AF/UNDP Project

Developing Climate Resilient Flood and Flash Flood Management Practices to Protect Vulnerable Communities of Georgia

DEVELOPING CLIMATE RESILIENT FLOOD AND FLASH FLOOD MANAGEMENT PRACTICES TO PROTECT VULNERABLE COMMUNITIES OF GEORGIA

Floodplain Zoning Policy Framework and Policy Guidance Notes

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1 INTRODUCTION

1.1 Introduction

The aim of the Floodplain Zoning Policy Framework is to integrate flood risk management into the land use planning process in Georgia. To this end the policy framework is aiming to:

1) Embed climate resilient flood risk management into existing planning policies and plans by focusing on managing floodplain development, and by extension impacting the management of development away from the floodplain.

2) Outline the policy based on detailed risk knowledge based on floodplain hazard and risk mapping.

3) Provide policy guidance for flood risk management in the form of guidelines documents (e.g. risk assessment, minimum design standards for buildings in different zones, retrofitting buildings, ensuring flood resilient critical infrastructure, insurance zoning, integration of flood zones with Flood Forecasting and Early Warning System (FFEWS)).

4) Ensure the designated flood zones are considered an integral aspect of determining and specifying appropriate land uses (through restricting and permitting)

5) Provide sound practice examples for managing existing risks (i.e. managing risks to buildings already in high hazard areas), and managing residual risks.

1.2 Purpose of the Document

The purpose of the report is to present the floodplain zoning policy and the associated development control rules to help guide future development in the Rioni basin away from the highest flood risk zones, and to enhance climate change resilient flood risk management within the Rioni floodplain. It should be noted that, while the policy has been developed for Rioni basin, it will eventually form the basis of national policy with application to other basins in Georgia.

1.3 Structure of the document

The document is divided into two parts. Part 1 presents the floodplain zoning policy based on detailed flood hazard mapping and risk assessment, in addition to describing the 7 flood risk zones, their designations, and permitted development in each. Part 2 provides a series of accompanying Policy Guidance Notes as listed:

- Policy Guidance Note 1 - Summary of Proposed Flood Insurance Scheme
- Policy Guidance Note 2 - Building Resilience and proposed Building Code
- Policy Guidance Note 3 – Flood Resilient Critical Infrastructure
- Policy Guidance Note 4 – Guidance on Carrying out a Strategic Flood Risk Assessment
- Policy Guidance Note 5 – Guidance on Carrying out Site-Specific Flood Risk Assessment
- Policy Guidance Note 6 – Description and Vulnerability Status of various types of buildings.

2 FLOODPLAINS AND FLOOD RISK

2.1 Floodplains

Floodplains have been, and continue to be, shaped by natural processes such as flooding, erosion and deposition over time. In addition, human intervention on floodplains has altered floodplain functions over time, and if not effectively managed leads to devastating impacts for people, property and the environment.

Humans have been traditionally attracted to floodplains and water bodies for the services they provide. These include, transportation, water supply, water power, fertile soil for agriculture, industry, trade and commerce, recreation and many others.

The focus of the project is on the promotion of floodplain zoning as a means of natural flood management, in order to retain the natural functions of the floodplain, minimise loss of life and property damage due to flooding, and maximise the goods and services that can be derived from harmonious existence on the floodplains. Natural floodplain management measures include reconnection of the river with its floodplain (through development zoning), re-establishment of the natural floodplain by designating floodways to help store and slow down floodwater, the use of bio-engineering measures such as bank terracing, vegetative buffers, bundles and tree revetments and flood plain seasonal productive systems e.g. short season annual cropping, cattle rearing plots or seasonal pastures, and agro-forestry which can store and slow down water during events and otherwise be high value agricultural areas. These measures will also help protect soils from eroding and contributing to landslides and mudflow. Natural floodplain management measures such as these achieve typical benefits such as avoided costs of damage to society, human health and well-being, economic activities, infrastructure, cultural heritage and the environment. Environmental benefits of natural floodplain management for a basin would normally comprise a complex set of environmental attributes from which a range of market and non-market goods and services derive. For the Rioni basin, these benefits will include:

- Habitat creation through the restoration of the natural floodplain by zoning development away from the functional floodplain and creating floodways
- Maintenance/restoration of biodiversity by strengthening the functionality of the ecosystems
- Enhanced landuse management through the use of agro-forestry which will help to alleviate the current pressures of deforestation in the upland catchments as well as other harmful landuse practices
- Improvement in water quality and restoration
- Improvement in water resources through improved infiltration, and transmission and all other functions of the full water cycle
- Contribution to the development of a green economy by enhancing sustainable agricultural productivity of the floodplains, thus securing livelihoods and promoting flood resilience within the floodplain. Whilst helping to stabilise and stimulate the local economyy.

2.2 Flood Hazard and Risk in the Rioni basin

Flood hazard and vulnerability maps have been developed for the Rioni basin and include flood outlines for events of different magnitudes (known as return periods) and anticipated long-term impacts of climate change (see Flood maps in Appendix A). These flood outlines have been used to develop flood zones for utilization in floodplain management activities such as floodplain zoning through development planning, and emergency planning. The aim

of floodplain zoning is to promote the sustainable use of floodplains in order to minimize flood risk, damages and losses and improve natural floodplain function.

Land use planning limits and control mechanisms are essential elements in managing flood risk and one of the most effective ways of ensuring future flood risk is managed appropriately. Local topography and flood response of the Rioni Basin have been considered in developing the flood hazard maps and flood zones, which ensure that the flood zones, and hence the policies and controls, are appropriate for the Rioni basin.

It is envisaged that land use management within the Rioni flood plains may involve trade-offs between flood risk and development, but this policy document is being proposed, to ensure that such policy decisions would strike a good balance between the flood management function and floodplain productive use, without disturbing such function. Hence, a strategic approach to flood risk management has been taken in the design of the flood zoning policy that maximizes the net-benefits from flood plains, rather than being aimed solely at minimizing flood damage that might potentially enter into conflict with development oriented land-use.

It is anticipated that the flood hazard maps, flood zones and associated policy will be used by national and local authorities and local communities in the management and control of development on the Rioni floodplains. The flood zone maps will benefit decision makers and all involved in natural hazard risk management at the national and local level and will enable government, NGOs and future donors to better focus their future efforts in dealing with flood hazards. Importantly it will enable all users of the Rioni floodplain to better plan their activities on the floodplain in a flood aware and flood resilient manner.

2.3 Envisaged Benefits

The overall benefits of floodplain management for Rioni basin has been assessed as part of the project socio-economics assessment at the strategic level and at the scheme level. This shows that that more than 38,857 properties and 283,163 people in the Rioni basin are currently at risk from flooding in the extreme 1 in 1,000 year fluvial flood event, mostly in the floodplains of Samredia, Khoni and Kutaisi. A 1 in 100 year flood event would result in more than 4 Million GEL of damages in the 6 pilot municipalities of the Rioni basin (from fluvial flooding only) (See Table 2-2).

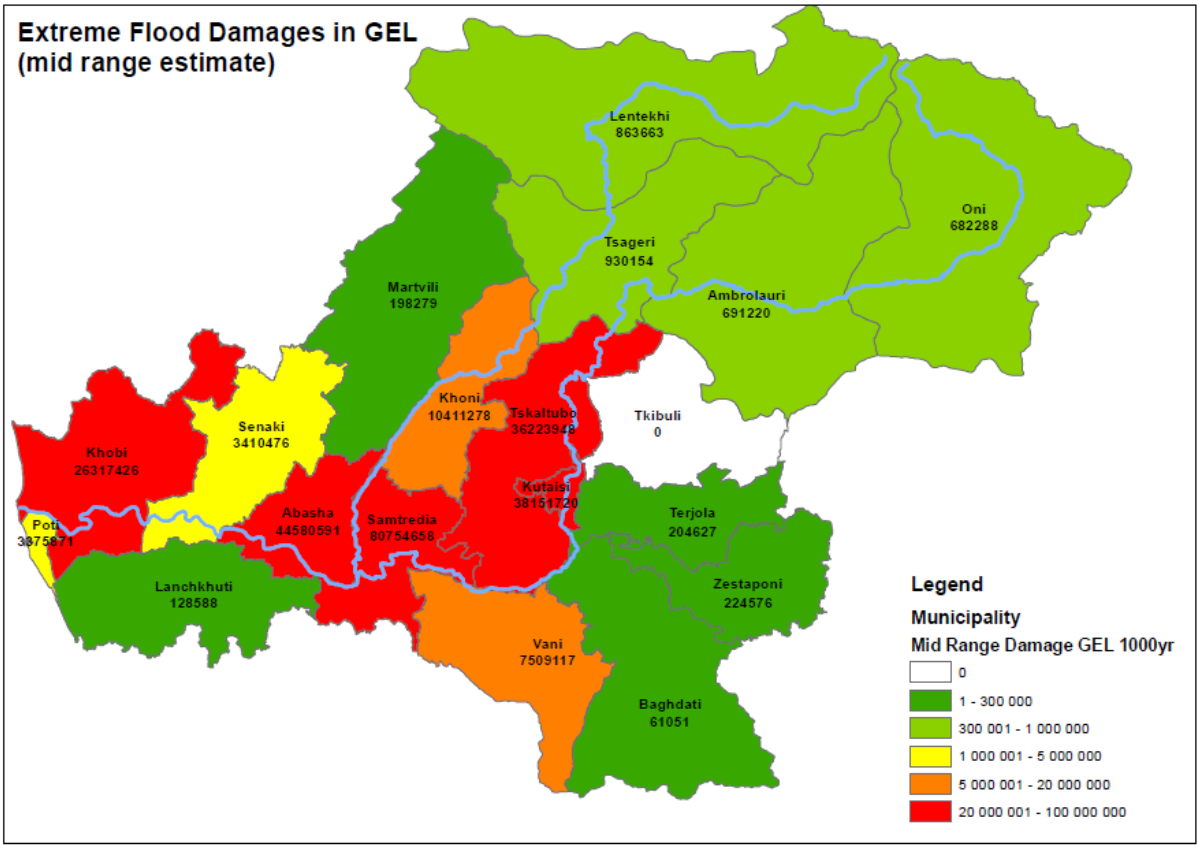
In terms of direct beneficiaries of adaptation measures being implemented in the Rioni basin, it is anticipated that people in key hot spot municipalities of Lentekhi, Ambrolauri, Oni, Tskaltubo, Samtredia and Tsageri will all benefit. The majority being women, elderly and children. A residual risk remains, however and it is estimated that more than 79.6 Million GEL will need to be spent if cost-beneficial mitigation measures are to be implemented to deal with flood risk by structural intervention measures.

Table 2-1: Flooding Demographics in the Rioni River Basin

	Flooding Demographics: Rioni River Basin					
	Municipality population for settlements in flood plain	**Municipality population affected by 0.1% per**	**% population flooded by 0.1% per annum flood**	**Municipality Properties for settlements in flood plain**	**Municipality properties affected by 0.1% per annum flood**	**% properties flooded by 0.1% per annum flood**
Khobi	12,035	6,841	56.8	4,055	2,502	61.7
Samtredia	54,538	200,418	367.5	20,418	11,348	55.6
Khoni	29,625	13,418	45.3	12,427	6,520	52.5
Abasha	28,442	10,706	37.5	18,015	6,901	38.3
Tskaltubo	43,064	12,614	29.3	14,428	4,466	31.0
Lentekhi	2,915	890	30.5	295	89	30.2
Zestaponi	303	70	23.1	101	28	27.7
Kutaisi	185,965	34,175	18.4	22,589	5,215	23.1
Vani	19,481	2,071	10.6	4,336	756	17.4
Terjola	6,017	107	1.8	1,020	72	7.1
Lanchkuti	1,243	53	4.3	329	15	4.6
Senaki	40,790	751	1.8	12,445	567	4.6
Tsgeri	7,754	577	7.4	2,424	107	4.4
Oni	7,369	196	2.7	4,019	128	3.2
Ambrolauri	9,709	188	1.9	4,582	97	2.1
Baghdati	4,104	15	0.4	854	11	1.3
Martvili	13,359	63	0.5	7,433	35	0.5
Rioni Basin	**466,713**	**283,163**	**60.7**	**129,770**	**38,857**	**29.9**

Table 2-2: Property flood damages in 6 Rioni municipalities for floods of different magnitude

Community	5 year flood damage (GEL)	50 year flood damage (GEL)	1000 year flood damage (GEL)	Annual Average Benefit (GEL) 100 year protection	Approximate cost (GEL) of flood mitigation to be cost beneficial
Kutaisi	485,578	5,940,109	9,673,503	721,853	14,437,068
Samtredia	17,279,375	28,566,353	47,033,977	2,039,357	40,787,136
Tsageri	1,176,465	1,913,282	2,211,745	1,456,480	29,129,600
Lentekhi	441,395	554,419	785,780	240,670	4,813,400
Kulashi	767,298	1,443,485	2,110,063	245,136	4,902,712
Total	**19,664,533**	**32,477,539**	**52,141,565**	**3,981,643**	**79,632,848**



2.4 Addressing the Challenge

To comprehensively address flood risk in a sustainable manner will require a combination of structural[1] and non-structural[2] intervention measures. Flood zoning policy is a non-structural

[1] Structural flood intervention measures refers to hard engineered structures such as flood walls, dams, canals that control water flows

[2] Non-structural flood intervention measures refers to measures such as source control (watershed/landscape structure management), laws and regulations (including zoning), economic instruments (such as flood insurance), an efficient flood forecast-warning system, a system of flood risk assessment, awareness raising.

method which can be used to reduce flood risk by zoning the most vulnerable people and property away from the highest risk areas.

As part of the implementation of the new policy, it would be important to raise public awareness of the designated flood zones and the permitted uses within each. In addition it should be noted that flood zoning has been developed to work in tandem with the catastrophe flood insurance scheme that has also been developed. Policy Guidance Note 2 provides a brief summary of the flood insurance scheme which is currently in preparation.

PART 1

The Floodplain Zoning Policy Framework

3 PART 1 – THE FLOODPLAIN ZONING POLICY FRAMEWORK

3.1 Introduction

- The Floodplain Zoning Policy Framework sets out the development planning policies, as it relates to the minimisation of flood risk, and details how these are expected to be applied. It provides a framework within which local land use planning can be done to minimise flood risk, while reflecting the needs and priorities of their communities.
- The framework provides for all applications for planning permission to be determined in accordance with the agreed uses within each flood zone, unless material considerations indicate otherwise, for example, when national priorities take precedence. While, this Framework does not contain specific policies for nationally significant infrastructure projects for which special considerations apply, and which are likely to be in accordance with the decision-making framework within existing planning laws governing major infrastructure, it is expected that all planning permission, whether outlined in the local plan or part of national development or infrastructure plan, will take account of flood risk, by using the 'Suitability' criteria outlined in Section 4.3.3 of this document, which will assess whether the development is suitable, based on the type of development and the vulnerability class of users of the development.
- This Floodplain Zoning Policy Framework does not change the statutory status of the Regional, Sub-regional or National development plans as the starting point for decision making, but aims to support existing plans by providing the framework within which flood risk is explicitly taken into account. Proposed development that accords with the designated/permitted development type in each flood zone should be approved and proposed development that conflicts should be refused unless other material considerations indicate otherwise. It is highly desirable that local planning authorities should have an up-to-date local plan in place which reflects the flood zoning policy detailed herein. Hence, the Floodplain Zoning Policy Framework must be taken into account in the preparation of local plans, and is a material consideration in planning decisions.
- The Floodplain Zoning Policy Framework constitutes guidance for local planning authorities and decision-takers both in drawing up plans and as a material consideration in determining applications.
- This framework should therefore be considered as part of the overall framework of national planning policy, on which decisions on planning applications will be made.
- The Floodplain Zoning Policy Framework reflects, and where appropriate promotes, relevant EU obligations and statutory requirements.

3.2 Guiding Principles

The purpose of this Floodplain Zoning Policy Framework is to contribute to the achievement of sustainable development and use of floodplains. Hence the key guiding principle is the development of resources of the floodplain in order to maximise socio-economic benefit, while minimising risks to human, material and environmental user/uses of the floodplain. The policies set out in this document, therefore reflect the priority that the Government of Georgia places on achieving sustainable, resilient development of human capacities, and

conservation of the environment for the benefit of future generations. Hence this Floodplain Zoning Policy Framework is seeking to:

1) Ensuring that sufficient land of the appropriate type is available in the right places and at the right time to support growth and innovation; and by identifying and coordinating locally- and nationally-significant development requirements;

2) Providing a means of identifying appropriate land for residential, cultural and recreational purposes, that minimises loss and damages from flooding, and meets the required needs of present and future generations. Thus creating a high quality built environment to support resilient and Climate Change adapted communities, contribute to protecting and enhancing the natural, built and historic environment;

3) Helping to maximise floodplain environmental and eco-system services, improve biodiversity, and use natural resources prudently, and mitigate and adapt to climate change;

4) Providing the platform within which economic, social and environmental gains can be jointly pursued and achieved, by actively guiding development to sustainable areas.

5) Enabling a planning environment within which plans and decisions take local circumstances into account, so that they respond to the different opportunities for achieving sustainable development in different areas.

3.3 The flood zones

3.3.1 Flood Zone designations

The aim of flood zoning is to ensure that vulnerability to flood hazards is reduced by zoning people, property and economic activity away from high risk areas. The flood zones have been developed to ensure that the policy which governs activities that influence flood hazards, are strengthened to provide comprehensive floodplain management and spatial planning.

Hence, it provides a tool for policy makers and development planners to implement effective landuse regulations and development control to halt or reverse the detrimental impact on flood risk that the combination of development activities and climate change can have on the floodplain. The policy therefore identifies appropriate development that will minimise the losses and damages from flooding, while maximising the benefits of the floodplain.

Acceptable risk criteria have been used in distinguishing between different degrees of risk for different development activities. The chosen acceptable frequency of a particular flood event is therefore appropriate for the type of development activity. For example, it may well be worth the risk of occasional flooding, to plant crops in the floodplain where soils are enriched by cyclical flooding and the deposition of sediments, where resulting sand and gravel deposits may lead to commercial exploitation. On the other hand, it is more appropriate to site a large agro-industrial or housing project in an area with a very small probability of a large flood occurring each year.

As certain types of development and the people who use and live in them are more at risk from flooding than others, development of flood zones and the development activities allowed in each, has been linked to the probability of flooding as well as the vulnerability of types of development and it's likely occupants and users. Hence development can be placed into different landuse categories for example, essential or critical infrastructure, highly

vulnerable, moderately vulnerable, less vulnerable and water compatible development, which reflect the level of risk to users. This takes account of both the type of development and also the vulnerability of its users (children, the elderly and people with mobility problems may have more difficulty escaping from fast flowing water). In developing the flood zones and their designations, international best practice was reviewed in a number of countries and a summary table is provided in Appendix 2. The following is a discussion of the vulnerability categories for the different land use development and the flood zone designations, which has been adopted from policy and planning guidance for UK flood plains. Appendix 3 provides a summary of vulnerability class for different types of buildings as described below.

3.3.2 Vulnerability Classes

3.3.2.1 Essential/Critical infrastructure

Critical infrastructure such as transportation and utility services like electricity substations and water treatment works, that have to be in flood risk areas, should be designed to remain operational during floods, including access, particularly where this is necessary on a continuous basis. To be considered as 'critical Infrastructure' there must be evidence that there are no other reasonably available sites in areas of lower flood risk on which they could be located and still provide the functions and operational requirements they are intended to provide. The need for such development should outweigh the flood risk and the installation will need to be able to remain operational and safe at times of flood, and not increase flood risk, or impede water flows. See Policy Guidance Note 2 for guidance on building codes and Policy Guidance Note 3 for guidance on ensuring flood resilient critical infrastructure, both of which are relevant to ensuring flood resilient critical infrastructure.

3.3.2.2 Water compatible development

While 'water compatible' development may need to include elements of other vulnerability classifications in order to operate, the development still needs to be designed to ensure the safety of occupants, with evacuation procedures clearly defined, and it must not increase flood risk to others or affect the functionality of the floodplain.

Water compatible development would normally include, flood control infrastructure such as pumping stations, water transmission infrastructure like canals and irrigation schemes, navigation facilities like docks, wharves, nature conservation and biodiversity, outdoor sports and recreation areas and essential residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

3.3.2.3 Emergency Services Infrastructure

Emergency services like police, fire and ambulance stations and hospitals need to be located within their catchment even where it may be at high risk of flooding. Overall risk to life may be greater than the risk from floods if response times for emergency services are longer, hence the need to site such infrastructure close to the likely affected area. There needs to be a balance between preventing emergency services' control systems and equipment being disabled in a flood, whilst providing emergency service cover to existing communities already located in flood risk zones. It is therefore important that emergency services have clear strategies to manage their operability during a flooding event. Flood risk should be a key consideration to the location of emergency service provision. See Policy Guidance Note 3.

3.3.2.4 Commercial/Public Buildings and Residential

Commercial, public and residential buildings can be further classified based on the likely vulnerability of the users/occupants as follows:

6) *Highly vulnerable Infrastructure*. Highly vulnerable infrastructure includes infrastructure which is required to be operational during a flood event (e.g. first responders during an emergency such as some police and fire stations and emergency response command centre, hospitals that might be needed to treat casualties of the emergency situation). Any churches, schools and communities centres which are used for flood relief centres will fall under this designation.

7) *Moderately Vulnerable Infrastructure.* Moderately vulnerable infrastructure includes infrastructure that is vulnerable due to the low probability of the type of structure physically withstanding a flood (such as mobile or temporary homes and camp sites with transient populations). Other infrastructure can be considered to be 'moderately' vulnerable due to the vulnerability or reduced capacity of its occupants to escape the flooded area, such as schools, old people's homes etc. Moderately vulnerable infrastructure also includes hotels and hospitals (not necessarily needed to be operational during a flood, but which may house sick and therefore vulnerable people).

8) *Less Vulnerable Infrastructure.* Less vulnerable infrastructure includes police, ambulance and fire stations which are not required to be operational during flooding. Buildings used for commercial, financial, professional and other services, restaurants, offices, general industry, storage and distribution, non–residential institutions not included in 'moderately vulnerable', and assembly and leisure centres (not used for assembly during emergencies), land used for agriculture and forestry, waste treatment (except landfill and hazardous waste facilities), minerals working and processing (except for sand and gravel working), water treatment works which do not need to remain operational during times of flood, sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place).

3.3.3 Flood zone designations within low, medium and high risk zones

Flood zones have been designated into Low, Medium and High risk categories, with different return period (or annual probability of exceedance) flood extents used to define each zone, based on flood hazard and risk maps for the Rioni floodplain. While the discussion below suggests what types of development should be allowed in each zone, it should be noted that for future development in each zone, the vulnerability to flooding from other sources (for example pluvial flooding or groundwater flooding), the potential to increase flood risk elsewhere through the addition of hard surfaces, and the effect of future development on surface water run-off, should be assessed. In addition, opportunities should be sought to reduce the overall level of flood risk in the area and beyond. The floodplain has been sub-divided into 6 zones which correspond to the following return periods or annual exceedance probabilities: 2 (50%), 5 (20%), 20 (5%), 50 (2%), 100 (1%), 1000 (0.1%) year return period floods. It should be noted that the 7 sub-divisions correspond to the insurance flood zones (See Policy Guidance Note 2). In addition, the various categories provide flexibility for future sub-divisions, additions and designations, should there be a requirement to do so.

3.3.3.1 Zone 7 - Low Flood Hazard Zone

This zone comprises land assessed to be flooded by events rarer than the 1000 year event and is therefore considered to be low risk. However land in this zone which has specific drainage problems (due to natural or non-natural reasons) and or which can pose a threat to land in other zones (e.g. dams and reservoirs located in this zone, but see guidance on managing residual risk in Policy Guidance Note 5), could be considered at higher risk

compared to the rest of this zone. All types of development is allowed within this zone, including critical infrastructure, highly vulnerable, moderately vulnerable, less vulnerable, water compatible infrastructure and emergency response infrastructure.

3.3.3.2 Zone 6 - Climate Change buffer

This zone is defined between the limit of the floodplain (1 in 100 year) and the low risk zone (1 in 1000 year flood). This zone represents the 1 in 100 year event with an allowance for climate change (1 in 100+CC) based on projections from the Second National Communication on climate change for Georgia. To be conservative, the 1 in 100+CC outline has been extended to the 1 in 1000 year event flood boundary (to take account of any uncertainties in the climate change estimates). The types of development that are likely to be allowed in this zone include critical/essential infrastructure, moderately and less vulnerable infrastructure as well as water compatible infrastructure. Highly vulnerable infrastructure such as emergency services can be located here, but only if there is nowhere else to locate them in the low flood hazard zone or beyond.

For all development in this zone, optional (opt in) flood warning is recommended. Emergency services infrastructure already located in this zone, should be made flood resilient, and should ensure free access from flooded areas. For Commercial/Public buildings and residential buildings in the zone, there should be targeted public awareness raising programmes to make occupants/users aware of the risk and their actions in the event of a flood.

3.3.3.3 Zones 3,4, 5 - Floodplain Fringe

The internationally accepted return period to define the floodplain is the 1 in 100 year return period flood outline. The floodplain fringe is the portion of the floodplain which will be covered by flood waters during the one in 100 year flood, but which will mainly be standing or low velocity water (so hazard here is more likely to be due to the depth of the standing water rather than the velocity of the water). This zone normally comprises land at risk of flooding from events rarer than that which defines the functional floodplain (see below) and the 100 year event.

Water compatible and less vulnerable development is permitted here. Highly vulnerable development should not be permitted in this zone, while the moderately vulnerable and essential infrastructure developments should be permitted in this zone only if there are no viable sites in lower risk zones. Essential infrastructure permitted in this zone should be designed and constructed to remain operational and safe for users in times of flood. It is essential that all development in this zone is cognizant of the likely extent of the 100 year flood under climate change. Hence development should be constructed to be safe up to the 100+CC flood level.

In addition to ensuring that future development in this zone does not increase flood risk, and opportunities sought to reduce the overall level of flood risk in the area and beyond, a combination of flood warning, flood resilience and cost effective and cost beneficial flood mitigation measures should be implemented, and space should be created for flooding to occur by allocating and safeguarding open space for natural flood storage, thus permitting the floodplain to function naturally.

For existing development in this zone, there should be flood-free access and egress routes (in the case of essential infrastructure, access should be raised if necessary). For essential infrastructure and water compatible infrastructure, it is additionally recommended that a bund is built around the infrastructure, while for Emergency infrastructure, Commercial/Public Buildings and residential buildings it is recommended that all sensitive equipment is installed above the flood level.

3.3.3.4 Zone 2 - Functional Floodplain

The definition of the functional floodplain is a very important planning tool in maintaining the natural functions of the floodplain and reducing flood risk. The functional floodplain is land within the floodplain where water has to flow or be stored in times of flood. Here, the functional floodplain is defined as land that would naturally flood with an annual exceedance probability of 1 in 20 (5 per cent) or greater. That is, the functional floodplain is land within the 1 in 20 year flood outline.

In general, development should be directed away from the functional flood plain. Only water compatible and essential critical infrastructure development would be suitable for location in the functional floodplain and these should be designed and constructed to remain operational and safe for users in times of flood, result in no net loss of floodplain storage, not impede water flows, and should not increase flood risk elsewhere. Essential infrastructure should only be located in this zone if there are no other viable sites in lower hazard zones. Development in the functional floodplain should be designed to flood periodically to preserve flood storage volumes of the floodplain. The functional floodplain may also include areas intended to provide transmission and storage of water from other sources of flooding (e.g. surface water). The area defined as functional floodplain should take into account the effects of defences and other flood risk management infrastructure. Some areas, such as flood storage areas, may flood at a lower frequency than other parts of the functional floodplain, but should still be classified as functional for the part that they play in managing the impacts of large scale floods.

As with the floodplain fringe opportunities should be sought to relocate existing development to land in lower flood hazard zones, and to create space for flooding to occur by restoring functional floodplain and flood flow pathways and by identifying, allocating and safeguarding open space for flood storage.

Parts of the functional floodplain may also be an area of high productivity for farming. It is therefore possible to define a further zone (for example between the 2-year and the 5-year flood outlines) which can be identified as being flooded cyclically and therefore be high productivity areas. This could be used to identify high-productivity areas, within which existing water compatible agricultural activity can continue, but within which residential dwellings and other uses that are not water compatible and not essential infrastructure, will not be allowed. Hence within this zone, strategic agricultural practises such as seasonal agriculture, designated cattle grazing and rearing, agro-forestry and other agricultural practices that reduce flooding, debris accumulation, scour erosion, and sand deposition, maximise productivity of the floodplain, and enhance environmental and ecological functions, should be encouraged.

For existing development in this zone it is recommended that essential infrastructure and emergency services re-locate if operationally feasible, or build bund walls and ensure flood free access, or raised access. For existing water compatible development it is recommended that bund walls are built and flood free raised access ensured. Commercial and public buildings and residential properties in this zone should consider property level protection (PLP) where practical (flood resistance and flood resilience essential in the case of residential), ensure free access to flood free areas and install sensitive equipment above flood level. In addition, residential properties should avoid use of basement and ground floor.

3.3.3.5 Zone 1 – The Floodway

The floodway is the zone from the river centreline to the 2-year flood extent, within which there is high flow conveyance and high values of velocity and depth. No development is permitted here and it is highly recommended that all existing properties in this zone should be relocated.

Table 3-1 summaries the landuse/development type for each flood zone.

Table 3-1: Summary landuse/Development type designations for flood zones and recommended measures to be taken for development already in the floodplain

Flood Zone	Designation	AEP%	Landuse/Development Type				
			Essential Infrastructure	Water Compatible	Emergency services infrastructure	Commercial/Public Buildings	Residential
1	Floodway	to 50%	Re-locate	Re-locate	Re-locate	Re-locate	Re-locate
2	Functional Flood Plain	Up to 20%	Re-locate if operationally feasible; or Build bund wall and ensure flood free access, or raise access	Build bund wall and ensure flood free access, or raise access	Re-locate if designated command centre or flood refuge; Ensure free access to flood free areas; install sensitive equipment above flood level (resilience)	Consider PLP where practical. Ensure free access to flood free areas; Install sensitive equipment above flood level	Property Level protection (resistance) Avoid use of basement and ground floor. Ensure free access to flood free areas; Install sensitive equipment above flood level
3, 4, 5	Flood plain Fringe	Up to 1%	Build bund wall and ensure flood free access, or raise access	Build bund wall and ensure flood free access, or raise access	Ensure free access to flood free areas; Install sensitive equipment above flood level	Ensure free access to flood free areas; Install sensitive equipment above flood level	Ensure free access to flood free areas; Install sensitive equipment above flood level
6	Climate change buffer	Up to 0.1%	Optional Flood warning	Optional Flood warning	Optional flood warning; Ensure free access ***from*** flood areas	Optional flood warning; Flood awareness programmes	Optional flood warning; Flood awareness programmes
	Low Hazard Zone		All permitted	All permitted	All permitted	All permitted	All permitted

3.4 The Policy

1) Local planning authorities should adopt proactive strategies to mitigate and adapt to climate change induced flood risk.

2) Local Plans should take account of flood risk under climate change over the longer term. New development should be planned to avoid increased vulnerability to the range of impacts arising from climate change induced flood risk. When new development is proposed in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure[3].

3) Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, it should be made safe without increasing flood risk elsewhere. Local Development Plans should be supported by Strategic Flood Risk Assessment and should include policies to manage flood risk from all sources, taking account of advice from the National Environmental Agency (NEA) and other relevant flood risk management bodies, such as MRDI and MIA. Local Development Plans should apply a sequential, risk-based approach to the location of development to avoid, where possible, flood risk to people and property and manage any residual risk, taking account of the impacts of climate change – the Suitability Test.

4) The aim of the Suitability Test is to steer new development to areas with the lowest probability of flooding. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower probability of flooding. The Strategic Flood Risk Assessment will provide the basis for applying this test. A sequential approach should be used in areas known to be at risk from any form of flooding.

5) If, following application of the Suitability Test, it is not possible or consistent with wider sustainability objectives, for the development to be located in zones with a lower probability of flooding the Exception Test can be applied if appropriate. For the Exception Test to be passed, it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a Strategic Flood Risk Assessment where one has been prepared; and

6) A site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall. Both elements of the test will have to be passed for development to be allocated or permitted.

7) For individual proposed developments on sites allocated in development plans through the Sequential Test, applicants need not apply the Suitability Test. Applications for minor development and changes of use should not be subject to the Suitability or Exception Tests but should still meet the requirements for site-specific flood risk assessments.

8) In developing local development plans, local planning authorities should reduce risk

[3] GI is the network of natural and semi-natural features, green spaces, rivers and lakes that intersperse and connect villages, towns and cities. It is a natural, service-providing infrastructure that is often more cost-effective, more resilient and more capable of meeting social, environmental and economic objectives than 'grey' infrastructure

from development in the floodplain by avoiding inappropriate development in vulnerable areas or adding to the impacts of physical changes to the floodplain. They should identify as Flood Risk Management Areas, any area likely to be affected by physical changes to the floodplain under climate change, and outline strategies to manage such areas.

9) When assessing planning applications, authorities should consider development in a Flood Risk Management Area appropriate where it is demonstrated that:

    - it will be safe over its planned lifetime and will not pose any unacceptable risks;
    - the character of the floodplain including designations is not compromised;
    - the development provides wider sustainability benefits; and

10) Where necessary, local planning authorities should ensure appropriate development is sustainable by limiting the planned life-time of the proposed development through temporary permission and restoration conditions where necessary to reduce the risk to people and the development.

4 GUIANCE FOR LOCAL AUTHORITIES

4.1 Introduction

This Section provides additional guidance to local planning authorities to ensure the effective implementation of the planning policy set out in the Floodplain Zoning Policy Framework on development in areas at risk of flooding.

As set out in the Floodplain Zoning Policy Framework above, inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere. For these purposes:

1) "areas at risk of flooding" means land within Flood Zones 1 to 6; or land within the Low Hazard Flood Zone which has critical drainage problems or other features that increases its risk above that of the zone;

2) "flood risk" means risk from all sources of flooding - including from rivers and the sea, directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources. With flood modelling in its infancy in Georgia, it should be noted that this policy document is currently based on fluvial flood risk (river bank overtopping) only. However, it should be noted that additional complexities to flood risk may arise once these other sources of flooding are modelled and these will need to be taken into account at that time. The general principles should, however, apply to all sources of flooding and their various combinations.

4.2 The Suitability and Exception Tests

The concept of Suitability and Exception testing has been adopted from the UK flood zoning policy. The aim of the Suitability Test is to steer new development to areas with the lowest probability of flooding. The flood zones (see Table 4-1) are the starting point for this sequential approach. Strategic Flood Risk Assessments will be required to refine information on the probability and consequences of flooding in each zone and will be an opportunity to take other sources of flooding into account and will provide the basis for applying the Suitability Test, and the Exception Test.

The scope of a Strategic Flood Risk Assessment (SFRA) could be widened to consider factors not included in the hazard and risk mapping (for example flood defences not included), as well as the impact of future/planned flood risk management infrastructure on the frequency, impact, speed of onset, depth and velocity of flooding within the flood zones considering a range of flood risk management and maintenance scenarios. The SFRA may therefore be used to assess how flooding can be reduced in the future. Such information can be used in the long-term planning and permitting system (where conditional permitting of long-term development can be granted dependent on the future flood risk management measures being implemented).

Where a Strategic Flood Risk Assessment is not available or where flood risk is not likely to be reduced with the planning horizon, the Suitability Test will be based on the existing flood zones.

Table 4-1: Requirement for exception test for new development in each flood zone

Flood Zone	Designation	AEP%	Landuse/Development Type				
			Essential Infrastructure	Water Compatible	Emergency services infrastructure	Commercial/Public Buildings	Residential
1	Floodway	to 50%	x	x	x	x	x
2	Functional Flood Plain	Up to 20%	Exception Test Required	✔	Exception Test Required	x	x
3, 4, 5	Flood plain Fringe	Up to 1%	Exception Test Required	✔	Exception Test Required	Not permitted if Highly Vulnerable, Exception test if Moderately Vulnerable, Permitted if less vulnerable	Not permitted if Highly Vulnerable, Exception test if Moderately Vulnerable, Permitted if less vulnerable
6	Climate change buffer	Up to 0.1%	✔	✔	✔	Exception Test only if Highly Vulnerable, permitted otherwise	Exception Test only if Highly Vulnerable, permitted otherwise
	Low Hazard Zone		✔	✔	✔	✔	✔

x – Development not permitted ✔ -Development permitted

4.3 Strategic Flood Risk Assessment

A Strategic Flood Risk Assessment is a study to assess the risk to an area from flooding from all sources, now and in the future, taking account of the impacts of climate change, and to assess the impact that land use changes and development in the area will have on flood risk. It should be carried out by the local planning authoritie(s) and should cover the whole territory and include consideration of all known land use changes and development in the area (including planned flood defences/risk management interventions), as part of long-term development planning. It is important, where necessary that authorities work collaborative especially where boundaries are such that changes to flood risk due to planned development from one authority will impact others.

It should be noted that the SFRA is a finer level of detail from the hazard, risk and vulnerability mapping which is the responsibility of the NEA and which will be the starting point of the SFRA.

The Strategic Flood Risk Assessment is therefore needed to refine information on flooding risk provided by the NEA flood hazard and risk maps and any strategic FRM options that have been identified by NEA during hazard and risk mapping. Local planning authorities should use the SFRA to:

- determine the variations in risk from all sources of flooding across their areas, and also the risks to and from surrounding areas in the same catchment;
- Incorporate into their Local Plan, so that flood risk is fully taken into account when considering allocation options and in the preparation of plan policies, including policies for flood risk management options;
- apply the Suitability Test and, where necessary, the Exception Test when determining land use allocations;
- identify the requirements for site-specific flood risk assessments in particular locations, including those at risk from sources other than river flooding;
- determine the acceptability of flood risk in relation to emergency planning capability;
- consider opportunities to reduce flood risk to existing communities and developments through better management of surface water, provision for conveyance and of storage for flood water.

4.3.1 Level 1 SFRA

A Level 1 Assessment should be carried out in areas where flooding is not a major issue and where development pressures are low. The Assessment should be sufficiently detailed to allow application of the Suitability Test to the location of development and to identify whether development can be allocated outside high and medium flood risk areas, based on all sources of flooding, without application of the Exception Test. The key output from the SFRA is

allocation of land for varying uses, demonstrating that flood risk is minimal (or non-existent) for each allocation.

Where a Level 1 Assessment shows that land outside flood risk areas cannot appropriately accommodate all the necessary development, it may be necessary to increase the scope of the Assessment to a Level 2 to provide the information necessary for application of the Exception Test where appropriate – see Table 3-1.

4.3.2 Level 2 SFRA

A Level 2 Strategic Flood Risk Assessment should consider the detailed nature of the flood characteristics within a flood zone including: flood probability; flood depth; flood velocity; rate of onset of flooding; and duration of flood.

It should be noted that these flood characteristics can be derived from detailed flood hazard modelling for the area but where such mapping only includes fluvial flooding, these parameters should be additionally assessed for all other significant sources of flooding in the area.

A Level 2 Strategic Flood Risk Assessment should also reduce burdens on developers with regard to the preparation of site-specific flood risk assessments.

4.3.3 Suitability Test

4.3.3.1 When is a Suitability Test needed?

A proposed development site would need a Suitability test if both of the following apply:

- the development is in flood zone 2, 3, 4 or 5
- a Suitability Test hasn't already been done for a development of the same type on the proposed site
- the development involves a change of land use not already permitted for the area and potentially incompatible with the flood zone (for example a change of land use e.g. forest cover to residential or agricultural)

The Suitability Test is not needed if the following applies:

- the development is a minor development (for example, extensions to an existing property)
- the development involves a change of use (e.g. from commercial to residential) which is permitted and is compatible with the flood zone.

If a site needs a suitability test, the local authority will need the following information:

- the name and location of the site to be developed
- Details about expected use of the site based on plans (outline/conceptual design documents. Must state the status of the plans)
- Number, type and vulnerability class of likely users/occupants of the site

- Whether the development type is compatible with the existing flood zone designated use
- If use is compatible - whether the development has the potential to increase flood risk at the site or other locations. If so, then undertake site-specific FRA and include flood management/flood resilience measures in design
- If use is not compatible, apply the Exception test. If accepted by exception test, undertake site specific FRA.

The outcome of site-specific FRA and the satisfaction that development will incorporate appropriate flood mitigation measures will clear the development on FRA criterion within the planning permission.

4.3.3.2 Who will carry out a Suitability Test?

It is anticipated that the average developer will not currently have the resources at his disposal to undertake a Suitability test, including the data on which the assessment is to be based. It is proposed at this stage that the Suitability test is undertaken by the local authority with the support of NEA and MRDI who will be holders of the flood hazard maps, models and underlying data that will be necessary for the assessment, and who will have the necessary training to conduct such assessments.

4.3.4 Exception Test

If the Suitability Test shows that the development is unsuitable for the target flood zone but cannot be located elsewhere, then a second test – The Exception Test - will be needed if the development is:

- essential infrastructure or emergency services infrastructure in flood zones 2, 3, 4 and 5
- Commercial/Public/Residential and moderately vulnerable users/occupants in flood zone 3, 4,5
- Commercial/Public/Residential and highly vulnerable and in flood zone 6

The exception test shows how flood risk will be managed at the proposed site. In addition to a site-specific FRA, showing how flood risk will be managed (on-site and off-site), that the development will be safe for its lifetime (if residential, then lifetime should be 100 years, otherwise lifetime is dependent on use) taking into account the vulnerability of its users, the exception test will also need to prove that the sustainability benefits of the development to the community outweigh the flood risk.

The output of the Exception Test will need to be submitted to the local planning authority along with the Suitability test, and the site-specific Flood Risk Assessment.

4.3.4.1 Who will carry out an Exception Test?

It will be the responsibility of the developer to undertake the Exception Test which will include proof of sustainability benefit and the associated site-specific Flood Risk Assessment.

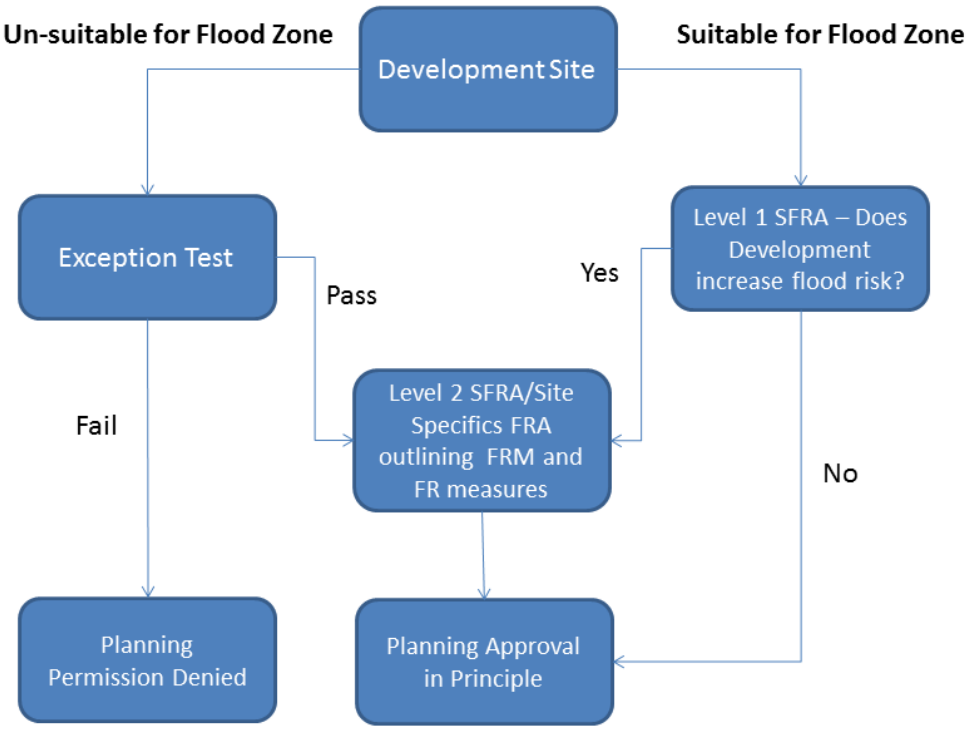
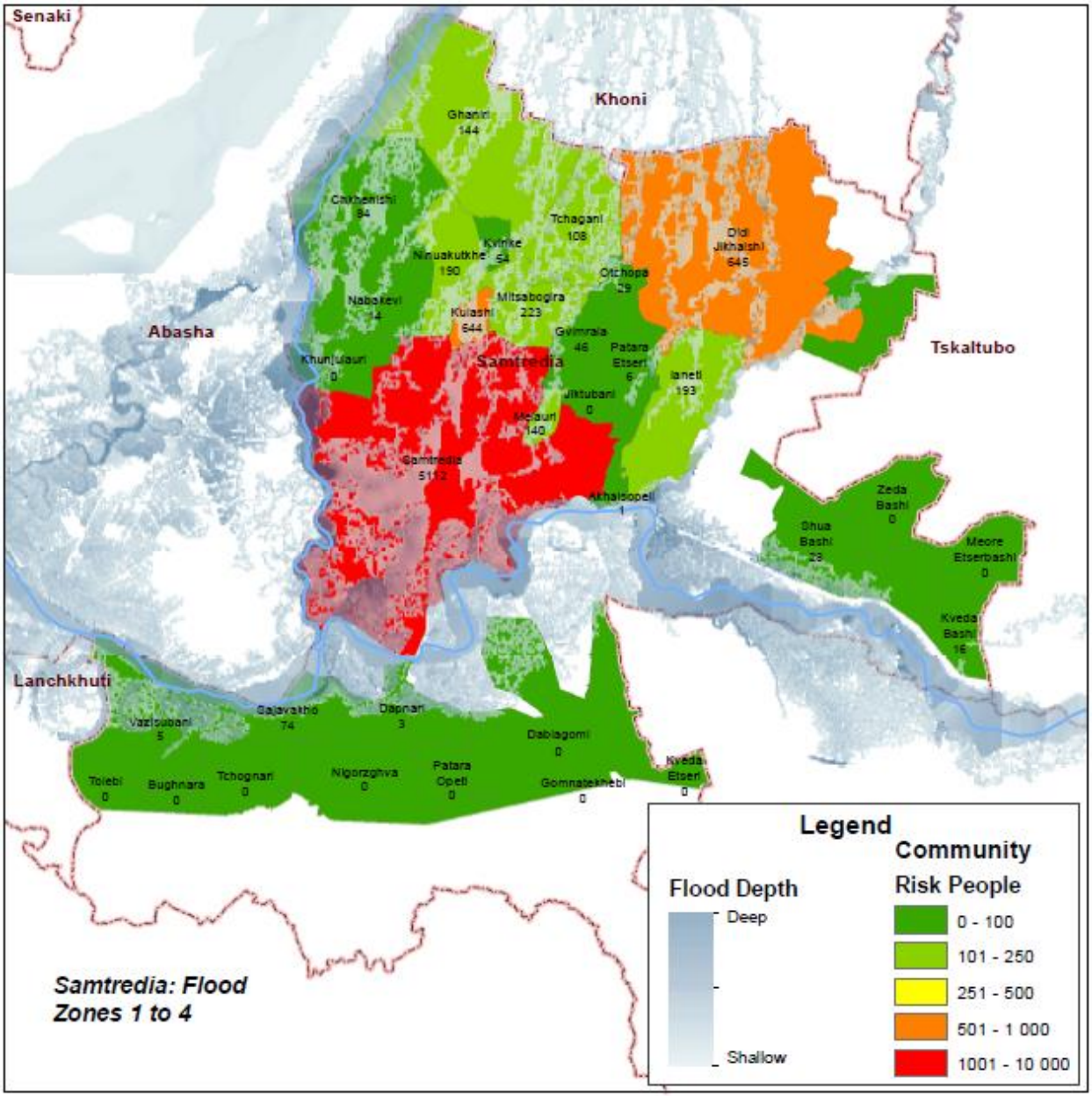
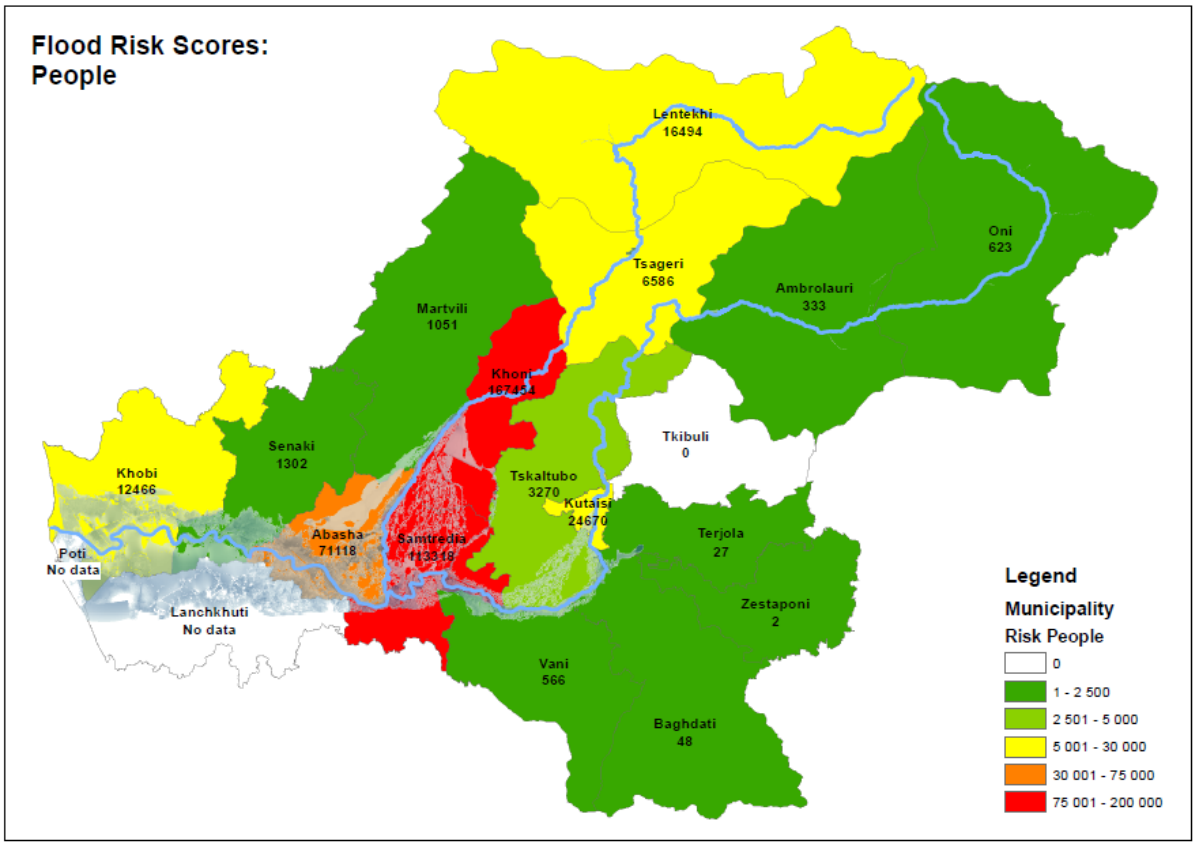


Figure 4-1: Flow chart showing requirements or Suitability Test, Exception Test, SFRA, site-specific FRA and conditions for planning approval in principle

APPENDIX 1 – RIONI FLOOD ZONES MAPS

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Oni
623
Tsageri
6586
Ambrolauri
333
Martvili
1051
Khoni
187454
Tkibuli
0
Senaki
1302
Khobi
12466
Tskaltubo
3270
Kutaisi
24670
Terjola
27
Abasha
71118
Samtredia
113318
Poti
No data
Zestaponi
2
Lanchkhuti
No data
Vani
566
Baghdati
48
Legend
Municipality
Risk People
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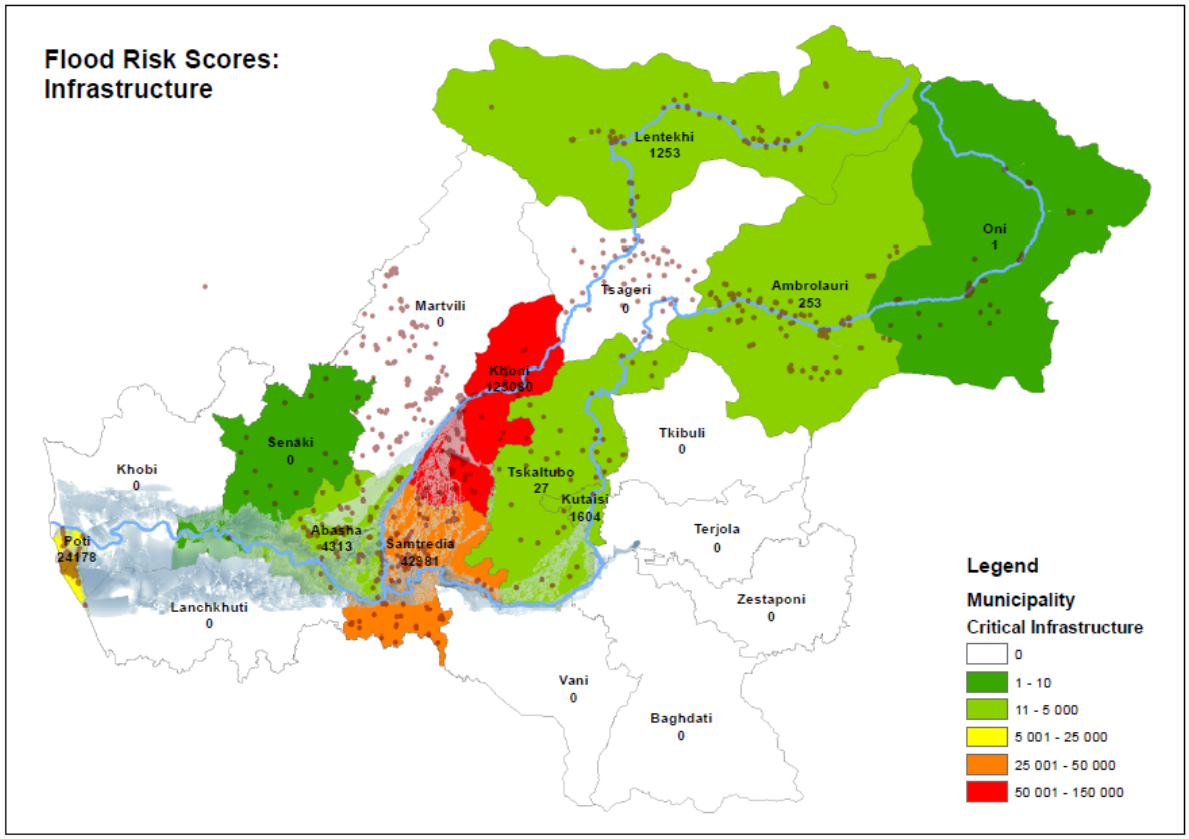
1 - 2 500
2 501 - 5 000
5 001 - 30 000
30 001 - 75 000
75 001 - 200 000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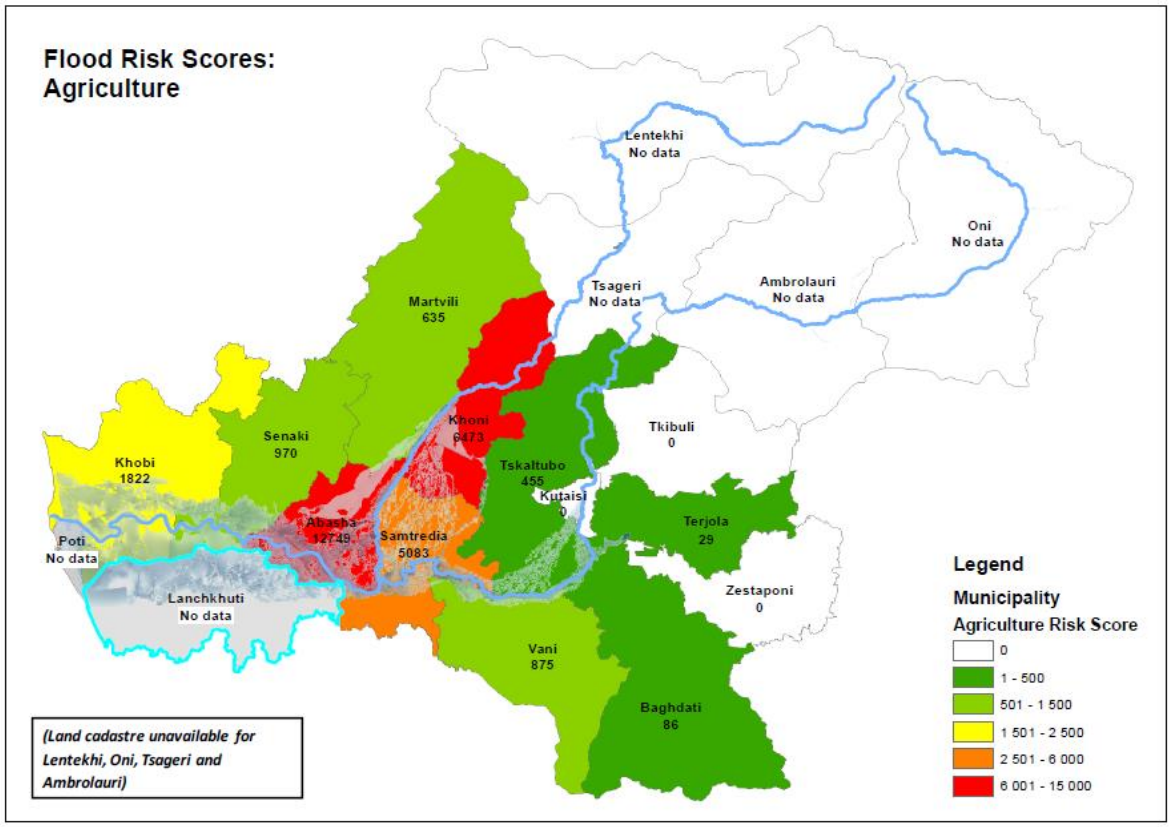
Oni
1
Ambrolauri
253
Tsageri
0
Martvili
0
Khoni
125050
Tkibuli
0
Senaki
0
Khobi
0
Tskaltubo
27
Kutaisi
1604
Terjola
0
Abasha
4313
Samtredia
42981
Poti
24178
Zestaponi
0
Lanchkhuti
0
Vani
0
Baghdati
0
Legend
Municipality
Critical Infrastructure
0
1 - 10
11 - 5 000
5 001 - 25 000
25 001 - 50 000
50 001 - 150 000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Lentekhi
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Oni
No data
Tsageri
No data
Ambrolauri
No data
Martvili
635
Khobi
1822
Senaki
970
Khoni
6473
Tkibuli
0
Tskaltubo
455
Kutaisi
Terjola
29
Abasha
12749
Samtredia
5083
Poti
No data
Zestaponi
0
Lanchkhuti
No data
Vani
875
Baghdati
86
(Land cadastre unavailable for Lentekhi, Oni, Tsageri and Ambrolauri)
Legend
Municipality
Agriculture Risk Score
0
1 - 500
501 - 1 500
1 501 - 2 500
2 501 - 6 000
6 001 - 15 000

APPENDIX 2 – SUMMARY OF INTERNATIONAL BEST PRACTICE IN FLOOD ZONING

	Flood outline – national scale	Flood outline - High resolution community scale	Hazard map Fluvial % Annual Exceedance Probability	Hazard map Tidal % AEP	Hazard map Surface Water %AEP	Climate change map	Land Use Planning
England and Wales	✓	✓	1%, 0.1%	1%, 0.5%	✓	X	National Planning Policy Framework
Scotland	✓	✓	0.5%, 0.1%	0.5%, 0.1%	H, M, L	X	Scottish Planning Policy
Northern Ireland	✓	✓	1%	0.5%	0.5%	2030	PPS15
Netherlands	✓	✓	H, M, L	H, M, L	X	X	
France	✓ (by end 2015)	Limited coverage	6 qualitative levels	6 qualitative levels	X	X	Local standards
Ireland	16 key risk areas	✓	Historic only	Historic only	Historic only	X	The Planning System & Flood Risk Management 2009 (Similar to PPS25)
Sweden	✓	In development	X	X	X	X	
Peru	✓	X	X	X	X	X	
Russia (Far Eastern / China border)	✓	X	planned	N/A	X	X	

	Flood outline – national scale	Flood outline - High resolution community scale	Hazard map Fluvial % Annual Exceedance Probability	Hazard map Tidal % AEP	Hazard map Surface Water %AEP	Climate change map	Land Use Planning
Australia	✓	Limited historic data	Limited historic data	Limited historic data	Limited historic data	X	Draft State Planning Policy Guidelines
USA	✓	✓	✓ (numerous zones including depth and pathways)	(numerous zones including depth and pathways)		X	State based planning systems
Philippines	✓	Major hotspots, based on historic events	1:5,10..100	1:5,10..100	N/A	X	Local master planning

APPENDIX 3 – DESCRIPTION AND VULNERABILITY STATUS OF VARIOUS TYPES OF BUILDINGS BASED ON FUNCTIONALITY

Functionality of the building

Res	Residential house	
Flat	Residential apartment	Moderately Vulnerable/Highly Vulnerable with Basement
CM	Commercial (if specific function unknown)	Less Vulnerable
RS	Retail store	Less Vulnerable
OF	Office	Moderately Vulnerable
FC	Factory	Moderately Vulnerable
MB	Municipal building	Moderately Vulnerable
SC	Schools	Moderately Vulnerable/Highly vulnerable if used as refuges
CH	Church	Less Vulnerable/ Highly vulnerable if used as refuges
HT	Hotel	Moderately Vulnerable
PL	Police station	Highly Vulnerable (if command centre)
RT	Restaurant	Less Vulnerable
HS	Hospital	Moderately Vulnerable
AS	Ambulance station	Highly Vulnerable
PS	Electrical substation	Essential infrastructure
FS	Fire station	Highly Vulnerable
PG	Power station	Essential infrastructure
WA	Water/sanitation building	Essential Infrastructure
OT	Other (specify) derelict	Not vulnerable

Type of structure

WST	Building without side stairs for accessing second floor from outside of the building
ST	Building with side stairs for accessing second floor from outside of the building
BP	Building on poles (elevated above the ground)

Material

W Wood
C concrete or block
OT other

No of rooms

L 5 or less
M 6 or more

Condition

NR Not renovated or badly maintained
R Renovated or under renovation
AB Kept largely as when built

Basement

Y Yes (without side windows / doors)
N No
YW Yes (with side windows / doors)

Foundation

NB Stacked elongate native boulders, which may be grouted or may not No
CB Concrete blocks, place on a smoothed dirt base
CW Poured concrete foundation wall

PART 2

The Floodplain Zoning Policy Framework

Policy Guidance Notes

5 POLICY GUIDANCE NOTE 1 - SUMMARY OF PROPOSED FLOOD INSURANCE SCHEME

5.1 Introduction

Insurance against natural disasters, in particular events where location can be predicted such as floods, reduces economic and social impacts and generally changes behaviour towards flooding. Even if there is very little physical flood management, only post-event intervention insurance ensures the follow-on economic impacts of extreme events are minimised, enables faster recovery, stabilizes the income and consumption stream of the affected, and ultimately reduces vulnerability and impacts.

The insurability of natural disasters and extreme weather events may be affected by increases in the frequency, severity, or unpredictability of these events as well as changing demographics. In relation to flooding there is a potential for increased development in flood prone areas, as well as a change in the patterns of flooding. This presents both technical and market based risks to the insurers and those wishing to obtain insurance, which are summarised below:

Technical Risks

- Shortening times between loss events, such as more hurricanes per season,
- Changing absolute and relative variability of losses,
- Changing structure of types of events,
- Shifting spatial distribution of events,
- Damages that increase exponentially or nonlinearly with weather intensity,
- Widespread geographical simultaneity of losses (e.g. tidal surges affecting large coastal areas),
- Increased difficulty in anticipating "hot spots" (geographic and demographic) for particular hazards,

Market-based Risks

- Historically-based premiums that lag behind actual losses,
- Failing to foresee and keep up with changing customer needs arising from the consequences of climate change,
- Unanticipated changes in patterns of claims, and associated difficulty in adjusting pricing and reserve practices to maintain profitability,
- Responses of insurance regulators,
- Reputation risks falling on insurers who do not, in the eyes of consumers, do enough to prevent losses arising
- Stresses unrelated to weather but conspiring with flood impacts to amplify the net adverse impact. These include draw-downs of capital and surplus due to earthquakes or terrorist attacks and increased competition from self-insurance or other competing methods of risk-spreading.

5.2 Georgia Flood Insurance: The way forward

It is agreed with the Georgian Insurance Association and the Insurance State Supervision Service of Georgia that a form of catastrophe insurance is required to help to mitigate against the effects of serious flooding. With occupancy high in the Rioni flood plain in Zones 2 and 3, it would not be either affordable to the householders or to the insurance industry to manage these risks through insurance. Other measures (where cost beneficial) related to Flood plain zoning policies will be more suited to these zones. These are detailed in the Flood Zoning Policy document.

Catastrophe insurance will be most suited to those households in flood zones 4, 5 and 6 where risk is relatively low but consequences of damages and losses are high.

Of course, properties in Zones 2 and 3 would also suffer in the zone 4, 5 and 6 catastrophes and pay out principles adopted would only apply to these properties when a zone 4 or above trigger flood is experienced. The principles of pay out would relate to proportional loss curves developed for Georgian properties for risk modelling. However, it is important for stakeholders to recognise that pay outs are to support recovery and are not total compensation for all perceived losses. The flood risk model will be used and refined to develop the premium and pay out principles.

With residential property retail or indemnity insurance wholly undeveloped in Georgia and not in any way mandatory, developing single peril insurance is challenging. Family income is also a limiting factor as even the smallest premium to support catastrophe risk would be a strain on family finances; (only 20,000 families earn more than 40,000 GEL per year). Those earning less than this are not subject to property tax, so levying a supplement on property taxes would exclude all but the wealthiest households. It is deduced that most families in the Rioni flood plain and other rural flood plains would not pay existing property tax.

Enforcement of a special levy would be impractical as the cost of collection via indemnity style insurance would be prohibitive. Lessons from the agri-insurance pilot would support this.

One innovative solution would be to levy via existing utility (electricity) bills as these are universally issued to all households. If flood levies were to exclude frequent flooding (up to the 1 in 20 year event) then the calculated levy of 46 GEL per year for properties in Zone 4; 12 GEL for properties in Zone 5 and 6 GEL for properties in Zone 6 might be acceptable if flood risk education is implemented[4]. Opt out would not be plausible as the Catastrophe insurance system is a pooled risk alternative to ex-ante payments by either National Government or International donor organisations. The levy could either be collected with monthly electricity bills or as a pro rate sum during summer months when utility bills are traditionally low.

An alternative suggestion is Government would fund the insurance premium with vouchers to property owners, and administered by insurance companies. This is a Government subsidy, introduced as a legally binding social mechanism. The question raised is what is the Government purchasing? The Government would not be agreeing to the restitution of all flood damages above a particular river trigger level but financing towards reparation of flood damage according to the pay out formula (derived by the UNDP risk model) by predicted flood depth in each flood zone[5]. This process must be transparent and agreed by all who sign up to catastrophe insurance.

<u>But what of Flood Zones 2 and 3?</u>

[4] These premiums must be confirmed by the Policy Unit and refined during improvements to the risk modelling

[5] Properties in flood zone 1 would not qualify

Flood Zones 2 and 3 would only receive pay outs for catastrophic flooding (Zone 4, 5, and 6 flood events). However where property is flooded by Flood Zone 2 and 3 events then there are non subsidised options open to house holder:

- Accept the risk and suffer the consequences
- Adapt to flooding by minimising potential losses in ground floor living areas
- Re-locate at householders cost or with Government grants
- Invest in property level protection (PLP) to improve resilience against flooding with Government grants
- Take out indemnity insurance with insurers prepared to accept the risk
- Sign up to flood warning alerts (compulsory in flood zones 2 and 3)

Some of these options would not be mutually exclusive and investing in PLP and signing up to flood warning might help to negotiate a lower flood premium. Legislation should be implemented to ensure premiums should reflect the efforts of Government in financing cost beneficial flood mitigation solutions

A third option might be a levy for properties in flood zones 4, 5 and 6 but with this pooled money bolstered by a direct Government insurance tax for all natural perils (earthquakes and landslides and floods). The Insurance State Supervision Service would oversee that resources are in place, with long term reserves unrestricted.

The main problem with any of the options above is the lack of tradition of insurance for the management of natural risks with post-Soviet personal insurance well down the household budgeting agenda. Insurance in Soviet times was implicit for private households where the state provided this safety net. Education is the key with stakeholder engagement on understanding flood risk through explicit flood zoning and local engagement. The 'riskiest' communities would be provided with, where technically, financially and environmentally sustainable, standards of flood protection commensurate with standards adhered to in western Europe (1 in 100 years). Insurance could then be used as a financial instrument for residual flooding over and above legislated standards of structural flood mitigation.

Thus a form of parametric insurance[6] is administratively simple but relies on accurate modelling to correlate trigger flood levels with actual flooding depths and velocities within households. Custodians of the Flood models would expect to increase reliability in time with long-term observation and correlation to trigger levels. Parametric insurance and the triggers established needs to be acceptable to Re-insurers, who will ultimately underwrite the risk, and the householders who may receive asymmetric payment following flooding. Continual improvement to modelling is key to this process.

An innovative supplementary approach may be to investigate 'no claims bonuses' whereby a proportion of pooled reserves not drawn on in non-catastrophic flood years can be re-cycled to Government to be used exclusively for flood mitigation projects (either structural or non-structural).

[6] **Parametric insurance** is a type of insurance that does not indemnify the pure loss, but ex ante agrees to make a payment upon the occurrence of a triggering event. The triggering event is often a catastrophic natural event which may ordinarily precipitate a loss or a series of losses.

A Policy Unit with insurers, the insurance regulator and Government is required to pursue options, and negotiate legal and institutional frameworks to instigate change. This must be supported by improvement to flood zoning, through improved modelling, as enabled by the present UNDP project.

5.3 Recommended Actions

- Convene a Policy Unit comprising:
    - Representatives of Georgian Government
    - Representatives of the Georgian Insurance industry
    - Insurance State Supervision Service of Georgia
    - Georgian Insurance Association
    - Rioni Basin stakeholder representative (House holders, MRDI, Municipality)
- Elect a chair person to convene meetings and progress actions
- The Policy Unit should discuss the strengths and weaknesses of the three suggested routes for insurance:
    - Traditional (private) insurance systems
    - Insurance or pooling systems
    - Systems administered by the government
    - Plus, Hybrid approaches
- The Policy Unit should elect technical representatives to study the UNDP Risk Model and the parametric approach to flood insurance and make recommendations as to how the model can be:
    - Improved to establish acceptable and affordable zonal premiums and pay outs
    - Extended to all Georgian flood plains
    - Extended to include flash flooding
- A full audit of the functionality and application of the flood risk model is required including the budgetary requirements for a comprehensive ground truthing of property data to supplement the sample ground truthing already completed in the riskiest communities
- The Policy Unit should evaluate both the technical and market-based risks of introducing parametric flood insurance in consultation with International Re- Insurance
- The Policy Unit should debate and define the most cost effective way to levy insurance premiums on a) flood plain population, b) the general population

- The Policy Unit should debate the ‘no claims bonus’ model where money from pooled risk is used to invest in structural mitigation of the riskiest communities.

- Catastrophe Insurance is the preferred approach to compensate for damages caused by the rarest flood events, including the residual risk associated with flooding exceeding the standards of protection from structural mitigation projects in the riskiest communities

- Implement the Floodplain Zoning Policy Framework and Guidance prepared by UNDP

- Publish flood zone maps on a publically accessible web site

- Convene Stakeholder workshops (local engagement) in all Rioni Municipalities to make flood plain inhabitants aware of their exposure to flooding and their options to mitigate against risk. This will include transparency in what householders will receive in return for the premium paid.

- Make householders aware that pay outs are to support recovery and are not total compensation for all perceived losses

- Review the option for Government subsidy for local property level protection measures in Zones 2 and 3

6 POLICY GUIDANCE NOTE 2 - BUILDING RESILIENCE AND PROPOSED BUILDING CODES

6.1 Introduction

This report is based on limited, but effective research on “best practice” building code provisions for resilience against flood damage, conducted primarily through internet based searches of building codes in countries known to the author as having advanced codes, as well as several representative countries that are experiencing increased flooding due to either cyclic or climate change induced increases in severe storms.

The research into the current building code provisions of Georgian codes that address flood damage resilience, has been restricted to research with the Georgian Ministry of Economy and Sustainable Development, which has current responsibility for building issues related to flood resilience.

6.2 Executive Summary

The Building Codes used in Georgia were reviewed for the inclusion of provisions for flood resilience in new construction, as well as measures that can be implemented on older buildings and the surrounding areas. The building codes available to designers / owners include those of the Georgian Republic, the Russian Federation (grandfathered in by the Georgian government), and the building codes of the country of incorporation of European contractors.

The multiplicity of building codes available to the designer / owner creates a situation where the designer / owner can pick and choose between codes that may be to his economic advantage, but deficient in flood damage resilience. Additionally, the Georgian and Russian Federation codes do not contain specific sections addressing flood resilience measures in any detailed fashion. The Russian Federation and Georgian codes are recognized as need significant updating and revision.

Best Practice building codes exist in a number of countries, that contain specific provisions that could be adapted into a revised building code for the Republic of Georgia. These address flood resilience planning, structure siting, selection of materials, and construction practices that would significantly increase the flood resilience of new and older construction in Georgia.

6.3 Objective of Task

The flood resilience task is a component of the overall flood protection project for selected areas along the Rioni River Basin in Western Georgia, which has as its outcomes the identification of flooding potential, estimation of probable maximum floods and their intervals of occurrence, the design and implementation of structural measures such as shoreline protection along critical areas, and non-structural measures such as the establishment of flood resilience within building codes.

The objective of the task was to identify to what extent “best practice” and Georgian building codes and their contained provisions addressed the inclusion of methods, design measures, material selection and structure placement to increase the resilience of new and existing industrial, commercial and residential construction to flood inundation or other flood induced effects. The overall goal is to recommend improvements to the building codes in use that will increase resilience to flooding, encourage placement of structures above or outside of flood prone zones, and reduce damage and the resultant costs of rehabilitation.

The results and recommendations of the task may be used beyond the Rioni Basin, as they would apply to any area of Georgia that is susceptible to river, lake or seacoast flooding. Additionally, it should be recognized that during heavy and intense storms, “sheet flooding” is common in flat areas with restricted drainage. Thus, structures situated at distance from a river or body of water may experience severe flooding of restricted or moderate duration.

6.4 General Scope and Methodology of the Study

The scope of the study included building code provisions for flood resilience of residential, commercial, industrial and governmental buildings; and included consideration of the materials used for construction, construction methods, normal skills of construction workers or local homeowners, and the capability of designers to include flood resilient measures in their designs..
The study considered both new construction and retrofitting of older construction.

The methodology of the study included:

- Review of the current building codes used in Georgia, that applied to flood resilience
- Review of the “best practices” used in several advanced countries prone to flooding
- Review of the typical flood scenarios in Georgia
- Review of the typical construction and flood mitigation measures in Georgia river basins
- Discussion with several governmental officials directly or indirectly responsible for construction compliance to current building codes in Georgia
- Observation of current flood resilience measures used in limited portions of the Rioni River Basin, during studies for shoreline protection of villages that are currently prone to flood damage

6.5 Building Code Evaluations

6.6 Building Code Improvement for New Construction

Improvement of the resilience of existing structures to flood damage is usually both difficult and expensive, particularly in countries that have undergone extended periods of economic stagnation. Revision of existing structures is beyond the means of most rural and peri-urban owners. For this reason, the focus of this task is on new construction that is planned, where resilience measures can usually be designed into the structure with little or moderate increase in cost. The increased cost could be offset by reduced insurance coverage and rates, reduced probability to flood damage, and reduced costs in repair and restoration of the affected structures.

Using a combination of flood plain mapping, flood plain zoning, flood routing and storage measures, and flood resilient designs and materials, the magnitude of flood damage can be reduced significantly.

6.7 Building Code Improvement for Existing Construction

Of key importance are practical measures that can be implemented in the villages along the Rioni River and its tributaries, to reduce damage due to flood events. While the type of construction used in most of the villages does not easily allow the buildings to be retrofitted in an economic manner, there are measures that can be implemented at relatively low cost, with significant gain in prevention of damage.

6.8 Past History of Building Codes in Georgia

The progression of building code use in Georgia follows the following path:

Pre – Soviet Era : pre 1922

Period of use of “standard practices” based on construction experience over many years. Probably no formalized codes

Soviet Era : 1922 – 1991

Russian Federation building codes that evolved over a period of many years, progressing from minimal codes to a set of formal codes, applied in Georgia with some modifications due to local conditions and materials

Post - Soviet Nation Building : 1992 – 1995

Following independence from the Soviet Union, continued use of Russian Federation building codes. Period of instability within the country, enforcement of codes may have been haphazard

Current : Circa 2000 – present

Development of building codes by Georgian ministries and agencies, mostly modified from previous Russian Federation codes; approval of the continued use of Russian Federation codes in Georgia; in 2013 permission granted for the use

of national building codes of the country of the constructor (requires approval by Georgian authority)

Future : 2015– onward

The government of Georgia has recognized that the Russian Federation building codes, the most commonly used ones in Georgia, are outdated and need revision or replacement. By recent directive, the government is obligated to adopt technical regulations and publish the list by the end of the year 2014. This will drive the generation of new building code provisions, however given the lack of capacity, the actual date of completion of a full set of building code provisions, including flood resilience, will undoubtedly take at least a year.

6.9 Current Building Codes for New Construction in Flood Prone Areas in Georgia

The current building codes for new construction in flood prone areas of Georgia are a "menu" of codes that developers can choose from, based on the types of structures planned and the desires of the prospective owner of the new construction. Building codes that are used, where they may have general or specific flood resilience provisions, include:

1. Russian Federation Building Codes
2. Georgian Building Codes
3. European Building Codes (those of the country of incorporation of the contractor)
4. North American Building Codes (generally restricted to North American owners / operators)

If a specific building code is not specified by the prospective owner or the financing entity for the project, the contractor/designer/architect is free to choose the code he prefers. This can lead to less resilient structures.

6.10 Best Practice Building Codes

"Best Practice" building codes that specifically address issues of resilience from flood damage, and suggest measures and materials that can be used to minimize the chance of flooding and maximize the resilience of new structures against flood damage, include those of the following countries:

The Netherlands	:	Bouwbesluit 2003
United States	:	Uniform Building Code
Australia	:	State of New South Wales
European Union	:	SMARTeST Program

These building codes have specific chapters that address flood protection and building resilience measures that may be taken in the planning and design stages of development. The measures recommended may also be retrofitted, to some extent, to

existing buildings. The discussions in the building code chapters are specific, usually with graphical depiction of the measures. The most extensive set of measures is those of the Australian State of New South Wales building code for flood resilience, and the European Union SMARTeST flood resilience document, references to which are

> *"Department of Natural Resources, New South Wales, Australia; Reducing Vulnerability of Buildings to Flood Damage – Guidance On Building in Flood Prone Areas, 2007"*
>
> *The SMARTeST Project ; Flood Resistant Technologies ; European Union's FP7 Research Programme, Technologies for improved safety of the built environment in relation to flood events (ENV.2009.3.1.5.1).*

6.11 Assessment of Current State of Building Codes in Georgia

Based on limited information and observation, it is probable that the most commonly used code in Georgia is the Russian Federation Building Code, as it has been in place for many years, developers and contractors are familiar with the provisions of the code, and the risk of structure damage in flood prone areas is generally under-recognized. Most of the buildings that are, or could be, affected by flood damage in the areas currently being studied for shoreline protection measures in the Rioni Basin are several decades old. Residences, in many cases, were constructed without much concern with building codes (construction techniques were those that were done by their forefathers). In addition, the dangers from flooding may have been under-recognized.

Factors contributing to the under – recognition of potential flood damage include:

- Lack of understanding of the potential impact of climate change on flood occurrence and severity
- Lack of understanding that watershed and river channel degradation has caused significant siltation in reservoirs (less flood control), and raised river beds (more overbank flow)
- Lack of understanding that downstream construction of channel training walls, bridges, and other obstacles that serve to narrow channels or impede flow, will cause more flooding of low elevations along the rivers
- Lack of understanding that the infrastructure and urban development away from river and stream channels can cause significant sheet flooding in residential and industrial areas
- Insufficient understanding of the types and severity of damage that can occur during flood events that submerge portions of commercial, industrial and residential construction

6.12 Gaps : Current Status in Georgia and Best Practice Codes

The current building codes in Georgia do not specifically have sections addressing structure resilience against flooding damage. There are general references to "ensuring the safety of the structure and its inhabitants", but no extended discussion of how that should be done. When project developers use European building codes, they may use sections of those codes which address flood resilience. The status of the Russian Federation codes with respect to flood damage resilience was not assessed in this study, but is thought to be less detailed than that of the European or Best Practice building codes. Given the existence of damaging floods currently, and the probability that these will increase in severity under climate change conditions, the Republic of Georgia would benefit from a more specific set of flood resilience measures in national building codes, or a requirement that developers seeking to design and construct new structures in flood plain areas (for a specified maximum flood, say 100 year) must use building code provisions from a named set of European or Best Practice codes. In addition, the easily implemented measures that can be used in retrofitting current buildings for additional flood resilience should be summarized and provided to the local authorities (mayors, building permit departments, flood response / control authorities) for distribution to the public, most effectively at the community level. Co-ordinated efforts would be more effective that individuals acting alone.

6.13 Impacts of Current Status and Gaps on Existing and New Structures in Flood Prone Areas

The 'gaps' between codes used in Georgia and more complete building code provisions for flood resilience can cause the following impacts on new or retrofit construction that use outdated or non-resilient approaches:

- Structural damage to the new construction due to flood dynamic forces during flooding
- Loss of structural integrity of building materials due to water submergence or soaking
- Loss of function of equipment in the building due to submergence in flood waters
- Loss of furnishings, office equipment, etc. due to partial or total submergence
- Requirement to replace flooring and wall coverings due to water damage
- Generation of molds, with consequent impact on the health of the inhabitants

Each of these impacts will result in direct and indirect costs to the owner of the building subsequent to the flood.

6.14 Status of Flood Plain Mapping and Flood Plain Building Restrictions

The current status of flood plain mapping and flood plain building restrictions in Georgia is not known to the author of this report. If it follows the pattern experienced in other developed countries, the flood plain mapping is probably at least 20 to 30 years out of date and does not consider:

- Changes in watershed vegetation and forest cover, usually depleted
- Changes in urban area growth, with increased hard surface coverage
- Changes in precipitation intensity and duration
- Damage to flood control structures along river courses
- Lack of early warning systems
- Incursions into current (unmapped) flood zones by local residential construction

The result is that many areas along rivers in Georgia have not had recent updating of flood plain extent, explanation of risk to the local inhabitants, regulation of building in flood plains, or strengthening of the flood control and protective structures. This leaves considerable areas of existing construction along the rivers in Georgia susceptible to flood damage.

6.15 Current Building Codes for Retrofitting Older Construction - Flood Prone Areas

To the knowledge of the writer, there are no specified building codes for retrofitting older construction in flood prone areas of Georgia. In most cases, retrofitting would be subject to the current new construction building codes, unless local building authorities granted exceptions to those codes. For residents and small enterprises in the villages of the Rioni River Basin, compliance with the current codes may be financially difficult. The following section discusses some practical measures that inhabitants of older buildings in small villages could consider in making their habitations / enterprises more flood resilient.

6.16 Assessment of Vulnerability of Existing Construction in Flood Prone Areas of Georgia

The primary areas of vulnerability of existing construction in flood prone areas along the rivers of Georgia are:

1. The exposure of the structure to inflow of flood waters into or around the building
2. The stability of the building foundation when subjected to flood water and flood flows
3. The stability and resistance to erosion of the ground around the structure
4. The maintenance of potable water to the structure / site

5. The functioning of electrical systems

6.17 General Observations on Types of Foundations / Structural Walls / Water / Electrical Systems

The following observations on the types of foundations, structural walls, water sources to structures, and electrical hookups are based on very limited entry into several typical buildings in villages / towns in the Rioni Basin, and limited external observations made during three mission trips in 2014 / 2015. They should not be viewed as the only types, nor as representing the majority of the structures. They are intended as "representative" of the issues that could be addressed in establishing building resilience to flood inflows and forces.

Foundations:

There are four most common foundation types in the villages along the Rioni Basin rivers:

a. Stacked elongate native boulders, which may be grouted or may not.
   This type of foundation is probably the oldest type, used prior to the access to concrete blocks or concrete grout materials. The stacked boulders appear to be stable under a vertical loading, but would be subject to movement or failure if undermined. Typically a foundation beam of wood is placed on the stacked boulders, and serves as the floorplate for wall beams
b. Concrete blocks, place on a smoothed dirt base, and may be grouted and reinforced with wire mesh or rod, or may not have any reinforcing. This type of foundation is fairly typical and would take vertical loading well. If flood waters were to erode the dirt layer under the concrete blocks, sequential failure could occur
c. Concrete blocks, placed on a layer of poured concrete. This variant adds a more competent layer of concrete beneath the concrete blocks, and offers more stability. Under minimal erosion forces from flood flows around the foundation, this type of foundation construction should perform well
d. Poured concrete foundation wall, probably with some wire mesh or steel reinforcing rod. This foundation type is more common in larger and more recent structures, as well as commercial use structures. It offers good resilience to flood flows and forces

Structural Walls

The structural walls of a building are somewhat less critical than the foundation, but should be considered in evaluation of flood resilience. The primary factor is the ability of the wall to resist hydrostatic pressures, either from flood waters external to the structure, or internal, in the case of flood water entering the structure through door or other openings, and remaining trapped as the external water level recedes. The common wall construction in the Rioni Basin is believed to be concrete blocks, or "lath and plaster". The concrete block walls would have high resistance to pressures, the lath and plaster

(in whatever form it takes), could fail if saturated and has insufficient lath or wooden branch support.

Potable Water Sources

Based on limited observation, the potable water source for many residences consists of a plastic inflow line from a central village storage tank (usually fed by a well), or a direct connection from a residential well. In some cases, the source may be simply a line from an intake structure in a stream or river. Flood action may damage the inflow lines and disrupt the normal water quality. It is important that inflow lines be checked after a flood, to ensure that the water coming to a structure is of good quality and is not being contaminated by external sources.

It should be noted also that water supply lines themselves can contribute to flooding of properties (e.g. through bursts/leakages) without the influence of a flood event, for examples when they burst or leak. An assessment of the flooding risk from water supply system failures has not been thoroughly assessed for Georgia and it is recommended that this is studied as one of the other sources of flooding that will need to be managed. It should be noted that these building code guidelines will apply to this sources of flooding.

Electrical Systems

Electrical systems to structures are believed to be a simple 240 volt line coming from a distribution transformer source. The lines are typically overhead lines into the structure, the internal system is not known, but may be exposed or hidden in the walls of the structure. It would be important for the lines to be placed above the nominal maximum flood level, in new construction; or moved to the position in modification to existing construction.

Mold Hazard

A common feature of flood damaged structures is the generation of hazardous molds in damp wall areas, subsequent to flooding. The primary defenses against molds, which can be a major factor in the health of the inhabitants, are rapid drying of the internal walls and floors after the flood, and a “wipedown” with a chlorine containing liquid. These two measures, if done as soon after the flood as possible, will reduce mold likelihood significantly.

6.18 Practical Approaches for Retrofitting Older Construction in Flood Prone Areas in Georgia

There are a number of practical measures that can be taken to increase the resilience of older structures in the villages of the Rioni River Basin to flooding events. These can be

undertaken in the areas around the structure, and then within the structure. The measures are:

Areas External to the Structure:

- Provide or expand drainage paths for floodwaters that come near the structure
- Prevent ponding of floodwaters near the structure or its foundations
- Construct small barrier walls to divert flood flow away from the structure
- Clean out drains, channels or ditches that handle normal rainfall flows
- Divert external flows from roads, parking areas, etc. away from structures

Measures Taken on the Exterior of the Structure or Within the Structure:

- Raise doorway sills to impede floodwater intrusion
- Create openings in exterior walls areas beneath the bottom floor to allow floodwaters to easily flow (recede) from the areas below the structure
- Consider openings in the first floor exterior walls to allow flow from flooded first floor areas (would need a flap valve, or small panel removable at the end of flooding)
- Move appliances (washing machines, dryers, TV's, etc.) to an elevated position on the first floor, or to the second floor
- Raise fuse boxes to an elevated position above experienced flood levels
- Use flood resilient materials in any first floor renovations

While these measures may not prevent flood damage, they can reduce the damages and make post flood recovery faster and less costly

6.19 Summary of Status of Georgian Building Codes and Practices for Flood Resilience

The following points summarize the Georgian and Russian Federation Building Code use in new construction in Georgia:

a. The codes are worded in general terms and are open to interpretation by the building designer / owner as to what emphasis should be placed on flood resilience measures
b. The codes do not provide specific references, design requirements, or graphic examples of flood resilience design or construction measures

c. It is probable that flood resilience decisions by the owner / designer are not necessarily tied to specific and up to date flood plain zoning or flood plain mapping of the planned construction site
d. The owner / designer can “pick and choose” between the provisions of the Georgian and Russian Federation Codes, which could lead to cost reduction and minimal flood resilience design included in the construction
e. The Georgian and Russian Federation Codes are probably outdated with respect to discussion of flood resilient construction materials and practices

The use of European Codes, which is allowed if the construction entity is incorporated in a European Country, and whose code is approved by the Ministry of Economy and Sustainable Development, may result in provision of flood resilience, if the European country code has adequate flood resilience sections included in the code. Thus depending on the flood awareness and building code provisions of the contractors country of incorporation, the flood resilience of the new construction may vary from adequate to excellent.

6.20 Recommendations:

The improvement of the flood resilience of existing construction along flood plain areas of the rivers of Georgia would be materially aided by the following:

a. Development by the Georgian Government, through the appropriate Ministry, of a building code that includes (or requires) provision for flood resilience in current or potential flood prone areas. This could be done by appropriate Georgian technical and contractor groups reviewing the Australian and European building codes for flood resilience (see references (g) and (h), in the reference section), and adopting relevant sections of those codes. The adoption would have include modification to account for the following factors:
    - The economic constraints of the average structure owner in Georgia
    - The potential limitations imposed by available building materials in Georgia
    - The coherence of any resilience code with other building codes in Georgia

It would be very important to establish a resilience building code, as the economic loss from flooding in Georgia, has been significant and could be reduced by implementation of resilient retrofits or application to new construction.

b. Adoption of flood zoning policy (as outlined in Part 1 of this document) which includes:
    - A exclusion zones, where no new residential or commercial building would be allowed (Flood Zones 1 and 2)

- Flood zones, where any permitted construction is required to have flood resilient measures included in the design (Zones 3-5)

c. Erection of signage and publishing of maps that delineate the flood zones for public viewing and understanding

d. Completion of a representative inventory of the types of older construction that exists in the villages along the Rioni Basin rivers, with identification of the vulnerabilities of those construction types, as has been undertaking in Rioni the ground truthing exercise.

e. Development of resilient measures that could be implemented to reduce the vulnerability and increase the resilience of structures that do not currently have flood resilience, communication of these measures (in plain and understandable language) to the inhabitants and the municipal authorities

f. Notification to all owners in the flood zones that their current or planned structures are in a flood plain, and that they will be required to include flood resilience, or be at risk with no guarantee of municipal or national program help

7.0 References

a. Government of Georgia; "Law on Construction Activities", 27 October 2000
b. Government of Georgia; " Law on Foundations for Spatial Planning and Urban Development", 2 June 2005
c. Government of Georgia; " Code of Product Safety and Free Movement", 8 May 2010
d. Government of Georgia; "Fundamental Provisions for the Use of Settlements and Their Development" Ministry of Economy Order N1-1/1254, 8 July 2008
e. Techlidze, Tamar; "Compendium of Building Code Provisions" 21 June 2013
   Tbilisi, Georgia
f. Johnson, Cassidy, Development Planning Unit, University College, London; "Recent Experience of Regulatory Frameworks for Land, Planning and Building in Low and Middle Income Countries", April 2011
g. Department of Natural Resources, New South Wales, Australia; "Reducing Vulnerability of Buildings to Flood Damage – Guidance On Building in Flood Prone Areas", 2007
h. The SMARTeST Project ; Flood Resistant Technologies ; European Union's FP7 Research Programme, Technologies for improved safety of the built environment in relation to flood events (ENV.2009.3.1.5.1).
i. Jeroen Aerts, The Netherlands; "Reduction of Exposure to Floods and Reduction of Flood Consequences, 2010
j. European Union; "European Directive on Flood Risk Assessment and Management (Directive 2007/60/EC), 2007
k. Bouwbesluit 2003; Ministry of Planning, Housing and Environment (VROM)l
   http://international.vrom.nl//pajmina.html
l. Federal Emergency Management Agency, United States; "State of Mississippi Model Flood Damage Prevention Ordinance for Communities", October 2000

7 POLICY GUIDANCE NOTE 3 – FLOOD RESILIENT CRITICAL INFRASTRUCTURE

7.1 Introduction

The European Union defines critical infrastructure as follows:

"Critical infrastructure (CI) consists of those physical and information technology facilities, networks, services and assets which, if disrupted or destroyed, have a serious impact on the health, safety, security or economic well-being of citizens or the effective functioning of governments".

It therefore includes infrastructure which is essential for the functioning of society, whose failure would seriously affect many people.

This Policy Guidance Note aims to provide recommendations on the management of critical infrastructure in the floodplain in order to improve the resilience of critical infrastructure and essential services to disruption from flooding. The guidance is based on developing a shared, consistent, proportionate and risk-based approach to reducing vulnerability over time, and eventually embedding flood resilience measures into the planning, design, construction and long-term management of critical infrastructure.

The main goal of CI resilience planning is to identify and assess risks from flooding in order to develop a range of options to manage those risks (e.g. through avoiding, reducing, transferring, or accepting the risk). Options could vary from the provision of physical protection, to the relocation of assets, building in contingency/redundancy within infrastructure, planning for 'business continuity' during and event, or improving arrangements for emergency response.

This Policy Guidance Note is primarily directed at central government departments, regulators, relevant public sector bodies and critical infrastructure owners. It aims to:

1) Encourage a co-ordinated and systematic approach to improving the resilience of the critical and essential infrastructure network.
2) Establish a minimum standard for resilience to flooding for critical infrastructure.
3) Clarify the roles and responsibilities of the wide range of public and private sector bodies who will contribute to the delivery of the shared goals of achieving flood resilience for critical infrastructure.

7.2 Background

Historically, flooding in Georgia has impacted critical infrastructure in the floodplain resulting in significant losses and damages. The recent flooding in Tbilisi (June 2015) resulted in XX GEL of damages to critical infrastructures (PDNA), and it was the lack of sufficient conveyance capacity of a critical tunnel in the floodplain which lead to/contributed to the scale of the flooding.

In the Rioni basin, the annual average losses to infrastructure has been assessed as XX GEL for a 1 in 1000 year flood event. Figure 7-1 is a map of the critical infrastructure currently at risk from fluvial flooding in the Rioni basin, Figure AA shows the flood score for main roads at risk in the Rioni basin, and Tables 7-1 to 7-5 itemise the types of infrastructure currently at risk from floods up to the 100 year event in 6 of the municipalities of the Rioni

basin which has been confirmed by detailed ground truthing of the 6 riskiest Rioni communities.

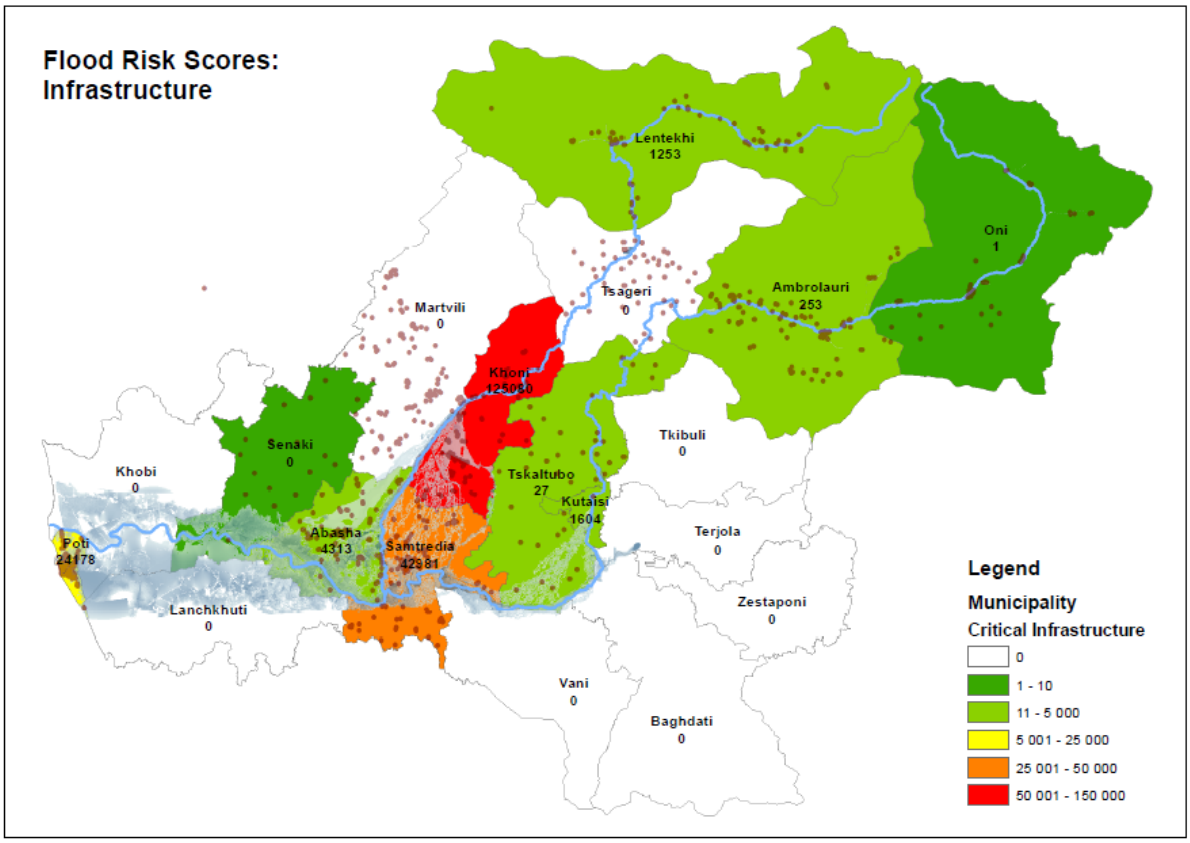

Figure 7-1: Flood Risk Score for Infrastructure (excluding roads)

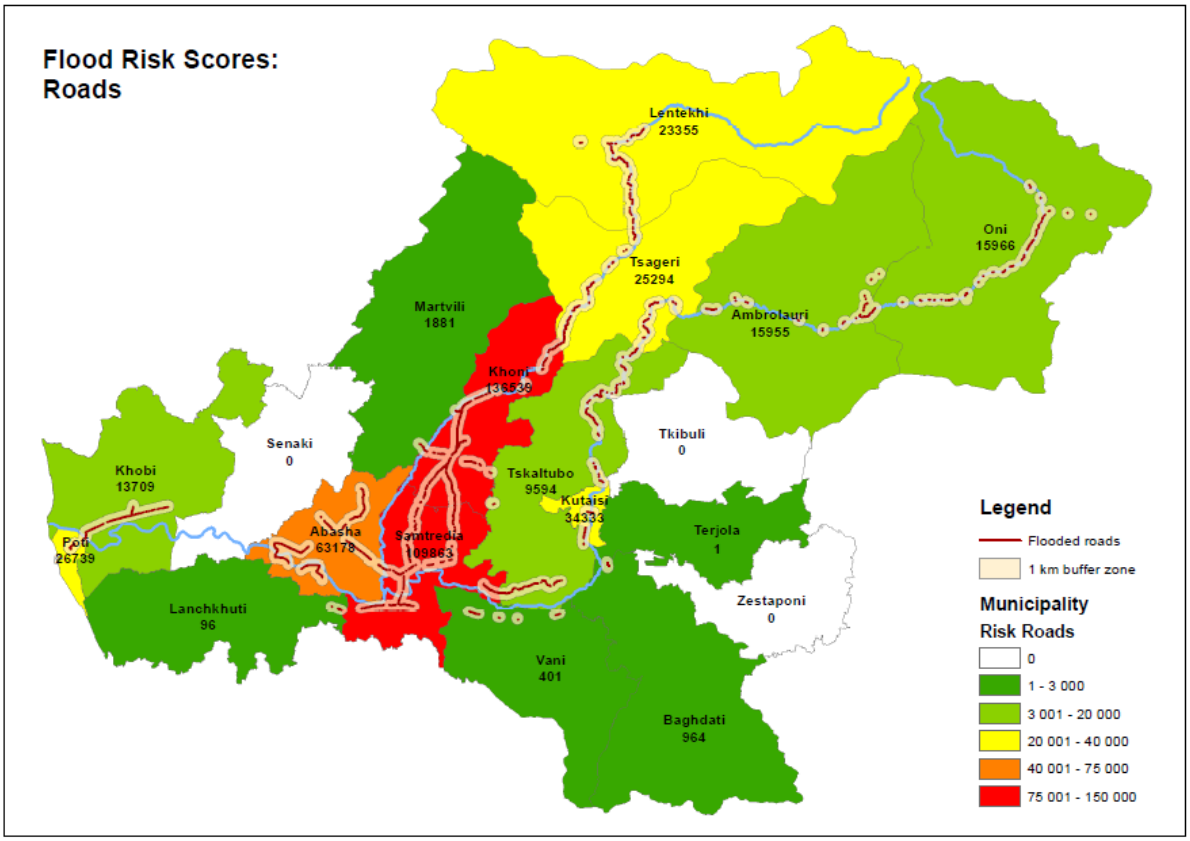

Figure 7-2: Flood Risk Score for roads

Table 7-1: Kutaisi Critical Infrastructure at risk

Kutaisi					
Critical Infrastructure	**Page number**	**Building number**	**d5**	**d20**	**d100**
Municipal Buildings	16	8	-0.08	0.00	0.08
Hotel	16	6	0.05	0.58	0.77
Hospital	17	22	0.41	0.99	1.06
Hospital	17	28	0.48	1.04	1.12
Fire Station	17	75	0.25	0.56	0.80

Table 7-2: Kulashi Critical Infrastructure at risk

Kulashi					
Critical Infrastructure	**Page number**	**Building number**	**d5**	**d20**	**d100**
Municipal Buildings	512	262	0.01	0.01	0.07
Municipal	512	263	0.06	0.06	0.14

Buildings					
Municipal Buildings	512	264	0.01	0.02	0.10
School	512	315	-0.08	-0.04	0.09
School	551	112	-0.18	-0.18	-0.16
School	551	113	-0.20	-0.18	-0.12
Church	242	264	2.54	2.99	4.29
Church	454	100	-0.03	0.00	0.76
Church	454	101	-0.03	0.01	0.72
Hospital	305	391	-0.08	0.24	1.31

Table 7-3: Samtredia Critical Infrastructure at risk

Samtredia					
Critical Infrastructure	**Page number**	**Building number**	**d5**	**d20**	**d100**
Municipal Buildings	768	75	0.16	0.17	0.322
Municipal Buildings	768	213	0.19	0.19	0.349
Church	621	61	-0.04	-0.04	0.02
Church	691	298	-0.01	-0.01	0.06
Church	742	191	0.79	0.77	0.81
Hotel	837	2	0.00	0.00	0.11
Police Station	743	422	0.00	0.00	0.04
Restaurant	718	88	-0.04	-0.04	0.22
Restaurant	718	96	-0.03	-0.03	0.09
Restaurant	744	425	0.31	0.31	0.40
Restaurant	837	4	-0.01	-0.01	1.10
Restaurant	718	619	-0.04	-0.04	0.06
Restaurant	743	456	0.12	0.12	0.18
Hospital	743	149	0.59	0.59	0.65
Hospital	691	71	-0.10	-0.10	0.00
Hospital	691	176	0.00	0.00	0.08
Hospital	718	421	-0.10	-0.10	0.02
Electricity sub station	769	7	0.00	0.86	2.34
Electricity sub station	718	552	0.00	0.00	0.18
Fire Station	743	457	0.63	0.63	0.63
Water/Sanitation	769	6	0.00	0.86	2.54
Water/Sanitation	769	8	-0.40	0.46	2.14
Water/Sanitation	769	264	-2.00	-1.14	0.54

Table 7-4: Lentekhi Critical Infrastructure at risk

Lentekhi					
Critical	**Page**	**Building**	**d5**	**d20**	**d100**

Infrastructure	number	number			
Municipal Buildings	3	41	0.05	0.15	0.35
Municipal Buildings	3	44	-0.04	-0.02	0.04
School	1	66	0.21	0.48	1.10
Church	3	2286	0.27	0.44	0.70
Hotel	3	2813	1.58	2.60	3.90
Fire Station	4	7	-0.03	0.50	1.74

Table 7-5: Tsageri Critical Infrastructure at risk

Tsageri					
Crtical Infrastructure	**page number**	**building number**	**d5**	**d20**	**d100**
Municipal Buildings	16	8	-0.08	0.00	0.08
Hotel	16	6	0.05	0.58	0.77
Hospital	17	22	0.41	0.99	1.06
Hospital	17	28	0.48	1.04	1.12
fire Station	17	75	0.25	0.56	0.80

7.3 Status of Critical Infrastructure flood resilience planning in Georgia

The Civil Protection legislation currently in place provides for the protection and security of critical national infrastructure against national security threats in Georgia, but currently has not systematically identified or assessed the risk from natural hazards. This is largely because, detailed risk knowledge is not currently available on actual risks arising from hydrometeorological threats and other related natural hazards, nor the increasing severity of those threats due to climate change. Hence until now, there has been limited (or no) understanding of the scale of vulnerability of critical infrastructure in each sector, nor the shared vulnerability across sectors to natural hazards.

To address this, the following essential next steps must be taken:

1) Systematic and comprehensive assessment of the flood hazard, risk and vulnerability should be undertaken. It is recommended that the approaches used and codified by the UNDP project for the Rioni basin, are adopted for all river basins in Georgia within a programme of national flood hazard and risk mapping.
2) Implement a systematic programme to reduce the disruption of essential services resulting from flood hazards with a clear timetable and expected outcomes. Embed the requirement for assessment and management of flood risks to critical infrastructure within the planning, design and construction and management framework for critical infrastructure.

3) Relevant government departments and the National Environmental Agency (NEA) should work with infrastructure operators to identify the vulnerability and risk of assets to flooding and Sector Resilience Plans should be developed.

4) Government and infrastructure operators should work together to build a level of resilience into critical infrastructure assets that ensures continuity during a worst case flood event.

5) Planning authorities should be empowered to (and required to) reject planning applications for critical infrastructure that do not include an appropriate level of flood resilience.

6) A statutory obligation should be placed on critical infrastructure owners to build resilience into their infrastructure.

7.4 Defining Critical Infrastructure flood resilience for Georgia

7.4.1 General Principles

Risk-based approach*.* The standards adopted and measures proposed to enhance resilience should be proportionate to the risks posed. Hence the assessment should be based on the probability or likelihood of the flood event, and the consequences to critical infrastructure including: complete loss or destruction of the infrastructure (or service), severity of disruption of the use/service due to the failure/loss of the infrastructure, size of the population affected, duration of the disruption, cumulative impact (knock-on effect) e.g. health and safety impacts, economic loss due to loss of service/business continuity, loss of life. It should be noted that the risk model developed as part of this project assesses the risk to critical infrastructure using such an approach, and calculates a risk score based on the criteria outlined here and more. It is therefore highly recommended that that approach (and model) is extended to all basins in Georgia, and is standardised for the assessment of risks to critical infrastructure.

Proportionality*.* The scale and cost of proposed resilience measures within each sector should be proportionate to the risks they face. This means taking into account the likelihood of their being affected, the "criticality" of the infrastructure in question and its vulnerabilities, and the different options available to improve resilience. The proportionality approach allows for the prioritisation of measures to be implemented based on risk profile and criticality of the infrastructure. Thus a portfolio risk assessment and prioritisation should be carried out for each sector (taking account of inter-sector dependencies and interdependencies)

Co-operation and co-ordination. Co-ordination and integration within and between sectors and essential services to deliver the aims set out above.

Precautionary. A precautionary approach should be taken where there are uncertainties in the estimation of the risks posed by floods across the medium-term.

Information sharing. Government and CI owners should promote appropriate information sharing to support resilience-building, especially on dependencies, interdependencies and arrangements for business continuity management across sectors.

Sustainability. Resilience-building for CI should be in line with the Government of Georgia's aims for sustainable development, and the creation and maintenance of sustainable communities.

7.4.2 Critical Infrastructure Sectors

As a minimum the following sectors should be considered: energy, food, water, transportation, communications, emergency services, health care, recreational, cultural and historical facilities (e.g.sports stadia, museums, churches, zoos, parks, conference centres, hotels), financial services and government. The general flood resilience requirements for some of the key sectors are discussed below.

In some sectors, critical infrastructure owners may already have in place, arrangements for improving and sustaining the resilience of their assets, networks and systems, and for risk assessment and business continuity management. Through partnerships among CI owners, lead government departments and regulators it would be important to share experience of activities already under way, and to assess the residual vulnerability of infrastructure assets to severe disruption caused by flooding and to determine what further measures are necessary to improve resilience.

A range of options can be considered to ensure resilience in critical infrastructure including:

1) Considering the threat from current and future flood hazard in the design of new assets, networks and systems.

2) Increasing the robustness and resilience of existing services or assets by building additional network connections, by providing backup facilities to ensure continuity of services, or by retro-fitting flood resilience measures to existing facilities. In general these measures may include permanent or temporary flood defences (for flood resistance), and location of sensitive and highly critical equipment above the flood level on site or relocate such equipment off-site to a lower-risk area (for flood resilience).

3) Relocate the entire critical infrastructure to a lower-risk area. For most infrastructure, relocation can only be a longer-term option, which may take time, hence, short–term measures such as retro-fitting resilience and resistance measures, may be needed in the meantime.

4) Improved information sharing on infrastructure network performance and standards.

5) Enhancing skills and capabilities to respond to emergencies arising from natural hazards.

6) Recording and sharing lessons from previous flood events and 'Build Back Better' when re-building critical infrastructure following flood events. Make 'Build Back Better' a requirement of provision of permission or funding for rebuilding.

7) Link service standards requirements to CI resilience and ensure associated penalties are in place should those minimum standards be breached due to failure of infrastructure owners to provide the necessary resilience.

8) This Policy Guidance Note, is being developed to consider fluvial flood risk, but can and should be extended to include resilience of critical infrastructure to all natural hazards. As a minimum, all other forms of flooding (including surface water (pluvial/flash flooding), reservoirs, canals and groundwater) should be incorporated into the sector resilience plans once the mapping of other hazards is completed. The process for extending the plans beyond flooding should be priority for development of the national planning policy.

7.5 Suggested Minimum Flood Resilience Standards for Critical Infrastructure

7.5.1 Publically-funded Infrastructure

The EU standard for CI is the 1 in 500 year flood level. It is proposed that this is adopted as a minimum standard for all publically funded CI in Georgia. In some cases, this level will need to include assessment of the joint probability of flooding from different sources, for example, fluvial and sewer flooding or fluvial and coastal flooding and the highest combined equivalent standard chosen where possible. This guidance is based on understanding that

there is a need to ensure that publically-funded critical infrastructure requires a higher minimum design threshold than privately-funded critical infrastructure. It should be noted that publically-funded infrastructure refers to government as well as IFI funding of critical infrastructure.

7.5.2 Non-Publicly Funded Infrastructure Mitigation/Resiliency Standards

Projects for which no public-funding assistance is provided, must comply with the existing minimum standards as set out by NEA (and EU Floods Directive eventually) but should nevertheless give serious consideration to maximizing protection of critical system components beyond these minimum requirements, such as the siting, design, construction, operation, and maintenance of the system (and therefore its integral components), for adequate operation and attainment of the service standard. Accordingly, additional resilience options based on an "avoidance, elevation, and flood-proofing" hierarchy should be applied.

7.6 The Water Sector

7.6.1 Water Supply and Sewerage

Floods can result in catastrophic damages to water infrastructure, which could take years to repair. Drinking-water infrastructure can be flooded and put out of commission for days, weeks or months at a time, while flooding of sanitation facilities will not only result in a break in services, but could have attendant health risks if water systems become contaminated.

Potential indirect effects of climate change on the water supply and sanitation situation include the impacts of energy interruptions, increasing the unreliability of piped water and sewerage services.

Asset owners in the water sector should hold information about risk and resilience for their sites (based on detailed risk assessments) and include budget provisions for maintaining resilience, associated with a longer term programme of resilience building across the sector.

Water supply and sanitation infrastructure should be made resilient to a very high standard of protection given the likely impact to disruption of services and consequent on health that flooding of such infrastructure can cause.

7.6.2 Water Control/Flood defence Infrastructure

The importance of ensuring resilience of flood defence infrastructure is obvious. Firstly, flood defences are normally the first line of defence of populations from flooding, and while it is impossible to build defences to eliminate all flooding, they can save lives, reduce damages, and buy time for action such as evacuation, or moving valuables to a higher level to be taken.

During the Soviet era there was a significant programme of flood defence construction, almost exclusively as a means of flood risk management. It is not known whether such schemes were designed to provide internationally accepted standards of protection at the time, and in any case, most have exceeded their design life and have not been upgraded, or maintained and are therefore now largely ineffective. They certainly would not have taken account of increasing flood risk due to climate change. Furthermore, in the modern era, flood risk management is now a mixed approach which combines both structural and non-structural measures (as done under the UNDP project for the Rioni basin).

In terms of design standards for flood defences, levels are normally defined as the 1% (or 1 in 100 year) event for rivers and 0.5% for coastal defences, subject to the proposed scheme

being cost beneficial and environmentally sustainable. It also depends on what is being protected behind the defence (1% being the minimum standard for populated areas). In addition, allowances need to be made for climate change and other future scenarios, which should be reviewed and updated frequently as further research is undertaken and knowledge is improved.

Two aspects of vulnerability of flood defences need to be considered:

1) Failure of the asset itself through damage during flood event, inadequate maintenance programme or the design capacity being exceeded.

2) Consequential damage to other infrastructure or assets protected by the flood defences.

The first of these is related to the intrinsic condition and performance of the flood defence asset, while the second is related to the infrastructure it protects from the flood event. It should be noted that the risk and vulnerability assessment done as part of the Rioni project provides a methodology and model for the assessment of infrastructure vulnerability based on impact on disruption to services provided by all critical infrastructure, but does not include the effect of flood defence failure other than overtopping. Hence while flood hazard and risk mapping provides assessment of vulnerability due to overtopping failure of food defences, there is a third aspect of vulnerability of populations and assets (i.e. other infrastructure) from the failure of flood defences due to breaching or collapse of flood defences. Guidance is provided for assessment of potential failure of flood defences in other technical documents from the UNDP Rioni project.

7.7 Communications Sector

The communication sector is key to a number of other sectors within Georgia essential for the functioning of government and society, and comprises telecommunications companies, postal services and broadcasting companies. Resilience within this sector is therefore critical to resilience in other sectors. The sector is comprised of a number of companies which it is anticipated will grow in line with other global competitive communications markets. Resilience in the sector will be enhanced by:

1) New technologies that will enhance contingencies such as: alternative power supplies; back-up control and data centres; and the capability to perform critical functions from multiple sites, thus providing the ability to switch between systems and networks in the event of failure or redundancy. Hence the sector will need to establish and maintain contingency plans to manage emergencies and restore service to customers.

2) The inclusion of resilience measures within existing business models, as would be expected in a competitive market such as this. Flood resilience should therefore be easy to build in to existing contingency plans.

3) Existing co-operation between Government and the communications sector should ensure essential lines of communication (e.g. for the emergency services) are maintained in the event of the failure of the network. Hence, government should look to strengthen existing relationships with the telecoms sector, and use existing procedures in place to ensure the continuity of essential communications in the event of the loss of part of the communications network as a means of adding flood resilience.

4) Where necessary NEA, MRDI and MIA should work more closely with the sector as a whole to address this knowledge gaps in flood resilience levels to ensure that resilience assessed and includes flood risks.

7.8 Energy Sector

The Energy sector is made up of the upstream oil and gas, downstream oil and gas, electricity generation and electricity networks sub-sectors. The infrastructure within this sector is extensive and varied and includes pipelines (some at river crossings), dams (for hydroelectric power which themselves pose flood risks), storage and transmission lines for hazardous material. Major risks to the energy sector from flooding and other natural hazards, requires resilience building which should include:

- Service provision standards linked to built-in and demonstrable resilience measures

- Given the size and complexity of energy networks, there will need to be cooperation between the various infrastructure owners in order to build resilience in this sector.

- Redundancy and contingency planning

1) *Upstream Oil and Gas*: Assessment of the risk to oil and gas terminals from all sources of flooding as the consequential failure of such terminals can be severe to both population centres and the environment. Particular attention should be paid to transmission lines crossing the floodplain. Establish agreed methodology and standards for the assessment of risks to oil and gas terminals and transmission lines, in particular when located on floodplains. Information about existing vulnerabilities and resilience measures can be utilised during price control reviews to support companies in accessing funding for improved resilience.

2) *Downstream oil and gas*: maintaining capability to make fuel deliveries in the event of a serious disruption. Ensure that multiple supply routes (pipeline, rail, coastal tanker and road) provides inherent resilience to any potential failure of individual assets.

3) *Electricity Generation*: Assessment of the risk to power stations and networks from all sources of flooding and development of sector management plan to include contingency and redundancy plans, and business continuity plans such as electricity distribution through alternative substations and, in particular for the transmission network. Establishment of mobile (demountable) flood defences where necessary. Establishment of a process for protecting all major substations and gas sites up to an agreed standard; Improved protection of specific sites, including permanent barriers and elevation. Investment in moveable flood defences (financed and owned by the CI owners)

4) For the energy sector as a whole, flood resilience activities should be prioritised based on impact of loss calculations from each sub-sector group or combinations thereof.

7.9 Transport Sector

The Transport sector comprises the road, aviation, rail and maritime sub-sectors. The scale and exposed nature of the network leaves it vulnerable to significant flood risk, particularly

where is crosses the floodplain. In addition, the attendant consequences of failure of parts of this sector during a flood event could be detrimental to large parts of the populations and could impact other sectors including emergency response, health and safety, communications and food (supplies), particularly to rural isolated communities. Within this sector flood resilience can be built in by considering the following:

1. Risk assessment and identification of the highest risk parts of the networks for each sub-sector. Development of strategies, plans and guidance for network operations staff for the management of flood risk.

2. The management, maintenance and improvement of the strategic transportation network are the responsibility of central government and they will need to be key partners in the assessment of risk to disruptions and losses to the network due to flood hazards.

3. Development of sector and sub-sector resilience and contingency plans for flood risk.

7.10 Emergency Services

The emergency services sector consists of the Fire and Rescue, Police, Ambulance and Maritime and Coastguard services and in many cases, the infrastructure related to this sector has to be located in flood risk areas in order to deal with affected areas, since preparedness for emergencies is inherent in the sector.

Emergency Services are subject to the full set of civil protection duties, which includes the requirement to assess the risk of emergencies to inform preparations and put in place emergency and business continuity plans.

The main risk to this sector is loss of communications, so it is essential that, in order to maintain operational effectiveness in times of disruption, a range of communications systems with the necessary redundancies are available. As a minimum, risk from flooding should be assessed for all infrastructure in this sector including the communications systems on which it relies, and a robust strategy, and sector resilience plan should be put in place. In general flood resilience in this sector will need to include:

1) Full risk assessment of infrastructure to identify critical areas likely to diminish the ability to fully function in an emergency situation.

2) Relocating of infrastructure, services and key information technology to areas of reduced flood risk, building and maintaining on-site flood defences if necessary.

3) Implement cross sector agreements to facilitate inter service mutual aid arrangements as and when necessary.

4) Undertake sector resilience planning, including business continuity planning

5) Develop well tested contingency arrangements, including back up operation centres and backup power supplies.

8 POLICY GUIDANCE NOTE 4 – GUIDANCE ON CARRYING OUT A STRATEGIC FLOOD RISK ASSESSMENT

8.1 General

A Strategic Flood Risk Assessment is a study to assess the risk to an area from flooding from all sources, now and in the future, taking account of the impacts of climate change, and to assess the impact that land use changes and development in the area will have on flood risk . It should be carried out by the local planning authoritie(s) and should cover the whole territory and include consideration of all known land use changes and development in the area (including planned flood defences/risk management interventions), as part of long-term development planning. It is important, where necessary that authorities work collaborative especially where boundaries are such that changes to flood risk due to planned development from one authority will impact others.

It should be noted that the SFRA is a finer level of detail from the hazard, risk and vulnerability mapping which is the responsibility of the NEA and which will be the starting point of the SFRA.

The Strategic Flood Risk Assessment is therefore needed to refine information on flooding risk provided by the NEA flood hazard and risk maps. Local planning authorities should use the SFRA to:

- determine the variations in risk from all sources of flooding across their areas, and also the risks to and from surrounding areas in the same catchment;
- Incorporate into their Local Plan, so that flood risk is fully taken into account when considering allocation options and in the preparation of plan policies, including policies for flood risk management options;
- apply the Suitability Test and, where necessary, the Exception Test when determining land use allocations;
- identify the requirements for site-specific flood risk assessments in particular locations, including those at risk from sources other than river flooding;
- determine the acceptability of flood risk in relation to emergency planning capability;
- consider opportunities to reduce flood risk to existing communities and developments through better management of surface water, provision for conveyance and of storage for flood water.

8.2 Flood risk from all sources of flooding

Flood hazard mapping as is normally developed for river basins as an initial assessment of flood risk, does not normally include flooding for all other sources.

Floods can also be caused by rising ground water levels, burst water pipes, flash floods due to rapid hillside run-off from sudden rain as well as flooding from the sea.

River flooding occurs when a watercourse cannot cope with the water draining into it from surrounding land. This can happen, for example, when heavy rain falls on an already waterlogged catchment.

Coastal flooding results from a combination of high tides and stormy conditions. If low atmospheric pressure coincides with a high tide, a tidal surge may happen which can cause serious flooding.

Surface water flooding occurs when heavy rainfall overwhelms the drainage capacity of the local area. It is much more difficult to predict and pinpoint than river or coastal flooding.

Sewer flooding occurs when sewers are overwhelmed by nearby rainfall or when they become blocked. The likelihood of flooding depends on the capacity of the local sewerage system. Land and property can be flooded with water contaminated with raw sewage as a result.

Groundwater flooding occurs when water levels in the ground rise above surface levels. It is most likely to occur in areas underlain by permeable rocks, called aquifers. These can be extensive regional aquifers, such as chalk or sandstone, or may be more local sand or river gravels in valley bottoms underlain by less permeable rocks.

The data requirements for developing a comprehensive hazard map for all sources of flooding can be onerous. In addition, because the methods of risk assessment of the various types of flooding involve modelling different types of flooding processes, the technologies required can vary widely. For this reason integrated modelling methods are sometimes used. In other cases, the risks are often assessed separately, and the various flood maps combined within a risk model when considering the impact on receptors.

8.3 Dealing with Residual Flood risk

SFRA also requires and assessment of the failure of flood defences in order to assess the residual risk that there structures can pose. The failure of a dam has the potential to cause catastrophic damage due to the sudden release of large volumes of water. The potential damage to buildings or loss of life in the event of dam failure, compared to other risks, when considering development downstream of a reservoir. The Strategic Flood Risk Assessments will need to undertake modelling and mapping of defence failure to determine how impounded water behind such structures will modify existing flood risk in the event of a flood in the catchment it is located within.

8.4 Incorporate of flood risk into Local Development Plans

Development Plans should be developed to provide the strategic locational guidance for development, and the detailed site specific policies and identification of proposals for developments of different types.

Local authorities should take account of the flood zones and designated uses, as outlined Part 1 of this policy document, in preparing their Development Plans, should consult with neighbouring local authorities, and communities on the issue of flooding.

Local authorities should use the flood zone maps and embed their local plans by considering the social, economic and environmental implications of zoning policy on the sustainability of their local area plans.

Where appropriate the Plan should include site specific policies and proposals for managing flood risk with the development.

8.5 Applying the Suitability Test and Exception Test when determining land use allocations

8.5.1 Suitability Test

When is a Suitability Test needed?

A proposed development site would need a Suitability test if both of the following apply:

- the development is in flood zone 2, 3, 4 or 5
- a Suitability Test hasn't already been done for a development of the same type on the proposed site
- the development involves a change of land use not already permitted for the area and potentially incompatible with the flood zone (for example a change of land use e.g. forest cover to residential or agricultural)

The Suitability Test is not needed if the following applies:

- the development is a minor development (for example, extensions to an existing property)
- the development involves a change of use (e.g. from commercial to residential) which is permitted and is compatible with the flood zone.

If a site needs a suitability test, the local authority will need the following information:

- the name and location of the site to be developed
- Details about expected use of the site based on plans (outline/conceptual design documents. Must state the status of the plans)
- Number, type and vulnerability class of likely users/occupants of the site
- Whether the development type is compatible with the existing flood zone designated use
- If use is compatible - whether the development has the potential to increase flood risk at the site or other locations. If so, then undertake site-specific FRA and include flood management/flood resilience measures in design
- If use is not compatible, apply the Exception test. If accepted by exception test, undertake site specific FRA.

The outcome of site-specific FRA and the satisfaction that development will incorporate appropriate flood mitigation measures will clear the development on FRA criterion within the planning permission.

8.6 Who will carry out a Suitability Test?

It is anticipated that the average developer will not currently have the resources at his disposal to undertake a Suitability test, including the data on which the assessment is to be based. It is proposed at this stage that the Suitability test is undertaken by the local authority with the support of NEA and MRDI who will be holders of the flood hazard maps,

models and underlying data that will be necessary for the assessment, and who will have the necessary training to conduct such assessments.

8.7 Exception Test

If the Suitability Test shows that the development is unsuitable for the target flood zone but cannot be located elsewhere, then a second test – The Exception Test - will be needed if the development is:

- essential infrastructure or emergency services infrastructure in flood zones 2, 3, 4 and 5
- Commercial/Public/Residential and moderately vulnerable users/occupants in flood zone 3, 4,5
- Commercial/Public/Residential and highly vulnerable and in flood zone 6

The exception test shows how flood risk will be managed at the proposed site. In addition to a site-specific FRA, showing how flood risk will be managed (on-site and off-site), that the development will be safe for its lifetime (if residential, then lifetime should be 100 years, otherwise lifetime is dependent on use) taking into account the vulnerability of its users, the exception test will also need to prove that the sustainability benefits of the development to the community outweigh the flood risk.

The output of the Exception Test will need to be submitted to the local planning authority along with the Suitability test, and the site-specific Flood Risk Assessment.

8.7.1 Who will carry out an Exception Test?

It will be the responsibility of the developer to undertake the Exception Test which will include proof of sustainability benefit and the associated site-specific Flood Risk Assessment.

8.7.2 Assessing Sustainability benefits

A sustainability appraisal is a systematic process that must be carried out when undertaking the Exception Test for developments that require one. The sustainability appraisal will need to identify and promote the sustainability benefits of the development by assessing the extent to which the development will help to achieve relevant environmental, economic and social objectives as compared to its capacity to achieve the same when located elsewhere.

It is also a means of identifying and mitigating any potential adverse effects that the development might otherwise have, thus helping to ensure that the proposed development is appropriately designed for the given location. Sustainability benefit assessment should be applied as an iterative process and should be used to inform the Local Development Plan.

The sustainability appraisals should include a ‘Strategic Environmental Assessment’, and a socio-economic assessment. The principle of Sustainability appraisal is in line with the EU Strategic Environmental Assessment Directive, which aims to “contribute to the integration of environmental considerations into the preparation and adoption of plans and programmes with a view to promoting sustainable development, by ensuing that, in accordance with this Directive, an environmental assessment is carried out of certain plans and programmes which are likely to have significant effects on the environment.”

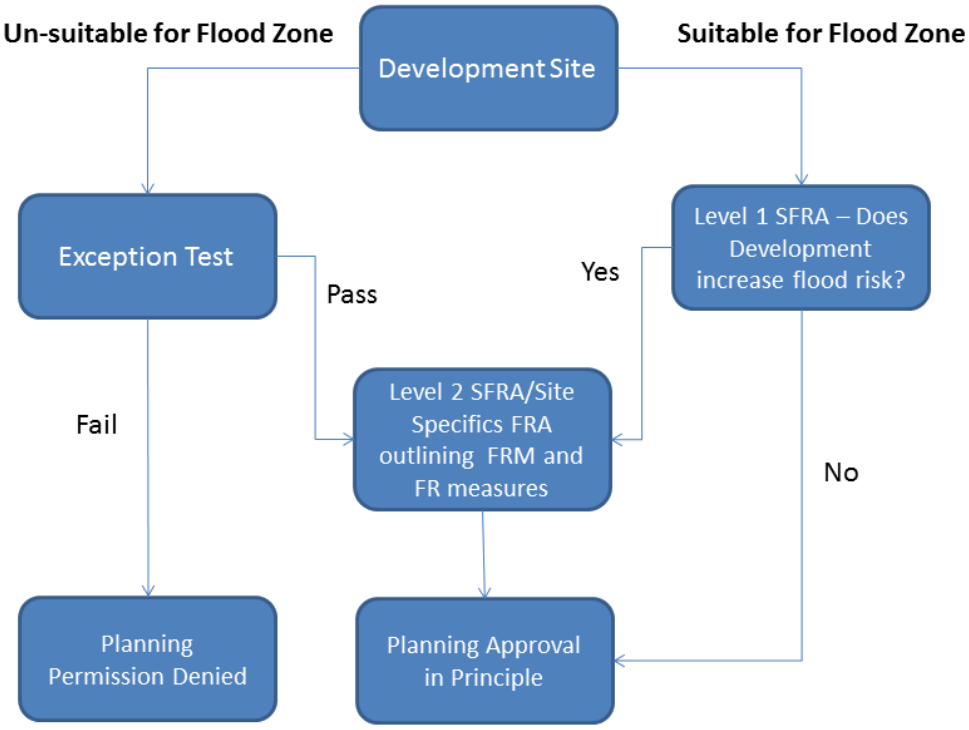

Figure 8-1: Flow chart showing requirements or Suitability Test, Exception Test, SFRA, site-specific FRA and conditions for planning approval in principle

9 POLICY GUIDANCE NOTE 5 – GUIDANCE ON CARRYING OUT A SITE-SPECIFIC FLOOD RISK ASSESSMENT

9.1 Introduction

A site-specific flood risk assessment (FRA) should be a fundamental consideration for all new development or redevelopment that is likely to increase flood risk, or that requires an Exception test (i.e. it does not fit with the designated land use but needs to be placed in the given location for other reasons).

Understanding the flood risk posed to and by a development is key to managing the risk to people and property thereby reducing the risk of injury, property damage or even death. The effects of climate change may exacerbate future flood risk. It is important that flood risk assessment of propose developments should take climate change into consideration as areas not currently flooded and which might appear as low risk under current conditions, may be subjected to future flood risk due to changes in the magnitude, frequency and intensity of flood events. In addition, account must be taken of future flood defences to be built, as some areas currently defended from flooding may be at greater risk in the future due to the effects of climate change or due to deterioration of the flood defence with age.

The site-specific flood risk assessment therefore provides an opportunity for early identification of flood risk constraints to ensure developments are sustainable whilst maximising development potential. Site-specific FRAs are required to assess the flood risk posed to and by proposed developments and to ensure that, where necessary, appropriate mitigation measures are included in the development.

9.2 What should a site-specific FRA consider?

A site-specific FRA should consider the risk of flooding arising from the development as well as the risk of flooding to the development. It should therefore:

1) Identify and quantify the vulnerability of the development to flooding from different sources and identify potential flood risk reduction measures (i.e. measures that can be built into the design of the development to reduce its vulnerability and reduce its impact on increasing food risk),

2) Assess the 'residual' risk after risk reduction measures have been taken into account and demonstrate that this is acceptable for the particular development,

3) Demonstrate that the vulnerability class of the occupants and users of the development is taken into account when designing the arrangements for safe access and egress to the site during a flood event.

4) Consider the resilience and resistance of the physical structure development to flooding by applying flood resilient building codes in the construction, and in the design of the proposed layout of development including the layout of the drainage systems,

5) Fully account for current climate change scenarios and their effect on flood zoning and risk.

9.3 Stages of a site-specific FRA

In general, the FRA can be phased in line with the stage of development of the site masterplan. The discussion of stages therefore considers the various possible stages of development of the masterplan and required level of flood risk assessment.

9.3.1 Stage 1 – Assess existing flood risk to the site – Flood Risk Scoping Report

A Flood Risk Scoping Report should be prepared to highlight the constraints and opportunities facing the development based on the development masterplan with regard to the risk of flooding. The Scoping Report should identify a number of possible considerations for appropriate flood risk management for the site through the development of a 'strategy' for dealing with flooding, in line with the emerging designs for site.

The development of a flood risk management strategy would require, in the first instance, a better understanding of the flood risk. Where available, this would be based on flood hazard and risk maps prepared by the NEA, but where not available, it would need hydrological and hydraulic assessment and modelling of the catchment to determine magnitude, timing and consequence of flood flows across the site due to events of different types.

9.3.2 Stage 2 - Develop initial high level flood risk management options

Following the initial scoping of the flood risks and opportunities of the site, an initial set of high level flood risk management options can be developed for the site to be incorporated into the initial design. These high level options will need to be investigated using quantitative measures.

The following strategic Flood Risk Management options should normally be considered for development sites and is comprised of five stages of management, numbered in the order in which they should be considered and take place (outlined in **Error! Reference source not found.**).

Table 9-1: Stages in developing FRM strategy for a development site

Management Option	Description of Option
1. Assess	Undertake studies to collect data at the appropriate scale and level of detail to understand what the flood risk is.
2. Avoid	Allocate parts of the development to areas of least flood risk and apportion parts of the development on the basis of types vulnerable to the impact of flooding, to areas of least risk.
3. Substitute	Substitute less vulnerable parts of the development for those incompatible with the degree of flood risk.
4. Control	Implement flood risk management measures to reduce the impact of new development on flood frequency and use appropriate design.
5. Mitigate	Implement measures to mitigate residual risks.

9.3.2.1 Options 2 and 3: Avoid and Substitute

Within a large-scale development flood risk management by avoidance and substitution can be realised through consideration of the layout and placement of individual parts of the development. In an ideal situation, a masterplan should be laid out sequentially, in line with a careful consideration of the risks of flooding and the relative vulnerability of the specific components of the development. This is called zoning of the development. Zoning development does not negate the need to carefully manage flooding, and the following considerations should still apply:

- Open spaces in flood risk areas should still be 'designed to flood', meaning that measures are taken to reduce the damage caused by flooding in these areas (such as by erosion, pollution and deposition). The potential effect of obstructions such as fences and vegetation should be considered, to avoid the collection of debris during a flood event, potentially increasing flooding upstream.

- Roads and car parks may be acceptable in flood risk areas, in terms of their relatively low vulnerability to flooding and in the context of a development zoning exercise. The form of use and the availability of roads and car parks should be considered however, with long-term residential car parks or principal access roads unsuitable in areas likely to flood to any great depth.

Whilst site layout is the preferred solution when planning for new development on a large scale, other constraints may exist which may mean that total avoidance of the floodplain for more vulnerable parts of the development may not be possible.

If vulnerable uses have to be located in flood risk areas, various mitigation measures may need to be included to reduce the flood risk to the site. Any building or flood mitigation measures which affect the existing nature of flooding in the development area must not increase flood risk elsewhere. As such, adequate compensatory flood storage may be required to offset the effects of any land raising or building within the fluvial floodplain.

9.3.2.2 Option 4: Flood Risk Management and Control by Design

It may be appropriate to raise the floor level of buildings above the design flood level, with the principal aim of reducing the damages caused by flooding. Ground floors at risk of flooding can be designed as utility areas, with more vulnerable uses at first-floor level or above. Raising of buildings on stilts can reduce the need for compensatory flood storage, but it should be noted that the 'voids' remaining under buildings can become blocked by debris during a flood, or become converted in future, unless sufficient maintenance and legal agreements are in place. For this reason floodplain compensation is sometimes necessary despite the presence of voids or stilts. As such, land raising, to achieve a higher ground floor level, combined with appropriate floodplain compensation, is often recommended over raising buildings structurally. It is recommended that finished floor levels for new residential developments should be set no lower than 300mm above the 1 in 100 flood level (including an allowance for climate change).

In large development areas, it is often possible and indeed necessary to change the makeup of the floodplain by raising land in some locations and lowering it in others. This can result in a re-distribution of predicted flooding within a given area. Appropriate conveyance of flood flows to the designated low areas can be facilitated by ensuring that areas of ground lowering are hydraulically connected and adjacent to existing watercourses, or by the use of storage areas and ponds. Altering the fluvial floodplain in this way can reduce some of the restrictions to development in current flood risk areas.

9.3.2.3 Options 4: Control by Defences

Flood storage can be an alternative way of reducing flooding to a particular area. By storing flood water, either by using natural ground with man-made modifications or by constructing entirely man-made embankments, peak flood flow (the amount of water passing along a watercourse at the flood peak) can be 'throttled' and effectively reduced as water is stored and released over a longer duration. Upstream storage can be provided "in-line" such that the storage itself occurs within the profile of the watercourse, and may involve the watercourse coming out of bank more frequently in the area of storage. It can also be provided "off-line" so that storage is engaged when river levels reach a threshold point, and the storage itself is normally not connected to the watercourse. Both types of solution increase the capacity of the river corridor, and furthermore make use of this capacity by actually slowing down the flow of water and storing it.

Any such potential site for upstream storage will require an appropriate assessment of its feasibility to mitigate flooding for a range of flood events occurring following storms of varying duration. The provision of upstream storage raises a number of general design considerations including residual risks associated with the potential failure of such structures and their safety and maintenance will need to be carefully considered.

Flood walls and bunds built around new development is another solution to prevent flooding to existing and new developments. Development behind defences of this type, however, creates residual risk, whereby potential defence failure or flood events in excess of the design event can result in flooding with significant consequences. As such, flood walls and embankments should be seen as the last 'control' measure in the flood risk management hierarchy.

9.3.2.4 Option 5: Flood Risk Mitigation through Building Design

The final step in the flood risk management hierarchy for new development, if all other options have been exhausted, is to mitigate flooding through building design. Building design mitigation measures can be broadly split into two categories:

- **Flood Resistance** measures involve designing buildings such that flood waters cannot enter buildings themselves, despite flooding the surrounding land. These can include flood boards and gates on building entrances and flood-proof covers for airbricks. Often, these measures rely on the occupier being (i) warned appropriately in advance of an incoming flood; and (ii) being present and able to install flood boards or close flood gates. For this reason, flood resistance measures are often only considered appropriate for retro-fitting to existing buildings which suffer frequent flooding or for minimising flood risk to developments classed as 'water compatible' which have to be located in flood risk areas. Flood resistance is also termed 'dry-proofing'.
- **Flood Resilience** measures involve accepting that buildings will flood but reducing the impact that flooding has on a building's fixtures and fittings. Hence, buildings are designed to flood and remain structurally sound, but walls and doors are treated with waterproof coverings; drainage systems are fitted with non-return valves; stone and tile floors are favoured over carpets; and electrical circuits, power points and switches are raised above a design flood level. Flood resilience measures are also often recommended for new developments where flood risk is controlled by defences or other measures, but a residual risk remains. The aim of flood resilience is to reduce the impact of damages in terms of financial losses incurred and the length of time for which people are displaced from their property for repairs. Flood resilience is also termed 'wet-proofing'.

9.3.2.5 Development Sites – flood risk constraints

The potential solutions outlined above are subject to a number of constraints when applied to a given development site.

Safe access: In order to be considered 'safe' with respect to flooding, safe access must be provided to and from new developments during flood events up to an appropriate design flood (the 1 in 100 flood including an allowance for climate change). The key determinants for safe access are for residents and occupiers to be able to leave, and emergency responders to be able to access, buildings in the flooded area. The requirements for safe access include:

- Safe dry route for people and vehicles.
- Safe dry route for people.
- If a dry route for people is not possible, a route for people where the flood hazard (in terms of depth and velocity of flooding) is low and should not cause a risk to people.
- If a dry route for vehicles is not possible, a route for vehicles where the flood hazard (in terms of depth and velocity of flooding) is low to permit access for emergency vehicles. The public should not drive vehicles in flood water.

When planning safe access routes into development, consideration should be given to flood hazard. Floodwaters can be hazardous at any depth if travelling with significant speed, so analysis of safe access should take account of both depth and velocity of floodwaters, informed by hydraulic modelling. Flood hazard mapping information, such as hazard maps, can be used to inform appropriate access routes.

Floodplain compensation: Development or land raising will require floodplain compensation as described above. Any ground level modification will need to be assessed as part of an overall 'compensation scheme' to ensure that post-development, a net decrease in flood storage is avoided and, where possible, additional floodplain storage is provided.

Development Phasing: For large developments, the proposed solutions of mitigation measures, for example ground level modification combined with some upstream flood storage and local conveyance improvements sometimes need to be implemented prior to development of individual parcels of land within the development site. It is therefore vitally important that an appropriately early or staged delivery of the flood risk management measures is considered during the development of the site design. Depending on the nature of the proposed flood risk management solution and the final masterplan layout, it may be necessary to prepare a detailed strategy for the implementation of the various individual components of the flood risk management solution, linked to the plans and timescales of the development.

9.3.3 Stage 3 - Assessing the post-development flood risk

At this stage a post-development risk technical assessment should be done, incorporating the new site layout and the flood management strategies (based on the preferred flood risk mitigation option/options) implemented as part of the design to test that the options work. Once the final development designs have been developed, and the flood mitigation measures incorporated, the residual risks to the development need to be assessed.