recipient will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be concurred by JICA in order to be verified as eligible for using the Japanese Grant.

7) Monitoring

The Recipient is required to take their initiative to carefully monitor the progress of the Project in order to ensure its smooth implementation as part of their responsibility in the G/A, and to regularly report to JICA about its status by using the Project Monitoring Report (PMR).

8) Safety Measures

The Recipient must ensure that the safety is highly observed during the implementation of the Project.

9) Construction Quality Control Meeting

Construction Quality Control Meeting (hereinafter referred to as the “Meeting”) will be held for quality assurance and smooth implementation of the Works at each stage of the Works. The member of the Meeting will be composed by the

Recipient (or executing agency), the Consultant, the Contractor and JICA. The functions of the Meeting are as followings:

a) Sharing information on the objective, concept and conditions of design from the Contractor, before start of construction.

b) Discussing the issues affecting the Works such as modification of the design, test, inspection, safety control and the Client's obligation, during of construction.

(2) Ex-post Monitoring and Evaluation Stage

1) After the project completion, JICA will continue to keep in close contact with the Recipient in order to monitor that the outputs of the Project is used and maintained properly to attain its expected outcomes.

2) In principle, JICA will conduct ex-post evaluation of the Project after three years from the completion. It is required for the Recipient to furnish any necessary information as JICA may reasonably request.

(3) Others

1) Environmental and Social Considerations

The Recipient shall carefully consider environmental and social impacts by the Project and must comply with the environmental regulations of the Recipient and JICA Guidelines for Environmental and Social Considerations (April, 2010).

2) Major undertakings to be taken by the Government of the Recipient

For the smooth and proper implementation of the Project, the Recipient is required to undertake necessary measures including land acquisition, and bear an advising commission of the A/P and payment commissions paid to the Bank as agreed with the GOJ and/or JICA. The Government of the Recipient shall ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the Recipient with respect to the purchase of the Products and/or the Services be exempted or be borne by its designated authority without using the Grant and its accrued interest, since the grant fund comes from the Japanese taxpayers.

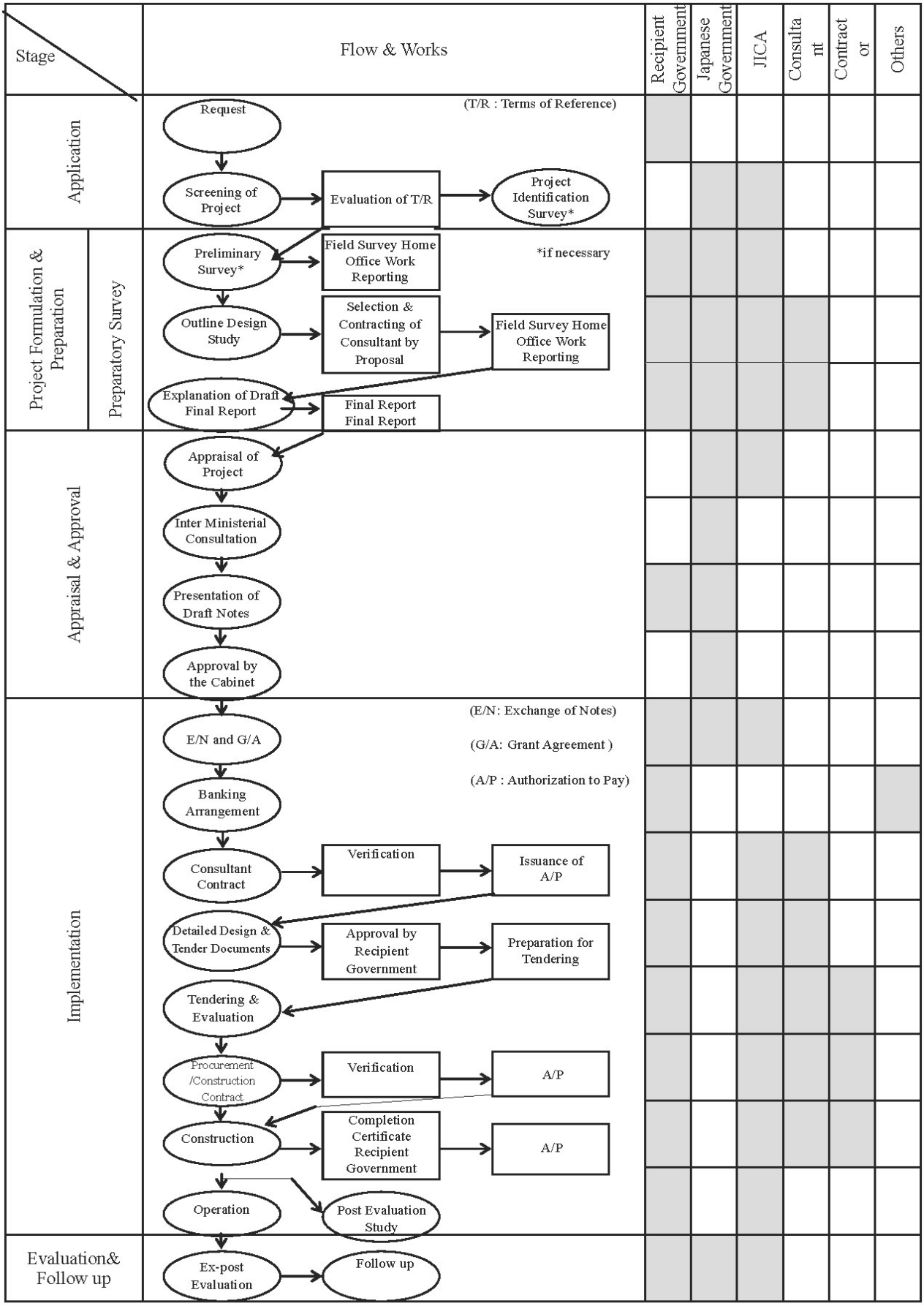
3) Proper Use

The Recipient is required to maintain and use properly and effectively the products and/or services under the Project (including the facilities constructed and the equipment purchased), to assign staff necessary for this operation and maintenance and to bear all the expenses other than those covered by the Japanese Grant.

4) Export and Re-export

The products purchased under the Japanese Grant should not be exported or re-exported from the Recipient.

Procedures of Japanese Grant

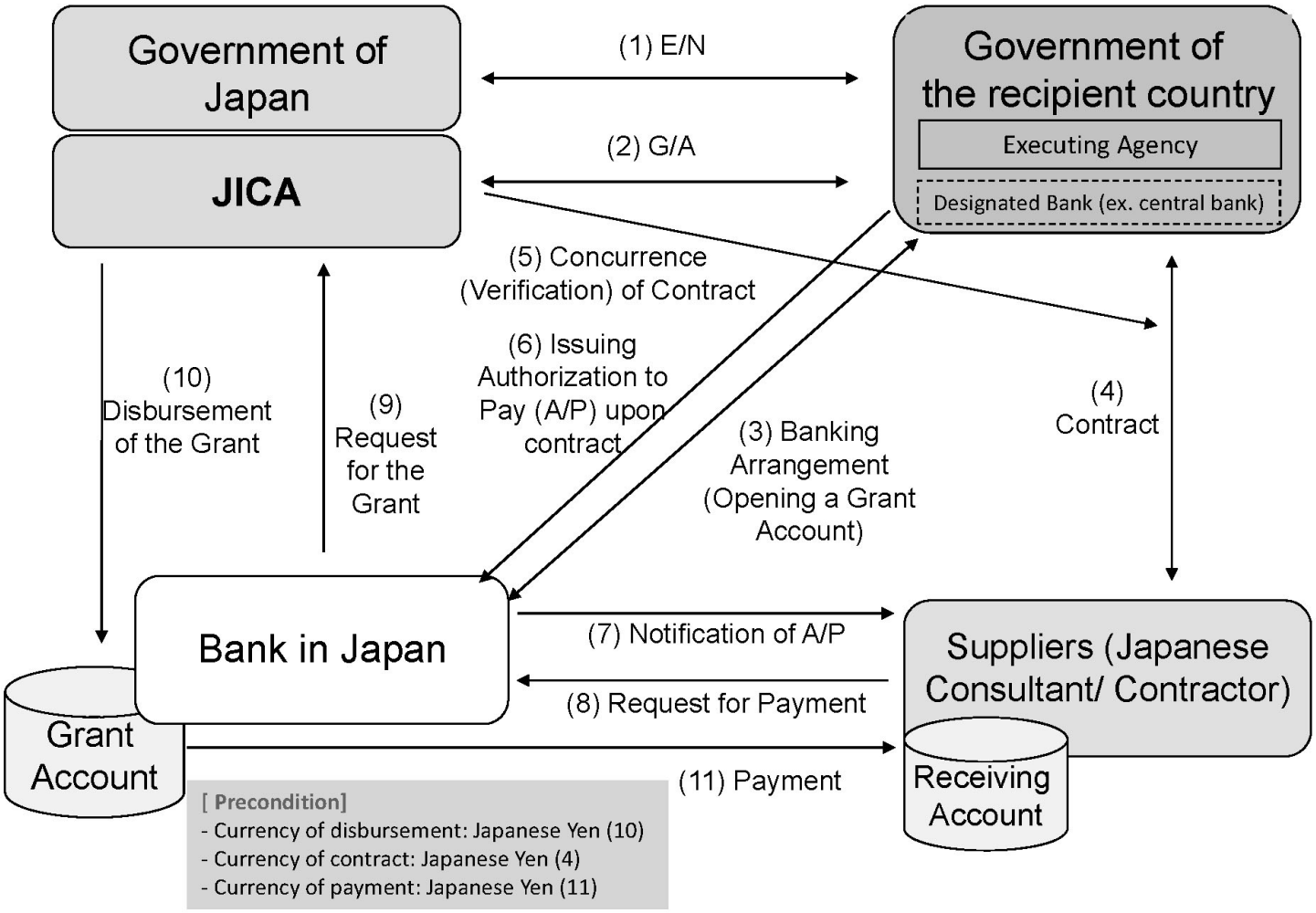


Stage	Procedures	Remarks	Recipient Government	Japanese Government	JICA	Consultants	Contractors	Agent Bank
Official Request	Request for grants through diplomatic channel	Request shall be submitted before appraisal stage.	x	x				
1. Preparation	(1) Preparatory Survey Preparation of outline design and cost estimate		x		x	x		
2. Appraisal	(2)Preparatory Survey Explanation of draft outline design, including cost estimate, undertakings, etc.		x		x	x		
	(3)Agreement on conditions for implementation	Conditions will be explained with the draft notes (E/N) and Grant Agreement (G/A) which will be signed before approval by Japanese government.	x	x (E/N)	x (G/A)			
	(4) Approval by the Japanese cabinet			x				
3. Implementation	(5) Exchange of Notes (E/N)		x	x				
	(6) Signing of Grant Agreement (G/A)		x		x			
	(7) Banking Arrangement (B/A)	Need to be informed to JICA	x					x
	(8) Contracting with consultant and issuance of Authorization to Pay (A/P)	Concurrence by JICA is required	x			x		x
	(9) Detail design (D/D)		x			x		
	(10) Preparation of bidding documents	Concurrence by JICA is required	x			x		
	(11) Bidding	Concurrence by JICA is required	x			x	x	
	(12) Contracting with contractor/supplier and issuance of A/P	Concurrence by JICA is required	x				x	x
	(13) Construction works/procurement	Concurrence by JICA is required for major modification of design and amendment of contracts.	x			x	x	
	(14) Completion certificate		x			x	x	
4. Ex-post monitoring & evaluation	(15) Ex-post monitoring	To be implemented generally after 1, 3, 10 years of completion, subject to change	x		x			
	(16) Ex-post evaluation	To be implemented basically after 3 years of completion	x		x			

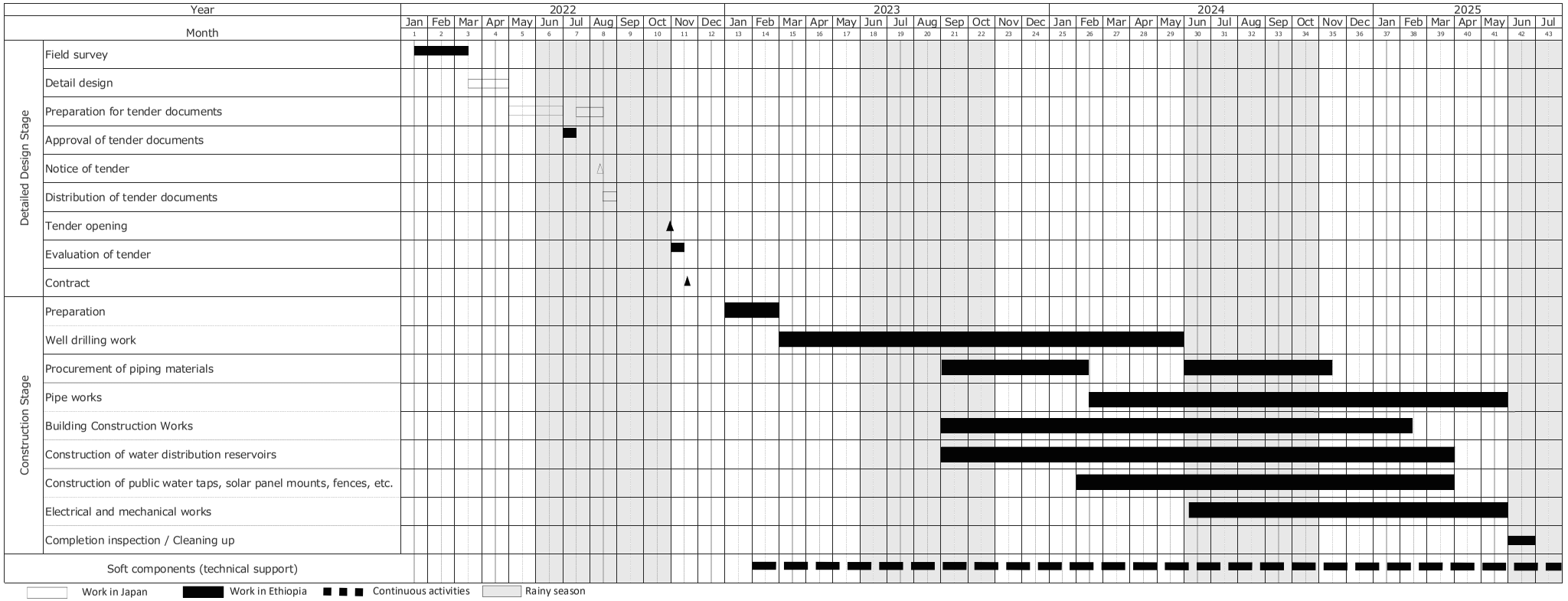
notes:

1. Project Monitoring Report and Report for Project Completion shall be submitted to JICA as agreed in the G/A.
2. Concurrence by JICA is required for allocation of grant for remaining amount and/or contingencies as agreed in the G/A.

Financial Flow of Japanese Grant (A/P Type)



Annex 4: Project Implementation Schedule



Annex 5

Confidential

Major Undertakings to be taken by the Government of Ethiopia

1. Specific obligations of the Government of Ethiopia which will not be funded with the Grant

(1) Before the Bidding

No.	Items	Deadline	In charge	Estimated Cost (Birr)	Ref.
1	To open bank account (Banking Arrangement （B/A）)	Within 1 month after the signing of the G/A	OWERDB	833,000	
	To issue Authorization to Pay (A/P) to a bank in Japan (the Agent Bank) for the payment to the consultant	Within 1 month after the signing of the contract	OWERDB		
	To bear the following commissions to a bank in Japan for the banking services based upon the B/A 1) Advising commission of A/P 2) Payment commission for A/P	1) Within 1 month after the signing of the contract 2) Every payment	OWERDB		
2	To implement EIA	EIA was completed	OEFCCA	N/A	
	To obtain approval of EIA	The EIA report was approved on September 28th, 2020.	OEFCCA	N/A	
3	To secure the necessary budget for compensation with full replacement cost required to implement land acquisition in accordance with land acquisition and resettlement report presented as Annex 10 of the M/D.	2 months before the announcement of pre-qualification (P/Q) for the bidding	OWERDB/TAOs	1,328,000	
	To implement social monitoring, and to submit the monitoring results to JICA, by using the monitoring form, on a quarterly basis as a part of Project Monitoring Report	Until land acquisition and resettlement complete	OWERDB/TAOs		
	To secure the following lands 1) Proposed public and agricultural land for constructing deep well facilities, small-scale structures and public taps in the targeting towns	2 months before the announcement of pre-qualification (P/Q) for the bidding	OWERDB/TAOs		
4	To amend Entitlement Matrix when new project affected persons with new attributes are found due to; 1) Temporary land acquisition due to construction of transmission pipeline 2) Changes of construction sites and routes for transmission and distribution pipelines	Soon after starting detail design survey	OWERDB	N/A	
5	To obtain the necessary permission for the implementation of the Project from the concerned organization (Road crossing of pipeline, commercial power connection) 1) Ethiopian Roads Authority: ERA 2) Oromia Roads Authority: ORA 3) Ethiopia Electric Utility: EEU 4) Other permission, if necessary	Before notice of the bidding document	OWERDB	N/A	
6	To assign counterparts for the Survey Team during the Detail Design Survey	Soon after starting Detail Design survey	OWERDB	36,000	
7	To submit the Project Monitoring Report (PMR) (with the result of the Detail Design)	Before preparation of bidding documents	OWERDB	N/A	
8	To maintain and protect, and not to use six test wells developed by JICA in the Preparatory survey	Until the Project will start	OWERDB	N/A	

(2) During the Project Implementation

No.	Items	Deadline	In charge	Estimated Cost (Birr)	Ref.
1	To issue A/P to a bank in Japan (the Agent Bank) for the payment to the contractors	Within 1 month after contract(s) signing	OWERDB	Included in the budget for item No.1 of above "(1) Before the Bidding"	
	To bear the following commissions to a bank of Japan for the banking services based upon the B/A 1) Advising commission of A/P 2) Payment commission for A/P	1) Within 1 month after the singing of the contract(s) 2) Every payment	OWERDB		
2	To obtain the necessary permission for the implementation of the Project from the concerned organization (Road crossing of pipeline, commercial power connection) 1) Ethiopian Roads Authority: ERA 2) Oromia Roads Authority: ORA 3) Ethiopia Electric Utility: EEU 4) Other permission, if necessary	During the project	OWERDB	N/A	
3	To ensure prompt customs clearance and assist the Contractor(s) with internal transportation in the Recipient country	During the project	OWERDB	N/A	
4	To accord Japanese physical persons and/or physical persons of third countries whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into the country of the Recipient and stay therein for the performance of their work.	During the project	OWERDB	N/A	
5	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the country of the Recipient with respect to the purchase of the Products and/or the Services be exempted / be borne by its designated authority without using the Grant.	During the project	BoFEC/OWERDB	123,124,000	
6	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project	During the project	OWERDB	N/A	
7	To notify JICA promptly of any incident or accident, which has, or is likely to have, a significant adverse effect on the environment, the affected communities, the public or workers.	During the construction	OWERDB	N/A	
8	1) To submit the Project Monitoring Report 2) To submit Project Monitoring Report (final)	1)Every month 2)Within one month after signing of Certificate of Completion for the works under the contract(s)	OWERDB	N/A	
	To submit a report concerning completion of the Project	Within six months after completion of the Project	OWERDB	N/A	
9	To construct access roads within the target sites	Within 2 month after contract(s) signing	OWERDB	N/A	
10	To provide facilities for distribution of electricity, water supply and drainage and other incidental facilities necessary for the implementation of the Project outside the site(s) 1)Water Supply Bring water supply to the facility construction point (water office)	During the project	OWERDB	N/A	
11	To ensure the safety of persons engaged in the implementation of the Project	During the project	OWERDB	N/A	
12	To implement Environmental Management Plan (EMP) and Environmental Monitoring Plan (EMoP)	During the project	OWERDB	Included in the budget for item No.3 of above "(1) Before the Bidding"	
	To submit results of environmental monitoring to JICA, by using the monitoring form, on a quarterly basis as a part of Project Monitoring Report	During the project	OWERDB		
	To implement Land Acquisition and Resettlement following JICA Guideline.	Before the constriction	OWERDB		

	To implement social monitoring, and to submit the monitoring results to JICA, by using the monitoring form, on a quarterly basis as a part of Project Monitoring Report. Period of the monitoring may be extended if affected persons' livelihoods are not sufficiently restored, extension of the monitoring will be decided based on agreement between OWERDB and JICA.	Until the livelihood restoration program (In case that income restoration program is provided.)	OWERDB		
	To implement additional programs related to project implementation in the vicinity of protected areas (if necessary)	During the project	OWERDB	N/A	
13	To clear and maintain access road to the sites	1 month before construction starts	OWERDB	820,000	
14	To secure stock yards for construction materials	Before construction starts	OWERDB	N/A	
15	To assign supervisor during the construction period	During the project	OWERDB	601,000	
16	To assign counterparts for the soft-component activities	During the project	OWERDB	316,000	
17	To implement construction of protection fences around public faucets	1 month before completion of construction	OWERDB／TAOs	1,000,000	
18	To construct the watchman houses	During the project	OWERDB／TAOs	N/A	
19	To prepare maintenance tools owned by each town water utility	During the project	OWERDB／TAOs	279,000	
20	To prepare office furniture and office automation equipment owned by each town water utility	3 months before completion of construction	OWERDB／TAOs	1,317,000	
21	To prepare the initial set of equipment for connecting the water supply pipes of each household owned by each town water utility	6 months before completion of construction	OWERDB／TAOs	1,542,000	
22	To promote and conduct house connections	During the project	OWERDB／TAOs	N/A	
23	Public relations activities in the Ethiopia at an opportunities such as completion ceremony	During the project	OWERDB	N/A	
24	To maintain and protect, and not to use five test wells excluding test well for Gonde site developed in the Preparatory Survey	Until the Project will start	OWERDB	N/A	
25	To establish Water Board members and Water Utility for each 6 small town	Within 3 months (Water Board) /10 months(Water Utility) after beginning of construction	OWERDB	N/A	
26	To assign suitable staffs to each Water Utility	Within 10 months after beginning of construction	OWERDB	N/A	

(3) After the Project

No.	Items	Deadline	In charge	Estimated Cost (Birr)	Ref.
1	To implement environmental management plan (EMP) and environmental monitoring plan (EMoP)	For a period based on EMP and EMoP	OWERDB	N/A	
2	To submit results of environmental monitoring to JICA, by using the monitoring form, semi annually - The period of environmental monitoring may be extended if any significant negative impacts on the environment are found. The extension of environmental monitoring will be decided based on the agreement between OWERDB and JICA.	For 3 years after the Project	OWERDB	N/A	
3	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid 1) Allocation of maintenance cost for each targeted town (especially Gonde Town) 2) Operation and maintenance structure 3) Routine check/Periodic inspection	After completion of the construction	OWERDB	N/A	
4	To promote the increase of the customers for house connections	After the project	OWERDB	N/A	

2. Other obligations of the Government of Ethiopia funded with the Grant

No.	Items	Deadline	Amount (Million Japanese Yen)*
1	-	-	-
	Total	-	[redacted]

* The Amount is provisional. This is subject to the approval of the Government of Japan.

OWERDB: Oromia Water and Energy Resources Development Bureau
OEFCCA: Oromia Environment, Forest and Climate Change Authority
TAO(s): Town Administration Office (s)
M/D: Minutes of discussions
PMR: Project Monitoring Report
EIA: Environmental Impact Assessment
EMP: Environmental Management Plan
EMoP: Environmental Monitoring Plan
N/A: Not Applicable

Annex 6

Responsible Organizations to Bear Customs Duties, Internal Taxes and Other Fiscal Levies

No.	Category	Items	Description	Tax rate (%)	Focal Organization	Organization allocates necessary finance or make the cost exempted
1	Indirect tax	Input VAT (paid)	Paid value added tax on purchasing goods and services	15	OWERDB	BoFEC
2		Output VAT (Received)	Received value added tax on selling goods and services	15	OWERDB	BoFEC
3		Withholding Tax	The current payments of income tax at time of payments made on account of goods and current services	2-30	OWERDB	BoFEC
4		Stamp Duty	Stamp duty	0.5-2 or 5-350 Birr	OWERDB	BoFEC
5		Technical Service Taxes	Technical Service Taxes	15	OWERDB	BoFEC
6	Others	Registration fee, License fee, and Permits and approvals fee, etc.	Registration fee, license fee, and permits and approvals fee, etc.	-	OWERDB	BoFEC
7		Other internal taxes and fiscal levies	Aside from the above listed, other internal and levies which Ethiopia government imposes, and payments and costs occurred realted on the Project	-	OWERDB	BoFEC
8		Penalty and interests imposed	Penalty and interests imposed from Ministry of Revenue (MoR), other related parties or companies	-	Indirect tax: OWERDB	Indirect tax and others: BoFEC

*Note: For Direct taxes, the Federal Ministry of Finance will take care of the process.
For Indirect taxes and other costs, BoFEC is supposed to allocate necessary budget from its own Regional Budget which is planned and secured in advance.

BoFEC: Bureau of Finance Economic Cooperation
MoR: Ministry of Revenue

Project Monitoring Report
on
Project Name
Grant Agreement No. XXXXXXX

20XX, Month

Organizational Information

Signer of the G/A (Recipient)	Person in Charge (Designation) Contacts Address: Phone/FAX: Email:
Executing Agency	Person in Charge (Designation) Contacts Address: Phone/FAX: Email:
Line Ministry	Person in Charge (Designation) Contacts Address: Phone/FAX: Email:

General Information:

Project Title	
E/N	Signed date: Duration:
G/A	Signed date: Duration:
Source of Finance	Government of Japan: Not exceeding JPY _____ mil. Government of (_____): _____

1: Project Description

1-1 Project Objective

1-2 Project Rationale

- Higher-level objectives to which the project contributes (national/regional/sectoral policies and strategies)
- Situation of the target groups to which the project addresses

1-3 Indicators for measurement of "Effectiveness"

Quantitative indicators to measure the attainment of project objectives		
Indicators	Original (Yr)	Target (Yr)
Qualitative indicators to measure the attainment of project objectives		

2: Details of the Project

2-1 Location

Components	**Original** *(proposed in the outline design)*	**Actual**
1.		

2-2 Scope of the work

Components	**Original*** *(proposed in the outline design)*	**Actual***
1.		

Reasons for modification of scope (if any).

(PMR)

2-3 Implementation Schedule

Items	Original		Actual
	(proposed in the outline design)	*(at the time of signing the Grant Agreement)*	

Reasons for any changes of the schedule, and their effects on the project (if any)

2-4 Obligations by the Recipient

2-4-1 Progress of Specific Obligations

See Attachment 2.

2-4-2 Activities

See Attachment 3.

2-4-3 Report on RD

See Attachment 11.

2-5 Project Cost

2-5-1 Cost borne by the Grant(Confidential until the Bidding)

Components			Cost (Million Yen)	
	Original *(proposed in the outline design)*	Actual *(in case of any modification)*	Original[1),2)] *(proposed in the outline design)*	Actual
	1.			
Total				

Note: 1) Date of estimation:
2) Exchange rate: 1 US Dollar = Yen

2-5-2 Cost borne by the Recipient

Components			Cost (1,000 Taka)	
	Original *(proposed in the outline design)*	Actual *(in case of any modification)*	Original[1),2)] *(proposed in the outline design)*	Actual
	1.			

Note: 1) Date of estimation:
2) Exchange rate: 1 US Dollar =

Reasons for the remarkable gaps between the original and actual cost, and the countermeasures (if any)

(PMR)

2-6 Executing Agency

- Organization's role, financial position, capacity, cost recovery etc,
- Organization Chart including the unit in charge of the implementation and number of employees.

Original *(at the time of outline design)* name: role: financial situation: institutional and organizational arrangement (organogram): human resources (number and ability of staff):
Actual *(PMR)*

2-7 Environmental and Social Impacts

- The results of environmental monitoring based on Attachment 5 (in accordance with Schedule 4 of the Grant Agreement).
- The results of social monitoring based on in Attachment 5 (in accordance with Schedule 4 of the Grant Agreement).
- Disclosed information related to results of environmental and social monitoring to local stakeholders (whenever applicable).

3: Operation and Maintenance (O&M)

3-1 Physical Arrangement

- Plan for O&M (number and skills of the staff in the responsible division or section, availability of manuals and guidelines, availability of spareparts, etc.)

Original *(at the time of outline design)*
Actual *(PMR)*

3-2 Budgetary Arrangement

- Required O&M cost and actual budget allocation for O&M

Original *(at the time of outline design)*

Actual *(PMR)*

4: Potential Risks and Mitigation Measures

- Potential risks which may affect the project implementation, attainment of objectives, sustainability
- Mitigation measures corresponding to the potential risks

Assessment of Potential Risks (*at the time of outline design)*

Potential Risks	Assessment
1. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:
	Contingency Plan (if applicable):
2. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:
	Contingency Plan (if applicable):
3. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:

	Contingency Plan (if applicable):
Actual Situation and Countermeasures	
(PMR)	

5: Evaluation and Monitoring Plan (after the work completion)

5-1 Overall evaluation

Please describe your overall evaluation on the project.

5-2 Lessons Learnt and Recommendations

Please raise any lessons learned from the project experience, which might be valuable for the future assistance or similar type of projects, as well as any recommendations, which might be beneficial for better realization of the project effect, impact and assurance of sustainability.

5-3 Monitoring Plan of the Indicators for Post-Evaluation

Please describe monitoring methods, section(s)/department(s) in charge of monitoring, frequency, the term to monitor the indicators stipulated in 1-3.

Attachment

1. Project Location Map
2. Specific obligations of the Recipient which will not be funded with the Grant
3. Monthly Report submitted by the Consultant

Appendix - Photocopy of Contractor's Progress Report (if any)
- Consultant Member List
- Contractor's Main Staff List

4. Check list for the Contract (including Record of Amendment of the Contract/Agreement and Schedule of Payment)
5. Environmental Monitoring Form / Social Monitoring Form
6. Monitoring sheet on price of specified materials (Quarterly)
7. Report on Proportion of Procurement (Recipient Country, Japan and Third Countries) (PMR (final) only)
8. Pictures (by JPEG style by CD-R) (PMR (final)only)
9. Equipment List (PMR (final) only)
10. Drawing (PMR (final) only)
11. Report on RD (After project)

Monitoring sheet on price of specified materials

1. Initial Conditions (Confirmed)

	Items of Specified Materials	Initial Volume A	Initial Unit Price (¥) B	Initial total Price C=A×B	1% of Contract Price D	Condition of payment	
						Price (Decreased) E=C−D	Price (Increased) F=C+D
1	Item 1	●●t	●	●	●	●	●
2	Item 2	●●t	●	●	●		
3	Item 3						
4	Item 4						
5	Item 5						

2. Monitoring of the Unit Price of Specified Materials

(1) Method of Monitoring : ●●

(2) Result of the Monitoring Survey on Unit Price for each specified materials

	Items of Specified Materials	1st ●month, 2015	2nd ●month, 2015	3rd ●month, 2015	4th	5th	6th
1	Item 1						
2	Item 2						
3	Item 3						
4	Item 4						
5	Item 5						

(3) Summary of Discussion with Contractor (if necessary)

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-
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Report on Proportion of Procurement (Recipient Country, Japan and Third Countries)
（Actual Expenditure by Construction and Equipment each）

		Domestic Procurement (Recipient Country) A	Foreign Procurement (Japan) B	Foreign Procurement (Third Countries) C	Total D
Construction Cost		(A/D%)	(B/D%)	(C/D%)	
	Direct Construction Cost	(A/D%)	(B/D%)	(C/D%)	
	others	(A/D%)	(B/D%)	(C/D%)	
Equipment Cost		(A/D%)	(B/D%)	(C/D%)	
Design and Supervision Cost		(A/D%)	(B/D%)	(C/D%)	
Total		(A/D%)	(B/D%)	(C/D%)	

ANNEX8: Environment Checklists

The contents of environmental and social consideration in the Project and the results of progress confirmation are summarized as shown in the JICA environmental checklist for water supply projects in the table below.

JICA Environmental Checklist for Water Supply Projects

Category	Environmental Item	Main Check Items	Yes: Y No: N Not Applicable: N/A	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1 Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process? (b) Have EIA reports been approved by authorities of the recipient country's government? (c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? (d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the recipient country's government?	(a) Y (b) Y (c) N (d) N/A	(a) It was created on June 15, 2020, and its content was verified by Japanese experts. (b) It was approved by the OEFCCA on September 28, 2020. (c) No. (d) N/A
	(2) Explanation to local stakeholders	(a) Have contents of the Project and the potential impacts been adequately explained to the local stakeholders based on appropriate procedures, including information disclosure? Has understanding been obtained from the local stakeholders? (b) Have the comment from the stakeholders (such as local residents) been reflected to the Project design?	(a) Y (b) Y	(a) Stakeholder meetings were held in each small town from December 15th, 2019 to February 2nd, 2020 for relevant agencies and local communities of the Project target small towns. Discussions were held on the Project overview, possible impacts and mitigation measures at this time. (b) Local communities made comments and asked questions, but none were critical of the Project.
	(3) Examination	(a) Have multiple alternative plans of the Project been	(a) Y	(a) When preparing the scoping report, a comparison was

Category	Environmental Item	Main Check Items	Yes: Y No: N Not Applicable: N/A	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	of Alternatives	examined with social and environmental considerations?		made with the proposal not to implement the Project. In addition, land taken by the construction of new water sources, reservoirs and public taps were discussed with the land owners in advance in the presence of the respective Town Administrative Offices.
2 Pollution control	(1) Air Quality	(a) Is there a possibility that chlorine from chlorine storage facilities and chlorine injection facilities will cause air pollution? Are any mitigating measures taken? (b) Do chlorine concentrations within the working environments comply with the country's occupational health and safety standards?	(a) N (b) N/A	(a) A disinfection facility will be installed on the inflow side of the distribution reservoir, but a powdered chlorine agent will be used as the disinfectant, and no impact on the atmosphere is expected. (b) In Ethiopia, there are no permissible chlorine concentrations in accordance with occupational health and safety standards, but if handled properly, such as by storing in a sealed, dry, cool and dark place, no adverse effects are expected.
	(2) Water quality	(a) Do pollutants, such as SS, BOD, COD contained in effluents discharged by the facility operations comply with the country's effluent standards?	(a) N/A	(a) In the Project, groundwater is used as the water source, so there is no need to perform water purification treatment such as sedimentation and filtration. Therefore, no wastewater will be generated from the facility activities.
	(3) Wastes	(a) Are wastes, such as sludge generated by the facility operations properly treated and disposed in accordance with the country's regulations?	(a) N/A	(a) No sludge or other wastes will be generated from the facility activities as no water purification treatment such as sedimentation or filtration will be used.
	(4) Noise and vibration	(a) Do noise and vibrations generated from the facilities, such as pumping stations comply with the country's	(a) Y	(a) The location of the newly installed pump building is away from residential areas and will be installed in reinforced

Category	Environmental Item	Main Check Items	Yes: Y No: N Not Applicable: N/A	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		standards?		concrete, so no vibration or noise impact is expected. Also, submersible pumps installed in deep wells are not expected to produce noise and vibration because they are installed under the water.
	(5) Subsidence	(a) In the case of extraction of a large volume of groundwater, is there a possibility that the extraction of groundwater will cause subsidence?	(a) N	(a) As a result of geotechnical investigations at the sites where the reservoirs and water committee offices are to be constructed, it was confirmed that there is no soft ground or other problematic ground, that the ground strength is sufficient to withstand the construction of the structures, and that there are no problems with soil corrosiveness, and no land subsidence is expected.
3 Natural environment	(1) Protected areas	(a) Is the Project site or discharge area located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the Project will affect the protected areas?	(a)Y	(a) According to the EWCA designated boundaries, the target small towns are not located in the protected area (Arsi Mountain National Park); however, based on the UNEP-WCMC designated boundary, two (2) small towns, Gonde and Bolo, are located within the protected area. In the Questions and Answers of JICA GL, projects can be implemented only if all the five requirements are met as exceptional cases. Thereby, it was confirmed by OWERDB that the five requirements for the implementing projects in protected areas were satisfied. Since the five requirements for the protected area will be properly complied by the Executing Agency, the impact on the protected area is

Category	Environmental Item	Main Check Items	Yes: Y No: N Not Applicable: N/A	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
				considered to be limited.
	(2) Ecosystem	(a) Does the Project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? (b) Does the Project site or discharge area encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? (c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem? (d) Is there a possibility that the amount of water used (e.g., surface water, groundwater) by project will adversely affect aquatic environments, such as rivers? Are adequate measures taken to reduce the impacts on aquatic environments, such as aquatic organisms	(a) Y (b) Y (c) Y (d) N	(a) (b) (c) Gonde is located within the Koffole Forest as KBA registered by UNEP-WCMC and Bolo is located near the above-mentioned KBA. Also, three (3) small towns, Ude Dhankaka, Kamise, and Biyo, are located within the Chelekleka Lake and Swamp as KBA/IBA registered by BI. Therefore, it was confirmed by the OWERDB that the three requirements for implementing projects in the critical natural habitat were satisfied, although it was also confirmed that each small town itself is not regarded as a critical natural habitat. Since the three requirements for the critical natural habitat will be properly complied by the Executing Agency, the impacts on the KBAs are considered to be limited. In addition, as a result of the field survey and the research using the geographical distribution data of the IUCN Red List, it was confirmed that the target small towns for the Project are not within the habitats of species with extremely high risk of extinction such as Critically Endangered (CR) and Endangered (EN). However, the Project sites are the habitats of species that may be at increased risk of extinction due to changes in habitat conditions. As a result of investigating the distribution area of each species in the existing literature, the area around

Category	Environmental Item	Main Check Items	Yes: Y No: N Not Applicable: N/A	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
				the small town is not a suitable habitat, and considering the scale and content of the Project, it is unlikely to have a significant negative impact on the ecosystem. In addition, as a result of the field survey, no forest conservation areas, wetlands, or wild animals and plants to be conserved were found in the target small towns. Furthermore, as a result of confirming the information on eyewitness report of wildlife from the OFWE branch's protected area management staff and local residents, no wildlife to be conserved was found. Based on the above, it was determined that the target small town does not fall under the habitat and migration route of wildlife to be conserved, and that the implementation of the Project is not likely to cause habitat fragmentation or degradation of connectivity. Therefore, by implementing mitigation measures and monitoring throughout the construction period, the impact on biodiversity will be minimized.
	(3) Hydrology	(a) Is there a possibility that the amount of water used (e.g., surface water, groundwater) by the Project will adversely affect surface water and groundwater flows?	(a) Y	(a) As for Ude Dhankaka, where there are many existing wells in the vicinity, there is a possibility that the construction of wells may affect each other's groundwater levels because of the amount of water level decline during pumping. Therefore, it is necessary to provide guidance on the implementation and methods of regular monitoring.

Category	Environmental Item	Main Check Items	Yes: Y No: N Not Applicable: N/A	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(1) Land acquisition and resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement? (b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement? (c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement? (d) Is the compensations going to be paid prior to the resettlement? (e) Is the compensation policies prepared in document? (f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, and the elderly people below the poverty line, ethnic minorities, and indigenous peoples? (g) Are agreements with the affected people obtained prior to resettlement? (h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan?	(a) Y (b) Y (c) Y (d) Y (e) Y (f) Y (g) Y (h) Y (i) Y (j) Y	(a) No physical resettlement will occur in the Project, but 6,438 m2 (0.64 ha) of agricultural land needs to be acquired for the construction of deep well facilities, small-scale structures and public taps. At present, 45 affected households and 250 affected persons have been identified. In order to minimize the impact, the Tem has considered installing pipelines on public land (along existing roads, etc.) as much as possible. (b) Stakeholder meetings were held in each small town from September 2019 to February 2021 for relevant organizations and residents of the Project area. (c) No resettlement plan will be prepared for the Project, but land acquisition procedures will be carried out in accordance with the compensation policy of JICA GL and World Bank policy. The entitlement matrix will be revised in consultation with the relevant parties in case of new affected persons due to route changes during Detailed Design Stage and temporal land acquisition. (d) In consultation with the Town Administrative Officer, the completion of compensation payment is planned two months before the P/Q of the Project, which will be the end of May, 2022. (e) The No. 89/1997 Proclamation on land acquisition indicates the right to lease agricultural land. In addition, the

Category	Environmental Item	Main Check Items	Yes: Y No: N Not Applicable: N/A	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		(i) Are any plans developed to monitor the impacts of resettlement? (j) Is the grievance redress mechanism established?		Ordinance No. 1161/2019 provides for compensation policy and procedures in the event that the Federal government acquires private land and also stipulates that the local government (in the case of the Project, the Town Administrative Office) shall provide appropriate compensation prior to the implementation of the Project. (f) Socially vulnerable households will be identified and will be given priority in providing employment opportunities created by the Project. (g) Prior consultations are held with the owners of land affected by the Project to confirm the landowners' willingness to cooperate in the land acquisition, the period the land can be vacated, compensation payment preferences and contact information. Thus, prior agreement has been obtained in writing. (h) The Town Administrative Office, and other organizations will establish a Property Evaluation Committee to conduct surveys of land area, market prices of crops to be compensated, and other data necessary to calculate the amount of compensation. The cost of these surveys will be borne by the Ethiopian Government and it is already estimated by the Team. (i) After compensation cost and provision of alternative

Category	Environmental Item	Main Check Items	Yes: Y No: N Not Applicable: N/A	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
				land, monitoring activities are planned to check the economic situation after the relocation of agricultural land. (j) In Ethiopia, complaints and objections related to resettlement and land acquisition are regulated in Proclamation No. 455/2005. In the Project, the Town Administrative Office will be in charge of grievance procedures.
4.Social environment	(2) Living and Livelihood	(a) Is there a possibility that the Project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary? (b) Is there a possibility that the amount of water used (e.g., surface water, groundwater) by the Project will adversely affect the existing water uses and water area uses?	(a)Y (b)Y	(a) Some farmers will face a reduction in farmland, but alternative land will be provided by the Town Administrative Office. Local residents will be hired for non-skilled construction jobs (security, cleaning, weeding, etc.), and priority will be given to the PAHs.
	(3) Heritage	(a) Is there a possibility that the Project will damage the local archaeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	(a)N	(a) No cultural heritage has been identified in the Project area.
	(4) Landscape	(a) Is there a possibility that the Project will adversely affect the local landscape? Are necessary measures taken?	(a)N	(a) There are no water supply facilities that would adversely affect the surrounding landscape. The elevated distribution reservoirs will have a highly visible shape, but there will be

Category	Environmental Item	Main Check Items	Yes: Y No: N Not Applicable: N/A	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
				no special surrounding landscape that will be adversely affected.
	(5) Ethnic minorities, indigenous peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples? (b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources respected?	(a)N/A (b)N/A	(a) Ethnic minorities and indigenous peoples have not been identified in the Project area. (b) Same as above
	(6) Working conditions	(a) Is the Project proponent not violating any laws and ordinances associated with the working conditions of the country which the Project proponent should observe in the Project? (b) Are tangible safety considerations in place for individuals involved in the Project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials? (c) Are intangible measures being planned and implemented for individuals involved in the Project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.? (d) Are appropriate measures taken to ensure that	(a)Y (b)Y (c)Y (d)Y	(a) Training on environmental health and safety shall be provided to all workers to raise awareness (including PPE, HIV prevention, and maintenance). (b) The necessary personal protective equipment shall be provided to all workers with to prevent accidents during construction work. Dust masks and eye protection against dust, flying debris, and fragments should also be provided. (c) A safety and health plan will be created and regular safety trainings will be conducted. (d) To prevent accidents and problems for local communities around the construction site, security guards with safety and health training will be assigned, and measures such as fences and signboards will be installed.

Category	Environmental Item	Main Check Items	Yes: Y No: N Not Applicable: N/A	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		security guards involved in the Project not to violate safety of other individuals involved, or local residents?		
5.Other	(1)Impact during construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)? (b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts? (c) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts? (d) If the construction activities might cause traffic congestion, are adequate measures considered to reduce such impacts?	(a)Y (b)Y (c)Y (d)Y	(a) Within the EIA report, a project impact assessment was made based on the survey and mitigation measures were planned accordingly (details are provided in the report). (b) Same as above (c) Same as above (d) There is a possibility of increased traffic congestion and traffic accidents, but the duration and scope of the impact will be small. Sufficient consultation and coordination with each Town Administrative Office regarding the time frame for traffic control and construction. In order to minimize the impact, trucks which remove materials and waste from the construction site will travel by selecting the least amount of traffic. In case of temporary road blockages or rerouting on roads in very close proximity to schools and clinics, traffic information will be provided to the surrounding communities in advance.
	(2) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts? (b) What are the items, methods and frequencies of the monitoring program?	(a)Y (b)Y (c)Y (d)Y	(a) Environmental monitoring plans have been prepared for the items covered by the mitigation measures and these monitoring will be carried out by the construction contractor. (b) Monitoring methods and frequency are described in the EIA report.

Category	Environmental Item	Main Check Items	Yes: Y No: N Not Applicable: N/A	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		(c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? (d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?		(c) The Town Administrative Office is the implementing agency for land acquisition, and the contractor is the implementing agency for other environmental and social items. As the responsible agencies, OWERDB and OEFCCA will conduct the monitoring and review the result reports, and if necessary, conduct site visits to check the status of environmental and social impacts. (d)Submission of environmental monitoring result reports to OEFCCA and consultants (4 times a year) is planned.
6. Note	Reference to Checklist of Other Sectors	(a) Where necessary, pertinent items described in the Dam and River Projects checklist should also be checked.	(a)N/A	(a) Since the Project uses deep wells as a water source, there is no need for additional evaluation of the items in the checklist for the development of dams and rivers.
	Note on Using Environmental Checklist	(a) If necessary, the impacts to transboundary or global issues should be confirmed (e.g., the Project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a)N/A	(a) Since the Project is not expected to have transboundary issues or global impacts, there is no possibility of significant adverse effects on the environment, including global warming.

ANNEX9: Environmental Management and Monitoring Plan

The following Environmental Management Plan and Environmental Monitoring Plan will be implemented in order to monitor mitigation measures before/during construction and during operation.

Environmental Management Plan (EMP)

Category	No.	Impact Item	Mitigation Measures		Implementing Organization	Responsible Organization	Cost
			Under Construction	During Operation			
Pollution Control	1	Air Pollution	− When using construction machinery, make efforts to perform necessary maintenance such as periodic and daily inspections to prevent deterioration in the properties of exhaust gas. − Provide education and training on periodic inspections to on-site workers. − Diesel generators will be used only for emergency power pack-up and will be procured that meet environmental standards. − During strong winds, water should be sprayed as necessary at earthwork sites, construction machinery operating areas, and temporary roads for vehicles transporting materials. − If necessary, cover the earthwork area with a sheet to prevent the dispersion of dust from the bare ground.	-	Japanese constructor	OEFCCA	Included in construction cost
	2	Water Pollution	− Pipe installation work in the sections that require river crossings will be carried out during the dry	-	Japanese constructor	OEFCCA	Included in construction

ANNEX 10: Report on Land Acquisition and Resettlement

1. Overview of Project Components with Environmental and Social Impacts

The Project aims to contribute to the improvement of safe water supply and access to safe water for the local communities by constructing new piped water supply facilities in 6 small towns in Oromia Region.

Table 1-1: Project Component Summary

1. Facility Construction: Construction of piped water supply facilities	
Small Town	Contents
Ude Dhankaka (ES-6)	・Water source: Deep well ・Water intake facilities: submersible pumps, electric power, etc. ・Water transmission facilities: water pipes, etc. ・Water distribution facilities: ground-based reservoirs, distribution pipes, public taps, etc. ・Buildings: Administration building, disinfection facilities, and water office building
Kamise (ES-8)	・Water source: Deep well ・Water intake facilities: submersible pumps, electric power, etc. ・Water transmission facilities: water pipes, etc. ・Water distribution facilities: ground-based reservoirs, distribution pipes, public taps, etc. ・Buildings: Administration building, disinfection facilities, and water office building
Areda (ES-10)	・Water source: Deep well ・Water intake facilities: submersible pumps, electric power, etc. ・Water transmission facilities: water pipes, etc. ・Water distribution facilities: elevated reservoirs, distribution pipes, public taps, etc. ・Buildings: Administration building, disinfection facilities, and water office building
Biyo (ES-11)	・Water source: Deep well ・Water intake facilities: submersible pumps, electric power, etc. ・Water transmission facilities: water pipes, etc. ・Water distribution facilities: ground-based reservoirs, distribution pipes, disinfection facilities, public taps, etc. ・Buildings: Administration building, disinfection equipment building, and water office building
Bolo (AR-2)	・Water source: Deep well ・Water intake facilities: submersible pumps, electric power, etc. ・Water transmission facilities: water pipes, etc. ・Water distribution facilities: elevated reservoirs, distribution pipes, public taps, etc. ・Buildings: Administration building, disinfection facilities, and water office building
Gonde (AR-6)	・Water source: Deep well ・Water intake facilities: submersible pumps, electric power, etc. ・Water transmission facilities: reservoirs, booster pump station, power, water pipes, etc. ・Water distribution facilities: ground-based reservoirs, distribution pipes, public taps, etc. ・Buildings: Administration building, disinfection facilities and water office building
2. Soft Component: Improved maintenance and management of water supply facilities	
● Support the establishment of water management organizations (Town Water Supply Enterprise and Water Board) and provide education and training for board members ● Education and training for water management organization staff (technical management of piped water supply facilities, water fees collection and financial management, preparation of management reports) ● Raise awareness of water sanitation among residents of target small towns	

The Project does not fall under the category of large-scale water supply and sewerage sector in the "Environmental Impact Consideration Guidelines of Japan International Cooperation Agency (JICA GL)", and the undesirable impacts on the environment are not significant; thus, the Project is categorized as Category B based on the JICA GL. In order to avoid or minimize the negative impacts on the environment and local communities, the Environmental and Social Consideration assessment was conducted based on the JICA GL and the Environmental Impact Assessment Guidelines of Ethiopia. In accordance with the Ethiopian Guidelines, the Project has been approved on September 28, 2020 without any supplementary conditions.

2. Social Environment

1) Population of the Target Small Towns

The table below shows the population and number of households independently counted by the Town Administrative Office. The population of the entire target small town is 33,089, and the number of households is 5,702. According to the latest census of 2007, the population growth rate in Oromia Region is 4.1% per year in urban areas, 2.6% in rural areas, and 2.9% on average.

Table 2-1：Population and the number of household of each small town

ID	Small Town	Population *1	No. of household*2	Date of Survey
ES-6	Ude Dhankaka	7,020	1,200	September, 2018
ES-8	Kamise	3,230	462	April, 2019
ES-10	Areda *2	4,021	944	April, 2019
ES-11	Biyo	2,661	334	April, 2019
AR-2	Bolo	8,306	1,362 *3	April, 2019 日
AR-6	Gonde	7,851	1,400	2018
Total		33,089	5,702	

*1：Source：Certificate issued by each Town Administrative Office
*2：It includes the population of the two surrounding villages (Kebele)
*3：It is calculated using the average number of persons in the household (Bolo: 6.1 persons/household) obtained from the household survey for the Project

2) Land Use

Land use at the Woreda level is shown in the table below. Agricultural land accounts for 231,089 hectares, which is about 71% of the total land in the target small towns, and the next largest share is forest, which accounts for 28,538 hectares, which is about 9% of the total land.

Table 2-2：Land use status of the project sites

Woreda	Small Town	Agricultural land (ha)	Forest (ha)	Water supply facility (ha)	Residence (ha)	Other (ha)
Adea	Ude Dhankaka	71,923 (81.4 %)	6,012 (6.8 %)	2,693 (3.0 %)	N/A	7,751 (8.8 %)
Lume	Kamise, Biyo	47,660 (63.4 %)	3,306 (4.4 %)	10,792 (14.3 %)	4,994 (6.6 %)	8,468 (11.3 %)
Gimbichu	Areda	48,798 (65.0 %)	3,003 (4.0 %)	8,258 (11.0 %)	N/A	15,015 (20.0 %)
Jeju	Bolo	36,808 (90.6 %)	3,217 (7.9 %)	617 (1.5 %)	N/A	N/A
Tiyo	Gonde	25,900 (56.8 %)	13,000 (28.5 %)	3,200 (7.0 %)	65 (0.1 %)	3,429 (7.5 %)
Total		231,089 (71.1 %)	28,538 (8.8 %)	25,560 (7.9 %)	5,059 (1.6 %)	34,663 (10.7 %)

Woreda	Small Town	Agricultural land (ha)	Forest (ha)	Water supply facility (ha)	Residence (ha)	Other (ha)
Source：Social economic survey for the Project Upper row：Area by use category of each small town, Lower row: Percentage of area by use category of each small town (%)						

3) Ethnic Minorities･Indigenous Peoples

According to the ethnicity survey in the household survey (random sampling) of 350 households in the target small towns of the Project, the Oromo ethnic group accounts for the highest percentage at 62% (217 households), followed by the Amhara ethnic group at 35% (123 households), and the mixed households of the Oromo and Amhara ethnic groups at 5 households. These two ethnic groups account for 98.5% of the total. The remaining households consist of four households of the minority Sirte ethnic group and one household of the Hadia ethnic group.

For these ethnic groups (Oromo, Amhara, Sirte, and Hadia), the World Bank's safeguard policy OP4.10-Indigenous Peoples was reviewed to determine if they fall under the four characteristics of indigenous peoples as follows

Table 2-3：Confirmation Result about the World Bank's Safeguard Policy OP4.10-Indigenous Peoples Four Characteristics

World Bank's safeguard policy OP4.10-Indigenous Peoples Four Characteristics	Confirmation Result
(a) self-identification as members of a distinct indigenous cultural group and recognition of this identity by others	Through the field survey and community consultation, no distinctive characteristics were observed or confirmed in comparison with other residents living in the Project area.
(b) collective attachment to geographically distinct habitats or ancestral territories in the project area and to the natural resources in these habitats and territories	From the field survey, no sense of collective belonging or actuality to a place or region of residence that is geographically different from the other population were observed or confirmed.
(c) customary cultural, economic, social, or political institutions that are separate from those of the dominant society and culture	According to interviews with local residents and Town Administrative Offices, there are no cultural, economic, social, or political practices or institutions that are significantly different from the surrounding residents.
(d) an indigenous language, often different from the official language of the country or region	According to interviews with local residents and Town Administrative Offices, no communication problems were identified between the ethnic groups concerned and other ethnic groups.

The Oromo, Amhara, Sirte, and Hadia peoples residing in the target small towns of the Project are not considered indigenous peoples as per OP 4.10 of the World Bank Safeguard Policy.

One household of the Sirte ethnic group has a lower household income than the regional average, but is able to receive livelihood support from the household's children who are of working age (15 years old). The other three households of the Sirte ethnic group are engaged in retail trade and restaurants, and their household income is higher than the regional average. Security and grain sales are the main sources of income for one household of the Hadia ethnic group, and its household income is below the regional average, but not extremely low.

3. Environmental Monitoring Plan

The following Environmental Monitoring Plan will be implemented in order to monitor mitigation measures before/during construction and during operation.

Table 3-1: Environmental Monitoring Plan (Social Environment)

Environment Item	Item	Frequency	Location	Method	Responsible Organization	Cost
Land Acquisition and Resettlement	Socio-economic status of PAHs and conditions of alternative land	May 2022, after the compensation payment and October 2023, six months after the compensation payment.	PAHs' residential area	Interview survey with PAHs	Town Administrative Office/ Property Evaluation Committee	Included in the cost to be borne by the Ethiopia (1,328,183 Birr)
Land Use and Local Resource Use						
Local Economy, including Employment and Means of Livelihood	Employment status of water seller	At start of operation	Water management office	Interview survey with water management organizations	Town Administrative Office	
The poor	Socioeconomic and employment status of socially vulnerable groups	May 2022, after the compensation payment and October 2023, six months after the compensation payment.	PAHs' residential area	Interview survey with PAHs	Town Administrative Office/ Property Valuation Committee	
Water Use (drinking water, domestic water)	Disposal method of generated residual soil	Once a month	Construction site	Visual inspection and interviewing of on-site workers	Japanese contractor	Included in construction cost
Existing Infrastructure and Services	Notification to residents	When infrastructure disruptions are planned	Construction site	Interview survey with affected households	Japanese contractor /Town Administrative Office	Included in construction cost
Working Conditions (including occupational safety)	Implementation of safety and health education	Once a month	Construction site	Provision of PPE and confirmation of training implementation	Japanese contractor	Included in construction cost
Accident	Accident occurrence/response records	Once a month	Construction site	Review of accident reports	Japanese contractor	Included in construction cost

4. Consultation with Local Community

Stakeholder meetings were held in each small town from December 18th, 2019 to January 2nd, 2020 for relevant agencies and residents of the Project target areas. First, the OWERDB and the subcontractor for the environmental and social impact assessment requested the Woreda and Town administrations of the six target small towns to convene representatives of the youth, women, elders and churches in each small town, as well as the residents who are expected to be affected by the Project. The meetings were held at the Town Administrative Office because it is an easy place for the local residents to meet. The Project requested that the target participants shall be notified

at least a few days in advance of the location, date and time of the meeting. In terms of notification methods, the Town Administrative Office convened participants in two ways: (i) announcements on the Town Administrative Office bulletin board; and (ii) the representatives of the small towns and the households affected by the Project will be contacted directly by phone. The discussions included an overview of the Project, the environmental and social impacts that can be expected at this time, and mitigation measures, followed by a question and answer session with local residents. Details of the date, time and participants are as follows.

Table 4-1：Summary of Consultations with Local Community

Date	Place	Participant
December 27th 2019	Ude Dhankaka town office	Town Administrative Officer, Youth, female, kebele, elder and religious representatives and local residents (5 women, 6 men)
December 24th, 2019	Kamise town office	Town Administrative Officer, Youth, female, kebele, elder and religious representatives, water association and local residents (5 women, 7 men)
January 2nd, 2020	Areda town office	Town Administrative Officer, Youth, female and kebele representatives, and local residents (4 women, 12 men)
December 26th, 2019	Biyo town office	Town Administrative Officer, Youth and female representatives, water association and local residents (2 women, 8 men)
December 18th, 2019	Bolo town office	Town Administrative Officer, Youth, female, kebele and religious representatives and local residents (2 women, 15 men)
December 18th, 2019	Gonde town office	Town Administrative Officer, Youth, female, woreda, kebele, elder and religious representatives, water association and local residents (4 women, 19 men)

Most of the comments received from the local communities were common among 6 small towns and were as follows:

Table 4-2 Opinions and Concerns from Local Communities and Results Reflected in the Project

Comments and Concerns from Local Communities	Response by the Executing Agency and Results Reflected in the Project
It is the women and children of the community who are responsible for collecting water for their families from far away. They spend a lot of time fetching water, which interferes with their commuting time to school. They hope that with the implementation of the Project, women and children will have more time to go to school to receive basic education.	The Project will contribute greatly to solving the community's problems by improving the piping network to schools and health facilities and constructing public taps at these facilities. In addition, disinfection facilities will be installed to provide safer and more reliable drinking water. The powdered chlorine will be selected as a disinfectant, which can be procured in Ethiopia, and for the chlorine injection system, the policy is to adopt a system that does not use electricity in considerations of the electricity situation in the target area.
−Clinics in small towns do not have enough drinking water, and maternal women, infants, and elders suffer from illnesses due to lack of sanitation. −Many of the communities spend a large part of their income on treating waterborne diseases, so implementing the Project will reduce these burdens.	
In order to prevent conflicts due to water use, it is necessary to provide water to the residents around the water source.	The final decision on the location and quantity of public taps to be constructed in the Project will be made with due considerations of the topography of each small town, population density, the extent of

Comments and Concerns from Local Communities	Response by the Executing Agency and Results Reflected in the Project
	the town, and the wishes of residents and water management organizations. In anticipation of water supply to each house, the Project plans to install not only public water taps, but also secondary distribution pipes.
As we have witnessed delays in project implementation many times in the past, we are doubtful that the Project will be completed on time.	Although the Project was delayed during the test drilling survey, during the implementation of the main construction work, construction will be managed by the Japanese expert based on the issues raised during the test drilling survey.

As mentioned above, no major objections or concerns about the Project itself were raised, except for concerns about delay or cancellation of the Project. In addition, many residents expressed their appreciation for the implementation of the Project, as shown below.

- Water supply to the community is an urgent priority and we are ready to provide the necessary support for the Project.
- Since cost of water purchase is high due to water shortage, the implementation of the Project is expected to not only reduce the time spent on fetching water, but also contribute significantly to the community economically.
- The construction of a water supply facility for our community has been a long-standing hope, and we are very happy that the problem of water shortage will finally be solved, and we are ready to help and support the implementation of the Project.
- All participants pledged their full support for the implementation of the Project and expressed their gratitude to JICA for the opportunity to provide drinking water to the community.

5. Land Acquisition and Resettlement

5－1 Necessity of Land Acquisition and Resettlement

A survey has been conducted on the necessity of land acquisition and resettlement for the Project. Land owners and conditions for land plots that require land acquisition has been confirmed together with the Town Administrative Officer. It was found that 12,642 m^2 (1.26 ha) of land is required for constructing deep well facilities (test wells and production wells), small-scale structures (reservoirs, disinfection facilities, pressure break tanks, booster pump stations, and solar power systems), and public taps (6 faucet-type, for school health facilities and livestock). Of these, about half (6,204 m^2 which is equivalent to 0.62 ha) was found to be public land and the remaining 6,438 m2 (0.64 ha) was found to be agricultural land. The land area required for constructing facilities in each small town is shown in the table below.

Table 5-1：Land Area that Needs to be Acquired for Constructing Facilities for the Project

Small Town Name	Land Use Type	Area (㎡)										Total
		Deep Well Facility		Small-scale Structure					Public Tap			
		Test well	Production well	Reservoir	Disinfection facility	Pressure break tank	Booster pump station	Solar panel system	6 faucet-type	School health facilities	Livestock	
Ude Dhankaka (ES-6)	Public land	400	800	317	100	-	-	-	288	192	60	2,157
	Agricultural land	-	-	-	-	-	-	-	72	-	-	72
Kamise (ES-8)	Public land	-	-	219	70	10	-	-	168	48	30	545
	Agricultural land	400	400	-	30	-	-	1,200	24	-	-	2,054
Areda (ES-10)	Public land	400	-	0	100	10	-	-	216	144	30	900
	Agricultural land	-	400	219	0	10	-	-	144	-	-	773
Biyo (ES-11)	Public land	-	-	219	100	10	-	-	144	48	-	521
	Agricultural land	400	400	-	-	-	-	-	120	-	-	920
Bolo (AR-2)	Public land	-	400	317	100	10	-	-	264	72	-	1,163
	Agricultural land	400	400	-	-	-	-	-	240	-	30	1,070
Gonde (AR-6)	Public land	-	400	-	50	30	-	-	360	48	30	918
	Agricultural land	800	-	317	50	10	300	-	72	-	-	1,549

Source: JICA Survey Team

The pipeline routes are selected so as not to affect the residential areas and existing buildings. Thus, none of the households will be affected by physical resettlement.

Table 5-2：Necessity for Land Acquisition and Resettlement

Name of Small Town	Land Acquisition	Resettlement
Ude Dhankaka (ES-6)	− 3 (three) out of 15 new public taps (6 faucet-type) will be constructed on private land (agricultural land), which will require land acquisition. − Transmission pipelines may be installed on private land (agricultural land), which will result in temporary land acquisition.	Since the affected land is agricultural land, resettlement is not expected for the Project.
Kamise (ES-8)	− The test well, disinfection facility and solar panel system will be constructed on private land (agricultural land), which will require land acquisition. − One (1) out of eight (8) new public taps (6 faucet-type) will be constructed on private land (agricultural land), which will require land acquisition. − Transmission pipelines may be installed on private land (agricultural land), which will result in temporary land acquisition.	
Areda (ES-10)	− The production well, reservoir and pressure break tank will be constructed on private land (agricultural land), which will require land acquisition. − Six (6) out of 14 new public taps (6 faucet-type) will be constructed on private land (agricultural land), which will require land acquisition. − Transmission pipelines may be installed on private land (agricultural land), which will result in temporary land acquisition.	

Biyo (ES-11)	- The test and production well will be constructed on private land (agricultural land), which will require land acquisition. - Five (5) out of 12 new public taps (6 faucet-type) will be constructed on private land (agricultural land), which will require land acquisition. - Transmission pipelines may be installed on private land (agricultural land), which will result in temporary land acquisition.	
Bolo (AR-2)	- The test and production well will be constructed on private land (agricultural land), which will require land acquisition. - 10 out of 21 new public taps (6 faucet-type) and one (1) public tap for livestock will be constructed on private land (agricultural land), which will require land acquisition. - Transmission pipelines may be installed on private land (agricultural land), which will result in temporary land acquisition.	
Gonde (AR-6)	- The test wells, reservoirs, disinfection facility, pressure break tank and booster pump station will be constructed on private land (agricultural land), which will require land acquisition. - 3 (three) out of 18 new public taps (6 faucet-type) will be constructed on private land (agricultural land), which will require land acquisition. - Transmission pipelines may be installed on private land (agricultural land), which will result in temporary land acquisition.	

In order to avoid or minimize the need for land acquisition and resettlement due to the Project, a site survey was conducted in the presence of the Town Administrative Officer, and construction sites and pipeline routes that avoided existing structures were selected by the Team. For the installation of the transmission/distribution pipelines, the route was planned to avoid the agricultural land as much as possible, and in some small towns, the installation work was planned to be conducted during the agricultural off-season to minimize the impact by the Project.

5－2 Legal Framework for Land Acquisition

(1) Overview of the Legal Framework for Land Acquisition and Resettlement in Ethiopia

Land use rights in Ethiopia are defined in the Constitution of the Federal Democratic Republic of Ethiopia (1995) as "Land is a common property of the Nations, Nationalities and Peoples of Ethiopia and shall not be subject to sale or other means of exchange". As land is considered a public asset, private citizens are not allowed to own land, but only to acquire the right to use it. The constitution also stipulates that if there is a possibility of the nation acquiring land for public needs, the government may accommodate private property for public purposes by making payment in advance commensurate with the value of the property.

With regard to agricultural land, Proclamation No. 456/2005 (Federal Rural Land Administrative and Land Use) has been enacted on agricultural land Administrative and land tenure. The Proclamation stipulates that "any citizen over the age of 18 who wishes to engage in agriculture has the right to use rural land and they shall be given rural land free of charge". In addition, land may be leased or given as gifts to family members, and land without heirs is redistributed to landless farmers by the government. Farmers with land holding certificates are allowed to lease their land to other farmers or investors, but the maximum areas (plots) and duration of the land lease are limited. The authority to manage agricultural land, including land distribution, has been transferred to the

regional governments, and each region has developed its own legal framework in compliance with the laws and regulations formulated by the federal government. In the Oromia Region, Proclamation No. 99/2005 (Oromia National Regional Government Rural Land Use Payment and Agricultural Income Tax Amendment) has been established and inheritance of land use right over one's holding land is allowed only to family members, and leasing is limited to half of the land owned to prevent land fragmentation. Land use fees and agricultural income taxes are set for the area of land owned by farmers (see table below), and are collected annually by the woreda administrative office. The amount of land use fee and agricultural income tax remains fixed unless the area of land owned changes or the law is amended.

Table 5-3：Land Use Fees and Agricultural Income Tax in Oromia Region (non-irrigated land)

Land area (ha)	Land use fees (Birr)	Agricultural Income Tax (Birr)	Total (Birr)
＜0.5	15.00	Exempted	15.00
0.5 ～ 1.0	20.00	20.00	40.00
1.0 ～ 2.0	30.00	35.00	65.00
2.0 ～ 3.0	45.00	55.00	100.00
3.0 ～ 4.0	65.00	70.00	135.00
4.0 ～ 5.0	90.00	100.00	190.00
＞ 5.0	120.00	140.00	260.00

Procedures and compensation standards for land acquisition for public purposes is stipulated by the Proclamation No. 1161/2019 (Expropriation of Land holdings for Public Purposes, Payments of Compensation and Resettlement of Displaced People). This Proclamation was newly issued in 2019 and repealed the Proclamation No. 455/2005. The concept of compensation is based on full replacement cost, where the landowner affected by the land acquisition is compensated equal to the present value of the capital and labor expended on the land for properties on the land and permanent improvements made on the land.

The main differences in the current law from the previous law with respect to the loss of agricultural land expected in the Project are as follows:

Table 5-4：Changes in Compensation for Permanent Agricultural Land Loss

Former law (No.455/2005)	Current law (No.1161/2019)
For permanent loss of agricultural land, provision of alternative land and compensation equivalent to one year of average annual income in the last five years	For permanent loss of agricultural land, provision of alternative land and compensation equivalent to one year of highest annual income in the last three years
For permanent loss of agricultural land, in case it is difficult to provide alternative land, compensation equivalent to an average annual income of 10 years in the last five years	For permanent loss of agricultural land, in case it is difficult to provide alternative land, compensation equivalent to 15 years of highest annual income in the last three years

The Proclamation also stipulates that the calculation of the compensation amount shall be conducted by the certified organization or individual. However, in the absence of a private property evaluation agency, the government agency shall establish a property evaluation committee to evaluate the property, considering the location of the land taken.

As a more detailed compensation standard, Regulation No. 135/2007 on Payment of Compensation for Property

Situated on Landholdings Acquired for Public Purposes, Council Ministers Regulation has been established and it provides the assessment method of the amount of compensation for houses, trees and crops affected by the land acquisition, as well as provision of livelihood restoration of project PAPs (PAPs).

The procedures for land acquisition are as follows:

1. The Town Administrative Offices hall consult with landowners at least one year prior to land acquisition on the Project outline, compensation coverage, and land acquisition procedures.
2. They shall collect land holding certificates or other proofs of land ownership and conduct a survey on the inventory, amount and size of all properties to be compensated. Property added after the cut-off date shall not be considered for compensation.
3. They shall calculate, determine and pay the amount of compensation after consultation with the landowner.
4. They shall inform the landowner or his/her representative of the amount of compensation paid for the land taken and the size and location of the land and housing, and notify the landowner in writing to hand over the land.
5. The landowner who receives the notice to surrender the land shall receive the compensation and the replacement land or house within 30 days of the notice. The landowner will be forced to surrender the land within 120 days after the compensation is paid in cash or through a bank. However, if there is no permanent property or crops on the land taken, the landowner must hand over the land to the Town Administrative Office within 30 days after the payment of compensation.

(2) JICA's Policy on Resettlement

JICA's policy on resettlement can be summarized as follows:

Table 5- 5: JICA's Policy on Resettlement

JICA's Policy on Resettlement	
I.	Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives.
II.	When, after such an examination, avoidance is proved unfeasible, effective measures to minimize impact and to compensate for losses must be agreed upon with the people who will be affected.
III.	People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported, so that they can improve or at least restore their standard of living, income opportunities and production levels to pre-project levels.
IV.	Compensation must be based on the full replacement cost[1)] as much as possible.
V.	Compensation and other kinds of assistance must be provided prior to displacement.
VI.	For projects that entail large-scale involuntary resettlement, resettlement action plans must be prepared and made available to the public. It is desirable that the resettlement action plan include elements laid out in the World Bank Safeguard Policy, OP 4.12, Annex A.
VII.	In preparing a resettlement action plan, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance. When consultations are held, explanations must be given in a form, manner, and language that are understandable to the affected people.
VIII.	Appropriate participation of affected people must be promoted in planning, implementation, and monitoring of resettlement action plans.
IX.	Appropriate and accessible grievance mechanisms must be established for the affected people and their communities.
Above principles are complemented by World Bank OP 4.12, since it is region in JICA Guideline that “JICA confirms that projects do not deviate significantly from the World Bank’s Safeguard Policies”. Additional key principle based on World Bank OP 4.12 is as follows.	
X.	Affected people are to be identified and recorded as early as possible in order to establish their eligibility through an initial baseline survey (including population census that serves as an eligibility cut-off date, asset inventory, and socioeconomic survey), preferably at the Project identification stage, to prevent a subsequent influx of encroachers of others who wish to take advance of such benefits.
XI.	Eligibility of Benefits include, the PAPs who have formal legal rights to land (including customary

and traditional land rights recognized under law), the PAPs who don't have formal legal rights to land at the time of census but have a claim to such land or assets and the PAPs who have no recognizable legal right to the land they are occupying.

XII. Preference shall be given to land-based resettlement strategies for displaced persons whose livelihoods are land-based.

XIII. Provide support for the transition period (between displacement and livelihood restoration.

XIV. Particular attention must be paid to the needs of the vulnerable groups among those displaced, especially those below the poverty line, landless, elderly, women and children, ethnic minorities etc.

XV. For projects that entail land acquisition or involuntary resettlement of fewer than 200 people, abbreviated resettlement plan is to be prepared.

In addition to the above core principles on the JICA policy, it also laid emphasis on a detailed resettlement policy inclusive of all the above points; project specific resettlement plan; institutional framework for implementation; monitoring and evaluation mechanism; time schedule for implementation; and, detailed Financial Plan etc.

Note:

1): Description of "replacement cost" is as follows.

Land	Agricultural Land	The pre-project or pre-displacement, whichever is higher, market value of land of equal productive potential or use located in the vicinity of the affected land, plus the cost of preparing the land to levels similar to those of the affected land, plus the cost of any registration and transfer taxes.
	Land in Urban Areas	The pre-displacement market value of land of equal size and use, with similar or improved public infrastructure facilities and services and located in the vicinity of the affected land, plus the cost of any registration and transfer taxes.
Structure	Houses and Other Structures	The market cost of the materials to build a replacement structure with an area and quality similar or better than those of the affected structure, or to repair a partially affected structure, plus the cost of transporting building materials to the construction site, plus the cost of any labor and contractors' fees, plus the cost of any registration and transfer taxes.

(3) Comparison of JICA GL with the Legal Framework of Ethiopia

The following table compares the JICA GL with the legal framework of Ethiopia.

Table 5- 6: Comparison of JICA GL with the Legal Framework of Ethiopia

No.	JICA Guidelines	Laws of Ethiopia	Gap between JICA Guidelines and Laws of Ethiopia	Policy
1	Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives. (JICA GL)	There is no provision for the avoidance of involuntary resettlement and loss of means of livelihood. (No.1161/2019)	Laws of Ethiopia does not stipulate the avoidance of resettlement.	The Project will identify possible alternative sites or routes that have the least adverse impact on the communities.
2	When population displacement is unavoidable, effective measures to minimize impact and to compensate for losses shall be taken. (JICA GL)	-There is no provision for minimizing the impact due to involuntary resettlement. (No.1161/2019) -It is essential to determine the types of compensable properties and lost economic interests and the principles thereof and establish the methods of valuation in order to pay land holders whose landholdings and property are acquired or damaged or lost their economic interests in the process of expropriation fair and equitable compensation. (No.1161/2019)	Laws of Ethiopia does not stipulate the measures to minimize the impact of resettlement, however, it describes the measures to determine the compensation for losses.	-The Project will identify possible alternative sites or routes that have the least adverse impact on the communities. -Compensation will be made for any loss caused by the Project based on legislations of the country and JICA guidelines.
3	People who must be resettled involuntarily and people whose means of livelihood will be hindered or	Compensation and resettlement assistance compensation for the acquired land shall sustainably restore and improve the livelihood of displaced people. (No.1161/2019)	No significant gap is observed.	Payment for land and/or non-land assets will be based on the principle of replacement cost. Compensation for the agricultural land is based on the law and JICA

No.	JICA Guidelines	Laws of Ethiopia	Gap between JICA Guidelines and Laws of Ethiopia	Policy
	lost must be sufficiently compensated and supported, so that they can improve or at least restore their standard of living, income opportunities and production levels to pre-project levels. (JICA GL)			guidelines. In addition to compensation for the loss of crops, trees, land, and property due to expropriation, the Project will cover the cost of preparing the land to levels similar to those of the affected land, plus the cost of any registration and transfer taxes. Furthermore, in case of there is voluntarily provision of the land, based on the Involuntary Resettlement Sourcebook published by World Bank, the following items shall be observed; 1. The infrastructure must not be site specific. 2. The impacts must be minor, that is, involve no more than 10 percent of the area of any holding and require no physical relocation. 3. The land required to meet technical project criteria must be identified by the affected community, not by line agencies or project authorities. 4. The land in question must be free of squatters, encroachers, or other claims or encumbrances. 5. Verification (for example, notarized or witnessed regiments) of the voluntary nature of land donations must be obtained from each person donating land. 6. If any loss of income or physical displacement is envisaged, verification of voluntary acceptance of community-devised mitigatory measures must be obtained from those expected to be adversely affected. 7. If community services are to be provided under the Project, land title must be vested in the community, or appropriate guarantees of public access to services must be given by the private titleholder. 8. Grievance mechanisms must be available.
4	Compensation must be based on the full replacement cost as much as possible. (JICA GL)	-The landholder whose land is acquired shall be paid compensation for the property on the land and the permanent improvement made on the land. -The amount of compensation for the property on the land shall cover the cost of replacing the property a new. - Compensation for permanent improvement to land shall be equal to the current value of capital and labor expended on the land. -Where the property on the land can be relocated and continue its service as before, the cost of removing, transporting, and erecting the property shall be paid as compensation. (No.1161/2019)	No significant gap is observed.	
5	Compensation and other kinds of assistance must be provided prior to displacement. (JICA GL)	The Town or Woreda Administrative shall pay compensation or provide substitute land before the displacement of people from their landholding. (No.1161/2019)	No significant gap is observed.	Compensation and other kinds of assistance must be provided prior to the resettlement activities such as land acquisition and the beginning of construction works. This is scheduled to be completed by the end of June, 2022.
6	For projects that entail large-scale involuntary resettlement, resettlement action plans must be prepared and made available to the public. (JICA GL)	There is no description regarding the resettlement action plan to be prepared. (No.1161/2019)	Laws of Ethiopia does not stipulate the needs for preparing resettlement action plans.	The schedule, evaluation measures, responsible organization, monitoring method of land acquisition shall be determined in accordance with WB safe guard policy and JICA guideline.
7	In preparing a resettlement action plan, consultations must be held with the affected people and their	-The Town or Woreda Administrative shall consult land holders who are to be displaced at least one year before they handover their holdings on the type; benefits and general process of the Project.	No significant gap is observed.	Consultations with the affected people and their communities shall be held at least one year before the land acquisition.

No.	JICA Guidelines	Laws of Ethiopia	Gap between JICA Guidelines and Laws of Ethiopia	Policy
	communities based on sufficient information made available to them in advance. (JICA GL)	-Land holders who are to be displaced may be consulted on the type; benefits and general process of the Project in less than one year if the concerned Federal or Regional Region decides that the land is required urgently for investment.		
8	When consultations are held, explanations must be given in a form, manner, and language that are understandable to the affected people. (JICA GL)	There is no description regarding procedures and approaches to consultation. (No.1161/2019)	Laws of Ethiopia does not specify the method/approach of holding consultation meetings.	Consultations must be held in the presence of the landowners and Town Administrative Officers familiar with local residents and land conditions. Town Administrative Offices hall provide relevant materials in a timely manner and in a language that are understandable to the groups being consulted.
9	Appropriate participation of affected people must be promoted in planning, implementation, and monitoring of resettlement action plans. (JICA GL)	-There is no provisions for the preparation of resettlement action plans. (No.1161/2019) -Woreda and Urban Administrative shall organize consultative meetings with people that are going to be displaced on the type; benefits; and generally the process of the Project.	Laws of Ethiopia does not specify the method/approach of participation of affected people.	Consultations must be held with affected people at least a year prior to the land acquisition and follow-up survey shall be conducted to confirm the social/economic status of affected people.
10	Appropriate and accessible grievance mechanisms must be established for the affected people and their communities. (JICA GL)	-Regional Regions, Addis Ababa and Dire Dawa Town Administrative shall establish Complaint Hearing Body and Appeal Hearing Council which shall have jurisdiction to entertain grievances arising from decisions -Any person who received an order of expropriation of his landholding; or who has an interest or claim on the property to be acquired may file an application within 30 days of service of the order to the Complaint Hearing Body -The body, after investigating the complaint submitted to it; shall make its decisions within 30 days of the filing of the application and notify in written to the parties.	No significant gap is observed.	Grievance mechanisms shall be established at each small town in accordance with Laws of Ethiopia and JICA guidelines.
11	Affected people are to be identified and recorded as early as possible in order to establish their eligibility through an initial baseline survey (including population census that serves as an eligibility cut-off date, asset inventory, and socioeconomic survey), preferably at the Project identification stage, to prevent a subsequent influx of encroachers of others who wish to take advance of such benefits. (WB OP4.12 Para.6)	- The Town or Woreda Administrative shall collect landholding rights and conduct inventory, amount and size of all compensable properties from displaced people or their legal representatives whose landholdings are determined to be acquired. Properties added after the expropriation notification is given to the land holder are not compensated.	No significant gap is observed.	An initial baseline survey (including socio-economic survey) has already conducted by the Project (excluding the affected people by transmission pipelines). Properties added after the initial baseline survey will not be compensated. Also, persons who encroach on the area after the cut-off date determined by each Town Administrative Office are not entitled to compensation or any other form of resettlement assistance.
12	Eligibility of benefits includes, the PAPs who have formal legal rights to land (including	A person who lost economic benefit either permanently or temporarily without being displaced as a consequence of land expropriation shall be paid compensation; the person	Laws of Ethiopia has provisions for only those who has legal title and doesn't give any provision for	Compensation shall be entitled to all affected individuals regardless of landholding rights to land titles.

No.	JICA Guidelines	Laws of Ethiopia	Gap between JICA Guidelines and Laws of Ethiopia	Policy
	customary and traditional land rights recognized under law), the PAPs who don't have formal legal rights to land at the time of census but have a claim to such land or assets and the PAPs who have no recognizable legal right to the land they are occupying. (WB OP4.12 Para.15)	entitled for the compensation, type and amount of compensation shall be determined by the Directives issued by a Regional Regions.	informal settlers.	
13	Preference shall be given to land-based resettlement strategies for displaced persons whose livelihoods are land-based. (WB OP4.12 Para.11)	-A landholder who is to be displaced permanently shall be substitute for a reasonable proportion of the land taken from the area, shall be given a substitute land if it is available. - If the land fails to serve as before, it shall be consider as acquired permanently and either a displacement compensation or substitute land shall be given to the land holder.	No significant gap is observed.	Compensation for those who dependent on agricultural activities will be land-based wherever possible. Also, replacement lands, shall be within the immediate vicinity of the affected lands and be of comparable productive capacity and potential.
14	Provide support for the transition period (between displacement and livelihood restoration). (WB OP4.12 Para.6)	Displacement compensation shall take in to consideration the amount of additional time necessary for the land to regain its productivity which shall be determined by the surrounding Agricultural Institution.	No significant gap is observed.	Displacement compensation shall include the amount of additional time necessary for the land to regain its productivity.
15	Particular attention must be paid to the needs of the vulnerable groups among those displaced, especially those below the poverty line, landless, elderly, women and children, ethnic minorities etc. (WB OP4.12 Para.8)	There is no provision for the needs of vulnerable groups. (No.1161/2019)	Laws of Ethiopia does not specify the rehabilitation assistance for the vulnerable groups.	The Project shall give particular attention to the needs of the poor and the vulnerable. Additional measures relating to livelihood improvement or restoration shall be taken such as the priority for construction-related job will be provided.
16	For projects that entail land acquisition or involuntary resettlement of fewer than 200 people, abbreviated resettlement plan is to be prepared. (WB OP4.12 Para.25)	There is no description regarding the resettlement action plan to be prepared. (No.1161/2019)	Laws of Ethiopia does not stipulate the needs for preparing resettlement action plans.	The schedule, evaluation measures, responsible organization, monitoring method of land acquisition shall be determined in accordance with WB safe guard policy and JICA guideline.

(4) Land Acquisition and Resettlement Policy for the Project

The following are the policies for land acquisition and resettlement for the Project. If there is any discrepancy between the laws and regulations of Ethiopia and the JICA GL/Safeguard policies of the World Bank, a practical way to satisfy both policies will be considered.

Table 5-7: Land Acquisition and Resettlement Policy for the Project

I.	The Government of Ethiopia will use the Project Resettlement Policy (the Project Policy) for the Project for Development of Water Supply Facilities of Small Towns in Oromia Region specifically, because existing national laws and regulations have not been designed to address involuntary resettlement according to international practice, including JICA's policy. The Project Policy is aimed at filling-in any gaps in what local laws and regulations cannot provide in order to help ensure that PAPs are able to rehabilitate themselves to at least their pre-project condition. This section discusses the principles of the Project Policy and the entitlements of the PAPs based on the type and degree of their losses. Where there are gaps between the Ethiopia legal framework for resettlement and JICA's Policy on Involuntary Resettlement, practicable mutually agreeable approaches will be designed consistent with Government practices and JICA's Policy.
II.	Land acquisition and involuntary resettlement will be avoided where feasible, or minimized, by identifying possible alternative project designs that have the least adverse impact on the communities in the Project area.
III.	Where displacement of households is unavoidable, all PAPs (including communities) losing assets, livelihoods or resources will be fully compensated and assisted so that they can improve, or at least restore, their former economic and social conditions.
IV.	Compensation and rehabilitation support will be provided to any PAPs, that is, any person or household or business which on account of project implementation would have his, her or their: • Standard of living adversely affected; • Right, title or interest in any house, interest in, or right to use, any land (including premises, agricultural and grazing land, commercial properties, tenancy, or right in annual or perennial crops and trees or any other fixed or moveable assets, acquired or possessed, temporarily or permanently; • Income earning opportunities, business, occupation, work or place of residence or habitat adversely affected temporarily or permanently; or • Social and cultural activities and relationships affected or any other losses that may be identified during the process of resettlement planning.
V.	All affected people will be eligible for compensation and rehabilitation assistance, irrespective of tenure status, social or economic standing and any such factors that may discriminate against achievement of the objectives outlined above. Lack of legal rights to the assets lost or adversely affected tenure status and social or economic status will not bar the PAPs from entitlements to such compensation and rehabilitation measures or resettlement objectives. All PAPs residing, working, doing business and/or cultivating land within the Project impacted areas as of the date of the latest census and inventory of lost assets(IOL), are entitled to compensation for their lost assets (land and/or non-land assets), at replacement cost, if available and restoration of incomes and businesses, and will be provided with rehabilitation measures sufficient to assist them to improve or at least maintain their pre-project living standards, income-earning capacity and production levels.
VI.	PAPs that lose only part of their physical assets will not be left with a portion that will be inadequate to sustain their current standard of living. The minimum size of remaining land and structures will be agreed during the resettlement planning process.
VII.	People temporarily affected are to be considered PAPs and resettlement plans address the issue of temporary acquisition.
VIII.	Where a host community is affected by the development of a resettlement site in that community, the host community shall be involved in any resettlement planning and decision-making. All attempts shall be made to minimize the adverse impacts of resettlement upon host communities.
IX.	The resettlement plans will be designed in accordance with Expropriation of Land holdings for Public Purposes, Payments of Compensation and Resettlement of Displaced People: Proclamation 1161/2019） and JICA's Policy on Involuntary Resettlement.
X.	The Resettlement Plan will be translated into local languages and disclosed for the reference of PAPs as well as other interested groups.
XI.	Payment for land and/or non-land assets will be based on the principle of replacement cost.
XII.	Compensation for PAPs dependent on agricultural activities will be land-based wherever possible. Land-based strategies may include provision of replacement land, ensuring greater security of tenure, and upgrading livelihoods of people without legal land titles. If replacement land is not available, other strategies may be built around opportunities for re-training, skill development, wage employment, or self-employment, including access to credit. Solely cash compensation will be avoided as an option if possible, as this may not address losses that are not easily quantified, such as access to services and traditional rights, and may eventually lead to those populations being worse off than without the Project.
XIII.	Replacement lands, if the preferred option of PAPs, shall be within the immediate vicinity of the affected lands wherever possible and be of comparable productive capacity and potential[1]. As a second option, sites shall be identified that minimize the social disruption of those affected; such lands shall also have access to services and facilities similar to those available in the lands affected.
XIV.	Resettlement assistance will be provided not only for immediate loss, but also for a transition period needed to restore livelihood and standards of living of PAPs. Such support could take the form of short-term jobs,

[1] Agricultural land for land of equal productive capacity means that the land provided as compensation shall be able to produce the same or better yield the AP was producing on his/her land prior to the project. The production shall be in the planting season immediately following the land acquisition. It can be for a future period if transitional allowance equal to the household's previous yield is provided to the AP household while waiting for the land to get back to the same productivity as the previous land.

subsistence support, salary maintenance, or similar arrangements.

XV. The resettlement plan must consider the needs of those most vulnerable to the adverse impacts of resettlement (including the poor, those without legal title to land, ethnic minorities, women, children, elderly and disabled) and ensure they are considered in resettlement planning and mitigation measures identified. Assistance shall be provided to help them improve their socio-economic status.

XVI. PAPs will be involved in the process of developing and implementing resettlement plans.

XVII. PAPs and their communities will be consulted about the Project, the rights and options available to them, and proposed mitigation measures for adverse effects, and to the extent possible be involved in the decisions that are made concerning their resettlement.

XVIII. Adequate budgetary support will be fully committed and made available to cover the costs of land acquisition (including compensation and income restoration measures) within the agreed implementation period. The funds for all resettlement activities will come from the Government.

XIX. Displacement does not occur before provision of compensation and of other assistance required for relocation. Sufficient civic infrastructure must be provided in resettlement site prior to relocation. Acquisition of assets, payment of compensation, and the resettlement and start of the livelihood rehabilitation activities of PAPs, will be completed prior to any construction activities, except when a court of law orders so in expropriation cases. (Livelihood restoration measures must also be in place but not necessarily completed prior to construction activities, as these may be ongoing activities.)

XX. Organization and administrative arrangements for the effective preparation and implementation of the resettlement plan will be identified and in place prior to the commencement of the process; this will include the provision of adequate human resources for supervision, consultation, and monitoring of land acquisition and rehabilitation activities.

XXI. Appropriate reporting (including auditing and redress functions), monitoring and evaluation mechanisms, will be identified and set in place as part of the resettlement management system. An external monitoring group will be hired by the Project and will evaluate the resettlement process and final outcome. Such groups may include qualified NGOs, research institutions or universities.

Cut-off-date of Eligibility

The cut-off-date of eligibility refers to the date prior to which the occupation or use of the Project area makes residents/users of the same eligible to be categorized as PAPs and be eligible to Project entitlements. In the Project, Cut-off dates for titleholders will be the date of notification under the Land Acquisition Act and for non-titled holders will be the beginning date of the population census; December, 2021 determined by the Town Administrative Office. This date has been disclosed to each affected village by the relevant local governments and the villages have disclosed to their populations. The establishment of the eligibility cut-off date is intended to prevent the influx of ineligible non-residents who might take advantage of Project entitlements.

Principle of Replacement Cost

All compensation for land and non-land assets owned by household/shop owners who meet the cut-off-date will be based on the principle of replacement cost. Replacement cost is the amount calculated before displacement which is needed to replace an affected asset without depreciation and without deduction for taxes and/or costs of transaction as follows:

Compensation for the agricultural land is based on the law and JICA guidelines. In addition to compensation for the loss of crops, trees, land, and property due to expropriation, the Project will cover the cost of preparing the land to levels similar to those of the affected land, plus the cost of any registration and transfer taxes.

1. Displacement compensation and land substitution for rural Landholders permanently displaced
Landholders who lose more than 20% of his/her agricultural land

a) A landholder who is to be displaced permanently shall be substitute for a reasonable proportion of the land taken from the area, shall be given a substitute land if it is available.

b) Where equivalent substitute land is given as per paragraph (a) this section, the land holder shall be paid a one-year landholding compensation income which is equal to the highest income he annually used to generate in the last three years preceding the expropriation of the land.

c) Displacement compensation shall be paid taking in to consideration the amount of additional time necessary for the land to regain its productivity which is equivalent to ten times the annual cost for growing the crops. In addition, the cost of any registration and transfer taxes shall be compensated.

d) A landholder shall be paid compensation for the permanent improvement made on the land. When calculating the cost of permanent improvement shall take in to consideration the amount of additional time necessary for the land to regain its productivity which is determined as ten-year by the Town Administrative Offices. In addition, the cost of any registration and transfer taxes shall be compensated.

e) The amount of compensation given to the temporarily displaced people shall not be greater than the amount of compensation given to permanently displaced people.

f) If the land fails to serve as before, it shall be consider as acquired permanently and either a displacement compensation (equivalent to fifteen times the highest annual income he generated during the last three years preceding the expropriation of the land) or substitute land shall be given to the land holder.

Landholders who lose less than 20% of his/her agricultural land

a) Where equivalent substitute land is not available or the landholder will lose, the land holder shall be paid

displacement compensation which is equivalent to fifteen times the highest annual income he generated during the last three years preceding the expropriation of the land.

2. Displacement compensation for temporarily displaced rural landholders:
a) a rural landholder whose landholding has been provisionally acquired shall, be paid displacement compensation for lost income based on the highest annual income secured during the last three years preceding the expropriation of the land until repossession of the land.
b) Displacement compensation for temporary expropriation shall not in any way exceed to the amount of compensation payable to permanent displaced compensation.

* (Expropriation of Land holdings for Public Purposes, Payments of Compensation and Resettlement of Displaced People: Proclamation 1161/2019)

1) Cut-off date Setting Policy

The cut-off date shall be June 2, 2021, when the population census survey is initiated. However, this cut-off date is tentative and the cut-off date will be re-set by the Town Administrative Office in December 2021, as the final compensation coverage and amount need to be calculated. The Project PAHs (PAHs) have already been identified by the Town Administrative Office through the population census survey, and the persons who encroach on the area after the cut-off date determined by each Town Administrative Office are not entitled to compensation or any other form of resettlement assistance. However, at the time of the official cut-off date (December 2021), if households that have acquired land through formal procedures (e.g. transfer of land use rights from family members) are found to be affected, they will be included in the compensation coverage. The affected communities and residents have been briefed on the procedures for land acquisition, including the cut-off date, at the community consultation, and they have been informed that any structures built after the cut-off date or any persons who have encroached on the Project area will not be eligible for compensation. When the Town Administrative Office and project local staff have visited and surveyed the land of PAHs, they also checked the GPS information of the land and the presence or absence of structures/buildings, and obtained the landowner's signature on the survey results. Therefore, even if structures are built illegally or a person encroach on the area after the cut-off date, it is possible to discuss and make decisions of their eligibility based on the survey results. After setting the official cut-off date, a community consultation is planned to be held to inform the local communities regarding the schedule for land acquisition for the Project and the cut-off date (around December 2021).

2) Method of Calculating Replacement Cost

The method of calculating the replacement cost in the Project is described in "1.3.2.4 Specific Measures for Compensation and Support" below.

5－3 Scale and Scope of Land Acquisition

(1) Scale and Scope of Land Acquisition and Number of PAHs

As mentioned earlier, about half of the land on which facilities such as deep wells and small-scale structures are planned to be constructed is publicly owned; however, the other half is privately owned (agricultural land). Thus, land acquisition needs to be conducted prior to the Project. The land area that needs to be permanently acquired is 6,438 m2 (0.64 ha).

Table 5- 8: Land Area Needed for Land Acquisition in Each Small Town

Small Town	Area requiring land acquisition (㎡)			Total
	Deep-well facility	Small-scale structures	public tap	
Ude Dhankaka (ES-6)	-	-	72	72
Kamise (ES-8)	800	1,230	24	2,054
Areda (ES-10)	400	229	144	773
Biyo (ES-11)	800	-	120	920
Bolo (AR-2)	800	-	270	1,070
Gonde (AR-6)	800	677	72	1,549
Total	3,600	2,136	702	6,438

In addition, the Project is expected to cause temporary land acquisition due to the installation of transmission pipelines. The construction period is shown in the below table and it varies among the small town. In Ethiopia, rain fed agriculture is practiced, relying on rainwater that falls during the rainy season. Cropping generally takes place between April and August and harvesting is conducted between September and December. Although the Town Administrative Office will request the affected landowners to adjust their cropping seasons and inform the local communities of the construction schedule, the Project may affect agricultural activities in the three small towns of Ude Dhankaka, Bolo, and Gonde; thus temporary land acquisition will be required.

Table 5- 9: Schedule of Transmission Pipeline Installation Works in Each Small Town

Small Town	Construction Period for Installing Transmission pipelines	Impact on Agricultural Activities
Kamise (ES-8)	Early January to late January 2024 (25 days)	No effect
Areda (ES-10)	Early January to late February 2024 (57 days)	No effect
Ude Dhankaka (ES-6)	Mid-March to late April 2024 (41 days)	Installation work may overlap with cropping season
Bolo (AR-2)	Late October to late November 2024 (25 days)	Installation work may start before harvesting
Gonde (AR-6)	Mid-November to mid-December 2024 (29 days)	Installation work may start before harvesting
Biyo (ES-11)	Mid-March to late March 2025 (13 days)	No effect

Regarding the construction of transmission pipelines in Kamise, Areda, and Biyo and the construction of access roads in the six small towns (January-February 2023), compensation for agricultural land and crops will not be required because the construction period falls during the agricultural off-season. In addition, distribution pipelines are planned to be installed along the existing road, land and therefore, land acquisition is not required. Although the construction work for distribution pipelines may close part of the road traffic, the excavation work will be conducted on the side of the road and it will not block and disturb the entire road and traffic.

Table 5-10: Scale and Scope of Land Acquisition under the Project

Small Town	Land area requiring permanent acquisition (m^2)	Land area requiring temporary acquisition (m^2)
Ude Dhankaka (ES-6)	72	3,424

Kamise (ES-8)	2,054	-
Areda (ES-10)	773	-
Biyo (ES-11)	920	-
Bolo (AR-2)	1,070	2,170
Gonde (AR-6)	1,549	2,430

A population census, property and land survey, and socio-economic survey were conducted from June 2 to June 9, 2021 for landowners and their representatives who own agricultural land (grain cultivation land) where facilities such as deep wells and small-scale structures are planned to be constructed. The number of PAHs and PAPs are shown in Table 5- 12 below. However, the number of PAHs due to the installation of transmission pipelines in the three small towns has not been identified at this time, as the specific pipeline routes will be determined during detailed design stage. The Town Administrative Office will identify and confirm the households when calculating the compensation cost, however the number of PAHs is expected to be small, as the pipelines are planned to be installed mainly along roads and in vacant plots on public land.

Regardless of the presence or absence of a land holding certificate (formal or informal legal rights to land), a total of 45 households (250 persons) were identified to be affected: 3 households in Ude Dhankaka, 5 households in Kamise, 9 households in Areda, 12 households in Biyo, and 9 households in Gonde. Physical resettlement is not envisaged in the Project, but economic resettlement due to loss of agricultural land will be expected.

Although Ethiopia has a legal requirement to issue land holding certificates, the current situation is that in some areas (especially in rural areas) the implementation of land registration and the delivery of land holding certificates is not well developed. As a result of confirming the status of the land affected by the Project with the Town Administrative Office, it is found that they are aware of the status of each household's land plot and can determine which plot is owned by whom. In the Project, PAPs will not be classified as the persons with formal or informal legal rights to land based on the presence or absence of a land holding certificates. All PAPs will be classified as "the persons with formal legal rights to land" and compensation will be provided regardless of the possession of a land holding certificate.

Table 5-11: Number of PAHs and PAPs by the Project

Type of Loss	Type of Displacement	Unit	Ude Dhankaka (ES-6)	Kamise (ES-8)	Areda (ES-10)	Biyo (ES-11)	Bolo (AR-2)	Gonde (AR-6)	Total
Loss of Housing	Physical Displacement	Household	0	0	0	0	0	0	0
		Person	0	0	0	0	0	0	0
Loss of Agricultural Land	Economic Displacement	Household	3	5	9	7	12	9	45
		Person	18	29	40	38	68	57	250

Source: JICA Survey Team

(2) Property and Land Survey

As a result of the property and land survey, it was found that the Project will not affect any of the existing structures (housings, store buildings, fences, etc.). In addition, perennial plant cultivation was not observed, and all PAHs were engaged in grain cultivation.

Table 5-12: Land Affected by the Project

Small Town	Land-use Type	Affected Area (m^2)	Total (m^2)
Ude Dhankaka (ES-6)	Agricultural Land	72	72
	Residential Area	0	
Kamise (ES-8)	Agricultural Land	2,054	2,054
	Residential Area	0	
Areda (ES-10)	Agricultural Land	773	773
	Residential Area	0	
Biyo (ES-11)	Agricultural Land	920	920
	Residential Area	0	
Bolo (AR-2)	Agricultural Land	1,070	1,070
	Residential Area	0	
Gonde (AR-6)	Agricultural Land	5,286	1,549
	Residential Area	0	
Total			6,438

(3) Socio-economic Survey

The results of the socio-economic survey for PAHs are shown in the table below. The ethnic groups of the household heads were Oromo or Amhara, and the main source of income for all households was agricultural activities.

Table 5-13: Results of Socio-economic Survey of PAHs

Small Town Name	PAHs Number	No. of Household (person)	Gender of household head	Main source of income	Ethnicity of household head	Presense of children（>18）	Presense of eldery person（≧60）
Ude Dhankaka(ES-6)	ES6-1	7	Male	Agriculture	Oromo	-	-
	ES6-2	5	Male		Oromo	○	-
	ES6-3	6	Male		Oromo	○	-
Kamise(ES-8)	ES8-1	5	Male		Amhara	○	○
	ES8-2	6	Male		Oromo	○	-
	ES8-3	5	Male		Oromo	-	-
	ES8-4	6	Male		Oromo	○	-
	ES8-5	7	Male		Oromo	○	○
Areda(ES-10)	ES10-1	4	Male		Oromo	○	-
	ES10-2	6	Male		Oromo	-	-
	ES10-3	5	Female		Oromo	○	○
	ES10-4	2	Male		Oromo	○	-
	ES10-5	4	Male		Amhara	-	-
	ES10-6	3	Male		Oromo	○	○
	ES10-7	5	Male		Oromo	○	-
	ES10-8	6	Male		Oromo	-	-
	ES10-9	5	Male		Oromo	○	-
Biyo(ES-11)	ES11-1	8	Male		Oromo	○	-
	ES11-2	4	Male		Oromo	○	-
	ES11-3	3	Male		Oromo	-	○
	ES11-4	5	Male		Oromo	○	-
	ES11-5	6	Male		Oromo	○	○
	ES11-6	5	Male		Oromo	○	-
	ES11-7	7	Male		Oromo	-	-
Bolo(AR-2)	AR2-1	6	Male		Oromo	-	○
	AR2-2	7	Male		Oromo	○	-
	AR2-3	4	Male		Oromo	-	-
	AR2-4	8	Male		Amhara	○	-
	AR2-5	7	Male		Oromo	○	○
	AR2-6	3	Male		Oromo	○	-
	AR2-7	5	Male		Oromo	○	-
	AR2-8	6	Male		Amhara	-	-
	AR2-9	5	Male		Oromo	○	-
	AR2-10	6	Male		Oromo	○	-
	AR2-11	5	Male		Amhara	○	-
	AR2-12	6	Male		Oromo	○	○
Gonde(AR-6)	AR6-1	5	Male		Oromo	-	-
	AR6-2	5	Male		Oromo	○	-
	AR6-3	7	Male		Amhara	○	○
	AR6-4	8	Female		Oromo	○	-
	AR6-5	7	Male		Oromo	○	-
	AR6-6	4	Female		Oromo	○	○
	AR6-7	7	Male		Oromo	○	○
	AR6-8	9	Male		Oromo	-	-
	AR6-9	5	Male		Amhara	○	-

Source: JICA Survey Team

(4) Socially Vulnerable Groups

According to the results of the population census and socio-economic survey, three of PAHs were female-headed households (1 in Areda and 2 in Gonde). In addition, 33 households with children under 18 years old and 12 households with elderly (over 60 years old) were identified. Regarding the ethnic minorities and indigenous people, no indigenous/minority households that meet the requirements of JICA GL and World Bank OP4.10 were identified.

5－4 Specific Measures for Compensation and Support

(1) Compensation for Loss

The policies related to compensation and support for the Project, requirements for beneficiaries, and calculation method of compensation are as follows.

- Type of loss: Loss due to partial or total removal of buildings (housings, stores), structures (block walls, fences, etc.), partial or total loss of land holdings, loss of income due to displacement, loss of means of livelihood due to displacement, loss of crops before harvesting
- Beneficiary requirements: All households affected by the Project regardless of the possession of land holding certificates
- Compensation type: cash compensation, provision of alternative land
- Compensation will be calculated based on the replacement cost in accordance with Ethiopian law and the World Bank Safeguard Policy. Replacement cost covers the compensation for loss of crops, trees, land and property due to land acquisition as well as the cost of preparing the land to a level similar to that of the affected land and cost of registration and transfer taxes.
- Cut-off date: June 2 2021, when the population census is launched. However, this cut-off date is tentative and will be re-established around December 2021 by each Town Administrative Office to calculate the final coverage and compensation price.
-

1-1) Types of Compensation for Loss

In accordance with Proclamation No. 1161/2019, the loss and compensation envisaged by the Project are calculated as follows:

a. Permanent Loss of Land

The construction of the facilities under the Project will result in the acquisition of approximately 0.64 ha of land, and a total of 45 households in 6 small towns will be affected and need to be compensated for the loss of income and livelihoods associated with the relocation of their agricultural lands. According to the World Bank's OP 4.12, it is desirable to give priority to the provision of alternative land to those who depend on the land for their livelihood, but if the land taken constitutes less than 20% of the total productive area, cash compensation is considered appropriate. In the case of the construction of small-scale structures such as public taps and disinfection facilities, most land taken constitutes less than 20% of the total productive area and 73% (33 households) of the PAHs fall under this category.

If the land taken constitutes 20% or more of the total productive area

As a compensation, the alternative land shall be provided as well as the cost equivalent to one year of the highest annual income of the last three years, the cost of preparing the land to a level similar to that of the affected land and cost of registration and transfer taxes. The annual income and the cost of preparing the land to a level similar to that of the affected land shall be calculated by multiplying the ratio of the land taken to the total land area.

According to Proclamation No. 1161/2019, the period of time for preparing the alternative land to the same level as the affected land shall be determined by the local agricultural administrative body. Based on the results of interviews with Town Administrative Offices in six small towns, it was found that 10 years of compensation would be required to prepare the replacement land to a level similar to that of the affected land, thus the cost of preparing the land to a level similar to that of the affected land is set at 10 years. Since each farmer has different expenses for land preparation, the unit cost of land preparation will be determined by confirming the annual required expenses (expenses for fertilizer and labor for land) of each PAHs in calculating the compensation amount. Regarding the registration tax and transfer tax, the cost for each small town are shown in the table below.

Table 5- 14: Registration and Transfer Tax of Agricultural Land in Each Small Town

Small Town	Ude Dhankaka (ES-6)	Kamise (ES-8)	Areda (ES-10)	Biyo (ES-11)	Bolo (AR-2)	Gonde (AR-6)
Required Taxes (Birr)	57	105	62	98	135	65

Source: Prepared by the Team

If the land taken constitutes less than 20% of the total productive area

As a compensation, the cost equivalent to the highest annual income of 15 years in the last three years shall be provided. The annual income will be calculated by multiplying the ratio of the land taken to the total land area.

Note: During the site survey, the land owners and the availability of land acquisition have been confirmed with the Town Administrative Office and it was found that most household affected by small-scale land acquisition (24 ㎡) for constructing public taps offered to donate their land due. With regard to land acquisition for test and production wells, and reservoirs (220 ~ 400 m2), it was confirmed that there were those who preferred to obtain an alternative land and cash compensation equivalent to one-year of highest annual income and those who preferred to receive the cash compensation equivalent to 15 years of highest annual income regardless of the percentage of the total productive area of the land taken. As a general policy, the PAPs whose land taken constitutes 20% or more of the total productive area will be given priority in the provision of alternative land. However, the PAPs' preferences shall be prioritized to determine the details of the compensation after consultation between the Town Administrative Office. In other words, even if the land taken constitutes less than 20% of the total productive area, it will be possible to receive alternative land and cash compensation equivalent to the cost for one year's annual income, land preparation costs (for 10 years), and expenses related to taxes. In addition, if the condition of the land is unfavourable after the provision of alternative land, and the land does not retain the same productivity, the provision of another alternative land or cash compensation equivalent to 15 years of highest annual income within the last 3 years shall be provided.

b. Temporary Loss of Land

Temporary land acquisition will be required for the installation of transmission pipelines in the Project. Losses can be minimized by restoring the construction site to its original condition as soon as possible after the installation work is completed, thereby shortening the period of temporary land acquisition at each agricultural plot. However, a certain amount of income loss is unavoidable, and compensation for income loss will be necessary. The compensation cost will be based on the highest annual income of the last three years for income loss during the period from land acquisition to restoration. However, a certain amount of income loss is unavoidable and compensation for income loss is necessary. The compensation cost will be based on the highest annual income of the last three years and income loss during the period from the time the land is acquired until it is restored to its original condition is compensated. In the Project, one season of cultivation will be lost due to temporary land acquisition, thus one-year income will be calculated as a compensation. However, as stipulated in Proclamation No. 1161/2019, it shall be noted that the amount of compensation for PAHs with temporary land loss shall not exceed the amount of compensation for PAHs with permanent land loss.

The number of PAHs will be identified when the Town Administrative Office conducts a re-survey of land and property (January 2022); however, the number of PAHs with temporary land loss is expected to be small, as the pipeline is planned to be installed mainly along roads and in vacant plots on public land.

c. Loss of Buildings and Structures

According to the survey results, no buildings and structures were identified on the land plots affected by the Project, therefore, no compensation for the loss of structures is expected. In case loss of buildings and structures are found in the future, the amount of compensation will be calculated based on the replacement cost in accordance with the Ethiopian Law. In Proclamation No. 1161/2019, the compensation for property on land is to cover the cost of replacing the property with a new one in a form equal to its current value. It also stipulates that if the property on land can be relocated and services can be continued as before, the cost of removal, transportation and construction of the property shall be paid as compensation

d. Crop Loss

According to the survey results, no cultivation of trees or perennial crops were observed at PAHs' agricultural land. All the land taken for the Project is under grain cultivation (teff, maize, wheat, etc.), and no loss of crops is expected since the land is planned to be handed over after the crops are harvested by PAHs with permanent loss of land.

e. Loss of Means of Livelihood

In the target small towns, 14 water retailers have been identified. They have a good understanding of the water supply situation around the area and are suitable to be members of the operation and management of the water supply facilities. Therefore, they will be given priority for employment in the staff of the new water management organization to be established by the Project.

1-2) Calculation Method of Compensation Cost

When the Land Taken constitutes 20% or More of the Total Productive Area

The compensation cost for 12 households whose land taken by the Project constitutes more than 20% of the total production area was calculated by the following equation, and the total amount of compensation cost was 416,883 Birr (JPY: 823,082 Yen[2]). In addition to the cash compensation, the alternative land shall be provided for these PAHs.

Compensation cost = (the highest annual income in the last 3 years x the ratio of the area of land taken to the total area of the land) + the cost of preparing the land to the same level as the affected land (10 years) + taxes on agricultural land transfer

The breakdown of each PAHs is shown in the table below.

Table 5-15: Compensation Cost for PAHs whose Land Taken Constitutes 20% or More of the Total Productive Area

Small Town Name	PAHs Number	① Total Land Area (㎡)	② Land to be Acquired (㎡)	③ Ratio of land area taken to the total land area (%)【②÷①】	⑤ Highest annual income in the last 3 years* (Birr)	⑥ Compensation cost		
						One-year income of the highest annual income in the last 3 years*× ratio (Birr)【1×⑤】	Cost for preparing the land to the same level as the affected land (Birr)	Taxes on agricultural land transfer (Birr)
Kamise(ES-8)	ES8-1	500	400	80.0%	8,000	6,400	24,000	105
	ES8-4	550	400	72.7%	12,000	8,727	29,091	105
	ES8-5	1350	830	61.5%	32,500	19,981	58,407	105
Areda(ES-10)	ES10-7	400	219	54.8%	4,500	2,464	13,688	98
	ES10-8	600	400	66.7%	8,500	5,667	20,000	98
Biyo(ES-11)	ES11-1	430	400	93.0%	12,000	11,163	23,256	135
	ES11-7	500	400	80.0%	13,500	10,800	36,000	135
Bolo(AR-2)	AR2-1	550	400	72.7%	7,000	5,091	21,818	62
	AR2-11	500	400	80.0%	9,000	7,200	24,000	62
Gonde(AR-6)	AR6-1	700	400	57.1%	11,500	6,571	28,571	65
	AR6-5	450	317	70.4%	7,600	5,354	21,133	65
	AR6-6	500	400	80.0%	8,000	6,400	20,000	65
					小計	95,818	319,965	1,100
					合計			**416,883**

*Annual household income for one plot of land affected by the Project
(it is not an annual household income from the total agricultural land PAHs holding)

When the Land Taken constitutes Less Than 20% of the Total Productive Area

The compensation cost for 33 households whose land taken by the Project constitutes less than 20% of the total productive area was calculated by the following equation, and the amount of compensation cost was 320,880 Birr (JPY: 1,069,337 Yen2).

Compensation cost = (the highest annual income in the last 3 years x the ratio of the land area to be acquired to the total land area) x 15 years

The breakdown of each affected household member is shown in the table below.

[2] JICA rate in June 2021 (1 Birr=2.56508 Japanese Yen)

Table 5- 16: Compensation cost for PAHs whose Land Taken Constitutes Less Than 20% of the Total Productive Area

Small Town Name	PAHs Number	① Total Land Area (㎡)	② Land to be Acquired (㎡)	③ Ratio of land area taken to the total land area (%) 【②÷①】	⑤ Highest annual income in the last 3 years* (Birr)	⑥ Compensation cost: the highest annual income in the last 3 years×15 years ×ratio (Birr)【⑤×15×③】
Ude Dhankaka(ES-6)	ES6-1	500	24	4.8%	12,000	8,640
	ES6-2	350	24	6.9%	9,000	9,257
	ES6-3	300	24	8.0%	7,000	8,400
Kamise(ES-8)	ES8-2	400	24	6.0%	10,000	9,000
	ES8-3	10000	400	4.0%	43,000	25,800
Areda(ES-10)	ES10-1	500	24	4.8%	11,000	7,920
	ES10-2	450	24	5.3%	13,000	10,400
	ES10-3	500	24	4.8%	10,000	7,200
	ES10-4	230	24	10.4%	4,500	7,043
	ES10-5	300	24	8.0%	6,000	7,200
	ES10-6	550	24	4.4%	7,000	4,582
	ES10-9	450	10	2.2%	5,200	1,733
Biyo(ES-11)	ES11-2	300	24	8.0%	9,000	10,800
	ES11-3	500	24	4.8%	11,000	7,920
	ES11-4	400	24	6.0%	14,000	12,600
	ES11-5	400	24	6.0%	13,000	11,700
	ES11-6	700	24	3.4%	14,000	7,200
Bolo(AR-2)	AR2-2	500	24	4.8%	4,500	3,240
	AR2-3	500	24	4.8%	5,000	3,600
	AR2-4	400	24	6.0%	7,000	6,300
	AR2-5	430	24	5.6%	4,800	4,019
	AR2-6	200	24	12.0%	3,700	6,660
	AR2-7	350	24	6.9%	3,500	3,600
	AR2-8	700	24	3.4%	9,500	4,886
	AR2-9	450	24	5.3%	5,000	4,000
	AR2-10	970	48	4.9%	11,600	8,610
	AR2-12	450	30	6.7%	7,000	7,000
Gonde(AR-6)	AR6-2	500	24	4.8%	9,800	7,056
	AR6-3	500	24	4.8%	7,000	5,040
	AR6-4	330	24	7.3%	5,000	5,455
	AR6-7	1520	225	14.8%	26,700	59,285
	AR6-8	450	75	16.7%	7,000	17,500
	AR6-9	940	60	6.4%	18,000	17,234
					合計	**320,880**

*Annual household income for one plot of land affected by the Project
(it is not an annual household income from the total agricultural land PAHs holding)

(2) Measures to Restoration of Livelihood

The Project will employ various types of local hired workers during the construction period, including skilled laborers such as engineers and survey workers and non-technical laborers such as clerks, office boys and security guards. The Project will give priority to inform and hire PAHs, especially female heads of households and households with children and elderly people, through the respective Town Administrative Offices. In addition, for the 13 households with the land taken constitutes more than 20%, the monitoring survey will focus on confirming whether their living environment, livelihood pattern, and means of livelihood have been damaged or not. However, it is not expected the Project will have a significant impact on their livelihoods. This is because farmers generally divide their land into plots within their holding agricultural land based on land use and cultivated crops, and in many cases, a household owns multiple plots. In addition to the land plots taken by the Project, most of the PAHs own other agricultural plots in the vicinity.

(3) Land Relocation/Displacement

In the Project, 12 PAHs whose land taken constitutes more than 20% of the total productive area will be provided with alternative land in addition to cash compensation. The alternative land will be selected from the land owned by the Farmers Association in each small town, and will therefore be chosen from nearby land. The relocation schedule is as described in “5-7 Implementation Schedule".

PAHs will be compensated for the cost of preparing the land to a level similar to that of the affected land (10

years' worth of land improvement cost), plus registration and transfer taxes. However, if the land to be relocated is undesirable to the affected person and the person files a complaint, or if the land does not retain the same productivity, the provision of another alternative land or cash compensation equivalent to 15 years of highest annual income within the last 3 years will be given after an investigation by the Town Administrative Office and the Agricultural Association.

(4) Entitlement Matrix

The entitlement matrix, which organizes the types of losses, beneficiaries and compensation to be incurred in the Project, is shown in the table below. If new PAHs with new attributes are found due to route changes during the Detailed Design Stage and temporary land acquisition due to transmission pipeline installation, the entitlement matrix will be revised after consultation with relevant agencies.

Table 5- 17: Entitlement Matrix

Type of loss	Eligibility Criteria	Type of Impact	Compensation	Responsible Organization
Loss of agricultural land	All households affected by the Project , regardless of the presence or absence of a land holding certificates/ formal or informal legal rights to land	Permanent loss of land	**If the land taken constitutes 20% or more of the total productive area** - Provision of alternative land + cash compensation equivalent to one year's highest annual income for the past three years + cost of preparing the alternative land to the same level as the acquired land (10 years' worth of land improvement costs) + registration tax and other taxes associated with the relocation Note1: If the condition of the above alternative land is undesirable and the land does not retain the same productivity, the provision of another alternative land or cash compensation equivalent to 15 years of highest annual income within the last 3 years will be provided. Note2：If residents wish to receive cash compensation instead of alternative land, cash compensation equivalent to 15 years of highest annual income within the last 3 years will be provided. In this case, alternative land will not be provided.	Town Administrative Office
			If the land taken constitutes less than 20% of the total productive area - Cash compensation equivalent to 15 years of the highest annual income in the past three years Note3: If residents wish to receive alternative land instead of cash compensation, the alternative land	Town Administrative Office

Type of loss	Eligibility Criteria	Type of Impact	Compensation	Responsible Organization
			as well as cash compensation (equivalent to the highest annual income for the past 3 years + cost of preparing the alternative land to the same level as the land taken (10 years' worth of land improvement cost) + registration tax cost) will be provided.	
Loss of income		Temporary loss of land	− Cash compensation equivalent to one year of the highest annual income in the past three years. Note4: The amount of compensation for PAHs with temporary land loss shall not exceed the amount of compensation for PAHs with permanent land loss.	Town Administrative Office
Crop loss		Loss of harvest	− Consultations with PAHs for permanent land loss will be held at least one year in advance, and the timing of land handover will be planned after the crops have been harvested. Thus, no loss of crops will occur.	Town Administrative Office
Socially vulnerable people	Socially vulnerable (female head of household, households with children/elderly)	Loss of means of livelihood (agricultural land)	− Provide priority employment opportunities	Town Administrative Office

5－5 Grievance Mechanism

In Proclamation No. 1161/2019, the provisions pertaining to complaints and objections regarding resettlement and land acquisition have been included. Any person who is dissatisfied with the land acquisition may file a complaint within 30 days from the date of issuance of the land acquisition order, and the agency receiving the complaint must render a decision within 30 days from the submission of the application and notify the parties in writing. In addition, if the landowner suffers financial loss due to the land acquisition and is unable to file a complaint, he or she may avail of free legal services provided by the government.

- Each Town Administrative Office will conduct the entire process from the contact point for opinions and complaints from residents to the investigation of the contents of complaints and specific procedures. For cases that are difficult for the Town Administrative Offices to judge and respond to, the Woreda Water and Energy Resource Development Office will be asked to provide support as needed and cooperate in investigating and responding to the complaints. If further support is required, assistance will be requested from the Zone Water and Energy Resource Development Office and the Oromia Water and Energy Resource Development Bureau. As the Town Administrative Office and the Woreda Water and Energy Resource Development Office are geographically close to each other, they have already established a

system for coordinating and responding to water supply and construction projects in the region. Thus, the above support system will be well coordinated to implement the grievance process smoothly.

- In the small towns of Areda, Bolo, and Gonde where piped water supply facilities are operated, the water management organizations such as water committee and town water supply service enterprises are mainly responsible for the maintenance and operation of the water supply facilities. Thus, it will be requested to share any opinions or complaints from local communities with the Town Administrative Office as needed.
- The Town Administrative Office will hold stakeholder meetings as necessary to obtain consensus from the target local community as well as explain the land acquisition procedures in advance. If any questions or complaints are raised at the meeting, they will be reported to the OWERDB as needed.

5－6 Implementation Structure

Proclamation No. 1161/2019 specifies the role and authority of the Town Administrative Office as follows, but does not specify the specific implementation structure.

- Pay compensation to PAPs whose land has been acquired.
- Implementation of resettlement package (if there is involuntary resettlement)
- Maintain property records on acquired land.
- Support and ensure livelihood improvement for relocated farmers and pastoralists
- Keep records and documentary evidence on relocated farmers and residents

In the Project, the following implementation structure will be applied for land acquisition procedures.

Table 5- 18: Implementation Structure for Land Acquisition

Organization Name	Activities
Oromia Water and Energy Resource Development Bureau (OWERDB)	– Monitoring the progress of compensation procedures to ensure that they are carried out in an appropriate manner and schedule – Organize the results of monitoring surveys from the Town Administrative Office.
Zone Water and Energy Resource Development Office	– Support the activities of the Woreda Water and Energy Resource Development Office as needed. – Request for assistance from the OWERDB
Woreda Water and Energy Resource Development Office	– Support the activities of the Town Administrative Office as needed. – Request for assistance from the Zone Water and Energy Resource Development Office
Town Administrative Office	– Establishment of Property Evaluation Committee – Explanation and consensus building with local communities – Calculation of compensation costs and make a payment – Provision of alternative land (selected from land owned by Farmers Association) – Implementation of livelihood restoration program – Technical support to the Property Evaluation Committee – Investigation and decision-making on complaints – Confirmation of socioeconomic status of PAHs after completion of compensation (Monitoring is conducted twice a year, once after one month and once after six months)
Property Evaluation Committee	– To be established in December 2021 by the Town Administrative Office in each small town. – The group consists of about five members: woreda administrative staff, town representatives, land management staff, legal system staff, and

	village committee members – Support for explanation to local communities and consensus building – Survey for calculating the amount of compensation cost – Survey and measurement of land that need to be acquired
Water management organizations (water committee and town water supply service enterprises)	– Provision of information on complaints and opinions from communities – Technical assistance to the Property Evaluation Committee – Support for explanation to local communities and consensus building

5－7 Implementation Schedule

The land acquisition procedures such as consultations with PAHs, determination of compensation amount or alternative lands and relocation need to be completed before the pre-qualification for bidding (P/Q). Therefore, it is planned that the cash compensation and provision of alternative land as well as the first monitoring will be completed by the end of May 2022, two months before the P/Q. The implementation schedule for land acquisition is shown in the table below.

Table 5-19: Implementation Schedule

Activity	Responsible Organization	2021		2022										
		11	12	1	2	3	4	5	6	7	8	9	10	11
Establish the Property Evaluation Commitee at each town office	Town Administrative Office													
Hold a stakeholder meeting and explain to PAHs	Property Evaluation Committee													
Survey on the land to be acquired and property	Town Administrative Office/Property Evaluation Committee													
Evaluate and determine the compensation costs	Town Administrative Office/Property Evaluation Committee													
Cash compensation payment and provision of alternative land	Town Administrative Office													
Complaint handling	Town Administrative Office/Water Committee													
Follow-up monitoring survey	Town Administrative Office/Property Evaluation Committee													

5－8 Costs and Budget

The costs involved for land acquisition are shown in the table below. Cash compensation for land acquisition or alternative lands will be provided to the PAHs after a decision is made by the Town Administrative Office. The costs involved for land acquisition process and monitoring is financed by the Federal Government's budget.

The cash compensation for land acquisition under the Project requires 737,763 Birr (JPY: 1,892,4213) as compensation for permanent loss of land and 152,905 Birr (JPY: 392,214) as compensation for temporary loss of land. Thus, the total amount will be 890,668 Birr (JPY: 2,284,635) to acquire the land for the Project.

[3] JICA rate in June 2021 (1 Birr=2.56508 yen)

Table 5-20: Compensation Cost for Land Acquisition

Small Town	Compensation costs for permanent agricultural land loss (Birr)	Compensation costs for temporary agricultural land loss (Birr)
Ude Dhankaka (ES-6)	26,297	83,356
Kamise (ES-8)	181,722	-
Areda (ES-10)	88,093	-
Biyo (ES-11)	131,709	-
Bolo (AR-2)	110,148	28,061
Gonde (AR-6)	199,794	41,488
Total	737,763	152,905

In addition to the compensation cost for PAHs, the Labour cost for Property Evaluation Committee is required for the Project. The required number of members to establish the Committee in each small towns is five (a woreda administrative officer, a town representative, a land supervisor, a legal system officer, and a village committee member), and the daily labor cost is around 400-750 Birr per person per small towns based on the interview results by the Town Administrative Office. In the Project, the average value of 550 Birr will be adopted as the personnel cost of the Property Evaluation Committee. The total cost of the activities of the Property Evaluation Committee for land acquisition procedures and monitoring is 350,625 Birr (JPY: 899,381) for the six small towns.

The following table shows the breakdown of costs for land acquisition procedures and monitoring activities by the Property Evaluation Committee.

Table 5- 21: Breakdown of costs for land acquisition procedures and monitoring activities

Item	Number of Days Required	Ude Dhankaka (ES-6)	Kamise (ES-8)	Areda (ES-10)	Biyo (ES-11)	Bolo (AR-2)	Gonde (AR-6)
Establishment of Property Evaluation Committee	1 day	2,750	2,750	2,750	2,750	2,750	2,750
Survey for calculation of compensation cost	0.5 days per household	4,125	6,875	12,375	9,625	16,500	12,375
Consultation and agreement with PAHs	3 days	8,250	8,250	8,250	8,250	8,250	8,250
Payment of cash compensation and provision of alternative land	3 days	8,250	8,250	8,250	8,250	8,250	8,250
Complaint handling	3 days	8,250	8,250	8,250	8,250	8,250	8,250
1st monitoring survey after compensation payment	0.5 days per household	4,125	6,875	12,375	9,625	16,500	12,375
2nd monitoring survey six months after compensation payment	0.5 days per household	4,125	6,875	12,375	9,625	16,500	12,375
Total		39,875	48,125	64,625	56,375	77,000	64,625

The following table is a summary of the amount to be borne by the Ethiopian government in acquiring the land for the Project. The total cost required for land acquisition and procedures/monitoring is 1,241,293 Birr (JPY: 3,184,016). As these costs will be incurred when the payment is made around March 2022, the coefficient of price fluctuation for the period from the cut-off date (June 2021) to the compensation payment (March 2022) is added to the total cost for land acquisition. The coefficient of price fluctuations is 0.07 based on the past five years of the Consumer Price Index for all items in the International Monetary Fund. Therefore, in total, the cost of 1,328,183

Birr (JPY: 3,406,896) shall be borne by the Ethiopian government.

Table 5- 22: Total Costs to be Borne by the Ethiopian Government for Land Acquisition

Item		Ude Dhankaka (ES-6)	Kamise (ES-8)	Areda (ES-10)	Biyo (ES-11)	Bolo (AR-2)	Gonde (AR-6)	Total
Cash compensation	Permanent land loss	26,297	181,722	88,093	131,709	110,148	199,794	737,763
	Temporary land loss	83,356	-	-	-	28,061	41,488	152,905
Sub-total		109,653	181,722	88,093	131,709	138,209	241,282	890,668
Labour cost for the Property Evaluation Committee		39,875	48,125	64,625	56,375	77,000	64,625	350,625
Sub-Total		149,528	229,847	152,718	188,084	215,209	305,907	1,241,293
Price fluctuation coefficient (0.07)		10,467	16,089	10,690	13,166	15,065	21,413	86,890
Total		159,995	245,936	163,408	201,250	230,274	327,320	**1,328,183**

5－9 Monitoring Structure by the Executing Agency and Monitoring Form

The main purpose of the monitoring is to confirm that the PAHs have received cash compensation and provision of alternative land in accordance with the compensation policy before the implementation of the Project, and that their livelihood level has recovered to at least the same or higher level than before the implementation of the Project after the commencement of the Project.

As part of the monitoring structure, each Town Administrative Office shall compile the survey results by the Property Evaluation Committee and report to the OWERDB. Then, OWERDB shall compile the reports from 6 small towns and prepare a report.

After the completion of the monitoring of land acquisition, the water management organization will continue to periodically confirm if local communities are dissatisfied with the current water supply situation or provided compensation. However, if it is difficult to resolve the grievances through discussion, recommendations will be sought from the Town Administrative Office or the OWERDB for solutions.

5－10 Community Consultation Meeting

According to Proclamation No. 1161/2019, when land acquisition is required for the public purposes, the Town Administrative Office and/or other governmental agencies must provide local communities an overview of the Project, compensation details, and general procedures at least one year in advance. In the Project, a consultation with local communities at 6 small towns were held during the scoping phase of the environmental impact assessment to explain the possibility of land acquisition by the Project. With the dissemination of the Town Administrative Office, the community consultations were held from December 2019 to January 2020.

For lands that need to be acquired by the Project, individual interviews were conducted through site visits, and initial negotiations with landowners were conducted. The Team confirmed their willingness to cooperate in the land acquisition, the period the land can be vacated, compensation payment preferences, contact information, and questions and concerns regarding the land acquisition. All individual interviews were conducted in the presence of the Town Administrative Office and recorded in writing with the signatures of the Town Administrative Officer

and the landowners.

Table 5- 23: Summary of Community Consultation

Method	Date	Location	Participant	Discussions
Public consultation meeting	December 27, 2019	Ude Dhankaka Town Office	Town Administrative Officer, Youth, female, kebele, elder and religious representatives and local residents (5 women, 6 men)	− Background of the Project − Details of the Project − Scoping results − Results of impact assessment − Compensation policy for land acquisition − Question and answer session
	December 24, 2019	Kamise Town Office	Town Administrative Officer, Youth, female, kebele, elder and religious representatives, water association and local residents (5 women, 7 men)	
	Jan. 2, 2020	Areda Town Office	Town Administrative Officer, Youth, female and kebele representatives, and local residents (4 women, 12 men)	
	Dec. 26, 2019	Biyo Town Office	Town Administrative Officer, Youth and female representatives, water association and local residents (2 women, 8 men)	
	December 18, 2019	Bolo Town Office	Town Administrative Officer, Youth, female, kebele and religious representatives and local residents (2 women, 15 men)	
	December 18, 2019	Gonde Town Office	Town Administrative Officer, Youth, female, woreda, kebele, elder and religious representatives, water association and local residents (4 women, 19 men)	
Individual interview	September 20, 23, 2019	Ude Dhankaka	3 PAHs, Town Administrative Officer, local staff	Confirm the following items with landowners − Land conditions and location information. − Types of crops − Willingness to cooperate in land acquisition − The period the land can be vacated − Compensation payment preference − Contact information − Questions and concerns about land acquisition
	November 22, 2019	Kamise	2 PAHs, Town Administrative Officer, local staff	
	Feb. 23, 2021		1 PAHs, Town Administrative Officer, local staff	
	May 6, 2021		2 PAHs, Town Administrative Officer, local staff	
	September 19, 28, 2019	Areda	7 PAHs, Town Administrative Officer, local staff	
	Feb. 24, 2021		1 PAHs, Town Administrative Officer, local staff	
	May 7, 2021		1 PAHs, Town Administrative Officer, local staff	
	September 20, 2019	Biyo.	6 PAHs, Town Administrative Officer, local staff	
	March 27, 2021		1 PAHs, Town Administrative Officer, local staff	
	September 21, 24, 2019	Bolo	11 PAHs, Town Administrative Officer, local staff	
	Feb. 22, 2021		1 PAHs, Town Administrative Officer, local staff	
	May 4, 2021		1 PAHs, Town Administrative Officer, local staff	
	September	Gonde	5 PAHs, Town Administrative	

	23, 24, 2019 May 5, 2021		Officer, local staff 4 PAHs, Town Administrative Officer, local staff	

Table 5- 24: Opinions and Concerns from Local Communities and Results Reflected in the Project

Comments and Concerns from Local Communities	Response by the Executing Agency	Results Reflected in the Project
Appropriate compensation shall be received for land and assets that will be lost due to Project implementation.	Appropriate compensation policies will be determined and implemented in accordance with national laws and World Bank safeguards and policies.	Appropriate compensation policies will be determined and implemented in accordance with national laws and World Bank safeguards and policies.
In Biyo, the community has donated 20,000 Birr to the PAHs who will lose their agricultural land due to the construction of the production well, which they hope to be used as compensation.	While we appreciate the gratitude, the compensation for the Project will be paid by the Town Administrative Office with funds from the Federal Government's budget.	The Team will explain and discuss the total amount of compensation (1,328,183 Birr) calculated in the draft preparatory survey report as the amount to be borne by the Ethiopian government to obtain a reliable budget.
There are concerns about the finances of the Town Administrative Office and whether they will be able to pay adequate compensation.	The compensation for the Project will be paid by the Town Administrative Office with funds from the Federal Government's budget.	Same as above
The Project is to solve the problem of water shortage in the region, and we would like to donate part of the agricultural land to the Town Administrative Office without the need to receive compensation.	We appreciate the offer to donate the land, but we will confirm your intentions again when we calculate and pay the actual compensation amount (around December 2021).	The Town Administrative Office will reconfirm with the landowners who have offered to donate their land, at the time of calculation and payment of the compensation amount (around December 2021), whether the land to be donated will not affect the owner's livelihood, whether they have expressed their intention to donate the land with the understanding that they have a right to refuse. There is possibility that the opinion on donation may change depending on changes in the landowner's economic situation or they are influenced by the opinions of the surrounding community. Thus, the compensation cost for all private land was estimated regardless of the landowners' willingness to donate as a matter to be borne by the Ethiopian government.

6. Proposed Monitoring Form (Land acquisition and Resettlement)

Proposed monitoring forms, based on Environmental Management and Monitoring Plan are shown below.

－Preparation of Alternative Agricultural Land

No.	Small Town	Status of Implementation (completed/not completed) *State the date if completed	Details (selection measures of alternative land, consultation with PAPs, etc.)	Scheduled Completion Date
1	Ude Dhankaka			
2	Kamise			
3	Areda			
4	Biyo			
5	Bolo			
6	Gonde			

－Community Consultation

No	Date/Time	Location	Discussions, main comments and replies from PAPs
1			
2			

－Status of Compensation Payment (for PAHs with the Land Taken constitutes 20% or More of the Total Productive Area

Small Town	PAHs No.	Land to be Acquired (m^2)	Estimated Compensation Cost (Birr)	Paid Compensation Cost	Payment Date
Ude Dhankaka (ES-6)	ES6-1	24	8,640		
	ES6-2	24	9,257		
	ES6-3	24	8,400		
Kamise (ES-8)	ES8-2	24	9,000		
	ES8-3	400	25,800		
Areda (ES-10)	ES10-1	24	7,920		
	ES10-2	24	10,400		
	ES10-3	24	7,200		
	ES10-4	24	7,043		
	ES10-5	24	7,200		
	ES10-6	24	4,582		
	ES10-9	10	1,733		
Biyo(ES-11)	ES11-2	24	10,800		
	ES11-3	24	7,920		
	ES11-4	24	12,600		
	ES11-5	24	11,700		
	ES11-6	24	7,200		
Bolo (AR-2)	AR2-2	24	3,240		
	AR2-3	24	3,600		
	AR2-4	24	6,300		

Small Town	PAHs No.	Land to be Acquired (m^2)	Estimated Compensation Cost (Birr)	Paid Compensation Cost	Payment Date
	AR2-5	24	4,019		
	AR2-6	24	6,660		
	AR2-7	24	3,600		
	AR2-8	24	4,886		
	AR2-9	24	4,000		
	AR2-10	48	8,610		
	AR2-12	30	7,000		
Gonde (AR-6)	AR6-2	24	7,056		
	AR6-3	24	5,040		
	AR6-4	24	5,455		
	AR6-7	225	59,285		
	AR6-8	75	17,500		
	AR6-9	60	17,234		

－Status of Compensation Payment (for PAHs with the Land Taken constitutes less than 20% of the Total Productive Area）

Small Town	PAHs No.	Land to be Acquired (m^2)	Estimated Compensation Cost (Birr)	Paid Compensation Cost	Payment Date	Provision of Alternative Land	Provision Date
Kamise (ES-8)	ES8-1	400	30,505				
	ES8-4	400	37,923				
	ES8-5	830	78,494				
Areda (ES-10)	ES10-7	219	16,249				
	ES10-8	400	25,765				
Biyo (ES-11)	ES11-1	400	34,554				
	ES11-7	400	46,935				
Bolo (AR-2)	AR2-1	400	26,971				
	AR2-11	400	31,262				
Gonde (AR-6)	AR6-1	400	35,208				
	AR6-5	317	26,552				
	AR6-6	400	26,465				

－Implementation Status of Restoration of Livelihoods

Survey Item	Monitoring Item	Results
Priority employment for socially vulnerable groups	Status of employment provision for 3 female-headed households, 33 households with children under 18 years old, and 12 households with elderly (over 60 years old)	
Priority in employment for water retailers	Status of employment provision for 14 water retailers in 6 small cities	

－Status of public awareness of the impact on existing infrastructure and services

Targeted infrastructure and services	Period of influence	Whether or not residents are informed	Response status and results

－Complaints from affected residents

Number of complaints	Complaints	Response status and results

－Safety education and traffic accidents

Action item	Action details	Results of action
Safety education	Implementation of safety education	
Traffic accident	Accident occurrence/response records	

－Other points to note (Write freely in the box below)

			season when the river flow rate is low. If muddy water is generated during construction, a sediment reservoir will be installed in the waterway to prevent the muddy water from flowing downstream.				cost
	3	Soil Pollution	− All storage containers containing fuel, oil, and lubricants are properly sealed and labelled − Contractors should have contingency plans in place in the event of a spill or release of hazardous materials. − Transport vehicles and equipment undergo regular maintenance to prevent oil leakage. − Workers are trained to prevent spills and leaks of diesel, oil, and used oil	-	Japanese constructor	OEFCCA/ Woreda Office (Agriculture department)	Included in construction cost
	4	Waste (construction waste)	− Verify that waste disposal contractors handle construction materials and waste in accordance with proper procedures. − Reuse and recycle waste concrete as much as possible. − Reuse construction waste as roadbed material as much as possible. − Temporary storage areas must be agreed upon in consultation with the community.	-	Japanese constructor	OEFCCA	Included in construction cost
	5	Noise and	− Minimize work involving vibration near the boundary with structures and buildings.	-	Japanese constructor	OEFCCA	Included in construction

		Vibration	– Set normal working hours from 6:00 a.m. to 6:00 p.m.				cost
	8	Sediment in Lakes and River Beds	– Do not leave construction debris or scrap it near river basins, and dispose of it properly.	-	Japanese constructor	OEFCCA	Included in construction cost
	9	Protected Area	– Do not remove under-bush and short-height trees except in the minimum area required for the installation of pipelines.	-	Japanese constructor	OEFCCA	Included in construction cost
	10	Ecosystem	– During site clearance, pay attention to the habitat of birds and other wild animals. – Provide sufficient curing to prevent wild animals from getting caught in the openings.	-	Japanese constructor	OEFCCA	Included in construction cost
	11	Hydrology	– A self-registering water level meter will be installed to measure the groundwater level in the test well near the production well at Ude Dhankaka. – Provide technical guidance so that OWERDB can manage the data appropriately. – If the groundwater level is identified as being lowered due to mutual interference with existing wells, it will be discussed with the relevant parties and adjusted according to the appropriate pumping rate of both wells.	– A self-registering water level meter will be installed to measure the groundwater level in the test well near the production well at Ude Dhankaka – If the groundwater level is identified as being lowered due to mutual interference with existing wells, it will be discussed with the relevant parties and	(Under construction) Japanese constructor (During operation) Water supply service enterprise	OWERDB	Included in construction cost

				adjusted according to the appropriate pumping rate of both wells.			
	12	Topography and Geology	– Excavation work should be done during the dry season. Excess topsoil should be used for grading to prevent it from flowing into drains, streams and roads. – Reduce fugitive dust emissions by spraying or wetting – Place buried materials (especially soil and sand) in appropriate locations, and install temporary enclosures and screens on buried materials to prevent erosion and generation of fugitive dust. Cover all construction materials with sheets when not in use. – ・Cover trucks transporting soil and materials with tarpaulins	-	Japanese constructor	OEFCCA/ Town Administrative Office	Included in construction cost
Social environment	13	Land Acquisition and Resettlement	– Compensate for land loss in accordance with appropriate procedures thorough consultation with the Town Administrative Officer and PAHs	-	Town Administrative Office/ Property Evaluation Committee	OEFCCA/ OWERDB	Included in the cost to be borne by the Ethiopia (1,328,183 Birr)
	14	The poor	– Priority will be given to the poor (socially	-			

			vulnerable groups) among the affected households to provide employment for construction work and facility operation. – Conduct monitoring after compensation is completed to check for changes in living conditions.				
	16	Local Economy, including Employment and Means of Livelihood	– Appropriate compensation procedures will be implemented at the initiative of the Town Administrative Office. – The compensation and provision of alternative land shall be completed before the start of the P/Q (Pre-Qualification for Bidding) of the Project. After payment, a monitoring survey shall be conducted to confirm any changes in living conditions. – Priority will be given to water vendors in each small town for employment in facility operations.	-			
	17	Land Use and Local Resource Use		-			
	18	Water Use (drinking water, domestic water)	– Dispose of the generated residual soil by spreading it evenly around the site, and be careful not to let it spill into nearby water sources.	-	Japanese constructor	OEFCCA	Included in construction cost
	19	Existing Infrastructure and Services	– Detailed construction plans will be developed and coordinated to minimize service disruptions and minimize the impact on public services. – Residents will be notified in advance of any planned disruptions to basic services such as water and electricity.	-	Japanese constructor /Town Administrative Office	OEFCCA	Included in construction cost

	28	Working Environment (including occupational safety)	– Provide training on environmental safety and health to all workers to raise awareness. (including Personal Protective Equipment (PPE), HIV prevention, and maintenance) – Provide all workers with the PPE they need. Dust masks and eye protection against dust, flying debris, and fragments shall be provided to construction workers. – Install signs at all construction sites to enforce/remind the use of PPE and safety practices.	-	Japanese constructor	OEFCCA	Included in construction cost
Other	29	Accident	– On major roads and in villages, curing of openings should be sufficiently carried out to prevent traffic and third-party disasters. – For pipe work on the side of a major road with heavy traffic, plan and implement detours and security equipment as necessary to eliminate the impact of traffic as much as possible.	-	Japanese constructor	OEFCCA	Included in construction cost

Environmental Monitoring Plan (EMoP)

1. Pollution Control

Environment Item	Item	Frequency	Location	Method	Responsible Organization	Cost
Air Pollution	Dust control (frequency of water spraying, condition of earthwork covering)	During construction, Once a week	Construction site	Visual inspection and interviewing of on-site workers	Japanese contractor	Included in construction cost
Water Pollution (drinking water)	Water quality (turbidity/odor)	Twice during construction around drinking water source (before and after construction)	Around drinking water sources (Ude Dhankaka and Biyo only)	Visual inspection for turbidity, abnormalities, etc.	Japanese contractor	Included in construction cost
Water Pollution (surrounding water sources)	Surface water quality	Once during construction	River (wadi) crossing point (Areda only)	− Visual inspection for turbidity, abnormalities, etc. − Monitoring and photographing of the river channel (flowing water) at the construction site	Japanese contractor	Included in construction cost
Soil Pollution	Fuel and oil spills	During construction, once every six months	Material storage area	Interview survey with field workers	Japanese contractor	Included in construction cost
Waste	− Confirmation of debris and construction material	During construction, once a month	Construction site	− Visual inspection and interviewing of	Japanese contractor	Included in construction

Environment Item	Item	Frequency	Location	Method	Responsible Organization	Cost
	− Disposal methods and loading capacity			on-site workers − Amount of waste (measured as an approximate amount based on the amount loaded on the back of a truck during transportation)		cost
Noise and Vibration	Noise and vibration level during the daytime	During construction, once a month	Construction sites and residences susceptible to noise	Noise and vibration level dB	Japanese contractor	Included in construction cost
Sediment in Lakes and River Beds	Disposal method of construction residual soil	During construction, once a month	Construction site	Visual inspection and interviewing of on-site workers	Japanese contractor	Included in construction cost
Soil Erosion	Extent and degree of erosion	During construction, once a month	Construction site	Visual inspection, site photos if necessary	Japanese contractor /Woreda Office (Agriculture department)	Included in construction cost

2. Natural environment

Environment Item	Item	Frequency	Location	Method	Responsible Organization	Cost
Protected Area	Permits for cutting trees	Before construction	Construction site	Check with the construction company	Contractor	Included in construction cost
	Coverage of under bush removal	Prior to construction at each site	Construction site	Visual inspection	Contractor/OEFCCA	Included in construction cost
	Confirmation of vegetation during under bush clearing and logging (whether it is not an endangered species)	Prior to construction	Construction site	Site verification by dispatched OEFCCA experts	OEFCCA	Dispatchment of OEFCCA staff does not require the cost
Ecosystem	Identification of bird nesting sites Identification of habitats and migration routes of wildlife	Once prior to construction and once during construction in each small town	Construction site	− Visual inspection, dispatch of experts from OEFCCA and other organizations to check sites − OEFCCA requests	OEFCCA	Dispatchment of OEFCCA staff does not require the cost

				cooperation from local NGOs as needed		
	Curing of openings	During construction, once a month	Construction site	Visual inspection and interviewing of on-site workers	Contractor	Included in construction cost
Hydrology	Observation of groundwater level	During construction, once a month	In Ude Dhankaka test wells in proximity to production wells	Install self-registering water level meters to measure groundwater levels, collect and record data	Japanese contractor	Included in construction cost
Topography and Geology	− Extent and degree of erosion − Removal of all construction materials and temporary structures	During construction (after completion of civil construction and wells)／After completion of construction	Construction site	Visual inspection	Japanese contractor /Town Administrative Office	Included in construction cost

3. Social Environment

Environment Item	Item	Frequency	Location	Method	Responsible Organization	Cost
Land Acquisition	Socio-economic status of	May 2022, after the	PAHs'	Interview survey with	Town	Included in the cost to

Environment Item	Item	Frequency	Location	Method	Responsible Organization	Cost
and Resettlement Land Use and Local Resource Use	PAHs and conditions of alternative land	compensation payment and October 2023, six months after the compensation payment.	residential area	PAHs	Administrative Office/ Property Evaluation Committee	be borne by the Ethiopia (1,328,183 Birr)
Local Economy, including Employment and Means of Livelihood	Employment status of water seller	At start of operation	Water management office	Interview survey with water management organizations	Town Administrative Office	
The poor	Socioeconomic and employment status of socially vulnerable groups	May 2022, after the compensation payment and October 2023, six months after the compensation payment.	PAHs' residential area	Interview survey with PAHs	Town Administrative Office/ Property Valuation Committee	
Water Use (drinking water, domestic water)	Disposal method of generated residual soil	Once a month	Construction site	Visual inspection and interviewing of on-site workers	Japanese contractor	Included in construction cost
Existing Infrastructure and Services	Notification to residents	When infrastructure disruptions are planned	Construction site	Interview survey with affected households	Japanese contractor /Town Administrative	Included in construction cost

Environment Item	Item	Frequency	Location	Method	Responsible Organization	Cost
					Office	
Working Conditions (including occupational safety)	Implementation of safety and health education	Once a month	Construction site	Provision of PPE and confirmation of training implementation	Japanese contractor	Included in construction cost
Accident	Accident occurrence/response records	Once a month	Construction site	Review of accident reports	Japanese contractor	Included in construction cost

2. Natural environment

Environment Item	Item	Frequency	Location	Method	Responsible Organization	Cost
Hydrology	Observation of groundwater level	During operation, once a month	Test wells in proximity to production wells in Ude Dhankaka	Installed self-registering water level meters to measure groundwater levels, collect and record data	Water supply service enterprise of each small town	The cost of implementation will be borne by Ude Dhankaka Water supply service enterprise as part of its operational maintenance and management.

ANNEX 11: Proposed Monitoring Form

Proposed monitoring forms, based on Environmental Management and Monitoring Plan are shown below.

(1) Monitoring Form for Environment Management Plan and Monitoring Plan

1. Response/Actions to Comments and Guidance from Government Authorities and the Public

Date:

Venue:

Organizations or Communities:

Monitoring items	Status during the reporting period
Date, time, and number of participants in the community consultation	
Opinions and comments from participants and responses from the Executing Agency	

2. Mitigation Measures

－Pollution Control

Survey item	Monitoring items	Status during the reporting period
Air pollution	Dust control (frequency of water spraying)	
	Dust control (covering of earthwork areas)	
Soil pollution	Fuel and oil spills	
Water pollution (drinking water)	Water quality (turbidity/odor)	
Water Pollution (surrounding water sources)	Surface water quality (turbidity/odor)	* Photographing the river channel (flowing water) at the construction site
Soil erosion	Extent and degree of erosion	* On-site photography as needed
Water use (drinking water, domestic water)	Disposal method of generated residual soil	

－Waste

Monitoring items	Status during the reporting period
Disposal of rubble and construction materials	
Amount of waste (loaded onto the back of a truck for transportation)	
Disposal method of construction residual soil	

－Noise and Vibration

Item	Measured Value (Average Value)	Measured Value (Maximum Value)	Baseline Value	Local Standards	Referenced International Standards	Remarks (Measurement location, frequency, method, etc.)
Noise level				-	85 (Japanese Standards[1])	
Vibration level				-	75 (Japanese Standards[2])	

3. Natural Environment

Survey item	Monitoring items	Status during the reporting period
Protected Area	Permits for cutting trees	
	Coverage of under bush removal	
	Confirmation of vegetation during under bush clearing and logging (whether it is not an endangered species)	*Describe the survey results from OEFCCA
Ecosystem	Identification of bird nesting sites	
	Identification of habitats and migration routes of wildlife	*Describe the survey results from OEFCCA and local NGOs
	Curing of openings	
Topography and	Removal of all construction	

[1] Reference to "Specific Construction Work" in the Noise Regulation Law, Ministry of the Environment.
[2] Reference to "Specific Construction Work" in the Vibration Regulation Law, Ministry of the Environment.

Geology	materials and temporary structures	

－Decrease in groundwater level

Item (Unit)	Measurement location	Data for water level
Groundwater level	Wells in the vicinity of the Ude Dhankaka test well	

4. Complaints related to Environmental Impact

Number of complaints	Complaints	Response status and results

－Other points to note (Write freely in the box below)

(2) Social Monitoring Form (Land acquisition and Resettlement)

－Preparation of Alternative Agricultural Land

No.	Small Town Name	Status of Implementation (completed/not completed) *State the date if completed	Details (selection measures of alternative land, consultation with PAPs, etc.)	Scheduled Completion Date
1	Ude Dhankaka			
2	Kamise			
3	Areda			
4	Biyo			
5	Bolo			
6	Gonde			

－Community Consultation

No	Date/Time	Location	Discussions, main comments and replies from PAPs
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2			

－Status of Compensation Payment (for PAHs with the Land Taken constitutes 20% or More of the Total Productive Area

Small Town Name	PAHs No.	Land to be Acquired (m^2)	Estimated Compensation Cost (Birr)	Paid Compensation Cost	Payment Date
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Small Town Name	PAHs No.	Land to be Acquired (m^2)	Estimated Compensation Cost (Birr)	Paid Compensation Cost	Payment Date
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Bolo (AR-2)	AR2-2	24	3,240		
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－Status of Compensation Payment (for PAHs with the Land Taken constitutes less than 20% of the Total Productive Area）

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Small Town Name	PAHs No.	Land to be Acquired (m^2)	Estimated Compensation Cost (Birr)	Paid Compensation Cost	Payment Date	Provision of Alternative Land	Provision Date
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－Implementation Status of Restoration of Livelihoods

Survey Item	Monitoring Item	Results
Priority employment for socially vulnerable groups	Status of employment provision for 3 female-headed households, 33 households with children under 18 years old, and 12 households with elderly (over 60 years old)	
Priority in employment for water retailers	Status of employment provision for 14 water retailers in 6 small cities	

－Status of public awareness of the impact on existing infrastructure and services

Targeted infrastructure and services	Period of influence	Whether or not residents are informed	Response status and results

－Complaints from affected residents

Number of complaints	Complaints	Response status and results

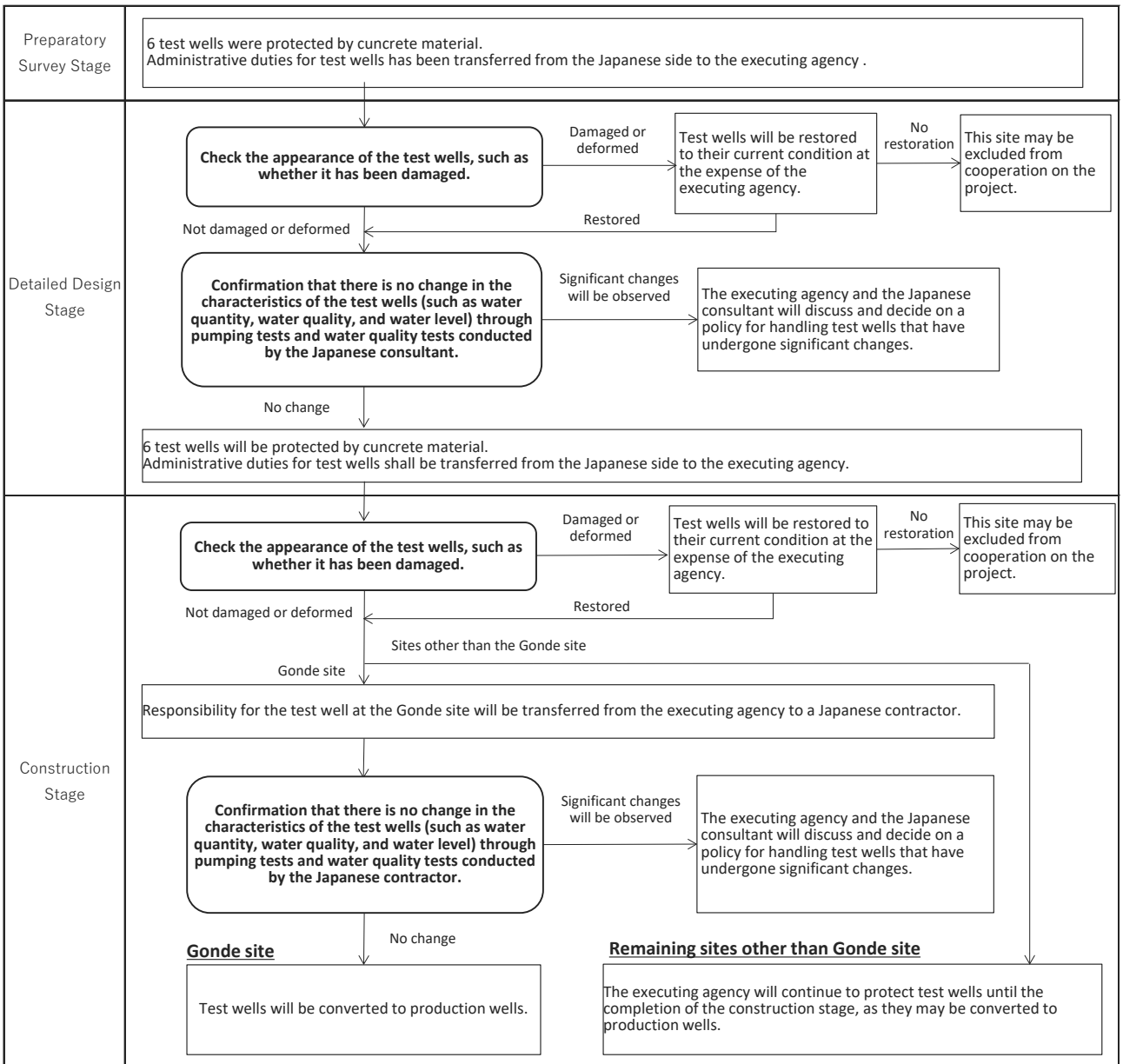
－Safety education and traffic accidents

Action item	Action details	Results of action
Safety education	Implementation of safety education	

Traffic accident	Accident occurrence/response records	

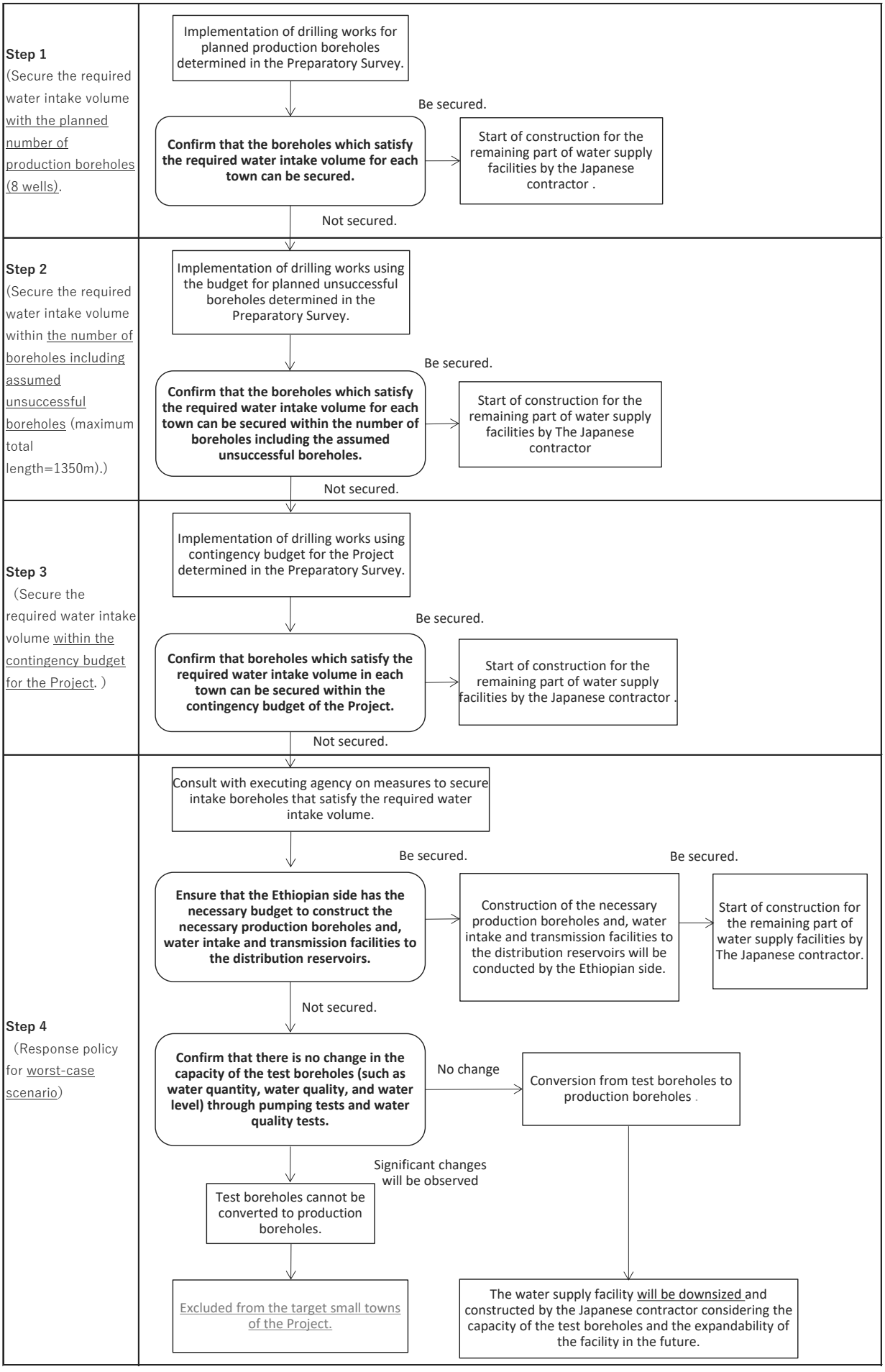
－Other points to note (Write freely in the box below)

Annex 12: Policy on Handling Test Boreholes Developed in the Preparatory Survey



Responsibilities for any defect in the test wells constructed in the Preparatory Survey Stage	(1) The Japanese side doesn't take any responsibility of structural defects inside the test boreholes after the Preparatory Survey. (2) One year after completion of test well drilling: The Local Contractors who built the test wells shall be liable for any defects of the test wells. (3) The Ethiopian side shall maintain, protect, and not use the test boreholes until the Construction Stage begins. In case that defects which is not related to construction quality or caused by natural causes were identified before the Construction Stage begins, the Ethiopian side will be responsible for repairing them, otherwise the sites will be excluded from the Project. (4) With regard to the test boreholes which will be converted to the production borehole, the Ethiopian side will transfer the responsibility of the test boreholes as mentioned above (2) to Japanese contractor soon after the Construction Stage begins, after the necessary verification of its maintenance condition. After all the facilities constructed and equipment procured, the responsibility of the test boreholes will be transferred to the Ethiopian side again. (5) In case that the test boreholes converted to the production boreholes, were discovered inadequate to use due to changing condition of aquifer or abnormal seasonal fluctuation after the completion of the Project, the Ethiopian side will inform the Japanese side within 3 years after the completion of the Project and both sides will discuss further actions.

Annex 13: Countermeasures to be taken when the Required Production Boreholes cannot be secured in the Construction Stage



資料 5. ソフトコンポーネント計画書

エチオピア連邦民主共和国
オロミア州水・エネルギー資源開発局

エチオピア連邦民主共和国
オロミア州小都市給水施設整備計画準備調査
ソフトコンポーネント計画書

2021 年 9 月

国 際 航 業 株 式 会 社
株式会社地球システム科学

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略　語　集

略語	英語	和訳
OWERDB	Oromia Water and Energy Resources Development Bureau	オロミア州水・エネルギー資源開発局
WASHCO	Water, Sanitation and Hygiene Committee	水衛生組合
WC	Water Committee	水組合
WWERDO	Woreda Water and Energy Resources Development Office	郡水・エネルギー資源開発事務所
ZWERDO	Zonal Water and Energy Resources Development Office	県水・エネルギー資源開発事務所

1　ソフトコンポーネントを計画する背景

1.1　事業概要

本事業は、オロミア州の 6 つの地方小都市（タウン）において管路系給水施設を整備し、安全な飲料水を持続的に供給して、給水率を向上させることを目標としている。本ソフトコンポーネントでは、建設された施設の運営維持管理体制の構築支援を行うものである。

1.2　ソフトコンポーネント計画の背景

1.2.1　オロミア州の給水施設の運営維持管理の枠組み

1.2.1.1　全体の枠組み

オロミア州では、給水サービスの運営組織について、都市部は都市上下水道公社（Urban Water Supply and Sewerage Service Enterprise）が、農村部は飲料水サービス組合（Portable Water Service Organization）が実施することになっており、これら運営管理組織や州政府の果たすべき責任、役割、権限等は州の布告に定められている[1]。組織形成に係わる具体的な区分は表 1に示すとおりである。

表 1:オロミア州の給水施設の運営維持管理組織の区分

タイプ	都市給水型		農村給水型
	大都市	中小都市	
監督組織	州水・エネルギー資源開発局（OWERDB）	県水・エネルギー資源開発事務所（ZWERDO）	郡水・エネルギー資源開発事務所（WWERDO）
等級 *1	1～2	3～5	なし
運営維持管理組織	● 水評議会 ● 水道公社（都市上下水道公社、市給水事務所）		● 水組合

*1：GTP2 で設定された等級

上表 1 の組織を含むオロミア州全体の運営維持管理体制は図 1 に示すとおりである。

[1] 2004, オロミア州都市上下水道公社設立のための布告78/2004号（Proclamation No.78/2004: A Proclamation to provide for the Establishment of Urban Water Supply and Sewerage Service Enterprises of the Oromia Regional State）、2009, オロミア州農村部飲料水サービス組合の設立及び管理のための布告152/2009号（Proclamation No.152/2009: A proclamation to provide for the Establishment and Administration of Oromia National Regional State Rural potable water service Organizations）

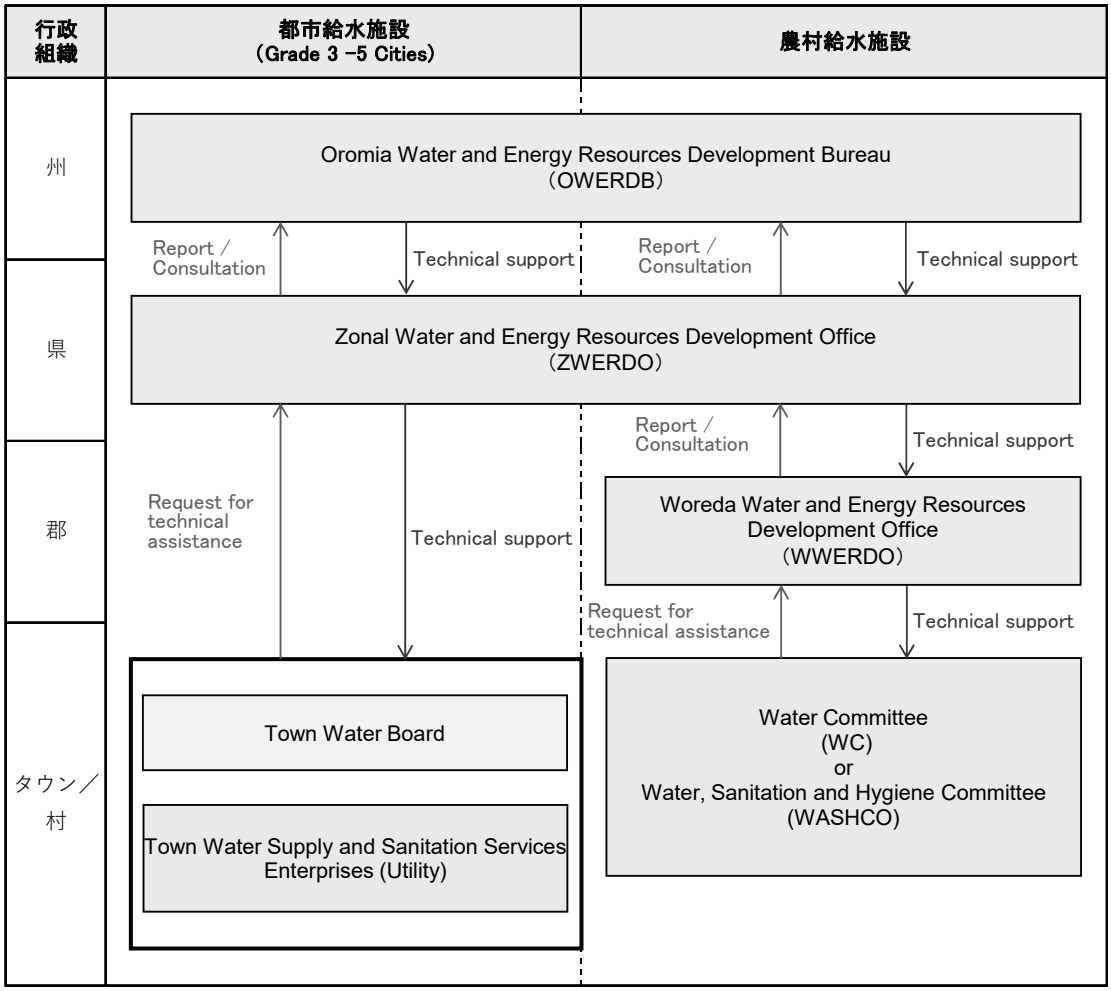


図 1:オロミア州の給水施設の運営維持管理体制の全体図

本事業対象の 6 タウンは、上表 1 の区分にあてはめると都市給水型の等級 5 に該当する。等級 5 に該当する都市の給水施設の運営維持管理の運用は下記に示すとおりである。

- 等級3～5に該当する都市の水管理組織がオロミア州に施設の保守･改修等の支援要請を行う場合、窓口はZWERDOとなる。ZWERDOが対応困難と判断した事案については、ZWERDOがOWERDBに支援要請する。
- ZWERDOは、等級3～5の水道公社の要請に応じて、水中ポンプや発電機等の修理を行っているが､ポンプの引き上げに必要なクレーンや井戸改修に必要なサービスリグ等を保有していない、あるいは保有していたとしても能力不足や故障によって対応できない場合は、OWERDBの維持管理チームに出動要請することになっている。
- 修理時の費用負担については、一般的に水管理組織がスペアパーツなど修理に必要な材料費、派遣職員の交通費、保守用機材の燃料費を負担するが、OWERDBへのサービス料の支払いは発生しない。

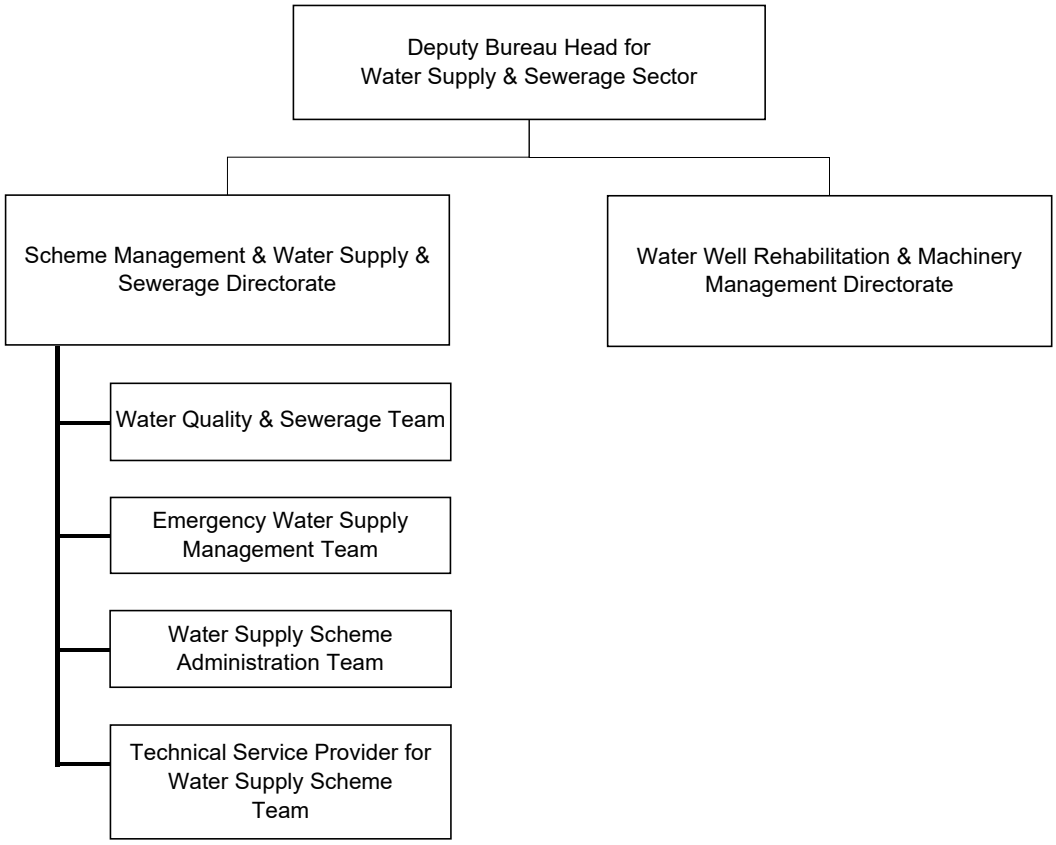


図 2:オロミア州の OWERDB の維持管理部門の組織体制

1.2.1.2 都市給水型の運営維持管理組織の詳細

都市給水型のうち、等級 3～5 の中小都市の運営維持管理は、オロミア州の ZWERDO とタウン役場が主導して、対象タウン毎に水評議会と水道公社を設立する必要がある。ZWERDO は、これまでも中都市レベルの給水施設の運営・維持管理を管轄しており、施設の運転管理及び料金徴収等の運営管理について十分な経験とノウハウを有する組織である。

図 3 に等級 3-5 の中小都市の給水施設の運営維持管理の基本体制図を、表 2に各組織の主な役割を示す。

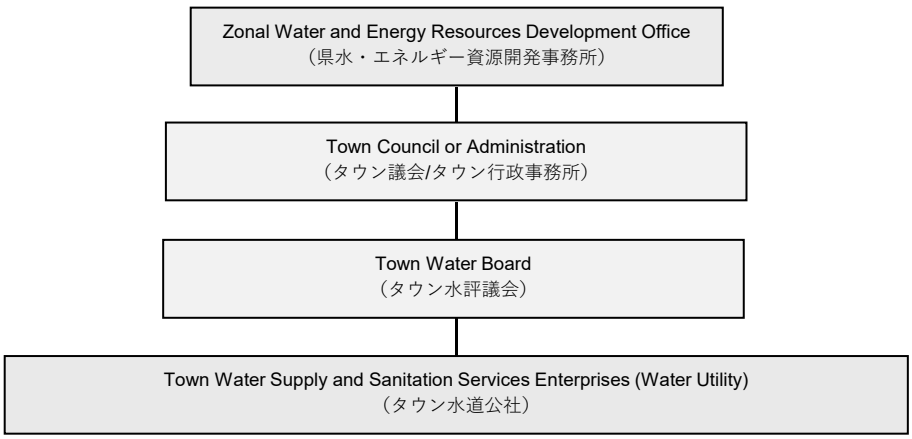


図 3:本事業の給水施設の運営維持管理のために設立される運営維持管理の基本体制図

表 2:給水施設の運営維持管理にかかわる各組織の役割

組織	主な役割／業務内容
県水・エネルギー資源開発事務所（ZWERDO）	● 水道公社への運営維持管理の支援 ● 井戸、ポンプ、発電機などの大規模故障への対応 ● タウン水評議会の設立（グレード 3～5 のタウンが対象） ● タウン水評議会のメンバーの任命（グレード 3～5 のタウンが対象）
タウン議会／タウン役場	● タウン水評議会の設立 ● タウン水評議会のメンバーの任命
タウン水評議会	● 水道公社の設立 ● 水道公社が提供する給水サービスの監視 ● 水道公社の最高管理機関 ● 水道公社のすべての最高意思決定機関 ● 水道料金の検証とレビュー
タウン水道公社	● 給水サービスの提供 ● 給水施設の運営・保守管理 ● 水道料金の設定

a. タウン水評議会／水道公社の組織体制

a.1 水道公社の組織体制

水道公社の内部組織の役割について、オロミア州の既存の中小都市の水道公社や現在実施中の水衛生国家プログラム（OneWaSH プログラム）で提案されている体制を参考に下記のとおり設定した。なお、水道公社に配置する職員の数は、施設規模に応じて複数の要職を兼任させるなどの対応を図り、生産性を高める努力が必要である。

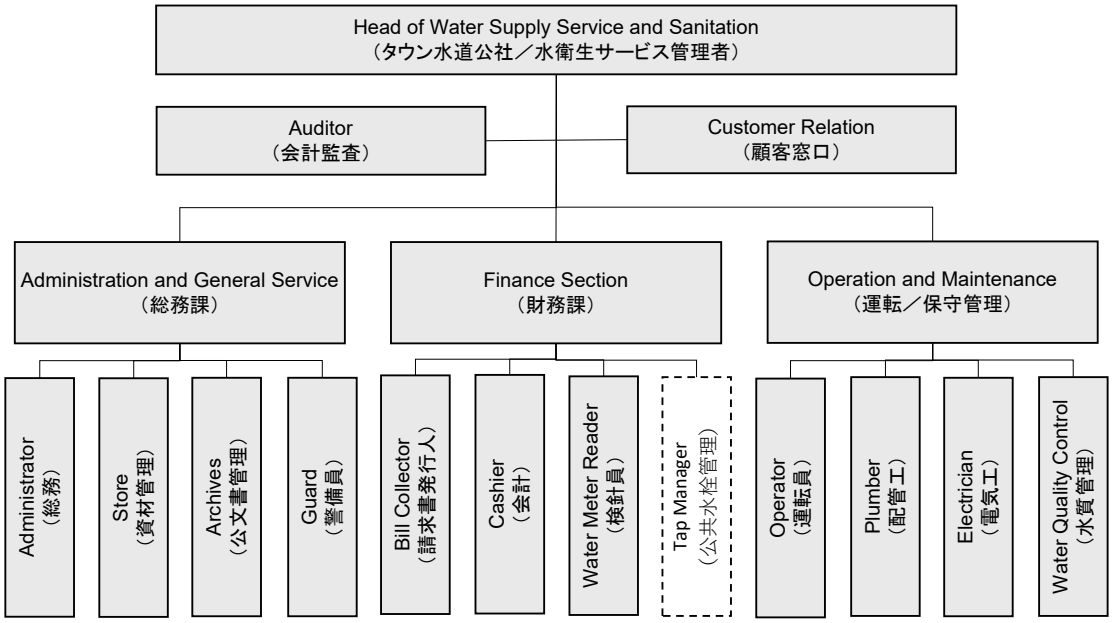


図 4:本事業の給水施設の運営維持管理のために設立される水道公社の組織図

表 3:水道公社の各要員の主な役割（案）

担当	役割
Head of Water Supply Service and Sanitation（タウン水道公社／	● 給水施設全体の運転・保守管理及び水道事業の運営を統括する ● 日々の業務に関する職員の指示・指導 ● 施設の運転管理記録、財務情報等を月報に取り纏め、タウン水評議会、県水開発事務所に報告

担当	役割
水衛生サービス管理者）	● 運営上の問題が生じた場合は、タウン評議会、県水開発事務所と協議し、速やかに問題の解決を図る。
Auditor （会計監査）	● 会計監査サービスの実行と成績を計画、編成、指示、監督、制御する ● 既存のシステム、アプローチ、手順についてレビューし、必要に応じて変更と改善を提案する ● すべての関係部門が州政府の財政政策、方針、手順書を遵守していることを確認する ● 内部統制システム、会計簿及びその他の文書の妥当性を検証し、是正措置を提案する ● 適切な蔵書目録の管理
Customer Relation （顧客窓口）	● 水道公社のオフィスと顧客の関係を維持する責務がある ● 顧客からの要求・苦情を受領し、苦情や水料金についての紛争処理のために顧客に情報を提供する ● 料金滞納者への督促及び給水中止措置の対応 ● 住民の各戸給水栓の接続に係わる申請書類の受理及び手続き ● 顧客リストを保管する ● 顧客とのすべての通信を処理する ● 給水サービスに関する住民への広報
Administrator and General service （総務課）	● 水道公社のすべての人事取引（募集、移籍、昇進を含む）を管理する ● 人事に関する政策と手順の実施を監視する ● 水道サービスの統計データと人員要件を準備する ● すべての従業員の苦情を処理し、経営陣と従業員の間の調和の取れた仕事関係を確保する ● 施設の運転管理に必要な薬品や資機材（給水装置一式、維持管理用資機材）の調達管理 ● 施設の運転記録、財務情報等の月報、年報等の保管・管理 ● 会計帳簿、管理文書等の保管・管理 ● 施設の警備
Finance section （財務課）	● 水道料金の請求書の発行、料金徴収、領収書の発行 ● 職員の給料支払い ● 資機材調達の支払い ● 年間予算の支出・歳入管理 ● 財務諸表（会計簿含む）の作成
Operation and Maintenance （運転／保守管理）	● ポンプ、発電機、塩素溶解注入設備等の電気・機械設備の保守管理 ● 管路の漏水処理 ● 給水施設の保守管理 ● 住民の申請に基づいて各戸給水栓の接続工事 ● 料金滞納者の水道メーターの撤去作業 ● ポンプ、発電機の運転（スイッチ開閉、運転台数の制御）、塩素溶解注入設備による給水の消毒作業 ● 高架水槽、配水池の水位の監視 ● 各種データの記録保管（ポンプ、発電機の運転時間、塩素剤（さらし粉）の使用量、流量計及び電力計の測定）

a.2　水評議会の組織体制

水評議会は、水道公社のすべての決議事項の最高意思決定機関であり、予算の承認、機材調達、水料金の設定、職員の雇用等の運営すべてに関与する。構成メンバーは、図 5に示すとおりタウンの主要機関から選出されることになっている。

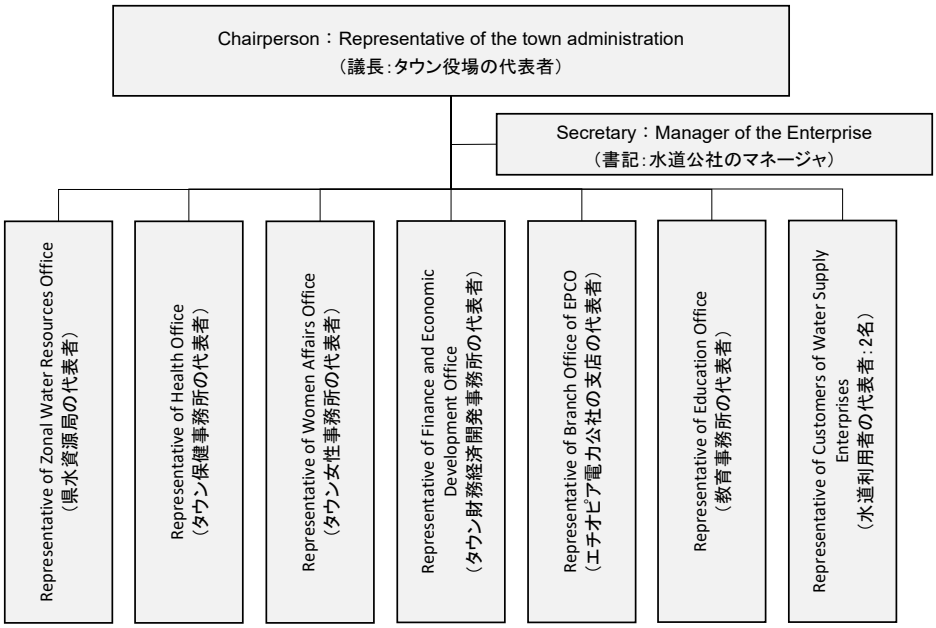


図 5:水評議会の組織図

1.2.2 対象タウンの既存給水施設の運営維持管理体制

対象 6 タウンのうち、既存の管路系給水施設が整備されているのは 3 タウンである。このうち 2 タウンは水組合、1 タウンは水道公社によって運営されている（表 4 参照）。従って、水道公社が設立されていない 5 タウンについては、オロミア州の運営維持管理の枠組に基づき、本事業を通じて新規に組織を設立する必要がある。また、Gonde タウンの既存の水道公社は、広域水道[2]を管理する組織で、本事業対象の Gonde タウンからは独立した組織となる。このため、既存水道公社と Gonde タウンは、事業内容の報告や権限を行使する関係性にはない。従って、本事業を通じて Gonde タウンの給水施設の専任の運営管理組織を設立する必要がある。なお、水評議会は水道公社の意思決定機関となる組織であることから、水道公社が存在しない場合は、組織化されていない。すなわち今回のケースでは対象 6 タウンに水評議会は存在しておらず、新規に設立する必要がある。また、Areda と Bolo の既存の水組合については、当面、水道公社とは独立して運営される想定であるが、将来的には水道公社に管理責任を移管し、タウン全体の水道サービスを一つの組織で実施することが望ましいと考えられる。この点については、ソフトコンポーネントの活動の中で新規に設立される水評議会メンバーと議論のうえ、将来的な方針を決定することとする。

表 4:既存の管路系給水施設の運営維持管理組織

ID	小都市名	現状の水管理組織	本事業の対応方針
ES-6	Ude Dhankaka	・ 管路系給水施設が存在しない ・ 水評議会は存在しない	新規に水評議会、水道公社を設立
ES-8	Kamise	・ 管路系給水施設が存在しない ・ 水評議会は存在しない	新規に水評議会、水道公社を設立
ES-10	Areda	・ 水組合（Water Committee）が存在 ・ 水評議会は存在しない	新規に水評議会、水道公社を設立
ES-11	Biyo	・ 管路系給水施設が存在しない ・ 水評議会は存在しない	新規に水評議会、水道公社を設立

[2] 広域水道がGondeタウンに給水しているエリアは、標高の低い一部の地区に配水されているだけで、大部分のサービスは別のタウンに提供されているものである。

ID	小都市名	現状の水管理組織	本事業の対応方針
AR-2	Bolo	・ 水衛生組合（WASHCO. : Water, Sanitation and Hygiene Committee） ・ 水評議会は存在しない	新規に水評議会、水道公社を設立
AR-6	Gonde	・ Gonde – Itaya水道公社（Gonde-Itaya Water Supply Administration Enterprises） ・ Gonde-Itaya水道公社の水評議会は存在するがGondeタウンの水評議会は存在しない	新規に水評議会、水道公社を設立

1.3 ソフトコンポーネント導入の理由／目的

1.3.1 給水施設の運営管理組織の能力強化

上記のとおり、オロミア州では、中小都市給水の運営維持管理組織として、水評議会を含む水道公社を設立することになっているが、徹底されておらず、特に本事業対象の等級 5 の小都市の給水システムは、依然、水組合（WC：Water Committee or WASHCO：Water, Sanitation and Hygiene Committee）によって運営維持管理されているケースが多い。

水組合の最大の弱点は、ボランティアベースの運営である。オロミア州の布告によると、組合員の任期は原則 2 年と定められていることから、組合員に能力強化の研修を行ったとしても、事業運営ノウハウが組織に蓄積されないことが問題として指摘されている。ボランティア組織による施設運営は、常にメンバー個人の能力に依存することになり、サービスの質はメンバーによるところがあり均一とならない。また、メンバーの責任範囲もあいまいであることから、給水サービスを向上させるインセンティブが働かないことも課題となる。

しかしながら、このような小都市レベルの給水施設の管理体制の構築については、州の支援が十分に行き渡っておらず、対象オロミア州だけでなく、全国的な課題の一つに挙げられている。

上記の課題も含め、本事業対象の等級 5 に該当する地方都市の管路系給水施設の運営・維持管理における課題とその対応方針について下記に整理する。

表 5:地方小都市の管路系給水施設の運営維持管理における現状・課題と対応方針

現状・課題	対応方針
既存の管路系給水施設の運営・維持管理組織の持続性 協力対象6小都市中3小都市には既存の管路系給水施設が存在し、そのうち2小都市は水組合によって運営されている。 既存の水組合の運営管理状況について、日常的な施設の運転については問題なく実施できているものの、施設データを保有していない、会計の収支記録以外の運営状況を示す月報、年報など作成は行っていないなど、給水施設を持続的に管理するための基礎的な行動がとられていない。 この原因の一つとして、オロミア州の維持管理フレームワークの中で、水組合員は原則、2年毎にメンバー交代することになっているため、運営や経営ノウハウが蓄積されないことが最大の課題となっている。さらに、モニタリングや質の向上を是正させる組織がないため、給水サービスの	**水評議会と水道公社を設立し、タウン役場と一体となった持続可能な運営・維持管理のメンバーを組織化する** オロミア州の給水施設の運営・維持管理フレームワークでは、小都市の給水サービの管理組織について、タウン毎に水評議会と水道公社を設立して、運営していくことが規定されている。 水評議会と水道公社による運営により、給水サービス提供のためのノウハウやスキルが組織に蓄積され、また行政サービスを統括するタウン役場の監視機能が強化されることで、施設に故障が発生した場合でもダウンタイムが縮小につながる組織体制となる。 従って、本事業ではソフトコンポーネントの活動を通じて、水評議会と水道公社の設立を確実に行う方針とする。

現状・課題	対応方針
監視体制が脆弱となっている。	
オロミア州の都市給水の運営・維持管理の支援体制の強化 オロミア州では、都市給水の運営・維持管理体制の枠組みは構築されており、OWERDB、ZWERDOは、村落やタウン給水の維持管理を支援するための専門部隊も組織化されている。これら組織の技術レベルも一定の水準にあり、機能している。 しかし、本事業対象の等級5に相当する小都市は、318タウン（オロミア州の全都市の86%に相当）[3]と多いうえ、村落給水の水組合への支援も実施しているため、すべてのタウンや村落に対して均一的でかつタイムリーに支援していくことについては、限られたリソースの中で、限界がある。	**OWERDB、ZWERDOによるフォローアップ体制を強化する** オロミア州の運営・維持管理フレームワークでは、州、県、郡の役割が明確に規定されて、支援活動は機能している。また、これらの職員の中には、エチオピアの水技術機構（EWTI）で技術研修を受け、管理職や技術的に指導的な役職に就いている者が多いとの報告がなされており、一定の技術レベルにある[4]。 しかし、これまで浅井戸やハンドポンプ付井戸施設に依存していた村落やタウンに対して、管路系給水施設の整備が急ピッチに進んでいる中で、行政への支援ニーズが高度化、多様化している。 そのため、本ソフトコンポーネント活動では、小都市の水道サービスを支援しているZWERDOやOWERDBを側方支援することで、新規に設立される水評議会と水道公社への支援の体制が確実に構築されることを目指す。
既存の水組合の電気・機械設備の運営・維持管理が不十分 既存の水組合の運営維持管理上の課題として、ポンプや発電機の運転・保守点検記録がない、ポンプや発電機等の電気・機械設備に関する予防保全の知識がないことなどが、指摘されている。	**電気・機械設備の技術面での知識・技能を強化する。** ・ 電気・機械設備の保守作業に係わる従業員の能力強化については、EWTIの研修コースを活用して実施する。 ・ 運転や保守点検記録が確実に実施されるようにソフトコンポーネントの中で研修を行う。 ・ 給水計画の図書、竣工図書はC/PのOWERDBだけでなく、水道公社にも提供し、運営維持管理の基礎データとして保管と活用することについて、ソフトコンポーネントの中で研修を行う。 ・ 現在実施中のOneWaSHプログラムでは、設立した水道公社への経営の安定化に向け、ビジネスプランの作成研修が盛り込まれている。本事業のソフトコンポーネントにおいても、既往の研修教材を活用して、ビジネスプランの策定に必要な財務、技術、商業データのモニタリング、それに基づく月報作成等の研修活動を盛り込むこととする。

上表の対応方針に基づき、ソフトコンポーネント活動を策定し、OWERDB による運営・維持管理の支援体制の強化とともに、新たに設立される水管理組織を確実に機能させる必要がある。

1.3.2 対象住民の衛生意識の向上、ジェンダー平等の推進

準備調査期間中に実施した社会調査の結果によると、対象住民の低い衛生意識やジェンダー不平等についての課題が確認された。調査結果の詳細は下記（1）～（4）に示すとおりである。

住民の衛生環境の改善のためには、住民自身が適切な水利用、手洗いの重要性、適切な衛生施設の利用、水因性疾患の原因と予防等について理解し、衛生意識を向上させる取り組みが必要となる。

ジェンダー不平等の問題を解消するためには、住民の意識改革が必要であり、長期的な取り組みが要求される。本事業においては、維持管理の組織形成するタイミングで、ジェンダー不平等が解消される仕組みを関係者と議論し、組み込むことで（例えば、維持管理組織の人員配置時のジェンダーバランスや女性の意見が意思決定に反映されるルールなど）、職員の意識の変化や組織風土の醸成を目指す取り組みが必要である。

上記の２つの課題については、協力成果の持続性確保やインパクトにも影響することから、ソフト

[3] GTP-II (2008-2012) Plan Document, Oromia Water Mineral and Energy Bureau, October 2014
[4] 2015年度 外部事後評価報告書 無償資金協力「オロミア州給水計画」

コンポーネント活動を通じた課題解決への協力が必要である。

(1) 衛生施設の整備状況

世帯調査の結果からトイレの保有状況を見ると、対象タウンの約半数の世帯がスラブの無い単に地面に穴を掘っただけの簡便なピット式トイレを使用しており、適切な衛生施設を使用できていない状況である。また、約 2 割の世帯がトイレを所有しておらず、その多くが野外排泄をしていると考えられる。

表 6:トイレの保有状況とトイレの種類

ID	小都市	腐敗槽付き水洗トイレ *1	改良換気型便槽トイレ *2	改善型ピット式トイレ *3	簡便なピット式トイレ *4	バケツトイレ *5	足場の無いトイレ *6	トイレ無し *7	合計
ES-6	Ude Dhankaka	0.0%	4.0%	38.0%	50.0%	0.0%	0.0%	8.0%	100%
ES-8	Kamise	0.0%	0.0%	8.0%	48.0%	0.0%	0.0%	44.0%	100%
ES-10	Areda	0.0%	6.0%	24.0%	50.0%	0.0%	0.0%	20.0%	100%
ES-11	Biyo	0.0%	4.0%	24.0%	68.0%	0.0%	0.0%	4.0%	100%
AR-2	Bolo	0.0%	0.0%	10.0%	44.0%	4.0%	16.0%	26.0%	100%
AR-6	Gonde	0.0%	6.0%	40.0%	38.0%	6.0%	0.0%	10.0%	100%
6 小都市の平均		0.0%	3.3%	24.0%	49.7%	1.7%	2.7%	18.7%	100.0%

*1:Flush to septic tank, *2:Ventilated improved pit latrine, *3:Pit latrine with slab, *4:Pit latrine without slab/ Open pit, *5: Bucket toilet, *6:Hanging toilet/ Hanging latrine, *7:No facility/ Bush/ Field

出典：本計画の世帯調査結果

(2) 手洗い設備の整備状況

手洗い設備の保有状況について、対象タウン全体の約 75 %の世帯は手洗い設備を所有していない。

表 7:手洗い設備の保有状況、設備の種類

ID	小都市	手洗い設備と石鹸	手洗い設備のみ	バケツ水と石鹸	バケツ水のみ	手洗い設備無し	合計
ES-6	Ude Dhankaka	14.0%	14.0%	2.0%	10.0%	60.0%	100%
ES-8	Kamise	6.0%	8.0%	2.0%	0.0%	84.0%	100%
ES-10	Areda	6.0%	6.0%	0.0%	2.0%	86.0%	100%
ES-11	Biyo	10.0%	8.0%	2.0%	4.0%	76.0%	100%
AR-2	Bolo	6.0%	6.0%	8.0%	12.0%	68.0%	100%
AR-6	Gonde	8.0%	14.0%	4.0%	2.0%	72.0%	100%
6 小都市の平均		8.3%	9.3%	3.0%	5.0%	74.3%	100.0%

出典：本計画の世帯調査結果

(3) 水因性疾患の罹患状況

対象タウンにおける水因性疾患の罹患割合を見ると成人男性が最も高く、約 2 割の成人男性が調査時の過去 2 週間の期間に水因性疾患に罹患している。タウン別に見ると、Kamise タウンで罹患割合

が相対的に高くなっている。

表 8:性別・年齢層別の水因性疾患の罹患割合

ID	小都市	水因性疾患の罹患割合		
		成人男性	成人女性	子供
ES-6	Ude Dhankaka	16.3%	8.2%	12.8%
ES-8	Kamise	36.4%	20.4%	21.7%
ES-10	Areda	11.6%	4.2%	4.4%
ES-11	Biyo	20.0%	12.2%	16.3%
AR-2	Bolo	20.4%	18.0%	23.4%
AR-6	Gonde	6.7%	6.3%	4.1%
6 小都市の平均		18.6%	11.6%	13.8%

出典：本計画の世帯調査結果

(4) 女性利用者の意見の反映の有無

給水施設の維持管理に女性の意見が反映されているかについて女性に尋ねた調査結果は「女性の意見が反映されていない」と感じる割合が、全体平均で 5 割を超え、多くの女性が発言力における男女格差を感じている結果となった。成人女性は、水汲みの担い手として大きな役割を果たしており、給水施設が持続的かつ適切に維持管理されるためには、女性の意見が反映され、さらに男女が平等に意思決定のプロセスに参加できる環境の整備が必要である。

表 9:給水施設の維持管理に女性の意見が反映されていると感じる割合

ID	小都市	反映されていると感じる	反映されていないと感じる	わからない	合計
ES-6	Ude Dhankaka	34.0%	56.0%	10.0%	100%
ES-8	Kamise	38.0%	56.0%	6.0%	100%
ES-10	Areda	34.0%	50.0%	16.0%	100%
ES-11	Biyo	30.0%	46.0%	24.0%	100%
AR-2	Bolo	40.0%	60.0%	0.0%	100%
AR-6	Gonde	32.0%	50.0%	18.0%	100%
6 小都市の平均		34.7%	53.0%	12.3%	100.0%

出典：本計画の世帯調査結果

2 ソフトコンポーネントの目標

本ソフトコンポーネントの目標を以下のとおり設定する。

表 10:ソフトコンポーネントの目標

項目	内容
上位目標	水道公社の自助努力及び先方実施機関の継続的な支援によって給水施設の運営・維持管理体制が継続的に機能する
プロジェクト目標	新規給水施設の運営・維持管理体制が整備され、飲料水が供給される

3　ソフトコンポーネントの成果

本ソフトコンポーネント完了時に達成される成果（直接的成果）を以下のとおり設定する。

表 11:ソフトコンポーネントの成果

成果 No.	内容
成果 1	水道公社が組織される
成果 2	適切な水料金が設定される
成果 3	水道公社による給水サービスの内容が住民に認知される
成果 4 4-1 4-2 4-3	水道公社職員の運転、保守・修理能力が向上する ・　機械・電気設備の運転、保守・修理能力が向上する ・　水質管理能力が向上する ・　配水ネットワークに関する管理能力が向上する
成果 5	水道公社職員の給水サービスのマネジメント能力が向上する
成果 6	住民の衛生意識が向上する

4　成果達成度の確認方法

本ソフトコンポーネントの各成果の達成度は下表に示す方法で確認し、その結果は完了報告書に取り纏めることとする。

表 12:成果毎の達成度の確認方法

成果の内容		達成度の確認項目	達成度の確認のポイント
成果 1	水道公社が組織される	・水道公社の運営に必要な人員が雇用されたか ・ジェンダーバランスに配慮して人員が配置されたか ・水道公社の定款・規約が作成されたか	・水評議会によって水道公社が組織化され、必要な人員が雇用されているか確認する ・水道公社の職員がジェンダーバランスに配慮した人員構成になっているか確認する ・水道公社の定款・規約が作成され、その規定の中で男女平等による意思決定が基本原則とする規定が盛り込まれているか確認する
成果 2	適切な水料金が設定される	・コストリカバリーできる料金体系になっているか ・社会的弱者に配慮した料金設定になっているか ・設定された水料金が水評議会で承認されたか ・水料金の設定について住民の承諾が得られたか	・施設の運営維持管理を考慮した水料金になっているか確認する ・社会的弱者用の水料金プランが設定されたか確認する ・設定された水料金は、水評議会で承認されたか確認する ・設定された水料金は、住民の承認（地区の代表者など）が得られているか確認する
成果 3	水道公社による給水サービスの内容が住民に認知される	・新規契約手続き開始予定者がリスト化される	・住民が本事業内容と自分達の役割を理解したうえで、各戸給水の新規接続に同意した結果が、新規契約者数に反映されることから、申込者数が少ない場合は、水評議会、水道公社が、継続して各戸給水接続の普及活動を継続する
成果 4	水道公社の運転、保守・修理能力が向上する	－	－
4-1	機械・電気設備の運転、保守・修理能力が向上する	・ポンプ運転時間が正しく記録されているか ・定期モニタリング（初期竣工時）を正しく実施しているか	・研修後、ローカルコンサルタントが電話によって実施状況を確認し、ポンプの運転記録表や日常点検の記録用紙の画像データをもとに、正しく実施できたか水道公社に確認する
4-2	水質管理能力が向上する	・残留塩素の測定値を正しく記録しているか ・末端の公共水栓での残留塩素濃度がエチオピアの基準値（0.2～0.5 mg/l）を満足しているか	・研修後、ローカルコンサルタントが電話によって実施状況を確認し、残留塩素濃度想定記録表の画像データをもとに、正しく実施できたか水道公社に確認する

成果の内容		達成度の確認項目	達成度の確認のポイント
4-3	配管ネットワークに関する管理能力が向上する	・水源井戸の生産量は正しく記録されているか ・流量計の測定値を正しく記録しているか ・各戸給水の接続工事が正しい手順で実施されているか	・研修後、ローカルコンサルタントが電話によって実施状況を確認し、流量測定の記録表の画像データをもとに、正しく実施できたか水道公社に確認する ・各戸給水の接続工事については、水事務所にヤードタップを接続する工事の演習を行う。達成度の評価は、事前に準備する実習評価シートにもとづき実施する
成果 5	水道公社職員の給水サービスのマネジメント能力が向上する	・水道公社職員が月報作成方法について理解したか ・水道公社によって月報が作成されているか ・水道公社から水評議会に月報が提出され、その内容が報告されたか	・研修実施後に実施する研修アンケートで月報の作成方法について理解したとの回答が得られているか確認する ・研修 1 ヶ月後、ローカルコンサルタントが電話によって月報が作成されたか水道公社に確認する。また、その月報が水評議会に提出されたか確認する。
成果 6	住民の衛生意識が向上する	・安全な水の利用方法について住民が理解したか ・住民の衛生意識が深められたか	・住民集会後に衛生行動に対するクイズを行い、正解する人数が参加者全体の半数以上であるか確認する ・研修 1 ヶ月後、ローカルコンサルタントが電話によって、共同水栓やヤードタップなどの水栓周りの環境が清潔に保持されているか水道公社に確認する ・研修 1 ヶ月後、ローカルコンサルタントが電話によって各タウンで無作為抽出された学校の校長に、生徒の手洗い励行状況の変化について確認する

5 ソフトコンポーネントの活動（投入計画）

本ソフトコンポーネントの各成果に対応する活動計画を以下に示す。

5.1 成果と活動内容

本ソフトコンポーネントの各成果に対応する活動内容を下表に示す。

表 13:ソフトコンポーネントの活動

成果の内容		活動	
成果 1	水道公社が設立される	1-1	実施機関関係者（OWERDB、ZWERDO）に対しプロジェクトオリエンテーションを実施し、全体スケジュールを作成する
		1-2	対象タウン、WWERDO に対し、プロジェクトオリエンテーションを実施し、水評議会の設立を行う
		1-3	対象タウンの水評議会が主導して、水道公社の設立を行う
		1-4	雇用された水道公社の職員に対してオリエンテーションを行う
		1-5	対象タウンの水道公社が定款・規約を策定する
成果 2	適切な水料金が設定される	2-1	対象タウンの水評議会、水道公社職員とともに水料金の設定計画書を策定する
		2-2	対象タウンの水評議会、水道公社職員とともに各戸給水接続のための手順書を策定する
		2-3	設定された水料金について水評議会で承認が得られるためのサポート活動を実施する
成果 3	水道公社による給水サービスの内容が住民に認知される	3-1	対象タウンの住民に対するオリエンテーション活動を支援する
成果 4	水道公社の運転、保守・修理能力が向上する		
4-1	機械・電気設備の運転、保守・修理能力が向上する	4-1	機械・電気設備の運転、保守・修理能力強化のための研修を実施する
		4-1-1	動力ポンプ、コントロールパネルの運営維持管理に係わる研修を実施する
		4-1-2	発電機の運営維持管理に係わる研修を実施する

成果の内容		活動	
		4-1-3	太陽光システムの運営維持管理に係わる研修を実施する
4-2	水質管理能力が向上する	4-2	水質管理能力強化のための研修を実施する
		4-2-1	水質管理全般(水質基準、水因性疾患、深井戸周辺保護、住民への衛生啓発等)に係わる研修を実施する
		4-2-2	塩素消毒設備の運転維持管理に係わる研修を実施する
		4-2-3	公共水栓末端での残留塩素濃度の測定に係わる研修を実施する
		4-2-4	測定された残留塩素濃度に基づき消毒液の濃度調整の研修を実施する
4-3	配管ネットワークに関する管理能力が向上する	4-3	配管ネットワーク管理能力強化のための研修を実施する
		4-3-1	配水池の配水管理に係わる研修を実施する
		4-3-2	送配水管及び付帯設備(バルブ類、減圧層)の維持管理に係わる研修を実施する
		4-3-3	給水装置の維持管理に係わる研修を実施する
		4-3-4	漏水などの緊急時の対応に係わる研修を実施する
成果 5	水道公社職員の給水サービスのマネジメント能力が向上する	5-1	会計、財務に係わる研修を実施する
		5-2	データ管理、月報作成に係わる研修を実施する
		5-3	水道メーターの検針、料金徴収に係わる研修を実施する
		5-4	ビジネスプランの作成に係わる研修を実施する
成果 6	住民の衛生意識が向上する	6-1	衛生啓発(水の清潔な保管、手洗い設備の設置推進、トイレのアップグレードまたは設置推進、栄養改善のための衛生行動改善)を実施する
		6-2	水源保護、公共水栓、ヤードタップなどの水栓周りの衛生環境の向上のための研修を実施する

5.2 活動区分

本ソフトコンポーネント活動は、施設建設着工期の「組織形成 1」、施設建設前期の「組織形成 2」施設建設中期の「運営維持管理能力強化 1&住民啓発」、施設建設後期～建設後の「運営維持管理能力強化 2」の 4 つのフェーズに区分される。

全ての活動において邦人コンサルタントが関与し、活動内容に応じて先方実施機関（OWERDB、ZWERDO、WWERDO）の協力を仰ぐ体制で実施される。

表 14:ソフトコンポーネント活動の活動区分

成果	活動
1:組織形成1(建設着工期)	
成果1:水道公社が設立される	活動1-1～活動1-3
2:組織形成2(建設前期)	
成果1:水道公社が設立される	活動1-4
成果2:適切な水料金が設定される	活動2-1～活動2-3
3:運営維持管理能力強化1及び住民啓発(建設中期)	
成果3:水道公社による給水サービスの内容が住民に認知される	活動3-1
成果5:水道公社職員の給水サービスのマネジメント能力が向上する	活動5-1～活動5-4
成果6:住民の衛生意識が向上する	活動6-1～活動6-2
4:運営維持管理能力強化2(建設後期～建設後)	
成果4:水道公社の運転、保守・修理能力が向上する	活動4-1-1～活動4-3-5

5.3 実施リソース

5.3.1 日本側

本ソフトコンポーネント活動を実施するために必要な日本側リソースは、邦人コンサルタント 2 名、ローカルコンサルタント 2 名、エチオピア水技術機構（EWTI）職員 1 名で構成される。各要員

の主な業務と要求されるスキルについて表 15に示す。

表 15:ソフトコンポーネント活動に必要な日本側の実施リソースと業務内容

要員	主な業務内容と求められるスキル
邦人コンサルタント	
運営維持管理計画／衛生啓発	主な業務 ・ 全活動において、準備、指示、取り纏め、報告を担当し、計画全体の管理を行う ・ 運営維持管理マニュアル（技術編）、運営維持管理マニュアル（マネジメント編）、衛生啓発マニュアルの作成の取り纏めを行う 求められるスキル ・ 短期間においてこれらを取りまとめるため、エチオピア国におけるプロジェクト経験があり、対象小都市に関する状況を把握し、かつ、ソフトコンポーネントの経験がある人材が必要である
水質管理	主な業務 ・ 水質管理全般（水質基準、水因性疾患、深井戸周辺保護、住民への衛生啓発等）に係わる研修を実施する ・ 塩素消毒設備の運転維持管理に係わる研修を実施する ・ 測定された残留塩素濃度に基づき消毒液の濃度調整の研修を実施する ・ 運営維持管理マニュアル（技術編）、運営維持管理マニュアル（マネジメント編）の取り纏め支援を行う 求められるスキル ・ 塩素消毒装置の管理方法について知識とスキルを有し、水質管理計画の改善、塩素注入の最適化、水質試験結果の分析について、指導経験を有する人材が必要である
ローカルコンサルタント	
技術担当	主な業務 ・ 配水池の配水管理に係わる研修を実施する ・ 送配水管及び付帯設備（バルブ類、減圧層）の維持管理に係わる研修を実施する ・ 給水装置の維持管理に係わる研修を実施する ・ 漏水などの緊急時の対応に係わる研修を実施する 求められるスキル ・ 管路系給水施設の日常点検、定期点検、計装機器の記録、管理方法について知識とスキルを有し、英語だけでなく、オロモ語による通訳や翻訳業務の能力を有する
マネジメント管理／衛生啓発担当	主な業務 ・ 対象タウンの住民に対しオリエンテーションを開催する ・ 会計、財務に係わる研修を実施する ・ データ管理、月報作成に係わる研修を実施する ・ 水道メーターの検針、料金徴収に係わる研修を実施する ・ ビジネスプランの作成に係わる研修を実施する ・ 衛生啓発を実施する ・ 衛生環境向上の研修を実施する 求められるスキル ・ 管路系給水施設の組織マネジメント、財務管理、顧客管理、住民合意形成などの知識とスキルを有し、英語だけでなく、オロモ語による通訳や翻訳業務の能力を有する
電気・機械設備担当（EWTI の講師）	主な業務 ・ 動力ポンプ、コントロールパネルの運営維持管理に係わる研修を実施する ・ 発電機の運営維持管理に係わる研修を実施する ・ 太陽光システムの運営維持管理に係わる研修を実施する 求められるスキル ・ ポンプ、発電機、太陽光システム等の管理方法について知識とスキルを有し、英語だけでなく、オロモ語による通訳や翻訳業務の能力を有する

5.3.2 エチオピア側

(1) オロミア州水・エネルギー資源開発局（OWERDB）

水道公社と ZWERDO の連携を支援し、オロミア州における給水施設の運営・維持管理を包括的に支援するため、OWERDB の協力が必須となる。このため、各活動の都度、OWERDB の協力を得ることができるよう、ソフトコンポーネントの開始時に OWERDB に対して依頼する。

(2) 県水・エネルギー資源開発事務所事務所（ZWERDO）

対象 6 タウンのうち、4 タウンは東シェワ県の ZWERDO、2 タウンはアルシ県の ZWERDO が所管している。図 3 に示すとおり、ZWERDO は、水道公社を監督・支援する立場にあることから、ソフトコンポーネントの活動全般に亘り、当事務所を常に巻き込む必要がある。特に、水道公社による水道サービスが軌道に乗るまでは、水道公社への必要な支援が適切なタイミングで行き渡るよう、OWERDB から県 ZWERDO に働きかけを強化してもらう必要がある。

(3) 郡水・エネルギー資源開発事務所（WWERDO）

対象 6 タウンには、既存の管路系給水施設、ハンドポンプ付井戸、湧水などがあり、WWERDO はこれらの給水施設の運営維持管理の支援を行ってきた。そのため、対象タウン事務所とも WWERDO と良好な関係を構築している。今後、本事業による給水サービスが開始されると ZWERDO が当施設を監督・支援する立場になるが、WWERDO は、対象タウンからも近く、水道行政の身近な相談窓口として引き続き関係を構築しておくことが重要である。そのため、本ソフトコンポーネント活動では、できるだけ WWERDO の職員も巻き込んで実施する方針とする。

5.4 活動内容及び投入計画

本ソフトコンポーネントの詳細プログラムおよび投入日数を次表に示す。また、活動毎の研修対象者、実施方法、成果品などを示した詳細計画書を添付資料 1 に示す。

5.4.1　第1回目：組織形成1（建設前期）

No.	活動内容	詳細プログラム		必要日数	実作業日数（日）				
					邦人コンサルタント		ローカルコンサルタント		EWTI
					運営維持管理計画／衛生啓発	水質管理	マネジメント管理／衛生啓発担当	技術担当	
1-1	実施機関関係者（OWERDB、ZWERDO）に対しプロジェクトオリエンテーションを実施し、全体スケジュールを作成する	準備	－	－	0.0	0.0	0.0	0.0	0.0
		主活動	・本事業およびソフトコンポーネント活動の方針、実施体制、全体工程、事業実施における各アクターの役割を理解する ・本事業の運営・維持管理体制について、水道公社、水評議会の責任、役割を理解する ・対象タウンで開催するオリエンテーションの詳細計画の作成	3日間（移動も含め、各機関1日）	3.0	0.0	3.0	3.0	0.0
1-2	対象タウン、WWERDOに対し、プロジェクトオリエンテーションを実施し、水評議会の設立を行う	準備	・オリエンテーション用資料を作成する	1日間	1.0	0.0	0.0	0.0	0.0
		主活動	・本事業およびソフトコンポーネント活動の方針、実施体制、全体工程、事業実施における各アクターの役割を理解する ・本事業の運営・維持管理体制について、水道公社、水評議会の責任、役割を理解する ・水評議会のメンバー選定における留意点（ジェンダーバランス）について理解する ・水評議会設立の事務局を設立する ・水道公社職員の選定方針、スケジュールを作成する	7日間 1日／タウン x 6タウン + 1日（移動）	7.0	0.0	7.0	0.0	0.0
1-3	対象タウンの水評議会が主導して、水道公社の設立を行う	準備	－	－	0.0	0.0	0.0	0.0	0.0
		主活動	・水評議会設立のための事務局へのフォローアップを実施する	2日間 0.3日／タウン x 6	0.0	0.0	2.0	0.0	0.0
合計					11.0	0.0	12.0	3.0	0.0

5.4.2　第2回目：組織形成2（建設前期）

No.	活動内容	詳細プログラム		必要日数	実作業日数（日）				
					邦人コンサルタント		ローカルコンサルタント		EWTI
					運営維持管理計画／衛生啓発	水質管理	マネジメント管理／衛生啓発担当	技術担当	
1-4	雇用された水道公社の職員に対してオリエンテーションを行う	準備	－	－	0.0	0.0	0.0	0.0	0.0
		主活動	・本事業およびソフトコンポーネント活動の方針、実施体制、全体工程、事業実施における各アクターの役割を理解する ・本事業の運営・維持管理体制について、水道公社、水評議会の責任、役割を理解する	6日間 1日／タウン x 6タウン	2.0 （2タウンのみ）	0.0	6.0	0.0	0.0

No.	活動内容	詳細プログラム		必要日数	実作業日数(日)				
					邦人コンサルタント		ローカル コンサルタント		EWTI
					運営維持管理計画／衛生啓発	水質管理	マネジメント管理／衛生啓発担当	技術担当	
			・ 給水施設の概要、運営維持管理の基礎について理解する						
1-5	対象タウンの水道公社が定款・規約を策定する	準備	・ 定款、規約のひな型を作成する	3日間 (1.5日 x 2人)	1.5	0.0	1.5	0.0	0.0
		主活動	・ 水道公社のビジョン、ミションを議論・決定する ・ 水道公社の定款・規約を(職掌、人事・労務体系等)を作成する。	12日間 2日／タウン x 6タウン	4.0 (2タウンのみ)	0.0	12.0	0.0	0.0
2-1	対象タウンの水評議会、水道公社職員とともに水料金の設定計画書を策定する	準備	・ 水省が作成している水料金設定ガイドラインをもとに、水料金の設定の手順書を作成する	1日間	1.0	0.0	0.0	0.0	0.0
		主活動	・ 運営・維持管理費の試算 ・ 水料金単価(料金体系、一般住民、公共施設、社会的弱者の料金区分)の設定 ・ 徴収方法の検討	6日間 1日／タウン x 6タウン	2.0 (2タウンのみ)	0.0	6.0	0.0	0.0
2-2	対象タウンの水評議会、水道公社職員とともに各戸給水接続のための手順書を策定する	準備	・ 各戸給水の接続手順書のひな型を作成する	0.5日間	0.5	0.0	0.0	0.0	0.0
		主活動	・ 給水装置の工事費用のルール ・ 手順書の作成 ・ 各戸給水申し込み用紙の作成 ・ 各戸給水を促進するための戦略についての議論	7日間 1日／タウン x 6タウン + 1日(移動)	2.0 (2タウンのみ)	0.0	7.0	0.0	0.0
2-3	設定された水料金について水評議会で承認が得られるためのサポート活動を実施する	準備	-	-	0.0	0.0	0.0	0.0	0.0
		主活動	・ 水評議会の会合で策定された水道料金表の承認を得られるように支援する ・ 承認された水道料金表が、各地区の住民代表者に周知されるようモニタリングを行う	2日間 0.3日／タウン x 6	0.0	0.0	2.0	0.0	0.0
合計					13.0	0.0	34.5	0.0	0.0

5.4.3 第3回目:運営維持管理能力強化1及び住民啓発(建設中期)

No.	活動内容	詳細プログラム		必要日数	実作業日数(日)				
					邦人コンサルタント		ローカル コンサルタント		EWTI
					運営維持管理計画／衛生啓発	水質管理	マネジメント管理／衛生啓発担当	技術担当	
3-1	対象タウンの住民に対しオリエンテーションを開催する	準備	・ 住民集会の準備を実施する	1日間	0.0	0.0	1.0	0.0	0.0
		主活動	・ 本事業の運営・維持管理体制について、水道公社、水評議会の役割を理解する ・ ユーザーの責務につい理解する ・ 各戸接続契約について理解する	7日間 1日／タウン x 6タウン + 1日(移動)	1.0 (1タウンのみ)	0.0	7.0	0.0	0.0
5-1	会計、財務に係わる研修を	準備	・ 運営維持管理マニュアル(マネジメント編)を作成する	0.25日間	0.25	0.0	0.0	0.0	0.0

No.	活動内容	詳細プログラム		必要日数	実作業日数(日)				
					邦人コンサルタント		ローカル コンサルタント		EWTI
					運営維持管理計画／衛生啓発	水質管理	マネジメント管理／衛生啓発担当	技術担当	
	実施する	主活動	・ 会計・財務管理の能力の向上 ・ 帳簿管理の目的 ・ 帳簿管理の基礎 ・ 運営維持管理の財務計算 ・ 運営維持管理の財務分析 ・ 会計監査の能力の向上 ・ 会計監査の目的 ・ 会計監査の実施方法 ・ 監査報告書の作成	3日間 0.5日／タウン x 6タウン	1.0 (2タウンのみ)	0.0	3.0	0.0	0.0
5-2	データ管理、月報作成に係わる研修を実施する	準備	・ 運営維持管理マニュアル(マネジメント編)を作成する	0.25日間	0.25	0.0	0.0	0.0	0.0
		主活動	・ データ管理、月報の作成方法を理解する ・ 井戸の生産量、送配水量、給水量データの管理 ・ 顧客情報、苦情等のコーマーシャルデータの管理 ・ 歳入、歳出などの財務データの管理 ・ 修理対応などの記録 ・ 竣工図書、施設図面などの管理 ・ 月報、年報の作成 ・ 水評議会メンバーによる月報、年報データへのフィードバックのポイント	6日間 1日／タウン x 6タウン	2.0 (2タウンのみ)	0.0	6.0	0.0	0.0
5-3	水道メーターの検針、料金徴収に係わる研修を実施する	準備	・ 運営維持管理マニュアル(マネジメント編)を作成する	0.25日間	0.25	0.0	0.0	0.0	0.0
		主活動	・ 水道メーターの検針、請求書作成方法について理解する ・ 水道メーターの仕組み ・ 水道メーターの読み方 ・ 請求書の作成方法	3日間 0.5日／タウン x 6タウン	1.0 (2タウンのみ)	0.0	3.0	0.0	0.0
5-4	ビジネスプランの作成に係わる研修を実施する	準備	・ 運営維持管理マニュアル(マネジメント編)を作成する	0.25日間	0.25	0.0	0.0	0.0	0.0
		主活動	・ ビジネスプランの作成方法を理解する ・ 給水装置のストック管理 ・ 職員の能力開発の計画 ・ 施設の年間維持管理計画 ・ 中期財務計画 ・ 顧客満足度の向上に向けた取組み ・ 水道公社、水評議会メンバーによるPDCAサイクルによる業務改善のポイント	6日間 1日／タウン x 6タウン	2.0 (2タウンのみ)	0.0	6.0	0.0	0.0
6-1	衛生啓発(水の清潔な保管、手洗い設備の設置推進、トイレのアップグレードまたは設置推進、栄養改善のための衛生行動改善)を実施する	準備	・ 衛生啓発マニュアルを作成する	0.5日間	0.5	0.0	0.0	0.0	0.0
		主活動	・ 正しい衛生習慣を行えるように住民の衛生意識を向上させる。 ・ 水衛生と水因性疾患(下痢症と栄養改善の関係、正しい衛生習慣とは) ・ 水因性疾患の予防のための糞口汚染経路のコントロール ・ 安全な水利用、保管と衛生環境 ・ 安全なトイレ、手洗い施設の整備	7日間 1回／1日 x 6タウン+ 1日(移動)	1.0 (1タウンのみ)	0.0	7.0	0.0	0.0

No.	活動内容	詳細プログラム		必要日数	実作業日数(日)				
					邦人コンサルタント		ローカル コンサルタント		EWTI
					運営維持管理計画／衛生啓発	水質管理	マネジメント管理／衛生啓発担当	技術担当	
			・ 正しい手洗い行動						
6-2	水源保護、公共水栓、ヤードタップなどの水栓周りの衛生環境の向上のための研修を実施する	準備	－	－	0.0	0.0	0.0	0.0	0.0
		主活動	・ 水源保護、公共水栓、ヤードタップ周辺の衛生環境を保持するための必要性を理解する。 ・ 家畜の放牧、トイレ建設の配置によって生じる水源汚染の原理について理解する ・ 正しい水源保護の方法を理解する ・ 公共水栓、ヤードタップ周辺の正しい排水処理について理解する	6-1、6-2は併せて実施する	0.0	0.0	0.0	0.0	0.0
合計					10.5	0.0	33.0	0.0	0.0

5.4.4 第4回目:運営維持管理能力強化2(建設後期～建設後)

No.	活動内容	詳細プログラム		必要日数	実作業日数(日)				
					邦人コンサルタント		ローカル コンサルタント		EWTI
					運営維持管理計画／衛生啓発	水質管理	マネジメント管理／衛生啓発担当	技術担当	
4-1-1	動力ポンプ、コントロールパネルの運営維持管理に係わる研修を実施する	準備	・ 運営維持管理マニュアル(技術編)を作成する	0.25日間	0.25	0.0	0.0	0.0	0.0
		主活動	・ 井戸の地下水位のモニタリングの方法を理解する ・ 動力ポンプの制御方法について理解する ・ 動力ポンプ、コントロールパネルの運転にかかわるトラブルシューティングについて理解する	3日間 0.5日／タウン x 6タウン	1.0 (2タウンのみ)	0.0	0.0	0.0	3.0
4-1-2	発電機の運営維持管理に係わる研修を実施する	準備	・ 運営維持管理マニュアル(技術編)を作成する	0.25日間	0.25	0.0	0.0	0.0	0.0
		主活動	・ 発電機の仕組みについて理解する ・ 発電機の日常点検、定期メンテナンスについて理解する ・ 発電機の運転にかかわるトラブルシューティングについて理解する	3日間 0.5日／タウン x 6タウン	1.0 (2タウンのみ)	0.0	0.0	0.0	3.0
4-1-3	太陽光システムの運営維持管理に係わる研修を実施する	準備	・ 運営維持管理マニュアル(技術編)を作成する	0.25日間	0.25	0.0	0.0	0.0	0.0
		主活動	・ PV システムの原理と基礎知識 ・ PV システムと電気技術の基礎 ・ 導入システムの概要 ・ モニタリング(日常点検、定期点検、評価項目、トラブルシューティング)について理解する	1日間	1.0	0.0	0.0	0.0	1.0
4-2-1	水質管理全般(水質基準、水因性疾患、深井戸周辺保護、住民への衛生啓発	準備	－	－	0.0	0.0	0.0	0.0	0.0
		主活動	・ 水質基準 ・ 飲料水の健康危機管理	3日間 0.5日／タウン x 6	0.0	3.0	0.0	0.0	0.0

No.	活動内容	詳細プログラム		必要日数	実作業日数(日)				
					邦人コンサルタント		ローカル コンサルタント		EWTI
					運営維持管理計画／衛生啓発	水質管理	マネジメント管理／衛生啓発担当	技術担当	
	等)に係わる研修を実施する		・ 水質のリスク評価 ・ 水源の保護の重要性 ・ 住民への衛生啓発の方法(トイレ建設の位置、家畜による水源汚染の防護、安全な水の保管)	タウン					
4-2-2	塩素消毒設備の運転維持管理に係わる研修を実施する	準備	－	－	0.0	0..0	0.0	0.0	0.0
		主活動	・ 塩素消毒の目的について理解する(座学) ・ 塩素注入設備の管理方法を理解する(塩素溶解タンクの管理、塩素注入濃度管理)	3日間 0.5日／タウン x 6タウン	0.0	3.0	0.0	0.0	0.0
4-2-3	公共水栓末端での残留塩素濃度の測定に係わる研修を実施する	準備	－	－	0.0	0..0	0.0	0.0	0.0
		主活動	・ 公共水栓末端での遊離残留塩素の測定スキルを身に着ける(現場実習) ・ 測定データの管理方法を理解する	3日間 0.5日／タウン x 6タウン	0.0	3.0	0.0	0.0	0.0
4-2-4	測定された残留塩素濃度に基づき消毒液の濃度調整の研修を実施する	準備	－	－	0.0	0..0	0.0	0.0	0.0
		主活動	・ 上記4-2-3の測定結果に基づき、塩素溶解水槽の濃度管理について理解する ・ 配水池の直下の公共水栓で残留塩素測定の復習(現場実習) ・ さらし粉の調達方法について理解する	3日間 0.5日／タウン x 6タウン	0.0	3.0	0.0	0.0	0.0
4-3-1	配水池の配水管理に係わる研修を実施する	準備	－	－	0.0	0..0	0.0	0.0	0.0
		主活動	・ 配水池の維持管理について理解する ・ 配水池に設置された流量計の計測・記録を行う ・ 配水池内部の定期点検 ・ 付属設備、保安設備の定期点検	3日間 0.5日／タウン x 6タウン	1.0 (2タウンのみ)	0.0	0.0	3.0	0.0
4-3-2	送配水管及び付帯設備(バルブ類、減圧層)の維持管理に係わる研修を実施する	準備	－	－	0.0	0.0	0.0	0.0	0.0
		主活動	・ 無収水対策とは ・ 無収水率の計算演習 ・ 送配水管の点検方法 ・ バルブ類の点検方法 ・ 減圧層の点検方法	3日間 0.5日／タウン x 6タウン	1.0 (2タウンのみ)	0.0	0.0	3.0	0.0
4-3-3	給水装置の維持管理に係わる研修を実施する	準備	－	－	0.0	0.0	0.0	0.0	0.0
		主活動	・ 給水装置の構造及び材質 ・ 給水装置の工事における留意事項 ・ 給水装置の維持管理(給水装置の故障・異常の原因と修繕工事法) ・ 給水装置の設置演習(水管理事務所内)	6日間 1日／タウン x 6タウン	2.0 (2タウンのみ)	0.0	0.0	6.0	0.0
4-3-4	漏水などの緊急時の対応に係わる研修を実施する	準備	－	－	0.0	0.0	0.0	0.0	0.0
		主活動	・ 漏水などの緊急時の対応方法について理解する ・ 漏水防止の必要性 ・ 漏水箇所の応急処置 ・ 漏水防止対策	3日間 0.5日／タウン x 6タウン	1.0 (2タウンのみ)	0.0	0.0	3.0	0.0

No.	活動内容	詳細プログラム	必要日数	実作業日数（日）				
				邦人コンサルタント		ローカル コンサルタント		EWTI
				運営維持管理計画／衛生啓発	水質管理	マネジメント管理／衛生啓発担当	技術担当	
合計				8.75	12.0	0.0	15.0	7.0

5.4.5 投入計画の取り纏め

（1） 活動毎の取り纏め

No.	活動	① 実作業日数					② 暦日作業日数 {① x 暦日換算係数 (1.35)}					③ 移動日数					④ 合計 (②+③)				
		邦人		ローカル			邦人		ローカル			邦人		ローカル			邦人		ローカル		
		運営維持管理計画／衛生啓発	水質管理	マネジメント管理／衛生啓発担当	技術担当	EWTI	運営維持管理計画／衛生啓発	水質管理	マネジメント管理／衛生啓発担当	技術担当	EWTI	運営維持管理計画／衛生啓発	水質管理	マネジメント管理／衛生啓発担当	技術担当	EWTI	運営維持管理計画／衛生啓発	水質管理	マネジメント管理／衛生啓発担当	技術担当	EWTI
1 回目	活動 1-1～活動 1-3	11.0	0.0	12.0	3.0	0.0	15.0	0.0	17.0	5.0	0.0	4.0	0.0	0.0	0.0	0.0	19.0	0.0	17.0	5.0	0.0
2 回目	活動 1-4～活動 2-3	13.0	0.0	34.5	0.0	0.0	18.0	0.0	47.0	0.0	0.0	4.0	0.0	0.0	0.0	0.0	22.0	0.0	47.0	0.0	0.0
3 回目	活動 3-1，活動 5-1～5-4、活動 6-1～6-4	9.5	0.0	33.0	0.0	0.0	13.0	0.0	45.0	0.0	0.0	4.0	0.0	0.0	0.0	0.0	17.0	0.0	45.0	0.0	0.0
4 回目	活動 4-1～4-3	8.75	12.0	0.0	15.0	7.0	12.0	17.0	0.0	21.0	10.0	4.0	4.0	0.0	0.0	0.0	16.0	21.0	0.0	21.0	10.0
合計（日）																	74	21	109	26	10
合計（M/M）																	2.47	0.70	3.63	0.87	0.33

(2)　年度毎の取り纏め

団員名／年度		ターム 2 2022 年度	ターム 3 2023 年度	ターム 4 2024 年度	ターム 5 2025 年度	合計 （日）
邦人コンサル	運営維持管理計画／衛生啓発	19	22	17	16	74
	水質管理	0	0	0	21	21
	小計（日）	**19**	**22**	**17**	**37**	**95**
ローカルコンサル	マネジメント管理／衛生啓発担当	17	47	45	0	109
	技術担当	5	0	0	21	26
	EWTI	0	0	0	10	10
	小計（日）	**22**	**47**	**45**	**31**	**145**
合計（日）		41	69	62	68	240
合計（M/M）		**1.36**	**2.30**	**2.07**	**2.27**	**8.00**

6　ソフトコンポーネントの実施リソースの調達方法

本ソフトコンポーネントは、給水施設の運営管理組織の形成から運営維持管理能力強化及び衛生教育に係わる支援であり、活動期間は、事業開始から長期間に亘って継続される。このため、実施リソースは、本邦コンサルタントが実施主体となるものの、ローカルコンサルタントを有効活用して、効果的・効率的に成果の達成を目指す。

本邦コンサルタントの介入については最小限とするものの、ソフトコンポーネントの目的を鑑み、本計画の各活動の品質・工程管理および各関係機関の他、エチオピア水技術機構（EWTI）との連携強化などの活動のため、本計画の実施リソースの総括として適宜投入することが必要である。

上記の基本方針のもと、本ソフトコンポーネントの実施リソースは、以下の方法によって調達する。

- **邦人コンサルタント**

本邦コンサルタントは、全活動において、準備、指示、取り纏め、報告を担当し、計画全体の管理を行う。短期間においてこれらを取りまとめるため、エチオピア国におけるプロジェクト経験があり、対象小都市に関する状況を把握し、かつ、ソフトコンポーネントの経験がある人材が必要である。このため、プロジェクト実施設計時の契約コンサルタントから人材を調達する。また、本計画では、給水施設の構成として塩素消毒設備を導入することになっている。しかし、エチオピア国では小都市レベルの給水施設で消毒設備を導入しているケースが少なく、塩素消毒設備の維持管理や水質管理の研修について経験のあるローカルコンサルタントは限られている。従って、水質管理の能力強化については、本邦コンサルタントの派遣による対応とする。

- **ローカルコンサルタント**

ローカルコンサルタントは、邦人コンサルタントの指示のもと、実施期間中全般に亘って活動する。水道施設建設及びソフトコンポーネントに対する類似案件の経験を有するコンルタント／現地 NGO を実施機関や他ドナーからの情報をもとにショートリストを作成し、プロポーザル形式（書類審査＋面接）による選定する。

なお、成果 4 の給水施設の電気・機械設備の能力強化研修については、高度な知識と技術力を持ち、オロモ語による講義が可能なエチオピア水技術機構（EWTI）からの職員が適任であると判断する。これに際し、事前に EWTI とのプログラムに関する協議を行い、講師を調達する方針とする。

7　ソフトコンポーネントの実施工程

本ソフトコンポーネントの実施工程を添付資料 2 に示す。

8　ソフトコンポーネントの成果品

本ソフトコンポーネントにおける成果品は以下のとおりである。

表 16:ソフトコンポーネントの成果品

No.	成果品名	作成時期
全体		
1	完了報告書(相手国政府、日本国側) (各成果の達成度の評価結果は、完了報告書に取り纏める)	業務完了時
2	ソフトコンポーネント実施状況報告書	邦人コンサルタント派遣毎
活動1		
3	州水資源局、県水開発事務所、対象タウンへのオリエンテーション資料	
4	会議議事録	活動1の実施時
5	水評議会のメンバー表	
6	水道公社職員の選定計画書	
7	水道公社職員リスト	
8	水道公社職員へのオリエンテーション資料	
9	水道公社の定款・規約	
活動2		
10	水料金表	活動2の実施時
11	水料金の設定計画書	
12	各戸給水の接続のための手順書	
13	各戸給水の申し込み用紙	
14	会議議事録	
活動3		
15	住民集会用の計画書と資料	活動3の実施時
活動4		
16	運営維持管理マニュアル(技術編) ●内容:井戸、土木施設、管路、電気施設、機械施設、水質 ●対象者:水道公社の職員 ●使用言語:英語(一部、オロモ語)	活動4の実施時
17	研修計画書	
活動5		
18	運営維持管理マニュアル(マネジメント編) ●内容:会計、財務、データ管理、月報作成、ビジネスプラン ●対象者:水道公社の職員、水評議会メンバー ●使用言語:英語(一部、オロモ語)	活動5の実施時
19	研修計画書	
活動6		
20	衛生啓発マニュアル	活動6の実施時
21	住民集会用の計画書と資料	

9　ソフトコンポーネントの概略事業費

「施工・調達業者契約認証まで非公表」

10　相手国側の責務

本ソフトコンポーネントの目標を達成するためには、ソフトコンポーネント投入による成果に加え、相手国機関の参加と実行が重要である。それぞれの組織レベルで必要となる責務は、以下のとおりである。

[州水・エネルギー資源開発局、県水・エネルギー資源開発事務所及び郡水・エネルギー資源事務所]

- 本邦コンサルタントとの提携によるプログラム全体を管理する
- プログラム実施にかかる関係部署への協力要請を行う
- 関係機関職員の提供及び職員の現地活動費用、移動交通費、日当・宿泊費等の経費を負担する
- 合同協議、各訓練及びワークショップの実施及び開催にかかる人員確保、会場準備、運営費用を負担する
- 対象タウンの水評議会の設立を主導する
- 上記の水評議会が主導する水道公社の設立活動を支援する
- 水道公社（水道公社、水評議会）への技術指導を行う
- 住民への各戸給水接続の支援を行う
- 各タウンが設定する水料金がタウン行政事務所で承諾されるように支援を行う
- 水管理事務所にストックされる給水装置（給水管、止水栓、水道メーター、給水栓、継手、ボール式サドル分水栓）の初期セットと必要工具の準備支援を行う
- プロジェクトのモニタリング及びモニタリング報告書の作成を行う

[タウン行政事務所、水評議会、水道公社]

- コンサルタント（本邦、ローカル）の現地活動時に協力・支援を行う
- タウン住民集会の開催にかかる人員確保、日程の調整、会場準備、運営費用を負担する
- 住民への各戸給水接続の支援を行う
- 水道公社が提案する水料金について、タウン行政事務所と水評議会で承認を行う
- 水管理事務所にストックされる給水装置（給水管、止水栓、水道メーター、給水栓、継手、ボール式サドル分水栓）の初期セットと必要工具を準備する

なお、関係者の移動交通費、日当、宿泊費等、先方実施機関において当該年度予算が計上されていない場合、ワークショップ等の開催が困難になることが考えられる。したがって、プロジェクトの工程を鑑みた先方実施機関の事前予算申請が重要となる。

添付資料1：ソフトコンポーネント詳細活動計画

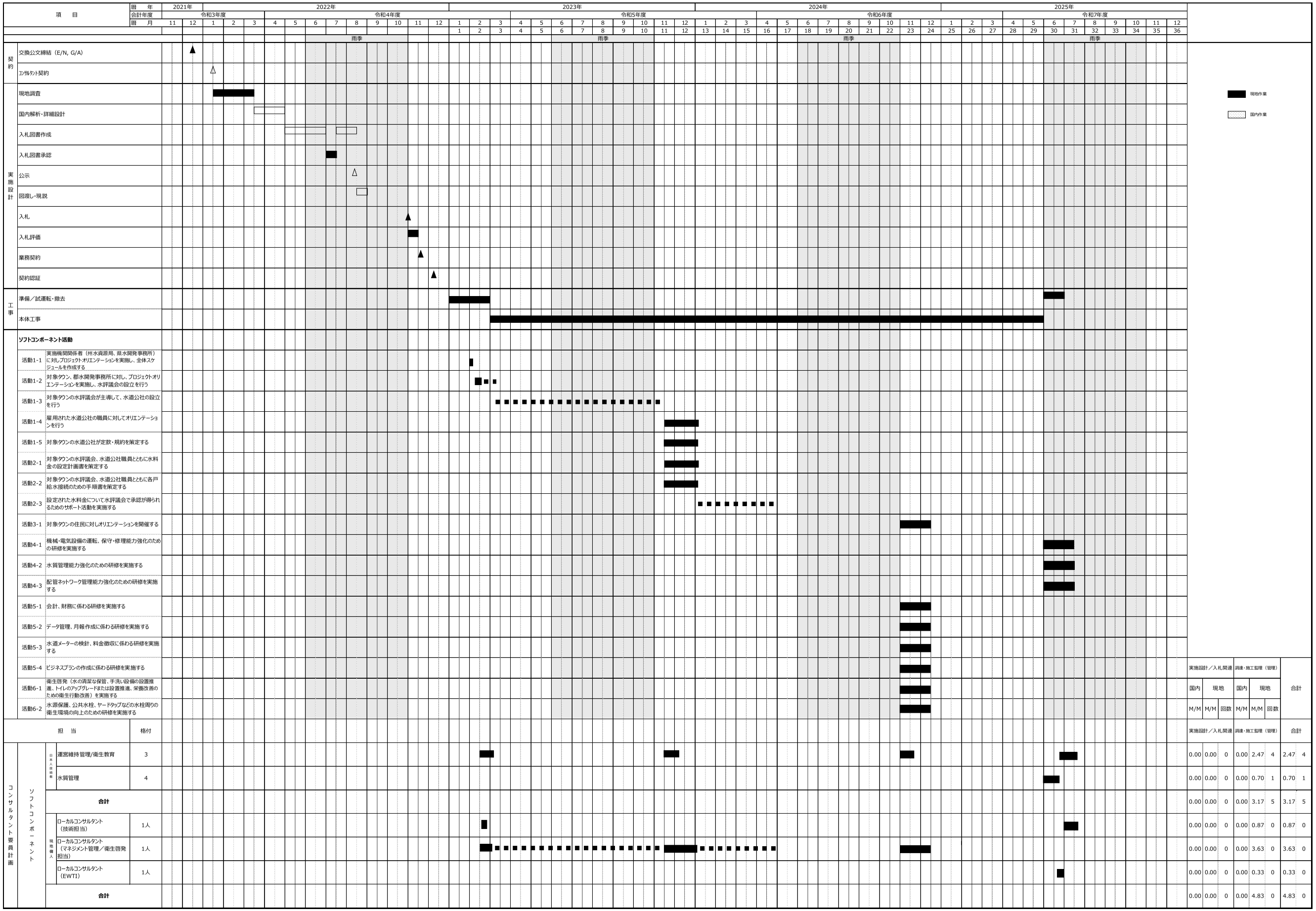
No.	活動内容	対象者	実施方法／場所	実作業日数	実施リソース	成果品
1-1	実施機関関係者（OWERDB、ZWERDO）に対しプロジェクトオリエンテーションを実施し、全体スケジュールを作成する	①OWERDBのC/P ②東シェワ県ZWERDOのC/P ③アルシ県ZWERDOのC/P	実施方法 実施機関関係者との協議 場所 ・OWERDB ・東シェワ県水開発事務所 ・アルシ県水開発事務所	3日間 （準備、移動含む）	● 邦人コンサルタント1名 ● ローカルコンサルタント2名	・州水資源局、県水開発事務所、対象タウンへのオリエンテーション資料 ・会議議事録
1-2	対象タウン、WWERDOに対し、プロジェクトオリエンテーションを実施し、水評議会の設立を支援する	①対象タウン事務所（計90名　約15名／タウン x 6タウン） ②対象タウン事務所を管轄する郡水開発事務所のC/P	実施方法 タウン毎に左記関係者との協議 場所 各タウン役場の会議室	8日間 （準備、移動含む）	● 邦人コンサルタント1名 ● ローカルコンサルタント1名 ● ZWERDO1名	・会議議事録 ・水評議会のメンバー表
1-3	対象タウンの水評議会が主導して、水道公社の設立を行う	対象タウン事務所、水評議会のメンバー（計30名　約5名／タウン x 6タウン）	実施方法 タウン毎に左記関係者との協議 場所 各タウン役場の会議室	2日間 （準備、移動含む）	● ローカルコンサルタント1名 ● ZWERDO1名	・水道公社職員の選定計画書 ・水道公社職員リスト
1-4	雇用された水道公社の職員に対してオリエンテーションを行う	対象タウン事務所、水評議会のメンバー、水道公社の職員（計60名　約10名／タウン x 6タウン）	実施方法 タウン毎に左記関係者との協議 場所 ・各タウン役場の会議室	6日間 （準備、移動含む）	● 邦人コンサルタント1名 ● ローカルコンサルタント1名 ● ZWERDO1名 ● WWERDO1名	・水道公社職員へのオリエンテーション資料
1-5	対象タウンの水道公社が定款・規約を策定する	対象タウン事務所、水評議会のメンバー、水道公社の職員（計60名　約10名／タウン x 6タウン）	実施方法 タウン毎に左記関係者との協議 場所 ・各タウン役場の会議室	15日間 （準備、移動含む）	● 邦人コンサルタント1名 ● ローカルコンサルタント2名 ● ZWERDO1名	・水道公社の定款・規約
2-1	対象タウンの水評議会、水道公社職員とともに水料金の設定計画書を策定する	①対象タウンの水評議会のメンバー（計18名　約3名／タウン x 6タウン） ②対象タウンの水道公社の職員（計18名　約3名／タウン x 6タウン）	実施方法 タウン毎に左記関係者との協議 場所 ・各タウン役場の会議室	7日間 （準備、移動含む）	● 邦人コンサルタント1名 ● ローカルコンサルタント1名 ● ZWERDO1名	・水料金表 ・水料金の設定計画書
2-2	対象タウンの水評議会、水道公社職員とともに各戸給水接続のための手順書を策定する	①対象タウンの水評議会のメンバー（計18名　約3名／タウン x 6タウン） ②対象タウンの水道公社の職員（計18名　約3名／タウン x 6タウン）	実施方法 タウン毎に左記関係者との協議 場所 ・各タウン役場の会議室	7.5日間 （準備、移動含む）	● 邦人コンサルタント1名 ● ローカルコンサルタント1名 ● ZWERDO1名	・各戸給水の接続のための手順書 ・各戸給水の申し込み用紙

No.	活動内容	対象者	実施方法／場所	実作業日数	実施リソース	成果品
2-3	設定された水料金について水評議会で承認が得られるためのサポート活動を実施する	①対象タウンの水評議会のメンバー（計18名　約3名／タウン x 6タウン）	実施方法 ・電話によるフォローアップ ・タウン毎に左記関係者との協議 場所 ・各タウン役場の会議室	2日間 （準備、移動含む）	● ローカルコンサルタント1名 ● ZWERDO1名	・会議議事録
3-1	対象タウンの住民に対しオリエンテーションを開催する	対象タウンの住民	実施方法 住民集会 場所 ・対象タウンの集会場（学校、ヘルスセンターまたは教会の広場等）	8日間 （準備、移動含む）	● 邦人コンサルタント1名 ● ローカルコンサルタント2名 ● ZWERDO1名 ● タウン事務所 ● 水評議会 ● 水道公社	・住民集会用の計画書と資料
4-1-1	動力ポンプ、コントロールパネルの運営維持管理に係わる研修を実施する	対象タウンの水道公社の職員（計30名　約5名／タウン x 6タウン	実施方法 研修 場所 ・各タウン役場の会議室 ・井戸、動力ポンプの設置現場	3日間 （準備、移動含む）	● 邦人コンサルタント1名 ● ローカルコンサルタント（EWTI）1名 ● ZWERDO1名	・運営維持管理マニュアル（技術編） ・研修計画書
4-1-2	発電機の運営維持管理に係わる研修を実施する	対象タウンの水道公社の職員（計30名　約5名／タウン x 6タウン	実施方法 研修 場所 ・各タウン役場の会議室 ・発電機の設置現場	3日間 （準備、移動含む）	● 邦人コンサルタン1ト名 ● ローカルコンサルタント（EWTI）1名 ● ZWERDO1名	・運営維持管理マニュアル（技術編） ・研修計画書
4-1-3	太陽光システムの運営維持管理に係わる研修を実施する	Kamiseタウンの水道公社の職員（約5名）	実施方法 研修 場所 ・Kamiseタウン役場の会議室 ・Kamiseタウンの太陽光システムの設置現場	1日間 （準備、移動含む）	● 邦人コンサルタント1名 ● ローカルコンサルタント（EWTI）1名 ● ZWERDO1名	・運営維持管理マニュアル（技術編） ・研修計画書
4-2-1	水質管理全般（水質基準、水因性疾患、深井戸周辺保護、住民への衛生啓発等）に係わる研修を実施する	対象タウンの水道公社の職員（計30名　約5名／タウン x 6タウン	実施方法 研修 場所 ・各タウン役場の会議室	3日間 （準備、移動含む）	● 邦人コンサルタント1名 ● ZWERDO1名	・運営維持管理マニュアル（技術編） ・研修計画書

No.	活動内容	対象者	実施方法／場所	実作業日数	実施リソース	成果品
4-2-2	塩素消毒設備の運転維持管理に係わる研修を実施する	対象タウンの水道公社の職員（計30名 約5名／タウン x 6タウン	実施方法 研修 場所 ・各タウン役場の会議室 ・消毒設備棟	3日間 （準備、移動含む）	● 邦人コンサルタント1名 ● ZWERDO1名	・運営維持管理マニュアル（技術編） ・研修計画書
4-2-3	公共水栓末端での残留塩素濃度の測定に係わる研修を実施する	対象タウンの水道公社の職員（計30名 約5名／タウン x 6タウン	実施方法 研修 場所 ・各タウン役場の会議室 ・末端の公共水栓	3日間 （準備、移動含む）	● 邦人コンサルタント1名 ● ZWERDO1名	・運営維持管理マニュアル（技術編） ・研修計画書
4-2-4	測定された残留塩素濃度に基づき消毒液の濃度調整の研修を実施する	対象タウンの水道公社の職員（計30名 約5名／タウン x 6タウン	実施方法 研修 場所 ・消毒設備棟	3日間 （準備、移動含む）	● 邦人コンサルタント1名 ● ZWERDO1名	・運営維持管理マニュアル（技術編） ・研修計画書
4-3-1	配水池の配水管理に係わる研修を実施する	対象タウンの水道公社の職員（計30名 約5名／タウン x 6タウン	実施方法 研修 場所 ・各タウン役場の会議室 ・配水池の現場	3日間 （準備、移動含む）	● 邦人コンサルタント1名 ● ローカルコンサルタント1名 ● ZWERDO1名	・運営維持管理マニュアル（技術編） ・研修計画書
4-3-2	送配水管及び付帯設備（バルブ類、減圧層）の維持管理に係わる研修を実施する	対象タウンの水道公社の職員（計30名 約5名／タウン x 6タウン	実施方法 研修 場所 ・各タウン役場の会議室 ・送配水管の現場	3日間 （準備、移動含む）	● 邦人コンサルタント1名 ● ローカルコンサルタント1名 ● ZWERDO1名	・運営維持管理マニュアル（技術編） ・研修計画書
4-3-3	給水装置の維持管理に係わる研修を実施する	対象タウンの水道公社の職員（計30名 約5名／タウン x 6タウン	実施方法 研修 場所 ・各タウン役場の会議室 ・送配水管の現場	6日間 （準備、移動含む）	● 邦人コンサルタント1名 ● ローカルコンサルタント1名 ● ZWERDO1名	・運営維持管理マニュアル（技術編） ・研修計画書
4-3-4	漏水などの緊急時の対応に係わる研修を実施する	対象タウンの水道公社の職員（計30名 約5名／タウン x 6タウン	実施方法 研修 場所 ・各タウン役場の会議室	3日間 （準備、移動含む）	● 邦人コンサルタント1名 ● ローカルコンサルタント1名 ● ZWERDO1名	・運営維持管理マニュアル（技術編） ・研修計画書

No.	活動内容	対象者	実施方法／場所	実作業日数	実施リソース	成果品
5-1	会計、財務に係わる研修を実施する	対象タウンの水道公社の職員、水評議会のメンバー（計30名　約5名／タウン x 6タウン	実施方法 研修 場所 ・各タウン役場の会議室	3.25日間 （準備、移動含む）	● 邦人コンサルタント1名 ● ローカルコンサルタント1名 ● ZWERDO1名	・運営維持管理マニュアル（マネジメント編） ・研修計画書
5-2	データ管理、月報作成に係わる研修を実施する	対象タウンの水道公社の職員、水評議会のメンバー（計30名　約5名／タウン x 6タウン	実施方法 研修 場所 ・各タウン役場の会議室	6.25日間 （準備、移動含む）	● 邦人コンサルタント1名 ● ローカルコンサルタント1名 ● ZWERDO1名	・運営維持管理マニュアル（マネジメント編） ・研修計画書
5-3	水道メーターの検針、料金徴収に係わる研修を実施する	対象タウンの水道公社の職員、水評議会のメンバー（計30名　約5名／タウン x 6タウン	実施方法 研修 場所 ・各タウン役場の会議室	3.25日間 （準備、移動含む）	● 邦人コンサルタント1名 ● ローカルコンサルタント1名 ● ZWERDO1名 ●	・運営維持管理マニュアル（マネジメント編） ・研修計画書
5-4	ビジネスプランの作成に係わる研修を実施する	対象タウンの水道公社の職員、水評議会のメンバー（計30名　約5名／タウン x 6タウン	実施方法 研修 場所 ・各タウン役場の会議室	6.25日間 （準備、移動含む）	● 邦人コンサルタント1名 ● ローカルコンサルタント1名 ● ZWERDO1名	・運営維持管理マニュアル（マネジメント編） ・研修計画書
6-1	衛生啓発（水の清潔な保管、手洗い設備の設置推進、トイレのアップグレードまたは設置推進、栄養改善のための衛生行動改善）を実施する	①対象タウンの住民 ②公共水栓が設置される学校、ヘルスセンター等の関係者	実施方法 住民集会 場所 ・対象タウンの集会場（学校、ヘルスセンターまたは教会の広場等）	7.5日間 （準備、移動含む）	● 邦人コンサルタント1名 ● ローカルコンサルタント1名 ● ZWERDO1名 ● WWERDO1名 ● タウン事務所 ● 水評議会 ● 水道公社	・衛生啓発マニュアル ・住民集会用の研修計画書と資料
6-2	水源保護、公共水栓、ヤードタップなどの水栓周りの衛生環境の向上のための研修を実施する					

添付資料2：ソフトコンポーネント活動工程表



担　当		格付	実施設計／入札関連 国内 M/M	実施設計／入札関連 現地 M/M	実施設計／入札関連 現地 回数	調達・施工監理（管理） 国内 M/M	調達・施工監理（管理） 現地 M/M	調達・施工監理（管理） 現地 回数	合計 M/M	合計 回数
コンサルタント要員計画 ソフトコンポーネント 日本人技術者	運営維持管理/衛生教育	3	0.00	0.00	0	0.00	2.47	4	2.47	4
	水質管理	4	0.00	0.00	0	0.00	0.70	1	0.70	1
	合計		0.00	0.00	0	0.00	3.17	5	3.17	5
現地傭人	ローカルコンサルタント（技術担当）	1人	0.00	0.00	0	0.00	0.87	0	0.87	0
	ローカルコンサルタント（マネジメント管理／衛生啓発担当）	1人	0.00	0.00	0	0.00	3.63	0	3.63	0
	ローカルコンサルタント（EWTI）	1人	0.00	0.00	0	0.00	0.33	0	0.33	0
	合計		0.00	0.00	0	0.00	4.83	0	4.83	0

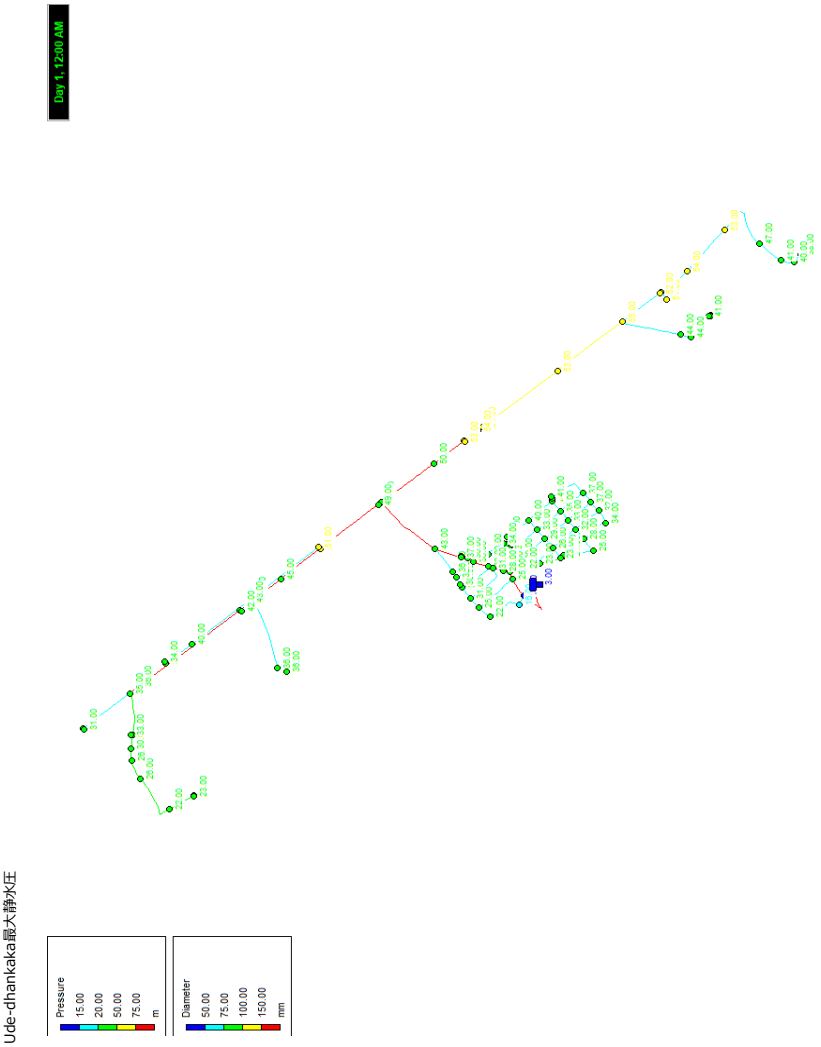
資料 6. 参考資料

6(1) 管網計算結果

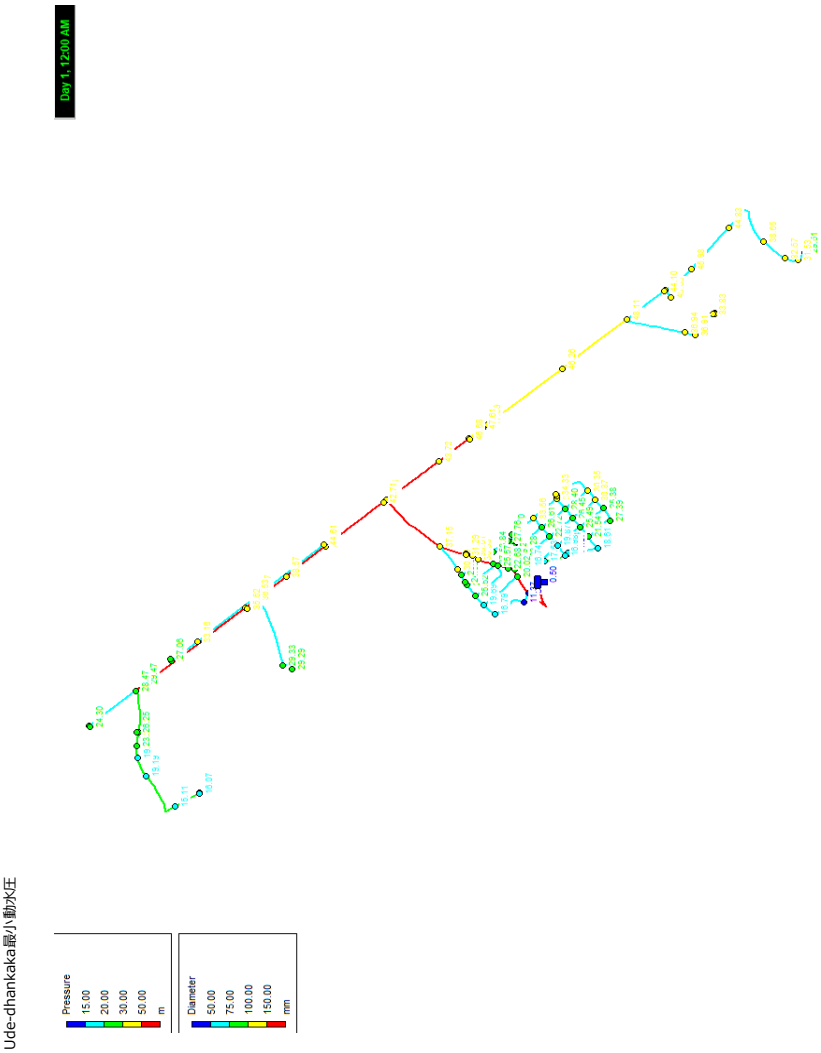
6(2) 収集資料リスト

6(1) 管網計算結果

A6(1) Pipe Network Analysis



Ude-dhankaka最大静水圧



Ude-dhankaka最小動水圧

```
******************************************************************************
*                                E P A N E T                                 *
*                        Hydraulic and Water Quality                         *
*                        Analysis for Pipe Networks                          *
*                              Version 2.0                                   *
******************************************************************************
```

Input File: Ude dhankaka最小動水圧

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
181	106	105	6.52785903715861	50.0
182	65	66	6.384681418044746	50.0
183	147	148	13.39052898047905	50.0
184	175	176	11.514541347075946	50.0
185	160	161	4.445844120214262	50.0
186	145	144	12.19403041905822	50.0
187	121	120	5.26344623180476	50.0
188	82	81	7.479435164239716	50.0
189	42	43	3.378281315221349	50.0
190	22	21	5.501955261062252	50.0
191	123	122	14.634553743570663	50.0
192	123	132	599.7420756307371	50.0
193	146	147	234.116223474999	50.0
199	172	171	16.45610815856848	50.0
203	28	27	1.450188778110006	50.0
205	107	105	48.5677507348079	50.0
206	108	107	7.020941139603234	50.0
207	75	76	41.119107666641725	50.0
208	65	67	24.565448032336747	50.0
209	72	71	89.0096531465184	50.0
210	71	70	88.6886525632574	50.0
211	70	69	85.8201668593681	50.0
212	67	63	49.8492280675578	50.0
214	51	52	85.1500271574459	50.0
215	52	56	93.4734573639743	50.0
216	46	47	15.17287974736148	50.0
217	77	76	17.050528946428663	50.0
218	76	73	51.3364611402117	50.0
219	45	46	23.1076779184184	50.0
220	87	88	6.70410326211179	50.0
221	75	74	23.94320025274567	50.0
223	86	85	106.391648362296	150.0
225	100	99	42.6802887513308	50.0
226	104	103	35.9642860260563	150.0
228	4	3	67.7680666226994	50.0
229	5	4	101.261240384551	50.0
230	5	6	197.04201637339102	50.0

Link - Node Table: (continued)

Link ID	Start Node	End Node	Length m	Diameter mm
231	11	6	454.967879154101	50.0
246	33	11	399.149609179897	50.0
247	29	33	243.564606407949	50.0
251	23	21	10.671594455573018	50.0
256	38	24	73.15295112923611	50.0
257	24	23	204.341532236819	50.0
261	29	27	64.1989824429319	50.0
262	30	29	7.621554593849068	50.0
267	39	38	435.094925416401	50.0
268	39	30	340.20924828294307	50.0
273	42	39	585.769846729445	100.0
274	44	42	668.128980274341	100.0
275	79	44	45.40846779160862	100.0
276	81	79	124.311862436602	100.0
285	83	81	273.079175451173	150.0
286	116	83	463.158114794368	150.0
287	117	116	4.05989054338015	75.0
288	110	116	511.937370302993	150.0
289	108	110	194.628808452554	150.0
290	100	110	215.99541429224104	50.0
292	97	99	60.21438589662569	50.0
293	96	97	24.730332456532867	50.0
294	99	102	170.348492352875	50.0
295	96	103	248.600263568587	50.0
296	95	104	319.85782875348303	50.0
297	94	90	318.311166598685	50.0
298	95	96	97.0061187893781	50.0
299	94	95	96.6057898537665	50.0
300	94	93	103.065561764451	50.0
302	93	92	253.752484558153	50.0
303	92	91	75.92449903696732	50.0
304	406	91	351.28039645988304	150.0
305	91	90	146.766903442615	150.0
306	90	86	55.4369884724687	150.0
307	86	88	49.915960138543966	150.0
308	88	104	72.6282115991375	150.0
309	103	102	108.905634100804	150.0
310	102	108	99.7977751794299	150.0
311	74	87	176.413285015619	50.0
312	87	84	138.549314137986	50.0
313	85	84	75.4297096637032	50.0
314	84	74	90.0556463625002	50.0
315	89	75	152.53766342438104	50.0
316	105	89	148.699183013484	50.0
317	89	77	146.7242925257	50.0
321	73	72	197.226278075326	50.0
322	72	45	214.094662060623	50.0

Link - Node Table: (continued)

Link	Start	End	Length	Diameter

ID	Node	Node	m	mm
323	74	71	229.248915309197	50.0
324	84	70	237.144430423341	50.0
325	85	68	114.341773222341	100.0
326	68	69	159.848727325373	50.0
327	68	67	157.583662774468	75.0
328	63	57	189.661168977863	50.0
330	65	56	190.099516101863	50.0
331	69	52	209.796169721574	50.0
332	56	57	108.91518232931	50.0
336	56	54	199.588978512668	50.0
338	54	53	101.918467446117	50.0
339	53	50	85.2436258162139	50.0
340	52	53	214.01976159288702	50.0
341	51	50	207.98375722922	50.0
342	70	51	211.57214127052504	50.0
343	49	51	88.362363334217	50.0
344	50	48	86.17354006457658	50.0
345	49	48	211.888578133153	50.0
346	46	48	291.689561901194	50.0
347	45	49	92.27082608049218	50.0
349	71	49	213.05904568233 7	50.0
351	120	117	24.464286451056424	100.0
353	120	122	525.445903294034	150.0
354	124	122	355.711413918309	150.0
361	136	124	276.20172402726	150.0
364	137	136	525.195208704097	50.0
365	137	138	88.35115345640514	50.0
379	162	160	198.885356930634	75.0
381	164	162	377.003942779101	75.0
383	164	166	144.80288197007	75.0
384	167	166	85.963297356351	75.0
385	167	171	102.62241200106	75.0
387	171	173	309.427051180921	75.0
393	175	173	416.24788099013	50.0
394	173	153	81.9566687497638	150.0
395	144	153	914.107105686011	150.0
396	144	136	92.5721515177072	150.0
405	146	132	548.977700970109	50.0
406	67	69	91.82310540547391	50.0

Page 4
Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality
3	0.17	1910.51	29.51	0.00
4	0.00	1910.53	31.53	0.00
5	0.00	1910.57	32.57	0.00
6	0.00	1910.65	38.65	0.00
11	0.00	1910.83	44.83	0.00
21	0.00	1911.83	33.83	0.00
22	0.17	1911.83	33.83	0.00
23	0.00	1911.83	33.83	0.00
24	0.00	1911.91	36.91	0.00
27	0.00	1911.05	43.05	0.00
28	0.17	1911.05	43.05	0.00
29	0.17	1911.08	44.08	0.00
30	0.00	1911.10	44.10	0.00
33	0.00	1910.98	45.98	0.00
38	0.00	1911.94	36.94	0.00
39	0.17	1912.11	48.11	0.00
42	0.17	1912.26	46.26	0.00
43	0.17	1912.26	46.26	0.00
44	0.10	1912.59	47.59	0.00
45	0.17	1912.36	33.36	0.00
46	0.17	1912.34	34.34	0.00
47	0.17	1912.33	34.33	0.00
48	0.17	1912.35	30.35	0.00
49	0.17	1912.40	28.40	0.00
50	0.17	1912.37	30.37	0.00
51	0.17	1912.45	26.45	0.00
52	0.17	1912.49	25.49	0.00
53	0.17	1912.38	25.38	0.00
54	0.17	1912.39	27.39	0.00
56	0.17	1912.54	21.54	0.00
57	0.10	1912.61	18.61	0.00
63	0.10	1912.87	14.87	0.00
65	0.17	1912.84	16.84	0.00
66	0.17	1912.84	16.84	0.00
67	0.17	1912.98	16.98	0.00
68	0.17	1913.53	17.53	0.00
69	0.17	1912.87	19.87	0.00
70	0.17	1912.72	22.72	0.00
71	0.17	1912.61	26.61	0.00
72	0.17	1912.56	33.56	0.00
73	0.10	1912.70	28.70	0.00
74	0.17	1912.95	27.95	0.00
75	0.17	1912.84	27.84	0.00
76	0.17	1912.76	27.76	0.00
77	0.10	1912.76	27.76	0.00
79	0.00	1912.61	47.61	0.00
81	0.17	1912.68	46.68	0.00

Page 5
Node Results: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality
82	0.17	1912.68	46.68	0.00
83	0.10	1912.72	43.72	0.00
84	0.17	1913.28	23.28	0.00
85	0.17	1913.74	16.74	0.00
86	0.17	1913.79	22.79	0.00
87	0.17	1913.59	22.59	0.00
88	0.17	1913.68	22.68	0.00
89	0.17	1912.84	29.84	0.00
90	0.17	1914.02	20.02	0.00
91	0.17	1914.69	8.69	0.00
92	0.17	1914.37	11.37	0.00

93	0.17	1913.79	16.79	0.00
94	0.17	1913.69	19.69	0.00
95	0.17	1913.52	25.52	0.00
96	0.17	1913.39	24.39	0.00
97	0.10	1913.36	24.36	0.00
99	0.17	1913.30	26.30	0.00
100	0.10	1913.26	30.26	0.00
102	0.17	1913.39	30.39	0.00
103	0.17	1913.53	27.53	0.00
104	0.17	1913.57	25.57	0.00
105	0.17	1913.01	29.01	0.00
106	0.17	1913.01	30.01	0.00
107	0.17	1913.24	31.24	0.00
108	0.17	1913.29	31.29	0.00
110	0.17	1913.15	37.15	0.00
116	0.17	1912.78	41.78	0.00
117	0.00	1912.75	41.75	0.00
120	0.17	1912.71	41.71	0.00
121	0.17	1912.71	42.71	0.00
122	0.17	1912.61	44.61	0.00
123	0.00	1912.61	44.61	0.00
124	0.00	1912.57	38.57	0.00
132	0.00	1912.37	37.37	0.00
136	0.17	1912.53	36.53	0.00
137	0.00	1912.33	29.33	0.00
138	0.17	1912.29	29.29	0.00
144	0.17	1912.52	35.52	0.00
145	0.17	1912.52	35.52	0.00
146	0.00	1912.16	33.16	0.00
147	0.00	1912.07	27.07	0.00
148	0.17	1912.06	27.06	0.00
153	0.00	1912.47	29.47	0.00
160	0.17	1912.08	16.08	0.00
161	0.17	1912.07	16.07	0.00
162	0.00	1912.11	15.11	0.00
164	0.00	1912.19	19.19	0.00

Node Results: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality
166	0.00	1912.22	19.22	0.00
167	0.00	1912.23	23.23	0.00
171	0.17	1912.25	26.25	0.00
172	0.17	1912.25	26.25	0.00
173	0.17	1912.47	28.47	0.00
175	0.00	1912.31	24.31	0.00
176	0.17	1912.30	24.30	0.00
406	-12.13	1916.50	0.50	0.00 Tank

Link Results:

Link ID	Flow LPS	VelocityUnit m/s	Headloss m/km	Status
181	-0.17	0.09	0.39	Open
182	0.17	0.09	0.40	Open
183	0.17	0.09	0.39	Open
184	0.17	0.09	0.39	Open
185	0.17	0.09	0.37	Open
186	-0.17	0.09	0.39	Open
187	-0.17	0.09	0.40	Open
188	-0.17	0.09	0.38	Open
189	0.17	0.09	0.35	Open
190	-0.17	0.09	0.41	Open
191	-0.17	0.09	0.40	Open
192	0.17	0.09	0.39	Open
193	0.17	0.09	0.39	Open
199	-0.17	0.09	0.39	Open
203	-0.17	0.09	0.41	Open
205	0.64	0.33	4.67	Open
206	0.81	0.41	7.16	Open
207	0.40	0.20	1.94	Open
208	-0.69	0.35	5.43	Open
209	-0.21	0.11	0.59	Open
210	-0.31	0.16	1.25	Open
211	-0.36	0.19	1.65	Open
212	0.42	0.22	2.18	Open
214	-0.20	0.10	0.55	Open
215	-0.19	0.09	0.47	Open
216	0.17	0.09	0.38	Open
217	0.09	0.05	0.13	Open
218	0.32	0.16	1.31	Open
219	0.28	0.14	1.00	Open
220	-1.16	0.59	13.96	Open
221	-0.61	0.31	4.34	Open
223	3.27	0.18	0.45	Open
225	-0.29	0.15	1.06	Open

Link Results: (continued)

Link ID	Flow LPS	VelocityUnit m/s	Headloss m/km	Status
226	5.88	0.33	1.35	Open
228	0.17	0.09	0.39	Open
229	0.17	0.09	0.39	Open
230	-0.17	0.09	0.39	Open
231	0.17	0.09	0.39	Open
246	0.17	0.09	0.39	Open
247	0.17	0.09	0.39	Open
251	0.17	0.09	0.38	Open
256	0.17	0.09	0.39	Open
257	0.17	0.09	0.39	Open
261	0.17	0.09	0.39	Open
262	0.50	0.26	2.97	Open
267	0.17	0.09	0.39	Open
268	0.50	0.26	2.97	Open
273	0.84	0.11	0.26	Open
274	1.17	0.15	0.49	Open
275	1.27	0.16	0.56	Open

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
276	1.27	0.16	0.57	Open
285	1.60	0.09	0.12	Open
286	1.70	0.10	0.13	Open
287	-2.34	0.53	7.15	Open
288	4.20	0.24	0.72	Open
289	4.18	0.24	0.72	Open
290	0.19	0.10	0.50	Open
292	0.26	0.13	0.86	Open
293	0.35	0.18	1.55	Open
294	-0.20	0.10	0.54	Open
295	-0.20	0.10	0.53	Open
296	-0.11	0.05	0.17	Open
297	-0.28	0.14	1.02	Open
298	0.32	0.16	1.31	Open
299	0.38	0.20	1.81	Open
300	-0.27	0.14	0.94	Open
302	-0.44	0.22	2.29	Open
303	-0.60	0.31	4.18	Open
304	12.13	0.69	5.15	Open
305	11.36	0.64	4.56	Open
306	10.91	0.62	4.23	Open
307	7.48	0.42	2.10	Open
308	6.16	0.35	1.47	Open
309	5.52	0.31	1.20	Open
310	5.15	0.29	1.05	Open
311	-0.56	0.28	3.63	Open
312	0.43	0.22	2.24	Open
313	0.74	0.38	6.10	Open
314	0.56	0.29	3.68	Open
315	-0.05	0.03	0.04	Open

Link Results: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
316	0.31	0.16	1.19	Open
317	0.19	0.10	0.48	Open
321	0.23	0.11	0.68	Open
322	0.27	0.14	0.93	Open
323	0.34	0.17	1.45	Open
324	0.44	0.22	2.33	Open
325	2.36	0.30	1.79	Open
326	0.60	0.31	4.16	Open
327	1.59	0.36	3.52	Open
328	0.33	0.17	1.35	Open
330	0.36	0.18	1.61	Open
331	0.38	0.19	1.78	Open
332	-0.23	0.12	0.70	Open
336	0.24	0.12	0.75	Open
338	0.07	0.04	0.08	Open
339	0.10	0.05	0.15	Open
340	0.20	0.10	0.53	Open
341	0.17	0.08	0.38	Open
342	0.32	0.16	1.31	Open
343	-0.19	0.10	0.50	Open
344	0.10	0.05	0.15	Open
345	0.12	0.06	0.23	Open
346	-0.06	0.03	0.05	Open
347	-0.18	0.09	0.43	Open
349	0.28	0.14	0.99	Open
351	-2.34	0.30	1.76	Open
353	2.00	0.11	0.18	Open
354	-1.67	0.09	0.13	Open
361	-1.67	0.09	0.13	Open
364	-0.17	0.09	0.39	Open
365	0.17	0.09	0.39	Open
379	0.33	0.08	0.19	Open
381	0.33	0.08	0.19	Open
383	-0.33	0.08	0.19	Open
384	0.33	0.08	0.19	Open
385	-0.33	0.08	0.20	Open
387	-0.67	0.15	0.70	Open
393	-0.17	0.09	0.39	Open
394	-1.00	0.06	0.05	Open
395	1.00	0.06	0.05	Open
396	-1.34	0.08	0.09	Open
405	-0.17	0.09	0.39	Open
406	0.31	0.16	1.22	Open

```
******************************************************************************
*                                E P A N E T                                 *
*                        Hydraulic and Water Quality                         *
*                        Analysis for Pipe Networks                          *
*                              Version 2.0                                   *
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Input File: Ude dhankaka最大静水圧

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
181	106	105	6.52785903715861	50.0
182	65	66	6.384681418044746	50.0
183	147	148	13.39052898047905	50.0
184	175	176	11.514541347075946	50.0
185	160	161	4.445844120214262	50.0
186	145	144	12.19403041905822	50.0
187	121	120	5.26344623180476	50.0
188	82	81	7.479435164239716	50.0
189	42	43	3.378281315221349	50.0
190	22	21	5.501955261062252	50.0
191	123	122	14.634553743570663	50.0
192	123	132	599.7420756307371	50.0
193	146	147	234.116223474999	50.0
199	172	171	16.45610815856848	50.0
203	28	27	1.450188778110006	50.0
205	107	105	48.5677507348079	50.0
206	108	107	7.020941139603234	50.0
207	75	76	41.119107666641725	50.0
208	65	67	24.565448032336747	50.0
209	72	71	89.0096531465184	50.0
210	71	70	88.6886525632574	50.0
211	70	69	85.8201668593681	50.0
212	67	63	49.8492280675578	50.0
214	51	52	85.1500271574459	50.0
215	52	56	93.4734573639743	50.0
216	46	47	15.17287974736148	50.0
217	77	76	17.050528946428663	50.0
218	76	73	51.3364611402117	50.0
219	45	46	23.1076779184184	50.0
220	87	88	6.70410326211179	50.0
221	75	74	23.94320025274567	50.0
223	86	85	106.391648362296	150.0
225	100	99	42.6802887513308	50.0
226	104	103	35.9642860260563	150.0
228	4	3	67.7680666226994	50.0
229	5	4	101.261240384551	50.0
230	5	6	197.04201637339102	50.0

Link - Node Table: (continued)

Link ID	Start Node	End Node	Length m	Diameter mm
231	11	6	454.967879154101	50.0
246	33	11	399.149609179897	50.0
247	29	33	243.564606407949	50.0
251	23	21	10.671594455573018	50.0
256	38	24	73.15295112923611	50.0
257	24	23	204.341532236819	50.0
261	29	27	64.1989824429319	50.0
262	30	29	7.621554593849068	50.0
267	39	38	435.094925416401	50.0
268	39	30	340.20924828294307	50.0
273	42	39	585.769846729445	100.0
274	44	42	668.128980274341	100.0
275	79	44	45.40846779160862	100.0
276	81	79	124.311862436602	100.0
285	83	81	273.079175451173	150.0
286	116	83	463.158114794368	150.0
287	117	116	4.05989054338015	75.0
288	110	116	511.937370302993	150.0
289	108	110	194.628808452554	150.0
290	100	110	215.99541429224104	50.0
292	97	99	60.21438589662569	50.0
293	96	97	24.730332456532867	50.0
294	99	102	170.348492352875	50.0
295	96	103	248.600263568587	50.0
296	95	104	319.85782875348303	50.0
297	94	90	318.311166598685	50.0
298	95	96	97.0061187893781	50.0
299	94	95	96.6057898537665	50.0
300	94	93	103.065561764451	50.0
302	93	92	253.752484558153	50.0
303	92	91	75.92449903696732	50.0
304	406	91	351.28039645988304	150.0
305	91	90	146.766903442615	150.0
306	90	86	55.4369884724687	150.0
307	86	88	49.915960138543966	150.0
308	88	104	72.6282115991375	150.0
309	103	102	108.905634100804	150.0
310	102	108	99.7977751794299	150.0
311	74	87	176.413285015619	50.0
312	87	84	138.549314137986	50.0
313	85	84	75.4297096637032	50.0
314	84	74	90.0556463625002	50.0
315	89	75	152.53766342438104	50.0
316	105	89	148.699183013484	50.0
317	89	77	146.7242925257	50.0
321	73	72	197.226278075326	50.0
322	72	45	214.094662060623	50.0

Link - Node Table: (continued)

Link	Start	End	Length	Diameter

ID	Node	Node	m	mm
323	74	71	229.248915309197	50.0
324	84	70	237.144430423341	50.0
325	85	68	114.341773222341	100.0
326	68	69	159.848727325373	50.0
327	68	67	157.583662774468	75.0
328	63	57	189.661168977863	50.0
330	65	56	190.099516101863	50.0
331	69	52	209.796169721574	50.0
332	56	57	108.91518232931	50.0
336	56	54	199.588978512668	50.0
338	54	53	101.918467446117	50.0
339	53	50	85.2436258162139	50.0
340	52	53	214.01976159288702	50.0
341	51	50	207.98375722922	50.0
342	70	51	211.57214127052504	50.0
343	49	51	88.362363334217	50.0
344	50	48	86.17354006457658	50.0
345	49	48	211.888578133153	50.0
346	46	48	291.689561901194	50.0
347	45	49	92.27082608049218	50.0
349	71	49	213.05904682337	50.0
351	120	117	24.464286451056424	100.0
353	120	122	525.445903294034	150.0
354	124	122	355.711413918309	150.0
361	136	124	276.20172402726	150.0
364	137	136	525.195208704097	50.0
365	137	138	88.35115345640514	50.0
379	162	160	198.885356930634	75.0
381	164	162	377.003942779101	75.0
383	164	166	144.80288197007	75.0
384	167	166	85.963297356351	75.0
385	167	171	102.62241200106	75.0
387	171	173	309.427051180921	75.0
393	175	173	416.24788099013	50.0
394	173	153	81.9566687497638	150.0
395	144	153	914.107105686011	150.0
396	144	136	92.5721515177072	150.0
405	146	132	548.977700970109	50.0
406	67	69	91.82310540547391	50.0

Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality
3	0.00	1919.00	38.00	0.00
4	0.00	1919.00	40.00	0.00
5	0.00	1919.00	41.00	0.00
6	0.00	1919.00	47.00	0.00
11	0.00	1919.00	53.00	0.00
21	0.00	1919.00	41.00	0.00
22	0.00	1919.00	41.00	0.00
23	0.00	1919.00	41.00	0.00
24	0.00	1919.00	44.00	0.00
27	0.00	1919.00	51.00	0.00
28	0.00	1919.00	51.00	0.00
29	0.00	1919.00	52.00	0.00
30	0.00	1919.00	52.00	0.00
33	0.00	1919.00	54.00	0.00
38	0.00	1919.00	44.00	0.00
39	0.00	1919.00	55.00	0.00
42	0.00	1919.00	53.00	0.00
43	0.00	1919.00	53.00	0.00
44	0.00	1919.00	54.00	0.00
45	0.00	1919.00	40.00	0.00
46	0.00	1919.00	41.00	0.00
47	0.00	1919.00	41.00	0.00
48	0.00	1919.00	37.00	0.00
49	0.00	1919.00	35.00	0.00
50	0.00	1919.00	37.00	0.00
51	0.00	1919.00	33.00	0.00
52	0.00	1919.00	32.00	0.00
53	0.00	1919.00	32.00	0.00
54	0.00	1919.00	34.00	0.00
56	0.00	1919.00	28.00	0.00
57	0.00	1919.00	25.00	0.00
63	0.00	1919.00	21.00	0.00
65	0.00	1919.00	23.00	0.00
66	0.00	1919.00	23.00	0.00
67	0.00	1919.00	23.00	0.00
68	0.00	1919.00	23.00	0.00
69	0.00	1919.00	26.00	0.00
70	0.00	1919.00	29.00	0.00
71	0.00	1919.00	33.00	0.00
72	0.00	1919.00	40.00	0.00
73	0.00	1919.00	35.00	0.00
74	0.00	1919.00	34.00	0.00
75	0.00	1919.00	34.00	0.00
76	0.00	1919.00	34.00	0.00
77	0.00	1919.00	34.00	0.00
79	0.00	1919.00	54.00	0.00
81	0.00	1919.00	53.00	0.00

Node Results: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality
82	0.00	1919.00	53.00	0.00
83	0.00	1919.00	50.00	0.00
84	0.00	1919.00	29.00	0.00
85	0.00	1919.00	22.00	0.00
86	0.00	1919.00	28.00	0.00
87	0.00	1919.00	28.00	0.00
88	0.00	1919.00	28.00	0.00
89	0.00	1919.00	36.00	0.00
90	0.00	1919.00	25.00	0.00
91	0.00	1919.00	13.00	0.00
92	0.00	1919.00	16.00	0.00

93	0.00	1919.00	22.00	0.00
94	0.00	1919.00	25.00	0.00
95	0.00	1919.00	31.00	0.00
96	0.00	1919.00	30.00	0.00
97	0.00	1919.00	30.00	0.00
99	0.00	1919.00	32.00	0.00
100	0.00	1919.00	36.00	0.00
102	0.00	1919.00	36.00	0.00
103	0.00	1919.00	33.00	0.00
104	0.00	1919.00	31.00	0.00
105	0.00	1919.00	35.00	0.00
106	0.00	1919.00	36.00	0.00
107	0.00	1919.00	37.00	0.00
108	0.00	1919.00	37.00	0.00
110	0.00	1919.00	43.00	0.00
116	0.00	1919.00	48.00	0.00
117	0.00	1919.00	48.00	0.00
120	0.00	1919.00	48.00	0.00
121	0.00	1919.00	49.00	0.00
122	0.00	1919.00	51.00	0.00
123	0.00	1919.00	51.00	0.00
124	0.00	1919.00	45.00	0.00
132	0.00	1919.00	44.00	0.00
136	0.00	1919.00	43.00	0.00
137	0.00	1919.00	36.00	0.00
138	0.00	1919.00	36.00	0.00
144	0.00	1919.00	42.00	0.00
145	0.00	1919.00	42.00	0.00
146	0.00	1919.00	40.00	0.00
147	0.00	1919.00	34.00	0.00
148	0.00	1919.00	34.00	0.00
153	0.00	1919.00	36.00	0.00
160	0.00	1919.00	23.00	0.00
161	0.00	1919.00	23.00	0.00
162	0.00	1919.00	22.00	0.00
164	0.00	1919.00	26.00	0.00

Node Results: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality
166	0.00	1919.00	26.00	0.00
167	0.00	1919.00	30.00	0.00
171	0.00	1919.00	33.00	0.00
172	0.00	1919.00	33.00	0.00
173	0.00	1919.00	35.00	0.00
175	0.00	1919.00	31.00	0.00
176	0.00	1919.00	31.00	0.00
406	0.00	1919.00	3.00	0.00 Tank

Link Results:

Link ID	Flow LPS	VelocityUnit m/s	Headloss m/km	Status
181	0.00	0.00	0.00	Open
182	0.00	0.00	0.00	Open
183	0.00	0.00	0.00	Open
184	0.00	0.00	0.00	Open
185	0.00	0.00	0.00	Open
186	0.00	0.00	0.00	Open
187	0.00	0.00	0.00	Open
188	0.00	0.00	0.00	Open
189	0.00	0.00	0.00	Open
190	0.00	0.00	0.00	Open
191	0.00	0.00	0.00	Open
192	0.00	0.00	0.00	Open
193	0.00	0.00	0.00	Open
199	0.00	0.00	0.00	Open
203	0.00	0.00	0.00	Open
205	0.00	0.00	0.00	Open
206	0.00	0.00	0.00	Open
207	0.00	0.00	0.00	Open
208	0.00	0.00	0.00	Open
209	0.00	0.00	0.00	Open
210	0.00	0.00	0.00	Open
211	0.00	0.00	0.00	Open
212	0.00	0.00	0.00	Open
214	0.00	0.00	0.00	Open
215	0.00	0.00	0.00	Open
216	0.00	0.00	0.00	Open
217	0.00	0.00	0.00	Open
218	0.00	0.00	0.00	Open
219	0.00	0.00	0.00	Open
220	0.00	0.00	0.00	Open
221	0.00	0.00	0.00	Open
223	0.00	0.00	0.00	Open
225	0.00	0.00	0.00	Open

Link Results: (continued)

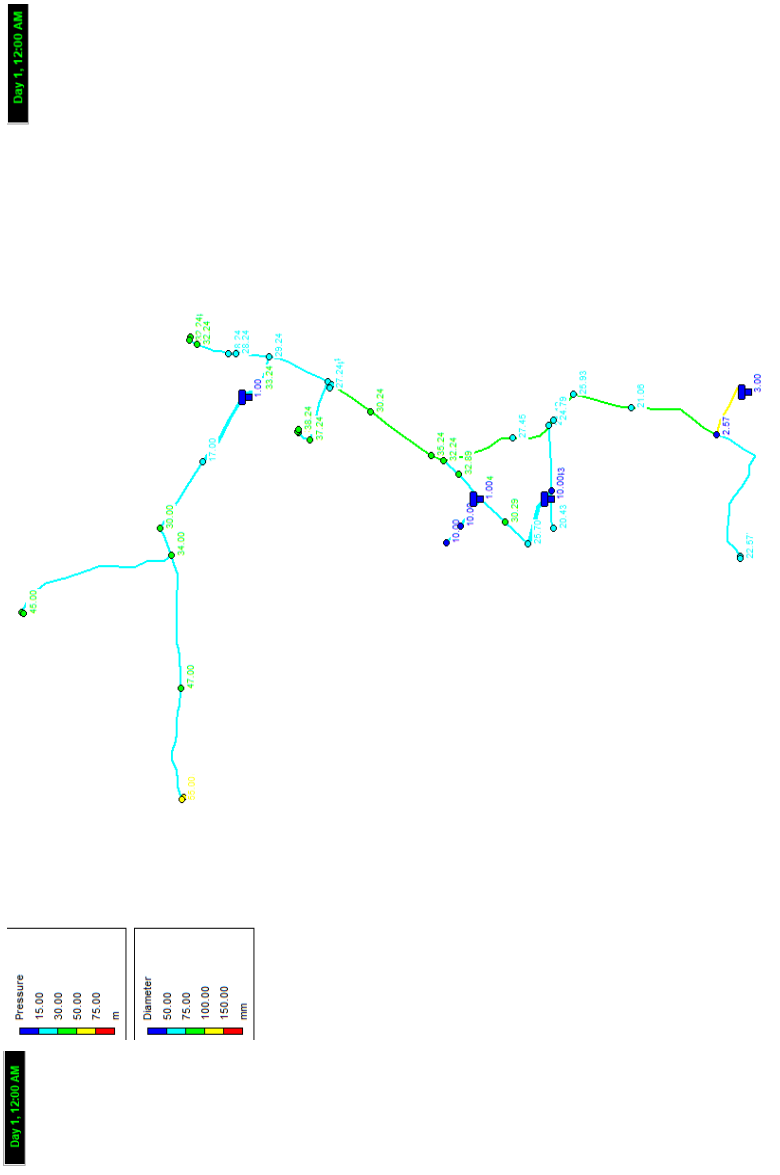
Link ID	Flow LPS	VelocityUnit m/s	Headloss m/km	Status
226	0.00	0.00	0.00	Open
228	0.00	0.00	0.00	Open
229	0.00	0.00	0.00	Open
230	0.00	0.00	0.00	Open
231	0.00	0.00	0.00	Open
246	0.00	0.00	0.00	Open
247	0.00	0.00	0.00	Open
251	0.00	0.00	0.00	Open
256	0.00	0.00	0.00	Open
257	0.00	0.00	0.00	Open
261	0.00	0.00	0.00	Open
262	0.00	0.00	0.00	Open
267	0.00	0.00	0.00	Open
268	0.00	0.00	0.00	Open
273	0.00	0.00	0.00	Open
274	0.00	0.00	0.00	Open
275	0.00	0.00	0.00	Open

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
276	0.00	0.00	0.00	Open
285	0.00	0.00	0.00	Open
286	0.00	0.00	0.00	Open
287	0.00	0.00	0.00	Open
288	0.00	0.00	0.00	Open
289	0.00	0.00	0.00	Open
290	0.00	0.00	0.00	Open
292	0.00	0.00	0.00	Open
293	0.00	0.00	0.00	Open
294	0.00	0.00	0.00	Open
295	0.00	0.00	0.00	Open
296	0.00	0.00	0.00	Open
297	0.00	0.00	0.00	Open
298	0.00	0.00	0.00	Open
299	0.00	0.00	0.00	Open
300	0.00	0.00	0.00	Open
302	0.00	0.00	0.00	Open
303	0.00	0.00	0.00	Open
304	0.00	0.00	0.00	Open
305	0.00	0.00	0.00	Open
306	0.00	0.00	0.00	Open
307	0.00	0.00	0.00	Open
308	0.00	0.00	0.00	Open
309	0.00	0.00	0.00	Open
310	0.00	0.00	0.00	Open
311	0.00	0.00	0.00	Open
312	0.00	0.00	0.00	Open
313	0.00	0.00	0.00	Open
314	0.00	0.00	0.00	Open
315	0.00	0.00	0.00	Open

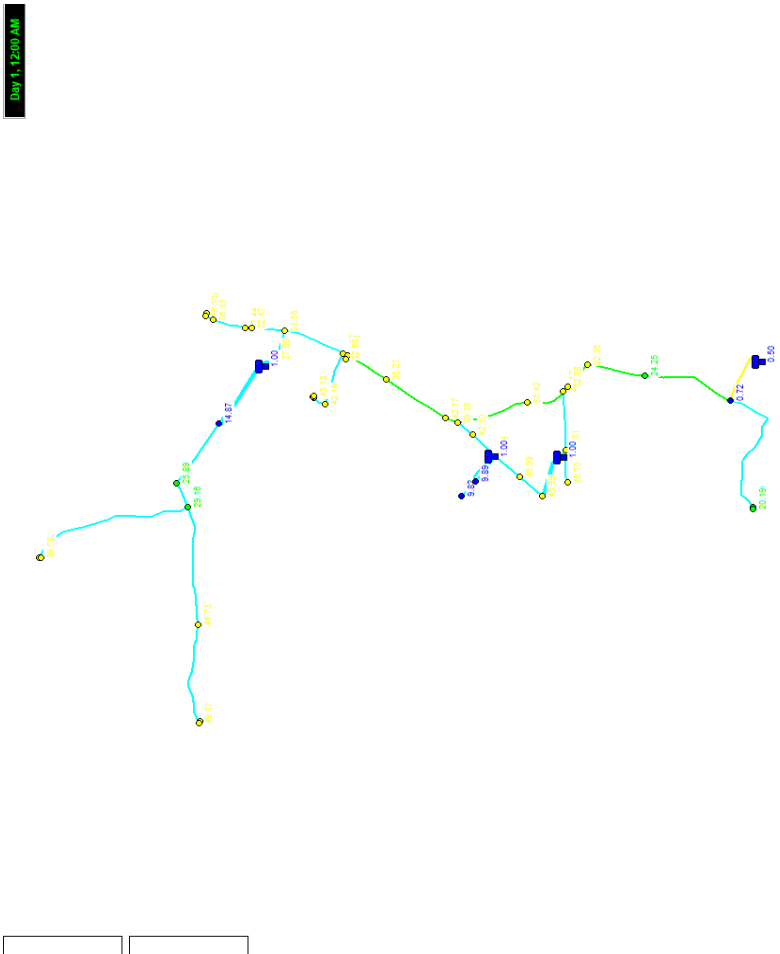
Link Results: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
316	0.00	0.00	0.00	Open
317	0.00	0.00	0.00	Open
321	0.00	0.00	0.00	Open
322	0.00	0.00	0.00	Open
323	0.00	0.00	0.00	Open
324	0.00	0.00	0.00	Open
325	0.00	0.00	0.00	Open
326	0.00	0.00	0.00	Open
327	0.00	0.00	0.00	Open
328	0.00	0.00	0.00	Open
330	0.00	0.00	0.00	Open
331	0.00	0.00	0.00	Open
332	0.00	0.00	0.00	Open
336	0.00	0.00	0.00	Open
338	0.00	0.00	0.00	Open
339	0.00	0.00	0.00	Open
340	0.00	0.00	0.00	Open
341	0.00	0.00	0.00	Open
342	0.00	0.00	0.00	Open
343	0.00	0.00	0.00	Open
344	0.00	0.00	0.00	Open
345	0.00	0.00	0.00	Open
346	0.00	0.00	0.00	Open
347	0.00	0.00	0.00	Open
349	0.00	0.00	0.00	Open
351	0.00	0.00	0.00	Open
353	0.00	0.00	0.00	Open
354	0.00	0.00	0.00	Open
361	0.00	0.00	0.00	Open
364	0.00	0.00	0.00	Open
365	0.00	0.00	0.00	Open
379	0.00	0.00	0.00	Open
381	0.00	0.00	0.00	Open
383	0.00	0.00	0.00	Open
384	0.00	0.00	0.00	Open
385	0.00	0.00	0.00	Open
387	0.00	0.00	0.00	Open
393	0.00	0.00	0.00	Open
394	0.00	0.00	0.00	Open
395	0.00	0.00	0.00	Open
396	0.00	0.00	0.00	Open
405	0.00	0.00	0.00	Open
406	0.00	0.00	0.00	Open

Kamise最大静水圧



Kamise最小動水圧



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*                              E P A N E T                                   *
*                     Hydraulic and Water Quality                            *
*                     Analysis for Pipe Networks                             *
*                          Version 2.0                                       *
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Input File: Kamise最小動水圧

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
103	42	41	4.922763289320914	50.0
104	26	25	4.66389493431299	50.0
105	15	16	8.253632796214212	50.0
106	53	52	10.863047961048302	50.0
107	88	87	5.26352666907267	50.0
110	66	67	59.23738219249598	50.0
111	67	68	91.76	50.0
115	64	68	89.84	50.0
116	71	97	86.08	50.0
120	29	30	4.941224759457074	50.0
123	45	46	87.85	50.0
124	75	74	18.429690195426236	75.0
125	65	56	37.7037657082487	75.0
126	52	51	13.5305222868995	50.0
127	21	20	19.40728773960215	50.0
141	16	17	24.242831459444176	50.0
148	20	17	93.53700472929532	50.0
149	23	22	211.75	50.0
150	22	45	259.84	50.0
151	21	46	96.1904337729127	50.0
160	41	40	4.291958585739167	50.0
166	43	51	160.623598885167	50.0
168	40	43	38.67552696849	50.0
169	51	46	181.07536470136702	50.0
173	52	54	131.029142376978	75.0
174	56	54	205.75260848299797	75.0
180	24	23	77.96	50.0
181	24	25	474.825787280682	50.0
183	24	28	351.440060922029	50.0
184	28	30	295.758510301158	50.0
202	96	97	156.90	50.0
203	72	65	208.693829732999	75.0
205	74	72	116.441002042303	75.0
207	75	77	87.6627372531696	75.0
208	96	74	171.79	50.0
209	95	96	97.21	50.0
210	77	82	170.641610342384	75.0

Link - Node Table: (continued)

Link ID	Start Node	End Node	Length m	Diameter mm
217	80	233	161.00	100.0
218	82	80	265.057401873523	75.0
232	68	71	92.09	50.0
999	80	87	427.965865143693	50.0
114	65	64	56.41928931627	50.0
2	45	1	54.53	50.0
3	1	22	228.11	50.0
12	96	4	27.36	50.0
13	4	97	130.71	50.0
14	68	3	11.44	50.0
15	3	67	89.23	50.0

Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality
15	0.31	1984.29	36.29	0.00
16	0.00	1984.30	36.30	0.00
17	0.00	1984.33	36.33	0.00
20	0.00	1984.44	32.44	0.00
21	0.00	1984.47	32.47	0.00
22	0.00	1945.87	14.87	0.00
23	0.00	1943.89	25.89	0.00
24	0.31	1943.16	29.16	0.00
25	0.00	1942.58	39.58	0.00
26	0.31	1942.58	39.58	0.00
28	0.00	1942.73	41.73	0.00
29	0.31	1942.37	49.37	0.00
30	0.00	1942.37	49.37	0.00
40	0.00	1985.14	43.14	0.00
41	0.00	1985.13	43.13	0.00
42	0.31	1985.13	43.13	0.00
43	0.00	1985.19	42.19	0.00
45	0.00	1984.58	37.58	0.00
46	0.31	1984.58	33.58	0.00
51	0.31	1985.38	31.38	0.00
52	0.31	1985.60	32.60	0.00
53	0.31	1985.58	32.58	0.00
54	0.00	1986.21	36.21	0.00
56	0.00	1987.17	42.17	0.00
64	0.31	1987.10	42.10	0.00
65	0.31	1987.35	39.35	0.00
66	0.31	1943.82	9.82	0.00
67	0.00	1943.89	9.89	0.00
68	0.31	1986.99	43.99	0.00
71	0.00	1986.99	46.99	0.00

Node Results: (continued)

Node	Demand	Head	Pressure	Quality

ID	LPS	m	m	
72	0.00	1989.42	35.42	0.00
74	0.31	1990.57	32.57	0.00
75	0.00	1990.88	32.88	0.00
77	0.00	1992.36	32.36	0.00
80	0.00	1999.72	0.72	0.00
82	0.00	1995.25	24.25	0.00
87	0.00	1999.20	20.20	0.00
88	0.31	1999.19	20.19	0.00
95	0.31	1989.70	46.70	0.00
96	0.31	1989.81	38.81	0.00
97	0.00	1986.99	45.99	0.00
233	-4.03	2000.50	0.50	0.00 Tank
1	-0.93	1948.00	1.00	0.00 Tank
3	-0.31	1944.00	1.00	0.00 Tank
4	0.00	1952.00	1.00	0.00 Tank

Link Results:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
103	-0.31	0.16	1.21	Open
104	-0.31	0.16	1.21	Open
105	-0.31	0.16	1.23	Open
106	-0.31	0.16	1.22	Open
107	-0.31	0.16	1.22	Open
110	-0.31	0.16	1.22	Open
111	0.00	0.00	0.00	Closed
115	0.31	0.16	1.22	Open
116	0.00	0.00	0.00	Open
120	-0.31	0.16	1.23	Open
123	0.00	0.00	0.00	Open
124	3.72	0.84	16.89	Open
125	1.86	0.42	4.68	Open
126	1.24	0.63	15.92	Open
127	0.31	0.16	1.22	Open
141	-0.31	0.16	1.22	Open
148	0.31	0.16	1.22	Open
149	-0.93	0.47	9.34	Open
150	0.00	0.00	0.00	Closed
151	-0.31	0.16	1.22	Open
160	-0.31	0.16	1.21	Open
166	-0.31	0.16	1.22	Open
168	-0.31	0.16	1.22	Open
169	0.62	0.32	4.41	Open
173	-1.86	0.42	4.68	Open
174	1.86	0.42	4.68	Open

Link Results: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
180	-0.93	0.47	9.34	Open
181	0.31	0.16	1.22	Open
183	0.31	0.16	1.22	Open
184	0.31	0.16	1.22	Open
202	0.00	0.00	0.00	Closed
203	2.79	0.63	9.91	Open
205	2.79	0.63	9.91	Open
207	-3.72	0.84	16.89	Open
208	-0.62	0.32	4.41	Open
209	-0.31	0.16	1.22	Open
210	-3.72	0.84	16.89	Open
217	-4.03	0.51	4.82	Open
218	-3.72	0.84	16.89	Open
232	0.00	0.00	0.00	Open
999	0.31	0.16	1.22	Open
114	0.62	0.32	4.41	Open
2	0.00	0.00	0.00	Closed
3	0.93	0.47	9.34	Open
12	0.00	0.00	0.00	Closed
13	0.00	0.00	0.00	Closed
14	0.00	0.00	0.00	Closed
15	0.31	0.16	1.22	Open

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*                                E P A N E T                                 *
*                      Hydraulic and Water Quality                           *
*                      Analysis for Pipe Networks                            *
*                            Version 2.0                                     *
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Input File: Kmiase最大静水圧

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
103	42	41	4.922763289320914	50.0
104	26	25	4.66389493431299	50.0
105	15	16	8.253632796214212	50.0
106	53	52	10.863047961048302	50.0
107	88	87	5.26352666907267	50.0
110	66	67	59.23738219249598	50.0
111	67	68	91.76	50.0
115	64	68	89.84	50.0
116	71	97	86.08	50.0
120	29	30	4.941224759457074	50.0
123	45	46	87.85	50.0
124	75	74	18.429690195426236	75.0
125	65	56	37.7037657082487	75.0
126	52	51	13.5305222868995	50.0
127	21	20	19.40728773960215	50.0
141	16	17	24.242831459444176	50.0
148	20	17	93.53700472929532	50.0
149	23	22	211.75	50.0
150	22	45	259.84	50.0
151	21	46	96.1904337729127	50.0
160	41	40	4.291958585739167	50.0
166	43	51	160.623598885167	50.0
168	40	43	38.67552696849	50.0
169	51	46	181.07536470136702	50.0
173	52	54	131.029142376978	75.0
174	56	54	205.75260848299797	75.0
180	24	23	77.96	50.0
181	24	25	474.825787280682	50.0
183	24	28	351.440060922029	50.0
184	28	30	295.758510301158	50.0
202	96	97	156.90	50.0
203	72	65	208.693829732999	75.0
205	74	72	116.441002042303	75.0
207	75	77	87.6627372531696	75.0
208	96	74	171.79	50.0
209	95	96	97.21	50.0
210	77	82	170.641610342384	75.0

Page 2

Link - Node Table: (continued)

Link ID	Start Node	End Node	Length m	Diameter mm
217	80	233	161.00	100.0
218	82	80	265.057401873523	75.0
232	68	71	92.09	50.0
999	80	87	427.965865143693	50.0
114	65	64	56.41928931627	50.0
2	45	1	50.75	50.0
3	1	22	223.37	50.0
4	68	2	14.59	50.0
5	2	67	92.31	50.0
6	96	3	22.37	50.0
7	3	97	136.61	50.0

Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality
15	0.00	1980.24	32.24	0.00
16	0.00	1980.24	32.24	0.00
17	0.00	1980.24	32.24	0.00
20	0.00	1980.24	28.24	0.00
21	0.00	1980.24	28.24	0.00
22	0.00	1948.00	17.00	0.00
23	0.00	1948.00	30.00	0.00
24	0.00	1948.00	34.00	0.00
25	0.00	1948.00	45.00	0.00
26	0.00	1948.00	45.00	0.00
28	0.00	1948.00	47.00	0.00
29	0.00	1948.00	55.00	0.00
30	0.00	1948.00	55.00	0.00
40	0.00	1980.24	38.24	0.00
41	0.00	1980.24	38.24	0.00
42	0.00	1980.24	38.24	0.00
43	0.00	1980.24	37.24	0.00
45	0.00	1980.24	33.24	0.00
46	0.00	1980.24	29.24	0.00
51	0.00	1980.24	26.24	0.00
52	0.00	1980.24	27.24	0.00
53	0.00	1980.24	27.24	0.00
54	0.00	1980.24	30.24	0.00
56	0.00	1980.24	35.24	0.00
64	0.00	1977.89	32.89	0.00
65	0.00	1980.24	32.24	0.00
66	0.00	1944.00	10.00	0.00
67	0.00	1944.00	10.00	0.00
68	0.00	1974.14	31.14	0.00
71	0.00	1970.29	30.29	0.00

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Node Results: (continued)

Node	Demand	Head	Pressure	Quality

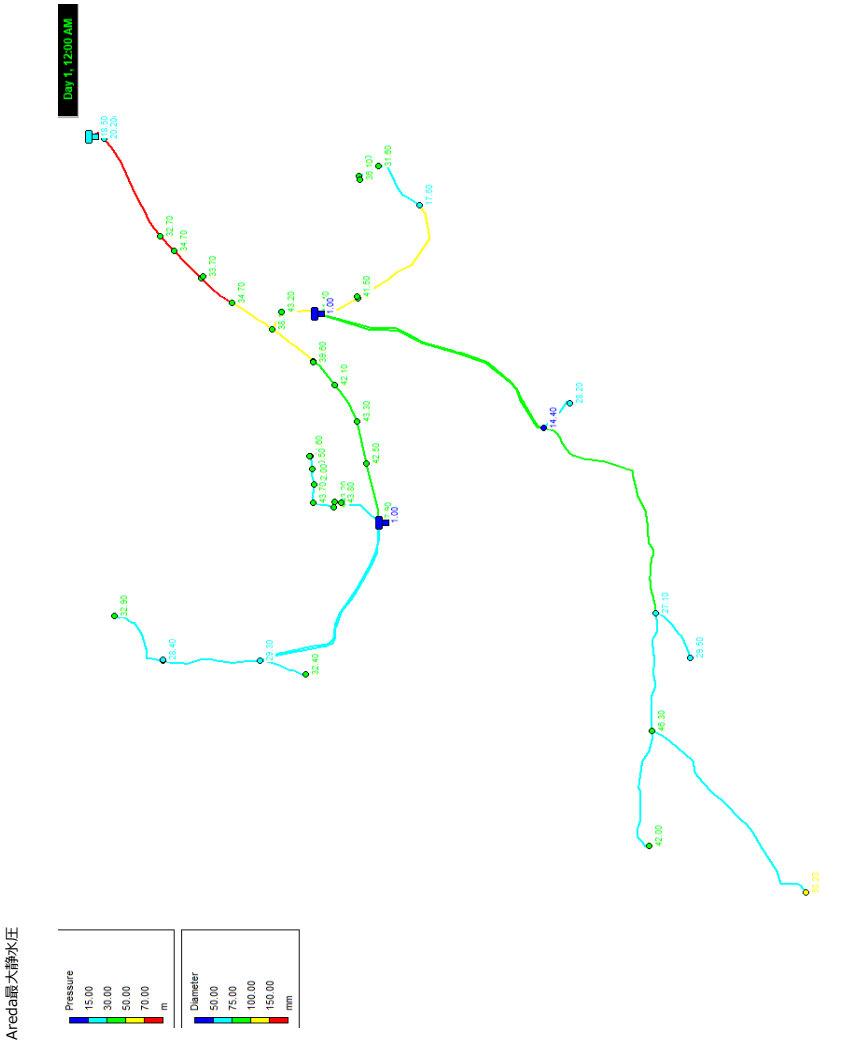
ID	LPS	m	m		
72	0.00	1981.45	27.45	0.00	
74	0.00	1982.12	24.12	0.00	
75	0.00	1982.79	24.79	0.00	
77	0.00	1985.93	25.93	0.00	
80	0.00	2001.57	2.57	0.00	
82	0.00	1992.06	21.06	0.00	
87	0.00	2001.57	22.57	0.00	
88	0.00	2001.57	22.57	0.00	
95	0.00	1963.43	20.43	0.00	
96	0.00	1963.43	12.43	0.00	
97	0.00	1966.70	25.70	0.00	
233	-5.59	2003.00	3.00	0.00	Tank
1	0.00	1948.00	1.00	0.00	Tank
2	0.00	1944.00	1.00	0.00	Tank
3	5.59	1961.00	10.00	0.00	Tank

Link Results:

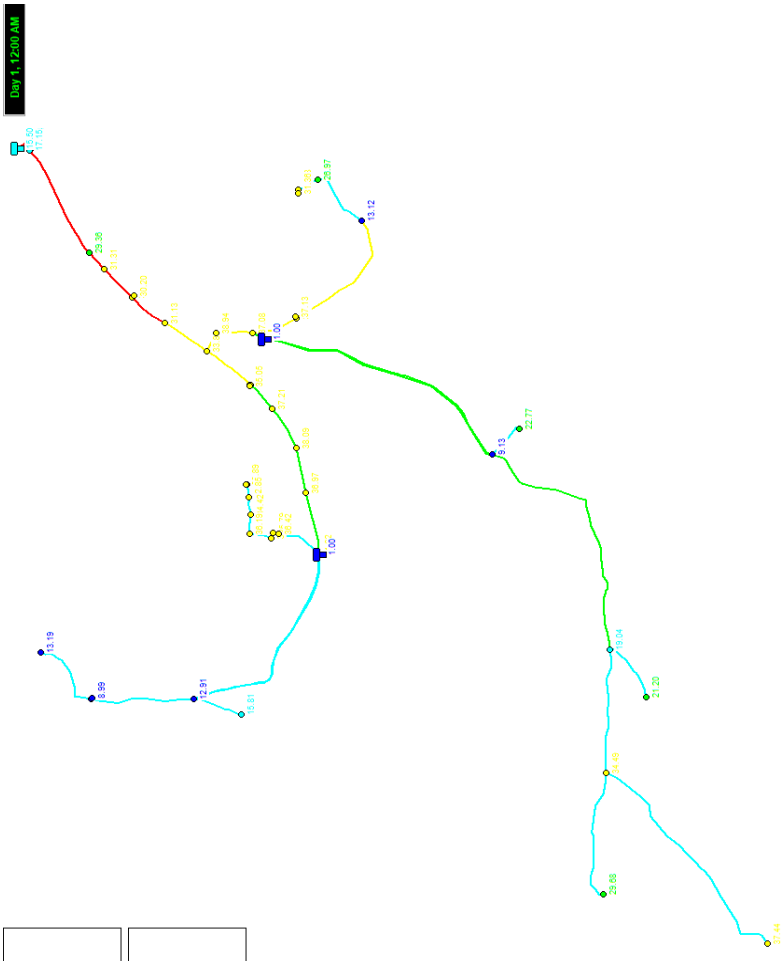
Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
103	0.00	0.00	0.00	Open
104	0.00	0.00	0.00	Open
105	0.00	0.00	0.00	Open
106	0.00	0.00	0.00	Open
107	0.00	0.00	0.00	Open
110	0.00	0.00	0.00	Open
111	0.00	0.00	0.00	Closed
115	2.09	1.06	41.74	Open
116	2.09	1.06	41.73	Open
120	0.00	0.00	0.00	Open
123	0.00	0.00	0.00	Open
124	5.59	1.27	35.90	Open
125	0.00	0.00	0.00	Open
126	0.00	0.00	0.00	Open
127	0.00	0.00	0.00	Open
141	0.00	0.00	0.00	Open
148	0.00	0.00	0.00	Open
149	0.00	0.00	0.00	Open
150	0.00	0.00	0.00	Closed
151	0.00	0.00	0.00	Open
160	0.00	0.00	0.00	Open
166	0.00	0.00	0.00	Open
168	0.00	0.00	0.00	Open
169	0.00	0.00	0.00	Open
173	0.00	0.00	0.00	Open
174	0.00	0.00	0.00	Open

Link Results: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
180	0.00	0.00	0.00	Open
181	0.00	0.00	0.00	Open
183	0.00	0.00	0.00	Open
184	0.00	0.00	0.00	Open
202	0.00	0.00	0.00	Closed
203	2.09	0.47	5.80	Open
205	2.09	0.47	5.80	Open
207	-5.59	1.27	35.90	Open
208	-3.50	1.78	108.80	Open
209	0.00	0.00	0.00	Open
210	-5.59	1.27	35.90	Open
217	-5.59	0.71	8.84	Open
218	-5.59	1.27	35.90	Open
232	2.09	1.06	41.73	Open
999	0.00	0.00	0.00	Open
114	-2.09	1.06	41.74	Open
2	0.00	0.00	0.00	Closed
3	0.00	0.00	0.00	Open
4	0.00	0.00	0.00	Closed
5	0.00	0.00	0.00	Open
6	3.50	1.78	108.77	Open
7	-2.09	1.06	41.73	Open



Aredaの最大静水圧



Aredaの最小動水圧

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*************************************************************************
*                            E P A N E T                                *
*                     Hydraulic and Water Quality                       *
*                     Analysis for Pipe Networks                        *
*                           Version 2.0                                 *
*************************************************************************
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Input File: Areda_最小動水圧

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
70	47	46	6.734506192390964	50.0
71	40	39	5.062009995447388	50.0
72	7	8	13.90766642276407	50.0
73	66	65	7.38771637122595	50.0
74	2	3	11.69	50.0
75	59	58	1.116514468661921	50.0
77	18	17	10.577655376672883	50.0
78	23	30	22.3794194144367	50.0
81	42	44	269.034989911338	75.0
83	57	56	33.9768817041321	50.0
84	3	147	97.66	150.0
85	4	3	700.05	150.0
87	4	5	124.58831187627078	150.0
88	5	7	236.56003057565	150.0
89	13	7	243.019458962719	150.0
95	14	15	120.919044408868	100.0
96	13	14	292.906493878651	100.0
98	15	16	209.53	100.0
99	16	17	273.64	100.0
100	17	19	803.030913175789	100.0
102	19	21	380.19900220288196	50.0
104	21	23	132.823173986579	50.0
110	16	31	1638.31	75.0
111	31	32	234.371861512238	50.0
112	31	33	1551.83773621744	75.0
113	33	34	367.282498024689	50.0
114	33	35	744.12983120375	50.0
115	35	37	783.974115388817	50.0
116	35	36	1441.10313491589	50.0
117	14	38	318.81912534313	100.0
118	39	38	2.43702210000876	50.0
120	39	41	191.69525071609004	75.0
121	42	41	266.5017956027	75.0
123	60	44	379.24	75.0
127	60	58	279.00	50.0
128	57	58	36.044977920325	50.0
129	56	55	124.42909555777499	50.0

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Link - Node Table: (continued)

Link ID	Start Node	End Node	Length m	Diameter mm
132	55	51	112.430888691758	50.0
133	51	48	101.975458448912	50.0
137	48	46	77.7565056607563	50.0
143	60	64	1257.14	50.0
144	64	63	292.532701553591	50.0
145	64	65	597.978885597925	50.0
146	65	67	470.133678494212	50.0
1	16	1	88.15	75
2	1	31	1572.07	75
3	60	6	6.54	50
4	6	64	1265.01	50

Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality
2	0.22	2562.64	17.14	0.00
3	0.22	2562.65	17.15	0.00
4	0.00	2562.36	29.36	0.00
5	0.00	2562.31	31.31	0.00
7	0.22	2562.21	30.21	0.00
8	0.22	2562.20	30.20	0.00
13	0.00	2562.13	31.13	0.00
14	0.22	2561.48	33.88	0.00
15	0.00	2561.44	38.94	0.00
16	0.22	2561.38	37.08	0.00
17	0.22	2561.33	37.13	0.00
18	0.22	2561.33	37.13	0.00
19	0.00	2561.32	13.12	0.00
21	0.00	2561.06	26.97	0.00
23	0.00	2560.98	31.68	0.00
30	0.22	2560.96	31.36	0.00
31	0.22	2519.73	9.13	0.00
32	0.22	2519.57	22.77	0.00
33	0.22	2516.94	19.04	0.00
34	0.22	2516.70	21.20	0.00
35	0.22	2513.19	34.49	0.00
36	0.22	2512.24	37.44	0.00
37	0.22	2512.68	29.68	0.00
38	0.00	2561.21	35.11	0.00
39	0.22	2561.16	35.05	0.00
40	0.22	2561.15	35.05	0.00
41	0.22	2560.81	37.21	0.00
42	0.00	2560.49	38.09	0.00
44	0.00	2560.17	36.97	0.00
46	0.00	2558.00	36.90	0.00

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Node Results: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality

47	0.22	2557.99	36.89	0.00
48	0.00	2558.05	32.85	0.00
51	0.00	2558.12	34.42	0.00
55	0.00	2558.19	36.19	0.00
56	0.00	2558.27	37.67	0.00
57	0.00	2558.29	35.79	0.00
58	0.22	2558.32	36.42	0.00
59	0.22	2558.32	36.42	0.00
60	0.22	2559.72	41.92	0.00
63	0.22	2501.41	15.81	0.00
64	0.22	2501.61	12.91	0.00
65	0.22	2498.60	9.00	0.00
66	0.22	2498.59	8.99	0.00
67	0.22	2498.29	13.19	0.00
147	-3.55	2562.70	15.50	0.00 Tank
1	-1.55	2525.00	1.00	0.00 Tank
6	-1.11	2518.00	1.00	0.00 Tank

Link Results:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
70	-0.22	0.11	0.66	Open
71	-0.22	0.11	0.71	Open
72	0.22	0.11	0.66	Open
73	-0.22	0.11	0.64	Open
74	-0.22	0.11	0.66	Open
75	-0.22	0.11	0.80	Open
77	-0.22	0.11	0.65	Open
78	0.22	0.11	0.65	Open
81	0.89	0.20	1.19	Open
83	0.22	0.11	0.66	Open
84	-3.55	0.20	0.53	Open
85	-3.11	0.18	0.41	Open
87	3.11	0.18	0.41	Open
88	3.11	0.18	0.41	Open
89	-2.66	0.15	0.31	Open
95	0.89	0.11	0.29	Open
96	2.66	0.34	2.24	Open
98	0.89	0.11	0.29	Open
99	0.67	0.08	0.17	Open
100	0.22	0.03	0.02	Open
102	0.22	0.11	0.66	Open
104	0.22	0.11	0.66	Open
110	0.00	0.00	0.00	Closed
111	0.22	0.11	0.66	Open

Link Results: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
112	1.11	0.25	1.80	Open
113	0.22	0.11	0.66	Open
114	0.67	0.34	5.03	Open
115	0.22	0.11	0.66	Open
116	0.22	0.11	0.66	Open
117	1.55	0.20	0.83	Open
118	-1.55	0.79	24.18	Open
120	1.11	0.25	1.80	Open
121	-0.89	0.20	1.19	Open
123	-0.89	0.20	1.19	Open
127	0.67	0.34	5.03	Open
128	-0.22	0.11	0.66	Open
129	0.22	0.11	0.66	Open
132	0.22	0.11	0.66	Open
133	0.22	0.11	0.66	Open
137	0.22	0.11	0.66	Open
143	0.00	0.00	0.00	Closed
144	0.22	0.11	0.66	Open
145	0.67	0.34	5.03	Open
146	0.22	0.11	0.66	Open
1	0.00	0.00	0.00	Closed
2	1.55	0.35	3.35	Open
3	0.00	0.00	0.00	Closed
4	1.11	0.57	12.96	Open

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*                             E P A N E T                                    *
*                     Hydraulic and Water Quality                            *
*                     Analysis for Pipe Networks                             *
*                           Version 2.0                                      *
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Input File: Areda最大静水圧

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
70	47	46	6.734506192390964	50.0
71	40	39	5.062009995447388	50.0
72	7	8	13.90766642276407	50.0
73	66	65	7.38771637122595	50.0
74	2	3	11.69	50.0
75	59	58	1.116514468661921	50.0
77	18	17	10.577655376672883	50.0
78	23	30	22.3794194144367	50.0
81	42	44	269.034989911338	75.0
83	57	56	33.9768817041321	50.0
84	3	147	97.66	150.0
85	4	3	700.05	150.0
87	4	5	124.58831187627078	150.0
88	5	7	236.56003057565	150.0
89	13	7	243.019458962719	150.0
95	14	15	120.919044408868	100.0
96	13	14	292.906493878651	100.0
98	15	16	209.53	100.0
99	16	17	273.64	100.0
100	17	19	803.030913175789	100.0
102	19	21	380.19900220288196	50.0
104	21	23	132.823173986579	50.0
110	16	31	1638.31	75.0
111	31	32	234.371861512238	50.0
112	31	33	1551.83773621744	75.0
113	33	34	367.282498024689	50.0
114	33	35	744.12983120375	50.0
115	35	37	783.974115388817	50.0
116	35	36	1441.10313491589	50.0
117	14	38	318.81912534313	100.0
118	39	38	2.43702210000876	50.0
120	39	41	191.69525071609004	75.0
121	42	41	266.5017956027	75.0
123	60	44	379.24	75.0
127	60	58	279.00	50.0
128	57	58	36.044977920325	50.0
129	56	55	124.42909555777499	50.0

Page 2
Link - Node Table: (continued)

Link ID	Start Node	End Node	Length m	Diameter mm
132	55	51	112.430888691758	50.0
133	51	48	101.975458448912	50.0
137	48	46	77.7565056607563	50.0
143	60	64	1257.14	50.0
144	64	63	292.532701553591	50.0
145	64	65	597.978885597925	50.0
146	65	67	470.133678494212	50.0
1	16	1	88.15	75.0
2	1	31	1572.07	75.0
3	60	6	6.54	50.0
4	6	64	1265.01	50.0
6	60	1	18.61	50.0

Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality
2	0.00	2565.70	20.20	0.00
3	0.00	2565.70	20.20	0.00
4	0.00	2565.70	32.70	0.00
5	0.00	2565.70	34.70	0.00
7	0.00	2565.70	33.70	0.00
8	0.00	2565.70	33.70	0.00
13	0.00	2565.70	34.70	0.00
14	0.00	2565.70	38.10	0.00
15	0.00	2565.70	43.20	0.00
16	0.00	2565.70	41.40	0.00
17	0.00	2565.70	41.50	0.00
18	0.00	2565.70	41.50	0.00
19	0.00	2565.70	17.50	0.00
21	0.00	2565.70	31.60	0.00
23	0.00	2565.70	36.40	0.00
30	0.00	2565.70	36.10	0.00
31	0.00	2525.00	14.40	0.00
32	0.00	2525.00	28.20	0.00
33	0.00	2525.00	27.10	0.00
34	0.00	2525.00	29.50	0.00
35	0.00	2525.00	46.30	0.00
36	0.00	2525.00	50.20	0.00
37	0.00	2525.00	42.00	0.00
38	0.00	2565.70	39.60	0.00
39	0.00	2565.70	39.60	0.00
40	0.00	2565.70	39.60	0.00
41	0.00	2565.70	42.10	0.00
42	0.00	2565.70	43.30	0.00
44	0.00	2565.70	42.50	0.00
46	0.00	2565.70	44.60	0.00

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Node Results: (continued)

Node	Demand	Head	Pressure	Quality

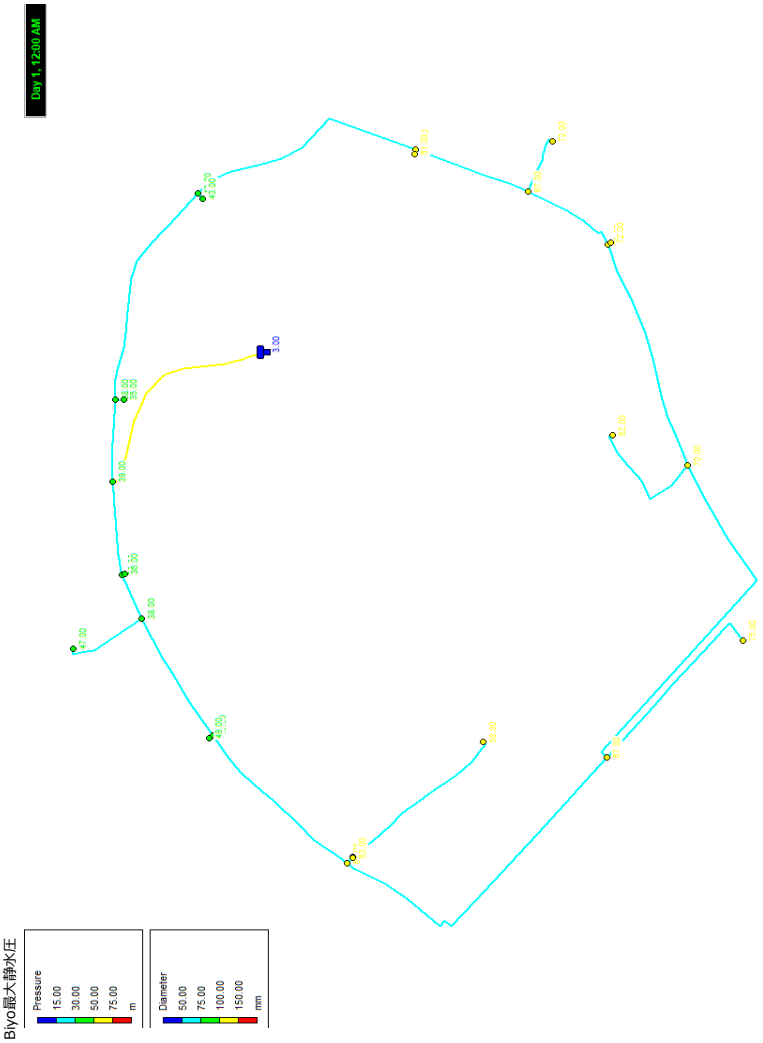
ID	LPS	m	m	
47	0.00	2565.70	44.60	0.00
48	0.00	2565.70	40.50	0.00
51	0.00	2565.70	42.00	0.00
55	0.00	2565.70	43.70	0.00
56	0.00	2565.70	45.10	0.00
57	0.00	2565.70	43.20	0.00
58	0.00	2565.70	43.80	0.00
59	0.00	2565.70	43.80	0.00
60	0.00	2565.70	47.90	0.00
63	0.00	2518.00	32.40	0.00
64	0.00	2518.00	29.30	0.00
65	0.00	2518.00	28.40	0.00
66	0.00	2518.00	28.40	0.00
67	0.00	2518.00	32.90	0.00
147	0.00	2565.70	18.50	0.00 Tank
6	0.00	2525.00	1.00	0.00 Tank
1	0.00	2518.00	1.00	0.00 Tank

Link Results:

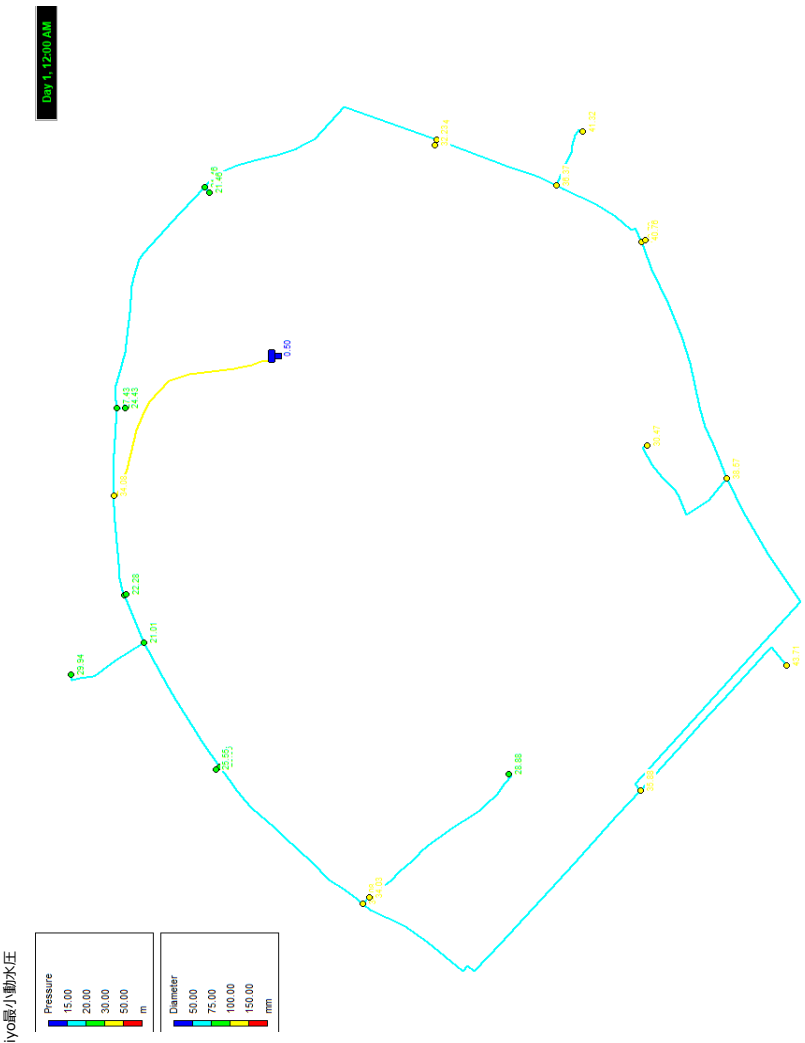
Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
70	0.00	0.00	0.00	Open
71	0.00	0.00	0.00	Open
72	0.00	0.00	0.00	Open
73	0.00	0.00	0.00	Open
74	0.00	0.00	0.00	Open
75	0.00	0.00	0.00	Open
77	0.00	0.00	0.00	Open
78	0.00	0.00	0.00	Open
81	0.00	0.00	0.00	Open
83	0.00	0.00	0.00	Open
84	0.00	0.00	0.00	Open
85	0.00	0.00	0.00	Open
87	0.00	0.00	0.00	Open
88	0.00	0.00	0.00	Open
89	0.00	0.00	0.00	Open
95	0.00	0.00	0.00	Open
96	0.00	0.00	0.00	Open
98	0.00	0.00	0.00	Open
99	0.00	0.00	0.00	Open
100	0.00	0.00	0.00	Open
102	0.00	0.00	0.00	Open
104	0.00	0.00	0.00	Open
110	0.00	0.00	0.00	Closed
111	0.00	0.00	0.00	Open

Link Results: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
112	0.00	0.00	0.00	Open
113	0.00	0.00	0.00	Open
114	0.00	0.00	0.00	Open
115	0.00	0.00	0.00	Open
116	0.00	0.00	0.00	Open
117	0.00	0.00	0.00	Open
118	0.00	0.00	0.00	Open
120	0.00	0.00	0.00	Open
121	0.00	0.00	0.00	Open
123	0.00	0.00	0.00	Open
127	0.00	0.00	0.00	Open
128	0.00	0.00	0.00	Open
129	0.00	0.00	0.00	Open
132	0.00	0.00	0.00	Open
133	0.00	0.00	0.00	Open
137	0.00	0.00	0.00	Open
143	0.00	0.00	0.00	Closed
144	0.00	0.00	0.00	Open
145	0.00	0.00	0.00	Open
146	0.00	0.00	0.00	Open
3	0.00	0.00	0.00	Closed
4	0.00	0.00	0.00	Open
5	0.00	0.00	0.00	Open
6	0.00	0.00	0.00	Closed



Biyo最大静水圧



Biyo最小動水圧

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******************************************************************
*                          E P A N E T                           *
*                  Hydraulic and Water Quality                   *
*                  Analysis for Pipe Networks                    *
*                        Version 2.0                             *
******************************************************************
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Input File: Biyo_最小動水圧

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
186	185	176	385.928553931909	50.0
187	175	173	808.556277998531	50.0
188	173	171	512.491439145298	50.0
189	161	162	178.99210354104997	50.0
190	179	178	10.09	50.0
191	172	171	7.58	50.0
192	169	168	11.4787613566137	50.0
193	167	166	15.63	50.0
194	184	165	18.1685417653984	50.0
195	170	183	133.653166034129	50.0
196	163	164	5.54	50.0
197	160	180	491.001929304642	100.0
198	175	174	438.226023882962	50.0
199	181	185	1.29	50.0
200	175	177	771.880608810454	50.0
201	162	163	104.026720316609	50.0
202	162	178	296.71188983311293	50.0
203	178	177	400.907764643353	50.0
204	177	185	17.56	50.0
205	173	182	283.845701496134	50.0
206	171	170	214.366415197469	50.0
207	170	168	255.690063581958	50.0
208	168	166	530.658258660722	50.0
209	166	165	505.619910082139	50.0
210	180	163	204.774892815948	50.0
211	165	180	179.512322585599	50.0

Page 2
Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality
161	0.16	1899.94	29.94	0.00
162	0.16	1900.01	21.01	0.00
163	0.16	1903.29	22.29	0.00
164	0.16	1903.28	22.28	0.00
165	0.16	1906.43	27.43	0.00
166	0.16	1895.46	21.46	0.00
167	0.16	1895.46	21.46	0.00
168	0.16	1888.24	31.24	0.00
169	0.16	1888.23	32.23	0.00
170	0.16	1886.37	36.37	0.00
171	0.16	1885.76	40.76	0.00
172	0.16	1885.76	40.76	0.00
173	0.16	1885.57	38.57	0.00
174	0.16	1885.71	43.71	0.00
175	0.16	1885.88	35.88	0.00
176	0.16	1887.88	28.88	0.00
177	0.16	1888.08	34.08	0.00
178	0.16	1893.55	25.55	0.00
179	0.16	1893.55	25.55	0.00
180	0.16	1912.08	34.08	0.00
181	0.16	1888.03	34.03	0.00
182	0.16	1885.47	30.47	0.00
183	0.16	1886.32	41.32	0.00
184	0.16	1906.43	24.43	0.00
185	0.16	1888.03	34.03	0.00
160	-4.08	1914.50	0.50	0.00 Tank

Link Results:

Link ID	Flow LPS	VelocityUnit m/s	Headloss m/km	Status
186	0.16	0.08	0.37	Open
187	0.16	0.08	0.38	Open
188	-0.16	0.08	0.37	Open
189	-0.16	0.08	0.37	Open
190	-0.16	0.08	0.37	Open
191	-0.16	0.08	0.37	Open
192	-0.16	0.08	0.38	Open
193	-0.16	0.08	0.37	Open
194	-0.16	0.08	0.37	Open
195	0.16	0.08	0.37	Open
196	0.16	0.08	0.38	Open
197	4.08	0.52	4.92	Open
198	0.16	0.08	0.37	Open
199	-0.16	0.08	0.35	Open
200	-0.49	0.25	2.85	Open

Page 3
Link Results: (continued)

Link ID	Flow LPS	VelocityUnit m/s	Headloss m/km	Status
201	-1.79	0.91	31.53	Open
202	1.47	0.75	21.75	Open
203	1.14	0.58	13.66	Open
204	0.49	0.25	2.84	Open
205	0.16	0.08	0.37	Open
206	-0.49	0.25	2.83	Open
207	-0.81	0.41	7.30	Open
208	-1.14	0.58	13.62	Open
209	-1.47	0.75	21.70	Open

210	2.12	1.08	42.96	Open
211	-1.79	0.91	31.47	Open


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*                            E P A N E T                                *
*                     Hydraulic and Water Quality                       *
*                     Analysis for Pipe Networks                        *
*                          Version 2.0                                  *
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Input File: Biyo最大静水圧

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
186	185	176	385.928553931909	50.0
187	175	173	808.556277998531	50.0
188	173	171	512.491439145298	50.0
189	161	162	178.99210354104997	50.0
190	179	178	10.09	50.0
191	172	171	7.58	50.0
192	169	168	11.4787613566137	50.0
193	167	166	15.63	50.0
194	184	165	18.1685417653984	50.0
195	170	183	133.653166034129	50.0
196	163	164	5.54	50.0
197	160	180	491.001929304642	100.0
198	175	174	438.226023882962	50.0
199	181	185	1.29	50.0
200	175	177	771.880608810454	50.0
201	162	163	104.026720316609	50.0
202	162	178	296.71188983311293	50.0
203	178	177	400.907764643353	50.0
204	177	185	17.56	50.0
205	173	182	283.845701496134	50.0
206	171	170	214.366415197469	50.0
207	170	168	255.690063581958	50.0
208	168	166	530.658258660722	50.0
209	166	165	505.619910082139	50.0
210	180	163	204.774892815948	50.0
211	165	180	179.512322585599	50.0

Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality
161	0.00	1917.00	47.00	0.00
162	0.00	1917.00	38.00	0.00
163	0.00	1917.00	36.00	0.00
164	0.00	1917.00	36.00	0.00
165	0.00	1917.00	38.00	0.00

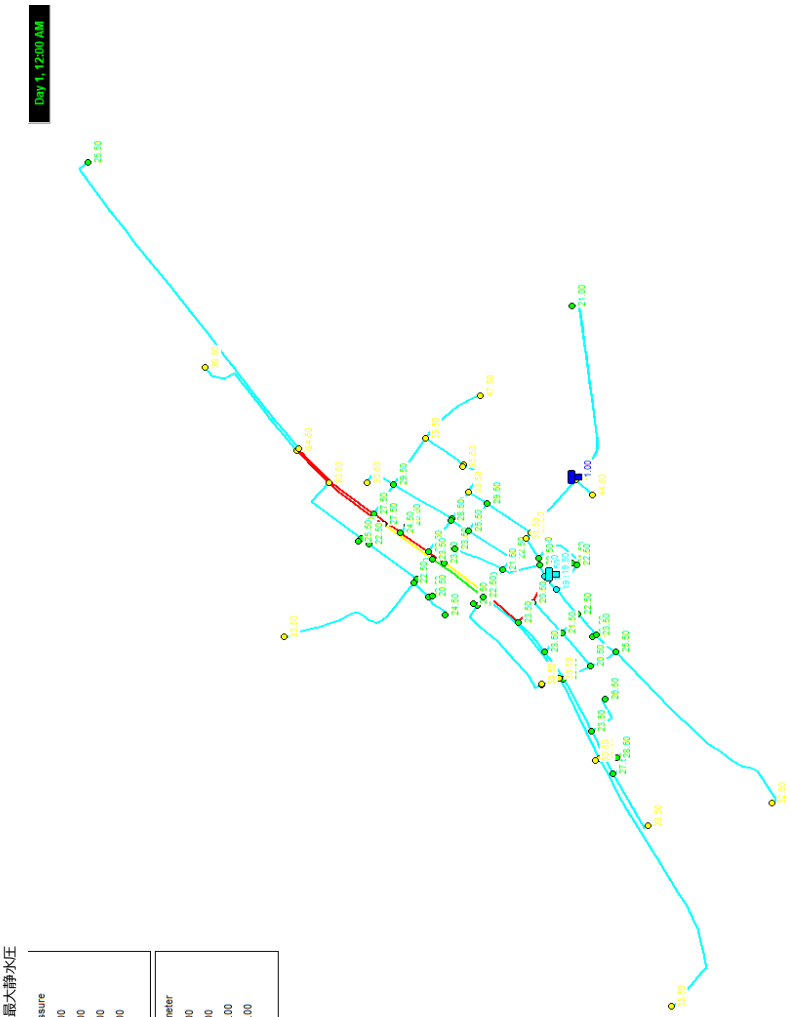
166	0.00	1917.00	43.00	0.00
167	0.00	1917.00	43.00	0.00
168	0.00	1917.00	60.00	0.00
169	0.00	1917.00	61.00	0.00
170	0.00	1917.00	67.00	0.00
171	0.00	1917.00	72.00	0.00
172	0.00	1917.00	72.00	0.00
173	0.00	1917.00	70.00	0.00
174	0.00	1917.00	75.00	0.00
175	0.00	1917.00	67.00	0.00
176	0.00	1917.00	58.00	0.00
177	0.00	1917.00	63.00	0.00
178	0.00	1917.00	49.00	0.00
179	0.00	1917.00	49.00	0.00
180	0.00	1917.00	39.00	0.00
181	0.00	1917.00	63.00	0.00
182	0.00	1917.00	62.00	0.00
183	0.00	1917.00	72.00	0.00
184	0.00	1917.00	35.00	0.00
185	0.00	1917.00	63.00	0.00
160	0.00	1917.00	3.00	0.00 Tank

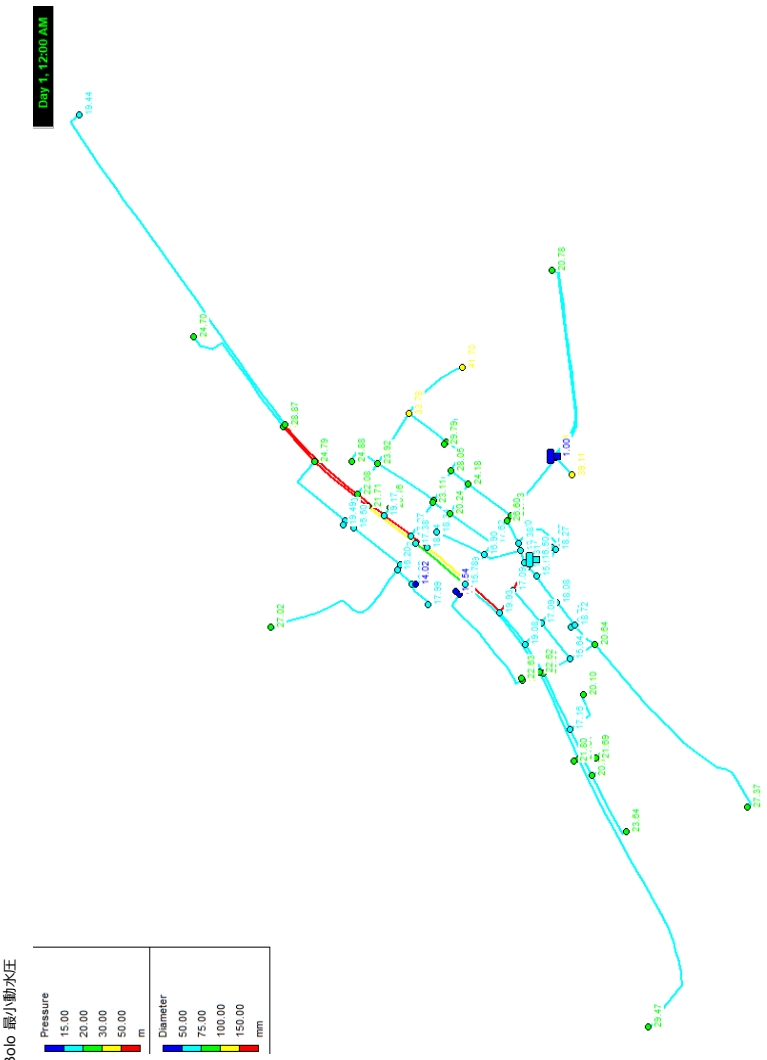
Link Results:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
186	0.00	0.00	0.00	Open
187	0.00	0.00	0.00	Open
188	0.00	0.00	0.00	Open
189	0.00	0.00	0.00	Open
190	0.00	0.00	0.00	Open
191	0.00	0.00	0.00	Open
192	0.00	0.00	0.00	Open
193	0.00	0.00	0.00	Open
194	0.00	0.00	0.00	Open
195	0.00	0.00	0.00	Open
196	0.00	0.00	0.00	Open
197	0.00	0.00	0.00	Open
198	0.00	0.00	0.00	Open
199	0.00	0.00	0.00	Open
200	0.00	0.00	0.00	Open

Link Results: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
201	0.00	0.00	0.00	Open
202	0.00	0.00	0.00	Open
203	0.00	0.00	0.00	Open
204	0.00	0.00	0.00	Open
205	0.00	0.00	0.00	Open
206	0.00	0.00	0.00	Open
207	0.00	0.00	0.00	Open
208	0.00	0.00	0.00	Open
209	0.00	0.00	0.00	Open
210	0.00	0.00	0.00	Open
211	0.00	0.00	0.00	Open


Day 1, 12:00 AM
Bolo 最大静水圧
Pressure
15.00
20.00
30.00
70.00
m
Diameter
50.00
75.00
100.00
150.00
mm


Day 1, 12:00 AM
Bolo 最小動水圧
Pressure
15.00
20.00
30.00
50.00
m
Diameter
50.00
75.00
100.00
150.00
mm

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*                             E P A N E T                               *
*                     Hydraulic and Water Quality                       *
*                     Analysis for Pipe Networks                        *
*                          Version 2.0                                  *
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Input File: Bolo最小動水圧

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
167	4	5	7.50039381576603	150.0
168	71	72	12.607465191542836	50.0
169	69	70	4.950747465745722	50.0
170	14	8	149.429765580151	50.0
171	27	19	87.390431490441	50.0
172	35	27	134.346652926563	50.0
173	28	19	138.179350998447	50.0
174	35	43	69.3060050357778	50.0
175	37	36	80.1336433651638	50.0
176	53	52	68.4259808231659	50.0
177	52	51	65.5428872486177	50.0
178	39	38	60.47	50.0
179	45	44	12.1341141513501	50.0
180	166	46	22.534877940042286	150.0
181	46	42	32.60853634663	50.0
182	41	43	64.0762939157028	50.0
183	43	28	17.852770426921555	50.0
184	26	27	59.4158651880991	50.0
185	27	21	53.7819299257858	50.0
186	26	25	46.62085463754445	50.0
187	47	46	13.628202067910344	150.0
188	12	29	155.603464823213	50.0
189	22	23	24.997861720133	50.0
190	21	20	4.873411280740426	50.0
191	16	17	5.930405237018946	50.0
192	55	54	12.243342639800694	50.0
193	10	12	64.9763275395167	50.0
194	12	11	28.2341357941729	50.0
195	11	13	11.0800260106997	50.0
196	30	31	52.773947206565005	50.0
197	31	32	11.6053331616096	50.0
198	68	69	48.93203961339963	50.0
199	66	67	13.284176863915079	50.0
200	2	5	976.55620063036	50.0
201	4	3	358.404002969418	50.0
202	9	5	262.33643447383	150.0
203	6	4	120.569345606577	150.0

Link - Node Table: (continued)

Link ID	Start Node	End Node	Length m	Diameter mm
204	11	6	229.300280731018	50.0
205	10	6	181.314082664753	150.0
206	74	10	156.852245094743	100.0
207	30	29	13.597635454553409	50.0
208	74	29	67.1474233165903	75.0
209	31	33	72.3622907742921	50.0
210	30	34	414.19305761718493	50.0
211	9	8	93.452486297204	50.0
212	8	7	94.106537381453	50.0
213	9	23	87.6184557177691	150.0
214	23	24	88.1658235393214	150.0
215	24	25	51.4705132730245	150.0
216	37	25	132.319119650131	100.0
217	42	36	100.782810583519	50.0
218	36	26	138.115176604305	50.0
219	36	35	35.8330352808591	50.0
220	19	18	57.2151539167406	50.0
221	28	38	185.48	50.0
222	38	40	510.07	50.0
223	14	15	187.904671978335	50.0
224	16	14	121.797521556766	50.0
225	18	16	106.889033604638	50.0
226	24	21	102.980611361704	50.0
227	20	18	85.2879647977874	50.0
228	8	20	178.10118307517	50.0
229	42	41	19.051869658839205	50.0
230	41	45	151.224320099262	50.0
231	48	45	92.3667286846197	50.0
232	51	48	85.6338310004641	50.0
233	48	47	33.78657356375997	50.0
234	55	51	73.8083409951103	50.0
235	56	55	71.762530939028	50.0
236	49	47	69.2371254821818	150.0
237	50	49	66.0107462139095	150.0
238	49	52	111.661201764818	50.0
239	57	52	117.184207638654	50.0
240	57	56	76.3711671072924	50.0
241	58	57	79.33042508760569	50.0
242	71	69	312.817838801177	50.0
243	71	73	29.6733686867234	50.0
244	68	73	297.979276927042	50.0
245	37	50	119.94913556312	150.0
246	50	53	104.31074141975893	50.0
247	53	58	88.4084612954889	50.0
248	60	58	158.17963092551	50.0
249	61	60	130.0466767838	50.0
250	60	59	122.30467762414501	50.0

Link - Node Table: (continued)

Link	Start	End	Length	Diameter

ID	Node	Node	m	mm
251	61	62	62.0104888119978	50.0
252	61	63	177.712855211216	50.0
253	56	64	599.103797502819	50.0
254	65	66	777.829834679531	50.0
255	66	68	240.079040260341	50.0
256	73	74	168.165435573531	75.0
1	38	1	4.71	12
2	1	40	502.74	50

Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality
2	0.18	2594.44	19.44	0.00
3	0.18	2594.70	24.70	0.00
4	0.18	2594.86	28.86	0.00
5	0.18	2594.87	28.87	0.00
6	0.18	2594.79	24.79	0.00
7	0.18	2594.88	24.88	0.00
8	0.18	2594.92	23.92	0.00
9	0.18	2595.08	22.08	0.00
10	0.18	2594.71	21.71	0.00
11	0.18	2594.50	18.50	0.00
12	0.18	2594.50	16.50	0.00
13	0.18	2594.49	19.49	0.00
14	0.18	2594.78	33.78	0.00
15	0.18	2594.70	41.70	0.00
16	0.18	2594.79	29.79	0.00
17	0.18	2594.79	29.79	0.00
18	0.18	2595.05	28.05	0.00
19	0.18	2595.18	24.18	0.00
20	0.18	2595.09	23.09	0.00
21	0.18	2595.11	23.11	0.00
22	0.18	2595.16	20.16	0.00
23	0.18	2595.17	19.17	0.00
24	0.18	2595.27	17.27	0.00
25	0.18	2595.34	18.34	0.00
26	0.18	2595.34	18.34	0.00
27	0.18	2595.24	20.24	0.00
28	0.18	2595.43	26.43	0.00
29	0.18	2594.32	16.32	0.00
30	0.18	2594.20	16.20	0.00
31	0.18	2594.02	16.02	0.00
32	0.18	2594.02	14.02	0.00
33	0.18	2593.99	17.99	0.00
34	0.18	2594.02	27.02	0.00

Node Results: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality
35	0.18	2595.62	17.62	0.00
36	0.18	2595.90	16.90	0.00
37	0.18	2596.69	18.69	0.00
38	0.18	2595.14	41.14	0.00
39	0.18	2595.11	39.11	0.00
40	0.18	2554.78	20.78	0.00
41	0.18	2596.20	16.20	0.00
42	0.18	2596.38	16.38	0.00
43	0.18	2595.60	26.60	0.00
44	0.18	2596.27	17.27	0.00
45	0.18	2596.27	18.27	0.00
46	0.18	2597.37	16.37	0.00
47	0.18	2597.31	16.31	0.00
48	0.18	2596.59	15.59	0.00
49	0.18	2597.09	17.09	0.00
50	0.18	2596.93	19.93	0.00
51	0.18	2596.08	18.08	0.00
52	0.18	2596.09	17.09	0.00
53	0.18	2596.08	19.08	0.00
54	0.18	2595.71	18.71	0.00
55	0.18	2595.72	18.72	0.00
56	0.18	2595.64	20.64	0.00
57	0.18	2595.64	15.64	0.00
58	0.18	2595.53	23.53	0.00
59	0.18	2594.10	20.10	0.00
60	0.18	2594.16	17.16	0.00
61	0.18	2593.72	20.72	0.00
62	0.18	2593.69	21.69	0.00
63	0.18	2593.64	23.64	0.00
64	0.18	2595.37	27.37	0.00
65	0.18	2591.47	29.47	0.00
66	0.18	2591.81	21.81	0.00
67	0.18	2591.80	21.80	0.00
68	0.18	2592.62	22.62	0.00
69	0.18	2592.63	22.63	0.00
70	0.18	2592.63	22.63	0.00
71	0.18	2593.54	14.54	0.00
72	0.18	2593.54	14.54	0.00
73	0.18	2593.78	15.78	0.00
74	0.18	2594.38	17.38	0.00
166	-12.89	2597.50	16.50	0.00 Tank
1	-0.18	2555.00	1.00	0.00 Tank

Link Results:

Link ID	Flow LPS	VelocityUnit m/s	Headloss m/km	Status
167	-4.12	0.23	0.71	Open
168	0.18	0.09	0.45	Open
169	0.18	0.09	0.42	Open
170	-0.27	0.14	0.96	Open
171	0.23	0.12	0.71	Open
172	0.49	0.25	2.86	Open
173	0.39	0.20	1.84	Open
174	0.17	0.09	0.39	Open

175	0.96	0.49	9.91	Open
176	-0.06	0.03	0.07	Open
177	0.10	0.05	0.15	Open
178	-0.18	0.09	0.44	Open
179	0.18	0.09	0.44	Open
180	12.89	0.73	5.76	Open
181	1.76	0.89	30.35	Open
182	0.94	0.48	9.45	Open
183	0.92	0.47	9.22	Open
184	0.37	0.19	1.69	Open
185	0.45	0.23	2.46	Open
186	0.04	0.02	0.03	Open
187	-10.95	0.62	4.26	Open
188	0.30	0.15	1.16	Open
189	-0.18	0.09	0.44	Open
190	0.63	0.32	4.52	Open
191	0.18	0.09	0.45	Open
192	0.18	0.09	0.44	Open
193	0.52	0.27	3.20	Open
194	0.04	0.02	0.03	Open
195	0.18	0.09	0.46	Open
196	0.54	0.27	3.38	Open
197	0.18	0.09	0.44	Open
198	-0.14	0.07	0.27	Open
199	0.18	0.09	0.45	Open
200	-0.18	0.09	0.44	Open
201	0.18	0.09	0.44	Open
202	4.48	0.25	0.81	Open
203	-3.76	0.21	0.59	Open
204	-0.32	0.16	1.27	Open
205	-3.26	0.18	0.45	Open
206	-2.56	0.33	2.09	Open
207	-0.89	0.46	8.69	Open
208	0.77	0.17	0.92	Open
209	0.18	0.09	0.44	Open
210	0.18	0.09	0.44	Open
211	0.37	0.19	1.67	Open
212	0.18	0.09	0.44	Open
213	-5.02	0.28	1.01	Open

Link Results: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
214	-5.38	0.30	1.14	Open
215	-5.91	0.33	1.36	Open
216	6.05	0.77	10.23	Open
217	0.65	0.33	4.78	Open
218	0.59	0.30	4.05	Open
219	0.84	0.43	7.68	Open
220	0.44	0.22	2.31	Open
221	0.36	0.18	1.60	Open
222	0.00	0.00	0.00	Closed
223	0.18	0.09	0.44	Open
224	0.08	0.04	0.11	Open
225	0.44	0.23	2.36	Open
226	0.35	0.18	1.57	Open
227	0.18	0.09	0.46	Open
228	-0.26	0.13	0.91	Open
229	0.93	0.47	9.34	Open
230	-0.18	0.09	0.47	Open
231	0.54	0.28	3.44	Open
232	-0.73	0.37	6.00	Open
233	-1.45	0.74	21.36	Open
234	-0.65	0.33	4.86	Open
235	-0.30	0.15	1.12	Open
236	-9.32	0.53	3.16	Open
237	-8.23	0.47	2.51	Open
238	0.91	0.46	9.01	Open
239	-0.57	0.29	3.78	Open
240	0.06	0.03	0.06	Open
241	-0.33	0.17	1.37	Open
242	0.49	0.25	2.90	Open
243	-0.85	0.43	7.95	Open
244	-0.58	0.29	3.88	Open
245	-7.19	0.41	1.95	Open
246	0.86	0.44	8.10	Open
247	0.74	0.38	6.19	Open
248	-0.89	0.46	8.70	Open
249	-0.54	0.27	3.38	Open
250	0.18	0.09	0.44	Open
251	0.18	0.09	0.44	Open
252	0.18	0.09	0.44	Open
253	0.18	0.09	0.44	Open
254	-0.18	0.09	0.44	Open
255	-0.54	0.27	3.38	Open
256	-1.61	0.36	3.58	Open
1	0.00	0.00	0.00	Closed
2	0.18	0.09	0.44	Open

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*************************************************************************
*                             E P A N E T                               *
*                     Hydraulic and Water Quality                       *
*                     Analysis for Pipe Networks                        *
*                          Version 2.0                                  *
*************************************************************************
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Input File: Bolo最大静水圧

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
167	4	5	7.50039381576603	150.0
168	71	72	12.607465191542836	50.0
169	69	70	4.950747465745722	50.0
170	14	8	149.429765580151	50.0
171	27	19	87.390431490441	50.0
172	35	27	134.346652926563	50.0
173	28	19	138.179350998447	50.0
174	35	43	69.3060050357778	50.0
175	37	36	80.1336433651638	50.0
176	53	52	68.4259808231659	50.0
177	52	51	65.5428872486177	50.0
178	39	38	60.47	50.0
179	45	44	12.1341141513501	50.0
180	166	46	22.534877940042286	150.0
181	46	42	32.60853634663	50.0
182	41	43	64.0762939157028	50.0
183	43	28	17.852770426921555	50.0
184	26	27	59.4158651880991	50.0
185	27	21	53.7819299257858	50.0
186	26	25	46.62085463754445	50.0
187	47	46	13.628202067910344	150.0
188	12	29	155.603464823213	50.0
189	22	23	24.997861720133	50.0
190	21	20	4.873411280740426	50.0
191	16	17	5.930405237018946	50.0
192	55	54	12.243342639800694	50.0
193	10	12	64.9763275395167	50.0
194	12	11	28.2341357941729	50.0
195	11	13	11.0800260106997	50.0
196	30	31	52.773947206565005	50.0
197	31	32	11.6053331616096	50.0
198	68	69	48.93203961339963	50.0
199	66	67	13.284176863915079	50.0
200	2	5	976.55620063036	50.0
201	4	3	358.404002969418	50.0
202	9	5	262.33643447383	150.0
203	6	4	120.569345606577	150.0

Link - Node Table: (continued)

Link ID	Start Node	End Node	Length m	Diameter mm
204	11	6	229.300280731018	50.0
205	10	6	181.314082664753	150.0
206	74	10	156.852245094743	100.0
207	30	29	13.597635454553409	50.0
208	74	29	67.1474233165903	75.0
209	31	33	72.3622907742921	50.0
210	30	34	414.19305761718493	50.0
211	9	8	93.452486297204	50.0
212	8	7	94.106537381453	50.0
213	9	23	87.6184557177691	150.0
214	23	24	88.1658235393214	150.0
215	24	25	51.4705132730245	150.0
216	37	25	132.319119650131	100.0
217	42	36	100.782810583519	50.0
218	36	26	138.115176604305	50.0
219	36	35	35.8330352808591	50.0
220	19	18	57.2151539167406	50.0
221	28	38	185.48	50.0
222	38	40	510.07	50.0
223	14	15	187.904671978335	50.0
224	16	14	121.797521556766	50.0
225	18	16	106.889033604638	50.0
226	24	21	102.980611361704	50.0
227	20	18	85.2879647977874	50.0
228	8	20	178.10118307517	50.0
229	42	41	19.051869658839205	50.0
230	41	45	151.224320099262	50.0
231	48	45	92.3667286846197	50.0
232	51	48	85.6338310004641	50.0
233	48	47	33.78657356375997	50.0
234	55	51	73.8083409951103	50.0
235	56	55	71.762530939028	50.0
236	49	47	69.2371254821818	150.0
237	50	49	66.0107462139095	150.0
238	49	52	111.661201764818	50.0
239	57	52	117.184207638654	50.0
240	57	56	76.3711671072924	50.0
241	58	57	79.33042508760569	50.0
242	71	69	312.817838801177	50.0
243	71	73	29.6733686867234	50.0
244	68	73	297.979276927042	50.0
245	37	50	119.94913556312	150.0
246	50	53	104.31074141975893	50.0
247	53	58	88.4084612954889	50.0
248	60	58	158.17963092551	50.0
249	61	60	130.0466767838	50.0
250	60	59	122.30467762414501	50.0

Link - Node Table: (continued)

Link	Start	End	Length	Diameter

ID	Node	Node	m	mm
251	61	62	62.0104888119978	50.0
252	61	63	177.712855211216	50.0
253	56	64	599.103797502819	50.0
254	65	66	777.829834679531	50.0
255	66	68	240.079040260341	50.0
256	73	74	168.165435573531	75.0
1	38	1	7.23	50
2	1	40	503.82	50

Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality	
2	0.00	2600.50	25.50	0.00	
3	0.00	2600.50	30.50	0.00	
4	0.00	2600.50	34.50	0.00	
5	0.00	2600.50	34.50	0.00	
6	0.00	2600.50	30.50	0.00	
7	0.00	2600.50	30.50	0.00	
8	0.00	2600.50	29.50	0.00	
9	0.00	2600.50	27.50	0.00	
10	0.00	2600.50	27.50	0.00	
11	0.00	2600.50	24.50	0.00	
12	0.00	2600.50	22.50	0.00	
13	0.00	2600.50	25.50	0.00	
14	0.00	2600.50	39.50	0.00	
15	0.00	2600.50	47.50	0.00	
16	0.00	2600.50	35.50	0.00	
17	0.00	2600.50	35.50	0.00	
18	0.00	2600.50	33.50	0.00	
19	0.00	2600.50	29.50	0.00	
20	0.00	2600.50	28.50	0.00	
21	0.00	2600.50	28.50	0.00	
22	0.00	2600.50	25.50	0.00	
23	0.00	2600.50	24.50	0.00	
24	0.00	2600.50	22.50	0.00	
25	0.00	2600.50	23.50	0.00	
26	0.00	2600.50	23.50	0.00	
27	0.00	2600.50	25.50	0.00	
28	0.00	2600.50	31.50	0.00	
29	0.00	2600.50	22.50	0.00	
30	0.00	2600.50	22.50	0.00	
31	0.00	2600.50	22.50	0.00	
32	0.00	2600.50	20.50	0.00	
33	0.00	2600.50	24.50	0.00	
34	0.00	2600.50	33.50	0.00	

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Node Results: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality	
35	0.00	2600.50	22.50	0.00	
36	0.00	2600.50	21.50	0.00	
37	0.00	2600.50	22.50	0.00	
38	0.00	2600.50	46.50	0.00	
39	0.00	2600.50	44.50	0.00	
40	0.00	2555.00	21.00	0.00	
41	0.00	2600.50	20.50	0.00	
42	0.00	2600.50	20.50	0.00	
43	0.00	2600.50	31.50	0.00	
44	0.00	2600.50	21.50	0.00	
45	0.00	2600.50	22.50	0.00	
46	0.00	2600.50	19.50	0.00	
47	0.00	2600.50	19.50	0.00	
48	0.00	2600.50	19.50	0.00	
49	0.00	2600.50	20.50	0.00	
50	0.00	2600.50	23.50	0.00	
51	0.00	2600.50	22.50	0.00	
52	0.00	2600.50	21.50	0.00	
53	0.00	2600.50	23.50	0.00	
54	0.00	2600.50	23.50	0.00	
55	0.00	2600.50	23.50	0.00	
56	0.00	2600.50	25.50	0.00	
57	0.00	2600.50	20.50	0.00	
58	0.00	2600.50	28.50	0.00	
59	0.00	2600.50	26.50	0.00	
60	0.00	2600.50	23.50	0.00	
61	0.00	2600.50	27.50	0.00	
62	0.00	2600.50	28.50	0.00	
63	0.00	2600.50	30.50	0.00	
64	0.00	2600.50	32.50	0.00	
65	0.00	2600.50	38.50	0.00	
66	0.00	2600.50	30.50	0.00	
67	0.00	2600.50	30.50	0.00	
68	0.00	2600.50	30.50	0.00	
69	0.00	2600.50	30.50	0.00	
70	0.00	2600.50	30.50	0.00	
71	0.00	2600.50	21.50	0.00	
72	0.00	2600.50	21.50	0.00	
73	0.00	2600.50	22.50	0.00	
74	0.00	2600.50	23.50	0.00	
166	-0.01	2600.50	19.50	0.00	Tank
1	0.00	2555.00	1.00	0.00	Tank

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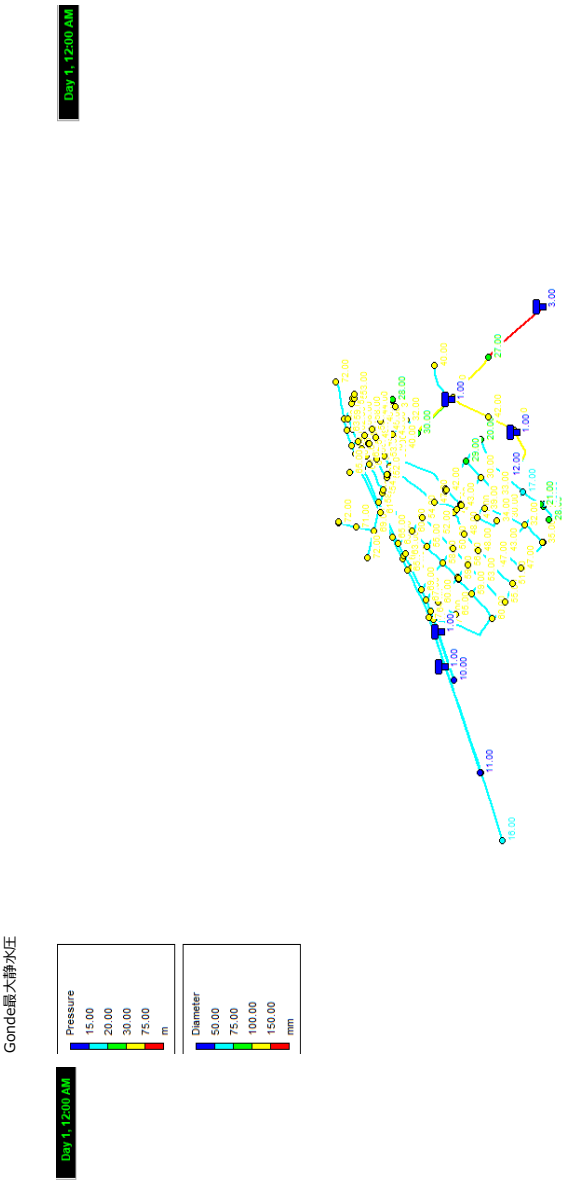
Link Results:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
167	0.00	0.00	0.00	Open
168	0.00	0.00	0.00	Open
169	0.00	0.00	0.00	Open
170	0.00	0.00	0.00	Open
171	0.00	0.00	0.00	Open
172	0.00	0.00	0.00	Open
173	0.00	0.00	0.00	Open
174	0.00	0.00	0.00	Open

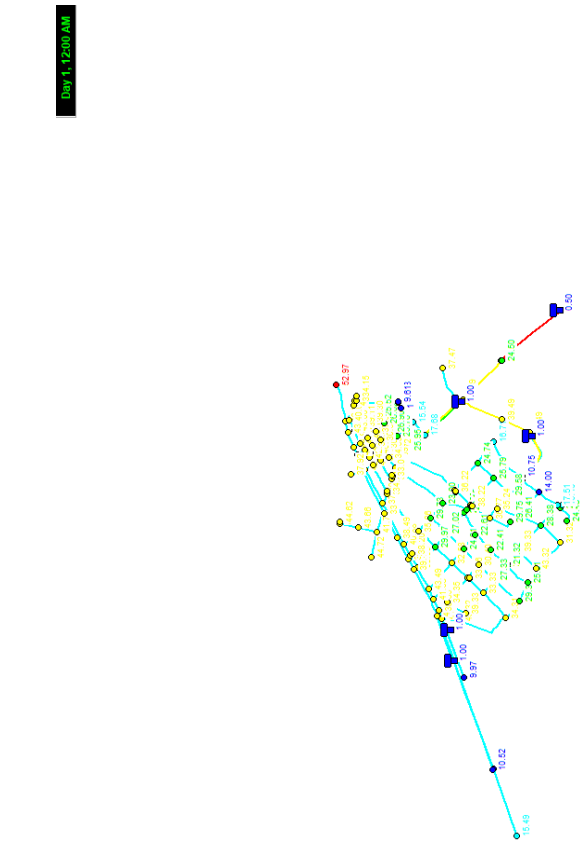
Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
175	0.00	0.00	0.00	Open
176	0.00	0.00	0.00	Open
177	0.00	0.00	0.00	Open
178	0.00	0.00	0.00	Open
179	0.00	0.00	0.00	Open
180	0.01	0.00	0.00	Open
181	0.00	0.00	0.00	Open
182	0.00	0.00	0.00	Open
183	0.00	0.00	0.00	Open
184	0.00	0.00	0.00	Open
185	0.00	0.00	0.00	Open
186	0.00	0.00	0.00	Open
187	-0.01	0.00	0.00	Open
188	0.00	0.00	0.00	Open
189	0.00	0.00	0.00	Open
190	0.00	0.00	0.00	Open
191	0.00	0.00	0.00	Open
192	0.00	0.00	0.00	Open
193	0.00	0.00	0.00	Open
194	0.00	0.00	0.00	Open
195	0.00	0.00	0.00	Open
196	0.00	0.00	0.00	Open
197	0.00	0.00	0.00	Open
198	0.00	0.00	0.00	Open
199	0.00	0.00	0.00	Open
200	0.00	0.00	0.00	Open
201	0.00	0.00	0.00	Open
202	0.00	0.00	0.00	Open
203	0.00	0.00	0.00	Open
204	0.00	0.00	0.00	Open
205	0.00	0.00	0.00	Open
206	0.00	0.00	0.00	Open
207	0.00	0.00	0.00	Open
208	0.00	0.00	0.00	Open
209	0.00	0.00	0.00	Open
210	0.00	0.00	0.00	Open
211	0.00	0.00	0.00	Open
212	0.00	0.00	0.00	Open
213	0.00	0.00	0.00	Open

Link Results: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
214	0.00	0.00	0.00	Open
215	0.00	0.00	0.00	Open
216	0.00	0.00	0.00	Open
217	0.00	0.00	0.00	Open
218	0.00	0.00	0.00	Open
219	0.00	0.00	0.00	Open
220	0.00	0.00	0.00	Open
221	0.00	0.00	0.00	Open
222	0.00	0.00	0.00	Closed
223	0.00	0.00	0.00	Open
224	0.00	0.00	0.00	Open
225	0.00	0.00	0.00	Open
226	0.00	0.00	0.00	Open
227	0.00	0.00	0.00	Open
228	0.00	0.00	0.00	Open
229	0.00	0.00	0.00	Open
230	0.00	0.00	0.00	Open
231	0.00	0.00	0.00	Open
232	0.00	0.00	0.00	Open
233	0.00	0.00	0.00	Open
234	0.00	0.00	0.00	Open
235	0.00	0.00	0.00	Open
236	-0.01	0.00	0.00	Open
237	-0.01	0.00	0.00	Open
238	0.00	0.00	0.00	Open
239	0.00	0.00	0.00	Open
240	0.00	0.00	0.00	Open
241	0.00	0.00	0.00	Open
242	0.00	0.00	0.00	Open
243	0.00	0.00	0.00	Open
244	0.00	0.00	0.00	Open
245	-0.01	0.00	0.00	Open
246	0.00	0.00	0.00	Open
247	0.00	0.00	0.00	Open
248	0.00	0.00	0.00	Open
249	0.00	0.00	0.00	Open
250	0.00	0.00	0.00	Open
251	0.00	0.00	0.00	Open
252	0.00	0.00	0.00	Open
253	0.00	0.00	0.00	Open
254	0.00	0.00	0.00	Open
255	0.00	0.00	0.00	Open
256	0.00	0.00	0.00	Open
1	0.00	0.00	0.00	Closed
2	0.00	0.00	0.00	Open



Gonde最大静水圧



Gonde最小動水圧

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*                             E P A N E T                               *
*                     Hydraulic and Water Quality                       *
*                     Analysis for Pipe Networks                        *
*                          Version 2.0                                  *
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Input File: Gondes最小動水圧

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
1334	1652	1651	6.775775426162696	50.0
1335	1671	1672	6.011997607511936	50.0
1336	1724	1725	1.884172077575189	50.0
1337	1612	1614	4.151277025258093	50.0
1338	1649	1650	96.8323077458249	50.0
1339	1631	1630	4.825839357136028	50.0
1340	1647	1671	41.156512051862805	50.0
1341	1603	1602	9.629507141033637	50.0
1342	1597	1598	14.6878898405987	50.0
1343	1578	1577	18.3651719385027	50.0
1344	1719	1721	25.931768015662	50.0
1345	1595	1594	2.241792478102379	50.0
1346	1604	1603	10.878199333774292	50.0
1352	1711	1713	32.8216601593953	50.0
1353	1697	1700	45.756043525676	50.0
1354	1695	1697	42.5250258643849	50.0
1355	1683	1684	43.3409470772008	50.0
1356	1678	1679	45.5599760931318	50.0
1357	1710	1711	44.4678904329185	50.0
1358	1710	1709	48.090466142336005	50.0
1359	1683	1682	48.6117969862412	50.0
1360	1680	1681	44.8450561959843	50.0
1361	1702	1686	71.2913809326975	50.0
1362	1685	1686	39.0515165313228	50.0
1363	1704	1708	46.4155196005035	50.0
1364	1707	1706	7.60	50.0
1366	1607	1640	111.000075932829	50.0
1367	1573	1572	60.4594536265418	50.0
1368	1574	1572	58.8636210118129	50.0
1369	1572	1570	45.59	50.0
1370	1570	1568	86.05	50.0
1371	1568	1569	50.3385821158312	50.0
1372	1639	1638	6.91536836450975	50.0
1373	1583	1581	63.5202973344365	50.0
1374	1581	1582	11.811853595495016	50.0
1378	1715	1714	19.1333687624565	50.0
1379	1696	1695	43.3581776115056	50.0

Link - Node Table: (continued)

Link ID	Start Node	End Node	Length m	Diameter mm
1380	1720	1719	12.027045497426068	50.0
1381	1639	1637	3.669426352811328	50.0
1384	1606	1603	235.30961853205	50.0
1385	1606	1640	134.640449235614	50.0
1386	1608	1607	113.29750502583	50.0
1387	1640	1638	177.478169235934	50.0
1388	1629	1607	174.670269613134	50.0
1389	1608	1602	103.080437980534	50.0
1390	1626	1608	91.16997103363381	50.0
1391	1626	1625	62.8085647473159	50.0
1392	1609	1626	120.06272046198	50.0
1393	1600	1609	112.742451581117	50.0
1394	1609	1601	155.907452657075	50.0
1395	1602	1601	109.112912753492	50.0
1396	1601	1599	115.884939883097	50.0
1397	1599	1597	18.342546633304	50.0
1398	1597	1596	88.5836568470468	50.0
1399	1599	1600	135.796122116837	50.0
1400	1611	1600	167.47412385338296	50.0
1401	1611	1593	124.954307250344	50.0
1402	1593	1595	181.011466727457	50.0
1404	1591	1592	102.56823544886701	50.0
1405	1613	1592	137.358228681006	50.0
1407	1613	1615	93.7927900759455	50.0
1408	1615	1591	168.362392279634	50.0
1409	1590	1591	109.570289755388	50.0
1410	1616	1590	166.654149019327	50.0
1411	1568	1590	284.542380030144	50.0
1412	1569	1616	135.118451550269	50.0
1413	1573	1569	111.147235227526	50.0
1414	1617	1618	9.90300482647948	50.0
1415	1618	1622	108.127753021637	50.0
1416	1573	1618	158.393148877244	50.0
1417	1620	1618	83.984204784511	50.0
1418	1620	1623	112.367267718666	50.0
1419	1621	1620	94.5329619114762	50.0
1420	1613	1621	112.3586690552	50.0
1421	1621	1624	107.6285609779	50.0
1423	1623	1624	92.1603479782683	50.0
1424	1623	1622	92.5310906848543	50.0
1425	1623	1632	115.273239569766	50.0
1426	1622	1633	117.715185346237	50.0
1427	1624	1627	125.164028650111	50.0
1428	1631	1629	7.348615055814616	50.0
1429	1629	1639	101.89347549091	50.0
1430	1638	1646	330.449535053239	50.0
1432	1632	1627	134.600887787658	50.0

Link - Node Table: (continued)

Link	Start	End	Length	Diameter

ID	Node	Node	m	mm
1433	1636	1628	125.523842220545	50.0
1434	1625	1631	109.622312809153	50.0
1435	1627	1628	21.08604281243982	50.0
1436	1615	1620	107.516599183176	50.0
1437	1616	1617	100.468880993009	50.0
1438	1617	1619	8.267286184000717	50.0
1439	1573	1574	106.581749315854	50.0
1440	1613	1614	7.90311141956763	50.0
1441	1595	1600	130.375446478378	50.0
1442	1625	1610	127.394307488865	50.0
1443	1602	1605	284.84	50.0
1444	1647	1636	299.433485503192	50.0
1445	1634	1668	256.601365205167	50.0
1446	1634	1583	97.871434316322	50.0
1447	1635	1636	95.8147625895389	50.0
1448	1635	1634	89.23041669282732	50.0
1449	1633	1634	110.694427378848	50.0
1450	1633	1577	137.272144775935	50.0
1451	1632	1633	88.1918764964327	50.0
1452	1632	1635	112.338964872586	50.0
1453	1577	1575	118.395513178973	50.0
1454	1574	1575	58.8211346233413	50.0
1455	1622	1575	174.447477143069	50.0
1456	1570	1567	314.81	50.0
1457	1577	1581	73.2152771211513	50.0
1458	1583	1667	228.782954708739	50.0
1459	1667	1678	189.438520173894	50.0
1460	1695	1678	83.0551364857994	50.0
1461	1669	1679	150.115170802897	50.0
1462	1679	1684	42.3460438275661	50.0
1463	1680	1679	43.70916172171209	50.0
1464	1669	1670	63.724686996639	50.0
1465	1670	1680	107.661014172536	50.0
1466	1668	1667	52.0247030613596	50.0
1467	1668	1669	15.987714084864937	50.0
1468	1670	1671	16.882030034657184	50.0
1469	1647	1646	48.6167565339682	50.0
1470	1681	1682	53.0118450358808	50.0
1471	1682	1702	45.30734598625288	50.0
1472	1702	1703	45.7603273490784	50.0
1473	1703	1709	58.7971857642778	50.0
1474	1701	1703	51.9335744546935	50.0
1475	1703	1704	60.4019221698996	50.0
1476	1686	1704	53.3449278751462	50.0
1477	1645	1685	88.8940837433557	50.0
1478	1704	1705	111.410021835041	50.0
1479	1644	1685	106.686814217377	50.0

Link ID	Start Node	End Node	Length m	Diameter mm
1480	1646	1645	69.9642028553048	75.0
1481	1643	1645	111.23729773794498	75.0
1482	1643	1641	257.68	75.0
1483	1644	1643	87.7035387428832	50.0
1484	1705	1644	91.6421647582152	50.0
1485	1705	1706	32.02	50.0
1486	1708	1709	52.2517636177915	50.0
1487	1706	1708	116.27	50.0
1488	1710	1718	110.936136287388	50.0
1489	1709	1720	122.56866922881	50.0
1490	1711	1715	59.1330974474218	50.0
1491	1696	1698	38.9393534272636	50.0
1492	1684	1697	43.8652657921648	50.0
1493	1697	1698	41.448847531197366	50.0
1494	1698	1701	47.6148369212191	50.0
1495	1698	1711	69.4676191725794	50.0
1496	1696	1713	78.5916392299693	50.0
1497	1713	1714	57.0127748561679	50.0
1498	1718	1715	83.7183382816001	50.0
1499	1719	1718	23.4833595218419	50.0
1500	1720	1707	214.66005231648498	50.0
1501	1714	1717	192.320555654528	50.0
1503	1571	1726	812.145528118512	50.0
1504	1571	1578	259.402923447308	50.0
1505	1578	1580	59.05231346107291	50.0
1506	1584	1664	137.986897634228	50.0
1507	1584	1580	120.69995829021715	50.0
1514	1664	1649	103.625036669512	50.0
1515	1650	1651	95.8314137990689	50.0
1553	1680	1683	43.7872570502907	50.0
1554	1683	1699	44.89236507413771	50.0
1555	1699	1701	44.2648414986718	50.0
1556	1701	1710	64.6659454627647	50.0
1557	1685	1682	87.1738255580576	50.0
1558	1647	1681	62.7850683863501	50.0
1561	1615	1616	88.2056121625668	50.0
1562	1333	1725	390.86	150.0
1563	1641	1725	275.40	100.0
1564	1727	1726	4.189221514172607	50.0
1565	1726	1566	354.281211232982	50.0
1730	1728	1649	130.44718382504	50.0
1731	1664	1729	309.619894313689	50.0
1733	1642	1641	206.82	50.0
1735	1732	1605	155.31	100.0
1736	1641	1732	219.11	100.0
2	1641	1	26.63	100.0
3	1	1643	239.67	100.0

Link ID	Start Node	End Node	Length m	Diameter mm
4	1605	2	19.37	100
5	2	1602	279.32	100
6	1571	3	245.17	50
7	3	1726	584.98	50

8	1570	4	65.77	50
9	4	1567	254.41	50

Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality
1566	0.08	2260.49	15.49	0.00
1567	0.08	2266.97	9.97	0.00
1568	0.08	2310.32	45.32	0.00
1569	0.08	2310.32	39.32	0.00
1570	0.08	2310.33	44.33	0.00
1571	0.08	2310.43	45.43	0.00
1572	0.08	2310.34	38.34	0.00
1573	0.08	2310.35	34.35	0.00
1574	0.08	2310.37	41.37	0.00
1575	0.08	2310.49	43.49	0.00
1577	0.08	2310.63	38.63	0.00
1578	0.08	2310.46	39.46	0.00
1580	0.08	2310.09	39.09	0.00
1581	0.08	2311.19	38.19	0.00
1582	0.08	2311.19	38.19	0.00
1583	0.08	2311.88	40.88	0.00
1584	0.08	2309.49	38.49	0.00
1590	0.08	2310.31	34.31	0.00
1591	0.08	2310.31	29.31	0.00
1592	0.08	2310.31	25.31	0.00
1593	0.08	2332.31	43.31	0.00
1594	0.08	2332.31	31.31	0.00
1595	0.08	2332.31	31.31	0.00
1596	0.08	2332.48	24.48	0.00
1597	0.08	2332.49	20.49	0.00
1598	0.08	2332.48	15.48	0.00
1599	0.08	2332.50	17.50	0.00
1600	0.08	2332.37	28.37	0.00
1601	0.08	2332.99	13.99	0.00
1602	0.08	2334.77	10.77	0.00
1603	0.08	2334.66	10.66	0.00
1604	0.08	2334.65	10.65	0.00
1605	0.08	2369.49	34.49	0.00
1606	0.08	2332.66	16.66	0.00
1607	0.08	2331.76	25.76	0.00

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Node Results: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality
1608	0.08	2332.57	29.57	0.00
1609	0.08	2332.40	26.40	0.00
1610	0.08	2331.74	29.74	0.00
1611	0.08	2332.32	39.32	0.00
1612	0.08	2310.31	21.31	0.00
1613	0.08	2310.32	21.32	0.00
1614	0.08	2310.31	21.31	0.00
1615	0.08	2310.32	27.32	0.00
1616	0.08	2310.32	33.32	0.00
1617	0.08	2310.36	33.36	0.00
1618	0.08	2310.38	33.38	0.00
1619	0.08	2310.36	33.36	0.00
1620	0.08	2310.40	30.40	0.00
1621	0.08	2310.41	22.41	0.00
1622	0.08	2310.58	32.58	0.00
1623	0.08	2310.61	24.61	0.00
1624	0.08	2310.61	22.61	0.00
1625	0.08	2331.75	36.75	0.00
1626	0.08	2332.22	35.22	0.00
1627	0.08	2311.03	20.03	0.00
1628	0.08	2311.14	20.14	0.00
1629	0.08	2331.18	38.18	0.00
1630	0.08	2331.20	38.20	0.00
1631	0.08	2331.20	38.20	0.00
1632	0.08	2311.01	27.01	0.00
1633	0.08	2310.96	29.96	0.00
1634	0.08	2311.86	35.86	0.00
1635	0.08	2311.72	29.72	0.00
1636	0.08	2311.99	22.99	0.00
1637	0.08	2330.20	36.20	0.00
1638	0.08	2330.15	36.15	0.00
1639	0.08	2330.20	36.20	0.00
1640	0.08	2331.71	24.71	0.00
1641	0.08	2369.49	44.49	0.00
1642	0.08	2369.47	37.47	0.00
1643	0.08	2323.68	17.68	0.00
1644	0.08	2319.54	15.54	0.00
1645	0.08	2321.95	25.95	0.00
1646	0.08	2321.72	35.72	0.00
1647	0.08	2317.59	33.59	0.00
1649	0.08	2308.73	41.73	0.00
1650	0.08	2308.65	43.65	0.00
1651	0.08	2308.62	44.62	0.00
1652	0.08	2308.62	44.62	0.00
1664	0.08	2308.95	33.95	0.00
1667	0.08	2315.37	37.37	0.00
1668	0.08	2315.53	33.53	0.00

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Node Results: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality
1669	0.08	2316.01	34.01	0.00
1670	0.08	2316.91	32.91	0.00
1671	0.08	2317.07	33.07	0.00
1672	0.08	2317.07	33.07	0.00
1678	0.08	2316.69	42.69	0.00
1679	0.08	2316.79	41.79	0.00
1680	0.08	2317.04	37.04	0.00
1681	0.08	2317.38	34.38	0.00
1682	0.08	2317.48	30.48	0.00
1683	0.08	2317.08	40.08	0.00

1684	0.08	2316.91	42.91	0.00
1685	0.08	2318.76	25.76	0.00
1686	0.08	2317.90	26.90	0.00
1695	0.08	2316.89	43.89	0.00
1696	0.08	2316.94	44.94	0.00
1697	0.08	2316.91	41.91	0.00
1698	0.08	2316.97	41.97	0.00
1699	0.08	2317.09	39.09	0.00
1700	0.08	2316.91	38.91	0.00
1701	0.08	2317.10	40.10	0.00
1702	0.08	2317.50	30.50	0.00
1703	0.08	2317.37	37.37	0.00
1704	0.08	2317.62	26.62	0.00
1705	0.08	2317.87	14.87	0.00
1706	0.08	2317.63	14.63	0.00
1707	0.08	2317.61	9.61	0.00
1708	0.08	2317.52	25.52	0.00
1709	0.08	2317.30	39.30	0.00
1710	0.08	2317.11	39.11	0.00
1711	0.08	2317.00	43.00	0.00
1713	0.08	2316.98	43.98	0.00
1714	0.08	2316.99	46.99	0.00
1715	0.08	2317.00	40.00	0.00
1717	0.08	2316.96	52.96	0.00
1718	0.08	2317.11	40.11	0.00
1719	0.08	2317.15	39.15	0.00
1720	0.08	2317.20	39.20	0.00
1721	0.08	2317.15	34.15	0.00
1724	0.08	2369.50	24.50	0.00
1725	0.08	2369.50	24.50	0.00
1726	0.08	2260.52	10.52	0.00
1727	0.08	2260.52	10.52	0.00
1728	0.08	2308.72	44.72	0.00
1729	0.08	2308.92	37.92	0.00
1732	0.00	2369.49	39.49	0.00
1333	-0.42	2369.50	0.50	0.00 Tank
1	-5.87	2326.00	1.00	0.00 Tank

Node Results: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality
2	-3.84	2336.00	1.00	0.00 Tank
3	-0.25	2261.00	1.00	0.00 Tank
4	-0.08	2267.00	1.00	0.00 Tank

Link Results:

Link ID	Flow LPS	VelocityUnit m/s	Headloss m/km	Status
1334	-0.08	0.04	0.11	Open
1335	0.08	0.04	0.12	Open
1336	-0.08	0.04	0.16	Open
1337	-0.08	0.04	0.11	Open
1338	0.25	0.13	0.81	Open
1339	0.08	0.04	0.12	Open
1340	1.10	0.56	12.70	Open
1341	-1.05	0.53	11.67	Open
1342	0.08	0.04	0.11	Open
1343	-0.91	0.47	9.03	Open
1344	0.08	0.04	0.10	Open
1345	0.08	0.04	0.13	Open
1346	-0.08	0.04	0.10	Open
1352	0.20	0.10	0.54	Open
1353	0.08	0.04	0.11	Open
1354	-0.20	0.10	0.55	Open
1355	0.59	0.30	3.99	Open
1356	-0.43	0.22	2.26	Open
1357	0.45	0.23	2.42	Open
1358	-0.59	0.30	3.98	Open
1359	-0.87	0.44	8.18	Open
1360	-0.83	0.42	7.63	Open
1361	-0.71	0.36	5.67	Open
1362	1.47	0.75	21.90	Open
1363	0.42	0.22	2.19	Open
1364	-0.48	0.24	2.72	Open
1366	0.18	0.09	0.47	Open
1367	0.05	0.02	0.04	Open
1368	0.19	0.10	0.50	Open
1369	0.16	0.08	0.34	Open
1370	0.07	0.04	0.08	Open
1371	-0.05	0.03	0.05	Open
1372	0.78	0.40	6.76	Open
1373	1.01	0.51	10.82	Open
1374	0.08	0.04	0.10	Open
1378	0.23	0.12	0.72	Open
1379	0.33	0.17	1.34	Open
1380	0.56	0.29	3.69	Open

Link Results: (continued)

Link ID	Flow LPS	VelocityUnit m/s	Headloss m/km	Status
1381	0.08	0.04	0.08	Open
1384	-0.88	0.45	8.47	Open
1385	0.80	0.41	7.05	Open
1386	0.80	0.41	7.09	Open
1387	0.90	0.46	8.81	Open
1388	-0.53	0.27	3.34	Open
1389	-1.45	0.74	21.34	Open
1390	-0.57	0.29	3.76	Open
1391	0.83	0.42	7.55	Open
1392	0.34	0.17	1.48	Open
1393	-0.14	0.07	0.29	Open
1394	-0.57	0.29	3.76	Open
1395	1.26	0.64	16.31	Open
1396	0.60	0.31	4.21	Open
1397	0.25	0.13	0.81	Open
1398	0.08	0.04	0.11	Open

1399	0.27	0.14	0.96	Open
1400	-0.15	0.08	0.31	Open
1401	0.07	0.03	0.07	Open
1402	-0.02	0.01	0.01	Open
1404	0.02	0.01	0.01	Open
1405	0.06	0.03	0.06	Open
1407	-0.07	0.03	0.07	Open
1408	0.07	0.04	0.09	Open
1409	0.03	0.02	0.02	Open
1410	0.07	0.04	0.08	Open
1411	0.04	0.02	0.03	Open
1412	-0.02	0.01	0.01	Open
1413	0.12	0.06	0.20	Open
1414	-0.33	0.17	1.38	Open
1415	-0.39	0.20	1.88	Open
1416	-0.11	0.06	0.19	Open
1417	0.14	0.07	0.27	Open
1418	-0.39	0.20	1.83	Open
1419	0.07	0.03	0.07	Open
1420	-0.24	0.12	0.79	Open
1421	-0.39	0.20	1.90	Open
1423	-0.06	0.03	0.05	Open
1424	0.14	0.07	0.28	Open
1425	-0.55	0.28	3.54	Open
1426	-0.53	0.27	3.27	Open
1427	-0.53	0.27	3.33	Open
1428	0.50	0.25	2.94	Open
1429	0.95	0.48	9.67	Open
1430	1.60	0.81	25.51	Open
1432	-0.08	0.04	0.11	Open
1433	0.78	0.40	6.78	Open

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
1434	0.66	0.34	4.99	Open
1435	-0.70	0.36	5.51	Open
1436	-0.23	0.12	0.70	Open
1437	-0.17	0.08	0.38	Open
1438	0.08	0.04	0.11	Open
1439	-0.13	0.07	0.25	Open
1440	0.17	0.08	0.38	Open
1441	-0.18	0.09	0.46	Open
1442	0.08	0.04	0.11	Open
1443	0.00	0.00	0.00	Closed
1444	1.35	0.69	18.69	Open
1445	-1.17	0.60	14.29	Open
1446	-0.12	0.06	0.22	Open
1447	-0.49	0.25	2.82	Open
1448	-0.35	0.18	1.52	Open
1449	-0.86	0.44	8.09	Open
1450	0.45	0.23	2.46	Open
1451	0.20	0.10	0.56	Open
1452	-0.75	0.38	6.32	Open
1453	0.30	0.15	1.13	Open
1454	-0.41	0.21	2.02	Open
1455	0.19	0.10	0.50	Open
1456	0.00	0.00	0.00	Closed
1457	-0.84	0.43	7.75	Open
1458	-1.21	0.62	15.26	Open
1459	-0.79	0.40	6.95	Open
1460	0.44	0.23	2.37	Open
1461	-0.68	0.35	5.20	Open
1462	-0.48	0.25	2.77	Open
1463	0.71	0.36	5.68	Open
1464	-1.16	0.59	14.07	Open
1465	-0.31	0.16	1.23	Open
1466	0.50	0.26	2.98	Open
1467	-1.76	0.89	30.30	Open
1468	-0.93	0.47	9.38	Open
1469	-3.06	1.56	84.94	Open
1470	-0.39	0.20	1.84	Open
1471	-0.15	0.08	0.33	Open
1472	0.48	0.24	2.70	Open
1473	0.32	0.16	1.26	Open
1474	-0.68	0.34	5.17	Open
1475	-0.60	0.30	4.12	Open
1476	0.68	0.35	5.23	Open
1477	1.93	0.98	35.96	Open
1478	-0.43	0.22	2.20	Open
1479	0.81	0.42	7.31	Open
1480	-1.55	0.35	3.32	Open

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
1481	3.56	0.80	15.53	Open
1482	0.00	0.00	0.00	Closed
1483	-2.23	1.14	47.25	Open
1484	-1.33	0.68	18.22	Open
1485	0.83	0.42	7.49	Open
1486	0.61	0.31	4.24	Open
1487	0.27	0.14	0.92	Open
1488	0.00	0.00	0.00	Open
1489	0.25	0.13	0.83	Open
1490	0.00	0.00	0.00	Open
1491	-0.23	0.11	0.68	Open
1492	0.02	0.01	0.01	Open
1493	-0.34	0.18	1.48	Open
1494	-0.48	0.25	2.78	Open
1495	-0.17	0.09	0.40	Open
1496	-0.18	0.09	0.46	Open
1497	-0.07	0.03	0.07	Open
1498	0.32	0.16	1.29	Open
1499	0.40	0.20	1.93	Open
1500	-0.39	0.20	1.91	Open
1501	0.08	0.04	0.11	Open
1503	0.00	0.00	0.00	Closed

1504	-0.08	0.04	0.11	Open
1505	0.75	0.38	6.23	Open
1506	0.58	0.30	3.91	Open
1507	-0.66	0.34	5.00	Open
1514	0.41	0.21	2.10	Open
1515	0.17	0.08	0.38	Open
1553	-0.27	0.14	0.96	Open
1554	-0.08	0.04	0.10	Open
1555	-0.16	0.08	0.36	Open
1556	-0.05	0.03	0.04	Open
1557	1.18	0.60	14.62	Open
1558	0.53	0.27	3.29	Open
1561	0.01	0.00	0.00	Open
1562	0.42	0.02	0.01	Open
1563	-0.25	0.03	0.03	Open
1564	-0.08	0.04	0.11	Open
1565	0.08	0.04	0.11	Open
1730	-0.08	0.04	0.11	Open
1731	0.08	0.04	0.11	Open
1733	-0.08	0.04	0.11	Open
1735	0.08	0.01	0.00	Open
1736	0.08	0.01	0.00	Open
2	0.00	0.00	0.00	Closed
3	5.87	0.75	9.68	Open
4	0.00	0.00	0.00	Closed

Link Results: (continued)

Link ID	Flow LPS	VelocityUnit m/s	Headloss m/km	Status
5	3.84	0.49	4.41	Open
6	0.00	0.00	0.00	Closed
7	0.25	0.13	0.81	Open
8	0.00	0.00	0.00	Closed
9	0.08	0.04	0.11	Open


```
*************************************************************************
*                            E P A N E T                                *
*                     Hydraulic and Water Quality                       *
*                     Analysis for Pipe Networks                        *
*                          Version 2.0                                  *
*************************************************************************
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Input File: Gonde最大静水圧

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
1334	1652	1651	6.775775426162696	50.0
1335	1671	1672	6.011997607511936	50.0
1336	1724	1725	1.884172077575189	50.0
1337	1612	1614	4.151277025258093	50.0
1338	1649	1650	96.8323077458249	50.0
1339	1631	1630	4.825839357136028	50.0
1340	1647	1671	41.156512051862805	50.0
1341	1603	1602	9.629507141033637	50.0
1342	1597	1598	14.6878898405987	50.0
1343	1578	1577	18.3651719385027	50.0
1344	1719	1721	25.931768015662	50.0
1345	1595	1594	2.241792478102379	50.0
1346	1604	1603	10.878199333774292	50.0
1352	1711	1713	32.8216601593953	50.0
1353	1697	1700	45.756043525676	50.0
1354	1695	1697	42.5250258643849	50.0
1355	1683	1684	43.3409470772008	50.0
1356	1678	1679	45.5599760931318	50.0
1357	1710	1711	44.4678904329185	50.0
1358	1710	1709	48.090466142336005	50.0
1359	1683	1682	48.6117969862412	50.0
1360	1680	1681	44.8450561959843	50.0
1361	1702	1686	71.2913809326975	50.0
1362	1685	1686	39.0515165313228	50.0
1363	1704	1708	46.4155196005035	50.0
1364	1707	1706	9.09579514123366	50.0
1366	1607	1640	111.000075932829	50.0
1367	1573	1572	60.4594536265418	50.0
1368	1574	1572	58.8636210118129	50.0
1369	1572	1570	45.59	50.0
1370	1570	1568	86.05	50.0
1371	1568	1569	50.3385821158312	50.0
1372	1639	1638	6.91536836450975	50.0
1373	1583	1581	63.5202973344365	50.0
1374	1581	1582	11.811853595495016	50.0
1378	1715	1714	19.1333687624565	50.0
1379	1696	1695	43.3581776115056	50.0

Link - Node Table: (continued)

Link ID	Start Node	End Node	Length m	Diameter mm
1380	1720	1719	12.027045497426068	50.0
1381	1639	1637	3.669426352811328	50.0
1384	1606	1603	235.30961853205	50.0
1385	1606	1640	134.640449235614	50.0
1386	1608	1607	113.29750502583	50.0
1387	1640	1638	177.478169235934	50.0
1388	1629	1607	174.670269613134	50.0
1389	1608	1602	103.080437980534	50.0
1390	1626	1608	91.16997103363381	50.0
1391	1626	1625	62.8085647473159	50.0
1392	1609	1626	120.06272046198	50.0
1393	1600	1609	112.742451581117	50.0
1394	1609	1601	155.907452657075	50.0
1395	1602	1601	109.112912753492	50.0
1396	1601	1599	115.884939883097	50.0
1397	1599	1597	18.342546633304	50.0
1398	1597	1596	88.5836568470468	50.0
1399	1599	1600	135.796122116837	50.0
1400	1611	1600	167.47412385338296	50.0
1401	1611	1593	124.954307250344	50.0
1402	1593	1595	181.011466727457	50.0
1404	1591	1592	102.56823544886701	50.0
1405	1613	1592	137.358228681006	50.0
1407	1613	1615	93.7927900759455	50.0
1408	1615	1591	168.362392279634	50.0
1409	1590	1591	109.570289755388	50.0
1410	1616	1590	166.654149019327	50.0
1411	1568	1590	284.542380030144	50.0
1412	1569	1616	135.118451550269	50.0
1413	1573	1569	111.147235227526	50.0
1414	1617	1618	9.90300482647948	50.0
1415	1618	1622	108.127753021637	50.0
1416	1573	1618	158.393148877244	50.0
1417	1620	1618	83.984204784511	50.0
1418	1620	1623	112.367267718666	50.0
1419	1621	1620	94.5329619114762	50.0
1420	1613	1621	112.3586690552	50.0
1421	1621	1624	107.6285609779	50.0
1423	1623	1624	92.1603479782683	50.0
1424	1623	1622	92.5310906848543	50.0
1425	1623	1632	115.273239569766	50.0
1426	1622	1633	117.715185346237	50.0
1427	1624	1627	125.164028650111	50.0
1428	1631	1629	7.348615055814616	50.0
1429	1629	1639	101.89347549091	50.0
1432	1632	1627	134.600887787658	50.0
1433	1636	1628	125.523842220545	50.0

Link - Node Table: (continued)

Link ID	Start Node	End Node	Length m	Diameter mm
1434	1625	1631	109.622312809153	50.0
1435	1627	1628	21.08604281243982	50.0
1436	1615	1620	107.516599183176	50.0
1437	1616	1617	100.468880993009	50.0
1438	1617	1619	8.267286184000717	50.0
1439	1573	1574	106.581749315854	50.0
1440	1613	1614	7.90311141956763	50.0
1441	1595	1600	130.375446478378	50.0
1442	1625	1610	127.394307488865	50.0
1443	1602	1605	284.84	50.0
1444	1647	1636	299.433485503192	50.0
1445	1634	1668	256.601365205167	50.0
1446	1634	1583	97.871434316322	50.0
1447	1635	1636	95.8147625895389	50.0
1448	1635	1634	89.23041669282732	50.0
1449	1633	1634	110.694427378848	50.0
1450	1633	1577	137.272144775935	50.0
1451	1632	1633	88.1918764964327	50.0
1452	1632	1635	112.338964872586	50.0
1453	1577	1575	118.395513178973	50.0
1454	1574	1575	58.8211346233413	50.0
1455	1622	1575	174.447477143069	50.0
1456	1570	1567	314.81	50.0
1457	1577	1581	73.2152771211513	50.0
1458	1583	1667	228.782954708739	50.0
1459	1667	1678	189.438520173894	50.0
1460	1695	1678	83.0551364857994	50.0
1461	1669	1679	150.115170802897	50.0
1462	1679	1684	42.3460438275661	50.0
1463	1680	1679	43.70916172171209	50.0
1464	1669	1670	63.724686996639	50.0
1465	1670	1680	107.661014172536	50.0
1466	1668	1667	52.0247030613596	50.0
1467	1668	1669	15.987714084864937	50.0
1468	1670	1671	16.882030034657184	50.0
1469	1647	1646	48.6167565339682	50.0
1470	1681	1682	53.0118450358808	50.0
1471	1682	1702	45.30734598625288	50.0
1472	1702	1703	45.7603273490784	50.0
1473	1703	1709	58.7971857642778	50.0
1474	1701	1703	51.9335744546935	50.0
1475	1703	1704	60.4019221698996	50.0
1476	1686	1704	53.3449278751462	50.0
1477	1645	1685	88.8940837433557	50.0
1478	1704	1705	111.410021835041	50.0
1479	1644	1685	106.686814217377	50.0
1480	1646	1645	69.9642028553048	75.0

Link - Node Table: (continued)

Link ID	Start Node	End Node	Length m	Diameter mm
1481	1643	1645	110.26	75.0

1482	1643	1641	257.68	75.0
1483	1644	1643	87.35	50.0
1484	1705	1644	91.6421647582152	50.0
1485	1705	1706	32.02910616440998	50.0
1486	1708	1709	52.2517636177915	50.0
1487	1706	1708	116.788031696158	50.0
1488	1710	1718	110.936136287388	50.0
1489	1709	1720	122.56866922881	50.0
1490	1711	1715	59.1330974474218	50.0
1491	1696	1698	38.9393534272636	50.0
1492	1684	1697	43.8652657921648	50.0
1493	1697	1698	41.448847531197366	50.0
1494	1698	1701	47.6148369212191	50.0
1495	1698	1711	69.4676191725794	50.0
1496	1696	1713	78.5916392299693	50.0
1497	1713	1714	57.0127748561679	50.0
1498	1718	1715	83.7183382816001	50.0
1499	1719	1718	23.4833595218419	50.0
1500	1720	1707	214.66005231648498	50.0
1501	1714	1717	192.320555654528	50.0
1503	1571	1726	812.145528118512	50.0
1504	1571	1578	259.402923447308	50.0
1505	1578	1580	59.05231346107291	50.0
1506	1584	1664	137.986897634228	50.0
1507	1584	1580	120.69995829021715	50.0
1514	1664	1649	103.625036669512	50.0
1515	1650	1651	95.8314137990689	50.0
1553	1680	1683	43.7872570502907	50.0
1554	1683	1699	44.89236507413771	50.0
1555	1699	1701	44.2648414986718	50.0
1556	1701	1710	64.6659454627647	50.0
1557	1685	1682	87.1738255580576	50.0
1558	1647	1681	62.7850683863501	50.0
1561	1615	1616	88.2056121625668	50.0
1562	1333	1725	390.86	150.0
1563	1641	1725	275.40	100.0
1564	1727	1726	4.189221514172607	50.0
1565	1726	1566	354.281211232982	50.0
1730	1728	1649	130.44718382504	50.0
1731	1664	1729	309.619894313689	50.0
1733	1642	1641	206.82	50.0
1735	1732	1605	155.31	100.0
1736	1641	1732	219.11	100.0
2	1641	1	26.40	100.0
3	1	1643	239.50	100.0
4	1605	2	14.18	100.0

Page 5
Link - Node Table: (continued)

Link ID	Start Node	End Node	Length m	Diameter mm
5	2	1602	281.50	100.0
6	1571	3	267.64	50.0
7	3	1726	575.76	50.0
1	1646	1638	331.71	50.0
8	1570	4	68.28	50.0
9	4	1567	252.34	50.0

Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality
1566	0.00	2261.00	16.00	0.00
1567	0.00	2267.00	10.00	0.00
1568	0.00	2336.00	71.00	0.00
1569	0.00	2336.00	65.00	0.00
1570	0.00	2336.00	70.00	0.00
1571	0.00	2336.00	71.00	0.00
1572	0.00	2336.00	64.00	0.00
1573	0.00	2336.00	60.00	0.00
1574	0.00	2336.00	67.00	0.00
1575	0.00	2336.00	69.00	0.00
1577	0.00	2336.00	64.00	0.00
1578	0.00	2336.00	65.00	0.00
1580	0.00	2336.00	65.00	0.00
1581	0.00	2336.00	63.00	0.00
1582	0.00	2336.00	63.00	0.00
1583	0.00	2336.00	65.00	0.00
1584	0.00	2336.00	65.00	0.00
1590	0.00	2336.00	60.00	0.00
1591	0.00	2336.00	55.00	0.00
1592	0.00	2336.00	51.00	0.00
1593	0.00	2336.00	47.00	0.00
1594	0.00	2336.00	35.00	0.00
1595	0.00	2336.00	35.00	0.00
1596	0.00	2336.00	28.00	0.00
1597	0.00	2336.00	24.00	0.00
1598	0.00	2336.00	19.00	0.00
1599	0.00	2336.00	21.00	0.00
1600	0.00	2336.00	32.00	0.00
1601	0.00	2336.00	17.00	0.00
1602	0.00	2336.00	12.00	0.00
1603	0.00	2336.00	12.00	0.00
1604	0.00	2336.00	12.00	0.00
1605	0.00	2372.00	37.00	0.00
1606	0.00	2336.00	20.00	0.00
1607	0.00	2336.00	30.00	0.00

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Node Results: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality
1608	0.00	2336.00	33.00	0.00
1609	0.00	2336.00	30.00	0.00
1610	0.00	2336.00	34.00	0.00
1611	0.00	2336.00	43.00	0.00
1612	0.00	2336.00	47.00	0.00
1613	0.00	2336.00	47.00	0.00
1614	0.00	2336.00	47.00	0.00

1615	0.00	2336.00	53.00	0.00
1616	0.00	2336.00	59.00	0.00
1617	0.00	2336.00	59.00	0.00
1618	0.00	2336.00	59.00	0.00
1619	0.00	2336.00	59.00	0.00
1620	0.00	2336.00	56.00	0.00
1621	0.00	2336.00	48.00	0.00
1622	0.00	2336.00	58.00	0.00
1623	0.00	2336.00	50.00	0.00
1624	0.00	2336.00	48.00	0.00
1625	0.00	2336.00	41.00	0.00
1626	0.00	2336.00	39.00	0.00
1627	0.00	2336.00	45.00	0.00
1628	0.00	2336.00	45.00	0.00
1629	0.00	2336.00	43.00	0.00
1630	0.00	2336.00	43.00	0.00
1631	0.00	2336.00	43.00	0.00
1632	0.00	2336.00	52.00	0.00
1633	0.00	2336.00	55.00	0.00
1634	0.00	2336.00	60.00	0.00
1635	0.00	2336.00	54.00	0.00
1636	0.00	2336.00	47.00	0.00
1637	0.00	2336.00	42.00	0.00
1638	0.00	2336.00	42.00	0.00
1639	0.00	2336.00	42.00	0.00
1640	0.00	2336.00	29.00	0.00
1641	0.00	2372.00	47.00	0.00
1642	0.00	2372.00	40.00	0.00
1643	0.00	2336.00	30.00	0.00
1644	0.00	2336.00	32.00	0.00
1645	0.00	2336.00	40.00	0.00
1646	0.00	2336.00	50.00	0.00
1647	0.00	2336.00	52.00	0.00
1649	0.00	2336.00	69.00	0.00
1650	0.00	2336.00	71.00	0.00
1651	0.00	2336.00	72.00	0.00
1652	0.00	2336.00	72.00	0.00
1664	0.00	2336.00	61.00	0.00
1667	0.00	2336.00	58.00	0.00
1668	0.00	2336.00	54.00	0.00

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Node Results: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality
1669	0.00	2336.00	54.00	0.00
1670	0.00	2336.00	52.00	0.00
1671	0.00	2336.00	52.00	0.00
1672	0.00	2336.00	52.00	0.00
1678	0.00	2336.00	62.00	0.00
1679	0.00	2336.00	61.00	0.00
1680	0.00	2336.00	56.00	0.00
1681	0.00	2336.00	53.00	0.00
1682	0.00	2336.00	49.00	0.00
1683	0.00	2336.00	59.00	0.00
1684	0.00	2336.00	62.00	0.00
1685	0.00	2336.00	43.00	0.00
1686	0.00	2336.00	45.00	0.00
1695	0.00	2336.00	63.00	0.00
1696	0.00	2336.00	64.00	0.00
1697	0.00	2336.00	61.00	0.00
1698	0.00	2336.00	61.00	0.00
1699	0.00	2336.00	58.00	0.00
1700	0.00	2336.00	58.00	0.00
1701	0.00	2336.00	59.00	0.00
1702	0.00	2336.00	49.00	0.00
1703	0.00	2336.00	56.00	0.00
1704	0.00	2336.00	45.00	0.00
1705	0.00	2336.00	33.00	0.00
1706	0.00	2336.00	33.00	0.00
1707	0.00	2336.00	28.00	0.00
1708	0.00	2336.00	44.00	0.00
1709	0.00	2336.00	58.00	0.00
1710	0.00	2336.00	58.00	0.00
1711	0.00	2336.00	62.00	0.00
1713	0.00	2336.00	63.00	0.00
1714	0.00	2336.00	66.00	0.00
1715	0.00	2336.00	59.00	0.00
1717	0.00	2336.00	72.00	0.00
1718	0.00	2336.00	59.00	0.00
1719	0.00	2336.00	58.00	0.00
1720	0.00	2336.00	58.00	0.00
1721	0.00	2336.00	53.00	0.00
1724	0.00	2372.00	27.00	0.00
1725	0.00	2372.00	27.00	0.00
1726	0.00	2261.00	11.00	0.00
1727	0.00	2261.00	11.00	0.00
1728	0.00	2336.00	72.00	0.00
1729	0.00	2336.00	65.00	0.00
1732	0.00	2372.00	42.00	0.00
1333	0.00	2372.00	3.00	0.00 Tank
1	0.00	2326.00	1.00	0.00 Tank

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Node Results: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality
2	-0.01	2336.00	1.00	0.00 Tank
3	0.00	2261.00	1.00	0.00 Tank
4	0.00	2267.00	1.00	0.00 Tank

Link Results:

Link ID	Flow LPS	VelocityUnit m/s	Headloss m/km	Status
1334	0.00	0.00	0.00	Open
1335	0.00	0.00	0.00	Open
1336	0.00	0.00	0.00	Open
1337	0.00	0.00	0.00	Open

1338	0.00	0.00	0.00	Open
1339	0.00	0.00	0.00	Open
1340	0.00	0.00	0.00	Open
1341	0.00	0.00	0.00	Open
1342	0.00	0.00	0.00	Open
1343	0.00	0.00	0.00	Open
1344	0.00	0.00	0.00	Open
1345	0.00	0.00	0.00	Open
1346	0.00	0.00	0.00	Open
1352	0.00	0.00	0.00	Open
1353	0.00	0.00	0.00	Open
1354	0.00	0.00	0.00	Open
1355	0.00	0.00	0.00	Open
1356	0.00	0.00	0.00	Open
1357	0.00	0.00	0.00	Open
1358	0.00	0.00	0.00	Open
1359	0.00	0.00	0.00	Open
1360	0.00	0.00	0.00	Open
1361	0.00	0.00	0.00	Open
1362	0.00	0.00	0.00	Open
1363	0.00	0.00	0.00	Open
1364	0.00	0.00	0.00	Open
1366	0.00	0.00	0.00	Open
1367	0.00	0.00	0.00	Open
1368	0.00	0.00	0.00	Open
1369	0.00	0.00	0.00	Open
1370	0.00	0.00	0.00	Open
1371	0.00	0.00	0.00	Open
1372	0.00	0.00	0.00	Open
1373	0.00	0.00	0.00	Open
1374	0.00	0.00	0.00	Open
1378	0.00	0.00	0.00	Open
1379	0.00	0.00	0.00	Open
1380	0.00	0.00	0.00	Open

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
1381	0.00	0.00	0.00	Open
1384	0.00	0.00	0.00	Open
1385	0.00	0.00	0.00	Open
1386	0.00	0.00	0.00	Open
1387	0.00	0.00	0.00	Open
1388	0.00	0.00	0.00	Open
1389	0.00	0.00	0.00	Open
1390	0.00	0.00	0.00	Open
1391	0.00	0.00	0.00	Open
1392	0.00	0.00	0.00	Open
1393	0.00	0.00	0.00	Open
1394	0.00	0.00	0.00	Open
1395	0.00	0.00	0.00	Open
1396	0.00	0.00	0.00	Open
1397	0.00	0.00	0.00	Open
1398	0.00	0.00	0.00	Open
1399	0.00	0.00	0.00	Open
1400	0.00	0.00	0.00	Open
1401	0.00	0.00	0.00	Open
1402	0.00	0.00	0.00	Open
1404	0.00	0.00	0.00	Open
1405	0.00	0.00	0.00	Open
1407	0.00	0.00	0.00	Open
1408	0.00	0.00	0.00	Open
1409	0.00	0.00	0.00	Open
1410	0.00	0.00	0.00	Open
1411	0.00	0.00	0.00	Open
1412	0.00	0.00	0.00	Open
1413	0.00	0.00	0.00	Open
1414	0.00	0.00	0.00	Open
1415	0.00	0.00	0.00	Open
1416	0.00	0.00	0.00	Open
1417	0.00	0.00	0.00	Open
1418	0.00	0.00	0.00	Open
1419	0.00	0.00	0.00	Open
1420	0.00	0.00	0.00	Open
1421	0.00	0.00	0.00	Open
1423	0.00	0.00	0.00	Open
1424	0.00	0.00	0.00	Open
1425	0.00	0.00	0.00	Open
1426	0.00	0.00	0.00	Open
1427	0.00	0.00	0.00	Open
1428	0.00	0.00	0.00	Open
1429	0.00	0.00	0.00	Open
1432	0.00	0.00	0.00	Open
1433	0.00	0.00	0.00	Open
1434	0.00	0.00	0.00	Open

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
1435	0.00	0.00	0.00	Open
1436	0.00	0.00	0.00	Open
1437	0.00	0.00	0.00	Open
1438	0.00	0.00	0.00	Open
1439	0.00	0.00	0.00	Open
1440	0.00	0.00	0.00	Open
1441	0.00	0.00	0.00	Open
1442	0.00	0.00	0.00	Open
1443	0.00	0.00	0.00	Closed
1444	0.00	0.00	0.00	Open
1445	0.00	0.00	0.00	Open
1446	0.00	0.00	0.00	Open
1447	0.00	0.00	0.00	Open
1448	0.00	0.00	0.00	Open
1449	0.00	0.00	0.00	Open
1450	0.00	0.00	0.00	Open
1451	0.00	0.00	0.00	Open
1452	0.00	0.00	0.00	Open
1453	0.00	0.00	0.00	Open

1454	0.00	0.00	0.00	Open
1455	0.00	0.00	0.00	Open
1456	0.00	0.00	0.00	Closed
1457	0.00	0.00	0.00	Open
1458	0.00	0.00	0.00	Open
1459	0.00	0.00	0.00	Open
1460	0.00	0.00	0.00	Open
1461	0.00	0.00	0.00	Open
1462	0.00	0.00	0.00	Open
1463	0.00	0.00	0.00	Open
1464	0.00	0.00	0.00	Open
1465	0.00	0.00	0.00	Open
1466	0.00	0.00	0.00	Open
1467	0.00	0.00	0.00	Open
1468	0.00	0.00	0.00	Open
1469	0.00	0.00	0.00	Open
1470	0.00	0.00	0.00	Open
1471	0.00	0.00	0.00	Open
1472	0.00	0.00	0.00	Open
1473	0.00	0.00	0.00	Open
1474	0.00	0.00	0.00	Open
1475	0.00	0.00	0.00	Open
1476	0.00	0.00	0.00	Open
1477	0.00	0.00	0.00	Open
1478	0.00	0.00	0.00	Open
1479	0.00	0.00	0.00	Open
1480	0.00	0.00	0.00	Open
1481	0.00	0.00	0.00	Closed

Link ID	Flow LPS	VelocityUnit m/s	Headloss m/km	Status
1482	0.00	0.00	0.00	Closed
1483	0.00	0.00	0.00	Open
1484	0.00	0.00	0.00	Open
1485	0.00	0.00	0.00	Open
1486	0.00	0.00	0.00	Open
1487	0.00	0.00	0.00	Open
1488	0.00	0.00	0.00	Open
1489	0.00	0.00	0.00	Open
1490	0.00	0.00	0.00	Open
1491	0.00	0.00	0.00	Open
1492	0.00	0.00	0.00	Open
1493	0.00	0.00	0.00	Open
1494	0.00	0.00	0.00	Open
1495	0.00	0.00	0.00	Open
1496	0.00	0.00	0.00	Open
1497	0.00	0.00	0.00	Open
1498	0.00	0.00	0.00	Open
1499	0.00	0.00	0.00	Open
1500	0.00	0.00	0.00	Open
1501	0.00	0.00	0.00	Open
1503	0.00	0.00	0.00	Closed
1504	0.00	0.00	0.00	Open
1505	0.00	0.00	0.00	Open
1506	0.00	0.00	0.00	Open
1507	0.00	0.00	0.00	Open
1514	0.00	0.00	0.00	Open
1515	0.00	0.00	0.00	Open
1553	0.00	0.00	0.00	Open
1554	0.00	0.00	0.00	Open
1555	0.00	0.00	0.00	Open
1556	0.00	0.00	0.00	Open
1557	0.00	0.00	0.00	Open
1558	0.00	0.00	0.00	Open
1561	0.00	0.00	0.00	Open
1562	0.00	0.00	0.00	Open
1563	0.00	0.00	0.00	Open
1564	0.00	0.00	0.00	Open
1565	0.00	0.00	0.00	Open
1730	0.00	0.00	0.00	Open
1731	0.00	0.00	0.00	Open
1733	0.00	0.00	0.00	Open
1735	0.00	0.00	0.00	Open
1736	0.00	0.00	0.00	Open
2	0.00	0.00	0.00	Closed
3	0.00	0.00	0.00	Closed
4	0.00	0.00	0.00	Closed
5	0.01	0.00	0.00	Open

Link ID	Flow LPS	VelocityUnit m/s	Headloss m/km	Status
6	0.00	0.00	0.00	Closed
7	0.00	0.00	0.00	Open
1	0.00	0.00	0.00	Open
8	0.00	0.00	0.00	Closed
9	0.00	0.00	0.00	Open

6(2) 収集資料リスト

資料- 6 (2) 収集資料リスト

No.	資料名	元データ	形式	発行機関	発行年
1	OWNP-CWA, Annual Report 2010 EFY, Oromia	報告書	World	Oromia National Regional State	Jul. 2018
2	Criteria of urban and rural drinking water which is administrative by Board and Oromia civil services	報告書	World	Oromia National Regional State	-
3	Proclamation No.78/2004: A Proclamation to provide for the Establishment of Urban Water Supply and Sewerage Service Enterprises of the Oromia Regional State	報告書	PDF	Oromia National Regional State	2004
4	Proclamation No.152/2009: A proclamation to provide for the Establishment and Administration of Oromia National Regional State Rural potable water service Organizations	報告書	PDF	Oromia National Regional State	2009
5	GTP-II (2008 -2012) Plan Document	報告書	PDF	OWERDB	Oct. 2014
6	Program Operational Manual (POM) for the Consolidated WASH Account (CWA) Phase II	報告書	PDF	Government of Ethiopia	Sep. 2019
7	ONE WASH NATIONAL PROGRAMME PHASE II Programme Document	報告書	PDF	Government of Ethiopia	Nov.2018
8	ONE WASH NATIONAL PROGRAMME REVIEW OF PHASE I	報告書	PDF	Government of Ethiopia	Mar. 2018
9	(OWNP-CWA) PHASE ONE PROGRAM COMPLETION REPORT Draft	報告書	PDF	Government of Ethiopia	Jun.2020
10	Flood Alert	報告書	PDF	Federal Democratic Republic of Ethiopia National Disaster Risk Management Commission, Early Warning and Emergency Response Directorate	Apr. 2018
11	NATIONAL GUIDELINE NATIONAL GUIDELINE FOR URBAN WATER UTILITIES TARIFF SETTING	報告書	PDF	MINISTRY OF WATER AND ENERGY	Mar. 2013
12	Design and Implementation Manual for Solar Water Pumping, Final Manual	報告書	PDF	Ministry of Water, Irrigation and Energy	Apr. 2018
13	Solar Water Pumping System (SWPS) Installation Guide	報告書	PDF	USAID Lowland WASH	Apr. 2018
14	DISASTER RISK PROFILE Ethiopia	報告書	PDF	World Bank	Jul. 2019
15	2017 Ethiopia Projected Population	データ	Excel	Central Statistical Authority	Arp. 2019
16	Ethiopian Drinking Water Standard Third Edition (ES 58)	基準	PDF	Ethiopia Standard Agency	2019
17	Ethiopian Drinking Water Standard First Edition (ES 58)	基準	PDF	Ethiopia Standard Agency	2013
18	National Guideline for Urban Water Utilities Tariff Setting	報告書	PDF	Ministry of Water and Energy	Mar. 2013
19	Operation and Maintenance Manual	報告書	PDF	Ministry of Water and Energy	Sep. 2012
20	Ten Year Development Plan (2021-2030)	報告書	PDF	Government of Ethiopia	Feb.2021
21	Growth and Transformation Plan II (GTP II) (2015/16-2019/20)	報告書	PDF	Government of Ethiopia	May. 2016
22	Ten Years (2020/21- 2029/30) Development Plan	報告書	PDF	Ministry of Water Irrigation and Energy	Jul. 2020
23	Second Growth and Transformation National Plan for the Water Supply and Sanitation Sub-Sector (2015/16 – 2019/20)	報告書	PDF	Ministry of Water Irrigation and Energy	2015
24	Revised Rural Water Supply Universal Access Plan (UAP)	報告書	PDF	MINISTRY OF WATER AND ENERGY	Dec. 2011
25	Council of Ministers Regulations No.1352007 Council of Ministers Regulations for Property Situated on Landholding Expropriated for Public Purposes	法規	PDF	Government of Ethiopia	May. 2007
26	Proclamation No. 1161/2019 Expropriation of Land holdings for Public Purposes, Payments of Compensation and Resettlement of Displaced People	法規	Photo	Government of Ethiopia	Sep. 2019
27	Proclamation No.130/2007 to amend the proclamation No.56/2002, 70/2003, 103/2005 of Oromia Rural Land Use and Administration	法規	PDF	Oromia National Regional State	July 2007

No.	資料名	元データ	形式	発行機関	発行年
28	Proclamation No.455／2005 Expropriation of Landholdings for Public Purposes and Payment of Compensation Proclamation	法規	PDF	Government of Ethiopia	July 2005
29	Proclamation No.456／2005 Federal Democratic Republic of Ethiopia Rural Land Administration and Land Use Proclamation	法規	PDF	Government of Ethiopia	July 2005
30	Census 2007 Report Oromia	報告書	PDF	Central Statistical Authority	2007
31	2007 Population and Housing Census of Ethiopia	報告書	PDF	Central Statistical Authority	2007
32	The 2015／16 Ethiopian Household Consumption-Expenditure (HCE) Survey Result for Oromia Region	報告書	PDF	Central Statistical Agency	Mar. 2018
33	National Statistics Abstract 2012_agriculture	報告書	PDF	Central Statistical Authority	2012
34	National Statistics Abstract 2012_Health	報告書	PDF	Central Statistical Authority	2012
35	National Statistics Abstract 2012_Education	報告書	PDF	Central Statistical Authority	2012
36	2007 Population and Housing Census of Ethiopia Statistical Oromia	報告書	PDF	Central Statistical Authority	2007
37	Health and Nutrition Survey 1998	報告書	PDF	Central Statistical Agency, Ministry of Finance and Economic Development	Jun. 2011
38	Demographic and Health Survey, HIV Prevalence Report 2016	報告書	PDF	Central Statistical Agency	Jan, 2018
39	Demographic and Health Survey Report 2016	報告書	PDF	Central Statistical Agency	Jul, 2017
40	Mini Demographic and Health Survey, Key Indicators 2019	報告書	PDF	Federal Ministry of Health	Jul, 2019
41	PROCLAMATION NO. 299/2002 ENVIRONMENTAL IMPACT ASSESSMENT PROCLAMATION	法規	PDF	Government of Ethiopia	Nov. 2003
42	ENVIRONMENTAL IMPACT ASSESSMENT PROCEDURAL GUIDELINE	報告書	PDF	Government of Ethiopia	Dec. 2002
43	ENVIRONMENTAL IMPACT ASSESSMENT GUIDELINE DOCUMENT	報告書	PDF	Government of Ethiopia	May. 2000
44	Environmental Standards for Industrial Pollution Control in Ethiopia	報告書	PDF	Government of Ethiopia	Nov. 2003
45	Proclamation No. 147/2009 A Proclamation to Provide for the Establishment of Oromia Bureau of Land and Environmental Protection	法規	PDF	Government of Ethiopia	March. 2009
46	ETHIOPIA’s ENVIRONMENTAL AND SOCIAL SAFEGUARDS FRAMEWORK (ESSF) FOR THE CRGE INITIATIVE	報告書	PDF	Government of Ethiopia	Feb. 2015
47	PROCLAMATION NO.300/2002 ENVIRONMENTAL POLLUTION CONTROL PROCLAMATION	法規	PDF	Government of Ethiopia	Dec.2002
48	Proclamation No. 513-2007 Solid Waste Management	法規	PDF	Government of Ethiopia	Dec. 2002
49	Proclamation No. 89/1997 Federal Rural Land Administration	法規	PDF	Government of Ethiopia	July. 1997
50	Council of Ministers Regulation No 135/2007 Payment of Compensation for Property Situated on Landholdings Expropriated for Public Purpose	法規	PDF	Government of Ethiopia	May. 2007
51	(Draft) Proclamation 2019, Expropriation of Landholdings for Public Purpose and Payment of Compensation	報告書	PDF	Government of Ethiopia	2019