DISTRICT ENVIRONMENTAL PLAN

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

PITHORAGARH

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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 Pithoragarh 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.

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Principal Investigator, Co Principal Investigators & Project staff

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TABLE OF CONTENTS

CONTRIBUTORS **2**

PREFACE **3**

ACKNOWLEDGEMENT **4**

ABBREVIATIONS **10**

EXECUTIVE SUMMARY **14**

INTRODUCTION **16**

FUNDAMENTAL PRINCIPLES OF ENVIRONMENT PROTECTION **18**

Sustainable Development 18
Precautionary Principle 18
Polluter Pays Principle 18
Public Trust Doctrine 19
Public Liability Insurance 19

ENVIRONMENT MANAGEMENT SYSTEM (ISO 14001:2015) **20**

DISTRICT PROFILE **20**

Topography 22
Climate 23
Rainfall 24
Forestry 24
Fauna and Flora 24
Flora 24
Fauna 25
Culture and Tradition 25
Trade and Commerce 25
Eco-Sensitive Zones in the District 25

ENVIRONMENT CONCERNS IN THE DISTRICT **26**

SOLID WASTE MANAGEMENT **28**

Integrated Solid Waste Management (ISWM) 28
Current status in the urban areas of the district 28
Methods used for the treatment of solid waste in the district 31
Gap Identification 32
Vegetation suitable for rehabilitation of dumping sites 35
Rural Solid Waste Management 35
Current standpoint about Rural Waste Management in India 36

BIOMEDICAL WASTE MANAGEMENT **37**

Importance of Biomedical Waste Management in The Wake of Pandemic 37
Biomedical waste management in Pithoragarh district 38
Gap Identification in The Management of Biomedical Waste in the District 39

CONSTRUCTION & DEMOLITION WASTE MANAGEMENT **40**

Implementation of 3r Principle in C&D Waste Management 40
Present State of Affairs 40
Present Infrastructure Within the State 41
C&D Waste Management in the district 41
C&D Waste Management in Rural Areas 42
HAZARDOUS WASTE MANAGEMENT 43
Present state of affairs 43
Hazardous Waste Management in the District 43
ELECTRONIC WASTE MANAGEMENT 45
Worldwide Scenario 45
Indian Scenario 45
E-waste Management in the district 46
WASTE WATER MANAGEMENT AND SEWAGE TREATMENT PLANT 47
Liquid Waste Management in Rural Areas 49
Current standpoint about Rural Waste Water Management in India 50
GROUND WATER EXTRACTION/CONTAMINATION AND RE-CHARGE 51
Ground water extraction: 51
Ground water contamination 51
Groundwater Recharge 51
Artificial Recharge of Groundwater 53
AIR AND NOISE POLLUTION MANAGEMENT 54
Air Pollution Management 54
Current standpoint regarding air pollution in the district 55
Noise Pollution Management 57
Noise Pollution in Pithoragarh district 58
ILLEGAL SAND MINING 59
Current Standpoints Regarding Mining Activities in the district 59
REJUVENATION OF WATER BODIES 61
Activities undertaken for the rejuvenation of water bodies in the district 61
Mission Yakshavati Resuscitation Program 62
Works to be Carried out under this Project 62
PLASTIC WASTE MANAGEMENT 64
Plastic Waste Management Amendment Rules, 2021 64
Gaps identified in the management of plastic waste in the district 66
ASSESSMENT OF URBAN LOCAL BODIES IN PITHORAGARH DISTRICT 67
Observations from data assessment 68
Action Plan for Solid Waste Management 70
Wet Waste Management through composting – A study by GBPNIHE 72
Microbial Bio-composting at Municipal level 73
Phytoremediation as a mitigation measure (For treatment of Solid waste) 73

Action Plan for rural waste management in India 74
Action Plan for Bio-Medical Waste 75
Action Plan for C&D Waste Management 77
Action Plan For Hazardous Waste 78
Action Plan for E-Waste 79
Action Plan For Waste Water Management (STPs) 81
Phytoremediation as a mitigation Measure *(for domestic waste water)* 82
Action Plan Forwater Resources Management and Ground Water Extraction/Contamination 83
Action Plan for Air Quality Management 85
Action Plan for Noise pollution management 86
Action Plan Mining Activity Management Plan 88
Action Plan for Rejuvenation of Waterbodies 89
Action Plan for Plastic Waste Management 90
CONCLUSION 92
REFERENCES 94

LIST OF FIGURES

Fig. 1. Location map of Pithoragarth district in Uttarakhand 21
Fig. 2. Waste management paradigm 28
Fig. 3. Segregation of biomedical waste as per BMW rules, 2016 37
Fig. 4. Structure and design of microbial composting pit 73
Fig. 5. A consultative workshop in Pithoragarh district on preparation for District Environment Plan 93

LIST OF TABLES

Table 1. District at a glance 21
Table 2. Altitudinal Variations 22
Table 3. Drainage System 23
Table 4. Forest Cover in Pithoragarh district 24
Table 5. Inventory of total solid waste generation 29
Table 6. waste management operations 29
Table 7. Present infrastructure for waste management operations 30
Table 8. Methods of treatment, disposal and recovery 31
Table 9. Gap identification 32
Table 10. Proposed policies and budget requirements put forward by different stakeholders in the district 34
Table 11. Suggested vegetation for reclaiming dumpsite sites in the Pithoragarh 35
Table 12. Inventory of current healthcare infrastructure for Bio-medical waste management 38
Table 13. Current status of biomedical waste management 39
Table 14. Thumb rule for estimation of C&D waste generation for India 40
Table 15. Current Status Related to C&D Waste Generation 41

Table 16. Gap identification 42
Table 17. Hazardous Waste generation in India 43
Table 18. Inventory of hazardous waste in the district 44
Table 19. Current status related to hazardous waste management 44
Table 20. Bifurcation of E-waste based on electronic appliances 45
Table 21. Current standpoints regarding e-waste generation and collection 46
Table 22. Gap identification 46
Table 23. Current Scenario related to STPs (MLD) in Uttarakhand 47
Table 24. Inventory of sewage treatment facilities in the district 47
Table 25. Major initiatives by the Government of India 48
Table 26. Proposed Policies and Budget Requirements Put Forward by Different Stakeholders in the District 49
Table 27. Policies Undertaken for Waste Water Management in Rural India 50
Table 28. Water resources in the District 52
Table 29. Pollution Control in Water Resources 52
Table 30. Information of Groundwater in District 52
Table 31. Scope of Artificial recharge in Pithoragarh district 53
Table 32. Artificial Recharge and RTRWH Structure constructed in Pithoragarh under catchment area conservation Program (CACMP) 53
Table 33. Artificial recharge and cost estimate in Pithoragarh 53
Table 34. National ambient air quality standards in India. 54
Table 35. Air quality monitoring and data accessibility 55
Table 36. Identification of sources of air pollution 56
Table 37. Control measures for industrial/non industrial air pollution 56
Table 38. Gap identification 57
Table 39. Permissible noise level standards 57
Table 40. Current status related to noise pollution management 58
Table 41. Prevalent Mining Activities 60
Table 42. Compliance with environmental standards 60
Table 43. Present scenario in the district 61
Table 44. Inventory of Plastic Waste Generation 65
Table 45. Plastic Waste Management Operations 65
Table 46. Present infrastructure for plastic waste management operations 66
Table 47. Assessment of Urban local bodies in Pithoragarh district 67
Table 48. Final Assessment of Urban Local bodies of Pithoragarh District 68
Table 49. Action plan for solid waste management 70
Table 50. Phytoremediation as a mitigation measures 74
Table 51. Policies undertaken for rural waste management in India 74
Table 52. Action plan for bio-medical waste 75
Table 53. Action plan for C&D waste management 77
Table 54. Action plan for hazardous waste 78
Table 55. Action plan for E-waste 79
Table 56. Action plan for waste water management 81
Table 57. Mitigation Measure *for domestic waste water*. 82

Table 58. Water Resources management 83
Table 59. Ground water management 84
Table 60. Action plan for air quality management 85
Table 61. Action Plan for Noise pollution management 86
Table 62. Mining activity management plan 88
Table 63. Action Plan for Rejuvenation of water bodies 89
Table 64. Action Plan for Plastic waste management 90

ABBREVIATIONS

AMRUT	-Atal mission for Rejuvenation and 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 and Demolition waste
CACMP	-Catchment Area Conservation Programme
CAGR	-Compound Annual Growth Rate
CANTT	-Cantonment Board
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
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
E-Waste	-Electronic Waste
EEE	-Electronics and Electrical Equipment
ENVIS	-Environmental Information System

ETPs	-Effluent Treatment Plants
F	-Fluoride
FPZ	-Flood Plain Zones
FSI	-Forest Survey of India
FSSM	-Faecal Sludge and Septage Management system
GBPNIHE	-G.B. Pant National Institute of Himalayan Environment
GIS	-Geographical Information System
GPS	-Global Positioning System
HCFs	-Health Care Facilities
ICT	-Information and Communication Technology
IEC	-Information, Education and 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 and 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	-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
NMHS	-National Mission of Himalayan Studies
NP	-Nagar Panchayat
NPP	-Nagar Palika Parishad
NTFPs	-Non-Timber Forest Products
ODF	-Open Defecation Free
OSHA	- Occupational Safety and Health Administrations
PAT	-Perform, Achieve &Trade
PCC	-Pollution Control Committee
PHCs	-Primary Health Centre
PIBO	-Producer, Importer and Brand Owner
PM	-Particulate Matter
PPP	-Polluter Pays Principle
PWD	-Public Works Department
QPD	-Quintal Per Day
RBMs	-Riverbed Minerals
ROHS	-Restriction of Hazardous Substances
RSM	-Rural Sanitary Marts
SBM-G	-Swachh Bharat Mission Gramin
SDGs	-Sustainable Developmental Goals
SIDCUL	-State Industrial Development Corporation of Uttarakhand Limited
SLWM	-Solid and Liquid Waste Management
SPCB	-State Pollution Control Board
STP	-Sewage Treatment Plant
TPD	-Tonne Per Day
TSDF	-Treatment Storage and 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
RTO	-Regional Transport Officer
µg	-Microgram

EXECUTIVE SUMMARY

Major part of the Pithorgarh district lies in upper Himalayas, which is covered with snow throughout the year. The valley areas are densely populated and needs planning in the areas such as waste management, air pollution mitigation, efficient water resources management etc. Anthropogenic activities in these valleys and lesser Himalaya regions have impact on high altitude regions which are very susceptible to climate change. Environmental and climate change issues are numerous and complex. Economic and population growth have been the factors that needs to be highlighted to explain the increasing stress imposed by human interference on the natural environment.

In view of analysing the current status and furnishing 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 explicitly on the following thematic areas which includes:

- ***Waste Management Operations:*** Almost half of the population in the district is practising segregation at source. Although door to door collection is 100% in all the ULBs of the district. Scientific treatment of dry waste is performed in Nagar Palika Pithoragarh at material recovery facility. Waste is openly dumped in rest of the ULBs.This could be due to lack of any waste recovery facility .no linkage with authorised recyclers and minimal involvement of third part in handling the waste management operations.

  Plastic waste is not yet estimated in the district. It forms the part of existing solid waste management operations which currently includes only collection and transportation; not processing and scientific handling. Other waste such as domestic hazardous waste, e-waste etc. are not streamlined in current waste management operations.

  DPR has been approved of each ULB to revamp their waste management operations. This is deemed necessary considering rapid urbanization and increasing population.
- ***Biomedical Waste Management:*** Although ample healthcare facilities are available in the district, only few of them are authorised by Uttarakhand State Pollution Control Board. All the major HCFs are disposing their waste by deep burial method. No HCFs has established linkage with any Common Biomedical Waste Management Facility for scientific handling of waste. Health care department has raised concerns regarding lack of land for deep burial of waste and has desired intervention from third party to effectively manage the increasing biomedical waste.
- ***Construction and Demolition Waste Management:*** C&D waste generated in the district is not yet quantifiable. Dumping zone are designated in different sites but most of C&D waste is being used for filling the low lying areas.

- ***Waste water Management***: Two STPs are operational in the district; both in Nagar Palika Pithorgarh.Rest of the district still relies on conventional septic tank+ Soak pit for disposal of liquid waste.
- ***Air and Noise Pollution:*** Air quality is still undetermined in the district due to lack of monitoring stations. Uncontrolled forest fires might lead to deterioration of air quality. Moreover, urbanisation and increase in population will increase vehicular pollution in the district.
- As such, noise pollution is not a big issue in the district except during festivals and public events. However, a regular monitoring drive must be launched to check noise pollution in the silent zones.
- ***Surface and Groundwater Management:*** The district has ample water resources which include rivers, lakes, ponds etc. Major rivers including Kali river, Gori river, Ram Ganga river etc., traverses through the district. Encroachment in the flood plains of river has been a common affair in the district. Water pollution is controlled in the district.
- Ground water studies are not possible in high altitude areas of the district, but the major cities of the district (low elevation areas) including district headquarters, Nagar Palika Pithoragarh faces water shortage in summer season. No studies have been conducted so far to check the adequacy of groundwater in the district. Major springs which are on the verge of extinction has the tendency to push the district towards water crisis.
- ***Mining activity:*** Soapstone, magnesite, sand etc. are some of minerals found in the district. Legal mining operations are carried out in the district but it has been found that some of the mining operations are devoid of environment clearance. Some cases of illegal mining have been noticed in the district and are subsequently dealt with by imposing penalties

The execution of this management plan will require the integration and co-operation of the people, private and public stakeholders of Pithoragarh district. 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

Pithoragarh district is the easternmost Himalayan district in the state of Uttarakhand. It shares international boundaries with Tibet on the north and Nepal on the east and district boundary on the west by the Garhwal region. The city of Pithoragarh, located in the Saur valley is its headquarters which lies under the Kumaon division of the state. The town of Pithoragarh is also known for its significant history as it was a major centre of power during the regime of the Chand Kings in Kumaon. The district is well connected with all major destinations across Uttarakhand and Northern India with the series of National Highways (NH 9 and NH 309A), accompanied by the development of first road connectivity to the Lipulekh Pass, which will offer a smooth ride for pilgrims going for the famous Kailash Mansarowar Yatra.

Also known as ‘Little Kashmir’, Pithoragarh is a place of exquisite divine deities, natural beauty and serenity. Grassy meadows, perennial streams rallying down the mountains and lush landscapes makes it a stopover not just for nature lovers but also for adventure enthusiasts who can indulge in activities like trekking, camping, hiking etc. Some of the most popular attractions in the district includes Kapileshwar Mahadev, the Royal Pithorgarh Fort, Dhwaj temple and the rich Askot wildlife Sanctuary. The district is also famous for aromatic tea (only grown in Berinag and Chaukori) which was a highly sought-after in London tea houses till early nineties because of its unique light taste and colour.

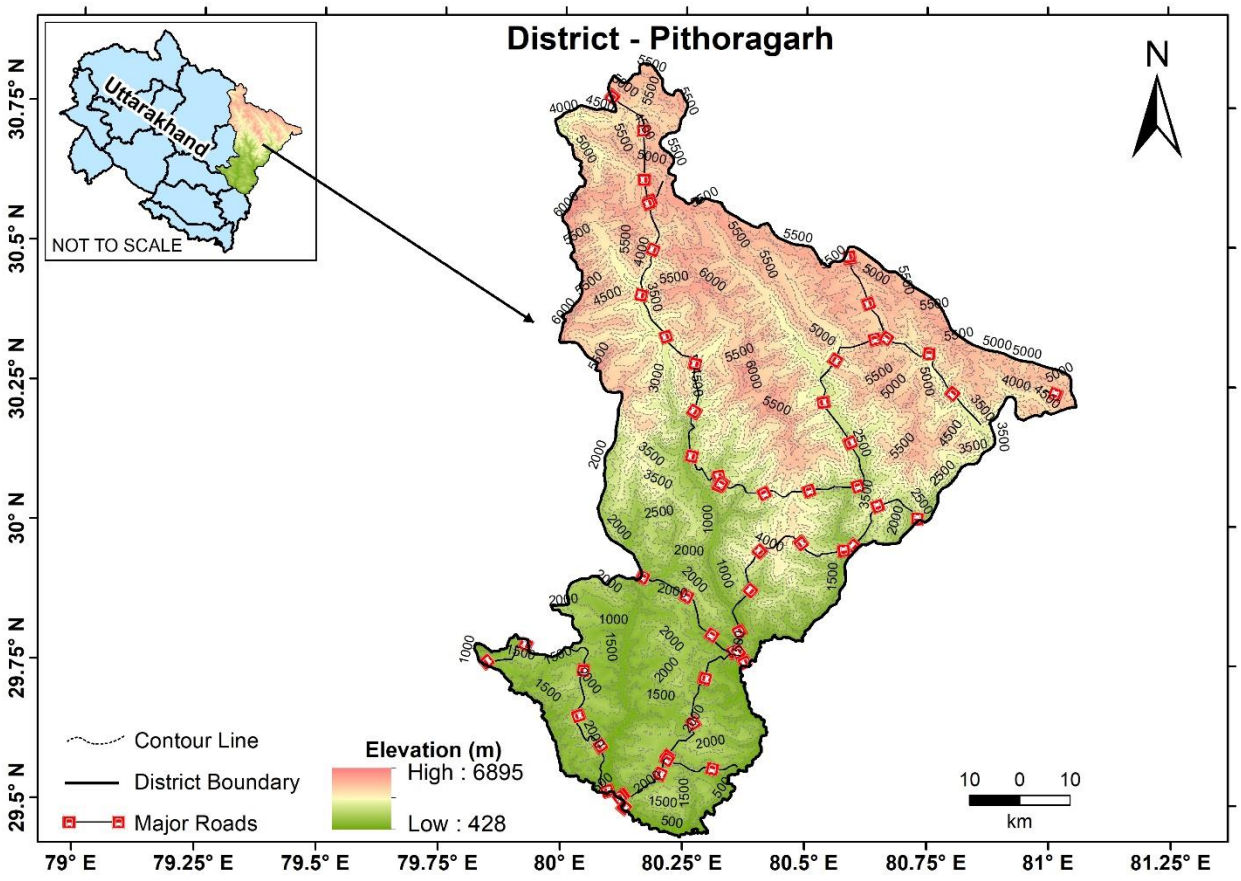


Fig. 1. Location map of Pithoragarth district in Uttarakhand

Having international frontiers on its entire northern and eastern boundaries, the district assumes a great strategic significance and obviously is a politically sensitive district along the northern borderline of India. It has tremendous strategic importance as the passes of lipulekh, Lampia dhura and many others open out to Tibet. The Hindu pilgrimage route for Kailash-Lake Mansarovar passes through the district via lipulekh pass in the greater Himalayas.

Table 1. District at a glance

Geographical Location	
Latitude	29°34'58.3"N
Longitude	80°13'5.48"E
Geographical Area	7,090 km2
Average elevation of district headquarter	1627m
Population Data (2011 census)	
Total Population	483,439
Male Population	239,306
Female Population	244,133
Population density	68

Population growth rate	4.58%
Overall Literacy rate	82.25%
Male literacy	79.24%
Female literacy	63.87%
Sex Ratio	1,020
Urbanised area	14.4%
Rural area	85.6%
Administrative Divisions	
Tehsils	6
Blocks	8
Nyay Panchayats	64
Village Panchayats	669
Total census villages	1674
Municipal councils	0
Nagar panchayats	3
Cantonment boards	0

Source: District census handbook 2011; District statistical report 2018

Topography

Located in the upper Himalayas, Pithoragarh district has within itself varying geographical environments as the altitude varies up to 6400 meters above the sea level. The whole of the area of the district sprawls in the ragged terrain of mystic Himalayas. The mountains on which this district is located are the youngest mountains in the world and the land mass now covered by them was occupied by the great Tethys seas during the Mesozoic period.The major portion of the district lies under perpetual snow and a considerable area is rocky and barren. Cultivation is therefore limited to river valleys and gently sloping belts.

Table 2. Altitudinal Variations

Geographical Belt	Demarcation	Altitude (m)	Significance
Zanskar Range	Along the Northern border of the district ,bounded by Greater Himalaya in the south	4000-7000	Adverse Climatic Conditions, not suitable for human life.
Greater Himalaya	Region extends between Zanskar range in North and Kali basin in south	2000-6500	Region has Glaciers and Snow cap soils.
Kali Basin	Along the Western side of Kali River	1200-4000	A low Altitudinal zone covered with mixed forests mainly of pine and oak

Gori Ganga Basin	Central part of the district	3000-5000	Rugged terrain with crest of the ridges, falls and deep valleys.
Saryu Ramganga Basin	Middle western part of the district	1500-4000	High altitudinal zone in the north gradually decreasing to the south.

The district abounds in rivers, some of which originate within the fold of the district and assuming a peripheral course along the borderline, enter the Garhwal region and eventually merges into the Ganga and have thus been geographically grouped under the Rivers of Ganga system. Apart from this, roughly 30% of the district wears the perpetual snow cover and the gigantic masses of sliding snow feed a number of glaciers which in turn feed important northern rivers namely Dhauli and Gori Ganga having their catchment in glaciated zones.

Milam, one of the most alluring glaciers of the world is located in Pithorgarh district at the height of 4250 meters above sea level. The glacier was named after a village nameMilam, which was once most populated village of the district but at present its population has been reduced to almost nil.

Table 3. Drainage System

Name of River/Stream	Place of Origin	Altitude at origin (m)
Dhauli Ganga River	Dhauli Glacier	5945
Gori Ganga River	Milam Glacier	5500
Ram Ganga River (E)	Namik Glacier	3600
Saryu River	Sarmul	3000
Kali Ganga River	Kala Pani	3600

Climate

Pithoragarh district has large distinction in temperature due to the substantial variations in altitude as the variations from place to place are considerable, ranging between the maximum of 30.3ºC and minimum (-)1. 7ºC.The areas above 3,500 metres (11,500 ft.) remain in a permanent snow cover. Regions lying at 3,000–3,500 metres (9,800–11,500 ft.) becomes snowbound for four to six months.During the coldest month of January, tropical ridges and high location along the lesser Himalayas records an average monthly temperature between 5.5ºC and 8ºC. By the march, the temperature begins to rise progressively till early June which is the hottest month. At places like the river gorges at Dharchula, Jhulaghat, Seraghat,the temperatures reach 40 °C.

Rainfall

As most of the district is situated in the on the southern slopes of the Himalayas, monsoon current penetrate through the deep valleys and rainfall is at the maximum in the monsoon season (June to September), particularly in the southern half of the district. The Northern half of the district also gets considerable rain during the winter season which lasts from mid-November to March. Most of the rainfall occurs during the monsoon period, being between 75% and 85% of the annual precipitation in the south and between 50% and 70% in the extreme north and north-east. In the monsoon season, there are few occasions when there are spurts of heavy rains in the hills causing floods in the rivers.

Forestry

Forests are mainly found in the river valleys and southern parts of the district. Major portions of Munsiyari and Dharchula areas situated in the northern parts of the district have high mountains covered with perpetual snow. Depending upon the altitude and the climatic conditions, the flora of the region can be divided into four divisions namely Sal, Chir, Oak and Coniferous forests. These forests are useful both from economic and industrial point of view. The Pithoragarh has recorded forest cover of 2,079 km^2 which is 39 % of its geographical area. The forest cover under different forest sub-type was highest in the district, moderate forest cover (965 km^2), open forest (609 km^2), and lowest in very dense forest (505 km^2) (FSI, 2019) Table 4

Table 4. Forest Cover in Pithoragarh district

District	Geographical Area	Very Dense Forest	Mod. Dense Forest	Open Forest	Total	Changes as of 2017 -2019 assessment
Forest Area of Pithoragarh District (km^2)	7090	505	965	609	2079	1.80

Fauna and Flora

Flora

Since the district possesses a great range of elevation, there is a remarkable diversity in its natural vegetation. Passing along the route of Chota Kailash, one moves into the enchanting world surrounded by the lush stretches of Bugyals (Alpine meadows) such as Chhiplakot and VyasValley. The northern hilly zone is covered with dense forests, particularly on northern slopes with diverse flora up to elevation of about 14000 ft. The district is also home to Askot Musk Deer Sanctuary, surrounded by all sides from majestic snowcapped peaks of Panchachuli. Spread over an area of

599km^2, the sanctuary was set up with an aim of protecting the precious collection of musk deer population. The alpine and sub alpine zones are considered as the natural adobe of the largest number of medicinal plants. In the district, various important species of trees, namely, Moru (*Q. floribunda*), *Pine (Pinus roxburghii),* Burans (*Rhododendron arboreum*), Anyar (*Lyonia ovalifolia*), Khaphal (*Myrica esculenta*), etc.

Fauna

Major attraction of this region is the plethora of wildlife species and bird species which enhance the ambience of the district. Sambhar. known as Jarau and Kakar or barking deer (found up to an altitude of 3050m above sea level) are prominent in the district. Flocks of snow-pigeons are also found in the district. As far as reptiles are concerned, 34 species of snakes are found in the district, of them only 8 species are poisonous. Large species of fish including Mahaseer and Kalabans and other species such as Ascla, Rohu and Garra are found in abundance in the district. In the district, various important wild animal such as Langur (*Semnopithecus entellus*) leopard (*Panthera pardus*), Monkey (*Macaca* spp.), etc., whereas the high altitude zones abound Himalayan black bear (*Euarctos americanus*), kakar (*Muntiacus*), Ghoral (*Nemorhaedus goral*), etc.

Culture and Tradition

Numerous fairs and festival are organized every year to demonstrate the authentic traditions, culture, rituals and Kumauni cuisine. The events organized are not only an expression of the religious, social and cultural urges of the local population but they help to preserves the tradition and folk of the region. Most of the fairs and festivals are based on beliefs and dedication of spirituality linked with seasons. Some of the locally known festivals which have the potential to be projected at national level are Bhitauli, Harela, Phool Dei, Bat Savitri,Khatarua,Ghughuti and Basant Panchami. Similarly, the fairs organized are very colorful and distinctive and promote the local craft and traditions like Jauljibi Fair, Purmagiri Fair, and others.

Trade and Commerce

Pithoragarh district is well connected with Tibet and Nepal which has resulted in people exchanging food grains, cloth, ornaments, wool, tea etc. with each other. Trade between villagers is usually conducted on the basis of barter system. The trade from the plains of Tanakpur, Bageshwar, Almora and Haldwani are dealt in wool, ringal, basket, mat, herbs, honey and turmeric in exchange of food grains, salt and sugar, garments etc. There are ample markets and trade centers in the district.

Eco-Sensitive Zones in the District

Askot Wildlife sanctuary, Patal Bhubneshwar (limestone caves), Milam, Namik and Rakam glacier, Munsiyari Bugyal etc. are some of the eco-sensitive zones in Pithoragarh district.

ENVIRONMENT CONCERNS IN THE DISTRICT

India and Nepal has jointly proposed a multi-purposeproject on Kali river at Pancheshwar and the project has been in works for a long time now. The State of Environment report compiled by the Uttarakhand Pollution Control Board in collaboration with GB Pant Agriculture and Technical University has claimed that the Proposed dam along the Indo-Nepal border will out more than 400 species of flora and fauna in danger. The dam would hinder the natural flow of Kali river. The report also postulates that around 87 villages of Almora, Champawat and Pithorgarh district will submerge in the lake if the dam is built.

A recent study has suggested that if executed in its current format, the proposed dam in the Indian central Himalayas raises a concerns about safety and its sustainability due to seismicity,reservoir-induced seismicity, slope instability due to reservoir drawdown effect and an unpredictable large volume sediment mobilisation from Para glacialzones. According to Pancheswar dam pre-feasibility report, a potentially active Rangunkhola fault capable of generating and earthquake of 7.4 magnitude (the project area lies in zone IV of seismic zone map of India where various faults are suggested to be currently active) traverses the dam site in Nepal Himalaya. There is a growing concerns regarding the implications of impounding large water bodies in a tectonically active terrain in Himalayas.

Moreover, Kali valley in Pithoragarh district has experienced maximum destruction caused by abnormally high precipitation and associated disasters. Geodynamic evolution history of the region indicates that Kali valley is prone to abnormally high precipitation and associated flash floods, Additionally, steep slopes, high altitude structural weakness, heavy rainfall and increasing anthropogenic interventions in close proximity of streams have added to the devastating potential of the disaster.

Pithoragarh district has enormous snow reservoirs which act as a natural source for big rivers originating at the base of less Himalayas.Roughly 30% of district wears the everlasting snow cover. Recent study has revealed that Milam Glacier (one of the largest glacier in the district) has receded 1450m in last 69 years with an average recession rate of 20.90 m/year.The results also show that Milam is not receding with an equal rate as its rate of recession is varying over time which has been a cause of concern. As Milam is almost 16 km long it can survive hundreds of years unlike the glaciers less than $1km^2$ which may disappear over the time and would drastically affect the freshwater supply to the Himalayan states.

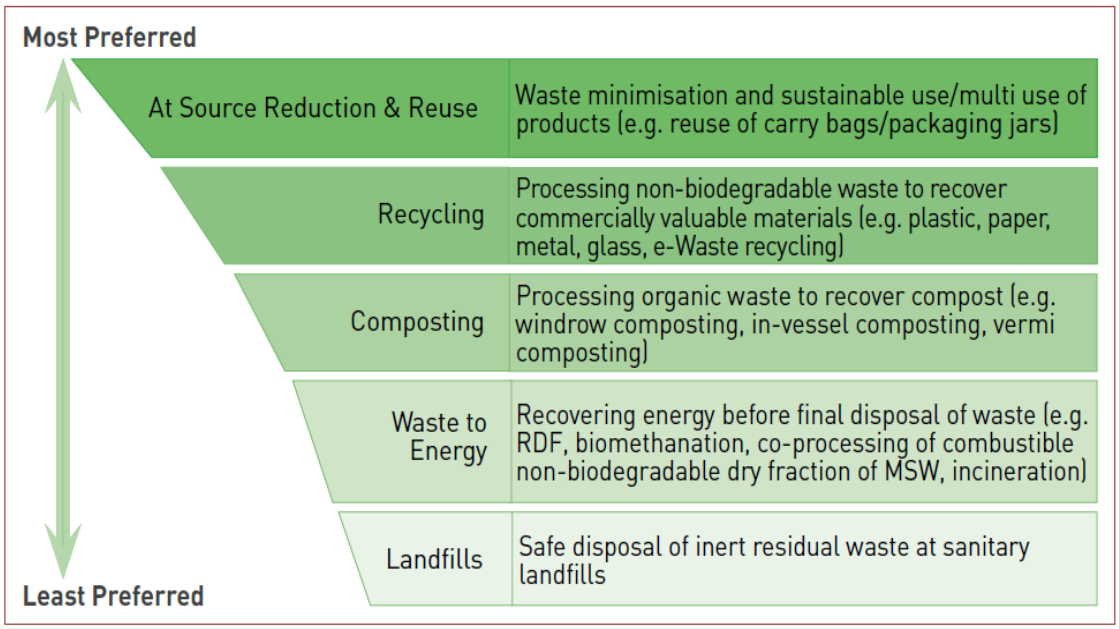
IMPACT AND DATA ANALYSIS

SOLID WASTE MANAGEMENT

Ministry of Environment, Forest and Climate Change (MoEF&CC) defines Municipal Solid Waste (MSW) 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 considered 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 of while maximizing resource recovery and efficiency(Fig. 2). 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: MoHUA, 2016)

Fig. 2. Waste management paradigm

Current status in the urban areas of the district

Waste generation in the urban areas of the district has seen a significant rise in recent times which stressed on the need for necessary infrastructure and manpower for the scientific disposal of waste. The waste generation within the district varies with the amount of tourist influx, consciousness among the masses regarding their role in waste management and enforcement of various policies of the government by the urban local bodies

All the ULBs of the district are trying to adopt the approach of integrated solid waste management which includes various operations such as segregation, collection, transportation, disposal and recovery (Table 5). The ultimate aim is the scientific handling and disposal of waste.

Table 5. 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 (Unsegregated waste)**	**Total**
Nagar Palika Parishad Pithoragarh	62502	20	12	16	Very Less	28
Nagar Palika Parishad Didihat	6522	07	02	01	Very Less	03
Nagar Palika Parishad Dharchula	7039	07	2.5	1.5	Very Less	04
Nagar Panchayat Berinag	7641	07	Not Estimated	Not Estimated	Very Less	1.5
Nagar Panchayat Gangolihat	7116	07	Not Estimated	Not Estimated	Very Less	1.5

Table 6. waste management operations

Waste management Operations	**Outcome**	
Segregation at source	**ULB**	**Source Segregation (%)**
	NPP Pithoragarh	50
	NPP Didihat	50
	NPP Dharchula	50
	NP Berinag	50
	NP Gangolihat	50
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 Pithoragarh	50
	NPP Didihat	50
	NPP Dharchula	50
	NP Berinag	50
	NP Gangolihat	50
Material Recovery Facility (MRF) operation	• Only NPP Pithoragarh in the district has installed a Material recovery facility. • Segregation of waste is done at some temporary sites in all the ULBs.	
Involvement Of NGOs (Non-Governmental Organizations)/ private agencies	• NPP Pithoragarh and NP Gangolihat have hired some private agencies to manage their waste management operations	

	• NPP Didihat, Dharchula, and NP Berinag are performing waste management operations by themselves	
Authorization and issuance of Identity cards to waste pickers/Sanitation workers	**ULB**	**Numbers**
	NPP Pithoragarh	150
	NPP Didihat	30
	NPP Dharchula	18
	NP Berinag	15
	NP Gangolihat	15
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.	

Table 7. 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 Pithoragarh	100	7	12	Available	Trenching Ground	DPR of 5.15 Cr. has been approved for revamping waste management operations in the ULB under which procurement of various types of machinery and construction of a Material recovery facility and sanitary landfill is proposed.
NPP Didihat	15	3	3	Not Available	Open dumping	A DPR of 2.35 Cr has been approved for upgrading the waste management operations under which procurement of machinery and construction of material recovery facility is proposed.
NPP Dharchula	40	5	6	Not Available	Open dumping	A DPR of 1.85 Cr has been approved for upgrading the waste management operations under

						which procurement of machinery and construction of material recovery facility is proposed.
NP Berinag	10	2	4	Not Available	Open dumping	A DPR of 1.41 Cr has been approved for upgrading the waste management operations under which procurement of machinery and construction of material recovery facility is proposed.
NP Gangolihat	20	2	7	Not Available	Open dumping	A DPR of 1.30 Cr has been approved for upgrading the waste management operations under which procurement of machinery and construction of material recovery facility is proposed.

Methods used for the treatment of solid waste in the district

Wet waste management is quite satisfactory in all the urban local bodies of the district as all of them have composting facilities for processing the wet waste. As far as the processing of dry waste is concerned nearly all the ULBs are focusing on the recovery of useful materials to reduce the stress on the landfill sites for it they have either established linkage with authorized recyclers or local scrap pickers. (Table 8).

Table 8. 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 the old dump site**
Nagar Palika Parishad Pithoragarh	There are 12 composting units are available in different wards of the ULB.	• Recyclable waste is sold to the local rag pickers. • The rest of the waste is dumped in the trenching ground.	DPR has been prepared for Remediation of the old dumpsite (8300MT)

		• All the residual (inert) waste is dumped in the trenching ground.	
Nagar Palika Parishad Didihat	There are 3 composting units are available in different wards of the ULB.	• Recyclable waste is sold to the local rag pickers. • The rest of the waste is dumped in the trenching ground.	(180MT) Remediation of the old dumpsite is not started.
Nagar Palika Parishad Dharchula	There are 6 composting units are available in different wards of the ULB.	• Recyclable waste is sold to the local rag pickers. • The rest of the waste is dumped in the open dumping.	(25MT) Remediation of the old dumpsite is not started.
Nagar Panchayat Berinag	There are 4 composting units are available in different wards of the ULB.	• Recyclable waste is sold to the local rag pickers. • The residual waste is dumped in the trenching ground.	Remediation of the old dumpsite has been Completed
Nagar Panchayat Gangolihat	There are 7 composting units are available in different wards of the ULB.	• Recyclable waste is sold to the local rag pickers. • The rest of the waste is dumped in the open dumping.	Remediation of the old dumpsite has been Completed

Gap Identification

Although all the urban local bodies are trying to adopt the holistic approach of integrated solid waste management due to some reasons such as financial and geographical limitations all the municipalities are somehow lacking in many aspects related to waste management. Almost all the ULBs are struggling to achieve the target of complete source segregation of waste apart from this unscientific disposal of waste is also a major concern in all the ULBs. (Table 9). However, almost all the ULBs has proposed some set of actions to overcome these gaps for which either fund have been allotted to them or will be allotted soon (Table 10).

Table 9. Gap identification

Name of ULB	Observed Shortcomings	Remarks
	Partial Source segregation of waste	ULB has achieved 50 % source segregation so far and targeting 100% source segregation.

Nagar Palika Parishad Pithoragarh	Partially segregated waste transport	Complete source segregation will only be possible once the complete source segregation will be achieved.
	Non-availability of any waste recovery facility	DPR has been approved for improving waste management operations in the ULB.
	Non-involvement of NGO/private firm for waste management operations.	As of now no NGO or Private firm is serving the ULB in its waste management operations. ULB is doing all the waste management operations by itself.
	No linkage with authorized waste recyclers	ULB sells their waste to local Rag pickers who are authorized by the municipal body.
Nagar Palika Parishad Didihat	Partial Source segregation of waste	ULB has achieved 50 % source segregation so far and targeting 100% source segregation.
	Partially segregated waste transport	Complete source segregation will only be possible once the complete source segregation will be achieved.
	Non-involvement of NGO/private firm for waste management operations.	The municipality is managing the waste management operations by itself.
	Non-availability of any waste recovery facility	DPR has been approved for setting up a recovery facility along with other equipment required for the scientific disposal of the waste.
	No linkage with authorized waste recyclers	ULB sells their waste to local Rag pickers who are authorized by the municipal body.
Nagar Palika Parishad Dharchula	Partial Source segregation of waste	ULB has achieved 50 % source segregation so far and targeting 100% source segregation.
	Partially segregated waste transport	Completely source segregation will only be possible once the complete source segregation will be achieved.
	Non-involvement of NGO/private firm for waste management operations.	As of now no NGO or Private firm is serving the ULB in its waste management operations.
	Non-availability of any waste recovery facility	DPR has been approved for improving waste management operations in the ULB.
Nagar Palika Parishad Berinag	Partial Source segregation of waste	ULB has achieved 50 % source segregation so far and targeting 100% source segregation.
	Partially segregated waste transport	Complete source segregation will only be possible once the complete source segregation will be achieved.
	Non-availability of any waste recovery facility	DPR has been approved for improving waste management operations in the ULB.

Nagar Panchayat Gangolihat	Partial Source segregation of waste	ULB has achieved 50 % source segregation so far and targeting 100% source segregation.
	Partially segregated waste transport	Complete source segregation will only be possible once the complete source segregation will be achieved.
	Non-involvement of NGO/private firm for waste management operations.	As of now no NGO or Private firm is serving the ULB in its waste management operations.
	Non-availability of any waste recovery facility	DPR has been approved for improving waste management operations in the ULB.
	Non-availability of any waste recovery facility	DPR has been approved for improving waste management operations in the ULB.

**There is a gap identified in the waste management operations of all the ULBs of the district as no ULB. has 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. Proposed policies and budget requirements put forward by different stakeholders in the district

ULB	Proposed Policy	Current status and Budget requirement
Nagar Palika Parishad Pithoragarh	Revamping Solid waste management	• DPR. of 5.15 Cr. has been approved for 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 this establishment of recovery facility and construction of sanitary landfills are also planned. • ULB has already achieved the ODF+ status and now aiming to achieve ODF++ status in the upcoming years.
Nagar Palika Parishad Didihat	Revamping Solid waste management	• DPR of 2.35 Cr. has been approved and some of the budget has been allocated to the ULB to improve its waste management operations. • The establishment of the material recovery facility and construction of sanitary landfill along with procurement of some machinery and vehicles is proposed under this budgetary allocation. • ULB has already achieved the ODF status and now aiming to achieve ODF+ status in the upcoming years.
Nagar Palika Parishad Dharchula	Revamping Solid waste management	• DPR of 1.85 Cr. has been approved and some instalments are allocated to the ULB to improve its waste management operations. • With this budgetary allocation, Nagar Palika is aiming to achieve complete scientific disposal of municipal waste. • ULB has already achieved the ODF status and now aiming for ODF+ & ODF ++ status in the upcoming years.
Nagar Panchayat Berinag	Revamping Solid waste management	• DPR of 1.41 Cr. has been approved to improve waste management operations in the ULB • The establishment of a material recovery facility is proposed under this allocation. • ULB has already achieved the status of ODF and now targeting the ODF+ status.

Nagar Panchayat Gangolihat	Revamping Solid waste management	• DPR of rupees 1.30 Cr. has been approved and the budget has been allocated to the ULB to improve its waste management operations. • With this allocation, various works such as the development of the trenching ground, etc. are proposed. • ULB has already been granted the status of ODF and the application for ODF+ is underway.

Vegetation suitable for rehabilitation of dumping sites

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 11).

Table 11. Suggested vegetation for reclaiming dumpsite sites in the Pithoragarh

Botanical Name	Local and English Name	Life form	Assimilating capacity	Altitude (m)	References
Bauhinia variegata L.	Kachnar	Tree	Absorbs Zn, Hg, As, Pb, Cu and Cd from wastewater	1250-1800	Das, 1981
Adina cordifolia (Roxb.) Hook. f. ex Brandis	Haldu	Tree	conversion of Se and Hg to volatile chemical from groundwater	Upto-1500	Prajapati, 2012
Berberis aristata DC.	Kingore	Shrub	Metals, radionuclides, hydrophobic organics	1350-2000	Das, 1981
Cynodon dactylon (L.) Persoon	Dubla, Doob	Herb	Absorbs Arsenic and Fluoride from wastewater	700-2500	Chaphekar, et al., 1980
Quercus leucotrichophora A. Camus	Banj oak	Tree	Microbial biodegradation, binding, holding soils, and/or decreased leaching	1200-2400	Meenakshy et al, 1981

Rural Solid Waste Management

The domestic waste generated in rural households of India is increasingly becoming an issue of serious concern. As reported by the Ministry of Drinking Water and Sanitation (MDWS) 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 improving 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 the generation rate of rural areas is much less as compared to urban areas.

Current standpoint about Rural Waste Management in India

- According to 2011 census, 68.84% of total population in India live 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 contains only domestic waste (92.4%) as a major contributor to the total waste generation.
- Rural community produces comparatively more biodegradable waste (63.5%) compared to non-biodegradable waste (36%).
- About 78% of the rural population use open dumping as storage and collection of solid waste.

BIOMEDICAL WASTE MANAGEMENT

According to latest biomedical waste management rules (published in 2016 and amended in 2019), biomedical waste is defined as such waste that is generated during diagnosis, treatment or immunization of human beings or animals, or in research activities pertaining thereto or in the production or testing of biological experiments. The fact sheet of WHO states that 20% of the total waste generated by health care activities is hazardous. All the biomedical waste generated is essential to be properly collected, segregated, stored, transported, treated and disposed of in a safe manner to prevent spreading infectious diseases. The health system of Uttarakhand constitutes a large network of health care facilities based on three-tier system that comprises of district level health care facilities (District hospitals, base hospitals, etc.), community health care centres (CHCs), and primary health care centres (PHCs). Biomedical waste generation has shown a wide variation in Uttarakhand due to its typical physiographical conditions and changing density of population. Handling and disposal of biomedical waste is done as per BMW rules, 2016 (Fig.3).

(Source: CPCB 2019

Fig. 3. Segregation of biomedical waste as per BMW rules, 2016

Importance of Biomedical Waste Management in The Wake of Pandemic

Due to the onset of covid pandemic, biomedical waste generation increased worldwide. Similar trend was also observed in our country from 2019 to 2021. The daily biomedical waste generation increased from 619 MTPD to 800 MTPD in India (CPCB, 2021) and from 3.8 MTPD to 6.26 MTPD in Uttarakhand state (ENVIS, 2020).At present, the biomedical waste is being generated not only from the health care facilities but also from the quarantine centres, and residential areas where

patients were in a home isolation. Bio-medical waste ought to be segregated in the households as well as from the municipal solid waste. Thus, it has to be properly disposed of to get rid of the risks of infection among the workers handling the municipal solid waste in urban local bodies.

Biomedical waste management in Pithoragarh district

Quite a few governments and private healthcare facilities are available in the Pithoragarh district, which consists of bedded and non-bedded hospitals, veterinary hospitals, pathology labs, clinics etc. The district relies on the conventional method of deep burial for the disposal of biomedical waste. So far none of the district-level healthcare facilities have established linkage with a Common Biomedical waste treatment facility (CBMWTF) (Table 12). Further many of the healthcare facilities are either not authorized by the state pollution control board or their authorized certificates were expired. Healthcare facilities in the district are also lagging in the barcode tracking of biomedical waste as per the Biomedical waste management rules 2016 (Table 13).

Table 12. Inventory of current healthcare infrastructure for Bio-medical waste management

S. No.	Parameter	Outcome	
1.	Health-care facilities in the district	***Facility***	***Numbers***
		Bedded HCFs	113
		Non-bedded HCFs	233
		Total	349
2.	Miscellaneous Health care Facilities in the District	***Facility***	***Numbers***
		Clinics	232
		Veterinary Hospitals	00
		Pathology Labs	02
		Dental Clinics	01
		Blood Banks	01
		Total	236
3.	Number of health care facilities authorised by SPCB/PCC	Only 132 Bedded health care facilities of the district are authorised by the state pollution control board (SPCB).	
4.	Linkage with Common Bio-medical Waste Treatment Facility (CBMWTF)	No Healthcare facilities of the district linkage with any of the CBMWTF.	
5.	Total Biomedical Waste (BMW) generation in the district	80kg/day	
6.	Daily Bio-Medical Waste (BMW) lifting by Common Bio-Medical Waste Treatment Facility (CBMWTF)	Nil	

7.	Method of treatment used for the treatment of biomedical waste in the district	• Method of deep burial is used (after disinfection with sodium hypochlorite) for the treatment of biomedical waste in the district. • Liquid waste is discharged after proper disinfection with either bleaching powder and sodium hypochlorite.

Table 13. Current status of biomedical waste management

S. No.	Action areas	Outcomes
1.	Authorization of health care facilities by SPCB	Only 132 Bedded health care facilities of the district are authorized by the state pollution control board (SPCB).
2.	Adequacy of facilities to treat biomedical waste	• At present no incineration facility is available in the district for the treatment of biomedical waste. • Biomedical waste is disposed of in deep burial pits after proper disinfection.
3.	Segregation of BMW as per guidelines of BMW rules, 2016	All the healthcare facilities of the district properly segregate their biomedical waste into separate color-coded bins as per biomedical waste medical waste management rules 2016.
4.	Tracking of biomedical waste *(Implementation of bar code system for tracking)*	There is no facility available in the district for the bar code tracking of biomedical waste.
5.	District level monitoring committee	Established under the chairmanship of the District Magistrate.

Gap Identification in The Management of Biomedical Waste in the District

As far as the management of the biomedical waste is concerned the district is lacking in many aspects is we compare the current status with the desired level as per biomedical waste management rules 2016. Some of them are as following:

- Very few healthcare facilities have authorised by the state pollution control board.
- No linkage is yet established with any of the Common Bio-Medical Waste Treatment Facility (CBMWTF).
- Bar code tracking facility is not available for biomedical waste so far in the district.

CONSTRUCTION & DEMOLITION WASTE MANAGEMENT

Construction and Demolition waste is produced in the construction, remodelling, repair and demolition of residential/commercial buildings and other structures and pavements. It is a basic thumb rule that 40% of the total C&D waste originates from renovation work, 50% from demolition work and 10% from new construction work (Table 14). 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. It is something like using recyclable materials more than actual practice, reusing raw materials if possible and reducing the 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 the application of the 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.
- The country generates 150 Million Tonne/Year of C&D waste but the official recycling capacity is a meagre of 6500 tonnes/day or just about 1%*(as per the building material promotion council)*.

Table 14. 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

Present Infrastructure Within the State

- Currently, no treatment facility is available in the state for processing the C&D waste.
- In the hilly districts, ample dumping zones are not established due to which waste is dumped at the riverbanks.
- 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.

C&D Waste Management in the district

Construction and demolition waste is not yet quantified in the district pertaining to the fact that its quantity is assumed to be nominal (Table 15). However, dumping zones are established along the Char-Dham national highway by the Public works department with rapid urbanization, as construction activities will rise, some strategy is definitely required for scientific management of C&D waste. This may include the establishment of dumping sites, framing of Byelaws etc (Table 16).

Table 15. 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 has 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 Char Dham highway project in the district. U.L.Bs 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 has linkage with any common C&D waste treatment facility.

Table 16. 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 points/Dumping Zones.	Most of the U.L.Bs has 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.
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 also 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 there0foreminimal 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 because 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 is 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.

Table 17. 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%

Hazardous Waste Management in the District

The quantity of hazardous waste generated in the district is very less. This pertains to lower segregation of waste in households, government offices and commercial establishments. However, the amount of industrial hazardous waste has been inventoried (Table 18). The industrial hazardous waste generated in the district is incinerable in nature and sent to the treatment facility at Roorkee. No linkage with any treatment, storage and disposal facility (TSDF) is established as of now by any of the ULB (Table 19).

Table 18. 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	Landfillable	Recyclable/ Reusable	Total
		0.00	0.00	0.21	0.21
2.	Number of Hazardous waste generating industries in the district	06			

Table 19. Current status related to hazardous waste management

S. No.	Action Areas	Outcome and Remarks
1.	No. of captive/common Treatment storage and disposal facilities (TSDF) in the district.	Currently, there is no captive or common treatment storage and disposal facility (TSDF) in the district for the treatment of hazardous waste. The hazardous waste generated in the district is sent to TSDFs available outside the district.
2.	Linkage with common TSDF	Currently, the hazardous waste generating industries of the district have linkage with the following Treatment storage and disposal facility. 01 (M/s Bharat Oil waste Management) at Roorkee, Haridwar.
3.	Display board of Hazardous waste generation in front of gates of respective industries	As per the state pollution control board, all the 06 hazardous waste generating industries in the district have installed a display boards 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/probably contaminated sites within the district	As per the 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 the state pollution control board.

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.

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 20. Bifurcation of E-waste based on electronic appliances

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

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%.

E-waste Management in the district

As the collection of e-waste is not initiated by any of the ULBs of the district so the it is not possible to quantify the e-waste (Table 21). Also, none of the ULBs has established linkage with any of the authorised electronic waste recycler/dismantler (Table 22).

Table 21. Current standpoints regarding e-waste generation and collection

SN	Parameter	Outcome & Remarks	
1.	Quantity of E-waste generated per annum *(As per State pollution control board)*	Uttarakhand (MT)	*16260*
		Pithoragarh	*Not Estimated*
2.	Toll-free number in the district for the citizens to deposit E-waste.	The 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 is no collection centres established by any of the ULBs or the district administration.	
4.	A 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 has established linkage with authorized E-waste recycling facility, However district administration has linkage with the authorized 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 22. Gap identification

SN	Observed Shortcomings	Remarks
1.	Establishment of collection centers & Toll-free number	• An 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 authorized recyclers/ Dismantlers	Yet to establish any linkage

WASTE WATER MANAGEMENT AND SEWAGE TREATMENT PLANT

Domestic sewage is the type of waste water that is produced by a community of people and is characterized by volume of flow, physical condition, chemical and toxic constitute and its bacteriologic status. Around 80% of water supply flows back into the ecosystem as wastewater, this can be a critical environmental and health hazard if not treated properly.

Currently, India has the capacity to treat approximately 37% of its wastewater, or 22,963 million litres per day (MLD), against a daily sewage generation of approximately 61,754 MLD according to the 2015 report of the Central Pollution Control Board. Moreover, most sewage treatment plants do not function at maximum capacity and do not conform to the standards prescribed (Table 23).

Piped sewerage system connects only 31.7 per cent of the total urban households with individual household latrines. More than half of the urban population in the State relies on On-Site Sanitation (OSS) systems such as septic tanks *(53.1 per cent)* 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 23. Current Scenario related to STPs (MLD) 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)

Table 24. Inventory of sewage treatment facilities in the district

Total no of STP in district	02				
Total Daily inflow	3.0 + 3.5 MLD (Peak Flow)				
Type of Treatment	Sequencing batch Reactor (SBR)				
Details of Existing STP in the district	Location	Existing STP Capacity (MLD)	Capacity Utilized (MLD)	Operational Status of STP	Compliance Status of STP
	Pithoragah	5.00	1.00	Operational	Complying
	Pithoragah	1.25	0.80	Operational	Complying

The urban centres of the district have seen rapid expansion over the years. However, the infrastructure development related to sewage management being capital intensive and involving complex engineering takes considerable time that often cannot match the pace of urbanisation.
Due to the lack of sewerage treatment facilities in the district the on-site sanitation facilities of the district are overstressed also with the rapid urbanisation of the urban centres there are many constraints especially the shortage of land for the construction of individual on-site sanitation (OSS) facilities. So the construction of sanitation facilities especially for the urban centres of the district becomes necessary.
Several initiatives have been taken by the Government of India to achieve decent sanitation in the urban areas of the country. These initiatives may be broadly classified into
(i) Programmatic initiatives
(ii) Policy initiatives

Table 25. Major initiatives by the Government of India

Major categories	Major Initiatives	Objectives
Programmatic initiatives	Swachh Bharat Mission – Urban (SBM-U)	To provide access to sanitary toilet facilities to the entire urban population and to eradicate the problem of Open Defecation from the country
	Atal Mission for Rejuvenation and Urban Transformation (AMRUT)	Creation of basic urban infrastructure including sewerage and septage management in 500 cities/towns in the country
Policy initiatives	National Urban Sanitation Programme (NUSP), 2008	To transform Urban India into community-driven, totally sanitized, healthy and liveable cities and towns." The specific goals include awareness generation and behaviour change; open defecation free cities; and integrated city-wide sanitation.
	Manual on Sewerage and Sewage Treatment Systems, 2013:	Separate chapters have been allocated for decentralized sewerage systems and onsite sanitation, wherein, the different methods of decentralized sewerage and onsite sanitation systems are discussed in detail.
	National Policy on Faecal Sludge and Septage Management (FSSM), 2017	To set the context, priorities, and direction for, and to facilitate, nationwide implementation of FSSM services in all ULBs such that safe and sustainable sanitation becomes a reality for all
	Standard Operating Procedure (SOP) for Cleaning of Sewers and Septic Tanks, 2018	The set of procedures to be followed while cleaning the sewers and septic tanks its cleaning frequency and the use of personal protective & cleaning equipment are discussed in detail

On-Site Sanitation (OSS) vs. Underground Sewerage system

Wherever a sewerage system is available within 30m from the proposed individual household, community or public toilets only the superstructure (i.e. toilets) may be constructed under SBM and connected to the existing sewerage system. No construction of treatment units such as twin pits, septic tank, bio-digester or bio- tank shall be allowed.

But in case no such sewerage network is available then On-site sanitation is the only option left. In this system sewage is collected, treated and/or disposed off at, or near the point of generation, without the use of an underground sewerage system. OSS systems are sanitation facilities provided for the use of individual households, community and the floating population There are a number of situations when an underground sewerage system may not be feasible or desirable. For example, for smaller cities where construction of sewerage infrastructure may be expensive, or those cities that are in hilly areas or in undulating terrain where it may not be practical to construct a sewer network, or even in many cities that have grown organically and where not all households are connected to the existing sewerage network.

Table 26. Proposed Policies and Budget Requirements Put Forward by Different Stakeholders in the District

Name of ULB	Type of Septage Management	Stakeholders Responsible	Proposed policy
Pithoragarh	Both On-site and Off-site Management.	Government of Uttarakhand	On-site Septage management (FSSM) is being planned by the respective committee, details of which have been sent for approval.

Liquid Waste Management in Rural Areas

Since the water supply for domestic purposes in rural areas has improved considerably over the years, the quantity of wastewater that is disposed of has also increased. 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 27. Policies Undertaken for Waste Water Management in Rural India

Current Policy	Sponsoring agency	Remarks
Construction and Usage of (Individual Household Latrines (IHHLs)	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 a clean environment.
Community Sanitary Complex (CSCs)	Under SBM-G(Swachh Bharat Mission- Gramin)	Such complexes comprise an appropriate number of toilet seats, bathing cubicles etc. (Only where there is a lack of space in the village for the 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 the 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 the behavioural change in the woman and adolescent 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 28. Water resources in the District

S. No	Water Resource	Inventory of water bodies		
1.	Rivers/Streams in the District	**Name**	**Perennial / Non-Perennial**	**Length (Km)**
		Kali River	Perennial	150.0
		Gori River	Perennial	100.0
		Ram Ganga River	Perennial	98.2
		Saryu River	Perennial	86.4
		Rai-Gaad	Perennial	70.2
2.	Lakes and ponds	**Name**	**Artificial/Natural**	**Area (ha)**
		Seepu Tal	Natural	0.075
		Parvati Kund	Natural	1.05
		Gauri Kund	Natural	0.03
		Braham Kund	Natural	0.06
		Mohtad Tal	Natural	0.0225
		Nanda Kund	Natural	Not Available
		Balchand Kund	Natural	Not Available
		Thamri Kund	Natural	Not Available
		Mesar Kund	Natural	Not Available
		Kwiri Kund	Natural	Not Available
		Dheelam Kund	Natural	Not Available
		Aanchri Kund	Natural	Not Available

Table 29. 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.	Nalas/drains meeting rivers	---
5.	Disposal of Untreated Sewage in Rivers	Sewage is not directly discharged into water bodies.
6.	Monitoring of Action Plans for rejuvenation of rivers	Monitored
7.	Encroachment near flood pains	Encroachment is found in almost all the urban settlements along the river valleys.
8.	Protection of flood plains	Robust measures have not been taken so far.

Table 30. Information of Groundwater in District

S. No.	Parameter	Current Status
1.	Groundwater polluted area in the district	Not Identified
2.	Adequacy of Groundwater Availability	No studies are conducted so far by the concerning department for the assessment of the groundwater.
3.	Disposal of Untreated Sewage in Rivers	Nil
4.	Access to surface water and groundwater quality data at DM office	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 31).

Table 31. Scope of Artificial recharge in Pithoragarh district

District	**Area (sq.km)**	**Area identified for AR (Artificial recharge) (sq.km)**	**Volume of unsaturated zone (MCM)**	**Available sub-surface space for AR (MCM)**	**Water required for artificial recharge (MCM)**	**Surplus available for recharge (MCM)**
Pithoragarh						

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 32 and 33)

Table 32. Artificial Recharge and RTRWH Structure constructed in Pithoragarh under catchment area conservation Program (CACMP)

District	Number of structures					Total cost (in lakhs)					Total cost (in lakhs)
	CD	CK	RTRWH	PT	CT	CD	CK	RTRWH	PT	CT	
Pithoragarh	166	29	84	00	00	16.6	0.87	29.4	00	00	46.87

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

Table 33. Artificial recharge and cost estimate in Pithoragarh

District	**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	
Pithoragarh	425	375	80	200	400	0.5	0.3	0.07	0.15	0.015	212.5	112.5	5.6	30	6	366.6

CT-Contour Trench, CK- Chal Khal, RTRWH- Rooftop rainwater harvesting, CD- Check Dam, PT- Percolation 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 Program (NCAP) 2019. Under this programme, 122 cities in the country are identified as non-attainment cities which includes 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 of National 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 PM2.5 and PM10 concentration by 2024 is proposed under the NCAP taking 2017 as the base year for the comparison of concentration.

Table 34. 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 (SO2), µg/m^3	Annual* 24 hours**	50 80	20 80
Nitrogen Dioxide (NO2), 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/m^3	Annual* 24 hours**	40 60	40 60

Ozone (O3) 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/m^3	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 (Table 35). 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 36). Although many steps have been taken to control the forest fires (Table 37) which is one of the major reasons behind this problem hardly any results have come out on the ground, every year hundreds of hectares of forest are destroyed by fire. This is happening due to the acute shortage of workforce in the forest department and the lack of mutual coordination among various departments (Table 38).

Table 35. 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 36. 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 a non-attainment city according to the 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 37. Control measures for industrial/non industrial air pollution

Action Areas	Outcomes
Identification of Prominent air polluting sources	Forest fires and Vehicular pollution are identified as major pollution sources.
Control of industrial air pollution	The district has two small industrial estates and only a few small scale industries are currently operational in these industrial estates. Some of them are found to violate the air pollution norms to which the notice has been sent by the state pollution control board.
Control of non-industrial air pollution	
(a) Control open burning of waste	Open burning of waste is strictly prohibited in the urban areas of the district. However due to lack of waste management system in the rural areas waste burning is still prevalent.
(b) Control of forest fires	The Forest department is trying its best to control forest fires but the result is yet to be seen on the ground. Every year hectares of forests are damaged due to forest fires.
(c) Control of vehicular pollution	04 PUC centres are available in Pithoragarh 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 in the district especially in the urban centres of the district.
Development of Air pollution complaint redressal system	Not Initiated

Table 38. Gap identification

S. No.	Area of Concern	Remarks
1.	Uncontrollable 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.	Lack of monitoring to assess the effects of 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 (Table 39). 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 39. 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

Note: - 1. Day time shall mean from 6.00 a.m. to 10.00 p.m.

2. Night time shall mean from 10.00 p.m. to 6.00 a.m.

3. 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

4. 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.

A "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 an energy mean of the noise level over a specified period.

Noise Pollution in Pithoragarh district

Thus far, Noise pollution is not a major issue in the district, but the installation of a monitoring station is necessary to examine the increased sound levels during festivals and other public events (Table 40).

Table 40. 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

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, Forest & Climate Change (MoEF&CC) put forward the sustainable sand management guidelines (SSMG) 2016, which focus on the management of sand mining in 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 (MoEF&CC) 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.

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

Current Standpoints Regarding Mining Activities in the district

As far as the matter of sand mining is concerned only a few mining sites are operational in the Pithoragarh district (Table 41). However, no complaints are registered so far by the state pollution control board for breaching the environmental norms during these mining activities (Table 42). Advanced surveillance is desired as per the sustainable sand mining guidelines 2016.

Table 41. Prevalent Mining Activities

Parameter	Outcome			
Total Area of District (km^2)	7110			
Area Covered under Mining (km^2)	169.453			
	Mining activity	***Legal\ Illegal***	***Area under mining (km^2)***	***Revenue (Financial Year 2020-21)***
Type of Mining Activity	Soapstone	Legal	154.728	19,06,0231.00
	Magnesite	Legal	8.425	15,48,351.00
	Sand/Bajri stone / E-Nivida	Legal	6.30	35,25,517.00
Total no of Mining sites in the district	***Type of Mineral***		***Mining sites***	
	Soapstone		26	
	Magnesite		02	
	Sand/Bajri stone / E-Nivida		08	
Mining activities under different department in the district (forest and mining department are usual stakeholders)	**Concerning department**	**Operational mining sites**		**Mining sities meeting consent of Pollution Control Board**
	Geology & Mining Unit Pithoragarh	20		35
Action against illegal mining activities in the district (*in the financial year 2020-21*)	**Concerning department**	**Case registered of illegal minig activities (2020-21)**		**Panalties charged for illegal sand mining activities (2020-21)**
	District Magistrate , Pithoragarh	252		1,13,60,881.00

Table 42. Compliance with environmental standards

Parameter	Outcome
Mining areas meeting Environmental Clearance Conditions	Nil
Any Additional capacity required for Surveillance of mining activities	Nil
Mining operations were suspended for violations of 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)*

Activities undertaken for the rejuvenation of water bodies in the district

Various measures are taken in the district for the restoration of conventional water sources which comprises the construction of rainwater retention structures such as Chal-Khal, contour trenches and ponds for groundwater recharge along with the plantation of the broadleaf trees which bring water to the subsoil (Table 43). The execution of these activities needs a multidisciplinary approach as it requires coordination among multiple government departments along with the local citizens.

Table 43. Present scenario in the district

The Technique Used In The District For Rejuvenation 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 contour trenches* • *Construction of ponds* • *Plantation drives*
Plant Species Used For Rejuvenation Of Water Bodies	• Banj *(Quercus leucotrichophora)* • Bhimal *(Grewia optiva)* • Kachnar *(Bahunia purpuria)* • Burans *(Rhododendron arborium)* • Utis *(Alnus nepalensis)*

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.

S.No	Name of the River	Total Length in the District (in Km)	Place of origin	Altitude at Origin (m)
1	Saryu River	150-160	Sarmal, 15 km south of Nandako	3000
2	Kali Ganga River	252	Kala Pani	3600
3	Ramganga River	200-230	Namik Glacier	3600
4	Gori Ganga River	190-200	Milam Glacier	5500
5	Dhauli Ganga River	80-90	Dhauli Glacier	5945

Mission Yakshavati Resuscitation Program

The life-giving Yakshwati river is the main source of drinking water for more than 50% population of Pithoragarh city. The district administration had started a 'Mission Pilot Project' in 2018 to revive the Yakshavati River in Pithoragarh district. The then DM Dr. Ranjit Sinha started the initiative of conservation of the Yakshavati river. In this, in the year 2018, nine other departments, including the Forest Department, did plantation work on 10 hectares of land, including the point of origin of the river, Silauli. And in what way to revive this river, topics like mapping of this area, data collection, how to increase silt water, what are the possible ways to clean water at the cheap and technical level, effective awareness campaign, this action plan The district administration has also started the "River Walk" program to make the general public aware of its importance, utility, and conservation for the protection of the Yakshavati river.

Works to be Carried out under this Project

Since this project has launched in 2018 and worked in by the Irrigation Department and Forest Department in the district. The nodal officer appointed by the DM will plan to revive the sustainable water flow with supporting components locally. The following works have been done so far in the catchment area of the Yakshavati river.

- Infiltration Trenches
- Chal-Khal
- Pirul Check dam
- Plantation Drive
- Percolation Pit

- Contour trenches
- Check Wall
- Napier grass plantation
- Small Water holes
- Gully Plugging

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. Its broad range of application is in packaging films, wrapping materials, shopping and garbage bags, fluid containers, clothing, toys, household and industrial products, building materials, etc. 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.).*

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 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).*

India is committed to take action for mitigation of pollution caused by littered Single Use Plastics. In the 4th United Nations Environment Assembly held in 2019, India has piloted a resolution on addressing single–use plastic products pollution, recognizing the urgent need for global community to focus on this very important issue. The adoption of this resolution at UNEP was a significant step.

Plastic Waste Management Amendment Rules, 2021

Keeping in view the adverse impacts of littered plastic on both terrestrial and aquatic ecosystems, the MOEF&CC 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 and associated 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 44. 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 Pithoragarh	62502	20	Not Estimated
Nagar Palika Parishad Didihat	6522	07	Not Estimated
Nagar Palika Parishad Dharchula	7039	07	Not Estimated
Nagar Panchayat Berinag	7641	07	Not Estimated
Nagar Panchayat Gangolihat	7116	07	Not Estimated

Table 45. Plastic Waste Management Operations

Waste management Operations	Outcome	
Door to Door Collection	Almost all the ULBs have 100% door to door collection in the district.	
Segregated Waste Collection (Single used plastic, Recyclable plastic, etc.)	***ULB***	***Segregation (%)***
	Nagar Palika Parishad Pithoragarh	50
	Nagar Palika Parishad Didihat	50
	Nagar Palika Parishad Dharchula	50
	Nagar Panchayat Berinag	50
	Nagar Panchayat Gangolihat	50
Material Recovery Facility (MRF) operation	Out of all the U.L.Bs. only Pithoragarh has functional MRF, MRF is under construction at Dharchula. 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 NGO or Private firm is assisting either of the ULBs in their waste management operations.	
Authorization and issuance of Identity cards to Waste Pickers/Sanitation workers	***ULB***	**Numbers**
	Nagar Palika Parishad Pithoragarh	150
	Nagar Palika Parishad Didihat	30

	Nagar Palika Parishad Dharchula	18
	Nagar Panchayat Berinag	15
	Nagar Panchayat Gangolihat	15

Table 46. Present infrastructure for plastic waste management operations

Name of ULB	Inventory of infrastructure available for plastic waste management operation			
	Plastic Waste collection centres	**Availability of plastic compacter**	**Linkage with Plastic waste Recyclers**	**Material recovery Facility (Available/ Not Available)**
Nagar Palika Parishad Pithoragarh	60	Available	Not Established	Available
Nagar Palika Parishad Didihat	40[a]	Available	Not Established	Not Available
Nagar Palika Parishad Dharchula	44 [a]	Available	Not Established	Under Construction
Nagar Panchayat Berinag	16	Not Available	Not Established	Not Available
Nagar Panchayat Gangolihat	09[a]	Not Available	Not Established	Not Available

[a] *Litter bin of capacity lesser than 50 liters are provided within ULB to collect plastic waste.*
[b] *Secondary storage bins*
[c] *Plastic waste is sold to local rag pickers which are authorized by the ULB.*

Gaps identified in the management of plastic waste in the district

Plastic waste management is also an important part of the solid waste management system. So, the shortcomings in the management of plastic waste are more or less similar as specified in section of solid waste management. As segregation, collection, compaction and linkage with authorised recyclers are some of the necessary aspects in the management of plastic waste and all the ULBs are somehow lagging in one or more of these aspects. Also, no system is there in the rural areas of the district for the management of plastic or any other kind of waste.

ASSESSMENT OF URBAN LOCAL BODIES IN PITHORAGARH DISTRICT

In order to push the Urban Local bodies to adopt effective waste management, an assessment of their waste management operations has been carried out (Table 47, Table 48). The main objective of this assessment is to let ULBs know their present status regarding various waste management operations in Solid waste management, bio-medical waste management, C&D waste management etc. Based on the adopted methodology, few inferences have been drawn to let administration know about their performance in various indicators.

Table 47. Assessment of Urban local bodies in Pithoragarh district

Indicators	**Maximum Points**	**Urban Local Body**				
		NPP Pithoragarh	**NPP Didihat**	**NPP Dharchula**	**NP Berinag**	**NP Gangolihat**
Solid Waste Management						
Segregation	**4**	3	3	3	3	3
Collection	**4**	4	4	4	4	4
Segregated Waste Transport	**4**	1	1	1	1	1
Wet Waste Processing	**2**	2	2	2	2	2
Dry Waste Processing	**4**	2	0	0	0	2
Disposal	**2**	1	0	0	0	0
Inclusion of Informal Sector	**1**	0	0	0	0	0
Bio-medical waste Management						
Linkage with CBWTF*(Common Bio-medical Waste Treatment and Disposal Facility)*	**1**	0	0	0	0	0
Hazardous Waste Management						
Linkage with TSDF (*Treatment, Storage and Disposal Facilities)*	**1**	0	0	0	0	0
C&D Waste management						
C&D Waste Processing	**1**	0	0	0	0	0
E-Waste Management						

E-waste Collection and Linkage with Recyclers	**2**	0	0	0	0	0
General Information						
Innovation and use of indigenous Techniques	**2**	0	0	0	0	0
Enforcement of Bye-laws and Waste Management Rules, 2016	**2**	2	2	2	2	2
Total	**30**	**15**	**12**	**12**	**12**	**14**

Table 48. Final Assessment of Urban Local bodies of Pithoragarh District

Name of ULB	Score (out of 30)	Score Percentage (%)
Nagar Palika Parishad Pithoragarh	15	50
Nagar Palika Parishad Didihat	12	40
Nagar Palika Parishad Dharchula	12	40
Nagar Panchayat Berinag	12	40
Nagar Panchayat Gangolihat	14	46.67

Observations from data assessment

- Except Pithoragarh, none of the ULBs have operational material recovery facility.
- Except for Pithoragarh, no trenching ground is available for the disposal of inert waste in ULBs. Some ULBs like Didihat, Dharchula, and Berinag have also not established relationships with authorized recyclers.
- None of the Urban Local Bodies has linkage with CBWTF (Common Biomedical Waste Treatment Facility) and TSDF (Treatment Storage and Disposal facility) for the disposal of municipal sanitary waste and domestic hazardous waste respectively.
- Overall , Nagar Palika Pithoragarh is performing decently in management the waste.

ACTION PLAN

Action Plan for Solid Waste Management

Pithoragarh district is currently in an intermediate phase of waste management operations where it is shifting from a mass consumption society to Sound material cycle society *(Sustainable society)*. 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 49).

Focus Areas

- *Segregation at source*
- *Home composting*
- *Scientific recovery and disposal of waste*

Table 49. Action plan for solid waste management

Action areas	Concerning ULB	Purpose	Strategy/Approach	Stakeholder Responsible
Primary Segregation (Segregation at Source)		• Higher Recovery of Recyclables. • Hygienic environment for handling of waste.	• Separate Storage Bins. • Regular awareness campaigns • Man power Management. • Behavioural change Communication techniques. • Promoting Home composting for wet waste.	Nagar Palika Parishad/ Nagar Panchayat Residents and NGOs
Segregated Waste Transport	All ULBs	• To reduce open dumping of waste. • Reduction of Historical waste. • To reduce contamination of ground water. Reduction of transportation charges.	• Optimizing Waste Management Infrastructure *(Collection trucks, trolleys*). • Man power optimization at Recovery facility.	Nagar Palika / Nagar Panchayat

Linkage with Treatment Storage and Disposal Facility (TSDF) and Common Biomedical Waste Treatment Facility (CBMWTF)	All ULBs	• Segregation and proper disposal of Municipal sanitary waste and domestic hazardous waste.	• Separate bins for sanitary and domestic hazardous waste. • Linkage with nearby TSDF and CBMWTF	Nagar Palika Parishad/ Nagar Panchayat
Landfill mining	All ULBs	• To mitigate the environmental impact of waste. *(Methane emission)* • Resource Recovery of excavated waste.	Converting bio-waste from landfill site into compost while plastic, glass etc., can be used for recycling.	Nagar Palika/Nagar Palika parishad/ Nagar Panchayat
Linkage with authorised recyclers	All ULBs (Except	• To reduce open dumping of waste. • To insure proper recycling of the waste.	Either the local scrap pickers can be authorised or direct linkage could be established with any recycling unit.	Nagar Palika Parishad/ Nagar Panchayat
Cluster based Approach to Solid waste management	All ULBs	• 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.	• By merging schemes from Central and state government department with Rurban Mission of Ministry of Rural development	District Administration District Panchayati Raj Officer (DPRO)
Scientific disposal of waste	All ULBs	• To reduce open dumping of waste. • To reduce the possible hazards due to contamination of the ambient environment.	• Material recovery facilities and sanitary landfills should be established in the ULBs as soon as possible.	• Nagar Palika parishad/ Nagar Panchayat State Government

Characterisation of waste	All ULBs	• To adopt proper treatment methods for disposal waste as per its nature. • To know the daily and seasonal variations in the generation of the waste	• Continuous sampling can be done from various transfer stations and landfill sites to study the nature of municipal solid waste.	Nagar Palika parishad/ Nagar Panchayat •
Community participation for waste management	All ULBs	• Social and Behavioural Change Communication • Cleanliness drive campaigns throughout the district	• Information, Education and Communication (IEC) activities in Educational institutions. • IPC (Inter-personal communication): School children and Sanitation workers to spread awareness amongst people regarding waste management.	District Administration
Establishment of Green Protocol	All ULBs	• To prevent use of disposables and using alternatives like glass/Stainless steel etc. • To bring generation of non-biodegradable waste close to zero.	By encouraging Green protocol in local schools, public functions, IEC campaigns, sports events, annual temple festivals and other gatherings.	District Administration

Wet Waste Management through composting – A study by GBPNIHE

The role of compost, organic fertiliser derived from waste, has been overshadowed by the excessive use of pesticides and chemical fertilisers in agricultural practices. The lack of compost used in farm fields and the dependence on chemical fertilisers have had a number of negative impacts, such as deteriorating soil conditions, deficient or excess nutrients, insect outbreaks and solidified soil. However, organic waste generated in daily life can help recover soil fertility if it is used to produce compost (Kuniyal et al.2005a &b).

Composting involves the breakdown of organic waste in the presence of microorganisms, heat and moisture. Effective microbial composting includes three types of microorganism namely bacteria,

fungi and actinomycetes that act upon waste to convert it into sugars, starch and organic acids. It is a self-reliant method of composting with little or no use of technology.

Microbial Bio-composting at Municipal level

A site was selected to construct an open below earth surface MBC pit (size 3 x 1 x 1 m) (Kuniyal and Thakur, 2013-14). Its roof top was covered with multi-layered ultraviolet (UV) resistant polyethylene sheet *(rainfall areas)* and UV treated fibre sheet *(Snowfall areas).* It was required to turn up the waste in an interval of 15 days for sufficient aeration. It was noticed that 500 kg of waste produced almost 167 kg compost (almost 1/3rd). Moreover, yield per hectare of garlic from the compost produced also showed desirable results.

Fig. 4. Structure and design of microbial composting pit

Phytoremediation as a mitigation measure (For treatment of Solid waste)

Natural or planted vegetation on a landfill has an important role in erosion control and removal of contaminants, besides imparting aesthetic value. Moreover, it may also be used in leachate treatment. Phytoremediation is a promising, plant-based technology in which the plants and their associated microbes are utilized to absorb and clean up environmental contamination through engineered constructed systems. The ultimate aim is to either remove the pollutant from the contaminated media or to alter the chemical and physical nature of the contaminant so that it eliminates the risk to human health and the environment. Several plants are being identified to be used in phytoremediation task.

Table 50. Phytoremediation as a mitigation measures

Botanical name	Local name	Remarks
Lemna minor	Duck Weed	Duckweeds can 'absorb' and 'adsorb' all the dissolved gases and substances, including the heavy metals, from the wastewater
Helianthus annus	Sunflower	Sunflower is reported to absorb radionuclides from soil and decontaminate it.
Morus alba	Mulberry	Absorbs Zn, Hg, As, Pb, Cu and Cd from wastewater
Ricninus communis	Castor	Uptake of Cd & DDT from soil
Canna spp.	Canna	Used for removal of ammonical nitrogen from wastewater
Cassia fistula	Amaltas	Absorbs Arsenic and Fluoride from wastewater
Nerium Indiana	Kaner	Absorbs chromium from wastewater
Brassica tunecia	Wild sarson	Absorbs Zinc from Soil

Action Plan for rural waste management in India

The Government of India as well as state government is looking up at every Gram Panchayats (GPs) 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 Pithoragarh 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 51).

Table 51. Policies undertaken for rural waste management in India

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 an appropriate number of toilet seats, bathing cubicles etc.*(Only where there is a lack of space in the village for the 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 a cluster of Gram panchayats that demonstrate economic growth potentials.
Community Participation through IEC*(Information, Education and Communication)* 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.

Action Plan for Bio-Medical Waste

Focus Areas

- *Pre segregation of waste*
- *Tracking of bio-medical waste*
- *Linkage of major HCFs with* CBMWTF.

With the onset of the pandemic, it has become clear that a proper healthcare system is the need of the hour. It also provides the opportunity to improve biomedical waste management in the district. Moreover, during outbreaks such as covid-19, materials or substances which carry infection (fomites) acts as a key vehicle for the transmission of the disease. Streamlining the bio-medical waste may help in reducing the infection and its transmission. This action plan provides a holistic approach, which includes governance, infrastructure, training and immunization, services, etc. to tackle the unprecedented growth in biomedical waste. Immediate action is required in some of the areas such as segregation and tracking of the waste generated etc. while other action points must be executed in due course of time (Table 52)

Table 52. Action plan for bio-medical waste

Action Areas	Purpose	Stakeholders
GOVERNANCE		
Periodic inspection of HCFs *(Health-care Facilities*) by UKPCB *(Uttarakhand state Pollution control board).*	To ensure proper segregation of Biomedical waste as per Biomedical waste management rules, 2016.	Uttarakhand state Pollution control board
Linkage of District level hospitals and CHCs *(Community Health Centres)* with CBWTF *(Common Biomedical waste treatment facility).*	To ensure proper disposal of Biomedical waste as specified under Biomedical waste management rules, 2016.	Health Department
Linkage of ULBs with CBWTF *(Common Biomedical waste treatment facility).*	To ensure segregation of Biomedical waste from Municipal solid waste and thus its proper disposal as per Biomedical waste management rules, 2016.	All ULBs
INFRASTRUCTURE		
Construction and maintenance of Biomedical waste collection shed at district level HCFs and CHCs.	To ensure proper segregation of Biomedical waste into different categories as specified under Biomedical waste management rules,2016.	Health Department
Installation of effluent treatment plants in district level HCFs and CHCs.	To ensure disposal of liquid effluent generated in the HCFs.	Health Department
TRAINING AND IMMUNISATION		

State-level and District level orientation programs for healthcare workers to sensitize them about effective Biomedical waste management.	To ensure proper handling and segregation of biomedical waste in HCFs	Health department
• Setting up of Biomedical Waste Database at State level *(specifically for primary healthcare facilities)* • Training on (BMWMIS) *(biomedical waste management information system)* to all data entry operators and pharmacists.	To keep records of biomedical waste generated in every HCF of the district *(especially in PHCs in rural areas).*	Health department
Immunisation *(Tetanus and complete doses of Hepatitis-B)* of all hospital staff involved in Biomedical waste management.	To avoid any kind of infection while handling Biomedical waste.	Health department
SERVICES		
Establishing bins and bags at each generation points in HCFs with IEC posters displayed.	• To ensure segregation at each generation point and avoid mixing with MSW. • To spread awareness amongst the people related to Biomedical waste management.	Health department
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.	Health Department and UKPCB*(Uttarakhand state Pollution control board).*
Bar code system for tracking bags and containers and use of GPS enabled systems in vehicles.	To ensure tracking of biomedical waste collection, Transportation, disposal and recycling as specified under Biomedical waste management rules,2016.	Health Department and UKPCB*(Uttarakhand state Pollution control board).*
INFORMATION		
Development of an IT-enabled data management system to keep an inventory of the waste collection, consumables supply, training programs etc. in HCFs *(including PHCs in the district)*	To ensure transparency in the biomedical waste management system up to the primary level.	Health Department
Display details of authorisation, treatment, annual report of all HCFs*(Health-care facilities)* on the website.	To make the information open-source and ensure transparency.	Health Department and UKPCB *(Uttarakhand state Pollution control board).*

Action Plan for C&D Waste Management

Increase in C&D waste generation is expected in decades to come due to rapid urbanization and modernising infrastructure. Hence, some basic facilities need to be developed to manage its growth. The action plan provides below (Table 53) provide a sustainable approach for the management of the C&D waste in compliance with the latest C&D waste management rules 2016.

Focus Areas

- *Establishment of dunping zones*
- *Framing of bye-laws*

Table 53. Action plan for C&D waste management

Action Point	Purpose	Strategy/Approach	Stakeholder Responsible
Setting up of C&D waste dumping Site for local construction activities and road construction debris.	To ensure compliance with C&D Waste Management Rules 2016.	• Establishment of dumping zone such that it also caters for C&D waste of Peri-urban areas nearby villages. • Proper collection and transportation systems should be set up to aid processing. Illegal dumping practices must be discouraged due to 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)
Framing by-laws for C&D waste management.	To ensure compliance with C&D Waste Management Rules 2016.	• 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 demolition 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)
Management of C&D waste.	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.	• Managing C&D waste separately from municipal solid waste. • Enhancing awareness and incentivization for efficient C&D waste handling and processing.	• All ULBs and *District Panchayati Raj officer* (DPRO) • *Public Works Department* (PWD)
Plantation in old dump sites.	Established the slope at old dumping zones.	• Plantation at old dumping zone should be done with the help of community participation to stabilize the slope over there.	• All ULBs and *District Panchayati Raj officer* (DPRO) • *Public Works Department* (PWD)

Action Plan For Hazardous Waste

Hazardous waste can be a potential threat to human health and environment. This makes it necessary to manage hazardous waste to minimize its harmful impact. At present in Pithoragarh district, hazardous waste is not handled in a scientific way. This action plan provides some key areas in which the district needs to work to achieve effective hazardous waste management complying with latest hazardous waste management rules, 2016 (Table 54).

Focus Areas

- *Primary segregation of hazardous waste*
- *Linkage of ULBs with TSDF*

Table 54. Action plan for hazardous waste

Action Point	Purpose	Strategy/Approach	Stakeholder Responsible
Linkage of ULBs with common Treatment, Storage and Disposal Facilities (TSDF) or disposal facility	To ensure segregation of domestic hazardous waste from municipal solid waste and its proper disposal.	All the ULBs of the district should establish linkage with nearby common TSDF or disposal facility to ensure proper disposal of hazardous waste to 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)
Training of sanitation workers regarding segregation of domestic hazardous waste	To ensure segregation of domestic hazardous waste from municipal solid waste	Training programme should be organised at state/district level for handling and segregation of domestic hazardous waste so that sanitation workers should not catch any kind of infection during its handing and its proper segregation could be possible.	State government and District Administration
IT enabled systems for inventorization of the hazardous waste m	To ensure compliance to Hazardous waste management rule 2016.	State pollution control board should inventories 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

Action Plan for E-Waste

Due to lack of basic waste management operations for E-waste, its quantity cannot be determined in the district. This may be due to lack of awareness amongst the people regarding E-waste as well as lack of concern by district administration. E-waste needs to be streamlined in the current waste management operation, moreover a detailed framework must be developed for its management. This action plan discusses key areas where intervention is needed to achieve effective waste management in compliance with E-waste management rules, 2016.Some of the action needs to be addressed immediately such as establishment of collection centre etc. while others can be initiated with the due course of time. (Table 55).

Focus Areas

- *Inventorization of e-waste generated*
- *Establishment of e-waste Collection Centres*
- *Authorization of e-waste pickers*

Table 55. Action plan for E-waste

Action Point	Purpose	Strategy/Approach	Stakeholder Responsible
Establishing E-waste Collection Centres	• To ensure proper segregation of E-waste from municipal solid waste • Capacity building of stakeholders to promote effective E-waste management.	• 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
Authorization of E-Waste Pickers	To avoid illegal trading and processing of e-waste.	Authorization of E-waste pickers should be done by district administration and urban local bodies. For that, Identity cards should be issued to them.	District administration and ULBs
Linkage of ULBs with authorized recyclers/ Dismantlers	To ensure proper recycling if possible and if not then proper disposal as per E-waste management rule 2016.	All the ULBs in the district should establish linkage with any of the five authorized E-waste recyclers.	All ULBs
District level Awareness campaign	Promoting behavioural change in public.	• 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

Extended Producer Responsibility	• Proper Collection and Disposal of E-waste • Channelization of e-waste generated from *the "end-of-life"* products to ensure environmentally sound management	• Random sampling of electrical and electronic equipment's placed on market to monitor and verify the compliance of *Restriction of Hazardous Substances* (RoHS) 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

Action Plan For Waste Water Management (STPs)

Scientific and technological interventions in wastewater management are lacking in most of the ULBs of Pithoragarh district. Except two, all other ULBs rely on conventional treatment of wastewater which has become obsolete and leads to environment degradation. However, some policies are promulgated in the district to revamp the liquid waste management in Pithoragarh district. This action plan focusses on addressing concerns of each ULB pertaining to the policies and design sanctioned by the respective administration. (Table 56).

Focus Areas

- *Decentralized waste water management*
- *Phytoremediation for natural treatment*
- *Linkage*

Table 56. Action plan for waste water management

Action areas	Concerning ULB	Strategy/Approach	Stakeholder Responsible
Upgradation of Sewer Network	Didihat Dharchula Berinag Gangolihat	• Reconnaissance survey of rest of the ULB. • Preparation of estimation for the required sewer network to receive the financial grant from the government. • If off-site sanitation is not financially viable then septage management is also one of the possible option by upgrading the existing STPs for co-treatment.	Jal Nigam/Jal Sansthan
City Sanitation Plan under National Urban Sanitation policy	All ULBs	• Citywide Sanitation Sector development. • Awareness generation and behaviour change in the field of Sanitation. Sanitation and safe disposal of waste.	• Enhance synergy among municipal government agencies, the private 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)*
Decentralized waste water management under Atal mission for Rejuvenation and Urban transformation		• In line with National FSSM policy, each state is expected to develop and issue an FSSM implementation strategy and plan guideline. This	Ministry of Housing and Urban development Government of India

(AMRUT) by Faecal Sludge and Septage Management system (FSSM)		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.	
City Sanitation Plan under National Urban Sanitation policy	All ULBs	• Enhance synergy among municipal government agencies, the private 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)*	Ministry of Housing and Urban Development ,Government of India

Phytoremediation as a mitigation Measure *(for domestic waste water)*

With removal of some biotic and abiotic pollutants (by absorbing these pollutants), certain plants, can help in the natural treatment of domestic waste water.

Table 57. Mitigation Measure *for domestic waste water*.

Botanical name	Local name	Remarks
Jacarnda mimosifolia	Jacarnda	Antimicrobial action against E.coli and Staph bacteria
Salix babylonica	Willow	Improve the quality of ground water by absorbing ammonical nitrogen and heavy metals
Canna spp.	Canna	Used for removal of ammonical nitrogen from sewage
Azolla pinnata	Azolla	Used for cleaning of sewage and degrades diesel fuel and absorbs mercury and cadmium
Typha domingenesis	Southern Cattail	Reduces bacteria from water and absorbs Al, Fe and Zn from Sewage.

Action Plan Forwater Resources Management and Ground Water Extraction/Contamination

Water Resources and Groundwater management requires an integrated approach from different departments such as the 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. The action plan focuses on the areas, which form the prerequisite for effective water resource management. Each action point is in compliance with the guidelines under Water (prevention and control of pollution act, 1974), (Amendment) Rules 2021 of water resource management act, 1986. The current action points must be addressed in a timeframe of 5-10 year considering the financial constraints. (Table 58 & 59).

Focus Areas

- *Mapping of water scarce areas*
- *Encouraging the use of organic fertilizers*
- *Crop diversification*

Table 58. Water Resources management

Action Point	Purpose	Strategy/Approach
Integrated water resources management (IWRM) at River basin level	To achieve water security for all purposes ,managing risks and to mitigate disasters	By Considering basin/sub basin as a basic unit for planning and management.
River Basin Master Plan	Periodic review of hydrological conditions prevailing over a basin Identification of protected areas	By analysing River Basin Characteristics
Mapping of water scarce areas in a district	To get estimate of vulnerable areas in the district.	• By using modern mapping tools such as *Geographical Information System* (GIS) and Remote sensing • By setting up an interdisciplinary framework consisting of Local institution and empowered government agency
Assessment of water Resources in various river basin	To collect reliable data To assess water resources potential and analysing water requirements for various uses,	Using Modern technology and Hydrological modelling
Public Awareness and use of Low Cost technologies	For better water application efficiency	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.

Integrated Rural area Programme*(IRAP)*	• For constant interactive relationships between different departments • Location specific programmes can be drawn up locally under this overall programme.	By bringing together all the programmes of different ministries as well as rural employment and development programme into one for effective collaboration and planning.

Table 59. Ground water management

Action Point	**Purpose**	**Strategy/Approach**
Multidisciplinary Approach *(Nexus between groundwater, agricultural policy, urban infrastructure and energy consumption*)	For groundwater sustainability	By integrated vision and coordination amongst different departments.
Mapping of aquifer at micro level	• To quantify the available ground water resources • To formulate plan appropriate to the scale of demands and aquifer characteristics.	By Maintaining an Aquifer information and Management system
Artificial recharge of Ground water	• To ensure sustainability of ground water resources • To ensure the quality of recharge to prevent possible contamination	• 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).*
Identification of Non-point sources of Pollution (*Pollution resulting from land runoff, precipitation, drainage, seepage etc.)*	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.	• Controlling soil erosion by planting more trees and covering bare soil with vegetation. • Constructing wetlands.
Mitigating Groundwater Contamination	• To ensure the ground water quality of an area. • To reduce health hazards caused due to contaminated water.	• Reducing the use of pesticides and fertilizers. • Encouraging Organic farming in the area by organising various *Information ,Education and Communication* (IEC) campaigns.

Action Plan for Air Quality Management

As the anthropogenic activities in the district are mainly responsible for increased levels of pollutants in the region, so the participation of various institutions along with the local community is desired. The first and the foremost thing is establishing air quality monitoring station in the district. The action plan provided below deals with all the aspects, which are necessary to solve the issue (Table 60)

Focus Areas

- *Air quality monitoring*
- *Control of forest fires*

Table 60. Action plan for air quality management

Action Areas	Purpose	Strategies/Approach	Stakeholders
Air quality monitoring	To identify the hotspots within the district and further development of mitigation measures for those areas.	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)
Solid waste collection system	To reduce emission of harmful gases by open burning of waste especially in urban areas.	• 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 DPRO District Panchayati Raj Office (DPRO)
Control over forest fires	To reduce harmful emissions due to massive forest fires in the district.	• Providing the forest department adequate manpower and machinery to control forest fires. • Proper coordination between various departments involved in this operation. • 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	Government of Uttarakhand and District Forest Department

		moisture in the soil and reduce the chances of fire.	
Vehicular Traffic management	To reduce emissions caused by vehicles.	• 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
District level action plan for air pollution	To improve existing air quality.	A district level task force with some experts can be formed for air quality management in the district.	District Administration
Awareness on air quality	To promote awareness among the masses regarding the issue.	Mass awareness can be promoted with IEC activities by involving institutions such as schools and colleges for this purpose.	District Administration
Complaint redressal system	To sort out grievances registered by citizens	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

Action Plan for Noise pollution management

Presently, Noise pollution is not a big issue in the district. It prevails only at festive times and public gatherings. However, actual noise level cannot be ascertained due to lack of monitoring station. This action plan focuses on key aspects that requires minimal financial interventions and maximum management. (Table 61).

Table 61. Action Plan for Noise pollution management

Action Areas	Purpose	Strategies/Approach	Stakeholders
Noise level monitoring	To recognize the current situation of noise levels in the district and identify the hotspots	Noise monitoring studies need to be done in the district especially within the urban centres within the district by manual monitoring. In the areas identified as hotspots, continuous monitoring stations should be set up.	Uttarakhand state pollution control board (UKPCB)
Traffic management	To ensure noise level within permissible limits	Signboards should be placed at sensitive locations in the towns within the districts and if required silent zones should be established	• District Administration

		Green belts can be formed along the roads in the urban areas to reduce noise levels.	• Public Works department and ULBs
Complaint redressing system	To sort out grievances registered by citizens	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
Mass Awareness	To promote awareness among the masses regarding the issue	Mass awareness campaigns must be organized with the help of IEC activities by taking the help of institutions such as schools and colleges for this purpose	District Administration

Action Plan Mining Activity Management Plan

Although the cases of illegal mining practices are not yet registered by the state pollution control board and other concerned authorities in the district, precautionary measures are necessary keeping in mind the future aspects. Further, it is also necessary to be aware of the cases of illegal mining, which remains unregistered so far. The action plan provided below mainly emphasize on areas, which includes monitoring of the mining operation by using the latest technologies as per the sustainable sand mining guidelines 2016 (Table 62).

Focus Areas

- *Identification of hotspots*
- *Digitization of trading process*

Table 62. Mining activity management plan

Action Areas	Purpose	Strategies/Approach	Stakeholders
Monitoring of mining activity	To ensure sustainable mining activity within the district.	• A district-level task force should be formed to monitor mining activities, 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
System for Online purchase and sale of Sand and Other RBMs (River Bed Minerals)	To ensure compliance to Enforcement and Monitoring guidelines for Sand mining, 2020.	An online system should be made at the state or district level for e-auctioning the mines and for the purchase of RBMs (River Bed Minerals) to ensure transparency in the system.	State Government and District Administration
Identification of hotspots for illegal mining	To have a check on the mining activities in the district.	The district task force should identify the possible hotspots for illegal mining through surveillance and patrolling.	District Administration
Community participation	• To understand the local community's willingness in curbing illegal mining from the area. • To have a local check on the illegal mining activities in the district.	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

Action Plan for Rejuvenation of Waterbodies

Pithoragarh district administration has already undertaken the task of rejuvenating two rivers using various methods. Aim is to revive the flow of the rivers and to restore their ecology. This action plan provides a holistic approach, which includes scientific interventions as well as convergence activities (Table 63).

Table 63. 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 IEC (Information, Education and Communication) activities in local institutions (schools, colleges etc.)	• To improve water resource sustainability • To enhance water discharge from springs and rivers
Convergence Activities	By making use of social media platforms.	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. The current policies and legislation against use of plastic in fragile Himalayan ecosystem needs revamp as most of the policies are plain centric. However, some basic action areas like source segregation, effective collection and transport requires urgent redressal. Each action point complies with the guidelines of Plastic Waste Management rules, 2016. The current action points must be addressed in a timeframe of 5-10 years considering the financial constraints (Table 64).

Focus Areas

- *Collection centres in rural areas.*
- *Formalisation of waste pickers*

Table 64. Action Plan for Plastic waste management

Action Point	Purpose	Strategy/Approach	Stakeholder Responsible
Source segregation	• To ensure better efficiency in waste processing • Higher recovery of resources. • To ensure optimum utilisation of manpower	• ULBs should distribute separate bins to households, street vendors and other shopkeepers. • Distribution of separate bins to every household and shopkeeper in rural areas under Swachh Bharat Mission Gramin should be ensured. • Mass awareness programmes regarding source segregation with the inclusion of institutions such as schools and colleges.	All ULBs, DPRO (District Panchayati raj Officer), Village Panchayats
Effective Collection and segregated waste transport	• To reduce open dumping of waste • To reduce monkey menace (which is a huge issue in the urban areas of the state) • To ensure compliance with plastic waste management rules 2016	• Training waste pickers and providing them with types of 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. • ULBs can establish linkage with the NGOs and private firms working in this field for effective waste collection in the urban areas.	All ULBs, DPRO (District Panchayati Raj Officer), Village Panchayats

Linkage of ULBs & other collection centres with recyclers/ cement plants / Construction Agencies	• To avoid open dumping of plastic waste. • To ensure reuse and recycle of plastic waste.	• Plastic waste collection centres to be started in rural areas should also be linked with recyclers. • Plastic waste can be utilised in road construction for this ULBs should coordinate with the construction agencies such as Public Works Department.	All ULBs, DPRO (District Panchayati raj Officer),
Implementation of extended producer responsibility (EPR) through producer/Brand owner	To reduce the workload of ULBs	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
Community participation for waste management	• Social and Behavioural Change Communication • 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
Establishment of Green Protocol	• To prevent the use of disposables and using alternatives like glass/Stainless steel etc. • To bring the generation of non-biodegradable waste close to zero.	By encouraging Green protocol in local schools, public functions, IEC campaigns, sports events, annual temple festivals and other gatherings.	District Administration

CONCLUSION

Geographical and topographical aspects of Pithorgarh district poses numerous challenges to environment planners. While the densely populated valley areas may require intervention in waste, management operations, the native people of high altitude wants their indigenous livelihood to be sustained. This plan focused on key thematic areas which included the parameters necessary for sustainable development of the district.

At present, primary waste management operations are performed in the ULBs of the district but not in an optimal way. Effective scientific management of waste is still a far cry as dry waste management is lacking in most of the ULBs of the district. This is having a snowballing effect as maximum waste is openly dumped. Due to ineffective processing of waste, the economical aspect of waste is also not realized, particulary plastic waste. DPR has been approved which is a silver linning and,may help the district to achieve effective waste management in near future. Biomedical waste management also lacks scientific and rules based approach. The waste is disposed using deep burial method while machinery and equipments required for scientific management of biomedical waste are unavailable. Health department has taken the cognizance of all the issues which will certainly help acknowledge the issues related to biomedical waste management. Nagar Palika Pithoragarh has two operational Sewage treatment plants. This pertains to high population density in this ULB. Rest of ULBs still rely on conventional Septic Tank+Soak pit method of disposal. Onsite/Offsite treatment of sewage is desired in the district keepin in mind the topography of the region. Air quality determination is still a distant dream as the district has no monitoring station. Increase in forest fires and vehicular pollution might have already deteriorated the air quality in the district and adjacent areas. District has abundance of surface water sources, be it rivers, ponds, springs etc. However, water scarcity in summer season has been a common affair nowadays. Water resources management techniques needs to be propogated to channelize the available water to drinking water and irrigation demand. Mining activities are prevalent in the district as the region is rich in minerals. However, environment clearance for mining activities has been a cause of concern.

Fig. 5. A consultative workshop (04.11.2020) in Pithoragarh district on preparation for District Environment Plan

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