Chapter 3 Project Evaluation and Recommendation

Chapter 3 Project Evaluation and Recommendations

3-1 Project Effect

The water supply in Abbottabd City, Nawanshehr City and 12 peripheral villages have been developed relying on groundwater for a long period. The population in the service area is estimated 169,880 in 2003, and the water supply capacity of the three water supply systems is 13,166 m3/day in total. The service coverage of Abbottabd City is estimated 79%, that of Nawanshehr City is almost 100% and 37 ~ 79% in peripheral villages. The groundwater and spring water in this area are widely used by Cantonment Boards, military facilities and private sectors in addition to the above mentioned water supply systems.

In recent years, the expansion and improvement of water supply are being required urgently to cope with the increasing population and expansion of urban areas in addition to decreasing of exploitation from the existing wells. It is estimated that the groundwater utilization in this area is presently near the limit according to the review on groundwater recharge comparing with increasing water demand. In other words, the groundwater recharge will be less than water demand by 2007 even during normal year of precipitation. Actually, the depletion phenomenon appears in Ilayasi Mosque Spring for a period from year 1998 up to now. There has never been experienced such phenomenon before.

Furthermore, current water supply system is such system that groundwater is once pumped up to the reservoirs at elevated positions from where water is distributed to the service areas by gravity. Accordingly high electric power cost by high pump lift affects largely financial deficit of the water supply agencies.

Taking such conditions of the present water supply system into account, the Project aims at increasing service coverage ratio and coping with increasing water demand for the target year of 2010, taking surface water, as stable and long term water source, from the valley located in the east of Abbottabad City and supply water to the service area by gravity. The effective use of the existing well water is also taking into account.

3-1-1 Direct Effects

1) Improvement of Water Supply Conditions

The improvement of water supply conditions can be expected from 2007 as a direct effect owing to the implementation of the project. The following table shows the improvement of water supply of each area by comparing the present situation in 2003 and that after project implementation in 2010.

Table 3-1 Water Supply Conditions of Each Area

Service Area	Effect Index	Before project implementation (2003)	After Project Implementation (2010)
Abbottabad City	Daily average water supply capacity	6,273 m3/d	8,068 m3/d
	Population Served	42,140	62,540
	Service Coverage	79 %	100 %
Nawanshehr City	Daily average water supply capacity	2,619 m3/d	3,945 m3/d
	Population Served	29,060	33,150
	Service Coverage	100 %	100 %
Peripheral Unions (12 villages)	Daily average water supply capacity	4,274 m3/d	11,072 m3/d
	Population Served	50,160	93,030
	Service Coverage	57 %	85 %
Whole Project Area	Daily average water supply capacity	13,166 m3/d	23,085 m3/d
	Population Served	121,360	188,720
	Service Coverage	71 %	92 %

3-1-2 Other Effects

The following effects can be named as indirect effects of the project.

1) Reduction of Operation Cost of the Existing Water Supply Agencies

Among the expenditures of each water supply agency in the project areas, the power cost for pump operation of wells occupies approximately 80% at present, and this cost is not covered by the water tariff, making deficit every year for water supply operation.

By switching the groundwater by pumping to surface water by gravity, the power cost for pumping of well water will be largely reduced. Especially in Abbottabad City, the reduction of the power cost will be significant as the whole amount of water supply will be switched to surface water. Since the treatment plant is designed basically by gravity and manual operation, power consumption is also small. Owing to lower power consumption as the effect of the project, the operation and maintenance cost especially in Abbottanbd City can be kept as low as about half of the present cost even in 2007.

2) Extension of Well Life

In many of the existing wells whose pumping rate is not appropriate one and exceeds the capacity of well yield, there is observed a well caving phenomenon. And, in some cases, the well is abandoned within a short period of several years. This may be caused by defective construction of wells such as lack of gravel packing. The excessive pumping rate of well also accelerates this phenomenon. At the event of the pump replacement works under the project, it is expected to prevent such phenomenon and to expand the well life by reviewing pumping rate suitable for the capacity of well and suppressing of flowing silt and clay into the well.

3) Decrease of Waterborne Disease

Though the statistics of symptom example number of waterborne disease is not obtained in Abbottabad City, it is reported that the number of patients of waterborne disease (diarrhea and dysentery) who were treated in the medical institutions in 2002 is 9 persons per 1,000, among whom 3 persons suffered from diarrhea, in Nawanshehr City and peripheral villages. Still, dysentery that is serious diarrhea occurs in the area. It is expected that the improvement of water supply such as water supply capacity, service coverage and extension of supply hour will contribute for reduction of such patients of waterborne disease.

3-2 Recommendations

3-2-1 Establishment of Bulk Water Supply Agency

In this plan, it is proposed to establish a new bulk water supply agency (tentatively named as Gravity Water Supply Unit) under the District Government, which supplies water to the three independent water supply agencies, separately from the existing water supply agencies. This agency will be established under District Government, separately from the existing departments. It is required to newly recruit human resources with qualification and capability suitable for the operation and maintenance of bulk water supply system. The establishment of new agency is required several months prior to the completion of the project.

The setting of appropriate tariff for bulk water supply is indispensable for sound operation of the new agency, which shall distribute bulk water to the existing water supply agencies with appropriate manner and receives water tariff from them. It is simultaneously proposed to establish Water Committee (tentatively named) whose members consist of the representatives of the District Government, Abbottabad City and Nawanshehr City for regulation and advice to activities of the new agency, and the coordination with the existing agencies. It is desirable to establish this Water Committee in an early stage obtaining the understanding of the relevant organizations.

The support with technical and managerial guidance is planned under the Project for the establishment of Water Committee and Gravity Water Supply Unit.

3-2-2 Revision of Tariff and Collection System of Existing Water Supply Agencies

The current water tariff system is flat rate system, except Nawanshehr City. In addition, the water supply accounting is not independent but mixed with that for other infrastructures facilities. It is not based upon the self-supporting accounting principle of water supply. Further, the current water tariff is set as low as approximately one to fifth of operation and maintenance cost.

By the implementation of the project, it is expected the improvement of the present water supply services such as short supply hour of only one hour per day. In conjunction of the project implementation, it is proposed to transfer the present flat rate tariff system to metered tariff system and revise water tariff to the suitable level based on the benefit principle. For this purpose, the measurement of consumption by water meters is indispensable. PC-1 lists up the meter installation cost as the responsibility of Pakistani side, and its realization is desired in an early stage.

It is expected that appropriate water tariff collection based on the metered consumption will prevent waste of water, which is sometimes observed under the flat rate system. By avoiding waste of water by the consumers, it is also expected that water distribution network could be functioned more effectively. As the results, an effect on preservation of precious water resources can be expected owing to reduction of waste of water.

The arrangement of appropriate tariff collection system is indispensable when the present flat rate system shifts to metered rate system. It is therefore recommended immediate action for arrangement of organization to establish appropriate tariff collection system.

The support with technical and managerial guidance is planned under the Project for the shifting metered tariff system, the revision of water tariff and the arrangement of tariff collection system.

3-2-3 Action Programme for Establishing New Agency and Water Tariff Revision

It is the responsibility of the Pakistan side to operate and maintain the completed facilities properly for sustainable bulk water supply operation. The above-mentioned establishment of new agencies and water tariff revision are important to be implemented steadily.

There are various activities and decisions to be done during the course of the implementation. Further, there are various steps to receive the consent from the various

agencies concerned including the existing water supply agencies, which are complex matters and require considerable time. Therefore, it is important to prepare action program beforehand for smooth implementation. In this connection, tentative action programme is prepared in this study as shown in **Figure 3-1** identifying necessary actions to be done by persons or agencies concerned and approval processes with target date for monitoring purpose.

It is recommended that the District Government as the implementation agency studies on the above action programme before the Project starts together with the existing water supply agencies of Abbottabad and Nawanshehr. It is also recommended to set up preparatory working group consisting of the representatives from the existing water supply agencies. The preparatory working group will act as a core for study and review on various aspects on the establishment of new agency and water tariff revision.

3-2-4 Preservation of Groundwater Source

As pointed out in this study, it is judged that the groundwater recharge in the Abbottabad Basin is limited and the exploitation of groundwater is already near the limit at present. Before the depletion of groundwater occurs due to its excessive abstraction, the monitoring of groundwater by continuous surveillance of groundwater level and abstraction is indispensable for preservation of precious groundwater source. To enable sustainable use of groundwater, it is recommended to take immediate actions for groundwater monitoring and regulation of groundwater utilization by the consultation of concerned agencies.

3-2-5 Development of Water Distribution Network

The Project is planned to supply bulk water to the distribution reservoirs of the existing water supply agencies, and the effect of the project can be born by the appropriate distribution of water to the service areas through the distribution networks. Therefore, execution of necessary strengthening and expansion of the existing distribution networks is required including rehabilitation of the existing pipelines where required in conjunction with the implementation of the Project. PC-1 contains the development cost for the existing distribution networks. It is essential to implement the development of the distribution network with steadily manner.

3-2-6 Others

1) Water Right Issue

The Project plans to intake from three tributaries of Dor River at 200 l/s. The effects of this intake are considered minor within the Abbottabd District. As the results of discussion with the Irrigation Department and other authorities concerned, the NWFP has determined the implementation of the Project. It was explained by the NWFP that the water right for the

Project was approved through the approval of PC-1. When the importance of water right issue is taken into account, it is required by the NWFP to monitor with due attention on the adjustment of water usage of Dor River between Abbottabad District and Haripur District who will be affected by the intake at the upstream of Dor River in Abbottabad.

2) Approval of PC-1

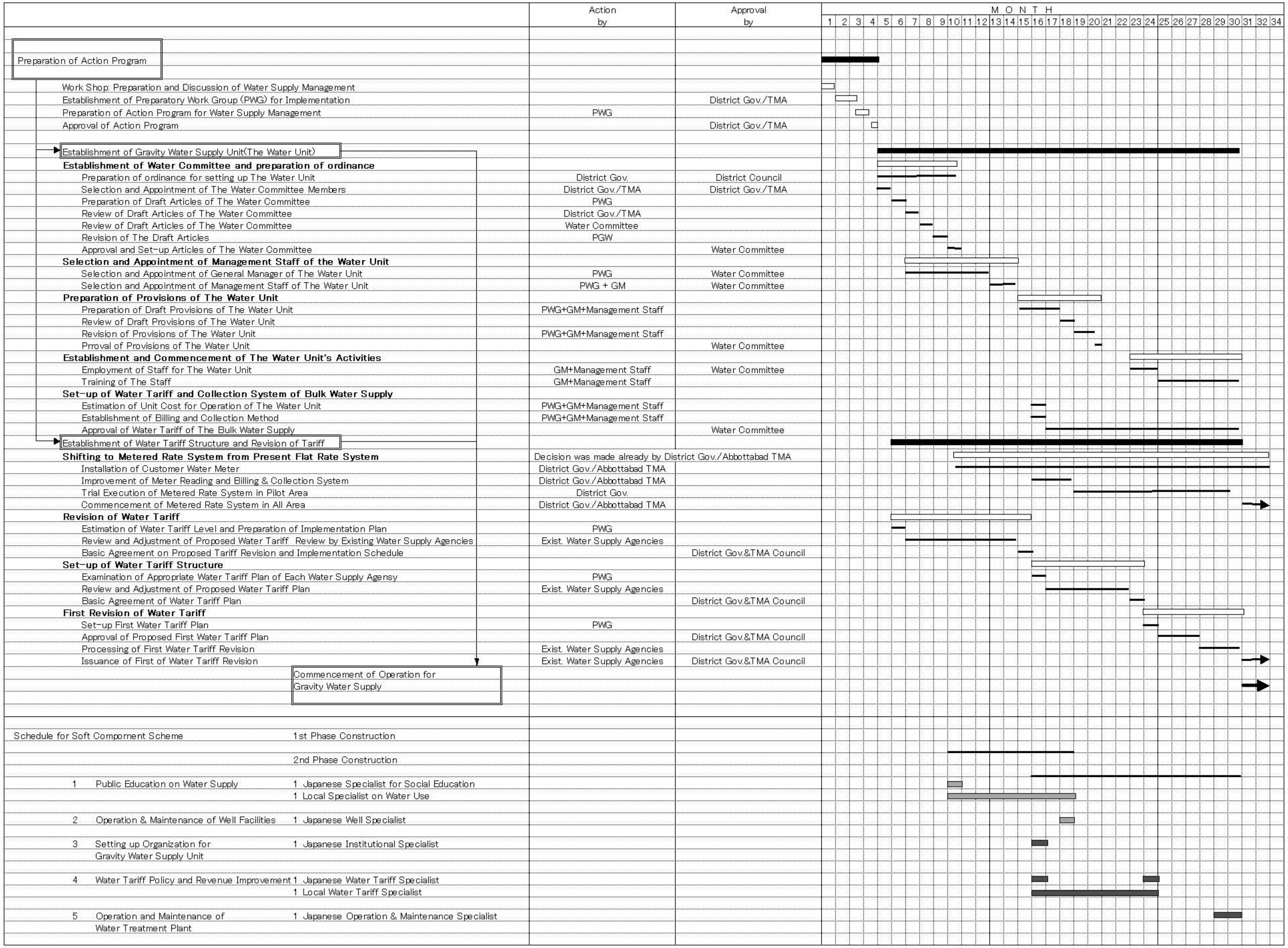
It is essential to obtain the approval of PC-1 that secures the obligation of Pakistani side for the implementation of the Project. The PC-1 shall be approved by the Federal Government after its approval of the Provincial Government. The procedure for the approval by the Federal Government shall be made smoothly and its approval shall be obtained as soon as possible.

3) Environmental Issue

The District Government of Abbottabad conducted the IEE (Initial Environmental Examination) and concluded that no further study of EIA (Environmental Impact Assessment) is required since the affects of the project implementation will be minor. After receipt of the IEE report, the EPA (Environmental Protection Agency) of the NWFP has issued Non-Objection Certificate for the implementation of the Project. However it is required, by the implementation agency, to take necessary measures where required and to monitor the affects to the environment to minimize them during the course of project implementation.

4) Improvement of Drainage System and Construction of Sewerage System

The improvement of water supply by increasing supply capacity results increase of waste water. It will be necessary to consider the improvement of drainage system first against waste water increase followed by the construction of sewerage system in the future to minimize the water pollution to the downstream.



Action by
Approval by
M O N T H
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34
Preparation of Action Program
Work Shop: Preparation and Discussion of Water Supply Management
Establishment of Preparatory Work Group (PWG) for Implementation | District Gov./TMA
Preparation of Action Program for Water Supply Management | PWG
Approval of Action Program | District Gov./TMA
Establishment of Gravity Water Supply Unit(The Water Unit)
Establishment of Water Committee and preparation of ordinance
Preparation of ordinance for setting up The Water Unit | District Gov. | District Council
Selection and Appointment of The Water Committee Members | District Gov./TMA | District Gov./TMA
Preparation of Draft Articles of The Water Committee | PWG
Review of Draft Articles of The Water Committee | District Gov./TMA
Review of Draft Articles of The Water Committee | Water Committee
Revision of The Draft Articles | PGW
Approval and Set-up Articles of The Water Committee | Water Committee
Selection and Appointment of Management Staff of the Water Unit
Selection and Appointment of General Manager of The Water Unit | PWG | Water Committee
Selection and Appointment of Management Staff of The Water Unit | PWG + GM | Water Committee
Preparation of Provisions of The Water Unit
Preparation of Draft Provisions of The Water Unit | PWG+GM+Management Staff
Review of Draft Provisions of The Water Unit
Revision of Provisions of The Water Unit | PWG+GM+Management Staff
Prroval of Provisions of The Water Unit | Water Committee
Establishment and Commencement of The Water Unit's Activities
Employment of Staff for The Water Unit | GM+Management Staff | Water Committee
Training of The Staff | GM+Management Staff
Set-up of Water Tariff and Collection System of Bulk Water Supply
Estimation of Unit Cost for Operation of The Water Unit | PWG+GM+Management Staff
Establishment of Billing and Collection Method | PWG+GM+Management Staff
Approval of Water Tariff of The Bulk Water Supply | Water Committee
Establishment of Water Tariff Structure and Revision of Tariff
Shifting to Metered Rate System from Present Flat Rate System | Decision was made already by District Gov./Abbottabad TMA
Installation of Customer Water Meter | District Gov./Abbottabad TMA
Improvement of Meter Reading and Billing & Collection System | District Gov./Abbottabad TMA
Trial Execution of Metered Rate System in Pilot Area | District Gov.
Commencement of Metered Rate System in All Area | District Gov./Abbottabad TMA
Revision of Water Tariff
Estimation of Water Tariff Level and Preparation of Implementation Plan | PWG
Review and Adjustment of Proposed Water Tariff Review by Existing Water Supply Agencies | Exist. Water Supply Agencies
Basic Agreement on Proposed Tariff Revision and Implementation Schedule | District Gov.&TMA Council
Set-up of Water Tariff Structure
Examination of Appropriate Water Tariff Plan of Each Water Supply Agensy | PWG
Review and Adjustment of Proposed Water Tariff Plan | Exist. Water Supply Agencies
Basic Agreement of Water Tariff Plan | District Gov.&TMA Council
First Revision of Water Tariff
Set-up First Water Tariff Plan | PWG
Approval of Proposed First Water Tariff Plan | District Gov.&TMA Council
Processing of First Water Tariff Revision | Exist. Water Supply Agencies
Issuance of First of Water Tariff Revision | Exist. Water Supply Agencies | District Gov.&TMA Council
Commencement of Operation for Gravity Water Supply
Schedule for Soft Compornent Scheme
1st Phase Construction
2nd Phase Construction
1 Public Education on Water Supply | 1 Japanese Specialist for Social Education
1 Local Specialist on Water Use
2 Operation & Maintenance of Well Facilities | 1 Japanese Well Specialist
3 Setting up Organization for Gravity Water Supply Unit | 1 Japanese Institutional Specialist
4 Water Tariff Policy and Revenue Improvement | 1 Japanese Water Tariff Specialist
1 Local Water Tariff Specialist
5 Operation and Maintenance of Water Treatment Plant | 1 Japanese Operation & Maintenance Specialist

Figure 3-1 Tentative Action Programme for Establishment of Gravity Water Supply Unit and Water Tariff Revision

Appendices - A

Appendix 1 Member List of the Study Team

Appendix 1　Member List of the Study Team

The First Field Study

Position	Name	Organization
Leader	Satoshi NAKANO	Deputy Director, Third Project Management Division, Grant Aid Management Department, Japan International Cooperation Agency
Technical Advisor	Yoshiki OMURA	Senior Advisor, JICA
Chief Consultant/ Water Supply Engineer/ Maintenance Planner	Takeshi SAKAI	Nihon Suido Consultants Co.Ltd.
Hydro geologist/ Underground Water Planner	Naoki TAIRA	Japan Techno Co.Ltd.
Hydrometeorology and Water Quality Surveyor	Toyosaku KATO	Japan Techno Co.Ltd.
Water Facilities Surveyor	Yoshiaki YOKOTA	Nihon Suido Consultants Co.Ltd.
Social and Environmental Surveyor	Naoki MORI	Japan Techno Co.Ltd.
Waterworks Planner	Hiroyasu SAITO	Nihon Suido Consultants Co.Ltd.
Construction and Procurement Planner/ Cost Estimator	Masami TSUYUKI	Nihon Suido Consultants Co.Ltd.

The Second Field Study

Position	Name	Organization
Project Coordinator	Yusuke TSUMORI	Third Project Management Division, Grant Aid Management Department, Japan International Cooperation Agency
Chief Consultant/ Water Supply Engineer/ Maintenance Planner	Takeshi SAKAI	Nihon Suido Consultants Co.Ltd.
Hydro geologist/ Underground Water Planner	Naoki TAIRA	Japan Techno Co.Ltd.
Water Facilities Surveyor	Yoshiaki YOKOTA	Nihon Suido Consultants Co.Ltd.

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Position	Name	Organization
Leader	Yoshio FUKUDA	Team Leader, Water and Sanitation Team, Project Management Group I, Grant Aid Management Dept. JICA
Chief Consultant/ Water Supply Engineer/ Maintenance Planner	Takeshi SAKAI	Nihon Suido Consultants Co.Ltd.
Hydro geologist/ Underground Water Specialist	Shigeyoshi KAGAWA	Japan Techno Co.Ltd.
Water Supply Facilities Specialist	Motoo YANAI	Nihon Suido Consultants Co.Ltd.
Waterworks Management Specialist	Koichi IWASAKI	Nihon Suido Consultants Co.Ltd.

Appendix 2 Study Schedule

The First Field Study

			Official Study Team	Consultants Study Team						
				Chief Consultant /Water Supply Planner/Maintenance Specialist	Water Supply Facilies Specialist	Hydrometeorogy and Water Quality Specialist	Social and Environmental Specialist	Hydrogeologist/Groundwater Specialist	Waterworks Management Specialist	Construction and Procurement Planner/Cost Estimate Specialist
			Mr.Nakano, Mr.Omura	**Mr.T.Sakai**	**Mr.Y.Yokota**	**Mr.T.Katou**	**Mr.N.Mori**	**Mr.N.Taira**	**Mr.H.Saito**	**Mr.M.Tsuyuki**
1	07/13/03	Sun	Travel to Lahore							
2	07/14/03	Mon	Courtesy call EOJ and JICA, Travel to Peshawar							
3	07/15/03	Tue	Courtesy call Related Authorities in Peshawar, Travel to Abbottabad							
4	07/16/03	Wed	Courtesy call Related Authorities in Abbottabad							
5	07/17/03	Thu	Discussion of the Minute of Discussion(M/D) with NWFP, Site Survey			Preparation of Office Space				
6	07/18/03	Fri	Discussion of the M/D with NWFP, Site Survey			Data Collection	Travel to Lahore			
7	07/19/03	Sat	Singing on M/D with NWFP			Data Collection	Travel to Abbottabad			
8	07/20/03	Sun	Travel to Islamabad			Data Processing	Data Processing			
9	07/21/03	Mon	Singing on M/D with MOEAS as the witness			Site Investigation	Data Collection			
10	07/22/03	Tue	Report to EOJ and JICA Office			Site Investigation				
11	07/23/03	Wed	Return to Japan	Travel to Islamabad		Site Investigation				
12	07/24/03	Thu		Team meeting						
13	07/25/03	Fri		Discussion with Related Authorities		Site Investigation		Travel to Lahore		
14	07/26/03	Sat		Site Investigation		Site Investigation		Travel to Abbottabad		
15	07/27/03	Sun		Data Processing						
16	07/28/03	Mon		Site Investigation						
17	07/29/03	Tue		Site Investigation						
18	07/30/03	Wed		Site Investigation						
19	07/31/03	Thu		Site Investigation				Electrical prospecting		
20	08/01/03	Fri		Site Investigation				Electrical prospecting	Travel to Lahore	
21	08/02/03	Sat		Site Investigation				Electrical prospecting	Travel to Abbottabad	
22	08/03/03	Sun		Data Processing						
23	08/04/03	Mon		Site Investigation				Geotechnical Investigation	Data Collection	
24	08/05/03	Tue		Site Investigation				Geotechnical Investigation	Discussion with Related Authorities	
25	08/06/03	Wed		Site Investigation				Test Well Digging/Pumping Test	Discussion with Related Authorities	
26	08/07/03	Thu		Site Investigation				Test Well Digging/Pumping Test	Discussion with Related Authorities	
27	08/08/03	Fri		Site Investigation				Test Well Digging/Pumping Test	Discussion with Related Authorities	
28	08/09/03	Sat		Site Investigation				Test Well Digging/Pumping Test	Discussion with Related Authorities	
29	08/10/03	Sun		Data Processing						
30	08/11/03	Mon		Site Investigation				Geotechnical Investigation	Discussion with Related Authorities	
31	08/12/03	Tue		Site Investigation				Test Well Digging/Pumping Test	Discussion with Related Authorities	
32	08/13/03	Wed		Site Investigation				Test Well Digging/Pumping Test	Discussion with Related Authorities	
33	08/14/03	Thu		Site Investigation				Test Well Digging/Pumping Test	Discussion with Related Authorities	
34	08/15/03	Fri		Site Investigation				Test Well Digging/Pumping Test	Discussion with Related Authorities	
35	08/16/03	Sat		Site Investigation		Return to Japan	Site Investigation	Test Well Digging/Pumping Test	Discussion with Related Authorities	
36	08/17/03	Sun		Data Processing			Data Processing			
37	08/18/03	Mon		Site Investigation			Site Investigation	Site Investigation	Discussion with Related Authorities	
38	08/19/03	Tue		Site Investigation			Site Investigation	Electrical prospecting	Discussion with Related Authorities	Travel to Lahore

			Official Study Team	Consultants Study Team						
				Chief Consultant /Water Supply Planner/Maintenance Specialist	Water Supply Facilies Specialist	Hydrometeorogy and Water Quality Specialist	Social and Environmental Specialist	Hydrogeologist/Groundwater Specialist	Waterworks Management Specialist	Construction and Procurement Planner/Cost Estimate Specialist
			Mr.Nakano, Mr.Omura	**Mr.T.Sakai**	**Mr.Y.Yokota**	**Mr.T.Katou**	**Mr.N.Mori**	**Mr.N.Taira**	**Mr.H.Saito**	**Mr.M.Tsuyuki**
39	08/20/03	Wed		Site Investigation			Site Investigation	Geotechnical Investigation	Discussion with Related Authorities	Travel to Abbottabad
40	08/21/03	Thu		Site Investigation			Site Investigation	Test Well Digging/Pumping Test	Discussion with Related Authorities	Cost Data Collection
41	08/22/03	Fri		Site Investigation			Site Investigation	Test Well Digging/Pumping Test	Discussion with Related Authorities	Cost Data Collection
42	08/23/03	Sat		Site Investigation			Site Investigation	Test Well Digging/Pumping Test	Discussion with Related Authorities	Cost Data Collection
43	08/24/03	Sun		Data Processing			Data Processing			Cost Data Collection
44	08/25/03	Mon		Site Investigation			Site Investigation	Test Well Digging/Pumping Test	Discussion with Related Authorities	Cost Data Collection
45	08/26/03	Tue		Site Investigation			Return to Japan	Test Well Digging/Pumping Test	Discussion with Related Authorities	Cost Data Collection
46	08/27/03	Wed		Site Investigation				Test Well Digging/Pumping Test	Discussion with Related Authorities	Cost Data Collection
47	08/28/03	Thu		Site Investigation				Test Well Digging/Pumping Test	Discussion with Related Authorities	Contractor's Capability Survey
48	08/29/03	Fri		Site Investigation				Electrical prospecting	Discussion with Related Authorities	Contractor's Capability Survey
49	08/30/03	Sat		Site Investigation				Geotechnical Investigation	Return to Japan	Contractor's Capability Survey
50	08/31/03	Sun		Data Processing				Data Processing		Contractor's Capability Survey
51	09/01/03	Mon		Site Investigation				Test Well Digging/Pumping Test		Contractor's Capability Survey
52	09/02/03	Tue		Site Investigation				Test Well Digging/Pumping Test		Contractor's Capability Survey
53	09/03/03	Wed		Site Investigation				Test Well Digging/Pumping Test		Cost Data Collection
54	09/04/03	Thu		Site Investigation				Test Well Digging/Pumping Test		Cost Data Collection
55	09/05/03	Fri		Site Investigation				Test Well Digging/Pumping Test		Cost Data Collection
56	09/06/03	Sat		Site Investigation				Test Well Digging/Pumping Test		Cost Data Collection
57	09/07/03	Sun		Data Processing				Data Processing		Cost Data Collection
58	09/08/03	Mon		Site Investigation				Test Well Digging/Pumping Test		Cost Data Collection
59	09/09/03	Tue		Site Investigation				Test Well Digging/Pumping Test		Cost Data Collection
60	09/10/03	Wed		Site Investigation				Test Well Digging/Pumping Test		Cost Data Collection
61	09/11/03	Thu		Site Investigation				Test Well Digging/Pumping Test		Cost Data Collection
62	09/12/03	Fri		Site Investigation				Site Investigation		Cost Data Collection
63	09/13/03	Sat		Site Investigation				Electrical prospecting		Cost Data Collection
64	09/14/03	Sun		Data Processing				Data Processing		Cost Data Collection
65	09/15/03	Mon		Site Investigation				Data Collection		Cost Data Collection
66	09/16/03	Tue		Team meeting				Team meeting		Team meeting
67	09/17/03	Wed		Site Investigation				Test Well Digging/Pumping Test		Return to Japan
68	09/18/03	Thu		Site Investigation				Test Well Digging/Pumping Test		
69	09/19/03	Fri		Team meeting				Test Well Digging/Pumping Test		
70	09/20/03	Sat		Report to JICA Office				Test Well Digging/Pumping Test		
71	09/21/03	Sun		Team meeting				Team meeting		
72	09/22/03	Mon		Return to Japan				Return to Japan		

The Second Field Study

			Official Study Team	Consultants Study Team		
				Chief Consultant /Water Supply Planner/Maintenance Specialist	Water Supply Facilies Specialist	Hydrogeologist/Grou ndwater Specialist
			Mr.Tsumori	**Mr.T.Sakai**	**Mr.Y.Yokota**	**Mr.N.Taira**
1	01/25/04	Sun	Travel to Lahore			
2	01/26/04	Mon	Courtesy call EOJ and JICA, Travel to Peshawar			
3	01/27/04	Tue	Discussion with NWFP Governemnt in		Site Survey	Travel to Abbottabad
4	01/28/04	Wed	Site Survey			Site Survey
5	01/29/04	Thu	Discussion with Abbottabad District Office			Site Survey
6	01/30/04	Fri	Report to EOJ and JICA Office		Site Survey	Site Survey
7	01/31/04	Sat	Return to Japan		Site Survey	Site Survey
8	02/01/04	Sun			Site Survey	Site Survey
9	02/02/04	Mon			Site Survey	Site Survey
10	02/03/04	Tue			Site Survey	Site Survey
11	02/04/04	Wed			Site Survey	Site Survey
12	02/05/04	Thu			Site Survey	Site Survey
13	02/06/04	Fri		Report to EOJ and JICA Office	Site Survey	Site Survey
14	02/07/04	Sat		Return to Japan	Site Survey	Site Survey
15	02/08/04	Sun			Site Survey	Site Survey
16	02/09/04	Mon			Site Survey	Site Survey
17	02/10/04	Tue			Site Survey	Site Survey
18	02/11/04	Wed			Site Survey	Return to Japan
19	02/12/04	Thu			Site Survey	
20	02/13/04	Fri			Site Survey	
21	02/14/04	Sat			Site Survey	
22	02/15/04	Sun			Site Survey	
23	02/16/04	Mon			Site Survey	
24	02/17/04	Tue			Site Survey	
25	02/18/04	Wed			Site Survey	
26	02/19/04	Thu			Site Survey	
27	02/20/04	Fri			Site Survey	
28	02/21/04	Sat			Site Survey	
29	02/22/04	Sun			Site Survey	
30	02/23/04	Mon			Return to Japan	

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			Official Study Team	Consultants Study Team			
				Chief Consultant /Water Supply Planner/Maintenance Specialist	Water Supply Facilies Specialist	Hydrogeologist/Grou ndwater Specialist	Waterworks Management Specialist
			Mr.Y. Fukuda	**Mr.T.Sakai**	**Mr.M. Yanai**	**Mr. S. Kagawa**	**Mr.K Iwasaki**
1	05/23/04	Sun	Travel to Lahore				
2	05/24/04	Mon	Travel to Islamabad				
			Courtesy call EOJ and JICA, and Economic Affairs Division (EAD)				
3	05/25/04	Tue	Travel to Abbottabad Courtesy Call and Discussion with Abbotabad District Office				
4	05/26/04	Wed	Discussion with Abbottabad District Office and drafting Minutes of Discussion (M/D)				
			Travel to Peshawal		Site Survey and Information Collection		
5	05/27/04	Thu	Discussion of the Minute of Discussion(M/D)		Site Survey and Information Collection		
6	05/28/04	Fri	Report to EOJ and JICA and EAD		Site Survey and Information Collection		
			Travel to Lahole	Travel to Abbotta			
7	05/29/04	Sat	Return to Japan	Site Investigation			
8	05/30/04	Sun		Team meeting			
9	05/31/04	Mon		Discussion with Abbottabad District Office, Site Investigation			
10	06/01/04	Tue		Discussion with Abbottabad District Office, Site Investigation			
11	06/02/04	Wed		Discussion with Abbottabad District Office, Site Investigation			
12	06/03/04	Thu		Discussion with Abbottabad District Office, Site Investigation			
13	06/04/04	Fri		Report to EOJ and JICA and EAD			
14	06/05/04	Sat		Travel to Lahole			
15	06/06/04	Sun		Return to Japan			

Appendix 3　List of Parties Concerned in Pakistan

Ministry of Economic Affairs & Statistics	
Mr. Muhammad Ashraf Khan	Joint Secretary , Economic Affairs Division
Government of North West Frontier Province	
Mr. Baz Muhanmmad Khattak	Secretary (former), Local Govt. Election & Rural Development Dept.
Mr. Wakil Khan Afridi	Secretary , Local Govt. Election & Rural Development Dept
Mr. Syed Manzoor Ali Shah	Secretary, Planning and Development Dept.
Mr. Jehangir Bashar	Additional Chief Secretary (Planning, Environmental & Development Dept.)
Mr. Laiq Shah	Chief Secretary Planning & Development Dept.
Mr. Mohammad Ikram Khan	Additional Secretary, Planning & Development Dept.
District Government Abbottabad	
Col(Rtd) Ghulam Mustafa Khan Jadoon	Zilla Nazim
Mr. Jamil Muhanmad	District Coordinate Officer
Mr. Khalid Mehmood	Distrct Coordinate Officer
Mr. Fahrat Amoz Khan	Superintending Engineer Works & Services Department
Mr. Khalid Aziz	Assistant District Officer Works & Services Department
Mr. Abbas Khan	Sub-Engineer Works & Services Department
Mr. Naeem	Sub-Engineer Works & Services Department
Mr. Ghulam Murtaza	Deputy director (B&R), Works & Services Department
Abbottabad City	
Mr. Rashid Kamal	Town Municipal Officer
Mr. Ziaul Dim	Technical Officer of Infrastructure
Nawanshehr City	
Mr. Javed Khan Jadoon	Town Municipal Nazim
Mr. Mohammad Iqbal Khan	Nazim Union Council Nawanshehr Urban
Mr. Rafiq-ur-Rehman	Project Managter, Water & Sanitation Unit Nawanchehr

Mr. Afsar Khan	Accountant Water & Sanitation Unit Nawanchehr

Others

Mr. Akbar Khan	Nazim Namly Maira
Mr. Abdul Rehman Khanzada	Deputy Director, National Highway Authority
Mr.MuhammadPervezNasir	Director Maintenance, Frontier Highways Authority

Japanese Embassy in Pakistan

Mr. Matsunaga Takeshi	Head of Economic and Development Section
Mr. Kitada Hoiromichi	First Secretary
Mr. Kobayashi Teruo	Second Secretary

JICA Pakistan Office

Mr. Yamaura Nobuyuki	Resident Representative
Ms. Misumi Sachiko	Sr. Deouty Resident Representative
Mr. Takahashi Makoto	Officer
Mr. Mahmaood A. Jilani	Deputy Resident Representative/Chief Programme Officer

Minutes of Discussions
on the Basic Design Study
on the Project for the Improvement of the Water Supply in Abbottabad
in the Islamic Republic of Pakistan

In response to the request from the Government of the Islamic Republic of Pakistan (hereinafter referred to as "Pakistan"), the Government of Japan decided to conduct a Basic Design Study on the Project for Improvement of the Water Supply in Abbottabad (hereinafter referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA sent to Pakistan the Basic Design Study Team (hereinafter referred to as "the Team"), headed by Mr. Satoshi Nakano, a Deputy Director of the Third Project Management Division, the Grant Aid Management Department, JICA, and is scheduled to stay in the country from July 13 to September 22, 2003.

The Team held a series of discussions with the officials concerned of the Government of Pakistan and conducted a field survey in the study area.

In the course of the discussions and field survey, both sides have confirmed the main items of the Project as described in the attached sheets. The Team will proceed to further works and prepare the Basic Design Study Report.

Peshawar, July 19, 2003

Satoshi Nakano
Leader
Basic Design Study Team
Japan International Cooperation Agency

Baz Muhammad Khattak
Secretary
Local Government and Rural Development Department
Government of North West Forntier Province
Islamic Republic of Pakistan

Ghulam Mustafa Khan Jadoon
Zilla Nazim
District Government Abbottabad
Government of North West Frontier Province

Farhat Amoz Khan
Superintendent Engineer
Works and Services Department
District Government Abbottabad

Rashid Kamal
Town Municipal Officer
Town Municipal Administration Abbottabad
District Government Abbottabad

Javed Khan Jadoon
Town Municipal Nazim
Town Municipal Administration Nawansher
District Government Abbottabad

Witnessed by:

Muhammad Ashraf Khan
Joint Secretary
Economic Affairs Division
Ministry of Economic Affairs and Statistics
Islamic Republic of Pakistan

Witnessed by:

Add: Chief Secretary, Laiq Shah
Planning and Development Department
Government of North West Frontier Province
Islamic Republic of Pakistan

ATTACHMENT

1. Objective

The objective of the Project is to improve the water supply services for the residents in Abbottabad city, Nawansher city, and their neighboring 12 villages.

2. Project Sites

The Project sites are shown in Annex-1.

3. Responsible and Implementing Organizations

The counterpart ministry is the Ministry of Economic Affairs and Statistics, the Government of Pakistan.

The responsible organization is the Government of the North West Frontier Province (hereinafter referred to as "the NWFP").

The implementing organization is the District Government Abbottabad under the Governmnet of the NWFP.

The operating organizations are the Town Municipal Administrarion Abbottabad and the Town Municipal Administration Nawansher.

The organization charts of the implementing and operating organizations are shown in Annex-2.

4. Items Requested by the Government of Pakistan

After discussions with the Team, the Pakistani side agreed that the Basic Design Study should be conducted based on the framework of the alternative plan, explained by the Team, as the results of the Preparatory Study. The alternative plan is shown in Annex-3 comparing with the originally requested plan by the Pakistani side. JICA will assess the appropriateness of the alternative plan and report to the findings to the Government of Japan.

5. Japan's Grant Aid Scheme

5-1 The Pakistani side understands the Japan's Grant Aid scheme explained by the Team, as described in Annex-4.

5-2 The Pakistani side will take necessary measures, as described in Annex-5, for smooth implementation of the Project as a condition for the Japan's Grant Aid to be extended.

6. Schedule of the Study

6-1 The consultant members of the Team will proceed to further studies in Pakistan until September 21, 2003.

6-2 JICA will prepare the draft Basic Design Study Report and dispatch a mission to Pakistan in order to explain its contents in (or around) December, 2003.

6-3 In case the contents of the Report are accepted in principle by the Government of Pakistan, JICA will complete the Final Report and send it to the Pakistani side by March, 2004.

7. Other Relevant Issues

7-1 The Pakistani side's official project document, PC-I, shall be reviewed in accordance with the results of the Basic Design Study, and shall be approved by the cabinet of the Government of Pakistan by the end of April, 2004.

7-2 The Team explained to the Pakistani side that the environmental and social consideration on the Project should be taken into seriously in case that the Japan's Grant Aid to be extended. The Pakistani side shall conduct the followings with scrupulous care:

7-2-1 The Pakistani side shall settle the water right issue of the Dor river between the Haripur district and the Abbottabad district. The Pakistani side shall also obtain the consent to the Project from the stakeholders at village level along the Gaya river and the Bagh river. The Pakistani side shall report in writing these results to the Team as soon as possible.

7-2-2 The Pakistani side shall conduct the Environmental Impact Assessment (EIA) in accordance with the proper procedures as stipulated in the Pakistan Environmental Protection Act by the end of April, 2004. The detailed timetable is shown in Annex-6.

7-2-3 The Pakistani side shall secure the land necessary for the Project, including test wells in the Basic Design Study, in accordance with the proper procedures as stipulated in the related acts and laws, such as the Land Acquisition Act. The Pakistani side shall obtain in-principle agreement(s) in writing to selling the land from the landowners by the end of April, 2004. The detailed timetable is shown in Annex-6.

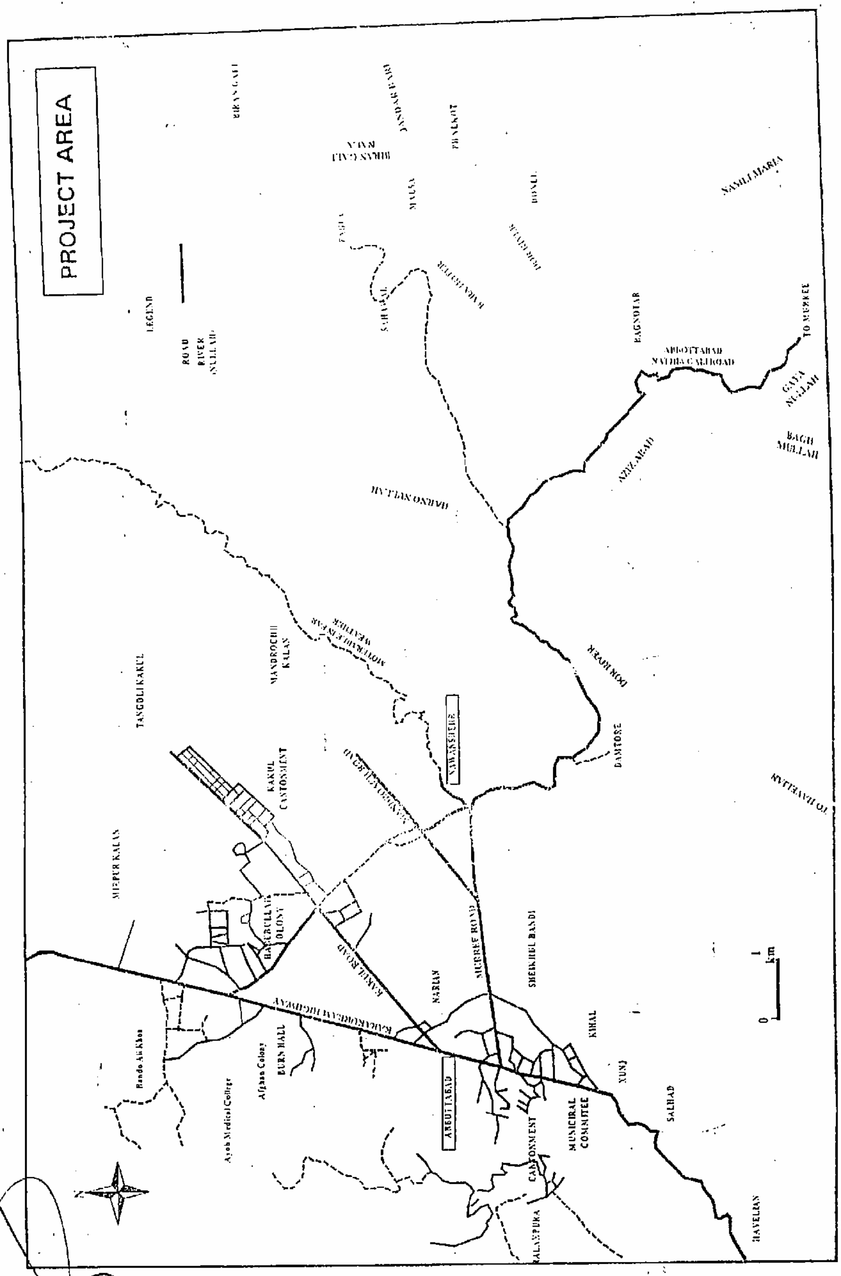
7-2-4 The Pakistani side shall conduct the public consultation on the relocation of the residents' houses inside the Project sites, where the proposed facilities are to be constructed, and obtain in-principle agreement(s) in writing from the residents by the end of April, 2004.

7-3 Since the self-sustainability of the Project is the most crucial, the Project shall be designed so that the recurrent cost be minimized, and the proper revenue from the water sale be secured. In this regard the Pakistani side shall make the implementation plan for the proper water tariff system referring to the recommendations of the Basic Design Study and report in writing the plan and its status to the Japanese side through the JICA Pakistan Office by the end of November, 2003.

7-4 The Pakistani side requested to the Team the consulting services, what is called "the soft-component," on water supply management as one of the components of the Project. The Team will examine the necessity and the contents of such component.

7-5 The Pakistani side requested to the Team the counterpart training in Japan on operation and maintenance of the water treatment facilities as well as water supply management as JICA's technical cooperation. The Team will examine the necessity and the contents of such training. The Pakistani side understands that another official request to the Japanese side through the JICA Pakistani Office will be needed for such training.

Annex-1



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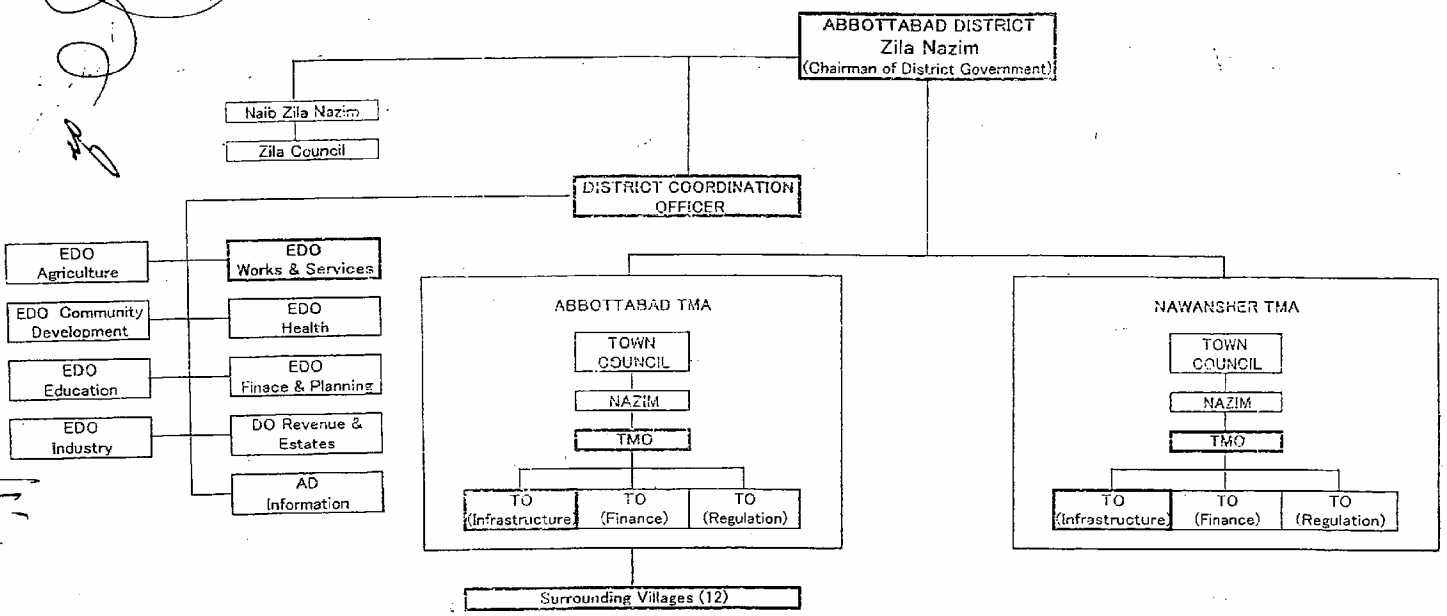
Annex-2

PROJECT RELATED ORGANIZATION CHART



Legend

Naib Zila Nazim: Deputy Chaiman of District Government
Nazil Council: District Council
EDO: Executive District Office
DO: District Officer
AD: Assistant Director

Nazim: Mayor
TMA: Town Municipal Administration
TMO: Town Municipal Officer
TO: Town Officer

Annex-3

Original Plan and Alternative Plan

Items			Requested Plan	Alternative Plan
Project Area			Abbottabad City, Nawansher City, Cantonment Board, and two Villages (Salhad, Sheikhul Bandi)	Abbottabad City, Nawansher City, and 12 Villages (Sheikhul Bandi, Salhad, Banda Pingwarian, Banda Dilazak, Banda Ghazan, Dobather, banda Anamlok, Lama Maira, Banda Jalal, Jhangi, Derawand, Mirpur)
Surface Water Gravity Supply System	1	Intake Facility	Beran Gari River Capacity; 200 lit/s (17,300 m3/d)	Gaya and Bagh Rivers Capacity; 150 lit/s (13,000 m3/d)
	2	Treatment Facilities	Coagulation and Sedimentation Basin, Rapid Sand Filter, Disinfection Capacity; 69 lit/s (6,000 m3/d)	Gravel Filter, Disinfection Capacity; 150 lit/s (13,000 m3/d)
	3	Transmission Pipeline	Dia; ϕ450 mm Length; 23 km	Dia; ϕ400 mm Length; 19 km
	4	Replacement of Existing Booster Pump	Not included	3 places
Ground-water Supply System	5	Replacement of Existing Well Pump	Not included	9 places
	6	New Well Construction	Not included	24 places
	7	Balancing Reservoir	Not included	12 places

JAPAN'S GRANT AID

The Grant Aid Scheme provides a recipient country with non-reimbursable funds to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for economic and social development of the country under principles in accordance with the relevant laws and regulations of Japan. The Grant Aid is not supplied through the donation of materials as such.

1. Grant Aid Procedures

Japan's Grant Aid scheme is executed through the following procedures.

Application	(Request made by the recipient country)
Study	(Basic Design Study conducted by JICA)
Appraisal &Approval	(Appraisal by the Government of Japan and Approval by the Cabinet)
Determination of Implementation	(The Note exchanged between the Governments of Japan and recipient country)

Firstly, the application or request for a Grant Aid project submitted by a recipient country is examined by the Government of Japan (the Ministry of Foreign Affairs) to determine whether or not it is eligible for Grant Aid. If the request is deemed appropriate, the Government of Japan assigns JICA (Japan International Cooperation Agency) to conduct a study on the request.

Secondly, JICA conducts the study (Basic Design Study) using (a) Japanese consulting firm(s).

Thirdly, the Government of Japan appraises the project to see whether or not it is suitable for Japan's Grant Aid Scheme, based on the Basic Design Study report prepared by JICA, and the results are then submitted to the Cabinet for approval.

Fourthly, the project, once approved by the Cabinet, becomes official with the Exchange of Notes (E/N) signed by the Governments of Japan and the recipient country.

Finally, for the implementation of the project, JICA assists the recipient country in such matters as preparing tenders, contracts and so on.

2. Basic Design Study

(1) Contents of the study

The aim of the Basic Design Study (hereafter referred to as "the Study") conducted by JICA on a requested project (hereafter referred to as "the Project") is to provide a basic document necessary for the appraisal of the Project by the Government of Japan. The contents of the Study are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of agencies concerned of the recipient country necessary for the Project's implementation.
- Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, social and economic point of view.
- Confirmation of items agreed on by both parties concerning the basic concept of the Project.
- Preparation of a basic design of the Project.
- Estimation of costs of the Project.

The contents of the original request are not necessarily approved in their initial form as the contents of the Grant Aid project. The Basic Design of the Project is confirmed considering the guidelines of the Japan's Grant Aid Scheme.

The Government of Japan requests the Government of the recipient country to take whatever measures are necessary to ensure 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 organization in the recipient country actually implementing the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country through the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Study, JICA uses (a) registered consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms. The firm(s) selected carry(ies) out a Basic Design Study and write(s) a report, based upon terms of reference set by JICA. The consultant firm(s) used for the Study is(are) recommended by JICA to the recipient country to also work on the Project's implementation after the Exchange of Notes, in order to maintain technical consistency.

3. Japan's Grant Aid Scheme

(1) Exchange of Notes (E/N)

Japan's Grant Aid is extended in accordance with the Notes exchanged by the two Governments concerned, in which the objectives of the Project, period of execution, conditions and amount of the Grant Aid, etc., are confirmed.

(2) "The period of the Grant Aid" means the one fiscal year which the Cabinet approves the Project for. Within the fiscal year, all procedures such as exchanging of the Notes, concluding contracts with (a) consultant firm(s) and (a) contractor(s) and final payment to them must be completed. However, in case of delays in delivery, installation or construction due to unforeseen factors such as national disaster, the period of the Grant Aid can be further extended for a maximum of one fiscal year at most by mutual agreement between the two Governments.

(3) Under the Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased. When the two Governments deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country. However, the prime contractors, namely, consulting, constructing and procurement firms, are limited to "Japanese nationals". (The term "Japanese nationals" means persons of Japanese nationality or Japanese corporations controlled by persons of Japanese nationality.)

(4) Necessity of "Verification"

The Government of recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by the Government of Japan. This "Verification" is deemed necessary to secure accountability to Japanese taxpayers.

(5) Undertakings required of the Government of the Recipient Country

In the implementation of the Grant Aid Project, the recipient country is required to undertake such necessary measures as the following:

a) To secure land necessary for the sites of the Project and to clear, level and reclaim the land prior to commencement of the construction,

b) To provide facilities for the distribution of electricity, water supply and drainage and other incidental facilities in and around the sites,

c) To secure buildings prior to the procurement in case the installation of the equipment,

d) To ensure all the expenses and prompt excursion for unloading, customs clearance at the port of disembarkation and internal transportation of the products purchased under the Grant Aid,

e) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in the recipient country with respect to the supply of the products and services under the Verified Contracts,

f) To accord Japanese nationals, whose services may be required in connection with the supply of the products and services under the Verified contracts, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.

(6) "Proper Use"

The recipient country is required to maintain and use the facilities constructed and the equipment purchased under the Grant Aid properly and effectively and to assign staff necessary for this operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.

(7) "Re-export"

The products purchased under the Grant Aid should not be re-exported from the recipient country.

(8) Banking Arrangements (B/A)

a) The Government of the recipient country or its designated authority should open an account in the name of the Government of the recipient country in a bank in Japan (hereinafter referred to as "the Bank"). The Government of Japan will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.

b) The payments will be made when payment requests are presented by the Bank to the Government of Japan under an Authorization to Pay (A/P) issued by the Government of the recipient country or its designated authority.

(9) Authorization to Pay (A/P)

The Government of the recipient country should bear an advising commission of an Authorization to Pay and payment commissions to the Bank.

(end)

Annex-5

Major Undertakings to be taken by Each Government

No.	Items	To be covered by Grant Aid	To be covered by Recipient Side
1	To secure land		◎
2	To clear, level and reclaim the site when needed		◎
3	To construct gates and fences in and around the site	○	
4	To construct the parking lot		
5	To construct roads	◎	
	1) Within the site		◎
	2) Outside the site	◎	
6	To construct the buildings		
7	To provide facilities for the distribution of electricity, water supply, drainage and other incidental facilities		
	1) Electricity		
	a. The distributing line to the site		◎
	b. The drop wiring and internal wiring within the site	○	
	c. The main circuit breaker and transformer	○	
	2) Water Supply		
	a. The city water distribution main to the site		◎
	b. The supply system within the site (receiving and elevated tanks)	◎	
	3) Drainage		
	a. The city drainage main (for storm, sewer and others to the site)		◎
	b. The drainage system (for toilet sewer, ordinary waste, storm drainage and others) within the site	○	
	4) Telephone System		
	a. The telephone trunk line to the main distribution frame/panel (MDF) of the building		◎
	b. The MDF and the extension after the frame/panel	○	
	5) Furniture and Equipment		
	a. General furniture		◎
	b. Project equipment	○	
8	To bear the following commission to the Japanese bank for banking services based upon the I/A		
	1) Advising commission of A/P		○
	2) Payment commission		○
9	To ensure unloading and customs clearance at port of disembarkation in recipient country		
	1) Marine (Air) transportation of the products from Japan to the recipient	○	
	2) Tax exemption and custom clearance of the products at the port of disembarkation		◎
	3) Inland transportation from the port of disembarkation to the project site	◎	
10	To accord Japanese nationals, whose service may be required in connection with the supply of the products and the services under the verified contract, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.		◎
11	To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the supply of the products and services under the verified contracts		◎
12	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid		◎
13	To bear all the expenses, other than those to be borne by the Grant Aid, necessary for construction of the facilities as well as for the transportation and installation of the equipment		◎

(B/A: Banking Arrangement, A/P: Authorization to pay)

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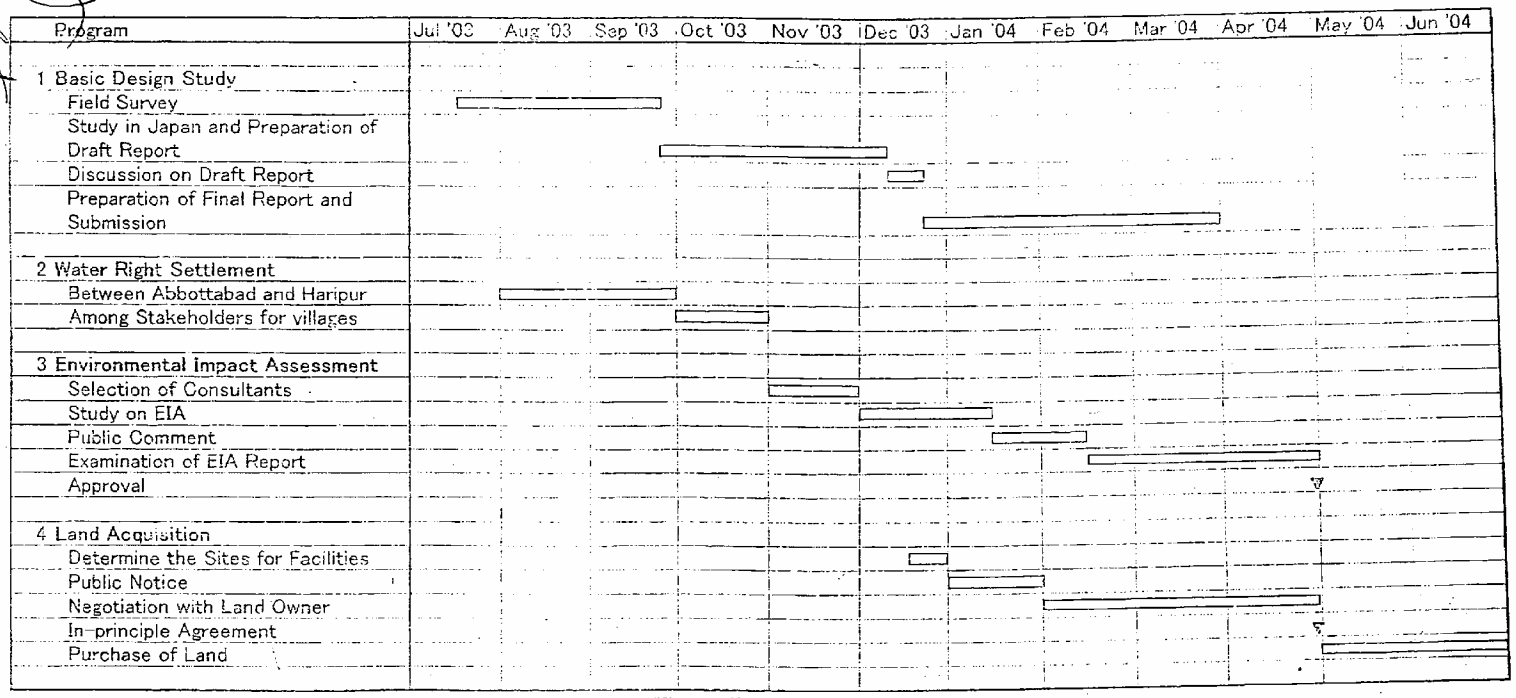
Annex-6

Program for Water Right Settlement, Environmental Impact Assessment (EIA) and Land Acquisition



Minutes of Discussions
The Basic Design Study on
The Project for Improvement of Water Supply in Abbottabad
in Islamic Republic of Pakistan
(Explanation on Draft Final Report)

In July, 2003 and January, 2004, Japan International Cooperation Agency (hereinafter referred to as 'JICA') dispatched Basic Design Study Team on the Project for Improvement of Water Supply in Abbottabad (hereinafter referred to as "the Project") to the Islamic Republic of Pakistan (hereinafter referred to as 'Pakistan'), and through discussion, field survey, and technical examination of the results in Japan, JICA prepared a draft final report of the study.

In order to explain and to consult with the Pakistan side on the contents of the draft final report, JICA sent to Pakistan the Draft Final Report Explanation Team (hereinafter referred to as 'the Team'), which was headed by Mr. Yoshio Fukuda, Team Director, Water and sanitation Team, Project Management Group 1, Grant Aid Management Department, JICA, and was scheduled to stay in the country from May 24th to Jun. 5th, 2004.

As a result of discussion, both parties confirmed the main items described on the attached sheets.

Peshawar, May 27, 2004

Yoshio Fukuda
Leader
Basic Design Study Team
Japan International Cooperation Agency

Wakil Khan Afridi
Secretary
Local Government and Rural Development Department
Government of North West Province
Islamic Republic of Pakistan

Ghulam Mustafa Khan Jadaoon
Zilla Nazim, Abbotabad
Government of North West Frontier Province
Islamic Republic of Pakistan

Farhad Amoz Khan
Executive District Officer
Works and Services Department
District Government Abbottabad
Islamic Republic of Pakistan

Rashid Kamal
Town Municipal Officer
Town Municipal Administration Abbottabad
Islamic Republic of Pakistan

Witnessed by :

Muhammad Ashraf Khan
Joint Secretary
Economic Affairs Division
Ministry of Economic Affairs & Statistics
Islamic Republic of Pakistan

Witnessed by :

Syed Manzoor Ali Shah
Secretary
Planning and Development Department
Government of North West Frontier Province
Islamic Republic of Pakistan

ATTACHMENT

1. Components of the Project

The Pakistan side agreed and accepted in principle the components of the draft final report explained by the Team.

2. Japan's Grant Aid Scheme

The Pakistan side understands the Japan's Grant Aid Scheme and the necessary measures to be taken by the Government of Pakistan as explained by the Team and described in **Annex-4** and **Annex-5** of the Minutes of Discussions signed by both sides on July 19th, 2003.

3. Schedule of the Study

JICA will complete the final report in accordance with the confirmed items and will send it to Pakistan by August 2004.

4. Other relevant issues

(1) Undertaking by the Pakistan side

The responsible organization of the Government of the North West Frontier Province and the implementing organization of the District Government Abbottabad understand Japan's Grant Aid shown in **Annex-4** of the Minutes of Discussions signed by both sides on July 19th, 2003.

They promised to take necessary actions and procedures according to **Annex-5** of the above-mentioned Minutes of Discussions on time and properly for successful implementation of the Project.

The said **Annex-4** and **Annex-5** are attached to this Minutes of Discussions.

(2) PC－1 form

The Pakistan side express to do its best for the purpose to obtain the approval at the ECNEC by the end of June, 2004.

For this purpose, both sides will have close communication to promptly offer necessary information between the Pakistan side and the Japanese side.

(3) Water Right

The Pakistan side confirmed that water right issue between the Haripur district and the Abbottabad district will be resolved by Jun. 5, 2004 as the result of the meeting held between the P&D Department, LG&RD Department and two district governments on May 26, 2004 to facilitate the approval of PC-1 and implementation of the Project.

(4) Environment Impact Assessment (EIA)

The Pakistan side confirmed that the EPA of the Government of North West Frontier Province completed examination on the IEE of the Project according to the

laws with the result of no negative impact and no requirement of EIA on the Project.

(5) Land Acquisition

The Pakistan side explained the progress that the survey on the market price of each land is under execution following the Public Notice.

(6) Project Operation Plan

The Team explained the Project Operation Plan, particularly Surface Water System Management including establishment of new organization, and stated that this point is very important to attain the purpose of the Project.

The Pakistan side understood necessity and importance of the new organization suggested in the Draft Final Report and promised to secure the necessary budget and personnel.

Necessary budget will be ensured based on the authorized PC-1 by the Pakistan side and actual implementation will be started with support by the Japanese side after the detailed design stage and a cell will be established under the District Government by the construction stage of the water treatment plant.

(7) Water tariff

The Pakistan side agreed to take necessary actions to apply metered tariff system suggested and to raise water tariff at appropriate level with appropriate tariff collection for sound operation of the new organization.

(8) Sewerage

The Pakistan side agreed to cope with the increase of sewage caused from the increase of water supply.

JAPAN'S GRANT AID

The Grant Aid Scheme provides a recipient country with non-reimbursable funds to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for economic and social development of the country under principles in accordance with the relevant laws and regulations of Japan. The Grant Aid is not supplied through the donation of materials as such.

1. Grant Aid Procedures

Japan's Grant Aid scheme is executed through the following procedures.

Application	(Request made by the recipient country)
Study	(Basic Design Study conducted by JICA)
Appraisal &Approval	(Appraisal by the Government of Japan and Approval by the Cabinet)
Determination of Implementation	(The Note exchanged between the Governments of Japan and recipient country)

Firstly, the application or request for a Grant Aid project submitted by a recipient country is examined by the Government of Japan (the Ministry of Foreign Affairs) to determine whether or not it is eligible for Grant Aid. If the request is deemed appropriate, the Government of Japan assigns JICA (Japan International Cooperation Agency) to conduct a study on the request.

Secondly, JICA conducts the study (Basic Design Study) using (a) Japanese consulting firm(s).

Thirdly, the Government of Japan appraises the project to see whether or not it is suitable for Japan's Grant Aid Scheme, based on the Basic Design Study report prepared by JICA, and the results are then submitted to the Cabinet for approval.

Fourthly, the project, once approved by the Cabinet, becomes official with the Exchange of Notes (E/N) signed by the Governments of Japan and the recipient country.

Finally, for the implementation of the project, JICA assists the recipient country in such matters as preparing tenders, contracts and so on.

2. Basic Design Study

(1) Contents of the study

The aim of the Basic Design Study (hereafter refered to as "the Study") conducted by JICA on a requested project (hereafter refered to as "the Project") is to provide a basic document necessary for the appraisal of the Project by the Government of Japan. The contents of the Study are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of agencies concerned of the recipient country necessary for the Project's implementation.
- Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, social and economic point of view.
- Confirmation of items agreed on by both parties concerning the basic concept of the Project.
- Preparation of a basic design of the Project.
- Estimation of costs of the Project.

The contents of the original request are not necessarily approved in their initial form as the contents of the Grant Aid project. The Basic Design of the Project is confirmed considering the guidelines of the Japan's Grant Aid Scheme.

The Government of Japan requests the Government of the recipient country to take whatever measures are necessary to ensure 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 organization in the recipient country actually implementing the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country through the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Study, JICA uses (a) registered consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms. The firm(s) selected carry(ies) out a Basic Design Study and write(s) a report, based upon terms of reference set by JICA. The consultant firm(s) used for the Study is(are) recommended by JICA to the recipient country to also work on the Project's implementation after the Exchange of Notes, in order to maintain technical consistency.

3. Japan's Grant Aid Scheme

(1) Exchange of Notes (E/N)

Japan's Grant Aid is extended in accordance with the Notes exchanged by the two Governments concerned, in which the objectives of the Project, period of execution, conditions and amount of the Grant Aid, etc., are confirmed.

(2) "The period of the Grant Aid" means the one fiscal year which the Cabinet approves the Project for. Within the fiscal year, all procedures such as exchanging of the Notes, concluding contracts with (a) consultant firm(s) and (a) contractor(s) and final payment to them must be completed. However, in case of delays in delivery, installation or construction due to unforeseen factors such as national disaster, the period of the Grant Aid can be further extended for a maximum of one fiscal year at most by mutual agreement between the two Governments.

(3) Under the Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased. When the two Governments deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country. However, the prime contractors, namely, consulting, constructing and procurement firms, are limited to "Japanese nationals". (The term "Japanese nationals" means persons of Japanese nationality or Japanese corporations controlled by persons of Japanese nationality.)

(4) Necessity of "Verification"

The Government of recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by the Government of Japan. This "Verification" is deemed necessary to secure accountability to Japanese taxpayers.

(5) Undertakings required of the Government of the Recipient Country

In the implementation of the Grant Aid Project, the recipient country is required to undertake such necessary measures as the following:

a) To secure land necessary for the sites of the Project and to clear, level and reclaim the land prior to commencement of the construction,

b) To provide facilities for the distribution of electricity, water supply and drainage and other incidental facilities in and around the sites,

c) To secure buildings prior to the procurement in case the installation of the equipment,

d) To ensure all the expenses and prompt excursion for unloading, customs clearance at the port of disembarkation and internal transportation of the products purchased under the Grant Aid,

e) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in the recipient country with respect to the supply of the products and services under the Verified Contracts,

f) To accord Japanese nationals, whose services may be required in connection with the supply of the products and services under the Verified contracts, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.

(6) "Proper Use"

The recipient country is required to maintain and use the facilities constructed and the equipment purchased under the Grant Aid properly and effectively and to assign staff necessary for this operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.

(7) "Re-export"

The products purchased under the Grant Aid should not be re-exported from the recipient country.

(8) Banking Arrangements (B/A)

a) The Government of the recipient country or its designated authority should open an account in the name of the Government of the recipient country in a bank in Japan (hereinafter referred to as "the Bank"). The Government of Japan will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.

b) The payments will be made when payment requests are presented by the Bank to the Government of Japan under an Authorization to Pay (A/P) issued by the Government of the recipient country or its designated authority.

(9) Authorization to Pay (A/P)

The Government of the recipient country should bear an advising commission of an Authorization to Pay and payment commissions to the Bank.

(enc

Annex-5

Major Undertakings to be taken by Each Government

No.	Items	To be covered by Grant Aid	To be covered by Recipient Side
1	To secure land		◎
2	To clear, level and reclaim the site when needed		◎
3	To construct gates and fences in and around the site	○	
4	To construct the parking lot		
5	To construct roads	◎	
	1) Within the site		◎
	2) Outside the site	◎	
6	To construct the buildings		
7	To provide facilities for the distribution of electricity, water supply, drainage and other incidental facilities		
	1) Electricity		
	a. The distributing line to the site		◎
	b. The drop wiring and internal wiring within the site	○	
	c. The main circuit breaker and transformer	○	
	2) Water Supply		
	a. The city water distribution main to the site		◎
	b. The supply system within the site (receiving and elevated tanks)	◎	
	3) Drainage		
	a. The city drainage main (for storm, sewer and others to the site)		◎
	b. The drainage system (for toilet sewer, ordinary waste, storm drainage and others) within the site	○	
	4) Telephone System		
	a. The telephone trunk line to the main distribution frame/panel (MDF) of the building		◎
	b. The MDF and the extension after the frame/panel	○	
	5) Furniture and Equipment		
	a. General furniture		◎
	b. Project equipment	○	
8	To bear the following commission to the Japanese bank for banking services based upon the I/A		
	1) Advising commission of A/P		○
	2) Payment commission		○
9	To ensure unloading and customs clearance at port of disembarkation in recipient country		
	1) Marine (Air) transportation of the products from Japan to the recipient	○	
	2) Tax exemption and custom clearance of the products at the port of disembarkation		◎
	3) Inland transportation from the port of disembarkation to the project site	○	
10	To accord Japanese nationals, whose service may be required in connection with the supply of the products and the services under the verified contract, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.		◎
11	To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the supply of the products and services under the verified contracts		◎
12	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid		◎
13	To bear all the expenses, other than those to be borne by the Grant Aid, necessary for construction of the facilities as well as for the transportation and installation of the equipment		◎

(B/A: Banking Arrangement, A/P: Authorization to pay)

Appendix 5　Cost Estimation Borne by the Government of Pakistan

Cost Estimation Borne by the Government of Pakistan

No.	Cost Items	Quantity	Unit	Unit Price ('000 Rs.)	Cost (million Rs.)
1.	Land Acquisition	100	kanal	400	40.00
2.	Access Road Construction				24.00
2-1	Widening water Works road	2	km	4170	8.34
2-2	Single road up to water source	3	km	2800	8.40
2-3	Improvement other road	10	km	726	7.26
3.	Provision of Facilities				26.40
3-1	Electricity		1 L.S.		13.40
3-2	Water Supply	12.5	Km	0.8	10.00
3-3	Gas	1	L.S.		3.00
4.	Furniture & Equipment	1	L.S.		0.10
5.	Interlinking old/new reservoir and tube well	14	site	128.57	18.00
6.	Extension/rehabilitation of existing distribution network	14	site	5714.2	80.00
7.	Supply and Installation of water meter/service connection	15000	sets	5	75.00
8.	PMU establishment	1	L.S.		5.97
9.	Bank charges and others	1	L.S.		28.45
10.	Contingencies	1	L.S.		2.08
	Total				300.00

Note: 1 kanal = 500 m2

Appendix 6 Other Relevant Data

6-1 Comparative Study on Pump-up System and Gravity Flow System

6-2 Population Projection in the Service Area

6-3 Results of Water Quality Test

6-4 Precipitation Data

6-5 Results of River Flow Measurement

6-6 Study on Hydrogeology and Groundwater Recharge

6-7 Evaluation on Existing Wells and New WellConstruction

6-8 Hydraulic Analysis of Raw Water/Treated Water Transmission Mains

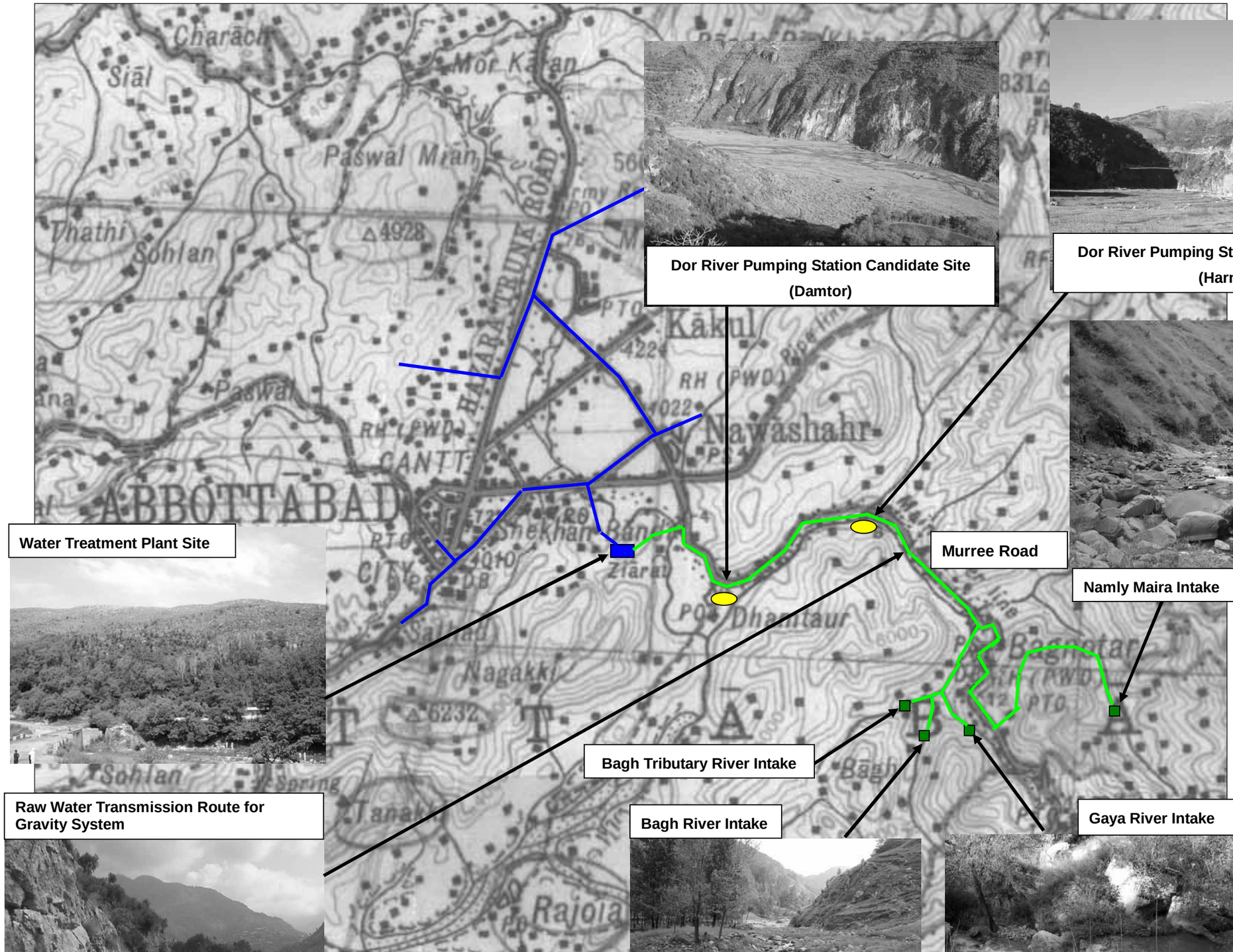
Appendix 6-1 Comparative Study on Pump-up System and Gravity Flow System

Basic Design Study
on the Project for the Improvement of the Water Supply
in Abbottabad

-Result of Second Field Survey-

Contents

Appendices in Appendix 6-1

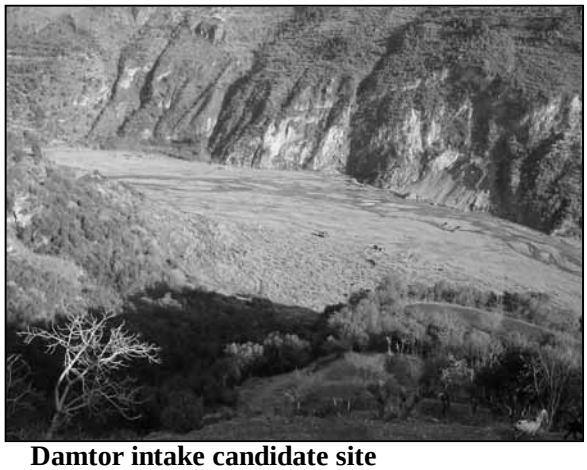


Appendix 6-1-0-2

1. Second Field Survey Result Outline

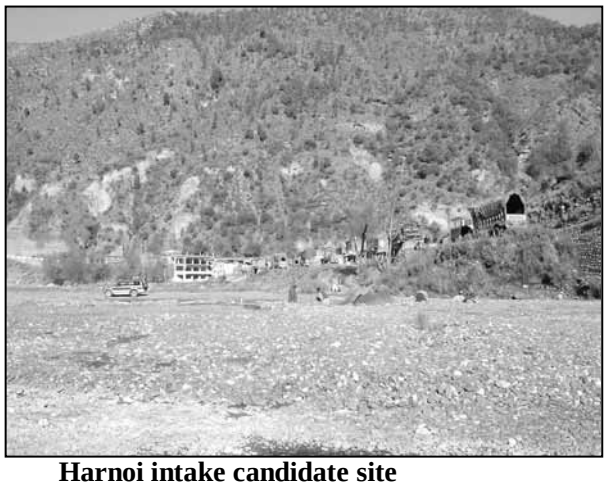
1-1 Outline of Pump-Up Intake Site of Dor River

As the subsoil water intake site candidates from Dor River, the 2 points were selected: Damtor that is near to the water treatment plant and Harnoi that is adjacent to Murree Road, shown in Fig.-1. It has been determined that these 2 points are selected as objects, as there continue steep slopes (vertical grade: 50% ~ 100% or more) that rise steeply on both banks from Damtor to near Harnoi, which is located upstream, and the conditions to be compared are evidently worse than Damtor. Moreover, it is clarified that contamination has become considerably worse, as the water quality test result showed 500 BOD or more, which is quality level of sewage, for small rivers flowing directly under the treatment plant. As treatment with this water quality is difficult and the water is not suitable to water source, this point is excluded from the water source candidate. (Refer to Appendix 6-1-A3.)



Damtor intake candidate site

Midpoint between Damtor and Harnoi



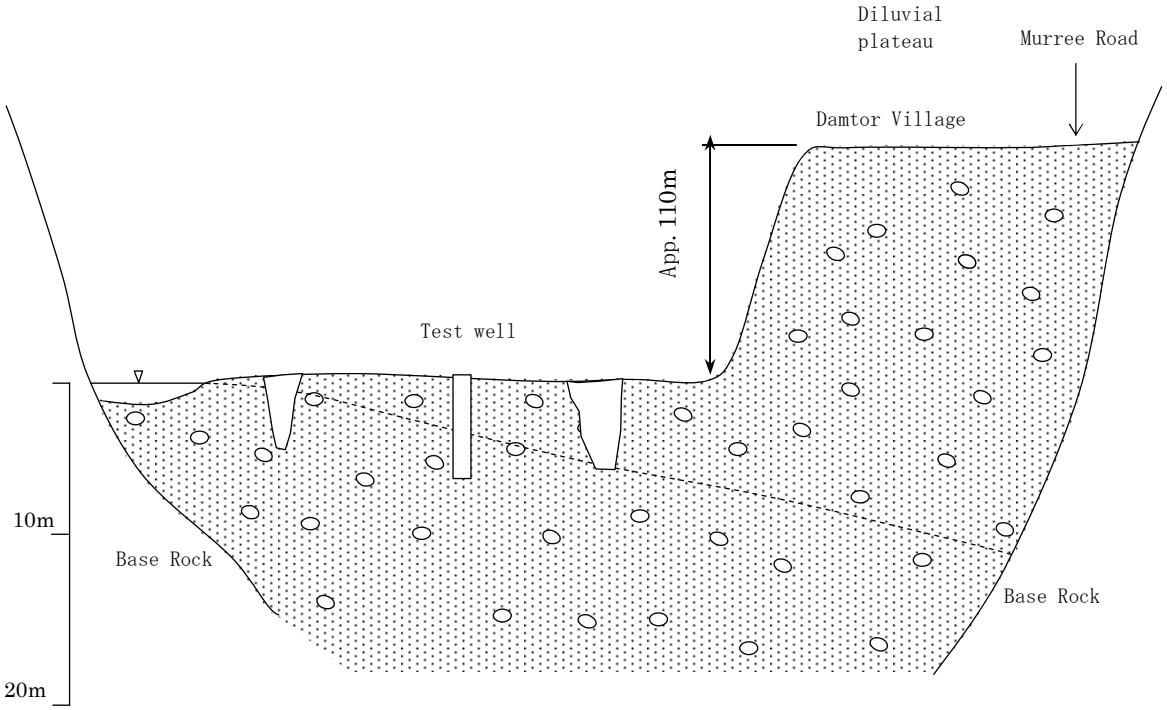
Harnoi intake candidate site

Table 1-1: General Situation of Dor River Subsoil Water Intake Candidate Point

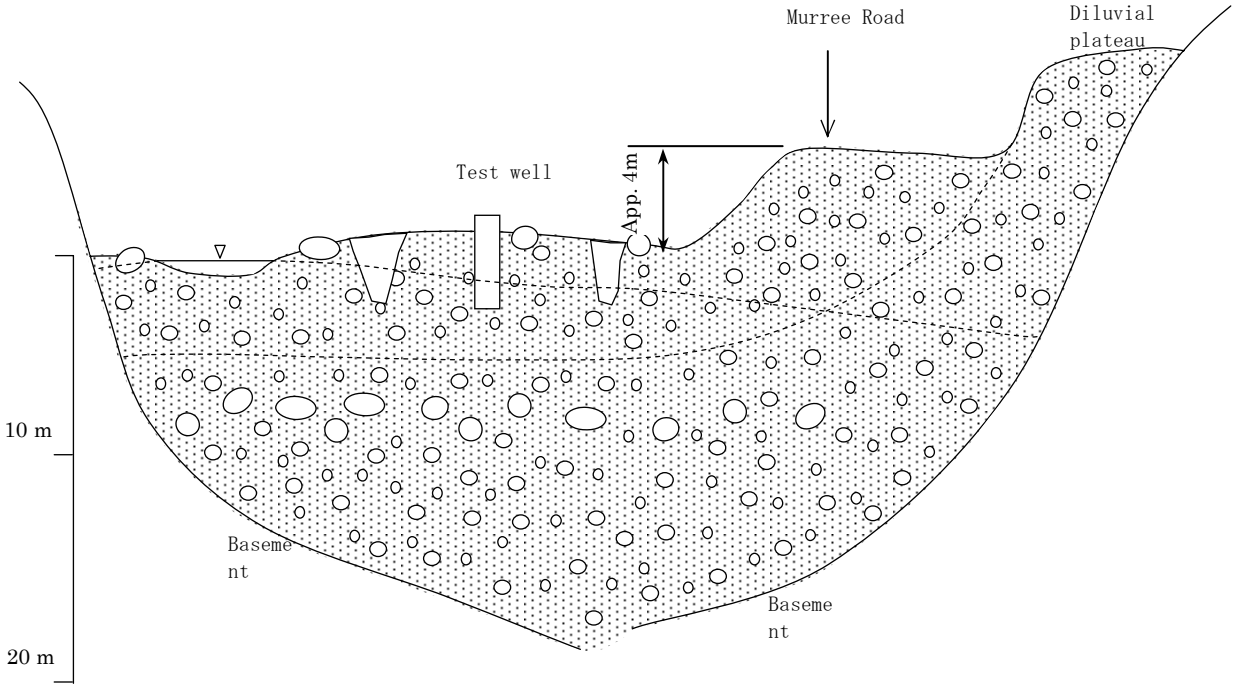
Intake Point	Intake Damtor	Intake Harnoi
Elevation of riverbed	+1075	+1130
Distance to treatment plant	4,203m	6,938m
Features of intake point	• Nearest to treatment plant. • Steep slopes on both banks (average vertical grade of right bank: 40% ~ 50%) and elevation difference of approximately 110 m between riverbed and flat area of right bank. • Construction of access road to intake point is required.	• Though far from treatment plant, right river bank is near Murree Road (elevation difference: 4m) and construction of access road is hardly required.
Geology	Mainly composed of gravel bed from fine-grained sand to cobbles, depth to bedrock of approximately 20m or more (result of electrical geological exploration). No distribution of large boulders, etc. is observed, and it is presumed that relatively mild depositional environment existed in comparison with Harnoi intake point.	1 ~ 2m large boulders are scattered on riverbed surface, and, boulder layer containing 0.6 ~ 0.8m large gravels is distributed up to depth of 3.5m. As for deeper layer, it is presumed based upon electrical geological exploration that 1 ~ 2m large boulders appear again between 7 ~ 10m and bedrock is distributed around 15 ~ 18m. Furthermore, it is certain that 1 ~ 2m large boulders flow down during flooding. If facilities are constructed on riverbed, damage and flowing-out may occur without impregnable structure.
Subsoil water level	Subsoil water level lowers toward bank at grade of approximately 2.2%, with current river surface on the highest level.	As gravel layer consists mainly of cobbles and boulders, water permeability is good. Underground water level lowers at grade of approximately 1.36% toward bank, with current river surface on the highest level.

Intake Point	Intake Damtor	Intake Harnoi
Others	In 1976, infiltration gallery and pump station were constructed to supply water to Damtor Village. River turbidity during rainy season was extremely high and clogging of infiltration gallery and shutdown of water supply occurred frequently. Accordingly, these facilities were abandoned and the system was switched to that of gravity flow water supply.	Elevation difference between vicinity to intake point and Murree Road is approximately 4m. Riverbed is used as recreation zone for citizens. Furthermore, gravel gathering businesses are run by many persons.

Reference Figures



Damtor Intake Point

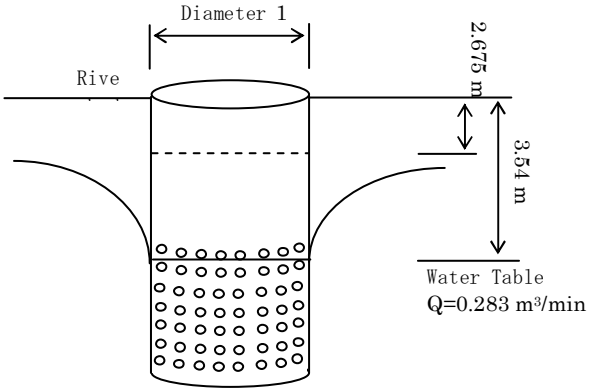


Harnoi Intake Point

1-2 Pumping Test Results

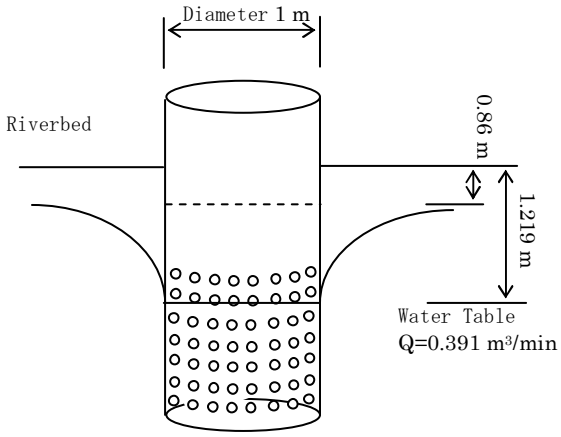
Pumping test was carried out by using holes that had been bored for test, with a steel pipe of 1m diameter and 4.8m length shown in the below figure. The pumping test result is as follows.

Intake Damtor



Transmissivity T(m^2/min)	
Continuous pumping test	0.114
Recovery test	0.095
Average	0.105
Permeability k(m/min)	0.040
Storativity S	0.410
Influence radius R(m)	15.748

Intake Harnoi



Transmissivity T(m^2/min)	
Continuous pumping test	0.252
Recovery test	0.332
Average	0.292
Permeability k(m/min)	0.104
Storativity S	0.362
Influence radius R(m)	9.274

1-3 Evaluation of Possible Amount of Intake

From the above-mentioned results, the pump discharge flow rate of the infiltration gallery was evaluated as per shown in the below table under the conditions of the infiltration gallery pipe diameter of 1000mm, water intake hole diameter of 20mm and water intake hole inlet velocity of 3cm/sec. or less. The shallow well with the same boring depth as the infiltration gallery was evaluated with well radius of 2.5m and respective influence radii of 18m and 15m at Damtor and Harnoi under condition of water intake from well bottom. (Refer to Attachments A-1 and A-5 for details.)

Intake Point	Intake Damtor	Intake Harnoi
Infiltration gallery pump discharge rate of flow (m^3/sec)	0.210 (L=270m、Φ1.0m)	0.433 (L=230m、Φ1.0m)
Shallow well pump discharge rate of flow (m^3/sec)	0.013 x 16 locations	0.019×11locations

For the planned water intake amount of 0.2m^3/sec, it is judged that the water intake amounts for both infiltration gallery and shallow well can be ensured.

1-4 Water Quality Test Results

As a result of the sampling prior to completion of pumping test for 24 hours and result of the analysis, the items to be objects of treatment as water source are turbidity and coliform group for the subsoil water quality of Damtor and Harnoi, among the test results of all the items. The other items have lower values than those of Potable Water Quality Guideline of WHO, which do not present any problem. (Refer to Attachment A-3.)

Intake Point	Intake Damtor	Intake Harnoi
Turbidity (NTU)	37	3.8
Coliform group (MPN/100ml) Fecal coliform group (MPN/100ml)	240 or more 240 or more	240 or more 240 or more
Treatment facilities required as minimum	Slow Sand Filter Chlorination facility	Slow Sand Filter Chlorination facility

Only one sampling was made during the field survey, and the turbidity at Intake Harnoi is lower than 5NTU of Guideline Value. As the turbidity of subsoil water increased at downstream Intake Damtor due to rainfall upstream, the turbidity rise that is of the same level or higher is expected in Harnoi that is upstream with higher permeability and higher water level.

Furthermore, the turbidity of Dor River water during sampling at Damtor was 550NTU.

2. Comparison between Pump-up Water Supply Plan and Gravity Water Supply Plan

2-1 Selection of Pump-up Intake Point

As the facilities required for subsoil water intake of planned water intake amount (200 l/sec), 2 methods such as infiltration gallery and shallow well can be considered. Tables 2-1 and 2-2 show the outline of facility plan of infiltration gallery and shallow well in respective candidate intake sites.

In case of shallow well, the well is planned near the river bank (right bank), considering maintenance. Accordingly, as the groundwater level lowers, the boring depth of well is deepened. As for Harnoi, as the underwater level is high and the permeability is also high, the depth of the infiltration gallery will have the same degree of depth.

Fig. 2 shows the standard cross sections of infiltration gallery laying and shallow wells at Damtor and Harnoi.

As a result of analysis, the required numbers of wells are 16 and 11 for Damtor and Harnoi, respectively. The total length of connecting pipes of each well pipes are required to be 576m and 330m considering the well influence radii. In case of shallow well, the excavation of long length for both intake candidates, and the construction cost becomes higher in comparison with infiltration gallery. Therefore, the infiltration gallery is more beneficial.

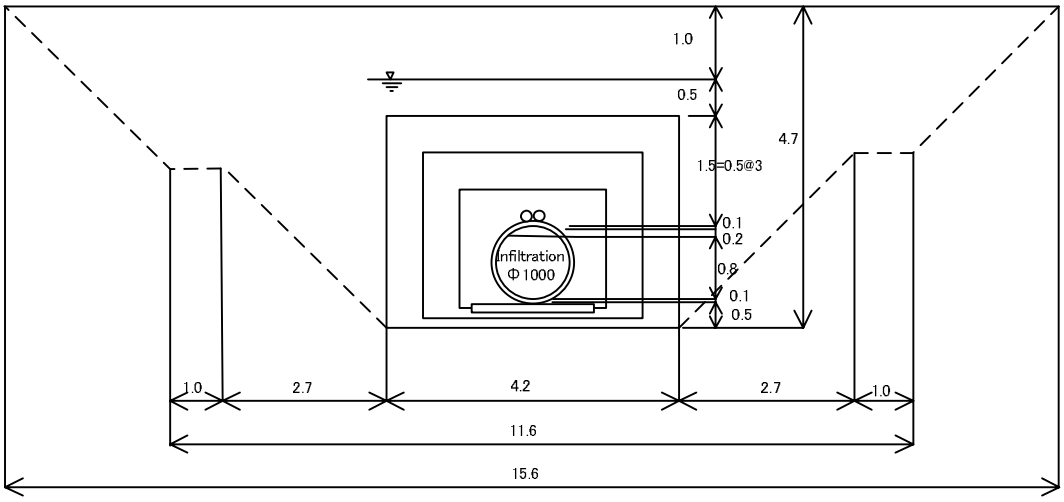
Table 2-1: Outline of Infiltration Gallery Facilities required for Intake of Planned Water Amount

Intake Point	Intake Damtor	Intake Harnoi
Infiltration gallery length (m)	270m	230m
Diameter (mm)	1,000mm	1,000mm
Burying depth (m)	4.7m	4.6m

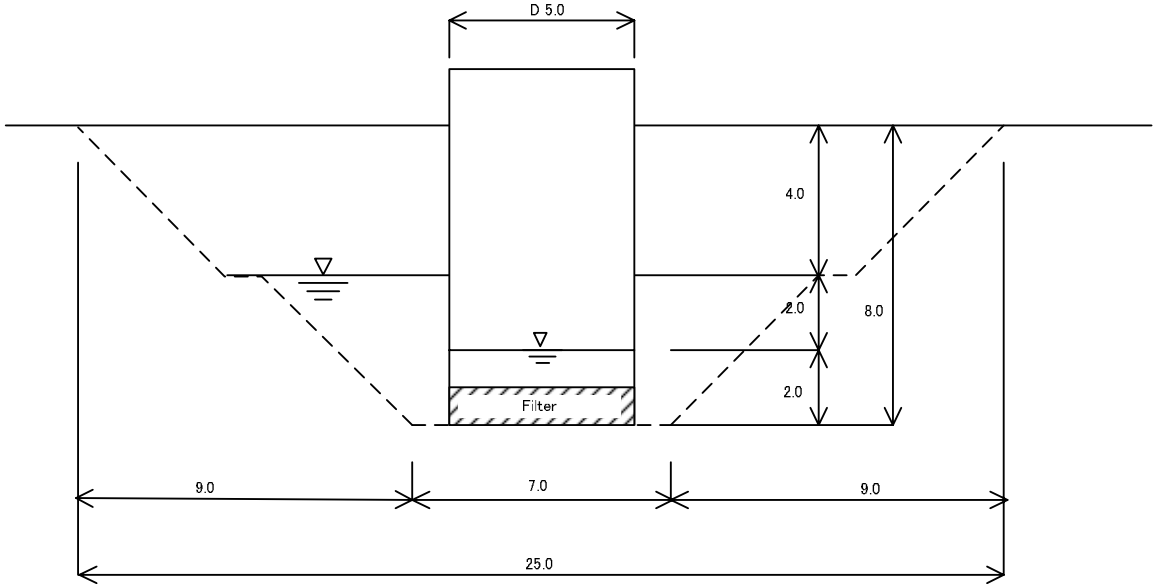
Table 2-2: Outline of Shallow Well Facilities required for Intake of Planned Water Amount

Intake Point	Intake Damtor	Intake Harnoi
Well diameter (m)	2.5m	2.5m
Well depth (m)	9m	4.6m
Required number of wells	16	11
Intervals between wells (m)	36m	30m
Connecting pipe diameter and total length (m)	576m	330m

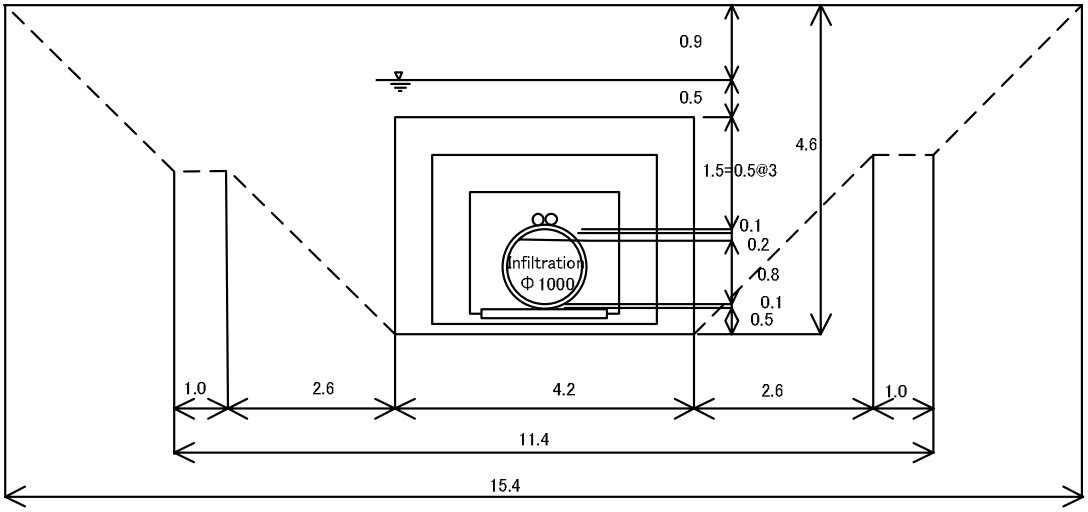
Infiltration Gallery at Damtor



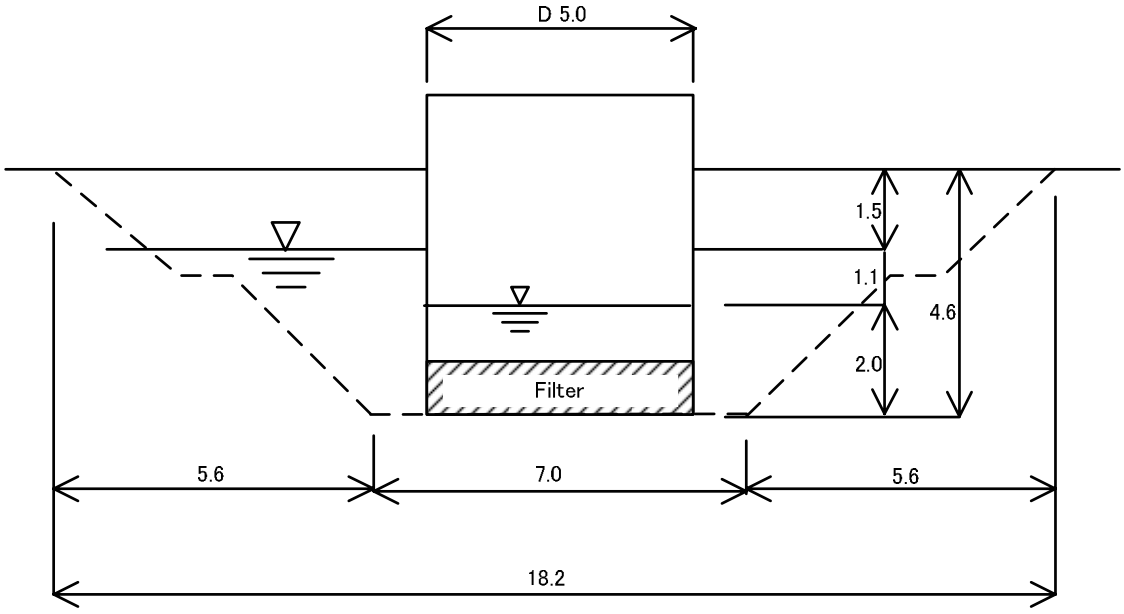
Shallow Well at Damtor



Infiltration Gallery at Harnoi



Shallow Well at Harnoi



Therefore, the infiltration gallery as intake method of subsoil water is more beneficial in both Damtor and Harnoi. However, Hanoi has the following problems for construction:

- Soil mitred work and dewatering are normally required in order to lay infiltration gallery pipes in deep location below riverbed surface. As the soil mitred work with steel sheet piles is difficult in the place where there are lot of boulders, special work such as diaphragm wall construction method becomes necessary. Furthermore, though there is deep well work method, etc. for dewatering, the adoption of these special work methods does not seem realistic, taking into consideration the technology level and the cost at site.
- Accordingly, though the pipe laying by normal work method needs dewatering by drain pumps, the problem will be how much water is required to be dewatered. Since the permeability is high and the underground water level is high in Harnoi, the scale of dewatering becomes very big. Excavation up to depth of 4.6m from riverbed is required for laying of infiltration gallery pipes, and lowering of underground water level approximately 4m or more is necessary. When base width is 4.2m, top width 15m and excavation length 30m, the necessary dewatering water amount will be approximately $0.3m^3$/sec., requiring large capacity drain pumps. Thus, the execution is realistically difficult. Incidentally, the dewatering water amount in Damtor is approximately $0.1m^3$/sec, which is approximately 1/3 of Harnoi.
- In order to ensure water intake amount that is object, the necessary infiltration gallery length becomes 230m. Accordingly, the execution during rainy season is difficult due to scale of dewatering works, even though the work should be executed by dividing the work sections. Furthermore, as there exist boulders on riverbed and a boulder bed containing 0.6 ~ 0.8m large pebbles is distributed in the depth of 3.5m or more, sufficient construction period is required as a whole.
- Moreover, a possibility of scouring of facilities under construction may not be denied, due to increase of river flow rate by sudden heavy rain during construction period. Countermeasures are required to be taken to protect the facilities from damage and scouring during flooding during and after construction, as the river width is approximately half of that of Damtor and there are observed lot of 1~2 m big boulders on the riverbed.

The following shows comparison of merits and demerits of both cases:

Items	Damtor		Harnoi	
Difficulty or easiness of execution	○	As permeability is relatively low and geotechnical conditions are good, execution by normal construction method of dewatering is possible.	×	As permeability is high and there is gravel stratum containing boulders, execution by normal construction method is difficult.
Construction cost	○	As execution can be done by normal construction method and the water transmission main laying distance is short, construction cost is lower than Harnoi.	×	As special construction method is required and water transmission main laying length is long, construction cost is high.

Maintenance cost	×	As riverbed level is low, electricity cost becomes so high due to high pump head. By the way, annual electricity cost is estimated 69 million yen.	○	As riverbed level is high, pump head is low. Though main laying distance is long, electricity cost is low. By the way, annual electricity cost is estimated 63 million yen.

As per above-mentioned, Harnoi has a merit that electrical charge for maintenance is lower than Damtor because pump head is low. However, construction work in Harnoi is difficult considering work execution meeting local technology level. Thus, Intake Harnoi is judged not realistic. Accordingly, it is determined that Damtor should be selected as the pump-up intake point.

2-2 Facility Plan of Pump-up Water Supply

2-2-1 Intake Facilities

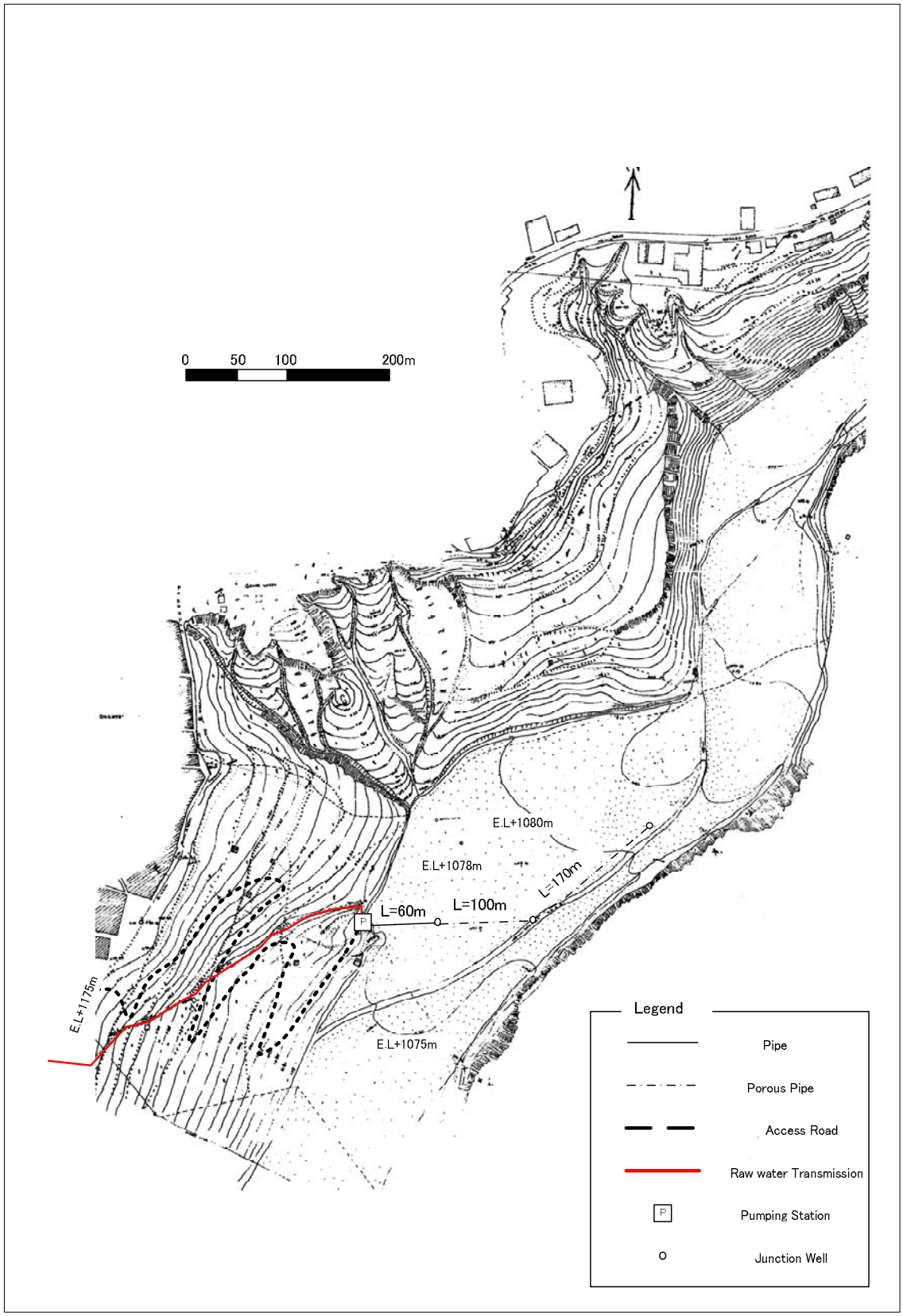
The outline of pump-up intake facility at Damtor point is shown in the following table:

Table 2-3: Outline of Infiltration Gallery Facilities required for Intake of Planned Water Amount

Intake Point	Intake Damtor
Infiltration gallery length (m)	270m
Diameter (mm)	1000mm
Burying depth (m)	4.7m
Water collecting hole	Diameter: 20mm; 30 holes/m^2
Junction wells	4 wells

Fig. 2 on the next page shows burying locations of infiltration gallery and layout plan of pumping station.

Fig.2: Infiltration Gallery Laying Locations in Damtor and Layout of Pump Station



2-2-2 Pump Station Facilities

The intake pump shall be specified by the following table, in connection with required pump head and discharge amount.

Table 2-4: Pump Facility Specifications

Intake Point	Intake Damtor
Pump type	Vertical axis multistage centrifugal pump
Number of operation pumps	2 operating + 1 standby
Total pump head (m)	310
Motor output (kWh)	475

2-2-3 Water Transmission Facilities

The transmission main laying route from the intake pump station to the predetermined point for the water treatment plant is a route from the existing road of Damtor Village via Murree Road, which is the shortest.

Table 2-5: Water Transmission Facilities

Intake Point	Intake Damtor
Transmission Main Diameter (mm)	450
Main Length (km)	4.2
Main Type	Ductile cast iron pipe
Reduction Countermeasures against Water Hammer	Pump + flywheel

2-2-4 Water Treatment Facilities

From the result of raw water quality test, it is judged to require filtration facilities as water treatment facilities against turbidity and bacteriological contamination.

As the turbidity of surface water is 550NTU and that of subsoil water is reduced to 37NTU, the treatment level is supposed that the slow sand filter can cope with that turbidity, which increases slightly for the raw water collected from infiltration gallery during raining. It is judged not to require pretreatment such as roughing filtration.

2-3 Comparison between the Water Supply by Pump-up Intake and the Gravity Water Supply

The following table shows the summery of comparison between Water Supply by Pump-up Intake and Gravity Water Supply:

Table 2-6: Comparison between the Water Supply by Pump-up Intake and the Gravity Water Supply

Item	Plan A Surface Water Gravity System + Underground Water	Plan B Pump Intake from Downstream of Dor River + Underground Water
Surface Water Sources	Gaya River + Bagh River + Namly Maira River: 200 lps	Downstream of Dor River (Damtor Site) 200 lps
Groundwater Source	New: 14.8 lps Existing: 93.5 lps (to use continuously the wells by Assistance of KfW, which were completed in 1999.)	New: 14.8 lps Existing: 93.5 lps (to use continuously the wells by Assistance of KfW, which were completed in 1999.)
Intake	Bar screen method: 4 sites	300m infiltration gallery （ϕ 600） Intake pump station (vertical axis multistage centrifugal pumps of 475kWh, head of 303m; 1 pump standby among 3 pumps)
Raw Water Transmission	ϕ 500mm 6km ϕ 450mm 6km ϕ 350mm 1.6km ϕ 250mm 0.3km ϕ 200mm 7.4km ϕ 150mm 2.0km Total 23.3km	ϕ 450mm 4,203m
Treatment Plant	Roughing filtration + slow sand filter method	Slow Sand Filtration
Well Construction	4 sites	4 sites
Treated Water Transmission (surface water)	Treated Water Transmission: ϕ 500 1.8km ϕ 450 2.4km ϕ 300 1.4km ϕ 250 6.7km ϕ 200 3.6km ϕ 150 6.9km ϕ 100 0.8km Total 23.1km	Treated Water Transmission: ϕ 500 1.8km ϕ 450 2.4km ϕ 300 1.4km ϕ 250 6.7km ϕ 200 3.6km ϕ 150 6.9km ϕ 100 0.8km Total 23.1km
Treated Water Transmission (underground water)	Water transmission from well: ϕ 150 0.8km ϕ 100 2.4km Total 3.2km	Water transmission from well: ϕ 150 0.8km ϕ 100 2.4km Total 3.2km

Land acquisition		Well sites: 4 sites Plant Site: 1 site Intake site: 4 sites Distribution reservoir site: 9 sites The intake facility of gravity plan is of small scale and is located in mountain of upstream of river. Land is not used at subject location and there is no problem for land acquisition.	Well sites: 4 sites Plant Site: 1 site Intake pump station site: 1 site Distribution reservoir site: 9 sites Intake site of pump plan is near existing intake pump station that has been abandoned. There is no problem for land acquisition.
Item		Plan A	Plan B
		Surface Water Gravity System + Underground Water	Pump Intake from Downstream of Dor River + Underground Water
Construction cost	Intake	33 million yen	782 million yen
	Water conveyance	891 million yen	204 million yen
	Water treatment	369 million yen	282 million yen
	Well Construction	50 million yen	50 million yen
	Replacement of well pumps	40 million yen	40 million yen
	Water transmission (surface water)	527 million yen	527 million yen
	Water transmission (underground water)	24 million yen	24 million yen
	Distribution Reservoirs	100 million yen	100 million yen
	Total of construction cost	2,034 million yen	2,009 million yen
Annual operation and maintenance cost for newly built facilities		Total: 28 million yen/year Because of gravity method to treatment plant, electrical charge is not necessary for maintenance.	Total: 100 million yen/year Out of the above figures, maintenance cost for intake pump operation (electrical charge is 69 million yen/year).

Influence on water tariff	<u>Necessary Multiple for the Present Tariff</u> Abbottabad TMA: 2.7 Nawansher TMA: 3.2 Peripheral Villages: 6.3 <u>Percentage of Water Tariff in the Average Household Expenses</u> Abbottabad TMA: 1.8% Nawansher TMA: 1.6% Peripheral Villages: 3.9% Average: 2.9%	<u>Necessary Multiple for the Present Tariff</u> Abbottabad TMA: 6.0 Nawansher TMA: 7.0 Peripheral Villages: 11.0 <u>Percentage of Water Tariff in the Average Household Expenses</u> Abbottabad TMA: 4.0% Nawansher TMA: 3.4% Peripheral Villages: 6.6% Average: 4.9%
	It is judged that there is sufficient possibility to provide maintenance cost only with water tariff, by 3 agencies' setting a tariff level within 4 % that is suitable level as a ratio occupying household income of habitants.	In 3 agencies, average ratio occupying household income exceeds 4% that is suitable level. For operation and maintenance, it is possible that waterworks cannot be sustained only by tariff revenue without subsidy even in the future.

Item	Plan A	Plan B
	Surface Water Gravity System + Underground Water	Pump Intake from Downstream of Dor River + Underground Water
Risk relating to business effect	As for transmission main laying along Murree Highway, damage to main due to rock falling from slope is taken into consideration. In the places where such damage may occur, appropriate earth covering shall be considered, and high strength and liability pipe materials shall be adopted, as well. (As for Murree Road, possibility where large scale of large collapse disaster of slope such as collapse of whole road occurs is low, which is not considered.) As for occurrence of water leakage from transmission main, it is proposed to repair the main during small scale leakage owing to early detection of water leakage by daily route surveillance. A maintenance organization is proposed to urgently shut down water flow by using gate valves installed at interval of 2km at the minimum, by any chance. Moreover, as for small diameter pipes installed in mountainous areas, even if they are damaged due to disasters such as slope collapse, etc., all the intake stations installed in 4 locations are not damaged simultaneously, and the other intake routes are assured to disperse risk. Furthermore, their restoration can be treated by the local side, as their diameter is small. The existing transmission mains to Damtor Village have been laid in water transmission route in mountainous area from Gaya River and in Murree Road. These mains have been already operated for 15 years or longer, and no big disaster has been experienced. (Hearing from the present Chief Engineer of Works & Service.)	As the intake pumps are of special high head, it is necessary to thoroughly transfer to the Pakistani side the knowledge on operation and maintenance, especially on surging countermeasures, etc. of emergency shutdown of pumps during power failure. They have no experience of pump intake of surface water by such huge pumps, and the technical assistance for pump operation is required. It seems difficult to take prompt action on the site against failures, etc. of pumps, as they are large. It is necessary to establish route to purchase spare parts, etc. In the site where the construction of infiltration gallery is planned, the infiltration gallery and pumping station were installed in 1976 to supply water to Damtor Village. However, as the turbidity of Dor River became very high, the clogging of gallery due to sand and silt and the failure of pumps occurred frequently. Each of such accidents resulted in long time stoppage of water supply, forcedly. Consequently, these facilities were abandoned, gravity system from upstream river (Gaya River) replaced them, as a background. (According to the description of Damtor Village Gravity Water Supply Plan.) Though we could not comprehend detailed specifications of the infiltration gallery facility, the present Chief Engineer of Works & Service, participating in the construction at that time, said that the burying depth of gallery is 4 ~ 5m. As this depth is similar to this comparison plan, the possibility of clogging of gallery during rainy season cannot be denied, and the countermeasures against clogging such as installation of diffusing pipes, pressure flushing pipes, etc. are required.
	As for the both plans, it is necessary to master the operation and maintenance technology of the water treatment plant due to the fact it will be the first facility on site as well as the above-mentioned technical features. Technical assistance such as technical guidance is necessary on operation and maintenance of the facilities after construction.	

Evaluation	Construction cost 2,034 million yen Maintenance cost 28 million yen/year Land expropriation risk: small Tariff increase range: small Maintenance risk: middle Total: ○	Construction cost 2,009 million yen Maintenance cost: 100 million yen/year Land expropriation risk: small Tariff increase range: large Maintenance risk: middle Total: ×

Appendix 6-1-A1　Examination of Intake Method at Damtor Intake Point

1．Geological State

Geology

Mainly composed of gravel bed from fine-grained sand to cobbles, depth to bedrock is approximately 20m or more (result of electrical geological exploration). No distribution of large boulders, etc. is observed, and it is presumed that mild depositional environment existed in comparison with Harnoi confluence point.

Groundwater level

Groundwater level lowers toward bank at grade of approximately 2.2%, with current river surface on the highest level.

Result of pump-up test

Location: Test well in the following figure: location at approximately 120m from the current river.

Pump-up amount：　0.283m^3/min

Groundwater level：　GL-2.675m

Pump-up water level：　GL-3.54m

Lowering water level: 0.865m

Influence radius: 15.748m

Permeability: 0.040m/min=(0.00066m/s)

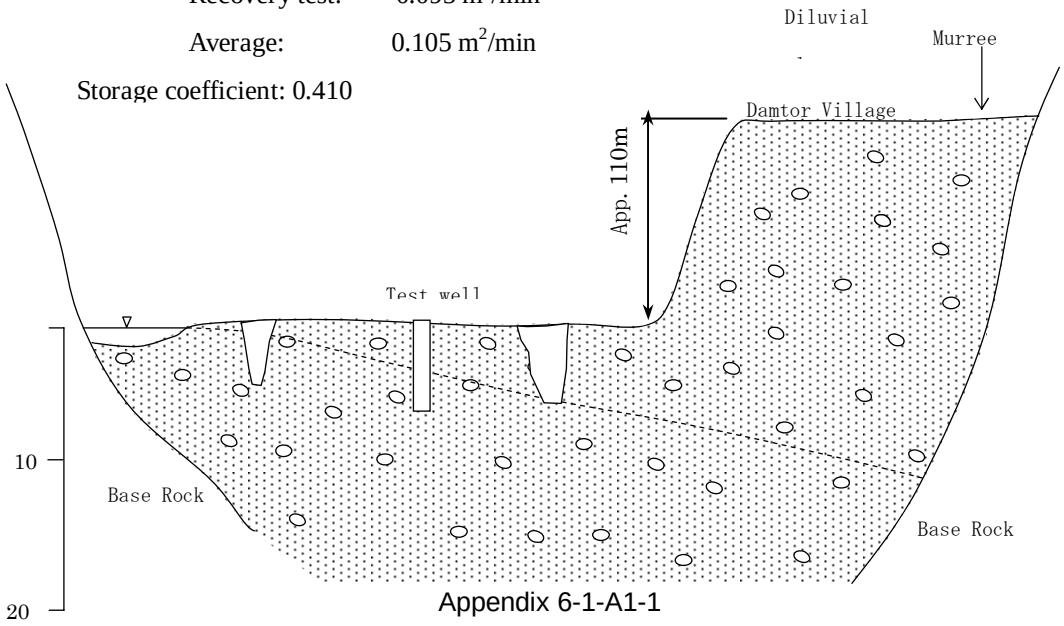
Transmissivity:

Continuous pump-up amount: 0.114m^2/min

Recovery test:　0.095 m^2/min

Average:　0.105 m^2/min

Storage coefficient: 0.410



Appendix 6-1-A1-1

2. Review of Infiltration Gallery

Setting of design conditions

Design pump-up amount: 0.2m^3/s

Inlet velocity from water collecting holes: 0.03m/s or less

Gallery diameter: Φ1000

Water collecting holes: 20mm in diameter, 30 holes (per m^2)

Sectional area of water collecting hole per m of gallery of Φ1000: 0.0296m^2

Required length L=0.2/0.03/0.0296＝225m

Groundwater level at gallery locations

Location A: GL-1.0m (location at 10m from current river)

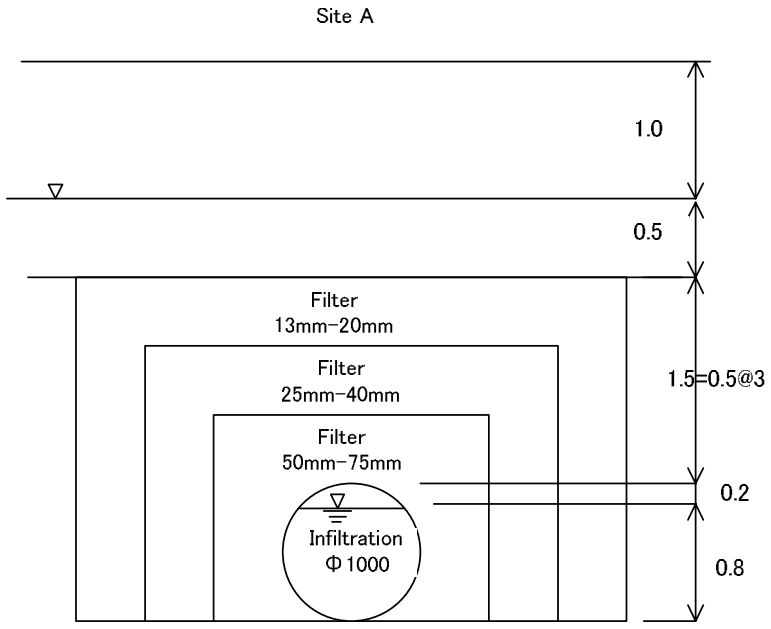
Location B: GL-2.675m

Review of pump-up amount

In case the gallery bottom does not reach impermeable layer and depth is not big up to impermeable layer.

$$Q = \frac{k(H^2 - h^2) * l}{L} \sqrt{\frac{t + 0.5r}{h}} \sqrt[4]{\frac{2h - t}{h}}$$

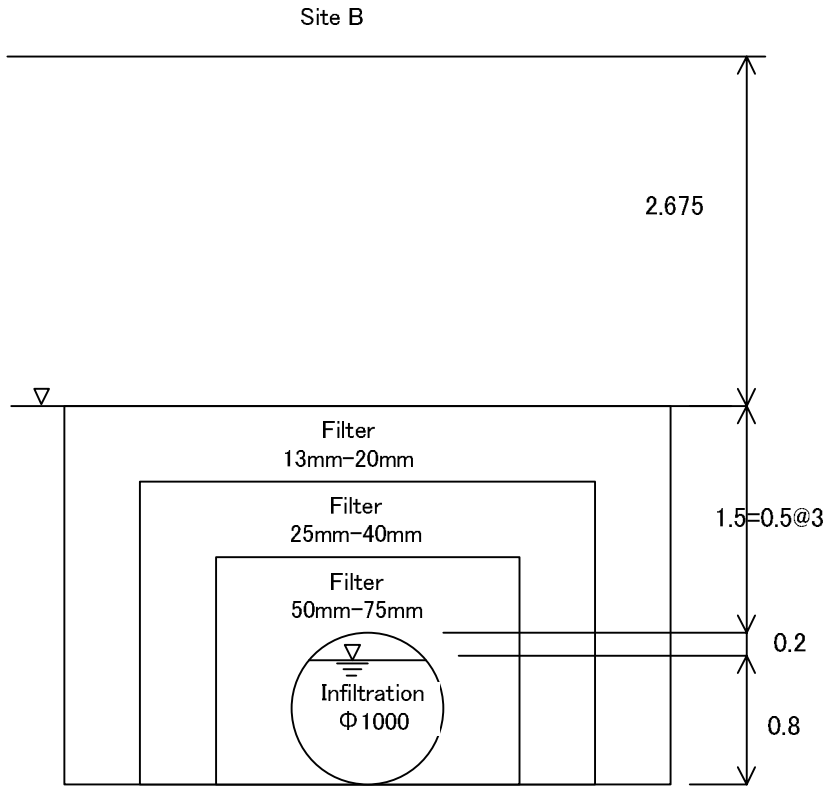
Site A



Q: Pump-up amount (m^3/s)	0.000853
H: Current groundwater depth (m)	19
h: Depth from gallery water level to impermeable layer (m)	16.8
t : Water depth in gallery (m)	0.8
l: Gallery length (m)	1
L: Influence radius R(m)	18
r : Radius in gallery (m)	0.5
k: Permeability (m/s)	0.00066

Digging depth: 4.0m

Site B



Q: Pump-up amount (m^3/s)	0.000629
H: Current groundwater depth (m)	17.325
h: Depth from gallery water level to impermeable layer (m)	15.625
t : Water depth in gallery (m)	0.8
l: Gallery length (m)	1
L: Influence radius R(m)	18
r : Radius in gallery (m)	0.5
k: Permeability (m/s)	0.00066

Digging depth: 5.2m

Required length

Location A La=170m Location B Lb=100m

Pump-up amount＝170 x 0.000853＋100 x 0.000629＝0.21m^3/s

Gallery length: 270m

Junction wells: installed in 3 locations: upstream end of gallery, winding point and downstream end.

3. Review of Shallow Well

Groundwater level

Location A: GL－1.0m

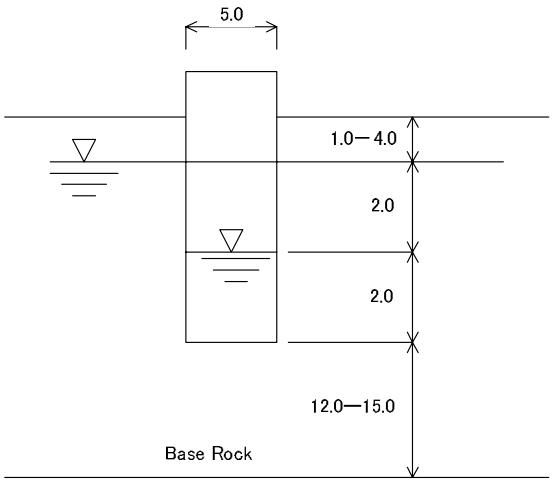
Location B: GL-2.675m

Location A: GL－4.0m

Review of pump-up amount

Conditional equation: in case of intake from well bottom.

$$Q = 4kr_0(H - h_0)$$



Location A

Q: Pump-up amount (m^3/s)	0.013
H: Current groundwater depth (m)	19
h_0: Depth from still water level to impermeable layer (m)	17
hs: Depth from groundwater level to impermeable layer (m)	5
t : Water depth in well (m)	2
R: Influence radius R(m)	18
r_0: Well radius (m)	2.5
k: Permeability (m/s)	0.00066

Digging depth: 6m

Location B

Q: Pump-up amount (m^3/s)	0.013
H: Current groundwater depth (m)	17.325
h_0: Depth from still water level to impermeable layer (m)	15.325
hs: Depth from groundwater level to impermeable layer (m)	5
t : Water depth in well (m)	2
R: Influence radius R(m)	18
r_0: Well radius (m)	2.5
k: Permeability (m/s)	0.00066

Digging depth: 7.675m

Location C

Q: Pump-up amount (m^3/s)	0.013
H: Current groundwater depth (m)	16
h_0: Depth from still water level to impermeable layer (m)	14
hs: Depth from groundwater level to impermeable layer (m)	5
t : Water depth in well (m)	2
R: Influence radius R(m)	18
r_0: Well radius (m)	2.5
k: Permeability (m/s)	0.00066

Digging depth: 9m

Required number of wells

0.2/0.013=16 wells

Distance between wells

18 x 2=36m

Total length： 36m x 16=576m

Figure shows Plan A of arrangement in center of Plan B of arrangement in bank.

Plan A has a problem in the aspect of river maintenance.

Shallow wells shall be located near bank, considering river maintenance.

Selection

If shallow wells and infiltration gallery are compared, 16 shallow wells are required with total length of connection pipe of 576m, which is longer than that of infiltration gallery and whose digging depth is deeper. Therefore, shallow wells are not economical.

4. Dewatering during Execution of Infiltration Gallery

$$Q = \pi k(H^2 - h_0^{\,2}) \Big/ 2.3(\log_{10} R - \log_{10} r)$$

Q: Pump-up amount during work $m^3/s/m$

k: Permeability (m/s)

H: Distance between impermeable layer to groundwater level m

h_0: Distance between impermeable layer and digging bottom m

R：2000 x (H－h_0) x $k^{1/2}$

r ：（A/π） $^{1/2}$

Dewatering amount of location A

In case length of execution for one work process is 30m:

R=2000 x (20.0 – 15.1) x $0.00066^{1/2}$=252

r =(41.4m x 15.6m + 30m x 4.2 /3.14)$^{1/2}$=11.08

Q=3.14 x 0.00066 x (20^2-15.3^2)/ 2.3(log252 – log11.08)

=0.114 m^3/s

Work period per 30m:

Excavation and temporary construction: 14 days

Pipe laying: 2 days

Filter installation: 7 days

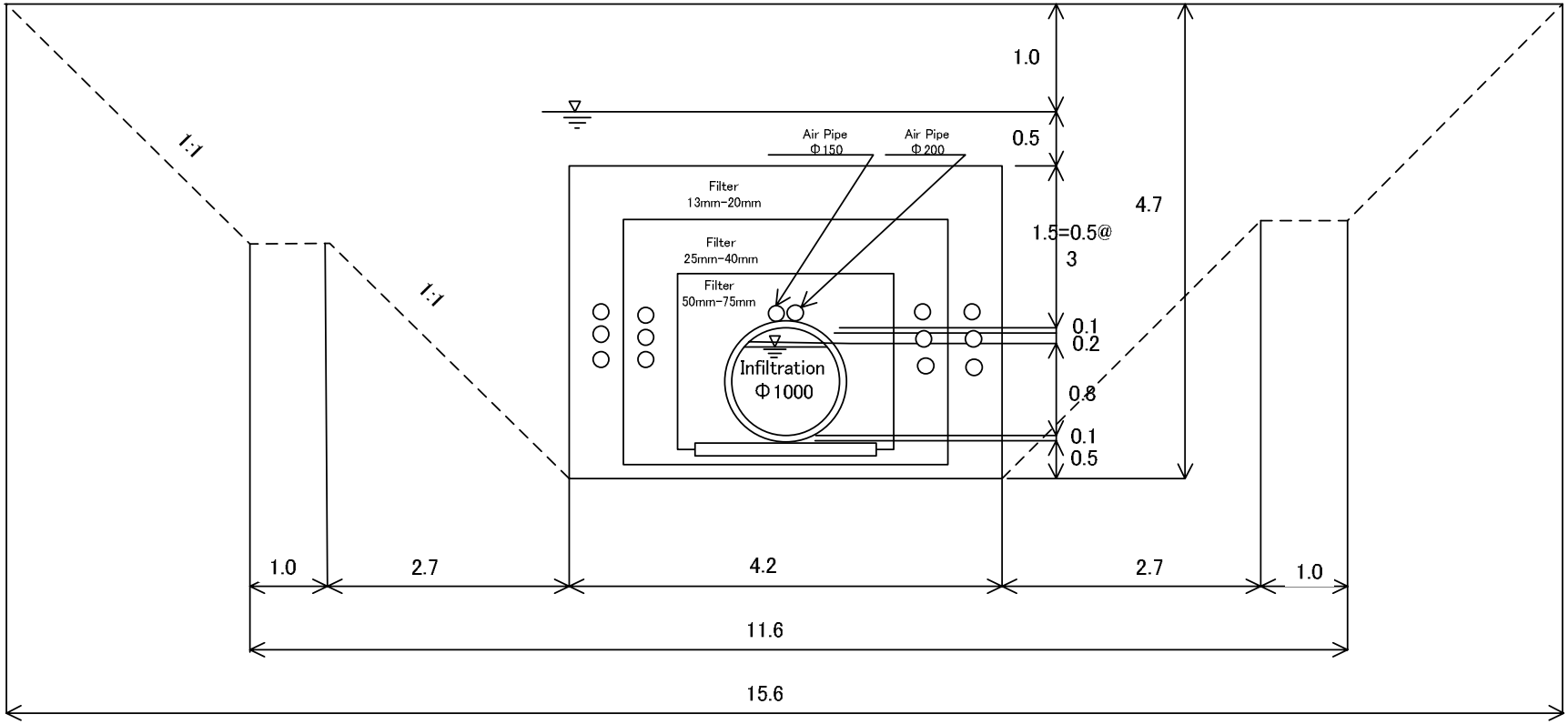
Back filling and temporary construction removal: 2 days

Total 25 days➡30 days

Work units: 270m/30m=9 units

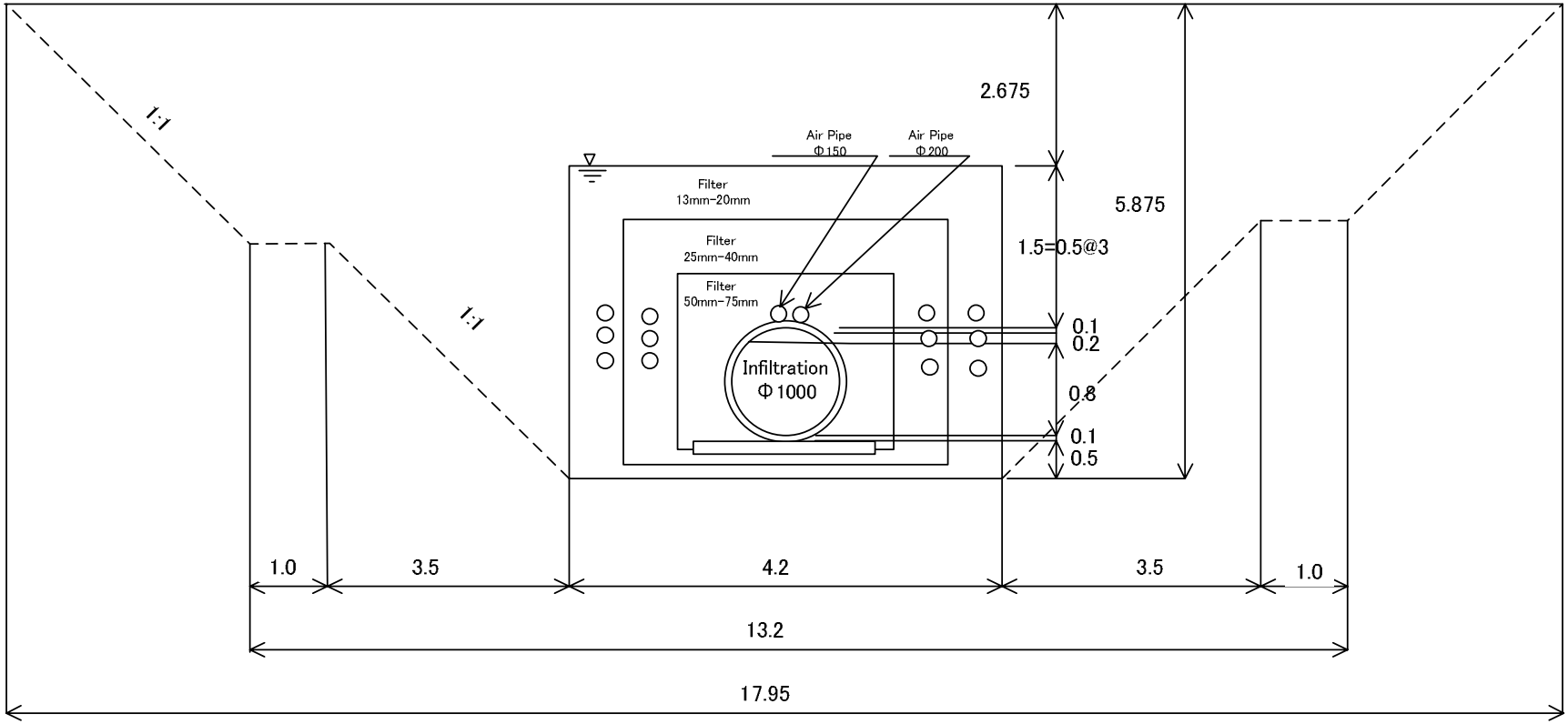
Construction work period: 9 x 30 =270➡300 days.

Site A



Cutting Area=45.83m^2

Site B



Cutting Area=63.94m^2

Appendix 6-1-A2 Examination of Intake Method at Harnoi Intake Point

-1 Geological State

Harnoi River flows into the point where installation of infiltration gallery is planned,
and it is told that considerable flow amount flows in with cobbles during flooding.
The installation location of inflitration gallery is planned
approximately 150m upstream from the confluence with Harnoi River.

As geological state, 1 ~ 2m large boulders are scattered on riverbed surface,
and boulder layer containing 0.6 ~ 0.8m large gravels is distributed up to depth of 3.5m.
As for the layer of depth of 3.5m or more, it is presumed based upon electrical geological exploration
that 1 ~ 2m large boulders appear again between 7 ~ 10m and bedrock is distributed around 13 ~ 18m.
.

As gravel layer consists mainly of cobbles and boulders, water permeability is good.
Underground water level lowers at grade of approximately 1.36% toward bank, with current river surface on the highest level.
(Groundwater level at pump-up test location is GL-0.86m.)
Furthermore, it is certain that 1 ~ 2m large boulders flow down during flooding.
If facilities are constructed on riverbed, damage and flowing-out may occur without impregnable structure.

-2 Idea of infiltration gallery

When the dimensions of infiltration gallery are determined,
the pipe is perforated Hume pipe with hole diameter of f20mm and 30 holes/m2.
(Refer to page 99 of Waterworks Design Guideline.)

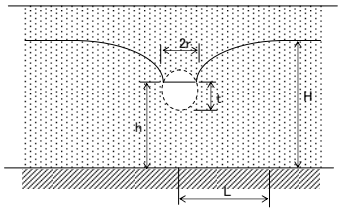
Perforated Hume	f1000	×	230 m	earth cove	3.36 m
				Pump-up a	0.201 m3/s
Hole diameter	f20		30 holes/m2		
Rate of hole area	0.94				
Rate of inflow	2.95	cm/s			

Calculation of pump-up amount
(a case is supposed where the infiltration gallery bottom does not reach impermeable layer, and the impermeable layer is not significantly deep.)

As already mentioned, the presumed rock surface is inclined
and the planned infiltration gallery point is located relatively near to the main stream of the river.
It is assumed that the rock surface is at GL-16m and the groundwater level GL-0.9m.
Furthermore, the water level in infiltration gallery is assumed GL-3.2m.

$$Q = \frac{k(H^2 - h^2) * l}{L} \sqrt{\frac{t + 0.5r}{h}} \sqrt[4]{\frac{2h - t}{h}}$$

Q: Pump-up amount (m3/s)	0.433
H: Current groundwater depth (m)	15.1
h: Depth from gallery water level to impermea	12.8
t: Water depth in gallery (m)	0.8
l: Gallery length (m)	230
L: Influence radius R(m)	20
r: Radius in gallery (m)	0.5
k: Permeability (m/s)	0.001738



From the above-mentioned, the rate of inflow is 0.43m3/s and intake amout of 200l/s can be ensured sufficiently.

On the top and side of the pipe, there are filled from inside to outside 50cm of cobblestones, 50cm of gravels and 50cm of coarse sands.
Distance from the top of coarse sands to the current groundwater level is 0.5m (margin from groundwater surface to filter media).
Distance from the current groundwater level to ground surface is 0.9m (during pump-up test).
Accordingly, earth covering of perforated Hume pipe is 3.36m (=0.50 X 3 + 1.00 + 0.86).
Excavation depth is 4.6m.

Intake pump well.		1 well
Junction well/ins	W2.0m×L2.0m×H6.5m (underground: 5.5m; surface: 1.00	4 wells

-3 Shallow well system

Shallow well f5.00m × H 5.6 m 11 wells
(underground: 4.6m; surface: 1.00m; water depth: 2.00m)

Pump-up amoun 0.0191 m3/s × 11 = 0.210 m3/s

Well interval 30 m

Intake connectin3ore diameter ? f400, L= 330 m (=30×11)

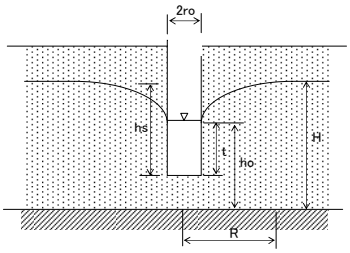
Intake pump well. 1 well

Calculation of pump-up amount (only the portion from well bottom is considered.)

Shallow well is planned at the point near to river bank. Considering the gradient of rock surface, the rock surface is presumed at GL-13m.
Furthermore, as the groundwater level lowers at approximately 1.36% toward river bank, GL-1.5m is presumed.
Assuming that the well bottom is lower by (t=2m) than well inside water level
and the excavation depth is the same as that of infiltration gallery of 4.6m, the calculation is performed.

Q=4kr0(H-h0)

Q: Pump-up amount (m3/s)	0.01912
H: Current groundwater depth (m)	11.5
h0: Depth from still water level to impermeab	10.4
hs: Depth from groundwater level to imperme	3.1
t: Water depth in well (m)	2
R: Influence radius R(m)	15
r0: Well radius (m)	2.5
k: Permeability (m/s)	0.001738



Facility layout 11 shallow wells are allocated at 30m interval as long as approximately 0.6km toward upstream direction from intake pump well.
Intake connecting pipes of 400~100mm diameter are installed approximately 330m long from 20 shallow wells to intake pump well.

-4 Selection

The intake system is determined to be infiltration gallery system because of the following reasons:

With the infiltration gallery system, gallery earth covering can be 2.9m
owing to high permeability layer and sufficient groundwater level, permitting appropriate plan.
Furthermore, the layout corresponding to the present situation can be adopted.

On the other hand, the shallow well system requires 11 shallow wells at 30m interval,
considering the pump-up affected zone of each well. Shallow wells are allocated upstream from intake pump well.
Therefore, it is necessary to install intake connecting pipe of approximately 330m to connect shallow wells and intake pump well.
Since the layout plan of these shallow wells is rather difficult
and the construction cost is higher than the infiltration gallery system, constructing the facilities in a wide range,
the expenditure for maintenance in the future will be big.

-5 Problems

The biggest problem is dewatering and water shut-off during execution of works.
Excavation from GL up to the depth of 4.6m is required for installation of infiltration pipes.
The groundwater of GL-0.9m at normal time should be lowered approximately 3.7m, and lowering of 4.6m during anomaly is necessary.

As for the drain in this case, the surface width becomes 15.4m with the bottom excavation width of 4.2m and the gradient of 10%.

Roughly estin p×k×(H2-h'2)/(2.3×(log R-log r)) 0.195 m3/s

R: Influence radius R(m)	
R=2000Svk	400
S: Water level descent value (m)	4.8
r: Assumed well radius R(m)	
r=v(A/p)	10.2
A: Object area	
H: Current groundwater depth (m)	16
h': Depth from excavation bottom level to imp	11.2
k: Permeability (m/s)	0.001738

Though the coefficient of permeability is 0.195m3/s by calculation,
the variation might be big due to boulder layer and the posibility to partially encounter the layer of high permeability coefficient can be well supposed.
It is necessary to expect the dewatering of approximately 0.3m3/s.
Accordingly, the execution becomes difficult due to boulders and dewatering.

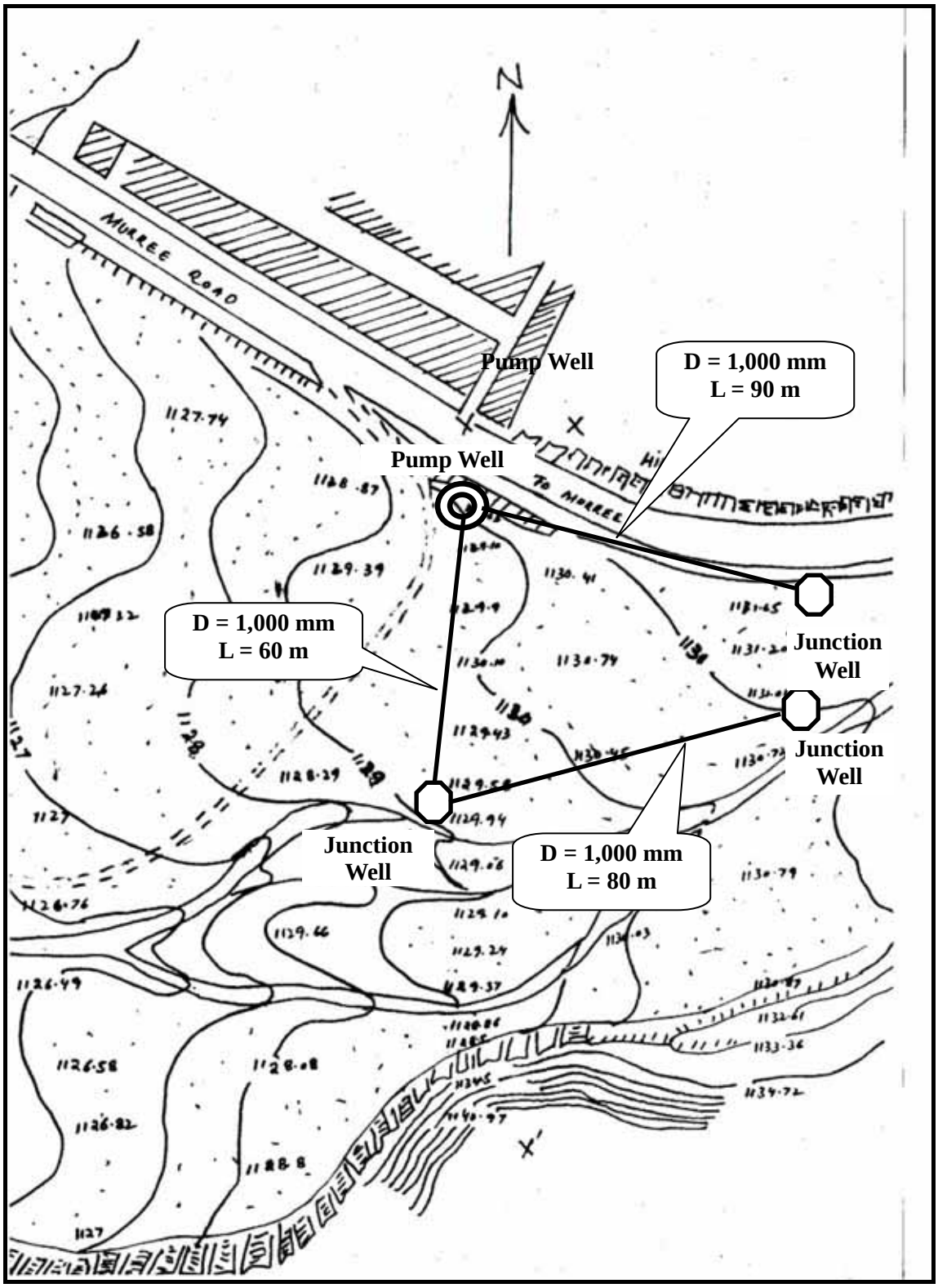


Figure Proposed Arrangement of Intake Facilities at Harnoi

Appendix 6-1-A3 Result of Water Quality Analysis

Sampling date 178; 2004/07/02, 183,184; 2004/10/02

Note: 178 – Harnoi, 183 – Dhamtaur、184—The river near the Treatment proposed site

Sr. No.	W.Q Parameter	Unit	G.V	178	183	184
1.	Alkalinity	m.mol/l	NGVS	2.6	2.4	-
2.	Ammonia	mg/l	1.5	Nil	Nil	-
3.	Arsenic	µg/l	10	0.3144	0.3011	-
4.	Bicarbonate	mg/l	NGVS	130	120	-
5.	Calcium	mg/l	75(KSA)	40	44	-
6.	Carbonate	mg/l	NGVS	Nil	Nil	-
7.	Chloride	mg/l	250	7	7	-
8.	Colour	TCU	C.Less	C.Less	Light Milky	-
9.	Conductivity	mS/cm	NGVS	316	312	750
10.	Fluoride	mg/l	1.5	0.08	0.04	-
11.	Hardness	mg/l	500	160	160	-
12.	Iron	mg/l	0.3	0.099	0.008	-
13.	Magnesium	mg/l	150	15	12	-
14.	Nitrate (N)	mg/l	10	1.4	4.1	-
15.	Nitrite (N)	mg/l	3	0.005	0.02	-
16.	Odor	-	Odorless	Odorless	Odorless	-
17.	pH	-	6.5-8.5	8.1	7.9	7.5
18.	Potassium	mg/l	12(EC)	0.9	1	-
19.	Sodium	mg/l	200	5	4	-
20.	Sulfate	mg/l	250	32	32	-
21.	Taste	-	Unobjec.	Unobjec.	Unobjec.	-
22.	TDS (mg/l)	mg/l	1000	181	179	-
23.	Turbidity		5	3.8	37	15
24.	T. Coliform	MPN/100ml	Nil	>240	>240	>240
25.	Fecal Coliform	MPN/100 ml	Nil	>240	>240	>240
26.	BOD	Mg/l	80 (NEQS)	8	10.8	520
27.	Ag	µg/l	U	BDL	BDL	-
28.	Al	µg/l	200	92.87	1415	-
29.	Au	µg/l	NGVS	BDL	BDL	-
30.	B	µg/l	300	6.8074	10.5773	-
31.	Ba	µg/l	70	9.8728	9.4974	-
32.	Be	µg/l	NGVS	BDL	BDL	-
33.	Bi	µg/l	NGVS	BDL	BDL	-
34.	Cd	µg/l	3	BDL	BDL	-
35.	Ce	µg/l	NGVS	BDL	15.2484	-
36.	Co	µg/l	NGVS	BDL	BDL	-
37.	Cr	µg/l	50	4.2052	2.5596	-
38.	Cu	µg/l	1000	2.9143	BDL	-
39.	Dy	µg/l	NGVS	1.0988	1.3577	-
40.	Er	µg/l	NGVS	15.4715	14.8516	-
41.	Eu	µg/l	NGVS	BDL	BDL	-

42.	Ga	µg/l	NGVS	BDL	12.51	-
43.	Gd	µg/l	NGVS	BDL	BDL	-
44.	Hf	µg/l	NGVS	BDL	6.2929	-
45.	Hg	µg/l	1	BDL	BDL	-
46.	Ho	µg/l	NGVS	BDL	BDL	-
47.	In	µg/l	NGVS	33.5397	46.0097	-
48.	Ir	µg/l	NGVS	BDL	BDL	-
49.	La	µg/l	NGVS	20.3237	22.4025	-
50.	Li	µg/l	NGVS	7.4933	7.3931	-
51.	Lu	µg/l	NGVS	BDL	3.1659	-
52.	Mn	µg/l	100	5.0421	33.2202	-
53.	Mo	µg/l	70	5.1162	5.7872	-
54.	Nb	µg/l	NGVS	BDL	6.7366	-
55.	Nd	µg/l	NGVS	BDL	BDL	-
56.	Ni	µg/l	20	2.3438	BDL	-
57.	P	µg/l	NGVS	BDL	80.0824	-
58.	Pb	µg/l	10	9	9	-
59.	Pt	µg/l	NGVS	BDL	BDL	-
60.	Rb	µg/l	NGVS	8.3459	20.3709	-
61.	Re	µg/l	NGVS	5.6167	BDL	-
62.	Rh	µg/l	NGVS	11.3703	4.9836	-
63.	Ru	µg/l	NGVS	4.1026	BDL	-
64.	Sc	µg/l	NGVS	BDL	BDL	-
65.	Se	µg/l	10	BDL	BDL	-
66.	Si	µg/l	NGVS	2654	4951	-
67.	Sm	µg/l	NGVS	BDL	2.081	-
68.	Sr	µg/l	NGVS	182.587	213.665	-
69.	Ta	µg/l	NGVS	BDL	BDL	-
70.	Tb	µg/l	NGVS	BDL	BDL	-
71.	Te	µg/l	NGVS	BDL	BDL	-
72.	Th	µg/l	NGVS	12.9303	BDL	-
73.	Ti	µg/l	NGVS	2.884	34.8286	-
74.	Tl	µg/l	NGVS	BDL	BDL	-
75.	Tm	µg/l	NGVS	BDL	BDL	-
76.	V	µg/l	NGVS	BDL	BDL	-
77.	W	µg/l	NGVS	BDL	9.9145	-
78.	Y	µg/l	NGVS	0.3016	0.6654	-
79.	Yb	µg/l	NGVS	0.4842	0.6277	-
80.	Zn	µg/l	3000	BDL	BDL	-
81.	Zr	µg/l	NGVS	BDL	0.9873	-

NEQS: National Environmental Quality Standards **BDL:** Below Detection Limit
PSQCA: Pakistan Standard Quality Control Authority **NGVS:** No Guideline Value Set
U: Unnecessary as concentrations normally found are not hazardous.

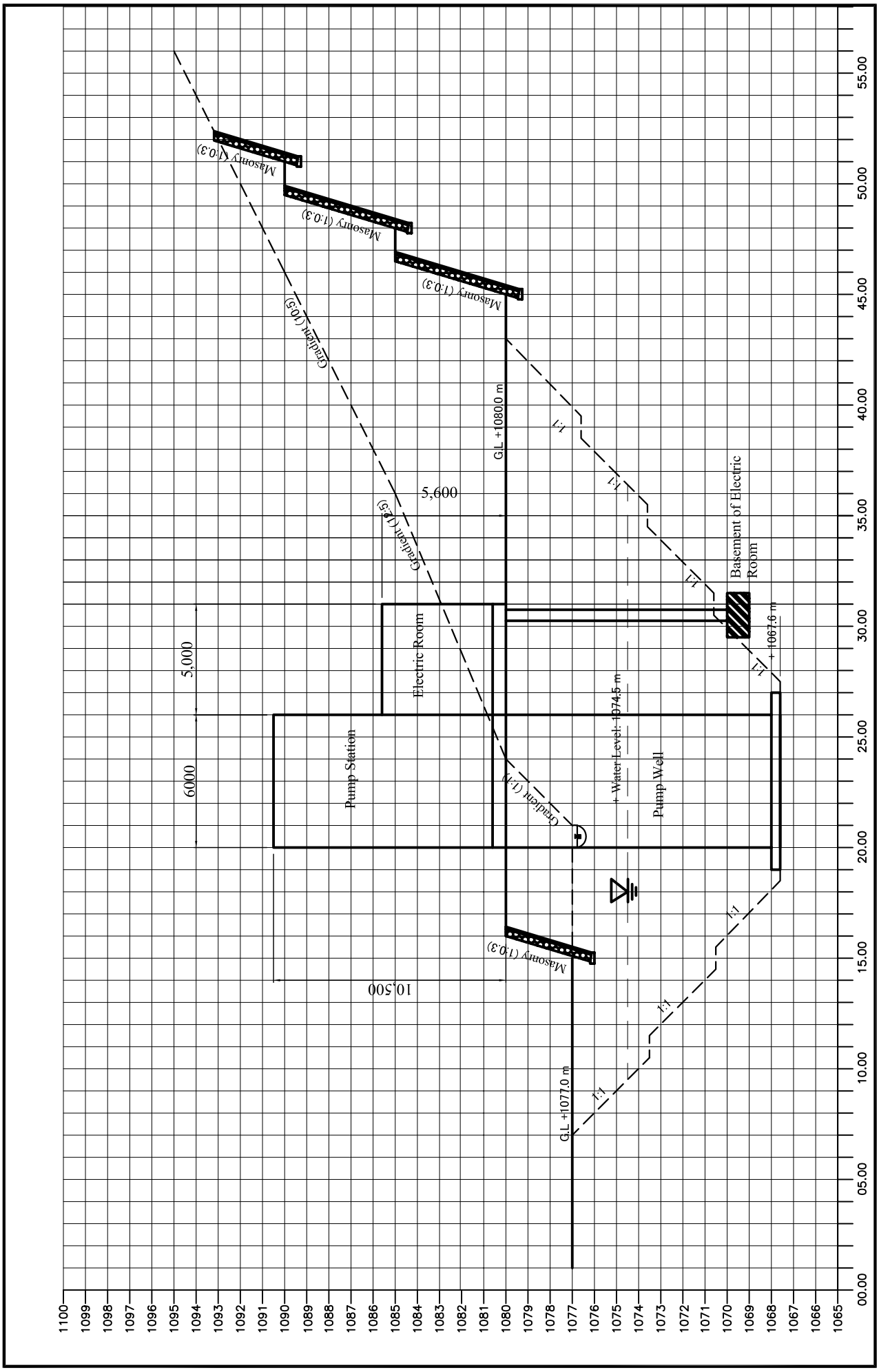


Figure Typical Cross Section of Intake Facility (Pump Station)

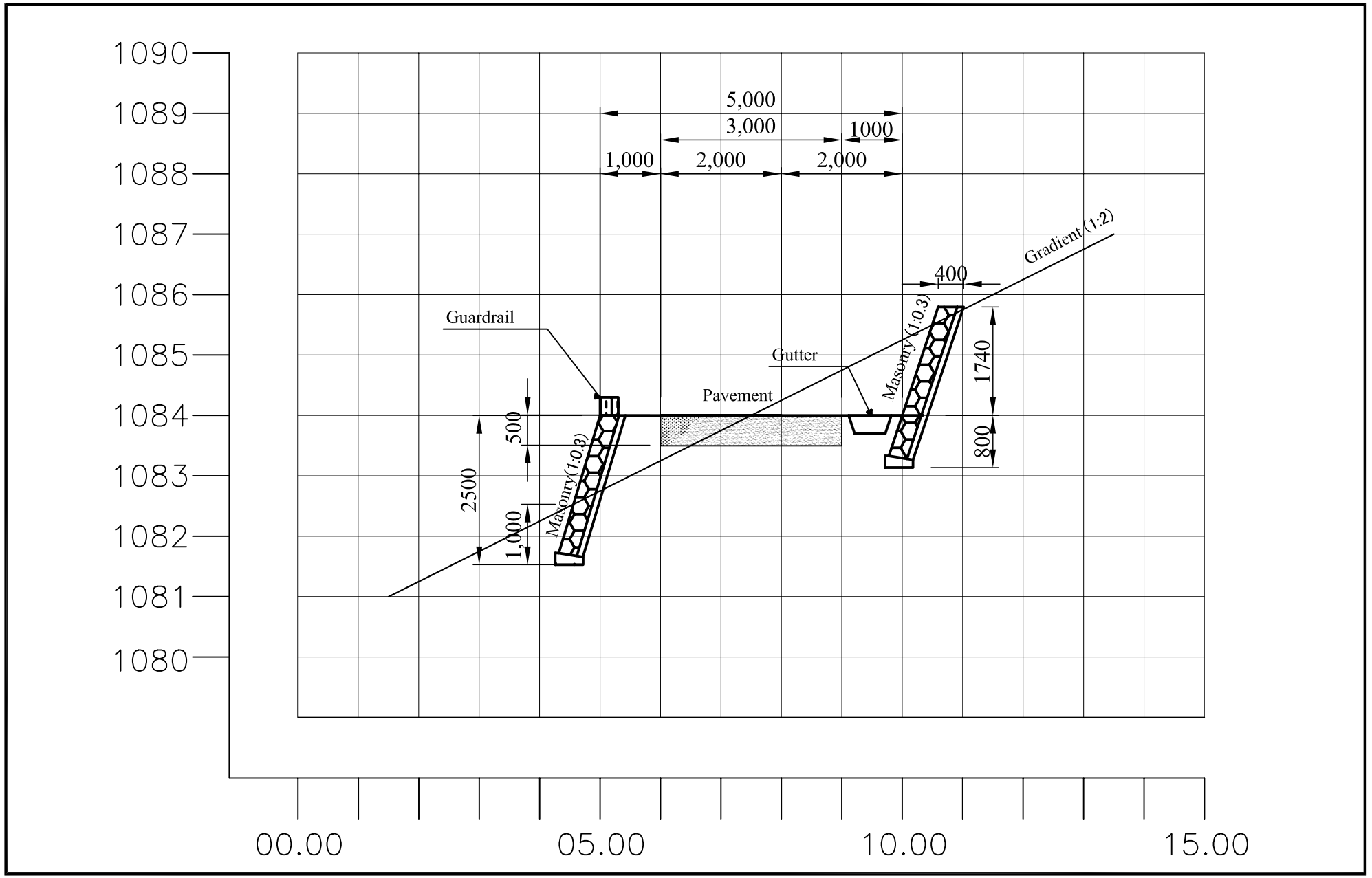


Figure Typical Cross Section of Intake Facility (Access Road)