ƏLAVƏ 3

SU TƏLƏBATININ HESABLANMASI

Khachmaz

[A] Population Forecast

Year	[A1] Urban population Urban persons	[A2] Annual Popuation Growth Rate Urban/ Village %/annum	[A3] Village Population Village persons	[A4] Total population ([A1] + [A3])
2009	38,500		8,277	46,777
2010	39,000	1.30	8,384	47,384
2011	39,500	1.28	8,491	47,991
2012	40,000	1.27	8,598	48,598
2013	40,500	1.25	8,705	49,205
2014	41,000	1.23	8,812	49,812
2015	41,500	1.22	8,919	50,419
2016	42,000	1.20	9,026	51,026
2017	42,400	0.95	9,112	51,512
2018	42,800	0.94	9,198	51,998
2019	43,200	0.93	9,284	52,484
2020	43,500	0.69	9,348	52,848
2021	43,800	0.69	9,412	53,212
2022	44,100	0.68	9,476	53,576
2023	44,400	0.68	9,540	53,940
2024	44,700	0.68	9,604	54,304
2025	44,900	0.45	9,647	54,547
2026	45,100	0.45	9,690	54,790
2027	45,300	0.44	9,733	55,033
2028	45,600	0.66	9,797	55,397
2029	45,900	0.66	9,861	55,761
2030	**46,200**	**0.65**	**9,925**	**56,125**
2031	46,600	0.87	10,011	56,611
2032	47,200	1.29	10,140	57,340
2033	47,600	0.85	10,226	57,826
2034	48,000	0.84	10,312	58,312
2035	48,400	0.83	10,398	58,798

[A1] Data from State Statistical Committee, No. 5/2-103, Year 2008

[A2] ([Pn: Population of the year] - [Pn-1: population of the previous year]) / [Pn-1]

[A3] Village population of 2009 is estimated from statistic data as of year 2006 and assumed population growth rate of 1.25%/annum.

[Village population as of 2006]

= [Armudpadar: 1027] + [Qobuqıran: 882] + [Köhna Xaçmaz: 3,507] + [Qaraqurtlu: 1,898] + [Qaraçı: 660]

= 7,974 persons (year 2006)

[Village population as of 2009]

= 7,974 x (1.0125^3) = 8,277 persons

Village population for 2010 afterward is forecast by using the same growth rate as urban.

Khachmaz

[B] Unit Water Demand / Peak Factor

Year	[B1] Unit domestic daily water demand	[B2] Commercial sector demand (Ratio to [B1])	[B3] Commercial sector demand (Ratio to [B1])	[B4] Institutional Organizations demand (Ratio to [B1])	[B5] Institutional Organizations demand (Ratio to [B1])	[B6] Industrial sector demand (Ratio to [B1])	[B7] Industrial sector demand (Ratio to [B1])	[B8] Unaccounted for water (Ratio of the average total demand)	[B9] Peak seasonal daily factor (maximum daily factor)	[B10] Hourly peak factor for network	[B11] Hourly peak factor for distribution mains	[B12] Hourly peak factor for transmission mains
		Urban	Village	Urban	Village	Urban	Village	Uban/ Village				
	L/c/d	%	%	%	%	%	%	%				
2009	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2010	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2011	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2012	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2013	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2014	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2015	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2016	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2017	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2018	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2019	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2020	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2021	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2022	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2023	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2024	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2025	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2026	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2027	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2028	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2029	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2030	**120**	**8**	**3**	**4**	**2**	**8**	**3**	**15**	**1.30**	**1.50**	**1.95**	**1.30**
2031	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2032	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2033	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2034	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2035	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30

Khachmaz

[C] Water Demand

Year	[C1] Average daily domestic water demand Urban m3/day	[C2] Average daily commercial water demand Urban m3/day	[C3] Average daily institutional water demand Urban m3/day	[C4] Average daily industrial water demand Urban m3/day	[C5] Average daily domestic water demand Village m3/day	[C6] Average daily commercial water demand Village m3/day	[C7] Average daily institutional water demand Village m3/day	[C8] Average daily industrial water demand Village m3/day	[C9] Unaccounted for water Urban/ Village m3/day	[C10] Average daily water demand Urban/ Village m3/day	[C11] Maximum daily water demand Urban/ Village m3/day
2009	4,620	370	185	2,370	993	30	20	30	1,521	10,139	13,181
2010	4,680	374	187	2,374	1,006	30	20	30	1,535	10,236	13,307
2011	4,740	379	190	2,379	1,019	31	20	31	1,551	10,340	13,442
2012	4,800	384	192	2,384	1,032	31	21	31	1,566	10,441	13,573
2013	4,860	389	194	2,389	1,045	31	21	31	1,581	10,541	13,703
2014	4,920	394	197	2,394	1,057	32	21	32	1,597	10,644	13,837
2015	4,980	398	199	2,398	1,070	32	21	32	1,611	10,741	13,963
2016	5,040	403	202	2,403	1,083	32	22	32	1,627	10,844	14,097
2017	5,088	407	204	2,407	1,093	33	22	33	1,639	10,926	14,204
2018	5,136	411	205	2,411	1,104	33	22	33	1,651	11,006	14,308
2019	5,184	415	207	2,415	1,114	33	22	33	1,663	11,086	14,412
2020	5,220	418	209	2,418	1,122	34	22	34	1,672	11,149	14,494
2021	5,256	420	210	2,420	1,129	34	23	34	1,681	11,207	14,569
2022	5,292	423	212	2,423	1,137	34	23	34	1,690	11,268	14,648
2023	5,328	426	213	2,426	1,145	34	23	34	1,699	11,328	14,726
2024	5,364	429	215	2,429	1,152	35	23	35	1,709	11,391	14,808
2025	5,388	431	216	2,431	1,158	35	23	35	1,715	11,432	14,862
2026	5,412	433	216	2,433	1,163	35	23	35	1,721	11,471	14,912
2027	5,436	435	217	2,435	1,168	35	23	35	1,727	11,511	14,964
2028	5,472	438	219	2,438	1,176	35	24	35	1,736	11,573	15,045
2029	5,508	441	220	2,441	1,183	35	24	35	1,745	11,632	15,122
2030	**5,544**	**444**	**222**	**2,444**	**1,191**	**36**	**24**	**36**	**1,754**	**11,695**	**15,204**
2031	5,592	447	224	2,447	1,201	36	24	36	1,766	11,773	15,305
2032	5,664	453	227	2,453	1,217	37	24	37	1,784	11,896	15,465
2033	5,712	457	228	2,457	1,227	37	25	37	1,796	11,976	15,569
2034	5,760	461	230	2,461	1,237	37	25	37	1,808	12,056	15,673
2035	5,808	465	232	2,465	1,248	37	25	37	1,821	12,138	15,779

[C1] [A1: Urban population] x [B1: Unit domestic water demand]
[C2] [C1: Urban domestic water demand] x [B2: Ratio of commercial sector demand]
[C3] [C1: Urban domestic water demand] x [B4: Ratio of institutional organization demand]
[C4] [C1: Urban domestic water demand] x [B2: Ratio of industrial sector demand] + 2,000 m3/day
[C5] [A3: Village population] x [B1: Unit domestic water demand]
[C6] [C2: Village domestic water demand] x [B3: Ratio of commercial sector demand]
[C7] [C2: Village domestic water demand] x [B5: Ratio of institutional organization demand]
[C8] [C2: Village domestic water demand] x [B5: Ratio of industrial sector demand]
[C9] (Total of [C1] to [C8]) x [B8: Unaccounted water ratio] / (100%- [B8])
[C10] Total of [C1] to [C9]
[C11] [C10] x [B9: Seasonal daily factor]

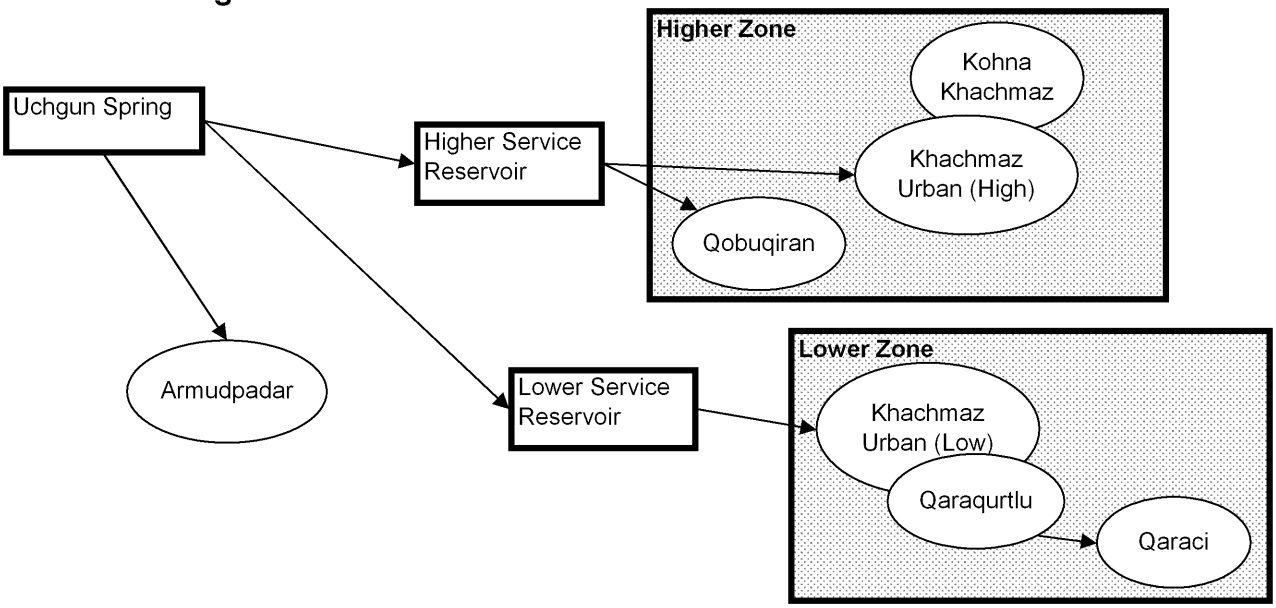
Khachmaz

Demand Calculation by Administrative Boundary

		Khachmaz (Urban)	Armudpadar (Village)	Qobuqıran (Village)	Köhnə Xaçmaz (Village)	Qaraqurtlu (Village)	Qaraçı (Village)
Population as of year 2030	(persons)	46,200	1,279	1,099	4,368	2,364	822
Average daily unit domestic water demand	(L/c/d)	120	120	120	120	120	120
Average daily unit commerical sector demand	(%)	8	3	3	3	3	3
Average daily unit institutional organization demand	(%)	4	2	2	2	2	2
Average daily unit industrial sector demand	(%)	8	3	3	3	3	3
Average daily domestic water demand	(m3/day)	5,544	153	132	524	284	99
Average daily commercial sector demand	(m3/day)	444	5	4	16	9	3
Average daily institutional organization demand	(m3/day)	222	3	3	10	6	2
Average daily industrial sector demand	(m3/day)	2,444	5	4	16	9	3
Unaccounted-for water (15% of demand)	(m3/day)	1,527	29	25	100	54	19
Average daily water demand	(m3/day)	10,181	195	168	666	362	126
Maximum daily water demand	(m3/day)	13,235	254	218	866	471	164

Khachmaz

Schematic Diagram of Distribution Zone



Demand Calculation by Distribution Zone

		Khachmaz (Urban)	Armudpadar (Village)	Qobuqıran (Village)	Köhnə Xaçmaz (Village)	Qaraqurtlu (Village)	Qaraçı (Village)	Total
Khachmaz Higher Zone	Average (m3/day)	7,636		168	666			**8,470**
(75% of Khachmaz urban, Qobuqiran, Kohna Khachmaz)	Maximum (m3/day)	9,926		218	866			**11,010**
Khachmaz Lower Zone	Average (m3/day)	2,545				362	126	**3,033**
(25% of Khachmaz urban, Qaraqurtlu, Qaraci)	Maximum (m3/day)	3,309				471	164	**3,944**
Armudpadar network	Average (m3/day)		195					**195**
	Maximum (m3/day)		254					**254**

Service Reservoir Capacity

Khachmaz Higher Zone	m3	**6,600**
Khachmaz Lower Zone	m3	**2,500**
Armudpadar zone	m3	400

Requirement of storage capacity: 75% of average todal demand + firefighting demand
Firefighting water demand: 216 m3 (20 L/sec x 3 hours)

Gusar

[A] Population Forecast

Year	[A1] Urban population Urban persons	[A2] Annual Popuation Growth Rate Urban/ Village %/annum	[A3] Village Population Village persons	[A4] Total population ([A1] + [A3])
2009	16,200		5,715	21,915
2010	16,400	1.23	5,786	22,186
2011	16,600	1.22	5,857	22,457
2012	16,800	1.20	5,928	22,728
2013	17,000	1.19	5,999	22,999
2014	17,200	1.18	6,070	23,270
2015	17,400	1.16	6,141	23,541
2016	17,600	1.15	6,212	23,812
2017	17,800	1.14	6,283	24,083
2018	18,000	1.12	6,354	24,354
2019	18,200	1.11	6,425	24,625
2020	18,300	0.55	6,460	24,760
2021	18,400	0.55	6,495	24,895
2022	18,500	0.54	6,530	25,030
2023	18,600	0.54	6,565	25,165
2024	18,700	0.54	6,600	25,300
2025	18,800	0.53	6,635	25,435
2026	18,900	0.53	6,670	25,570
2027	19,000	0.53	6,705	25,705
2028	19,100	0.53	6,740	25,840
2029	19,200	0.52	6,775	25,975
2030	**19,300**	**0.52**	**6,810**	**26,110**
2031	19,400	0.52	6,845	26,245
2032	19,600	1.03	6,916	26,516
2033	19,800	1.02	6,987	26,787
2034	20,000	1.01	7,058	27,058
2035	20,200	1.00	7,129	27,329

[A1] Data from State Statistical Committee, No. 5/2-103, Year 2008

[A2] ([Pn: Population of the year] - [Pn-1: population of the previous year]) / [Pn-1]

[A3] Village population of 2009 is estimated from statistic data as of year 2006 and assumed population growth rate of 1.25%/annum.

[Village population as of 2006]

= [Həsənqələ: 872] + [Balaqusar: 1382] + [Çiləgir: 950] + [Kohmə xudat: 1,777] + [Yuxarı Ləyər: 525]

= 5,506 persons (year 2006)

[Village population as of 2009]

= 5,506 x (1.0125^3) = 5,715 persons

Village population for 2010 afterward is forecast by using the same growth rate as urban.

Gusar

[B] Unit Water Demand / Peak Factor

Year	[B1] Unit domestic daily water demand	[B2] Commercial sector demand (Ratio to [B1])	[B3] Commercial sector demand (Ratio to [B1])	[B4] Institutional Organizations demand (Ratio to [B1])	[B5] Institutional Organizations demand (Ratio to [B1])	[B6] Industrial sector demand (Ratio to [B1])	[B7] Industrial sector demand (Ratio to [B1])	[B8] Unaccounted for water (Ratio of the average total demand)	[B9] Peak seasonal daily factor (maximum daily factor)	[B10] Hourly peak factor for network	[B11] Hourly peak factor for distribution mains	[B12] Hourly peak factor for transmission mains
		Urban	Village	Urban	Village	Urban	Village	Uban/ Village				
	L/c/d	%	%	%	%	%	%	%				
2009	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2010	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2011	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2012	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2013	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2014	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2015	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2016	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2017	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2018	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2019	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2020	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2021	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2022	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2023	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2024	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2025	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2026	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2027	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2028	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2029	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2030	**120**	**8**	**3**	**4**	**2**	**8**	**3**	**15**	**1.30**	**1.50**	**1.95**	**1.30**
2031	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2032	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2033	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2034	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30
2035	120	8	3	4	2	8	3	15	1.30	1.50	1.95	1.30

Gusar

[C] Water Demand

Year	[C1] Average daily domestic water demand Urban m3/day	[C2] Average daily commercial water demand Urban m3/day	[C3] Average daily institutional water demand Urban m3/day	[C4] Average daily industrial water demand Urban m3/day	[C5] Average daily domestic water demand Village m3/day	[C6] Average daily commercial water demand Village m3/day	[C7] Average daily institutional water demand Village m3/day	[C8] Average daily industrial water demand Village m3/day	[C9] Unaccounted for water Urban/ Village m3/day	[C10] Average daily water demand Urban/ Village m3/day	[C11] Maximum daily water demand Urban/ Village m3/day
2009	1,944	156	78	1,656	686	21	14	21	808	5,384	6,999
2010	1,968	157	79	1,657	694	21	14	21	814	5,425	7,053
2011	1,992	159	80	1,659	703	21	14	21	820	5,469	7,110
2012	2,016	161	81	1,661	711	21	14	21	827	5,513	7,167
2013	2,040	163	82	1,663	720	22	14	22	834	5,560	7,228
2014	2,064	165	83	1,665	728	22	15	22	841	5,605	7,287
2015	2,088	167	84	1,667	737	22	15	22	847	5,649	7,344
2016	2,112	169	84	1,669	745	22	15	22	854	5,692	7,400
2017	2,136	171	85	1,671	754	23	15	23	861	5,739	7,461
2018	2,160	173	86	1,673	762	23	15	23	867	5,782	7,517
2019	2,184	175	87	1,675	771	23	15	23	874	5,827	7,575
2020	2,196	176	88	1,676	775	23	16	23	878	5,851	7,606
2021	2,208	177	88	1,677	779	23	16	23	881	5,872	7,634
2022	2,220	178	89	1,678	784	24	16	24	885	5,898	7,667
2023	2,232	179	89	1,679	788	24	16	24	888	5,919	7,695
2024	2,244	180	90	1,680	792	24	16	24	891	5,941	7,723
2025	2,256	180	90	1,680	796	24	16	24	894	5,960	7,748
2026	2,268	181	91	1,681	800	24	16	24	897	5,982	7,777
2027	2,280	182	91	1,682	805	24	16	24	901	6,005	7,807
2028	2,292	183	92	1,683	809	24	16	24	904	6,027	7,835
2029	2,304	184	92	1,684	813	24	16	24	907	6,048	7,862
2030	**2,316**	**185**	**93**	**1,685**	**817**	**25**	**16**	**25**	**911**	**6,073**	**7,895**
2031	2,328	186	93	1,686	821	25	16	25	914	6,094	7,922
2032	2,352	188	94	1,688	830	25	17	25	921	6,140	7,982
2033	2,376	190	95	1,690	838	25	17	25	928	6,184	8,039
2034	2,400	192	96	1,692	847	25	17	25	934	6,228	8,096
2035	2,424	194	97	1,694	855	26	17	26	941	6,274	8,156

[C1] [A1: Urban population] x [B1: Unit domestic water demand]
[C2] [C1: Urban domestic water demand] x [B2: Ratio of commercial sector demand]
[C3] [C1: Urban domestic water demand] x [B4: Ratio of institutional organization demand]
[C4] [C1: Urban domestic water demand] x [B2: Ratio of industrial sector demand] + 1,500m3/day
[C5] [A3: Village population] x [B1: Unit domestic water demand]
[C6] [C2: Village domestic water demand] x [B3: Ratio of commercial sector demand]
[C7] [C2: Village domestic water demand] x [B5: Ratio of institutional organization demand]
[C8] [C2: Village domestic water demand] x [B5: Ratio of industrial sector demand]
[C9] (Total of [C1] to [C8]) x [B8: Unaccounted water ratio] / (100%- [B8])
[C10] Total of [C1] to [C9]
[C11] [C10] x [B9: Seasonal daily factor]

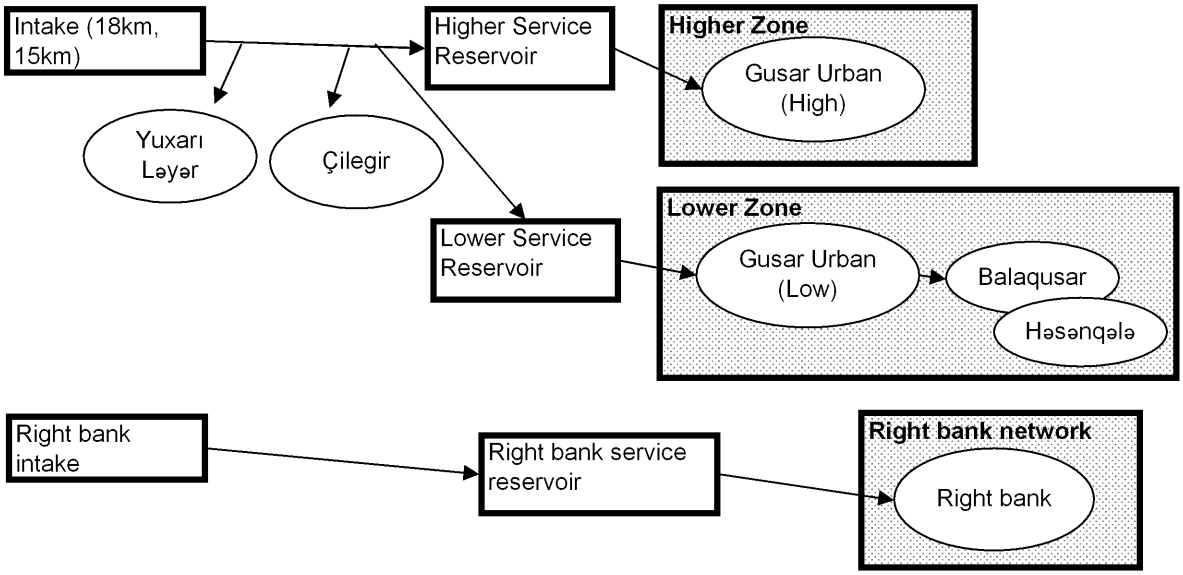
Gusar

Demand Calculation by Administrative Boundary

		Gusar (Urban)	Həsənqələ (Village)	Balaqusar (Village)	Çiləgir (Village)	Köhmə xudat (Village)	Yuxarı Leyər (Village)
Population as of year 2030	(persons)	19,300	1,086	1,721	1,183	2,213	654
Average daily unit domestic water demand	(L/c/d)	120	120	120	120	120	120
Average daily unit commerical sector demand	(%)	8	3	3	3	3	3
Average daily unit institutional organization demand	(%)	4	2	2	2	2	2
Average daily unit industrial sector demand	(%)	8	3	3	3	3	3
Average daily domestic water demand	(m3/day)	2,316	130	207	142	266	78
Average daily commercial sector demand	(m3/day)	185	4	6	4	8	2
Average daily institutional organization demand	(m3/day)	93	3	4	3	5	2
Average daily industrial sector demand	(m3/day)	1,685	4	6	4	8	2
Unaccounted-for water (15% of demand)	(m3/day)	755	25	39	27	51	15
Average daily water demand	(m3/day)	5,034	166	262	180	338	99
Maximum daily water demand	(m3/day)	6,544	216	341	234	439	129

Gusar

Schematic Diagram of Distribution Zone



Demand Calculation by Distribution Zone

		Gusar (Urban)	Həsənqələ (Village)	Balaqusar (Village)	Çiləgir (Village)	Köhmə xudat (Village)	Yuxarı Ləyər (Village)	Total
Gusar Zone I	Average (m3/day)	1,797						**1,797**
(35.7% of Gusar urban)	Maximum (m3/day)	2,336						**2,336**
Gusar Zone II	Average (m3/day)	1,908						**1,908**
(37.9% of Gusar urban)	Maximum (m3/day)	2,480						**2,480**
Gusar Zone III	Average (m3/day)	1,007	166	262				**1,435**
(20.0% of Gusar urban, Həsənq ələç Balaqusar)	Maximum (m3/day)	1,309	216	341				**1,866**
Gusar right bank network	Average (m3/day)	322						**322**
(6.4% of Gusar urban)	Maximum (m3/day)	419						**419**
Çiləgir	Average (m3/day)				180			180
	Maximum (m3/day)				234			234
Köhmə xudat	Average (m3/day)					338		338
	Maximum (m3/day)					439		439
Yuxarı Ləyər	Average (m3/day)						99	99
	Maximum (m3/day)						129	129

Service Reservoir Capacity

Gusar Higher Zone	m3	**1,600**
Gusar Lower Zone	m3	**1,600**
Gusar Lower Zone	m3	**1,300**
Gusar Right Bank	m3	**500**

Requirement of storage capacity: 75% of average todal demand + firefighting demand
Firefighting water demand: 216 m3 (20 L/sec x 3 hours)

ƏLAVƏ 4
KOLLEKTOR QURĞUSUNUN PLANI (PLAN)

Intake Facility Plan (Draft)

1. Khacmaz New Uchgun Spring Field

1-1. Design Conditions

1-2. Plan of Intake Facility (Draft)

2. Gusar River Sub-surface Water

2-1. Design Conditions

2-2. Plan of Intake Facility (Draft)

1. Khacmaz New Uchgun Spring Field

1-1. Design Conditions

Perforated collecting pipe or intake pipe head are planned for an intake facility for New Uchgun spring field. It will be shown that the perforated collecting pipe is use proven method and effective instrument for the water collecting in the river bed which recommended by Sukanal.

Whole, the intake pipe head collects the surface water directory in the riverbed at the downstream of meeting of streams. It is a possibility that is exposed to pollution of muddy water or live stock excretion. However, the area is fenced and planted that it can be stop the pollutants from coming into the river. It is rational way to keep a lid on construction cost under condition of the water system with total 4,000m in length. It shall be reconsider the intake facility plan for condition of the construction cost.

Design conditions of the intake facility for New Uchgun spring water are shown blow.

- Total length of stream: 4,000m
- Elevation of the area: about 103m to 136m
- Spring water points: unknown. 12 points are confirmed
- Water system: Dendritically-expanded with 8 branch
- Flow rate: min. 260m^3/day in the branch (Dec. '09). Max. 24,000m^3/day (Dec. '09) and 13,000m^3/day (Oct. '09).
- Planed quantity of water intake : 91,000m^3/day (70% of 13,000m^3/day)
- Foundation condition: clay soil with 0.3m below surface and sandy clay with pebble with 4.5m below surface.

1-2. Intake Facility Plane (Draft)

A plan of the perforated collecting pipe is outlined below.

1-2-1. Perforated Pipe

The perforated pipe is planed tree size of diameter which consists of 200mm, 400mm and 600mm. The pore diameter is 15mm and open porosity of it is more than 1 % should be designed in accordance with existing facility.

Table below describe the diameter of perforated pipe in relation to the quantity of water flow in the area.

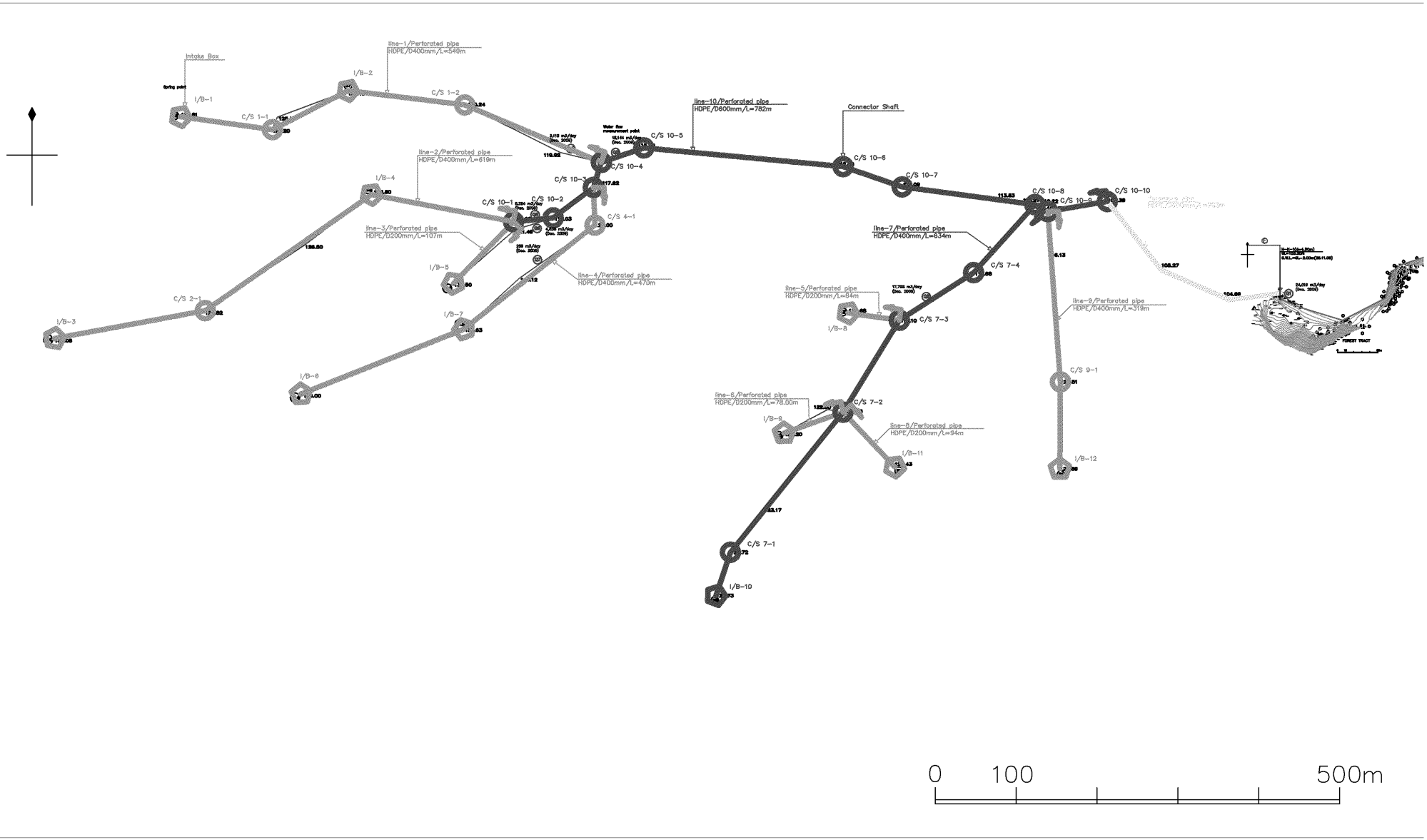
Relation between diameter of perforated pipe and quantity of water flow

Diameter (mm)	Quantity of water flow (m3/day)
200	≦2,500
400	2,500＜Q≦10,000
600	10,000<

Table below shows length of each perforated pipe, quantity of the spring intake and connector shaft. Plan of perforated pipe is shown below.

Length of perforated pipe and quantity of related facility

Line	Pipeline	Length (m)				Facility (site)	
		φ200mm	φ400mm	φ600mm	total	Spring Intake	Connector shaft
Line-1	Perforated/HDPE	0	549	0	549	2	2
Line-2	Perforated/HDPE	0	619	0	619	2	1
Line-3	Perforated/HDPE	0	107	0	107	1	0
Line-4	Perforated/HDPE	470	0	0	470	2	1
Line-5	Perforated/HDPE	64	0	0	64	1	0
Line-6	Perforated/HDPE	78	0	0	78	1	0
Line-7	Perforated/HDPE	0	0	634	634	1	4
Line-8	Perforated/HDPE	94	0	0	94	1	0
Line-9	Perforated/HDPE	319	0	0	319	1	1
Line-10	Perforated/HDPE	0	0	782	782	0	10
Transmission	Plane/HDPE	0	0	263	263	0	0
total		1025	1275	1679	3979	12	19

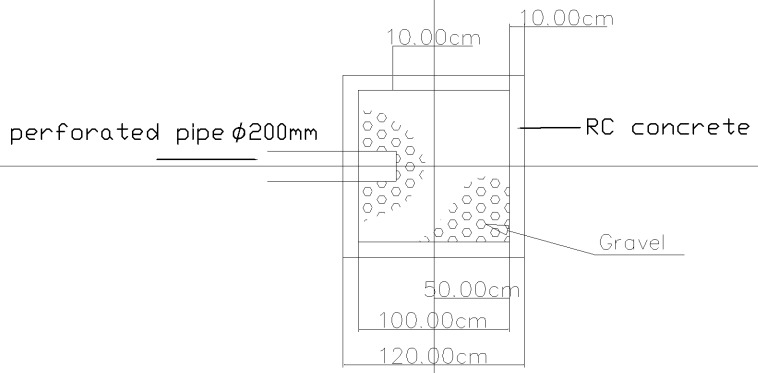

Intake Box
line-1/Perforated pipe
HDPE/D400mm/L=548m
I/B-1
I/B-2
C/S 1-1
C/S 1-2
line-2/Perforated pipe
HDPE/D400mm/L=619m
line-10/Perforated pipe
HDPE/D600mm/L=782m
Connector Shaft
C/S 10-1
C/S 10-2
C/S 10-3
C/S 10-4
C/S 10-5
C/S 10-6
C/S 10-7
C/S 10-8
C/S 10-9
C/S 10-10
I/B-3
I/B-4
I/B-5
I/B-6
I/B-7
C/S 2-1
C/S 4-1
line-3/Perforated pipe
HDPE/D200mm/L=107m
line-4/Perforated pipe
HDPE/D400mm/L=470m
line-5/Perforated pipe
HDPE/D200mm/L=64m
line-6/Perforated pipe
HDPE/D200mm/L=78.00m
line-7/Perforated pipe
HDPE/D400mm/L=634m
line-8/Perforated pipe
HDPE/D200mm/L=94m
line-9/Perforated pipe
HDPE/D400mm/L=319m
I/B-8
I/B-9
I/B-10
I/B-11
I/B-12
C/S 7-1
C/S 7-2
C/S 7-3
C/S 7-4
C/S 9-1
FOREST TRACT
0
100
500m

Appendix 4-4

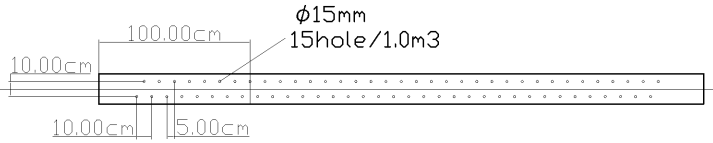
1-2-2. Relation Facility of Perforated Pipe

According to the results of water flow measurement in New Uchgun spring field, at least 12 spring water intake facility and 19 connector shaft are needed for the perforated collecting pipe. Figure below describe the facility plan. It should be reconsider the intake facility plan and require topographic survey and detailed water flow survey for detailed design.

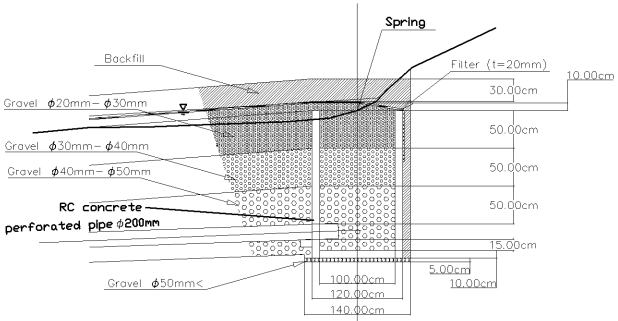
Spring Water Intake
-Plane-



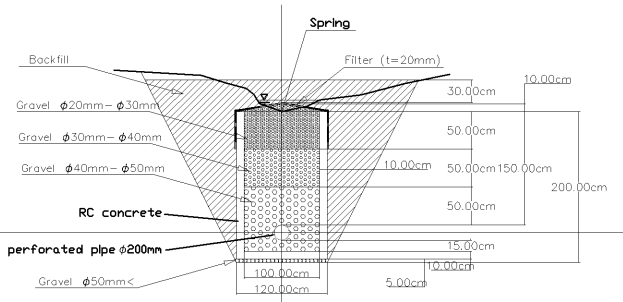
Perforated pipe ϕ200mm/HDPE



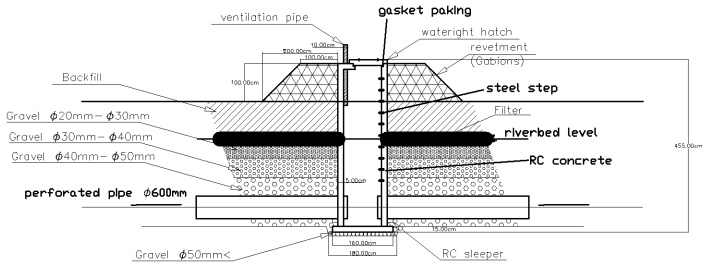
Spring Water Intake
-Typical Vertical Section-



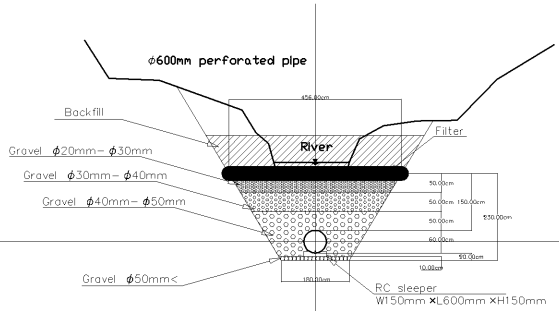
Spring Water Intake
-Typical Cross Section-



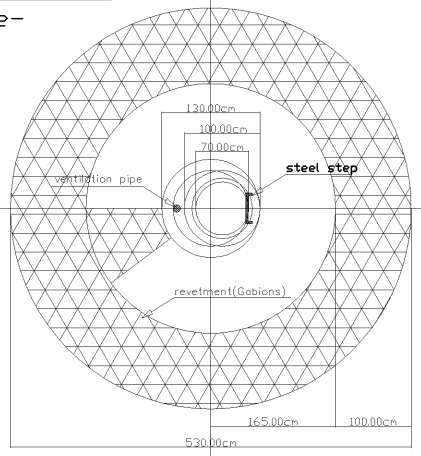
Connector Shaft
-Section-



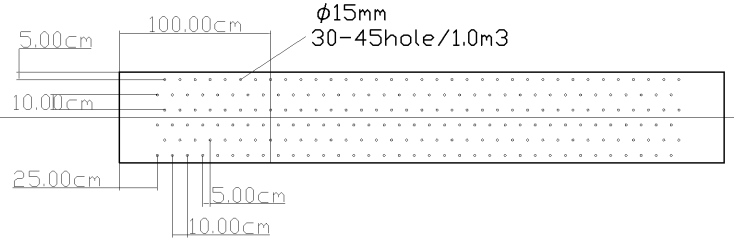
Perforated pipe
-Typical Cross Section-



Connector Shaft
-Plane-



Perforated pipe ϕ600mm/HDPE



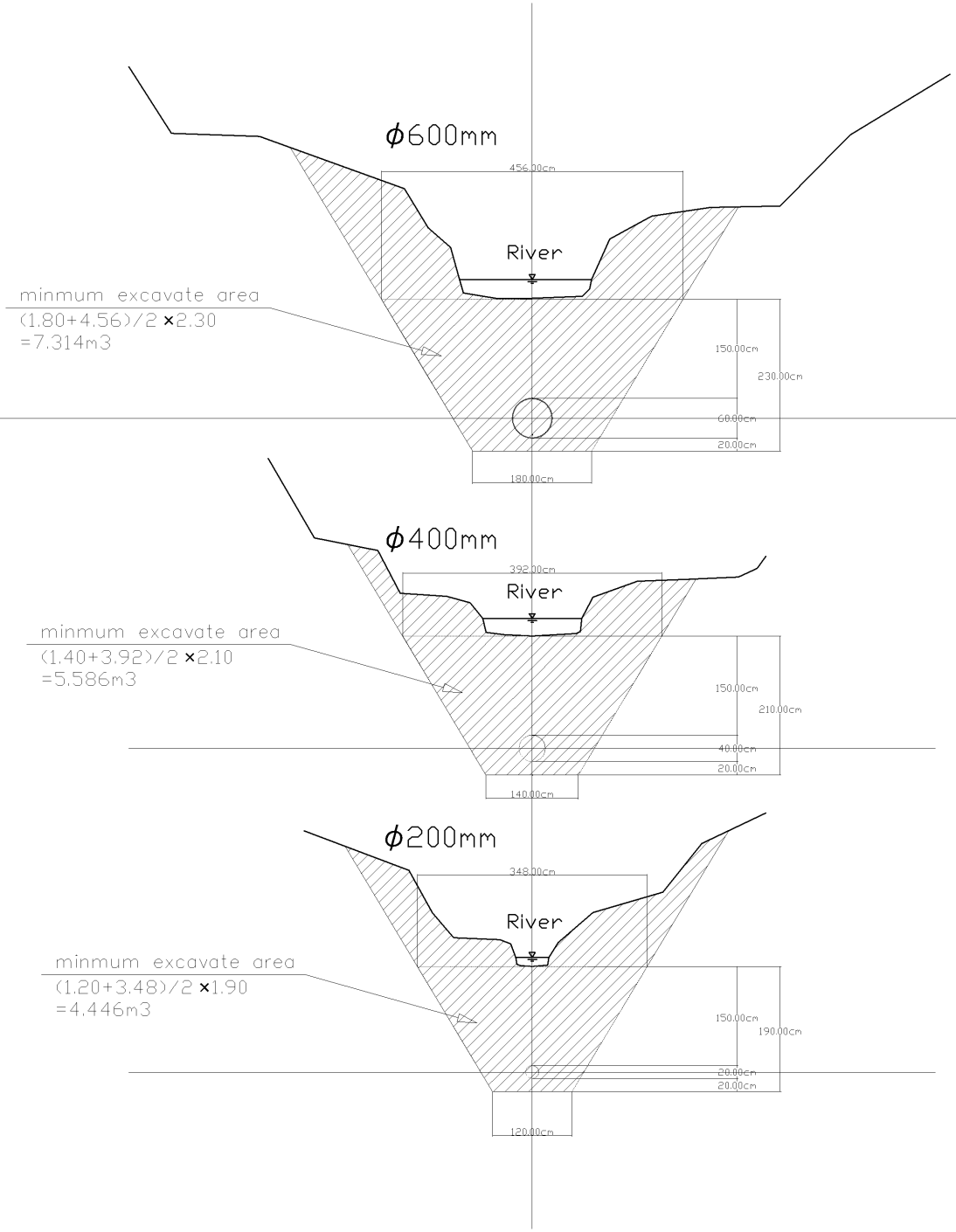
1-2-3. Quantity of Earth Work (tentative calculation)

New Uchgun spring field locates along a narrow valley consequently many amount of earth works needs for intake facility construction. At least below bottom of river needed to excavate for pipe installation. Table below shows a trial calculation of a minimum quantity of earth work.

Minimum Quantity of Earth Work (tentative calculation)

Perforated Pipe	earth work (m2)	length (m)	total (m3)
200mm	4,446	1,025	5,471
400mm	5,586	1,275	6,861
600mm	7,314	1,679	8,993
total	-	3,979	21,325

Typical Cross Section



2. Gusar River Sub-surface water Intake Facility

2-1. Design Conditions

Perforated collecting pipe is planned for the intake facility of Gusar River. Perforated collecting pipe is planned separate setting for both side of river. Perforated collecting pipe is use proven method and effective instrument for the water collecting in the river bed that is recommended by Gusar Sukanal.

However, connecting shaft and material of the pipe are reconsidered to prevention of intrusion of contamination and flood countermeasure.

Design conditions of the intake facility for Gusar riverbed water are shown blow.

- Elevation of construction site for right bank: more than 720m in the riverbed.
- Elevation of construction site for left bank: more than 967m in the riverbed
- Depth of pipe installation: 5m below surface (for natural filtration function)
- Lay out of perforated pipe for right bank: cross direction to the river (an existing facility along right side)
- Lay out of perforated pipe for left bank: parallel to the river (some of existing facility in the riverbed. It will be almost impossible to cross the river)
- Hydro-geological Constant shows in table below;

Intake facility	Perforated collecting pipe
Hydro-geological condition	Pipe installation depth is more than below 5m. (Sukanal)
Groundwater level (S.W.L)	8m below surface (Test pip)
Depth to impermeable layer	7m (Sukanal)
Q: design discharge	Right bank: 420 m^3/day Left bank: 7,500 m^3/day
k: permeability coefficient	4×10^{-4}m/sec （permeability test）
L: radius of influence	279m （$L=3{,}000\times s\times\sqrt{k}$） Siehart formula s=4.65m
H: depth to groundwater	6.2m （test pit and Sukanal）
2r: diameter of perforated pipe	φ500mm or φ900mm
h: depth from water level in the pipe to impermeable layer	1.75m （φ500mm） or 1.55m （φ900mm）
t: depth of water in the pipe	0.25m （φ500mm） or 0.45m （φ900mm）
l: length of perforated pipe	$Q=(k\times(H2-h2)\times l)/L\times\sqrt{((t+0.5r)/h)}\times\sqrt[4]{((2h-t)/h)}$

2-2. Plan of Intake Facility (Draft)

Design of perforated collecting pipe is shown below.

2-2-1. Perforated Pipe

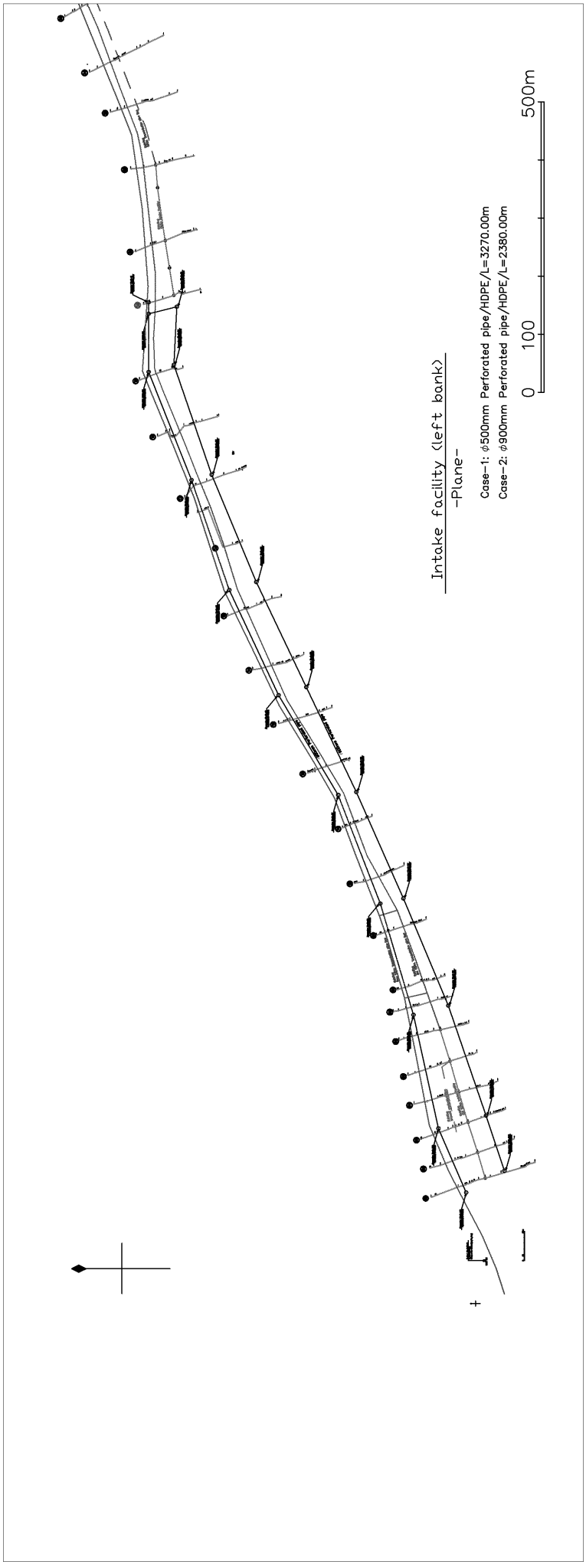
500mm and 900mm in diameter of HDPE perforated pipes are planned for the facility. The pore diameter is 15mm and open porosity of it is more than 1 % should be designed in accordance with existing facility.

Table below shows the result of trial calculation and design plan.

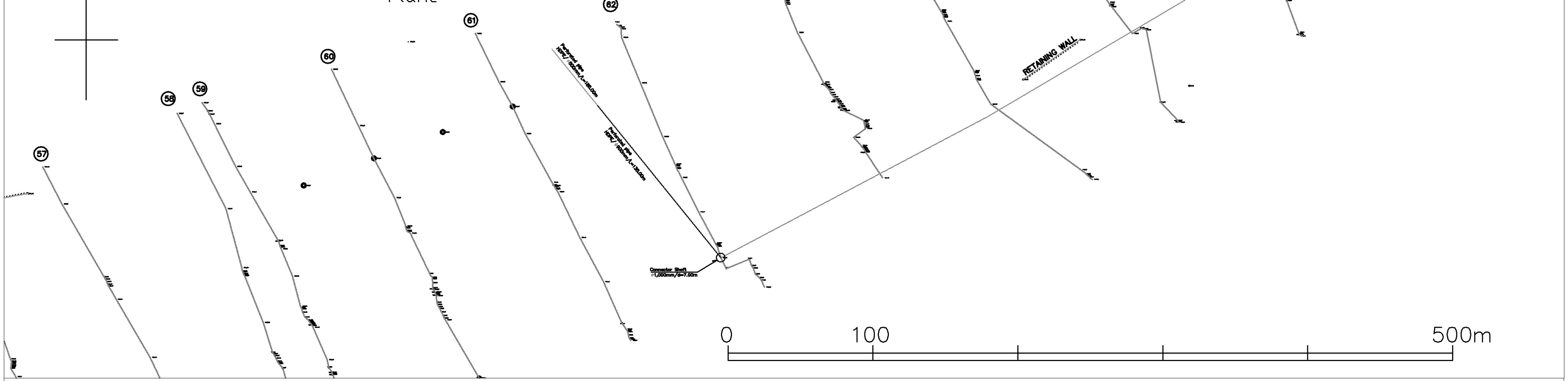
Result of a trail calculation of pipe length

Diameter (mm)	Right bank	Left bank
500	185m	3,720m
900	135m	2,380m

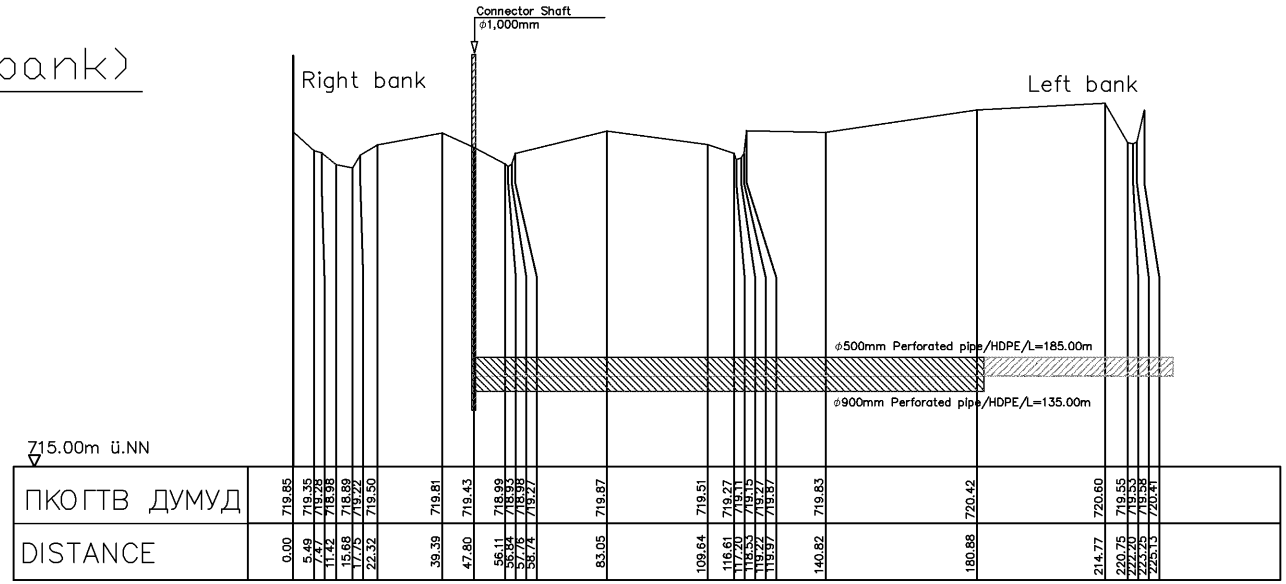
Plan below shows that the filter material are consists of gravels mesh controlled to cover the perforated pipe , however, riverbed deposits in the area has natural filtration functions to prevent contamination of muddy river water. Therefore, earth works production of pipe installation should be use for a backfilling as a filter material directly around the pipe.


Intake facility (left bank)
-Plane-
Case-1: φ500mm Perforated pipe/HDPE/L=3270.00m
Case-2: φ900mm Perforated pipe/HDPE/L=2380.00m
0
100
500m

Intake facility (right bank)
-Plane-



Intake facility (right bank)
-Section-



2-2-2. Related Facilities

Connecter shaft and flood countermeasure are shown in figure below.

(1) Connecter Shaft

The design of connecter shaft is improved and it is placed at 100m to 200m apart to solve the conventional problems.

A connecter shaft is placed at a joint part of perforated pipe with transmission pipe only for right bank system.

The result of trial calculation of 900mm in diameter shows below.

Connecter Shaft (right bank): 1 installation

Connecter Shaft (left bank): 21 installations

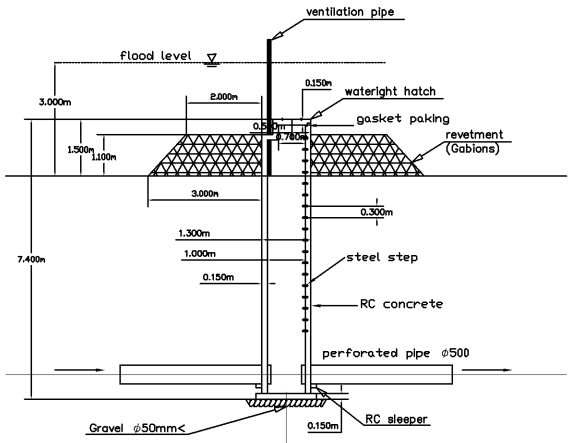
Distance of connecter shaft must be explored when location of the facility fixed under the inclines of the site.

(2) Flood Countermeasure

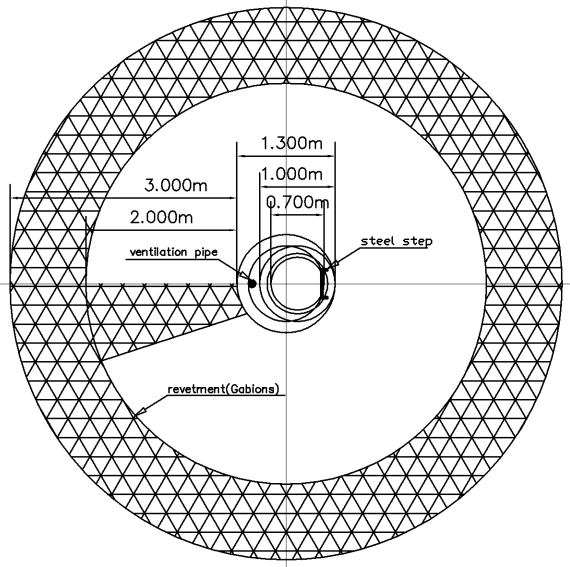
Existing flood countermeasure was eroded within a few years after construction of the facility by flood. It was a counterweight fill without erosion prevention on.

Gabion composed of boulder is planned to set up around a connecter shaft at over ground part for flood countermeasure under conceder construction work and material procurement.

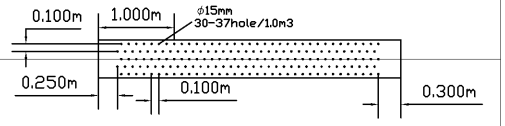
Connector Shaft -Section-



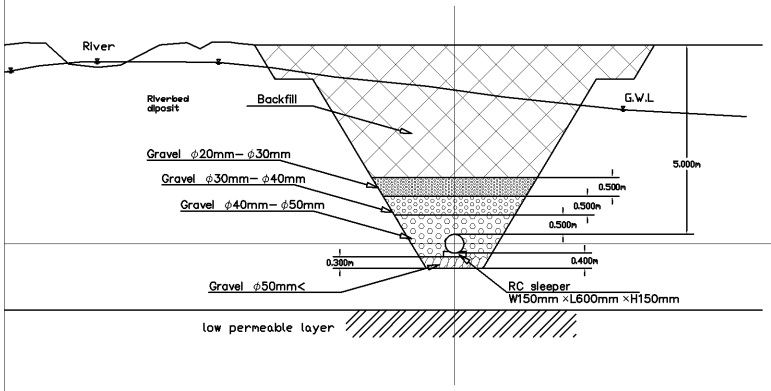
Connector Shaft -Plane-



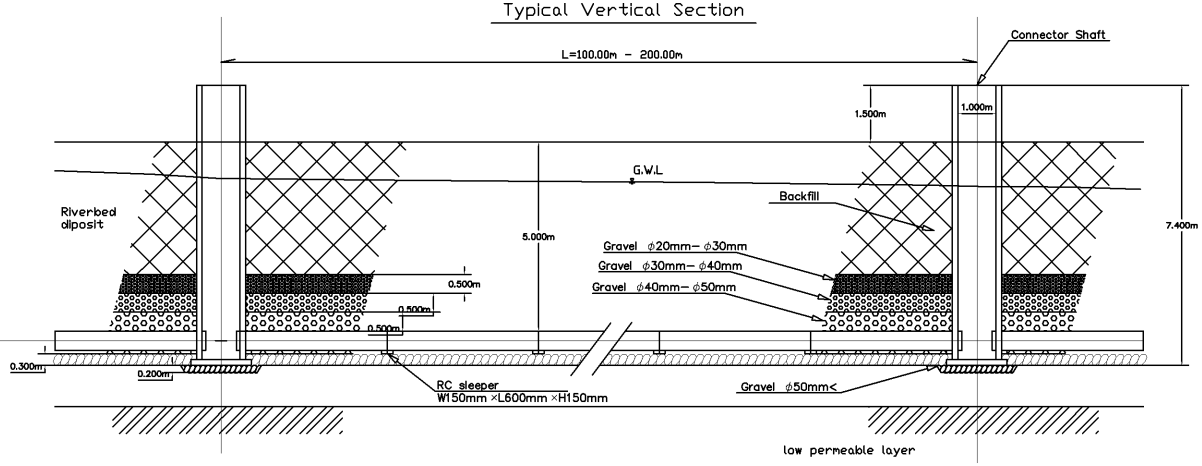
Perforated pipe φ500/HDPE



Typical Cross Section



Typical Vertical Section



2-2-3. Quantity of Earth Work (tentative calculation)

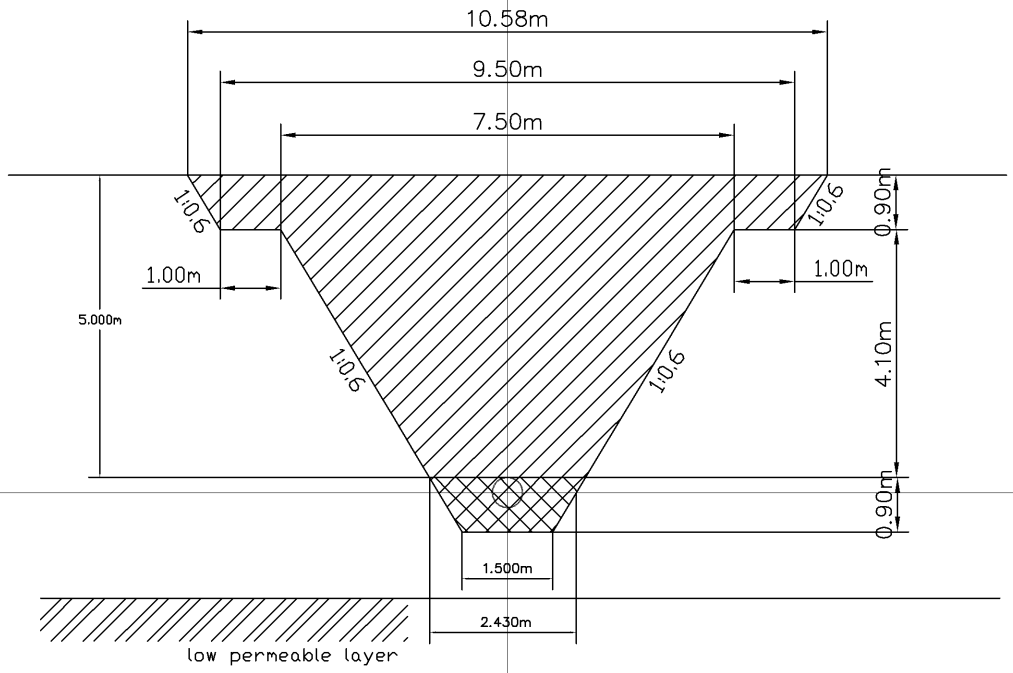
Quantity of earth work is calculated based on length of perforated pipe and typical section of it designed shows table below. Open cut planned for earth work.

It is required to confirm an inclination pitch and geological condition of cut slop with test pit before detail design.

Quantity of Earth Work (tentative calculation)

Diameter	Depth (m)	area	a (m)	b (m)	h (m)	(a+b)/2*h (m^2)	A (m^2)	Length (m)	Q1 (m^3)	Total (m^3)
500mm	<5m	S1	9.50	10.58	0.90	9.04	29.40	3,270	96,138	101,926
		S2	2.43	7.50	4.10	20.36				
	5m<	S3	1.50	2.43	0.90	1.77	1.77		5,788	
900mm	<5m	S4	9.90	11.46	1.30	13.88	34.90	2,380	83,062	91,344
		S5	3.46	7.90	3.70	21.02				
	5m<	S5	1.90	3.46	1.30	3.48	3.48		8,282	

Typical Cross Section ϕ500mm



Typical Cross Section ϕ900mm