उत्तराखंड शासन

STRATEGIC PLAN FOR RISK REDUCTION

Increasing resilience through effective

RESPONSE, RECOVERY, MITIGATION, & PREPAREDNESS

TOURISM RISK HOTSPOT

KEDARNATH

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 this Location

This is one of a series of case studies developed for "hotspots" in the Indian State of Uttarakhand and is one of four relating to disaster risk management issues and strategies to address tourism concerns in the State. As such, the strategic focus is entirely on tourism. Other case studies deal with the strategies to address earthquakes flooding and landslides in both urban and rural settings within the State. These documents should be consulted with respect to non-tourism-based strategies.

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. Promotion of effective disaster preparedness in tourism destinations is a governmental function yet requires the participation of all at the destinations.

It is important to recognise that tourism from the DRM point of view needs to be considered in terms of individual destinations and the way people travel to and from these. Even so, leadership in this regard has to come from Government, the industry is a key stakeholder but is not likely to undertake a whole of system approach to the management of the problem. Moreover, policy and regulations may need to be enforced as it has been demonstrated elsewhere that short-term commercial imperatives will frequently overtake long-term benefits to the whole economy and society at large.

Disaster management generally needs to be systematic and positive in approach. DMP should promote collaboration between public, private and community stakeholders and seek proactive responses to perceived threats. Adopting strategies that are positive, integrating and allow changes with changing circumstances is important. This is particularly true when considering DRM for the tourism sector within a region or area.

The Kedarnath Strategic Tourism 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 (**EXTREME**), fluvial flooding (None), flash flooding (**MODERATE**) and landslides (**HIGH**). Kedarnath is one of two of the 14 case studies presented here that is categorized as Extreme for earthquake risk. The implications for this with respect to tourism are that every year lakhs of pilgrims are exposed

to this risk. Risk mitigation hence assumes great importance in this case. Kedarnath has a unique importance from a disaster risk mitigation point of view due to the fairly recent tragic disaster in 2013. There were many aspects in which the Kedarnath hotspot was highly vulnerable and unprepared for a disaster of such proportions. The strategies in this document seek to address these vulnerabilities in a way that prepares Kedarnath better in case of a future event. It is useful to note briefly some of the infrastructure projects/development already initiated by the government post the 2013 disaster:

- Widening of the approach road to Kedarnath.
- Construction of ghat and retaining walls on rivers Mandakini and Saraswati.
- Construction of houses for the purohit community.
- Construction of a museum and a grand 'samadhi sthal' of Adi Sankara.
- The platform of the shrine has been expanded from 1500 sq m to 4125 sq m.
- 12 feet of debris that had spread across 270 metres from the shrine location had been cleared to make the shrine visible to pilgrims from a distance.

The retaining walls on the rivers is very important as it prevents toe erosion and hence lends strength to the trekking route. The widening of the approach road is also a step in the right direction as a wider road will ease the pilgrim traffic and prove helpful in case pilgrims need to rush to safety. The museum will be a powerful communication tool and should incorporate disaster preparedness to help instill a sense of "Do's and Don't's" amongst the tourists.

Disaster management needs to be systematic and positive in approach DMP should promote collaboration between public, private and community stakeholders and seek proactive responses to perceived threats. Adopting strategies that are positive, integrating and adaptable to change due to changing circumstances is important.

Tourism features as a prime element in the Uttarakhand Vision 2022[1]. The two goals are:

- Promote the state as a global tourist destination by show-casing its spiritual, cultural and adventure tourism.
- Target 5 lakh international tourists by 2022.

Inflow of foreign tourists into the state increased from 1.01 lakh in 2014-15 to 1.05 lakh in 2015-16.

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.

[1] IBEF Brief Uttarakhand May 2017 www.ibef.org

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, Plan, Action?

"… a plan of action designed to achieve a long-term or overall aim."

A **Strategy** is a planning tool developed with a long-term perspective. It provides a common vision and includes certain guiding principles and priorities. It needs to incorporate certain flexibility and periodic evaluation mechanisms to adjust course, evolve and adapt to changing circumstances, while continuing to provide guidance.

A **Plan** provides the operational orientation for implementing the strategy. It defines specific goals to reduce … risk together with priority actions and activities to achieve these goals. It goes into needed detail as it assigns roles and responsibilities, mobilizes resources and allocates budget. It also sets timelines, indicators, and mechanisms for monitoring progress.

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

Abstracted in the main from: Implementation guide for local disaster risk reduction and resilience strategies, UNDSIR 2018

Mid to Long Term
Understanding risk and identification of areas of greatest loss. Mitigate potential problems in advance of event.

Ongoing & Long Term
Prepare agencies, private sector and communities for the next event. Maintain state of "Readiness".

Short Term & Long Term
Once the event, and the immediate threat to life, property, and the environment is over, recovery can begin.

Damage Assessment, Stabilise & Provide
First repsonders save and secure lives and assess damage. Coordination of resources and provision of critical supplies.

1.3 Area and Community Profile

1.3.1 Topography

Kedarnath is located in the Himalayas, about 3,583 m (11,755 ft) above sea level near Chorabari Glacier, the head of river Mandakini, and is flanked by snow-capped peaks. The topography is highly undulating which is made up of immature terrain and very young mountains. The steep terrain, loose rocks, sharp mountain sides makes any infrastructure development very difficult. The Mandankini running through the hotspot area has a very strong flow aided by the steep slopes and gorges. These conditions have made the river highly eroding in this area having created deep gorges throughout.

1.3.2 Climate

Due to its high altitude the weather in Kedarnath remains cold for most part of the year. Hence, summer here is cool with pleasant temperature while winter is severe. It also experiences heavy rainfall during monsoon season and light to heavy rainfall due to local disturbances in the summer season. During summer season the temperature varies around 20°Celsius. Generally, it is cold and temperate in Kedarnath. The overall precipitation in the hotspot area is very high, in the summer and it being in the form rainfall whereas in the winters in the form of heavy snow fall. The average temperature in Kedarnath is 5.1 °C. The average annual rainfall is 1278 mm which is much higher than most areas in the world.

1.3.3 Demographics

The Kedarnath hotspot area experiences a highly transient population, which corresponds to the opening and closing of the Char Dham pilgrim yatra. This population consists of laborers, porters, artists, transport facilitators and tradesman who come to the Kedarnath hotspot area to earn their livelihood for the year through the pilgrimage. These people come from all the districts of Uttarakhand and nearby states also. Many laborers also come from Nepal to earn sustenance in the pilgrim period. It can be said that the 4 pilgrim shrines of Char Dham offer livelihoods and sustenance to most of the population of the state.

Kedarnath town becomes uninhabited for the winter months, where the residents shift their settlements to villages, hamlets and towns in the downstream of the valley. In spite of the population being a highly transient one, it must be kept in mind that the population increases during summer and the monsoon, overlapping it with a weather period in the greater Himalayas (especially in Kedarnath valley) which is highly erratic with high risk of flash floods and landslides in these areas. In the hotspot area considered, Gaurikund and Sonprayag are left with only few residents who belong to these areas in winter. Most of the population of the town consists of people who earn their livelihoods from religious tourism. This is evident from the high percentage of workers (99.5%) and men (98.7%). However, the demographics of the transient populations assume greater significance in the context of disaster risk mitigation. Up till 2013, the average annual pilgrim count was at around 5 lakh pilgrims. Post 2013, there has been a lull in the number of pilgrims due to drop in tourist confidence and inadequate infrastructure in the aftermath of the 2013 disaster. However, the year 2018 has seen a resurgent tourist confidence with the pilgrim count having surpassed 6 lakhs within the first half of the season.

1.3.4 Economy

Kedarnath's economy and that of the hotspot area is entirely dependent on religious tourism. There are no recorded workers engaged in agriculture or the household industry. The ever-increasing tourist number is driving the economy of the hotspot area. The tourism industry is leading massive infrastructure change in this region despite it being a hazard prone region.

1.3.5 Development History

The 2013 floods caused a lot of destruction in Kedarnath, Rambara and Sonprayag with the first two almost entirely destroyed. The flooding river threw huge amounts of debris which caused great losses to life and property in the region. This was a major event in the history of the region and Kedarnath has since been rebuilding and recuperating from the impact of the 2013 disaster. Post the devastating floods of 2013, 5 redevelopment projects were undertaken for the restoration of the pilgrim town. Kedarpuri –which is the name given to the settlement around the temple – is being developed on the lines of a smart city with technology aiding crowd management and other pilgrim services as well. As on 2018, the huge rise in the number of tourists indicate that the infrastructure development has been able to cope with the demand.

The Char Dham Expressway National Highway project aims to connect the four dhams to Rishikesh with a two lane (each direction) road with a minimum width of 10 metres. This all-weather road will improve access to Kedarnath and potentially augment the tourist capacity of the region.

1.3.6 Regional Context

The area defined under this hotspot encompasses the entire stretch from Kedarnath in the north to village Tarsali towards the south including prominent villages and hamlets such as Rambara, Gaurikund, Sonprayag and Sitapur. Sonprayag is the first point where all the pilgrims come to park their private vehicles and embark on the pilgrimage journey in a government taxi meant to carry the pilgrims to Gaurikund from where the arduous hike to Kedarnath starts. Since the motorable road is only upto Gaurikund, the towns north of Gaurikund are practical resting/halting spots for the large number of tourists arriving every day during the peak season. Due to the tedious terrain, services (Power, communications and transport) are bound to be disrupted in the event of an earthquake, landslide or flood. Disruption of services lead to complications in relief and recovery efforts that, in turn, exacerbate the disaster risk.

The motivation behind choosing the Kedarnath hotspot area from Sonprayag up to Kedarnath is that the entire area behaves in a homogeneous manner to achieve a successful pilgrimage season. Once the pilgrims reach Sonprayag, they have to leave their private vehicles and board on taxis to take them to Gaurikund. Once the hike for Kedarnath starts from Gaurikund, the pilgrims are completely dependent on the local people and the local system to ensure their safe return. The hamlets like Chotta Chatti, Rambara, Linchauli enroute are used as resting spots by the pilgrims and the locals here have opened many resting eateries to support their livelihoods. This hotspot area is unique in a way none other than any of the Char Dham locations because of the unique nature of hike and the interdependent

behavior of habitations along the way. It is important from a disaster risk point of view to study such an area in Uttarakhand and understand sustainable disaster risk management strategies for this area.

1.3.7 Critical Facilities/Infrastructure

Kedarnath has no direct road nor rail connectivity. The only connectivity is via hiking trails in the mountains and an aerial helicopter service. This increases the vulnerability of the area multifold.

Below is a snapshot of lifeline buildings and helipads that are important from the disaster risk management perspective:

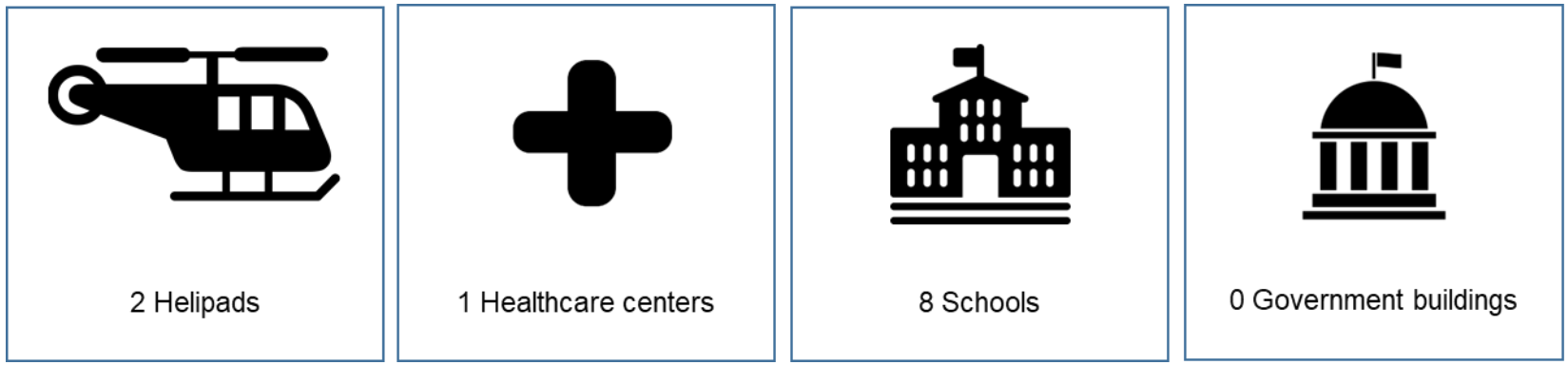


Figure 1: Snapshot of Critical Infrastructure in the Hotpost

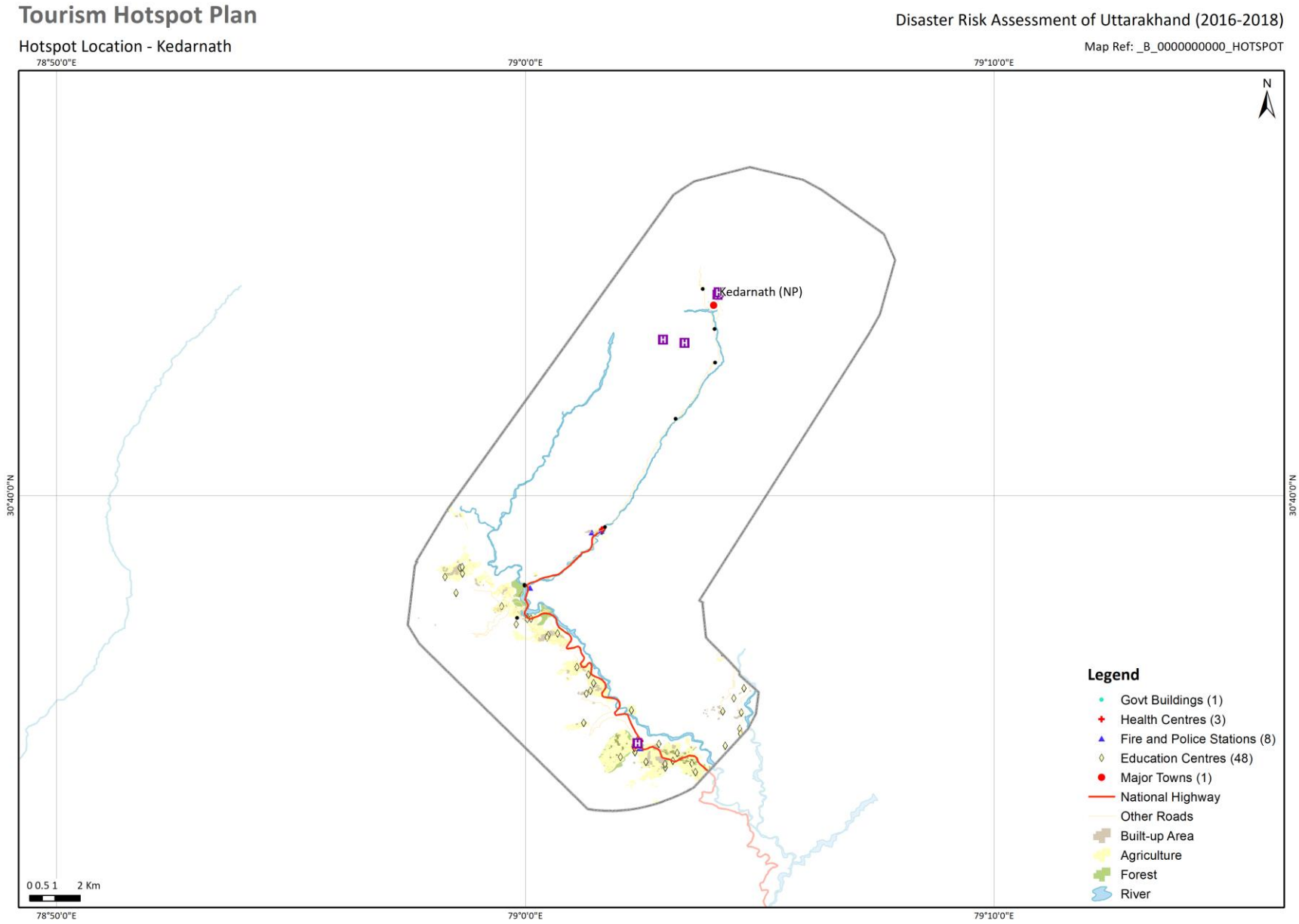
There are presently a total of 9 lifeline buildings consisting of 8 schools and 1 hospital in the kedarnath hotspot. Post 2013, the use of helicopters by tourists has increased to an average of 300 daily sorties and 1000 pilgrims per day.

Sewage management in the Kedarnath is rudimentary with many buildings using on-site sanitation systems or draining untreated sewage into the Mandakini river. However, under the clean Ganga mission, several of these direct drains have been identified and an STP is to be built at some distance from Kedarpuri.

In the downstream areas around Sonprayag, direct motor pumps and hand pumps are used to extract water from the river and the water table. In Kedarnath, there are natural small reservoirs formed in various parts by molten glacier/snow which are used as a water supply.

LPG or kerosene cylinders are used for cooking fuel in Kedarnath. Beyond the motorable road, all supplies are carried on mules and human porters.

The Kedarnath hotspot is a mix of urban and rural areas. Some of the DRM strategies may require efforts that cut across administrative boundaries. Kedarnath (NP) is the urban town whereas the rural areas are governed by Ukhimath block and tehsil.



Map 1: Kedarnath Hotspot Boundaries and Extent

1.4 Kedarnath 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 Kedarnath temple area –also called Kedarpuri – is inhabited by a highly vulnerable community although this population is transient. Also, some parts of Sonprayag also consist of vulnerable communities. The rest of the hotspot is not vulnerable as per this study. The population density is high in Kedarpuri and Sonprayag. Maps 2 and 3 illustrate the social vulnerability and population density in this hotspot.

1.4.2 Earthquakes

The Kedarnath hotspot area sits in the very high to extreme earthquake zone and is highly susceptible to large earthquakes and earthquake induced damages. Often landslides are a secondary consequence to earthquakes, however, landslide hazard is addressed separately.

Maps 4 to 6 illustrate the predicted earthquake severity in the Kedarnath hotspot area for different return periods.

1.4.3 Flash Floods

Flash flooding is seen as a moderate to high reoccurring risk in this hotspot location. The area exhibits flash flood risk because of the highly undulating terrain, and very high mountains with steep gradients increasing the runoff of rainfall and snowfall to a high degree. Kedarnath shrine is located very close to the mouth of the river of Mandakini. The first tributary of Mandakini, the Saraswati River encircles the Kedarnath valley and meets the Mandakini River right as the start of the Kedarnath valley. Both the rivers have a high gradient and flow with a high velocity at this stage.

Fluvial vs. Flash Floods

Fluvial Floods, or riverine flooding, occurs when excessive rainfall over an extended period causes a river to overflow its banks and to spread out over a wide area. The damage from a fluvial flood can be widespread.

Flash floods are intense, high velocity torrents of water that occur in an existing river channel with little notice. Flash floods are very destructive because of the force of the water and the debris they carry.

The river Mandakini leaving from Kedarnath gains a high force due to very high gradient and rocky terrain. The nature of the climate in this region is observed to be very delicate being affected by minor changes in the weather around the Kedarnath valley. In summer and monsoon season, the hotspot area receives a very high rainfall, increasing the susceptibility of landslides, and small streams surging with every rain.

The local population is no doubt, susceptible to the highly destructive nature of flash flooding, it is essential to understand the unstable nature of the weather in this hotspot area to plan better for the ever increasing pilgrim population in this area. To maintain the perfect balance, the development of valley and the understanding of the changing weather must go hand in hand.

Map 7 illustrates the flash flood risk in Kedarnath hotspot area.

1.4.4 Fluvial Floods

There is no significant fluvial flood Risk for Kedarnath hotspot, which is largely a result of Kedarnath being a small valley before the high steeps starts towards the south.

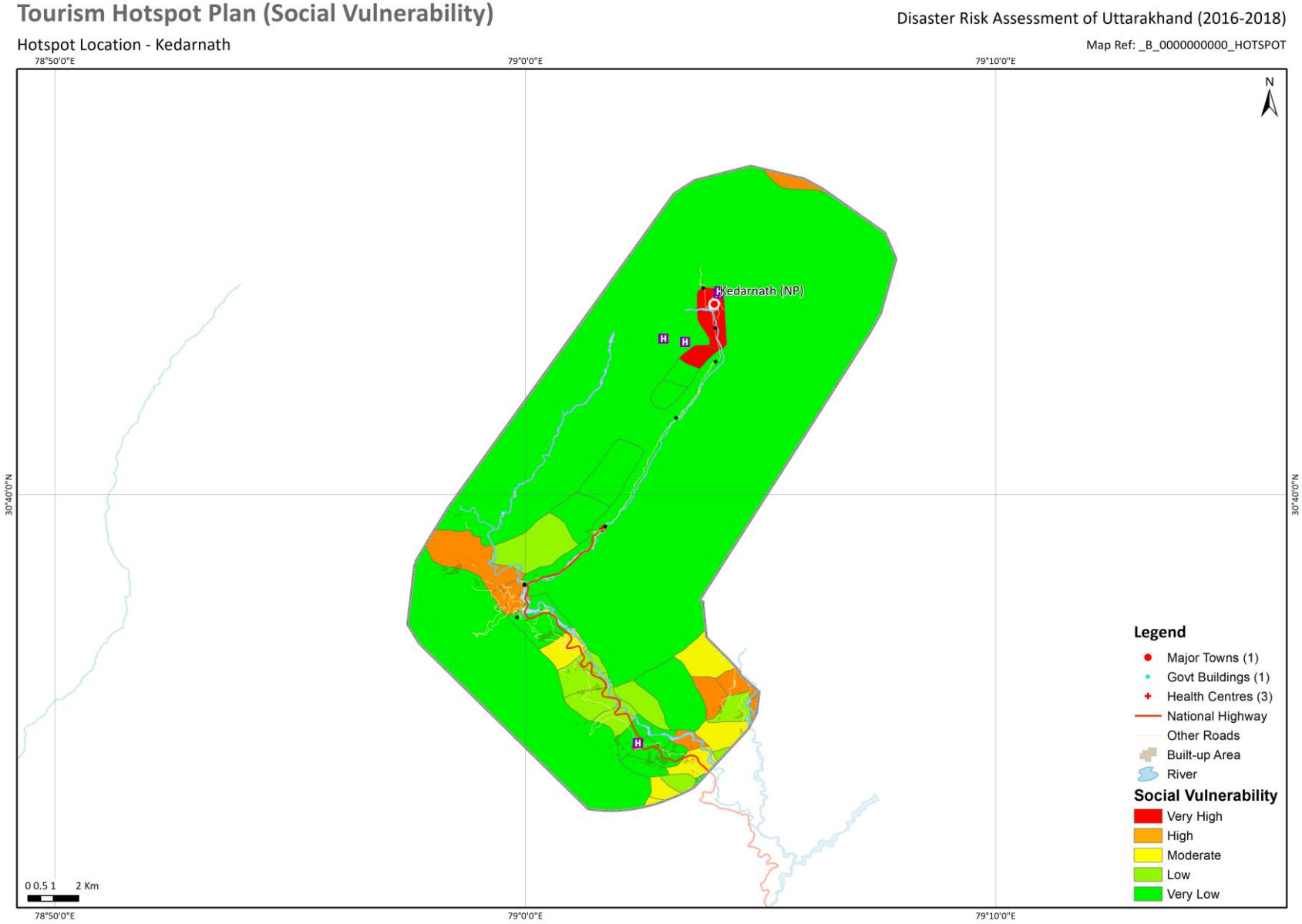
1.4.5 Landslide Hazard

Landslides have been assessed as a high-risk hazard in Kedarnath. Although frequently considered a secondary consequence of earthquakes co-seismic landslides are not uncommon and can be of great consequence. Landslides are a hazard in this area due predominantly to the immature nature of the mountains as a result of them being fairly young in geological terms.

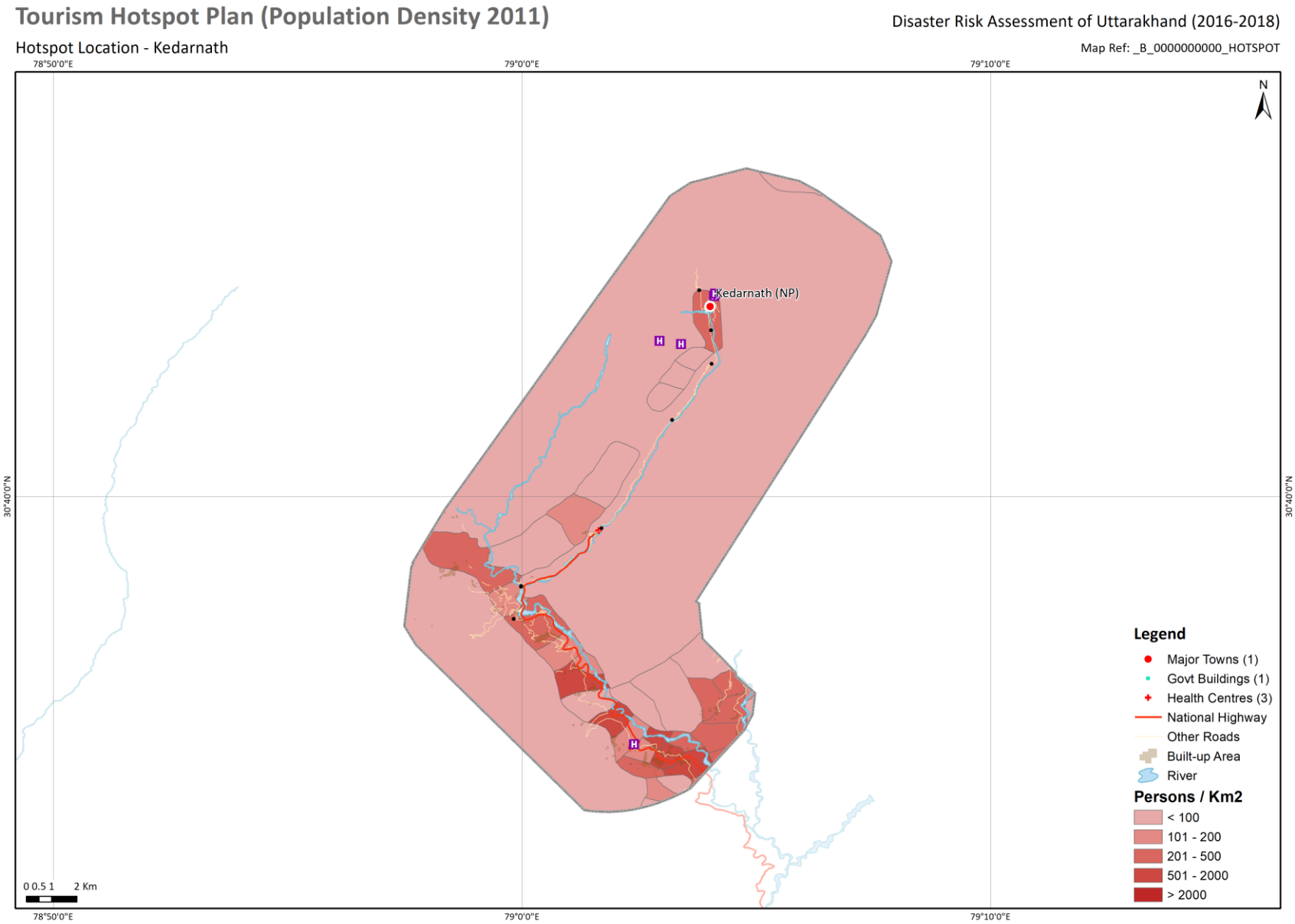
They may also be caused by flooding, heavy rain and hydraulic soil changes, land clearing and infrastructure development such as dams and roads landslides. Apart from directly threatening life and property, in road systems they can cause frequent long periods of obstruction with all the direct and indirect consequences experienced by what are frequently poor or already marginalized communities.

Landslide dams can lead to upstream flooding, downstream flash flooding when breached, bank erosion and silting of dams. Note that "landslide" is generic term for a range of slope failure processes including rock falls, slides, slumps, flows and a combination of failures leading composite or complex movements.

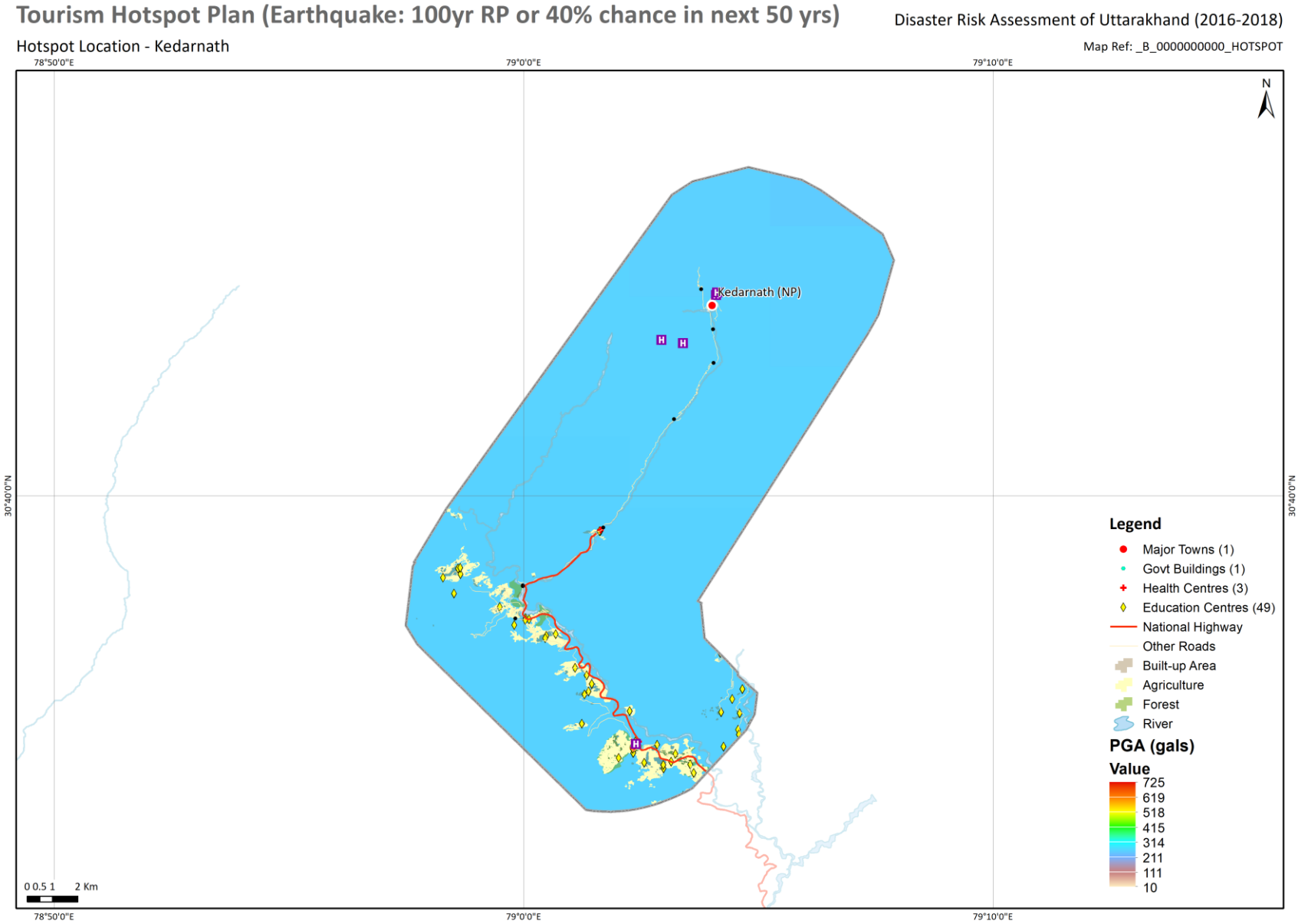
Map 8 illustrates the landslide risk in Kedarnath hotspot area.



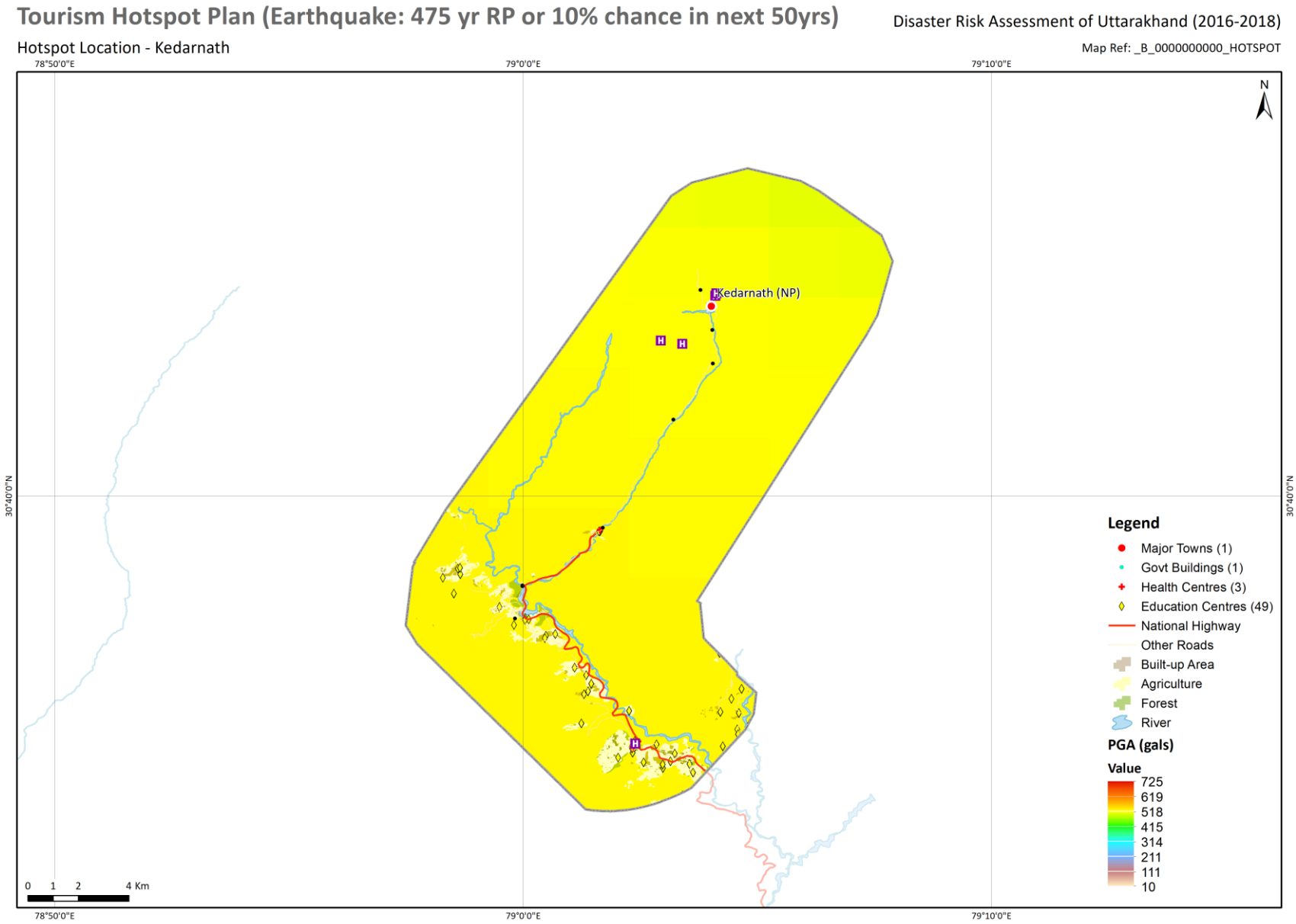
Map 2: Social Vulnerability Index for the Kedarnath Hotspot



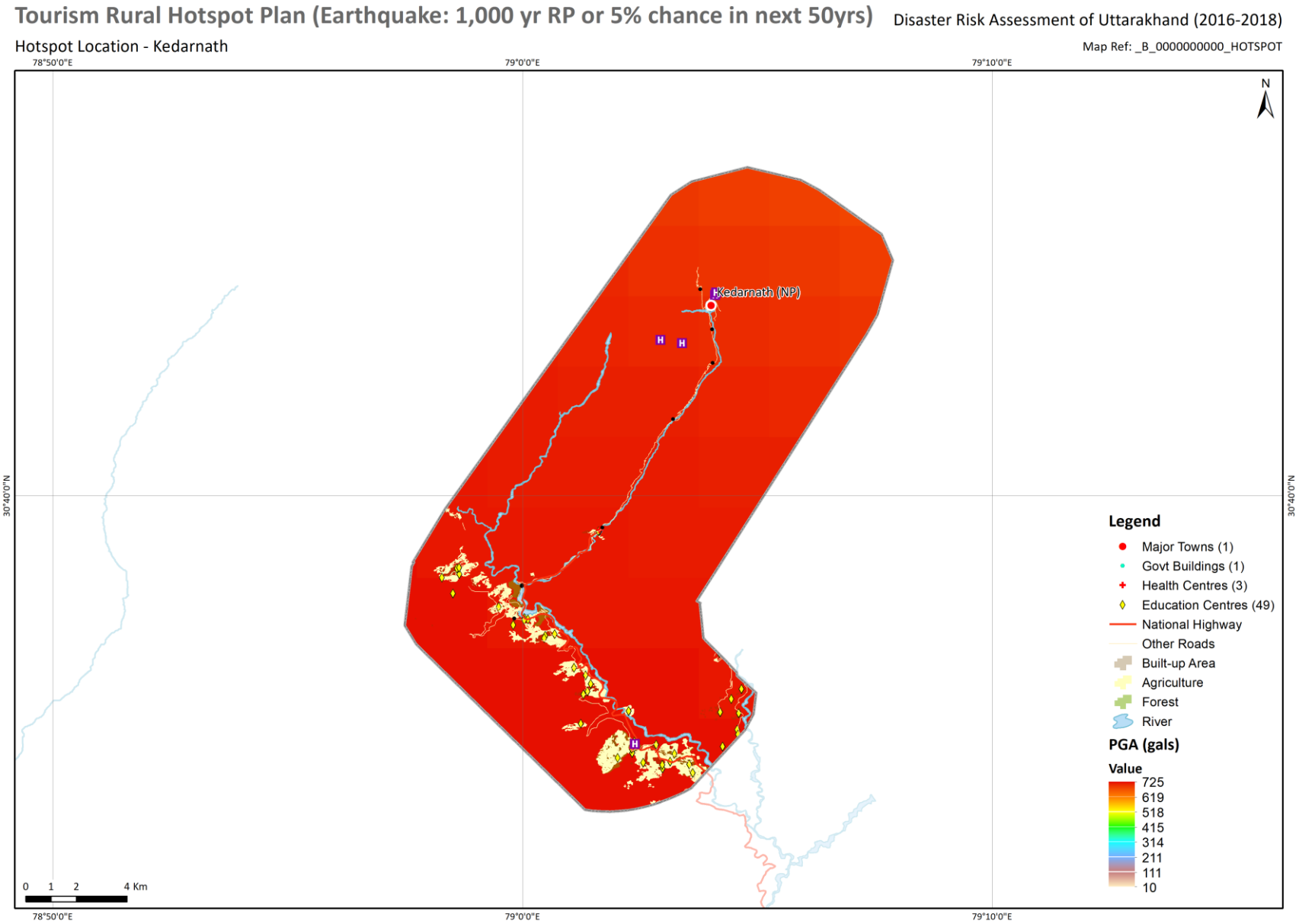
Map 3: Population Density for the Kedarnath Hotspot



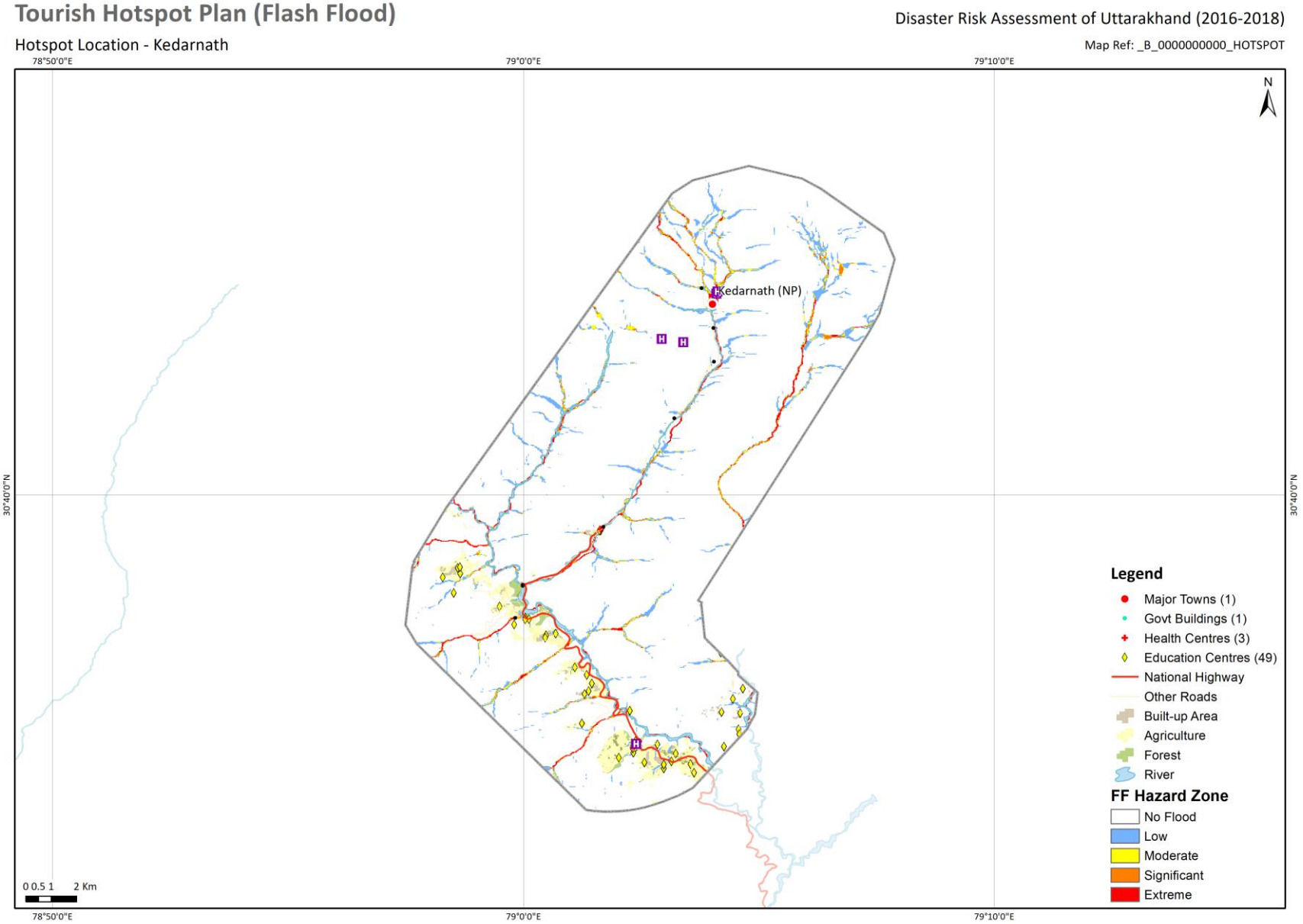
Map 4: Predicted Earthquake Intensity in Kedarnath Hotspot Location (100 yr RP)



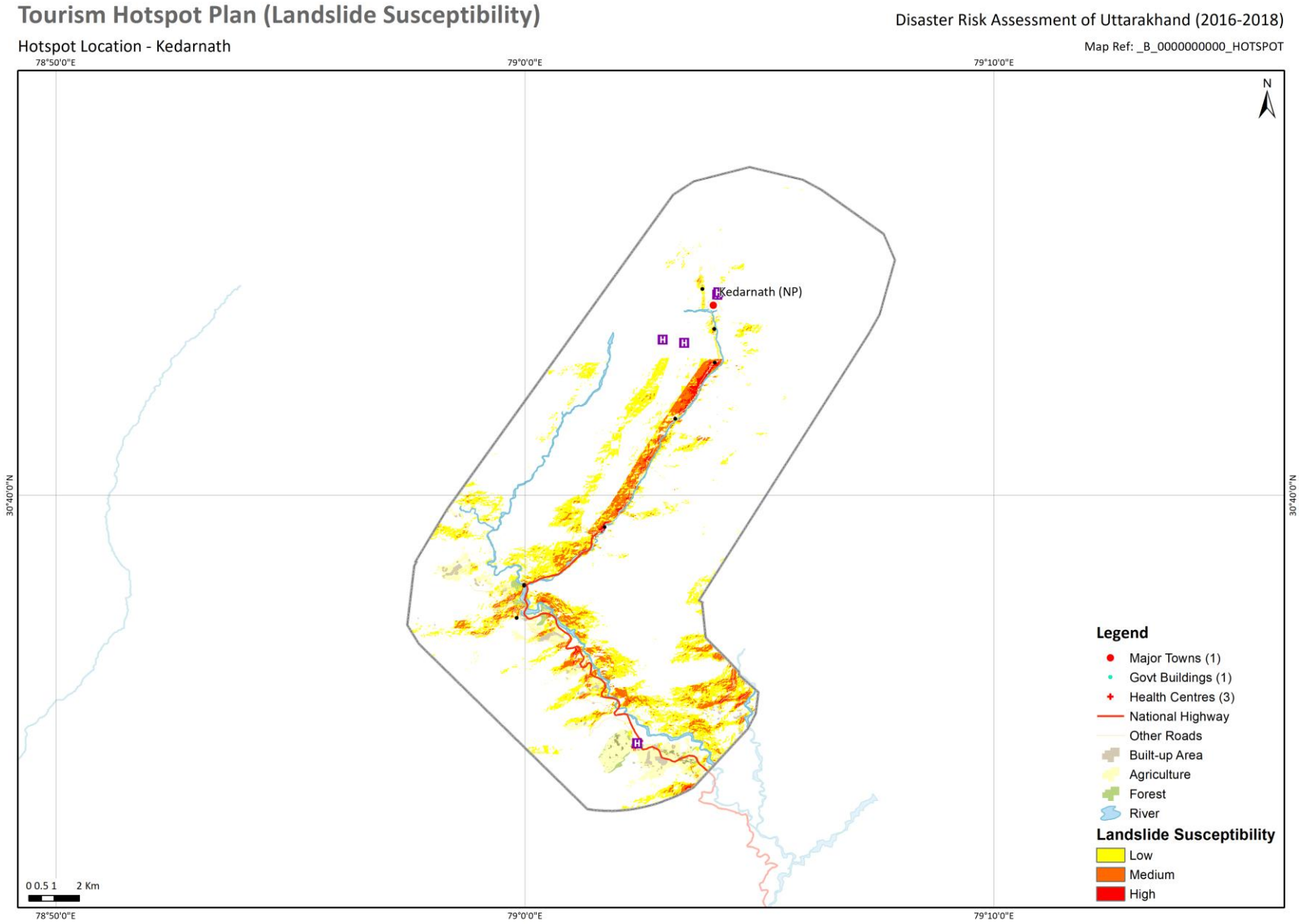
Map 5: Predicted Earthquake Intensity in Kedarnath Hotspot Location (475 yr RP)



Map 6: Predicted Earthquake Intensity in Kedarnath Hotspot Location (1000yr RP)



Map 7: Flash Flood Hazard and Exposure for the Kedarnath Hotspot



Map 8: Landslide Susceptibility in the Kedarnath Hotspot Location

1.5 Strategy Implementation, Monitoring, Evaluation

1.5.1 Challenges in Implementation

Three challenges have been identified with respect to DRM in Kedarnath and surrounds. In brief these are:

Finance & HR - 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).

The relevant departments are also seen to be understaffed to enforce building compliance and other risk mitigation measures as a majority of officials are stressed with other operational works related to managing the massive tourist season in the region.

Technical – the way data and other information are acquired and transferred is still essentially dependent on manual processes especially in rural blocks such as Ukhimath. 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 specialisation viz; 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 specialisation need to be considered.

As with all the cases studies there are several issues that need to be addressed no matter where the location.

- Preparation & updating of Hazard Zonation map of the City, which includes: update & maintain current map of areas within the City that are subject to be sensitive/ vulnerable to the EQ; identify the location & extent of hazard areas.
- Enforce the most current Building Codes Standards to protect the built environment in the City.
- Enforce Earthquake Safe Construction Technology in the City.
- Retrofitting existing public facilities & services of the City to contemporary standards.
- Seek to reduce non-structural hazards in homes, schools, business centers & offices of the City.

1.5.2 Proposed Management and Governance Structure

It is proposed that a Kedarnath Hazard Mitigation Working Group is established by the appropriate municipality. The Group is seen as being responsible for coordinating implementation of plan's strategies and undertaking an annual review process. In order to develop momentum for plan implementation, the Group will establish an appropriate timeframe for the meeting schedule as plan implementation begins.

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 District/Block, Gram Panchayat level. Reporting to the State on all such Expenditure is also 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

Like all DRM planning Tourism DRM is undertaken as five basic and sequential steps.

1 *Identifying hazard risks:* analyzing hazards resulting from a natural or manmade event, along with an understanding of the full range of probable effects and consequences.

2 *Assessing a community's vulnerability to the risk:* a community's vulnerability may be measured in terms of its size, geographic location, economic status, level of organization, and available resources; infrastructure, and response capability, among other factors. Its vulnerability will therefore depend upon the level of exposure and its capacity to adapt, respond to or recover from the hazard.

3 *Developing a preparedness and mitigation plan:* a plan will be required to address any institutional or systemic weaknesses, which could limit the destination or community's ability to mitigate disaster risks.

4 *Implementing the plan:* implementation may be simulated to ensure that the plan is workable during real disaster conditions. It is also important to document the lessons learned from the exercises in order to assemble a databank of learning, experience and information.

5 *Monitoring, evaluating, revising and updating the plan:* the information assembled provides essential learning for revising and updating the plan, correcting any areas of weakness or ineffectiveness, reallocating resources

These elements are not static but revolve around a continuous cycle of activity and interaction among the responsible and collaborating agencies. For such groups a common objective to reduce the probability for disaster occurrence is important. This is the framework used here in developing strategies for the hot spots.

For DRM in tourist hotspots, there needs to be very specific data internalized to the process. For example, when managing tourism disaster risks, the tourism value chain must be central to the planning and organization process. This needs to be understood so that all aspects of the DM plan can build the necessary links to the other relevant sectors and the broader community.

In the case of the Uttarakhand hotspots and elsewhere there is more than one tourism type as a result there is more than one value chain that needs to be considered.

DRM needs to be adopted as a continuous cycle of activity and interlocution among the responsible and collaborating agencies, united by a common objective to reduce the probability for disaster occurrence.

In preparing a Tourism DM plan for individual locations the following key strategies need to be adopted:

2.1 Overarching Strategies

2.1.1 Mitigation

STRATEGY	DRIVER	OUTCOMES	KPI
Establish a Tourism Disaster Management Committee (TDMC).	The TMDC needs to be led by the appropriate municipality and include representation from relevant government agencies, police, fire, govt. healthcare, the Army, highway construction, Dam construction, hotel association, tourist operators, restaurants, All India Radio, Met office, Water Commission, Gram Panchayat and community tourism representatives.	A TDMC with responsibility to ensure a TDMP is 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.
Develop a Hazard identification Prioritisation and Tourism Risk (HIPTR) assessment by mapping of hazard areas against tourist areas, activities and movements (vulnerable populations), to derive a level of exposure and value chain for each of the tourist categories[2]	The development of a knowledge management system which is regularly updated is an important first step. The DRMA data portal is a prime source for some but not all of the required data. A series of surveys will be required. Risk mitigation and management options need to derived.	A risk assessment of which tourist, where and when they are exposed, as well as the exposure of the relevant service industries and secondary suppliers.	HIPTR to be drafted within 6 months of the TOR being finalized.
Establish a TDMC funding arrangement and resourcing to undertake technical aspects of the work.	The formulation of the HIPTR is going to be a specialized set of tasks that will require skills not already available in administration i.e. GIS, community consultation, undertaking a range of	A funded and resourced task team to undertake key elements of data collection, analysis and plan preparation.	A five-year funding plan to be established within 6 months of TDMC inception.

[2] There is a need to understand the risk profile in terms of loss of life and assets but also any additional risks including risks to tourism resources (e.g. biodiversity, water supply), plant and infrastructure (e.g. coastal resorts), business risks (e.g. supply disruptions, changes in insurance coverage), or market risks (e.g. changes in competitiveness through increased transportation costs).

	survey and economic evaluations. Specialist training may be required.		Recruitment/contracting of key personnel within 3 months of TOR being signed
Develop a Tourism Disaster Management Plans (TDMP) at all levels of jurisdictions, across departments, the industry and communities.	A TDMP is the basis on which all forward planning for mitigation and preparation is based. Risk mitigation and management options need to be assessed and adopted.	A well prepared and tested DMP that is regularly reviewed, amended and distributed.	DM Plans developed within 6 months of the drafted HIPTR, followed by annual reviews.
As part of the TDMP, increase public awareness, understanding, support & demand for hazard mitigation through the development of a city-wide sales and marketing strategy and campaign focused on building awareness and a "need to know" desire focused on key participants in the tourism sector.	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 well-informed tourism sector capable of planning for and responding to disasters at a level that will significantly diminish probable loss of life and assets.	A public awareness campaign designed and sponsored within 12 months.
An effective Pilgrim Control & Regulatory Body may be constituted for management & control of tourists/pilgrims.	Pilgrim management requires strengthening across the state, but especially in these hotspot locations. This regulatory body would oversee the programme of improvement for pilgrim management.	Pilgrims safer and risk reduced during high tourism season.	Body to be established and mandated within 18 months.
Ensure that the principle of "build back better" is applied fully in the ongoing recovery efforts in the Kedarnath area.	Kedarnath can be a showcase for strong recovery and new developments should not exacerbate risk. Build back better is a key principle for recovery and a commitment of the State Government.	All repairs and new structures to meet or exceed code for earthquake and flood protection.	Zero structures failing to meet code.
While planning for tourism related developmental activities, besides environmental & social-cultural issues, carrying capacity of tourism sites should also be kept in mind.	Often ancillary infrastructure such as parking, public spaces etc. are inadequate compared to the residential accommodation of the tourist locations.	A properly planned tourist infrastructure that has adequate infrastructure related to accommodation, parking and adequate public spaces.	Assessment of max carrying capacity to be completed within 18 months. Effective regulation and controls in place within 36 months.
In disaster prone areas like Kedarnath, tourists contribute a major portion of floating population,	Pilgrims are vulnerable, exposed, and displaced. An effective Pilgrim Management System for these hotspot	Pilgrims are informed, risk aware, locatable, and managed in the event of a major disaster.	Pilgrim Management System in place within 24 months.

therefore there should be an effective pilgrim management system.	areas would allow for more effective planning, communication, response and immediate recovery.		
To create awareness amongst tourists and even local population, a Museum may be established in Kedarnath, displaying memories of 2013. People visiting Uttarakhand from different parts of the Country may be made aware on various aspects of disaster management.	The 2013 event was a tragic reminder that natural disasters can potentially cause huge losses of life and property. Knowledge of the event, causes, and possible precautions (in terms of disaster preparedness) is not available to every tourist in a systematic manner.	A museum in Kedarnath will be a powerful tool for communicating aspects about the 2013 event that will educate tourists on disaster preparedness, "Dos and Don'ts" etc.	Disaster preparedness to be included in the planned museum before the next tourist season.
Building of a fence along the trek route.	Currently most of the route is exposed to steep falls on one or more sides. This exacerbates the risk to the pilgrims in the event of a disaster.	A fence will help reduce the potential risks due to slippery conditions which are very frequent in Kedarnath.	Planning and implementation before next tourist season.
There are a few buildings in the proximity of the temple that are partly damaged, structurally fragile and unsafe. These buildings should be demolished.	These buildings (remnants of the 2013 disaster) are highly vulnerable and likely to fall/get swept away in the event of an earthquake or flood.	Reduction in the infrastructure vulnerability of the area.	All partly damaged and unsafe buildings to be demolished within a stipulated time frame.
There are a number of huge boulders lying in & around the temple area which should not be disturbed (using explosives or otherwise).	The area and ecology is very fragile and attempts to move the huge boulders may have an adverse impact on the stability of the region.	No major disturbance to the geo-stability of the fragile temple town area.	Status quo to be maintained with respect to huge boulders.
Anthropogenic activities of any kind should be banned in the Rambara area.	There are many illegal encroachments and constructions in Rambara which is a vulnerable area and a critical pilgrim shelter zone. These constructions are not earthquake resistant or disaster-prepared. Moreover, they occupy majority of the space in this area.	Regulated infrastructure development in Rambara is the desired outcome where emphasis is laid on pilgrim needs and structural robustness.	Evaluation of constructions/encroachments in Rambara and appropriate subsequent action taken so as to prepare Rambara for the next tourist season.
Ensure there are adequate shelter facilities in hazard free zones to serve pilgrims in Rambara.	The illegal constructions in Rambara are mostly shops and restaurants. However, this space must be maximized	Maximum shelter capacity built at Rambara for pilgrims leading to an increased response capacity during a disaster event.	Planning and building of shelter facilities to be completed within a stipulated time frame preferably before the next tourist season.

	for sheltering pilgrims in the event of a disaster.		

2.1.2 Planning and Preparation

STRATEGY	DRIVER	OUTCOMES	KPI
Establish an integrated Hazard Emergency Warning System and awareness education for all tourists on arrival.	The warning or alarm elements of a EWS need to be simple in its approach and easy to understand so that public awareness is not compromised due to complexity.	A readily understood EWS notification system integrated to include all hazards and an indication of level of response needed.	EWS established within 12 months, awareness training and education material created and distributed as soon as W|EWS activated.
Develop a Tourist DM Evacuation Plan (TDMEP) and ensure it is widely distributed and understood.	The TDMEP not only needs to be part of the mainstream processes of the city but tailored to the site characteristics associated with the tourism type. Signage (international/Multilanguage) and other awareness programmes to be developed.	A well prepared and tested TDMEP that is regularly reviewed, amended and distributed.	Development of the DMP within 12 months followed by regular annual reviews.
Emergency response testing (closing the gap).	Experience elsewhere shows that education and awareness does not guarantee the right responses nor in a timely manner. Response testing with tourists is not normally possible in terms of a training exercise but can be checked through questionnaires to assess understanding and to improve awareness. Such questionnaires can be used to also gain valuable feedback data on tourism processes.	An effective awareness programme tested against regular measures of understanding and response.	Annual survey reports based on awareness and response testing.

Develop damage assessment competency as part of the HIPTR process.	As with all DMPs an understanding the damage the sector has suffered as a result of a disaster is fundamental to planning for future recovery and mitigation. In this case socio economic data are critical as is the need to present a realistic picture of the level of damage and functionality to tourist.	Competent assessors able to undertake evaluations with respect to infrastructure, socio-economic conditions, supply chain functionality.	Annual assessments as part of the overall TDM plan and assessment review
Seek out mechanisms to introduce both microfinance and micro-insurance opportunities relating to the tourism supply chain as a way to build resilience in the sector.	Both micro-finance and micro-insurance needs a lot of efforts to put in place such as onboarding authorities, re-insurers, local insurers and banks with their distribution channels. This takes time and effort but both have been shown to make a positive contribution in disaster situations towards improving livelihoods and building resilience as a result of readily available funding to help people and businesses get back on their feet.	A reduced dependency on post event State funding for compensation of loss to life, property, livelihood etc.	Annual assessment of share of people/buildings insured.
Develop a specific Hazard identification Prioritisation and Pilgrimage Risk (HIPTR) assessment to deal with large numbers involved and the need for crowd control during response and initial recovery post an event.	There is a fundamental issue with pilgrims that comes out of the sheer numbers involved. Mass movement is a critical issue. Panic will be a major issue should a large hazard event occur and crowd control will be paramount as a first response capability in this situation. Focus needs to be on understanding temple capacity, inclusive of all waiting areas and develop plans to deal with this. Consider reasonable waiting time - compare with requirement and assess faster turnaround. Escape routes and safe places to be clearly identified.	An analysis focused on the temples and waiting areas and a plan to manage congestion, choke points and potential solutions.	HIPPR to be drafted within 6 months of the TOR being finalized.

Proper implementation of the biometric registration of each pilgrim at Sonprayag with limited points of entry and exit.	Currently the registration is not fool proof as only those pilgrims register who voluntarily wish to do so. This is preventing the administration from having an accurate count and detail of the pilgrims potentially at risk in the event of a disaster.	Limited exit and entry points allow a fool proof biometric registration giving the administration a real-time view of the count and details of pilgrims inside the Kedarnath hotspot. The accurate data will be immensely useful for future tourism studies.	Pilgrim Registration and Management System in place within 24 months.
Establishment of multiple first aid clinics with capability to administer basic medical emergency response and first aid across the entire route from Sonprayag to Kedarnath at appropriate locations.	The current first aid support is inadequate to meet the potential requirement in the event of a disaster considering the massive inflow of pilgrims. This capacity must be upgraded.	Every pilgrim should have access to first-aid responses in the event of a disaster. These clinics can also double up as relief centers. This will reduce fatality from minor injuries.	Planning, feasibility and implementation to be completed within 12 months.
Installation of more helipads in between the trek route.	Currently there is only one helipad in the trek route. This is inadequate for a disaster scenario.	More helipads will lead to incremental capacity for response in the event of a disaster. Helicopters are often used to transport supplies, ferry the injured etc. and are hence critical during response measures.	Planning, feasibility and implementation to be completed within 12 months.

2.1.3 Response

STRATEGY	DRIVER	OUTCOMES	KPI
Develop local warden skills in tourist guides or comparable staff in hotels, medical and police forces.	Language and cultural differences can vary amongst all tourists. Such traits are exacerbated under stress. As a result there is a need for designated wardens trained in suitable communications and cultural behaviors/understanding during emergency evacuation and response situations.	A well-recognized and trained Warden task force capable of bridging both language and cultural gaps under emergency situations.	Evaluation of effectiveness under annual DM training programs.

Development of an international, national language and cultural aid database.	All countries are tied to international tourism with respect to their own citizens as a result of their proactive use of travel advisors and aid in time of crises. Understanding how to take advantage of both and to seek support in times of crises is an important resource for the management of the tourism sector and the region's perception in the market.	A resources database and communications process relating to foreign country tourists facilitating access to interpreter skills and travel advisory content.	An annual review of a database accessible through the TDM process.
Involve the entire community that supports the pilgrimage services in Kedarnath. For example, the priest and nomadic priest community must be involved in imparting key disaster response knowledge to pilgrims as they are also effective influencers for the pilgrims. They should also be assigned roles for disaster response.	In the event of a disaster, the working resident communities of Kedarnath often have very good knowledge of the area. Also, additional human resources are helpful for recovery and relief efforts.	The resident communities when properly organized and briefed may prove to be of immense support when the SDRF and NDRF are busy with their other critical functions in the event of a disaster.	Proper briefing and assigning of roles before the next tourist season.
Before entry to a disaster prone/ high altitude area like Kedarnath, tourists/ pilgrims should be clearly warned about the weather conditions. They must also be provided basic "Dos & Dont's" & latest information on weather.	Tourists are often unaware of the extreme weather conditions and disaster related "Do's and Don't's".	A well-informed tourist takes adequate precautions and is more aware of next steps in the event of a disaster.	Implementation of the communication program within an immediate time frame or latest by the start of the next tourist season.
There should be alternate routes for emergency evacuation wherever possible & these routes must be identified & maintained by State Govt.	Currently evacuation routes aren't entirely pre-planned and are often a result of post-disaster improvisation. This leads to wastage of crucial time and usage of potentially sub-optimal evacuation routes.	Pre-identified evacuation routes equip the administration and affected populations to perform better in response to a disaster.	Evacuation routes to be identified and documented within an immediate timeframe.

2.1.4 Recovery

STRATEGY	DRIVER	OUTCOMES	KPI

Undertake tourism Sector damage assessment as part of the DM response process	An understanding of the damage the sector has suffered is fundamental to planning for future recovery and mitigation. Including the need to present a realistic picture of the level of damage and functionality to tourism within the market in order to minimize losses.	Competent assessment of the status and actions needed with respect to infrastructure, socio-economic conditions, supply chain functionality.	An immediate assessment as part of the overall DM response and recovery process with the first 6 months.
Establish a Sector recovery plan including a media plan to inform national and international perceptions.	A sector recovery plan serves 2 functions. One is to ensure that the hardships associated post even recovery are minimized, and the sector reestablishes it functionality as a soon as possible. The second it to advise the market of the real status of the sector as opposed to what is frequently reported in the media and in travel advisory's.	A well-planned recovery minimizing socioeconomic losses and human hardship. A well informed national and intentional market as to the unfolding realities.	Number of returning tourist and the reestablishment of the supply chain on an initial 6 and then 12-month basis.

2.2 Specific Strategies for Earthquakes

2.2.1 Introduction

Earthquakes of any magnitude in a tourist zone like Kedarnath bring a particular challenge that means many people and much property is at risk as result of the vast number of tourists and infrastructure that is exposed especially in the tourist season. As a result, creating resilient and capable communities across the tourism value chain is a critical element of dealing with earthquake risk and thereby reducing the loss of life and property damage. Water supply, food supply, access to shelter and medical aid are key factors in longer-term response and recovery and need to be addressed, as does alternative road access.

2.2.2 Earthquakes - Mitigation

STRATEGY	DRIVER	OUTCOMES	KPI
Strengthen planning, management and regulation of EQ risks on infrastructure through access to data to improve understanding of existing and future risk 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 Block as the basis to planning and preparation procedures and training simulations.	Complete within a three year period detailed mapping of all areas in the Block 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 rural and urban part of the Block is required, as is retrofitting. The State has amended building byelaws 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 and formulate a policy, retrofit existing public facilities & services to contemporary standards.	The USDMA (formerly DMMC) has been imparting training to the practicing Masons in all 13 districts (at Block Level) for the last 15 years & have more than 10k trained Masons across the State, however due to lack of awareness in the community about the trained manpower, this technology has not yet attained popularity.	Significantly increased EQ resilience in life line buildings within towns and villages.	Assessment should be completed within 3 years.
Seek to reduce non-structural hazards in homes, schools, business centers & offices as part of the overall awareness campaign	Significant harm can occur to people in situations where nonstructural 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

2.2.1 Earthquakes - Planning and Preparation

STRATEGY	DRIVER	OUTCOMES	KPI
Design & develop public education campaign for emergency preparedness & hazard mitigation for those who live & work in the Kedarnath hotspot area (Sonprayag, Gaurikund, Rambara and Kedarnath)	Just as DM needs to be come 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	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.

	research[3] shows that "shock" from traumatic situations can be very debilitating but can be overcome through awareness and training.		
Increase the community resilience by expanding the number of Community Emergency Response Teams (CERT) in the towns and villages of the Block.	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.
Modify evacuation plans to incorporate City Public Safety Agencies such as Police & Fire, Health	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.

2.2.2 Earthquake - Response

See strategies listed in Overarching Strategies above.

2.2.3 Earthquake - Recovery

See strategies listed in Overarching Strategies above.

[3] See for example: Laurence Gonzales, *Deep Survival* , 2017;

2.3 Specific Strategies for Flash Floods

2.3.1 Flash Floods Introduction

Flash flood events can be very unpredictable and of extreme magnitude: impacts are nearly-impossible to mitigate in many cases. The focus should be on minimizing human losses with economic (asset) losses being secondary.

For mitigation of the frequent events (<100Y), entrainment walls and structural mitigation are good solutions. Flood zone delineation should help to reduce or reverse exposure – ideally a 500Y event risk profile could be used to identify high risk areas.

Early warning systems using simple upstream indicators are now both feasible and effective – see Box. The warning does not necessarily need to rely on real-time hydrological modelling. Hydrological analysis could be used to define trigger levels of rainfall intensity that could potentially lead to either direct flash flood or landslide that might subsequently to dam break type of flooding. The system needs to be integrated with local knowledge and communities involved in the development and operation. Forecasting if feasible should be prioritized and should rely primarily on high temporal and spatial resolution rainfall data.

With respect to tourists and locals alike early warnings and evacuation routes need to be clearly defined and emergency response communicated to the public through education, leaflet, signs, and locals or in transit.

Building community capacity for flash flood risk management.

The flood warning instruments installed by the project have provided communities with early warning of flash flood waves on six occasions between August 2010 and August 2011. In each of these flood events, the flood alarms woke villagers during the night or early morning drawing their attention to the rising water level. The villagers remained alert and disseminated the flood information to downstream areas using mobile phones. As a result, the downstream communities had lead time of one to one-and-a-half hours to move people and valuables to safe areas.

Source: Partha J Das in Shrestha, AB; Bajracharya, SR (eds) (2013) Case studies on flash flood risk management in the Himalayas: In support of specific flash flood policies. Kathmandu: ICIMOD

2.3.2 Flash Floods - Mitigation

FLASH FLOODS - MITIGATION			
STRATEGY	**DRIVER**	**OUTCOMES**	**KPI**
Develop a Flood Plain Zoning assessment[4] as the basis to strengthening planning, management and regulation of flooding impacts.	Compliance of NDMA flood regulations which provide a platform for Flood Plain Zoning, which includes:- Broad demarcation of areas vulnerable to floods; Preparation of large scale maps (1:10k/ 1:15k) with contours at an interval of 0.3m or 0.5m; Demarcation of areas liable to inundation by floods of different frequencies, similarly demarcation of areas likely to be affected on account of accumulation of rain water; Marking of likely submersion areas for different flood stages.	An accurate assessment of flood levels and likelihood as well as testing of mitigation strategies as the basis to formulation of flood management policies.	Flood assessment completed within 12 months.
Compliance of building by-laws in flood prone areas, which provide following provisions. Important to regulate development along the river banks.	In the areas liable to floods, significant reductions in vulnerability can be achieved through all the buildings preferably being double & multiple stories; If there is a single story building, a stairway will invariably be provided to the roofs; The roof level of single story buildings and first floor level of double story buildings will be above 100 years flood levels. Plinth level of all buildings should be 0.6m above the drainage/ flood submersion lines; Foundations need also be suited to high	Reduced vulnerability of flood prone communities through a regulatory process and auditing programme of compliance with Flood Plain Zoning.	The total number of sites audited each year for compliance. Follow up where non- compliances recorded, including imposition of fines.

[4] 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 needed for finer scale modelling (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. The state government has procured. Ideally the flood modelling should be advised to be re-done in high exposure areas. 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).

	velocity erosion and setbacks set for flood plain edges.		
Provide Structural hazard mitigation assistance to communities through the Gram Panchayat.	Specific funding does not exist to support a range of construction activities to protect against flood damage including construction of Embankments/Banks, flood walls, Flood Levees, Channel improvements, Desilting/ Dredging of rivers, Drainage improvement, Diversion of flood water, Catchment area treatment/ Afforestation, anti-erosion works, alignment, location, design & provision of water ways i.e. Vents, Culverts, Bridges & Causeways on National Highways, State Highways, District & other roads.	Improved resilience as a result of community led development of structural mitigation projects as well a reduction in flood risk.	Structural hazard assessment to be done every year by the Gram Panchayat.
Suitably designed flood protection structures are required along the river bank of Mandakini at the Gaurikund and Sonprayag locations.	Currently in absence of flood protection structures, the Mandakini flood plains are being encroached upon for parking of vehicles. Also, flood protection structures are necessary for safeguarding the settlements during a potential flooding event.	Communities along Mandakini river bank are protected from flooding.	Identify sites within 2018 and construct flood protection measures in areas of flood risk within 36 months.

2.3.3 Flash Floods - Planning and Preparation

FLASH FLOODS - PLANNING AND PREPARATION			
STRATEGY	**DRIVER**	**OUTCOMES**	**KPI**
Development & updating of Disaster Management Plans for those high exposure areas including escape routes and early warning systems (EWS).	Once the precise locations of all high-risk flood areas are established, flood incident management plans need to be prepared.	Flood DM Plans developed for all high-risk areas in the Block.	Flood DM Plans developed within 12 months.

Increase public awareness, understanding, support & demand for flood risk management plans in high risk areas.	Hazard mitigation awareness efforts include: - design & implement a comprehensive campaign of public awareness of local natural hazards & disaster preparedness techniques, using TV, radio, lectures & hands-on-training.	Increased community awareness, planning and preparation to flood risk and incident responsiveness.	An awareness campaign plan should be developed for 12 months.

2.3.4 Flash Floods - Response

FLOODS - RESPONSE			
STRATEGY	**DRIVER**	**OUTCOMES**	**KPI**
Increase public awareness, understanding, support & demand for hazard mitigation through the development of a campaign focused on building a brand awareness and 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, private sector community groups, industry, block level agencies and tourists.	As noted above planning for flood 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.	A flood management capable community/stakeholder lessening the level of probable loss of life and assets.	A public awareness campaign designed and sponsored within 12 months.
Develop, enhance & implement education programs designed to reduce loss from hazards based on simple and internationally based information "packages" describing simple steps and procedures to follow at different alert levels and what to do in the event of an incident.	A lack of awareness policy and planning leads to an increased vulnerability in response capability of all members of the community and associated tourists.	A raised level of awareness based on internationally recognised language/symbols that are easy to assimilate and remember.	Develop and disseminate information packages within 12 months as part of the community awareness campaign.
Test and revise evacuation plans across the block through mock drills and conduct an area wide review workshop following each one focused on gleaning strengths, limitations, opportunities to improve and risks if these are not realised.	Mock drills are a critical element of DRM planning and training. With the help of local NGOs/CVOs and local residents mock drills can be conducted on regular basis to check the evacuation plans.	An increase in the number and preparedness of all participants in an incident thereby lowering the risk of loss of life and property during incidents.	A mock drill run in every settlement every 12 months. A block wide drill run every 2 years.

2.3.5 Flash Floods - Recovery

See strategies listed in Overarching Strategies above.

2.4 Specific Strategies for Landslides

2.4.1 Landslides Introduction

Landslides (including rock falls) are a common geohazard and although frequently considered a secondary consequence of earth quakes co-seismic landslides are not uncommon and can be of great consequence. They are also caused by flooding, heavy rain and hydraulic soil changes, land clearing and infrastructure development such as dams and roads landslides. Apart from directly threatening life and property, in road systems they can cause frequent long periods of obstruction with all the direct and indirect consequences experienced by what are frequently poor or already marginalized communities. Landslide dams can lead to upstream flooding, downstream flash flooding when breached, bank erosion and silting of dams. Note that "landslide" is generic term for a range of slope failure processes including rock falls, slides, slumps, flows and a combination of failures leading composite or complex movements. As such it requires considerable skill and technical support to map high risk areas and propose mitigation strategies. Particular reference with respect to a broad understanding of landslides should be made to Parkash Surya (2012). Training Module on Comprehensive Landslides Risk Management. National Institute of Disaster Management, New Delhi - 110002, Pages 282.

> *….In Nepal, there was a six-fold increase in landslide fatalities (from 20 to 120 on average per year, the average for the last five years is 152 deaths per year) between 1978 and 2005. A primary driver of this increased mortality has been a deadly combination of an increase in poorly constructed roads with more intense monsoon rains due to climate change.*
>
> (see:http://blogs.worldbank.org/endpovertyinsouthasia/minimizing-risks-caused-geohazards-south-asia)

2.4.2 Landslide Mitigation Strategies

STRATEGY	DRIVER	OUTCOMES	KPI

Identify the location & extent of landslide hazard areas in the hotspot surrounds.	Preparation & updating of Hazard Zonation maps of the City is required, which includes updating & maintenance of current maps of areas within the City that are subject to mass movements;	A basic tool for development planning.	Mapping exercise within 24 months.
Determine the level of risk presented by the existing development in landslide prone areas and develop a landslide Risk Management Plan.	Protect existing development in landslide prone area, which includes:- Provide information to residents on landslide prevention, retain & restore existing vegetation, avoid certain activities by private owner on landslide prone properties and construct debris flow diversion to protect existing properties.	Risk management strategies to protect property and life including advising all owners and relevant City and Government agencies.	Avoid construction for next 5 years.
Establish an assessment and approval process for all structures approved for construction in landslide zones.	Stringent planning and design requirements in landslide-prone and unstable areas need to be imposed.	Significant reduction in life and property loss as well as costs and social trauma associated with landslides.	Ongoing process.
Within the Landslide Management Plan there is a need to assess and manage hydraulic drivers for landslides.	Maintenance of public & private drainage system is a critical part of landslide prevention. This includes:- ensure that culverts, nalahs are inspected & cleared prior to rainy season each year; encourage pervious, and minimize impervious surfaces to reduce storm water runoff.	Increased resilience to land slide risk as a result of knowledge, planning and information transfer as well as active management of hydraulic structures.	Ongoing process.
Retaining structures are required to be built along the Rambara area.	Due to toe erosion, the slopes are highly unstable threatening the high number of tourists halting at Rambara.	Higher stability in the Rambara slopes due to reduced toe erosion.	Retaining structures to be built within a stipulated time frame preferably before the next tourist season.

2.4.3 Planning and Preparation

STRATEGY	DRIVER	OUTCOMES	KPI
Develop emergency response procedures as part of the City and surrounds Landslide Managements Plan.	Having understood areas of highest risk it becomes critical to then generate emergency response scenarios and plan for suitable responses.	An increased level of awareness leading to mitigation and improved preparation for response to landslides.	Establishment of response structure, tested annually.
Design & develop public education campaign for emergency preparedness & hazard mitigation for those who live & work in affected areas.	By creating awareness amongst exposed populations there may be a mitigation effect and also an improved resilience as a result of people understanding what has happened and how to respond.	An improved resilience as a result of people understanding what has happened and how to respond.	Ongoing process.

3 LINKS TO NATIONAL AND STATE LEVEL PLANS

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

UNISDR
The United Nations Office for Disaster Risk Reduction

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

USDMA
आपदा सुरक्षित उत्तराखण्ड

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:

DHI — The expert in WATER ENVIRONMENTS — www.dhigroup.com

ERN International — www.ern.com.mx

Asian Institute of Technology — www.ait.ac.th

Earth Observatory of Singapore — www.earthobservatory.sg

PROJECT PROGRAMME

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








State Government Point of Contact:
Program Manager
Project Implementation Unit TA & CBDRM
Uttarakhand Disaster Recovery Project,
SIIDCUL Building 29 IIE IT Park,
Sahastradhara Road, Dehradun, Uttarakhand.

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