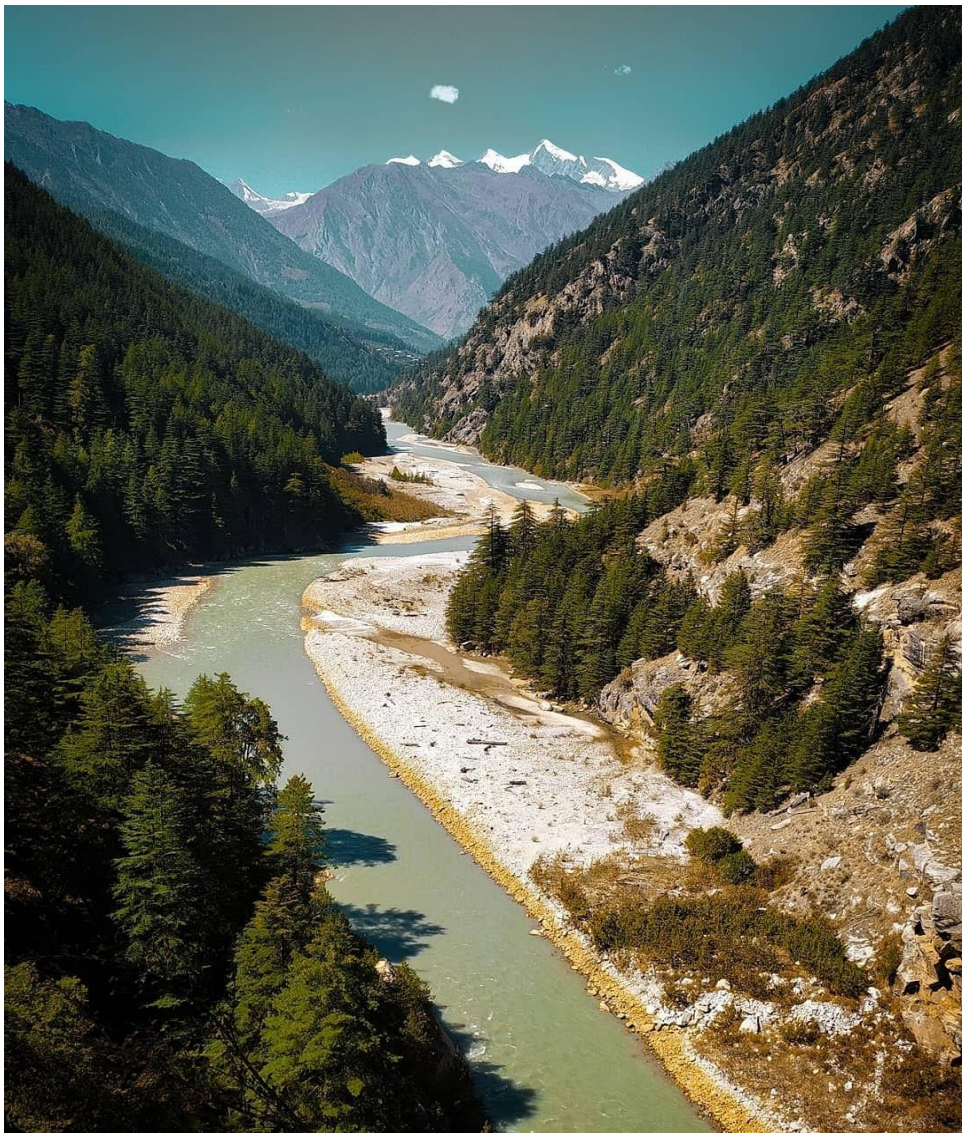
DRAFT

DISTRICT ENVIRONMENTAL PLAN

(As per the Hon'ble National Green Tribunal (NGT) vide order O.A. no. 360/2018 dated 26.09.2019)

UTTARKASHI



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PREFACE

Hon'ble National Green Tribunal (NGT) vide order, dated 26/09/2019 in O.A. No. 360 of 2018 filed by Shree Nath Sharma vs. Union of India and Others directed that Central Pollution Control Board (CPCB) shall facilitate the District Magistrates in preparation of District Environmental Plan by placing a model plan on its website. This model plan may be adopted as per local requirements by all Districts under the supervision of District Magistrate. The said order also directs that Department of Environment in respective States should collect district plans to prepare State Environment Plan, which shall be monitored by respective Chief Secretaries of the State by 15/12/2019. Based on State Environmental Plans, CPCB and Ministry of Environment, Forest & Climate Change (MoEF&CC) shall prepare a National Environmental Plan, under the supervision of Secretary, MoEF&CC and Chairman, CPCB.

There are diverse environmental issues that address our key responsibilities to the community and its surrounding environment. As a set of target, fourteen areas by Hon'ble NGT and one more- plastic waste by Govt. of Uttarakhand were included under district plan. These 14 areas were regarding compliance to rules for: solid waste including legacy waste, bio-medical waste, construction & demolition waste, hazardous waste, E-waste, polluter stretches, non-attainment cities, industrial clusters, status of sewage treatment plants (STPs) and re-use of treated water, status of common effluent treatment plants (CETPs) / effluent treatment plants (ETPs), ground water extraction / contamination and re-charge, air pollution including noise pollution, illegal sand mining, and rejuvenation of water bodies. In addition, plastic waste was also assessed based on consultative workshops with the State Government including SPCB.

Implementation of the environment plan based on fundamental indicators will do noticeably more to ensure that these objectives are achieved and our compliance obligations are met. It will also allow environmental opportunities associated with our activities to be further explored and undertaken. Environmental plan describes how action might impact the natural environment in which it occurs and set out clear commitments how those impacts will be avoided, minimized, and managed so that they are environmentally acceptable. We hope this document will act as an easy reference for various stakeholders interested in progression of sustainable development planning for the Uttarakashi district. Moreover, it will help develop a comprehensive understanding of environmental planning process, which has gone into development of the area over the period. Finally, it briefly touches upon the imminent need for bringing in mountain perspective in developmental planning for the district.

Date: October 01, 2021

Principal Investigator, Co Principal Investigators & Project staff

ACKNOWLEDGEMENT

The present 'District Environment Plan' has been an outcome due to coordinated efforts put together by different stakeholders from top to bottom in the State as well as in the district. At the outset, we thank Chief Secretary, Uttarakhand Government; Secretary, Forest Department, Secretary, Ministry of Environment, Forest and climate change (MoEFCC), Government of India, Principal Secretary/Chairman, UKPCB, Dehradun and Member Secretary, Uttarakhand Pollution Control Board (UKPCB). We also thank the Director, G.B. Pant National Institute of Himalayan Environment (GBPNIHE), Kosi-Katarmal, Almora for providing necessary facilities, instrumental support and encouragement. We are also thankful to Chairman & District Magistrate (DM), Uttarakashi, Shri Mayur Dixit, and District Forest Officer (DFO) Uttarakashi, Member Secretary, for their time to time valuable inputs in the formulation of district environment plan. We acknowledge all the support received from different departments including DM office, UKPCB, Nagar Palika Parishad, Forest Department, Health Department, Jal Sansthan, Irrigation Department, Mining Department, and Regional Transport Officer (RTO) for providing the information in a very satisfactory manner. The guidance and support from MoEF&CC and Government of Uttarakhand remained a constant source of inspiration at stages of this work. We thank and acknowledge all officers/staff who could directly or indirectly contribute their valuable inputs in completing the work. We also extend our thanks to all the colleagues who made this work a memorable and worthwhile experience.

Lastly but not least, our especial thanks go to Uttarakhand Pollution Control Board (UKPCB), Government of Uttarakhand, for financial support (Letter No. UKPCB/HO/Gen.183-431/2020/2156-415, dated 05/08/2020) to conduct the study in the 13 districts as well as the state of Uttarakhand.

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ABBREVIATIONS

AMRUT	-Atal Mission for Rejuvenation &Urban Transformation
APL	-Above Poverty Line
AR	-Assessment Report
As	-Arsenic
BMWMIS	-Biomedical Waste Management Information System
BPL	-Below Poverty Line
C	-Carbon
C&D waste	-Construction & Demolition waste
CACMP	-Catchment Area Conservation Programme
CAGR	-Compound Annual Growth Rate
CBMWTF	-Common Bio-Medical Waste Treatment Facility
Cd	-Cadmium
CD	-Check Dam
CEMS	-Continuous Emission Monitoring System
CETP	-Common Effluent Treatment Plant
CFL	-Compact Fluorescent Lamps
CGWB	-Central Ground Water Board
CH_4	-Methane
CK	-Chal Khal
CO	-Carbon monoxide
CO_2	-Carbon dioxide
CPCB	-Central Pollution Control Board
CPHEEO	-Central Public Health and Environmental Engineering Organisation,
Cr	-Chromium
CSCs	-Community Sanitary Complex
CT	-Contour Trench
Cu	-Copper
DDT	-Di-chloro diphenyltrichloroethane
DPR	-District Project Report
DPRO	-District Panchayati Raj officer
EEE	-Electronics & Electrical Equipment
EEMI	-Electricals & Electronics Manufacturing in India
ENVIS	-Environmental Information System

ETPs	-Effluent Treatment Plants
E-Waste	-Electronic Waste
F	-Fluoride
FPZ	-Flood plain zones
FSI	-Forest Survey of India
FSSM	-Faecal Sludge & Septage Management System
GBPNIHE	-G.B. Pant National Institute of Himalayan Environment
GIS	-Geographical Information System
GPS	-Global Positioning System
HCFs	-Health Care Facilities
HFL	-Highest Flood level
ICIMOD	-International Centre for Integrated Mountain Development
ICT	-Information & Communication Technology
IEC	-Information, Education & Communication
IHHLs	-Individual Household Latrines
IPC	-Inter-Personal Communication
IPCC	-Intergovernmental Panel on Climate Change
IRAP	-Integrated Rural Area Programme
ISO	-International Organization for Standardization
ISWM	-Integrated Solid Waste Management
IWRM	-Integrated Water Resources Management
MBBR	-Moving Bed Biofilm Reactor
MDWS	-Ministry of Drinking Water & Sanitation
MMT	-Million Metric Tons
MoEF&CC	-Ministry of Environment, Forest & Climate Change
MoF	-Ministry of Finance
MoUHA	-Ministry of Urban & Housing Development
MPCC	-Medical Pollution Control Committee
MRF	-Material Recovery Facility
MSMEs	-Micro, Small & Medium Enterprises
MSW	-Municipal Solid Waste
MTPD	-Metric Ton Per Day
NA	-Data Not Available
NA	-Not Applicable

NAAQS	-National Ambient Air Quality Standards
NACP	-National Clean Air Program
NASA	-National Aeronautics & Space Administration
NCEPC	-National Committee on Environment Planning & Co-ordination
NGOs	-Non-Governmental Organizations
NGT	-National Green Tribunal
NH	-National Highway
NITI	-National Institution for Transforming India
NP	-Nagar Panchayat
NPP	-Nagar Palika Parishad
NTFPs	-Non-Timber Forest Products
ODF	-Open Defecation Free
OSS	-On-Site Sanitation
PAT	-Perform, Achieve & Trade
PCC	-Pollution Control Committee
PHCs	-Primary Health Centre
PM	-Particulate Matter
PT	-Percolation Tank
PWD	-Public Works Department
QPD	-Quintal Per Day
RBMs	-Riverbed Minerals
ROHS	-Restriction of Hazardous Substances
RSM	-Rural Sanitary Marts
RTRWH	-Rooftop Rain Water Harvesting
SBM-G	-Swachh Bharat Mission Gramin
SDGs	-Sustainable Developmental Goals
SIDCUL	-State Industrial Development Corporation of Uttarakhand Limited
SLWM	-Solid & Liquid Waste Management
SPCB	-State Pollution Control Board
SSMG	-Sustainable Sand Management Guidelines
STP	-Sewage Treatment Plant
TPD	-Ton Per Day
TSDF	-Treatment Storage & Disposal Facilities
UKPCB	-Uttarakhand Pollution Control Board

ULBs	-Urban Local Bodies
UNDP	-United Nations Development Programme
UREDA	-Uttarakhand Renewable Energy Development Agency
WHO	-World Health Organization
ZED	-Zero Effect Zero Defect
ZLD	-Zero Liquid Discharge
µg	-Microgram

EXECUTIVE SUMMARY

Uttarkashi district is witnessing an unprecedented rise in levels of urbanization, rising quantity of waste and lack of sustainable public transport. Moreover, increased tourism has brought with it several environmental and urban planning related challenged for the district. While the causal mechanisms of environmental and climate change are numerous and complex, economic growth and population growth are the factors that can be highlighted to explain the increasing stress imposed by human interference on the natural environment.

To analyse the current environmental status and to furnish a comprehensive plan to mitigate the environmental deterioration, GBPNIHE was assigned with the task to prepare district Environment plan. Detailed deliberations were carried out to devise the action plan focusing on explicit thematic areas which includes:

- ***Waste Management Operations:*** At present, proper collection and disposal of solid waste *(both dry and wet)* is practiced in the urban centres of the district. However, there is no established mechanism for waste collection in the rural areas.
- Waste segregation at source is a major issue in all the urban local bodies of the district. Moreover, the waste recovery and disposal facilities are not robust. Due to improper segregation of municipal solid waste, the domestic hazardous and E- waste are also dumped in the landfill sites causing environmental hazards.
- ***Biomedical Waste Management:*** The district has adopted a very unique centralized mechanism for the collection and treatment of biomedical waste where the biomedical waste is lifted by treatment facility *i.e. Medical Pollution Control Committee (MPCC), Roorkee)* from the major health care facilities of the district which act as a transfer points for nearby healthcare facilities.
- Overall the district is performing well in Biomedical waste management. The only work that needs to be done is the linkage of all the leftover health care facilities with the Common Biomedical waste treatment facility through this mechanism.
- ***Construction and demolition waste management:*** Rapid urbanisation and development of road infrastructure *(especially The Char Dham road project)* in the district has led to increase in the generation of construction and demolition waste. Indiscriminate disposal of road construction and debris from landslides have endangered downhill slopes and polluted rivers. Still the district lacks mechanism for proper handling of this waste. By laws must be framed to have a common set of guidelines for management of C&D waste.

- ***Waste water Management***: At present 35% and 40% population in Badahat (Uttarkashi) and Gangotri are connected through sewerage network respectively. To connect rest of the population, the urban local bodies have sent the proposals to the government. Other urban local bodies are also planning to adopt suitable treatment facilities *(off-site or on-site)* based on the topography and financial conditions.
- The district has no operational industrial effluent treatment plant as liquid waste industrial units are not established in the district so far.
- ***Air and Noise Pollution:*** Compared to a couple of decades ago, particulate pollution is no longer a feature of Indo-Gangetic plains alone. Events of massive forest fires are increasing and the numbers of vehicles are also soaring. Thus there is need of continuous monitoring of air quality and noise levels in the district to come up with a mitigating strategy.
- ***Surface and Groundwater Management:*** As the global temperatures are rising and weather patterns are changing drastically, the water sources in the Himalayan region are severely affected. As the district is dependent on glacier fed water bodies and ground water sources for its water needs, hence proper watershed and spring shed management needs to be done for sustainable management of water sources.
- ***Mining activity:*** As of now, illegal mining is not a big issue in the district however penalties were imposed on those who were found violating the norms. With the rapid urbanisation, there is a possibility of exponential rise in the demand of sand and other RBMs (Riverbed Minerals), so proper surveillance with the help of modern equipment's is now becomes necessary to have a check on the mining activities within the district.

The execution of this management plan will require the integration and co-operation of the people, private and public stakeholders of Uttarakashi. This plan aims at reducing the risk on the human health and environment with a target of sustainable development.

INTRODUCTION

Establishing a link between environmental degradation, poverty and economic sustainability have been always a challenging task before the planners. The world's poor are significantly prone to natural disasters pertaining to the fact that in many cases their livelihoods are directly dependent on the natural resources. Human welfare is closely associated with the health of the environment. Around the world, 24 percent of deaths can be traced back to avoidable environmental factors (WHO, 2018). People are in direct need of clean air to breathe, freshwater to drink and suitable places to live in that are free from pollutions including toxic substances and hazards. The 2030 agenda for Sustainable Development Goals (SDGs) and its 17 Goals adopted by world leaders define a blueprint for future development trajectory to all the nations with a focus on poverty eradication, environmental sustainability, peace and harmony (Anonymous, 2018; WHO, 2018; Azash, & Thirupalu, 2017). Recently, Intergovernmental Panel on Climate Change (IPCC) released a Report on "Climate Change 2021- The Physical Science Basis" as a part of IPCC's Sixth Assessment report *(AR6)*. The facts presented in this report regarding raising a crucial red flag that global temperatures have already risen by about 1.1ºC from pre-industrial times and has warned that 1.5ºC threshold is likely to be breached before 2040 *(the stated objective of 2015 Paris Agreement, the international architecture to fight climate change, is to limit temperature increase to within 2 ºC from pre-industrial times)* (IPCC, 2021). For the Indian, perspective, the report says that waves and humid heat stress will be more intense and frequent in 21st century (IPCC, 2021). Changes in monsoon precipitation are also expected, both annual and summer monsoon precipitation are projected to increase (Krishnan, et al., 2020). In regard to the Himalayan context, the area is one of the most fragile mountainous regions of the world. Hence, it is susceptible to changes in Environmental conditions and ecology (Krishnan et al., 2020). These mountains are considered to be the Water tower of South Asia, as major rivers of the Indian sub-continent originate from the Himalayan Mountains. However, the area has become a global hotspot since the past two decades in view of environmental degradation. The indirect impact has also seen in the glaciological aspect of these mountains (Eriksson, et al., 2019). Almost, 500 million people of South Asia are dependent upon the health aspect of the Himalayan ecosystem. In India, the Himalayan Mountain Chain directly serves as a national interest because of working as a guard in view of defense purpose, unique ecosystem in view of permanent snow cover and incessant sources of water and biodiversity hotspots. The people in downhill slopes and in the Indo–Gangetic plains realize its significance in many more aspects in view of sustainable development. A prerequisite for such

sustainability is ecological audit in areas, which at once would apprise about the present environmental issues and a strategy to meet the targets for the future (Sandhu & Sandhu, 2015).

Uttarakhand being a crucial chunk of the Himalayan regime is utmost vulnerable to environmental degradations and risks. About three fourth of the state's population is rural, therefore their livelihoods are almost dependent on natural resources (Raj 2015). The traditional customs and traditional knowledge of the local people of Uttarakhand tend to be sustainable and are in harmony with the natural ecosystem. However, these traditional customs and traditional knowledge are often overlooked as sometimes reckless development of roads, infrastructure, and environmental degradation takes precedence over the traditional ecological knowledge. The recent data on SDGs indices released by NITI Aayog shows that the state is one of the top gainers with increase in overall index by 8 points. However, a lot is needed to be done in terms of the indicators related to Climate Action *(SDG, 13)* (Chopra, 2014). The tragedy of ecological governance in most parts is that it remains trapped in Environment - Development Binary. In contrast, the people of Uttarakhand had in past shown with movements such as the Chipko Andolan (1953), which gave an idea of human well-being sensitive to forests, mountains, and water bodies (Sarkar, 2018).

The art of establishing balance between economic development and sustainable development is known to many, but how is implemented in the ground is known by few. We need to devise a strategy to break this trade off so that a mutually beneficial situation is achieved for the environment and society (Messerli et al., 2019). Environment plan is a prerequisite to understand how the social, political and economic factors are affecting the environment considering development. Environmental planning begins in India in early 1970s after Human Environment Conference at Stockholm held by United Nations which led to the formation of National Committee on Environment Planning and Co-ordination (NCEPC*)* (NATCOM, 2012). Subsequently, then the Ministry of Environment and Forest (MoEF) was formed in mid 1980s by Government of India. Realizing that the conservation of nature and its sustainability is a basic requirement for sustaining healthy life on globe. The key purpose of this plan is therefore to implement and devise programs intended to reduce pollution loads in different natural components, suggest mitigating or minimizing impacts, conserving and protecting the environment which could be considered together as a base for sustainable development (UNDP, 2015; Gaur, 2008).

FUNDAMENTAL PRINCIPLES OF ENVIRONMENT PROTECTION

(Judgments of the Hon'ble Supreme Court of India)

Sustainable Development

Hon'ble Supreme Court has recognized the principle of sustainable development as a basis for balancing ecological imperatives with development goals. In rural litigation and entitlement Kendra, *Dehradun Vs. State of U.P.*, the Supreme Court 1985 was apprised with the problem of the mining activities in the limestone quarries in Dehradun-Mussoorie area (Azash, No, 2014; Thirupalu, 2017). This was the first case of its kind in the country involving issues relating to environment and ecological balance and brought into sharp focus the conflict between development and conservation. In this case, the Supreme Court emphasized the need for reconciling development and conservation in the larger interest of the country (No, 2014; Sahu, 2014). Furthermore, it was realized that the necessary condition for achieving sustainable development is ecological security, economic efficiency and social equity (Rajaram, 2005).

Precautionary Principle

The emergence of precautionary principle marked a shift in the international environmental jurisprudence– a shift from assimilative capacity principle to precautionary principle. Basically, it is a principle which ensures that a substance or activity posing threat to the environment is prevented due to adversely affecting it, even if there is no conclusive scientific proof lining that particular substance or activity to the environment damage (Kriebel, et. al., 2001). In *Vellore Citizens Welfare Forum Vs. Union of India*, it was alleged that the untreated effluent being discharged by tanneries in Tamil Nadu was entering into the river, agricultural fields and was significantly polluting the water. Justice Kuldip Singh *(Known to be Green Judge)* observed that "even otherwise once these principles are accepted as a part of the Customary International Law, there would not be difficulty in accepting them as a part of domestic law (Venkat, 2012). It is almost accepted proposition of municipal law, that the rule of customary international law, which are not contrary to the municipal law shall be deemed to be incorporated in the domestic law and shall also be followed by the courts of laws of the country. According to this special principle, the burden is on the person wanting to change the status quo to show that the actions proposed will not have any adverse effect, the presumption operating in favor of environmental protection (Singh, 2000).

Polluter Pays Principle

Polluter Pays Principle (PPP) has become a popular slogan in recent times. *"If you make a mess, it's your duty to clean it up".* It should be mentioned that in environmental law, this principle doesn't refer to Fault". Instead, it favours a curative approach which is concerned with repairing ecological

damage (Kriebel, et al., 2001). The Hon'ble Supreme Court held that as per the Polluter Pays Principle, "once the activity carried on is hazardous or inherently dangerous, the person carrying out such activity is liable to make good the loss caused to any other person by this activity irrespective of the fact whether he took reasonable care while carrying on his activity. While applying the principle of polluter pays, the Supreme Court later expressed the view that compensation to be awarded must have some correlation not only with the magnitude and capacity of the enterprise but also with the harms caused by it (Kriebel, et al., 2001).

Public Trust Doctrine

The public trust doctrine primarily rests on the principle that certain resources like air, sea water and forests have such a great importance to the people as a whole that it would be wholly unjustified to make them a subject of private ownership. The said resources being a gift of nature, they should be made freely available to everyone irrespective of the status in life. This doctrine came up 2014 for consideration in the *M.C. Mehta vs. Kamal Nath* (No. 2014). A rather unusual situation had arisen in this case had also encroached on protracted forestland after which encroachment was subsequently regularized. Though the Supreme Court did not specifically refer to the Doctrine of Public Trust directly in many cases they have given impact on this doctrine implicitly (Abash and Thirupalu, 2017). Traditionally, the doctrine of public trust was applied only for protection of access to the common for public benefit, now the doctrine is being applied even to prevent over-exploitation of the environmental components (Azash, and Thirupalu, 2017).

Public Liability Insurance

The Public Liability Insurance Act 1991 has been enacted with the objective of providing immediate relief to the victims of accidents that might occur while handling hazardous substances. The owner who has control over handling of hazardous substances is required under the act to pay specified amounts to the victims as interim relief based on "No-Fault" liability. The expression 'Handling' is defined widely to include manufacture, trade and transport of hazardous substances. *Accidents by reason of war or radioactivity are excluded from the scope of the Act (*Azash and Thirupalu, 2017). The principle of absolute liability was propounded in case of *MC Mehta vs. Union of India* with the primary question regarding the extent to which industries engaged in hazardous and inherently dangerous industries can be held liable. This principle was further reaffirmed in the Indian Council for *Enviro Legal Action vs. Union of India* in which it was held that industries will be absolutely liable to the harm caused to villages due to pollution caused due to soil and underground water. Hence, these are bound to take remedial measure to improve the situation *(*Azash, and Thirupalu, 2017).

ENVIRONMENT MANAGEMENT SYSTEM (ISO 14001:2015)

An environmental management system helps organizations identify, manage, monitor, and control their environmental issues in a holistic manner. ISO 14001 is an internationally agreed standard that sets out the requirements for an environmental management system (Da, 2015). It helps organizations to improve their environmental performance through more efficient ways of resource use and reduction of waste. Other ISO standards that look at different types of management systems such as ISO 9001 for quality management and ISO 45001 for occupational health and safety, all use a high-level of structure. This means that ISO 14001 can be integrated easily into existing ISO management systems. ISO 14001 includes the need for continual improvement of an organization system and approach to environmental concern (Da, 2015). It is suitable for organizations of all types and sizes, let they be private, or not-profit organisation or governmental. It is desirable that an organisation should consider all environmental issues relevant to its operations such as air pollution, water and sewage issues, waste management, soil contamination, climate change mitigation and adaptation, and resource use efficiency (Ferronato and Torretta, 2019).

DISTRICT PROFILE

Uttarkashi district is carved out of the erstwhile Tehri Garhwal district on February 20, 1960. It sprawls in the rugged terrain of the mystic Himalayas over an area of 8016 km^2. Geographically the district lies in the north western part of Uttarakhand. It is bounded by Himachal Pradesh and Tibet (China) in the north, Tehri Garhwal district on the south, districts Chamoli and Rudraprayag on the east and district Dehradun on the west (Parkash, 2015). The district is well connected with a vast network of national and state highways including NH 134, NH34, NH 507, NH 707 and NH 707A. The nearest railway station from the district headquarters is Rishikesh (Dehradun) and the nearest airport is Jolly Grant airport, Dehradun. The district also has an airstrip at Chinyalisaur, about 35 km away from the district headquarters, which is currently suitable for emergency operations and could play an important role in enhancing national security.

The district is named after its headquarters town Uttarkashi, an ancient place with rich cultural heritage and as the name suggests is the Kashi of North (Uttara) held almost as high a veneration as Kashi of the plain (Varanasi). Both the Kashi of the plain (Varanasi) as well as the Kashi of north are situated on the banks of the river Ganga (Bhagirathi). The land of Uttarkashi has been held sacred by Indian since ages where the seers and sages had found solace and spiritual aspiration and performed penances. Two out of the four major Dhams *(also referred as "the four abodes")* of the

Hindus namely Gangotri and Yamunotri are situated in the district which gives immense religious importance.

Uttarkashi is famous for its scenic and surreal landscape. The district is mostly visited for spiritual awakening, but there are unquestionably many other scenic places such as high alpine meadows, hot water springs, and wildlife protected areas such as Gangotri National Park and Govind Pashu Vihar National Park which attracts the travellers from around the world. Uttarkashi hosts Nehru Institute of Mountaineering *(a premier mountaineering institute working under aegis of ministry of defence)* which offers professional mountaineering and adventure sport courses for all age groups and is certified by international federation for climbing and mountaineering. Notably, apple is a vital horticulture crop in Uttarkashi as the district is largest producer in Uttarakhand, which is the third largest apple producer state in India (District Survey Report, 2016; Dash and Punia, 2019).

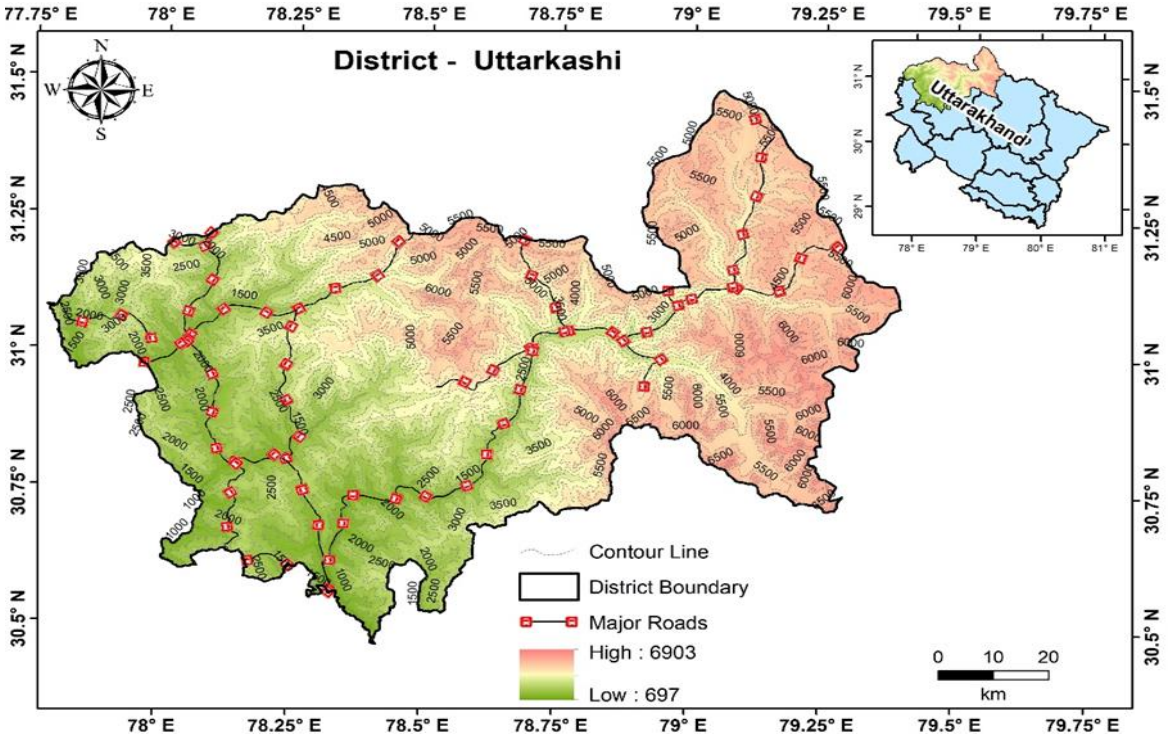


Fig. 1 Location and Salient feature of Uttarakashi District.

Table 1. District at a Glance

Geographical Location	
Latitude	$30^0$27’18” N - $31^0$27’42” N
Longitude	$78^0$48’26” E - $79^0$24’00” E
Geographical Area	8016 km^2
Average elevation of district Headquarter	1158 m
Population Data	

Total Population	330086
Male Population	168597
Female Population	161489
Population density	41
Decadal Population growth rate (2001-2011)	11.89 %
Overall Literacy rate	75.81 %
Male literacy	88.79 %
Female literacy	62.35 %
Sex Ratio	958
Urbanised area	0.34%
Rural area	99.66%
Administrative Divisions	
Tehsils	06
Blocks	06
Nyay Panchayats	36
Village Panchayats	500
Total census villages	703
Municipal councils	01
Nagar panchayats	05
Cantonment boards	--

Source: District Census Handbook 2011 and District Survey Report 2016

Topography

District Uttarkashi is represented by highly rugged topography. The region is covered with very sharp undulated terrain owing to high mountains, narrow valleys, deep gorges, plateaus, and flatlands. The northern and eastern parts are covered with snow throughout the year as the area is preoccupied of glaciers namely Gangotri, Yamunotri, Raktvarn, Bunderpoonch, Charan, and Rahita. It is the land of Uttarkashi district that gives rise to two great and reverent rivers on India, the Bhagirathi, called the Ganga in the plains and the Yamuna (Table 2).

Table 2.Mountain ranges in Uttarkashi District

Ranges	Major Peaks	Elevation (m)
The Gangotri Mountain Range	Chaukhamba I, II & III	7138, 7058 & 6974
	Satopanth	7075
	Kedarnath	6940
	Sri Kailash	6931
	Thalay Sagar	6904
	Bhagirathi Parbat I	6856
	Janhukut	6805

	Pilapani Parbat	6796
	Mana Parbat I	6794
	Vasuki Parbat	6792
	Bhrighupant	6772
	Gangotri I	6672
The Bunderpoonch Mountain Range	Kalanag	6387
	Bunderpoonch I & II	6316 & 6102
	Swargarohini I, II & III	6252, 6247 & 6209

Source: *District Survey Report, Uttarkashi (2018)*

Table 3.Major River Systems in Uttarkashi district

River System	Origin	Tributaries
The Bhagirathi River System	Gangotri-Gaumukh Glacier, Gangotri, Uttarkashi	Kedar Ganga, Jadh Ganga, Kakora Gad, Jalandhari Gad, Asi Ganga, Bhilangana River etc.
The Yamuna River system	Yamunotri Glacier, Near Bunderpoonch peak, Uttarkashi	Rishi Ganga Kunta, Hanuman ganga, Tons, Giri, Chambal, The Sind, The Betwa etc.
The Tons River System	Bunderpoonch Mountain, Uttarkashi	Pabbar River, Asan River

(Source: District Survey Report, Uttarkashi 2018)

Climate

Due to wide variation in elevation, the region experiences different weather conditions throughout the year. The northern part of the district is perennially under snow cover; here the climate is sub-arctic type as the area is represented by the lofty Himalayan range. Severe winter and comparatively higher rainfall are the characteristic features of the northern part of this district (Gupta, 2014). The district experiences four major weather seasons i.e., winter season *(December to Februar*y), summer *season (March to May),* Southwest monsoon season *(June to September*), Post monsoon *season (October to November).* June is the warmest and January is the coldest months when cold wave following the western disturbances often leads to chilling conditions and the temperature goes down below freezing points. The annual average temperature of the district is 14.1°C (Attri and Tyagi, 2010).

Rainfall

The larger part of the district is situated on the southern slopes of the outer Himalayas. Monsoon currents can penetrate through trenched valleys; the rainfall reaches its maximal in the monsoon season. 70% to 80% of the annual rainfall happens during the months of June to September (Gupta, 2014). August is usually the wettest month which accounts for about 75% of the annual rainfall. November is the driest month in this region. Winter precipitation, mostly in the form of snowfall *(in higher elevations) is* usually derived essentially from the western disturbances and frontal

cyclones along the Polar front in this district. The annual average rainfall in the district is about 1902 mm (District Survey Reports, 2018).

Groundwater status of the district

The district Uttarkashi is mainly covered by Himalayan Mountain ranges. A large part of the district is perennially under snow cover. Groundwater investigations can't be carried out in the snow-covered areas due to the accessibility problem. Hence, there is no scope of ground water development in this area. However, ground water can be extracted in the lower reaches through hand pumps (GWB, 2011). Besides, there are number of natural springs which can be utilized to cater the need for drinking water and irrigation. Four valleys have been identified in the region with sufficient thickness of valley fill deposits where ground water can be developed (CGWB, 2020).

Forestry

Forests are mainly found in the upper ridges and around the valleys of the district. As much as 88% of the total area of the district is administrated by forest department (Table 4). Valuable fuels and buildings wood trees include Pine (*Pinus roxburghii* Sarg.), Deodar (*Cedrus deodara* Roxb. ex D.Don.), Oak (*Quercus leucotrichophora* A.Camus), Burans (*Rhododendron arboreum* Sm.), Spruce (*Abies pindrow* Royle ex D.Don. Royle), Birch (*Betula utilis* D.Don), etc. are found in this district. These forests are also beneficial from economic, industrial and environmental point of view. Providing refuge to sensitive sub-alpine and alpine vegetation lies Gangotri National Park which is one of the largest protected areas of Uttarakhand (Negi et al, 2012). The major portion of Gangotri National park is rugged and snow-covered. Moreover, the district also hosts Govind Wildlife Sanctuary and National park which managed *"Snow Leopard Project"* by Government of India to ensure the long-term conservation of elusive and endangered snow leopard.

Table 4.Forest Cover of Uttarakashi District

District	Geographical Area	Very Dense Forest	Mod. Dense Forest	Open Forest	Changes as of 2017-2019 assessment
Uttarkashi (km^2)	8016	614.67	1706.86	714.47	8.00

Source: FSI, (2019)

Flora and Fauna

Flora

Due to the inaccessibility of the region and relatively fewer human habitations, the flora in the district is abundant. The region being at a significant range of elevation is home of rich species of

trees, medicinal plants and flowers, which are full of various colors and fragrances. Many delightful flowers such as *'Hemkamal* (*Saussurea simpsoniana* Lipsch)' or snow lotus and the state flower of Uttarakhand *Brahma Kamal* (*Saussurea obvallata* Wall.) flourishes in the high Himalayan regions of the district. One of the most important flora categories named as Bugyals *(3500–4500m elevation)* with a rich variety of flowering grass and shrubs are prevalent in the district. The alpine and sub alpine zones are considered as the most natural adobe of the largest number of medicinal plants. Atis (*Aconitum heterophyllum* Wall. ex Royle), Masi (*Nardostachys jatamansi* C.B. Clarke), Padam (*Prunus cerasoides* D.Don), Chiraita (*Swertia chirayita* (Roxb.) Buch.-Ham. ex C.B. Clarke) etc. are the major herbal varieties which are available in abundance (Kala et al. 2006).

Fauna

Major attraction of this region is the abundance of wildlife and bird species that can be seen enhancing the ambience of the district. Snow leopards, one of the rarest wild animals have been spotted multiple times in Gangotri national park (Table 5).

Table 5. Faunal distribution in the District

Felines	Antelopes	Birds
Snow leopard (*Panthera uncia*)	Bharal (*Pseudois nayaur*)	Monal (*Lophophorus*)
Tiger (*Panthera tigris*)	Serow (*Capricornis*)	Kokla (*Treron sphenurus*)
Leopard Cat (*Prionailurus bengalensis*)	Musk dear (*Moschus chrysogaster*)	Cheer (*Catreus wallichii*)
Civet cat (*Paradoxurus hermaphroditus*)	Sambhar (*Rusa unicolor*)	Kalij (*Lophura leucomelanos*)

Culture and Tradition

Culture of Uttarkashi district is the amalgamation of varied beliefs and practices. This land was inhabited by hill tribes named as Kiratas, Uttara kurus, Khasas, Tangnas, Kunindas since ancient times. The people of Uttarkashi have been fond of fairs and festivals since very long, which bring them joy and amusement. The major festival observed here includes Makar Sankranti, Diwali, Shivaratri and Butter Holi. Unique religious' rituals with traditional songs and dances also accompany the celebration. Apart from this, cultural and religious fairs are also organized by the district administration which includes Magh Mela, Sainik Mela, Krishi Mela and many more. Woolen cloths made from sheep's wool, wooden sculpture, eco-friendly basket etc. are the common crafts in the district. Uttarkashi district is filled with divine aura of ancient temple include Kashi Viswanath Temple, Gangotri Temple, Yamunotri Temple and many more (District Survey Report, 2018).

ENVIRONMENT CONCERNS IN THE DISTRICT

The district is located in the seismic zones IV and V. It is traversed by the Main Central Thrust (MCT) and has witnessed history of disasters. Higher intensity of rainfall and cloud burst phenomenon is also common in the region. It was noticed that during last 10 years' maximum loss of life and property was caused by cloudburst (Varghese and Paul, 2013; Khanduri, 2018).

Population has brought certain irreversible changes endangering life support system. Over exploitation of forests, destruction of slope stability by indiscriminate and ruthless excavation of roads, tunnels, dams etc. has prompted environmental degradation in the past decade. Landslides have become common and soil erosion is increasing at a very fast rate. The springs are drying up or becoming seasonal (Varghese and Paul, 2013). A large number of slope failures have affected the main highways in the Himalayas, which are important routes for pilgrims around the world. Such unstable slopes on Rishikesh-Uttarakshi highway has caused road subsidence and has consequently affected several houses situated on downhill slopes (Varghese and Paul, 2013; Forbes et al, 2013).

As number of tourist visiting the Char Dham Yatra increase every year, so does the influx of vehicles, especially diesel vehicles. This is resulting in the settling of a particle known as ***Black Carbon***, which absorbs sunlight and causes rapid depletion of the glacier. For instance, the Gangotri glacier, which is feeding ground for Ganga River, is blackening due to increased pollution levels (Varghese and Paul, 2013).

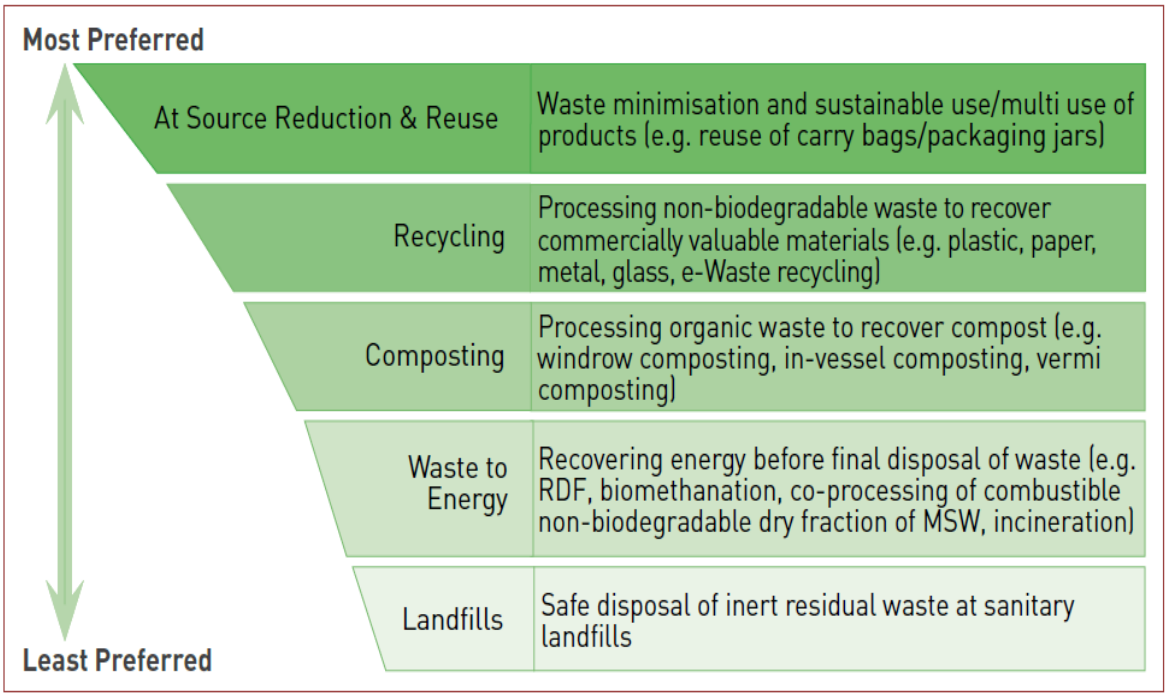
DATA AND IMPACT ANALYSIS

SOLID WASTE MANAGEMENT

MoEF&CC *(Ministry of Environment, Forest and Climate Change)* defines MSW *(Municipal Solid Waste)* as commercial and residential waste generated from a municipal area in either solid or semi-solid form excluding hazardous waste *(Industrial*), but including treated bio-medical waste. Predominantly, about *0.17 kg* of MSW is generated per capita per day in small towns compared to about *0.67 kg* per capita per day in cities. More than *70%* of waste in India is believed to be dumped in an unsatisfactory manner (Sharma and Jain, 2019).

Integrated Solid Waste Management (ISWM)

It is based on the waste management hierarchy, with an aim to reduce the amount of waste being disposed while maximizing resource recovery and efficiency. Based on this waste management hierarchy, an assessment of local needs and conditions should lead to the selection of an appropriate mix of process and technologies.



Source: MoUHA, 2016

Fig. 2 New Waste Management Paradigm

Table 6. Inventory of Total Solid Waste Generation

Name of Urban Local Body	**Population *(2011 census)***	**Number of Wards**	**Solid waste generation *(MTPD)***			
			Dry	**Wet**	**C&D and others**	**Total**
Nagar Palika Parishad Badahat,(Uttarkashi)	27102	11	4.5	4.5	1.0	10
Nagar Palika Parishad Chinyalisaur	8844	07	1.5	1.0	0.22	2.72
Nagar Palika Parishad Badkot	7414	07	02	0.5	0.5	03
Nagar Panchayat Purola	7931	07	1.06	1.43	0.01	2.5
Nagar Panchayat Naugaon	5174	07	0.3	1.7	0.025	2.025
Nagar Panchayat Gangotri	110	-	0.04	0.46	0.004	0.504

(*Source: District Administration Uttarakashi, 2021*)

Table 7. Waste Management Operations

Waste management Operations	**Outcome**	
Segregation at source	***ULB***	***Source Segregation* (%)**
	NPP Badahat	20
	NPP Chinyalisaur	70
	NPP Badkot	70
	NP Purola	20
	NP Naugaon	30
	NP Gangotri	100
Door to Door Collection	All the ULBs in the district have 100% coverage for door to door collection.	
Sweeping	All the ULBs in the district are accomplishing 100% sweeping by manual method.	
Segregated waste Transport	***ULB***	***Segregated waste Transport***
	NPP Badahat	Partially
	NPP Chinyalisaur	Partially
	NPP Badkot	Partially
	NP Purola	Partially
	NP Naugaon	Partially
	NP Gangotri	Complete
Material Recovery Facility (MRF) operation	• Only NP Gangotri has functional Material Recovery Facility (MRF). • Recovery facilities in NPP Badahat and NPP Badkot are under construction. • NPP Chinyalisaur, NP Purola, NP Naugaon have approved DPR for the construction of recovery facilities.	

Involvement of Non-Governmental Organizations (NGOs) /private agencies	NPP Badahat and NPP Badkot have hired a private firm (*Zero Waste Incorporation*) to handle their waste management operations. Other ULBs are performing their waste management operations by themselves.	
Authorization and issuance of Identity cards to waste pickers/Sanitation workers	***ULB***	***Numbers***
	NPP Badahat	68
	NPP Chinyalisaur	17
	NPP Badkot	14
	NP Purola	16
	NP Naugaon	15
	NP Gangotri	19
Linkage With Treatment Storage and Disposal Facilities (TSDF) /Bio-Medical Waste Treatment Facility (CBMWTF)	No ULB in the district have linkage with the treatment storage and disposal facility.	

(Source: District Administration Uttarakashi, 2021)

Table 8. Present Infrastructure for Waste Management Operations

Name of ULB	**Inventory of Infrastructure Involved in Waste Management Operation**					
	Waste collection trolleys	**Mini collection trucks/tractors/ others**	**Composting units/ On site composting facilities**	**Material recovery Facility (Available/Not Available)**	**Landfills (open dumping/Trenching Ground/sanitary landfills)**	**Remarks**
NPP Badahat	60	5	8	Not Available	Open dumping	Material Recovery facility is under construction in the land approved.
NPP Chinyalisaur	17	3	8	Not Available	Dumping in trenching ground	DPR is approved by the Government of India to set up facility for scientific disposal of waste in the U.L.B.
NPP Badkot	20	4	5	Not Available	Dumping in trenching ground	Material recovery facility is under construction in the ULB.
NP Purola	17	1	8	Not Available	Dumping in trenching ground	DPR. is approved by the Government of India to set up facility for scientific disposal of waste in the ULB
NP Naugaon	18	02	17	Not Available	Open dumping	Out of 17 composting pits, 15 are constructed by horticulture department in the outskirts of the ULB. Remaining 2 are

						constructed by NP itself.
NP Gangotri	15	01	02	Available	Dumping in trenching ground	Trenching ground is constructed temporarily on a land nearby to ULB

(*Source: District Administration Uttarakashi, 2021*)

Table 9.Methods of Treatment, Disposal and Recovery

Name of ULB	**Wet waste management *(Centralised or on-site composting)***	**Dry Waste Management *(waste to Energy/Recycling/incineration/ open Dumping in Trenching ground/ sanitary landfill)***	**Remediation of old dump site**
NPP Badahat	There are 8 composting pits operational for wet waste management in the ULB	• Non-biodegradable waste after segregation and compaction is send to the recycling facility at Rishikesh. N.P.P. has so far earned Rupees 1,34,165 by selling its waste to the recyclers • All the residual and inert waste is dumped in an open dump site.	Bio-Remediation of legacy waste is initiated at the old dump site.
NPP Chinyalisaur	There are 8 composting pits operational for wet waste management in the ULB	• Dry waste is collected at the tertiary collection point near trenching ground of the ULB out of which recyclable waste is sold to the local rag pickers. • NPP has earned almost 39400 rupees by selling their waste. • Non-recyclable waste is dumped in the trenching ground	There is no old dump site within ULB.
NPP Badkot	There are 5 composting pits operational for wet waste management in the ULB	• Non-biodegradable waste after segregation and compaction is send to the recycling facility at Rishikesh. NPP has so far earned Rupees 1.5 lakhs by selling its waste to the recyclers. • All the residual and inert waste is dumped in an open dump site.	There is no old dump site within ULB.
NP Purola	There are 8 composting pits operational for wet waste management.	• Dry waste after collection is segregated near the trenching ground, after that the recyclable waste is compacted and then stored. Process to sell the compacted recyclable waste is under progress and NP is negotiating with private agency (*Zero Waste Incorporation*). • The residual waste is dumped in the trenching ground.	There is no old dump site within ULB.
NP Naugaon	There are 17 composting pits operational for wet waste management.	• Dry waste after collection is dumped in an open dumping site in the outskirts of the ULB	Not Initiated
NP Gangotri	There are 2 composting pits (*can cater up to 5 yatra seasons*) operational for wet waste management.	• All the recyclable waste after compaction is sold to local scrap pickers. • The residual waste/inert waste is dumped in a trenching ground.	No old dump sites are present.

(Source: District Administration Uttarakashi, 2021)

Gap Identification

A common gap has been identified in the waste management operations of all the ULBs of the district as none of them have established linkage with Treatment Storage and Disposal Facility (TSDF) and Common Biomedical Waste Treatment Facility (CBMWTF) for the disposal of domestic hazardous waste and municipal sanitary waste respectively (Table 10).

Table 10. Gap Identification of Uttarakashi District

Name of ULB	Observed Shortcomings	Remarks
NPP Badahat	*Partial Source segregation of waste*	Source segregation is performed in only 2 out of 11 wards. Badahat is trying to achieve 100% source segregation as soon as possible.
	Partial segregated waste transport	As source segregation is partial in the ULB so complete segregated waste transport is not possible as of now.
	Open Dumping of waste	Land is transferred recently to the ULB by forest department for trenching ground.
	Non-availability of any waste recovery facility.	Material recovery facility is under construction in the ULB
NPP Chinyalisaur	*Partial Source segregation of waste*	NPP has achieved 70% source segregation so far and is aiming for 100% segregation at source.
	Partially segregated waste transport	As source segregation is partial in the ULB so complete segregated waste transport is not possible as of now
	Minimal involvement of NGO/private firm for waste management operations.	As of now, no NGO or Private firm has collaborated with the ULB for tis waste management operations. ULB is doing all the waste management operations by itself.
	Non-availability of any waste recovery facility	DPR has been approved for improving waste management operations in the ULB.
	No linkage with authorised waste recyclers	ULB sells their waste to local rag pickers who are not authorised so far.
NPP Badkot	*Partial Source segregation of waste*	As of now, partial source segregation is achieved and ULB is trying their best to achieve the target of 100%.
	Partially segregated waste transport	As source segregation is partial in the ULB so complete segregated waste transport is not possible as of now.
	Non-availability of any waste recovery facility.	Material recovery facility is under construction in the ULB
NP Purola	*Partial Source segregation of waste*	Only 20% household are performing source segregation. Combined waste is received from rest of the households.
	Partially segregated waste transport	As source segregation is partial in the ULB so complete segregated waste transport is not possible as of now.
	Non-availability of any waste recovery facility	DPR has been approved for improving waste management operations in the ULB.
	Minimal involvement of NGO/private firm for waste management operations.	As of now, no NGO or Private firm has collaborated with the ULB for tis waste management operations. ULB is doing all the waste management operations by itself.

	No linkage with authorised waste recyclers	ULB sells their waste to local Rag pickers who are not authorised so far.
NP Naugaon	*Partial Source segregation of waste*	Only 30% household are performing source segregation. Combined waste is received from rest of the households.
	Partially segregated waste transport	As source segregation is partial in the ULB so complete segregated waste transport is not possible as of now..
	Non-availability of any waste recovery facility	DPR has been approved for improving waste management operations in the ULB.
	Open Dumping of waste	Currently ULB does not have any trenching ground for the disposal of residual/inert waste.
	Minimal involvement of NGO/private firm for waste management operations.	As of now, no NGO or Private firm has collaborated with the ULB for tis waste management operations. ULB is doing all the waste management operations by itself
	No linkage with authorised waste recyclers	ULB sells their waste to local rag pickers who are not authorised so far.
NP Gangotri	*Minimal involvement of NGO/private firm for waste management operations.*	As of now, no NGO or Private firm has collaborated with the ULB for tis waste management operations. ULB is doing all the waste management operations by itself.

(Source: District Administration Uttarakashi, 2021)

Table 11. Proposed Policies and Budget Requirement put forward by Different Stakeholders in the District

ULB	Stakeholders Responsible	Proposed Policy	Current status and Budget requirement
NPP Badahat	Nagar Palika	Revamping Solid waste management	• ULB is aiming to achieve O.D.F. + and further ODF ++ status in the upcoming years. • NPP is trying to make the city single use plastic free in the current year. • A new site is under development (*with the budgetary allocation of 1.16 cr.*) to be used as segregation centre and waste recovery facility. Construction of sanitary landfill is also proposed at the new site. • NPP has set the target of 100% decentralised composting up to 2024-25 to reduce its expenditure on waste transportation.
		Remediation of legacy waste	Bio-remediation of 3000 tons old dump site is under process. (The legacy waste from the dump site is transferred to Gazipur (Delhi) waste to energy plant with the help of a private firm Rekart).
NPP Chinyalisaur	Nagar Palika	Revamping Solid waste management	• U.L.B. is declared as bin free city in the year 2021. • D.P.R. of rupees 1.82 crores is approved and budget has been allocated to the ULB to improve its waste management operations. • With the use of this budgetary allocation ULB is planning to procure waste pickers, vehicles and litter bins along with the site development for recovery facility.
NPP Badkot	Nagar Palika	Revamping Solid waste management	• ULB is declared as bin free city in Feb, 2019 and ODF+ in Apr, 2021. • DPR of 1.86 crores is approved and budget has been allocated to the U.L.B. to improve its waste management operations. • With the help of this allocation NPP is planning to procure various equipment's and machinery. Some other works such as segregation & recovery sheds and sanitary landfills are also planned.
NP Purola	Nagar Panchayat	Revamping Solid waste management	• ULB is declared as bin free city in February 2021. • DPR of Rs.1.61 crores is approved for the ULB under which various works such as development of segregation and recovery centre, procurement of waste collection vehicles and construction of sanitary landfill etc. are proposed.
NP Naugaon	Nagar Panchayat	No policy defined for future course of action.	• ULB is declared as bin free city in 2020. • DPR of 2.54 crores is approved for the ULB under which various works such as development of segregation and recovery centre, procurement of waste collection vehicles and construction of sanitary landfill etc. are proposed.
NP Gangotri	Nagar Panchayat	No policy defined for future course of action.	**NA**

(Source: District Administration Uttarakashi, 2021)

Vegetation Suitable for Rehabilitation of Dump Sites

Phytoremediation, collectively referring to all plant based technologies, uses green plants to remediate contaminated sites (Sadowsky, 1999). Natural or planted vegetation on landfill sites has a key role in soil erosion control and removal of contaminants, besides imparting aesthetic value. Moreover, it may be used in leachate treatment. Landfill vegetation often shows signs of damage commonly caused by the presence of landfill gas in the root protection zone. The aim for the reconstruction of a suitable medium for landfill re-vegetation is to provide a cover that is deep and as favorable to root growth as is necessary to achieve desired plant performance (Nagendran, et al. 2006)

Table 12. Vegetation suitable for rehabilitation of dump sites

Botanical Name	Vernacular Name (English Name)	Life form	Altitude (m)	References
Ficus infectoria Willd.	Fig	Tree	1600	Nagendran, et al. 2006
Ficus palmata Forssk.	Timla	Tree	1300	Das, 1981
Pyrus pashia Buch.-Ham. ex D. Don	Melu	Tree	1500	Nagendran, et al. 2006
Bauhinia variegata L.	Kachnar	Tree	1250	Prajapati, 2012
Quercus leucotrichophora A. Camus	Banj oak	Tree	1200	Das, 1981
Bauhinia purpurea L.	Guiral (Purple Bauhinia)	Tree	1250	Chaphekar, et al., 1980
Acer macrophyllum Pursh.	Maple	Tree		Smith, 1981
Celtis australis L.	Kharik	Tree	1650	Meenakshy et al, 1981
Morus alba L.	Shehtoot	Tree	1500	Das, 1981
Alnus nepalensis D.Don	Utish	Tree	1100	Das, 1981
Melia azedarach L	Denkan	Tree	1300	Das, 1981
Tectona grandis L.f.	Teak	Tree		Das, 1981
Debregeasia longifolia (Burm.f.) Wedd.	Tusiyari	Shrub	1250	Das, 1981
Calotropis gigantea (L.) Dryand.	Crown flower	Shrub		Prajapati, 2012
Cynodon dactylon (L.) Persoon	Doob, Dubla	Herb	1650	Prajapati, 2012
Helianthus annus L.	Sunflower	Herb	1200	Chaphekar, et al., 1980

Estimated Future Population and Waste Generation in Uttarkashi District

Forecasting waste quantities in the future is as difficult as it is in predicting changes of waste composition. Storage methods, salvaging activities, exposure to the weather, handling methods and

decomposition, all have their effects on changes in waste density. As a general rule, the lower the level of economic development, the greater the change between generation and disposal.

Census population data for the year 2001 and 2011 has been taken for population forecast. Decadal population and subsequent waste forecast *(For the year 2031)* has been done based on following presumptions:

- Arithmetic increase method has been used for the decadal population forecast, hence the rate of change of population with time is assumed to be constant.
- 1.5% yearly growth in per capita waste generation has been taken keeping in mind the changing waste paradigm and floating population *(MOF, 2009).*
- Analysis includes population and waste generation estimations only for Urban local bodies and does not include peri-urban and rural areas.

Table 13. Projected population and estimated waste generation

ULB	**Projected Population**			**Projected Solid waste (MTPD)**		
	2021	***2031***	***2041***	***2021***	***2031***	***2041***
Badahat	37986	48870	59754	10	14.80	20.45
Chinyalisaur	11510	14176	16842	2.72	3.85	5.17
Badkot	8733	10052	11371	3	3.97	5.08
Puraula	9523	11115	12707	2.5	3.36	4.34
Naugaon	7119	9064	11009	2.02	2.96	4.07
			Total waste	***20.24***	***28.94***	***39.11***

Table 14. Decadal increase in waste generation

Name of ULB	**Rate of growth in % *(2021-2031)***	**Rate of growth in % *(2031-2041)***
Badahat	4.8	3.81
Chinyalisaur	4.15	3.43
Badkot	3.23	2.79
Puraula	3.44	2.91
Naugaon	4.70	3.75

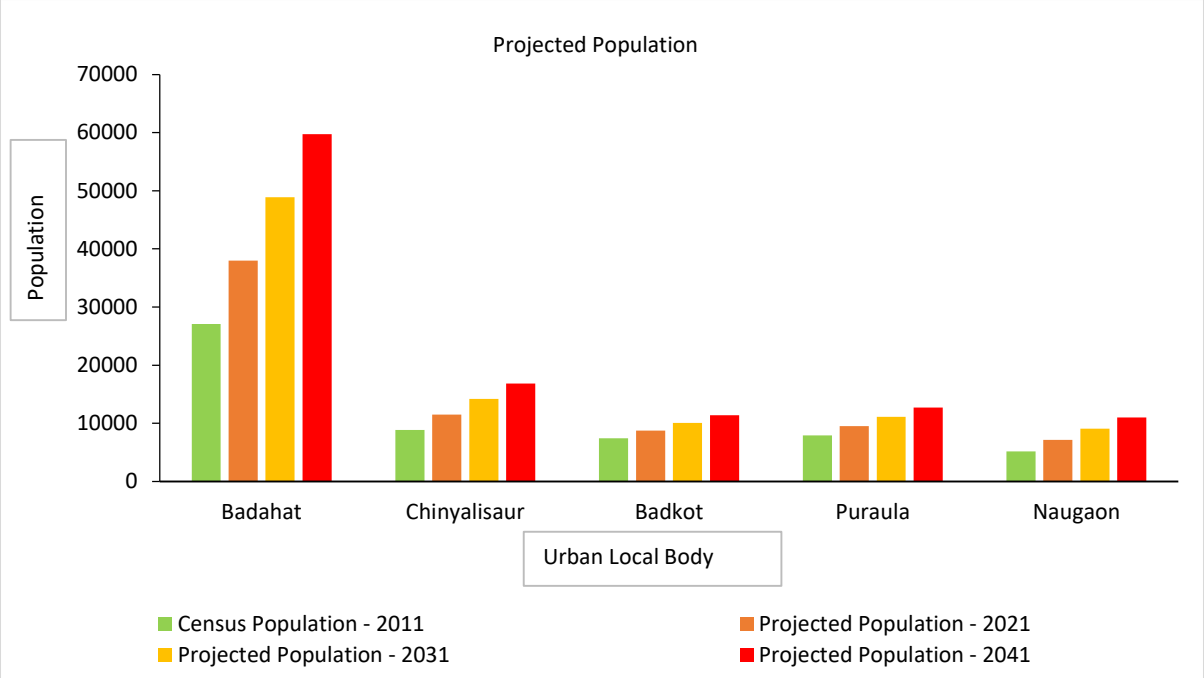


Fig. 3 Graphical representation of predicted population

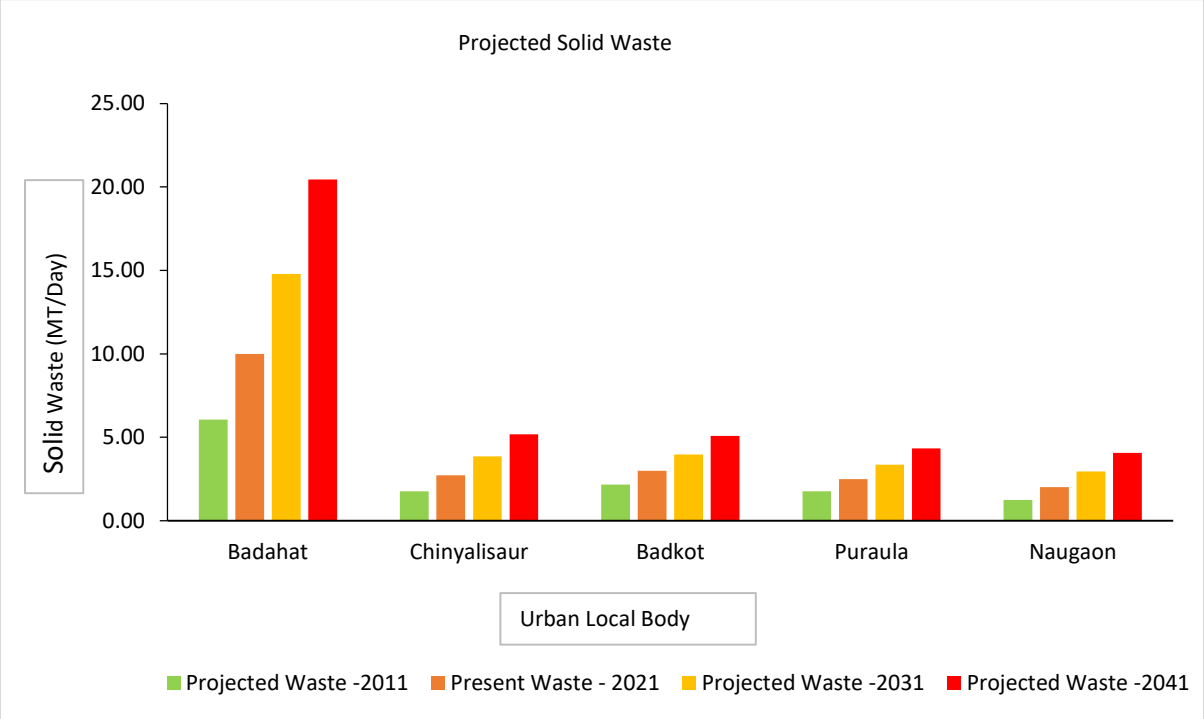


Fig. 4 Graphical representation of predicted waste

Inferences from the Forecasted Data

- The amount of solid waste generated will increase by 3-5% in the next two decades.
- Gangotri is visited by thousands of pilgrims every year on a particular season during Charm Dham Yatra, hence waste forecast in such a case would be erroneous.
- With increasing urbanization, the physical characteristics of waste will also change. The quantity of wet waste may decease however there would be increase in E-waste, Hazardous waste generation.

Rural Solid Waste Management

The domestic waste generated in rural households of India is increasingly becoming an issue of serious concern. As per reported by MDWS *(Ministry of Drinking Water and Sanitation)* about 0.3 to 0.4 million metric tonnes of solid waste is generated in rural India every day. With the objective of achieving ODF plus status and to improve cleanliness, hygiene and the general quality of life in rural areas, the aspect of Solid and Liquid Waste Management (SLWM) assumes greater significance. Most of the solid waste generated in rural areas can be reused after generation, because of that generation rate of rural areas is much less as compared to urban areas.

Current Standpoint Regarding Rural Waste Management in India

- According to 2011 census, 68.84% of total population in India lives in rural areas which generate almost 0.3-0.4 million metric tonnes of waste per day.
- Due to lack of commercial development, rural solid waste only contains Domestic waste (92.4%) as a major contributor to the total waste generated.
- Rural community produces comparatively more bio-degradable waste (63.5%) compared to non-bio-degradable waste (36%).
- About 78% of the rural population use open dumping as storage and collection of solid waste.

BIO MEDICAL WASTE MANAGEMENT

According to latest biomedical waste management rules (published in 2016 and amended in 2019), Biomedical waste is defined as any waste, which is generated during the diagnosis, treatment or immunization of human beings or animals or in research activities pertaining thereto or in the production or testing of biologicals. WHO fact sheet reported that from total of waste generated by health care activities, 20% is hazardous. All the biomedical waste generated is very essential to be properly collected, Segregated, Stored, Transported, Treated and disposed of in safe manner to prevent spread infectious diseases. The health systems of Uttarakhand constitute a large network of health care facilities based on three-tier system. Due to its typical physiographical disposition and changing density of population in decadal growths, the Biomedical waste management needs of the state of Uttarakhand has shown wide variations among its 13 districts (Fig 5).

Source: CPCB (Central pollution Control Board)

Fig. 5 Segregation of Biomedical Waste as per BMW Rules, 2016

Importance of Biomedical Waste Management in the Wake of Pandemic

As the whole world is facing the dearth of pandemic, this has led to increase in the generation of biomedical waste manifolds. Similar trend is also observed in our country as from 2019 to 2021, the daily biomedical waste generation increased from 619 MTPD to 800 MTPD *(CPCB,2021)* in the country and from 3.8 MTPD to 6.26 MTPD *(Envis,2020)* in the state. In the district itself the daily biomedical waste generation increased by four times during the peak of the pandemic. In the

present times, the biomedical waste is generating not only from the health care facilities but also from the quarantine centres, residential areas where patients are in home isolation. Bio-medical waste is ought to be segregated from the municipal solid waste generated in the households during this time and thus has to be properly disposed to set aside the risk of infection to the workers handling the municipal waste (SBM, 2016).

Inventory of current healthcare infrastructure for Bio-medical waste Management

Table 15. Inventory of Healthcare Facilities in the District

Healthcare facility (HCF)	**Developmental Block**						
	Dunda	**Batwari**	**Chiniyalisaur**	**Mori**	**Naugaon**	**Purola**	**Total**
Bedded hospitals	06	11	04	06	09	03	**39**
Non-bedded hospitals	15	19	14	13	18	08	**87**
Clinics	08	27	07	07	11	04	**64**
Veterinary hospitals	05	06	05	02	05	03	**26**
Pathology labs	01	03	01	01	02	01	**09**
Dental clinics	00	02	01	00	01	00	**04**
Blood banks	00	01	00	00	00	00	**01**
Total							***230***

Table 16. Biomedical waste management infrastructure in the district

Parameter	**Outcome**
Number of health care facility authorised by SPCB/PCC	All the 230 health care facilities of the district are authorised with state pollution control board (SPCB).
Linkage with Common Bio-medical Waste Treatment Facility (CBMWTF)	(1) MPCC (*Medical Pollution Control Committee, Roorkee*).
Capacity of Common Bio-medical Waste Treatment Facility (CBMWTF)	100kg/hr (incinerator)
Number of HCFs linked to CBWTF	At present 8 healthcare facilities of the district direct linkage with CBWTF namely: • *District Hospital, Uttarkashi* • *Community health centre (CHC), Badkot* • *Community health centre (CHC), Naugaon* • *Community health centre (CHC), Purola* • *Community health centre (CHC), Chinyalisaur* • *Primary health centre (PHC), Bhatwari* • *Primary health centre (PHC), Dunda* • *Primary health centre (PHC), Mori*

Table 17. Current Status of Biomedical Waste Management

S. No.	Action areas	Outcomes
1.	Adequacy of facilities to treat biomedical waste	At present no facility is available in the district, solely for the treatment of biomedical waste.
2.	Segregation of BMW as per guidelines of BMW rules, 2016	All the healthcare facilities of the district properly segregate their biomedical waste into separate colour coded bins as per biomedical waste medical waste management rules 2016.
3.	Tracking of biomedical waste *(Implementation of bar code system for tracking)*	There is no such facility available in the district.
4.	District level monitoring committee	Established under the chairmanship of District Magistrate.

Disposal of Bio-Medical Waste in the District

- At present biomedical waste from all the healthcare facilities of the district is collected at eight specified health care facilities from where it is lifted by vehicles of CBWTF (*i.e. Medical Pollution Control Committee (MPCC), Roorkee)*.
- Some of the HCFs such as APHCs, Sub Centres and ANM centres located in the remote areas of the district have pits for deep burial of biomedical waste.
- Usually, around 20 kg/day biomedical waste is transferred to common biomedical waste treatment facility from the district. Following the pandemic, this quantity has escalated three times (60 kg/day).

CONSTRUCTION & DEMOLITION WASTE MANAGEMENT

Construction and Demolition waste is produces in the construction, remodelling, repair and demolition of residential/commercial buildings and other structures and pavements. It is basic thumb rule that 40% of the total C&D waste originates from renovation work, 50% from the demolition work and 10% from new construction work. C&D waste mainly consists of Concrete, Bricks, Timber, and Sanitary ware, Glass, Steel, and Plastic etc.

Implementation of 3R Principle in C&D Waste management

The concept of 3R which refers to reduce, reuse, and recycle particularly in the context of production and consumption is well known today (Srinivas, 2007). It is something like using recyclable materials more than actual practice, reusing of raw materials if possible and reducing use of resources and energy. These can be applied to the entire life cycles of products and services – starting from design and extraction of raw materials to transport, manufacture, use, dismantling and disposal. The quantity of waste generated in the construction industry is quite large and much of this waste can be predicted and avoided. Hence it is evident that application of 3R principle will help reduce the C&D waste in the construction industry.

Present state of affairs

- The volume of construction waste generated worldwide every year will nearly double to 2.2 billion tons by 2025, according to a report by Transparency Market Research (CWM, 2020).
- The country generates 150 Million Tonne/Year C&D waste but the official recycling capacity is a meagre 6500 tonnes/day or just about 1% *(as per building material promotion council).*

Table 18. Characteristics of C&D Waste in India

Debris type	Percentage (%)
Wood	42.4
Drywall	27.3
Concrete	12.0
Brick and Other Mixed Debris	7.3
Cardboard	5.4
Metals	1.8
Asphalt	1.4
Plastic & Foam	1.4
Other packaging	0.6
Textiles	0.4

(SWM Report, 2017, Uttarakhand)

Table 19. Thumb Rule for Estimation of C&D Waste Generation for India

Range	Type of construction
40-60 kg/m^2	New construction
40-50 kg/m^2	Building repair
300-500 kg/m^2	Demolition of building

(Sekhar, 2015)

Present Infrastructure within the State

- Currently, no treatent facility is available in the state for processing the C&D waste.
- In hilly districts, ample dumping zones are not established due to which waste is dumped at the river banks.
- As the management of C&D waste is not done in the state, so it is not possible to assess the total amount of waste generated.

Table 20. Current status related to C&D waste generation

S. No.	Action Areas	Outcomes/Remarks
1.	Quantity of C&D waste generated *(KGPD)*	Not estimated as no collection initiated. However the quantity is assumed to be minimal.
2.	Collection of C&D waste	None of the ULBs have initiated the collection of C&D waste in the district.
3.	Establishment of Deposition points/Dumping Zones	Dumping zones are established in the district by various construction agencies such as NH & PMGSY divisions of state PWD, and Border Road Organisation. Most of the dumping zones are established along the under construction highway projects in the district. ULBs are also using these dumping zones to deposit C&D waste generated within the towns.
4.	Establishment of Linkage with any C&D waste recycling facility	There is no C&D waste treatment facility in the district. Moreover; none of the ULBs have linkage with any common C&D waste treatment facility.

(Source: District Administration Uttarakashi, 2021)

Table 21. Gap Identification

S. No.	Observed shortcoming	Outcome/Remarks
1.	Quantification of C&D waste.	As the collection of C&D waste is not initiated hence quantification of C&D waste generated in the district is not possible.
2.	Establishment of collection centre /Deposition	Most of the ULBs have not established dedicated deposition points for C&D waste, as present they are using the dumping zones established by the construction agencies such as state PWD.

	points/Dumping Zones.	
3.	Implementation of by-laws for C&D waste management.	Due to lack of awareness regarding C&D waste management, it is not properly segregated, and as of now the process of implementing by-laws for the C&D waste management is not initiated by any of the ULBs within the district.
4.	Lack of strategies for C&D waste management.	Due to a lack of strategies for C&D waste management, dumping of C&D waste is done along the banks of rivers openly at many places in the district which is hampering the river profile.

C & D Waste Management in Rural Areas

In the rural areas of the district, construction work is very limited therefore minimal amount of C&D waste is generated which mainly consists of the soil excavated from the foundation trenches and stones from the hill slopes. This excavated soil is reused in filling the plinth and trenches or many times used in filling the low-lying area. Stones obtained from the hill slopes are used in masonry work. There is an issue of improper dumping of muck on the river banks during the construction of roads which needs to be addressed.

HAZARDOUS WASTE MANAGEMENT

Hazardous Waste is any waste which by reason of characteristics such as physical, chemical, biological, reactive, toxic, flammable, explosive or corrosive, causes danger or is likely to cause danger to health or environment whether alone or in contact with other wastes or substances. Tabulation of Hazardous waste generating units and quantification of wastes generated in India is done by the respective State Pollution control boards (SPCBs). Hazardous industrial wastes in India can be categorized broadly into two categories:

- Hazardous wastes generated from various industries in India.
- Hazardous industrial wastes transported to India from western Countries for re-processing and recycling.

Present state of affairs

- The collection, transfer, Processing, treatment and disposal of hazardous waste are governed by Hazardous and Other wastes (Management and Trans -boundary Movement) rules, 2016.
- According to CPCB Report 2019-20. In India, there are 69,308 hazardous waste generating units having authorized annual capacity to generate about 39.46 Million MT of hazardous waste. However, during 2019-20, about 8.78 Million MT hazardous waste has been generated as per the annual returns submitted by such units (CPCB, 2020).

Table 22. Hazardous waste generation in India

Type of hazardous waste	Quantity/Year (MMT)	% age of Total waste
Land-fillable	2.13	24.29
Incinerable	0.40	4.52
Recyclable	2.07	23.59
Utilizable	4.18	47.60

(Source: District Administration Uttarakashi, 2021)

Table 23. Inventory of Hazardous Waste in the District

S. No.	Parameter	Present status			
1.	Quantity of Hazardous waste generated in the district (in MT/Annum)	Incinerable	Landfill able	Recyclable/ Reusable	Total
		0	0	0.725	0.725
2.	Number of Hazardous waste generating industries in the district	15			

Table 24. Current status related to Hazardous Waste Management

S. No.	Action Areas	Outcome and Remarks
1.	No. of captive / common TSDF *(Treatment storage and disposal facilities)* in the district.	Currently, there is no captive or common treatment storage and disposal facility (TSDF) in the district. The hazardous waste generated in the district is directed to TSDFs outside the district.
2.	Linkage with common TSDF	**(01)** *(Bharat Oil & Waste Management Ltd., Roorkee, Uttarakhand)*
3.	Display board of Hazardous waste generation in front of gates of respective industries	As per state pollution control board only 3 out of 15 Hazardous waste generating industries in the district have installed display board in front of their gates.
4.	Number of ULBs linked with common TSDFs	No ULB in the district is linked with common TSDFs.
5.	Contaminated sites/probable contaminated sites within the district	As per state pollution control board there are no contaminated sites within the district.
6.	Regulation of industries & facilities generating Hazardous waste	Industries generating hazardous waste are strictly regulated by state pollution control board.

(Source: District Administration Uttarakashi, 2021)

ELECTRONIC WASTE MANAGEMENT

The Discarded and end-of-life electronics products ranging from computers, equipment used in Information and Communication technology (ICT), home appliances, audio and video products and all of their peripherals are known as Electronic waste (E-waste). The ill effects of e-waste could be on soil through leaching of hazardous contents from landfills; in water due to recycling process *(if not carried our properly),* through inhalation of gases during recycling, contact of the skin of the workers with hazardous substances and contact during acid treatment used in recovery process (EEMI, 2018).

Government of India has notified E-Waste Management Rules 2016, which are expanded to manufacturer, dealer, re-furbisher and Producer Responsibility Organization (PRO) of components, consumables, spares and parts of Electronics and Electrical Equipment (EEE) in addition to equipment as listed in Schedule I appended with the rules. Moreover, Compact Fluorescent Lamps (CFL) and other mercury containing lamps are also brought under the provisions of these Rules**.**

Table 25. Bifurcation of E-waste based on electronic appliances

Types of Waste	**Percentage (%) contribution**
Computer devices	70
Telecom sector	12
Medical equipment	7
Electric equipment	8
Others	3

(Garg, 2019)

Worldwide Scenario

- Electronics and Electrical Equipment (EEE) are manufactured and disposed worldwide. In 2016, 44.7 Million Metric Tons (MMT) of e-waste was generated worldwide *(equivalent to 6.1kg/inhabitant).* Following the current growth rate of rising e-waste, it is estimated that by 2021, quantity has already risen to 52.2 Million Metric Tons or 6.8 kg/inhabitant.
- Out of the total e-waste produced in 2016, only 20% *(8.9 MT)* is documented to be collected properly and recycled, while there is no record of the remaining e-waste. The quantity of e-waste generated worldwide is expected to grow at a rate of 3.15% (CAGR).

Indian Scenario

- In 2016, India generated 2 Million Metric Tons (MMT) of E-waste. The transported e-waste in India from developed countries has further complicated the management of e-waste.
- India discarded approximately 1.85 million tonnes (MT) of e-waste in 2016 which is about 12% of the global e-waste production.

- India has emerged as fifth largest Electronic waste producer in world. City-wise, Mumbai tops the list in producing electronic waste, followed by New Delhi, Bangalore and Chennai.
- The government offices, public and private sector companies generate nearly 75% of e-waste; with the contribution of individual household only being 16%.

Table 26. Current standpoints regarding E-Waste generation and collection

S. No.	Parameter	Outcome & Remarks	
1.	Quantity of E-waste generated per annum *(As per State pollution control board)*	**Uttarakhand**	*16260 MT*
		Uttarkashi	*Not Estimated*
2.	Toll-free number in the district for the citizens to deposit E-waste.	Facility of toll free number to deposit E-waste is not initiated in the district.	
3.	Collection centre established by ULBs in the district.	At present there are no collection centre established by any of the ULBs or the district administration.	
4.	Number of authorized E-waste Recyclers/dismantlers in the state.	**(05)** • *Attero Recycling Pvt. Ltd. Raipur, Bhagwanpur* • *Bharat Oil & Waste Management, Mukhimpur, Laksar* • *Resource E-Waste Solution Pvt. Ltd. Bahadrabad* • *Scarto Metal Recycle Plant, Mewar Khurd, Roorkee* • *Anmol Paryavaran Sarakshan Samiti, Daulatpur Budhwa Shahid, Banjarewala*	
5.	Linkage with any E-waste recycling facility	No ULBs in the district have established linkage with authorised E-waste recycling facility. However district administration have linkage with the authorised E-waste recycling facility to deposit E-waste generated from the government office.	
6.	Control over illegal trading or processing of E-waste in the district.	Controlled	

Table 27. Gap Identification

S. No.	Observed Shortcomings	Remarks
1.	Establishment of collection centres & Toll free number	• Ample amount of E-waste is lying idle in the government offices of the district which cannot be sent for recycling as there is no facility in the district to deposit E-waste. • As there is no facility of Toll free number to deposit E-waste in the district so all the E-waste generated from the residential areas is mixed with municipal solid waste and thus not treated properly.
2.	Segregation of E-waste by ULBs	• As the quantity of E-waste generated is very less so there is no mechanism in the ULBs for segregation.
3.	Linkage of ULBs with authorised recyclers/ Dismantlers	• Yet to establish any linkage

WASTE WATER MANAGEMENT AND SEWAGE TREATMENT PLANT

Domestic sewage is such a waste water that is produced by a community within a certain locality. It is characterized by a certain volume of flow and physical condition, along with chemical and toxic constituents and its bacteriologic properties. Around 80% of water supply flows back into the ecosystem as wastewater which can be a critical to landscape and other environmental components (Denchak, 2018) Also, health hazard could be other issue in case it could not be treated properly.

According to a report of the Central Pollution Control Board (2015), India has the capacity to treat approximately 37% of its wastewater. In other words, this comes about 22,963 million litres per day (MLD), against a daily sewage generation of approximately 61,754 MLD. Moreover, most of the sewage treatment plants do not function at their optimum capacity and do not conform to the standards as prescribed

Sewerage system with individual household latrines connecting with pipelines comes only 31.7 per cent of the total urban households., More than half of the urban population in the State relies on on-site sanitation (OSS) systems like septic tanks. Septic tanks cover *53.1 per cent* of the total sludge for the collection of faecal sludge and wastewater. Further, some individual households in the state discharge the waste from their toilets directly into open drains.

Table 28. Current Scenario related to STPs in Uttarakhand

Number of STPs Installed in Uttarakhand	71
Total Sewage Generation (MLD)	627
Installed Capacity (MLD)	448.18
Operational Treatment Capacity (MLD)	345
Actual Utilization (MLD)	187 *(42% of installed capacity, 54% of Operational capacity)*
80 % of the state's total sewage treatment plant capacity caters to Dehradun, Rishikesh and Haridwar (Plain areas).	

Source: ENVIS Centre on Hygiene, sanitation, sewage treatment systems and technology)

Current Scenario related to STPs in the District

At present, two STPs are there in the district, one at ULB. Badahat (Uttarkashi) other one at ULB Gangotri of 1 MLD installed capacity.

Table 29. Inventory of Sewage Management

Name of ULB	Population	Percentage households connected with Sewerage Line	Quantity Of Sewage Generated From The Households Connected Through Sewerage Line (MLD)		Total Installed Capacity (MLD)
Badhaat (Uttarkashi)	27102	35%	1.75		02
Gangotri	110	40%	Yatra season	Non Yatra season	01
			0.010	0.005	

(*District Administration, Uttarakashi, 2021*)

Table 30. Adequacy of Sewerage Network in Uttarkashi Town

Name of ULB	Action areas	Outcomes
Badahat (Uttarkashi)	Coverage area of Sewerage Network	Total Number of Wards = 11 Wards totally connected with Sewerage Network = 0 Wards Partially connected with Sewerage Network =10 Wards with no sewerage connection = 1
	Percentage of population covered under Sewerage Network	Around 35 % population covered under sewerage network.
	Additional Treatment Capacity Required	6 MLD additional capacities are required to cater rest of the households.
Gangotri	Coverage area of Sewerage Network	Almost 40 % population of the Gangotri ULB is covered with the sewerage network.

Table 31. Current standpoint regarding Sewage Management in the District

Name of ULB	Present state of affairs
Badahat (Uttarkashi)	• Sewage Treatment plant is thoroughly monitored by state pollution control board. Random sampling of the treated waste water in performed regularly ensuing to Hon'ble NGT norms. Chemical dosing is done if tested sample is found undesirable. • Uttarakhand state pollution control board and Jal Sansthan are the departments responsible for ensuring compliance to provision under statues related to Sewage Treatment Plants Management.
Gangotri	• Only one third households are covered under the existing sewerage network and rests of the households are not connected due to topographical limitations. The households and ashrams which are not connected with sewerage network uses conventional treatment method of Septic Tank + Soak Pit for sewage disposal. • Sewage Treatment plant is thoroughly monitored by state pollution control board. Random sampling of the treated waste water in performed regularly ensuing to Hon'ble NGT norms. Chemical dosing is done if tested sample is found undesirable. • Uttarakhand state pollution control board and Jal Sansthan are the departments responsible for ensuring compliance to provision under statues related to Sewage Treatment Plants Management.
Other ULBs	• Rest of the district uses the conventional treatment method of Septic Tank + Soak Pit for sewage disposal.

Table 32. Proposed policies and budget Requirement put forward by different stakeholders in the district

Name of ULB	Type of Septage Management	Stakeholders Responsible	Proposed policy	Instruments and Budget Requirement
Badahat (Uttarkashi)	Off-site Management.	Jal Sansthan and State Pollution Control Board (SPCB)	• Household survey has been done by Jal Sansthan for laying sewer lines. Moreover, DPR has been prepared and sent for approval.	• An additional sewage treatment plant is required of 6 MLD capacities. • Estimated cost of the new project is rupees 20 crores.
Other ULBs *(Chinyalisaur, Barkot, Purola, Naugaon)*	Both off-site and on-site Management.	Jal Sansthan and State Pollution Control Board (SPCB)	• Off-site management is planned for Chinyalisaur and Barkot ULBs for which DPR is to be prepared by Jal Sansthan. • Furthermore, On-site Septage management (FSSM) is being planned for Purola and Naugaon U.L.Bs for which DPR is to be prepared by Jal Sansthan.	According to the preliminary planning and studies the capacity requirement of various ULBs are as follows: • *NPP Chinyalsaur = 3MLD* • *NPP Barkot = 2 MLD* • *NP Purola = Not estimated* • *NP Naugaon = Not estimated*

(*District Administration, Uttarakashi, 2021*)

Liquid Waste Management in Rural Areas

Since the water supply for domestic purposed in rural areas has improved considerably over the years, the quantity of wastewater that is disposed as also increases. Hence effective wastewater management systems need to be introduced in the rural areas to mitigate the problem of contamination in the majority of rural areas, untreated wastewater is discharged directly into the local surroundings and water bodies. This leads to contamination of surface as well as sub-surface water, having negative effects on the environment and human health.

Current Standpoint about Rural Waste Water Management in India

- With Population growth and rapid industrialization, wastewater management has become a serious issue. Rural India with old or no infrastructure has reached a tipping point.
- India has the highest number of people who don't have access to clean drinking water. Even abundance of water in certain places do not guarantee access to safe, reliable, drinking water.
- United Nations Sustainable Development goal 6 focuses on access to clean water and sanitation for all. The goal of the initiative is to sensitize communities to the advantages of hygiene and sanitation.

Table 33. Policies Undertaken for Waste Water Management in Rural India

Current Policy	Sponsoring agency	Remarks
Construction and Usage of IHHLs *(Individual Household Latrines)*	Under SBM-G *(Swachh Bharat Mission-Gramin)*	There are various models of toilets available based on safe sanitation technologies like Twin pit, Septic tank, Bio toilets etc.
Availability of Sanitation Material through Rural Sanitary marts (RSM), Self-help groups (SHGs)	Under SBM-G *(Swachh Bharat Mission-Gramin)*	To provide material, services and guidance needed for constructing different types of latrines and other sanitary facilities for clean environment,
Community Sanitary Complex (CSCs)	Under SBM-G *(Swachh Bharat Mission-Gramin)*	Such complexes comprise of appropriated number of toilet seats, bathing cubicles etc. *(Only where there is lack of space in the village for construction of household toilets.)*
Financial Assistance	Under SBM-G *(Swachh Bharat Mission-Gramin)*	Up to Rs.12000 is provided to BPL *(below poverty line*) households and identified APL *(Above poverty line)* households for construction of one unit of IHHL. It is not the cost of the toilet but an incentive amount.
Mensural Health Management	Under SBM-G *(Swachh Bharat Mission-Gramin)*	It is aimed at making behavioural change in woman and adolescence girls using a clean menstrual management material to absorb or collect blood that can be changed in privacy as often as necessary for the duration of the menstruation period, and having access to facilities to dispose of used menstrual management materials.

GROUND WATER EXTRACTION/CONTAMINATION AND RE-CHARGE

Groundwater is found underground in the cracks and spaces in soil, sand and rock. Over 70% of the earth's surface is covered in water but of that water, just 1% is readily available for human use, out of which, 99% is stored beneath our feet as groundwater *(The Groundwater Foundation, 2021).*

Ground water extraction

Over 80-85% of our country population depends on groundwater for drinking water. Groundwater is also one of our most important sources of water for irrigation. Due to overuse and leverage of high amount of groundwater water table decreasing with rapid rate and it will very harmful for mankind

Ground water contamination

Groundwater contamination occurs when man-made products (such as, gasoline, oil, road salts and chemicals) get into the groundwater and makes it unsafe and unfit for any kind of use for humans and as well as other animals *(The Groundwater Foundation, 2021*). Unfortunately, groundwater is susceptible to pollutants. Hazardous materials from the land surface can move through the soil and end up in the groundwater. For example, pesticides and fertilizers can find their way into groundwater supplies over time. Also, groundwater is contaminated by the untreated waste from septic tanks and toxic chemicals from underground storage tanks and leaky landfills.

Groundwater Recharge

Groundwater recharge is a hydrologic process, when water (rain, snow-melt etc.) moves downward from surface to groundwater. Mostly groundwater recharged by naturally but due to high amount of groundwater extraction, water table is falling down day by day. Saving groundwater is very important for mankind as it is the major sources of drinking water and agricultural irrigation water (The Groundwater Foundation, 2021). A comparison of depth to water level of August 2019 with decadal mean of august (2009-2018) indicates that there is decline of more than 4m in the groundwater level in state of Uttarakhand (CGWB, 2019-20). Therefore, some artificial methods (Rainwater harvesting, Injection wells) are applied nowadays to save groundwater.

Table 34. Water Resources in the District

S. No.	Water Resource	Remarks		
1.	Rivers/Streams in the District	***Name***	***Origin***	***Major Tributaries***
		Bhagirathi river system	Gaumukh (*Gangotri Glacier*)	*Jalkur, Indrawati, Dhanpati, Varuna, Assi Ganga, Khurmola Gaad, Nagun Gaad*
		Yamuna river system	Yamunotri and Champasar Glacier	*Tons, Kamal River, Kedar Ganga, Bedieyar Gaad, Rishi Ganga, Hanuman Ganga, Pujar Gaad, Banal Gad*
3.	Nalas/drains meeting rivers	**Confluence**		**Numbers**
		In Areas under the jurisdiction of ULBs		
		Gangotri		*01*
		Badahat		*13*
		Chinyalisaur		*01*
		Badkot		*02*
		Naugaon		*05*
		Purola		*03*
		In Areas under the jurisdiction of Forest department and rural areas		
		Forest area *Rural areas*		*110*
		Total		***135***
4.	Lakes and ponds	22 *(All are present in the forest area within the district.)*		

(*District Administration, Uttarakashi, 2021*)

Table 35. Pollution Control in Water Resources

S. No.	Parameter	Current Status
1.	Open Defecation in River/Nala/Khad	Fully Controlled
2.	Dumping of Solid waste on River Banks	Fully Controlled
3.	Control Measures for idol immersion	Measures taken
4.	Disposal of Untreated Sewage in Rivers	Sewage is not directly discharged into water bodies
5.	Monitoring of Action Plans for rejuvenation of rivers	Monitored
6.	Encroachment near flood pains	Along both the banks of the Bhagirathi river.
7.	Protection of flood plains	Demarcation pillars with red sign are constructed at 25 year HFL *(Highest Flood level)* for prohibited zone along both sides of the Bhagirathi river and demarcation pillars with yellow sign are constructed at 100 years HFL for regulated zones along both sides of the Bhagirathi river.

Table 36. Information of Groundwater in District

S. No.	Parameter	Current Status
1.	Estimated numbers of bore-wells/Hand pumps	841 (approx.)
2.	Groundwater polluted area in the district	None
3.	Adequacy of Groundwater Availability	Adequate in the river valleys but inadequate on hill slopes.
4.	Disposal of Untreated Sewage in Rivers	Sewage is not directly discharged into water bodies.
5.	Access to surface water and groundwater quality data at DM office	Data is not available.

Artificial Recharge of Groundwater

The geographical area of the district is divided into units like high relief glaciated area, Structural hills, Denudational hills, dissected fans, River terraces and flood plains. Major part of the hilly area has a slope more than 20%. The slope of this magnitude makes the area unsuitable for groundwater development due to low groundwater potential. In this region the groundwater mainly manifests in the form of springs and occurs under unconfined conditions and the water table follows the topography.

Table 37. Artificial Recharge of Groundwater

District	Area (km^2)	Area identified for AR (Artificial recharge) (km^2)	Volume of unsaturated zone (MCM)	Available sub-surface space for AR (MCM)	Water required for artificial recharge (MCM)	Surplus available for recharge (MCM)
Uttarkashi	8016	2004	4008	601	800	5013

The major part of the district is hilly with localized small valleys through which the entire runoff passes. Major part of the rainfall is lost as surface runoff. Apart from this the small rivers, Nallas also act as carriers for base flow & spring water. In spite of good rainfall there is acute shortage of water especially during the summer. The state government is working for rainwater harvesting in the state under many projects to solve this issue.

Table 38. Artificial Recharge and RTRWH Structure constructed in Uttarakhand under catchment area conservation Program (CACMP)

District Name	Number of structures					Total cost (in lakhs)					Total cost (in lakhs)
	CD	CK	RTRWH	PT	CT	CD	CK	RTRWH	PT	CT	
Uttarkashi	147	0	0	2	40	14.7	0	0	0.04	0.04	14.78

CT-Contour Trench, CK- Chal Khal, RTRWH- Rooftop Rain Water Harvesting, CD- Check Dam, PT- Perculation Tank, NA- Data Not Available

Table 39. Artificial recharge and cost Estimate in Uttarakhand

District Name	Structures proposed					Unit cost Estimate (in lakhs)					Total cost (in lakhs)					Total cost (in lakhs)
	RTRWH	CD	PT	CK	CT	RTRWH	CD	PT	CK	CT	RTRWH	CD	PT	CK	CT	
Uttarkashi	450	350	60	150	300	0.5	0.3	0.07	0.15	0.015	225	105	4.2	22.5	4.5	361.2

CT-Contour Trench, CK- Chal Khal, RTRWH- Rooftop Rain Water Harvesting, CD- Check Dam, PT- Perculation Tank, NA- Data Not Available

AIR AND NOISE POLLUTION MANAGEMENT

Air Pollution Management

The ambient air that is the atmospheric air in its natural form consists of nearly 99.9% of Nitrogen, Oxygen, Water vapors, Carbon dioxide, and some other gases like helium, argon, methane, argon, etc. surrounds the earth and forms its atmosphere. Any undesirable change in the composition of ambient air is called air pollution. The undesirable substances can be in solid, liquid, and gaseous forms and when present in sufficient concentration for a sufficient time under certain conditions can endanger human health and welfare of plants and animals. According to state of Global Air report 2020, Air pollution has now become the biggest health risk in India. Most of the cities in our country (majority of them are from the region of Indo-Gangetic plains) are facing the problem of air pollution which has led to increase in cases of breathing discomfort and other related diseases. To tackle the problem of air pollution in our cities, Government of India has taken many steps, one of them being National Clean Air Programme (NCAP, 2019). Under this programme, 122 cities in the country are identified as non-attainment cities which include three cities from the Uttarakhand *(Dehradun, Rishikesh and Kashipur)*. These are the cities that have fallen short of the National Ambient Air Quality Standards (NAAQS) for over five years. Goal ofNational Clean Air Program (NCAP) is to meet the prescribed annual average ambient air quality standards at all locations in the country in a stipulated timeframe. The tentative national level target of 20% to 30% reduction of $PM_{2.5}$ and PM_{10} concentration by 2024 is proposed under the NCAP taking 2017 as the base year for the comparison of concentration.

Table 40. National ambient air quality standards in India

Pollutant	**Time weighted average**	**Concentration in Ambient Air**	
		Industrial, Residential, Rural and Other Areas	Ecologically Sensitive Area (notified by Central (Government)
Sulphur Dioxide (SO_2), µg/m^3	Annual* 24 hours**	50 80	20 80
Nitrogen Dioxide (NO_2), µg/m^3	Annual* 24 hours**	40 80	30 80
Particulate Matter (size less than 10 µm) or PM_{10} µg/m^3	Annual* 24 hours**	60 100	60 100
Particulate Matter (size less than 2.5 µm) or $PM_{2.5}$ µg/m3	Annual* 24 hours**	40 60	40 60
Ozone (O_3) µg/m^3	8 hours* 1 hour**	100 180	100 180

Lead (Pb) µg/m	Annual* 24 hours**	0.50 1.0	0.50 1.0
Carbon Monoxide (CO) mg/m^3	8 hours* 1 hour**	02 04	02 04
Ammonia (NH_3) µg/m3	Annual* 24 hours**	100 400	100 400
Benzene (C_6H_6) µg/m^3	Annual*	5	5
Benzo (a) Pyrene (BaP)- particulate phase only, ng/m^3	Annual*	1	1
Arsenic(As), ng/m^3	Annual*	6	6
Nickel (Ni), ng/m^3	Annual*	20	20

Source: National Ambient Air Quality Standards, Central Pollution Control Board Notification in the Gazette of India, Extraordinary, New Delhi, 18th November, 2009.

** Annual arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals.*
*** 24 hourly or 8 hourly or 1 hourly monitored values, as applicable, shall be complied with 98% of the time, they may exceed the limits but not on two consecutive days of monitoring.*

Current Standpoint Regarding Air Pollution in the District

As the monitoring of ambient air quality is not yet started in the district so the present condition regarding the air quality is very difficult to ascertain. With the increase in number of forest fire events and number of vehicles in the district, the problem of air pollution is gradually increasing which needs to be addressed.

Table 41. Air Quality Monitoring and Data Accessibility

Action Area	Outcomes
Number of automatic air quality monitoring stations in the district	Yet to be installed
Number of manual air quality monitoring stations in the district	Yet to be installed
Availability of air quality monitoring data	Ample readings are not taken to provide necessary information about prevalent air quality standards.

Table 42. Identification of Sources of Air Pollution

Action area	Outcomes
Number of non-attainment cities in the district	No city in the district is classified as non-attainment city according to national clean air program *(NCAP).*
Prominent sources of air pollution in the district	Unprecedented forest fires and vehicular pollution are major reasons for Air pollution in the district.

Table 43. Control Measures for Industrial/Non Industrial Air Pollution

Action Areas	Outcomes
Identification of Prominent air polluting sources	Forest fires are the only prominent source identified.
Control of industrial air pollution	There are very few industrial units in the district. So industrial pollution is not an issue in the district.
Control of non-industrial air pollution	
(a) Open burning of waste	As almost 100% door to door collection is done in all the ULBs in the districts so practices of open burning of waste is not observed however, in the rural areas, open burning of waste is a common practise.
(b) Control of forest fires	Forest department has deployed fire watchers in the district which are connected with local outposts of the forest department via wireless communication and those outposts are further connected with the central control room in the district. In this way a centralised mechanism is accomplished in the district to control forest fires. Even then hectares of forest are wrecked due to massive fire breakouts.
(c) Control of vehicular pollution	3 PUC centres are available in Uttarkashi district.
District level action plan for air pollution	At present, no such action plan has been prepared.
Awareness on air Quality	There is the mind set in the district that air pollution is not an issue in the hilly region so local citizens are not aware of the problem of increasing levels of air pollutants especially in the urban centres of the district.
Development of Air pollution complaint redressal system	Not Initiated

Table 44. Proposed Policies and Budget Requirement put forward by Stakeholders in the District

Proposed policies	Responsible agencies	Action plan and Budget requirement
Electricity Generation thorough Pine needle	• Forest Department • UREDA *(Uttarakhand Renewable energy development Agency)*	One plant of 25 KW capacities is operational in the Dunda block of the district and there is a plan to establish 6 more plants each of 25 KW capacities.
Conversion of pine forests into mixed forests	Forest Departments	To avoid forest fires, forest department is trying to transform pine forests into mixed forests.

Table 45. Gap Identification

Serial No.	Area of Concern	Remarks
1.	Forest Fires	• Lack of staff • Multiple departments are involved to resolve the issue, hence lack of coordination and responsibility sharing has been observed. • Sloping terrain makes it difficult for fire tenders to reach high altitudinal areas. • Abrupt migration from villages and change in living habits has exaggerated the situation. • Lack of inspection in forest areas under Van panchayat and Civil Forest.
2.	Vehicular Pollution	No Air pollution monitoring in the town, hence much of the pollution goes unnoticed.

Noise Pollution Management

Regular exposure to elevated sound levels that may lead to adverse effects in humans or other living organisms. According to WHO sound levels less than 70 dB are not damaging to living organisms and exposure of noise level beyond 85 dB constantly for more than 8 hrs. May be hazardous and leads to loss of hearing. Although noise pollution is a big issue in the district but proper monitoring is required maintain noise level within the desirable limits. Following table represents the permissible noise level standards in India.

Table 46. Permissible Noise level standards

Area code	Category of area/zone	Limits in dB(A) L_{eq}*	
		Day Time	Night Time
A	Industrial Zones	75	70
B	Commercial Zones	65	55
C	Residential Zones	55	45
D	Silence Zones	50	40

Source- Noise Pollution (Regulation and Control) Rules, 2000

- Day time shall mean from 6.00 a.m. to 10.00 p.m.
- Night time shall mean from 10.00 p.m. to 6.00 a.m.
- Silence zone is an area comprising not less than 100 metres around hospitals, educational institutions, courts, religious places or any other area which is declared as such by the competent authority
- Mixed categories of areas may be declared as one of the four above mentioned categories by the competent authority.
- dB(A) L_{eq} denotes the time weighted average of the level of sound in decibels on scale 'A' which is relatable to human hearing.
- "Decibel" is a unit in which noise is measured.
- "A", in dB(A) L_{eq}, denotes the frequency weighting in the measurement of noise and corresponds to frequency response characteristics of the human ear.
- L_{eq}: It is energy mean of the noise level over a specified period.

Table 47. Current status related to noise pollution management

S. No.	Parameter	Current Status
1.	Number of noise level measuring devices available with various agencies in the district	At present no noise level monitoring device is installed in the district.
2.	Number of complaints received by state pollution control board related to noise pollution in last 1 year	No complaint either by SPCB or District Authority is received by state pollution control board in last 1 year
3.	Implementation of ambient noise standards in residential and silent zones.	Local police is responsible for the implementation of the ambient noise level standards.
4.	Silent Zones in the district	No place in the district is declared as silent zones.
5.	Setting up of Sign Boards	Sign boards are installed around hospitals, schools and along the highways by the concerned authorities.

ILLEGAL SAND MINING

Sand being an important economic resource and second most used mineral after water, is one of the main ingredient of concrete and mortar. Beside its economic importance, it also constitutes an important abiotic component in aquatic ecosystem like rivers. As our country has seen robust growth in the infrastructure sector in the recent decade the demand of sand increased by manifolds. Further with the announcement of national infrastructure pipeline project the demand of sand is going to increase exponentially in the near future. In recent years, Uttarakhand has also seen increase in the riverbed quarrying operations. With the establishment of stone crusher industry especially in the southern Terai and Bhabar region of the state, scale and intensity of RBM (Riverbed Minerals) excavation has further increased in past few decades. Uncontrolled and illegal mining of river bed minerals like sand has led to loss of revenue to the state, degradation of aquatic and riparian habitat *(through large changes in the channel morphology)* and geology of adjoining ground water system.

Guidelines to Monitor Sand Mining in India

The Mines and Minerals (Development and Regulation) Act, 1957 has empowered state governments to make rules to prevent illegal mining, transportation and storage of minerals. However, still large numbers of illegal mining cases are registered in the country and in some cases; many of the officers even lost their lives while executing their duties to curb illegal mining. Ministry of Environment, Forests and Climate Change (MoEFCC) put forward the Sustainable Sand Management Guidelines (SSMG) 2016, which focuses on the management of the sand mining India, but there is a need to revamp the existing system for effective enforcement of regulatory provisions and their monitoring. Recently, in 2020, new set of guidelines have been put forward by Ministry of Environment, Forests and Climate Change (MoEFCC) in 2020, which focuses on the effective monitoring of sand mining (from the identification of sand mineral sources to its dispatch and end-use by consumers and general public) and uniform protocol for the whole country. Also, states are advised to conduct river audits and monitoring of mining activities with night vision drones and other modern surveillance equipment.

Table 48. Prevalent Mining Activities

Total Area of District (km^2)	8016			
Area Covered under Mining (km^2)	0.011356			
Type of Mining Activity	**Mining activity**	**Legal \Illegal**	**Area under mining (m^2)**	**Revenue**
	Minor Minerals (*River Bed Materials*)	Legal	11356	1,74,24,718.00 (*Annually*)
Number of Mining Licenses given by the District Authority	12			
Action against illegal mining activities in the district (*in the financial year 2020-21*)	**Concerned department**		**Location**	**Penalty**
	Revenue Department		Village- Astal, Tehsil- Dunda	24,78,686.00
	Revenue, Irrigation, Geology and Mining Department		Village- Matli Tehsil- Dunda	6,96,250.00
	Revenue, Irrigation, Geology and Mining Department		Village- Matli Tehsil- Dunda	3,83,260.00

(*District Admistration Uttarakashi, 2021*)

Table 49. Compliance to Environmental Standards

Mining areas meeting Environmental Clearance Conditions	12
Mining areas meeting consent conditions of UKPCB	12
Mining operations suspended for violations to environmental norms	Nil
Pollutions related complaints against Mining operations in past one year	Nil

REJUVENATION OF WATER BODIES

Most of India's major water resources *(underground waterways, lakes, rivers and reservoirs)* have to depend on monsoon rains to replenish/recover them. Nearly 600 million Indians faced high to extreme water stress and about 2 lakh people died every year due to inadequate access to safe water. The NITI Aayog in 2018 released the results of a study warning that India is facing its "worst water crisis" in history and that demand for potable water will outstrip supply by 2030, if concrete steps are not taken. If matters are to continue, there will be a 6% loss in the country's GDP by 2050. Due the high amount of water extraction and mismanagement of water resources are causing drought and sudden flood in several part of our country. Rejuvenation of water bodies also play a vital role to improve the water quality and storage of surface runoff water. For these reasons we must need to store, manage and rejuvenate the existing water bodies. We can use several government policies/Schemes like Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS), Atal Bhujal Mission etc. to restore and rejuvenate the water bodies. The Water Stress Index 2019 by London-based Verisk Maplecroft ranks India as the 46th highest risk country *(Verisk Maplecroft 2019)*. India is also 13th on the Aqueduct's Water Risk atlas and listed as one of the world's ***"extremely water-stressed countries"*** *(World Resources Institute 2019)*

Table 50. Details of Water Bodies

Water bodies	**Development block**						
	Dunda	**bhatwari**	**Chiniyalisaur**	**Mori**	**Naugaon**	**Purola**	**Total**
Perennial springs	17	36	06	35	12	26	**132**
Seasonal springs	09	12	NA	16	06	09	**52**
Lakes	00	11	01	02	05	00	**19**
Ponds	05	NA	NA	NA	12	15	**32**
Perennial streams	12	NA	12	NA	NA	NA	**24**
Seasonal streams	08	NA	08	NA	NA	NA	**16**

Table 51. Present Scenario in the District

Technique used in the district for rejuvenated of water bodies	To rejuvenate water bodies following works are done under various schemes such as MNREGA. • *Construction of recharge pits* • *Construction of Infiltration trenches* • *Construction of chal-khals* • *Construction of LDEP Tanks* • *Plantation drives*

Plant Species used for rejuvenation of water bodies	• Banj *(Quercus leucotrichophora)* • Bhimal *(Grewia optiva)* • Kachnar *(Bauhinia variegata)* • Burans *(Rhododendron arboretum)*
Local action plan for rejuvenation of water bodies	The district is running a water conservation and augmentation program in which the conservation of water sources, rural ponds, Chal-Khals and traditional water sources are being renovated in the gram panchayats of the district.

Mission Indrawati

Indrawati, a 12 km long river and a primary source of irrigation for at least 5,000 people of 11 villages in the district. It supports the lives and livelihood of thousands. In the recent years the river has seen decline in the water level especially during the summer and winter season when water level dips down to low levels. To revive the river, the district administration has launched 'Mission Indrawati' in March 2021.

The objective of the Indravati initiative is to first identify the reasons for the decline in the water flow or in some cases, death of the water sources. After that, sustainable revival plans will be laid out where most supporting ingredients are sourced locally.

Table 52. Indrawati River Information

Origin	Harunta Bugyal (Uttarkashi)
Location	Latitude: 30°39'35''N Longitude : 78°31'35''E
Elevation (m)	2700
Length (km)	12
Confluence	Bhagirathi (Uttarkashi Town)

Works to be Carried Out Under this Project

Under the initiative, the DM-appointed nodal officers will lay down sustainable water flow reviving plans with locally-sourced supporting components, mainly 'Chaal-Khaal'. So far following works have been undertaken in the catchment of the Indrawati River:

- *Infiltration Trenches*
- *Wooden Check Dams*
- *Water Tanks (Capacity 10,000 ltr. and 20,000 ltr.)*
- *Small Water holes*
- *Gully Plugging*
- *Random Rubble Dry Check Dams*
- *Crate wire Check Dams*

PLASTIC WASTE MANAGEMENT

Plastic waste is defined as the accumulation of plastic objects (e.g. Plastic bottles, bags etc.) in the environment that adversely affects the Wildlife and Humans. The ongoing pandemic has caused a rapid growth in the generation of Plastic waste for the medical, packaging and other services *(like PPE kit, gloves, face shield, packaged food etc.).* Its broad range of application is in packaging films, wrapping materials, shopping and garbage bags, fluid containers, clothing, toys, household and industrial products, and building materials.

Plastic products have become an integral part in our daily life pertaining to the fact that its production has crossed 150 million tons per year globally *(CPCB, 2013).* India generates 15 million tons of plastic waste every year but only one fourth of this is recycled due to lack of a functioning solid waste management system. This leads to burden on the landfills and poor socio-economic conditions of the waste pickers, mostly women *(UNDP, 2018-2024).*

It is a fact that plastics will never degrade and remains on landscape for several years. The recycled plastics are more harmful to the environment than the virgin products due to mixing of color, additives, stabilizers, flame retardants etc.

Plastic Waste Management Amendment Rules, 2021

Keeping in view the adverse impacts of littered plastic on both terrestrial and aquatic ecosystems, the ministry of Environment, Forest and Climate Change has notified the Plastic Waste Management Amendment Rules, 2021, which prohibits identified single use plastic items which have low utility and high littering potential by 2022. Salient features of this amendment are as follows:

- The manufacture, import, stocking, distribution, sale and use of single-use plastic, including polystyrene and expanded polystyrene, commodities shall be prohibited with effect from the 1st July, 2022.
- In order to stop littering due to light weight plastic carry bags, with effect from 30th September,2021, the thickness of plastic carry bags has been increase from 50 microns to 75 microns and to 125 microns with effect from 31st December ,2022. This will allow reuse of plastic carry due to increase in thickness.
- The plastic packaging waste, which is not covered under the phase out of identified single use plastic items, shall be collected and managed in an environmentally sustainable way through Extended Producers Responsibility of the producer, importer and Brand owner (PIBO). For effective implementation of Extended Producer Responsibility, the guidelines for Extended

Producer Responsibility being brought out have been given legal force through Plastic Waste Management Amendment Rules, 2021.

- The State government and concerned Central ministries departments have also been requested to develop a comprehensive Action plan for elimination of single use plastics and effective implementation of Plastic Waste Management rules,2016 and its execution in a time bound manner,
- Directions under Section 5 of Environment (Protection) Act, 1986, have been issued to all state for setting up for institutional mechanism for strengthening enforcement of plastic waste management rules, 2016.

Table 53. Inventory of Plastic Waste Generation

Name of Urban Local Body	Population (2011 census)	Number of Wards	Estimated Quantity of Plastic Waste Generated (MT/Day)	
Nagar Palika Parishad Badahat,(Uttarkashi)	27102	11	0.50	
Nagar Palika Parishad Chinyalisaur	8844	06	0.07	
Nagar Palika Parishad Badkot	7414	06	0.25	
Nagar Panchayat Purola	7931	07	0.03	
Nagar Panchayat Naugaon	5174	07	0.03	
Nagar Panchayat Gangotri	110	-	*Non Yatra season*	*Yatra Season*
			0.01	0.02

Current Standpoints Regarding Plastic Waste Management

Table 54. Plastic Waste Management Operations

Waste management Operations	Outcome	
Door to Door Collection	Almost all the U.L.Bs have 100% door to door collection in the district.	
Segregated Waste Collection (Single used plastic, Recyclable plastic, etc.)	***ULB***	***Segregation* (%)**
	NPP Badahat	20
	NPP Chinyalisaur	70
	NPP Badkot	70
	NP Purola	20
	NP Naugaon	30
	NP Gangotri	100
Material Recovery Facility (MRF) operation	Out of all the ULBs only Gangotri has functional MRF, MRF is under construction at Badahat and Badkot. For other ULBs, DPR has been approved.	

Linkage with Public Relation Officers (PROs) of producers	No ULB in the district has linkage with Public Relation Officers (PROs) of producers.	
Involvement of Non-Governmental Organizations (NGOs)/ private agencies	No other ULB than Badahat and Badkot have hired any private firm/NGO.	
Authorization and issuance of Identity cards to Waste Pickers/Sanitation workers	***ULB***	***Numbers***
	NPP Badahat	68
	NPP Chinyalisaur	17
	NPP Badkot	14
	NP Purola	16
	NP Naugaon	15
	NP Gangotri	19

Table 55. Present Infrastructure for Plastic Waste Management Operations

Name of ULB	**INVENTORY OF INFUSTRUCTURE AVAILABLE FOR PLASTIC WASTE MANAGEMENT OPERATION**				
	Plastic Waste collection centres	**Plastic Compactors and its Capacity**	**Linkage with Plastic waste Recyclers**	**Material recovery Facility (Available/Not Available)**	**Remarks**
NPP Badahat	22	01	01	Not Available (Under Construction)	• Recyclable waste is transported to a recycler at Rishikesh by the private firm Zero waste incorporation which is handling the waste management operations in the ULB. • Non-Recyclable waste, multi layered plastic and legacy waste is transported to Gazipur (Delhi) with the help of a private firm Rekart.
NPP Chinyalisaur	50	1 *(with 4 Ton/day capacity)*	Plastic waste is sold to local rag pickers	Not Available (DPR approved)	• Chinyalisaur is declared as bin free city in 2021 so all the bins are of capacity lesser than 50kg.

NPP Badkot	20	01	01	Not Available (Under Construction)	• Recyclable waste is transported to a recycler at Rishikesh by the private firm Zero waste incorporation which is handling the waste management operations in the ULB. • Badkot is declared as bin free city in 2019.
NP Purola	40	01	Plastic waste is sold to local rag pickers	Not Available (DPR approved)	• Purola is declared as bin free city in 2021 so all the bins are of capacity lesser than 50kg. .
NP Naugaon	7	In Process of Purchasing	Plastic waste is sold to local rag pickers.	Not Available (DPR approved)	• Naugaon is declared as bin free city in 2021 so all the bins are of capacity lesser than 50kg.
NP Gangotri	3 (Secondary collection in dustbins)	0 791 (can compact 50 kg waste at a time)	Plastic waste is sold to local rag pickers.	Available	**NA**

Projected Population and Plastic Waste Generation in Uttarkashi District

Plastic waste in India has surged over the past 50 years and is expected to double again over the next 20 years. The growth rate of the Indian plastic industry is one of the highest in the world.

Forecasting waste quantities in the future is as difficult as it is in predicting changes of waste composition. As a general rule, the lower the level of economic development, the greater the change between generation and disposal.

Census population data for the year 2001 and 2011 has been taken for population forecast. Decadal population and subsequent waste forecast *(For the year 2031)* has been done based on following presumptions:

- Arithmetic increase method has been used for the decadal population forecast, hence the rate of change of population with time is assumed to be constant.

- The per capita consumption of plastic waste has been taken as 11kg/annum. *(*MoEF&CC, 2018*).*
- It is considered that 70% of total plastic waste consumption is discarded as waste. *(CPCB,2013)*
- 16 % yearly growth in per capita plastic waste consumption has been taken keeping in mind the changing waste paradigm and floating population (MoEF&CC, 2018).
- Analysis includes population and waste generation estimations only for Urban local bodies and does not include peri-urban and rural areas.

Table 56. Projected population and estimated waste generation

ULB	Projected Population			Projected Plastic waste (MTPD)		
	2021	***2031***	***2041***	***2021***	***2031***	***2041***
Badahat	37986	48870	59754	0.5	1.67	3.30
Chinyalisaur	11510	14176	16842	0.07	0.22	0.43
Badkot	8733	10052	11371	0.25	0.75	1.37
Puraula	9523	11115	12707	0.03	0.09	0.17
Naugaon	7119	9064	11009	0.03	0.10	0.19
			Total waste	***0.88***	***2.83***	***5.46***

Table 57. Decadal increase in waste generation

Name of ULB	Rate of growth(2021-2031)	Rate of growth(2031-2041)
Badahat	23.4%	9.76%
Chinyalisaur	21.43%	9.54%
Badkot	20%	8.27%
Puraula	20%	8.89%
Naugaon	23.33%	9%

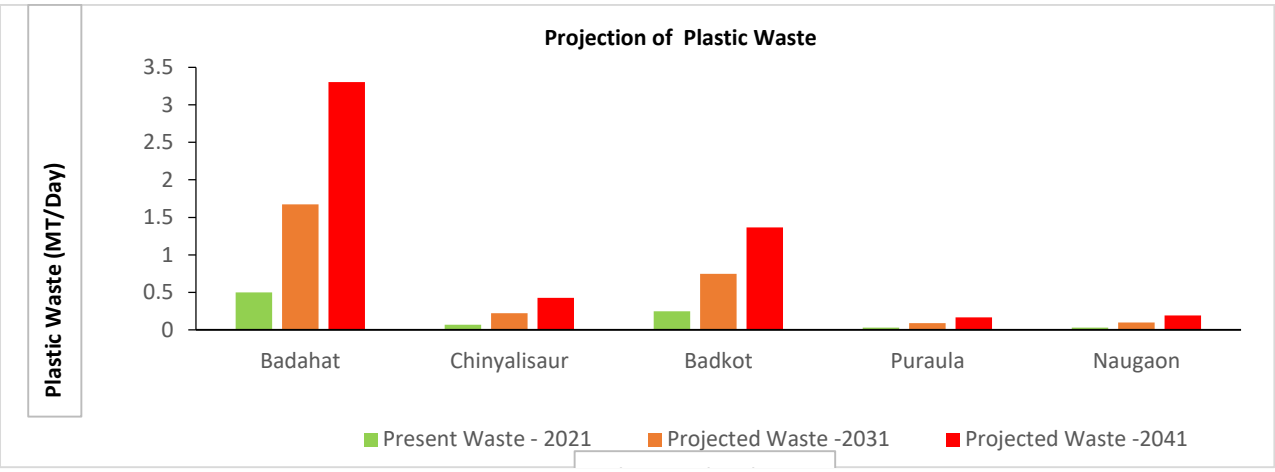


Fig. 6 Graphical Representation of Projected Plastic Waste

ASSESSMENT OF URBAN LOCAL BODIES

Table 58. Assessment of Urban Local Bodies in Uttarkashi District

Indicators	**Maximum Points**	**Urban Local Body**					
		NPP Badahat	**NPP Chinyalisaur**	**NPP Badkot**	**NP Purola**	**NP Naugaon**	**NP Gangotri**
Solid Waste Management							
Segregation	**4**	3	3	3	3	3	4
Collection	**4**	4	4	4	4	4	4
Segregated Waste Transport	**4**	1	1	1	1	1	2
Wet Waste Processing	**2**	2	2	2	2	2	2
Dry Waste Processing	**4**	2	2	2	2	2	2
Disposal	**2**	0	1	1	1	0	1
Inclusion of Informal Sector	**1**	1	0	1	0	0	0
Bio-medical waste Management							
Linkage with CBWTF*(Common Bio-medical Waste Treatment and Disposal Facility)*	**1**	0	0	0	0	0	0
Hazardous Waste Management							
Linkage with TSDF (*Treatment, Storage and Disposal Facilities)*	**1**	0	0	0	0	0	0
C&D Waste management							
C&D Waste Processing	**1**	0	0	0	0	0	0
E-Waste Management							
E-waste Collection and Linkage with Recyclers	**2**	0	0	0	0	0	0
General Information							
Innovation and use of indigenous Techniques	**2**	2	2	2	2	2	0
Enforcement of Bye-laws and Waste Management Rules, 2016	**2**	2	1	2	1	1	1
Total	**30**	**17**	**16**	**18**	**16**	**15**	**16**

Table 59. Final Assessment of Urban Local Bodies of Uttarkashi District

Name of ULB	Score (out of 30)	Score Percentage (%)
NPP Badkot	18	60%
NPP Badahat	17	56.66%
NPP Chinyalisaur	17	56.66%
NP Purola	17	56.66%
NP Gangotri	16	53.33%
NP Naugaon	15	50%

Observations from data assessment

- Overall, NPP Badkot is performing well in comparison to other Urban Local Bodies with better waste management operations.
- Nagar Palika Bdahat and Nagar Palika Badkot have established linkage with authorised recyclers, other ULBs needs to focus on this.
- None of the Urban Local Bodies have linkage with Common Biomedical Waste Treatment Facility (CBWTF) and Treatment Storage and Disposal facility (TSDF) for the disposal of municipal sanitary waste and domestic hazardous waste respectively.
- Almost all ULBS except Nagar Panchayat Gangotri are lacking on implementing source segregation of waste which requires regular Information, Education, and Communication (IEC) activities and awareness programs to sensitize the people about the importance of segregating the waste at source.

ACTION PLAN

ACTION PLAN FOR SOLID WASTE MANAGEMENT

The urban areas of Uttarkashi district are propagating the concept of bin free city as major towns have been declared bin free. Moreover, the district has almost 100% waste collection which is very rare to see. Though some efforts are required for the scientific disposal of solid waste.

The action plan focuses on the basic point which forms the prerequisite for effective waste management. Each action point is in compliance with the guidelines of Solid Waste Management rules, 2016. It is expected that the district would be able to scientifically manage their waste in a decadal timeline. The current action points must be addressed in a timeframe of 5-10 years considering the financial constraints.

Table 60. Action Plan for Solid Waste Management

Action Point	**Concerning ULB**	**Strategy/Approach**	**Stakeholder Responsible**	**Purpose**
Primary Segregation *(Segregation at Source)*	All ULBs *(Except NP Gangotri)*	• Separate Storage Bins. • Regular awareness campaigns. • Incentivizing wards having 100% source segregation. • Man power Management. • Behavioural change Communication techniques. • Promoting Home composting for wet Waste.	• Nagar Palika/Nagar Panchayat • Residents and NGOs	• Higher Recovery of Recyclables. • Better handling of waste. • Efficient Energy recovery
Segregated Waste Transport	All ULBs *(Except NP Gangotri)*	• By Optimizing Waste Management Infrastructure *(Collection trucks, trolleys*).	• Nagar Palika / Nagar Panchayat	• Man power Optimization.
Characterisation of waste	All ULBs	• By periodically checking and measuring the waste volume to establish the baseline for the waste generation. • Waste volumes should also consider seasonal variations and should be temporal in nature.	• Nagar Palika / Nagar Panchayat	• To keep an accurate estimate of waste generation.

Linkage with *Treatment Storage and Disposal Facility* (TSDF) and Common Biomedical Waste Treatment Facility (CBMWTF) for waste generated from households.	All ULBs	• Separate bins for sanitary and domestic hazardous waste. • Establishing collection centre at a common place for all the ULBs. *(Hospitals could be such place).* • Weekly transportation of waste to the nearest CBWTF or TSDF from that common facility.	• Nagar Palika/Nagar Panchayat	• For scientific disposal of Municipal waste, sanitary waste and domestic hazardous waste.
Landfill mining	All ULBs	Converting bio-waste from landfill site into compost while plastic, glass etc. can be used for recycling.	• Nagar Palika/Nagar Panchayat	• To mitigate environmental impact of waste. *(Methane emission)* • Resource Recovery of excavated waste. • To mitigate the garbage slide
Linkage with authorised recyclers	NP Naugaon NP Gangotri NPP Chinyalisaur NP Purola	Either the local scrap pickers can be authorised or direct linkage could be established with any recycling unit.	• Nagar Palika /Nagar Panchayat	• To reduce open dumping of waste. • To insure proper recycling of the waste.
Cluster based Approach to Solid waste management	All ULBs	• By merging schemes from Central and state government department with Rurban Mission of Ministry of Rural development.	• District Administration • DPRO *(District Panchayati Raj Officer)*	• To club the villages in peri-urban areas of the town with the nearby solid waste management facility for effective waste management in rural areas. • To execute Rurban mission of Government of India.

Community based waste management programs	All ULBs	• Cleanliness drive campaigns throughout the district • IEC *(Information, Education and Communication)* activities in Educational institutions. • IPC *(Inter-personal communication):* School children and Sanitation workers to spread awareness amongst people regarding waste management.	• District Administration	• Social and Behavioural Change Communication • To provide training necessary to establish effective waste management operations.
Establishment of Green Protocol	All ULBs	By encouraging Green protocol in local schools, public functions, IEC campaigns, sports events, annual temple festivals and other gatherings.	• District Administration	• To prevent use of disposables and using alternatives like glass/Stainless steel etc. • To bring generation of non-biodegradable waste close to zero.
Scientific recovery and disposal of waste	All ULBs	• Establishing a waste recovery facility • Construction of sanitary landfill. • Linkage with authorised recyclers and centralized treatment facilities.	• Nagar Panchayat • District administration	• To eliminate the risk of waste seeping underground *(Leachate)* within the landfill. • To reduce the risk of health hazards. • Reduction of Historical waste.

Phytoremediation as a Mitigation Measure *(For Treatment of Solid Waste)*

Besides having aesthetic value, vegetation (natural or planted) on a landfill site has an important role to play in soil formation, removal of contaminants and erosion control (Sadowsky, 1999). Moreover, vegetation may also be used in leachate treatment. Sometimes, vegetation over landfill

sites may show signs of damage due to presence of landfill gas *(LFG)* in the root zone. In view of reconstruction of a suitable medium for landfill, afforestation, plantation, or re-vegetation might provide a capping that is deep and as favourable as to root growth to achieve desired plants' performance in getting over these degradations. In this context, locally available species could be hardened and resistant in reclaiming the waste dump problem.

Table 61. Suggested vegetation for reclaiming landfill sites in the district Uttarakashi

Botanical Name	Local and English Name	Altitude (m)	Life form	Assimilating capacity	References
Quercus leucotrichophora A. Camus	Banj oak	1200-2400	Tree	Microbial biodegradation, binding, holding soils, and/or decreased leaching	Meenakshy et al, 1981
Bauhinia variegata L.	Kachnar	1250-1800	Tree	Absorbs Zn, Hg, As, Pb, Cu and Cd from wastewater	Das, 1981
Bauhinia acuminata L	Kachnar	1150-1500	Tree	conversion of Hg to volatile chemical from groundwater	Chaphekar, et al., 1980
Adina cordifolia (Roxb.) Hook. f. ex Brandis	Haldu	Upto-1500	Tree	conversion of Se and Hg to volatile chemical from groundwater	Prajapati, 2012
Berberis aristata DC.	Kingore	1350-2000	Shrub	Metals, radionuclides, hydrophobic organics	Das, 1981
Berberis asiatica Roxb. ex DC.	Kilmora	1650-2400	Shrub	Adsorb' all the dissolved gases	Das, 1981
Cynodon dactylon (L.) Persoon	Dubla, Doob	700-2500	Herb	Absorbs Arsenic and Fluoride from wastewater	Chaphekar, et al., 1980
Azolla pinnata R. Br.	Azolla	400-2200	Herb	Control the Hg, and Cd from wastewater also known as bio-fertilizer	Rai, 2008

Action Plan for Rural Waste Management in India

The Government of India as well as state government is looking up every gram panchayat to come up with a working system to manage solid waste. At the moment there are Gram panchayats in Tamil Nadu, Andhra Pradesh, West Bengal, Gujarat and Chhattisgarh which have created a robust and sustainable system to manage solid waste.

Presently in Uttarkashi district, the amount of solid waste generation from rural areas is unaccounted due to lack of waste management facilities and awareness. Some of the policies are propagated by both central and state government to come up with an array of practicable models for solid waste management in rural areas.

Table 62. Proposed policies for Rural Waste Management

Current Policy	Sponsoring agency	Remarks
Decentralized Waste Management	Under SBM-G *(Swachh Bharat Mission-Gramin)*	Decentralized systems such as household compost and biogas plants shall be encouraged.
Community Sanitary Complex (CSCs)	Under SBM-G *(Swachh Bharat Mission- Gramin)*	Such complexes comprise of appropriated number of toilet seats, bathing cubicles etc. *(Only where there is lack of space in the village for construction of household toilets).*
Cluster Approach to Solid Waste Management	Rurban Mission of Ministry of Rural Development	It aims at developing infrastructure and livelihood opportunities in cluster of Gram panchayats that demonstrate economic growth potentials.
Community Participation through *Information, Education and Communication* (IEC) Activities	National Institute of Rural Development and Panchayati Raj	All the stakeholders need to plan for a series of IEC campaigns to educate the residents on how proper segregation at the household levels eases the entire process of managing waste at subsequent stages.

Table 63. Action Plan for Bio-Medical Waste Management

Action Areas	Stakeholders	Purpose
Governance		
Periodic inspection of *Health-care Facilities* (HCFs) by Uttarakhand state Pollution control board (UKPCB).	Uttarakhand state Pollution control board (UKPCB).	To ensure proper segregation of Biomedical waste and adherence as per Bio-medical waste management rules, 2016
Linkage of ULBs with *Common Biomedical waste treatment facility* (CBWTF).	All ULBs	To ensure segregation of Biomedical waste from Municipal solid waste and thus its proper disposal as per Biomedical waste management rules, 2016.
Infrastructure		
Construction and maintenance of Biomedical waste collection shed at district level HCFs and CHCs.	Health Department	To ensure scientific handling and segregation of Bio-medical waste into different categories as specified under Bio-medical waste management rules, 2016.
Installation of effluent treatment plants in district level HCFs and CHCs.	Health Department	To ensure scientific disposal of liquid effluent generated in the HCFs.
Training and Immunisation		
State level and District level orientation programs for healthcare workers to sensitize them about effective Biomedical waste management.	Health Department	To ensure proper handling and segregation of biomedical waste in HCFs.
• Setting up of Biomedical Waste Database at State level *(specifically for primary health-care facilities)* • Training on Biomedical waste management information system (BMWMIS) to all data entry operators and pharmacists.	Health Department	To keep records of biomedical waste generated in every HCF of the district *(especially in PHCs at rural areas).*
Immunisation *(Tetanus and complete doses of Hepatitis-B)* of all hospital staff involved in Biomedical waste management.	Health department	To avoid any kind of infection while handling Biomedical waste
Services		
Establishing bins and bags at each generation points in HCFs with IEC posters displayed.	Health department	• To ensure segregation at each generation point and avoid mixing with MSW. • To spread awareness amongst the people related to biomedical waste management.

Timely replacement of bags, BMW transfer to collection shed and then prompt lifting to biomedical waste treatment facility from the shed.		• To ensure timely disposal of biomedical waste.
Bar code system for tracking bags and containers and use of GPS enabled systems in waste transportation vehicles.	Health Department and Uttarakhand state Pollution control board (UKPCB).	To ensure tracking of biomedical waste collection, Transportation, disposal and recycling as specified under Biomedical waste management rules, 2016 .
Information		
Development of an IT-enabled data management system to keep inventory of waste collection, consumables supply, training programs etc. in including PHCs in the district (HCFs)	Health Department	To ensure transparency in the biomedical waste management system up to primary level.
Display details of authorisation, treatment, annual report of all Health-care facilities (HCFs) on website.	Health Department and Uttarakhand state Pollution control board (UKPCB).	To make the information open source and ensure transparency.

Table 64. Action Plan for C&D Waste Management

Action Point	Strategy/Approach	Stakeholder Responsible	Purpose
Setting up of C&D Waste Dumping Site for local construction activities and road construction debris.	• Notifying dumping zones. • Establishment of dumping zone such that it also caters for C&D waste of Peri-urban areas and nearby villages. • Illegal dumping practices must be discouraged by charging penalties on open dumping. • Establishment of dumping zone in district road, village road.	• All ULBs and District Panchayati Raj officer (DPRO) • Public Works Department (PWD)	To ensure compliance with C&D Waste Management Rules, 2016.
Framing by-laws for C&D waste management.	• By-laws should be framed by each ULBs and DPRO as per C&D waste management rule for proper disposal of C&D waste in the district. • Provision of heavy fines should be done under these by-laws for illegal dumping of waste such as excavated earth material on the banks of river or on the hill slopes.	• All ULBs and District Panchayati Raj officer (DPRO) • Public Works Department (PWD)	To ensure compliance with C&D Waste Management Rules, 2016.
Management of C&D waste.	• Managing C&D waste separately from municipal solid waste. • Enhancing awareness and incentivisation for efficient C&D waste handling and processing.	• All ULBs and District Panchayati Raj officer (DPRO) • Public Works Department (PWD)	To ensure that C&D waste comes to the recycling plants as segregated input, and the recycled products are picked up for use in construction.
Plantation in old dump sites.	Providing vegetation cover to control soil erosion, gully formation, consolidation of dump top and side surfaces.	• All ULBs and District Panchayati Raj officer (DPRO) • Public Works Department (PWD)	Dump Slope stabilization and erosion control

Table 65. Action Plan for Hazardous Waste

Action Point	**Strategy/Approach**	**Stakeholder Responsible**	**Purpose**
Linkage of ULBs with common *Treatment, Storage and Disposal Facilities* (TSDF) or disposal facility	• All the ULBs of the district should establish linkage with nearby common TSDF or disposal facility to ensure proper disposal of hazardous waste and avoid its dumping in the landfill site. • One Collection facility should be setup in the district to collect domestic hazardous waste from the rural areas of the district.	All ULBs & *District Panchayati Raj officer* (DPRO)	To ensure segregation and scientific disposal of domestic hazardous waste from municipal solid waste and its proper disposal.
Training of sanitation workers regarding domestic hazardous waste	• By organizing district level workshops to sensitize the sanitation workers regarding hazardous waste management. • By adopting standard operating procedure for all the sanitation jobs related to hazardous waste handling.	State government and District Administration	• To ensure proper segregation of domestic hazardous waste from municipal solid waste. • To ensure disposal of materials in a safe, efficient and environmental friendly manner. • To minimize exposure to unhealthy waste by adhering to safety guidelines proposed by Occupational Safety and health administration. (OSHA)
IT enabled systems for inventorization of the hazardous waste m	• State pollution control board should inventorize the generation, collection, and disposal of both domestic and industrial hazardous waste on its website so that complete transparency is maintained in the management of hazardous waste in the district.	State pollution control board	To ensure compliance to Hazardous waste management rule 2016.

Table 66. Action Plan for E-Waste

Action Point	Strategy/Approach	Stakeholder Responsible	Purpose
Establishing E-waste Collection Centres	• Collection centre should be established for all ULBs in such a way that they could also cater the collection from nearby rural areas. • A Toll Free Number must be issued for the collection of E-waste	All ULBs	• To ensure proper segregation of E-waste from municipal solid waste • Capacity building of stakeholders to promote effective E-waste management.
Authorization of E-Waste Pickers	• Authorization of E-waste pickers should be done by district administration and urban local bodies. For that, Identity cards must be issued to them.	District administration and ULBs	To avoid illegal trading and processing of e-waste.
Linkage of ULBs with authorized recyclers/ Dismantlers	• All the ULBs in the district should establish linkage with any of the five authorized E-waste recyclers.	All ULBs	To ensure proper recycling if possible and if not then proper disposal as per E-waste management rule 2016.
District level Awareness campaign	• Promoting *Information, Education and Communication* (IEC) activities in educational institutions (Schools, Colleges etc.) • Promoting Awareness programmes under Digital India Initiative *(Initiated by Ministry of Electronics and Information Technology*) about alternate methods of disposing E-waste.	District administration	Promoting behavioural change in public.
Extended Producer Responsibility	• Random sampling of electrical and electronic equipment's placed on market to monitor and verify the compliance of RoHS *(Restriction of Hazardous Substances)* provisions as per the guidelines of *Central Pollution Control Board* CPCB • "E-waste Return" Programme should be initiated to incentivize people and bring about behaviour change	State government	• Proper Collection and Disposal of E-waste • Channelization of e-waste generated from *the "end-of-life"* products to ensure environmentally sound management

Table 67. Action Plan for Waste Water Management (STPs)

Action Point	**Concerning ULB**	**Strategy/Approach/Current status**	**Stakeholder Responsible**	**Purpose**
Upgradation of Sewer Network	NPP Badahat	• Badahat *(Uttarkashi)* Sewerage network partially covers 10 out of the 11 wards of the town. To connect rest of the households survey work has been done and DPR has been sent for approval.	Jal Sansthan	To increase household coverage of Sewer Network in Badahat *(Uttarkashi)* town.
Additional/ New STP Requirement	• NPP Badahat, • NPP Chinyalisaur • NPP Badkot • NP Naugaon • NP Purola, • NP Gangotri	• DPR for NPP Badahat has been sent for approval. • For other ULBs DPR is yet to be prepared.	Jal Sansthan	• To increase percentage population covered under Sewage management. • To accommodate the tourist influx during char Dham yatra season.
Continuous Effluent Monitoring station	• NPP Badahat • NP Gangotri	• Self-monitoring mechanism in the form of Online Continuous effluent monitoring system.	• Jal Sansthan • State Pollution control board (UKPCB)	To ensure that the STP meet out the prescribed standards as per Environment Protection Act, 1986.
Decentralized waste water management under AMRUT *(Atal mission for Rejuvenation and Urban transformation)* by FSSM (Faecal Sludge and Septage Management system)	All ULBs	• In line with National FSSM policy, each state is expected to develop and issue an FSSM implementation strategy and plan guideline. This may be integrated with overall city land use planning. • Capacity building and training on FSSM *(at City level)* to build their personnel capacities and organizational systems for delivery of sanitation services.	• Ministry of Housing and Urban development , Government of India • State Government	• Promoting community-planned and managed faecal sludge and septage management for group of households. • Rehabilitation of old sewerage system. • To augment limited treatment capacity. • Recycling and reuse of waste water for beneficial purposes.
City Sanitation Plan under National Urban	All ULBs	• Enhance synergy among municipal government agencies, the private	• Ministry of Housing and Urban	• Citywide Sanitation Sector development.

Sanitation policy		sector, NGOs and others. • Increase funding from sources other than municipal government*(such as from the national and provincial governments, donor agencies, the private sector)*	Development, Government of India	• Awareness generation and behaviour change in field of Sanitation. • Sanitation and safe disposal of waste.

Action Plan for Water Resources Management and Ground Water Extraction/Contamination

*Water Resources and Ground water management requires an integrated approach from different departments such as District administration, Panchayati Raj, Jal Sansthan, Jal Nigam, Payjal Nigam, Forest Department etc. Each department is expected to work in tandem with each other to achieve effective management of resources, be it land or water.

Table 68. Water Resources Management

Action Point	Strategy/Approach	Purpose
Integrated water resources management (IWRM) (at River basin level	• By considering basin/sub basin as a basic unit for planning and management.	• To achieve water security for all purposes, managing risks and to mitigate disasters
River Basin Master Plan	• By analysing River Basin Characteristics	• Periodic review of hydrological conditions prevailing over a basin • Identification of protected areas
Mapping of water scarce areas in a district	• By using modern mapping tools such as Geographical Information System and remote sensing (GIS). • By setting up an interdisciplinary framework consisting of Local institution and empowered government agency.	• To get estimate of vulnerable areas in the district.
Assessment of water Resources in various river basin	• Using Modern technology and Hydrological modelling	• To collect reliable data. • To assess water resources potential and analysing water requirements for various uses.
Public Awareness and use of Low Cost technologies	• Using field application methods such as Drip irrigation/micro sprinkler irrigation systems in water scarce areas. This can be achieved by bringing government subsidies in this area as the local people needs incentives to up bring this modern technology.	• For better water application efficiency
Integrated Rural area Programme (IRAP)	By bringing together all the programmes of different ministries as well as rural employment and development programme into one for effective collaboration and planning.	• For constant interactive relationships between different departments. • Location specific programmes can be drawn up locally under this overall programme.

Table 69. Ground Water Management

Action Point	Strategy/Approach	Purpose
Multidisciplinary Approach (Nexus between groundwater, agricultural policy, urban infrastructure and energy consumption)	• By integrated vision and coordination amongst different departments.	• For groundwater sustainability
Mapping of aquifer at micro level	• By Maintaining an Aquifer information and Management system	• To quantify the available ground water resources. • To formulate plan appropriate to the scale of demands and aquifer characteristics.
Artificial recharge of Ground water	• By demarcating groundwater recharge zones by identifying critical natural recharge areas of an aquifer and those areas that require special attention with regard to recharge of groundwater. • By using broad leaf plants to improve the moisture content in the soil and thereby increasing the groundwater level and water holding capacity of soil. • Improving the scale of work done through various schemes such as MNREGA which will help develop indigenous recharge methods *(such as Chal-khal).*	• To ensure sustainability of ground water resources • To ensure the quality of recharge to prevent possible contamination
Identification of Non-point sources of Pollution (*Pollution resulting from land runoff, precipitation, drainage, seepage etc.)*	• Controlling soil erosion by planting more trees and covering bare soil with vegetation. • Constructing wetlands.	• Non-point source pollution is a leading cause of deteriorating water quality as when the runoff moves, it picks up and carries away natural and human-made pollutants finally depositing them in lakes, rivers and groundwater.
Mitigating Groundwater Contamination	• Reducing the use of pesticides and fertilizers. • Encouraging Organic farming in the area by organising various Information, Education and Communication (IEC) campaigns.	• To ensure the ground water quality of an area. • To reduce health hazards caused due to contaminated water.

Table 70. Action Plan for Air Quality Management

Action Areas	Strategies/Approach	Stakeholders	Purpose
Air quality monitoring	• Ambient air quality monitoring stations can be installed in all the urban centres and other identified areas such as construction sites after manual air quality monitoring.	Uttarakhand state pollution control board (UKPCB)	To identify the hotspots within the district and further development of mitigation measures for those areas.
Solid waste collection system	• Door to door collection of waste in the peri-urban areas and provision of dry waste collection from rural areas within the district. • After implementing proper collection mechanism, provision of heavy fines should be made on open burning of waste.	All ULBs and *District Panchayati Raj Office* (DPRO)	To reduce emission of harmful gases by open burning of waste especially in urban areas.
Control over forest fires	• Providing the forest department adequate manpower and machinery to control forest fires. • Proper coordination between various departments involved. • Proper inspection of civil forests and forests under van panchayats by training the personnel engaged in the maintenance of these forests. • Development of mixed forests by planting indigenous broadleaf plants which maintains moisture in the soil and reduce the chances of fire.	• Government of Uttarakhand and District Forest Department	To reduce harmful emissions due to massive forest fires in the district.
Vehicular Traffic management	• Checking adulteration of fuel. • Promoting intercity and intra-city public transportation with green fuel alternatives such e-buses & rickshaws etc. • Paving of road shoulders especially in urban areas.	• Department of Police • Transport Department • Public works department	To reduce emissions caused by vehicles.
District level action plan for air pollution	• A district level task force with some experts can be formed for air quality management in the district.	District Administration	To improve existing air quality.

Awareness on air quality	• Mass awareness can be promoted with IEC activities by involving institutions such as schools and colleges.	District Administration	To promote awareness among the masses regarding the issue.
Complaint redressal system	• Online complaint registration and redressal system should be formed at the district level to register complaints regarding air pollution issues.	• Uttarakhand State Pollution Control Board (UKPCB) • District administration	To sort out grievances registered by citizens

Table 71. Action Plan for Noise Pollution Management

Action Areas	Strategies/Approach	Stakeholders	Purpose
Noise level monitoring	• Noise monitoring studies need to be done in the district especially within the urban centres by manual monitoring. • In the areas identified as hotspots, continuous monitoring stations should be set up.	Uttarakhand state pollution control board (UKPCB)	To recognize the current situation of noise levels in the district and identify the hotspots.
Traffic management	• Signboards should be placed at sensitive locations in the towns within the districts and if required silent zones should be established. • Green belts can be formed along the roads in the urban areas to reduce noise levels.	• District Administration • Public Works department and ULBs	To ensure noise level within permissible limits
Complaint redressing system	• Online complaint registration and redressal system for noise pollution should be made which can be used by citizens, traffic police, ULBs and state pollution control board.	District Administration	To sort out grievances registered by citizens
Mass Awareness	• Mass awareness campaigns must be organized with the help of IEC activities by taking the help of institutions such as schools and colleges.	District Administration	To promote awareness among the masses regarding the issue

Table 72. Action Plan for Mining Activity

Action Areas	Strategies/Approach	Stakeholders	Purpose
Monitoring of mining activity	• A district-level task force should be formed to monitor mining activities and to conduct river audits and surveillance. • For the rivers marking the boundaries with other districts, a combined task force should be formed to monitor mining activity in the river.	District Administration	To ensure sustainable mining activity within the district.
System for Online purchase and sale of Sand and Other RBMs	• An online system should be made at the state or district level for e-auctioning the mines to ensure transparency in the system.	State Government and District Administration	To ensure compliance to Enforcement and Monitoring guidelines for Sand mining, 2020.
Identification of hotspots for illegal mining	• The district task force should identify the possible hotspots for illegal mining through surveillance and patrolling. • Satellite based remote sensing to provide near real time monitoring of mining areas.	District Administration	To mitigate and stop adverse environmental impacts and economic losses.
Community participation	• A toll-free number must be issued for citizens in the district to register any complaint against any illegal mining practices as identified by them in their vicinity	District Administration	• To understand local community's willingness in curbing illegal mining from the area. • To have local check on the illegal mining activities in the district.

ACTION PLAN FOR REJUVENATION OF WATERBODIES

*Rejuvenation of water bodies requires an integrated approach from different departments such as District administration, Rural Development department, Irrigation department, Jal Sansthan, Jal Nigam, Payjal Nigam, Forest Department, and NGOs etc. Each department is expected to work in tandem with each other to achieve effective management of resources, be it land or water.

Table 73. Action plan for Rejuvenation of Water bodies

Action Point	**Strategy/Approach**	**Purpose**
River Catchment/Basin Management	• Participatory and self-management institutional framework for administering the catchment with a combination of engineering, social and scientific management.	• Reducing levels of potential contaminants in raw water. • Distribution of water and prioritization of water uses under stressed conditions.
Plantation in Flood plain zones (FPZ)	• Vegetation that acts as natural resistant to soil disturbances and standing water must be encouraged.	• To reduce shoreline erosion. • Particular type of plants acts as natural barriers to dissipate waves and back-lying areas from flooding.
Prohibition of disposal of Municipal Plastic waste and Biomedical waste (Specially in flood plain zones)	• Awareness and behavioural change activities. • Provisions of heavy fine for those found throwing garbage in rivers.	• To maintain ecological balance of the water body To prevent pollution activities nearby river basin.
Spring-shed and Stream shed management	• By constructing loose boulder check dams. • Encouraging Information, Education and Communication (IEC) activities.	• To improve water resource sustainability • To enhance water discharge from springs and rivers
Convergence Activities		• Ensuring Community participation

**Key points for the action areas in this thematic are influenced by rejuvenation activities carries out for Kosi river (Almora), Bhela River (Kashipur) and Heval River (Tehri Garhwal)*

ACTION PLAN FOR PLASTIC WASTE MANAGEMENT

Plastic waste causes a plethora of problems when it leaks into the environment. Stranded single use plastics create visual pollution. There is evidence that the toxic chemicals added during the manufacture of plastic, transfers to animal tissue, eventually entering the human food chain. Moreover, by clogging sewers and providing breeding grounds for mosquitoes and pests, plastic bags can increase the transmission of vector-borne diseases like malaria, cholera etc.

Uttarkashi town has adopted the idea of reusing empty plastic bottles in various construction activities. Used plastic bottles are also being filled with sand and are being deployed for building public facilities like toilets and benches in the town.

Table 74. Action plan for Plastic Waste Management

Action Point	Strategy/Approach	Stakeholder Responsible	Purpose
Source segregation	• ULBs should distribute separate bins to households, street vendors and other shopkeepers. • Mass awareness programmes regarding source segregation with the inclusion of institutions such as schools and colleges.	All ULBs, District Panchayati raj Officer (DPRO) Village Panchayats	• To ensure better efficiency in waste processing. • Higher recovery of resources.
Effective Collection and segregated waste transport	• Training waste pickers and providing them proper equipment suitable as per the topography of the area for door to door collection in urban areas. • Establishing plastic waste collection centres in rural areas where door to door collection is not possible. • Provision of separate vehicles for dry and wet waste to ensure utilisation of manpower. • ULBs can establish linkage with the NGOs working in this field for effective waste collection in the urban areas.	All ULBs, District Panchayati Raj Officer (DPRO) Village Panchayats	• To reduce open dumping of waste • To reduce monkey menace (which is a huge issue in the urban areas of the state) • To ensure optimum utilisation of manpower • To ensure compliance with plastic waste management rules 2016
Linkage of ULBs & other collection centres with recyclers/ cement plants /	• NPP Chinyalisaur, NP Naugon, NP Purola, NP Gangotri should establish linkage with any authorised recyclers. • Plastic waste can be used in road construction. For this, ULBs should coordinate with the construction agencies	All ULBs, District Panchayati Raj Officer (DPRO)	• To avoid open dumping of plastic waste. • To ensure reusing and recycling of plastic waste.

Public Works Department		Village Panchayats	
Implementation of Extended Producer Responsibility (EPR) through producer/Brand owner	• ULBs can ask the manufacturers collectively or individually in line with the principle of Extended Producer Responsibility (EPR) to provide the required finance to establish plastic waste collection centres.	All ULBs	• To reduce the workload of ULBs
Community participation for waste management	• Cleanliness drive campaigns throughout the district. • Information, Education and Communication (IEC) activities in Educational institutions. • Inter-personal communication (IPC) School children and Sanitation workers to spread awareness amongst people regarding waste management.	District Administration	• Social and Behavioural Change Communication.
Establishment of Green Protocol	• By encouraging Green protocol in local schools, public functions, IEC campaigns, sports events, annual temple festivals and other gatherings.	District Administration	• To prevent use of disposables and using alternatives like glass/Stainless steel etc. • To bring generation of non-biodegradable waste close to zero.

CONCLUSION

Over the past few decades, ever growing environmental problems have invited lots of attention of the stakeholders like academicians, local government, environmental planners, social activists and judiciaries. The environmental issue has therefore raised a large scale public concern. Many actions have been taken by the Government of India and concerned Environmental Protection Agencies to protect different environmental components, ecosystem services and human health from a particular pollution and degradation threat. Despite, some of the successes achieved on the grounds, many more problems continue to remain unresolved with the new ones emerging continuously day by day. With the ever increasing native and floating population and resultant anthropogenic pressures, sometimes addressing a strategy becomes a bit difficult. However, combined and interdependence might reduce complexity of environmental systems. The present new challenges before planners and policymakers might be resolved if a scientific spirit could be maintained in management actions on a ground. Scientific research could play an important role in managing and minimising pollution loads. The scientific studies and their implementation on ground will continue to play its vital role in resolving environmental problems. The environmental problems may lead to a sectoral view of problems like pollution, health, basic sanitation, land management, and conservation and sustainable use of natural resources. Decisions based on incorrect or incomplete understanding of environmental components would not allow to achieve the targeted goals of environmental management with lower risks and cost. This report as an environment plan of the district describes a framework for acquiring an idea to manage current problems of environmental aspects such as solid waste, biomedical waste, C&D waste, e-waste, industrial waste water, plastic waste, etc. These problems need to be considered as a tool to prepare for a variety of problems in view of emerging in near future. Though there is no any optimal institutional framework for environmental and natural resource management at the district level, yet some general features of an ideal institutional system could be many. These could be as follows: (i) flexibility of a plan or a model, (ii) capacity to generate information and create awareness of the importance of environmental problems among the decision-makers at all levels, (iii) decentralized decision-making and enforcement, (iv) involvement of individuals for a clear-cut role, and consensus of stakeholders (governmental agencies, non-governmental organizations, community groups and other associations) in environmental management; and (v) a high-level political will and support . There is a need to apply from the sectoral approach to collaborate approach. This is a need of the hour to mitigate and minimise the environmental impacts in our surroundings.

Environmental planning for different environmental components need to be adhered to the principle of sustainability where science serves as a quantifiable tool. The environmental management approach needs to be holistic in nature. Decision making is an integration of science and management to get people involved and managers to act and to plan.

Fig. 7 Different activities in Uttarakashi District for preparation of District Environment Plan

(A & B) A consultative workshop in Uttarakashi district on preparation for District Environment Plan **(C)** Gram Panchayat Bagori has been awarded by Best Ganga Gram award in year 2019 by Hon'ble President of India for best management of Solid Waste Management in Rural Areas, **(D)** Collect the Plastic waste in high Himalaya region (Gangotri to Gomukh route) a combined drive with Indian Army/ITBP/SHG/Local people.

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