

**HP STATE POLLUTION CONTROL BOARD**  
**BELOW BCS, PHASE-III, NEW SHIMLA (H.P.)**

No. PCB-OA No. 187/2023- 651

Dated: 23/05/2023

To

✓  
**The Registrar General**  
**Hon'ble National Green Tribunal**  
Faridkot House, Copernicus Marg, New Delhi-110001

**Subject: Joint Inspection Report in compliance to Hon'ble NGT's order dated 13.03.2023, passed in O.A. No. 187/2023 titled as Shailendra Kumar Yadav Vs. State of Himachal Pradesh & Ors., pending before the Hon'ble NGT, Delhi.**

Sir,

Kindly refer to the order dated 13.03.2023, passed by Hon'ble NGT in the afore-cited matter wherein, following directions have been passed:-

*".....7. In our view, a substantial question relating to environment due to implementation of Scheduled Enactments under NGT Act, 2010 has arisen but before taking any further action in the matter, we find it appropriate to obtain a factual report for which purpose we constitute a joint Committee comprising Divisional Forest Officer, Shimla, Regional Officer, MoEF&CC, Chandigarh, State PCB and District Magistrate, Shimla who shall visit the site, collect relevant information and submit a factual as well as action taken, if any, report within two months by e-mail at judicialngt@gov.in preferably in the form of searchable PDF/ OCR Support PDF and not in the form of Image PDF.*

*9. List this matter for further consideration on 25.05.2023.....".*

In compliance to afore-cited Hon'ble NGT's order dated 13.03.2023, the Committee has submitted a Joint Inspection Report dated 23.05.2023 (annexed at **Annexure R-1**) which may kindly be placed on record please. The State Board has also requested the concerned Forest Department vide letter dated 23.05.2023 (**Annexure R-2**) to take all necessary remedial/regulatory actions in view of the observations/recommendations of the Joint Committee.

**(Encl: as above)**  
*(through e mail)*

Yours faithfully,

  
**(Lalit Kumar)**  
**Regional Officer**  
**HPSPCB, Shimla**



**HP STATE POLLUTION CONTROL BOARD**  
**REGIONAL OFFICE, "HIM PARIVESH"**  
**PHASE - III, NEW SHIMLA - 171009**



[www.hppcb.nic.in](http://www.hppcb.nic.in)

[e-mail: pcbroschimla@gmail.com](mailto:pcbroschimla@gmail.com)

No. PCB/ROS/ Court Case (OA No. 187/2023)/23- 647-50

Dated- 28/05/2023

To

**The Member Secretary,**  
 HP State Pollution Control Board,  
 Him Parivesh, Phase-III,  
 New Shimla, Distt. Shimla (HP)-9

**Subject: - OA No. 187/2023 titled Shailendra Kumar Yadav Vs State of HP pending before Hon'ble National Green Tribunal- regarding.**

Sir,

This is in reference to HPSPCB HO letter No. PCB-OA No. 187/2023-22442-45, dated 21.02.2023 on the subject cited above. In this context, please find attached herewith the joint inspection report of the committee.

Submitted for kind information please.

Yours Faithfully,

**Enclosed: - i) Joint Committee Report**  
**ii) Proceeding of the Joint Committee**  
**iii) Forest Department Report**  
**iv) HFRI Expert Report**  
**v) Water Sampling Report**  
**vi) Revenue Map**  
**vii) IS:10500:2012**

  
**Environmental Engineer**  
**HP SPCB, Shimla**

Copy to: -

- 1) **The Deputy Commissioner, Shimla (HP)** for information, please.
- 2) **The Regional Officer, MoEF & CC, Integrated Regional Office, Bays No. 24-25, Sector 31A, Dakshin Marg, Chandigarh (UT) 160030** for information, please.
- 3) **The Divisional Forest Officer, HP Forest Department, Division Shimla (Rural), Distt. Shimla (HP)** for information, please

  
**Environmental Engineer**  
**HP SPCB, Shimla**

**Joint Inspection Report of the Committee Constituted in Compliance to Order Passed By Hon'ble National Green Tribunal in O.A No. 187/2023 titled Shailendra Kumar Yadav Vs State of HP on dated 13.03.2023.**

**Background Note:-** Hon'ble National Green Tribunal passed the following orders on 13.03.2023 in O.A No. 187/2023 titled Shailendra Kumar Yadav Vs State of HP.

*".....7. In our view, a substantial question relating to environment due to implementation of Scheduled Enactments under NGT Act, 2010 has arisen but before taking any further action in the matter, we find it appropriate to obtain a factual report for which purpose we constitute a joint Committee comprising Divisional Forest Officer, Shimla, Regional Officer, MoEF&CC, Chandigarh, State PCB and District Magistrate, Shimla who shall visit the site, collect relevant information and submit a factual as well as action taken, if any, report within two months.*

*9. List this matter for further consideration on 25.05.2023....."*

In compliance to the orders passed by Hon'ble National Green Tribunal dated 13.03.2023, first meeting of joint committee was held at HP Forest Rest House, Kufri on 24.03.2023. Physical inspection of various spots i.e. starting point of Kufri-Mahasu peak, Horse Stable and other surrounding areas of Kufri was also carried out. After detailed deliberation, following decisions were taken:-

- a) Patwari, Mundaghat will prepare the revenue map of the area in question and will provide the same to HPSPCB.
- b) The carrying capacity of Kufri area in terms of maximum no. of horses and the impact of movement of horses (on Kufri-Mahasu peak mule path) on the surrounding forests need to be assessed for which services of an expert from HFRI may be taken. Forest department, SADA Kufri, Gram Panchayat Kufri and HPSPCB will assist the expert for the same.
- c) State Pollution Control Board will collect the samples from nearby water sources (if any), in order to assess the possibility of ground water contamination from horse dung.

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- d) SADA Kufri in consultation with DFO, Shimla (Rural) & DFO (Wild Life), Kufri, HP Forest Department will study the *SADA Kufri Ghudsawari Niyamavali, 2016* and will incorporate the changes suggested by Forest Department in the same. The copy of proceedings of first meeting of the joint committee is attached as **Annexure-I**.

As per information received from various departments, the detailed report is as under.

- (I) Patwari, Mundaghat has prepared the revenue map as per which total length of the mule path is 1087 mtrs. and width 6 mtrs. Further, there are 1029 no. of horses registered with SADA in Kufri area. The people located in surrounding Gram Panchayat of Kufri Shawah, Nala, Makhrol, Tayia etc. earn their livelihood from these horses.
- (II) Out of the total 1 Km, approx. 800 mtrs. falls under the administrative control of Theog Forest Division and the said area is reserve forest (R4 Teer Mahsu compartment 1) whereas, the rest of the area approx. 200 meters is under the possession of Central Potato Research Institute. Kufri is located at an elevation of 2,720 mtrs. and is known for good snowfall during the months of December to February, the best time to visit Kufri is during summers ( April- June). The area has lush green deodar forest with Shimla water catchment wildlife sanctuary on one side and Shimla Forest Division (Rural) on another side. The trails/paths in question lead to the highest points of Kufri called Mahasu peak which is one of the major attractions of Kufri. Being located at the edge of wildlife sanctuary the area is having prominent importance to deal with management/supervision of horses operating in that area, It has been observed that horses/ponies are being parked at random sites in large number and non supervision of the same leads to entry of horses in nearby forest area of Shimla forest division and Shimla wildlife catchment WLS which as per Wildlife Protection Act, 1972, Section 33A mandates the Chief Wildlife Warden to take all such measures as may be prescribed for immunization of communicable disease of livestock kept in or within 5 km of a sanctuary. Further, the act also prohibits that no person should take or cause to be taken or grazed any livestock in a

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sanctuary without getting it immunized. The unregulated horses/ponies are responsible for causing damage to the ecology not only of the prescribed trail/path but also responsible for the destruction of the green areas in and around the area in question. Further it has been found that certain assets in the form of temporary shops, parking for vehicles, halting points for horses/pony and other related activities have been created and the legalities need to be verified.

From field visits, it has been found that the path utilized for horse riding is poorly maintained and does not fit into the preview of equestrian trail as followed in developed countries. Further huge no. of horses are in operation in the said area which is not only creating chaos among the visitors but also leading to fatal accidents on certain occasions. Being a highly crowded area the same is not recommended for visitors who come with families and children. The facts can be verified from the views offered by the visitors on trip advisor.

To assess the carrying capacity of the trail with respect to operationalization of horse riding for the visitors, it has been calculated that 200-217 horses/ponies per day can be allowed with a check of 27 horses/ponies per hour. Physical, real, and effective carrying capacity were assessed by Cifuentes' methodology (Cifuentes, 1992), adapted according to specific bio-physical peculiarities and characteristics of the area, as suggested by the IUCN (Ceballos-Lascuráin, 1996).

Detailed report of Forest Department is attached as **Annexure-II**.

- (III) The area was visited by experts from HFRI on 02.05.2023, 06.05.2023 and 09.05.2023. Field surveys were also conducted as per the reconnaissance. Three sampling sites were marked for data collection; one site was along the pony/mule path, the other site was 50 mtrs. away from the path, while the third sampling site was over 100 mtrs. away from the pony/mule path. Quadrates were laid for phyto-sociological attributes and soil samples (edaphic data) were collected for further analysis at the Institutes laboratory. Besides, the general vegetation was also recorded in the study area, details of study are as under:

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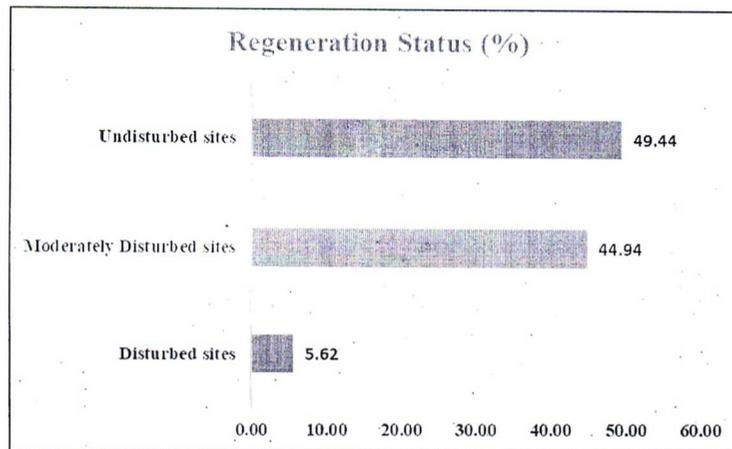
**(a) Plant Community Data Analysis:**

The plant community data gathered from the sample plots were analyzed for plant species composition within given plant communities by estimating the dominance in density (D), frequency (F), abundance and important value index (IVI) of all species. For comparison, the vegetation has been classified into three main zones as mentioned above: 1) Besides the pony/mule trail (referred to as the **Disturbed area**); 2) Natural Forest 50 mtrs. (**Fringe area**); and 3). Natural forest 100 mtrs. away (Natural Forest/**Control**). From the data obtained, it can be stated that the forest community is dominantly *Cedrus deodara* - *Picea smithiana*, with *C. deodara* having highest density (Zone I). At Zone II, it is *C. deodara-Quercus floribunda* - *Abies pindrow* community; while at Zone III it is *A. pindrow* - *Q. floribunda* - *C. deodara* community.

**(b) Tree Regeneration:**

A process that allows a forest to sustain itself through the growth and survival of seedlings and saplings that replace large forest trees with time. Higher number of new recruits (seedling/saplings) indicates good regeneration potentials. The subplots were studied to survey saplings and seedlings, respectively, and to compare natural tree regeneration between the various vegetation types to identify the influence of tourism activity. It was found that these activities differentially influenced sapling and seedling density among vegetation types. The density value of seedlings and saplings are considered as an indicator of regeneration potential of the species in which the presence of good regeneration indicates the suitability of a species to the environment, which is in turn affected by climatic factors and biotic interference influence.

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The data from the above tables clearly indicate that the disturbed site (zone I) has “poor” regeneration in comparison to natural forests (Zone II & Zone III). The greater regeneration status augers well for the sustainability of the forest.

- ✓ In Zone I, regeneration of **2** tree species (*Picea smithiana* & *Euonymus tingens*) recorded.
- ✓ In Zone II, **5** species were observed: *Q. semecarpifolia*, *E. tingens*, *C. deodara*, *P. wallichiana*, and *P. smithiana*.
- ✓ Zone III had better regeneration, with **6** tree species: *C. deodara*, *E. tingens*, *P. wallichiana*, *Ilex dipyrena*, *P. smithiana*, and *A. pindrow*.

The regeneration of trees in disturbed sites was significantly low, but it increased from 44.94% in moderately disturbed sites to 49.44% in undisturbed sites. This discontinuous regeneration at the site adjoining the mule/pony tracks, due to which it is expected that the tree species although dominant at present, may be at risk in the future.

**(c) Alien Invasive Plants:**

Based on published secondary data on invasive alien species in Himachal Pradesh, a number of non-native alien invasive plants (**12**) were found in this study area. However, the more realistic number of exotics/invasives will be found only after the monsoon season, when majority of the alien plant species dominate the degraded areas.

**(d) Edaphic Factor Data Analysis:**

The soil samples collected from three main zones/sites mentioned above were analyzed in the institution laboratory, and parameters such as pH, Electric Conductivity (EC), available Nitrogen (N), Phosphorous (P) and Potassium (K) were recorded. The observed data can be enlisted as given below:

**Different Soil Parameters of Samples from Different Zones**

Site	pH	EC ( $\mu$ S)	N (Kg/ha)	P(Kg/ha)	K(Kg/ha)
<b>Zone 1 (Disturbed area)</b>	7.03	130.7	206.97 (Low)	57.31	861.28 (High)
<b>Zone 2 (Fringe Area)</b>	6.96	115.2	292.02 (Low)	41.13	847.84 (High)
<b>Zone 3 (Natural Forest/Control)</b>	6.17	92.4	345.21 (High)	4.04	264.44 (Low)

From the observed data, it can be assumed that the disturbed area with high pH i.e., alkaline in nature with high electric conductivity of 130.7  $\mu$ S, along with the available N is lowest in the disturbed area; while the available P and K are highest. High phosphorus and low nitrogen content indicates the excessive presence of inorganic extraneous substances which ultimately given rise to deficiency of iron and zinc, which are vital micronutrient for the growth of annual and perennial plants. Another major concern regarding high phosphorous content in the disturbed area can further find its way to the nearby streams during rains, thereby contaminating them with the inorganic pollutants, that would ultimately reduce the water quality.

**Noteworthy Observations:**

(a) ***Degradation Of Natural Vegetation:*** This has degraded not only the substantial proportion of the forest soils near the path, but also areas well beyond and forests at other sites are also becoming part of the degradation process. The construction activities along with the extensive paving/tiling of

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pathways and, the creation of parking lots, are also adding to the physical impacts of development on native vegetation. These developmental activities can cause severe disturbance and erosion of the local ecosystem, resulting in higher destruction in the long term.

(b) The mule/pony ride activity is emerging here as a distinct **driver of degradation**, and such anthropogenic pressures are reducing both the quantity and quality of the local forest around Kufri. The ponies are using the same trail repeatedly, resulting in trampling of the vegetation and soil, causing permanent damage to the trail, that can further lead to loss of biodiversity and other impacts in the forests further away. Such damage is visible even more extensive, where the ponies or even tourists frequently stray off the established trails, into the forest.

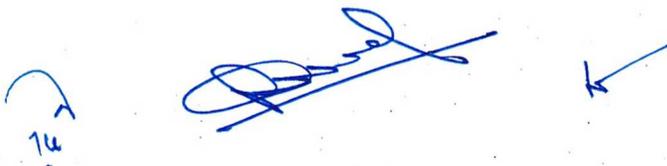
(c) In a nutshell, the overall vegetation population structure of the study sites showed absence of seedlings and saplings in the disturbed area. The findings revealed that **tree sapling/tree seedling densities** and the percentage ground cover were significantly lower in areas where the tourism activity was being undertaken, than in areas of natural undisturbed forests. This reflected the inability of native species to regenerate and disperse naturally in the degraded landscape. Thus, utmost care is required to ensure the survival of seedlings and saplings for restocking of adult individuals in times ahead.

(d) In addition, several introduced, invasive, alien plants and weeds were encountered, the diversity of these would normally increase during the monsoon months. Invasive alien plant species threaten native biodiversity, disrupt ecosystem functions, and can cause large economic damage. Plant invasions have been predicted to further increase under ongoing global environmental change (Liu et al., 2017).

(e) The degradation has also put in danger some unique and rare flora of this area. Notable being the Lady's Slipper Orchid (*Cypripedium cordigerum*).

The copy of the report of HFRI is attached as **Annexure-III**.

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- (IV) There was no ground water source in the vicinity of mule path. However, State Pollution Control Board collected water samples of two springs at i) Downstream Mule Path Kufri and ii) Bowdi near Kufri area. As per results received from HPSPCB Regional Lab, Shimla, all the parameters except, Turbidity and Faecal Coliform are within acceptable limits. Turbidity is within permissible limits. However, bacteriological analysis of the samples shows presence of Faecal Coliform in the water. (Results of water samples collected are annexed as **Annexure-IV**.)
- (V) At present solid waste management in Kufri area is being looked after by Gram Panchayat, Kufri. Door to door collection is being carried out partially from Kufri market area and some hotels. Solid waste collected is being sent to Waste to Energy Plant (M/s Elephant Energy Pvt. Ltd.) Bhariyal. As per information received from M/s Elephant Energy Pvt. Ltd., Bhariyal, Distt. Shimla (HP) about 68,980 Kg of waste has been sent for the month of April, 2023.
- (VI) HPSPCB and other stakeholders are carrying out cleanliness campaign in Kufri area from time to time. Apart from this mass awareness activities are also being carried out. One such program was carried out by HPSPCB in Kufri area on 11.02.2023. In addition to this, directions are also being issued to Gram Panchayat Kufri regularly for scientific management of solid waste.

**Conclusion:-** It is true that the field data collected point to a variety of probable impacts to the natural vegetation, resulting from tourism activity at Kufri. Mule or horse trails have many impacts on vegetation and soil that include damage to native vegetation, soil erosion, compaction, exposure of roots, etc. Plant damage includes reduction in vegetation height and biomass, changes in species composition and the spread of exotic weeds and plant pathogens. However, livelihood of thousands of people located in the Gram Panchayat Kufri Shawah, Nala, Makhrol, Tayia etc. depend upon the horses and other tourism related activities in Kufri. Therefore, the horse riding activity being carried out on a commercial scale involving 1029 horses/ponies need to be regulated as per the guidelines of MoEF & CC as the area of operation is Reserve forest and no such FCA Clearance has been sought in this regard. Further, the role of the Forest department in checking/managing the affairs has



been found almost negligible thus the same is to be carried out under the supervision of the Forest department. Also, registration of new horses may be restricted by SADA Kufri till adjoining forest area of the mule path be revived by forest department.



Lalit Thakur,  
Environmental Engineer,  
HPSPCB Shimla



Krishan Kumar (IFS),  
Divisional Forest Officer, Shimla Rural



Ravinder Singh,  
Assistant Commissioner (Forestry),  
MoEF & CC, IRO Chandigarh



Aditya Negi (IAS),  
Deputy Commissioner,  
Shimla

**Proceedings of the meeting of Joint Committee constituted by Hon'ble NGT vide order dated 13.03.2023 in O.A No. 187/2023 titled, Shailendra Kumar Yadav Vs State of HP held under the Chairmanship of Sh. Aditya Negi , IAS, Deputy Commissioner, Shimla in HP Forest Rest House, Kufri on dated 24-03-2023 at 02:00 PM.**

In compliance to the orders of hon'ble National Green Tribunal on 13.03.2023 in O.A. No. 187/2023, titled as Shailendra Kumar Vs. State of H.P., the meeting of joint committee was held in HP Forest Rest House, Kufri on 24.03.2023 at 2:00 PM. The following officers/officials were present in the meeting:

Sr. No.	Name & Designation	Department
1.	Sh. Krishan Kumar, DFO (Rural)	HP Forest Department
2.	Sh. Ravinder Singh, Technical Officer (Forestry)	MoEF&CC, IRO, Chandigarh
3.	Sh. N Ravisankar, DCF(WL), Shimla	HP Forest Department
4.	Sh. Chetan Sharma, Planning Officer	SADA, Kufri
5.	Sh. Surinder Kumar	SADA Kufri
6.	Sh. Yoginder Singh, RFO Theog	HP Forest Department
7.	Ms. Priyanka Verma, Panchayat Secretary	Gram Panchayat Kufri
8.	Ms. Shital Sharma, Forest Guard	HP Forest Department
9.	Sh. Akshay Mahant, Patwari (Mundaghat)	HP Revenue Department
10.	Sh. Neeraj Gupta, JE	SADA, Kufri
11.	Sh. Manoj Kumar, Tax Clerk	SADA, Kufri
12.	Sh. Lalit Thakur, EE	HP SPCB, Shimla
13.	Sh. Deepak Dogra, AEE	HP SPCB, Shimla
14.	Sh. Meharban Bharti, JEE	HP SPCB, Shimla

At the outset, Environmental Engineer, HPSPCB Shimla welcomed the Deputy Commissioner, Shimla and all the members of the committee. Thereafter, he apprised that an order has been passed by Hon'ble National Green Tribunal on 13.03.2023 in O.A No. 187/2023 titled Shailendra Kumar Yadav Vs State of HP wherein following directions have been passed:-

*".....7. In our view, a substantial question relating to environment due to implementation of Scheduled Enactments under NGT Act, 2010 has arisen but before taking any further action in the matter, we find it appropriate to obtain a factual report for which purpose we constitute a joint Committee comprising Divisional Forest Officer, Shimla, Regional Officer, MoEF&CC, Chandigarh, State PCB and District Magistrate, Shimla who shall visit the site, collect relevant information and submit a factual as well as action taken, if any, report within two months.*

*9. List this matter for further consideration on 25.05.2023....."*

PO, SADA Kufri apprised the committee that there are about 1,000 horses registered & regulated under "SADA Kufri Ghudsawari Niyamavali, 2016". Earlier tagging & immunization of the horses was initiated by SADA in 2022, but due to infection in horses, same was stopped. It is pertinent to mention here that fitness certificate of horses is taken by SADA at the time of registration.

Patwari, Mundaghat, HP Revenue Department apprised the committee that, the site in question belongs to three patwar circle. However, the road mentioned in the complaint is recorded as mule-path wherein 800 meter falls under the jurisdiction of HP Forest Department and rest belongs to Central Potato Research Institute, Kufri.

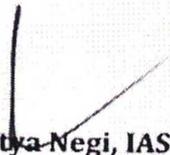
DFO, Shimla Rural apprised the committee that involvement of forest department should be there in framing any rules/policies for Kufri area. In addition to this, he suggested that carrying capacity of Kufri area in terms of maximum no. of horses may also be assessed to control the damage to ecology in surrounding area by horses.

Panchayat Secretary, Gram Panchayat Kufri apprised the committee that non bio-degradable waste from Kufri area is being sent to Waste to Energy Plant at Bharyal. Further, a bio-methanation plant of capacity 5 MT per day is proposed for the disposal of horse dung and other bio-degradable waste on PPP mode.

Thereafter, physical inspection of various spots i.e. starting point of Kufri-Mahasu peak, Horse Stable and other surrounding areas of Kufri were carried out. After detailed deliberation, following decisions were taken:-

- a) Patwari, Mundaghat will prepare the revenue map of the area in question and will provide the same to HPSPCB within 15 days.
- b) The carrying capacity of Kufri area in terms of maximum no. of horses and the impact of movement of horses (on Kufri-Mahasu peak mule path) on the surrounding forests need to be assessed for which services of an expert from HFRI may be taken. Forest department, SADA Kufri, Gram Panchayat Kufri and HPSPCB will assist the expert for the same. The team should submit its findings within 15 days.
- c) State Pollution Control Board will collect the samples from nearby water sources (if any), in order to assess the possibility of ground water contamination from horse dung.
- d) SADA Kufri in consultation with DFO, Shimla (Rural) & DFO (Wild Life), Kufri, HP Forest Department will study the "SADA Kufri Ghudsawari Niyamavali, 2016" and will incorporate the changes suggested by Forest Department in the same.

Finally, the meeting ended with the vote of thanks to and from the chair.

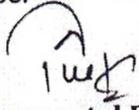
  
 (Aditya Negi, IAS)  
 Deputy Commissioner, Shimla

No. HPPCB/ROS/OA NO. 187/2023 (SKY Vs HP)/202-<sup>2604-2621</sup>

Dated: 31/03/2023

Copy forwarded to the following for information and necessary action:-

1. The Member Secretary, Himachal Pradesh, Pollution Control Board, Shimla.
2. The Director, HPFRI, Shimla for information and with a request to nominate an expert on the subject matter to evaluate the impact of movement of horses on the surrounding forest area.
3. All the Members of the Joint Inspection Committee for information and further necessary action please.
4. PA to The Deputy Commissioner, Shimla for information please.

  
Nodal Officer -cum- Environmental Engineer  
HPSPCB, Shimla, H.P.

### **Horse Riding Activity in Kufri (NGT Report)**

The issue of plying of horses in Kufri (Shimla) has been discussed at length with the locals, line departments and other stakeholders. The trail/path used for horse riding is approx. 01 km in length and on an average 4.3m in width. with respect to the legal status of the land approx. 800 mtrs. falls under the administrative control of Theog Forest Division and the said area is reserve forest (R4 Teer Mahsu compartment 1) whereas, the rest of the area approx. 200 meters is under the possession of Central Potato Research Institute.

The horse riding activity being carried out on a commercial scale involving 1029 horses/ponies thus need to be regulated as per the guidelines of MoEF & CC as the area of operation is Reserve forest and no such FCA Clearance has been sought in this regard. The role of the Forest department in checking/managing the affairs has been found almost negligible thus the same is to be carried out under the supervision of the Forest department. As on date the activity is being managed By SADA and & local panchayats of the area.

Kufri is located at an elevation of 2,720 m and is known for good snowfall during the months of December to February, the best time to visit Kufri is during summers ( April- June). The area has lush green deodar forest with Shimla water catchment wildlife sanctuary on one side and Shimla Forest Division (Rural) on another side.

The trails/paths in question lead to the highest points of Kufri called Mahsu peak which is one of the major attractions of Kufri.. Being located at the edge of wildlife sanctuary the area is having prominent importance to deal with management/supervision of horses operating in that area, a It has been has observed that horses/ponies are being parked at random sites in large number and non supervision of the same leads to entry of horses in nearby forest area of Shimla forest division and Shimla wildlife catchment WLS which as per WPA, 1972, Section 33A mandates the Chief Wildlife Warden 1. To take all such measures as may be prescribed for immunization of communicable disease of livestock kept in or within 5 km of a sanctuary further the act also prohibits that 2. No person should take or cause to be taken or grazed any livestock in a sanctuary without getting it immunized. The unregulated horses/ponies are responsible for causing damage to the ecology not only of the prescribed trail/path but also responsible for the destruction of the green areas in and around the area in question. Further it has been found that certain assets in the form of temporary shops, parkings for vehicles, halting points for horses/pony and other related activities have been created and the legalities need to be verified.

From field visits it has been found that the path utilized for horse riding is poorly maintained and does not fit into the preview of equestrian trail as followed in developed countries. Further huge no. of horses are in operation in the said area which is not only creating chaos among the visitors but also leading to fatal accidents on certain occasions. Being a highly crowded area the same is not recommended for visitors who come with families and children. The facts can be verified from the views offered by the visitors on trip advisor.

To assess the carrying capacity of the trail with respect to operationalization of horse riding for the visitors. It has been calculated that 200-217 horses/ponies per day can be allowed with a check of 27 horses/ponies per hour.

Further strict regulations are required to be adhered in black and white and suggestive regulation submitted below

### Management of equestrian trail for Kufri

In order to manage the existing trail at Kufri, the manager needs to focus on the challenge of identifying the carrying capacity of the trail as below.

Length of trail (total)	Number of visitors per year	Open window for tourists	Per visitor time span	Area required by horse to walk comfortably
1000m X 4.3m	2.5 lacs	8 hours	1 hour	3 meter

### Method to identify the carrying capacity :

Physical, real, and effective carrying capacity were assessed by Cifuentes' methodology (Cifuentes, 1992), adapted according to specific bio-physical peculiarities and characteristics of the area, as suggested by the IUCN (Ceballos-Lascuráin, 1996).

Physical Carrying Capacity (PCC) PCC is defined as the maximum number of users that can physically fit into, or onto, a specific area.

$$PCC = A \times U/a \times RF$$

Where: A = available area for public use (trail distance)

U/a= = Area required per user to walk comfortably

RF= = Rotation factor (number of visits/day)

$$\text{As per equation} = 4300 \times 1/3 \times 8 = 11,464$$

$$\text{Physical Carrying Capacity} = 11,464$$

Real Carrying Capacity (RCC) RCC is the maximum allowable number of users to the hiking trails, once the correction factors (Cf) derived from the particular characteristics of the site have been applied to the PCC.

$$RCC = PCC \times cf_1 \times cf_2 \dots$$

Where: Cf = correction factor

Firstly, we have to identify average no. = PCC/ average number of tourists per day

To calculate per day =  $250,000/365 \text{ days} = 685 \text{ tourist per day}$

$$= 11464/685 = 17 \text{ on average}$$

Putting cf for number of registered horse with number of visitors

$$= 1029/685$$

$$= 1.5 \text{ horse per visitor available}$$

Correction Factor				
Sunlight	Rainfall	Wind	Damage to wildlife	Temporary closure
.87	.85	.88	.92	.80

$$RCC = 11464 \times .87 \times .85 \times .88 \times .92 \times .80$$

$$RCC = 5550$$

Here = RCC/AVERAGE TOURIST

$$= 5550/17$$

$$= 326$$

326/horse per visitor available

$$= 326/1.5$$

$$= 217$$

The real carrying capacity of total 1 km trail is 217 horses for the span of 8 hours in 1 day

In 1 hour maximum horses/ponies that can walk in the trail is fixed as 27 No. keeping the distance of 37 meters between them

Other Management interventions required to be followed :

Management Strategy	Details
<b>Zoning</b>	
Defined Trails/Path	(1) The horse/pony trail to be defined and clearly marked with information for the visitors.
	(2) The path/trails must be located at a minimum distance of 500 meters from the edge of the nearest wildlife sanctuary (Shimla Water Catchment WLS)
	(3) No horse/pony activities to be allowed in ecologically sensitive areas.
<b>Site specific management</b>	
Managing Trails/Path	(1) The trail/path must be maintained on regular basis, as the said trail/path is utilized for horse riding thus special emphasis to be made to ensure the requirements it is recommended to apply trail hardening and surfacing techniques, such as gravel, earth, crushed stone and geo-synthetic (e.g. geo-textiles).

Management Strategy	Details
Regulating visitor use: Numbers of horses	(1) 27 horse/pony per hour
	(2) maximum no. of horse/pony allowed in span of 8 hours is 217

	(3) There should be a gap of 37 meter between two horses/pony
<b>Length of stay</b>	(4) Limit the length of time horse/pony users can access the area is 8 hours (10 am- 5 pm).

## Forest Degradation at Kufri: Probable Causes and Major Threats

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### Brief Introduction:

Shimla is a famous tourist destination, and more for its green scenic landscapes and forests. The world famous 'Kufri' and 'Mashobra,' near Shimla, are the centers of great tourist attraction on account of their scenic grandeur and cedar forests. Human activities such as tourism and biotic pressure (construction, development, road widening, rural influx, tourism activities, grazing, etc.) have tremendously increased during the last two decades that has put a profound effect on the ecology of Shimla and the adjoining area, which has resulted in a change on the vegetation composition of this once beautiful hill destination.

With reference to Kufri, the seasonal character of tourism here, a large number of visitors arrive here in the peak season in comparison to the lean season time. Resultant, a high demand has been placed upon this fragile destination in the form of increased construction of tourism and recreational facilities, causing both direct and indirect impacts on the nearby forest vegetation. The rise in vehicular arrival can add to the fuel emissions, while the tourist populations add to the solid waste littered, which eventually finds a way to the nearby forest, thus impacting the ground vegetation. The vehicular emissions are also linked to global warming and climate change, thus impacting at the global level, especially from CO<sub>2</sub> emissions.

*Sewage, Solid Waste Management and Garbage:* Kufri, with high concentrations of tourist activities, has a serious problem of waste disposal, and improper disposal can be a major despoiler of the natural environment - forest, scenic areas, and along roadsides. Tourists generate and leave behind a great deal of waste, in the form of wrappers, plastic bottles, etc., practices that degrade the environment, effecting native vegetation. The surrounding construction activities and upcoming hotels often leads to increased sewage pollution, also adding to the detrimental impact on native biodiversity.

Forest degradation, leads to the decline in the forest's productivity, deterioration in its vegetative cover, both, qualitatively and quantitative. Vegetation degradation is referred to as reduction in the biomass and / or decline in the vegetative ground cover, as a result of deforestation and / or overgrazing. Such degradation is a major contributory factor to soil degradation particularly regarding soil erosion and loss of soil organic matter (Aulakh et al., 2015). The land degradation is caused by excessive anthropogenic pressure on land to meet the competing demands of the

growing population, which has led to accelerated soil degradation. The causes of soil degradation at Kufri, points to the direct/indirect influence of the large number of ponies/mules operating in a clustered small area. Moreso, the daily assemblage at this small space is compounded by the numerous, arrival and departure routes of these ponies from all directions, surrounding Kufri. This daily assemblage of a large number of ponies at a limited area, result in the gradual loosening of the top soil, leading in its erosion.

### **Methodology Followed:**

Here, the sampling selection, methodology of data collection and analysis of data has been outlined. The study has been conducted to evaluate the impact of anthropogenic interference on the floral elements (vegetation) of the Kufri tourist destination, in the light of steep rise in tourism activities (including the equine population). The data required for the study is collected from both primary and secondary data.

#### *1) Secondary data*

To make the study more authentic various sources have been consulted to study the vegetation of the area, mainly the data has been collected through literature reviews (*Flora of British India* and *Flora Simlensis*)

#### *2) Primary data:*

The primary data for the study has been collected with the help of interviews, personal observation over a period, and real time field sampling for ecological studies pertaining to phyto-sociological attributes of the vegetation.

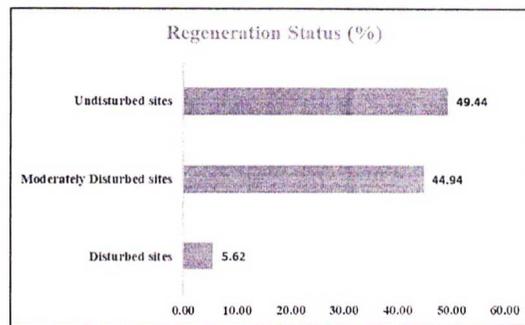
The area was visited on three dates (02/05/2023; 06/05/2023; 09/05/2023). Field surveys were conducted as per the reconnaissance. Reconnaissance involves a trip to the site where the investigation is to be carried out. Three sampling sites were marked for data collection; one site was along the pony/mule path, the other site was 50 m.. away from the path, while the third sampling site was over 100 m away from the pony/mule path. Quadrates were laid for phyto-sociological attributes and soil samples (edaphic data) were collected for further analysis at the Institutes laboratory. Besides, the general vegetation was also recorded in the study area.

### **Plant Community Data Analysis:**

The plant community data gathered from the sample plots were analyzed for plant species composition within given plant communities by estimating the dominance in density (D), frequency (F), abundance and important value index (IVI) of all species. For comparison, the vegetation has been classified into three main zones as mentioned above: 1) Besides the pony/mule trail (referred to as the **Disturbed area**); 2) Natural Forest 50 m (**Fringe area**); and 3). Natural forest 100 m away (Natural Forest/**Control**). From the data obtained (Annexure I) it can be stated that the forest community is dominantly *Cedrus deodara* – *Picea smithiana*, with *C. deodara* having highest density (Zone I). At Zone II, it is *C. deodara-Quercus floribunda* - *Abies pindrow* community; while at Zone III it is *A. pindrow* – *Q. floribunda* – *C. deodara* community.

### Tree Regeneration:

A process that allows a forest to sustain itself through the growth and survival of seedlings and saplings that replace large forest trees with time. Higher number of new recruits (seedling/saplings) indicates good regeneration potentials. The subplots were studied to survey saplings and seedlings, respectively, and to compare natural tree regeneration between the various vegetation types to identify the influence of tourism activity. It was found that these activities differentially influenced sapling and seedling density among vegetation types. The density value of seedlings and saplings are considered as an indicator of regeneration potential of the species in which the presence of good regeneration indicates the suitability of a species to the environment, which is in turn affected by climatic factors and biotic interference influence.



The data from the above tables clearly indicate that the disturbed site (zone I) has “poor” regeneration in comparison to natural forests (Zone II & Zone III). The greater regeneration status augers well for the sustainability of the forest.

- ✓ In Zone I, regeneration of 2 tree species (*Picea smithiana* & *Euonymus tingens*) recorded.
- ✓ In Zone II, 5 species were observed: *Q. semecarpifolia*, *E. tingens*, *C. deodara*, *P. wallichiana*, and *P. smithiana*.
- ✓ Zone III had better regeneration, with 6 tree species: *C. deodara*, *E. tingens*, *P. wallichiana*, *Ilex dipyrena*, *P. smithiana*, and *A. pindrow*.

The regeneration of trees in disturbed sites was significantly low, but it increased from 44.94% in moderately disturbed sites to 49.44% in undisturbed sites. This discontinuous regeneration at the site adjoining the mule/pony tracks, due to which it is expected that the tree species although dominant at present, may be at risk in the future.

### Alien Invasive Plants:

Based on published secondary data on invasive alien species in Himachal Pradesh, a number of non-native alien invasive plants (12) were found in this study area. However, the more realistic number of exotics/invasives will be found only after the monsoon season, when majority of the alien plant species dominate the degraded areas (annexure II).

### Edaphic Factor Data Analysis:

The soil samples collected from three main zones/sites mentioned above were analyzed in the institution laboratory, and parameters such as pH, Electric Conductivity (EC), available Nitrogen (N), Phosphorous (P) and Potassium (K) were recorded. The observed data can be enlisted as given below:

**Table-10: Different Soil Parameters of Samples from Different Zones**

Site	pH	Ec ( $\mu$ S)	N (Kg/ha)	P (Kg/ha)	K (Kg/ha)
Zone 1 (Disturbed Area)	7.03	130.7	206.97 (Low)	57.31	861.28 (High)
Zone 2 (Fringe Area)	6.96	115.2	292.02 (Low)	41.13	847.84 (High)
Zone3 (Natural Forest/Control)	6.17	92.4	345.21 (High)	4.04	264.44 (Low)

From the observed data, it can be assumed that the disturbed area with high pH i.e., alkaline in nature with high electric conductivity of 130.7  $\mu$ S, along with the available N is lowest in the disturbed area; while the available P and K are highest. High phosphorus and low nitrogen content indicates the excessive presence of inorganic extraneous substances which ultimately given rise to deficiency of iron and zinc, which are vital micronutrient for the growth of annual and perennial plants. Another major concern regarding high phosphorous content in the disturbed area can further find its way to the nearby streams during rains, thereby contaminating them with the inorganic pollutants, that would ultimately reduce the water quality.

### Noteworthy Observations:

- Degradation Of Natural Vegetation:** This has degraded not only the substantial proportion of the forest soils near the path, but also areas well beyond and forests at other sites are also becoming part of the degradation process. The construction activities along with the extensive paving/tiling of pathways and, the creation of parking lots, are also adding to the physical impacts of development on native vegetation. These developmental activities can cause severe disturbance and erosion of the local ecosystem, resulting in higher destruction in the long term.
- The mule/pony ride activity is emerging here as a distinct **driver of degradation**, and such anthropogenic pressures are reducing both the quantity and quality of the local forest around Kufri. The ponies are using the same trail repeatedly, resulting in trampling of the vegetation and soil, causing permanent damage to the trail, that can further lead to loss of biodiversity and other impacts in the forests further away. Such damage is visible even more extensive, where the ponies or even tourists frequently stray off the established trails, into the forest.
- In a nutshell, the overall vegetation population structure of the study sites showed absence of seedlings and saplings in the disturbed area. The findings revealed that **tree sapling/tree**

**seedling densities** and the percentage ground cover were significantly lower in areas where the tourism activity was being undertaken, than in areas of natural undisturbed forests. This reflected the inability of native species to regenerate and disperse naturally in the degraded landscape. Thus, utmost care is required to ensure the survival of seedlings and saplings for restocking of adult individuals in times ahead.

- (d) In addition, several introduced, invasive, alien plants and weeds were encountered, the diversity of these would normally increase during the monsoon months. Invasive alien plant species threaten native biodiversity, disrupt ecosystem functions, and can cause large economic damage. Plant invasions have been predicted to further increase under ongoing global environmental change (Liu et al., 2017).
- (e) The degradation has also put in danger some unique and rare flora of this area. Notable being the Lady's Slipper Orchid (*Cypripedium cordigerum*).

### **Conclusion:**

The field data collected point to a variety of probable impacts to the natural vegetation, resulting from tourism activity at Kufri. Mule or horse trails have many impacts on vegetation and soil, that include damage to native vegetation, soil erosion, compaction, exposure of roots, etc. Plant damage include reduction in vegetation height and biomass, changes in species composition, and the spread of exotic weeds and plant pathogens. Anthropogenic disturbances are responsible for the high mortality of seedlings (Malik & Bhatt, 2016).

Infrastructure development, increased soil erosion from pony movements, trampling of natural vegetation by tourists and ponies, emergence of non-native flora (alien invasive species), pollution from increased vehicular movement, garbage/waste generation, and their littering that is an eyesore, and destroys the forest composition and health. *The development of tourism activities and more particularly the unregulated pony/mule activity, are among the probable factors, which substantially threaten the sustainability of the natural ecosystem of the Kufri landscape.*

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**Zone 1. Disturbed Area:****Trees**

The quadrates were laid along the both sides of trail from starting point to the top of the Mahasu peak. Total 8 tree species were recorded and among these, *Cedrus deodara*(devdar) was the most dominant species having highest density of 3.89/m<sup>2</sup> followed by *Picea smithiana*(rai) (3.56/m<sup>2</sup>) and *Abies pindrow*(tosh) (1.22/m<sup>2</sup>). *C. deodara* has the highest value of frequency. (88.89%) followed by *P. smithiana* (77.78%) and *Quercus floribunda* (33.33%). *A. pindrow* recorded the highest value for abundance (5.5) followed by *P. smithiana* (4.5) and *C. deodara* (9.33) and others. *C. deodara* was most dominant species with the highest value of IVI (88.73) followed by *P. smithiana* (70.84). The value of Dominance Index and Diversity Index for trees were 0.18 and 1.88 respectively.

**Table-1: Phyto-sociological attributes of tree species in Zone 1**

Species	Density/m <sup>2</sup>	Frequency (%)	Abundance	A/F	IVI
<i>Abies pindrow</i>	1.22	22.22	5.5	0.25	35.37
<i>Cedrus deodara</i>	3.89	88.89	4.3	0.05	88.73
<i>Euonymus tingens</i>	0.22	11.11	2	0.18	12.17
<i>Ilex dipyrena</i>	0.11	11.11	1	0.09	15.25
<i>Picea smithiana</i>	3.56	77.78	4.5	0.06	70.84
<i>Quercus floribunda</i>	0.33	33.33	1	0.03	30.14
<i>Quercus semecarpifolia</i>	0.44	22.22	2	0.09	31.52
<i>Taxus contorta</i>	0.11	11.11	1	0.09	15.98

Shannon Weiner Diversity Index (H') = 1.88, Dominance Index (C)= 0.18

**Shrubs**

*Lonicera quinquelocularis* was dominant species having highest value for density (5.47/m<sup>2</sup>), followed by *Berberis chitria* and *Viburnum cotinifolium* (1.87/m<sup>2</sup>) and *Rosa macrophylla* (1.47/m<sup>2</sup>). In terms of abundance, *Lonicera quinquelocularis* recorded the highest value (9.11) followed by *B. chitria* (7) and *Rosa macrophylla* (5.50). Based on IVI, *Lonicera quinquelocularis* (140.3) recorded the highest value followed by *V. cotinifolium* (36.49) while *Rubus niveus* (6.41) recorded the lowest value. The value of Dominance Index and Diversity Index for shrubs were 0.27 and 1.65 respectively.

**Table 2: Phytosociological attributes of shrub species in Zone 1**

S. No.	Species	Density/m <sup>2</sup>	Frequency (%)	Abundance	A/F	IVI
1	<i>Berberis chitria</i>	1.87	20.00	7.00	0.35	27.20
2	<i>Cotoneaster microphyllus</i>	0.47	10.00	3.50	0.35	12.67
3	<i>Lonicera quinquelocularis</i>	5.47	45.00	9.11	0.20	140.30
4	<i>Rosa macrophylla</i>	1.47	20.00	5.50	0.28	27.23

5	<i>Rubus macilentus</i>	0.40	10.00	3.00	0.30	12.82
6	<i>Rubus niveus</i>	0.20	5.00	3.00	0.60	6.41
7	<i>Salix</i> sp.	0.93	30.00	2.33	0.08	30.61
8	<i>Viburnum cotinifolium</i>	1.87	30.00	4.67	0.16	36.49

Shannon Weiner Diversity Index ( $H'$ ) = 1.65,  $C$  = 0.27

### Herbs:

Total 14 species of herbs were recorded and it was found that *Rumex nepalensis* was the most dominant species with highest density  $3.47/m^2$  followed by *Potentilla indica* ( $3.33/m^2$ ) and *Valeriana jatamansi* ( $3/m^2$ ). *Rumex nepalensis* has the highest value of frequency (60%) followed by *Valeriana jatamansi* (53.33%) and *Potentilla indica* (46.67%). *Leucanthemum vulgare* recorded the highest value for Abundance (11.67) followed by *Oxalis corniculata* (8.00) and *Potentilla indica* (7.14) and others. *Rumex nepalensis* was most dominant species with the highest value of IVI (51.14) followed by *Valeriana jatamansi* (41.94). Value of Dominance Index and Diversity Index for herbs were 0.1 and 2.42, respectively.

**Table-3: Phytosociological attributes of herb species in Zone 1**

S. No.	Species	Density/ $m^2$	Frequency (%)	Abundance	A/F	IVI
1	<i>Ainsliaea aptera</i>	0.20	6.67	3.00	0.45	5.35
2	<i>Galium aparine</i>	2.80	40.00	7.00	0.18	28.63
3	<i>Geranium nepalense</i>	0.40	13.33	3.00	0.23	14.94
4	<i>Leucanthemum vulgare</i>	2.33	20.00	11.67	0.58	38.28
5	<i>Oxalis corniculata</i>	0.53	6.67	8.00	1.20	5.58
6	<i>Potentilla indica</i>	3.33	46.67	7.14	0.15	35.27
7	<i>Rubia cordifolia</i>	0.13	6.67	2.00	0.30	7.64
8	<i>Rumex nepalensis</i>	3.47	60.00	5.78	0.10	51.41
9	<i>Sonchus oleraceus</i>	0.20	6.67	3.00	0.45	16.50
10	<i>Taraxacum officinale</i>	0.27	13.33	2.00	0.15	14.21
11	<i>Thymus linearis</i>	0.33	6.67	5.00	0.75	7.27
12	<i>Urtica dioica</i>	0.20	6.67	3.00	0.45	16.50
13	<i>Valeriana jatamansi</i>	3.00	53.33	5.63	0.11	41.94
14	<i>Viola pilosa</i>	1.07	26.67	4.00	0.15	16.47

Shannon Weiner Diversity Index ( $H'$ ) = 2.42, Dominance Index ( $C$ ) = 0.1

**Zone 2. Fringe Area:****Trees**

Total 7 species of trees were recorded. *C. deodara* is the most dominant species having highest density of 1.75/m<sup>2</sup> followed by *Quercus floribunda* (1.63) and *Abies pindrow* (1.50). *Q. floribunda* has the highest value of frequency (62.50%) followed by *A. pindrow* and *C. deodara* (50%). *C. deodara* recorded the highest value for abundance (3.50) followed by *A. pindrow* (3.00) and *Q. semecarpifolia* (2.67) and others. *C. deodara* was most dominant species with the highest value of IVI (87.44) followed by *Q. floribunda* (48.79). Values of Dominance Index and Diversity Index for trees were 0.17 and 1.47 respectively.

**Table-4: Phytosociological attributes of trees species in Zone 2**

Sl. No.	Species	Density/ m <sup>2</sup>	Frequency (%)	Abundance	A/F	IVI
1	<i>Abies pindrow</i>	1.50	50.00	3.00	0.06	46.30
2	<i>Cedrus deodara</i>	1.75	50.00	3.50	0.07	87.44
3	<i>Euonymus tingens</i>	0.38	37.50	1.00	0.03	21.73
4	<i>Picea smithiana</i>	0.88	37.50	2.33	0.06	42.56
5	<i>Pinus wallichiana</i>	0.50	25.00	2.00	0.08	19.02
6	<i>Quercus floribunda</i>	1.63	62.50	2.60	0.04	48.79
7	<i>Quercus semecarpifolia</i>	1.00	37.50	2.67	0.07	34.16

Diversity Index (H') = 1.47, Dominance Index (C) = 0.17

**Shrubs:**

Total 7 species of shrubs were recorded, *Lonicera quinquelocularis* was the most dominant species having highest density of 6.64/m<sup>2</sup> followed by *Berberis chitria* (3.18/m<sup>2</sup>) and *Rosa macrophylla* (1.73/m<sup>2</sup>). *Lonicera quinquelocularis* has the highest value of frequency (72.73%) followed by *B. chitria* (54.55%) and *Lonicera angustifolia* & *Rosa macrophylla* (27.27%). *Lonicera quinquelocularis* was most dominant species with the highest value of IVI (64.57) followed by *Berberis chitria* (43.40). The value of Dominance Index and Diversity Index for herbs were 0.12 and 2.07 respectively.

**Table-5: Phytosociological attributes of shrub species in Zone 2**

S. No.	Species	Density/ m <sup>2</sup>	Frequency (%)	Abundance	A/F	IVI
1	<i>Berberis chitria</i>	3.18	54.55	5.83	0.11	43.40
2	<i>Cotoneaster microphyllus</i>	1.09	9.09	12.00	1.32	14.57

3	<i>Daphne papyracea</i>	0.45	9.09	5.00	0.55	10.76
4	<i>Lonicera quinquelocularis</i>	6.64	72.73	9.13	0.13	64.57
5	<i>Lonicera angustifolia</i>	0.36	27.27	1.33	0.05	19.06
6	<i>Rosa macrophylla</i>	1.73	27.27	6.33	0.23	28.62
7	<i>Rubus macilentus</i>	0.27	9.09	3.00	0.33	11.63

Shannon Weiner Diversity Index ( $H'$ ) = 2.07, Dominance Index (C) = 0.12

### Herbs:

Total 20 species of herbs were recorded (Table-6) and it was observed that *Potentilla indica* and *Leucanthemum vulgare* were the most dominant species with density of 4.40/m<sup>2</sup> and 4.20/m<sup>2</sup> followed by *Viola pilosa* (3.20/m<sup>2</sup>). *P. indica*, *Valeriana jatamansi* and *Viola pilosa* has the highest value of frequency (50%) followed by *Ajuga parviflora* (40%). *Thymus linearis* recorded the highest value for Abundance (18) followed by *Leucanthemum vulgare* (14) and others. *Leucanthemum vulgare* was most dominant species with the highest value of IVI (32.98) followed by *Potentilla indica* (26.80) and *Valeriana jatamansi* (23.86). The value of Dominance Index and Diversity Index for herbs were 0.06 and 2.88 respectively.

**Table-6: Phytosociological attributes of herb species in Zone 2**

Sl. No.	Species	Density /m <sup>2</sup>	Frequency (%)	Abundance	A/F	IVI
1	<i>Ainsliaea aptera</i>	0.90	30.00	3.00	0.10	10.52
2	<i>Ajuga parviflora</i>	1.20	40.00	3.00	0.08	13.57
3	<i>Artemisia vestita</i>	0.50	20.00	2.50	0.13	8.82
4	<i>Bergenia ciliata</i>	0.40	10.00	4.00	0.40	11.91
5	<i>Cephalantheraensifolia</i>	0.70	20.00	3.50	0.18	18.70
6	<i>Clematis montana</i>	0.20	10.00	2.00	0.20	14.95
7	<i>Gentiana argentea</i>	0.50	10.00	5.00	0.50	4.09
8	<i>Geranium nepalense</i>	1.20	30.00	4.00	0.13	15.65
9	<i>Hedera nepalensis</i>	1.30	30.00	4.33	0.14	13.62
10	<i>Impatiens scabrida</i>	1.80	20.00	9.00	0.45	15.76
11	<i>Leucanthemum vulgare</i>	4.20	30.00	14.00	0.47	32.98
12	<i>Potentilla indica</i>	4.40	50.00	8.80	0.18	26.80
13	<i>Rumex nepalensis</i>	1.40	30.00	4.67	0.16	19.42
14	<i>Sonchus oleraceus</i>	0.50	20.00	2.50	0.13	14.26

15	<i>Taraxacum officinale</i>	0.60	20.00	3.00	0.15	11.55
16	<i>Thymus linearis</i>	1.80	10.00	18.00	1.80	9.68
17	<i>Valeriana jatamansi</i>	2.40	50.00	4.80	0.10	23.86
18	<i>Veronica arvensis</i>	1.00	10.00	10.00	1.00	6.87
19	<i>Viola pilosa</i>	3.20	50.00	6.40	0.13	22.59
20	<i>Decalepidanthus racemosus</i>	0.30	10.00	3.00	0.30	4.41

Shannon Weiner Diversity Index ( $H'$ ) = 2.88, Dominance Index (C) = 0.06

### Zone 3. Natural Forest/Control

#### Trees

Total 6 species of trees were recorded, *Abies pindrowis* the most dominant species with density 2.71/m<sup>2</sup> followed by *Quercus floribunda* (2.43/m<sup>2</sup>) and *Cedrus deodara* (1.86/m<sup>2</sup>). *Picea smithiana* has the highest value of frequency (71.43%) followed by *C. deodara* and *Q. floribunda* (57.14%). *A. pindrow* recorded the highest value for Abundance (9.50) followed by *Q. floribunda*. (4.25) and *Q. semecarpifolia* (3.50) and others. *A. pindrow* was most dominant species with the highest value of IVI (75.19) followed by *C. deodara* (68.51). The value of Dominance Index and Diversity Index for trees were 0.18 and 1.52, respectively.

**Table-7: Phytosociological attributes of tree species in Zone 3**

Sl. No.	Species	Density/ m <sup>2</sup>	Frequency (%)	Abundance	A/F	IVI
1	<i>Cedrus deodara</i>	1.86	57.14	3.25	0.06	68.51
2	<i>Picea smithiana</i>	1.43	71.43	2.00	0.03	50.22
3	<i>Abies pindrow</i>	2.71	28.57	9.50	0.33	75.19
4	<i>Quercus semecarpifolia</i>	1.00	28.57	3.50	0.12	32.61
5	<i>Quercus floribunda</i>	2.43	57.14	4.25	0.07	50.53
6	<i>Pinus wallichiana</i>	0.43	42.86	1.00	0.02	22.95

Diversity Index ( $H'$ ) = 1.52, Dominance Index (C) = 0.18

#### Shrubs:

In term of density *Lonicera quinquelocularis* was dominant species having highest value for density (6/m<sup>2</sup>) followed by *Viburnum cotinifolium* (3.88/m<sup>2</sup>) and *Salix* sp., (3.38/m<sup>2</sup>). In terms of abundance, *Salix* sp. (9.0) recorded the highest value for followed by *Lonicera*

*quinelocularis*(8.0)and*V. cotinifolium* (7.75). Based on the value of IVI, *Lonicera quinelocularis*(52.38) recorded the highest value followed by *Rosa macrophylla* (37.92) and *Viburnum cotinifolium* (37.87). *Cotoneaster microphyllus*(12.17) recorded the lowest value. The value of Dominance Index and Diversity Index for shrubs were 0.11 and 2.28, respectively.

**Table 8: Phytosociological attributes of herb Species in Zone 3**

S. No.	Species	Density/ m <sup>2</sup>	Frequency (%)	Abundance	A/F	IVI
1	<i>Berberis chitria</i>	2.25	50.00	4.50	0.09	32.46
2	<i>Clematis montana</i>	0.88	37.50	2.33	0.06	16.99
3	<i>Cotoneaster microphyllus</i>	0.50	12.50	4.00	0.32	12.17
4	<i>Daphne papyracea</i>	0.75	12.50	6.00	0.48	12.26
5	<i>Lonicera quinelocularis</i>	6.00	75.00	8.00	0.11	52.38
6	<i>Lonicera angustifolia</i>	1.00	25.00	4.00	0.16	17.15
7	<i>Rosa macrophylla</i>	2.63	50.00	5.25	0.11	37.92
8	<i>Rubus macilentus</i>	2.75	50.00	5.50	0.11	31.13
9	<i>Salix</i> sp.	3.38	37.50	9.00	0.24	36.65
10	<i>Viburnum cotinifolium</i>	3.88	50.00	7.75	0.16	37.87
11	<i>Viburnum mullah</i>	0.63	25.00	2.50	0.10	13.03

Shannon Weiner Diversity Index (H') = 2.28, C= 0.11

### Herbs:

Total 15 species of Herbs were recorded. *Potentilla indica* is the most dominant species having highest density of 6.88/m<sup>2</sup> followed by *Galium aparine* (4.13/m<sup>2</sup>) and *Valeriana jatamansi*(3.13/m<sup>2</sup>). *P. indica* has the highest value of frequency (75%) followed by *Galium aparine* and *V. jatamansi*(62.50%). *P. indica* recorded the highest value for abundance (9.17) followed by *G. aparine* (6.60) and *Gentiana argentea* & *V. jatamansi*(5.0) and others. *P. indica* was most dominant species with the highest value of IVI (46.85) followed by *V. jatamansi*(33.93). The value of Dominance Index and Diversity Index for herbs were 0.09 and 2.56, respectively.

**Table-9: Phytosociological attributes of herb species in Zone 3**

Sl. No.	Species	Density/m <sup>2</sup>	Frequency (%)	Abundance	A/F	IVI
1	<i>Ainsliaea aptera</i>	0.63	37.50	1.67	0.04	12.18

2	<i>Ajuga parviflora</i>	1.38	37.50	3.67	0.10	15.44
3	<i>Bergenia ciliata</i>	0.38	12.50	3.00	0.24	16.39
4	<i>Cephalantheraensifolia</i>	0.38	25.00	1.50	0.06	24.28
5	<i>Clematis montana</i>	0.13	12.50	1.00	0.08	20.69
6	<i>Galium aparine</i>	4.13	62.50	6.60	0.11	32.40
7	<i>Gentiana argentea</i>	0.63	12.50	5.00	0.40	5.71
8	<i>Geranium nepalense</i>	1.63	50.00	3.25	0.07	24.91
9	<i>Hedera nepalensis</i>	0.13	12.50	1.00	0.08	7.46
10	<i>Potentilla indica</i>	6.88	75.00	9.17	0.12	46.85
11	<i>Rumex nepalensis</i>	0.75	25.00	3.00	0.12	20.52
12	<i>Taraxacum officinale</i>	0.13	12.50	1.00	0.08	10.89
13	<i>Valeriana jatamansi</i>	3.13	62.50	5.00	0.08	33.93
14	<i>Veronica arvensis</i>	0.38	12.50	3.00	0.24	6.09
15	<i>Viola pilosa</i>	2.38	50.00	4.75	0.10	22.29

Shannon Weiner Diversity Index ( $H'$ ) = 2.56, Dominance Index (C) = 0.09

## List of Invasive Alien Species

S. No	Botanical Name	Family	Life Form	Habit	Habitat	Nativity
1	<i>Bidens pilosa</i> L.	Asteraceae	H	P	DA	TA
2	<i>Cardamine hirsuta</i> L.	Brassicaceae	H	P	RB	TA
3	<i>Chenopodium album</i> L.	Chenopodiaceae	H	A	WP	EU
4	<i>Conyza canadensis</i> (L.) Cronquist	Asteraceae	H	A	RS	SA
5	<i>Emilia sonchifolia</i> (L.) DC.	Asteraceae	H	A	RS	TA
6	<i>Galinsoga parviflora</i> Cav.	Asteraceae	H	A	RS	TA
7	<i>Galinsoga quadriradiata</i> Ruiz & Pav.	Asteraceae	H	A	RS	MX
8	<i>Impatiens scabrida</i>	Balsaminaceae	H	A	WP	TA
9	<i>Oxalis corniculata</i> L.	Oxalidaceae	H	P	RS	EU
10	<i>Rubus ellipticus</i> Smith	Rosaceae	S	P	WP	TA
11	<i>Solanum nigrum</i> L.	Solanaceae	H	A	WP	TA
12	<i>Solanum pseudo-capsicum</i>	Solanaceae	US	P	FU	TA

Life form: H—Herb; C—Climber; US—Undershrub; S—Shrub; SE—Sedges; T—Tree; G—Grass. Habit: A—Annual; P—Perennial.



**H.P.STATE POLLUTION CONTROL BOARD  
REPORT BY STATE BOARD ANALYST**

Report No: 9414920/W-7653

18/05/2023

**ISSUED TO:** Study Sample  
, Shimla Urban  
Distt.Shimla, H.P.

Sample received on: 03/05/2023

Description of sample: Spring Source D/s Mule Path Kufri

SAMPLING PARAMETERS					
Sr. No.	Parameter Name	Results	Units	Permissible Limit	Remark/Result Analysis
1	Turbidity	4.2	NTU	NA	NA
2	Ca <sup>++</sup>	40.08	mg/L	NA	NA
3	pH	7.86		NA	NA
4	Conductivity	263.8	microsiemens	NA	NA
5	Fecal Coliform	350.0	MPN/100ml	NA	NA
6	TSS	14	mg/L	NA	NA
7	Fluoride	0.19	mg/L	NA	NA
8	Boron	0.12	mg/L	NA	NA
9	Nitrate-N	10.4	mg/L	NA	NA
10	Nitrite-N	0.0	mg/L	NA	NA
11	Sodium	13.50	mg/L	NA	NA
12	TDS	174.0	mg/L	NA	NA
13	Potassium	2.30	mg/L	NA	NA
14	P-Alkalinity	0.0	mg/L	NA	NA
15	Sulphate	28.80	mg/L	NA	NA
16	T-Alkalinity	47.0	mg/L	NA	NA
17	Total Phosphate	0.0	mg/L	NA	NA
18	Total Hardness	119.0	mg/L	NA	NA







## H.P.STATE POLLUTION CONTROL BOARD REPORT BY STATE BOARD ANALYST

Report No: 9414920/W-7653

18/05/2023

**ISSUED TO:** Study Sample  
 , Shimla Urban  
 Distt.Shimla, H.P.

Sample received on: 03/05/2023

Description of sample: Spring Source D/s Mule Path Kufri

SAMPLING PARAMETERS					
Sr. No.	Parameter Name	Results	Units	Permissible Limit	Remark/Result Analysis
1	Turbidity	4.2	NTU	NA	NA
2	Ca <sup>++</sup>	40.08	mg/L	NA	NA
3	pH	7.86		NA	NA
4	Conductivity	263.8	microsiemens	NA	NA
5	Fecal Coliform	350.0	MPN/100ml	NA	NA
6	TSS	14	mg/L	NA	NA
7	Fluoride	0.19	mg/L	NA	NA
8	Boron	0.12	mg/L	NA	NA
9	Nitrate-N	10.4	mg/L	NA	NA
10	Nitrite-N	0.0	mg/L	NA	NA
11	Sodium	13.50	mg/L	NA	NA
12	TDS	174.0	mg/L	NA	NA
13	Potassium	2.30	mg/L	NA	NA
14	P-Alkalinity	0.0	mg/L	NA	NA
15	Sulphate	28.80	mg/L	NA	NA
16	T-Alkalinity	47.0	mg/L	NA	NA
17	Total Phosphate	0.0	mg/L	NA	NA
18	Total Hardness	119.0	mg/L	NA	NA





Sr. No.	Parameters	Requirement (Acceptable Limit) as per IS 10500:2012	Report No. 9414920 sample collected on 03.05.2023 from spring source D/s Mule Path Kufri.	Remarks
1.	pH	6.5-8.5	7.86	Within Limit
2.	Turbidity	1 NTU	4.2 NTU	Above Limit
3.	Faecal Coliform	0, MPN/100 ml	350 MPN/100 ml	Shall not be detectable in 100ml sample.
4.	Hardness (Total)	200 mg/l	119.0 mg/l	Within Limit
5.	Ca <sup>++</sup>	75mg/l	40.08mg/l	Within Limit
6.	T-Alkalinity	200 mg/l (Total Alkalinity)	47.0 mg/l	Within Limit
7.	P-Alkalinity	200 mg/l (Total Alkalinity)	0.0 mg/l	Within Limit
8.	Sulphate	200mg/l	28.80 mg/l	Within Limit
9.	Fluoride	1.0 mg/l	0.19 mg/l	--
10.	Nitrate-N	45 mg/l	10.4 mg/l	--
11.	Nitrite-N	--	0.0mg/l	--
12.	Total Dissolved Solids	500 mg/l	174.0 mg/l	Within Limit
13.	Ammonical Nitrogen	--	0.0 mg/l	--
14.	Conductivity	--	263.8 microsiemens/cm	--
15.	Total Suspended Solids	--	14.0 mg/l	--
16.	Sodium	---	13.50 mg/l	--
17.	Boron	0.5mg/l	0.12 mg/l	Within Limit
18.	Potassium	--	2.30 mg/l	--

  
**Environmental Engineer,**  
 H.P. SPCB, R.O. Shimla.

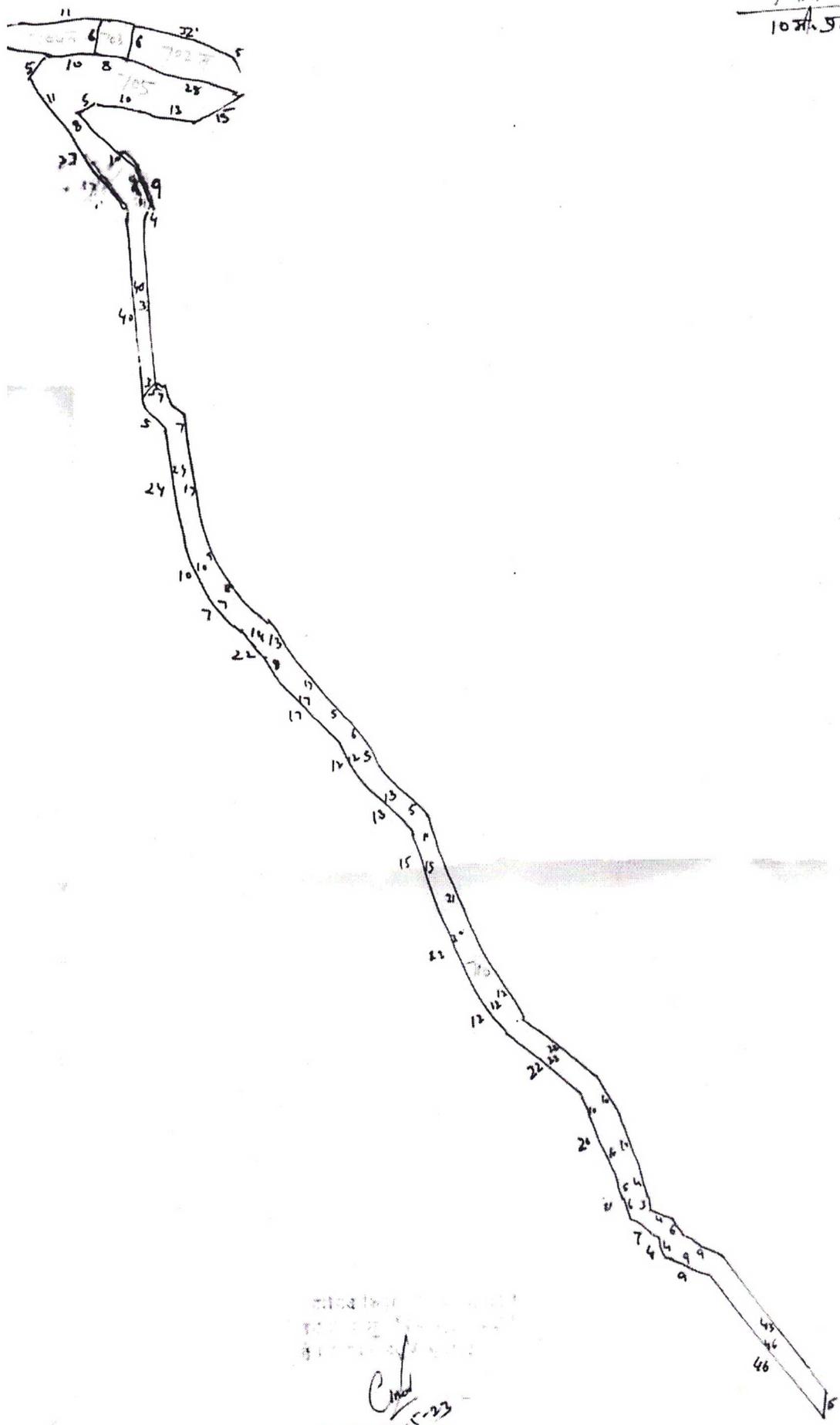
Sr. No.	Parameters	Requirement (Acceptable Limit) as per IS 10500:2012	Report No. 9415004 sample collected on 03.05.2023 from spring source (Bowdi) nearby Kufri Area.	Remarks
1.	pH	6.5-8.5	7.88	Within Limit
2.	Turbidity	1 NTU	3.4 NTU	Above Limit
3.	Faecal Coliform	0, MPN/100ml	17 MPN/100 ml	Shall not be detectable in 100ml sample.
4.	Hardness (Total)	200 mg/l	24.0 mg/l	Within Limit
5.	Ca <sup>++</sup>	75mg/l	8.01mg/l	Within Limit
6.	T-Alkalinity	200 mg/l (Total Alkalinity)	20.0 mg/l	Within Limit
7.	P-Alkalinity	200 mg/l (Total Alkalinity)	0.0 mg/l	Within Limit
8.	Sulphate	200mg/l	2.84 mg/l	Within Limit
9.	Fluoride	1.0 mg/l	0.15 mg/l	--
10.	Nitrate-N	45 mg/l	0.26 mg/l	--
11.	Nitrite-N		0.0mg/l	
12.	Total Dissolved Solids	500 mg/l	40.0mg/l	Within Limit
13.	Ammonical Nitrogen	--	0.0 mg/l	--
14.	Conductivity	--	67.40 microsiemens/cm	--
15.	Total Suspended Solids	--	2.0 mg/l	--
16.	Sodium	---	1.22 mg/l	--
17.	Boron	0.5mg/l	0.10 mg/l	Within Limit
18.	Potassium	--	0.71mg/l	--

  
**Environmental Engineer,**  
 H.P. SPCB, R.O. Shimla.

चकल फसल तालीम राजरा किवात वा 61 मीप बेगो वित भू. समदा कु मदी - जु - गा  
 तखील शिमला (१०) जिल्हा शिमला (डि. प्र.)

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पे माग वीट लास  
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शिमला जिल्हा  
 शिमला (डि. प्र.)

19-5-23

राजस्व विभाग, हिमाचल प्रदेश - नकल जमाबंदी

एस.सी.ए रसीद संख्या: 3137150523395432

जिला : शिमला  
तहसील : शिमला(ग्रामीण)  
कानूनगोवृत : मशोबरा  
पटवार वृत : मूलकोटी  
हदबस्त न. : 228

नाम : .  
पिता/पति : .

नकल शुल्क : 1  
सेवा शुल्क : 10  
कुल शुल्क : 11

मोहाल : कुफरी जन्गा

साल : 2014-2015

रकबा ईकाई: है-आ-से

खेवट नं.	खतीनी नं.	नाम मालिक व एहवाल	नाम काश्तकार व एहवाल	नाम चाह व दीगर वसायल आबपाशी	नम्बर खसरा हाल	रकबा हर खेत व मिजान खाता मय किस्म अराजी	हिस्सा या पैमाना हकीयत व तरीका बाछ	कैफियत
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134 निन	158 निन	सरकार हिमाचल प्रदेश	शारे-आम		710	00-15-22	रकबा व पडला बरतई	नोट : इ.न. 97 सेहत नलकियत
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भारत खेवट न.								
(1)								

Common Service Centre  
Mashobra  
CSC ID-374220640018

Certified that this copy has been generated from the database of Revenue Department at Central Server- HP as accessed by the Lok Mitra Kendra Neelam Prakash Sharma on 17-May-2023

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<https://himbhoomilmk.nic.in>  
For Validity Refer : Notific. No-Rev-C(F)/10-1/2009 Dated 14-Feb-2011

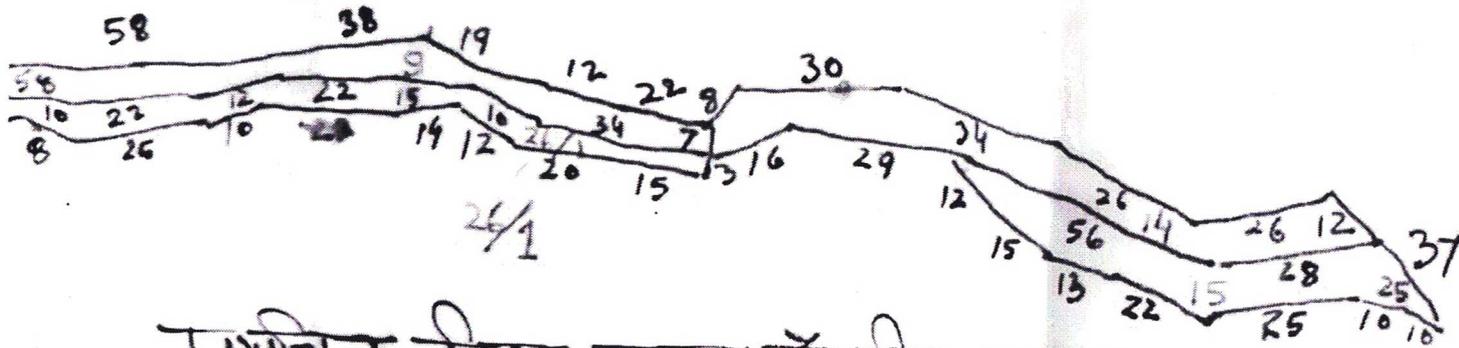
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अब यह तब तक शहर निवात वार द्वितीय संशोधित व्यवस्था  
सम्पन्न मौरा- जंगल उपलब्ध शिष्ट रूप रख प्रथम तब तक विमला (शा  
जिला विमला हि २० - १।

~~जमा~~

पैमाना व हिसाब २० बीस  
मीटर प्रति सेंटीमीटर - १।

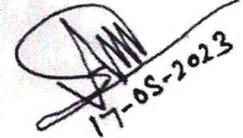


प्रमाणित किया जाता है कि जमल  
मूलाधिक असल के सही व वास्त  
है एवं मंशा सायल प्रेशा की गई।

~~17-05-2023~~

जमाबंदी		मौजा		परगना		तहसील		जिला			
2015/16		तंगल झवल रातेरु ख पथम				शिमला ग्राम		शिमला हि०			
नं. खेपट या जमाबंदी	नम्बर खतीनी	नाम पति या तरफ मय नाम नम्बरदार व तादाद मुआमला	नाम मालिक व ऐहवाल	नाम काश्तकार व ऐहवाल	नाम चाह व दीगर वसायल आवपाशी	नम्बर हाय खसरा	रकबा हर खेत व मिजान खाता मय किस्म अराजी	लगान जो मुजारा अदा करता है व तफसील शरह व तादाद	हिस्सा या पैमाना हकीयत व तरीका बाछ	मुतालबा व शरह मुआमला व हबूब	कैफियत
1	2	3	4	5	6	7	बीघों में मीट्रिक इकाईयों में	9	10	11	12
5	7	बबराहा खेपट नं० (२)	सरकार हिमाचल प्रदेश	काबत व नरुला कृषि अनुसन्धान विभाग कुजरी	वीनी बंगला	15	00-07-14 बंजर रुहीम	बबराहा खेपट नं० (२)	0.00 0.00 0.00	माल	पोट - खसरा नं० 66 में सुब्बिन सिंह पुत्र देवी दास निवासी बरौली जमैहर मोसम गर्गी में खंम मुसाफिरों पानी पिलाता कही 3

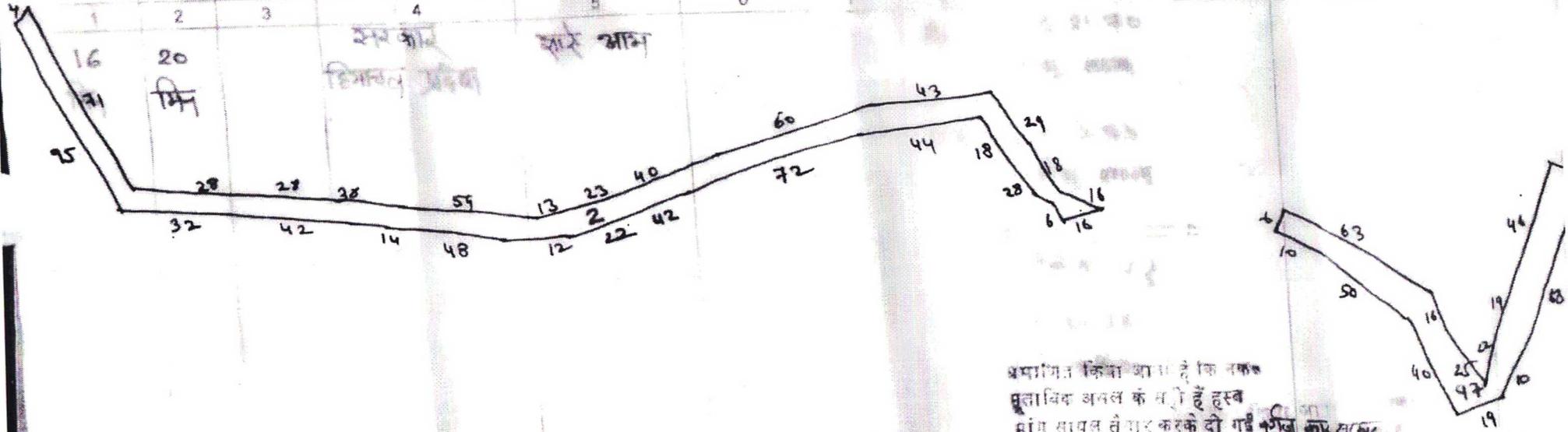
प्रमाणित किया जाता है कि नरुला भुलाविड असल के सही व हस्तक्षेप संका साधल पत्रा को गरी

  
17-05-2023

जवाब अक्स राजरा किशतवार वन्दोषल जदीद मडाल जंगल कोर  
 नदलील डिपोज जिला जिला दि. १९/०५/२०२३

जवाब - २०१९ - २०२०  
 जवाबदी विस्तार वन्दोषल वन्दोषल वन्दोषल वन्दोषल

नम्बर खेत या जमाबन्दी	नम्बर खतीनी	काम पति या तरफ नम्बरदार या जमा	जवाब सहित	जवाब सहित	बसायल आबपाशी	जवाब सहित	जवाब सहित	जवाब सहित	जवाब सहित
1	2	3	4	5	6	7	8	9	10



प्रमाणित किया जाता है कि नकल  
 मुताबिक अवल क मी हैं हस्त  
 मांग साफल तैयार करके दी गई नकल को लक्ष्य  
 विलुप्त करके बसूल शुद्ध। रसीद न.

पटवारी 19/05/2023  
 पटवार बत... सी...  
 नदलील डिपोज

पटवारी  
 पटवार बत...  
 नदलील डिपोज



## Indian Standard

# DRINKING WATER — SPECIFICATION

## ( Second Revision )

### 1 SCOPE

This standard prescribes the requirements and the methods of sampling and test for drinking water.

### 2 REFERENCES

The standards listed in Annex A contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated in Annex A.

### 3 TERMINOLOGY

For the purpose of this standard the following definition shall apply.

**3.1 Drinking Water** — Drinking water is water intended for human consumption for drinking and cooking purposes from any source. It includes water (treated or untreated) supplied by any means for human consumption.

### 4 REQUIREMENTS

Drinking water shall comply with the requirements given in Tables 1 to 4. The analysis of pesticide residues given in Table 3 shall be conducted by a recognized laboratory using internationally established test method meeting the residue limits as given in Table 5.

Drinking water shall also comply with bacteriological requirements (*see 4.1*), virological requirements (*see 4.2*) and biological requirements (*see 4.3*).

#### 4.1 Bacteriological Requirements

##### 4.1.1 Water in Distribution System

Ideally, all samples taken from the distribution system including consumers' premises, should be free from coliform organisms and the following bacteriological quality of drinking water collected in the distribution system, as given in Table 6 is, therefore specified when tested in accordance with IS 1622.

#### 4.2 Virological Requirements

4.2.1 Ideally, all samples taken from the distribution

**Table 1 Organoleptic and Physical Parameters**  
(Foreword and Clause 4)

Sl No.	Characteristic	Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate Source	Method of Test, Ref to Part of IS 3025	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
i)	Colour, Hazen units, <i>Max</i>	5	15	Part 4	Extended to 15 only, if toxic substances are not suspected in absence of alternate sources
ii)	Odour	Agreeable	Agreeable	Part 5	a) Test cold and when heated b) Test at several dilutions
iii)	pH value	6.5-8.5	No relaxation	Part 11	—
iv)	Taste	Agreeable	Agreeable	Parts 7 and 8	Test to be conducted only after safety has been established
v)	Turbidity, NTU, <i>Max</i>	1	5	Part 10	—
vi)	Total dissolved solids, mg/l, <i>Max</i>	500	2 000	Part 16	—

NOTE — It is recommended that the acceptable limit is to be implemented. Values in excess of those mentioned under 'acceptable' render the water not suitable, but still may be tolerated in the absence of an alternative source but up to the limits indicated under 'permissible limit in the absence of alternate source' in col 4; above which the sources will have to be rejected.

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**Table 2 General Parameters Concerning Substances Undesirable in Excessive Amounts**  
(Foreword and Clause 4)

Sl No.	Characteristic	Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate Source	Method of Test, Ref to	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
i)	Aluminium (as Al), mg/l, <i>Max</i>	0.03	0.2	IS 3025 (Part 55)	—
ii)	Ammonia (as total ammonia-N), mg/l, <i>Max</i>	0.5	No relaxation	IS 3025 (Part 34)	—
iii)	Anionic detergents (as MBAS) mg/l, <i>Max</i>	0.2	1.0	Annex K of IS 13428	—
iv)	Barium (as Ba), mg/l, <i>Max</i>	0.7	No relaxation	Annex F of IS 13428* or IS 15302	—
v)	Boron (as B), mg/l, <i>Max</i>	0.5	1.0	IS 3025 (Part 57)	—
vi)	Calcium (as Ca), mg/l, <i>Max</i>	75	200	IS 3025 (Part 40)	—
vii)	Chloramines (as Cl <sub>2</sub> ), mg/l, <i>Max</i>	4.0	No relaxation	IS 3025 (Part 26)* or APHA 4500-Cl G	—
viii)	Chloride (as Cl), mg/l, <i>Max</i>	250	1 000	IS 3025 (Part 32)	—
ix)	Copper (as Cu), mg/l, <i>Max</i>	0.05	1.5	IS 3025 (Part 42)	—
x)	Fluoride (as F) mg/l, <i>Max</i>	1.0	1.5	IS 3025 (Part 60)	—
xi)	Free residual chlorine, mg/l, <i>Min</i>	0.2	1	IS 3025 (Part 26)	To be applicable only when water is chlorinated. Tested at consumer end. When pro- tection against viral infec- tion is required, it should be minimum 0.5 mg/l
xii)	Iron (as Fe), mg/l, <i>Max</i>	0.3	No relaxation	IS 3025 (Part 53)	Total concentration of man- ganese (as Mn) and iron (as Fe) shall not exceed 0.3 mg/l
xiii)	Magnesium (as Mg), mg/l, <i>Max</i>	30	100	IS 3025 (Part 46)	—
xiv)	Manganese (as Mn), mg/l, <i>Max</i>	0.1	0.3	IS 3025 (Part 59)	Total concentration of man- ganese (as Mn) and iron (as Fe) shall not exceed 0.3 mg/l
xv)	Mineral oil, mg/l, <i>Max</i>	0.5	No relaxation	Clause 6 of IS 3025 (Part 39) Infrared partition method	—
xvi)	Nitrate (as NO <sub>3</sub> ), mg/l, <i>Max</i>	45	No relaxation	IS 3025 (Part 34)	—
xvii)	Phenolic compounds (as C <sub>6</sub> H <sub>5</sub> OH), mg/l, <i>Max</i>	0.001	0.002	IS 3025 (Part 43)	—
xviii)	Selenium (as Se), mg/l, <i>Max</i>	0.01	No relaxation	IS 3025 (Part 56) or IS 15303*	—
xix)	Silver (as Ag), mg/l, <i>Max</i>	0.1	No relaxation	Annex J of IS 13428	—
xx)	Sulphate (as SO <sub>4</sub> ) mg/l, <i>Max</i>	200	400	IS 3025 (Part 24)	May be extended to 400 pro- vided that Magnesium does not exceed 30
xxi)	Sulphide (as H <sub>2</sub> S), mg/l, <i>Max</i>	0.05	No relaxation	IS 3025 (Part 29)	—
xxii)	Total alkalinity as calcium carbonate, mg/l, <i>Max</i>	200	600	IS 3025 (Part 23)	—
xxiii)	Total hardness (as CaCO <sub>3</sub> ), mg/l, <i>Max</i>	200	600	IS 3025 (Part 21)	—
xxiv)	Zinc (as Zn), mg/l, <i>Max</i>	5	15	IS 3025 (Part 49)	—

## NOTES

1 In case of dispute, the method indicated by '\*' shall be the referee method.

2 It is recommended that the acceptable limit is to be implemented. Values in excess of those mentioned under 'acceptable' render the water not suitable, but still may be tolerated in the absence of an alternative source but up to the limits indicated under 'permissible limit in the absence of alternate source' in col 4, above which the sources will have to be rejected.

**Table 3 Parameters Concerning Toxic Substances**  
(Foreword and Clause 4)

SI No.	Characteristic	Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate Source	Method of Test, Ref to	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
i)	Cadmium (as Cd), mg/l, <i>Max</i>	0.003	No relaxation	IS 3025 (Part 41)	—
ii)	Cyanide (as CN), mg/l, <i>Max</i>	0.05	No relaxation	IS 3025 (Part 27)	—
iii)	Lead (as Pb), mg/l, <i>Max</i>	0.01	No relaxation	IS 3025 (Part 47)	—
iv)	Mercury (as Hg), mg/l, <i>Max</i>	0.001	No relaxation	IS 3025 (Part 48)/ Mercury analyser	—
v)	Molybdenum (as Mo), mg/l, <i>Max</i>	0.07	No relaxation	IS 3025 (Part 2)	—
vi)	Nickel (as Ni), mg/l, <i>Max</i>	0.02	No relaxation	IS 3025 (Part 54)	—
vii)	Pesticides, µg/l, <i>Max</i>	See Table 5	No relaxation	See Table 5	—
viii)	Polychlorinated biphenyls, mg/l, <i>Max</i>	0.000 5	No relaxation	ASTM 5175*	—
ix)	Polynuclear aromatic hydro- carbons (as PAH), mg/l, <i>Max</i>	0.000 1	No relaxation	APHA 6440	or APHA 6630 —
x)	Total arsenic (as As), mg/l, <i>Max</i>	0.01	0.05	IS 3025 (Part 37)	—
xi)	Total chromium (as Cr), mg/l, <i>Max</i>	0.05	No relaxation	IS 3025 (Part 52)	—
xii)	Trihalomethanes:				
a)	Bromoform, mg/l, <i>Max</i>	0.1	No relaxation	ASTM D 3973-85* or APHA 6232	—
b)	Dibromochloromethane, mg/l, <i>Max</i>	0.1	No relaxation	ASTM D 3973-85* or APHA 6232	—
c)	Bromodichloromethane, mg/l, <i>Max</i>	0.06	No relaxation	ASTM D 3973-85* or APHA 6232	—
d)	Chloroform, mg/l, <i>Max</i>	0.2	No relaxation	ASTM D 3973-85* or APHA 6232	—

## NOTES

1 In case of dispute, the method indicated by '\*' shall be the referee method.

2 It is recommended that the acceptable limit is to be implemented. Values in excess of those mentioned under 'acceptable' render the water not suitable, but still may be tolerated in the absence of an alternative source but up to the limits indicated under 'permissible limit in the absence of alternate source' in col 4, above which the sources will have to be rejected.

**Table 4 Parameters Concerning Radioactive Substances**  
(Foreword and Clause 4)

SI No.	Characteristic	Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate Source	Method of Test, Ref to Part of IS 14194	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
i)	Radioactive materials:				
a)	Alpha emitters Bq/l, <i>Max</i>	0.1	No relaxation	Part 2	—
b)	Beta emitters Bq/l, <i>Max</i>	1.0	No relaxation	Part 1	—

NOTE — It is recommended that the acceptable limit is to be implemented. Values in excess of those mentioned under 'acceptable' render the water not suitable, but still may be tolerated in the absence of an alternative source but up to the limits indicated under 'permissible limit in the absence of alternate source' in col 4, above which the sources will have to be rejected.

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**Table 5 Pesticide Residues Limits and Test Method**  
(Foreword and Table 3)

Sl No. (1)	Pesticide (2)	Limit µg/l (3)	Method of Test, Ref to	
			USEPA (4)	AOAC/ ISO (5)
i)	Alachlor	20	525.2, 507	—
ii)	Atrazine	2	525.2, 8141 A	—
iii)	Aldrin/ Dieldrin	0.03	508	—
iv)	Alpha HCH	0.01	508	—
v)	Beta HCH	0.04	508	—
vi)	Butachlor	125	525.2, 8141 A	—
vii)	Chlorpyrifos	30	525.2, 8141 A	—
viii)	Delta HCH	0.04	508	—
ix)	2,4- Dichlorophenoxyacetic acid	30	515.1	—
x)	DDT ( <i>o, p</i> and <i>p, p</i> – Isomers of DDT, DDE and DDD)	1	508	AOAC 990.06
xi)	Endosulfan (alpha, beta, and sulphate)	0.4	508	AOAC 990.06
xii)	Ethion	3	1657 A	—
xiii)	Gamma — HCH (Lindane)	2	508	AOAC 990.06
xiv)	Isoproturon	9	532	—
xv)	Malathion	190	8141 A	—
xvi)	Methyl parathion	0.3	8141 A	ISO 10695
xvii)	Monocrotophos	1	8141 A	—
xviii)	Phorate	2	8141 A	—

NOTE — Test methods are for guidance and reference for testing laboratory. In case of two methods, USEPA method shall be the reference method.

**Table 6 Bacteriological Quality of Drinking Water<sup>1)</sup>**  
(Clause 4.1.1)

Sl No. (1)	Organisms (2)	Requirements (3)
i)	<i>All water intended for drinking:</i>	
a)	<i>E. coli</i> or thermotolerant coliform bacteria <sup>2), 3)</sup>	Shall not be detectable in any 100 ml sample
ii)	<i>Treated water entering the distribution system:</i>	
a)	<i>E. coli</i> or thermotolerant coliform bacteria <sup>2)</sup>	Shall not be detectable in any 100 ml sample
b)	Total coliform bacteria	Shall not be detectable in any 100 ml sample
iii)	<i>Treated water in the distribution system:</i>	
a)	<i>E. coli</i> or thermotolerant coliform bacteria	Shall not be detectable in any 100 ml sample
b)	Total coliform bacteria	Shall not be detectable in any 100 ml sample

<sup>1)</sup>Immediate investigative action shall be taken if either *E.coli* or total coliform bacteria are detected. The minimum action in the case of total coliform bacteria is repeat sampling; if these bacteria are detected in the repeat sample, the cause shall be determined by immediate further investigation.

<sup>2)</sup>Although, *E. coli* is the more precise indicator of faecal pollution, the count of thermotolerant coliform bacteria is an acceptable alternative. If necessary, proper confirmatory tests shall be carried out. Total coliform bacteria are not acceptable indicators of the sanitary quality of rural water supplies, particularly in tropical areas where many bacteria of no sanitary significance occur in almost all untreated supplies.

<sup>3)</sup>It is recognized that, in the great majority of rural water supplies in developing countries, faecal contamination is widespread. Under these conditions, the national surveillance agency should set medium-term targets for progressive improvement of water supplies.

**HP State Pollution Control Board,**

Below BCS, Phase-III, New Shimla

No. PCB-OA No. 187/2023-2443-44

Dated: 23-05-2023

To

**The Divisional Forest Officer**  
Shimla (Rural), District Shimla H.P.**Subject: Compliance of order dated 13.03.2023 passed by the Hon'ble NGT in O.A. No. 187/2023, titled as Shailendra Kumar Vs. State of H.P.**

Sir,

This is in reference to letter No. 647-50 dated 23.05.2023 of the Environmental Engineer, Regional Office, HPSPCB, Shimla vide which, Report of Joint Committee (constituted by Hon'ble NGT) in the afore-cited matter has been endorsed to you.

In this connection, it is requested that necessary remedial/regulatory actions be taken at your end in view of the recommendations made by the Joint Committee in its Report and further compliance be kindly reported to the Hon'ble NGT.

Kindly treat it most urgent being NGT matter.

o/c

  
(Anil Joshi, IFS)  
Member Secretary  
HPSPCB, Shimla  
y

**Copy forwarded to following for information and necessary action:-**

- The Regional Officer/EE, HPSPCB, Shimla H.P. for information.

o/c

  
(Anil Joshi, IFS)  
Member Secretary  
HPSPCB, Shimla  
y