Appendix-4 Water Quality and Water Resources Survey

Appendix 4 Water Quality and Water Resources Survey

1． Result of Water Quality Analysis for Water Supply

(1) Method of Water Quality Survey

In 4 cities, Butwal, Hetauda, Birgunj and Jankpur, JICA team conducted the water quality analysis of water source of NWSC and water taps etc. twice at dry season (from March to April) and at rainy season (August) at 6 points.

JICA team conducted the water quality analysis on site in person. Besides JICA team took the samples and outsourced water quality analysis in accordance with Standard Methods to the accredited water laboratory in Kathmandu.

Water quality parameters for on-site analysis (12 parameters) and for water quality analysis in laboratory (26 parameters) are shown in Table 1 and Table 2, respectively.

Table 1 Parameter and Analysis Method for On-Site Analysis

(Conducted by JICA team)

Parameter	Analysis Method	Parameter	Analysis Method
Water Temperature	Platinum Temperature Sensor （Including Multi Water Quality Checker）	Nitrate	Reduction and Naphthylethylenediamine Visual Colorimetric Method （PACKTEST）
pH	Glass Electrode Method （Including Multi Water Quality Checker）	Phosphate	4-Aminoantipyrin Visual Colorimetric Method with Enzyme （PACKTEST）
DO	Polarographic Method （Including Multi Water Quality Checker）	Total Coliform	Simple Test Paper for Fecal Coliform （SUNCOLI No.6）
EC	Four AC electrode method （Including Multi Water Quality Checker）	Fecal Coliform	Simple Test Paper for Fecal Coliform （SUNCOLI No.6）
Turbidity	LED forward 30°transmission/scattering method （Including Multi Water Quality Checker）	Color	Visual Colorimetric Method
Ammonia	Indophenol Blue Visual Colorimetric Method （PACKTEST）	Odor	Simple Sensory Test

Table2 Parameters and Analysis Methods for Analysis in Laboratory

(Conducted by Outsourcing)

Parameter	Analysis Method	Parameter	Analysis Method
pH	Glass Electrode Method	Calcium	EDTA Titrimetric Method
Turbidity	Light Transmission/Scattering Method	Iron	Atomic Absorption Spectrometric Method
EC	Electrode Method	Manganese	Atomic Absorption Spectrometric Method
TDS	Filtration Method	Zinc	Atomic Absorption Spectrometric Method
Color	Light Transmission Method	Copper	Atomic Absorption Spectrometric Method
Total Hardness	EDTA Titrimetric Method	Cadmium	Atomic Absorption Spectrometric Method
Residual Chlorine (Free+Combined)	DPD Colorimetric Method	Chromium	Atomic Absorption Spectrometric Method
Chloride	Silver Nitrate Titration Method	Lead	Atomic Absorption Spectrometric Method
Sulfate	Barium Sulfate Turbidimetric Method	Mercury	Cold Vaper Atomic Absorption Spectrometric Method
Nitrate	Ion-Selective Electrode Method	Arsenic	Atomic Absorption Spectrometric Method with Hydride Technique
Ammonia	Nesslerization Method	Aluminum	Eriochrome Cyanine R Spectrophotometric Method
Fluoride	Ion-Selective Electrode Method	Total Coliform	Most Probable Number (MPN) Method
Cyanide	Colorimetric Method	E. Coli	Most Probable Number (MPN) Method

Water analysis reports conducted by outsourcing (4 city × 6 points × 2 times = total 48 papers) are attached in APPENDIX, 1. Result of Water Quality Survey for Water Supply.

In addition to the water analysis in the above 6 points, on-site water quality analysis on the water in the wells mainly used for drinking water was also conducted in 4 cities to survey the current situation regarding the contamination by fecal coliform.

(2) Result of Water Quality Survey on Each City

1) Butwal

The Location where water quality survey was conducted is shown in Figure 1 and the result of water quality survey is shown in Table 3.

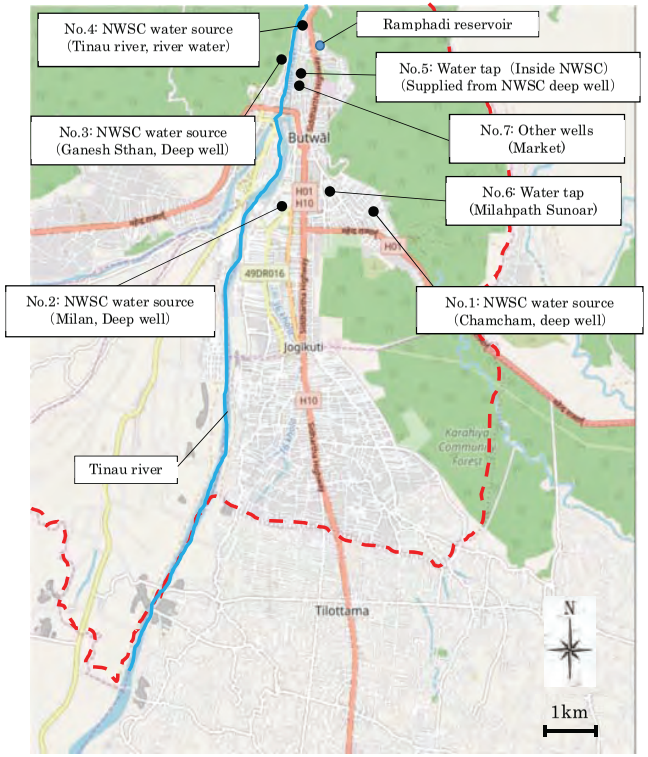

Figure 1 Location where Water Quality Analysis was Conducted in Butwal

Supplemental explanation regarding water quality analysis result

- Basically we studied water quality of each site except for nitrogen (ammonia and nitrate-nitrogen) and residual chlorine on the basis of the result of water quality analysis in laboratory, not on the basis of the result of on-site analysis. The reason is as follows:
- On-site water quality analysis was conducted with simple method using potable water quality sensor while water quality analysis in laboratory was conducted by Standard Methods. Therefore the analysis value by water analysis in laboratory is generally more reliable.
- For example, on-site analysis of total coliform and E.Coli is conducted using simple test paper and is incubated at the room temperature without any temperature control while analysis in laboratory are incubated at the constant temperature in the incubator.
- Regarding the nitrogen (ammonia and nitrate-nitrogen), the ammonia in sample No.2 and No.4 by analysis in laboratory is 0.1 mg/l or less while ammonia in these samples by on-site analysis is 0.2 mg/L or more. As the reason, it is thought that nitrification in the sample arose and ammonia was converted into nitrogen during the transfer of sample for approximately 1-2 days. So regarding the nitrogen, basically we will study the water quality on the basis of the result of on-site analysis.
- Regarding residual chlorine at water tap, because analysis at laboratory was conducted after 1 or 2 days from at the sampling, the residual chlorine in the sample may be consumed by reacting with ammonia or organic mattes in the samples during the period. Therefore we will study the water quality on the basis of the result of on-site analysis
- Regarding the mercury, according to the result of analysis by outsourcing to the laboratory, they are 0.001 mg/L or more at all 6 points at 4 cities, Nepal water quality standard. But because there are not any factories discharging the mercury near the sapling site, we need to analyze more samples and study the possibility of pollution by mercury.

The knowledge obtained through the result of water quality analysis at the water source and water tap in 6 points and the other well in Table 3 is as follows:

(Analysis value with ※ is referred to the result of on-site analysis and analysis value without ※ is referred to the result of water analysis in laboratory.)

- Regarding No.1 (deep well, Chamcham), at the survey of dry season and rainy season, the nitrate-nitrogen is approximately 10 mg/L or more※, the electro conductivity is 800uS/cm or more (810uS/cm at dry season, rainy 880 uS/cm at rainy season) and the chloride is 20mg/L or more (dry season 23mg/L, rainy season 23 mg/L). The water quality of these parameter in No.1 is much higher than No.2 (deep well, Milan). Besides, fecal coliform is detected in No.1 at the survey of rainy season （9.3×10 (MPN/100ml)）. Therefore there is the possibility of bacterial contamination in the well of No.1, which is caused by domestic water being soaked into the ground.
- Regarding No. 5 (water tap, inside NWSC office, supplied from deep well in NWSC office), the nitrate-nitrogen is 10mg/L or more※, the electro conductivity is 850uS/cm or more (870uS/cm at dry season, 930uS/cm at rainy season） and the chloride is 25mg/L or more (28mg/L at dry season, 25 mg/L at rainy season). The water quality of these parameter in No.5 is much higher than No.2 (deep well, Milan). Therefore there is the possibility of contamination by domestic wastewater in the well of No.5. But fecal coliform was not detected in this survey.
- No.6 (Water tap, Milahpath Suoar) is supplied from Ramphadi reservoir for approximately 3 km. Chlorine is injected into Ramphadi reservoir. At No.6 residual chlorine was detected at the survey of dry season and rainy season (0.1mg/L as free chlorine and 0.3 mg/L as total chlorine at dry season, 0.1mg/L as total chlorine at rainy season) and fecal coliform was not detected. While at No.4 (Tinau rever), the water source of No. 6, fecal coliform was detected at the survey of dry season and rainy season (43 (MPN/100ml) at dry season, 93 (MPN/100ml) at rainy season). Therefore it is thought that fecal coliform was not detected at the water tap of No. 6 by the effect of disinfection with chorine at the reservoir and by the effect of residual chlorine during the process of water distribution.
- The concentration of hazardous substance including arsenic and lead etc. were much less than WHO guideline value of those substance at the survey of dry season and rainy season at 6 points where water quality survey was conducted.

Table 3 Result of Water Quality Survey in Butwal

Kind of Sample		NWSC Water Source								Water Tap				Other Wells etc.	<Reference> Water Quality Standard	
		(Deep well)		(Deep well)		(Deep well)		(River water)						(Deep Well)		
Sample No		No.1※1		No.2※2		No.3※3		No.4		No.5※4		No.6※5		No.7※8	NDWQS※7	WHO Guideline Value
Location		Chamcham		Milan		Ganesh Sthan		Tinaw Sump Well		NWSC Butwal		Milahpath Sunoar		Market		
Sampling Date		March 31	August 11	March 31	August 11	March 31	August 11	March 31	August 11	March 31	August 11	March 31	August 11	August 11		
Parameter	Unit															
1. On Site Analysis																
Water Temperature	℃	27.5	29.9	26.5	26.2	26.2	25.9	26.0	27.2	27.3	26.8	25.7	29.8	25.5		
pH	−	7.1	7.1	7.5	7.6	7.2	7.3	8.8	8.4	7.3	7.0	8.3	7.5	7.8		
DO	mg/L	7.8	3.6	5.3	4.2	5.0	3.6	7.9	3.8	7.8	2.7	7.0	4.0	4.5		
EC	mS/cm	0.91	0.92	0.46	0.49	0.84	0.80	0.36	0.30	0.98	0.96	0.37	0.58	0.43		
Turbidity※6	NTU	1 or less	−	1 or less	−	1 or less	−	6	−	1 or less	−	11	−	−		
Ammonia	mg-N/L	0.2	0.2 or less	0.5	0.2	0.2	0.2 or less	0.5	0.2	0.5	0.2 or less	0.2	0.2	0.2 or less		
Nitrate	mg-N/L	10	10 or more	0.5	2.0	0.5	1.0	0.2	0.2 or less	10 or more	10 or more	0.2	2.0	2.0		
Residual Chlorine (Free)	mg-Cl_2/L	−	−	−	−	−	−	−	−	0.1 or less	0.1 or less	0.1	0.1 or less	−		
Residual Chlorine (Total)	mg-Cl_2/L	−	−	−	−	−	−	−	−	0.1 or less	0.1 or less	0.3	0.1	−		
Coliform	CFU/ml	Nil	1	Nil	Nil	1.0	3	14	47	Nil	13	Nil	2	Nil		
Fecal Coliform	CFU/ml	Nil	1	Nil	Nil	1.0	3	6	Too many	Nil	8	Nil	Nil	Nil		
Color	TCU	10 or less	10 or less	10 or less	10 or less	10 or less	10	10 or less	20	10 or less	10	10 or less	10	10 or less		
Odor	−	No Smell	No smell	No Smell	No smell	No Smell	No smell	No Smell	No smell	No Smell	No smell	Smell of chlorine	Smell of chlorine	No smell		
2.Offical Analysis																
<Physical>																
pH	−	6.6	7.2	7.4	7.8	7.0	7.5	8.6	8.7	7.0	7.2	8.4	7.8		6.5-8.5	−
Turbidity	NTU	1 or less	1 or less	1 or less	1 or less	4	6	3	23	1 or less	1 or less	1	4		5	5
EC	mS/cm	0.81	0.88	0.41	0.48	0.75	0.77	0.32	0.29	0.87	0.93	0.33	0.43		1.5	−
TDS	mg/L	545	578	251	321	389	453	162	159	583	597	170	252		1000	1000
Color	TCU	1 or less	1 or less	1 or less	1 or less	1 or less	1 or less	1 or less	1 or less	1 or less	1 or less	1 or less	1 or less		5	15
Total Hardness	mg/L as $CaCO_3$	381	400	204	239	310	318	157	145	412	439	177	208		500	−
<Residual Chlorine>																
Chlorine (Free+Combined)	mg/L	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.2	0.1 or less		0.1-0.2 (as free chlorine)	−
<Nonmetal>																
Chloride	mg/L	23	23	6	9	7	7	3	3	28	25	4	4		250	250
Sulfate	mg/L	14	16	8	11	5	7	8	11	14	15	8	11		250	250
Ammonia	mg-N/L	0.10	0.03 or less	0.05	0.05	0.1	0.03 or less	0.08	0.07	0.09	0.03 or less	0.09	0.03 or less		1.2	1.2
Nitrate	mg-N/L	9.7	12.6	2.2	5.9	2.5	5.2	0.5	2.1	11.5	13	0.7	4.3		11.3	11.3
Fluoride	mg/L	0.5 or less	0.5 or less	0.5 or less	0.5 or less	0.5 or less	0.5 or less	0.5 or less	0.5 or less	0.5 or less	0.5 or less	0.5 or less	0.5 or less		0.5-1.5	1.5
Cyanide	mg/L	0.07 or less	0.07 or less	0.07 or less	0.07 or less	0.07 or less	0.07 or less	0.07 or less	0.07 or less	0.07 or less	0.07 or less	0.07 or less	0.07 or less		0.07	0.07
<Metal>																
Calcium	mg/L	112	118	51	62	73	76	37	36	117	126	40	56		200	−
Iron	mg/L	0.03	0.06	0.04	0.04	0.19	0.36	0.07	0.47	0.07	0.04	0.09	0.20		0.3	0.3
Manganese	mg/L	0.02 or less	0.02 or less	0.02 or less	0.02 or less	0.06	0.08	0.02	0.10	0.02	0.02 or less	0.04	0.02 or less		0.2	0.5
Zinc	mg/L	0.2	0.3	0.3	0.1	0.1 or less	0.1 or less	0.1 or less	0.1	0.1 or less	0.1 or less	0.1 or less	0.3		3	3
Copper	mg/L	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less		0.1	2
Cadmium	mg/L	0.003 or less	0.003 or less	0.003 or less	0.003 or less	0.003 or less	0.003 or less	0.003 or less	0.003 or less	0.003 or less	0.003 or less	0.003 or less	0.003 or less		0.003	0.003
Chromium	mg/L	0.05 or less	0.05 or less	0.05 or less	0.05 or less	0.05 or less	0.05 or less	0.05 or less	0.05 or less	0.05 or less	0.05 or less	0.05 or less	0.05 or less		0.05	0.05
Lead	mg/L	0.01 or less	0.01 or less	0.01 or less	0.01 or less	0.01 or less	0.01 or less	0.01 or less	0.01 or less	0.01 or less	0.01 or less	0.01 or less	0.01 or less		0.01	0.01
Mercury	mg/L	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.004	0.003	0.003	0.003		0.001	0.001
Arsenic	mg/L	0.005 or less	0.005 or less	0.005 or less	0.005 or less	0.005 or less	0.005 or less	0.005 or less	0.005 or less	0.005 or less	0.005 or less	0.005 or less	0.005 or less		0.05	0.01
Aluminum	mg/L	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less		0.2	0.2
<Bacteriological>																
Total Coliform	MPN/100ml	Nil	1.1×10^3	Nil	9.3×10	Nil	Nil	2.4×10^2	4.6×10^2	Nil	Nil	Nil	2.3×10		Nil	−
E. Coli	MPN/100ml	Nil	9.3×10	Nil	Nil	Nil	Nil	4.3×10	9.3×10	Nil	Nil	Nil	Nil		Nil	Nil

Note:
※1 Well depth is approxymately 70m.
※2 Sample is taken from No.1 well (well depth is approxymately 90m).
※3 Well depth is approxymately 70m.
※4 Water is supplied from NWSC office Well(No.5, well depth is approxymately 70m).
※5 Water is supplied from Rumphadi reservoir.
※6 Turbidity on April 11 could not be measured due to during the adjustment of the sensor.
※7 NDWQS means "National Drinking Water Quality Standard in Nepal".
※8 This well (moter pump well) is for portable watar of the people around the market, which was consturcted by the community. Well depth is approxymately 65m.

- There were no distinctive differences of water quality between dry season and rainy season at each point.
- The result of on-site water analysis on the other well etc. is as follows:
  - Fecal coliform was not detected at No.7, which is located in the central market (well depth 65m, motor pump well), although there are pollution sources such as toilet near the well.

2) Hetauda

The Location where water quality survey was conducted is shown in Figure 2 and the result of water quality survey is shown in Table 4.

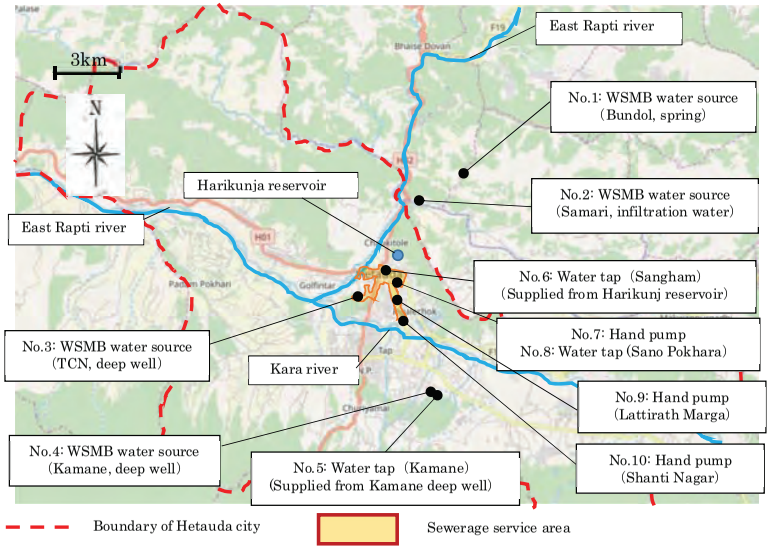

Figure 2 Location where Water Quality Analysis was Conducted in Hetauda

The knowledge obtained through the result of water quality analysis at the water source and water tap in 6 points and the other wells in Table 4 is as follows:

(Analysis value with ※ is referred to the result of on-site analysis and analysis value without ※ is referred to the result of water analysis in laboratory.)

- Regarding No.3 (deep well, TCN), at the survey of dry season and rainy season, the nitrate-nitrogen is approximately 10 mg/L or more※, the electro conductivity is 550uS/cm or more (580uS/cm at dry season, 590 uS/cm at rainy season) and the chloride is 20mg/L or more (27 mg/L at dry season, 22 mg/L at rainy season). The water quality of these parameter in No.3 is much higher than No.4 (deep well, Kamane). Therefore there is the possibility of contamination by domestic wastewater in the well of No.5. But fecal coliform was not detected in this survey.
- No.6 (Water tap, Sangham) is supplied from Harikuja reservoir for approximately 3 km. Chlorine is injected into Harikuja reservoir. At No.6 residual chlorine was detected at the survey of dry season (0.3mg/L as free chlorine and 0.4 mg/L as total chlorine) and fecal coliform was not detected. While at No.1 (spring, Bundol), the water source of No. 6, fecal coliform was detected at the survey of dry season (43 (MPN/100ml) at dry season). Therefore it is thought that fecal coliform was not detected at No. 6 by the effect of disinfection with chorine at the reservoir and by the effect of residual chlorine during the process of water distribution. On the other hand, at the survey of rainy season, residual chlorine was not detected and fecal coliform was detected at No.6 (Water tap, Sangham). Therefore it is thought that fecal coliform was detected at the water tap of No. 6 because supplied water is not disinfected by chlorine.
- The concentration of hazardous substance including arsenic and lead etc. were much less than WHO guideline value of those substance at the survey of dry season and rainy season at 6 points where water quality survey was conducted.
- There were no distinctive differences of water quality between dry season and rainy season at each point.
- The result of on-site water analysis on the other wells etc. is as follows:
  - Fecal coliform was detected at No.7, which is located in the city center (well depth 21m, hand pump well).
  - While residual chlorine was detected and fecal coliform was not detected at No.8 (water tap supplied from HWSB), which is located next to No.7.
  - Fecal coliform was not detected at No.9 and No.10 (well depth 7m, hand pump well), which is located outside of city center.

3) Birgunj

Table 4 Result of Water Quality Survey in Hetauda

Name of Sample		NWSC Water Source								Water Tap				Other Wells etc.				<Reference> Water Quality Standard	
		(Spring)		(Infiltration water)		(Deep well)		(Deep well)						(Hand Pump, Shallow well)	(Water tap supplied from HWMB)	(Hand Pump, Shallow well)	(Hand Pump, Shallow well)		
Sample No.		No.1		No.2		No.3※1		No.4※2		No.5※3		No.6※4		No.7※6	No.8※7	No.9※8	No.10※9	NDWQS※5	WHO Guideline Value
Location		Bundol		Samari		TCN		Kamane		Kamane		Sangham Chowk		Sano Pokhara-4	Sano Pokhara-4	Lattirath Marga	Shanti Nagar		
Sampling Date		April 7	August 14	April 7	August 14	April 7	August 14	April 7	August 14	April 7	August 14	April 7	August 14	August 15	August 15	August 15	August 15		
Parameter	Unit																		
1. On Site Analysis																			
Water Temperature	℃	20.9	25.3	22.1	26.9	26.2	27.5	25.7	26.1	25.8	27.2	24.1	27.4	27.1	27.9	28.8	27.5		
pH	−	8.2	7.9	8.1	7.8	7.0	6.8	5.3	6.4	5.5	5.8	7.4	7.2	6.7	7.2	6.2	6.5		
DO	mg/L	7.8	4.5	6.5	3.8	4.8	1.6	6.2	5.4	7.7	4.3	7.5	5.2	2.1	4.6	2.3	2.1		
EC	mS/cm	0.42	0.34	0.36	0.35	0.66	0.62	0.04	0.04	0.04	0.03	0.45	0.4	0.4	0.5	0.3	0.3		
Turbidity	NTU	1 or less	1 or less	1 or less	1 or less	1 or less	1 or less	1 or less	1 or less	57	1 or less	1 or less	1 or less	8.5	1 or less	5.8	1 or less		
Ammonia	mg-N/L	0.2	0.2	0.2	0.5	0.2	0.2	0.5	0.2	0.5	0.2	0.5	0.2 or less	0.2	0.2	0.2 or less	1.0		
Nitrate	mg-N/L	0.2 or less	0.2 or less	0.2	0.2 or less	10 or more	10 or more	0.5	0.5	0.5	1	1	1	2.0	2.0	1.0	0.2 or less		
Residual Chlorine (Free)	mg-Cl_2/L	−	−	−	−	−	−	−	−	0.1 or less	0.1 or less	0.3	0.1 or less	−	0.0	−	−		
Residual Chlorine (Total)	mg-Cl_2/L	−	−	−	−	−	−	−	−	0.1 or less	0.1 or less	0.4	0.1 or less	−	0.1	−	−		
Coliform	CFU/ml	9	2	Nil	Nil	Nil	Nil	1	Nil	6	1	Nil	Nil	Too many	Nil	Nil	Nil		
Fecal Coliform	CFU/ml	2	2	Nil	Nil	Nil	Nil	Nil	Nil	2	Nil	Nil	Nil	Too many	Nil	Nil	Nil		
Color	TCU	10 or less	10 or less	10 or less	10 or less	10 or less	10 or less	10 or less	10 or less	10 or less	10 or less	10 or less	10 or less	10.0	10 or less	10.0	10.0		
Odor	−	A little smell	No smell	A little smell	No smell	A little smell	No smell	No smell	No smell	A little smell	No smell	A little smell	No smell	A little smell	A little smell	Smell	A little smell		
2. Official Analysis																			
<Physical>																			
pH	−	8.0	8.3	7.7	7.9	5.9	6.8	4.6	5.3	4.0	5.2	6.7	7.5					6.5-8.5	−
Turbidity	NTU	1 or less	1 or less	1 or less	1 or less	1 or less	1 or less	1 or less	1 or less	1 or less	1 or less	1 or less	1 or less					5	5
EC	mS/cm	0.37	0.33	0.32	0.33	0.58	0.59	0.04	0.04	0.03	0.04	0.40	0.39					1.5	−
TDS	mg/L	217	222	266	197	352	488	21	26	25	25	267	298					1000	1000
Color	TCU	1 or less	1 or less	1 or less	1 or less	1 or less	1 or less	1 or less	1 or less	1 or less	1 or less	1 or less	1 or less					5	15
Total Hardness	mg/L as $CaCO_3$	200	181	169	177	247	255	24	12	12	12	204	204					500	−
<Residual Chlorine>																			
Chlorine (Free+Combined)	mg/L	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less					0.1-0.2 (as free chlorine)	−
<Nonmetal>																			
Chloride	mg/L	2	1	2	1	27	22	2	1	3	1	6	4					250	250
Sulfate	mg/L	44	34	20	18	20	18	1 or less	1	1 or less	1 or less	19	19					250	250
Ammonia	mg-N/L	0.03 or less	0.03 or less	0.03 or less	0.03 or less	0.03 or less	0.03 or less	0.03 or less	0.03 or less	0.03 or less	0.03 or less	0.03 or less	0.03 or less					1.2	1.2
Nitrate	mg-N/L	0.7	2.1	1.4	2.2	16.3	12.2	2.0	1.5	1.8	1.5	4.2	4.7					11	11
Fluoride	mg/L	0.5 or less	0.5 or less	0.5 or less	0.5 or less	0.5 or less	0.5 or less	0.5 or less	0.5 or less	0.5 or less	0.5 or less	0.5 or less	0.5 or less					0.5-1.5	1.5
Cyanide	mg/L	0.07 or less	0.07 or less	0.07 or less	0.07 or less	0.07 or less	0.07 or less	0.07 or less	0.07 or less	0.07 or less	0.07 or less	0.07 or less	0.07 or less					0.07	0.07
<Metal>																			
Calcium	mg/L	48	42	51	36	79	76	3	3	3	3	62	58					200	−
Iron	mg/L	0.03 or less	0.05	0.05	0.06	0.04	0.07	0.05	0.05	0.05	0.03	0.07	0.07					0.3	0.3
Manganese	mg/L	0.02 or less	0.02 or less	0.02 or less	0.02 or less	0.02 or less	0.02 or less	0.02 or less	0.02 or less	0.02 or less	0.02	0.02	0.02 or less					0.2	0.5
Zinc	mg/L	0.1 or less	0.3	0.1 or less	0.1	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.9	0.4					3	3
Copper	mg/L	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less					0.1	2
Cadmium	mg/L	0.003 or less	0.003 or less	0.003 or less	0.003 or less	0.003 or less	0.003 or less	0.003 or less	0.003 or less	0.003 or less	0.003 or less	0.003 or less	0.003 or less					0.003	0.003
Chromium	mg/L	0.05 or less	0.05 or less	0.05 or less	0.05 or less	0.05 or less	0.05 or less	0.05 or less	0.05 or less	0.05 or less	0.05 or less	0.05 or less	0.05 or less					0.05	0.05
Lead	mg/L	0.01 or less	0.01 or less	0.01 or less	0.01 or less	0.01 or less	0.01 or less	0.01 or less	0.01 or less	0.01 or less	0.01 or less	0.01 or less	0.01 or less					0.01	0.01
Mercury	mg/L	0.005	0.004	0.011	0.011	0.010	0.010	0.003	0.003	0.008	0.007	0.006	0.005					0.001	0.001
Arsenic	mg/L	0.007	0.005 or less	0.005	0.005 or less	0.006	0.005 or less	0.005 or less	0.005 or less	0.005	0.005 or less	0.005	0.005 or less					0.05	0.01
Aluminum	mg/L	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less					0.2	0.2
<Bacteriological>																			
Total Coliform	MPN/100ml	4.3×10	4.3×10	4	Nil	Nil	Nil	Nil	Nil	Nil	4	Nil	4					Nil	−
E. Coli	MPN/100ml	9	4	Nil	Nil	Nil	Nil	Nil	Nil	Nil	4	Nil	4					Nil	Nil

Note:
※1 Sample is taken from No.2 well (well depth is approxymately 84m).
※2 Well depth is approxymately 120m.
※3 Water is supplied from Kamene deep well (No. 4).
※4 Water is supplied from Harikunj reservoir.
※5 NDWQS means "National Drinking Water Quality Standard in Nepal".
※6&7 No.7 and No.8 are located in the same premise of a household. No.7 is hand pump and No.8 is water tap from HWMB. Well depth of No.7 is approxymately 21m and static water level at the suvey was approxymately 1.1m from the ground.
※8 No.9 is hund pump in the household. Well depth is approxymately 7m from the ground.
※9 No.10 is hund pump in the household. Well depth is approxymately 7m from the ground.

A-4-5

The Location where water quality survey was conducted is shown in Figure 3 and the result of water quality survey is shown in Table 5.

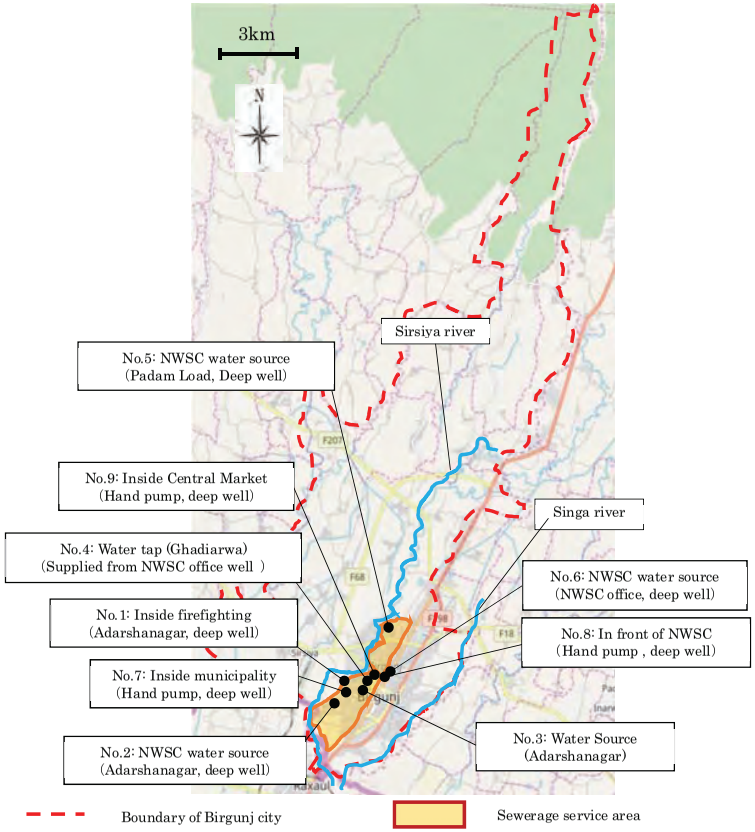

Figure 3 Location where Water Quality Analysis was Conducted in Birgunj

The knowledge obtained through the result of water quality analysis at the water source and water tap in 6 points and the other wells in Table5 is as follows:

(Analysis value with ※ is referred to the result of on-site analysis and analysis value without ※ is referred to the result of water analysis in laboratory.)

- Regarding No.2 (Adarchanagar NWSC), No.5(Padam Road) , No.6(NWSC office well) and No.1 (Municipality) at the survey of dry season and rainy season, the nitrate-nitrogen is 0.2 mg/L or less※, the electro conductivity is approximately 400uS/cm or less and the chloride is 2mg/L or less. That is , there are not such deep wells that nitrate-nitrogen, electro conductivity and chloride are high among water sources in NWSC Birgunj as confirmed at the deep well at TCN in Hetauda. Besides fecal coliform was also not detected at No.2 (Adarchanagar NWSC), No.6 (NWSC office well) and No. 1 (municipality). Therefore it was confirmed that these 3 wells were not contaminated by the domestic wastewater etc.

※ Fecal coliform was detected at rainy season at No.5 (Padam Road). We need to conduct more water quality survey in No.5 and study the possibility of contamination by domestic wastewater etc. on the basis of more data.

- Besides, at the survey of dry season and rainy season, residual chlorine was not detected and fecal coliform was detected at No.4 (Water tap, Ghadiarwa), which is supplied from No.6 (deep well, NWSC office). Therefore it is thought that fecal coliform was detected at No. 4 because supplied water was not disinfected by chlorine and contaminated by domestic wastewater etc. including fecal coliform although fecal coliform was not detected at the deep well of No.6.
- According to the result of water quality analysis in laboratory in this survey, iron and manganese are detected at some deep wells more than 0.3mg/L and 0.2 mg/L, drinking water quality standard in Nepal, respectively. However it is not reported about the color at water tap or the scaling in the water pipe in this area. Therefore we need to conduct more water quality survey regarding iron and manganese in the deep wells and grasp the actual situation at first.
- The concentration of hazardous substance including arsenic and lead etc. were much less than WHO guideline value of those substance at the survey of dry season and rainy season at 6 points where water quality survey was conducted.
- There were no distinctive differences of water quality between dry season and rainy season at each point.
- The result of on-site water analysis on the other well etc. is as follows:
  - Fecal coliform was not detected at No.7, which is located in the municipality (well depth: 84m, hand pump well).
  - Fecal coliform was detected at No.8, which is located in front of NWSC near side ditch with accumulated sludge (well depth approximately 72 m, hand pump well), and at No.9, located in the central market (well depth approximately 72 m, hand pump well), although these wells are

Table 5 Result of Water Quality Survey in Birgunj

Kind of Sample		NWSC Water Source						Municipality		Water Tap				Other Wells etc.			<Reference> Water Quality Standard	
		(Deep well)		(Deep well)		(Deep well)		(Deep well)						(Hand Pump, Deep well)	(Hand Pump, Deep well)	(Hand Pump, Deep well)		
Sample No.		No.2※1		No.5※2		No.6※3		No.1		No.3※4		No.4※5		No.7※7	No.8※8	No.9※9	NDWQS※6	WHO Guideline Value
Location		Adarshanagar NWSC		Padam Road		Sripur NWSC		Adarshanagar Municipality		Adarshanagar		Ghadiarwa		Municipality	In front of NWSC	Central Market		
Sampling Date		April 11	August 18	April 11	August 18	April 11	August 18	April 11	August 18	April 11	August 18	April 11	August 18	August 18	August 19	August 19		
Parameter	Unit																	
1.On Site Analysis																		
Water Temperature	℃	26.9	26.0	26.9	27.7	26.7	26.6	27.2	26.6	26.8	27.7	25.7	29.5	26.3	26.5	26.8		
pH	–	7.9	7.6	8.1	7.7	8.0	7.8	7.8	7.7	8.1	7.7	8.0	7.7	7.6	7.7	7.6		
DO	mg/L	4.7	2.0	5.6	3.9	3.0	2.1	3.8	3.4	5.5	3.0	4.4	6.0	3.0	3.2	2.2		
EC	mS/cm	0.46	0.43	0.42	0.42	0.39	0.36	0.46	0.42	0.46	0.43	0.45	0.44	0.43	0.43	0.39		
Turbidity	NTU	1 or less	3.9	1 or less	1 or less	4	1 or less	1 or less	1 or less	1	1 or less	1 or less	1 or less	1 or less	1 or less	1 or less		
Ammonia	mg-N/L	0.2	0.2	0.5	0.2 or less	0.2	0.2 or less	0.2	0.2 or less	0.5	0.2	0.5	0.2 or less	0.2	0.2	0.5		
Nitrate	mg-N/L	0.2 or less	0.2 or less	0.2 or less	0.2 or less	0.2 or less	0.2 or less	0.2	0.2 or less	0.2 or less	0.2 or less	0.2 or less	0.2 or less	0.2 or less	0.2 or less	0.2 or less		
Residual Chlorine (Free)	mg-Cl_2/L	–	–	–	–	–	–	–	–	0.1 or less	0.1 or less	0.1 or less	0.1 or less	–	–	–		
Residual Chlorine (Total)	mg-Cl_2/L	–	–	–	–	–	–	–	–	0.1 or less	0.1 or less	0.1 or less	0.1 or less	–	–	–		
Coliform	CFU/ml	2	Nil	Nil	2	1	Nil	2	Nil	Nil	1	26	22	Nil	45	26		
Fecal Coliform	CFU/ml	2	Nil	Nil	1	1	Nil	2	Nil	Nil	Nil	5	2	Nil	5	7		
Color	TCU	10 or less	10	10 or less	10 or less	10 or less	10 or less	10 or less	10 or less	10 or less	10	10 or less	10 or less	10 or less	10 or less	10 or less		
Odor	–	A little smell	No smell	A little smell	No smell	A little smell	No smell	A little smell	No Smell	A little smell	A little smell	A little smell	A little smell	A little smell	A little smell	A little smell		
2.Offical Analysis																		
<Physical>																		
pH	–	7.4	7.8	7.6	7.9	7.6	8.0	7.2	7.9	7.6	8.0	7.6	8.0				6.5–8.5	–
Turbidity	NTU	1	1 or less	1	1 or less	1	1 or less	1	1 or less	1	1 or less	1	1 or less				5	5
EC	mS/cm	0.40	0.41	0.37	0.40	0.34	0.35	0.39	0.40	0.40	0.41	0.40	0.41				1.5	–
TDS	mg/L	268	270	212	217	211	266	232	220	233	283	266	222				1000	1000
Color	TCU	1 or less	1 or less	1 or less	1 or less	1 or less	1 or less	1 or less	1 or less	1 or less	1 or less	1 or less	1 or less				5	15
Total Hardness	mg/L as $CaCO_3$	200	200	177	190	161	165	192	181	196	200	192	194				500	–
<Residual Chlorine>																		
Chlorine (Free+Combined)	mg/L	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less				0.1–0.2 (as free chlorine)	–
<Nonmetal>																		
Chloride	mg/L	1	1	1	2	1	1	1	1	1	2	1	2				250	250
Sulfate	mg/L	3	3	2	4	3	6	2	3	2	3	3	6				250	250
Ammonia	mg-N/L	0.03 or less	0.08	0.03 or less	0.03	0.03 or less	0.12	0.03 or less	0.20	0.03 or less	0.06	0.03 or less	0.02				1.2	1.2
Nitrate	mg-N/L	0.47	1.99	0.34	2.08	0.34	1.85	0.47	2.01	0.43	1.83	0.38	2.24				11	11
Fluoride	mg/L	0.5 or less	0.5 or less	0.5 or less	0.5 or less	0.5 or less	0.5 or less	0.5 or less	0.5 or less	0.5 or less	0.5 or less	0.5 or less	0.5 or less				0.5–1.5	1.5
Cyanide	mg/L	0.07 or less	0.07 or less	0.07 or less	0.07 or less	0.07 or less	0.07 or less	0.07 or less	0.07 or less	0.07 or less	0.07 or less	0.07 or less	0.07 or less				0.07	0.07
<Metal>																		
Calcium	mg/L	62	62	54	54	45	47	59	59	59	58	58	58				200	–
Iron	mg/L	0.26	0.28	0.23	0.26	0.40	0.25	0.17	0.19	0.47	0.17	0.17	0.09				0.3	0.3
Manganese	mg/L	0.20	0.20	0.12	0.15	0.12	0.09	0.25	0.24	0.07	0.06	0.05	0.01				0.2	0.5
Zinc	mg/L	0.1 or less	0.1	0.1 or less	0.1	0.1 or less	0.2	0.2	0.2	0.1 or less	0.1 or less	0.1 or less	0.1				3	3
Copper	mg/L	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less				0.1	2
Cadmium	mg/L	0.003 or less	0.003 or less	0.003 or less	0.003 or less	0.003 or less	0.003 or less	0.003 or less	0.003 or less	0.003 or less	0.003 or less	0.003 or less	0.003 or less				0.003	0.003
Chromium	mg/L	0.05 or less	0.05 or less	0.05 or less	0.05 or less	0.05 or less	0.05 or less	0.05 or less	0.05 or less	0.05 or less	0.05 or less	0.05 or less	0.05 or less				0.05	0.05
Lead	mg/L	0.01 or less	0.01 or less	0.01 or less	0.01 or less	0.01 or less	0.01 or less	0.01 or less	0.01 or less	0.01 or less	0.01 or less	0.01 or less	0.01 or less				0.01	0.01
Mercury	mg/L	0.008	0.008	0.003	0.003	0.003	0.003	0.005	0.005	0.011	0.011	0.006	0.006				0.001	0.001
Arsenic	mg/L	0.007	0.005 or less	0.005	0.005 or less	0.006	0.005 or less	0.008	0.005 or less	0.007	0.005 or less	0.007	0.005 or less				0.05	0.01
Aluminum	mg/L	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less				0.2	0.2
<Bacteriological>																		
Total Coliform	MPN/100ml	Nil	Nil	Nil	1.1×10^3	Nil	Nil	Nil	Nil	9	Nil	4.3×10	1.1×10^3				Nil	–
E. Coli	MPN/100ml	Nil	Nil	Nil	4.3×10	Nil	Nil	Nil	Nil	Nil	Nil	4	4.3×10				Nil	Nil

Note:
※1 Sample is taken from No.2 well (well depth is approxymately 150m).
※2 Sample is taken from No.2 well (well depth is approxymately 150m).
※3 Sample is taken from No.2 well (well depth is approxymately 150m).
※4 Water is supplied from Adarshanagar reservoir.
※5 Water is supplied from NWSC office reservoir.
※6 NDWQS means "National Drinking Water Quality Standard in Nepal".
※7 No.7 is hand pump in the Municipality. Well depth is approxymately 84m from the ground.
※8 No.8 is hand pump in front of NWSC. Well depth is approxymately 72m from the ground.
※9 No.9 is hand pump in the central market. Well depth is approxymately 72m from the ground.

relatively deep.

4) Janakpur

The Location where water quality survey was conducted is shown in Figure 4 and the result of water quality survey is shown in Table 6.

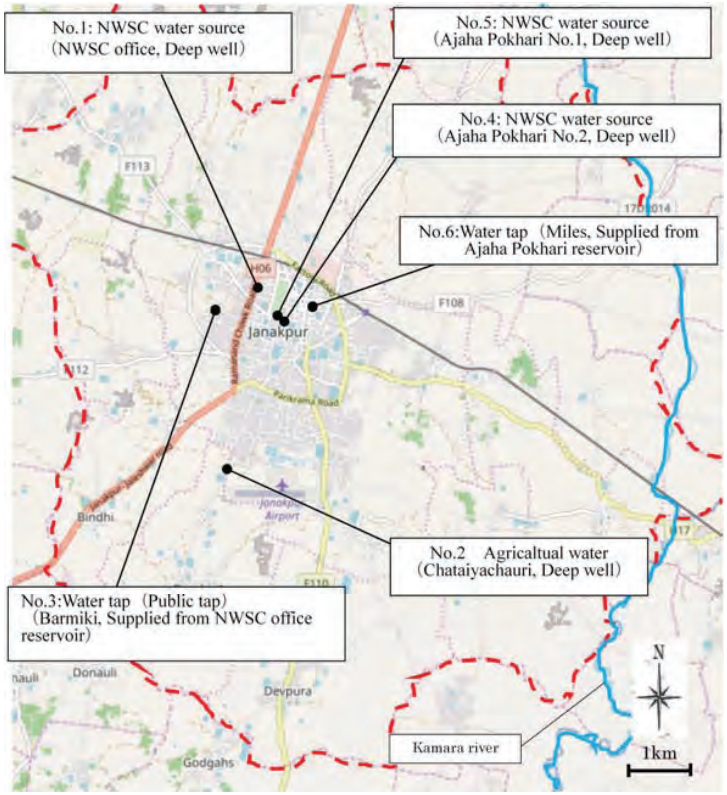

Figure 4 Location where Water Quality Analysis was Conducted in Janakpur

The knowledge obtained through the result of water quality analysis at the water source and water tap in 6 points and the other wells in Table 6 is as follows:

(Analysis value with ※ is referred to the result of on-site analysis and analysis value without ※ is referred to the result of water analysis in laboratory.)

- Regarding No.5 (Ajaha Pohkari No.1) and No.2 (Chataiyachauri) at the survey of dry season and rainy season, the nitrate-nitrogen is 0.2 mg/L or less※, the electro conductivity is 220uS/cm or less and the chloride is 3mg/L or less. That is, there are not such deep wells that nitrate-nitrogen, electro conductivity and chloride are high among deep wells in Janakpur as confirmed in the deep well at Chamcham in Butwal and at TCN in Hetauda. Besides fecal coliform was also not detected at No.5 (Ajaha Pohkari No.1) and No.2 (Chataiyachauri). Therefore it was confirmed that these 2 wells were not contaminated by the domestic wastewater etc.
- On the other hand, regarding No. 1 (deep well inside NWSC office) at the survey of dry season and rainy season, fecal coliform was detected (9 (MPN/100ml) at dry season and at rainy season) although the nitrate-nitrogen is 0.2 mg/L or less※, the electro conductivity is 220 uS/cm or less and the chloride is 2 mg/L or less and the concentration of these parameter is relatively low. Because high turbidity was detected in No.1 at rainy season, as one of the reason, it is thought that the surface water including fecal bacteria may be soaked into the well due to the structural issue on the well as explained later.
- At the survey of dry season and rainy season, a lot of number of fecal coliform (1.5×10^2(MPN/100ml) at dry season, 93(MPN/100ml) at rainy season) were detected at No.6 (Water tap, Miles), which is supplied from Ajaha Pohkari reservoir injecting chlorine for approximately 0.5 km. Besides, at the survey of dry season and rainy season at No.6, residual chlorine was not detected. Therefore it is thought that a lot of number of fecal coliform were detected at water tap of No. 6 although fecal coliform was not detected at water source at No.4 (deep well, Ajaha Pokhari No.2) because the contamination by domestic wastewater etc. arose and fecal bacteria was not disinfected during the process of water distribution.
- On the other hand, at the survey of rainy season, residual chlorine (0.4mg/L as free chlorine, 0.5mg as total chlorine) was detected and fecal coliform was not detected at No.3 (Water tap, Barmiki). So it is thought that fecal coliform was not detected at No.3 by the effect of disinfection with chorine at the NWSC office reservoir and by the effect of residual chlorine during the process of water distribution.
- The concentration of hazardous substance including arsenic and lead etc. were much less than WHO guideline value of those substance at the survey of dry season and rainy season at 6 points where water quality survey was conducted.
- There were no distinctive differences of water quality between dry season and rainy season at each

Table 6　Result of Water Quality Survey in Janakpur

Kind of Sample		NWSC Water Source						Community Water Supply		Water Tap				Other Wells etc.				<Reference> Water Quality Standard	
		(Deep well)		(Deep well)		(Deep well)		(Deep well)						(Hand Pump, Shallow well)	(Hand Pump, Deep well)	(Hand Pump, Deep well)	(Hand Pump, Deep well)		
Sample No.		No.1※1		No.5※2		No.4※3		No.2※4		No.3※5		No.6※6		No.7※8	No.8※9	No.9※10	No.10※11	NDWQS※7	WHO Guideline Value
Location		NWSC Ramananda		Ajaha Pohkari No.1		Ajaha Pokhari No.2		Chataiyachauri		Barmiki		Miles		Miles	Barmiki	In front of NWSC office	Ratna Sagar		
Sampling Date		April 17	August 21	April 17	August 21	April 17	August 21	April 17	August 21	April 17	August 21	April 17	August 21	August 21	August 21	August 22	August 22		
Parameter	Unit																		
1.On Site Analysis																			
Water Temperature	℃	29.8	26.2	27.3	27.4	27.0	27.2	27.2	27.0	30.6	33.8	26.9	29.3	27.2	27.7	27.6	27.8		
pH	−	7.5	6.7	7.1	6.6	7.5	6.8	6.9	6.8	7.4	7.1	7.6	6.9	7.4	7.5	7.2	6.7		
DO	mg/L	6.5	2.8	4.5	2.7	5.8	2.0	2.5	2.2	5.5	3.9	8.0	3.4	1.6	1.8	2.4	2.1		
EC	mS/cm	0.24	0.23	0.23	0.22	0.32	0.27	0.24	0.23	0.29	0.23	0.30	0.22	0.56	0.41	0.74	0.22		
Turbidity	NTU	1 or less	68	1 or less	1 or less	9	69	1 or less	1 or less	1 or less	1 or less	8	1 or less	1 or less	1 or less	1	1 or less		
Ammonia	mg-N/L	0.2 or less	0.2 or less	0.2	0.2	0.2	0.2	0.2	0.2	0.2 or less	0.2 or less	0.2	0.2 or less	0.2	0.2	1	0.2		
Nitrate	mg-N/L	0.2 or less	0.2 or less	0.2 or less	0.2 or less	0.2 or less	0.2 or less	0.2 or less	0.2 or less	0.2 or less	0.2 or less	0.2 or less	0.2 or less	0.2 or less	0.2 or less	0.2 or less	0.2 or less		
Residual Chlorine (Free)	mg-Cl2/L	−	−	−	−	−	−	−	−	0.1 or less	0.4	0.1 or less	0.1 or less	−	−	−	−		
Residual Chlorine (Total)	mg-Cl2/L	−	−	−	−	−	−	−	−	0.1 or less	0.5	0.1 or less	0.1 or less	−	−	−	−		
Coliform	CFU/ml	19	1	3	1	2	2	3	1	13	Nil	69	Too many	1	1	1	5		
Fecal Coliform	CFU/ml	4	Nil	2	Nil	1	Nil	2	1	1	Nil	6	Too many	1	0	0	0		
Color	TCU	10 or less	50	10 or less	10	20	50	10 or less	10 or less	10 or less	10 or less	10	10	10 or less	10 or less	20	10		
Odor	−	A little smell	A little smell	A little smell	No smell	A little smell	No smell	No smell	No smell	A little smell	No smell	A little smell	No smell	A little smell	No smell	No smell	A little smell		
2.Offical Analysis																			
<Physical>																			
pH	−	6.4	6.6	5.9	6.6	6.5	7.0	5.9	6.6	6.3	7.0	7.0	7.0					6.5-8.5	−
Turbidity	NTU	1 or less	55	1	1 or less	9	54	1 or less	1	1 or less	1	2	2					5	5
EC	mS/cm	0.22	0.22	0.20	0.21	0.28	0.25	0.21	0.22	0.24	0.21	0.28	0.21					1.5	−
TDS	mg/L	142	132	124	109	180	145	129	183	165	133	158	131					1000	1000
Color	TCU	1 or less	1	1 or less	1 or less	1 or less	1	1 or less	1 or less	1 or less	1 or less	1 or less	1 or less					5	15
Total Hardness	mg/L as $CaCO_3$	86	82	86	82	110	98	78	82	94	86	110	90					500	−
<Residual Chlorine>																			
Total Chlorine	mg/L	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.5	0.1 or less	0.1 or less					0.1-0.2 (as free chlorine)	−
<Nonmetal>																			
Chloride	mg/L	2	2	3	2	2	2	2	1	2	1	2	2					250	250
Sulfate	mg/L	3	8	1 or less	5	3	5	1 or less	4	3	4	2	4					250	250
Ammonia	mg-N/L	0.03	0.03	0.03	0.03 or less	0.09	0.03	0.03 or less	0.03 or less	0.05	0.03 or less	0.08	0.03 or less					1.2	1.2
Nitrate	mg-N/L	0.5	1.2	0.4	1.0	0.5	5.0	0.5	1.1	0.5	1.1	0.5	1.0					11	11
Fluoride	mg/L	0.5 or less	0.5 or less	0.5 or less	0.5 or less	0.5 or less	0.5 or less	0.5 or less	0.5 or less	0.5 or less	0.5 or less	0.5 or less	0.5 or less					0.5-1.5	1.5
Cyanide	mg/L	0.07 or less	0.07 or less	0.07 or less	0.07 or less	0.07 or less	0.07 or less	0.07 or less	0.07 or less	0.07 or less	0.07 or less	0.07 or less	0.07 or less					0.07	0.07
<Metal>																			
Calcium	mg/L	25	23	23	20	34	25	25	22	26	25	31	25					200	−
Iron	mg/L	0.07	1.43	0.03	0.12	0.53	2.56	0.03 or less	0.03	0.07	0.17	0.36	0.10					0.3	0.3
Manganese	mg/L	0.02 or less	0.11	0.05	0.061	0.13	0.18	0.02 or less	0.10	0.02 or less	0.02 or less	0.02 or less	0.02 or less					0.2	0.5
Zinc	mg/L	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1	0.3	0.1	0.1 or less	0.1					3	3
Copper	mg/L	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less					0.1	2
Cadmium	mg/L	0.003 or less	0.003 or less	0.003 or less	0.003 or less	0.003 or less	0.003 or less	0.003 or less	0.003 or less	0.003 or less	0.003 or less	0.003 or less	0.003 or less					0.003	0.003
Chromium	mg/L	0.05 or less	0.05 or less	0.05 or less	0.05 or less	0.05 or less	0.05 or less	0.05 or less	0.05 or less	0.05 or less	0.05 or less	0.05 or less	0.05 or less					0.05	0.05
Lead	mg/L	0.01 or less	0.01 or less	0.01 or less	0.01 or less	0.01 or less	0.01 or less	0.01 or less	0.01 or less	0.01 or less	0.01 or less	0.01 or less	0.01 or less					0.01	0.01
Mercury	mg/L	0.008	0.008	0.017	0.016	0.005	0.005	0.002	0.002	0.004	0.003	0.016	0.014					0.001	0.001
Arsenic	mg/L	0.005	0.005 or less	0.005	0.005 or less	0.005	0.005 or less	0.005	0.005 or less	0.005	0.005 or less	0.005	0.005 or less					0.05	0.01
Aluminium	mg/L	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less	0.1 or less					0.2	0.2
<Bacteriological>																			
Total Coliform	MPN/100ml	93	1.5×10^2	Nil	Nil	3	4	Nil	Nil	2.4×10^2	Nil	1.1×10^3	1.1×10^3					Nil	−
E. Coli	MPN/100ml	9	9	Nil	Nil	Nil	Nil	Nil	Nil	4	Nil	1.5×10^2	9.3×10					Nil	Nil

Note:
※1 Well depth is approxymately 170m.
※2 Well depth is approxymately 180m.
※3 Well depth is approxymately 180m.
※4 Well depth is approxymately 150m. This well is managed by municipality. Water is used for agriculual and drinking water.
※5 Water is supplied from NWSC office reservoir.
※6 Water is supplied from Ajaha Pokhari reservoir.
※7 NDWQS means "National Drinking Water Quality Standard in Nepal".
※8 No.7 is hand pump in the household. There are No6 and No.7 in the same premise. Well depth is approxymately 40m from the ground.
※9 No.8 is hand pump in the household. Well depth is approxymately 70m from the ground.
※10 No.9 is hand pump in front of NWSC. Well depth is approxymately 70m from the ground..
※11 No.10 is hand pump in the household. Well depth is approxymately 70m from the ground..

point.

- The result of on-site water analysis on the other well etc. is as follows:
  - Fecal coliform was detected at No.7, (well depth 40 m, hand pump well in the household).
  - Fecal coliform was not detected at No.8 (well depth 70 m, hand pump well in the household) and at No.9, located in front of NWSC office (well depth approximately 70 m, hand pump well), although both wells are located near pollution source such as toilet.

２． Result of Water Resources Survey

(1) Hetauda

1) Information on Hydrogeology Acquired at the Survey

Information on hydrogeology in Hetauda acquired at the survey is as follows:

- Borehole log of NWSC well in TCN (No.1) and in Kamane, which are acquired at the survey, is shown in Figure 5.

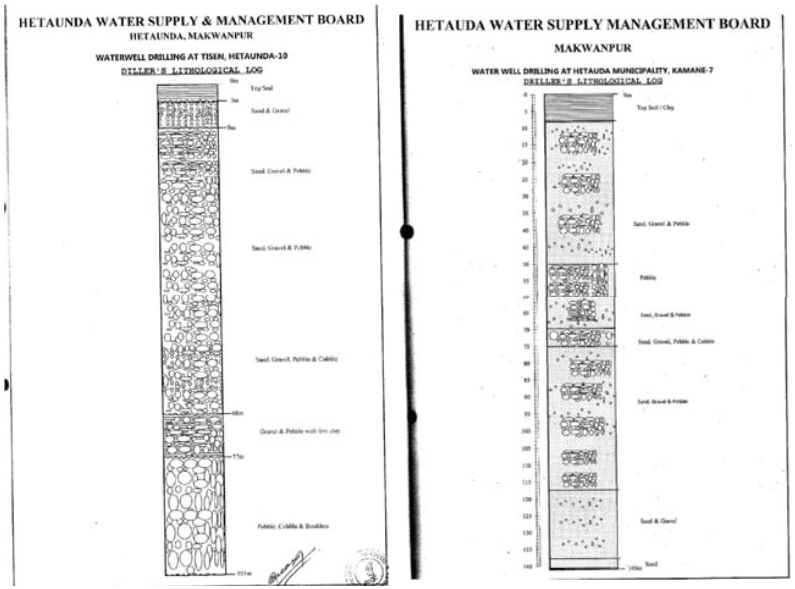

Figure 5 Borehole log of Deep Wells in Hetauda

（Left：NWSC well in TCN(No.1)※1, Right：NWSC well in Kamane）

Source: NWSC in Hetauda

※1 TCN well (No.1) is located approximately 200m away from TCN well (No.2) which conducted water analysis at this survey.

- Main specification of NWSC well in TCN(No.1) is as follows:
  - Diameter of well: 200mm
  - Depth of well : 100m
  - 3 sets of screen (total 27m) are installed at from 50 to 100 m below the ground.
  - Designed static water level is GL-15m and dynamic water level is GL-29m at 28L/sec (=2,419m^3/day)

- Main specification of NWSC well in Kamane is as follows:
  - Diameter of well: 200mm
  - Depth of well : 120m
  - 3 sets of screen (total 24m) are installed at from 65 to 120 m below the ground.
  - Designed static water level is GL-18m and dynamic water level is GL-29m at 20 L/sec (=1,728m^3/day)

- According to borehole log of 2 wells in Figure 5, distinct clay layer (impermeable layer) is not found. It is a different point comparing with soil property in Birgunj and in Janakpur as explained later.
- At the result of water quality survey, it is reported that the concentration of nitrate, electro conductivity is relatively high especially at NWSC well in TCN and there is the possibility of the contamination by domestic water. The assumption can be explained on the basis of soil property around NWSC well in TCN.

(2) Birgunj

1) Information on Hydrogeology Acquired at the Survey

Information on hydrogeology in Bigunj acquired at the survey is as follows:

- Borehole log of NWSC well in Padam road, which is acquired at the survey, is shown in Figure 6.

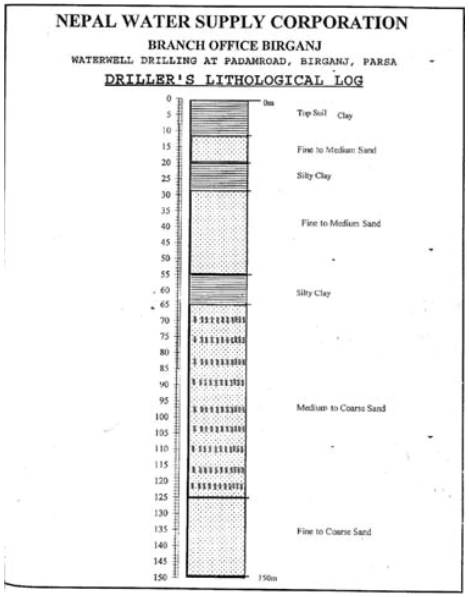

Figure 6 Borehole log of Deep Wells in Birgunj
（NWSC well in Padam Road）

Source: NWSC in Birgunj

- Main specification of NWSC well in Padam Road is as follows:
  - Diameter of well: 200mm
  - Depth of well : 150m
  - 4 sets of screen (total 34m) are installed at from 65 to 150 m below the ground.
  - Designed static water level is GL-12m and dynamic water level is GL-18m at 20L/sec (=1,728m^3/day)

- According to the information of the staffs of NWSC and borehole construction company in Birgunj, hydrogeology in the plain area including the city center of Birgunj is almost the same as the one around NWSC well in Padam road. That is, there is fine sand layer which is relatively high permeability up to approximately 60m below the ground and under the layer there is clay layer (impermeable layer) and there is an artesian aquifer with fine sand layer at approximately 65 m or deeper below the ground. The existence of clay layer (impermeable layer) is a different point

comparing with soil property in Hetauda .

- At the result of water quality survey, it is reported that the concentration of nitrate, electro conductivity is relatively low especially at 3 deep wells of NWSC (Adarshanagar, Padam Road and NWSC office well) and the possibility of the contamination by domestic water is low. The assumption can be explained on the basis of soil property in Birgunj.
- The screens are installed at from 65m to 100m below the ground in the most of deep wells (including hand pump wells) install the screens at from 65m to 100m below the ground.

2) Survey of Water Depth in Well

JICA survey team measured the static water level using rope typed water level gauge at 4 wells total 2 times at the survey of dry season and rainy season.

The location where static water level was measured is shown in Figure 7 and static water level measured at each survey is shown in Table 7.

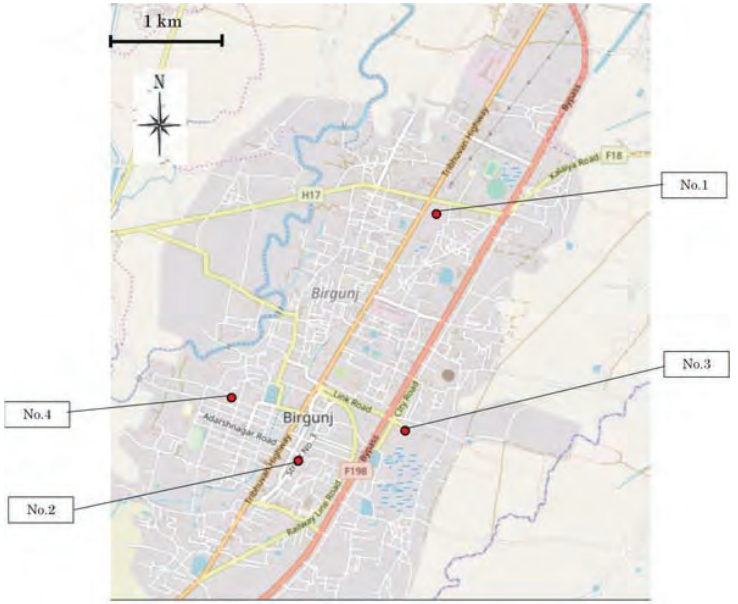

Figure 7 Location where Water Depth was Measured

Table 7 Static Water Level Measured at the Survey

No.	Name of Location	Depth of well (m) ※1	Static water level measured (m) ※2		Purpose of use	Date Measured
			1st survey	2nd survey		
1	Power house	100	3.18	-	Portable water （for household）	April 15th
2	Birta	90	8.35	-	Portable water （for household）	April 15th
3	Buspark	90	6.68	6.45	Portable water	1st survey：April 15th 2nd survey：August 19th
4	Adarshanagar	84	7.40	7.34	Portable water （inside firefighting facility ）	1st survey：April 11th 2nd survey：August 18th

※1 According to the information through construction company or municipality
※2 Static water level is the depth from the ground.

It is confirmed that static water level at the survey of rainy season increase from 6 to 23 cm comparing with at the survey of dry season at No. 3 and No.4.

(3) Janakpur

1) Information on Hydrogeology Acquired at the Survey

Information on hydrogeology in Janakpur acquired at the survey is as follows:

- Borehole log of NWSC office well and the well in Charan Tatha Ghansbali （No.5 in 2）Survey of Water Depth in Well）, which is acquired at the survey, is shown in Figure 8.

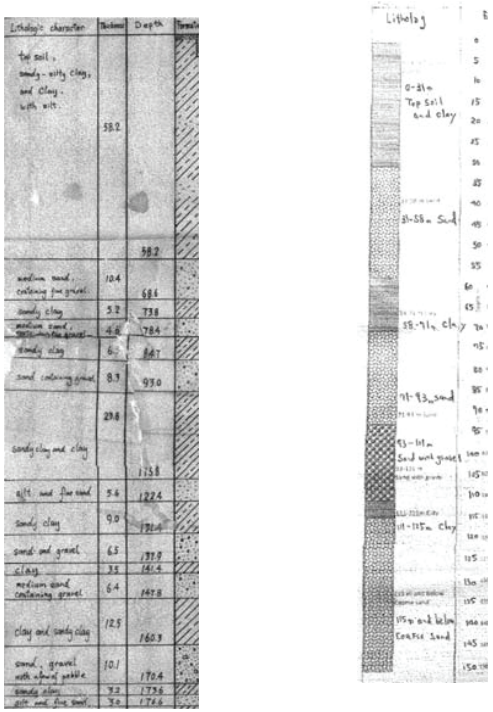

Figure 8 Borehole log of Deep Wells in Janakpur
（Left：Well inside NWSC office, Right：Well in Charan Tatha Ghansbali）
Source: NWSC in Janakpur and Janakpur Construction and Tube-Well Drilling Company Pvt.Ltd.

- Main specification of well in NWSC is as follows:
  - Diameter of well: 250mm
  - Depth of well : 170m
  - 6 sets of screen (total 37m) are installed at from 60 to 100 m below the ground.
  - Designed static water level (at year 1986) is GL+2.1m and dynamic water level is GL-10.8m at 37L/sec (=3,200m^3/day)

- Main specification of well in Charan Tatha Ghansbali is as follows:
  - Diameter of well: 150mm
  - Depth of well : 140m
  - 4 sets of screen (total 18m) are installed at from 80 to 140 m below the ground.
  - Designed static water level (at year 2017) is GL-1m and dynamic water level is GL-10m at 20L/sec (=1,728m^3/day)

- According to the information of the staffs of NWSC and borehole construction company in Janakpur, hydrogeology in the plain area including the city center of Janakpur is almost the same as the one around the well inside NWSC office or the well in Charan Tatha. That is, there is fine sand layer with relatively high permeability up to approximately 70m below the ground and under the layer there is clay layer (impermeable layer) and there is an artesian aquifer with fine sand layer at approximately 70 m or deeper below the ground. The existence of clay layer (impermeable layer) is a different point comparing with soil property in Hetauda .
- According to the result of water quality survey, fecal coliform was detected at 2 deep wells in NWSC (inside NWSC office and Ajaha Pohkari No.2) among 3 deep wells in NWSC although a district impermeable layer can be found. It is already explained that there is the possibility of the contamination by domestic water etc. and the reason may be due to some issues on the structure of well.
- Concretely, on the basis of the structural drawing on the deep well inside NWSC office, fecal coliform was detected at 2 deep wells of NWSC at the survey although some clay layers with relatively low permeabilkity, can be found up to 55m below the ground. As one of the reason, it is thought that surface water is soaked into the well due to inappropriate sealing on the clearance between the wall of borehole and the casing of well.
- Besides, also regarding the deep well in Ajaha Pohkari No.2, it is also thought that surface water is soaked into the well due to inappropriate sealing on the clearance between the wall of borehole and casing of well because high turbidity was detected at the sampling (9NTU at on-site analysis) although JICA team could not acquire the drawing.

2) Survey of Water Depth in Well

JICA survey team measured the static water level using rope typed water level gauge at 5 wells total 2 times at the survey of dry season and rainy season.

The location where static water level was measured is shown in Figure 9 and static water level measured at each survey is shown in Table 8.

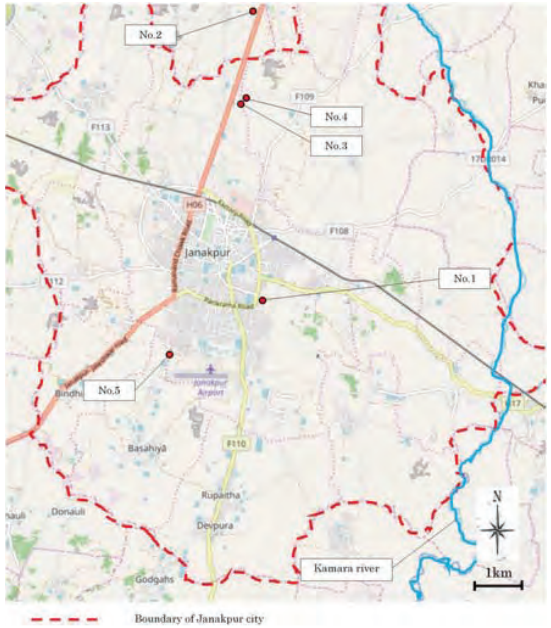

Figure 9 Location where Water Depth was Measured

Table 8 Static Water Level Measured at the Survey

No.	Name of Location	Depth of well (m) ※5	Static water level measured (GL-m)		Discharging rate※6 (L/min)		Purpose of use	Date Measured
			1st survey	2nd survey	1st survey	2nd survey		
1	Charan Tatha Ghanbali ※1, ※2	140	0.15	0.03	-	-	Agricultural water	1st survey : April 21st 2nd survey : August 22nd
2	Kumarahharu Bagbatipur※3	130	Artesian wel l	Artesian well	-	約 10	Portable water (for community)	1st survey : April 21st 2nd survey : August 22nd
3	Mujeliya (shallow well) ※3	35	(below grou nd)	(below ground)	-		Agricultural water	1st survey : April 21st 2nd survey : August 22nd
4	Mujeliya (deep well) ※1	150	Artesian well	GL+0.34	-	-	Agricultural water	1st survey : April 21st 2nd survey : August 22nd
5	Chataiyachauri No.1※4	150	Artesian well	Artesian well	約 60	約 40	Portable water and agricultural water	1st survey : April 17st 2nd survey : August 21st

※1 Constructed by Janakpur Construction
※2 Designed static water level is GL-1m

※3 Constructed by the community
※4 Height of casing above the ground is GL+0.61m
※5 The information on the depth of well for No.1 and No. 4 is based on the specification at the delivery. The information on the depth of well for No.2 and No.3 is based on the information from the community. The information on the depth of well for No.5 is the information from NWSC.
※6 Discharge rate is measured using bracket and stopwatch .

Static water level in 3 wells (No.2, No.4 and No.5) was above the ground among 4 deep wells（No.1、No.2、No.4、No.5）and the static water level in the other deep well (No. 1) was also within 1m below the ground at the survey of dry season and rainy season.

Comparing with static water level or artesian flow rate on each well of between dry season and rainy season, regarding No.1, the static water level at the survey of rainy season increased 12 cm against at the survey of dry season. Regarding No.4, the water was overflowed from the top cover at the survey of dry season (static water level is GL+0.61m or more) while the water was not overflowed and the static water level was down and at the location of 27cm lower than the top cover at the survey of rainy season. Regarding No.5, the discharge rate at the survey of rainy season decreased by approximately 30% against at the survey of dry season although water was overflowed at the survey of dry season and rainy season. According to the result of the survey, it was found that the changes regarding the static water level and discharging rate though the year differ at each area in Janakpur

Moreover, according to the staff of NWSC, there was no rainfall for approximately one month at the survey of rainy season. So as one of the reason for the decrease of the static water level or the discharging rate at No.4 and No.5 at the survey of rainy season comparing with at the survey of dry season, it is thought that the climate in Janakpur city at the survey of rainy season caused the decrease of the pressure in the deep aquifer and caused the decrease of the static water level or the discharging rate at the site.

３． Water Quality Survey for Water Environment in Pokhara

(1) Result of Water Quality Survey for Water Environment in Pokhara

1) Method of Water Quality Survey

JICA team conducted the water quality analysis of the environmental water twice at dry season (from March to April) and at rainy season (in August) at 2 points near existing sludge treatment plant, at 2 points near Phewa lake and at 2 points in Seti river.

JICA team conducted the water quality analysis on site in person. Besides JICA team took the samples and outsourced water quality analysis in accordance with Standard Methods to the accredited water laboratory in Kathmandu.

Water quality parameters for on-site analysis (12 parameters) and for water quality analysis in laboratory (9 parameters) are shown in Table 9 and Table 10, respectively.

Table 9 Parameter and Analysis Method for On-Site Analysis
(Conducted by JICA team)

Parameter	Analysis Method	Parameter	Analysis Method
Water Temperature	Platinum Temperature Sensor （Including Multi Water Quality Checker）	Nitrate	Reduction and Naphthylethylenediamine Visual Colorimetric Method （PACKTEST）
pH	Glass Electrode Method （Including Multi Water Quality Checker）	Phosphate	4-Aminoantipyrin Visual Colorimetric Method with Enzyme （PACKTEST）
DO	Polarographic Method （Including Multi Water Quality Checker）	Total Coliform	Simple Test Paper for Fecal Coliform （SUNCOLI No.6）
EC	Four AC electrode method （Including Multi Water Quality Checker）	Fecal Coliform	Simple Test Paper for Fecal Coliform （SUNCOLI No.6）
Turbidity	LED forward 30°transmission/scattering method （Including Multi Water Quality Checker）	Color	Visual Colorimetric Method
Ammonia	Indophenol Blue Visual Colorimetric Method（PACKTEST）	Odor	Simple Sensory Test

Table 10 Parameters and Analysis Methods for Analysis in Laboratory
(Conducted by Outsourcing)

Parameter	Analysis Method	Parameter	Analysis Method
pH	Glass Electrode Method	Total Nitrogen	Kjeldahl Nitrogen Method
Suspended Solids	Filtration Method	COD_{Cr}	Open Refulx Method
Total Solids	Gravimetric Method	BOD_5	5 day method
Total Phosphate	Ammonium Molybdate Method	Fecal Coliform	Most Probable Number (MPN) Method
Oil and Grease	Diethyl Ether Extraction Method		

Water analysis reports conducted by outsourcing (1 city × 6 points × 2 times = total 12 papers) are attached in APPENDIX, 2. Result of Water Quality Survey for Water Environment.

2) Result of Water Quality Survey in Pokhara

The Location where water quality survey was conducted is shown in Figure 10 and the result of water quality survey is shown in Table 11.

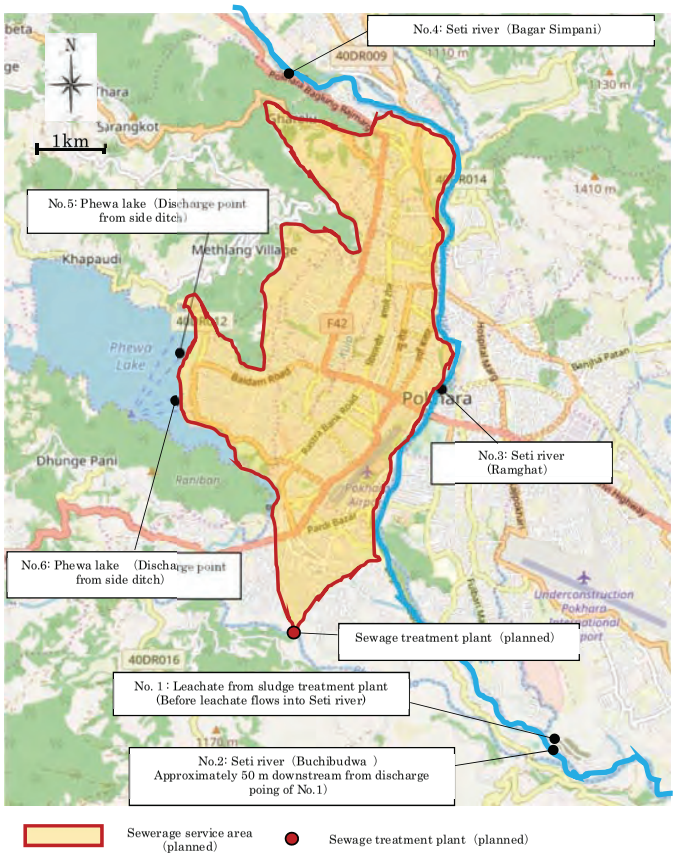

Figure 10 Location where Water Quality Analysis was Conducted in Pohkhara

Condition of each point at the sampling in dry season (March 27) and in rainy season (August 8) is shown in Photo 1.

Dry season : Sampling in March 27		
		
Rainy season : Sampling in August 8		
		
No.1	No.2	No.3

Dry season : Sampling in March 27		
		
Rainy season : Sampling in August 8		
		
No.4	No.5	No.6

Photo 1 Condition of Each Point at the Sampling

As shown in Photo 1, it was confirmed with eye measurement that the flow rate of Seti river at

Table 11 Result of Water Quality Survey in Pokhara

Kind of Sample		Leachate of Sludge Treatment Plant		River Water (Seti River)						Lake Water (Phewa Lake)				<Reference:>Water Quality Standard in Japan	
Sample No.		No.1※1		No.2※2		No.3		No.4		No.5※3		No.6※4		Environmental Standard	Waste water quality standard
Location		Bachibuduwa		Bachibuduwa		Ramghat		Bagar Simpani		–		–			
Sampling Date		March 27	August 8	March 27	August 8	March 27	August 8	March 27	August 8	March 27	August 8	March 27	August 8		
Parameter	Unit														
1. On Site Analysis															
Water Temperature	℃	23.3	28.2	20.7	23.0	20.1	23.3	19.7	24.5	23.7	31.4	22.9	31.1		
pH	–	8.2	8.1	7.9	8.2	8.3	8.2	8.2	8.3	7.8	8.0	8.2	8.0		
DO	mg/L	7.4	3.1	8.9	6.1	8.8	6.1	8.7	4.6	7.5	5.0	7.7	4.9		
EC	mS/cm	7.49	8.20	0.33	0.21	0.29	0.20	0.29	0.16	0.36	0.10	0.10	0.05		
Turbidity	NTU	73	152	36	230	37	220	48	140	40	11	5	17		
Ammonia	mg-N/L	500	1000	0.5	0.2	0.2	0.2 or less	0.2	0.2 or less	0.2	0.2	0.2	0.5		
Nitrate	mg-N/L	50	2 or less	0.5	0.2 or less	0.2	0.2 or less	0.2	0.2 or less	0.5	0.2 or less	0.2	0.2 or less		
Phosphate	mg-P/L	20	100	0.2	0.05	0.05	0.05	0.05	0.05	0.05	0.1	0.05	0.05		
Coliform	CFU/ml	500	4	66	Too many	70	Too many	24	17	Too many	Too many	38	Too many		
Fecal Coliform	CFU/ml	300	Too many	21	Too many	28	Too many	7	6	Too many	11	11	Too many		
Color	TCU	2,000	2,000	10	10	10	20	10	20	20	50	10	20		
Odor	–	No smell	No smell	No smell	No smell	No smell	a little smell	No smell	No smell	a little smell of fish	No smell	No smell	No smell		
2.Offical Analysis															
<General Item>															
pH	–	8.6	8.9	7.9	8.6	8.0	8.7	8.1	8.6	7.5	7.6	7.7	7.2	6.5-8.5	5.6-8.6
Total Suspended Solids	mg/L	76	52	27	166	40	259	75	69	22	10	32	3		200
Total Solids	mg/L	4,076	4,822	179	277	169	358	205	151	189	54	78	75		
<Organic Matter etc.>															
COD_{Cr}	mg/L	448	633	2 or less	2 or less	2 or less	2 or less	2 or less	3	12	7	2 or less	3		
BOD_5	mg/L	65	300	3 or less	3 or less	3 or less	3 or less	3 or less	3 or less	4	3 or less	3 or less	3 or less	1(Class AA), 2 (Class A) , 3(Class B)	160
Total Nitrogen	mg-N/L	578	639	7	2	3	2	3	1	5	1	4	3	0.1(Class Ⅰ), 0.2(ClassⅡ), 0.4(ClassⅢ), 0.6(ClassⅣ), 1(Class Ⅴ)※5	120
Total Phosphate	mg-P/L	18.6	11.2	0.10	0.03	0.02	0.07	0.03	0.04	0.20	0.01	0.04	0.01	0.005 (Class Ⅰ), 0.01(Class Ⅱ), 0.03(ClassⅢ), 0.05(Class Ⅳ), 0.1(Class Ⅴ)※5	16
Oil & Grease	mg/L	6	11	3	1 or less	3	1 or less	4	1 or less	4	1 or less	2	1 or less		5(mineral oil), 30 (animal and vegetable fats)
<Bacteria.>															
Fecal Coliform	MPN/100ml	9.2×10^3	9.2×10^3	2.4×10^3	2.3×10^2	4.6×10^2	2.4×10^3	1.5×10^2	4.6×10^2	4.6×10^3	2.0×10	4.6×10^2	9.3×10	※As Coliform 50MPN/100ml(Class AA) 1000MPN/100ml(Class A)	※As Coliform 3×10^3MPN/100ml

Note:
※1 Sample is taken at the location just before leachate flows into Seti river. Discharge flow rate in March 27 and in August 27 are approximately 10L/min and 25L/min, respectively.
※2 Sample is taken at the location of 50m downstream from P1.
※3 Sample is taken at the location in the Phewa lake where wastewater is just discharged from side ditch for road.
※4 Sample is taken at the location in the Phewa lake where wastewater is just discharged from side ditch for road.
※5 Environmental standards for the lake designated by Ministry of the Environment in Japan as the lake where phytoplankton broom may occurs.

the survey of rainy season increased 10 times or more than that at the survey of dry season and the water level of Phewa lake also at the survey of rainy season increased approximately 0.5 or 1 m higher than that at the survey of dry season.

The knowledge obtained through the result of water quality at the discharge point of the leachate from existing sludge treatment site, seti river and Phewa lake in Table11, is as follows:

- Regarding No.1, color, BOD, COD_{Cr}, total nitrogen and total phosphate in the leachate from sludge treatment plant, are as follows;
  - Dry season

  Color: approximately 2,000 TCU, BOD 65 mg/L, COD_{Cr} 448mg/L, Total nitrogen 578mg/L and Total phosphate 19 mg/L
  - Rainy season

  Color: approximately 2,000 TCU, BOD 300 mg/L, COD_{Cr} 633mg/L, Total nitrogen 639mg/L and Total phosphate 11 mg/L

- Water quality of the above described each parameter is higher than the water quality standard in Japan of each parameter. The sample is the runoff after the leachate from solid waste and sludge being treated by lagoon. It was no rain at the survey of dry season and rainy season and the discharge rate at each survey are approximately 10 L/min and 25 L/min, respectively. But after rain, the discharge rate of leachate will increase and the leachate with the high concentration of organic matters, nitrogen and phosphate as measured in this survey will be discharged into Seti river.
- No.4 (Bagar Simpani) is located at the junction between Seti river and Yandi river at the northern part of city center and No.3 (Ramghat) is located in the city center. Besides, No.2 (Buchibuduwa) is located at the southern part of city center and at approximately 50 m downstream of No.1, the discharge point of leachate.
- Turbidity of each point at rainy season was approximately 3 times or more of that at dry season as shown below;
  - No.2

  Dry season: 36NTU, Rainy season: 230NTU
  - No.3

  Dry season: 37NTU, Rainy season: 220NTU
  - No.4

  Dry season: 48NTU, Rainy season: 140NTU

- Regarding the fecal coliform at No.2, No.3 and No.4, at the survey of dry season, the concentration of fecal coliform became lower as the point goes to the downstream. While, at the survey of rainy season, the concentration of fecal coliform was the highest at No.3, which is located at the city center (2.4×10^3(MPN/100ml).
- No.5 and No.6 are the same sampling points where Pokhara city is conducting for water quality survey of Phewa lake and the discharge points from side ditches for collecting the wastewater generated at the city center. At the survey of dry season, the wastewater were flowing into Phewa lake at No. 5 while the wastewater were not flowing into Phewa lake at No.6. Therefore, COD_{Cr}, total phosphate and fecal coliform at No. 5 are relatively higher than at No.6 at the survey of dry season.
- Regarding the total nitrogen of No.5 and No.6, they are 5 mg/l and 4mg/L, respectively, at the survey of dry season and they are 1mg/L and 3mg/L, respectively, at the survey of rainy season. That is, total nitrogen of No.5 and No.6 at the survey of both seasons is higher than 1mg/L, the classV in the environmental water quality standard in Japan.

End

Attachment

Water Analysis Reports (Conducted by Outsourcing)

1. Result of Water Quality Survey for Water Supply
   - Butwal （6 Points ×2 times（Dry season, Rain season）=12 papers）
   - Hetauda （6 Points ×2 times（Dry season, Rain season）=12 papers）
   - Birgunj （6 Points ×2 times（Dry season, Rain season）=12 papers）
   - Janakpur （6 Points ×2 times（Dry season, Rain season）=12 papers）

2. Result of Water Quality Survey for Water Environment
   - Pokhara （6 Points × 2 Times (Dry Season, Rain Season）=12 Papers）

Sample Numbers and sampled locations are as follows:

B	Butowal	H	Hetauda	BR	Birgunj	J	Janakpur	P	Pokhara
1	Chamcham	1	Bundol	1	Adarshanagar Municipality	1	NWSC Ramananda	1	Bachibuduwa
2	Milan	2	Samari	2	Adarshanagar NWSC	2	Chataiyachauri	2	Bachibuduwa
3	Ganesh Sthan	3	TCN	3	Adarshanagar	3	Barmiki	3	Ramghat
4	Tinaw Sump Well	4	Kamane	4	Ghadiarwa	4	Ajaha Pokhari No2	4	Bagar Simpani
5	NWSC Butwal	5	Kamane	5	Padam Road	5	Ajaha Pokhari No1	5	Phewa Lake
6	Milahpath Sunoar	6	Sangham Chowk	6	Sripur NWSC	6	Miles	6	Phewa Lake

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	1600/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Butwal
Source :-	B1	Analysis Date :-	1 April, 2019
Receipt Date :-	1 April, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	6.6	6.5-8.5	ISO 10523:1994 (E)
Turbidity	NTU	< 1	5 (10) (Max)	2130 B, APHA,17th Ed.
Electric conductivity	$\mu S/cm$	812	1500 (Max)	ISO 7888:1985
Total dissolved solids	mg/L	545	1000 (Max)	Filtration & Evaporation
Color	TCU	< 1	5 (15) (Max)	ISO 7887:1994 (E), Section 3
Lab.Temperature	^0C	24.0		Thermometer
CHEMICAL				
Chloride	mg/L as Cl	23	250 (Max)	ISO 9297:1989
Sulphate	mg/L as SO_4	14	250 (Max)	4500-SO_4^{2-} E, APHA 17th Ed.
Nitrate	mg/L as NO_3	42.9	50 (Max)	Ion Selective
Ammonia	mg/L as NH_3	0.13	1.5 (Max)	4500-NH3C, APHA 17th edn
Total Hardness	mg/L as $CaCO_3$	381	500 (Max)	2340 C APHA 17th edn
Calcium	mg/L as Ca	112	200 (Max)	3500-Ca D APHA 17th edn
Iron	mg/L as Fe	0.03	0.3 (3)(Max)	ISO 8288:1998
Manganese	mg/L as Mn	< 0.005	0.2 (Max)	ISO 8288:1998
Total Chlorine	mg/L as Cl	< 0.1	-	4500-Cl G, APHA 17th Ed.
Fluoride	mg/L as F	**< 0.5**	0.5-1.5(Max)	Ion Selective
Zinc	mg/L as Zn	0.2	3 (Max)	3111, APHA 17th Ed.
Copper	mg/L as Cu	< 0.1	1 (Max)	3111, APHA 17th Ed.
Cadmium	mg/L as Cd	< 0.003	0.003 (Max)	3111, APHA 17th Ed.
Chromium	mg/L as Cr	< 0.05	0.05(Max)	3500-Cr, APHA 17th Ed.
Cyanide	mg/L as Cn	< 0.07	0.07 (Max)	4500-CN E APHA 17th Ed.
Lead	mg/L as Pb	< 0.01	0.01 (Max)	3111, APHA 17th Ed.
Mercury	ppb as Hg	**2**	1 (Max)	ISO 5666:1999
Arsenic	mg/L as As	< 0.005	0.05 (Max)	ISO 11969:1996
Aluminium	mg/L as Al	< 0.1	0.2 (Max)	3500-Al D, APHA 17th Ed.
BACTERIOLOGICAL				
Total Coliform	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition
E. coli	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition

NDWQS= National Drinking Water Quality Standard (2062) ( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of all the tested parameters are found to be within the limit of NDWQS, except that of **Fluoride** and **Mercury.**

Analyzed by: **Checked by:** **Authorized sign:**
9 June, 2019 **9 June, 2019**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	1601/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Butwal
Source :-	B2	Analysis Date :-	1 April, 2019
Receipt Date :-	1 April, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	7.4	6.5-8.5	ISO 10523:1994 (E)
Turbidity	NTU	< 1	5 (10) (Max)	2130 B, APHA,17th Ed.
Electric conductivity	$\mu S/cm$	410	1500 (Max)	ISO 7888:1985
Total dissolved solids	mg/L	251	1000 (Max)	Filtration & Evaporation
Color	TCU	< 1	5 (15) (Max)	ISO 7887:1994 (E), Section 3
Lab.Temperature	^0C	24.0		Thermometer
CHEMICAL				
Chloride	mg/L as Cl	6	250 (Max)	ISO 9297:1989
Sulphate	mg/L as SO_4	8	250 (Max)	4500-SO_4^{2-} E, APHA 17th Ed.
Nitrate	mg/L as NO_3	9.8	50 (Max)	Ion Selective
Ammonia	mg/L as NH_3	0.06	1.5 (Max)	4500-NH3C, APHA 17th edn
Total Hardness	mg/L as $CaCO_3$	204	500 (Max)	2340 C APHA 17th edn
Calcium	mg/L as Ca	51	200 (Max)	3500-Ca D APHA 17th edn
Iron	mg/L as Fe	0.04	0.3 (3)(Max)	ISO 8288:1998
Manganese	mg/L as Mn	< 0.005	0.2 (Max)	ISO 8288:1998
Total Chlorine	mg/L as Cl	< 0.1	-	4500-Cl G, APHA 17th Ed.
Fluoride	mg/L as F	**< 0.5**	0.5-1.5(Max)	Ion Selective
Zinc	mg/L as Zn	0.3	3 (Max)	3111, APHA 17th Ed.
Copper	mg/L as Cu	< 0.1	1 (Max)	3111, APHA 17th Ed.
Cadmium	mg/L as Cd	< 0.003	0.003 (Max)	3111, APHA 17th Ed.
Chromium	mg/L as Cr	< 0.05	0.05(Max)	3500-Cr, APHA 17th Ed.
Cyanide	mg/L as Cn	< 0.07	0.07 (Max)	4500-CN E APHA 17th Ed.
Lead	mg/L as Pb	< 0.01	0.01 (Max)	3111, APHA 17th Ed.
Mercury	ppb as Hg	**2**	1 (Max)	ISO 5666:1999
Arsenic	mg/L as As	< 0.005	0.05 (Max)	ISO 11969:1996
Aluminium	mg/L as Al	< 0.1	0.2 (Max)	3500-Al D, APHA 17th Ed.
BACTERIOLOGICAL				
Total Coliform	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition
E. coli	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition

NDWQS= National Drinking Water Quality Standard (2062) ( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of all the tested parameters are found to be within the limit of NDWQS, except that of **Fluoride** and **Mercury.**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	1602/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Butwal
Source :-	B3	Analysis Date :-	1 April, 2019
Receipt Date :-	1 April, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	7.0	6.5-8.5	ISO 10523:1994 (E)
Turbidity	NTU	4	5 (10) (Max)	2130 B, APHA,17th Ed.
Electric conductivity	$\mu S/cm$	750	1500 (Max)	ISO 7888:1985
Total dissolved solids	mg/L	389	1000 (Max)	Filtration & Evaporation
Color	TCU	< 1	5 (15) (Max)	ISO 7887:1994 (E), Section 3
Lab.Temperature	^0C	24.0		Thermometer
CHEMICAL				
Chloride	mg/L as Cl	7	250 (Max)	ISO 9297:1989
Sulphate	mg/L as SO_4	5	250 (Max)	4500-SO_4^{2-} E, APHA 17th Ed.
Nitrate	mg/L as NO_3	10.9	50 (Max)	Ion Selective
Ammonia	mg/L as NH_3	0.10	1.5 (Max)	4500-NH3C, APHA 17th edn
Total Hardness	mg/L as $CaCO_3$	310	500 (Max)	2340 C APHA 17th edn
Calcium	mg/L as Ca	73	200 (Max)	3500-Ca D APHA 17th edn
Iron	mg/L as Fe	0.19	0.3 (3)(Max)	ISO 8288:1998
Manganese	mg/L as Mn	0.058	0.2 (Max)	ISO 8288:1998
Total Chlorine	mg/L as Cl	< 0.1	-	4500-Cl G, APHA 17th Ed.
Fluoride	mg/L as F	**< 0.5**	0.5-1.5(Max)	Ion Selective
Zinc	mg/L as Zn	< 0.1	3 (Max)	3111, APHA 17th Ed.
Copper	mg/L as Cu	< 0.1	1 (Max)	3111, APHA 17th Ed.
Cadmium	mg/L as Cd	< 0.003	0.003 (Max)	3111, APHA 17th Ed.
Chromium	mg/L as Cr	< 0.05	0.05(Max)	3500-Cr, APHA 17th Ed.
Cyanide	mg/L as Cn	< 0.07	0.07 (Max)	4500-CN E APHA 17th Ed.
Lead	mg/L as Pb	< 0.01	0.01 (Max)	3111, APHA 17th Ed.
Mercury	ppb as Hg	1	1 (Max)	ISO 5666:1999
Arsenic	mg/L as As	< 0.005	0.05 (Max)	ISO 11969:1996
Aluminium	mg/L as Al	< 0.1	0.2 (Max)	3500-Al D, APHA 17th Ed.
BACTERIOLOGICAL				
Total Coliform	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition
E. coli	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition

NDWQS= National Drinking Water Quality Standard (2062)

( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of all the tested parameters are found to be within the limit of NDWQS, except that of **Fluoride.**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	1603/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Butwal
Source :-	B4	Analysis Date :-	1 April, 2019
Receipt Date :-	1 April, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	**8.6**	*6.5-8.5*	*ISO 10523:1994 (E)*
Turbidity	*NTU*	3	*5 (10) (Max)*	*2130 B, APHA,17th Ed.*
Electric conductivity	*µS/cm*	316	*1500 (Max)*	*ISO 7888:1985*
Total dissolved solids	*mg/L*	162	*1000 (Max)*	*Filtration & Evaporation*
Color	*TCU*	< 1	*5 (15) (Max)*	*ISO 7887:1994 (E), Section 3*
Lab.Temperature	*^{0}C*	24.0		*Thermometer*
CHEMICAL				
Chloride	*mg/L as Cl*	3	*250 (Max)*	*ISO 9297:1989*
Sulphate	*mg/L as SO_4*	8	*250 (Max)*	*4500-SO_4^{2-} E, APHA 17th Ed.*
Nitrate	*mg/L as NO_3*	2.3	*50 (Max)*	*Ion Selective*
Ammonia	*mg/L as NH_3*	0.10	*1.5 (Max)*	*4500-NH3C, APHA 17th edn*
Total Hardness	*mg/L as $CaCO_3$*	157	*500 (Max)*	*2340 C APHA 17th edn*
Calcium	*mg/L as Ca*	37	*200 (Max)*	*3500-Ca D APHA 17th edn*
Iron	*mg/L as Fe*	0.07	*0.3 (3)(Max)*	*ISO 8288:1998*
Manganese	*mg/L as Mn*	0.023	*0.2 (Max)*	*ISO 8288:1998*
Total Chlorine	*mg/L as Cl*	< 0.1	-	*4500-Cl G, APHA 17th Ed.*
Fluoride	*mg/L as F*	**< 0.5**	*0.5-1.5(Max)*	*Ion Selective*
Zinc	*mg/L as Zn*	< 0.1	*3 (Max)*	*3111, APHA 17th Ed.*
Copper	*mg/L as Cu*	< 0.1	*1 (Max)*	*3111, APHA 17th Ed.*
Cadmium	*mg/L as Cd*	< 0.003	*0.003 (Max)*	*3111, APHA 17th Ed.*
Chromium	*mg/L as Cr*	< 0.05	*0.05(Max)*	*3500-Cr, APHA 17th Ed.*
Cyanide	*mg/L as Cn*	< 0.07	*0.07 (Max)*	*4500-CN E APHA 17th Ed.*
Lead	*mg/L as Pb*	< 0.01	*0.01 (Max)*	*3111, APHA 17th Ed.*
Mercury	*ppb as Hg*	1	*1 (Max)*	*ISO 5666:1999*
Arsenic	*mg/L as As*	< 0.005	*0.05 (Max)*	*ISO 11969:1996*
Aluminium	*mg/L as Al*	< 0.1	*0.2 (Max)*	*3500-Al D, APHA 17th Ed.*
BACTERIOLOGICAL				
Total Coliform	*MPN index/100 ml*	**2.4×10^2**	Nil	*9221 B APHA 17th Edition*
E. coli	*MPN index/100 ml*	**43**	Nil	*9221 B APHA 17th Edition*

NDWQS= National Drinking Water Quality Standard (2062) ( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of **pH, Fluoride, Total Coliform** and ***E.coli*** are found to be out of the limit of NDWQS.

Analyzed by: **Checked by:** **Authorized sign:**
9 June, 2019 **9 June, 2019**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	1604/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Butwal
Source :-	B5	Analysis Date :-	1 April, 2019
Receipt Date :-	1 April, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	7.0	6.5-8.5	ISO 10523:1994 (E)
Turbidity	NTU	< 1	5 (10) (Max)	2130 B, APHA,17th Ed.
Electric conductivity	µS/cm	872	1500 (Max)	ISO 7888:1985
Total dissolved solids	mg/L	583	1000 (Max)	Filtration & Evaporation
Color	TCU	< 1	5 (15) (Max)	ISO 7887:1994 (E), Section 3
Lab.Temperature	^0C	24.0		Thermometer
CHEMICAL				
Chloride	mg/L as Cl	28	250 (Max)	ISO 9297:1989
Sulphate	mg/L as SO_4	14	250 (Max)	4500-SO_4^{2-} E, APHA 17th Ed.
Nitrate	mg/L as NO_3	**50.9**	50 (Max)	Ion Selective
Ammonia	mg/L as NH_3	0.11	1.5 (Max)	4500-NH3C, APHA 17th edn
Total Hardness	mg/L as $CaCO_3$	412	500 (Max)	2340 C APHA 17th edn
Calcium	mg/L as Ca	117	200 (Max)	3500-Ca D APHA 17th edn
Iron	mg/L as Fe	0.07	0.3 (3)(Max)	ISO 8288:1998
Manganese	mg/L as Mn	0.023	0.2 (Max)	ISO 8288:1998
Total Chlorine	mg/L as Cl	< 0.1	-	4500-Cl G, APHA 17th Ed.
Fluoride	mg/L as F	**< 0.5**	0.5-1.5(Max)	Ion Selective
Zinc	mg/L as Zn	< 0.1	3 (Max)	3111, APHA 17th Ed.
Copper	mg/L as Cu	< 0.1	1 (Max)	3111, APHA 17th Ed.
Cadmium	mg/L as Cd	< 0.003	0.003 (Max)	3111, APHA 17th Ed.
Chromium	mg/L as Cr	< 0.05	0.05(Max)	3500-Cr, APHA 17th Ed.
Cyanide	mg/L as Cn	< 0.07	0.07 (Max)	4500-CN E APHA 17th Ed.
Lead	mg/L as Pb	< 0.01	0.01 (Max)	3111, APHA 17th Ed.
Mercury	ppb as Hg	**4**	1 (Max)	ISO 5666:1999
Arsenic	mg/L as As	< 0.005	0.05 (Max)	ISO 11969:1996
Aluminium	mg/L as Al	< 0.1	0.2 (Max)	3500-Al D, APHA 17th Ed.
BACTERIOLOGICAL				
Total Coliform	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition
E. coli	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition

NDWQS= National Drinking Water Quality Standard (2062) ( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of all the tested parameters are found to be within the limit of NDWQS, except that of **Nitrate, Fluoride** and **Mercury.**

Analyzed by: **Checked by:** **Authorized sign:**
9 June, 2019 **9 June, 2019**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	1605/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Butwal
Source :-	B6	Analysis Date :-	1 April, 2019
Receipt Date :-	1 April, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	8.4	6.5-8.5	ISO 10523:1994 (E)
Turbidity	NTU	1	5 (10) (Max)	2130 B, APHA,17th Ed.
Electric conductivity	$\mu S/cm$	334	1500 (Max)	ISO 7888:1985
Total dissolved solids	mg/L	170	1000 (Max)	Filtration & Evaporation
Color	TCU	< 1	5 (15) (Max)	ISO 7887:1994 (E), Section 3
Lab.Temperature	^0C	24.0		Thermometer
CHEMICAL				
Chloride	mg/L as Cl	4	250 (Max)	ISO 9297:1989
Sulphate	mg/L as SO_4	8	250 (Max)	4500-SO_4^{2-} E, APHA 17th Ed.
Nitrate	mg/L as NO_3	3.3	50 (Max)	Ion Selective
Ammonia	mg/L as NH_3	0.12	1.5 (Max)	4500-NH3C, APHA 17th edn
Total Hardness	mg/L as $CaCO_3$	177	500 (Max)	2340 C APHA 17th edn
Calcium	mg/L as Ca	40	200 (Max)	3500-Ca D APHA 17th edn
Iron	mg/L as Fe	0.09	0.3 (3)(Max)	ISO 8288:1998
Manganese	mg/L as Mn	0.035	0.2 (Max)	ISO 8288:1998
Total Chlorine	mg/L as Cl	0.2	-	4500-Cl G, APHA 17th Ed.
Fluoride	mg/L as F	**< 0.5**	0.5-1.5(Max)	Ion Selective
Zinc	mg/L as Zn	< 0.1	3 (Max)	3111, APHA 17th Ed.
Copper	mg/L as Cu	< 0.1	1 (Max)	3111, APHA 17th Ed.
Cadmium	mg/L as Cd	< 0.003	0.003 (Max)	3111, APHA 17th Ed.
Chromium	mg/L as Cr	< 0.05	0.05(Max)	3500-Cr, APHA 17th Ed.
Cyanide	mg/L as Cn	< 0.07	0.07 (Max)	4500-CN E APHA 17th Ed.
Lead	mg/L as Pb	< 0.01	0.01 (Max)	3111, APHA 17th Ed.
Mercury	ppb as Hg	**3**	1 (Max)	ISO 5666:1999
Arsenic	mg/L as As	< 0.005	0.05 (Max)	ISO 11969:1996
Aluminium	mg/L as Al	< 0.1	0.2 (Max)	3500-Al D, APHA 17th Ed.
BACTERIOLOGICAL				
Total Coliform	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition
E. coli	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition

NDWQS= National Drinking Water Quality Standard (2062)
( )=If there is no other alternative source of water
Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of all the tested parameters are found to be within the limit of NDWQS, except that of **Fluoride** and **Mercury.**

Analyzed by: **Checked by:** **Authorized sign:**
9 June, 2019 **9 June, 2019**

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Pawan Marg-33, Maitidevi, Kathmandu, Nepal

WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	402/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Butwal
Source :-	B1	Analysis Date :-	12 Aug, 2019
Receipt Date :-	12 Aug, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	7.2	6.5-8.5	ISO 10523:1994 (E)
Turbidity	NTU	< 1	5 (10) (Max)	2130 B, APHA,17th Ed.
Electric conductivity	$\mu S/cm$	875	1500 (Max)	ISO 7888:1985
Total dissolved solids	mg/L	578	1000 (Max)	Filtration & Evaporation
Color	TCU	< 1	5 (15) (Max)	ISO 7887:1994 (E), Section 3
Lab.Temperature	^0C	30.0		Thermometer
CHEMICAL				
Chloride	mg/L as Cl	23	250 (Max)	ISO 9297:1989
Sulphate	mg/L as SO_4	16	250 (Max)	4500-SO_4^{2-} E, APHA 17th Ed.
Nitrate	mg/L as NO_3	**55.8**	50 (Max)	Ion Selective
Ammonia	mg/L as NH_3	< 0.04	1.5 (Max)	4500-NH3C, APHA 17th edn
Total Hardness	mg/L as $CaCO_3$	400	500 (Max)	2340 C APHA 17th edn
Calcium	mg/L as Ca	118	200 (Max)	3500-Ca D APHA 17th edn
Iron	mg/L as Fe	0.06	0.3 (3)(Max)	ISO 8288:1998
Manganese	mg/L as Mn	< 0.005	0.2 (Max)	ISO 8288:1998
Total Chlorine	mg/L as Cl	< 0.1	-	4500-Cl G, APHA 17th Ed.
Fluoride	mg/L as F	**< 0.5**	0.5-1.5(Max)	Ion Selective
Zinc	mg/L as Zn	0.3	3 (Max)	3111, APHA 17th Ed.
Copper	mg/L as Cu	< 0.1	1 (Max)	3111, APHA 17th Ed.
Cadmium	mg/L as Cd	< 0.003	0.003 (Max)	3111, APHA 17th Ed.
Chromium	mg/L as Cr	< 0.05	0.05(Max)	3500-Cr, APHA 17th Ed.
Cyanide	mg/L as Cn	< 0.07	0.07 (Max)	4500-CN E APHA 17th Ed.
Lead	mg/L as Pb	< 0.01	0.01 (Max)	3111, APHA 17th Ed.
Mercury	ppb as Hg	**2**	1 (Max)	ISO 5666:1999
Arsenic	mg/L as As	< 0.005	0.05 (Max)	ISO 11969:1996
Aluminium	mg/L as Al	< 0.1	0.2 (Max)	3500-Al D, APHA 17th Ed.
BACTERIOLOGICAL				
Total Coliform	MPN index/100 ml	**1.1×10^3**	Nil	9221 B APHA 17th Edition
E. coli	MPN index/100 ml	**93**	Nil	9221 B APHA 17th Edition

NDWQS= National Drinking Water Quality Standard (2062) ( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of **Nitrate, Fluoride, Mercury, Total Coliform** and ***E.coli*** are found to be out of the limit of NDWQS.

Analyzed by: **Checked by:** **Authorized sign:**
25 Sep, 2019 **25 Sep, 2019**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	403/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Butwal
Source :-	B2	Analysis Date :-	12 Aug, 2019
Receipt Date :-	12 Aug, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	7.8	6.5-8.5	ISO 10523:1994 (E)
Turbidity	NTU	< 1	5 (10) (Max)	2130 B, APHA,17th Ed.
Electric conductivity	$\mu S/cm$	479	1500 (Max)	ISO 7888:1985
Total dissolved solids	mg/L	321	1000 (Max)	Filtration & Evaporation
Color	TCU	< 1	5 (15) (Max)	ISO 7887:1994 (E), Section 3
Lab.Temperature	^0C	30.0		Thermometer
CHEMICAL				
Chloride	mg/L as Cl	9	250 (Max)	ISO 9297:1989
Sulphate	mg/L as SO_4	11	250 (Max)	4500-SO_4^{2-} E, APHA 17th Ed.
Nitrate	mg/L as NO_3	26.2	50 (Max)	Ion Selective
Ammonia	mg/L as NH_3	0.07	1.5 (Max)	4500-NH3C, APHA 17th edn
Total Hardness	mg/L as $CaCO_3$	239	500 (Max)	2340 C APHA 17th edn
Calcium	mg/L as Ca	62	200 (Max)	3500-Ca D APHA 17th edn
Iron	mg/L as Fe	0.04	0.3 (3)(Max)	ISO 8288:1998
Manganese	mg/L as Mn	< 0.005	0.2 (Max)	ISO 8288:1998
Total Chlorine	mg/L as Cl	< 0.1	-	4500-Cl G, APHA 17th Ed.
Fluoride	mg/L as F	**< 0.5**	0.5-1.5(Max)	Ion Selective
Zinc	mg/L as Zn	0.1	3 (Max)	3111, APHA 17th Ed.
Copper	mg/L as Cu	< 0.1	1 (Max)	3111, APHA 17th Ed.
Cadmium	mg/L as Cd	< 0.003	0.003 (Max)	3111, APHA 17th Ed.
Chromium	mg/L as Cr	< 0.05	0.05(Max)	3500-Cr, APHA 17th Ed.
Cyanide	mg/L as Cn	< 0.07	0.07 (Max)	4500-CN E APHA 17th Ed.
Lead	mg/L as Pb	< 0.01	0.01 (Max)	3111, APHA 17th Ed.
Mercury	ppb as Hg	**2**	1 (Max)	ISO 5666:1999
Arsenic	mg/L as As	< 0.005	0.05 (Max)	ISO 11969:1996
Aluminium	mg/L as Al	< 0.1	0.2 (Max)	3500-Al D, APHA 17th Ed.
BACTERIOLOGICAL				
Total Coliform	MPN index/100 ml	**93**	Nil	9221 B APHA 17th Edition
E. coli	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition

NDWQS= National Drinking Water Quality Standard (2062)

( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of **Fluoride,Mercury** and **Total Coliform** are found to be out of the limit of NDWQS.

Analyzed by: **Checked by:** **Authorized sign:**

25 Sep, 2019 **25 Sep, 2019**

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Pawan Marg-33, Maitidevi, Kathmandu, Nepal

WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	404/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Butwal
Source :-	B3	Analysis Date :-	12 Aug, 2019
Receipt Date :-	12 Aug, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	7.5	*6.5-8.5*	*ISO 10523:1994 (E)*
Turbidity	*NTU*	**6**	*5 (10) (Max)*	*2130 B, APHA,17th Ed.*
Electric conductivity	*µS/cm*	767	*1500 (Max)*	*ISO 7888:1985*
Total dissolved solids	*mg/L*	453	*1000 (Max)*	*Filtration & Evaporation*
Color	*TCU*	< 1	*5 (15) (Max)*	*ISO 7887:1994 (E), Section 3*
Lab.Temperature	^0C	30.0		*Thermometer*
CHEMICAL				
Chloride	*mg/L as Cl*	7	*250 (Max)*	*ISO 9297:1989*
Sulphate	*mg/L as* SO_4	7	*250 (Max)*	*4500-*SO_4^{2-} *E, APHA 17th Ed.*
Nitrate	*mg/L as* NO_3	22.9	*50 (Max)*	*Ion Selective*
Ammonia	*mg/L as* NH_3	< 0.04	*1.5 (Max)*	*4500-NH3C, APHA 17th edn*
Total Hardness	*mg/L as* $CaCO_3$	318	*500 (Max)*	*2340 C APHA 17th edn*
Calcium	*mg/L as Ca*	76	*200 (Max)*	*3500-Ca D APHA 17th edn*
Iron	*mg/L as Fe*	**0.36**	*0.3 (3)(Max)*	*ISO 8288:1998*
Manganese	*mg/L as Mn*	0.080	*0.2 (Max)*	*ISO 8288:1998*
Total Chlorine	*mg/L as Cl*	< 0.1	-	*4500-Cl G, APHA 17th Ed.*
Fluoride	*mg/L as F*	**< 0.5**	*0.5-1.5(Max)*	*Ion Selective*
Zinc	*mg/L as Zn*	< 0.1	*3 (Max)*	*3111, APHA 17th Ed.*
Copper	*mg/L as Cu*	< 0.1	*1 (Max)*	*3111, APHA 17th Ed.*
Cadmium	*mg/L as Cd*	< 0.003	*0.003 (Max)*	*3111, APHA 17th Ed.*
Chromium	*mg/L as Cr*	< 0.05	*0.05(Max)*	*3500-Cr, APHA 17th Ed.*
Cyanide	*mg/L as Cn*	< 0.07	*0.07 (Max)*	*4500-CN E APHA 17th Ed.*
Lead	*mg/L as Pb*	< 0.01	*0.01 (Max)*	*3111, APHA 17th Ed.*
Mercury	*ppb as Hg*	1	*1 (Max)*	*ISO 5666:1999*
Arsenic	*mg/L as As*	< 0.005	*0.05 (Max)*	*ISO 11969:1996*
Aluminium	*mg/L as Al*	< 0.1	*0.2 (Max)*	*3500-Al D, APHA 17th Ed.*
BACTERIOLOGICAL				
Total Coliform	*MPN index/100 ml*	Nil	Nil	*9221 B APHA 17th Edition*
E. coli	*MPN index/100 ml*	Nil	Nil	*9221 B APHA 17th Edition*

NDWQS= National Drinking Water Quality Standard (2062) ( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of **Turbidity,Iron** and **Fluoride** are found to be out of the limit of NDWQS.

Analyzed by: **Checked by:** **Authorized sign:**
25 Sep, 2019 **25 Sep, 2019**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	405/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Butwal
Source :-	B4	Analysis Date :-	12 Aug, 2019
Receipt Date :-	12 Aug, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	**8.7**	*6.5-8.5*	*ISO 10523:1994 (E)*
Turbidity	*NTU*	**23**	*5 (10) (Max)*	*2130 B, APHA,17th Ed.*
Electric conductivity	*µS/cm*	285	*1500 (Max)*	*ISO 7888:1985*
Total dissolved solids	*mg/L*	159	*1000 (Max)*	*Filtration & Evaporation*
Color	*TCU*	< 1	*5 (15) (Max)*	*ISO 7887:1994 (E), Section 3*
Lab.Temperature	^0C	30.0		*Thermometer*
CHEMICAL				
Chloride	*mg/L as Cl*	3	*250 (Max)*	*ISO 9297:1989*
Sulphate	*mg/L as* SO_4	11	*250 (Max)*	*4500-*SO_4^{2-} *E, APHA 17th Ed.*
Nitrate	*mg/L as* NO_3	9.5	*50 (Max)*	*Ion Selective*
Ammonia	*mg/L as* NH_3	0.09	*1.5 (Max)*	*4500-NH3C, APHA 17th edn*
Total Hardness	*mg/L as* $CaCO_3$	145	*500 (Max)*	*2340 C APHA 17th edn*
Calcium	*mg/L as Ca*	36	*200 (Max)*	*3500-Ca D APHA 17th edn*
Iron	*mg/L as Fe*	**0.47**	*0.3 (3)(Max)*	*ISO 8288:1998*
Manganese	*mg/L as Mn*	0.102	*0.2 (Max)*	*ISO 8288:1998*
Total Chlorine	*mg/L as Cl*	< 0.1	-	*4500-Cl G, APHA 17th Ed.*
Fluoride	*mg/L as F*	**< 0.5**	*0.5-1.5(Max)*	*Ion Selective*
Zinc	*mg/L as Zn*	0.1	*3 (Max)*	*3111, APHA 17th Ed.*
Copper	*mg/L as Cu*	< 0.1	*1 (Max)*	*3111, APHA 17th Ed.*
Cadmium	*mg/L as Cd*	< 0.003	*0.003 (Max)*	*3111, APHA 17th Ed.*
Chromium	*mg/L as Cr*	< 0.05	*0.05(Max)*	*3500-Cr, APHA 17th Ed.*
Cyanide	*mg/L as Cn*	< 0.07	*0.07 (Max)*	*4500-CN E APHA 17th Ed.*
Lead	*mg/L as Pb*	< 0.01	*0.01 (Max)*	*3111, APHA 17th Ed.*
Mercury	*ppb as Hg*	1	*1 (Max)*	*ISO 5666:1999*
Arsenic	*mg/L as As*	< 0.005	*0.05 (Max)*	*ISO 11969:1996*
Aluminium	*mg/L as Al*	< 0.1	*0.2 (Max)*	*3500-Al D, APHA 17th Ed.*
BACTERIOLOGICAL				
Total Coliform	*MPN index/100 ml*	**4.6×10^2**	Nil	*9221 B APHA 17th Edition*
E. coli	*MPN index/100 ml*	**93**	Nil	*9221 B APHA 17th Edition*

NDWQS= National Drinking Water Quality Standard (2062) ( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of **pH, Turbidity,Iron, Fluoride,Total Coliform** and ***E.coli*** are found to be out of the limit of NDWQS.

Analyzed by: **Checked by:** **Authorized sign:**
25 Sep, 2019 **25 Sep, 2019**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	406/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Butwal
Source :-	B5	Analysis Date :-	12 Aug, 2019
Receipt Date :-	12 Aug, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	7.2	*6.5-8.5*	*ISO 10523:1994 (E)*
Turbidity	*NTU*	< 1	*5 (10) (Max)*	*2130 B, APHA,17th Ed.*
Electric conductivity	*µS/cm*	932	*1500 (Max)*	*ISO 7888:1985*
Total dissolved solids	*mg/L*	597	*1000 (Max)*	*Filtration & Evaporation*
Color	*TCU*	< 1	*5 (15) (Max)*	*ISO 7887:1994 (E), Section 3*
Lab.Temperature	^0C	30.0		*Thermometer*
CHEMICAL				
Chloride	*mg/L as Cl*	25	*250 (Max)*	*ISO 9297:1989*
Sulphate	*mg/L as* SO_4	15	*250 (Max)*	*4500-*SO_4^{2-} *E, APHA 17th Ed.*
Nitrate	*mg/L as* NO_3	**57.5**	*50 (Max)*	*Ion Selective*
Ammonia	*mg/L as* NH_3	< 0.04	*1.5 (Max)*	*4500-NH3C, APHA 17th edn*
Total Hardness	*mg/L as* $CaCO_3$	439	*500 (Max)*	*2340 C APHA 17th edn*
Calcium	*mg/L as Ca*	126	*200 (Max)*	*3500-Ca D APHA 17th edn*
Iron	*mg/L as Fe*	0.04	*0.3 (3)(Max)*	*ISO 8288:1998*
Manganese	*mg/L as Mn*	< 0.005	*0.2 (Max)*	*ISO 8288:1998*
Total Chlorine	*mg/L as Cl*	< 0.1	-	*4500-Cl G, APHA 17th Ed.*
Fluoride	*mg/L as F*	**< 0.5**	*0.5-1.5(Max)*	*Ion Selective*
Zinc	*mg/L as Zn*	< 0.1	*3 (Max)*	*3111, APHA 17th Ed.*
Copper	*mg/L as Cu*	< 0.1	*1 (Max)*	*3111, APHA 17th Ed.*
Cadmium	*mg/L as Cd*	< 0.003	*0.003 (Max)*	*3111, APHA 17th Ed.*
Chromium	*mg/L as Cr*	< 0.05	*0.05(Max)*	*3500-Cr, APHA 17th Ed.*
Cyanide	*mg/L as Cn*	< 0.07	*0.07 (Max)*	*4500-CN E APHA 17th Ed.*
Lead	*mg/L as Pb*	< 0.01	*0.01 (Max)*	*3111, APHA 17th Ed.*
Mercury	*ppb as Hg*	**3**	*1 (Max)*	*ISO 5666:1999*
Arsenic	*mg/L as As*	< 0.005	*0.05 (Max)*	*ISO 11969:1996*
Aluminium	*mg/L as Al*	< 0.1	*0.2 (Max)*	*3500-Al D, APHA 17th Ed.*
BACTERIOLOGICAL				
Total Coliform	*MPN index/100 ml*	Nil	Nil	*9221 B APHA 17th Edition*
E. coli	*MPN index/100 ml*	Nil	Nil	*9221 B APHA 17th Edition*

NDWQS= National Drinking Water Quality Standard (2062) ( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of **Nitrate,Fluoride** and **Mercury** are found to be out of the limit of NDWQS.

Analyzed by: **Checked by:** **Authorized sign:**
25 Sep, 2019 **25 Sep, 2019**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	407/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Butwal
Source :-	B6	Analysis Date :-	12 Aug, 2019
Receipt Date :-	12 Aug, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	7.8	6.5-8.5	ISO 10523:1994 (E)
Turbidity	NTU	4	5 (10) (Max)	2130 B, APHA,17th Ed.
Electric conductivity	$\mu S/cm$	428	1500 (Max)	ISO 7888:1985
Total dissolved solids	mg/L	252	1000 (Max)	Filtration & Evaporation
Color	TCU	< 1	5 (15) (Max)	ISO 7887:1994 (E), Section 3
Lab.Temperature	^0C	30.0		Thermometer
CHEMICAL				
Chloride	mg/L as Cl	4	250 (Max)	ISO 9297:1989
Sulphate	mg/L as SO_4	11	250 (Max)	4500-SO_4^{2-} E, APHA 17th Ed.
Nitrate	mg/L as NO_3	19.2	50 (Max)	Ion Selective
Ammonia	mg/L as NH_3	< 0.04	1.5 (Max)	4500-NH3C, APHA 17th edn
Total Hardness	mg/L as $CaCO_3$	208	500 (Max)	2340 C APHA 17th edn
Calcium	mg/L as Ca	56	200 (Max)	3500-Ca D APHA 17th edn
Iron	mg/L as Fe	0.20	0.3 (3)(Max)	ISO 8288:1998
Manganese	mg/L as Mn	< 0.005	0.2 (Max)	ISO 8288:1998
Total Chlorine	mg/L as Cl	< 0.1	-	4500-Cl G, APHA 17th Ed.
Fluoride	mg/L as F	**< 0.5**	0.5-1.5(Max)	Ion Selective
Zinc	mg/L as Zn	0.3	3 (Max)	3111, APHA 17th Ed.
Copper	mg/L as Cu	< 0.1	1 (Max)	3111, APHA 17th Ed.
Cadmium	mg/L as Cd	< 0.003	0.003 (Max)	3111, APHA 17th Ed.
Chromium	mg/L as Cr	< 0.05	0.05(Max)	3500-Cr, APHA 17th Ed.
Cyanide	mg/L as Cn	< 0.07	0.07 (Max)	4500-CN E APHA 17th Ed.
Lead	mg/L as Pb	< 0.01	0.01 (Max)	3111, APHA 17th Ed.
Mercury	ppb as Hg	**3**	1 (Max)	ISO 5666:1999
Arsenic	mg/L as As	< 0.005	0.05 (Max)	ISO 11969:1996
Aluminium	mg/L as Al	< 0.1	0.2 (Max)	3500-Al D, APHA 17th Ed.
BACTERIOLOGICAL				
Total Coliform	MPN index/100 ml	**23**	Nil	9221 B APHA 17th Edition
E. coli	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition

NDWQS= National Drinking Water Quality Standard (2062) ( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of **Fluoride, Mercury** and **Total Coliform** are found to be out of the limit of NDWQS.

Analyzed by: **Checked by:** **Authorized sign:**
25 Sep, 2019 **25 Sep, 2019**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	1652/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Hetauda
Source :-	H1	Analysis Date :-	8 April, 2019
Receipt Date :-	8 April, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	8.0	6.5-8.5	ISO 10523:1994 (E)
Turbidity	NTU	< 1	5 (10) (Max)	2130 B, APHA,17th Ed.
Electric conductivity	$\mu S/cm$	374	1500 (Max)	ISO 7888:1985
Total dissolved solids	mg/L	217	1000 (Max)	Filtration & Evaporation
Color	TCU	< 1	5 (15) (Max)	ISO 7887:1994 (E), Section 3
Lab.Temperature	^0C	20.0		Thermometer
CHEMICAL				
Chloride	mg/L as Cl	2	250 (Max)	ISO 9297:1989
Sulphate	mg/L as SO_4	44	250 (Max)	4500-SO_4^{2-} E, APHA 17th Ed.
Nitrate	mg/L as NO_3	3.3	50 (Max)	Ion Selective
Ammonia	mg/L as NH_3	< 0.04	1.5 (Max)	4500-NH3C, APHA 17th edn
Total Hardness	mg/L as $CaCO_3$	200	500 (Max)	2340 C APHA 17th edn
Calcium	mg/L as Ca	48	200 (Max)	3500-Ca D APHA 17th edn
Iron	mg/L as Fe	< 0.03	0.3 (3)(Max)	ISO 8288:1998
Manganese	mg/L as Mn	< 0.005	0.2 (Max)	ISO 8288:1998
Total Chlorine	mg/L as Cl	< 0.1	-	4500-Cl G, APHA 17th Ed.
Fluoride	mg/L as F	**< 0.5**	0.5-1.5(Max)	Ion Selective
Zinc	mg/L as Zn	< 0.1	3 (Max)	3111, APHA 17th Ed.
Copper	mg/L as Cu	< 0.1	1 (Max)	3111, APHA 17th Ed.
Cadmium	mg/L as Cd	< 0.003	0.003 (Max)	3111, APHA 17th Ed.
Chromium	mg/L as Cr	< 0.05	0.05(Max)	3500-Cr, APHA 17th Ed.
Cyanide	mg/L as Cn	< 0.07	0.07 (Max)	4500-CN E APHA 17th Ed.
Lead	mg/L as Pb	< 0.01	0.01 (Max)	3111, APHA 17th Ed.
Mercury	ppb as Hg	**5**	1 (Max)	ISO 5666:1999
Arsenic	mg/L as As	0.007	0.05 (Max)	ISO 11969:1996
Aluminium	mg/L as Al	< 0.1	0.2 (Max)	3500-Al D, APHA 17th Ed.
BACTERIOLOGICAL				
Total Coliform	MPN index/100 ml	**43**	Nil	9221 B APHA 17th Edition
E. coli	MPN index/100 ml	**9**	Nil	9221 B APHA 17th Edition

NDWQS= National Drinking Water Quality Standard (2062) ( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of **Fluoride,Mercury,Total Coliform** and ***E.coli*** are found to be out of the limit of NDWQS.

Analyzed by: **Checked by:** **Authorized sign:**
9 June, 2019 **9 June, 2019**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	1653/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Hetauda
Source :-	H2	Analysis Date :-	8 April, 2019
Receipt Date :-	8 April, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	7.7	6.5-8.5	ISO 10523:1994 (E)
Turbidity	NTU	< 1	5 (10) (Max)	2130 B, APHA,17th Ed.
Electric conductivity	$\mu S/cm$	324	1500 (Max)	ISO 7888:1985
Total dissolved solids	mg/L	266	1000 (Max)	Filtration & Evaporation
Color	TCU	< 1	5 (15) (Max)	ISO 7887:1994 (E), Section 3
Lab.Temperature	^0C	20.0		Thermometer
CHEMICAL				
Chloride	mg/L as Cl	2	250 (Max)	ISO 9297:1989
Sulphate	mg/L as SO_4	20	250 (Max)	4500-SO_4^{2-} E, APHA 17th Ed.
Nitrate	mg/L as NO_3	6.2	50 (Max)	Ion Selective
Ammonia	mg/L as NH_3	< 0.04	1.5 (Max)	4500-NH3C, APHA 17th edn
Total Hardness	mg/L as $CaCO_3$	169	500 (Max)	2340 C APHA 17th edn
Calcium	mg/L as Ca	51	200 (Max)	3500-Ca D APHA 17th edn
Iron	mg/L as Fe	0.05	0.3 (3)(Max)	ISO 8288:1998
Manganese	mg/L as Mn	< 0.005	0.2 (Max)	ISO 8288:1998
Total Chlorine	mg/L as Cl	< 0.1	-	4500-Cl G, APHA 17th Ed.
Fluoride	mg/L as F	**< 0.5**	0.5-1.5(Max)	Ion Selective
Zinc	mg/L as Zn	< 0.1	3 (Max)	3111, APHA 17th Ed.
Copper	mg/L as Cu	< 0.1	1 (Max)	3111, APHA 17th Ed.
Cadmium	mg/L as Cd	< 0.003	0.003 (Max)	3111, APHA 17th Ed.
Chromium	mg/L as Cr	< 0.05	0.05(Max)	3500-Cr, APHA 17th Ed.
Cyanide	mg/L as Cn	< 0.07	0.07 (Max)	4500-CN E APHA 17th Ed.
Lead	mg/L as Pb	< 0.01	0.01 (Max)	3111, APHA 17th Ed.
Mercury	ppb as Hg	**11**	1 (Max)	ISO 5666:1999
Arsenic	mg/L as As	0.005	0.05 (Max)	ISO 11969:1996
Aluminium	mg/L as Al	< 0.1	0.2 (Max)	3500-Al D, APHA 17th Ed.
BACTERIOLOGICAL				
Total Coliform	MPN index/100 ml	**4**	Nil	9221 B APHA 17th Edition
E. coli	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition

NDWQS= National Drinking Water Quality Standard (2062) ( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of **Fluoride, Mercury** and **Total Coliform** are found to be out of the limit of NDWQS.

Analyzed by: **Checked by:** **Authorized sign:**

9 June, 2019 **9 June, 2019**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co. Ltd	Lab No. :-	1654/19
Collector :-	Yachiyo Engineering Co. Ltd	Location :-	Hetauda
Source :-	H3	Analysis Date :-	8 April, 2019
Receipt Date :-	8 April, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	**5.9**	*6.5-8.5*	*ISO 10523:1994 (E)*
Turbidity	*NTU*	< 1	*5 (10) (Max)*	*2130 B, APHA,17th Ed.*
Electric conductivity	*µS/cm*	584	*1500 (Max)*	*ISO 7888:1985*
Total dissolved solids	*mg/L*	352	*1000 (Max)*	*Filtration & Evaporation*
Color	*TCU*	< 1	*5 (15) (Max)*	*ISO 7887:1994 (E), Section 3*
Lab.Temperature	^0C	20.0		*Thermometer*
CHEMICAL				
Chloride	*mg/L as Cl*	27	*250 (Max)*	*ISO 9297:1989*
Sulphate	*mg/L as* SO_4	20	*250 (Max)*	*4500-*SO_4^{2-} *E, APHA 17th Ed.*
Nitrate	*mg/L as* NO_3	**72.2**	*50 (Max)*	*Ion Selective*
Ammonia	*mg/L as* NH_3	< 0.04	*1.5 (Max)*	*4500-NH3C, APHA 17th edn*
Total Hardness	*mg/L as* $CaCO_3$	247	*500 (Max)*	*2340 C APHA 17th edn*
Calcium	*mg/L as Ca*	79	*200 (Max)*	*3500-Ca D APHA 17th edn*
Iron	*mg/L as Fe*	0.04	*0.3 (3)(Max)*	*ISO 8288:1998*
Manganese	*mg/L as Mn*	< 0.005	*0.2 (Max)*	*ISO 8288:1998*
Total Chlorine	*mg/L as Cl*	< 0.1	-	*4500-Cl G, APHA 17th Ed.*
Fluoride	*mg/L as F*	**< 0.5**	*0.5-1.5(Max)*	*Ion Selective*
Zinc	*mg/L as Zn*	< 0.1	*3 (Max)*	*3111, APHA 17th Ed.*
Copper	*mg/L as Cu*	< 0.1	*1 (Max)*	*3111, APHA 17th Ed.*
Cadmium	*mg/L as Cd*	< 0.003	*0.003 (Max)*	*3111, APHA 17th Ed.*
Chromium	*mg/L as Cr*	< 0.05	*0.05(Max)*	*3500-Cr, APHA 17th Ed.*
Cyanide	*mg/L as Cn*	< 0.07	*0.07 (Max)*	*4500-CN E APHA 17th Ed.*
Lead	*mg/L as Pb*	< 0.01	*0.01 (Max)*	*3111, APHA 17th Ed.*
Mercury	*ppb as Hg*	**10**	*1 (Max)*	*ISO 5666:1999*
Arsenic	*mg/L as As*	0.006	*0.05 (Max)*	*ISO 11969:1996*
Aluminium	*mg/L as Al*	< 0.1	*0.2 (Max)*	*3500-Al D, APHA 17th Ed.*
BACTERIOLOGICAL				
Total Coliform	*MPN index/100 ml*	Nil	Nil	*9221 B APHA 17th Edition*
E. coli	*MPN index/100 ml*	Nil	Nil	*9221 B APHA 17th Edition*

NDWQS= National Drinking Water Quality Standard (2062) ( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of **pH, Nitrate,Fluoride** and **Mercury** are found to be out of the limit of NDWQS.

Analyzed by: **Checked by:** **Authorized sign:**
9 June, 2019 **9 June, 2019**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	1655/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Hetauda
Source :-	H4	Analysis Date :-	8 April, 2019
Receipt Date :-	8 April, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	**4.6**	*6.5-8.5*	*ISO 10523:1994 (E)*
Turbidity	*NTU*	< 1	*5 (10) (Max)*	*2130 B, APHA,17th Ed.*
Electric conductivity	*µS/cm*	36	*1500 (Max)*	*ISO 7888:1985*
Total dissolved solids	*mg/L*	21	*1000 (Max)*	*Filtration & Evaporation*
Color	*TCU*	< 1	*5 (15) (Max)*	*ISO 7887:1994 (E), Section 3*
Lab.Temperature	^0C	20.0		*Thermometer*
CHEMICAL				
Chloride	*mg/L as Cl*	2	*250 (Max)*	*ISO 9297:1989*
Sulphate	*mg/L as* SO_4	< 1	*250 (Max)*	*4500-*SO_4^{2-} *E, APHA 17th Ed.*
Nitrate	*mg/L as* NO_3	8.8	*50 (Max)*	*Ion Selective*
Ammonia	*mg/L as* NH_3	< 0.04	*1.5 (Max)*	*4500-NH3C, APHA 17th edn*
Total Hardness	*mg/L as* $CaCO_3$	24	*500 (Max)*	*2340 C APHA 17th edn*
Calcium	*mg/L as Ca*	3	*200 (Max)*	*3500-Ca D APHA 17th edn*
Iron	*mg/L as Fe*	0.05	*0.3 (3)(Max)*	*ISO 8288:1998*
Manganese	*mg/L as Mn*	< 0.005	*0.2 (Max)*	*ISO 8288:1998*
Total Chlorine	*mg/L as Cl*	< 0.1	-	*4500-Cl G, APHA 17th Ed.*
Fluoride	*mg/L as F*	**< 0.5**	*0.5-1.5(Max)*	*Ion Selective*
Zinc	*mg/L as Zn*	< 0.1	*3 (Max)*	*3111, APHA 17th Ed.*
Copper	*mg/L as Cu*	< 0.1	*1 (Max)*	*3111, APHA 17th Ed.*
Cadmium	*mg/L as Cd*	< 0.003	*0.003 (Max)*	*3111, APHA 17th Ed.*
Chromium	*mg/L as Cr*	< 0.05	*0.05(Max)*	*3500-Cr, APHA 17th Ed.*
Cyanide	*mg/L as Cn*	< 0.07	*0.07 (Max)*	*4500-CN E APHA 17th Ed.*
Lead	*mg/L as Pb*	< 0.01	*0.01 (Max)*	*3111, APHA 17th Ed.*
Mercury	*ppb as Hg*	**3**	*1 (Max)*	*ISO 5666:1999*
Arsenic	*mg/L as As*	< 0.005	*0.05 (Max)*	*ISO 11969:1996*
Aluminium	*mg/L as Al*	< 0.1	*0.2 (Max)*	*3500-Al D, APHA 17th Ed.*
BACTERIOLOGICAL				
Total Coliform	*MPN index/100 ml*	Nil	Nil	*9221 B APHA 17th Edition*
E. coli	*MPN index/100 ml*	Nil	Nil	*9221 B APHA 17th Edition*

NDWQS= National Drinking Water Quality Standard (2062) ( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of **pH,Fluoride** and **Mercury** are found to be out of the limit of NDWQS.

Analyzed by: **Checked by:** **Authorized sign:**
9 June, 2019 **9 June, 2019**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	1656/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Hetauda
Source :-	H5	Analysis Date :-	8 April, 2019
Receipt Date :-	8 April, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	**4.0**	*6.5-8.5*	*ISO 10523:1994 (E)*
Turbidity	*NTU*	< 1	*5 (10) (Max)*	*2130 B, APHA,17th Ed.*
Electric conductivity	*µS/cm*	34	*1500 (Max)*	*ISO 7888:1985*
Total dissolved solids	*mg/L*	25	*1000 (Max)*	*Filtration & Evaporation*
Color	*TCU*	< 1	*5 (15) (Max)*	*ISO 7887:1994 (E), Section 3*
Lab.Temperature	^0C	20.0		*Thermometer*
CHEMICAL				
Chloride	*mg/L as Cl*	3	*250 (Max)*	*ISO 9297:1989*
Sulphate	*mg/L as* SO_4	< 1	*250 (Max)*	*4500-* SO_4^{2-} *E. APHA 17th Ed.*
Nitrate	*mg/L as* NO_3	7.9	*50 (Max)*	*Ion Selective*
Ammonia	*mg/L as* NH_3	< 0.04	*1.5 (Max)*	*4500-NH3C, APHA 17th edn*
Total Hardness	*mg/L as* $CaCO_3$	12	*500 (Max)*	*2340 C APHA 17th edn*
Calcium	*mg/L as Ca*	3	*200 (Max)*	*3500-Ca D APHA 17th edn*
Iron	*mg/L as Fe*	0.05	*0.3 (3)(Max)*	*ISO 8288:1998*
Manganese	*mg/L as Mn*	< 0.005	*0.2 (Max)*	*ISO 8288:1998*
Total Chlorine	*mg/L as Cl*	< 0.1	-	*4500-Cl G, APHA 17th Ed.*
Fluoride	*mg/L as F*	**< 0.5**	*0.5-1.5(Max)*	*Ion Selective*
Zinc	*mg/L as Zn*	< 0.1	*3 (Max)*	*3111, APHA 17th Ed.*
Copper	*mg/L as Cu*	< 0.1	*1 (Max)*	*3111, APHA 17th Ed.*
Cadmium	*mg/L as Cd*	< 0.003	*0.003 (Max)*	*3111, APHA 17th Ed.*
Chromium	*mg/L as Cr*	< 0.05	*0.05(Max)*	*3500-Cr, APHA 17th Ed.*
Cyanide	*mg/L as Cn*	< 0.07	*0.07 (Max)*	*4500-CN E APHA 17th Ed.*
Lead	*mg/L as Pb*	< 0.01	*0.01 (Max)*	*3111, APHA 17th Ed.*
Mercury	*ppb as Hg*	8	*1 (Max)*	*ISO 5666:1999*
Arsenic	*mg/L as As*	0.005	*0.05 (Max)*	*ISO 11969:1996*
Aluminium	*mg/L as Al*	< 0.1	*0.2 (Max)*	*3500-Al D, APHA 17th Ed.*
BACTERIOLOGICAL				
Total Coliform	*MPN index/100 ml*	Nil	Nil	*9221 B APHA 17th Edition*
E. coli	*MPN index/100 ml*	Nil	Nil	*9221 B APHA 17th Edition*

NDWQS= National Drinking Water Quality Standard (2062) ( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of **pH,Fluoride** and **Mercury** are found to be out of the limit of NDWQS.

Analyzed by: **Checked by:** **Authorized sign:**
9 June, 2019 **9 June, 2019**

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Pawan Marg-33, Maitidevi, Kathmandu, Nepal

WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	1657/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Hetauda
Source :-	H6	Analysis Date :-	8 April, 2019
Receipt Date :-	8 April, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	6.7	6.5-8.5	ISO 10523:1994 (E)
Turbidity	NTU	< 1	5 (10) (Max)	2130 B, APHA,17th Ed.
Electric conductivity	$\mu S/cm$	402	1500 (Max)	ISO 7888:1985
Total dissolved solids	mg/L	267	1000 (Max)	Filtration & Evaporation
Color	TCU	< 1	5 (15) (Max)	ISO 7887:1994 (E), Section 3
Lab.Temperature	^0C	20.0		Thermometer
CHEMICAL				
Chloride	mg/L as Cl	6	250 (Max)	ISO 9297:1989
Sulphate	mg/L as SO_4	19	250 (Max)	4500-SO_4^{2-} E, APHA 17th Ed.
Nitrate	mg/L as NO_3	18.4	50 (Max)	Ion Selective
Ammonia	mg/L as NH_3	< 0.04	1.5 (Max)	4500-NH3C, APHA 17th edn
Total Hardness	mg/L as $CaCO_3$	204	500 (Max)	2340 C APHA 17th edn
Calcium	mg/L as Ca	62	200 (Max)	3500-Ca D APHA 17th edn
Iron	mg/L as Fe	0.07	0.3 (3)(Max)	ISO 8288:1998
Manganese	mg/L as Mn	0.023	0.2 (Max)	ISO 8288:1998
Total Chlorine	mg/L as Cl	< 0.1	-	4500-Cl G, APHA 17th Ed.
Fluoride	mg/L as F	**< 0.5**	0.5-1.5(Max)	Ion Selective
Zinc	mg/L as Zn	0.9	3 (Max)	3111, APHA 17th Ed.
Copper	mg/L as Cu	< 0.1	1 (Max)	3111, APHA 17th Ed.
Cadmium	mg/L as Cd	< 0.003	0.003 (Max)	3111, APHA 17th Ed.
Chromium	mg/L as Cr	< 0.05	0.05(Max)	3500-Cr, APHA 17th Ed.
Cyanide	mg/L as Cn	< 0.07	0.07 (Max)	4500-CN E APHA 17th Ed.
Lead	mg/L as Pb	< 0.01	0.01 (Max)	3111, APHA 17th Ed.
Mercury	ppb as Hg	**6**	1 (Max)	ISO 5666:1999
Arsenic	mg/L as As	0.005	0.05 (Max)	ISO 11969:1996
Aluminium	mg/L as Al	< 0.1	0.2 (Max)	3500-Al D, APHA 17th Ed.
BACTERIOLOGICAL				
Total Coliform	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition
E. coli	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition

NDWQS= National Drinking Water Quality Standard (2062) ( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of all the tested parameters are found to be within the limit of NDWQS, except that of **Fluoride** and **Mercury.**

Analyzed by: **Checked by:** **Authorized sign:**
9 June, 2019 **9 June, 2019**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	419/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Hetauda
Source :-	H1	Analysis Date :-	16 Aug, 2019
Receipt Date :-	16 Aug, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	8.3	6.5-8.5	ISO 10523:1994 (E)
Turbidity	NTU	< 1	5 (10) (Max)	2130 B, APHA,17th Ed.
Electric conductivity	$\mu S/cm$	325	1500 (Max)	ISO 7888:1985
Total dissolved solids	mg/L	222	1000 (Max)	Filtration & Evaporation
Color	TCU	< 1	5 (15) (Max)	ISO 7887:1994 (E), Section 3
Lab.Temperature	^0C	29.0		Thermometer
CHEMICAL				
Chloride	mg/L as Cl	1	250 (Max)	ISO 9297:1989
Sulphate	mg/L as SO_4	34	250 (Max)	4500-SO_4^{2-} E, APHA 17th Ed.
Nitrate	mg/L as NO_3	9.5	50 (Max)	Ion Selective
Ammonia	mg/L as NH_3	< 0.04	1.5 (Max)	4500-NH3C, APHA 17th edn
Total Hardness	mg/L as $CaCO_3$	181	500 (Max)	2340 C APHA 17th edn
Calcium	mg/L as Ca	42	200 (Max)	3500-Ca D APHA 17th edn
Iron	mg/L as Fe	0.05	0.3 (3)(Max)	ISO 8288:1998
Manganese	mg/L as Mn	< 0.005	0.2 (Max)	ISO 8288:1998
Total Chlorine	mg/L as Cl	< 0.1	-	4500-Cl G, APHA 17th Ed.
Fluoride	mg/L as F	**< 0.5**	0.5-1.5(Max)	Ion Selective
Zinc	mg/L as Zn	0.3	3 (Max)	3111, APHA 17th Ed.
Copper	mg/L as Cu	< 0.1	1 (Max)	3111, APHA 17th Ed.
Cadmium	mg/L as Cd	< 0.003	0.003 (Max)	3111, APHA 17th Ed.
Chromium	mg/L as Cr	< 0.05	0.05(Max)	3500-Cr, APHA 17th Ed.
Cyanide	mg/L as Cn	< 0.07	0.07 (Max)	4500-CN E APHA 17th Ed.
Lead	mg/L as Pb	< 0.01	0.01 (Max)	3111, APHA 17th Ed.
Mercury	ppb as Hg	**4**	1 (Max)	ISO 5666:1999
Arsenic	mg/L as As	< 0.005	0.05 (Max)	ISO 11969:1996
Aluminium	mg/L as Al	< 0.1	0.2 (Max)	3500-Al D, APHA 17th Ed.
BACTERIOLOGICAL				
Total Coliform	MPN index/100 ml	**43**	Nil	9221 B APHA 17th Edition
E. coli	MPN index/100 ml	**4**	Nil	9221 B APHA 17th Edition

NDWQS= National Drinking Water Quality Standard (2062)

( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of **Fluoride, Mercury,Total Coliform** and ***E.coli*** are found to be out of the limit of NDWQS.

Analyzed by: **Checked by:** **Authorized sign:**
25 Sep, 2019 **25 Sep, 2019**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	420/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Hetauda
Source :-	H2	Analysis Date :-	16 Aug, 2019
Receipt Date :-	16 Aug, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	7.9	6.5-8.5	ISO 10523:1994 (E)
Turbidity	NTU	< 1	5 (10) (Max)	2130 B, APHA,17th Ed.
Electric conductivity	$\mu S/cm$	328	1500 (Max)	ISO 7888:1985
Total dissolved solids	mg/L	197	1000 (Max)	Filtration & Evaporation
Color	TCU	< 1	5 (15) (Max)	ISO 7887:1994 (E), Section 3
Lab.Temperature	^0C	29.0		Thermometer
CHEMICAL				
Chloride	mg/L as Cl	1	250 (Max)	ISO 9297:1989
Sulphate	mg/L as SO_4	18	250 (Max)	4500-SO_4^{2-} E, APHA 17th Ed.
Nitrate	mg/L as NO_3	9.7	50 (Max)	Ion Selective
Ammonia	mg/L as NH_3	< 0.04	1.5 (Max)	4500-NH3C, APHA 17th edn
Total Hardness	mg/L as $CaCO_3$	177	500 (Max)	2340 C APHA 17th edn
Calcium	mg/L as Ca	36	200 (Max)	3500-Ca D APHA 17th edn
Iron	mg/L as Fe	0.06	0.3 (3)(Max)	ISO 8288:1998
Manganese	mg/L as Mn	< 0.005	0.2 (Max)	ISO 8288:1998
Total Chlorine	mg/L as Cl	< 0.1	-	4500-Cl G, APHA 17th Ed.
Fluoride	mg/L as F	**< 0.5**	0.5-1.5(Max)	Ion Selective
Zinc	mg/L as Zn	0.1	3 (Max)	3111, APHA 17th Ed.
Copper	mg/L as Cu	< 0.1	1 (Max)	3111, APHA 17th Ed.
Cadmium	mg/L as Cd	< 0.003	0.003 (Max)	3111, APHA 17th Ed.
Chromium	mg/L as Cr	< 0.05	0.05(Max)	3500-Cr, APHA 17th Ed.
Cyanide	mg/L as Cn	< 0.07	0.07 (Max)	4500-CN E APHA 17th Ed.
Lead	mg/L as Pb	< 0.01	0.01 (Max)	3111, APHA 17th Ed.
Mercury	ppb as Hg	**11**	1 (Max)	ISO 5666:1999
Arsenic	mg/L as As	< 0.005	0.05 (Max)	ISO 11969:1996
Aluminium	mg/L as Al	< 0.1	0.2 (Max)	3500-Al D, APHA 17th Ed.
BACTERIOLOGICAL				
Total Coliform	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition
E. coli	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition

NDWQS= National Drinking Water Quality Standard (2062) ( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of **Fluoride** and **Mercury** are found to be out of the limit of NDWQS.

Analyzed by: **Checked by:** **Authorized sign:**
25 Sep, 2019 **25 Sep, 2019**

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Pawan Marg-33, Maitidevi, Kathmandu, Nepal

WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	421/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Hetauda
Source :-	H3	Analysis Date :-	16 Aug, 2019
Receipt Date :-	16 Aug, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	6.8	6.5-8.5	ISO 10523:1994 (E)
Turbidity	NTU	< 1	5 (10) (Max)	2130 B, APHA,17th Ed.
Electric conductivity	$\mu S/cm$	590	1500 (Max)	ISO 7888:1985
Total dissolved solids	mg/L	488	1000 (Max)	Filtration & Evaporation
Color	TCU	< 1	5 (15) (Max)	ISO 7887:1994 (E), Section 3
Lab.Temperature	^0C	29.0		Thermometer
CHEMICAL				
Chloride	mg/L as Cl	22	250 (Max)	ISO 9297:1989
Sulphate	mg/L as SO_4	18	250 (Max)	4500-SO_4^{2-} E, APHA 17th Ed.
Nitrate	mg/L as NO_3	**54.0**	50 (Max)	Ion Selective
Ammonia	mg/L as NH_3	< 0.04	1.5 (Max)	4500-NH3C, APHA 17th edn
Total Hardness	mg/L as $CaCO_3$	255	500 (Max)	2340 C APHA 17th edn
Calcium	mg/L as Ca	76	200 (Max)	3500-Ca D APHA 17th edn
Iron	mg/L as Fe	0.07	0.3 (3)(Max)	ISO 8288:1998
Manganese	mg/L as Mn	< 0.005	0.2 (Max)	ISO 8288:1998
Total Chlorine	mg/L as Cl	< 0.1	-	4500-Cl G, APHA 17th Ed.
Fluoride	mg/L as F	**< 0.5**	0.5-1.5(Max)	Ion Selective
Zinc	mg/L as Zn	< 0.1	3 (Max)	3111, APHA 17th Ed.
Copper	mg/L as Cu	< 0.1	1 (Max)	3111, APHA 17th Ed.
Cadmium	mg/L as Cd	< 0.003	0.003 (Max)	3111, APHA 17th Ed.
Chromium	mg/L as Cr	< 0.05	0.05(Max)	3500-Cr, APHA 17th Ed.
Cyanide	mg/L as Cn	< 0.07	0.07 (Max)	4500-CN E APHA 17th Ed.
Lead	mg/L as Pb	< 0.01	0.01 (Max)	3111, APHA 17th Ed.
Mercury	ppb as Hg	**10**	1 (Max)	ISO 5666:1999
Arsenic	mg/L as As	< 0.005	0.05 (Max)	ISO 11969:1996
Aluminium	mg/L as Al	< 0.1	0.2 (Max)	3500-Al D, APHA 17th Ed.
BACTERIOLOGICAL				
Total Coliform	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition
E. coli	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition

NDWQS= National Drinking Water Quality Standard (2062) ( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of **Nitrate,Fluoride** and **Mercury** are found to be out of the limit of NDWQS.

Analyzed by: **Checked by:** **Authorized sign:**
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Pawan Marg-33, Maitidevi, Kathmandu, Nepal

WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	422/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Hetauda
Source :-	H4	Analysis Date :-	16 Aug, 2019
Receipt Date :-	16 Aug, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	**5.3**	*6.5-8.5*	*ISO 10523:1994 (E)*
Turbidity	*NTU*	< 1	*5 (10) (Max)*	*2130 B, APHA,17th Ed.*
Electric conductivity	*µS/cm*	40	*1500 (Max)*	*ISO 7888:1985*
Total dissolved solids	*mg/L*	26	*1000 (Max)*	*Filtration & Evaporation*
Color	*TCU*	< 1	*5 (15) (Max)*	*ISO 7887:1994 (E), Section 3*
Lab.Temperature	^0C	29.0		*Thermometer*
CHEMICAL				
Chloride	*mg/L as Cl*	1	*250 (Max)*	*ISO 9297:1989*
Sulphate	*mg/L as* SO_4	1	*250 (Max)*	*4500-*SO_4^{2-} *E, APHA 17th Ed.*
Nitrate	*mg/L as* NO_3	6.5	*50 (Max)*	*Ion Selective*
Ammonia	*mg/L as* NH_3	< 0.04	*1.5 (Max)*	*4500-NH3C, APHA 17th edn*
Total Hardness	*mg/L as* $CaCO_3$	12	*500 (Max)*	*2340 C APHA 17th edn*
Calcium	*mg/L as Ca*	3	*200 (Max)*	*3500-Ca D APHA 17th edn*
Iron	*mg/L as Fe*	0.05	*0.3 (3)(Max)*	*ISO 8288:1998*
Manganese	*mg/L as Mn*	< 0.005	*0.2 (Max)*	*ISO 8288:1998*
Total Chlorine	*mg/L as Cl*	< 0.1	-	*4500-Cl G, APHA 17th Ed.*
Fluoride	*mg/L as F*	**< 0.5**	*0.5-1.5(Max)*	*Ion Selective*
Zinc	*mg/L as Zn*	< 0.1	*3 (Max)*	*3111, APHA 17th Ed.*
Copper	*mg/L as Cu*	< 0.1	*1 (Max)*	*3111, APHA 17th Ed.*
Cadmium	*mg/L as Cd*	< 0.003	*0.003 (Max)*	*3111, APHA 17th Ed.*
Chromium	*mg/L as Cr*	< 0.05	*0.05(Max)*	*3500-Cr, APHA 17th Ed.*
Cyanide	*mg/L as Cn*	< 0.07	*0.07 (Max)*	*4500-CN E APHA 17th Ed.*
Lead	*mg/L as Pb*	< 0.01	*0.01 (Max)*	*3111, APHA 17th Ed.*
Mercury	*ppb as Hg*	**3**	*1 (Max)*	*ISO 5666:1999*
Arsenic	*mg/L as As*	< 0.005	*0.05 (Max)*	*ISO 11969:1996*
Aluminium	*mg/L as Al*	< 0.1	*0.2 (Max)*	*3500-Al D, APHA 17th Ed.*
BACTERIOLOGICAL				
Total Coliform	*MPN index/100 ml*	Nil	Nil	*9221 B APHA 17th Edition*
E. coli	*MPN index/100 ml*	Nil	Nil	*9221 B APHA 17th Edition*

NDWQS= National Drinking Water Quality Standard (2062) ( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of **pH,Fluoride** and **Mercury** are found to be out of the limit of NDWQS.

Analyzed by: **Checked by:** **Authorized sign:**
25 Sep, 2019 **25 Sep, 2019**

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Pawan Marg-33, Maitidevi, Kathmandu, Nepal

WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	423/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Hetauda
Source :-	H5	Analysis Date :-	16 Aug, 2019
Receipt Date :-	16 Aug, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	**5.2**	*6.5-8.5*	*ISO 10523:1994 (E)*
Turbidity	*NTU*	< 1	*5 (10) (Max)*	*2130 B, APHA,17th Ed.*
Electric conductivity	*µS/cm*	38	*1500 (Max)*	*ISO 7888:1985*
Total dissolved solids	*mg/L*	25	*1000 (Max)*	*Filtration & Evaporation*
Color	*TCU*	< 1	*5 (15) (Max)*	*ISO 7887:1994 (E), Section 3*
Lab.Temperature	^0C	29.0		*Thermometer*
CHEMICAL				
Chloride	*mg/L as Cl*	1	*250 (Max)*	*ISO 9297:1989*
Sulphate	*mg/L as* SO_4	< 1	*250 (Max)*	*4500-*SO_4^{2-} *E, APHA 17th Ed.*
Nitrate	*mg/L as* NO_3	6.8	*50 (Max)*	*Ion Selective*
Ammonia	*mg/L as* NH_3	< 0.04	*1.5 (Max)*	*4500-NH3C, APHA 17th edn*
Total Hardness	*mg/L as* $CaCO_3$	12	*500 (Max)*	*2340 C APHA 17th edn*
Calcium	*mg/L as Ca*	3	*200 (Max)*	*3500-Ca D APHA 17th edn*
Iron	*mg/L as Fe*	0.03	*0.3 (3)(Max)*	*ISO 8288:1998*
Manganese	*mg/L as Mn*	0.023	*0.2 (Max)*	*ISO 8288:1998*
Total Chlorine	*mg/L as Cl*	< 0.1	-	*4500-Cl G, APHA 17th Ed.*
Fluoride	*mg/L as F*	**< 0.5**	*0.5-1.5(Max)*	*Ion Selective*
Zinc	*mg/L as Zn*	< 0.1	*3 (Max)*	*3111, APHA 17th Ed.*
Copper	*mg/L as Cu*	< 0.1	*1 (Max)*	*3111, APHA 17th Ed.*
Cadmium	*mg/L as Cd*	< 0.003	*0.003 (Max)*	*3111, APHA 17th Ed.*
Chromium	*mg/L as Cr*	< 0.05	*0.05(Max)*	*3500-Cr, APHA 17th Ed.*
Cyanide	*mg/L as Cn*	< 0.07	*0.07 (Max)*	*4500-CN E APHA 17th Ed.*
Lead	*mg/L as Pb*	< 0.01	*0.01 (Max)*	*3111, APHA 17th Ed.*
Mercury	*ppb as Hg*	**7**	*1 (Max)*	*ISO 5666:1999*
Arsenic	*mg/L as As*	< 0.005	*0.05 (Max)*	*ISO 11969:1996*
Aluminium	*mg/L as Al*	< 0.1	*0.2 (Max)*	*3500-Al D, APHA 17th Ed.*
BACTERIOLOGICAL				
Total Coliform	*MPN index/100 ml*	**4**	Nil	*9221 B APHA 17th Edition*
E. coli	*MPN index/100 ml*	**4**	Nil	*9221 B APHA 17th Edition*

NDWQS= National Drinking Water Quality Standard (2062)

( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of **pH, Fluoride, Mercury, Total Coliform** and ***E.coli*** are found to be out of the limit of NDWQS.

Analyzed by: **25 Sep, 2019** **Checked by:** **Authorized sign:** **25 Sep, 2019**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	424/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Hetauda
Source :-	H6	Analysis Date :-	16 Aug, 2019
Receipt Date :-	16 Aug, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	7.5	*6.5-8.5*	*ISO 10523:1994 (E)*
Turbidity	*NTU*	< 1	*5 (10) (Max)*	*2130 B, APHA,17th Ed.*
Electric conductivity	*µS/cm*	386	*1500 (Max)*	*ISO 7888:1985*
Total dissolved solids	*mg/L*	298	*1000 (Max)*	*Filtration & Evaporation*
Color	*TCU*	< 1	*5 (15) (Max)*	*ISO 7887:1994 (E), Section 3*
Lab.Temperature	^0C	29.0		*Thermometer*
CHEMICAL				
Chloride	*mg/L as Cl*	4	*250 (Max)*	*ISO 9297:1989*
Sulphate	*mg/L as* SO_4	19	*250 (Max)*	*4500-*SO_4^{2-} *E, APHA 17th Ed.*
Nitrate	*mg/L as* NO_3	20.8	*50 (Max)*	*Ion Selective*
Ammonia	*mg/L as* NH_3	< 0.04	*1.5 (Max)*	*4500-NH3C, APHA 17th edn*
Total Hardness	*mg/L as* $CaCO_3$	204	*500 (Max)*	*2340 C APHA 17th edn*
Calcium	*mg/L as Ca*	58	*200 (Max)*	*3500-Ca D APHA 17th edn*
Iron	*mg/L as Fe*	0.07	*0.3 (3)(Max)*	*ISO 8288:1998*
Manganese	*mg/L as Mn*	< 0.005	*0.2 (Max)*	*ISO 8288:1998*
Total Chlorine	*mg/L as Cl*	< 0.1	-	*4500-Cl G, APHA 17th Ed.*
Fluoride	*mg/L as F*	**< 0.5**	*0.5-1.5(Max)*	*Ion Selective*
Zinc	*mg/L as Zn*	0.4	*3 (Max)*	*3111, APHA 17th Ed.*
Copper	*mg/L as Cu*	< 0.1	*1 (Max)*	*3111, APHA 17th Ed.*
Cadmium	*mg/L as Cd*	< 0.003	*0.003 (Max)*	*3111, APHA 17th Ed.*
Chromium	*mg/L as Cr*	< 0.05	*0.05(Max)*	*3500-Cr, APHA 17th Ed.*
Cyanide	*mg/L as Cn*	< 0.07	*0.07 (Max)*	*4500-CN E APHA 17th Ed.*
Lead	*mg/L as Pb*	< 0.01	*0.01 (Max)*	*3111, APHA 17th Ed.*
Mercury	*ppb as Hg*	**5**	*1 (Max)*	*ISO 5666:1999*
Arsenic	*mg/L as As*	< 0.005	*0.05 (Max)*	*ISO 11969:1996*
Aluminium	*mg/L as Al*	< 0.1	*0.2 (Max)*	*3500-Al D, APHA 17th Ed.*
BACTERIOLOGICAL				
Total Coliform	*MPN index/100 ml*	**4**	Nil	*9221 B APHA 17th Edition*
E. coli	*MPN index/100 ml*	**4**	Nil	*9221 B APHA 17th Edition*

NDWQS= National Drinking Water Quality Standard (2062) ( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of **Fluoride, Mercury, Total Coliform** and ***E.coli*** are found to be out of the limit of NDWQS.

Analyzed by: **Checked by:** **Authorized sign:**
25 Sep, 2019 **25 Sep, 2019**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd.	Lab No. :-	1675/19
Collector :-	Yachiyo Engineering Co.,Ltd.	Location :-	Birgunj
Source :-	BR-1	Analysis Date :-	12 April, 2019
Receipt Date :-	12 April, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	7.2	6.5-8.5	ISO 10523:1994 (E)
Turbidity	NTU	1	5 (10) (Max)	2130 B, APHA,17th Ed.
Electric conductivity	$\mu S/cm$	394	1500 (Max)	ISO 7888:1985
Total dissolved solids	mg/L	232	1000 (Max)	Filtration & Evaporation
Color	TCU	< 1	5 (15) (Max)	ISO 7887:1994 (E), Section 3
Lab.Temperature	^0C	25.0		Thermometer
CHEMICAL				
Chloride	mg/L as Cl	1	250 (Max)	ISO 9297:1989
Sulphate	mg/L as SO_4	2	250 (Max)	4500-SO_4^{2-} E, APHA 17th Ed.
Nitrate	mg/L as NO_3	2.1	50 (Max)	Ion Selective
Ammonia	mg/L as NH_3	< 0.04	1.5 (Max)	4500-NH3C, APHA 17th edn
Total Hardness	mg/L as $CaCO_3$	192	500 (Max)	2340 C APHA 17th edn
Calcium	mg/L as Ca	59	200 (Max)	3500-Ca D APHA 17th edn
Iron	mg/L as Fe	0.17	0.3 (3)(Max)	ISO 8288:1998
Manganese	mg/L as Mn	**0.250**	0.2 (Max)	ISO 8288:1998
Total Chlorine	mg/L as Cl	< 0.1	-	4500-Cl G, APHA 17th Ed.
Fluoride	mg/L as F	**< 0.5**	0.5-1.5(Max)	Ion Selective
Zinc	mg/L as Zn	0.2	3 (Max)	3111, APHA 17th Ed.
Copper	mg/L as Cu	< 0.1	1 (Max)	3111, APHA 17th Ed.
Cadmium	mg/L as Cd	< 0.003	0.003 (Max)	3111, APHA 17th Ed.
Chromium	mg/L as Cr	< 0.05	0.05(Max)	3500-Cr, APHA 17th Ed.
Cyanide	mg/L as Cn	< 0.07	0.07 (Max)	4500-CN E APHA 17th Ed.
Lead	mg/L as Pb	< 0.01	0.01 (Max)	3111, APHA 17th Ed.
Mercury	ppb as Hg	**5**	1 (Max)	ISO 5666:1999
Arsenic	mg/L as As	0.008	0.05 (Max)	ISO 11969:1996
Aluminium	mg/L as Al	< 0.1	0.2 (Max)	3500-Al D, APHA 17th Ed.
BACTERIOLOGICAL				
Total Coliform	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition
E. coli	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition

NDWQS= National Drinking Water Quality Standard (2062) ( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of **Manganese, Fluoride** and **Mercury** are found to be out of the limit of NDWQS.

Analyzed by: **Checked by:** **Authorized sign:**
9 June, 2019 **9 June, 2019**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd.	Lab No. :-	1676/19
Collector :-	Yachiyo Engineering Co.,Ltd.	Location :-	Birgunj
Source :-	BR-2	Analysis Date :-	12 April, 2019
Receipt Date :-	12 April, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	7.4	6.5-8.5	ISO 10523:1994 (E)
Turbidity	NTU	1	5 (10) (Max)	2130 B, APHA,17th Ed.
Electric conductivity	$\mu S/cm$	404	1500 (Max)	ISO 7888:1985
Total dissolved solids	mg/L	268	1000 (Max)	Filtration & Evaporation
Color	TCU	< 1	5 (15) (Max)	ISO 7887:1994 (E), Section 3
Lab.Temperature	^0C	25.0		Thermometer
CHEMICAL				
Chloride	mg/L as Cl	1	250 (Max)	ISO 9297:1989
Sulphate	mg/L as SO_4	3	250 (Max)	4500-SO_4^{2-} E, APHA 17th Ed.
Nitrate	mg/L as NO_3	2.1	50 (Max)	Ion Selective
Ammonia	mg/L as NH_3	< 0.04	1.5 (Max)	4500-NH3C, APHA 17th edn
Total Hardness	mg/L as $CaCO_3$	200	500 (Max)	2340 C APHA 17th edn
Calcium	mg/L as Ca	62	200 (Max)	3500-Ca D APHA 17th edn
Iron	mg/L as Fe	0.26	0.3 (3)(Max)	ISO 8288:1998
Manganese	mg/L as Mn	**0.202**	0.2 (Max)	ISO 8288:1998
Total Chlorine	mg/L as Cl	< 0.1	-	4500-Cl G, APHA 17th Ed.
Fluoride	mg/L as F	**< 0.5**	0.5-1.5(Max)	Ion Selective
Zinc	mg/L as Zn	< 0.1	3 (Max)	3111, APHA 17th Ed.
Copper	mg/L as Cu	< 0.1	1 (Max)	3111, APHA 17th Ed.
Cadmium	mg/L as Cd	< 0.003	0.003 (Max)	3111, APHA 17th Ed.
Chromium	mg/L as Cr	< 0.05	0.05(Max)	3500-Cr, APHA 17th Ed.
Cyanide	mg/L as Cn	< 0.07	0.07 (Max)	4500-CN E APHA 17th Ed.
Lead	mg/L as Pb	< 0.01	0.01 (Max)	3111, APHA 17th Ed.
Mercury	ppb as Hg	8	1 (Max)	ISO 5666:1999
Arsenic	mg/L as As	0.007	0.05 (Max)	ISO 11969:1996
Aluminium	mg/L as Al	< 0.1	0.2 (Max)	3500-Al D, APHA 17th Ed.
BACTERIOLOGICAL				
Total Coliform	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition
E. coli	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition

NDWQS= National Drinking Water Quality Standard (2062) ( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of **Manganese, Fluoride** and **Mercury** are found to be out of the limit of NDWQS.

Analyzed by: **Checked by:** **Authorized sign:**
9 June, 2019 **9 June, 2019**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	1677/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Birgunj
Source :-	BR-3	Analysis Date :-	12 April, 2019
Receipt Date :-	12 April, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	7.6	6.5-8.5	ISO 10523:1994 (E)
Turbidity	NTU	1	5 (10) (Max)	2130 B, APHA,17th Ed.
Electric conductivity	$\mu S/cm$	400	1500 (Max)	ISO 7888:1985
Total dissolved solids	mg/L	233	1000 (Max)	Filtration & Evaporation
Color	TCU	< 1	5 (15) (Max)	ISO 7887:1994 (E), Section 3
Lab.Temperature	^0C	25.0		Thermometer
CHEMICAL				
Chloride	mg/L as Cl	1	250 (Max)	ISO 9297:1989
Sulphate	mg/L as SO_4	2	250 (Max)	4500-SO_4^{2-} E, APHA 17th Ed.
Nitrate	mg/L as NO_3	1.9	50 (Max)	Ion Selective
Ammonia	mg/L as NH_3	< 0.04	1.5 (Max)	4500-NH3C, APHA 17th edn
Total Hardness	mg/L as $CaCO_3$	196	500 (Max)	2340 C APHA 17th edn
Calcium	mg/L as Ca	59	200 (Max)	3500-Ca D APHA 17th edn
Iron	mg/L as Fe	**0.47**	0.3 (3)(Max)	ISO 8288:1998
Manganese	mg/L as Mn	0.071	0.2 (Max)	ISO 8288:1998
Total Chlorine	mg/L as Cl	< 0.1	-	4500-Cl G, APHA 17th Ed.
Fluoride	mg/L as F	**< 0.5**	0.5-1.5(Max)	Ion Selective
Zinc	mg/L as Zn	< 0.1	3 (Max)	3111, APHA 17th Ed.
Copper	mg/L as Cu	< 0.1	1 (Max)	3111, APHA 17th Ed.
Cadmium	mg/L as Cd	< 0.003	0.003 (Max)	3111, APHA 17th Ed.
Chromium	mg/L as Cr	< 0.05	0.05(Max)	3500-Cr, APHA 17th Ed.
Cyanide	mg/L as Cn	< 0.07	0.07 (Max)	4500-CN E APHA 17th Ed.
Lead	mg/L as Pb	< 0.01	0.01 (Max)	3111, APHA 17th Ed.
Mercury	ppb as Hg	**11**	1 (Max)	ISO 5666:1999
Arsenic	mg/L as As	0.007	0.05 (Max)	ISO 11969:1996
Aluminium	mg/L as Al	< 0.1	0.2 (Max)	3500-Al D, APHA 17th Ed.
BACTERIOLOGICAL				
Total Coliform	MPN index/100 ml	**9**	Nil	9221 B APHA 17th Edition
E. coli	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition

NDWQS= National Drinking Water Quality Standard (2062) ( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of **Iron, Fluoride, Mercury** and **Total Coliform** are found to be out of the limit of NDWQS.

Analyzed by: **9 June, 2019** **Checked by:** **Authorized sign:** **9 June, 2019**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co. Ltd	Lab No. :-	1678/19
Collector :-	Yachiyo Engineering Co. Ltd	Location :-	Birgunj
Source :-	BR-4	Analysis Date :-	12 April, 2019
Receipt Date :-	12 April, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	7.6	6.5-8.5	ISO 10523:1994 (E)
Turbidity	NTU	1	5 (10) (Max)	2130 B, APHA,17th Ed.
Electric conductivity	$\mu S/cm$	400	1500 (Max)	ISO 7888:1985
Total dissolved solids	mg/L	266	1000 (Max)	Filtration & Evaporation
Color	TCU	< 1	5 (15) (Max)	ISO 7887:1994 (E), Section 3
Lab.Temperature	^0C	25.0		Thermometer
CHEMICAL				
Chloride	mg/L as Cl	1	250 (Max)	ISO 9297:1989
Sulphate	mg/L as SO_4	3	250 (Max)	4500-SO_4^{2-} E, APHA 17th Ed.
Nitrate	mg/L as NO_3	1.7	50 (Max)	Ion Selective
Ammonia	mg/L as NH_3	< 0.04	1.5 (Max)	4500-NH3C, APHA 17th edn
Total Hardness	mg/L as $CaCO_3$	192	500 (Max)	2340 C APHA 17th edn
Calcium	mg/L as Ca	58	200 (Max)	3500-Ca D APHA 17th edn
Iron	mg/L as Fe	0.17	0.3 (3)(Max)	ISO 8288:1998
Manganese	mg/L as Mn	0.048	0.2 (Max)	ISO 8288:1998
Total Chlorine	mg/L as Cl	< 0.1	-	4500-Cl G, APHA 17th Ed.
Fluoride	mg/L as F	**< 0.5**	0.5-1.5(Max)	Ion Selective
Zinc	mg/L as Zn	< 0.1	3 (Max)	3111, APHA 17th Ed.
Copper	mg/L as Cu	< 0.1	1 (Max)	3111, APHA 17th Ed.
Cadmium	mg/L as Cd	< 0.003	0.003 (Max)	3111, APHA 17th Ed.
Chromium	mg/L as Cr	< 0.05	0.05(Max)	3500-Cr, APHA 17th Ed.
Cyanide	mg/L as Cn	< 0.07	0.07 (Max)	4500-CN E APHA 17th Ed.
Lead	mg/L as Pb	< 0.01	0.01 (Max)	3111, APHA 17th Ed.
Mercury	ppb as Hg	**6**	1 (Max)	ISO 5666:1999
Arsenic	mg/L as As	0.007	0.05 (Max)	ISO 11969:1996
Aluminium	mg/L as Al	< 0.1	0.2 (Max)	3500-Al D, APHA 17th Ed.
BACTERIOLOGICAL				
Total Coliform	MPN index/100 ml	**43**	Nil	9221 B APHA 17th Edition
E. coli	MPN index/100 ml	**4**	Nil	9221 B APHA 17th Edition

NDWQS= National Drinking Water Quality Standard (2062) ( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of **Fluoride, Mercury, Total Coliform** and ***E.coli*** are found to be out of the limit of NDWQS.

Analyzed by: **Checked by:** **Authorized sign:**
9 June, 2019 **9 June, 2019**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co. Ltd	Lab No. :-	1679/19
Collector :-	Yachiyo Engineering Co.,Ltd.	Location :-	Birgunj
Source :-	BR-5	Analysis Date :-	12 April, 2019
Receipt Date :-	12 April, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	7.6	6.5-8.5	ISO 10523:1994 (E)
Turbidity	NTU	1	5 (10) (Max)	2130 B, APHA,17th Ed.
Electric conductivity	$\mu S/cm$	368	1500 (Max)	ISO 7888:1985
Total dissolved solids	mg/L	212	1000 (Max)	Filtration & Evaporation
Color	TCU	< 1	5 (15) (Max)	ISO 7887:1994 (E), Section 3
Lab.Temperature	^0C	25.0		Thermometer
CHEMICAL				
Chloride	mg/L as Cl	1	250 (Max)	ISO 9297:1989
Sulphate	mg/L as SO_4	2	250 (Max)	4500-SO_4^{2-} E, APHA 17th Ed.
Nitrate	mg/L as NO_3	1.5	50 (Max)	Ion Selective
Ammonia	mg/L as NH_3	< 0.04	1.5 (Max)	4500-NH3C, APHA 17th edn
Total Hardness	mg/L as $CaCO_3$	177	500 (Max)	2340 C APHA 17th edn
Calcium	mg/L as Ca	54	200 (Max)	3500-Ca D APHA 17th edn
Iron	mg/L as Fe	0.23	0.3 (3)(Max)	ISO 8288:1998
Manganese	mg/L as Mn	0.119	0.2 (Max)	ISO 8288:1998
Total Chlorine	mg/L as Cl	< 0.1	-	4500-Cl G, APHA 17th Ed.
Fluoride	mg/L as F	**< 0.5**	0.5-1.5(Max)	Ion Selective
Zinc	mg/L as Zn	< 0.1	3 (Max)	3111, APHA 17th Ed.
Copper	mg/L as Cu	< 0.1	1 (Max)	3111, APHA 17th Ed.
Cadmium	mg/L as Cd	< 0.003	0.003 (Max)	3111, APHA 17th Ed.
Chromium	mg/L as Cr	< 0.05	0.05(Max)	3500-Cr, APHA 17th Ed.
Cyanide	mg/L as Cn	< 0.07	0.07 (Max)	4500-CN E APHA 17th Ed.
Lead	mg/L as Pb	< 0.01	0.01 (Max)	3111, APHA 17th Ed.
Mercury	ppb as Hg	**3**	1 (Max)	ISO 5666:1999
Arsenic	mg/L as As	0.005	0.05 (Max)	ISO 11969:1996
Aluminium	mg/L as Al	< 0.1	0.2 (Max)	3500-Al D, APHA 17th Ed.
BACTERIOLOGICAL				
Total Coliform	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition
E. coli	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition

NDWQS= National Drinking Water Quality Standard (2062) ( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of all the tested parameters are found to be within the limit of NDWQS, except that of **Fluoride** and **Mercury.**

Analyzed by: **Checked by:** **Authorized sign:**
9 June, 2019 **9 June, 2019**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	1680/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Birgunj
Source :-	BR-6	Analysis Date :-	12 April, 2019
Receipt Date :-	12 April, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	7.6	6.5-8.5	ISO 10523:1994 (E)
Turbidity	NTU	1	5 (10) (Max)	2130 B, APHA,17th Ed.
Electric conductivity	$\mu S/cm$	340	1500 (Max)	ISO 7888:1985
Total dissolved solids	mg/L	211	1000 (Max)	Filtration & Evaporation
Color	TCU	< 1	5 (15) (Max)	ISO 7887:1994 (E), Section 3
Lab.Temperature	^0C	25.0		Thermometer
CHEMICAL				
Chloride	mg/L as Cl	1	250 (Max)	ISO 9297:1989
Sulphate	mg/L as SO_4	3	250 (Max)	4500-SO_4^{2-} E, APHA 17th Ed.
Nitrate	mg/L as NO_3	1.5	50 (Max)	Ion Selective
Ammonia	mg/L as NH_3	< 0.04	1.5 (Max)	4500-NH3C, APHA 17th edn
Total Hardness	mg/L as $CaCO_3$	161	500 (Max)	2340 C APHA 17th edn
Calcium	mg/L as Ca	45	200 (Max)	3500-Ca D APHA 17th edn
Iron	mg/L as Fe	**0.40**	0.3 (3)(Max)	ISO 8288:1998
Manganese	mg/L as Mn	0.119	0.2 (Max)	ISO 8288:1998
Total Chlorine	mg/L as Cl	< 0.1	-	4500-Cl G, APHA 17th Ed.
Fluoride	mg/L as F	**< 0.5**	0.5-1.5(Max)	Ion Selective
Zinc	mg/L as Zn	< 0.1	3 (Max)	3111, APHA 17th Ed.
Copper	mg/L as Cu	< 0.1	1 (Max)	3111, APHA 17th Ed.
Cadmium	mg/L as Cd	< 0.003	0.003 (Max)	3111, APHA 17th Ed.
Chromium	mg/L as Cr	< 0.05	0.05(Max)	3500-Cr, APHA 17th Ed.
Cyanide	mg/L as Cn	< 0.07	0.07 (Max)	4500-CN E APHA 17th Ed.
Lead	mg/L as Pb	< 0.01	0.01 (Max)	3111, APHA 17th Ed.
Mercury	ppb as Hg	**3**	1 (Max)	ISO 5666:1999
Arsenic	mg/L as As	0.006	0.05 (Max)	ISO 11969:1996
Aluminium	mg/L as Al	< 0.1	0.2 (Max)	3500-Al D, APHA 17th Ed.
BACTERIOLOGICAL				
Total Coliform	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition
E. coli	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition

NDWQS= National Drinking Water Quality Standard (2062)

( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of **Iron, Fluoride** and **Mercury** are found to be out of the limit of NDWQS.

Analyzed by: **Checked by:** **Authorized sign:**
9 June, 2019 **9 June, 2019**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	434/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Birgunj
Source :-	BR1	Analysis Date :-	19 Aug, 2019
Receipt Date :-	19 Aug, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	7.9	6.5-8.5	ISO 10523:1994 (E)
Turbidity	NTU	< 1	5 (10) (Max)	2130 B, APHA,17th Ed.
Electric conductivity	$\mu S/cm$	403	1500 (Max)	ISO 7888:1985
Total dissolved solids	mg/L	220	1000 (Max)	Filtration & Evaporation
Color	TCU	< 1	5 (15) (Max)	ISO 7887:1994 (E), Section 3
Lab.Temperature	^0C	28.0		Thermometer
CHEMICAL				
Chloride	mg/L as Cl	1	250 (Max)	ISO 9297:1989
Sulphate	mg/L as SO_4	3	250 (Max)	4500-SO_4^{2-} E, APHA 17th Ed.
Nitrate	mg/L as NO_3	8.9	50 (Max)	Ion Selective
Ammonia	mg/L as NH_3	0.26	1.5 (Max)	4500-NH3C, APHA 17th edn
Total Hardness	mg/L as $CaCO_3$	181	500 (Max)	2340 C APHA 17th edn
Calcium	mg/L as Ca	59	200 (Max)	3500-Ca D APHA 17th edn
Iron	mg/L as Fe	0.19	0.3 (3)(Max)	ISO 8288:1998
Manganese	mg/L as Mn	**0.244**	0.2 (Max)	ISO 8288:1998
Total Chlorine	mg/L as Cl	< 0.1	-	4500-Cl G, APHA 17th Ed.
Fluoride	mg/L as F	**< 0.5**	0.5-1.5(Max)	Ion Selective
Zinc	mg/L as Zn	0.2	3 (Max)	3111, APHA 17th Ed.
Copper	mg/L as Cu	< 0.1	1 (Max)	3111, APHA 17th Ed.
Cadmium	mg/L as Cd	< 0.003	0.003 (Max)	3111, APHA 17th Ed.
Chromium	mg/L as Cr	< 0.05	0.05(Max)	3500-Cr, APHA 17th Ed.
Cyanide	mg/L as Cn	< 0.07	0.07 (Max)	4500-CN E APHA 17th Ed.
Lead	mg/L as Pb	< 0.01	0.01 (Max)	3111, APHA 17th Ed.
Mercury	ppb as Hg	**5**	1 (Max)	ISO 5666:1999
Arsenic	mg/L as As	< 0.005	0.05 (Max)	ISO 11969:1996
Aluminium	mg/L as Al	< 0.1	0.2 (Max)	3500-Al D, APHA 17th Ed.
BACTERIOLOGICAL				
Total Coliform	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition
E. coli	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition

NDWQS= National Drinking Water Quality Standard (2062) ( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of **Manganese, Fluoride** and **Mercury** are found to be out of the limit of NDWQS.

Analyzed by: **Checked by:** **Authorized sign:**
25 Sep, 2019 **25 Sep, 2019**

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(Water Analysis, Treatment Consultancy & Environment Research)

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Pawan Marg-33, Maitidevi, Kathmandu, Nepal

WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	435/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Birgunj
Source :-	BR2	Analysis Date :-	19 Aug, 2019
Receipt Date :-	19 Aug, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	7.8	6.5-8.5	ISO 10523:1994 (E)
Turbidity	NTU	< 1	5 (10) (Max)	2130 B, APHA,17th Ed.
Electric conductivity	$\mu S/cm$	414	1500 (Max)	ISO 7888:1985
Total dissolved solids	mg/L	270	1000 (Max)	Filtration & Evaporation
Color	TCU	< 1	5 (15) (Max)	ISO 7887:1994 (E), Section 3
Lab.Temperature	^0C	28.0		Thermometer
CHEMICAL				
Chloride	mg/L as Cl	1	250 (Max)	ISO 9297:1989
Sulphate	mg/L as SO_4	3	250 (Max)	4500-SO_4^{2-} E, APHA 17th Ed.
Nitrate	mg/L as NO_3	8.8	50 (Max)	Ion Selective
Ammonia	mg/L as NH_3	0.10	1.5 (Max)	4500-NH3C, APHA 17th edn
Total Hardness	mg/L as $CaCO_3$	200	500 (Max)	2340 C APHA 17th edn
Calcium	mg/L as Ca	62	200 (Max)	3500-Ca D APHA 17th edn
Iron	mg/L as Fe	0.28	0.3 (3)(Max)	ISO 8288:1998
Manganese	mg/L as Mn	0.198	0.2 (Max)	ISO 8288:1998
Total Chlorine	mg/L as Cl	< 0.1	-	4500-Cl G, APHA 17th Ed.
Fluoride	mg/L as F	**< 0.5**	0.5-1.5(Max)	Ion Selective
Zinc	mg/L as Zn	0.1	3 (Max)	3111, APHA 17th Ed.
Copper	mg/L as Cu	< 0.1	1 (Max)	3111, APHA 17th Ed.
Cadmium	mg/L as Cd	< 0.003	0.003 (Max)	3111, APHA 17th Ed.
Chromium	mg/L as Cr	< 0.05	0.05(Max)	3500-Cr, APHA 17th Ed.
Cyanide	mg/L as Cn	< 0.07	0.07 (Max)	4500-CN E APHA 17th Ed.
Lead	mg/L as Pb	< 0.01	0.01 (Max)	3111, APHA 17th Ed.
Mercury	ppb as Hg	8	1 (Max)	ISO 5666:1999
Arsenic	mg/L as As	< 0.005	0.05 (Max)	ISO 11969:1996
Aluminium	mg/L as Al	< 0.1	0.2 (Max)	3500-Al D, APHA 17th Ed.
BACTERIOLOGICAL				
Total Coliform	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition
E. coli	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition

NDWQS= National Drinking Water Quality Standard (2062) ( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of **Fluoride** and **Mercury** are found to be out of the limit of NDWQS.

Analyzed by: **Checked by:** **Authorized sign:**
25 Sep, 2019 **25 Sep, 2019**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	436/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Birgunj
Source :-	BR3	Analysis Date :-	19 Aug, 2019
Receipt Date :-	19 Aug, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	8.0	6.5-8.5	ISO 10523:1994 (E)
Turbidity	NTU	< 1	5 (10) (Max)	2130 B, APHA,17th Ed.
Electric conductivity	$\mu S/cm$	412	1500 (Max)	ISO 7888:1985
Total dissolved solids	mg/L	283	1000 (Max)	Filtration & Evaporation
Color	TCU	< 1	5 (15) (Max)	ISO 7887:1994 (E), Section 3
Lab.Temperature	^0C	28.0		Thermometer
CHEMICAL				
Chloride	mg/L as Cl	2	250 (Max)	ISO 9297:1989
Sulphate	mg/L as SO_4	3	250 (Max)	4500-SO_4^{2-} E, APHA 17th Ed.
Nitrate	mg/L as NO_3	8.1	50 (Max)	Ion Selective
Ammonia	mg/L as NH_3	0.08	1.5 (Max)	4500-NH3C, APHA 17th edn
Total Hardness	mg/L as $CaCO_3$	200	500 (Max)	2340 C APHA 17th edn
Calcium	mg/L as Ca	58	200 (Max)	3500-Ca D APHA 17th edn
Iron	mg/L as Fe	0.17	0.3 (3)(Max)	ISO 8288:1998
Manganese	mg/L as Mn	0.058	0.2 (Max)	ISO 8288:1998
Total Chlorine	mg/L as Cl	< 0.1	-	4500-Cl G, APHA 17th Ed.
Fluoride	mg/L as F	**< 0.5**	0.5-1.5(Max)	Ion Selective
Zinc	mg/L as Zn	< 0.1	3 (Max)	3111, APHA 17th Ed.
Copper	mg/L as Cu	< 0.1	1 (Max)	3111, APHA 17th Ed.
Cadmium	mg/L as Cd	< 0.003	0.003 (Max)	3111, APHA 17th Ed.
Chromium	mg/L as Cr	< 0.05	0.05(Max)	3500-Cr, APHA 17th Ed.
Cyanide	mg/L as Cn	< 0.07	0.07 (Max)	4500-CN E APHA 17th Ed.
Lead	mg/L as Pb	< 0.01	0.01 (Max)	3111, APHA 17th Ed.
Mercury	ppb as Hg	**11**	1 (Max)	ISO 5666:1999
Arsenic	mg/L as As	< 0.005	0.05 (Max)	ISO 11969:1996
Aluminium	mg/L as Al	< 0.1	0.2 (Max)	3500-Al D, APHA 17th Ed.
BACTERIOLOGICAL				
Total Coliform	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition
E. coli	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition

NDWQS= National Drinking Water Quality Standard (2062) ( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of **Fluoride** and **Mercury** are found to be out of the limit of NDWQS.

Analyzed by: **Checked by:** **Authorized sign:**
25 Sep, 2019 **25 Sep, 2019**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	437/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Birgunj
Source :-	BR4	Analysis Date :-	19 Aug, 2019
Receipt Date :-	19 Aug, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	8.0	6.5-8.5	ISO 10523:1994 (E)
Turbidity	NTU	< 1	5 (10) (Max)	2130 B, APHA,17th Ed.
Electric conductivity	$\mu S/cm$	412	1500 (Max)	ISO 7888:1985
Total dissolved solids	mg/L	222	1000 (Max)	Filtration & Evaporation
Color	TCU	< 1	5 (15) (Max)	ISO 7887:1994 (E), Section 3
Lab.Temperature	^0C	28.0		Thermometer
CHEMICAL				
Chloride	mg/L as Cl	2	250 (Max)	ISO 9297:1989
Sulphate	mg/L as SO_4	6	250 (Max)	4500-SO_4^{2-} E, APHA 17th Ed.
Nitrate	mg/L as NO_3	9.9	50 (Max)	Ion Selective
Ammonia	mg/L as NH_3	0.02	1.5 (Max)	4500-NH3C, APHA 17th edn
Total Hardness	mg/L as $CaCO_3$	194	500 (Max)	2340 C APHA 17th edn
Calcium	mg/L as Ca	58	200 (Max)	3500-Ca D APHA 17th edn
Iron	mg/L as Fe	0.09	0.3 (3)(Max)	ISO 8288:1998
Manganese	mg/L as Mn	0.012	0.2 (Max)	ISO 8288:1998
Total Chlorine	mg/L as Cl	< 0.1	-	4500-Cl G, APHA 17th Ed.
Fluoride	mg/L as F	**< 0.5**	0.5-1.5(Max)	Ion Selective
Zinc	mg/L as Zn	0.1	3 (Max)	3111, APHA 17th Ed.
Copper	mg/L as Cu	< 0.1	1 (Max)	3111, APHA 17th Ed.
Cadmium	mg/L as Cd	< 0.003	0.003 (Max)	3111, APHA 17th Ed.
Chromium	mg/L as Cr	< 0.05	0.05(Max)	3500-Cr, APHA 17th Ed.
Cyanide	mg/L as Cn	< 0.07	0.07 (Max)	4500-CN E APHA 17th Ed.
Lead	mg/L as Pb	< 0.01	0.01 (Max)	3111, APHA 17th Ed.
Mercury	ppb as Hg	**6**	1 (Max)	ISO 5666:1999
Arsenic	mg/L as As	< 0.005	0.05 (Max)	ISO 11969:1996
Aluminium	mg/L as Al	< 0.1	0.2 (Max)	3500-Al D, APHA 17th Ed.
BACTERIOLOGICAL				
Total Coliform	MPN index/100 ml	**1.1×10^3**	Nil	9221 B APHA 17th Edition
E. coli	MPN index/100 ml	**43**	Nil	9221 B APHA 17th Edition

NDWQS= National Drinking Water Quality Standard (2062) ( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of **Fluoride, Mercury, Total Coliform** and ***E.coli*** are found to be out of the limit of NDWQS.

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	438/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Birgunj
Source :-	BR5	Analysis Date :-	19 Aug, 2019
Receipt Date :-	19 Aug, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	7.9	*6.5-8.5*	*ISO 10523:1994 (E)*
Turbidity	*NTU*	< 1	*5 (10) (Max)*	*2130 B, APHA,17th Ed.*
Electric conductivity	*µS/cm*	397	*1500 (Max)*	*ISO 7888:1985*
Total dissolved solids	*mg/L*	217	*1000 (Max)*	*Filtration & Evaporation*
Color	*TCU*	< 1	*5 (15) (Max)*	*ISO 7887:1994 (E), Section 3*
Lab.Temperature	^0C	28.0		*Thermometer*
CHEMICAL				
Chloride	*mg/L as Cl*	2	*250 (Max)*	*ISO 9297:1989*
Sulphate	*mg/L as* SO_4	4	*250 (Max)*	*4500-*SO_4^{2-} *E, APHA 17th Ed.*
Nitrate	*mg/L as* NO_3	9.2	*50 (Max)*	*Ion Selective*
Ammonia	*mg/L as* NH_3	0.04	*1.5 (Max)*	*4500-NH3C, APHA 17th edn*
Total Hardness	*mg/L as* $CaCO_3$	190	*500 (Max)*	*2340 C APHA 17th edn*
Calcium	*mg/L as Ca*	54	*200 (Max)*	*3500-Ca D APHA 17th edn*
Iron	*mg/L as Fe*	0.26	*0.3 (3)(Max)*	*ISO 8288:1998*
Manganese	*mg/L as Mn*	0.151	*0.2 (Max)*	*ISO 8288:1998*
Total Chlorine	*mg/L as Cl*	< 0.1	-	*4500-Cl G, APHA 17th Ed.*
Fluoride	*mg/L as F*	**< 0.5**	*0.5-1.5(Max)*	*Ion Selective*
Zinc	*mg/L as Zn*	0.1	*3 (Max)*	*3111, APHA 17th Ed.*
Copper	*mg/L as Cu*	< 0.1	*1 (Max)*	*3111, APHA 17th Ed.*
Cadmium	*mg/L as Cd*	< 0.003	*0.003 (Max)*	*3111, APHA 17th Ed.*
Chromium	*mg/L as Cr*	< 0.05	*0.05(Max)*	*3500-Cr, APHA 17th Ed.*
Cyanide	*mg/L as Cn*	< 0.07	*0.07 (Max)*	*4500-CN E APHA 17th Ed.*
Lead	*mg/L as Pb*	< 0.01	*0.01 (Max)*	*3111, APHA 17th Ed.*
Mercury	*ppb as Hg*	**3**	*1 (Max)*	*ISO 5666:1999*
Arsenic	*mg/L as As*	< 0.005	*0.05 (Max)*	*ISO 11969:1996*
Aluminium	*mg/L as Al*	< 0.1	*0.2 (Max)*	*3500-Al D, APHA 17th Ed.*
BACTERIOLOGICAL				
Total Coliform	*MPN index/100 ml*	**1.1×10^3**	Nil	*9221 B APHA 17th Edition*
E. coli	*MPN index/100 ml*	**43**	Nil	*9221 B APHA 17th Edition*

NDWQS= National Drinking Water Quality Standard (2062) ( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of **Fluoride, Mercury, Total Coliform** and ***E.coli*** are found to be out of the limit of NDWQS.

Analyzed by: **Checked by:** **Authorized sign:**
25 Sep, 2019 **25 Sep, 2019**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	439/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Birgunj
Source :-	BR6	Analysis Date :-	19 Aug, 2019
Receipt Date :-	19 Aug, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	8.0	6.5-8.5	ISO 10523:1994 (E)
Turbidity	NTU	< 1	5 (10) (Max)	2130 B, APHA,17th Ed.
Electric conductivity	$\mu S/cm$	350	1500 (Max)	ISO 7888:1985
Total dissolved solids	mg/L	266	1000 (Max)	Filtration & Evaporation
Color	TCU	< 1	5 (15) (Max)	ISO 7887:1994 (E), Section 3
Lab.Temperature	^0C	28.0		Thermometer
CHEMICAL				
Chloride	mg/L as Cl	1	250 (Max)	ISO 9297:1989
Sulphate	mg/L as SO_4	6	250 (Max)	4500-SO_4^{2-} E, APHA 17th Ed.
Nitrate	mg/L as NO_3	8.2	50 (Max)	Ion Selective
Ammonia	mg/L as NH_3	0.12	1.5 (Max)	4500-NH3C, APHA 17th edn
Total Hardness	mg/L as $CaCO_3$	165	500 (Max)	2340 C APHA 17th edn
Calcium	mg/L as Ca	47	200 (Max)	3500-Ca D APHA 17th edn
Iron	mg/L as Fe	0.25	0.3 (3)(Max)	ISO 8288:1998
Manganese	mg/L as Mn	0.093	0.2 (Max)	ISO 8288:1998
Total Chlorine	mg/L as Cl	< 0.1	-	4500-Cl G, APHA 17th Ed.
Fluoride	mg/L as F	**< 0.5**	0.5-1.5(Max)	Ion Selective
Zinc	mg/L as Zn	< 0.1	3 (Max)	3111, APHA 17th Ed.
Copper	mg/L as Cu	< 0.1	1 (Max)	3111, APHA 17th Ed.
Cadmium	mg/L as Cd	< 0.003	0.003 (Max)	3111, APHA 17th Ed.
Chromium	mg/L as Cr	< 0.05	0.05(Max)	3500-Cr, APHA 17th Ed.
Cyanide	mg/L as Cn	< 0.07	0.07 (Max)	4500-CN E APHA 17th Ed.
Lead	mg/L as Pb	< 0.01	0.01 (Max)	3111, APHA 17th Ed.
Mercury	ppb as Hg	**3**	1 (Max)	ISO 5666:1999
Arsenic	mg/L as As	< 0.005	0.05 (Max)	ISO 11969:1996
Aluminium	mg/L as Al	< 0.1	0.2 (Max)	3500-Al D, APHA 17th Ed.
BACTERIOLOGICAL				
Total Coliform	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition
E. coli	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition

NDWQS= National Drinking Water Quality Standard (2062) ( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of **Fluoride** and **Mercury** are found to be out of the limit of NDWQS.

Analyzed by: **Checked by:** **Authorized sign:**
25 Sep, 2019 **25 Sep, 2019**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	1691/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Janakpur
Source :-	J-1	Analysis Date :-	18 April, 2019
Receipt Date :-	18 April, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	**6.4**	*6.5-8.5*	*ISO 10523:1994 (E)*
Turbidity	*NTU*	< 1	*5 (10) (Max)*	*2130 B, APHA,17th Ed.*
Electric conductivity	*µS/cm*	216	*1500 (Max)*	*ISO 7888:1985*
Total dissolved solids	*mg/L*	142	*1000 (Max)*	*Filtration & Evaporation*
Color	*TCU*	< 1	*5 (15) (Max)*	*ISO 7887:1994 (E), Section 3*
Lab.Temperature	^0C	23.0		*Thermometer*
CHEMICAL				
Chloride	*mg/L as Cl*	2	*250 (Max)*	*ISO 9297:1989*
Sulphate	*mg/L as* SO_4	3	*250 (Max)*	*4500-*SO_4^{2-} *E, APHA 17th Ed.*
Nitrate	*mg/L as* NO_3	2.0	*50 (Max)*	*Ion Selective*
Ammonia	*mg/L as* NH_3	0.04	*1.5 (Max)*	*4500-NH3C, APHA 17th edn*
Total Hardness	*mg/L as* $CaCO_3$	86	*500 (Max)*	*2340 C APHA 17th edn*
Calcium	*mg/L as Ca*	25	*200 (Max)*	*3500-Ca D APHA 17th edn*
Iron	*mg/L as Fe*	0.07	*0.3 (3)(Max)*	*ISO 8288:1998*
Manganese	*mg/L as Mn*	< 0.005	*0.2 (Max)*	*ISO 8288:1998*
Total Chlorine	*mg/L as Cl*	< 0.1	-	*4500-Cl G, APHA 17th Ed.*
Fluoride	*mg/L as F*	**< 0.5**	*0.5-1.5(Max)*	*Ion Selective*
Zinc	*mg/L as Zn*	< 0.1	*3 (Max)*	*3111, APHA 17th Ed.*
Copper	*mg/L as Cu*	< 0.1	*1 (Max)*	*3111, APHA 17th Ed.*
Cadmium	*mg/L as Cd*	< 0.003	*0.003 (Max)*	*3111, APHA 17th Ed.*
Chromium	*mg/L as Cr*	< 0.05	*0.05(Max)*	*3500-Cr, APHA 17th Ed.*
Cyanide	*mg/L as Cn*	< 0.07	*0.07 (Max)*	*4500-CN E APHA 17th Ed.*
Lead	*mg/L as Pb*	< 0.01	*0.01 (Max)*	*3111, APHA 17th Ed.*
Mercury	*ppb as Hg*	8	*1 (Max)*	*ISO 5666:1999*
Arsenic	*mg/L as As*	0.005	*0.05 (Max)*	*ISO 11969:1996*
Aluminium	*mg/L as Al*	< 0.1	*0.2 (Max)*	*3500-Al D, APHA 17th Ed.*
BACTERIOLOGICAL				
Total Coliform	*MPN index/100 ml*	**93**	Nil	*9221 B APHA 17th Edition*
E. coli	*MPN index/100 ml*	**9**	Nil	*9221 B APHA 17th Edition*

NDWQS= National Drinking Water Quality Standard (2062) ( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of **pH, Fluoride, Mercury, Total Coliform** and ***E.coli*** are found to be out of the limit of NDWQS.

Analyzed by: **Checked by:** **Authorized sign:**
9 June, 2019 **9 June, 2019**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No.:-	1692/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Janakpur
Source :-	J-2	Analysis Date :-	18 April, 2019
Receipt Date :-	18 April, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	**5.9**	*6.5-8.5*	*ISO 10523:1994 (E)*
Turbidity	*NTU*	< 1	*5 (10) (Max)*	*2130 B, APHA,17th Ed.*
Electric conductivity	*µS/cm*	210	*1500 (Max)*	*ISO 7888:1985*
Total dissolved solids	*mg/L*	129	*1000 (Max)*	*Filtration & Evaporation*
Color	*TCU*	< 1	*5 (15) (Max)*	*ISO 7887:1994 (E), Section 3*
Lab.Temperature	^0C	23.0		*Thermometer*
CHEMICAL				
Chloride	*mg/L as Cl*	2	*250 (Max)*	*ISO 9297:1989*
Sulphate	*mg/L as* SO_4	< 1	*250 (Max)*	*4500-*SO_4^{2-} *E, APHA 17th Ed.*
Nitrate	*mg/L as* NO_3	2.0	*50 (Max)*	*Ion Selective*
Ammonia	*mg/L as* NH_3	< 0.04	*1.5 (Max)*	*4500-NH3C, APHA 17th edn*
Total Hardness	*mg/L as* $CaCO_3$	78	*500 (Max)*	*2340 C APHA 17th edn*
Calcium	*mg/L as Ca*	25	*200 (Max)*	*3500-Ca D APHA 17th edn*
Iron	*mg/L as Fe*	< 0.03	*0.3 (3)(Max)*	*ISO 8288:1998*
Manganese	*mg/L as Mn*	< 0.005	*0.2 (Max)*	*ISO 8288:1998*
Total Chlorine	*mg/L as Cl*	< 0.1	-	*4500-Cl G, APHA 17th Ed.*
Fluoride	*mg/L as F*	**< 0.5**	*0.5-1.5(Max)*	*Ion Selective*
Zinc	*mg/L as Zn*	< 0.1	*3 (Max)*	*3111, APHA 17th Ed.*
Copper	*mg/L as Cu*	< 0.1	*1 (Max)*	*3111, APHA 17th Ed.*
Cadmium	*mg/L as Cd*	< 0.003	*0.003 (Max)*	*3111, APHA 17th Ed.*
Chromium	*mg/L as Cr*	< 0.05	*0.05(Max)*	*3500-Cr, APHA 17th Ed.*
Cyanide	*mg/L as Cn*	< 0.07	*0.07 (Max)*	*4500-CN E APHA 17th Ed.*
Lead	*mg/L as Pb*	< 0.01	*0.01 (Max)*	*3111, APHA 17th Ed.*
Mercury	*ppb as Hg*	**2**	*1 (Max)*	*ISO 5666:1999*
Arsenic	*mg/L as As*	0.005	*0.05 (Max)*	*ISO 11969:1996*
Aluminium	*mg/L as Al*	< 0.1	*0.2 (Max)*	*3500-Al D, APHA 17th Ed.*
BACTERIOLOGICAL				
Total Coliform	*MPN index/100 ml*	Nil	Nil	*9221 B APHA 17th Edition*
E. coli	*MPN index/100 ml*	Nil	Nil	*9221 B APHA 17th Edition*

NDWQS= National Drinking Water Quality Standard (2062) ( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of **pH,Fluoride** and **Mercury** are found to be out of the limit of NDWQS.

Analyzed by: **Checked by:** **Authorized sign:**
9 June, 2019 **9 June, 2019**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	1693/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Janakpur
Source :-	J-3	Analysis Date :-	18 April, 2019
Receipt Date :-	18 April, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	**6.3**	*6.5-8.5*	*ISO 10523:1994 (E)*
Turbidity	*NTU*	< 1	*5 (10) (Max)*	*2130 B, APHA,17th Ed.*
Electric conductivity	*µS/cm*	241	*1500 (Max)*	*ISO 7888:1985*
Total dissolved solids	*mg/L*	165	*1000 (Max)*	*Filtration & Evaporation*
Color	*TCU*	< 1	*5 (15) (Max)*	*ISO 7887:1994 (E), Section 3*
Lab.Temperature	*^{0}C*	23.0		*Thermometer*
CHEMICAL				
Chloride	*mg/L as Cl*	2	*250 (Max)*	*ISO 9297:1989*
Sulphate	*mg/L as SO_4*	3	*250 (Max)*	*4500-SO_4^{2-} E, APHA 17th Ed.*
Nitrate	*mg/L as NO_3*	2.2	*50 (Max)*	*Ion Selective*
Ammonia	*mg/L as NH_3*	0.06	*1.5 (Max)*	*4500-NH3C, APHA 17th edn*
Total Hardness	*mg/L as $CaCO_3$*	94	*500 (Max)*	*2340 C APHA 17th edn*
Calcium	*mg/L as Ca*	26	*200 (Max)*	*3500-Ca D APHA 17th edn*
Iron	*mg/L as Fe*	0.07	*0.3 (3)(Max)*	*ISO 8288:1998*
Manganese	*mg/L as Mn*	< 0.005	*0.2 (Max)*	*ISO 8288:1998*
Total Chlorine	*mg/L as Cl*	< 0.1	-	*4500-Cl G, APHA 17th Ed.*
Fluoride	*mg/L as F*	**< 0.5**	*0.5-1.5(Max)*	*Ion Selective*
Zinc	*mg/L as Zn*	0.3	*3 (Max)*	*3111, APHA 17th Ed.*
Copper	*mg/L as Cu*	< 0.1	*1 (Max)*	*3111, APHA 17th Ed.*
Cadmium	*mg/L as Cd*	< 0.003	*0.003 (Max)*	*3111, APHA 17th Ed.*
Chromium	*mg/L as Cr*	< 0.05	*0.05(Max)*	*3500-Cr, APHA 17th Ed.*
Cyanide	*mg/L as Cn*	< 0.07	*0.07 (Max)*	*4500-CN E APHA 17th Ed.*
Lead	*mg/L as Pb*	< 0.01	*0.01 (Max)*	*3111, APHA 17th Ed.*
Mercury	*ppb as Hg*	**4**	*1 (Max)*	*ISO 5666:1999*
Arsenic	*mg/L as As*	0.005	*0.05 (Max)*	*ISO 11969:1996*
Aluminium	*mg/L as Al*	< 0.1	*0.2 (Max)*	*3500-Al D, APHA 17th Ed.*
BACTERIOLOGICAL				
Total Coliform	*MPN index/100 ml*	**2.4×10^2**	Nil	*9221 B APHA 17th Edition*
E. coli	*MPN index/100 ml*	**4**	Nil	*9221 B APHA 17th Edition*

NDWQS= National Drinking Water Quality Standard (2062) ( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of **pH, Fluoride, Mercury, Total Coliform** and ***E.coli*** are found to be out of the limit of NDWQS.

Analyzed by: **Checked by:** **Authorized sign:**
9 June, 2019 **9 June, 2019**

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Pawan Marg-33, Maitidevi, Kathmandu, Nepal

WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd.	Lab No. :-	1694/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Janakpur
Source :-	J-4	Analysis Date :-	18 April, 2019
Receipt Date :-	18 April, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	6.5	6.5-8.5	ISO 10523:1994 (E)
Turbidity	NTU	**9**	5 (10) (Max)	2130 B, APHA,17th Ed.
Electric conductivity	$\mu S/cm$	275	1500 (Max)	ISO 7888:1985
Total dissolved solids	mg/L	180	1000 (Max)	Filtration & Evaporation
Color	TCU	< 1	5 (15) (Max)	ISO 7887:1994 (E), Section 3
Lab.Temperature	^0C	23.0		Thermometer
CHEMICAL				
Chloride	mg/L as Cl	2	250 (Max)	ISO 9297:1989
Sulphate	mg/L as SO_4	3	250 (Max)	4500-SO_4^{2-} E, APHA 17th Ed.
Nitrate	mg/L as NO_3	2.1	50 (Max)	Ion Selective
Ammonia	mg/L as NH_3	0.11	1.5 (Max)	4500-NH3C, APHA 17th edn
Total Hardness	mg/L as $CaCO_3$	110	500 (Max)	2340 C APHA 17th edn
Calcium	mg/L as Ca	34	200 (Max)	3500-Ca D APHA 17th edn
Iron	mg/L as Fe	**0.53**	0.3 (3)(Max)	ISO 8288:1998
Manganese	mg/L as Mn	0.125	0.2 (Max)	ISO 8288:1998
Total Chlorine	mg/L as Cl	< 0.1	-	4500-Cl G, APHA 17th Ed.
Fluoride	mg/L as F	**< 0.5**	0.5-1.5(Max)	Ion Selective
Zinc	mg/L as Zn	< 0.1	3 (Max)	3111, APHA 17th Ed.
Copper	mg/L as Cu	< 0.1	1 (Max)	3111, APHA 17th Ed.
Cadmium	mg/L as Cd	< 0.003	0.003 (Max)	3111, APHA 17th Ed.
Chromium	mg/L as Cr	< 0.05	0.05(Max)	3500-Cr, APHA 17th Ed.
Cyanide	mg/L as Cn	< 0.07	0.07 (Max)	4500-CN E APHA 17th Ed.
Lead	mg/L as Pb	< 0.01	0.01 (Max)	3111, APHA 17th Ed.
Mercury	ppb as Hg	**5**	1 (Max)	ISO 5666:1999
Arsenic	mg/L as As	0.005	0.05 (Max)	ISO 11969:1996
Aluminium	mg/L as Al	< 0.1	0.2 (Max)	3500-Al D, APHA 17th Ed.
BACTERIOLOGICAL				
Total Coliform	MPN index/100 ml	**3**	Nil	9221 B APHA 17th Edition
E. coli	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition

NDWQS= National Drinking Water Quality Standard (2062) ( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of **Turbidity, Iron, Fluoride, Mercury** and **Total Coliform** are found to be out of the limit of NDWQS.

Analyzed by: **Checked by:** **Authorized sign:**
9 June, 2019 **9 June, 2019**

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Pawan Marg-33, Maitidevi, Kathmandu, Nepal

WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	1695/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Janakpur
Source :-	J-5	Analysis Date :-	18 April, 2019
Receipt Date :-	18 April, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	**5.9**	*6.5-8.5*	*ISO 10523:1994 (E)*
Turbidity	*NTU*	1	*5 (10) (Max)*	*2130 B, APHA,17th Ed.*
Electric conductivity	*µS/cm*	200	*1500 (Max)*	*ISO 7888:1985*
Total dissolved solids	*mg/L*	124	*1000 (Max)*	*Filtration & Evaporation*
Color	*TCU*	< 1	*5 (15) (Max)*	*ISO 7887:1994 (E), Section 3*
Lab.Temperature	*^{0}C*	23.0		*Thermometer*
CHEMICAL				
Chloride	*mg/L as Cl*	3	*250 (Max)*	*ISO 9297:1989*
Sulphate	*mg/L as SO_4*	< 1	*250 (Max)*	*4500-SO_4^{2-} E, APHA 17th Ed.*
Nitrate	*mg/L as NO_3*	1.9	*50 (Max)*	*Ion Selective*
Ammonia	*mg/L as NH_3*	0.04	*1.5 (Max)*	*4500-NH3C, APHA 17th edn*
Total Hardness	*mg/L as $CaCO_3$*	86	*500 (Max)*	*2340 C APHA 17th edn*
Calcium	*mg/L as Ca*	23	*200 (Max)*	*3500-Ca D APHA 17th edn*
Iron	*mg/L as Fe*	0.03	*0.3 (3)(Max)*	*ISO 8288:1998*
Manganese	*mg/L as Mn*	0.045	*0.2 (Max)*	*ISO 8288:1998*
Total Chlorine	*mg/L as Cl*	< 0.1	-	*4500-Cl G, APHA 17th Ed.*
Fluoride	*mg/L as F*	**< 0.5**	*0.5-1.5(Max)*	*Ion Selective*
Zinc	*mg/L as Zn*	< 0.1	*3 (Max)*	*3111, APHA 17th Ed.*
Copper	*mg/L as Cu*	< 0.1	*1 (Max)*	*3111, APHA 17th Ed.*
Cadmium	*mg/L as Cd*	< 0.003	*0.003 (Max)*	*3111, APHA 17th Ed.*
Chromium	*mg/L as Cr*	< 0.05	*0.05(Max)*	*3500-Cr, APHA 17th Ed.*
Cyanide	*mg/L as Cn*	< 0.07	*0.07 (Max)*	*4500-CN E APHA 17th Ed.*
Lead	*mg/L as Pb*	< 0.01	*0.01 (Max)*	*3111, APHA 17th Ed.*
Mercury	*ppb as Hg*	**17**	*1 (Max)*	*ISO 5666:1999*
Arsenic	*mg/L as As*	0.005	*0.05 (Max)*	*ISO 11969:1996*
Aluminium	*mg/L as Al*	< 0.1	*0.2 (Max)*	*3500-Al D, APHA 17th Ed.*
BACTERIOLOGICAL				
Total Coliform	*MPN index/100 ml*	Nil	Nil	*9221 B APHA 17th Edition*
E. coli	*MPN index/100 ml*	Nil	Nil	*9221 B APHA 17th Edition*

NDWQS= National Drinking Water Quality Standard (2062) ( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of **pH,Fluoride** and **Mercury** are found to be out of the limit of NDWQS.

Analyzed by: **Checked by:** **Authorized sign:**
9 June, 2019 **9 June, 2019**

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Pawan Marg-33, Maitidevi, Kathmandu, Nepal

WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	1696/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Janakpur
Source :-	J-6	Analysis Date :-	18 April, 2019
Receipt Date :-	18 April, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	7.0	6.5-8.5	ISO 10523:1994 (E)
Turbidity	NTU	2	5 (10) (Max)	2130 B, APHA,17th Ed.
Electric conductivity	$\mu S/cm$	276	1500 (Max)	ISO 7888:1985
Total dissolved solids	mg/L	158	1000 (Max)	Filtration & Evaporation
Color	TCU	< 1	5 (15) (Max)	ISO 7887:1994 (E), Section 3
Lab.Temperature	^0C	23.0		Thermometer
CHEMICAL				
Chloride	mg/L as Cl	2	250 (Max)	ISO 9297:1989
Sulphate	mg/L as SO_4	2	250 (Max)	4500-SO_4^{2-} E, APHA 17th Ed.
Nitrate	mg/L as NO_3	2.1	50 (Max)	Ion Selective
Ammonia	mg/L as NH_3	0.10	1.5 (Max)	4500-NH3C, APHA 17th edn
Total Hardness	mg/L as $CaCO_3$	110	500 (Max)	2340 C APHA 17th edn
Calcium	mg/L as Ca	31	200 (Max)	3500-Ca D APHA 17th edn
Iron	mg/L as Fe	**0.36**	0.3 (3)(Max)	ISO 8288:1998
Manganese	mg/L as Mn	< 0.005	0.2 (Max)	ISO 8288:1998
Total Chlorine	mg/L as Cl	< 0.1	-	4500-Cl G, APHA 17th Ed.
Fluoride	mg/L as F	**< 0.5**	0.5-1.5(Max)	Ion Selective
Zinc	mg/L as Zn	< 0.1	3 (Max)	3111, APHA 17th Ed.
Copper	mg/L as Cu	< 0.1	1 (Max)	3111, APHA 17th Ed.
Cadmium	mg/L as Cd	< 0.003	0.003 (Max)	3111, APHA 17th Ed.
Chromium	mg/L as Cr	< 0.05	0.05(Max)	3500-Cr, APHA 17th Ed.
Cyanide	mg/L as Cn	< 0.07	0.07 (Max)	4500-CN E APHA 17th Ed.
Lead	mg/L as Pb	< 0.01	0.01 (Max)	3111, APHA 17th Ed.
Mercury	ppb as Hg	**16**	1 (Max)	ISO 5666:1999
Arsenic	mg/L as As	0.005	0.05 (Max)	ISO 11969:1996
Aluminium	mg/L as Al	< 0.1	0.2 (Max)	3500-Al D, APHA 17th Ed.
BACTERIOLOGICAL				
Total Coliform	MPN index/100 ml	**1.1×10^3**	Nil	9221 B APHA 17th Edition
E. coli	MPN index/100 ml	**1.5×10^2**	Nil	9221 B APHA 17th Edition

NDWQS= National Drinking Water Quality Standard (2062) ( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of **Iron, Fluoride, Mercury, Total Coliform** and ***E.coli*** are found to be out of the limit of NDWQS.

Analyzed by: **Checked by:** **Authorized sign:**
9 June, 2019 **9 June, 2019**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	474/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Janakpur
Source :-	J1	Analysis Date :-	22 Aug, 2019
Receipt Date :-	22 Aug, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	6.6	6.5-8.5	ISO 10523:1994 (E)
Turbidity	NTU	**55**	5 (10) (Max)	2130 B, APHA,17th Ed.
Electric conductivity	$\mu S/cm$	215	1500 (Max)	ISO 7888:1985
Total dissolved solids	mg/L	132	1000 (Max)	Filtration & Evaporation
Color	TCU	1	5 (15) (Max)	ISO 7887:1994 (E), Section 3
Lab.Temperature	^0C	28.0		Thermometer
CHEMICAL				
Chloride	mg/L as Cl	2	250 (Max)	ISO 9297:1989
Sulphate	mg/L as SO_4	8	250 (Max)	4500-SO_4^{2-} E, APHA 17th Ed.
Nitrate	mg/L as NO_3	5.4	50 (Max)	Ion Selective
Ammonia	mg/L as NH_3	0.04	1.5 (Max)	4500-NH3C, APHA 17th edn
Total Hardness	mg/L as $CaCO_3$	82	500 (Max)	2340 C APHA 17th edn
Calcium	mg/L as Ca	23	200 (Max)	3500-Ca D APHA 17th edn
Iron	mg/L as Fe	**1.43**	0.3 (3)(Max)	ISO 8288:1998
Manganese	mg/L as Mn	0.110	0.2 (Max)	ISO 8288:1998
Total Chlorine	mg/L as Cl	< 0.1	-	4500-Cl G, APHA 17th Ed.
Fluoride	mg/L as F	**< 0.5**	0.5-1.5(Max)	Ion Selective
Zinc	mg/L as Zn	< 0.1	3 (Max)	3111, APHA 17th Ed.
Copper	mg/L as Cu	< 0.1	1 (Max)	3111, APHA 17th Ed.
Cadmium	mg/L as Cd	< 0.003	0.003 (Max)	3111, APHA 17th Ed.
Chromium	mg/L as Cr	< 0.05	0.05(Max)	3500-Cr, APHA 17th Ed.
Cyanide	mg/L as Cn	< 0.07	0.07 (Max)	4500-CN E APHA 17th Ed.
Lead	mg/L as Pb	< 0.01	0.01 (Max)	3111, APHA 17th Ed.
Mercury	ppb as Hg	8	1 (Max)	ISO 5666:1999
Arsenic	mg/L as As	< 0.005	0.05 (Max)	ISO 11969:1996
Aluminium	mg/L as Al	< 0.1	0.2 (Max)	3500-Al D, APHA 17th Ed.
BACTERIOLOGICAL				
Total Coliform	MPN index/100 ml	**1.5×10^2**	Nil	9221 B APHA 17th Edition
E. coli	MPN index/100 ml	**9**	Nil	9221 B APHA 17th Edition

NDWQS= National Drinking Water Quality Standard (2062) ( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of **Turbidity,Iron,Fluoride, Mercury, Total Coliform** and ***E.coli*** are found to be out of the limit of NDWQS.

Analyzed by: **Checked by:** **Authorized sign:**
25 Sep, 2019 **25 Sep, 2019**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	475/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Janakpur
Source :-	J2	Analysis Date :-	22 Aug, 2019
Receipt Date :-	22 Aug, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	6.6	6.5-8.5	ISO 10523:1994 (E)
Turbidity	NTU	1	5 (10) (Max)	2130 B, APHA,17th Ed.
Electric conductivity	$\mu S/cm$	220	1500 (Max)	ISO 7888:1985
Total dissolved solids	mg/L	183	1000 (Max)	Filtration & Evaporation
Color	TCU	< 1	5 (15) (Max)	ISO 7887:1994 (E), Section 3
Lab.Temperature	^0C	28.0		Thermometer
CHEMICAL				
Chloride	mg/L as Cl	1	250 (Max)	ISO 9297:1989
Sulphate	mg/L as SO_4	4	250 (Max)	4500-SO_4^{2-} E, APHA 17th Ed.
Nitrate	mg/L as NO_3	4.8	50 (Max)	Ion Selective
Ammonia	mg/L as NH_3	< 0.04	1.5 (Max)	4500-NH3C, APHA 17th edn
Total Hardness	mg/L as $CaCO_3$	82	500 (Max)	2340 C APHA 17th edn
Calcium	mg/L as Ca	22	200 (Max)	3500-Ca D APHA 17th edn
Iron	mg/L as Fe	0.03	0.3 (3)(Max)	ISO 8288:1998
Manganese	mg/L as Mn	0.098	0.2 (Max)	ISO 8288:1998
Total Chlorine	mg/L as Cl	< 0.1	-	4500-Cl G, APHA 17th Ed.
Fluoride	mg/L as F	**< 0.5**	0.5-1.5(Max)	Ion Selective
Zinc	mg/L as Zn	0.1	3 (Max)	3111, APHA 17th Ed.
Copper	mg/L as Cu	< 0.1	1 (Max)	3111, APHA 17th Ed.
Cadmium	mg/L as Cd	< 0.003	0.003 (Max)	3111, APHA 17th Ed.
Chromium	mg/L as Cr	< 0.05	0.05(Max)	3500-Cr, APHA 17th Ed.
Cyanide	mg/L as Cn	< 0.07	0.07 (Max)	4500-CN E APHA 17th Ed.
Lead	mg/L as Pb	< 0.01	0.01 (Max)	3111, APHA 17th Ed.
Mercury	ppb as Hg	**2**	1 (Max)	ISO 5666:1999
Arsenic	mg/L as As	< 0.005	0.05 (Max)	ISO 11969:1996
Aluminium	mg/L as Al	< 0.1	0.2 (Max)	3500-Al D, APHA 17th Ed.
BACTERIOLOGICAL				
Total Coliform	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition
E. coli	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition

NDWQS= National Drinking Water Quality Standard (2062) ( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of **Fluoride** and **Mercury** are found to be out of the limit of NDWQS.

Analyzed by: **Checked by:** **Authorized sign:**
25 Sep, 2019 **25 Sep, 2019**

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Pawan Marg-33, Maitidevi, Kathmandu, Nepal

WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	476/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Janakpur
Source :-	J3	Analysis Date :-	22 Aug, 2019
Receipt Date :-	22 Aug, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	7.0	6.5-8.5	ISO 10523:1994 (E)
Turbidity	NTU	1	5 (10) (Max)	2130 B, APHA,17th Ed.
Electric conductivity	$\mu S/cm$	214	1500 (Max)	ISO 7888:1985
Total dissolved solids	mg/L	133	1000 (Max)	Filtration & Evaporation
Color	TCU	< 1	5 (15) (Max)	ISO 7887:1994 (E), Section 3
Lab.Temperature	^0C	28.0		Thermometer
CHEMICAL				
Chloride	mg/L as Cl	1	250 (Max)	ISO 9297:1989
Sulphate	mg/L as SO_4	4	250 (Max)	4500-SO_4^{2-} E, APHA 17th Ed.
Nitrate	mg/L as NO_3	5.0	50 (Max)	Ion Selective
Ammonia	mg/L as NH_3	< 0.04	1.5 (Max)	4500-NH3C, APHA 17th edn
Total Hardness	mg/L as $CaCO_3$	86	500 (Max)	2340 C APHA 17th edn
Calcium	mg/L as Ca	25	200 (Max)	3500-Ca D APHA 17th edn
Iron	mg/L as Fe	0.17	0.3 (3)(Max)	ISO 8288:1998
Manganese	mg/L as Mn	< 0.005	0.2 (Max)	ISO 8288:1998
Total Chlorine	mg/L as Cl	0.5	-	4500-Cl G, APHA 17th Ed.
Fluoride	mg/L as F	**< 0.5**	0.5-1.5(Max)	Ion Selective
Zinc	mg/L as Zn	0.1	3 (Max)	3111, APHA 17th Ed.
Copper	mg/L as Cu	< 0.1	1 (Max)	3111, APHA 17th Ed.
Cadmium	mg/L as Cd	< 0.003	0.003 (Max)	3111, APHA 17th Ed.
Chromium	mg/L as Cr	< 0.05	0.05(Max)	3500-Cr, APHA 17th Ed.
Cyanide	mg/L as Cn	< 0.07	0.07 (Max)	4500-CN E APHA 17th Ed.
Lead	mg/L as Pb	< 0.01	0.01 (Max)	3111, APHA 17th Ed.
Mercury	ppb as Hg	**3**	1 (Max)	ISO 5666:1999
Arsenic	mg/L as As	< 0.005	0.05 (Max)	ISO 11969:1996
Aluminium	mg/L as Al	< 0.1	0.2 (Max)	3500-Al D, APHA 17th Ed.
BACTERIOLOGICAL				
Total Coliform	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition
E. coli	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition

NDWQS= National Drinking Water Quality Standard (2062) ( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of **Fluoride** and **Mercury** are found to be out of the limit of NDWQS.

Analyzed by: **Checked by:** **Authorized sign:**
25 Sep, 2019 **25 Sep, 2019**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	477/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Janakpur
Source :-	J4	Analysis Date :-	22 Aug, 2019
Receipt Date :-	22 Aug, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	7.0	6.5-8.5	ISO 10523:1994 (E)
Turbidity	NTU	**54**	5 (10) (Max)	2130 B, APHA,17th Ed.
Electric conductivity	$\mu S/cm$	253	1500 (Max)	ISO 7888:1985
Total dissolved solids	mg/L	145	1000 (Max)	Filtration & Evaporation
Color	TCU	1	5 (15) (Max)	ISO 7887:1994 (E), Section 3
Lab.Temperature	^0C	28.0		Thermometer
CHEMICAL				
Chloride	mg/L as Cl	2	250 (Max)	ISO 9297:1989
Sulphate	mg/L as SO_4	5	250 (Max)	4500-SO_4^{2-} E, APHA 17th Ed.
Nitrate	mg/L as NO_3	5.0	50 (Max)	Ion Selective
Ammonia	mg/L as NH_3	0.04	1.5 (Max)	4500-NH3C, APHA 17th edn
Total Hardness	mg/L as $CaCO_3$	98	500 (Max)	2340 C APHA 17th edn
Calcium	mg/L as Ca	25	200 (Max)	3500-Ca D APHA 17th edn
Iron	mg/L as Fe	**2.56**	0.3 (3)(Max)	ISO 8288:1998
Manganese	mg/L as Mn	0.183	0.2 (Max)	ISO 8288:1998
Total Chlorine	mg/L as Cl	< 0.1	-	4500-Cl G, APHA 17th Ed.
Fluoride	mg/L as F	**< 0.5**	0.5-1.5(Max)	Ion Selective
Zinc	mg/L as Zn	< 0.1	3 (Max)	3111, APHA 17th Ed.
Copper	mg/L as Cu	< 0.1	1 (Max)	3111, APHA 17th Ed.
Cadmium	mg/L as Cd	< 0.003	0.003 (Max)	3111, APHA 17th Ed.
Chromium	mg/L as Cr	< 0.05	0.05(Max)	3500-Cr, APHA 17th Ed.
Cyanide	mg/L as Cn	< 0.07	0.07 (Max)	4500-CN E APHA 17th Ed.
Lead	mg/L as Pb	< 0.01	0.01 (Max)	3111, APHA 17th Ed.
Mercury	ppb as Hg	**5**	1 (Max)	ISO 5666:1999
Arsenic	mg/L as As	< 0.005	0.05 (Max)	ISO 11969:1996
Aluminium	mg/L as Al	< 0.1	0.2 (Max)	3500-Al D, APHA 17th Ed.
BACTERIOLOGICAL				
Total Coliform	MPN index/100 ml	**4**	Nil	9221 B APHA 17th Edition
E. coli	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition

NDWQS= National Drinking Water Quality Standard (2062)

( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of **Turbidity, Iron, Fluoride, Mercury** and **Total Coliform** are found to be out of the limit of NDWQS.

Analyzed by: **Checked by:** **Authorized sign:**

25 Sep, 2019 **25 Sep, 2019**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	478/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Janakpur
Source :-	J5	Analysis Date :-	22 Aug, 2019
Receipt Date :-	22 Aug, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	6.6	6.5-8.5	ISO 10523:1994 (E)
Turbidity	NTU	< 1	5 (10) (Max)	2130 B, APHA,17th Ed.
Electric conductivity	$\mu S/cm$	209	1500 (Max)	ISO 7888:1985
Total dissolved solids	mg/L	109	1000 (Max)	Filtration & Evaporation
Color	TCU	< 1	5 (15) (Max)	ISO 7887:1994 (E), Section 3
Lab.Temperature	^0C	28.0		Thermometer
CHEMICAL				
Chloride	mg/L as Cl	2	250 (Max)	ISO 9297:1989
Sulphate	mg/L as SO_4	5	250 (Max)	4500-SO_4^{2-} E, APHA 17th Ed.
Nitrate	mg/L as NO_3	4.6	50 (Max)	Ion Selective
Ammonia	mg/L as NH_3	< 0.04	1.5 (Max)	4500-NH3C, APHA 17th edn
Total Hardness	mg/L as $CaCO_3$	82	500 (Max)	2340 C APHA 17th edn
Calcium	mg/L as Ca	20	200 (Max)	3500-Ca D APHA 17th edn
Iron	mg/L as Fe	0.12	0.3 (3)(Max)	ISO 8288:1998
Manganese	mg/L as Mn	0.061	0.2 (Max)	ISO 8288:1998
Total Chlorine	mg/L as Cl	< 0.1	-	4500-Cl G, APHA 17th Ed.
Fluoride	mg/L as F	**< 0.5**	0.5-1.5(Max)	Ion Selective
Zinc	mg/L as Zn	< 0.1	3 (Max)	3111, APHA 17th Ed.
Copper	mg/L as Cu	< 0.1	1 (Max)	3111, APHA 17th Ed.
Cadmium	mg/L as Cd	< 0.003	0.003 (Max)	3111, APHA 17th Ed.
Chromium	mg/L as Cr	< 0.05	0.05(Max)	3500-Cr, APHA 17th Ed.
Cyanide	mg/L as Cn	< 0.07	0.07 (Max)	4500-CN E APHA 17th Ed.
Lead	mg/L as Pb	< 0.01	0.01 (Max)	3111, APHA 17th Ed.
Mercury	ppb as Hg	**16**	1 (Max)	ISO 5666:1999
Arsenic	mg/L as As	< 0.005	0.05 (Max)	ISO 11969:1996
Aluminium	mg/L as Al	< 0.1	0.2 (Max)	3500-Al D, APHA 17th Ed.
BACTERIOLOGICAL				
Total Coliform	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition
E. coli	MPN index/100 ml	Nil	Nil	9221 B APHA 17th Edition

NDWQS= National Drinking Water Quality Standard (2062)

( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of **Fluoride** and **Mercury** are found to be out of the limit of NDWQS.

Analyzed by: **Checked by:** **Authorized sign:**
25 Sep, 2019 **25 Sep, 2019**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	479/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Janakpur
Source :-	J6	Analysis Date :-	22 Aug, 2019
Receipt Date :-	22 Aug, 2019		

Parameters	Unit	Result	NDWQS	Method
PHYSICAL				
pH	-	7.0	6.5-8.5	ISO 10523:1994 (E)
Turbidity	NTU	2	5 (10) (Max)	2130 B, APHA,17th Ed.
Electric conductivity	$\mu S/cm$	214	1500 (Max)	ISO 7888:1985
Total dissolved solids	mg/L	131	1000 (Max)	Filtration & Evaporation
Color	TCU	< 1	5 (15) (Max)	ISO 7887:1994 (E), Section 3
Lab.Temperature	^0C	28.0		Thermometer
CHEMICAL				
Chloride	mg/L as Cl	2	250 (Max)	ISO 9297:1989
Sulphate	mg/L as SO_4	4	250 (Max)	4500-SO_4^{2-} E, APHA 17th Ed.
Nitrate	mg/L as NO_3	4.5	50 (Max)	Ion Selective
Ammonia	mg/L as NH_3	< 0.04	1.5 (Max)	4500-NH3C, APHA 17th edn
Total Hardness	mg/L as $CaCO_3$	90	500 (Max)	2340 C APHA 17th edn
Calcium	mg/L as Ca	25	200 (Max)	3500-Ca D APHA 17th edn
Iron	mg/L as Fe	0.10	0.3 (3)(Max)	ISO 8288:1998
Manganese	mg/L as Mn	< 0.005	0.2 (Max)	ISO 8288:1998
Total Chlorine	mg/L as Cl	< 0.1	-	4500-Cl G, APHA 17th Ed.
Fluoride	mg/L as F	**< 0.5**	0.5-1.5(Max)	Ion Selective
Zinc	mg/L as Zn	0.1	3 (Max)	3111, APHA 17th Ed.
Copper	mg/L as Cu	< 0.1	1 (Max)	3111, APHA 17th Ed.
Cadmium	mg/L as Cd	< 0.003	0.003 (Max)	3111, APHA 17th Ed.
Chromium	mg/L as Cr	< 0.05	0.05(Max)	3500-Cr, APHA 17th Ed.
Cyanide	mg/L as Cn	< 0.07	0.07 (Max)	4500-CN E APHA 17th Ed.
Lead	mg/L as Pb	< 0.01	0.01 (Max)	3111, APHA 17th Ed.
Mercury	ppb as Hg	**14**	1 (Max)	ISO 5666:1999
Arsenic	mg/L as As	< 0.005	0.05 (Max)	ISO 11969:1996
Aluminium	mg/L as Al	< 0.1	0.2 (Max)	3500-Al D, APHA 17th Ed.
BACTERIOLOGICAL				
Total Coliform	MPN index/100 ml	**1.1×10^3**	Nil	9221 B APHA 17th Edition
E. coli	MPN index/100 ml	**93**	Nil	9221 B APHA 17th Edition

NDWQS= National Drinking Water Quality Standard (2062) ( )=If there is no other alternative source of water

Sample was collected and sent to Lab by Yachiyo Engineering Co., Ltd.

Remarks: The observed values of **Fluoride, Mercury, Total Coliform** and ***E.coli*** are found to be out of the limit of NDWQS.

Analyzed by: **Checked by:** **Authorized sign:**
25 Sep, 2019 **25 Sep, 2019**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co. Ltd	Lab No. :-	1571/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Pokhara
Source :-	P1	Analysis Date :-	29 March, 2019
Receipt Date :-	29 March, 2019		

Parameters	Unit	Result	Method
PHYSICAL			
pH	-	8.6	*ISO 10523:1994 (E)*
Total Suspended Solids	*mg/L*	76	*2540 D, APHA 17edition*
Total Solids	*mg/L*	4076	*2540 B, APAH 17edition*
Lab.Temperature	^0C	23.0	*Thermometer*
CHEMICAL			
T. Phosphorous	*mg/L as P*	18.6	*ISO 6878:1998(E)*
Oil & Grease	*mg/L*	6	*5520B,APHA 17th Ed.*
Total Nitrogen	*mg/L as N*	578	*ISO 5663:1984(E)*
C.O.D.	*mg/L*	448	*5220 B, APHA 17th Ed.*
B.O.D.	*mg/L*	65	*5210 B, APHA 17th Ed.*
BACTERIOLOGICAL			
E. coli	*MPN index/100 ml*	9.2×10^3	*9221 B APHA 17th Edition*

Sample was collected and send to Lab by Yachiyo Engineering Co., Ltd.

Analyzed by: **Checked by:** **Authorized sign:**
7 April, 2019 **7 April, 2019**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd.	Lab No. :-	1572/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Pokhara
Source :-	P2	Analysis Date :-	29 March, 2019
Receipt Date :-	29 March, 2019		

Parameters	Unit	Result	Method
PHYSICAL			
pH	-	7.9	*ISO 10523:1994 (E)*
Total Suspended Solids	*mg/L*	27	*2540 D, APHA 17edition*
Total Solids	*mg/L*	179	*2540 B, APAH 17edition*
Lab.Temperature	^0C	23.0	*Thermometer*
CHEMICAL			
T. Phosphorous	*mg/L as P*	0.1	*ISO 6878:1998(E)*
Oil & Grease	*mg/L*	3	*5520B,APHA 17th Ed.*
Total Nitrogen	*mg/L as N*	7	*ISO 5663:1984(E)*
C.O.D.	*mg/L*	< 2	*5220 B, APHA 17th Ed.*
B.O.D.	*mg/L*	< 3	*5210 B, APHA 17th Ed.*
BACTERIOLOGICAL			
E. coli	*MPN index/100 ml*	2.4×10^3	*9221 B APHA 17th Edition*

Sample was collected and send to Lab by Yachiyo Engineering Co., Ltd.

Analyzed by: **7 April, 2019** **Checked by:** **Authorized sign:** **7 April, 2019**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	1573/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Pokhara
Source :-	P3	Analysis Date :-	29 March, 2019
Receipt Date :-	29 March, 2019		

Parameters	Unit	Result	Method
PHYSICAL			
pH	-	8.0	*ISO 10523:1994 (E)*
Total Suspended Solids	*mg/L*	40	*2540 D, APHA 17edition*
Total Solids	*mg/L*	169	*2540 B, APAH 17edition*
Lab.Temperature	^0C	23.0	*Thermometer*
CHEMICAL			
T. Phosphorous	*mg/L as P*	0.02	*ISO 6878:1998(E)*
Oil & Grease	*mg/L*	3	*5520B,APHA 17th Ed.*
Total Nitrogen	*mg/L as N*	3	*ISO 5663:1984(E)*
C.O.D.	*mg/L*	< 2	*5220 B, APHA 17th Ed.*
B.O.D.	*mg/L*	< 3	*5210 B, APHA 17th Ed.*
BACTERIOLOGICAL			
E. coli	*MPN index/100 ml*	4.6×10^2	*9221 B APHA 17th Edition*

Sample was collected and send to Lab by Yachiyo Engineering Co., Ltd.

Analyzed by: **Checked by:** **Authorized sign:**
7 April, 2019 **7 April, 2019**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	1574/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Pokhara
Source :-	P4	Analysis Date :-	29 March, 2019
Receipt Date :-	29 March, 2019		

Parameters	Unit	Result	Method
PHYSICAL			
pH	-	8.1	*ISO 10523:1994 (E)*
Total Suspended Solids	*mg/L*	75	*2540 D, APHA 17edition*
Total Solids	*mg/L*	205	*2540 B, APAH 17edition*
Lab.Temperature	^0C	23.0	*Thermometer*
CHEMICAL			
T. Phosphorous	*mg/L as P*	0.03	*ISO 6878:1998(E)*
Oil & Grease	*mg/L*	4	*5520B,APHA 17th Ed.*
Total Nitrogen	*mg/L as N*	3	*ISO 5663:1984(E)*
C.O.D.	*mg/L*	< 2	*5220 B, APHA 17th Ed.*
B.O.D.	*mg/L*	< 3	*5210 B, APHA 17th Ed.*
BACTERIOLOGICAL			
E. coli	*MPN index/100 ml*	1.5×10^2	*9221 B APHA 17th Edition*

Sample was collected and send to Lab by Yachiyo Engineering Co., Ltd.

Analyzed by: **7 April, 2019** **Checked by:** **Authorized sign:** **7 April, 2019**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd.	Lab No. :-	1575/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Pokhara
Source :-	P5	Analysis Date :-	29 March, 2019
Receipt Date :-	29 March, 2019		

Parameters	Unit	Result	Method
PHYSICAL			
pH	-	7.5	*ISO 10523:1994 (E)*
Total Suspended Solids	*mg/L*	22	*2540 D, APHA 17edition*
Total Solids	*mg/L*	189	*2540 B, APAH 17edition*
Lab.Temperature	^0C	23.0	*Thermometer*
CHEMICAL			
T. Phosphorous	*mg/L as P*	0.2	*ISO 6878:1998(E)*
Oil & Grease	*mg/L*	4	*5520B,APHA 17th Ed.*
Total Nitrogen	*mg/L as N*	5	*ISO 5663:1984(E)*
C.O.D.	*mg/L*	12	*5220 B, APHA 17th Ed.*
B.O.D.	*mg/L*	4	*5210 B, APHA 17th Ed.*
BACTERIOLOGICAL			
E. coli	*MPN index/100 ml*	4.6×10^3	*9221 B APHA 17th Edition*

Sample was collected and send to Lab by Yachiyo Engineering Co., Ltd.

Analyzed by: **Checked by:** **Authorized sign:**
7 April, 2019 **7 April, 2019**

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Pawan Marg-33, Maitidevi, Kathmandu, Nepal

WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	1576/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Pokhara
Source :-	P6	Analysis Date :-	29 March, 2019
Receipt Date :-	29 March, 2019		

Parameters	Unit	Result	Method
PHYSICAL			
pH	-	7.7	*ISO 10523:1994 (E)*
Total Suspended Solids	*mg/L*	32	*2540 D, APHA 17edition*
Total Solids	*mg/L*	78	*2540 B, APAH 17edition*
Lab.Temperature	^0C	23.0	*Thermometer*
CHEMICAL			
T. Phosphorous	*mg/L as P*	0.04	*ISO 6878:1998(E)*
Oil & Grease	*mg/L*	2	*5520B,APHA 17th Ed.*
Total Nitrogen	*mg/L as N*	4	*ISO 5663:1984(E)*
C.O.D.	*mg/L*	< 2	*5220 B, APHA 17th Ed.*
B.O.D.	*mg/L*	< 3	*5210 B, APHA 17th Ed.*
BACTERIOLOGICAL			
E. coli	*MPN index/100 ml*	4.6×10^2	*9221 B APHA 17th Edition*

Sample was collected and send to Lab by Yachiyo Engineering Co., Ltd.

Analyzed by: **Checked by:** **Authorized sign:**
7 April, 2019 **7 April, 2019**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	380/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Pokhara
Source :-	P1	Analysis Date :-	9 Aug, 2019
Receipt Date :-	9 Aug, 2019		

Parameters	Unit	Result	Method
PHYSICAL			
pH	-	8.9	*ISO 10523:1994 (E)*
Total Suspended Solids	*mg/L*	52	*2540 D, APHA 17edition*
Total Solids	*mg/L*	4822	*2540 B, APAH 17edition*
Lab.Temperature	^0C	29.0	*Thermometer*
CHEMICAL			
T. Phosphorous	*mg/L as P*	11.209	*ISO 6878:1998(E)*
Oil & Grease	*mg/L*	11	*5520B,APHA 17th Ed.*
Total Nitrogen	*mg/L as N*	639	*ISO 5663:1984(E)*
C.O.D.	*mg/L*	633	*5220 B, APHA 17th Ed.*
B.O.D.	*mg/L*	300	*5210 B, APHA 17th Ed.*
BACTERIOLOGICAL			
E. coli	*MPN index/100 ml*	9.2×10^3	*9221 B APHA 17th Edition*

Sample was collected and send to Lab by Yachiyo Engineering Co., Ltd.

Analyzed by: **Checked by:** **Authorized sign:**
29 Aug, 2019 **29 Aug, 2019**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	381/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Pokhara
Source :-	P2	Analysis Date :-	9 Aug, 2019
Receipt Date :-	9 Aug, 2019		

Parameters	Unit	Result	Method
PHYSICAL			
pH	-	8.6	*ISO 10523:1994 (E)*
Total Suspended Solids	*mg/L*	166	*2540 D, APHA 17edition*
Total Solids	*mg/L*	277	*2540 B, APAH 17edition*
Lab.Temperature	^0C	29.0	*Thermometer*
CHEMICAL			
T. Phosphorous	*mg/L as P*	0.034	*ISO 6878:1998(E)*
Oil & Grease	*mg/L*	< 1	*5520B,APHA 17th Ed.*
Total Nitrogen	*mg/L as N*	2	*ISO 5663:1984(E)*
C.O.D.	*mg/L*	< 2	*5220 B, APHA 17th Ed.*
B.O.D.	*mg/L*	< 3	*5210 B, APHA 17th Ed.*
BACTERIOLOGICAL			
E. coli	*MPN index/ 100 ml*	2.3×10^2	*9221 B APHA 17th Edition*

Sample was collected and send to Lab by Yachiyo Engineering Co., Ltd.

Analyzed by: **Checked by:** **Authorized sign:**
29 Aug, 2019 **29 Aug, 2019**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	382/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Pokhara
Source :-	P3	Analysis Date :-	9 Aug, 2019
Receipt Date :-	9 Aug, 2019		

Parameters	Unit	Result	Method
PHYSICAL			
pH	-	8.7	*ISO 10523:1994 (E)*
Total Suspended Solids	*mg/L*	259	*2540 D, APHA 17edition*
Total Solids	*mg/L*	358	*2540 B, APAH 17edition*
Lab.Temperature	^0C	29.0	*Thermometer*
CHEMICAL			
T. Phosphorous	*mg/L as P*	0.070	*ISO 6878:1998(E)*
Oil & Grease	*mg/L*	< 1	*5520B,APHA 17th Ed.*
Total Nitrogen	*mg/L as N*	2	*ISO 5663:1984(E)*
C.O.D.	*mg/L*	< 2	*5220 B, APHA 17th Ed.*
B.O.D.	*mg/L*	< 3	*5210 B, APHA 17th Ed.*
BACTERIOLOGICAL			
E. coli	*MPN index/100 ml*	2.4×10^3	*9221 B APHA 17th Edition*

Sample was collected and send to Lab by Yachiyo Engineering Co., Ltd.

Analyzed by: **29 Aug, 2019** **Checked by:** **Authorized sign:** **29 Aug, 2019**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	383/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Pokhara
Source :-	P4	Analysis Date :-	9 Aug, 2019
Receipt Date :-	9 Aug, 2019		

Parameters	Unit	Result	Method
PHYSICAL			
pH	-	8.6	*ISO 10523:1994 (E)*
Total Suspended Solids	*mg/L*	69	*2540 D, APHA 17edition*
Total Solids	*mg/L*	151	*2540 B, APAH 17edition*
Lab.Temperature	^0C	29.0	*Thermometer*
CHEMICAL			
T. Phosphorous	*mg/L as P*	0.035	*ISO 6878:1998(E)*
Oil & Grease	*mg/L*	< 1	*5520B,APHA 17th Ed.*
Total Nitrogen	*mg/L as N*	1	*ISO 5663:1984(E)*
C.O.D.	*mg/L*	3	*5220 B, APHA 17th Ed.*
B.O.D.	*mg/L*	< 3	*5210 B, APHA 17th Ed.*
BACTERIOLOGICAL			
E. coli	*MPN index/100 ml*	4.6×10^2	*9221 B APHA 17th Edition*

Sample was collected and send to Lab by Yachiyo Engineering Co., Ltd.

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	384/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Pokhara
Source :-	P5	Analysis Date :-	9 Aug, 2019
Receipt Date :-	9 Aug, 2019		

Parameters	Unit	Result	Method
PHYSICAL			
pH	-	7.6	*ISO 10523:1994 (E)*
Total Suspended Solids	*mg/L*	10	*2540 D, APHA 17edition*
Total Solids	*mg/L*	54	*2540 B, APAH 17edition*
Lab.Temperature	^0C	29.0	*Thermometer*
CHEMICAL			
T. Phosphorous	*mg/L as P*	0.008	*ISO 6878:1998(E)*
Oil & Grease	*mg/L*	< 1	*5520B,APHA 17th Ed.*
Total Nitrogen	*mg/L as N*	1	*ISO 5663:1984(E)*
C.O.D.	*mg/L*	7	*5220 B, APHA 17th Ed.*
B.O.D.	*mg/L*	< 3	*5210 B, APHA 17th Ed.*
BACTERIOLOGICAL			
E. coli	*MPN index/100 ml*	20	*9221 B APHA 17th Edition*

Sample was collected and send to Lab by Yachiyo Engineering Co., Ltd.

Analyzed by: **29 Aug, 2019** **Checked by:** **Authorized sign:** **29 Aug, 2019**

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WATER ANALYSIS REPORT

Sender :-	Yachiyo Engineering Co.,Ltd	Lab No. :-	385/19
Collector :-	Yachiyo Engineering Co.,Ltd	Location :-	Pokhara
Source :-	P6	Analysis Date :-	9 Aug, 2019
Receipt Date :-	9 Aug, 2019		

Parameters	Unit	Result	Method
PHYSICAL			
pH	-	7.2	*ISO 10523:1994 (E)*
Total Suspended Solids	*mg/L*	3	*2540 D, APHA 17edition*
Total Solids	*mg/L*	75	*2540 B, APAH 17edition*
Lab.Temperature	^0C	29.0	*Thermometer*
CHEMICAL			
T. Phosphorous	*mg/L as P*	0.008	*ISO 6878:1998(E)*
Oil & Grease	*mg/L*	< 1	*5520B,APHA 17th Ed.*
Total Nitrogen	*mg/L as N*	3	*ISO 5663:1984(E)*
C.O.D.	*mg/L*	3	*5220 B, APHA 17th Ed.*
B.O.D.	*mg/L*	< 3	*5210 B, APHA 17th Ed.*
BACTERIOLOGICAL			
E. coli	*MPN index/100 ml*	93	*9221 B APHA 17th Edition*

Sample was collected and send to Lab by Yachiyo Engineering Co., Ltd.

Analyzed by: **29 Aug, 2019** **Checked by:** **Authorized sign:** **29 Aug, 2019**

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Appendix-5 The Result of Interview Survey regarding Current Situation of Waste Water Treatment in Each City

Data Collection Survey for Water Supply and Waste Water Sector in Nepal

The Result of Interview Survey regarding Current Situation of Waste Water Treatment in Each City

A-5-1

June 2019

Yachiyo Engineering Co., Ltd.

1. Purpose

This survey is conducted for collecting the information regarding the current situation of wastewater treatment in the households and the hotels in 5 cities (Pokhara, Butwal, Hetauda, Birgunj and Janakpur).

Since the survey on the current situation of wastewater treatment on the households in Kathmandu was conducted in 2017 and the report "Study on Wastewater Management in Kathmandu Valley" was prepared by JICA in 2017, the interview survey in Kathmandu Valley was not conducted.

2. Overview of Each City（Geography, Population, Current Situation of Sewerage and Sanitation Facility and Future Plan）

（1） Pokhara

Overview of city center in Pokhara city is shown in Figure 1.

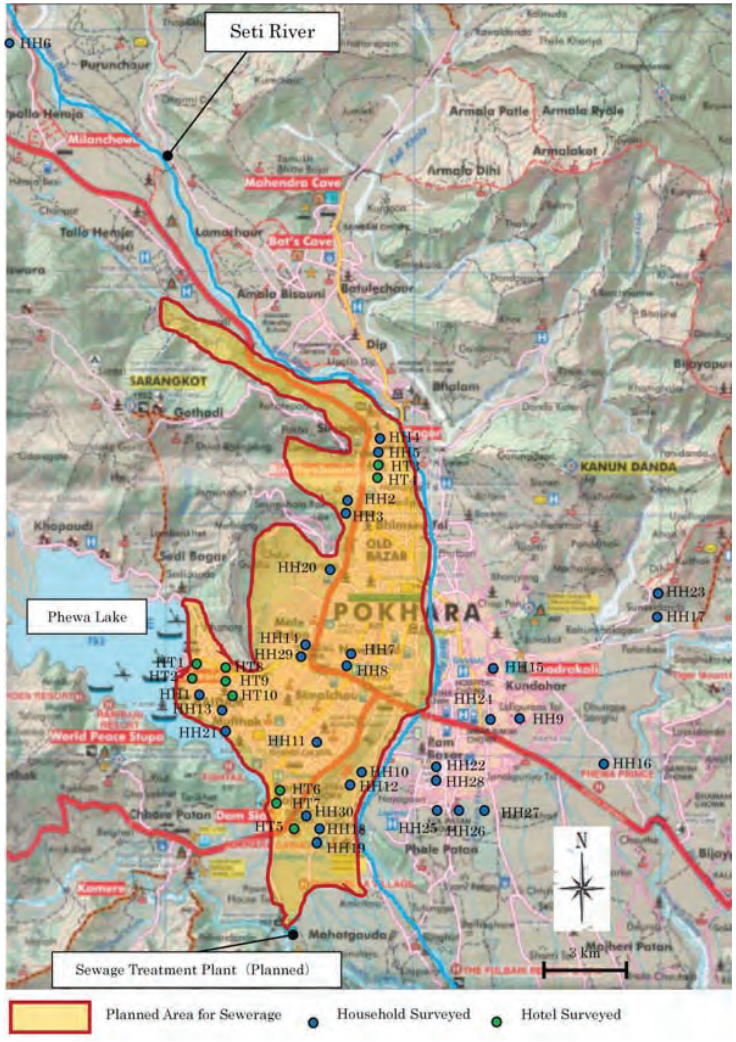


Figure 1 Overview of City Center in Pokhara City

Pokhara city is populated about 400 thousand. Seti River flows at the central part of the city

from north to south and Phewa lake at the western part of the city.

The city center in Pokhara locates between Seti River and Phewa Lake and the city stretches 4km east and west and about 5km north and south. There are some gradient against Phewa lake at the western part of Seti River in the central part of the city and therefore most storm water flows into Phewa lake.

Recently, a lot of tourist hotels have been built at the surrounding area of Phewa Lake. Currently, sewerage system has not yet installed in the city and mainly on-site sanitation is used for wastewater treatment. Sewerage system is planned to be introduced in the western part of city center of Pokhara.

（2） Butwal

Overview of city center in Butwal is shown in Figure 2.

Figure 2 Overview of City Center in Butwal

Butwal city is populated about 150 thousand people. Tinau river flows in the city center from

north to south.

The northern part of city center in relatively higher than the other area in elevation, but most of city center is almost flat.

Currently, sewerage system has not yet installed in the city and mainly on-site sanitation is used for wastewater treatment.

There is no specific plan for sewerage system and sludge disposal plan in current.

（3） Hetauda

Overview of city center in Hetauda city is shown in Figure 3.

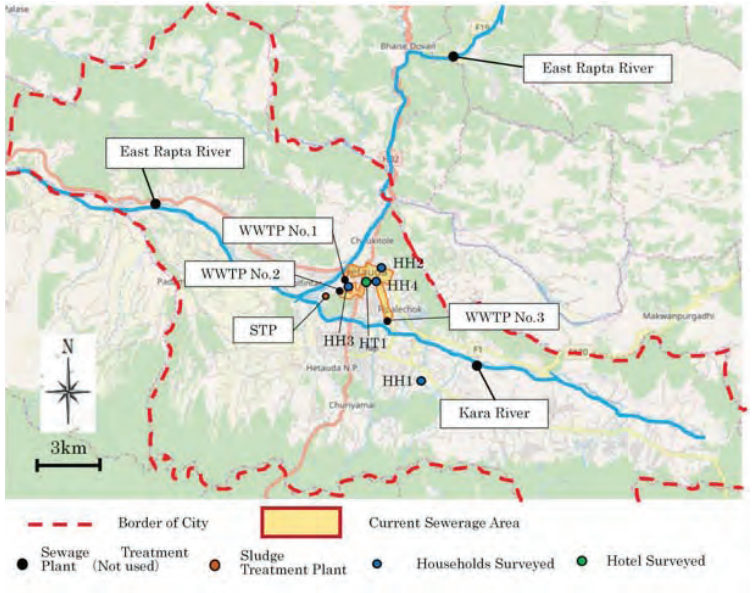


Figure 3 Overview of City Center in Hetauda

Hetauda city is populated about 170 thousand people and east Raputa River flows across the city center from north to west and Kara River flows across the city center from east to west.

Currently, approximately 800 households in the city center connect to existing combined sewer treatment system. Sewage generated from the objective area flows down to three existing sewage treatment plants (not in operation) by gravity and is finally discharged into East Rapta River and Kara River. On-site sanitation is commonly used in the non-covered sewerage area.

（4） Birgunj

Overview of city center in Birgunj is shown in Figure 4.

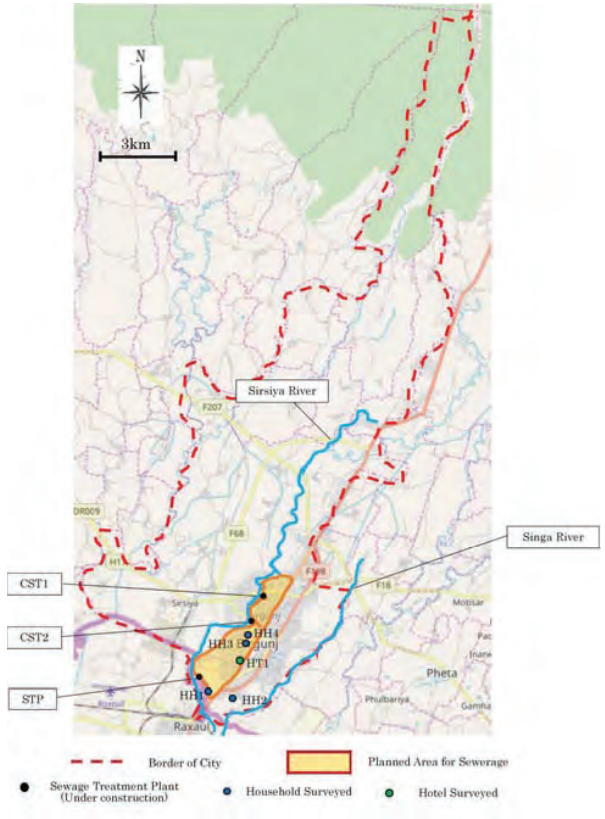


Figure 4 Overview of City Center in Birgunj

Birgunj is populated about 260 thousand people and adjacent to Indian border. Sirsiya River flows the western side of city center and Singa River flows the eastern side of city center. But most part of the city is almost flat.

Currently, the design population of 40 thousand in 2035 and 10,000m^3/day capacity of sewage treatment plant has been under construction in the southern part of city center near Indian border and two community plants have also been under construction in the northern part of city center.

Therefore in current sewerage system has not been installed in the city yet and mainly on-site sanitation is used for wastewater treatment.

（５） Janakpur

Overview of city center in Janakpur city is shown in Figure 5.

Figure 5 Overview of City Center in Jankpur

Janakpur city is populated about 180 thousand people and adjacent to Indian border. Kamra river flows east side of the city boundary from north to south. But there are no big rivers in the city and most of city center is almost flat.

Currently, there is no sewerage system in the city and mainly on-site sanitation is used for wastewater treatment.

Besides, no specific plan for sewerage system and sludge disposal plan are proposed in current.

3. Survey Method

（１） Number Surveyed

JICA team conducted interview survey to households and hotels in accordance with the questionnaire.

The number surveyed on each city is shown in Table 1.

Table 1 The Number Surveyed on Each City

	Name of City	Number Surveyed
1.	Pokhara	Household: 30, Hotel:5
2.	Butwal	Household: 4, Hotel:1
3	Hetauda	Household: 4, Hotel:1
4	Birgunj	Household: 4, Hotel:1
5	Janakpur	Household: 4, Hotel:1

Due to the constraints on the period of survey, JICA team mainly interviewed the household and the hotel located in the city center.

（２） Survey Area, Location Map

１） Pokhara

Interview survey area on household is shown in Table 2 and Interview survey area on hotel is shown in Table 3.

Survey location map of households and hotels is shown in Figure 1.

Table 2 Area of Household Interviewed

No.	Name of Area	No.	Name of Area
HH1	Lakeside	HH16	Khasi Bazar
HH2	Alchal Bot	HH17	Kaukhola
HH3	Alchal Bot	HH18	Gharipatan
HH4	Bagar	HH19	Gharipatan
HH5	Bagar	HH20	Parshang
HH6	Deep	HH21	Lakeside
HH7	Shuijana	HH22	Rambazar
HH8	Shuijana	HH23	Kaukhola
HH9	Laligurans Tol	HH24	Amarsimgh
HH10	Airport	HH25	Kolpatan
HH11	Anapurna Tol	HH26	Kolpatan
HH12	Airport	HH27	Kolpatan
HH13	Lakeside	HH28	Rambazar
HH14	Malepatan	HH29	Malepatan
HH15	Malepani	HH30	Hiurali Tol

Table 3 Area of Hotel Interviewed

No.	Name of Area
HT1	Lakeside
HT2	Lakeside
HT3	Bagar
HT4	Lakeside
HT5	Bisauta

No.	Name of Area
HT6	Damside
HT7	Damside
HT8	Lakeside
HT9	Lakeside
HT10	Lakeside

2） Butwal

Interview survey area on household is shown in Table 4 and Interview survey area on hotel is shown in Table 5.

Survey location map of households and hotel is shown in Figure 2.

Table 4 Area of Household Interviewed

No.	Name of Area
HH1	Mijahpath Sunoar
HH2	Satyanarayan
HH3	Chandbari
HH4	Golpark

Table 5 Area of Hotel Interviewed

No.	Name of Area
HT1	Golpark

3） Hetauda

Area of household interviewed is shown in Table 6 and area of hotel interviewed is shown in Table 7.

Location map of households and hotel surveyed is shown in Figure 3.

Table 6 Area of Household Interviewed

No.	Name of Area
HH1	Kamane
HH2	Sangham
HH3	TCN
HH4	Ajaramar

Table 7 Area of Hotel Interviewed

No.	Name of Area
HT1	Bank Road

The households and a hotel except for HH4 are interviewed in the sewerage covered area.

4） Birgunj

Area of household interviewed is shown in Table 8 and area of hotel interviewed is shown in Table 9.

Survey location map for households and hotel is shown in Figure 4.

Table 8 Area of Household Interviewed

No.	Name of Area
HH1	Bhanshar
HH2	Luarwa
HH3	Adarshanagar
HH4	Ghadiarwa

Table 9 Area of Hotel Interviewed

No.	Name of Area
HT1	Adarshanagar

5） Janakpur

Area of household interviewed is shown in Table 10 and area of hotel interviewed is shown in Table 11.

Location map of households and hotel surveyed is shown in Figure 5.

Table 10 Area of Household Interviewed

No.	Name of Area
HH1	Kishori Nagar
HH2	Miles
HH3	Balmiki Nagar
HH4	Rajaul

Table 11 Area of Hotel Interviewed

No.	Name of Area
HT1	New Bus Park

（3） Questionnaire

Questionnaires for household and hotel are shown in Table 12 and Table 13, respectively.

Table 12 Question Items for Household

Question No.	Question
General	Name of Area, Name of Enumerator, Date of Interview Executed
1.	Number of Family
2.	Possession of toilet
3.	Kind of toilet（Pour flush toilet or the other toilet）
4.	Water source used for toilet（Water from NWSC, Water from well owned by each household）
5.	Method for discharging wastewater（Directly discharge into the side drainage, discharge into the septic tank, soak into groundwater etc.）
6.	（In case of not pour flush toilet） Kind of toilet
7.	Treatment method for wastewater from kitchen, washing cloth, washing body and toilet

Question No.	Question
8.	Approximate dimension and volume of septic tank etc.
9.	Frequency of de-sludge from septic tank
10.	Agency for sludge collection
11.	Volume of sludge withdrawn from septic tank etc. and the amount of payment for one time
12.	Reason for withdrawing sludge
13.	With or without bottom slab in the septic tank
14.	Interest of sewerage service and willingness to connect with sewer pipe
15.	Willingness to pay for sewerage

Table 13 Question Items for Hotel

Question No.	Question Items
General	Name of Area, Name of Enumerator, Date of Interview Executed
1.	Number of people to be accommodated
2.	Water source used for toilet（Water from NWSC, Water from well owned by each hotel）
3.	Kind of wastewater facility owned by hotel
4.	Method for discharging wastewater（Directly discharge into the side drainage, discharge into the septic tank, soak into groundwater etc.）
5.	Treatment method for wastewater from kitchen, washing cloth, washing body and toilet
6.	Approximate dimension and volume of septic tank etc.
7.	Working items for operation and maintenance of wastewater treatment facility
8.	Breakdown of the cost for operation and maintenance of wastewater treatment facility
9.	Frequency of de-sludge from septic tank
10.	Agency for sludge collection
11.	Volume of sludge withdrawn from septic tank etc. and the amount of payment for one time
12.	Reason for withdrawing sludge
13.	With or without slab at the bottom of septic tank
14.	Interest of sewerage service and willingness to connect with sewer pipe

At Birgunj city, JICA team interviewed whether on-going sewerage project under the construction is known or not in addition.

（4） Interviewer

Interview was conducted by the following 3 persons.

Interviewers which is shown in 2) Interviewers were hired for this survey by Yachiyo Engineering Co., Ltd.

1) Supervisor of Survey

Mr. Tsuyoshi ONOZATO

（In charge of sewerage facility plan, Yachiyo Engineering Co., Ltd.）

2) Interviewers

Ms. Meena Pun

Mr. Bijay Maharjan

（5） Implementation day of Interview

Interview survey date is shown in Table 14 on each city.

Table 14 Interview survey date

Name of City	Implementation Day of Interview	Name of City	Implementation Day of Interview
Pokhara	March 25, 26, 27 , 28 in 2019	Birgunj	April 12 in 2019
Butwal	April 2 in 2019	Janakpur	April 19 in 2019
Hetauda	April 8 in 2019		

4. Outline of Survey Result

（1） Pokhara

1） Situation of Wastewater Treatment in a Household

① Possession of toilet

Possession of toilet in the household is shown in Figure 6.

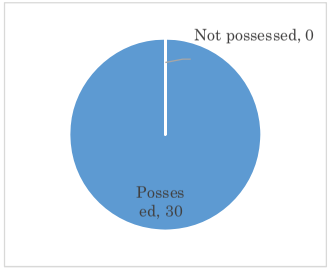


Table 6 Possession of Toilet

All of 30 households surveyed had toilets in their house.

② Type of toilet

Type of toilet is shown in Figure 7.

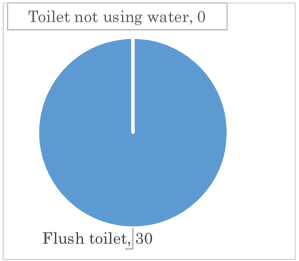


Figure 7 Type of Toilet

All of 30 households surveyed had flush toilets.

③ Water for toilet

Type of water for toilet is shown in Figure 8.

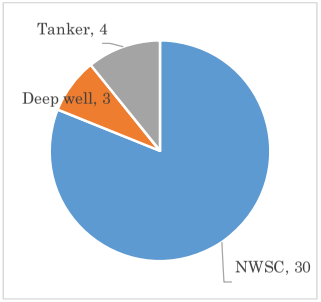


Figure 8 Water source of toilet water

All survey targeted 30 households use water from NWSC for flushing the toilet and some households additionally use water from own well or water tanker for flushing the toilet.

The result of the survey finds that it needs to consider not only water from NWSC but also water except from NWSC when sewerage system is planned.

④ On-site treatment process

Treatment process of domestic wastewater from toilet and wastewater from kitchen etc. in Household are shown in Figure 9.

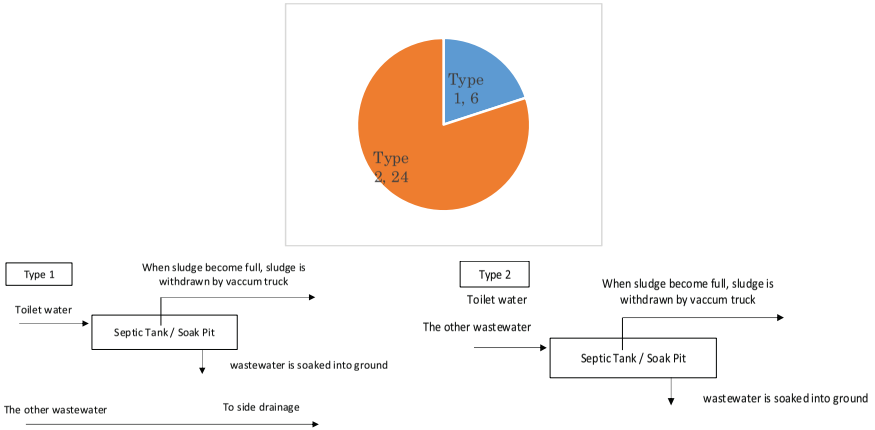


Figure 9 Treatment Process of Domestic Wastewater in Household

Among 30 hotels, 6 hotels adopted Type 1 and its process consists of treating wastewater from toilet in the septic tank or soak pit while the other wastewater from kitchen, washing body and clothes etc. is discharged directly into side ditch or gutter next to the house.

24 hotels adopted Type 2 and its process consisting of treating both wastewater from toilet and wastewater from kitchen etc. in the septic tank or soak pit.

The survey finds that the treatment process of wastewater from household on each area tends to depend on the regional characteristics. For example, it is confirmed that there are no side ditches in Lakeside and relatively high number of households with Type 2 while there are relatively high number of household with Type 1 in Bagar at the northern part of city center.

Note:

In this report, soak pit defines the on-site wastewater treatment facility which does not have a bottom slab and soaks wastewater into the ground while septic tank defines the on-site wastewater treatment facility which has a bottom slab.

As described later, studying the relationship between the volume of septic tank and the frequency of de-sludge on the basis of the result of interview, it is found that the volume of septic

tank is too small and the wastewater is overflowed soon. Thus, it is considerable that most septic tanks leak a lot of wastewater into the ground.

⑤ De-sludge

The number of household which has the experience of de-sludge from septic tank or soak pit is shown in Figure 10.

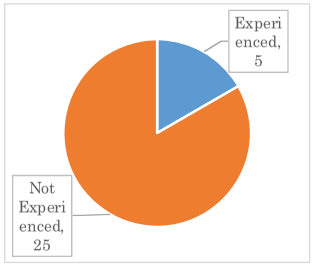


Figure 10 Experience of De-sludge from Septic Tank or Soak Pit

Among 30 households, the number of household that has conducted de-sludge from the tank is only 5. Among the 5 households, the most frequent of de-sludge form the tank in a household is once for 3 years and the least frequent of de-sludge in a household was once for 20 years. (The 3 households have the septic tank with bottom slab and without any outlets)

Besides, de-sludge has not been conducted for more than 15 years in 6 households out of 25 households. (1 household has the septic tank with bottom slab and without any outlets.)

⑥ Volume of septic tank etc.

Volume of septic tank and soak pit per one person are shown in Figure 11 and Figure 12, respectively.

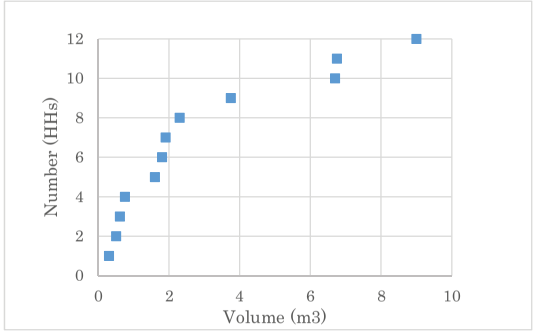


Figure 11 Volume of Septic Tank per One Person

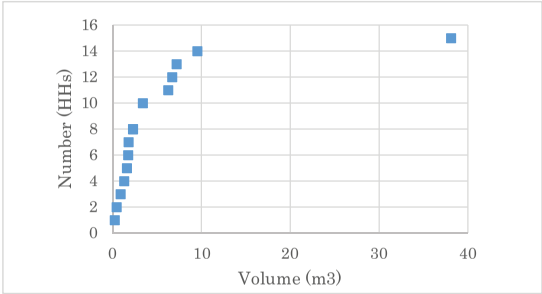


Figure 12 Volume of Soak Pit per One Person

Intermediate value among 12 respondents regarding the volume of septic tank in the household per one person was approximately 2 m^3 and intermediate value among 15 respondents regarding the volume of soak pit in the household per one person was also approximately 2 m^3.

For verifying the validity of the capacity of septic tank and the frequency of de-sludge, the duration when tank is filled with the sludge is estimated by assuming the use of 20 Litter of water per a day per capita for toilet water (calculated years of de-sludge) and the result of the interview. The comparison between calculated years of de-sludge and frequency of de-sludge based on the result of the interview is shown in Figure 13.

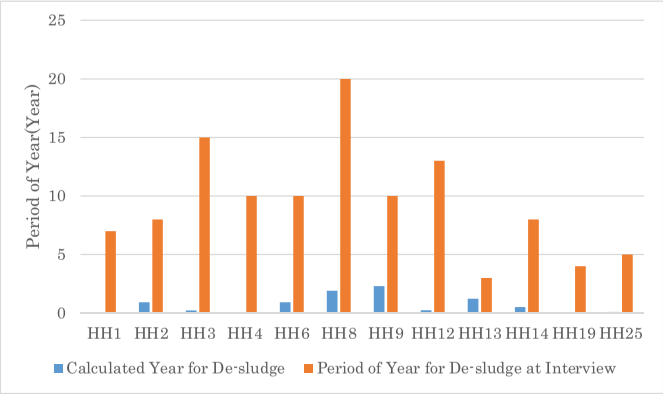


Figure 13 Comparison between Calculated Year for De-sludge and Period of Year for De-sludge at Interview

Note:

The years of filling up the sludge in the tank is calculated by following equation:

The years of filling up the sludge in the tank (Year)

= Volume of Septic Tank （m^3） ÷ ($0.02m^3$×365 days)

Water for toilet per one person is set as 20 Litter.

The result of the study shows that years of de-sludge for septic tank in the target household is much longer than estimated years of de-sludge. Therefore, if years of de-sludge at interview is correct, it is assumed that wastewater from most household with septic tank leak into the ground.

⑦ De-sludge cost

Cost of de-sludge per $1m^3$ sludge of 5 respondents from households is shown in Figure 14.

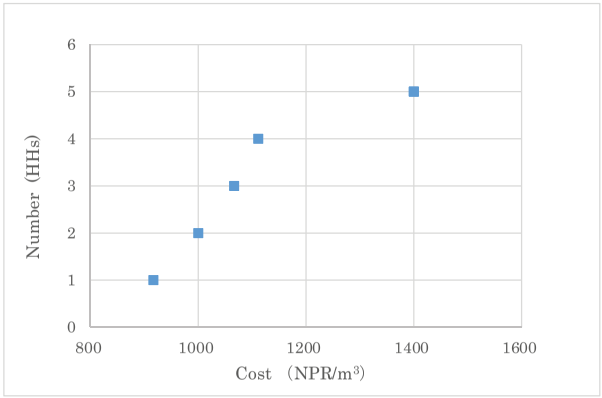


Figure 14 Cost of De-sludge per 1 m^3 Sludge

The result of the study finds out that the intermediate value for de-sludge cost per 1 m^3 sludge among 5 respondents from households is approximately NPR1,100.

This result is almost the same as tariff for de-sludge from municipality (approximately NPR800～1000 per 1 m^3 sludge).

⑨ De-sludge company

De-sludge company for household is shown in Figure 15.

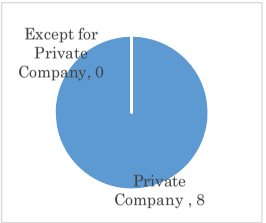


Figure 15 Agency for de-sludge

All 8 respondents from households ask private companies for de-sludge.

This result corresponds to the information from Pokhara municipality.

⑩ Reason for de-sludge

The reason for de-sludge is shown in Figure 16.

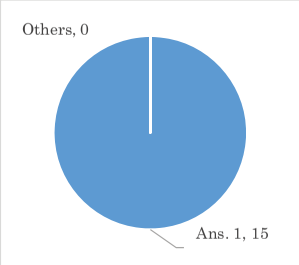


Figure 16 Reason for De-sludge

Answers in the Questionnaire :

Answer 1 : Because the tank became full of the sludge

Others : Because odor was generated from the tank. Because we need to follow the regulation in Pokhara city. Because we would like to contribute to environmental conservation etc.

Note:

These answers include ones from the households which is going to do de-sludge in the future but have never experienced de-sludge until now.

All the 15 respondents from households answered “Answer 1”, “Because the tank became full of the sludge”.

⑪ Structure of septic tank and soak pit

Installation of the bottom slab in the septic tank and soak pit on each household is shown in Figure 17.

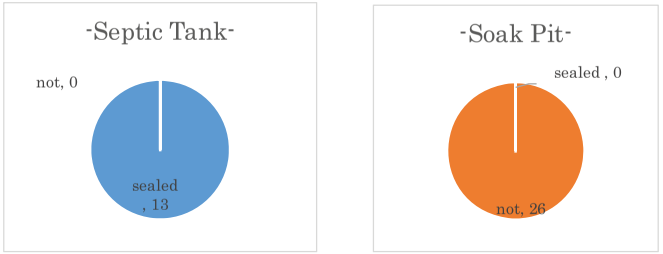


Figure 17 Installation of the Bottom Slab in the Septic Tank and Soak Pit

All of 13 respondents from households with septic tank answered that a bottom slab is installed and wastewater from the tank does not leak the wastewater into the ground. Besides, all of 26 respondents from households with soak pit answered that a bottom slab s not installed and wastewater from the pit leaks into the ground.

Schematic structural drawing for septic tank and soak pit based on the result of interview is shown in Figure 18.

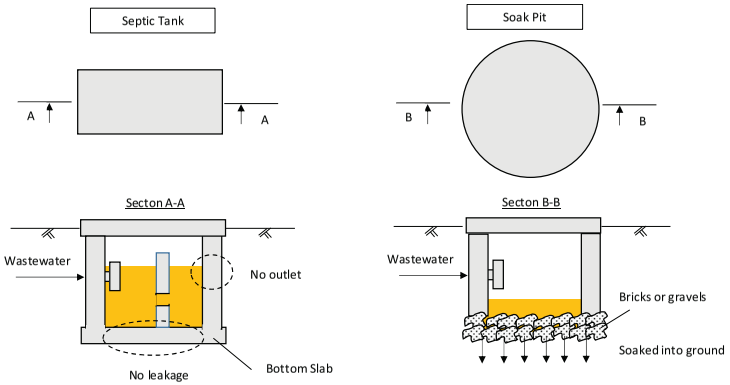


Figure 18 Schematic Structural Drawing of Septic Tank and Soak Pit
(Based on the result of interview)

⑫ Interest level for sewerage

Interest level for sewerage is shown in Figure 19.

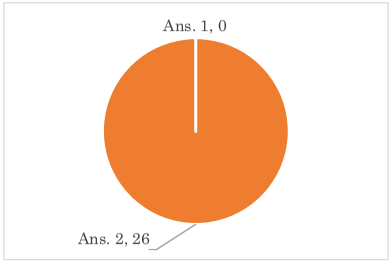


Figure 19 Interst for Sewerage

Answers in the Questionnaire：

Answer 1 : No willingness to connect with sewer pipe

Answer 2 : I am interested in sewerage service. But it depends on the tariff.

All of 26 respondents from households have much interest in sewerage service and want to connect with sewege pipe although it depends on the tariff.

Besides, the reason for interst in sewerage service is shown in Figure 20.

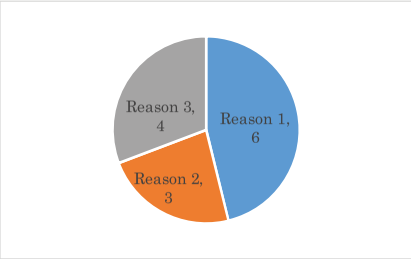


Figure 20 Reason for Interst in Sewerage Service

Note：

Answer 1 : We want to use the space of the existing septic tank etc. for other purpose.

Answer 2 : We want to contribute to the environmental conservation in Pokhara.

Answer 3 : We want to reduce the work load for keeping sanitary condition in current.

※Multiple answers

Among 13 respondents from households, the number of answer 1, “We want to use the space of the existing septic tank etc. for the other purpose.”, was 6 and the number of answer 2, “We want to contribute to the environmental conservation in Pokhara.”, was 3 and the number of answer 3, “We want to reduce the work load for keeping sanitary condition in current.”, was 4.

⑬ Willingness to pay for sewerage service

Willingness to pay for sewerage service for one month is shown in Figure 21.

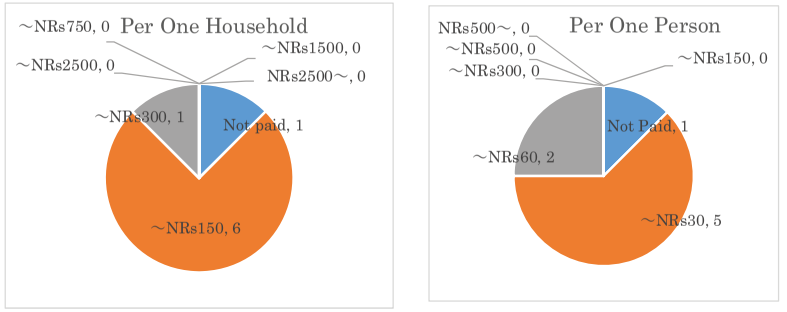


Figure 21 Willingness to Pay for Sewerage Service for One Month

Among 8 repondents from household, the answer for willingness to pay for sewerage service on each household is as follows:

- “We will connect if the tariff is free” is 1
- “We will connect if the tariff is from 0 to NPR150 per household for one month “is 6
- “We will connect if the tariff is from NPR150 to NPR300 per household for one month” is 1

Besides, willingness to pay for sewerage service per one person (or one connection) to septic tank or soak pit is as follows:

- “We will connect if the tariff is free” is 1
- “We will connect if the tariff is from 0 to NPR30 per one person for one month “is 5
- “We will connect if the tariff is from NPR30 to NPR60 per person for one month” is 2

2） Situation of Wastewater Treatment in Hotel

① Accommodation capacity of target hotel

Accommodation capacity of target 10 hotels is shown in Figure 22.

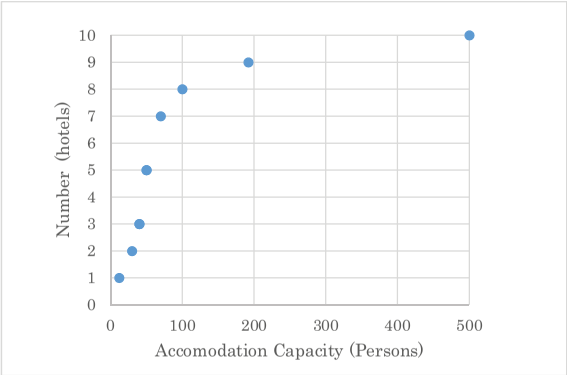


Figure 22 Accommodation Capacity of Hotel Surveyed

② Water for toilet

Water for toilet water in hotel is shown in Figure 23.

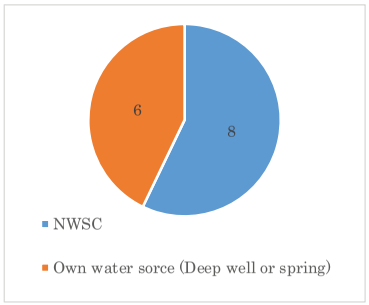


Figure 23 Water Source of Toilet Water in Hotel

8 out of 10 hotels use water from NWSC. 2 out of 10 hotels do not connect with water from NWSC and use only the water from own water source such as deep well or spring etc. 4 out of 6 hotels use water from own water source such as deep well etc. in addition to water from NWSC.

The result of the survey shows that wastewater collection needs to consider not only water from NWSC but also water except from NWSC when sewerage system is planned.

③ On-site treatment process

Wastewater treatment process for toilet and kitchen etc. in hotel are shown in Figure 24.

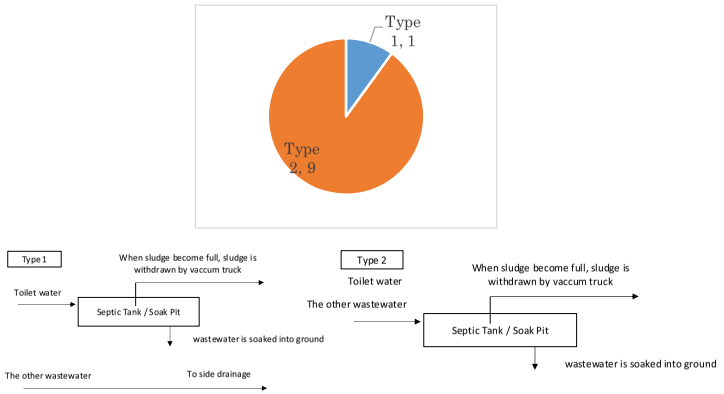


Figure 24 Treatment Process of Domestic Wastewater in Hotel

Among 10 hotels, 1 hotel adopted Type 1, the process consisting of treating wastewater from toilet in the septic tank or soak pit while discharging the other wastewater from kitchen, washing body and clothes etc. directly into side ditch.

9 hotels adopted Type 2, the process consisting of treating both wastewater from toilet and wastewater from kitchen etc. in the septic tank or soak pit.

④ De-sludge

The number of hotel which has the experience of de-sludge from septic tank or soak pit is shown in Figure 25.

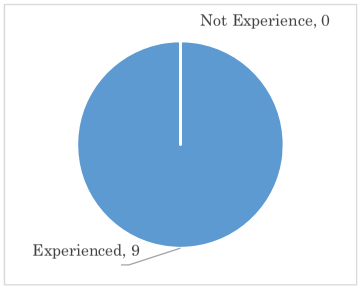


Figure 25 Experience of De-sludge from Septic Tank or Soak Pit

All of 9 respondents from hotel have conducted de-sludge for their facilities. Among the 9

hotels, the most frequent for de-sludge at the hotel is once for 3 months and the least frequency for de-sludge at the hotel is once for 20 years. (The 5 hotels have the septic tank with bottom slab and without any outlets)

⑤ Volume of Septic Tank etc.

Volume of septic tank and soak pit per one person are shown in Figure 26 and Figure 27, respectively.

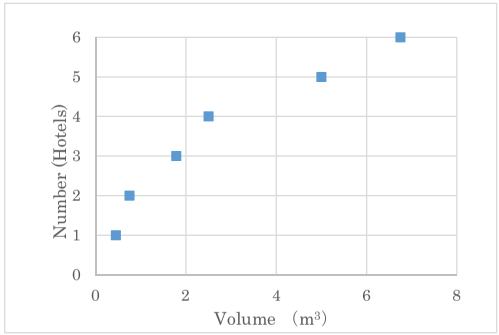


Figure 26 Volume of Septic Tank per One Person

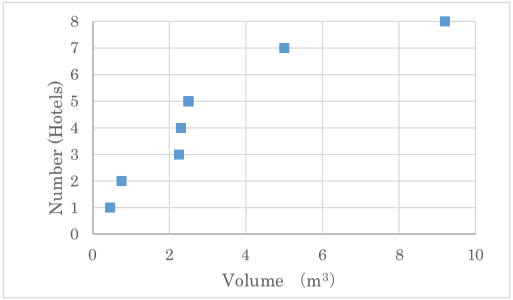


Figure 27 Volume of Soak Pit per One Person

Intermediate value among 6 respondents regarding the volume of septic tank in the hotel per one person was approximately 2m³ and intermediate value among 7 respondents regarding the volume of soak pit in the hotel per one person was also approximately 2m³.

To verify the relationship between volume of septic tank and period of year for de-sludge, JICA team studied the relationship between the period of year when sludge reaches up to the full in case one person uses 20L per a day for toilet water and operation rate of hotel is 50% (calculated year for de-sludge) and the period of year for de-sludge on the basis of the answer at the interview. The comparison between calculated year for de-sludge and period of year for de-sludge at interview is shown in Figure 28.

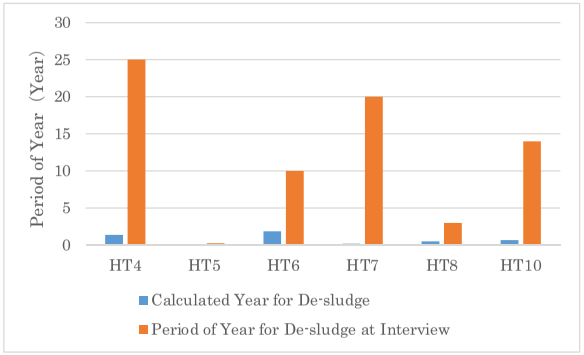


Figure 28 Comparison between Calculated Year for De-sludge and Period of Year for De-sludge at Interview for Hotels

Note:

Calculated year when sludge reaches up to full is calculated on the basis of the following equation:

Calculated year for de-sludge (Year)

= Volume of Septic Tank （m³） ÷ (0.02m³×365 days×50%)

However, water used for toilet per one person is set as 20L and operation rate of hotel is set as 50%.

As the result of the study, we found that the period of year for de-sludge of septic tank in the hotel of all the respondents is much longer than the period of year calculated for de-sludge. Therefore, if the period of year for de-sludge at interview is correct, most of septic tank installed on hotels are sure to leak a lot of wastewater into the ground.

⑥ Cost for De-sludge

Cost of de-sludge per 1m³ sludge of 4 respondents from hotels is shown in Figure 29.

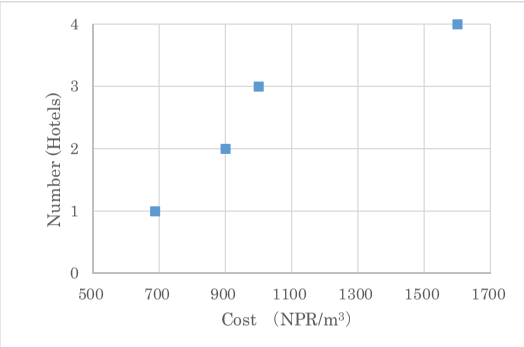


Figure 29 Cost of De-sludge per 1 m^3 Sludge

As the result of the study, the intermediate number regarding the cost of de-sludge per 1 m3 sludge among 4 respondents from hotels was approximately NPR900.

This result is almost the same as the information from municipality regarding tariff for de-sludge (approximately NPR800～1000 per 1 m3 sludge).

⑦ Working items for O&M

Working items for O&M of septic tank etc., which is regularly conducted by hotels, is shown in Figure 30.

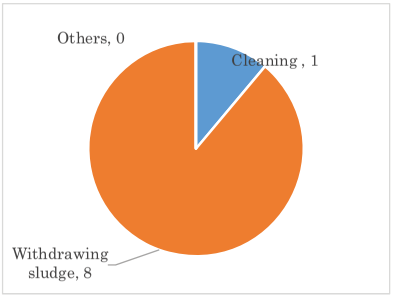


Figure 30 Working Items for O&M of Septic Tank

Among 9 repondents from hotels, the answer for working items for O&M of septic tank etc., on each hotel was as follows:

- "De-sludge" is 8

- "Cleaing "is 1

There were no answers except for the above 2 answers.

⑧ Agency for de-sludge

Agency for de-sludge which each hotel requests is shown in Figure 31.

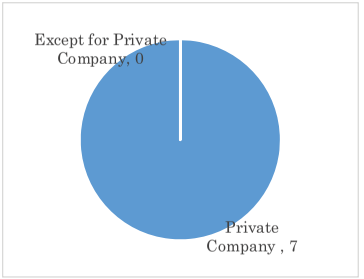


Figure 31 Agency for de-sludge

All of 7 respondents from hotels asked private companies for de-sludge.

This result is the same as the information regarding agency for de-sludge in Pokhara, which was collected from municipality

⑨ Reason for de-sludge

The reason for de-sludge is shown in Figure 32.

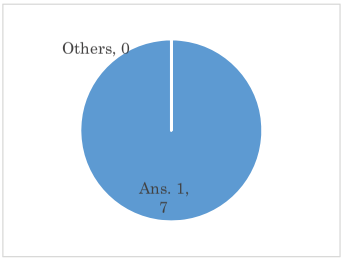


Figure 32 Reason for De-sludge

Answers in the Questionnaire :

Answer 1 : Because the tank became full of the sludge

Others : Because odor was generated from the tank. Because we need to follow the

regulation in Pokhara city. Because we would like to contribute to environmental conservation etc.

All the 7 respondents from households answered “Answer 1”, “Because the tank became full of the sludge”.

⑩ Structure of septic tank and soak pit

Recognition of each hotel regarding presence of bottom slab in the septic tank and soak pit is shown in Figure 33.

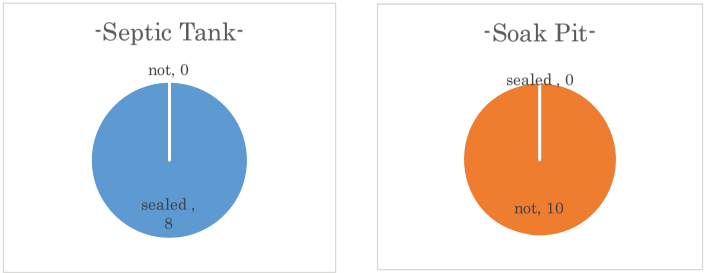


Figure 33 Recognition of Each Hotel regarding Presence of Bottom Slab in the Septic Tank and Soak Pit

All of 8 respondents from hotels which own septic tank answered that septic tank has a bottom slab and basically does not leak the wastewater into the ground. Besides, all of 10 respondents from hotels which own soak pit answered that soak pit does not have a bottom slab and leak the wastewater into the ground.

On the basis of the result of interview, structure of septic tank and soak pit which each hotel recognizes is almost the same as the one which is described in 1) Situation of Domestic Wastewater Treatment on Household.

⑪ Interest for Sewerage

Interest for sewerage is shown in Figure 34.

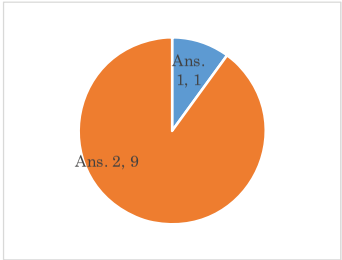


Figure 34 Interst for Sewerage

Answers in the Questionnaire :

Answer 1 : No willingness to connect with sewer pipe

Answer 2 : I am interested in sewerage service. But it depends on the tariff.

9 out of 10 respondents from hotels had much interest in sewerage service and wanted to connect with sewege pipe although it depends on the tariff. 1 hotels answered that “we don’t need sewerage service because we recoginize we have already installed the appropriate wastewater treatement facility in the hotel”.

Besides, the reason for interst in sewerage service is shown in Figure 35.

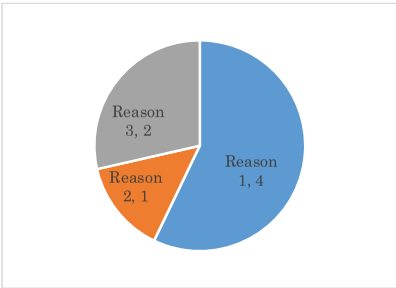


Figure 35 Reason for Interst in Sewerage Service

Note :

Answer 1 : We want to use the space of the existing septic tank etc. for other purpose.

Answer 2 : We want to contribute to the environmental conservation in Pokhara.

Answer 3 : We want to reduce the work load for keeping sanitary condition in current.

※Multiple answers

Among 7 respondents from hotels, the number of answer 1, “We want to use the space of the existing septic tank etc. for the other purpose.”, was 4 and the number of answer 2, “We want to contribute to the environmental conservation in Pokhara.”, was 1 and the number of answer 3, “We want to reduce the work load for keeping sanitary condition in current.”, was 2.

（2） Butwal

1） Situation of Wastewater Treatment in Household and Hotel

① Possession of toilet

Possession of toilet in the households and hotel is shown in Figure 36.

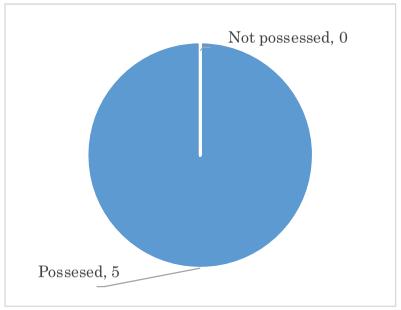


Figure 36 Possession of Toilet

All of 4 households and 1 hotel surveyed had toilets in their houses or hotel.

② Type of Toilet

Type of toilet is shown in Figure 37.

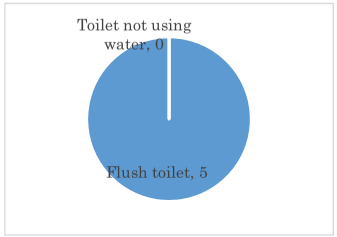


Figure 37 Type of Toilet

All of 4 households and 1 hotel surveyed had flush toilets.

③ Water used for toilet

Water source of toilet water is shown in Figure 38.

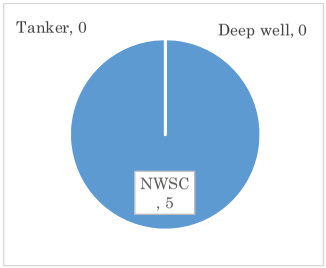


Figure 38 Water source of toilet water

All of 4 households and 1 hotel surveyed use water from NWSC.

④ On-site treatment process

Treatment process of wastewater from toilet and wastewater from kitchen etc. in households and hotel are shown in Figure 39.

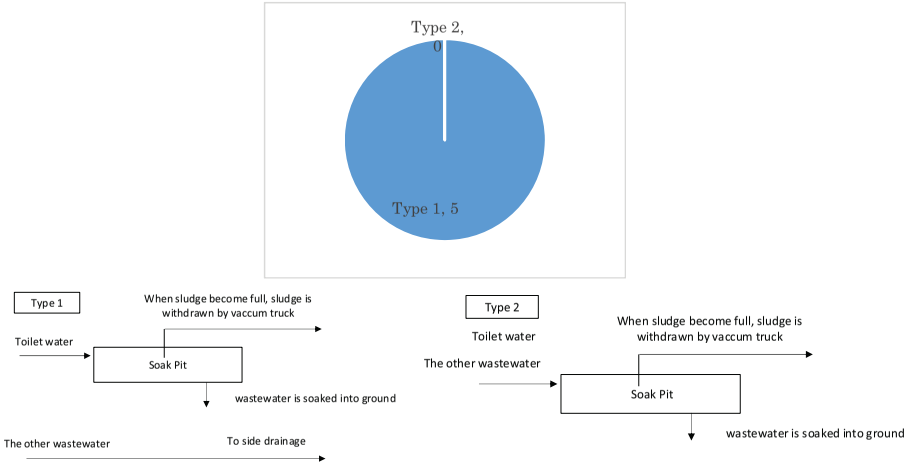


Figure 39 Treatment Process of Wastewater in Household and Hotel

All of 4 households and 1 hotel adopted Type 1, the process consisting of treating wastewater from toilet into soak pit while discharging the other wastewater from kitchen, washing body and clothes etc. directly into side ditch.

⑤ De-sludge

The number of household which conducted de-sludge from soak pit is shown in Figure 40.

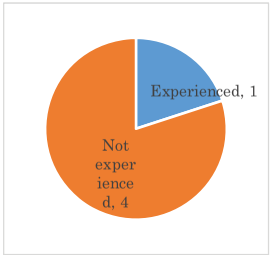


Figure 40 Experience of De-sludge from Soak Pit

Among 4 households and 1 hotel, only 1 household had the experience of de-sludge and the period of year for de-sludge was once for 1.5 years.

Besides, there was the household which has never withdrawn the sludge in the soak pit for 25 years.

⑥ Volume of septic tank etc.

Volume of soak pit per one person is shown in Figure 41.

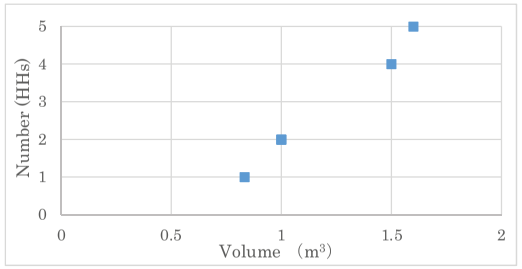


Figure 41 Volume of Soak Pit per One Person

Intermediate value of the volume of soak pit per one person in the household among 4 respondents was approximately 1m^3.

⑦ Cost for de-sludge

As the result of the study, the answer for the cost of de-sludge per 1 m^3 sludge from 1 respondents from households was approximately NPR750.

⑧ Agency for de-sludge

One respondent from household asked private companies for de-sludge.

⑨ Reason for de-sludge

The reason for de-sludge is shown in Figure 42.

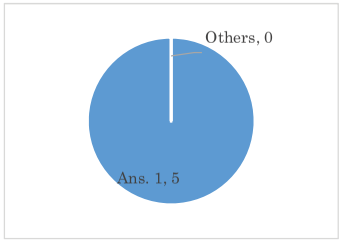


Figure 42 Reason for De-sludge

Answers in the Questionnaire :

Answer 1 : Because the tank became full of the sludge

Others : Because odor was generated from the tank. Because we need to follow the regulation in Pokhara city. Because we would like to contribute to environmental conservation etc.

Note:

These answers are including ones from the households which is going to do de-sludge in the future but have never experienced de-sludge until now.

All of 4 respondents from households and 1 responded from hotel answered “Answer 1”, “Because the tank became full of the sludge”.

⑩ Structure of septic tank and soak pit

Recoginitition of each household and hotel regarding presence of bottom slab in the soak pit is shown in Figure 43.

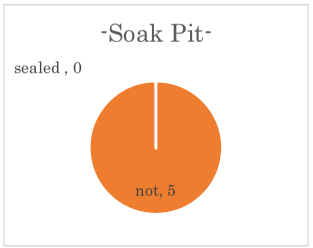


Figure 43 Recognition of Each Household and Hotel regarding Presence of Bottom Slab in the Soak Pit

All of 4 respondents from households and 1 respondent from hotel with soak pit that the bottom slab is not installed in the soak pit and wastewater leaks into the ground.

Schematic structural drawing of soak pit based on the result of interview is shown in Figure 44.

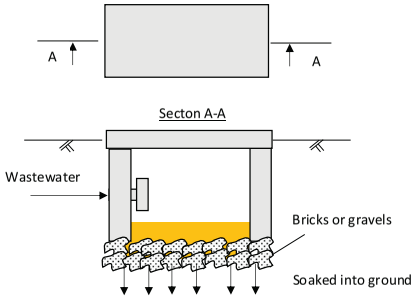


Figure 44 Schematic Structural Drawing of Soak Pit
(Based on the result of interview)

⑪ Interest for sewerage

Interest for sewerage is shown in Figure 45.

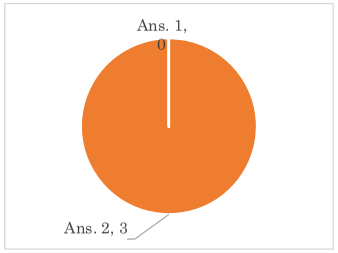


Figure 45 Interst for Sewerage

Answers in the Questionnaire :

Answer 1 : No willingness to connect with sewer pipe

Answer 2 : I am interested in sewerage service. But it depends on the tariff.

2 respondents from households and 1 respondent from hotel had much interest in sewerage service and wanted to connect with sewege pipe although it depends on the tariff.

Besides, the reason for interst in sewerage service is shown in Figure 46.

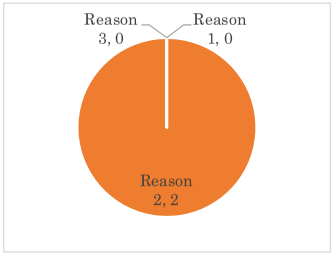


Figure 46 Reason for Interst in Sewerage Service

Note :

Answer 1 : We want to use the space of the existing septic tank etc. for the other purpose.

Answer 2 : We want to contribute to the environmental conservation.

Answer 3 : We want to reduce the work load for keeping sanitary condition in current.

※Multiple answers

1 respondent from household and 1 respondent from hotel answered Answer 2, “We want to contribute to the environmental conservation in Butwal.”.

⑫ Willingness to pay for sewerage service

1 respondent from household answered that “We will connect if the tariff is from NPR150 to NPR300 per household for one month “. The tariff is equivalent to from NPR0 to NPR30 per one person for one month

（3） Hetauda

1） Situation of Wastewater Treatment in Household and Hotel

① Possession of toilet

Possession of toilet in the households and hotel is shown in Figure 47.

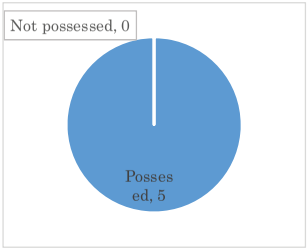


Figure 47 Possession of Toilet

All of 4 households and 1 hotel surveyed had toilets in their houses or hotel.

② Type of Toilet

Type of toilet is shown in Figure 48.

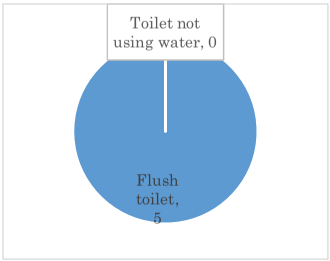


Figure 48 Type of Toilet

All of 4 households and 1 hotel surveyed had flush toilets.

③ Water used for toilet

Water for toilet water is shown in Figure 49.

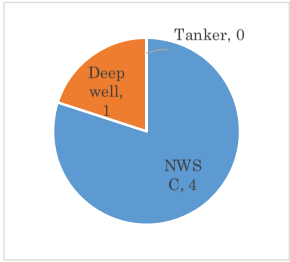


Figure 49 Water source of toilet water

All of 4 households surveyed use water from NWSC. While one hotel surveyed use water from own water source (deep well).

④ On-site treatment process

Treatment process of wastewater from toilet and wastewater from kitchen etc. in households and hotel are shown in Figure 50.

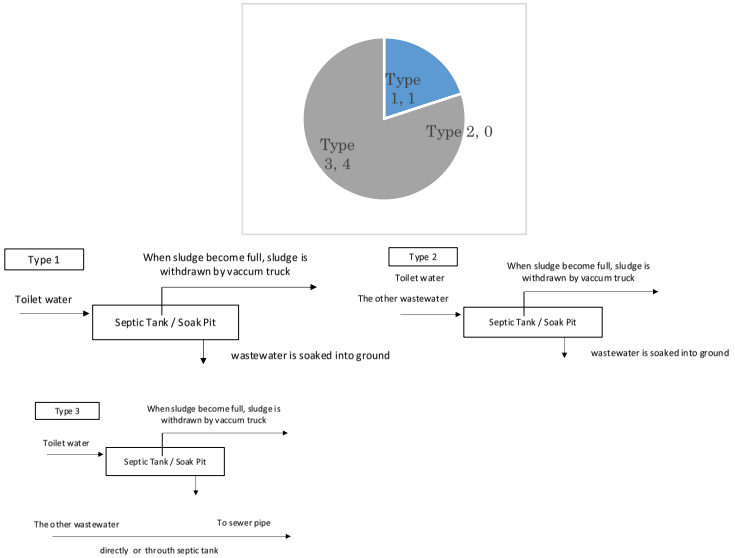


Figure 50 Treatment Process of Wastewater in Household and Hotel

1 household outside sewerage area adopted Type 1, the process consisting of treating wastewater from toilet in the soak pit while discharging the other wastewater from kitchen, washing body and clothes etc. directly into side ditch.

3 households inside sewerage area adopted Type 3, the process consisting of treating wastewater from toilet in the septic tank or soak pit while discharging the other wastewater from kitchen, washing body and clothes etc. directly into sewer pipe.

1 hotel adopted Type 3, the process consisting of treating wastewater from toilet in the septic tank while treating the other wastewater from kitchen, washing body and clothes etc. in the septic tank and discharging the treated water into sewer pipe.

JICA team asks the municipality the reason why some households etc. do not connect the pipe line for wastewater from toilet to the sewer line and they replied that it was not allowed to connect it to the sewer line in current because the chamber was not installed on each household yet and the sewer pipe might be clogged.

⑤ De-sludge

The number of household and hotel which has the experience of de-sludge from septic tank or soak pit is shown in Figure 51.

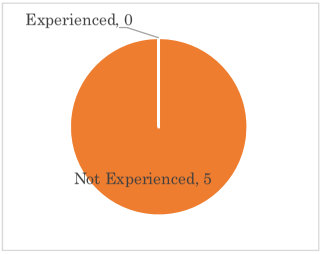


Figure 51 Experience of De-sludge from Septic Tank or Soak Pit

All of 4 households and 1 hotel did not carry out de-sludge.

Besides, there was the household which has never withdrawn the sludge in the soak pit for 35 years.

⑥ Volume of septic tank etc.

Volume of soak pit per one person is shown in Figure 52.

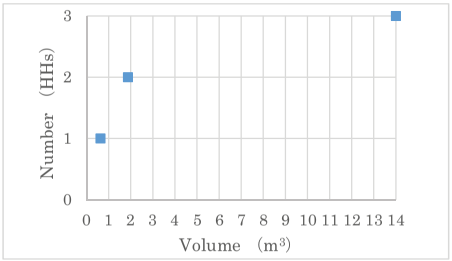


Figure 52 Volume of Soak Pit per One Person

Intermediate value of the volume of soak pit per one person in the household among 3 respondents was approximately 2m^3.

⑦ Cost for de-sludge

JICA team did not get any answers regarding this question because all of 4 households and 1 hotel did not execute de-sludge.

⑧ Agency for de-sludge

3 households and 1 hotel inside sewerage area answered that they contact the municipality when sewer pipe is clogged.

JICA team did not collect the answer for this question from 1 household outside sewerage area because they never have the experience of de-sludge.

⑨ Reason for de-sludge

The reason for de-sludge is shown in Figure 53.

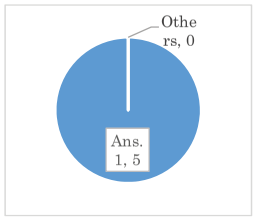


Figure 53 Reason for De-sludge

Answers in the Questionnaire :

Answer 1 : Because the tank became full of the sludge

Others : Because odor was generated from the tank. Because we need to follow the regulation in the city. Because we would like to contribute to environmental conservation etc.

Note:

These answers are including ones from the households which is going to do de-sludge in the future but have never experienced de-sludge until now.

All of 4 respondents from households and 1 responded from hotel answered “Answer 1”, “Because the tank became full of the sludge”.

⑩ Structure of septic tank and soak pit

Recognition of each hosehold and hotel regarding presence of bottom slab in the soak pit is shown in Figure 54.

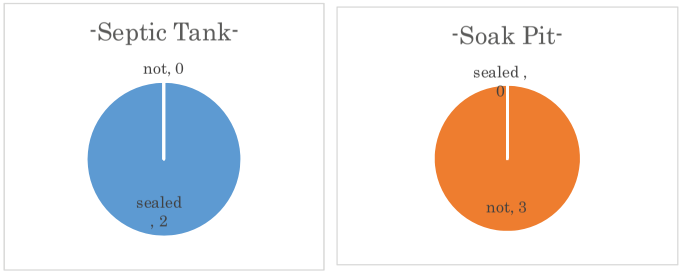


Figure 54 Recognition of Each Household and Hotel regarding Presence of Bottom Slab in the Septic Tank and Soak Pit

1 respondents from households and 1 respondent from hotel which own septic tank answered that septic tank has a bottom slab and never leak the wastewater into ground. While 3 respondents from households which own soak pit answered that soak pit does not have a bottom slab and leak the wastewater into the ground.

Schematic structural drawing of septic tank and soak pit based on the result of interview is shown in Figure 55.

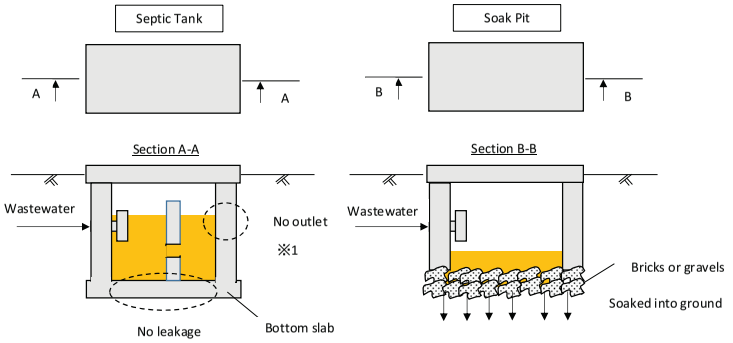


Figure 55 Schematic Structural Drawing of Septic Tank and Soak Pit
(Based on the result of interview)

※1　1 respondent from hotel answered that septic tank for treatment of wastewater from kitchen etc. has an outlet for going out treated water and discharging it into sewer pipe.

⑪ Interest for sewerage

Interest for sewerage is shown in Figure 56.

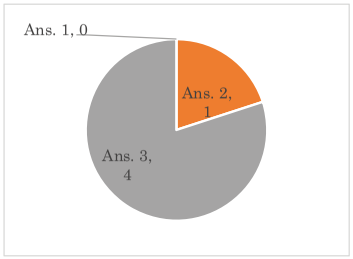


Figure 56 Interst for Sewerage

Answers in the Questionnaire：

Answer 1　: No willingness to connect with sewer pipe

Answer 2　: I am interested in sewerage service. But it depends on the tariff.

Answer 3　: I have already connected with sewer pipe

3 respondents from households and 1 respondent from hotel answerd Answer 3, “I have already connected with sewer pipe”.

The other 1 household answered Answer 2, “I am interested in sewerage service. But it depends on the tariff.” And as the reason for interest in sewerage service, they answered that “ I want to contribute to the environmental conservation”.

⑫ Willingness to pay for sewerage service

Although JICA team asked 1 household outside sewerage area about the willingness to pay for sewerage service, we could not have the answer.

Asking 3 households insdie sewerage area about the tariff for sewerage in current, they answered that they never pay any fee for sewerage after they paid at the contract of sewerage service. 1 respondent answered that they paid NPR9,000 to municipality at the contract.

1 respondent from hotel also answered that they never pay any fee for sewerage after they paid at the contract of sewerage service and pays approxymately NPR5,000 for one time when they ask the municipality for cleaing of sewer pipe.

（4） Birgunj

1） Situation of Wastewater Treatment in Household and Hotel

① Possession of toilet

Possession of toilet in the households and hotel is shown in Figure 57.

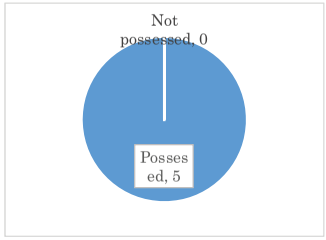


Figure 57 Possession of Toilet

All of 4 households and 1 hotel have toilets in their houses or hotel.

② Type of Toilet

Type of toilet is shown in Figure 58.

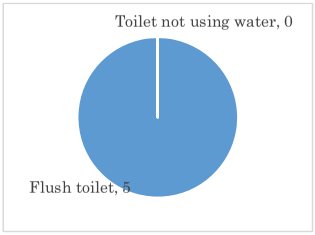


Figure 58　Type of Toilet

All of 4 households and 1 hotel surveyed had flush toilets.

③ Water used for toilet

Water source of toilet water is shown in Figure 59.

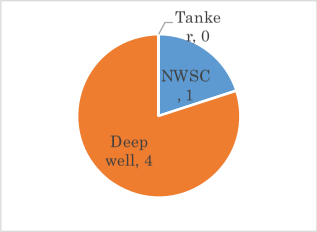


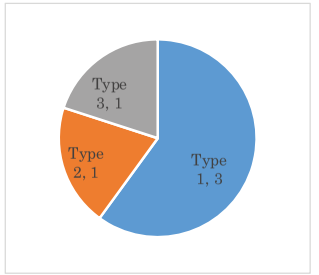
Figure 59 Water source of toilet water

1 household among 4 households use water from NWSC and 3 households use water from own water source (deep well).

One hotel surveyed use water from own water source (deep well).

④ On-site treatment process

Treatment process of wastewater from toilet and wastewater from kitchen etc. in households and hotel are shown in Figure 60.



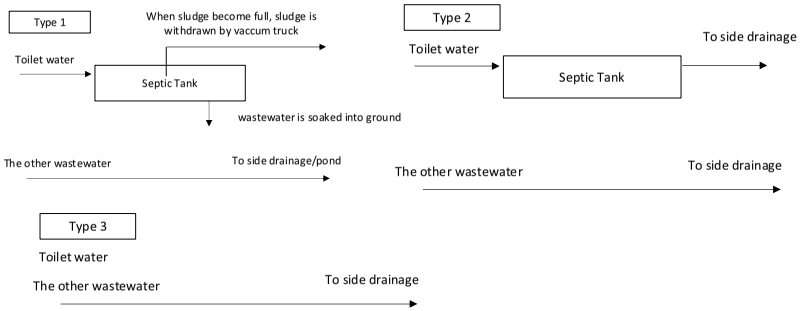


Figure 60 Treatment Process of Wastewater in Household and Hotel

3 household among 4 households adopted Type 1, the process consisting of treating wastewater from toilet in the septic tank while discharging the other wastewater from kitchen, washing body and clothes etc. directly into side ditch.

The other 1 household adopted Type 3, the process consisting of discharging wastewater from toilet and the other wastewater from kitchen, washing body and clothes etc. directly into side ditch.

1 hotel surveyed adopted Type 2, the process consisting of treating wastewater from toilet in the septic tank and discharging the treated water into side ditch while discharging wastewater from kitchen etc. directly into side ditch.

⑤ De-sludge

The number of household and hotel which has the experience of de-sludge from septic tank is shown in Figure 61

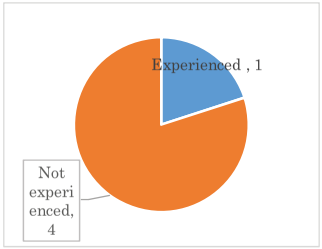


Figure 61 Experience of De-sludge from Septic Tank

All of 4 households did not carry out de-sludge. One of the households has not withdrawn the sludge from the septic tank for 20 years.

While 1 hotel answers that they conduct de-sludge of septic tank regularly (once for 2 years).

⑥ Volume of septic tank etc.

Volume of septic tank per one person is shown in Figure 62.

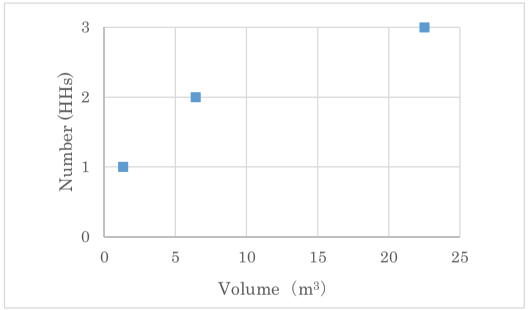


Figure 62 Volume of Septic Tank per One Person

Intermediate value of the volume of septic tank per one person in the household among 3 respondents is approximately 7m³.

⑦ Cost for de-sludge

JICA team did not receive any answers from households regarding this question because all of

4 households surveyed did not have the experience of de-sludge.

While 1 hotel surveyed answered that the cost for de-sludge is approximately NPR1,300/m³.

⑧ De-sludge company

JICA team did not receive any answers from households regarding this question because all of 4 households surveyed did not conduct de-sludge.

While 1 hotel surveyed answered that they ask private companies for de-sludge.

⑨ Reason for de-sludge

JICA team did not receive any answers from households regarding this question because all of 4 households surveyed did not have the experience of de-sludge.

While 1 hotel answers “Because the tank became full of the sludge” as the reason for de-sludge.

⑩ Structure of septic tank

Recognition of each hosehold and hotel regarding presence of bottom slab in the septic tank is shown in Figure 63.

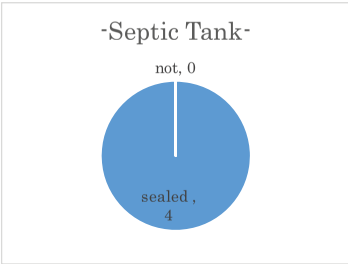


Figure 63 Recognition of Each Household and Hotel regarding Presence of Bottom Slab in the Septic Tank

3 respondents from households with septic tank answers that septic tank has a bottom slab and wastewater never leaks into ground.

While 1 respondent from hotel with septic tank answers that septic tank has a bottom slab and the outlet for discharging the treated water into the side ditch.

Schematic structural drawing of septic tank based on the result of interview is shown in Figure 64.

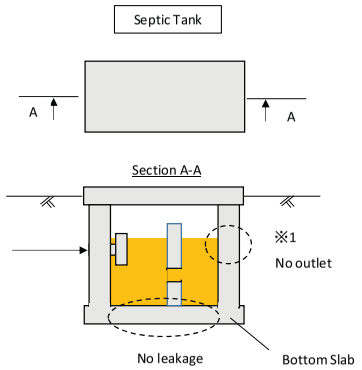


Figure 64 Schematic Structural Drawing of Septic Tank
(Based on the result of interview)

※1 An outlet is installed in the septic tank in the hotel and the treated water from the tank is discharged into side ditch.

⑪ Interest for sewerage

Interest for sewerage is shown in Figure 65

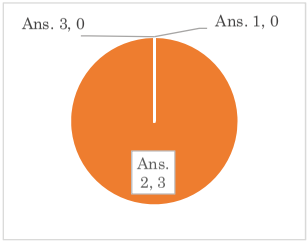


Figure 65 Interst for Sewerage

Answers in the Questionnaire :

Answer 1 : No willingness to connect with sewer pipe

Answer 2 : I am interested in sewerage service. But it depends on the tariff.

Answer 3 : I have already connected with sewer pipe

All of 2 respondents from households and 1 respondent from hotel answerd Answer 2, "I am interested in sewerage service. But it depends on the tariff."

Besides, the reason for interst in sewerage service is shown in Figure 66.

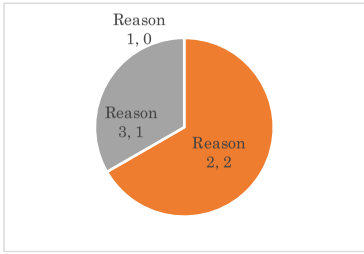


Figure 66 Reason for Interst in Sewerage Service

Note :

Answer 1 : We want to use the space of the existing septic tank etc. for the other purpose.

Answer 2 : We want to contribute to the environmental conservation.

Answer 3 : We want to reduce the work load for keeping sanitary condition in current.

※Multiple answers

2 respondents answered Answer 2, "We want to contribute to the environmental conservation in Birgunj." And 1 respondent answered Answer 3, "We want to reduce the work load for keeping sanitary condition in current."

⑫ Willingness to pay for sewerage service

Among 4 households and 1 hotel, 2 respondents from households answered that we want to connect with sewer pipe if it is free.

⑬ Regarding sewerage treatment system under construction in Birgunj

JICA team asked 4 households and one 1 hotel weather they know on-going seweage project in Birgunj or not.

The results are shown in Table 67.

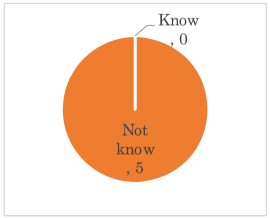


Figure 67 Regarding On-going Sewerage Project in Birgunj

All of 4 respondents from household and 1 respondent from hotel answered that "We don' t almost know it ".

（5） Janakpur

1） Situation of Wastewater Treatment in Household and Hotel

① Possession of toilet

Possession of toilet in the households and hotel is shown in Figure 68.

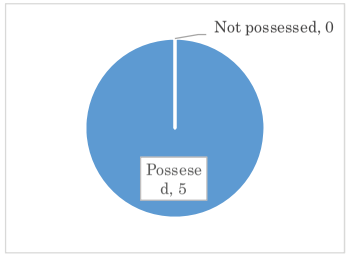


Figure 68 Possession of Toilet

All of 4 households and 1 hotel have toilets in their houses or hotel.

② Type of toilet

Type of toilet is shown in Figure 69.

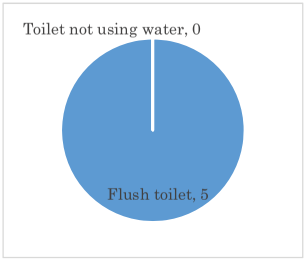


Figure 69 Type of Toilet

All of 4 households and 1 hotel have flush toilets.

③ Water used for toilet

Water source of toilet water is shown in Figure 70.

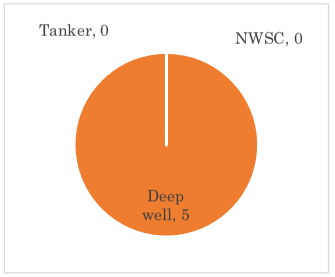


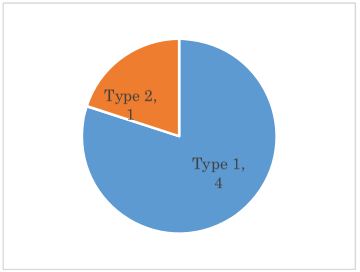
Figure 70 Water Source of Toilet Water

All of 4 respondents from households use water from own water source (deep well with motor pump or hand pump).

One hotel surveyed use water from own water source (deep well with motor pump).

④ On-site treatment process

Treatment process of wastewater from toilet and wastewater from kitchen etc. in households and hotel are shown in Figure 71.



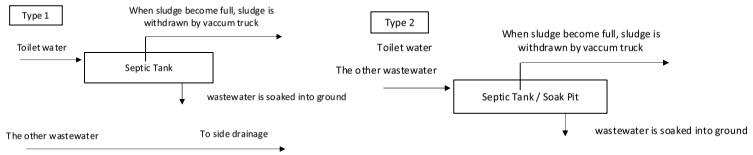


Figure 71 Treatment Process of Wastewater in Household and Hotel

3 household among 4 households adopted Type 1, the process consisting of treating wastewater from toilet in the septic tank while discharging the other wastewater from kitchen, washing body and clothes etc. directly into side ditch.

The other 1 household adopted Type 2, the process consisting of treating wastewater from toilet and the other wastewater from kitchen, washing body and clothes etc. in the soak pit.

1 hotel surveyed adopted Type 1, the process consisting of treating wastewater from toilet in the septic tank while discharging wastewater from kitchen etc. directly into side ditch.

⑤ De-sludge

The number of household and hotel which have conducted de-sludge from septic tank is shown in Figure 72.

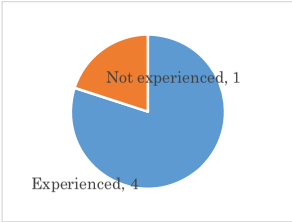


Figure 72 Experience of De-sludge from Septic Tank or Soak Pit

3 out of 4 households conducted de-sludge.

1 hotel also conducetd de-sludge. (Period of year for de-sludge is not answered.)

⑥ Septic tank volume etc.

Volume of septic tank per one person is shown in Figure 73.

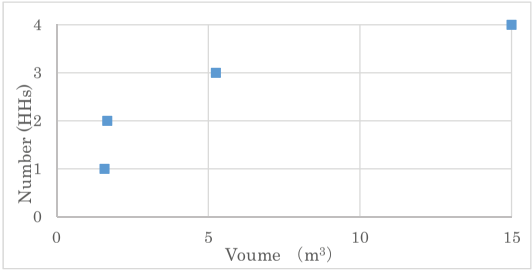


Figure 73 Volume of Septic Tank per One Person

Intermediate value of the volume of septic tank per one person in the household among 4 respondents was approximately 2m^3.

For verifying the validity of the capacity of septic tank and the frequency of de-sludge, the duration when tank is filled with the sludge is estimated by assuming the use of 20 litter of water per day per capita for toilet water (calculated year for de-sludge) and the result of the interview. The comparison between calculated year for de-sludge and frequency of de-sludge based of the result of the interview is shown in Figure 74.

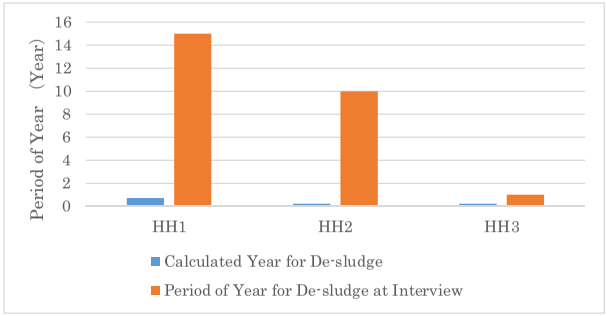


Figure 74 Comparison between Calculated Year for De-sludge and Period of Year for De-sludge at Interview for Households

Note:

The years of filing up the sludge in the tank is calculated by following equation:

Calculated year for de-sludge (Year)

= Volume of Septic Tank（m^3）÷ ($0.02m^3$×365 days)

Water for toilet per one person is set as 20 Litter.

The result of the study finds that the period of year for de-sludge of septic tank in the house of 3 respondents is much longer than the calculated year calculated of de-sludge. Therefore, if the period of year for de-sludge at interview is correct, most of septic tank installed in the household are sure to leak a lot of wastewater into the ground.

⑦ De-sludge cost

De-sludge cost per $1m^3$ sludge of 3 respondents from households is shown in Figure 75.

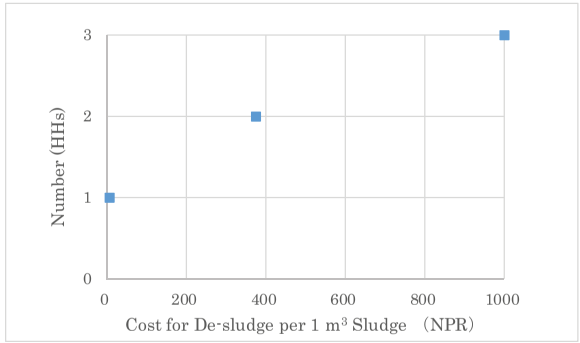


Figure 75 Cost for De-sludge per 1 m^3 Sludge

The result of the study shows that the intermediate number regarding the de-sludge cost per 1 m^3 sludge among 3 respondents from households is approximately NPR400.

Asking the household which answered the lowest cost for de-sludge (NPR100 per 1 time) about the disposal method for sludge withdrawn, they explained that the private company dug the hole in the premise of their household and just put the sludge into the hole and covered the soil on it.

JICA team did not receive the answer regarding this question from 1 hotel surveyed.

⑧ De-sludge company

3 respondents from households and 1 hotel answered that they ask private companies for de-sludge.

⑨ Reason for de-sludge

3 respondents from household and 1 hotel answered “Because the tank became full of the sludge” as the reason for de-sludge.

⑩ Structure of septic tank

Recognition of each household and hotel regarding presence of bottom slab in the septic tank and the soak pit is shown in Figure 76.

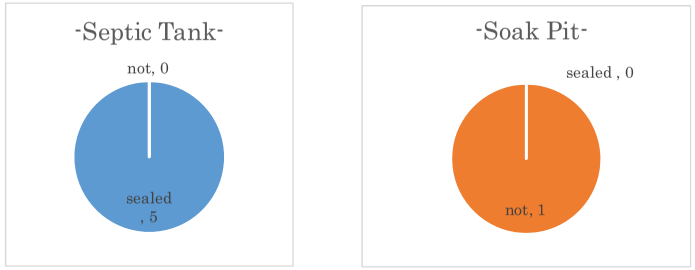


Figure 76 Recognition of Each Household and Hotel regarding Presence of Bottom Slab in the Septic Tank and Soak Pit

4 respondents from households with a septic tank answer that septic tank has a bottom slab and wastewater never leaks into ground.

Beside, 1 household with a soak pit in addition to a septic tank answered that soak pit does not has a bottom slab and wastewater basically leaks into ground.

1 hotel which own septic tank also answered septic tank has a bottom slab and never leak the wastewater into ground.

Schematic structural drawing of septic tank and soak pit based on the result of interview is shown in Figure 77.

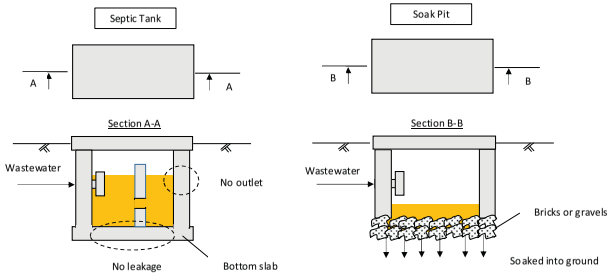


Figure 77 Schematic Structural Drawing of Septic Tank and Soak Pit (Based on the result of interview)

⑪ Interest for Sewerage

Interest for sewerage is shown in Figure 78.

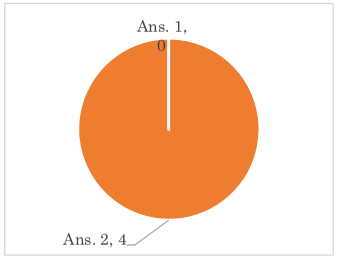


Figure 78 Interst for Sewerage

Answers in the Questionnaire :

Answer 1 : No willingness to connect with sewer pipe

Answer 2 : I am interested in sewerage service. But it depends on the tariff.

Answer 3 : I have already connected with sewer pipe

All of 4 respondents from households answerd Answer 2, "I am interested in sewerage service. But it depends on the tariff."

Besides, the reason for interst in sewerage service is shown in Figure 79.

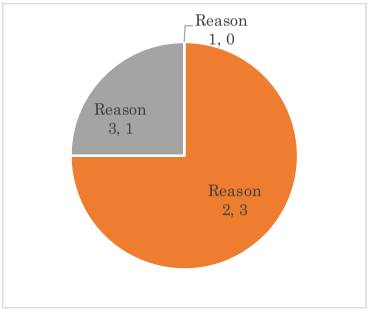


Figure 79 Reason for Interst in Sewerage Service

Note :

Answer 1 : We want to use the space of the existing septic tank etc. for the other purpose.

Answer 2 : We want to contribute to the environmental conservation.

Answer 3 : We want to reduce the work load for keeping sanitary condition in current.

※ Multiple answers

3 respondents from households answered Answer 2, “We want to contribute to the environmental conservation in Janakpur.” And 1 respondent answered Answer 3, “We want to reduce the work load for keeping sanitary condition in current.”

⑫ Willingness to pay for sewerage service

Willingness to pay for sewerage service for one month is shown in Figure 80.

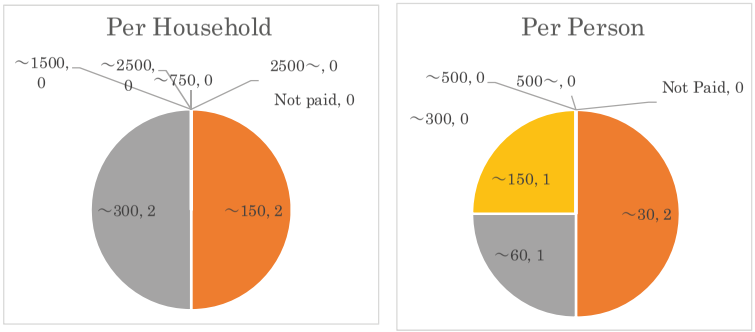


Figure 80 Willingness to Pay for Sewerage Service for One Month

Among 4 repondents from households, the answer for willingness to pay for sewerage service on each household was as follows:

- “We will connect if the tariff is from 0 to NPR150 per household for one month “is 2.
- “We will connect if the tariff is from NPR150 to NPR300 per household for one month” is 2.

Besides, willingness to pay for sewerage service per one person (or one connection) to septic tank or soak pit was as follows:

- “We will connect if the tariff is from 0 to NPR30 per one person for one month “is 2.
- “We will connect if the tariff is from NPR30 to NPR60 per person for one month” is 1.
- “We will connect if the tariff is from NPR60 to NPR150 per person for one month” is 1.

5. Summary of Survey Result

（1） Pokhara

The results of interviews with 30 households and 10 hotels are as follows:

① Type of toilet

- All households have toilets in their houses. There are no households with open defecation etc.
- All households had flush toilets.

② Water for toilet

- Many households use tap water (supplied by NWSC) in the toilet and some use groundwater (hand pump) owned by each house
- Especially for large sized hotels, they use their own water sources (deep wells) and do not use tap water.

③ Structure of septic tank and soak pit

- All houses and hotels recognize that a bottom slab and side walls are installed in septic tank but no outlet for treated water is installed.
- All houses and hotels have recognize that a soak pit is a tank without any bottom slab.
- However, the year of de-sludge is longer compared with the estimated period when the tank is filled with sludge. Therefore it is doubted that wastewater leaks into the ground.
- Volume of septic tank for household per one person (intermediate value among 12 respondents) is approximately 2m^3.
- Volume of soak pit for household per one person (intermediate value among 15 respondents) is approximately 2m^3.
- Volume of septic tank for hotel per one person (intermediate value among 6 respondents) is approximately 2m^3.
- Volume of soak pit for hotel per one person (intermediate value among 7 respondents) is approximately 2m^3.

④ On-site treatment process

- In the households and hotels, basically, wastewater from toilet and wastewater from kitchen, washing clothes and body etc. are treated with the separate line
- Wastewater from toilets is not directly discharged into the side ditch, basically, treated in a septic tank and then stored in a water tank or soaked into the ground through a soak pit.
- Approximately 75% of the respondents from households treat wastewater from kitchen etc. in the soak pit. Approximately 25 % of the respondents from households directly discharge it into side ditch. There are some areas where wastewater from kitchen etc. is soaked into the ground because side ditches are not allowed to be installed there in accordance with urban planning

- Approximately 90% of the respondents from hotels treat wastewater from kitchen etc. in the soak pit. Approximately 10% of the respondents from hotel directly discharge it into side ditch. We found that on-site treatment process mainly depends on each area.

⑤ De-sludge cost

- Approximately 15% of the respondents from households have experiences of de-sludge. The rest have never conducted de-sludge.
- De-sludge is conducted by a private company.
- Tariff of sludge disposal per $1m^3$ of sludge from households (intermediate value among 5 respondents) is approximately NPR1,100.
- The reason for de-sludge of household is mainly “when the tank is full of sludge”. There is no household having scheduled de-sludge except for the other reason
- All the respondents from hotel have experience of de-sludge
- All the respondents from hotel have outsourced de-sludge to a private company.
- Tariff of sludge disposal per $1m^3$ of sludge from hotels (intermediate value among 4 respondents) is approximately NPR900.
- The reason for de-sludge of hotel is mainly “when the tank is full of sludge”. There is no hotels having scheduled de-sludge except for the other reason

⑥ Interest level for Sewerage

- Many households and hotels are interested in the sewerage, but it depends on the tariff to be collected.
- The reasons are “because the space of the existing septic tank or soak pit can be used for the other purpose”, “because work load on keeping sanitation can be reduced more ” and “because water environment can be improved” etc.
- Among 8 respondents from households as one month’s willingness to pay to the sewers,
  1 is connected if it is free,
  6 is connected if NPR 0 to 150/month,
  1 is connected if NPR 150 to 300/month,

  As one month’s willingness to pay per one person (or one connection) to septic tank or soak pit,
  1 is connected if it is free,
  5 is connected if NPR 0 to 30/month,
  2 is connected if NPR 30 to 60/month,

（２） Butwal

Based on the results of interviews with 4 general households and 1 hotel, only the characteristic points in comparison with Pokhara are described below:

② Water used for toilet

- All household and hotel use tap water (provided by NWSC) for toilet

④ On-site treatment process

- In all the households and hotels, wastewater from toilet is treated in soak pit. There are no householes and hotels that waterwater from toilet is treated in septic tank.
- In all the households and hotels, wastewater from kitchen etc. is drained directly to the ditch.

⑤ De-sludge

- Only one respondent out of 5 household have conducted de-sludge.

（３） Hetauda

Based on the results of interviews with 4 general households and 1 hotel, only the characteristic points in comparison with Pokhara are described below:

④ On-site treatment process

- In all the householes and hotels, wastewater from toilte is treated in septic tand and the treated water is stored in the tank or watewater from toiltet is tretated with soak pit.
- In 3 households and 1 hotel in the sewerage covered area, wastewater from toilet is treated in septic tank or soak pit because Municipality does not allow wastewater to directly discharge into sewer yet.
- In 3 households and 1 hotel in the sewerage area, wastewater from kitchen etc. is directly discharged into sewer. One case in no-sewerage covered area, wastewater from kitchen etc. is directly discharged into side ditch.

（４） Birgunj

Based on the results of interviews with 4 general households and 1 hotel, only the characteristic points in comparison with Pokhara are described below:

② Water used for toilet

- 4 out of 5 households and hotel use water from their own water source (hand pump etc.) as water for toilet

④ On-site treatment process

- In 3 households and 1 hotel, wastewater from toilet is treated in septic tank and the treated water is stored in the tank or discharged into the side ditch. There are no households which own a soak pit.
- cases that wastewater from toilet is treated in soak pit.
- All the households and hotel directly discharge wastewater from kitchen etc. into side ditch.

⑤ De-sludge

- Only 1 out of 5 respondents has conducted de-sludge.

（5） Janakpur

Based on the results of interviews with 4 general households and 1 hotel, only the characteristic points in comparison with Pokhara are described below:

② Water for toilet

- All the households and hotel use water from their own water source (hand pump etc.) as water for toilet.

④ On-site treatment process

- All the households and hotel treat wastewater from toilet in septic tank and the treated water is stored in the tank or treat it in soak pit.
- Among the households and hotel surveyed, 4 cases directly discharge wastewater from kitchen etc. into side ditch and 1 case treat it in soak pit.
- According to 1 respondent from household using soak pit, the respondant never had the experience that water level became high and ground water overflowed even at rainy eanly season before.

⑤ De-sludge

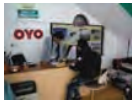
- 4 out of 5 respondents has conducted de-sludge for their tanks.

Finally, it should be considered that there are some bias in the result in this report because they are based on the information through the limited number of interview during this survey. Therefore, JICA team recommends to conduct additional interview survey for collecting the current condition of domestic wastewater treatment in 5 cities with accuracy by increasing the number of target households, if necessary.

End

Attachment-1

1. Pokhara

				
HH1(Lakeside)	HH2(Alchal Bot)	HH3(Alchal Bot)	HH4(Bagar)	HH5(Bagar)
				
HT1(Lakeside)	HT2(Lakeside)	HT3(Bagar)	HT4(Lakeside)	HT5(Bisauta)
				
HT6(Damside)	HT6(Damside)	HT8(Lakeside)	HT9(Lakeside)	HT10(Lakeside)

2. Butwal

				
HH1(Mjah Path Sanoar)	HH2(Satyanarayan)	HH3(Chandbari)	HH4(Golpark)	HT1(Golpark)

3. Hetauda

				
HH1(Kamane)	HH2(Sangham)	HH3(TCN)	HH4(Ajaramar)	HT1(Bank Road)

4. Birgunj

				
HH1(Bhanshar)	HH2(Luarwa)	HH3(Adarshanagar)	HH4(Ghadiarwa)	HT1(Adarshanagar)

5. Jankpur

				
HH1(Kishori Nagar)	HH2(Miles)	HH3(Balmiki)	HH4(Rajaul)	HT1(New Bus Park)

End

A-5-33

Appendix-6 LIST OF WUSC

Appendix-6　List of WUSC

（1）　Kathmandu Valley

i) Kathmandu

Table 1　Kathmandu

No.	Name of Project	Name and Wards of New Municipality	Year of completion	Population	Type of project
1	Panchdharamul WS Project	Nagarjun Municipality ward- 2, 3	2007	5000	Gravity
2	Dholunge Bimire WS Project	Nagarjun Municipality ward- 5	2007	300	Gravity
3	Ichangu Narayan WS Project	Nagarjun Municipality ward- 3	2008	11850	Gravity
4	Kapan Shivapuri WS Project	Budhanilkantha Municipality ward- 12	2000	13124	Gravity
5	Naikap (Old) WS Project	Chandragiri Municipality ward- 13	1983	2011	Gravity
6	Tarkeshwar Brihat WS Project	Tarkeshwar Municipality ward- 3	2000	989	Gravity
7	Dahachok WS Project	Chandragiri Municipality ward- 1	2002	150	Gravity
8	Nayapati WS Project	Gokarneshwar Municipality ward- 1	2006	800	Gravity
9	Pasikot WS Project	Budhanilkantha Municipality ward- 4	2008	2453	Gravity
10	Kyurining WS Project	Chandragiri Municipality ward- 1	2001		Gravity
11	Radhakrishna WS Project	Nagarjun Municipality ward- 6	1993	500	Gravity
12	Baadbhanjyang WS Project	Chandragiri Municipality ward- 2	2005	1400	Gravity
13	Nayapati WS Project	Gokarneshwar Municipality ward- 1	2006	1000	Gravity
14	Goldhunga WS Project	Tarkeshwar Municipality ward- 5	2002	1350	Gravity
15	Gauridhara WS Project	Nagarjun Municipality ward- 5	2002	125	Gravity
16	Tanum WS Project	Budhanilkantha Municipality ward- 2	1991	2000	Gravity
17	Simalika WS Project	Budhanilkantha Municipality ward- 2	1991	500	Gravity
18	Purano Naikap WS Project	Chandragiri Municipality ward- 14	2002	600	Gravity/Pumping
19	Dhobidhunga WS project	Budhanilkantha Municipality ward- 2	1991	3000	Gravity/Pumping
20	Dahachok Dhobidhunga WS Project	Chandragiri Municipality ward- 1	2001	410	Gravity/Pumping
21	Nayapati WS Project	Gokarneshwar Municipality ward- 2	2005	1500	Gravity/Pumping
22	Purano Naikap WS Project	Chandragiri Municipality ward- 13	2001	1000	Gravity/Pumping
23	Jitpurphedi WS Project	Tarkeshwar Municipality ward- 3	2007	600	Gravity/Pumping

No.	Name of Project	Name and Wards of New Municipality	Year of completion	Population	Type of project
24	Thankot WS Project	Chandragiri Municipality ward- 4	2005	200	Gravity/Pumping
25	Matatirtha WS Project	Chandragiri Municipality ward- 8	2005	275	Gravity/Pumping
26	Sudarijal WS Project	Gokarnewshar Municipality ward- 1	1999	725	Gravity/Pumping
27	Ramkot WS Project	Nagarjun Municipality ward- 6	1993	450	Gravity/Pumping
28	Swatigaun WS Project	Nagarjun Municipality ward- 7	1999	500	Gravity/Pumping
29	Khaharekhola WS Project	Nagarjun Municipality ward- 6	1999	150	Gravity/Pumping
30	Baluwa WS Project	Gokarneshwar Municipality ward- 3	2000	1000	Gravity/Pumping
31	Dahachok WS Project	Chandragiri Municipality ward- 1	2012	11617	Gravity/Pumping
32	Goldhunga Brihat WS Project	Tarkeshwar Municipality ward- 4, 5	2012	352	Gravity/Pumping
33	Syuchatar WS Project	Nagarjun Municipality ward- 7, 10	2014	6655	Gravity/Pumping
34	Tinthana WS Project	Chandragiri Municipality ward- 15	2014	6622	Gravity/Pumping
35	Ramkot WS Project	Nagarjun Municipality ward- 10	2016-17	450	Gravity
36	Jhorjania WS Project	Tokha Municipality ward - 1, 2	2016-17	1317	Gravity
37	Machcchegaun WS Project	Chandragiri Municipality ward- 9	2017	6542	Gravity/Pumping
38	Sitapaila 5,6 Harisiddhi WS Project	Nagarjun Municipality ward- 5	2017	2656	Pumping
39	Sundarijal 7, 8 WS Project	Gokarnewshar Municipality ward- 1	2017	828	Gravity
40	Manakamanatol Manamainju WS Project	Tarakeshwar Municipality ward- 8	2017	350	Gravity/Pumping
41	Shikharmarga Deep Boring WS Project	Budhanilkantha Municipality ward- 10	2017	250	Gravity/Pumping
42	Dudhpokhari WS Project	Kirtipur Municipality ward-	2017	150	Gravity
43	Minalbasti Bishnu Panchayan WS Project	Tarakeshwar Municipality ward- 9	2017	200	Gravity
44	Nagarjun Khopatol WS Project	Nagarjun Municipality ward -	2017	300	Pumping
45	Tarkeswar 12 WS Pipeline Extension Project	Tarakeshwar Municipality ward- 12	2017	250	Pumping
46	Ichangu Narayan WS Project	Nagarjun Municipality ward -1	2018	5750	Pumping
47	Matatirtha WS Project	Chandragiri Municipality ward- 11	2018	986	Pumping
48	Jhangatol Bhadrabas- 8, 9 WS Project	Kageshwari Manohara Municipality ward -2	2018	268	Gravity
49	Baluwa- 5, 6 WS Project	Gokarneshwar Municipality ward- 3	2018	936	Gravity

No.	Name of Project	Name and Wards of New Municipality	Year of completion	Population	Type of project
50	Budhanilkantha HS School WS Project	Budhanilkantha Municipality ward- 6	2018	200	Pumping

ii) Bhaktapur

Table 2 Bhaktapur

No.	Name of Project	Name and Wards of New Municipality	Year of completion	Population	Type of project
1	Nangkhel WS Project	Suryabinayak Municipality ward- 9	1994-95	3956	Gravity
2	Gundu Ranikhola WS Project	Suryabinayak Municipality ward- 7	2000-01	5645	Gravity
3	Sudal WS Project	Changu Narayan Municipality ward- 3	2000-01	6261	Gravity
4	Katunje Ghattekhola	Suryabinayak Municipality ward- 5	2000-01	5710	Pumping
5	Pandu Bazaar WS Project	Suryabinayak Municipality ward- 6	2002-03	1177	Gravity
6	Dadhikot WS Project	Suryabinayak Municipality ward- 1, 4	2000-01	6326	Gravity
7	Chittapol WS Project	Suryabinayak Municipality ward-10	2002-3	3452	Gravity
8	Uttisghari (Old) WS Project	Suryabinayak Municipality ward- 4	1997-98	1635	Gravity
9	Dahaltol WS Project	Changu Narayan Municipality ward- 3	2005-06	812	Gravity
10	Changu, Jhoukhel, Dubakot WS Project	Changu Narayan Municipality ward- 1, 2, 3	1999-00	8720	Pumping
11	Tathali WS Project	Changu Narayan Municipality ward- 5	1991-92	6784	Gravity
12	Katunje Dadhikot WS Project	Suryabinayak Municipality ward- 5, 6	1978-79	6529	Gravity
13	Changu Narayan WS Project	Changu Narayan Municipality ward- 4	1999-00	2500	Gravity
14	Gundu WS Project	Suryabinayak Municipality ward- 7	1996-97	672	Gravity
15	Tallu Jitpur WS Project	Changu Narayan Municipality ward- 5	2005-06	3790	Gravity
16	Uttisghari Dadhikot (I) WS Project	Suryabinayak Municipality ward- 4	2005-06	4871	Pumping
17	Sirutal WS Project	Suryabinayak Municipality ward- 1	2006-07	3594	Gravity
18	Thakurigaun WS Project	Changu Narayan Municipality ward- 3	2007-08	1049	Gravity
19	Nangkhel WS Project	Suryabinayak Municipality ward- 9	2007-08	1332	Gravity
20	Katunje Subarneshwar WS Project	Suryabinayak Municipality ward- 5, 6	2008-09	5760	aPumping/Gravity
21	Suryabinayak Tindhara WS Project	Suryabinayak Municipality ward- 5, 6	2008-09	1541	Pumping

No.	Name of Project	Name and Wards of New Municipality	Year of completion	Population	Type of project
22	Uttisghari Dadhikot (II) WS Project	Suryabinayak Municipality ward- 4	2007-08	542	Pumping
23	Gundu 3 Aaitabare Ashram WS Project	Suryabinayak Municipality ward- 7		1042	Gravity
24	Changu Narayan WS Project	Changu Narayan Municipality ward- 4		4648	Gravity
25	Pandu Bazaar WS Project	Suryabinayak Municipality ward- 6		3976	Pumping
26	Biruwa WS Project	Suryabinayak Municipality ward- 1			Gravity
27	Changu, Jhoukhel, Dubakot WS Project	Changu Narayan Municipality ward- 1, 2, 3, 4		5422	Pumping
28	Simkhola Chittapol WS Project	Suryabinayak Municipality ward-10	2013-14	6849	Pumping
29	Changu Narayan WS Project	Changu Narayan Municipality ward- 4	2014-15	1141	Pumping
30	Jhoukhel Kulmukteshwar WS Project	Changu Narayan Municipality ward- 3	2016-17	4630	Gravity

iii) Lalitpur

Table 3 Lalitpur

No.	Name of Project	New Municipality and ward no	Year of completion	Type of system	Type of source	Benefited HHs
1	Bungmati Pharsidol WS Project	Lalitpur Metropolitancity ward- 22	2015	Gravity	Spring	120
2	Twatigal WS Project	Lalitpur Metropolitancity ward- 22	1997	Gravity	Spring	250
3	Hilekholsa WS Project	Lalitpur Metropolitan City ward- 22		Gravity	Spring	5
4	Sainbu Bhainsepati WS Project	Lalitpur Metropolitan City ward- 25	2018	Overhead Pumping	Underground water	300
5	Sainbu WS Project	Lalitpur Metropolitan City ward- 25		Gravity	Spring	200
6	Dolbhangeri WS Project	Godari Municipality ward- 2	2013	Gravity	Spring	114
7	Sotikuwa WS Project	Godari Municipality ward- 2		Gravity	Spring	143
8	Muldol Scheme 1 WS Project	Godawari Municipality ward- 10, 11	1971	Gravity	Spring	2043
9	Mulko WS Project	Godari Municipality ward- 2		Gravity	Spring	35

No.	Name of Project	New Municipality and ward no	Year of completion	Type of system	Type of source	Benefited HHs
10	Badikhel WS Project	Godawari Municipality ward-4	2006	Gravity	Spring	373
11	Kitachaur WS Project	Godawari Municipality ward-4	2007	Gravity	Spring-fed stream	100
12	Khasimara WS Project	Godawari Municipality ward-13	2014	Gravity	spring	745
13	Kalechaur WS Project	Godawari Municipality ward- 3	2015	Gravity	Stream	112
14	Godawari Scheme 1 WS Project	Godawari Municipality ward- 3	1994	Gravity	Spring	1492
15	Godawari WS Project	Godawari Municipality ward- 3		Gravity	Spring-fed stream	1700
16	Godamchaur Scememe 1 WS Project	Godawari Municipality ward- 1	1998	Gravity	Spring	360
17	Godamchaur Scememe 2 WS Project	Godawari Municipality ward- 1	2005	Gravity	Spring	485
18	Bishankhu Scheme 2 WS Project	Godari Municipality ward- 2	1999	Pumping	Spring	292
19	Gaurikunda Muhan WS Project	Godari Municipality ward- 2	2007	Gravity	Spring	93
20	Niurebari WS Project	Mahalaxmi Municipality ward-9	1993	Gravity	Spring	175
21	Sasambu WS Project	Mahalaxmi Municipality ward-9	2005	Gravity	Spring	255
22	Chapakhark WS Project (I)	Mahalaxmi Municipality ward-9	1999	Gravity	Spring	795
23	Chapakhark WS Project (II)	Mahalaxmi Municipality ward-8	1999	Gravity	Spring	1024
24	Lubhu Mathillodobhan WS Project	Mahalaxmi Municipality ward-8	2001	Gravity	Stream	580
25	Lubhu Tallodobhan WS Project	Mahalaxmi Municipality ward-8		Gravity	Stream	1200
26	Chapakhark WS Project (III)	Mahalaxmi Municipality ward-5, 7	1999	Gravity	Spring	1531
27	Tikathali Chashathali WS Project	Mahalaxmi Municipality ward-5, 7	2005	Pumping	River	475
28	Siddhipur WS Project (I)	Mahalaxmi Municipality ward-6	1995	Gravity	Spring	1128

No.	Name of Project	New Municipality and ward no	Year of completion	Type of system	Type of source	Benefited HHs
29	Siddhipur WS Project (II)	Mahalaxmi Municipality ward-6	2008	Gravity	Stream	1500
30	Imadol WS Project	Mahalaxmi Municipality ward-1, 2, 3, 4		Gravity	Stream	27000
31	Bishnudol WS Project	Mahalaxmi Municipality ward-8		Gravity	Spring	201
32	Muldol WS Project	Lalitpur Metropolitan City ward- 26, 27	1998	Pumping	Spring	1415
33	Thaiba WS Project	Godawari Municipality ward-14	1981	Gravity	Spring	1139
34	Thaiba Harisiddhi WS Project	Lalitpur Metropolitan City ward- 28, 29	1977	Gravity	Spring	1036
35	Bugnmati Scheme 1 WS Project	Lalitpur Metropolitan City ward- 22	1981	Gravity	Spring	982
36	Charghare Muldol Nallu Muhan WS Project	Gowari Municipality ward- 12	1999	Gravity	Spring	1320
37	Muldol Charghare WS Project	Lalitpur Metropolitan City ward- 23, 26	1995	Gravity	Spring	1180
38	Nallu, Basuki and Devaki WS Project	Lalitpur Metropolitan City ward- 23	1999	Gravity	River	207
39	WS Project	Lalitpur Metropolitan City ward- 22	1978	Gravity	Spring	978
40	Radhakrishna WS Project	Mahalaxmi Municipality ward-5, 7		Gravity	Underground water	1500
41	Tikathali WS Project	Mahalaxmi Municipality ward-5		Overhead Pumping	Underground water	1000
42	Chomalpngol WS Project	Lalitpur Metropolitan City ward- 22	1996	Gravity	Spring	80
43	Changthali WS Project	Mahalaxmi Municipality ward-5, 7		Overhead Pumping	Underground water	859
44	Godamchaur WS Project	Godawari Municipality ward- 1		Gravity	Spring	1500
45	Gwalindaha WS Project	Godawari Municipality ward-14		Gravity	Spring	1900
46	Jharuwarasi WS Project	Godawari Municipality ward-13		Pumping	Spring	599
47	Sano Khokana WS Project	Lalitpur Metropolitancity ward-21		Gravity	Spring	63
48	Khokana WS Project	Lalitpur Metropolitancity ward-21		Gravity	Spring	1056

No.	Name of Project	New Municipality and ward no	Year of completion	Type of system	Type of source	Benefited HHs
49	Khasimara WS Project	Godawari Municipality ward-10	2017	Gravity	Spring	227
50	Tribeni WS Project	Godari Municipality ward- 2		Gravity	Spring	35
51	Dhobikhola Tindhare WS Project	Godari Municipality ward- 2		Pumping	Spring	61
52	Hedadol WS Project	Godari Municipality ward- 2		Gravity	Spring	195
53	Sainbu WS Project	Lalitpur Metropolitan City ward- 25		Gravity	Spring	200
54	Pharsikhel Scheme 2 WS Project	Lalitpur Metropolitan City ward- 22	1997	Gravity	Spring	44
55	Bistachhap WS Project	Godari Municipality ward- 2	1992	Gravity	Spring	668
56	Bishankhu Scheme 2 WS Project	Godari Municipality ward- 2	1999	Pumping	Spring	292
57	Bistachhap WS Project	Godari Municipality ward- 2	1993	Gravity	Spring	200
58	Gwalindaha WS Project (ii)	Godawari Municipality ward-4		Pumping	Spring	400
59	Chandol WS Project	Godawari Municipality ward-4		Gravity	Spring	220
60	Badikhel Tholukhola WS Project	Godawari Municipality ward-4	1997	Gravity	Spring	124
61	Khasimara WS Project	Godawari Municipality ward-4		Gravity	Spring	110
62	Sarbeshor WS Project	Godawari Municipality ward-10	2015	Gravity	Spring-fed stream	300
63	Muldol, Charghare, Basuki WS Project	Godawari Municipality ward-10, 11	1980	Gravity	Spring	2300
64	Muldol, Charghare, Basuki WS Project	Gowari Municipality ward- 12		Pumping	Spring	1623
65	Sainbu WS Project	Lalitpur Metropolitan City ward- 25		Gravity	Spring	200
66	Brihat lalitpur WS Project	Lalitpur Metropolitan City ward- 15, 25	1981	Gravity	Spring	1634
67	Hilekholsa WS Project	Lalitpur Metropolitan City ward- 22		Gravity	Spring	5

（２） Pokhara

Table 4　Pokhara

No.	Name of Project	Target Ward	Completed/Under construction	Implementing agency	Year of completion/to be completed	Poplulation	Households
1	Pokhara Mertopolis Ward No 2 WSP	2	Under construction	DWSS	2021-22	4,000	1,090
2	Pokhara Mertopolis Ward No 2 and 26 WSP	2	Under construction	DWSS	2021-22	3,000	820
3	Kahun WSP	11	Under construction	DWSS	2019-20	662	180
4	Kahun WSP	12	Under construction	DWSS	2021-22	2,310	630
5	Amalachaur Bhedikhark WSP	13	Under construction	DWSS	2020-21	1,085	290
6	Cumisre-Arwa WSP	13	Under construction	DWSS	2021-22	1,176	320
7	Ratanpande WSP	13	Under construction	DWSS	2018-19	2,075	565
8	Bhedikharka Chanpdanda WSP	13	Under construction	DWSS	2021-22	950	260
9	Armala WSP	16	Under construction	DWSS	2020-21	4,350	1,185
10	Budhimul WSP	18	Under construction	DWSS	2021-22	2,043	556
11	Setibagar WSP	18	Under construction	DWSS	2021-22	1,130	310
12	Smali Kulandhary, Bohorekhola WSP	18	Completed	Fund Board	2006-07	859	235
13	Dumdhare WSP	18	Completed	Fund Board	2006-07	1,116	300
14	Bhakunde WSP	18	Completed	NGO	2006-07	207	70
15	Chankhur WSP	18	Completed	DWSS	2003-04	324	90
16	Dhikurpokhari, Kaskikot, Sarangkot WSP	18	Under construction	DWSS	2018-19	4,150	1,130
17	Puranchaur Jalkini Sardikhola Lamachaur WSP	19	Under construction	DWSS	2019-20	2,909	800
18	Thulokhola WSP	19	Completed	Red Cross	1998-99	702	190
19	Rubikhola WSP	19	Completed	Red Cross	1998-99	675	184
20	Puranchaur WSP	19	Completed	DWSS	1997-98	1,386	380
21	Lamachaur Jimire WSP	19	Completed	DWSS	2019-20	1,037	280
22	Lamachaur Brihat WSP	19	Under construction	DWSS	2020-21	1,075	290
23	Bhotikhola WSP	19	Completed	NWSC	1988-89	2,475	670
24	Mathure WSP	19	Completed	DWSS	2014-15	180	55
25	Khahare WSP	19	Completed	DWSS	2003-04	135	45

No.	Name of Project	Target Ward	Completed/Under construction	Implementing agency	Year of completion/to be completed	Poplulation	Households
26	Lamachaur Tallo Gharmi Lift WSP	19	Completed	DWSS	2021-22	1,668	455
27	Riyalechaur WSP	20	Under construction	DWSS	2018-19	1,665	410
28	Mauja WSP	20	Under construction	DWSS	2021-22	1,855	505
29	Bhalam WSP	20	Completed	DWSS	2013-2014	2,250	550
30	Maidan Muni Sarki Sunar Gaun WSP	21	Completed	DWSS	2010-11	625	155
31	Dobilla Ragaichaur	21	Completed	DWSS	2007-08	335	80
32	Chilaune Khark WSP	21	Completed	DWSS	2008-09	890	100
33	Thaple Tilhar WSP	21	Completed	DWSS	2008-09	769	40
34	Banspani WSP	21	Completed	DWSS	2008-09	459	35
35	Dharapani WSP	21	Completed	DWSS	2008-09	789	70
36	Lewade Sammi WSP	21	Completed	DWSS	2008-09	454	110
37	Dubar WSP	21	Completed	DWSS	2008-09	356	90
38	Bharatpokhari WSP	21	Completed	DWSS	2000-01	1,645	405
39	Churemul WSP	21	Completed	DWSS	2008-09	2,880	695
40	Nirmalpokhari Kaule Shivalaya	21	Under construction	DWSS	2020-21	987	270
41	Bharatpokhari Gairagaun WSP	21	Under construction	DWSS	2018-19	2,050	560
42	Chahanchal Thamako Lift WSP	21	Under construction	DWSS	2019-20	459	125
43	Okhaleko Pandhero Jyamire WSP	21	Under construction	DWSS	2021-22	879	240
44	Kristi, Tijubot WSP	21	Under construction	DWSS	2021-22	190	55
45	Kristi, Chimdikhola WSP	21	Under construction	DWSS	2021-22	789	215
46	Katwakhola Kaule Shivalaya Lifting WSP	21	Under construction	DWSS	2021-22	789	210
47	Pumdi Bhumdi WSP	22	Under construction	DWSS	2018-19	8,790	1,940
48	Thuldhunga WSP	22	Under construction	DWSS	2021-22	897	245
49	Mahabhir Khalse WSP	22	Completed	DWSS	1998-99	456	125
50	Seraghat, Serakhola WSP	22	Completed	DWSS	2010-11	1,795	490
51	Bhumdi WSP	22	Completed	DWSS	2003-04	1,234	335
52	Khesrekhole WSP	22	Under construction	DWSS	2021-22	1,132	310
53	Chapakot with Bhulbhule WSP	23	Under construction	DWSS	2018-19	4,567	1,245
54	Chapakot 3-6 WSP	23	Under construction	DWSS	2021-22	1,875	510

No.	Name of Project	Target Ward	Completed/Under construction	Implementing agency	Year of completion/to be completed	Poplulation	Households
55	Asalachaur Dalitbasti WSP	23	Under construction	DWSS	2021-22	890	245
56	Dhikurpokhari, Kaskikot, Sarangkot WSP	24	Under construction	DWSS	2018-19	5,188	1,410
57	Smali Guntechaur WSP	24	Under construction	DWSS	2021-22	890	245
58	Sighare WSP	24	Completed	DWSS	1986-87	765	210
59	Chaturghat Rupakhola WSP	24	Completed	Fund Board	2012-13	897	245
60	Newarekhola Jhakrithan WSP	25	Completed	Fund Board	2012-13	2,970	810
61	Thadokhola WSP	25	Completed	DWSS	1998-99	875	240
62	Lekhnath First Small Town WSP	27	Completed	DWSS	2007-08	20,000	5,395
63	Majthana WSP	28	Under construction	DWSS	2020-21	4,567	810
64	Thak WSP	28	Under construction	DWSS	2020-21	15,000	3,305
65	Thak WSP (I)	28	Completed	DWSS	2005-06	13,000	3,190
66	Kalika WSP	28	Under construction	DWSS	2020-21	5,265	1,535
67	Dhurbapur, Kalika-2 WSP	28	Under construction	DWSS	2021-22	987	270
68	Lekhnath First Small Town WSP	29	Completed	DWSS	2007-08	12,150	3,310
69	Lekhnath First Small Town WSP	30	Completed	DWSS	2007-08	9,875	2,330
70	Begnas-10 WSP	31	Under construction	DWSS	2021-22	785	215
71	Kaluri, Serakhola Lift WSP	31	Under construction	DWSS	2021-22	352	95
72	Tallo Jyamire WSP	31	Under construction	DWSS	2021-22	897	245
73	Jamune Piple WSP	31	Under construction	DWSS	2021-22	575	156
74	Serakhola, Kotwari WSP	31	Under construction	DWSS	2021-22	987	268
75	Nirmalpokhari Kaule Shivalaya	31	Under construction	DWSS	2019-20	1,280	348
76	Dhodbesi Malepatan WSP	32	Under construction	DWSS	2021-22	1,550	425
77	Kristi, Tijubot WSP	32	Under construction	DWSS	2021-22	190	55
78	Punditar WSP	33	Under construction	DWSS	2021-22	2,500	675
79	Upallo Punditar WSP	33	Under construction	DWSS	2021-22	875	240
80	Khallu Barah Dandagaun Banjhpokhari WSP	33	Under construction	DWSS	2021-22	987	270
81	Bhargo WSP	33	Under construction	DWSS	2020-21	689	190

No.	Name of Project	Target Ward	Completed/Under construction	Implementing agency	Year of completion/to be completed	Poplulation	Households
82	Andherikhola Byarthok WSP	33	Under construction	DWSS	2018-19	3,567	970
83	Dhikurpokhari, Paundurkot WSP	33	Under construction	DWSS	2019-20	4,360	1,280

（３） Butwal

Table 5 Butwal-1

No.	NWSC／WUSC	Ward
1	NWSC Butwal	1-13
2	Jyotinagar WUSC	5
3	Devsiddha WUSC	4
4	Fulbari WUSC	1
5	BramahKumari Dabawa WUSC	12
6	Purbakalika Nagar WUSC	10 and Rupendhi
7	Sundarnagar WUSC	7-8
8	Milanpark WUSC	14
9	Butwal 1,4 WUSC	1-4
10	Santidev WUSC	17
11	Chandranagar WUSC	8
12	Kapan Nabadurga WUSC	14
13	Salaghari WUSC	15
14	Barpipal Chhunikhel Ganeshmarga WUSC	10
15	Majuwa Majgaun Deversi Srijannagar WUSC	2-3

Table 6 Butwal-2

No.	Name of Project	Name and Wards of New Municipality	Year of completion	Poplulation	Type of project	Remarks
1	Nayagaun WS Project	Butwal Metropolitan City ward- 12, 13	2009	19,605	Pumping	Overhead tank
2	Motipur WS Project	Butwal Metropolitan City ward- 17, 18, 19	2015	9,717	Pumping	Overhead tank
3	Salghari WS Project	Butwal Metropolitan City ward- 13	1984	1,620		
4	Chisapani Brihat WS Project	Butwal Metropolitan City ward- 1, 2		3,735		
5	Chidiyakhola WS Project	Butwal Metropolitan City ward- 3	2009	480		
6	Dandatol WS Project	Butwal Metropolitan City ward- 2	2010	1,313		
7	Laxminagar Bikas Kendra WS Project	Butwal Metropolitan City ward- 4	2010	3,638		
8	Uttar Naharpur WS Project	Butwal Metropolitan City ward- 11	2005	12,375		
9	Jyoti Nagar Kshetra Bikas Parishad WS Project	Butwal Metropolitan City ward- 3	1995	1,598		
10	Sirangaun Majuwa WS Project	Butwal Metropolitan City ward-11	2006	1,388		

No.	Name of Project	Name and Wards of New Municipality	Year of completion	Poplulation	Type of project	Remarks
11	Pipaldhara WS Project	Butwal Metropolitan City ward- 11	2001	2,040		Boring
12	Mainabagar WS Project	Butwal Metropolitan City ward-2	2003-04	1,898		
13	MajuwaWS Project	Butwal Metropolitan City ward-11	2009	713		
14	Pragatinagar WS Project	Butwal Metropolitan City ward-11	2007	8,535		Overhead tank
15	Kalika Bikas Tatha Sudhar Samaj WS Project	Butwal Metropolitan City ward-11	2002	2,303		
16	Ganeshthan WS Project	Butwal Metropolitan City ward-3	1995	1,313		
17	Shrijananagar WS Project	Butwal Metropolitan City ward-11	2007	2,138		

（4） Hetauda

表 7 Hetauda

No.	Name of Project	Name and Wards of New Municipality	Year of completion	Poplulation	Type of project
1	Dobhanchaur WS Project	Hetauda Sub-Metropolitan City ward- 17		150	Gravity
2	Newarpani WS Project	Hetauda Sub-Metropolitan City ward- 19		700	Gravity
3	Basamadi WS Project	Hetauda Sub-Metropolitan City ward- 3	1997-98	4,623	Gravity
4	Basamadi II WS Project	Hetauda Sub-Metropolitan City ward- 19		410	Gravity
5	Bastipur WS Project	Hetauda Sub-Metropolitan City ward- 19	1996-97	2,039	Gravity
6	Padampokhari WS Project	Hetauda Sub-Metropolitan City ward- 12	1999-00	13,803	Pumping
7	Nakaulidarimtar WS Project	Hetauda Sub-Metropolitan City ward- 1, 19	1999-00	966	Gravity
8	Kaptedamar WS Project	Hetauda Sub-Metropolitan City ward-	2000-00	282	Gravity
9	Duibasti WS Project	Hetauda Sub-Metropolitan City ward-11	2014-15	2,151	Gravity
10	Padampokhari WS Project	Hetauda Sub-Metropolitan City ward- 13	2016	11,959	Pumping
11	Basamadi WS Project	Hetauda Sub-Metropolitan City ward- 3, 19	1997-98	2,303	

Appendix-7 Record of workshop in Kathmandu and Pokhara

Data Collection Survey for Water Supply and Waste Water Sector

Record of Validation Workshop in Pokhara

Date: 6 August 2019 10:00 – 12:00

Venue: Hotel Pokhara Grande

1. Report of Findings by JICA Study Team

(1) Water Supply in Pokhara

Water supply is managed by NWSC and Water Users Service Committees (WUSCs) which cover the service population of approx. 384 thousand with approx. 54.71 MLD of water.

The project for improvement of water supply in Pokhara is now under implementation through Japan's Grant Aid. Through this project some improvements are expected such as improvement in water quality, increase in water supply hours as well as improvement in Non-Revenue Water (NRW). However, some further issues will be faced by NWSC after the project, such as management of water treatment plant (WTP), water distribution management, daily assurance of water quality. Therefore, technical capacity development is suggested to NWSC for O&M of WTP, management of water distribution and NRW, water quality management.

As for Pokhara Metropolitan City (PMC), some important issues were found such as difficulty to manage and to integrate information for overall Pokhara water supply due to a lot of WUSCs in the city area. Since it's difficult for PMC to propose improvement plans and to assure water flow/ quality for citizens, PMC is required to enhance its capacity for WASH management as well as supervision and monitoring water service providers.

(2) Watershed Environment in Pokhara

Phewa Lake as well as surrounding area was declared on February 2016 as Ramsar Site. Water samples from Phewa Lake and Seti River were taken in March 2019 by the study team and compared with the Japanese standard. According to the data, it is supposed that the eutrophication has been progressed in Phewa Lake.

The risk of eutrophication has been already reported in 2002 by JICA. In 2002, some suggestions were made such as reduction of the pollution loads, improvement in wastewater management system and solid waste management, environmental education, soil conservation, etc.

Water quality of leachate of waste landfill site which was taken in March 2019 shows high COD as well as TN and TP. Therefore, improvement of the landfill site is also required.

In the study, following are found:

1) Inappropriate management of wastewater
2) Less integrated management of watershed
3) Little budget to proceed the planned sewerage
4) Less management system of on-site sanitation as well as inappropriate treatment of sludge

On the basis of these issues, formulation of master plan for watershed conservation and wastewater management is necessary as well as capacity improvement for environmental management.

2. Comments / Recommendation of Mayor

The data collection survey team has come up with their draft findings and this workshop is expected to know if any issue has been missed or any questions on the relevancy of the data presented by the survey team. This kind of work should be done by Local Government and thankful for supporting it. Master Plan on integrated wastewater management including sewerage is the utmost need of the PMC and this study has identified issues pertaining to this.

There are NWSC and WUSCs that are providing the water to the public. Besides, 25-30% of people get the drinking water without paying to the organizations. If it can be stopped, the problem is mitigated for revenue collection.

PMC should be the sole organization in the management of the drinking water. PMC is trying to coordinate with other organizations to make a master plan and implement it properly.

Once service is improved for water supply and sewerage, there will be no problem collecting tariff on both water and sewerage service as people understand the need of water and sewerage facility. Hence, once service is improved, revenue collection would not be the problem. However, Current tariff collection system is not effective and need to review.

3. Comments / Recommendation of Participants

3-1 General

(1) The main issue is in management and lacks of coordination between Metropolitan City and other organizations (NWSC, DWSSM, etc.). Therefore, the general public are unable to be satisfied. If the services is provided satisfactorily, local people will pay their charge without hesitation. It will help in the revenue collection.
(2) Infrastructure development is not coordinated. Master Plan should be done systematically and sustainably. Pokhara is the highest rainfall area in Nepal, but no proper drainage system is available. People are paying for water, but they do not receive the safe drinking water. PMC should be responsible for all WASH activities.
(3) Information exchange system should be prioritized. In the design implementation phase, local people should also be included. And capacity development in school and universities is necessary.
(4) There are only 6 regional laboratories in Nepal. It is insufficient for water quality monitoring.
(5) Interagency coordination between road, water, electricity, telecom as such has posed challenge in any development project.

3-2 Water Supply

(1) No improvement in the quality of the water from 2010. The main issue may be on Nepali people who are focusing on water volume and not on quality. The governmental organizations also do not keep the record of water quality.
(2) If NWSC provides safe drinking water, the people won't buy bottled water. Then, NWSC revenue will increase.
(3) It is necessary to reduce water leakage.
(4) Pipelines should be installed at road side rather than center of the road to avoid damage and to keep easiness of repair.
(5) Currently, water is supplied for a several hours per day. If it is caused by water source capacity, rain water harvesting can help for achieving the goal of 24 hours supply.
(6) For the demand calculation, floating population such as tourists should also be taken into consideration as Pokhara is the tourist place.
(7) For the safe drinking water, WHO standard should be taken into considerations.
(8) The current demand of Pokhara is 61 MLD for water supply, but even with JICA funded project only 41 MLD supply is secured. So, 100% coverage is still a challenge.
(9) Intake conservation shall be prioritized in any development project of water supply. For this, coordination with Province government is necessary
(10) Study shall explore current problems of distribution system and pipe laying (bubbles and seepage is rampant in the street). No standard has been maintained while laying the pipe for instance how much distance is necessary between drainage and water pipe as such.

3-3 Watershed Management / Wastewater Management

(1) Since there are other small lakes in Pokhara than Phewa, those should be included in the watershed management.
(2) On 6 February 2005, sanitary landfill site came into operation, but it's not functioning properly. The data of landfill site leachate was very dangerous. Due to the conditions, aquatic animals are affected. If data of ground water contamination is analyzed, it would be beneficial to prepare improvement plan. The data of industrial waste (chemical waste) which affects the agriculture as well as aquatic lives should also be collected and analyzed.
(3) Septic tank/ soak pit is compulsory for any building construction, however, weak monitoring by PMC has been posing problem in ensuring such establishment. Generally, the people built a septic tank nearby water tank where there is a risk of seepage. The situation is negative on the health. Therefore, to minimize the risk, a proper law is necessary.
(4) Household boring is rampant and posing challenge on groundwater, data on it shall be collected.
(5) Wastewater including sewerage management is a challenge. Although data shows 99% households in PMC has septic tank, number of onsite pit latrine is huge. This might have impacted on groundwater quality. There is no data on such issue. Data shall show the ground reality and suggest what kind of sewerage or septic management is better for PMC. Impact of contamination on groundwater quality shall also be monitored.
(6) Issue of wastewater shall explore issues relating to Phewa Lake and other nine lakes of Pokhara and study shall come up with feasible technology/options to adopt for integrated waste water management in Pokhara. Also, requirement of Ramasr convention and water resource conservation shall be taken into account in the study.
(7) Leachate management is one of the core concerns as there has been no data on production, treatment and impact of leachate on water and groundwater.

(8) Waste landfill site has been designed about fifteen years ago. It has already exceeded its design capacity, leachate treatment in the landfill site is also not working causing huge impact in river water. It is high time to address the issue to land fill site including solid waste management. Such issue shall be incorporated in the report.

(9) Industrial waste is big challenge in PMC but having less focus. Particularly, it has huge adverse impact on agriculture and irrigation. Data on it would be useful.

(10) PMC is in utmost need to sort issue of solid waste management as well particularly after international airport comes under operation. It has been difficult for them to acquaint land for dumping site as people start oppose and demand a lot of compensation. PMC is exploring options on how to reduce the waste by 3R concept and some technological innovation so that final waste to be dump can be hugely reduced. Technical support from JICA in this regard would be highly helpful.

(11) Water quality data has been compared from Japanese standards, it is recommended to use Nepal standard as far as possible. If Nepal standard is not available. Mention it and refer to International Standard.

end

Data Collection Survey for Water Supply and Waste Water Sector

Record of Validation Workshop in Kathmandu

Date: 27 August 2019 10:00 – 12:00

Venue: Hotel Shangri-la Kathmandu

1. Report of Findings by JICA Study Team

(1) General

According to "Sustainable Development Goals Baseline Report, National Planning Commission, 2017", SDG 6.1.1 (Household with access to piped water supply), SDG 6.1.5 (Population using safe drinking water) and SDG 6.2.5 (Urban households with toilets connected to sewer / proper fecal sludge management) are very critical for achievement. Improvement to overcome the gap is urgently recommended.

SDG	Indicator	Goal 2030	Achievement 2015
SDG 6.1.1	Household with access to piped water supply	90%	49.5%
SDG 6.1.5	Population using safe drinking water	90%	15%
SDG 6.2.5	Urban households with toilets connected to sewer / proper fecal sludge management	90%	30%

Source: Sustainable Development Goals Baseline Report, National Planning Commission, 2017

(2) Water Supply

According to the obtained information from key service provider for the 6 target cities of this present study, basic service level water supply (45-65LCD) is almost achieved. Significant issue is "Household with access to piped water supply" especially for Birgunj and Janakpur of which achievement is 23% and 24% respectively. Improvement of piped water supply system for the two cities is urgently required.

Regarding water distribution system, shortage of reservoirs' capacity is remarkable in common for the 6 cities. Cases for Birgunj and Janakpur systems show simple examples. Those tube well stations are not operated for 24 hours per day although the service coverage is not fully extended. It is due to insufficiency of overhead tanks (OHTs) capacity. To maintain the 24 hours operation, enhancement of OHTs' capacity is urgently recommended.

As for Pokhara where the Japan's Grant Aid is implemented for water treatment plant (WTP), reservoirs and 100km of pipelines, capacity development is urgently required for NWSC in order to operate appropriately the constructed facilities. Especially, operation training of slow sand filter system, water quality management and water distribution management based on metered flow as well as non-revenue water (NRW) management are required for the capacity development. Such capacity development program is urgently recommended to be conducted.

As a result, the study team recommends programs as shown in following table.

Priority	Target	Summary
1	NWSC	Technical Assistance To improve water distribution, NRW management, water quality management, Water Treatment Plants management, wells and underground water management. To determine Pilot branch office, and the achievement is spread to all NWSC branch offices.
2	Birgunj	Facility construction To construct new wells, elevated tanks, and distribution pipes in Birgunj.
3	Janakpur	Facility construction To construct new wells, elevated tanks, and distribution pipes in Janakpur.
4	Hetauda	Facility construction To construct new wells, elevated tanks, and distribution pipes in Hetauda.
5	Butwal	Facility construction To renew distribution pipes of NWSC in Butwal to reduct NRW as well as elevated tank construction.

Source: JICA Study Team

(3) Wastewater Management

Little sewerage system is conducted in the 6 cities, and on-site sanitation is a main stream of wastewater management. However, small systems are operated in Kathmandu and Hetauda. In Birgunj, sewerage to cover a half of core city area has been just constructed.

As for Kathmandu Valley, sewerage plan and design are now being conducted to have 500MLD of capacity. Once it is completed, the present conditions are improved.

In Hetauda, sewers are usable to remove the wastewater from a core city area. However, sewage treatment plants (STPs) are suspended in operation due to technical problem. Rehabilitation of STPs are urgently required.

Regarding sewerage operation, the present conditions of Hetauda and Birgunj may be critical for sustainability due to institutional system having no exclusive organization and tariff system.

The study team notices that Phewa Lake and surrounding area in Pokhara is registered as Ramsar site, which is especially required for environmental conservation. Since water supply conditions will be improved by the present Japan's Grant Aid, watershed environment and wastewater management system are urgently required to be conducted. Risks of eutrophication of Phewa Lake has been already reported by JICA since 2002. Water quality data obtained in this study indicates also that the eutrophication has been progressed. In the circumstances, the study team recommends to concentrate on Pokhara and to have a program shown in following table.

Priority	Target	Summary
1	Pokara and Phewa Lake	Technical Assistance (Development study type) To formulate masterplan of water environment conservations (water quality monitoring/management and wastewater treatment) in Pokara city and Phewa Lake To have Pre F/S for prioritized projects

		To have ordinances To set up organization to implement wastewater management

Source: JICA Study Team

2. Comments / Recommendation of Mr. Madhav Belbase, Secretary of MoWS

Issues on water should be incorporated with groundwater recharge. Including institutional setups, many approaches from different directions are necessary for improvement of water supply and wastewater management.

As for the water demand forecast, it is recommended to refer past studies report such as Bagmati River Basin Improvement Project.

3. Comments / Recommendation of Mr. Tej Raj Bhatta, Joint Secretary of MoWS

Since many stakeholders are involved water supply and wastewater management, a lot of confusions are occurred. Since the contact agency is DWSSM, MoWS recommends to contact DWSSM for consultation of stakeholders' roles.

Following are expected to JICA for assistance in water supply and wastewater management fields:

- Water supply masterplan for whole municipality area of 5 cities excluding Kathmandu Valley.
- Wastewater management masterplan for whole municipality area of 5 cities excluding Kathmandu Valley.
- In those masterplans, phasing financial assistance plan of development partners is expected to be included for both facilities construction and capacity development programs.

4. Comments / Recommendation of Participants

4-1 General

(1) There are some doubtful data in the workshop presentation. It is recommended to clarify the data sources. (Mr. Rajan Raj Pandey, Joint Secretary, MoWS)

(2) Recommendation for restructuring governing system of water supply and wastewater management is necessary for Kathmandu Valley. (Mr. Rajan Raj Pandey, Joint Secretary, MoWS)

4-2 Water Supply

(1) Service area coverage of piped water supply is not sufficient in Nepal. It is necessary to have more development. (Dr. Bhupendra Prasad, General Manager, NWSC)

(2) Human resources development as well as technical assistance is expected to JICA. To minimize gaps, good advices are necessary for the Nepali water service providers. (Dr. Bhupendra Prasad, General Manager, NWSC)

(3) Introduction of IT system may be necessary to make operation easier. (Mr. Kabindra Pudasaini, Water Aid)

(4) Although Melamchi water supply project will bring a large improvement to Kathmandu Valley, it is not a perfect solution. Since it will be a single water source, there are risks for continuous water supply in case of disasters such as flood and landslide. Therefore, water issues in Kathmandu Valley will not be solved by only Melamchi water supply project. (Mr. Rabindra Pokharel, KUKL)

(5) In KUKL, improvement of utility management and staff employment are necessary. (Mr. Rabindra Pokharel, KUKL)

(6) Regarding small water supply systems for village level communities, WUSC system is presently effective. Extension of WUSC system is also important. (Dr. Joshi, Embassy of Finland)

(7) WUSC is managing the water supply business under self-sustainability basis for all related works including financial, technical and human resources management. However, it is a question whether WUSC is able to perform all works satisfactory. (Mr. Rajan Raj Pandey, Joint Secretary, MoWS)

(8) Investment should be provided to improve water quality. (Mr. Bipin Dangol, ENPHO)

(9) Responsibility of O&M of water supply belongs to Local Governments. It may be a time to reconsider NWSC's role. (Mr. Rajan Raj Pandey, Joint Secretary, MoWS)

4-3 Watershed Management / Wastewater Management

(1) Sewerage is costly. Rather than the sewerage, actions to reduce open defecation are necessary. (Mr. Devendra Kumar Jha, DWSSM)

(2) New technology for wastewater treatment is necessary such as sludge recycle to agriculture or to energy generation. (Mr. Devendra Kumar Jha, DWSSM)

(3) 500MLD of Sewerage project in Kathmandu Valley is costly. Reconsideration may be necessary for the project plan. (Mr. Rajan Raj Pandey, Joint Secretary, MoWS)

(4) Regarding sewage treatment method, simple system such as stabilization pond is preferable. (Mr. Rajan Raj Pandey, Joint Secretary, MoWS)

(5) Improvement of on-site sanitation is a significant issue. It is however difficult how to convince the people and how to promote the public awareness / self-assistance. (Mr. Rajan Raj Pandey, Joint Secretary, MoWS)

(6) Septic tank has a bottom slab and impermeable. If bottom less, it is a pit latrine. It is recommended to separate the technical term from septic tank. (Mr. Rajan Raj Pandey, Joint Secretary, MoWS)

(7) In Nepal, effluent quality standards are available. However, no standard is available for environment quality of lake and river. (Mr. Rajan Raj Pandey, Joint Secretary, MoWS)

(8) As for eutrophication of Phewa Lake, there are several pollution sources. Not only wastewater but also others such as fertilizer are significant pollution sources. It is recommended to separate the issues by pollution source. (Mr. Rajan Raj Pandey, Joint Secretary, MoWS)

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