World Bank Funded
UTTARAKHAND DISASTER RECOVERY PROJECT
UDRP

OFFICE OF THE PROGRAM MANAGER
P.I.U., (Bridge, Irrigation & Slope), UDRP-AF, UTTARAKHAND, DEHRADUN
(Fourth Floor, DDPM Tower, Haridwar Bypass Road, Ajabpur Khurd, Dehradun – 248001)
E-mail: piu.irri.udrpaf@gmail.com

Letter No: 707 /PIU/IRI/GCFPIU/UDRP-AF/08/2018-19 Date: 16 /08/2023

To,

ACEO,
USDMA,
4, Subhash Road, Secretariat Complex,
Dehradun - 248001,
Uttarakhand.

Subject : Submission of Field Visit/Study Report.

Ref : Office Order No- 723/USDMA-140293 (2023), dated 24.07.2023 and 757/USDMA (Online)/ 2022, dated 27.07.2023.

Sir,

In compliance of above referenced Office Order, the constituted committee has conducted a detailed survey from 27 July 2023 to 01 August 2023; to accomplish the objectives mentioned in above office order which is related to assess the quantum of run-off and drainage capacities of various drains constructed within Joshimath town. Please find enclosed the Report on said visit for your kind perusal and consideration.

Encl.: As above.

Yours faithfully,

16/08/2023

(Ajay Verma)
Deputy Program Manager

Copy to:

1. Secretary, Disaster Management and Rehabilitation Department, Uttarakhand, Secretariat.
2. Projec t Director, UDRP-AF, Dehradun.
3. Director, ULMMC, Dehradun.
4. Dr Gopal Krishan, Scientist D, Hydrological Investigation Division, NIH, Roorkee.

(Ajay Verma)
Deputy Program Manager

REPORT ON

Survey Report of Joshimath Town on established nalas and underground seepage, Chamoli District

Submitted to
Uttarakhand State Disaster Management Authority

1. Introduction

The Joshimath is one of the townships of district Chamoli with total a population of 21000 (approx.) and situated along the left bank of river Alaknanda between the Latitude N 30°31'& 30°35' N and Longitude E 79°32'& 79°36'. The township is located along the NH 07 (Rishikesh- Mana) and it is a junction point of NH Badrinath – Mana along Alaknada river and NH Malari-Niti along Dhauliganga river.

Joshimath town experienced accelerated land subsidence activities along with widening/ development of previous/new cracks in several buildings, road and grounds and unexpected gushing of muddy water in Marwari area during January 2023. Considering the above mentioned subsidence, Uttarakhand Government engaged various institutions/ organizations to conduct study(s) as per their respective domains such as, geological, seismological, topographical, aerial, geophysical, geotechnical, hydrological etc; to find out the cause of subsidence and submit separate reports. The conclusion drawn from these studies the drainage issues were considered one of the causes for land subsidence in Joshimath.

As per the Report of National Institute of Hydrology, Roorkee (2023), the drainage network of the town was delineated from the SOI toposheet no. 53N/10. Most of the water streams originated from the NW-SE trending ridge Auli area and flowing parallel to each other and joining the main river Alkananda at right angles and is called a trellised drainage pattern.

Therefore, in order to study the seepage & discharge of water in the area, a committee was constituted comprising of following members; vide ACEO, USDMA, GoU Office Order No-723/USDMA-140293 (2023), dated 24.07.2023 and 757/USDMA(Online)/2022, dated 27.07.2023 -

i. Shri Ajay Verma, Deputy Project Manager, UDRP-AF, Dehradun.
ii. Dr Gopal Krishan, Scientist D, Hydrological Investigation Division, NIH, Roorkee.
iii. Dr Ruchika Tandon, Senior Geologist, ULMMC, Dehradun.
iv. Shri Vishal Rastogi, Bio-Engineering Specialist, ULMMC, Dehradun.

The committee has conducted a detailed survey from 27 July 2023 to 01 August 2023; to assess the quantum of run-off and drainage capacities of various drains constructed within Joshimath town.

2. Scope of Study/ Visit

As per the above order the scope of the study is defined as under-

i. The Committee will conduct a survey pertaining to all the drains established under the Joshimath Town and identify the specific points of water infiltration/seepage.
ii. The Committee will identify the suitable points to estimate the quantity of water discharge within each drain. In the same context, the committee will also impart training or suggest methods to the nominated officials of the Irrigation department. So that, designated officials would be able to maintain a periodic database of water discharge in each drain.
iii. The Committee will report about discharge of rainfall runoff through said drains and provide suggestive measures.
iv. The Committee will conduct a detailed survey about existing mechanism of domestic waste water disposal and furnish suggestive measures to improve the system.
v. The Committee will move to Joshimath immediately and ensure to conduct the survey for 07 days (minimum) and submit a report within 01 week from the date of return.

3. Current scenario

a) A brief of Joshimath Township

There is small network of roads which connect the local wards and nearby villages passing through upper bazaar road, lower bazaar road, Auli and bypass Auli road etc. These locations are Parsari, Gandhinagar, Marwari, Singhdhar, Ravigram, Sunil Gaon, Auli, Lower Bazar, Upper Bazar and Manoharbagh. The Auli area is situated on the top of the hill and covered with dense forest towards its western side above Joshimath. Geologically, all these regions of Joshimath township in the Alaknanda valley situated on a slope cover with semi-consolidated material with large gneissic boulders varying in size from few to several meters which are scattered in almost entire Joshimath township. The few outcrops of gneisses are seen either on the crest of the hill near Auli or at base of the hill. Geomorphologically, there are numerous breaks in slope from Auli to Alaknanda river base. The elevation of Joshimath hills are varies from 1330 m to 3230 m (max. elevation near Auli and a min. at the Alaknanda river bank). The slopes are very steep (>70°) about 40 m above the Alaknanda river bank whereas gentle (20° –35°) at lower middle, moderate to high in upper middle whereas again very gentle at top near Auli area.

b) Network of Streams

The committee conducted a detailed survey along the 7 main nalas namely- Prasari, Gandhinagar, Nav-ganga, Tehsil, Kamet, Dronagiri, and AT. Location of Nalas found on transact walk and google images shown in Fig. 1, 2, 3 & 4.

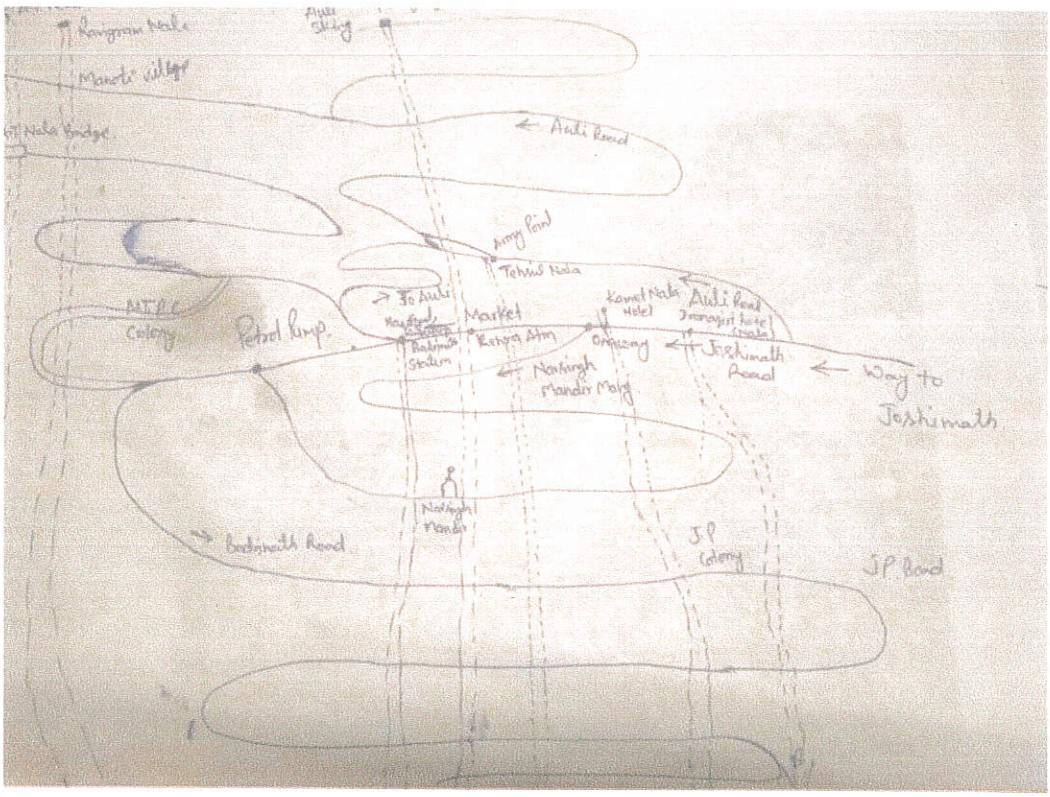


Fig-1: Transact Walk map to depict Nalas in Joshimath Town.

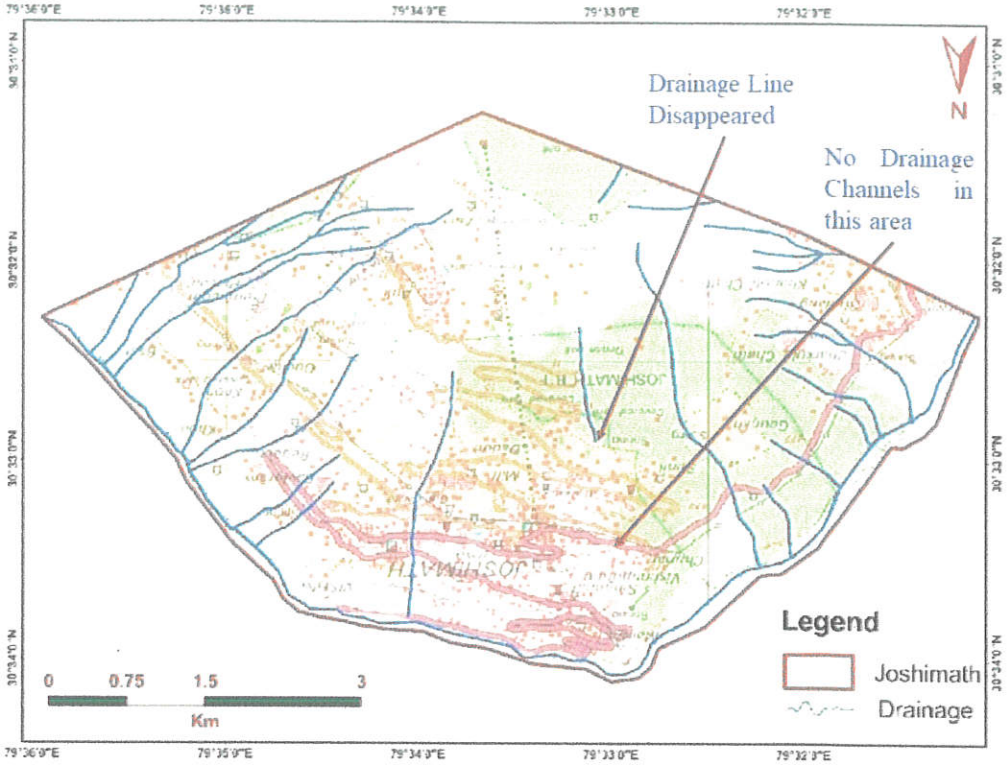


Fig-2: Topo-sheet with Drainage Map of Joshimath (Source: Study conducted by NIH, Roorkee).

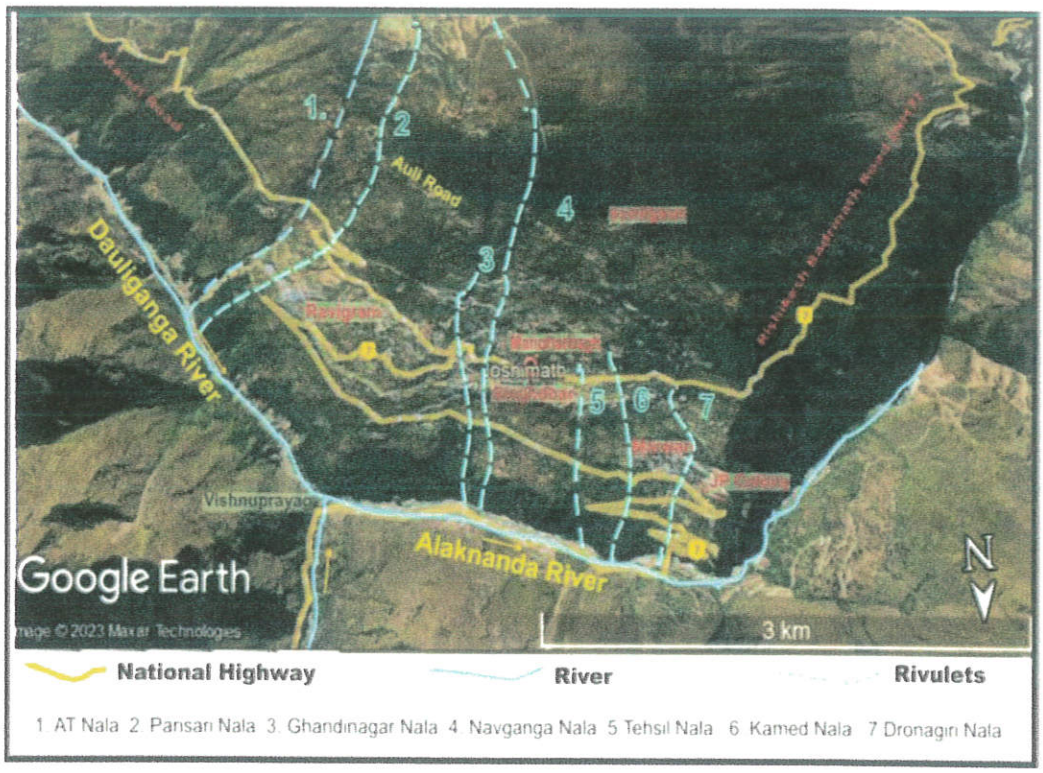


Fig-3: Google earth image.

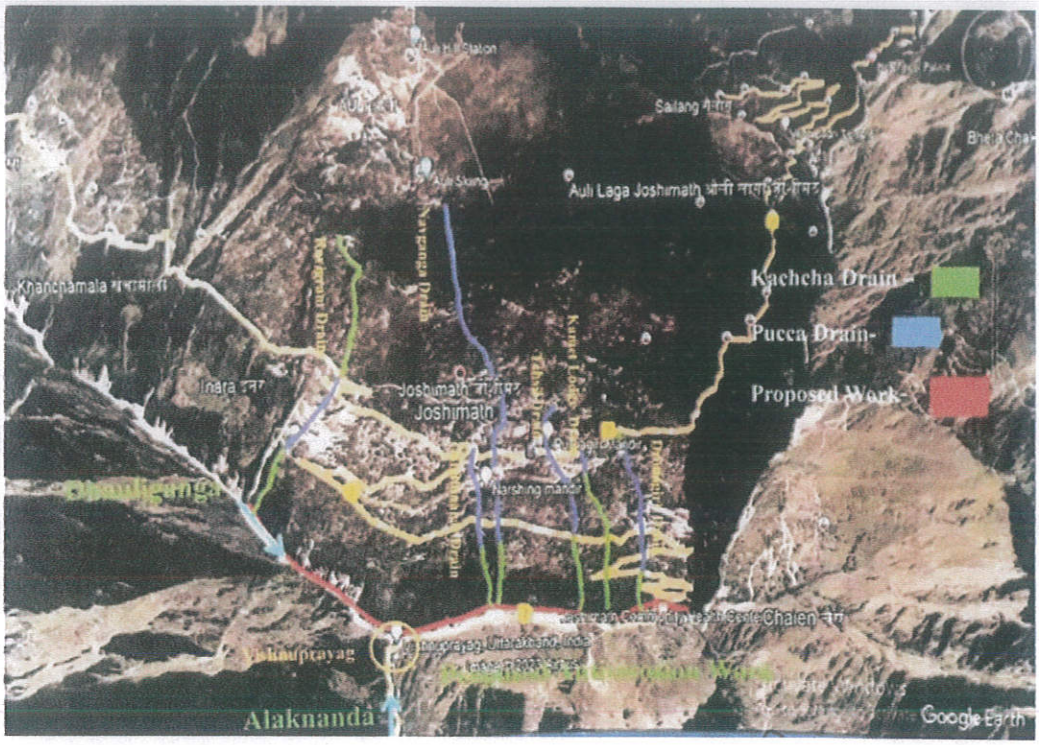


Fig-4: Google earth image.

c) Inventory of Streams/ Nalas

S.No	Drain Name	Origin & end points of Drain	Total Length (m)	Pucca Length (m)	Kuchha Length (m)	Flowing through Wards	Estimated HH connected to Drain (nos)
1	Ravigram (Parsari)	Malari Road to NTPC boundary	3050.00	600.00	2450.00	i. Parsari ii. Ravigarm	500
2	Gandhinagar	Nautiyal Workshop (Near Badrinath taxi Stand) to Kamd Village	1680.00	730.00	950.00	i. Gandhinagar ii. Lower Bazar	430
3	Nav- ganga	Near TV Tower to Sem Village	5105.00	2730.00	2375.00	i. Dodo ii. Sunil iii. Lower Bazar	592
4	Tehsil	Manohar Bagh to Chunar, Badrinath Road	2971.00	1921.00	1050.00	i. Manohar Bagh ii. Sunil	300
5	Kamet lodge	TCP Marwari Hotel to Aaraghar	1900.00	300.00	1600.00	i. Marwari ii. Singhdhar iii. Manohar Bagh	475
6	Dronagiri	Jyoti School to Badrinath road	2100.00	1400.00	700.00	i. Singhdhar	208
	Total		**16806.00**	**7681.00**	**9125.00**		**2505**

Source: Irrigation Department, Joshimath.

d) Existing waste water management

i. Run-off

- All above drains flowing in vertical along the slope through the town.
- At present there is no mechanism to measure water discharge in each drain. The CWC has a gauge site at Joshimath to measure the discharge of river Alaknada.
- Around 55% of the total length of drains are not lined and considered as kuchha.
- At some places seepage found even the stream is lined due to cracks in drain bed & side walls.
- At some places, slabs, building constructions and other obstacles eg- domestic GI pipe connection etc; hindering the capacity/flow of the drain(s).

ii. Domestic

- Soak pits are being in practice for black water management but somewhere foul odour experienced along these drains.
- Grey water is generally flowing in these drains.
- Laying the sewage system in progress.

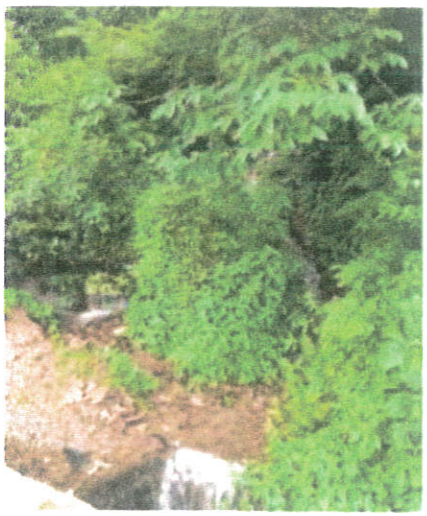
e) Saturation of land with water

The water coming from steep slopes gets opportunity to infiltrate in the areas due to varied slopes or soil texture/ properties or both. Disappeared water may flow in the form of a subsurface channels, which either feed the local springs or directly appeared to the river/streams as a base flow or there is a possibility of accumulation of this water as subsurface/ underground water.

4. About each Drain/ Nala

i. Parsari Nala (N30°32'27.4", E79°34'22.5", 2353 m and N30°32' 27.2" E79°34' 22.7"/ 2350m)

The Parsari nala originates near village Manoti along the road diverted from the Auli road. At the initial stage the nala is kuchha which crosses the Malari road at Ravigram Ward. It is concrete lined (puckka) in Ravigram area and also in the NTPC camp area. There is absence of side drain along Malari road side so water spillage may be possible. On the left side of the Parsari nala a at one or two places subsidence has been is observed along the road. The nala further confluence with Dhauli Ganga river after crossing the NTPC Camp area.



Parsari nala near Manoti village

Spring Near Parsari

ii. Ghandhinagar Nala

The Ghandhinagar nala originates within Ghandinagar ward at Badrinath taxi stand near Nautiyal work shop. The condition of nala in upper section is not good whereas as it passes down it is well concrete lined. It was observed that water flow is minimal even in monsoon season. It was also found that the grey water from settlements is being discharged into the nala. It flows through Narsingh Mandir area, various Wards, Kamd & Sem villages and ultimately join in Alaknanda river. The nala is seems to be encroached at few places by the settlements.

Gandhinagar Nala- Source

Gandhinagar Nala merging in Alaknanda

iii. Navganga Nala

The Navganga nala starts from Auli area and then passes through Dodo, Sunil Ward, Lower Bazar and further to Sem village. At the base, it flows parallel to Ghandinagar nala. Initially from the origin upto market area the nala is kuccha and thereafter it is concrete lined within the local settlements limits. It further flows downstream through various Wards and ultimately join the Alaknanda river. It was also found that the grey water from settlements is being discharged into the nala. The nala seems to be encroached at few places by the settlements. It was observed that water flow is moderate even in monsoon season. It is the largest nala among all the 7 nalas in the Joshimath and having good discharge of water right from its source point.

Nav- Ganga Nala- Source point

Nav- Ganga Nala merging in Alaknanda

iv. Tehsil Nala

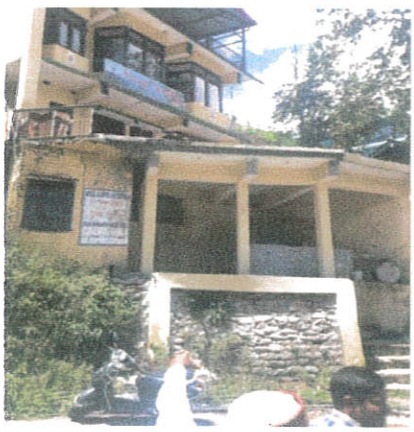
The water from the slopes above the army camp where local settlements are established is coming through various small drains also along the Auli Road and takes the form of nala near Army Camp. This nala is concrete lined in the area of settlements whereas it is kaccha as it flows downwards. It further flows downstream through various Wards upto Marwari Ward and ultimately join the Alaknanda river. It was also found that the grey water from settlements is being discharged into the nala. The nala seems to be encroached at few places by the settlements.

Tehsil Nala- Near Badrinath Taxi Stand

Tehsil Nala merging in Alaknanda

v. Kamet Nala

The origin of Kamet nala is not visible due to various constructions in the area of Manohar Bagh ward. The committee initiated survey from the Auli bye-pass road passing just above the Ward but no sign of any source/ spring was observed. The egress of water first appears near rope-way parking area from where the water flows below some buildings and crosses the Main Bazar road Joshimath. In the present monsoon season, the discharge is minimal in this area and water flows downwards along the side of pathway to Singhdhar Ward and takes the form of nala. The nala seems to be encroached at few places by settlements upto Singhdhar Ward therefore it was difficult to traverse along it. Although wherever possible to approach, it was found that the grey water from settlements is being discharged into the nala. This nala is concrete lined in the area of settlements whereas it is kaccha as it flows downwards. A concrete lined subsidiary nala also joins Kamet nala near Marwari. Some houses in this Ward were found damaged due to subsidence. After flowing from Marwari Ward the Kamet nala joins the river Alaknanda.



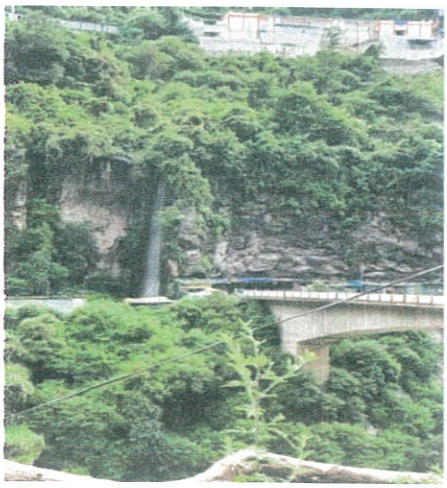
Kamet Nala- Below building source point

Kamet Nala merging in Alaknanda

vi. Dronagiri Nala

The first appearance of source of Dronagiri nala is a perineal source along Auli bypass road which is considered as fresh, clean and used for drinking purpose. It was observed that this water source is further discharging through two underground water springs near Dronagiri Hotel and Sapphire Hotel on NH7. Just below the Dronagiri Hotel on the main Joshimath Road it takes shape of nala (kuchha upto Singhdhar Ward) and further at some places it is concrete lined. The water gets polluted due to passing through the settlements area. It further flows downstream towards Marwari Ward and ultimately joins the Alaknanda river. The discharge of water in nala is minimal even in the monsoon season.

Dronagiri- Near Dronagiri Hotel

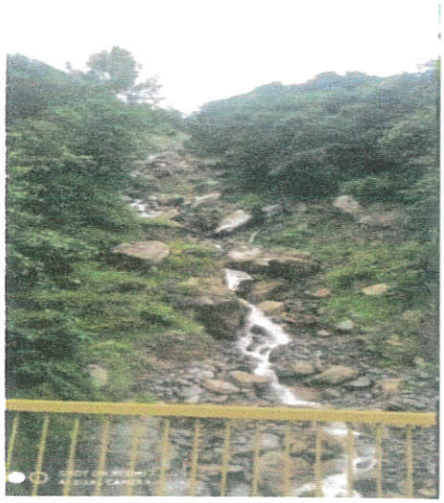


Dronagiri Nala - Near Alaknada

vii. AT Nala

AT nala lies at extreme eastern end of Joshimath. It is beyond the municipal boundaries and merges in Dhauliganga river. The nala is found as kuchha and sides are protected by gabion structures at one side. It was informed that during the monsoon season the nala flows with heavy discharge carrying good quantity of bed material also, thus causing the damage to its banks resulting into erosion.

At Nala- Source Point



At Nala- Middle point

Other Spring(s)-

Sunil Kund (Dried-up)

A natural spring above Sunil gaon was found which is totally dry at present. Information given by dwellers, the spring disappeared about 10 to 15 years ago and the pond that existed in a depression area is surrounded by hill slopes, where the rain water and spring water used to get collected also got dried up. The soil at pond site is having moisture & high in clay content which strengthen the idea that the rain water/ sub-surface flow was retained.

Sunil Kund Spring (Dried-up)

Singhdhar Spring

A natural spring found in Singhdhar Ward on main pathway. Dwellers informed that the name of Ward is derived from the name of this spring. It has been observed that Singhdhar ward is densely populated and one of the wards which are majorly impacted with subsidence. This spring is just below a house. It is also informed that the spring is evergreen from many decades and its water is considered as fresh, clean and potable. The discharge further merges into Kamet nala which ultimately joins the river Alaknanda.

Singhdhar Spring

5. Other Significant Photographs-

Please refer Annexure-I.

6. Suggestions

1. Identify the Catchment area of each drain (07 nos) or total catchment area for joshimath township which feeds runoff to listed drains. Quantification of run-off need to be estimated.
2. Identification of initial point, junction points of two /more drains and just before STP (pre & post treatment) or river Alaknanda.
3. Measurement of each drain length (from initial point to end point) with civil construction (pucca) and kuchha.
4. Collect information about Chal-khal and other earthen water storage structures in fringe area of Joshimath under Nanda Devi National Park Forest Division.
5. Collect information about status of drainage system under Military/Para-military establishments and their junction within listed drains.

6. Information about source(s) of Municipal water supply and total Water supply in MLD/KLD may be estimated. In general, all the municipal water supply transformed into domestic waste water and shall be considered accordingly.
7. Document the status of Black, Grey and other municipal waste water management system, including connected House Holds to each STPs.
8. Verification of land ownership is required from revenue department (adjoining listed drains) to remove encroachment, if any.
9. Discharge/flow measurement in each stream must be conducted on seasonal basis at sampling points, eg- Initial point, junction points of two /more drains and just before STPs with defined drain sections and maintain a database on identified parameters. A 'Flow Meter' may be used for the same at defined sections of drain(s) or if required, a suitable section can be constructed.
10. Considering the saturation of ground with water/seepage from drains/infiltration from soak pits/grey & black water disposal in drains, there may a chance of contamination/ pollution in water. A data base of Water quality analysis (on identified parameters) must be maintained on daily basis for identified sampling points, eg- Initial point (origion of Nala), junction points of two /more drains and just before STP (pre & post treatment) or river Alaknanda.
11. All road side drains must be lined and properly connected with main drains.
12. All the roof top rain water must be channelized and connect with drains.
13. All the drains must be lined throughout of their length (upto river Alaknanda) with flow control measures eg- cascading/steps/bed bars. Further, section/width of Drains should not be reduced in downstream. A proposal for retrofitting/ lining of said listed drains may be proposed.
14. A sewage network must be available to cater all domestic & commercial settlements to abandoning traditional soak pits.
15. Discharge of public toilets should not to be allowed to flow within said drains.
16. All sources of grey and black water must be tapped and not to be allowed to flow within said drains.
17. Suitable capacity of STP(s) must be established to treat sewage before disposal in river Alaknanda.
18. Treated waste water may be used in low lying areas for agriculture purposes.

7. Conclusion

During the detailed survey committee has assessed the quantum of run-off and drainage capacities of various drains constructed within Joshimath town. Transact walk, on site ocular observation, primary information source (from local public) and secondary information source (information lies with Irrigation Department and NIH, Roorkee) were used as survey tools and came to the following conclusion-

In light of discharge (1670 cumecs) of river Alaknanda recorded during Reni Disaster on 07.02.2021 at CWC guage site at Joshimath, the capacity of existing drains seems to be sufficient to carry the run-off (capacity varying from 36.80 to 42.99 m^3/sec). The estimated peak domestic discharge in said drains ranging between 312 to 888 kld. Further, a proposal for retrofitting/ lining

of said listed drains may be proposed to strengthen drainage network and reduce scope of infiltration of waste water. Moreover, sewage network must be available to cater all domestic & commercial settlements to abandon the traditional 'soak pits' which will also reduce infiltration of waste water. The committee has submitted its suggestions under para # 5 of this report.

During the survey, Officials of Irrigation Department facilitated the committee. The committee benefited with the relevant knowledge & already collected data lying with Officials of Irrigation Department. We express special thanks to Shri Manoj Aswal (AE), Shri Sanjay Purohit (JE), Shri Amit Lingwal (JE) and Shri Harendra Rana (JE) deputed from Irrigation department.

16/8/2023

(Gopal Krishan)
Scientist D, Hydrological Investigation Division, NIH, Roorkee.

16/08/2023

(Ajay Verma)
Deputy Project Manager, UDRP-AF, Dehradun.

16/8/23

(Ruchika Tandon)
Senior Geologist, ULMMC Dehradun.

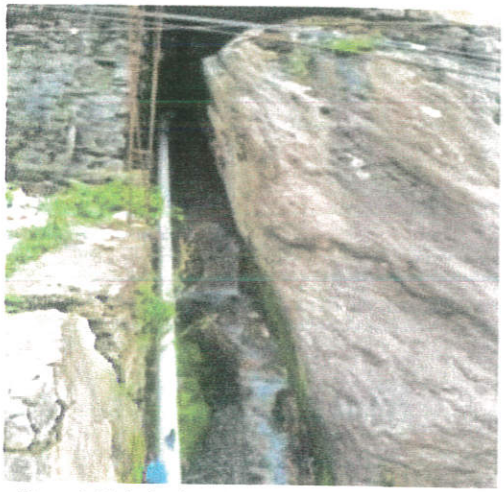
(Vishal Rastogi)
Bio-engineering Specialist, ULMMC, Dehradun.

Other Significant Photographs

Kamet Nala

Kamet Nala

Kamet Nala below the building



Kamet Nala below the building (Left Photo)

Broken drain at Main Bazar

Various unknown sources on roadside

Merger of Two Drains

Merger of Two Drains

Nav- ganga near STP

STP near JP Colony (Marwari)