



STRATEGIC PLAN FOR RISK REDUCTION

Increasing resilience through effective

RESPONSE, RECOVERY, MITIGATION, & PREPAREDNESS

URBAN RISK HOTSPOT

SRINAGAR TO KARNAPRAYAG

STATE LEVEL ENDORSEMENT

“The magnitude of hazards and frequency of extreme weather events in Uttarakhand has increased due to climate change. The traditional methods of disaster management need to be overhauled, earlier the traditional methods used to be relief, response and rehabilitation, but now the whole scenario has changed. We really have to upgrade our capacities and strengthen our people.”

Mr. Amit Singh Negi

Disaster Management Secretary, Govt. of Uttarakhand

(State Workshop on “Strengthening Resilience to Climate Change Related Disaster Risks” held in Dehradun on 21st July 2017)

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1 INTRODUCTION

1.1 Overview of Area

The Srinagar to Karnaprayag Corridor Strategic Risk Mitigation Plan presented here is intended to provide key strategies and their priority with respect to mitigation of the identified risks associated with earthquakes (High), flooding (Moderate), Landslides (None) and flash flooding (None). Greater detail is provided in the Risk profile below (Section 1.4).

The strategies are for municipal leaders and planners, and are not technical. They are easy to understand, realistic, and they are all achievable.

Successful implementation of the strategies will reduce the risk profile of this location.

There is a need to address the congested urbanized areas of the towns in this corridor notable amongst which are Srinagar, Kirtinagar, Rudraprayag and Karnaprayag with respect to structural resilience to earthquakes.

In addition, there is a risk of flooding to infrastructure that has been built close to the floodplains in Srinagar and Kirtinagar areas that needs to be addressed.

The Hotspot is a corridor extending from Srinagar to Karnaprayag, and the extent of the Hotspot is shown in Map 1.

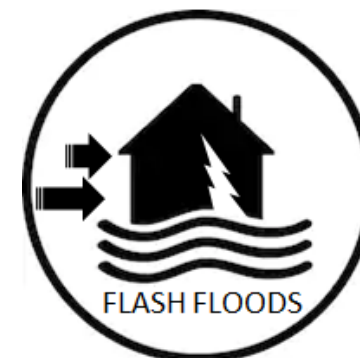
This corridor is developing rapidly and is a key gateway for tourists and goods into the Hills. A railway is planned and Karnaprayag is set to become the terminus for the hill railway. Hence, this hotspot has strategic significance.



HIGH RISK



VERY LOW RISK



NO RISK



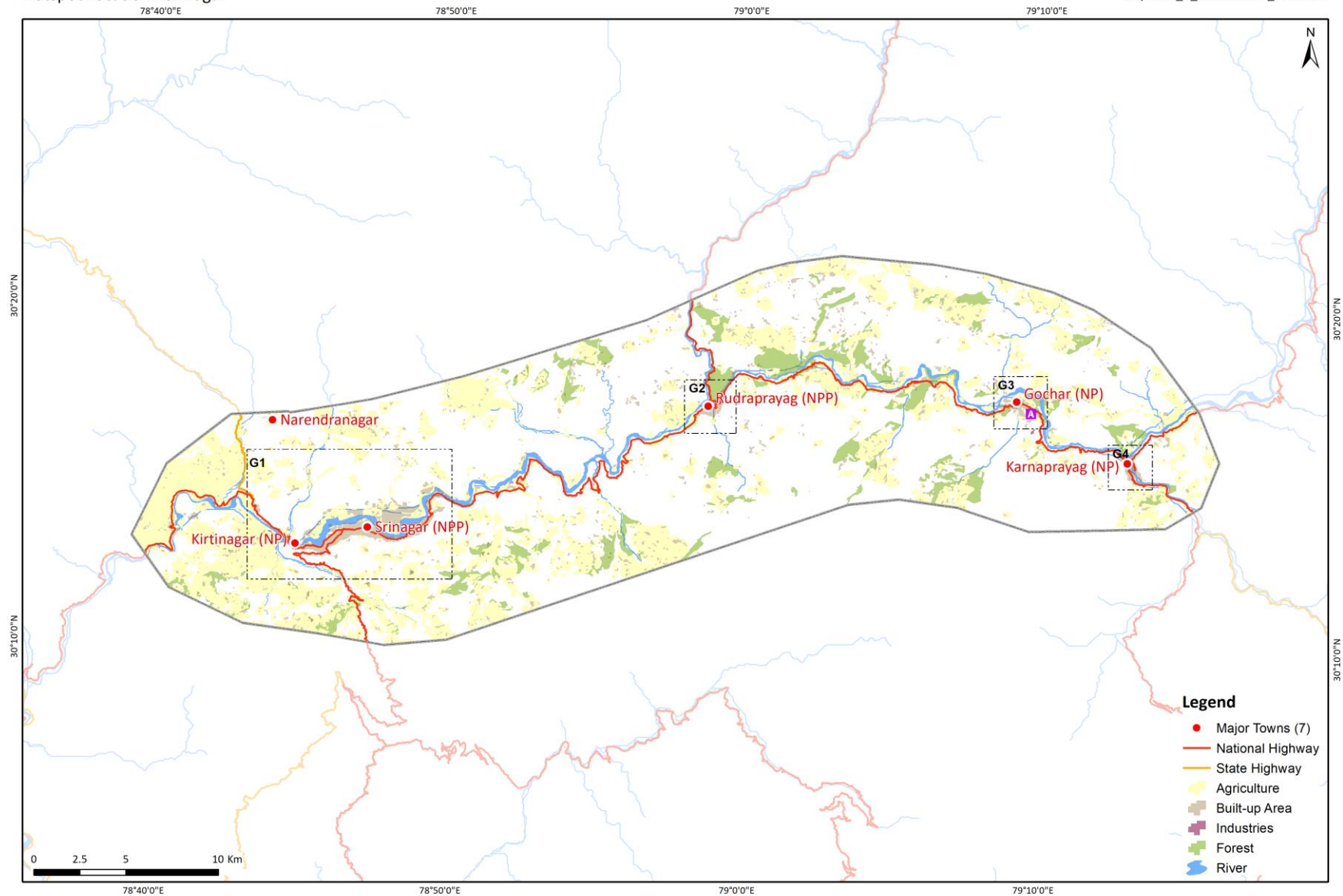
MODERATE RISK

Urban Hotspot Plan

Hotspot Location - Srinagar

Disaster Risk Assessment of Uttarakhand (2016-2018)

Map Ref: _B_0000000000_HOTSPOT



Map 1: The Hotspot boundary and extent from Srinagar to Karnaprayag

1.2 About this Strategic Plan

This document is an output of the Disaster Risk Assessment. It is one of 14 strategic plans produced under the study that aim to reduce risk in the selected locations and serve as case studies for other areas of risk in the State.

This Strategic Plan is built upon the hazard risk analysis undertaken by the project and formulated around key elements of the disaster risk management (DRM) framework embodied in the Sendia Framework.

The DRM process is sequential (cyclic) in order to allow adaptive improvement over time in order to build back better. It is also intended to incorporate a focus on pre-impact preparation through planning in order to mitigate risk associated with incidents before they occur.

This approach has been adopted at the National level.

While response and recovery are recognised as being reasonably short time frame processes (hours and days to months), Mitigation and Preparation are seen as much more strategic processes over longer time frames (months to years).

The National DRMP recognises three recovery periods after a disaster: a) Early – three to eighteen months, b) Medium – within five years and c) Long-term – within five to ten years. The concept of “build back better” points to continuous improvement in the mitigation and preparation process and its implementation, over all time frames as funds and resources come to hand, risk profiles change, and skills and mitigation outcomes are increased or realised. Continuous improvement represents a learning curve reflecting successes and failure – what has worked, what has not worked and how do we do better into the future?

By developing strategies around the separate phases of DRM and recognizing the opportunity for improvements over time it is possible to prioritize the actions that need to be taken. For each strategy presented here there is an initial list of key Actions include as the start of the process.

The strategies offered here are intended to aid the Municipality and its citizens, local authorities, businesses, private residents, and local NGOs, with the intent of driving a ground up approach within a State level top down policy context. The challenge is for all organizations and individuals to take upon themselves the responsibility of being prepared and being better able to offset the risks and manage the consequences of these disasters.

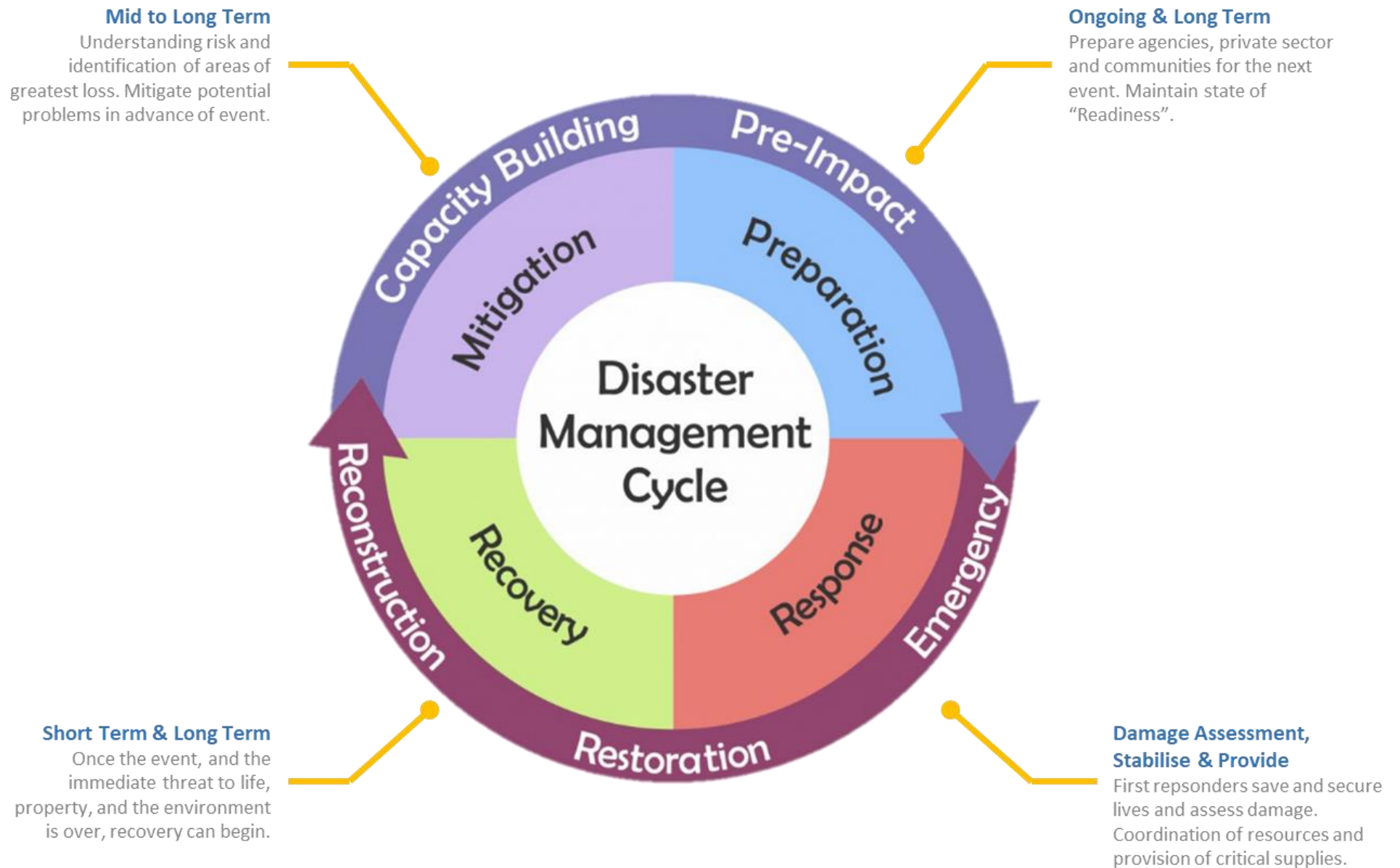
What is a Strategy?

“... a plan of action designed to achieve a long-term or overall aim.”

A strategy gives recognition to an overall goal and the way it might be achieved, taking into account the resource limitations and other constraints being faced.

What is an Action?

An Action is a key step to be taken in concert with other actions also needed for the strategy to succeed.



1.3 Area and Community Profile

1.3.1 Topography

The towns in the Srinagar- Karnaprayag hotspot lie on the east side of the Alaknanda River in the Middle Himalaya physiographic zone. Srinagar is located in a valley region at an elevation of 560 metres above sea level with an almost flat terrain of low gradient slopes. Upstream of Srinagar are the towns of Rudraprayag, Gauchar and Karnaprayag. Rudraprayag and Karnaprayag have mostly hilly terrain whereas Gauchar is nestled in a small valley with mostly flat terrain.

1.3.2 Climate

The Srinagar-Karnaprayag has a warm and temperate climate with an elevation varying from 560 metres to 1450 metres above sea level. The average temperatures range from a minimum of 6 °C and a maximum of 36 °C with temperatures reducing as the height increases. The annual rainfall in the region averages around 1400 mm with the bulk of precipitation in the summers.

1.3.3 Demographics

The hotspot has a population of 48106, a literacy rate of 80% and a sex ratio of 840 females to 1000 males (Census 2011). A majority of the population consists of non-workers (65%) i.e. homemakers, students, retirees, unemployed etc. A low but significant percentage of population are engaged in agriculture (10%). Most workers are engaged in the "Others" category which consist of the secondary and tertiary sectors (public and private). The decadal growth rate of the hotspot was 28.7% which is higher than that of Uttarakhand (18.8%) and India (17.64%) indicating an inflow of migrants (census 2011 vs 2001). Moreover, this is in line with the state decadal growth trends where urban areas have shown higher population growth rates than rural areas.

1.3.4 Economy

The Srinagar-Karnaprayag corridor is en-route to Kedarnath and Badrinath and hence a practical halt for religious tourists who contribute to the economy. Rudraprayag and Karnaprayag are also two of the five sacred river confluences in the Garhwal region and hence popular amongst religious tourists. Manufacturing too plays a role in Srinagar's economy with stone, furniture and steel goods being the important products and exports of the town. Srinagar also happens to be one of the important trading posts for the hill villages due to proximity and access to the main road. Also, there are some prominent educational centers in Srinagar such as Garhwal university and national institute of technology amongst others.

1.3.5 Development History

Srinagar came into the limelight in the early 16th century when it became the capital of the then Garhwal kingdom. It remained the capital for over 300 years until the British rule. A significant event in Srinagar's timeline occurred in 1893-94, a big landslide blocked the Birahi Ganga (a tributary of the Alaknanda) north of Srinagar

to form a temporary lake. The dam would break close to a year later and wash away the old parts of Srinagar city. However, close monitoring of the situation ensured that the city could be evacuated in time and hence there was minimum or no loss of life.

This corridor is getting a massive infrastructure boost with respect to road transport and rail transport in the near future. The Char Dham expressway project plans to connect the four dhams to Rishikesh with a two lane (each direction) road of a minimum width of 10 metres. This corridor's road route connects with two of the most visited shrines of Kedarnath and Badrinath. In addition, the rail network from Rishikesh is getting built/extended till Karnaprayag. The growth in the pilgrim count has been unprecedented in the year 2018. With the new infrastructure, one can expect a massive influx of tourists into Rudraprayag and Karnaprayag during the tourist season. It is hence critical that the Srinagar-Karnaprayag corridor develops the capacity and resilience to safeguard the infrastructure and the resident/transient population.

1.3.6 Regional Context

The area defined under this hotspot stretches from Kirtinagar and Srinagar to Karnaprayag along the Alaknanda river and national highway 7. Other important towns in the hotspot include Rudraprayag and Gauchar. The hotspot stretching from west to east is important as a halting spot for various tourists travelling to Kedarnath and Badrinath. From Rudraprayag, there is a road that leads to Kedarnath. Both Srinagar and Karnaprayag have 3 ingress routes. Due to the hilly terrain, it is found that services (Power, communications and transport) are often early casualties of an earthquake, landslide or flood event. Disruption of services lead to complications in relief and recovery efforts which in turn exacerbate the disaster risk.

1.3.7 Critical Facilities/Infrastructure

The hotspot is connected by air via Gauchar airport which is located on a flat strip of land at Gauchar. This airport does not operate regular flights but is commonly used for helicopters. However, the access road from Rudraprayag is highly susceptible to landslides at various sections which may cause delays in relief/recovery in a disaster scenario. There aren't any railway stations in the hotspot yet but construction is going on for a rail line till Karnaprayag with stations at Rudraprayag. Below is a snapshot of lifeline buildings and helipads which are important from the disaster risk management perspective:

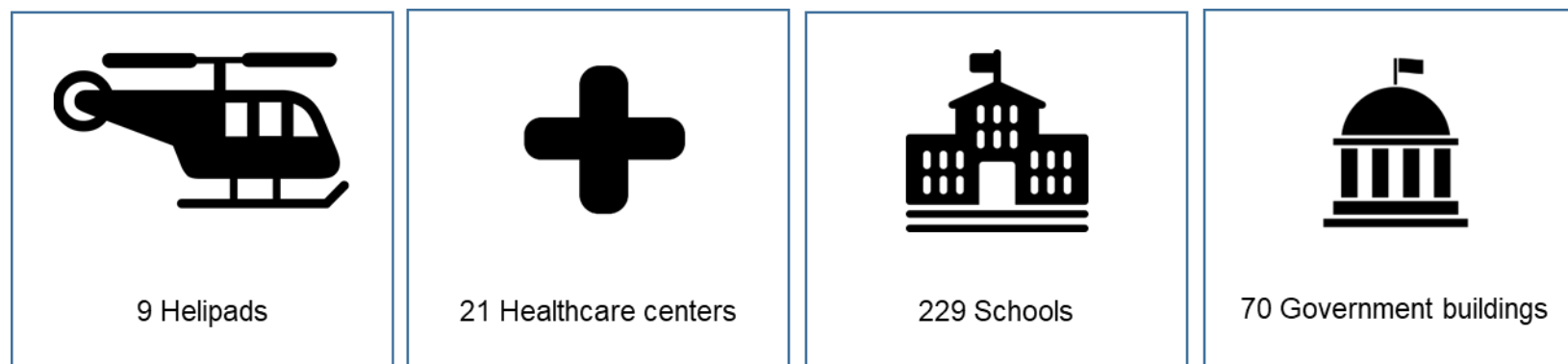


Figure 1: Snapshot of lifeline buildings and helipads

Ten out of the 21 healthcare centers are sub-centers. The total lifeline buildings in this hotspot are approximately 310.

In this hotspot, the sewage management is a mixture of piped systems and unorganized on-site sanitation systems with many instances of direct untreated sewage draining into the river. For cooking fuel, the urban areas mostly use LPG cylinders whereas in some rural areas firewood, cow dung and kerosene is still used.

The Srinagar-Karnaprayag hotspot is broadly a mixture of rural and urban areas. The administrations governing the hotspot are diverse. Some of the disaster risk management strategies may require efforts that cut across administrative boundaries. Below is a general view of the different administrations involved in this hotspot:

Table 1 List of the different administrative areas within Srinagar to Karnaprayag hotspot

Urban	Rural	
	Block	Tehsil
Srinagar (NPP)	Karnaprayag	Karnaprayag
Kirtinagar (NP)	Agastmuni	Rudraprayag
Rudraprayag (NPP)	Khirsu	Srinagar
Gauchar (NP)		
Karnaprayag (NP)		

1.4 Srinagar to Karnaprayag Corridor Risk Profile

1.4.1 Social Vulnerability

The social vulnerability has been ascertained by analyzing a combination of indicators that define certain characteristics or qualities (such as socio-economic and demographic attributes) within social systems that create the potential for loss or harm. According to this study, the towns of Rudraprayag, Gauchar and Karnaprayag are highly vulnerable whereas certain pockets in the mountain villages adjoining Srinagar and Kirtinagar towns are also vulnerable.

Rudraprayag and Karnaprayag are also densely populated whereas Gauchar is relatively less densely populated. The vulnerable pockets near Srinagar/Kirtinagar are sparsely populated.

Maps 2 and 3 illustrate the social vulnerability and population density in the Srinagar – Karnaprayag corridor.

1.4.2 Earthquakes



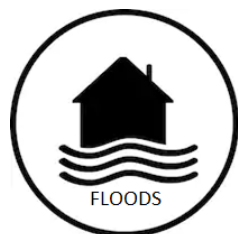
HIGH RISK

Srinagar to Karnaprayag City and its surrounds are classified as being High Risk with respect to earthquakes. Srinagar has a densely urbanized market area with many shopfront facades not tied up effectively with their respective buildings. Hence, these facades risk detachment from the building in the event of an earthquake. Karnaprayag has many structures built on top of the river bank at a height which aren't earthquake resistant.

These buildings are likely to collapse into the river in the event of an earthquake. Rudraprayag too has a hilly terrain which can pose complications in the event of an earthquake. Gauchar in contrast has a flat terrain and the built up area is away from the river.

Maps 4 to 6 illustrate the earthquake risk in the Srinagar-Karnaprayag corridor.

1.4.3 Fluvial Floods



MODERATE RISK

Fluvial flood Risk for Srinagar to Karnaprayag is seen as Moderate, which is largely a result of most of the built-up area being outside of the flood plains.

Maps 7 to 10 illustrate the flood risk in the Srinagar-Karnaprayag corridor.

1.4.4 Flash Floods



NO RISK

Flash flooding is not assessed to be a significant risk in the Srinagar to Karnaprayag urban corridor.

1.4.5 Landslide Hazard



VERY LOW RISK

Landslides pose negligible risk in the Srinagar to Karnaprayag corridor. However, there are certain chronic landslide zones (notably near Kalyasaur) which lie between Srinagar and Rudraprayag in the rural areas. These need to be addressed with respect to road accessibility issues since it is a key route for the pilgrim tourists.

Given the negligible risk, strategies for landslide management have not been put forward explicitly for this hotspot area.

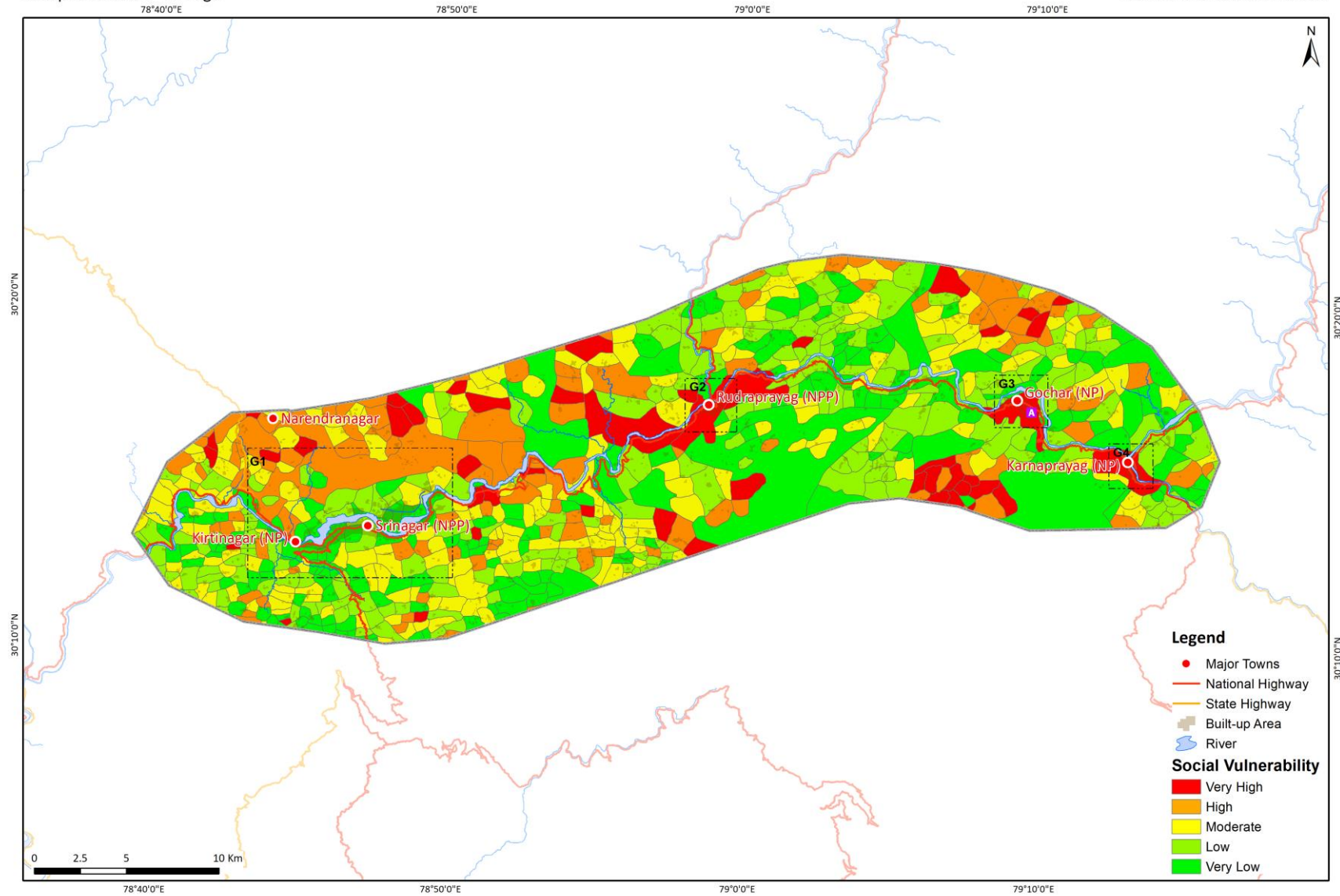
Maps 11 to 14 illustrate the negligible landslide risk and exposure in the Srinagar – Karnaprayag corridor.

Urban Hotspot Plan (Social Vulnerability)

Disaster Risk Assessment of Uttarakhand (2016-2018)

Hotspot Location - Srinagar

Map Ref: _B_0000000000_HOTSPOT



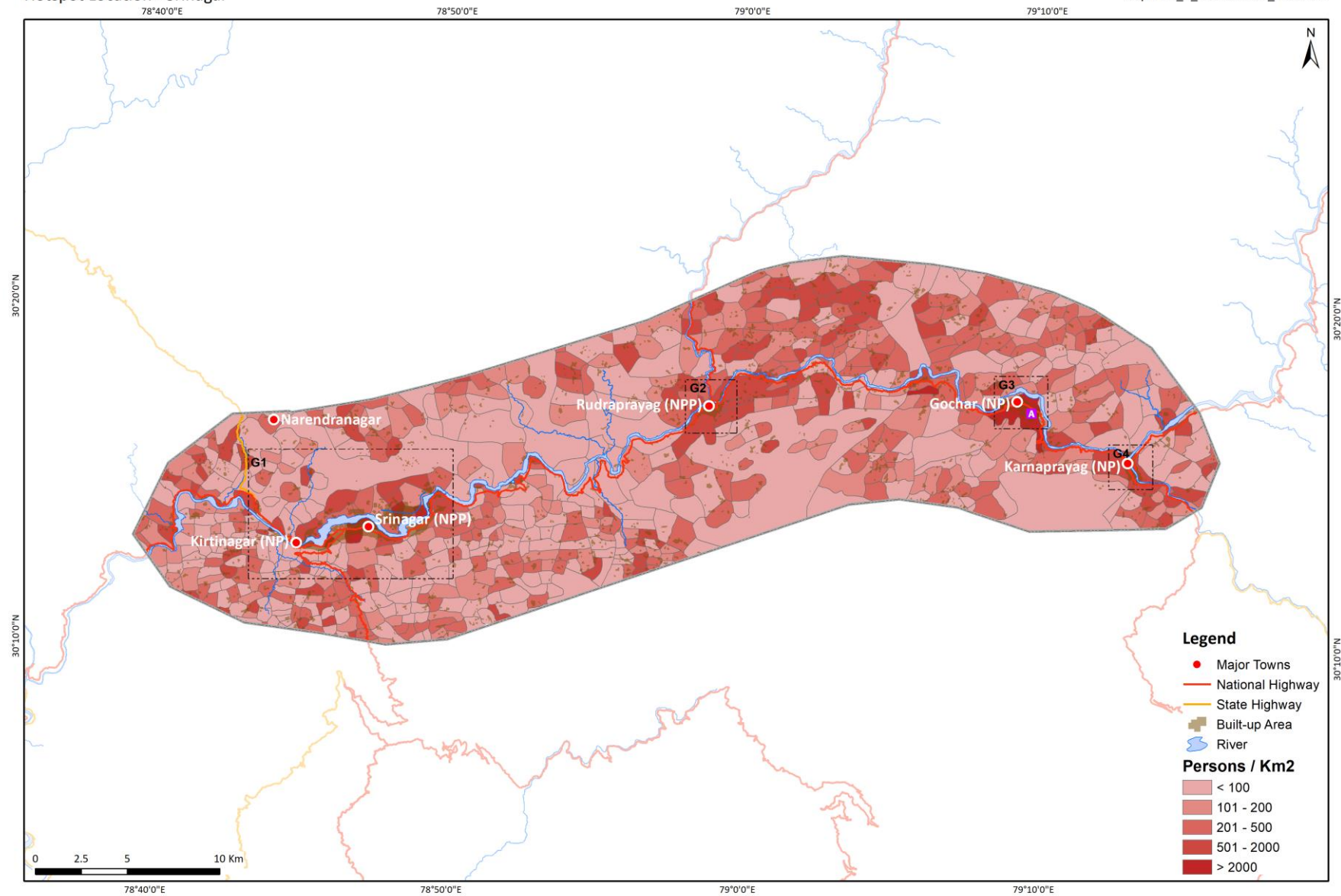
Map 2: Integrated Social Vulnerability Index Srinagar-Karnaprayag Hotspot Area

Urban Hotspot Plan (Population Density 2011)

Disaster Risk Assessment of Uttarakhand (2016-2018)

Hotspot Location - Srinagar

Map Ref: _B_0000000000_HOTSPOT



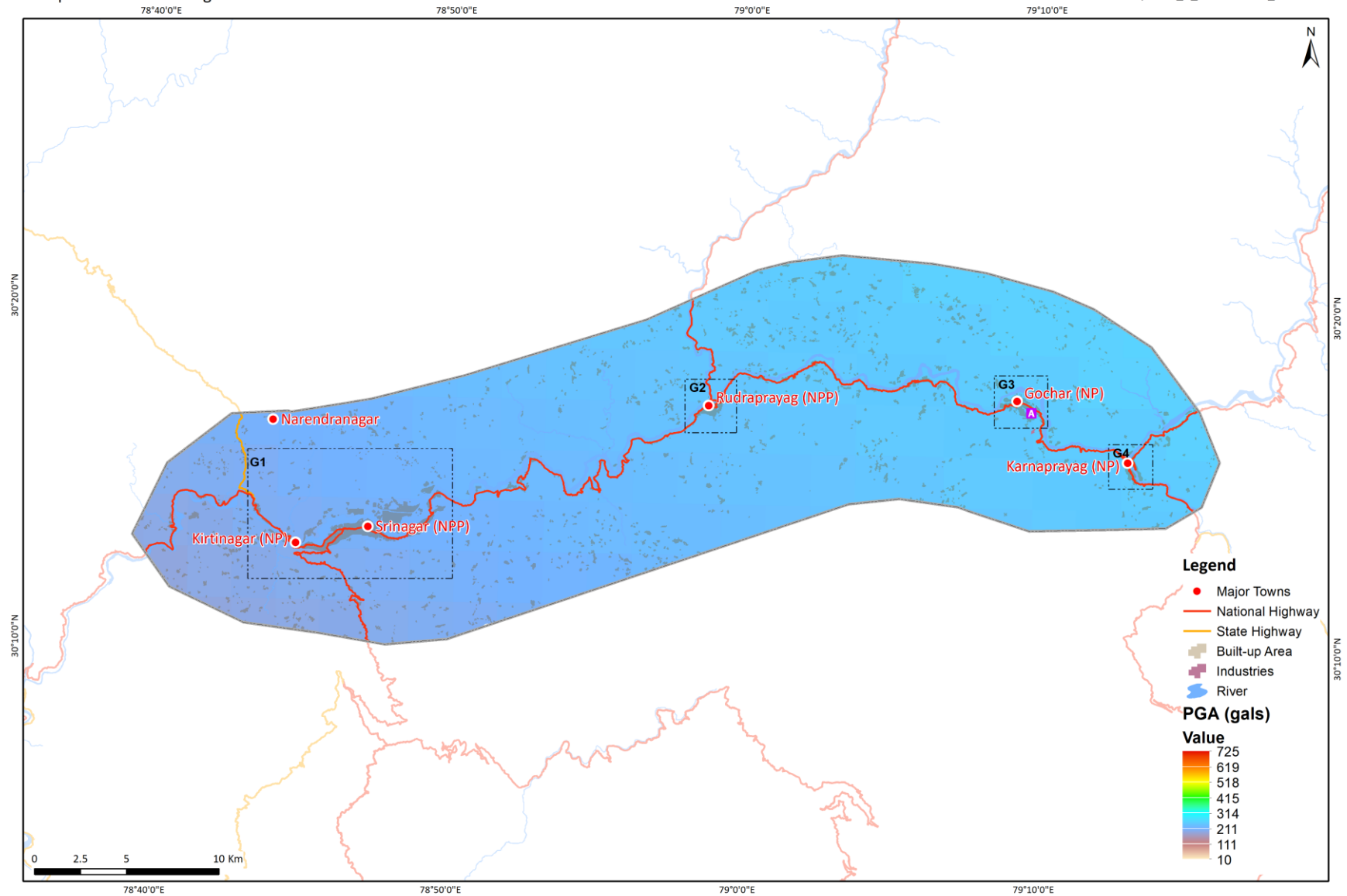
Map 3: Population Density Srinagar-Karnaprayag Hotspot Area

Urban Hotspot Plan (Earthquake: 100yr RP or 40% chance in next 50 yrs)

Disaster Risk Assessment of Uttarakhand (2016-2018)

Hotspot Location - Srinagar

Map Ref: _B_0000000000_HOTSPOT



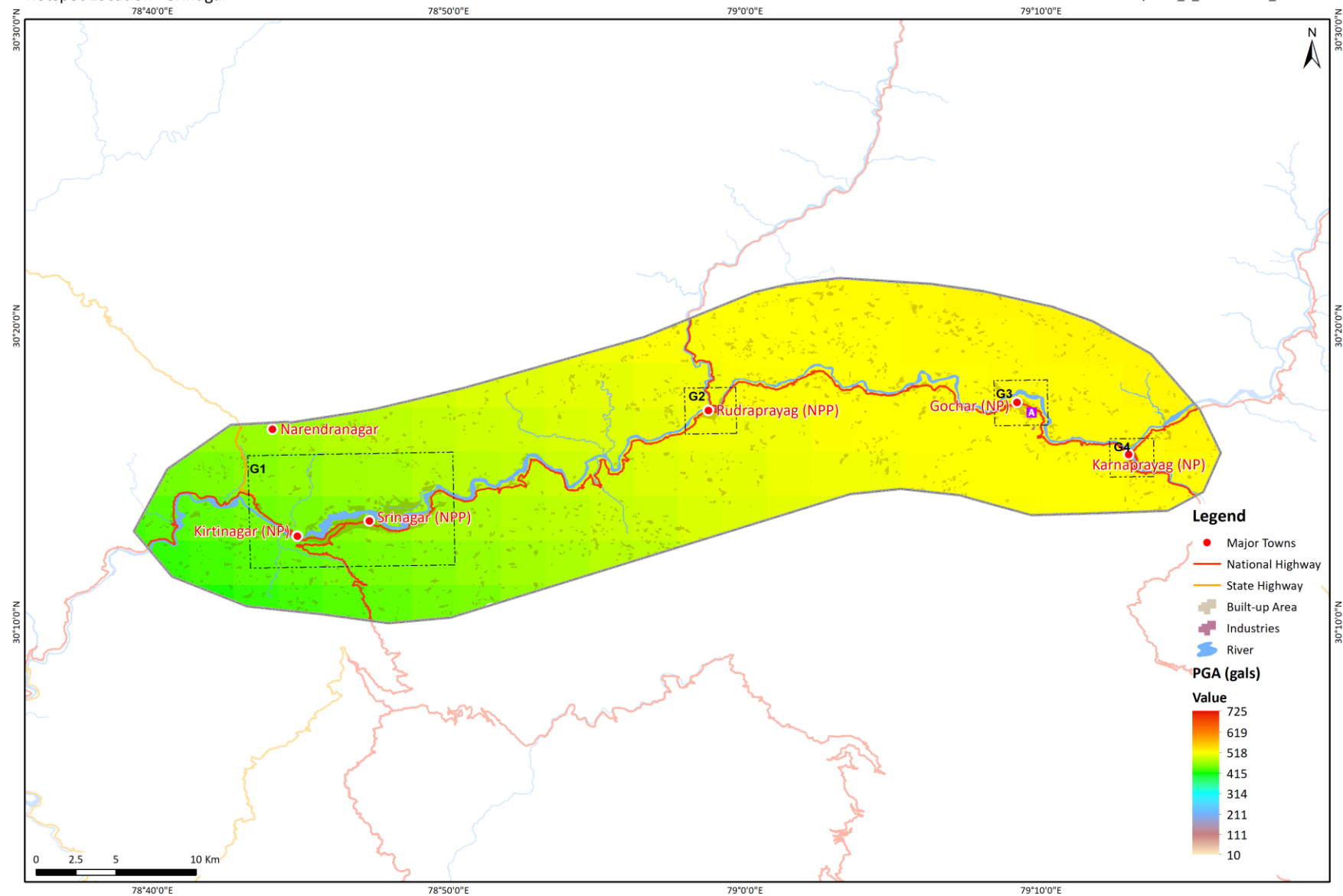
Map 4: Earthquake Hazard Map - Srinagar-Karnaprayag Hotspot (100yr Return Period)

Urban Hotspot Plan (Earthquake: 475 yr RP or 10% chance in next 50yrs)

Disaster Risk Assessment of Uttarakhand (2016-2018)

Hotspot Location - Srinagar

Map Ref: _B_0000000000_HOTSPOT



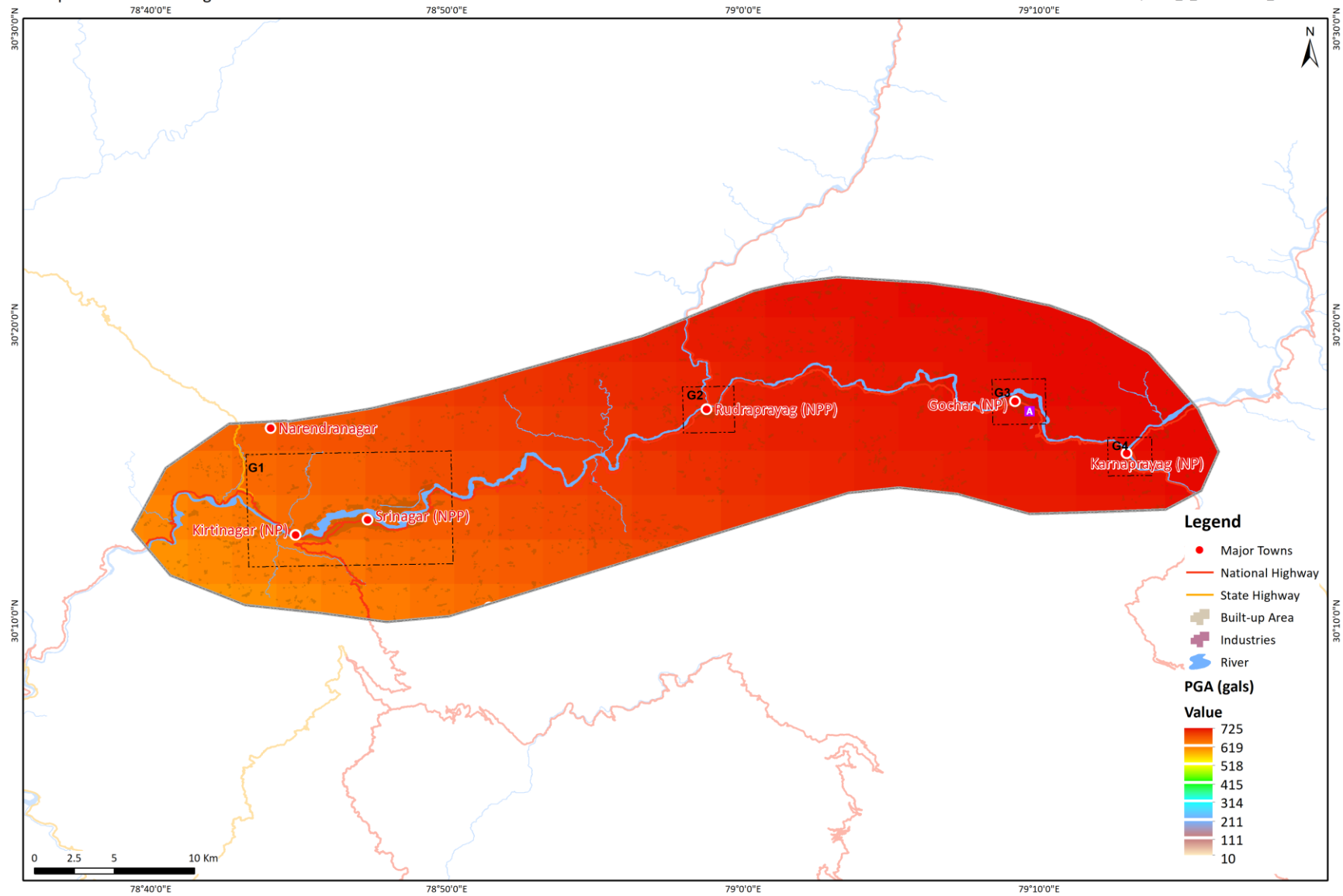
Map 5: Earthquake Hazard Map - Srinagar-Karnaprayag Hotspot (475yr Return Period)

Urban Hotspot Plan (Earthquake: 1,000 yr RP or 5% chance in next 50yrs)

Disaster Risk Assessment of Uttarakhand (2016-2018)

Hotspot Location - Srinagar

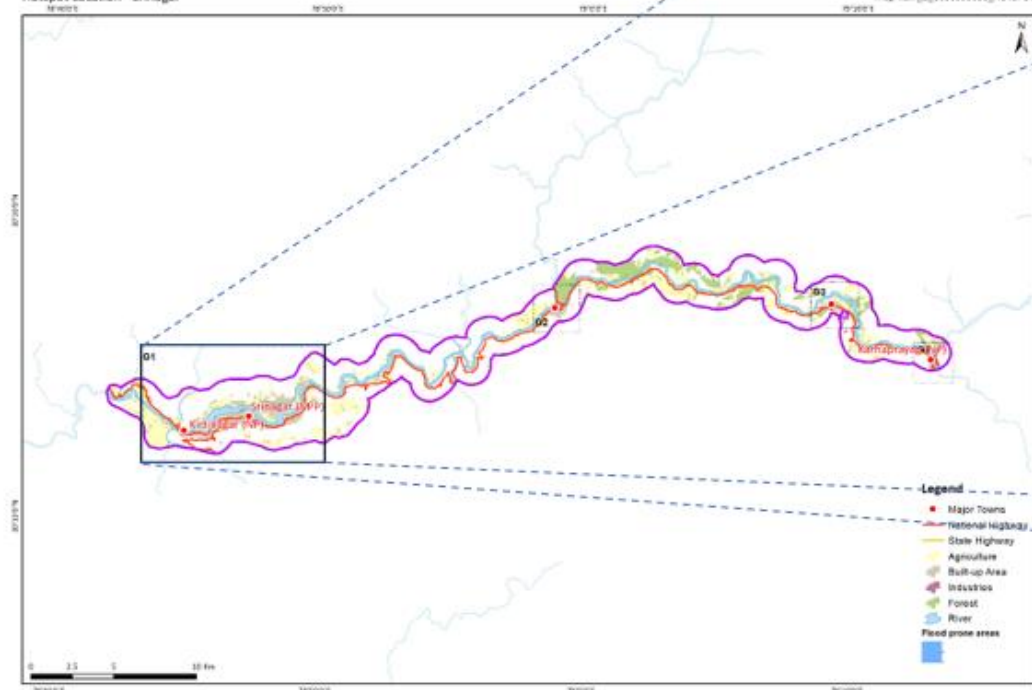
Map Ref: _B_0000000000_HOTSPOT



Map 6: Earthquake Hazard Map - Srinagar-Karnaprayag Hotspot (1000yr Return Period)

Urban Hotspot Plan (Flood Prone Areas)

Hotspot Location - Srinagar

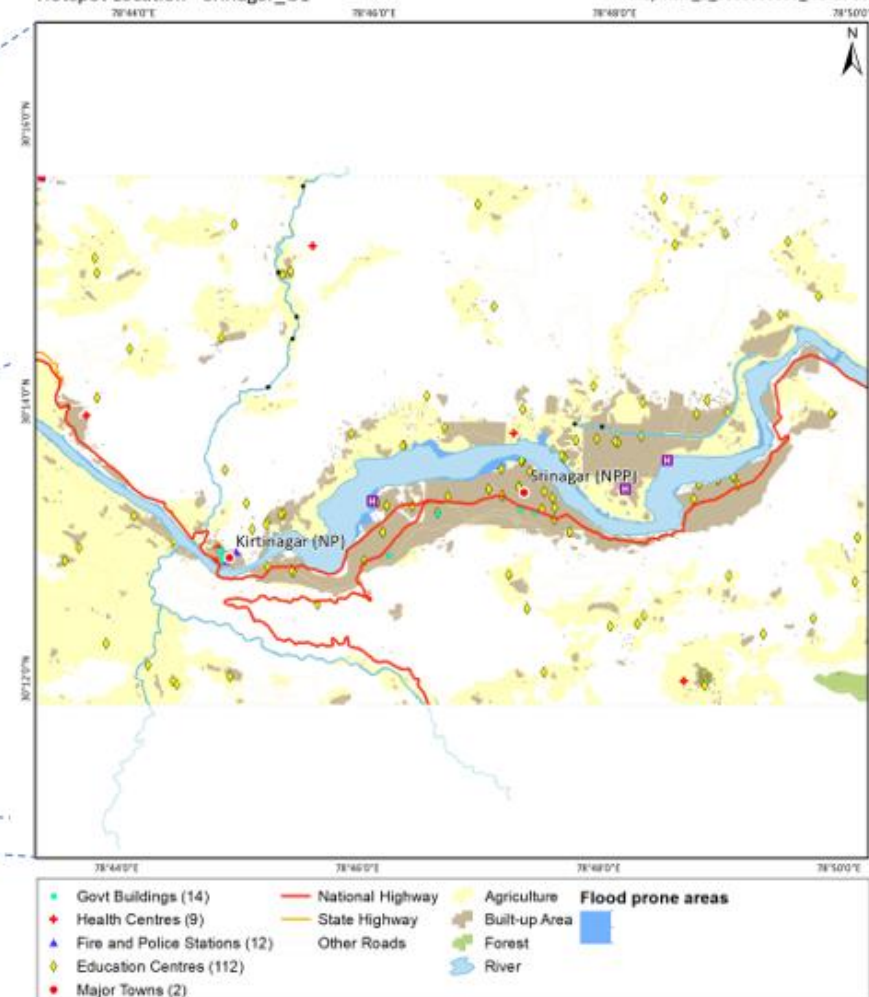


Urban Hotspot Plan (Flood Areas)

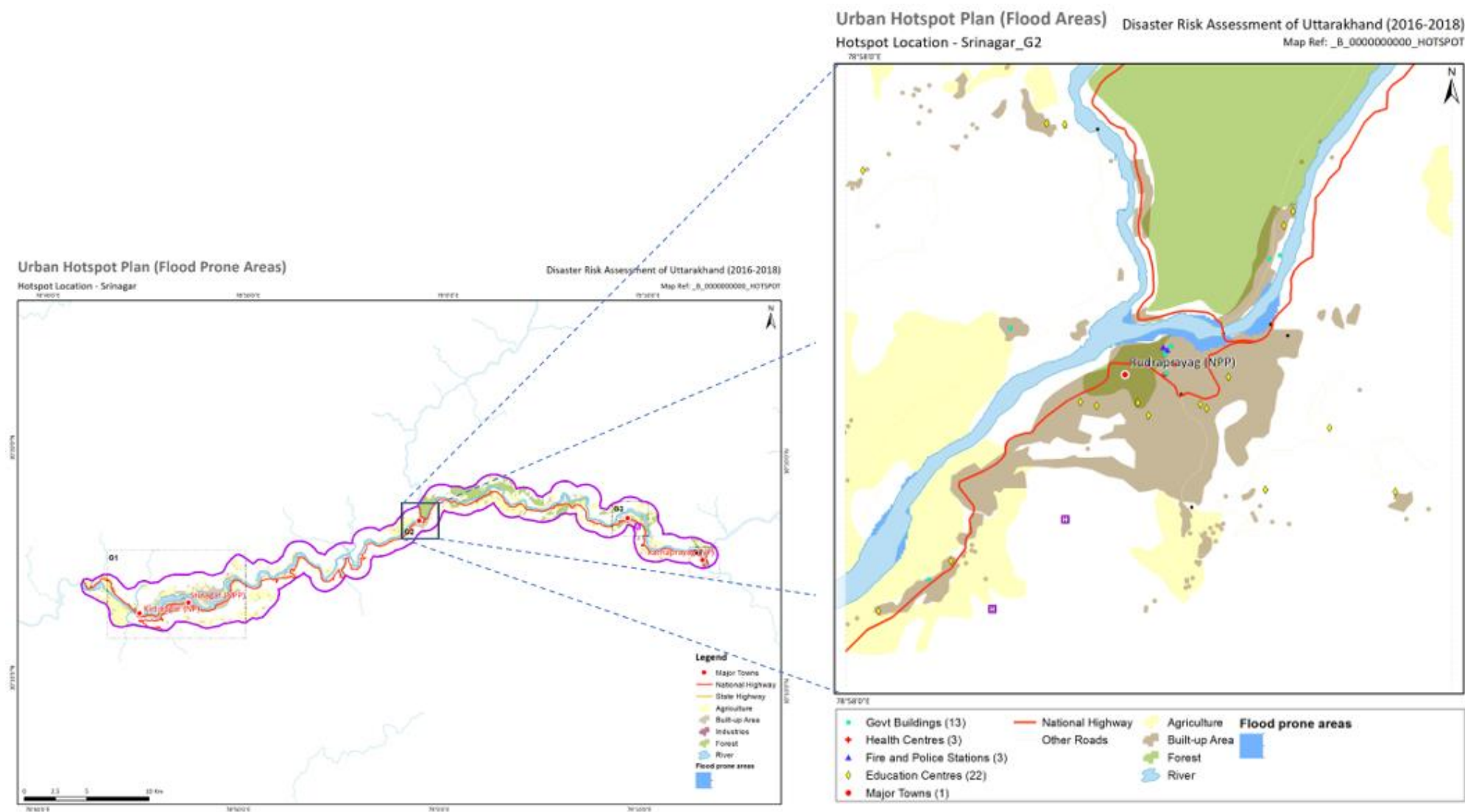
Hotspot Location - Srinagar_G1

Disaster Risk Assessment of Uttarakhand (2016-2018)

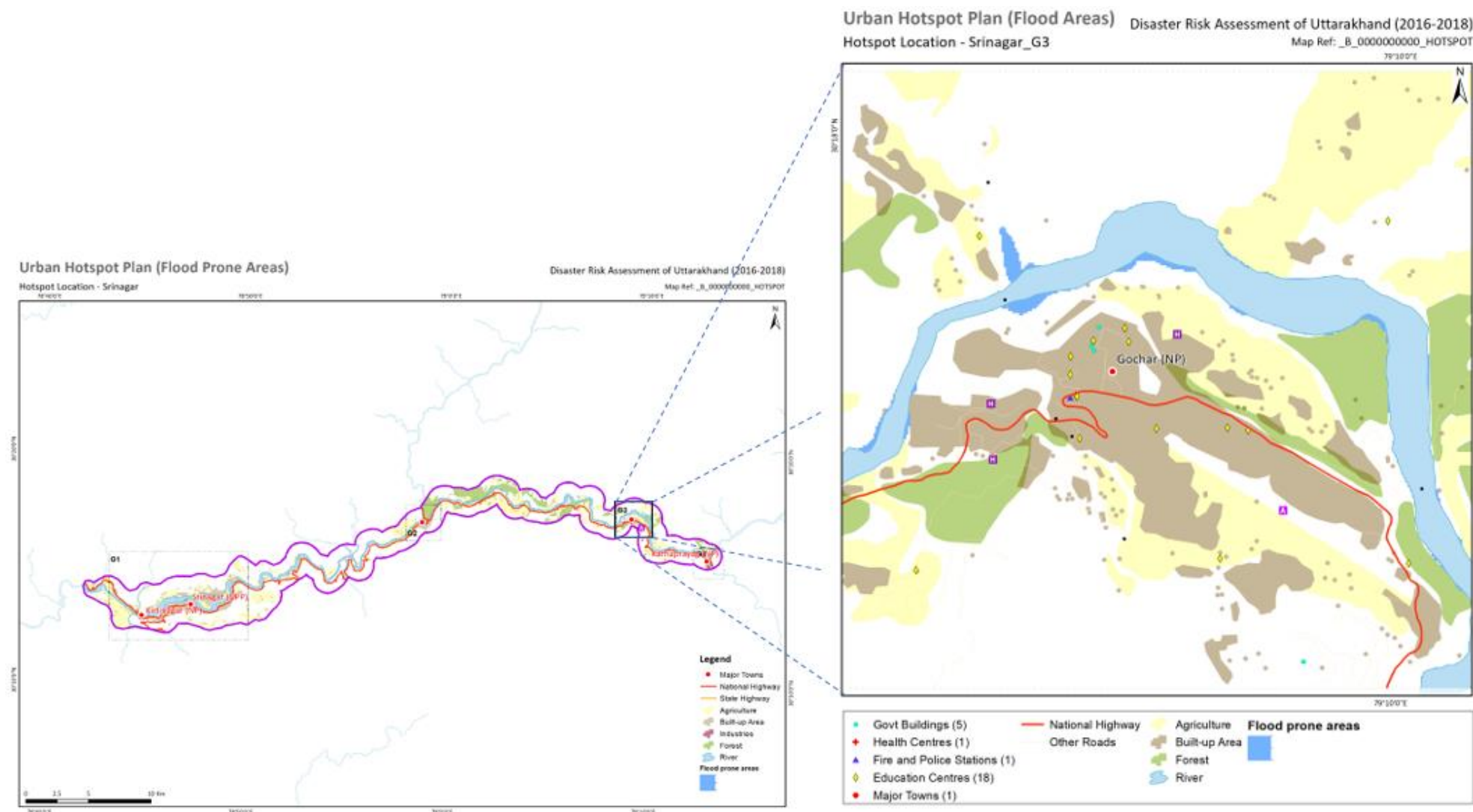
Map Ref: _B_000000000_HOTSPOT



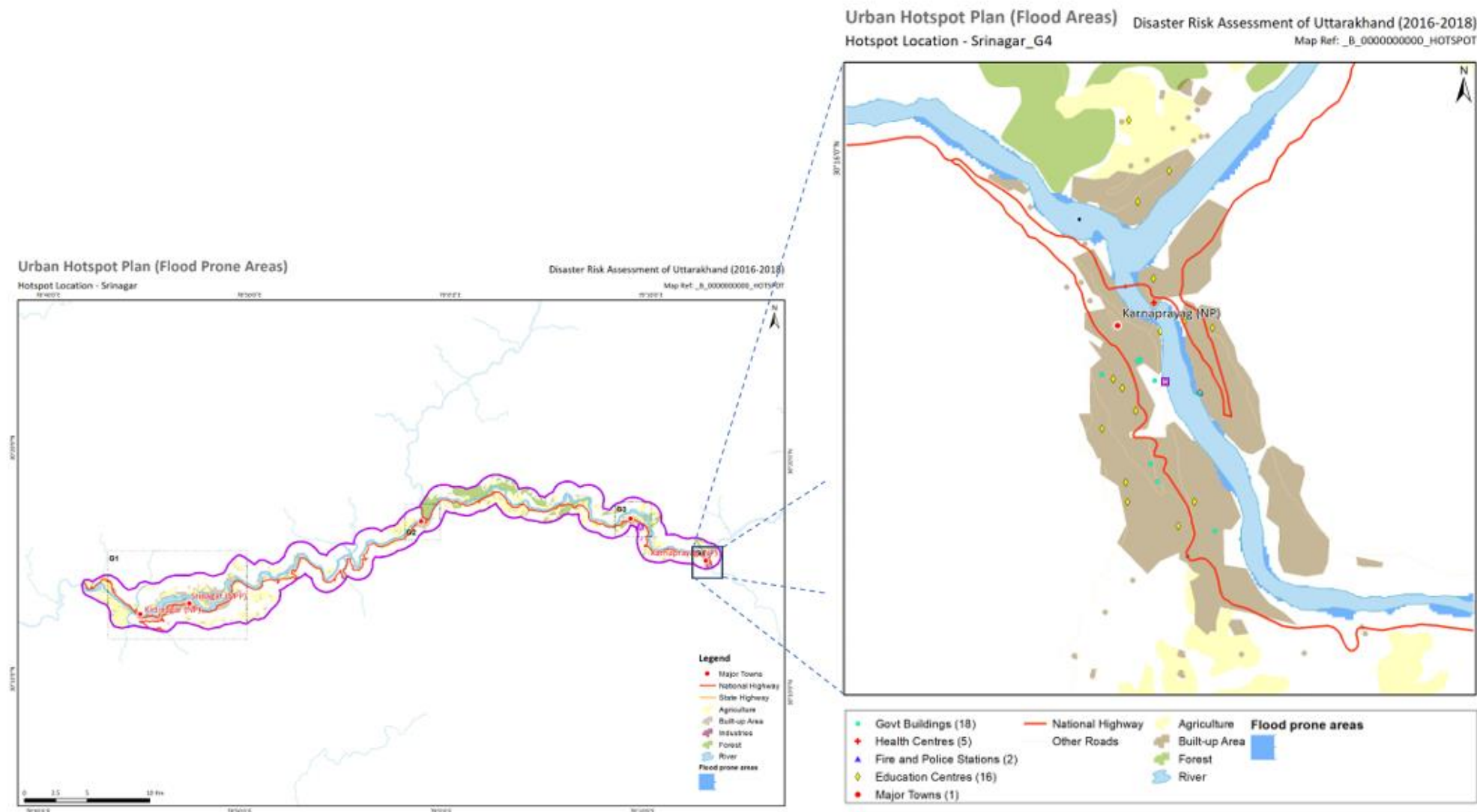
Map 7: Srinagar-Karnaprayag Fluvial Flood Hazard (Area G1)



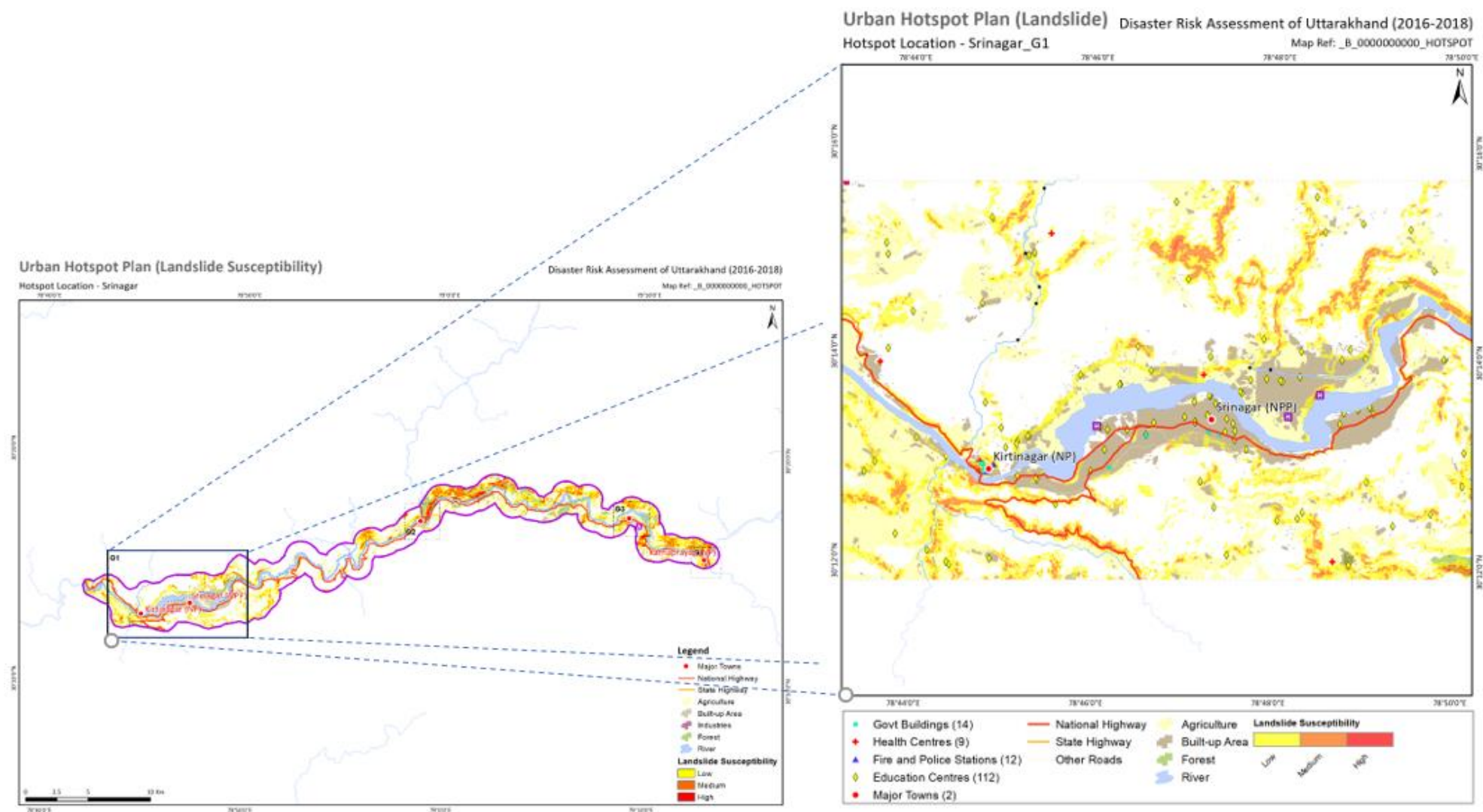
Map 8: Srinagar-Karnaprayag Fluvial Flood Hazard (Area G2)



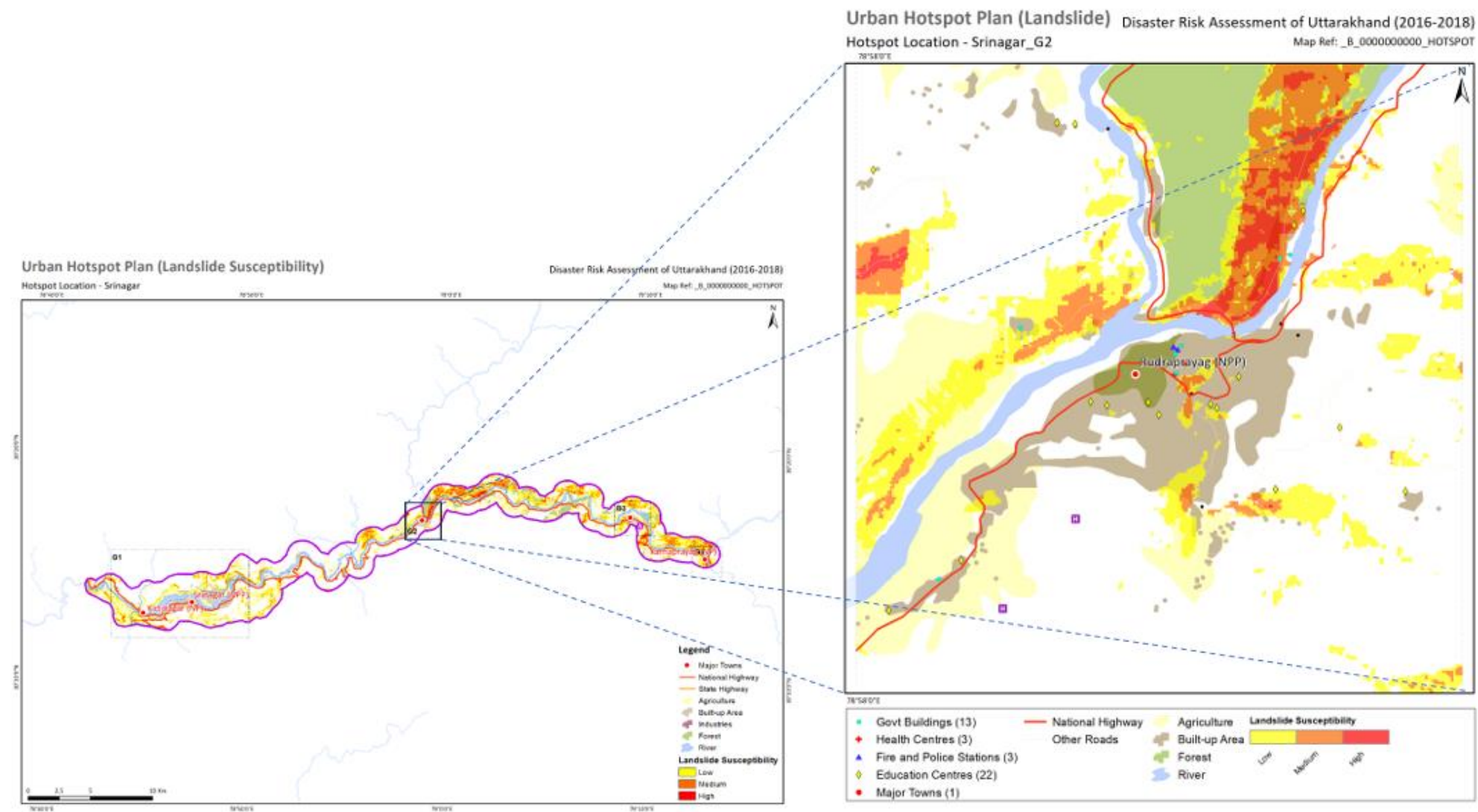
Map 9: Srinagar-Karnaprayag Fluvial Flood Hazard (Area G3)



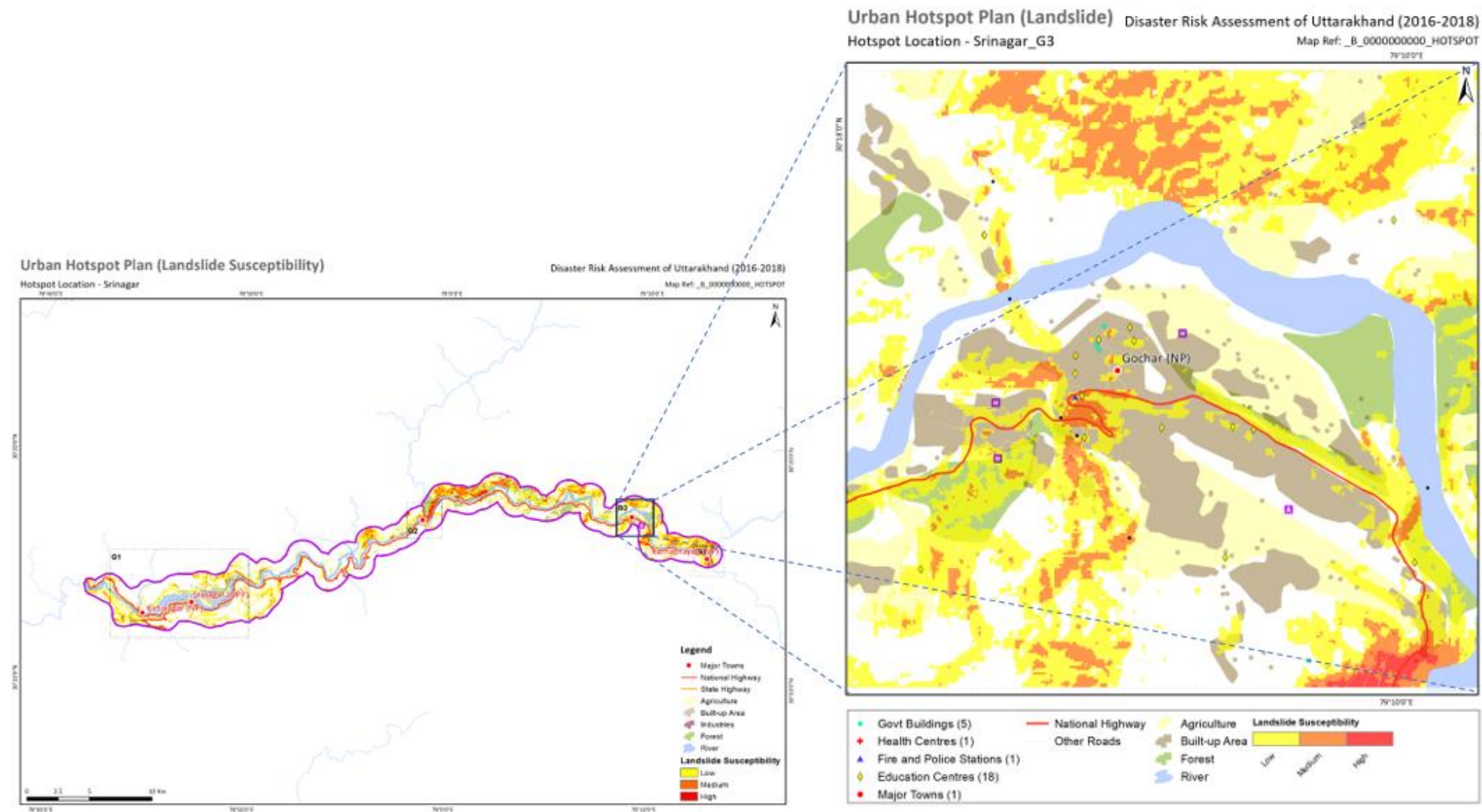
Map 10: Srinagar-Karnaprayag Fluvial Flood Hazard (Area G4)



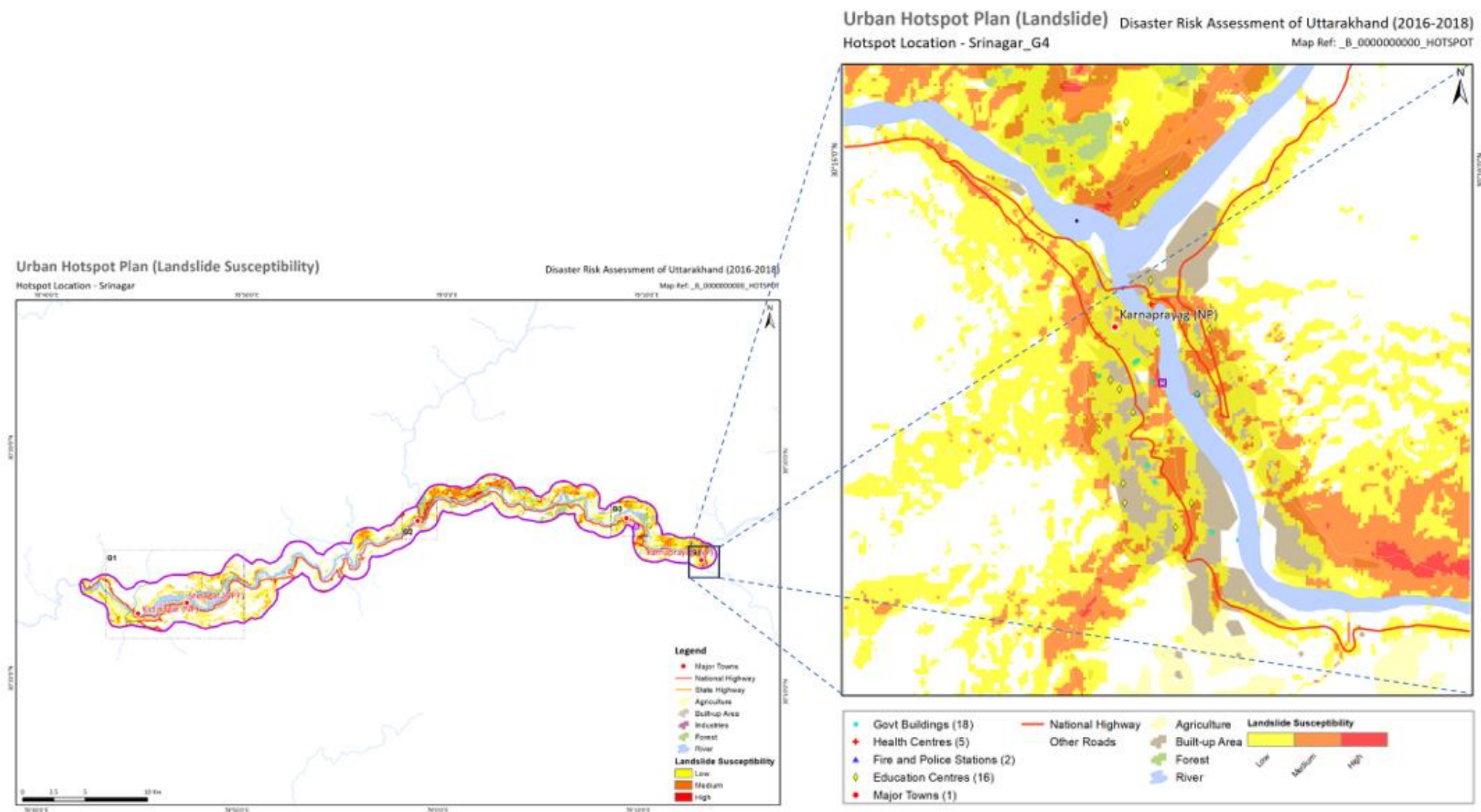
Map 11: Srinagar-Karnaprayag Landslide Susceptibility Map (Area G1)



Map 12: Srinagar-Karnaprayag Landslide Susceptibility Map (Area G2)



Map 13: Srinagar-Karnaprayag Landslide Susceptibility Map (Area G3)



Map 14: Srinagar-Karnaprayag Landslide Susceptibility Map (Area G4)

1.5 Strategy Implementation, Monitoring, Evaluation

1.5.1 Challenges in Implementation

Three challenges have been identified with respect to DRM in the Srinagar to Karnaprayag corridor and surrounds. In brief these are:

Finance - Section 40(2) of the DM Act 2005 stipulates that every department of the State, while preparing the DM plan shall make the provisions for financing the activities proposed therein.

The marginal cost involved in mainstreaming DRR in existing programs, activities and projects of the department are not very sizable and the departments may not find it difficult to arrange such funds. However, funds for disaster prevention and mitigation may not be available so easily unless the departments are able to negotiate such projects with the planning and finance departments with proper Cost Benefit Analysis (CBA).

Technical – the way data and other information are acquired and transferred is still essentially dependent on manual processes. As a result, planning and awareness are both compromised, as is an ability to take an effective overview and achieve a ‘whole of government’ capacity to integrated strategic planning. Best practice statutory planning and regulation (including enforcement) is now done at this level using a spatial approach with a GIS and data sets available with all departments. It is time for the city to enter the digital age in this respect. First steps are related to recruiting young graduate qualified spatial planners and engineers to deliver access to the requisite GIS data sets and facilitate planning and regulation.

Integrated mitigation, planning and preparation - An integrated approach across Government, the private sector and the community is required to ensure fully effective DRM. A simple example, is the need to pay much attention to Police & Fire, health specialisations; i.e. how to evacuate disabled, sick people or evacuation during fire/ smoke *etc*, During the development of any evacuation plan whether for city or rural, these specialisations need to be considered.

1.5.2 Proposed Management and Governance Structure

It is proposed that a Srinagar to Karnaprayag Hazard Mitigation Working Group is established by the Mayor/ or the Chairman of the Municipal Corporation as they can constitute a CDMC any time and then seek endorsement by the DDMA. The Municipal Commissioner/ or MNA (Mukhya Nagar Adhikari) should be the Secretary, with some Municipal Councilors, the city Chief of Police plus Head of relevant line Departments. City Trade Association, NGOs, CVOs, Civil Defense also need to be considered as possible members (not more than 20 people). This CDMC will take care & report to the District Disaster Management Authority (DDMA).

Once established the Group is to become responsible for coordinating implementation of the DRM Plan and its associated strategies and undertake the recommended annual review and reporting process. In order to develop momentum for plan implementation, the Group needs to establish an appropriate timeframe for the meeting schedule as plan implementation begins, meeting quarterly, half yearly or annually, depending upon the hazard profile of the cities.

The HMWG will meet annually to identify funding needs for the implementation of mitigation strategies, evaluate the effectiveness of the plan, and develop new mitigation strategies to reduce loss from natural hazards. The HMWG must have core level of funding to facilitate their own activities as well as giving effect to key recommendations at the municipal level. Reporting to the State (USDMA) on all such Expenditure and plans and accomplishments should also be an annual obligation.

1.5.3 Monitoring and Evaluation

The National DMP calls for all DMPs to be updated annually through a process of stakeholder review and revision. It is proposed here that Uttarakhand State, the Districts and Sub-Districts undertake an annual assessment and adopt a reporting process on the status and progress made in implementing the strategies adopted in taking the respective DRMPs forwards. If formulated as a report card then this can be used as both a governmental and Institutional device to drive mitigation, planning and preparation processes and yielding political and funding benefits to support the continuation of the process.

For each strategy there is the need to determining an indicator of progress and success. It is international best practice for all strategies to have a monitoring and evaluation component so that progress and can be measured and reported upon. Such a key performance indicator (KPI) needs to be defined using realistic time periods and a quantitative rather than a qualitative measure. For each strategy presented here a Key Performance Indicator (KPI) has also been provided is a measurable value that demonstrates how effectively the strategy is being achieved. These KPIs are indicative and need to be agreed and adopted as implementation part of the implementation process the relevant stakeholders.

2 STRATEGIES

2.1 Overarching Strategies

Overarching strategies are intended to apply to all disaster types and provide the backbone to a strong disaster risk management approach to mainstream administration.

2.1.1 Mitigation

Mitigation			
STRATEGY	DRIVER	OUTCOMES	KPI
Constitute a City Disaster Management Committee (CDMC).	The key to effective cross organization collaboration is to make it top down with designated tasks to be reported upwards, and then run a process of participatory engagement.	A CDMC with responsibility to ensure all DMP are formulated, understood and implemented with an obligation to report to the respective city/ward and state government.	A committee established and appropriate TOR agreed and signed off on within 6 months.
Development & updating of Disaster Management Plans at all levels within the Cities jurisdictions and across its departments.	At city level, DM Plans have not yet been developed.	DM Plans developed for all sectors of the City.	DM Plans developed within 12 months.
Development of City DM Plan/ Evacuation Plan (CDMP) and ensure it is widely distributed and understood.	The DMP not only needs to be up-to-date but it needs to be part of mainstream administration of the city.	A well prepared and tested DMP that is regularly reviewed, amended and distributed.	Development of the DMP within 12 months followed by regular annual reviews.
Development and implementation testing of Hospital/ Mass Casualty Plans.	DMP needs to be a mainstream component for both hospital and medical administrators as well as front line medical and support staff, including pharmacy and medical supply lines.	Demonstrated response capability within the medical and para medical support system of the city.	Development of the DMP within 12 months followed by regular annual reviews.

Development of school DMPs with appropriate simulations and debriefings.	School children not only need to be protected but are also a strong mechanism for dissemination of DRM thinking within families and the broader community.	Greater resilience at schools and with school children with demonstrated response capability.	Development of the DMP within 12 months followed by regular annual reviews.
Undertake an audit of the structural and life line support capability of all lifeline buildings to ensure that all are assessed and that the results of the comprehensive assessments are reported ¹ .	The National Institute of Disaster Management makes clear that preparedness and mitigation measures should include retrofitting of life-line buildings not only for saving lives of the vulnerable people, but also to ensure prompt and efficient response to disasters. Lack of information on this is an issue facing each hotspot and it needs to be a strategic priority so that appropriate works can be planned and budgeted for.	A report on the results of a comprehensive assessments of the structural resilience and life line support capability of all lifeline buildings so that appropriate works can be planned and budgeted for.	Twenty (?) percent of all life line buildings assessed annually and a comprehensive report provided to government.
Hydro-power projects in ecological sensitive regions like Srinagar must have comprehensive Disaster Impact Assessment (DIA) along with EIA & it should be mandatory for project clearance.	Hydro-power projects often negatively impact the ecology and disaster vulnerability of the region due to less emphasis placed on DIA and EIA.	Minimum adverse impact to ecology of the region post development of future hydro-power projects.	All proposed and existing hydropower schemes to have a disaster impact assessment mandated under the EIA process.
Hydro power projects must have muck disposal plan with proper site for muck disposal and plans for transportation of muck to the developmental sites should be well above the high flood zones.	Currently hydro-power projects don't follow an appropriate muck disposal plan, muck is hence disposed in convenient nearby locations. This causes damage to the ecology and exposes infrastructure downstream to potential debris during a flood event.	Reduction in debris in the event of a flood and reduced damage to ecology due to inappropriate muck disposal.	Muck disposal plans to be drafted and implemented within a stipulated time frame.

2.1.2 Planning and Preparation

¹ There are now web based assessments available specifically designed for this task. See for example, <http://www.retrota.com/>

Planning and Preparation			
STRATEGY	DRIVER	OUTCOMES	KPI
Increase public awareness, understanding, support & demand for hazard mitigation through the development of a city wide sales and marketing strategy and campaign focused on private sector community groups, industry, city agencies, pilgrims and tourists.	As noted above planning for risk management and response is still to be undertaken. Community awareness, preparedness and response capability is predicated on risk awareness and right response behavior. This process needs to be fast tracked and focused on. A brand awareness needs to be built along with a "need to know" desire using professional education and publicity expertise which is focused on a complete DRM cycle approach within key "market" sectors: schools and youth.	A risk management capable community/stakeholder lessening the level of probable loss of life and assets.	A public awareness campaign designed and sponsored within 12 months.
Training of school staff, hospital staff, municipal councilors, officials, community members, city/municipal ward level ERTs, students and teachers.	Training and testing of training through simulations and post-simulation debriefing/review sessions is critical for a deep response capacity within organizations and institutions.	A well trained and capable response capacity within and across key organizations and institutions.	Annual training and simulation testing developed within 12 months with annual testing and review.
Development of Standard Operating Procedure (SOPs) for DM within line departments, including delineated responsibilities down to individual level, resource inventories and training.	It is a first principal in organizational OH&S that SOPs are developed for disaster response with simple and clear directions as to how to respond and who has what responsibilities. This needs to include recovery planning such as the establishment of relief camps at identified safe zones and how these will be serviced.	A well trained and capable response capacity within and across organizations.	Development of organizational SOPs and lines of responsibility within 12 months; semiannual simulations and assessments undertaken and reported on the organizations executive management.
Development of Early Warning Systems and assessing their effectiveness within the city and surrounds.	Having effective and tested EWS capability is an important element of response planning and preparation as even several seconds warning may lead	A well founded, tested and serviced EWS for all critical response agencies and the community.	It should be established within 12 months and can be tested during regular mock exercises.

	to the saving of many lives. Such systems should be graded so that if there is a level of early warning this can lead to better short-term preparation by all agencies and citizens.		
Sensitization meetings at municipal ward level/ awareness camps.	To generate awareness about various types of disasters and associated vulnerabilities amongst community, making them better prepared.	A well awakened and enabled community to make effective decisions about reducing loss from various hazards.	Sensitization and awareness camps on regular basis.
Training of officials on damage & need assessment.	Training to undertake a damage and needs assessment across the entire city is critical to undertaking a successful assessment as a first step in building back better.	The assessment lays down the foundation for a fresh start in City's development efforts.	Designed training for 12 months. Annually tested.
Sensitization of NGO/CVO & other civil organizations to disaster risk mitigation, planning and preparation.	NGOs, CVOs and other civil organizations have a vital role to play in disaster mitigation, planning and preparation. Frequently they have expertise and funding that strongly compliments the government capacity and capability and they also have strong international connections that can provide rapid response support and additional capability.	Trained volunteers of social organizations can be a good resource for District & State Govt. for all DM related activities.	Interaction and meetings with these organizations on regular basis.
Building on the development of Standard Operating Procedure (SOPs) for DM within line departments, undertake a program of evacuation planning, training and practice within the City Public Safety Agencies such as Police & Fire, Health and the private sector.	Evacuation planning, training and practice within key response agencies such as Police & Fire, Health and the private sector and hotels is seen as a critical element in the planning and preparation process, particularly where multi-agency coordination is a vital component in response efficiency.	A well planned and trained response capability for all disasters that spreads across the City's Public Safety Agencies and the private sector.	It should be conducted on regular basis.

2.1.3 Response

Response			
STRATEGY	DRIVER	OUTCOMES	KPI
Establishment/ Activation of City level Emergency Operation Center (EOC).	A EOC is a combination of various line departments of Govt./ or other agencies whose services are generally required during incident response. At District level, EOCs are well established, however, at City level, this still needs to be done. Consideration should be given to incorporating EOC capacity into the existing processes for managing pilgrimage movements.	A well-established EOC directs the operations at the disaster site and coordinates at all levels to meet the conflicting demand at the time of disaster.	Establishment and functioning of EOC within 12 months.
Establishment of Incident Response Mechanism (IRS) at the city level.	Effective response to emergency situation requires a high degree of coordination amongst various departments and agencies within and outside Government at different levels for performing multiple tasks in an integrated and time bound manner for achieving specific results.	NDMA has developed an IRS as an effective mechanism for performing various tasks of disaster response and issued comprehensive guidelines for the same. In the State of Uttarakhand, all districts have adopted & established IRS. However at City level, it is yet to initiated.	Establishment and functioning of IRS at City level within 12 months.
Establishment of Emergency Support Functions (ESF).	Disaster response is a multi-agency function. The Department of Disaster management is the Nodal Agency which will be responsible for managing/ coordinating all the functions of disaster response, while other agencies will provide necessary support and assistance in managing emergency situations.	In order that these functions are performed in smooth, effective and fail proof manner.	In specific context of Uttarakhand, important ESF should be identified with 12 months.
Deployment of ERTs.	Emergency response to be performed during disaster shall depend on the level of disaster. At local level, the emergency response teams, consisting volunteers	A smooth & effective response by trained ERTs.	Performance/ level of readiness should always be checked on regular basis.

	from Wards, NGOs, CVOs & other organizations can be deployed.		
Development of regular set of simulation exercises around a designated disaster and area within the city.	Based on the given disaster scenario, the simulation or mock exercises can be performed at school, offices, market and ward level to check the level of preparedness & readiness of various ERTS and community.	Simulation or mock drills reduces the gaps in preparedness & increases the level of response.	The City DMG can develop a simulation exercise calendar annually.

2.1.4 Recovery (Short-Term)

Recovery			
STRATEGY	DRIVER	OUTCOMES	KPI
Conduct damage & need assessment just after disaster as the basis to planning the restoration & improved disaster resilient housing, government buildings & cultural heritage in city.	A damage and needs assessment across the entire city that includes all structures and infrastructure support as well as non-structural attributes is the first step in building back better.	Foundation is laid for a fresh start in an area's development efforts as well as to reconstruct the damaged areas & contribute to the long term development plan.	Assessments should be undertaken within 24 hours of disaster.
Provide community safety and effective management of victims through the establishment of relief camps at identified safe zones.	Based on pre-disaster planning adequate numbers of buildings/ open space shall be identified where relief camps can be set up during an emergency. This will be guided by the minimum standards of relief as laid down by the NDMA & the SDMA in terms of Section 12 & 19 respectively of DM Act.	The affected community must be provided all assistance so as to ensure that they are able to live with dignity.	Members of ERTs can be designated to monitor the RF functioning.
Restoration of essential services: road connectivity, electricity supply, water supply etc.	Disruption in essential services hamper recovery efforts and are a cause of distress for the affected people.	Actions are taken swiftly with resolve in order to retain community confidence & minimize economic disruption.	Recovery plan should be developed, tested annually.

2.1.5 Recovery (Long Term)

Recovery			
STRATEGY	DRIVER	OUTCOMES	KPI
Strengthen the capacity of people and communities to reduce the risks and vulnerability & enhance social cohesion through a Post Disaster Recovery Framework.	There is not at present a Post Disaster Recovery Framework (PDRF) for the State, however, all responsible agencies, the community and the private sector need to plan not for the inevitable disasters that will occur but also for recovery. The proposed City Disaster Management Committee (CDMC) needs to take the lead as part of its obligations.	A Post Disaster Recovery Framework that links to specific hazard responses, recovery Plans and the agencies responsible for pilgrim activities; as well as strategic growth strategies for the city and surrounds.	A first draft within three years.
Develop sector (e.g. defence, industry, tourism, agriculture, NGO etc) plans to restore & improve access to services & improve environmental resilience in rebuilding communities and community cohesion.	Sector specific plans should be used to guide, plan & estimate resource requirements for recovery & reconstruction at the sector level. Sector plans should also be developed into tools to monitor progress against targets on an ongoing basis. Similarly, social sectors which include education, shelter, food & nutrition, health also frequently are neglected, so social sector planning is very essential. The scope of the sectoral plans include both the development deficit & the needs/ damage emerging out of the recent disaster.	To quantify the needs for each of the sectors to enable a convergent and coordinated recovery process wherein Govt., NGOs & corporate sectors could bring in their respective capacities & capabilities to implement the plan.	Each plan should be developed within 12 months. Updated annually.
Restore & improve disaster resilient housing, government buildings & cultural heritage in City.	Disaster Resilient Housing (multi-resistant) is a key priority in building back, whereby the owners will be responsible for and will manage their own reconstruction, make their own choices & mobilize their own resources	The development of multi-hazard resistant housing as a fundamental rebuilding block for the city and surrounds.	Initiate once response & relief phase is over. Monitoring through team of experts. Guidelines for owners should be developed within 12 months.

	i.e. in other words an Owner driven Reconstruction (ODRC). After the June 2013 disaster, this exercise was carried out by the State Govt., where more than 2500 houses were reconstructed across the State under ODRC.		
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2.2 Specific Strategies for Earthquakes

2.2.1 Introduction

Earthquakes of any magnitude in highly urbanized areas bring a particular challenge that means many people and much property is at risk as result of the high population and building density. Many parts of the Srinagar-Karnaprayag corridor are definitely in a category where serious loss to life and property damage demands full attention to both structural and non-structural solutions in reducing risk and improving resilience.

Rudraprayag and Karnaprayag being two of the five sacred river confluences in the region are particularly congested due to rapid urbanization encouraged by high returns from real estate during the tourist season. It is in these two cities where strategies to mitigate risk of earthquakes are critical to the adequate safeguarding of life and property.

2.2.2 Earthquakes - Planning and Preparation

Earthquakes - Planning and Preparation			
STRATEGY	DRIVER	OUTCOMES	KPI
Design & develop public education campaign for emergency preparedness & hazard mitigation for those who live & work in Srinagar to Karnaprayag cities and surrounds.	Just as DM needs to become mainstream in the thinking and actions of Government institutions so should Disaster response awareness in businesses and the community generally be integral to their daily lives. This awareness will then play a key part in reducing vulnerability, raising resilience and reducing impacts of a disaster as a result of people responding in a well informed and disciplined manner. Significant research ² shows that “shock” from traumatic situations can be very debilitating but can be overcome through awareness and training.	Create community resilience through emergency preparedness & hazard mitigation awareness programs via communication channels such as TV, print, pamphlets, street plays etc.	An awareness campaign plan should be developed for 12 months.
Increase the community resilience by expanding the number of Community Emergency Response Teams (CERT) in the Srinagar to Karnaprayag corridor and surrounds.	CERTS are seen as excellent first responders as they are first on-site, have in-depth knowledge of resources and victim location likelihood, strongly motivated and effective networks. Funding remains an issue. As per the guidelines of GOI, 10% of State Disaster Response Fund (SDRF) can be spent on Training & capacity Building programs; Every DDMA needs a yearly allocation out of SDRF for this purpose.	Increased community resilience through first response capability by community members.	Formation of CERTS within 6 months & their training. follow-up trainings every 3 months.

² See for example: Laurence Gonzales, *Deep Survival*, 2017;

Modify evacuation plans to incorporate City Public Safety Agencies such as Police & Fire, Health departments.	Evacuation plans need to be developed hazard specific & in consultation/collaboration with the specialized agencies.	A well updated & documented evacuation plan can reduce the life loss.	Ongoing process.
Train employees & practice City Facility Evacuation Plans.	The evacuation plans need to be well disseminated amongst community, business community, schools, city facility centers , offices.	Increases community resilience	Ongoing process. Practice every 3 months.

2.2.3 Earthquakes - Mitigation

Earthquakes - Mitigation			
STRATEGY	DRIVER	OUTCOMES	KPI
Strengthen planning, management and regulation of EQ risks on infrastructure through improved understanding of existing and future risk (data) to private and public infrastructure, transport and communications.	Several State & National level Institutes/ Organizations in the State, are engaged in the researches concerning hazard zonation & risk/vulnerability assessment of the State, however the recommendations/ results of the studies are not commonly available to the concern authorities. Mapping should be done on a priority area basis focused on high density or vulnerability areas first.	Preparation & updating of Hazard Zonation maps of the City as the basis to planning and preparation procedures and training simulations.	Complete within a three year period mapping of all areas in the City with annual reporting of progress against an agreed plan of priority areas.
Review current building standard compliance and develop mechanisms to strengthen levels of compliance.	Enforcement of the most current Building Codes Standards to protect the built environment in the City is required as is retrofitting. The State has amended building by-laws and the Town & Country Planning Act, however due to non-compliance/ or lack of	Effective compliance to building codes and statutory planning zonation and codes for the City and surrounds,	Ongoing process. Review every 6 months by State Govt.

	enforcement by the concerned authorities, the habitation of unsafe/high risk areas is expanding.		
In line with the overarching strategy to audit lifeline buildings, formulate a policy for retrofitting of existing public facilities & services according to contemporary standards.	The seismic safety of all lifeline buildings must be assessed in a time bound manner. A approach should be to selectively retrofit lifeline structures and buildings on the basis of priorities to be fixed by the Govt.	A detailed & comprehensive safety assessment of buildings/ structures to determine type of retrofit technique.	Assessment should be completed within 3 years.
Enforce Earthquake Safe Construction Technology in the City and incentivize with insurance benefits and/ or utility access.	All departments/ agencies must ensure that construction undertaken by their depts. and agencies under their control strictly comply with the standards & specifications prescribed by the Bureau of Indian Standards & further included in the NBC.	Appropriate mechanism for compliance & review of all construction designs submitted to ULBs/ Development Authorities/ construction agencies.	Ongoing process
As part of the overall awareness campaign, emphasize reduction of non-structural hazards in homes, schools, business centers & offices of the city.	Significant harm can occur to people in situations where non-structural hazards fall onto them during an earthquake. Awareness and subsequent repositioning/fastening etc. can significantly reduce the risks of damage.	Improved resilience to harm and likely damage as a result of awareness and small amounts of preparation/investment.	Ongoing process

2.2.4 Earthquakes – Response

See strategies listed in Overarching Strategies above.

2.2.5 Earthquakes - Recovery (Short & Long Term)

See strategies listed in Overarching Strategies above.

2.3 Specific Strategies for Fluvial Floods

2.3.1 Fluvial Floods – Mitigation Strategies

FLUVIAL FLOODS - MITIGATION			
STRATEGY	DRIVER	OUTCOMES	KPI
Improve the understanding (and access to data) of flood risk ³ as the basis to strengthening planning, management and regulation of flooding impacts.	Limited access to critical information including a detailed flood assessment base on accurate survey data results in poor planning and management, including sand extraction (mining).	A scientifically accurate assessment of flood levels and likelihood as well as testing of mitigation strategies as the basis to formulation of flood management policies within the city.	Flood assessment completed within 12 months.
Srinagar to Karnaprayag Corridor to develop a Municipality Flood Risk Mitigation Strategy which includes funding mechanisms, KPIs and auditing and reporting processes.	NDMA has issued guidelines for management of floods, but there is no adoption of these guidelines/ regulations in the Srinagar to Karnaprayag corridor.	Strategy formulated and implemented. Formulation and adoption of flood management policies within the City.	Flood risk strategy drafted in 12 months, finalized in 18 months following the completion of the flood risk assessment.
Develop compliance policies and associated regulations that provide realistic incentives supported by regular auditing and reporting of compliance to the State Government.	The Municipality via the State is responsible to incorporate NDMA guidelines/ provisions into the Building by-laws & to implement. As yet this has not happened in the Srinagar-Karnaprayag corridor.	A regulatory process and auditing program of compliance.	A total number of agreed sites audited each year for compliance. Follow up where non-compliances recorded, including imposition of fines.

³ Note that UDRP for flood risk was undertaken at a Block level with no access to suitable high resolution and accurate elevation and drainage data (the Cartosat satellite imagery used has an accuracy is 8m vertical). The flood maps produced cannot capture some of the localized effects (particularly for rainfall ponding) that are critical in flood modelling and the level of detail needed for drainage planning at the city level. The state government has procured for a LIDAR data covering from Haridwar to Kedarnath – it should be available in a few month time. Ideally the flood modelling should be advised to be re-done in high exposure areas (e.g. Srinagar, Rishikesh, Haridwar) if possible using a 2D models for the larger floodplains (Rishikesh, Haridwar) and using accurate elevation of embankments and detailed operation rules of the barrages and other structures. The UDRP has provided discharge return periods (mean, std. dev) for 120 locations across the state that should be valuable for any other studies downstream. Gauging records can help confirm those results in more locations but will take time to acquire (basically 30+ years of data are required for proper extreme statistics).

Construction of properly designed RCC structures, concrete slabs and masonry retaining structures are recommended along the Alaknanda river bed for reduction in undercutting and river bank erosion.	Constant river bank erosion causes an increase in the flood plain and becomes a significant hurdle for river bank development apart from risking collapse of the river bank.	River bank erosion is prevented paving the way for sustainable river bank development.	Site identification complete and construction to be completed within 24 months.
Develop a City - Insurance Sector - Private sector dialogue around flood mitigation and risk management incentives through premium structures and assessment payout adjustments for proven compliance.	Positive incentives are required to encourage community engagement in adopting flood risk policies and complying with regulations.	A measured reduction in non-compliance as designated in the Municipality flood risk management strategy targets.	Increase of properties (target % rate of increase to be determined by State Govt) taking out flood risk insurance policies annually.
Develop a trans-institutional legal framework for flood management at the State and Municipality level.	In developing a Strategy there is the need to consider trans-jurisdictional boundaries across departments and state agencies, noting that the State of Uttarakhand does not have a legal framework. But even more so, the framework when developed needs to be clear as to institutional responsibilities and ensure an easily understood and simple set of approval and regulatory processes.	An easily understood and simple set of approval and regulatory processes bound in law that can operate at the municipality level.	A draft set of Laws within 12 months. A final set of ratified laws with 24 months. A set of policies and regulations drafted and ratified in parallel.

2.3.2 Floods - Planning and Preparation

FLOODS - PLANNING AND PREPARATION			
STRATEGY	DRIVER	OUTCOMES	KPI
Develop a municipality wide Flood Risk Mitigation Strategy which includes funding mechanisms and KPIs with auditing and reporting processes.	A lack of funds and a strategic approach to addressing flood risk is still an issue in Srinagar to Karnaprayag. The lack of scientifically based data and risk analysis at the fine scale (see above in Overarching Strategies) is part of the reason but there is still a need to develop a strategy to underpin funding and the planning of response strategies based on the scale of the floods and the desirable levels of early warning.	A well thought out strategy for funding and delivering on risk reduction associated with flood mitigation and response.	The Flood Risk Mitigation Strategy drafted with 12 months and enacted within 24 months.
Develop public-private partnerships for addressing Flood Risk Mitigation Strategy issues, which include funding mechanisms, awareness and the implementation of mitigation projects.	There is a lack of funds and CSR driven partnerships in addressing flood risk.	Corporate Social Responsibility (CSR) activities from the Corporates/ Industries and funds from many bigger NGO's or CVO's will be harnessed for future mitigation projects.	The Flood Risk Mitigation Strategy drafted with 12 months and enacted within 24 months. CSR partnership agreements drafted with three large Companies and three local NGOS within 18 months.
Develop policies and programs intended to increase the number and preparedness of CERTS at a ward level.	At municipal ward level, there is an opportunity for CERTs to be formed comprising community members. This should be done as part of the Flood DRM Plan.	An increase in the number and preparedness of CERTS at a Ward level lowering the risk of loss of life and property during incidents.	Six (6) certification programs run per 12 months period with a 80% or greater accreditation.
Test and revise evacuation plans across the city through a process of mock disaster drills and a city wide review workshop following each drill focused	Mock drills are a critical element of DRM planning and training. With the help of local NGOs/CVOs, local residents mock drills can be conducted	An increase in the number and preparedness of all participants in an incident thereby lowering the risk of	A mock drill run in every ward every 12 months. A citywide drill run every 2 years.

on gleaning strengths, limitations, opportunities to improve and risks if these are not realised.	on regular basis to check the evacuation plans.	loss of life and property during incidents.	
Development & updating of Disaster Management Plans at all levels within the Cities jurisdictions and across its departments.	At City Level, DM Plans have not yet been developed.	Flood DM Plans developed for all sectors of the city.	Flood DM Plans developed within 12 months.

2.3.3 Floods – Response

See strategies listed in Overarching Strategies above.

2.3.4 Floods – Recovery

See strategies listed in Overarching Strategies above.

3 LINKS TO NATIONAL AND STATE LEVEL PLANS

Sendai Framework

www.unisdr.org/we/coordinate/sendai-framework



National Disaster Management Plan

www.ndma.gov.in/en/national-plan.html



Uttarakhand State Disaster Management Authority

www.usdma.uk.gov.in



Uttarakhand State Disaster Management Plan

www.dmmc.uk.gov.in/files/pdf/complete_sdmap.pdf

Disaster Risk Assessment of Uttarakhand

Project Information Sheet

OVERVIEW

With support from the World Bank, the Uttarakhand State Government has engaged experts to complete a disaster risk assessment of the entire state so that it can understand the threat from natural hazards and the exposure of communities and critical infrastructure. This is the first attempt to develop an integrated disaster risk inventory for the state and is viewed as an important step to support the recovery efforts and to underpin future decision-making and planning.

This report is one of the outputs from the risk assessment and presents risk mitigation strategies for a location of high risk in the state. It serves as a case study for similar locations throughout Uttarakhand.

WHAT RISKS HAVE BEEN ASSESSED AND HOW?

This project assessed the threat and potential consequences of **flooding** (both fluvial and flash floods), **earthquakes**, **landslides**, and **industrial hazards** in Uttarakhand. It developed a comprehensive inventory of data for hazards and assessed the likelihood and consequence of these hazards in the future.

This hazard assessment adopted proven tools preferred by the World Bank for assessing risks, and the team collated existing data and completed field surveys to build up a strong profile of vulnerability and exposure across the state.



One of the tools is CAPRA. It is a software suite that is a free, modular, open-source, and multi-hazard tool for risk assessment. CAPRA provides a risk calculation platform integrating exposure databases and physical vulnerability functions under a probabilistic approach. CAPRA evaluates risk in terms of physical damage and estimates direct economic and human losses.

HOW WILL THE PROJECT BENEFIT UTTARAKHAND?

The outcomes from this project will help Uttarakhand to develop its resilience to natural and industrial hazards. The information will be used by the State Disaster Management Authority to support recovery efforts and future master planning. It will help them prioritise activities and investments in infrastructure.

The system deployed for is easy to maintain and manage and will add value for the State Government and communities. The team looks forward to engaging with local experts and stakeholders to understand the vulnerabilities and exposure of communities across the state.

THE TEAM

The project was completed by technical implementation experts from the following partner organisations:



www.dhigroup.com



www.ern.com.mx



www.ait.ac.th



www.earthobservatory.sg



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Track the project activity at:

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PROJECT PROGRAMME

The project started in May 2016 and concluded at the end of October 2018.