उत्तराखंड शासन

STRATEGIC PLAN FOR RISK REDUCTION

Increasing resilience through effective

RESPONSE, RECOVERY, MITIGATION, & PREPAREDNESS

RURAL RISK HOTSPOT

BHATWARI BLOCK

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

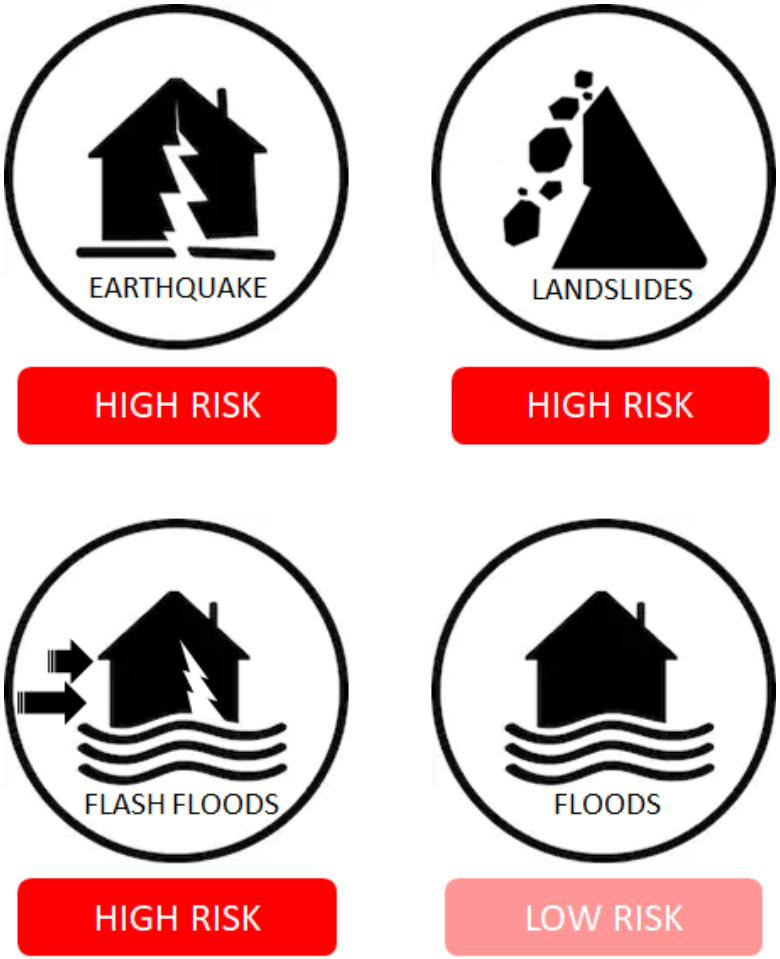
1.1 Overview of Area

The Bhatwari 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 (Low), flash flooding (**High**) and landslides (**High**) Greater detail is provided in the Risk profile below (Section 1.4).

Bhatwari is an important region for the Uttarakhand tourism as well for the Hindu belief as it houses Gangotri, the mouth of river Ganga. Along with being a popular pilgrim destination, Bhatwari block is also one of rural blocks in the state with a large area under its administration jurisdiction. The Bhatwari Head Quarters of the block is on its way to become an important town for the state. The effect of rise in the number of tourists in terms of unplanned urban expansion leading to sub-par structures with respect to earthquake resilience is resulting into high risks.

As part of the state government's policy to increase tourism in the state, Bhatwari block has experience a surge in the construction of urban infrastructure. It is important to assess the risk and exposure this infrastructure faces along with strengthening the already exposed infrastructure to earthquake resilience.

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.



1.2 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 (see figure below).

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 and is encompassed in ten key principals (see box).

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.

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 ands 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.

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

Bhatwari lies in the Upper Bhagirathi basin along the Bhagirathi River. The elevation varies between 1200 to 3000 metres above sea level in the valleys to the ridges of the region. Bhatwari lies in the Middle Himalaya physiographic zone between the main central thrust and the main boundary thrust.

1.3.2 Climate

The valley regions around Bhatwari enjoy pleasant and warm summers, however the winters are cold and snow falls at as low an altitude as 1200 metres above sea level. The monthly average temperatures vary from a minimum of 3.4 °C in January and a maximum of 28.4 °C in May. About 1400 mm precipitation falls annually with the summers rainier than the winters.

1.3.3 Demographics

Bhatwari block has a population of 56,405 across 97 inhabited villages with a literacy rate of 82.73% and a sex ratio of 886. Notably the male literacy rate is healthy at 93.88% whereas the females lag behind at 70.14%. Around 48% of the population are main or marginal workers. Amongst the working population, 64% are engaged as cultivators whereas a high percentage of the remaining are engaged as 'other' workers (30%). The decadal growth rate of the Bhatwari tehsil was 7.5% which is lower than that of Uttarakhand (18.8%) and India (17.64%) indicating an out-migration of people (census 2011 vs 2001). Moreover, this is in line with the state decadal growth trends where urban areas have seen a growth of 40% whereas rural areas are growing at only around 11%.

1.3.4 Economy

Bhatwari's economy is primarily dependent on agriculture wherein horticulture contributes significantly due to the rich biodiversity of the forests of the region. Since Bhatwari is en-route Gangotri which is a popular pilgrimage, many tourists halt here for accommodation and food. Also, Bhatwari has many secular tourist attractions such as the many "bugyals" which are high altitude alpine meadows and Shastra Tal (lake).

1.3.5 Development History

The Char Dham Expressway National Highway project was flagged of in late 2016 and is currently underway. This project plans to connect the four dhams to Rishikesh with a two lane (each direction) road with a minimum width of 10 metres. Since Gangotri is within Bhatwari block, the wider all-weather road will improve access to Bhatwari. Also, Bhatwari is developing secular tourism along the lines of the Dayara Bugyal (where the annual butter festival is a huge draw) for other locations abundant with natural beauty and local culture.

1.3.6 Regional Context

The area defined under this hotspot is taken as the entire block area mapped as per administrative boundaries. Bhatwari is connected via national highway 34 which goes all the way to Gangotri in the north. There isn't any alternate route of access for Bhatwari block. Also, this route is highly vulnerable to landslides and floods. Due to this, road transport services can become early casualties of a landslide or flood event. Disruption of these services lead to complications in relief and recovery efforts which in turn exacerbate the disaster risk in the area.

1.3.7 Critical Facilities/Infrastructure

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

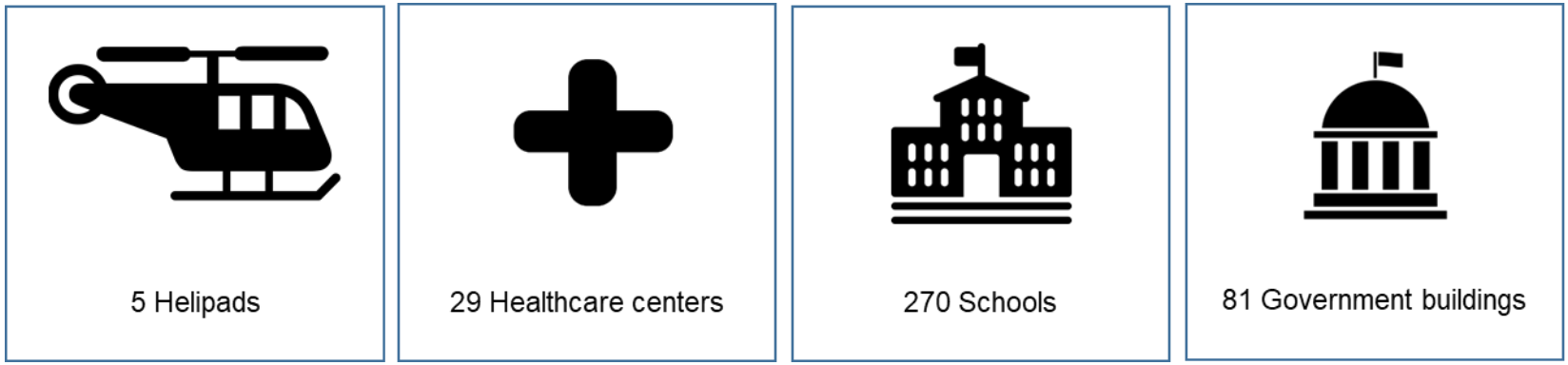
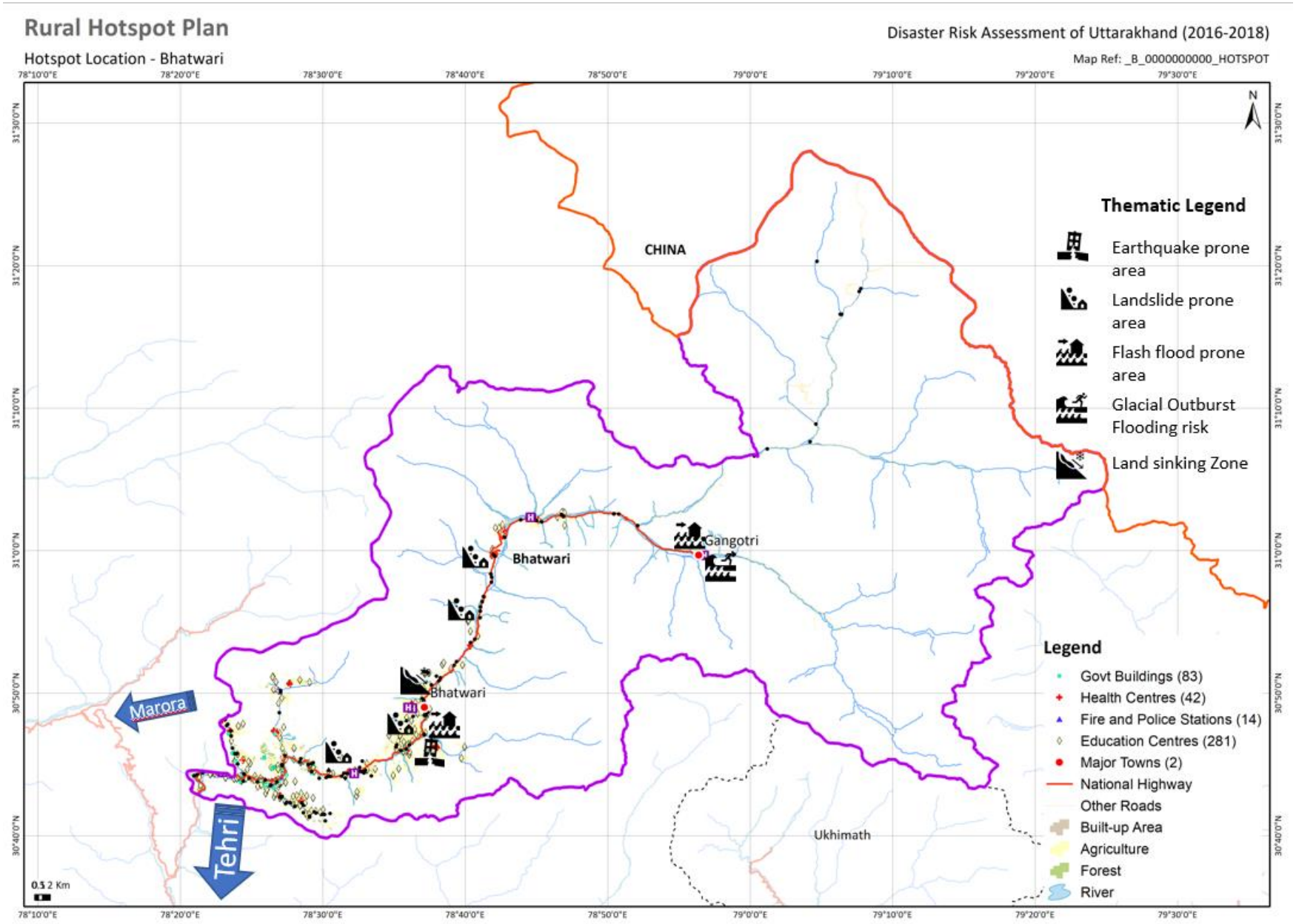


Figure 1: Snapshot of lifeline buildings and helipads

The health care centers consist of 10 sub-centers, 2 PHC's, 1 CMO, 1 CMO and 1 district hospital. The total lifeline buildings in the Bhatwari hotspot are 370.

Sewage management in Bhatwari is rudimentary with many buildings using on-site sanitation systems or draining untreated sewage into the Bhagirathi River. For water, most people rely on hand/motor pumps or bore-wells to extract water from the water table, however the water table supply is often not

adequate in hilly areas causing regular shortages of water for the people of the area. For cooking gas, there is an LPG service in Bhatwari village (block HQ), however many in the block area still use traditional cooking fuels such as firewood and cow dung.



Map 1: Contextual Map of Bhatwari Block

1.4 Bhatwari Risk Profile

1.4.1 Social Vulnerability

The social vulnerability has been ascertained by analysing 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 Bhatwari block has large swathes of land occupied by highly vulnerable communities, however, these areas are also sparsely populated. The most densely populated areas of Bhatwari are less vulnerable. The area from Uttarkashi to Bhatwari is densely populated and less vulnerable whereas the region beyond Bhatwari village is sparsely populated and highly vulnerable. This is also incidentally the zone that handles high traffic of pilgrim and tourists.

Maps 2 and 3 illustrate the social vulnerability and population density of Bhatwari block.

1.4.2 Earthquakes

Earthquake has been assessed as a “High” risk hazard in Bhatwari being ranked 30th for the state on median PGA values (for the 475 year return period) at 481.2 gals. Bhatwari block lies on the Berinag Thrust hanging Wall and the MCT Zone encompassing over MCT I and II, Berinag Thrust and Vaitrika Thrust. The combination of this geological position makes Bhatwari a highly susceptible block for Earthquakes.

Maps 4 to 6 illustrates the earthquake hazard profile.

1.4.3 Fluvial Flood

Fluvial Flood Risk for Bhatwari is seen as Low being ranked at a state level as only about 3.2 % of the block would be inundated to 0.3m or more in a 100-year event. This is largely a result of the very steep nature of the topography which does not allow for Fluvial Flooding.

Map 7 illustrates the fluvial flood risk in Bhatwari.

1.4.4 Flash Flood

Flash flooding is seen as a High risk in Bhatwari as a result of highly mountainous terrain. Bhagirathi is the main river flowing through Bhatwari which becomes Ganga after meeting the Alaknanda at Devprayag. Bhatwari block also houses major glacier such as the Gangotri Glacier, Bhagirathi Glacier,

etc. These glaciers give rise to major rivers for Uttarakhand and also for India. The Mountainous terrain and the volume of water from these glaciers give rise to violent stretches of river Bhagirathi which is highly susceptible to flooding. Bhatwari block also experiences dynamic local weather disturbances which lead to high local weather disturbances leading to heavy rains in short durations resulting into flash floods. Bhatwari receives an annual average of 1400 mm rainfall which shows the high precipitation in the block letting to flash floods.

Glacial Lake Outburst Flooding is also another risk posed in this area especially at Gangotri, wherein the risk is also against flash flooding induced by glacial lake outburst flooding. Gangotri sits exactly on the drain path of the lake Kedar Tal, a lateral glacier lake fed by the Bhrigupanth glacier. This glacier lake can be considered as the third largest glacier lake in Uttarakhand. Any trigger events for e.g. Avalanche, Landslide, Cloudburst, mudslide, earthquake can produce displacement waves so strong to breach the lake as happened in the case of lake Chorabari in Kedarnath in 2013. This breach will cause an enormous amount of flooding carrying huge moraine sediments endangering the existence of settlements in the path. Gangotri in particular is a major town in the path of the drainage area of this lake. And hence the risk should be analysed in detail.

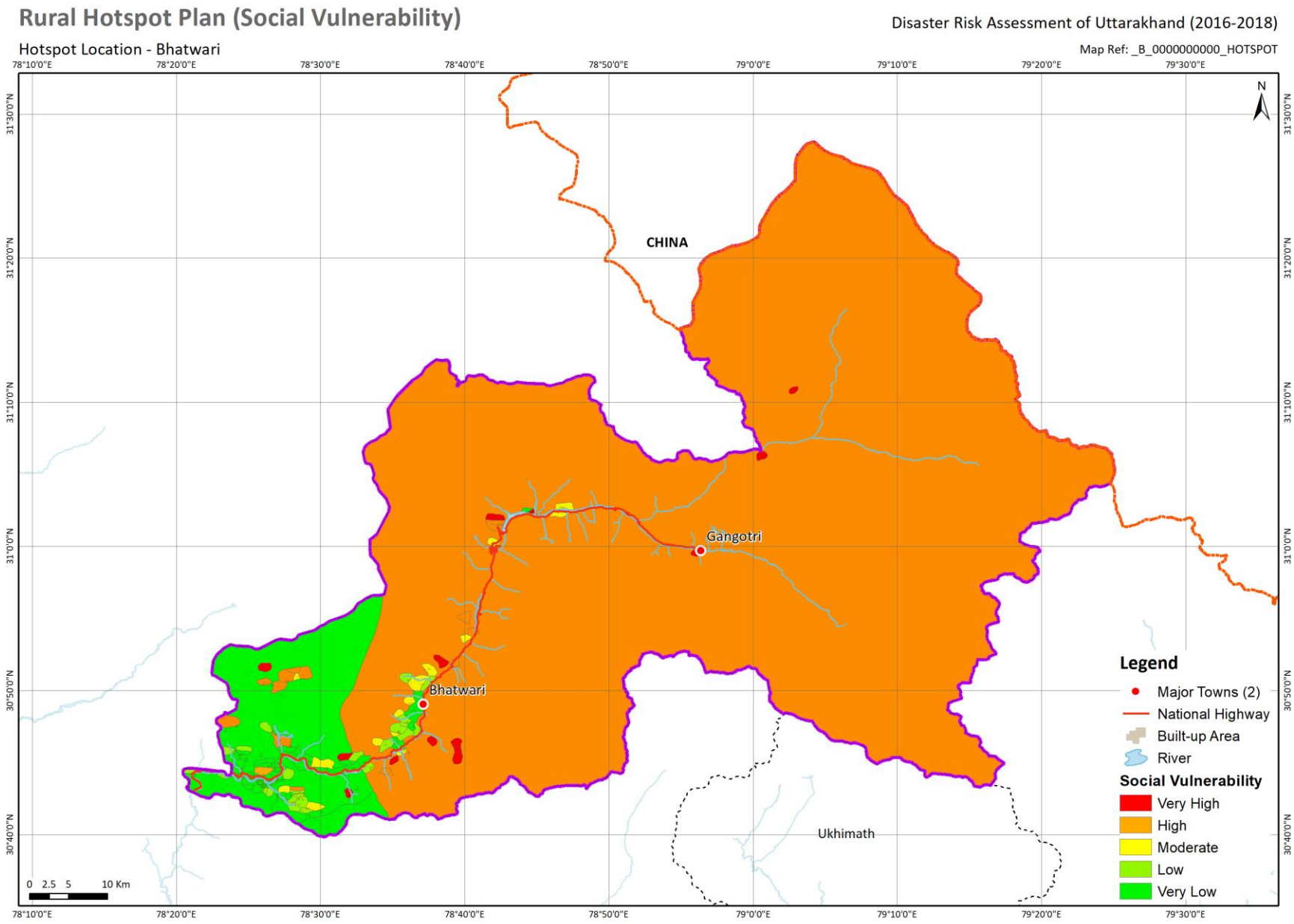
Map 8 illustrates the flash flood risk across Bhatwari.

1.4.5 Landslide

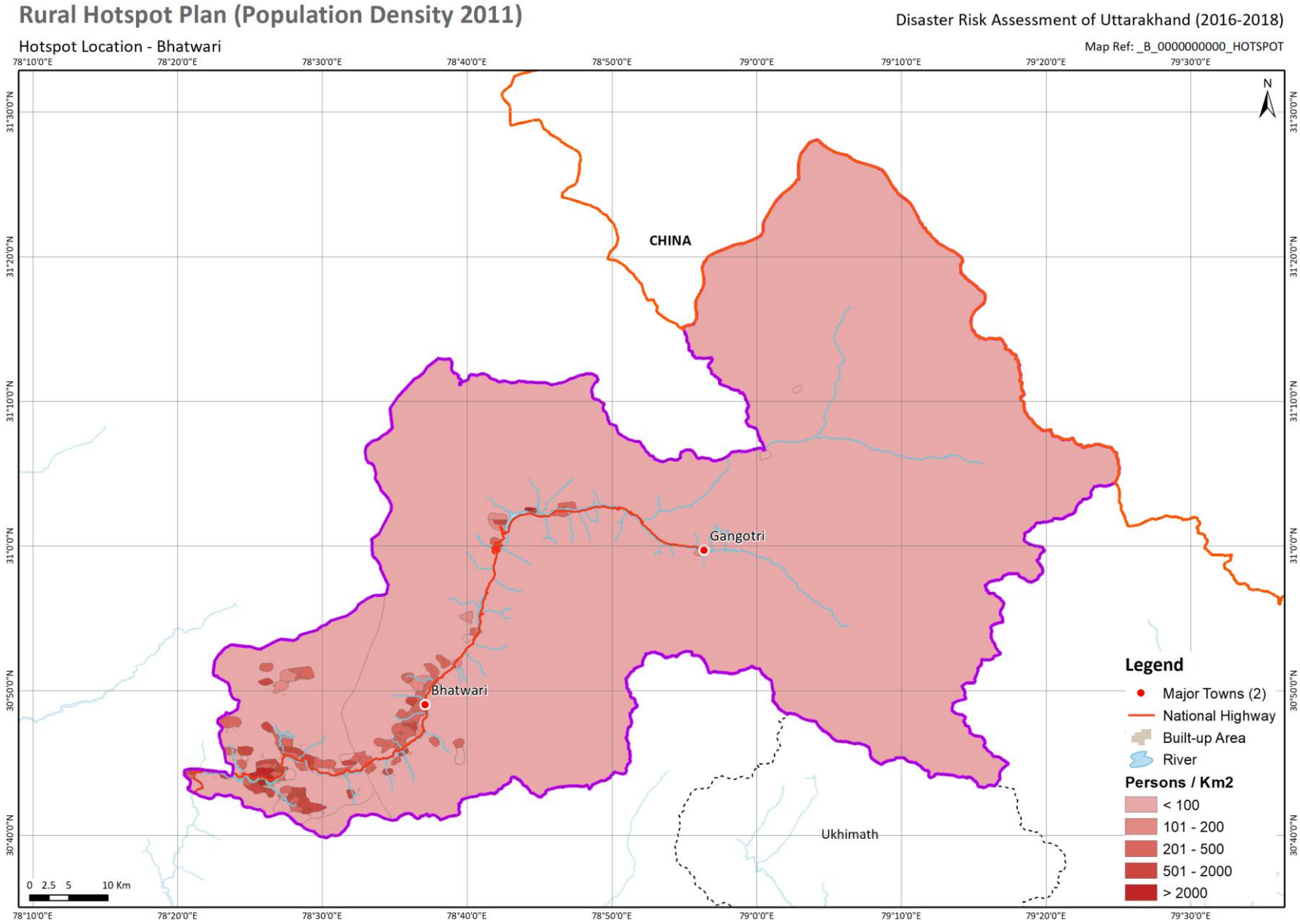
The landslide hazard is labelled as “high risk”. The high landslide risk corresponds to the unstable geology and immature terrain. The soil and rocks in the Garhwal mountains are considered to be more unstable because of higher tectonic activity. The road from Uttarkashi to Gangnani (ahead of Bhatwari) is seen to be highly prone to landslides.

Beyond Gangnani, the landslide risk is greatly reduced or almost nonexistent.

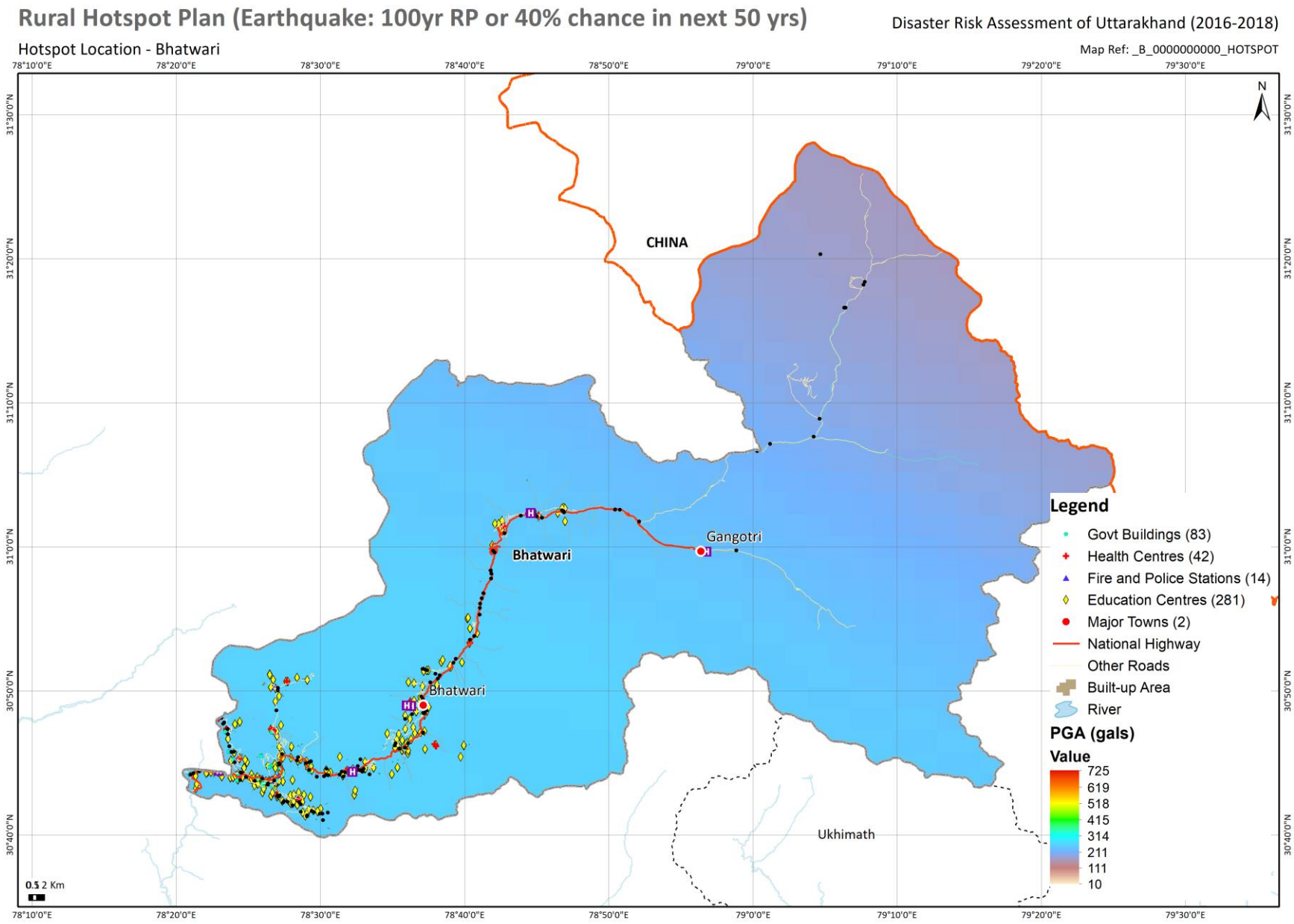
Map 9 illustrates the landslide risk in Bhatwari block.



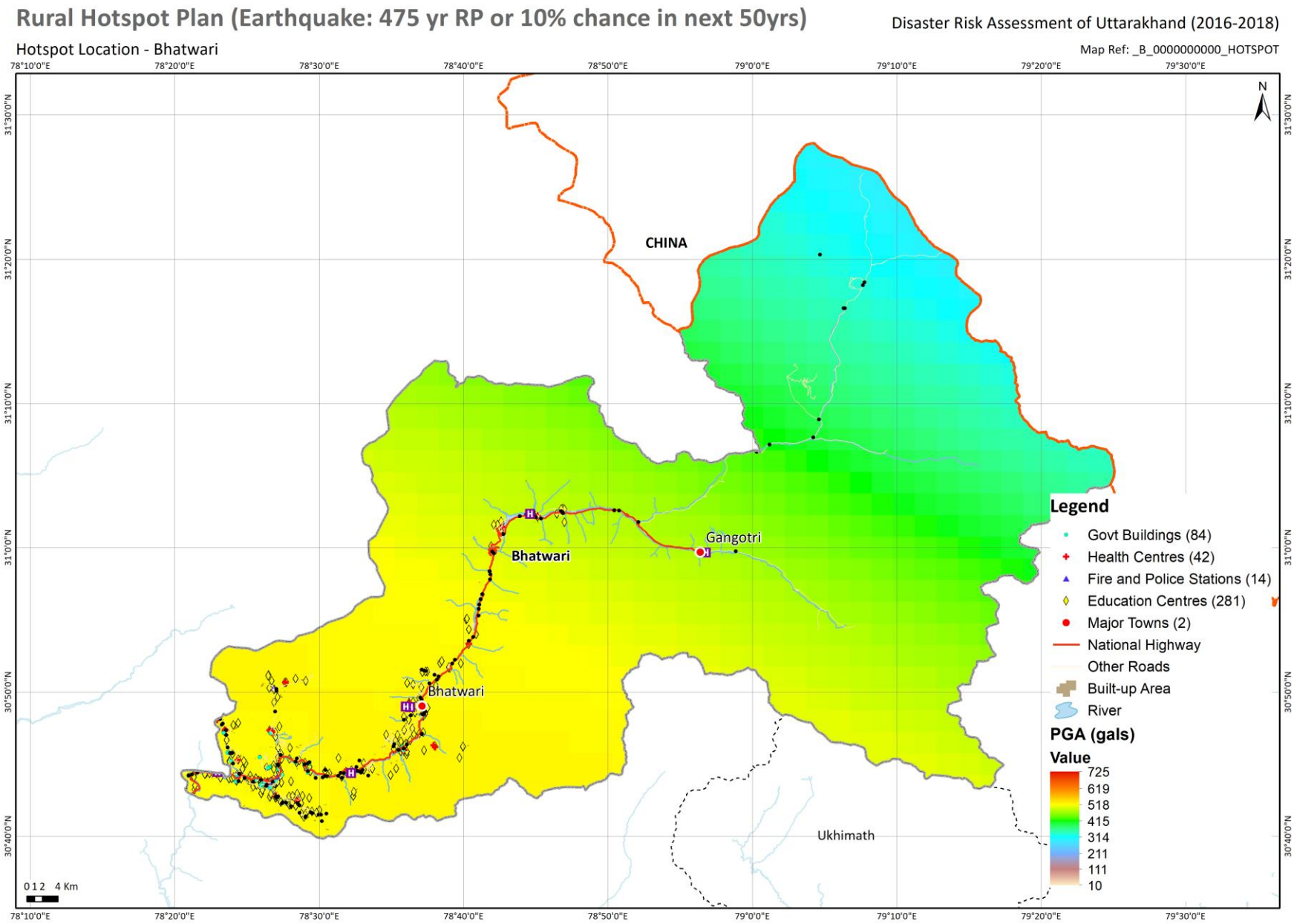
Map 2: Integrated Social Vulnerability Index of Bhatwari



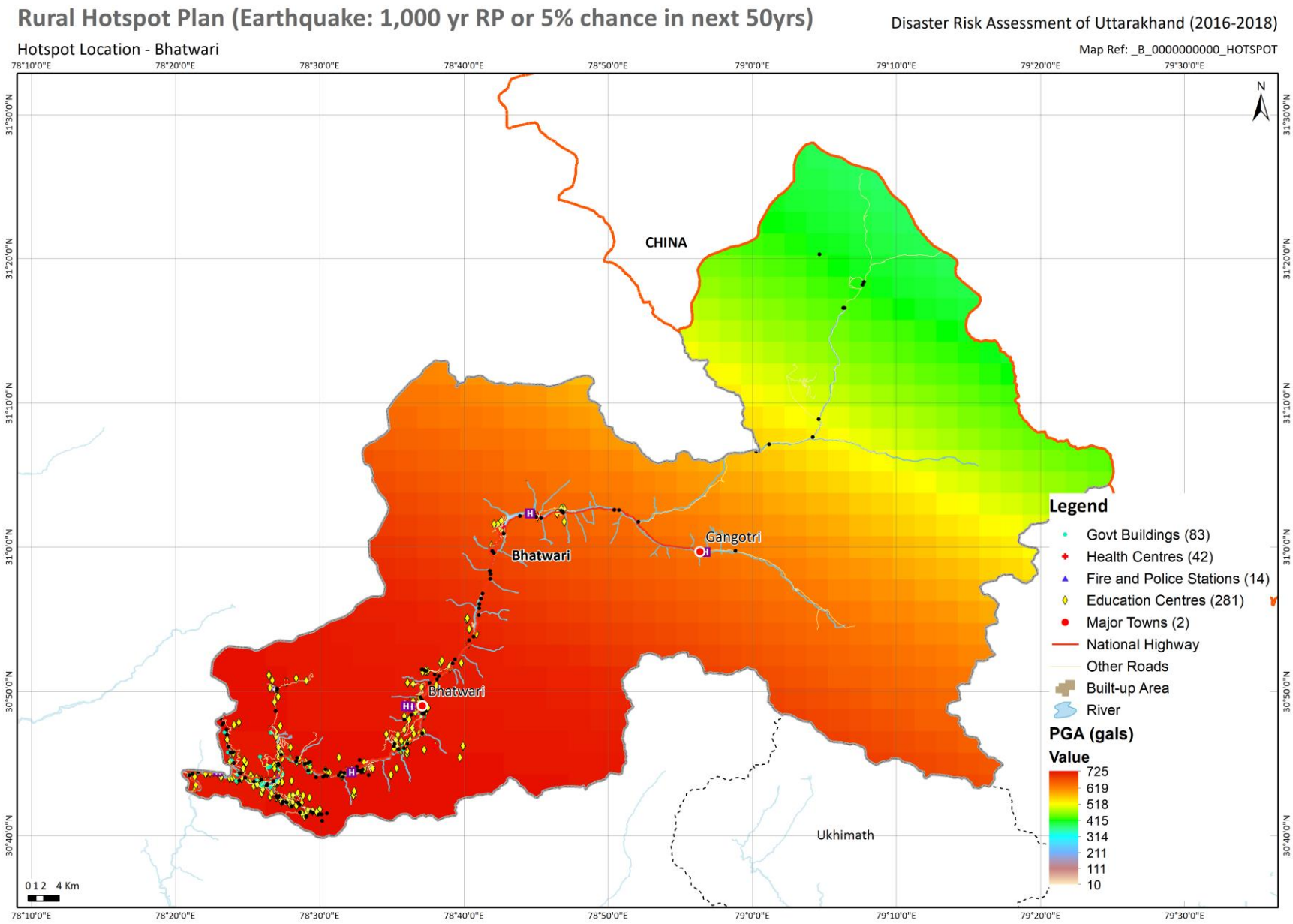
Map 3: Population Density Map for Bhatwari



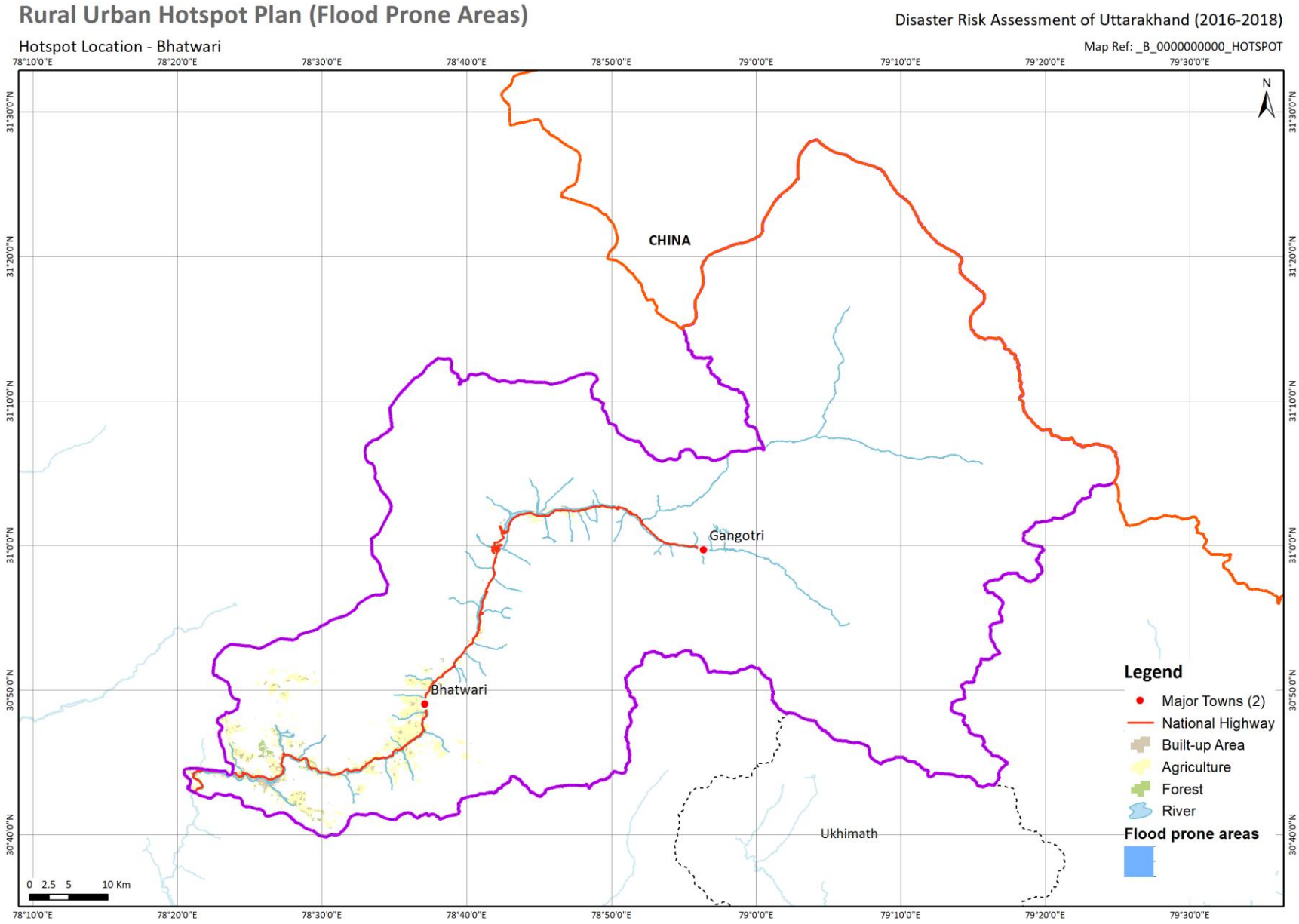
Map 4: Earthquake Hazard Profile (100yr RP) – Bhatwari Block



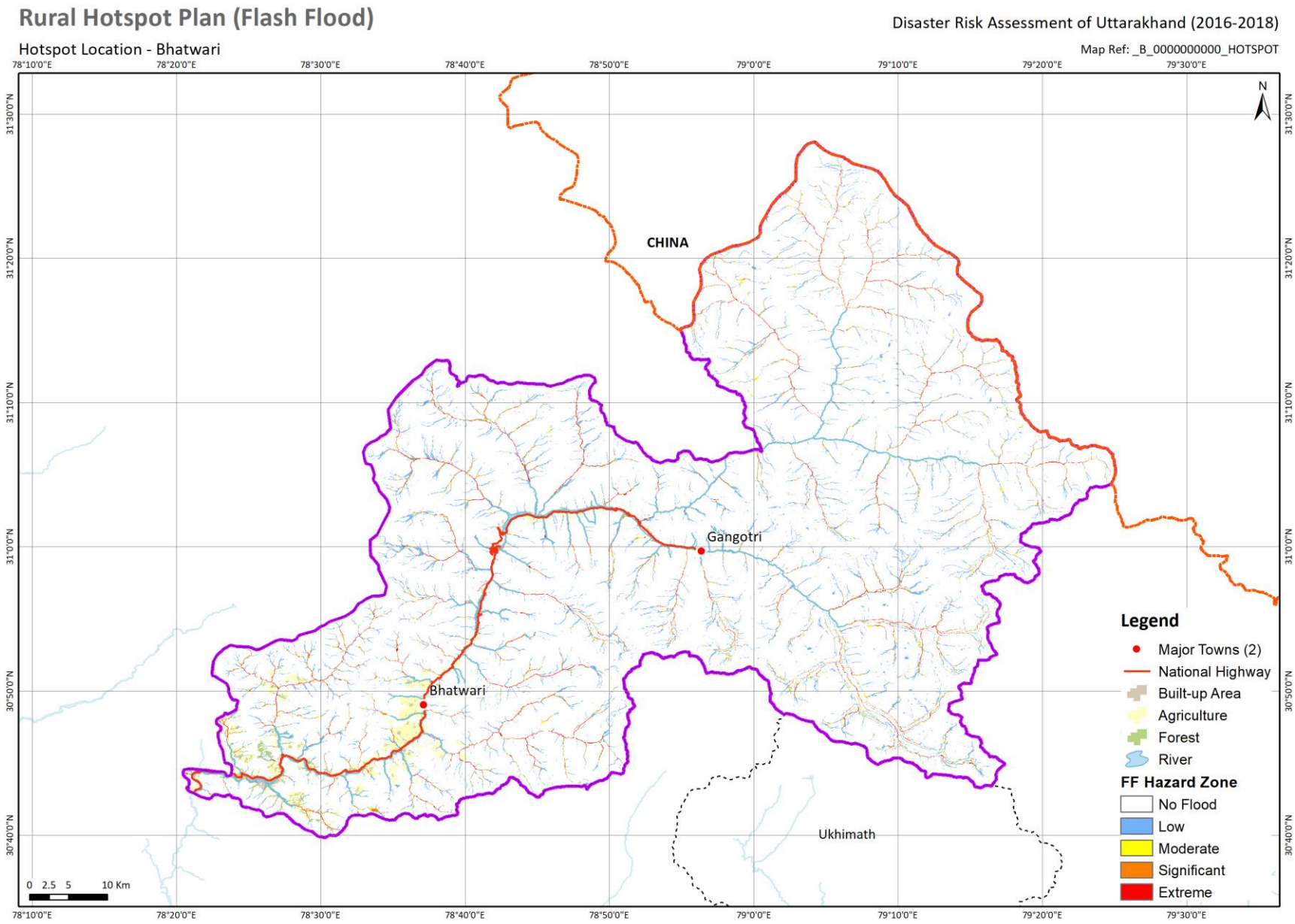
Map 5: Earthquake Hazard Profile (475yr RP) – Bhatwari Block



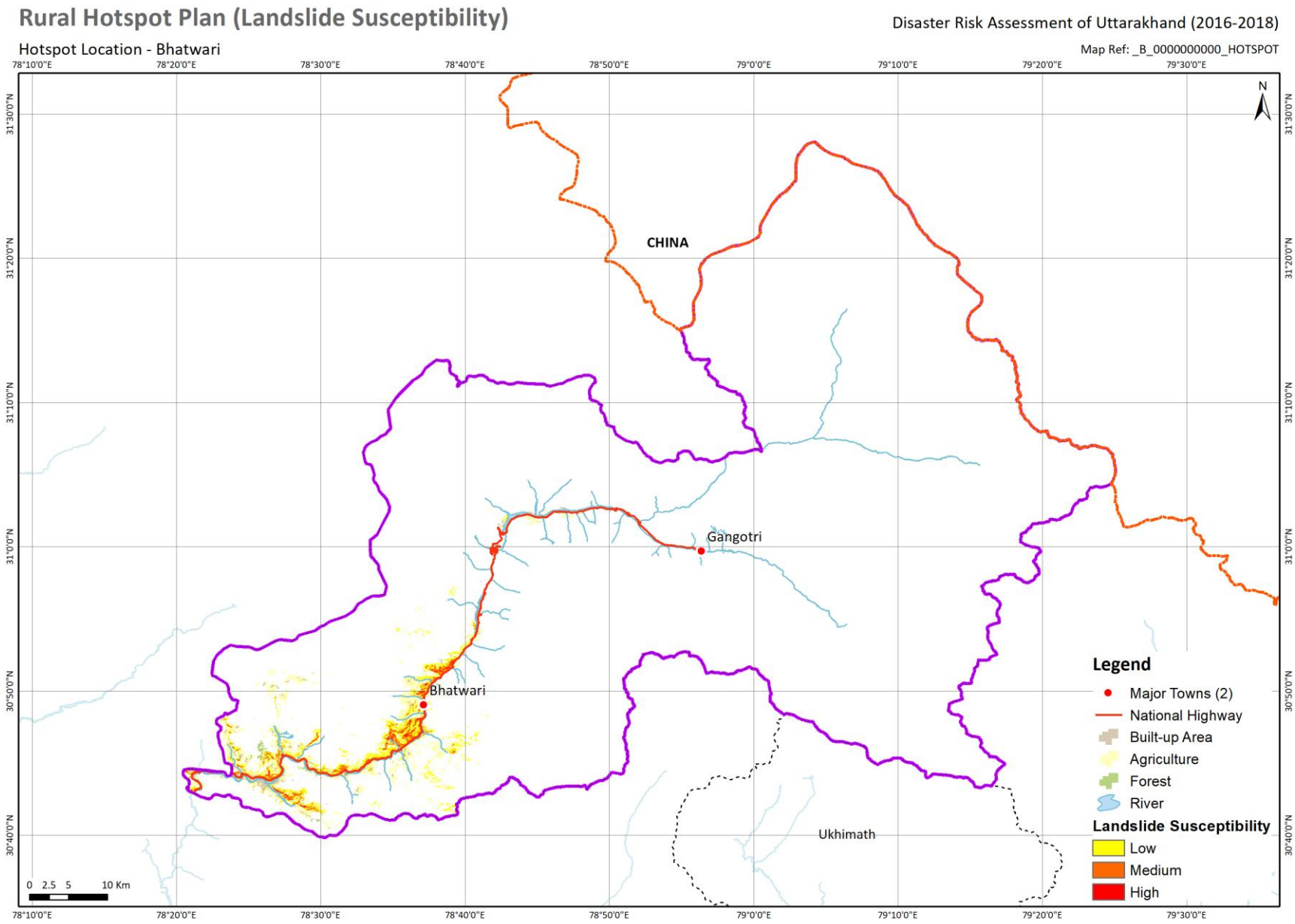
Map 6: Earthquake Hazard Profile (1000yr RP) – Bhatwari Block



Map 7: Fluvial Flood Hazard for Bhatwari



Map 8: Flash Flood Profile of Bhatwari



Map 9: Landslide Hazard Profile of Bhatwari

1.5 Strategy Implementation, Monitoring, Evaluation

1.5.1 Challenges in Implementation

Four challenges have been identified with respect to DRM in Bhatwari Block. 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 block administration 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 specialization 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 specialisations need to be considered.

Creation of DM Committees within the GP – Consistent with the Panchayati Raj Act (73rd Amendment) in 2016, there is the need to include DM as a primary function within the Gram Panchayat. As the State Finance Commission has the responsibility to make recommendations as regards the financial powers of the Panchayats this provision should be an inclusion within the State DM Policy and suitable funding and other requirements – principally coordination and integration at the GP level.

1.5.2 Proposed Management and Governance Structure

It is proposed that a **Bhatwari Hazard Mitigation Working Group** is established by the BDO. 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 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 as 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 amongst 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, and in the case of Bhatwari, and other important pilgrimage centers, are fundamental to strengthening the existing management planning of the observances and movement of many millions of pilgrims.

Social vulnerability in the context of rural areas is slightly different from the urban context. In the rural areas, vulnerability is most likely influenced by access to basic services, remoteness, socio-economic conditions including employment opportunities locally for those not engaged in agriculture, etc. Thus, the strategies needed to reduce vulnerability should be:

A. Increase access to basic services,
B. Promote natural resources management,
C. Sustainable and diversifying agriculture,
D. Promote alternative livelihoods
E. A focus on education

2.1.1 Mitigation

Mitigation			
STRATEGY	**DRIVER**	**OUTCOMES**	**KPI**
Constitute a Disaster Management Committee (DMC) at the Panchayat Samiti (block panchayat), across its departments and the Gram Panchayats (Villages).	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 DMC with responsibility to ensure all DMP are formulated, understood and implemented with an obligation to report to the respective block, district and state government.	A committee established, and appropriate TOR agreed and signed off on within 6 months.

Create Disaster Management Committees (DMC) at the Gram Panchayats (Village) level.	Consistent with the intent of the State Panchayat Raj Act (2016) for every Gram Panchayat a DMC should be formally created. The DMC would have the full constitutional (legal) rights and level of responsibilities, afforded to other committees and the same membership structure. The DMC is to carry out all DM related activities and provide a strong link back across the other four Committees and any special infrastructure or climate change projects being undertaken.	The inclusion of DM thinking and planning at the Gram Panchayat level of development.	Committees established, and appropriate TOR agreed and signed off on within 6 months.
Development & updating of Disaster Management Plans at all levels within the Panchayat Samiti (block panchayat) and across its departments and Gram Panchayats (Village) jurisdictions.	At Block Level, DM Plans have not yet been developed. The DMP not only needs to be up-to-date but it needs to be a part of mainstream administration in the Block.	A well prepared and tested DMP that is regularly reviewed, amended and integrated across all departments.	DM Plans developed 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 rural block.	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 school children equipped with demonstrated response capability.	Development of the DMP within 12 months followed by regular annual reviews.
Combine DM planning into the development programme process at the Gram Panchayat level by placing a young and qualified engineer, trained in DM, in every panchayat with significant funding.	At the Gram Panchayat level, there is funding being provided for a range of activities focused on increased social and economic growth, infrastructure and sustainability. The programmes involve significant funds and place a strong technical demand on the	DM becomes a key consideration in aspects of GP growth, sustainability and resilience.	Every programme to have graduate engineer trained in DM working in the Panchayat.

	Panchayat where the Panchayats are lacking.		
Undertake an audit of the structural and lifeline support capability of all lifeline buildings to ensure that all are assessed and that the results of the comprehensive assessments are reported.	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.
Strictly regulate development initiatives in close vicinity of Bhagirathi River and along its tributaries.	By-laws prohibit development initiatives in the close vicinity of Bhagirathi river. However poor compliance leads to unregulated infrastructure development along the river banks. This poses a risk to settlements downstream in the event of a flooding or landslide event. Also, this infrastructure is inherently vulnerable to disaster events.	Reduction in exposure of infrastructure in the event of a flood/landslide event.	All current and future infrastructure projects along the river areas to be scrutinized and due diligence to be ensured on their by-law compliance within 12 months.
Regulation of commercial development in the vicinity of state highways/ district roads.	The rapid urbanization along the state highways/district roads comprising of hotels, restaurants etc. is encouraged by the high economic returns during the tourist season. However most of this rapidly growing infrastructure is vulnerable due to its location and structural weakness.	Tourist infrastructure will move to safer designated areas away from the vicinity of state highways/district roads hence easing traffic on these roads as well.	Reduced development along the state highways/district roads going forward.
Removal of severely damaged structures located on extremely critical slopes.	Severely damaged structures are often abandoned and neglected. On critical slopes, these structures are a grave risk	Potential damage to infrastructure exposed to critical slopes in the event of	Damaged structures removed off critical slopes within an immediate timeframe.

	to the infrastructure downhill in the event of a landslide.	an earthquake/landslide event is reduced.	

2.1.2 Planning and Preparation

Planning and Preparation			
STRATEGY	**DRIVER**	**OUTCOMES**	**KPI**
Increase public awareness, understanding, support & demand for hazard mitigation through the development of a rural block-wide sales and marketing strategy and campaign focused on private sector community groups, industry (if any), 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.
Sensitization meetings at GP level through 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.
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	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.

	provide rapid response support and additional capability.		
Training of school staff, Hospital staff, Officials, Community members, 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.
Training of officials on damage & need assessment.	Training to undertake a damage and needs assessment across the entire rural block 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 the block's development efforts.	Designed training for 12 months. Annually tested.
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 organization's executive management.
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 Rural Public Safety Agencies such as Police & Fire, Health and the private sector.	There is a need for undertaking a regular set of simulation exercises around a designated disaster type and area within the Block as part of the Block DMP. 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 block's rural Public Safety Agencies and the private sector.	It should be conducted on regular basis i.e. at least two per year.

Development of Early Warning Systems (EWS) and assessing their effectiveness within the Block	Having effective and tested EWS capability is an important element of response planning and preparation as even several seconds warning may lead 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.	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.

2.1.3 Response

Response			
STRATEGY	**DRIVER**	**OUTCOMES**	**KPI**
Establishment/ Activation of Block 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 Block 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 level to meet the conflicting demand at the time of disaster.	Establishment and functioning of EOC within 12 months.
Establishment of Incident Response Mechanism (IRS)	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, it has not been initiated at a block level.	Establishment and functioning of IRS at Block 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 ERT's	Emergency response to be performed during disaster shall depend on the level of disaster. At local level, the emergency response teams, consisting volunteers from GP', NGO's, CVO's & other organizations can be deployed.	A smooth & effective response by trained ERT's.	Performance/ level of readiness should always be checked on regular basis.

2.1.4 Recovery (Short-Term)

Recovery			
STRATEGY	**DRIVER**	**OUTCOMES**	**KPI**
Conduct damage & need assessment post-disaster as the basis to planning the restoration & improved disaster resilient housing, government buildings & cultural heritage in the block.	A damage and needs assessment across the entire block 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 and tested annually.

2.1.1 Recovery (Long-Term)

Recovery			
STRATEGY	**DRIVER**	**OUTCOMES**	**KPI**
Strengthen the capacity of people and communities to reduce the risks and vulnerability & to enhance	There is not at present a Post Disaster Recovery Framework (PDRF) for the State, however, all responsible agencies, the community and the local	A Post Disaster Recovery Framework that links to specific hazard responses recovery Plans and the agencies responsible for pilgrim activities; as well	A first draft within three years.

social cohesion through a Post Disaster Recovery Framework.	businesses need to plan not for the inevitable disasters that will occur but also for recovery. The proposed Disaster Management Committee (DMC) needs to take the lead as part of its obligations.	as strategic growth strategies for the Block.	
Develop Sector 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 includes education, shelter, food & nutrition and health are often neglected, so social sector planning is very essential.	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 the entire block.	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, 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.	The development of multi-hazard resistant housing as a fundamental rebuilding block for the area.	Initiate once response & relief phase is over. Monitoring through team of experts. Guidelines for owners should be developed within 12 months.

2.2 Specific Strategies for Earthquakes

2.2.1 Introduction

Earthquakes of any magnitude in rural dominated blocks like Bhatwari bring a particular challenge that means many people and much property is at risk as result of the dendritic distribution of communities along river valleys and the associated limited options with respect to access. This situation gets exacerbated particularly in the winter period. As a result, creating resilient and capable communities 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

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	Effective compliance to building codes and statutory planning zonation and codes for the block and surrounds	Ongoing process. Review every 6 months by State Govt.

	building byelaws and the Town & Country Planning Act, however due to non-compliance/ or lack of 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

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 Bhatwari block.	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	Create community resilience through emergency preparedness & hazard mitigation awareness programs via communication channels	An awareness campaign plan should be developed for 12 months.

	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[1] shows that "shock" from traumatic situations can be very debilitating but can be overcome through awareness and training.	such as TV, pamphlets, street plays etc.	
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 rural 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 Earthquakes - Response

See strategies listed in Overarching Strategies above.

2.2.3 Earthquakes - Recovery

See strategies listed in Overarching Strategies above.

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

2.3 Specific Strategies for Flash Floods

2.3.1 Introduction

Flash Flood strategies in general are discussed in the Preface to the Hotspot case studies and in the case of Bhatwari flash flooding is seen as impacting a critical area along the Bhagirathi River. In this context, the risks are posed to entire villages for example Gangotri, wherein the risk is also against flash flooding induced by glacial lake outburst flooding. As explained in section 1.2.4. it is important for the local communities and officials to be aware of this such risk which can be induced due to any natural trigger event. The area where in this glacier lake sits is also a very popular hiking route for experienced mountaineers who are always accompanied by local guides. It is important that from the tourism point of view is imperative that the locals spread the awareness against the presence of such hazards.

2.3.2 Floods - Mitigation

FLOODS - MITIGATION			
STRATEGY	**DRIVER**	**OUTCOMES**	**KPI**
Develop a Flood Plain Zoning assessment[2] 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	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.

[2] 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).

	of areas likely to be affected on account of accumulation of rain water; Marking of likely submersion areas for different flood stages.		
Compliance of building by-laws in flood prone areas, which provide following provisions. Important to regulate development strictly in close vicinity to Bhatwari River and along its tributaries.	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 velocity erosion and setbacks set for flood plain edges.	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.
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.
Develop low cost, community based flash flood warning systems in those areas were vulnerability is particularly high. See: 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 See: https://unfccc.int/climate-action/momentum-for-change/information-	Flash flooding can be caused by intense rainfall events (cloudbursts) that maybe very localized and occur in remote, isolated and inaccessible areas. Events can be very unpredictable and of extreme magnitude: economic impacts are nearly-impossible to mitigate in many case so there focus should be on minimizing human losses.	A set of early warning systems that have strong community engagement and support that will lead to a reduction in loss of life.	Develop and install a set of 5 systems in high risk village catchments within the first 12 months

and-communications-technology-solutions/community-based-flood-early-warning-system-india	Early warning systems need to be developed with local knowledge and communities involved in their development and operation.		
Adequate information spread across local communities against the Glacial Lake Outburst Flooding risk (GLOF).	A GLOF event is very difficult to contain which makes it important that the local communities at least be aware of such a risk in their area.	The awareness will help the communities to not be taken by shock and avoid panic in case such event occurs. The aware communities perform much better to develop resilience than an unaware community.	Adequate notices along the hiking route and the roads near to Gangotri should bear notice boards and warning signs.

2.3.3 Floods - Planning and Preparation

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.
Monitoring the glacial lake by local communities and gram panchayat	It is important that such glacial lakes which are prone to outburst by the virtue of their type and formation be monitored for increase in area and	The local communities and the Gram Panchayat will be aware of the development of the glacial lake and its surrounding on an annual basis. This	A log book be maintained by the Gram Panchayat assessing the area of the lake and the surrounding conditions every year. The information should be relayed

	volume of water. The surrounding concave cliffs should also be monitored for any anticipated risk of rock fall, landslide or avalanche fall in the lake.	will also make people avoid heavy construction directly in the path of the drainage of the lake. Also, any anomalies in the lake structures and the surrounding will be noticed in a timely manner.	by local guides who travel with the hikers to Bhrigupanth glacier.

2.3.4 Floods - Response

FLOODS - RESPONSE			
STRATEGY	**DRIVER**	**OUTCOMES**	**KPI**
Increase public awareness, understanding, support & demand for hazard mitigation through the development of a rural block-wide sales and marketing strategy and 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, local business groups, industry, rural public agencies, pilgrims 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 tourist and Pilgrims.	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 block every 12 months. A block wide drill run every 2 years.

2.3.5 Floods - Recovery

See strategies listed in Overarching Strategies above.

2.4 Landslides

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 requires considerable skill to map and propose mitigation strategies in high risk areas.

….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)

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. National Institute of Disaster Management, New Delhi - 110002, Pages 282.

2.4.1 Landslides - Mitigation

Landslides - Mitigation			
STRATEGY	**DRIVER**	**OUTCOMES**	**KPI**
Identify the location & extent of landslide hazard areas in the block and surrounds	Preparation & updating of Hazard Zonation maps of the block is required, and which includes: - update & maintain current maps of areas within the block 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	Risk management strategies to protect property and life including advising all owners and relevant government agencies.	Avoid construction for next 5 years.

	properties; construct debris flow diversion to protect existing properties		
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 Land slide Management Plan the is the 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, nalah 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.

2.4.2 Landslides - Planning and Preparation

Landslides - Planning and Preparation			
STRATEGY	**DRIVER**	**OUTCOMES**	**KPI**
Develop emergency response procedures as part of the Block Landslide Management 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 but 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.

2.4.3 Landslides – Response & 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.

CAPRA
Probabilistic Risk Assessment Initiative

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 1959 — 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.





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