

## Drinking Water Quality Aspects of Shimla City

Rajesh Singh, M. K. Sharma, Omkar Singh, V. K. Choubey

National Institute of Hydrology, Roorkee – 247 667 (Uttarakhand)

Himachal Pradesh is one of the States which is included in the Hydrology Project - Phase II. Mass level Jaundice has been reported due to influx of pollutants/bacteria in the drinking water of Shimla Town during 2007. In this connection, a PDS entitled "Impact of sewage effluent on drinking water sources of Shimla city and suggesting ameliorative measures" has been awarded to the Institute under HP-II keeping in view the mass level, jaundice witnessed in a part of Shimla City in the recent past years due to entry of bacteria/pollutants into the drinking water supply system. Thereafter, various field and lab investigations under PDS are in progress in collaboration with I&PHE Dept., Shimla.

Samples of groundwater, surface water, treated water from water treatment plant (WTP) and sewage treatment plant (STP) were collected in the year 2010 & 2011. The samples were preserved as per standard procedures and were analyzed for physico chemical as well as bacteriological parameters in the NIH water quality laboratory.

**Drainage Map of Study Area:** Drainage area of Shimla city consisting of part of Satluj and Yamuna sub-basins digitized. Two watersheds fall in Satluj river sub basin, while one watershed falls in Yamuna river sub basin.

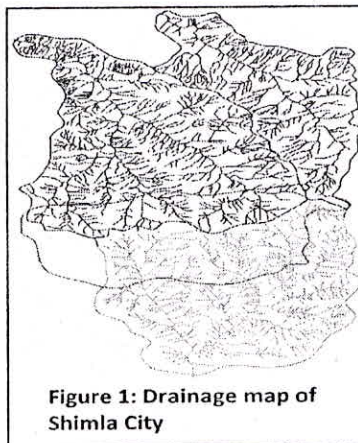


Figure 1: Drainage map of Shimla City

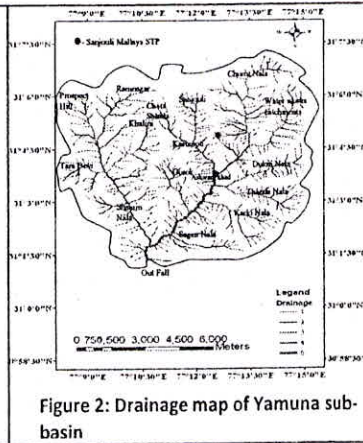


Figure 2: Drainage map of Yamuna sub-basin

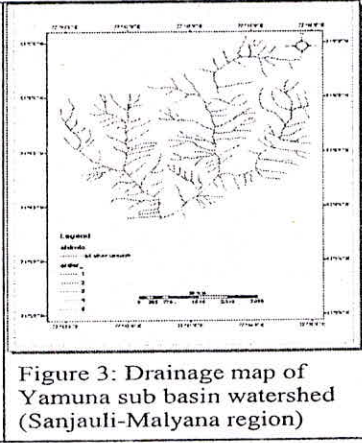


Figure 3: Drainage map of Yamuna sub basin watershed (Sanjauli-Malyana region)

The jaundice outbreak was mostly in the Sanjauli-Malyana region of Shimla and hence the study was confined to this area.

**Groundwater:** Samples were collected from 30 locations covering entire Shimla city.

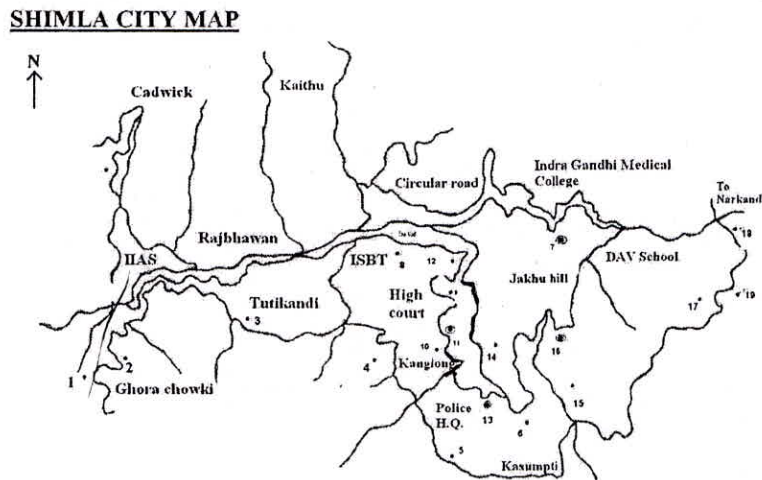


Figure 4: Groundwater sampling locations of Shimla City (● denotes contaminated site)

Analysis results of groundwater samples lead to following conclusions-

- 25% ground water samples were high in total dissolved solids, hardness, and nitrate.
- 16 samples were having more than 10 mg/L NO<sub>3</sub>-N during pre monsoon analysis whereas only 10 samples exceeded this value in post monsoon analysis.
- NO<sub>3</sub> concentration ranges from 0-66 mg/L in pre-monsoon samples and 0-29 mg/L in post monsoon season. Although, the NO<sub>3</sub> concentration in the ground water is well with the permissible limit set by Bureau of Indian Standards for drinking water but the concentration is enough to produce methamoglobinemia (blue baby syndrome) in infants. Nitrates/nitrites also lead to formation of nitrosamines which are carcinogenic. Maximum concentration limit of nitrate is 10 mg/L as per USEPA.
- Sample from following locations were positive in E-coli
  - Bharari
  - Cart road to Mall road
  - Circular road
  - New Shimla - Sector 3
- Presence of nitrate and E-coli in groundwater indicates contamination with sewage. This is due to improper sanitation facilities in the city.

**Sewage Treatment Plant & Open Drains:** Jaundice cases were noted mainly from the localities receiving water from Ashwani Khud water supply system. This system receives water from a natural stream which in turn receives water from Sanjouli-Malyana



STP and three natural (open) drains. The samples were collected from the ETP as well as natural drains. The results lead to following conclusion-

- Presence of organics (COD: 100-400 mg/L) and nitrate (15-45 mg/L) in the open drains indicates heavy contamination with sewage. The contamination results from the human defecation in open and absence of sewerage lines in the areas like Dhingoo, Engine ghar etc.
- Water quality deterioration of the open drains was also due to malpractice of throwing the garbage in the drains which slowly degrades and contributes to organics and micro-organisms.
- Only 30-40% reduction in BOD is observed in the Malyana STP. The high organics in the treated water was found to be mainly due to presence of suspended solids due to poor settling.

**Sewerage Network:** The efficacy of the sewerage network of the affected area was checked with Bentley SewerCAD software. The output of the software indicates that the network is able to cop up the present sewage load and chances of overflow is remote. During the study, few manholes were found overflowing due to blockage in lines. Although I&PHE try to sort out these types of problems in 24 hours but due to mountainous terrain, the sewage finds its way to water sources.

**Water Treatment Plant & User Point:** Water samples were collected and analyzed from Dhalli as well as Ashwani Khud water treatment plant including borewells. Following conclusion can be drawn from the results-

- Inlet water to Dhalli as well as Ashwani Khud WTP is contaminated with organics (COD: 12-150 mg/L) as well as bacteria.
- Bore wells supplementing water to Ashwani Khud WTP is also contaminated with fecal coliform and nitrate indicating contamination with sewage.
- The profile of free residual chlorine from water treatment plant to user point (reduces from 25 mg/L at WTP to 1 mg/L at user point) clearly indicates high chlorine demand of water due to presence of organics which will lead to formation of organic halides. Actual chlorine demand was not determined due to faulty chlorine flow meter at the WTP.
- Qualities of water samples from tap were similar to that of municipal distribution tank and free from bacteria due to very high dosage of chlorine at various stages.
- Samples collected from Dinu Bhojnalaya (New Shimla-Phase 3, Part 2) which receives water from Bawadi was found to be contaminated with organics as well as fecal coliform indicating immediate need to isolate such sources.

