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# Review on Water Quality Deterring Elements of Potable Water in Kangra, Himachal Pradesh

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***Abstract***

*In the present paper, we are trying to elucidate the status of water quality of Dhauladhar range of district Kangra Himachal Pradesh. Various literatures provide the analysis of water quality in several parts of the world confirming water contamination caused by the anthropogenic activities and nature induced situations. The groundwater of Kangra district is affected by intrusion of salt water or toxic substances penetrating through the soil. Kangra is the most populated district of Himachal Pradesh, India, and has been a victim of low water quality attributed to factors such as agriculture, industries and tourism. These aspects have led to reduced quality of water thereby causing insufficient water quantity. While several water samples suggest the bacteriological presence in Kangra's water resources, the groundwater board has affirmed that groundwater quality has not been compromised.*

***Keywords:*** Ground water, anthropogenic activities, tourism, Kangra district, water quality

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## INTRODUCTION

Water is unquestionably an important facet for life on earth and every living organism is inadvertently reliant on water. Equally important is Good water quality which is a crucial aspect of a healthy ecosystem. Water quality defines the features of water such as its physical appearance, chemical composition, and biological characteristics in order to ascertain the suitability of water for definite purposes like domestic, agricultural, drinking, industrial use. As a treasured natural resource, it includes marine, estuaries, freshwater such as river, ponds and lakes and ground water. While water is the most essential element for the existence of all living beings, water is incessantly subjected to contamination due to several factors such as increased anthropogenic activities, surface water runoff and organic influences. Water contamination severely affects the smooth functioning of the ecosystems attributed to the degraded water quality. Water contamination deteriorates or destroys natural ecosystems and affects human health, food production, and biodiversity.

Water quality is assessed by numerous features, such as the concentration of dissolved oxygen, bacteria levels, salinity and turbidity. However certain water forms require measuring the concentration of microscopic algae and quantities of pesticides, herbicides, heavy metals, and other contaminants [1].

One cannot deny that quality of water of equally important when compared with quantity of water for human beings. But most of the researches focus mainly on quantity of water available. Taking cognizance of this issue, UNEP (United Nations Environmental Programme) has offered to provide assistance to researches across world which will look into water quality problems and the remedies for it [2].

Water quality is influenced by an extensive variety of natural and anthropogenic activities. The utmost imperative of the natural impacts are geological, hydrological and climatic, as these intrude the quantity and the quality of existing water. The impact of these factors is highest when available water quantities are little, and scarce resources are used extensively. For instance, high salinity is a recurrent problem in dry and coastal areas. If the monetary and technical resources are offered, seawater or saline groundwater can be

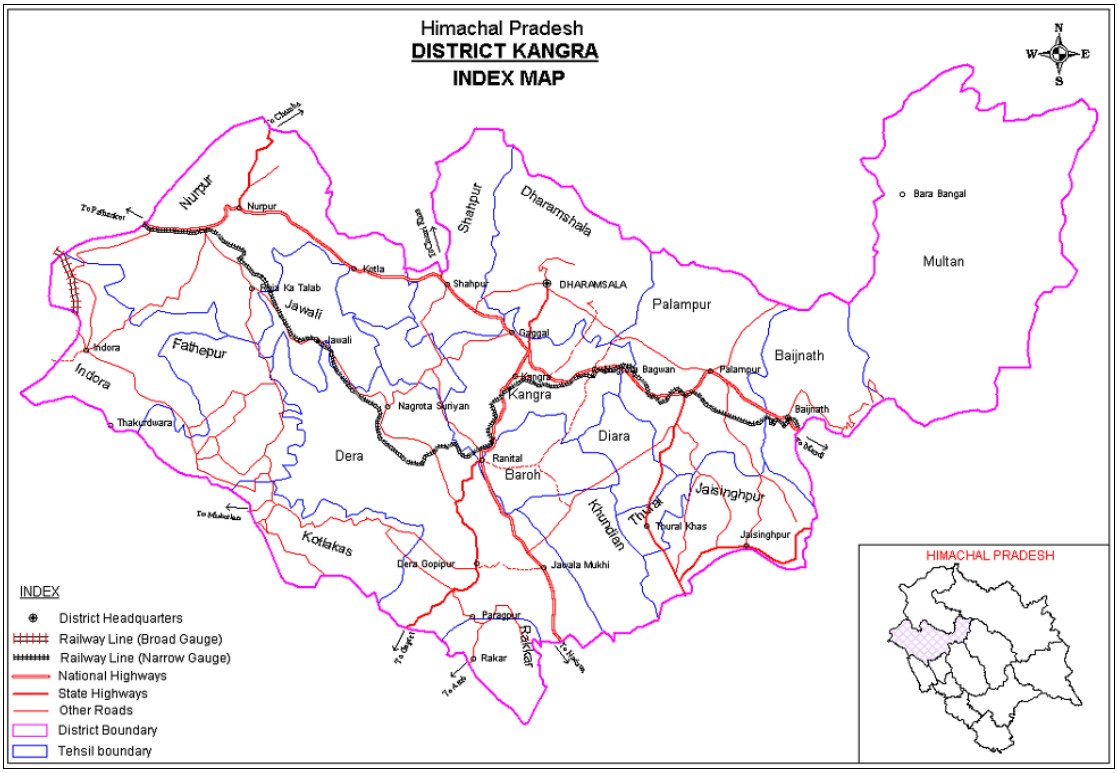
  

refined but in several situations this is not viable. Despite the fact that water is available in ample quantities, the unapt quality parameters make it unavailable. While the natural ecosystem is in accord with natural water quality, some important alterations to water quality will commonly be disturbing to the ecosystem [3]. Contaminated water that cannot be used for consumption, washing, industry, or cultivation negatively impact the quantity and the use of water present in a given area. Treatment of contaminated water that usually contains toxins is difficult because high level of contamination makes the process complicated and therefore it is practically impossible to maintain the WHO standard.

## AREA OF STUDY

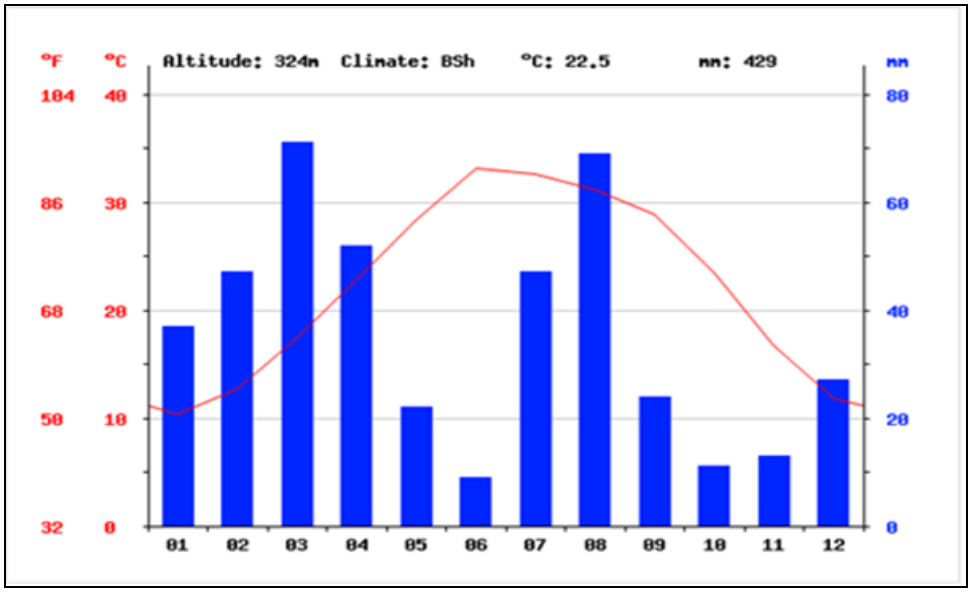
Kangra, (Fig. 1) , the most populated district of Himachal Pradesh, with a population of 1,507,223, is located on the southern ridge of the Himalaya between 31°2 to 32°5 N and 75° to 77°45 E. The complete part of the district is crossed by the wavering altitude of the Shivaliks, Dhauladhar and the Himalayas from north-west to south-east. The district has a geographical area of 5,739 km. The altitude varies from 500 meters above the average sea level to 5000 meters. According to the 2011 census Kangra district has a population of 15,07,223. Due to its ideal location, Kangra is renowned for tourism activities and therefore the district's economy is centered mainly on tourism apart from agriculture and industrial resource [4]. While Kangra is gifted with ample freshwater resources such as River Beas, River Ravi, Dal Lake, Kareri Lake and Pong reservoir; along with numerous ground water sources such as dug wells, hand pumps, tube wells and springs, due to environmental degradation, tourism and several developmental activities, the water quality is grimly impacted.

The climatic condition of the region of district Kangra is a mixture of Sub-Trophical and Sub-Humid. The time period of December to February is of winter and summer extends from March to June while July to September are Rainy Months. Snow fall is received in the higher reaches of Dhauladhar ranges. Average Minimum and Maximum temperature are 3°C and 45°C [6].Fig.2 shows the climate and rainfall of the Kangra.




*(Source: CGWB, 2013* [5]).

***Fig.1:*** *Location map of Kangra district, Himachal Pradesh.*




*(Source: en.climate-data.org/location/52082)* [6].

***Fig.2:*** *Climate and rainfall pattern of Kangra district, Himachal Pradesh.*

## MEASURING WATER QUALITY

There is a need to analyze the water bodies on regular intervals for its suitability for drinking. One may do it through simple field testing for a single analysis or through laboratory based multi-component instrumental analysis. The chemical analysis of water commonly reports the total quantity of a particular element or ion without specifying its actual form in solution. For use in chemical thermodynamic calculations, the concentrations of participating reactants or products must be identified as specific solute species.

The existence of pollutants and the physiognomies of water are used to specify the quality of water. These water quality indicators can be characterized as a) Chemical b) Biological c) Aesthetic d) Physical and e)Radioactive.

Amounts of these quality indicators can be used to ascertain and observe variations in water quality, and conclude if the water is fit for the wellbeing of the ecosystem and the purposes for which the water is required. While the development of water quality monitoring programs is an intricate and dedicated study, the cost of a monitoring program to evaluate them would be expensive and therefore the resources are generally focused on evaluating the contaminants that are important for the local environment or for a specific use of the water. This water quality data must be applied to improve management programs and action plans to ensure that water quality is protected [7].

There are numerous method to check the quality of water. One of them is measuring the salinity. To measure the salinity we first take a standard solution and then we compare the sample against the standard one. We can measure the dissolved solids by calculating the specific conductance.

As per the United Nations [8], water contamination not only affects the water quality but also directly impacts the quantity as the contaminated water cannot be utilized for drinking, agricultural, domestic purposes due to which the amount of useable water significantly reduces. However, fresh water and ground water quality is influenced by human-induced activities and natural processes. Water quality problems are different and composite and therefore require immediate worldwide attention and equivalent action.

According to the United Nations World Water Assessment Programme [9], every day, 2 million tons of sewage and industrial and agricultural waste are discharged into the world's water system, the equal to the weight of the complete human population of 6.8 billion people. They also evaluated that the

quantity of wastewater generated every year was about 1,500 km3, which is six times more water that exists in all the rivers of the world. Absence of sufficient sanitation pollutes water resources globally and is one of the utmost important forms of water pollution.

A survey report by the UNICEF and WHO[10], across the world about 2.5 billion people live without better sanitation of which more than 70 per cent of these people lack sanitation.

Contaminated or insufficient water, sanitation, and infection are source to roughly 3.1 per cent of all deaths globally, and 3.7 per cent of DALYs (disability adjusted life years) globally. Universal use of polluted or insufficient water, lack of sanitization and hygiene will nearly drive 1.7 million deaths annually [11].

Extensive human activities are also the cause of poor water quality in a particular area. Four main kinds of activities are agricultural practice, industrial and mining activities, and the direct dumping of untreated or moderately treated human wastes into water systems. Some other factors like growth of population, growth in urbanization and the climate change causes negative effect on water quality, [2].

Tourism's influence on fresh water availability and quality is reliant on an extensive array of aspects, such as the comparative ample water quantity and quality in the tourist region, the present and predicted future rates for extracting water, the part of non-consumptive set against consumptive uses, the seasonal and spatial character of water extraction, challenging practices, and the management of sewage and wastewater. As these issues are interconnected there is a serious requirement to examine the likely measures to water management: there may be negotiated explanations, or a compromise may be obligatory amongst these aspects. Several hotels provide lavish water entertainments such as water games, swimming pools, fountains etc. despite having significant prospects to reduce water consumption. Water management should also reflect indirect water consumption; though, as a large share of water use might be rooted in the consumption of goods imported from elsewhere. Evidence recommends that where water consumption is reduced, this can usually be achieved without any loss of convenience for guests, and at a financial gain. As an example, investments in water saving technology in hotels, including new showerheads, new pan and cisterns, or flow control in taps typically have reimbursement periods from a few months to less than five years [12].

In an article cited by Lenntech [13], metals enter the water resources due to the weathering of soils and rocks, from volcanic eruptions, and from a variety of human activities involving the mining, manufacturing, and consumption of metals and substances that comprise of metallic contaminants. The utmost common heavy metal pollutants are arsenic, cadmium, chromium, copper, nickel, lead and mercury. After the pH level in water drops, metal solubility upsurges and the metal particles become more movable. "That is why metals are more toxic in soft waters. Metals can become 'locked up' in bottom sediments, where they remain for many years. Streams coming from draining mining areas are often very acidic and contain high concentrations of dissolved metals with little aquatic life. Both localized and dispersed metal pollution cause environmental damage because metals are non-biodegradable."

As per Woodford [14], surface waters and ground waters are severely impacted by water contamination. There are two diverse means of water contamination. If contamination originates from a distinct site, such as a discharge pipe attached to a factory, it is known as point-source pollution or an oil spill from a tanker, a discharge from a mining factory chimney and the like. If contamination occurs from several distributed causes, it is called nonpoint-source pollution. When point-source pollution comes into contact with the environment, it normally impacts the place within the proximity around the source. For instance, the oil spilt from a tanker, is high around the tanker, but in the right oceanic surroundings, the pollution scatters further away from the tanker. This is less likely to happen with nonpoint source pollution which,

by definition, enters the environment from many different places at once. At times when the contamination enters the environment in one place, has a wider consequence. Such pollution is termed as trans-boundary pollution.

The highly toxic chemicals are polychlorinated biphenyls (PCBs) that were used in the production of electronic circuit boards, their detrimental effects have now been identified and their use is greatly constrained in several countries. Yet, a projected half million tons of PCBs were discharged into the environment during the 20th century. While PCBs are extensively disqualified for use, their influence will be felt for many years since they last an extended period of time in the environment without breaking down [15].

A different kind of toxic contamination derives from heavy metals, such as lead, cadmium, and mercury. While Lead was frequently used in gasoline, its use is now constrained in some countries. Mercury and cadmium are continually used in batteries although many products have replaced them with other metals. Of late, an extremely toxic chemical called tributyltin (TBT) was used in paints to shield boats from the damaging effect of the saline water of the oceans. Poignantly however, TBT was progressively known as a contaminant: boats painted with it were doing as much damage to the oceans as the oceans were doing to the boats [16].

An extensive study was carried out by Sharma and Walia [17] in 256 km stretch of river Beas in Himachal Pradesh for analysis of the significant physical, chemical and biological water quality factors during winter season. Factors such as temperature, pH, conductivity, turbidity, alkalinity, total dissolved solids (TDS), total hardness, calcium, magnesium, potassium, sodium, cadmium, copper, iron, lead, chloride, fluoride, nitrate, biological oxygen demand (BOD), chemical oxygen demand (COD), Colliform and Escherichia coli were evaluated from six sampling stations i.e. Beaskund, Shamshi, Pandohdam, Dharampur, Nadaun and Pongdam in the study area. The analysis of data reveals that turbidity, cadmium and lead, were found to be greater than the permissible limit prescribed by Bureau of Indian standards (BIS), 2012 for water consumption in India. Colliform and E.coli occurred in all the sampling stations of river Beas except two substations at SS-1 and SS-2. All the other physicochemical factors excluding pH at SS-5 (8.98±0.057) were within the permissible limit prescribed by World Health Organization (WHO), 2011 and BIS, 2012 for drinking water in India.

According to the study carried out by Thakur and Panda [18], a high gradation of contamination in the potable water sources was observed in Kangra. The bacteria coliform was present in 90 per cent of the water supply and the natural water resources that indicates poor water management and disinfection of these sources. Of the total 70 water resources, 18.5 per cent i.e. 13 water resources provided uncontaminated potable water and reduced water quality throughout Kangra is a warning to a severe public health hazard due to waterborne diseases in the region. Whereas a survey report by MWR (2013) says that ground water quality is good both for irrigation and domestic purpose. The chemical properties were also found to be intact and within permissible limit.

Water pollution by plastic and micro plastic is another big issue that world is facing today. Due to tourism and other anthropogenic activities plastic litter and micro plastic litter adversely polluted the local water bodies and ultimately affect living organism and at the end human health. This is one of the concerning area one should focus in future research to minimize the water pollution due to plastic and micro plastic.

## DISCUSSION

The literature as given in table 1, presents a wide range of studies pertaining to water contamination, the possible impact on human health and ecosystems. While there is much emphasis on conservation of water, yet water contamination is a major crisis across the world attributable to diminishing water quality and quantity. On a daily basis, myriad tons of ineffectively treated sewage, industrial and agricultural effluents are discharged into the waters. Despite several measures undertaken by the international organizations, water contamination still persists as the world's top most concern.

***Table 1:*** *Findings of literature review.*

| Sl. No. | References | Findings |
|---|---|---|
| 1. | United Nations (2011) | Water contamination affects the water quality and quantity as the contaminated water cannot be utilized for drinking, agricultural, domestic purposes due to which the amount of useable water significantly reduces [8]. |
| 2. | United Nations World Water Assessment Programme (2003) | Per day, 2 million tons of sewage and industrial and agricultural waste are discharged into the world's water. The quantity of wastewater generated every year was about 1,500 km3 [9] |
| 3. | UNICEF and WHO (2008) | About 2.5 billion people live without an apt sanitation system and 70 per cent of these people lack sanitation [10] |
| 4. | WHO (2002) | Contaminated or insufficient water, sanitation, and infection are source to roughly 3.1 per cent of all deaths globally, and 3.7 per cent of DALYs (disability adjusted life years) globally. These factors will drive 1.7 million deaths annually.[11] |
| 5. | Carr and Neary (2008) | The causative factor for water contamination includes both the Anthropogenic activities and natural activities.It ultimately results into changes in nutritional components, Ph value of the water. [19] |
| 6. | Palaniappan et al, (2010) | Human induced activities such as agricultural production, industrial and mining activities, water infrastructure, and the direct dumping of untreated or moderately treated human wastes into water systems – impact water quality. Population development, urbanization, and climate change also hamper water quality.[2] |
| 7. | Postel (1999) | The Indus basin retained salts in the soils and groundwater [20]. |
| 8. | Gossling (2002) | Tourism affects water quality and thus requires water management for convenient use for guests must be undertaken and investments in water saving technology in hotels must be preferred [12]. |
| 9. | Dakers et al. (2004) | The tourism related activities in small regions affect the town's water, wastewater and waste services. The amount of impact differs extensively, reliant on the nature of the activity.[21] |
| 10. | Lenntech (2012) | The common heavy metal pollutants of water are arsenic, cadmium, chromium, copper, nickel, lead and mercury. Metals are more toxic in soft waters. Both localized and dispersed metal pollution cause environmental damage because metals are non-biodegradable [13]. |
| 11. | Woodford (2016) | Surface waters and ground waters are severely impacted by water contamination. There are 2 ways of contamination, point-source pollution and nonpoint-source pollution [14]. |
| 12. | Fiedler (1997) | The use of highly toxic chemicals are polychlorinated biphenyls (PCBs) are now restricted but the impacts of this chemical will last for a long duration [15]. |
| 13. | Santillo et al (2001) | Lead, cadmium, tributyltin (TBT) and mercury are toxic contaminants of water [16]. |
| 14. | Sharma and Walia (2016) | Bacteria Colliform and Escherichia coli were found in several parts of River Beas in Himachal Pradesh. Also, turbidity, cadmium and lead, were found to be greater than the permissible limit. pH was normal [17]. |
| 15. | Thakur and Panda (2011) | The bacteria coliform was present in 90 per cent of the water supply and the natural water resources. Of 70 water resources, 13 water resources provided uncontaminated potable water and reduced water quality throughout Kangra [18]. |
| 16. | MWR (2013) | Water samples procured from shallow and deep aquifers suggested that the complete ground water quality in the Kangra is good, both for irrigation and domestic purpose. The chemical parameters are also within the permissible limits [19]. |
| 17. | Gleick (2010) | In Switzerland 80 per cent of plastic PET bottles are recycled which is more than the European average of 40 percent [20]. |
| 18. | Ghimire et al (2013) | Water contamination has shown a correlation with season. It is found to higher in summer relative to winter [21]. |
| 19. | Jarup (2003) | Continual contact to arsenic in drinking-water accounts for skin cancer and other types of cancers, along with other skin lesions such as hyperkeratosis and pigmentation changes. Cadmium exposure may cause skeletal damage [22]. |
| 20. | Verma and Dwivedi (2013) | Excessive metal toxic content in water can result in several disorders like failure of central nervous system, allergy. Certain other result can be damage of lungs, reduces level of energy and damage of kidney[23]. |
| 21. | Edutree | Hepatitis, cholera, dysentery, and typhoid are the most common water-borne diseases that are contagious and occur due to poor sanitization.[24] |

The major cause of deteriorating water quality is water illiteracy of people. Several villages across the world have no sanitation which is a source of water contamination. The primary causes for water contamination are the human-induced activities such as agrarian activities, industrial and mining effluents, lack of sanitation; and naturally occurring activities

such as volcano, salt water intrusion and the like. In addition to these activities, rapid growth in population and urbanization has led to diminishing water quality. Tourism also has contributed to reduced water quality ascribable to poorer water management of the tourist regions. The industrial and mining activities discharge harmful and hazardous effluents that cause massive water pollution.

Heavy metals that are not biodegradable and result in water pollution are Cadmium, Chromium, Copper, Nickel, Lead, Mercury and the like. There are various toxic chemicals such as polychlorinated biphenyls that are also a source of water quality reduction. The reduced water quality and insufficient water quantity may lead to higher rate of deaths. In spite of ample water present across the world, water has become inadequate as low quality water is not suitable for drinking, domestic and agricultural purposes.

Various literatures provide the analysis of water quality in several parts of the world confirming water contamination caused by the anthropogenic activities and nature induced situations. The surface waters are contaminated by the mentioned activities and groundwater is affected by intrusion of salt water or toxic substances penetrating through the soil.

Kangra, the most populated district of Himachal Pradesh, India, has been a victim of low water quality attributed to factors such as agriculture, industries and tourism. These aspects have led to reduced quality of water thereby causing insufficient water quantity. While several water samples suggest the bacteriological presence in Kangra's water resources, the groundwater board has affirmed that groundwater quality has not been compromised.

The common heavy metal pollutants of water are arsenic, cadmium, chromium, copper, nickel, lead and mercury. Metals are more toxic in soft waters. Both localized and dispersed metal pollution cause environmental damage because metals are non-biodegradable. The literature provides a brief note on the health consequences of the heavy metals leading to skin diseases, cancers, nervous system damage, allergies, reduced energy levels, damage to vital organs and many more. The contamination caused by lack of sanitization can lead to several water- borne diseases such as cholera, typhoid, hepatitis and dysentery.

The literature is extensively precise on the consequences of water contamination. A well-defined water management system must be undertaken by the authorities to avert the declining water quality.

## CONCLUSION

Water has always been the focus of healthy ecosystems and human societies, yet the freshwater resources on human beings rely are becoming gradually more contaminated. This review briefly describes several studies and articles related to water quality daunting factors. The decline of drinking water quality due to various factors has been well documented. However, there is a view that post-supply contamination is of little public health consequence. The literature provides evidence that while the water quality of fresh water and ground water is an important facet, several factors such as human induced activities and natural have severely caused continual detriment to the world.

Kangra, the most populated district of Himachal Pradesh, is facing water quality problems due to its economy of agriculture, tourism and farming. However, with water becoming scarce in Kangra and various parts of the world, mainly due to water illiteracy, achieving high water quality requires a thorough study for determining approaches that enhance the water quality for drinking purposes.

The world is subjected to a quickly growing set of water quality challenges. Nevertheless, operational explanations to these challenges occur and can be instigated. Solutions to water quality glitches can be established at numerous scales. There is an excessive amount of unpredictability in the water quality status and in the supervisory administration guarding water quality in countries all over the world.

**REFERENCES**


1. NOAA, Florida Keys National Marine Sanctuary, Available at http://floridakeys.noaa.gov/ocean/waterquality.html
2. Palaniappan M, Gleick PH, Allen L, Cohen MJ, Christian-Smith J, Smith C. Clearing the waters: a focus on water quality solutions. UNEP, Nairobi. 2010.
3. Bartram, Jamie, Richard Ballance, and World Health Organization. Water quality monitoring: a practical guide to the design and implementation of freshwater quality studies and monitoring programs. (1996).
4. Kangra official website, About Kangra, Available at http://himachal.nic.in/index1.php?lang=1&dpt_id=219&level=0&lid=11351&linkid=3787
5. Central Ground Water Board. 2013. Ground water information booklet; Kangra District, Himachal Pradesh. Northern Himalayan Region, Dharamshala. Ministry of Water Resources, Government of India.
6. en.climate-data.org/location/52082
7. NSW, Office of Environment and Heritage, NSW, Water quality, http://www.environment.nsw.gov.au/water/waterqual.htm
8. Water, U. N. Water quality policy brief. Nairobi 22, 2011.
9. WWAP, UN. "United Nations World Water Assessment Programme. The World Water Development Report 1: Water for People, Water for Life." 2003.
10. UNICEF W. WHO Joint Monitoring Programme for Water Supply and Sanitation. Progress on drinking water and sanitation. 2012.
11. World Health Organization. The world health report 2002: reducing risks, promoting healthy life. World Health Organization; 2002.
12. Gössling S. Global environmental consequences of tourism. Global environmental change. 2002; 12(4):283-302p.
13. Lenntech B.V., Heavy Metals, Available at Website:www.lenntech.co./periodic.periodic-chart.htm (2012)
14. Woodford C. Water pollution an introduction, Environ Sci, 2016 5: 365-69p.
15. Fiedler H. 12. Polychlorinated Biphenyls (PCBs): Uses and Environmental Releases. URL http://www. Chem. unep. Ch/pops/POPs_Inc/proceedings/bangkok/FIEDLER1. Html. 1997.
16. Santillo D, Johnston P, Langston WJ. 13. Tributyltin (TBT) antifoulants: a tale of ships, snails and imposex. Late lessons from early warnings: the precautionary principle 1896–2000. 2001:135.135–48p
17. Sharma S, Walia YK. Water Quality Assessment of River Beas during Winter Season in Himachal Pradesh, India. Current World Environment. 2016; 11(1):194p.
18. Thakur SD, Panda AK. Laboratory Investigation of Drinking Water Sources of Kangra, Himachal Pradesh. J. Commun. Dis. 2012; 44(2):103-8p.
19. Ministry of Water Resources, Ground Water Information Booklet Kangra District, Himachal Pradesh. Central Ground Water Board.2013
20. Gleick PH. Bottled and sold: The story behind our obsession with bottled water. Island Press; 2010.
21. Ghimire G, Adhikari B, Pradhan M. Bacteriological analysis of water of Kathmandu Valley. Medical Journal of Shree Birendra Hospital. 2015; 12(2):19-22p.
22. Järup L. Hazards of heavy metal contamination. British medical bulletin. 2003 Dec 1; 68(1):167-82.
23. Verma R, Dwivedi P. Heavy metal water pollution-A case study. Recent research in science and technology. 2013 Jul 27; 5(5).
24. The energy and resource institute, Health impacts of water pollution, Available athttp://edugreen.teri.res.in/explore/water/health.htm



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