Appendix B: Final Report

NESS

Complementary Environmental Baseline

Upper Trishuli-1 Hydropower Project, Nepal

Prepared for:

NWEDC NEPAL WATER & ENERGY DEVELOPMENT COMPANY

IFC International Finance Corporation World Bank Group

Appendix B: Complementary Environmental Baseline

Supplemental ESIA-

Upper Trishuli-1 Hydropower Project, Nepal

December 2014

Prepared for:
Nepal Water and Energy Development Company
&
International Finance Corporation (IFC)

Prepared by:
Nepal Environmental & Scientific Services Pvt. Ltd.

Cover Photo:
Trishuli River downstream from the proposed powerhouse site, facing upstream. October, 2013

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1 Overview

The gap analysis conducted as part of Phase I of the Independent Environmental and Social Consultant (IESC) services for the Upper Trishuli-1 Hydropower Project identified a number of priority information gaps in the environmental baseline of the Project. In order to address these gaps, and to provide input to the other supplemental studies that have been conducted to help bring the Project in conformance with international standards (i.e. environmental flows, cumulative impacts assessment, and the environmental and social management plan for the construction phase), Nepal Environmental & Scientific Services (NESS) led a series of environmental surveys since August 2013 to upgrade the Project baseline in the following domains:

- Aquatic habitats
- Water quality and water users
- Groundwater
- Ambient air quality
- Soils
- Vegetation
- Biodiversity (terrestrial wildlife)
- Hazards

The following sections present the results obtained for the various complementary environmental studies.

2 Aquatic habitat, water quality and fisheries

2.1 Introduction

For a one-year period, from August 2013 to July 2014, Nepal Environmental and Scientific Services (NESS) conducted an aquatic survey program in a 15-km long river stretch in the Project area. As part of this program, water quality, aquatic habitat characterization and fish surveys were conducted monthly. The goals of this aquatic survey were to understand the physical, chemical and biological status of the Trishuli River in the Project's area of influence and to establish a baseline that allows to study and follow-up on the potential impacts during the operations phase.

Aquatic habitat, fish and water quality samples have been taken at five locations (as shown in Figure 2-1), representative of the conditions upstream of the intake site (F1), along the 11-km diversion reach (F2, F3, and F4) and downstream of the powerhouse (F5).

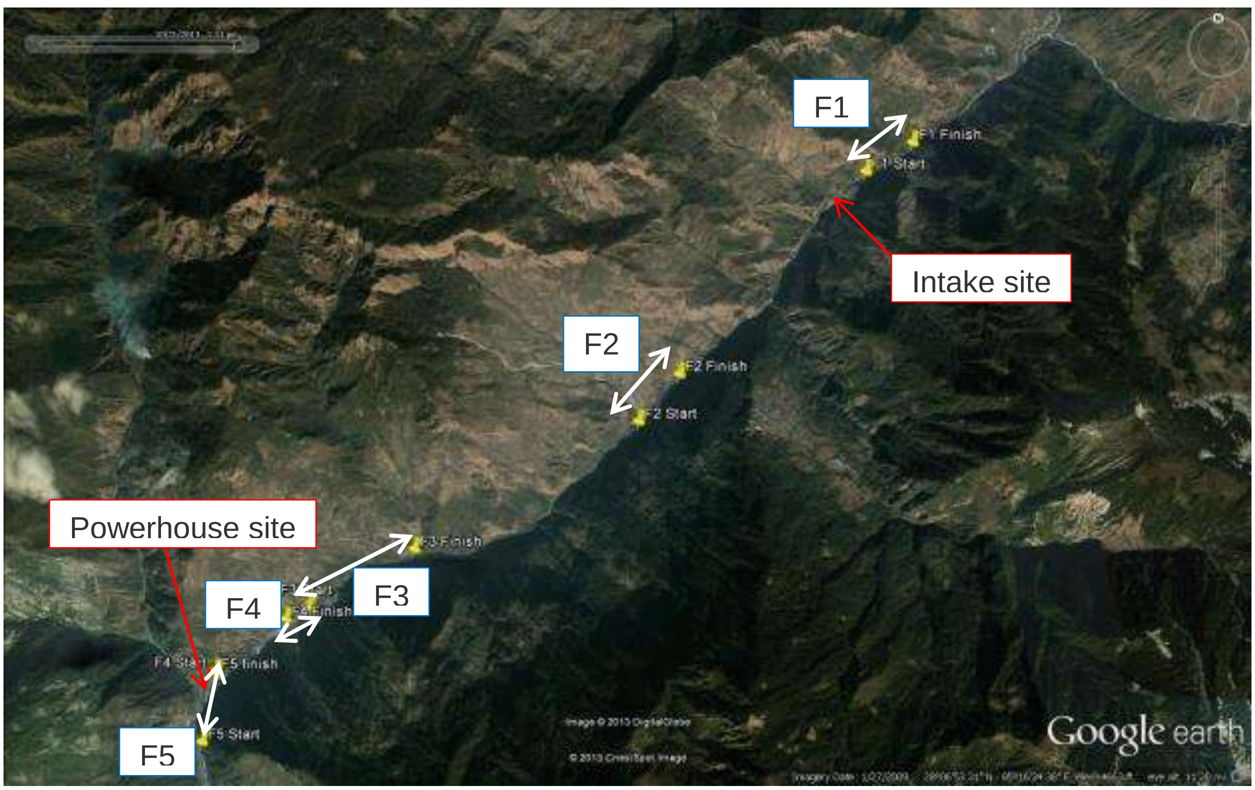


Figure 2-1: Location of monitoring sites for the monthly aquatic habitat and water quality surveys

The monthly aquatic surveys will continue until August 2014 in order to complete an entire year of monitoring.

Table 2-1: Sampling locations for NESS aquatic survey

Site	Elevation (m)	Latitude (N)	Longitude (E)	Location	VDC	Bank
F1	1338	28^o 08' 41.4"	85^o 18' 47.1"	Upstream of dam site	Syapru	Left
F2	1216	28^o 06' 47.8"	85^o 16' 53.6"	Diversion reach	Dhunche	Left
F3	1031	28^o 05' 20.6"	85^o 13' 50.4"	Diversion reach	Haku	Right
F4	986	28^o 04' 50.1"	85^o 13' 01.6"	Diversion reach (Upstream of powerhouse)	Haku	Right
F5	908	28^o 04' 15.1"	85^o 12' 29.0"	Downstream of powerhouse	Ramche	Left

2.2 Water quality

The combined information on physical and chemical parameters of water quality provides insight into the current status of the portion of Trishuli River under study as well as an indication of the ability of the system to support a healthy aquatic community vis-à-vis presence of chemical and non-chemical stressors.

Water quality, including physical a chemical parameters, was monitored from August 2013 to July 2014 in the five locations representative of the conditions of the upstream, diversion, and downstream reaches: F1, F2, F3, F4 and F5, as mentioned above.

Some of the physical parameters were directly measured on site (i.e. air temperature, water temperature, pH, conductivity, turbidity, and dissolved oxygen) using portable equipment. For the rest of the parameters, the water samples were collected, preserved, transported and tested at NESS's laboratory facilities in Kathmandu. Laboratory tests followed the standard procedures of *Standard Methods for the Examination of Water and Wastewater* of the American Public Health Association (APHA 1995). Detailed results of the analysis of water quality samples are presented in Annex 1

Specifics formats were developed for the field forms used during the survey in order to capture information on general land use, description of the stream origin and type, summary of the riparian vegetation features, and measurements of in stream parameters such as width, depth, flow, and substrate for the sampling river reach.

Water quality parameters were compared against the *Generic Effluent Standards Discharged into Inland Surface Water*, issued by the Government of Nepal in 2001.

2.2.1 Physical Parameters

Temperature

Trishuli is a snow feed river. The water temperature of the river thus is governed by atmospheric temperature of the surrounding area and the contribution of the snow melt water in the river discharge. Monthly variation trends of the water and air temperature along the river reaches in different months is depicted in Figure 2-2, while the average difference in water and air temperature is shown in Figure 2-5.

The water temperature is at its minimum during December and maximum at September, while the air temperature is maximum during May and minimum at December. The average difference between air and water temperature is around 8 degree Celsius, maximum being at May (14°C) and minimum during October.

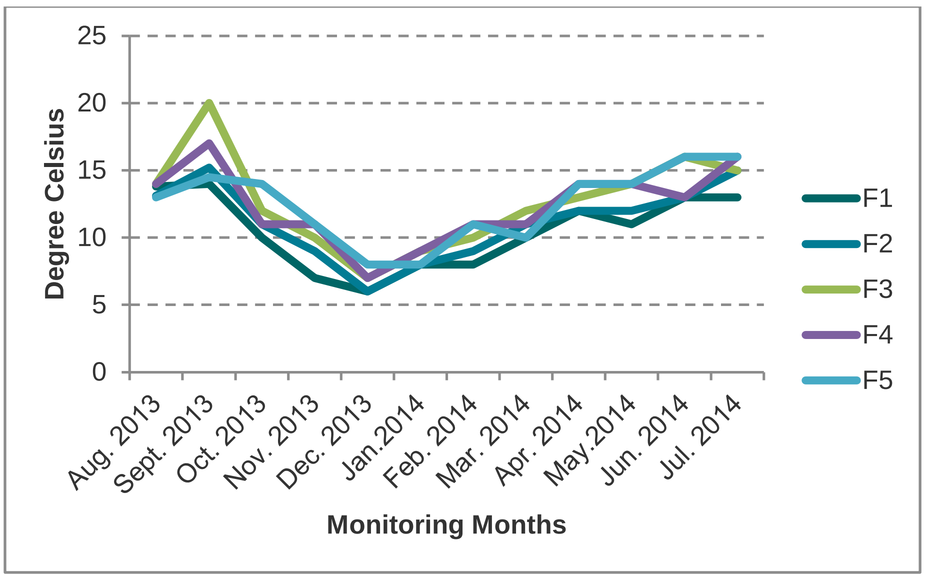


Figure 2-2: Monthly variation of water temperature

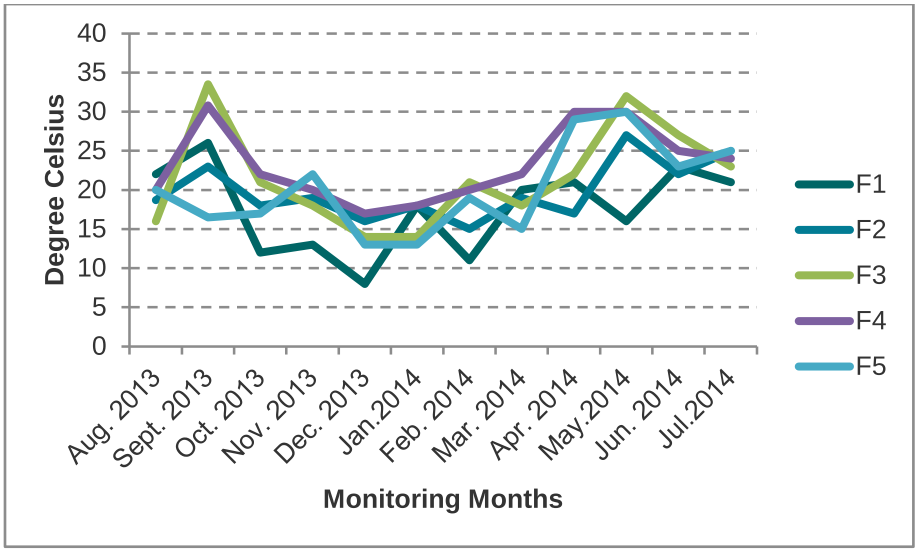


Figure 2-3: Monthly variation of air temperature at the monitoring sites

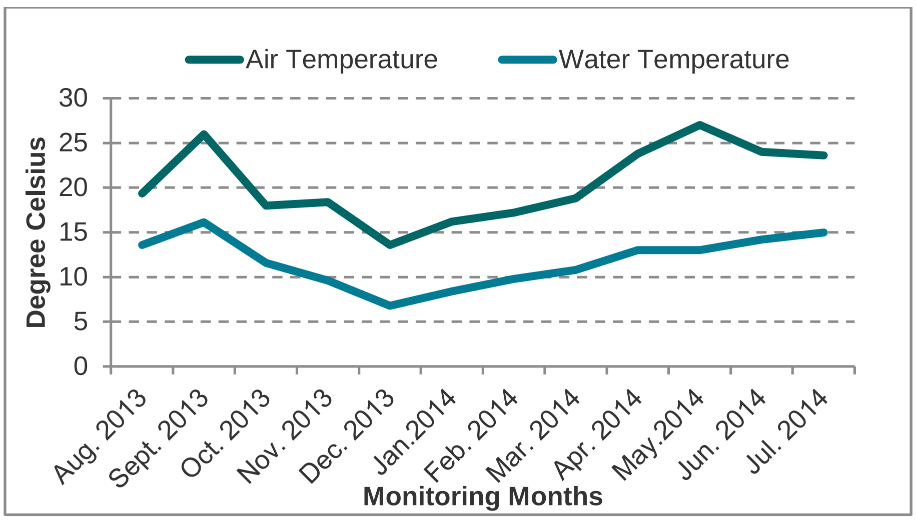


Figure 2-4: Average air and water temperature in the monitored river strech

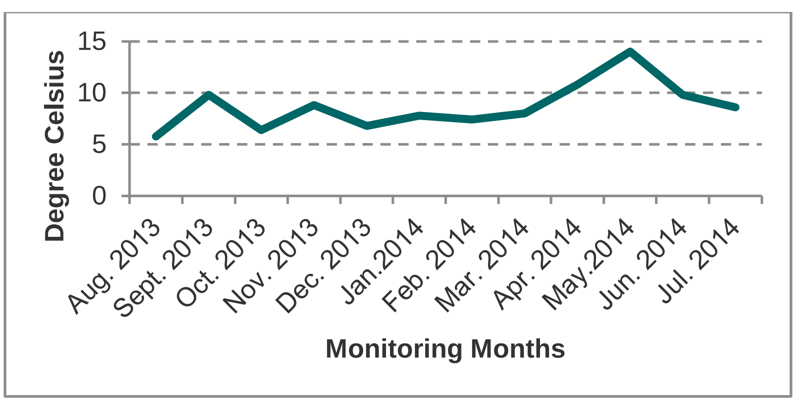


Figure 2-5: Monthly difference of air and water temperature

The spring and rain feed tributaries of the Trishuli River in the monitored stretch, such as Khorsyong Khola, Gogane Khola, Daldung Khola, Thanku Khola, Pangling Khola, and Bimali Khola, show water temperature about 5 to 8 degree Celsius above the Trishuli River Water which is at the threshold of potential thermal shock to the instream fish population and should be subject of further study.

Conductivity

The conductivity monthly variation trends in the monitored river reaches is depicted in Figure 2-6 over the monitoring period. The average monthly conductivity trend in the monitored river stretch is presented in Figure 2-7.

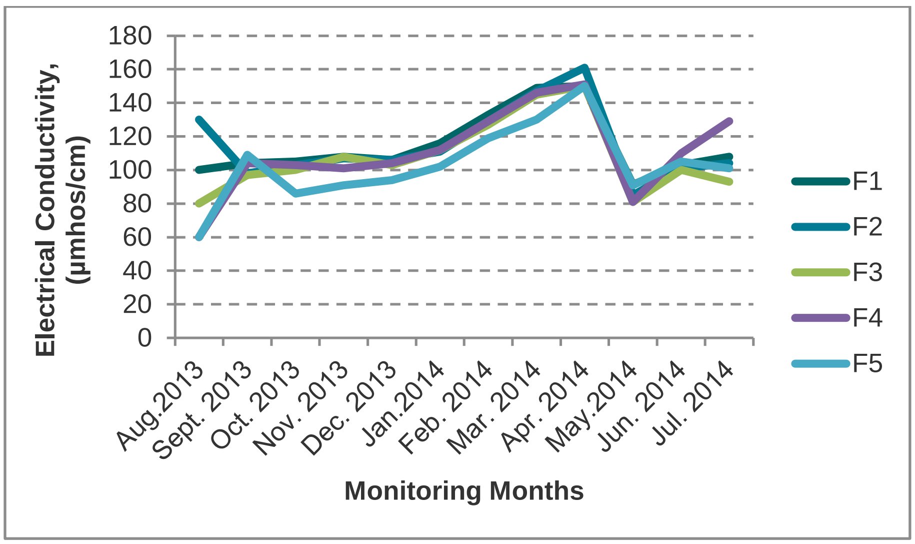


Figure 2-6: Electrical conductivity at the monitoring sites

Conductivity values range from 60 to 161 ɥmhos/cm. The peak value is registered in April, followed by a significant decline and a slight increase from May onwards. This is a peculiar trend and it seems to relate with the snow melting process. Further studies are however essential to validate the variation trends and reasons for such variation.

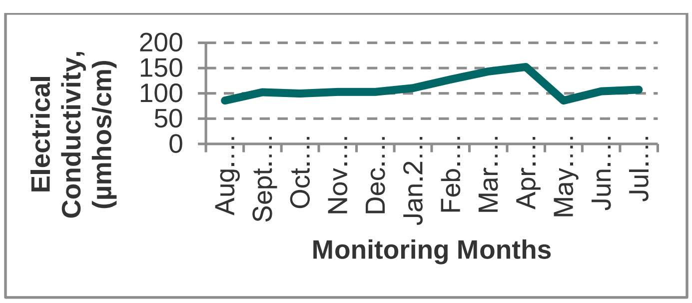


Figure 2-7: Average electrical conductivity in the monitored river stretch

Turbidity

Monthly turbidity trends in the river reaches over the monitoring period is depicted in Figure 2-8, while Figure 2-9 shows the average monthly variation trends on the monitored Trishuli river stretch.

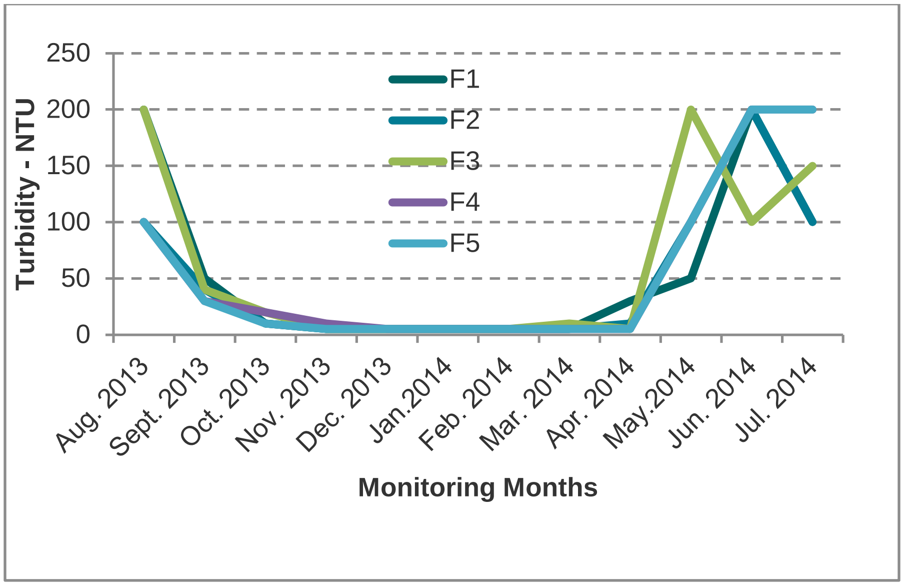


Figure 2-8: turbidity at the monitoring sites

The turbidity variation trends reflect effects of monsoon and snow melt at the catchment and related surface runoff and erosion. Turbidity values are at its peak during peak monsoon (June, July, and August) and decline steeply to values less than 6NTU from November through March.

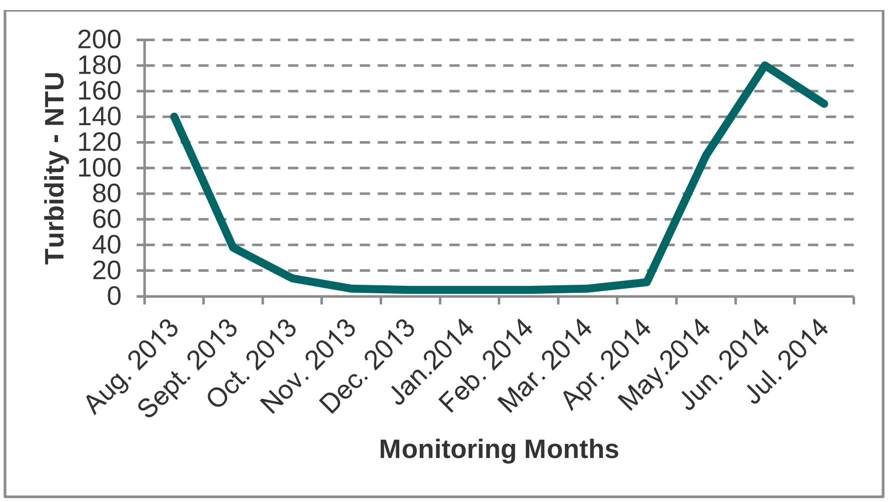


Figure 2-9: Average turbidity values in the monitored river stretch

Total suspended solids, total solids, settelable solids, and non-settelable solids

The monthly variation trends of Suspended Solids, Total Solids, Settelable Solids and Non-settelable Solids are in conformity with the variation trends of turbidity (Figure 2-10, Figure 2-11, Figure 2-12 Figure 2-13 and Figure 2-14). The effects of monsoon and snow melt in the solids concentration in the river water are quite apparent. Values of total suspended solids during June and July exceed the effeluent standard of 300 mg/l.

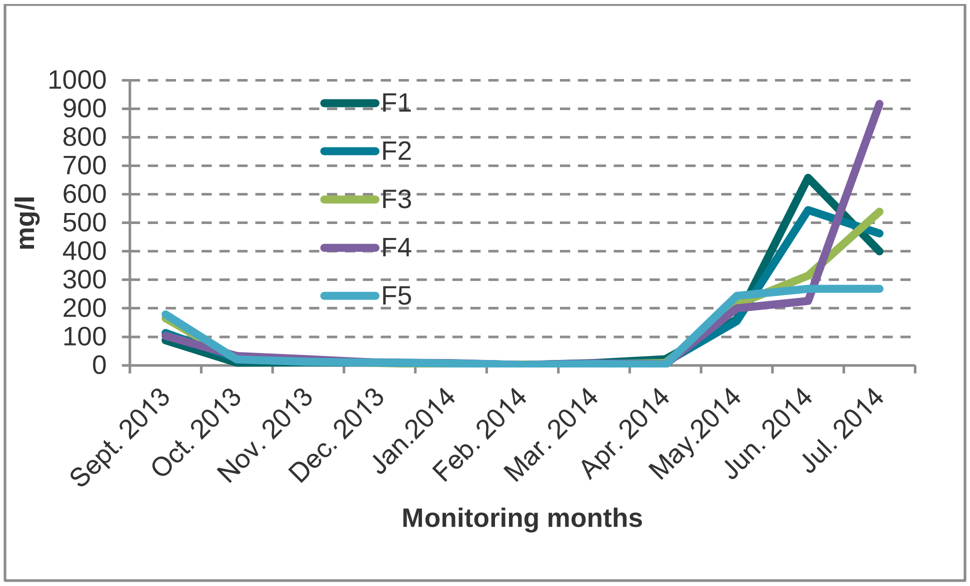


Figure 2-10: Total suspended solids at the monitoring sites

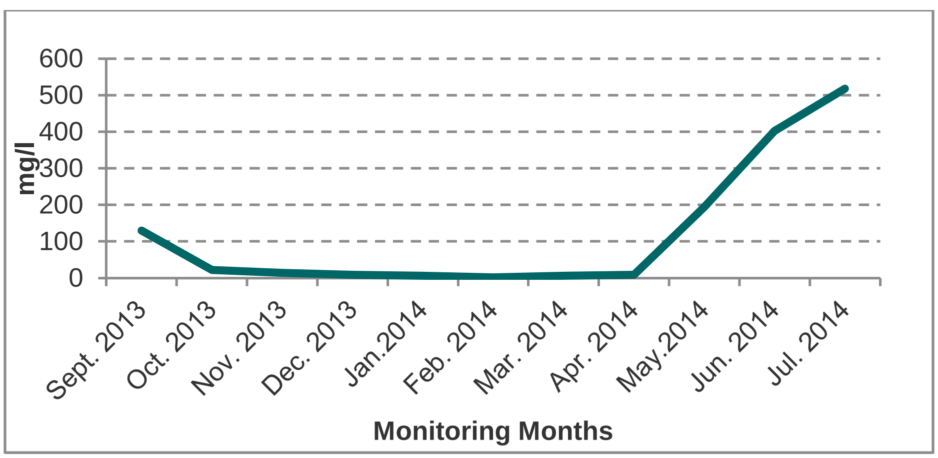


Figure 2-11: Average total suspended solids in the monitored river stretch

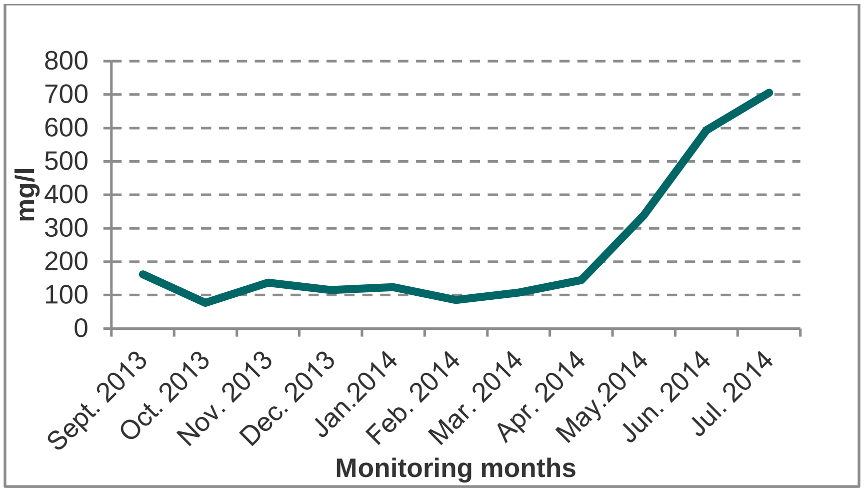


Figure 2-12: Average total solids in the monitored nriver stretch

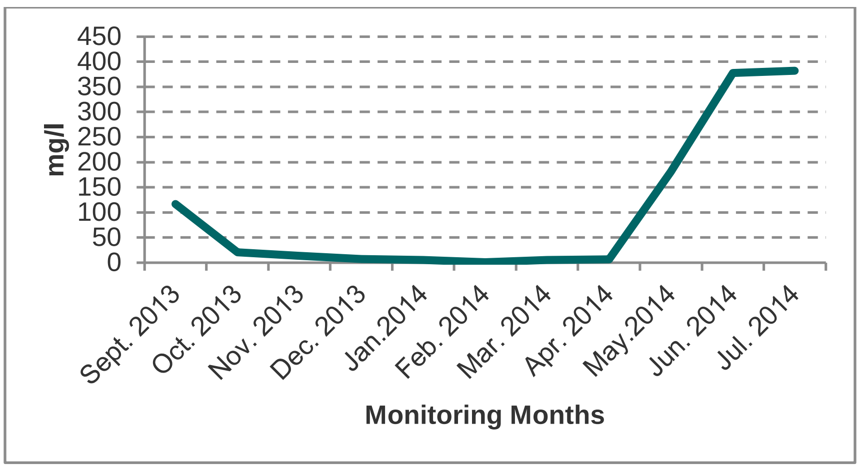


Figure 2-13: Average settleable solids in the monitored river stretch

2.2.2 Chemical Parameters

pH

Field measurements of pH show variations from 6.5 to 8.5. This range indicates neutral or slightly alkaline water. No distinct seasonal variations in pH were detected (Figure 2-14 and 2-16), except for a slight alkaline tendency during the dry periods (October through March).

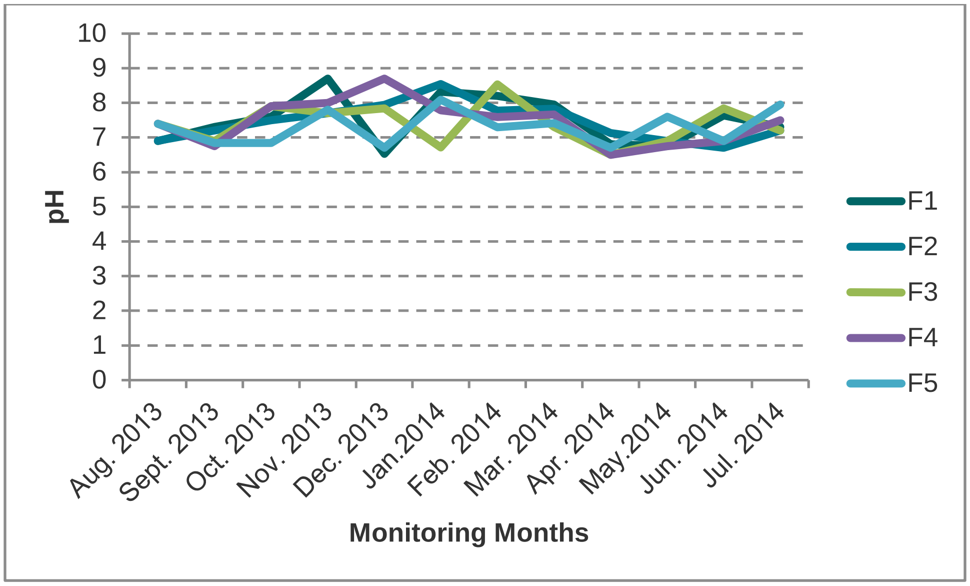


Figure 2-14: Monthly pH measurements at the monitoring sites

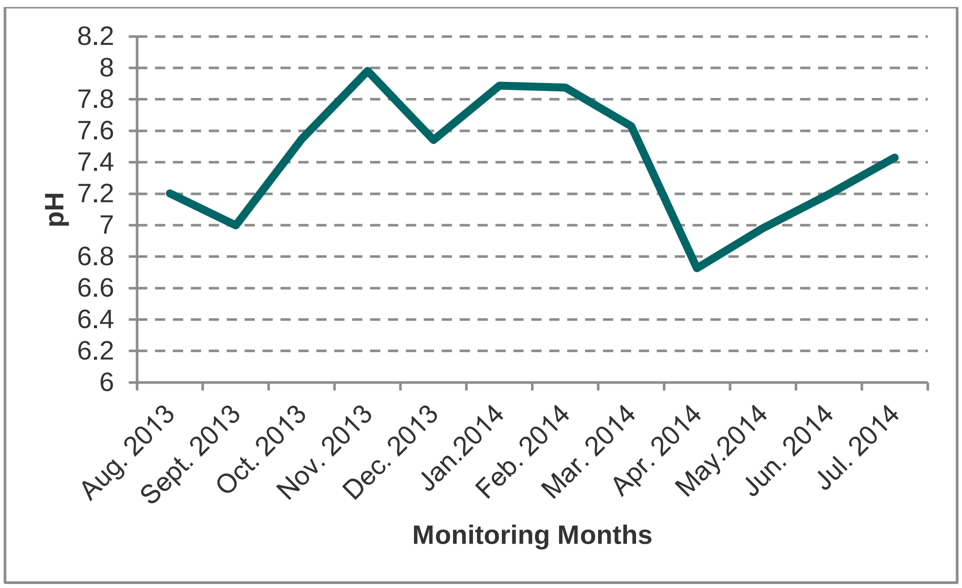


Figure 2-15: Average pH in the monitored river stretch

Total hardness as $CaCO_3$

The water in the in the monitored stretch of the Trishuli River varies from soft to moderately hard with average values ranging from 47 to 85 mg/l (Figure 2-16). In general, total hardness value increase from soft to moderately hard in the dry season and steeply drops to soft values with the onset of monsoon.

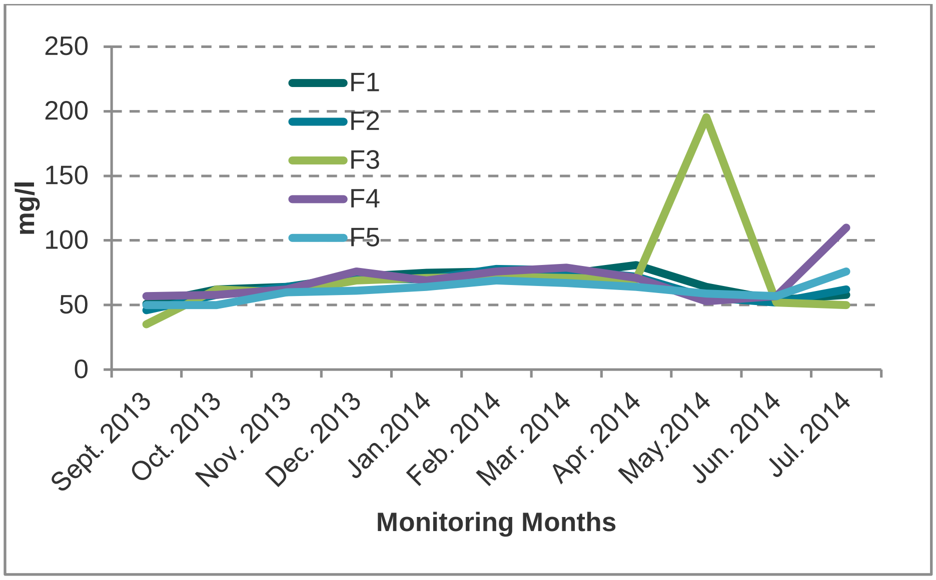


Figure 2-16: Monthlly total hardness as $CaCO_3$ at the monitoring sites

Note: The observed value for Total Hardness for F3 river reach in the month of May seems to be an outlier value.

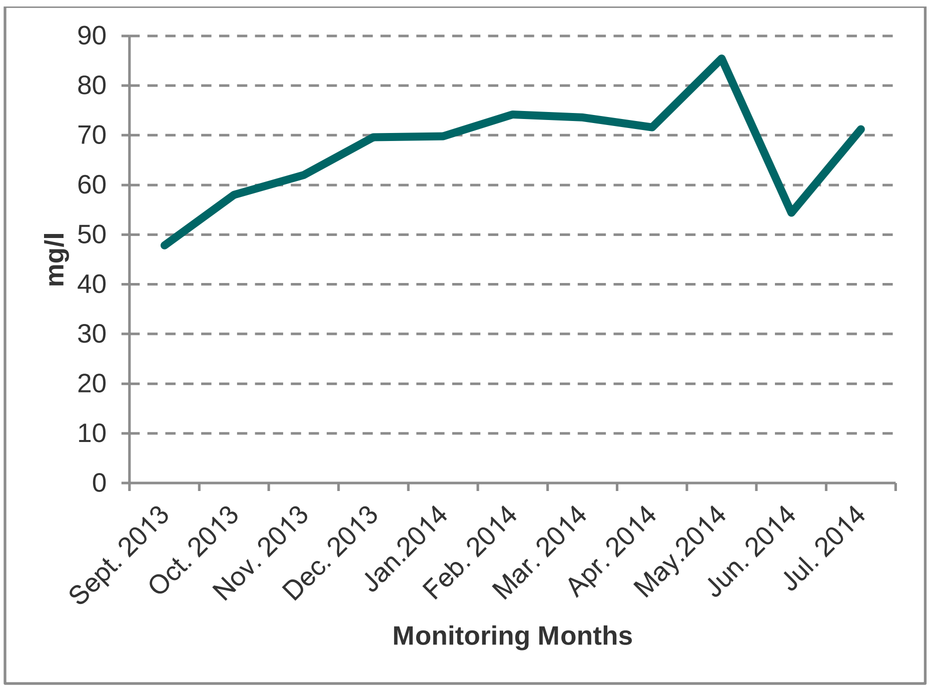


Figure 2-17: Average hardness as total $CaCO_3$ in the monitored river stretch

Total Alkalinity

The monthly variation tends of total alkalinity in the sampled river reaches is depicted in Figure 2-18.

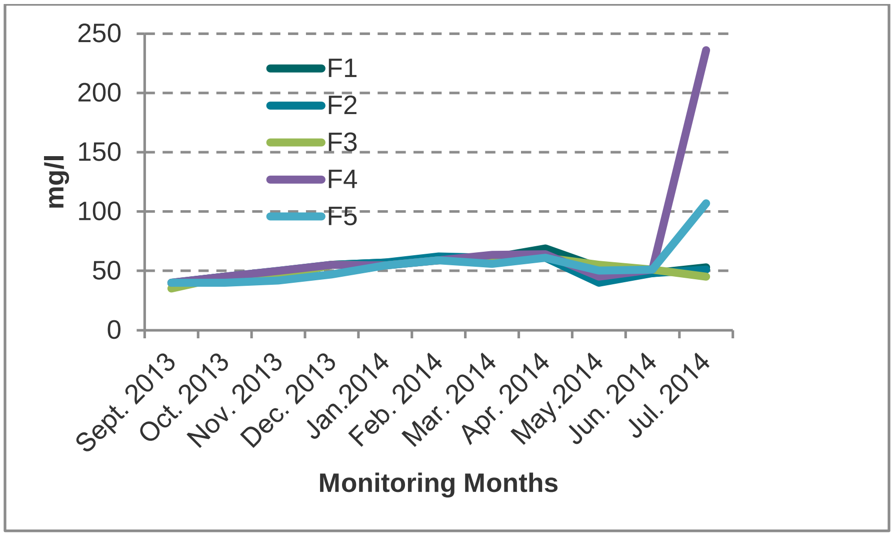


Figure 2-18: monthly alkalinity at the monitoring sites

The observed values of the total alkalinity indicate that the river is not sensitive to acidification risk. Alkalinity increases during the dry season (October through March) and declines rather steeply on the onset of snow melt (April/May). The July observation (F4) seems to be an outlier. The alkalinity monthly variation roughly correlates with observed pH variation trends.

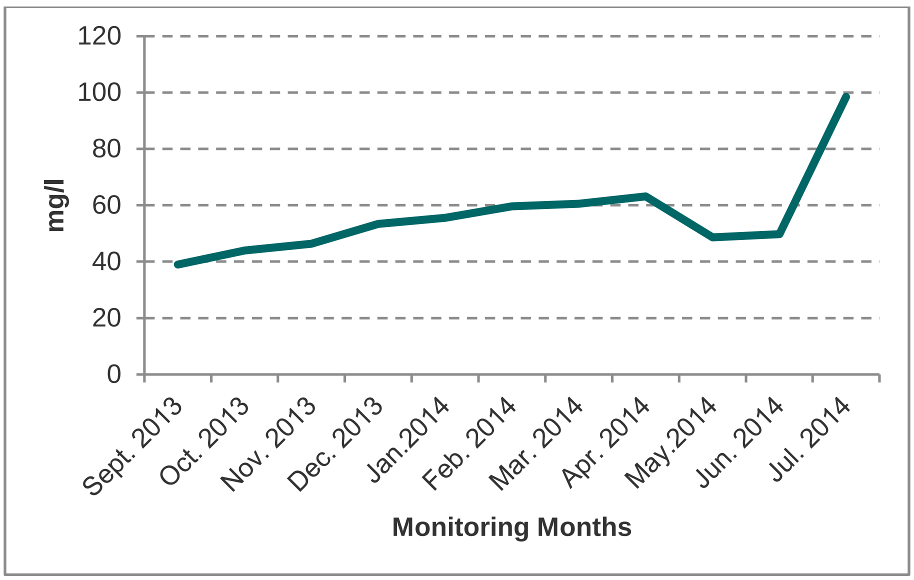


Figure 2-19: Average alkalinity in the monitored river stretch

Chloride

Figure 2-20 presents the monthly variation of chloride (Cl^-) concentration in the monitored river reaches. There is a general increase in chloride concentration in the dry months and a sharp decline with the onset of snowmelt (April/May) and again increase sharply in the month of June probably related to the washout of fertilizers applied to agricultural fields.

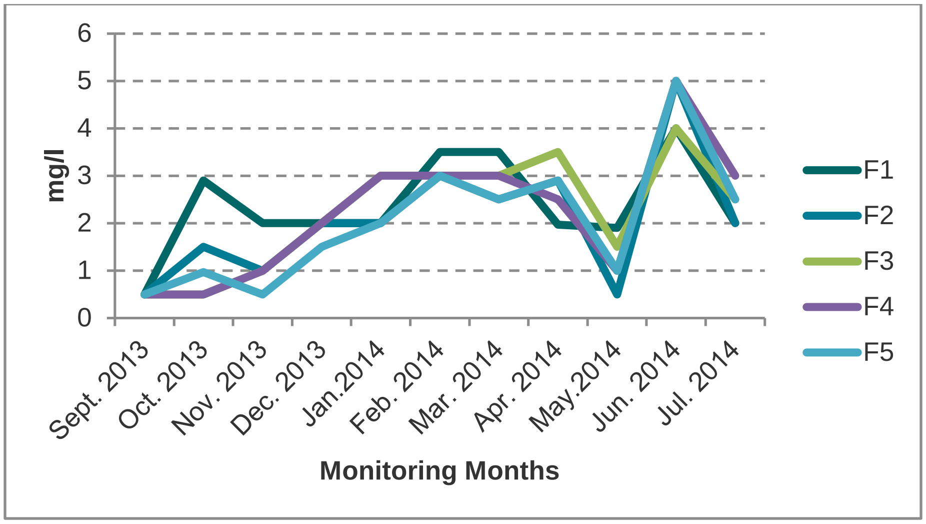


Figure 2-20: Monthly concentration of chloride at the monitoring sites

Despite the general trend observed, the values of chloride concentration are low indicating that the water is less polluted by anthropogenic and industrial activities than in other catchment areas.

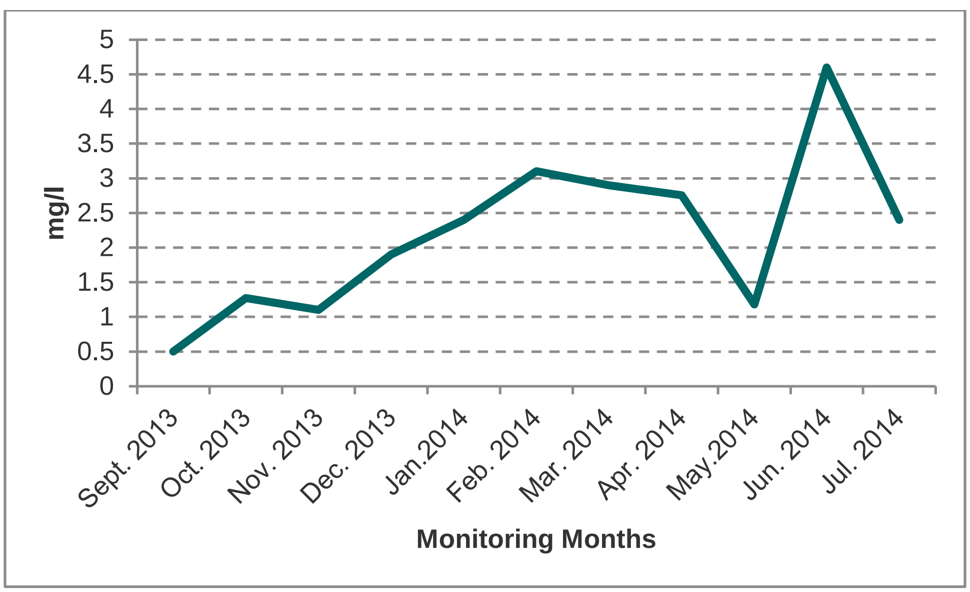


Figure 2-21: Average concentration of chloride in the monitored river stretch

Biological Oxygen Demand BOD_5

The observed monthly BOD_5 values ranges between 1 to 9.4mg/l. The Trishuli River in the monitoring stretch is considered pristine to moderately polluted by organic pollutants. This might be related to the poor sanitary conditions of settlements in the catchment. Open defecation and direct discharge of the household waste on the open land/water bodies is a common practice in the catchment settlements. There are no distinctive monthly differences in the BOD_5 values, although a slight decline is noticed in the winter months.

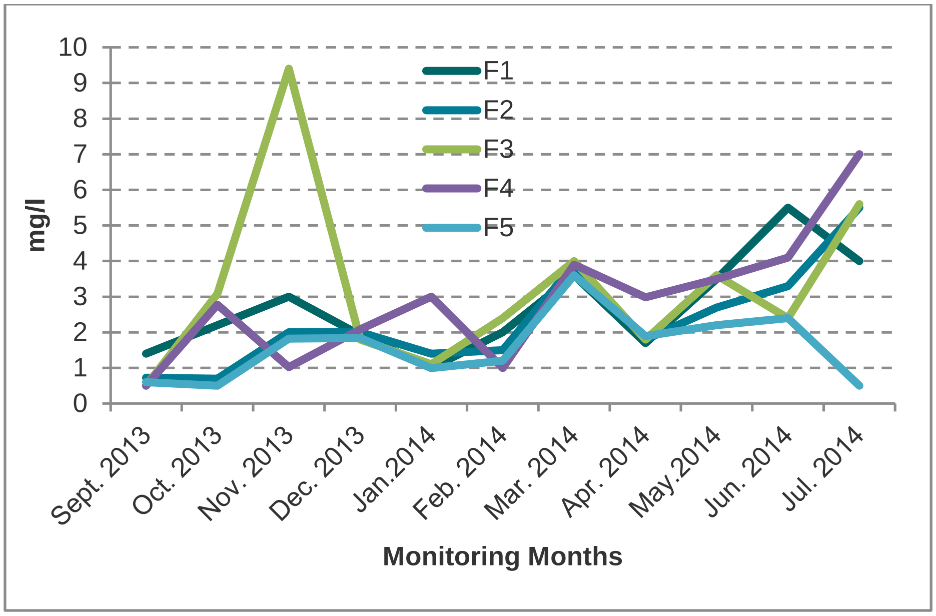


Figure 2-22: BOD_5 demand at the monitoring sites

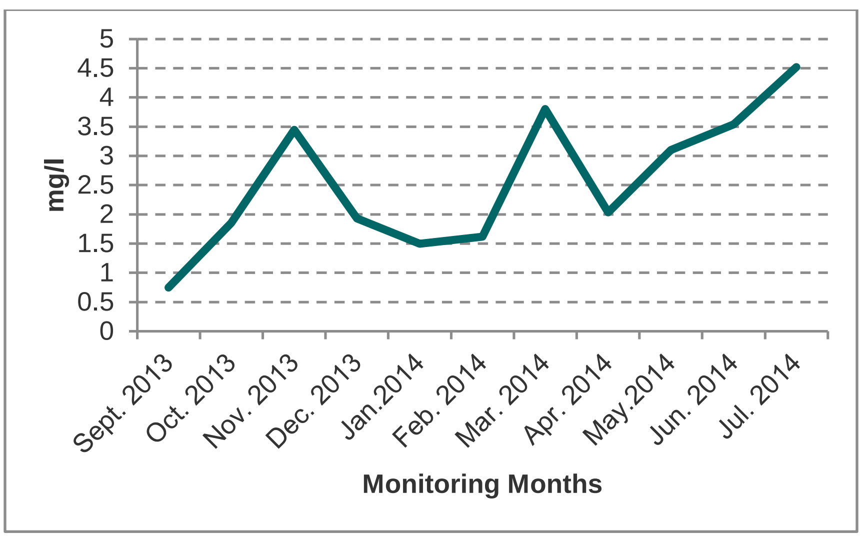


Figure 2-23: Average BOD_5 in the monitored river stretch

Chemical oxygen demand

Average BOD/COD ratio is about 0.19, meaning the river water also has inorganic compounds. The monthly and average monthly variations (Figure 2-24 and 2-25) are in correlation with the BOD_5 trends in general. The COD concentrations indicate that the water is also slightly polluted by the inorganic compounds.

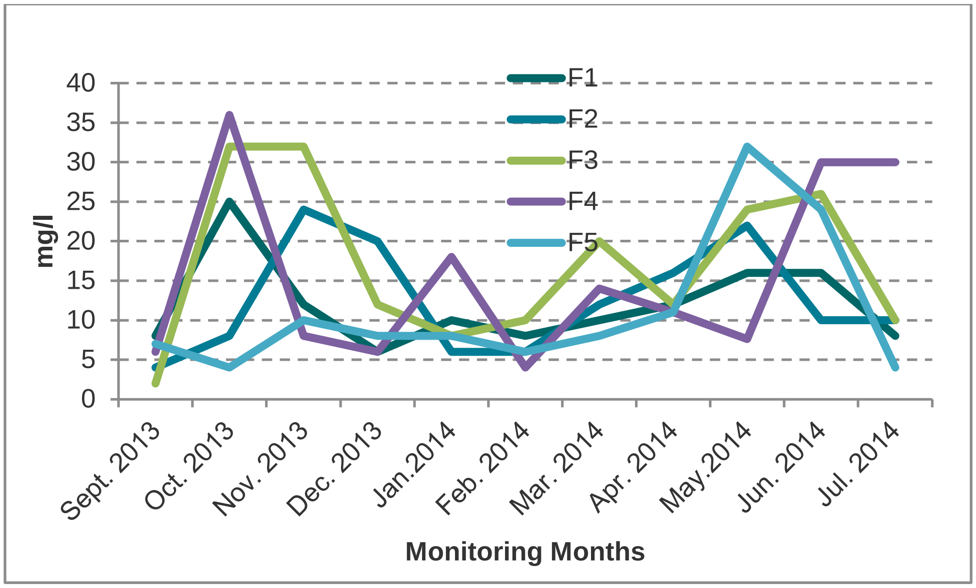


Figure 2-24: Chemical oxygen demand at the monitoring sites

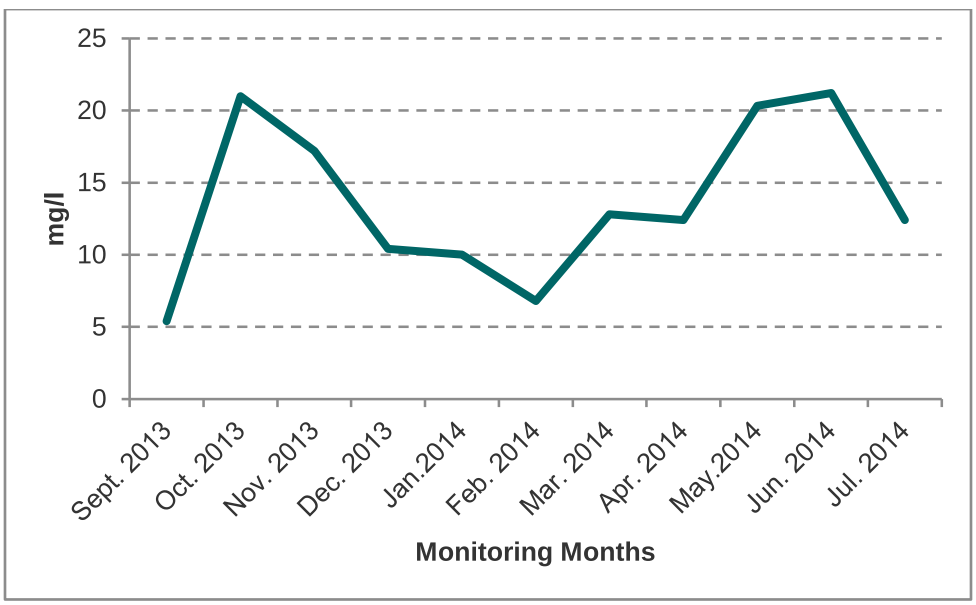


Figure 2-25: Average chemical oxygen demand in the monitored river stretch

Disslolved Oxygen

Dissolved oxygen concentration varies between 7.2 to 9.2 mg/l. There is no distinctive monthly variation trends observed at the monitored reaches (Figure 2-26), although a slight decline is observed during the winter months (Figure 2-27) when the water temperature is at its minimum. Surprisingly, the observed data shows no relationship between temperature and dissolved oxygen in the Trishuli River water (Figure 2-28). Nevertheless, the concentration of dissolved oxygen is well above required dissolved oxygen for the aquatic life.

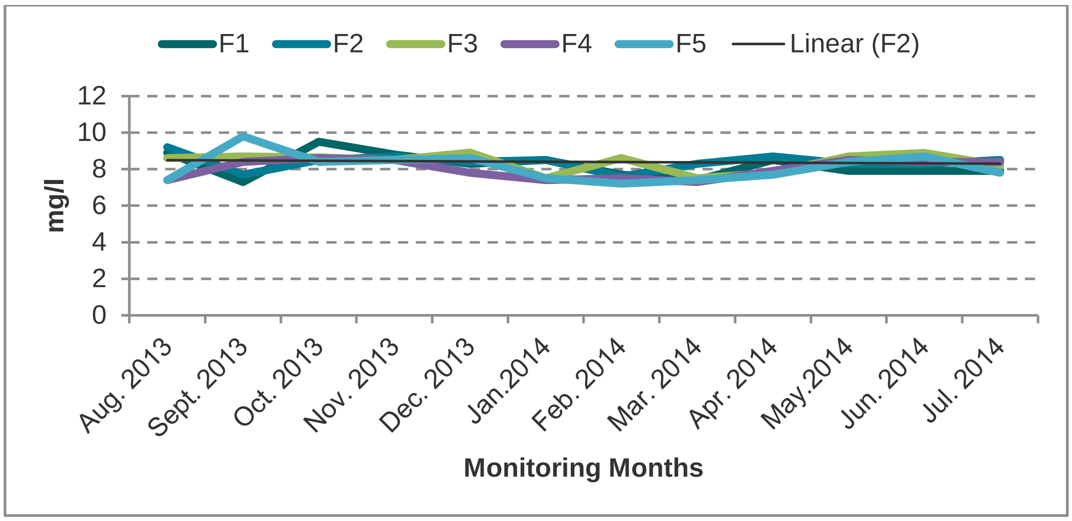


Figure 2-26: Dissolved oxygen concentration at the monitoring sites

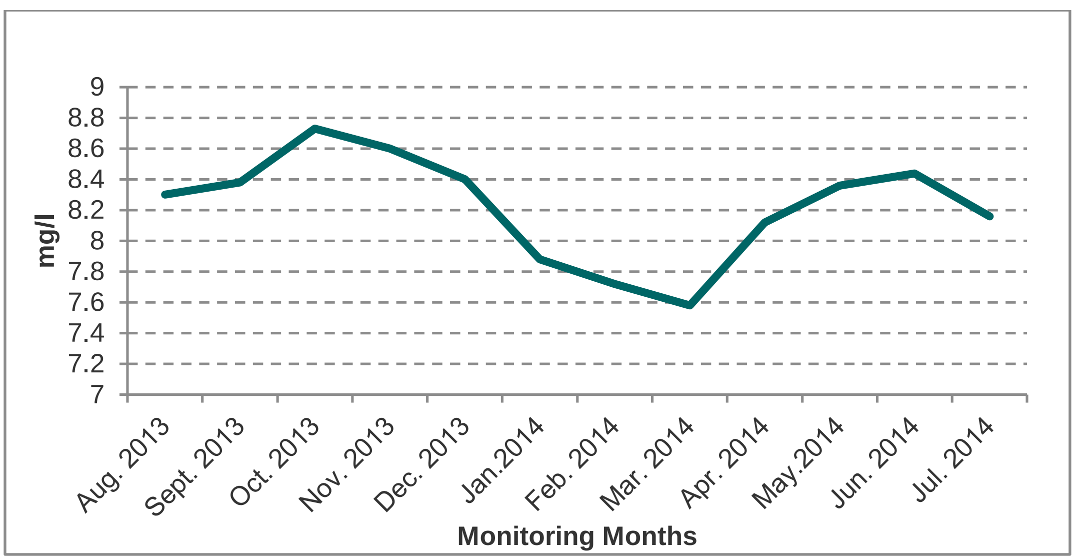


Figure 2-27: Average dissolved oxygen concentration in the monitored river stretch

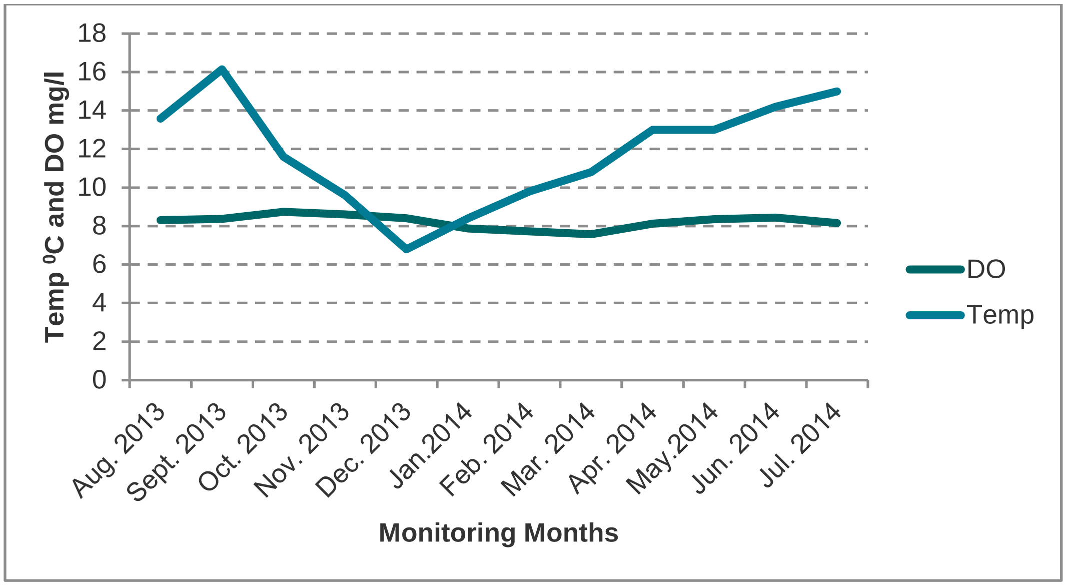


Figure 2-28: Average temperature and dissolved oxygen concentration in the monitored river stretch

Oil and grease

Oil and grease concentration varied between <0.5 to 6mg/l, the average being 1.6mg/l. There is no distinctive monthly variation in the oil and grease concentration. Nevertheless, spike high values are noted in the pre-monsoon and monsoon months, which may be due washout of oil and grease from the road corridors of the catchment.

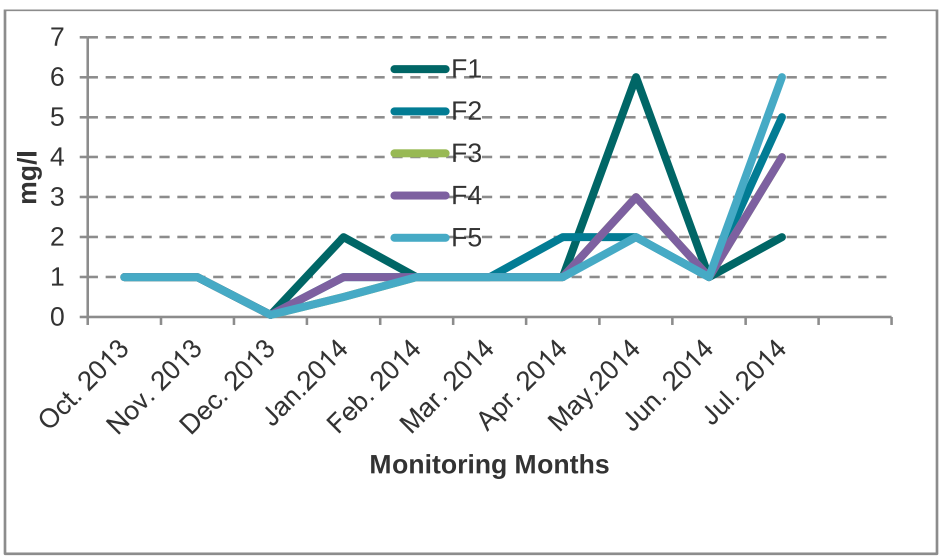


Figure 2-29: Oil and grease concentration at the monitoring sites

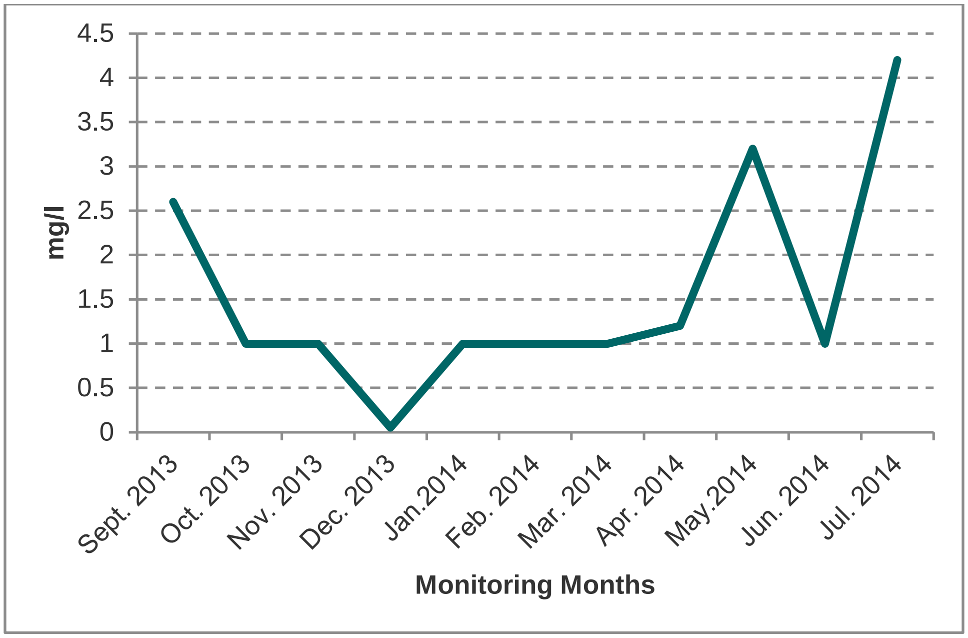


Figure 2-30: Average oil and grease concentration in the monitored river reach

Sulphate

Sulphate concentrations ranged from 1 to 32.5 mg/l in the monitoring period, with an average of about 11.9 mg/l. Distinctive monthly trends were not clear; a peak of concentration was detected in January in all monitoring sites.

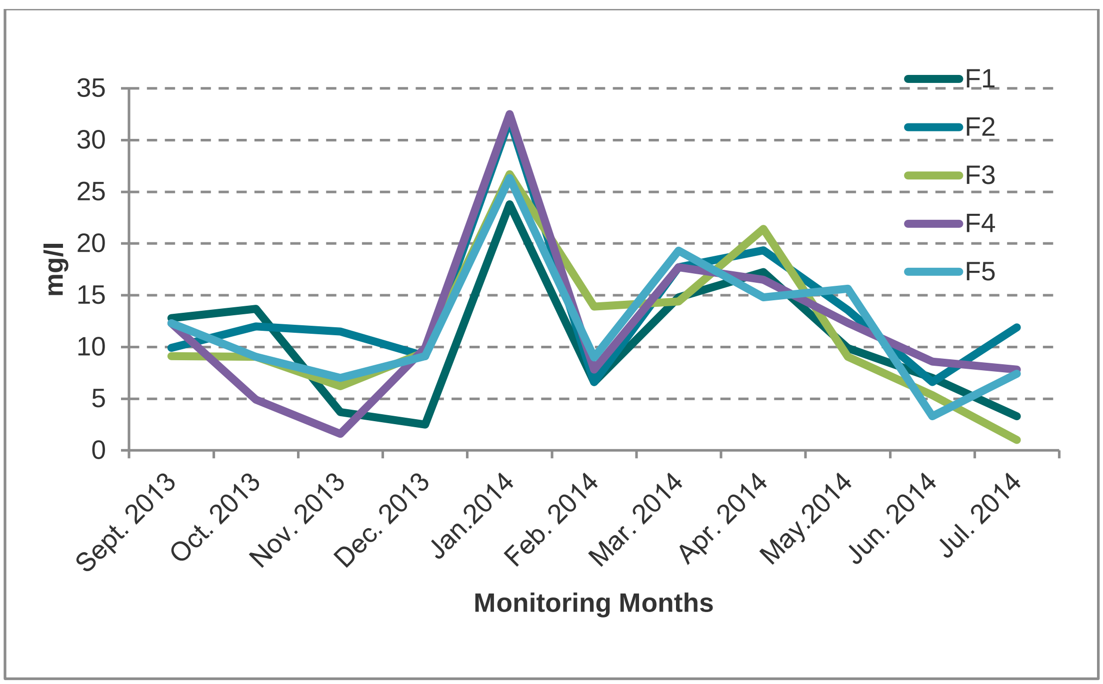


Figure 2-31: Sulphate concentrations at the monitoring sites

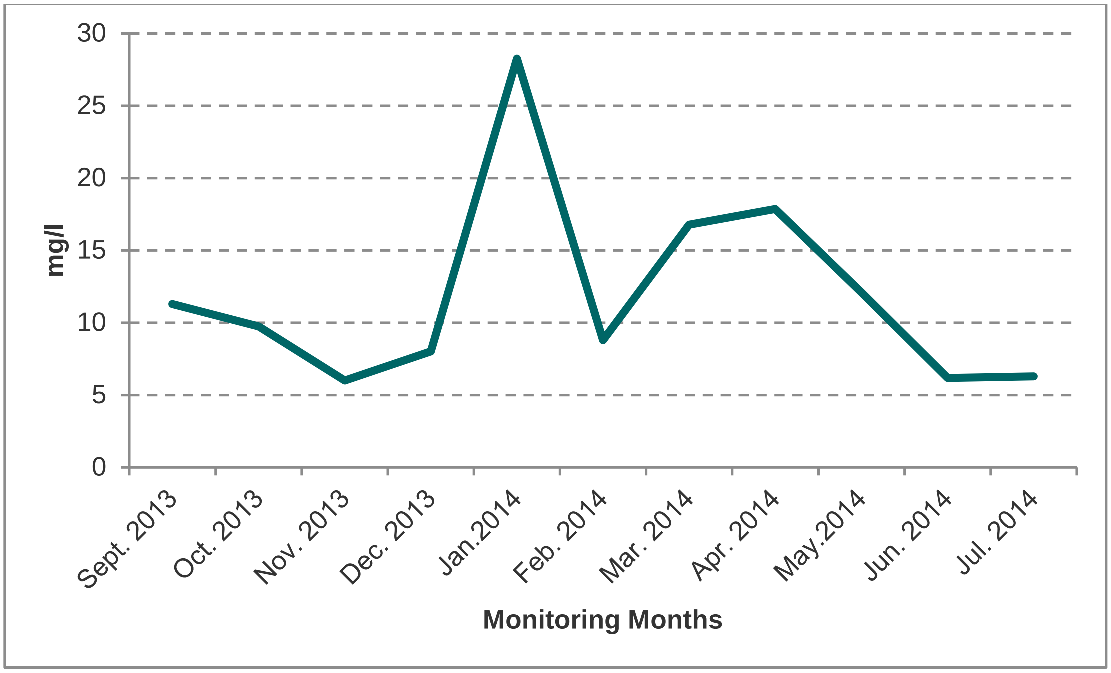


Figure 2-32: Average monthly concentration in the monitored river reach

Free carbon dioxide

Figure 3-33 and 3-34 presents the monthly variation trends of Carbon Dioxide concentration in the river reaches and in the monitored stretch of Trishuli River. There is no trend on the Carbon Dioxide concentrations. The concentration is seen to vary from 0.56 to 2.8 with an average of 1.45 mg/l.

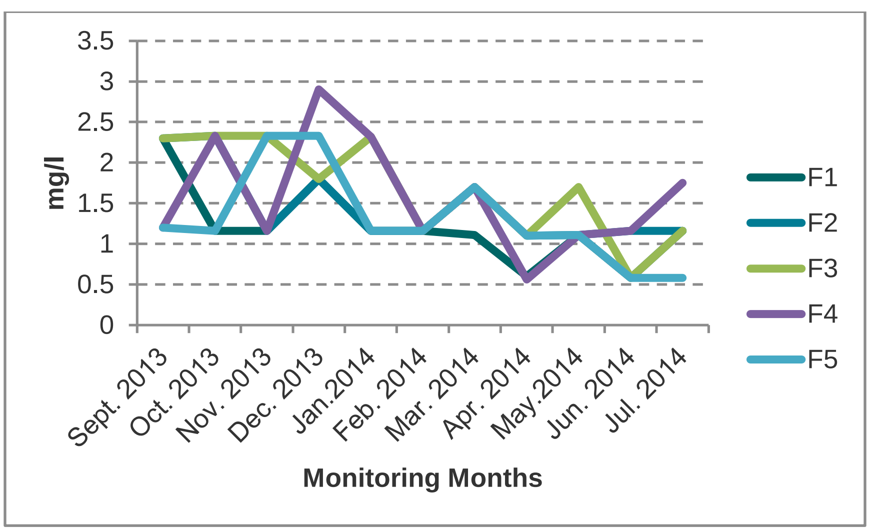


Figure 2-33: Free carbon dioxide in the monitoring sites

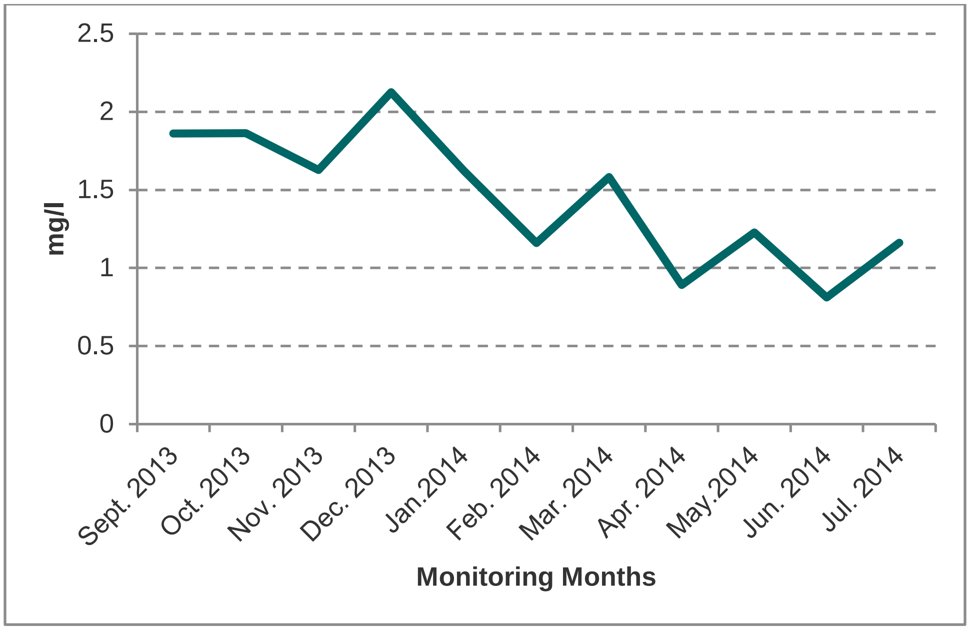


Figure 2-34: Average carbon dioxide in the monitored river reach

Ammonical, nitrite and nitrate nitrogen

The concentrations of ammonical nitrogen, nitrite nitrogen and nitrate nitrogen are low. Average concentrations in the monitoring period were 0.07, 0.34 and 0.009 mg/l, respectively. Occasional higher values above the average were observed but did not show any distinct trends.

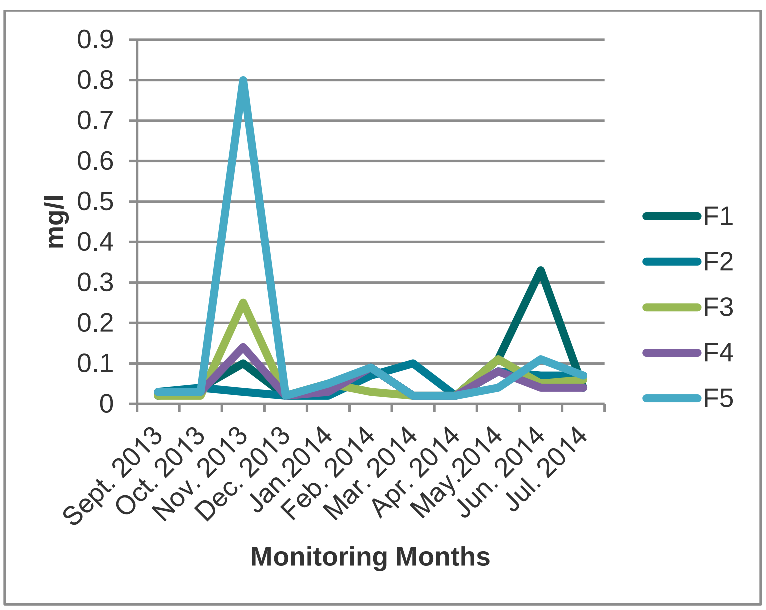


Figure 2-35: Ammoniacal nitrogen concentration at the monitoring sites

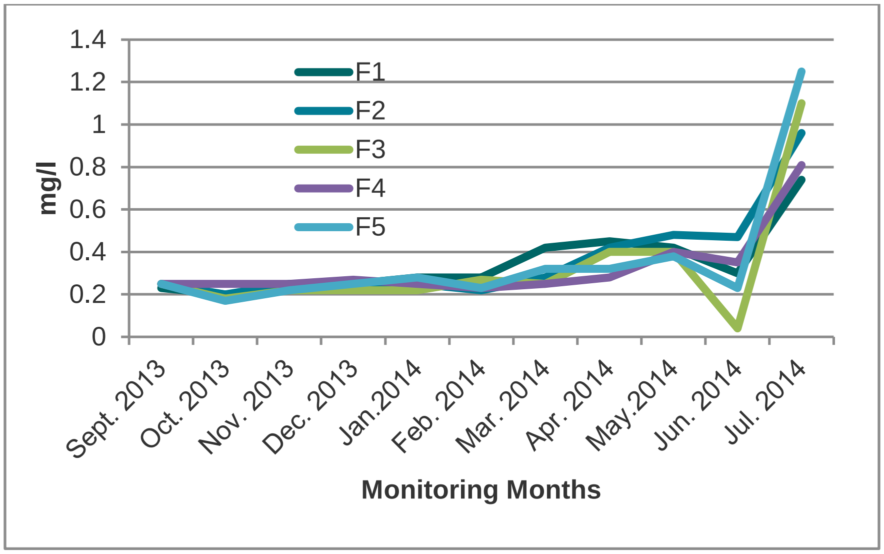


Figure 2-36: Nitrite concentrations at the monitoring sites

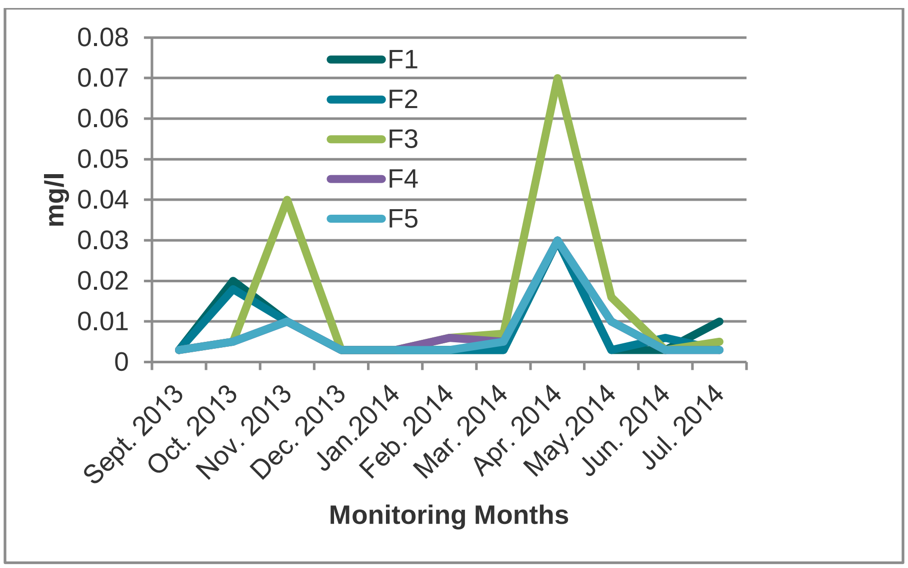


Figure 2-37: Nitrate concentrations in the monitored river reach

Fluoride

Fluoride concentration for most of the monitoring period is below the detection limit of 0.01mg/l (Figure 2-38). Only in the month of March a concentration ranging from 0.23 to 0.33mg/l is observed. This observation seems to be an outlier. The observed values are well within the limits for the aquatic life.

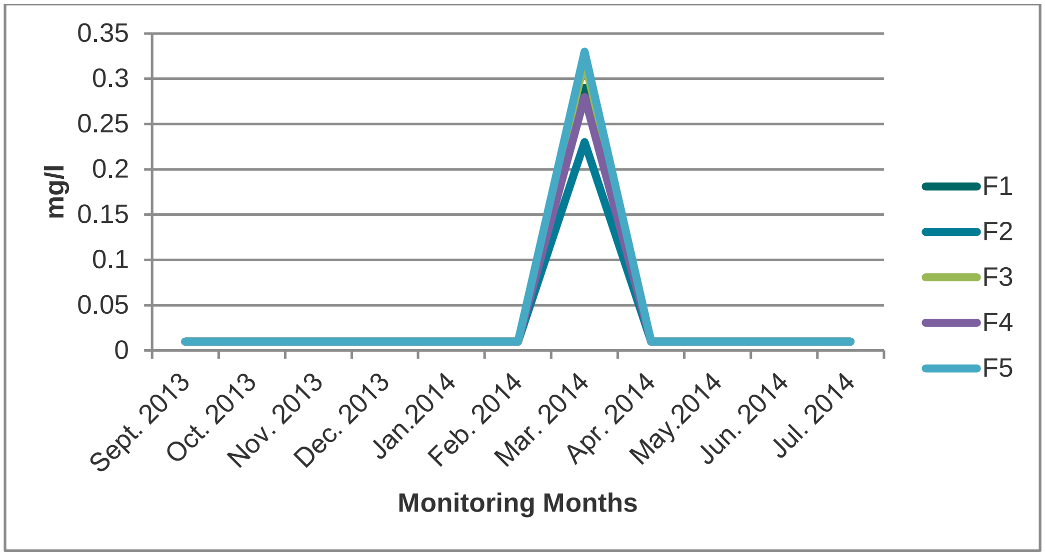


Figure 2-38: Fluoride concentrations at the monitoring sites

Hydrogene sulphide

Concentration of hydrogen sulphide ranges from <0.1 to 1.9 mg/l in the monitoring period with an average of 0.36 mg/l. There is no distinct trend in the concentration of hydrogen sulphide across the months. Concentrations are below the limit of 2 mg/l established by the *Generic Effluent Standards* of the Government of Nepal (2001).

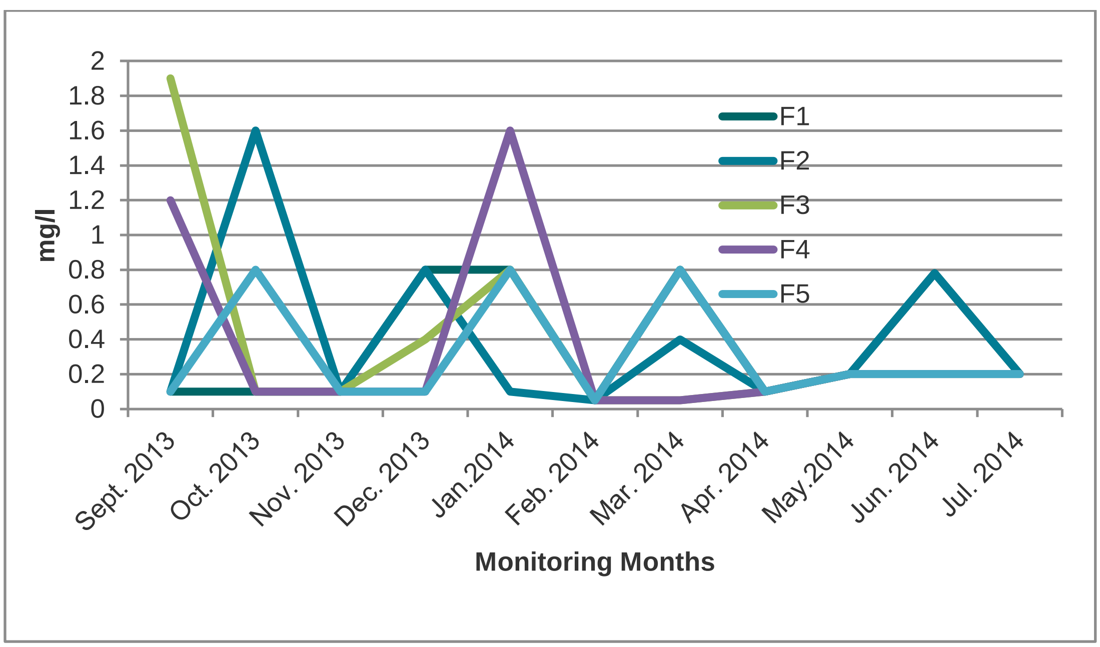


Figure 2-39: Hydrogen sulphide concentration at the monitoring sites

Iron

Iron shows a distinct monthly variation; concentrations are higher in late summer (onset of snowmelt) and in the monsoon months (April to September) and decline in the post monsoon and dry seasons (October to March). The trend is well related with the high discharge of run-off and the associated catchment erosion. The concentrations of iron in the monsoon months are above accepted limits for the protection of aquatic life (300 mg/l[1]).

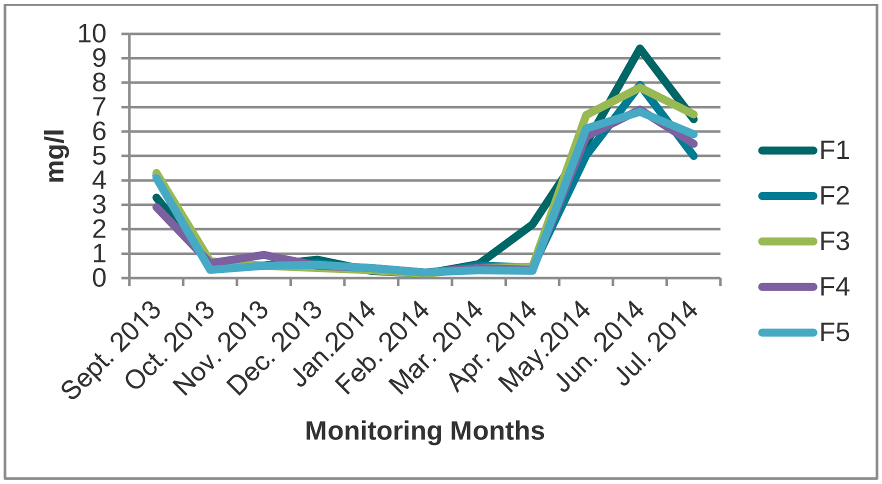


Figure 2-40: Iron concentrations at the monitoring sites

Manganese

Manganese monthly concentration correlates well with the pattern observed for iron. The concentration of manganese ranges from <0.01 to 0.8 mg/l.

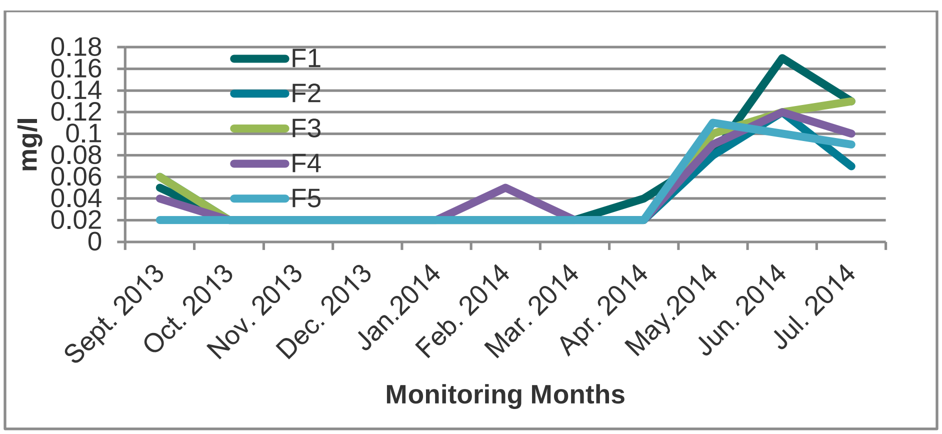


Figure 2-41: Manganese concentration at the monitoring sites

1 http://st-ts.ccme.ca/en/index.html?chems=123&chapters=1

Zinc

The concentration of zinc range from less than 0.01 to 0.08 mg/l. Onset of snow melting and monsoon months show higher concentration compared to the post monsoon and winter months, as like with iron and manganese. The higher concentration levels (>0.03 mg/l) exceed accepted limits for the protection of aquatic life.

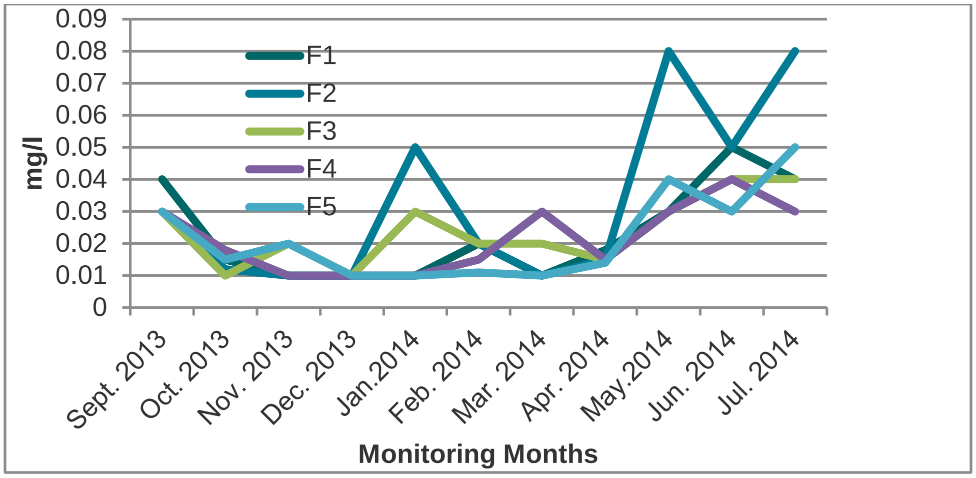


Figure 2-42: Zinc concentration at the monitoring sites

Other heavy metals

The other heavy metals monitored in the Trishuli River were: cadmium, lead, copper, nickel, silver, arsenic and mercury. All these heavy metals showed concentration below detection limits (cadmium -<0.003 mg/l, cead, copper, nickel, and silver - <0.01 mg/l, arsenic - <0.005 mg/l, and mercury - <0.0005mg/l). The low concentrations do not represent a risk for aquatic life.

2.2.3 Microbiological quality

Coliform count

Coliform counts varied considerably within the river reaches and across the months. Higher counts were observed at the onset (March through July) and decline of the monsoon, and lower values were detected during the winter season.

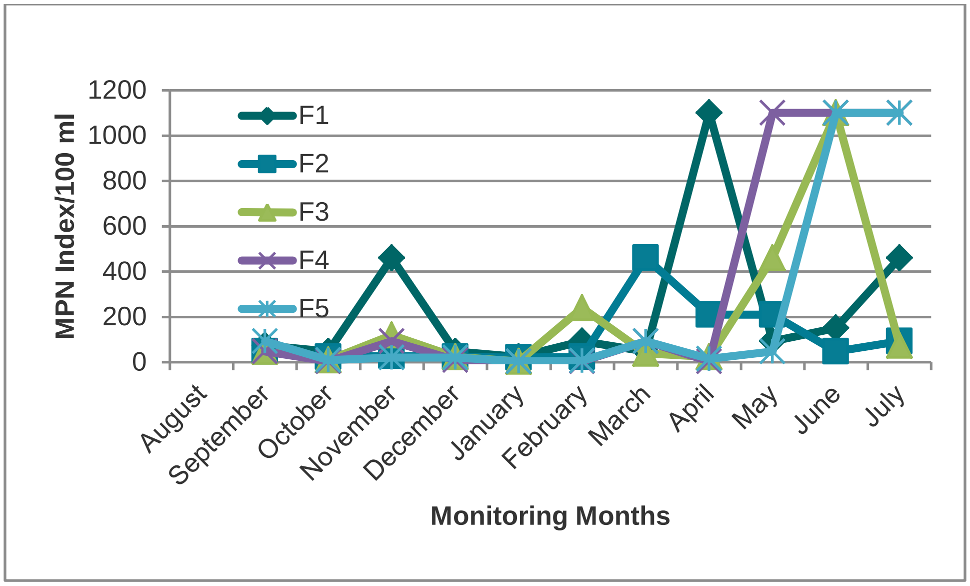


Figure 2-43: Coliform counts at the monitoring sites

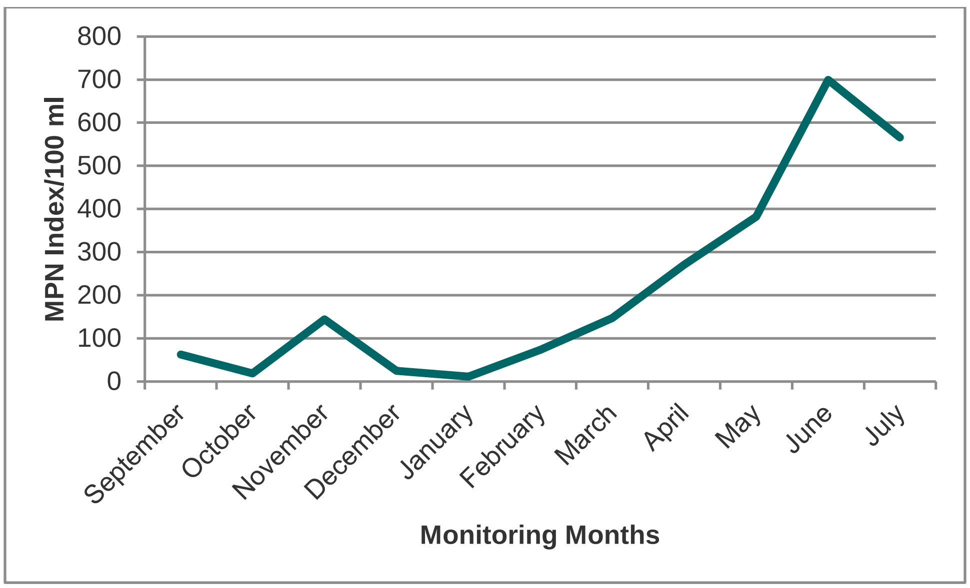


Figure 2-44: Average coliform counts in the monitored river reach

E coli Count

E-coli counts show a similar trend as that of the *coliform* count. In the wither months *E-coli* is even absent in some of the river reaches but it is invariably present in all the river reaches in the pre-monsoon and post monsoon months.

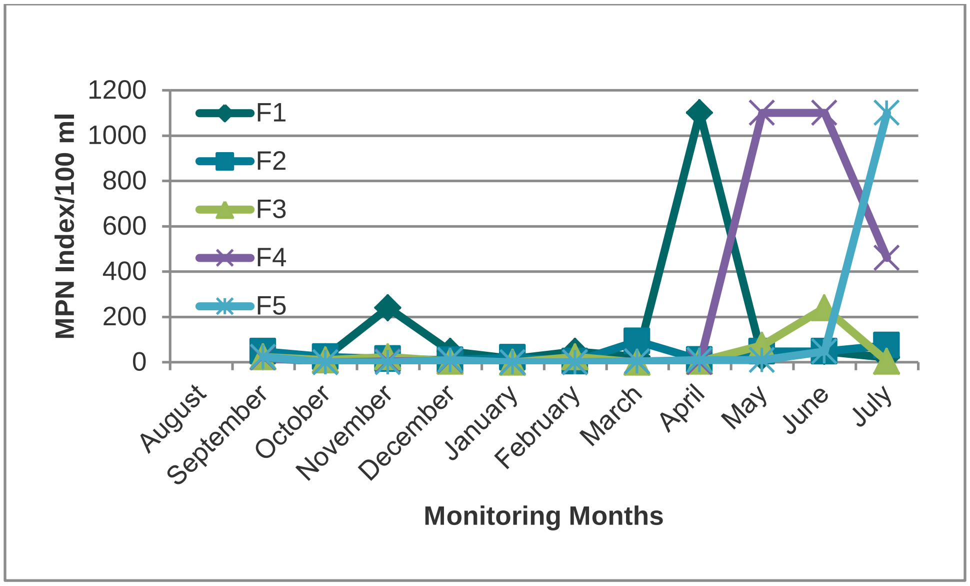


Figure 2-45: E. coli counts at the monitoring sites

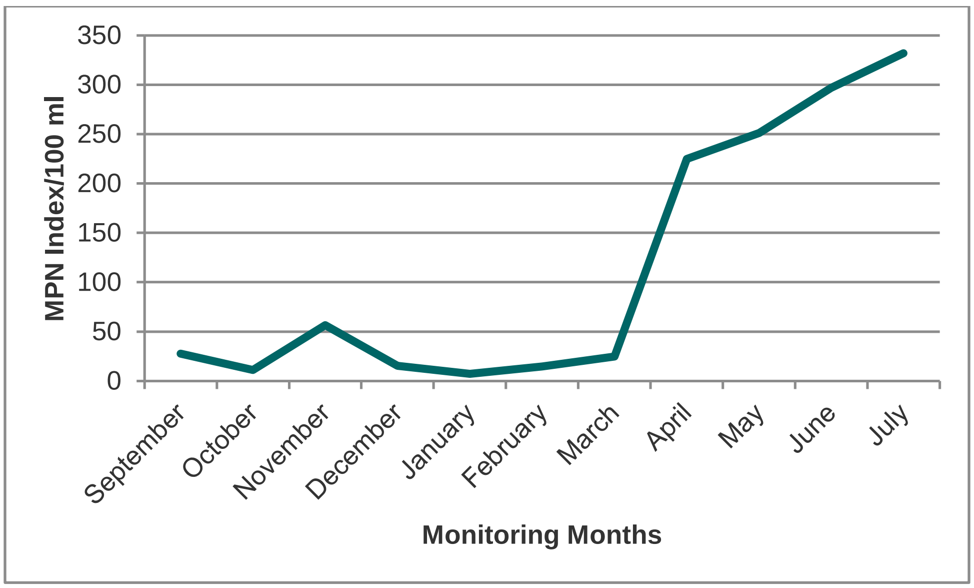


Figure 2-46: Average E. Coli counts in the monitored river reach

2.2.4 Overall assessment

Physical Water Quality

The physical quality of the water is not influenced by industrial activities and impact of anthropogenic activities is limited. Seasonal variation due to high monsoon rains has a dominant effect on the physical quality of the Trishuli river water. Values of total suspended solids during June and July are significantly high.

Chemical Water Quality

The chemical quality of the Trishuli River in the monitored stretch is noted to be influenced by the river hydrology which in turn is influenced by the snow melt and the monsoon runoff. Upstream erosion and sediment loads of iron, manganese, and zinc seem to contribute to the higher concentrations of these elements in the river water. Potential deleterious, from the perspective of the aquatic life, levels of concentration were observed during the monsoon period (April through September).

The BOD5 and COD concentration, although low, shows that the river is not pristine and is influenced by anthropogenic activities. Improvement in sanitation habits of the catchment population, particularly related to discharge of the household wastes and open defecation, would help improviong these parameters of water quality.

The observed spike concentration of oil and grease in some months in the river water indicates leakages linked to the traffic and construction activities in the Trishuli corridor. Better management practices of these substances need to be implemented.

A number of metals (iron, manganese and zinc) showed high concentrations during the monsoon period, probably linked to the high volume of sediments mobilized during these months. Some of the recorded values for iron and zinc concentration were higher than the accepted values for the protection of aquatic life.

Otherwise, the river water quality, in the monitored stretch of the Trishuli River is overall good and not affected by industrial pollution.

Microbiological quality

E-coli presence in higher numbers particularly in the pre-monsoon and monsoon months (April through September) indicates that the river water is contaminated with human excreta. Monsoon runoff brings sewage from the catchment settlements to the river as most of the population in the catchment do practice open defecation in the open fields. The river water is not safe for human consumption without treatment particularly in the pre-monsoon and monsoon seasons.

2.3 Aquatic Habitat

2.3.1 Habitat physical characterization

The 15-km monitored river stretch represents the main river course of Trishuli, a major tributary of the Gandaki River Basin in the Central and Western Development Region of Nepal and locates in the High Mountain Physiographic/Ecological Zone covering the administrative area of Rasuwa District. The total length of the monitored river stretch is about 15 km with catchment varying from 4350km^2 to 4500km^2. Of the total catchment, above 60% is located in Tibet Autonomous Region of Peoples Republic of China, while less than 40% lies within Nepal. Above 93% of the catchment area lies above 3000m. It is a perennial snow feed river. The stream discharge is highly influenced by monsoon rains (June through September) and snow melt (April through May). Climatic condition at the valley bottom is dominantly sub-tropical, while the upper catchment area it ranges from Temperate to Alpine depending on altitudinal level.

It is a high gradient river in the monitored stretch. Estimated drop in the river level is nearly 1m in every 45m. Wetted river width varies widely depending on seasons, and upstream/downstream location (Figure 2-47). Wetted widths are widest in the peak monsoon (August/September) and narrowest during winter (January/February). Downstream river reaches are comparatively wider than the upstream reaches.

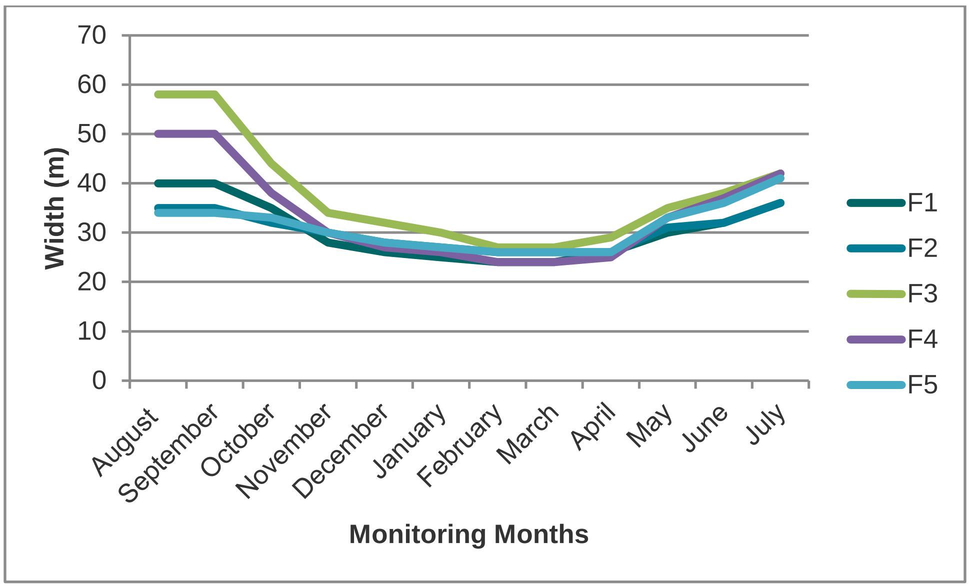


Figure 2-47: Wetted width variation at the monitoring sites

- *Source: Field Monitoring August 2013 to July 2014*

The river substratum is constituted of boulder, cobble, gravel, bed rock and sand components in decreasing order. Average boulder constituents is over 35% while cobble rage from 25 to 30%, gravel from 15% to 20%, bed rock 15% to 10% and sand from <5% to 5%. Silt and clay fraction on the substratum are almost nil. The adjacent land use on either river bank is dominantly forest with few patches of agricultural land in the downstream river reaches. Large woody debris is very rare on the river banks. Aquatic vegetation is scarce on the flood plain as well as in the wetter shore.

The river habitat is dominated by riffle accounting nearly 80 to 90 percent of the river stretch while run constitute about 20 to 10 percent. Pool habitat is almost absent, limited to a few meters in the geomorphologically protected areas. The average relationship of the river wetted width, rapid riffle, riffle, and run over the monitoring period is presented in Figure 2-48.

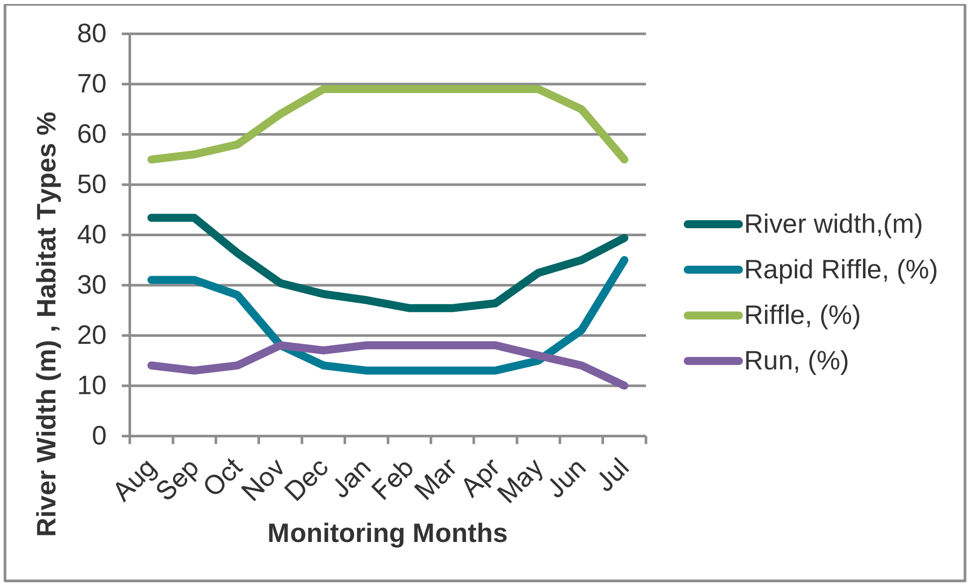


Figure 2-48: Relation between wetted width and habitat types in the monitored river reach

Length of the **riffle habitat** increases in the monsoon months with the increase of river discharge and increased river wetted width, while in the dry season, with the corresponding decline in the river discharge and wetted river width run habitat show increasing trends. The river stretch shows characteristic of high Gradient River. Erosion and transportation of the sediment is very active on the river stretch. Sediment supply from the catchment area is high which at places (near the confluence with the minor tributaries) surpasses the erosion and sediment transport and show depositional features such alluvial cones at the tributary mouth. The finer fraction of sediment along the river bed is constantly on movement, while the large fraction including boulders also shows considerable movement during the monsoon period. Major fraction of river substratum is renewed after every monsoon.

2.3.2 Phytoplankton

Chlorophyll a/Pheophytin-a[2]

Chlorophyll-a/Phenophytin-a concentrations were monitored every month from August 2013 to July 2014 (Box 1). The objective was to get an overview of the phytoplankton (such as

[2] Phenophytin –a is the degraded form of Chlorophyll -a

unicellular algae and cyanobacteria) concentration on the potentially affected river reaches of the Trishuli. Detailed analytical results are provided in Annex 1.

The ratio of Chlorphyll-a and Phenophytin-a shows that the sample preservation was not effective, however, the measure of the phenophytin–a provided the estimates of the chlorophyll-a concentration in the different months of the year.

Box -1

Chlorophyll *a*, a characteristic algal pigment, constitutes approximately 1% to 2% (dry weight) of planktonic algal biomass. This feature makes chlorophyll *a*, a convenient indicator of algal biomass. Algal cells were concentrated through filtering a known volume of water sample through a membrane filter. The pigments were extracted from the concentrated algal sample in an aqueous solution of acetone. The chlorophyll *a* concentration was determined spectrophotometrically by measuring the absorbance (optical density - OD) of the extract at 750nm, 664nm & 665nm wavelengths.

The sampling protocol applied was the following:

- Sample all habitats (riffles, runs, shallow pools, nearshore areas) roughly in proportion to their areal coverage in the predefined river reach. All habitat sites sampled were located using GPS
- Sampling at the habitat types was in shallow water sections because of the torrent characteristic of the river
- Prepared a sample of equal volume for each of the sampling locations (about 1000ml for each location)
- Combined all samples of the reach representing different habitats into a common container and mix it well. A composite sample was prepared for a sampling river reach (5 nos) representing the habitat types.
- Prepared a composite sample of the reach (about 2.5lt) in a PVC bottle
- Homogenized samples by vigorous shaking
- Concentrate the chlorophyll subsample on a membrane through filtration
- Fold the filter and wrap with aluminum foil to exclude light with a label
- Stored the filter in a cold container and send to laboratory with the filed data forms
- Analyzed the sample in compliance to Standard Methods for the Examination of Water and Wastewater (APHA 1995)

Figure 2-49 presents the variation in the concentration of combined chlorophyll-a and phenophytin –a in the various reaches of Trishuli River within the project area. Though there is difference in concentration at various river reaches even for the same monitoring months, shows a cyclic trend over the year. Post-monsoon (October/November) and post-winter (February) months showed elevated concentration level above 10mg/m^3, highest being in the post monsoon while it declines through summer (March to May) up to monsoon (July to September) and in the winter season (December to January) being less than 5mg/m^3. The trend seems to relate with water temperature, discharge volume (flushing rate) and turbidity (refer water quality). Given the available nutrients in the water, elevated water temperature, low turbidity, moderate to low discharge rate seems to favor high concentration of phytoplankton, while low temperature, flushing discharge and the relatively high turbidity cause low concentration of phytoplankton in the monitored stretches of the Trishuli River.

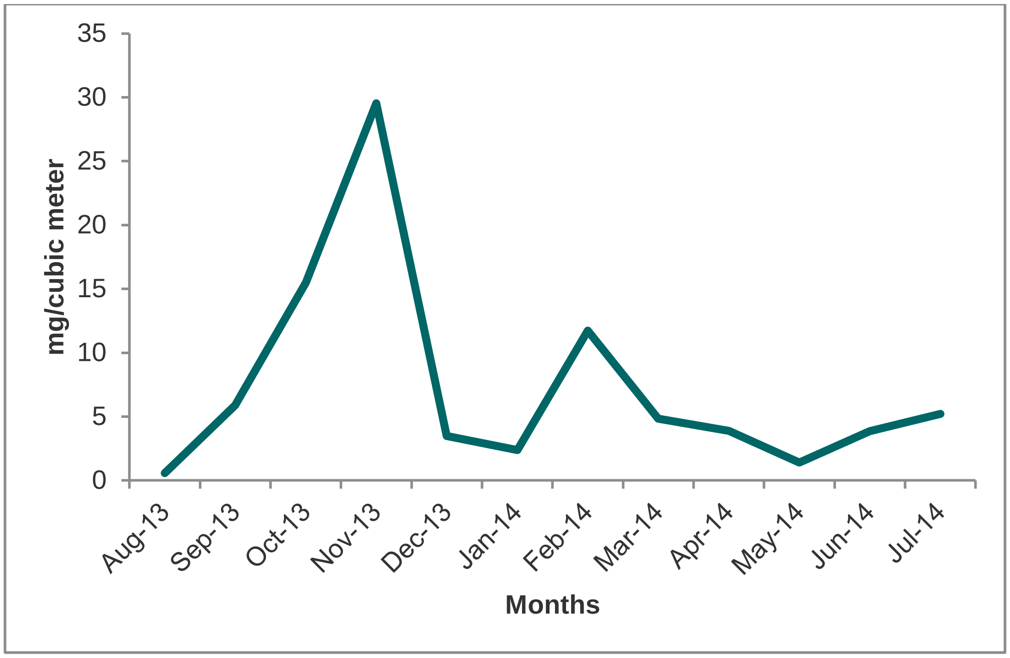


Figure 2-49 Average combined Chlorophyll- a and Phenophytin-a concentration in the monitored river reach

2.3.3 Periphyton

Periphyton or phytobenthos are primary producers and an important foundation of many stream's food webs. These organisms also stabilize substrata and serve as habitat for many other organisms. Periphytons were monitored every month from August 2013 to July 2014 (Box 2). The objective of the monitoring was to get an overview of the phytobenthos types and density on the potentially affected river reaches of the Trishuli.

Box – 2

Sampling approaches followed was a Multihabitat sampling which take account of all the habitat types observed in given reach of the river.The following procedures for multihabitat sampling of periphyton was adopted.

- Sampled all substrates and habitats (riffles, runs, shallow pools, nearshore areas) roughly in proportion to their areal coverage in the predefined river reach using techniques as stipulated in the Table below. All habitat sites sampled was located using GPS

Substrate Type	Collection Technique
Removable substrates (hard): gravel, pebbles, cobble, and woody debris	Remove representative substrates from water; brush or scrape representative area of algae from surface and rinse into sample jar.
Removable substrates (soft): mosses, macroalgae, vascular plants, root masses	Place a portion of the plant in a sample container with some water. Shake it vigorously and rub it gently to remove algae. Remove plant from sample container.
Large substrates (not removable): boulders, bedrock, logs, trees, roots	Place PVC pipe with a neoprene collar at one end on the substrate so that the collar is sealed against the substrate. Dislodge algae in the pipe with a toothbrush, nail brush, or scraper. Remove algae from pipe with pipette.
Loose sediments: sand, silt, fine particulate organic matter, clay	Invert petri dish over sediments. Trap sediments in petri dish by inserting spatula under dish. Remove sediments from stream and rinse into sampling container. Algal samples from depositional habitats can also be collected with spoons, forceps, or pipette.

Box – 2 Continued

- **Sampling at the habitat types was restricted to shallow water sections only**
- Prepared a sample of equal volume for each of the sampling locations (about 10ml for each location)
- Combined all samples of the reach representing different habitats into a common container and mixed it well
- Prepared a composite sample of the reach (about 125 ml) in a water tight bottle and level the bottle
- Preserved the sample by adding recommended amount of Lugol's (IKI) solution
- Analyzed the samples at the lab in compliance to Standard Methods

A total of 23 types of periphyton were identified by microscopic analysis of the collected periphyton samples. Of the total identified types 21 could be identified at Genus/Genera level while 2 could not be identified even at genus level and are named as Unknown A and Unknown B.

Monthly trend analysis of the Periphyton in terms of the presence of number of genera in the five monitored river reaches (Figure 2-50) presents an interesting trend. This number increases in the winter and summer months (December through April) and decline sharply in the monsoon and pre-monsoon season (May through November).

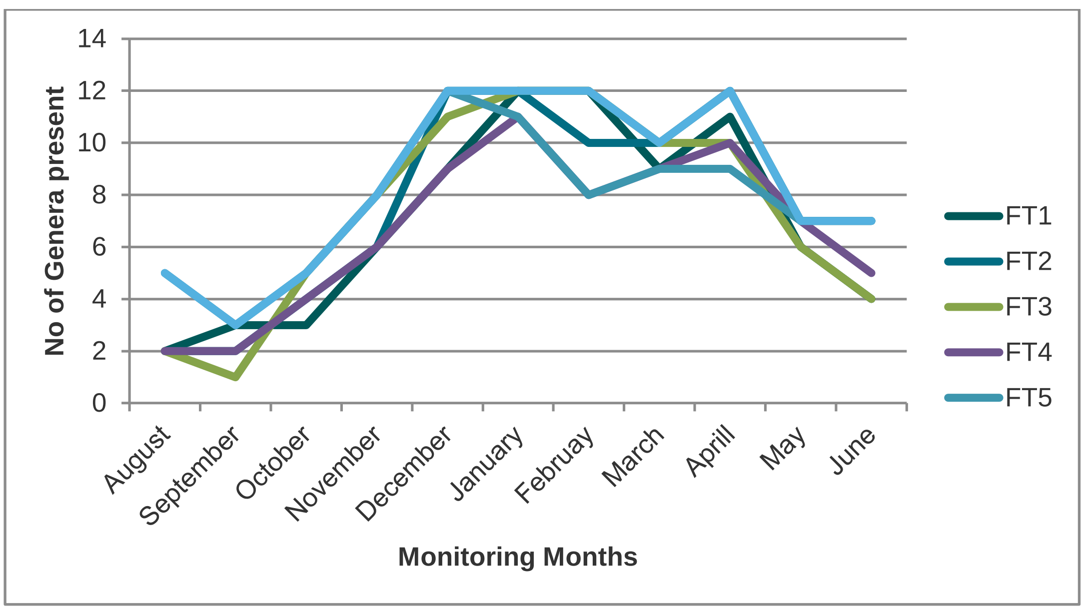


Figure 2-50: Monthly number of periphyton genera at the monitoring sites

None of the genera are present throughout the year. Figure 2-51 shows the number of months of presence of the different genera during the monitoring period. Most common periphyton genera are: Gomphoneis, Fragilaria, Frustulia, Microspora, and Rivularia, occurring 11 to 10 months of the year. Periphyton which was observed from 8 to 6 months includes: Actinella, Cymbella, Nitzschia, Synedra, Ulothrix, and Voucheria. Audouinella, Coleodesmium, Lynba, Phormidium, Unknown A and B and Westella are observed only once, rest occur between two to five months during the monitoring period.

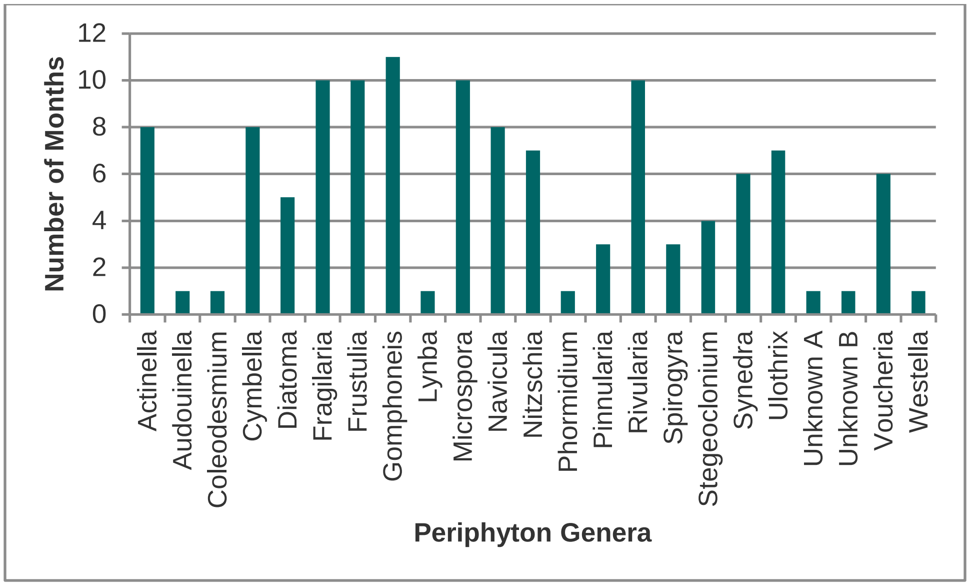


Figure 2-51 Number of months periphyton Genera presence

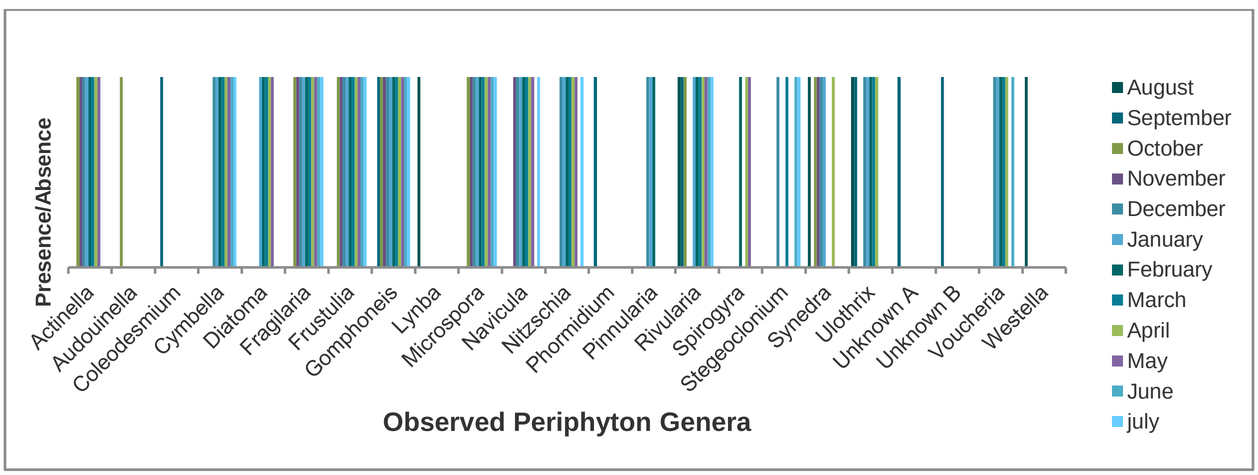


Figure 2-52: Monthly observation of periphyton genera

Figure 2-53 presents the periphyton monthly density variation trends in the river reaches. Density is at a minium during the monsoon season. With the withdrawal of the monsoon and the corresponding decline in the river discharge, the density of periphyton increases significantly.

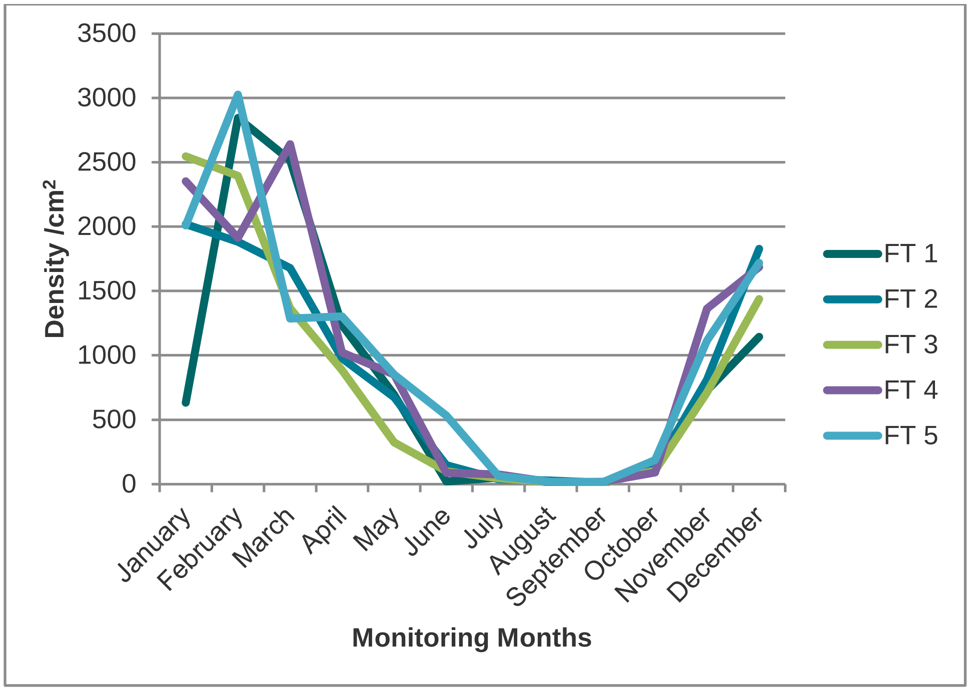


Figure 2-53 Periphyton density monthly variation

2.3.4 Macro-invertebrates

Rapid bio-assessment of the benthic macro-invertebrate assemblage was conducted using the *Surber* sampling method. Macro-invertebrates were monitored every month from August 2013 to July 2014 (Box 3). The objective of the monitoring was to get an overview of the macro-invertebrate types and density on the potentially affected river reaches.

Box 3

- Sampling approach followed a multi-habitat sampling. The approach take account of all the habitat types observed in given reach of the river. The following procedures for multi-habitat sampling macro-invertebrate was adopted.
- Collected sample from the different habitats in proportion to the habitat types in the reach; estimating the percentage of the reach in each habitat type. All habitat sites sampled were located using GPS.
- **Sampling at the habitat types was in shallow water sections because of the torrent characteristic of the river**
- Samples collected from the multiple habitats were combined to obtain a single homogeneous sample in a container for the reach.
- Covered the sample collected in the sample container with 95% ethanol for sample preservation
- Labeled the sample container and bring to lab for further analysis with field data forms

A total of 25 types of macro-invertebrates have been observed in the monitored stretch of the Trishuli River. Twenty-four of the macro-invertebrate types are identified at order level, while a few could be identified up to family and Sub-family and Genus level. One type of macro-invertebrate could not be identified even at order level. Identified macro-invertebrates belong to 7 Order. Order Coleptera is comprised of 1 type, while order Diptera, Ephemeroptera, Meghaloptera, Odonata, Plecoptera, and Trichoptera comprises 7, 4, 1, 2, 6, and 3 types respectively.

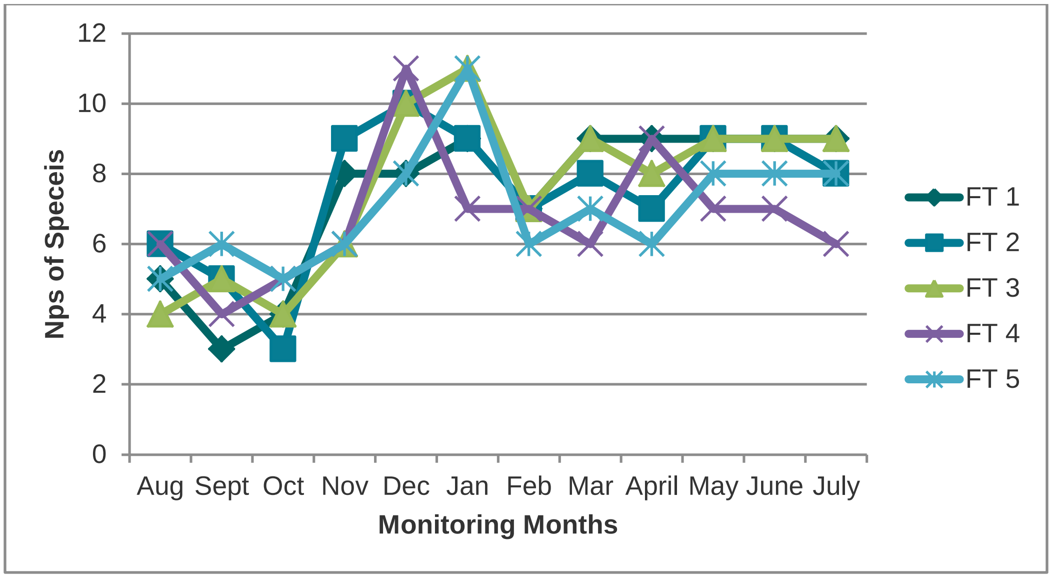


Figure 2-54: Number of macro-invertebrates species variation at the monitoring sites

The number of macro-invertebrate types increases during the winter months (November through January) and declines gently in the pre-monsoon and monsoon months. Except for the net spiner caddisfly, none of the other types are present throughout the year. Figure 2-55 shows the number of month-presence of the identified macro-invertebrate types in the river stretch, while Figure 2-56 depicts the presence of the macro-invertebrate types in each of the monitored months. The most common micro-invertebrate types include: net spiner caddisfly, and free living caddisfly (order *Trichoptera*); and may flies belonging to various genuses (*Epeorus*, *Rhithrogena*, *Stenonema*, and *Ephemerela*) of the order *Ephemeroptera*; golden stone fly (family *Peltoperlidae*) of Order *Plecoptera*; and midge, and net-winged midge of order *Diptera*.

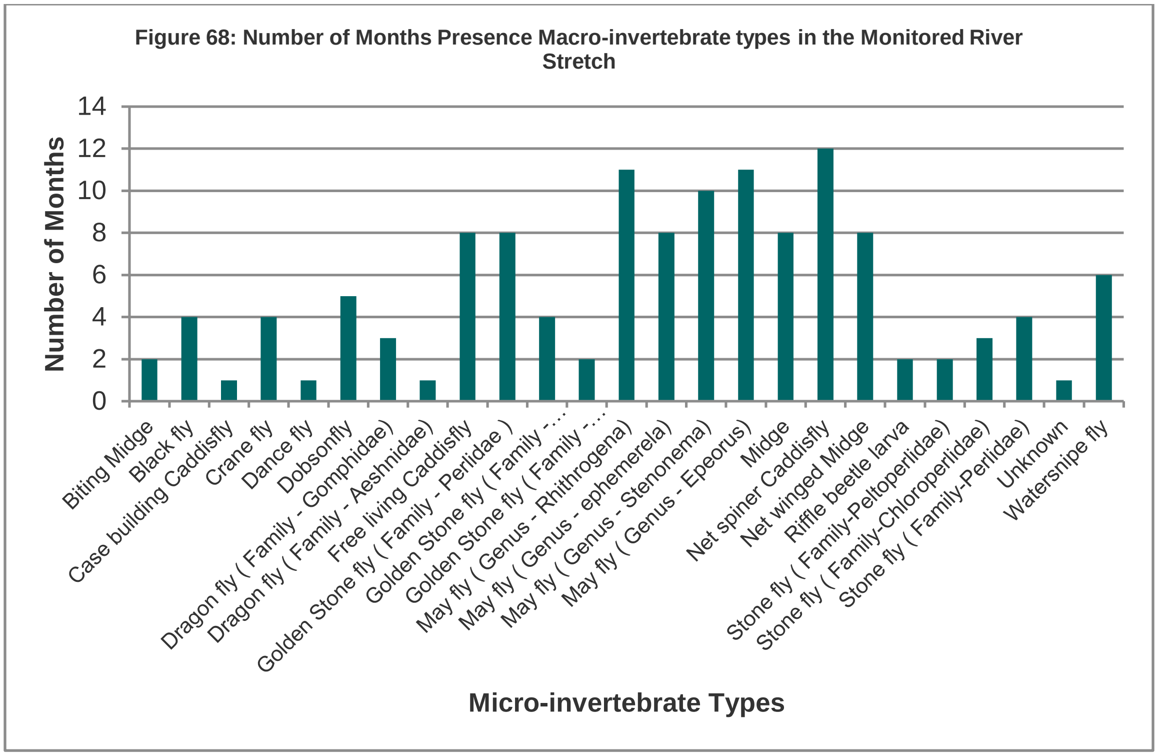


Figure 2-55: Month presence of the observed macro-invertebrate types

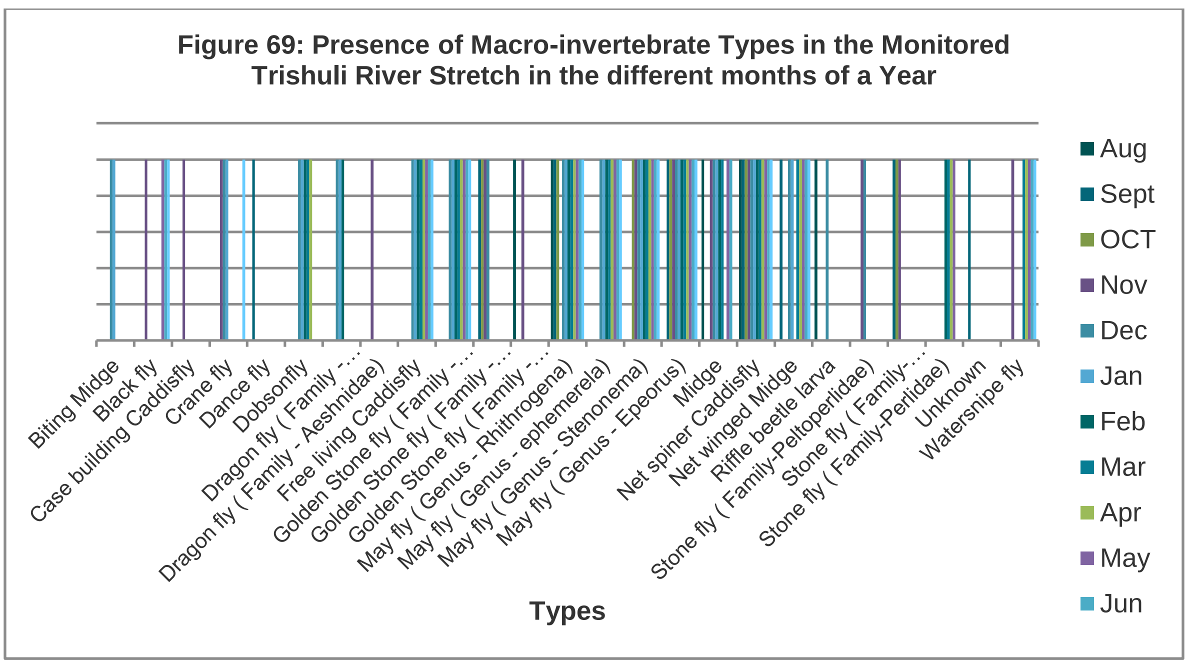


Figure 2-56: Presence of macro-invertebrate types in the different months of the monitoring period

In terms of macro-invertebrates density, the monitoring data shows a similar trend to the number of types of these organisms; density peaks during the winter months coinciding with low flows in the river and decreases to almost zero at the peak of the monsoon (August-September)

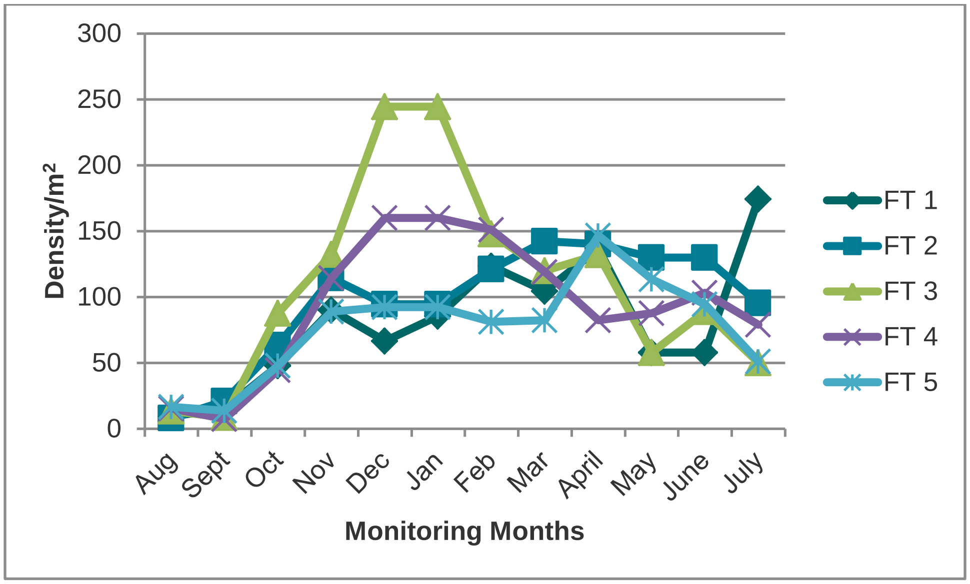


Figure 2-57: Macro-invertebrates density at the monitoring sites

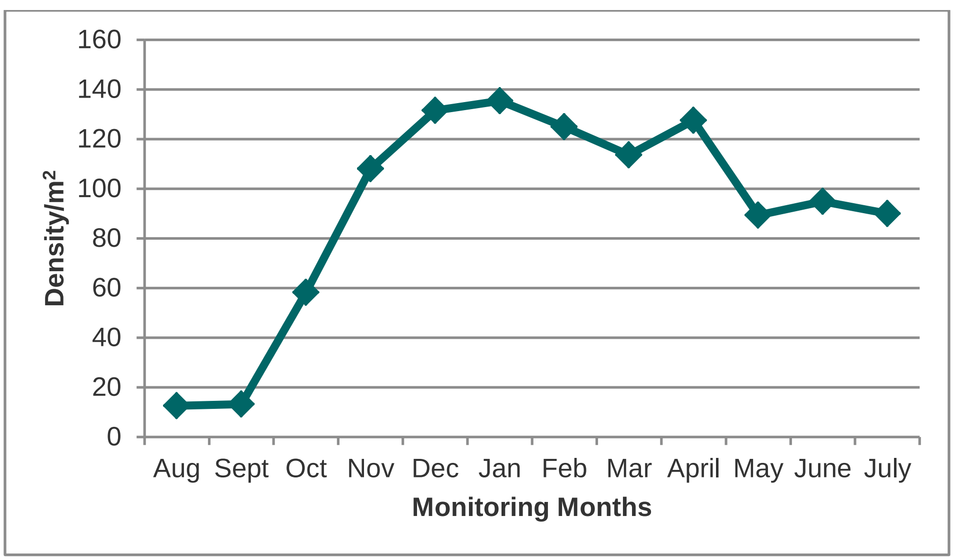


Figure 2-58: Average macro-invertebrates density in the monitored river stretch

2.3.5 Overall assessment

Phytoplankton

The mean yearly concentration of combine *chlorophyll–a* and *phenophytin–a* is 7.36 mg/m^3, with a standard deviation 8.18 and a coefficient of variation of 0.9. The year-round water quality based on chlorophyll-a concentration is considered “good” at this stage. With the project, the dewatered stretch of the Trishuli River is likely to show high concentration of phytoplankton due to alteration on discharge rates (low discharge), decline in turbidity and increase in the water temperature.

Periphyton

Overall periphyton density and the number of genera found in the samples are closely linked with the river hydrology and potentially with the total suspended solids (Figure 2-59) concentration and the water temperature. Availability of periphyton, which is key food resource for fish that feed on the detritus deposited on the river bottom (such as the snow trout *Schizothorax richardsonii*), is highest during the winter months (November-March) and decreases significantly during the monsoon period.

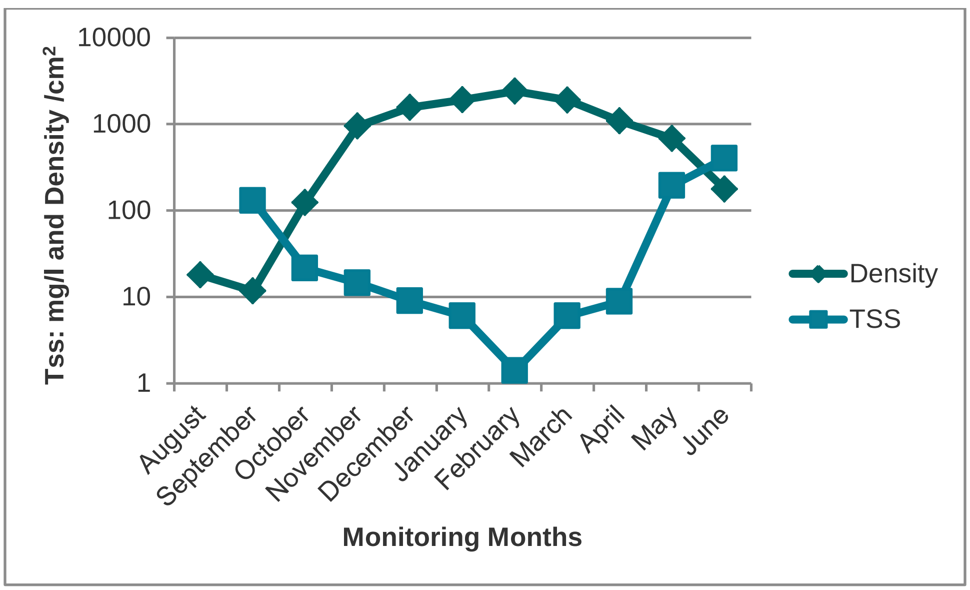


Figure 2-59: Average total suspended solids and periphyton density

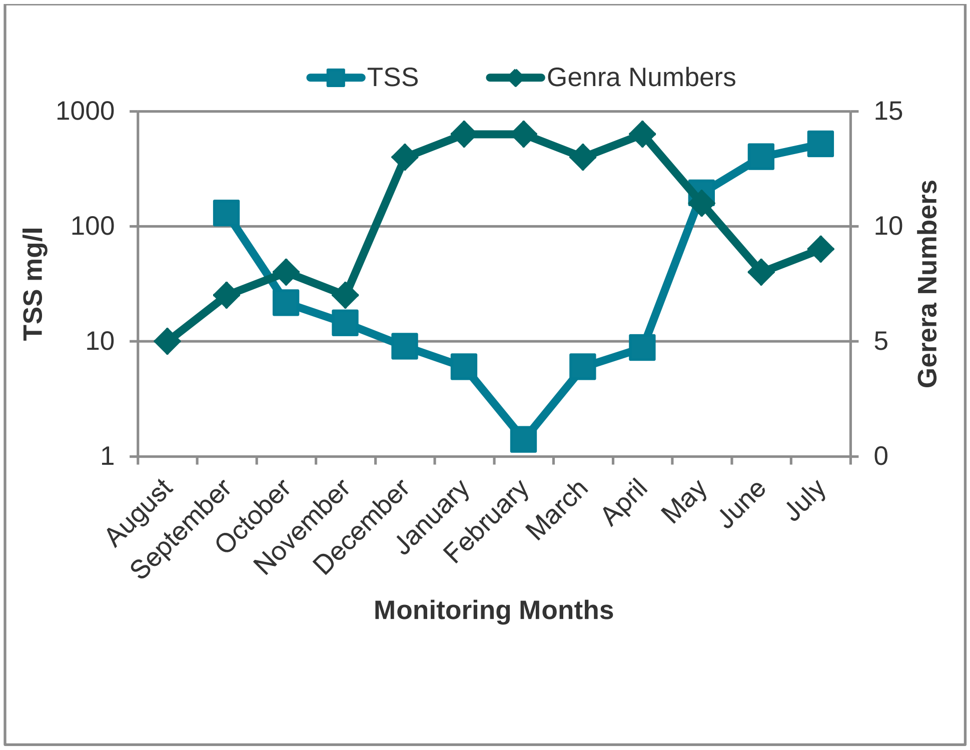


Figure 2-60: Average total suspended solids and periphyton diversity (genera)

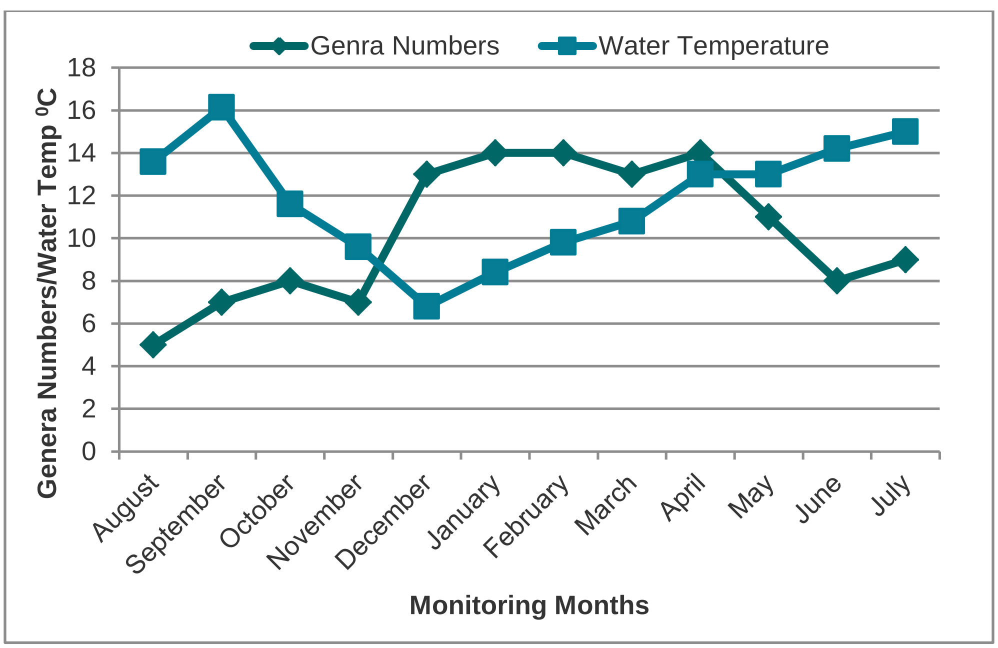
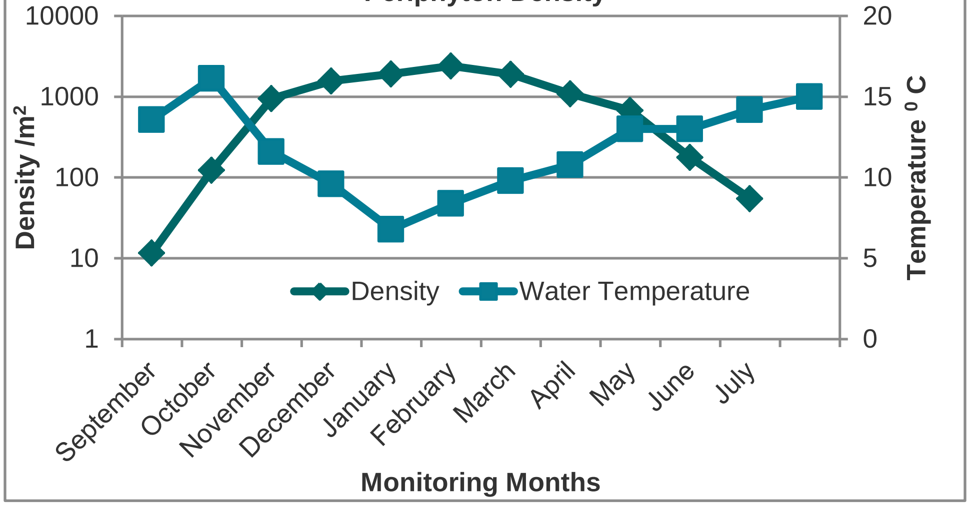


Figure 2-61: Average water temperature and periphyton diversity (genera)

Macro-invertebrates

Macro-invertebrates show a similar pattern as that of the periphyton density and diversity. and type numbers and the average density shows inverse relationship with TSS (Figure 72). The macro-invertebrate diversity is controlled by the variation in TSS which is related with the monsoon rains and associated with the corresponding increase in the river discharge. Unlike periphyton, the density and numbers of macro-invertebrate types seems to decrease sharply only after the peak monsoon floods. Macro-invertebrate relationship with water temperature is rather non- significant.

Figure 63: Relation between Water Temperature and Periphyton Density



Macro-invertebrates

As periphyton, macro-invertebrates are most abundant during the winter months and its density decreases after the peak of the monsoon (July). Their abundance seems to be inversely related to the concentration of total suspended solids (Figure 2-62), which in turn is linked to the river discharge.

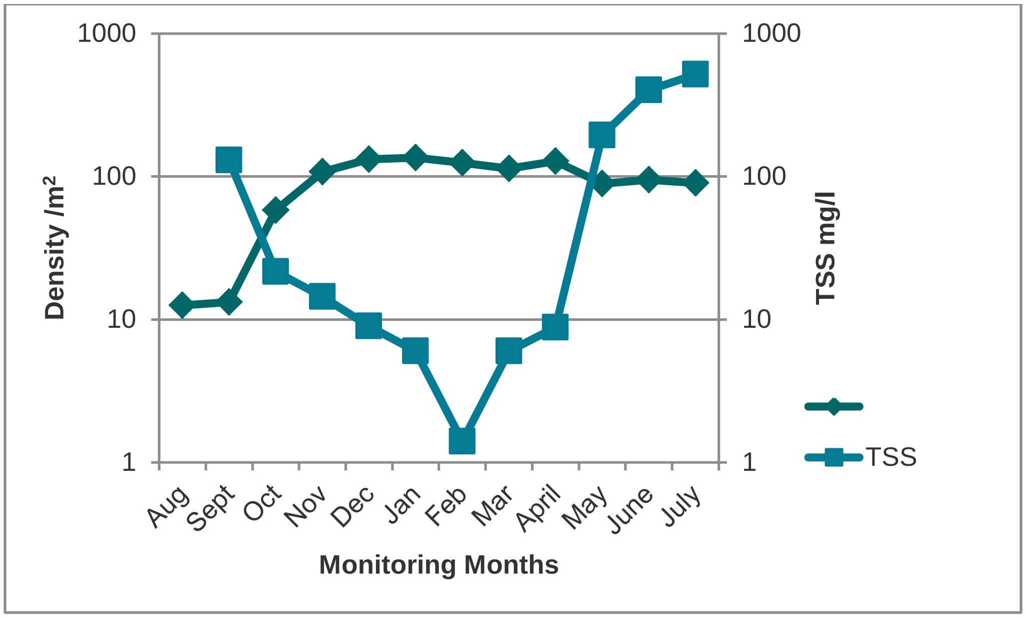


Figure 2-62: Average macro-invertebrate density and total suspended solids concentration

2.4 Fish surveys

2.4.1 Fish survey methodology

Fish constitute an important component of aquatic life in the Trishuli River. Fish species and catch per unit effort were monitored from August 2013 to July 2014 in the five river reaches indicated in Figure 2-1, using the fish sampling protocol described in Box 4. More detailed results of the monthly fish surveys are presented in Annex 1.

Photo: Gill net used for the fish surveys

Box 4

Following fish sampling methods were used for the fish sampling.

- ***Active Method – Cast nets***:
- ***Passive Method – Gill nets***

The sampling protocol for the cast net method is shown below:

A. Cast Net Method

- Cast net diameter 4.6 m, net mesh adequate to catch even the small fish size
- Permanent sampling stations will be identified and used each month:
  - Above dam site (one station)
  - Dewatered stretch (one station in every 3 kilometer river stretch)
  - Below tailrace outlet (one station)
- Sampling reach (river reach of the station) -1.5 km of the river stretch on either banks of the river in each station
- Total effort – 200 throws of the cast net
- Identification – Field identification of the catch at site. One or two numbers of all the collected species will be preserved at site with 10% formalin, bottled., labeled and brought to laboratory for reconfirming the site identification
- Measurements - number of fish captured (total and species wise), weight of the fish captured (total, species wise total, individual, and species average), and length of the fish species (individual, and species wise average) will be noted and transferred to Excel spreadsheet.
- Field notes: For each fish species captured the habitat characteristics of the thrown cast net site will be noted.

B. Gill Net Method

Gill net length used was 5m. The gill net could not be extended from bank to bank for a torrent river like Trishuli. The sampling was carried along the banks of the river in shallow water representing the habitat types

Gill net mesh – customary different mesh size to capture large and small fish available commercially in the market

Sampling stations and reach – same as cast net

Permanent sampling points will identified in each station reach:

Run habitat – one location

Riffle habitat – one location

2.4.2 Monitoring results

A total of 6 fish species were observed during the monitoring period based on caste net, gill net and local fisherman catch surveys. Of the observed species *Schizothorax richardsoni* (Buche Asala), *Euchiloglanis hodgarti* (Till Kabre), *Schitura savona* (Gadela), *Psedecheneis sulcatus* (Kabre) and *Noemacheilus Beavani* (Gadela) are all native fish species, while

Onchorhyncus mykiss (Rainbow trout) is an exotic species probably introduced in the river system from the rainbow trout farms present in the catchment, around the Dhunche in Rasuwa District.

Schizothorax richardsoni is the dominant fish species of the monitored Trishuli River stretch. It accounts for above 99% of the total fish catch by caste net and 100% of the fish catch by gill net. Figure 2-63 presents the total (cumulative for the five monitoring sites and all the sampling methods) monthly number of species observed in the monitored Trishuli river stretch using cast net, gill net and local fisherman catch. Figure 2-64 shows fish diversity (species) variation at the five monitoring sites. *Schizothorax richardsonii* is observed throughout the monitoring period, while other species are observed sporadically in the monsoon months.

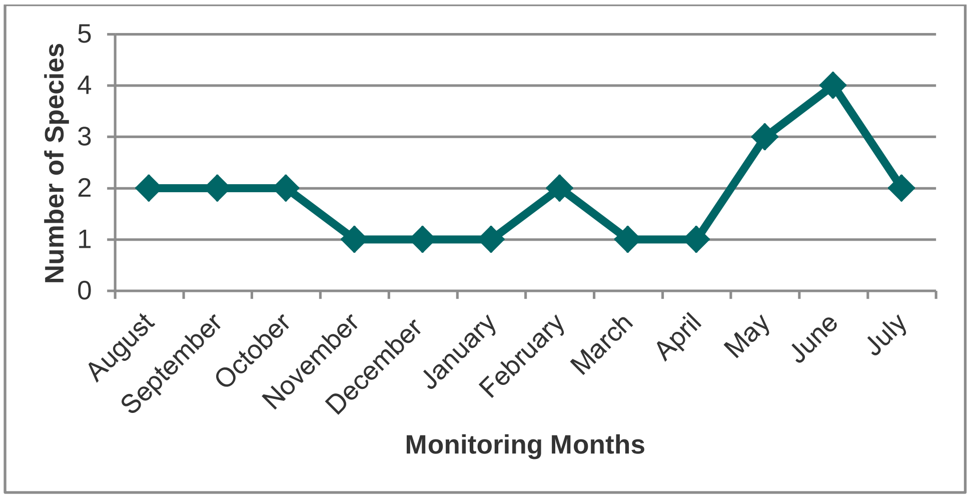


Figure 2-63: Total fish monthly fish diversity (number of species) in the monitored river stretch

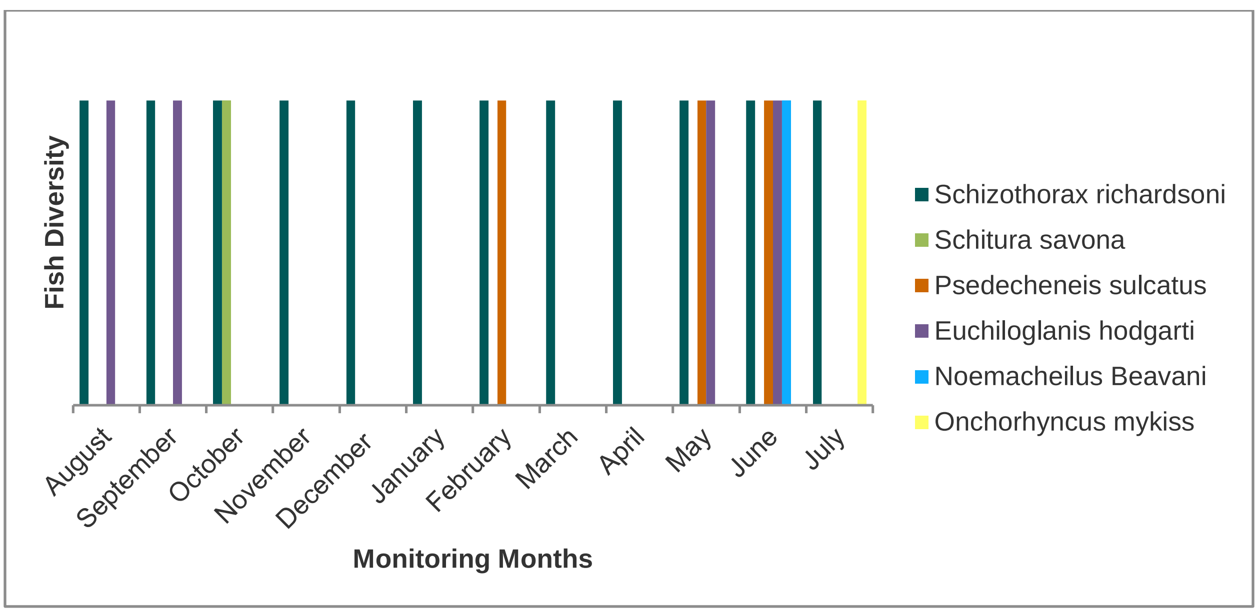


Figure 2-64: Total monthly fish diversity (species) in the monitored river stretch

Figure 2-65 shows the monthly fish diversity in the sampling using caste net. This sampling method resulted in higher species diversity than gill net, which only sampled one species: the snow trout *Schizothorax richardsonii*. Figure 2-66 shows the species diversity for cast net through at the five monitoring sites and through the monitoring period. The highest diversity (3 species) was observed at the downstream reach (F5).

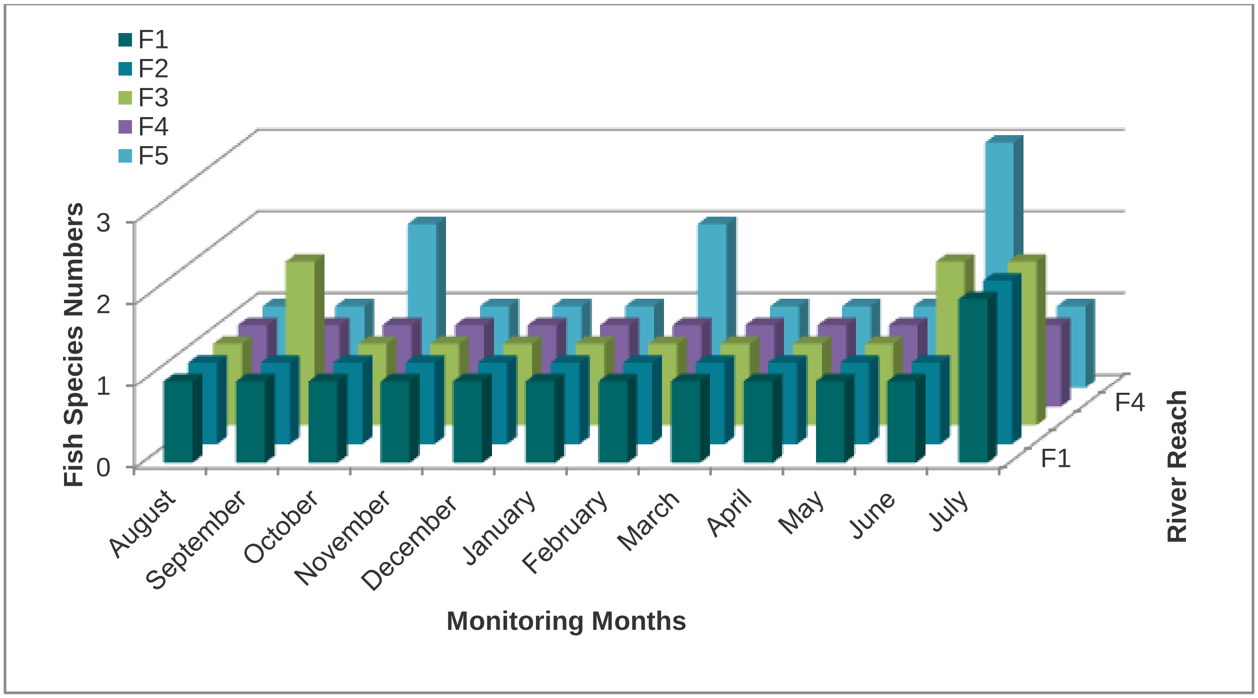
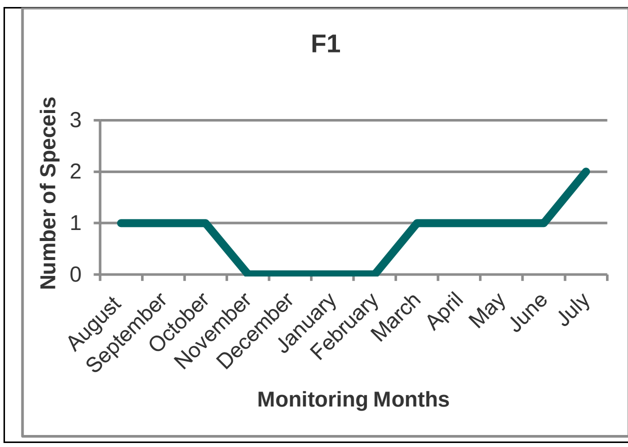
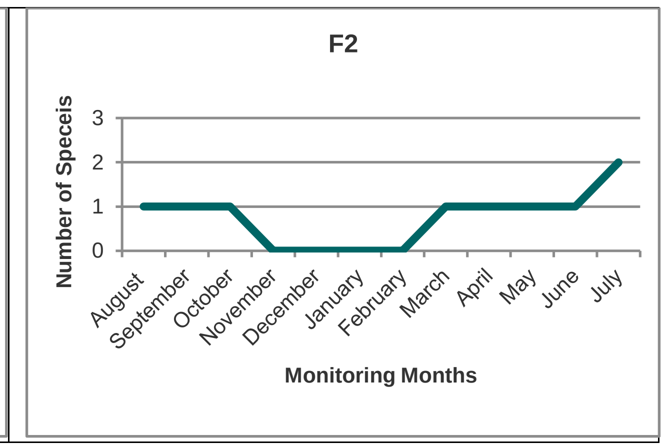


Figure 2-65: Monthly fish diversity (number of species) for the cast net sampling method





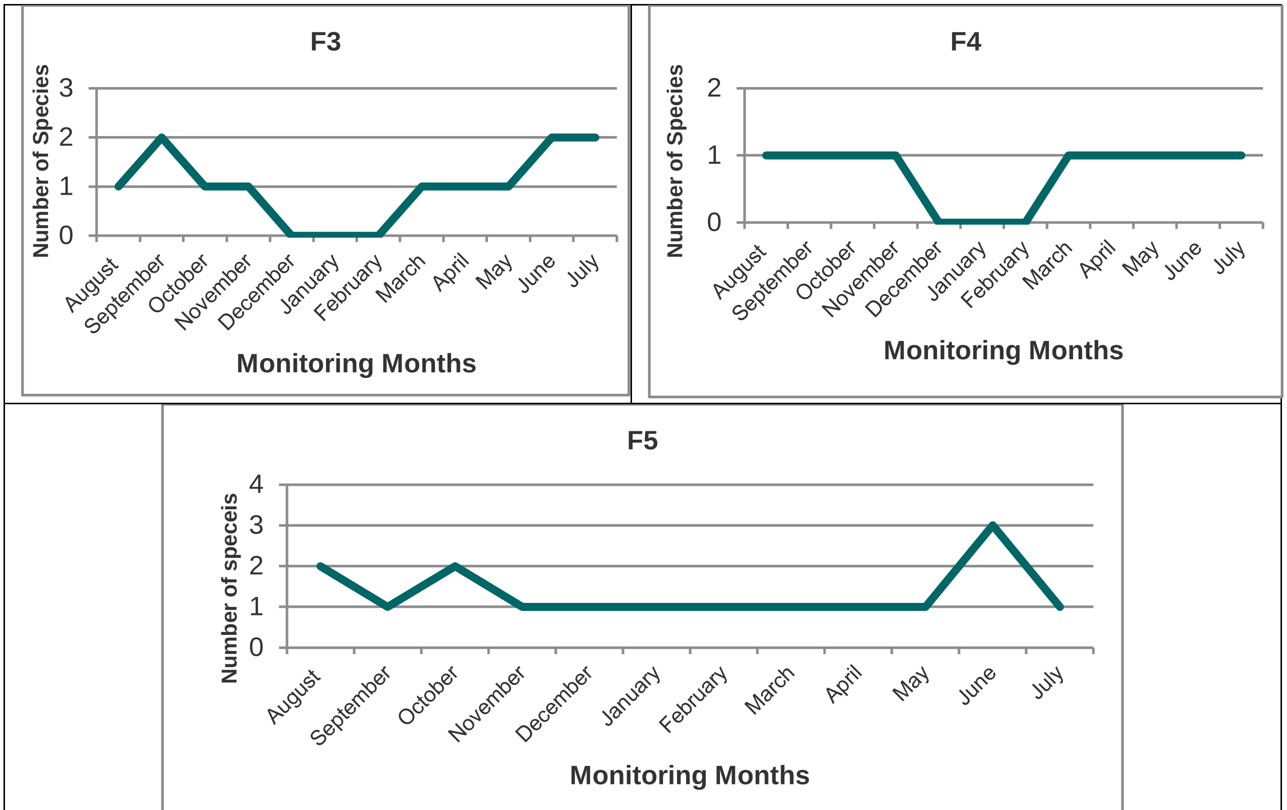


Figure 2-66: Species diversity for cast net sampling at the monitoring sites

Distinct differences were also noted for the two sampling methods in terms of catch per unit effort. Cast net was thrown 200 times at each monitoring site while the gill net was fixed and left for 12 hours at one location (the gill net was set three times at each monitoring site). Figures 2-67 and 2-68 show the results for catch per unit effort for cast and gill net, respectively. The gill net sampling method showed a significantly higher catch per unit effort compared to cast net.

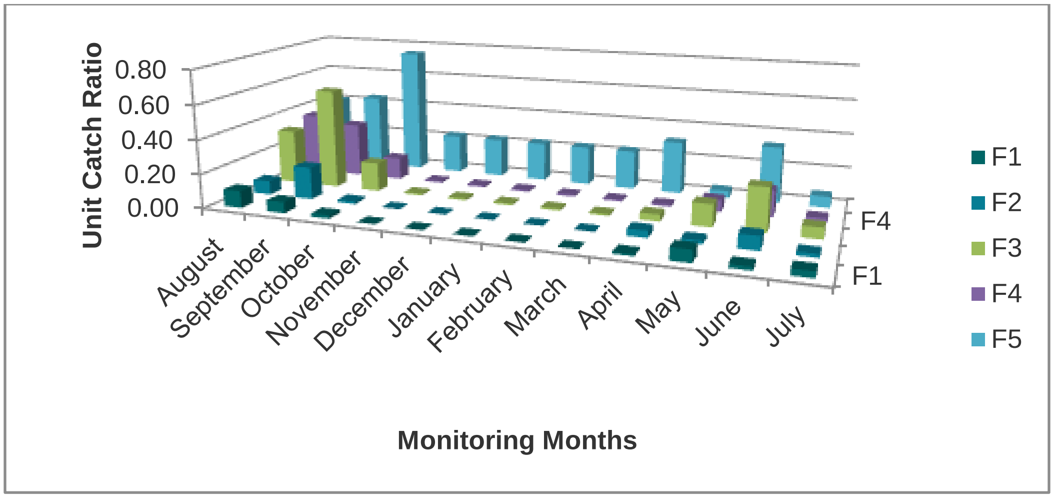


Figure 2-67: Cast net catch per unit effort

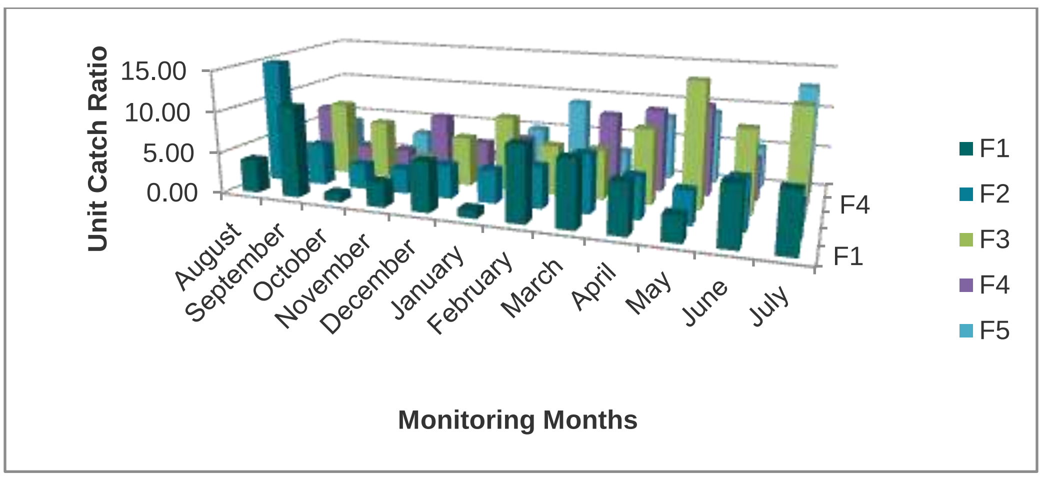


Figure 2-68: Gill net catch per unit effort

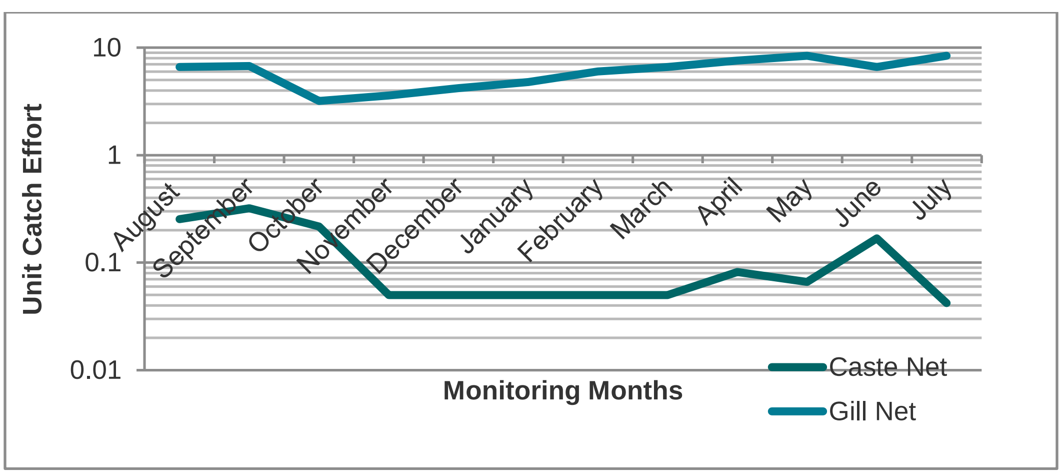


Figure 2-69: Average cast and gill net catch per unit effort in the monitored river stretch

Similar differences were obsewrved for the cast net and gill net sampling methods in terms of the length and weight relationship. On average, fish captured through gill net were larger and heavier throughout the year. The fish catched with cast net were smaller, with an increasing trend in the monsoon months (June-July). In general, fish captured by gill net have an average length to weight (L/W) ratio of 0.44, while caste net ratio is 0.95 (Figure 2-71), which indicates this sampling method might differentially select younger individuals.

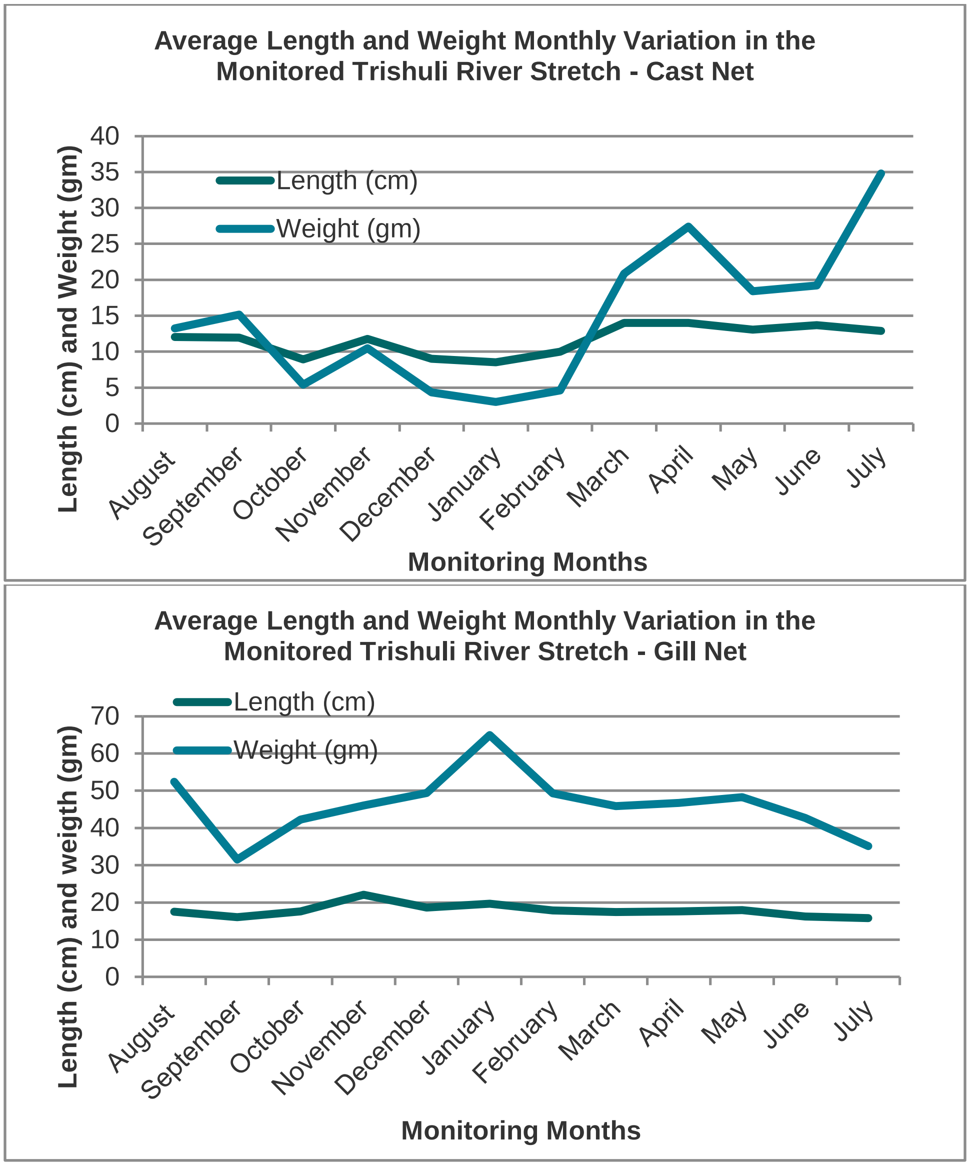


Figure 2-70: Average length and weight of fish captured with cast and gill net

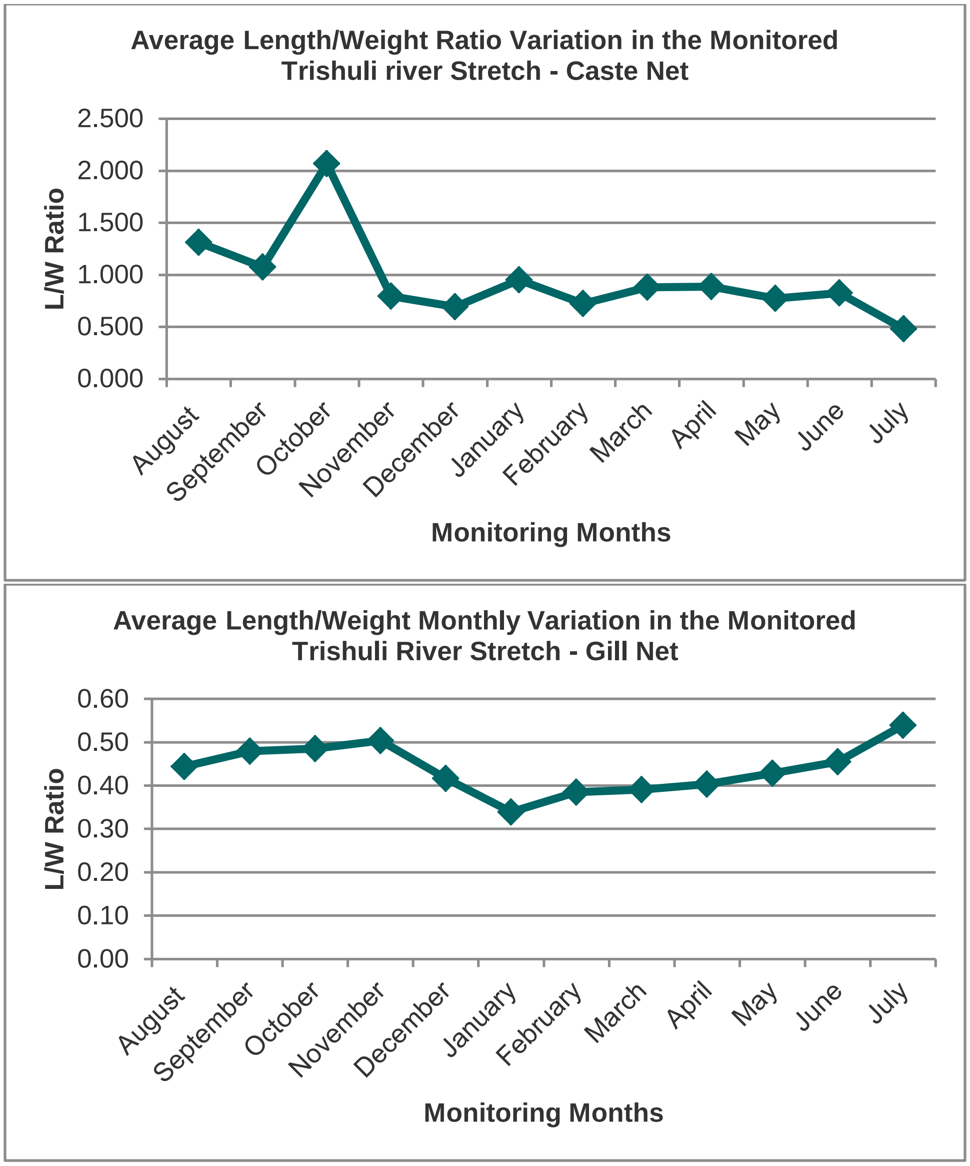


Figure 2-71: Average length/weight ratio for the cast and gill net sampling methods

Field observation of gonads of the captured *Schizothorax richardsoni* over the monitoring period shows presence of ovaries full of mature ova during the period from July to February (Photographs 1). No ovaries are observed for the months of March and April while immature ova in the ovaries are observed in the month of May and June.

Figure 2-72: Ovservation of ovaries through the monitoring period

From the observations it appears that *Schizothorax richardsoni* spawning period spans from March to May. Nevertheless, further research on this regard is desired to verify this observation.

Fishing activity in the monitored stretch of the Trisuli River is practically non-existent in the upper river reaches (River reach F1, F2 and F3), probably due to the difficult access to the river in this area and the restriction imposed by the Langtang National Park. In the lower river reaches (F4 and F5), however, limited fishing activities are practiced by the local communities. Figure 2-73 presents the monthly total number of fishermen observed during the monitoring period.

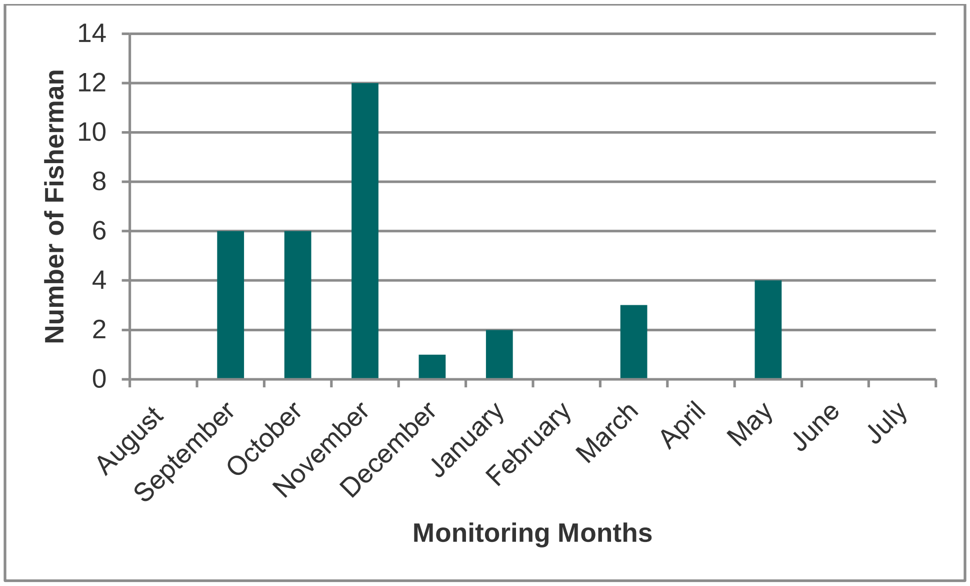


Figure 2-73: Fishing activity during the monitoring period

Only two fishermen reported having a livelihood relying on the fishing activities, while the others are recreational fishermen visiting the Trishuli river area in their leisure time.

2.4.3 Overall assessment

Schizothorax richardsonii is the dominant fish species in the monitored portion of the Trishuli River. This species is listed in the IUCN Red List as vulnerable (VU). Although it has a wide geographically distribution in the Himalyas region, this snow trout is reported to be declining[3] in numbers across its distribution range.

IFC Performance Standard 6 recognizes that protecting and conserving biodiversity is fundamental to sustainable development. Though *S. richardsonii* is an abundant species of the Himalayan rivers of Nepal, it attracts the IFC Performance Standard 6 due to the presence of a IUCN-listed vulnerable species in the river stretch. According to IFC PS 6, the project location represents the natural habitat of *Schizothorax richardsonii.* For the protection and conservation of this species the mitigation hierarchy to be adopted requires a no net loss approach.

[3] http://www.iucnredlist.org/details/166525/0

Schizothorax richardsonii is cited as breeding during April-May, before the monsoon flood. The present observations, however, indicate the breeding of the species to end by the mid of March in the study area.

It should be noted that the Upper Trishuli is already significantly fragmented. Locals reported a drastic decline in fish diversity and abundance after the implementation of Trishuli Hydroelectric Project, located near Betrawati about 25 km downstream of the location of the UT-1 Project. The upcoming Upper Trishuli-A and Trishuli-B will further fragment the river connectivity.

An additional risk to the local fishery is due to introduction of the exotic species *Onchorhyncus mykiss* (rainbow trout) from fish farms of the region. Figure 2-74 shows a snow trout specimen whith a *Schizothorax richardsonii* fingerling in its mouth. This observation indicates the potential of invasive rainbow trout contributing to *S. richarsonii* mortality by feeding on the young fish.


:

Figure 2-74: *Onchorhyncus mykiss* with a fingerling of *Schizothorax richardsonii in its mouth*

Further surveys are required to characterize the population dynamics (temporal and spatial) of *S. richarsonii* in the project's area of influence. Recommendations for further monitoring of aquatic habitats are provided as part of the terms of reference of the Environmental Flows Management Plan (Appendix E).

3 Vegetation and flora

3.1 Approach and methodology

The vegetation and flora baseline captured in the 2011 EIA report (Jade Consult) was based on a one-time field survey conducted during the dry season. In order to complete this baseline, NESS carried out two campaigns of studies; in August 2013 (monsoon season) and February 2014 (dry season). These additional studies included the following activities:

i. Identification of plant species distribution and diversity further in the Project's directly affected area
ii. Identify the presence of rare, threatened or endangered floral species
iii. Collect information on the regional vegetation and flora
iv. Identify potential impacts on plants diversity and distribution due to the Project's construction and associated human activities.
v. Propose mitigation measures to ensure no net loss of plant bioversity in the Project area.

Besides direct identification of ppolant species during the field surveys, literature sources were consulted to characterize the regional vegetation, and locals were also consulted (using focus group discussions and key informant interviews) to gather information on the ethnobotanical use and value of local plant species.

3.2 Scope of the vegetation and flora surveys

The regional vegetation was defined by plant species present within 5 km from the Project's footprint or directly affected area. With the purpose of characterizing the regional forests, this regional area of influence was extended to 10 km from the Project.

Within this regional context, directly and indirectly project influence areas, DPIA and IPIA, respectively, were defined. The indirectly affected areas are those geographical areas where the construction and operation activities will not take place but that could be subject to indirect affects, suchs as added pressure on forest resources due to improved or new access to previously remote areas. The DPIAs, where most of the Project activities will concentrate, include the settlements of Mailung, Gogane, and Haku besi.

During the two field surveys concentric plot samplings at various locations within the DPIAs and the IPIAs were inspected and the plant species (trees, shrubs and herbs) within these plots were identified and their morphometric parameters (including height and circumference at breast height or CBH) were measured and recorded. The same survey methods were applied in the two site visits.

- Field survey August 2013: During this seven-day field visit, 16 sample plots for trees, 32 sample plots each for shrubs, herbs and seedlings-saplings were laid down in different locations during the visit. Information gas gathered from direct observation and measurement and consultations with locals and key informants (see list of acknowledged informants in Section 3.5).

- Field survey February 2014: A total of 12 sample plots for trees and 24 for shrubs, herbs and seedlings were surveyed during five days during the month of February. The location of the sampling sites is shown in Figure 3-1 and the GPS coordinates of these locations are referenced in Section 3.6. Sampling areas included: community forests, access road, head works and areas designated for disposal of materials, and the Langtang National Park. As in the previous survey, data collected in the sampling plots was complemented with consultations with locals, especially in order to obtain information on the ethnobotanical use of the local plants.

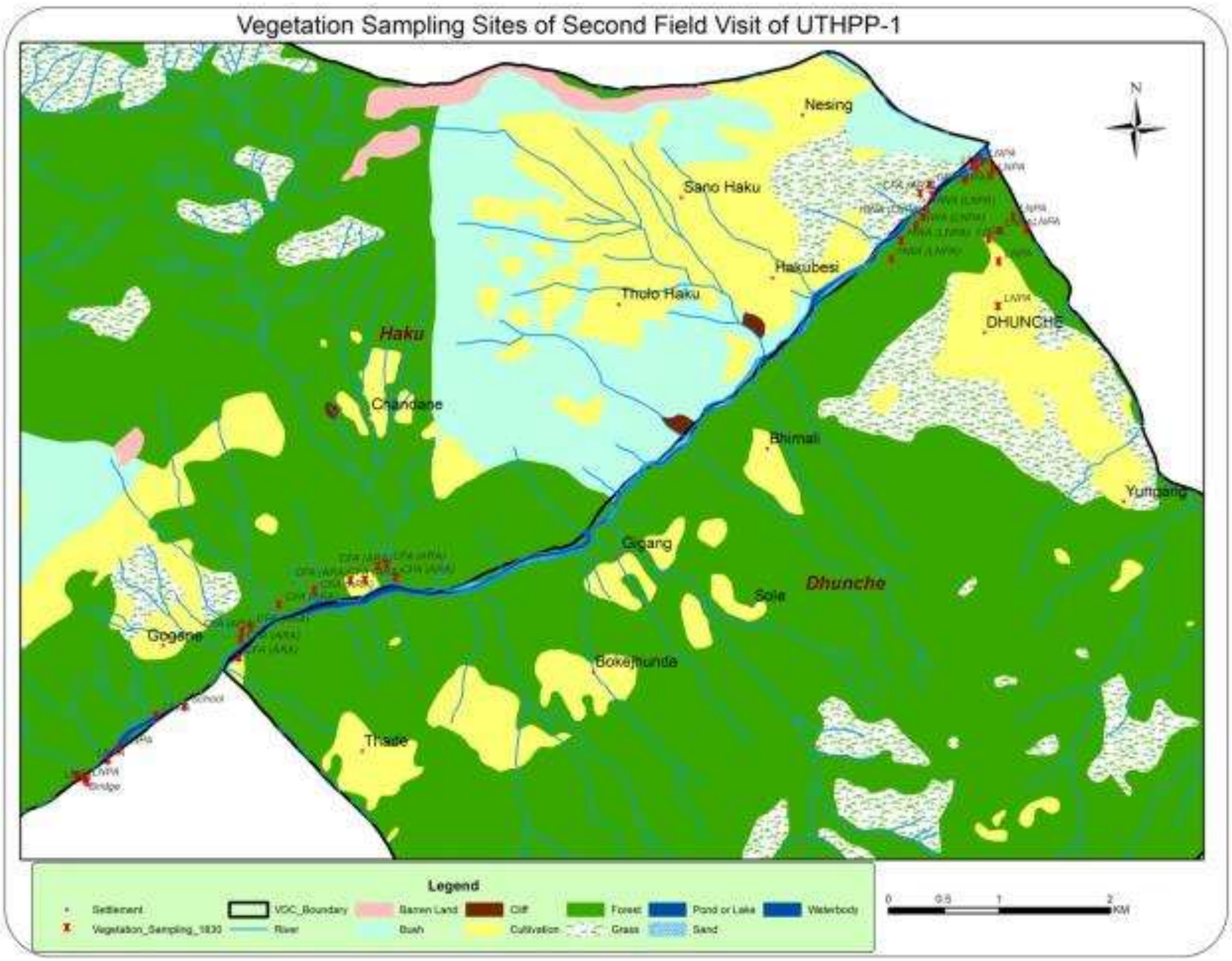


Figure 3-1: Vegetation and flora sampling sites for second field survey (February 2014)

3.3 Regional and local flora

3.3.1 Regional vegetation and flora

Regional characteristics

The Project area is situated in the Midland and Midhill physiographic zones (Hagen 1998 and LRMP 1986). The Midlands lie north of the Mahabharat, and occupy the central region of the country. The average altitude is 2000 m with elevations ranging from 600-3500 m. The Midlands includes the high valleys of Nepal including the Trishuli.

The Midhills (600-3500 m) host the greatest diversity of ecosystems and species in Central Nepal. Nearly 32% of the forests in Nepal are located in Midhills and they include 52 types of ecosystem. Studies indicate that about 1,989 species of flowering plants can be found in the 2000-3000 m range, followed by 1645 species between 3000-4000 m.

The Biodiversity Profiles Project (BPP 1995) listed 3364 species of angiosperms, 493 species of bryophytes, 272 species of pteridophytes and 16 species of gymnosperms in Mid-Hills. Out of 399 endemic flowering plants, about 38% are from the Mid-Hills.

Three distinct life zones and vegetation types are observed in the region, namely: subtropical (1000-2000 m), temperate (2000-3000 m), and subalpine (3000-4000 m). Phytogeographical studies of Nepali flowering plants indicate that the central belt, composed of upper subtropical and temperate bioclimatic zones at altitudes ranging from 1500 to 3000 m are floristically related to the sino-Japanese floristic region.

Forest Types

A total of eight forest types belonging to montane-tropical, subtropical, temperate, subalpine and alpine zones can be found in the region. The area of the montane-tropical zone is represented by the hill *sal* forest (*Shorea robusta*), predominatly below 1000 m of altitude. In the subtropical zone (between 1000-2000 m), *Schima wallichii* and *Castanopsis indica* forest extend in the damper areas while patches of *Pinus roxburghii* forest occur on the drier and rockier terrains. The most common shrubs and herbs in this altitudinal range are: *Ageratina adenophora*, *Berberis asiatica*, *Rubus ellipticus*, *Rosa brunonii*, *Artemisia vulgaris*, etc.

The temperate zone (between 2000-3000 m) comprises forests of *Quercus lamellose* in the wetter sites, and of *Pinus wallichiana* in the drier areas. Other common tree species found in this are include: *Q. lanata*, *Rhododendron arboreum*, *Ilex dipyrena*, *Lyonia ovalifolia* and *Pieris formosa*. The common shrubs and herbs associated to these forests are: *Daphne bholua*, *Viburnum grandiflorum*, *Berberis spp*., *Rubus fragarioides*, *Fragaria nubicola*, and *Arundinaria spp*.

The subalpine zone (3000-4000 m) is characterized by the dominance of *Tsuga dumosa*, *Abies spectabilis*, and *Rhododendron barbatum* mixed with *Acer campbellii* in wetter sites and gullies. *Betula utilis* forest is also dominant in the upper subalpine zone and can be found mixed with *Rhododendron campanulatum*. The commonly associated shrubs and herbs are: *R. lepidotum*, *Allium wallichii*, *Iris kemaonensis*, etc. The lower alpine zone (4000-4600 m) is rich in *R. anthopogon*, *Ephedra gerardiana*, *Anemone rivularis*, *Bistorta spp.*, *Androsace spp.* The upper alpine zone (above 4600 m) consists of alpine meadows where grass species such as *A. tapete*, *Gentiana depressa*, *Pedicularis longiflora*, predominate.

The number of vascular plants recorded in the region (Langtang National Park) is 1043 (Bhuju et al., 2007) including 15 species of endemic flowering plants. The Project site in the Rasuwa districts is heavily influenced by anthropogenic activities and in general shows degraded ecological and habitat characteristics.

Regional Plant Diversity

Altogether, 231 plant species (Table 3-1) have been reported in this region.

Table 3-1: Regional flora of the study area

SN	Scientific Name	Nepali name	Life form
1	*Achyranthes aspera* L.	Datiwan	Shrub
2	*Aconogonum molle* (D.Don) Hara	Thotne	Herb
3	*Aesandra butyracea* (Roxb.) Baehni	Chiuri	Tree
4	*Agave americana* L.	Ketuki	Shrub
5	*Ageratina adenophora* (spreng.) R.M. King & H. Rob.	Banmara	Shrub
6	*Ageratum conyzoides* L.	Gandhe	Herb
7	*Albizia chinensis* (Osbeck) Merr.	Kalo siris	Tree
8	*Albizia procera* (Roxb.) Benth.	Seto siris	Tree
9	*Alnus nepalensis* D. Don	Utis	Tree
10	*Amaranthus spinosus* L.	Lunde kanda	Herb
11	*Anemone rivularis* Buch.-Ham. ex DC.	Seto Bikh	Herb
12	*Anisadenia khasyana* Grift.		Herb
13	*Anthocephalus chinensis* (Lam.) A. Rich. ex Walp.	Kadam	Tree
14	*Ariopsis peltata* Nimmo		Herb
15	*Arisaema concinnum* Schott	Sarpa ko makai	Herb
16	*Arisaema tortuosum* (Wall.) Schott	Sarpa ko makai	Herb
17	*Artemisia* spp.	Titepati	Herb
18	*Artemisia vulgaris* Linn.	Titepati	Herb
19	*Arthraxon lancifolius* (Trin.) Hochst	Chitre bans	Herb
20	*Arundinaria* spp.		Herb
21	*Arundinella nepalensis* Trin.	Phurke Khar	Herb
22	*Asparagus racemosus* Willd.	Kurilo	Herb
23	*Bauhinia purpurea* L.	Tankee	Tree
24	*Begonia picta* Smith	Magar kanche	Herb

25	*Berberis asiatica* Roxb. ex DC.	Chutro	Shrub
26	*Berberis chitria* Lindl.	Chutro	Shrub
27	*Bergenia ciliata* (Haw.) Sternb.	Pakhenved	Herb
28	*Bidens pilosa* L.	Tikhe kuro	Herb
29	*Boehmeria platyphylla* D. Don	Kamle	Shrub
30	*Boehmeria rugulosa* Wedd.	Dar	Tree
31	*Boenninghausenia albiflora* (Hook.) Rchb. ex Meisn.	Daampate	Herb
32	*Bombax ceiba* L.	Simal	Tree
33	*Botrychium lanuginosum* Wall. ex Hook. et Greville		Herb
34	*Brachiaria ramosa* (L.) Stapf	Likhe Banso	Herb
35	*Brachypodium sylvaticum* (Huds.) P. Beauv.		Herb
36	*Butea minor* Buch.-Ham. ex Baker	Bhuletro	Shrub
37	*Calanthe puberula* Lindl.		Herb
38	*Callicarpa arborea* Roxb.	Maas Gedaa	Tree
39	*Carex cruciata* Wahlenb.	Lamo hat katuwa	Herb
40	*Cassia fistula* L.	Raajbriksha	Tree
41	*Castanopsis indica* (Roxb.) Miq.	Dhalne katus	Tree
42	*Celastrus stylosus* Wall.		Shrub
43	*Cheilanthes* spp.		Herb
44	*Chirita* spp.		Herb
45	*Chromolaena odorata* (L.) R.M. King & H. Rob.	Aule banmara	Shrub
46	*Chrysopogon gryllus* (L.) Trin.	Dhaple ghans	Herb
47	*Cinnamomum* spp.	Sinkaulee	Tree
48	*Cissampelos pareira* L.	Batul pate	Herb
49	*Clematis napaulensis* DC.		Shrub
50	*Clematis* spp.	Junge lahara	Shrub
51	*Clerodondron serratum* (Linn.) Moon		Shrub
52	*Codonopsis* spp.		Herb
53	*Colebrookia oppositifolia* Sm.	Dhusure	Shrub
54	*Commelina benghalensis* L.	Kane	Herb
55	*Cotoneaster microphyllus* Wall. ex Lindl.		Shrub
56	*Crassocephalum crepidioides* (Benth.) S. Moore	Anikale jhar	Herb
57	*Curcuma angustifolia* Roxb.	Kalo besar	Herb
58	*Cynodon dactylon* (L.) Pers.	Dubo	Herb
59	*Cynoglossum zeylanicum* (Vahl ex Hornem.)	Kanike kuro	Herb
60	*Cyperus niveus* Retz.	Seto mothe	Herb
61	*Deeringia amaranthoides* (Lam.) Merrill		Shrub
62	*Delphinium altissimum* Wall.	Bikhadi ghans	Herb
63	*Desmodium oojeinense* (Roxb.) H. Ohashi	Sandan	Tree
64	*Desmodium tiliaefolium* (D.Don) Wall. ex G.Don	Rato bakre ghans	Shrub
65	*Deutzia staminea* R.Br. ex Wall.		Shrub
66	*Dicranopteris linearis* (Burm.) Underw.		Herb
67	*Dioscorea bulbifera* L.	Gitthe tarul	Herb
68	*Dioscorea deltoidea* Wall. ex Griseb.	Bhyakur tarul	Herb
69	*Drepanostachyum falcatum* (Nees) Keng f.	Sano nigalo	Herb
70	*Dryoathyrium* spp.	Kalo neuro	Herb

71	*Dryopteris chrysocoma* (Christ.) C. Chr.		Herb
72	*Duchesnea indica* (Andr.) Focke		Herb
73	*Engelhardia spicata* Lesch. ex Blume	Mauwa	Tree
74	*Eria muscicola* Lindl.		Herb
75	*Eria* spp.		Herb
76	*Eulaliopsis binata* (Retz.) C.E. Hubb.	Babiyo	Herb
77	*Euphorbia royleana* Boiss.	Siundee	Shrub
78	*Eurya cerasifolia* (D. Don) Kobuski	Jhingani	Tree
79	*Eurya* spp.	Jhingane	Tree
80	*Ficus semicordata* Buch.-Ham. ex J.E. Smith	Khanayo	Tree
81	*Fragaria nubicola* Lacaita	Bhuin ainselu	Herb
82	*Galium asperuloides* Edgew.		Herb
83	*Gaultheria fragrantissima* Wall.	Dhasingare	Shrub
84	*Geranium nepalense* Sweet		Herb
85	*Girardinia diversifolia* (Link) Friis	Allo sisnu	Herb
86	*Gnaphalium affine* D.Don	Bokre phul	Herb
87	*Habenaria* spp.		Herb
88	*Hedychium ellipticum* Buch.-Ham. ex Sm.	Rato saro	Herb
89	*Homalium napaulense* (DC.) Benth.		Tree
90	*Hypericum cordifolium* Choisy	Areli	Shrub
91	*Hypericum elodeoides* Choisy	Jibri ghans	Herb
92	*Impatiens amplexicaulis* Edgew.	Tiuree	Herb
93	*Impatiens racemosa* DC.		Herb
94	*Impatiens scabrida* DC.	Tiuri jhar	Herb
95	*Imperata cylindrica* (L.) P. Beauv.	Siru	Herb
96	*Indigofera constricta* (Thur.) Trimen		Shrub
97	*Indigofera dosua* Buch.-Ham. ex D. Don	Phusre ghans	Shrub
98	*Inula cappa* (Buch.-Ham. ex D. Don) DC.	Gaitihare	Shrub
99	*Ipoemea* spp.		Herb
100	*Iris decora* Wall.	Padam pushkar	Herb
101	*Jasminum nepalense* Spreng.	Jai	Shrub
102	*Jatropha curcas* Linn.	Sajiyoun	Shrub
103	*Juglans regia L.*	Okhar	Tree
104	*Lagerstroemia parviflora* Roxb.	Bot dhayero	Tree
105	*Lagerstroemia* spp.	Asare	Tree
106	*Lepisorus* spp.		Herb
107	*Leptodermis lanceolate* Wall.		Shrub
108	*Leucostegia immersa* (Wall.) Presl		Herb
109	*Lindelofia longiflora* (Benth.) Baill.		Herb
110	*Lindera pulcherrima* (Nees) Benth. ex Hook. f.	Phusure	Tree
111	*Lonicera quinquelocularis* Hardw.	Bangjhi	Shrub
112	*Lonicera* spp.		Shrub
113	*Lycopodium* spp.		Herb
114	*Lyonia ovalifolia* (Wall.) Drude	Angeri	Tree
115	*Machilus duthiei* King ex Hook.f.	Kaulo	Tree
116	*Maesa chisia* Buch.-Ham. ex D.Don	Bilaune	Shrub

117	*Maesa macrophylla* (Wall.) A. Dc.		Shrub
118	*Malaxis muscifera* (Lindl.) Kuntze		Herb
119	*Mallotus* spp.	Sindure	Tree
120	*Mangifera indica* L.	Aanp	Tree
121	*Marsdenia roylei* Wight		Shrub
122	*Maytenus rufa* (Wall.) Hara		Shrub
123	*Melia azadirach* Linn.	Bakainu	Tree
124	*Mentha* spp.		Herb
125	*Michelia kisopa* Buch.-Ham. ex DC.	Seto champ	Tree
126	*Microsorium membranaceum* (Don) Ching		Herb
127	*Microstegium* spp.		Herb
128	*Mimosa* spp.		Shrub
129	*Murdannia edulis* (Stokes) Faden	Nigale gava	Herb
130	*Murraya paniculata* (L.) Jack		Shrub
131	*Myrica esculenta* Buch.-Ham. ex D. Don	Kafal	Tree
132	*Neillia thyrsiflora* D. Don		Shrub
133	*Nephrolepis cordifolia* (Linn.) Presl	Paniamala	Herb
134	*Oleandra wallichii* (Hook.) Presl		Herb
135	*Onychium* spp.		Herb
136	*Osbeckia stellata* D.Don	Rato chulsi	Shrub
137	*Osmunda claytoniana* Linn.		Herb
138	*Osyris wightiana* Wall. ex Wight	Nun Dhicki	Shrub
139	*Oxalis corniculata* Linn.	Chari amilo	Herb
140	*Oxalis latifolia* H.B.K.		Herb
141	*Oxyspora paniculata* (D.Don) DC.		Shrub
142	*Paspalum scrobiculatum* L.	Kode banso	Herb
143	*Pedicularis bifida* (D. Don) Pennell		Herb
144	*Pennisetum* spp.		Herb
145	*Persicaria capitata* (Buch.-Ham.) H. Gross	Ratnaule jhar	Herb
146	*Persicaria nepalensis* (Meisn.) H. Gross	Priya ghans	Herb
147	*Persicaria* spp.		Herb
148	*Phyllanthus emblica* L.	Amala	Tree
149	*Phyllanthus parvifolius* Buch.-Ham. ex D. Don	Khareto	Shrub
150	*Phyllanthus urinaria* L.	Bhuin amala	Herb
151	*Picris hieracioides* Linn.	Ban dudhe	Herb
152	*Pieris formosa* (Wall.) D. Don	Balu	Tree
153	*Pilea* spp.		Herb
154	*Pinus roxburghii* Sarg.	Rani sallo	Tree
155	*Piptanthus nepalensis* (Hook.) D.Don		Shrub
156	*Plantago major Linn.*	Esapgol	Herb
157	*Polygala arillata* Buch.-Ham. ex D.Don	Luiche phul	Shrub
158	*Polypodium amoenum* Wall. ex Mett.		Herb
159	*Polypodium* spp.		Herb
160	*Polystichum prescottianum* (Wall. ex Mett.) Moore		Herb
161	*Populus ciliata* Wall. ex Royle	Bhote pipal	Tree
162	*Porana grandiflora* Wall.	Chamero lahero	Shrub

163	*Porana racemosa* Roxb.		Shrub
164	*Porana* spp.	Chamero lahara	Shrub
165	*Premna* spp.		Tree
166	*Prinsepia utilis* Royle	Dhatelo	Shrub
167	*Psidium guajava* L.	Amba	Tree
168	*Pteris* spp.		Herb
169	*Pteris wallichiana* Agardh.		Herb
170	*Pyrus pashia* Buch.-Ham. ex D.Don	Mayel	Tree
171	*Quercus* spp.	Banjh	Tree
172	*Randia* spp.		Shrub
173	*Ranunculus diffusus* DC.		Herb
174	*Ranunculus* spp.		Herb
175	*Rhamnus napalensis* (Wall.) M.A. Lawson	Chille kath	Tree
176	*Rhamnus virgatus* Roxb.	Kande painyu	Shrub
177	*Rhododendron arboreum* Sm.	Lali gurans	Tree
178	*Rhus javanica* Linn.	Bhakki amilo	Tree
179	*Rhus succedanea* Linn.	Bhalayo	Tree
180	*Rhus wallichii* Hook. f.	Bhalayo	Tree
181	Rosaceae		Tree
182	*Rubia manjith* Roxb. ex Fleming	Majitho	Shrub
183	*Rubus ellipticus* Sm.	Ainselu	Shrub
184	*Rubus foliolosus* D.Don	Kalo ainselu	Shrub
185	*Rumex nepalensis* Spreng.	Halhale	Herb
186	*Saccharum spontaneum* L.	Kans	Herb
187	*Sagina saginoides* (Linn.) Karsten		Herb
188	*Sambucus adanata* Wall. ex DC.		Shrub
189	*Sarcococca coriacea* (Hook.f.) Sweet	Fiti fiya	Shrub
190	*Satyrium nepalense* D.Don		Herb
191	*Saurauia napaulensis* DC.	Gogan	Tree
192	*Schima wallichii* (DC.) Korth.	Chilaune	Tree
193	*Schisandra grandiflora* (Wall.) Hook. f. & Thomson	Theki phul	Shrub
194	*Schisandra propinqua* (Wall.) Baillon	Pahenlo singalto	Shrub
195	*Scrophularia urticaefolia* Wall. ex Benth.	Mokhi ghans	Herb
196	*Selaginella* spp.		Herb
197	*Selinum tenuifolium* Wall. ex C.B. Clarke	Bhutkesh	Herb
198	*Senna occidentalis* (L.) Roxb.	Thulo Tapre	Shrub
199	*Senna tora* (L.) Roxb.	Tapre	Shrub
200	*Shorea robusta* Gaertn.	Sal	Tree
201	*Sida* spp.		Herb
202	*Solanum aculeatissimum* Jacq.	Kantakaari	Shrub
203	*Solanum indicum* Linn.	Nilo bihin	Herb
204	*Spilanthus acmella* (Linn.) Murr.	Marati	Herb
205	*Spiraea bella* Sims	Seto khareto	Shrub
206	*Stranvaesia glaucescens* Lindl.	Jure mayal	Tree
207	*Swertia angustifolia* Buch.-Ham. ex D.Don	Chiraito	Herb
208	*Symplocos pyrifolia* Wall. ex G.Don	Seti kath	Tree

209	*Syzigium cumini* (Linn.) Skeels	Ban Jamun	Tree
210	*Syzygium jambos* (Linn.) Alston	Jamun	Tree
211	*Terminalia alata* Heyne ex Roth	Saaj	Tree
212	*Thalictrum foliolosum* DC.	Dampate	Herb
213	*Thalictrum punduanum* Wall.	Dampate	Herb
214	*Thalictrum* spp.		Herb
215	*Thysanolaena maxima* (Roxb.) Kuntze	Amreso	Herb
216	*Toona ciliata* M. Roem.	Tunee	Tree
217	*Toricellia tiliaefolia* DC.	Lekh Bhogate	Tree
218	Unidentified 1	Maletro	Tree
219	Unidentified 2 (Araliaceaea)		Tree
220	Unidentified 3 (Poaceae)		Herb
221	Unidentified 4 (Urticaceae)		Shrub
222	Unidentified 5	Dipath (Tam.)	Tree
223	*Urena lobata* L.	Nalu kuro	Herb
224	*Urtica dioica* L.	Sisnu	Herb
225	*Utricularia* spp.		Herb
226	*Verbascum thapsus* Linn.		Herb
227	*Viburnum erubescens* Wall. ex DC.	Ganmane	Shrub
228	*Viburnum* spp.		Shrub
229	*Woodfordia fruticosa* (L.) Kurz	Dhainyaro	Shrub
230	*Xanthium strumarium* L.	Bhende kuro	Herb
231	*Zanthoxylum acanthopodium* DC.	Boke timmur	Shrub

Out of these 231 regional plant species, 55 are trees, 63 shrubs and 113 herbs (Figure 3-2).

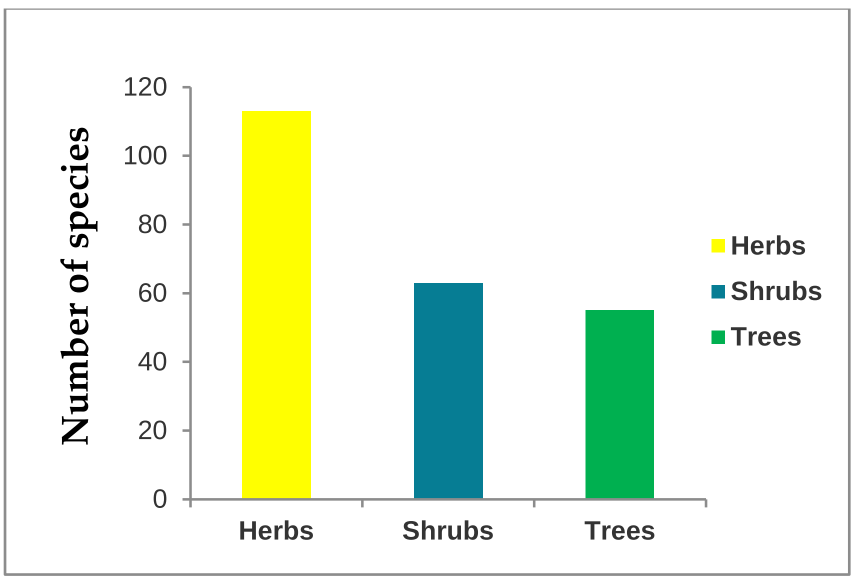


Figure 3-2: Regional plant diversity of the study area

Regional flora of conservation significance

A total of five plant species under different threat or protection categories have been reportedf orthe region (see Table 3-2). There are also a number of species of lichens and of orchids (family *Orchidaceae*) of conservation significance under some protection/threat category. Three of these species, all threes, are protected by the Government of Nepal based on their economic value: the red-silk cotton (*Bombax ceiba*), the walnut (*Juglans regia*), and *sal* (*Shorea robusta*). The species of lichens are also now banned for export by national regulations.

The other species referenced in Table 3-2 are: *Pinus roxburghii*, classified as 'least concern' in IUCN red list; Dioscorea deltoidea, which is included in Appendix II of CITES, and the species of the Orchidaceae family, which are included in Appendix II of CITES.

Table 3-2: Regional plant species under different protection categories

SN	Scientific name	Nepali name	Family	GoN	IUCN	CITES	Classification
1	*Bombax ceiba L.*	Simal	Bombacaceae	P	-	-	Timber trees; cutting, transportation and export are banned.
2	*Dioscorea deltoidea* Wall. ex Griseb.	Bhyakur tarul	Dioscoreaceae	-		II	
3	*Juglans regia* L.	Okhar	Juglandaceae	P	-	-	Species banned for collection, use, sale, distribution, transportation and export
4	*Lichens*	Jhyau		P	-	-	
5	*Pinus roxburghii*	Salla	Pinaceae	-	LC	-	Species banned for export
6	Several species of Orchids		Orchidaceae	-	-	III	
7	*Shorea robusta* Gaertn.	Sal	Dipterocarpaceae	P	-	-	Species banned for export

IUCN Threat Category: NT: Near Threatened, E: Endangered, R: Rare, V: Vulnerable, LC: Least concern
CITES Category: Appendix I, II, III (classified according to the threat due to trade);
Government of Nepal (GoN) Protection Category: P: Protected
(Source: Stainton 1972; HMGN 2002; NESS Field survey 2013, 2014)

Regional plants of ethnobotanical significance

A total of 119 regional plant species (Table 3-3) have been reported as having ethnobotanical value. These plants are used for a number of purposes, including: medicinal, timber, firewood, fodder, etc.

Table 3-3: Ethnobotanical usage of regional plant species

SN	Scientific Name	Nepali name	Ethnobotanical uses
1	*Achyranthes aspera* L.	Datiwan	Medicine, ritual
2	*Aesandra butyracea* (Roxb.) Baehni	Chiuri	Food, medicine, fuel
3	*Agave americana* L.	Ketuki	Medicine
4	*Ageratina adenophora* (spreng.) R.M. King & H. Rob.	Banmara	Medicine
5	*Ageratum conyzoides* L.	Gandhe	Medicine
6	*Albizia chinensis* (Osbeck) Merr.	Kalo siris	Medicine, timber, fuel, fodder
7	*Albizia procera* (Roxb.) Benth.	Seto siris	Timber, fuel, charcoal
8	*Alnus nepalensis* D. Don	Utis	Medicine, fodder, timber, fuel, construction, furniture, dye
9	*Amaranthus spinosus* L.	Lunde kanda	Medicine, food
10	*Anemone rivularis* Buch.-Ham. ex DC.	Seto Bikh	Medicine, food
11	*Anthocephalus chinensis* (Lam.) A. Rich. ex Walp.	Kadam	Timber, fuel
12	*Artemisia vulgaris* Linn.	Titepati	Medicine
13	*Arthraxon lancifolius* (Trin.) Hochst	Chitre bans	Fodder
14	*Arundinaria* spp.		Household articles, construction materials
15	*Arundinella nepalensis* Trin.	Phurke Khar	Fodder
16	*Asparagus racemosus* Willd.	Kurilo	Food, medicine
17	*Bauhinia purpurea* L.	Tankee	Fuel
18	*Begonia picta* Smith	Magar kanche	Medicine, food, non vertebrate poison
19	*Berberis asiatica* Roxb. ex DC.	Chutro	Food, medicine
20	*Berberis chitria* Lindl.	Chutro	Food
21	*Bergenia ciliata* (Haw.) Sternb.	Pakhenved	Medicine
22	*Boehmeria platyphylla* D. Don	Kamle	Medicine
23	*Boehmeria rugulosa* Wedd.	Dar	Fuel
24	*Boenninghausenia albiflora* (Hook.) Rchb. ex Meisn.	Daampate	Medicine
25	*Bombax ceiba* L.	Simal	Medicine, timber, stuffing pillows, cushions
26	*Callicarpa arborea* Roxb.	Maas Gedaa	Fuel
27	*Carex cruciata* Wahlenb.	Lamo hat katuwa	Fodder
28	*Cassia fistula* L.	Raajbriksha	Medicine
29	*Castanopsis indica* (Roxb.) Miq.	Dhalne katus	Timber, fuel, food
30	*Chromolaena odorata* (L.) R.M. King & H. Rob.	Aule banmara	Medicine
31	*Chrysopogon gryllus* (L.) Trin.	Dhaple ghans	Fodder
32	*Cinnamomum* spp.	Sinkaulee	Food, Medicine
33	*Cissampelos pareira* L.	Batul pate	Medicine
34	*Colebrookia oppositifolia* Sm.	Dhusure	Medicine
35	*Cotoneaster microphyllus* Wall.		Food

	ex Lindl.		
36	*Crassocephalum crepidioides* (Benth.) S. Moore	Anikale jhar	Medicine
37	*Curcuma angustifolia* Roxb.	Kalo besar	Medicine
38	*Cynodon dactylon* (L.) Pers.	Dubo	Fodder
39	*Cynoglossum zeylanicum* (Vahl ex Hornem.) Thunb. ex Lehm.	Kanike kuro	Medicine
40	*Desmodium oojeinense* (Roxb.) H. Ohashi	Sandan	Medicine, fodder, handles of agricultural tools, fish poison, fuel
41	*Dioscorea bulbifera* L.	Githte tarul	Food
42	*Dioscorea deltoidea* Wall. ex Griseb.	Bhyakur tarul	Food, medicine
43	*Drepanostachyum falcatum* (Nees) Keng f.	Sano nigalo	Food, household articles, fence, fuel
44	*Engelhardia spicata* Lesch. ex Blume	Mauwa	Fuel
45	*Eulaliopsis binata* (Retz.) C.E. Hubb.	Babiyo	Fodder
46	*Euphorbia royleana* Boiss.	Siundee	Medicine
47	*Eurya cerasifolia* (D. Don) Kobuski	Jhingani	Fuel
48	*Ficus semicordata* Buch.-Ham. ex J.E. Smith	Khanayo	Fodder, Food, fuel
49	*Fragaria nubicola* Lacaita	Bhuin ainselu	Food, medicine
50	*Gaultheria fragrantissima* Wall.	Dhasingare	Medicine
51	*Geranium nepalense* Sweet		Medicine
52	*Girardinia diversifolia* (Link) Friis	Allo sisnu	Medicine,food
53	*Hedychium ellipticum* Buch.-Ham. ex Sm.	Rato saro	Medicine
54	*Hypericum cordifolium* Choisy	Areli	Medicine, religious
55	*Imperata cylindrica* (L.) P. Beauv.	Siru	Medicine, fodder
56	*Iris decora* Wall.	Padam pushkar	Medicine
57	*Jatropha curcas* Linn.	Sajiyoun	Medicine, food, hedge, oil used for lighting
58	*Juglans regia* L.	Okhar	Medicine, food
59	*Lagerstroemia parviflora* Roxb.	Bot dhayero	Timber, fuel
60	*Lagerstroemia* spp.	Asare	Fuel
61	*Lyonia ovalifolia* (Wall.) Drude	Angeri	Fuel
62	*Machilus duthiei* King ex Hook.f.	Kaulo	Fuel
63	*Maesa chisia* Buch.-Ham. ex D.Don	Bilaune	Fuel
64	*Mallotus* spp.	Sindure	Fuel
65	*Mangifera indica* L.	Aanp	Medicine, food, timber, fuel
66	*Melia azadirach* Linn.	Bakainu	Fodder, fuel
67	*Michelia kisopa* Buch.-Ham. ex DC.	Seto champ	Timber, food, fodder
68	*Murraya paniculata* (L.) Jack		Food

69	*Myrica esculenta* Buch.-Ham. ex D. Don	Kafal	Medicine, food, timber
70	*Nephrolepis cordifolia* (Linn.) Presl	Paniamala	Medicine
71	*Onychium* spp.		Food
72	*Oxalis corniculata* Linn.	Chari amilo	Medicine
73	*Phyllanthus emblica* L.	Amala	Medicine, food, fuel
74	*Phyllanthus urinaria* L.	Bhuin amala	Medicine
75	*Pieris formosa* (Wall.) D. Don	Balu	Fuel
76	*Pinus roxburghii* Sarg.	Rani sallo	dicine, fuel, fence, timber, Me construction, decoration material
77	*Piptanthus nepalensis* (Hook.) D.Don		Fodder, fish poison
78	*Plantago major Linn.*	Esapgol	Medicine
79	*Polygala arillata* Buch.-Ham. ex D.Don	Luiche phul	Medicine
80	*Populus ciliata* Wall. ex Royle	Bhote pipal	Timber, fuel
81	*Prinsepia utilis* Royle	Dhatelo	Mediicne, food, fence
82	*Psidium guajava* L.	Amba	Medicine, food
83	*Pyrus pashia* Buch.-Ham. ex D.Don	Mayel	Food, fuel
84	*Quercus* spp.	Banjh	Timber, fuel
85	*Rhododendron arboreum* Sm.	Lali gurans	Fuel, medicine, decoration material
86	*Rhus javanica* Linn.	Bhakki amilo	Medicine, food, fodder, fuel
87	*Rhus wallichii* Hook. f.	Bhalayo	Medicine, fuel
88	Rosaceae		Timber, fuel
89	*Rubia manjith* Roxb. ex Fleming	Majitho	Medicine
90	*Rubus ellipticus* Sm.	Ainselu	Medicine, food
91	*Rubus foliolosus* D.Don	Kalo ainselu	Medicine, food
92	*Rumex nepalensis* Spreng.	Halhale	Medicine
93	*Saccharum spontaneum* L.	Kans	Fodder
94	*Salix* spp.		Fuel
95	*Schima wallichii* (DC.) Korth.	Chilaune	Medicine, timber, fuel
96	*Selinum tenuifolium* Wall. ex C Clarke	Bhutkesh	Medicine
97	*Senna occidentalis* (L.) Roxb.	Thulo Tapre	Medicine
98	*Senna tora* (L.) Roxb.	Tapre	Medicine
99	*Shorea robusta* Gaertn.	Sal	Medicine, timber, fuel
100	*Solanum indicum* Linn.	Nilo bihin	Medicine
101	*Spilanthus acmella* (Linn.) Murr.	Marati	Medicine
102	*Stranvaesia glaucescens* Lindl.	Jure mayal	Medicine, food, fodder
103	*Swertia angustifolia* Buch.-Ham. ex D.Don	Chiraito	Medicine
104	*Symplocos pyrifolia* Wall. ex G.Don	Seti kath	Fuel
105	*Syzigium cumini* (Linn.) Skeels	Ban Jamun	Medicine, food, timber, fuel
106	*Syzygium jambos* (Linn.) Alston	Jamun	Medicine, food, timber, fuel
107	*Terminalia alata* Heyne ex Roth	Saaj	Medicine, timber, fuel

108	*Thalictrum foliolosum* DC.	Dampate	Medicine
109	*Thysanolaena maxima* (Roxb.) Kuntze	Amreso	Medicine, broom
110	*Toona ciliata* M. Roem.	Tunee	Timber, fuel
111	Unidentified 1	Maletro	Timber
112	Unidentified 3 (Poaceae)		Fodder
113	Unidentified 5	Dipath (Tamang)	Timber, fuel
114	*Urena lobata* L.	Nalu kuro	Medicine
115	*Urtica dioica* L.	Sisnu	Medicine, food
116	*Verbascum thapsus* Linn.		Medicine
117	*Woodfordia fruticosa* (L.) Kurz	Dhainyaro	Medicine, food, fodder
118	*Xanthium strumarium* L.	Bhende kuro	Medicine
119	*Zanthoxylum acanthopodium* DC.	Boke timmur	Food, medicine

(Sources: Rajbhandari 2001, Manandhar 2002, Baral and Kurmi 2006, GoN 2007, Field survey 2014)

Out of these 119 plant species, 76 species were used as medicines, 39 as fuel, 36 as food, 20 as timber, 16 as fodder, and 14 as miscellaneous purposes (see Figure 3-3).

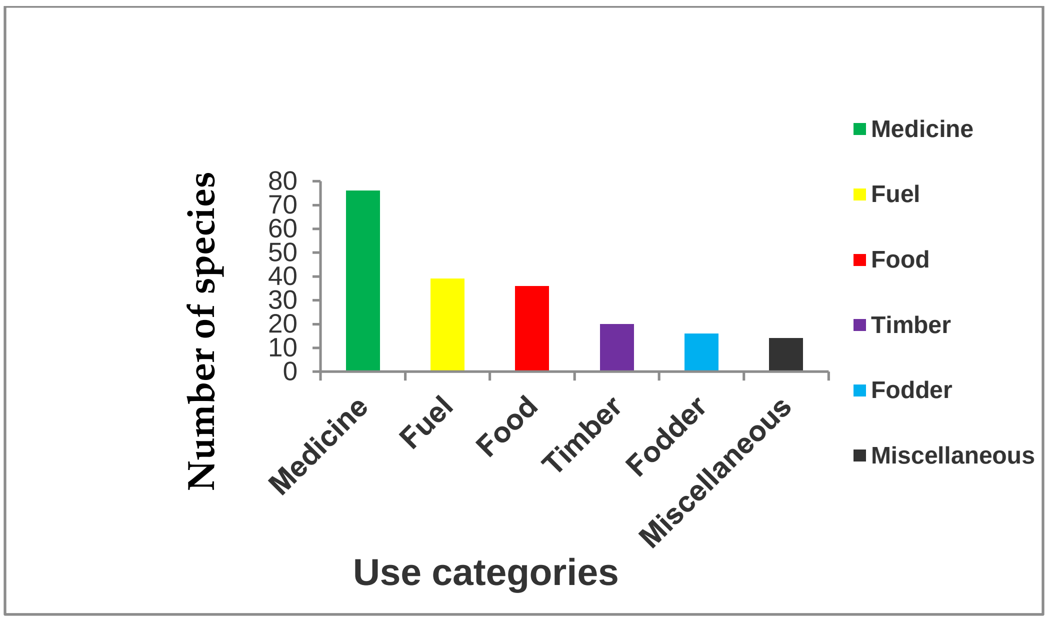


Figure 3-3: Ethnobotanical uses of regional plants

3.3.2 Local vegetation and flora

Local Characterstics

The forest coverage in the Rasuwa District is 42,616 hectares. Out of these, 23,539 ha fall under the Langtang National Park, with the remaining 19,077 ha being managed by the District Forest Office (DFO). The forest under DFO mandate is organized in community forests; in the Project area there are six: Labing Pakha Community Forest (Haku-3), Labing Pakha Tutidanda Community Forest (Haku-3), Lumbu Danda Community Forest (Haku-7), Brathar Community Forest (Haku-7), Dakshin Kalika Community Forest (Haku-8, & 9), Dharna Shilkanya Community Forest (Haku-9).

Figure 3-4 shows a map of the land cover in the Project area. This map was manually digitized by NESS based on Google Earth imaginery from the year 2010. As shown in this map, the western slope of the Trishuli, where most of the Project infrastructure will be located, constitutes a mosaic of forest, agriculture and scrub (grazing/marginal) lands.

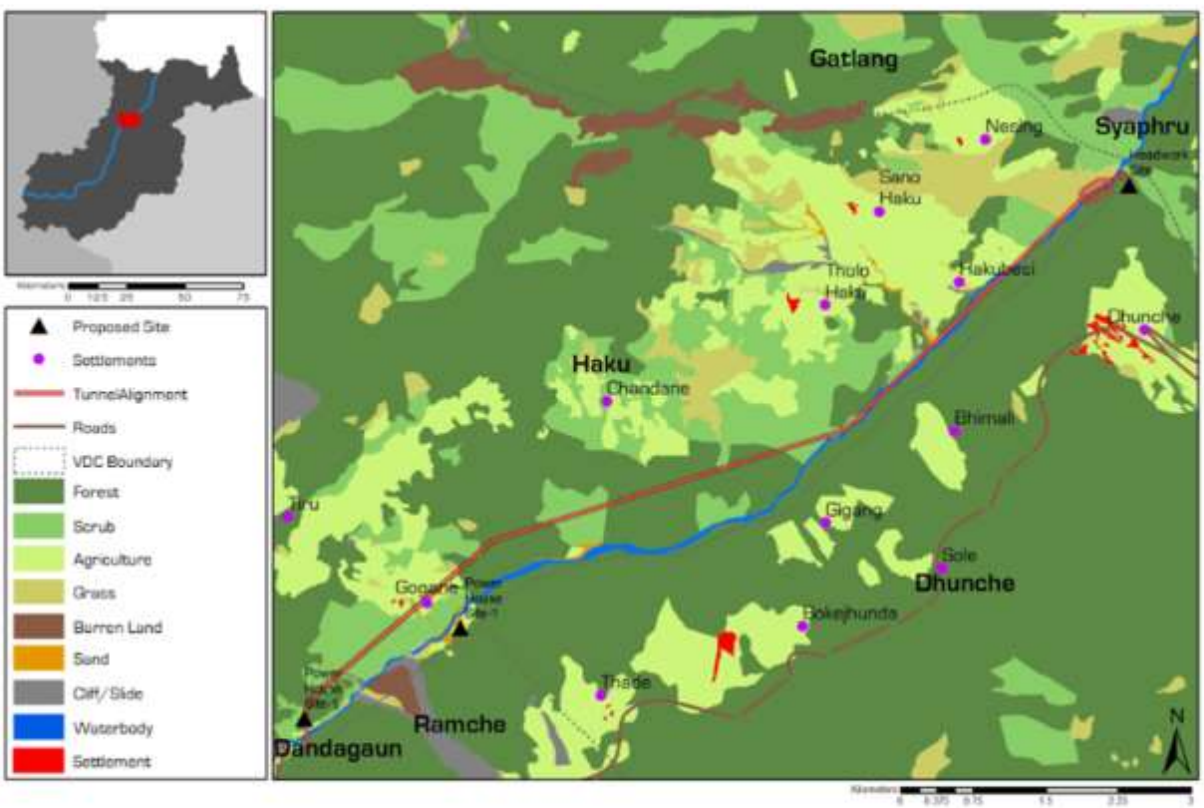


Figure 3-4: Land use in the UT-1 Project Site area

The western slope shows a high contrast with the eastern slope, located within the Langtang National Park, where the forest cover is more extense and dense, indicative of a better ecological status.

Forest types

Surveys of sample plots in and around the project construction sites reveal different types of forest patches. Though the major plant species constituting the forest vegetation are almost the same, dominated by the tree species Sal, Schima, Pinus, Alnus, etc. On closer examination, the following groups forest types can be established:

a. Hill Sal Forest

The *Shorea robusta* grows up to 1500 m on the outer foot hills which constitute the predominant Hill Montane Sal forest. The common associates are *Schima wallichii*, *Terminalia* spp., *Alnus nepalensis*, *Pinus roxburghii*, etc.

b. Pine Forest

Pinus roxburghii (Chir pine) is dominant in between 1000-2000 m and is largely confined to the dry situations. The associated species are *Schima wallichii*, *Terminalia* spp., *Alnus nepalensis,* etc.

c. Alder Forest

The *Alnus nepalensis* often grows in place of *Schima-Castanopsis* forests in between 1000-2000 m. It occurs most prominently in the form of small isolated woods along the banks of streams and field margins and on unstable grounds.

d. Mixed Riverine Forest

There is a mixed type of riverine forest in study area close to the bank of Trishuli river (900-1500 m). The most common species are *Alnus nepalensis*, *Pinus roxburghii*, *Schima wallichii*, *Toona ciliata*, *Mallotous* spp., *Bauhnia purpurea*, *Albizia* spp., etc.

Local flora diversity

A total of 124 plant species were recorded during the first field survey in August 2013 (see Section 3.6). Out of these 124 species, 27 were trees, with *Shorea robusta*, *Alnus nepalensis*, and *Pinus roxburghii* as predominant species; 33 were shrubs (i.e. *Achyranthes aspera*, *Ageratina adenophora*, *Woodfordia fruticosa*, etc.) and a total 64 herbs (i.e. *Saccharum spontaneum*, *Arundinaria spp*., *Chrysopogon gryllus*, *Drepanostachyum falcatum*) were also recorded.

At the second field survey during the dry season (February 2014) a total of 73 plant species (see Section 3.6 for the detailed list of species) were identified, including 23 species of trees (i.e. *Alnus nepalensis*, *Bauhinia purpurea*, *Pinus roxburghii*, *Schima wallichii*, etc.), 20 shrubs (i.e. *Ageratina adenophora*, *Woodfordia fruticosa*, etc.) and a total of 30 herbs (i.e. *Arundinaria* spp., *Drepanostachyum falcatum*, etc.). Figure 3-4 represents the abundance of plant types (i.e. trees, shrubs, and herbs) identified during the February 2014 field survey.

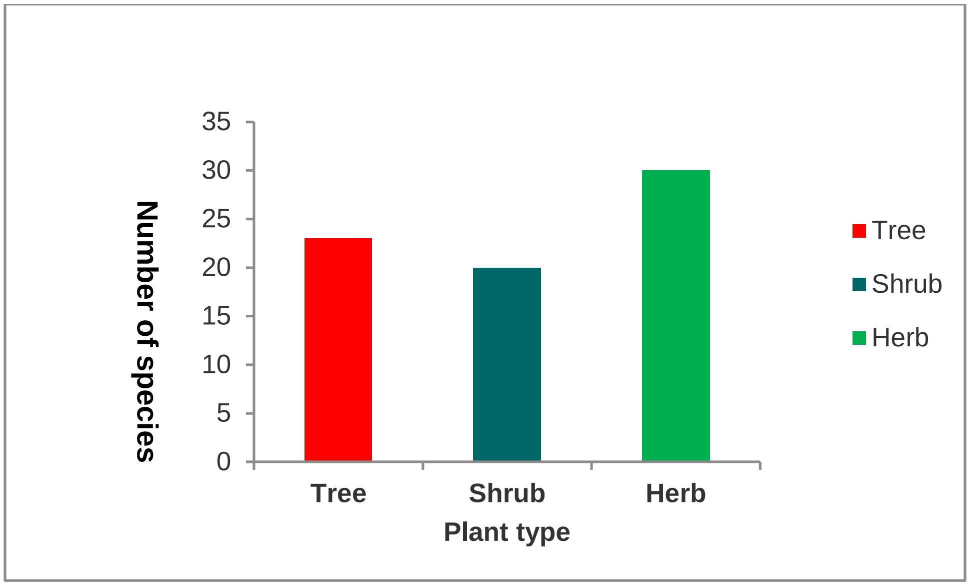


Figure 3-5: Local plant diversity

In terms of plant diversity and abundance in the two main areas where most of the Project construction will take place, i.e. the access road and the headworks, the following observations were recorded during the February 2014 survey:

- **Headworks area**: The tree *Schima wallichii* showed the highest density (74 trees per ha and 4000 seedlings per ha) at the headworks site. In terms of shrubs, *Ageratina adenophora* was the predominat species, with 3400 plants per ha. The grass *Arundinaria spp*. also showed a high density (12, 4167 plants per ha). In the indirect impact area (IPIAs) around the headworks site, the forest is dominated by *Pinus roxburghii* in the higher altitudes (1500-1700 m), and *Alnus nepalensis* in shady and damp gullies. A mixed forest of *Schima wallichii*, *Lyonia ovalifolia*, *Rhododendron arboreum*, *Zizyphus spp*., *Mallotous spp*., etc., was also observed in the altitudinal range 1200-1500 m. The most dominant shrubs and herbs recorded in the indirect impact area were: *Ageratina adenophora*, *Maesa chisia*, *Berberis spp*., *Arundinaria spp*., *Woodfordia fruticosa* and the species from the family *Poaceae*.

- **Access road area**: In the direct impact area (i.e. road footprint) along the access road, the survey showed that the tree *Bauhinia purpurea* had highest density (54 plants per ha and 960 seedlings per ha, which is the highest recorded number in a community forest), along with the srub species *Murraya paniculata* (2467 plants per ha) and the herb *Eulaliopsis binata* (70000 plants per ha). The indirect impact areas of the access road is also mostly dominated by *Pinus roxburghii* in the higher altitudes (1500-2000 m), and *Alnus nepalensis* in shady and damp gullies. But, a mixed forest of *Shorea robusta*, *Aesandra butyracea*, *Schima wallichii*, *Lyonia ovalifolia*, *Rhododendron arboreum*, *Bauhinia purpurea*, *Mallotous spp*., etc., were also observed in between (1000-1500 m). The most dominant shrubs and herbs are: *Ageratina adenophora*, *Berberis spp*., *Euphorbia royleana*, *Woodfordia fruticosa*, *Eulaliopsis binata*, and the species from the family *Poaceae.*

Local flora of conservation significance

During the first field survey (August 2013) four plant species under some protection category were recorded, including: *Bombax ceiba*, *Dioscorea deltoidea*, *Pinus roxburghii*, and *Shorea robusta*. Species of lichens and three species of orchids (*Calanthe puberula*, *Malaxis muscifera*, *Satyrium nepalense*) were also reported.

Table 3-4: Plant species of conservation significance observed during August 2013 field survey

SN	Scientific name	Nepali name	Family	Remarks
1	*Bombax ceiba L.*	Simal	Bombacaceae	
2	*Calanthe puberula* Lindl.		Orchidaceae	
3	*Dioscorea deltoidea* Wall. ex Griseb.	Bhyakur tarul	Dioscoreaceae	
4	Lichens	Jhyau		Observed in the sampling forest
5	*Malaxis muscifera* (Lindl.) Kuntze		Orchidaceae	
6	*Pinus roxburghii* A.B. Jacks	Salla	Pinaceae	
7	*Satyrium nepalense* D.Don		Orchidaceae	
8	*Shorea robusta* Gaertn.	Sal	Dipterocarpaceae	

Bombax ceiba, *Dioscorea deltoidea*, *Pinus roxburghii*, and *Shorea robusta*, all species that show a wide range of ecological distribution in Nepal, were observed close to the direct impact area (i.e. DPIA). Community forests in the area are actively managed by Forest Users Groups (FUGs) and, during the field surveys, cutting and extraction of trees were observed.

Observations during the second field survey (February 2014) confirmed the first results; three plant species under protection were reported, including: *Dioscorea deltoidea*, *Pinus roxburghii*, and *Shorea robusta*.

Local flora of ethnobotanical significance

The field surveys showed that local people are partially dependant on forest and non-timber forest products to fulfill their daily needs. The Project area harbours several plant species with utility values for local communities.

The first survey (August 2013) identified 65 species of ethnobotanical usage (see Section 3.6 for detailed list of species) including medicine, food, timber, fuel, household articles, rituals and others. 26 of these species are used for multiple purposes. See detailed list of plants species in Section 3.6.

It should be noted that forest-based resources are mostly valued by locals for self-consumption The .selling of the forest- based resourcesin nearby markets is not a common practice due to theirlimited availability and the absence ofa reliable market.

During the second field survey (February 2014) 58 species of ethnobotanical usage were recorded; 23 of them for multiple purposes. Out of these 58 plant species, 23 are reported to be used as fuel, 18 for medicine, 15 for food, 12 for timber, 10 sfor fodder and the remaining 4 species for miscellaneous purposes (see Figure 3-6).

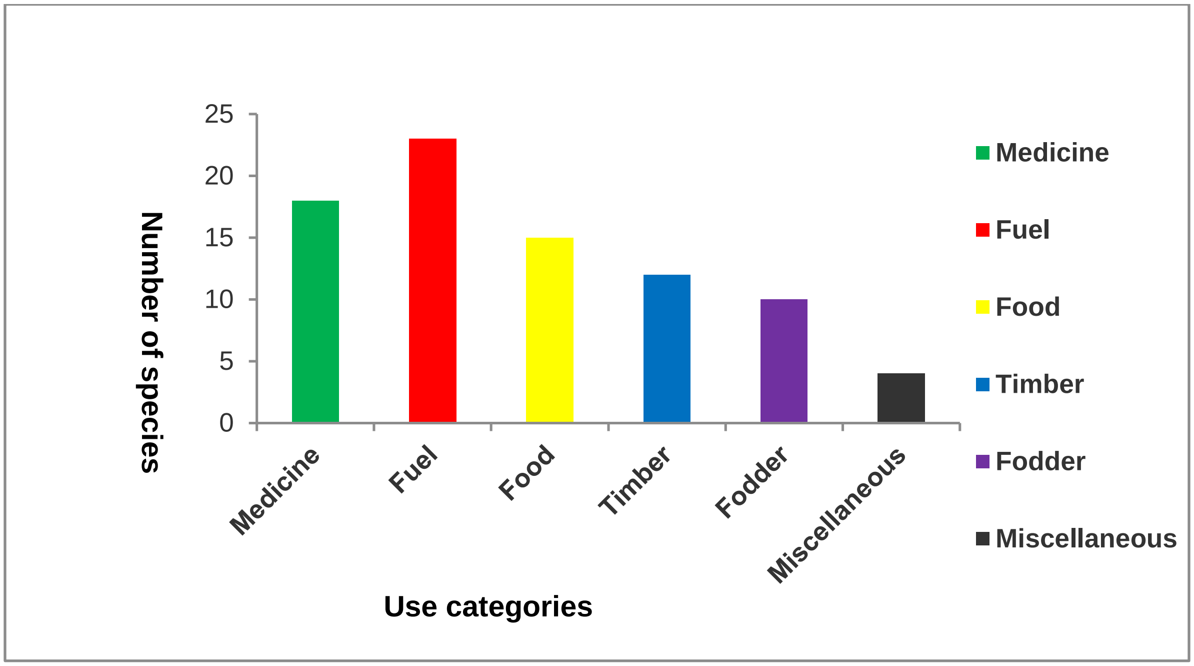


Figure 3-6: Ethnobotanical usage of local plants (February 2014 field survey)

3.4 Forest Status and Management

Most of the forest within the Project's area of influence corresponds to community forests and a small part lies within the Langtang National Park area. About 95% of the Project area lies within the subtropical zone (between 1000-1500 m) and about 5% lies within the tropical zone (below 1000 m). The forest of the study area is not conspicuous may be due to adverse topographic condition.

3.4.1 Forest in the Langtang National Park

The Langtang National Park (LNP) was designated as the first Himalayan National Park in 1970-71. Relative to the Project, the Trishuli River acts as border with the LNP, which extends to the east from the eastern river bank. Most of the Project infrastructure is located on the western bank of the Trishuli River and therefore outside of the LNP area. However, at the headworks site there is the potential to affect the eastern bank and the forests located within the LNP. It is for this reason that a number of vegetation sampling plots (see Figure 3-6) were set up in the LNP area.

Forest density is higher in the LNP as compared to the community forests on the western bank. The LNP has been playing a significant role in conserving regional biodiversity and its forest is well preserved (e.g. no cut trees were observed during the field surveys). Plantation works of *Pinus roxburghii* inside the LNP are being undertaken in the Dhunche area

Figure 3-7: Vegetation sampling sites at the headworks area

The results of vegetation sampling in the LNP showed higher circumference at breast height (CBH) of trees compared to the community forest. Within the LNP forest, the species *Schima wallichii, Toona ciliata*, Maletro has bigger CBH in comparision to other species. This indicates that the froest in this area is in a mature ecological stage and has been effectively poreserved by LNP authorities.

3.4.2 Forest in the Community Forest Area

The forest vegetation in the community forests, located along the western bank and managed and conserved by local communities, showed evident signs of anthropogenic activities and of ecological degradation (i.e. deteriorated habitats). The local Forests Users Groups (FUGs) protect and manage these forest and also conduct development activities. The FUGs have to strictly follow the operational management plan approved by the District Forest Office.

The observations of the field survey shouwed that the CBH of the tree species found inside the Community forest is small in comparision to the tree species of the National park. The species of *Aesandra butyracea, Alnus nepalensis*, *Bauhinia purpurea* have all smaller CBH in comparision to the same species inside the LNP area. The vegetation status indicates that these forests are in a phase of regeneration.

Figure 3-8: Vegetatioon sampling sites in the community forests area

The community forests face west and are exposed to drier conditions. This orientation, along with human intervention (settlements are located close to these forests) and the rugged terrain and high slopes, contribute to the degradation of these forests. Vegetation is generally thinner and patchy in this area. Reforestation of *Pinus roxburghii* and *Alnus nepalensis,* in the proximity of the access road area, was observed during the field visits.
The Project will acquire 76.7 ha of government land, currently distributed in six community forests (See Table 3-5).

Table 3-5: Project land requirements and community forests

SN	Name of community forest	Area (ha)	Number of trees/seedlings to cut down
1	Daksin Kalika Haku-8,9	17.25	330
2	Dharnasila Kanya Haku-9	24.57	736
3	Bratar Haku-7	0.99	105
4	Lumbudanda Haku-7	9.85	138
5	Labingpakha Tutudanda Haku-	9.49	54

SN	Name of community forest	Area (ha)	Number of trees/seedlings to cut down
	3		
6	Labingpakha Haku-3	14.51	254
Total		**76.66**	**1617 trees/2239 seedlings (total 3856)**

3.5 Conclusions and recommendations

3.5.1 Status of vegetation and flora in the Project area and expected impacts

The Project requires a total of approximately 100 hectares of land for its implementation. Out of this total area, 79.3 ha correspond to forest land. The majority (76.7 ha) of the forested area that will be affected by the Project is located on the western slope of the Trishuli and is under the management of six community forests. The other 2.6 ha to be used by the Project will be leased from Langtang National Park.

Some of the vegetation in the areas to be occupied by the Project will be completely cleared and other will be indirectly affected in other ways, such as added pressure and harvesting by increased population (i.e. influx of workers), increased sedimentation and erosion during construction, etc.

The vegetation and flora surveys confirmed that most of the natural vegetation in the Project's area corresponds to forest under the management of community forests. The forest types found in the area are mainly *Sal* (*Shorea robusta*) and pine (*Pinus roxburghii*), and alder and riparian forests along the stream banks and the wetter areas. The community forests showed evident signs of anthropogenic activities and of ecological degradation (i.e. patchy vegetation, smaller trees, etc.).

The local forests do not provide habitat for any critically endangered flora species, but a number of species with conservation significance were identified. These plant species include: the tree Sal (*Bombax ceiba*), which is protected by Nepal Government for its economic interest, *Pinus roxburghii*, classified as LC by the IUCN and banned for exportation, and *Dioscorea deltoidea*, which is included in the Appendix II of CITES

Locals reported an increasing trend in forest degradation in recent years due to the increase demand for timber for house building and other purposes. Ineffective control (e.g. uncontrolled grazing) and management were also pointed out as other causes/contributors to the deterioration of the forest area.

Taking all this into consideration most of the forest in the Project area can be classified as **modified habitat**. The smaller fraction (aound the headworks' area) of affected forest on the eastern slope of the Trishuli, within the Langtang National Park, can be identied as **natural habitat.**

3.5.2 Mitigation measures

Most of the vegetation in the Project area corresponds to modified forest habitat managed, for various production purposes, by local communites. These community forests showed signs of ecological degradation. However, they provide key ecosystem services to local communities (i.e. firewood, timber, medicinal plants, protection against erosion and landslides, etc.) and provide refuge and habitat for the local wildlife.

IFC Performance Standard 6 recognizes the importance of conserving biodiversity and maintaining ecosystem services. The forests of the area, although degraded, provide key ecosystem services for local communities and wildlife.

In view of the potential impacts to the forests in the Project area, two main migation actions are proposed:

- Develop and implement a **Reforestation Plan**: include compensatory plantation and/or protection of existing degraded forest land to compensate the forest area removed during the project implementation. The Plan should include a community forestry support program, including establishment of nurseries.

- Develop and implement a **Biodiversity and Wildlife Conservation Management Plan** to be implemented outside the Langtang National Park boundary in the immediate catchment surroundings. This plan should integrate existing EIA mitigation measures to protect natural vegetation and specific provision to followup on the evolution of plant biodiversity (see Section 3.5.3)

3.5.3 Monitoring of plant biodiversity

The effects of the Project on plant biodiversity, as well as the results of the mitigation measures to minimize the loss of biodiversity, will manifest in the long-term (depending on the particular ecology of the affected species). Therefore, a long-term adaptive monitoring approach is required to validate the Project's impacts and the effectiveness of the mitigation measures.

This monitoring protocol for plant biodiversity will need to be incorporated into and aligned with the Reforestation Plan and the Biodiversity and Wildlife Conservation Management Plan. The proponent should adopt a participatory approach and engage the Forest User Groups (FUGs) and the local communities in the monitoring activity. Local and traditional knowledge contributions from locals can complement the information

Table 3-5 presents a set of indicators that, based on the baseline results and the expected impats, could provide a framework for the evaluation of plant biodiversity in the Project area.

Table 3-6: Proposed plant biodiversity indicators

SN	Indicator	Monitoring area/sites	Timeframe/Comments
Monitoring during the construction phase			
1	**Area (m^2/ha) cleared of vegetation**	Project areas where vegetation will be cleared.	As clearing of vegetation progresses/Indicator to confirm the area of forest loss (identify the community forest to which the cleared area belongs).
2	**Presence of valuable[1] plant species**	Project areas where vegetation will be cleared.	As clearing of vegetation progresses/These valuable plant species should be saved and used for compensatory planting.
3	**Reforested area (m^2/ha)**	Areas under compensatory planting.	As reforestation activity advances/Align with compensatory planting schedule.
4	**Incidence of forest products extraction by non-forest users**	All the Project area	Throughout the construction phase/Integrate with the stakeholder engagement and grievance mechanism/Reporting from locals.
Monitoring during the operations phase			
5	**Plant diversity[2] in proximity areas**	Buffer areas around the main Project components (i.e. access road, powerhouse, etc.).	For 5 years after construction/regeneration time and life cycles of the different species have to be taken into consideration.
6	**Plant diversity in LNP**	Headworks area; consider monitoring the baseline study sites.	For 5 years after construction/explore opportunities to coordinate with LNP authorities.
7	**Plant establishment[3] and diversity in the reforested areas**	Reforested areas	Long-term (throughout operations)/Align with the Reforestation Plan.

(1) Plant species with significant biodiversity (protected/threatened/local) and/or ethnobotanical value as identified in this Vegetation and Flora Baseline Survey
(2) Ideally, monitoring indicators could include should be the same as the baseline indicators (i.e. species, density, and CBH)
(3) Document successful establishment of the plant species used in compensatory planting

3.6 Detailed results of vegetation and flora field surveys

Table 3-7: GPS coordinates of sampling sites (February 2014 field survey)

SN	Location	GPS Coordinates		Altitude (ft)	Point No.
1	Mailung Bhatti	28 04 15.8 N	85 12 24.31 E	3080	174
2	CFA (ARA)	28 04 38.9 N	85 12 52.3 E	3206	176
3	LNPA	28 04 36.6 N	85 12 55.7 E	3179	177
4	(LNPA)	28 04 37.3 N	85 12 55.2 E	3156	178
5	(LNPA)	28 04 42.5 N	85 13 03.2 E	3183	179
6	(LNPA)	28 04 46 N	85 13 06.2 E	3237	180
7	(LNPA)	28 05 08.6 N	85 13 20.7 E	4353	181
8	School (LNPA)	28 04 58.2 N	85 13 28.09 E	3341	182
9	CFA (ARA)	28 05 12.6 N	85 13 46.3 E	3360	183
10	CFA (ARA)	28 05 17.9N	85 13 47.05E	3440	184
11	CFA (ARA)	28 05 20.4 N	85 13 47.5 E	3622	185
12	CFA (ARA)-	28 05 21.7 N	85 13 50.3 E	3602	186
13	CFA (ARA)	28 05 28.1 N	85 13 59.7 E	3627	187
14	CFA (ARA)	28 05 32.2 N	85 14 11.5 E	3650	188
15	CFA (ARA)	28 05 35.0 N	85 14 23.5 E	3803	189
16	CFA (ARA) (DA-1)	28 05 35.1 N	85 14 28.2 E	3807	190
17	CFA (ARA)	28 05 39.0 N	85 14 32.7 E	4115	191
18	CFA (ARA)	28 05 39.7 N	85 14 35.5 E	4190	192
19	CFA (ARA)	28 05 35.9 N	85 14 38.4 E	3947	193
20	(LNPA)	28 06 53.2 N	85 17 58.7 E	6171	194
21	(LNPA)	28 07 06.8 N	85 17 59.1 E	5689	195
22	(LNPA)	28 07 08.9 N	85 17 55.6 E	5683	196
23	(LNPA)	28 07 10.4 N	85 17 59.5 E	5296	197
24	(LNPA)	28 07 15.8 N	85 18 08.4 E	5015	198
25	(LNPA)	28 07 14.3N	85 18 04.07E	4916	199
26	(LNPA)	28 07 31.9N	85 17 57.2E	4577	200
27	(LNPA)	28 07 32.9N	85 17 57.5E	4481	201
28	(LNPA)	28 07 34.9N	85 17 54.2E	4276	202
29	HWA (LNPA)	28 07 35.3N	85 17 51.7 E	4238	203
30	HWA (LNPA)	28 07 33.6N	85 17 50.7 E	4197	204
31	HWA (LNPA)	28 07 32.7N	85 17 52.2 E	4261	205
32	HWA (LNPA)	28 07 29.7N	85 17 48.3 E	4266	206
33	HWA (LNPA)	28 07 25.0N	85 17 37.3 E	4172	207
34	HWA (LNPA)	28 07 21.3N	85 17 35.3 E	4211	208
35	HWA (LNPA)	28 07 12.8N	85 17 33.8 E	4299	209
36	HWA (LNPA)	28 07 17.4N	85 17 31.9 E	4328	210
37	HWA (LNPA)	28 07 12.8N	85 17 26.6 E	4422	211
38	HWA (LNPA)	28 07 07.6 N	85 17 23.7 E	4573	212
39	CFA (ARA)	28 07 26.7E	85 17 33.3	4342	213
40	CFA (ARA)	28 07 29.1N	85 17 36.6 E	4423	214

Key: CFA: Community Forest Area; ARA: Access Road Area; LNPA: Langtang National Park Area; Head Work Area: HWA; DA: Disposal Area

Table 3-8: List of informants

SN	Name	Sex	Age	Place
1	Aasa Man Tamang	Male	19	Gogane
2	Chiring Tamang	Male	46	Maylung Bhatti
3	Grocho Tamang	Male	19	Maylung Bhatti
4	Junkiri Tamang	Female	22	Gumchet
5	Krunga Tamang	Male	45	Dhunche
6	Lama Tenzing Ghale	Male	50	Dhunche
7	Phul maya Tamang	Female	63	Maylung Bhatti
8	Raju Tamang	Male	19	Maylung Bhatti
9	Ramesh Basnet	Male	40	Dhunche
10	Shante Tamang	Male	20	Maylung Bhatti

Table 3-9: Plant species recorded during the August 2013 field survey

SN	Scientific name	Nepali name	Life form
1	*Achyranthes aspera* L.	Datiwan	Shrub
2	*Aesandra butyracea* (Roxb.) Baehni	Chiuri	Tree
3	*Agave americana* L.	Ketuki	Shrub
4	*Ageratina adenophora* (spreng.) R.M. King & H. Rob.	Banmara	Shrub
5	*Ageratum conyzoides* L.	Gandhe	Herb
6	*Albizia chinensis* (Osbeck) Merr.	Kalo siris	Tree
7	*Alnus nepalensis* D. Don	Utis	Tree
8	*Amaranthus spinosus* L.	Lunde kanda	Herb
9	*Arisaema concinnum* Schott	Sarpa ko makai	Herb
10	*Arisaema tortuosum* (Wall.) Schott	Sarpa ko makai	Herb
11	*Artemisia vulgaris* Linn.	Titepati	Herb
12	*Arundinaria* spp.		Herb
13	*Arundinella nepalensis* Trin.	Phurke Khar	Herb
14	*Bauhinia purpurea* L.	Tankee	Tree
15	*Begonia picta* Smith	Magar kanche	Herb
16	*Berberis asiatica* Roxb. ex DC.	Chutro	Shrub
17	*Bidens pilosa* L.	Tikhe kuro	Herb
18	*Boehmeria platyphylla* D. Don	Kamle	Shrub
19	*Boehmeria rugulosa* Wedd.	Dar	Tree
20	*Boenninghausenia albiflora* (Hook.) Rchb. ex Meisn.	Daampate	Herb
21	*Bombax ceiba* L.	Simal	Tree
22	*Brachiaria ramosa* (L.) Stapf	Likhe Banso	Herb
23	*Calanthe puberula* Lindl.		Herb
24	*Callicarpa arborea* Roxb.	Maas Gedaa	Tree
25	*Carex cruciata* Wahlenb.	Lamo hat katuwa	Herb
26	*Castanopsis indica* (Roxb.) Miq.	Dhalne katus	Tree
27	*Cheilanthes* spp.		Herb
28	*Chromolaena odorata* (L.) R.M. King & H. Rob.	Aule banmara	Shrub

SN	Scientific name	Nepali name	Life form
29	*Chrysopogon gryllus* (L.) Trin.	Dhaple ghans	Herb
30	*Cissampelos pareira* L.	Batul pate	Herb
31	*Clerodondron serratum* (Linn.) Moon		Shrub
32	*Colebrookia oppositifolia* Sm.	Dhusure	Shrub
33	*Commelina benghalensis* L.	Kane	Herb
34	*Cotoneaster microphyllus* Wall. ex Lindl.		Shrub
35	*Crassocephalum crepidioides* (Benth.) S. Moore	Anikale jhar	Herb
36	*Curcuma angustifolia* Roxb.	Kalo besar	Herb
37	*Cynodon dactylon* (L.) Pers.	Dubo	Herb
38	*Cynoglossum zeylanicum* (Vahl ex Hornem.) Thunb. ex Lehm.	Kanike kuro	Herb
39	*Cyperus niveus* Retz.	Seto mothe	Herb
40	*Delphinium altissimum* Wall.	Bikhadi ghans	Herb
41	*Dicranopteris linearis* (Burm.) Underw.		Herb
42	*Dioscorea bulbifera* L.	Gitthe tarul	Herb
43	*Dioscorea deltoidea* Wall. ex Griseb.	Bhyakur tarul	Herb
44	*Drepanostachyum falcatum* (Nees) Keng f.	Sano nigalo	Herb
45	*Dryoathyrium* spp.	Kalo neuro	Herb
46	*Dryopteris chrysoc*oma (Christ.) C. Chr.		Herb
47	*Engelhardia spicata* Lesch. ex Blume	Mauwa	Tree
48	*Eulaliopsis binata* (Retz.) C.E. Hubb.	Babiyo	Herb
49	*Euphorbia royleana* Boiss.	Siundee	Shrub
50	*Ficus semicordata* Buch.-Ham. ex J.E. Smith	Khanayo	Tree
51	*Fragaria nubicola* Lacaita	Bhuin ainselu	Herb
52	*Galium asperuloides* Edgew.		Herb
53	*Gaultheria fragrantissima* Wall.	Dhasingare	Shrub
54	*Geranium nepalense* Sweet		Herb
55	*Girardinia diversifolia* (Link) Friis	Allo sisnu	Herb
56	*Hedychium ellipticum* Buch.-Ham. ex Sm.	Rato saro	Herb
57	*Hypericum cordifolium* Choisy	Areli	Shrub
58	*Impatiens amplexicaulis* Edgew.	Tiuree	Herb
59	*Imperata cylindrica* (L.) P. Beauv.	Siru	Herb
60	*Indigofera constricta* (Thur.) Trimen		Shrub
61	*Indigofera dosua* Buch.-Ham. ex D. Don	Phusre ghans	Shrub
62	*Inula cappa* (Buch.-Ham. ex D. Don) DC.	Gaitihare	Shrub
63	*Ipoemea* spp.		Herb
64	*Iris decora* Wall.	Padam pushkar	Herb
65	*Lagerstroemia* spp.	Asare	Tree
66	*Leucostegia immersa* (Wall.) Presl		Herb
67	*Lindelofia longiflora* (Benth.) Baill.		Herb
68	*Lonicera quinquelocularis* Hardw.	Bangjhi	Shrub
69	*Lyonia ovalifolia* (Wall.) Drude	Angeri	Tree
70	*Machilus duthiei* King ex Hook.f.	Kaulo	Tree
71	*Maesa chisia* Buch.-Ham. ex D.Don	Bilaune	Shrub
72	*Malaxis muscifera* (Lindl.) Kuntze		Herb

SN	Scientific name	Nepali name	Life form
73	*Mallotus* spp.	Sindure	Tree
74	*Mangifera indica* L.	Aanp	Tree
75	*Mentha* spp.		Herb
76	*Mimosa* spp.		Shrub
77	*Murdannia edulis* (Stokes) Faden	Nigale gava	Herb
78	*Murraya paniculata* (L.) Jack		Shrub
79	*Myrica esculenta* Buch.-Ham. ex D. Don	Kafal	Tree
80	*Nephrolepis cordifolia* (Linn.) Presl	Paniamala	Herb
81	*Oleandra wallichii* (Hook.) Presl		Herb
82	*Onychium* spp.		Herb
83	*Osbeckia stellata* D.Don	Rato chulsi	Shrub
84	*Oxyspora paniculata* (D.Don) DC.		Shrub
85	*Persicaria* spp.		Herb
86	*Phyllanthus emblica* L.	Amala	Tree
87	*Phyllanthus parvifolius* Buch.-Ham. ex D. Don	Khareto	Shrub
88	*Phyllanthus urinaria* L.	Bhuin amala	Herb
89	*Pinus roxburghii* Sarg.	Rani sallo	Tree
90	*Polypodium* spp.		Herb
91	*Polystichum prescottianum* (Wall. ex Mett.) Moore		Herb
92	*Populus ciliata* Wall. ex Royle	Bhote pipal	Tree
93	*Prinsepia utilis* Royle	Dhatelo	Shrub
94	*Pteris* spp.		Herb
95	*Rhamnus virgatus* Roxb.	Kande painyu	Shrub
96	*Rhododendron arboreum* Sm.	Lali gurans	Tree
97	*Rhus wallichii* Hook. f.	Bhalayo	Tree
98	Rosaceae		Tree
99	*Rubia manjith* Roxb. ex Fleming	Majitho	Shrub
100	*Rubus ellipticus* Sm.	Ainselu	Shrub
101	*Rubus foliolosus* D.Don	Kalo ainselu	Shrub
102	*Saccharum spontaneum* L.	Kans	Herb
103	*Sarcococca coriacea* (Hook.f.) Sweet	Fiti fiya	Shrub
104	*Satyrium nepalense* D.Don		Herb
105	*Schima wallichii* (DC.) Korth.	Chilaune	Tree
106	*Selaginella* spp.		Herb
107	*Selinum tenuifolium* Wall. ex C.B. Clarke	Bhutkesh	Herb
108	*Senna tora* (L.) Roxb.	Tapre	Shrub
109	*Shorea robusta* Gaertn.	Sal	Tree
110	*Sida* spp.		Herb
111	*Solanum aculeatissimum* Jacq.	Kantakaari	Shrub
112	*Spilanthus acmella* (Linn.) Murr.	Marati	Herb
113	*Symplocos pyrifolia* Wall. ex G.Don	Seti kath	Tree
114	*Terminalia alata* Heyne ex Roth	Saaj	Tree
115	*Thalictrum foliolosum* DC.	Dampate	Herb
116	*Thalictrum punduanum* Wall.	Dampate	Herb
117	*Thysanolaena maxima* (Roxb.) Kuntze	Amreso	Herb

SN	Scientific name	Nepali name	Life form
118	*Toona ciliata* M. Roem.	Tunee	Tree
119	*Urena lobata* L.	Nalu kuro	Herb
120	*Urtica dioica* L.	Sisnu	Herb
121	*Viburnum erubescens* Wall. ex DC.	Ganmane	Shrub
122	*Woodfordia fruticosa* (L.) Kurz	Dhainyaro	Shrub
123	*Xanthium strumarium* L.	Bhende kuro	Herb
124	*Zanthoxylum acanthopodium* DC.	Boke timmur	Shrub

Table 3-10: Plant species recorded during the February 2014 field survey

SN	Scientific name	Nepali name	Life form
1	*Achyranthes aspera L.*	Datiwan	Shrub
2	*Aesandra butyracea (Roxb.) Baehni*	Chiuri	Tree
3	*Ageratina adenophora (spreng.) R.M. King & H.Rob.*	Banmara	Shrub
4	*Ageratum conyzoides L.*	Gandhe	Herb
5	*Albizia chinensis (Osbeck) Merr.*	Kalo siris	Tree
6	*Alnus nepalensis D. Don*	Utis	Tree
7	*Artemisia vulgaris Linn.*	Titepati	Herb
8	*Arthraxon lancifolius (Trin.) Hochst*	Chitre bans	Herb
9	*Arundinaria spp.*	Nigalo	Herb
10	*Arundinella nepalensis Trin.*	Phurke Khar	Herb
11	*Bauhinia purpurea L.*	Tankee	Tree
12	*Berberis asiatica Roxb. ex DC.*	Chutro	Shrub
13	*Bidens pilosa L.*	Tikhe kuro	Herb
14	*Boehmeria platyphylla D. Don*	Kamle	Shrub
15	*Carex cruciata Wahlenb.*	Lamo hat katuwa	Herb
16	*Cassia fistula L.*	Raajbriksha	Tree
17	*Chromolaena odorata (L.) R.M. King & H. Rob.*	Aule banmara	Shrub
18	*Chrysopogon gryllus (L.) Trin.*	Dhaple ghans	Herb
19	*Cinnamomum spp.*	Sinkaulee	Tree
20	*Clematis spp.*		Herb
21	*Colebrookia oppositifolia Sm.*	Dhusure	Shrub
22	*Crassocephalum crepidioides (Benth.) S. Moore*	Anikale jhar	Herb
23	*Cynodon dactylon (L.) Pers.*	Dubo	Herb
24	*Desmodium tiliaefolium (D.Don) Wall. ex G.Don*	Rato bakre ghans	Shrub
25	*Dicranopteris linearis (Burm.) Underw.*		Herb
26	*Dioscorea bulbifera L.*	Gitthe tarul	Herb
27	*Dioscorea deltoidea Wall. ex Griseb.*	Bhyakur tarul	Herb
28	*Drepanostachyum falcatum (Nees) Keng f.*	Sano nigalo	Herb
29	*Eulaliopsis binata (Retz.) C.E. Hubb.*	Babiyo	Herb
30	*Euphorbia royleana Boiss.*	Siundee	Shrub
31	*Ficus semicordata Buch.-Ham. ex J.E. Smith*	Khanayo	Tree
32	*Fragaria nubicola Lacaita*	Bhuin ainselu	Herb

33	*Galium asperuloides Edgew.*		Herb
34	*Hypericum cordifolium Choisy*	Areli	Shrub
35	*Impatiens amplexicaulis Edgew.*	Tiuree	Herb
36	*Imperata cylindrica (L.) P. Beauv.*	Siru	Herb
37	*Inula cappa (Buch.-Ham. ex D. Don) DC.*	Gaitihare	Shrub
38	*Maesa chisia Buch.-Ham. ex D. Don*	Bilauni	Shrub
39	*Mallotus spp.*	Sindure	Tree
40	*Melia azadirach Linn.*	Bakainu	Tree
41	*Murraya paniculata (L.) Jack*		Shrub
42	*Myrica esculenta Buch.-Ham. ex D. Don*	Kafal	Tree
43	*Nephrolepis cordifolia (Linn.) Presl*	Paniamala	Herb
44	*Onychium spp.*		Herb
45	*Osbeckia stellata D.Don*	Rato chulsi	Herb
46	*Osyris wightiana Wall. ex Wight*	Nun Dhicki	Shrub
47	*Phyllanthus parvifolius Buch.-Ham. ex D. Don*	Khareto	Shrub
48	*Pinus roxburghii Sarg.*	Rani sallo	Tree
49	*Populus ciliata Wall. ex Royle*	Bhote pipal	Tree
50	*Pteris spp.*		Herb
51	*Rhus wallichii Hook. f.*	Bhalayo	Tree
52	*Rosaceae*		Tree
53	*Rubia manjith Roxb. ex Fleming*	Majitho	Shrub
54	*Rubus ellipticus Sm.*	Ainselu	Shrub
55	*Rubus foliolosus D.Don*	Kalo ainselu	Shrub
56	*Saccharum spontaneum L.*	Kans	Herb
57	*Salix spp.*		Tree
58	*Schima wallichii (DC.) Korth.*	Chilaune	Tree
59	*Senna occidentalis (L.) Roxb.*	Thulo Tapre	Shrub
60	*Shorea robusta Gaertn.*	Sal	Tree
61	*Syzygium cumini (L.) Skeels*	Jamun	Tree
62	*Terminalia alata Heyne ex Roth*	Saj	Tree
63	*Thalictrum spp.*		Herb
64	*Thysanolaena maxima (Roxb.) Kuntze*	Amreso	Herb
65	*Toona ciliata M. Roem.*	Tunee	Tree
66	*Unidentified 1*	Maletro	Tree
67	*Unidentified 2 (Araliaceaea)*		Tree
68	*Unidentified 3 (Poaceae)*		Herb
69	*Unidentified 4 (Urticaceae)*		Shrub
70	*Unidentified 5*	Dipath (Tamang)	Tree
71	*Urena lobata L.*	Nalu kuro	Herb
72	*Urtica dioica L.*	Sisnu	Herb
73	*Woodfordia fruticosa (L.) Kurz*	Dhainyaro	Shrub

4 Terrestrial Wildlife

4.1 Approach and methodology

The potential for important natural habitats outside the protected area (Langtang Natural Park) system needed to be studied. An assessment of the status of some of the species identified as threatened or endangered by international standards (IUCN) was required. The effects that the construction and operation of the 19 km access road on the north bank of the Trishuli River may have on fauna (the road is located at mid-slope and might be a barrier to river access) needs to be evaluated in order to help identify appropriate mitigation measures as required. In compliance with IFC Performance Standard 6 (*Biodiversity Conservation and Sustainable Management of Living Natural Resources*), the ecological status of the terrestrial habitats (i.e. modified, natural or critical habitat) needs to be assessed.

The approach adopted by NESS for the terrestrial wildlife survey included the following methods:

1. Direct observation at selected sites using digital camera, GPS, binoculars, and identification guides.
2. Indirect data collection (i.e. signs of animal presence such as prints, vegetation trampling, carcasses/kills, dens and burrows, pellets and dung, fur and hairs, etc.)
3. Questionnaire survey: structural, pre-tested questionnaire based on National EIA Guidelines designed and filled during the field study period.
4. Group Discussion**:** with Community Forest User's Groups or nearby house owners, herders and farmers.
5. Identification of habitat presence and distribution through transect walks (transect and quadrate method) at both sides of the Trisuli River.
6. For birds, information was collected from various early morning transect walks across the Project area. Binoculars (10 × 42) were used to spot and identify birds, with the help of guide books. Secondary data (i.e. nest, droppings, feathers, footprints) were also collected for identification purposes.
7. Whenever possible, color sketches were done and photographs were taken to assist in species identification with local people.
8. Field data of herpetofauna was collected from Project sites and its peripheral area using following techniques:
    a. Direct observation for amphibian was carried out by walking and collection of specimens in the evening and night time along the project and its peripheral area.
    b. For other reptilian species, the information was collected during the field visit by direct observation and also acquired by questionnaire, interviews, group discussion, etc.
9. Assess impact on fauna due to construction and human activities.
10. Identify nearby habitat where displaced fauna can move to.
11. Suggest mitigation measures to minimize impacts on terrestrial fauna.

4.2 Results

4.2.1 Overview of terrestrial fauna in the Project Area

The following sections describe the fauna assemblages found in the sites surveyed in the Project Area, representative of the local fauna. Terrestrial fauna surveys were conducted in two occasions: in August-September 2013 and in completed with a second survey in Aporil 2014. The combined findings are presented in the following sections.

Mailung Dovan (1000 masl)

This site is located in the powerhouse area, in the confluence of the Trishuli with Mailung Khola. It was reported that three species of monkeys and one species of deer (*Ghoral*) frequented the area but the ongoing construction of Mailung Hydropower Project has caused local fauna to flee the area.

Figure 4-1: Mailung area and Trisuli river, starting point of Upper Trisuli -1 HEP

(North and South view)

Simal Chautari Upper Part of Suspension Bridge (950 masl)

Continuing upstream from the powerhouse area, the next transect site was located close to the settlement of Thade, in Dhunche VDC. In this part of the valley, on the western slope of the Trishuli and within the community forests present in the area, there are fruit trees such as *Phyllanthus embelica*, *Rubus ellepticus* and some Ficus species. These trees offer a suitable habitat for protected species like the Assamese monkey and the Ghoral. The field team sighted a troop of assamese monkey eating the fruits from these trees. There were 2 adult male, 3 adult female, 2 subadult and 2 infants were observed.

Figure 4-2: Area around Gomchet (E 00914545, N 31113619)

Figure 4-3: Troop of assamese monkey at 1065 masl
(E 00914534, N 311213713)

Gomchet village near the suspension bridge south 930 masl (28°04'16.0", N 85°12'24.7")

Patchy and degraded *Sal* (*Shorea robusta*) forest, with *Dhayaro* shrubs (*Woodfordia fruiticosa*), can be found on the western bank opf the Trishuli, near the village of Gomchet. The eastern bank (within Langtang Park), on the contrary, have preserved forests and offers suitable habitat.

Figure 4-4: Construction activities in the west bank of Trisuli River and a rodent

Along the trail to Gomchet hemlet, scattered trees of Uttish (*Alnus nepalensis*) can be found and birds tits and wabblers were observed in the area. Due to the construction activities going on in that area, the team did not observe any sign of wildlife.

Gomchet hemlet 956 masl (28°04'42.1", N 85°13'02.6")

Gomchet is a cave village with 13 households. The dominnt tree species (scattered distribution) include the regional species: *simal* (*Bombax ceiba*), *chilaune* (*Schima walichii*) and *chiuri* (*Aesandra butyracea*). The lower slope near the Trishuli River is occupied by agricultural land. Locals reported the presence of jackals howlings and balck bears in the forested area up the mountain from the village.

Figure 4-5: Gomchet hamlet and its typical cave houses

The forest on this area, western slope of the Trishuli, is fragmented and scatterd, compared to the forest on the eastern bank, in the Langtang National Park (see Figure 4-6). The conditions on the eastern slope are in general more favorable for a variety of fauna species.

Figure 4-6: Contrast in the forest cover between the western (left) slope and the eastern (right) slope, on the Langtang National Park

During a walk through the forest in this area, the team observed a troop of Himalayan langurs and evidence of the prsence of carnivores (i.e. leopard and jungle cat) and some herbivores (Figure 4-7).

Figure 4-7: Himalayan lagur and signs of the presence of other animals

Gogane village 1797 masl (E00917272, N 3116356)

The village Gogane, also called Danga by locals, is located on the west slope of of the Trishuli, in the upper part of Simal Chautari. Locals reported having seen mongoose, porcupines, monkeys, boars, barking deer and Ghoral. The research heard foxes howling during the night.

Figure 4-8: Forest habitat type in the Gogane area

While in the lower part of the Gogane area the terrain is fully utilized for agricultural practices, the upper parts of the village (above 2,000 masl) provides a forest habitat (Figure 4-8) characterized by *Rhododendron* and *Pinus* trees with many shrubs like *Melastoma normali* and *Osbekia* species. It was in this area where what could be print of a leaopard was observed

Figure 4-9: Pugmark of a carnivore and droppings of a small mammal

Haku Village 2100 mals

The area around Haku village is a rugged landscape. There is a significant agricultural extension around the settlement but in the lower part of the valley the slopes are very steep and form a gorge (Figure 4-10). Forest habitat can only be found in the narrow strip of riparian forest along the Trishuli, and it is unaccesible from the village..

Local inhabitants reported complains for the damage that monkeys (Assamese, Langurs and rhesus) do in the crop fields, and also from some incidents of carnivores attacking poultry and other small domestic animals.

Figure 4-10: Trishuli gorge at Hakubeshi

Figure 4-11: Both sides of the Trishuli River around the headworks area

Figure 4-12: Agricultural fields on the western slope of the Trishuli Valley at Hakubesi

In the headworks area there is a clear constrast between the eastern slope, under the LNP and with dense vegetation, and the western slope in Haku village, much more intervened and dedicated mostly to agriculture. On the eastern side around Dhunche, the team observed barking deer, Assamese monkeys and Hanuman langurs, as well as evidence of other animals.

Figure 4-13: Barking deer, Assamese monkeys and Hanuman langur troops (Dhunche)

Headworks/Damsites 1264masl (28°07'25.0", N 85°18'00.7")

The proposed headworks are located at the confluence of Kerung Khola (Bhote Koshi) and the Trisuli River. There is a trail access to the damsite through agricultural fields, and steep-rocky- slopes with scattered trees from Haku besi in the west bank.

Figure 4-14: Northern part of the headworks site, at the confluence of Kerung Khola and Trishuli River

Figure 4-15: Southern part of headworks site (eastern bank is forested and west bank is a dry steep slope)

Two *Kharkas*, or temporary facilities for keeping cattle, were observed on the eastern bank. The rest of the forested areas are traversed by livestock grazing and human trails to harvest fodder and woods. The area provides good habitat for barking deer and Ghoral as well as civet and jungle cat. Local herders reported sightings of occasional sightings of leopards.

Barking deer (*Muntiacus muntijak*) seems to be very frequent in the area and the survey team heard its barking during the forest (one individual was observed at Hakubesi). Locals also reported porcupine (*Hystrix indica*) and martine (*Martes flavigula*) as frequent species. Common leopard (*Panthera pardus*) and jungle cat (*Felis chaus*) are uncommon.

4.2.2 Mammals of the Project Area

Nepal hots 186 species of mammals, account for 4.5% of the global diversity. Including small mammals, some authors increase the total number of species up to 212 (Shrestha 1997, Chalise 2008). According to local respondents, most of the wildlife can be found in the upper forest and kharka areas. Monkeys, especially Assamese monkey and Hanuman langurs, regularly descend to raid agricutlural fields. The research team located two troops of Assmese monkeys and one troop of Hanuman Langur along the forest walk. A total of 20 species of mammals were recorded, directly and indirectly, at the project area during the field trip (Table 4-1).

The complex topography and geology together with the varied climatic patterns have enabled a wide spectrum of vegetation types that in turn has supported a good faunal diversity. Most of the animals at the project sites exhibit altitudinal seasonal migration thus very few of the faunal species were sighted very shortly during field survey except barking deer, Assamese monkey (*Macaca assamensis*) and Hanuman Langur (*Semnopithecus entellus*), which are scattered to the location. Assamese monkeys are protected under the National Parks and Wildlife Conservation Act, 1973.

Eastern side of the Trishuli River is comparatively dense forest of Langtang National Park and contains the major wildlife habitat in the project area. The werstern bank of the river, where the project features are proposed to be built, has a narrow band of forest but no major wildlife habitat has been identified there except some crop raider.

Table 4-1: Mammals identified in the Project area

Local Name	Common Name	Scientific Name	Local Use	CITIES	IUCN	Abundance
Timnyau	Assamese monkey	*Macaca assamensis*		II	VU	Common
Bandar	Rhesus Monkey	*Macaca mullata*		II	NT	Common Pest
Langur	Hanuman Langur	*Semnopithecus entellus*		I	LR/NT	Abundant Pest
Bandel	Wild Boar	*Sus scrofa*	Meat		LC	
Chituwa	Common Leopard	*Panthera pardus*		I	LR/NT	Common
Dumsi	Porcupine	*Hystrix indica*			LR/LC	Abundant Pest
Fyauro	Fox	*Vulpes vulpes*			LC	Common Pest
Ghoral	Himalayan Goral	*Nemorhedus goral*			NT	
Kalo Bhalu	Himalayan Black Bear	*Selenarctos thibetanus*		I	VU	Rare
Kharayo	Indian Hare	*Lepus nigricollis*	Meat		LC	
Malsapro	Yellow throated Marten	*Martes flavigula*		III	LR/LC	Common
Ratuwa	Barking Deer	*Muntiacus muntjak*	Meat		LR/LC	
Shyal	Jackal	*Canis aureus*		III	LC	Abundant Pest
Ban Biralo	Jungle cat	*Felis chaus*			LC	Common
Nyauri	Mongoose	*Herpestes fuscus*		III		
Dangsari	Small Civet	*Viverricula indica*		III		
Chhuram	Smooth-coated Otter	*Lutra perspicilliata*		I		
Chhuchundro	House Shrew	*Suncus murinus*				
Lokharke	Himalayan squirrel	*Callosciurus pygerythrus*				
Muso	Field rat	*Rattus rattus*				

Source: Field Survey, 2013 CITES Appendices I: Species threatened with extinction; II: Species not yet threatened, but could become endangered if trade is not controlled; III: Species requirING international co-operation to control trade. IUCN Red List (1995); LR: Low Risk; NT: Near Threatened; LC: Least Concern; VU: Vulnerable; EN: Endangered; CR: Critically Endangered; K: Insufficiently Known

4.2.3 Birds of the Project Area

The UT-1 Project and its surrounding area habour 94 Species of avifauna. Most of the birds are sedentary and breed and live in the area (>75%). Remaining (<25%) are winter or summer visitor (i.e. migratory).

Along the river corridor and streams, ten riparian species were identified, including: common kingfisher (*Alcedo atthis*), white-throated kingfisher (*Halcyon smyrnensis*), Ibisbill (*Ibidorhyncha struthersii*), brown dipper (*Cinclus pallasii*), little forktail (*Enicurus scouleri*), blue whistiling thrush (*Myophonus caeruleus*), plumbeous water redstart (*Rhyacornis fuliginosus*) etc. These species are common and not fall under any local (national) and global (IUCN) threat categories. Similarly, forest or terresterial-dependent birds found in the area include: long-tailed minivet (*Pericrocotus ethologus*), great tit (*Parus major*), oriental white-eye (*Zosterops palpebrosus*), grey-hooded warbler (*Seicercus xanthoschistos*), spotted dove (*Streptopelia chinensis*), common kestrel (*Falco tinnunculus*), bar-wing flycatcher-shrike (*Hemipus picatus*), ashy Drongo (*Dicrurus leucophaeus*), Nepal housemartin (*Delichon nipalensis*), Himalayan Bulbul (*Pycnonotus leucogenys*), striated prinia (*Prinia criniger*).

Figure 4-16: Some commonly available bird species along the transect walk of project area

Table 4-2: Threatrened and CITES Appendix avifauna species from the Project area

SN	Common Name	Scientific name	NG/P	CITES	IUCN	NRDB
1	Kalij Pheasant	*Lophura leucomelanos*	-	-	LC	S
2	Slaty-headed Parakeet	*Psittacula himalayana*	-	II	LC	S
3	Eurasian Eagle Owl	*Bubo bubo*	-	II	LC	V
4	Asian Barred Owlet	*Glaucidium cuculoides*	-	II	LC	-
5	Blue Rock Pigeon	*Columba livia*	-	III	LC	-
6	Ibisbill	*Ibidorhyncha struthersii*	-	-	LC	S
7	Shikra	*Accipiter badius*	-	II	LC	S
8	Common Buzzard	*Buteo buteo*	-	II	LC	-
9	Hen Harrier	*Circus cyaneus*	-	II	LC	-
10	Himalayan Griffon	*Gyps himalayensis*	-	II	LC	S
11	Black Kite	*Milvus migrans*	-	II	LC	-
12	Common Kestrel	*Falco tinnunculus*	-	II	LC	-
13	Pied Thrush	*Zoothera wardii*	-	-	LC	S

NRDB Redlist: E = Endangered: V = Vulnerable: S = Susceptible

4.2.4 Herpeto-fauna in the Project Area

Similarly, the Project area and its impact zone host 12 species of herpetofauna. Among them, five species of amphibia and reptiles, including: the Himalayan toad (*Bufo himalayanus*), common garden lizard (*Calotes versicolor*), Kashmir agama (*Laudakia tuberculata*), saffron-bellied wall Gecko (*Hemidactylus flaviviridis*) and St. John's keelback water snake (*Xenochrophis piscator*).

Figure 4-17: Lizard spotted in the Gogane area

Kashmir agama was recorded in Haku village at 1800m, in the indirect impact zon. All speices, except Asiatic Rat Snake (*Ptyas mucosus*), which is listed in CITES Appendix II and categorised as Susceptible by Nepal Red Data Book, are common and listed as least concern (LC) by IUCN Red List Category.

Table 4-3: Herpeto-fauna of the Project area

Order/Family/Local Names	**Scientific names**	**NG/P**	**CITES**	**IUCN**	**NRDB**
ORDER : ANURA					
Family – Bufonidae					
Himalayan Toad	Bufo himalayanus*			LC v3.1	
Family – Ranidae					
Beautiful stream frog	Amolops formosus			LC v3.1	
Skittering Frog	Euphlyctis cyanophlyctis			LC v3.1	
ORDER : SAURIA					
Family – Agamidae					
Common Garden Lizard	Calotes versicolor*				
Kashmir agama	Laudakia tuberculata*			DD v3.1	
Family – Gekkonidae					
Saffron-bellied Wall Gecko	Hemidactylus flaviviridis*			LC v3.1	
Family – Scincidae					
Himalayan ground skink	Asymblepharus himalayanus			LC v3.1	

ORDER : SERPENTES					
Family – Colubridae					
Mountain Keelback	Amphiesma platyceps			LC v3.1	
Asiatic Rat Snake	Ptyas mucosus		II	LC v3.1	S
Himalayan Keelback	Rhabdophis himalayanus			LC v3.1	
St. John's keelback water snake	Xenochrophis piscator*			LC v3.1	
Family – Viperidae					
Mountain Pit Viper	Ovophis monticola			LC v3.1	

Sources: Field Visit (2013), BPP (1995 No 2) & Shah and Tiwari (2004)

***** Species recorded from direct impact zone

4.2.5 Threatened and Protected Species

From the mammal species of the Project area, the Assamese monkey is protected by national regulations. There are also some species considered vulnerable or nearly threatened by international classifications (IUCN), including the Himalayan goral, and the Rhesus monkeys.

Al the bird species fall under different categories of the national and international conservation lists (e.g. IUCN red list, CITES Appendix and the national NRDB red list) categories. Similarly seven species of avifauna fall under the NRDB red list. Among them, the Eurasian eagle owl (*Bubo bubo*) was the only one species that categorized as Vulnerable by NRDB. The Asiatic rat snake (*Ptyas mucosus*) is also listed in CITES Appendix II

4.3 Conclusions and recommendations

4.3.1 Status of terrestrial wildlife in the Project area and expected impacts

Terrestrial habitats on the west bank of the Trishuli River, where most of the Project components will be built, consist mostly of forest under management by local communities and agricultural or marginal lands. This forest on the western slope is highky intervened and degraded by human activity (e.g. extraction of forests products, cattle grazing, etc.) and can be classified, following the premises of the IFC Performance Standard 6 (Biodiversity Conservation and Sustainable Management of Living Natural Resources), as **modified habitat**. The eastern bank in the headworks area, part of the Langtang National Park, can be considered **natural habitat**.

The community forests on the western slope of the Trishuli offer foraging and refuge for local wildlife, including monkeys, deers, boars, bears, etc. In total, 20 mammal, 13 bird and 12 herpeto-fauna species were recorded in the Project area. None of these species is endangered or critically endangered. Although the Assamese monkey is protected under

Nepal laws and there are other two mammal species classified as nearly threatened by the IUCN; the Himalayan goral, and the Rhesus monkeys.

In terms of habitat use, it seems that most of the local wildlife inhabits predominantly the upper, forest-covered areas, and would go down for foraging and/or hunting pruposes. Monkeys and boars are reported to raid agricultural fields. The riparian area along the Trishuli and other water courses offers specific habitat to a number of bird species, including the kingsfish.

It should be noted that locals informed that the construction of other hydropower facilities and associated infrastructure in the vicinity of the UT-1 Project has caused the displacement of mobile fauna (e.g. monkeys and deer in Mailung Dovan area).

The construction of the Project will have direct impacts on wildlife in the form of loss of terrestrial habitat along the 19 km access road and disturbance and displacement during the various construction activities. The area around Hakubeshi will be the most impacted since it is where the head works will be located and the influx of workers is likely to be more intense. These impacts will concentrate during the construction period. Some animals will flee to the LNP but for small mammals and other herpeto-fauna with reduced mobility, the impacts can be more significant. The reduction of flow in the diversion reach can have negative impacts on riparian habitats, on which some bird species depend.

Indirectly, the Project could have impacts on the overall habitat availability and connectivity for terrestrial fauna in the area by fragmenting the river corridor and by hindering altitudinal migration due to the contruction of the access road at mid-slope.

4.3.2 Mitigation measures

The Project has the potential to reduce local wildlife biodiversity by the direct and indirect impacts that will occur mainly during construction. Although degraded and not of good quality, the community forests on the western slope offer habitat (**modified habitat**) for local wildlife. In compliance with IFC Performance Standard 6, the proponent should strive for minimizing the impact on local biodiversity and managing the project in a sustainable way.

In view of the potential impacts to local wildlife in the Project area, the main migation actions are proposed:

- According to the specifications in the **Construction Environmental and Social Management Plan** (see Appendix F, Supplemental ESIA 2014), apply measures to minimize disruption and impacts on local wildlife during construction, such as ensuring that no hunting, fishing or poaching takes place; demarcate natural habitats significant from a conservation point of view before starting construction, etc. Construction staff needs to be trained in local biodiversity.

- Develop and implement a **Biodiversity and Wildlife Conservation Management Plan** to be implemented outside the Langtang National Park boundary in the immediate catchment surroundings. This plan should integrate existing EIA mitigation measures to protect wildlife as well as any other additional mitigation measure that is deemed necessary based on the baseline results.

4.3.3 Monitoring of wildlife biodiversity

The effects of the Project on wildlife will manifest in the long-term (depending on the particular ecology of the affected species). The assessment of local biodiversity evolution requires a long-term adaptive monitoring approach, involving participatory monitoring with local communities and LNP authorities, is required to validate the Project's impacts and the effectiveness of the mitigation measures.

The monitoring program for wildlife should allow the proponent to assess how the Project has impacted local wildlife and how effective the mitigation measures are to counter these effects. Table 3-5 presents a set of indicators that could provide a framework for the evaluation of plan biodiversity in the Project area.

Table 4-4: Proposed plant biodiversity indicators

SN	Indicator	Monitoring area/sites	Timeframe/Comments
Monitoring during the construction phase			
1	**Presence of key[1] species**	Subset of monitoring sites based on baseline results	Periodically during construction
2	**Presence of vulnerable[2] species**	High impact areas (reservoir, work camps)	Periodically during construction
3	**Incidence (mortality) of road accidents/hunting or fishing**	All the Project area	Throughout the construction phase/Include reporting from locals.
Monitoring during the operations phase			
4	**Wildlife biodiversity in indirectly impacted areas**	Sites outside the direct footprint of the Project	For 5 years after construction/ life cycles of the different species have to be taken into consideration.
5	**Presence of key species**	Subset of monitoring sites based on baseline results	For 5 years after construction
6	**Birds in riparian habitat**	Selected sites along the diversion reach	For 5 years after construction/explore opportunities to integrate with aquatic habitat monitoring.
7	**Wildlife biodiversity in the reforested areas**	Reforested areas	Long-term/Align with the Reforestation Plan. It is expected that the reforested areas will provide additional habitat for wildlife.
8	**Wildlife in LNP**	Selected sites in the LNP, along the Trishuli	For 5 years after construction/explore opportunities to coordinate with LNP authorities

(1) Include species of conservation significance based on their protection and/or threatened status (e.g. Assamese monkey, goral, etc.)

(2) Species with reduced mobility, at a vulnerable stage in their life cycle (e.g. breeding individuals), etc.

4.4 References and information sources

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Local informants

1. Kami Chhiring, Hakku Byasi - riverside resident
2. Shanta Tamang, Mailung Dovan resident.
3. Mr. Soti Teacher Mailung School
4. Som B. Tamang – Hakubeshi
5. Lama Chhering Ghale Dhunche
6. Dhan Bahadur Gurung Dhunche
7. Junkiri Lama, Gomchet Teacher
8. Sonam Ghale, Gogane
9. Mingmar Ghale Bhargu
10. Purna Ghale

5 Groundwater Survey

5.1 Overview

This report presents the results and interpretations of 2D-electrical resistivity tomography (2D-ERT) study that was carried out to investigate the hydrological conditions in Gogane and Hakubeshi area of Rasuwa district. These areas include the major settlements along the headrace tunnel of the proposed Trishuli-1 Hydroelectric Project and need detail investigation to identify any problem in water resources due to the construction of the tunnel. In this report, interpretation is made based on the ERT result and geological and hydro geological observations in the field.

The main objective of this study is to find the impact of proposed headrace tunnel of Trishuli-1 Hydropower Project on groundwater resources in Gogane and Hakubesi areas, major settlements along the headrace tunnel. Other objectives of this study area:

1. To identify major sources of water in the study area,
2. To estimate depth and extent of subsurface water bodies,
3. To evaluate the hydrological properties of the subsurface water bodies.

Fieldwork was carried out in February, 2014. In the field, the apparent resistivity using the Wenner Electrode layout was measured. The technique of data acquisition is discussed in detail in next chapter. The measurements had been carried out in three profiles each of 400m length in each area. One of the profiles is along the proposed headrace tunnel while the remaining two are almost at right angles to the headrace tunnel. The location of these profiles is shown in Figure 1 and Figure 2.

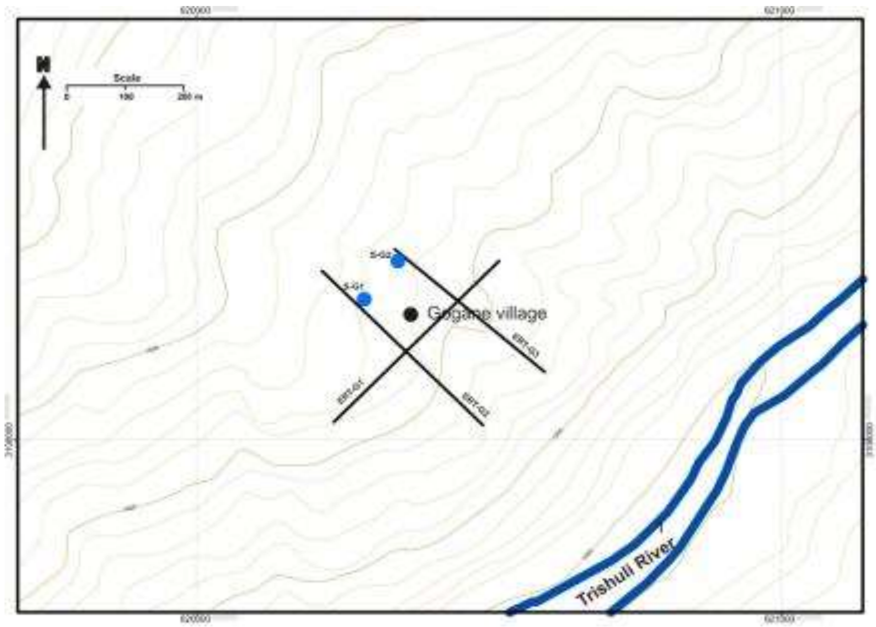

Figure 5-1: Location of ERT lines in Gogane area. Solid lines labeled ERT-G1, ERT-G2 etc represent the ERT lines. Solid blue circles labeled S-G1, S-G2 represent the location of natural spring in the area

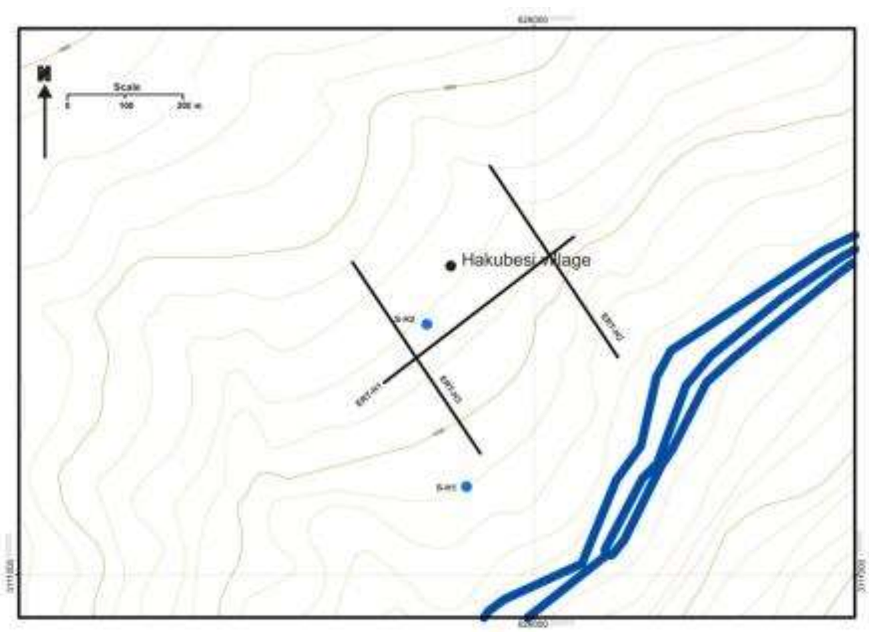

Figure 5-2: Location of ERT lines in Hakubesi area. Solid lines labeled ERT-H1, ERT-H2 etc represent the ERT lines. Solid blue circles labeled S-H1, S-H2 represent the location of natural spring in the area.

5.2 Approach and methodology

5.2.1 Physical and Geological Basis of Electrical Resistivity Method

2D-ERT (Electrical Resistivity Tomography) is a common and economic geophysical tool in the study of groundwater. It is useful in characterizing the subsurface geology and to identify water-bearing layers (aquifers). Geological observations provide a priori information while processing the data and interpreting the tomogram.

If an electric current is introduced into the subsurface, depending upon the electrical resistance of the subsurface material the electric current will flow variably giving rise to a potential difference between two points in the subsurface. This is the main basis of the 2D-ERT survey. In 2D-ERT, electrical current of very low frequency is passed through the geological subsurface. The response of current on geological formations such as clay, silt, sand, gravel, boulders, and bedrock are different. By virtue of different capacity of different material on electrical conductivity, it is possible to separate different materials from each other. Electrical resistivity of a geological material depends both on the matrix (rock and/or sediments) and on the salinity of the fluids (water) and degree of saturation of pore spaces.

In 2D-ERT the apparent resistivity along the given profile is measured. The electrode spread (array) and the electrode spacing are fixed according to the objective of the survey. To measure the resistivity different instruments can be used. However in this survey, Terrameter (SAS 300 C) is used. Terrameter directly measures the apparent resistivity between two potential electrodes. The apparent resistivity measured is used to obtain the resistivity model after inversion. In 2D-inversion the best fitting model is searched by minimizing the error between the observed and the calculated apparent resistivities.

5.2.2 Data Acquisition

Resistivity data was gathered to obtain a continuous coverage of the subsurface along the lines of investigation. In 2D-ERT, data are collected using any one of the conventional or non-conventional electrode configurations having different degree of sensitivity, resolution and depth penetration. Selection of any electrode configuration for data acquisition mainly depends on the geological and topographical setup of the area, requirements of the depth of investigation, resolution, and sensitivity of the selected electrode configuration. Further the choice of a particular electrode configuration depends on level of noise, field logistics and data processing facilities. In this study Wenner array was used for all profiles.

5.2.3 Data Quality

Field data are commonly influenced by telluric and electrochemical activities in the subsurface. The subsurface electrochemical activity is checked by SP measurements, which would help in interpretation of resistivity data. The level of noise on the collected data depends on the quality of the equipment and accessories, methods of data acquisition and geological setup. Selection of appropriate equipment and accessories and data acquisition system helps to gather reliable field data. Proper selection of the orientation of the profiles or an additional cross profiles helps to recognize noise due to the geological and morphological setup of the area. The three dimensional subsurface heterogeneity may influence the observed data in large scale particularly when the electrode spacing is large. Further the distortion of signal due to geological variations within the profile in sideways also influences the observations. Further, noise can be introduced in the data by polarization of the electrodes. To reduce the noise by polarization, the frequency of electric current was increased after each 20 readings and the machine was switched off every 30 minutes for five minutes in each profiling. These noises caused by subsurface geology are regarded as geological noises and are not easily interpretable. In addition to the geological noises, the quality of the data and the results depend on the following factors:

1. Type of the equipments and the accessories used,
2. Field crew (geophysicist, assistants, surveyors, laborers),
3. Method of inversion, and
4. Interpretation capacity of the geophysicist.

Type of Equipment and Accessories Used

Data acquisition was carried out by using equipment known under the brand name Terrameter SAS 300 C, manufactured by ABEM Instruments, Sweden. It consists of three main units all housed in a single casing: the transmitter, the receiver and the microprocessor. The electrically isolated transmitter sends out well-defined and regulated signal currents. The receiver discriminates noise and measures voltages correlated with transmitted signal current. The microprocessor monitors and controls operations and calculates results. The apparent resistivity is calculated automatically and displayed in digital form. The Terrameter SAS 300C has an advantage of consecutive and continuous average readings. The continuously updated running average is presented automatically on the display. The overall range extends from 0.05 milliohms to 1999 kilo-ohms. The range can be extended down to 0.002 milliohms by means of SAS 2000 Booster.

Stainless steel electrodes (30 cm long) were used for both current transmission and voltage receiving. These electrodes were grounded in each profile and were connected with the Terrameter by specially designed shielded multicore cables.

For each observation the instrument was set to display average value of four cycles of readings. This average value is used in order to minimize the geological noise. Each observation with supplied current was recorded on a laptop.

One of the unwanted noise in ERT survey comes from induced polarization especially in the wet ground. To eliminate this noise, electric current was increased after 20 readings. The increment in electric current generally sweeps away the ions clustered along the electrode-ground interface and removes the artificially increased resistivity. Further, the machine was switched off for 5 minutes after each 30 minutes of the survey for natural decay of the induced polarization.

Field Crew

The members of the geophysical field crew are a geophysicist, an engineering geologist, two assistants and laborers. The geophysicist and the engineering geologists are from the Central Department of Geology, Tribhuvan University. Four local people worked as laborers.

Data Inversion Code

Data inversion code is also the main component of the 2D-ERT method. There are numbers of commercially available inversion code designed for the processing of 2D-ERT data. The inversion code should be robust and precise. The limitation of the inversion code is that it is not free from artifacts of the data processing. Therefore, the processing and the interpretation must be done based on the geological/hydrological condition that has been observed during the field visit.

For the inversion, Fortran code written by Ichihara and Ghimire (2009) at Hokkaido University of Japan was used. The program was successfully applied in analyzing shallow crustal structure (~1500m) to monitor the volcanic activities and to investigate underground water in Japan.

Interpretation Capacity of Geophysicist

For the interpretation of the result obtained from the inversion, detailed geological observations were made during the fieldwork. For this purpose an experienced engineering geologist was included in the team. During the data processing, the geologist and the geophysicist of the team made intensive discussions to come up this report.

5.2.4 Data Processing

The main task of 2D-ERT is to search the best fitting electrical model of the subsurface that simulates the apparent resistivity very close to the observations. In 2D-ERT, the observed pseudosections are first prepared from the raw field data. Pseudosections show the variation of resistivity in the subsurface, which have been affected by the electrode arrangement and relative apparent resistivity distribution in the subsurface. The inversion of the pseudosection was carried out to get the best fitting model of true resistivity distribution.

For inversion of the pseudosection, it is necessary to input processing parameters. The input of the processing parameters largely depends on the geological concepts and data quality. The program calculates a two-dimensional resistivity model for the subsurface using the apparent resistivity measured along a profile and the processing parameters suitable for the geology of the area. The depth of the bottom row of the resistivity blocks is set to be approximately equal to the equivalent depth of investigation (median depth) of the datum points with the largest electrode spacing. A finite element modeling is used to calculate the apparent resistivity values, and a non-linear least-squares optimization technique is used for the inversion. The least-square optimization basically reduces the difference between the observed and calculated resistivity values by adjusting the resistivity of the model blocks. The end products of the processing are refined tomograms (images) of resistivity distribution in subsurface.

5.3 Analysis and interpretation

5.3.1 Relation of Electrical Resistivity with Hydrogeological Parameters

Electrical resistivity depends on porosity, permeability, moisture content and material type of the soil and rocks. Depending upon the constituent minerals, the ratio between zones of aeration to zone of saturation may range between 4 and 10. For saturated and clay free soil the relation between porosity and resistivity is related by Archie's law. For saturated granular material there is direct log-log relationship between permeability and resistivity, i.e. the log of permeability will decrease with log of resistivity.

5.3.2 Correlation of Model Resistivity and Lithology

For the interpretation of electrical resistivity model, to extract subsurface geological information, knowledge of geological setting is very important. Geological setting in ERT implies the lithological composition along and around the profile lines. Since different geological formation can give rise to similar resistivity, it is worth gathering detailed geological information in order to correlate lithology with the model resistivity values. Further, the climatic condition (especially rain) during the data acquisition may impair the resistivity data. Therefore the climatic conditions for past few days should be considered while correlating the lithology with the resistivity. During the data acquisition, there was no rain and thus no influence of climate in data. The geological setting, along each profile, is described individually in forthcoming sections.

5.3.3 Interpretation of Model Resistivity Patterns and Values with Geology

An ERT-image provides spatial distribution of model resistivity values providing structural information with the section. This structural information together with the geological observations helps to form geological concepts important for 2D-ERT interpretations.

Interpretation of Surface Layers and Bodies:

Usually surface layers are highly heterogeneous and disconnected. As they are isolated and have less moisture content, they are usually identified as zones of very high electrical resistivity. Generally, in the case of soil, the resistivity increases with the grain size. In the case of gravel rich soil the resistivity may reach several kilo-Ohms. These gravel rich soil will exhibit isolated patches of very high resistivity. If the surface layer is made up of weathered rocks or fine materials the electrical resistivity may lower significantly.

Interpretation of Intermediate Layers and Bodies:

Intermediate layers are marked by relatively lower resistivity. This is specially due to the relatively higher moisture content specially in the soil. Fine grained materials, weathered and highly fractured rock mass are indicated by relatively low electrical resistivity values.

Interpretation of Deep Layers and Bodies:

At greater depths the electrical resistivity increases in soil because of loss of porosity due to compaction. Rocks are fresh and show high resistivity.

5.3.4 Pitfalls of the Processing and Interpretation

Usually every geophysical tool has some advantages and some disadvantages. In 2D-ERT, the interpretation could be misleading due to the inherent noise during data recording. Further the artifacts imposed by the processing of data may mislead the interpretation. In this analysis, slight deviation in the spatial distribution of the identified layers is inevitable due to the topographic setting of the project site.

5.3.5 Resistivity Tomograms and Interpretative Cross Sections

This study is motivated in order to find the impact of the proposed headrace tunnel of Upper Trishuli-1 Hydroelectric project in ground water resources of Gogane and Hakubesi areas of Rasuwa district. In each area ERT survey was carried out along three profiles, each of 400m length. During the data acquisition the existing water resources were also explored. The locations of natural springs in the area are shown in Figures 1 and 2. In the following sections, the interpretation of ERT results along with existing hydro geological conditions are discussed.

Gogane Area

Gogane is a small village of Dandagaun VDC lying along the proposed headrace tunnel. It is located on the hill slopes on the right bank of the Trishuli River. The local people in the area use water for domestic purpose from small tributaries (S-G1 and S-G2 in Figure 1). S-G1 is a seasonal spring (Figure 3) that supplies water until October while S-G2 is perennial and is the main source of domestic water in the area. During the dry season, the deficit water is supplied from the springs in neighboring villages.

ERT-G1

This profile lies along the alignment of the headrace tunnel of the Upper Trishuli-1 Hydroelectric project. ERT-G2 and ERT-G3 crosses this profile at the chainage of 170m and 80m respectively. The profile is located on a colluvial slope on the right bank of the Trishuli River (Figure 4) and is comprised of colluvial soil with abundant large boulders. Total length of the profile is 400m. Data acquisition was carried out using Wenner Array with an electrode spacing of 10m.

Figure 5-3: Photograph showing a seasonal spring S-G1 in the Gogane area (view to the NW).

The ERT lines in Gogane area are shown in Figure 1. Altogether three profiles, namely ERT-G1, ERT-G2, and ERT-G3, were surveyed in the area. Among them ERT-G1 is along the alignment of headrace tunnel while ERT-G2 and ERT-G3 are across the alignment of headrace tunnel.

Figure 5 shows the best-fit resistivity model along this profile with root mean square errot of 7.6%. In electrical resistivity tomography with long profile (>250m) the level of error generally ranges between 5 and 10%.

The resistivity tomogram (Figure 5) shows a wide range in the electrical properties of the subsurface material. The resistivity at the surface exceeds 9000 Ohm-m while at the bottommost part the resistivity drops significantly below 100 Ohm-m. Many isolated patches made of very high resistive (>9000 Ohm-m) surface layers. These isolated patches predominates the surface materials in the southern (south of electrode E15) part of the profile. Thickness of these high resistive surface bodies reaches up to 20m. However these high resistive layers are correlatable with gravel-rich soil, this study is focused in finding water-bodies (aquifers), all the materials exhibiting resistivities above 500 Ohm-m are interpreted as dry soil or bedrock according to the depth of extent of these materials. Resistivity decreases to the depth throughout the profile and reaches the minimum (<100 Ohm-m) at the depth of 60m from the surface. In the northeastern part of the profile, resistivity of the material increases again after reaching the minimum value for example at the electrode E15, resistivity of the layer exceeds 200 Ohm-m at the depth of 78m.

Figure 5-4: Photograph showing the lithology along ERT-G1 (view to the northeast). The white solid line in the figure represents the segment of ERT-G1. A few large boulder are also seen in the figure

The geological section based on the resistivity tomogram is presented in Figure 6. Surface observations during data acquisition provided important a priori information while preparing the geological section. High resistive layers with resistivity > 500 Ohm-m in the tomogram at the upper part of the profile are collectively interpreted as dry colluvium soil. The thickness of the dry soil along this profile ranges between 30 and 50m. The underlying low resistive (<500 Ohm-m) are interpreted as the water bearing layer or aquifer. Along this profile the water body shows a regional extent and dips gently towards northeast. Thickness of this water saturated layer is > 75m in the southern part of the profile where the underlying bedrocks are not detected in the profile. In the northern part of the profile (Figure 5) relatively high resistive layer (>200 Ohm-m) is observed at the depth of 78m. This layer is interpreted as the bedrock (Figure 6).

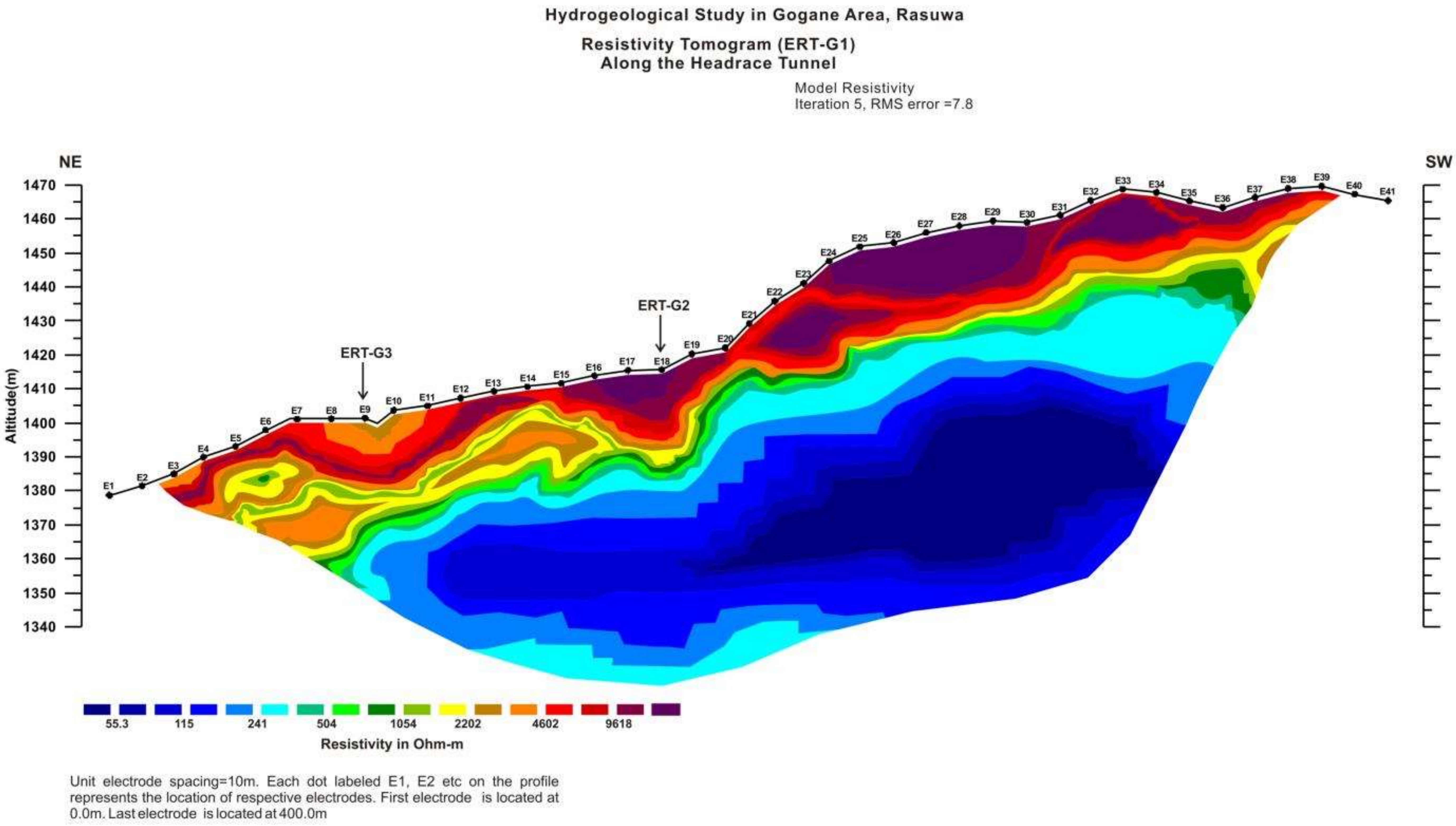

Figure 5-5: Tomogram showing the model resistivity section along the profile ERT-G1. The vertical scale represents the altitude from mean sea level. Horizontal and vertical scales are the same.

Color scale in Ohm-m is shown in the left bottom corner of the figure

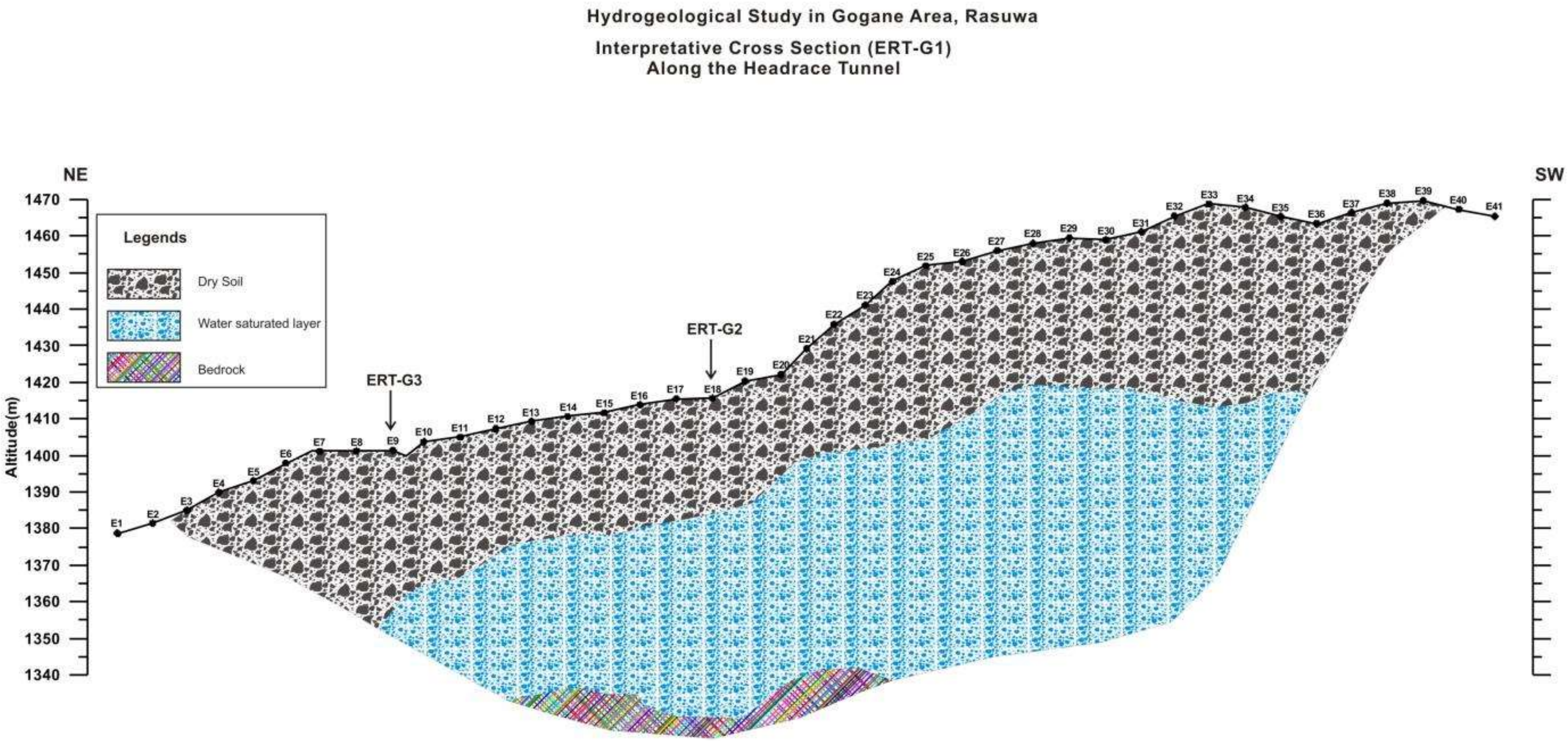

Figure 5-6: Figure 5 7: Interpretative cross section along the profile ERT-G1. The geological section is based on the resistivity tomogram (Figure 5) and observations in the field

ERT-G2

This profile lies across the alignment of the headrace tunnel of the Upper Trishuli-1 Hydroelectric project and crosses ERT-G1 at the chainage of 200m. This profile lies along an adit in this area. The profile is located on a colluvial slope on the right bank of the Trishuli River (Figure 7) and is comprised of colluvial soil with abundant large boulders. Total length of the profile is 400m. Data acquisition was carried out using Wenner Array with an electrode spacing of 10m.

Figure 8 shows the best-fit resistivity model along this profile with root mean square errot of 6.5%. The resistivity tomogram (Figure 8) shows a wide range in the electrical properties of the subsurface material. The resistivity at the surface exceeds 9000 Ohm-m while the bottommost layers in the southeastern part of the profile exhibit significantly low (below 100 Ohm-m) resistivity. Two isolated patches made of very high resistive (>9000 Ohm-m) surface layers are observed in the northwestern part of the profile. Thickness of the high resistive surface bodies reaches up to 16m. These high resistive layers are correlatable with gravel-rich soil. A small patch of low resistive (<200 Ohm-m) layers is observed below the depth of 20m (at electrode E25) in the northwestern part of the profile. This low resistive body gently dips southeastward and disappears further south from electrode E33. A regional body of low resistive layers appears below the depth of 35m at electrode E31 and dips gently to the southeast. This regional body of low resistive layers is separated from a local body of low resistive layers in south by relatively high resistive (>2000 Ohm-m) layers. This body of high resistive layers, dips steep at the beginning then gently towards northwest and extends between E23 and E33 at the the bottommost part of the profile. The regional low resistive body seen below E31 gradually swells northeastward and reaches the bottommost part of the profile from E21.

Figure 9 represents the geological section along profile ERT-G2. The geological section is prepares based on the resistivity tomogram (Figure 8) and the surface observations during the fieldwork. High resistive layers with resistivity > 500 Ohm-m in the tomogram at the upper part of the profile are collectively interpreted as dry colluvium soil. The thickness of the dry soil is the maximum below E26 and reaches up to 42m. In the northern and southern parts of the profile, the thickness of soil cover is 20 and 15m respectively. A natural spring was observed (S-G1 in Figure 1) near this profile in its northern part such that low resistive body seen in the northern part of the profile in Figure 8 is interpreted as a water bearing body. The average thickness of this local water body is 20m (Figure 9) where water flows southeastward.

Figure 5-7 Photograph showing the lithology along ERT-G2 (view to the northwest). The white solid line in the figure represents the segment of ERT-G2. A few large boulder are also seen in the figure.

The regional low resistive body seen in resistivity tomogram (Figure 8) is also seen in profile ERT-G1 (Figures 5 and 6) and is interpreted as water rich material (aquifer). This regional aquifer is separated from the local aquifer seen in the northern part of the profile by high resistive (and thus less permeable) materials interpreted in Figure 9 as bedrocks. The maximum thickness of the regional water body is 58m below E15. To the south of E23 (Figure 8 and 9) the tomogram does not provide any information regarding the underlying material of the regional water body.

ERT-G3

This profile lies across the alignment of the headrace tunnel of the Upper Trishuli-1 Hydroelectric project and crosses ERT-G1 at the chainage of 180m. This profile is located on a colluvial slope on the right bank of the Trishuli River and is comprised of colluvial soil with abundant large boulders. Total length of the profile is 400m. Data acquisition was carried out using Wenner Array with an electrode spacing of 10m.

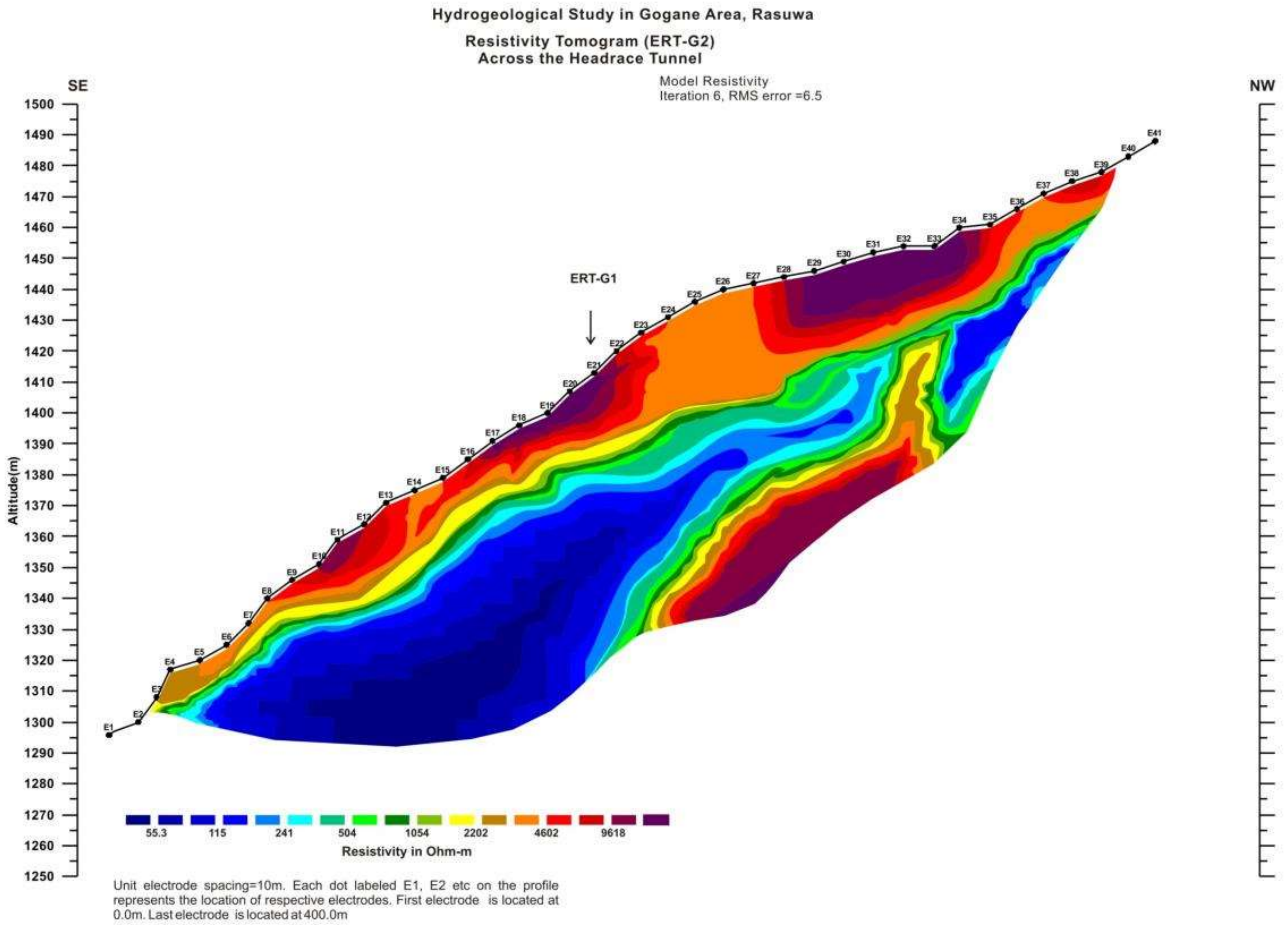

Figure 5-8: Tomogram showing the model resistivity section along the profile ERT-G2. The vertical scale represents the altitude from mean sea level. Horizontal and vertical scales are the same.

Color scale in Ohm-m is shown in the left bottom corner of the figure

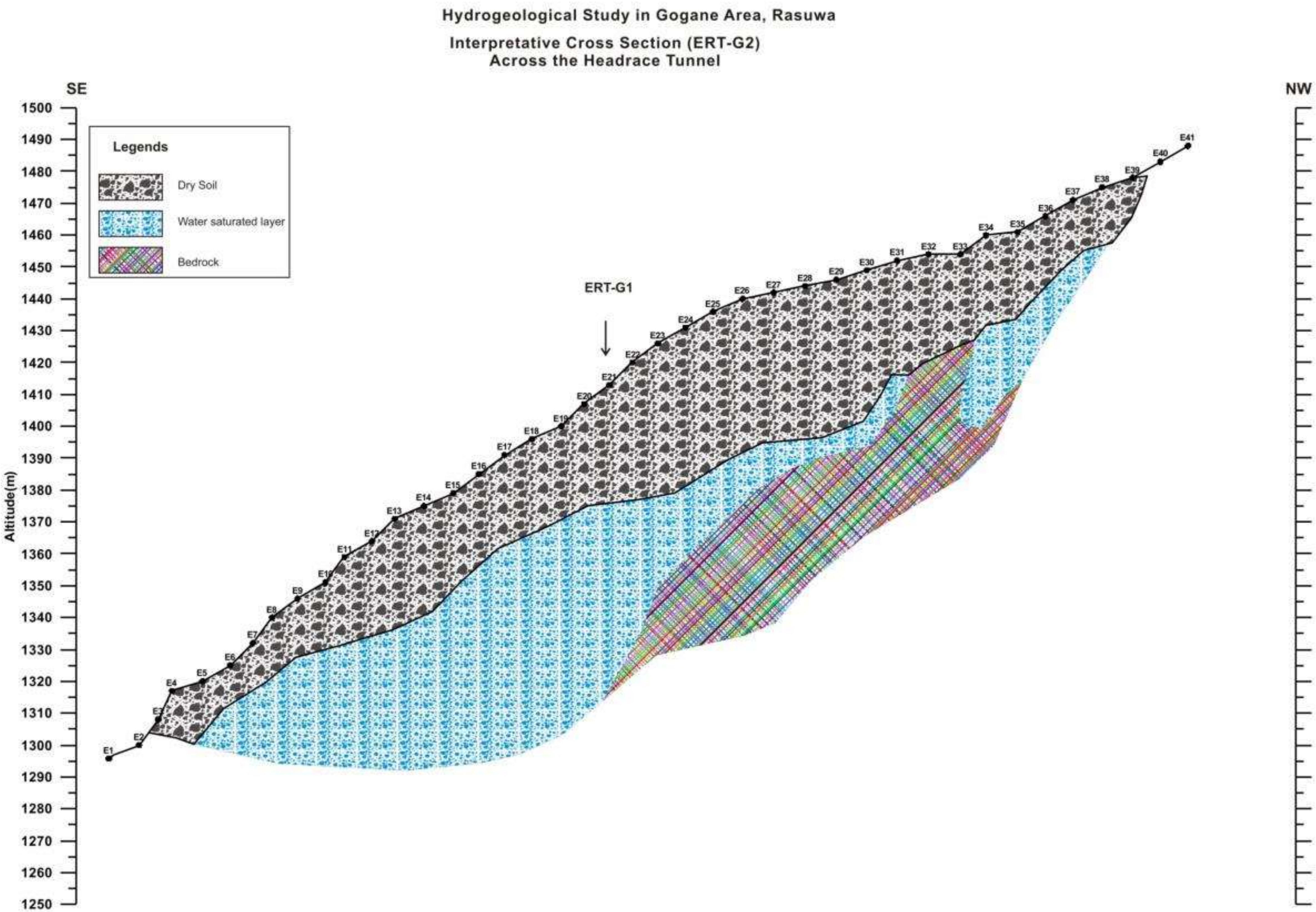

Figure 5-9: Interpretative cross section along the profile ERT-G2. The geological section is based on the resistivity tomogram (Figure 8) and observations in the field

The best-fit resistivity model with root mean square error of 5.9% is shown in Figure 10. The resistivity tomogram shows a wide range in the electrical properties of the subsurface material. The resistivity at the surface exceeds 9000 Ohm-m while the bottommost layers in the southeastern part of the profile exhibit significantly low (below 100 Ohm-m) resistivity. A large isolated patch made of very high resistive (>9000 Ohm-m) surface layers is observed between E26 and E31 in the northern part of the profile with the maximum thickness of 27m below E29. To the further north two small patches of high resistive layers are observed. Another high resistive patch is observed in the southernmost part of the profile at the depth of 8m below E6. These high resistive layers are correlatable with gravel-rich soil. To the north of E32 at intermediated depths (between 15 and 25m) a small patch of low resistive layers (<200 Ohm-m) is observed. The average thickness of this low resistive body is 10m. This low resistive body gently dips southeastward and disappears. Further to the south, a small isolated patch of low resistivity is observed at the depth of 32m below E32. Another anomalous low resistive patch surrounded by high resistive layers is observed at the depth of 48m below E24. A regional body of low resistivity up to the bottommost part of the profile is observed toward the south of E22. To the north of E22, the resistivity tomogram shows a pattern with high resistive surface layers underlain by relatively low resistive layers which are further underlain by high resistive layers. The topmost high resistive layers throughout the profile exhibit an irregular pattern with some isolated patches of very high resistivity while the bottommost high resistive layers are regular and continuous.

Based on the ERT results (Figure 10) and the surface observations a geological section along this profile is prepared and presented in Figure 11. Similar to the previous profiles the high resistive upper layers are interpreted as dry colluvium soil and the low resistive bodies are interpreted as water bearing materials (aquifer) along this profile. Average thickness of the colluvium soil along this profile is 40m. Similar to the previous profiles a regional water body is observed in the southeastern part of the profile. A local aquifer is found on the northeastern part of the profile at the depth of 18m, which gently dips southward. Besides these water bodies, other three small patches of water rich material are observed along this profile. The regional water body along this profile is underlain by bedrock particularly in the southern part of the profile (Figure 11).

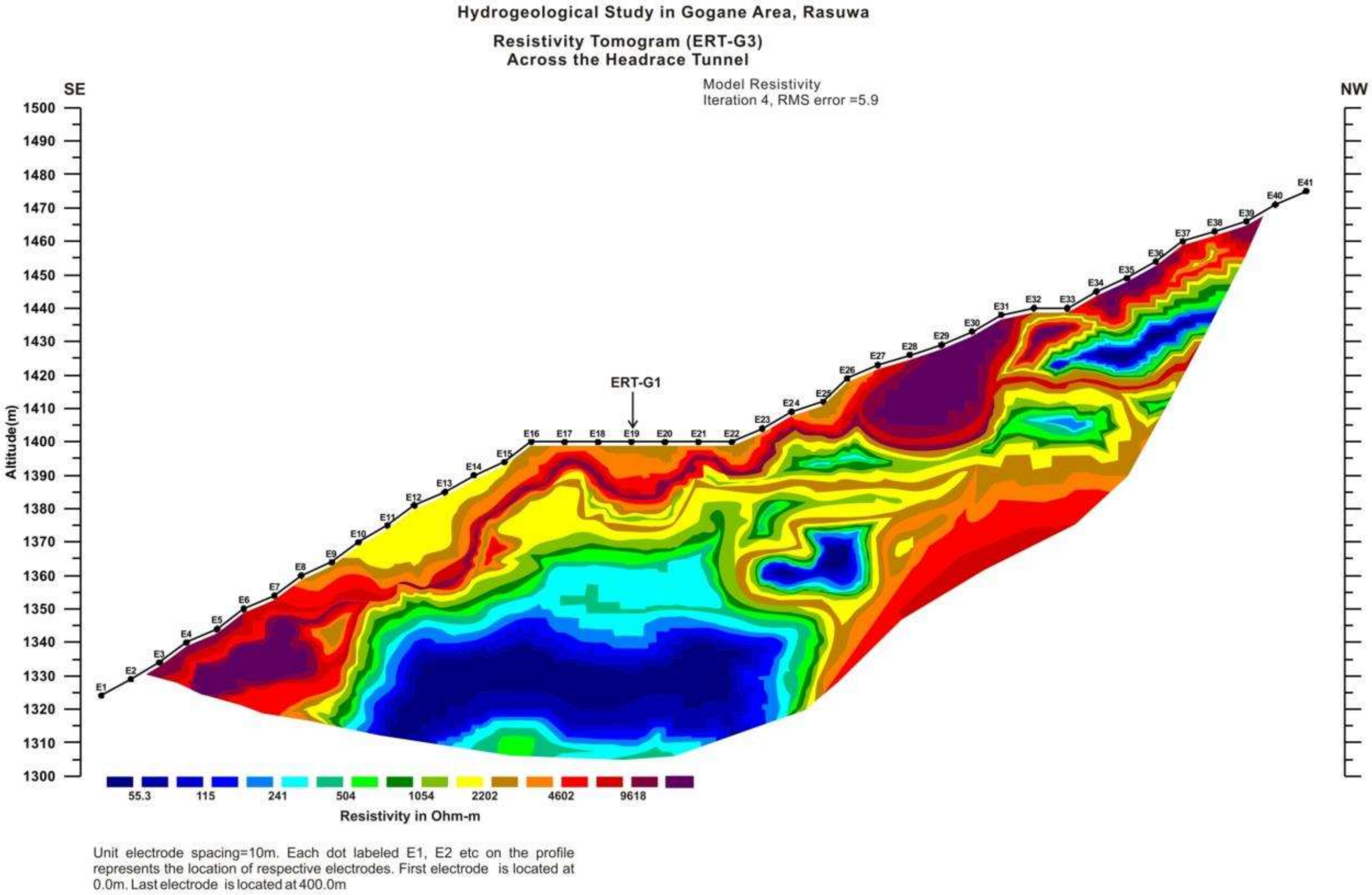

Figure 5-10: Tomogram showing the model resistivity section along the profile ERT-G3. The vertical scale represents the altitude from mean sea level. Horizontal and vertical scales are the same. Color scale in Ohm-m is shown in the left bottom corner of the figure

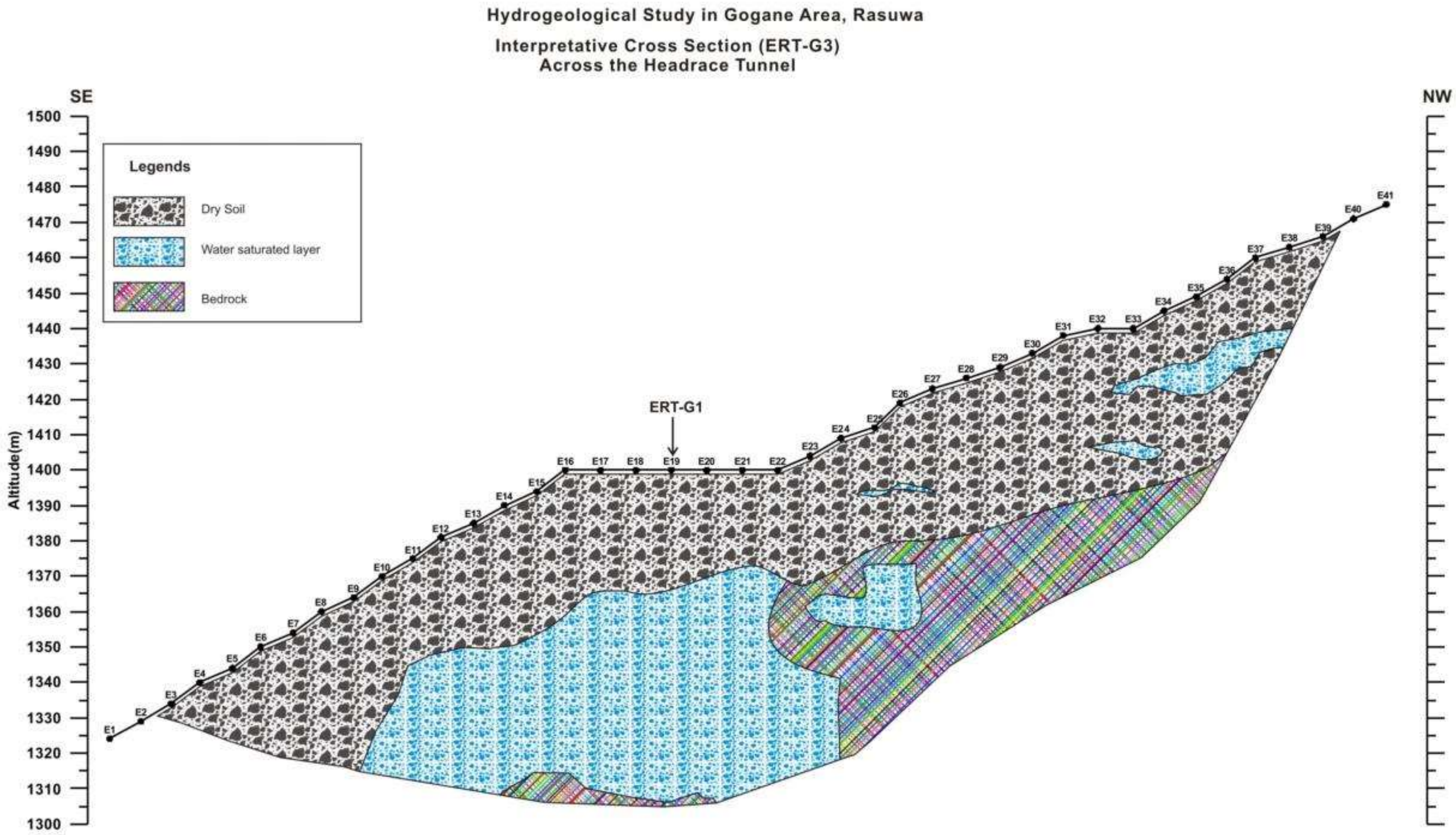

Figure 5-11: Interpretative cross section along the profile ERT-G3. The geological section is based on the resistivity tomogram (Figure 10) and observations in the field

The electrical resistivity tomography in Gogane area unveils two kinds of water bodies in the subsurface, deep aquifer and shallow aquifer. The deep aquifer identified along all three ERT profiles is a regional aquifer seated at the depth below 30m from the ground surface having an average thickness of 60m. The aquifer shows gentle dip towards south along ERT-G2 and ERT-G3 indicating that the regional flow direction of this aquifer is towards the Trishuli River. Along profiles ERT-G1 and ERT-G3, bedrocks underlie this regional aquifer indicating that aquifer material is comprised partly of bedrock (deeper part) and partly of soil (shallower part). Considering an average resistivity of 200 Ohm-m for the aquifer material and 40 Ohm-m for the ground water, using Archie's formula the effective porosity of this aquifer material is calculated to be 40%. In the calculation the upper half part of the aquifer is assumed to compose unconsolidated soil while the lower half part of the aquifer is assumed to compose fractured rocks (phyllite as observed in the area).

The shallow aquifers are localized in the northern part of ERT-G2 and ERT-G3 (Figures 9 and 11) at shallow depths (15-20m) with average thickness of 10m. These aquifers are the main sources of water for domestic purpose in Gogane area. Both of these aquifers are manifested in the surface by springs S-G1 and S-G2 (Figure 1). These aquifers are developed in the colluvial soil and show no relation with the regional aquifer. In both of the profiles, high resistive less permeable layers surround these aquifers. Considering an average resistivity of 200 Ohm-m for aquifer material (unconsolidated sediments) and 40 Ohm-m for the ground water, using Archie's formula the effective porosity is calculated as 44%.

Hakubesi Area

Hakubesi is a small village of Haku VDC lying along the proposed headrace tunnel at about 5km downstream from the proposed intake on the right bank of the Trishuli River. In this area, domestic water is supplied from natural springs S-H1 and S-H2. Spring S-H1 is located at the end of the Hakubesi village while Spring SH-2 lies on the upper part of the village (Figure 2). Both of these springs are perennial and supplies sufficient water even in dry season in the area for drinking and other domestic purposes (Figures 12).

ERT-H1

This profile lies along the alignment of the headrace tunnel of the Upper Trishuli-1 Hydroelectric project in Hakubesi village. ERT-H2 and ERT-H3 crosses this profile at the chainage of 360m and 90m respectively. The profile is located on a colluvial slope on the right bank of the Trishuli River (Figure 13) and is comprised of colluvial soil with abundant large boulders. Total length of the profile is 400m. Data acquisition was carried out using Wenner Array with an electrode spacing of 10m.

Figure 5-12: Photographs showing natural spring in the Hakubesi area; the left panel shows the status of spring S-H1 and the right panel shows the status of spring S-H2.

Figure 5-13: Photograph showing the lithology along ERT-H1 (view to the northeast). The white solid line in the figure represents the segment of ERT-H1. A few large boulder are also seen in the figure.

The best-fit resistivity model with root mean square error of 6.9% is shown in Figure 14. The resistivity tomogram shows a wide range in resistivity of the subsurface material. The resistivity tomogram shows a regional body of low resistivity (<500 Ohm-m) which is overlain and underlain by high resistive layers. The resistivity at the surface exceeds 9000 Ohm-m giving rise to many isolated patches of high resistivity throughout the profile. Thickness of these very high resistive patches reaches up to 22m. These high resistive isolated patches are correlatable with boulder rich soil. Resistivity of the subsurface material decreases to the depth. Below 22m (in the northern part of the profile) and 37m (in the southern part of the profile) resistivity drops below 500 Ohm-m. Below 50m from the surface, resistivity drops to the minimum value of 50 Ohm-m. From the depth of 75m, resistivity increases again and reaches up to 9000 Ohm-m at the bottommost part of the profile.

Based on the ERT results (Figure 14) and the surface observations an interpretative cross section along this profile is prepared in Figure 15. The high resistive layers overlying the regional body of low resistivity (Figure 14) are interpreted as dry colluvium soil. Average thickness of the colluvium along this profile is 40m. The colluvium cover is almost regular throughout the profile. Regional, low resistive body observed on the tomogram below 20m from the surface represents water rich materials (aquifer) with an apparent flow direction of groundwater toward northeast. Average thickness of this aquifer is 48m and is almost regular throughout the profile. High resistive layers underlying this low resistive regional body are continuous and exhibit a regular pattern. These high resistive layers are interpreted as bedrocks. Depth to the bedrock is 50m at the central part of the profile (at E21, Figure 15). The aquifer interpreted so far should comprise colluvial soils in the topmost part and fractured rocks in the bottommost part.

ERT-H2

This profile lies across the alignment of the headrace tunnel of the Upper Trishuli-1 Hydroelectric project in Hakubesi village. ERT-H1 crosses this profile at the chainage of 250m. The profile is located on a colluvial slope on the right bank of the Trishuli River and is comprised of colluvial soil with abundant large boulders. Total length of the profile is 400m. Data acquisition was carried out using Wenner Array with an electrode spacing of 10m.

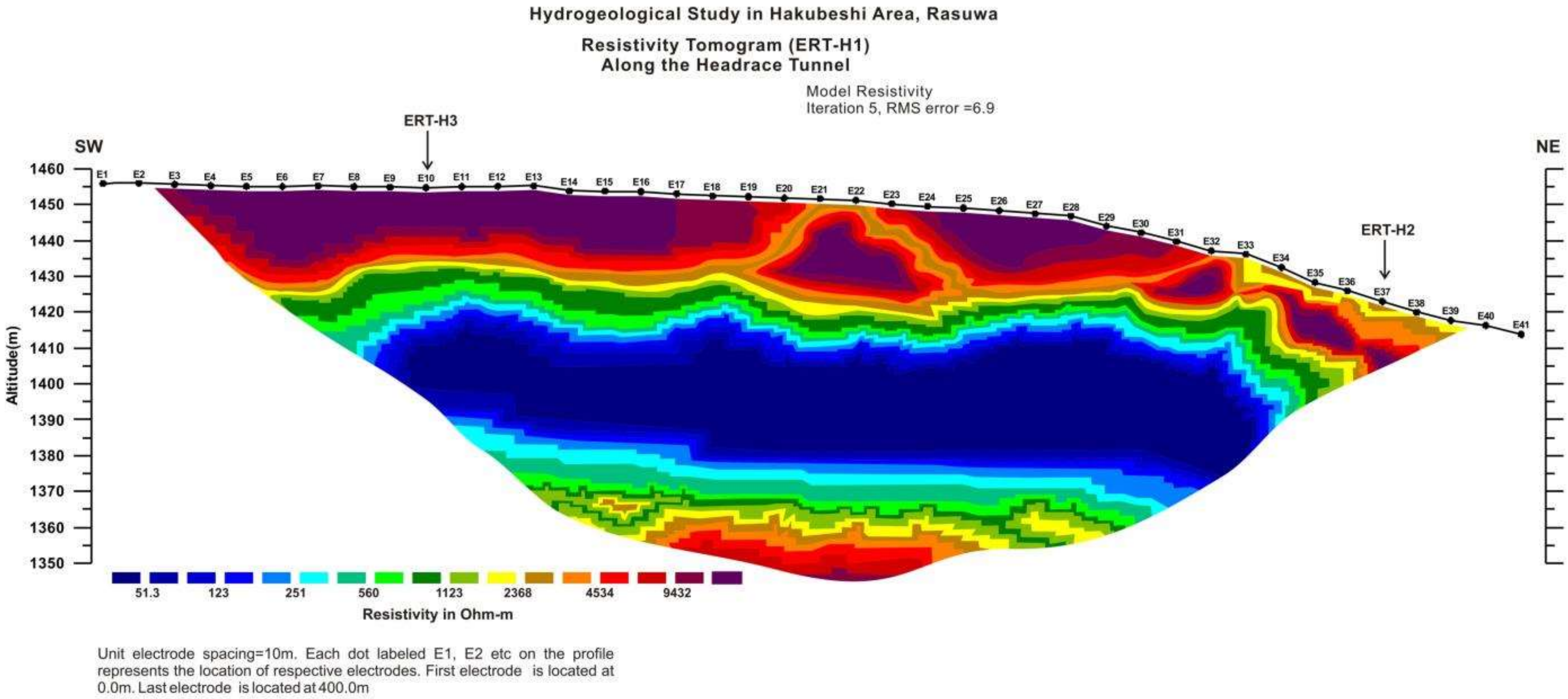

Figure 5-14: Tomogram showing the model resistivity section along the profile ERT-H1. The vertical scale represents the altitude from mean sea level. Horizontal and vertical scales are the same. Color scale in Ohm-m is shown in the left bottom corner of the figure. Arrows labeled as ERT-H2 and ERT-H3 represent the positions of ERT-H2 and ERT-H3 on this profile

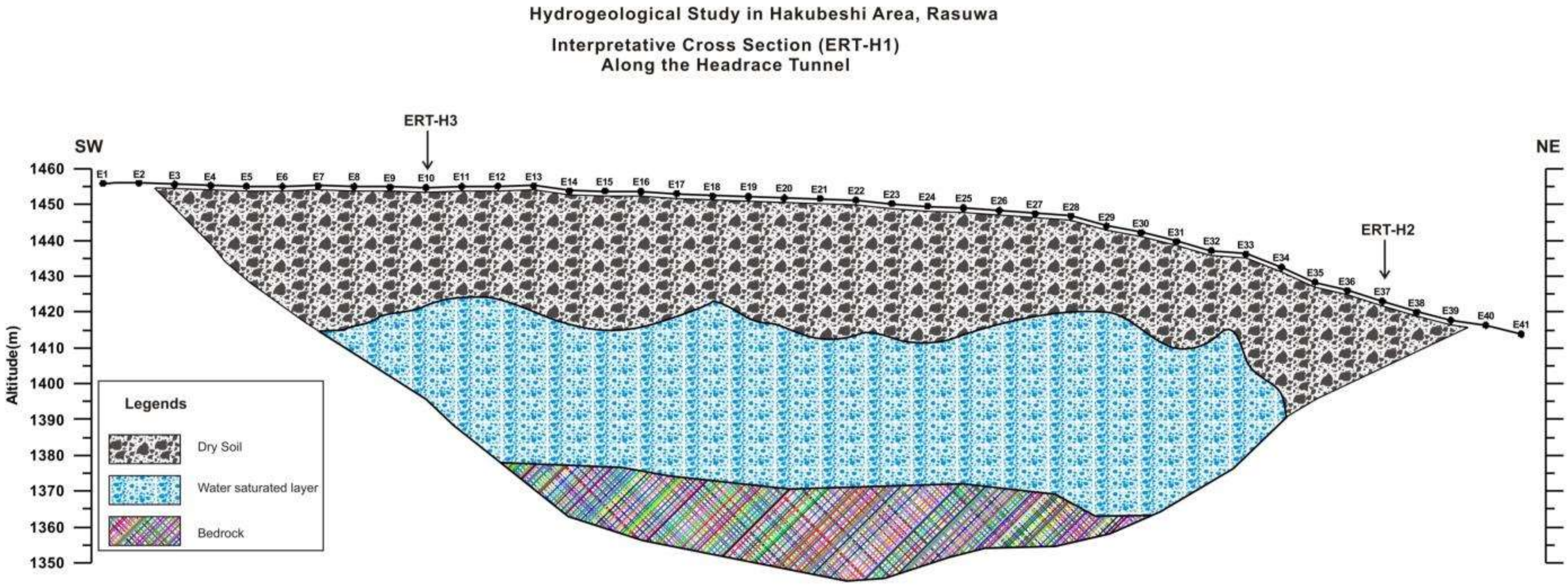

Figure 5-15: Interpretative cross section along the profile ERT-H1. The geological section is based on the resistivity tomogram (Figure 14) and observations in the field

Figure 16 shows the best-fit resistivity model with root mean square error of 4.7% along this profile. A wide range in resistivity of the subsurface material is evident from the model resistivity section. To the northwest of E22 a large body of high resistive (>9000 Ohm-m) layers is seen near the ground surface. Another surface patch of high resistive layers is observed on the northernmost part of the profile between E34 and E36. To the south of E22 patches of low resistive layers underlie intermediately resistive (<5000 Ohm-m) surface layers at an average depth of 18m. These patches of low resistive layers are separated from a regional body of low resistivity by a thin layer of intermediate resistivity. The regional body of low resistive layers (<500 Ohm-m) appears at the depth of 68m below E27 and extends to the southern part of the profile (Figure 16). In the northern (north of E28) part of the profile, a southerly dipping body of low resistive (<500 Ohm-m) appears. It is located below the depth of 50m near E28 while at E36 this low resistive body is located below 28m. Average thickness of this low resistive body is 18m. The regional low resistive body in the southern part of the profile is separated from this relatively thin low resistive body by high resistive layers. Between E24 and E34 the bottommost part of the profile exhibit high ressitive layers.

Based on the ERT results (Figure 16) and the surface observations an interpretative cross section along this profile is prepared in Figure 17. The high resistive layers overlying the regional body of low resistivity (Figure 15) are interpreted as dry colluvium soil. Small low resistive patches in the southern part of the profile are interpreted as local patches of water saturated colluvium soil. A south dipping low resistive body seen in the northernmost part of the profile is interpreted as a local water body. Thickness of the colluvium soil along this profile reaches the maximum of 50m at the central part of the profile, near E25 (Figure 17). The high resistive layers observed in the deeper of the profile are interpreted as bedrock. As shown in Figure 17, the water body in the northernmost part of the profile is developed in the colluvium soil while the regional water body in the southern part of the profile is comprised of both the colluvium soil and bedrocks.

ERT-H3

This profile lies across the alignment of the headrace tunnel of the Upper Trishuli-1 Hydroelectric project in Hakubesi village. ERT-H1 crosses this profile at the chainage of 240m. The profile is located on a colluvial slope on the right bank of the Trishuli River and is comprised of colluvial soil with abundant large boulders (Figure 18). Total length of the profile is 400m. Data acquisition was carried out using Wenner Array with an electrode spacing of 10m.

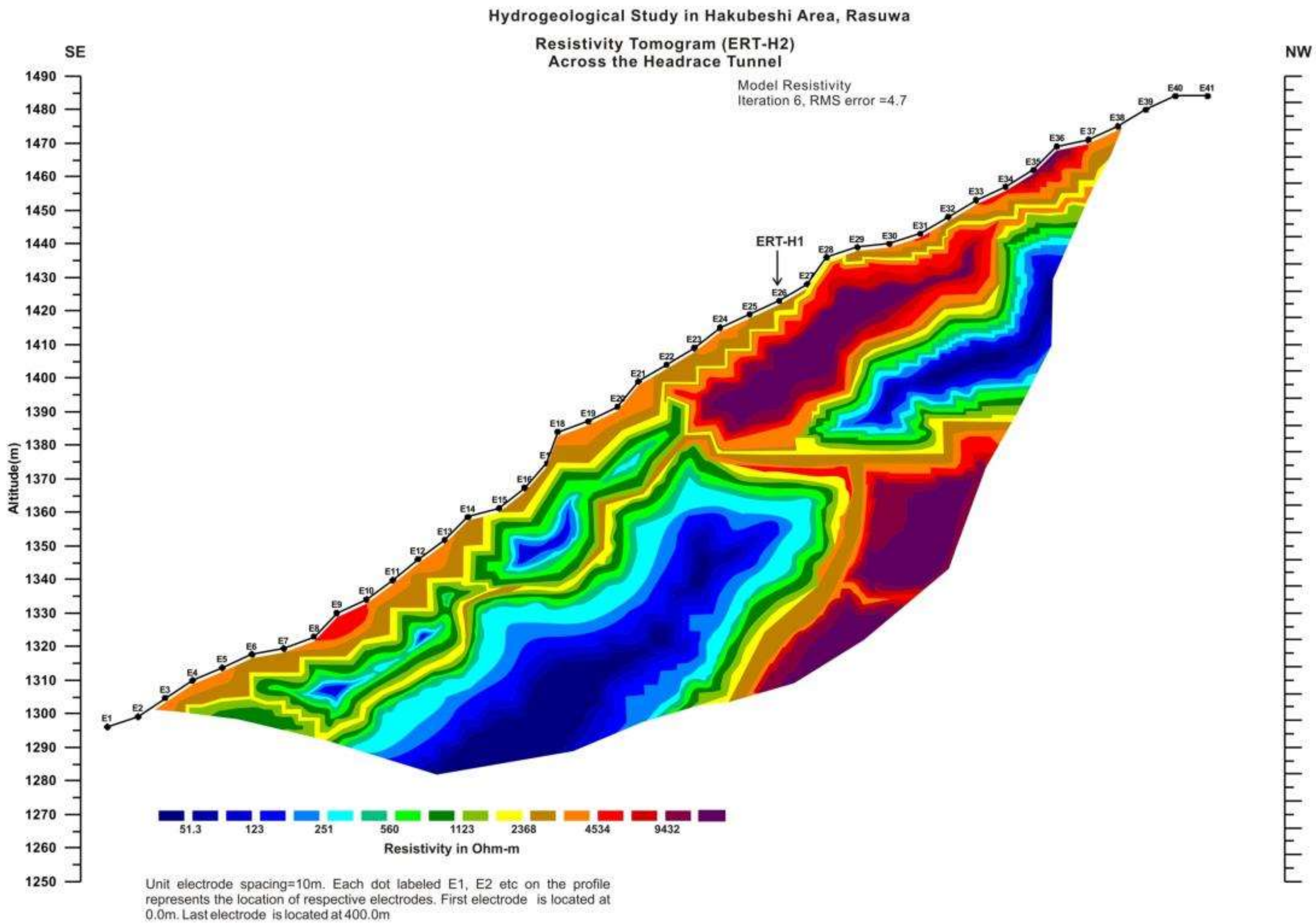

Figure 5-16: Tomogram showing the model resistivity section along the profile ERT-H2. The vertical scale represents the altitude from mean sea level. Horizontal and vertical scales are the same. Color scale in Ohm-m is shown in the left bottom corner of the figure. Arrow labeled as ERT-H1 represents the positions of ERT-H1 on this profile

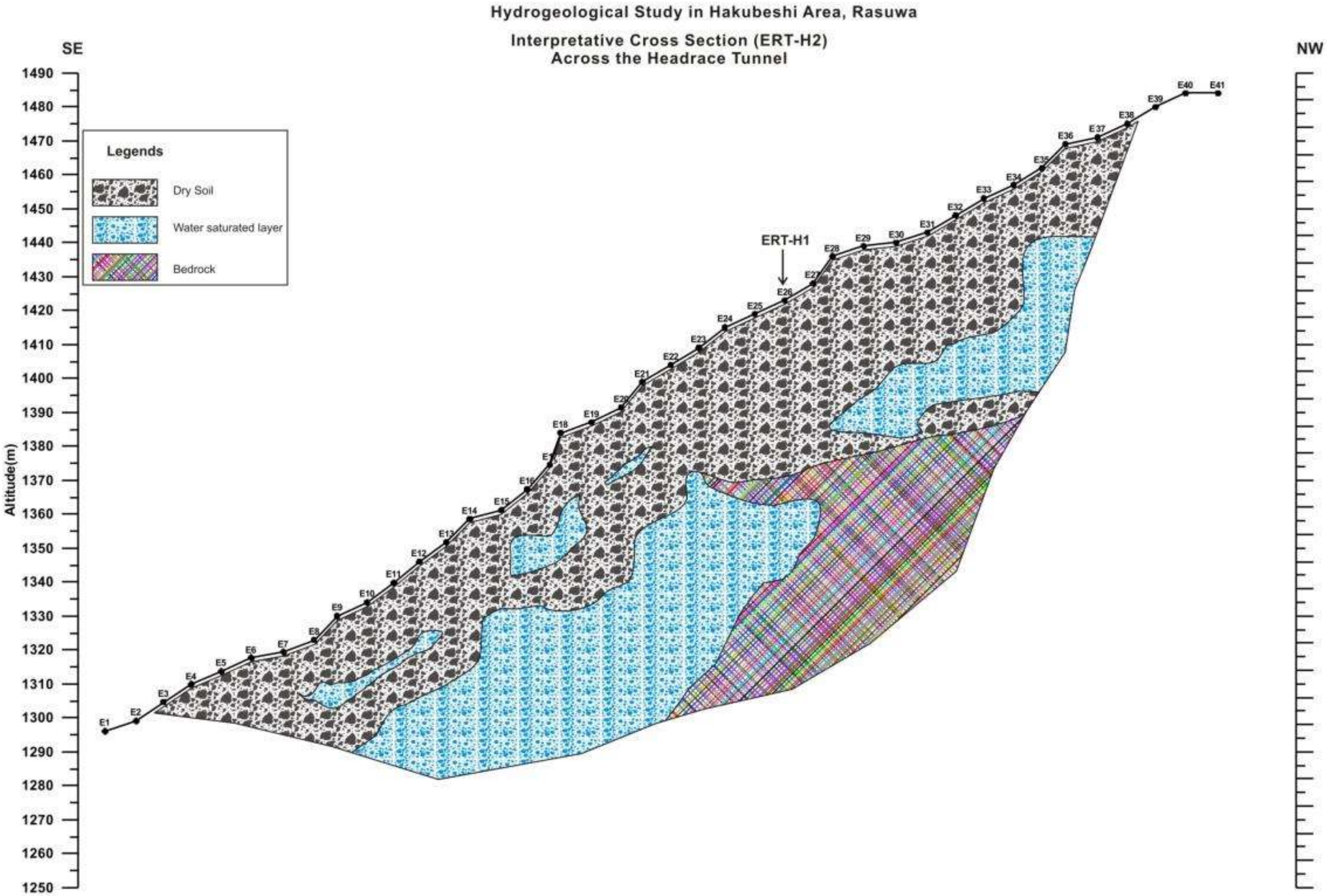

Figure 5-17: Interpretative cross section along the profile ERT-H2. The geological section is based on the resistivity tomogram (Figure 16) and observations in the field

Figure 5-18: Photograph showing the lithology along ERT-H3 (view to the northwest). The white solid line in the figure represents the segment of ERT-H3. A few large boulder are also seen in the figure

The best-fit resistivity model with root mean square error of 6.7% along this profile, is presented in Figure 19. A wide range in resistivity of the subsurface material is evident from the model resistivity section. To the northwest of E21 many patches of high resistive (>9000 Ohm-m) layers are observed. These high resistive surface bodies are the representative of boulder rich colluvial soil. To the south of E21, surface layers exhibit intermediate resistivity (<5000 Ohm-m). Thickness of high resistive (>500 Ohm-m) surface layers varies between 20m (in the southernmost part of the profile) and 45m in the northern part of the profile. Resistivity of subsurface material decreases to the depth forming three bodies of low resistivity (<500 Ohm-m) at different depths. A low resistive body with average thickness of 22m appears in the northwestern part of the profile at the depth of 42m below E34. This low resistive body dips very gentle to the southeast and disappears southward from E27. A large body of low resistive layers with an average thickness of 50m is observed at the depth of 33m from E25. This low resistive body dips steep to the south and reaches at the depth of 65m below E15. Another small body of low resistive layers is seen in the southeastern corner of the profile at the depth of 21m below E9 (Figure 19) with an average thickness of 10m. These low resistive bodies are separated from each other by intermediate resistive (<5000 Ohm-m) layers. To the deeper part, resistivity increases again and reaches up to 9000 Ohm-m at the bottommost part of the profile (Figure 19).

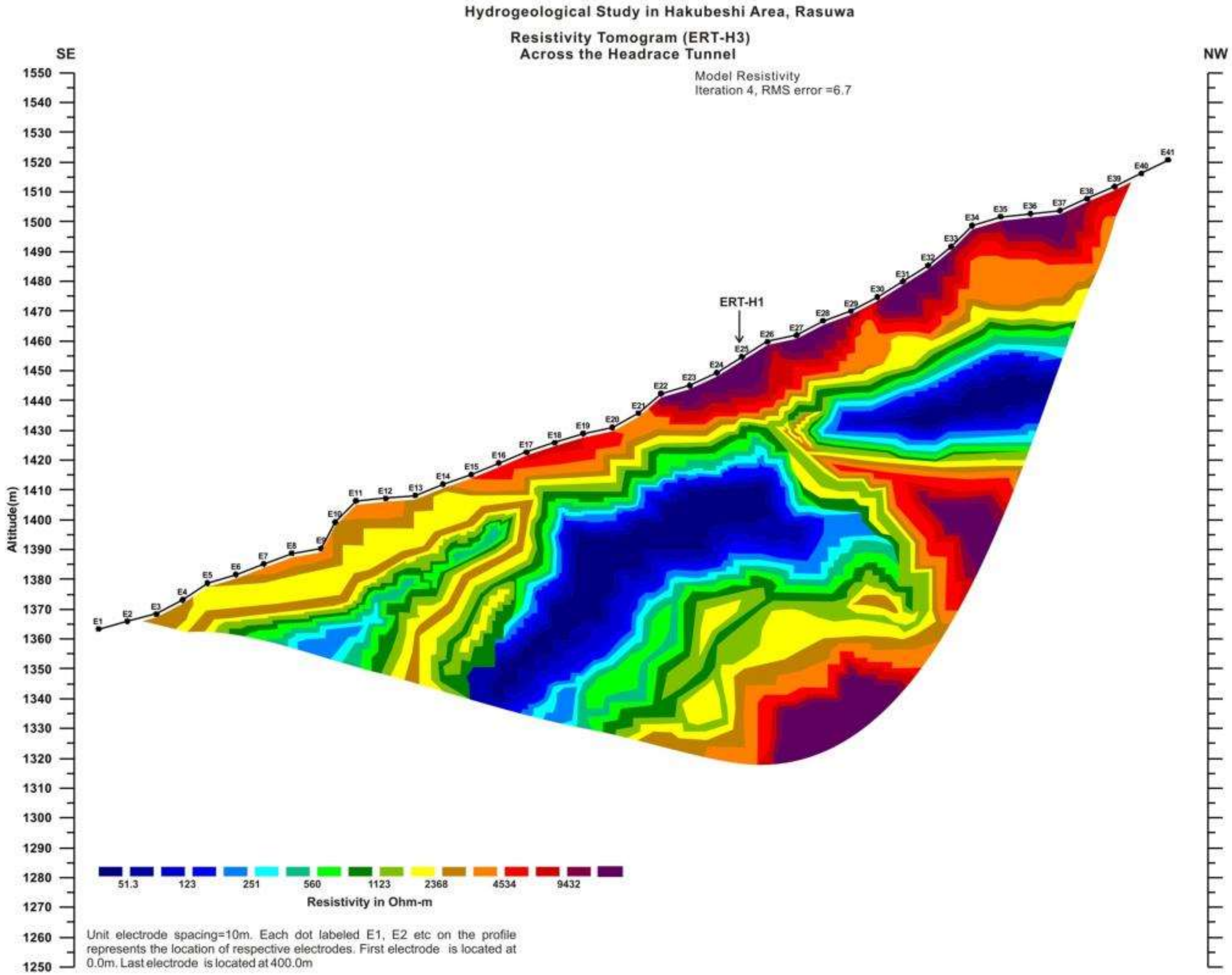

Figure 5-19: Tomogram showing the model resistivity section along the profile ERT-H3. The vertical scale represents the altitude from mean sea level. Horizontal and vertical scales are the same. Color scale in Ohm-m is shown in the left bottom corner of the figure. Arrow labeled as ERT-H1 represents the positions of ERT-H1 on this profile

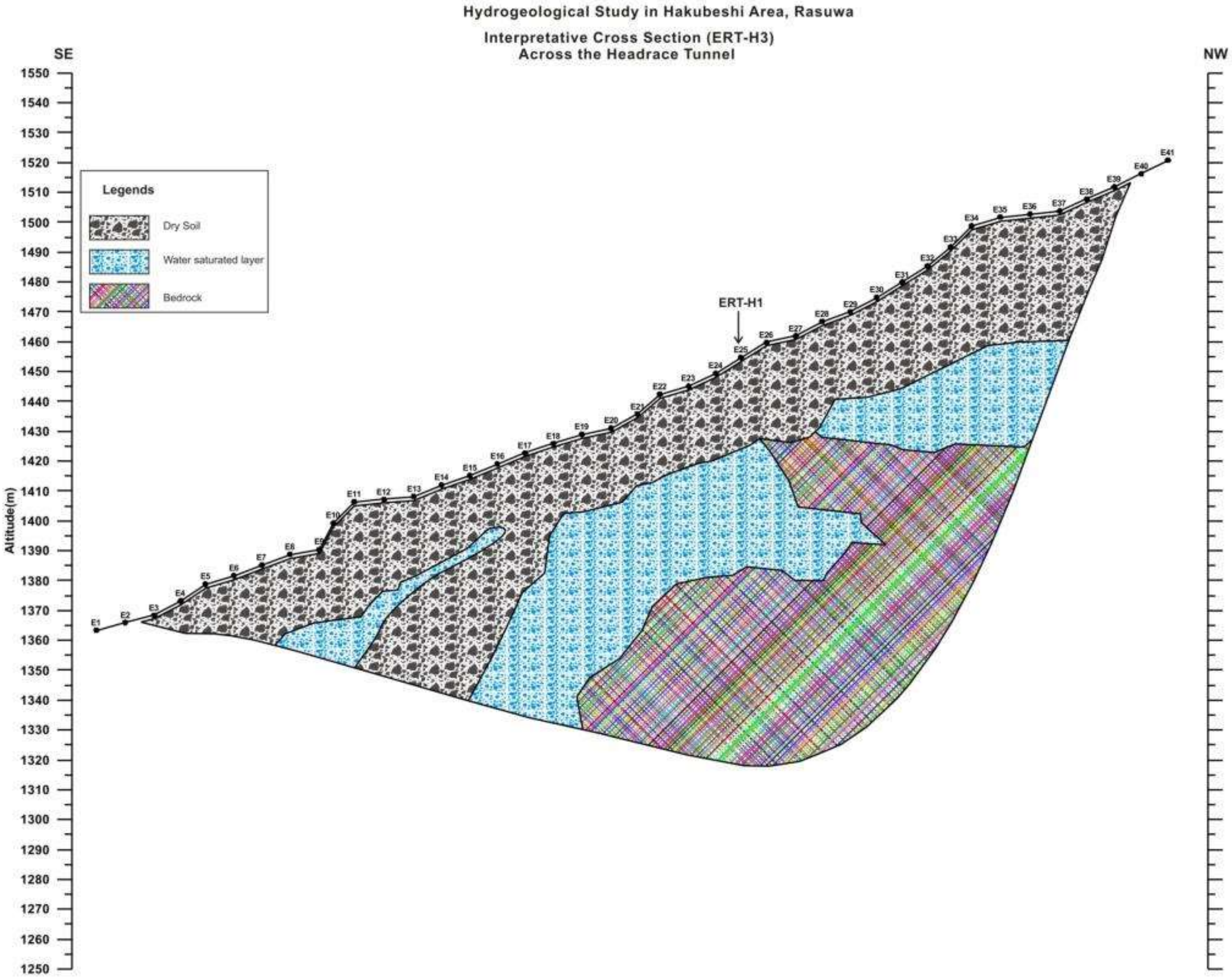

Figure 5-20: Interpretative cross section along the profile ERT-H3. The geological section is based on the resistivity tomogram (Figure 19) and observations in the field

Based on the ERT results (Figure 19) and the surface observations an interpretative cross section along this profile is prepared in Figure 20. The high resistive layers overlying the low resistive bodies are interpreted as dry colluvium soil. The low resistive bodies are interpreted as subsurface water bodies (aquifers) and the high resistive layers at the deeper part are interpreted as bedrocks.

The electrical resistivity tomography in Hakubesi area unveils two kinds of water bodies in the subsurface, deep aquifer and shallow aquifer. The deep aquifer identified along all three ERT profiles is a regional aquifer seated at the depth below 25m the ground surface having an average thickness of 50m. The aquifer shows gentle dip towards south along ERT-H2 and steep dip towards south along ERT-H3 indicating that the regional flow direction of this aquifer is towards the Trishuli River. Along all profiles in Hakubesi area, bedrocks are inferred at depths of more than 50m. The deeper or regional aquifer thus is composed partly of bedrock (deeper part) and partly of soil (shallower part). Considering an average resistivity of 200 Ohm-m for the aquifer material and 40 Ohm-m for the ground water, using Archie's formula the effective porosity of this aquifer material is calculated to be 40%. In the calculation the upper half part of the aquifer is assumed to compose unconsolidated soil while the lower half part of the aquifer is assumed to compose fractured rocks (phyllite as observed in the area).

The shallow aquifers are localized in the northern part of ERT-H2 and ERT-H3 (Figures 17 and 20) at shallow depths (15-20m) with average thickness of 10 to 15m. These aquifers are the main sources of water for domestic purpose in Hakubesi area. Both of these aquifers are manifested in the surface by springs S-H1 and S-H2 (Figure 1). These aquifers are developed in the colluvial soil and show no relation with the regional aquifer. In both of the profiles, high resistive less permeable layers surround these aquifers. Considering an average resistivity of 200 Ohm-m for aquifer material (unconsolidated sediments) and 40 Ohm-m for the ground water, using Archie's formula the effective porosity is calculated as 44%.

5.4 Conclusions

The detailed interpretation of the result of the 2D-ERT has already been discussed in the previous chapters. The main conclusions are provided in the following sections.

5.4.1 Hydrogeological Conditions in Gogane Area

In the Gogane area, local people are depended on two natural springs for domestic water. Water from these springs is insufficient for the local people during the dry season. People supply deficit water during dry season from the neighboring villages.

The electrical resistivity tomography in this area unveiled two kinds of underground water bodies. The shallow one is confined in colluvium deposit in the northern region and correlates well with the existing natural sources of water. This underground water body is separated from the deeper water body by less permeable layers, rocks or colluvium soil. The effective porosity of the aquifer material is high (44%).

The deep aquifer is a regional aquifer and exhibits an effective porosity of 40%. It is underlain by bedrocks and is composed partly of bedrocks and partly of colluvium soil.

Both the subsurface water bodies in the area exhibit a flow direction towards Trishuli River.

5.4.2 Hydrogeological Conditions in Hakubesi Area

Sufficient water supply for local people exists in Hakubesi area. There are two natural perennial springs in this area.

Similar to the Gogane area, the electrical resistivity tomography in this area unveiled two kinds of underground water bodies. The shallow one is confined in colluvium deposit in the northern region, flow toward southward and correlates well with the existing natural sources of water. This underground water body is separated from the deeper water body by less permeable layers, rocks or colluvium soil. The effective porosity of the aquifer material is high (44%).

The deep aquifer is a regional aquifer flowing southward and exhibits an effective porosity of 40%. It is underlain by bedrocks and is composed partly of bedrocks and partly of colluvium soil.

5.4.3 Impact of Headrace Tunnel on Present hydro geological Conditions

Since the proposed headrace tunnel in both areas passes below 175 m from the surface, impacts of the tunnel on the shallow aquifers are not expected. These shallow water bodies in both areas are developed in the soil colluvium, in a superficial layer. Cracks or other geology disruptions during the excavation of the tunnel are unlikely to affect the surface aquifers.

The deep aquifer is a regional one and exhibits an effective porosity of 40%. It is developed partly on bedrocks in both Gogane and Hakubesi areas such that pervasively developed cracks and fractures during the construction of tunnel may drain water from this aquifer. However, these cracks and fractures would be filled in during the sealing of the tunnel.

5.4.4 Recommendations

The resistivity study contributes to the understanding of hydrological functioning and connectivity of the Project area. No significant impacts are expected as a consequence of the tunnel construction. The information generated is intended to be used as reference or baseline data.

6 Hazard Study: Preliminary Assessment of Landslides along the Tunnel Alignment

6.1 Overview

Hydroelectric facilities are vulnerable to several types of natural hazards, especially since they are usually located in steep, mountainous terrain with significant seasonal or annual precipitation. The same physical conditions which favor hydroelectric generation also favor a host of geologic hazards (see Figure 6-1 for a map of the regional geology). Landslides are one of the most pervasive natural hazards. Landslide movement can remove support to the foundations of power stations, dams, tunnels and other structures. It can also affect the function of these facilities by impact or burial from locations upslope. Landslides deliver large amounts of sediment to streams and rivers. This sediment can exceed the ability of intakes to prevent its entry into tunnel and cause damage to turbines. Over time, sediment from landslides can affect the efficiency of diversions and reduce the storage capacity of reservoirs.

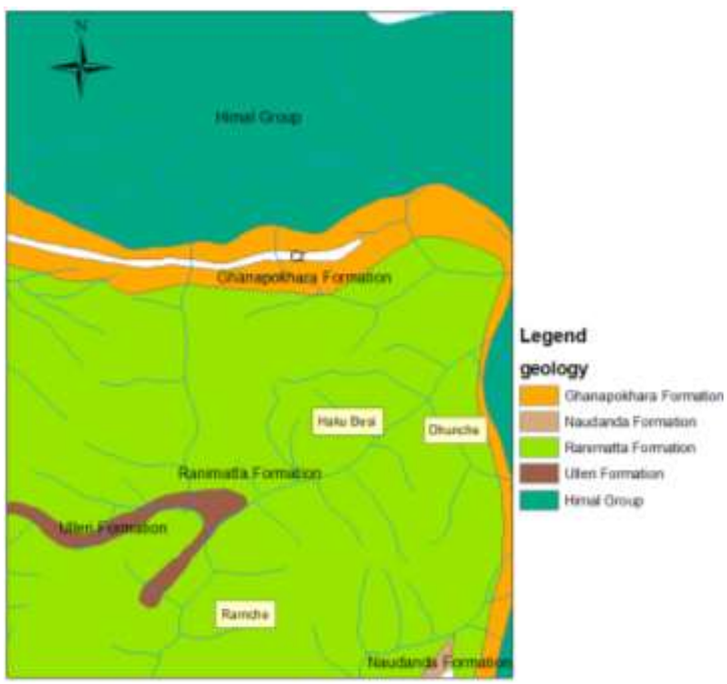

Figure 6-1: Generalized geology of the study area

Nepal is a mountainous Himalayan kingdom with a surface area of 147,181 km^2 (Figure 1). Globally, it is the country with the highest relative relief on earth, with a lowest elevation of 70 m above sea level and a maximum elevation at the summit of Mount Everest of 8848 m.

As would be expected for a country with such an extreme range of elevations, the climate varies greatly, ranging from subtropical on the lowland plains to glacial in the high mountains. The climate throughout most of the country is strongly monsoonal. It is well recognized that landslides occur extensively in the Himalayas, and in particular within Nepal. An area such as the Himalayas should be expected to have a high level of natural landslide activity. In tectonically active mountain chains such as the Himalayas, natural landslides play a fundamental role in the evolution of the landscape, providing a mechanism through which a mass balance can be achieved between uplift and erosion.

This study focuses on the preliminary assessment of landslides along the tunnel alignment of the Project and proposing preventive mitigation measures as required.

6.2 Landslides in the Project Area

Landslides in the project area were identified by the Department of Survey, Government of Nepal from aerial photographs taken in 1992 at scale 1:50,000 and represnted in the topographic map of 1995 on scale 1:25,000. This landslide inventory was verified and updated by a field visit in February 2014. Based on this survey, a polygon map was prepared using GIS (Figure 6-2).

Figure 6-2: Landslide observed at Haku Besi area, view northwest

The landslide distribution map helps with understanding the factors and conditions controlling the landslides and is used as a basis for landslide susceptibility zonation. Preparation of a landslide distribution or inventory map is the most important and initial step for landslide susceptibility analysis.

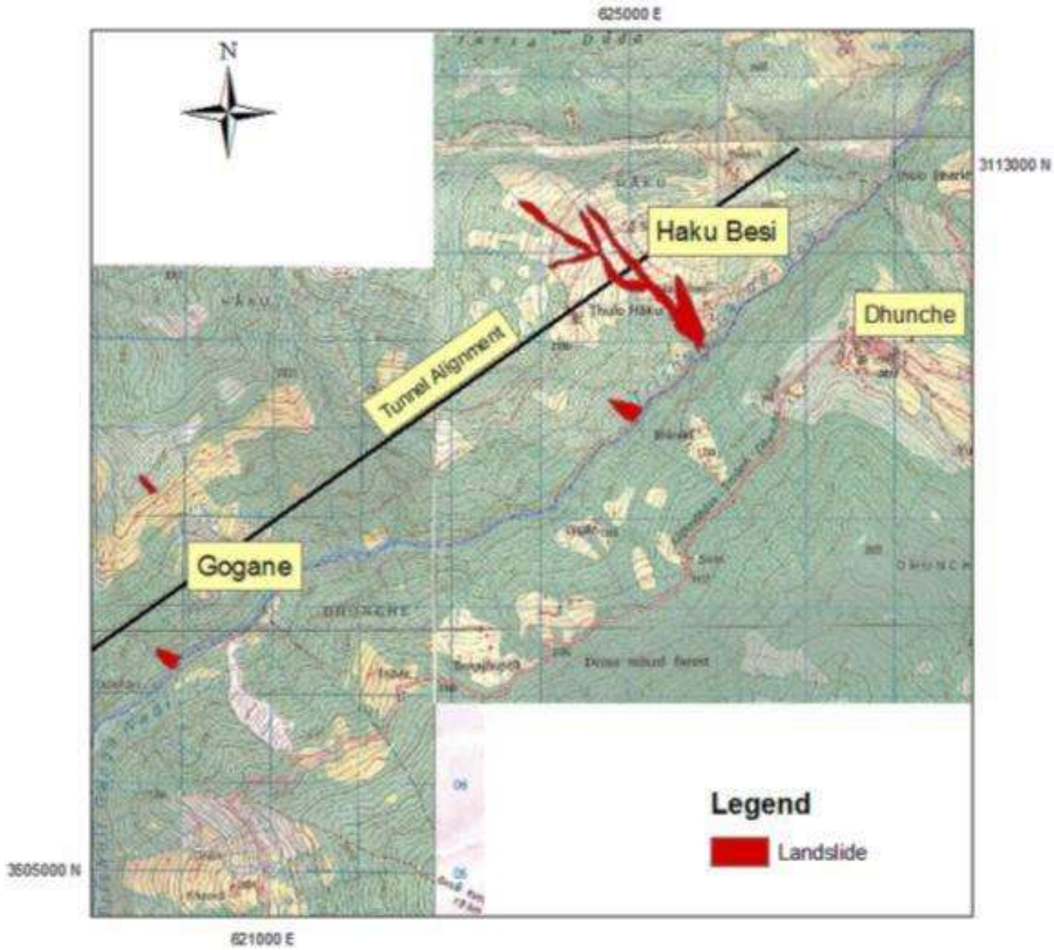

Figure 6-3: Landslide inventory map along the tunnel alignment of Upper Trishuli-A HEP area

Landslides observed along the tunnel alignment are mostly on southeast facing slope with thick soil cover that is prone to landslide. Most of the identified landslides concentrate in the Haku Besi area (Figure 6-3), whith a slope range of 30-35°. The landslide lies in the soft soil cover over the Ranimatta Formation that is represented by dark greenish grey phyllites. The landuse pattern in around Haku Besi shows that most of the land in the lower slope, close to the Trishuli, is dedicated to agriculture. The climatic factor especially high monsoon rainfall in combination with slope, soft soil cover made the area highly susceptible to slope failure. Observations show weak and fragile geology is the main cause of generating landslides in this region. Although observed landslides are not currently active, they constitute a potential threat to the tunnel during construction works. Hence, mitigation works need to be planned.

6.3 Conclusions and recommendations

The study area is characterized by the presence of metamorphic rocks of Ranimatta Formation that is represented by dark greenish grey phyllites. Landslides observed along the tunnel alignment are mostly on southeast facing slope with thick soil cover that is prone to landslide. The number of landslides observed is very few in the periphery of the tunnel alignment especially between Gogane and Haku Besi villages. The landuse pattern in the Haku Besi shows most of the land is cultivated that lies in the area of the lower slope of Trishuli River valley. The climatic factor especially high monsoon rainfall in combination with slope, soft soil cover made the area highly susceptible to slope failure. Observations show weak and fragile geology is the main cause of generating landslides in this region. Although observed landslides are not active at present condition, it could be a threat to the tunnel during construction works. Hence, mitigation works are to be undertaken carefully. Some of the remedial measures that have been felt acutely essential are described below:

For proper surface and subsurface water drainage some drainage ditch, transverse perforated polythene pipe, lime sand piles, deep drainage wells, horizontal drainage boring and support structure are proposed. To decrease deepening of the stream bed, some gulley protection works such as check dams with ground seals should be constructed in the course of local streams along the tunnel alignment. However, the structures should not be high, so that the flow would still be confined in the present flow path. Bio-engineering works should be encouraged in and around the area of landslides. This would also help to stabilize the agricultural fields lying nearby. For the analysis of the landslide and planning of countermeasures, the effect of ground water should be analyzed.

7 Inventory of springs

7.1 Springs identified

This section presents the location and description (i.e. uses, seasonality, etc.) of the springs inventoried along the western bank of the Trishuli River, where the access road and the underground tunnel will be located and most of the construction activities will take place.

Spring Source No. 1

Name of spring: Budget form Mul
Location: Budge form, Haku VDC, Wada No.7

GPS:
Latitude:28° 05' 52.4" N
Longitude:085° 15' 38.7" E
Elevation:1251m

Discharge: (30 sec/l+33sec/l+30sec/l) 1lit. **=** 0.032 L/Sec.

Uses
- Wild animals feeding
- Drinking purpose (people while in forest ,Tudhidada community forest)
- Agricultural purpose (Used for agricultural purpose before 2 year in monsoon period)

Seasonal condition:
- Low discharge in dry season but high at monsoon periods or rainy season.
- Do not dry up both seasons

Photos:

	
Surrounding environment	Spring sources and measurement

Spring source No. 2

Name of spring: Bhatermul

Location: Bhater community forest, HakuVDC,Wada No.7 (Budget form)

GPS:

Latitude: 28° 05' 53.3" N
Longitude:085° 15' 40.7" E
Elevation: 1255m

Discharge**:** Not measurable discharge, as there is no flowing water, stagnant water in small pond “kuwa”

Uses:

- Drinking purpose (people while in forest and walking human)
- Agricultural purpose
- Wild animals and domestic animals feeding

Seasonal condition:

- Low discharge in dry season but high at monsoon periods or rainy season.
- Do not dry up - both season

Photos:


Surrounding environment and spring source	Surrounding environment, this is community forest area and spring sources expose in big rock

Spring source No. 3

Name of spring: Bhatermul

Location: Bhater community forest, HakuVDC,wada no.7
GPS:

Latitude: 28° 06' 19.5" N
Longitude:85° 16' 11.6" E

Elevation: 1261m

Discharge: (120s/l+120s/l+121s/l) 1 lit = 0.0089 L/sec.
Uses:

- Wild animals feeding
- Drinking purpose (people while in forest ,walking human is the main sources

Seasonal condition:

- Low discharge in dry season but high at monsoon periods or rainy season.
- Do not dry up both seasons

Photos:

	
Surrounding environment,spring source	Spring sources, surrounding environment and measurement the water discharge

Spring Source No. 4

Name of spring: Nagh Dhungamul

Location: Haku VDC,wada no.3, Thankubesi

GPS:

Latitude: 28° 06' 34.5" N
Longitude: 85° 16' 30.9" E
Elevation: 1239m

Discharge: Not measurable, very low flow, seems in drying stage

Uses:

- Wild and domestic animals feeding
- Drinking, bathing, cooking etc. all activity
- Major water sources before alternative sources at present time
- Total population:20
- Total household:3

Seasonal condition:

- According to sources, high discharge in rainy season and in this season very low or no measureable condition (scenario of drying stage)

Photos:

	
Spring source	Nagh Dhunga mul, located the Gps Point

<u>Spring Source No. 5</u>

Name of spring: Gumboatingmul

Location: HakuVDC,wada no.3, Thankubesi

GPS:

Latitude: 28° 06' 26.8" N
Longitude:085° 16' 23.8" E

Elevation: 1218m

Discharge:(15s/l+17s/l+17s/l) 15 lit=0.918 L/Sec.

Uses:

- Wild and domestic animals feeding
- Drinking, bathing, cooking etc. all activity
- Used by total population:20
- Total household:3

Seasonal condition:

- Low discharge in dry season but high inmonsoon periods or rainy season.
- Water available in both season

Photos:

	
Surrounding environment	Gumboating spring mul ,measurement the water discharge and Gps located

Spring source No. 6

Name of spring: Kulumul (this water sources is made by fund board about 5 years ago)

Location: Haku VDC,wada no.3, Thanku

GPS:

Latitude: 28° 06' 49.5" N
Longitude: 85° 16' 27.5" E

Elevation: 1429m

Discharge: (33+33+33)s/l 15 lit.=0.454 L/Sec.
Uses:

- Drinking ,Bathing , washing, cooking, etc. all activities
- Agricultural purpose
- Number of household :5
- Total population:28

Seasonal condition:

- Low discharge in dry season but high at monsoon periods or rainy season.
- Not dry up both season

Photos:

	
Spring source	Kulu mul, Spring source water Discharge measurement and fom fill up

Spring source No. 7

Name of spring: Thankukhola mul

Location: Haku VDC, wada no.3 Thanku

GPS:

Latitude: 28° 06' 52.8" N
Longitude: 85° 16' 30.0" E

Elevation: 1403m

Discharge: (2+3+2) s/l 15 lit.=6.429 L/Sec.

Uses:

- Animals feeding
- Drinking ,Bathing , washing, cooking, etc. all activities
- Irrigation

Seasonal condition:

- Low discharge in dry season but high at monsoon periods or rainy season.
- yearly changes in discharge
- Perennial discharge Will not dry up in both season

Photos:

	
Thankukhola is a main alternative source of water in hHakubesi and Thankugaun	GPS Point located

Spring source No. 8

Name of spring: Wamrang mul

Location: Haku VDC,wada no.3 Hakubesi

GPS:

Latitude: 28° 06' 50.9" N
Longitude: 85° 16' 44.8" E
Elevation: 1343m

Discharge: (225+225+226)s/l 15lit **=**0.066 L /Sec.

Uses:

- Drinking ,washing ,bathing livestock feeding
- Kitchen Garden irrigation
- Total household:1
- Total population:7

Seasonal condition:

- Low discharge in dry season but high at monsoon periods or rainy season.
- Dry up once before 30 years
- Not dry up both season

Photos:

	
Spring source	Warmrang mul, measurement the water discharge and Gps point located

Spring source No. 9

Name of spring: Besimul

Location: HakuVDC,wada no.3, Hakubesi

GPS:

Latitude: 28° 06' 50.0" N
Longitude: 85° 16' 46.2" E
Elevation: 1318m

Discharge:(210+211+210)s/L15 lit=0.072 L /Sec.

Uses:

- Agricultural purpose
- Drinking
- Bathing
- Cooking
- Animals feeding
- Total household dependent :1
- Total population:8

Seasonal condition:

- Low discharge in dry season but high at monsoon periods or rainy season.
- Not dry up both season

Photos:

	
Spring source and surrounding environment	Besi mul ,Fom fillup and Discharge measurement

Spring source No. 10

Name of spring: Unidentified mul

Location: HakuVDC,wada no.3, Hakubesi

GPS:

Latitude: 28° 06' 56.1" N
Longitude:085° 16' 49.9" E

Elevation: 1346m

Discharge: (45+46+45)s/l 1 lit **=**0.022L/Sec.

Uses:

- Drinking purpose
- Irrigation

Seasonal condition:

- Low discharge in dry season but high at monsoon periods or rainy season.
- Not dry up both season

Photos:

	
Surrounding enviround, water discharge measurement,this area are totally agricultural land	Spring sources surrounding environment

Spring source No. 11

Name of spring: Unidentified mul

Location: Haku VDC, wada no.3. Hakubesi

GPS:

Latitude: 28° 06' 56.1" N
Longitude: 085° 16' 49.9" E
Elevation: 1346m

Discharge: (19+19+20) s /l 1lit.
=0.052 L/Sec.

Uses:

- Wild and domestic animals feeding
- Drinking purpose
- Irrigation

Seasonal condition:

- Low discharge in dry season but high at monsoon periods or rainy season.
- Not dry up both season

Photos:

	
Sources, around agricultural land	Surrounding environment, this area are totally agricultural land, Water discharge measurement

Spring source No. 12

Name of spring: Fulbarimul

Location: Haku VDC, wada no.3, Fulbari

GPS:

Latitude: 28° 07' 06.8" N
Longitude: 085° 17' 00.2" E
Elevation: 1330m

Discharge: (25+24+25)s/l 15 lit. = 0.617 L/ Sec
Uses:

- Drinking purpose (all activities)
- Irrigation
- Animals feeding
- Total house hold dependent: 17
- Total Population dependent: 60

Seasonal condition:

- Low discharge in dry season but high at monsoon periods or rainy season.
- Water available in both season (no seasonal drying up)

Photos:

	
Fulbari mul	Fulbari mul,This area near the dam site areas and near the sattlement area.

Spring source No. 13

Name of spring: Peepal botmul

Location: HakuVDC,wada no.3, phulbari

GPS:

Latitude: 28° 07' 10.8" N
Longitude: 085° 17' 10.4" E

Elevation: 1324m

Discharge: (20+21+20) s/l 1 lit.= 0.049 L/Sec.

Uses:

- Drinking, Bathing, animals feeding
- Agricultural purpose
- Total household dependent : 3
- Total population: 15

Seasonal condition:

- Low discharge in dry season but high at monsoon periods or rainy season.
- Water available both season (no drying up of springs)

Photos:

<table>
<tr><td></td><td></td></tr>
<tr><td>Peepal bot mul,this source is very old water resources</td><td>Peepal bot mul,GPS point located</td></tr>
</table>

Spring source No. 14

Name of spring: Prajomul (Bansko bot)

Location: Haku VDC, wada no.3, phulbari

GPS:

Latitude: 28° 07' 10.4" N
Longitude: 085° 17' 05.4" E
Elevation: 1350m

Discharge: (28+29+29) s/l 15s/l =0.524 L/Sec.

Uses:

- Animals feeding
- Drinking, Bathing, Washing, etc. all activities
- Agricultural purpose
- Total household dependent: 5
- Total population dependent: 30

Seasonal condition:

- Low discharge in dry season but high at monsoon periods or rainy season.
- Water available in both season

Photos:

	
Prajo Mul	This area is agricultural land, near the dam site.

Spring source No. 15

Name of spring: Majhowamul

Location: HakuVDC ,wada no.3, phulbarigaun

GPS:

Latitude: 28° 07' 06.8" N
Longitude: 085° 17' 03.5" E
Elevation: 1322m

Discharge: (83+83+83) s/l 15lit.= 0.181 L/Sec.

Uses:

- Drinking, Washing and Bathing
- Animals feeding
- Irrigation etc.

Seasonal condition:

- Low discharge in dry season but high during monsoon periods or rainy season.
- Water available in both seasons (no drying up of spring)

Photos:

	
Majhowa mul, water discharge measurement	Surroundings of the source

Spring source No. 16

Name of spring: Gansingmul

Location: Haku VDC, wada no.3, phulbarigaun

GPS:

Latitude: 28° 07' 10.6" N
Longitude: 085° 17' 00.5" E
Elevation: 1360m

Discharge: (98+98+97) s/l   15 lit = 0.153 L/Sec

Uses:

- Drinking, Washing and Bathing
- Animals feeding
- Irrigation etc.
- Total Household:16
- Total Population:100

Seasonal condition:

- Low discharge in dry season but high at monsoon periods or rainy season.
- Water available in both season (no drying up of springs)

Photos:

	
This water source name is Gansingmul, main sources of this fulberigaun (Fund board water supply project)	GPS point observed

Spring source No.17

Name of spring: Chitaumul

Location: Haku VDC,wada no.3, Hakubesi

GPS:

Latitude: 28° 06' 57.9" N
Longitude: 085° 16' 42.9" E
Elevation: 1421m

Discharge: (100+101+100) s/l; 15lit = 0.150 L/Sec.

Uses:

- Drinking, Washing and Bathing
- Animals feeding
- Agricultural activity
- Total Household :15
- Total Population: 89

Seasonal condition:

- Low discharge in dry season but high at monsoon periods or rainy season
- Water available in both season (no drying up of springs)

Photos:

	
Surrounding the water source	Water discharge measurement

Spring source No. 18

Name of spring: ThuloDhungamul

Location: HakuVDC,wada no.3, Hakubesi

GPS:

Latitude: 28° 07' 02.6" N
Longitude: 085° 16' 30.9" E
Elevation: 1560m

Discharge: (10+11+10) s/l 1 lit = 0.096 L/Sec.

Uses:

- Domestic and wild animals feeding
- Drinking purpose (Nomads and cow boys humans)

Seasonal condition:

- Low discharge in dry season but high at monsoon periods or rainy season.
- Water available in both season (no drying up of springs)

Photos:

	
Thulo Dhungamul	Water discharge measurement

<u>Spring source No. 19</u>

Name of spring: Manchumul

Location: HakuVDC,wada no.2, sanohaku

GPS:

Latitude: 28° 07' 04.3" N
Longitude: 085° 15' 30.8" E
Elevation: 1581m

Discharge: (160+160+161) s/l 15lit = 0.094 L/sec.

Uses:

- Mainly domestic and wild animals feeding
- Drinking purpose
- Mainly this spring sources is drinking and bathing by people walking on the way

Seasonal condition:

- Low discharge in dry season but high during monsoon periods or rainy season.
- Water available in both season (no drying up of springs)

Photos:

	
Water discharge measurement	Surrounding sources

Spring source No. 20

Name of spring: Mnchu mul-2

Location: Haku VDC, wada no.2 Hakubesi

GPS:

Latitude: 28° 07' 05.6" N
Longitude: 085° 16' 27.6" E
Elevation: 1613m

Discharge: (28+27+28) s/l 1 lit = 0.037 L/Sec.

Uses:

- Mainly used by livestock's
- Walking people on the way

Seasonal condition:

- Low discharge in dry season but high at monsoon periods or rainy season.
- Water available in both season (no drying up of springs)

Photos:

	
Surrounding source environment	Water discharge measurement at Haku besi

Spring source No. 21

Name of spring: Mnchu mul-3

Location: HakuVDC,wada no.2 Sanohaku

GPS:

Latitude: 28° 07' 06.2" N
Longitude: 085° 16' 22.4" E
Elevation: 1647m

Discharge: (10+11+10)s/l 1 lit=0.096 L/Sec

Uses:

- Wild animals feeding
- Drinking purpose
- Irrigation

Seasonal condition:

- Low discharge in dry season but high during monsoon periods or rainy season.
- Water available in both season (not drying up in both seasons)

Photos:

	
Water discharge measurement	Surrounding source

Spring source No. 22

Name of spring: Ghattekholamul (Branch of thankukhola)

Location: HakuVDC, Ward no.2 ,Sanohaku

GPS:

Latitude: 28° 07' 05.8" N
Longitude: 085° 16' 20.8" E
Elevation: 1640m

Discharge: (2+3+2)s/l 15 lit **=** 6.429 L/Sec.

Uses:

- Used by domestic as will as wild animals feeding
- Drinking purpose (Alternative sources)
- Agricultural purpose

Seasonal condition:

- Low discharge in dry season but high at monsoon periods or rainy season.
- Water available in both seasons (no seasonal drying up)

Photos:

Ghattekhola mul	Discharge measurement

<u>Spring source No. 23</u>

Name of spring: Panglingkholamul

Location: Haku VDC, wada no.2, Sanohaku

GPS:

Latitude: 28° 07' 17.2" N
Longitude: 085° 15' 28.1" E
Elevation: 1720m

Discharge: (20+20+21)s/l 15 lit. = 0.738 L/Sec,

Uses:

- Drinking purpose (Main sources in the downstream , Hakubesi drinking water supply project)
- Irrigation
- Bathing, Washing and all activity
- Domestic animals and others animals

Seasonal condition:

- Low discharge in dry season but high during monsoon periods or rainy season.
- Water available in both season (no seasonal drying up of springs)

Photos:

	
Water discharge measurement at sanohaku	Source

Spring source No. 24

Name of spring: Sano hakumul

Location: Haku VDC, wada no.2 sanohaku

GPS:

Latitude: 28° 07' 17.5" N
Longitude: 085° 16' 20.2" E
Elevation: 1805m

Discharge: (188+187+188) s/l 15 lit = 0.079 L/Sec.

Uses:

- Domestic animals feeding
- Drinking purpose
- Mainly used for Irrigation purpose

Seasonal condition:

- Low discharge in dry season but high during monsoon periods or rainy season.
- Water available in both season (no seasonal drying up)

Photos:

	
Sano haku mul,Discharge measurement	Surrounding Environment

<u>Spring source No. 25</u>

Name of spring: Chanchane mul-1

Location: HakuVDC,wada no.7, LumbuDanda(chandane)

GPS:

Latitude: 28° 06' 07.1" N
Longitude: 085° 14' 41.6" E
Elevation: 1829m

Discharge: (13+14+14) s/l 15 lit = 1.097 L/Sec.

Uses:

- Domestic and wild animals feeding
- Drinking purpose (Walking person or human)
- Agricultural purpose
- Used in micro hydro power (Lumhudandah.p)
- Total household: 12
- Total population: 76

Seasonal condition:

- Low discharge in dry season but high during monsoon periods or rainy season.
- Water available in both seasons (no seasonal drying up)

Photos:

Water discharge measurement	Water source surrounding environment,this area are mixed forest area, steep slop

Spring source No. 26

Name of spring: Chanchane mul-2

Location: Haku VDC,wada no.7, Lumbudanda, chandane

GPS:

Latitude: 28° 06' 06.8" N
Longitude: 085° 14' 37.2" E
Elevation: 1809m

Discharge: (38+38+40) s/l 15 lit. **=** 0.388 L/Sec

Uses:

- Mainly domestic and wild animals feeding
- Drinking by walking and cow boy or chauripeople

Seasonal condition:

- Low discharge in dry season but high at monsoon periods or rainy season.
- No seasonal drying up (water available in both season)

Photos:

	
Chanchane mul-2 surrounding	Water discharge measurement

Spring source No. 27

Name of spring: Amchurowamul

Location: Haku VDC, wada no.8, Gogane

GPS:

Latitude: 28° 05' 45.4" N
Longitude: 085° 13' 53.9" E
Elevation: 11608m

Discharge: Not Measurable, No flowing water

Uses:

- Mainly old domestic animals feeding
- Drinking purpose

Seasonal condition:

- Low discharge in dry season but high during monsoon periods or rainy season.
- Water available in both season (no seasonal drying up)

Photos:

	
Amchurowamul area	Surrounding source are

Spring source No. 28

Name of spring: Thangachuebamul

Location: HakuVDC,wada no.8, Gogane

GPS:

Latitude: 28° 05' 49.4" N
Longitude: 085° 13' 48.1" E
Elevation: 1555m

Discharge: (3+4+3) s/l; 15 lit = 4.500 L/Sec.

Uses:

- Used for Drinking purpose
- Used for Irrigation purpose
- Used for Water mill

Seasonal condition:

- Low discharge in dry season but high at monsoon periods or rainy season.
- No seasonal drying up (water available in both season)

Photos:

	
Source area	Surrounding environd and water mill

Spring source No. 29

Name of spring: Kulmowamul

Location: HakuVDC,wada no.8, Gogane

GPS:

Latitude: 28° 05' 39.7" N
Longitude: 085° 13' 43.0" E
Elevation:1537m

Discharge: Not measurable only the standing water in the small kuwa

Uses:

- Mainly old domestic animals feeding
- Drinking purpose
- Old " kuwa" people walking on the way ,this is the suitable and middle point of this spring sources

Seasonal condition:

- Low discharge in dry season but high during monsoon periods or rainy season.
- Water available in both season (no seasonal dying up of springs)

Photos:

	
Old kuwa surrounding	Kulmowa mul

Spring source No. 30

Name of spring: Bhumedhanmul

Location: HakuVDC,wada no.8,Gogane

GPS:

Latitude: 28° 05' 23.0" N
Longitude: 085° 13' 16.3" E
Elevation: 1532m

Discharge: (72+73+73) s/l; 15lit. =0.207 L/Sec.

Uses:

- Drinking, Washing, Bathing, Livestock's feeding etc.
- Agricultural purpose
- Major drinking water sources of Gogane village
- Total household: 170
- Total population: 1113

Seasonal condition:

- Low discharge in dry season but high during monsoon periods or rainy season.
- Water available in both season (no seasonal dying up of springs)

Photos:

	
Surrounding environment, this block or intake is made by fund board,	Surrounding environment and water discharge measurement

Spring source No. 31

Name of spring: Milisongmul

Location: HakuVDC,wada no.8 Gogane

GPS:

Latitude: 28° 05' 21.5" N
Longitude: 085° 13' 19.3" E
Elevation: 1493m

Discharge: Not measurable

Uses:

- Domestic animals feeding
- Irrigation purpose
- Drinking Purpose

Seasonal condition:

- Present at monsoon season but going to be dry up in dry season
- Low discharge in dry season but high at monsoon periods or rainy season.

Photos:

	
Source Area	Surrounding environment

Spring source No. 32

Name of spring: Kakasongmul

Location: Haku VDC, wada no.9, Gogane

GPS:

Latitude: 28° 05'24.9" N
Longitude: 085° 13' 23.7" E
Elevation: 1460m

Discharge: (80+81+81) s/l 15lit = 0.185 L/Sec.

Uses:

- Animals feeding
- Drinking, Bathin, Washing, Cooking etc
- Agricultural purpose

Seasonal condition:

- Low discharge in dry season but high at monsoon periods or rainy season.
- Water available in both season (no seasonal drying up)

Photos:

	
Kakasong mul and surrounding environment	Kakasong mul and surrounding environment

Spring source No. 33

Name of spring: Gulunglungmul

Location: Haku VDC, wada no.9, Gogane

GPS:

Latitude: 28° 05' 26.1" N
Longitude: 085° 13' 29.4" E
Elevation: 1391m

Discharge: (22+21+23) s/l 1 lit = 0.045 L/Sec.

Uses:

- Animals feeding
- Drinking purpose
- Agricultural purpose

Seasonal condition:

- Low discharge in dry season but high at monsoon periods or rainy season.
- Water available in both season (no seasonal drying up)

Photos:

	
Gulunglungmul at gogane and surrounding area	Gulunglungmul at gogane and surrounding area

Spring source No. 34

Name of spring: Gulunglung mul-2
Location**:** HakuVDC,wada no.9, Gogane
GPS:

Latitude: 28° 05' 25.1" N
Longitude**:** 085° 13' 30.8" E
Elevation: 1399m

Discharge: (7+8+6) s/l 15 lit **=** 2.142 L/Sec.

Uses:

- Used for Micro hydro power (600 watt power generate)
- (5PM_6am open hydro-power and one household=3 cfl bulb)
- Used for water mill
- Drinking purpose (All activists)
- Agricultural purpose
- Total household dependent: 72
- Total population dependent: 482

Seasonal condition:

- Low discharge in dry season but high at monsoon periods or rainy season.
- Not dry up both season
- Uses for different purposes Uses for irrigation
- Use in water mills

Photos:

	
This spring sources is very hight discharge in this season ,	Water discharge measurement

Spring source No. 35

Name of spring: Gulungmulung mul-3
Location: HakuVDC,wada no.9 Gogane

GPS:

Latitude: 28° 05' 24.5" N
Longitude**:** 085° 13' 31.3" E

Elevation: 1398m

Discharge: (30+31+30) s/l 15 lit **=** 0.494 L/ Sec.

Uses:

- Domestic animals feeding
- Drinking purpose
- Mainly Agricultural purpose

Seasonal condition:

- Low discharge in dry season but high at monsoon periods or rainy season.
- Water available in both season (no seasonal drying up)

Photos:

Water discharge measurement at gogane

Gulungmulung mul-3 area

Spring source No. 36

Name of spring: Chirwatikhola mul

Location: Haku VDC, Ward no.9 Gogane

GPS:

Latitude: 28° 05' 21.4" N
Longitude: 085° 13' 26.9" E
Elevation: 1389m

Discharge: (60+61+60) s/l 15 lit. = 0.248 L/Sec.

Uses:

- Used for livestock feeding
- Drinking purpose
- Agricultural purpose

Seasonal condition:

- Low discharge in dry season but high at monsoon periods or rainy season.
- Water available in both season (no seasonal drying up of springs)

Photos:

Water discharge calculation and this source around area

Spring source No. 37

Name of spring: Chirwati mul

Location: HakuVDC,wada no.8 Gogane

GPS:

Latitude: 28° 05' 21.1" N
Longitude: 085° 13' 26.6" E
Elevation: 1381m

Discharge: (54+55+54) s/l 15 lit = 0.276 L/Sec.

Uses:

- Domestic animals feeding
- Drinking, Washing, Bathing, etc.
- Irrigation
- Total benefited house hold: 8
- Total population:52

Seasonal condition:

- Low discharge in dry season but high at monsoon periods or rainy season.
- Water available in both season (no seasonal drying up of springs)

Photos:

Water source, Water discharge measurement

Spring source No. 38

Name of spring: Thungbar mul

Location: HakuVDC,wada no.9, Gogane

GPS:

Latitude: 28° 05' 31.7" N
Longitude: 085° 14' 29.0" E
Elevation: 1040m

Discharge: Not measureable, only the stagnant water in small kuwa

Uses:

- Used for animals feeding during seasonal (husbandry of livestock's)
- Drinking purpose
- Used for agricultural purpose before 1 year in monsoon period

Seasonal condition:

- High discharge in monsoon season but not measurable discharge during dry season

Photos:

Thungbarmul and surrounding area

Spring source No. 39

Name of spring: Garuwa mul

Location: HakuVDC,wada no.9 Gogane

GPS:

Latitude: 28° 05' 23.6" N
Longitude: 085° 13' 53.4" E
Elevation: 1006m

Discharge: (19+20+19) s/l 15 lit. = 0.776 L/Sec.

Uses:

- No use ,directly discharged to Trishuli River

Seasonal condition:

- Low discharge in dry season but high at monsoon periods or rainy season.
- Water available in both seasons

Photos:

	
Source area	Water discharge measurement and Gps point located

Spring source No. 40

Name of spring: Thulodhunga mul

Location: HakuVDC, wada no.9 Gogane

GPS:

Latitude: 28° 05' 28.1" N
Longitude: 085° 13' 54.7" E
Elevation: 1096m

Discharge: (30+31+31) s/l 1 lit = 0.032 L/Sec.

Uses:

- Wild and domestic animals feeding
- Drinking purpose (Used by people walking on the jungle)

Seasonal condition:

- Low discharge in dry season but high at monsoon periods or rainy season.
- Water available in both season (no seasonal drying up of springs)

Photos:

	
Water discharge measurement at gogane	Spring source, surrounding area

Spring source No. 41

Name of spring: Thangachanwameri mul

Location: HakuVDC,wada no.9 Gogane

GPS:

Latitude: 28° 05' 28.4" N
Longitude: 085° 13' 50.1" E
Elevation: 1154m

Discharge: (61+60+61) s /l   15 lit = 0.248 L/Sec.

Uses:

- Used for drinking purposed by the people walking on the food trail and jungle
- Used for domestic and wild animals

Seasonal condition:

- Low discharge in dry season but high at monsoon periods or rainy season.
- Water available in both seasons

Photos:

	
Thangachanwamerimul, surrounding environment	Discharge Measurement

Spring source No. 42

Name of spring: Ghattekholamul

Location: HakuVDC,wada no.9 Gogane

GPS:

Latitude: 28° 05' 24.9" N
Longitude: 085° 13' 39.4" E
Elevation: 1202m

Discharge: (10+11+10) s/l 15lit. = 1.451 L/Sec.

Uses:

- Used for drinking purpose
- Used for water mill, by coming with ghattekhola mul-2
- Total household benefited: 8
- Total population: 53

Seasonal condition:

- Low discharge in dry season but high at monsoon periods or rainy season.
- Water available in both seasons

Photos:

	
Ghattekholamulsource	Water Discharge Measurement

Spring source No. 43

Name of spring: Ghuttekhola mul-2

Location: HakuVDC,wada no.9 Gogane

GPS:

Latitude: 28° 05' 23.9" N
Longitude: 085° 13' 41.1" E
Elevation: 1251M

Discharge: (5+6+5) s/l   15 lit. = 2.812 L/Sec

Uses:

- Domestic animals feeding
- Drinking purpose
- Used for water mill
- Benefited household:6

Seasonal condition:

- Low discharge in dry season but high at monsoon periods or rainy season.
- Water available in both season

Photos:

	
Spring sourceof Ghuttekhola mul-2	Water discharge measurement

Spring source No. 44

Name of spring: Khuleamul

Location: Haku VDC,wada no.9 Gogane

GPS:

Latitude: 28° 04' 44.9" N
Longitude: 085° 12' 58.5" E
Elevation: 970m

Discharge: (84+83+84) s/l 15 lit = 0.180 L/Sec.

Uses:

- Was used for drinking purpose before the construction of road
- Washing, bathing, and cooking etc.

Seasonal condition:

- Low discharge in dry season but high at monsoon periods or rainy season.
- Water available in both season

Photos:

	
Water discharge measurement and discussion	Spring sources of Khuleamul

Spring source No. 45

Name of spring: Chiuribotmul

Location: HakuVDC,wada no.9 Gogaane

GPS:

Latitude: 28° 04' 46.2" N
Longitude: 085° 12' 53.7" E
Elevation: 1058m

Discharge: (31+30+31) s/l 1 lit **=** 0.032 L/Sec.
Uses:

- Wild animals feeding
- Drinking purpose
- Used for drinking purposed by the people walking on the food trail and jungle

Seasonal condition:

- Low discharge in dry season but high at monsoon periods or rainy season.
- Water available in both seasons

Photos:

Chiuribotmul and surrounding environment	Surrounding environment and the water discharge measuremen

7.2 Conclusions and recommendations

The western bank of the Trishuli River between the powerhouse and the weir will be a very active area during the construction phase of the Project. Potential impacts on the identified springs, mainly through physical damage during construction, constitute a major concern for local communities.

In terms of potential impacts to these water sources during the construction of the Project, estimations of changes in water yields have not been made but 16 out of the 45 identified springs (i.e. springs numbered: 4, 5, 6, 8, 9, 12, 13, 14, 16, 17, 25, 30, 34, 37, 42, and 43) are considered more vulnerable given their status of main sources for water supply for the communities in their vicinity.

Monitoring and mitigation of these potential impacts to community vulnerable springs/water sources, which would most likely happen during the construction phase, are included as part of the Construction Environmental and Social Management Plan (Appendix F, Section 5.6.8). The recommended mitigation measures include: (i) identify the location of these springs (coordinates provided in Appendix B); (ii) monitor water yield before, during and after construction; (iii) notify communities in advance if any restriction or impact to the access and use of springs will occur during construction works; (iv) enable a grievance mechanism that allows communities to express their concerns/claims in relation to local water supplies.

Annex 1: Aquatic habitat and water quality survey data

A.1 Water Quality

A.1.1. On-site Data Sheets: Physical Characterization and Water Quality Parameters

August 2013/Reach FT 1 (Upstream reach)

STREAM NAME: Trishuli River Reach: 1 LAT: 28°08'41.46''N LONG: 085°18'47.14''E INVESTIGATORS: Rai, N.K. FORM COMPPLETED BY: Dhruba+Krishna				LOCATION: Sano Bharkhu STREAM CLASS: Main River , Greater than 6th order RIVER BASIN: Gandaki DATE: 28,8,2013 TIME: 4:30 pm REASON FOR SURVEY: To study water quality		
WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other:
	Storm	N	N	Y	22°C	
	Rain	N	Y			
	Showers	Y	N			
	% cloud cover	40%	50%			
	Clear/Sunny	Y	Y			
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perennial, Cold water		
	Stream Origin	Glacial	Catchment area above sampling reach (km^2):		4,200	
WATERSHED FEATURES	Predominant surrounding land use:	Forest	Local watershed NPS Pollution:	N	Local watershed erosion:	Moderate
RIPARIAN VEGETATION (18 m buffer)	Dominant type	Trees	Dominant species	Pine		
INSTREAM FEATURES	Estimated reach length:	900 m	Canopy cover:	Partly cover		
	Estimated stream width:	40m	High water mark:	1 m above the river current water level		

	Sampling reach area m^2 (reach length * stream width):	36,000	Reach area /basin area above sampling reach	0.09%		
	Area in sq. Km	3.6	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion		
	Estimated stream depth:	<3m	Channeled:	No		
	Surface velocity:	2.5 - 3 m/s	Dam present:	No		
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD: m^2/Km^2	0		
AQUATIC VEGETATION	Dominant type	Absent	Dominant species:	N		
	Proportion of the reach with aquatic vegetation:	0				
WATER QUALITY	Temperature:	13.8°C	Water odour:	N		
	Specific conductance:	01ms/cm	Water surface oil:	None		
	Dissolved oxygen:	8.9 mg/l				
	pH	6.9(-037mv)				
	Turbidity:	High				
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer				
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits:	No	Black deposits under non-embedded stones?	No
	Oil:	Absent				

INORGANIC SUBSTRATE COMPONENTS*			**ORGANIC SUBSTRATE COMPONENTS**		
Substrate type	Diameter	% composition	Substrate type	Characteristics	% composition
Bedrock		20%	Detritus	N	0
Boulder	>10''	49%	Muck-Mud	N	0
Cobble	2.5''-10''	15%	Marl	N	0

Gravel	0.1''- 2.5''	15%	Coarse plant material (CPOM)	N (occasional twigs on the banks)	0
Sand	0.06-2mm	1%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

August 2013/Reach FT 2 (Diversion reach)

STREAM NAME: Trishuli River Reach: 2 LAT: 28°06'42.53''N LONG: 085°16'45.75''E INVESTIGATORS: Rai, N.K. FORM COMPPLETED BY: Dhruba+Krishna	LOCATION: Haku Bensi STREAM CLASS: Main River , Greater than 6th order RIVER BASIN: Gandaki DATE: 26,8,2013 TIME: 8:45 am REASON FOR SURVEY: To study water quality

WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other:
	Storm	N	N	Y	18.7°C	
	Rain	N	Y			
	Showers	N	N			
	% cloud cover	70%	60%			
	clear/sunny	y	y			
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perennial, cold water		
	Stream Origin	Glacial	Catchment area above sampling reach (km^2):		4,300	
WATERSHED FEATURES	Predominant surounding landuse	Forest	Local watershed NPS Pollution	N	Local watershed erosion	Moderate
RIPARIAN VEGETATION (18 m buffer)	Dominant type	Trees	Dominant species	Mouwa		
INSTREAM FEATURES	Estimated reach length:	1000	Canopy cover:	Partly cover		
	Estimated stream width:	40m	High water mark:	1m above the river current water level		

	Sampling reach area m^2 (reach length * stream width):	40,000	Reach area /basin area above sampling reach)	0.90%		
	Area in sq. Km	4	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,		
	Estimated stream depth: ..	<3m	Channelized:	Y		
	Surface velocity:	2.5 -3 m/s	Dam present:	N		
LARGE WOODY DEBRIS	LWD:	N	Density of LWD (m^2/Km^2)	0		
AQUATIC VEGETATION	Dominant type	Absent	Dominant species:	N		
	Proportion of the reach with aquatic vegetation:	0				
WATER QUALITY	Temperature:	13.1°C	Water odour:	N		
	Specific conductance:	0.13ms/cm	Water surface oil:	None		
	Dissolved oxygen:	9.2 mg/l				
	pH	6.9(-002mv)				
	Turbidity:	High				
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer				
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits:	NO	Black deposits under non-embedded stones?	NO
	Oil:	Absent				

INORGANIC SUBSTRATE COMPONENTS*			ORGANIC SUBSTRATE COMPONENTS		
Substrate type	Diameter	% composition	Substrate type	Characteristics	% composition
Bedrock		25%	Detritus	N	0
Boulder	>10''	49%	Muck-Mud	N	0

Cobble	2.5''-10''	15%	Marl	N	0
Gravel	0.1''- 2.5''	10%	sticks, woods coarse plant material (CPOM)	N (occasional twigs on the banks)	0
Sand	0.06-2mm	1%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

August 2013/Reach FT 3 (Diversion reach)

STREAM NAME: Trishuli	LOCATION: Gogane Fedi
River Reach: 3	STREAM CLASS: Main River , Greater than 6th order
LAT: 28°05'15.71''N LONG: 085°13'45.18''E	RIVER BASIN: Gandaki
INVESTIGATORS: Rai, N.K.	DATE: 25,8,2013 TIME: 2.00 pm
FORM COMPPLETED BY: Dhruba+Krishna	REASON FOR SURVEY: To study water quality

WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other: ….
	Storm	N	N	Y	16°C	
	Rain	N	Y			
	Showers	N	N			
	% cloud cover	100%	30%			
	clear/sunny	N	Y			
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perenniall, cold water		
	Stream Origin	Glacial	Catchment area above sampling reach (km^2):		4,400	
WATERSHED FEATURES	Predominant surounding landuse	Forest	Local watershed NPS Pollution	N	Local watershed erosion	Moderate

RIPARIAN VEGETATION (18 m buffer)	Dominant type	Trees	Dominant species	Mouwa, chilaune and saj		
INSTREAM FEATURES	Estimated reach length:	1500m	Canopy cover:	Partly cover		
	Estimated stream width:	40m	High water mark:	1m above the river current water level		
	Sampling reach area m^2 (reach length * stream width):	60,000	Reach area /basin area above sampling reach	0.13%		
	Area in sq. Km	6	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,		
	Estimated stream depth: ..	3-6 m	Channelized:	Y		
	Surface velocity:	2.5 - 3 m/s	Dam present:	N		
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD (m^2/Km^2)	0		
AQUATIC VEGETATION	Dominant type	Absent	Dominant species:	N		
	Proportion of the reach with aquatic vegetation:	0				
WATER QUALITY	Temperature:	14°C	Water odour:	N		
	Specific conductance:	0.08ms/cm	Water surface oil:	None		
	Dissolved oxygen:	8.6 mg/l				
	pH	7.4(-033mv)				
	Turbidity:	High				
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer				
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits:	NO	Black deposits under non-embedded stones?	NO
	Oil:	Absent				

INORGANIC SUBSTRATE COMPONENTS*			ORGANIC SUBSTRATE COMPONENTS		
Substrate type	Diameter	% composition	Substrate type	Characteristics	% composition
Bedrock		20%	Detritus	N	0
Boulder	>10''	49%	Muck-Mud	N	0
Cobble	2.5''-10''	15%	Marl	N	0
Gravel	0.1''- 2.5''	15%	sticks, woods coarse plant material (CPOM)	N (occasional twigs on the banks)	0
Sand	0.06-2mm	1%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

August 2013/Reach FT 4 (Diversion reach)

STREAM NAME: Trishuli	LOCATINON: Near Gunchet, Ramche VDC.
River Reach: 4	STREAM CLASS: Main River , Greater than 6th order
LAT: 28°04'46.62''N LONG: 085°13'4.62''E	RIVER BASIN: Gandaki
INVESTIGATORS: Rai, N.K.	DATE: 24,8,2013 TIME: 2.00 PM
FORM COMPPLETED BY: Dhruba+Krishna	REASON FOR SURVEY: To study water quality

	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other: ....
WEATHER CONDITIONS	Storm	N	N	Y	20°C	
	Rain	N	Y			
	Showers	N	N			
	% cloud cover	30%	80%			
	clear/sunny	Y	N			
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perennial, cold water		
	Stream Origin	Glacial	Catchment area above sampling reach (km^2):		4,500	

WATERSHED FEATURES	Predominant surounding landuse	Forest	Local watershed NPS Pollution	N	Local watershed erosion	Moderate
RIPARIAN VEGETATION (18 m buffer)	Dominant type	Trees	Dominant species	Chilaune ,Sanjh		
INSTREAM FEATURES	Estimated reach length:	1500m	Canopy cover:	Partly cover		
	Estimated stream width:	40m	High water mark:	1m above the river current water level		
	Sampling reach area m^2 (reach length * stream width):	60000	Reach area /basin area abovesampling reach	0.13%		
	Area in sq. Km	6	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,		
	Estimated stream depth: ..	<3m	Channelized:	Y		
	Surface velocity:	2.9 m/s	Dam present:	N		
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD (m^2/Km^2)	0		
AQUATIC VEGETATION	Dominant type	Absent		Dominant species:	N	
	Proportion of the reach with aquatic vegetation:	0				
WATER QUALITY	Temperature:	14°C	Water odour:	N		
	Specific conductance:	0.09ms/cm	Water surface oil:	None		
	Dissolved oxygen:	8.3 mg/l				
	pH	7.3(-033mv)				
	Turbidity:	High				
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer				

SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits:	NO	Black deposits under non-embedded stones?	No
	Oil:	Absent				

INORGANIC SUBSTRATE COMPONENTS*			**ORGANIC SUBSTRATE COMPONENTS**		
Substrate type	Diameter	% composition in sampling reach	Substrate type	Characteristics	% composition in sampling area
Bedrock		10%	Detritus	N	0
Boulder	>10''	56%	Muck-Mud	N	0
Cobble	2.5''-10''	25%	Marl	N	0
Gravel	0.1''- 2.5''	10%	Sticks, woods coarse plant material (CPOM)	N (occasional twigs on the banks)	0
Sand	0.06-2mm	1%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

August 2013/Reach FT 5 (Downstream reach)

STREAM NAME: Trishuli	LOCATION: Mailung dovan
River Reach: 5	STREAM CLASS: Main River , Greater than 6th order
LAT: 28°04'14.63''N LONG: 085°12'29.80''E	RIVER BASIN: Gandaki
INVESTIGATORS: Rai, N.K.	DATE: 23,8,2013 TIME: 7:30 am
FORM COMPPLETED BY: Dhruba+Krishna	REASON FOR SURVEY: To study water quality

WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other: ….
	Storm	N	N	Y	16°C	
	Rain	N	Y			
	Showers	N	N			
	% cloud cover	80%	95%			
	clear/sunny	20%	5%			
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perrineal, Cold water		
	Stream Origin	Glacial	Catchment area above sampling reach (km^2):		4700	
WATERSHED FEATURES	Predominant surounding landuse:	Forest , residential, hydropower	Local watershed NPS Pollution	N	Local watershed erosion	Moderate
RIPARIAN VEGETATION (18 m buffer)	Dominant type	Trees	Dominant species	Mouwa		
INSTREAM FEATURES	Estimated reach length:	1500m			Canopy cover:	Partly cover
	Estimated stream width:	50m	High water mark:	1m above the river current water level		
	Sampling reach area m^2 (reach length * stream width):	75,000	Reach area /basin area above sampling reach	0.16%		

	Area in sq. Km	7.5	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,		
	Estimated stream depth: ..	3-6 m	Channelized:	Y		
	Surface velocity:	2.9 m/s	Dam present:	N		
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD (m^2/Km^2)	0		
AQUATIC VEGETATION	Dominant type	Absent		Dominant species:	N	
	Proportion of the reach with aquatic vegetation:	0				
WATER QUALITY	Temperature:	13°C	Water odour:	N		
	Specific conductance:	0.06ms/cm	Water surface oil:	None		
	Dissolve oxygen:	7.4 mg/l				
	pH	7.4(-033mv)				
	Turbidity:	High				
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer				
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits:	No	Black deposits under non-embedded stones?	No
	Oil:	Absent				

INORGANIC SUBSTRATE COMPONENTS*			**ORGANIC SUBSTRATE COMPONENTS**		
Substrate type	Diameter	% composition	Substrate type	Characteristics	% composition
Bedrock		15%	Detritus	N	0
Boulder	>10''	59%	Muck-Mud	N	0
Cobble	2.5''-10''	20%	Marl	N	0
Gravel	0.1''- 2.5''	5%	coarse plant material (CPOM)	N (occasional)	0

Sand	0.06-2mm	1%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

September 2013/Reach FT 1 (Upstream reach)

STREAM NAME: Trishuli	LOCATION: Sano Bharkhu
River Reach: 1	STREAM CLASS: Main River , Greater than 6th order
LAT: 28°08'41.46''N LONG: 085°18'47.14''E	RIVER BASIN: Gandaki
INVESTIGATORS: Rai, N.K.	DATE: 26/9/2013 TIME: 1:45 pm
FORM COMPLETED BY: Dhruba+Krishna	REASON FOR SURVEY: To study water quality

WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other:
	Storm	N	N	Y	26°C	
	Rain	N	N			
	Showers	N	N			
	% cloud cover	60%	40%			
	clear/sunny	Y	Y			
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perennial, cold water		
	Stream Origin	Glacial	Catchment area above sampling reach (km^2):		4,200	
WATERSHED FEATURES	Predominant surounding landuse:	Forest	Local watershed NPS Pollution	N	Local watershed erosion	Moderate
RIPARIAN VEGETATION (18 m buffer)	Dominant type	Trees	Dominant species	Pine		

INSTREAM FEATURES	Estimated reach length:	900 m	Canopy cover:	Partly cover		
	Estimated stream width:	38m	High water mark:	1.5m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	34200	Reach area /basin area above sampling reach	0.09%		
	Area in sq. Km	3.42	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion.		
	Estimated stream depth:	<3m	Channelized:	N		
	Surface velocity:	2.5 - 3 m/sec aprox	Dam present:	N		
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD (m2/Km2)	0		
AQUATIC VEGETATION	Dominant type	Absent	Dominant species:	N		
	Proportion of the reach with aquatic vegetation:	0				
WATER QUALITY	Temperature:	14°C	Water odour:	N		
	Specific conductance:	0.07ms/cm	Water surface oil:	None		
	Dissolved oxygen:	7.3 mg/l				
	pH	7.3(-011mv)				
	Turbidity:	50				
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer				
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits:	NO	Black deposits under non-embedded stones?	NO
	Oil:	Absent				

INORGANIC SUBSTRATE COMPONENT*			ORGANIC SUBSTRATE COMPONENTS		
Substrate type	Diameter	% composition	Substrate type	Characteristics	% composition
Bedrock		20%	Detritus	N	0
Boulder	>10''	49%	Muck-Mud	N	0
Cobble	2.5''-10''	15%	Marl	N	0
Gravel	0.1''- 2.5''	15%	sticks, woods coarse plant material (CPOM)	N (rare twigs of trees on the river banks occasionally)	0
Sand	0.06-2mm	1%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

September 2013/Reach FT 2 (Diversion reach)

STREAM NAME: Trishuli	LOCATION: Hanku Bensi
River Reach: 2	STREAM CLASS: Main River , Greater than 6th order
LAT: 28°06'42.53''N LONG: 085°16'45.75''E	RIVER BASIN: Gandaki
INVESTIGATORS: Rai, N.K.	DATE: 25/9/2013 TIME: 3:10 pm
FORM COMPLETED BY: Dhruba+Krishna	REASON FOR SURVEY: To study water quality

	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other: ....
WEATHER CONDITIONS	Storm	N	N	Y	23°C	
	Rain	N	N			
	Showers	N	N			
	% cloud cover	20%	60%			
	clear/sunny	Y	Y			

STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perennial, cold water		
	Stream origin:	Glacial	Catchment Area above sampling reach (km^2):		4200	
WATERSHED FEATURES	Predominant surounding landuse:	Forest	Local watershed NPS Pollution	N	Local watershed erosion	Moderate
RIPARIAN VEGETATION (18 m buffer)	Dominant type:	Trees	Dominant species:	Mouwa		
INSTREAM FEATURES	Estimated reach length:	1000	Canopy cover:	Partly cover		
	Estimated stream width:	38m	High water mark:	1.5 m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	38,000	Reach area /basin area above sampling reach	0.09%		
	Area in sq. Km	3.8	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,		
	Estimated stream depth: ..	<3m	Channelized:	N		
	Surface velocity:	2.5 -3 m/s	Dam present:	N		
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD (m2/Km2)	0		
AQUATIC VEGETATION	Dominant type	Absent	Dominant species:	N		
	Proportion of the reach with aquatic vegetation:	0				
WATER QUALITY	Temperature:	15.2°C	Water odour:	N		
	Specific conductance:	0.07ms/cm	Water surface oil:	None		
	Dissolved oxygen:	7.7 mg/l				
	pH	7.2(-004mv)				
	Turbidity:	40 NTU				
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer				

SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits:	NO	Black deposits under non-embedded stones?	NO
	Oil:	Absent				

INORGANIC SUBSTRATE COMPONENTS*			**ORGANIC SUBSTRATE COMPONENTS**		
Substrate type	Diameter	% composition	Substrate type	Characteristics	% composition
Bedrock		25%	Detritus	N	0
Boulder	>10''	49%	Muck-Mud	N	0
Cobble	2.5''-10''	15%	Marl	N	0
Gravel	0.1''- 2.5''	10%	sticks, woods coarse plant material (CPOM)	N (occasional twigs)	0
Sand	0.06-2mm	1%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

September 2013/Reach FT 3 (Diversion reach)

STREAM NAME: Trishuli	LOCATION: Gogane Fedi
River Reach: 3	STREAM CLASS: Main River , Greater than 6th order
LAT: 28°05'15.71''N LONG: 085°13'45.18''E	RIVER BASIN: Gandaki
INVESTIGATORS: Rai, N.K.	DATE: 24,9,2013 TIME: 2.30 pm
FORM COMPPLETED BY: Dhruba+Krishna	REASON FOR SURVEY: To study water quality

WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other: ….
	Storm	N	N	Y	33.5°C	
	Rain	N	Y			
	Showers	N	N			
	% cloud cover	20%	30%			
	clear/sunny	Y	N			
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perennial, cold water		
	Stream Origin	Glacial	Catchment Area above sampling reach (km^2):		4400	
WATERSHED FEATURES	Predominant surounding landuse	Forest, agriculture and residences	Local watershed NPS Pollution	N	Local watershed erosion	Moderate
RIPARIAN VEGETATION (18 m buffer)	Dominant type	Trees	Dominant species	Mouwa, chilaune and saj		
INSTREAM FEATURES	Estimated reach length:	1500m	Canopy cover:	Partly cover		
	Estimated stream width:	38m	High water mark:	1.5m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	57,000	Reach area /basin area above sampling reach	0.13%		
	Area in sq. Km	5.7	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion.		

	Estimated stream depth: ..	3-6m	Channelized:	Y		
	Surface velocity:	2.5 - 3 m/s	Dam present:	N		
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD: m2/Km2	0		
AQUATIC VEGETATION	Dominant type	Absent	Dominant species:	N		
	Proportion of the reach with aquatic vegetation:	0				
WATER QUALITY	Temperature:	20°C	Water odour:	N		
	Specific conductance:	0.06ms/cm	Water surface oil:	None		
	Dissolved oxygen:	8.7 mg/l				
	pH	6.9(-033mv)				
	Turbidity:	40NTU				
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer				
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits:	NO	Black deposits under non-embedded stones?	NO
	Oil:	Absent				

INORGANIC SUBSTRATE COMPONENTS*			**ORGANIC SUBSTRATE COMPONENTS**		
Substrate type	Diameter	% composition	Substrate type	Characteristics	% composition
Bedrock		20%	Detritus	N	0
Boulder	>10''	49%	Muck-Mud	N	0
Cobble	2.5''-10''	15%	Marl	N	0
Gravel	0.1''- 2.5''	15%	sticks, woods coarse plant material (CPOM)	N (occasionally)	0
Sand	0.06-2mm	1%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

September 2013/Reach FT 4 (Diversion reach)

STREAM NAME: Trishuli River Reach: 4 LAT: 28°04'46.62''N LONG: 085°13'4.62''E INVESTIGATORS: Rai, N.K. FORM COMPLETED BY: Dhruba+Krishna	LOCATINON: Near Gunchet, Ramche VDC. STREAM CLASS: Main River , Greater than 6th order RIVER BASIN: Gandaki DATE: 22/9/2013 TIME: 2.00 PM REASON FOR SURVEY: To study water quality

WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other: ....
	Storm	N	N	Y	30.8°C	
	Rain	N	Y			
	Showers	N	N			
	% cloud cover	100%	80%			
	clear/sunny	N	N			
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perennial, cold water		
	Stream Origin	Glacial	Catchment Area above sampling reach (km^2):		4,500	
WATERSHED FEATURES	Predominant surounding landuse	Forest	Local watershed NPS Pollution	N	Local watershed erosion	Moderate
RIPARIAN VEGETATION (18 m buffer)	Dominant type	Trees	Dominant species	Chilaune ,Sanjh		
INSTREAM FEATURES	Estimated reach length:	1500m	Canopy cover:	Partly cover		
	Estimated stream width:	35m	High water mark:	2m above the river current water level		
	Sampling reach area m^2 (reach length * stream width):	52,500	Reach area /basin area abovesampling reach	0.13%		
	Area in sq. Km	5.25	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,		

	Estimated stream depth:	<3m	Channelized:	Y (For the water mill of Pari Mailung)		
	Surface velocity:	2.9 m/s	Dam present:	N		
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD: m2/Km2	0		
AQUATIC VEGETATION	Dominant type	Absent	Dominant species:	N		
	Proportion of the reach with aquatic vegetation:	0				
WATER QUALITY	Temperature:	17°C	Water odour:	N		
	Specific conductance:	0.09ms/cm	Water surface oil:	None		
	Dissolved oxygen:	8.4 mg/l				
	pH	6.75(009mv)				
	Turbidity:	30 NTU				
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer				
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits:	NO	Black deposits under non-embedded stones?	NO
	Oil:	Absent				

INORGANIC SUBSTRATE COMPONENTS*			**ORGANIC SUBSTRATE COMPONENTS**		
Substrate type	Diameter	% composition	Substrate type	Characteristics	% composition
Bedrock		10%	Detritus	N	0
Boulder	>10''	56%	Muck-Mud	N	0
Cobble	2.5''-10''	25%	Marl	N	0
Gravel	0.1''- 2.5''	10%	sticks, woods coarse plant material (CPOM)	N (occasionally)	0
Sand	0.06-2mm	1%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

September 2013/Reach FT 5 (Downstream reach)

STREAM NAME: Trishuli River Reach: 5 LAT: 28°04'14.63''N LONG: 085°12'29.80''E INVESTIGATORS: Rai, N.K. FORM COMPLETED BY: Dhruba+Krishna				LOCATION: Mailung dovan STREAM CLASS: Main River , Greater than 6th order RIVER BASIN: Gandaki DATE: 24/9/2013 TIME: 7:20 am REASON FOR SURVEY: To study water quality		
WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other: ….
	Storm	N	N	Y	16.5°C	
	Rain	N	Y			
	Showers	N	N			
	% cloud cover	100%	80%			
	clear/sunny	N	N			
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perennial, cold water		
	Stream Origin	Glacial	Catchment Area above sampling reach (km^2):		4,700	
WATERSHED FEATURES	Predominant surounding landuse:	Forest, agriculture, residence and hydropower	Local watershed NPS Pollution	N	Local watershed erosion	Moderate
RIPARIAN VEGETATION (18 m buffer)	Dominant type	Trees	Dominant species	Mouwa		
INSTREAM FEATURES	Estimated reach length:	1500m	Canopy cover:	Partly cover		
	Estimated stream width:	45m	High water mark:	2m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	67,500	Reach area /basin area above sampling reach	0.16%		
	Area in sq. Km	6.75	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,		

	Estimated stream depth:	3-6m	Channelized:	Y (For the irrigation of Grecho paddy field)		
	Surface velocity:	2.9 m/s	Dam present:	N		
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD (m^2/Km^2)	0		
AQUATIC VEGETATION	Dominant type	Absent	Dominant species:	N		
	Proportion of the reach with aquatic vegetation:	0				
WATER QUALITY	Temperature:	14.5°C	Water odour:	N		
	Specific conductance:	0.06ms/cm	Water surface oil:	None		
	Dissolved oxygen:	9.8 mg/l				
	pH	6.84(002mv)				
	Turbidity:	30 NTU				
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer				
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits:	NO	Black deposits under stones?	NO
	Oil:	Absent				

INORGANIC SUBSTRATE COMPONENTS*			**ORGANIC SUBSTRATE COMPONENTS**		
Substrate type	Diameter	% composition	Substrate type	Characteristics	% composition
Bedrock		15%	Detritus	N	0
Boulder	>10''	59%	Muck-Mud	N	0
Cobble	2.5''-10''	20%	Marl	N	0
Gravel	0.1''- 2.5''	5%	Coarse plant material (CPOM)	N (occasionally)	0
Sand	0.06-2mm	1%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

October 2013/Reach FT 1 (Upstream reach)

STREAM NAME: Trishuli
River Reach: FT 1
LAT: 28°08'41.2''N LONG: 085°18'46.4''E
INVESTIGATORS: Dhurba ,Krishna and Nirsing
FORM COMPPLETED BY: Dhruba+Krishna

LOCATION: Sano Bharkhu(Suntalabari)
STREAM CLASS: Rapid
RIVER BASIN: Gandaki
DATE: 02/11/2013 TIME: 8:20 Am
REASON FOR SURVEY: To study water quality

WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other:
	Storm	N	N	Y	12°C	
	Rain	N	N			
	Showers	N	N			
	% cloud cover	100%	100%			
	clear/sunny	N	N			
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perennial, cold water		
	Stream Origin	Glacial	Catchment area above sampling reach (km2):		4,200	
WATERSHED FEATURES	Predominant surounding land use:	Forest	Local watershed NPS Pollution	N	Local watershed erosion	None
RIPARIAN VEGETATION (18 m buffer)	Dominant type:	Trees	Dominant species:	Pine		
INSTREAM FEATURES	Estimated reach length:	900 m	Canopy cover:	Partly cover		
	Estimated stream width:	40m	High water mark:	1m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	36000	Reach area /basin area above sampling reach	0.09%		
	Area in sq. Km	3.6	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,		
	Estimated stream depth: ..	<3m	Channelized:	N		
	Surface velocity:	2.5 - 3 m/s	Dam present:	N		

LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD (m2/Km2)	0		
AQUATIC VEGETATION	Dominant type	Absent	Dominant species:	N		
	Proportion of the reach with aquatic vegetation:	0				
WATER QUALITY	Temperature:	10°C	Water odour:	N		
	Specific conductance:	0.10ms/cm	Water surface oil:	None		
	Dissolved oxygen:	9.5mg/l				
	pH	7.60(-012mv)				
	Turbidity:	10 NTU(Low)				
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer				
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits:	NO	Black deposits under stones?	YES
	Oil:	Absent				

INORGANIC SUBSTRATE COMPONENTS			ORGANIC SUBSTRATE COMPONENTS		
Substrate type	Diameter	% composition	Substrate type	Characteristics	% composition
Bedrock		5%	Detritus	N	0
Boulder	>10''	40%	Muck-Mud	N	0
Cobble	2.5''-10''	30%	Marl	N	0
Gravel	0.1''- 2.5''	10%	coarse plant material (CPOM)	N (occasional twigs)	0
Sand	0.06-2mm	5%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

October 2013/Reach FT 2 (Diversion reach)

STREAM NAME: Trishuli
River Reach: 2
LAT: 28°06'53.1''N LONG: 085°16'56.6''E
INVESTIGATORS: Rai, N.K.
FORM COMPLETED BY: Dhruba+Krishna

LOCATION: Haku Bensi
STREAM CLASS: Main River , Greater than 6th order
RIVER BASIN: Gandaki
DATE: 01/112013 TIME: 12:30 Pm
REASON FOR SURVEY: To study water quality

WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other:
	Storm	N	N	Y	18°C	
	Rain	N	Y			
	Showers	N	N			
	% cloud cover	100%	30%			
	clear/sunny	y	y			
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perennial,cold water		
	Stream Origin	Glacial	Catchment area above sampling reach (km^2):		4,300	
WATERSHED FEATURES	Predominant surounding landuse	Forest	Local watershed NPS Pollution	N	Local watershed erosion	Moderate
RIPARIAN VEGETATION (18 m buffer)	Dominant type	Trees	Dominant species	Mouwa		
INSTREAM FEATURES	Estimated reach length:	1000	Canopy cover:	Partly cover		
	Estimated stream width:	40m	High water mark:	1m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	40000	Reach area /basin area above sampling reach	0.90%		
	Area in sq. Km	4	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,		
	Estimated stream depth: ..	<3m	Channelized:	Y		
	Surface velocity:	2.5 -3 m/sec aprox	Dam present:	N		

LARGE WOODY DEBRIS	LWD:	N	Density of LWD:0 m2/Km2	0		
AQUATIC VEGETATION	Dominant type	Absent	Dominant species:	N		
	Proportion of the reach with aquatic vegetation:	0				
WATER QUALITY	Temperature:	11°C	Water odour:	N		
	Specific conductance:	0.5ms/cm	Water surface oil:	None		
	Dissolved oxygen:	8.5 mg/l				
	pH	7.5(-002mv)				
	Turbidity:	10 NTU(Low)				
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer				
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits:	NO	Black deposits under non-embedded stones?	YES
	Oil:	Absent				

INORGANIC SUBSTRATE COMPONENTS			**ORGANIC SUBSTRATE COMPONENTS**		
Substrate type	Diameter	% composition	Substrate type	Characteristics	% composition
Bedrock		15%	Detritus	N	0
Boulder	>10''	40%	Muck-Mud	N	0
Cobble	2.5''-10''	20%	Marl	N	0
Gravel	0.1''- 2.5''	20%	Sticks, woods coarse plant material (CPOM)	N (occasional twigs on the banks)	0
Sand	0.06-2mm	5%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

October 2013/Reach FT 3 (Diversion reach)

STREAM NAME: Trishuli	LOCATION: Gogane Fedi
River Reach: 3	STREAM CLASS: Main River , Greater than 6th order
LAT: 28°05'16.8''N LONG: 085°13'45.2''E	RIVER BASIN: Gandaki
INVESTIGATORS: Dhurba, Krishna and Nirsing	DATE: 30/10/2013 TIME: 11:05 Am
FORM COMPPLETED BY: Dhruba+Krishna	REASON FOR SURVEY: To study water quality

WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other: ....
	Storm	N	N	Y	21°C	
	Rain	N	Y			
	Showers	N	N			
	% cloud cover	100%	20%			
	clear/sunny	Y	N			
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perennial, cold water		
	Stream Origin	Glacial	Catchment area above sampling reach (km^2):		4,400	
WATERSHED FEATURES	Predominant surounding landuse	Forest	Local watershed NPS Pollution	N	Local watershed erosion	Moderate
RIPARIAN VEGETATION (18 m buffer)	Dominant type	Trees	Dominant species	Mouwa, chilaune and saj		
INSTREAM FEATURES	Estimated reach length:	1500m	Canopy cover:	Partly cover		
	Estimated stream width:	40m	High water mark:	1m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	60,000	Reach area /basin area above sampling reach	0.13%		
	Area in sq. Km	6	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,		
	Estimated stream depth: ..	3-6m	Channelized:	Y		

	Surface velocity:	2.5 - 3 m/s	Dam present:	N		
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD (m2/Km2)	0		
AQUATIC VEGETATION	Dominant type	Absent	Dominant species:	N		
	Proportion of the reach with aquatic vegetation:	0				
WATER QUALITY	Temperature:	12°C	Water odour:	N		
	Specific conductance:	0.06ms/cm	Water surface oil:	None		
	Dissolved oxygen:	8.65mg/l				
	pH	7.9(004mv)				
	Turbidity:	20NTU(LOW)				
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer				
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits:	NO	Black deposits under non-embedded stones?	NO
	Oil:	Absent				

INORGANIC SUBSTRATE COMPONENTS			**ORGANIC SUBSTRATE COMPONENTS**		
Substrate type	Diameter	% composition in sampling reach	Substrate type	Characteristics	% composition in sampling area
Bedrock		15%	Detritus	N	0
Boulder	>10''	40%	Muck-Mud	N	0
Cobble	2.5''-10''	20%	Marl	N	0
Gravel	0.1''- 2.5''	20%	Sticks, woods coarse plant material (CPOM)	N (occasional twigs on the banks)	0
Sand	0.06-2mm	5%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

October 2013/Reach FT 4 (Diversion reach)

STREAM NAME: Trishuli	LOCATINON: Near Gunchet, Ramche VDC.
River Reach: 4	STREAM CLASS: Main River , Greater than 6th order
LAT: 28°04'46.9''N LONG: 085°12'06.6''E	RIVER BASIN: Gandaki
INVESTIGATORS:Dhurba, Krishan and Nirsing	DATE: 29,10,2013 TIME: 12.55 PM
FORM COMPPLETED BY: Dhruba+Krishna	REASON FOR SURVEY: To study water quality

WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other:
	Storm	N	N	Y	22°C	
	Rain	N	Y			
	Showers	N	N			
	% cloud cover	10%	20%			
	clear/sunny	Y	Y			
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perennial, cold water		
	Stream Origin	Glacial	Catchment area above sampling reach (km^2):		4,500	
WATERSHED FEATURES	Predominant surounding landuse	Forest	Local watershed NPS Pollution	N	Local watershed erosion	Moderate
RIPARIAN VEGETATION (18 m buffer)	Dominant type	Trees	Dominant species	Chilaune ,Sanjh		
INSTREAM FEATURES	Estimated reach length:	1500m	Canopy cover:	Partly cover		
	Estimated stream width:	40m	High water mark:	1m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	60000	Reach area /basin area abovesampling reach	0.13%		
	Area in sq. Km	6	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,		
	Estimated stream depth:	<3m	Channelized:	N		
	Surface velocity:	2.9 m/s	Dam present:	N		

LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD (m2/Km2)	0		
AQUATIC VEGETATION	Dominant type	Absent	Dominant species:	N		
	Proportion of the reach with aquatic vegetation:	0				
WATER QUALITY	Temperature:	11°C	Water odour:	N		
	Specific conductance:	0.19ms/cm	Water surface oil:	None		
	Dissolved oxygen:	8.6 mg/l				
	pH	7.9(008mv)				
	Turbidity:	20 NTU (LOW)				
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer				
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits:	NO	Black deposits under non-embedded stones?	NO
	Oil:	Absent				

INORGANIC SUBSTRATE COMPONENTS			**ORGANIC SUBSTRATE COMPONENTS**		
Substrate type	Diameter	% composition in sampling reach	Substrate type	Characteristics	% composition in sampling area
Bedrock		15%	Detritus	N	0
Boulder	>10''	40%	Muck-Mud	N	0
Cobble	2.5''-10''	20%	Marl	N	0
Gravel	0.1''- 2.5''	20%	Coarse plant material (CPOM)	N (occasional twigs)	0
Sand	0.06-2mm	5%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

October 2013/Reach FT 5 (Downstream reach)

STREAM NAME: Trishuli	LOCATION: Mailung dovan
River Reach: 5	STREAM CLASS: Main River , Greater than 6th order
LAT: 28°04'15.1''N LONG: 085°12'29.0''E	RIVER BASIN: Gandaki
INVESTIGATORS: Rai, N.K.	DATE: 28/10/2013 TIME: 7:00 Am
FORM COMPPLETED BY: Dhruba+Krishna	REASON FOR SURVEY: To study water quality

WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other:
	Storm	N	N	Y	17°C	
	Rain	N	Y			
	Showers	N	N			
	% cloud cover	20%	30%			
	clear/sunny	y	y			
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perennial, cold water		
	Stream Origin	Glacial	Catchment area above sampling reach (km^2):		4,700	
WATERSHED FEATURES	Predominant surrounding landuse:	Forest , residential, hydropower	Local watershed NPS Pollution	N	Local watershed erosion	Moderate
RIPARIAN VEGETATION (18 m buffer)	Dominant type	Trees	Dominant species	Mouwa		
INSTREAM FEATURES	Estimated reach length:	1500m	Canopy cover:	Partly cover		
	Estimated stream width:	50m	High water mark:	1m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	75,000	Reach area /basin area above sampling reach	0.16%		
	Area in sq. Km	7.5	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,		
	Estimated stream depth: ..	3-6m	Channelized:	Y		
	Surface velocity:	2.9 m/sec aprox	Dam present:	N		

LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD:0 m2/Km2	0		
AQUATIC VEGETATION	Dominant type	Absent	Dominant species:	N		
	Proportion of the reach with aquatic vegetation:	0				
WATER QUALITY	Temperature:	14°C	Water odour:	N		
	Specific conductance:	0.16ms/cm	Water surface oil:	None		
	Dissolved oxygen:	8.4 mg/l				
	pH	6.84(002mv)				
	Turbidity:	10NTU(Low)				
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer				
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits:	NO	Black deposits under non-embedded stones?	NO
	Oil:	Absent				

INORGANIC SUBSTRATE COMPONENTS			**ORGANIC SUBSTRATE COMPONENTS**		
Substrate type	Diameter	% composition in sampling reach	Substrate type	Characteristics	% composition in sampling area
Bedrock		10%	Detritus	N	0
Boulder	>10''	40%	Muck-Mud	N	0
Cobble	2.5''-10''	30%	Marl	N	0
Gravel	0.1''- 2.5''	15%	Coarse plant material (CPOM)	N (occasional twigs)	0
Sand	0.06-2mm	5%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

November 2013/Reach FT 1 (Upstream reach)

STREAM NAME: Trishuli	LOCATION: Sano Bharkhu(Suntalabari)
River Reach: FT 1	STREAM CLASS: Rapid
LAT: 28°08'41.6''N LONG: 085°18'47.1''E	RIVER BASIN: Gandaki
INVESTIGATORS: Dhurba ,Krishna and Nirsing	DATE: 11,12,2013 TIME: 11:20 Am
FORM COMPLETED BY: Dhruba+Krishna	REASON FOR SURVEY: To study water quality

WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other:
	Storm	N	N	N	13°C	
	Rain	N	N			
	Showers	N	N			
	% cloud cover	5%	10%			
	clear/sunny	Y	Y			
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perrineal, Cold water		
	Stream Origin	Glacial	Catchment Area above sampling reach (km2):	4200		
WATERSHED FEATURES	Predominant surrounding land use	Forest	Local watershed NPS Pollution	N	Local watershed erosion	None
RIPARIAN VEGETATION (18 m buffer)	Dominant type:	Trees	Dominant species:	Pine		
INSTREAM FEATURES	Estimated reach length:	900 m	Canopy cover:	Partly cover		
	Estimated stream width:	28m	High water mark:	1m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	36000	Reach area /basin area above sampling reach	0.09%		

	Area in sq. Km	3.6	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,		
	Estimated stream depth:	<3m	Channelized:	N		
	Surface velocity:	2.5 - 3 m/s	Dam present:	N		
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD m2/Km2	0		
AQUATIC VEGETATION	Dominant type	Absent	Dominant species:	N		
	Proportion of the reach with aquatic vegetation:	0				
WATER QUALITY	Temperature:	7°C	Water odour:	N		
	Specific conductance:	0.10ms/cm	Water surface oil:	None		
	Dissolved oxygen:	8.8.mg/l				
	pH	8.70(013mv)				
	Turbidity:	5 NTU(Low)				
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer				
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits:	No	Black deposits under rocks?	No
	Oil:	Absent				

INORGANIC SUBSTRATE COMPONENTS		
Substrate type	Diameter	% composition
Bedrock		15%
Boulder	>10''	35%
Cobble	2.5''-10''	30%
Gravel	0.1''- 2.5''	15%
Sand	0.06-2mm	5%
Silt	0.004-0.06mm	0%
Clay	<0.004mm	0%

ORGANIC SUBSTRATE COMPONENTS		
Substrate type	Characteristics	% composition
Detritus	N	0
Muck-Mud	N	0
Marl	N	0
Coarse plant material (CPOM)	N (occasional twigs)	0
Black,very fine organic (FPOM)	N	0
Grey shell fragments	N	0

November 2013/Reach FT 2 (Diversion reach)

STREAM NAME: Trishuli River Reach: 2 LAT: 28°06'52.9''N LONG: 085°16'56.7''E INVESTIGATORS: Rai, N.K. FORM COMPPLETED BY: Dhruba+Krishna				LOCATION: Haku Bensi STREAM CLASS: Main River , Greater than 6th order RIVER BASIN: Gandaki DATE: 01,12,2013 TIME: 1:26 Pm REASON FOR SURVEY: To study water quality		
WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other:
	Storm	N	N	N	19°C	
	Rain	N	Y			
	Showers	N	N			
	% cloud cover	5%	10%			
	clear/sunny	Y	Y			
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perrineal, Cold water		
	Stream Origin	Glacial	Catchment Area above sampling reach (km2):	4300		
WATERSHED FEATURES	Predominant surounding landuse	Forest	Local watershed NPS Pollution	N	Local watershed erosion	Moderate
RIPARIAN VEGETATION	Dominant type:	Trees	Dominant species:	Mouwa		
INSTREAM FEATURES	Estimated reach length:	1000	Canopy cover:	Partly cover		
	Estimated stream width:	30m	High water mark:	1m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	40000	Reach area /basin area above sampling reach	0.90%		
	Area in sq. Km	4	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,		
	Estimated stream depth: ..	<3m	Channelized:	Y		
	Surface velocity:	2.5 -3 m/sec aprox	Dam present:	N		

LARGE WOODY DEBRIS	LWD:	N	Density of LWD m2/Km2	0
AQUATIC VEGETATION	Dominant type	Absent	Dominant species:	N
	Proportion of the reach with aquatic vegetation:	0		
WATER QUALITY	Temperature:	9°C	Water odour:	N
	Specific conductance:	0.15ms/cm	Water surface oil:	None
	Dissolved oxygen:	8.7mg/l		
	pH	7.70(060mv)		
	Turbidity:	5 NTU(Low)		
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer		
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits:	NO — Black deposits under rocks?
	Oil:	Absent		

INORGANIC SUBSTRATE COMPONENTS			**ORGANIC SUBSTRATE COMPONENTS**		
Substrate type	Diameter	% composition	Substrate type	Characteristics	% composition
Bedrock		15%	Detritus	N	0
Boulder	>10''	35%	Muck-Mud	N	0
Cobble	2.5''-10''	30%	Marl	N	0
Gravel	0.1''- 2.5''	15%	Coarse plant material (CPOM)	N (rare twigs on the river banks)	0
Sand	0.06-2mm	5%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

November 2013/Reach FT 3 (Diversion reach)

STREAM NAME: Trishuli
River Reach: 3
LAT: 28°05'16.5''N LONG: 085°13'45.3''E
INVESTIGATORS: Dhurba, Krishna and Nirsing
FORM COMPPLETED BY: Dhruba+Krishna

LOCATION: Gogane Fedi
STREAM CLASS: Main River , Greater than 6th order
RIVER BASIN: Gandaki
DATE: 29,11,2013 TIME: 10:20 Am
REASON FOR SURVEY: To study water quality

WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other:
	Storm	N	N	N	18°C	
	Rain	N	Y			
	Showers	N	N			
	% cloud cover	5%	10%			
	clear/sunny	Y	Y			
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perrineal, Cold water		
	Stream Origin	Glacial	Catchment Area above sampling reach (km2):	4400		
WATERSHED FEATURES	Predominant surounding landuse	Forest	Local watershed NPS Pollution	N	Local watershed erosion	Moderate
RIPARIAN VEGETATION	dominant type	Trees	Dominant species	Mouwa, chilaune and saj		
INSTREAM FEATURES	Estimated reach length:	1500m	Canopy cover:	Partly cover		
	Estimated stream width:	34m	High water mark:	1m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	60000	Reach area /basin area above sampling reach	0.13%		

	Area in sq. Km	6	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,		
	Estimated stream depth:	>3m<6m	Channelized:	Y		
	Surface velocity:	2.5 - 3 m/s	Dam present:	N		
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD:0 m2/Km2	0		
AQUATIC VEGETATION	Dominant type	Absent	Dominant species:	N		
	Proportion of the reach with aquatic vegetation:	0				
WATER QUALITY	Temperature:	10°C	Water odour:	N		
	Specific conductance:	0.10ms/cm	Water surface oil:	None		
	Dissolved oxygen:	8.5mg/l				
	pH	7.70(-047mv)				
	Turbidity:	5NTU(LOW)				
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer				
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits: No	Black deposits under rocks?	NO	
	Oil:	Absent				

INORGANIC SUBSTRATE COMPONENTS			**ORGANIC SUBSTRATE COMPONENTS**		
Substrate type	Diameter	% composition in sampling reach	Substrate type	Characteristics	% composition in sampling area
Bedrock		15%	Detritus	N	0
Boulder	>10''	35%	Muck-Mud	N	0

Cobble	2.5''-10''	30%	Marl	N	0
Gravel	0.1''- 2.5''	15%	Coarse plant material (CPOM)	N occasional twigs)	0
Sand	0.06-2mm	5%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

November 2013/Reach FT 4 (Diversion reach)

STREAM NAME: Trishuli
River Reach: 4
LAT: 28°04'46.9''N LONG: 085°12'06.6''E
INVESTIGATORS:Dhurba, Krishan and Nirsing
FORM COMPPLETED BY: Dhruba+Krishna

LOCATINON: Near Gunchet, Ramche VDC.
STREAM CLASS: Main River , Greater than 6th order
RIVER BASIN: Gandaki
DATE: 28,11,2013 TIME: 1.15 PM
REASON FOR SURVEY: To study water quality

WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other: ....
	Storm	N	N	N	2220°C	
	Rain	N	Y			
	Showers	N	N			
	% cloud cover	5%	15%			
	clear/sunny	Y	Y			
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perrineal, Cold water		
	Stream Origin	Glacial	Catchment Area above sampling reach (km2):	4500		
WATERSHED FEATURES	Predominant surounding landuse	Forest	Local watershed NPS Pollution	N	Local watershed erosion	Moderate

RIPARIAN VEGETATION	Dominant type	Trees	Dominant species	Chilaune ,Sanjh
INSTREAM FEATURES	Estimated reach length:	1500m	Canopy cover:	Partly cover
	Estimated stream width:	30m	High water mark:	1m above the river current water level
	Sampling reach area m2 (reach length * stream width):	60000	Reach area /basin area above sampling reach	0.13%
	Area in sq. Km	6	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,
	Estimated stream depth: ..	<3m	Channelized:	N
	Surface velocity:	2.9 m/sec aprox	Dam present:	N
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD:0 m2/Km2	0
AQUATIC VEGETATION	dominant type	Absent		Dominant species: N
	Proportion of the reach with aquatic vegetation:	0		
WATER QUALITY	Temperature:	11°C	Water odour:	N
	Specific conductance:	0.10ms/cm	Water surface oil:	None
	Dissolve oxygen:	8.5 mg/l		
	pH	8.00(-004mv)		
	Turbidity:	10 NTU (LOW) DUT TO CONSTRUCTION ACTIVITY		
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer		
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits: No	Black deposits under rocks? No
	Oil:	Absent		

INORGANIC SUBSTRATE COMPONENTS			ORGANIC SUBSTRATE COMPONENTS		
Substrate type	Diameter	% composition	Substrate type	Characteristics	%

						composition
Bedrock		10%		Detritus	N	0
Boulder	>10''	35%		Muck-Mud	N	0
Cobble	2.5''-10''	30%		Marl	N	0
Gravel	0.1''- 2.5''	20%		sticks, woods coarse plant material (CPOM)	N (rare twigs of trees on the river banks occasionally)	0
Sand	0.06-2mm	5%		Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%		Grey shell fragments	N	0
Clay	<0.004mm	0%				

November 2013/Reach FT 5 (Downstream reach)

STREAM NAME: Trishuli	LOCATION: Mailung dovan
River Reach: 5	STREAM CLASS: Main River , Greater than 6th order
LAT: 28°04'15.3''N LONG: 085°12'29.1''E	RIVER BASIN: Gandaki
INVESTIGATORS: Rai, N.K.	DATE: 27,11,2013 TIME:4:00 PM
FORM COMPPLETED BY: Dhruba+Krishna	REASON FOR SURVEY: To study water quality

	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other: ....
WEATHER CONDITIONS	Storm	N	N	N	22°C	
	Rain	N	N			
	Showers	N	N			
	% cloud cover	7%	10%			
	clear/sunny	Y	Y			

STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perrineal, Cold water
	Stream Origin	Glacial	Catchment Area above sampling reach (km2):	4700

WATERSHED FEATURES	Predominant surounding landuse	forest , residential, industrial (HP)	Local watershed NPS Pollution	N	Local watershed erosion	Moderate
RIPARIAN VEGETATION	dominant type	Trees	Dominant species	Mouwa		
INSTREAM FEATURES	Estimated reach length:	1500m	Canopy cover:	Partly cover		
	Estimated stream width:	30m	High water mark:	1m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	75000	Reach area /basin area above sampling reach	0.16%		
	Area in sq. Km	7.5	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,		
	Estimated stream depth: ..	>3m<6m	Channelized:	Y		
	Surface velocity:	2.9 m/sec aprox	Dam present:	N		
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD:0 m2/Km2	0		
AQUATIC VEGETATION	dominant type	Absent		Dominant species:	N	
	Proportion of the reach with aquatic vegetation:	0				
WATER QUALITY	Temperature:	11°C	Water odour:	N		
	Specific conductance:	0.30ms/cm	Water surface oil:	None		
	Dissolve oxygen:	8.5 mg/l				
	pH	7.80(002mv)				
	Turbidity:	5NTU(Low)				
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer				
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits: No	Black deposits under rocks?	No	
	Oil:	Absent				

INORGANIC SUBSTRATE COMPONENTS			ORGANIC SUBSTRATE COMPONENTS		
Substrate type	Diameter	% composition	Substrate type	Characteristics	% composition
Bedrock		15%	Detritus	N	0
Boulder	>10''	40%	Muck-Mud	N	0
Cobble	2.5''-10''	25%	Marl	N	0
Gravel	0.1''- 2.5''	15%	sticks, woods coarse plant material (CPOM)	N (occasional twigs and other materials)	0
Sand	0.06-2mm	5%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

December 2013/Reach FT 1 (Upstream reach)

STREAM NAME: Trishuli	LOCATION: Sano Bharkhu(Suntalabari)
River Reach: FT 1	STREAM CLASS: Rapid
LAT: 28° 8'43.60"N LONG: 85°18'49.75"E	RIVER BASIN: Gandaki
INVESTIGATORS: Dhurba ,Krishna and Nirsing	DATE: 30,12,2013 TIME: 11:49 Am
FORM COMPPLETED BY: Dhruba+Krishna q1	REASON FOR SURVEY: To study water quality

	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other: ….
WEATHER CONDITIONS	Storm	N	N	N	8°C	
	Rain	N	N			
	Showers	N	N			
	% cloud cover	10%	5%			
	clear/sunny	Y	Y			

STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perrineal, Cold water		
	Stream Origin	Glacial	Catchment Area above sampling reach (km2):	4200		
WATERSHED FEATURES	Predominant surounding land use	Forest	Local watershed NPS Pollution	N	Local watershed erosion	None
RIPARIAN VEGETATION (18 m buffer)	Dominant type	Trees	Dominant species	Pine		
INSTREAM FEATURES	Estimated reach length:	900 m	Canopy cover:	Partly cover		
	Estimated stream width:	26m	High water mark:	1m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	23400	Reach area /basin area above sampling reach	0.09%		
	Area in sq. Km	0.0234	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,		
	Estimated stream depth: ..	<3m	Channelized:	N		
	Surface velocity:	2.5 - 3 m/sec aprox	Dam present:	N		
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD m2/Km2	0		
AQUATIC VEGETATION	Dominant type	Absent		Dominant species:	N	
	Proportion of the reach with aquatic vegetation:	0				
WATER QUALITY	Temperature:	6°C	Water odour:	N		
	Specific conductance:	0.02ms/cm	Water surface oil:	None		

	Dissolve oxygen:	8.3mg/l				
	pH	6.53(-0040mv)				
	Turbidity:	<5 NTU(Low)				
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer				
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits:	No	Black deposits under rocksr?	No
	Oil:	Absent				

INORGANIC SUBSTRATE COMPONENTS			**ORGANIC SUBSTRATE COMPONENTS**		
Substrate type	Diameter	% composition	Substrate type	Characteristics	% composition
Bedrock		15%	Detritus	N	2%
Boulder	>10''	35%	Muck-Mud	N	0
Cobble	2.5''-10''	30%	Marl	N	0
Gravel	0.1''- 2.5''	15%	sticks, woods coarse plant material (CPOM)	N (rare)	0
Sand	0.06-2mm	5%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

December 2013/Reach FT 2 (Diversion reach)

STREAM NAME: Trishuli River Reach: 2 LAT: 28°06'53.23''N LONG: 085°16'56.60''E INVESTIGATORS: Rai, N.K. Dhurba,krishna and Nirsing FORM COMPLETED BY: Dhruba+Krishna	LOCATION: Haku Bensi STREAM CLASS: Main River , Greater than 6th order RIVER BASIN: Gandaki DATE: 29,12,2013 TIME: 1:34 Pm REASON FOR SURVEY: To study water quality

WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other: ….
	Storm	N	N	N	16°C	
	Rain	N	Y			
	Showers	N	N			
	% cloud cover	5%	5%			
	clear/sunny	Y	Y			
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perrineal, Cold water		
	Stream Origin	Glacial	Catchment Area above sampling reach (km2):	4300		
WATERSHED FEATURES	Predominant surounding landuse	Forest	Local watershed NPS Pollution	N	Local watershed erosion	Moderate
RIPARIAN VEGETATION	Dominant type	Trees	Dominant species	Mouwa		
INSTREAM FEATURES	Estimated reach length:	1000	Canopy cover:	Partly cover		
	Estimated stream width:	28m	High water mark:	1m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	28000	Reach area /basin area above sampling reach	0.90%		

	Area in sq. Km	0.028	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,		
	Estimated stream depth: ..	<3m	Channelized:	Y		
	Surface velocity:	2.5 -3 m/sec aprox	Dam present:	N		
LARGE WOODY DEBRIS	LWD:	N	Density of LWD:0 m2/Km2	0		
AQUATIC VEGETATION	dominant type	Absent		Dominant species:	N	
	Proportion of the reach with aquatic vegetation:	0				
WATER QUALITY	Temperature:	6°C	Water odour:	N		
	Specific conductance:	0.02ms/cm	Water surface oil:	None		
	Dissolve oxygen:	8.4mg/l				
	pH	7.94(-0340mv)				
	Turbidity:	<5 NTU(Low)				
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer				
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits:	No	Black deposits under rocks?	No
	Oil:	Absent				

INORGANIC SUBSTRATE COMPONENTS			ORGANIC SUBSTRATE COMPONENTS		
Substrate type	Diameter	% composition	Substrate type	Characteristics	% composition
Bedrock		15%	Detritus	N	0%
Boulder	>10''	35%	Muck-Mud	N	0
Cobble	2.5''-10''	30%	Marl	N	0
Gravel	0.1''- 2.5''	15%	Coarse plant material (CPOM)	N (occasionally)	0
Sand	0.06-2mm	5%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

December 2013/Reach FT 3 (Diversion reach)

STREAM NAME: Trishuli	LOCATION: Gogane Fedi
River Reach: 3	STREAM CLASS: Main River , Greater than 6th order
LAT: 28° 5'16.90"N LONG: 85°13'46.23"E	RIVER BASIN: Gandaki
INVESTIGATORS: Dhurba, Krishna and Nirsing	DATE: 28,12,2013 TIME: 11:10 Am
FORM COMPPLETED BY: Dhruba+Krishna	REASON FOR SURVEY: To study water quality

WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Has there been a heavy rain in the last 7 days?	Air Temperature:	Other: ....
	Storm	N	N	N	14°C	
	Rain	N	Y			
	Showers	N	N			
	% cloud cover	5%	10%			
	clear/sunny	Y	Y			
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perrineal, Cold water		
	Stream Origin	Glacial	Catchment Area above sampling reach (km2):	4400		
WATERSHED FEATURES	Predominant surounding landuse	Forest	Local watershed NPS Pollution	N	Local watershed erosion	Moderate
RIPARIAN VEGETATION (18 m buffer)	dominant type	Trees	Dominant species	Mouwa, chilaune and saj		
INSTREAM FEATURES	Estimated reach length:	1500m	Canopy cover:	Partly cover		
	Estimated stream width:	32m	High water mark:	1m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	48000	Reach area /basin area above sampling reach	0.13%		
	Area in sq. Km	0.048	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,		

	Estimated stream depth: ..	>3m	Channelized:	Y		
	Surface velocity:	2.5 - 3 m/sec aprox	Dam present:	N		
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD:0 m2/Km2	0		
AQUATIC VEGETATION	dominant type	Absent		Dominant species:	N	
	Proportion of the reach with aquatic vegetation:	0				
WATER QUALITY	Temperature:	7°C	Water odour:	N		
	Specific conductance:	0.020ms/cm	Water surface oil:	None		
	Dissolve oxygen:	8.9mg/l				
	pH	7.84(-030mv)				
	Turbidity:	<5NTU(LOW)				
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer				
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits: No	Black deposits under rocks?	NO	
	Oil:	Absent				

INORGANIC SUBSTRATE COMPONENTS			**ORGANIC SUBSTRATE COMPONENTS**		
Substrate type	Diameter	% composition	Substrate type	Characteristics	% composition
Bedrock		15%	Detritus	N	0
Boulder	>10''	35%	Muck-Mud	N	0
Cobble	2.5''-10''	25%	Marl	N	0
Gravel	0.1''- 2.5''	20%	sticks, woods coarse plant material (CPOM)	N (occasionally)	0
Sand	0.06-2mm	5%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

December 2013/Reach FT 4 (Diversion reach)

STREAM NAME: Trishuli	LOCATINON: Near Gunchet, Ramche VDC.
River Reach: 4	STREAM CLASS: Main River , Greater than 6th order
LAT: 28° 4'47.10"N LONG: 85°13'5.39"E	RIVER BASIN: Gandaki
INVESTIGATORS:Dhurba, Krishan and Nirsing	DATE: 26,12,2013 TIME: 1.43 PM
FORM COMPLETED BY: Dhruba+Krishna	REASON FOR SURVEY: To study water quality

WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other: ....
	Storm	N	N	N	17°C	
	Rain	N	Y			
	Showers	N	N			
	% cloud cover	5%	10%			
	clear/sunny	Y	Y			
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perrineal, Cold water		
	Stream Origin	Glacial	Catchment Area above sampling reach (km2):	4500		
WATERSHED FEATURES	Predominant surounding landuse		Forest		Local watershed NPS Pollution	N
RIPARIAN VEGETATION (18 m buffer)	dominant type	Trees	Dominant species	Chilaune ,Sanjh		
INSTREAM FEATURES	Estimated reach length:	1500m	Canopy cover:	Partly cover		
	Estimated stream width:	26m	High water mark:	1m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	39000	Reach area /basin area abovesampling reach	13.00%		
	Area in sq. Km	0.039	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,		

	Estimated stream depth: ..	<3m	Channelized:	N		
	Surface velocity:	2.9 m/sec aprox	Dam present:	N		
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD m2/Km2	0		
AQUATIC VEGETATION	dominant type	Absent		Dominant species:	N	
	Proportion of the reach with aquatic vegetation:	0				
WATER QUALITY	Temperature:	7°C	Water odour:	N		
	Specific conductance:	0.020ms/cm	Water surface oil:	None		
	Dissolve oxygen:	7.8 mg/l				
	pH	8.70(-075mv)				
	Turbidity:	5 NTU (LOW) DUT TO CONSTRUCTION ACTIVITY				
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer				
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits:	NO	Black deposits under rocks?	No
	Oil:	Absent				

INORGANIC SUBSTRATE COMPONENTS			**ORGANIC SUBSTRATE COMPONENTS**		
Substrate type	Diameter	% composition	Substrate type	Characteristics	% composition
Bedrock		10%	Detritus	N	0
Boulder	>10''	35%	Muck-Mud	N	0
Cobble	2.5''-10''	30%	Marl	N	0
Gravel	0.1''- 2.5''	20%	Coarse plant material (CPOM)	N (rare twigs)	0
Sand	0.06-2mm	5%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

December 2013/Reach FT 5 (Downstream reach)

STREAM NAME: Trishuli	LOCATION: Mailung dovan
River Reach: 5	STREAM CLASS: Main River , Greater than 6th order
LAT: 28° 4'15.17"N LONG: 85°12'29.67"E	RIVER BASIN: Gandaki
INVESTIGATORS: Rai, N.K. Dhurba,Krishna and Nirsing	DATE: 27,11,2013 TIME:4:00 PM
FORM COMPLETED BY: Dhruba+Krishna	REASON FOR SURVEY: To study water quality

WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other: ....
	Storm	N	N	N	13°C	
	Rain	N	N			
	Showers	N	N			
	% cloud cover	10%	15%			
	clear/sunny	Y	Y			
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perrineal, Cold water		
	Stream Origin	Glacial	Catchment Area above sampling reach (km2):	4700		
WATERSHED FEATURES	Predominant surounding landuse	forest , residential, industrial (HP)	Local watershed NPS Pollution	N	Local watershed erosion	Moderate
RIPARIAN VEGETATION (18 m buffer)	dominant type	Trees	Dominant species	Mouwa		
INSTREAM FEATURES	Estimated reach length:	1500m	Canopy cover:	Partly cover		
	Estimated stream width:	30m	High water mark:	1m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	75000	Reach area /basin area above sampling reach	0.16%		

	Area in sq. Km	0.075	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,		
	Estimated stream depth: ..	>3m	Channelized:	Y		
	Surface velocity:	2.9 m/sec aprox	Dam present:	N		
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD:0 m2/Km2	0		
AQUATIC VEGETATION	dominant type	Absent		Dominant species:	N	
	Proportion of the reach with aquatic vegetation:	0				
WATER QUALITY	Temperature:	8°C	Water odour:	N		
	Specific conductance:	0.10ms/cm	Water surface oil:	None		
	Dissolve oxygen:	8.6 mg/l				
	pH	6.70(007mv)				
	Turbidity:	<5NTU(Low)				
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer				
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits: No	Black deposits under stones?	No	
	Oil:	Absent				

INORGANIC SUBSTRATE COMPONENTS			**ORGANIC SUBSTRATE COMPONENTS**		
Substrate type	Diameter	% composition	Substrate type	Characteristics	%
Bedrock		10%	Detritus	N	0
Boulder	>10''	40%	Muck-Mud	N	0
Cobble	2.5''-10''	30%	Marl	N	0
Gravel	0.1''- 2.5''	15%	Coarse plant material (CPOM)	N (rare)	0
Sand	0.06-2mm	5%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

January 2014/Reach FT 1 (Upstream reach)

STREAM NAME: Trishuli River Reach: FT 1 LAT: 28° 8'43.60"N LONG: 85°18'49.75"E INVESTIGATORS: Dhurba ,Krishna and Nirsing FORM COMPPLETED BY: q1 Dhruba+Krishna	LOCATION: Sano Bharkhu(Suntalabari) STREAM CLASS: Rapid RIVER BASIN: Gandaki DATE: 25.01.014 TIME: 11:33 Am REASON FOR SURVEY: To study water quality

WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Has there been a heavy rain in the last 7 days?	Air Temperature:	Other: ....
	Storm	N	N	N	14°C	
	Rain	N	N			
	Showers	N	N			
	% cloud cover	10%	5%			
	clear/sunny	Y	Y			
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perrineal, Cold water		
	Stream Origin	Glacial	Catchment Area above sampling reach (km2):	4200		
WATERSHED FEATURES	Predominant surounding land use	Forest	Local watershed NPS Pollution	N	Local watershed erosion	None
RIPARIAN VEGETATION (18 m buffer)	dominant type	Trees	Dominant species	Pine		
INSTREAM FEATURES	Estimated reach length:	900 m	Canopy cover:	Partly cover		
	Estimated stream width:	26m	High water mark:	1m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	23400	Reach area /basin area above sampling	0.09%		

	Area in sq. Km	0.0234	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,		
	Estimated stream depth: ..	<3m	Channelized:	N		
	Surface velocity:	2.5 - 3 m/sec aprox	Dam present:	N		
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD: m2/Km2	0		
AQUATIC VEGETATION	dominant type	Absent	Dominant species:	N		
	Proportion of the reach with aquatic vegetation:	0				
WATER QUALITY	Temperature:	8°C	Water odour:	N		
	Specific conductance:	0.02ms/cm	Water surface oil:	None		
	Dissolve oxygen:	7.5mg/l				
	pH	8.32(-025mv)				
	Turbidity:	<5 NTU(Low)				
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer				
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits:	No	Black deposits under rocks?	No
	Oil:	Absent				

INORGANIC SUBSTRATE COMPONENTS			**ORGANIC SUBSTRATE COMPONENTS**		
Substrate type	Diameter	% composition	Substrate type	Characteristics	%
Bedrock		15%	Detritus	N	2%
Boulder	>10''	35%	Muck-Mud	N	0
Cobble	2.5''-10''	30%	Marl	N	0
Gravel	0.1''- 2.5''	15%	Coarse plant material (CPOM)	N (rare twigs)	0

Sand	0.06-2mm	5%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

January 2014/Reach FT 2 (Diversion reach)

STREAM NAME: Trishuli	LOCATION: Haku Bensi
River Reach: 2	STREAM CLASS: Main River , Greater than 6th order RIVER BASIN: Gandaki
LAT: 28°06'53.23''N LONG: 085°16'56.60''E INVESTIGATORS: Rai, N.K. Dhurba,krishna and Nirsing FORM COMPPLETED BY: Dhruba+Krishna	DATE: 26.01.014 TIME: 12:40Pm REASON FOR SURVEY: To study water quality

WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Has there been a heavy rain in the last 7 days?	Air Temperature:	Other: ....
	Storm	N	N	N	18°C	
	Rain	N	Y			
	Showers	N	N			
	% cloud cover	5%	5%			
	clear/sunny	Y	Y			
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perrineal, Cold water		
	Stream Origin	Glacial	Catchment Area above sampling reach (km2):	4300		
WATERSHED FEATURES	Predominant surounding landuse	Forest	Local watershed NPS Pollution	N	Local watershed erosion	Moderat e
RIPARIAN VEGETATION (18 m buffer)	dominant type	Trees	Dominant species	Mouwa		

INSTREAM FEATURES	Estimated reach length:	1000	Canopy cover:	Partly cover		
	Estimated stream width:	28m	High water mark:	1m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	28000	Reach area /basin area above sampling reach)	0.90%		
	Area in sq. Km	0.028	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,		
	Estimated stream depth: ..	<3m	Channelized:	Y		
	Surface velocity:	2.5 -3 m/sec aprox	Dam present:	N		
LARGE WOODY DEBRIS	LWD:	N	Density of LWD:0 m2/Km2	0		
AQUATIC VEGETATION	dominant type	Absent		Dominant species:	N	
	Proportion of the reach with aquatic vegetation:	0				
WATER QUALITY	Temperature:	8°C	Water odour:	N		
	Specific conductance:	0.02ms/cm	Water surface oil:	None		
	Dissolve oxygen:	8.5mg/l				
	pH	8.54(016mv)				
	Turbidity:	<5 NTU(Low)				
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer				
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits:	No	Black deposits under rocks?	Yes
	Oil:	Absent				

INORGANIC SUBSTRATE COMPONENTS			ORGANIC SUBSTRATE COMPONENTS		
Substrate type	Diameter	% composition	Substrate type	Characteristics	%
Bedrock		15%	Detritus	N	0%
Boulder	>10''	35%	Muck-Mud	N	0
Cobble	2.5''-10''	30%	Marl	N	0
Gravel	0.1''- 2.5''	15%	sticks, woods coarse plant material (CPOM)	N (rare)	0
Sand	0.06-2mm	5%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

January 2014/Reach FT 3 (Diversion reach)

STREAM NAME: Trishuli	LOCATION: Gogane Fedi
River Reach: 3	STREAM CLASS: Main River , Greater than 6th order
LAT: 28° 5'16.90"N LONG: 85°13'46.23"E	RIVER BASIN: Gandaki
INVESTIGATORS: Dhurba, Krishna and Nirsing	DATE: 23.01.014 TIME: 10:33 Am
FORM COMPPLETED BY: Dhruba+Krishna	REASON FOR SURVEY: To study water quality

	Particulars	NOW	PAST 24 HR	Has there been a heavy rain in the last 7 days?	Air Temperature:	Other: ….
WEATHER CONDITIONS	Storm	N	N	N	14°C	
	Rain	N	Y			
	Showers	N	N			
	% cloud cover	5%	10%			
	clear/sunny	Y	Y			

STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perrineal, Cold water		
	Stream Origin	Glacial	Catchment Area above sampling reach (km2):	4400		
WATERSHED FEATURES	Predominant surounding landuse	Forest	Local watershed NPS Pollution	N	Local watershed erosion	Moderate
RIPARIAN VEGETATION (18 m buffer)	dominant type	Trees	Dominant species	Mouwa, chilaune and saj		
INSTREAM FEATURES	Estimated reach length:	1500m	Canopy cover:	Partly cover		
	Estimated stream width:	32m	High water mark:	1m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	48000	Reach area /basin area above sampling reach	0.13%		
	Area in sq. Km	0.048	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,		
	Estimated stream depth: ..	>3m	Channelized:	Y		
	Surface velocity:	2.5 - 3 m/sec aprox	Dam present:	N		
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWDm2/Km2	0		
AQUATIC VEGETATION	dominant type	Absent		Dominant species:	N	
	Proportion of the reach with aquatic vegetation:	0				

WATER QUALITY	Temperature:	9°C	Water odour:	N		
	Specific conductance:	0.020ms/cm	Water surface oil:	None		
	Dissolve oxygen:	7.5mg/l				
	pH	6.71(-001mv)				
	Turbidity:	<5NTU(LOW)				
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer				
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits:	No	Black deposits under rocks?	No
	Oil:	Absent				

INORGANIC SUBSTRATE COMPONENTS			**ORGANIC SUBSTRATE COMPONENTS**		
Substrate type	Diameter	% composition	Substrate type	Characteristics	%
Bedrock		15%	Detritus	N	0
Boulder	>10''	35%	Muck-Mud	N	0
Cobble	2.5''-10''	25%	Marl	N	0
Gravel	0.1''- 2.5''	20%	sticks, woods coarse plant material (CPOM)	N (rare)	0
Sand	0.06-2mm	5%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

January 2014/Reach FT 4 (Diversion reach)

STREAM NAME: Trishuli River Reach: 4 LAT: 28° 4'47.10"N LONG: 85°13'5.39"E INVESTIGATORS:Dhurba, Krishan and Nirsing FORM COMPPLETED BY: Dhruba+Krishna				LOCATINON: Near Gunchet, Ramche VDC. STREAM CLASS: Main River , Greater than 6th order RIVER BASIN: Gandaki DATE: 22.01.014 TIME: 1.43 PM REASON FOR SURVEY: To study water quality		
WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Has there been a heavy rain in the last 7 days?	Air Temperature:	Other: ....
	Storm	N	N	N	18°C	
	Rain	N	Y			
	Showers	N	N			
	% cloud cover	5%	10%			
	clear/sunny	Y	Y			
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perrineal, Cold water		
	Stream Origin	Glacial	Catchment Area above sampling reach (km2):	4500		
WATERSHED FEATURES	Predominant surounding landuse	Forest	Local watershed NPS Pollution	N	Local watershed erosion	Moderate
RIPARIAN VEGETATION (18 m buffer)	dominant type	Trees	Dominant species	Chilaune ,Sanjh		
INSTREAM FEATURES	Estimated reach length:	1500m	Canopy cover:	Partly cover		
	Estimated stream width:	26m	High water mark:	1m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	39000	Reach area /basin area abovesampling reach	13.00%		

	Area in sq. Km	0.039	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,		
	Estimated stream depth: ..	<3m	Channelized:	N		
	Surface velocity:	2.9 m/sec aprox	Dam present:	N		
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD:0 m2/Km2	0		
AQUATIC VEGETATION	dominant type	Absent		Dominant species:	N	
	Proportion of the reach with aquatic vegetation:	0				
WATER QUALITY	Temperature:	9°C	Water odour:	N		
	Specific conductance:	0.020ms/cm	Water surface oil:	None		
	Dissolve oxygen:	7.4mg/l				
	pH	7.78(-087mv)				
	Turbidity:	<5NTU				
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer				
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits:	No	Black deposits under rocks?	No
	Oil:	Absent				

INORGANIC SUBSTRATE COMPONENTS			**ORGANIC SUBSTRATE COMPONENTS**		
Substrate type	Diameter	% composition	Substrate type	Characteristics	% area
Bedrock		10%	Detritus	N	0
Boulder	>10''	35%	Muck-Mud	N	0
Cobble	2.5''-10''	30%	Marl	N	0

Gravel	0.1''- 2.5''	20%	Coarse plant material (CPOM)	N (rare twigs)	0
Sand	0.06-2mm	5%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

January 2014Reach FT 5 (Downstream reach)

STREAM NAME: Trishuli	LOCATION: Mailung dovan
River Reach: 5	STREAM CLASS: Main River , Greater than 6th order
LAT: 28° 4'15.17"N LONG: 85°12'29.67"E	RIVER BASIN: Gandaki
INVESTIGATORS: Rai, N.K. Dhurba,Krishna and Nirsing	DATE: 21.01.014 TIME:4:00 PM
FORM COMPPLETED BY: Dhruba+Krishna	REASON FOR SURVEY: To study water quality

WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other: ....
	Storm	N	N	N	13°C	
	Rain	N	N			
	Showers	N	N			
	% cloud cover	10%	15%			
	clear/sunny	Y	Y			
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perrineal, Cold water		
	Stream Origin	Glacial	Catchment Area above sampling reach (km2):		4700	
WATERSHED FEATURES	Predominant surounding landuse	forest , residential, hydropower	Local watershed NPS Pollution	N	Local watershed erosion	Moderate

RIPARIAN VEGETATION (18 m buffer)	dominant type	Trees	Dominant species	Mouwa		
INSTREAM FEATURES	Estimated reach length:	1500m	Canopy cover:	Partly cover		
	Estimated stream width:	30m	High water mark:	1m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	75000	Reach area /basin area above sampling reach	0.16%		
	Area in sq. Km	0.075	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,		
	Estimated stream depth:	>3m	Channelized:	Y		
	Surface velocity:	2.9 m/sec aprox	Dam present:	N		
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD m2/Km2	0		
AQUATIC VEGETATION	dominant type	Absent		Dominant species:	N	
	Proportion of the reach with aquatic vegetation:	0				
WATER QUALITY	Temperature:	8°C	Water odour:	N		
	Dissolve oxygen:	7.5 mg/l				
	pH	8.09(-08mv)				
	Turbidity:	<5NTU(Low)				
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer				
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits:	No	Black deposits under rocks?	No
	Oil:	Absent				

INORGANIC SUBSTRATE COMPONENTS			ORGANIC SUBSTRATE COMPONENTS		
Substrate type	Diameter	% composition	Substrate type	Characteristics	%
Bedrock		10%	Detritus	N	0
Boulder	>10''	40%	Muck-Mud	N	0
Cobble	2.5''-10''	30%	Marl	N	0
Gravel	0.1''- 2.5''	15%	sticks, woods coarse plant material (CPOM)	N (rare)	0
Sand	0.06-2mm	5%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

February 2014/Reach FT 1 (Upstream reach)

STREAM NAME: Trishuli	LOCATION: Sano Bharkhu(Suntalabari)
River Reach: FT 1	STREAM CLASS: Rapid
LAT: 28° 8'43.60"N LONG: 85°18'49.75"E	RIVER BASIN: Gandaki
STORET:	AGENCY: NESS
INVESTIGATORS: Dhurba ,Krishna and Nirsing	DATE: 4.03.014 TIME: 10:51 Am
FORM COMPPLETED BY: Dhruba+Krishna	REASON FOR SURVEY: To study water quality

WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other: ....
	Storm	N	N	N	11°C	
	Rain	N	N			
	Showers	N	N			
	% cloud cover	5%	15%			
	clear/sunny	Y				
			Y			

STREAM CHARACTERIZATION	Stream subsystem Stream Origin	Trishuli Glacial	Stream type Catchment Area above sampling reach (km2):	Perrineal, Cold water 4200		
WATERSHED FEATURES	Predominant surounding land use	Forest	Local watershed NPS Pollution	N	Local watershed erosion	None
RIPARIAN VEGETATION (18 M buffer)	dominant type	Trees	Dominant species	Pine		
INSTREAM FEATURES	Estimated reach length:	900 m	Canopy cover:	Partly cover		
	Estimated stream width:	26m	High water mark:	1m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	23400	Reach area /basin area above sampling reach)	0.09%		
	Area in sq. Km	0.0234	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,		
	Estimated stream depth: ..	<3m	Channelized:	N		
	Surface velocity:	2.5 - 3 m/sec aprox	Dam present:	N		
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD: m2/Km2	0		
AQUATIC VEGETATION	dominant type	Absent		Dominant species:	N	
	Proportion of the reach with aquatic vegetation:	0				
WATER QUALITY	Temperature:	8°C	Water odour:	N		
	Specific conductance:	0.13ms/cm	Water surface oil:	None		

	Dissolve oxygen:	7.7mg/l				
	pH	8.20 (-0.04mv)				
	Turbidity:	<5 NTU(Low)				
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer				
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits: No	Deposits: No	Black deposits under rocks?	No
	Oil:	Absent				

INORGANIC SUBSTRATE COMPONENTS			**ORGANIC SUBSTRATE COMPONENTS**		
Substrate type	Diameter	% composition	Substrate type	Characteristics	%
Bedrock		15%	Detritus	N	2%
Boulder	>10''	35%	Muck-Mud	N	0
Cobble	2.5''-10''	30%	Marl	N	0
Gravel	0.1''- 2.5''	15%	sticks, woods coarse plant material (CPOM)	N (rare twigs of trees on the river banks occasionally)	0
Sand	0.06-2mm	5%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

February 2014/Reach FT 2 (Diversion reach)

STREAM NAME: Trishuli River Reach: 2 LAT: 28°06'53.23''N LONG: 085°16'56.60''E INVESTIGATORS: Rai, N.K. Dhurba,krishna and Nirsing FORM COMPPLETED BY: Dhruba+Krishna				LOCATION: Haku Bensi STREAM CLASS: Main River , Greater than 6th order RIVER BASIN: Gandaki DATE: 03.03.014 TIME: 1:15Pm REASON FOR SURVEY: To study water quality		
WEATHER CONDITIONS	Particulars Storm Rain Showers % cloud cover clear/sunny	NOW N N N 5% Y	PAST 24 HR N Y N 5% Y	Has there been a heavy rain in the last 7 days? N	Air Temperature: 15°C	Other: ....
STREAM CHARACTERIZATION	Stream subsystem Stream Origin	Trishuli Glacial	Stream type Catchment Area above sampling reach (km2):	Perrineal, Cold water 4300		
WATERSHED FEATURES	Predominant surounding landuse	Forest	Local watershed NPS Pollution	N	Local watershed erosion	Moderate
RIPARIAN VEGETATION (18 M buffer)	dominant type	Trees	Dominant species	Mouwa		
INSTREAM FEATURES	Estimated reach length: Estimated stream width:	1000 26m	Canopy cover: High water mark:	Partly cover 1m above the river current water level		

	Sampling reach area m2 (reach length * stream width):	28000	Reach area /basin area	0.90%		
	Area in sq. Km	0.028	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,		
	Estimated stream depth: ..	<3m	Channelized:	Y		
	Surface velocity:	2.5 -3 m/sec aprox	Dam present:	N		
LARGE WOODY DEBRIS	LWD:	N	Density of LWD:0 m2/Km2	0		
AQUATIC VEGETATION	dominant type	Absent		Dominant species:	N	
	Proportion of the reach with aquatic vegetation:	0				
WATER QUALITY	Temperature:	9°C	Water odour:	N		
	Specific conductance:	0.13ms/cm	Water surface oil:	None		
	Dissolve oxygen:	7.6mg/l				
	pH	7.77(016mv)				
	Turbidity:	<5 NTU(Low)				
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer				
SEDIMENT/ SUBSTRATE	Odors:	Normal		Deposits: No	Black deposits?	No
	Oil:	Absent				

INORGANIC SUBSTRATE COMPONENTS			**ORGANIC SUBSTRATE COMPONENTS**		
Substrate type	Diameter	% composition	Substrate type	Characteristics	%
Bedrock		15%	Detritus	N	0%
Boulder	>10''	35%	Muck-Mud	N	0
Cobble	2.5''-10''	25%	Marl	N	0

Gravel	0.1''- 2.5''	15%	sticks, woods coarse plant material (CPOM)	N	0
Sand	0.06-2mm	10%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

February 2014/Reach FT 3 (Diversion reach)

STREAM NAME: Trishuli	LOCATION: Gogane Fedi
River Reach: 3	STREAM CLASS: Main River , Greater than 6th order
LAT: 28° 5'16.90"N LONG: 85°13'46.23"E	RIVER BASIN: Gandaki
STORET:	AGENCY: UT-I, HEP
INVESTIGATORS: Dhurba, Krishna and Nirsing	DATE: 1.03.014 TIME: 10:30 Am
FORM COMPPLETED BY: Dhruba+Krishna	REASON FOR SURVEY: To study water quality

WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Has there been a heavy rain in the last 7 days?	Air Temperature:	Other: ….
	Storm	N	N	N	21°C	
	Rain	N	Y			
	Showers	N	N			
	% cloud cover	5%	10%			
	clear/sunny	Y	Y			
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perrineal, Cold water		
	Stream Origin	Glacial	Catchment Area above sampling reach (km2):	4400		
WATERSHED FEATURES	Predominant surounding landuse	Forest	Local watershed NPS Pollution	N	Local watershed erosion	Moderate

RIPARIAN VEGETATION **(**18 M buffer)	dominant type	Trees	Dominant species	Mouwa, chilaune and saj
INSTREAM FEATURES	Estimated reach length:	1500m	Canopy cover:	Partly cover
	Estimated stream width:	27m	High water mark:	1m above the river current water level
	Sampling reach area m2 (reach length * stream width):	48000	Reach area /basin area above sampling reach	0.13%
	Area in sq. Km	0.048	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,
	Estimated stream depth: ..	>3m	Channelized:	Y
	Surface velocity:	2.5 - 3 m/sec aprox	Dam present:	N
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD:0 m2/Km2	0
AQUATIC VEGETATION	dominant type	Absent		Dominant species: N
	Proportion of the reach with aquatic vegetation:	0		
WATER QUALITY	Temperature:	10°C	Water odour:	N
	Specific conductance:	0.11ms/cm	Water surface oil:	None
	Dissolve oxygen:	8.6mg/l		
	pH	8.53 (0.30mv)		
	Turbidity:	<5NTU(LOW)		
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer		

SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits: No	NO	Black deposits?	NO
	Oil:	Absent				

INORGANIC SUBSTRATE COMPONENTS			**ORGANIC SUBSTRATE COMPONENTS**		
Substrate type	Diameter	% composition in sampling reach	Substrate type	Characteristics	%
Bedrock		15%	Detritus	N	0
Boulder	>10''	35%	Muck-Mud	N	0
Cobble	2.5''-10''	25%	Marl	N	0
Gravel	0.1''- 2.5''	20%	sticks, woods coarse plant material (CPOM)	N	0
Sand	0.06-2mm	5%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

February 2014/Reach FT 4 (Diversion reach)

STREAM NAME: Trishuli River Reach: 4 LAT: 28° 4'47.10"N LONG: 85°13'5.39"E STORET: INVESTIGATORS:Dhurba, Krishan and Nirsing FORM COMPPLETED BY: Dhruba+Krishna				LOCATINON: Near Gunchet, Ramche VDC. STREAM CLASS: Main River , Greater than 6th order RIVER BASIN: Gandaki AGENCY: UT-I, HEP DATE: 28.02.014 TIME: 1.15 PM REASON FOR SURVEY: To study water quality		
WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Has there been a heavy rain in the last 7 days?	Air Temperature:	Other: ....
	Storm	N	N	N	20°C	
	Rain	N	Y			
	Showers	N	N			
	% cloud cover	15%	10%			
	clear/sunny	Y	Y			
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perrineal, Cold water		
	Stream Origin	Glacial	Catchment Area above sampling reach (km2):	4500		
WATERSHED FEATURES	Predominant surounding landuse	Forest	Local watershed NPS Pollution	N	Local watershed erosion	Moderat e
RIPARIAN VEGETATION (18 M buffer)	dominant type	Trees	Dominant species	Chilaune ,Sanjh		
INSTREAM FEATURES	Estimated reach length:	1500m	Canopy cover:	Partly cover		
	Estimated stream width:	24m	High water mark:	1m above the river current water level		

	Sampling reach area m2 (reach length * stream width):	39000	Reach area /basin area abovesampling reach	13.00%		
	Area in sq. Km	0.039	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,		
	Estimated stream depth:	<3m	Channelized:	N		
	Surface velocity:	2.9 m/sec aprox	Dam present:	N		
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD:0 m2/Km2	0		
AQUATIC VEGETATION	dominant type	Absent		Dominant species:	N	
	Proportion of the reach with aquatic vegetation:	0				
WATER QUALITY	Temperature:	11°C	Water odour:	N		
	Specific conductance:	0.1ms/cm	Water surface oil:	None		
	Dissolve oxygen:	7.5mg/l				
	pH	7.59(032mv)				
	Turbidity:	<5NTU				
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer				
SEDIMENT/ SUBSTRATE	Odors:	Normal		Deposits: No	Black deposits?	No
	Oil:	Absent				

INORGANIC SUBSTRATE COMPONENTS			ORGANIC SUBSTRATE COMPONENTS		
Substrate type	Diameter	% composition	Substrate type	Characteristics	% a
Bedrock		10%	Detritus	N	0
Boulder	>10''	35%	Muck-Mud	N	0
Cobble	2.5''-10''	30%	Marl	N	0
Gravel	0.1''- 2.5''	20%	sticks, woods coarse plant material (CPOM)	N (rare twigs))	0
Sand	0.06-2mm	5%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

February 2014Reach FT 5 (Downstream reach)

STREAM NAME: Trishuli	LOCATION: Mailung dovan
River Reach: 5	STREAM CLASS: Main River , Greater than 6th order
LAT: 28° 4'15.17"N LONG: 85°12'29.67"E	RIVER BASIN: Gandaki
STORET:	AGENCY: UT-I, HEP
INVESTIGATORS: Rai, N.K. Dhurba,Krishna and Nirsing	DATE: 27.02.014 TIME: 4:30 PM
FORM COMPPLETED BY: Dhruba+Krishna	REASON FOR SURVEY: To study water quality

WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Has there been a heavy rain in the last 7 days?	Air Temperature:	Other: ....
	Storm	N	N	N	19°C	
	Rain	N	N			
	Showers	N	N			
	% cloud cover	10%	15%			
	clear/sunny	Y	Y			

STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perrineal, Cold water		
	Stream Origin	Glacial	Catchment Area above sampling reach (km2):	4700		
WATERSHED FEATURES	Predominant surounding landuse	forest , residential, hydropower	Local watershed NPS Pollution	N	Local watershed erosion	Moderate
RIPARIAN VEGETATION (18 M buffer)	dominant type	Trees	Dominant species	Mouwa		
INSTREAM FEATURES	Estimated reach length:	1500m	Canopy cover:	Partly cover		
	Estimated stream width:	26m	High water mark:	1m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	75000	Reach area /basin area	0.16%		
	Area in sq. Km	0.075	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,		
	Estimated stream depth: ..	>3m	Channelized:	Y		
	Surface velocity:	2.9 m/sec aprox	Dam present:	N		
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD:0 m2/Km2	0		
AQUATIC VEGETATION	dominant type	Absent		Dominant species:	N	
	Proportion of the reach with aquatic vegetation:	0				
WATER QUALITY	Temperature:	11°C	Water odour:	N		
	Specific conductance:	0.1ms/cm	Water surface oil:	None		

	Dissolve oxygen:	7.29 mg/l			
	pH	7.29(007mv)			
	Turbidity:	<5NTU(Low)			
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer			
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits: No	Black deposits?	No
	Oil:	Absent			

INORGANIC SUBSTRATE COMPONENTS			**ORGANIC SUBSTRATE COMPONENTS**		
Substrate type	Diameter	% composition in sampling reach	Substrate type	Characteristics	%
Bedrock		10%	Detritus	N	0
Boulder	>10''	40%	Muck-Mud	N	0
Cobble	2.5''-10''	30%	Marl	N	0
Gravel	0.1''- 2.5''	15%	sticks, woods coarse plant material (CPOM)	N	0
Sand	0.06-2mm	5%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

March 2014/Reach FT 1 (Upstream reach)

STREAM NAME: Trishuli River Reach: FT 1 LAT: 28° 8'43.60"N LONG: 85°18'49.75"E STORET: INVESTIGATORS: Dhurba ,Krishna and Nirsing FORM COMPPLETED BY: Dhruba+Krishna				LOCATION: Sano Bharkhu(Suntalabari) STREAM CLASS: Rapid RIVER BASIN: Gandaki AGENCY: NESS DATE: 26.03.014 TIME: 11.31Am REASON FOR SURVEY: To study water quality		
WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Has there been a heavy rain in the last 7 days?	Air Temperature:	Other: ....
	Storm	N	N	N	20°C	
	Rain	N	N			
	Showers	N	N			
	% cloud cover	10%	20%			
	clear/sunny	Y	Y			
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perrineal, Cold water		
	Stream Origin	Glacial	Catchment Area above sampling reach (km2):	4200		
WATERSHED FEATURES	Predominant surounding land use	Forest	Local watershed NPS Pollution	N	Local watershed erosion	None
RIPARIAN VEGETATION (18 M buffer)	dominant type	Trees	Dominant species	Pine		
INSTREAM FEATURES	Estimated reach length:	900 m	Canopy cover:	Partly cover		
	Estimated stream width:	26m	High water mark:	1m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	23400	Reach area /basin area	0.09%		

	Area in sq. Km	0.0234	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,	
	Estimated stream depth: ..	<3m	Channelized:	N	
	Surface velocity:	2.5 - 3 m/sec aprox	Dam present:	N	
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD: m2/Km2	0	
AQUATIC VEGETATION	dominant type	Absent		Dominant species:	N
	Proportion of the reach with aquatic vegetation:	0			
WATER QUALITY	Temperature:	10°C	Water odour:	N	
	Specific conductance:	0.13ms/cm	Water surface oil:	None	
	Dissolve oxygen:	7.5mg/l			
	pH	7.3(006mv)			
	Turbidity:	10 NTU			
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer			
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits: No	Black deposits?	No
	Oil:	Absent			

INORGANIC SUBSTRATE COMPONENTS			**ORGANIC SUBSTRATE COMPONENTS**		
Substrate type	Diameter	% composition	Substrate type	Characteristics	%
Bedrock		15%	Detritus	N	2%
Boulder	>10''	35%	Muck-Mud	N	0
Cobble	2.5''-10''	30%	Marl	N	0
Gravel	0.1''- 2.5''	15%	Coarse plant material (CPOM)	N	0

Sand	0.06-2mm	5%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

March 2014/Reach FT 2 (Diversion reach)

STREAM NAME: Trishuli River Reach: 2 LAT: 28°06'53.23''N LONG: 085°16'56.60''E STORET: INVESTIGATORS: Rai, N.K. Dhurba,krishna and Nirsing FORM COMPPLETED BY: Dhruba+Krishna				LOCATION: Haku Bensi STREAM CLASS: Main River , Greater than 6th order RIVER BASIN: Gandaki AGENCY: UT-I, HEP DATE: 27.03.014 TIME:3.19Pm REASON FOR SURVEY: To study water quality		
WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Has there been a heavy rain in the last 7 days?	Air Temperature:	Other: ….
	Storm	N	N	N	19°C	
	Rain	N	Y			
	Showers	N	N			
	% cloud cover	5%	5%			
	clear/sunny	Y	Y			
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perrineal, Cold water		
	Stream Origin	Glacial	Catchment Area above sampling reach (km2):	4300		

WATERSHED FEATURES	Predominant surounding landuse	Forest	Local watershed NPS Pollution	N	Local watershed erosion	Modera te
RIPARIAN VEGETATION (18 M buffer)	dominant type	Trees	Dominant species	Mouwa		
INSTREAM FEATURES	Estimated reach length:	1000	Canopy cover:	Partly cover		
	Estimated stream width:	26m	High water mark:	1m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	28000	Reach area /basin area	0.90%		
	Area in sq. Km	0.028	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,		
	Estimated stream depth: ..	<3m	Channelized:	Y		
	Surface velocity:	2.5 -3 m/sec aprox	Dam present:	N		
LARGE WOODY DEBRIS	LWD:	N	Density of LWD:0 m2/Km2	0		
AQUATIC VEGETATION	dominant type	Absent		Dominant species:	N	
	Proportion of the reach with aquatic vegetation:	0				
WATER QUALITY	Temperature:	11°C	Water odour:	N		
	Specific conductance:	0.23ms/cm	Water surface oil:	None		
	Dissolve oxygen:	8.3mg/l				
	pH	7.83(-030mv)				
	Turbidity:	<5 NTU(Low)				
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer				

SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits: No	Black deposits under the rocks?	NO
	Oil:	Absent			

INORGANIC SUBSTRATE COMPONENTS			ORGANIC SUBSTRATE COMPONENTS		
Substrate type	Diameter	% composition in sampling reach	Substrate type	Characteristics	%
Bedrock		15%	Detritus	N	0%
Boulder	>10''	35%	Muck-Mud	N	0
Cobble	2.5''-10''	25%	Marl	N	0
Gravel	0.1''- 2.5''	15%	sticks, woods coarse plant material (CPOM)	N (rare twigs)	0
Sand	0.06-2mm	10%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

March 2014/Reach FT 3 (Diversion reach)

STREAM NAME: Trishuli	LOCATION: Gogane Fedi
River Reach: 3	STREAM CLASS: Main River , Greater than 6th order
LAT: 28° 5'16.90"N LONG: 85°13'46.23"E	RIVER BASIN: Gandaki
STORET:	AGENCY: UT-I, HEP
INVESTIGATORS: Dhurba, Krishna and Nirsing	DATE: 24.03.014 TIME: 5.00 pm
FORM COMPPLETED BY: Dhruba+Krishna	REASON FOR SURVEY: To study water quality

WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Has there been a heavy rain in the last 7 days?	Air Temperature:	Other: ....
	Storm	N	N	N	18°C	
	Rain	N	Y			
	Showers	N	N			
	% cloud cover	5%	5%			
	clear/sunny	Y	Y			

STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perrineal, Cold water		
	Stream Origin	Glacial	Catchment Area above sampling reach (km2):	4400		
WATERSHED FEATURES	Predominant surounding landuse	Forest	Local watershed NPS Pollution	N	Local watershed erosion	Moderat e
RIPARIAN VEGETATION (18 M buffer)	dominant type	Trees	Dominant species	Mouwa, chilaune and saj		
INSTREAM FEATURES	Estimated reach length:	1500m	Canopy cover:	Partly cover		
	Estimated stream width:	29m	High water mark:	1m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	48000	Reach area /basin area	0.13%		
	Area in sq. Km	0.048	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,		
	Estimated stream depth: ..	>3m	Channelized:	Y		
	Surface velocity:	2.5 - 3 m/sec aprox	Dam present:	N		
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD:0 m2/Km2	0		
AQUATIC VEGETATION	dominant type	Absent		Dominant species:	N	
	Proportion of the reach with aquatic vegetation:	0				
WATER QUALITY	Temperature:	12°C	Water odour:	N		
	Specific conductance:	0.13ms/cm	Water surface oil:	None		
	Dissolve oxygen:	7.5mg/l				
	pH	7.3(006mv)				

	Turbidity:	10NTU			
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer			
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits: No	Black deposits?	NO
	Oil:	Absent			

INORGANIC SUBSTRATE COMPONENTS			ORGANIC SUBSTRATE COMPONENTS		
Substrate type	Diameter	% composition in sampling reach	Substrate type	Characteristics	%
Bedrock		15%	Detritus	N	0
Boulder	>10''	35%	Muck-Mud	N	0
Cobble	2.5''-10''	25%	Marl	N	0
Gravel	0.1''- 2.5''	20%	sticks, woods coarse plant material (CPOM)	N	0
Sand	0.06-2mm	5%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

March 2014/Reach FT 4 (Diversion reach)

STREAM NAME: Trishuli River Reach: 4 LAT: 28° 4'47.10"N LONG: 85°13'5.39"E STORET: INVESTIGATORS:Dhurba, Krishan and Nirsing FORM COMPPLETED BY: Dhruba+Krishna				LOCATINON: Near Gunchet, Ramche VDC. STREAM CLASS: Main River , Greater than 6th order RIVER BASIN: Gandaki AGENCY: UT-I, HEP DATE: 23.03.014 TIME: 1.05PM REASON FOR SURVEY: To study water quality		
WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other: ....
	Storm Rain Showers % cloud cover clear/sunny	N N N 5% Y	N Y N 5% Y	N	22°C	
STREAM CHARACTERIZATION	Stream subsystem Stream Origin	Trishuli Glacial	Stream type Catchment Area above sampling reach (km2):	Perrineal, Cold water 4500		
WATERSHED FEATURES	Predominant surounding landuse	Forest	Local watershed NPS Pollution	N	Local watershed erosion	Moderat e
RIPARIAN VEGETATION (18 M buffer)	dominant type	Trees	Dominant species	Chilaune ,Sanjh		
INSTREAM FEATURES	Estimated reach length: Estimated stream width:	1500m 24m	Canopy cover: High water mark:	Partly cover 1m above the river current water level		

	Sampling reach area m2 (reach length * stream width):	39000	Reach area /basin area	13.00%	
	Area in sq. Km	0.039	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,	
	Estimated stream depth: ..	<3m	Channelized:	N	
	Surface velocity:	2.9 m/sec aprox	Dam present:	N	
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD:0 m2/Km2	0	
AQUATIC VEGETATION	dominant type	Absent		Dominant species:	N
	Proportion of the reach with aquatic vegetation:	0			
WATER QUALITY	Temperature:	11°C	Water odour:	N	
	Specific conductance:	0.10ms/cm	Water surface oil:	None	
	Dissolve oxygen:	7.3mg/l			
	pH	7.66(-012mv)			
	Turbidity:	<5NTU			
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer			
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits: No	Looking at stone which are not deeply embeded are the underside black in color?	NO
	Oil:	Absent			

INORGANIC SUBSTRATE COMPONENTS			ORGANIC SUBSTRATE COMPONENTS		
Substrate type	Diameter	% composition	Substrate type	Characteristics	%
Bedrock		10%	Detritus	N	0
Boulder	>10''	35%	Muck-Mud	N	0
Cobble	2.5''-10''	30%	Marl	N	0
Gravel	0.1''- 2.5''	20%	sticks, woods coarse plant material (CPOM)	N (rare twigs)	0
Sand	0.06-2mm	5%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

March 2014Reach FT 5 (Downstream reach)

STREAM NAME: Trishuli	LOCATION: Mailung dovan
River Reach: 5	STREAM CLASS: Main River , Greater than 6th order
LAT: 28° 4'15.17"N LONG: 85°12'29.67"E	RIVER BASIN: Gandaki
STORET:	AGENCY: UT-I, HEP
INVESTIGATORS: Rai, N.K. Dhurba,Krishna and Nirsing	DATE: 22.03.014 TIME: 3.49 PM
FORM COMPPLETED BY: Dhruba+Krishna	REASON FOR SURVEY: To study water quality

WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other: ....
	Storm	N	N	N	15°C	
	Rain	N	N			
	Showers	N	N			
	% cloud cover	5%	5%			
	clear/sunny	Y	Y			

STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perrineal, Cold water		
	Stream Origin	Glacial	Catchment Area above sampling reach (km2):	4700		
WATERSHED FEATURES	Predominant surounding landuse	forest , residential, industrial (HP)	Local watershed NPS Pollution	N	Local watershed erosion	Moderate
RIPARIAN VEGETATION (18 M buffer)	dominant type	Trees	Dominant species	Mouwa		
INSTREAM FEATURES	Estimated reach length:	1500m	Canopy cover:	Partly cover		
	Estimated stream width:	26m	High water mark:	1m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	75000	Reach area /basin area	0.16%		
	Area in sq. Km	0.075	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,		
	Estimated stream depth: ..	>3m	Channelized:	Y		
	Surface velocity:	2.9 m/sec aprox	Dam present:	N		
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD:0 m2/Km2	0		
AQUATIC VEGETATION	dominant type	Absent		Dominant species:	N	
	Proportion of the reach with aquatic vegetation:	0				

WATER QUALITY	Temperature:	10°C	Water odour:	N	
	Specific conductance:	0.10ms/cm	Water surface oil:	None	
	Dissolve oxygen:	7.4 mg/l			
	pH	7.41(-023mv)			
	Turbidity:	<5NTU(Low)			
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer			
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits: No	Looking at stone which are not deeply embeded are the underside black in color?	No
	Oil:	Absent			

INORGANIC SUBSTRATE COMPONENTS			ORGANIC SUBSTRATE COMPONENTS		
Substrate type	Diameter	% composition	Substrate type	Characteristics	%
Bedrock		10%	Detritus	N	0
Boulder	>10''	40%	Muck-Mud	N	0
Cobble	2.5''-10''	30%	Marl	N	0
Gravel	0.1''- 2.5''	15%	sticks, woods coarse plant material (CPOM)	N (rare twigs)	0
Sand	0.06-2mm	5%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

April 2014/Reach FT 1 (Upstream reach)

STREAM NAME: Trishuli River Reach: FT 1 LAT: 28° 8'43.60"N LONG: 85°18'49.75"E STORET: INVESTIGATORS: Dhurba ,Krishna and Nirsing FORM COMPPLETED BY: Dhruba+Krishna				LOCATION: Sano Bharkhu(Suntalabari) STREAM CLASS: Rapid RIVER BASIN: Gandaki AGENCY: NESS DATE: 26.04.014 TIME: 8:42Am REASON FOR SURVEY: To study water quality		
WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other: ....
	Storm	N	N	Y	21°C	
	Rain	N	N			
	Showers	N	N			
	% cloud cover	30%	5%	(Rainning period 9.45 to 10.15) am in the morning)		
	clear/sunny	Y	Y			
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perrineal, Cold water		
	Stream Origin	Glacial	Catchment Area above sampling reach (km2):	4200		
WATERSHED FEATURES	Predominant surounding land use	Forest	Local watershed NPS Pollution	N	Local watershed erosion	None
RIPARIAN VEGETATION (18 M buffer)	dominant type	Trees	Dominant species	Pine		
INSTREAM FEATURES	Estimated reach length:	900 m	Canopy cover:	Partly cover		
	Estimated stream width:	26m	High water mark:	1m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	23400	Reach area /basin area	0.09%		

	Area in sq. Km	0.0234	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,	
	Estimated stream depth: ..	<3m	Channelized:	N	
	Surface velocity:	2.5 - 3 m/sec aprox	Dam present:	N	
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD: m2/Km2	0	
AQUATIC VEGETATION	dominant type	Absent		Dominant species:	N
	Proportion of the reach with aquatic vegetation:	0			
WATER QUALITY	Temperature:	12°C	Water odour:	N	
	Specific conductance:	0.12ms/cm	Water surface oil:	None	
	Dissolve oxygen:	8.5mg/l			
	pH	6.8(033mv)			
	Turbidity:	30NTU			
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer			
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits: No	Looking at stone which are not deeply embeded are the underside black in color?	No
	Oil:	Slight			

INORGANIC SUBSTRATE COMPONENTS			ORGANIC SUBSTRATE COMPONENTS		
Substrate type	Diameter	% composition	Substrate type	Characteristics	%
Bedrock		15%	Detritus	N	2%
Boulder	>10''	35%	Muck-Mud	N	0
Cobble	2.5''-10''	30%	Marl	N	0
Gravel	0.1''- 2.5''	15%	sticks, woods coarse plant material (CPOM)	N (rare twigs)	0
Sand	0.06-2mm	5%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

April 2014/Reach FT 2 (Diversion reach)

STREAM NAME: Trishuli River Reach: 2 LAT: 28°06'53.23''N LONG: 085°16'56.60''E INVESTIGATORS: Rai, N.K. Dhurba,krishna and Nirsing FORM COMPPLETED BY: Dhruba+Krishna	LOCATION: Haku Bensi STREAM CLASS: Main River , Greater than 6th order RIVER BASIN: Gandaki DATE: 25.04.014 TIME: 11:57Am REASON FOR SURVEY: To study water quality

WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other: ....
	Storm	N	N	N	27°C	
	Rain	N	Y			
	Showers	N	N			
	% cloud cover	2%	5%			
	clear/sunny	Y	Y			

STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perrineal, Cold water		
	Stream Origin	Glacial	Catchment Area above sampling reach (km2):	4300		
WATERSHED FEATURES	Predominant surounding landuse	Forest	Local watershed NPS Pollution	N	Local watershed erosion	None
RIPARIAN VEGETATION (18 M buffer)	dominant type	Trees	Dominant species	Mouwa		
INSTREAM FEATURES	Estimated reach length:	1000	Canopy cover:	Partly cover		
	Estimated stream width:	26m	High water mark:	1m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	28000	Reach area /basin area	0.90%		
	Area in sq. Km	0.028	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,		
	Estimated stream depth: ..	<3m	Channelized:	Y		
	Surface velocity:	2.5 -3 m/sec aprox	Dam present:	N		
LARGE WOODY DEBRIS	LWD:	N	Density of LWD:0 m2/Km2	0		
AQUATIC VEGETATION	dominant type	Absent		Dominant species:	N	
	Proportion of the reach with aquatic vegetation:	0				
WATER QUALITY	Temperature:	12°C	Water odour:	N		
	Specific conductance:	0.11ms/cm	Water surface oil:	None		

	Dissolve oxygen:	8.7mg/l			
	pH	7.13(0.13mv)			
	Turbidity:	10 NTU			
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer			
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits: No	Looking at stone which are not deeply embeded are the underside black in color?	YES
	Oil:	Absent			

INORGANIC SUBSTRATE COMPONENTs			**ORGANIC SUBSTRATE COMPONENTS**		
Substrate type	Diameter	% composition in sampling reach	Substrate type	Characteristics	%
Bedrock		15%	Detritus	N	0%
Boulder	>10''	35%	Muck-Mud	N	0
Cobble	2.5''-10''	25%	Marl	N	0
Gravel	0.1''- 2.5''	15%	sticks, woods coarse plant material (CPOM)	N (rare twigs)	0
Sand	0.06-2mm	10%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

April 2014/Reach FT 3 (Diversion reach)

STREAM NAME: Trishuli River Reach: 3 LAT: 28° 5'16.90"N LONG: 85°13'46.23"E STORET: INVESTIGATORS: Dhurba, Krishna and Nirsing FORM COMPPLETED BY: Dhruba+Krishna				LOCATION: Gogane Fedi STREAM CLASS: Main River , Greater than 6th order RIVER BASIN: Gandaki AGENCY: UT-I, HEP DATE: 23.04.014 TIME: 10:02 Am REASON FOR SURVEY: To study water quality		
WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other: ....
	Storm Rain Showers % cloud cover clear/sunny	N N N 5% Y	N Y N 5% Y	N	22°C	
STREAM CHARACTERIZATION	Stream subsystem Stream Origin	Trishuli Glacial	Stream type Catchment Area above sampling reach (km2):	Perrineal, Cold water 4400		
WATERSHED FEATURES	Predominant surounding landuse	Forest	Local watershed NPS Pollution	N	Local watershed erosion	None
RIPARIAN VEGETATION (18 M buffer)	dominant type	Trees	Dominant species	Mouwa, chilaune and saj		
INSTREAM FEATURES	Estimated reach length: Estimated stream width:	1500m 29m	Canopy cover: High water mark:	Partly cover 1m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	48000	Reach area /basin area	0.13%		

	Area in sq. Km	0.048	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,	
	Estimated stream depth: ..	>3m	Channelized:	Y	
	Surface velocity:	2.5 - 3 m/sec aprox	Dam present:	N	
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD:0 m2/Km2	0	
AQUATIC VEGETATION	dominant type	Absent		Dominant species:	N
	Proportion of the reach with aquatic vegetation:	0			
WATER QUALITY	Temperature:	13°C	Water odour:	N	
	Specific conductance:	0.09ms/cm	Water surface oil:	None	
	Dissolve oxygen:	7.8mg/l			
	pH	6.50(034mv)			
	Turbidity:	5NTU			
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer			
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits: No	Looking at stone which are not deeply embeded are the underside black in color?	NO
	Oil:	Absent			

INORGANIC SUBSTRATE COMPONENTS			ORGANIC SUBSTRATE COMPONENTS		
Substrate type	Diameter	% composition in sampling reach	Substrate type	Characteristics	%
Bedrock		15%	Detritus	N	0
Boulder	>10''	35%	Muck-Mud	N	0
Cobble	2.5''-10''	25%	Marl	N	0
Gravel	0.1''- 2.5''	20%	sticks, woods coarse plant material (CPOM)	N (rare twigs)	0
Sand	0.06-2mm	5%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

April 2014/Reach FT 4 (Diversion reach)

STREAM NAME: Trishuli	LOCATINON: Near Gunchet, Ramche VDC.
River Reach: 4	STREAM CLASS: Main River , Greater than 6th order
LAT: 28° 4'47.10"N LONG: 85°13'5.39"E	RIVER BASIN: Gandaki
STORET:	AGENCY: UT-I, HEP
INVESTIGATORS:Dhurba, Krishan and Nirsing	DATE: 22.04.014 TIME: 12.48 pm
FORM COMPPLETED BY: Dhruba+Krishna	REASON FOR SURVEY: To study water quality

WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other: ....
	Storm	N	N	N	30°C	
	Rain	N	Y			
	Showers	N	N			
	% cloud cover	5%	5%			
	clear/sunny	Y	Y			

STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perrineal, Cold water		
	Stream Origin	Glacial	Catchment Area above sampling reach (km2):	4500		
WATERSHED FEATURES	Predominant surounding landuse	Forest	Local watershed NPS Pollution	N	Local watershed erosion	Moderate
RIPARIAN VEGETATION (18 M buffer)	dominant type	Trees	Dominant species	Chilaune ,Sanjh		
INSTREAM FEATURES	Estimated reach length:	1500m	Canopy cover:	Partly cover		
	Estimated stream width:	24m	High water mark:	1m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	39000	Reach area /basin area	13.00%		
	Area in sq. Km	0.039	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,		
	Estimated stream depth: ..	<3m	Channelized:	N		
	Surface velocity:	2.9 m/sec aprox	Dam present:	N		
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD:0 m2/Km2	0		
AQUATIC VEGETATION	dominant type	Absent		Dominant species:	N	
	Proportion of the reach with aquatic vegetation:	0				
WATER QUALITY	Temperature:	14°C	Water odour:	N		
	Specific conductance:	0.11ms/cm	Water surface oil:	None		

	Dissolve oxygen:	7.9mg/l			
	pH	6.5(037mv)			
	Turbidity:	5NTU			
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer			
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits: No	Looking at stone which are not deeply embeded are the underside black in color?	No
	Oil:	Absent			

INORGANIC SUBSTRATE COMPONENTS			ORGANIC SUBSTRATE COMPONENTS		
Substrate type	Diameter	% composition	Substrate type	Characteristics	%
Bedrock		10%	Detritus	N	0
Boulder	>10''	35%	Muck-Mud	N	0
Cobble	2.5''-10''	25%	Marl	N	0
Gravel	0.1''- 2.5''	20%	sticks, woods coarse plant material (CPOM)	N (rare twigs)	0
Sand	0.06-2mm	10%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

April 2014Reach FT 5 (Downstream reach)

STREAM NAME: Trishuli River Reach: 5 LAT: 28° 4'15.17"N LONG: 85°12'29.67"E STORET: INVESTIGATORS: Rai, N.K. Dhurba,Krishna and Nirsing FORM COMPPLETED BY: Dhruba+Krishna				LOCATION: Mailung dovan STREAM CLASS: Main River , Greater than 6th order RIVER BASIN: Gandaki AGENCY: UT-I, HEP DATE: 21.04.014 TIME: 3:44 PM REASON FOR SURVEY: To study water quality		
WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other: ....
	Storm	N	N	N	29°C	
	Rain	N	N			
	Showers	N	N			
	% cloud cover	5%	5%			
	clear/sunny	Y	Y			
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perrineal, Cold water		
	Stream Origin	Glacial	Catchment Area above sampling reach (km2):	4700		
WATERSHED FEATURES	Predominant surounding landuse	forest , residential, industrial (HP)	Local watershed NPS Pollution	N	Local watershed erosion	Modera te
RIPARIAN VEGETATION (18 M buffer)	dominant type	Trees	Dominant species	Mouwa		
INSTREAM FEATURES	Estimated reach length:	1500m	Canopy cover:	Partly cover		
	Estimated stream width:	26m	High water mark:	1m above the river current water level		

	Sampling reach area m2 (reach length * stream width):	75000	Reach area /basin area	0.16%	
	Area in sq. Km	0.075	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,	
	Estimated stream depth: ..	>3m	Channelized:	Y	
	Surface velocity:	2.9 m/sec aprox	Dam present:	N	
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWDm2/Km2	0	
AQUATIC VEGETATION	dominant type	Absent		Dominant species:	N
	Proportion of the reach with aquatic vegetation:	0			
WATER QUALITY	Temperature:	14°C	Water odour:	N	
	Specific conductance:	0.05ms/cm	Water surface oil:	None	
	Dissolve oxygen:	7.7 mg/l			
	pH	6.70(030mv)			
	Turbidity:	<5NTU(Low)			
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer			
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits: No	Looking at stone which are not deeply embeded are the underside black in color?	No
	Oil:	Absent			

INORGANIC SUBSTRATE COMPONENTS			ORGANIC SUBSTRATE COMPONENTS		
Substrate type	Diameter	% composition in sampling reach	Substrate type	Characteristics	%
Bedrock		10%	Detritus	N	0
Boulder	>10''	40%	Muck-Mud	N	0
Cobble	2.5''-10''	30%	Marl	N	0
Gravel	0.1''- 2.5''	15%	sticks, woods coarse plant material (CPOM)	N (rare twigs)	0
Sand	0.06-2mm	5%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

May 2014/Reach FT 1 (Upstream reach)

STREAM NAME: Trishuli	LOCATION: Sano Bharkhu(Suntalabari)
River Reach: 1	STREAM CLASS: Rapid
LAT: 28° 8'43.51.2"N LONG: 85°18'14.0"E	RIVER BASIN: Gandaki
INVESTIGATORS: Dhurba ,Krishna and Nirsing	DATE: 27.05.014 TIME: 9:45 a.m
FORM COMPLETED BY: Dhruba+Krishna	REASON FOR SURVEY: To study water quality

WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other: ....
	Storm	No	No	Yes	16°C(at 9:45 a.m)	
	Rain	No	Yes			
	Showers	No	No			
	% cloud cover	100%	80%			
	clear/sunny		No			
		No				

STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perennial,Cold water		
	Stream Origin	Glacial	Catchment Area above sampling reach (km2):	4200		
WATERSHED FEATURES	Predominant surounding land use	Forest	Local watershed NPS Pollution	No evidence	Local watershed Erosion	None
RIPARIAN VEGETATION (18 meter buffer)	dominant type	Trees	Dominant species	Pinus, Uttish, Tuni etc.		
INSTREAM FEATURES	Estimated reach length(m):	900	Canopy cover:	Partly cover		
	Estimated stream width(m):	30	High water mark:	1m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	27000	Reach area /basin area	0.0009		
	Area in sq. Km	0.027	Morphology type:	High gradient, straight & boulder ladden chanel, dominant channel bed erosion,		
	Estimated stream depth: ..	<3m	Channelized:	No		
	Surface velocity:	2.5 - 3 m/sec aprox	Dam present:	No		
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD: m2/Km2	0		
AQUATIC VEGETATION	dominant type	Absent		Dominant species:	No	
	Proportion of the reach with aquatic vegetation:	0				
WATER QUALITY	Temperature:	11°C(at 9:45 a.m)	Water odour:	Normal/None		
	Specific conductance:	0.09 mS/cm	Water surface	None		

			oil:		
	Dissolved oxygen:	7.9 mg/l			
	pH	6.75(137mv)			
	Turbidity:	50 NTU			
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer			
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits: No	Looking at stone which are not deeply embeded are the underside black in color?	No
	Oil:	Slight			

INORGANIC SUBSTRATE COMPONENTS			ORGANIC SUBSTRATE COMPONENTS		
Substrate type	Diameter	% composition	Substrate type	Characteristics	%
Bedrock		15%	Detritus	No	0%
Boulder	>10''	35%	Muck-Mud	No	0
Cobble	2.5''-10''	30%	Marl	No	0
Gravel	0.1''- 2.5''	15%	sticks, woods coarse plant material (CPOM)	No(rare twigs)	0
Sand	0.06-2mm	5%	Black,very fine organic (FPOM)	No	0
Silt	0.004-0.06mm	0%	Grey shell fragments	No	0
Clay	<0.004mm	0%			

May 2014/Reach FT 2 (Diversion reach)

STREAM NAME: Trishuli

River Reach: 2

LAT: 28°06'53.23''N LONG: 085°16'56.60''E
INVESTIGATORS: Rai, N.K. Dhurba,krishna and Nirsing
FORM COMPLETED BY: Dhruba+Krishna

LOCATION: Haku Bensi
STREAM CLASS: Main River , Greater than 6th order
RIVER BASIN: Gandaki

DATE: 26.05.014 TIME: 11:57 a.m
REASON FOR SURVEY: To study water quality

WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other: ....
	Storm	No	Yes	Yes	17°C	
	Rain	No	No			
	Showers	No	No			
	% cloud cover	100%	60%			
	clear/sunny	No	No			
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perrineal, Cold water		
	Stream Origin	Glacial	Catchment Area above sampling reach (km2):		4300	
WATERSHED FEATURES	Predominant surounding landuse	Forest	Local watershed NPS Pollution	No evidence	Local watershed Erosion	None
RIPARIAN VEGETATION (18 meter buffer)	dominant type	Trees	Dominant species	Mouwa, Tuni,Uttish etc.		
INSTREAM FEATURES	Estimated reach length(m):	1000	Canopy cover:	Partly cover		
	Estimated stream width(m):	31	High water mark:	1m above the river current water level		

	Sampling reach area m2 (reach length * stream width):	31000	Reach area /basin area	0.90%	
	Area in sq. Km	0.031	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,	
	Estimated stream depth: ..	<3m	Channelized:	No	
	Surface velocity:	2.5 -3 m/sec aprox	Dam present:	No	
LARGE WOODY DEBRIS	LWD:	No	Density of LWD:0 m2/Km2	0	
AQUATIC VEGETATION	dominant type	Absent		Dominant species:	No
	Proportion of the reach with aquatic vegetation:	0			
WATER QUALITY	Temperature:	12°C	Water odour:	Normal/ None	
	Specific conductance:	0.07mS/cm	Water surface oil:	None	
	Dissolved oxygen:	8.3mg/l			
	pH	6.9(020mv)			
	Turbidity:	100 NTU			
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer			
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits: No	Looking at stone which are not deeply embeded are the underside black in color?	YES
	Oil:	Absent			

INORGANIC SUBSTRATE COMPONENTS			ORGANIC SUBSTRATE COMPONENTS		
Substrate type	Diameter	% composition	Substrate type	Characteristics	%
Bedrock		15%	Detritus	No	0%
Boulder	>10''	35%	Muck-Mud	No	0
Cobble	2.5''-10''	25%	Marl	No	0
Gravel	0.1''- 2.5''	15%	sticks, woods coarse plant material (CPOM)	No (rare twigs of trees on the river banks occasionally)	0
Sand	0.06-2mm	10%	Black,very fine organic (FPOM)	No	0
Silt	0.004-0.06mm	0%	Grey shell fragments	No	0
Clay	<0.004mm	0%			

May 2014/Reach FT 3 (Diversion reach)

STREAM NAME:
Trishuli
River Reach: 3
LAT: 28° 5'04.8"N LONG: 85°13'33.0"E
INVESTIGATORS: Dhurba, Krishna and Nirsing
FORM COMPLETED BY: Dhruba+Krishna

LOCATION: Gunchet
STREAM CLASS: Main River , Greater than 6th order
RIVER BASIN: Gandaki
DATE: 24.05.014 TIME: 12: 15 p.m
REASON FOR SURVEY: To study water quality

WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other: ....
	Storm	No	No	Yes	32°C(at12:15 p.m)	
	Rain	No	Yes			
	Showers	No	No			
	% cloud cover	60%	60%			
	clear/sunny	No	No			

STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perrineal, Cold water		
	Stream Origin	Glacial	Catchment Area above sampling reach (km2):	4400		
WATERSHED FEATURES	Predominant surounding landuse	Forest	Local watershed NPS Pollution	No evidence	Local watershed Erosion	None
RIPARIAN VEGETATION (18 meter buffer)	dominant type	Trees	Dominant species	chilaune,Sirish etc.		
INSTREAM FEATURES	Estimated reach length(m):	1500	Canopy cover:	Partly cover		
	Estimated stream width(m):	35	High water mark:	1m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	52500	Reach area /basin area	0.13%		
	Area in sq. Km	0.0525	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,		
	Estimated stream depth: ..	>3m	Channelized:	No		
	Surface velocity:	2.5 - 3 m/sec aprox	Dam present:	No		
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD:0 m2/Km2	0		
AQUATIC VEGETATION	dominant type	Absent		Dominant species:	No	
	Proportion of the reach with aquatic vegetation:	0				
WATER QUALITY	Temperature:	14°C(at 12:15 p.m)	Water odour:	Normal/None		
	Specific conductance:	0.07 mS/cm	Water surface oil:	None		

	Dissolved oxygen:	8.7 mg/l			
	pH	6.90(010 mv)			
	Turbidity:	200 NTU			
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer			
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits: No	Looking at stone which are not deeply embeded are the underside black in color?	NO
	Oil:	Absent			

INORGANIC SUBSTRATE COMPONENTS			ORGANIC SUBSTRATE COMPONENTS		
Substrate type	Diameter	% composition	Substrate type	Characteristics	%
Bedrock		15%	Detritus	No	0
Boulder	>10''	35%	Muck-Mud	No	0
Cobble	2.5''-10''	25%	Marl	No	0
Gravel	0.1''- 2.5''	20%	Coarse plant material (CPOM)	No(rare twigs)	0
Sand	0.06-2mm	5%	Black,very fine organic (FPOM)	No	0
Silt	0.004-0.06mm	0%	Grey shell fragments	No	0
Clay	<0.004mm	0%			

May 2014/Reach FT 4 (Diversion reach)

STREAM NAME: Trishuli River Reach: 4 LAT: 28° 4'46.2"N LONG: 85°13'05.6"E INVESTIGATORS:Dhurba, Krishan and Nirsing FORM COMPLETED BY: Dhruba+Krishna				LOCATINON: Near Gunchet, Ramche VDC. STREAM CLASS: Main River , Greater than 6th order RIVER BASIN: Gandaki DATE: 23.05.014 TIME: 4:03 pm REASON FOR SURVEY: To study water quality		
WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other: ....
	Storm	No	No	Yes	30°C(at 4:03 p.m)	
	Rain	No	No			
	Showers	No	N			
	% cloud cover	5%	5%			
	clear/sunny	Yes	Yes			
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perennial, Cold water		
	Stream Origin	Glacial	Catchment Area above sampling reach (km2):		4500	
WATERSHED FEATURES	Predominant surounding landuse	Forest	Local watershed NPS Pollution	No evidence	Local watershed Erosion	None
RIPARIAN VEGETATION (18 meter buffer)	dominant type	Trees	Dominant species	Chilaune ,Sanjh, Sirish etc.		
INSTREAM FEATURES	Estimated reach length(m):	1500	Canopy cover:	Partly cover		
	Estimated stream width(m):	33	High water mark:	1m above the river current water level		

	Sampling reach area m2 (reach length * stream width):	49500	Reach area /basin area	13.00%	
	Area in sq. Km	0.0495	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,	
	Estimated stream depth: ..	<3m	Channelized:	No	
	Surface velocity:	2.9 m/sec aprox	Dam present:	No	
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD m2/Km2	0	
AQUATIC VEGETATION	dominant type	Absent		Dominant species:	No
	Proportion of the reach with aquatic vegetation:	0			
WATER QUALITY	Temperature:	14°C (at 4:03 p.m)	Water odour:	Normal/None	
	Specific conductance:	0.07 mS/cm	Water surface oil:	None	
	Dissolve oxygen:	8.5 mg/l			
	pH	6.75 (023 mv)			
	Turbidity:	100 NTU			
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer			
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits: No	Looking at stone which are not deeply embeded are the underside black in color?	No
	Oil:	Absent			

INORGANIC SUBSTRATE COMPONENTS			ORGANIC SUBSTRATE COMPONENTS		
Substrate type	Diameter	% composition	Substrate type	Characteristics	%
Bedrock		10%	Detritus	No	0
Boulder	>10''	35%	Muck-Mud	No	0
Cobble	2.5''-10''	30%	Marl	No	0
Gravel	0.1''- 2.5''	20%	sticks, woods coarse plant material (CPOM)	No (rare twigs)	0
Sand	0.06-2mm	5%	Black,very fine organic (FPOM)	No	0
Silt	0.004-0.06mm	0%	Grey shell fragments	No	0
Clay	<0.004mm	0%			

May 2014Reach FT 5 (Downstream reach)

STREAM NAME: Trishuli				LOCATION: Mailung dovan		
River Reach: 5				STREAM CLASS: Main River , Greater than 6th order		
LAT: 28° 4'14.8"N LONG: 85°12'28.9"E				RIVER BASIN: Gandaki		
INVESTIGATORS: Rai, N.K. Dhurba,Krishna and Nirsing				DATE: 22.05.014 TIME: 4:10 PM		
FORM COMPLETED BY: Dhruba+Krishna				REASON FOR SURVEY: To study water quality		
WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other: ....
	Storm	No	No	No	30°C (at 4:10 p.m)	
	Rain	No	No			
	Showers	No	No			
	% cloud cover	0%	0%			
	clear/sunny	Yes	Yes			
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perennial, Cold water		

	Stream Origin	Glacial	Catchment Area above sampling reach (km2):		4700	
WATERSHED FEATURES	Predominant surounding landuse	Forest , residential, industrial (HP)	Local watershed NPS Pollution	No	Local watershed erosion	Moderate
RIPARIAN VEGETATION (18 meter buffer)	dominant type	Trees	Dominant species	Pinus, Sal,Kafal etc.		
INSTREAM FEATURES	Estimated reach length(m):	1500	Canopy cover:	Partly cover		
	Estimated stream width(m):	33	High water mark:	1m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	49500	Reach area /basin area	0.16%		
	Area in sq. Km	0.0495	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,		
	Estimated stream depth: ..	>3m	Channelized:	No		
	Surface velocity:	2.9 m/sec aprox	Dam present:	No		
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD:0 m2/Km2	0		
AQUATIC VEGETATION	dominant type	Absent		Dominant species:	No	
	Proportion of the reach with aquatic vegetation:	0				
WATER QUALITY	Temperature:	14°C	Water odour:	Normal/None		
	Specific conductance:	0.07 mS/cm	Water surface oil:	None		
	Dissolve oxygen:	8.4mg/l				
	pH	7.60 (-035mv)				
	Turbidity:	100 NTU				
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer				

SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits: No	Looking at stone which are not deeply embeded are the underside black in color?	No	
	Oil:	Absent				
INORGANIC SUBSTRATE COMPONENTS				ORGANIC SUBSTRATE COMPONENTS		
Substrate type	Diameter	% composition		Substrate type	Characteristics	%
Bedrock		10%		Detritus	No	0
Boulder	>10''	40%		Muck-Mud	No	0
Cobble	2.5''-10''	30%		Marl	No	0
Gravel	0.1''- 2.5''	15%		Coarse plant material (CPOM)	No(rare twigs)	0
Sand	0.06-2mm	5%		Black,very fine organic (FPOM)	No	0
Silt	0.004-0.06mm	0%		Grey shell fragments	No	0
Clay	<0.004mm	0%				

June 2014/Reach FT 1 (Upstream reach)

STREAM NAME: Trishuli River Reach: 1 LAT: 28° 8'43.40.8"N LONG: 85°18'46.6"E INVESTIGATORS: Dhurba ,Krishna and Nirsing FORM COMPLETED BY: Dhruba+Krishna				LOCATION: Sano Bharkhu(Suntalabari) STREAM CLASS: Rapid RIVER BASIN: Gandaki DATE: 26.06.014 TIME: 9:10 a.m REASON FOR SURVEY: To study water quality		
WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other: ....
	Storm	No	No	Yes	23°C (at 9:10 a.m)	
	Rain	No	No			
	Showers	No	Yes			
	% cloud cover	5%	10%			
	clear/sunny	No	No			
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perennial,Cold water		
	Stream Origin	Glacial	Catchment Area above sampling reach (km2):		4200	
WATERSHED FEATURES	Predominant surrounding land use	Forest	Local watershed NPS Pollution	No evidence	Local watershed Erosion	None
RIPARIAN VEGETATION (18 meter buffer)	dominant type	Trees	Dominant species	Pinus, Uttish,Tuni etc.		
INSTREAM FEATURES	Estimated reach length(m):	900	Canopy cover:	Partly cover		
	Estimated stream width(m):	30	High water mark:	1m above the river current water level		

	Sampling reach area m2 (reach length * stream width):	27000	Reach area /basin area	0.09%	
	Area in sq. Km	0.027	Morphology type:	High gradient, straight & boulder ladden chanel, dominant channel bed erosion,	
	Estimated stream depth: ..	<3m	Channelized:	No	
	Surface velocity:	2.5 - 3 m/sec aprox	Dam present:	No	
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD: m2/Km2	0	
AQUATIC VEGETATION	dominant type	Absent		Dominant species:	No
	Proportion of the reach with aquatic vegetation:	0			
WATER QUALITY	Temperature:	13°C (at 9:10 a.m)	Water odour:	Normal/None	
	Specific conductance:	0.05 mS/cm	Water surface oil:	None	
	Dissolved oxygen:	7.9 mg/l			
	pH	7.64(-019mv)			
	Turbidity:	200 NTU			
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer			
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits: No	Looking at stone which are not deeply embeded are the underside black in color?	No
	Oil:	Slight			

INORGANIC SUBSTRATE COMPONENTS			ORGANIC SUBSTRATE COMPONENTS		
Substrate type	Diameter	% composition	Substrate type	Characteristics	%
Bedrock		15%	Detritus	N	0%
Boulder	>10''	35%	Muck-Mud	N	0
Cobble	2.5''-10''	30%	Marl	N	0
Gravel	0.1''- 2.5''	15%	Coarse plant material (CPOM)	N (rare twigs))	0
Sand	0.06-2mm	5%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

June 2014/Reach FT 2 (Diversion reach)

STREAM NAME: Trishuli	LOCATION: Haku Bensi
River Reach: 2	STREAM CLASS: Main River , Greater than 6th order
LAT: 28°06'53.23''N LONG: 085°16'56.60''E	RIVER BASIN: Gandaki
INVESTIGATORS: Rai, N.K. Dhurba,krishna and Nirsing	DATE: 27.06.014 TIME: 12:13 p.m
FORM COMPLETED BY: Dhruba+Krishna	REASON FOR SURVEY: To study water quality

WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other: ....
	Storm	No	No	Yes	22°C (at 12:13 p.m)	
	Rain	No	No			
	Showers	No	No			
	% cloud cover	5%	5%			
	clear/sunny	Yes	Yes			

STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perennial, Cold water		
	Stream Origin	Glacial	Catchment Area above sampling reach (km2):		4300	
WATERSHED FEATURES	Predominant surrounding land use	Forest	Local watershed NPS Pollution	No evidence	Local watershed Erosion	None
RIPARIAN VEGETATION (18 meter buffer)	dominant type	Trees	Dominant species	Mouwa, Tuni, Uttish		
INSTREAM FEATURES	Estimated reach length(m):	1000	Canopy cover:	Partly cover		
	Estimated stream width(m):	31	High water mark:	1m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	31000	Reach area /basin area	0.90%		
	Area in sq. Km	0.031	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,		
	Estimated stream depth: ..	<3m	Channelized:	No		
	Surface velocity:	2.5 -3 m/sec aprox	Dam present:	No		
LARGE WOODY DEBRIS	LWD:	No	Density of LWD m2/Km2	0		
AQUATIC VEGETATION	dominant type	Absent		Dominant species:	No	
	Proportion of the reach with aquatic vegetation:	0				
WATER QUALITY	Temperature:	13°C (at 12:13 p.m)	Water odour:	Normal/None		
	Specific conductance:	0.06 mS/cm	Water surface oil:	None		
	Dissolved oxygen:	8.3 mg/l				
	pH	6.7(005mv)				
	Turbidity:	200 NTU				

	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer			
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits: No	Looking at stone which are not deeply embeded are the underside black in color?	Yes
	Oil:	Absent			

INORGANIC SUBSTRATE COMPONENTS			ORGANIC SUBSTRATE COMPONENTS		
Substrate type	Diameter	% composition	Substrate type	Characteristics	%
Bedrock		15%	Detritus	No	0%
Boulder	>10''	35%	Muck-Mud	No	0
Cobble	2.5''-10''	25%	Marl	No	0
Gravel	0.1''- 2.5''	15%	Coarse plant material (CPOM)	No(occasional twigs)	0
Sand	0.06-2mm	10%	Black,very fine organic (FPOM)	No	0
Silt	0.004-0.06mm	0%	Grey shell fragments	No	0
Clay	<0.004mm	0%			

June 2014/Reach FT 3 (Diversion reach)

STREAM NAME: Trishuli River Reach: 3 LAT: 28° 5'03.8"N LONG: 85°13'36.1"E INVESTIGATORS: Dhurba, Krishna and Nirsing FORM COMPLETED BY: Dhruba+Krishna				LOCATION: Gunchet STREAM CLASS: Main River , Greater than 6th order RIVER BASIN: Gandaki DATE: 28.06.014 TIME: 1:11 p.m REASON FOR SURVEY: To study water quality		
WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other: ....
	Storm Rain Showers % cloud cover clear/sunny	No No No 10% Yes	No No No 5% Yes	Yes	27°C (at 1:11 p.m)	
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perennial, Cold water		
	Stream Origin	Glacial	Catchment Area above sampling reach (km2):		4400	
WATERSHED FEATURES	Predominant surrounding land use	Forest	Local watershed NPS Pollution	No evidence	Local watershed Erosion	None
RIPARIAN VEGETATION (18 meter buffer)	dominant type	Trees	Dominant species	Mouwa, chilaune and saj		
INSTREAM FEATURES	Estimated reach length(m):	1500	Canopy cover:	Partly cover		
	Estimated stream width(m):	35	High water mark:	1m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	52500	Reach area /basin area	0.13%		

	Area in sq. Km	0.0525	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,		
	Estimated stream depth: ..	>3m	Channelized:	No		
	Surface velocity:	2.5 - 3 m/sec aprox	Dam present:	No		
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD m2/Km2	0		
AQUATIC VEGETATION	dominant type	Absent		Dominant species:	No	
	Proportion of the reach with aquatic vegetation:	0				
WATER QUALITY	Temperature:	16°C	Water odour:	Normal/None		
	Specific conductance:	0.06 mS/cm	Water surface oil:	None		
	Dissolved oxygen:	8.89mg/l				
	pH	7.84 (036 mv)				
	Turbidity:	100 NTU				
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer				
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits: No	Black deposits unde rocks?	No	
	Oil:	Absent				

INORGANIC SUBSTRATE COMPONENTS			ORGANIC SUBSTRATE COMPONENTS		
Substrate type	Diameter	% composition	Substrate type	Characteristics	%
Bedrock		15%	Detritus	No	0
Boulder	>10''	35%	Muck-Mud	No	0
Cobble	2.5''-10''	25%	Marl	No	0
Gravel	0.1''- 2.5''	20%	Coarse plant material (CPOM)	No(occasional twigs)	0
Sand	0.06-2mm	5%	Black,very fine organic (FPOM)	No	0
Silt	0.004-0.06mm	0%	Grey shell fragments	No	0
Clay	<0.004mm	0%			

June 2014/Reach FT 4 (Diversion reach)

STREAM NAME: Trishuli River Reach: 4 LAT: 28° 4'46.9"N LONG: 85°13'06.5"E INVESTIGATORS:Dhurba, Krishan and Nirsing FORM COMPLETED BY: Dhruba+Krishna				LOCATINON: Near Gunchet, Ramche VDC. STREAM CLASS: Main River , Greater than 6th order RIVER BASIN: Gandaki DATE: 29.06.014 TIME: 1:25 pm REASON FOR SURVEY: To study water quality		
WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other: ....
	Storm	No	No	Yes	25°C(at 1:25 p.m)	
	Rain	No	No			
	Showers	Yes	No			
	% cloud cover	95%	10%			
	clear/sunny	No	No			
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perennial, Cold water		
	Stream Origin	Glacial	Catchment Area above sampling reach (km2):		4500	
WATERSHED FEATURES	Predominant surrounding land use	Forest	Local watershed NPS Pollution	No evidence	Local watershed Erosion	None
RIPARIAN VEGETATION	dominant type	Trees	Dominant species	Chilaune, Sirish,Uttish		
INSTREAM FEATURES	Estimated reach length(m):	1500	Canopy cover:	Partly cover		
	Estimated stream width(m):	33	High water mark:	1m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	49500	Reach area /basin area	13.00%		

	Area in sq. Km	0.0495	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,	
	Estimated stream depth: ..	<3m	Channelized:	No	
	Surface velocity:	2.9 m/sec	Dam present:	No	
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD m2/Km2	0	
AQUATIC VEGETATION	dominant type	Absent		Dominant species:	No
	Proportion of the reach with aquatic vegetation:	0			
WATER QUALITY	Temperature:	13°C	Water odour:	Normal/None	
	Specific conductance:	0.06 mS/cm	Water surface oil:	None	
	Dissolve oxygen:	8.4 mg/l			
	pH	6.9(010 mv)			
	Turbidity:	200 NTU			
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer			
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits: No	Black deposits under rocks?	No
	Oil:	Absent			

INORGANIC SUBSTRATE COMPONENTS			**ORGANIC SUBSTRATE COMPONENTS**		
Substrate type	Diameter	% composition	Substrate type	Characteristics	%
Bedrock		10%	Detritus	No	0
Boulder	>10''	35%	Muck-Mud	No	0
Cobble	2.5''-10''	30%	Marl	No	0
Gravel	0.1''- 2.5''	20%	Coarse plant material (CPOM)	No (occasional twigs)	0
Sand	0.06-2mm	5%	Black,very fine organic (FPOM)	No	0
Silt	0.004-0.06mm	0%	Grey shell fragments	No	0
Clay	<0.004mm	0%			

June 2014Reach FT 5 (Downstream reach)

STREAM NAME: Trishuli	LOCATION: Mailung dovan
River Reach: 5	STREAM CLASS: Main River , Greater than 6th order
LAT: 28° 4'15"N LONG: 85°12'29.1"E	RIVER BASIN: Gandaki
INVESTIGATORS: Rai, N.K. Dhurba,Krishna and Nirsing	DATE: 30.06.014 TIME: 2:39 PM
FORM COMPLETED BY: Dhruba+Krishna	REASON FOR SURVEY: To study water quality

WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other: ….
	Storm	No	No	Yes	23°C (at 2:39 p.m)	
	Rain	No	No			
	Showers	No	No			
	% cloud cover	10%	15%			
	clear/sunny	No	No			
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perrineal, Cold water		
	Stream Origin	Glacial	Catchment Area above sampling reach (km2):		4700	
WATERSHED FEATURES	Predominant surounding landuse	forest , residential, industrial (HP)	Local watershed NPS Pollution	No	Local watershed erosion	Moderate
RIPARIAN VEGETATION (18 meter buffer)	dominant type	Trees	Dominant species	Pinus, Sal,Kafal		
INSTREAM FEATURES	Estimated reach length(m):	1500	Canopy cover:	Partly cover		
	Estimated stream width(m):	33	High water mark:	1m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	49500	Reach area /basin area	0.16%		

	Area in sq. Km	0.0495	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,	
	Estimated stream depth: ..	>3m	Channelized:	No	
	Surface velocity:	2.9 m/sec aprox	Dam present:	No	
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD m2/Km2	0	
AQUATIC VEGETATION	dominant type	Absent		Dominant species:	N
	Proportion of the reach with aquatic vegetation:	0			
WATER QUALITY	Temperature:	16°C	Water odour:	Normal/None	
	Specific conductance:	0.07 mS/cm	Water surface oil:	None	
	Dissolve oxygen:	8.7 mg/l			
	pH	6.9(012 mv)			
	Turbidity:	200 NTU			
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer			
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits: No	Black deposits under rocks?	No
	Oil:	Absent			

INORGANIC SUBSTRATE COMPONENTS

Substrate type	Diameter	% composition
Bedrock		10%
Boulder	>10''	40%
Cobble	2.5''-10''	30%
Gravel	0.1''- 2.5''	15%
Sand	0.06-2mm	5%
Silt	0.004-0.06mm	0%
Clay	<0.004mm	0%

ORGANIC SUBSTRATE COMPONENTS

Substrate type	Characteristics	%
Detritus	No	0
Muck-Mud	No	0
Marl	No	0
Coarse plant material (CPOM)	No (occasional twigs)	0
Black,very fine organic (FPOM)	No	0
Grey shell fragments	No	0

July 2014/Reach FT 1 (Upstream reach)

STREAM NAME: Trishuli River Reach: 1 LAT: 28° 8'43.40.8"N LONG: 85°18'46.6"E INVESTIGATORS: Dhurba ,Krishna and Nirsing FORM COMPLETED BY: Dhruba+Krishna	LOCATION: Sano Bharkhu(Suntalabari) STREAM CLASS: Rapid RIVER BASIN: Gandaki DATE: 29.07.014 TIME: 10:03 a.m REASON FOR SURVEY: To study water quality

WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other: ….
	Storm	No	No	Yes	21°C (at 10:10 a.m)	
	Rain	No	No			
	Showers	No	Yes			
	% cloud cover	90%	75%			
	clear/sunny	No	No			
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perennial,Cold water		
	Stream Origin	Glacial	Catchment Area above sampling reach (km2):		4200	
WATERSHED FEATURES	Predominant surounding land use	Forest	Local watershed NPS Pollution	No evidence	Local watershed Erosion	None
RIPARIAN VEGETATION (18 meter buffer)	dominant type	Trees	Dominant species	Pinus, Uttish,Tuni etc.		
INSTREAM FEATURES	Estimated reach length(m):	900	Canopy cover:	Partly cover		
	Estimated stream width(m):	35	High water mark:	1m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	31500	Reach area /basin area	0.00%		

	Area in sq. Km	0.0315	Morphology type:	High gradient, straight & boulder ladden chanel, dominant channel bed erosion,	
	Estimated stream depth: ..	<3m	Channelized:	No	
	Surface velocity:	2.5 - 3 m/sec	Dam present:	No	
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD: m2/Km2	0	
AQUATIC VEGETATION	dominant type	Absent		Dominant species:	No
	Proportion of the reach with aquatic vegetation:	0			
WATER QUALITY	Temperature:	13°C	Water odour:	Normal/None	
	Specific conductance:	0.07 mS/cm	Water surface oil:	None	
	Dissolved oxygen:	7.9 mg/l			
	pH	7.3(013mv)			
	Turbidity:	100 NTU			
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer			
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits: No	Black deposits under rocks?	No
	Oil:	Slight			

INORGANIC SUBSTRATE COMPONENTS			**ORGANIC SUBSTRATE COMPONENTS**		
Substrate type	Diameter	% composition	Substrate type	Characteristics	%
Bedrock		15%	Detritus	N	0%
Boulder	>10''	35%	Muck-Mud	N	0
Cobble	2.5''-10''	30%	Marl	N	0
Gravel	0.1''- 2.5''	15%	Coarse plant material (CPOM)	N (occasional twigs)	0
Sand	0.06-2mm	5%	Black,very fine organic (FPOM)	N	0
Silt	0.004-0.06mm	0%	Grey shell fragments	N	0
Clay	<0.004mm	0%			

July 2014/Reach FT 2 (Diversion reach)

STREAM NAME: Trishuli River Reach: 2 LAT: 28°06'53.23''N LONG: 085°16'56.60''E INVESTIGATORS: Rai, N.K. Dhurba,krishna and Nirsing FORM COMPLETED BY: Dhruba+Krishna				LOCATION: Haku Bensi STREAM CLASS: Main River , Greater than 6th order RIVER BASIN: Gandaki DATE: 30.07.014 TIME: 11:54 a.m REASON FOR SURVEY: To study water quality		
WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other: ....
	Storm	No	No	Yes	25°C	
	Rain	No	No			
	Showers	No	No			
	% cloud cover	10%	75%			
	clear/sunny	Yes	Yes			
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perennial, Cold water		
	Stream Origin	Glacial	Catchment Area above sampling reach (km2):		4300	
WATERSHED FEATURES	Predominant surounding land use	Forest	Local watershed NPS Pollution	No evidence	Local watershed Erosion	None
RIPARIAN VEGETATION	dominant type	Trees	Dominant species	Mouwa, Tuni, Uttish		
INSTREAM FEATURES	Estimated reach length(m):	1000	Canopy cover:	Partly cover		
	Estimated stream width(m):	35	High water mark:	1m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	31000	Reach area /basin area	0.01%		
	Area in sq. Km	0.031	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,		
	Estimated stream depth: ..	<3m	Channelized:	No		
	Surface velocity:	2.5 -3 m/sec	Dam present:	No		

LARGE WOODY DEBRIS	LWD:	No	Density of LWD:0 m2/Km2	0	
AQUATIC VEGETATION	dominant type	Absent		Dominant species:	No
	Proportion of the reach with aquatic vegetation:	0			
WATER QUALITY	Temperature:	15°C	Water odour:	Normal/None	
	Specific conductance:	0.05 mS/cm	Water surface oil:	None	
	Dissolved oxygen:	8.5 mg/l			
	pH	7.2(023mv)			
	Turbidity:	100 NTU			
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer			
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits: No	Black deposits under rocks?	Yes
	Oil:	Absent			

INORGANIC SUBSTRATE COMPONENTS			ORGANIC SUBSTRATE COMPONENTS		
Substrate type	Diameter	% composition	Substrate type	Characteristics	%
Bedrock		15%	Detritus	No	0%
Boulder	>10''	35%	Muck-Mud	No	0
Cobble	2.5''-10''	25%	Marl	No	0
Gravel	0.1''- 2.5''	15%	sticks, woods coarse plant material (CPOM)	No(rare twigs of trees on the river banks occasionally)	0
Sand	0.06-2mm	10%	Black,very fine organic (FPOM)	No	0
Silt	0.004-0.06mm	0%	Grey shell fragments	No	0
Clay	<0.004mm	0%			

July 2014/Reach FT 3 (Diversion reach)

STREAM NAME: Trishuli River Reach: 3 LAT: 28° 5'03.8"N LONG: 85°13'36.1"E INVESTIGATORS: Dhurba, Krishna and Nirsing FORM COMPLETED BY: Dhruba+Krishna				LOCATION: Gunchet STREAM CLASS: Main River , Greater than 6th order RIVER BASIN: Gandaki DATE: 01.08.014 TIME: 9:48 a.m REASON FOR SURVEY: To study water quality		
WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other: ….
	Storm	No	No	Yes	23°C	
	Rain	No	No			
	Showers	No	No			
	% cloud cover	10%	75%			
	clear/sunny	Yes	Yes			
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perennial, Cold water		
	Stream Origin	Glacial	Catchment Area above sampling reach (km2):		4400	
WATERSHED FEATURES	Predominant surounding land use	Forest	Local watershed NPS Pollution	No evidence	Local watershed Erosion	None
RIPARIAN VEGETATION (18 meter buffer)	dominant type	Trees	Dominant species	Mouwa, chilaune and saj		
INSTREAM FEATURES	Estimated reach length(m):	1500	Canopy cover:	Partly cover		
	Estimated stream width(m):	41	High water mark:	1m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	61500	Reach area /basin area	0.00%		

	Area in sq. Km	0.0615	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,
	Estimated stream depth: ..	>3m	Channelized:	No
	Surface velocity:	2.5 - 3 m/sec	Dam present:	No
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD m2/Km2	0
AQUATIC VEGETATION	dominant type	Absent		Dominant species: No
	Proportion of the reach with aquatic vegetation:	0		
WATER QUALITY	Temperature:	15°C	Water odour:	Normal/None
	Specific conductance:	0.04 mS/cm	Water surface oil:	None
	Dissolved oxygen:	8.2mg/l		
	pH	7.2 (036 mv)		
	Turbidity:	150NTU		
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer		
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits: No	Black deposits under rocks? No
	Oil:	Absent		

INORGANIC SUBSTRATE COMPONENTS			ORGANIC SUBSTRATE COMPONENTS		
Substrate type	Diameter	% composition	Substrate type	Characteristics	%
Bedrock		15%	Detritus	No	0
Boulder	>10''	35%	Muck-Mud	No	0
Cobble	2.5''-10''	25%	Marl	No	0
Gravel	0.1''- 2.5''	20%	Coarse plant material (CPOM)	No(rare twigs)	0
Sand	0.06-2mm	5%	Black,very fine organic (FPOM)	No	0
Silt	0.004-0.06mm	0%	Grey shell fragments	No	0
Clay	<0.004mm	0%			

July 2014/Reach FT 4 (Diversion reach)

STREAM NAME: Trishuli River Reach: 4 LAT: 28° 4'46.9"N LONG: 85°13'06.5"E INVESTIGATORS:Dhurba, Krishan and Nirsing FORM COMPLETED BY: Dhruba+Krishna	LOCATINON: Near Gunchet, Ramche VDC. STREAM CLASS: Main River , Greater than 6th order RIVER BASIN: Gandaki DATE: 02.08.014 TIME: 1:38 pm REASON FOR SURVEY: To study water quality

WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other: ….
	Storm	No	No	Yes	24°C	
	Rain	No	No			
	Showers	Yes	No			
	% cloud cover	10%	10%			
	clear/sunny	Yes	Yes			
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perennial, Cold water		
	Stream Origin	Glacial	Catchment Area above sampling reach (km2):		4500	
WATERSHED FEATURES	Predominant surounding land use	Forest	Local watershed NPS Pollution	No evidence	Local watershed Erosion	None
RIPARIAN VEGETATION (18 meter buffer)	dominant type	Trees	Dominant species	Chilaune, Sirish,Uttish		
INSTREAM FEATURES	Estimated reach length(m):	1500	Canopy cover:	Partly cover		
	Estimated stream width(m):	41	High water mark:	1m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	61500	Reach area /basin area	13.00%		
	Area in sq. Km	0.0615	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion,		

	Estimated stream depth: ..	<3m	Channelized:	No	
	Surface velocity:	2.9 m/sec	Dam present:	No	
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD:0 m2/Km2	0	
AQUATIC VEGETATION	dominant type	Absent		Dominant species:	No
	Proportion of the reach with aquatic vegetation:	0			
WATER QUALITY	Temperature:	16°C	Water odour:	Normal/None	
	Specific conductance:	0.067mS/cm	Water surface oil:	None	
	Dissolve oxygen:	8.4 mg/l			
	pH	7.5(-045 mv)			
	Turbidity:	200 NTU			
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer			
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits: No	Black deposits under rocks?	No
	Oil:	Absent			

INORGANIC SUBSTRATE COMPONENTS			ORGANIC SUBSTRATE COMPONENTS		
Substrate type	Diameter	% composition	Substrate type	Characteristics	%
Bedrock		10%	Detritus	No	0
Boulder	>10''	35%	Muck-Mud	No	0
Cobble	2.5''-10''	30%	Marl	No	0
Gravel	0.1''- 2.5''	20%	sticks, woods coarse plant material (CPOM)	No (rare twigs of trees on the river banks occasionally)	0
Sand	0.06-2mm	5%	Black,very fine organic (FPOM)	No	0
Silt	0.004-0.06mm	0%	Grey shell fragments	No	0
Clay	<0.004mm	0%			

July 2014Reach FT 5 (Downstream reach)

STREAM NAME: Trishuli	LOCATION: Mailung dovan
River Reach: 5	STREAM CLASS: Main River , Greater than 6th order
LAT: 28° 4'15"N LONG: 85°12'29.1"E	RIVER BASIN: Gandaki
INVESTIGATORS: Rai, N.K. Dhurba,Krishna and Nirsing	DATE: 3.08.014 TIME: 3:59 PM
FORM COMPLETED BY: Dhruba+Krishna	REASON FOR SURVEY: To study water quality

WEATHER CONDITIONS	Particulars	NOW	PAST 24 HR	Heavy rain in the last 7 days?	Air Temperature:	Other: ....
	Storm	No	No	Yes	25°C	
	Rain	No	No			
	Showers	No	No			
	% cloud cover	10%	15%			
	clear/sunny	Yes	Yes			
STREAM CHARACTERIZATION	Stream subsystem	Trishuli	Stream type	Perenniall, Cold water		
	Stream Origin	Glacial	Catchment Area above sampling reach (km2):		4700	
WATERSHED FEATURES	Predominant surounding landuse	forest , residential, industrial (HP)	Local watershed NPS Pollution	No	Local watershed erosion	Moderate
RIPARIAN VEGETATION (18 meter buffer)	dominant type	Trees	Dominant species	Pinus, Sal,Kafal		
INSTREAM FEATURES	Estimated reach length(m):	1500	Canopy cover:	Partly cover		
	Estimated stream width(m):	40	High water mark:	1m above the river current water level		
	Sampling reach area m2 (reach length * stream width):	60000	Reach area /basin area	0.16%		

	Area in sq. Km	0.06	Morphology type:	High gradient, straigh & boulder ladden chanel, dominant channel bed erosion.	
	Estimated stream depth: ..	>3m	Channelized:	No	
	Surface velocity:	2.9 m/sec	Dam present:	No	
LARGE WOODY DEBRIS	LWD:	Normal	Density of LWD m2/Km2	0	
AQUATIC VEGETATION	dominant type	Absent		Dominant species:	N
	Proportion of the reach with aquatic vegetation:	0			
WATER QUALITY	Temperature:	16°C	Water odour:	Normal/None	
	Specific conductance:	0.06 mS/cm	Water surface oil:	None	
	Dissolve oxygen:	7.8 mg/l			
	pH	7.95(-012 mv)			
	Turbidity:	200 NTU			
	WQ instrument used:	Digital DO meter, Digital pH meter, Turbidometer, Conductivity meter, Digital thermometer			
SEDIMENT/ SUBSTRATE	Odors:	Normal	Deposits: No	Black deposits under rocks?	No
	Oil:	Absent			

INORGANIC SUBSTRATE COMPONENTS			**ORGANIC SUBSTRATE COMPONENTS**		
Substrate type	Diameter	% composition	Substrate type	Characteristics	%
Bedrock		10%	Detritus	No	0
Boulder	>10''	40%	Muck-Mud	No	0
Cobble	2.5''-10''	30%	Marl	No	0
Gravel	0.1''- 2.5''	15%	sticks, woods coarse plant material (CPOM)	No (rare twigs of trees on the river banks occasionally)	0
Sand	0.06-2mm	5%	Black,very fine organic (FPOM)	No	0
Silt	0.004-0.06mm	0%	Grey shell fragments	No	0
Clay	<0.004mm	0%			

A.1.2. Water Quality Parameters-Laboratory Results

September 2013/Reach FT 1 (Upstream reach)

Entry No. : NCL – 115 (W) (4) - 09 - 2013
Sample : Water (FT1. W.L2)
Client : Upper Trishuli HEP - 1
Sampled By : NESS

Date Received : 29 - 09 - 2013
Date Completed : 07 - 10 - 2013
Sampling Date : 27 - 09 - 2013
Location : Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 24°C	Electromeric, 4500 - H^+ B,: APHA	7.3	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	104	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	**45**	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	87.7	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	107	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	76	-
7.	Non-Settleable Solids, (mg/l)		11.7	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	51	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	39.6	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	12.8	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	<0.5	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	2.3	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	<0.02	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.23	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	<0.003	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	<0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	1.4	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	8	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	5	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	N. D. (<0.1)	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	3.3	-
23.	Manganese, (mg/l)		0.05	
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		0.01	0.1, *max*
26.	Copper, (mg/l)		N. D. (<0.01)	3, *max*
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.04	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*
32.	Total Coliform Count, (MPN Index/100 ml)	Multiple Tube Fermentation, 9221 B, APHA	**75**	-
33.	E. Coil Count, (MPN Index/100 ml)	Multiple Tube Fermentation, 9221 E, APHA	**23**	-

Note:
AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; MPN: Most Probable Number; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: All observed values complied wth the prescribed effluent standards discharged into inland surface water. But the water was contaminated with coliform bacteria. The water was moderately turbid in nature.

September 2013/Reach FT 2 (Diversion reach)

Entry No. : NCL – 115 (W) (4) - 09 - 2013
Sample : Water (FT 2. W. L2)
Client : Upper Trishuli HEP - 1
Sampled By : NESS

Date Received : 29 - 09 - 2013
Date Completed : 07 - 10 - 2013
Sampling Date : 25 - 09 - 2013
Location : Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 24°C	Electromeric, 4500 - H^+ B,: APHA	7.4	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	98	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	**60**	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	113.6	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	188	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	96.6	-
7.	Non-Settleable Solids, (mg/l)		17	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	46	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	40	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	9.9	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	<0.5	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	2.3	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	0.03	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.25	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	<0.003	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	<0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	0.73	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	4	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	2	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	N. D. (<0.1)	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS,	4.2	-

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
23.	Manganese, (mg/l)	3111 B, APHA	0.06	
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		0.01	0.1, *max*
26.	Copper, (mg/l)		N. D. (<0.01)	3, *max*
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.03	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*
32.	Total Coliform Count, (MPN Index/100 ml)	Multiple Tube Fermentation, 9221 B, APHA	**48**	-
33.	E. Coil Count, (MPN Index/100 ml)	Multiple Tube Fermentation, 9221 E, APHA	**48**	-

N. D.: Not Detected

Note:

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; MPN: Most Probable Number; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: All observed values complied the prescribed effluent standards discharged into inland surface water. But the water was contaminated with coliform bacteria. The water was highly turbid in nature.

September 2013/Reach FT 3 (Diversion reach)

Entry No. : NCL – 115 (W) (4) - 09 - 2013
Sample : Water (FT 3. W.L2)
Client : Upper Trishuli HEP - 1
Sampled By : NESS

Date Received : 29 - 09 - 2013
Date Completed : 07 - 10 - 2013
Sampling Date : 23 - 09 - 2013
Location : Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 24°C	Electromeric, 4500 - H^+ B,: APHA	7.5	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	97	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	**90**	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	165.4	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	111	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	152.4	-
7.	Non-Settleable Solids, (mg/l)		13	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	35	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	35	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	9.1	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	<0.5	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	2.3	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	<0.02	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.25	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	<0.003	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	<0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	0.5	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	2	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	1	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	1.9	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS,	4.3	-

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
23.	Manganese, (mg/l)	3111 B, APHA	0.06	
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		0.01	0.1, *max*
26.	Copper, (mg/l)		N. D. (<0.01)	3, *max*
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.03	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*
32.	Total Coliform Count, (MPN Index/100 ml)	Multiple Tube Fermentation, 9221 B, APHA	**48**	-
33.	E. Coil Count, (MPN Index/100 ml)	Multiple Tube Fermentation, 9221 E, APHA	**23**	-
34.	Chlorophyll a, (mg/m^3)	Spectrophotometric) 10200H, APHA	<0.11	-
35.	Pheophytin a, (mg/m^3)		26.92	-

N. D.: Not Detected

Note:

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; MPN: Most Probable Number; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: All observed values complied the prescribed effluent standards discharged into inland surface water. But the water was contaminated with coliform bacteria. The water was highly turbid in nature.

September 2013/Reach FT 4 (Diversion reach)

Entry No. : NCL – 115 (W) (4) - 09 - 2013
Sample : Water (FT 4. W.L2)
Client : Upper Trishuli HEP - 1
Sampled By : NESS

Date Received : 29 - 09 - 2013
Date Completed : 07 - 10 - 2013
Sampling Date : 22 - 09 - 2013
Location : Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 24^{o}C	Electromeric, 4500 - H^+ B,: APHA	7.5	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	104	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	**50**	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	103	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	105	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	93.3	-
7.	Non-Settleable Solids, (mg/l)		9.7	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	57	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	40	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	12.3	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	<0.5	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	1.2	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	0.03	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.25	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	<0.003	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	<0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	0.5	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	6	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	3	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	1.2	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS,	2.9	-

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
23.	Manganese, (mg/l)	3111 B, APHA	0.04	
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		0.01	0.1, *max*
26.	Copper, (mg/l)		N. D. (<0.01)	3, *max*
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.03	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*
32.	Total Coliform Count, (MPN Index/100 ml)	Multiple Tube Fermentation, 9221 B, APHA	**48**	-
33.	E. Coil Count, (MPN Index/100 ml)	Multiple Tube Fermentation, 9221 E, APHA	**21**	-

N. D.: Not Detected

Note:

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; MPN: Most Probable Number; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: All observed values complied the prescribed effluent standards discharged into inland surface water. But the water was contaminated with coliform bacteria. The water was moderately turbid in nature.

September 2013/Reach FT 5 (Downstream reach)

Entry No. : NCL – 115 (W) (1) - 09 - 2013
Sample : Water (FT 5. W.L2)
Client : Upper Trishuli HEP - 1
Sampled By : NESS

Date Received : 22 - 09 - 2013
Date Completed : 07 - 10 - 2013
Sampling Date : 21 - 09 - 2013
Location : Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 24°C	Electromeric, 4500 - H^+ B,: APHA	6.6	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	109	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	**65**	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	179	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	300	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	166	-
7.	Non-Settleable Solids, (mg/l)		13	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	50	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	40	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	12.3	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	<0.5	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	1.2	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	0.03	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.25	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	0.003	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	<0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	0.6	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	7	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	2	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	N.D. (<0.1)	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS,	4.1	-

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
23.	Manganese, (mg/l)	3111 B, APHA	N. D. (<0.02)	
24.	Cadmium, (mg/l)		(<0.003)	2, *max*
25.	Lead, (mg/l)		N. D. (<0.01)	0.1, *max*
26.	Copper, (mg/l)		N. D. (<0.01)	3, *max*
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.03	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*
32.	Total Coliform Count, (MPN Index/100 ml)	Multiple Tube Fermentation, 9221 B, APHA	**93**	-
33.	E. Coil Count, (MPN Index/100 ml)	Multiple Tube Fermentation, 9221 E, APHA	**23**	-

N. D.: Not Detected

Note:

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; MPN: Most Probable Number; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: All observed values complied with the prescribed effluent standards discharged into inland surface water. But the water was contaminated with coliform bacteria. The water was moderately turbid in nature.

October 2013/Reach FT 1 (Upstream reach)

Entry No. : NCL – 141(W) (5) - 11 - 2013 Date Received : 07 - 11 - 2013
Sample : Water (FT1. W.L3) Date Completed : 13 - 11 - 2013
Client : Upper Trishuli HEP - 1 Sampling Date : 02 - 11 - 2013
Sampled By : NESS Location : Trishuli

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 19°C	Electromeric, 4500 - H^+ B,: APHA	6.9	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	105	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	4	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	9	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	91	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	6	-
7.	Non-Settleable Solids, (mg/l)		3	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	62	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	45	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	13.7	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	2.9	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	1.16	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	0.04	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.20	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	0.02	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	<0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	2.2	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	25	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	N. D. {<1)	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	N. D. (<0.1)	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS,	0.53	-

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
23.	Manganese, (mg/l)	3111 B, APHA	N. D. (<0.02)	
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		N. D. (<0.01)	0.1, *max*
26.	Copper, (mg/l)		N. D. (<0.01)	3, *max*
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.015	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note:

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: All observed values complied the prescribed effluent standards discharged into inland surface water.

October 2013/Reach FT 2 (Diversion reach)

Entry No. : NCL – 141(W) (5) - 11 - 2013 Date Received : 07 - 11 - 2013
Sample : Water (FT2. W.L3) Date Completed : 13 - 11 - 2013
Client : Upper Trishuli HEP - 1 Sampling Date : 01 - 11 - 2013
Sampled By : NESS Location : Trishuli

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 19°C	Electromeric, 4500 - H^+ B,: APHA	7	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	103	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	**10**	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	24	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	74	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	23.33	-
7.	Non-Settleable Solids, (mg/l)		0.67	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	58	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	45	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	12	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	1.5	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	2.33	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	0.04	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.20	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	0.018	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	<0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	0.70	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	8	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	N. D. {<1)	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	1.6	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS,	0.39	-

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
23.	Manganese, (mg/l)	3111 B, APHA	N. D. (<0.02)	
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		N. D. (<0.01)	0.1, *max*
26.	Copper, (mg/l)		N. D. (<0.01)	3, *max*
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.012	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note:

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: All observed values complied with the prescribed effluent standards discharged into inland surface water. The water was slightly turbid in nature.

October 2013/Reach FT 3 (Diversion reach)

Entry No. : NCL – 141(W) (5) - 11 - 2013
Sample : Water (FT3. W.L3)
Client : Upper Trishuli HEP - 1
Sampled By : NESS

Date Received : 07 - 11 - 2013
Date Completed : 13 - 11 - 2013
Sampling Date : 30 - 10 - 2013
Location : Trishuli

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 19^{o}C	Electromeric, 4500 - H^+ B,: APHA	7	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	100	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	6	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	21.3	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	94	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	20	-
7.	Non-Settleable Solids, (mg/l)		1.3	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	62	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	45	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	9.04	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	0.5	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	2.33	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	0.02	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.18	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	<0.005	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	<0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	3.08	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	32	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	N. D. {<1)	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	N. D. (<0.1)	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS,	0.69	-

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
23.	Manganese, (mg/l)	3111 B, APHA	N. D. (<0.02)	
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		N. D. (<0.01)	0.1, *max*
26.	Copper, (mg/l)		N. D. (<0.01)	3, *max*
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.01	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note:

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: All observed values complied the prescribed effluent standards discharged into inland surface water.

October 2013/Reach FT 4 (Diversion reach)

Entry No. : NCL – 141(W) (5) - 11 - 2013
Sample : Water (FT4. W.L3)
Client : Upper Trishuli HEP - 1
Sampled By : NESS

Date Received : 07 - 11 - 2013
Date Completed : 13 - 11 - 2013
Sampling Date : 29 - 10 - 2013
Location : Trishuli

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 19^{o}C	Electromeric, 4500 - H^+ B,: APHA	7	5.5 - 9
2.	Electrical Conductivity, (μmhos/cm)	Conductivity Meter, 2510 B, APHA	103	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	**14**	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	32.7	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	57	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	32.7	-
7.	Non-Settleable Solids, (mg/l)		Nil	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	58	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	45	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	4.9	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	<0.5	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	2.33	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	0.03	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.25	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	<0.005	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	<0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	2.78	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	36	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	N. D. {<1)	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	N. D. (<0.1)	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS,	0.61	-

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
23.	Manganese, (mg/l)	3111 B, APHA	N. D. (<0.02)	
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		N. D. (<0.01)	0.1, *max*
26.	Copper, (mg/l)		N. D. (<0.01)	3, *max*
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.018	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note:

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: *All observed values complied the prescribed effluent standards discharged into inland surface water. The water was slightly turbid in nature.*

October 2013/Reach FT 5 (Downstream reach)

Entry No. : NCL – 141(W) (5) - 11 - 2013
Sample : Water (FT5. W.L3)
Client : Upper Trishuli HEP - 1
Sampled By : NESS

Date Received : 07 - 11 - 2013
Date Completed : 13 - 11 - 2013
Sampling Date : 28 - 10 - 2013
Location : Trishuli

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 19°C	Electromeric, 4500 - H^+ B,: APHA	7	5.5 - 9
2.	Electrical Conductivity, (μmhos/cm)	Conductivity Meter, 2510 B, APHA	86	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	6	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	20.7	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	68	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	20.03	-
7.	Non-Settleable Solids, (mg/l)		0.67	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	50	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	40	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	9.04	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	0.97	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	1.16	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	0.03	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.17	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	<0.005	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	<0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	0.50	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	4	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	N. D. {<1)	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	0.8	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS,	0.33	-

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
23.	Manganese, (mg/l)	3111 B, APHA	N. D. (<0.02)	
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		N. D. (<0.01)	0.1, *max*
26.	Copper, (mg/l)		N. D. (<0.01)	3, *max*
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.015	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note:

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: All observed values complied with the prescribed effluent standards discharged into inland surface water.

October-Bacteria testing

S. N.	Samples ↓ / Test Methods →	Sampling Date	Observed Values, (MPN Index / 100ml)	
			Total Coliform Count	**E. Coli Count**
			Multiple Tube Fermentation, 9221 B, APHA	***Multiple Tube Fermentation, 9221 E, APHA***
1.	WFT1 Ba. L3 (F1)	02 - 11 - 2013	48	23
2.	WFT2 Ba. L3 (F2)	01 - 11 - 2013	23	23
3.	WFT 3 Ba. L3 (F3)	30 - 10 - 2013	9	9
4.	WFT 4 Ba. L3 (F4)	29 - 10 - 2013	4	Nil
5.	WFT 5 Ba. L3 (F5)	28 - 10 - 2013	9	Nil

Note:

MPN: Most Probable Number; APHA: American Public Health Association.

Remarks: All samples were contaminated with total coliform bacteria whereas samples 4 Ba. L3 and 5 Ba. L3 were found free from *E. coli* contamination.

November 2013/Reach FT 1 (Upstream reach)

Entry No. : NCL – 164(W) (5) - 12- 2013 Date Received : 04 - 12 - 2013
Sample : River Water (FT1. W. L4) Date Completed : 09 – 12 - 2013
Client : Upper Trishuli HEP Sampled By :NESS

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 16^oC	Electromeric, 4500 - H^+ B,: APHA	6.8	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	108	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	6	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	10	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	125	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	9.67	-
7.	Non-Settleable Solids, (mg/l)		0.33	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	64	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	45	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	3.7	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	2	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	1.16	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	0.10	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.22	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	N. D. (<0.01)	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	<0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	3	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	12	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	N. D. {<1)	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	N. D. (<0.1)	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	0.52	-
23.	Manganese, (mg/l)		N. D. (<0.02)	

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		N. D. (<0.01)	0.1, *max*
26.	Copper, (mg/l)		N. D. (<0.01)	3, *max*
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.01	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note:

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: All observed values complied the prescribed effluent standards discharged into inland surface water.

November 2013/Reach FT 2 (Diversion reach)

Entry No. : NCL – 164(W) (5) - 12- 2013 Date Received : 04 - 12 - 2013
Sample : River Water (FT2. W. L4) Date Completed : 09 – 12 - 2013
Client : Upper Trishuli HEP Sampled By :NESS

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 16^{o}C	Electromeric, 4500 - H^+ B,: APHA	6.8	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	107	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	9	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	11.2	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	145	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	11	-
7.	Non-Settleable Solids, (mg/l)		0.2	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	64	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	50	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	11.5	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	1	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	1.16	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	0.03	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.25	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	N. D. (<0.01)	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	<0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	2	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	24	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	N. D. {<1)	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	N. D. (<0.1)	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	0.51	-
23.	Manganese, (mg/l)		N. D. (<0.02)	

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		N. D. (<0.01)	0.1, *max*
26.	Copper, (mg/l)		N. D. (<0.01)	3, *max*
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.01	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note:

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: All observed values complied with the prescribed effluent standards discharged into inland surface water.

November 2013/Reach FT 3 (Diversion reach)

Entry No. : NCL – 164(W) (5) - 12- 2013 Date Received : 04 - 12 - 2013
Sample : River Water (FT3. W. L4) Date Completed : 09 – 12 - 2013
Client : Upper Trishuli HEP Sampled By :NESS

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 16°C	Electromeric, 4500 - H^+ B,: APHA	6.9	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	108	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	11	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	16	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	125	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	14.89	-
7.	Non-Settleable Solids, (mg/l)		1.11	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	60	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	45	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	6.2	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	1	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	2.33	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	0.25	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.22	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	0.04	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	<0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	9.4	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	32	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	N. D. {<1)	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	N. D. (<0.1)	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	0.50	-
23.	Manganese, (mg/l)		N. D. (<0.02)	

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		N. D. (<0.01)	0.1, *max*
26.	Copper, (mg/l)		N. D. (<0.01)	3, *max*
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.02	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note:

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: All observed values complied the prescribed effluent standards discharged into inland surface water.

November 2013/Reach FT 4 (Diversion reach)

Entry No. : NCL – 164(W) (5) - 12- 2013 Date Received : 04 - 12 - 2013
Sample : River Water (FT4. W. L4) Date Completed : 09 – 12 - 2013
Client : Upper Trishuli HEP Sampled By : NESS

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 16^{o}C	Electromeric, 4500 - H^+ B,: APHA	7	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	101	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	16	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	22	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	153	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	21.2	-
7.	Non-Settleable Solids, (mg/l)		0.8	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	62	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	50	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	1.6	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	1	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	1.16	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	0.14	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.25	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	N. D. (<0.01)	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	<0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	1.02	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	8	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	N. D. {<1)	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	N. D. (<0.1)	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	0.95	-
23.	Manganese, (mg/l)		N. D. (<0.02)	

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		N. D. (<0.01)	0.1, *max*
26.	Copper, (mg/l)		N. D. (<0.01)	3, *max*
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.01	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note:

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: All observed values complied the prescribed effluent standards discharged into inland surface water.

November 2013/Reach FT 5 (Downstream reach)

Entry No. : NCL – 164(W) (5) - 12- 2013 Date Received : 04 - 12 - 2013
Sample : River Water (FT5. W. L4) Date Completed : 09 – 12 - 2013
Client : Upper Trishuli HEP Sampled By :NESS

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 16^oC	Electromeric, 4500 - H^+ B,: APHA	7	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	91	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	9	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	13	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	137	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	12.33	-
7.	Non-Settleable Solids, (mg/l)		0.67	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	60	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	42	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	7	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	<0.5	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	2.33	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	0.8	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.22	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	<0.01	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	<0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	1.82	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	10	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	N. D. {<1)	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	N. D. (<0.1)	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	0.51	-
23.	Manganese, (mg/l)		N. D. (<0.02)	

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		N. D. (<0.01)	0.1, *max*
26.	Copper, (mg/l)		N. D. (<0.01)	3, *max*
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.02	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note:

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethylenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: All observed values complied with the prescribed effluent standards discharged into inland surface water.

November-Bacteria testing

S. N.	Samples ↓ / Test Methods ⟶	Sampling Date	Observed Values, (MPN Index / 100ml) Total Coliform Count	E. Coli Count
			Multiple Tube Fermentation, 9221 B, APHA	***Multiple Tube Fermentation, 9221 E, APHA***
1.	WFT 1, Ba L4 (F1)	02 -12 - 2013	460	240
2.	WFT2, Ba L4 (F2)	01 - 12 - 2013	28	15
3.	WFT3, Ba. L4 (F3)	29 - 11 - 2013	120	23
4.	WFT4, Ba L4 (F4)	28 - 11 - 2013	93	4
5.	WFT5, Ba L4 (F5)	27- 11 - 2013	20	Nil

Note:

MPN: Most Probable Number; APHA: American Public Health Association.

Remarks: All samples were contaminated with total coliform bacteria whereas sample FT5 Ba 4 was free from *E. coli* contamination.

December 2013/Reach FT 1 (Upstream reach)

Entry No. : NCL – 206 (W) (5) - 01 - 2014 — Date Received : 01 - 01 - 2014
Sample : Water (FT1. W. L5) — Date Completed : 09 - 01 - 2014
Client : Upper Trishuli HEP - 1 — Sampling Date : 30 - 12 - 2013
Sampled By : NESS — Location : Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 12^{o}C	Electromeric, 4500 - H^{+} B,: APHA	6.9	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	106	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	**7**	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	9	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	114	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	8.67	-
7.	Non-Settleable Solids, (mg/l)		0.33	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	72	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	55	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	2.5	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^{-} B, APHA	2	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	1.8	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	<0.02	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^{-} B, APHA	0.25	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^{-} B, APHA	<0.003	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^{-} D, APHA	<0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	1.92	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	6	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	N. D. (<0.05)	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	0.80	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS,	0.76	-

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
23.	Manganese, (mg/l)	3111 B, APHA	0.02	
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		N. D. (<0.01)	0.1, *max*
26.	Copper, (mg/l)		N. D. (<0.01)	3, *max*
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.01	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note:

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: All observed values complied the prescribed effluent standards discharged into inland surface water. The water was slightly turbid in nature.

December 2013/Reach FT 2 (Diversion reach)

Entry No. : NCL – 206 (W) (5) - 01 - 2014
Sample : Water (FT2. W. L5)
Client : Upper Trishuli HEP - 1
Sampled By : NESS

Date Received : 01 - 01 - 2014
Date Completed : 09 - 01 - 2014
Sampling Date : 29 - 12 - 2013
Location : Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 12^{o}C	Electromeric, 4500 - H^+ B,: APHA	7	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	106	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	**7**	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	10	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	143	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	8.67	-
7.	Non-Settleable Solids, (mg/l)		1.33	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	70	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	55	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	9.1	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	2	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	1.8	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	<0.02	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.25	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	<0.003	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	<0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	2	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	20	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	N. D. (<0.05)	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	0.80	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS,	0.61	-

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
23.	Manganese, (mg/l)	3111 B, APHA	N. D. (<0.02)	
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		N. D. (<0.01)	0.1, *max*
26.	Copper, (mg/l)		N. D. (<0.01)	3, *max*
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.01	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note:

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: All observed values complied the prescribed effluent standards discharged into inland surface water. The water was slightly turbid in nature.

December 2013/Reach FT 3 (Diversion reach)

Entry No. : NCL – 206 (W) (5) - 01 - 2014
Sample : Water (FT3. W. L5)
Client : Upper Trishuli HEP - 1
Sampled By : NESS

Date Received : 01 - 01 - 2014
Date Completed : 09 - 01 - 2014
Sampling Date : 27 - 12 - 2013
Location : Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 12°C	Electromeric, 4500 - H^+ B,: APHA	7.1	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	103	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	5	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	8	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	97	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	6.33	-
7.	Non-Settleable Solids, (mg/l)		1.67	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	69	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	55	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	9.5	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	2	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	1.8	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	<0.02	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.22	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	<0.003	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	<0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	1.8	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	12	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	N. D. (<0.05)	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	0.40	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS,	0.42	-

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
23.	Manganese, (mg/l)	3111 B, APHA	N. D. (<0.02)	
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		N. D. (<0.01)	0.1, *max*
26.	Copper, (mg/l)		N. D. (<0.01)	3, *max*
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.01	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note:

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: All observed values complied the prescribed effluent standards discharged into inland surface water.

December 2013/Reach FT 4 (Diversion reach)

Entry No. : NCL – 206 (W) (5) - 01 - 2014
Sample : Water (FT4. W. L5)
Client : Upper Trishuli HEP - 1
Sampled By : NESS

Date Received : 01 - 01 - 2014
Date Completed : 09 - 01 - 2014
Sampling Date : 26 - 12 - 2013
Location : Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 12°C	Electromeric, 4500 - H^+ B,: APHA	7.1	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	104	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	**6**	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	9	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	118	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	5.67	-
7.	Non-Settleable Solids, (mg/l)		0.33	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	76	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	55	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	9.9	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	2	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	2.9	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	<0.02	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.27	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	<0.003	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	<0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	2.08	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	6	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	N. D. (<0.05)	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	N. D. (<0.1)	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS,	0.51	-

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
23.	Manganese, (mg/l)	3111 B, APHA	N. D. (<0.02)	
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		N. D. (<0.01)	0.1, *max*
26.	Copper, (mg/l)		N. D. (<0.01)	3, *max*
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.01	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note:

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: All observed values complied the prescribed effluent standards discharged into inland surface water. The water was slightly turbid in nature.

December 2013/Reach FT 5 (Downstream reach)

Entry No. : NCL – 206 (W) (5) - 01 - 2014
Sample : Water (FT5. W. L5)
Client : Upper Trishuli HEP - 1
Sampled By : NESS

Date Received : 01 - 01 - 2014
Date Completed : 09 - 01 - 2014
Sampling Date : 25 - 12 - 2013
Location : Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 12°C	Electromeric, 4500 - H^+ B,: APHA	7.2	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	94	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	**6**	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	9	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	103	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	8	-
7.	Non-Settleable Solids, (mg/l)		1	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	61	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	47	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	9.1	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	1.5	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	2.33	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	<0.02	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.25	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	<0.003	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	<0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	1.84	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	8	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	N. D. (<0.05)	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	N. D. (<0.1)	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS,	0.55	-

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
23.	Manganese, (mg/l)	3111 B, APHA	N. D. (<0.02)	
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		N. D. (<0.01)	0.1, *max*
26.	Copper, (mg/l)		N. D. (<0.01)	3, *max*
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.01	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note:

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: All observed values complied the prescribed effluent standards discharged into inland surface water. The water was slightly turbid in nature.

December- Bacteria testing

S. N.	Samples ↓ / Test Methods ⟶	Sampling Date	Observed Values, (MPN Index / 100ml)	
			Total Coliform Count	E. Coli Count
			Multiple Tube Fermentation, 9221 B, APHA	***Multiple Tube Fermentation, 9221 E, APHA***
1.	WFT 1, Ba L5 (F1)	30 - 12 - 2013	48	48
2.	WFT2, Ba L5 (F2)	29 - 12 - 2013	23	9
3.	WFT3, Ba. L5 (F3)	27 - 12 - 2013	23	4
4.	WFT4, Ba L5 (F4)	26 - 12 - 2013	9	7
5.	WFT5, Ba L5 (F5)	25 - 12 - 2013	21	9

Note:

MPN: Most Probable Number; APHA: American Public Health Association.

Remarks: All samples were contaminated with bacteria.

January 2014/Reach FT 1 (Upstream reach)

Entry No. : NCL – 250 (W) (5) - 01 - 2014
Sample : Water (FT1.W. L6)
Client : Upper Trishuli HEP - 1
Sampled By : NESS

Date Received : 28 - 01 - 2014
Date Completed : 04 - 02 - 2014
Sampling Date : 25 - 01 - 2014
Location : Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 14^oC	Electromeric, 4500 - H^+ B,: APHA	6.8	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	116	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	3	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	4	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	112	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	3.5	-
7.	Non-Settleable Solids, (mg/l)		0.5	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	75	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	57	-
10.	Sulphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	23.8	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	2	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	1.16	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	0.04	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.28	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	<0.003	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	<0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	1	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	10	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	2	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	0.80	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS,	0.29	-

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
23.	Manganese, (mg/l)	3111 B, APHA	N. D. (<0.02)	
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		N. D. (<0.01)	0.1, *max*
26.	Copper, (mg/l)		N. D. (<0.01)	3, *max*
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.01	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note:

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: All observed values complied the prescribed effluent standards discharged into inland surface water.

January 2014/Reach FT 2 (Diversion reach)

Entry No. : NCL – 250 (W) (5) - 01 - 2014
Sample : Water (FT2.W. L6)
Client : Upper Trishuli HEP - 1
Sampled By : NESS

Date Received : 28 - 01 - 2014
Date Completed : 04 - 02 - 2014
Sampling Date : 26 - 01 - 2014
Location : Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 14^{o}C	Electromeric, 4500 - H^+ B,: APHA	7	5.5 - 9
2.	Electrical Conductivity, (μmhos/cm)	Conductivity Meter, 2510 B, APHA	111	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	5	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	7	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	80	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	6.34	-
7.	Non-Settleable Solids, (mg/l)		0.66	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	70	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	57	-
10.	Sulphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	32	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	2	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	1.16	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	0.02	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.25	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	<0.003	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	<0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	1.4	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	6	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	1	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	N. D. (<0.1)	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS,	0.34	-

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
23.	Manganese, (mg/l)	3111 B, APHA	N. D. (<0.02)	
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		N. D. (<0.01)	0.1, *max*
26.	Copper, (mg/l)		N. D. (<0.01)	3, *max*
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.05	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note:

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: All observed values complied the prescribed effluent standards discharged into inland surface water.

January 2014/Reach FT 3 (Diversion reach)

Entry No. : NCL – 250 (W) (5) - 01 - 2014
Sample : Water (FT3.W. L6)
Client : Upper Trishuli HEP - 1
Sampled By : NESS

Date Received : 28 - 01 - 2014
Date Completed : 04 - 02 - 2014
Sampling Date : 23 - 01 - 2014
Location : Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 14°C	Electromeric, 4500 - H^+ B,: APHA	7	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	112	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	3	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	4	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	156	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	3.5	-
7.	Non-Settleable Solids, (mg/l)		0.5	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	71	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	54.5	-
10.	Sulphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	26.7	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	3	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	2.32	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	0.05	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.22	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	<0.003	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	<0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	1.1	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	8	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	<0.5	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	0.8	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS,	0.32	-

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
23.	Manganese, (mg/l)	3111 B, APHA	N. D. (<0.02)	
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		N. D. (<0.01)	0.1, *max*
26.	Copper, (mg/l)		N. D. (<0.01)	3, *max*
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.03	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note:

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: All observed values complied with the prescribed effluent standards discharged into inland surface water.

January 2014/Reach FT 4 (Diversion reach)

Entry No. : NCL – 250 (W) (5) - 01 - 2014
Sample : Water (FT4. W. L6)
Client : Upper Trishuli HEP - 1
Sampled By : NESS

Date Received : 28 - 01 - 2014
Date Completed : 04 - 02 - 2014
Sampling Date : 22 - 01 - 2014
Location : Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 14^{o}C	Electromeric, 4500 - H^+ B,: APHA	7.1	5.5 - 9
2.	Electrical Conductivity, (μmhos/cm)	Conductivity Meter, 2510 B, APHA	112	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	4	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	8	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	161	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	7.2	-
7.	Non-Settleable Solids, (mg/l)		0.8	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	69	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	54.5	-
10.	Sulphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	32.5	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	3	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	2.32	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	0.03	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.25	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	<0.003	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	<0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	3	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	18	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	1	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	1.6	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS,	0.42	-

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
23.	Manganese, (mg/l)	3111 B, APHA	N. D. (<0.02)	
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		N. D. (<0.01)	0.1, *max*
26.	Copper, (mg/l)		N. D. (<0.01)	3, *max*
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.01	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note:

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: All observed values complied with the prescribed effluent standards discharged into inland surface water.

January 2014/Reach FT 5 (Upstream reach)

Entry No. : NCL – 250 (W) (5) - 01 - 2014
Sample : Water (FT5. W. L6)
Client : Upper Trishuli HEP - 1
Sampled By : NESS

Date Received : 28 - 01 - 2014
Date Completed : 04 - 02 - 2014
Sampling Date : 21 - 01 - 2014
Location : Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 14°C	Electromeric, 4500 - H^+ B,: APHA	7.1	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	102	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	4	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	7	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	108	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	5.67	-
7.	Non-Settleable Solids, (mg/l)		1.33	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	64	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	54.5	-
10.	Sulphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	26.32	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	2	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	1.16	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	0.05	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.28	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	<0.003	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	<0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	1	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	8	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	<0.5	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	0.8	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS,	0.42	-

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
23.	Manganese, (mg/l)	3111 B, APHA	N. D. (<0.02)	
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		N. D. (<0.01)	0.1, *max*
26.	Copper, (mg/l)		N. D. (<0.01)	3, *max*
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.01	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note:

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethylenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: All observed values complied with the prescribed effluent standards discharged into inland surface water.

January- Bacteria testing

S. N.	Samples ↓ / Test Methods →	Sampling Date	Observed Values, (MPN Index / 100ml)	
			Total Coliform Count	E. Coli Count
			Multiple Tube Fermentation, 9221 B, APHA	***Multiple Tube Fermentation, 9221 E, APHA***
1.	WFT 1, Ba L6 (F1)	25 - 01 - 2014	23	15
2.	WFT2, Ba L6 (F2)	26 - 01 - 2014	21	21
3.	WFT3, Ba. L6 (F3)	23 - 01 - 2014	4	Nil
4.	WFT4, Ba L6 (F4)	22 - 01 - 2014	4	Nil
5.	WFT5, Ba L6 (F5)	21 - 01 - 2014	4	Nil

Note:

MPN: Most Probable Number; APHA: American Public Health Association.

Remarks: All samples were contaminated with total coliform bacteria whereas FT3, Ba L6; FT4, Ba L6 & FT5, Ba L6 samples were not found contaminated with *E. coli*.

February 2014/Reach FT 1 (Upstream reach)

Entry No. : NCL – 330(W) (5) - 01- 2014
Sample : River Water (FT1. W., L7)
Client : Upper Trishuli HEP
Sampled By : NESS

Date Received : 06 - 03 - 2014
Date Completed : 25 – 03 - 2014
Sampling Date : 04 – 03 - 2014
Location : Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 18°C	Electromeric, 4500 - H^+ B,: APHA	6.6	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	133	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	1	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	1	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	90	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	0.67	-
7.	Non-Settleable Solids, (mg/l)		0.33	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	76	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	59	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	6.6	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	3.5	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	1.16	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	0.09	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.28	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	<0.003	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	<0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	2	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	8	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	<1	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	N. D. (<0.05)	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	0.18	-
23.	Manganese, (mg/l)		N. D. (<0.02)	
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		N. D. (<0.01)	0.1, *max*
26.	Copper, (mg/l)		N. D. (<0.01)	3, *max*

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.02	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note:

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: All observed values complied the prescribed effluent standards discharged into inland surface water.

February 2014/Reach FT 2 (Diversion reach)

Entry No. : NCL – 330(W) (5) - 01- 2014
Sample : River Water (W.FT2, L7)
Client : Upper Trishuli HEP
Sampled By : NESS

Date Received : 06 - 03 - 2014
Date Completed : 25 – 03 - 2014
Sampling Date : 03 - 03 - 2014
Location : Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 18°C	Electromeric, 4500 - H^+ B,: APHA	6.9	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	129	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	<1	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	1.5	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	83	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	0.50	-
7.	Non-Settleable Solids, (mg/l)		1	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	78	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	62	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	6.6	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	3	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	1.16	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	0.07	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.22	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	0.003	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	<0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	1.5	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	6	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	<1	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	N. D. (<0.05)	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	0.17	-
23.	Manganese, (mg/l)		N. D. (<0.02)	
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		N. D. (<0.01)	0.1, *max*
26.	Copper, (mg/l)		N. D. (<0.01)	3, *max*

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.02	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note:

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: All observed values complied with the prescribed effluent standards discharged into inland surface water.

February 2014/Reach FT 3 (Diversion reach)

Entry No. : NCL – 330(W) (5) - 01- 2014
Sample : River Water (W.FT3, L7)
Client : Upper Trishuli HEP
Sampled By : NESS

Date Received : 06 - 03 - 2014
Date Completed : 25 – 03 - 2014
Sampling Date : 06 - 03 - 2014
Location : Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 18°C	Electromeric, 4500 - H^+ B,: APHA	7	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	127	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	1	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	2	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	78	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	0.67	-
7.	Non-Settleable Solids, (mg/l)		1.33	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	72	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	59	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	13.9	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	3	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	1.16	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	0.03	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.27	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	0.006	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	<0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	2.4	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	10	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	<1	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	N. D. (<0.05)	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	0.18	-
23.	Manganese, (mg/l)		N. D. (<0.02)	
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		N. D. (<0.01)	0.1, *max*
26.	Copper, (mg/l)		N. D. (<0.01)	3, *max*

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.02	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note:

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: All observed values complied with the prescribed effluent standards discharged into inland surface water.

February 2014/Reach FT 4 (Diversion reach)

Entry No. : NCL – 330(W) (5) - 01- 2014
Sample : River Water (W.FT4, L7)
Client : Upper Trishuli HEP
Sampled By : NESS

Date Received : 06 - 03 - 2014
Date Completed : 25 – 03 - 2014
Sampling Date : 28 - 02 - 2014
Location : Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 18°C	Electromeric, 4500 - H^+ B,: APHA	7.1	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	129	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	<1	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	1	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	92	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	0.67	-
7.	Non-Settleable Solids, (mg/l)		0.33	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	76	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	59	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	7.8	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	3	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	1.16	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	0.09	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.23	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	0.006	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	<0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	<1	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	4	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	<1	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	N. D. (<0.05)	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	0.23	-
23.	Manganese, (mg/l)		0.05	
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		N. D. (<0.01)	0.1, *max*
26.	Copper, (mg/l)		N. D. (<0.01)	3, *max*

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.015	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note:

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: All observed values complied with the prescribed effluent standards discharged into inland surface water.

February 2014/Reach FT 5 (Downstream reach)

Entry No. : NCL – 330(W) (5) - 01- 2014
Sample : River Water (W.FT5, L7)
Client : Upper Trishuli HEP
Sampled By : NESS

Date Received : 06 - 03 - 2014
Date Completed : 25 – 03 - 2014
Sampling Date : 27 - 02 - 2014
Location : Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 18°C	Electromeric, 4500 - H^+ B,: APHA	7	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	119	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	1	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	1.5	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	86	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	0.5	-
7.	Non-Settleable Solids, (mg/l)		1	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	69	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	59	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	9	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	3	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	1.16	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	0.09	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.23	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	<0.003	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	<0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	1.2	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	6	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	<1	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	N. D. (<0.05)	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	0.23	-
23.	Manganese, (mg/l)		N. D. (<0.02)	
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		N. D. (<0.01)	0.1, *max*
26.	Copper, (mg/l)		N. D. (<0.01)	3, *max*

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.011	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note:

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: All observed values complied the prescribed effluent standards discharged into inland surface water.

February-Bacteria testing

S. N.	Samples ↓ / Test Methods →	Sampling Date	Observed Values, (MPN Index / 100ml)	
			Total Coliform Count	E. Coli Count
			Multiple Tube Fermentation, 9221 B, APHA	***Multiple Tube Fermentation, 9221 E, APHA***
1.	FT 1, Ba L7 (F1)	04 - 03 - 2014	93	48
2.	FT2, Ba L7 (F2)	03 - 03 - 2014	23	3
3.	FT3, Ba. L7 (F3)	06 - 03 - 2014	240	23
4.	FT4, Ba L7 (F4)	28 - 02 - 2014	3	Nil
5.	FT5, Ba L7 (F5)	27 - 02 - 2014	7	Nil

Note:

MPN: Most Probable Number; APHA: American Public Health Association.

Remarks: All samples were contaminated with total coliform bacteria whereas FT1, Ba L7; FT2, Ba L7 & FT3, Ba L76 samples were not found contaminated with E. coli.

March 2014/Reach FT 1 (Upstream reach)

Entry No. : NCL – 372(W) (5) - 03- 2014
Sample : River Water (FT1, W. L8)
Client : Upper Trishuli HEP
Sampled By : NESS

Date Received : 30 - 03 - 2014
Date Completed : 13 – 04 - 2014
Sampling Date : 26 – 03 - 2014
Location : Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 24°C	Electromeric, 4500 - H^+ B,: APHA	7.4	5.5 - 9
2.	Electrical Conductivity, (μmhos/cm)	Conductivity Meter, 2510 B, APHA	149	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	10	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	8	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	121	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	7.67	-
7.	Non-Settleable Solids, (mg/l)		0.33	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	74	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	61	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	14.8	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	3.5	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	1.11	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	<0.02	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.42	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	0.003	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	0.29	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	3.6	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	10	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	<1	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	0.80	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	0.57	-
23.	Manganese, (mg/l)		N. D. (<0.02)	
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		N. D. (<0.01)	0.1, *max*
26.	Copper, (mg/l)		N. D. (<0.01)	3, *max*

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		<0.01	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note:

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: All observed values complied with the prescribed effluent standards discharged into inland surface water.

March 2014/Reach FT 2 (Diversion reach)

Entry No. : NCL – 372(W) (5) - 03- 2014
Sample : River Water (FT2, W. L8)
Client : Upper Trishuli HEP
Sampled By : NESS

Date Received : 30 - 03 - 2014
Date Completed : 13 – 04 - 2014
Sampling Date : 27 – 03 - 2014
Location : Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 24^{o}C	Electromeric, 4500 - H^{+} B,: APHA	7.4	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	147	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	9	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	6	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	101	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	5.33	-
7.	Non-Settleable Solids, (mg/l)		0.67	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	77	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	61	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	17.7	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^{-} B, APHA	2.5	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	1.7	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	0.10	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^{-} B, APHA	0.28	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^{-} B, APHA	<0.003	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^{-} D, APHA	0.23	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	3.9	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	12	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	<1	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	0.40	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	0.52	-
23.	Manganese, (mg/l)		N. D. (<0.02)	
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		N. D. (<0.01)	0.1, *max*
26.	Copper, (mg/l)		N. D. (<0.01)	3, *max*

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		N. D. (<0.01)	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note:

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: All observed values complied with the prescribed effluent standards discharged into inland surface water.

March 2014/Reach FT 3 (Diversion reach)

Entry No. : NCL – 372(W) (5) - 03- 2014
Sample : River Water (FT3, W. L8)
Client : Upper Trishuli HEP
Sampled By : NESS

Date Received : 30 - 03 - 2014
Date Completed : 13 – 04 - 2014
Sampling Date : 24 – 03 - 2014
Location : Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 24^{o}C	Electromeric, 4500 - H^+ B,: APHA	7.4	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	145	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	6	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	4	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	122	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	3.67	-
7.	Non-Settleable Solids, (mg/l)		0.33	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	71	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	61	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	14.4	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	3	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	1.7	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	<0.02	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.25	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	0.007	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	0.32	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	4	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	20	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	<1	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	N. D. (<0.05)	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	0.41	-
23.	Manganese, (mg/l)		N. D. (<0.02)	
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		N. D. (<0.01)	0.1, *max*
26.	Copper, (mg/l)		N. D. (<0.01)	3, *max*

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.02	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note:

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: All observed values complied with the prescribed effluent standards discharged into inland surface water.

March 2014/Reach FT 4 (Diversion reach)

Entry No. : NCL – 372(W) (5) - 03- 2014
Sample : River Water (FT4, W. L8)
Client : Upper Trishuli HEP
Sampled By : NESS

Date Received : 30 - 03 - 2014
Date Completed : 13 – 04 - 2014
Sampling Date : 23 – 03 - 2014
Location : Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 24°C	Electromeric, 4500 - H^+ B,: APHA	7.3	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	146	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	7	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	7	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	98	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	6.67	-
7.	Non-Settleable Solids, (mg/l)		0.33	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	79	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	63.5	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	17.7	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	3	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	1.7	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	<0.02	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.25	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	0.005	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	0.28	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	3.9	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	14	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	<1	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	N. D. (<0.05)	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	0.42	-
23.	Manganese, (mg/l)		N. D. (<0.02)	
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		N. D. (<0.01)	0.1, *max*
26.	Copper, (mg/l)		N. D. (<0.01)	3, *max*

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.03	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note:

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: All observed values complied with the prescribed effluent standards discharged into inland surface water.

March 2014/Reach FT 5 (Downstream reach)

Entry No. : NCL – 372(W) (5) - 03- 2014 | Date Received : 30 - 03 - 2014
Sample : River Water (FT5, W. L8) | Date Completed : 13 – 04 - 2014
Client : Upper Trishuli HEP | Sampling Date : 22 – 03 - 2014
Sampled By : NESS | Location: Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 24^oC	Electromeric, 4500 - H^+ B,: APHA	7.4	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	130	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	6	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	5	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	96	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	4.67	-
7.	Non-Settleable Solids, (mg/l)		0.33	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	67	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	56	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	19.3	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	2.5	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	1.7	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	0.02	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.32	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	0.005	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	0.33	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	3.6	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	8	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	<1	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	0.80	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	0.32	-
23.	Manganese, (mg/l)		N. D. (<0.02)	
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		N. D. (<0.01)	0.1, *max*
26.	Copper, (mg/l)		N. D. (<0.01)	3, *max*

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.01	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note:

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: All observed values complied the prescribed effluent standards discharged into inland surface water.

March –Bacteria testing

S. N.	Samples ↓ / Test Methods →	Sampling Date	Observed Values, (MPN Index / 100ml)	
			Total Coliform Count	E. Coli Count
			Multiple Tube Fermentation, 9221 B, APHA	***Multiple Tube Fermentation, 9221 E, APHA***
1.	FT 1, Ba L8 (F1)	26 - 03 - 2014	48	23
2.	FT2, Ba L8 (F2)	26 - 03 - 2014	460	93
3.	FT3, Ba. L8 (F3)	24 - 03 - 2014	39	Nil
4.	FT4, Ba L8 (F4)	23 - 03 - 2014	93	4
5.	FT5, Ba L8 (F5)	22 - 03- 2014	93	4

Note:

MPN: Most Probable Number; APHA: American Public Health Association.

Remarks: All samples were contaminated with total coliform bacteria whereas FT1, Ba L8; FT2, Ba L8; FT4 Ba L8, & FT5, Ba L8 samples were also found contaminated with E. coli.

April 2014/Reach FT 1 (Upstream reach)

Entry No. : NCL – 450 (W) (5) - 04 - 2014
Sample : Water (F1.W.L9)
Client : Upper Trishuli HEP
Sampled By : NESS

Date Received : 28 - 04 - 2014
Date Completed : 16 - 05 - 2014
Sampling Date : 26 - 04 - 2014
Location : Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 25^{o}C	Electromeric, 4500 - H^{+} B,: APHA	7.3	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	150	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	**31**	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	21	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	210	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	17.33	-
7.	Non-Settleable Solids, (mg/l)		3.67	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	81	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	68.8	-
10.	Sulphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	17.24	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^{-} B, APHA	1.97	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	0.60	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	<0.02	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^{-} B, APHA	0.45	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^{-} B, APHA	0.03	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^{-} D, APHA	<0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	1.7	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	12	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	1	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	N. D. (<0.1)	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS,	2.19	-

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
23.	Manganese, (mg/l)	3111 B, APHA	0.04	
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		<0.01	0.1, *max*
26.	Copper, (mg/l)		N. D. (<0.01)	3, *max*
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.018	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note:

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: All observed values complied with the prescribed effluent standards discharged into inland surface water. The water was moderately turbid in nature.

April 2014/Reach FT 2 (Diversion reach)

Entry No. : NCL – 450 (W) (5) - 04 - 2014
Sample : Water (F2.W.L9)
Client : Upper Trishuli HEP
Sampled By : NESS

Date Received : 28 - 04 - 2014
Date Completed : 16 - 05 - 2014
Sampling Date : 25 - 04 - 2014
Location : Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 25^{o}C	Electromeric, 4500 - H^{+} B,: APHA	7.3	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	161	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	**7**	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	10	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	160	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	7.67	-
7.	Non-Settleable Solids, (mg/l)		2.33	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	72	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	61	-
10.	Sulphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	19.33	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^{-} B, APHA	2.9	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	1.1	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	<0.02	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^{-} B, APHA	0.42	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^{-} B, APHA	0.03	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^{-} D, APHA	<0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	1.8	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	16	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	2	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	N. D. (<0.1)	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS,	0.43	-

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
23.	Manganese, (mg/l)	3111 B, APHA	0.02	
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		0.01	0.1, *max*
26.	Copper, (mg/l)		N. D. (<0.01)	3, *max*
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.015	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note:

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: All observed values complied the prescribed effluent standards discharged into inland surface water. The water was slightly turbid in nature.

April 2014/Reach FT 3 (Diversion reach)

Entry No. : NCL – 450 (W) (5) - 04 - 2014
Sample : Water (F3.W.L9)
Client : Upper Trishuli HEP
Sampled By : NESS

Date Received : 28 - 04 - 2014
Date Completed : 16 - 05 - 2014
Sampling Date : 23 - 04 - 2014
Location : Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 25^{o}C	Electromeric, 4500 - H^{+} B,: APHA	7.3	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	150	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	**6**	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	8	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	124	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	5.67	-
7.	Non-Settleable Solids, (mg/l)		2.33	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	70	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	61	-
10.	Sulphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	21.4	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^{-} B, APHA	3.5	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	1.1	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	<0.02	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^{-} B, APHA	0.40	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^{-} B, APHA	0.07	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^{-} D, APHA	<0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	1.8	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	12	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	1	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	N. D. (<0.1)	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS,	0.47	-

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
23.	Manganese, (mg/l)	3111 B, APHA	0.02	
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		0.01	0.1, *max*
26.	Copper, (mg/l)		N. D. (<0.01)	3, *max*
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.015	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note:

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: All observed values complied with the prescribed effluent standards discharged into inland surface water. The water was slightly turbid in nature.

April 2014/Reach FT 4 (Diversion reach)

Entry No. : NCL – 450 (W) (5) - 04 - 2014 | Date Received : 28 - 04 - 2014
Sample : Water (F4.W.L9) | Date Completed : 16 - 05 - 2014
Client : Upper Trishuli HEP | Sampling Date : 22 - 04 - 2014
Sampled By : NESS | Location : Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 25^{o}C	Electromeric, 4500 - H^+ B,: APHA	7.4	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	151	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	4	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	3	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	122	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	1.33	-
7.	Non-Settleable Solids, (mg/l)		1.67	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	71	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	64	-
10.	Sulphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	16.5	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	2.5	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	0.56	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	<0.02	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.28	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	0.03	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	<0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	2.98	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	11	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	1	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	N. D. (<0.1)	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS,	0.34	-

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
23.	Manganese, (mg/l)	3111 B, APHA	N. D. (<0.02)	
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		<0.01	0.1, *max*
26.	Copper, (mg/l)		N. D. (<0.01)	3, *max*
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.015	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note:

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: All observed values complied the prescribed effluent standards discharged into inland surface water.

April 2014/Reach FT 5 (Downstream reach)

Entry No. : NCL – 450 (W) (5) - 04 - 2014 Date Received : 28 - 04 - 2014
Sample : Water (F5.W.L9) Date Completed : 16 - 05 - 2014
Client : Upper Trishuli HEP Sampling Date : 21 - 04 - 2014
Sampled By : NESS Location : Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 25°C	Electromeric, 4500 - H^+ B,: APHA	7.4	5.5 - 9
2.	Electrical Conductivity, (μmhos/cm)	Conductivity Meter, 2510 B, APHA	150	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	3	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	2	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	108	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	1	-
7.	Non-Settleable Solids, (mg/l)		1	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	64	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	61	-
10.	Sulphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	14.8	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	2.9	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	1.1	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	<0.02	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.32	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	<0.03	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	<0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	1.9	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	11	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	<1	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	N. D. (<0.1)	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS,	0.29	-

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
23.	Manganese, (mg/l)	3111 B, APHA	N. D. (<0.02)	
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		<0.01	0.1, *max*
26.	Copper, (mg/l)		N. D. (<0.01)	3, *max*
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.014	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note:

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethylenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: All observed values complied the prescribed effluent standards discharged into inland surface water.

April –Bacteria testing

S. N.	Samples ↓ / Test Methods →	Sampling Date	Observed Values, (MPN Index / 100ml)	
			Total Coliform Count	E. Coli Count
			Multiple Tube Fermentation, 9221 B, APHA	***Multiple Tube Fermentation, 9221 E, APHA***
1.	FT 1, Ba L9	26 - 04 - 2014	>1100	>1100
2.	FT2, Ba L9	25 - 04 - 2014	210	11
3.	FT3, Ba. L9	23 - 04 - 2014	23	4
4.	FT4, Ba L9	22 - 04 - 2014	4	Nil
5.	FT5, Ba L9	21 - 04 - 2014	15	9

Note:

MPN: Most Probable Number; APHA: American Public Health Association.

Remarks: All samples were contaminated with total coliform bacteria whereas FT4, Ba L9 was not found contaminated with E. coli.

May 2014/Reach FT 1 (Upstream reach)

Entry No. : NCL – 518(W) (5) – 05 - 2014
Sample : River Water (F1, W. L10)
Client : Upper Trishuli HEP
Sampled By : NESS

Date Received : 28 - 05 - 2014
Date Completed : 11 – 06 - 2014
Sampling Date : 27 – 05 - 2014
Location : Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 25^{0}C	Electromeric, 4500 - H^+ B,: APHA	7.3	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	91.4	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	90	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	161	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	332	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	145.33	-
7.	Non-Settleable Solids, (mg/l)		15.67	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	64	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	53	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	9.87	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	1.9	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	1.11	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	0.11	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.42	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	<0.003	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	3.5	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	16	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	6	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	N. D. (<0.20)	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	5.51	-
23.	Manganese, (mg/l)		0.08	
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		N. D. (<0.01)	0.1, *max*
26.	Copper, (mg/l)		<0.01	3, *max*

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.03	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note: The river was at flooded condition.

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: All observed values complied with the prescribed effluent standards discharged into inland surface water. The water was highly turbid in nature.

May 2014/Reach FT 2 (Diversion reach)

Entry No. : NCL – 518(W) (5) – 05 - 2014
Sample : River Water (F2. W. L10)
Client : Upper Trishuli HEP
Sampled By : NESS

Date Received : 28 - 05 - 2014
Date Completed : 11 – 06 - 2014
Sampling Date : 26 – 05 - 2014
Location : Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 25^oC	Electromeric, 4500 - H^+ B,: APHA	7.2	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	85	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	120	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	155	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	317	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	140.67	-
7.	Non-Settleable Solids, (mg/l)		14.33	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	56	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	40	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	13.57	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	<0.5	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	1.11	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	0.08	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.48	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	0.003	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	2.7	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	22	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	2	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	N. D. (<0.20)	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	5.03	-
23.	Manganese, (mg/l)		0.08	
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		N. D. (<0.01)	0.1, *max*
26.	Copper, (mg/l)		<0.01	3, *max*

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.08	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note: The river was at flooded condition.

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: All observed values complied with the prescribed effluent standards discharged into inland surface water. The water was highly turbid in nature.

May 2014/Reach FT 3 (Diversion reach)

Entry No. : NCL – 518(W) (5) – 05 - 2014
Sample : River Water (F3. W. L10)
Client : Upper Trishuli HEP
Sampled By : NESS

Date Received : 28 - 05 - 2014
Date Completed : 11 – 06 - 2014
Sampling Date : 24 – 05 - 2014
Location : Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 25°C	Electromeric, 4500 - H^+ B,: APHA	7.2	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	81	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	170	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	**213**	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	404	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	195.33	-
7.	Non-Settleable Solids, (mg/l)		17.67	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	195.3	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	55	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	9.04	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	1.5	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	1.7	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	0.11	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.40	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	0.016	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	3.6	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	24	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	3	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	N. D. (<0.20)	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	6.68	-
23.	Manganese, (mg/l)		0.10	
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		N. D. (<0.01)	0.1, *max*
26.	Copper, (mg/l)		<0.01	3, *max*

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.03	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note: The river was at flooded condition.

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: Except total suspended solids, all observed values complied the prescribed effluent standards discharged into inland surface water. The water was highly turbid in nature.

May 2014/Reach FT 4 (Diversion reach)

Entry No. : NCL – 518(W) (5) – 05 - 2014
Sample : River Water (F4. W. L10)
Client : Upper Trishuli HEP
Sampled By : NESS

Date Received : 28 - 05 - 2014
Date Completed : 11 – 06 - 2014
Sampling Date : 23 – 05 - 2014
Location : Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 25°C	Electromeric, 4500 - H^+ B,: APHA	7.3	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	81	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	180	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	200	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	312	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	188.33	-
7.	Non-Settleable Solids, (mg/l)		12.67	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	53	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	45	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	12.33	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	1	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	1.11	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	0.08	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.40	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	0.01	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	<0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	3.5	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	7.6	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	3	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	N. D. (<0.2)	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	5.8	-
23.	Manganese, (mg/l)		0.09	
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		N. D. (<0.01)	0.1, *max*
26.	Copper, (mg/l)		<0.01	3, *max*

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.03	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note: The river was at flooded condition.

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: All observed values complied the prescribed effluent standards discharged into inland surface water. The water was highly turbid in nature.

May 2014/Reach FT 5 (Downstream reach)

Entry No. : NCL – 518(W) (5) – 05 - 2014
Sample : River Water (F5. W. L10)
Client : Upper Trishuli HEP
Sampled By : NESS

Date Received : 28 - 05 - 2014
Date Completed : 11 – 06 - 2014
Sampling Date : 22 – 05 - 2014
Location: Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 25^{o}C	Electromeric, 4500 - H^{+} B,: APHA	7.3	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	91	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	150	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	**244**	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	328	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	235.67	-
7.	Non-Settleable Solids, (mg/l)		8.33	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	59	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	50.3	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	15.63	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^{-} B, APHA	1	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	1.11	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	0.04	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^{-} B, APHA	0.38	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^{-} B, APHA	0.01	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^{-} D, APHA	0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	2.2	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	32	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	2	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	N. D. (<0.2)	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	6.13	-
23.	Manganese, (mg/l)		0.11	
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		N. D. (<0.01)	0.1, *max*
26.	Copper, (mg/l)		<0.01	3, *max*

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.04	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note: The river was at flooded condition.

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: Except total suspended solids, all observed values complied with the prescribed effluent standards discharged into inland surface water. The water was highly turbid in nature.

May –Bacteria testing

S. N.	Samples ↓ / Test Methods ⟶	Sampling Date	Observed Values, (MPN Index / 100ml)	
			Total Coliform Count	E. Coli Count
			Multiple Tube Fermentation, 9221 B, APHA	***Multiple Tube Fermentation, 9221 E, APHA***
1.	FT 1, Ba L10 (F1)	27 - 05 - 2014	93	23
2.	FT2, Ba L10 (F2)	26 - 05 - 2014	210	48
3.	FT3, Ba. L10 (F3)	24 - 05 - 2014	460	75
4.	FT4, Ba L10 (F4)	23 - 05 - 2014	>1100	>1100
5.	FT5, Ba L10 (F5)	22 - 05- 2014	48	9

Note:

MPN: Most Probable Number; APHA: American Public Health Association.

Remarks: All samples were found contaminated with coliform bacteria.

June 2014/Reach FT 1 (Upstream reach)

Entry No. : NCL – 593(W) (5) – 07 - 2014
Sample : River Water (FT1, Wa L11)
Client : Upper Trishuli HEP
Sampled By : NESS

Date Received : 02 - 07 - 2014
Date Completed : 10 – 07 - 2014
Sampling Date : 26 – 06 - 2014
Location : Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 27°C	Electromeric, 4500 - H^+ B,: APHA	6.7	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	103	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	200	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	**658**	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	1119	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	633.7	-
7.	Non-Settleable Solids, (mg/l)		24.3	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	54	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	48	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	7	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	4	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	0.58	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	0.33	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.30	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	0.003	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	5.5	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	16	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	<1	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	0.78	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	9.4	-
23.	Manganese, (mg/l)		0.17	-
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		N. D. (<0.01)	0.1, *max*
26.	Copper, (mg/l)		0.01	3, *max*

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.05	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note: The River was at flooded condition.

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: Except total suspended solids, all observed values complied the prescribed effluent standards discharged into inland surface water. The water was found highly turbid in nature.

June 2014/Reach FT 2 (Diversion reach)

Entry No. : NCL – 593(W) (5) – 07 - 2014
Sample : River Water (FT2, Wa L11)
Client : Upper Trishuli HEP
Sampled By : NESS

Date Received : 02 - 07 - 2014
Date Completed : 10 – 07 - 2014
Sampling Date : 27 – 06 - 2014
Location : Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 27°C	Electromeric, 4500 - H^+ B,: APHA	6.9	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	101	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	175	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	**544**	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	699	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	520.7	-
7.	Non-Settleable Solids, (mg/l)		23.3	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	52	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	48	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	6.6	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	5	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	1.16	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	0.07	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.47	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	0.006	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	<0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	3.3	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	10	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	<1	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	0.78	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	7.9	-
23.	Manganese, (mg/l)		0.12	-
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		N. D. (<0.01)	0.1, *max*
26.	Copper, (mg/l)		<0.01	3, *max*

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.06	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note: The River was at flooded condition.

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: Except total suspended solids, all observed values complied with the prescribed effluent standards discharged into inland surface water. The water was found highly turbid in nature.

June 2014/Reach FT 3 (Diversion reach)

Entry No. : NCL – 593(W) (5) – 07 - 2014
Sample : River Water (FT3, Wa L11)
Client : Upper Trishuli HEP
Sampled By : NESS

Date Received : 02 - 07 - 2014
Date Completed : 10 – 07 - 2014
Sampling Date : 25 – 06 - 2014
Location : Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 27°C	Electromeric, 4500 - H^+ B,: APHA	7.1	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	100	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	175	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	**314**	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	395	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	291.3	-
7.	Non-Settleable Solids, (mg/l)		22.7	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	52	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	51	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	5.34	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	4	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	0.58	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	0.05	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.40	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	0.003	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	<0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	2.4	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	26	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	<1	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	N. D. (<0.2)	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	7.8	-
23.	Manganese, (mg/l)		0.12	-
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		N. D. (<0.01)	0.1, *max*
26.	Copper, (mg/l)		<0.01	3, *max*

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.04	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note: The River was at flooded condition.

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: Except total suspended solids, all observed values complied with the prescribed effluent standards discharged into inland surface water. The water was found highly turbid in nature.

June 2014/Reach FT 4 (Diversion reach)

Entry No. : NCL – 593(W) (5) – 07 - 2014
Sample : River Water (FT4, Wa L11)
Client : Upper Trishuli HEP
Sampled By : NESS

Date Received : 02 - 07 - 2014
Date Completed : 10 – 07 - 2014
Sampling Date : 29 – 06 - 2014
Location : Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 27°C	Electromeric, 4500 - H^+ B,: APHA	7.2	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	110	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	225	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	**226**	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	345	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	198.3	-
7.	Non-Settleable Solids, (mg/l)		27.7	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	57	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	51	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	8.6	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	5	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	1.16	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	0.04	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.35	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	0.003	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	<0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	4.1	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	30	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	<1	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	N. D. (<0.2)	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	6.9	-
23.	Manganese, (mg/l)		0.12	-
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		N. D. (<0.01)	0.1, *max*
26.	Copper, (mg/l)		<0.01	3, *max*

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.04	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note: The River was at flooded condition.

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: Except total suspended solids, all observed values complied with the prescribed effluent standards discharged

June 2014/Reach FT 5 (Downstream reach)

Entry No. : NCL – 593(W) (5) – 07 - 2014
Sample : River Water (FT5, Wa L11)
Client : Upper Trishuli HEP
Sampled By : NESS

Date Received : 02 - 07 - 2014
Date Completed : 10 – 07 - 2014
Sampling Date : 30 – 06 - 2014
Location : Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 27°C	Electromeric, 4500 - H^+ B,: APHA	7.3	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	105	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	225	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	**268**	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	408	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	242.3	-
7.	Non-Settleable Solids, (mg/l)		25.7	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	57	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	51	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	3.3	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	5	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	0.58	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	0.11	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.23	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	0.003	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	0.01	2, *max*
17.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	2.4	30 - 100
18.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	24	250, *max*
19.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
20.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	<1	10, *max*
21.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	N. D. (<0.2)	2, *max*
22.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	6.8	-
23.	Manganese, (mg/l)		0.10	-
24.	Cadmium, (mg/l)		N. D. (<0.003)	2, *max*
25.	Lead, (mg/l)		N. D. (<0.01)	0.1, *max*
26.	Copper, (mg/l)		<0.01	3, *max*

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
27.	Nickel, (mg/l)		N. D. (<0.01)	3, *max*
28.	Silver, (mg/l)		N. D. (<0.01)	0.1, *max*
29.	Zinc, (mg/l)		0.03	5, *max*
30.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, *max*
31.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, *max*

N. D.: Not Detected

Note: The River was at flooded condition.

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: Except total suspended solids, all observed values complied with the prescribed effluent standards discharged into inland surface water. The water was found highly turbid in nature.

June –Bacteria testing

S. N.	Samples ↓ / Test Methods ⟶	Sampling Date	Observed Values, (MPN Index / 100ml)	
			Total Coliform Count	E. Coli Count
			Multiple Tube Fermentation, 9221 B, APHA	***Multiple Tube Fermentation, 9221 E, APHA***
1.	FT 1, Ba L11 (F1)	26 - 06 - 2014	150	48
2.	FT2, Ba L11 (F2)	27 - 06 - 2014	48	48
3.	FT3, Ba. L11 (F3)	25 - 06 - 2014	>1100	240
4.	FT4, Ba L11 (F4)	29 - 06 - 2014	>1100	1100
5.	FT5, Ba L11 (F5)	30 - 06- 2014	>1100	48

Note:

MPN: Most Probable Number; APHA: American Public Health Association.

Remarks: All samples were found contaminated with coliform bacteria.

July 2014/Reach FT 1 (Upstream reach)

Entry No. : NCL – 39(W) (5) –08- 2014 | Date Received : 05 - 08 - 2014
Sample : River Water (F1, Wa L12) | Date Completed : 08 – 08 - 2014
Client : Upper Trishuli HEP | Sampling Date : 29 – 07 - 2014
Sampled By : NESS | Location : Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 28°C	Electromeric, 4500 - H^+ B,: APHA	7.3	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	108	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	100	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	**400**	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	442	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	357	-
7.	Non-Settleable Solids, (mg/l)		43	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	58	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	53	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	3.3	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	2	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	1.16	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	N. D. (<0.04)	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.74	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	0.01	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	<0.01	2, *max*
17.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	8	250, *max*
18.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
19.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	2	10, *max*
20.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	N. D. (<0.20)	2, *max*
21.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	6.5	-
22.	Manganese, (mg/l)		0.13	
23.	Cadmium, (mg/l)		N. D. (<0.003)	2, max
24.	Lead, (mg/l)		<0.01	0.1, max
25.	Copper, (mg/l)		<0.01	3, max
26.	Nickel, (mg/l)		N. D. (<0.01)	3, max
27.	Silver, (mg/l)		N. D. (<0.01)	0.1, max

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
28.	Zinc, (mg/l)		0.04	5, max
29.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, max
30.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, max
31.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	4	30 - 100

N. D.: Not Detected

Note: The river was at flooded condition.

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: Except total suspended solids, all observed values complied the prescribed effluent standards discharged into inland surface water. The water was highly turbid in nature.

July 2014/Reach FT 2 (Diversion reach)

Entry No. : NCL – 39(W) (5) –08 - 2014 Date Received : 05 - 08 - 2014
Sample : River Water (F2, Wa L12) Date Completed : 08 – 08 - 2014
Client : Upper Trishuli HEP Sampling Date : 30 – 07 - 2014
Sampled By : NESS Location : Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 28°C	Electromeric, 4500 - H^+ B,: APHA	7.5	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	104	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	140	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	**463**	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	653	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	362	-
7.	Non-Settleable Solids, (mg/l)		101	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	62	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	51	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	11.9	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	2	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	1.16	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	0.07	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.96	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	N. D. (<0.003)	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	<0.01	2, *max*
17.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	10	250, *max*
18.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
19.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	5	10, *max*
20.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	N. D. (<0.20)	2, *max*
21.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	5.0	-
22.	Manganese, (mg/l)		0.07	
23.	Cadmium, (mg/l)		N. D. (<0.003)	2, max
24.	Lead, (mg/l)		N. D. (<0.01)	0.1, max
25.	Copper, (mg/l)		<0.01	3, max
26.	Nickel, (mg/l)		N. D. (<0.01)	3, max
27.	Silver, (mg/l)		N. D. (<0.01)	0.1, max

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
28.	Zinc, (mg/l)		0.08	5, max
29.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, max
30.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, max
31.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	5.5	30 - 100

N. D.: Not Detected

Note: The river was at flooded condition.

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: Except total suspended solids, all observed values complied the prescribed effluent standards discharged into inland surface water. The water was highly turbid in nature.

July 2014/Reach FT 3 (Diversion reach)

Entry No. : NCL – 39(W) (5) –08 - 2014
Sample : River Water (F3, Wa L12)
Client : Upper Trishuli HEP
Sampled By : NESS

Date Received : 05 - 08 - 2014
Date Completed : 08 – 08 - 2014
Sampling Date : 01 – 08 - 2014
Location : Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 28^{o}C	Electromeric, 4500 - H^{+} B,: APHA	7.5	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	93	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	170	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	**539**	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	637	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	481	-
7.	Non-Settleable Solids, (mg/l)		58	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	50	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	45	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	<1	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	2.5	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	1.16	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	0.06	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	1.10	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	0.005	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	<0.01	2, *max*
17.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	10	250, *max*
18.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
19.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	4	10, *max*
20.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	N. D. (<0.20)	2, *max*
21.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	6.7	-
22.	Manganese, (mg/l)		0.13	
23.	Cadmium, (mg/l)		N. D. (<0.003)	2, max
24.	Lead, (mg/l)		N. D. (<0.01)	0.1, max
25.	Copper, (mg/l)		<0.01	3, max
26.	Nickel, (mg/l)		N. D. (<0.01)	3, max
27.	Silver, (mg/l)		N. D. (<0.01)	0.1, max

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
28.	Zinc, (mg/l)		0.04	5, max
29.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, max
30.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, max
31.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	5.6	30 - 100

N. D.: Not Detected

Note: The river was at flooded condition.

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: Except total suspended solids, all observed values complied the prescribed effluent standards discharged into inland surface water. The water was highly turbid in nature.

July 2014/Reach FT 4 (Diversion reach)

Entry No. : NCL – 39(W) (5) –08 - 2014
Sample : River Water (F4, Wa L12)
Client : Upper Trishuli HEP
Sampled By : NESS

Date Received : 05 - 08 - 2014
Date Completed : 08 – 08 - 2014
Sampling Date : 02 – 08 - 2014
Location : Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 28^{o}C	Electromeric, 4500 - H^+ B,: APHA	7.7	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	129	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	480	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	**917**	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	1243	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	566	-
7.	Non-Settleable Solids, (mg/l)		351	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	110	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	236	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	7.81	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	3	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	1.75	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	N. D. (<0.04)	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	0.81	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	N. D. (<0.003)	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	<0.01	2, *max*
17.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	30	250, *max*
18.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
19.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	4	10, *max*
20.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	N. D. (<0.20)	2, *max*
21.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	5.5	-
22.	Manganese, (mg/l)		0.10	
23.	Cadmium, (mg/l)		N. D. (<0.003)	2, max
24.	Lead, (mg/l)		N. D. (<0.01)	0.1, max
25.	Copper, (mg/l)		<0.01	3, max
26.	Nickel, (mg/l)		N. D. (<0.01)	3, max
27.	Silver, (mg/l)		N. D. (<0.01)	0.1, max

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
28.	Zinc, (mg/l)		0.03	5, max
29.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, max
30.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, max
31.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	7	30 - 100

N. D.: Not Detected

Note: The river was at flooded condition.

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association

Remarks: Except total suspended solids, all observed values complied the prescribed effluent standards discharged into inland surface water. The water was highly turbid in nature.

July 2014/Reach FT 5 (Downstream reach)

Entry No. : NCL – 39(W) (5) –08 - 2014
Sample : River Water (F5, Wa L12)
Client : Upper Trishuli HEP
Sampled By : NESS

Date Received : 05 - 08 - 2014
Date Completed : 08 – 08 - 2014
Sampling Date : 03 – 08 - 2014
Location : Rasuwa

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
1.	pH @ 28°C	Electromeric, 4500 - H^+ B,: APHA	7.8	5.5 - 9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	101	-
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	180	-
4.	Total Suspended Solids, (mg/l)	Oven Drying, 2540 D APHA	**268**	30 - 200
5.	Total Solids, (mg/l)	Oven Drying, Gravimetric, 2540 C, APHA	553	-
6.	Settleable Solids, (mg/l)	Settling, 2540 F, APHA	144	-
7.	Non-Settleable Solids, (mg/l)		124	-
8.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	76	-
9.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	107	-
10.	Sullphate, (mg/l)	Gravimetric Method with Ignition of Residue, 4500 - SO_4^{2-} C, APHA	7.4	-
11.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	2.5	-
12.	Free Carbon Dioxide, (mg/l)	Titrimetric, 4500 - CO_2 C: APHA	0.58	-
13.	Ammoniacal - N, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	0.07	50, *max*
14.	Nitrate - N, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	1.25	-
15.	Nitrite - N, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	N. D. (<0.003)	-
16.	Fluoride, (mg/l)	SPANDS, 4500 - F^- D, APHA	<0.01	2, *max*
17.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	4	250, *max*
18.	Phenol, (mg/l)	Chloroform Extraction, 5530 C, APHA	N. D. (<0.005)	1, *max*
19.	Oil & Grease, (mg/l)	Partition – Gravimetric, 5520 B, APHA	6	10, *max*
20.	Hydrogen Sulphide, (mg/l)	Iodometric, Titration4500 - S^{2-} F, APHA	N. D. (<0.20)	2, *max*
21.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	5.89	-
22.	Manganese, (mg/l)		0.09	
23.	Cadmium, (mg/l)		N. D. (<0.003)	2, max
24.	Lead, (mg/l)		N. D. (<0.01)	0.1, max
25.	Copper, (mg/l)		<0.01	3, max
26.	Nickel, (mg/l)		N. D. (<0.01)	3, max
27.	Silver, (mg/l)		N. D. (<0.01)	0.1, max

S. N.	Parameters	Test Methods	Observed Values	Generic Effluent Standards Discharged into Inland Surface Water, GoN 2001
28.	Zinc, (mg/l)		0.05	5, max
29.	Arsenic, (mg/l)	SDDC, 3500 - As, C: APHA	N. D. (<0.005)	0.2, max
30.	Mercury, (mg/l)	Cold Vapor AAS, 3112 B: APHA	N. D. (<0.0005)	0.01, max
31.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 - 1989	0.5	30 - 100

N. D.: Not Detected

Note: The river was at flooded condition.

AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: Except total suspended solids, all observed values complied with the prescribed effluent standards discharged into inland surface water. The water was highly turbid in nature.

A.2 Aquatic habitat surveys

A.2.2 Chlorophyll

August 2013

Entry No. : NCL – 99 (W) (5) - 09 - 2013
Sample : River Water
Client : Upper Trishuli HEP 1
Sampled By : NESS

Date Received : 13 - 09 - 2013
Date Completed : 16 - 09 - 2013
Sampling Date : 23 - 08 - 2013
Location : Rasuwa

S. N.	Samples	Observed Chlorophyll$_a$, (mg/m^3)
1.	FT1.Ch.L1 (F1)	<0.15
2.	FT2.Ch. L1 (F2)	0.96
3.	FT3.Ch. L1 (F3)	0.15
4.	FT4.Ch. L1 (F4)	<0.15
5.	FT5.Ch. L1 (F5)	1.41

N. D.: Not Detected

Note: Thick deposit of sediments was seen on the filter paper. The test item was concentrated from 1.5l of water sample at each site. The analysis was carried out in field concentrated and preserved samples by following method 2 (Spectrophotometric) 10200H, APHA

Remarks: The sample FT1.Ch.L1 and FT4.Ch. L1 had phenophythin$_a$ concentrations of 1.69 mg/m^3 and 0.24 mg/m^3 respectively

September 2013

Entry No. : NCL – 115 (Ch) (4) - 09 - 2013
Sample : River Water
Client : Upper Trishuli HEP 1
Sampled By : NESS

Date Received : 29 - 09 - 2013
Date Completed : 07 - 10 - 2013
Sampling Date : 27 - 09 - 2013
Location : Rasuwa

S. N.	Samples	Observed Chlorophyll$_a$, (mg/m^3)	Observed Pheophytin a, (mg/m^3)
1.	FT1.Ch.L2	<0.11	0.35
2.	FT2.Ch. L2	<0.11	0.86
3.	FT3.Ch. L2	<0.11	26.92
4.	FT4.Ch. L2	0.49	<0.19
5.	FT.Ch. L2	<0.11	<0.19

N. D.: Not Detected

Note: Thick deposit of sediments was seen on the filter paper. The test item was concentrated from 1.5l of water sample at each site. The analysis was carried out in field concentrated and preserved samples by following method 2 (Spectrophotometric) 10200H, APHA

October 2013

Entry No. : NCL – 143 (W) (5) - 11 - 2013   Date Received : 07 - 11 - 2013
Sample : River Water   Date Completed : 12 – 11 - 2013
Client : Upper Trishuli HEP   Sampled By :NESS

S. N.	Samples ↓ / Test Method ⟶	Sampling Date	Observed Values, (mg/m^3)	
			Chlorophyll a	Pheophytin a
			Method 2,10200H, APHA	
1.	FT1 Ch. L3	02 - 11 - 2013	N. D. (<0.10)	29.31
2.	FT2 Ch. L3	01 - 11 - 2013	N. D. (<0.10)	13.89
3.	FT3 Ch. L3	30 - 10 - 2013	0.38	N. D. (<0.17)
4.	FT4 Ch. L3	29 - 10 - 2013	N. D. (<0.10)	12.3
5.	FT5 Ch. L3	28 - 10 - 2013	N. D. (<0.10)	21.02

N. D.: Not Detected

Note:

The test item was concentrated from 2.5l of water sample at each site.

Remarks: Except in 3 Ch. L3, chlorophyll a was not detected in all samples.

November 2013

Entry No. : NCL – 166(W) (5) - 12- 2013   Date Received : 04 - 12 - 2013
Sample : River Water   Date Completed : 10 – 12 - 2013
Client : Upper Trishuli HEP   Sampled By :NESS

S. N.	Samples ↓ / Test Method ⟶	Sampling Date	Observed Values, (mg/m^3)	
			Chlorophyll a	Pheophytin a
			Method 2,10200H, APHA	
1.	FT 1, Ch L4	02 -12 - 2013	20.85	N. D. (<0.17)
2.	FT2, Ch L4	01 - 12 - 2013	64.23	N. D. (<0.17)
3.	FT3,Ch. L4	29 - 11 - 2013	6.56	N. D. (<0.17)
4.	FT4, Ch L4	28 - 11 - 2013	9.74	N. D. (<0.17)
5.	FT5, Ch L 4	07- 12 - 2013	45.5	N. D. (<0.17)

N. D.: Not Detected

Note:

The test item was concentrated from 2.5l of water sample at each site.

Remarks: Phenophytin-a were not detected in all samples.

December 2013

Entry No. : NCL – 208(W) (5) - 12- 2014
Sample : River Water
Client : Upper Trishuli HEP

Date Received : 01 - 01 - 2014
Date Completed : 14 – 01 - 2014
Sampled By :NESS

S. N.	Samples ↓ / Test Method →	Sampling Date	Observed Values, (mg/m^3)	
			Chlorophyll a	Pheophytin a
			Method 2,10200H, APHA	
1.	FT 1, Ch L5	30 - 12 - 2013	<0.10	1.04
2.	FT2, Ch L5	29 - 12 - 2013	<0.10	8.73
3.	FT3,Ch. L5	27 - 12 - 2013	<0.10	4
4.	FT4, Ch L5	26 - 12 - 2013	0.41	N. D. (<0.17)
5.	FT5, Ch L 5	25 - 12 - 2013	<0.10	2.62

N. D.: Not Detected

Note:

The test item was concentrated from 2.5l of water sample at each site.

Remarks: Phenophytin-a were not detected in all samples.

January 2014

Entry No. : NCL – 252(W) (5) - 12- 2014
Sample : River Water
Client : Upper Trishuli HEP

Date Received : 28 - 01 - 2014
Date Completed : 04 – 02 - 2014
Sampled By :NESS

S. N.	Samples ↓ / Test Method →	Sampling Date	Observed Values, (mg/m^3)	
			Chlorophyll a	Pheophytin a
			Method 2,10200H, APHA	
1.	FT 1, Ch L6	25 - 01 - 2014	0.21	N. D. (<0.18)
2.	FT2, Ch L6	26 - 01 - 2014	N. D. (<0.10)	1.8
3.	FT3,Ch. L6	23 - 01 - 2014	N. D. (<0.10)	0.36
4.	FT4, Ch L6	22 - 01 - 2014	N. D. (<0.10)	3.96
5.	FT5, Ch L 6	21 - 01 - 2014	N. D. (<0.10)	5.04

N. D.: Not Detected

Note:

The test item was concentrated from 2.5l of water sample at each site.

Remarks: Except in FT1, CH L6, Phenophytin-a was detected in all samples whereas chlorophyll a was detected only in FT1, Ch L6 sample.

February 2014

Entry No. : NCL – 332(W) (5) - 01- 2014
Sample : River Water
Client : Upper Trishuli HEP

Date Received : 06 - 03 - 2014
Date Completed : 25 – 03 - 2014
Sampled By :NESS

S. N.	Samples ↓ / Test Method →	Sampling Date	Observed Values, (mg/m^3)	
			Chlorophyll a	Pheophytin a
			Method 2,10200H, APHA	
1.	FT 1, Ch L7	04 - 03 - 2014	N. D. (<0.10)	23.3
2.	FT2, Ch L7	03 - 03 - 2014	N. D. (<0.10)	19.24
3.	FT3, Ch L7	06 - 03 - 2014	N. D. (<0.10)	1.79
4.	FT4, Ch L7	28 - 02 - 2014	0.21	N. D. (<0.18)
5.	FT5, Ch L7	27 - 02 - 2014	N. D. (<0.10)	13.54

N. D.: Not Detected

Note:

The test item was concentrated from 2.5l of water sample at each site.

Remarks: *Except in FT4 Ch L7, Phenophytin a was detected in all samples whereas chlorophyll a was detected only in FT4, Ch L7 sample.*

March 2014

Entry No. : NCL – 374(W) (5) - 03- 2014
Sample : River Water
Client : Upper Trishuli HEP

Date Received : 30 - 03 - 2014
Date Completed : 03 – 04 - 2014
Sampled By :NESS

S. N.	Samples ↓ / Test Method →	Sampling Date	Observed Values, (mg/m^3)	
			Chlorophyll a	Pheophytin a
			Method 2,10200H, APHA	
1.	FT 1, Ch L8	26 - 03 - 2014	N. D. (<0.10)	2.49
2.	FT2, Ch L8	27- 03 - 2014	N. D. (<0.10)	0.53
3.	FT3, Ch L8	24 - 03 - 2014	<0.10	N. D. (<0.18)
4.	FT4, Ch L8	23 - 03 - 2014	N. D. (<0.10)	5.76
5.	FT5, Ch L8	22 - 03- 2014	N. D. (<0.10)	14.78

N. D.: Not Detected

Note:

The test item was concentrated from 2.5l of water sample at each site.

Remarks: *Except in FT3 Ch L8, Phenophytin-a was detected in all samples whereas chlorophyll a was not detected in all samples.*

April 2014

Entry No. : NCL – 452(W) (5) - 04- 2014
Sample : River Water
Client : Upper Trishuli HEP
Date Received : 28 - 04 - 2014
Date Completed : 14 – 05 - 2014
Sampled By :NESS

S. N.	Samples ↓ / Test Method ⟶	Sampling Date	Observed Values, (mg/m^3)	
			Chlorophyll a	**Pheophytin a**
			Method 2,10200H, APHA	
1.	FT 1, Ch L9	26 - 04 - 2014	N. D. (<0.10)	5.52
2.	FT2, Ch L9	25 - 04 - 2014	N. D. (<0.10)	5.04
3.	FT3, Ch L9	23 - 04 - 2014	N. D. (<0.10)	0.36
4.	FT4, Ch L9	22 - 04 - 2014	N. D. (<0.10)	3.56
5.	FT5, Ch L9	21 - 04 - 2014	N. D. (<0.10)	4.5

N. D.: Not Detected

Note:

The test item was concentrated from 2.5l of water sample at each site.

Remarks: Chlorophylla was not detected in entire sample.

May 2014

Entry No. : NCL – 520 (W) (5) - 05- 2014
Sample : River Water
Client : Upper Trishuli HEP
Date Received : 28 - 05 - 2014
Date Completed : 11 – 06 - 2014
Sampled By :NESS

S. N.	Samples ↓ / Test Method ⟶	Sampling Date	Observed Values, (mg/m^3)	
			Chlorophyll a	**Pheophytin a**
			Method 2,10200H, APHA	
1.	FT 1, Ch L10	27 - 05 - 2014	N. D. (<0.10)	2.14
2.	FT2, Ch L10	26 - 05 - 2014	N. D. (<0.10)	0.89
3.	FT3, Ch L10	24 - 05 - 2014	N. D. (<0.10)	0.36
4.	FT4, Ch L10	23 - 05 - 2014	0.10	N. D. (<0.18)
5.	FT5, Ch L10	22 - 05 - 2014	N. D. (<0.10)	2.88

N. D.: Not Detected

Note:

The test item was concentrated from 2.0l of water sample at each site. The water samples were taken during flooded condition.

Remarks: The chlorophyll a was detected and pheophytin a was absent in FT4, Ch L10 sample.

June 2014

Entry No. : NCL – 595 (W) (5) - 07- 2014
Sample : River Water
Client : Upper Trishuli HEP

Date Received : 02 - 07 - 2014
Date Completed : 10 – 07 - 2014
Sampled By :NESS

S. N.	Samples ↓ / Test Method →	Sampling Date	Observed Values, (mg/m^3)	
			Chlorophyll a	Pheophytin a
			Method 2,10200H, APHA	
1.	FT 1, Ch L11	26 - 06 - 2014	0.21	N. D. (<0.18)
2.	FT2, Ch L11	27 - 06 - 2014	0.20	N. D. (<0.18)
3.	FT3, Ch L11	25 - 06 - 2014	N. D. (<0.10)	7.48
4.	FT4, Ch L11	29 - 06 - 2014	N. D. (<0.10)	10.40
5.	FT5, Ch L11	30 - 06 - 2014	0.21	N. D. (<0.18)

N. D.: Not Detected

Note:

The test item was concentrated from 2.5l of water sample at each site. The water samples were taken during flooded condition.

Remarks: The chlorophyll a was not detected in samples FT3, Ch L11 & FT4, Ch L11 whereas pheophytin a was absent in FT1, Ch L11, FT2, Ch L11 & FT5, Ch L11 samples.

July 2014

Entry No. : NCL – 41 (W) (5) - 08- 2014
Sample : River Water
Client : Upper Trishuli HEP

Date Received : 05 - 08 - 2014
Date Completed : 08 – 08 - 2014
Sampled By :NESS

S. N.	Samples ↓ / Test Method →	Sampling Date	Observed Values, (mg/m^3)	
			Chlorophyll a	Pheophytin a
			Method 2,10200H, APHA	
1.	FT 1, Ch L12	29 - 07 - 2014	N. D. (<0.10)	0.18
2.	FT2, Ch L12	30 - 07 - 2014	N. D. (<0.10)	2.34
3.	FT3, Ch L12	01 - 08 - 2014	N. D. (<0.10)	12.11
4.	FT4, Ch L12	02 - 08 - 2014	N. D. (<0.10)	6.90
5.	FT5, Ch L12	03 - 08- 2014	N. D. (<0.10)	4.09

N. D.: Not Detected

Note:

The test item was concentrated from 2.5l of water sample at each site. The water samples were taken during flooded condition.

Remarks: The chlorophyll-a was not detected in entire sample.

A.2.3 Periphyton

August 2013

River Reach	Sample Code	Analysed Date	Common name	Division	Class	Order	Family	Genus	Species	#	Total no. per 0.1ml	density/ square cm.
FT1	FT1.P.L1	22.10.2013	Weatella	Chlorophyta				*Westella*		1	8	266.67
			Ulothrix	Chlorophyta	Chlorophyceae	Ulothricales	Ulothricaceae	*Ulothrix*		7		
FT2	FT2.P.L1	21.10.2013	Lyngbya	Cynobacteria		Ocillatoriales		*Lyngbya*		15	17	566.67
			Ulothrix	Chlorophyta	Chlorophyceae	Ulothricales	Ulothricaceae	*Ulothrix*		2		
FT3	FT3.P.L1	20.10.2013	Synedra	Bacillariophyta		Flagilariales		*Synedra*		6	9	300
			Ulothrix	Chlorophyta	Chlorophyceae	Ulothricales	Ulothricaceae	*Ulothrix*		3		
FT4	FT4.P.L1	12.10.2013	Ulothrix	Chlorophyta	Chlorophyceae	Ulothricales	Ulothricaceae	*Ulothrix*		8	9	300
			Synedra	Bacillariophyta		Flagilariales		*Synedra*		1		
FT5	FT5.P.L1	11.10.2013	Ulothrix	Chlorophyta	Chlorophyceae	Ulothricales	Ulothricaceae	*Ulothrix*		7	11	366.67
			Synedra	Bacillariophyta		Flagilariales		*Synedra*		1		
			Westella	Chlorophyta				*Westella*		1		
			Lyngbya	Cynobacteria		Ocillatoriales		*Lyngbya*		1		
			Rivularia	Cynobacteria		Nostocales		*Rivularia*		1		

- Density/sq.cm= (Volume of samples concentrated* 2* 10* total number of species)/No of loop observed
- Method: 20 ml of homogenised sample were concentrated to 5 ml using centrifuge. 0.1 ml (one loop) suspension is then observed on 100X magnification microscope for identification in 5 field views. Such observation were made for three different loops for idetification and estimation of desity.

Identification and Analysis by: N.K. Rai
Checked by: Pradeep Kumar shaha

September 2013

River Reach	Sample Code	Analysed Date	Common name	Division	Class	Order	Family	Genus	#	Total no. per 0.1ml	density/ square cm.
FT1	FT1.P.L2	6.10.2013	Phormidium	Cynobacteria		Ocillatoriales		Phormidium	2		
			Rivularia	Cynobacteria		Nostocales		Rivularia	1		
			Unknown A						1	4	133.33
FT2	FT2.P.L2	7.10.2013	Coleodesmium	Cynobacteria		Nostocales		Coleodesmium	5		
			Unknown B						1	6	200.00
FT3	FT3.P.L2	8.10.2013	Coleodesmium	Cynobacteria		Nostocales		Coleodesmium	5	5	166.67
FT4	FT4.P.L2	9.10.2013	Coleodesmium	Cynobacteria		Nostocales		Coleodesmium	6		
			Rivularia	Cynobacteria		Nostocales		Rivularia	**5**	11	366.67
FT5	FT5.P.L2	10.10.2013	Coleodesmium	Cynobacteria		Nostocales		Coleodesmium	2		
			Ulothrix	Chlorophyta	Chlorophyceae	Ulothricales	Ulothricaceae	Ulothrix	1		
			Gomphoneis	Bacillarlophyta		Cymbellales		Gomphoneis	6	9	300.00

- Density/sq.cm= (Volume of samples concentrated* 2* 10* total number of species)/No of loop observed
- Method: 20 ml of homogenised sample were concentrated to 5 ml using centrifuge. 0.1 ml (one loop) suspension is then observed on 100X magnification microscope for identification in 5 field views. Such observation were made for three different loops for idetification and estimation of desity.

Analysed By: Rai Nirsing Kumar
Checked and verified By: Pradip Kumar Sah

October 2013

River Reach	Sample Code	Analysed Date	Common name	Division	Order	Genus	#	Total no. per 0.3ml	density/ square cm.
			Frustulia	Bacillariophyta	Naviculales	Frustulia	48		
			Actinella	Bacillariophyta	Eunotiales	Actinella	13		
FT1	FT1.P.L3	13.11.013	Synedra	Bacillariophyta	Fragilariales	Synedra	10	71	118.4
			Gomphonema	Bacillariopbyta	Cymbellales	Gomphonema	7		
			Frustulia	Bacillariopbyta	Naviculales	Frustulia	50		
			Actinella	Bacillariopbyta	Eunotiales	Actinella	12		
FT2	FT2.P.L3	14.11.013	Microspora	Chlorophyta	Microsporales	Microspora	1	70	116.6
			Frustulia	Bacillariophyta	Naviculales	Frustulia	49		
			Actinella	Bacillariophyta	Eunotiales	Actinella	7		
			Gomphonema	Bacillariophyta	Cymbellales	Gomphonema	3		
			Fragilaria	Bacillariophyta	Fragilariales	Fragilaria	3		
FT3	FT3.P.L3	14.11.013	Synedra	Bacillariophyta	Fragilariales	Synedra	1	63	105
			Frustulia	Bacillariophyta	Naviculales	Frustulia	21		
			Actinella	Bacillariophyta	Eunotiales	Actinella	28		
			Rivularia	Cynobacteria	Nostocales	Rivularia	1		
FT4	FT4.P.L3	15.11.013	Microspora	Chlorophyta	Microsporales	Microspora	4	54	90
			Frustulia	Bacillarlophyta	Naviculales	Frustulia	84		
			Synedra	Bacillarlophyta	Fragilariales	Synedra	16		
			Microspora	Chlorophyta	Microsporales	Microspora	1		
			Audouinella	Rhodophyta		Audoinella	1		
FT5	FT5.P.L3	15.11.013	Actinella	Bacillarlophyta	Eunotiales	Actinella	10	112	186.6

- Density/sq.cm= (50.k.n/3.a), where k=2, n=no of cells or fillament observed in three loops and 15 fields of view and a= area of each original sample
- Method: 20 ml of homogenised sample were concentrated to 5 ml using centrifuge. 0.1 ml (one loop) suspension is then observed on 100X magnification microscope for identification in 5 field views. Such observation were made for three different loops for idetification and estimation of desity. Analysed By: Rai Nirsing Kumar/Checked and verified By: Pradip Kumar Sah

November 2013

River Reach	Sample Code	Analysed Date	Common name	Division	Class	Order	Family	Genus	#	Total no. per 0.1ml	density/ square cm.
FT1	FT1.P.L4	14.12.2013	Frustulia	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	Frustulia	224		
			Actinella	Bacillariophyta	Bacillariophyceae	Eunotiales	Eunotiaceae	Actinella	72		
			Gomphoneis	Bacillarlophyta		Cymbellales	Cymbellaceae	Gomphoneis	60		
			Synedra	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	Synedra	64		
			Navicula	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	Navicula	12		
			Microspora	Chlorophyta	Chlorophyceae	Microsporales	Microsporaceae	Microspora	4	436	726.67
FT2	FT2.P.L4	15.12.2013	Frustulia	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	Frustulia	284		
			Synedra	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	Synedra	28		
			Navicula	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	Navicula	3		
			Actinella	Bacillariophyta	Bacillariophyceae	Eunotiales	Eunotiaceae	Actinella	52		
			Gomphoneis	Bacillarlophyta		Cymbellales	Cymbellaceae	Gomphoneis	24		
			Fragilaria	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	Fragilaria	96	487	811.67
FT3	FT3.P.L4	15.12.2013	Frustulia	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	Frustulia	100		
			Synedra	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	Synedra	7		
			Navicula	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	Navicula	76		
			Gomphoneis	Bacillarlophyta		Cymbellales	Cymbellaceae	Gomphoneis	60		
			Actinella	Bacillariophyta	Bacillariophyceae	Eunotiales	Eunotiaceae	Actinella	12		
			Cymbella	Bacillariophyta	Bacillariophyceae	Cymbellalles	Cymbellaceae	Cymbella	72		
			Microspora	Chlorophyta	Chlorophyceae	Microsporales	Microsporaceae	Microspora	10		
			Fragilaria	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	Fragilaria	90	427	711.67
FT4	FT4.P.L4	16.12.2013	Frustulia	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	Frustulia	592		
			Navicula	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	Navicula	36		
			Actinella	Bacillariophyta	Bacillariophyceae	Eunotiales	Eunotiaceae	Actinella	88		
			Cymbella	Bacillariophyta	Bacillariophyceae	Cymbellalles	Cymbellaceae	Cymbella	24	818	1363.33

			Microspora	Chlorophyta	Chlorophyceae	Microsporales	Microsporaceae	Microspora	2		
			Fragilaria	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	Fragilaria	76		
FT5	FT5.P.L4	16.12.2013	Frustulia	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	Frustulia	224		
			Synedra	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	Synedra	5		
			Navicula	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	Navicula	64		
			Gomphoneis	Bacillarlophyta		Cymbellales	Cymbellaceae	Gomphoneis	180		
			Actinella	Bacillariophyta	Bacillariophyceae	Eunotiales	Eunotiaceae	Actinella	64		
			Cymbella	Bacillariophyta	Bacillariophyceae	Cymbellalles	Cymbellaceae	Cymbella	96		
			Microspora	Chlorophyta	Chlorophyceae	Microsporales	Microsporaceae	Microspora	4		
			Fragilaria	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	*Fragilaria*	32	669	1115

- Density/sq.cm= (50.k.n/3.a), where k=2, n=no of cells or fillament observed in three loops and 15 fields of view and a= area of each original sample
- Method: 20 ml of homogenised sample were concentrated to 5 ml then observed 0.1 ml (one loop) suspension on 100X magnificatio with microscope in 5 field views. Such observation was made for three different loops.

December 2013

River Reach	Sample Code	Analysed Date	Common name	Division	Class	Order	Family	Genus	#	Total no. per 0.1ml	density/ square cm.
FT1	FT1.P.L5	14.12.2013	Frustulia	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	Frustulia	264		
			Actinella	Bacillariophyta	Bacillariophyceae	Eunotiales	Eunotiaceae	Actinella	80		
			Gomphoneis	Bacillarlophyta	Bacillariophyceae	Cymbellales	Cymbellaceae	Gomphoneis	24		
			Cymbella	Bacillariophyta	Bacillariophyceae	Cymbellalles	Cymbellaceae	Cymbella	80		
			Navicula	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	Navicula	132		
			Voucheria	Xanthophyta		Voucheriales		Voucheria	4		
			Fragillaria	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	Fragilaria	88		
			Ulothrix	Chlorophyta	Chlorophyceae	Ulothricales		Ulothirx	3		
			Microspora	Chlorophyta	Chlorophyceae	Microsporales	Microsporaceae	Microspora	11	686	1143.33
FT2	FT2.P.L5	15.12.2013	Frustulia	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	Frustulia	264		
			Fragilaria	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	Fragilaria	100		
			Navicula	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	Navicula	500		
			Actinella	Bacillariophyta	Bacillariophyceae	Eunotiales	Eunotiaceae	Actinella	48		
			Gomphoneis	Bacillariophyta	Bacillariophyceae	Cymbellales	Cymbellaceae	Gomphoneis	36		
			Diatoma	Bacillariophyta	Bacillariophyceae	Fragilariales		Diatoma	16		
			Voucheria	Xanthophyta		Vaucheriales		Voucheria	1		
			Cymbella	Bacillariophyta	Bacillariophyceae	Cymbellalles	Cymbellaceae	Cymbella	96		
			Pinnularia	Bacillariophyta	Bacillariophyceae	Naviculales		Pinnularia	20		
			Stegioclonium	Chlorophyta		Chaetophorales		Stegioclonium	4		
			Microspora	Chlorophyta	Chlorophyceae	Microsporales		Microspora	10		
			Ulothrix	Chlorophyta	Chlorophyceae	Ulothricales		Ulothirx	2	1097	1828.33
FT3	FT3.P.L	15.12.20	Frustulia	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	Frustulia	190	862	1436.67

	5	13	Fragilaria	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	Fragilaria	60		
			Navicula	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	Navicula	160		
			Gomphoneis	Bacillarlophyta	Bacillariophyceae	Cymbellales	Cymbellaceae	Gomphoneis	64		
			Actinella	Bacillariophyta	Bacillariophyceae	Eunotiales	Eunotiaceae	Actinella	124		
			Cymbella	Bacillariophyta	Bacillariophyceae	Cymbellalles	Cymbellaceae	Cymbella	196		
			Microspora	Chlorophyta	Chlorophyceae	Microsporales	Microsporaceae	Microspora	3		
			Ulothrix	Chlorophyta	Chlorophyceae	Ulothricales		Ulothirx	1		
			Diatoma	Bacillariophyta	Bacillariophyceae	Fragilariales		Diatoma	16		
			Pinnularia	Bacillariophyta	Bacillariophyceae	Naviculales		Pinnularia	40		
			Nitzschia	Bacillariophyta		Bacillariales		Nitzschia	8		
FT4	FT4.P.L5	16.12.2013	Frustulia	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	Frustulia	466		
			Navicula	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	Navicula	104		
			Actinella	Bacillariophyta	Bacillariophyceae	Eunotiales	Eunotiaceae	Actinella	98		
			Cymbella	Bacillariophyta	Bacillariophyceae	Cymbellalles	Cymbellaceae	Cymbella	180		
			Gomphoneis	Bacillariophyta	Bacillariophyceae	Cymbellalles	Cymbellaceae	Gomphoneis	48		
			Fragilaria	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	Fragilaria	72		
			Diatoma	Bacillariophyta	Bacillariophyceae	Fragilariales		Diatoma	16		
			Nitzschia	Bacillariophyta		Bacillariales		Nitzschia	24		
			Rivularia	Cynobacteria		Nostocales		Rivularia	4	1012	1686.67
FT5	FT5.P.L5	16.12.2013	Frustulia	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	Frustulia	464		
			Synedra	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	Synedra	24		
			Navicula	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	Navicula	124		
			Gomphoneis	Bacillarlophyta	Bacillariophyceae	Cymbellales	Cymbellaceae	Gomphoneis	64	1031	1718.33

			Actinella	Bacillariophyta	Bacillariophyceae	Eunotiales	Eunotiaceae	Actinella	40		
			Cymbella	Bacillariophyta	Bacillariophyceae	Cymbellalles	Cymbellaceae	Cymbella	200		
			Microspora	Chlorophyta	Chlorophyceae	Microsporales	Microsporaceae	Microspora	6		
			Pinnularia	Bacillariophyta	Bacillariophyceae	Naviculales		Pinnularia	4		
			Nitzschia	Bacillariophyta		Bacillariales		Nitzschia	8		
			Diatoma	Bacillariophyta	Bacillariophyceae	Fragilariales		Diatoma	12		
			Rivularia	Cynobacteria		Nostocales		Rivularia	1		
			Fragilaria	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	*Fragilaria*	84		

- Density/sq.cm= (50.k.n/3.a), where k=2, n=no of cells or fillament observed in three loops and 15 fields of view and a= area of each original sample
- Method: 20 ml of homogenised sample were concentrated to 5 ml then observed 0.1 ml (one loop) suspension on 100X magnificatio with microscope in 5 field views. Such observation were made for three different loops.

January 2014

River Reach	Sample Code	Analysed Date	Common name	Division	Class	Order	Family	Genus	#	Total no. per 0.3ml	density/ square cm.
FT1	FT1.P.L6	12.02.014	Frustulia	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Frustulia*	152	379	631.67
			Actinella	Bacillariophyta	Bacillariophyceae	Eunotiales	Eunotiaceae	*Actinella*	9		
			Gomphoneis	Bacillarlophyta	Bacillariophyceae	Cymbellales	Cymbellaceae	*Gomphoneis*	76		
			Cymbella	Bacillariophyta	Bacillariophyceae	Cymbellalles	Cymbellaceae	*Cymbella*	60		
			Navicula	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Navicula*	40		
			Pinnularia	Bacillariophyta	Bacillariophyceae	Naviculales		*Pinnularia*	1		
			Fragillaria	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	*Fragilaria*	28		
			Ulothrix	Chlorophyta	Chlorophyceae	Ulothricales		*Ulothirx*	1		
			Nitzschia	Bacillariophyta		Bacillariales		*Nitzschia*	2		
			Rivularia	Cynobacteria		Nostocales		*Rivularia*	3		
			Synedra	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	*Synedra*	4		
			Microspora	Chlorophyta	Chlorophyceae	Microsporales	Microsporaceae	*Microspora*	3		
FT2	FT2.P.L6	13.02.014	Frustulia	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Frustulia*	408	1212	2020.00
			Fragilaria	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	*Fragilaria*	52		
			Navicula	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Navicula*	124		
			Actinella	Bacillariophyta	Bacillariophyceae	Eunotiales	Eunotiaceae	*Actinella*	60		
			Gomphoneis	Bacillariophyta	Bacillariophyceae	Cymbellales	Cymbellaceae	*Gomphoneis*	64		
			Diatoma	Bacillariophyta	Bacillariophyceae	Fragilariales		*Diatoma*	225		
			Voucheria	Xanthophyta		Vaucheriales		*Voucheria*	5		
			Cymbella	Bacillariophyta	Bacillariophyceae	Cymbellalles	Cymbellaceae	*Cymbella*	224		
			Pinnularia	Bacillariophyta	Bacillariophyceae	Naviculales		*Pinnularia*	13		

			Nitzschia	Bacillariophyta		Bacillariales		*Nitzschia*	28		
			Microspora	Chlorophyta	Chlorophyceae	Microsporales		*Microspora*	8		
			Ulothrix	Chlorophyta	Chlorophyceae	Ulothricales		*Ulothirx*	1		
FT3	FT3.P.L6	14.02.014	Frustulia	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Frustulia*	680		
			Fragilaria	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	*Fragilaria*	88		
			Navicula	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Navicula*	220		
			Gomphoneis	Bacillariophyta	Bacillariophyceae	Cymbellales	Cymbellaceae	*Gomphoneis*	56		
			Actinella	Bacillariophyta	Bacillariophyceae	Eunotiales	Eunotiaceae	*Actinella*	196		
			Cymbella	Bacillariophyta	Bacillariophyceae	Cymbellalles	Cymbellaceae	*Cymbella*	176		
			Microspora	Chlorophyta	Chlorophyceae	Microsporales	Microsporaceae	*Microspora*	12		
			Rivularia	Cynobacteria		Nostocales		*Rivularia*	6		
			Voucheria	Xanthophyta		Vaucheriales		*Voucheria*	3		
			Diatoma	Bacillariophyta	Bacillariophyceae	Fragilariales		*Diatoma*	76		
			Synedra	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	*Synedra*	1		
			Nitzschia	Bacillariophyta		Bacillariales		*Nitzschia*	13	1527	2545.00
FT4	FT4.P.L6	16.02.014	Frustulia	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Frustulia*	620		
			Synedra	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	*Synedra*	1		
			Navicula	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Navicula*	228		
			Gomphoneis	Bacillariophyta	Bacillariophyceae	Cymbellales	Cymbellaceae	*Gomphoneis*	24		
			Actinella	Bacillariophyta	Bacillariophyceae	Eunotiales	Eunotiaceae	*Actinella*	104		
			Cymbella	Bacillariophyta	Bacillariophyceae	Cymbellalles	Cymbellaceae	*Cymbella*	376		
			Microspora	Chlorophyta	Chlorophyceae	Microsporales	Microsporaceae	*Microspora*	2		
			Voucheria	Xanthophyta		Vaucheriales		*Voucheria*	9		
			Nitzschia	Bacillariophyta		Bacillariales		*Nitzschia*	3		
			Diatoma	Bacillariophyta	Bacillariophyceae	Fragilariales		*Diatoma*	12	1411	2351.67

			Fragilaria	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	*Fragilaria*	32		
FT5	FT5.P.L6	17.02.014	Frustulia	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Frustulia*	744		
			Navicula	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Navicula*	172		
			Gomphoneis	Bacillarlophyta	Bacillariophyceae	Cymbellales	Cymbellaceae	*Gomphoneis*	6		
			Actinella	Bacillariophyta	Bacillariophyceae	Eunotiales	Eunotiaceae	*Actinella*	60		
			Cymbella	Bacillariophyta	Bacillariophyceae	Cymbellalles	Cymbellaceae	*Cymbella*	156		
			Microspora	Chlorophyta	Chlorophyceae	Microsporales	Microsporaceae	*Microspora*	1		
			Pinnularia	Bacillariophyta	Bacillariophyceae	Naviculales		*Pinnularia*	20		
			Nitzschia	Bacillariophyta		Bacillariales		*Nitzschia*	1		
			Diatoma	Bacillariophyta	Bacillariophyceae	Fragilariales		*Diatoma*	12		
			Rivularia	Cynobacteria		Nostocales		*Rivularia*	2		
			Fragilaria	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	*Fragilaria*	32	1206	2010

- Density/sq.cm= (50.k.n/3.a), where k=2, n=no of cells or fillament observed in three loops and 15 fields of view and a= area of each original sample
- Method: 20 ml of homogenised sample were concentrated to 5 ml then observed 0.1 ml (one loop) suspension on 100X magnificatio with microscope in 5 field views. Such observation was made for three different loops.

February 2014

River Reach	Sample Code	Analysed Date	Common name	Division	Class	Order	Family	Genus	#	Total no. per 0.3ml	density/ square cm.
FT1	FT1.P.L7	16.03.014	Frustulia	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Frustulia*	944		
			Actinella	Bacillariophyta	Bacillariophyceae	Eunotiales	Eunotiaceae	*Actinella*	40		
			Gomphoneis	Bacillarlophyta	Bacillariophyceae	Cymbellales	Cymbellaceae	*Gomphoneis*	12		
			Cymbella	Bacillariophyta	Bacillariophyceae	Cymbellalles	Cymbellaceae	*Cymbella*	104		
			Navicula	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Navicula*	84		
			Pinnularia	Bacillariophyta	Bacillariophyceae	Naviculales		*Pinnularia*	4		
			Fragillaria	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	*Fragilaria*	20		
			Diatoma	Bacillariophyta	Bacillariophyceae	Fragilariales		*Diatoma*	478		
			Nitzschia	Bacillariophyta		Bacillariales		*Nitzschia*	1		
			Rivularia	Cynobacteria		Nostocales		*Rivularia*	6		
			Voucheria	Xanthophyta		Vaucheriales		*Voucheria*	8		
			Microspora	Chlorophyta	Chlorophyceae	Microsporales	Microsporaceae	*Microspora*	6	1707	2845.00
FT2	FT2.P.L7	17.03.014	Frustulia	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Frustulia*	543		
			Fragilaria	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	*Fragilaria*	6		
			Navicula	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Navicula*	192		
			Actinella	Bacillariophyta	Bacillariophyceae	Eunotiales	Eunotiaceae	*Actinella*	108		
			Gomphoneis	Bacillariophyta	Bacillariophyceae	Cymbellales	Cymbellaceae	*Gomphoneis*	12		
			Diatoma	Bacillariophyta	Bacillariophyceae	Fragilariales		*Diatoma*	52		
			Cymbella	Bacillariophyta	Bacillariophyceae	Cymbellalles	Cymbellaceae	*Cymbella*	208		
			Nitzschia	Bacillariophyta		Bacillariales		*Nitzschia*	5		
			Microspora	Chlorophyta	Chlorophyceae	Microsporales		*Microspora*	2		
			Rivularia	Cynobacteria		Nostocales		*Rivularia*	2	1130	1883.33
FT3	FT3.P.L7	18.03.014	Frustulia	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Frustulia*	728		
			Fragilaria	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	*Fragilaria*	24		
			Navicula	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Navicula*	164		
			Gomphoneis	Bacillarlophyta	Bacillariophyceae	Cymbellales	Cymbellaceae	*Gomphoneis*	12	1436	2393.33

			Actinella	Bacillariophyta	Bacillariophyceae	Eunotiales	Eunotiaceae	*Actinella*	64		
			Cymbella	Bacillariophyta	Bacillariophyceae	Cymbellalles	Cymbellaceae	*Cymbella*	340		
			Microspora	Chlorophyta	Chlorophyceae	Microsporales	Microsporaceae	*Microspora*	4		
			Rivularia	Cynobacteria		Nostocales		*Rivularia*	6		
			Spirogyra	Chlorophyta	Chlorophyceae			*Spirogyra*	4		
			Diatoma	Bacillariophyta	Bacillariophyceae	Fragilariales		*Diatoma*	76		
			Ulothrix	Chlorophyta	Chlorophyceae	Ulothricales		*Ulothrix*	1		
			Nitzschia	Bacillariophyta		Bacillariales		*Nitzschia*	13		
FT4	FT4.P.L7	19.03.014	Frustulia	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Frustulia*	552		
			Navicula	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Navicula*	340		
			Actinella	Bacillariophyta	Bacillariophyceae	Eunotiales	Eunotiaceae	*Actinella*	16		
			Cymbella	Bacillariophyta	Bacillariophyceae	Cymbellalles	Cymbellaceae	*Cymbella*	144		
			Nitzschia	Bacillariophyta		Bacillariales		*Nitzschia*	4		
			Diatoma	Bacillariophyta	Bacillariophyceae	Fragilariales		*Diatoma*	22		
			Rivularia	Cynobacteria		Nostocales		*Rivularia*	1		
			Fragilaria	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	*Fragilaria*	68	1147	1911.67
FT5	FT5.P.L7	20.02.014	Frustulia	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Frustulia*	1056		
			Navicula	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Navicula*	440		
			Gomphoneis	Bacillarlophyta	Bacillariophyceae	Cymbellales	Cymbellaceae	*Gomphoneis*	4		
			Cymbella	Bacillariophyta	Bacillariophyceae	Cymbellalles	Cymbellaceae	*Cymbella*	192		
			Nitzschia	Bacillariophyta		Bacillariales		*Nitzschia*	5		
			Diatoma	Bacillariophyta	Bacillariophyceae	Fragilariales		*Diatoma*	44		
			Rivularia	Cynobacteria		Nostocales		*Rivularia*	3		
			Fragilaria	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	*Fragilaria*	72	1816	3026.67

- Density/sq.cm= (50.k.n/3.a), where k=2, n=no of cells or fillament observed in three loops and 15 fields of view and a= area of each original sample
- Method: 20 ml of homogenised sample were concentrated to 5 ml then observed 0.1 ml (one loop) suspension on 100X magnificatio with microscope in 5 field views. Such observation was made for three different loops.

March 2014

River Reach	Sample Code	Analysed Date	Common name	Division	Class	Order	Family	Genus	#	Total no. per 0.3ml	density/ square cm.
FT1	FT1.P.L8	26.03.014	Frustulia	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Frustulia*	832		
			Actinella	Bacillariophyta	Bacillariophyceae	Eunotiales	Eunotiaceae	*Actinella*	48		
			Gomphoneis	Bacillarlophyta	Bacillariophyceae	Cymbellales	Cymbellaceae	*Gomphoneis*	0		
			Cymbella	Bacillariophyta	Bacillariophyceae	Cymbellalles	Cymbellaceae	*Cymbella*	120		
			Navicula	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Navicula*	336		
			Pinnularia	Bacillariophyta	Bacillariophyceae	Naviculales		*Pinnularia*	0		
			Fragillaria	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	*Fragilaria*	84		
			Diatoma	Bacillariophyta	Bacillariophyceae	Fragilariales		*Diatoma*	80		
			Nitzschia	Bacillariophyta		Bacillariales		*Nitzschia*	3		
			Rivularia	Cynobacteria		Nostocales		*Rivularia*	0		
			Voucheria	Xanthophyta		Vaucheriales		*Voucheria*	2		
			Microspora	Chlorophyta	Chlorophyceae	Microsporales	Microsporaceae	*Microspora*	5	1510	2516.67
FT2	FT2.P.L8	27.03.014	Frustulia	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Frustulia*	580		
			Fragilaria	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	*Fragilaria*	6		
			Navicula	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Navicula*	172		
			Actinella	Bacillariophyta	Bacillariophyceae	Eunotiales	Eunotiaceae	*Actinella*	40		
			Gomphoneis	Bacillariophyta	Bacillariophyceae	Cymbellales	Cymbellaceae	*Gomphoneis*	22		
			Diatoma	Bacillariophyta	Bacillariophyceae	Fragilariales		*Diatoma*	54		
			Cymbella	Bacillariophyta	Bacillariophyceae	Cymbellalles	Cymbellaceae	*Cymbella*	116		
			Nitzschia	Bacillariophyta		Bacillariales		*Nitzschia*	3		
			Microspora	Chlorophyta	Chlorophyceae	Microsporales		Microspora	7		
			Rivularia	Cynobacteria		Nostocales		Rivularia	7	1007	1678.33
FT4	FT4.P.L8	23.03.014	Frustulia	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Frustulia*	1280		
			Navicula	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Navicula*	136		
			Actinella	Bacillariophyta	Bacillariophyceae	Eunotiales	Eunotiaceae	*Actinella*	0	1584	2640.00

			Cymbella	Bacillariophyta	Bacillariophyceae	Cymbellalles	Cymbellaceae	*Cymbella*	68		
			Nitzschia	Bacillariophyta		Bacillariales		*Nitzschia*	12		
			Diatoma	Bacillariophyta	Bacillariophyceae	Fragilariales		*Diatoma*	28		
			Rivularia	Cynobacteria		Nostocales		*Rivularia*	8		
			Microspora	Chlorophyta	Chlorophyceae	Microsporale s	Microsporaceae	*Microspora*	3		
			Voucheria	Xanthophyta		Vaucheriales		*Voucheria*	1		
			Fragilaria	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	*Fragilaria*	48		
FT5	FT5.P.L8	22.03.01 4	Frustulia	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Frustulia*	396	772	1286.67
			Navicula	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Navicula*	240		
			Gomphoneis	Bacillarlophyta	Bacillariophyceae	Cymbellales	Cymbellaceae	*Gomphoneis*	0		
			Cymbella	Bacillariophyta	Bacillariophyceae	Cymbellalles	Cymbellaceae	*Cymbella*	52		
			Nitzschia	Bacillariophyta		Bacillariales		*Nitzschia*	1		
			Diatoma	Bacillariophyta	Bacillariophyceae	Fragilariales		*Diatoma*	0		
			Rivularia	Cynobacteria		Nostocales		*Rivularia*	3		
			Microspora	Chlorophyta	Chlorophyceae	Microsporale s	Microsporaceae	*Microspora*	9		
			Ulothrix	Chlorophyta	Chlorophyceae	Ulothricales		*Ulothrix*	2		
			Voucheria	Xanthophyta		Vaucheriales		*Voucheria*	1		
			Fragilaria	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	*Fragilaria*	68		

- Density/sq.cm= (50.k.n/3.a), where k=2, n=no of cells or fillament observed in three loops and 15 fields of view and a= area of each original sample
- Method: 20 ml of homogenised sample were concentrated to 5 ml then observed 0.1 ml (one loop) suspension on 100X magnificatio with microscope in 5 field views. Such observation was made for three different loops.

April 2014

River Reach	Sample Code	Analysed Date	Common name	Division	Class	Order	Family	Genus	#	Total no. per 0.3ml	density/ square cm.
FT1	FT1.P.L9	15.05.014	Frustulia	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Frustulia*	592	742	1236.67
			Actinella	Bacillariophyta	Bacillariophyceae	Eunotiales	Eunotiaceae	*Actinella*	12		
			Gomphoneis	Bacillarlophyta	Bacillariophyceae	Cymbellales	Cymbellaceae	*Gomphoneis*	18		
			Cymbella	Bacillariophyta	Bacillariophyceae	Cymbellalles	Cymbellaceae	*Cymbella*	56		
			Navicula	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Navicula*	4		
			Pinnularia	Bacillariophyta	Bacillariophyceae	Naviculales		*Pinnularia*	0		
			Fragillaria	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	*Fragilaria*	4		
			Diatoma	Bacillariophyta	Bacillariophyta	Bacillariophyta		*Diatoma*	32		
			Nitzschia	Bacillariophyta		Bacillariales		*Nitzschia*	16		
			Rivularia	Cynobacteria		Nostocales		*Rivularia*	3		
			Synedra	Bacillariophyta	Bacillariophyta			*Synedra*	2		
			Microspora	Chlorophyta	Chlorophyceae	Microsporales	Microsporaceae	*Microspora*	3		
FT2	FT2.P.L9	16.05.014	Frustulia	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Frustulia*	462	586	976.67
			Fragilaria	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	*Fragilaria*	7		
			Navicula	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Navicula*	28		
			Actinella	Bacillariophyta	Bacillariophyceae	Eunotiales	Eunotiaceae	*Actinella*	4		
			Gomphoneis	Bacillariophyta	Bacillariophyceae	Cymbellales	Cymbellaceae	*Gomphoneis*	19		
			Diatoma	Bacillariophyta	Bacillariophyceae	Fragilariales		*Diatoma*	0		
			Cymbella	Bacillariophyta	Bacillariophyceae	Cymbellalles	Cymbellaceae	*Cymbella*	36		
			Nitzschia	Bacillariophyta		Bacillariales		*Nitzschia*	14		
			Microspora	Chlorophyta	Chlorophyceae	Microsporales		*Microspora*	7		
			Ulothrix	Chlorophyta	Chlorophyceae	Ulothricales	Ulothricaceae	*Ulothrix*	1		
			Voucheria	Xanthophyta		Voucheriales		*Voucheria*	1		
			Synedra	Bacillariophyta	Bacillariophyta			*Synedra*	2		
			Rivularia	Cynobacteria		Nostocales		*Rivularia*	5		

FT3	FT3.P.L9	18.05.014	Frustulia	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Frustulia*	392	532	886.67
			Fragilaria	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	*Fragilaria*	1		
			Navicula	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Navicula*	40		
			Gomphoneis	Bacillarlophyta	Bacillariophyceae	Cymbellales	Cymbellaceae	*Gomphoneis*	7		
			Actinella	Bacillariophyta	Bacillariophyceae	Eunotiales	Eunotiaceae	*Actinella*	5		
			Cymbella	Bacillariophyta	Bacillariophyceae	Cymbellalles	Cymbellaceae	*Cymbella*	60		
			Microspora	Chlorophyta	Chlorophyceae	Microsporales	Microsporaceae	*Microspora*	3		
			Rivularia	Cynobacteria		Nostocales		*Rivularia*	1		
			Spirogyra	Chlorophyta	Chlorophyceae			*Spirogyra*	11		
			Diatoma	Bacillariophyta	Bacillariophyceae	Fragilariales		*Diatoma*	0		
			Ulothrix	Chlorophyta	Chlorophyceae	Ulothricales		*Ulothrix*	0		
			Nitzschia	Bacillariophyta		Bacillariales		*Nitzschia*	12		
FT4	FT4.P.L9	18.05.014	Frustulia	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Frustulia*	480	613	681.11
			Navicula	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Navicula*	48		
			Actinella	Bacillariophyta	Bacillariophyceae	Eunotiales	Eunotiaceae	*Actinella*	24		
			Cymbella	Bacillariophyta	Bacillariophyceae	Cymbellalles	Cymbellaceae	*Cymbella*	24		
			Gomphoneis	Bacillarlophyta	Bacillariophyceae	Cymbellales	Cymbellaceae	*Gomphoneis*	2		
			Nitzschia	Bacillariophyta		Bacillariales		*Nitzschia*	2		
			Diatoma	Bacillariophyta	Bacillariophyceae	Fragilariales		*Diatoma*	0		
			Rivularia	Cynobacteria		Nostocales		*Rivularia*	10		
			Microspora	Chlorophyta	Chlorophyceae	Microsporales	Microsporaceae	*Microspora*	12		
			Spirogyra	Chlorophyta	Chlorophyceae			*Spirogyra*	6		
			Fragilaria	Bacillariophyt a	Bacillariophycea e	Fragilariales	Fragilariaceae	*Fragilaria*	5		
FT5	FT5.P.L9	19.05.14	Frustulia	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Frustulia*	396	782	868.89
			Navicula	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Navicula*	232		
			Actinella	Bacillariophyta	Bacillariophyceae	Eunotiales	Eunotiaceae	*Actinella*	14		
			Gomphoneis	Bacillarlophyta	Bacillariophyceae	Cymbellales	Cymbellaceae	*Gomphoneis*	10		
			Cymbella	Bacillariophyta	Bacillariophyceae	Cymbellalles	Cymbellaceae	*Cymbella*	104		
			Nitzschia	Bacillariophyta		Bacillariales		*Nitzschia*	1		

			Diatoma	Bacillariophyta	Bacillariophyceae	Fragilariales		*Diatoma*	0		
			Rivularia	Cynobacteria		Nostocales		*Rivularia*	2		
			Microspora	Chlorophyta	Chlorophyceae	Microsporales	Microsporaceae	*Microspora*	6		
			Fragilaria	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	*Fragilaria*	17		

- Density/sq.cm= (50.k.n/3.a), where k=2, n=no of cells or fillament observed in three loops and 15 fields of view and a= area of each original sample
- Method: 20 ml of homogenised sample were concentrated to 5 ml then observed 0.1 ml (one loop) suspension on 100X magnificatio with microscope in 5 field views. Such observation was made for three different loops.

May 2014

River Reach	Sample Code	Analysed Date	Common name	Division	Class	Order	Family	Genus	Number	Total no. per 0.3ml	density/ square cm.
FT1	FT1.P.L10	6.06.014	Frustulia	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Frustulia*	294	416	693.33
			Actinella	Bacillariophyta	Bacillariophyceae	Eunotiales	Eunotiaceae	*Actinella*	20		
			Gomphoneis	Bacillarlophyta	Bacillariophyceae	Cymbellales	Cymbellaceae	*Gomphoneis*	20		
			Cymbella	Bacillariophyta	Bacillariophyceae	Cymbellalles	Cymbellaceae	*Cymbella*	72		
			Navicula	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Navicula*	0		
			Pinnularia	Bacillariophyta	Bacillariophyceae	Naviculales		*Pinnularia*	0		
			Fragillaria	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	*Fragilaria*	0		
			Diatoma	Bacillariophyta	Bacillariophyceae	Fragilariales		*Diatoma*	8		
			Nitzschia	Bacillariophyta		Bacillariales		*Nitzschia*	2		
			Rivularia	Cynobacteria		Nostocales		*Rivularia*	0		
			Voucheria	Xanthophyta		Vaucheriales		*Voucheria*	0		
			Microspora	Chlorophyta	Chlorophyceae	Microsporales	Microsporaceae	*Microspora*	0		
FT2	FT2.P.L10	8.06.014	Frustulia	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Frustulia*	240	404	673.33
			Fragilaria	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	*Fragilaria*	14		
			Navicula	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Navicula*	0		
			Actinella	Bacillariophyta	Bacillariophyceae	Eunotiales	Eunotiaceae	*Actinella*	0		
			Gomphoneis	Bacillariophyta	Bacillariophyceae	Cymbellales	Cymbellaceae	*Gomphoneis*	6		
			Diatoma	Bacillariophyta	Bacillariophyceae	Fragilariales		*Diatoma*	0		
			Cymbella	Bacillariophyta	Bacillariophyceae	Cymbellalles	Cymbellaceae	*Cymbella*	140		
			Nitzschia	Bacillariophyta		Bacillariales		*Nitzschia*	0		
			Microspora	Chlorophyta	Chlorophyceae	Microsporales		*Microspora*	2		
			Spirogyra	Chlorophyta	Chlorophyceae			*Spirogyra*	1		
			Rivularia	Cynobacteria		Nostocales		*Rivularia*	1		

FT3	FT3.P.L10	9.06.014	Frustulia	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Frustulia*	172	194	323.33
			Fragilaria	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	*Fragilaria*	2		
			Navicula	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Navicula*	0		
			Gomphoneis	Bacillarlophyta	Bacillariophyceae	Cymbellales	Cymbellaceae	*Gomphoneis*	3		
			Actinella	Bacillariophyta	Bacillariophyceae	Eunotiales	Eunotiaceae	*Actinella*	0		
			Cymbella	Bacillariophyta	Bacillariophyceae	Cymbellalles	Cymbellaceae	*Cymbella*	12		
			Microspora	Chlorophyta	Chlorophyceae	Microsporales	Microsporaceae	*Microspora*	0		
			Rivularia	Cynobacteria		Nostocales		*Rivularia*	3		
			Spirogyra	Chlorophyta	Chlorophyceae			*Spirogyra*	0		
			Diatoma	Bacillariophyta	Bacillariophyceae	Fragilariales		*Diatoma*	0		
			Stigioclonium	Chlorophyta	Chlorophyceae	Chaetophorales		*Stigioclonium*	0		
			Nitzschia	Bacillariophyta		Bacillariales		*Nitzschia*	2		
FT4	FT4.P.L10	10.06.014	Frustulia	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Frustulia*	384	511	851.67
			Navicula	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Navicula*	30		
			Actinella	Bacillariophyta	Bacillariophyceae	Eunotiales	Eunotiaceae	*Actinella*	0		
			Cymbella	Bacillariophyta	Bacillariophyceae	Cymbellalles	Cymbellaceae	*Cymbella*	76		
			Nitzschia	Bacillariophyta		Bacillariales		*Nitzschia*	1		
			Diatoma	Bacillariophyta	Bacillariophyceae	Fragilariales		*Diatoma*	0		
			Rivularia	Cynobacteria		Nostocales		*Rivularia*	1		
			Microspora	Chlorophyta	Chlorophyceae	Microsporales	Microsporaceae	*Microspora*	0		
			Gomphoneis	Bacillarlophyta	Bacillariophyceae	Cymbellales	Cymbellaceae	*Gomphoneis*	8		
			Fragilaria	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	*Fragilaria*	11		
FT5	FT5.P.L10	11.06.014	Frustulia	Bacillariophyta	Bacillariophyce ae	Naviculales	Naviculaceae	*Frustulia*	356	511	851.67
			Navicula	Bacillariophyta	Bacillariophyce ae	Naviculales	Naviculaceae	*Navicula*	28		
			Gomphoneis	Bacillarlophyta	Bacillariophyce ae	Cymbellales	Cymbellaceae	*Gomphoneis*	2		
			Cymbella	Bacillariophyta	Bacillariophyce ae	Cymbellalles	Cymbellaceae	*Cymbella*	72		
			Nitzschia	Bacillariophyta		Bacillariales		*Nitzschia*	0		
			Diatoma	Bacillariophyta	Bacillariophyce ae	Fragilariales		*Diatoma*	0		

			Rivularia	Cynobacteria		Nostocales		*Rivularia*	12		
			Microspora	Chlorophyta	Chlorophyceae	Microsporales	Microsporaceae	*Microspora*	0		
			Actinella	Bacillariophyta	Bacillariophyceae	Eunotiales	Eunotiaceae	*Actinella*	28		
			Voucheria	Xanthophyta		Vaucheriales		*Voucheria*	0		
			Fragilaria	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	*Fragilaria*	13		

- Density/sq.cm= (50.k.n/3.a), where k=2, n=no of cells or fillament observed in three loops and 15 fields of view and a= area of each original sample
- Method: 20 ml of homogenised sample were concentrated to 5 ml then observed 0.1 ml (one loop) suspension on 100X magnificatio with microscope in 5 field views. Such observation was made for three different loops.

June 2014

River Reach	Sample Code	Analysed Date	Common name	Division	Class	Order	Family	Genus	#	Total no. per 0.3ml	density/ square cm.
FT1	FT1.P.L11	6.06.014	Frustulia	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Frustulia*	0	14	23.33
			Actinella	Bacillariophyta	Bacillariophyceae	Eunotiales	Eunotiaceae	*Actinella*	0		
			Gomphoneis	Bacillarlophyta	Bacillariophyceae	Cymbellales	Cymbellaceae	*Gomphoneis*	0		
			Cymbella	Bacillariophyta	Bacillariophyceae	Cymbellalles	Cymbellaceae	*Cymbella*	8		
			Navicula	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Navicula*	0		
			Pinnularia	Bacillariophyta	Bacillariophyceae	Naviculales		*Pinnularia*	0		
			Fragillaria	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	*Fragilaria*	2		
			Diatoma	Bacillariophyta	Bacillariophyceae	Fragilariales		*Diatoma*	0		
			Nitzschia	Bacillariophyta		Bacillariales		*Nitzschia*	0		
			Rivularia	Cynobacteria		Nostocales		*Rivularia*	2		
			Stigioclonium	Chlorophyta	Chlorophyceae	Chaetophoral es		*Stigioclonium*	2		
			Microspora	Chlorophyta	Chlorophyceae	Microsporale s	Microsporaceae	*Microspora*	0		
FT2	FT2.P.L11	8.06.014	Frustulia	Bacillariophyta	Bacillariophyce ae	Naviculales	Naviculaceae	Frustulia	64	88	146.67
			Fragilaria	Bacillariophyta	Bacillariophyce ae	Fragilariales	Fragilariaceae	Fragilaria	3		
			Navicula	Bacillariophyta	Bacillariophyce ae	Naviculales	Naviculaceae	Navicula	0		
			Actinella	Bacillariophyta	Bacillariophyce ae	Eunotiales	Eunotiaceae	Actinella	0		
			Gomphoneis	Bacillariophyta	Bacillariophyce ae	Cymbellales	Cymbellaceae	Gomphoneis	3		
			Diatoma	Bacillariophyta	Bacillariophyce ae	Fragilariales		Diatoma	0		
			Cymbella	Bacillariophyta	Bacillariophyce ae	Cymbellalles	Cymbellaceae	Cymbella	8		
			Nitzschia	Bacillariophyta		Bacillariales		Nitzschia	0		
			Microspora	Chlorophyta	Chlorophyceae	Microsporale s		Microspora	3		
			Stigioclonium	Chlorophyta	Chlorophyceae	Chaetophoral es		Stigioclonium	2		
			Rivularia	Cynobacteria		Nostocales		Rivularia	5		
FT3	FT3.P.L11	9.06.014	Frustulia	Bacillariophyta	Bacillariophyce ae	Naviculale s	Naviculaceae	*Frustulia*	40	60	100.00
			Fragilaria	Bacillariophyta	Bacillariophyce	Fragilariales	Fragilariaceae	*Fragilaria*	3		

					ae						
			Navicula	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Navicula*	0		
			Gomphoneis	Bacillarlophyta	Bacillariophyceae	Cymbellales	Cymbellaceae	*Gomphoneis*	0		
			Actinella	Bacillariophyta	Bacillariophyceae	Eunotiales	Eunotiaceae	*Actinella*	0		
			Cymbella	Bacillariophyta	Bacillariophyceae	Cymbellalles	Cymbellaceae	*Cymbella*	12		
			Microspora	Chlorophyta	Chlorophyceae	Microsporales	Microsporaceae	*Microspora*	0		
			Rivularia	Cynobacteria		Nostocales		*Rivularia*	5		
			Spirogyra	Chlorophyta	Chlorophyceae			*Spirogyra*	0		
			Diatoma	Bacillariophyta	Bacillariophyceae	Fragilariales		*Diatoma*	0		
			Stigioclonium	Chlorophyta	Chlorophyceae	Chaetophorales		*Stigioclonium*	0		
			Nitzschia	Bacillariophyta		Bacillariales		*Nitzschia*	0		
FT4	FT4.P.L11	10.06.014	Frustulia	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Frustulia*	40	53	88.33
			Navicula	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Navicula*	0		
			Actinella	Bacillariophyta	Bacillariophyceae	Eunotiales	Eunotiaceae	*Actinella*	0		
			Cymbella	Bacillariophyta	Bacillariophyceae	Cymbellalles	Cymbellaceae	*Cymbella*	4		
			Nitzschia	Bacillariophyta		Bacillariales		*Nitzschia*	0		
			Diatoma	Bacillariophyta	Bacillariophyceae	Fragilariales		*Diatoma*	0		
			Rivularia	Cynobacteria		Nostocales		*Rivularia*	4		
			Stigioclonium	Chlorophyta	Chlorophyceae	Chaetophorales		*Stigioclonium*	3		
			Gomphoneis	Bacillarlophyta	Bacillariophyceae	Cymbellales	Cymbellaceae	*Gomphoneis*	0		
			Fragilaria	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	*Fragilaria*	2		
FT5	FT5.P.L11	11.06.014	Frustulia	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Frustulia*	160	319	531.67
			Navicula	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Navicula*	0		
			Gomphoneis	Bacillarlophyta	Bacillariophyceae	Cymbellales	Cymbellaceae	*Gomphoneis*	11		
			Cymbella	Bacillariophyta	Bacillariophyceae	Cymbellalles	Cymbellaceae	*Cymbella*	104		

			Nitzschia	Bacillariophyta		Bacillariales		*Nitzschia*	0		
			Diatoma	Bacillariophyta	Bacillariophyceae	Fragilariales		*Diatoma*	0		
			Rivularia	Cynobacteria		Nostocales		*Rivularia*	0		
			Microspora	Chlorophyta	Chlorophyceae	Microsporales	Microsporaceae	*Microspora*	7		
			Actinella	Bacillariophyta	Bacillariophyceae	Eunotiales	Eunotiaceae	*Actinella*	34		
			Voucheria	Xanthophyta		Vaucheriales		*Voucheria*	1		
			Fragilaria	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	*Fragilaria*	2		

- Density/sq.cm= (50.k.n/3.a), where k=2, n=no of cells or fillament observed in three loops and 15 fields of view and a= area of each original sample
- Method: 20 ml of homogenised sample were concentrated to 5 ml then observed 0.1 ml (one loop) suspension on 100X magnificatio with microscope in 5 field views. Such observation was made for three different loops.

July 2014

River Reach	Sample Code	Analysed Date	Common name	Division	Class	Order	Family	Genus	Total no. per 0.3ml	density/ square cm.
FT1	FT1.P.L12	14.08.014	Frustulia	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Frustulia*	31	51.67
			Actinella	Bacillariophyta	Bacillariophyceae	Eunotiales	Eunotiaceae	*Actinella*		
			Gomphoneis	Bacillarlophyta	Bacillariophyceae	Cymbellales	Cymbellaceae	*Gomphoneis*		
			Cymbella	Bacillariophyta	Bacillariophyceae	Cymbellalles	Cymbellaceae	*Cymbella*		
			Navicula	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Navicula*		
			Pinnularia	Bacillariophyta	Bacillariophyceae	Naviculales		*Pinnularia*		
			Fragillaria	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	*Fragilaria*		
			Diatoma	Bacillariophyta	Bacillariophyceae	Fragilariales		*Diatoma*		
			Nitzschia	Bacillariophyta		Bacillariales		*Nitzschia*		
			Rivularia	Cynobacteria		Nostocales		*Rivularia*		
			Stigioclonium	Chlorophyta	Chlorophyceae	Chaetophorales		*Stigioclonium*		
			Microspora	Chlorophyta	Chlorophyceae	Microsporales	Microsporaceae	*Microspora*		
FT2	FT2.P.L12	15.08.014	Frustulia	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Frustulia*	23	38.33
			Fragilaria	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	*Fragilaria*		
			Navicula	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Navicula*		
			Actinella	Bacillariophyta	Bacillariophyceae	Eunotiales	Eunotiaceae	*Actinella*		
			Gomphoneis	Bacillariophyta	Bacillariophyceae	Cymbellales	Cymbellaceae	*Gomphoneis*		
			Diatoma	Bacillariophyta	Bacillariophyceae	Fragilariales		*Diatoma*		
			Cymbella	Bacillariophyta	Bacillariophyceae	Cymbellalles	Cymbellaceae	*Cymbella*		
			Nitzschia	Bacillariophyta		Bacillariales		*Nitzschia*		
			Microspora	Chlorophyta	Chlorophyceae	Microsporales		*Microspora*		
			Stigioclonium	Chlorophyta	Chlorophyceae	Chaetophorales		*Stigioclonium*		
			Rivularia	Cynobacteria		Nostocales		*Rivularia*		
FT3	FT3.P.L12	19.08.014	Frustulia	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Frustulia*	28	46.67
			Fragilaria	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	*Fragilaria*		
			Navicula	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Navicula*		

			Gomphoneis	Bacillarlophyta	Bacillariophyceae	Cymbellales	Cymbellaceae	*Gomphoneis*		
			Actinella	Bacillariophyta	Bacillariophyceae	Eunotiales	Eunotiaceae	*Actinella*		
			Cymbella	Bacillariophyta	Bacillariophyceae	Cymbellalles	Cymbellaceae	*Cymbella*		
			Microspora	Chlorophyta	Chlorophyceae	Microsporales	Microsporaceae	*Microspora*		
			Rivularia	Cynobacteria		Nostocales		*Rivularia*		
			Spirogyra	Chlorophyta	Chlorophyceae			*Spirogyra*		
			Diatoma	Bacillariophyta	Bacillariophyceae	Fragilariales		*Diatoma*		
			Stigioclonium	Chlorophyta	Chlorophyceae	Chaetophorales		*Stigioclonium*		
			Nitzschia	Bacillariophyta		Bacillariales		*Nitzschia*		
FT4	FT4.P.L12	19.08.014	Frustulia	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Frustulia*	45	75.00
			Navicula	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Navicula*		
			Actinella	Bacillariophyta	Bacillariophyceae	Eunotiales	Eunotiaceae	*Actinella*		
			Cymbella	Bacillariophyta	Bacillariophyceae	Cymbellalles	Cymbellaceae	*Cymbella*		
			Nitzschia	Bacillariophyta		Bacillariales		*Nitzschia*		
			Diatoma	Bacillariophyta	Bacillariophyceae	Fragilariales		*Diatoma*		
			Rivularia	Cynobacteria		Nostocales		*Rivularia*		
			Stigioclonium	Chlorophyta	Chlorophyceae	Chaetophorales		*Stigioclonium*		
			Gomphoneis	Bacillarlophyta	Bacillariophyceae	Cymbellales	Cymbellaceae	*Gomphoneis*		
			Fragilaria	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	*Fragilaria*		
FT5	FT5.P.L12	20.08.014	Frustulia	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Frustulia*	37	61.67
			Navicula	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	*Navicula*		
			Gomphoneis	Bacillarlophyta	Bacillariophyceae	Cymbellales	Cymbellaceae	*Gomphoneis*		
			Cymbella	Bacillariophyta	Bacillariophyceae	Cymbellalles	Cymbellaceae	*Cymbella*		
			Nitzschia	Bacillariophyta		Bacillariales		*Nitzschia*		
			Diatoma	Bacillariophyta	Bacillariophyceae	Fragilariales		*Diatoma*		
			Rivularia	Cynobacteria		Nostocales		*Rivularia*		
			Microspora	Chlorophyta	Chlorophyceae	Microsporales	Microsporaceae	*Microspora*		
			Actinella	Bacillariophyta	Bacillariophyceae	Eunotiales	Eunotiaceae	*Actinella*		
			Voucheria	Xanthophyta		Vaucheriales		*Voucheria*		

			Fragilaria	Bacillariophyta	Bacillariophyceae	Fragilariales	Fragilariaceae	*Fragilaria*		

- Density/sq.cm= (50.k.n/3.a), where k=2, n=no of cells or fillament observed in three loops and 15 fields of view and a= area of each original sample
- Method: 20 ml of homogenised sample were concentrated to 5 ml then observed 0.1 ml (one loop) suspension on 100X magnificatio with microscope in 5 field views. Such observation was made for three different loops.

A.2.4 Macro-invertebrates

August 2013

River Reach	Sample Code	Date Analised	Common name	Order	Family	Sub-Family	Genus	Species	#	Total No.	Density/ m2
FT1	FT1.MA. L1	10.9.2013	net spiner caddishfly	Trichoptera	Hydropsychidae				12	28	9.33
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Epeorus*	*pleuralis*	10		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Rhithrogena*		1		
			Golden Stone fly	Plecoptera	Peltoperlidae				4		
			Midge	diptera	Chironomidae				1		
FT2	FT2.MA.L1	13.9.2013	net spiner caddishfly	Trichoptera	Hydropsychidae				10	24	8.00
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Epeorus*	*pleuralis*	2		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Rhithrogena*		1		
			Stone fly	Plecoptera	Peltoperlidae				2		
			Golden Stone fly	Plecoptera	Chloroperlidae		*Acroneuria*	*abnormis*	8		
			Midge	Diptera	Chironomidae				1		
FT3	FT3.MA. L1	14.9.2013	net spiner caddishfly	Trichoptera	Hydropsychidae				19	40	13.33
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Stenonema*		6		
			Golden Stone fly	Plecoptera	Chloroperlidae		*Acroneuria*	*abnormis*	4		
			stone fly	Plecoptera	peltoperlidae				11		
FT4	FT4.MA. L1	15.9.2013	net spiner caddishfly	Trichoptera	Hydropsychidae				22	46	15.33
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Epeorus*	*pleuralis*	5		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Rhithrogena*		11		

			Golden Stone fly	Plecoptera	Chloroperlidae		*Acroneuria*	*abnormis*	3			
			Midge	Diptera	Chironomidae				1			
			net-winged midges	Diptera	Blephariceridae				4			
FT5	FT5.MA.L1	16.9.2013	net spiner caddishfly	Trichoptera	Hydropsychidae				24	50	16.67	
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Rhithrogena*		5			
			Golden Stone fly	Plecoptera	Chloroperlidae		*Acroneuria*	*abnormis*	19			
			Midge	Diptera	Chironomidae				1			
			Riffle beetle larva	coleptera			*Stenelmis*	*sexlineata*	1			

- Analysed By: Rai Nirsing Kumar
- Checked and verified by: Dr. Kishor Upadhya

December 2013

River Reach	Sample Code	Date Analysed	Common name	Order	Family	Sub-Family	Genus	#	Total	Density /m2
FT1	FT1.MA.L5	10.12.2013	net spiner Caddisfly	Trichoptera	Hydropsychidae			14	60	66.67
			Free living Caddisfly	Trichoptera	Rhyacophilidae			8		
			Golden stone fly	Plecoptera	Perlidae			8		
			Midge	Diptera	Chironomidae			1		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	Rhithrogena	5		
			May fly	Ephemeroptera	Ephemerellidae		*ephemerela*	4		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Stenonema*	15		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Epeorus*	5		
FT2	FT2.MA.L5	11.12.2013	net spiner Caddisfly	Trichoptera	Hydropsychidae			4	85	94.44
			Free living Caddish fly	Trichoptera	Rhyacophilidae			4		
			May fly	Ephemeroptera	Heptageniidae		*Epeorus*	2		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Stenonema*	23		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*rhithrogena*	23		
			May fly	Ephemeroptera	ephemerellidae		*ephimerela*	17		
			Midge	Diptera	Chironomidae			9		
			Stone fly	Plecoptera	Peltoperlidae			1		
			Crane fly	Diptera	Tipuladae			1		
			Golden Stone fly	Plecoptera	Perlidae			1		
FT3	FT3.MA.L5	11.12.2013	net spiner Caddisfly	Trichoptera	Hydropsychidae			36	220	244.4
			Free living Caddish fly	Trichoptera	Rhyacophilidae			17		
			Golden Stonefly	Plecoptera	Perlidae			2		

			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Epeorus*	13		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Stenonema*	84		
			May fly	Ephemeroptera	Ephemerillidae		*ephimerella*	55		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*rhithrogena*	10		
			Dragonfly	Anisoptera	Gomphidae			1		
			Crane fly	Diptera	Tipulidae			1		
			Midge	Diptera	Chironomidae			1		
FT4	FT4.MA.L5	12.12.2013	net spiner Caddisfly	Trichoptera	Hydropsychidae			20	144	160.0
			May Fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Epeorus*	49		
			May Fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Stenonema*	17		
			May Fly	Ephemeroptera	Ephemerellidae		*Ephemerella*	10		
			May Fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Rhithrogena*	18		
			Midge	Diptera	Chironomidae			5		
			Net-winged midge	Diptera	Blephariceridae			1		
			Cranefly	Diptera	Tipulidae			2		
			Golden Stone fly	Plecoptera	Peltoperlidae			10		
			Free living Caddish fly	Trichoptera	Rhyacophilidae			2		
			Dobsonfly(Helgramite)	Meghaloptera	Corydalidae	Corydalinae		10		
FT5	FT5.MA.L5	12.12.2013	net spiner Caddisfly	Trichoptera	Hydropsychidae			15	83	92.22
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Stonenoma*	26		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Epeorus*	11		
			Free living Caddish fly	Trichoptera	Rhyacophilidae			14		
			Cranefly	Diptera	Tipulidae			3		
			Biting Midge	Diptera	Ceratopogonidae			1		
			Midge	Diptera	chironomidae			10		
			Golden Stone fly	Plecoptera	Perlidae			3		

Note: Two different species of Nematodes from river reach 3 and one Platyhelmminth from river reach 1 have been sampled.

January 2014

River Reach	Sample Code	Date Analysed	Common name	Order	Family	Sub-Family	Genus	#	Total	Density /m2
FT1	FT1.MA.L6	25.01.014	net spiner Caddisfly	Trichoptera	Hydropsychidae			9	60	66.67
			Free living Caddisfly	Trichoptera	Rhyacophilidae			4		
			Golden stone fly	Plecoptera	Perlidae			5		
			Crane fly	Diptera	Tipulidae			1		
			Midge	Diptera	Chironomidae			1		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Rhithrogena*	13		
			May fly	Ephemeroptera	Ephemerellidae		*Ephemerela*	15		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Stenonema*	11		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Epeorus*	18		
FT2	FT2.MA.L6	26.01.014	net spiner Caddisfly	Trichoptera	Hydropsychidae			6	85	94.44
			Free living Caddish fly	Trichoptera	Rhyacophilidae			6		
			May fly	Ephemeroptera	Heptageniidae		*Epeorus*	9		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Stenonema*	18		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*rhithrogena*	32		
			May fly	Ephemeroptera	ephemerellidae		*ephimerela*	5		
			Midge	Diptera	Chironomidae			2		
			Dragon fly	Anisoptera	Gomphidae			1		
			Golden Stone fly	Plecoptera	Perlidae			8		
FT3	FT3.MA.L6	23.01.014	net spiner Caddisfly	Trichoptera	Hydropsychidae			10	220	244.44
			Free living Caddish fly	Trichoptera	Rhyacophilidae			8		
			Golden Stonefly	Plecoptera	Perlidae			6		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Epeorus*	17		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Stenonema*	35		
			May fly	Ephemeroptera	Ephemerillidae		*ephimerella*	25		

			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*rhithrogena*	11		
			Dragonfly	Anisoptera	Gomphidae			1		
			Crane fly	Diptera	Tipulidae			2		
			Dobson fly	Meghaloptera	Corydalidae	Corydalinae		2		
			Midge	Diptera	Chironomidae			12		
FT4	FT4.MA.L6	22.01.014	net spiner Caddisfly	Trichoptera	Hydropsychidae			21	144	160.00
			May Fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Epeorus*	8		
			May Fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Stenonema*	67		
			May Fly	Ephemeroptera	Ephemerellidae		*Ephemerella*	46		
			May Fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Rhithrogena*	21		
			Free living Caddish fly	Trichoptera	Rhyacophilidae			15		
			Dobsonfly(Helgramite)	Meghaloptera	Corydalidae	Corydalinae		1		
FT5	FT5.MA.L6	21.01.014	net spiner Caddisfly	Trichoptera	Hydropsychidae			21	83	92.22
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Stonenoma*	33		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Epeorus*	2		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Rhithrogena*	3		
			May fly	Ephemeroptera	Ephimerellidae	Ephimereliinae		19		
			Free living Caddish fly	Trichoptera	Rhyacophilidae			2		
			Cranefly	Diptera	Tipulidae			1		
			Dragon fly	Anisoptera	Gomphidae			1		
			Biting Midge	Diptera	Ceratopogonidae			2		
			Midge	Diptera	chironomidae			2		
			Net winged Midge	Diptera	Blephariceridae			2		

Note: Two different species of Nematodes from river reach 3 and one Platyhelmminth from river reach 1 have been sampled.

March 2014

River Reach	Sample Code	Date Analysed	Common name	Order	Family	Sub-Family	Genus	#	Total	Density /m2
FT1	FT1.MA.L8	26.03.014	net spiner Caddisfly	Trichoptera	Hydropsychidae			3	94	104.44
			Free living Caddisfly	Trichoptera	Rhyacophilidae			2		
			Golden stone fly	Plecoptera	Perlidae			2		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Rhithrogena*	10		
			May fly	Ephemeroptera	Ephemerellidae		*Ephemerela*	3		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Stenonema*	70		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Epeorus*	2		
			Dobson fly	Meghaloptera	Corydalidae	Corydalinae		1		
			Midge	Diptera	Chironomidae			1		
FT2	FT2.MA.L8	27.03.014	Free living Caddisfly	Trichoptera	Rhyacophilidae			3	128	142.22
			net spiner Caddisfly	Trichoptera	Hydropsychidae			8		
			May fly	Ephemeroptera	Heptageniidae		*Epeorus*	6		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Stenonema*	70		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*rhithrogena*	25		
			May fly	Ephemeroptera	ephemerellidae		*ephimerela*	6		
			Golden Stone fly	Plecoptera	Perlidae			9		
			Watersnipe fly	Diptera	Athericidae			1		
FT3	FT3.MA.L8	24.03.014	Free living Caddish fly	Trichoptera	Rhyacophilidae			6	108	120.00
			net spiner Caddisfly	Trichoptera	Hydropsychidae			22		
			Golden Stone fly	Plecoptera	Perlidae			10		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Epeorus*	2		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Stenonema*	18		
			May fly	Ephemeroptera	Ephemerillidae		*ephimerella*	13		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*rhithrogena*	31		

			Dobson fly	Meghaloptera	Corydalidae	Corydalinae		2		
			Net Winged Midge	Diptera	Blephariceridae			4		
FT4	FT4.MA.L8	23.03.014	Free living Caddish fly	Trichoptera	Rhyacophilidae			2	107	118.89
			May Fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Epeorus*	3		
			May Fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Stenonema*	25		
			May Fly	Ephemeroptera	Ephemerellidae		*Ephemerella*	3		
			May Fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Rhithrogena*	64		
			Stonefly	Plecoptera	Perlidae			10		
FT5	FT5.MA.L8	22.03.014	net spiner Caddisfly	Trichoptera	Hydropsychidae			4	74	82.22
			Free living Caddish fly	Trichoptera	Rhyacophilidae			3		
			Stonefly	Plecoptera	Perlidae			9		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Stonenoma*	23		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Epeorus*	12		
			May Fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Rhithrogena*	21		
			Net Winged Midge	Diptera	Blephariceridae			2		

March 2014

River Reach	Sample Code	Date Analysed	Common name	Order	Family	Sub-Family	Genus	#	Total	Density /m2
FT1	FT1.MA.L10	1.06.014	net spiner Caddisfly	Trichoptera	Hydropsychidae			15	52	57.78
			Free living Caddisfly	Trichoptera	Rhyacophilidae			1		
			Golden stone fly	Plecoptera	Perlidae			15		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Rhithrogena*	10		
			May fly	Ephemeroptera	Ephemerellidae		*Ephemerela*	1		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Stenonema*	3		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Epeorus*	5		
			Black Fly	Diptera				1		
			Midge	Diptera	Chironomidae			1		
FT2	FT2.MA.L10	1.06.014	Free living Caddisfly	Trichoptera	Rhyacophilidae			0	117	130.00
			net spiner Caddisfly	Trichoptera	Hydropsychidae			2		
			May fly	Ephemeroptera	Heptageniidae		*Epeorus*	78		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Stenonema*	5		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*rhithrogena*	11		
			May fly	Ephemeroptera	ephemerellidae		*ephimerela*	0		
			Golden Stone fly	Plecoptera	Perlidae			1		
			Black Fly	Diptera				6		
			Net winged midge	Diptera				14		
FT3	FT3.MA.L10	2.06.014	Free living Caddish fly	Trichoptera	Rhyacophilidae			0	52	57.78
			net spiner Caddisfly	Trichoptera	Hydropsychidae			3		
			Golden Stone fly	Plecoptera	Perlidae			13		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Epeorus*	19		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Stenonema*	4		
			May fly	Ephemeroptera	Ephemerillidae		*ephimerella*	10		

			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*rhithrogena*	0		
			Black fly					1		
			Midge	Diptera				2		
FT4	FT4.MA.L10	2.06.014	net spiner Caddisfly	Trichoptera	Hydropsychidae			4	79	87.78
			May Fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Epeorus*	59		
			May Fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Stenonema*	3		
			May Fly	Ephemeroptera	Ephemerellidae		*Ephemerella*	4		
			May Fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Rhithrogena*	1		
			Net winged midge	Diptera				1		
			Stonefly	Plecoptera	Perlidae			7		
FT5	FT5.MA.L10	3.06.014	net spiner Caddisfly	Trichoptera	Hydropsychidae			3	102	113.33
			Free living Caddish fly	Trichoptera	Rhyacophilidae			0		
			Stonefly	Plecoptera	Perlidae			0		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Stonenoma*	4		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Epeorus*	86		
			May Fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Rhithrogena*	0		
			Water snipe					1		
			Net Winged Midge	Diptera	Blephariceridae			8		

June 2014

River Reach	Sample Code	Date Analysed	Common name	Order	Family	Sub-Family	Genus	#	Total	Density /m2
FT1	FT1.MA.L11	1.06.014	net spiner Caddisfly	Trichoptera	Hydropsychidae			8	52	57.78
			Free living Caddisfly	Trichoptera	Rhyacophilidae			0		
			Golden stone fly	Plecoptera	Perlidae			16		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Rhithrogena*	11		
			May fly	Ephemeroptera	Ephemerellidae		*Ephemerela*	1		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Stenonema*	12		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Epeorus*	2		
			Water snipe	Diptera				2		
			Midge	Diptera	Chironomidae			0		
FT2	FT2.MA.L11	1.06.014	Free living Caddisfly	Trichoptera	Rhyacophilidae			0	117	130.00
			net spiner Caddisfly	Trichoptera	Hydropsychidae			57		
			May fly	Ephemeroptera	Heptageniidae		*Epeorus*	19		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Stenonema*	5		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*rhithrogena*	18		
			May fly	Ephemeroptera	ephemerellidae		*ephimerela*	0		
			Golden Stone fly	Plecoptera	Perlidae			10		
			Black Fly	Diptera				0		
			Net winged midge	Diptera				8		
FT3	FT3.MA.L11	2.06.014	Free living Caddish fly	Trichoptera	Rhyacophilidae			0	80	88.89
			net spiner Caddisfly	Trichoptera	Hydropsychidae			55		
			Golden Stone fly	Plecoptera	Perlidae			13		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Epeorus*	2		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Stenonema*	4		
			May fly	Ephemeroptera	Ephemerillidae		*ephimerella*	0		

			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*rhithrogena*	5		
			Water Snipe					1		
			Midge	Diptera				0		
FT4	FT4.MA.L11	2.06.014	net spiner Caddisfly	Trichoptera	Hydropsychidae			53	93	103.33
			May Fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Epeorus*	10		
			May Fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Stenonema*	0		
			May Fly	Ephemeroptera	Ephemerellidae		*Ephemerella*	0		
			May Fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Rhithrogena*	3		
			Net winged midge	Diptera				7		
			Golden Stonefly	Plecoptera	Perlidae			20		
FT5	FT5.MA.L11	3.06.014	net spiner Caddisfly	Trichoptera	Hydropsychidae			39	85	94.44
			Free living Caddish fly	Trichoptera	Rhyacophilidae			0		
			Golden Stonefly	Plecoptera	Perlidae			27		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Stonenoma*	0		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Epeorus*	0		
			May Fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Rhithrogena*	2		
			Water snipe					0		
			Net Winged Midge	Diptera	Blephariceridae			17		

July 2014

River Reach	Sample Code	Date Analysed	Common name	Order	Family	Sub-Family	Genus	#	Total	Density /m2
FT1	FT1.MA.L12	10.08.014	net spiner Caddisfly	Trichoptera	Hydropsychidae			88	157	174.44
			Free living Caddisfly	Trichoptera	Rhyacophilidae			0		
			Golden stone fly	Plecoptera	Perlidae			13		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Rhithrogena*	31		
			May fly	Ephemeroptera	Ephemerellidae		*Ephemerela*	0		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Stenonema*	18		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Epeorus*	4		
			Black fly	Diptera				1		
			Net winged Midge	Diptera	Chironomidae			2		
FT2	FT2.MA.L12	10.08.014	net spiner Caddisfly	Trichoptera	Hydropsychidae			56	86	95.56
			Golden stone fly	Plecoptera	Perlidae			6		
			May fly	Ephemeroptera	Heptageniidae		*Epeorus*	16		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Stenonema*	7		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*rhithrogena*	0		
			May fly	Ephemeroptera	ephemerellidae		*ephimerela*	1		
			Black Fly	Diptera				0		
			Net winged midge	Diptera				0		
FT3	FT3.MA.L12	11.08.014	Free living Caddish fly	Trichoptera	Rhyacophilidae			0	45	50.00
			net spiner Caddisfly	Trichoptera	Hydropsychidae			31		
			Golden Stone fly	Plecoptera	Perlidae			4		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Epeorus*	3		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Stenonema*	4		
			May fly	Ephemeroptera	Ephemerillidae		*ephimerella*	0		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*rhithrogena*	0		

			Crane fly	Diptera				1		
			Net winged midge	Diptera				2		
FT4	FT4.MA.L12	11.08.014	net spiner Caddisfly	Trichoptera	Hydropsychidae			25	71	78.89
			May Fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Epeorus*	5		
			May Fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Stenonema*	13		
			May Fly	Ephemeroptera	Ephemerellidae		*Ephemerella*	0		
			May Fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Rhithrogena*	16		
			Golden Stonefly	Plecoptera	Perlidae			12		
FT5	FT5.MA.L12	12.08.014	net spiner Caddisfly	Trichoptera	Hydropsychidae			16	46	51.11
			Free living Caddish fly	Trichoptera	Rhyacophilidae			0		
			Golden Stonefly	Plecoptera	Perlidae			8		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Stonenoma*	0		
			May fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Epeorus*	7		
			May Fly	Ephemeroptera	Heptageniidae	Heptageniinae	*Rhithrogena*	15		
			Water snipe					0		
			Net Winged Midge	Diptera	Blephariceridae			0		

A.3 Fish surveys

August 2013

Sampling Location	Upstream of Dam Site
River Reach	**F T 1**
Date	27/28.08.2013

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	10	8.5 to 20	5 to 66	30.7	307
B	**Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	4	19 to 23	67 to 95	77.5	310

Sampling Location	Downstream of Dam Site De-water Zone
River Reach	**F T 2**
Date	26.08.2013

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	3	11 to15.5	11 to 33	18.33	55
B	**Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	15	10 to 24	10 to 128	59.47	892

Sampling Location	De-water Zone
River Reach	**F T 3**
Date	24.08.2013

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						

1	*Schizothorax richardsoni*	Buchche asala	64	5 to 15.5	1 to 23	5.58	357
B	**Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	3	16 to 17.5	29 to 41	35.33	106

Sampling Station: Upstream of Power House Site De-water Zone

Sampling Station No.: F T 4

Date 23.08.2013

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	71	5.5 to 19	1 to 51	5.14	365
B	**Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	7	17.5 to 26	39 t0 130	79.14	554

Sampling Station: Downstream of Power House Site

Sampling Station No.: F T 5

Date 22.08.2013

A	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	82	4.5 to 16	1 to 27	6.51	534
2	*Euchiloglanis hodgarti*	Till kabre	1	10	4	4	4
B	**Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	4	9 to 13	10 to 12	10.75	43

Summary Catch (August 2013)-Cast and gill net

Cast net

River Reach	Location	Number of Fish caught	Total Weight (gms)	Number of species	Catch Percentage	Percentage of catch (weight)	Scientific Name of observed Fish Species
F T 1	Upstream of Dam Site	10	307	1	4.33	18.93	
F T 2	Downstream of Dam Site-Diversion reach	3	55	1	1.30	3.39	*Schizothorax richardsoni*
F T 3	Diversion reach	64	357	1	27.71	22.01	*Schizothorax richardsoni*
F T 4	Upstream of Power House Site Diversion reach	71	365	1	30.74	22.50	*Schizothorax richardsoni*
F T 5	Downstream reach	83	538	1	35.93	33.17	*Schizothorax richardsoni*
	Total	**231**	**1622**		100.00	100.00	

Gill net

River Reach	Location	Number of Fish caught	Total Weight (gms)	Number of species	Catch Percentage	Percentage of catch (weight)	Scientific Name of observed Fish Species
F T 1	Upstream of Dam Site	4	310	1	12.12	16.27	
F T 2	Downstream of Dam Site-Diversion reach	15	892	1	45.45	46.82	*Schizothorax richardsoni*
F T 3	Diversion reach	3	106	1	9.09	5.56	*Schizothorax richardsoni*
F T 4	Upstream of Power House Site Diversion reach	7	554	1	21.21	29.08	*Schizothorax richardsoni*
F T 5	Downstream reach	4	43	1	12.12	2.26	*Schizothorax richardsoni*
	Total	**33**	**1905**		100.00	100.00	*Schizothorax richardsoni*

September 2013

Sampling Location	Upstream of Dam Site
River Reach	**F T 1**
Date	9/26/2013

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	13	9.5 to 16	4 to33	12.923	168
B	**Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	11	14.5 to 27	22 to147	60.182	662

Sampling Location	Downstream of Dam Site De-water Zone
River Reach	**F T 2**
Date	9/25/2013

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	36	11 to15.5	11 to 33	33.06	1190
B	**Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	5	13 to 15	19 to 30	23.20	116

Sampling Location	De-water Zone
River Reach	**F T 3**
Date	9/22/2013 & 9/23/2013

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	115	5 to 15.5	1 to 23	13.70	1576
2	*Euchiloglanis hodgarti*	Till kabre	2	6 to 9	1 to 5	3.00	6
	Total			**117**			**1582**

B	**Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	9	11 to 22	13 to 82	26.11	235

Sampling Location: Upstream of Power House Site De-water Zone

River Reach: **F T 4**

Date: 8/25/2013

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Averag e Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	63	5.5 to 19	1 to 51	11.46	722
B	**Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	2	11.5 to 14.5	21 t0 21	16.50	33

Sampling Location: Downstream of Power House Site

River Reach: **F T 5**

Date: 9/21/2013

S.No .	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	88	4.5 to 18.5	1 to 40	4.66	410
B	**Gill net**						
	None		0				

Summary Catch-Cast (September 2013) and gill net

Cast net

River Reach	Location	Number of Fish caught	Total Weight (gms)	Number of species	Catch Percentage	Percentage of catch (weight)	Scientific Name of observed Fish Species
F T 1	Upstream of Dam Site	13	168	1	4.10	4.13	*Schizothorax richardsoni*
F T 2	Downstream of Dam Site De-water Zone	36	1190	1	11.36	29.22	*Schizothorax richardsoni*
F T 3	De-water Zone	117	1582	2	36.91	38.85	*Schizothorax richardsoni & Euchiloglanis hodgarti*
F T 4	Upstream of Power House Site De-water Zone	63	722	1	19.87	17.73	*Schizothorax richardsoni*
F T 5	Downstream of Power House Site	88	410	1	27.76	10.07	*Schizothorax richardsoni*
	Total	**317**	**4072**		**100.00**	**100.00**	

Gill net

River Reach	Location	Number of Fish caught	Total Weight (gms)	Number of species	Catch Percentage	Percentage of catch (weight)	Scientific Name of observed Fish Species
F T 1	Upstream of Dam Site	11	662	1	40.74	63.29	*Schizothorax richardsoni*
F T 2	Downstream of Dam Site-Diversion reach	5	116	1	18.52	11.09	*Schizothorax richardsoni*
F T 3	Diversion reach	9	235	1	33.33	22.47	*Schizothorax richardsoni*
F T 4	Upstream of Power House Site Diversion reach	2	33	1	7.41	3.15	*Schizothorax richardsoni*
F T 5	Downstream reach			1	0.00	0.00	*Schizothorax richardsoni*
	Total	**27**	**1046**		**100.00**	**100.00**	

Catch per unit effort (September 2013)-Cast net

Site No.	Sites	Level of Effort (# of attempts)	No. of Fish caught	Catch per unit effort (CPUE)	Attempt Catch Ratio
F T 1	Upstream of Dam Site	200	13	0.065	1:0.065
F T 2	Downstream of Dam Site- Diversion reach	185	36	0.19459	1:0.195
F T 3	Diversion reach	200	117	0.585	1:0.585
F T 4	Upstream of Power House Site Diversion reach	200	63	0.315	1:0.315
F T 5	Downstream reach	200	88	0.44	1:0.440
	Total	**985**	**317**	**0.32183**	**1:0.322**

October 2013

Sampling Location Upstream of Dam Site
River Reach **F T 1**
Date 11/2/2013

During Field Survey 27, oct 2013 to 3, Nov 2013

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	3	5.5 to 7.5	1 to 4	3	9
B	**Fish Catch by Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	1	21	62	62	62

Sampling Location Downstream of Dam Site De-water Zone
River Reach **F T 2**
Date 11/1/2013

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	3	5.5 to 7.5	1 to 4	3	9
B	**Fish Catch by Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	1	21	62	62	62

Sampling Location De-water Zone
River Reach **F T 3**
Date 10/30/2013

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	34	4.5 to 18	1 to 39	9.41	320
B	**Fish Catch by Gill net**						
	Schizothorax richardsoni	Buchche asala	7	11 to 15	11 to	18.29	128

					26		

Sampling Location	Upstream of Power House Site De-water Zone
River Reach	**F T 4**
Date	10/29/2013

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	34	4.5 to 18	1 to 39	9.41	320
B	**Fish Catch by Gill net**						
	Schizothorax richardsoni	Buchche asala	7	11 to 15	11 to 26	18.29	128

Sampling Location	Downstream of Power House Site
River Reach	**F T 5**
Date	10/28/2013

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	184	4.5 to 15.5	1 to 26	2.23	410
2	*Schitura savona*	Gadela	1	8	4	4.00	4
B	**Fish Catch by Gill net**						
	Schizothorax richardsoni	Buchche asala	3	15 to 25	15 to 93	50.67	152

Summary Catch (October 2013)-Cast and gill net

Cast net

River Reach	Location	Number of Fish caught	Total Weight (gms)	Number of species	Catch Percentage	Percentage of catch (weight)	Scientific Name of observed Fish Species
F T 1	Upstream of Dam Site	3	9	1	1.20	0.73	*Schizothorax richardsoni*
F T 2	Downstream of Dam Site-Diversion reach	3	240	1	1.20	19.51	*Schizothorax richardsoni*
F T 3	Diversion reach	34	320	1	13.60	26.02	*Schizothorax richardsoni*
F T 4	Upstream of Power House Site Diversion reach	25	247	1	10.00	20.08	*Schizothorax richardsoni*
F T 5	Downstream reach	185	414	2	74.00	33.66	*Schizothorax richardsoni & Schitura savona*
	Total	**250**	**1230**		**100.00**	**100.00**	

Gill net

River Reach	Location	Number of Fish caught	Total Weight (gms)	Number of species	Catch Percentage	Percentage of catch (weight)	Scientific Name of observed Fish Species
F T 1	Upstream of Dam Site	1	62	1	6.25	9.78	*Schizothorax richardsoni*
F T 2	Downstream of Dam Site-Diversion reach	3	254	1	18.75	40.06	*Schizothorax richardsoni*
F T 3	Diversion reach	7	128	1	43.75	20.19	*Schizothorax richardsoni*
F T 4	Upstream of Power House Site Diversion reach	2	38	1	12.50	5.99	*Schizothorax richardsoni*
F T 5	Downstream reach	3	152	1	18.75	23.97	*Schizothorax richardsoni*
	Total	**16**	**634**		**100.00**	**100.00**	

Catch per unit effort (October 2013)-Cast net

Site No.	Sites	Level of Effort (# of attempts)	No. of Fish caught	Catch per unit effort (CPUE)	Attempt Catch Ratio
F T 1	Upstream of Dam Site	200	3	0.015	1:0.065
F T 2	Downstream of Dam Site-Diversion reach	200	3	0.015	1:0.195
F T 3	Diversion reach	200	34	0.17	1:0.585
F T 4	Upstream of Power House Site Diversion reach	200	25	0.125	1:0.315
F T 5	Downstream reach	200	185	0.925	1:0.440
	Total	**1000**	**250**	**0.25**	**1:0.322**

November 2013

Sampling Location Upstream of Dam Site
River Reach **F T 1**
Date 12/2/2013

Field Survey 26, November 2013 to 3, December 2013

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala					
B	**Fish Catch by Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	3	16.5 to 21	40 to 77	59	177

Sampling Location Downstream of Dam Site De-water Zone
River Reach **F T 2**
Date 12/1/2013

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala					
B	**Fish Catch by Gill net**						
	Schizothorax richardsoni	Buchche asala	3	17 to 20	35 to 57	46.67	140

Sampling Location De-water Zone
River Reach **F T 3**
Date 11/29/2013

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	1	12	12	12.00	12
B	**Fish Catch by Gill net**						
	Schizothorax richardsoni	Buchche asala	3	12 to 15	13 to 24	20.33	61

Sampling Location	Upstream of Power House Site De-water Zone
River Reach	**F T 4**
Date	11/28/2013

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	2	7.5 to 10	3 to 8	5.50	11
B	**Fish Catch by Gill net**						
	Schizothorax richardsoni	Buchche asala	7	12 to 21	12 t0 67	49.71	348

Sampling Location	Downstream of Power House Site
River Reach	**F T 5**
Date	11/27/2013

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	Schizothorax richardsoni	Buchche asala	45	4 to 25	1 to 128	13.89	**625**
B	**Fish Catch by Gill net**						
	Schizothorax richardsoni	Buchche asala	2	19 to 21	49 to 60	54.50	109

Summary Catch (November 2013)-Cast and gill net

Cast net

River Reach	Location	Number of Fish caught	Total Weight (gms)	Number of species	Catch Percentage	Percentage of catch (weight)	Scientific Name of observed Fish Species
F T 1	Upstream of Dam Site	3	177	1	16.67	21.20	*Schizothorax richardsoni*
F T 2	Downstream of Dam Site-Diversion reach	3	140	1	16.67	16.77	*Schizothorax richardsoni*
F T 3	Diversion reach	3	61	1	16.67	7.31	*Schizothorax richardsoni*
F T 4	Upstream of Power House Site Diversion reach	7	348	1	38.89	41.68	*Schizothorax richardsoni*
F T 5	Downstream reach	2	109	1	11.11	13.05	*Schizothorax richardsoni*
	Total	**18**	**835**		**100.00**	**100.00**	

Gill net

River Reach	Location	Number of Fish caught	Total Weight (gms)	Number of species	Catch Percentage	Percentage of catch (weight)	Scientific Name of observed Fish Species
F T 1	Upstream of Dam Site	0			0.00	0.00	*Schizothorax richardsoni*
F T 2	Downstream of Dam Site-Diversion reach	0			0.00	0.00	*Schizothorax richardsoni*
F T 3	Diversion reach	1	12	1	2.08	1.85	*Schizothorax richardsoni*
F T 4	Upstream of Power House Site Diversion reach	2	11	1	4.17	1.70	*Schizothorax richardsoni*
F T 5	Downstream reach	45	625	1	93.75	96.45	*Schizothorax richardsoni*
	Total	**48**	**648**		**100.00**	**100.00**	

Catch per unit effort (November 2013)-Cast net

Site No.	Sites	Level of Effort (# of attempts)	No. of Fish caught	Catch per unit effort (CPUE)	Attempt Catch Ratio
F T 1	Upstream of Dam Site	200	3	0.015	1:0.065
F T 2	Downstream of Dam Site-Diversion reach	200	3	0.015	1:0.195
F T 3	Diversion reach	200	34	0.17	1:0.585
F T 4	Upstream of Power House Site Diversion reach	200	25	0.125	1:0.315
F T 5	Downstream reach	200	185	0.925	1:0.440
	Total	**1000**	**250**	**0.25**	**1:0.322**

December 2013

Sampling Station: Upstream of Dam Site
Sampling Station No.: F T 1
Date 30/12/2013

Field Survey 24th, December 2013 to 31st, December 2013

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
B	**Fish Catch by Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	6	14 to 21	22 to 65	41.67	250

Sampling Station: Downstream of Dam Site De-water Zone
Sampling Station No.: F T 2
Date 28/12/2013

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
B	**Fish Catch by Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	4	17 to 20	36 to 70	50.75	203

Sampling Station: De-water Zone
Sampling Station No.: F T 3
Date 27/12/2013

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						

B	**Fish Catch by Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	6	11 to 17	12 to 39	20.00	120

Sampling Station: Upstream of Power House Site De-water Zone
Sampling Station No.: F T 4
Date 26/12/2013

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
B	**Fish Catch by Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	4	19 to 25	47 to 107	70.75	283

Sampling Station: Downstream of Power House Site
Sampling Station No.: F T 5
Date 25/12/2013

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	9	7 to 11	3 to 7	4.33	39
B	**Fish Catch by Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	1	21	64	64.00	64

Summary Catch (December 2013)-Cast and gill net

Cast net

River Reach	Location	Number of Fish caught	Total Weight (gms)	Number of species	Catch Percentage	Percentage of catch (weight)	Scientific Name of observed Fish Species
F T 1	Upstream of Dam Site	6	250	1	28.57	27.17	*Schizothorax richardsoni*
F T 2	Downstream of Dam Site-Diversion reach	4	203	1	19.05	22.07	*Schizothorax richardsoni*
F T 3	Diversion reach	6	120	1	28.57	13.04	*Schizothorax richardsoni*
F T 4	Upstream of Power House Site Diversion reach	4	283	1	19.05	30.76	*Schizothorax richardsoni*
F T 5	Downstream reach	1	64	1	4.76	6.96	*Schizothorax richardsoni*
	Total	**21**	**920**		**100.00**	**100.00**	

Gill net

River Reach	Location	Number of Fish caught	Total Weight (gms)	Number of species	Catch Percentage	Percentage of catch (weight)	Scientific Name of observed Fish Species
F T 1	Upstream of Dam Site	0			0.00	0.00	
F T 2	Downstream of Dam Site-Diversion reach	0			0.00	0.00	
F T 3	Diversion reach	0			0.00	0.00	
F T 4	Upstream of Power House Site Diversion reach	0			0.00	0.00	
F T 5	Downstream reach	9	39	1	100.00	100.00	*Schizothorax richardsoni*
	Total	**9**	**39**		**100.00**	**100.00**	

Catch per unit effort (December 2013)-Cast net

Site No.	Sites	Level of Effort (# of attempts)	No. of Fish caught	Catch per unit effort (CPUE)	Attempt Catch Ratio
F T 1	Upstream of Dam Site	200	3	0.015	1:0.065
F T 2	Downstream of Dam Site-Diversion reach	200	3	0.015	1:0.195
F T 3	Diversion reach	200	34	0.17	1:0.585
F T 4	Upstream of Power House Site Diversion reach	200	25	0.125	1:0.315
F T 5	Downstream reach	200	185	0.925	1:0.440
Total		**1000**	**250**	**0.25**	**1:0.322**

January 2014

Sampling Station: Upstream of Dam Site
Sampling Station No.: F T 1
Date 25/01/2014

During Field Survey 20th, January 2014 to 27th, January 2014

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
B	**Fish Catch by Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	1	22	103	103.00	103

Sampling Station: Downstream of Dam Site De-water Zone
Sampling Station No.: F T 2
Date 26/01/2014

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
B	**Fish Catch by Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	4	21 to 24	71 to 108	94.75	379

Sampling Station: De-water Zone
Sampling Station No.: F T 3
Date 23/01/2014

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
B	**Fish Catch by Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	9	13 to 23	17 to 99	42.11	379

Sampling Station:	Upstream of Power House Site De-water Zone
Sampling Station No.:	F T 4
Date	22/01/2014

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
B	**Fish Catch by Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	5	13 to 19	17 to 55	35.80	179

Sampling Station:	Downstream of Power House Site
Sampling Station No.:	F T 5
Date	21/01/2014

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	60	5 to 12	1 to 13	2.98	179
B	**Fish Catch by Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	5	15 to 25	26 to 120	49.20	246

Summary Catch (January 2014)-Cast and gill net

Cast net

River Reach	Location	Number of Fish caught	Total Weight (gms)	Number of species	Catch Percentage	Percentage of catch (weight)	Scientific Name of observed Fish Species
F T 1	Upstream of Dam Site	1	103	1	4.17	8.01	*Schizothorax richardsoni*
F T 2	Downstream of Dam Site-Diversion reach	4	379	1	16.67	29.47	*Schizothorax richardsoni*
F T 3	Diversion reach	9	379	1	37.50	29.47	*Schizothorax richardsoni*
F T 4	Upstream of Power House Site Diversion reach	5	179	1	20.83	13.92	*Schizothorax richardsoni*
F T 5	Downstream reach	5	246	1	20.83	19.13	*Schizothorax richardsoni*
	Total	**24**	**1286**		**100.00**	**100.00**	

Gill net

River Reach	Location	Number of Fish caught	Total Weight (gms)	Number of species	Catch Percentage	Percentage of catch (weight)	Scientific Name of observed Fish Species
F T 1	Upstream of Dam Site	0			0.00	0.00	
F T 2	Downstream of Dam Site-Diversion reach	0			0.00	0.00	
F T 3	Diversion reach	0			0.00	0.00	
F T 4	Upstream of Power House Site Diversion reach	0			0.00	0.00	
F T 5	Downstream reach	60	179	1	100.00	100.00	*Schizothorax richardsoni*
	Total	**60**	**179**		**100.00**	**100.00**	

Catch per unit effort (January 2014)-Cast net

Site No.	Sites	Level of Effort (# of attempts)	No. of Fish caught	Catch per unit effort (CPUE)	Attempt Catch Ratio
F T 1	Upstream of Dam Site	200	3	0.015	1:0.065
F T 2	Downstream of Dam Site-Diversion reach	200	3	0.015	1:0.195
F T 3	Diversion reach	200	34	0.17	1:0.585
F T 4	Upstream of Power House Site Diversion reach	200	25	0.125	1:0.315
F T 5	Downstream reach	200	185	0.925	1:0.440
	Total	**1000**	**250**	**0.25**	**1:0.322**

February 2014

Sampling Station: Upstream of Dam Site
Sampling Station No.: F T 1
Date 4/3/2014

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
B	**Fish Catch by Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	9	14 to 19	19 to 50	44.44	400

Sampling Station: Downstream of Dam Site De-water Zone
Sampling Station No.: F T 2
Date 3/3/2014

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
B	**Fish Catch by Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	5	16.5 to 22	31 to 107	55.20	276

Sampling Station: De-water Zone
Sampling Station No.: F T 3
Date 1/3/2014

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
B	**Fish Catch by Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	6	17 to 28	43 to 172	75.83	455

Sampling Station: Upstream of Power House Site De-water Zone
Sampling Station No.: F T 4
Date 28/02/2014

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
B	**Fish Catch by Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	1	15	26	26.00	26

Sampling Station: Downstream of Power House Site
Sampling Station No.: F T 5
Date 27/02/2014

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	64	4 to 16	1 to 33	4.61	295
B	**Fish Catch by Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	9	11 to 21	13 to 83	45.22	407
C	**Local fisherman catch by Gillnet**						
1	*Schizothorax richardsoni*	Buchche asala	8	19 to 25	50 to 125	64.63	517
2	*Psedecheneis sulcatus*	Kabre	1	16	45	45.00	45

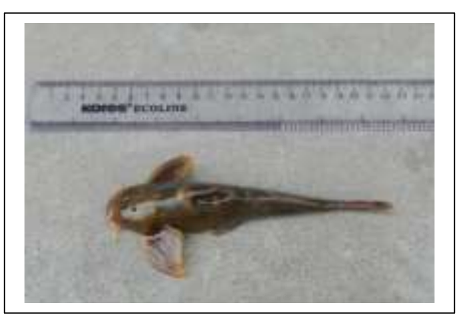

Photo: Kabre (*Psedecheneis sulcatus*)

Summary Catch (February 2014)-Cast and gill net

Cast net

River Reach	Location	Number of Fish caught	Total Weight (gms)	Number of species	Catch Percentage	Percentage of catch (weight)	Scientific Name of observed Fish Species
F T 1	Upstream of Dam Site	0			0.00	0.00	
F T 2	Downstream of Dam Site-Diversion reach	0			0.00	0.00	
F T 3	Diversion reach	0			0.00	0.00	
F T 4	Upstream of Power House Site Diversion reach	0			0.00	0.00	
F T 5	Downstream reach	64	295	1	100.00	100.00	*Schizothorax richardsoni*
	Total	**64**	**295**		**100.00**	**100.00**	

Gill net

River Reach	Location	Number of Fish caught	Total Weight (gms)	Number of species	Catch Percentage	Percentage of catch (weight)	Scientific Name of observed Fish Species
F T 1	Upstream of Dam Site	9	400	1	30.00	25.58	*Schizothorax richardsoni*
F T 2	Downstream of Dam Site-Diversion reach	5	276	1	16.67	17.65	*Schizothorax richardsoni*
F T 3	Diversion reach	6	455	1	20.00	29.09	*Schizothorax richardsoni*
F T 4	Upstream of Power House Site Diversion reach	1	26	1	3.33	1.66	*Schizothorax richardsoni*
F T 5	Downstream reach	9	407	1	30.00	26.02	*Schizothorax richardsoni*
	Total	**30**	**1564**		**100.00**	**100.00**	

Catch per unit effort (February 2014)-Cast net

Site No.	Sites	Level of Effort (# of attempts)	No. of Fish caught	Catch per unit effort (CPUE)	Attempt Catch Ratio
F T 1	Upstream of Dam Site	200	3	0.015	1:0.065
F T 2	Downstream of Dam Site-Diversion reach	200	3	0.015	1:0.195
F T 3	Diversion reach	200	34	0.17	1:0.585
F T 4	Upstream of Power House Site Diversion reach	200	25	0.125	1:0.315
F T 5	Downstream reach	200	185	0.925	1:0.440
	Total	**1000**	**250**	**0.25**	**1:0.322**

March 2014

Sampling Station: Upstream of Dam Site
Sampling Station No.: F T 1
Date: 25/3/2014

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	9	13 to 19	17 to 51	29.00	261
B	**Fish Catch by Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	8	14 to 26	23 to 156	64.00	512

Sampling Station: Downstream of Dam Site De-water Zone
Sampling Station No.: F T 2
Date 27/3/2014

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	9	13 to 23	13 to 101	34.00	306
B	**Fish Catch by Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	7	12 to 20	12 to 61	44.00	308

Sampling Station: De-water Zone
Sampling Station No.: F T 3
Date 24/3/2014 & 25/3/2014

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	10	8 to 18	5 to 44	18.80	188
B	**Fish Catch by Gill net**						

1	*Schizothorax richardsoni*	Buchche asala	6	14 to 21	23 to 75	45.83	275

Sampling Station: Upstream of Power House Site De-water Zone
Sampling Station No.: F T 4
Date 23/3/2014

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	2	12 to 13	14 to 21	17.50	35
B	**Fish Catch by Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	9	12 to 24	15 to 125	44.78	403

Sampling Station: Downstream of Power House Site
Sampling Station No.: F T 5
Date 22/3/2014

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	54	5 to 17	1 to 37	4.94	267
B	**Fish Catch by Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	3	12 to 19	12 to 52	30.67	92
C	**Local fisherman catch by Gillnet**						
1	*Schizothorax richardsoni*	Buchche asala	16	10 to 23	10 to 117	77.75	1244

Summary Catch (March 2014)-Cast and gill net

Cast net

River Reach	Location	Number of Fish caught	Total Weight (gms)	Number of species	Catch Percentage	Percentage of catch (weight)	Scientific Name of observed Fish Species
F T 1	Upstream of Dam Site	9	261	1	10.71	24.69	*Schizothorax richardsoni*
F T 2	Downstream of Dam Site De-water Zone	9	306	1	10.71	28.95	*Schizothorax richardsoni*
F T 3	De-water Zone	10	188	1	11.90	17.79	*Schizothorax richardsoni*
F T 4	Upstream of Power House Site De-water Zone	2	35	1	2.38	3.31	*Schizothorax richardsoni*
F T 5	Downstream of Power House Site	54	267	1	64.29	25.26	*Schizothorax richardsoni*
	Total	**84**	**1057**		**100.00**	**100.00**	

Gill net

River Reach	Location	Number of Fish caught	Total Weight (gms)	Number of species	Catch Percentage	Percentage of catch (weight)	Scientific Name of observed Fish Species
F T 1	Upstream of Dam Site	8	512	1	24.24	32.20	*Schizothorax richardsoni*
F T 2	Downstream of Dam Site De-water Zone	7	308	1	21.21	19.37	*Schizothorax richardsoni*
F T 3	De-water Zone	6	275	1	18.18	17.30	*Schizothorax richardsoni*
F T 4	Upstream of Power House Site De-water Zone	9	403	1	27.27	25.35	*Schizothorax richardsoni*
F T 5	Downstream of Power House Site	3	92	1	9.09	5.79	*Schizothorax richardsoni*
	Total	**33**	**1590**		**100.00**	**100.00**	

Catch per unit effort (March 2014)-Cast net

Site No.	Sites	Level of Effort (# of attempts)	No. of Fish caught	Catch per unit effort (CPUE)	Attempt Catch Ratio
F T 1	Upstream of Dam Site	200	3	0.015	1:0.065
F T 2	Downstream of Dam Site-Diversion reach	200	3	0.015	1:0.195
F T 3	Diversion reach	200	34	0.17	1:0.585
F T 4	Upstream of Power House Site Diversion reach	200	25	0.125	1:0.315
F T 5	Downstream reach	200	185	0.925	1:0.440
	Total	**1000**	**250**	**0.25**	**1:0.322**

April 2014

Sampling Station: Upstream of Dam Site
Sampling Station No.: **F T 1**
Date 25/4/2014 & 26/4/2014

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	1	16	33	33.00	33
B	**Fish Catch by Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	6	17 to 25	41 to118	66.5	399

Sampling Station: Downstream of Dam Site De-water Zone
Sampling Station No.: **F T 2**
Date 24/4/2014 & 25/4/2014
During Field Survey 20th, April 2014 to 27th, April 2014

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	7	13 to 23	17 to 118	55.00	385
B	**Fish Catch by Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	5	15 to 19	28 to 59	42.4	212

Sampling Station: De-water Zone
Sampling Station No.: **F T 3**
Date 23/4/2014 & 24/4/2014
During Field Survey 20th, April 2014 to 27th, April 2014

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	8	10 to 21	8 to 70	35.00	280
B	**Fish Catch by Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	9	10 to 19	10 to 57	24	216

Sampling Station:	Upstream of Power House Site De-water Zone
Sampling Station No.:	**F T 4**
Date	22/4/2014
During Field Survey 20th, April 2014 to 27th, April 2014	

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	1	10	10	10.00	10
B	**Fish Catch by Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	10	12 to 25	16 to 145	59.2	592

Sampling Station:	Downstream of Power House Site
Sampling Station No.:	**F T 5**
Date	21/4/2014
During Field Survey 20th, April 2014 to 27th, April 2014	

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	62	5 to 16	1 to 22	4.11	255
B	**Fish Catch by Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	8	12 to 22	15 to 92	41.5	332

Summary Catch (April 2014)-Cast and gill net

Cast net

River Reach	Location	Number of Fish caught	Total Weight (gms)	Number of species	Catch Percentage	Percentage of catch (weight)	Scientific Name of observed Fish Species
F T 1	Upstream of Dam Site	1	33	1	1.27	3.43	*Schizothorax richardsoni*
F T 2	Downstream of Dam Site De-water Zone	7	385	1	8.86	39.98	*Schizothorax richardsoni*
F T 3	De-water Zone	8	280	1	10.13	29.08	*Schizothorax richardsoni*
F T 4	Upstream of Power House Site De-water Zone	1	10	1	1.27	1.04	*Schizothorax richardsoni*

F T 5	Downstream of Power House Site	62	255	1	78.48	26.48	*Schizothorax richardsoni*
	Total	**79**	**963**		**100.00**	**100.00**	

Gill net

River Reach	Location	Number of Fish caught	Total Weight (gms)	Number of species	Catch Percentage	Percentage of catch (weight)	Scientific Name of observed Fish Species
F T 1	Upstream of Dam Site	6	399	1	15.79	22.79	*Schizothorax richardsoni*
F T 2	Downstream of Dam Site De-water Zone	5	212	1	13.16	12.11	*Schizothorax richardsoni*
F T 3	De-water Zone	9	216	1	23.68	12.34	*Schizothorax richardsoni*
F T 4	Upstream of Power House Site De-water Zone	10	592	1	26.32	33.81	*Schizothorax richardsoni*
F T 5	Downstream of Power House Site	8	332	1	21.05	18.96	*Schizothorax richardsoni*
	Total	**38**	**1751**		**100.00**	**100.00**	

Catch per unit effort (April 2014)-Cast net

Site No.	Sites	Level of Effort (# of attempts)	No. of Fish caught	Catch per unit effort (CPUE)	Attempt Catch Ratio
F T 1	Upstream of Dam Site	200	1	0.005	1:0.045
F T 2	Downstream of Dam Site-Diversion reach	200	7	0.035	1:0.045
F T 3	Diversion reach	200	8	0.04	1:0.05
F T 4	Upstream of Power House Site Diversion reach	200	1	0.005	1:0.01
F T 5	Downstream reach	200	62	0.3	1:0.3
	Total	**1000**	**79**	**0.079**	**1:0.084**

May 2014

Sampling Station: Upstream of Dam Site
Sampling Station No.: F T 1
Date 27/5/2014

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	13	9 to 20	9 to 74	31.31	407
B	**Fish Catch by Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	3	19 to 23	56 to 93	72.33	217

Sampling Station: Downstream of Dam Site De-water Zone
Sampling Station No.: F T 2
Date 25/5/2014 & 26/5/2014

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	3	9.5 to 13	7 to 18	12.67	38
B	**Fish Catch by Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	4	11 to 29	12 to 179	76	304

Sampling Station: De-water Zone
Sampling Station No.: F T 3
Date 24/5/2014

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	26	8 to 15	5 to 25	11.96	311
B	**Fish Catch by Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	15	10 to 21	10 to 61	23.07	346

Sampling Station: Upstream of Power House Site De-water Zone
Sampling Station No.: F T 4
Date 23/4/2014

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	14	6 to 24	5 to 75	22.07	309
B	**Fish Catch by Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	11	12 to 26	19 to 115	43.36	477

Sampling Station: Downstream of Power House Site
Sampling Station No.: F T 5
Date 22/5/2014

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	80	5 to 21	1 to 80	13.94	1115
B	**Fish Catch by Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	9	9 to 19	4 to 41	26.56	239
C	**Rod and Line/paso (local Fishermen catch)**						
1	*Psedecheneis sulcatus*	Kabre	7	13 to 19	18 to 37	19.71	138.00
2	*Euchiloglanis hodgarti*	Till kabre	1	6.5	3	3.00	3
3	*Schizothorax richardsoni*	Buchche asala	23	6 to 18	2 to 27	12.43	286

Summary Catch (May 2014)-Cast ang gill net

Cast net

River Reach	Location	Number of Fish caught	Total Weight (gms)	Number of species	Catch Percentage	Percentage of catch (weight)	Scientific Name of observed Fish Species
F T 1	Upstream of Dam Site	7	150	2	16.67	18.75	*Schizothorax richardsoni* *Euchiloglanis hodgarti*
F T 2	Downstream of Dam Site-Diversion reach	4	142	2	9.52	17.75	*Schizothorax richardsoni* *Onchorhyncus mykiss*

F T 3	Diversion reach	13	216	2	30.95	27.00	*Schizothorax richardsoni Onchorhyncus mykiss*
F T 4	Upstream of Power House Site Diversion reach	5	87	1	11.90	10.88	*Schizothorax richardsoni*
F T 5	Downstream reach	13	205	1	30.95	25.63	*Schizothorax richardsoni*
	Total	**42**	**800**		**100.00**	**100.00**	

Gill net

River Reach	Location	Number of Fish caught	Total Weight (gms)	Number of species	Catch Percentage	Percentage of catch (weight)	Scientific Name of observed Fish Species
F T 1	Upstream of Dam Site	8	559	1	44.44	62.60	*Schizothorax richardsoni*
F T 2	Downstream of Dam Site De-water Zone	5	234	1	27.78	26.20	*Schizothorax richardsoni*
F T 3	De-water Zone	2	41	1	11.11	4.59	*Schizothorax richardsoni*
F T 4	Upstream of Power House Site De-water Zone	1	18	1	5.56	2.02	*Schizothorax richardsoni*
F T 5	Downstream of Power House Site	2	41	1	11.11	4.59	*Schizothorax richardsoni*
	Total	**18**	**893**		**100.00**	**100.00**	

Catch per unit effort (May 2014)-Cast net

Site No.	Sites	Level of Effort (# of attempts)	No. of Fish caught	Catch per unit effort (CPUE)	Attempt Catch Ratio
F T 1	Upstream of Dam Site	200	4	0.02	1:0.02
F T 2	Downstream of Dam Site-Diversion reach	200	16	0.08	1:0.08
F T 3	Diversion reach	200	51	0.26	1:0.26
F T 4	Upstream of Power House Site Diversion reach	200	31	0.16	1:0.16
F T 5	Downstream reach	200	66	0.33	1:0.33
	Total	**1000**	**168**	0.168	**1:0.168**

June 2014

Sampling Station: Upstream of Dam Site
Sampling Station No.: F T 1
Date 25.6/2014 to 26/6/2014

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	4	15 to 27	25 to 78	43.00	172
B	**Fish Catch by Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	7	17 to 20	44 to 68	61.43	430

Sampling Station: Downstream of Dam Site De-water Zone
Sampling Station No.: F T 2
Date 26/6/2014 & 27/6/2014

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	16	7 to 20	2 to 66	17.38	278
B	**Fish Catch by Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	6	13 to 25	19 to 134	74.67	448

Sampling Station: De-water Zone
Sampling Station No.: F T 3
Date 27.6/2014 to 28/6/2014

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	50	5 to 20	1 to 62	10.98	549
2	*Euchiloglanis hodgarti*	Till kabre	1	5	1	1.00	1
B	**Fish Catch by Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	10	10 to 15	9 to 26	16.40	164

Sampling Station: Upstream of Power House Site De-water Zone

Sampling Station No.: **F T 4**

Date 28/6/2014 to 29/6/2014

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	31	5 to 18	1 to 41	10.58	328
B	**Fish Catch by Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	5	13 to 20	15 to 72	35.40	177

Sampling Station: Downstream of Power House Site

Sampling Station No.: **F T 5**

Date 29/6/2014 to 30/6/2014

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	65	5 to 20	1 to 65	14.06	914
2	*Noemacheilus Beavani*	Gadela	1	8	3	3.00	3
B	**Fish Catch by Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	5	10 to 19	10 to 42	25.60	128
C	**Rod and Line (local Fisher man catch)**						
1	*Psedecheneis sulcatus*	Kabre	1	14	20	20.00	20

Summary Catch (June 2014)-Cast ang gill net

Cast net

River Reach	Location	Number of Fish caught	Total Weight (gms)	Number of species	Catch Percentage	Percentage of catch (weight)	Scientific Name of observed Fish Species
F T 1	Upstream of Dam Site	7	150	2	16.67	18.75	*Schizothorax richardsoni* *Euchiloglanis hodgarti*
F T 2	Downstream of Dam Site- Diversion reach	4	142	2	9.52	17.75	*Schizothorax richardsoni* *Onchorhyncus mykiss*
F T 3	Diversion reach	13	216	2	30.95	27.00	*Schizothorax richardsoni* *Onchorhyncus mykiss*
F T 4	Upstream of Power House Site Diversion reach	5	87	1	11.90	10.88	*Schizothorax richardsoni*

F T 5	Downstream reach	13	205	1	30.95	25.63	*Schizothorax richardsoni*
	Total	**42**	**800**		**100.00**	**100.00**	

Gill net

River Reach	Location	Number of Fish caught	Total Weight (gms)	Number of species	Catch Percentage	Percentage of catch (weight)	Scientific Name of observed Fish Species
F T 1	Upstream of Dam Site	8	559	1	44.44	62.60	*Schizothorax richardsoni*
F T 2	Downstream of Dam Site-Diversion reach	5	234	1	27.78	26.20	*Schizothorax richardsoni*
F T 3	Diversion reach	2	41	1	11.11	4.59	*Schizothorax richardsoni*
F T 4	Upstream of Power House Site Diversion reach	1	18	1	5.56	2.02	*Schizothorax richardsoni*
F T 5	Downstream reach	2	41	1	11.11	4.59	*Schizothorax richardsoni*
	Total	**18**	**893**		**100.00**	**100.00**	

Catch per unit effort (June 2014)-Cast net

Site No.	Sites	Level of Effort (# of attempts)	No. of Fish caught	Catch per unit effort (CPUE)	Attempt Catch Ratio
F T 1	Upstream of Dam Site	200	4	0.02	1:0.02
F T 2	Downstream of Dam Site- Diversion reach	200	16	0.08	1:0.08
F T 3	Diversion reach	200	51	0.26	1:0.26
F T 4	Upstream of Power House Site Diversion reach	200	31	0.16	1:0.16
F T 5	Downstream reach	200	66	0.33	1:0.33
Total		**1000**	**42**	**168**	**0.168**

July 2014

Sampling Station: Upstream of Dam Site
Sampling Station No.: **F T 1**
Date 28/7/2014

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	5	13 to 19	13 to 46	29.40	147
2	*Euchiloglanis hodgarti*	Tilchapre	2	7 to8	3 to 3	1.50	3
		Total	**7**				**150**
B	**Fish Catch by Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	8	15 to 25	26 to 131	69.88	559

Sampling Station: Downstream of Dam Site De-water Zone
Sampling Station No.: **F T 2**
Date 30/7/2014

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	3	7 to 17	2 to 38	21.33	64
2	*Onchorhyncus mykiss*	Trout	1	19	78	78.00	78
		Total	**4**				**142**
B	**Fish Catch by Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	5	11 to 23	12 to 98	46.80	234

Sampling Station: De-water Zone
Sampling Station No.: **F T 3**
Date 1/8/2014

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	12	6 to 14	2 to 24	12.83	154
2	*Onchorhyncus mykiss*	Trout	1	19	62	62.00	62
			13				**216**
B	**Fish Catch by Gill net**						

1	*Schizothorax richardsoni*	Buchche asala	2	12 to 15	14 to 27	20.50	41

Sampling Station: Upstream of Power House Site De-water Zone
Sampling Station No.: F T 4
Date 2/8/2014

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	5	10 to 14	9 to 27	17.40	87
B	**Fish Catch by Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	1	13.00	18.00	18.00	18

Sampling Station: Downstream of Power House Site
Sampling Station No.: F T 5
Date 3/8/2014

S.No.	Scientific Name	Local name	No. of fish caught	Length Range (cm)	Weight Range (gms)	Average Weight (Gm)	Total Wt. (gms)
A	**Caste Net**						
1	*Schizothorax richardsoni*	Buchche asala	13	7 to 20	2 to 53	15.77	205
B	**Fish Catch by Gill net**						
1	*Schizothorax richardsoni*	Buchche asala	2	15 to 16	23 to 25	20.50	41

Summary Catch (July 2014)-Cast ang gill net

Cast net

River Reach	Location	Number of Fish caught	Total Weight (gms)	Number of species	Catch Percentage	Percentage of catch (weight)	Scientific Name of observed Fish Species
F T 1	Upstream of Dam Site	7	150	2	16.67	18.75	*Schizothorax richardsoni* *Euchiloglanis hodgarti*
F T 2	Downstream of Dam Site-Diversion reach	4	142	2	9.52	17.75	*Schizothorax richardsoni* *Onchorhyncus mykiss*
F T 3	Diversion reach	13	216	2	30.95	27.00	*Schizothorax richardsoni* *Onchorhyncus mykiss*
F T 4	Upstream of Power House Site Diversion reach	5	87	1	11.90	10.88	*Schizothorax richardsoni*
F T 5	Downstream reach	13	205	1	30.95	25.63	*Schizothorax richardsoni*
	Total	**42**	**800**		**100.00**	**100.00**	

Gill net

River Reach	Location	Number of Fish caught	Total Weight (gms)	Number of species	Catch Percentage	Percentage of catch (weight)	Scientific Name of observed Fish Species
F T 1	Upstream of Dam Site	8	559	1	44.44	62.60	*Schizothorax richardsoni*
F T 2	Downstream of Dam Site-Diversion reach	5	234	1	27.78	26.20	*Schizothorax richardsoni*
F T 3	Diversion reach	2	41	1	11.11	4.59	*Schizothorax richardsoni*
F T 4	Upstream of Power House Site Diversion reach	1	18	1	5.56	2.02	*Schizothorax richardsoni*
F T 5	Downstream reach	2	41	1	11.11	4.59	*Schizothorax richardsoni*
	Total	**18**	**893**		**100.00**	**100.00**	

Catch per unit effort (July 2014)-Cast net

Level of Effort (# of attempts)	No. of Fish caught	Catch per unit effort (CPUE)	Attempt Catch Ratio	Level of Effort (# of attempts)	No. of Fish caught
F T 1	Upstream of Dam Site	200	7	0.035	1:0.035
F T 2	Downstream of Dam Site De-water Zone	200	4	0.02	1:0.03
F T 3	De-water Zone	200	13	0.07	1:0.07
F T 4	Upstream of Power House Site De-water Zone	200	5	0.03	1:0.03
F T 5	Downstream of Power House Site	200	13	0.07	1:0.07
	Total	**1000**	**42**	**0.042**	**1:0.042**

Appendix B: Final Report